U.S. DEPARTMENT OF THE NAVY

BRUNSWICK NAVAL AIR STATION

BRUNSWICK, MAINE

WORK PLAN

POLLUTION ABATEMENT CONFIRMATION STUDY RI AND EXTENDED SI STUDIES CONTRACT: N62472-84-C-1108

E.C. JORDAN PROJECT NO. 4607-05

JANUARY 1988

E.C. JORDAN CO.

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4607-05

January 29, 1988

Mr. Ronald Springfield
Department of the Navy
Northern Division
Naval Facilities Engineering Command
Philadelphia, PA 19112-5094

Dear Mr. Springfield:

Subject: Transmittal of Work Plan for Pollution Abatement Confirmation Study
RI and Extended SI Studies
Contract No. N62472-84-C-1108
Brunswick Naval Air Station
Brunswick, ME

In accordance with our Scope of Services dated January 7, 1988, we are pleased to submit 2 copies of the updated Work Plan for the RI and Extended SI Studies for the Brunswick Naval Air Station. The updated Work Plan incorporates the comments from the June 12, 1987 meeting and describes the RI field work for Sites 1, 2 and 3 and the Extended SI field studies for Sites 4, 7, 8 and 9.

We have been pleased to assist you in this portion of the Navy IR Program at BNAS. We look forward to your review of this document and welcome any questions, concerns or comments regarding the contents of the Work Plan.

Sincerely,

E.C. JORDAN CO.

David B Gulick

David B. Gulick
Task Order Manager

cc: Charlotte Head, USEPA, Boston, MA
Geoffry Cullision, BNAS, Brunswick, ME
Richard Wardwell

WORK PLAN

POLLUTION ABATEMENT
CONFIRMATION STUDY
RI AND EXTENDED SI STUDIES
CONTRACT: N62472-84-C-1108

PREPARED FOR

U.S. DEPARTMENT OF THE NAVY
BRUNSWICK NAVAL AIR STATION
BRUNSWICK, MAINE

PREPARED BY

E.C. JORDAN CO.
PORTLAND, MAINE

JANUARY 1988

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1.0 INTRODUCTION

1.1 THE IR AND NACIP PROGRAMS AND BRUNSWICK NAVAL AIR STATION

Brunswick Naval Air Station (BNAS) is included in the Navy's Installation Restoration (IR) Program (formally known as the Navy Assessment and Control of Installation Pollutants (NACIP) Program). The Navy IR Program was established to identify the presence of any suspected contamination at Navy and Marine Corps lands resulting from past operations, and if needed, to institute corrective remedial measures. Prior to establishment of the IR Program the NACIP program directed contamination studies implemented in three phases:

1. Initial Assessment Study (IAS) The study consists of records searches and personnel interviews to collect and evaluate evidence supporting the existence of any potential contamination problems at BNAS.

2. Confirmation Study The study consists of on-site investigations including physical and chemical analyses to confirm or deny the existence of contamination, to quantify the extent of the problem, and to recommend necessary corrective measures if contamination is present.

3. Remedial Measures The study identifies corrective actions to control and mitigate contamination.

Subsequent to the NACIP Program, the Navy developed a new Statement of Work (SOW) for the IR Program under A/E Contract N62472-84-C-1108. As described in Appendix A of this new SOW, the IR Program is implemented in four phases:

1. Preliminary Assessment (PA) - The PA, formerly known as IAS under the NACIP program, determines the seriousness of the hazardous substance release or threat of release. The purpose of the PA is to evaluate the release or potential release of hazardous substances, and to recommend additional response action to the site (see Section 1.2, Appendix A of the SOW).

2. Site Inspection (SI) - The SI augments the information collected in the PA and:

   - Eliminates from further consideration those releases that pose no threat or potential threat to public health or the environment.
   - Determines the potential need for removal action.
   - Collects or develops additional data, as appropriate, to evaluate the release pursuant to the Hazard Ranking System (HRS).
   - Collects data, as appropriate, beyond that required to score and list the release pursuant to the HRS, in order to better characterize the release for more effective and rapid implementation of the Remedial Investigation/Feasibility Studies.

3. Remedial Investigation/Feasibility Study (RI/FS) - The RI/FS performs extensive on-site investigations including physical and analytical monitoring to quantify the extent of the problem and to develop alternatives for possible corrective measures.

4. Remedial Action (RA) Plans - The RA evaluates and implements corrective projects to control and mitigate confirmed contamination.

The PA of the IR Program is equal to and replaces the IAS of the NACIP program. Similarly, the SI and RI/FS studies and the RA Plans replace the Confirmation Study and the Remedial Measures of the NACIP Program respectively. Several studies at BNAS were implemented under the NACIP Program and are reviewed below.

The IAS was completed for BNAS by Roy F. Weston, Inc. (Weston) and a report submitted to the Navy in June 1983. The IAS contains background information on the chemicals which were used at the Navy facility and on specific sites where chemical wastes were known to have been disposed, or where such activity was suspected to have occurred. Ten sites were identified in the IAS report. The IAS provides a ranking of these sites based on the available information and any potential hazard to human health and the environment. On the basis of this ranking, seven sites were selected under the NACIP program format for the Confirmation Study phase. The Confirmation Study is divided into four steps. The steps are described below:

CONFIRMATION STUDY STEPS

Step	Description
IA	Verification of existence of contamination.
IB	Characterization of extent and rate of migration of contaminants, hydrogeological and other factors.
II	Evaluation of alternatives to achieve compliance, preparation of cost estimates, and project effectiveness of alternatives.
III	Preparation of site operation and government project documentation with cost estimate satisfactory for project funding requests for remedial measures.

On September 15, 1984 E.C. Jordan Co. (Jordan) was contracted by the U.S. Department of the Navy to complete Step IA-Verification for the seven sites selected at BNAS. The seven sites are grouped into the five areas noted below.

AREA	BNAS IDENTIFICATION
Sites 1,2,3	Orion Street Landfill and Hazardous Waste Burial Area
Site 4	Acid/Caustic Pit
Site 7	Old Acid/Caustic Pit
Site 8	Perimeter Road Disposal Site
Site 9	Neptune Drive Disposal Site

The locations of these sites are presented on Figure 1. The scope of work and findings of studies conducted by Jordan for Confirmation Study Step IA at each area are present in a report submitted to the Navy dated June 1985.

Based on the conclusions and recommendations presented by Jordan in this report, and meetings with regulatory agencies, the U.S. Department of the Navy selected Sites 1, 2 and 3 for RI studies and Sites 4, 7, 8 and 9 for extended SI investigations under the Extended Services Program (see Appendix A, SOW).

1.2 WORK PLAN OVERVIEW

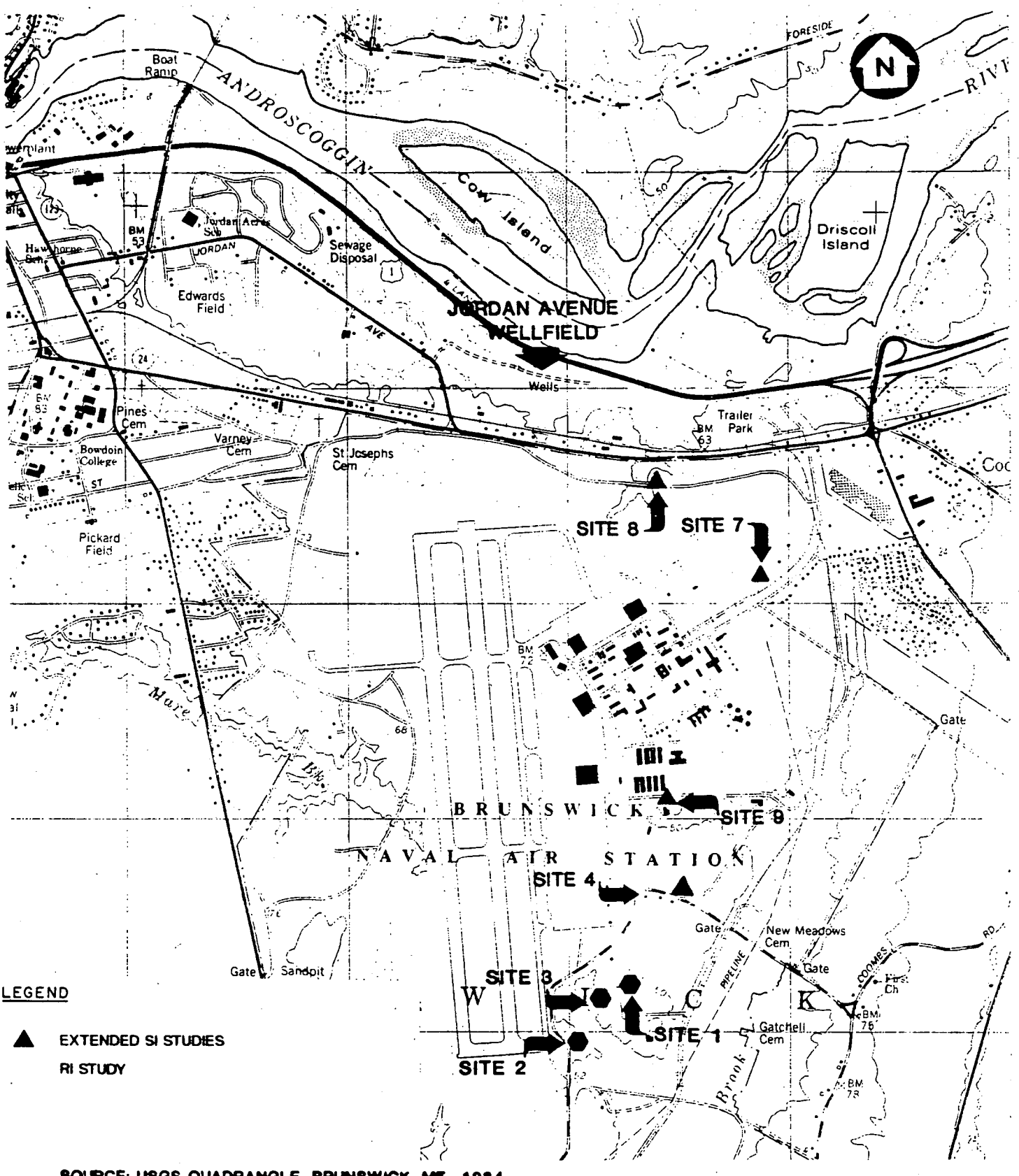
This work plan describes the IR Program's scope of work and methodology which will be employed by Jordan to conduct RI studies at Sites 1, 2 and 3 and extended SI studies at Sites 4, 7, 8 and 9. While the tasks to conduct the work are the same, the purposes of the SI and RI activities are distinctly different. These differences for each task will be described separately in the work plan. Section 2.2 is devoted to the RI study and Section 2.3 is devoted to the extended SI studies being carried out under the Extended Services Program.

The following seven tasks are common to both studies:

Task 1	Project Operations Plan
Task 2	Exploration and Sampling Program (Sites 1, 2 and 3)
Task 3	Exploration and Sampling Program (Sites 4, 7, 8 and 9)
Task 4	Elevation Survey
Task 5	Analytical Program
Task 6	Evaluation and Draft Report
Task 7	Final Report
Task 8	Meetings and Presentations

A brief review of items in each task addressed in the work plan follows.

Task 1 - Project Operations Plan. The Project Operations Plan will provide methods, criteria and guidelines by which the work is to be conducted. This work plan will provide a brief description of the two principle elements of the Project Operations Plan, Quality Assurance/Quality Control (QA/QC) and Health and Safety (HAS).



