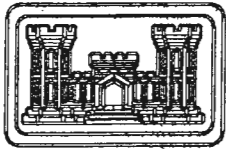


U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA

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DRAFT FINAL

SEAD-4

PROJECT SCOPING PLAN FOR PERFORMING A
CERCLA REMEDIAL INVESTIGATION/FEASIBILITY
STUDY (RI/FS) AT THE MUNITIONS WASHOUT FACILITY
AND LEACH FIELD, SENECA ARMY DEPOT ACTIVITY

JULY 1996

**PROJECT SCOPING PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
AT SEAD-4
SENECA ARMY DEPOT ACTIVITY
ROMULUS, NEW YORK**

Prepared For:

**Seneca Army Depot Activity
Romulus, New York**

Prepared By:

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Appendix F	Scope of Work
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LIST OF ACRONYMS

AA	Atomic absorption
AMC	U.S. Army Material Command
AN	Army-Navy
AOC	Area of Concern
APCS	Air Pollution Control System
AQCR	Genesee-Finger Air Quality Control Region
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
atm	atmosphere
BCF	Bioconcentration Factor
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
C	Celsius
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
cm	Centimeters
cm/sec	Centimeters per second
COD	Chemical Oxygen Demand
Cr	Chromium
CaCO ₃	Calcium Carbonate
CRT	Cathode ray tube
DARCOM	Development and Readiness Command
DERA	Defense Environmental Restoration Account
DO	Dissolved oxygen
DOT	Department of Transportation
DQO	Data Quality Objective
DRMO	Defense, Revitalization and Marketing Office
Eh	Oxidation-Reduction Potential
EM-31	Electromagnetic
EPA	Environmental Protection Agency
ESI	Expanded Site Inspection
FS	Feasibility Study
ft	feet

**LIST OF ACRONYMS
(CONT.)**

ft/ft	feet per foot
ft/sec	feet per second
ft/yr	feet per year
GA	Classification: The best usage of Class GA waters is as a source of potable water supply. Class GA waters are fresh groundwaters
GC	Gas chromatograph
gpm	Gallons per minute
GPR	Ground penetrating radar
GRI	Gas Research Institute
GSSI	Geophysical Survey Systems, Inc.
HSWA	Hazardous and Solid Waste Amendments
IAG	Interagency Agreement
kg	kilogram
k_{obs}	psuedo-first-order rate constant
K_{oc}	Organic carbon partition coefficient
K_{ow}	Octanol-water partition coefficient
lb	pound
L/min	Liters per minute
MCL	Maximum Contaminant Level
m	meter
mg	milligram
mg/l	milligram per liter
mg/kg	milligrams per kilogram
MHz	Megahertz
Miniram	Minature Real-Time Aerosol Meter
mL	milliliter
mmhos/m	millimhos per meter
mol	mole
MS	Mass spectrometry
MSL	Mean sea level
mV	millivolts
MW	Monitoring Well
NA	Not analyzed or not available
NBS	National Bureau of Standards

**LIST OF ACRONYMS
(CONT.)**

NGVD	National Geologic Vertical Datum
NO ₂ /N	Nitrite-Nitrogen
NO ₃ /N	Nitrate-Nitrogen
NPL	National Priority List
NTU	Nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
OB	Open Burning
OD	Open Detonation
OVM	Organic Vapor Meter
Pb	Lead
PAH	Polynuclear Aromatic Hydrocarbon
Parsons ES	Parsons Engineering Science, Inc.
PCB	Polychlorinated biphenyls
PEP	Propellants, Explosives, Pyrotechniques
PID	Photoionization detector
ppm	parts per million
ppmv	parts per million per volume
PSCR	Preliminary Site Characterization Report
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RAGS	EPA Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RF	Response factor
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RQD	Rock Quality Designation
SB	Soil boring
SCS	Soil Conservation Service
SD	Sediment sample
SEAD	Seneca Army Depot (old name)
SEDA	Seneca Army Depot Activity
sec	seconds
SOW	Statement of Work
SS	Soil sample

**LIST OF ACRONYMS
(CONT.)**

SVO	Semivolatile Organic Compound
SW	Surface water sample
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TAL	Target analyte list
TCL	Target compound list
TDS	Total dissolved solids
TKN	Total Kjeldah Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TRPH	Total Recovered Petroleum Hydrocarbons
TP	Test Pit
UCL	Upper Confidence Level
$\mu\text{g/g}$	micrograms per gram
$\mu\text{g/kg}$	micrograms per kilogram
$\mu\text{g/mg}$	micrograms per milligram
$\mu\text{g/L}$	micrograms per liter
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VOST	Volatile Organic Sampling Train
Vs	Volt Second

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this Remedial Investigation/Feasibility Study (RI/FS) Project Scoping Plan is to provide site specific information for the RI/FS project at the SEAD-4 operable unit at the Seneca Army Depot Activity (SEDA) in Romulus, NY. This plan outlines work to be conducted at SEAD-4 based upon recommendations specified in the Seven High Priority SWMUs Expanded Site Inspection (ESI) Report (draft final, Parsons ES, 1995). The sites are called SWMUs because the Army elected in their Federal Facilities Agreement to combine RCRA and CERCLA obligations and the Army uses RCRA terms to describe the units.

The Generic Installation RI/FS Workplan that accompanies this document was designed to serve as a foundation for this RI/FS Project Scoping Plan and provides generic information that is applicable to all site activities at SEDA.

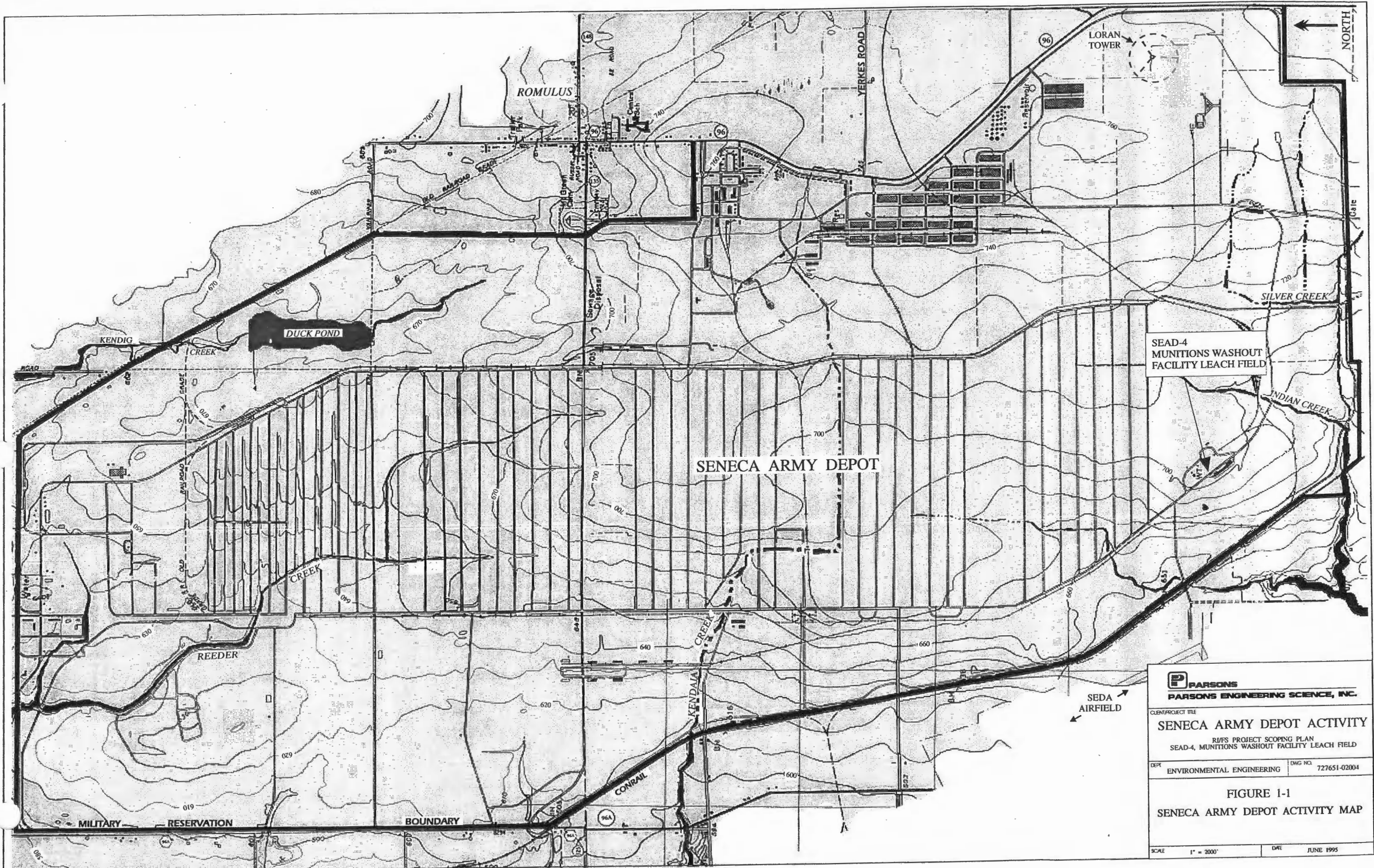
This RI/FS Project Scoping Plan is based upon a conceptual site model that identified potential source areas, release mechanisms, and receptor pathways; determined data requirements for an evaluation of risks to human health and the environment; and developed a task plan to address the data requirements that have been identified. Following the completion of the field investigation, the data will be used as the basis of the risk assessment.

1.2 REPORT ORGANIZATION

The remaining sections of this report are organized to describe the overall site conditions, provide a scoping of the RI/FS and to provide task plans for the RI and FS. Section 2.0, Site Conditions, presents a description of regional geological and hydrogeological conditions. Section 3.0, Scoping of the RI/FS, presents the conceptual site model, the results of previous investigations, potential receptors and exposure scenarios, scoping of potential remedial action technologies, preliminary identification of ARARs, data quality objectives, and data gaps and needs. The task plans for the RI and FS are discussed in Sections 4.0 and 5.0, respectively. Section 6.0, Plans and Management, discusses scheduling and staffing.

1.3 SITE BACKGROUND

SEAD-4 is the Munitions Washout Facility Leach Field located in the southwestern portion of SEDA shown in Figure 1-1. The Munitions Washout Facility was part of the Ammunition Renovation Workshop, which is still in operation. The Munitions Washout Facility was active



PARSONS PARSONS ENGINEERING SCIENCE, INC.	
CLIENT/PROJECT TITLE SENECA ARMY DEPOT ACTIVITY RI/FS PROJECT SCOPING PLAN SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD	
DEPT ENVIRONMENTAL ENGINEERING	DWG NO. 727651-02004
FIGURE I-1 SENECA ARMY DEPOT ACTIVITY MAP	
SCALE 1" = 2000'	DATE JUNE 1995

between 1948 and 1963. The Munitions Washout Building was demolished, and at present, only the foundation of the Munitions Washout Building is visible as shown on the site map in Figure 1-2. Based upon a review of historical information concerning the site, and as a result of work conducted as part of the ESI, it is now believed that a leach field never existed at the site.

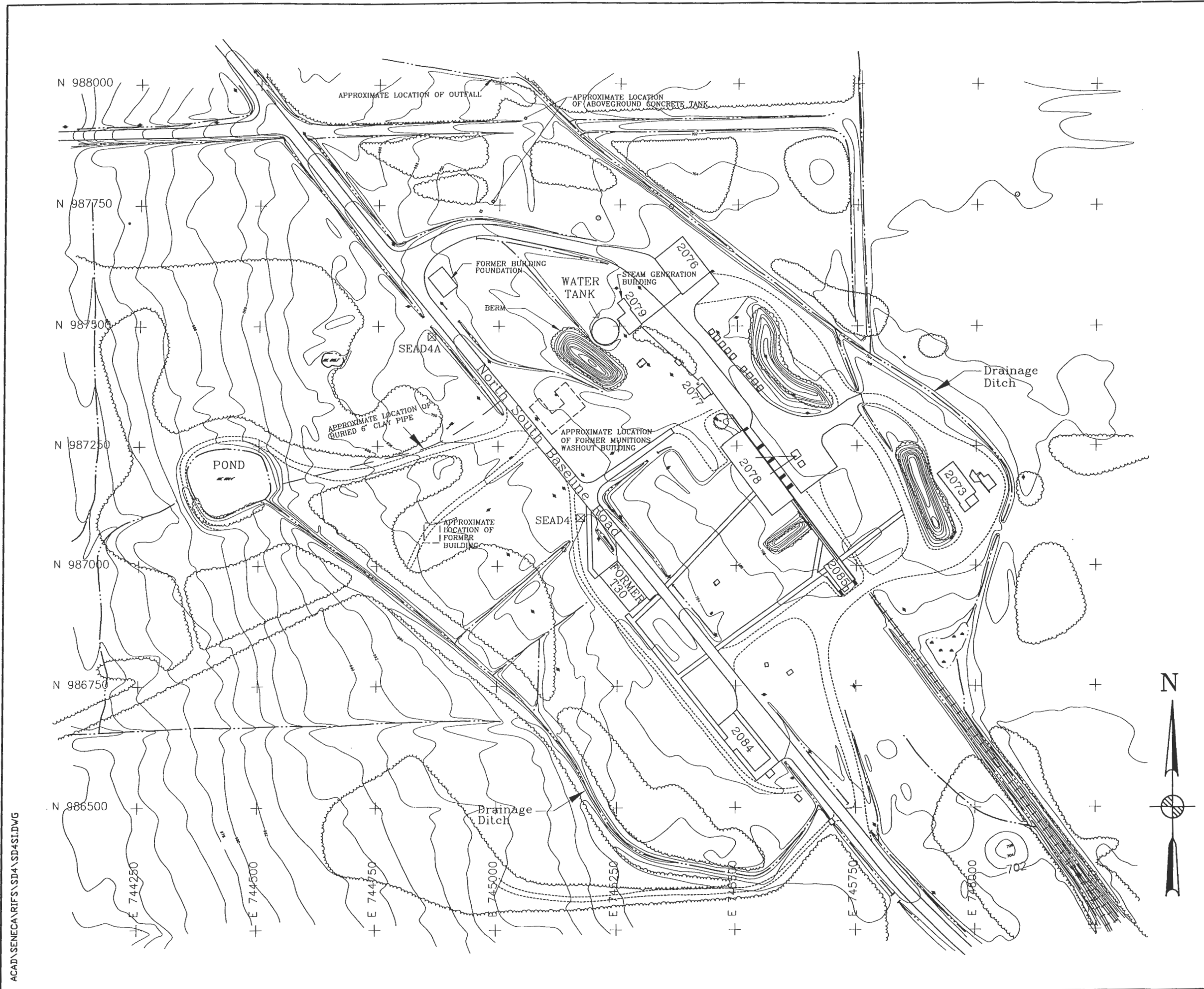
Operations at this facility involved the dismantling of munitions and removing the explosives by steam cleaning. This produced recyclable and non-recyclable explosive solids and wastewater. The details of the operation and the location where the wastewater was discharged are not well understood. However, there is some information on the chemical components of various propellants, explosives, pyrotechnics (PEP), and related items that are thermally treated at the OB/OD grounds at SEDA, and these chemical components are likely to be the same similar to those used in the munitions handled at the Munitions Washout Building. Table 1-1 presents a list of military propellants and corresponding identification numbers. After the PEP has been identified, Table 1-1 is used to determine the chemical composition for any given propellant. Likewise, Table 1-2 is used to determine the chemical composition for any given explosive or pyrotechnic.

The Groundwater Contamination Survey Number 38-26-0868-88 (U.S. Army Environmental Hygiene Agency, 1988) states that the water from the washout operation at SEAD-4 was processed to concentrate the explosives. The concentrated explosives were then shipped to a munitions manufacturing facility and used in new munitions. Although the actual explosive compounds handled at the site are unknown, TNT was probably the primary explosive compound handled.

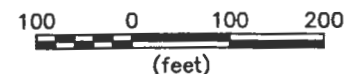
The Groundwater Contamination Survey also stated that after processing, the wastewater was discharged near building 2084 where it either leached into the ground or flowed into a nearby ditch. The wastewater was also possibly discharged into a pond that is located to the west of the facility or discharged into Indian Creek which is also to the west of the facility.

The Munitions Washout Facility Building was removed sometime between 1963 and 1968. This is known only because operations at the building ceased in 1963 and the building does not appear on 1968 air photos taken of SEDA.

Within the past 8 years, the pond to the west of the facility was widened and deepened with a bulldozer. Pond sediment was pushed southwest of the pond to a 400-foot by 150-foot area



LEGEND		
	MINOR WATERWAY	
	MAJOR WATERWAY	
	FENCE	
	UNPAVED ROAD	
	BRUSH LINE	
	LANDFILL EXTENT	
	RAILROAD	
	GROUND SURFACE ELEVATION CONTOUR	
	ROAD SIGN	
	DECIDUOUS TREE	
	GUIDE POST	
	FIRE HYDRANT	
	MANHOLE	
	POLE	
	OVERHEAD UTILITY POLE	



ACAD\SENECA\RIFS\SD4\SD4S1.DWG

PARSONS ENGINEERING SCIENCE, INC.	
CLIENT/PROJECT TITLE	
SENECA ARMY DEPOT ACTIVITY RI/FS PROJECT SCOPING PLAN SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD	
DEPT. ENVIRONMENTAL ENGINEERING	Dwg No. 727851-02004
FIGURE 1-2 SITE MAP	
SCALE 1" = 200'	DATE JUNE 1996
REV C	

TABLE 1-1
COMPOSITION OF PROPELLANT TREATED
BY OPEN BURNING (OB)

Composition (% by wt.)

Propellant Designation	Hazardous Waste ID No.	M1	M2	M5	M6	M7	M8
Chemical							
Nitrocellulose	D001	85.0	77.45	81.95	87.0	54.6	52.15
Nitroglycerin	D001	-	19.50	15.00	-	35.5	43.00
Nitroguanidine	D001	-	-	-	-	-	-
Dinitrotoluene	D001	10.0	-	-	10.0	-	-
Dibutylphthalate	D001	5.0	-	-	3.0	-	-
Diethylphthalate	D001	-	-	-	-	-	3.0
Diphenylamine	D001	1.0*	-	-	1.0	-	-
Ethyl Centralite	D001	-	0.60	0.60	-	0.9	0.60
Barium Nitrate	D001, D005	-	1.40	1.40	-	-	-
Potassium Nitrate	D001	-	-	-	-	7.8	-
Lead Carbonate	D001, D008	1.0**	-	-	-	-	-
Potassium Sulfate	D001	1.0**	-	-	1.0*	-	-
Tin	D001	-	-	-	-	-	-
Carbon Black	D001	-	-	-	-	1.2	-
Graphite	D001	-	0.30	0.30	-	-	-
Cryolite	D001	-	-	-	-	-	-
2-Dinitro-diphenyldiamine	D001	-	-	-	-	-	-
Lead Stearate	D001, D008	-	-	-	-	-	-
Triacetin	D001	-	-	-	-	-	-
Charcoal	D001	-	-	-	-	-	-
Sulfur	D001	-	-	-	-	-	-

Notes: *Added basis
 **Added basis when specified

**TABLE 1-1
(Cont.)**

Composition (% by wt.)

Propellant Designation	M9	M10	M12	M13	M14	M15
Chemical						
Nitrocellulose	57.75	98.00	97.70	57.30	90.00	20.0
Nitroglycerin	40.00	-	-	40.00	-	19.0
Nitroguanidine	-	-	-	-	-	54.7
Dinitrotoluene	-	-	Coating	-	8.00	-
Dibutylphthalate	-	-	-	-	2.00	-
Diethylphthalate	-	-	-	-	-	-
Diphenylamine	-	1.0	0.80	0.20	1.00*	-
Ethyl Centralite	0.75	-	-	1.00	-	6.0
Barium Nitrate	-	-	-	-	-	-
Potassium Nitrate	-	-	-	-	-	-
Lead Carbonate	-	-	-	-	-	-
Potassium Sulfate	-	1.0	0.75	1.50	-	-
Tin	-	-	0.75	-	-	-
Carbon Black	-	-	-	0.05*	-	-
Graphite	-	Glaze 0.1	-	-	-	-
Cryolite	-	-	-	-	-	0.3
2-Dinitro-diphenyldiamine	-	-	-	-	-	-
Lead Stearate	-	-	-	-	-	-
Triacetin	-	-	-	-	-	-
Charcoal	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-

Notes: *Added basis
 **Added basis when specified

**TABLE 1-1
(Cont.)**

Composition (% by wt.)

Propellant Designation	M16	M17	M18	M26	M26 E1	M30	M30 A1
Chemical							
Nitrocellulose	55.50	22.0	80.00	67.25	68.70	28.00	28.00
Nitroglycerin	27.50	21.5	10.00	25.00	25.00	22.50	22.50
Nitroguanidine	-	54.7	-	-	-	47.70	47.00
Dinitrotoluene	10.50	-	-	-	-	-	-
Dibutylphthalate	-	-	-	-	-	-	-
Diethylphthalate	-	-	-	-	-	-	-
Diphenylamine	-	-	.70	-	-	-	-
Ethyl Centralite	4.00	1.5	-	6.00	6.00	1.50	1.50
Barium Nitrate	-	-	-	0.75	-	-	-
Potassium Nitrate	-	-	-	0.70	-	-	-
Lead Carbonate	-	-	-	-	-	-	-
Potassium Sulfate	1.50	-	-	-	-	-	1.00
Tin	-	-	-	-	-	-	-
Carbon Black	0.50	-	-	-	-	-	-
Graphite	-	Glaze 0.1	-	0.30	0.30	Glaze 0.10	-
Cryolite	-	0.3	-	-	-	0.30	-
2-Dinitro-diphenyldiamine	-	-	-	-	-	-	-
Lead Stearate	.505	-	-	-	-	-	-
Triacetin	-	-	-	-	-	-	-
Charcoal	-	-	-	-	-	-	-
Sulfur	-	-	-	-	-	-	-

Notes: *Added basis
**Added basis when specified

**TABLE 1-1
(Cont.)**

Composition (% by wt.)

Propellant Designation	M31	M31 A1	IMR	T2	T8	T23	Black Powder
Chemical							
Nitrocellulose	20.00	20.00	90.00	57.50	58.00	67.25	-
Nitroglycerin	19.00	19.00	-	30.00	22.50	0.25	-
Nitroguanidine	54.70	54.00	-	-	-	-	-
Dinitrotoluene	-	4.50	9.00	4.50	2.50	-	-
Dibutylphthalate	-	-	-	-	-	-	-
Diethylphthalate	-	-	-	-	-	-	-
Diphenylamine	-	-	-	-	-	-	-
Ethyl Centralite	-	-	-	8.00	8.00	6.00	-
Barium Nitrate	-	-	-	-	-	0.75	-
Potassium Nitrate	-	-	-	-	-	0.70	74.00
Lead Carbonate	-	-	-	-	-	-	-
Potassium Sulfate	-	1.50	1.00*	1.50	-	-	-
Tin	-	-	-	-	-	-	-
Carbon Black	-	-	-	0.02*	-	-	-
Graphite	-	-	-	-	-	0.30	-
Cryolite	0.30	-	-	-	-	-	-
2-Dinitro-diphenyldiamine	1.50	-	-	-	-	-	-
Lead Stearate	-	-	-	0.50	0.50	-	-
Triacetin	-	-	-	-	8.50	-	-
Charcoal	-	-	-	-	-	-	15.60
Sulfur	-	-	-	-	-	-	10.40

Notes: *Added basis
 **Added basis when specified

TABLE 1-2
CHEMICAL FORMULA OF EXPLOSIVES TREATED
BY OPEN DETONATION (OD)

Primary Explosives - Chemical Name	Chemical Formula	Hazardous Waste ID Number
Lead Azide	N_6Pb (71 % Pb)	D003, D008
Mercury Fulminate	$C_2HgN_2O_2$ (7.05 % Hg)	D003, D009
Diazodinitrophenol (DDNP)	$C_6H_2N_4O_5$	D003
Lead Styphnate	$C_6HN_3O_8Pb$ (44.2 % Pb)	D003, D008
Tetracene	$C_{18}H_{12}$	D003
Potassium Dinitrobenzofuroxane (KDNBF)	$C_6H_2N_4O_6K$	D003
Lead Mononitroresorcinate (LMNR)	$C_6H_3NO_2Pb$ (57.5 % Pb)	D003, D008
Lead Thiocyanate (fuel)	$Pb(SCN)_2$ (64 % Pb)	D008
Antimony Sulfide (fuel)	Sb_2S_5	D003
Calcium Silicate (fuel)	$CaSiO_3$	D003, D001
Potassium Chlorate (oxidizer)	$KClO_3$	D003
Ammonium Perchlorate (oxidizer)	NH_4ClO_4	D003
Barium Nitrate	$Ba(NO_3)_2$	D003, D005

**TABLE 1-2
(Cont.)**

High Explosives - Chemical Name	Chemical Formula	Hazardous Waste ID Number
(Aliphatic Nitrate Esters)		
1,2,4-Butanetriol Trinitrate (BTN)	$C_4H_7N_3O_9$	D003
Diethyleneglycol Dinitrate (DEGN)	$C_4H_8N_2O_7$	D003
Nitroglycerine (NG)	$C_3H_5N_3O_9$	D003
Nitrostarch (NS)	$C_6H_{10}O_5NO_2$	D003
Pentaerythritol Tetranitrate (PETN)	$C_5H_8N_4O_{12}$	D003
Trimethylene Glycoldinitrate (TEGN)	$C_6H_{12}O_4N_2O_4$	D003
1,1,1-Trimethylolethane Trinitrate (TMETN)	$C_5H_9O_9N_3$	D003
Nitrocellulose (NC)	$C_{12}H_{16}(ONO_2)_4O_6$	D003
(Nitramines)		
Cyclotetramethylenete-Tranitramine (HMX)	$C_4H_8N_8O_2$	D003
Cyclotrimethylene-Trinitramine (RDX)	$C_3H_6N_6O_6$	D003
Ethylenediamine Dinitrate (EDDN: Haleite)	$C_2H_6N_4O_4$	D003
Nitroguanidine (NQ)	$CH_4N_4O_2$	D003
2,4,6-Trinitrophenyl-Methylnitramine	$C_7H_5N_5O_8$	D003

**TABLE 1-2
(Cont.)**

High Explosives - Chemical Name	Chemical Formula	Hazardous Waste ID Number
(Nitroaromatics)		
Ammonium Picrate (Explosive D)	$C_6H_3N_3O_7H_3N$	D003
1,3-Diamino-2,4,6-Trinitrobenzene (DATB)	$C_6H_4N_6O_6$	D003
2,2'4,4'6,6'-Hexanitroazobenzene (HNAB)	$C_{12}N_8O_{12}$	D003
Hexnitrostilbene (HNS)	$C_{14}H_2N_6O_{12}$	D003
1,3,5-Triamino-2,4,6-Trinitrobenzene (TATB)	$C_6H_6N_6O_6$	D003
2,4,6-Trinitrofluorene (TNT)	$C_7H_5N_3O_6$	D003
Ammonium Nitrate	HN_4NO_3	D003
Plastic Bonded Explosive (PBX)		
Explosives (see above) and polymer binder, plasticizer, and fuel (aluminum or iron)		
(Pyrotechnics)		
Combination of: Oxidizer - oxygen or fluorine Fuel - powdered aluminum or magnesium Binding Agents - resins, waxes, plastics, oils, retardants, waterproofing, color intensifier		

TABLE 1-2
(Cont.)

Explosives - Chemical Name	Hazardous Waste ID No.	Chemical Formula	Percent
Black Powder	D003	Potassium Nitrate	74.0
		Charcoal	15.6
		Sulfur	10.4
Composition B	D003	60/40 Cyclotol	
		RDX	60
		TNT	39
		WAX	17
Photoflash	D003	Laminac	96.8
		Lupersol, DDM	3.0
		Iron Oxide	.2
Composition C4	D003	RDX	91.0
		Polyisobutylene	2.1
		Motor Oil	1.6
		Di-(2-Ethylhexyl)	5.3
		Sebacate	
TPA Incendiary	D003	Triethylaluminum	?
Amatol	D003	Ammonium Nitrate	?
		TNT	?
Composition A3	D003	RDX	91
		WAX	9
Explosive A4	D003	RDX	97
		WAX	3
HBX-1.3 & 6	D003	RDX	39.6
		TNT	37.8
		Aluminum	17.1
		Densitizer Comp D2	5.0
		CACL	.5
Octol	D003	HMX	75
		TNT	25

**TABLE 1-2
(Cont.)**

Explosives - Chemical Name	Hazardous Waste ID No.	Chemical Formula	Percent
PBX	D003	RDX Polystyrene Diocylphthalate	? ? ?
Pentolite	D003	PETN TNT	50 50
Picratol	D003	Explosive D TNT	52 48
Tetrytol	D003	Tetryl TNT	? ?
Torpex	D003	RDX TNT Aluminum	42 40 18
Tritonal	D003	Aluminum TNT	? ?
Military Dynamite - Medium Velocity	D003	RDX TNT Starch SAE No. 10 Oil Polysobutylene	75 15 5 4 1
Military Dynamite - Low Velocity	D003	RDX/dye* TNT Tripenaery-Thritol Binder** Celluloseacetate	17.5 67.8 8.6 4.1 2.0

Notes: * The dye is 1 - methylamino-anthraquinone (1-MA) used in the amount of .5% of the RDX mixture

** The binder is vistac No. 1 consisting of polybutene and diotyseabacate

adjacent to the pond. In 1990, soil samples were collected from the pond area and analyzed for explosives, none were detected.

SEAD-4 is classified as a High Priority Area of Concern (AOC) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). In accordance with the decision process outlined in the Interagency Agreement (IAG) between the U.S. Army Corps of Engineers (USACE) the U.S. Environmental Protection Agency (EPA) Region II, and the New York State Department of Environmental Conservation (NYSDEC), an Expanded Site Inspection was performed at SEAD-4 in 1993 and 1994. The draft final ESI Report (Parsons ES, May 1995) indicated that a threat may exist at SEAD-4 due to the presence of metals, semivolatile organic compounds, pesticides and PCBs in sediment, and metals in surface soil and groundwater. On the basis of the ESI data, explosives are believed to present less of a threat to human and environmental receptors than the constituents listed above, however, the full extent of explosive impacts was not known upon completion of the ESI.

As part of the draft final ESI Report, a CERCLA RI/FS was recommended to be performed at SEAD-4. This RI/FS Project Scoping Plan along with the Generic Installation RI/FS Workplan outlines the recommended approach and methodologies for completion of an RI/FS at this site in accordance with EPA CERCLA guidelines.

2.0 SITE CONDITIONS

2.1 PHYSICAL SETTING

The physical setting of SEDA is described in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

2.2 REGIONAL GEOLOGICAL SETTING

The geological setting of SEDA is described in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

2.3 REGIONAL HYDROGEOLOGICAL SETTING

The hydrogeological setting of SEDA is described in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

3.0 SCOPING OF THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)

This section describes the current understanding of SEAD-4 based upon the results of the Expanded Site Inspection (ESI) Report (draft final, Parsons ES, May 1995). This includes the development of a conceptual model describing all known contaminant sources and receptor pathways. This conceptual model will be used to develop and implement additional studies which may be required to fully assess risks to human health and the environment. Other considerations which are discussed are data quality objectives (DQOs) and potential remedial actions for SEAD-4. These considerations have been integrated into the scoping process to ensure that adequate data is collected to complete the RI/FS process for this AOC.

3.1 CONCEPTUAL SITE MODEL

The conceptual site model for SEAD-4 takes into account both site conditions and accepted pollutant behavior to formulate an understanding of the site. This model will serve as a basis for determining necessary additional studies for the RI. The model was developed by evaluating the following aspects:

- **Historical usage**
- **Physical site characteristics:** This considers the physical aspects of environmental conditions and the effect these conditions may have on potential pollutant migration. These include groundwater characteristics, surface water run-off characteristics and local terrain.
- **Environmental fate of constituents:** This considers the fate and transport of residual materials in the environment based upon known chemical and physical properties.

3.1.1 Physical Site Characterization

The Munitions Washout Facility is part of an ammunition workshop facility that is approximately 30 acres in size. The workshop facility is characterized by developed and undeveloped areas, as shown in Figure 1-2. It is surrounded by open grassland and low, thick brush on all sides. North South Baseline Road is the main access road to the facility and bisects the site running from south-southeast to north-northwest. There is also a network of minor paved driveways in the eastern half of the site. The SEDA railroad tracks lead into the

site from the southeast and terminate in the vicinity of Buildings 2078 and 2085.

The ammunition workshop facility is almost entirely surrounded by two drainage ditches which are both approximately 3 feet deep. One of the ditches forms the eastern boundary of the site, originates in the southeastern part of the site, and circles around to the north where it joins the drainage ditch alongside North South Baseline Road. The second drainage ditch forms the southwestern boundary. It originates south of the site next to North South Baseline Road, circles to the northwest, and discharges into the man-made pond which lies on the western edge of the site.

Eleven buildings existed at the ammunition workshop facility during the years that the munitions washout building was operating. Three of the buildings are believed to have been used in the washout process. None of these three buildings currently exist.

An air photo taken in 1959 shows the former Munitions Washout Building, a building that was possibly used as a cleaning or decontamination building for workers or equipment, and a third building that's use is unknown. The Washout Building was located in the approximate center of the facility, adjacent to North South Baseline Road; the "decontamination building" was located 350 feet to the northwest of the Washout Building, also adjacent to North South Baseline Road; and the third building was located directly across North South Baseline Road and approximately 300 feet from the Washout Building. It is assumed that the buildings were razed sometime between 1963 and 1968 because 1963 was the year that washout operations stopped at the site and as shown by air photos, by 1968 the buildings no longer existed. The foundation of the "decontamination building" still exists and drains in the floor of the building also exist, but nothing remains of the other two buildings. A crushed shale road leads from the road to where the third building once stood.

The former Washout Building was approximately 100 feet by 30 feet in size and was located adjacent to North South Baseline Road. The decontamination building's foundation is 40 feet by 55 feet, and the third building measured approximately 30 feet by 30 feet. To the northeast of the former Washout Building is a berm approximately 25 feet high and 150 feet long. Directly behind the berm is a water tank approximately 50 feet in diameter. The remainder of the buildings at the ammunition workshop facility (all but one of which are still standing) were used for ammunition renovation. Activities such as replacing the propellant in munitions or introducing tracers to 90 mm shells were performed in Buildings 2073 and 2078. Building 2073 is still active, and is the only building at the facility that is still active, but it is rarely used. Building 2085 was a receiving building for the ammunition to be

renovated. Building 2079 was a steam generation building and Building 2077 was a steam condensate return station. Building T30 and 2084 were used to prepare the packing material for the shipment of the renovated munitions. Building 2076 was the employee break room and laundry facility. Building T30 is the only building used for the ammunition renovation that was demolished. It was razed sometime between 1968 and 1993, but the foundation still exists.

All but two of the buildings are located to the east of North South Baseline Road. The area to the west of North South Baseline Road is mostly undeveloped. During the years of operation, the area was covered in grass, but currently it is mostly covered with thick, low brush.

Because no records were kept that describe the actual washout process, former and current SEDA employees, air photos, and documents describing the washout process at the Umatilla Army Depot Activity in Oregon and the Savanna Army Depot Activity in Illinois were consulted to reconstruct the activities at the site. The munitions were probably brought into the site by rail and were received at Building 2085. The munitions to be renovated were then taken to buildings 2078 or 2073, the two main workshops. The munitions scheduled to go through the washout process were brought to Building 2078, disassembled, and then moved to the Washout Building. The washout process involved the use of steam or hot water to remove the solid explosives from munitions ranging in size from 90 mm shells to 500-pound bombs. The heated water dissolved the solid explosives from the shells. The water was then passed over screens and agitated. As the water cooled while being agitated, the explosives would re-solidify, were funneled into non-sparking containers, and were sent to weapons manufacturing plants to be re-used. The wastewater was then disposed of on-site. According to a former SEDA employee, the site workers referred to the wastewater as "red water," which suggests that the water that was discharged contained high concentrations of dissolved explosives.

The exact location where the wastewater from the washout operation was discharged is unknown. There are two areas suspected to have been used and there may be other unidentified areas where wastewater was discharged. It is unlikely that any explosive waste from the other ammunition renovation activities performed on-site was disposed of on-site.

The first area where the wastewater is suspected to have been discharged is the pond to the west of the site, as shown in Figure 1-2. The pond is approximately 150 feet in diameter and is man-made, so it is assumed that the pond was created for the sake of containing the

wastewater. There are no known records of its excavation and it is assumed not to have a liner. A 6-inch diameter clay pipe discharges into the southeast corner of the pond. The pipe appears to originate in the area of the former Washout Building. Three test pits were excavated to determine the orientation and origin of the clay pipe. At 75 feet and 200 feet away from the pond, the pipe was found to be oriented such that it appeared to originate in the area of the former Washout Building. The pipe was not located, however, 400 feet from the pond where a 48-foot trench was excavated to bedrock (a depth of 6 feet) perpendicular to the suspected trend of the clay pipe. The failure to locate the pipe 400 feet from the pond suggests that the pipe either makes a bend to the north or south and does not originate at the former Washout Building, or the eastern end of the pipe was removed or destroyed with the rest of the Washout Building.

The second area where wastewater is suspected to have been discharged is into Indian Creek on the north side of Indian Creek Road. No sampling has been done in Indian Creek, but a former SEDA employee indicated that while the Washout Facility was in operation, approximately 100 gallons of wastewater was discharged per day into Indian Creek.

The building foundation to the northwest of the former Washout Building location has drains in the floor suggesting it was used for decontamination of equipment or employees. Because this building was demolished not long after the washout process was stopped, it is assumed that it was used to support the washout process. No leach field was identified during the ESI in the field to the north of the facility where it was suspected to be, but several underground piping structures were identified at the surface in that area. The visible evidence of underground piping structures included 1) terracotta pipe that passed through a concrete holding tank with a steel cover at two locations, 30 feet and 210 feet north of the road near the suspected leach field, 2) a vertical cylindrical steel pipe near the concrete tank farthest from the road, 3) an outfall that emptied into a drainage ditch that surrounds most of the northern portion of the site and 4) a manhole between the vertical steel pipe and the outfall pipe. An outfall was also found to drain into the ditch to the north of the area. The chemical analyses performed on the sediment samples collected downstream of the outfall show that the sediment has been impacted by metals and semivolatile organic compounds (SVOCs). None of the piping structures seem to originate in the Washout Building, so the metals and the SVOCs released are not thought to be from the washout wastewater. The piping structures may originate in the "decontamination building" that was potentially used in the washout process. The contamination in the ditch to the north of the facility, therefore, may be the result of activities associated with the washout process, but not from the washout wastewater itself.

Building 2076 was the break room and laundry facility for the site workers. A former SEDA employee indicated that the laundry washwater was placed in a pit to the northeast of Building 2076. Seepage or overflow from this pit may be a source for the sediment impacts found in the drainage ditch to the northwest.

The Groundwater Contamination Survey performed by the U.S. Army Environmental Hygiene Agency in 1988 states that the wastewater from the munitions washout operation was discharged near Building 2084. According to a current SEDA employee and a former SEDA employee, Building 2084 and T30 were used to paint, stencil, and otherwise prepare the packing material for the shipment of the renovated munitions. Another current SEDA employee reported seeing painting booths in Building 2084, so it seems unlikely that the wastewater from the washout operation was handled in these two buildings. A former SEDA employee has indicated that the washed out projectiles were painted in this building, so there may have been residual explosives in the projectiles that became part of the waste stream of these two buildings. The chemical analyses of the soil samples collected from soil borings near the two buildings show that the soil has been impacted by metals, SVOCs and one explosive compound. The chemical analyses of the sediment samples collected from the drainage ditch that originates immediately to the south of building 2084 show that the sediment in the ditch has been impacted by metals and SVOCs. While it is unlikely that washout wastewater was discharged near Building 2084, wastes of some kind may have been discharged in this area.

3.1.1.1 Local Geology

As part of the ESI performed at SEAD-4 in 1993 and 1994, 10 soil borings were performed and 8 test pits were excavated. The logs from the soil borings and test pits are presented in Appendix G. The three geologic units observed in this drilling program were topsoil, till and shale. The depths of the soil borings were up to 10.5 feet below the ground surface.

In most of the soil borings, a thin layer of topsoil was observed, usually less than a foot thick. The till observed was light brown and composed of silt and clay, with some black shale fragments (up to 0.25 inch). Larger shale fragments (rip-up clasts) were also observed at many locations near the till/weathered shale contact. Some oxidized areas were noted in the upper portion of the till strata.

Competent, calcareous black shale was encountered at depths between approximately 4 and 10.5 feet below the ground surface. The upper portion of the competent shale had a weathered zone that was from 0.2 to 2.5 feet thick.

The topography gently slopes to the west on the eastern portion of the facility, and steepens to the west of North South Baseline Road. The elevations of the competent bedrock determined during the drilling and seismic programs indicate that the bedrock surface slopes to the west mimicking the land surface.

3.1.1.2 Geophysics

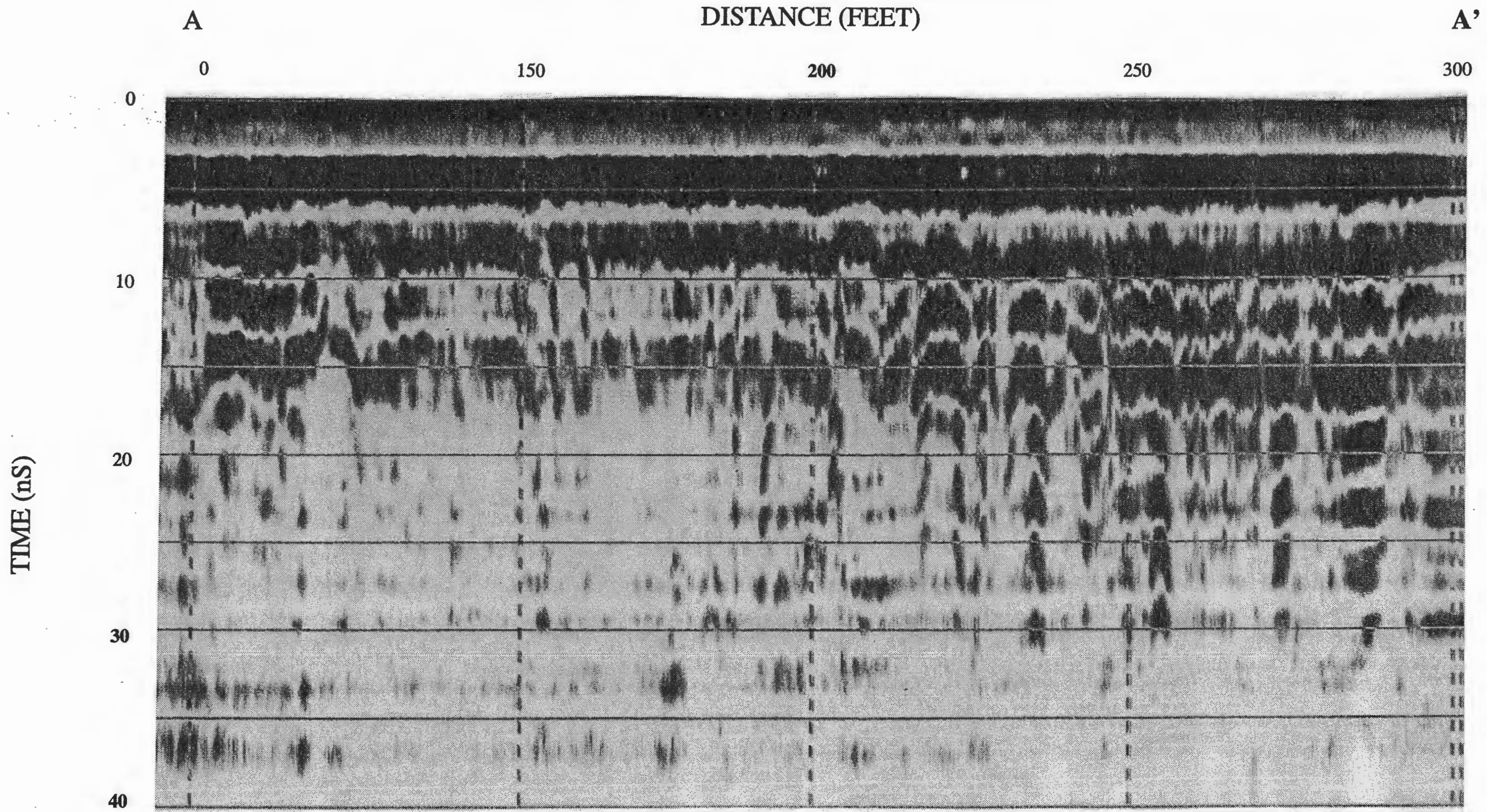
The geophysical investigations completed as part of the SEAD-4 ESI involved a seismic survey, an electromagnetic (EM-31) survey, and a ground penetrating radar (GPR) survey. The objective of the seismic survey was to determine the direction of groundwater flow, while the objective of the EM-31 and the GPR surveys were to delineate the location of the suspected leach field and the locations of subsurface pipes and structures that may have carried the wastewater from the washout operation to the suspected leach field. The locations where the geophysical investigations were conducted are shown in Figure 3-1, and the results of the geophysical investigations are presented in Figures 3-2 through 3-5.

Four 115-foot long seismic refraction profiles were performed along two lines laid out perpendicular to each other. The seismic profiles detected 5 to 15 feet of till (seismic velocity of 1,000-7,700 feet/second) overlying bedrock (seismic velocity of 12,000-14,000 ft/s). In particular, the unconsolidated material included unsaturated till (seismic velocity of 1,000-1,400 ft/s), compact unsaturated till (3,500-4,200 ft/s), and saturated till (seismic velocity of 5,000-7,700 ft/s).

Saturated till was only detected beneath profile P4 near the pond. At the locations of the other profiles, either saturated till was not present or the saturated layer was too thin to be detected by the seismic refraction method. An interpretation of the data collected along profiles P2 and P3 suggest that a layer of compact, unsaturated till is present at a depth of 1 to 3 feet. The bedrock surface slopes to the west or southwest following the slope of the surface topography. Groundwater flow is also expected to be directed to the west or southwest, following the slope of the relatively impermeable bedrock surface.

EM-31 and GPR surveys were conducted in the following three areas: in the vicinity of the former Munitions Washout Facility building, in the area of the suspected leach field, and across the drainage pipe leading west to the pond.

The quadrature response from the EM-31 survey performed across the suspected leach field clearly shows the more conductive road bed and the effects of the two concrete tanks, as shown in Figure 3-2. Otherwise, the apparent conductivity (quadrature response) of the ground is extremely uniform in this area. The in-phase response shows a greater variability, perhaps suggestive of disrupted ground, as shown in Figure 3-3.



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SENECA ARMY DEPOT ACTIVITY
 RI/FS PROJECT SCOPING PLAN
 SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD

DEPT. ENVIRONMENTAL ENGINEERING	DWG NO. 727651-02004
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FIGURE 3-5
EXPANDED SITE INSPECTION
GPR PROFILE A-A'

SCALE NA	DATE JUNE 1995
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The depth of penetration of the radar was limited to about 3 to 5 feet due to the abundance of electrically conductive clay in the till. The GPR survey conducted in the area of the suspected leach field detected an anomalous zone parallel to the road in the main section of the grid. This zone is characterized by strong banding and reverberation throughout the record. An example of the response is shown in profile B-B' from about 55 to 80 feet along the length of the profile, as shown in Figure 3-4. No pronounced linear anomalies or pipes were detected in this area.

The quadrature response from the EM-31 survey in the area of the former Munitions Washout Facility Building is dominated by the linear signatures of buried pipes, as shown in Figure 3-2. Four pipes are clearly visible. Large anomalies in the south and east corners of this grid are due to reinforced concrete pads. The pipes are also evident in the in-phase response, as shown in Figure 3-3.

The GPR survey conducted in the vicinity of the former Munitions Washout Building detected numerous anomalous responses that may be classified as linear anomalies, point source anomalies, and stratigraphic anomalies. Some of the linear anomalies correspond to segments of buried pipes detected by the EM-31 survey. Point source anomalies are very common to the GPR method. Such anomalies may be attributed to buried metallic debris, construction debris, boulders, or local inhomogeneities in the soil. Stratigraphic anomalies are typically evidenced by disruption of layering of the soil or by local changes in the electrical properties of the soil. Stratigraphic anomalies are typically caused by excavation and backfilling, although natural variation in the composition of glacial till may produce such effects.

The GPR record acquired across profile A-A', as shown in Figure 3-4, exhibits a GPR response characteristic of the GPR survey conducted in this grid. The left half of the record shows limited penetration of only about 15 nanoseconds (ns) or about 3 feet. The right half of the profile shows 6 to 8 hyperbolic anomalies located at about 10 ns (2 feet), reverberating to a time of about 30 ns. Areas of abundant hyperbolic anomalies are interspersed with areas of limited penetration. Some of the hyperbolic anomalies can be correlated from line to line (linear anomalies) but most appear to be isolated sources.

The EM-31 data acquired between the road and the pond, as shown in Figures 3-2 and 3-3, failed to detect any significant anomalies. Both EM parameters exhibit very little variability, suggesting that the soil is relatively uniform and undisturbed. The clay pipe which discharges into the pond was not detected.

The GPR profiles between the road and the pond did not detect any continuous anomalies that could be attributed to the 6-inch clay pipe that terminates at the pond. Several strong hyperbolic anomalies were observed in the transect along the road; however, none of these features could be traced away from the road. The GPR records acquired in this area were devoid of anomalous responses.

3.1.1.3 Local Hydrology and Hydrogeology

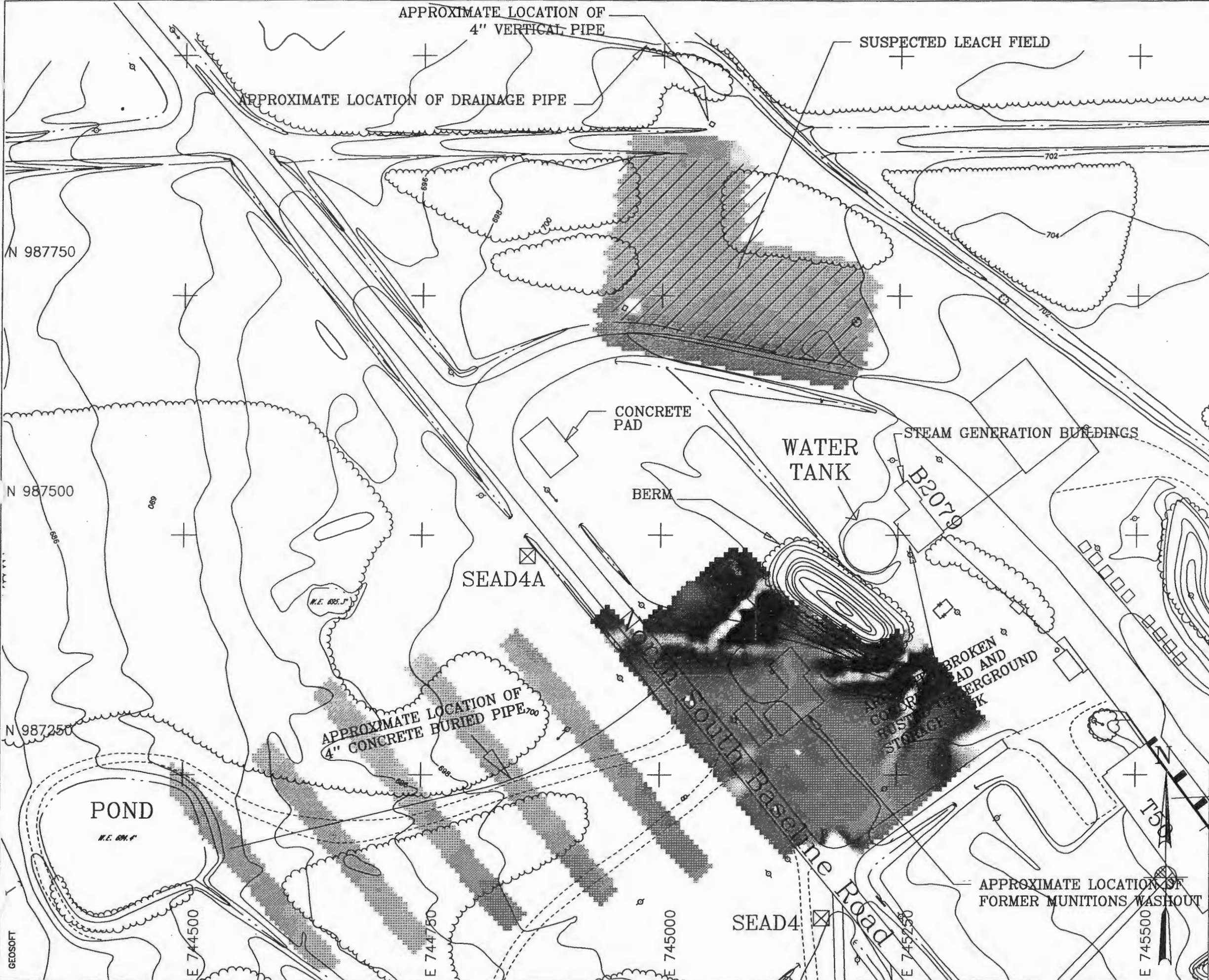
The Munitions Washout Facility is almost entirely surrounded by 2 man-made drainage ditches(both approximately 3 feet deep) into which most runoff from the facility flows. Figure 3-6 shows the surface water flow directions at the site.

Runoff toward the east and north of the facility flows into the eastern drainage ditch that flows northward. Surface water in this ditch flows west under North South Baseline Road and then flows into Indian Creek just north of the facility. Runoff toward the west of the facility flows into the western ditch which drains to the north into the pond located approximately 500 feet west of the former Washout Building.

This pond is approximately 150 feet in diameter and is man-made. It is the only sustained water body on site. Air photos from 1968 show that from an outlet on the western edge of the pond, water in the pond flowed to the west and eventually to the south through small drainage swales and drainage ditches alongside the SEDA railroad tracks and roads. This natural outlet no longer exists and overflow is piped immediately to the west of the pond by a PVC overflow pipe located on the western bank of the pond. Currently, the static water level of the pond is low enough that overflow is unusual and the pond is stagnant.

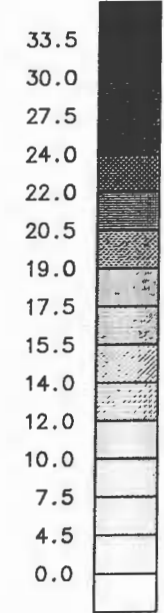
While the majority of the surface water runoff flows into either of these two main drainage ditches, a minor amount of runoff is either directed into the drainage ditches flowing north along North South Baseline Road or into the drainage ditches flowing south along North South Baseline Road and the SEDA railroad tracks.

As part of the ESI program, 5 groundwater monitoring wells were installed at SEAD-4. The locations of the monitoring wells are shown in Figure 3-7. The monitoring well installation diagrams are presented in Appendix G. Groundwater elevations were measured in the five monitoring wells on April 4, 1994. From these measurements, which are presented in Table 3-1, a groundwater elevation map has been developed and is shown in Figure 3-7. Based on these data, the groundwater flow direction in the till/weathered shale aquifer is generally

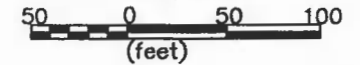


LEGEND

- MINOR WATERWAY
- MAJOR WATERWAY
- - - - - FENCE
- UNPAVED ROAD
- ~ BRUSH LINE
- - - - - LANDFILL EXTENTS
- ##### RAILROAD
- 780 — GROUND SURFACE ELEVATION CONTOUR
- ⊙ ROAD SIGN
- ⊗ DECIDUOUS TREE
- △ GUIDE POST
- ⊕ FIRE HYDRANT
- ⊗ MANHOLE
- ⊕ COORDINATE GRID (250' GRID)
- POLE
- UTILITY BOX
- MAILBOX/RR SIGNAL
- OVERHEAD UTILITY POLE
- ⊗ SURVEY MONUMENT



QUADRATURE (mS/m)



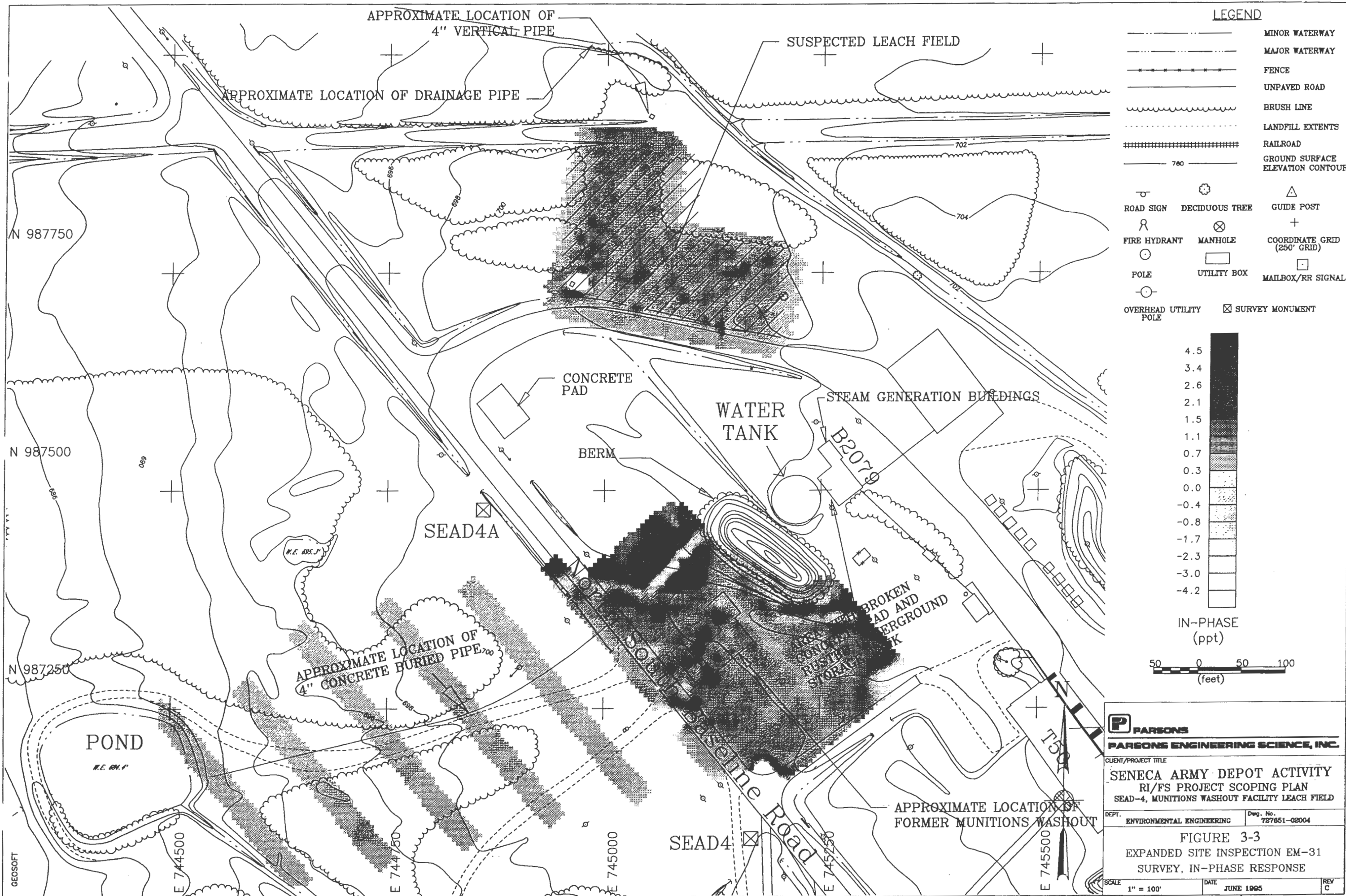
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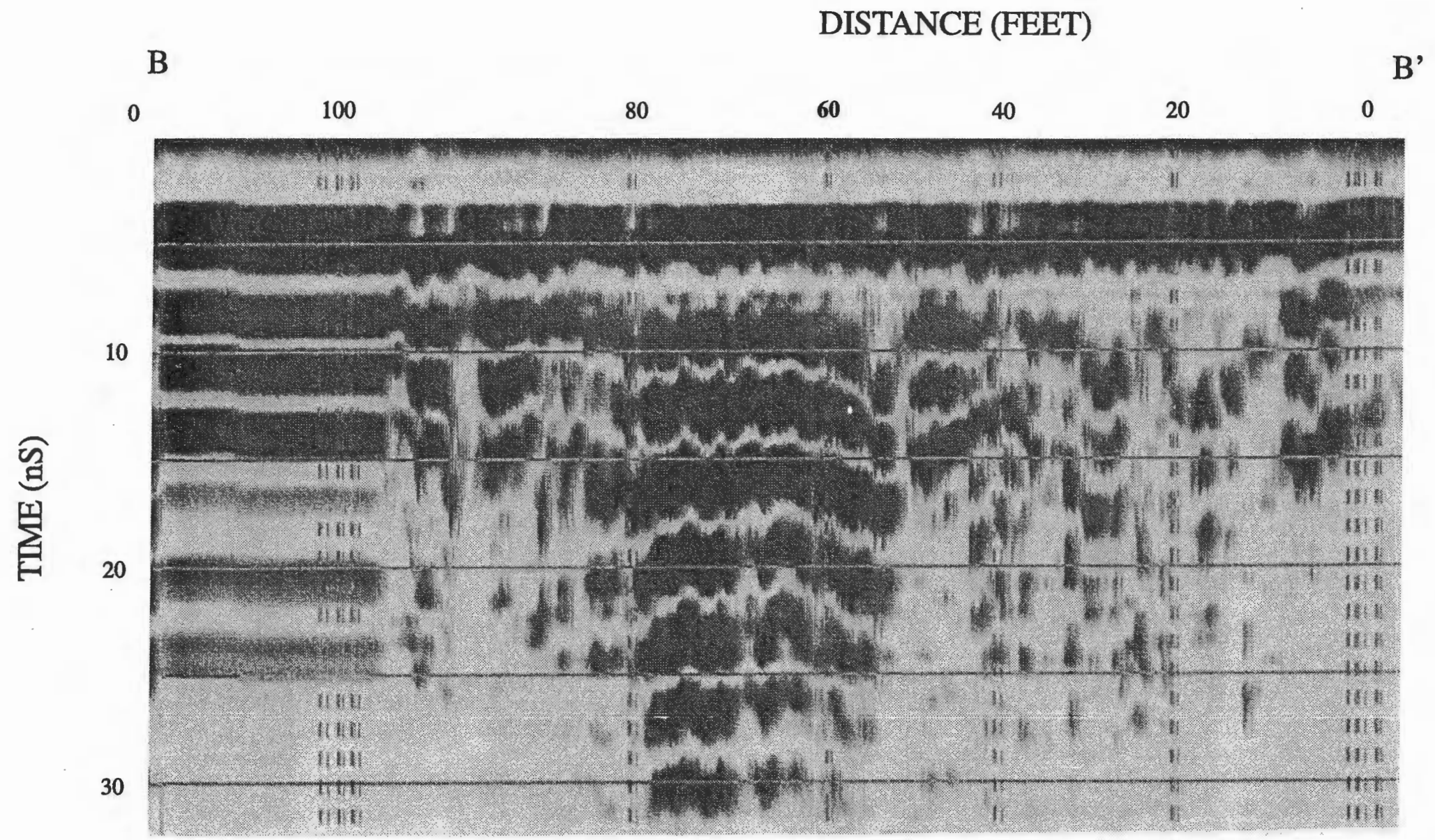
CLIENT/PROJECT TITLE
**SENECA ARMY DEPOT ACTIVITY
 RI/FS PROJECT SCOPING PLAN
 SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD**


DEPT. ENVIRONMENTAL ENGINEERING Dwg. No. 727851-02004

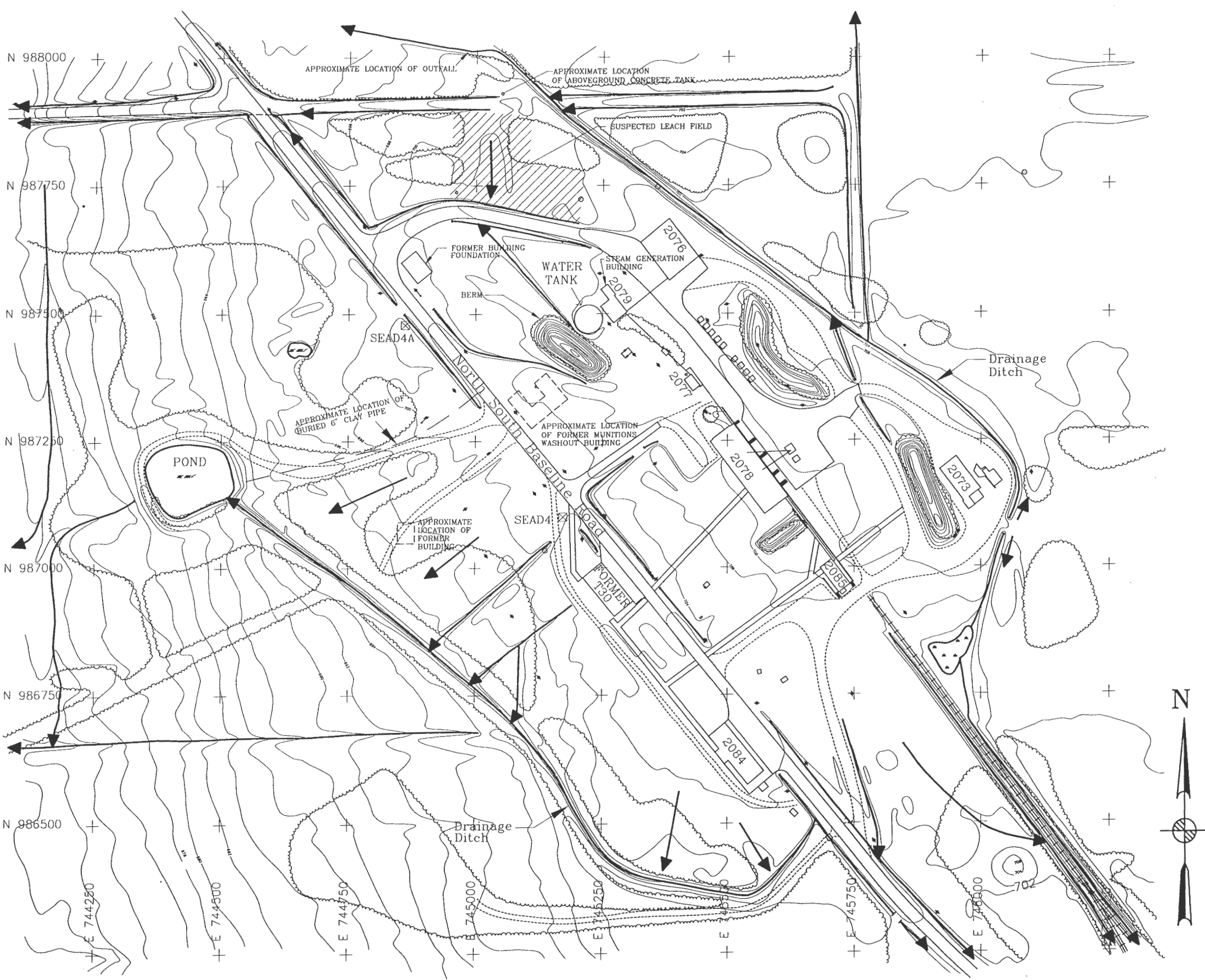
FIGURE 3-2
 EXPANDED SITE INSPECTION EM-31
 SURVEY, QUADRATURE RESPONSE

SCALE 1" = 100' DATE JUNE 1995 REV C





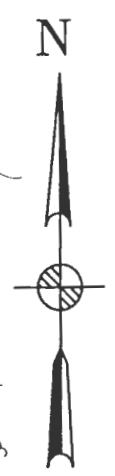
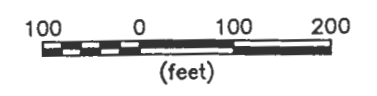
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CLIENT/PROJECT TITLE SENECA ARMY DEPOT ACTIVITY RI/FS PROJECT SCOPING PLAN SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD	
DEPT ENVIRONMENTAL ENGINEERING	DWG NO 727651-02004
FIGURE 3-4 EXPANDED SITE INSPECTION GPR PROFILE B-B'	
SCALE NA	DATE JUNE 1995



LEGEND

	MINOR WATERWAY
	MAJOR WATERWAY
	FENCE
	UNPAVED ROAD
	BRUSH LINE
	LANDFILL EXTENT
	RAILROAD
	GROUND SURFACE ELEVATION CONTOUR
	ROAD SIGN
	DECIDUOUS TREE
	GUIDE POST
	FIRE HYDRANT
	MANHOLE
	COORDINATE GRID (250' GRID)
	POLE
	UTILITY BOX
	MAILBOX/RR SIGNAL
	OVERHEAD UTILITY POLE
	SURVEY MONUMENT

DIRECTION OF SURFACE WATER FLOW



ACAD\SENECA\RIFS\SD4\SD4FLOW.DWG

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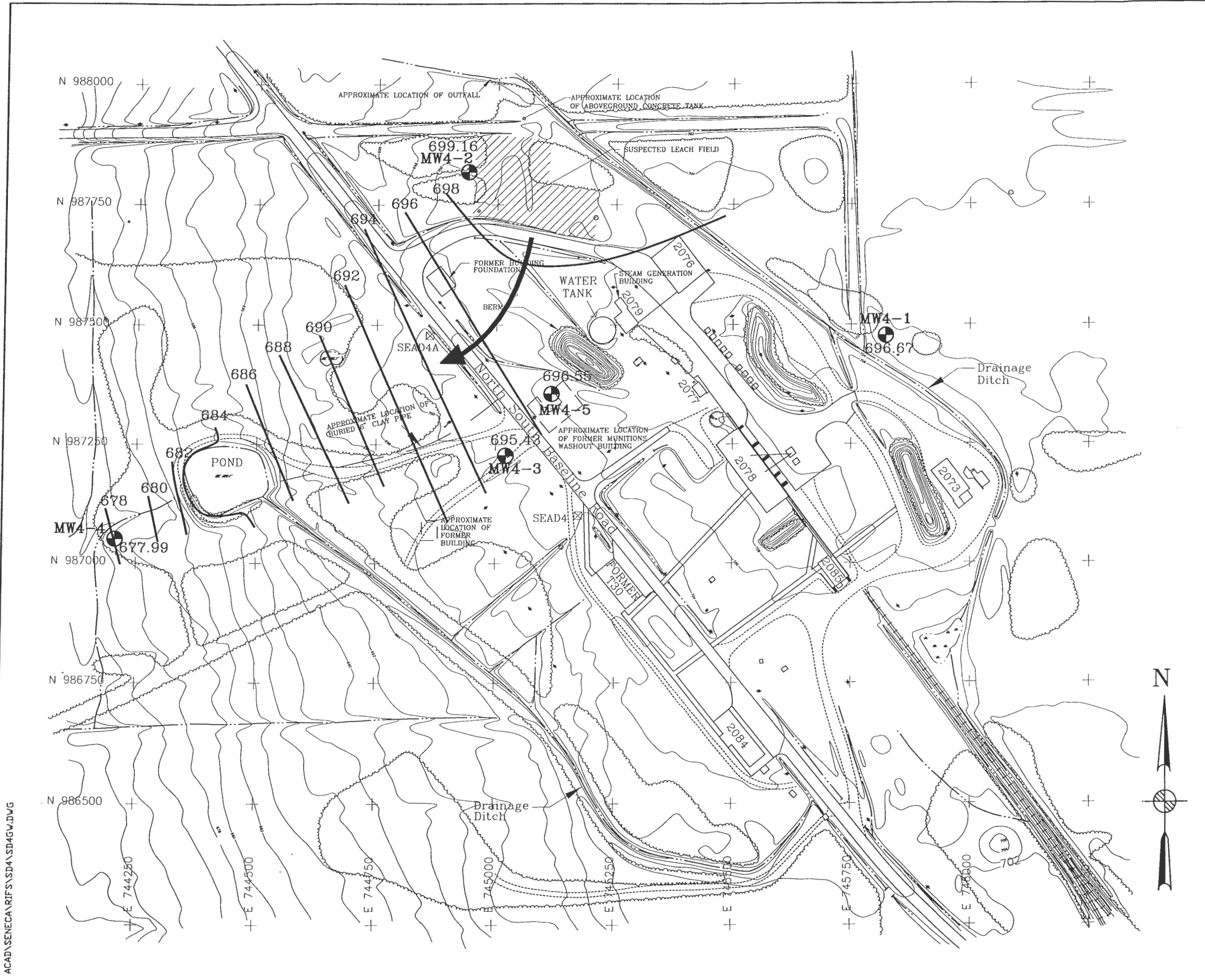
FIGURE 3-6
SURFACE WATER FLOW MAP

SCALE 1" = 200' DATE JUNE 1995 REV C

TABLE 3-1
MONITORING WELL WATER LEVEL SUMMARY

SENECA ARMY DEPOT ACTIVITY
SEAD-4 MUNITIONS WASHOUT FACILITY

MONITORING WELL NUMBER	TOP OF PVC CASING ELEVATION (MSL)	WELL DEVELOPMENT			SAMPLING			WATER LEVEL MEASUREMENTS		
		DATE	DEPTH TO GROUNDWATER WATER TOC (FT)	GROUNDWATER ELEVATION (MSL)	DATE	DEPTH TO GROUNDWATER WATER TOC (FT)	GROUNDWATER ELEVATION (MSL)	DATE	DEPTH TO GROUNDWATER WATER TOC (FT)	GROUNDWATER ELEVATION (MSL)
MW4-1	700.12	12/16/93	6.44	693.68	1/21/94	5.24	694.88	4/4/94	3.45	696.67
MW4-2	702.44	11/20/93	4.53	697.91	2/4/94	4.87	697.57	4/4/94	3.28	699.16
MW4-3	699.90	11/20/93	4.62	695.28	1/20/94	7.06	692.84	4/4/94	4.47	695.43
MW4-4	680.37	12/18/93	2.76	677.61	1/31/94	2.76	677.61	4/4/94	2.38	677.99
MW4-5	700.46	12/18/93	5.72	694.74	1/20/94	7.14	693.32	4/4/94	3.91	696.55

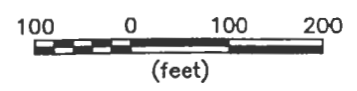


LEGEND

- MINOR WATERWAY
- MAJOR WATERWAY
- FENCE
- UNPAVED ROAD
- BRUSH LINE
- LANDFILL EXTENT
- RAILROAD
- GROUND SURFACE ELEVATION CONTOUR
- ROAD SIGN
- DECIDUOUS TREE
- GUIDE POST
- FIRE HYDRANT
- MANHOLE
- COORDINATE GRID (250' GRID)
- POLE
- UTILITY BOX
- MAILBOX/RR SIGNAL
- OVERHEAD UTILITY POLE
- SURVEY MONUMENT

- MW4-3
695.4
- MONITORING WELL WITH WATER TABLE ELEVATION**
- 692
- GROUNDWATER ELEVATION CONTOUR
ARROW INDICATES DIRECTION
OF GROUNDWATER FLOW**

- NOTES**
1. MONITORING WELL WATER LEVEL SURVEY DATE: 4/4/94
 2. GROUNDWATER CONTOUR ELEVATION DATUM IS NAVD OF 1988



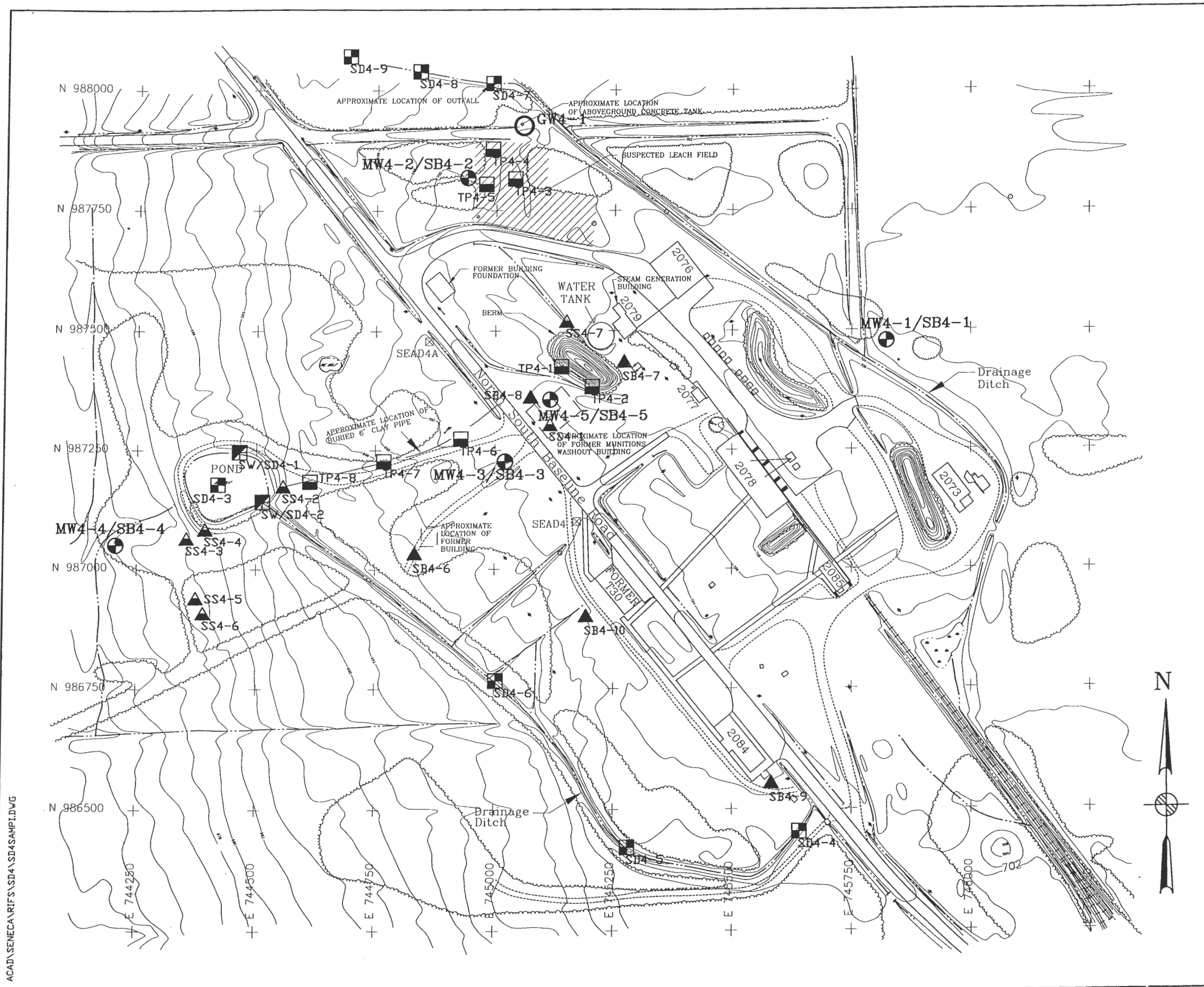
P PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
**SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD**

DEPT. ENVIRONMENTAL ENGINEERING Des. No. 727651-02004

**FIGURE 3-7
GROUNDWATER ELEVATION MAP**

SCALE: 1" = 200' DATE: JUNE 1995 REV: A

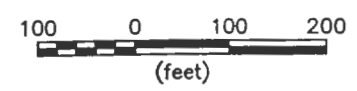


LEGEND

	MINOR WATERWAY
	MAJOR WATERWAY
	FENCE
	UNPAVED ROAD
	BRUSH LINE
	LANDFILL EXTENT
	RAILROAD
	GROUND SURFACE ELEVATION CONTOUR

	ROAD SIGN		DECIDUOUS TREE		GUIDE POST
	FIRE HYDRANT		MANHOLE		COORDINATE GRID (250' GRID)
	POLE		UTILITY BOX		MAILBOX/RR SIGNAL
	OVERHEAD UTILITY POLE		SURVEY MONUMENT		

- TEST PIT
- MONITORING WELL
- SOIL BORING
- SURFACE SOIL SAMPLE
- SEDIMENT SAMPLE
- SURFACE WATER/SEDIMENT SAMPLE



ACAD\SENECA\RI\FS\SD4\SD4SAMP1.DWG

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD

DEPT. ENVIRONMENTAL ENGINEERING Eng. No. 727851-02004

FIGURE 3-8
SAMPLE LOCATIONS FOR EXPANDED
SITE INSPECTION

SCALE 1" = 200' DATE JUNE 1995 REV C

toward the west. It is likely that there are local variations in the flow direction and gradient. The noticeable steepening of the land surface gradient in the western portion of the site is probably also present in the groundwater gradient in that part of the site. The distribution of groundwater in the till/weathered shale aquifer is characterized by moist soil with coarse-grained lenses of water-saturated soil and, in most instances, the deeper weathered shale horizons are saturated.

On the basis of data collected from vertical connection tests at two other sites at SEDA (the Ash Landfill and SEAD-25), there is very little vertical connection between the till/weathered shale and the competent shale. The chemical data from these sites also supports this.

3.1.1.4 Results of Chemical Analyses

As part of the Solid Waste Management Unit (SWMU) classification process at SEDA, 70 soil samples were collected from the area surrounding the pond located to the west of the Munitions Washout Facility. The soil samples were analyzed for three nitroaromatic compounds (2,4,6-TNT, 2,4-DNT and 2,6-DNT). None of these compounds were detected.

An ESI was conducted at SEAD-4 by Parsons Engineering Science, Inc. in 1993 and 1994. The results of the ESI were presented in the draft final Seven High Priority SWMUs Expanded Site Inspection Report (Parsons ES, May 1995). This investigation involved a geophysical investigation, completion of 8 test pits, installation of 5 groundwater monitoring wells, and the collection of 17 surface soil samples, 25 subsurface soil samples, 3 surface water samples, and 9 sediment samples. The locations and results of the geophysical surveys are shown in Figures 3-1 through 3-5. The test pit and sample locations are shown in Figure 3-8.

All of the soil, groundwater, surface water and sediment samples were analyzed according to the NYSDEC Contract Laboratory Program Statement of Work for the following: Target Compound List volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and PCBs and Target Analyte List metals and cyanide. Explosive compounds were analyzed by EPA Method 8330; herbicide compounds were analyzed by EPA Method 8150; and nitrates were analyzed by EPA Method 352.2. The results of the analyses are presented in Tables 3-2 through 3-5. The following sections describe the investigations that were performed for the ESI and the nature and extent of the environmental impacts identified from these investigations.

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4 0-0.5 12/13/93 SS4-1 206836	SOIL SEAD-4 0-0.5 12/13/93 SS4-2 206837	SOIL SEAD-4 0-0.5 12/13/93 SS4-3 206838	SOIL SEAD-4 0-0.5 12/13/93 SS4-4 206839	SOIL SEAD-4 0-0.5 12/13/93 SS4-5 206840	SOIL SEAD-4 0-0.5 12/13/93 SS4-6 206841	SOIL SEAD-4 0-0.5 12/13/93 SS4-7 206842	SOIL SEAD-4 0-2 12/06/93 SB4-1.1 206265	SOIL SEAD-4 0-2 12/06/93 SB4-1.5 206268	SOIL SEAD-4 4-6 12/06/93 SB4-1.3 206267
VOLATILE ORGANICS															
Acetone	ug/kg	2	2.4%	200	0	14 U	12 U	13 U	14 U	13 U	13 U	24 U	12 U	12 U	12 U
Chloroform	ug/kg	15	16.7%	300	0	14 U	12 U	13 U	14 U	13 U	13 U	24 U	12 U	12 U	12 U
HERBICIDES															
Dicamba	ug/kg	23	2.4%	NA	NA	6.1 U	6 U	6.3 U	6.3 U	6.1 U	6.7 U	11 UJ	5.9 U	6 U	5.9 U
NITROAROMATICS															
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	120 J	130 U	130 U	130 U	130 U	130 U	130 UJ	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 UJ	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	72 J	130 U	130 U	130 U	130 U	130 U	130 UJ	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	90 J	130 U	130 U	130 U	130 U	130 U	130 UJ	130 U	130 U	130 U
SEMI-VOLATILE ORGANICS															
Acenaphthylene	ug/kg	45	4.8%	41000	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Acenaphthene	ug/kg	380	4.8%	50000 *	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Dibenzofuran	ug/kg	380	4.8%	6200	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Fluorene	ug/kg	380	4.8%	50000 *	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Phenanthrene	ug/kg	1400	9.5%	50000 *	0	110 J	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Anthracene	ug/kg	340	7.1%	50000 *	0	25 J	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Carbazole	ug/kg	380	4.8%	50000 *	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	85 J	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Fluoranthene	ug/kg	2400	23.8%	50000 *	0	230 J	18 J	410 U	19 J	400 U	440 U	720 UJ	56 J	50 J	52 J
Pyrene	ug/kg	1800	14.3%	50000 *	0	210 J	400 U	410 U	410 U	400 U	440 U	720 UJ	64 J	390 U	390 U
Butylbenzylphthalate	ug/kg	380	4.8%	50000 *	0	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	66 J	390 U	390 U
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	110 J	400 U	410 U	410 U	400 U	440 U	720 UJ	48 J	390 U	390 U
Chrysene	ug/kg	1000	14.3%	400	1	140 J	400 U	410 U	410 U	400 U	440 U	720 UJ	67 J	390 U	390 U
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000 *	0	45 J	400 U	410 U	23 J	33 J	440 U	720 UJ	86 J	390 U	390 U
Benzo(k)fluoranthene	ug/kg	730	16.7%	1100	0	150 J	400 U	410 U	24 J	400 U	440 U	720 UJ	90 J	390 U	390 U
Benzo(i)fluoranthene	ug/kg	890	11.9%	1100	0	65 J	400 U	410 U	410 U	400 U	440 U	720 UJ	55 J	390 U	390 U
Benzo(a)pyrene	ug/kg	880	11.9%	61	3	100 J	400 U	410 U	410 U	400 U	440 U	720 UJ	55 J	390 U	390 U
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	3200	0	75 J	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Dibenz(a,h)anthracene	ug/kg	32	2.4%	14	1	400 U	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U
Benzo(g,h,i)perylene	ug/kg	270	7.1%	50000 *	0	66 J	400 U	410 U	410 U	400 U	440 U	720 UJ	390 U	390 U	390 U

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						0-0.5 12/13/93 SS4-1 206836	0-0.5 12/13/93 SS4-2 206837	0-0.5 12/13/93 SS4-3 206838	0-0.5 12/13/93 SS4-4 206839	0-0.5 12/13/93 SS4-5 206840	0-0.5 12/13/93 SS4-6 206841	0-0.5 12/13/93 SS4-7 206842	0-2 12/06/93 SB4-1.1 206265	0-2 12/06/93 SB4-1.5 206268	4-6 12/06/93 SB4-1.3 206267
PESTICIDES/PCB															
delta-BHC	ug/kg	5.9	2.4%	300	0	2.1 U	2 U	2.1 U	2.1 U	2.1 U	2.3 U	3.7 UJ	2 UJ	2 U	2 U
Aldrin	ug/kg	8.2	4.8%	41	0	2.2 J	2 U	2.1 U	2.1 U	2.1 U	2.3 U	3.7 UJ	2 UJ	2 U	2 U
Endosulfan I	ug/kg	11	2.4%	900	0	2.1 U	2 U	2.1 U	2.1 U	2.1 U	2.3 U	3.7 UJ	2 UJ	2 U	2 U
Dieldrin	ug/kg	5.4	2.4%	44	0	4 U	4 U	4.1 U	4.1 U	4 U	5.4 J	7.2 UJ	3.9 UJ	3.9 U	3.9 U
4,4'-DDE	ug/kg	21	9.5%	2100	0	8.5 J	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
Endrin	ug/kg	34	2.4%	100	0	4 U	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.1 J	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	2.5 J	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.8 J	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	6.2 J	4 U	4.1 U	4.1 U	4 U	4.4 U	7.2 UJ	3.9 UJ	3.9 U	3.9 U
alpha-Chlordane	ug/kg	10	16.7%	540	0	4.9 J	2 U	2.1 U	2.1 U	2.1 U	2.3 U	3.7 UJ	2 UJ	2 U	2 U
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.1 J	2 U	2.1 U	2.1 U	2.1 U	2.3 U	3.7 UJ	2 UJ	2 U	2 U
Aroclor-1248	ug/kg	38	14.3%	1000(a)	0	40 U	40 U	41 U	41 U	40 U	44 U	72 UJ	39 UJ	39 U	39 U
Aroclor-1254	ug/kg	1600	28.6%	1000(a)	1	250 J	40 U	41 U	36 J	28 J	44 U	70 J	39 UJ	39 U	39 U
Aroclor-1260	ug/kg	110	14.3%	1000(a)	0	40 U	40 U	41 U	41 U	40 U	44 U	110 J	39 UJ	39 U	39 U
METALS															
Aluminum	mg/kg	21000	100.0%	15523	19	15600	18700	10300	15100	15900	18800	14100 J	14800	21000	15300
Antimony	mg/kg	96.1	31.0%	5	10	3.9 UJ	4.3 UJ	37.1 J	76.9 J	96.1 J	5.9 J	7.8 UJ	4.8 UJ	3.8 UJ	5 UJ
Arsenic	mg/kg	21.5	100.0%	7.5	4	5.9	5.9	7	6.1	9.8	7	13.1 J	6.2	4.2	3.9
Barium	mg/kg	277	100.0%	300	0	62	76.1	34.4	58.2	92.1	129	277 J	72	97.7	40.4 J
Beryllium	mg/kg	1.8	100.0%	1	1	0.69 J	0.84 J	0.53 J	0.7 J	0.73 J	1 J	1.8 J	0.73 J	0.64 J	0.74 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.36 U	0.42 U	0.36 U	0.51 U	0.48 U	0.54 U	1.8 J	0.47 U	0.37 U	0.49 U
Calcium	mg/kg	196000	100.0%	120725	1	14300	3480	11200	6930	7210	5410	196000 J	4280	2460	30900
Chromium	mg/kg	4870	66.7%	24	18	25.3 J	56.1 J	1790 J	4200 J	4870 J	395 J	34.1 J	23.2	27.9	27.6
Cobalt	mg/kg	29.1	100.0%	30	0	12.7	15.3	10.2	12.8	14.9	17.7	12.4 J	11.3	5.9 J	16.5
Copper	mg/kg	3410	100.0%	25	20	20 J	40.6 J	1350 J	3410 J	3120 J	234 J	335 J	14.1	15.1	62.8
Iron	mg/kg	64500	100.0%	28986	19	29800	33600	21900	31000	31000	34300	64600 J	27500	19500	34300
Lead	mg/kg	116	83.3%	30	2	23.7	12	27.3	19	27.2	22.7	102 J	17.7 J	9.8 J	7.5 J
Magnesium	mg/kg	32000	100.0%	12308	4	6850	6100	4400	5950	5470	5030	8550 J	4270	4460	7130
Manganese	mg/kg	1340	66.7%	759	6	708	638	335	339	533	1080	1220 J	615 J	119 J	337
Mercury	mg/kg	0.27	73.8%	0.1	4	0.02 J	0.04 J	0.15	0.21	0.15	0.04 J	0.27 J	0.05 J	0.04 J	0.04 J
Nickel	mg/kg	228	100.0%	37	15	36.8	40.1	25.9	34.3	37.2	228 J	27.8	25.1	47.6	
Potassium	mg/kg	2490	100.0%	1548	12	1650	1930	861	1310	1870	2080	2340 J	1250	2490	1300
Selenium	mg/kg	3.4	59.5%	2	1	0.27 J	0.15 U	0.2 J	0.16 J	0.21 J	0.55 J	3.4 J	0.4 J	0.23 J	0.09 U
Silver	mg/kg	1.2	11.9%	0.5	5	0.76 U	0.84 U	0.72 U	1 U	0.96 U	1.1 U	1.5 UJ	0.93 U	0.74 U	0.98 U
Sodium	mg/kg	1270	95.2%	114	9	61.8 J	49.2 J	57.8 J	50.4 J	47.7 J	54.9 J	1270 J	43.8 U	39.2 J	105 J
Vanadium	mg/kg	1250	100.0%	150	1	22.9	27.2	14.7	24.1	28.7	31.7	1250 J	28.6	31	22.2
Zinc	mg/kg	1010	100.0%	90	18	65.9	96.5	566	755	636	140	859 J	79.6	72.1	102
OTHER ANALYSES															
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.05	0.1	0.1	1.51	0.07	0.08	0.11	0.07	0.04	0.05
Total Solids	%WWW	94.9		NA	NA	82	63.2	79.8	79.7	61.6	75.1	45.8	85.2	83.8	85.2

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
						SEAD-4 8-10 12/06/93 SB4-1.6 206269	SEAD-4 0-2 11/10/93 SB4-2.1 204099	SEAD-4 2-4 11/10/93 SB4-2.2 204100	SEAD-4 0-2 11/10/93 SB4-3.1 204101	SEAD-4 4-6 11/10/93 SB4-3.3 204102	SEAD-4 6-8 11/10/93 SB4-3.4 204103	SEAD-4 0-2 12/05/93 SB4-4.1 206144	SEAD-4 0-2 12/05/93 SB4-4.5 206148 SB4-4.1DUP
VOLATILE ORGANICS													
Acetone	ug/kg	2	2.4%	200	0	11 U	19 U	11 U	11 U	11 U	10 U	2 J	13 U
Chloroform	ug/kg	15	16.7%	300	0	11 U	12 U	11 U	11 U	11 U	10 U	13 U	13 U
HERBICIDES													
Dicamba	ug/kg	23	2.4%	NA	NA	5.5 U	6.2 U	5.3 U	5.5 U	5.5 UJ	5.4 U	23	6.4 U
NITROAROMATICS													
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
SEMIVOLATILE ORGANICS													
Acenaphthylene	ug/kg	45	4.8%	41000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Acenaphthene	ug/kg	380	4.8%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Dibenzofuran	ug/kg	380	4.8%	6200	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Fluorene	ug/kg	380	4.8%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Phenanthrene	ug/kg	1400	9.5%	50000	0	360 U	400 U	340 U	340 U	350 U	350 U	450 U	410 UJ
Anthracene	ug/kg	340	7.1%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Carbazole	ug/kg	380	4.8%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	48 J	28 J	18 J	29 J	19 J	19 J	450 UJ	410 UJ
Fluoranthene	ug/kg	2400	23.8%	50000	0	360 U	400 U	340 U	62 J	350 U	350 U	450 U	410 UJ
Pyrene	ug/kg	1800	14.3%	50000	0	360 U	400 U	340 U	52 J	350 U	350 U	450 U	410 UJ
Butylbenzylphthalate	ug/kg	380	4.8%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 UJ	410 UJ
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	360 U	400 U	340 U	26 J	350 U	350 U	450 U	410 UJ
Chrysene	ug/kg	1000	14.3%	400	1	360 U	400 U	340 U	39 J	350 U	350 U	450 U	410 UJ
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000	0	360 U	1900	1100	2000	1500	1400	47 J	130 J
Benzo(b)fluoranthene	ug/kg	730	16.7%	1100	0	360 U	400 U	340 U	32 J	350 U	350 U	450 U	410 UJ
Benzo(k)fluoranthene	ug/kg	890	11.9%	1100	0	360 U	400 U	340 U	31 J	350 U	350 U	450 U	410 UJ
Benzo(e)pyrene	ug/kg	880	11.9%	81	3	360 U	400 U	340 U	27 J	350 U	350 U	450 U	410 UJ
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	3200	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Dibenz(a,h)anthracene	ug/kg	32	2.4%	14	1	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ
Benzo(g,h)perylene	ug/kg	270	7.1%	50000	0	360 U	400 U	340 U	360 U	350 U	350 U	450 U	410 UJ

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
						SEAD-4 8-10 12/06/93 SB4-1.6 206269	SEAD-4 0-2 11/10/93 SB4-2.1 204099	SEAD-4 2-4 11/10/93 SB4-2.2 204100	SEAD-4 0-2 11/10/93 SB4-3.1 204101	SEAD-4 4-6 11/10/93 SB4-3.3 204102	SEAD-4 6-8 11/10/93 SB4-3.4 204103	SEAD-4 0-2 12/05/93 SB4-4.1 206144	SEAD-4 0-2 12/05/93 SB4-4.5 206148 SB4-4.1DUP
PESTICIDES/PCB													
deta-BHC	ug/kg	5.9	2.4%	300	0	1.9 UJ	2.1 U	1.8 U	1.9 U	1.8 U	1.8 U	2.3 U	2.2 UJ
Aldrin	ug/kg	8.2	4.8%	41	0	1.9 UJ	2.1 U	1.8 U	1.9 U	1.8 U	1.8 U	2.3 U	2.2 UJ
Endosulfan I	ug/kg	11	2.4%	900	0	1.9 UJ	2.1 U	1.8 U	1.9 U	1.8 U	1.8 U	2.3 U	2.2 UJ
Dieldrin	ug/kg	5.4	2.4%	44	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
4,4'-DDE	ug/kg	21	9.5%	2100	0	3.6 UJ	4.1 U	3.5 U	3.2 J	3.6 U	3.5 U	4.5 U	4.2 UJ
Endrin	ug/kg	34	2.4%	100	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	3.6 UJ	4.1 U	3.5 U	3.6 U	3.6 U	3.5 U	4.5 U	4.2 UJ
alpha-Chlordane	ug/kg	10	16.7%	540	0	1.9 UJ	2.1 U	1.8 U	1.9 U	1.8 U	1.8 U	2.3 U	2.2 UJ
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.9 UJ	2.1 U	1.8 U	1.9 U	1.8 U	1.8 U	2.3 U	2.2 UJ
Aroclor-1248	ug/kg	38	14.3%	1000(e)	0	3.6 UJ	4.1 U	3.5 U	27 J	36 U	35 U	45 U	42 UJ
Aroclor-1254	ug/kg	1600	28.6%	1000(e)	1	3.6 UJ	4.1 U	3.5 U	28 J	36 U	35 U	29 J	42 UJ
Aroclor-1260	ug/kg	110	14.3%	1000(e)	0	3.6 UJ	4.1 U	3.5 U	36 U	36 U	35 U	45 U	42 UJ
METALS													
Aluminum	mg/kg	21000	100.0%	15523	19	19200	16300	15600	9590	9680	9730	16100	16200
Antimony	mg/kg	96.1	31.0%	5	10	2.8 UJ	10.5 U	7.6 U	5.8 U	10.1 U	5.8 U	16.1 J	57.8 J
Arsenic	mg/kg	21.5	100.0%	7.5	4	21.5	5.8 J	4.2 J	4.9 J	6.8 J	9.5 J	6.9	7.1
Barium	mg/kg	277	100.0%	300	0	81.2	133	46	29.8	49.6	39.7	107	122
Beryllium	mg/kg	1.8	100.0%	1	1	1	1	0.72 J	0.48 J	0.43 J	0.52 J	0.8 J	0.8 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.27 U	0.66 U R	0.48 U R	0.37 U R	0.63 U R	0.36 U R	0.51 U	0.34 U
Calcium	mg/kg	196000	100.0%	120725	1	14400	2900	12700	24700	59600	31400	4500	6840
Chromium	mg/kg	4870	66.7%	24	18	32.7	22.9	27.5	19.1	17.3	17.2	936	2670
Cobalt	mg/kg	29.1	100.0%	30	0	29.1	12.5	14.3	11.1	9.9	12.5	11.8 J	15.2
Copper	mg/kg	3410	100.0%	25	20	21.6	17 J	27.5 J	27.8 J	19.1 J	17.5 J	1290 J	1520 J
Iron	mg/kg	64600	100.0%	28986	19	37900	28600	33900	21900	22300	21200	28400	33700
Lead	mg/kg	116	83.3%	30	2	9.1 J	14.4	8.3	19.7	5.4	10.1	20.9 J	19.1 J
Magnesium	mg/kg	32000	100.0%	12308	4	8040	3770	7160	4920	12100	5610	4380	5110
Manganese	mg/kg	1340	66.7%	759	6	795	1340	436	338	388	373	564	917
Mercury	mg/kg	0.27	73.8%	0.1	4	0.04 J	0.03 U	0.02 U	0.03 J	0.02 U	0.04 U	0.03 U	0.04 J
Nickel	mg/kg	228	100.0%	37	15	62.3	27.3	42.7	36.6	28.6	28.5	39.6	35.4
Potassium	mg/kg	2490	100.0%	1548	12	2030	1270	1210	923	1090	1050	1510	1430
Selenium	mg/kg	3.4	59.5%	2	1	0.14 U	0.32 J	0.21 UJ	0.36 J	0.2 UJ	0.22 UJ	0.73 J	0.76 J
Silver	mg/kg	1.2	11.9%	0.5	5	0.64 J	1.3 UJ	0.97 UJ	0.74 UJ	1.3 UJ	0.73 UJ	1 U	0.68 U
Sodium	mg/kg	1270	95.2%	114	9	91.6 J	39.3 J	71.1 J	78.8 J	126 J	96 J	51.3 J	49.2 J
Vanadium	mg/kg	1250	100.0%	150	1	29.3	29.3	22.5	15	15.5	13.8	25.3	27.7
Zinc	mg/kg	1010	100.0%	90	18	115	61.3 J	95 J	45.5 J	87.3 J	69.4 J	1010	423
OTHER ANALYSES													
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.02	0.58	0.04	0.15	0.06	0.05	0.05	0.01
Total Solids	%WW	94.9		NA	NA	91.1	80.8	94.9	90.8	90.9	93.6	73.3	78.3