SOURCE: USGS QUADRANGLE, BRUNSWICK, ME. 1984

0 2000 4000 FEET

FIGURE 1
SITE LOCATION MAP

BRUNSWICK NAVAL AIR STATION
POLLUTION ABATEMENT CONFIRMATION STUDY
RI AND EXTENDED SI STUDIES

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Tasks 2 & 3 - Exploration Program. This work plan will describe and provide the rationale for the exploration program for the RI Studies (Task 2) and the extended SI Studies (Task 3). The exploration program for the RI Studies of Sites 1, 2 and 3 will include the following activities:

- o geophysical surveys including magnetometer, ground penetrating radar and seismic refraction profiling;
- o test pits;
- o test borings and soil sampling and groundwater sampling;
- o monitoring well installation and groundwater sampling;
- o surface water and sediment sampling;
- o stream gauging; and
- o field analysis of surface waters and seeps.

The exploration program for the extended SI Studies will include:

- o magnetometer survey;
- o borings and soil sampling;
- o monitoring well installation;
- o groundwater sampling;
- o surface water sampling;
- o evaluation of aerial photographs; and
- o field analysis of surface waters and seeps.

This work plan also discusses the phasing of the activities.

Task 4 - Elevation Survey. This task will describe the scope of the survey program required for piezometric surface mapping and assessment of groundwater flow direction.

Task 5 - Analytical Program. Parameters and analytical methods to be used for analysis of samples of each media will be identified in this work plan. Further, the work plan will review the rationale for selection of parameters for each media.

Task 6 - Evaluation and Draft Report. The work plan will describe the characteristics of the site to be evaluated. These would include:

- o Site geology;
- o Site hydrogeology;
- o Site hydrology;
- o Concentrations and distribution of contaminants;
- o Contaminant migration pathways;
- o Impact assessment; and;
- o Remedial action response objectives (if necessary).

Task 7 - Final Report. The work plan presents the process for review of the draft report and preparation of the final report. This process may include meetings with the Navy and/or preparation of the Final Draft Report.

Task 8 - Meetings and Presentations. Project meetings with the Navy will be required and may take place in Philadelphia, Boston, Brunswick or Portland. In

addition, a presentation of the project to the public may be required. A recommendation for the number and location of meetings/presentations is provided in the work plan.

1.3 PROJECT LOGISTICS

This section is devoted to the logistics of on-site field work to be carried out at BNAS. Sites 1, 2 and 3 are located in a highly restricted magazine area and to insure proper security arrangements for access and operations in this area and the base in general, a meeting was held on March 5, 1985 at BNAS with representatives from Weapons, Security, Ground Electronics, Engineering and the Marines. The following sections will address the logistics of security arrangements, communications, field operations, decontamination facilities and disposal of wastes based on practices employed during the verification field work and the results of the March 5, 1985 meeting.

1.3.1 Security Arrangements

Access to the base in general and to the restricted area will be with one security pass. The pass will be a picture identification contractor pass and one pass will be adequate for the entire field program. All information on Jordan personnel involved in the project will be provided to the Chief Warrant Officer as soon as the schedule for the project is finalized.

1.3.2 Communications

Jordan personnel while on the base will use telephones to communicate with off-base parties and will have a list of emergency phone numbers available to them at all times. Personnel conducting on-site work in one area of the BNAS will use two-way radios supplied by the Navy to maintain a communication link with personnel working in other areas. This will also allow the Marines and security to monitor communications for added security and safety reasons. Personnel will be assigned the use of one of the BNAS radio frequencies.

1.3.3 Field Operations

The geophysical portion of the field investigation will require the use of small amounts of explosives to conduct a seismic refraction survey in the restricted magazine area. Jordan is pursuing permission for this operation from Naval Command. During the seismic survey a person from Weapons will be present on-site to communicate the timing of each blast to the Marines and Security. The locations of all seismic lines have been given preliminary approval by Marines, Weapons, Security and Ground Electronics and will be checked again by site reconnaissance after the lines have been staked out in the field. Weapons will store the explosives and blasting caps in a magazine and will escort Jordan personnel on and off the the base when carrying explosives. Jordan will also provide Weapons with copies of the quantity logs required by the federal government.

Drill rigs and backhoes left in the restricted area overnight will be disabled each night before on-site personnel leave the restricted area. Boring and test

pit locations were given preliminary approval during the meeting of March 5, 1985. Final approval will be given after a site reconnaissance is made to observe staked locations in the field prior to the beginning of the fieldwork.

Potable water, necessary for drilling and decontamination procedures, will be obtained at the BNAS fire station (Building No. 292) as necessary. This will be arranged by Engineering.

1.3.4 Decontamination Facilities

The field work at the BNAS Sites will require mobilization and field support of subcontractors, sampling crews, and survey crews. Staging and decontamination facilities will be needed to conduct these operations. Staging of the field operations will be done from vehicles used by Jordan personnel. These vehicles will be parked in uncontaminated areas identified at each site and will not require decontamination.

Decontamination zones for personnel and equipment will be established at locations to be determined for each site. All contaminated materials and protective gear will either be disposed of or decontaminated in these areas before site personnel proceed into the clean zone. The specific decontamination procedures to be employed are outlined in the Health and Safety Plan which will be included as part of the Project Operations Plan.

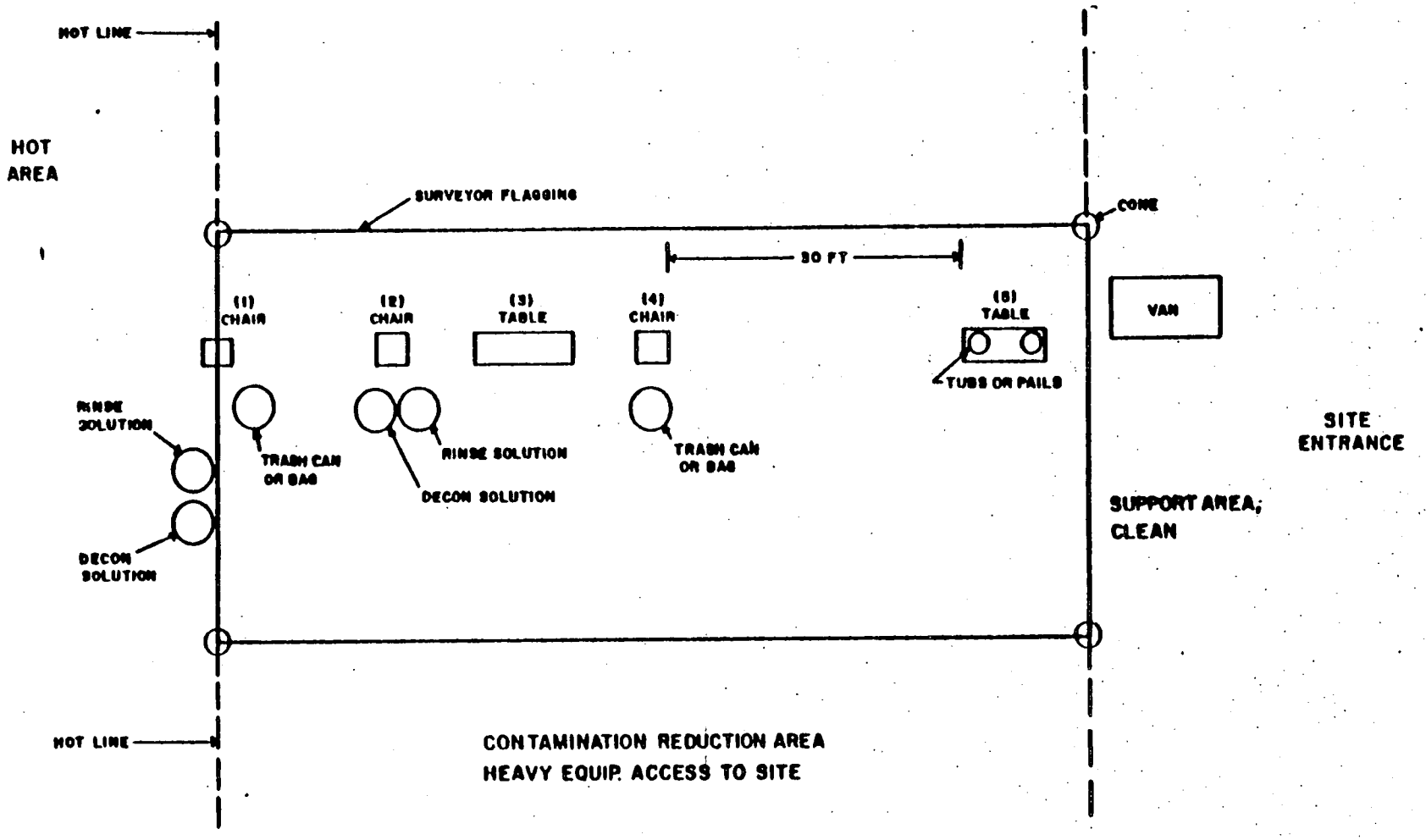
A heavy equipment decontamination zone will be designated at each site. Drill rigs, casing, rods and associated equipment will be decontaminated and steam cleaned prior to setting up at each boring or monitoring well location. Sampling tools will be decontaminated more frequently as required by the sampling protocol provided in the Project Operations Plan.

Figure 2 is a schematic diagram of the contamination reduction zone layout. The arrows show the directions personnel and drilling equipment will be permitted to move through this zone.

1.3.5 Disposal of Wastes

All fluids generated by personnel and equipment decontamination will be disposed of on-site, inside of the contamination reduction area (Figure 2). Contaminated items such as disposable safety and sampling equipment will be placed in doubled plastic bags which will be collected daily and stored in 55-gallon drums with locking ring lids. The drums will be supplied by Engineering and left on-site for future transportation by the Department of the Navy to a suitable disposal facility.

Drill fluids, drill cuttings and water resulting from monitoring well and piezometer installation and development will be monitored for contamination using a portable photoionization meter. There is no plan to collect or store any of these materials. Those materials will remain on-site at the location where they are generated. Soil cuttings will be buried and drilling fluids will be allowed to infiltrate into the soil.



NOT TO SCALE

TASK

(1) Wash boots
(2) Wash gloves—Rinse gloves
(3) SCBA Tank change over table w/spare tanks
(4) Remove boots, gloves
(5) Remove SCBA, wash mask in pails or tubs

FIGURE 2

TYPICAL PERSONNEL DECONTAMINATION STATION

POLLUTION ABATEMENT CONFIRMATION STUDY
BRUNSWICK NAVAL AIR STATION
RI AND EXTENDED SI STUDIES

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2.0 WORK PROGRAM

This Work Plan for the BNAS extended SI and RI studies has been developed based on Jordan's review of the NACIP Initial Assessment Study (IAS) for BNAS; results of the NACIP Verification Step IA conducted between September 1984 and June 1985; USEPA comments; and discussions with US Navy officials. This Work Plan consists of tasks which were identified in the Step IA Verification report dated June 1985; Appendix A, SOW - Confirmation Study, received from the Department of Navy and dated 25 June, 1984; Appendix A, SOW - IR Program, received from the Department of the Navy dated 25 November, 1987; and on the basis of meetings with the Department of the Navy and regulatory agencies on June 12, 1987 as summarized in the recorded minutes dated June 30, 1987.

The results of the Extended SI portion of this study will be to verify contamination at sites where only low levels of concentrations were encountered during our initial work. The results of the RI portions of this study will be a quantitative assessment of the distribution of contamination, sources, and contaminant migration pathways. The scope of work described herein has been designed to provide sufficient data to permit an evaluation of the levels and distribution of contamination, both vertical and horizontal, around the sites. It will also evaluate the site hydrogeology and specifics of groundwater movement and/or surface water movement. This study will provide the data necessary to support Feasibility Studies as described in Appendix A, Statement of Work, November 1987.

Feasibility Studies, if required, shall be for the purpose of identifying and evaluating both interim and long term remedial alternatives and cost estimates consistent with DOD policy to effect compliance with applicable health and environmental standards.

2.1 TASK 1 - PROJECT OPERATIONS PLAN

The Project Operations Plan (POP) will include a quality assurance/quality control program, and a site specific health and safety plan (HASP). This document, once approved by the Navy, will provide procedures for field work and laboratory analyses for the duration of the project.

The laboratory quality assurance/quality control portion of the POP will be in compliance with the Sampling and Chemical Analysis Quality Assurance Guide for Navy Assessment and Control of Installation Pollutants (NACIP) Program (NEESA 20.2-047A June, 1986). Jordan's analytical laboratory has received Navy approval and may begin laboratory analysis under contract N62467-86-C-0174.

The Quality Assurance/Quality Control program will contain the following sections:

- Project Organization and Responsibilities
- Quality Assurance Objectives
- Sampling Procedures
- Sample Custody

- Calibration Procedures and Frequency
- Analytical Procedures
- Data Reduction, Validation and Reporting
- Internal Quality Control
- Audits
- Preventive Maintenance
- Data Assessment
- Corrective Action
- Reports to Management.

This program is necessary to establish methods, criteria and guidelines by which the work is to be conducted.

The Health and Safety Plan will be developed based on background information and the findings of the NACIP Verification Step IA activities previously conducted by Jordan at BNAS. Potential problems will be assessed with regard to known contaminants and site conditions to insure safe working conditions during the field and laboratory activities. The health and safety program will include:

- Identification of site hazards and specified levels of protection;
- Safe work procedures;
- Emergency response/evacuation procedures;
- Local authority contacts and medical personnel; and
- On-site decontamination procedures and facilities.

Base personnel located nearby or supervising field work will be briefed on the health and safety plan to provide familiarity in the case of emergency.

2.2 TASK 2 - EXPLORATION PROGRAM - RI STUDIES AT SITES 1, 2 AND 3

The quantity of volatile organic compounds detected in the surface water and groundwater at Sites 1, 2 and 3 by the NACIP Step IA - Verification Study, and the concentration of pesticides detected in the soils at Site 3 by the NUS Corporation Field Investigation Team site inspection, pose a potential threat to human health and the environment. Additional RI studies will be conducted at these three sites to assess the distribution of these compounds and others that may be identified during the RI.

The result of this step will be a quantitative assessment of the distribution of contamination, sources, and contaminant migration potential. The study described herein is designed to evaluate the levels and distribution of contamination, both vertical and horizontal, site hydrogeology and specifics of groundwater flow and/or surface water movement.

The exploration program at Sites 1, 2 and 3 will include geophysical surveys, test pit program, boring and monitoring well installation program and soil,

groundwater and surface water and sediment sampling. The methods and rationale for each of the above are described in detail in the following sections.

2.2.1 Geophysical Surveys

A magnetometer survey is recommended at Site 3 to determine the presence and location of buried barrels and/or drums. The magnetometer will also be used at Sites 1 and 2 in an attempt to delineate former landfill trenches which may contain buried metal objects. The location of these trenches will enable borings and monitoring wells to be placed outside the trenches, thereby, avoiding drilling through refuse. The magnetometer survey will be conducted on a 25 foot by 25 foot grid which will cover the entire area of Sites 2 and 3 and the portions of Site 1 in which test pitting and soil borings are planned. The results of this survey will be used to optimize test pit and borings/monitoring well locations. The magnetometer to be used for this survey is an Omni IV Vertical Gradiometer manufactured by EDA Instruments, Inc.

A ground penetrating radar (GPR) survey will be conducted at Sites 1 and 2 to confirm the magnetometer survey results. The geologic conditions at Sites 1 and 2 are suitable for GPR and the trenches should be visible using this geophysical method. GPR may also provide data on the depth to shallow groundwater, if present, above the marine silts and clays which are believed to be present beneath the outwash sands and fill materials, and the continuity of this restrictive strata, if present.

Seismic refraction profiling (4000 lineal feet) will be conducted to determine the depth to bedrock and a possible aquitard in the vicinity of Sites 1 and 3. The locations of the seismic profile lines are presented in Figure 3. The purpose for assessing the depth to bedrock and any significant aquitards is to further understand the hydrogeology at the site and optimize the placement and depth of monitoring wells. The seismic survey will be conducted with an EG&G Geometrics 24-Channel Signal Enhancement Seismograph, Model ES-2415F. After completion of the geophysics at these sites, the results will be evaluated to determine when test pits or soil borings are used for further investigations. Monitoring well locations will be adjusted if necessary.

2.2.2 Test Pit Program

A test pit program has been proposed for Sites 1 and 3 because the shallow subsurface source characterization information gathered by this method is more extensive than can be gained by test borings. Since VOCs, pesticides or PCBs were not detected at Site 2, test pits are not proposed for this site. This decision will be re-evaluated after the geophysics results have been obtained.

This method of investigation has, in Jordan's experience, proven to be a cost-effective approach to site characterization. Additionally, engineering information can be collected which will prove useful during the Feasibility Study's remedial alternatives evaluation. There are, however, physical factors which affect the applicability of test pitting for subsurface exploration. One of these factors, which may be a concern at Sites 1 and 3, is the unknown depth to clay and/or wastes below ground surface. The magnetometer and GPR surveys may reveal the depth to clay and/or wastes permitting a reassessment of the

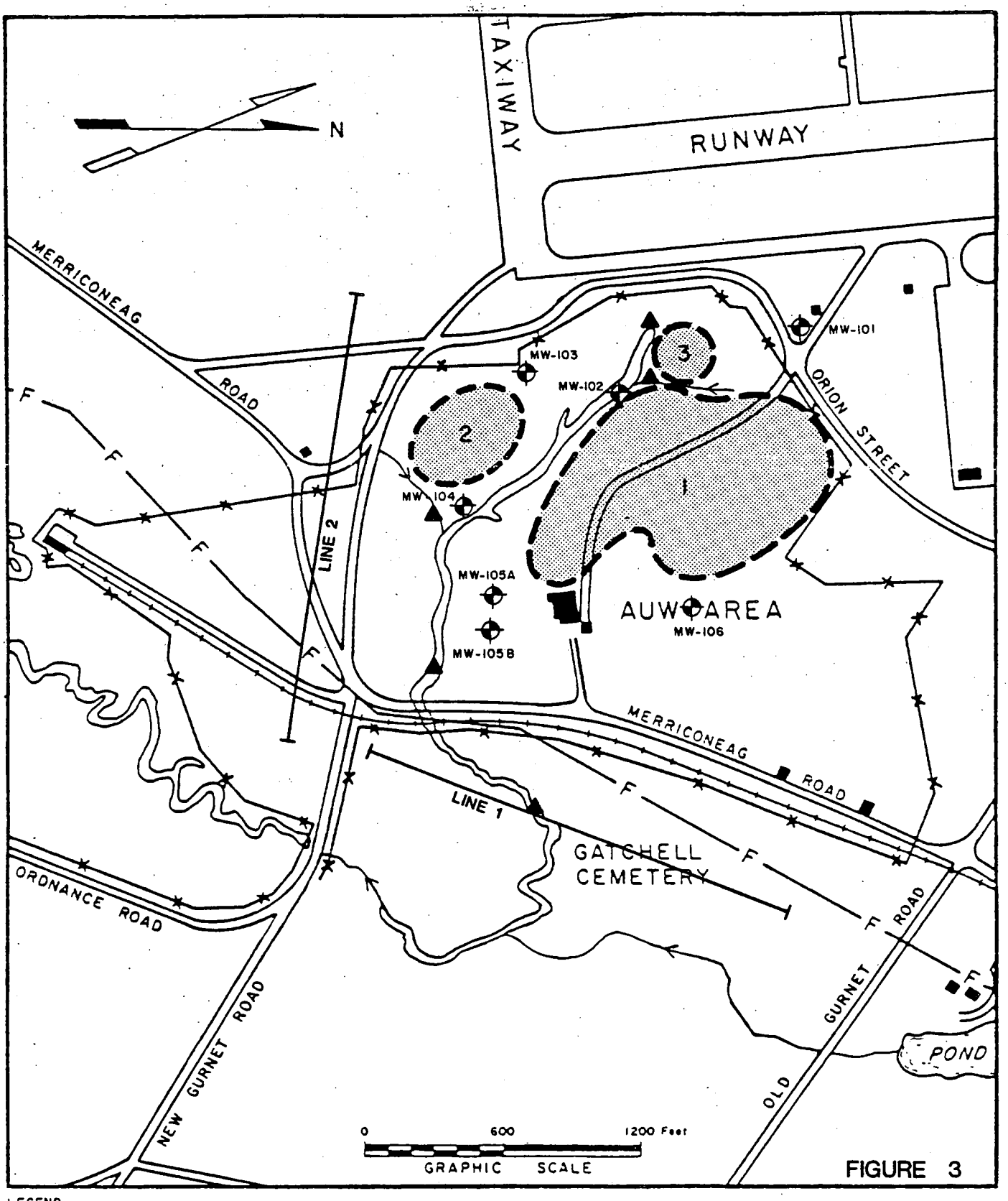

FIGURE 3

LEGEND

- BORING AND MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING LOCATION (EXISTING)
- SURFACE WATER SAMPLE LOCATION (EXISTING)
- APPROXIMATE LOCATION OF WASTE SITE
- SEISMIC PROFILE LINES

LOCATION OF SEISMIC PROFILES
SITES 1,2, AND 3
RI STUDY
POLLUTION ABATEMENT CONFIRMATION STUDY
BRUNSWICK NAVAL AIR STATION

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usefulness of test pitting. Subsequent to the geophysical program, the results will be evaluated to determine whether test pits or test borings should be employed to characterize the landfill (Sites 1 and 3). If test pits will be effective, the program described in the following sections will be conducted. Should test borings not prove to be the best method of shallow exploration, a program which will generate an equivalent amount of information will be designed, adjusting the monitoring well locations if necessary.

Six test pits will be excavated at Sites 1 and 3 for the purpose of characterizing the location and concentration of chemical sources, if present. The proposed locations of these test pits are presented in Figure 4. Three test pits will be located adjacent to the maximum extent of waste at Site 1 based on the information developed during the magnetometer survey. The excavations will consist of small trenches approximately 10 feet in depth and up to 25 feet in length. In each test pit Jordan will observe the subsurface soils and water table conditions, collect soil samples for analysis and observe the conditions of the landfill trenches, if exposed. A photoionization meter and visual evidence of contamination will be used to screen soils for the purpose of selecting six samples for laboratory analysis. The samples will be analyzed for organochloride pesticides, PCBs and volatile organic compounds (VOCs) on the Target Compound List (TCL). A summary of chemical analyses and methods is presented in Section 2.5.

Three test pits will be located adjacent to Site 3 based on the results of the magnetometer survey. The purpose of these excavations will be to describe the shallow overburden soils, collect soil samples for chemical analysis and observe groundwater seepage conditions near the reported barrel disposal area. A photoionization meter will be used to screen soils for the purpose of selecting six soil samples for laboratory chemical analysis. The samples will be analyzed for organochloride pesticides, PCBs and VOCs.