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
						SEAD-4 4-6 12/05/93 SB4-4.2 206145	SEAD-4 6-8 12/05/93 SB4-4.3 206147	SEAD-4 0-2 12/05/93 SB4-5.1 206149	SEAD-4 2-4 12/05/93 SB4-5.2 206150	SEAD-4 0-2 12/06/93 SB4-6.1 206270	SEAD-4 2-4 12/06/93 SB4-6.2 206271
VOLATILE ORGANICS											
Acetone	ug/kg	2	2.4%	200	0	11 U	11 U	11 U	11 U	13 U	11 U
Chloroform	ug/kg	15	16.7%	300	0	11 U	11 U	11 U	11 U	13 U	11 U
HERBICIDES											
Dicamba	ug/kg	23	2.4%	NA	NA	5.4 U	5.5 U	5.9 U	5.8 U	6.7 U	5.4 U
NITROAROMATICS											
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
SEMIVOLATILE ORGANICS											
Acenaphthylene	ug/kg	45	4.8%	41000	0	350 UJ	370 U	30 J	370 UJ	440 U	350 U
Acenaphthene	ug/kg	380	4.8%	50000 *	0	350 UJ	370 U	380 UJ	370 UJ	440 U	350 U
Dibenzofuran	ug/kg	380	4.8%	6200	0	350 UJ	370 U	380 UJ	370 UJ	440 U	350 U
Fluorene	ug/kg	380	4.8%	50000 *	0	350 UJ	370 U	380 UJ	370 UJ	440 U	350 U
Phenanthrene	ug/kg	1400	9.5%	50000 *	0	350 UJ	370 U	380 UJ	370 UJ	440 U	350 U
Anthracene	ug/kg	340	7.1%	50000 *	0	350 UJ	370 U	120 J	370 UJ	440 U	350 U
Carbazole	ug/kg	380	4.8%	50000 *	0	350 UJ	370 U	33 J	370 UJ	440 U	350 U
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	350 UJ	370 UJ	380 UJ	370 UJ	440 U	350 U
Fluoranthene	ug/kg	2400	23.8%	50000 *	0	350 UJ	370 U	380 UJ	370 UJ	51 J	35 J
Pyrene	ug/kg	1800	14.3%	50000 *	0	350 UJ	370 U	380 J	370 UJ	440 U	350 U
Butylbenzylphthalate	ug/kg	380	4.8%	50000 *	0	350 UJ	370 UJ	380 UJ	370 UJ	440 U	350 U
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	350 UJ	370 U	210 J	370 UJ	440 U	350 U
Chrysene	ug/kg	1000	14.3%	400	1	350 UJ	370 U	260 J	370 UJ	440 U	350 U
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000 *	0	110 J	370 UJ	37 J	370 UJ	440 U	350 U
Benzo(b)fluoranthene	ug/kg	7300	16.7%	1100	0	350 UJ	370 U	130 J	370 UJ	440 U	350 U
Benzo(k)fluoranthene	ug/kg	890	11.9%	1100	0	350 UJ	370 U	150 J	370 UJ	440 U	350 U
Benzo(a)pyrene	ug/kg	880	11.9%	61	3	350 UJ	370 U	180 J	370 UJ	440 U	350 U
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	3200	0	350 UJ	370 U	59 J	370 UJ	440 U	350 U
Dibenz(a,h)anthracene	ug/kg	32	2.4%	14	1	350 UJ	370 U	32 J	370 UJ	440 U	350 U
Benzo(g,h,i)perylene	ug/kg	270	7.1%	50000 *	0	350 UJ	370 U	120 J	370 UJ	440 U	350 U

TABLE 3-2

SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
						SEAD-4 4-6 12/05/93 SB4-4.2 206145	SEAD-4 6-8 12/05/93 SB4-4.3 206147	SEAD-4 0-2 12/05/93 SB4-5.1 206149	SEAD-4 2-4 12/05/93 SB4-5.2 206150	SEAD-4 0-2 12/06/93 SB4-6.1 206270	SEAD-4 2-4 12/06/93 SB4-6.2 206271
PESTICIDES/PCB											
delta-BHC	ug/kg	5.9	2.4%	300	0	1.8 U	1.9 U	5.9 J	2 U	2.3 UJ	1.8 UJ
Aldrin	ug/kg	8.2	4.8%	41	0	1.8 U	1.9 U	8.2 J	2 U	2.3 UJ	1.8 UJ
Endosulfan I	ug/kg	11	2.4%	900	0	1.8 U	1.9 U	11	2 U	2.3 UJ	1.8 UJ
Dieldrin	ug/kg	5.4	2.4%	44	0	3.6 U	3.7 U	11	2 U	2.3 UJ	1.8 UJ
4,4'-DDE	ug/kg	21	9.5%	2100	0	3.6 U	3.7 U	19 U	3.8 U	4.4 UJ	3.5 UJ
Endrin	ug/kg	34	2.4%	100	0	3.6 U	3.7 U	21 J	3.8 U	4.4 UJ	3.5 UJ
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.6 U	3.7 U	34 J	3.8 U	4.4 UJ	3.5 UJ
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	3.6 U	3.7 U	19 U	3.8 U	4.4 UJ	3.5 UJ
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.6 U	3.7 U	19 U	3.8 U	4.4 UJ	3.5 UJ
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	3.6 U	3.7 U	19 U	3.8 U	4.4 UJ	3.5 UJ
alpha-Chlordane	ug/kg	10	16.7%	540	0	1.8 U	1.9 U	10 J	2 U	2.3 UJ	1.8 UJ
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.8 U	1.9 U	9.8 U	2 U	2.3 UJ	1.8 UJ
Aroclor-1248	ug/kg	38	14.3%	1000(a)	0	3.6 U	3.7 U	19 U	3.8 U	4.4 UJ	3.5 UJ
Aroclor-1254	ug/kg	1600	28.6%	1000(a)	1	3.6 U	3.7 U	1600	38 U	44 UJ	35 UJ
Aroclor-1260	ug/kg	110	14.3%	1000(a)	0	3.6 U	3.7 U	190 U	38 U	44 UJ	35 UJ
METALS											
Aluminum	mg/kg	21000	100.0%	15523	19	9500	10200	15000	15700	17100	12800
Antimony	mg/kg	96.1	31.0%	5	10	3.4 UJ	4.4 UJ	6.3 J	3.5 J	4.8 UJ	4 UJ
Arsenic	mg/kg	21.5	100.0%	7.5	4	4.5	5	3.3	6.9	7.3	5.5
Barium	mg/kg	277	100.0%	300	0	45.4	50.5	92.7	99.8	132	37.1 J
Beryllium	mg/kg	1.8	100.0%	1	1	0.37 J	0.38 J	0.65 J	0.65 J	0.96 J	0.64 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.33 U	0.42 U	0.66 J	0.3 U	0.46 U	0.39 U
Calcium	mg/kg	196000	100.0%	120725	1	65300	61300	42800	55000	3750	12400
Chromium	mg/kg	4870	66.7%	24	18	21.8	75.8	23.5	26.5	25.7	24.4
Cobalt	mg/kg	29.1	100.0%	30	0	10.5	9.8 J	12.3	9.5	12.5	14.9
Copper	mg/kg	3410	100.0%	25	20	19.6 J	52.8 J	26.2 J	28.1 J	25.7	19.5
Iron	mg/kg	64600	100.0%	28966	19	20500	24400	27900	26700	28600	28600
Lead	mg/kg	116	83.3%	30	2	8.7 J	6.8 J	116	11.8 J	18.8 J	11 J
Magnesium	mg/kg	32000	100.0%	12308	4	11700	8390	10200	11800	4560	5820
Manganese	mg/kg	1340	66.7%	759	6	543	540	648	436	1260	415
Mercury	mg/kg	0.27	73.8%	0.1	4	0.03 J	0.04 U	0.03 J	0.04 U	0.08 J	0.02 J
Nickel	mg/kg	228	100.0%	37	15	24.6	27.2	34.9	32.4	35.2	39.3
Potassium	mg/kg	2490	100.0%	1548	12	1040	1090	1720	1400	2000	1250
Selenium	mg/kg	3.4	59.5%	2	1	0.1 UJ	0.23 J	0.32 J	0.45 J	0.86 J	0.12 U
Silver	mg/kg	1.2	11.9%	0.5	5	0.67 U	0.85 U	0.75 U	0.6 U	1 J	0.78 U
Sodium	mg/kg	1270	95.2%	114	9	116 J	132 J	90.1 J	106 J	43.7 U	49.1 J
Vanadium	mg/kg	1250	100.0%	150	1	13.1	14.4	23.8	24.4	29	18.5
Zinc	mg/kg	1010	100.0%	90	18	61.6	112	236	67.3	87.4	91.5
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.03	0.01	0.01	0.14	0.16	0.04
Total Solids	%WW	94.9		NA	NA	92.2	89.9	85.1	86.4	75.3	93.1

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						0-2 12/05/93 SB4-7.1 206151	4-6 12/05/93 SB4-7.3 206152	6-8 12/05/93 SB4-7.4 206153	0-2 12/05/93 SB4-8.1 206154	2-4 12/05/93 SB4-8.2 206155
VOLATILE ORGANICS										
Acetone	ug/kg	2	2.4%	200	0	12 U	11 U	11 U	12 U	12 U
Chloroform	ug/kg	15	16.7%	300	0	12 U	11 U	11 U	12 U	14
HERBICIDES										
Dicamba	ug/kg	23	2.4%	NA	NA	5.5 U	5.7 U	5.5 U	5.8 U	5.8 U
NITROAROMATICS										
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U
SEMIVOLATILE ORGANICS										
Acenaphthylene	ug/kg	45	4.8%	41000	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Acenaphthene	ug/kg	380	4.8%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Dibenzofuran	ug/kg	380	4.8%	6200	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Fluorene	ug/kg	380	4.8%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Phenanthrene	ug/kg	1400	9.5%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Anthracene	ug/kg	340	7.1%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Carbazole	ug/kg	380	4.8%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	360 UJ	370 UJ	350 UJ	380 UJ	380 UJ
Fluoranthene	ug/kg	2400	23.8%	50000 *	0	22 J	370 UJ	350 UJ	380 U	380 U
Pyrene	ug/kg	1800	14.3%	50000 *	0	19 J	370 UJ	350 UJ	380 U	380 U
Butylbenzylphthalate	ug/kg	380	4.8%	50000 *	0	360 UJ	370 UJ	350 UJ	380 UJ	380 UJ
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	360 UJ	370 UJ	350 UJ	380 U	380 U
Chrysene	ug/kg	1000	14.3%	400	1	20 J	370 UJ	350 UJ	380 U	380 U
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000 *	0	21 J	370 UJ	350 UJ	380 UJ	32 J
Benzo(b)fluoranthene	ug/kg	730	16.7%	1100	0	20 J	370 UJ	350 UJ	380 U	380 U
Benzo(k)fluoranthene	ug/kg	890	11.9%	1100	0	19 J	370 UJ	350 UJ	380 U	380 U
Benzo(a)pyrene	ug/kg	880	11.9%	61	3	360 UJ	370 UJ	350 UJ	380 U	380 U
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	3200	0	360 UJ	370 UJ	350 UJ	380 U	380 U
Dibenz(s,h)anthracene	ug/kg	32	2.4%	14	1	360 UJ	370 UJ	350 UJ	380 U	380 U
Benzo(g,h,i)perylene	ug/kg	270	7.1%	50000 *	0	360 UJ	370 UJ	350 UJ	380 U	380 U

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						0-2 12/05/93 SB4-7.1 206151	4-6 12/05/93 SB4-7.3 206152	6-8 12/05/93 SB4-7.4 206153	0-2 12/05/93 SB4-8.1 206154	2-4 12/05/93 SB4-8.2 206155
PESTICIDES/PCB										
delt-BHC	ug/kg	5.9	2.4%	300	0	1.9 U	1.9 U	1.8 U	2 U	1.9 U
Aldrin	ug/kg	8.2	4.8%	41	0	1.9 U	1.9 U	1.8 U	2 U	1.9 U
Endosulfan I	ug/kg	11	2.4%	900	0	1.9 U	1.9 U	1.8 U	2 U	1.9 U
Dieldrin	ug/kg	5.4	2.4%	44	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
4,4'-DDE	ug/kg	21	9.5%	2100	0	3.6 J	3.7 U	3.5 U	3.8 U	3.8 U
Endrin	ug/kg	34	2.4%	100	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	3.6 U	3.7 U	3.5 U	3.8 U	3.8 U
alpha-Chlordane	ug/kg	10	16.7%	540	0	1.9 U	1.9 U	1.8 U	2 U	1.9 U
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.9 U	1.9 U	1.8 U	2 U	1.9 U
Aroclor-1248	ug/kg	38	14.3%	1000(s)	0	36 U	37 U	35 U	38 U	38 U
Aroclor-1254	ug/kg	1600	28.6%	1000(s)	1	36 U	37 U	35 U	38 U	38 U
Aroclor-1260	ug/kg	110	14.3%	1000(s)	0	36 U	37 U	35 U	38 U	38 U
METALS										
Aluminum	mg/kg	21000	100.0%	15523	19	14600	11400	8410	13300	16700
Antimony	mg/kg	96.1	31.0%	5	10	6.4 J	2.9 J	3 J	2.7 UJ	4.2 UJ
Arsenic	mg/kg	21.5	100.0%	7.5	4	5.1	3.4	5.7	5.6	5.1
Barium	mg/kg	277	100.0%	300	0	61.5	77.3	45.4	69.4	116
Beryllium	mg/kg	1.8	100.0%	1	1	0.62 J	0.46 J	0.38 J	0.65	0.72 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.39 U	0.27 U	0.29 U	0.27 J	0.41 U
Calcium	mg/kg	196000	100.0%	120725	1	38600	71600	87500	25200	9320
Chromium	mg/kg	4870	66.7%	24	18	25.4 R	21.4 R	14 R	21.4 R	24.9 R
Cobalt	mg/kg	29.1	100.0%	30	0	12.7	9.1	8.3	11.7	15.3
Copper	mg/kg	3410	100.0%	25	20	27.5 J	21 J	19.5 J	25.6 J	21.6 J
Iron	mg/kg	64600	100.0%	28986	19	29400	21800	19100	25900	29700
Lead	mg/kg	116	83.3%	30	2	16.6 J	9.4 J	16.6 J	19.7 J	10.3 J
Magnesium	mg/kg	32000	100.0%	12308	4	6650	15200	11900	6380	5870
Manganese	mg/kg	1340	66.7%	759	6	622	423	383	418	1240
Mercury	mg/kg	0.27	73.8%	0.1	4	0.03 J	0.02 U	0.03 U	0.03 J	0.03 J
Nickel	mg/kg	228	100.0%	37	15	40.2	29.3	22.3	31.7	37.3
Potassium	mg/kg	2490	100.0%	1548	12	1420	1470	1030	1470	2090
Selenium	mg/kg	3.4	59.5%	2	1	0.36 J	0.11 UJ	0.1 UJ	0.42 J	0.53 J
Silver	mg/kg	1.2	11.9%	0.5	5	0.79 U	0.55 U	0.57 U	0.52 U	0.82 U
Sodium	mg/kg	1270	95.2%	114	9	100 J	120 J	133 J	64.4 J	53.3 J
Vanadium	mg/kg	1250	100.0%	150	1	23.4	18.1	13	22	28.7
Zinc	mg/kg	1010	100.0%	90	18	93.2	72.1	84	71.7	73.9
OTHER ANALYSES										
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.16	0.02	0.01	1	0.36
Total Solids	%WW	94.9		NA	NA	89.9	88.4	91.9	85.8	85.6

TABLE 3-2
SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						4-6 12/05/93 SB4-8.3 206156	0-2 12/05/93 SB4-9.1 206157	2-4 12/05/93 SB4-9.2 206158	4-6 12/05/93 SB4-9.3 206159	0-2 12/06/93 SB4-10.1 206272	2-4 12/06/93 SB4-10.2 206273
VOLATILE ORGANICS											
Acetone	ug/kg	2	2.4%	200	0	11 U	11 U	12 U	11 U	12 U	11 U
Chloroform	ug/kg	15	16.7%	300	0	2 J	11 U	2 J	3 J	12 U	11 U
HERBICIDES											
Dicamba	ug/kg	23	2.4%	NA	NA	5.6 U	5.9 U	6.1 U	5.4 U	5.8 U	5.3 U
NITROAROMATICS											
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	67 J	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U
SEMIVOLATILE ORGANICS											
Acenaphthylene	ug/kg	45	4.8%	41000	0	360 UJ	45 J	380 UJ	340 UJ	390 U	350 U
Acenaphthene	ug/kg	380	4.8%	50000 *	0	360 UJ	72 J	380 UJ	340 UJ	390 U	350 U
Dibenzofuran	ug/kg	380	4.8%	6200	0	360 UJ	33 J	380 UJ	340 UJ	390 U	350 U
Fluorene	ug/kg	380	4.8%	50000 *	0	360 UJ	110 J	380 UJ	340 UJ	390 U	350 U
Phenanthrene	ug/kg	1400	9.5%	50000 *	0	360 UJ	1400	380 UJ	340 UJ	390 U	350 U
Anthracene	ug/kg	340	7.1%	50000 *	0	360 UJ	340 J	380 UJ	340 UJ	390 U	350 U
Carbazole	ug/kg	380	4.8%	50000 *	0	360 UJ	160 J	380 UJ	340 UJ	390 U	350 U
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	360 UJ	390 UJ	380 UJ	340 UJ	58 J	41 J
Fluoranthene	ug/kg	2400	23.8%	50000 *	0	360 UJ	2400	380 UJ	340 UJ	390 U	350 U
Pyrene	ug/kg	1800	14.3%	50000 *	0	360 UJ	1800	380 UJ	340 UJ	390 U	350 U
Butylbenzylphthalate	ug/kg	380	4.8%	50000 *	0	360 UJ	390 UJ	18 J	340 UJ	390 U	350 U
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	360 UJ	1100	380 UJ	340 UJ	390 U	350 U
Chrysene	ug/kg	1000	14.3%	400	1	360 UJ	1000	380 UJ	340 UJ	390 U	350 U
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000 *	0	360 UJ	390 UJ	380 UJ	340 UJ	390 U	350 U
Benzo(b)fluoranthene	ug/kg	730	16.7%	1100	0	360 UJ	730	380 UJ	340 UJ	390 U	350 U
Benzo(k)fluoranthene	ug/kg	890	11.9%	1100	0	360 UJ	890	380 UJ	340 UJ	390 U	350 U
Benzo(a)pyrene	ug/kg	880	11.9%	61	3	360 UJ	880	380 UJ	340 UJ	390 U	350 U
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	3200	0	360 UJ	260 J	380 UJ	340 UJ	390 U	350 U
Dibenzo(a,h)anthracene	ug/kg	32	2.4%	14	1	360 UJ	390 U	380 UJ	340 UJ	390 U	350 U
Benzo(g,h)perylene	ug/kg	270	7.1%	50000 *	0	360 UJ	270 J	380 UJ	340 UJ	390 U	350 U

TABLE 3-2

SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						4-6 12/05/93 SB4-8.3 206156	0-2 12/05/93 SB4-9.1 206157	2-4 12/05/93 SB4-9.2 206158	4-6 12/05/93 SB4-9.3 206159	0-2 12/06/93 SB4-10.1 206272	2-4 12/06/93 SB4-10.2 206273
PESTICIDES/PCB											
delta-BHC	ug/kg	5.9	2.4%	300	0	1.9 U	2 U	2.1 U	1.8 U	2 U	1.8 U
Aldrin	ug/kg	8.2	4.8%	41	0	1.9 U	2 U	2.1 U	1.8 U	2 U	1.8 U
Endosulfan I	ug/kg	11	2.4%	900	0	1.9 U	2 U	2.1 U	1.8 U	2 U	1.8 U
Dieldrin	ug/kg	5.4	2.4%	44	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
4,4'-DDE	ug/kg	21	9.5%	2100	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
Endrin	ug/kg	34	2.4%	100	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
alpha-Chlordane	ug/kg	10	16.7%	540	0	1.9 U	2 U	2.1 U	1.8 U	2 U	1.8 U
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.9 U	2 U	2.1 U	1.8 U	2 U	1.8 U
Aroclor-1248	ug/kg	38	14.3%	1000(e)	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
Aroclor-1254	ug/kg	1600	28.6%	1000(e)	1	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
Aroclor-1260	ug/kg	110	14.3%	1000(e)	0	3.6 U	3.9 U	4 U	3.5 U	3.9 U	3.5 U
METALS											
Aluminum	mg/kg	21000	100.0%	15523	19	9180	12800	20400	13500	15600	17000
Antimony	mg/kg	96.1	31.0%	5	10	2.5 UJ	3.7 J	4.1 UJ	3.3 UJ	4.7 UJ	43.8 J
Arsenic	mg/kg	21.5	100.0%	7.5	4	4.9	4.5	6.5	4.6	6.5	5.6
Barium	mg/kg	277	100.0%	300	0	63.5	94.1	102	51.3	126	58.4
Beryllium	mg/kg	1.8	100.0%	1	1	0.37 J	0.75 J	0.97	0.69 J	0.82 J	0.87 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.24 U	0.35 U	0.4 U	0.32 U	0.46 U	0.37 U
Calcium	mg/kg	196000	100.0%	120725	1	77000	3660	2770	2350	3250	6540
Chromium	mg/kg	4870	66.7%	24	18	14.1	17.6	33.2	23.3	17.8	2560
Cobalt	mg/kg	29.1	100.0%	30	0	7.9	9	17.3	14.8	19.5	18.7
Copper	mg/kg	3410	100.0%	25	20	21.1 J	13.1 J	24.9 J	11 J	28	1790
Iron	mg/kg	64600	100.0%	28986	19	18500	20600	39000	29600	34700	37200
Lead	mg/kg	116	83.3%	30	2	44.2	26.4 J	12.2 J	6.3 J	12.8 J	9 J
Magnesium	mg/kg	32000	100.0%	12308	4	17700	3090	7870	5950	5370	7870
Manganese	mg/kg	1340	66.7%	759	6	420	794	633	252	1390	299
Mercury	mg/kg	0.27	73.8%	0.1	4	0.01 U	0.07 J	0.03 U	0.02 U	0.06 J	0.03 J
Nickel	mg/kg	228	100.0%	37	15	23.1	18.3	57.1	42.2	51.3	56
Potassium	mg/kg	2490	100.0%	1548	12	1380	1020	1800	980	1170	1090
Selenium	mg/kg	3.4	59.5%	2	1	0.22 J	0.47 J	0.47 J	0.11 J	0.23 J	0.31 J
Silver	mg/kg	1.2	11.9%	0.5	5	0.48 U	0.7 U	0.79 U	0.63 U	0.91 U	0.73 U
Sodium	mg/kg	1270	95.2%	114	9	134 J	49.1 J	44.1 J	39.3 J	42.9 U	55.7 J
Vanadium	mg/kg	1250	100.0%	150	1	14.8	22.6	28.4	17.8	26.9	24.6
Zinc	mg/kg	1010	100.0%	90	18	58.5	56.6	93.6	80.5	89.8	576
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.04	0.86	0.44	0.02	0.13	0.03
Total Solids	%W/W	94.9		NA	NA	89.1	83.9	81.6	92.9	84.6	93.1

TABLE 3-2
 SOIL ANALYSIS RESULTS
 SENECA ARMY DEPOT
 SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						4-6	3	3	4	4	6	5	3	
						12/05/93	11/10/93	11/10/93	12/05/93	12/05/93	12/05/93	12/05/93	12/05/93	12/05/93
						SB4-10.3	TP4-1	TP4-2	TP4-3	TP4-4	TP4-5	TP4-6	TP4-7	TP4-8
						206274	204020-	204023-	206190	206191	206192	206276	206193	206194
VOLATILE ORGANICS														
Acetone	ug/kg	2	2.4%	200	0	11 U	11 U	11 U	11 U	13 U	11 U	11 U	11 U	12 U
Chloroform	ug/kg	15	16.7%	300	0	11 U	11 U	11 U	15	12 U	11 U	11 U	5 J	12 U
HERBICIDES														
Dicamba	ug/kg	23	2.4%	NA	NA	5.4 U	5.7 U	5.6 U	5.9 U	5.9 U	5.8 U	5.5 U	5.8 U	6 U
NITROAROMATICS														
1,3,5-Trinitrobenzene	ug/kg	120	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
Tetryl	ug/kg	67	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
2,4,6-Trinitrotoluene	ug/kg	72	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
2-amino-4,6-Dinitrotoluene	ug/kg	90	2.4%	NA	NA	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
SEMIVOLATILE ORGANICS														
Acenaphthylene	ug/kg	45	4.8%	41000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Acenaphthene	ug/kg	380	4.8%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Dibenzofuran	ug/kg	380	4.8%	6200	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Fluorene	ug/kg	380	4.8%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Phenanthrene	ug/kg	1400	9.5%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Anthracene	ug/kg	340	7.1%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Carbazole	ug/kg	380	4.8%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Di-n-butylphthalate	ug/kg	380	40.5%	8100	0	63 J	33 J	370 U	380 U	380 U	380 U	55 J	380 UJ	390 U
Fluoranthene	ug/kg	2400	23.8%	50000	0	350 U	19 J	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Pyrene	ug/kg	1800	14.3%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Butylbenzylphthalate	ug/kg	380	4.8%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Benzo(a)anthracene	ug/kg	1100	11.9%	220	1	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Chrysene	ug/kg	1000	14.3%	400	1	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
bis(2-Ethylhexyl)phthalate	ug/kg	2000	33.3%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Benzo(b)fluoranthene	ug/kg	730	16.7%	1100	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Benzo(k)fluoranthene	ug/kg	890	11.9%	1100	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Benzo(a)pyrene	ug/kg	880	11.9%	61	3	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Indeno(1,2,3-cd)pyrene	ug/kg	260	7.1%	1100	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Dibenz(a,h)anthracene	ug/kg	32	2.4%	14	1	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U
Benzo(g,h,i)perylene	ug/kg	270	7.1%	50000	0	350 U	370 U	370 U	380 U	380 U	380 U	370 U	380 UJ	390 U

TABLE 3-2

SOIL ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	TAGM	NUMBER ABOVE TAGM	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4	SOIL SEAD-4
						4-6 12/05/93 SB4-10.3 206274	3 11/10/93 TP4-1 204020- 204022	3 11/10/93 TP4-2 204023- 204025	4 12/05/93 TP4-3 206190	4 12/05/93 TP4-4 206191	4 12/05/93 TP4-5 206192	6 12/05/93 TP4-6 206276	5 12/05/93 TP4-7 206193	3 12/05/93 TP4-8 206194
PESTICIDES/PCB														
delta-BHC	ug/kg	5.9	2.4%	300	0	1.8 U	1.9 U	1.9 U	2 U	2 U	2 U	1.9 U	2 U	2 U
Aldrin	ug/kg	8.2	4.8%	41	0	1.8 U	1.9 U	1.9 U	2 U	2 U	2 U	1.9 U	2 U	2 U
Endosulfan I	ug/kg	11	2.4%	900	0	1.8 U	1.9 U	1.9 U	2 U	2 U	2 U	1.9 U	2 U	2 U
Dieldrin	ug/kg	5.4	2.4%	44	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
4,4'-DDE	ug/kg	21	9.5%	2100	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
Endrin	ug/kg	34	2.4%	100	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
Endosulfan II	ug/kg	3.1	2.4%	900	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
4,4'-DDD	ug/kg	2.5	2.4%	2900	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
Endosulfan sulfate	ug/kg	3.8	2.4%	1000	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
4,4'-DDT	ug/kg	6.2	2.4%	2100	0	3.5 U	3.7 U	3.7 U	3.8 U	3.8 U	3.8 U	3.7 U	3.8 U	3.9 U
alpha-Chlordane	ug/kg	10	16.7%	540	0	1.8 U	1.9 U	1.9 U	2 U	2 U	2 U	1.9 U	2 U	2 U
gamma-Chlordane	ug/kg	2	14.3%	540	0	1.8 U	1.9 U	1.9 U	2 U	2 U	2 U	1.9 U	2 U	2 U
Aroclor-1248	ug/kg	38	14.3%	1000(e)	0	35 U	37 U	37 U	38 U	38 U	38 U	37 U	38 U	39 U
Aroclor-1254	ug/kg	1600	28.6%	1000(e)	1	35 U	37 U	37 U	38 U	38 U	38 U	37 U	38 U	39 U
Aroclor-1260	ug/kg	110	14.3%	1000(e)	0	35 U	37 U	37 U	38 U	38 U	38 U	37 U	38 U	39 U
METALS														
Aluminum	mg/kg	21000	100.0%	15523	19	17200	18200	17700	10200	12100	10800	6100	10500	12500
Antimony	mg/kg	96.1	31.0%	5	10	40.9 J	11.1 U	11.2 U	3.5 UJ	4 UJ	4.6 UJ	4.6 UJ	3.5 UJ	3.5 UJ
Arsenic	mg/kg	21.5	100.0%	7.5	4	6.4	7.2 J	6.4 J	5.1	4.3	5.2	5.6	4.2	3.5
Barium	mg/kg	277	100.0%	300	0	54.3	91.9	86.3	65.4	74.9	60.6	37.4 J	64.8	71.8
Beryllium	mg/kg	1.8	100.0%	1	1	0.83	0.83 J	0.83 J	0.46 J	0.53 J	0.53 J	0.29 J	0.52 J	0.61 J
Cadmium	mg/kg	1.8	9.5%	1	2	0.34 U	0.69 U R	0.7 U R	0.34 U	0.39 U	1.5	0.45 U	0.34 U	0.34 U
Calcium	mg/kg	196000	100.0%	120725	1	2140	6450	3130	88300	76800	86400	64300	59500	2130
Chromium	mg/kg	4870	66.7%	24	18	2470	27.1	27.6	15.1	19.4	16.5	10.8	16.3	20.4
Cobalt	mg/kg	29.1	100.0%	30	0	14.7	13.5	13.9	9.1	10.3	6.6 J	5.9 J	8.3	11.9
Copper	mg/kg	3410	100.0%	25	20	2030	21.3 J	23.8 J	17.3	20	12	21.7	14.9	14.9
Iron	mg/kg	64600	100.0%	28986	19	35100	33500	35400	18900	24100	20000	13900	21400	27300
Lead	mg/kg	116	83.3%	30	2	5.2 J	11.3	13.4	11 J	10.9 J	11.2 J	8 J	13.1 J	10.6 J
Magnesium	mg/kg	32000	100.0%	12308	4	7530	5920	5500	32000	10700	24600	11400	10000	4170
Manganese	mg/kg	1340	66.7%	759	6	267 R	687	714	510 R	488 R	349 R	309 R	435 R	658 R
Mercury	mg/kg	0.27	73.8%	0.1	4	0.02 J	0.04 J	0.04 J	0.04 J	0.03 J	0.02 U	0.03 J	0.03 J	0.03 J
Nickel	mg/kg	228	100.0%	37	15	49.8	33.7	36	22.6	32.1	25.2	17.7	25.5	27.8
Potassium	mg/kg	2490	100.0%	1548	12	1320	1680	1480	1130	1470	1130	690 J	1020	807
Selenium	mg/kg	3.4	59.5%	2	1	0.21 J	0.21 UJ	0.16 UJ	0.15 U	0.12 U	0.13 U	0.13 U	0.14 U	0.12 J
Silver	mg/kg	1.2	11.9%	0.5	5	0.92 J	1.4 UJ	1.4 UJ	0.68 U	0.92 J	1.2 J	0.89 U	0.67 U	0.68 U
Sodium	mg/kg	1270	95.2%	114	9	57.6 J	64.7 J	53.8 J	126 J	88.3 J	111 J	118 J	107 J	31.8 U
Vanadium	mg/kg	1250	100.0%	150	1	25.1	28.8	27.2	17.9	21.4	19.3	10.3 J	18.3	19.9
Zinc	mg/kg	1010	100.0%	90	18	440	73.4 J	72.7 J	46.8	68.4	64.1	46.5	75.4	67.8
OTHER ANALYSES														
Nitrate/Nitrite-Nitrogen	mg/kg	3.3	100.0%	NA	NA	0.02	3.3	1.2	0.1	1.99	0.12	0.02	0.16	0.89
Total Solids	%WW	94.9		NA	NA	92.9	88.3	89	86.4	85.9	85.9	89.8	87.3	84

Notes:

- The TAGM value for PCBs is 1000 ug/kg for surface soils and 10,000 ug/kg for subsurface soils.
- * = As per proposed TAGM, total VOCs < 10ppm; total Semi-VOCs < 500ppm; individual semi-VOCs < 50 ppm.
- NA = Not Available
- U = Compound was not detected.
- J = the reported value is an estimated concentration.
- R = the data was rejected in the data validating process.
- UJ = the compound was not detected; the associated reporting limit is approximate.

**TABLE 3-3
GROUNDWATER ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION**

COMPOUND	MATRIX LOCATION SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	NY AWQS CLASS GA (a)	MCL STANDARDS	NO. ABOVE CRITERIA	WATER SEAD-4 01/21/94 MW4-1 209252	WATER SEAD-4 02/04/94 MW4-2 210478	WATER SEAD-4 01/20/94 MW4-3 209091	WATER SEAD-4 02/01/94 MW4-4 210061	WATER SEAD-4 01/20/94 MW4-5 209092, 209943
SEMIVOLATILE ORGANICS											
Diethylphthalate	ug/L	0.9	60.0%	50	NA	0	0.9 J	10 U	0.5 J	10 U	0.6 J
METALS											
Aluminum	ug/L	1240	80.0%	NA	NA	NA	41.9 U	435	725	1240	108 J
Antimony	ug/L	39.3	40.0%	3	6	2	21.6 U	39.3 J	21.4 U	33.8 J	21.4 U
Arsenic	ug/L	2.2	40.0%	25	50	0	2.2 J	1.4 U	1 J	1.4 U	0.8 U
Barium	ug/L	46.7	100.0%	1000	2000	0	19.6 J	19.3 J	42.7 J	46.7 J	36.1 J
Beryllium	ug/L	6.3	20.0%	3	4	1	0.4 U	0.4 U	6.3	0.4 U	0.4 U
Cadmium	ug/L	5.6	20.0%	10	5	1	2.1 U	2.1 U	5.6	2.1 U	2.1 U
Calcium	ug/L	147000	100.0%	NA	NA	NA	137000	66300	122000	123000	147000
Chromium	ug/L	21.3	40.0%	50	100	0	2.6 U	2.6 U	6.9 J	21.3	2.6 U
Cobalt	ug/L	8.2	60.0%	NA	NA	NA	4.6 J	4.4 U	8.2 J	4.4 U	5.2 J
Copper	ug/L	37.6	40.0%	200	1300(g)	0	3.1 U	3.1 U	6.6 J	37.6	3.1 U
Iron	ug/L	2270	100.0%	300	NA	4	332	471	745	2270	143
Lead	ug/L	0.56	60.0%	25	15(h)	0	0.5 U	1.9 J	0.56 J	2.2 J	0.5 U
Magnesium	ug/L	57600	100.0%	35000	NA	1	57600	10100	32800	19100	31000
Manganese	ug/L	477	100.0%	300	NA	2	346	60.5	229	263	477
Mercury	ug/L	0.04	40.0%	2	2	0	0.04 U	0.04 U	0.04 J	0.04 U	0.04 J
Nickel	ug/L	6.4	40.0%	NA	100	0	4 U	4 U	4.4 J	6.4 J	4 U
Potassium	ug/L	7380	100.0%	NA	NA	NA	7380	1840 J	5250	4540 J	7320
Selenium	ug/L	2.1	60.0%	10	50	0	2.1 J	0.7 U	1.4 J	0.7 U	0.9 J
Silver	ug/L	6.7	20.0%	50	NA	0	4.2 U	4.2 U	6.7 J	4.2 U	4.2 U
Sodium	ug/L	31100	100.0%	20000	NA	1	11700	12400	31100	11200	14100
Vanadium	ug/L	7.7	60.0%	NA	NA	NA	3.7 U	3.7 U	7.7 J	4.9 J	3.7 U
Zinc	ug/L	NA	100.0%	300	NA	0	19.1 J	15.2 J	17.7 J	95	42.6
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen	mg/L	0.25	100.0%	10	10	0	0.12	0.23	0.25	0.11	0.07
pH	standard units	7.76	NA				7.2	7.46	7.46	7.76	7.57
Specific Conductivity	umhos/cm	600	NA				600	228	550	400	480
Turbidity	NTU	72.7	NA				3.1	72.7	12.4	6.2	1.1

NOTES:

- a) NY State Class GA Groundwater Regulations
- b) NA = Not Available
- c) U = compound was not detected
- d) J = the report value is an estimated concentration
- e) UJ = the compound was not detected; the associated reporting limit is approximate
- f) R = the data was rejected in the data validating process
- g) The value listed is an Action Level for copper, and not an MCL Standard
- h) The value listed is an Action Level for lead at the tap, and not an MCL Standard

TABLE 3-4
SURFACE WATER ANALYSIS RESULTS
SENECA ARMY DEPOT
SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	NYS GUIDELINES CLASS D (a)	EPA AWQC ACUTE (b)	EPA AWQC CHRONIC (b)	NO. ABOVE CRITERIA	WATER SEAD-4 11/02/93 SW4-1 203210	WATER SEAD-4 11/02/93 SW4-3 203213	WATER SEAD-4 11/02/93 SW4-2 203212 SW4-1DUP	WATER SEAD-4 12/17/93 4PIPE 206099
NITROAROMATICS											
1,3-Dinitrobenzene	ug/L	0.07	33.3%	5	NA	NA	0	0.13 UJ	0.13 U	0.13 U	0.07 J
METALS											
Aluminum	ug/L	314	100.0%	NA	750	87	3	237	194 J	314	42.6 J
Barium	ug/L	49.6	100.0%	NA	NA	NA	NA	21.3 J	21.5 J	24.9 J	49.6 J
Calcium	ug/L	115000	100.0%	NA	NA	NA	NA	45600	46800	51200	115000
Chromium	ug/L	44.8	66.7%	4270	4270	509	0	19.2	19.7	44.8	2.6 U
Copper	ug/L	66.9	100.0%	50	50	30.2	3	47.3	50.9	66.9	6 J
Iron	ug/L	657	100.0%	300	NA	1000	4	443 J	349 J	630 J	657
Lead	ug/L	10.7	66.7%	330	330.6	12.9	0	0.79 UJ	10.7 J	3.1	5.7
Magnesium	ug/L	21100	100.0%	NA	NA	NA	NA	10500	10700	10800	21100
Manganese	ug/L	45.6	100.0%	NA	NA	NA	NA	28.1	25	45.6	1.8 J
Potassium	ug/L	1830	100.0%	NA	NA	NA	NA	1680 J	1830 J	1720 J	1170 J
Sodium	ug/L	21700	100.0%	NA	NA	NA	NA	12800	13300	13200	21700
Thallium	ug/L	2.4	33.3%	NA	1400	40	0	1.2 U	1.2 U	1.2 U	2.4 J
Zinc	ug/L	20.3	100.0%	800	296.8	268.9	0	10.7 J	9.2 J	20.3	4 J
OTHER ANALYSES											
Nitrate/Nitrite-Nitrogen	mg/L	0.33	100.0%	NA	NA	NA	NA	0.03	0.02	0.03	0.33

Notes:

- The New York State Ambient Water Quality Standards and Guidelines for Class "D" Water.
- EPA Water Quality Criteria Summary (1991), Quality Criteria for Water 1986 Updates # 1 and # 2.
- Hardness dependent values assume a hardness of 300 mg/l.
- NA = Not Available
- U = Compound was not detected.
- J = the reported value is an estimated concentration.
- R = the data was rejected in the data validating process.
- UJ = the compound was not detected; the associated reporting limit is approximate.

TABLE 3-5
 SEDIMENT ANALYSIS RESULTS
 SENECA ARMY DEPOT
 SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	NYSDEC SEDIMENT CRITERIA FOR AQUATIC LIFE (a)	NYSDEC SEDIMENT CRITERIA FOR HUMAN HEALTH (a)	NYSDEC SEDIMENT CRITERIA FOR WILDLIFE (a)	LOT (b)	NO. ABOVE CRITERIA	SOIL SEAD-4 0-0.5 11/02/93 SD4-1 203271	SOIL SEAD-4 0-0.5 11/02/93 SD4-2 203272	SOIL SEAD-4 0-0.5 11/02/93 SD4-3 203273	SOIL SEAD-4 0-0.5 12/14/93 SD4-4 206905	SOIL SEAD-4 0-0.5 12/14/93 SD4-5 206906	SOIL SEAD-4 0-0.5 12/14/93 SD4-6 206907	SOIL SEAD-4 0-0.5 12/14/93 SD4-7 206908	SOIL SEAD-4 0-0.5 12/14/93 SD4-8 206909	SOIL SEAD-4 0-0.5 12/14/93 SD4-9 206910	
VOLATILE ORGANICS																		
Methylene Chloride	ug/kg	11	22.2%	NA	NA	NA	NA	NA	36 UJ	33 U	23 U	18 U	17 U	18 UJ	2 J	11 J	31 UJ	
Acetone	ug/kg	210	44.4%	NA	NA	NA	NA	NA	210 J	51	23 U	18 U	17 U	18 UJ	21 U	180 J	36 J	
Carbon Disulfide	ug/kg	18	33.3%	NA	NA	NA	NA	NA	10 J	33 U	12 J	18 U	17 U	18 UJ	14 U	56 UJ	18 J	
2-Butanone	ug/kg	49	11.1%	NA	NA	NA	NA	NA	49 J	33 U	23 U	18 U	17 U	18 UJ	14 U	28 UJ	31 UJ	
Styrene	ug/kg	3	22.2%	NA	NA	NA	NA	NA	38 UJ	33 U	23 U	18 U	3 J	3 J	14 U	56 UJ	31 UJ	
Xylene (total)	ug/kg	7	22.2%	NA	NA	NA	NA	NA	38 UJ	33 U	23 U	18 U	7 J	4 J	14 U	56 UJ	31 UJ	
HERBICIDES																		
2,4,5-T	ug/kg	21	11.1%	NA	NA	NA	NA	NA	21 J	8.7 U	8.2 U	8.8 U	9.8 U	12 UJ	8 U	15 UJ	21 UJ	
NITROAROMATICS																		
4-amino-2,6-Dinitrotoluene	ug/kg	140	11.1%	NA	NA	NA	NA	NA	130 UJ	140 J	130 U	130 U	130 U	130 UJ	130 U	130 UJ	130 UJ	
SEMI-VOLATILE ORGANICS																		
4-Methylphenol	ug/kg	140	11.1%	6(d)	NA	NA	NA	1	140 J	580 U	410 U	580 U	630 U	780 UJ	1000 UJ	3900 UJ	2800 UJ	
N-Nitroso-D-n-propylamine	ug/kg	410	11.1%	NA	NA	NA	NA	NA	1200 UJ	410 J	410 U	580 U	630 U	780 UJ	1000 UJ	3900 UJ	2800 UJ	
Acenaphthene	ug/kg	58	11.1%	7300	NA	NA	NA	0	1200 UJ	580 U	410 U	580 U	630 U	780 UJ	58 J	3900 UJ	2800 UJ	
Dibenzofuran	ug/kg	63	11.1%	NA	NA	NA	NA	NA	1200 UJ	580 U	410 U	580 U	630 U	780 UJ	63 J	3800 UJ	2800 UJ	
Fluorene	ug/kg	85	22.2%	NA	NA	NA	NA	NA	1200 UJ	29 J	410 U	580 U	630 U	780 UJ	85 J	3800 UJ	2800 UJ	
N-Nitrosodiphenylamine	ug/kg	760	11.1%	NA	NA	NA	NA	NA	1200 UJ	580 U	410 U	580 U	630 U	780 UJ	760 J	3800 UJ	2800 UJ	
Phenanthrene	ug/kg	490	33.3%	1390	NA	NA	NA	0	1200 UJ	580 U	410 U	86 J	630 U	780 UJ	490 J	3800 UJ	220 J	
Anthracene	ug/kg	170	11.1%	NA	13	NA	NA	1	1200 UJ	580 U	410 U	580 U	630 U	780 UJ	170 J	3800 UJ	2800 UJ	
Di-n-butylphthalate	ug/kg	250	33.3%	1197(c)	NA	NA	NA	0	1200 UJ	580 U	410 U	580 U	630 U	69 J	83 J	250 J	2800 UJ	
Fluoranthene	ug/kg	580	55.8%	NA	NA	NA	NA	NA	1200 UJ	31 J	410 U	190 J	630 U	780 UJ	580 J	330 J	310 J	
Pyrene	ug/kg	480	55.8%	NA	NA	NA	NA	NA	1200 UJ	28 J	410 U	180 J	630 U	780 UJ	480 J	320 J	280 J	
Benzo(a)anthracene	ug/kg	300	22.2%	NA	13	NA	NA	2	1200 UJ	580 U	410 U	95 J	630 U	780 UJ	300 J	3800 UJ	2800 UJ	
Chrysene	ug/kg	290	33.3%	NA	13	NA	NA	3	1200 UJ	580 U	410 U	160 J	630 U	780 UJ	290 J	3800 UJ	200 J	
bis(2-Ethylhexyl)phthalate	ug/kg	3600	44.4%	1197(c)	NA	NA	NA	2	1200 UJ	580 U	410 U	500 J	630 U	780 UJ	2200 J	3800 J	560 J	
Di-n-octylphthalate	ug/kg	48	11.1%	NA	NA	NA	NA	NA	1200 UJ	48 J	410 U	580 U	630 U	780 UJ	1000 UJ	3800 UJ	2800 UJ	
Benzo(b)fluoranthene	ug/kg	330	33.3%	NA	13	NA	NA	3	1200 UJ	580 U	410 U	250 J	630 U	780 UJ	330 J	3800 UJ	230 J	
Benzo(k)fluoranthene	ug/kg	120	22.2%	NA	13	NA	NA	2	1200 UJ	580 U	410 U	95 J	630 U	780 UJ	120 J	3800 UJ	2800 UJ	
Benzo(a)pyrene	ug/kg	240	22.2%	NA	13	NA	NA	2	1200 UJ	580 U	410 U	140 J	630 U	780 UJ	240 J	3800 UJ	2800 UJ	
Indeno(1,2,3-cd)pyrene	ug/kg	130	22.2%	NA	13	NA	NA	2	1200 UJ	580 U	410 U	86 J	630 U	780 UJ	130 J	3800 UJ	2800 UJ	
Benzo(g,h,i)perylene	ug/kg	79	22.2%	NA	NA	NA	NA	NA	1200 UJ	580 U	410 U	85 J	630 U	780 UJ	79 J	3800 UJ	2800 UJ	
PESTICIDES/PCB																		
Aldrin	ug/kg	2.5	11.1%	84	1	7.7	NA	1	6.1 UJ	3 U	2.1 U	2.9 U	3.3 U	4 UJ	2.7 U	2.5 J	7.1 UJ	
Dieldrin	ug/kg	4.8	11.1%	195	1.3	7.7	NA	1	12 UJ	5.8 U	4.1 U	5.7 U	6.3 U	7.9 UJ	5.2 U	4.8 J	14 UJ	
4,4'-DDE	ug/kg	88	44.4%	500	0.1	10	NA	4	12 UJ	4.1 J	4.1 U	9.4 J	6.3 U	7.9 UJ	9.8 J	88 J	14 UJ	
4,4'-DDD	ug/kg	90	33.3%	500	0.1	10	NA	3	12 UJ	5.8 U	4.1 U	5.1 J	6.3 U	7.9 UJ	9.1 J	90 J	14 UJ	
Endrin aldehyde	ug/kg	11	33.3%	NA	NA	NA	NA	NA	12 UJ	3 J	4.1 U	5.7 U	6.3 U	7.9 UJ	3.2 J	11 J	14 UJ	
alpha-Chlordane	ug/kg	18	44.4%	0.08	0.01	0.08	NA	4	6.1 UJ	3 U	2.1 U	4.5 J	3.3 U	4 UJ	7.5 J	12 J	18 J	
gamma-Chlordane	ug/kg	12	44.4%	NA	NA	NA	NA	NA	6.1 UJ	3 U	2.1 U	3.2 J	3.3 U	4 UJ	6.8 J	11 J	12 J	
Aroclor-1254	ug/kg	430	77.8%	NA	0.008	195	NA	7	120 UJ	280	29 J	360 J	130 J	79 UJ	95	430 J	74 J	
Aroclor-1260	ug/kg	230	22.2%	NA	0.008	195	NA	2	120 UJ	58 U	41 U	57 U	63 U	78 UJ	48 J	230 J	140 UJ	

TABLE 3-5
 SEDIMENT ANALYSIS RESULTS
 SENECA ARMY DEPOT
 SEAD-4 EXPANDED SITE INSPECTION

COMPOUND	MATRIX LOCATION DEPTH (FEET) SAMPLE DATE ES ID LAB ID UNITS	MAXIMUM	FREQUENCY OF DETECTION	NYSDEC SEDIMENT CRITERIA FOR AQUATIC LIFE (a)	NYSDEC SEDIMENT CRITERIA FOR HUMAN HEALTH (a)	NYSDEC SEDIMENT CRITERIA FOR WILDLIFE (a)	LOT (b)	NO. ABOVE CRITERIA	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5	SOIL SEAD-4 0-0.5
									11/02/93 SD4-1	11/02/93 SD4-2	11/02/93 SD4-3	12/14/93 SD4-4	12/14/93 SD4-5	12/14/93 SD4-6	12/14/93 SD4-7	12/14/93 SD4-8	12/14/93 SD4-9
METALS																	
Aluminum	mg/kg	19700	100.0%	NA	NA	NA	NA	NA	17500 J	12000	15000	19700	18200	16500 J	9720	13000 J	10200 J
Antimony	mg/kg	82.7	88.7%	NA	NA	NA	NA	NA	24.5 UJ	30.1	50.4	7.2 UJ	7 J	82.7 J	38.2 J	14.1 J	14.9 UJ
Arsenic	mg/kg	8.1	100.0%	5	NA	NA	33	6	7.4 J	3.8	8.1	4.5	5.2	5.8 J	5.9	4.8 J	8 J
Barium	mg/kg	311	100.0%	NA	NA	NA	NA	NA	102 J	61.3	88.8	121	130	120 J	311	121 J	150 J
Beryllium	mg/kg	NA	100.0%	NA	NA	NA	NA	NA	0.58 J	0.54 J	0.85 J	1 J	0.99 J	0.82 J	0.91 J	0.87 J	0.66 J
Cadmium	mg/kg	34.1	55.8%	0.8	NA	NA	10	5	1.5 UJ	0.92 U	0.59 U	3.1	2.8	0.78 UJ	34.1	8.3 J	8.8 J
Calcium	mg/kg	127000	100.0%	NA	NA	NA	NA	NA	68100 J	28200	11800	13800	19800	7720 J	127000	15500 J	33700 J
Chromium	mg/kg	4170	100.0%	28	NA	NA	111	9	538 J	2230	3310	89.3 J	59.9 J	4170 J	61.3	49.7 J	29.8 J
Cobalt	mg/kg	NA	100.0%	NA	NA	NA	NA	NA	14.1 J	9.5 J	12.4	17.3	15.1	11.3 J	112	151 J	84 J
Copper	mg/kg	2840	100.0%	19	NA	NA	114	9	411 J	1580	2840	46.5 J	33 J	497 J	14 J	12.2 J	11.8 J
Iron	mg/kg	37200	100.0%	24000	NA	NA	40000	7	25400 J	21100	28200	35200	37200	30200 J	23300	24700 J	27000 J
Lead	mg/kg	374	88.7%	27	NA	NA	250	3	13.5 J	18.6	16.8	535	238	30.7 J R	254	374 J	117 J
Magnesium	mg/kg	9130	100.0%	NA	NA	NA	NA	NA	7830 J	4830	6070	9130	7750	4420 J	4220	5080 J	4980 J
Manganese	mg/kg	1790	100.0%	428	NA	NA	1100	4	569 J	383	430	289	337	525 J	1790	274 J	381 J
Mercury	mg/kg	0.55	88.9%	0.11	NA	NA	2	6	0.07 J	0.16	0.13	0.07 J	0.04 U	0.55 J	0.55	0.52 J	0.27 J
Nickel	mg/kg	53.1	100.0%	22	NA	NA	90	9	32.8 J	26.5	33.4	53.1	47.7	27 J	28.7	42.4 J	33.9 J
Potassium	mg/kg	NA	100.0%	NA	NA	NA	NA	NA	2780 J	1640	1410	2540	1580	1680 J	1370 J	1750 J	1690 J
Selenium	mg/kg	2.5	85.7%	NA	NA	NA	NA	NA	0.84 UJ	0.27 U	0.28 U	0.93 J	0.53 J	0.58 J	2.1	2.2 J	2.5 J
Silver	mg/kg	1.7	11.1%	NA	NA	NA	NA	NA	3.1 UJ	1.9 U	1.2 U	1.4 U	1.2 U	1.7 J	1.2 U	1.9 UJ	2.9 UJ
Sodium	mg/kg	NA	100.0%	NA	NA	NA	NA	NA	207 J	97 J	78 J	194 J	127 J	98.3 J	575 J	183 J	225 J
Vanadium	mg/kg	49.9	100.0%	NA	NA	NA	NA	NA	28.2 J	19.5	23.7	35.6	27.7	35.1 J	29.8	49.9 J	29.1 J
Zinc	mg/kg	685	100.0%	85	NA	NA	800	9	180 J	526	630	687	674	330 J	685	484 J	383 J
OTHER ANALYSES																	
Nitrate/Nitrite-Nitrogen	mg/kg	0.05	55.8%	NA	NA	NA	NA	NA	0.05	0.02 U	0.02	0.05	0.02	0.05	0.02 U	0.03 U	0.04 U
Total Solids	%W/W	62.8							NS	NS	NS	57.5	51.5	42.2	62.8	33.9	24.5

NOTES:

- a) NYSDEC Sediment Criteria - 1989.
- b) LOT = limit of tolerance; represents point at which significant toxic effects on benthic species occur.
- c) Used NYSDEC 1989 guideline for phthalates (bis(2-Ethylhexyl)phthalate).
- d) NYSDEC 1989 guidelines for total phenols
- e) NA = Not Available
- f) U = compound was not detected
- g) J = the reported value is an estimated concentration
- h) R = the data was rejected in the data validation process
- i) UJ = the compound was not detected; the associated reporting limit is approximate.