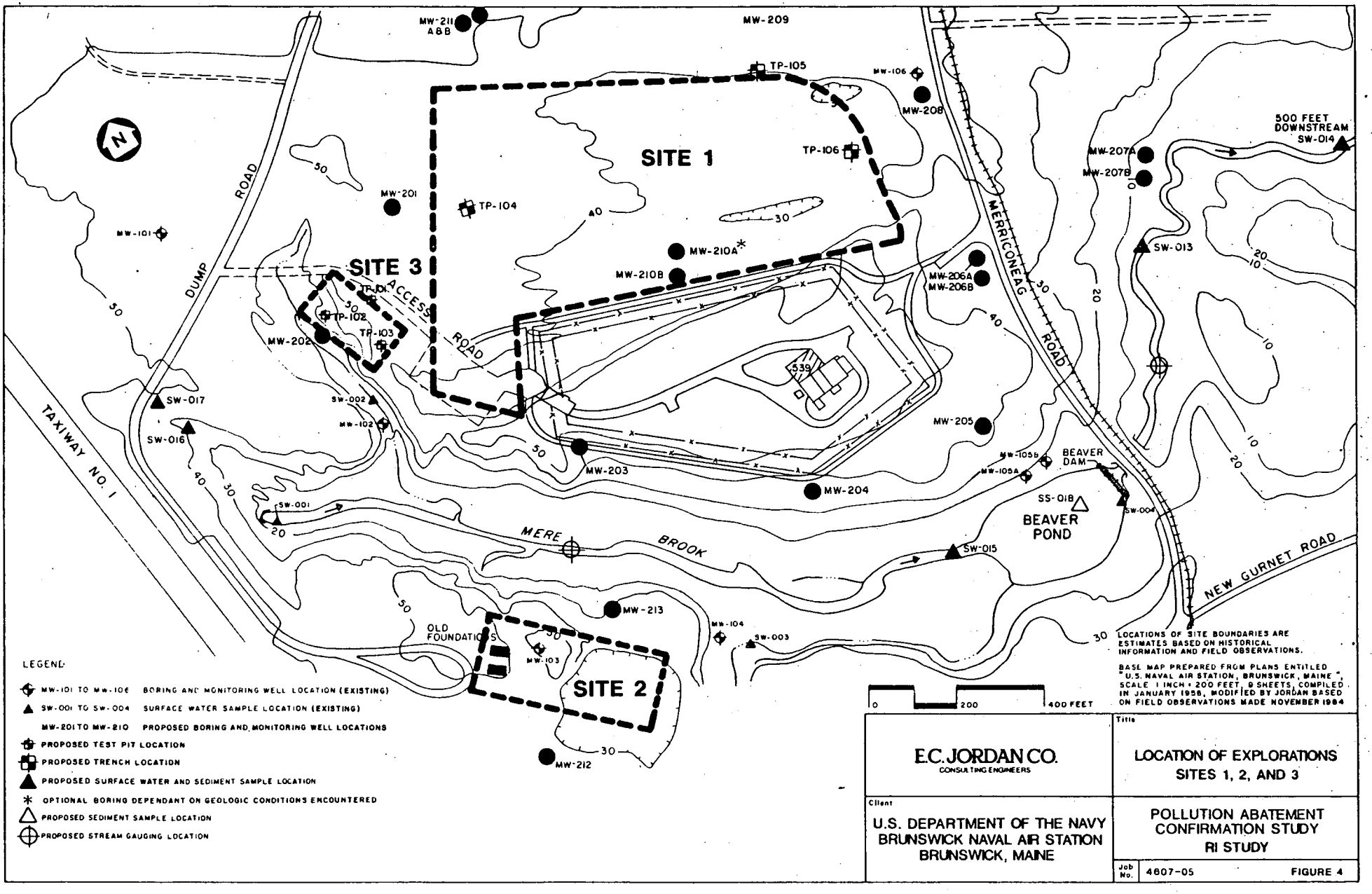
2.2.3 Boring and Monitoring Well Installation Program

This subtask includes a description of the quantities and methods to be used in conducting:

- soil borings;
- soil sampling and analysis;
- monitoring well installation and development;
- groundwater sampling and analysis; and
- aquifer testing.

Seventeen soil borings with monitoring well installations will be completed, and 24 groundwater samples and 30 soil samples will be collected at Sites 1, 2 and 3 for the purpose of assessing the distribution, concentration and migration of contamination in soils and groundwater.

The actual location of each boring/monitoring well will depend on the results of the geophysical surveys and the test pitting program. Soil borings will be advanced using either wash boring techniques or hollow-stem augers with split-spoon soil samples taken at 5-foot intervals by standard penetration methods. Three representative samples of the water used during the drilling program will


MW-211 A&B
MW-209
TP-105
MW-106
MW-208
SITE 1
TP-106
500 FEET DOWNSTREAM
SW-014
MW-207A
MW-207B
MW-201
TP-104
SW-013
MW-101
SITE 3
MW-210A*
MW-210B
MW-206A
MW-206B
MERRICONEAG ROAD
DUMP ROAD
ACCESS ROAD
TP-101
TP-102
TP-103
MW-202
SW-017
SW-016
SW-002
MW-102
MW-205
MW-203
MW-204
MW-105B
MW-105A
BEAVER DAM
SS-018
BEAVER POND
SW-004
SW-001
MERE BROOK
SW-015
NEW GURNET ROAD
TAXIWAY NO. 1
MW-213
MW-104
SW-003
OLD FOUNDATIONS
MW-103
SITE 2
MW-212
LEGEND
MW-101 TO MW-106 BORING AND MONITORING WELL LOCATION (EXISTING)
SW-001 TO SW-004 SURFACE WATER SAMPLE LOCATION (EXISTING)
MW-201 TO MW-210 PROPOSED BORING AND MONITORING WELL LOCATIONS
PROPOSED TEST PIT LOCATION
PROPOSED TRENCH LOCATION
PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATION
* OPTIONAL BORING DEPENDANT ON GEOLOGIC CONDITIONS ENCOUNTERED
PROPOSED SEDIMENT SAMPLE LOCATION
PROPOSED STREAM GAUGING LOCATION
0 200 400 FEET
LOCATIONS OF SITE BOUNDARIES ARE ESTIMATES BASED ON HISTORICAL INFORMATION AND FIELD OBSERVATIONS.
BASE MAP PREPARED FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE", SCALE 1 INCH = 200 FEET, 8 SHEETS, COMPILED IN JANUARY 1958, MODIFIED BY JORDAN BASED ON FIELD OBSERVATIONS MADE NOVEMBER 1984
E.C. JORDAN CO.
CONSULTING ENGINEERS
Client
U.S. DEPARTMENT OF THE NAVY
BRUNSWICK NAVAL AIR STATION
BRUNSWICK, MAINE
Title
LOCATION OF EXPLORATIONS
SITES 1, 2, AND 3
POLLUTION ABATEMENT
CONFIRMATION STUDY
RI STUDY
Job No. 4807-05
FIGURE 4

be collected and analyzed in the laboratory for the presence of all elements and compounds being investigated in this study. Soil sampling will not be conducted in the shallow borings at shallow/deep paired boring locations. The proposed locations of these borings/monitoring wells are presented in Figure 4. Thirty soil samples will be collected from the soil borings for laboratory chemical analysis. All soil samples will be analyzed for the presence of HSL VOCs. Seven of the soil samples collected will be analyzed for organochloride pesticides and PCBs. These seven samples will be collected from borings MW-202, MW-203, MW-204, MW-206A, MW-210A (2 soil samples analyzed) and MW-213. A more detailed description of the laboratory analytical program is presented in Section 2.5.

Monitoring wells will be installed in the borings for the purpose of monitoring groundwater quality and assessing the direction and rate of groundwater flow in the shallow and deep aquifers. Installation of monitoring wells will comply with 40 CFR § 265 Subpart F. Monitoring well installation details are presented in Figure 5. The monitoring wells will be installed in the completed boreholes generally in the most permeable strata of the aquifers. The total depth of soil drilling is estimated at 1,070 lineal feet. Depths, number of samples, and quantities of materials for well installation are presented in Table 1. The specific rationale for each boring/monitoring well location is presented below.

- MW-201 will be a shallow monitoring well located west of Site 1 and east of Site 3. This location is anticipated to be downgradient of Site 1 and upgradient of Site 3 and a small tributary stream of Mere Brook.

- MW-202 will be a shallow monitoring well located west of Site 3, anticipated to be downgradient of Site 3 and upgradient of a small tributary stream of Mere Brook.

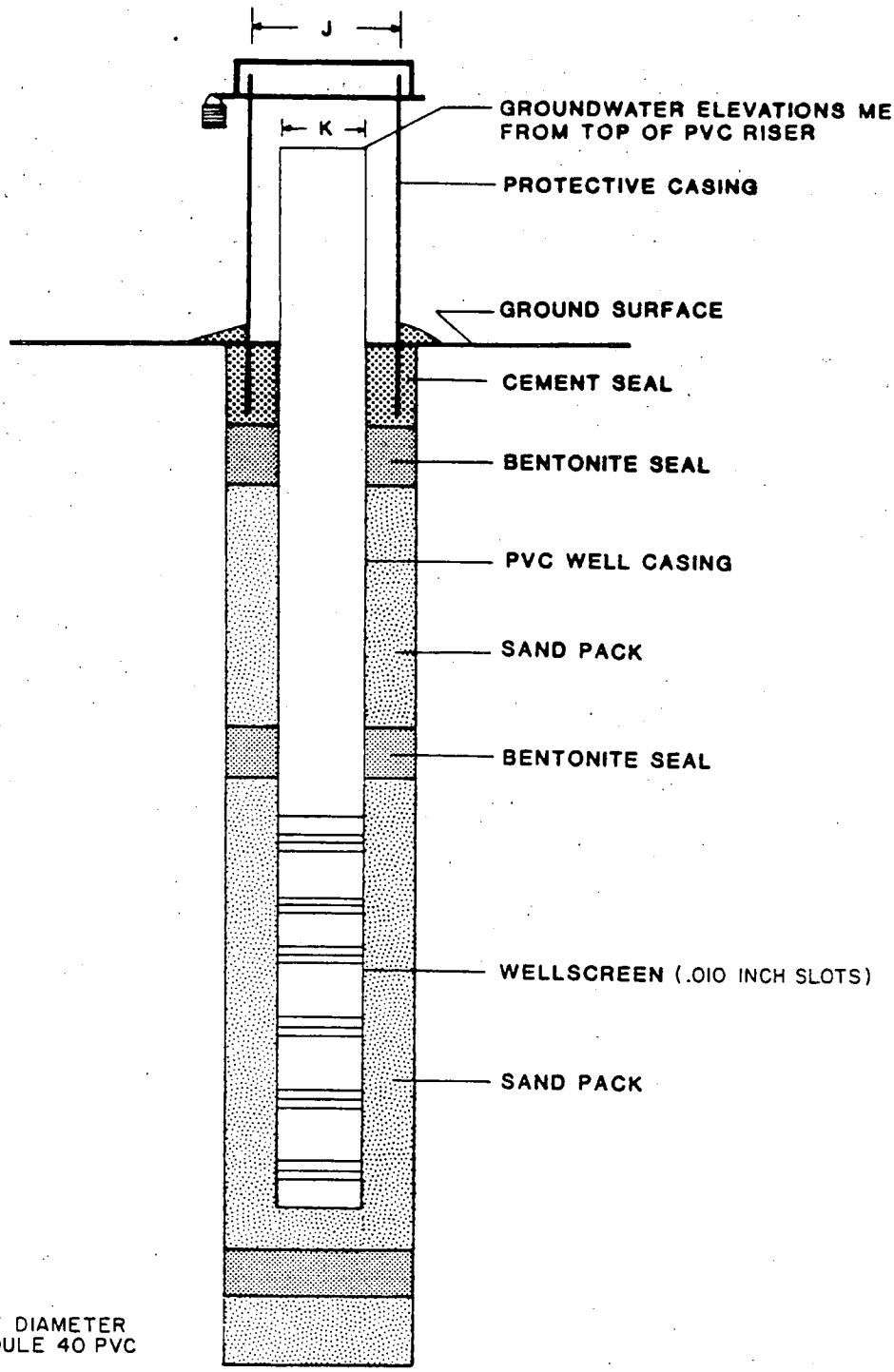
- MW-203 will be located southwest of Site 1 and northeast of Mere Brook and is anticipated to monitor shallow groundwater downgradient of Site 1 and upgradient of Mere Brook in this location.

- MW-204 will be located south of Site 1 and north of Mere Brook and is anticipated to monitor shallow groundwater downgradient of Site 1 and upgradient of Mere Brook in this location.

- MW-205 will be located southeast of Site 1 and north of the Beaver Pond and is anticipated to monitoring deep groundwater downgradient of Site 1 and to help further understand the upward gradients encountered at MW-105A & B.

- MW-206 A & B will be located west of Merriconeag Road and southeast of Site 1 and are anticipated to monitor deep and shallow groundwater downgradient of Site 1 and upgradient of Mere Brook, respectively.

- MW-207 A & B will be located east of Site 1 and west of Mere Brook and are anticipated to monitor deep and shallow groundwater downgradient of Site 1 and upgradient of Mere Brook in this location.



NOTE:

K= 2" INSIDE DIAMETER SCHEDULE 40 PVC

J= 4" STEEL PROTECTIVE CASING WITH LOCKING COVER

NOT TO SCALE

FIGURE 5
MONITORING WELL INSTALLATION DETAIL
POLLUTION ABATEMENT CONFIRMATION STUDY
RI AND EXTENDED SI STUDIES

TABLE 1
SUMMARY OF ESTIMATED QUANTITIES FOR
MONITORING WELL INSTALLATION
SITES 1, 2 AND 3
RI STUDY
POLLUTION ABATEMENT CONFIRMATION STUDY
BRUNSWICK NAVAL AIR STATION

Monitoring Well No.	Estimate Depth (Ft.)	Number Analytical Soil Samples	Well Materials 2" PVC Screen (Ft.)	Well Materials 2" PVC Riser (Ft.)
MW-201	30	2	10	20
MW-202	30	2	10	20
MW-203	30	2	10	20
MW-204	30	2	10	20
MW-205	100	3	10	90
MW-206A	100	3	10	90
MW-206B[1]	50	--	10	40
MW-207A[2]	100	3	10	90
MW-207B	50	--	10	40
MW-208	100	3	10	90
MW-209	50	--	10	40
MW-210A	100	3	10	90
MW-210B[1]	50	--	10	40
MW-211A	100	3	10	90
MW-211B	50	--	10	40
MW-212	50	2	10	40
MW-213	50	2	10	40
	1,070	30	170	900

Notes:
[1] Boreholes will be advanced to depth without sampling. Soil samples will be obtained using a split-spoon sampler at 5-ft. intervals.
[2] Optional deep boring to be installed if the presence of a significantly thick strata of marine clay is not encountered in boring MW-210B. If such a clay layer is encountered, then this boring will be installed to a depth of 50 feet elsewhere within Site 1.

- MW-208 will be located adjacent to MW-106 east of Site 1 and west of Merriconeag Road and is anticipated to monitor deep groundwater downgradient of Site 1 in this location.

- MW-209 will be located northeast of Site 1 and is anticipated to monitor shallow groundwater downgradient of Site 1 in this location.

- MW-210 A & B will be located within the boundaries of Site 1 based on the geophysical surveys and test pitting program and are anticipated to monitor deep and shallow groundwater directly beneath Site 1 in this location. To avoid contamination of a deep aquifer, MW-210A will not be installed deep (100 feet) if the presence of a continuous and significant aquitard (marine clay) is encountered in MW-210B. If such an aquitard is present, MW-210A will instead be installed as two (2) shallow monitoring wells within Site 1.

- MW-211 A & B will be located north of Site 1 and southeast of the Dump Road and are anticipated to monitor deep and shallow groundwater upgradient of Site 1 in this location.

- MW-212 will be installed southwest of Site 2 and east of the Dump Road and is anticipated to monitor shallow groundwater upgradient of Site 2.

- MW-213 will be installed between Site 2 and Mere Brook to monitor shallow groundwater, downgradient of Site 2.

The monitoring wells will be developed by pumping and/or surge block techniques to insure a good hydraulic connection between the well and the aquifer. At least two weeks after monitoring well development, groundwater samples will be collected for laboratory chemical analysis at the seventeen new wells to develop an initial set of data for the new wells. Sampling and analysis of the new and existing wells will occur three times at three month intervals before a final RI Study evaluation is made.

Sampling of the wells at all the sites will occur as follows:

- initial round of sampling of new wells only to develop a data base similar to the existing wells; and

- 3 subsequent quarterly rounds of sampling including both the new and existing wells, commencing 3 months after collection of the initial round.

The parameters of laboratory chemical analysis for all groundwater samples collected will include iron, lead, chromium, cadmium and TCL VOCs. compounds. Four groundwater samples collected from monitoring wells MW-202, MW-204, MW-210B, and MW-213 will also be analyzed for the presence of organochloride pesticides and PCBs in the first round. The second round will include a similar analysis for the sample obtained from MW-106. The analyses are to confirm the fact that no pesticides or PCBs were detected during the NACIP Step IA Verification Study. If pesticides or PCBs are detected, additional analyses of the other wells at Sites 1, 2 and 3 will be necessary.

Five of the groundwater samples collected from the new wells will be analyzed for the presence of semi-volatile organic compounds. These samples will be collected from monitoring wells MW-204, MW-206B, MW-210B, MW-212, and MW-213. The second round sampling will also include analysis of samples obtained from 3 existing wells, MW-103, MW-104 and MW-106, in addition to samples from the five new wells for semi-volatile organic TCL compounds. The analysis of groundwater from MW-103, MW-104 and MW-212 is to investigate an anomalous level of total organic halogens (TOX) detected during the NACIP Step IA Verification Study. If levels of semi-volatile organic compounds (SVOCs) are detected in these monitoring wells, then additional groundwater sampling and analysis for SVOCs may be necessary. A more detailed description of the laboratory analytical program is presented in Section 2.5.

Subsequent to groundwater sampling, aquifer testing will be conducted in monitoring wells using rising and/or falling head test methods. This data will develop information on hydraulic conductivity of the aquifers tested. Water level observations surveyed to a known datum will provide hydraulic gradients and this information combined with the aquifer testing data will allow an assessment of groundwater flow direction and rate.

2.2.4 Surface Water and Sediment Sampling Program

The purpose of the surface water sampling is to assess the impact of Sites 1, 2 and 3 on the water quality of Mere brook and to evaluate whether these impacts pose a potential threat to human health or the environment. The surface water and sediment sampling program described in this section includes quantities of samples, sampling locations and parameters for laboratory chemical analysis.

The sampling program for Mere Brook is an expansion of the plan followed in the NACIP Step IA Verification Study. The locations are presented in Figure 4. Surface water sampling will be conducted during low flow conditions to reduce the dilution effect of high runoff. The original surface water sampling locations (SW-001 through SW-004) will be resampled. Three additional sampling points, located downstream of the sites, will be sampled to detect shallow groundwater discharge from Site 1 to Mere Brook and Merriconeag Stream. Two additional sample points will be located upstream of SW-001 to determine the contribution from potential upgradient sources. Surface water samples collected for laboratory chemical analysis will be analyzed for the presence of iron, lead, chromium, cadmium and volatile organic TCL compounds.

Sediment samples will be taken from all surface water sampling locations, including the original surface water sampling locations (SW-001 through SW-004). In addition, a sediment sample will be taken from the deeper portion of Beaver Pond, which is downstream of Sites 1,2 and 3. Sediments samples collected for laboratory chemical analysis will be analyzed for the presence of iron, lead, chromium, cadmium, and TCL VOCs.

2.2.5 Stream Gauging and Location of Surface Seeps

To provide a monitor of flow conditions on Mere Brook and the impact of runoff from adjacent Taxiway No. 1, two stream gauging stations will be established on Mere Brook. These stream gauging stations will identify low flow conditions

appropriate for the surface water sampling programs for Mere Brook. The locations of the stream gauging stations are shown on Figure 4.

To evaluate the impact of surface seeps associated with Sites 1, 2, and 3 and potential contamination of Mere Brook, a field reconnaissance program will be undertaken to locate and sample surface seeps. Up to five seeps will be sampled from the embankments between the Mere Brook and Sites 1 and 3, while up to 2 seeps will be sampled from terrain between Site 2 and Mere Brook. Samples of both surface water and sediment will be collected for chemical analysis from each seep and analyzed for the presence of iron, lead, chromium, cadmium and TCL VOCs.

2.2.6 Additional Comments

Mere Brook and Merriconeag Stream are tributaries of Harpswell Cove, a Marine estuary. The characterization of potential impacts, posed by Sites 1, 2 and 3 on the estuary habitats of Harpswell Cove are not considered warranted at this time in view of the concentrations of chemicals detected in surface water. However, if subsequent water quality data indicates contaminant concentrations are high enough to cause a potential impact on wildlife, considering dispersion, dilution and partitioning, a critical habitat risk assessment may be necessary. Such an assessment is not included as part of this program and will be proposed at a later date, if necessary.

2.3 TASK 3 - EXPLORATION AND SAMPLING PROGRAM - EXTENDED SI STUDIES AT SITES 4, 7, 8 AND 9

Due to the detection of low levels of chemicals in the groundwater or an incomplete site understanding, four of the sites studied previously by Jordan have been recommended for additional SI study under the Extended Services (Task E1) of the IR Program.

Due to small hydraulic gradients encountered at Site 4, the groundwater flow direction is not clearly understood although it appears to move toward the southwest. The purpose of additional study at this site is to; 1) determine the direction of groundwater flow; 2) monitor the groundwater quality to confirm or deny the presence of lead, TCL VOCs and SVOCs, and PCBs downgradient from the suspected disposal pit location; and 3) sample and characterize the source of hazardous substances. To help locate the position of this site, historic aerial photographs will be obtained.

The groundwater surface at Site 7 is not well-defined, although, it appears to slope downward to the south-southeast. In addition the exact location of the source is poorly known. The purpose of additional study at this site is to; 1) determine the direction of groundwater flow; 2) monitor the groundwater quality for the presence of lead, TCL VOCs and SVOCs, and PCBs downgradient from the suspected disposal pit location; and 3) provide a better definition of source location. To assist in source location, historic aerial photographs of the site will be obtained and reviewed.

Site 8 requires further study under the SI Extended Services due to the presence of heavy metals that exceed USEPA National Interim Primary Drinking Water

Standards (lead and chromium) in shallow groundwater and the site's proximity to the City of Brunswick's Jordan Avenue Wellfield. The purpose of additional study is to; 1) monitor the deep groundwater for the presence of contamination; 2) determine the significance of contaminants detected in the shallow and deep groundwater; and 3) assess the impact of this site on surface water quality.

Site 9 requires additional study under the SI Extended Services due to the presence of TCL VOCs detected in surface water, and mercury detected in the groundwater. The purpose of the program is to better define the source of the chemicals, i.e., groundwater at Site 9 or surface runoff from the runway area.