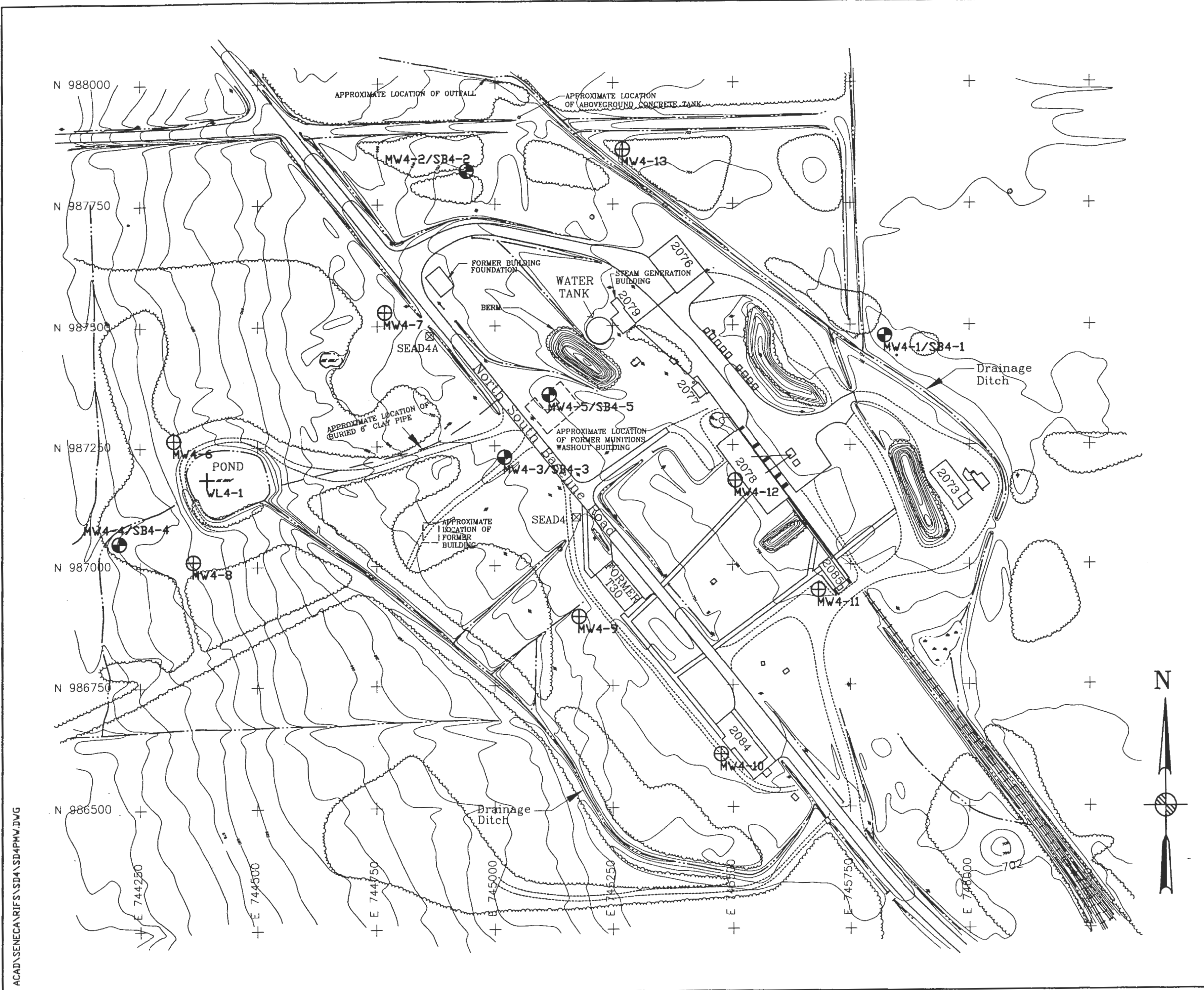
Soil Investigation

Ten soil borings were completed at SEAD-4 to evaluate the subsurface conditions at the site. The locations of the soil borings are shown in Figure 3-8. Soil boring SB4-1 was located in an area considered free of influences of the site activities and provided data on the background soil chemistry. The other soil borings were at locations where releases to the environment may have occurred. Five of the soil borings were completed as groundwater monitoring wells. A sample was collected from the 0 to 2-foot interval at each of the soil borings. If the soil boring was deeper than 6 feet, then a sample was also collected from the interval directly above the water table and from an interval between the surface and the water table, resulting in three samples from the boring. If the boring was less than 6 feet, then a second sample was collected from the deepest interval. The soil borings were located as follows:

- SB4-1, on the upgradient side of the site
- SB4-2, downgradient of the suspected leach field
- SB4-3, SB4-6, downgradient of the former Munitions Washout Facility Building
- SB4-4, downgradient of the pond
- SB4-5, in the area of the former Munitions Washout Facility Building
- SB4-7, near Building 2079
- SB4-8, near the former building where disturbed soil is present and where a building was once located
- SB4-9, near Building 2084
- SB4-10, near Building T-30

Eight test pits were excavated at SEAD-4, and their locations are shown in Figure 3-8. Two excavations (TP4-1 and TP4-2) were located in the former Munitions Washout Facility building. Three excavations (TP4-3 to 4-5) were located within the suspected leach field, north of the Munitions Washout Facility and three excavations (TP4-6 to 4-8) were located along the clay pipe running west to the pond. Four soil samples were composited into one sample for each test pit, and submitted for chemical analysis.

Seven surface soil samples were collected from around the site. The sample locations are shown in Figure 3-8. Two samples (SS4-1 and SS4-2) were collected from the original bed of the ditch that leads west to the pond. Samples SS4-3 to SS4-6 were obtained from the material that was bulldozed from the pond. Sample SS4-7 was obtained from the original bed of the ditch that leads north from the former facility.



LEGEND

	MINOR WATERWAY
	MAJOR WATERWAY
	FENCE
	UNPAVED ROAD
	BRUSH LINE
	LANDFILL EXTENT
	RAILROAD
	GROUND SURFACE ELEVATION CONTOUR
	ROAD SIGN
	DECIDUOUS TREE
	GUIDE POST
	FIRE HYDRANT
	MANHOLE
	COORDINATE GRID (250' GRID)
	POLE
	UTILITY BOX
	MAILBOX/RR SIGNAL
	OVERHEAD UTILITY POLE
	SURVEY MONUMENT

EXISTING MONITORING WELL
 PROPOSED MONITORING WELL
 PROPOSED STAFF GAUGE

100 0 100 200
 (feet)

PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD

DEPT. ENVIRONMENTAL ENGINEERING Dwg. No. 727851-02004

FIGURE 4-3
PROPOSED AND EXISTING MONITORING WELL
AND STAFF GAUGE LOCATIONS

SCALE 1" = 200' DATE JULY 1996 REV C

ACAD\SENECA\RI\FS\SD4\SD4PMV.DWG

The results of the chemical analyses show that subsurface soil at SEAD-4 have been impacted primarily by metals. Antimony, copper, chromium, and zinc were detected at significant concentrations above their respective TAGM values in the subsurface soil samples. The remaining organic and inorganic constituents which were detected in the subsurface soil samples were considered to pose little impact due to their detection at concentrations which were below or only slightly above their respective TAGM values.

The results of the chemical analyses show that surface soil at the site have been impacted primarily by SVOCs and metals. Other constituents that were detected, but are considered to pose little impact, include volatile organic compounds, pesticides and PCBs, herbicides, nitroaromatic compounds and nitrate/nitrite nitrogen. Only small numbers of these constituents exceed their respective TAGM values.

A total of 13 SVOCs were detected at varying concentrations in the surface soil samples analyzed. The compounds benzo(a)anthracene, chrysene, benzo(a)pyrene, and dibenz(a,h)anthracene were reported in three surface soil samples at concentrations exceeding the associated TAGM values. The first three compounds were found at maximum concentrations of 1100 $\mu\text{g}/\text{kg}$, 1000 $\mu\text{g}/\text{kg}$, and 880 $\mu\text{g}/\text{kg}$, respectively in the surface soil sample SB4-9.1, located southeast of the loading dock at building 2084. The maximum concentration of dibenz(a,h)anthracene, 32 $\mu\text{g}/\text{kg}$, was found in surface soil sample SB4-5.1, located southwest of the former Munitions Washout Facility building.

Of the 22 metals reported in the surface soil, 17 of these were found in one or more samples at concentrations above the TAGM value. While the majority of these exceedances were found in only one or two samples, or were only marginally above the TAGM values, several metals were identified at concentrations which were significantly above the TAGM values. Of particular note are the metals antimony, chromium, copper, and zinc, where a large percentage of the samples exceeded the TAGM values and the concentrations at which they were detected were generally an order of magnitude or greater above the TAGM values. The highest concentrations of these metals (antimony at 96.1J mg/kg, chromium at 4870J mg/kg, copper at 3410J mg/kg, and zinc at 859J mg/kg) were found in surface soil samples west and south of the pond, in and near the area where the sediment previously dredged from the pond is located.

Some of the VOC and SVOC compounds detected in the soil are common laboratory contaminants. These are acetone, which was found in one sample, and chloroform, which was

found in six samples. Therefore, these compounds can be potentially attributed to the laboratory and not site conditions.

Groundwater Investigation

Five monitoring wells were installed as part of the ESI conducted at SEAD-4. The locations are shown in Figure 3-8. The monitoring wells were located as follows:

- MW4-1 was installed upgradient of the ammunition workshop facility to obtain background groundwater quality data
- MW4-2 was installed downgradient of the suspected leach field location
- MW4-3 was installed directly downgradient of the former Munitions Washout Facility Building
- MW4-4 was installed downgradient of the pond
- MW4-5 was installed in the location of the former Munitions Washout Facility Building

All monitoring wells were constructed so that the entire thickness of the aquifer was screened. Following installation and development, one groundwater sample was collected from each monitoring well.

Groundwater at the site has been impacted by metals. The seven metals antimony, beryllium, cadmium, iron, magnesium, manganese, and sodium were found in one or more of the groundwater samples at concentrations above the standard values. Antimony was detected in the groundwater samples collected from MW4-2 and MW4-4 at concentrations of 39.3 $\mu\text{g/L}$ and 33.8 $\mu\text{g/L}$, respectively, both of which exceed the NYSDEC GA groundwater standard of 3 $\mu\text{g/L}$ and the EPA Maximum Contaminant Level of 6 $\mu\text{g/L}$. Beryllium was detected in the groundwater sample collected from MW4-3 at a concentration of 6.3 $\mu\text{g/L}$, which exceeds the NYSDEC GA groundwater standard of 3 $\mu\text{g/L}$ and the EPA Maximum Contaminant Level of 4 $\mu\text{g/L}$. Cadmium was detected in the groundwater sample collected from MW4-3 at a concentration of 5.6 $\mu\text{g/L}$, which exceeds the EPA Maximum Contaminant Level of 5 $\mu\text{g/L}$. Iron was detected in the groundwater samples collected from MW4-1, MW4-2, MW4-3 and MW4-4 at concentrations of 332 $\mu\text{g/L}$, 471 $\mu\text{g/L}$, 745 $\mu\text{g/L}$ and 2270 $\mu\text{g/L}$, respectively, all of which exceed the NYSDEC GA groundwater standard of 300 $\mu\text{g/L}$. Magnesium was detected in the groundwater sample collected from MW4-1 at a concentration of 57600 $\mu\text{g/L}$, which exceeds the NYSDEC GA groundwater standard of 35,000 $\mu\text{g/L}$. Manganese was detected in the groundwater samples collected from MW4-1 and MW4-5 at concentrations of 346 $\mu\text{g/L}$ and 477 $\mu\text{g/L}$, respectively, both of which exceed the NYSDEC GA groundwater standard of 300 $\mu\text{g/L}$. Sodium was detected in the groundwater sample

collected from MW4-3 at a concentration of 31,100 $\mu\text{g/L}$, which exceeds the NYSDEC GA groundwater standard of 20,000 $\mu\text{g/L}$.

Other constituents that were detected in the groundwater samples include SVOCs and nitrate/nitrite nitrogen. The SVOC diethylphthalate was detected in MW4-1, MW4-3 and MW4-5 at concentrations of 0.9J $\mu\text{g/L}$, 0.5J $\mu\text{g/L}$ and 0.6J $\mu\text{g/L}$, respectively. Each of these values is well below the NYSDEC GA groundwater standard of 50 $\mu\text{g/L}$. Nitrate/nitrite-nitrogen was detected in all five of the wells, and all of the concentrations were below the NYSDEC GA groundwater standard and EPA Maximum Contaminant Level of 10 mg/L. Constituents that were not detected in the groundwater include volatile organic compounds, pesticides, PCBs, herbicides and nitroaromatic compounds.

One semivolatile organic compound (diethylphthalate), which was found in three samples, is a common laboratory contaminant and can be potentially attributed to the laboratory and not site conditions.

The nature of these constituents (metals and semivolatile organics), combined with the hydrologic data that shows very little vertical connection between the till/weathered shale aquifer and the competent shale aquifer (Section 3.1.1.3), suggests that the potential for vertical migration of these constituents is low.

Surface Water and Sediment Investigation

A total of nine sediment samples and three surface water samples were collected at SEAD-4. The locations are shown in Figure 3-8. Two sediment samples (SD4-1 and SD4-2) and two surface water samples (SW4-1 and SW4-2) were collected near the edge of the pond, and, using a boat, one sediment sample (SD4-3) was collected from the deepest part of the pond.

Three sediment samples (SD4-4, 5, and 6) were collected from the drainage ditch located on the southwest side of the site. The remaining three sediment samples (SD4-7, 8 and 9) were collected from the drainage ditch on the northeast side of the site. An additional surface water sample (4PIPE) was collected from a vertical pipe that was found to be located directly to the north of the suspected leach field.

In the surface water samples, three metals, aluminum, copper and iron, were found at concentrations above the most stringent state or federal criteria value in three of the four samples. In addition, one nitroaromatic compound (1,3-dinitrotoluene) was detected in the sample from the vertical pipe at the suspected leach field. No volatile organic compounds, SVOCs, pesticides, PCBs or herbicides were detected in the surface water. Nitrate/nitrite nitrogen was detected below the Class GA groundwater standard and federal MCL standard of 10 mg/L.

Sediment at the site has been impacted by SVOCs, pesticides, PCBs, and metals. Other constituents that were detected, but are considered to pose little impact, include volatile organic compounds, herbicides and nitrate/nitrite nitrogen. These latter constituents were detected at low concentrations and/or in only a small number of samples. In general, the exceedances were only slightly above their respective TAGM values. No nitroaromatic compounds were detected in the sediment at SEAD-4.

A total of nine SVOCs were identified in nine sediment samples. The maximum SVOC concentration reported was for bis(2-ethylhexyl)phthalate, where 3600 $\mu\text{g}/\text{kg}$ was found in sample SD4-8 collected in the drainage swale north of the suspected leach field. The three sediment samples collected from this swale (SD4-7, SD4-8, and SD4-9) had the highest total SVOC concentrations of the nine samples analyzed. A wide distribution of SVOCs, including polynuclear aromatic hydrocarbons (PAHs), were detected at low concentrations in sample SD4-4, collected from the southern drainage swale.

Seven pesticide or PCB compounds were identified at concentrations above the criteria value in one or more of the nine sediment samples. Aroclor-1254 was found in seven of the nine sediment samples at concentrations ranging from 29 $\mu\text{g}/\text{kg}$ to 430 $\mu\text{g}/\text{kg}$ (in sample SD4-8). The compounds 4,4'-DDE and alpha-chlordane were found at low concentrations in four of the nine sediment samples.

A variety of metals were found at concentrations above the NYSDEC Limit of Tolerance values. Of these metals, chromium and copper appear in a large number of samples and/or at concentrations greater than the criteria value. Their maximum concentrations are 4170 mg/kg and 2640 mg/kg, respectively. Two sediment samples collected from the pond (SD4-2 and SD4-3) had concentrations of chromium, copper, and zinc that exceeded the NYSDEC sediment criteria values for protection of aquatic life.

Two volatile organic compounds methylene chloride and acetone were detected in two and four samples, respectively. These compounds are common laboratory contaminants and can be potentially attributed to the laboratory and not site conditions.

3.1.2 Environmental Fate of Constituents at SEAD-4

The potential contaminants of concern at SEAD-4 are metals, SVOCs (SVOCs), pesticide compounds, PCB compounds, and explosive compounds and their environmental fate is discussed below. The discussion is meant to present general information on the fate of the potential contaminants of concern. Further discussion of these potential contaminants of concern, and all contaminants of concern at SEDA, is presented in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan. A summary of fate and transport characteristics of selected SVOCs is presented in Table 3-6.

3.1.2.1 **Metals**

In general, metals tend to be persistent and relatively insoluble in the environment. The behavior of heavy metals in soil is unlike organic compounds in many aspects. For example, volatilization of metals from soil is not considered a realistic mechanism for contaminant migration and is not considered here. However, leaching and sorption will be considered.

Leaching of heavy metals from soil is controlled by numerous factors. The most important consideration for leaching of heavy metals is the chemical form of the metal (base metal or cation) present in the soil. The leaching of metals from soil is substantial if the metal exists as a soluble salt. Metallic salts have been identified as a component of such items as tracer ammunition, ignitor compositions, incendiary ammunition, flares, colored smoke and primer explosive compositions. In particular, barium nitrate, lead stearate, lead carbonate, and mercury fulminate are potential heavy metal salts or complexes which are components of ammunition that may have been tested or disposed of at SEDA. During the burning of these materials, a portion of these salts oxidize to their metallic oxide forms. In general, metal oxides are considered less likely to leach metallic ions than metallic salts. Upon contact with surface water or precipitation, the heavy metal salts may be dissolved, increasing their mobility and increasing the potential for leaching to the groundwater.

Heavy metals may also exist in the base metallic form as a component of the projectiles tested or disposed of at SEDA. Bullets are composed mainly of lead, which may contain trace amounts of cadmium and selenium. Metals which exist in base metallic form, bullet or projectile casings for example, will tend to dissolve much more slowly than the metallic salts.

TABLE 3 - 6

SUMMARY OF FATE AND TRANSPORT PARAMETERS FOR SELECTED ORGANIC COMPOUNDS
SENECA ARMY DEPOT ACTIVITY

COMPOUND	SOLUBILITY (mg/l)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm-m ³ /mol)	Koc (ml/g)	Kow	HALF - LIFE (days)	BCF
Semivolatile Organic Compounds							
Phenol	93000	0.341	4.54E-07	1.42E+01	2.88E+01	3-5	1.4-2
2-Methylphenol	25000	0.24	1.50E-06	2.74E+02	8.91E+01	1-3	
4-Methylphenol		0.11	4.43E-07	2.67E+02	8.51E+01	1-3	
2,4-Dimethylphenol	4200	0.0573	2.38E-06	2.22E+02	2.63E+02	1-3	9.5-150
Benzoic Acid	2700			2.48E+02	7.41E+01		
Naphthalene	31.7	0.23	1.15E-03	1.30E+03	2.76E+03	1-110	44-95
2-Methylnaphthalene	25.4	0.0083	5.80E-05	8.50E+03	1.30E+04	1-3	
2-Chloronaphthalene	6.74	0.017	4.27E-04	4.16E+03	1.32E+04		
2,6-Dinitrotoluene	1320	0.018	3.27E-06	9.20E+01	1.00E+02	4	4.6
Acenaphthene	3.42	0.00155	9.20E-05	4.60E+03	1.00E+04		
Dibenzofuran				4.16E+03	1.32E+04		
2,4-Dinitrotoluene	240	0.0051	5.09E-06	4.50E+01	1.00E+02	5	
Diethylphthalate	896	0.0035	1.14E-06	1.42E+02	3.16E+02	1-3	14-117
Fluorene	1.69	0.00071	6.42E-05	7.30E+03	1.58E+04		
N-Nitrosodiphenylamine	113		1.40E-06	6.50E+02	1.35E+03	4	65-217
Hexachlorobenzene	0.006	0.000019	6.81E-04	3.90E+03	1.70E+05		
Phenanthrene	1	0.00021	1.59E-04	1.40E+04	2.88E+04	1-200	
Anthracene	0.045	0.000195	1.02E-03	1.40E+04	2.82E+04		
Di-n-butylphthalate	13	0.00001	2.82E-07	1.70E+05	3.98E+05	1-3	89-1800
Fluoranthene	0.206	0.0177	6.46E-06	3.80E+04	7.94E+04	140-440	
Pyrene	0.132	2.50E-06	5.04E-06	3.80E+04	7.59E+04	9-1900	
Butylbenzylphthalate	2.9	8.60E-06	1.20E-06	2.84E+04	5.89E+04		663
Benzo(a)anthracene	0.0057	1.50E-07	1.16E-06	1.38E+06	3.98E+05	240-680	
Chrysene	0.0018	6.30E-09	1.05E-06	2.00E+05	4.07E+05	160-1900	
Bis(2-Ethylhexyl)phthalate	0.285	2.00E-07	3.61E-07	5.90E+03	9.50E+03	Neg. Deg.	
Di-ni-octylphthalate	3			2.40E+06	1.58E+09		
Benzo(b)fluoranthene	0.014	5.00E-07	1.19E-05	5.50E+05	1.15E+06	360-610	
Benzo(k)fluoranthene	0.0043	5.10E-07	3.94E-05	5.50E+05	1.15E+06	910-1400	
Benzo(a)pyrene	0.0012	0.000568	1.55E-06	5.50E+06	1.15E+06	220-530	
Indeno(1,2,3-cd)pyrene	0.00053	1.00E-10	6.86E-08	1.60E+06	3.16E+06	600-730	
Dibenz(a,h)anthracene	0.0005	5.20E-11	7.33E-08	3.30E+06	6.31E+06	750-940	
Benzo(g,h,i)perylene	0.0007	1.03E-10	5.34E-08	1.60E+06	3.24E+06	590-650	

TABLE 3 - 6

SUMMARY OF FATE AND TRANSPORT PARAMETERS FOR SELECTED ORGANIC COMPOUNDS
SENECA ARMY DEPOT ACTIVITY

COMPOUND	SOLUBILITY (mg/l)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm-m ³ /mol)	Koc (ml/g)	Kow	HALF - LIFE (days)	BCF
Pesticides/PCBs							
beta-BHC	0.24	2.80E-07	4.47E-07	3.80E+03	7.94E+03		
gamma-BHC (Lindane)	7.8	0.00016	7.85E-06	1.08E+03	7.94E+03	Neg. Deg.	250
Heptachlor	0.18	0.0003	8.19E-04	1.20E-04	2.51E+04	Neg. Deg.	3600-37000
Aldrin	0.18	6.00E-06	1.60E-05	9.60E+04	2.00E+05	Neg. Deg.	3890-12260
Endosulfan I	0.16	0.00001	3.35E-05	2.03E+03	3.55E+03		
Heptachlor epoxide	0.35	0.0003	4.39E-04	2.20E+02	5.01E+02	Neg. Deg.	851-66000
Dieldrin	0.195	1.78E-07	4.58E-07	1.70E+03	3.16E+03	Neg. Deg.	3-10000
4,4'-DDE	0.04	6.50E-06	6.80E-05	4.40E+06	1.00E+07	Neg. Deg.	110000
Endrin	0.024	2.00E-07	4.17E-06	1.91E+04	2.18E+05	Neg. Deg.	1335-49000
Endosulfan II	0.07	0.00001	7.65E-05	2.22E+03	4.17E+03		
4,4'-DDD	0.16	2.00E-09	3.10E-05	2.40E+05	3.60E+05		
Endosulfan sulfate	0.16			2.33E+03	4.57E+03		
4,4'-DDT	0.005	5.50E-06	5.13E-04	2.43E+05	1.55E+06	Neg. Deg.	38642-110000
Endrin aldehyde							
alpha-Chlordane	0.56	0.00001	9.63E-06	1.40E+05	2.09E+03	Neg. Deg.	400-38000
Aroclor-1254	0.012	0.00008	2.70E-03	4.25E+04	1.07E+06	42	10E4-10E6
Aroclor-1260	0.0027	0.000041	7.10E-03	1.30E+06	1.38E+07	Neg. Deg.	10E4-10E6
Explosives							
HMX	66	3.90E-09		5.08E+02	1.30E-01		
RDX	50	4.10E-09	2.00E-05	5.38E+02	7.80E-01		
1,3,5-Trinitrobenzene	35	2.20E-04	1.30E+00	5.20E+02			
1,3-Dinitrobenzene	470			1.50E+02	4.17E+01		
Tetryl							
2,4,6-Trinitrotoluene	130	0.0001	1.37E-06	5.34E+02	1.90E+00		
4-amino-2,6-Dinitrotoluene							
2-amino-4,6-Dinitrotoluene							
2,6-Dinitrotoluene	182	0.018	3.27E-06	2.49E+02	1.00E+02	4	4.6
2,4-Dinitrotoluene	270	0.0051	5.09E-06	2.01E+02	1.00E+02	5	

Notes:

Koc = organic carbon partition coefficient

Kow = octanol-water partition coefficient

BCF = bioconcentration factor

Neg. Deg. = Negligible Biodegradation

References:

- IRP Toxicology Guide
- Basics of Pump-and-Treat Ground-Water Remediation Technology (EPA, 1990).
- Handbook of Environmental Fate and Exposure Data (Howard, 1989).
- Soil Chemistry of Hazardous Materials (Dragun, 1988)
- Hazardous Waste Treatment, Storage, and Disposal Facilities, Air Emissions Models (EPA, 1989).
- USATHAMA, 1985
- Values for Koc not found were estimated by: $\log Koc = 0.544 \log Kow + 1.377$ (Dragun, 1988).

Oxidation and reduction involves the change of the valence state of the metals and has a large influence on the other fate mechanisms. A good example of the variation in contamination fate due to oxidation and reduction changes is iron. Iron (Fe) normally exists in one of two valence states, +2 and +3 [Fe(II) and Fe(III)]. Fe(II) is far more soluble than Fe(III) and therefore has a greater mobility.

Soil pH is often correlated with potential metal migration. If the soil pH is greater than 6.5, most metals are fairly immobile, particularly those normally present as cations. This is because at higher pH values, metals form insoluble carbonate and hydroxide complexes. Metals would be most mobile in highly acidic soil (pH of less than 5).

A RI was performed at the Open Burning (OB) Grounds at SEDA in 1992 for which over 50 surface soil samples and over 300 subsurface soil samples were collected. The pH values of the surface soil samples ranged from 5 to 8.4, and the subsurface soil samples had values ranging from 7 to 9 (Parsons ES, 1994). The soil at the OB Grounds is lithologically similar to the soil at the Munitions Washout Facility, therefore, metals in the soil at the Munitions Washout Facility are expected to be primarily present in insoluble forms. A detailed evaluation of select metals (barium, copper, lead, mercury, and zinc) is given below.

Barium is a highly reactive metal that occurs naturally only in the combined state. Most barium released to the environment from industrial sources is in forms that do not become widely dispersed. Barium in soil may be taken up to a small extent either by vegetation, or transported through soil with infiltration of precipitation. Barium is not very mobile in most soil systems. The higher the level of organic matter, the greater the adsorption. The presence of calcium carbonate will also limit mobility, since barium will form BaCO_3 , an insoluble carbonate. In aquatic media, barium is likely to precipitate out of solution as an insoluble salt, or adsorb to suspended particulate matter. Sedimentation of suspended solids removes a large portion of the barium from surface waters. Barium in sediment is found largely in the form of barium sulfate. Bioconcentration in freshwater aquatic organisms is minimal.

Copper is considered to be among the more mobile of the heavy metals in surface environments. Seasonal fluctuations have been observed in surface water copper concentrations, with higher levels in fall and winter, and lower levels in the spring and summer. Copper is not expected to volatilize from water. Since copper is an essential nutrient, it is strongly accumulated by all plants and animals, but is probably not biomagnified. The degree of persistence of copper in soil depends on the soil characteristics and the forms of copper present. For example, in soil of low organic content, soluble copper compounds may move into groundwater at a significant rate. On the other hand, the presence of organic

complexing agents may restrict movement in soil, and copper may be immobilized in the form of various inorganic complexes. Copper is not expected to volatilize from soil. Several processes determine the fate of copper in aquatic environments, these being: formation of complexes, especially with humic substances; sorption to hydrous metal oxides, clays, and organic materials; and bioaccumulation. Organic complexes of copper are more easily adsorbed on clay and other surfaces than the free form. The aquatic fate of copper is highly dependent on factors such as pH, oxidation-reduction potential, concentration of organic matter, and the presence of other metals. With regard to the latter, it has been demonstrated that co-precipitation of copper with hydrous oxides of iron effectively scavenges copper from solution, although in most surface waters organic materials prevail over inorganic ions in complexing copper.

Lead is extremely persistent in both water and soil. Environmental fate processes may transform one lead compound to another; however, lead is generally present in the +2 oxidation state, and will form lead oxides. It is largely associated with suspended solids and sediment in aquatic systems, and it occurs in relatively immobile forms in soil. Lead which has been released to soil may become airborne as a result of fugitive dust generation.

Elemental mercury is insoluble in water and binds tightly to soil particles giving it a relatively low mobility. Bacterial and fungal organisms in sediment are capable of methylating mercury. Methyl mercury, which is soluble in water, is a mobile substance and can then be ingested or absorbed. Until altered by biological processes, the primary transport method for mercury is the erosion and transportation of soil and sediment (Gough, *et al.*, 1979). Mercury most likely exists at SEDA in the elemental state as a result of the testing or demolition of munitions containing mercury fuzes. Although a mercury salt, mercury fulminate, was used in the past as a priming explosive, it has not been commonly used since 1925 (Dunstan and Bell, 1972), and its environmental fate will not be considered at the site.

Zinc is stable in dry air, but upon exposure to moist air will form a white coating composed of basic carbonate. Zinc loses electrons (oxidizes) in aqueous environments. In the environment, zinc is found primarily in the +2 oxidation state. Elemental zinc is insoluble; most zinc compounds show negligible solubility as well, with the exception of elements (other than fluoride) from Group VII of the Periodic Table compounded with zinc (i.e., $ZnCl_2$, ZnI_2) showing a general 4:1 compound to water solubility level. In contaminated waters, zinc often complexes with a variety of organic and inorganic ligands. Therefore, the overall mobility of zinc in an aqueous environment, or through moist-to-wet soil, may be accelerated by compounding/complexing reactions.

Zinc has a tendency to adsorb to soil, sediment and suspended solids in water. Adsorption to sediments and suspended solids is the primary fate for zinc in aqueous environments, and will greatly limit the amount of solubilized zinc. Zinc is an essential element and, therefore, is accumulated by all organisms. Zinc concentrations in air are relatively low except near industrial sources. Volatilization is not an important process from soil or water.

3.1.2.2 Semivolatile Organic Compounds

The following information was obtained from the document, "Management and Manufactured Gas Plant Sites, Volume III, Risk Assessment," GRI, May 1988, GRI-87/0260.3.

Polynuclear Aromatic Hydrocarbons (PAHs)

PAH compounds have a high affinity for organic matter and low water solubility. Water solubility tends to decrease and affinity for organic material tends to increase with increasing molecular weight. Therefore, naphthalene is much more soluble in water than is benzo(a)pyrene. When present in soil or sediment, PAHs tend to remain bound to the soil particles and dissolve only slowly into groundwater or the overlying water column. Because of the high affinity for organic matter, the physical fate of the chemicals is usually controlled by the transport of particulates. Thus, soil, sediment and suspended particulate matter (in air) represent important media for the transport of the chemicals.

Because of their high affinity for organic matter, PAH compounds are readily taken up (bioaccumulated) by living organisms. However, organisms have the potential to metabolize the chemicals and to excrete the polar metabolites. The ability to do this varies among organisms. Fish appear to have well-developed systems for metabolizing the chemicals. The metabolites are excreted. Shellfish (bi-valves) appear to be less able to metabolize the compounds. As a result, while PAH compounds are seldom high in fish tissues, they can be high in shellfish tissues.

Several factors can degrade PAH compounds in the environment. Biodegradation on soil microorganisms is an important process affecting the concentrations of the chemicals in soil, sediment and water. Volatilization may also occur. This mechanism is effective for the lighter molecular weight compounds. However, the volatilization of higher molecular weight PAH compounds occurs slowly.

Phenolic Compounds

These compounds are highly water soluble and, therefore, easily leach from soil environments into the underlying groundwater. They are not persistent in surface water environments. Phenolic compounds are not as volatile as benzene, xylene or toluene, but can volatilize at a moderate rate. Therefore, there may be some potential for exposure to gases. Non-chlorinated phenolic compounds are not readily bioaccumulated by terrestrial or aquatic biota (GRI-87/0260.3).

3.1.2.3 Pesticide and PCB Compounds

This section discusses only selected pesticides and PCBs that are suspected to be applicable to SEDA. It is not meant to present a complete summary of all possible pesticides and PCBs that could be found at SEDA.

Chlordane

The following information was obtained from "Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol. III, Pesticides (ed. Philip H. Howard, Lewis Publishers, 1991).

Chlordane has been released in the past into the environment primarily from its application as an insecticide. Technical grade chlordane is a mixture of at least 50 compounds. If released to soil, chlordane may persist for long periods of time. Under field conditions, the mean degradation rate has been observed to range from 4.05-28.33%/yr with a mean half-life of 3.3 years. Chlordane is expected to be generally immobile or only slightly mobile in soil based on field tests, soil column leaching tests and estimated K_{oc} estimation; however, its detection in various ground waters in NJ and elsewhere indicates that movement to ground water can occur. Adsorption to sediment is expected to be a major fate process based on soil adsorption data, estimated K_{oc} values (24,600-15,500), and extensive sediment monitoring data. The presence of chlordane in sediment core samples suggests that chlordane may be very persistent in the adsorbed state in the aquatic environment.

If released to water, chlordane is not expected to undergo significant hydrolysis, oxidation or direct photolysis. Sensitized photolysis in the water column may be possible, however. The observation that 85% of the chlordane originally present in a sealed glass jar under sunlight and artificial light in a river die-away test remained at the end of two weeks and persisted at that level through week 8 of the experiment; this indicates that chlordane will be very persistent in aquatic environments.

found in six samples. Therefore, these compounds can be potentially attributed to the laboratory and not site conditions.

Groundwater Investigation

Five monitoring wells were installed as part of the ESI conducted at SEAD-4. The locations are shown in Figure 3-8. The monitoring wells were located as follows:

- MW4-1 was installed upgradient of the ammunition workshop facility to obtain background groundwater quality data
- MW4-2 was installed downgradient of the suspected leach field location
- MW4-3 was installed directly downgradient of the former Munitions Washout Facility Building
- MW4-4 was installed downgradient of the pond
- MW4-5 was installed in the location of the former Munitions Washout Facility Building

All monitoring wells were constructed so that the entire thickness of the aquifer was screened. Following installation and development, one groundwater sample was collected from each monitoring well.

Groundwater at the site has been impacted by metals. The seven metals antimony, beryllium, cadmium, iron, magnesium, manganese, and sodium were found in one or more of the groundwater samples at concentrations above the standard values. Antimony was detected in the groundwater samples collected from MW4-2 and MW4-4 at concentrations of 39.3 $\mu\text{g/L}$ and 33.8 $\mu\text{g/L}$, respectively, both of which exceed the NYSDEC GA groundwater standard of 3 $\mu\text{g/L}$ and the EPA Maximum Contaminant Level of 6 $\mu\text{g/L}$. Beryllium was detected in the groundwater sample collected from MW4-3 at a concentration of 6.3 $\mu\text{g/L}$, which exceeds the NYSDEC GA groundwater standard of 3 $\mu\text{g/L}$ and the EPA Maximum Contaminant Level of 4 $\mu\text{g/L}$. Cadmium was detected in the groundwater sample collected from MW4-3 at a concentration of 5.6 $\mu\text{g/L}$, which exceeds the EPA Maximum Contaminant Level of 5 $\mu\text{g/L}$. Iron was detected in the groundwater samples collected from MW4-1, MW4-2, MW4-3 and MW4-4 at concentrations of 332 $\mu\text{g/L}$, 471 $\mu\text{g/L}$, 745 $\mu\text{g/L}$ and 2270 $\mu\text{g/L}$, respectively, all of which exceed the NYSDEC GA groundwater standard of 300 $\mu\text{g/L}$. Magnesium was detected in the groundwater sample collected from MW4-1 at a concentration of 57600 $\mu\text{g/L}$, which exceeds the NYSDEC GA groundwater standard of 35,000 $\mu\text{g/L}$. Manganese was detected in the groundwater samples collected from MW4-1 and MW4-5 at concentrations of 346 $\mu\text{g/L}$ and 477 $\mu\text{g/L}$, respectively, both of which exceed the NYSDEC GA groundwater standard of 300 $\mu\text{g/L}$. Sodium was detected in the groundwater sample

air, water, sediment, soil, fish and other aquatic organisms, wildlife, food, and humans. Human exposure result primarily from food.

Endosulfan

The following information was obtained from "Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol. III, Pesticides (ed. Philip H. Howard, Lewis Publishers, 1991).

Endosulfan is used as an insecticide against a variety of insects on a variety of crops. Technical endosulfan is composed of α -endosulfan and β -endosulfan. Release of endosulfan isomers to soil will most likely result in biodegradation and in hydrolysis, especially under alkaline conditions. Endosulfan isomers on the soil surface may photolyze. Volatilization and leaching are not expected to be significant due to the high estimated soil-sorption coefficients of the isomers. When release to water, endosulfan isomers are expected to hydrolyze readily under alkaline conditions, and more slowly at neutral and acidic pH values (α half-lives=35.4 and 150.6 days for pH 7 and 5.5, respectively; β half-lives=37.5 and 187.3 days for pH 7 and 5.5, respectively). Volatilization and biodegradation are also expected to be significant. Endosulfan released to the atmosphere will react with photochemically generated hydroxyl radicals with an estimated half-life of 1.23 hr. Bioconcentration of endosulfan is expected to be significant. Isomers of endosulfan are contaminants in air, water, sediment, soil, fish and other aquatic organisms, and food. Human exposure results primarily from food, and by occupational exposure.

DDT

The following information was obtained from "The Installation Restoration Program Toxicology Guide," Vol. III, Arthur D. Little, Inc. June 1987.

From 1946 to 1972, DDT was one of the most widely used agricultural insecticides in the world. During this time, DDT played an important role in many phases of agriculture and in the eradication of malaria, typhus and plague. As of January 1, 1973, all uses of DDT in the United States were cancelled with the exception of emergency public health however, it is still used extensively in some tropical countries.

DDT is expected to be highly immobile in the soil/groundwater environment when present at low dissolved concentrations. Bulk quantities of DDT dissolved in an organic solvent could

be transported through the unsaturated zone as the result of a spill or improper disposal of excess formulations. However, the extremely low solubility of DDT and its strong tendency to sorb to soil results in a very slow transport rate in soil.

In general transport pathways can be assessed by using an equilibrium-partitioning models. These calculations predict the partitioning of low soil concentrations of DDT among soil particles, soil water, and soil air. Due to its strong tendency to sorb to soil, virtually all of the DDT partitions to the soil particles of unsaturated top soil, with negligible amounts associated with the soil water or air. Even in saturated deep soil, which is assumed to contain no soil air and a smaller organic carbon fraction, almost all of the DDT is retained on the soil.

DDT is characterized by a strong tendency to sorb to organic carbon. Kadeg *et al.* report an arithmetic mean K_{oc} of 670,200 for 17 reported values; the corresponding geometric mean was $\log K_{oc} = 5.48$. As with all neutral organic chemicals, the extent of sorption is proportional to the soil organic carbon content. In soil with little organic carbon (e.g., clays) the extent of sorption may also depend upon soil properties such as surface area, cation exchange capacity and degree of hydration.

The apparent sorption of DDT to soil and sediment is lessened, and thus its mobility is enhanced by the presence of dissolved organic matter in solution. Caron *et al.* found the sorption of DDT to a natural freshwater sediment to be reduced by 75% in the presence of 6.95 mg/L of dissolved organic carbon (in the form of humic acid extracted from another sediment). Using p,p'-DDT, Chiou *et al.* observed the apparent water solubility to be significantly enhanced (roughly 2-5 times) in the presence of 100 mg/L of humic and fulvic acids. (Sorption will decrease with increasing water solubility). The partitioning of p,p'-DDT between soil-derived humic acid and water was approximately 4 times greater than with soil fulvic acids and 5-7 times greater than with aquatic (freshwater) humic and fulvic acids. These findings indicated that the mobility of DDT in natural waters may be several times greater than predicted (though probably still small) when the effect of dissolved organic matter is present. In waters containing large concentrations of dissolved organic material, such as swamps and bogs, this may be especially important.

The vapor pressure of DDT at 25°C has been given as 2.6×10^{-10} atm with estimates of its Henry's law constant at 25°C ranging from 2.8×10^{-5} to 2.0×10^{-6} atm · m³/mol. Volatilization is expected to be an important loss process in aquatic environments with the half-life for DDT on the order of several hours to several days. The presence of sediment particles, which would adsorb DDT from solution, would significantly reduce volatilization losses.

In soil, volatilization is much slower. Jury *et al.* using soil of 1.25% organic carbon to which

DDT was applied uniformly to a depth of 1 cm at the rate of 1 kg/hectare, calculated volatilization half-lives of 497 and 432 days when water evaporation rates were 0.0 and 5.0 mm/day, respectively. The corresponding figures when the same quantity of DDT was mixed to a depth of 10 cm were 2300 and 2069 days.

Similar results were obtained by Lichtenstein *et al.* who studied the persistence of technical DDT (84% p,p', 15% o,p') in agricultural loam soil with crops over a 15 year period. Calculated half-lives for both isomers fell between 4.0 and 4.7 years for DDT applied at 10 pounds/acre; somewhat longer half-lives were measured for applications of 100 pounds/acre. These half-lives should be taken as upper limits of the volatilization rate since other processes such as leaching and degradation contribute to the DDT loss.

In tropical soil, the loss of DDT has been found to be much more rapid. El Zorgani found a half-life of less than three weeks for DDT applied at an initial concentration of 6.65 ppm to the soil surface beneath a cotton crop in the Sudan. The loss of the o,p' isomer was several times greater than for the p,p' isomer; and insignificant fraction of the loss could be accounted for by conversion to p,p'-DDE. A half-life 110 days has been reported for DDT in Kenya where it was found to sublime directly into the atmosphere without conversion to DDE.