The following exploration and sampling program sections describe in detail the methods and rationale to be used at each site for:

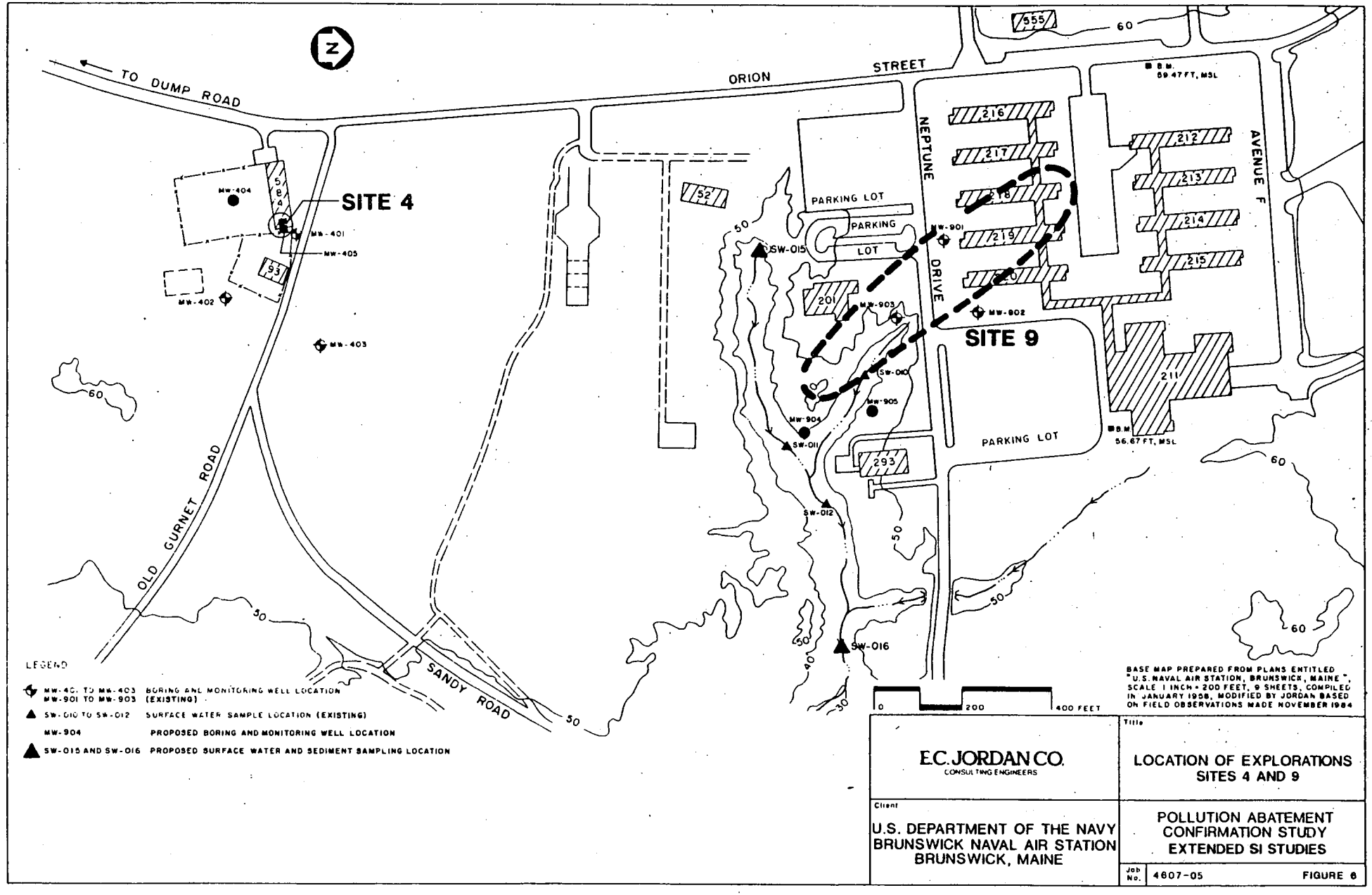
- soil borings;
- soil sampling and analysis;
- monitoring well installation and development;
- groundwater, surface water, and sediment sampling and analysis; and
- aquifer testing.

2.3.1 Site 4 - Exploration and Sampling Program

The purpose for this investigation is to more fully understand the source locations, the groundwater flow direction, and confirm the absence of chemicals analyzed for in the groundwater. Locations of explorations are presented in Figure 6. The exploration and sampling program for Site 4 will include two soil borings, three analytical soil samples, two monitoring well installations and five analytical groundwater samples.

Since the location of Site 4 is presently under Building 584, aerial photographs taken prior to the erection of Building 584 will be procured to assist in site location. Upon locating Site 4 from the aerial photographs, a test boring and groundwater table monitoring well will be installed to characterize the source. If necessary, the possibility of installing a boring and monitoring well through the floor of Building 584 extension to help characterize the source will be discussed with NAS Brunswick command. In addition to the soil boring and monitoring well located at the source, a downgradient soil boring will be installed. Soil samples will be collected for laboratory analysis of lead, TCL VOCs and SVOCs, organochloride pesticides, and PCBs.

The soil borings will be advanced 30 feet below ground surface using the selected techniques with split-spoon soil samples collected at 5-foot intervals using standard penetration test techniques. Three soil samples will be selected for laboratory chemical analysis based on screening with a photoionization meter and visual evidence of contamination. The three soil samples will be analyzed for the presence of lead, TCL VOCs, organochloride pesticides and PCBs. Subsequent to the soil boring and sample collection, a monitoring well will be installed in the completed borehole with a 10-foot wellscreen placed in the shallow permeable aquifer above the marine sediments encountered in previous explorations at the site. A summary of estimated quantities for monitoring well installations is presented in Table 2.



E.C. JORDAN CO.
CONSULTING ENGINEERS

Client
U.S. DEPARTMENT OF THE NAVY
BRUNSWICK NAVAL AIR STATION
BRUNSWICK, MAINE

Title
LOCATION OF EXPLORATIONS
SITES 4 AND 9

POLLUTION ABATEMENT
CONFIRMATION STUDY
EXTENDED SI STUDIES

Job No. 4607-05 FIGURE 8

TABLE 2
SUMMARY OF ESTIMATED QUANTITIES FOR
MONITORING WELL INSTALLATION AT SITES 4, 7, 8 AND 9
EXTENDED SI STUDY
BRUNSWICK NAVAL AIR STATION

SITE NO.	MONITORING WELL NO.	ESTIMATED DEPTH (FT)	NUMBER OF ANALYTICAL SOIL SAMPLES	WELL MATERIALS 2" PVC SCREEN (FT)	WELL MATERIALS 2" PVC RISER (FT)
SITE 4	MW-404	30	3	10	20
	MW-405	30	2	10	20
SITE 7	MW-704	30	3	10	20
	MW-705	30	3	10	20
	MW-706	20	3	10	10
SITE 8	MW-805	50	2	10	40
	MW-806	50	2	10	40
	MW-807	30	2	10	20
	MW-808	50	2	10	40
SITE 9	MW-904	30	2	10	20
	MW-905	30	2	10	20
	TOTAL	380	26	110	270

NOTES:

1. MW-904 is an optional monitoring well contingent on results of surface water laboratory chemical analysis.

2. Soil samples will be obtained using a split spoon sampler at 5-foot intervals.

The monitoring wells, once installed, will be developed by pumping to establish a good hydraulic connection between the well and the aquifer. At least two weeks following well development, groundwater samples will be collected from the new monitoring wells MW-404 and MW-405. Subsequent events will also include obtaining samples from all three existing monitoring wells (MW-401, 402 and MW-403). Chemical analysis of the groundwater collected will include lead, TCL VOCs and SVOCs, organochloride pesticides and PCBs. Analytical methods to be used are described in Section 2.5. Aquifer testing of the new monitoring wells (MW-404 and MW-405) will be conducted using rising and/or falling head test methods following groundwater sampling.

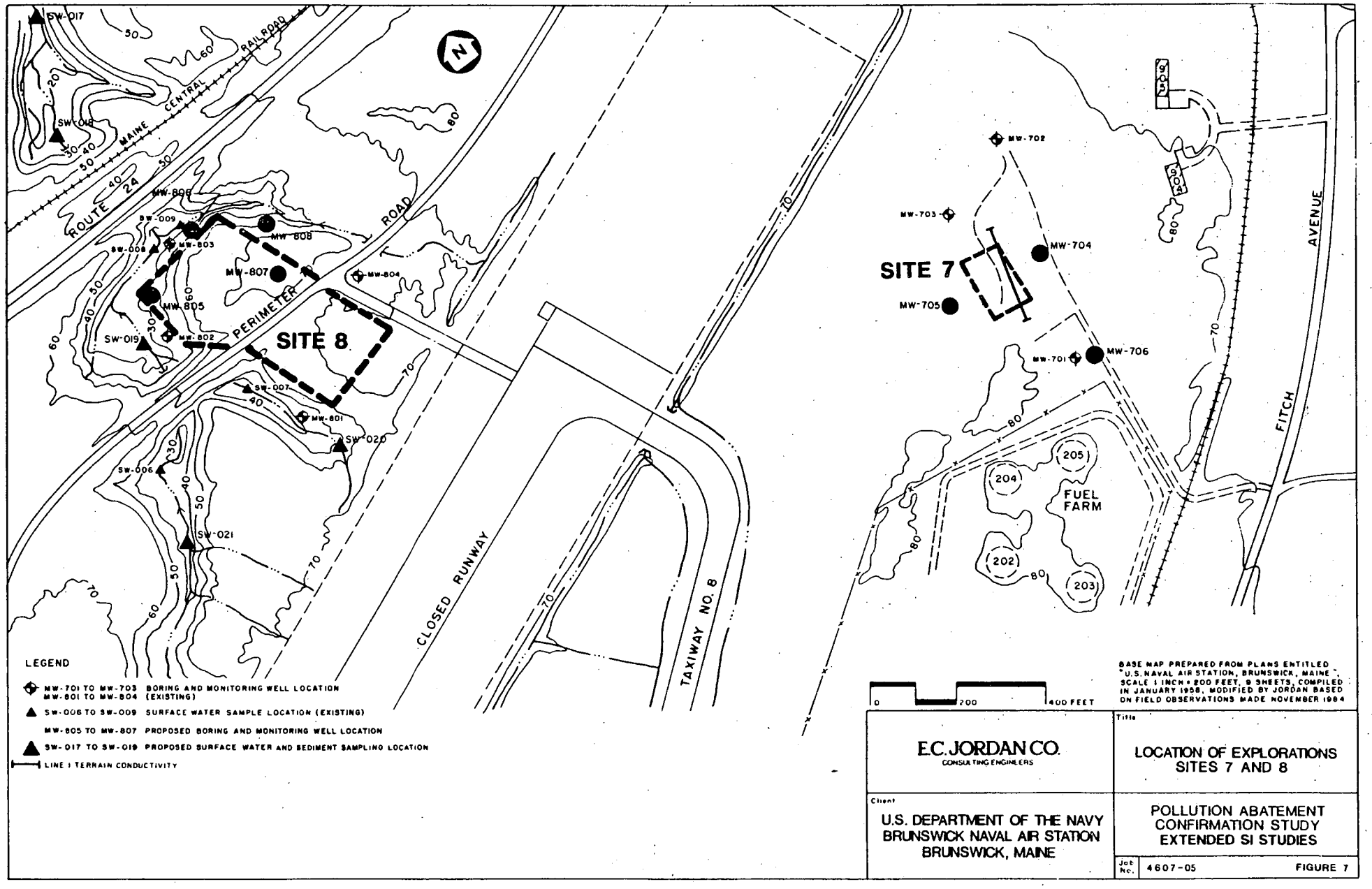
2.3.2 Site 7 - Exploration and Sampling Program

The purpose for the investigation at Site 7 is to provide a better understanding of source location, to determine groundwater flow direction, and confirm the absence of target hazardous materials in the groundwater. To provide a better understanding of source location aerial photographs will be procured and a geophysical study including both terrain conductivity and a ground penetrating radar surveys will be conducted. The groundwater flow direction and analytical sampling will be supported by an exploration and sampling program. The exploration and initial sampling program for Site 7 will include three soil borings, nine analytical soil samples, three monitoring well installations and three analytical groundwater samples. Subsequent sampling events will also include obtaining groundwater samples from the previously installed wells. Locations of explorations are presented in Figure 7.

To provide a better understanding of site location, a geophysical program including both terrain conductivity and ground penetrating radar will be conducted. Initially, a terrain conductivity survey will be conducted on a grid pattern centered on the anomaly previously determined on Line 1 in the NACIP Step 1A Verification Study (Figure 7). The terrain conductivity survey will be supplemented by a ground penetrating radar survey to assist in identifying the site location.

Once the geophysical work is completed, the subsurface investigations will be implemented. The soil borings for MW-704 and MW-705 will be advanced 30 feet below ground surface. A shallow well (MW-706) will be installed near MW-701 to depths so as not to penetrate the marine silt and clay layer. Split-spoon soil samples will be collected at 5-foot intervals using the standard penetration test. Three soil samples will be collected from each boring for laboratory chemical analysis based on screening with a photoionization meter and visual observation. The nine soil samples will be analyzed for the presence of lead, TCL VOCs, organochloride pesticides and PCBs. Subsequent to the soil boring and sample collection, the monitoring wells will be installed in each boring with a 10-foot wellscreen in the shallow permeable aquifer above the marine sediments encountered in previous explorations at the site. A summary of estimated quantities for monitoring well installations is presented in Table 2.

The monitoring wells, once installed, will be developed by pumping to establish a good hydraulic connection between the well and the aquifer. Water level readings in the wells will be measured with a wetted tape. At least two weeks following well development, groundwater samples will be collected for labora



BASE MAP PREPARED FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE", SCALE 1 INCH = 200 FEET, 8 SHEETS, COMPILED IN JANUARY 1958, MODIFIED BY JORDAN BASED ON FIELD OBSERVATIONS MADE NOVEMBER 1984

E.C. JORDAN CO.
CONSULTING ENGINEERS

Title: LOCATION OF EXPLORATIONS SITES 7 AND 8

Client: U.S. DEPARTMENT OF THE NAVY
BRUNSWICK NAVAL AIR STATION
BRUNSWICK, MAINE

POLLUTION ABATEMENT CONFIRMATION STUDY
EXTENDED SI STUDIES

Job No. 4607-05 FIGURE 7

tory chemical analysis (including at least one downgradient well), which will include lead, TCL VOCs and SVOCs, organochloride pesticides and PCBs. Analytical methods to be used are described in Section 2.5. Aquifer testing using rising and/or falling head test techniques will be conducted following groundwater sampling.

2.3.3 Site 8 - Exploration and Sampling Program

The purpose of the investigation is to assess the areal distribution of waste deposited at this site; monitor the deep groundwater downgradient of the site for the presence of contamination; assess the significance of the chemicals detected in the shallow and deep groundwater; and determine whether a RI Study of this site is warranted. The exploration and sampling program for Site 8 will include a magnetometer survey, four soil borings, eight soil samples, four monitoring wells, eight groundwater samples, nine surface water and sediment samples, and a field reconnaissance to investigate, identify, and sample seeps into tributaries of the Androscoggin River that may be impacted by the site.

A five day magnetometer survey will be conducted at Site 8 to assess the areal distribution of wastes deposited at this site. This information will be used to optimize the locations of monitoring wells and surface water/sediment sampling locations and confirm the present location which is based on historical information and the NACIP Initial Assessment Study.

Three of the soil borings will be advanced to a depth of approximately 50 feet below ground surface and one boring to a depth of 30 feet. Split-spoon soil samples will be collected at 5-foot intervals using a standard penetration test. The locations of explorations are presented in Figure 7. Two soil samples will be collected from each boring for laboratory chemical analysis based on screening with a photoionization meter and visual observation. Soil samples submitted to the laboratory will be analyzed for TCL VOCs and general water quality parameters. Analytical methods to be used are presented in Section 2.5.

A monitoring well will be installed in each of the 4 borings subsequent to completion. Installation of monitoring wells will comply with 40 CFR § 265 Subpart F. Typical monitoring well installation details are presented in Figure 5 and a summary of estimated quantities for monitoring well installation is presented in Table 2. The new boring/monitoring well installations will be located near the existing shallow monitoring wells to form multi-level paired well locations and, thereby, allow an assessment of vertical gradients to be used for the evaluation of deep groundwater migration pathways. Monitoring wells will be developed to establish good hydraulic connections between the wells and the aquifer, by pumping and/or surge block techniques. At least two weeks following monitoring well development, a groundwater sample will be collected from the four new monitoring wells. Subsequent sampling events will include obtaining samples from both the new and existing wells for laboratory chemical analysis.

Groundwater samples collected for laboratory chemical analysis will be analyzed for iron, lead, chromium, cadmium, mercury and TCL VOCs and general water quality parameters. Groundwater samples collected from MW-803, MW-806 and

MW-807 will also be analyzed for the presence of TCL SVOCs. Analytical methods and a summary of the analytical program are presented in Section 2.5.

The purpose of the surface water and sediment sampling is to assess the impact the site may have on the surface water quality in the stream adjacent to the site which is a tributary to the Androscoggin River. The sampling plan suggested is an expansion of the surface water sampling program conducted during Step IA - Verification study. The surface water and sediment sampling locations are presented in Figure 7. In addition to the four original sampling locations, five additional locations will be sampled for laboratory chemical analyses. Sediment samples will be collected at all surface water sampling locations. Sampling will be conducted during low flow conditions to reduce the potential for dilution effects caused by high surface runoff. Parameters of chemical analysis for surface water and sediment samples will include iron, lead, chromium, cadmium, mercury and TCL VOCs. TCL SVOCs will be analyzed for in samples collected from surface water and sediment sampling locations SW-007, SW-008 and SW-009. Analytical methods and a summary of the analytical program are presented in Section 2.5.

To further investigate the impact of the site on surface water quality, a field reconnaissance will be conducted to identify and sample surface seeps in the tributaries of the Androscoggin River adjacent to the site. Up to three of the identified seeps will be sampled for laboratory analysis. Both surface water and sediment samples will be collected and analyzed for iron, lead, chromium, cadmium, mercury, TCL VOCs and general water quality parameters.

2.3.4 Site 9 - Exploration and Sampling Program

Site 9 has been recommended for additional study under the SI Extended Services Program due to the presence of detectable concentrations of VOCs in surface water and mercury in the groundwater. The purpose of the proposed program is to better define the source of these chemicals, i.e. groundwater from Site 9 or surface runoff from the runway area and to confirm whether mercury is present in the groundwater. The addendum program will consist of five surface water and sediment samples, two groundwater samples (subsequent sampling will include samples from the new and existing wells), two borings/monitoring wells, four soil samples and a sediment sample from the deeper portions of the pond near the Meadow Cemetery.

Four of the five surface water and sediment sampling locations are shown on Figure 6. The fifth sample will be obtained from the pond adjacent to Meadow Cemetery. Five samples are proposed to monitor variations in concentrations of TCL VOCs and selected metals and the dilution of contaminants in surface water with distance from the site.

The results of chemical analyses of surface water and sediment samples will assess whether the contaminant source is groundwater beneath Site 9 or the surface water drainage system from the runway area. Two soil borings and monitoring wells (MW-904 and MW-905) will be installed at Site 9 and are anticipated to monitor the shallow groundwater downgradient of the site and upgradient of Merriconeag Stream. The locations of the boring/monitoring wells are presented on Figure 6. The two borings will extend 30 feet below the

ground surface and a monitoring well installed in each with a 10-foot wellscreen set near the surface of the water table. Two soil samples taken from each boring will be analyzed for TCL VOCs. The monitoring well installation will comply with 40 CFR § 265. A typical monitoring well installation detail is presented in Figure 5 and a summary of estimated monitoring well quantities is presented in Table 2. The monitoring wells will be developed by pumping and groundwater sampling will be conducted at least two weeks after development.

Groundwater samples will be collected from the existing wells and the new wells at Site 9 and analyzed for mercury, iron, lead, chromium, cadmium, and TCL VOCs. Subsequent sampling events will include obtaining samples from both the new and existing monitoring wells. Analytical methods and a summary of the analytical program are presented in Section 2.5. Subsequent to sampling rising and/or falling head tests will be conducted on the new wells to determine aquifer permeability.

2.4 TASK 4 - SURVEY

The location of completed monitoring wells, test pits and surface water sampling points will be identified on available topographic maps of the sites which are to be provided by the Navy. The elevation of the wells, test pits and surface water sampling points will be surveyed to the nearest 0.01 feet and referenced to BNAS datum.

2.5 TASK 5 - ANALYTICAL PROGRAM

Samples of soil or water selected for analytical testing will be chemically analyzed to identify and quantify the chemical contaminants detected for each analytical method. A summary of the analytical program is given in Table 3. The analyses specified for each sample type were chosen based on the type of waste reported to have been disposed of at each site according to the IAS, those compounds detected in the NACIP Step IA - Verification Step, and on the basis of Jordan's negotiations with the Navy.

Analysis for specific chemical parameters will identify the detectable presence of the primary hazardous materials known to be present on-site. The specific methods of analyses to be used are presented in Tables 4 and 5. Analyses will be performed for iron which, because it is a mobile element, may provide an indication of paths of groundwater flow. Analyses for other metals (Pb, Cr, Cd, Hg) will be performed at sites suspected of receiving plating or paint sludges or which may contain metal wastes. A background sample of surface water will collected in the BNAS area to establish background levels of metals.

TCL VOC analysis will identify and quantify many of the solvents commonly used in metal degreasing operations. Both trichloroethylene and toluene detected in earlier studies will be identified by this analysis. These chemicals which are mobile in groundwater systems, were reportedly disposed of in large quantities at BNAS. Since they may be present in both water and soil, both media will be tested for VOCs.

TABLE 3
SUMMARY OF CHEMICAL ANALYSIS
RI AND EXTENDED SI STUDIES
POLLUTION ABATEMENT CONFIRMATION STUDY
BRUNSWICK NAVAL AIR STATION

SAMPLE SOURCE	MEDIA	IRON	LEAD	MERCURY	CHROMIUM	CADMIUM	VOC	PEST PCB	SEMI VOC	GENERAL WATER QUALITY
SITE 1,2 AND 3	BORING (SOIL)	--	--	--	--	--	30	7	--	--
	GROUNDWATER	17(24)	17(24)	--	17(24)	17(24)	17(24)	4(5)	5(8)	--
	SURFACE WATER	9	9	--	9	9	9	--	--	--
	TEST PIT (SOIL)	--	--	--	--	--	12	12	--	--
	SEDIMENT	10	10	--	10	10	10	--	--	--
	SEEPS (SEDIMENT)	7	7	--	7	7	7	--	--	--
	SEEPS (WATER)	7	7	--	7	7	7	--	--	--
SITE 4	BORING (SOIL)	--	5	--	--	--	5	5	5	--
	GROUNDWATER	--	2(5)	--	--	--	2(5)	2(5)	2(5)	--
SITE 7	BORING (SOIL)	--	9	--	--	--	9	9	--	--
	GROUNDWATER	--	3(6)	--	--	--	3(6)	3(6)	3(6)	--
SITE 8	BORING (SOIL)	--	--	--	--	--	8	--	--	--
	GROUNDWATER	4(8)	4(8)	4(8)	4(8)	4(8)	4(8)	--	3(3)	4(8)
	SURFACE WATER	9	9	--	9	9	9	--	9	--
	SEDIMENT	9	9	--	9	9	9	--	9	--
	SEEPS (SEDIMENT)	3	3	--	3	3	3	--	3	--
	SEEPS (WATER)	3	3	--	3	3	3	--	3	--
SITE 9	BORING (SOIL)	--	--	--	--	--	4	--	--	--
	GROUNDWATER	2(5)	2(5)	2(5)	2(5)	2(5)	2(5)	--	--	--
	SURFACE WATER	5	5	5	5	5	5	--	--	--
	SEDIMENT	6	6	6	6	6	6	--	--	--
SUBTOTAL	SOIL/SEDIMENT	28	42	6	28	28	96	33	--	--
	WATER	4(53)	54(64)	11(18)	49(63)	49(63)	54(64)	9(16)	25(33)	4(8)
DUPLICATES	SOIL/SEDIMENT	3	4	1	3	3	10	4	2	--
	WATER	5(7)	6(7)	2(2)	5(7)	5(7)	6(7)	1(2)	3(4)	1(1)
SAMPLER BLANKS (WATER)		1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	--
BACKGROUND (SURFACE WATER)		1(1)	1(1)	--	1(1)	1(1)	--	--	--	--
FILTRATION BLANK (WATER)		1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	1(1)	--
DRILL WATER BLANKS		3(3)	3(3)	3(3)	3(3)	3(3)	3(3)	3(3)	3(3)	--
TRIP BLANKS (WATER)		--	--	--	--	--	5(5)	--	--	--

TABLE 3 (continued)
SUMMARY OF CHEMICAL ANALYSIS
RI AND EXTENDED SI STUDIES
POLLUTION ABATEMENT CONFIRMATION STUDY
BRUNSWICK NAVAL AIR STATION

SAMPLE SOURCE	MEDIA	IRON	LEAD	MERCURY	CHROMIUM	CADMIUM	VOC	PEST PCB	SEMI VOC	GENERAL WATER QUALITY
SUBTOTAL	SOIL/SEDIMENT	31	46	7	31	31	106	37	14	--
	WATER	58(74)	71(77)	18(25)	60(76)	60(76)	69(80)	15(23)	33(42)	10(14)
MS/MSD	SOIL/SEDIMENT	3	5	1	3	3	11	4	2	--
	WATER	6(8)	8(8)	2(3)	6(8)	6(8)	7(8)	2(3)	4(5)	1(2)
TOTAL	SOIL/SEDIMENT	34	51	8	34	34	117	41	16	--
	WATER	66(84)	79(85)	20(28)	66(84)	66(84)	76(88)	17(25	37(47)	11(16)

Note: Numbers in parenthesis reflect sample quantities for sampling rounds subsequent to the initial round of sampling and analysis for the new wells. The subsequent rounds of sampling will include samples being obtained from both the new and existing wells, commencing 3 months after collection of the initial round of samples.