The rate at which DDT degrades in the soil/groundwater environment is dependent on the conditions under which it is present. The pH strongly affects the rate of aqueous hydrolysis. Over the pH range typical of natural waters (pH 5-9), Wolfe *et al.* found the pseudo-first-order rate constant (k_{obs}) at 27°C could be expressed as:

$$k_{obs} = 1.9 \times 10^{-9} + 9.9 \times 10^{-3} \cdot [\text{OH}^-]$$

where k_{obs} is in s^{-1} and $[\text{OH}^-]$, the concentration of the hydroxide ion, is in moles/liter. Hydrolysis half-lives of roughly 81 days, 8 years and 12 years at pH 9, 7, and 5, respectively, result from the rate constant obtained from this equation. The hydrolysis product of p,p'-DDT is p,p'-DDE.

A photolysis half-life of 5 days was measured for DDT when it was present in natural water exposed to summer sunlight, although no photolysis was observed when the chemical was present in pure water. Again, p,p'-DDE is a degradation product. Chen *et al.* observed a similar half-life of 8 days for p,p'-DDT applied as a thin film ($0.67 \mu\text{g}/\text{cm}^2$) to glass plates and exposed to light of environmentally important wavelengths (maximum intensity at 300 nm). The degradation of DDT by ultraviolet light was found to be more effective when the DDT was present in humus-free soil than in soil containing humus.

DDT has been found to undergo abiotic, reductive dehalogenation to DDD in the presence of Fe(II) porphyrin. It has been suggested that the Fe(III) porphyrin, which results from the oxidation of the Fe(II) porphyrin in this process, is reconverted to the Fe(II) porphyrin in the presence of reduced organic material. Dehydrochlorination of DDT to DDE (removal of a hydrogen and chlorine atom to form a double bond) has also been observed in model systems containing reduced porphyrins and in the natural environment.

Gambrell *et al.* found the degradation of DDT to be little affected by pH but greatly affected by redox conditions. Under strongly reducing conditions ($E_h = 150$ mV), over 90% of the DDT was degraded within a few days. The authors note that this is an unusually rapid rate.

The half-life for the decomposition of DDT in aerobic soil has been reported to be in the range of 10-14 years compared to half-lives of 28-33 days in moist soil incubated under anaerobic conditions. DDE is the major degradation product in aerobic soil, and it is believed to be produced predominantly by chemical processes. Under anaerobic conditions DDD is the major metabolite.

The bacterial and fungal cometabolism of DDT has been observed in the laboratory and has been suggested to be potentially important in the field as well. In these reactions, bacteria which are not able to use DDT as their sole carbon source grow on non-chlorinated analogues of DDT, but degrade DDT in the process.

Information on the fate and transport parameters of DDT (i.e., solubility, vapor pressure, Henry's Law Constant, K_{oc} , K_{ow} , half-life and BCF) are provided in Table 3-1.

DDD

The following information was obtained from "The Installation Restoration Program Toxicology Guide," Vol. III, Arthur D. Little, Inc. June 1987.

DDD, no longer manufactured commercially, is still found as an impurity in the pesticide DDT and the miticide dicofol. It is also the major breakdown product of DDT under anaerobic conditions. The p,p' isomer of DDD is the third largest component of the technical DDT product after the two DDT isomers accounting for >4% of the mixture. It is present in somewhat lower concentrations in dicofol. In one study of several dicofol products, DDD was present in amounts ranging from 0.1 to 2.5% of the amount of dicofol.

Like DDT, DDD is expected to be highly immobile in the soil/groundwater environment when present at low dissolved concentrations. Bulk quantities of DDD dissolved in an organic

solvent could be transported through the unsaturated zone as a result of a spill or the improper disposal of excess formulations. However, the extremely low solubility of DDD and its strong tendency to sorb to soil organic carbon results in a very slow transport rate in soil.

In general, transport pathways can be assessed by using an equilibrium partitioning models. These calculations predict the partitioning of low soil concentrations of DDD among soil particles, soil water, and soil air. Due to its strong sorption to soil, virtually all of the DDD partitions to the soil particles of unsaturated top soil and negligible amounts to the soil air or water. Even in saturated deep soil, which is assumed to contain no soil air, and a smaller organic carbon fraction, almost all of the DDD is retained on the soil.

DDD, like DDT, is characterized by a strong tendency to sorb to soil organic carbon. While only one measured K_{oc} value for DDD was found ($\log K_{oc} = 5.38$) it is consistent with the value obtained for DDT, as would be expected based on the similarity of their structures and their octanol water partition coefficients (DDD $\log K_{ow} = 5.56$). As with all neutral organic chemicals, the extent of DDD sorption is proportional to the soil organic carbon content. In soil with little organic carbon (e.g., clays), the extent of sorption may also depend upon such soil properties as surface area, cation exchange capacity, and degree of hydration.

The sorption of DDD to soil is lessened and thus its mobility is enhanced by the presence of dissolved organic matter in solution. The apparent solubility of DDT was increased several times in solutions containing humic and fulvic acids. Because the sorption behavior of DDD is expected to be much like that of DDT, its mobility in natural waters may be several times greater than predicted (though probably still small) if dissolved organic matter is present. In waters containing large concentrations of dissolved organic matter, such as swamps and bogs, this may be especially important.

The vapor pressures of the p,p' and o,p' - isomers of DDD at 30°C have been measured as 1.3×10^{-9} and 2.5×10^{-9} atm, respectively. The Henry's law constant estimated by use of the average vapor pressure of the two isomers and an aqueous solubility of 20 ppb is $3.1 \times 10^{-5} \cdot \text{atm} \cdot \text{m}^3/\text{mol}$. This value is almost identical to that for DDT and roughly an order of magnitude less than that for DDE.

Experimental evidence indicates that DDT volatilization from water occurs at about one-third the rate for DDT, which may seem at odds with the similar estimates for the Henry's law constants for these two compounds. Given the uncertainties involved in measuring both the aqueous solubilities and the vapor pressures of these compounds, from which H is estimated,

the findings cannot be considered inconsistent. Using a factor of one-third for the difference in the rate of volatilization of DDD and DDT, a volatilization half-life for DDD ranging from a day to less than a month has been estimated.

Volatilization of DDD from soil can be expected to be much slower than from water because of the strong tendency of DDD to sorb to soil. Using wet river bed quartz sand in 15 mm deep petri dishes, Ware *et al.* measured volatilization losses of p,p'-DDD (present initially at 10 ppm) that corresponded to a volatilization half-life of roughly 170 days, slightly more than twice that for p,p'-DDT under the same conditions. Because these experiments were conducted with a relatively thin layer of soil with a small organic carbon fraction, the actual volatilization rate of DDD in the field would be expected to be lower. If the relative volatilization rates of DDD and DDT in the field were the same as those observed by Ware *et al.*, the volatilization half-life of DDD from soil could be assumed to be double the value of one to several years for DDT.

Hydrolysis of DDD can be expected to be extremely slow under environmental conditions. Over the pH range typical of natural waters (pH 5-9), Wolfe *et al.* found the pseudo-first-order rate constant (k_{obs}) at 27°C could be expressed as:

$$k_{obs} = 1.1 \times 10^{-10} + 1.4 \times 10^{-3} \cdot [\text{OH}^-]$$

where k_{obs} is in s^{-1} and $[\text{OH}^-]$, the concentration of the hydroxide ion, in moles/liter. Hydrolysis half-lives of roughly 1.6, 88, and 190 years at pH 9, 7, and 5, respectively, correspond to the rate constant estimated from this equation. These estimates are consistent with the observations of Eichelberger and Lichtenberg that no DDD, initially present in river water at 20 ppb, degraded over an eight week period (within 2.5%).

No information was found on the photolysis of DDD in natural waters. Direct photolysis of DDD (i.e., in pure water) is believed to be slower than that for DDT which is estimated to have a half-life of over 150 years. However, DDT in natural water has been estimated to have a photolysis half-life of 5 days when exposed to sunlight in mid-June; DDD might be expected to have a similar half-life based on the similar structure of the two chemicals.

Data on the biodegradation of DDD are limited. In aquatic systems, biotransformation is believed to be slow, although a model ecosystem study has shown DDD to be more biodegradable than either DDT or DDE. The ketone analogue of DDD (i.e., p,p'-dichlorobenzophenone) has been suggested as the end product of the biodegradation of DDD in the environment. DDD undergoes dehydrochlorination to 2,2-bis-(p-chlorophenyl)-1-chloroethylene, reduction to 2,2-bis-(p-chlorophenyl)-1-chlorethane, dehydrochlorination to

2,2-bis-(p-chlorophenyl)-ethylene, reduction to 1,1-bis-(p-chlorophenyl)-ethane and eventual oxidation to bis-(p-chlorophenyl)-acetic acid (DDA), the ultimate excretory product of higher animals. DDD has also been observed to degrade in anaerobic sewage sludge.

The above discussion of fate pathways suggests that DDD is moderately volatile, very strongly sorbed to soil, and has a high potential for bioaccumulation. Information on the fate and transport parameters (i.e., solubility, vapor pressure, Henry's Law Constant, K_{oc} , K_{ow} , half-life and BCF) are provided in Table 3-1.

DDE

The following information was obtained from "The Installation Restoration Program Toxicology Guide," Vol. III, Arthur D. Little, Inc. June 1987.

The presence of DDE in the environment is primarily the result of the use of the insecticide DDT and the miticide dicofol. DDE is the principal degradation product of DDT under aerobic conditions, and it has been found to equal roughly 1-3% of the weight of dicofol in the technical mixture. Like DDT, DDE exists as both an o,p' and a p,p' isomer, with the o,p' and the p,p' isomers of DDT degrading to the respective DDE isomer. Because technical DDT consists of 65-80% p,p' - DDT and 15-21% o,p' - DDT, the p,p' - DDE isomer might be expected to predominate in the environment. In dicofol, however, the o,p' isomer typically makes up 80-90% of the DDE present. The two isomers of DDE are considered individually below where data are available.

Like DDT, DDE is expected to be highly immobile in the soil/groundwater environment when present at low dissolved concentrations. Bulk quantities of DDE dissolved in an organic solvent (e.g., as a contaminant in dicofol) could be transported through the unsaturated zone as a result of a spill or improper disposal of excess formulations. However, the extremely low solubility of DDE and its strong tendency to sorb to soil would result in a very slow transport rate in soil.

In general, transport pathways can be assessed by using an equilibrium partitioning model. These calculations predict the partitioning of low soil concentrations of DDE among soil particles, soil water and soil air. Due to its strong tendency to sorb to soil, virtually all of the DDE partitions to the soil particles of unsaturated topsoil, with negligible amounts associated with the soil water or air. Even in saturated deep soil, which is assumed to contain no soil air and a smaller organic carbon fraction, almost all of the DDE is retained on the soil.

DDE is characterized by a strong tendency to sorb to organic matter in soil and in sediment. Only one value, $\log K_{oc} = 5.17$ was found in the literature for the soil organic carbon partition coefficient. A $\log K_{oc}$ value of roughly 5 has been suggested based on $\log K_{ow}$ measurements of 5.69 for the p,p' isomer and 5.78 for the o,p' isomer. Using the geometric mean of these K_{ow} values and a regression equation, a $\log K_{oc}$ value of 5.41 is estimated. As with all neutral organic chemicals, the extent of sorption is proportional to the soil organic carbon content. In soil with little organic carbon (e.g., clays), the extent of sorption may also depend upon soil properties such as surface area, cation exchange capacity, and degree of hydration.

The apparent sorption of DDE to soil and sediment (like that of DDT), is lessened, and thus its mobility is enhanced by the presence of dissolved organic matter. DDT concentrations were found to be higher in aqueous solutions containing humic and fulvic acids. Because the sorption behavior of DDE is expected to be much like that of DDT, its mobility in natural waters may be several times greater than predicted (though probably still small) if dissolved organic matter is present. In waters containing large concentrations of dissolved organic matter such as swamps and bogs, this may be especially important.

The vapor pressure of p,p'- isomer of DDE at 20°C has been given as 8.7×10^{-9} atm and that of the o,p' isomer as 8.2×10^{-9} atm. A somewhat lower value of roughly eight times the vapor pressure of DDT has been suggested. Using the average vapor pressures for the two isomers to estimate the Henry's law constant, a value of 1.9×10^{-4} atm · m³/mol is obtained.

This estimate is roughly an order of magnitude larger than the Henry's law constant for DDT. Because volatilization losses for DDT are expected to be important, the same is also true for DDE. DDE has been found to volatilize from distilled and natural waters five times faster than DDT. Since the volatilization half-life for DDT has been reported to range from several hours to several days (see Section 57.2.1.3) proportionately shorter half-lives would be expected for DDE.

In soil, volatilization of DDE is much slower. Using wet river bed, quartz sand in 15 mm deep petri dishes, Ware *et al.* measured volatilization losses of p,p'-DDE (present initially at 10 ppm) that corresponded to a half-life of roughly 40 days. This value may be more indicative of an upper limit of the volatilization rate because soil of higher organic matter content would tend to sorb more of the DDE, and the rate of volatilization would be expected to be lower from thicker layers of soil. In the same study and under the same conditions, the o,p' isomer of DDT took 50% longer to reach half its initial concentration; p,p'-DDT took twice as long. This suggests that the volatilization of DDE in the field may occur at a rate somewhat greater than that for DDT, which has been found to have a volatilization half-life of one to several years. The observation that the volatilization rate of

DDE from soil is not several times the rate for DDT, given that it has an order of magnitude larger Henry's law constant, may be explained by its strong sorption to soil, which tends to impede volatilization.

DDE is the hydrolysis product of DDT and is quite resistant to further hydrolysis. A hydrolysis half-life of over 120 years at pH 5 and 27°C has been given. Thus, hydrolysis is not expected to be an environmentally significant process.

Several studies have examined the aqueous photolysis of DDE. Zepp and Schlotzhauer found that DDE in the aqueous phase of sediment suspensions exposed to ultraviolet light of wavelength > 300 nm had a half-life of roughly 13 to 17 hours. Under the same conditions, DDE equilibrated with sediment for 60 days (i.e., sorbed to the sediment) photodegraded much more slowly. To reach 25% of its initial concentration, roughly seven half-lives were needed instead of the expected two, and little further degradation occurred. The authors suggested that over time, part of the DDE diffused into the sediment particles and became unavailable for photolysis. Chen *et al.* found the thin film photodegradation rate of p,p'-DDE to be about 90% of that for p,p'-DDT, and the half-life of DDE in aquatic systems at 40°N latitude has been estimated to range from one day in summer to six days in winter. These findings suggest that photolysis of DDE may be an important loss process, as it is for DDT. However, for photolysis to occur, the chemical must be exposed to sunlight, which often is not the case for a large fraction of the amount sorbed to soil or deep sediment.

The biological degradation of DDE in aquatic environments is believed to occur very slowly if at all. In modeling the fate of DDE in a quarry, Di Toro and Paquin considered biodegradation to be insignificant compared to loss by photolysis and volatilization. The half-life for biodegradation in sediments has also been found to be extremely slow. Using radiolabeled p,p'-DDE mixed with river sediment, Lee and Ryan measured a half-life of 1100 days based on the evolution of CO₂. In short, photolysis appears to be the only degradation process that affects DDE significantly under environmental conditions.

Information on the fate and transport parameters (i.e., solubility, vapor pressure, Henry's Law Constant, K_{oc} , K_{ow} , half-life and BCF) are provided in Table 3-1.

Aroclor PCBs 1016, 1242, 1254, 1260

The following information was obtained from "The Installation Restoration Program Toxicology Guide", Vol. II, Arthur D. Little, Inc., June 1987.

This section encompasses a general review of the environmental fate of polychlorinated biphenyl (PCBs) mixtures marketed in the U.S. under the name Aroclor (Aroclor 1016, 1242, 1254, and 1260).

Aroclor compounds are very inert, thermally and chemically stable compounds with dielectric properties. They have been used in nominally closed systems as heat transfer liquids, hydraulic fluids and lubricants, and in open-ended systems in which they came in direct contact with the environment as plasticizers, surface coatings, inks, adhesives, pesticide extenders and for microencapsulation of dyes for carbonless duplicating paper. In 1974, use of PCBs in the United States was limited to closed systems, i.e., approximately 70% of PCBs produced were used in capacitors while the remaining 30% were utilized in transformers.

The environmental behavior of the Aroclor mixtures is a direct function of their relative composition with respect to the individual chlorinated biphenyl species. It is important to remember that Aroclor formulations are mixtures and the physical properties and chemical behavior of mixtures cannot be precisely defined. The individual PCBs in a pure state are generally solids at room temperature; however, due to melting point depression, Aroclor mixtures are oily to resinous liquids at ambient temperatures.

Individual PCBs vary widely in their physical and chemical properties according to the degree of chlorination and position of the chlorines on the biphenyl structure. In general, as chlorine content increases, adsorption increases while transport and transformation processes decrease. Except for Aroclor 1016, the last two digits in the Aroclor number identification denote the approximate chlorine content by weight percent. The specific PCB distribution measured in environmental samples may be distorted and may not correspond to the specific Aroclor mixture responsible for the contamination. For this reason, most of the fate and transport discussion will focus on the chlorinated biphenyl species rather than the Aroclor mixtures.

In general, transport pathways can be assessed by using an equilibrium partitioning model. These calculations predict the partitioning of low soil concentrations of the PCB mixtures among soil particles, soil water and soil air; portions associated with the water and air phases of the soil have higher mobility than the adsorbed portion. Estimates for the unsaturated topsoil model indicate that almost all (>99.99%) of the Aroclor formulations are expected to be associated with the stationary phase. Much less than 1% is expected to partition to the soil-water phase; therefore, only a small portion would be available to migrate by bulk transport (e.g., the downward movement of infiltrating water), dispersion and diffusion. An insignificant portion of the Aroclor formulations is expected in the gaseous phase of the soil; diffusion of vapors through the soil-air pores up to the ground surface is not expected to be important. In saturated, deep soil (containing no soil air and negligible soil organic carbon),

sorption is still expected to be the most significant fate process. Overall, groundwater underlying PCB-contaminated soil is not expected to be vulnerable to contamination.

Adsorption to soil and sediment is the major fate process affecting PCBs in the environment. PCB sorption has been studied and reviewed in a number of reports. In general, the rate of adsorption by soil materials was found to be rapid and conformed to the Freundlich adsorption equation; adsorption capacity was highly correlated with organic content, surface area, and clay content of the soil materials; PCBs were reported to be unable to penetrate into the inner surfaces of clay materials. Desorption of sorbed PCB is not expected to be rapid.

Distribution coefficients for PCBs on suspended solids in Saginaw Bay have been reported to range from 4×10^4 to 9×10^4 . In general, higher chlorinated isomers are more strongly sorbed; however, preferential adsorption is also dependent on ring position of the substituted chlorine; values for K_{oc} range from approximately 10^5 for dichlorobiphenyl to 10^9 for octachlorobiphenyl.

Experimental studies on the mobility of Aroclor 1242 and 1254 in soil materials indicate that these PCBs were adsorbed strongly and remained immobile when leached with water or aqueous leachate from a waste disposal site. However, they were found to be highly mobile when leached with carbon tetrachloride. The mobilities of the PCBs were highly correlated with their solubilities in the leaching solvent and the organic content of the soil material. It should be noted that even with carbon tetrachloride, a high percentage of the PCBs were retained on the soil while some moved with the solvent front.

Additional studies were performed using different solvents and varying amounts of water. Relatively small amounts of water (9%) in methanol were shown to significantly reduce the mobility of PCBs compared to the mobility in the pure solvent.

In summary, the available data indicate that sorption of PCBs, particularly the higher chlorinated biphenyls onto soil materials, will be rapid and strong. In the absence of organic solvents, leaching is not expected to be important, and PCBs are expected to be immobile in the soil/groundwater system; PCBs will be much more mobile in the presence of organic solvents. In the case of large spills of PCB/solvent mixtures, the soil and aqueous phases may become saturated resulting in a separate oily phase which may be more mobile.

Transport of PCB vapors through the air-filled pores of unsaturated soil is not expected to be a rapid transport pathway. Modeling results indicate that a very small fraction of PCB loading will be present in the soil-air phase. On the other hand, volatilization (mostly from aqueous systems) and atmospheric transport are thought to account for the widespread, almost

ubiquitous, distribution of PCBs in the environment. Several studies have shown that vapor phase transport can be a significant process for loss of PCBs from water bodies. Adsorption to organic matter, however, has been shown to compete strongly with volatilization. Adsorption onto suspended sediment has been presented as an explanation for the lower rates of volatilization exhibited for natural water bodies compared to estimated rates. Volatilization from soil was reported to be slow compared to volatilization from sand or PCB solution.

Calculated half-lives for the volatilization of Aroclor 1242, 1248, 1254, and 1260 from 1 mm water column have been reported to range from 9.5 hours to 12.1 hours; other authors have reported half-lives on the order of 3-4 hours for di- and tetrachlorobiphenyls. Volatilization of Aroclor 1260 from river water was reported to be only 67% after 12 weeks; after addition of sediment, the loss dropped to 34% after 12 weeks. The Henry's law constants and volatilization half-lives do not vary widely with degree of chlorination of the PCBs.

The available data indicate that due to low water solubility, volatilization of water-borne PCBs not sorbed to sediment or suspended solids may be significant; when sorbed to soil/sediment, volatilization will be drastically reduced. However, since other fate and transport processes in the soil environment are relatively slow, volatilization of PCBs sorbed on surface soil may occur. Elevated airborne concentrations of PCBs have been measured near PCB disposal area.

PCBs have been reported to be strongly resistant to chemical degradation by oxidation or hydrolysis. However, they have been shown to be susceptible to photolytic and biological degradation. Baxter and Sutherland have shown that successive biochemical and photochemical processes contribute to the degradation of PCBs in the environment. Experimental results indicate that the highly chlorinated PCBs can be photolytically degraded, resulting in the formation of lower chlorinated species and substituted products, as well as potential formation of biphenylenes and chlorinated dibenzofurans; the presence of oxygen retards the photolytic degradation of PCBs.

There is some doubt as to the applicability of these photolysis experiments to environmental conditions, since they were generally carried out in organic solvents, often in the presence of other additives. However, since the rate of photolytic dechlorination is greatest for the highly chlorinated species (i.e., those species that are most resistant to biodegradation), photolytic degradation, although slow, may be a significant transformation process for these molecules. Furthermore, since they are rapidly adsorbed to soil, these highly chlorinated PCBs may be concentrated in the surface layers and their actual photolysis rates may be higher than expected.

Microbial degradation has been reported to be an important transformation process for PCBs. In general, the lower chlorinated PCBs were more easily degraded than the higher chlorinated species. Position of chlorine substitution on the biphenyl molecule also affected the rate of PCB degradation. Biodegradability of PCBs has been reported to be a function of the number of carbon-hydrogen bonds available for hydroxylation by microbial oxidation; adjacent unchlorinated carbons have been shown to facilitate metabolism through formation of arene oxide intermediates. Both aerobic oxidative biodegradation and anaerobic dechlorination have been identified as PCB transformation processes in Hudson River sediments. Composting studies indicate that aerobic systems exhibited greater PCB reductions than anaerobic systems (42 to 48% vs. 18 to 28% reduction after two weeks).

The biodegradation of Aroclor 1016, 1242, 1254, and 1260 is a function of their relative content of the lower chlorinated biphenyls. Aroclor 1016 and 1242 are largely comprised of di-, tri- and tetra-chloro biphenyls, which have been shown to be biodegraded in microbial cultures, aquatic systems, and soil at fairly rapid rates. Aroclor 1254 and 1260 are largely comprised of higher chlorinated species and are expected to be resistant to biodegradation. In fact, Liu reported that an increase of chlorination from monochlorobiphenyls to predominantly trichlorobiphenyls (Aroclor 1016 and 1242) and pentachlorobiphenyls (Aroclor 1254) resulted in a corresponding decrease in degradation from 100% to 29% and 19%, respectively; similar results were reported by other authors. In an experiment with reservoir sediment, Aroclor 1254 was degraded approximately 50% in six weeks. Using an acclimated semi-continuous activated sludge experiment with 48-hour exposure, degradation rates of 33%, 26% and 19% were determined for Aroclor 1016, 1242, and 1254, respectively.

A study of the fate of Aroclor 1254 in soil and groundwater after an accidental spill showed essentially no reduction in Aroclor 1254 concentration due to biodegradation after two years. On the other hand, other authors reported moderate biodegradation of Aroclor 1254 in soil (40% degraded in 112 days) and no degradation of Aroclor 1260 (primarily hexa- and heptachlorobiphenyls). The presence of the lower chlorinated biphenyls has been shown to actually increase the rate of biodegradation of the higher PCBs through co-metabolism.

In summary, most studies have reported substantial PCB degradation in aqueous solutions; biodegradation rates are greatest for the lower chlorinated species. While adsorption of PCBs by soil and competition by native soil organisms may alter the degradation rate, several authors have reported substantial PCB degradation in soil systems. Mixed cultures of PCB-degrading microbes have been isolated from PCB-contaminated soil, suggesting that PCBs will be degraded to some extent in the environment.

3.1.2.4 Explosives

Table 3-6 presents the information which will serve as a basis for understanding the likely environmental fate of explosives at SEDA. The chemical class of the compounds identified in Table 3-6 is considered to be semivolatile. This is based upon the high molecular weights of these compounds and their low vapor pressures, typical of most SVOCs. The most volatile of the five explosives considered at this site is 2,6-dinitrotoluene (2,6 DNT), with a vapor pressure of 0.018 millimeters mercury (mm Hg). Compared to benzene, a volatile compound, which has a vapor pressure of 95.2 mm Hg it is apparent that volatilization of this compound is expected to be low, especially in soil which has a high clay content. Soil with a high clay content generally has a high, i.e. >50%, ratio of water filled to air filled porosity, therefore, there is a small amount of air space through which vapor can migrate. Compounds such as RDX and HMX have extremely low vapor pressures and would not volatilize through the soil. Consequently, volatilization of RDX and HMX are not expected to represent a significant environmental pathway.

The potential for explosives to leach to the groundwater is a complicated consideration and influenced by many factors such as solubility, cation exchange capacity (CEC), clay content and percolation rate. For this evaluation, solubility has been considered as the most representative parameter for leaching potential. Of the six explosives considered, the most soluble of the explosives are the di- and trinitrotoluenes. Their solubilities range from approximately 130 mg/l to 270 mg/l. These are similar to the solubilities of organic hydrocarbons such as toluene, (500 mg/l), or the xylenes, (150 mg/l). This range of solubilities is considered to represent a moderate degree of leaching potential. Compounds which would represent a high degree of leachability, i.e., high solubility, would be methylene chloride, (20,000 mg/l), benzene (1780 mg/l) and TCE, (1100 mg/l). The solubilities of HMX and RDX are approximately four times less than that for the di- and trinitrotoluenes and therefore represent a smaller potential for leaching.

A review of the melting points of these compounds indicates that explosives are solids at room temperature and therefore would not migrate through soil as separate liquid phases. Instead, as precipitation interacts with these solid residues a small portion would dissolve or erode away. Complete leaching would require a long interaction period.

Field studies have confirmed the long-term potential for leaching of explosives into the groundwater. An evaluation of the critical parameters affecting the migration of explosives through soil indicated that at a former propellant manufacturing facility, 2,4-DNT leached from soil contaminated with smokeless powder for over 35 years after cessation of operations (USATHAMA, 1985). At another facility, leaching of 2,4-DNT into groundwater from

former burning grounds has been documented to occur for as long as 10 years after operations had been discontinued.

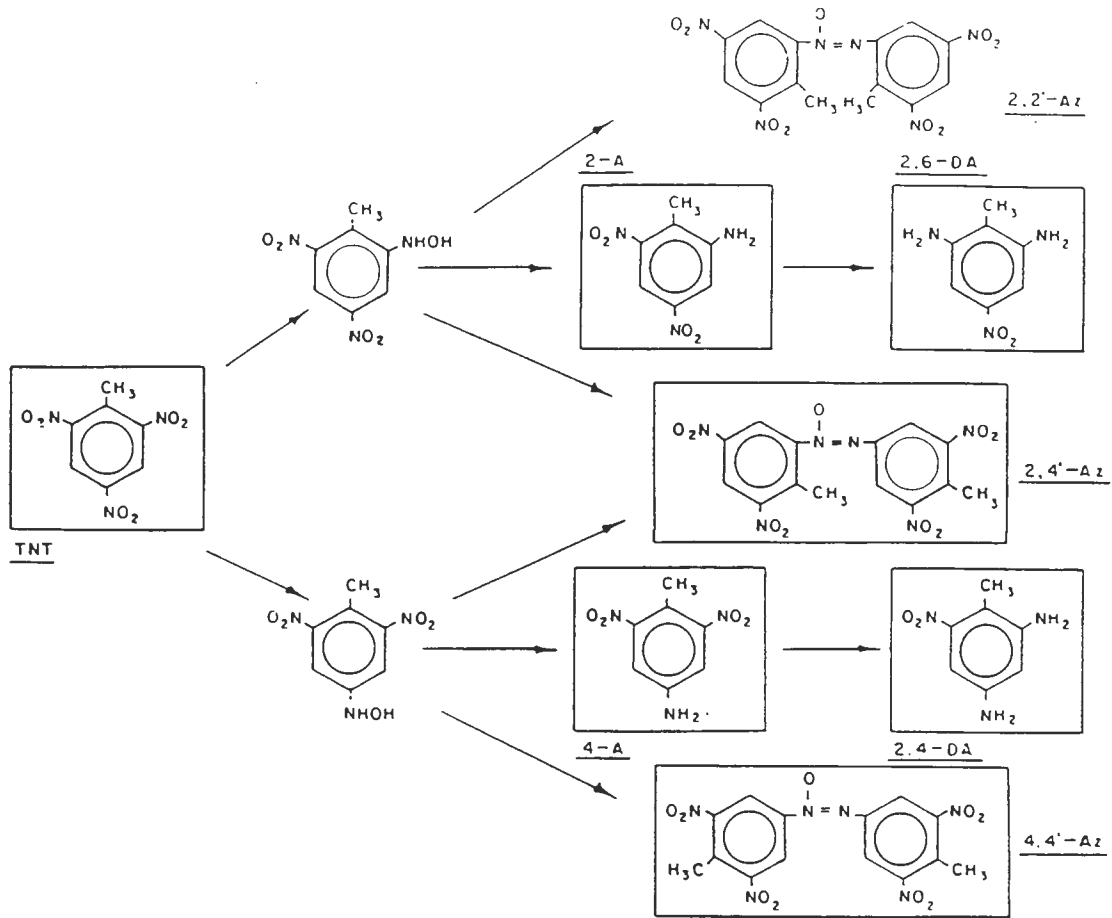
Another factor to examine is the tendency of explosives compounds to adsorb to the soil. The compounds considered in this evaluation show K_{oc} values which range from approximately 100 to 500 mL/g. The SEDA site soil has been shown to possess a high percentage of fines including clay, thereby increasing the sorption potential of these compounds to the soil. As shown in Table 3-6, for the range of K_{oc} exhibited by explosives, i.e., 100-500 mL/g, these compounds would be considered intermediately mobile.

Environmental degradation of these parent organic compounds has been shown to occur by various investigators. The information available on this subject is substantial and a detailed discussion is beyond the scope of this document. However, a review of the available information indicates that nitroaromatics and nitroamines are susceptible to environmental transformations. Since some of the byproducts of these transformations may be environmentally persistent, there is a potential for concern.

Much of the available research has been conducted on the environmental transformation of TNT. Figure 3-10 provides a summary of the identified breakdown products resulting from environmental degradation of TNT. Figure 3-11 presents breakdown products which have been identified from the breakdown of 2,4-DNT. The environmental fate of RDX is less defined than that of the other two compounds previously mentioned. Figure 3-12 provides an overview of the expected degradation pathways and the byproducts produced as a result of the environmental degradation of RDX. Clearly, the breakdown byproducts which have been identified are diverse. Analytical methods have only recently been developed which are capable of accurately detecting these compounds. The widespread application of these analytical techniques are greatly limited by the availability of standards which are essential for the analyses. Responding to the need for accurate analytical procedures and recognizing that standards for every breakdown product are not available, USATHAMA has developed Method 8330 (A copy of this method is included in Appendix C). This method is intended for the analysis of explosive residues in water, soil and sediment.

3.1.3 Data Summary and Conclusions

The chemical data collected from the Expanded Site Inspection (ESI) conducted by Parsons ES in 1993 and 1994 indicate that there has been a release of hazardous constituents at the Munitions Washout Facility. The sources of the release were 1) the wastewater from the washout operation that was discharged on site which contained dissolved metals and explosive compounds and 2) from different operations related to past land use at the site or operations related to the munitions washout facility that may have released pesticides, PCBs and SVOCs.



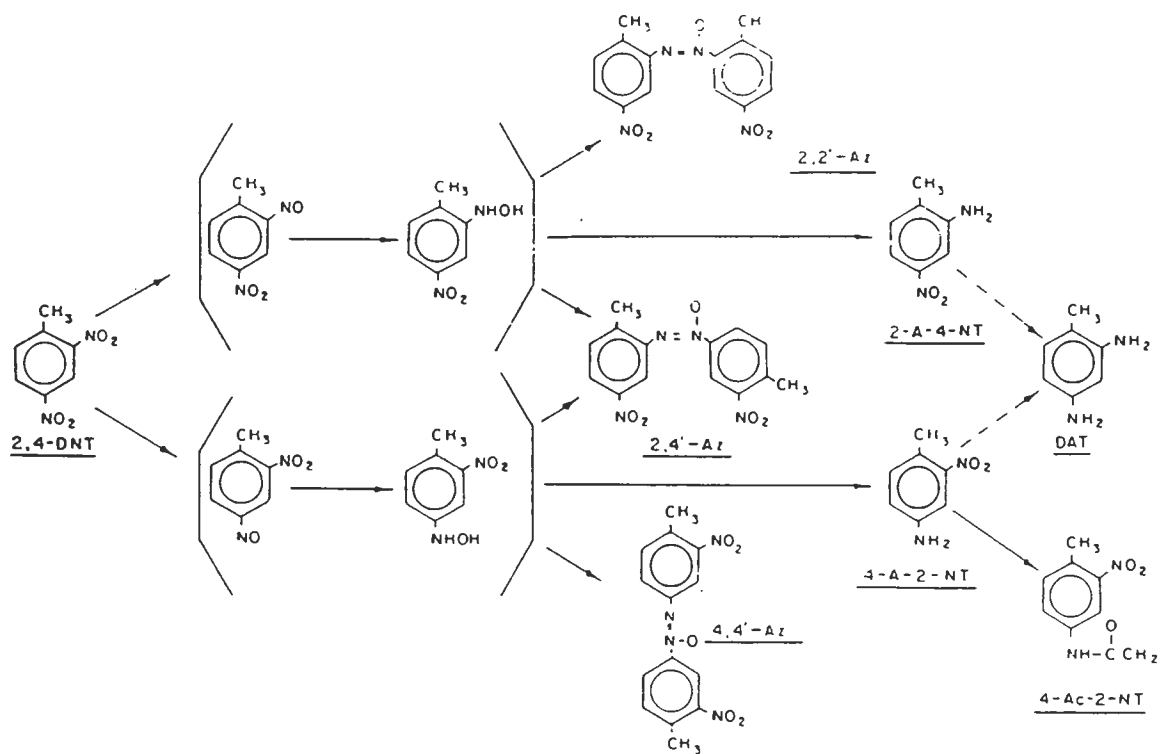
NOMENCLATURE:

- 2-A - 2-amino-4,6-dinitrotoluene
- 4-A - 4-amino-2,6-dinitrotoluene
- 2,2'-AZ - 4,4'-dinitro-2,2'-azoxytoluene
- 2,4'-AZ - 2,4'-dinitro-2,4'-azoxytoluene
- 4,4'-AZ - 2,2'-dinitro-4,4'-azoxytoluene
- 2,6-DA - 2,6-diamino-4-nitrotoluene
- 2,4-DA - 2,4-diamino-6-nitrotoluene

SOURCE:

Special Report 90-2: Environmental Transformation Products of Nitroaromatics and Nitramines; Literature Review and Recommendations for Analytical Method Development; U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Feb. 1990

 PARSONS ENGINEERING SCIENCE, INC.	
<small>CLIENT/PROJECT TITLE</small> SENECA ARMY DEPOT ACTIVITY RI/FS PROJECT SCOPING PLAN SEAD-4 MUNITIONS WASHOUT FACILITY LEACH FIELD	
<small>DEPT.</small> ENVIRONMENTAL ENGINEERING	<small>DWG NO.</small> 727651-02004
FIGURE 3-10 TRANSFORMATION PATHWAYS AND PRODUCTS OF TNT	
<small>SCALE</small>	<small>DATE</small> JUNE 1995




NOMENCLATURE:

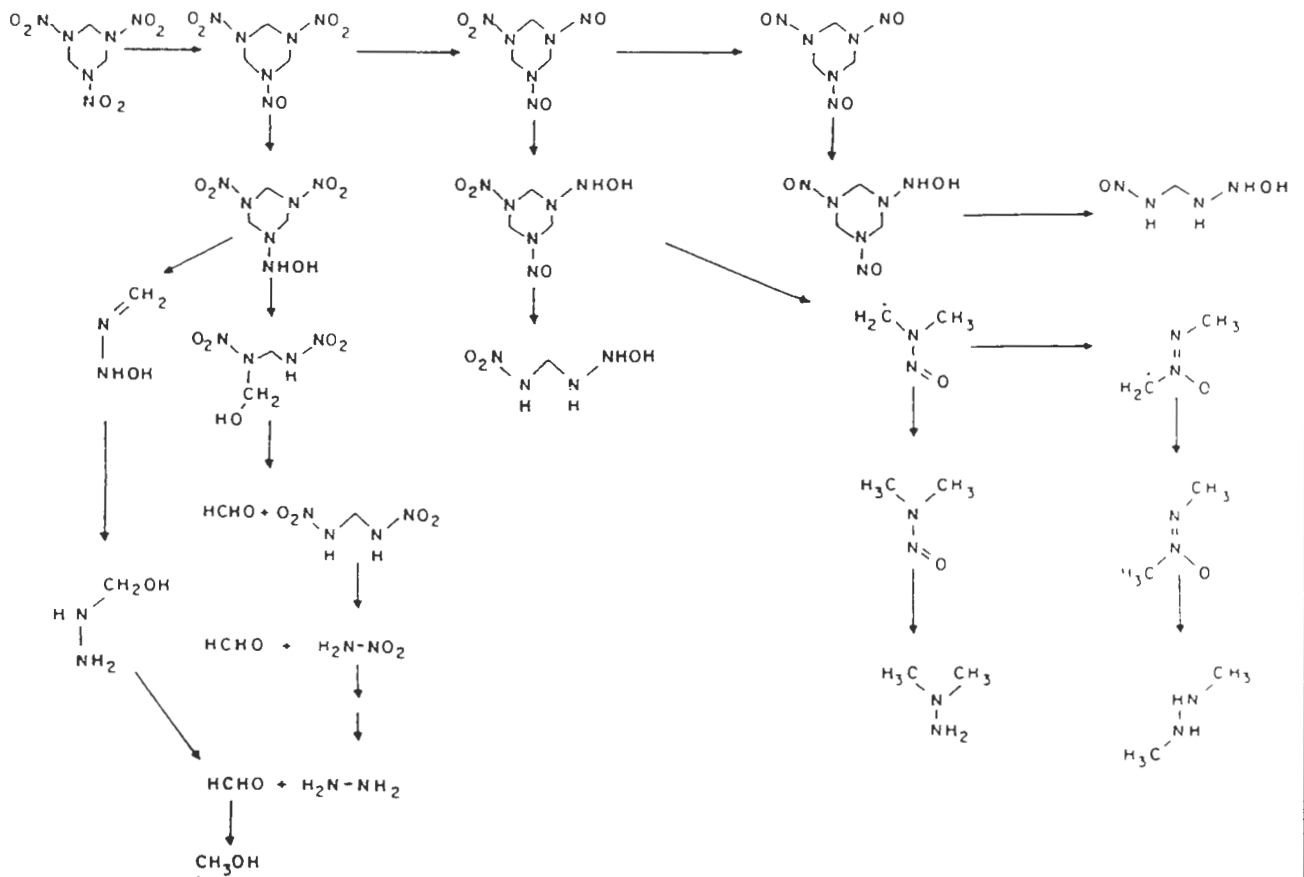
2,2'-AZ - 4,4'-dinitro-2,2'-azoxytoluene
 2,4'-AZ - 2',4'-dinitro-2,4'-azoxytoluene
 4,4'-AZ - 2,2'-dinitro-4,4'-azoxytoluene
 DAT - Diaminotoluene
 2-A-4-NT - 2-amino-4-nitrotoluene
 4-A-2-NT - 4-amino-2-nitrotoluene
 4-AC-2-NT - 4-acetamide-2-nitrotoluene

SOURCE:

Special Report 90-2: Environmental
 Transformation Products of Nitroaromatics
 and Nitramines; Literature Review and
 Recommendations for Analytical Method Development:


U.S. Army Corps of Engineers, Cold Regions Research
 and Engineering Laboratory, Feb. 1990

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<small>DEPT.</small> ENVIRONMENTAL ENGINEERING	<small>DWG NO.</small> 727651-02004
FIGURE 3-11 TRANSFORMATION PATHWAYS AND PRODUCTS OF 2,4-DNT	
<small>SCALE</small>	<small>DATE</small> JUNE 1995



SOURCE:

Special Report 90-2: Environmental Transformation Products of Nitroaromatics and Nitramines; Literature Review and Recommendations for Analytical Method Development; U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Feb. 1990

 PARSONS PARSONS ENGINEERING SCIENCE, INC.	
CLIENT/PROJECT TITLE SENECA ARMY DEPOT ACTIVITY RI/FS PROJECT SCOPING PLAN SEAD-4 MUNITIONS WASHOUT FACILITY LEACH FIELD	
DEPT. ENVIRONMENTAL ENGINEERING	DWG. NO. 727651-02004
FIGURE 3-12 TRANSFORMATION PATHWAYS AND PRODUCTS OF RDX	
SCALE	DATE JUNE 1995

No leach field was identified in this investigation, but three different surface water drainage areas were found to have been impacted by high concentrations of contaminants. These three areas are a drainage ditch on the northern edge of the site, a pond on the western edge of the site and a drainage ditch on the southwestern edge of the site which drains into the pond. The pond area has been impacted primarily by metals, the southwestern drainage ditch has been impacted by metals and SVOCs, and the northern drainage ditch has been impacted by metals, SVOCs, pesticides and PCBs. The area near the former Munitions Washout Building has also been impacted by metals and SVOCs, but to a lesser extent than the three surface water drainage areas.

Underground piping structures were found to be associated with the northern drainage ditch area and the pond, and the samples collected from the areas between the buildings and the water bodies did not contain the high concentrations of the constituents found in the samples collected from these water bodies. It has therefore been concluded that wastewater was piped into these water bodies rather than discharged onto the surface and allowed to flow into the water bodies.

No piping structures were found to be associated with the southwestern drainage ditch, and the chemical analyses of the samples collected from the area between Buildings T30 and 2084 and the ditch show that both surface and subsurface soil has been impacted by high concentrations of metals. This suggests that wastes from Building T30 and 2084 were discharged directly onto the ground surface or the smaller drainage swales that flow into the southwestern ditch.

Because all of the drainage areas that were investigated during the ESI have been impacted with contaminants, samples should be collected from each of the drainage ditches on site to investigate the potential for additional wastewater discharge areas.

The groundwater samples collected from three of the on-site monitoring wells contained high concentrations of metals. The three monitoring wells were located downgradient of the former Munitions Washout Building, downgradient of the pond, and downgradient of the northern drainage ditch. To determine the extent of the impacts to groundwater from seepage from the pond, additional monitoring wells should be installed around the perimeter of the pond. Monitoring wells should also be installed to determine whether the groundwater has been impacted from wastes that may have been released from the other ammunition renovation buildings on-site.

From the chemical analyses performed on the 59 samples collected for the ESI, it has been concluded the primary contaminants of concern at the Munitions Washout Facility, in order of importance, are metals, SVOCs, pesticides/PCBs, and explosives. It is clear that the metals that have been detected in high concentrations (antimony, chromium, copper and zinc) are on site as a result of the munitions washout operation. While the actual mechanism in the washout process that may have been the source of SVOCs is not known, it is probable that the SVOCs on site are also a result of the munitions washout operation. The presence of pesticides and PCBs, however, is probably not the result of the munitions washout operation. Farming was the primary use of the land before the Army bought the land in 1941, so the pesticides and PCBs are probably the result of the use of the land for farming. These may also be due to related operations at the munitions washout facility, such as vegetation control (pesticides) and transformer leakage (PCBs).

Explosive compounds found on site, along with metals, are clearly the result of the munitions washout operation. They were expected to have been among the primary contaminants of concern at this site, but explosive compounds were detected in only 4 of the 59 samples collected for the ESI and in none of the 70 soil samples collected for the Groundwater Contamination Survey conducted by the U.S. Army Environmental Hygiene Agency in 1988. The samples in which explosive compounds were detected were each located in different areas of the site. One sample was a surface soil sample collected in the location of the former Munitions Washout Building, one was a subsurface soil sample collected near the southwestern ditch, one was a sediment sample collected in the pond, and one was a stagnant water sample collected from the manhole near the northern drainage ditch. Although the frequency at which explosive compounds were detected is relatively low, they are still considered to be a primary contaminant of concern. This is because they were obviously released as a result of the munitions washout operation, and were released at several different areas at the facility. Because explosive compounds are generally more soluble and more mobile than metals, it is to be expected that explosive compounds would not be as persistent and would have had more of a tendency to be transported off site in the thirty years since the Washout Facility has been in operation.

Metals, pesticides and PCBs tend to be relatively immobile, so they may be a threat to humans, terrestrial biota, and aquatic biota at the facility. Because SVOCs and explosive compounds tend to be more mobile, they may be a threat to humans, terrestrial biota and aquatic biota downstream of the facility.

3.2 PRELIMINARY IDENTIFICATION OF POTENTIAL RECEPTORS AND EXPOSURE SCENARIOS

This section will identify the source areas, release mechanisms, potential exposure pathways and the likely human and environmental receptors at SEAD-4 based upon the conceptual site model, which was described in the previous section.

This section discusses the current understanding of site risks for SEAD-4. This information is used to assess whether sources of contamination, release mechanisms, exposure routes and receptor pathways developed in the conceptual site model for SEAD-4 are valid, or if they may be eliminated from further consideration prior to conducting a risk assessment. Additionally, this information will determine what data are necessary to develop a better conceptual understanding of the site, in order that risk to human health and the environment can be determined, Applicable or Relevant and Appropriate Requirements (ARARs) can be defined, and appropriate remedial actions can be developed.

A conceptual site model, which is based upon an understanding of historical usage, physical site characteristics and current site usage, was developed for SEAD-4 in Section 3.1. This model helped to identify potential source areas, release mechanisms, exposure pathways and receptors for the various media investigated during the ESI. The potential source areas, release mechanisms, exposure pathways and receptors are discussed in the following subsections.

As of early July 1995, the Base Realignment and Closure Act (BRAC) Commission voted to recommend closure of SEDA. The President and Congress have approved the recommendations, which became public law on October 1, 1995. According to BRAC regulations, future use of the sites will be determined by the Army and the Army will perform any additional investigations and remedial actions to assure that any change in intended land use is protective of human health and the environment. Thus, although future use scenarios are developed for the SEAD-4 risk assessment (Section 3.2.3), the actual future use at SEAD-4 will be determined by the Army according to the BRAC regulations. The actual future use scenario and the required degree of cleanup will be proposed as part of the feasibility study. The future plans for the site will be taken into account at that time.

At this time, the specific details for closure procedures, projected timetables of closure,

discussion of the Army's future intention for the sites, and detailed account of notification methods to prospective purchasers are unavailable for inclusion in this Workplan. If it is decided that the base will be closed, then closure procedures will be obtained.

3.2.1 Potential Source Areas and Release Mechanisms

The Munitions Washout Facility was in operation from 1948 to 1963. The wastes generated from this process included wastewater containing dissolved explosive compounds. The wastewater was discharged on site and is considered to have been a source of potential contaminants at SEAD-4. Currently, the sources of potential contaminants are the soil into which the wastewater leached, and the surface water and sediment in the drainage ditches through which the wastewater may have flowed.

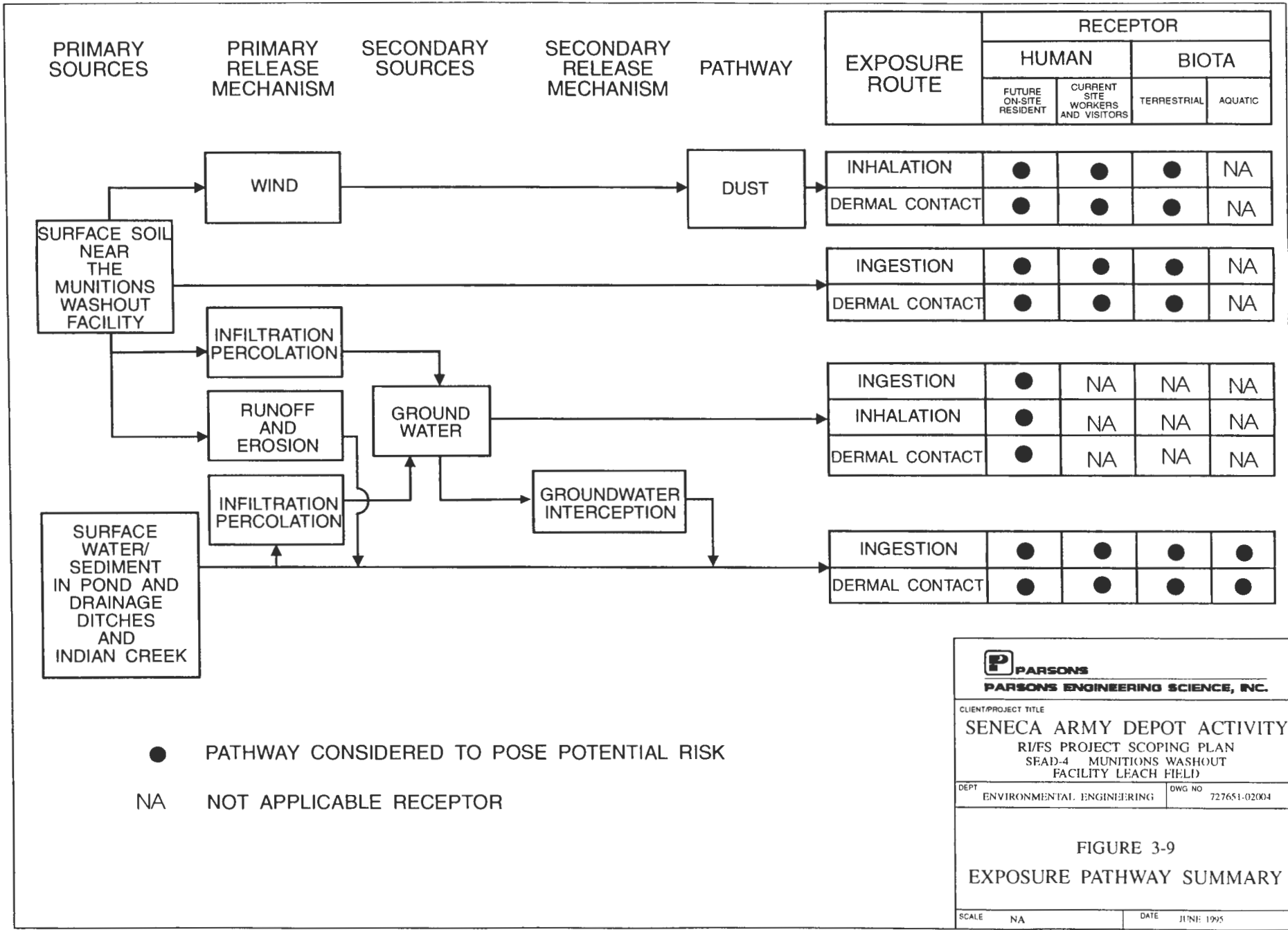
The primary release mechanisms acting on the impacted soil would be infiltration and percolation to groundwater, and runoff and erosion to surface water and sediment. Wind may also release the impacted soil as fugitive dust, but because the area is heavily vegetated, this is not expected to be a significant release mechanism.

3.2.2 Potential Exposure Pathways and Receptors - Current Uses

The potential exposure pathways from sources to receptors based upon current and future use scenarios are shown in Figure 3-9. The potential for human exposure is directly affected by the accessibility to the site with the exception of fugitive dust. The Munitions Washout Facility is located within the Ammunition Storage Area, so access to the site is restricted. There are three primary receptor populations for potential releases of contaminants from SEAD-4:

- Current site workers and visitors
- Terrestrial biota on or near the site
- Aquatic biota on or near the site.

The exposure pathways and media of exposure are described below as they may affect the various receptors. The numerical assumptions that will be used in the risk assessment for the current use exposure scenario are listed in Table 4-1 of the Generic Installation RI/FS Workplan.



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CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
 R/FS PROJECT SCOPING PLAN
 SEAD-4 MUNITIONS WASHOUT FACILITY LEACH FIELD

DEPT ENVIRONMENTAL ENGINEERING DWG NO 727651-02004

FIGURE 3-9
EXPOSURE PATHWAY SUMMARY

SCALE NA DATE JUNE 1995

3.2.2.1 Ingestion and Dermal Exposure Due to Surface Water and Sediment

Current site workers and visitors could be exposed by way of ingestion or dermal contact to surface water or sediment in the drainage ditches or in Indian Creek. Terrestrial biota that ingest or come in contact with surface water or sediment in the drainage ditches, the pond or Indian Creek may be exposed. Aquatic biota in the drainage ditches or Indian Creek may also be exposed.

3.2.2.2 Dust Inhalation and Dermal Contact

Contaminated fugitive dust may be released from SEAD-4 due to high winds, vehicle traffic through the area, or disturbance of the soil during site use. The receptors of fugitive dust releases by way of inhalation and dermal contact are current site workers, visitors and terrestrial biota. Because the site is heavily vegetated, the amount of fugitive dust is not expected to be significant.

3.2.2.3 Incidental Soil Ingestion and Dermal Contact

Incidental ingestion of, and dermal contact with, impacted soil is a potential exposure pathway for current site workers, visitors and terrestrial biota.

3.2.2.4 Ingestion of Groundwater

The groundwater at SEAD-4 is not used as a drinking water source. It is not anticipated that there will be direct exposure to the groundwater from the site under current uses to current site workers, visitors or terrestrial biota.

3.2.3 Potential Exposure Pathways and Receptors - Future Uses

Under current conditions, access to the site is limited. While strict land use control cannot be ensured in future uses, limitations may be imposed through zoning restrictions or deed restrictions. Potential future uses of the site include light industrial and unrestricted residential or other private development.

For future uses of SEAD-4, the receptor population that would differ from the above-mentioned receptors would be on-site residents. For the ingestion of soil, surface water, and sediment and dermal contact with surface water and sediment, the receptors would be

primarily children. Dermal contact with soil; ingestion of, inhalation of, and dermal contact with groundwater; and inhalation and dermal contact with fugitive dust are potential exposure pathways for all future on-site residents.

The numerical assumptions that will be used in the risk assessment for the future use exposure scenario are listed in Table 4-1 of the Generic Installation RI/FS Workplan.

3.3 SCOPING OF POTENTIAL REMEDIAL ACTION ALTERNATIVES

A comprehensive list of remedial response action alternatives is discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

3.4 PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

A comprehensive list of ARARs is discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

Identification and refinement of ARARs will be performed during the RI process. As data are collected regarding the nature and extent of contamination, site specific conditions, and potential use of various remedial technologies, additional ARARs will be selected and existing ARARs will be reviewed for their applicability.

3.5 DATA QUALITY OBJECTIVES (DQOs)

DQOs are discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

Investigations conducted at SEAD-4, either as part of this RI or additional work, will conform with all the stated DQOs. Sampling of groundwater, soil, sediment and surface water will generally require Level IV Quality Data.

3.6 DATA GAPS AND DATA NEEDS

The data needs for SEAD-4 are a result of the need to meet the DQOs identified in the Generic Installation RI/FS Workplan. By media, these data needs are:

Groundwater Data

- Re-sample existing monitoring wells at SEAD-4 to verify the analytical results obtained in the ESI.
- Install and sample additional overburden monitoring wells in the till/weathered shale aquifer. Determine the extent to which groundwater has been impacted by constituents on-site and establish concentrations of constituents in the aquifer with collected data.
- Determine background water quality at SEAD-4 to allow comparison with other SEAD-4 groundwater data.
- In addition to assessing the ground water quality, determine hydraulic conductivity of the aquifer to assess contaminant migration and potential remedial actions.
- Establish database to determine compliance with ARARs, to perform baseline risk assessment and to develop remedial action alternatives.

Surface Water/Sediment Data

- Determine extent of impacts in the drainage ditches at SEAD-4.
- Establish potential for contamination of off-site surface water and sediment.
- Compare SEAD-4 sediment data to sediment background data that has been compiled for SEAD-4.
- Assess the sorptive potential of the sediment by performing total organic carbon (TOC) and grain size analyses on sediment samples.
- Establish database to determine compliance with ARARs, to perform baseline risk assessment and to develop remedial action alternatives.
- Determine the source of the outfall pipe in the northern portion of the site.

Soil Data

- Collect surface soil samples to determine the extent of surface soil impacts in three areas of concern identified during the ESI.
- Collect subsurface soil samples in impacted areas identified from surface soil sampling to determine the vertical extent of the soil impacts.
- Compare SEAD-4 soil data to site-wide soil background data that has been compiled from 57 background samples obtained from the ESIs performed at 25 SEADs and RIs completed at the OB Grounds and the Ash Landfill.
- Assess the sorptive potential of the soil by performing TOC and grain size analyses on soil samples.
- Perform fugitive dust emissions modeling.
- Establish database to determine compliance with ARARs, to perform baseline risk assessment and to develop remedial action alternatives.

Ecological Data

- Document visual observations discriminating between obviously and potentially impacted and non-impacted areas. This will determine where and if there is a need for further investigation.
- Establish database to determine compliance with ARARs, to perform baseline risk assessment and to develop remedial action alternatives.

4.0 TASK PLAN FOR THE REMEDIAL INVESTIGATION (RI)

This section describes the tasks required for the Remedial Investigation (RI) at SEAD-4. These include the following:

- Pre-field Activities
- Field Investigations
- Data Reduction, Interpretation and Assessment
- Data Reporting
- Task Plan Summary

4.1 PRE-FIELD ACTIVITIES

The pre-field activities include the following:

- A site inspection to familiarize key project personnel with site conditions and finalize direction and scope of field activities
- A comprehensive review of the Health & Safety Plan with field team members to ensure that site hazards and preventive and protective measures are completely understood
- Inspection and calibration of all equipment necessary for field activities to ensure proper functioning and usage
- A comprehensive review of sampling protocols and work procedures with field team members

4.2 FIELD INVESTIGATIONS

The following field investigations will be performed to complete the RI of SEAD-4:

- Building Investigation
- Geophysical Investigation
- Soil Investigation
- Surface Water and Sediment Investigation
- Groundwater Investigation
- Ecological Investigation

These investigations are described in the following sections.

4.2.1 Building Investigation

To evaluate the potential for source areas to be currently present in the existing buildings at the ammunition workshop, each of the six buildings at the facility will be inspected. Where possible, material handling processes will be identified, and an inventory will be made of all equipment present in the buildings. To evaluate potential release mechanisms, the buildings will be inspected for floor drains and subterranean piping structures, and all such piping structures found will be documented.

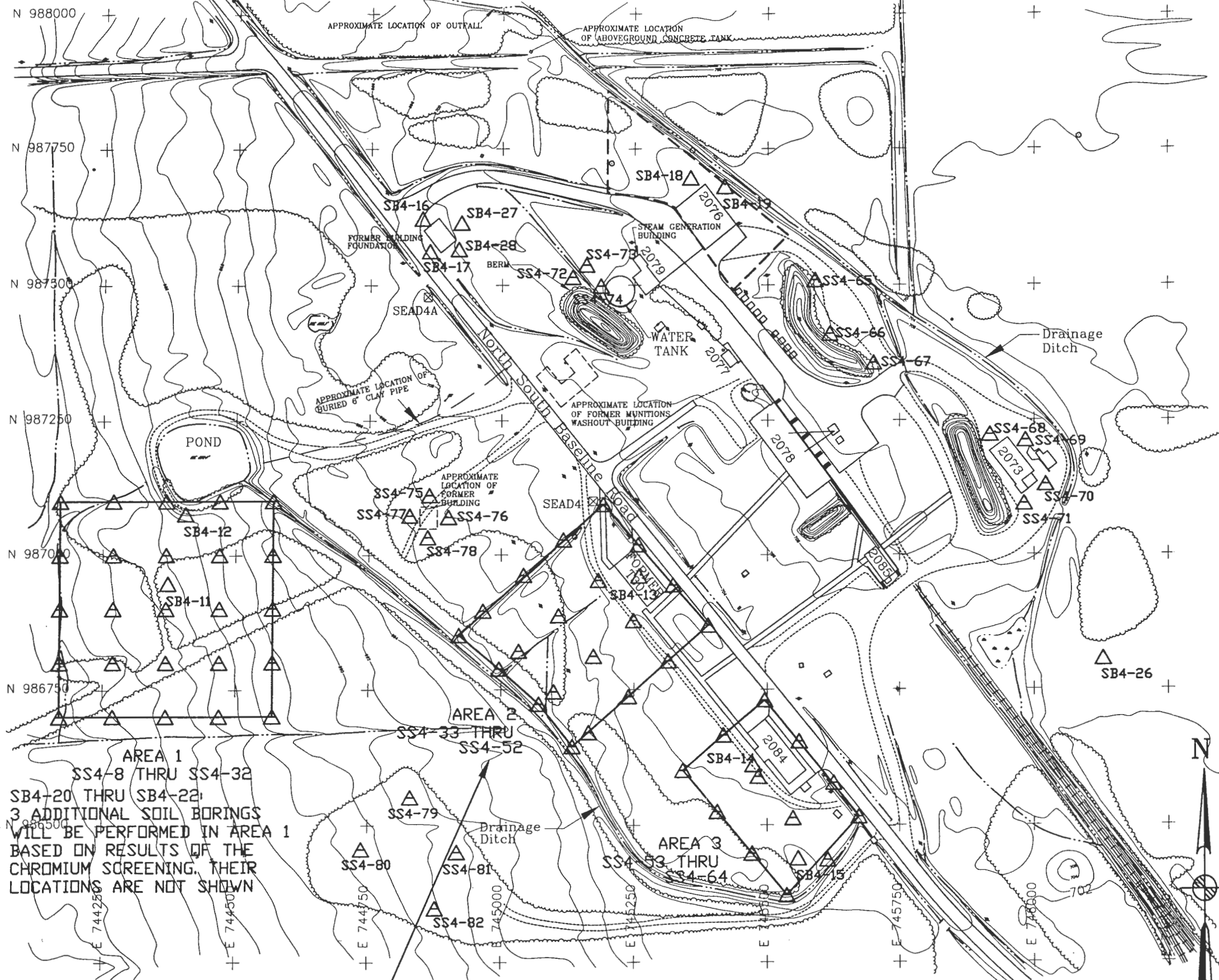
In addition, inquiries will continue to be made with former workers at the Munitions Washout facility, or persons knowledgeable with the site, to gather additional information on where potential contaminants are coming from, what the potential contaminants are, and the potential quantities and time frames of the operations at the site.

A total of 6 soil/debris samples will be collected from the buildings. One sample of soil/debris will be collected from each of the six buildings to determine whether the building has been adversely impacted. The sample will be selected based on an evaluation of the most likely area to be impacted by activities within the building.

4.2.2 Geophysical Investigation

It was reported that laundry washwater that may have contained explosive compounds was released to a pit to the northeast of Building 2076. The pit may have been a concrete tank. Electromagnetic (EM-31) and ground penetrating radar (GPR) surveys will be performed around Building 2076 to determine if an underground tank exists. The initial geophysical investigation will be an EM-31 survey performed on a 10 by 10-foot grid throughout the area shown on Figure 4-1. The EM-31 survey will be used to locate an underground tank containing metal in the structure, such as a concrete tank that is reinforced with iron bars. Upon completion of the EM-31 survey, contour maps of the in-phase and quadrature components of the electromagnetic field will be generated to aid in the identification of any existing underground tanks.

Subsequent to the EM-31 survey, a GPR survey will be performed. GPR data will be collected on a 10 by 10-foot grid throughout the same area that the EM-31 survey is conducted. The GPR survey will be used to locate disturbed soil or concrete tank at a shallow depth.

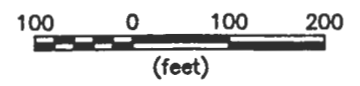


AREA 1
 SS4-8 THRU SS4-32
 SB4-20 THRU SB4-22
 3 ADDITIONAL SOIL BORINGS
 WILL BE PERFORMED IN AREA 1
 BASED ON RESULTS OF THE
 CHROMIUM SCREENING. THEIR
 LOCATIONS ARE NOT SHOWN

SB4-23 THRU SB4-25
 3 ADDITIONAL SOIL BORINGS
 WILL BE PERFORMED IN AREA 2
 BASED ON RESULTS OF THE
 CHROMIUM SCREENING. THEIR
 LOCATIONS ARE NOT SHOWN

LEGEND

- MINOR WATERWAY
- MAJOR WATERWAY
- FENCE
- UNPAVED ROAD
- BRUSH LINE
- LANDFILL EXTENT
- ===== RAILROAD
- 760 --- GROUND SURFACE ELEVATION CONTOUR
- ⊕ ROAD SIGN
- ⊗ DECIDUOUS TREE
- △ GUIDE POST
- ⊕ FIRE HYDRANT
- ⊗ MANHOLE
- ⊕ COORDINATE GRID (250' GRID)
- POLE
- UTILITY BOX
- MAILBOX/RR SIGNAL
- OVERHEAD UTILITY POLE
- ⊗ SURVEY MONUMENT
- △ PROPOSED SURFACE SOIL SAMPLE
- △ PROPOSED SOIL BORING
- EXTENT OF GEOPHYSICAL SURVEY



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PARSONS
PARSONS ENGINEERING SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RI/FS PROJECT SCOPING PLAN
SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD

DEPT. ENVIRONMENTAL ENGINEERING Dep. No. 727651-02004

FIGURE 4-1
PROPOSED GEOPHYSICAL SURVEY, SOIL BORING
AND SURFACE SOIL SAMPLE LOCATIONS

SCALE 1" = 200' DATE JULY 1998 REV C

An investigation into the source of the pipe at the outfall in the northern portion of the site will be performed. The investigation will involve geophysical methods and, if necessary, a backhoe. The two geophysical methods that may be used are 1) magnetic locator and, 2) earth resistivity/ground impedance. One or both of these methods will be used depending on their effectiveness. For the first method, the pipe will be traced by with the magnetic locator to its farthest point. To help increase the magnetic signal from the pipe a metal "snake" (or similar device) may be used. For the second method, earth resistivity and ground impedance will be used to locate the pipe using IEEE Standards documents. Then, if the geophysical methods do not trace it to a source, a backhoe will be used to trace the pipe the remainder of the way. The backhoe will excavate a series of cross-sectional trenches to the top of the pipe. The pipe is expected to extend toward the suspected leach field.

4.2.3 Soil Investigation

The purpose of the soil investigation program at SEAD-4 is to:

- Determine the extent of metals and semivolatile organic compound (SVOC) impacts in three of the areas identified as part of the ESI
- Determine whether the soil has been impacted in four new areas that have been identified as potential release areas for metals, SVOCs or explosive compounds
- Locate areas for potential removal actions
- Provide database for baseline risk assessment
- Provide database for feasibility study and scoping of remedial actions

4.2.3.1 Surface Soil Program

Figure 4-1 shows the locations where surface soil samples (0-2") will be collected. A total of 75 surface soil samples will be collected (excluding those from soil borings). These samples are intended to delineate the extent of impacted surface soil at specific areas of concern that were identified as part of the ESI. Also, the surface soil samples will be used to determine locations where soil borings will be performed.

The three areas that have been identified for surface soil sampling are shown in Figure 4-1 as Area 1, Area 2 and Area 3. Area 1 is a 400-foot by 400-foot area to the south and southwest of the pond where sediment dredged from the pond was placed. Area 2 is a 350-foot by 300-foot area between former Building T30 and the western drainage ditch. Area 3 is a 200-foot by 300-foot area between Building 2084 and the western drainage ditch. In each

of these areas, surface soil samples are proposed to be performed on a 100-foot by 100-foot grid. Sampling on a grid of this size will result in the collection of 25 samples in Area 1, 20 samples in Area 2 and 12 samples in Area 3.

The samples collected in Areas 1 and 2 for the ESI contained high levels of total chromium. To choose which surface soil samples in these areas should undergo the full Level IV analyses, and to choose locations to collect subsurface soil samples, each of the proposed surface soil samples shown in Figure 4-1 will be collected, submitted to the lab, and screened for total chromium. The chromium screening analysis is considered to be Level II quality data. The chromium screening analysis will be the same procedure as the Level IV analysis, but the screening analyses will not be supported by a NYSDEC ASP Category B deliverable, and is therefore Level II quality data. Based on the screening results, the 13 samples in Area 1 with the highest concentrations of total chromium will undergo the Level IV analyses described in Section 4.2.7, Analytical Program. In Area 2, the 10 samples with the highest concentrations of chromium will undergo the Level IV analyses.

In Area 3, the primary contaminants of concern are SVOCs, so none of the surface soil samples will be screened for chromium. All of the surface soil samples collected in Area 3 will undergo the Level IV analyses.

The chromium screening data will be used to choose locations to perform soil borings in Areas 1 and 2. The proposed surface soil samples in those areas will be collected and submitted to the lab on a daily basis, they will be screened for chromium, and the chromium screening data will be available within 24 hours of the lab receiving the samples. In Area 1, one soil boring will be performed in each of the three surface soil sample locations with the highest concentrations of chromium. In Area 2, one soil boring will also be performed at each of the three surface sample locations with the highest concentration of chromium.

In addition to the surface soil samples proposed to be collected from Areas 1, 2 and 3, seven surface soil samples are proposed to be collected in the eastern portion of the site. No soil data was collected from this area during the ESI. Building 2073 has been used as a ammunition renovation workshop since the 1950s, and waste containing explosive compounds may have been released near the building. Four surface soil samples are proposed to be collected around this building. The purpose for the berm that is located to the northwest of

Building 2073 is unknown. Three surface soil samples have been proposed to be collected in the area of the berm to determine the potential for contaminants to have been released there.

Also, three surface soil samples will be collected around sample location SS4-7, where several semivolatile organic compounds were detected for the ESI. These samples will help determine if the semivolatiles previously detected are part of a larger, more significantly impacted area.

And, four samples will be collected from around the former building located approximately 350 feet east-southeast of the pond. These samples will be collected from locations immediately outside the walls of the former building.

Lastly, four samples will be collected from areas that may be impacted by dumping, specifically the cleared area at the end of an unpaved road in the southern portion of the site. The actual sample locations will be determined in the field based on historical usage and visual evidence.

Surface soil sampling procedures are described in Appendix A, Field Sampling and Analysis Plan. The samples will be tested according to the analyses specified in Section 4.2.7, Analytical Program.

4.2.3.2 Subsurface Soil Sampling Program

A total of 18 soil borings are proposed to be performed. Twelve of the 18 proposed soil boring locations are shown in Figure 4-1. The six soil boring locations that are not shown on Figure 4-1 will be determined from the chromium screening data from the surface soil sampling grids, as described above.

Eleven of the soil borings will be performed in the three areas where the surface soil sampling grids are proposed, also shown in Figure 4-1. Five soil borings are proposed to be performed in Area 1; four soil borings are proposed to be performed in Area 2; and two soil borings are proposed to be performed in Area 3.

In Area 1, a soil boring will be located at each of the two surface sample locations from the ESI that contained the highest concentrations of chromium, SS4-4 and SS4-5. Based on the

screening data from the proposed surface soil samples, three additional soil borings will be located at each of the three screening locations with the highest concentrations of chromium.

In Area 2, a soil boring will be performed on the foundation of former Building T30. Based on the screening data from the proposed surface soil samples, three additional soil borings will be performed at each of the three screening locations with the highest concentrations of chromium.

In Area 3, the proposed locations for the two soil borings to be performed are shown in Figure 4-1. Because the primary contaminants of concern in Area 3 are SVOCs no chromium screening will be performed on the surface soil samples to be collected in this area. One of the soil borings has been located adjacent to the southwest side of Building 2084 and the second soil boring has been located to the southwest of Building 2084 in a small drainage swale that flows into the western drainage ditch. The soil boring located adjacent to Building 2084 will be completed as a monitoring well.

Two soil borings will be performed in the vicinity of Building 2076. The proposed locations for the soil borings, as shown in Figure 4-1, are to the northeast and to the northwest of the Building. Based upon the results of the proposed geophysical surveys to be performed in that area, the soil borings will be moved if a tank or a pit is located. If a tank or pit is located, the soil borings will be located either directly on top of or downgradient of the tank or pit.

Four soil borings will also be performed in the vicinity of the existing building foundation that is located to the northwest of the location of the former Munitions Washout Building. This building is suspected to have been a decontamination building for workers or for equipment as part of the munitions washout operation. Currently, there is no indication that one side of the building was more susceptible to a release than another. To assess whether decontamination water was released in the vicinity of the building, soil borings will be performed on all four sides of the building.

One background soil boring will be performed approximately 250 feet southeast of building 2073 (Figure 4-1).

Soil borings will be performed by the continuous split-spoon method. Samples will be collected every two feet from the ground surface to the bottom of the soil boring. In the soil borings to be performed in Area 3, near building 2076 and near the suspected

decontamination building foundation, two subsurface soil samples will be selected from each soil boring along with a 0-2" surface soil sample to be submitted for chemical testing. Because each of the soil borings that are proposed to be performed in Areas 1 and 2 are to be performed in the same location where a surface soil sample (0-2") has been collected, an additional 0-2" sample will not be collected for the soil boring. The criteria for the selection of the subsurface soil samples submitted to the lab for chemical testing is provided in Appendix A, Field Sampling and Analysis Plan.

Additional soil samples will be collected from two soil boring locations and analyzed for grain size, total organic carbon, cation exchange capacity, pH, and density. The two soil borings from which these additional samples will be chosen at random from the 18 soil borings that are proposed to be performed. At the chosen soil boring locations, three samples will be collected: one from the surface, one from below the water table and one from an intermediate depth.

The soil sampling will be performed until split-spoon refusal is encountered. The soil boring (i.e., augering) will continue until auger refusal is reached. Auger refusal for this project is defined in Appendix A, Field Sampling and Analysis Plan. Soil boring procedures are described in Appendix A, Field Sampling and Analysis Plan.

4.2.3.3 Soil Sampling Summary

Eighty-seven (87) surface soil samples will be collected: 25 samples will be collected from Area 1; 20 samples will be collected from Area 2; 12 samples will be collected from Area 3, 7 samples will be collected from the eastern portion of the site, 3 samples will be collected from locations north of the water tank and berm near Building 2079, 4 samples will be collected from around the former building 350 feet east-southeast of the pond, 4 samples will be collected from the cleared area at the end of the unpaved road in the southern portion of the site, and 12 surface soil samples will be collected as part of soil borings to be performed. Also, Thirty-six (36) total subsurface soil samples will be collected from the 18 proposed soil borings. The soil sampling procedures are described in Appendix A, Field Sampling and Analysis Plan.

All surface soil samples collected in Areas 1 and 2 (a total of 45 samples) will be screened for chromium. In Area 1, the 13 samples that have the highest concentrations of chromium and in Area 2, the 10 samples with the highest concentrations of chromium (a total of 23

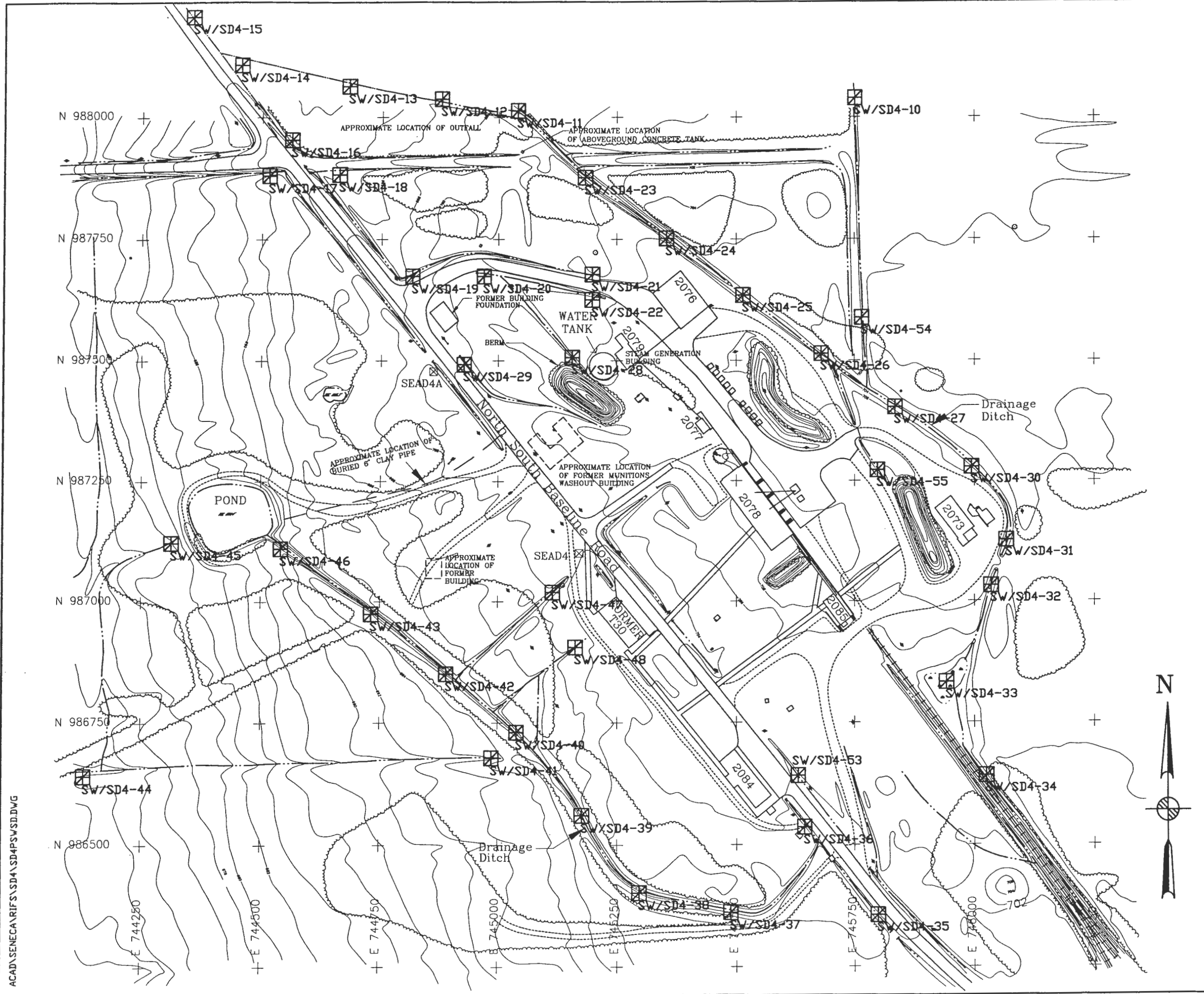
samples) will undergo the full analyses specified in section 4.2.7, Analytical Program. The 12 surface soil samples collected in Area 3, the 7 surface soil samples collected from the eastern portion of the site, the 4 surface soil samples from the former building location, the 3 surface soil samples near the water tank and berm, the 4 surface soil samples from the cleared area, and all of the soil samples collected from the soil borings (a total of 80 samples) will undergo the full analyses specified in Section 4.2.7, Analytical Program.

4.2.4 Surface Water and Sediment Investigation

A review of the of the surface water and sediment samples collected for the ESI indicates that these media have been impacted by metals, SVOCs and pesticides. The presence of pesticides is probably not due to the activities at the Munitions Washout Facility, rather, these compounds may be due to the use of the land for farming before 1941 when the Army bought the property. The metals and the SVOCs, however, are probably the result of activities at the Munitions Washout Facility. To further refine the locations of potential source areas, and to define the fullest extent of impacts, an extensive surface water and sediment sampling program is proposed. Surface water and sediment samples are proposed to be collected at 200-foot intervals along the entire length of the two main drainage ditches at the site. Samples are also proposed to be collected in many of the smaller drainage ditches at the site and in Indian Creek. A total of 46 surface water and sediment samples will be collected (42 from on-site and 4 from Indian Creek).

The proposed locations for 42 surface water and sediment samples to be collected on-site are shown in Figure 4-2. Surface water and sediment sampling will be conducted in areas of SEAD-4 that have the potential for acting as an exposure pathway, transporting contaminants off-site or infiltrating into the soil and percolating to groundwater. The surface water and sediment sampling procedures are described in Appendix A, Field Sample and Analysis Plan. The surface water and sediment samples will be tested according to the analyses described in section 4.2.7, Analytical Program.

Because it was reported by a former SEDA employee that wastewater from the washout process may have been released in Indian Creek, surface water and sediment samples will be collected from there as well. A total of four surface water and sediment samples will be collected from Indian Creek. Two samples are proposed to be collected upstream of Indian Creek Road and two sample are proposed to be collected downstream of Indian Creek Road. The surface water and sediment samples from Indian Creek will also be used to assess the

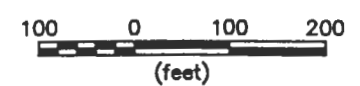


LEGEND

	MINOR WATERWAY
	MAJOR WATERWAY
	FENCE
	UNPAVED ROAD
	BRUSH LINE
	LANDFILL EXTENT
	RAILROAD
	GROUND SURFACE ELEVATION CONTOUR

	ROAD SIGN		DECIDUOUS TREE		GUIDE POST
	FIRE HYDRANT		MANHOLE		COORDINATE GRID (250' GRID)
	POLE		UTILITY BOX		MAILBOX/RR SIGNAL
	OVERHEAD UTILITY POLE		SURVEY MONUMENT		

PROPOSED SURFACE WATER SW/SD4-1 AND SEDIMENT SAMPLE LOCATION



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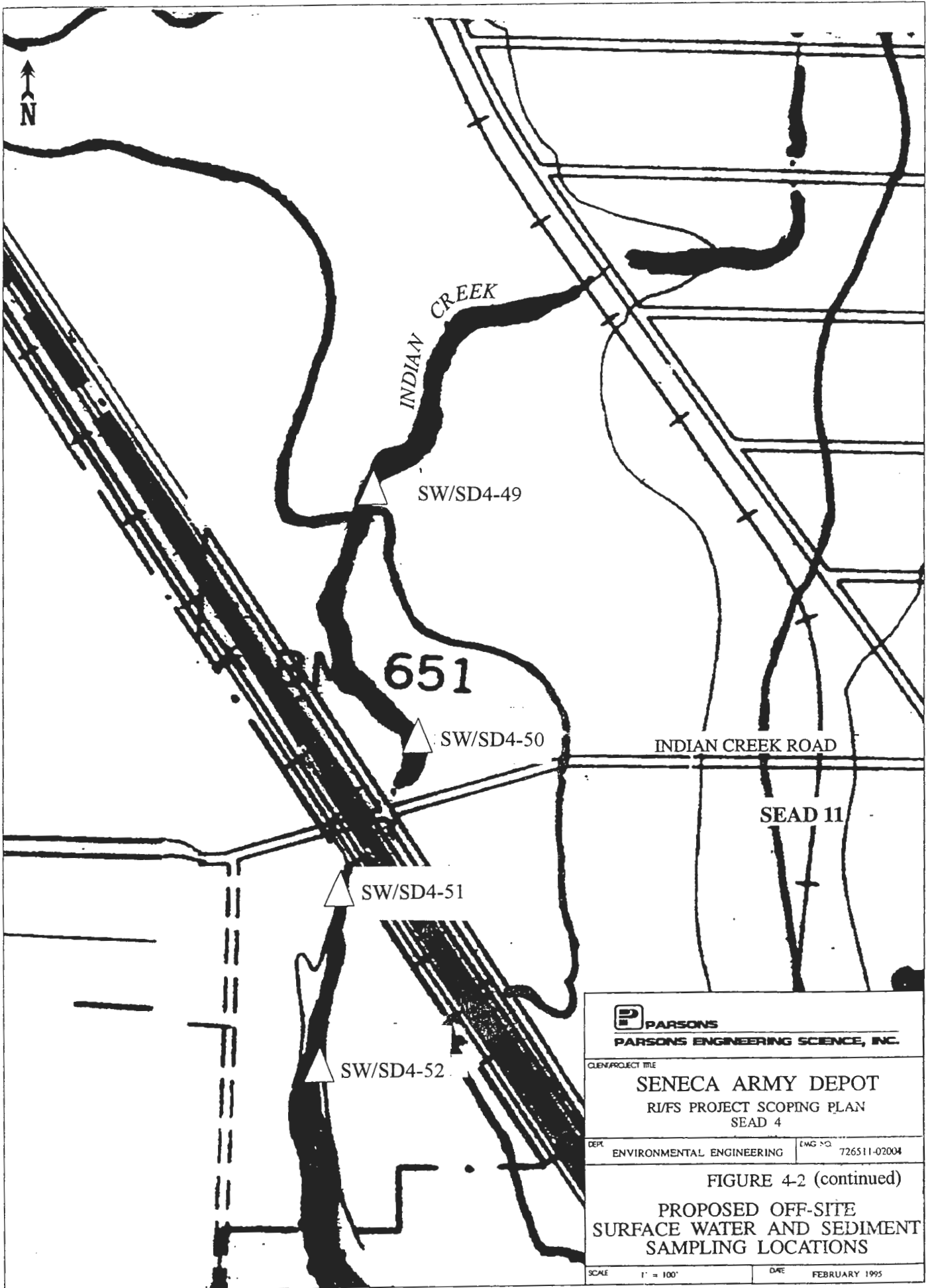
CLIENT/PROJECT TITLE
**SENECA ARMY DEPOT ACTIVITY
 RI/FS PROJECT SCOPING PLAN
 SEAD-4, MUNITIONS WASHOUT FACILITY LEACH FIELD**


DEPT. ENVIRONMENTAL ENGINEERING Dwg. No. 727651-02004

FIGURE 4-2
 PROPOSED SURFACE WATER AND
 SEDIMENT SAMPLE LOCATIONS

SCALE 1" = 200' DATE JULY 1996 REV C

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 PARSONS PARSONS ENGINEERING SCIENCE, INC.	
CLIENT/PROJECT TITLE SENECA ARMY DEPOT RI/FS PROJECT SCOPING PLAN SEAD 4	
DEPT ENVIRONMENTAL ENGINEERING	ENG NO 726511-02004
FIGURE 4-2 (continued) PROPOSED OFF-SITE SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS	
SCALE 1" = 100'	DATE FEBRUARY 1995

presence and extent of impacts from SEAD-11. The locations of the surface water and sediment samples to be collected in Indian Creek for the SEAD-4 RI/FS are shown in Figure 4-2. SEAD-4, which could not be shown on Figure 4-2 because of the scale of the map, is located approximately 600 feet east of sample location SW/SD4-51.

4.2.5 Groundwater Investigation

The locations of proposed and existing monitoring wells are shown in Figure 4-3. The goals of the groundwater investigation during the RI are to determine the extent of groundwater contamination, to characterize the aquifer and to determine the direction and rate of groundwater flow. To accomplish this, eight monitoring wells will be installed in addition to the five existing monitoring wells at the Munitions Washout Facility. All monitoring wells will be screened in the till/weathered shale aquifer. Because the potential for vertical migration of the constituents of concern at SEAD-4 (metals and semivolatiles) is low (Section 3.1.1.3 and Section 3.1.1.4), no paired (or bedrock) wells are proposed at SEAD-4.

The pond water has been demonstrated to contain metals concentrations exceeding the respective TAGM values, and the monitoring wells located downgradient of the pond contained two metals at concentrations higher than their respective TAGM values. To further monitor the infiltration and percolation of the impacted surface water from the pond to the groundwater three additional monitoring wells are proposed to supplement the monitoring well that already exists downgradient of the pond. The three monitoring wells are spaced approximately 150 feet from each other and from the existing monitoring well. The monitoring wells are placed so that radial flow away from the area of the pond may be monitored.

Also, to investigate the possibility of radial flow from the pond a staff gauge will be installed in the pond and surveyed.

Surface and subsurface samples collected from the soil boring that was located immediately to the west of former Building T30 contained metals that exceed the respective TAGM values. To monitor the groundwater in this area, a monitoring well is proposed to be installed at the location where soil boring SB4-10 was performed.

Because Building 2084 appears to be a source of the metals and SVOC impacts identified in the western drainage ditch, a monitoring well will be installed directly downgradient of Building 2084.

Buildings 2085 was the main receiving building for munitions that came to the site for renovation or washout, and Building 2078 was one of the main ammunition renovation workshops. Either of these buildings may be a source of metals, SVOCs or explosive compounds, and a monitoring well is proposed immediately downgradient of each.

An additional background monitoring well has been proposed on the northeast edge of the site to supplement the existing background monitoring well at the eastern edge of the site.

Monitoring well installation and development procedures for overburden monitoring wells are described in Appendix A, Field Sampling and Analysis Plan. All monitoring wells will be properly developed prior to sampling. Groundwater sampling procedures are described in Appendix A, Field Sampling and Analysis Plan. Two separate rounds of groundwater sampling will be performed. The groundwater samples will be tested according to the analyses described in section 4.2.7, Analytical Program.

Aquifer testing will be performed at the 13 monitoring wells. In-situ hydraulic conductivity tests will be performed on the 13 monitoring wells using either a rising or falling head test. Three rounds of water levels will be measured at each of the monitoring wells at SEAD-4 to further define the groundwater flow at the site. Procedures for in-situ conductivity tests and water level measurements are outlined in Appendix A, Field Sampling and Analysis Plan.

4.2.6 Ecological Investigation

The following procedure for the ecological investigation was developed from the New York State Department of Environmental Conservation (NYSDEC) Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (1994). The purpose of the ecological investigation is to determine if aquatic and terrestrial resources have been affected by a release of contaminants from the site. The investigation will be completed in two parts. The first part will be the site description, which will involve the accumulation of data describing the physical characteristics of the site, as well as the identification of aquatic and terrestrial resources present or expected to be present at the site. The second part will be the contaminant-specific impact analysis, which involves the determination of whether the

identified aquatic and terrestrial resources have been impacted by contaminants that have been released at the site. The second part of the ecological investigation is dependent upon the chemical analyses of the samples collected for the RI, described in Sections 4.2.3 through 4.2.5.

The ecological investigation will involve wetlands delineation. Recently the U.S. Fish and Wildlife Service mapped all of the wetlands on the 10,000 acre SEDA site as part of the BRAC closure of the depot. And these wetland maps will provide the basis for the wetland maps developed for SEAD-4 and the reach of Indian Creek from which surface water and sediment samples will be performed. And, if necessary wetlands will be mapped using the methods described in the Generic RI/FS Work Plan.

The ecological investigation and the chemical characterization of various media on-site provides information that will be used for the Ecological Risk Assessment. This assessment will follow the "Procedural Guidelines for Ecological Risk Assessment at U.S. Army Sites", (Edgewood Research, Development & Engineering Center, ERDEC-TR-221; December, 1994) which is patterned after the paradigm put forward in the 1992 EPA report entitled "Framework for Ecological Risk Assessment."

4.2.6.1 Site Description

The purpose of the site description is to determine whether aquatic and terrestrial resources are present at the site and if they were present at the site prior to contaminant introduction; and if they were present prior to contaminant introduction, to provide the appropriate information to design a remedial investigation of the resources. The information to be gathered includes site maps, descriptions of aquatic and terrestrial resources at the site, the assessment of the value of the aquatic and terrestrial resources, and the appropriate contaminant-specific and site-specific regulatory criteria applicable to the remediation of the identified aquatic and terrestrial resources.

A topographic map showing the site and documented aquatic and terrestrial resources within a two mile radius from the site will be obtained. The aquatic and terrestrial resources of concern are Significant Habitats as defined by the New York State Natural Heritage Program; habitats supporting endangered, threatened or rare species or species of concern; regulated wetlands; wild and scenic rivers; significant coastal zones; streams; lakes; and other major resources.

A map showing the major vegetative communities within a half mile radius of the site will be developed. The major vegetative communities will include wetlands, aquatic habitats, NYSDEC Significant Habitats, and areas of special concern. These covertypes will be identified using the NYSDEC Natural Heritage Program descriptions and classifications of natural communities.

To describe the covertypes at the site, the abundance, distribution, and density of the typical vegetative species will be identified. To describe the aquatic habitats at the site, the abundance and distribution of aquatic vegetation will be identified. The physical characteristics of the aquatic habitats will also be described and will include parameters such as the water chemistry, water temperature, dissolved oxygen content, depth, sediment chemistry, discharge, flow rate, gradient, stream-bed morphology, and stream classification.

The aquatic and terrestrial species that are expected to be associated with each coertype and aquatic habitat will be determined. In particular, endangered, threatened and rare species, as well as species of concern, will be identified. Alterations in biota, such as reduced vegetation growth or quality will be described. Alterations in, or absence of, the expected distribution or assemblages of wildlife will be described.

A qualitative assessment will be conducted evaluating the ability of the area within a half mile of the site to provide a habitat for aquatic and terrestrial species. The factors that will be considered will include the species' food requirements and the seasonal cover, bedding sites, breeding sites and roosting sites that the habitats provide.

The current and potential use of the aquatic and terrestrial resources of the site by humans will be assessed. Included with the assessment of the site, the area within a half mile of the site, documented resources within two miles of the site, and documented resources downstream of the site that are potentially affected by contaminants will also be assessed. Human use of the resources that will be considered will be activities such as hunting, fishing, wildlife observation, scientific studies, agriculture, forestry, and other recreational and economic activities.

The appropriate regulatory criteria will be identified for the remediation of aquatic and terrestrial resources and will include both site-specific and contaminant-specific criteria.

4.2.6.2 Contaminant-Specific Impact Analysis

Information from the site description developed in Section 4.2.6.1 and from the characterization of the contaminants at the site developed from the results of the RI will be used to assess the impacts of contaminants on aquatic and terrestrial resources. The impact analysis will involve three steps, each using progressively more specific information and fewer conservative assumptions and will depend upon the conclusion reached at the previous step regarding the degree of impact. If minimal impact can be demonstrated at a specific step, additional steps will not be conducted.

Pathway Analysis

A pathway analysis will be performed identifying aquatic and terrestrial resources, contaminants of concern and potential pathways of contaminant migration and exposure. After performing the pathway analysis, if no significant resources or potential pathways are present, or if results from field studies show that contaminants have not migrated to a resource along a potential pathway, the impact on aquatic and terrestrial resources will be considered to be minimal and additional impact analyses will not be performed.

Criteria-Specific Analysis

Presuming that the presence of contaminated resources and pathways of migration of site-related contaminants has been established, the contaminant levels identified in the field investigation will be compared with available numerical criteria or criteria developed according to methods established as part of the criteria. If contaminant levels are below criteria, the impact on resources will be considered to be minimal and additional impact analyses will not be performed. If numerical criteria are exceeded or if they do not exist and cannot be developed, an analysis of the toxicological effects will be performed.

Analysis of Toxicological Effects

The analysis of toxicological effects is based on the assumption that the presence of contaminated resources and pathways of migration of site-related contaminants has been established. The purpose of the analysis of toxicological effects is to assess the degree to which contaminants have affected the productivity of a population, a community, or an

ecosystem and the diversity of species assemblages, species communities or an entire ecosystem through direct toxicological and indirect ecological effects.

A number of approaches are available to conduct an analysis of toxicological effects. One or more of the four following approaches will be used to assess the toxicological effects.

- **Indicator Species Analysis**—A toxicological analysis for a indicator species will be used if the ecology of the resource and the exposure scenarios are simple. This approach assumes that exposure to contaminants is continuous throughout the entire life cycle and does not vary among individuals.
- **Population Analysis**—A population level analysis is relevant to and will be used for the evaluation of chronic toxicological effects of contaminants to an entire population or to the acute toxicological effect of contaminant exposure limited to specific classes of organisms within a population.
- **Community Analysis**— A community with highly interdependent species including highly specialized predators, highly competitive species, or communities whose composition and diversity is dependent on a key-stone species, will be analyzed for alternations in diversity due to contaminant exposure.
- **Ecosystem Analysis**—If contaminants are expected to uniformly affect physiological processes that are associated with energy transformation within a specific trophic level, an analysis of the effects of contaminant exposure on trophic structure and trophic function within an ecosystem will be performed. Bioconcentration, bioaccumulation, biomagnification, etc., are concepts that may be used to evaluate the potential effects of contaminant transfer on trophic dynamics.

4.2.7 Analytical Program

A total of 45 surface soil samples will be collected for Level II total chromium screening. A total of 89 soil samples, 6 soil/debris samples, 13 groundwater samples and 46 surface water and sediment samples will be collected from SEAD-4 for Level IV analyses. All of these samples will be analyzed for the following: Target Compound List volatile organic compounds (EPA Method 524.2 on groundwater), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), Target Analyte List metals and cyanide according to the NYSDEC Contract Laboratory Program Statement of Work; explosive compounds by EPA Method 8330; and nitrate-nitrogen by EPA Method 352.1. Additional analyses to be performed on specific media are provided below.

Six (6) subsurface samples from two soil boring locations will be tested for TOC, grain size distribution (including the distribution within the silt and clay size fraction), cation exchange capacity, pH and density. The 13 groundwater samples will be analyzed for volatile organic compounds by EPA Method 524.2. The 46 surface water samples will also be analyzed for pH, hardness, TOC, total suspended solids, total dissolved solids, alkalinity, ammonia, nitrate/nitrite-nitrogen, and phosphate. The 46 sediment samples will also be analyzed for TOC, grain size distribution (including the distribution within the silt and clay size fractions), cation exchange capacity, pH and density. The methods by which these analyses will be performed are given in Appendix C, Chemical Data Acquisition Plan.

Quality Assurance/Quality Control (QA/QC) sampling requirements are described in Section 5.3 of Appendix C, Chemical Data Acquisition Plan. Analyses for all of the media to be sampled are summarized in Table 4-1. A detailed description of these methods, as well as lists of each compound included in each of the categories is presented in Appendix C, Chemical Data Acquisition Plan.