TABLE 4
LABORATORY ANALYTICAL PROCEDURES
POLLUTION ABATEMENT CONFIRMATION STUDY
RI AND SI EXTENDED STUDIES
CHARACTERIZATION - BRUNSWICK NAVAL AIR STATION

Media	Parameter	Method	Reference
Soils	Volatile Organic	Purge and Trap/ GC/MS	CLP-COP
	Pesticides and PCB's	GC	CLP-COP
	Lead	AA	CLP-CIP
	Semivolatile Organic B/N/A	GC/MS	CLP-COP
Surface Water Groundwater	Volatile Organic	GC/MS	CLP-COP
	Semivolatile Organic B/N/A	GC/MS	EPA Method
	Pesticides and PCB's	GC	CCP-COP
	Cd, Cr, Fe, Hg, Pb	AA/PES	CLP-CIP
	pH (field)	Potentiometric	EPA Method 150.1
	Specific Conductance (field)	Conductance	EPA Method 120.1

GC/MS - Gaschromatography/mass spectrometry
CLP-COP - Contract Laboratory Program - Caucus Organic Protocol
CLP-CIP - Contract Laboratory Program - Caucus Inorganic Protocol
AA - Atomic Absorption Spectrometry
PES - Plasma Emission Spectroscopy
B/N/A - Base/Neutral/Acid
EPA Method - Methods for the Chemical Analysis of Water and Wastes, USEPA 600/4-79-028, March 1983.

TABLE 5
LABORATORY ANALYTICAL PROCEDURES
GENERAL WATER QUALITY
POLLUTION ABATEMENT CONFIRMATION STUDY
RI AND SI EXTENDED STUDIES
CHARACTERIZATION - BRUNSWICK NAVAL AIR STATION

MEDIA	PARAMETERS	METHOD	REFERENCE
Surface Water/ Groundwater	Total dissolved solids	Gravimetric	EPA 160.1
	Chloride	Titrimetric	EPA 325.1-3
	Sulphate	Turbidimetric	EPA 375.1-4
	Nitrate	Colorimetric	EPA 353.1-3
	Iron	*	*
	Manganese	*	*
	Copper	*	*
	Zinc	*	*
	Boron	Colorimetric	EPA 212.3
	Hydrogen Sulfate	Titrimetric	EPA 376.1-2
	Arsenic	*	*
	Barium	*	*
	Cadmium	*	*
	Chromium (Cr^{IV})	Chelation-Extraction*	*
	Selenium	*	*
	Antimony	*	*
	Lead	*	*
	Mercury	*	*
	Fluoride	Potentiometric	EPA 340.1-3
	Cyanide	*	*
	Endrine	*	*
	Lindane	*	*
	Methoxychlor	*	*
	Toxaphene	*	*
	2,4-D	Gas Chromatography	SM 509B
	2,4,5-TP silvex	Gas Chromatography	SM 509B
	Phenols	Colorimetric	EPA 420.1-3
	Synthetic detergents (MBAS)	Colorimetric	EPA 425.1
	Total chloroform Bacteria	Standard Plate Count	SM 909A

EPA - Methods for the Chemical Analysis of Water and Wastes, USEPA 600/4-79-020, March 1983
SM - Standard Methods for the Examination of Water and Wastes, 16th Edition
* - Analyzed under TCL procedures (see Table 4).

Analysis of PCBs and pesticides will be limited to those sites where the IAS identified possible past disposal of PCB contaminated transformer oils and pesticides. PCBs accumulate primarily on soil, so most PCB analyses will be performed on soil samples. However, water samples will also be tested because PCBs are soluble to a limited extent, and detection limits are much lower in the liquid phase.

The TCL acid and base neutral extractable organic compounds, also known as semi-volatile organics (SVOCs) comprise a broad range of hazardous organic compounds including phenolics, polyaromatics and phthalates. Review of available information suggest such compounds had limited use at BNAS. However, their presence has been detected and some disposed waste materials may have contained these compounds. To confirm the presence of these materials, provision has been made for SVOC analyses at Sites 1, 2,3 and 7 where these components may exist. These analyses will be limited to the indicated number of samples at each site which, by initial inspection, are found to be most highly contaminated.

To increase the statistical significance of groundwater data at BNAS, all monitoring wells will be sampled and analyzed a total of three times at three month intervals.

2.6 TASK 6 - EVALUATION AND DRAFT REPORT

Because of the three complete rounds of groundwater sampling at three month intervals, a final evaluation and reporting effort will not be started until seven (7) months after the initial round of sampling. However, interim reports will be completed after receipt of the first and second rounds of laboratory analytical results. These reports will include the results, a discussion of any significant findings and any interim recommendations that may be conclusively drawn from the findings.

The final evaluation of Sites 1, 2, and 3, and 4, 7, 8 and 9 will be presented in two separate draft and final reports as described in the following sections.

2.6.1 RI Study

To meet the objective of the RI Studies, Jordan will review the data developed during the SI and RI investigations and will make a quantitative assessment of detectable contamination. Actual versus potential migration from Sites 1, 2 and 3 and the threat posed to human health and the environment will be evaluated to make recommendations for alternative remedial actions and monitoring programs.

Field data, the approach used to evaluate areas requiring remedial actions (if any), and evaluations developed in support of these recommendations will be presented in the RI Draft Report.

2.6.2 SI Extended Studies

Jordan will evaluate the data gathered during this and previous investigations to assess whether Sites 4, 7, 8, and 9 should be eliminated from further study or recommended for further RI investigations.

2.7 TASK 7 - FINAL REPORT

Subsequent to the Navy's review of the RI draft report, a meeting will be held at Brunswick Naval Air Station in Brunswick, Maine to discuss written comments provided by the Navy. The purpose of this meeting will be finalizing changes to the draft report. A final RI report will be completed by Jordan following this meeting.

The SI Extended Study draft report results will also be reviewed by the Navy and a meeting held at BNAS to finalize written comments. Once comments are finalized they will be inserted into the SI Extended Report issued in June of 1985 and the report will be reissued.

2.8 TASK 8 - MEETINGS AND PRESENTATIONS

One site meeting will be held at the base after completion of the geophysics program for the purpose of discussing implementation of the remainder of the exploration program. Pursuant to discussions with Navy officials, no additional meetings or presentations other than the meeting at BNAS to discuss the draft report comments and the exploration program will be required, therefore, none are included in the scope of this work plan.

3.0 SCHEDULE

The schedule for this work is presented in Figure 8 and is contingent upon notification to proceed from the Navy. Notification to proceed should include a signed contract between Jordan and the Navy.

The schedule illustrated in Figure 8 is approximate. If authorization is received during the spring of 1988, optimum field conditions will exist. However, the schedule may be still influenced by factors over which Jordan has no control. These factors would include the following:

- weather conditions during field work;
- constraints on working hours due to BNAS security in restricted areas (Sites 1, 2 and 3); and
- time necessary for review of draft documents by the Navy, BNAS and regulatory agencies.

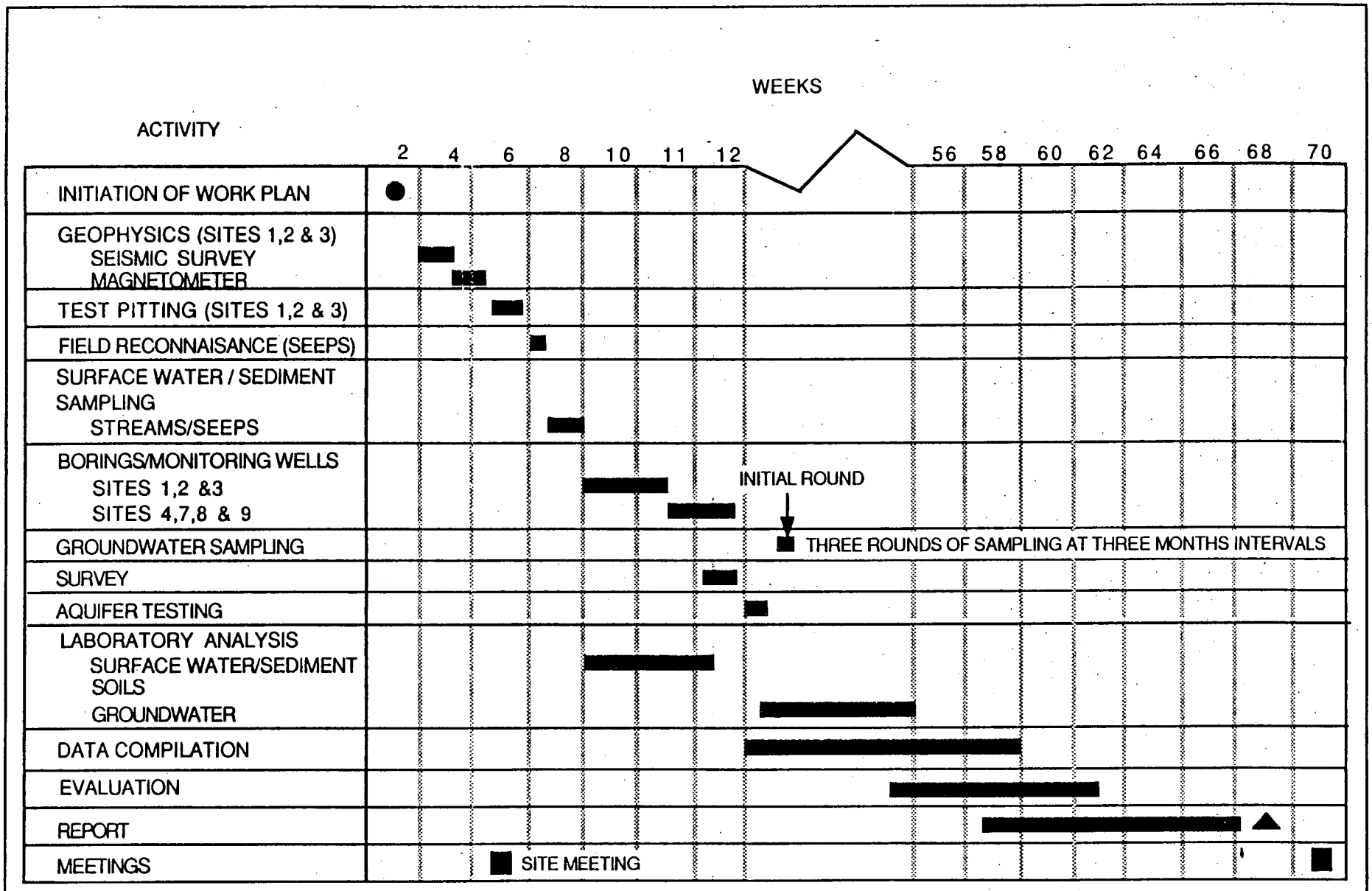


FIGURE 8
PROJECT SCHEDULE
BRUNSWICK NAVAL AIR STATION
E.C. JORDAN CO.