4.2.8 Surveying

Surveying will be performed at SEAD-4 for the following purposes:

- Locate all of the environmental sampling points
- Map the direction and compute the velocity of groundwater movement
- Serve as the basis for volume estimates of impacted soil and sediment which may require a remedial action
- Map the extent of any impacted groundwater above established ARAR limits

Table 4-1
 Summary of Sampling and Analyses
 Seneca Army Depot Activity
 SEAD-4

MEDIA	VOCs		SVOCs		Explosives		Pest/Pcbs		Metals		Nitrate-Nitrogen	Grain Size*	pH	Hardness	TSS	TDS	Alkalinity	Ammonia	Phosphate	Cat Ex Cap.	Density	TOC
	NYSDEC	EPA	NYSDEC	EPA	NYSDEC	NYSDEC	NYSDEC	NYSDEC	EPA	ASTM	EPA	EPA	EPA	EPA	EPA	EPA	EPA	EPA	EPA	EPA	COE	EPA
	YCL	Method	YCL	Method	YCL	Method	Chromium Screening	TAL	Method	Method	Method	Method	Method	Method	Method	Method	Method	Method	Method	Method	Method	Method
	NYSDEC CLP	524.2 rev. 4	NYSDEC CLP	8330	NYSDEC CLP		NYSDEC CLP		MCAWW 353.2	D-422-63	150.1/9045#											
Soil	Surface	56	0	56	56	56	45	56	56@	2	2	0	0	0	0	0	0	0	0	2	2	2
	Subsurface	44	0	44	44	44	0	44	44@	4	4	0	0	0	0	0	0	0	0	4	4	4
	Soil/Debris	6	0	6	6	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dredging																					
Groundwater		0	13	13	13	13	0	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0
Surface water		46	0	46	46	46	0	46	46	0	43	43	43	43	43	43	43	43	43	0	0	43
Sediment		46	0	46	46	46	0	46	46@	43	0	0	0	0	0	0	0	43	43	43	43	43

Notes:

- 1) * Grain size analysis includes determination of the grain size distribution within the silt and clay size fraction.
- 2) @ Method for soil samples will be modified. For soils, a known quantity of soil will be mixed with a known volume of water, stirred, then filtered to form an aqueous extract.
- 3) # Method 9045 will be used for soil samples. Method 150.1 will be used for water samples.
- 4) ^ Method 415.1 will be used for water and the Lyod Kahn Method will be used for soils.
- 5) QA/QC samples are not included in the totals shown above. QA/QC sampling requirements are described in Section 5.3 of Appendix C of the Generic Installation RI/FS Workplan.
- 6) EPA = Environmental Protection Agency
- 7) ASTM = American Society for Testing and Materials
- 8) COE = Corps of Engineers

The location, identification, coordinates and elevations of all the control points recovered and/or established at the site and all of the soil borings, monitoring wells (new and existing) and all surface soil, sediment and surface water sampling points and the staff gauge will be surveyed and plotted on the site base map to show their location with respect to surface features within the project area. Site surveys will be performed in accordance with good land surveying practices and will conform to all pertinent state laws and regulations governing land surveying. The surveyor shall be licensed and registered in New York. A detailed discussion of the site field survey requirements is presented in Appendix A, Field Sampling and Analysis Plan.

4.3 DATA REDUCTION, ASSESSMENT AND INTERPRETATION

Data reduction, assessment, and interpretation is discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

To determine if the air pathway is significant, air dispersion modeling will be performed. The protocol described in the Superfund Exposure Assessment Manual (EPA, 1988) will be followed in order to evaluate the total emission rates for this transport mechanism. This method is further defined in Agricultural Handbook No. 346, "Wind Erosion Forces in the United States and Their Use in Predicting Soil Loss," (USDA, 1968). This technique, which estimates annual losses of surface soil to wind erosion, will be used to estimate the potential particulate emissions of hazardous constituents associated with the surface soils at the site. The results of the dispersion modeling will provide useful information for the risk assessment.

4.4 BASELINE RISK ASSESSMENT

The baseline risk assessment is discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

Because SEDA has recently been added to the BRAC list, the scenarios evaluated in the baseline risk assessment will be based on the community reuse plan, as described in BRAC guidance. Therefore, the future receptors currently listed in the Risk Assessment section of the Generic Installation RI/FS workplan will be revised when the community reuse plan is written.

4.5 DATA REPORTING

Data reporting is discussed in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

4.6 TASK PLAN SUMMARY FOR THE RI

General information about the Task Plan Summary is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

A detailed Task Plan Summary that indicates the number and type of samples to be collected at SEAD-4 is provided in Table 4-1.

5.0 TASK PLAN FOR THE FEASIBILITY STUDY (FS)

The task plan for the FS is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

5.1 DEVELOPMENT OF OBJECTIVES

A discussion of the development of objectives for the FS is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

5.2 SCREENING OF ALTERNATIVES

A discussion of the screening of alternatives for the FS is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

Additionally, as part of the FS process, at least one innovative technology will be evaluated for the Munition Washout Facility.

5.3 DETAILED ANALYSIS OF ALTERNATIVES

A discussion of the detailed analysis of alternatives for the FS is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

Additionally, as part of the FS process, at least one innovative technology will be evaluated for the Munition Washout Facility.

5.4 TASK PLAN SUMMARY FOR THE FS

The task plan summary for the FS is given in the Generic Installation RI/FS Workplan that serves as a supplement to this RI/FS Project Scoping Plan.

The remedial action cost estimate for the RI/FS report will be prepared in accordance with ER 1110-3-1301. Additionally, the estimate for the selected plan will be prepared using MCASES Gold Software, and structured using the Remedial Action Work Breakdown Structure (RA-WBS).

6.0 PLANS AND MANAGEMENT

The purpose of this workplan is to present and describe the activities that will be required for the site Remedial Investigation/Feasibility Study at SEAD-4. The Field Sampling and Analyses Plan (Appendix A), details procedures which will be used during the field activities. Included in this plan are procedures for sampling soil, sediment, surface water, fish, shellfish and groundwater. Also included in this plan are procedures for developing and installing monitoring wells, measuring water levels and packaging and shipment of samples.

The Health and Safety Plan (Appendix B) details procedures to be followed during field activities to protect personnel involved in the field program.

The Chemical Data Acquisition Plan (Appendix C) describes the procedures to be implemented to assure the collection of valid data. It also describes the laboratory and field analytical procedures which will be utilized during the RI. The contracted laboratory is Inchape Testing Services (Aquatec Laboratory).

6.1 SCHEDULING

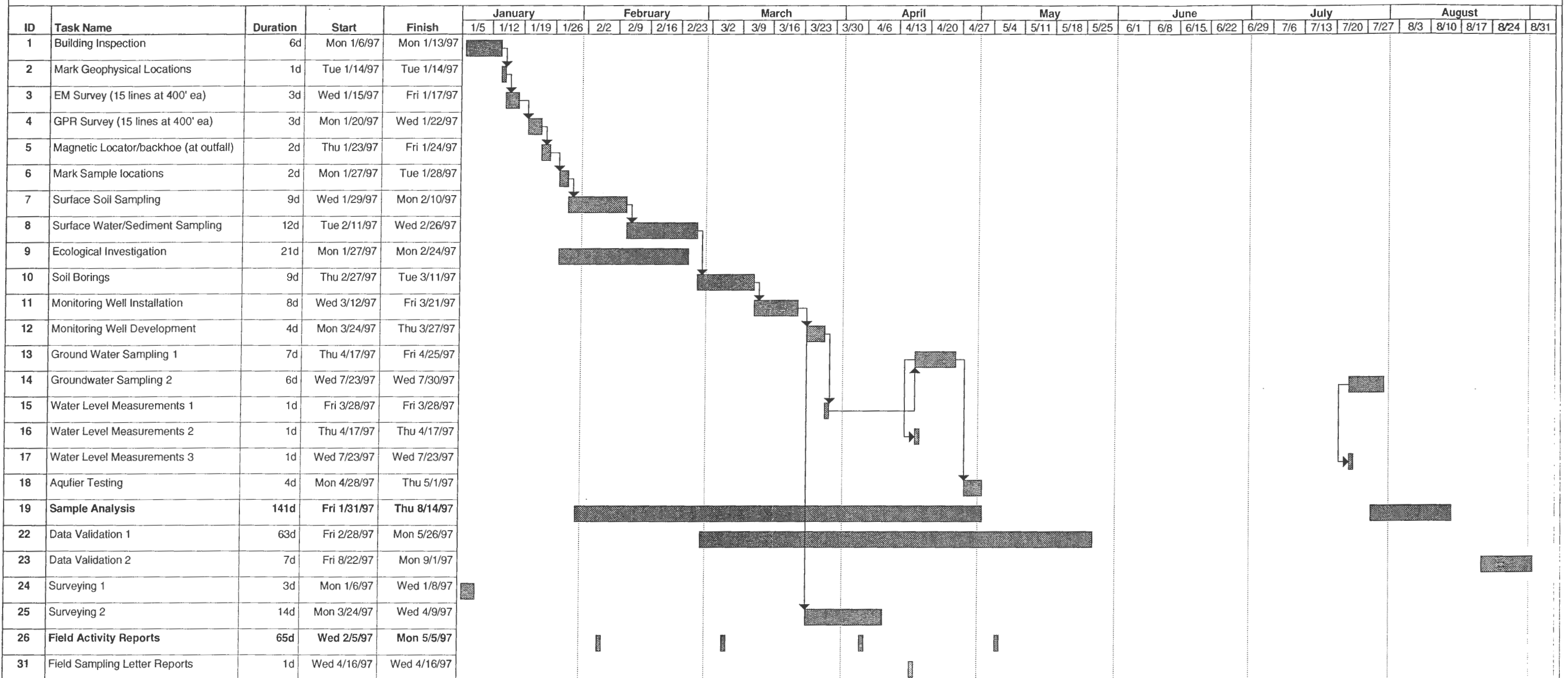
The proposed schedule for the RI/FS at SEAD-4 is shown in Figure 6-1. Because the start date was unknown at the time of the preparation of this Scoping Plan, the times indicates are relative to arbitrary start data.

6.2 STAFFING

The staffing for the RI/FS at SEAD-4 is shown on Figure 6-2.

Figure 6-1

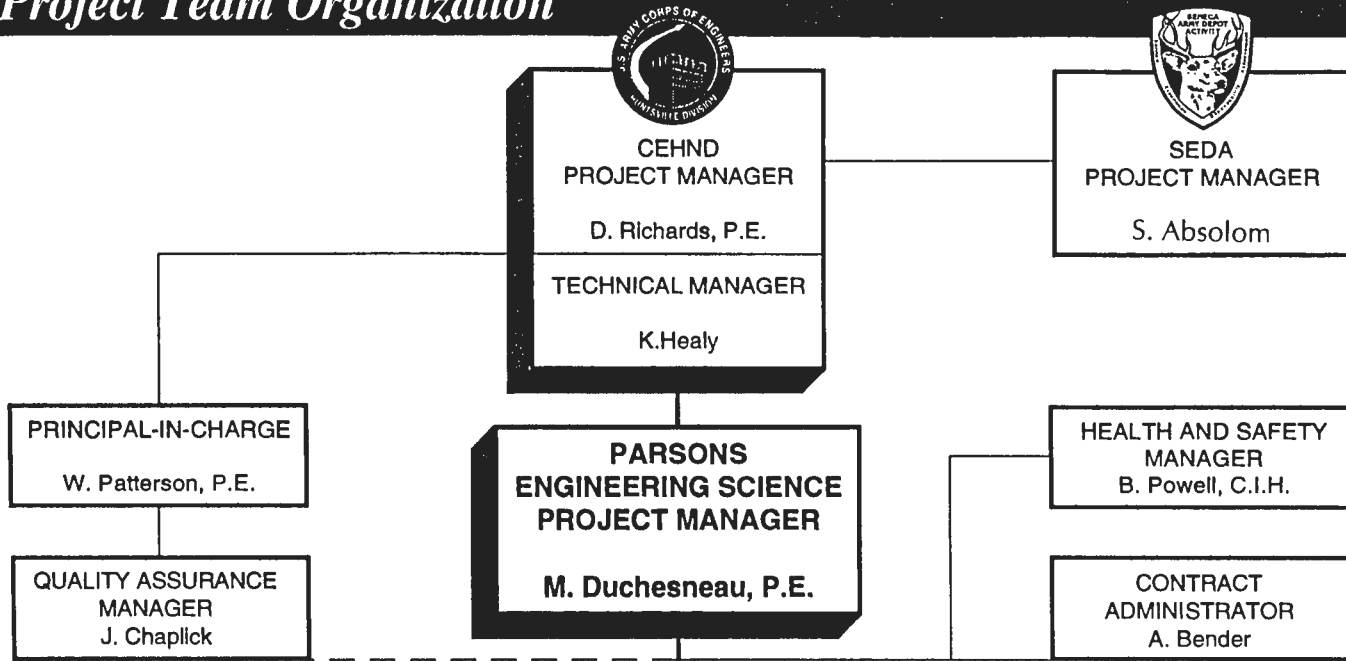
Project Schedule for SEAD-4 (start date is uncertain)



Project:
Date: Fri 7/19/96

Task [shaded box] rolled up task [shaded box]

Parsons ES Project Team Organization



DELIVERY ORDER MANAGERS						
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ENVIRONMENTAL	P. O'Brien, P.E.			COST ESTIMATING	W. Christner	
				SURVEYING	D. Fry, L.L.S.	
				CONSTRUCTION MGMT.	N. Sulock	
				AIR QUALITY	J. Pollack	
				DATA VALIDATION	J. Hall	

Figure 6-2

7.0 REFERENCES

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- Parsons Engineering Science, Inc., May 1995, Draft Final Report, Expanded Site Inspections of Seven High Priority Solid Waste Management Units.
- Parsons Engineering Science, Inc., September 1994, Remedial Investigation Report at the Open Burning Grounds.
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- U.S. Army Toxic and Hazardous Materials Agency, (USATHAMA), Installation Assessment of Seneca Army Depot, Report No. 157, AMXTH-IR-A-157, January 1980.
- U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1985, Evaluation of Critical Parameters Affecting Contaminant Migration through Soils, Report No. AMXTH-TE-CR-85030, July 1985.
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U.S. Geological Survey Quadrangle Maps, Towns of Ovid and Dresden, New York, 1970.

APPENDIX A
FIELD SAMPLING AND
ANALYSIS PLAN

*Appendix A information is contained in the Generic Installation
RI/FS Workplan that serves as a supplement to this RI/FS Project
Scoping Plan*

APPENDIX B
HEALTH AND SAFETY PLAN

*Appendix B information is contained in the Generic Installation
RI/FS Workplan that serves as a supplement to this RI/FS Project
Scoping Plan*

APPENDIX C
CHEMICAL DATA ACQUISITION PLAN

*Appendix C information is contained in the Generic Installation
RI/FS Workplan that serves as a supplement to this RI/FS Project
Scoping Plan*

APPENDIX D

**UNITED STATES DEPARTMENT OF INTERIOR
FISH AND WILDLIFE SERVICES ENDANGERED AND
THREATENED SPECIES LETTER**

*Appendix D information is contained in the Generic Installation
RI/FS Workplan that serves as a supplement to this RI/FS Project
Scoping Plan*

APPENDIX E
RESPONSE TO REVIEW COMMENTS

**Comments for
Draft SEAD-4 Project Scoping Plan
for Performing a CERCLA Remedial Investigation/
Feasibility Study (RI/FS) at the Munitions Washout
Facility and Leach Field**

EPA

General Comments

Comment #1 In several locations throughout the document ES states that groundwater samples exceed the TAGM values. This is an incorrect as TAGM values are soil cleanup objectives, and not groundwater guidance values. ES should use Federal MCLs and the NYSDEC Class GA standards in comparison to existing groundwater analytical data.

Response #1 Agreed. Groundwater analytical data will be compared to NYSDEC Class GA Standards and Federal MCLs in the RI that will be prepared for SEAD-4. As a note, both NYSDEC Class GA and EPA MCLs were provided in Table 3-3. The references to TAGM values for groundwater samples has been changed on page 3-37.

Comment #2 The table of contents is missing the appropriate page numbers.

Response #2 Agreed. Page numbers have been added to the Table of Contents.

Specific Comments

Comment #1 Page 3-2, p4: The third building which is referenced appears on the site map to be closer to 300 feet from the washout building than the 400 feet cited in the text.

Response #1 Agreed. The distance to the third building has been changed to “approximately 300 feet” on Page 3-2, as noted in the comment.

Comment #2 Page 3-4, p3: The text should more clearly define the nature of the “several underground piping structures” in the area of the suspected leach field. Subsequently on Page 3-12 text indicates that the GPR survey detected “no pronounced linear anomalies or pipes” in this area. If this is the case, how was the presence of “piping structures” determined? Also, an outfall to a drainage ditch is mentioned in the text. Is it possible to televise or otherwise trace (such as by trenching) this structure since it appears that it may have been a significant contaminant transport route?

Response #2 Agreed. The text on Page 3-4 has been modified to include an explanation of how the presence of piping structures was determined on this portion of the site. With regard to the second part of the comment that refers to the

outfall, we proposes to use geophysics and, if necessary, a backhoe to trace the outfall pipe to its source . The text was changed in Section 4.2.2 to reflect the added field investigations.

- Comment #3** Figure 3-7: The data presented on this figure have been rounded to the nearest tenth of a foot. However, the data presented in Table 3-1 is shown to the nearest 0.01 feet. The data presented in the figure should be the same as shown in the table and the contouring should be checked.
- Response #3** Agreed. The data presented on Figure 3-7 has been changed to the nearest 0.01 feet, as shown in Table 3-1.
- Comment #4** Figure 3-8: The symbol presented for the surface water/sediment sampling locations is not consistent between the legend and the main body of the figure. The sampling location SB4-1, was not found on the figure.
- Response #4** Agreed. The symbol for the surface water/sediment sampling locations (SW/SD4-1 and SW/SD4-2) was refined so that it is consistent with the symbol used in the legend. Also, the borings SB4-1 through SB4-5 were identified on Figure 3-8; they are associated with wells MW4-1 through MW4-5.
- Comment #5** Section 3.2, Page 3-69: If the future plans for the facility and the future use scenarios will be proposed as part of the feasibility study as indicated in the current text, it is not clear how the future use scenarios will be evaluated in the baseline risk assessment; this statement should be clarified.
- Response #5** Agreed. The text on page 3-69 has been modified so that it is clear that, although future use scenarios are developed for SEAD-4 for the risk assessment (Section 3.2.3), the actual future use at SEAD-4 will be determined by the Army according to BRAC regulations.
- Comment #6** Page 3-73, Bullet 3: The need for the comparison of the data to other sites is unclear, since the surface water/sediment samples collected from this site are most likely to be affected by upgradient sources rather than regional sources. The samples collected from this site should be compared to upgradient sampling locations.
- Response #6** Agreed. the text on page 3-73 has been modified to state that the sediment data from SEAD-4 will be compared to background sediment data from SEAD-4.
- Comment #7** Section 4.2.1, Building Inspection: Based on the results of the building inspections, additional samples from floor drains, vents/exhaust fans, etc. may be appropriate.

Response #7 Agreed. Based on the results of the building inspections, one sample from each building will be collected. Details of the sampling are presented in Section 4.2.1.

Comment #8 Section 4.2.3.1: During the ESI, a single soil boring (SB4-6) was conducted to the southwest of the former building location which is approximately 350 feet east-southeast of the pond. While the results of soil samples for SB4-6 did not indicate contamination, several surface soil samples in the immediate vicinity of the former building should be collected to confirm these results.

During the ESI, several semivolatile compounds were detected below TAGM values in surface sample SS4-7, located at the northern edge of the berm to the northeast of the washout building. The surface soil sampling program proposed in the work plan does not include any additional sampling in this area to evaluate if this sample was from the margin of an area of higher contamination. Several surface soil samples should be collected from this area to confirm the previous sampling result.

The figure used in this section shows a cleared area of land approximately 800 feet to the southwest of the pond with a connecting road to the North South Baseline Road. Has the prior use of this area been determined? Based on the available information for this area, surface soil sampling may be appropriate.

Response #8 Agreed. Four surface soil samples have been proposed immediately outside the walls of the former building located approximately 350 feet east-southeast of the pond. These samples will address any impacts that may not have been detected in the soil samples collected from SB4-6 during the ESI.

Agreed. Three additional samples have been proposed to be collected around sample SS4-7 to evaluate the hypothesis that the semivolatile organics detected during the ESI are part of an area of higher impacts.

Agreed. While there is no direct evidence of historical release in this area, the dirt road that leads to this area is suspect and it could have been used for access and disposal of materials related to the Munitions Washout Facility. Therefore, to address this area, four surface soil samples will be collected. The text on page 4.2.3.1 was modified to include this added sampling.

Comment #9 Section 4.2.3.1, Page 4-4, p4: The use of laboratory screening for chromium is appropriate for surface soil samples. However, the work plan proposes to use this screening to select only the most contaminated soil samples for Level IV analysis. A small percentage of samples which the Level II screening indicates which are “clean” should also be submitted for Level IV analysis to confirm that the screening is not biased low.

- Response #9** Disagree. Because the chromium screening analytical method is the same as the Level IV method (NYSDEC CLP), there is no reason to analyze the samples two times by the same method. As stated in the SEAD-4 Work Plan, the screening analyses will not include a NYSDEC ASP Category A deliverable, but the Level IV data will include such a deliverable.
- Comment #10** Section 4.2.3.1, Page 4-5, p2: The surface soil sampling locations in the vicinity of Building 2073 should be moved closer to the building, to within approximately 20 feet, in order to better evaluate the potential for contamination related to the building.
- Response #10** Agreed. The locations of the samples will be moved to within 20 feet of Building 2073.
- Comment #11** Section 4.2.3.2, Page 4-6, p4: The rationale for locating the proposed soil borings in the area of foundation (SB4-16 and SB4-17) should be provided. Is it not possible that the north/northeast (backside of the building) is an area where a surface discharge could have occurred?
- Response #11** Agreed. Currently, there is no evidence to suggest that one side of the building is more likely to have a release than any other, and the two proposed borings (SB4-16 and SB4-17) were originally located on the downgradient sides of the building. However, because the comment indicates that more borings are necessary to investigate a possible release around this building, two additional borings are proposed for the north/northeastern and southeastern sides of the building. The changes were made on page 4-6 and Figure 4-1.
- Comment #12** Page 4-7: The text in paragraphs 2 and 4 conflicts. In paragraph 2 the text states that 15 soil borings will be conducted, but in paragraph 4 the text states that 16 soil borings will be conducted. This contradiction should be corrected.
- Response #12** Agreed. The discrepancy on page 4-7 has been corrected.
- Comment #13** Figure 4-2: It appears as if the proposed sediment/surface water sampling location SW/SD4-30 is for all practical purposes the same as the sediment sampling location SD4-5 from the ESI. If this is the case, then there is no reason to recollect a sediment sample. Although the work plan text concludes on page 3-5 that it is unlikely that wastewater was discharged from Building 2084, there is conflicting information on this point. Because of this it may be warranted to collect a sediment sample from the drainage which is located to the northeast of Building 2084.
- Figure 3-6 indicates that surface water flow in the drainage ditch to the northeast of Building 2073 divides approximately 300 feet downgradient from Building 2073. Figure 4-2 concentrates the sediment/surface water

sampling locations along the northwest-southeast trending arm of this drainage ditch. An additional sampling location on the north-south trending arm near the division of this drainage ditch would be appropriate. An additional sediment sample on the northwest-southeast trending drainage way which drains from the berm to the west of Building 2073 should also be collected.

Response #13

Agreed. However, as a point of clarification, the sample location referred to in the comment is SW/SD4-38 not SW/SD4-30. The two sample locations SW4-5 and SW/SD4-38 do coincide, however, because surface water data was not previously collected from this location, we propose to retain this sample location for this phase of the investigation - also this would ensure that the chemical database is complete for all media in the drainage swales. And, as recommended in the comment, a sample location was added to the drainage swale northeast of the building 2084 (SW/SD4-49). Changes to the Scoping Plan were made on page 4-8 and Figure 4-2.

Agreed. Two additional sample locations were added. Additional sample locations have been added to the north-south trending arm of the drainage ditch (SW/SD4-50), and to the northwest-southeast trending drainage ditch that drains from the berm west of Building 2073 (SW/SD4-51). The changes in the SEAD-4 Scoping Plan were made on page 4-8 and Figure 4-2.

Comment #14

Section 4.2.5: There is no discussion in the work plan of evaluating the vertical extent of potential groundwater contamination. The potential for vertical transport of contaminants in the groundwater should be discussed here or in Section 3.1, Conceptual Site Model. The need or lack of need for paired monitoring wells to evaluate vertical groundwater flow directions should be discussed.

Response #14

Agreed. On the basis of hydrologic data collected at two other sites at SEDA (Ash Landfill and SEAD-25) and on the chemical data collected for the ESI at SEAD-4, we believed that the potential for vertical migration is low and, therefore, no paired (i.e., bedrock) wells are necessary. A discussion of the potential for vertical (i.e., downward) migration of the constituents of concern at SEAD-4 (predominantly metals and semivolatiles) has been added to Sections 3.1.1.3 and 3.1.1.4, and page 4-10 of the SEAD-4 Scoping Plan..

Comment #15

Section 4.2.5, Page 4-10, p1: The text indicates that "All monitoring wells will be screened in the saturated overburden overlying the shale bedrock". This appears to conflict with the statement in Section 3.6, Page 3-73, Bullet 2 that wells will be installed in the "till/weathered shale aquifer". The intent of the work plan should be clarified to avoid confusion during field activities.

Response #15 Agreed. Although the two statements were intended to mean the same thing, they were unintentionally worded differently. To avoid any confusion, the text on page 4-10 has been changed to read, “till/weathered shale aquifer” and not “screened in the saturated overburden overlying the shale bedrock.”

Comment #16 Figure 4-3: The work plan proposes to install three additional monitoring wells to the west of the pond to evaluate possible radial flow from the pond. Radial flow may occur from the pond but given its size the horizontal effects of any such radial flow is likely to be limited. It is recommended that the westernmost of these proposed wells (MW4-7) be relocated. The proposed location is on the west side of North South Baseline Road, downgradient of the former building foundation. This location will provide for monitoring of this former building as well as additional monitoring of the suspected leach field.

As part of the investigation of radial flow from the pond, a staff gage should be installed and surveyed so that surface water elevations can be determined.

The work plan also proposes the installation of MW4-13 to supplement the existing background monitoring well MW4-1. It is recommended that this well be relocated so that is on the northeast side of the northwest-southeast trending drainage ditch which flows along the northeast edge of the SEAD. This would place this well in an upgradient position relative to the suspected leach field. However, this location would also help to evaluate if operation of the suspected leach field resulted in any groundwater mounding and contaminant transport in an “upgradient” direction.

Response #16 Agreed. The proposed well MW4-7 was moved to the recommended location. The changed was made to Section 4.2.5 and Figure 4-3

Agreed. A staff gauge will be installed in the pond and surveyed to help evaluate radial flow from the pond. The changes was made to page 4-10 and Figure 4-3 of the Scoping Plan.

Agreed. The proposed background well (MW4-13) was moved to the northeast side of the northwest-southeast trending drainage ditch. The Change was made on Figure 4-3.

Comment #17 Section 4.2.6: Although the Ecological Investigation described in Section 4.2.6 is consistent with the NYSDEC Fish and Wildlife Impact Analysis for Inactive Waste Sites (1994), no mention is made of USEPA guidance regarding Ecological Risk Assessment. USEPA guidance should be considered in the investigation and risk assessment portions of the project.

- Response #17** Agreed. We have clarified how the USEPA guidance regarding ecological risk characterization fits into the proposed work for the field ecological investigation and the ecological risk characterization for SEAD-4. The text changes were made to Section 4.2.6 of the SEAD-4 Scoping Plan.
- Comment #18** Section 4.4: A copy of the community reuse plan for the Depot along with the proposed Risk Assessment text should be provided when complete.
- Response #18** Agreed. No change was made to the text in the SEAD-4 Scoping Plan.
- Comment #19** Section 6.0, 6.1 & 6.2: The text in these sections has been reversed. In addition, the Generic Plan referred the reader to the site specific plans for details i.e., project schedule and staffing, these details have not been provided in this plan.
- Response #19** Agreed. The SEAD-4 Scoping Plan has been revised to contain the appropriate project schedule and staffing information for sections 6.1 and 6.2.
- Comment #20** Appendix C. The plan does not contain the contract laboratories Quality Assurance Project Plan (QAPP) as stated in the generic work plan, this should be provided. Once again, this is a recurring cross-referencing error that has to be corrected.
- Response 20** Disagree. Currently, Appendix C of the Generic Installation RI/FS Work Plan for Seneca Army Depot does contain a QAPP for the contract laboratory, Inchcape Testing Services (Aquatec Laboratories); the latest revision to the Generic Workplan (August 1995) was made in December 1995. The SEAD-4 Scoping Plan correctly states that the Chemical Data Acquisition Plan, which contains the QAPP, is contained in the Generic Workplan.

BIOLOGICAL AND TECHNICAL ASSISTANCE GROUP

- Comment #1** Figure 4-2 (continued) illustrates the locations of four sampling points, two upstream of Indian Point Road and two downstream from the Road. It is unclear why Indian Point Road was chosen to delineate between upstream and downstream points. The location of SEAD-4 should be provided in this figure, along with the location of the drainage ditch and any discharge points into the Creek. In the future RI/FS Report for SEAD-4, topographic figures indicating surface water drainage should also be provided to illustrate the flow of wastewater and stormwater towards the Creek. Sampling should be conducted in depositional areas.
- Response #1** Agreed. This is because it was reported by former SEDA employees that while the washout facility was in operation approximately 100 gallons of wastewater were discharged to Indian Creek; it was reported to have been

transported by vehicles down Indian Creek Road and discharged into Indian Creek. Indian Creek Road provides the only access to Indian Creek in the vicinity of SEAD-4. We believe that they dumped the materials adjacent to the road, which would thus define upstream and downstream relative to this location. No change was made to the text in the Scoping Plan.

SEAD-4 was not included on Figure 4-2 because of scale restrictions. However, to provide a frame of reference for the reader text has been added to page 4-8 of the SEAD-4 Scoping Plan that states that SEAD-4 is located approximately 600 feet east of sample location SW/SD4-51.

Agreed. Currently, Figure 3-6 of the Scoping Plan indicates surface water flow directions on and downgradient of SEAD-4; this map shows flow towards Indian Creek and we have currently proposed to sample several of the drainage ditches west of SEAD-4 that flow towards Indian Creek. The four sample locations in Indian Creek, are designed primarily to address discharge of wastewater by former washout facility employees directly to the creek from Indian Creek Road. We agree that in the future RI/FS Report for SEAD-4, topographic figures that indicate surface water drainage will be provided to illustrate the flow of wastewater and stormwater towards the Creek. Also, we propose to collect surface water samples in depositional areas. No changes were made to the SEAD-4 Scoping Plan.

Comment #2

All wetland areas associated with Indian Creek and/or SEAD-4 should be delineated. In order to comply with federal wetland ARARs, the three parameter method should be used to delineate wetlands. Also note that a wetlands assessment and restoration plan will be needed for any wetlands impacted of disturbed by contamination or remedial activities.

Response #2

Agreed. We agreed that all wetlands associated with SEAD-4 should be delineated, and the wetlands that fall within the reach of Indian Creek where the four surface water and sediment samples are proposed will also be mapped. As a note, all wetlands at SEDA (all 10,000 acres) were recently delineated by the U.S. Fish and Wildlife service as part of the BRAC closure of SEDA. We intend to use these wetland maps as the basis for mapping the wetlands at SEAD-4 and the selected reach of Indian Creek. This information was incorporated into Section 4.2.6.1 of the SEAD-4 Scoping Plan. It is noted that a wetlands assessment and restoration plan will be necessary for any wetlands disturbed by contamination or remedial activities.

Comment #3

Soil analysis results are compared to NYSDEC TAGM values which do not address ecological concerns. Soil contaminants of concern (COCs) for ecological receptors should be screened against site reference values.

Response #3

Agreed. Currently, soil analysis results are compared to NYSDEC TAGM values in Section 4.0 of an RI report (Nature and Extent of

Impacts), however, in Section 6.0 of an RI report (Baseline Risk Assessment) the soil COCs for ecological receptors are screened against site reference values.

Comment #4 The location of SB4-1, the soil background sample, should be shown in Figure 3-8, "Sample Locations for Expanded Site Inspection."

Response #4 Agreed. The location of SB4-1 has been added to Figure 3-8.

Comment #5 For intermittent streams, such as drainage swales, surface water and sediment sampling should occur during high flow conditions in order to assure that water is present for collection (i.e., that samples can be obtained), as well as to characterize storm water patterns.

Response #5 Agreed. As a note, the Generic Work Plan currently states that surface water and sediment samples will be collected during high flow conditions. No change was made to the text in either the SEAD-4 or Generic Work Plan.

Comment #6 BTAG recommends the use of the acute and chronic effect levels from the federal ambient water quality criteria (AWQC) appearing in the Federal Register, Volume 57, No. 246, Dec. 22, 1992. However, where specific contaminants have been dropped (e.g., 2-4-DNT), the 1987 criteria values may still be considered for guidance levels. These numbers should be reflected in Table 3-4, "Surface Water Analysis Results." Further, several inorganic analytes are missing from this table including, but not limited to arsenic, cadmium, and mercury. Surface water should also undergo a full TCL analysis, as SVOCs, pesticides and PCBs are COCs at this SEAD.

Response #6 Agreed. We will use the acute and chronic levels from the ambient water quality criteria (AWQC) appearing in the Federal Register, Volume 57, No. 246, December 22, 1992, and where specific constituents have been dropped, the 1987 criteria values will still be considered. However, Table 3-4 is from the ESI report and we have noted changed it for the SEAD-4 Scoping Plan, however, we agree that this comment will be incorporated into the SEAD-4 RI tables for surface water/sediment. As a note, the SEAD-4 Scoping Plan calls for the following analysis for surface water and sediment: TCL VOCs and TCL SVOCs by NYSDEC CLP Methods, TCL Pesticides/PCBs by NYSDEC CLP Methods, and TAL Metals by NYSDEC CLP Methods as well as other analyses listed on Table 4-1.

Comment #7 In Table 3-5, "Sediment Analysis Results," the reference to the 1989 NYSDEC Sediment guidance should be revised to the 1994 document. In addition, for freshwater sediments, we recommend screening against the lowest effect levels (LELs) and severe effect levels (SELs) taken from "Guidelines for the Protection and Management of Aquatic Sediment

Quality in Ontario” (Persaud, et. al., 1993). These criteria should be included in Table 3-5.

Response #7

Agreed. The sediment analysis results table that will be prepared for the SEAD-4 RI will reference the 1994 NYSDEC document and use updated values. We will also use the 1993 values from the “Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario” in the sediment analysis table. Table 3-5 is taken from the ESI report that was prepared prior to this workplan and no changes were made to this table in the SEAD-4 Scoping Plan. However, as stated above, the sediment analysis results table for the RI will include updated values from the recommended documents.

Comment #8

The main COCs at this facility include explosive compounds. However, “explosive compounds do not appear to pose a threat to human or environmental receptors” (page 1-13). Documentation supporting this statement should be provided.

Response #8

Agreed. This statement indicates that explosives do not appear to pose a threat to receptors (on the basis of the ESI data), and, we acknowledge that this statement is confusing as explosives were identified as one of the major COCs on the site; they are also part of the analytical program for the SEAD-4 RI. Therefore, the statement has been modified to state that “on the basis of the ESI data, explosives are believed to present less of a threat to human and environmental receptors than the constituents listed above, however, the full extent and magnitude of explosives impacts were not known at the completion of the ESI.” This statement was added to the text on page 1-13 of the SEAD-4 Scoping Plan.

Comment #9

In Section 3.2.2.1, “Ingestion and Dermal Exposure Due to Surface Water and Sediment,” it should be noted that terrestrial biota may also come into contact with surface water or sediment in the pond, in addition to the drainage ditches or Indian Creek. Figure 3-9 illustrates the exposure pathways. For biota, inhalation and dermal contact are diagrammed as a pathway considered to pose significant risk. Due to the fact that limited ecological data is available for these exposure routes, exposure via ingestion is the main concern. In addition, due to the high water table, there is a potential that groundwater may discharge into Indian Creek, and therefore ingestion of groundwater by ecological receptors may need to be considered.

Response #9

Agreed. The text in Section 3.2.2.1 has been modified to include the pond as a possible area where terrestrial biota may come into contact with surface water or sediment. We agree that exposure via ingestion is a main concern for biota as is indicated in the last group of exposure route blocks on Figure 3-9, Exposure Pathway Summary. Lastly, ingestion of groundwater by ecological receptors is currently diagrammed in Figure 3-9. But, to address the comment, surface water and sediment in Indian Creek has been added to the “Primary Sources” heading to address the

potential that waste water was directly discharged to the creek by former munitions washout facility employees.

TOXIC AND HAZARDOUS WASTE SECTION, ESD

Draft Scoping Plan for SEAD-4

Comment #1 Section 4.2.3.1, Page 4-4 and 4-5

a. Additional details are required regarding the proposed chromium screening of the surface soils. Please state which speciation of Chromium will be screened (trivalent or hexavalent) as well as the method to be employed (this information is not in the Scoping Plan or the Generic FSP/CDAP). A copy of the SOP used by personnel for the screening analysis must be provided in the Plan. If Cr(VI) species is to be screened, then confirmatory Level IV analyses at the fixed lab should be performed for both Cr(III) and CR(VI).

In addition, remove reference to “Level IV QA package” as this is undefined. Use of this terminology is defined in EPA/540/G-87/003, March 1987 and refers to data quality objectives (see Generic WP Figure 3-9), not a deliverables package. The correct terminology for the data deliverables package to be produced is the NYSDEC ASP Category B deliverables. See comments below on the Generic FSP/CDAP for additional details on the NYSDEC deliverables package.

b. Specify the analyses scheduled for the seven surface soils to be collected from the eastern portion of this site. Are these samples included in the discussion in Section 4.2.7 and on Table 4-1?

Response #1

a. The samples will be screened for total chromium; the valence state of chromium will not be determined.. The method that will be used to screen the samples for chromium the same method that will be used for the sample that will undergo Level IV analysis (NYSDEC CLP Methods), however, a NYSDEC ASP Category B deliverable will not be generated for the screening data. Page 4-4 of the SEAD-4 Scoping Plan has been modified to state that screening samples will be analyzed for total chromium. Currently, the Scoping Plan states that “the chromium screening analysis will be the same procedure as the Level IV analysis, but the screening analyses will not be supported by a NYSDEC ASP Category B deliverable.”

Also, the reference to “Level IV Quality Assurance” package has been changed to “NYSDEC ASP Category B deliverables” on page 4-4 of the SEAD-4 Scoping Plan as recommended in the comment.

b. Agreed. The seven samples that will be collected from the eastern portion of the site are scheduled for Level IV NYSDEC CLP analyses with a NYSDEC ASP Category B deliverable. Yes, these seven samples

are included in those discussed in Section 4.2.7 and Table 4-1. Except for the chromium screening analyses in Areas 1 and 2, all other surface soil samples will be undergo the full analyses specified in Section 4.2.7.

Comment #2

Table 4-1

a. The parameter and method number listed for analysis of nitrate-nitrite is incorrect and inconsistent with the information presented in the Generic CDAP. Nitrate-nitrite analysis is to be performed by MCAWW Method 353.2, Automated Cadmium Reduction method for **aqueous** samples only. Remove reference to this analysis for soil matrices, or provide the method modification which the lab will utilize to accommodate soil samples. If the method is modified, the lab is to include information which demonstrates acceptable performance of their technique.

b. Please provide the method modifications on the following which will be used by the lab to accommodate soil samples: Method 150.1 for pH and Method 415.1 for TOC. Attachment 1 contains a Region II method for analysis of TOC in soil/sediment matrices which may be utilized in lieu of modifying Method 415.1.

c. Method 524.2, Revision 4.0, August 1992 is the correct reference for the analysis of VOCs in groundwater. In addition, it should be noted that the compound list for Method 524.2 varies from that contained in the NYSDEC CLP SOW for VOCs. SEDA must decide which compound list is appropriate for this investigation.

In addition, the SOP for validating data acquired through Method 524.2 must be included in the Plan, preferably as an attachment to the Generic WP. In lieu of using Method 524.2 for groundwater VOC sample analysis, the EPA CLP SOW entitled “Superfund Analytical Method for Low Concentration Organics in Water” (most recent revision) and corresponding regional data validation SOP HW-13, Revision 1, 10/92 may be used. This SOP is included here as Attachment 2. This option presents a more cost effective approach to low concentration VOC analysis since the data validation SOP is provided and would eliminate the need for it’s development by the A-E contractor.

Response #2

a. Agreed. The analysis method for nitrate/nitrite has been modified in Table 4-1 as recommended. A note has been added to Table 4-1 that briefly describes the modified method that will be used for soil. The modified method for nitrate/nitrite in soil (an extract method) that is cited in Table C-2 of the Generic Work Plan (Appendix C) was used in Table 4-1 of the SEAD-4 Scoping Plan. In the modified method, a known volume of soil and a known volume of water are combined, stirred, and then filtered to form an aqueous extract. Also, it is unclear in the comment what type of information would demonstrate acceptable performance of their technique.

b. Agreed. The methods for pH and TOC in soil were included in Table 4-1 in the SEAD-4 Scoping Plan. Table C-2 in the Generic Work Plan was also updated.

c. Agree with some aspects of the comment and disagree with some aspects of it.. The most recent revision of Method 524.2 has been added to Table 4-1.

The discussion of the difference in the list of compounds for NYSDEC CLP TCL and Method 524.2 has been had many times in the past. At the beginning of the Superfund program at SEDA, all parties (EPA, NYSDEC and ACE) agreed that NYSDEC CLP Methods would be used. And, subsequent to this, EPA recommended that Method 524.2 be used to meet the drinking water ARAR. At this time, we made it known to EPA that the compound lists for the two methods were different. But, we are not in the position to manage or develop analytical protocols, which is a responsibility that is shared by state and federal agencies - we use the analytical methods that are approved by these agencies. Therefore, realizing this difference, the approach of using both NYSDEC CLP TCL for VOCs followed by EPA Method 524.2 was incorporated into the RI/FS programs. The consequence of this is that we are left with additional data for the Method 524.2 analysis compared to the data obtained from the NYSDEC CLP analysis. This is a limitation of the analytical methods that we acknowledge and live with. No change was made to the text in the SEAD-4 Scoping Plan.

With regard to validating Method 524.2 data, currently we obtain an equivalent NYSDEC ASP Category B data deliverable from the laboratory for the 524.2 analysis that contains the appropriate information (duplicates, matrix spikes, etc.) so that NYSDEC data validation methods can be used. No change was mad to the text in the SEAD-4 Scoping Plan.

Generic Work Plan-Field Sampling Plan

Comment #3

WP Tables 3-11 and 3-12

These tables have been revised as per prior EPA comments and ACE responses to incorporate the laboratory reporting limits for each analyte of interest. However, it is evident upon reviewing these tables that the reporting limits listed exceed ARARs for certain parameters. The prior response to EPA comments states that alternate analytical procedures are being evaluated in conjunction with the contracted lab. However, no alternate methods are mentioned further in the Generic FSP/CDAP. Prior to commencement of field activities, the analytical scheme necessary to achieve ARARs must be finalized. If the lab proceeds using the methodologies currently stated in the CDAP, data will be acquired which exceeds ARARs for certain parameters.

Response #3

Acknowledged. We recognize and have pointed out that for some constituents the analytical method detection limits are above the ARAR. This is an unfortunate limitation of the protocols. It should be noted that at the beginning of the Superfund program at SEDA, ACE, EPA and NYSDEC agreed that NYSDEC Analytical Services Protocols would be used for the remedial investigations at SEDA. These are the identical protocols used by NYSDEC in their Superfund work throughout New York State. Special analytical services could be arranged with the contracted laboratory to reduce the detection limits, however, this would involve an R&D program that the ACE believes is outside of what should be performed. But, if alternative methods were developed, then these methods would no longer be NYSDEC ASP Methods (which the laboratory is currently contracted to perform) and also, they would require EPA, NYSDEC and MRD approval prior to being used. No changes were made to the text.

Comment #4

FSP: Section 3.6.5, Page A-56

This section states that low flow centrifugal or bladder pumps will be used for groundwater purging and sampling. The following comments must be incorporated into this section of the FSP which outlines purging and sampling with a low flow pump. Note: while the Region II SOP for Low Flow Purging and Sampling is included as Attachment A-3 to the Generic WP FSP, it is a draft document which is still evolving. Region II personnel remain dedicated to producing a thorough and technically sound SOP, thus warranting approval of its use on a case by case basis.

Comment #4

a. Will the pumps used be dedicated and/or permanently installed in each groundwater well? If the pumps and associated tubing are dedicated to each well, decontamination is unnecessary except prior to installation into the well. At this time, an equipment rinse blank must be collected. Equipment blanks are intended to assess the potential introduction of contamination during sample collection and handling. Therefore, demonstrated analyte-free deionized water must be circulated through all pumps and associated tubing to collect a representative equipment blank. In conjunction, we recommend rinsing the outside of the pumps and tubing as well. This will ensure that the pumps and tubing are contaminant-free.

*Please note that when decontaminating centrifugal pumps manufactured by GRUNDFOS, the motor coolant chamber contains water and potential contaminants from prior usage. Therefore, to avoid cross contamination, the coolant fluid must be removed and replaced. See manufacturers installation and operating instructions for further details.

Response #4

a. Agreed. The pumps will not be dedicated or permanently installed in the wells; this has been specified on page A-57 of Appendix A of the Generic Work Plan. At this time we anticipate using a bladder pump to sample groundwater, which is driven by a controller at the ground surface. Also, we will collect equipment blanks (or rinse blanks)

at the rate specified in the Generic Work Plan. Also, we have added the note about the motor coolant chamber of the Grundfos pumps to page A-62a of Appendix A of the Generic Work Plan.

Comment #4

b. Actual sampling flow rate must be accomplished with a gradual reduction in the flow rate down to 0.1 liters per minute and sustained hydraulic head pressure within the sampling tube. A gradual reduction in association with sustained hydraulic head pressure will minimize aeration, bubble formation, turbulent filling of sample bottles, and loss of volatiles due to extended residence time in the tubing. Hence, this coincides with the USEPA Region II Quality Assurance Manual (October 1989) and the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (OSWER Directive #9950.1, September 1986), which state that when collecting samples where volatile constituents are of concern using a bladder pump, pumping rates should not exceed 100 milliliters per minute (mls/min). If problems are encountered trying to maintain a uniform 100 mls/min flow rate during sampling, we recommend that the inside diameter (I.D.) of the sampling tube be reduced as it reaches the well head to ensure hydraulic head pressure is maintained. A reducer coupling (0.5 inch to 0.25 inch) installed approximately six feet from the actual sample port would suffice. Proper fitting installation, including the use of Teflon tape, will eliminate connection problems. Therefore, the text must be amended accordingly.

Response #4

b. Agreed. The recommended text regarding the sampling flow rate has been added to pages A-58 and A-59 of Appendix A of the Generic Work Plan.

Comment #4

c. The document should state how the flow rate will be measured. For example, the actual apparatus, i.e., graduated cylinder and stopwatch, may be used. Therefore, the text must be amended accordingly.

Response #4

c. Agreed. The flow rate will be measured with a graduated cylinder and a stop watch. The text on page A-57 of Appendix A of the Generic Work Plan has been amended to include the actual apparatus that will be used to measure the flow rate.

Comment #4

d. While step 3 on page A-58 states that the field parameters to be monitored are turbidity, temperature, specific conductance pH, Eh, and dissolved oxygen, the text does not delineate the order of equilibration for each water quality indicator parameter identified. In general, the order of equilibration is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. However, it should be noted that temperature and pH, while often used as equilibration indicators, are actually quite insensitive in terms of distinguishing between formation water and stagnant casing water. Therefore, the text must be amended accordingly.

- Response #4** d. Agreed. The recommended text has been added to Section 3.6.5., page A-56.
- Comment #4** e. The text specifies that the field parameters should not vary more than $\pm 10\%$ in order for the well to be considered stable. However, the following criteria, which is parameter specific, should be used. Three successive readings must be within ± 0.05 for pH, $\pm 3\%$ for conductivity, and $\pm 10\%$ for dissolved oxygen and Eh, and 5 NTUs for turbidity. The variability within each water quality indicator parameter is the current recommendation out of the EPA Office of Research and Development and has been adopted by Region II.
- Response #4** e. Agreed. The recommended text has been added to Section 3.6.5, page A-56.
- Comment #4** f. To remain consistent with comment #4b, it is recommended that the inside diameter (I.D.) of the sampling tube be reduced as it reaches the well head to ensure hydraulic head pressure is maintained. A reducer coupling (0.5 inch to 0.25 inch) installed approximately six feet from the actual sample port would suffice. Proper fitting installation, including the use of Teflon tape, will eliminate connection problems. Therefore, the text must be amended accordingly. Consequently, sample discharge must be a continuous flow of 100 ml/minute for volatile organics and up to 500 ml/minute for other analytical parameters of interest. However, to increase sample collection time for the other analytical parameters, a normal 0.5 inch coupling and previous tubing should replace the reducer coupling and 0.25 inch tubing. Therefore, a stoppage in flow could occur after the collection of volatile organic samples in order to change the coupling/tubing. In addition, a caveat should be added to reiterate that static water column level drawdown is minimal during sampling.
- Response #4** f. Agreed. The recommended text has been added to page A-58 of Appendix A of the Generic Work Plan
- Comment #4** g. The outlined procedures do not delineate the placement of the gas powered generator, in the proximity of the well, to drive the pump motor. If a gas powered generator is utilized, the generator must be placed, at a minimum of 25 feet, downwind of the well to limit the incidence of cross-contamination. Therefore, the text must be amended to incorporate this scenario.
- Response #4** g. Agreed. The recommended text has been added to page A-57 of Appendix A of the Generic Work Plan
- Comment #4** h. Amend page A-59 to include collection of samples for explosives analysis.

Response #4 h. Agreed. The text on page A-59 of Appendix A of the Generic Work Plan has been modified as recommended in the comment.

Comment #5 **FSP: Section 4.3, Page A-154**

Remove the reference to using plastic bottles for metals and water quality parameters. Polyethylene is the material of choice for these samples. In addition, all glass bottles used should have Teflon lined caps, except those for VOC samples which require Teflon septa with separate cap.

Response #5 Agreed. The word “plastic” has been replaced with the word “polyethylene” on page A-154.

Comment #6 **FSP: Section 4.4, Page A-155**

The sampling equipment decontamination procedure listed must be modified as follows: add a tap water rinse after the nitric acid rinse and prior to the use of methanol/hexane.

Response #6 Agreed. A tap water rinse has been added to the sampling equipment decontamination procedure on page A-155.

Generic Work Plan-Chemical Data Acquisition Plan

Comment #7 **CDAP: Section 3.2, Page C-4**

The first paragraph here incorrectly references the NYSDEC data deliverables packages. The NYSDEC Analytical Services Program (ASP) is intended to support the Superfund Program and defines two types of deliverables packages: ASP Category A and ASP Category B. In this investigation, use of ASP Category B warranted. Please replace the text with the correct NYSDEC terminology.

Response #7 Agreed. The terminology has been replaced. As a note, for Level IV data, the NYSDEC ASP Category A deliverables will be used, and for Level III data the NYSDEC ASP Category B deliverables will be used.

Comment #8 **CDAP: Section 4.1, Page C-5**

The second paragraph here states that the details of the project organization are contained in the correlating Scoping Plan. However, the Scoping Plan for SEAD-4 does not list this information. Please modify the SEAD-4 Plan appropriately.

Response #8 Agreed. The details of the project organization have been added to the SEAD-4 Scoping Plan. No change was made to the Generic Work Plan.

Comment #9 **CDAP: Section 4.3, Page C-6**

The second paragraph here states that a discussion on the contracted laboratory is contained in the correlating Scoping Plan. However, the Scoping Plan for SEAD-4 does not list this information. Please modify the SEAD-4 Plan appropriately. This applies to CDAP Section 5.3, bullet (a) as well.

Response #9

Agreed. In response to this comment we have modified the second paragraph to read: "...to this appendix. The contracted laboratory is identified in Section 6.0 of the appropriate RI/FS Project Scoping Plan..." In addition, the contracted laboratory is identified in Section 6.0 of the SEAD-4 Project Scoping Plan (page 6-1).

Comment #10

CDAP: Section 5.3, Page C-8

The frequency for collecting replicate and rinse blank samples must be specified. The correct frequency is as follows. Replicate samples must be collected at a rate of one per twenty environmental samples or less per matrix. This is a separate replicate from that prepared and analyzed by the laboratory. Rinse blanks must be collected at a rate of one rinse blank per type of equipment used each day a decontamination event is carried out. It is permissible to use the same aliquot of water on all equipment associated to a particular matrix for analysis of Semi-VOCs, pesticides, PCBs, Explosives, and inorganics. This rinse must be performed sequentially on all sampling equipment. However, a separate rinse blank is required for each piece of equipment used to collect a sample of a particular matrix undergoing VOC analysis.

Also, trip blanks are only required when sampling aqueous samples undergoing VOC analysis.

Response #10

Agreed with most of the comment, but disagree with a few aspects of it. We agree with the comment on replicates. We agree with most of comments on rinse blanks, except we disagree with the frequency for groundwater rinsates. For groundwater samples we feel that this frequency is not reasonable. This is because the site-specific geologic conditions at SEDA (i.e., relatively impermeable till) typically result in slow recharging wells translates into long periods of time for sampling. Thus, if we obtain anywhere from 2 to 4 groundwater samples in a day, under the recommended frequency, we would obtain an unnecessary large percentage of QC samples (up to 50 percent). Therefore, we believe that a frequency of one rinsate sample for every two days of groundwater sampling is more reasonable for SEDA. Also we disagree that a separate rinse blank is required for each piece of equipment used to collect a sample of a particular media undergoing VOC analysis. We intend to use the same aliquot of water on all equipment associated to a particular matrix for all analyses. Lastly, we agree with the comment on trip blanks. The text changes were made to pages A-8 and A-9 of Appendix C of the Generic Work Plan.

- Comment #11** **CDAP: Section 5.4.1, Page C-10**
- When acidifying an aqueous VOC sample, use 12N HCL to prepare the 1:1 preservation solution.
- Response #11** Agreed. The recommended text has been added to page C-10 of Appendix C of the Generic Work Plan.
- Comment #12** **CDAP: Table C-1, Page C-11**
- Comment #12** a. Prior EPA Comment 4 on this Appendix stated that the holding time must be specified from Verified Time of Sample Receipt (VTSR). However, the holding time specified for explosives, pesticides/PCBs, and Semi-VOCs in groundwater/surface water, soil and fish tissue (explosives only) specifies a holding time of 7 days to extraction, which is correct from the time of collection. If VTSR is used, the correct holding time to extraction is 5 days, which considers shipping time. Amend this table appropriately.
- Response #12** a. Agreed. Table C-1 has been amended as recommended in the comment. Also, footnote 4 now indicates 5 days from VTSR.
- Comment #12** b. Specify a holding time for cyanide in groundwater/surface water samples.
- Response #12** b. Agreed. A holding time of 14 days for Total Cyanide has been added Table C-1.
- Comment #12** c. The containers listed for semi-VOCs and pesticides/PCBs in water (footnote 6 to table C-1) are incorrect. Four liters per sample are required for aqueous samples for extractable analyses.
- Response #12** c. Agreed. We agree that the cited footnote incorrectly states the volume of sample required. However, the contracted laboratory stated that they require at least 2 liters of water for each analysis. Therefore, Table C-1 has been modified so that footnote 3 now reads “2 1 liter amber glass containers with Teflon-lined cap.”
- Comment #12** d. The containers listed for semi-VOCs and pesticides/PCBs in soil (footnote 3 to table C-1) are incorrect. Footnote 6 is appropriate for soil samples for extractable analyses.
- Response #12** d. Agreed. Table C-1 has been amended so that footnote 6 is referenced for the semivolatile and pesticides/PCBs analyses.
- Comment #12** e. Correct the VOC soil holding time to 10 days.

Response #12

e. Agreed. The VOC soil holding time has been changed to 10 days.

Comment #13

CDAP: Section 5.4.3.5, Page C-15

The correct frequency of collecting a rinse blank is stated in Comment 10 above. A field equipment rinse blank is required for dedicated equipment. It should be collected prior to placement at the particular sampling location. Also, field QC samples, i.e. rinse blank, trip blank, and replicate samples, must be prepared and analyzed by the laboratory in conjunction with their associated samples. Results of these QC samples must be reported with the associated field samples for use during data validation. Also the field forms containing dates and times of sample collection must be available to the data validation personnel in order to correctly correlate the QC samples to their associated environmental samples.

Response #13

Agreed with most of comment on QC samples, but disagree with a few aspects of the comment (as explained in the response to Comment #10 above). We agree that for soil, sediment, surface water rinse blank samples should be collected at a frequency of one rinse blank per type of equipment used each day a decontamination event is performed. However, for groundwater samples we feel that this frequency is not reasonable. This is because the site-specific geologic conditions at SEDA (i.e., relatively impermeable till) typically result in slow recharging wells translates into long periods of time for sampling. Thus, if we obtain anywhere from 2 to 4 groundwater samples in a day, under the recommended frequency, we would obtain an unnecessary large percentage of QC samples (up to 50 percent). Therefore, we believe that a frequency of one rinse sample for every two days of sampling is more reasonable for SEDA. Also we disagree that a separate rinse blank is required for each piece of equipment used to collect a sample of a particular media undergoing VOC analysis. We intend to use the same aliquot of water on all equipment associated to a particular matrix for all analyses. Lastly, we agree with the comment on trip blanks

No dedicated sampling equipment is planned at this time, however, should it be used, a field equipment rinse blank will be taken for dedicated equipment (It will be collected prior to placement at the particular sampling location).

Agreed. field QC samples, i.e. rinse blank, trip blank, and replicate samples, will be prepared and analyzed by the laboratory in conjunction with their associated samples.

Agreed. results of these QC samples will be reported with the associated field samples for use during data validation. Also the field forms containing dates and times of sample collection will be available to the data validation personnel in order to correctly correlate the QC samples to their associated environmental samples.

Comment #14

CDAP: Section 5.4.3.6, Page C-15

Analytical results for the demonstrated analyte free water (whether originating at the lab or the site) must be made available upon request. Also, if this water is shipped on-site, store away from any organic solvents in order to avoid extraneous contamination.

Response #14

Agreed. The results of the analysis of the demonstrated-free water are available upon request - this statement has been added to Section 5.4.3.5. Also, if the demonstrated analyte-free water is stored on-site, it will be kept away from organic solvents to avoid extraneous contamination - this text was added to Section 5.4.3.6.

Comment #15

CDAP: Table C-2

a) Comment 3 above regarding reporting limits exceeding ARARs applies here as well.

b) Information pertaining to the screening for chromium to be performed at SEAD 4 should be on this table.

c) Method 524.2 is only applicable to aqueous samples, therefore correct the listing in Part IB, (vi) of this table. This also applies to Part IC, (i) and (ii).

d) Correct Part IIC, (1) and (2) as incorrect entries are listed for the preparative method, analytical method and reporting limit.

Response #15

a) Acknowledged. We recognize and have pointed out that for some constituents the analytical method detection limits are above the ARAR. This is an unfortunate limitation of the protocols. It should be noted that at the beginning of the Superfund program at SEDA, ACE, EPA and NYSDEC agreed that NYSDEC Analytical Services Protocols would be used for the remedial investigations at SEDA. These are the identical protocols used by NYSDEC in their Superfund work throughout New York State. Special analytical services could be arranged with the contracted laboratory to reduce the detection limits, however, this would involve an R&D program that the ACE believes is outside of what should be performed. But, if alternative methods were developed, then these methods would no longer be NYSDEC ASP Methods (which the laboratory is currently contracted to perform) and also, they would require EPA, NYSDEC and MRD approval prior to being used. No changes were made to the text.

b) Agreed. Because chromium screening will be performed using the same method used for the normal Level IV samples (i.e., NYSDEC CLP Method), a parenthetical note indicating this has been added to the chromium listing on page 2 of Table C-2. Also, a note at the end of the

Table C-2 explains that a NYSDEC ASP Category A deliverable will not be generated for the chromium screening results.

c) Agreed. The reference to Method 524.2 has been deleted from the soil and sediment analyses listing for Part IB. Also, the entries for Part IC (I) and (ii) have been corrected.

d) Agreed. The entries for the preparative method, analytical method and reporting limits have been corrected.

Comment #16

CDAP: Section 7.2, Pages C-20 and C-33

a) The most recent (at the time of analysis) revisions of the analytical methods must be employed. As per comment 3 above, ARARs must be achieved.

b) Note-when using any method from SW-846, all requirements specified in the method as “recommended” are required (for example but not limited to analysis/reporting of VOC and Semi-VOC TICs, and other QA/QC requirements). Other specifications contained in Chapter One of SW-846 are also required to be performed. The data should be reported in a format equivalent to the NYSDEC ASP Category B package. This includes but is not limited to all raw data, quantitation reports, sample and standard spectra and QA/QC information.

c) The last paragraph on page C-33 states that asbestos “re-analysis will be requested for questionable results, i.e. significant discrepancies between spilt samples” is unclear. An acceptable RPD should be specified here.

Response #16

a) Agree with the first part of the comment and acknowledge the second part of the comment. A statement that the most recent (at the time of the analysis) revisions of the analytical methods will be employed has been added to Section 7.2. However, we recognize and have pointed out that for some constituents the analytical method detection limits are above the ARAR. This is an unfortunate limitation of the protocols. It should be noted that at the beginning of the Superfund program at SEDA, ACE, EPA and NYSDEC agreed that NYSDEC Analytical Services Protocols would be used for the remedial investigations at SEDA. These are the identical protocols used by NYSDEC in their Superfund work throughout New York State. Special analytical services could be arranged with the contracted laboratory to reduce the detection limits, however, this would involve an R&D program that the ACE believes is outside of what should be performed. But, if alternative methods were developed, then these methods would no longer be NYSDEC ASP Methods (which the laboratory is currently contracted to perform) and also, they would require EPA, NYSDEC and MRD approval prior to being used. No changes were made to the text.

b) Agreed. The recommended text has been added to item number 2, which concerns SW-846.

c) Agree. The text has been clarified as much as possible. However, we are not aware of any value (i.e., RPD) in the guidance that can be used in this situation. Thus, this statement has changed to read “the lab may be contacted on a case by case basis if the results are judged to be questionable (i.e., significant discrepancies between split samples) by the inspector for sample result consistency, and in some instances reanalysis may be requested - guidance does not specify a value (or RPD) for asbestos samples.

Comment #17 **CDAP: Table C-10, Page C-42**

This table should specify information regarding the chromium screening to be employed, i.e. at SEAD 4.

Response #17 Disagree. We do not believe that is appropriate to incorporate the chromium screening method into this table because in previous responses (that have been incorporated into the Generic Work Plan) we have stated that chromium screening will be performed using NYSDEC CLP Methods, but the results will not be reported using a NYSDEC ASP Category A deliverable. Thus, the calibration criteria for the chromium screening is the same as that for the Level IV chromium analyses, which is already included in the Table C-10.

Comment #18 **CDAP: Section 7.3.2, Page C-43**

An MS/MSD/MSB should be prepared and analyzed for parameters in addition to explosives. See the individual analytical method for required frequency.

Response #18 Agreed. This paragraph is not meant to indicate that explosives are the only compounds for which MS/MSD/MSB samples will be prepared - other compounds have always been included in the analytical program as indicated in the first sentence of Section 7.3.2. We agree it is not clear in this instance. Thus, the text has been clarified.

Comment #19 **CDAP: Section 8.3, Page C-45**

If calibration of the pH meter indicates that the response of this meter has decayed, all data collected with the meter in question should be rejected. Remove reference to “adjusting” the data as this is undefined.

Response #19 Agreed. The word “adjust” has been removed from the sentence as recommended - we do not intend to adjust any pH data. However, we have included a description of acceptable data. If pH meter calibrates to within 0.5 pH units then the data collected prior to this will be considered

acceptable . If the meter calibrates to within 0.5 and 1 pH unit then the data will be flagged with a “J” indicating that it is estimated . If the meter calibration indicates that it deviates by greater than 1 pH unit then the data will be rejected (“R”). This text has been added to the second full paragraph on page C-45.

Comment #20

CDAP: Section 9.2.4, Page C-49

a) The second paragraph here states that the “detection limit” will be included in the tabulated results for those analytes not found. Specify whether this is the Contract Required Quantitation Limits in the NYSDEC CLP SOWs or the PQLs or the Instrument Detection Limits (inorganics only). In addition, the results and quantitation limits for soil/sediment samples must be corrected by the lab % Moisture and this correction verified during data validation. All tabulated results should note the % Moisture per sample.

b) The following SOPs must also be used for data validation of herbicide and explosive results:

Attachment 3: SOP No. HW-17, Rev. 1.3, November 1994
SOP for Validating Chlorinated Herbicides by GC

Attachment 4: SOP No. HW-16, Rev. 1, September 1994
SOP for Validating Nitroaromatics and Nitramines by HPLC

Response #20

a) Agreed. The type of detection limit has been specified in paragraph two of Section 9.2.4. Also, the results and quantitation limits for soil/sediment analyses will be corrected by the lab % moisture and -this has always been done by the lab for samples at SEDA. And, the correction for % moisture will be verified during the data validation. In addition, the tabulated results will note the percent moisture per sample.

b) Agreed. These two SOPs were added to paragraph three of Section 9.2.4.

Comment #21

CDAP: Section 9.3.2, Page C-50

Comments 1 and 7 above apply here as well.

Response #21

Agreed. Text has been added to the paragraph one of Section 9.3.2 that states that the data deliverable packages will be NYSDEC ASP Category A and Category B .

Comment #22

CDAP: Attachment C-2

This attachment states that the non-routine analytical methods are contained in the individual Scoping Plan for the subject site. This is not true. The Scoping Plan for SEAD 4 does not contain any information

regarding non-standard analytical methods. Please correct the Scoping Plan appropriately.

Response #22

Disagree. The italicized statement says that “additional non-standard analytical methods may be a part of the RI of the subject site are contained in the appropriate RI/FS Project Scoping Plan...” This statement was included in the Generic Workplan to account for any additional methods that may be use on sites at SEDA in the future - by including any additional method in the Project Scoping Plan it avoids having to continually update the Generic Work Plan. However, it is not meant to imply that all Project Scoping Plans contain non-standard analytical methods. None are listed in Appendix C of the SEAD-4 Project Scoping Plan because all of them are covered in the Generic Work plan

To avoid confusion in the future, the statement has been amended to read “If warranted, additional non-standard...may be contained in the ...” Also, a statement has been added to the SEAD-4 Scoping Plan that reads “The Generic Work Plan contains standard and non-standard analytical methods - no additional non-standard analytical methods have been added to this Project Scoping Plan.”

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APPENDIX F
SCOPE OF WORK

27 Jan 95
SEDAWP2.SOW

ANNEX AQ
PREPARATION OF WORK PLANS FOR
REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES
AT VARIOUS SITES AT
SENECA ARMY DEPOT ACTIVITY, ROMULUS, NEW YORK

1.0 GENERAL STATEMENT OF SERVICES

1.1 Background. As part of its continuing program of evaluating its hazardous waste management practices, the Army will perform Remedial Investigations/Feasibility Studies (RI/FS) at various sites on Seneca Army Depot Activity (SEDA). The RI/FS investigations are to be conducted to determine the magnitude of environmental contamination and appropriate remedial actions. The US Army Corps of Engineers, Huntsville Division, on behalf of SEDA, will contract for the required work.

1.2 Location. Seneca Army Depot Activity is a US Army facility located in Seneca County, New York. SEDA occupies approximately 10,700 acres. It is bounded on the west by State Route 96A and on the east by State Route 96. The cities of Geneva and Rochester are located to the northwest (14 and 50 miles, respectively); Syracuse is 53 miles to the northeast and Ithaca is 31 miles to the south. The surrounding area is generally used for farming.

1.3 Regulatory Status. SEDA was proposed for the Federal Facilities National Priorities List on 13 July 1989. Consequently, all work to be performed under this contract shall be performed according to CERCLA guidance as put forth in the Interim Final "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", dated October 1988 (Reference 11.13). Additionally, all work performed as part of this

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contract shall be performed according to the Interagency Agreement negotiated between Seneca Army Depot, the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (USEPA), Region II (Reference 11.10).

1.4 Previous Investigations. Previous investigations have been performed at various SEDA units. In general, an "Installation Assessment and Update" (USATHAMA Reports No. 157 (1980) and 157(U) (1987), respectively) (References 11.1 and 11.3) was conducted by the U.S. Army Toxic and Hazardous Materials Agency. The purpose of the assessment was to identify potentially contaminated areas at the Depot. The U.S. Army Environmental Hygiene Agency's Groundwater Contamination Survey No. 38-26-0868-88, "Evaluation of Solid Waste Management Units, Seneca Army Depot" (Reference 11.4) identified and described all solid waste management units (SWMU's) at SEDA at the time of its preparation. More recently, a "SWMU Classification Report" (Reference 11.5) was prepared to present the results of records searches at all currently identified SWMU's at SEDA and, based on its recommendations, site investigations have been completed at twenty five SWMU's where additional work was recommended as being necessary (References 11.6, 11.7, 11.8 and 11.9). A complete list of previous investigations is presented as References in Section 11.0.

1.5 Units to be Investigated Under this Contract. Work Plans for RI/FS investigations will be prepared for the following sites: 1) Building 804 and the associated Radioactive Waste Burial sites (SEAD-12); the Pitchblende Storage igloos (SEAD-48); the Miscellaneous Components Burial site (SEAD-63); the Munitions Washout Facility Leach Field (SEAD-4); the Garbage Disposal Areas (SEAD-64A and 64D); the IRFNA Disposal Pits (SEAD-13); the Ammunition Breakdown Area (SEAD-52); the Oil Discharge Area Adjacent to Building 609 (SEAD-60); the Sewage Sludge Piles (SEAD-005); the Fill Area West of Building 135 (SEAD-59);

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Alleged Paint Disposal Area (SEAD-71) and the Explosive Ordnance Disposal Area (SEAD-57).

1.6 Security Requirements. Compliance with SEDA security requirements is mandated. These requirements are presented in Section 9.0.

2.0 OBJECTIVE

The objective of this Statement of Work is to prepare a site specific Project Scoping Plan for each of the Areas of Concern listed in Section 1.5 of this SOW. At completion, these Project Scoping Plans, taken together with the generic RI/FS Work Plan previously prepared for SEDA, shall form a complete Work Plan for implementing an RI/FS at each site. All Work Plans shall be developed as defined by Office of Solid Waste and Emergency Response Directive 9355 (Reference 11.13, beginning with the RI/FS scoping process and ending with a regulatorally approved Work Plan at the identified site. Additionally, this Work Plan shall maintain the basic format of the Work Plan developed for the SEDA Ash Landfill and Open Burning Grounds RI/FS (References 11.11 and 11.12).

3.0 DETAILED DESCRIPTION OF SERVICES

3.1 General Requirements. All work performed by the AE shall be designed and implemented in a manner which complements earlier investigations and shall conform to this Statement of Work (SOW). The AE, through the Work Plans, shall present a complete description of the RI/FS process as applied to each operable unit. All work shall be performed under the general supervision of a Professional Engineer registered in the State of New York.

3.2 (Task 1) Site Visit and Review Existing Data. The AE shall perform a visual inspection of the sites, review records, reports and other data provided by the Contracting Officer and the facility, or made available to the AE from sources such as

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public records, the USEPA, the State Regulators, the State Geological Survey, or from interviews with local residents and officials who have knowledge of past site activities.

3.3 (Task 2) RI/FS Project Scoping Plan Preparation.

3.3.1 General. The AE shall prepare multiple site specific Project Scoping Plans which are intended to do the following: (1) to provide a consolidated report on site history, current site activities, and resulting environmental impacts; (2) to familiarize personnel who will be working on the project with site conditions; and (3) to provide project plans and proposed tasks by which RI/FS activities shall be conducted. These scoping plans shall provide a summary of site specific conditions, give an overview of the RI/FS process at each operable unit and describe how the process will be implemented at each. The plans shall conform to the outline presented in Figure 1. All detailed information required to implement a thorough RI/FS investigation at each Area of Concern shall be presented. The documents shall be prepared as follows:

3.3.3.2 Site Specific Health Plan. The AE shall develop a Site-Specific Safety and Health Plan (SSHP), as part of the HSP, in accordance with the requirements of Section 5.0 of this SOW. The SSHP shall be submitted to the Contracting Officer for review and approval prior to any field work.

3.3.3.3 Field Sampling Plan. The AE shall prepare and submit, as part of the Project Scoping Plans, a Field Sampling Plan (FSP). The FSP shall describe in detail all sampling and analysis activities to be exercised including site background, sampling objectives, sampling locations and frequency, designations, equipment and procedures and handling and analysis requirements to be applied at each site. It is intended that the AE, in the Field Sampling Plan, propose and justify how the field investigation activities will be allocated. As part of the FSP, the A-E shall discuss specific plans to meet all QA/QC requirements.

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FIGURE 1
WORK PLAN OUTLINE

INTRODUCTION

Background

SITE CONDITIONS

Physical Setting

Geological Setting

Hydrogeology

Regional

Local

Results of Previous Investigations

SCOPING OF THE RI/FS

Conceptual Site Model

Physical Site Characterization

Environmental Fate of Constituents at SEAD

Identification of Potential Receptors and Exposure Scenarios

Potential Source Areas and Release Mechanism

Potential Exposure Pathways and Receptors -

Current Uses

Potential Exposure Pathways and Receptors -

Future Uses

Scoping of Potential Remedial Action Alternatives

No Action

Capping

Excavation and Landfilling

In Situ Detoxification and Solidification

Resource Reclamation

Institutional Controls

Composting

Soil Washing/Soil Flushing

Excavation, Incineration and Disposal

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FIGURE 1 (CONTINUED)

- Carbon Adsorption
- Ion Exchange
- Chemical Oxidation
- Reverse Osmosis
- Preliminary Identification of Applicable or Relevant and Appropriate Requirements (ARARs) Introduction
- Preliminary Identification of ARARs and "To Be Considered" (TBCs)
 - Potential ARARs
 - Potential Sources of Items To Be Considered" (TBC) as Alternative Sources of ARARs
 - Potential Chemical-Specific ARAR and TBC Levels
- Data Quality Objectives (DQO's)
 - Intended Use of Data
 - Data Quality
 - Data Quantity
- Data Gaps and Data Needs

TASK PLAN FOR THE RI

- Pre-Field Activities
- Field Investigations
 - Geophysical Investigation
 - Soils Investigation
 - Surface Water and Sediment Investigation
 - Groundwater Investigation
 - Ecological Investigation
 - surveying
- Data Reduction, Assessment and Interpretation

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FIGURE 1 (CONTINUED)

Baseline Risk Assessment

- Identification of Contaminants of Concern
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Environmental Assessment
- Identification of ARARs

Data Reporting

- Preliminary Reports
- Quarterly Reports
- Monthly Report

TASK PLAN FOR THE FS

- Development of Remedial Action Objectives
- Develop Remedial Action Alternatives
- Screening of Remedial Action Alternatives
- Detailed Analysis of Remedial Action Alternatives

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3.4 (Task 3) Project Management. The AE shall manage the delivery order in accordance with Appendix A of the basic contract statement of work. All project management associated with the delivery order, with the exception of the direct technical oversight of the work described in the preceding tasks, shall be accounted for in this task.

4.0 SUBMITTALS AND PRESENTATIONS

4.1 Format and Content. All submittals identified in the SOW shall be prepared in accordance with the suggested RI/FS Format as presented in the RI/FS Guidance Manual. Each submittal shall be accompanied by an EPA completeness checklist (where applicable), completed by the AE, which references the specific location of each required item within the submitted document. All drawings shall be of engineering quality in drafted form with sufficient detail to show interrelations of major features on the installation site map. When drawings are required, data may be combined to reduce the number of drawings. The documents shall consist of 8-1/2" x 11" pages with drawings folded, if necessary, to this size. A decimal paragraphing system shall be used, with each section and paragraph of the documents having a unique decimal designation. The document covers shall consist of vinyl 3-ring binders and shall hold pages firmly while allowing easy removal, addition, or replacement of pages. A document title page shall identify the AE, the Corps of Engineers, Huntsville Division, and the date. The AE identification shall not dominate the title page. Each page of draft and draft-final documents shall be stamped "DRAFT" and "DRAFT-FINAL" respectively. Each document shall identify the members and title of the AE's staff which had significant, specific input into the document's preparation or review. Submittals shall include incorporation of all previous review comments accepted by the AE as well as a section describing the disposition of each comment. Disposition of comments submitted with the final document shall be separate

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from the document itself. All final submittals shall be sealed by both the registered Professional Engineer-In-Charge.

4.2 Presentations. The AE shall make presentations of work performed according to the schedule in paragraph 4.6. Each presentation will consist of a summary of the work accomplished and anticipated followed by an open discussion among those present. The AE shall provide a minimum of two persons at the meetings which are expected to last one day each.

4.3 Conference Notes. The AE will be responsible for taking notes and preparing the reports of all conferences, presentations, and review meetings. Conference notes will be prepared in typed form and the original furnished to the Contracting Officer (within five (5) working days after date of conference) for concurrence and distribution to all attendees. This report shall include the following items as a minimum:

a. The date and place the conference was held with a list of attendees. The roster of attendees shall include name, organization, and telephone number.

b. Written comments presented by attendees shall be attached to each report with the conference action noted. Conference action as determined by the Government's Project Manager shall be "A" for an approved comment, "D" for a disapproved comment, "W" for a comment that has been withdrawn, and "E" for a comment that has an exception noted.

c. Comments made during the conference and decisions affecting criteria changes, must be recorded in the basic conference notes. Any augmentation of written comments should be documented by the conference notes.

4.4 Confirmation Notices. The AE will be required to provide a record of all discussions, verbal directions, telephone conversations, etc., participated in by the AE and/or representatives on matters relative to this contract and the work. These records, entitled "Confirmation Notices", will be numbered sequentially and shall fully identify participating personnel,

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subject discussed, and any conclusions reached. The AE shall forward to the Contracting Officer as soon as possible (not more than five (5) work days), a reproducible copy of said confirmation notices. Distribution of said confirmation notices will be made by the Government.

4.5 Progress Reports and Charts. The AE shall submit progress reports to the Contracting Officer with each request for payment. The progress reports shall indicate work performed, and problems incurred during the payment period. Upon award of this delivery order, the AE shall, within 15 days, prepare a progress chart to show the proposed schedule for completion of the project. The progress chart shall be prepared in reproducible form and submitted to the Contracting Officer for approval. The actual progress shall be updated and submitted by the 15th of each month and may be included with the request for payment.

4.6 Schedule of Deliverables and Review Meetings. Deliverables shall be submitted according to the following schedule.

<u>Deliverable/Meeting</u>	<u>Date</u>
Preliminary-Draft Project Scoping Plans	16 ¹⁶ JAN 95
Comments Provided by the Army	³⁰ 16 Jun 95
Draft, Project Scoping Plans	21 Jul 95
Regulatory Comments Provided	25 Aug 95
Draft-Final, Project Scoping Plans	13 Oct 95
Final, Project Scoping Plans	17 Nov 95
Project Review Meetings (3)	TBD
Contract Completion	1 Mar 96

4.7 Submittals.

4.7.1 General Submittal Requirements.

4.7.1.1 Distribution. The AE is responsible for reproduction and distribution of all documents. The AE shall furnish copies of submittals to each addressee listed in paragraph 4.7.3 in the quantities listed in the document submittal list.

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Submittals are due at each of the addressees not later than the close of business on the dates shown in paragraph 4.6.

4.7.1.2 Partial Submittals. Partial submittals will not be accepted unless prior approval is given.

4.7.1.3 Cover Letters. A cover letter shall accompany each document and indicate the project, project phase, the date comments are due, to whom comments are submitted, the date and location of the review conference, etc., as appropriate. (Note that, depending on the recipient, not all letters will contain the same information.) The contents of the cover letters should be coordinated with CEHND-PM-ED prior to the submittal date. The cover letter shall not be bound into the document.

4.7.1.4 Supporting Data and Calculations. The tabulation of criteria, data, circulations, and etc., which are performed but not included in detail in the report shall be assembled as appendices. Criteria information provided by CEHND need not be reiterated, although it should be referenced as appropriate. Persons performing and checking calculations are required to place their full names on the first sheet of all supporting calculations, and etc., and initial the following sheets. These may not be the same individual. Each sheet should be dated. A copy of this scope of work shall be included as appendix A in the Draft RI/FS report only.

4.7.1.5 Reproducibles. One camera-ready, unbound copy of the final submittal of each document shall be provided to the Contracting Officer in addition to the submittals required in the document and submittal list. All final submittals shall also be provided on 3.5-inch floppy disks compatible with the Intel 310/80286 computer in ASCII format and in WordPerfect 5.1/5.2 format.

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A.A.Q.

4.7.3 Addressees.

Commander
 U.S. Army Corps of Engineers
 Huntsville Division
 ATTN: CEHND-PM-ED (Ms. Richards)
 106 Wynn Drive
 Huntsville, AL 35805-1957

Commander
 U.S. Army Depot Systems
 Command (DESCOM)
 ATTN: AMSDS-EN-FD
 (Ms. Johnson)
 Chambersburg, PA 17201

Commander
 U.S. Army Environmental
 Hygiene Agency (USAEHA)
 ATTN: HSHB-ME-SR (Mr. Hoddinott)
 Building 1677
 Aberdeen Proving Ground
 MD 21010-5422

Commander
 U.S. Army Corps of Engineers
 Missouri River Division
 ATTN:CEMRD-ED-GL
 (Ms. Percifield)
 420 South 18th Street
 Omaha, Nebraska, 68102

Commander
 U.S. Army Material Command (USAMC)
 ATTN: AMCEN-A (Mr. Bob King)
 5001 Eisenhower Ave.
 Alexandria, VA 22333-0001

Commander
 US Army Corps of Engineers,
 New York District
 ATTN: CENAN-PP-E
 26 Federal Plaza
 New York, New York, 10278

Commander
 U.S. Army Environmental Center
 ATTN: CETHA-IR-D (Dr. Buchi)
 Aberdeen Proving Ground,
 MD 21010-5401

Commander
 Seneca Army Depot Activity
 ATTN:SDSSE-HE(Randy Battaglia)
 Romulus, New York, 14541

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Commander
 U.S. Army Corps of Engineers,
 North Atlantic Division,
 ATTN: CENAD-CO-EP (Mr. Pickett)
 90 Church Street
 New York, NY 10007-9998

4.6.4 Document and Submittal List.

	No. of Copies			
	Preliminary-Draft	Draft	Draft-Final	Final
CEHND-ED-PM	4	4	4	4
DESCOM	2	2	2	2
AEC	1	1	1	1
CEMRD-EA-GL	1	1	1	1
SDSSE-HE	2	23	23	23
CENAD-CO-EP	1	1	1	1
CENAN-PP-E	2	2	2	2
AMC	1	1	1	1
USAEHA	8	8	8	8
<u>TOTAL</u>	<u>22</u>	<u>43</u>	<u>43</u>	<u>43</u>

~~AAL-13~~

AAQ-13

APPENDIX G

EXPANDED SITE INSPECTION SUBSURFACE INVESTIGATIONS

- **Boring Logs**
- **Test Pit Logs**
- **Monitoring Well Installation Diagrams**

BORING LOGS

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC. CLIENT: ACOE BORING NO.: MW4-1

PROJECT : 10 SW MLU
 LOCATION : SEAD 4

JOB NO.: 720477
 EST. GROUND ELEV.: 698.392
 START DATE: 12-6-93
 FINISH DATE: 12-6-93
 CONTRACTOR: Empire
 DRILLER: Scott
 INSPECTOR: ES/LB
 CHECKED BY: AW
 CHECK DATE: 4/5/94

DRILLING SUMMARY:

DRILLING METHOD	HOLE DIA.	DEPTH INT.	SAMPLER		HAMMER	
			SIZE	TYPE	TYPE	WT/FALL
<u>HSA</u>	<u>8 1/2"</u>		<u>3" x 2'</u>	<u>SS</u>	<u>HMR</u>	<u>140 / 30"</u>

DRILLING ACRONYMS:

HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING
MRLSC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE
				3S	3 INCH SPLIT SPOON

MONITORING EQUIPMENT SUMMARY

INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
<u>01M</u>		<u>0-2000</u>	<u>0-0.4</u>	<u>1000</u>	<u>12-6-93</u>			<u>cloudy</u>
<u>Dust</u>		<u>0-0.99</u>	<u>.03</u>	<u>1000</u>	<u>12-6-93</u>			
<u>01m</u>		<u>0-2000</u>	<u>0-0.4</u>	<u>1330</u>	<u>12-6-93</u>			

MONITORING ACRONYMS

PID	PHOTO - IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES
FID	FLAME - IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT
SCT	SCINTILLATION DETECTOR	RAD	RADIATION		

COMMENTS:	OTHER REPORTS	DATE/PENDING	N/A
	WELL DEVELOPMENT	_____	_____
	SURVEYOR	_____	_____
	CORE LOG	_____	_____
	WELL INSTALLATION DETAILS	_____	_____
	HYDRAULIC TESTING	_____	_____
	GEOPHYSICAL LOGGING	_____	_____

OVERBURDEN BORING REPORT

SB4-1

ENGINEERING-SCIENCE, INC.			CLIENT: ACOE			BORING #: MW4-1		
MONITORING				COMMENTS: Sent SB4-1.1; -1.3, -1.5, -1.6			DRILLER: Empire	
INSTRUMENT	INTERVAL	BGD	TIME				INSPECTOR: ES/LB	
OVM		0-0.4	1000				DATE: 12-6-93	
Dust		.03	1000					

DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION <small>(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)</small>	USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC			
CL 1	2	0		0	4-		Lt brown SILT, and shale fragments (.25" to .75") little clay, moist		Fill
	2		2	1.1	0	X			
	4			1.5					
2	5	2		2	1.1		Lt. brown SILT, some clay, trace shale fragments (.25" dia), oxidation, moist		
	6			2	4-				
ML 3	8		1.5		4-		Lt. brown SILT, some shale fragments (to 2" dia, little clay, moist, dense		
	10				1.2	X			
4	12	4		4					
	8			4	4-				
ML 5	12		1.7		4-		Lt. brown SILT, some clay, little shale fragments, moist gray weath. shale		
	21				13	X			
6	31	6		6			Lt. brown SILT, some clay, little shale fragments, dense, moist		
	28			6	4-				
ML 7	22		2.0		4-		shale fragments (to 2" dia.)		
	32				1.4	X			
8	35			8			Lt. brown SILT, some clay, little shale fragments, dense, moist		
	16				4-				
ML 9	32				1.6				
	42					X			
10	109.1						↑ Weathered shale		
	109.3								
							Spoon refusal at 10.3'		
							Augered to 10.5'		
15									
20									

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: <u>ACOE</u>	BORING NO.: <u>MW4-2</u>		
PROJECT: <u>10 SWMU</u>		JOB NO.: <u>720477</u> EST. GROUND ELEV.: <u>1099.448</u> START DATE: <u>11/10/93</u> FINISH DATE: <u>11/10/93</u> CONTRACTOR: <u>Empire</u> DRILLER: <u>Bob</u> INSPECTOR: <u>ES</u> CHECKED BY: <u>AW</u> CHECK DATE: <u>4/5/94</u>		
LOCATION: <u>SEAD 4</u>				
DRILLING SUMMARY:				
DRILLING METHOD	HOLE DIA	DEPTH INT.	SAMPLER SIZE TYPE	HAMMER TYPE W/FALL
<u>HSA</u>	<u>8 1/2"</u>		<u>3'x2'</u> <u>SS</u>	<u>HMK</u> <u>1.40"/30"</u>

DRILLING ACRONYMS:

HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING
MRS LC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE
				3S	3 INCH SPLIT SPOON

MONITORING EQUIPMENT SUMMARY

INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
<u>OVM</u>	<u>PID</u>	<u>0-2000</u>	<u>0-1</u>	<u>1345</u>	<u>11/10/93</u>			<u>sunny</u>

MONITORING ACRONYMS

PID	PHOTO - IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES
FID	FLAME - IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT
SCT	SCINTILLATION DETECTOR	RAD	RADIATION		

<p>COMMENTS:</p> <p><u>Drill Rig was 45C.</u> <u>No downwind readings - had</u> <u>1 OVM.</u></p>	<table style="width: 100%;"> <tr> <th style="text-align: left;">OTHER REPORTS</th> <th style="text-align: left;">DATE/PENDING</th> <th style="text-align: left;">N/A</th> </tr> <tr> <td>WELL DEVELOPMENT</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>SURVEYOR</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>CORE LOG</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>WELL INSTALLATION DETAILS</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>HYDRAULIC TESTING</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>GEOPHYSICAL LOGGING</td> <td>_____</td> <td>_____</td> </tr> </table>	OTHER REPORTS	DATE/PENDING	N/A	WELL DEVELOPMENT	_____	_____	SURVEYOR	_____	_____	CORE LOG	_____	_____	WELL INSTALLATION DETAILS	_____	_____	HYDRAULIC TESTING	_____	_____	GEOPHYSICAL LOGGING	_____	_____
OTHER REPORTS	DATE/PENDING	N/A																				
WELL DEVELOPMENT	_____	_____																				
SURVEYOR	_____	_____																				
CORE LOG	_____	_____																				
WELL INSTALLATION DETAILS	_____	_____																				
HYDRAULIC TESTING	_____	_____																				
GEOPHYSICAL LOGGING	_____	_____																				

OVERBURDEN BORING REPORT

SB4-2

ENGINEERING-SCIENCE, INC. CLIENT: ACOE BORING #: MW4-2

MONITORING				COMMENTS
INSTRUMENT	INTERVAL	BGD	TIME	
<u>OTM</u>	<u>0-2000</u>	<u>0-1</u>	<u>1345</u>	

Sent SB4-2.1, SB4-2.2

DRILLER: <u>Empire</u>
INSPECTOR: <u>ES</u>
DATE: <u>11/10/93</u>

DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION <small>(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)</small>	USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC			
1	86 8 9	0	0 ↓ 1.2	0	4-21	0	Med brown SILT, some Clay, little cobbles (.5-.75") rounded. moist.		
2	11 45	2	2	2			No Recovery		
3	100/5		1.7 ↓ 3.7		4-22	0	weathered shale, dry		
4				4					
5									
6									
7									
8									
9									
10									
15									
20									

Spoon refusal @ 3.0'
Auger refusal at 4.0'

ML
ML
ST

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.			CLIENT: ACOE				BORING #: MW4-3		
MONITORING				COMMENTS					
INSTRUMENT	INTERVAL	BGD	TIME	Sent 3.1, 3.3, 3.4					
OVN	0-2000	0-.5	1500						
DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION <small>(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)</small>	USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC			
1	9 26 26	0	1.8	0	SBA 3.1	0	4' topsoil Gray weathered shale fill, some SILT, shale fragments to .75". moist		
2	18	2		2					
3	16 28	2	1.5	2	SBA 3.2	0	lt brown SILT, some clay, little SOBBLES rounded (to .75") oxidation. moist, dense.		
4	30	4		4			coarse sand lens.		
5	15 26 36	4	2	4	SBA 3.3	0	lt brown SILT, some fine sand, little shale fragments moist AA ← weak. shale lens.		
6	90 33	6		6			b.c.		
7	46 100/5	6	1.7	6	SBA 3.4	0	lt. brown to lt gray SILT, some weathered shale fragments (to 1.5" dia.) lt. brown fine SAND, some shale fragments	Water layer 2" ext.	7
8	100/3	8		8			gray weathered shale, wet.		
9			0		SBA 3.5				
10		10					Spoon refusal at 8.3' Augered to 9.0'		
15									
20									

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.		CLIENT: <u>AOE</u>			BORING NO.: <u>MWA-4</u>			
PROJECT: <u>10 SWM4</u>		LOCATION: <u>SEAD 4</u>			JOB NO.: <u>720477</u>			
					EST. GROUND ELEV.: <u>678.217</u>			
DRILLING SUMMARY:					START DATE: <u>12-5-93</u>			
DRILLING METHOD	HOLE DIA.	DEPTH INT.	SAMPLER SIZE TYPE		HAMMER TYPE W/FALL		FINISH DATE: <u>12-5-93</u>	
<u>HSA</u>	<u>8 1/2"</u>		<u>3"x2'</u>	<u>SS</u>	<u>HMR</u>	<u>140/30"</u>	CONTRACTOR: <u>Empire</u>	
							DRILLER: <u>JOA</u>	
							INSPECTOR: <u>ES/LB</u>	
							CHECKED BY: <u>AW</u>	
							CHECK DATE: <u>4/5/99</u>	
DRILLING ACRONYMS:								
HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON			
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING			
MRLSC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING			
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING			
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE			
				3S	3 INCH SPLIT SPOON			
MONITORING EQUIPMENT SUMMARY								
INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
<u>0VM</u>			<u>1.6</u>	<u>12/5</u>	<u>12-5-93</u>			
MONITORING ACRONYMS								
PID	PHOTO-IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES			
FID	FLAME-IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION			
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT			
SCT	SCINTILLATION DETECTOR	RAD	RADIATION					
COMMENTS:				OTHER REPORTS		DATE/PENDING		N/A
				WELL DEVELOPMENT		_____		_____
				SURVEYOR		_____		_____
				CORE LOG		_____		_____
				WELL INSTALLATION DETAILS		_____		_____
				HYDRAULIC TESTING		_____		_____
GEOPHYSICAL LOGGING		_____		_____				

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC. CLIENT: USACO E BORING NO: SBY-6

PROJECT: SEAD
 LOCATION: Romulus, NY SEAD Y

JOB NO.: 720477
 EST. GROUND ELEV.: 696.240
 START DATE: 12-6-93
 FINISH DATE: 12-6-93
 CONTRACTOR: Empire
 DRILLER: Bob Lal
 INSPECTOR: BA/MCR
 CHECKED BY: _____
 CHECK DATE: _____

DRILLING SUMMARY:

DRILLING METHOD	HOLE DIA.	DEPTH INT.	SAMPLER		HAMMER	
			SIZE	TYPE	TYPE	WTR/FALL
HSA	8 1/2"		2" x 3'	SS	HMR	170# / 30"

DRILLING ACRONYMS:

HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING
MRS LC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE
				3S	3 INCH SPLIT SPOON

MONITORING EQUIPMENT SUMMARY

INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
VVM	PIP	0-2000	0	1420	12-6-93			Cloudy Cold
RAD		0-100	14-16	1420	12-6-93			LT Snow
DUST		0-.99	0	1420	12-6-93			
VVM		6	0	1435	12-6-93			
RAD			14-16	1435	12-6-93			
DUST			0	1435	12-6-93			

MONITORING ACRONYMS

PID	PHOTO - IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES
FID	FLAME - IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT
SCT	SCINTILLATION DETECTOR	RAD	RADIATION		

COMMENTS:

OTHER REPORTS	DATE/PENDING	N/A
WELL DEVELOPMENT	_____	_____
SURVEYOR	_____	_____
CORE LOG	_____	_____
WELL INSTALLATION DETAILS	_____	_____
HYDRAULIC TESTING	_____	_____
GEOPHYSICAL LOGGING	_____	_____

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC. **CLIENT:** _____ **BORING #:** SB 4-6

MONITORING				COMMENTS	DRILLER: <u>B. G. / A</u>
INSTRUMENT	INTERVAL	BGD	TIME		
<u>W/P</u>	<u>0-2000</u>	<u>0</u>	<u>1420</u>		
<u>RAD</u>	<u>0-1000</u>	<u>14-16</u>	<u>1420</u>		
<u>D.S.T.</u>	<u>0-99</u>	<u>0</u>	<u>1420</u>		

Sent to 1, 10.2

INSPECTOR: B.H. / A

DATE: 12-6-93

DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION <small>(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)</small>	USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC			
	4	0		0	4				
1420	6		62		6.1	0	X	organic roots loam	
	10								
2	23	2						Sand, clay no rocks	
1470	92	2		2	4			weathered shale with	
3	100/13		0.8		6.2	0	X	SPLIT spoon refusal 2.8'	
4		4		4					
5									
6									
10									
15									
20									

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.		CLIENT: <u>USAID</u>		BORING NO.: <u>SS 4-7</u>				
PROJECT: <u>SEAO</u>		LOCATION: <u>Romulus, NY SEAO Y</u>		JOB NO.: <u>720477</u>	EST. GROUND ELEV.: <u>704.071</u>			
DRILLING SUMMARY:								
DRILLING METHOD	HOLE DIA	DEPTH INT.	SAMPLER		HAMMER			
			SIZE	TYPE	TYPE	W/FALL		
<u>HSA</u>	<u>8 1/2</u>		<u>2' x 3"</u>	<u>SS</u>	<u>HMR</u>	<u>140# / 30"</u>		
DRILLING ACRONYMS:								
HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON			
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING			
MRS LC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING			
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING			
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE			
				3S	3 INCH SPLIT SPOON			
MONITORING EQUIPMENT SUMMARY								
INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
<u>VVM</u>	<u>PID</u>	<u>0-2000</u>	<u>0</u>	<u>1450</u>	<u>12/5/93</u>			<u>cloudy, cool</u>
<u>RAD</u>		<u>0-100</u>	<u>15.8</u>	<u>1450</u>	<u>12-5-93</u>			
<u>QJSS</u>		<u>0-.99</u>	<u>0</u>	<u>1450</u>	<u>12-5-93</u>			
<u>VVM</u>			<u>0</u>	<u>1530</u>	<u>12-5-93</u>			
<u>RAD</u>			<u>15.6</u>	<u>1530</u>	<u>12-5-93</u>			
<u>QJSS</u>			<u>0</u>	<u>1530</u>	<u>12-5-93</u>			
MONITORING ACRONYMS								
PID	PHOTO-IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES			
FID	FLAME-IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION			
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT			
SCT	SCINTILLATION DETECTOR	RAD	RADIATION					
COMMENTS:		OTHER REPORTS		DATE/PENDING	N/A			
		WELL DEVELOPMENT		_____	_____			
		SURVEYOR		_____	_____			
		CORE LOG		_____	_____			
		WELL INSTALLATION DETAILS		_____	_____			
		HYDRAULIC TESTING		_____	_____			
		GEOPHYSICAL LOGGING		_____	_____			

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.

CLIENT:

BORING # SB 4-7

MONITORING

INSTRUMENT	INTERVAL	BGD	TIME
UVM	0-2000	0	1450
Cal	0-100	5-10	1450
DUST	0-199	0	1450

COMMENTS

DRILLER: JW
 INSPECTOR: DH + MB
 DATE: 12-5-93

SAMPLING

SAMPLE

SAMPLE DESCRIPTION

USCS CLASS

STRATUM CLASS

(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)

DEPTH (FT)	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC	RAD SCR	SAMPLE DESCRIPTION	USCS CLASS	STRATUM CLASS
ML 1450	3 7	0		0	4			oxides, shale clay sand		
1	9		1.7		7.0		X			
2	10	2		2				Shale clay oxidation Hard dry		
3	13 16 25	2		2	4		X			
1500	4	4	1.8		7.2					
5	28 35	4		4	4					
1508	6	4	1.8		7.3		X	clay rock - sticky (wet)		
7	28 38	6		6	4					
1518	8	2.3		8	7.4		X	more clay/sand		
ST 1525	9	.2					X	Silt + sand refusal P. 3'		
10	10									
11										
12										
15										
20										

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.			CLIENT:			BORING #: S/S 4-8			
MONITORING				COMMENTS				DRILLER: <u>B.B.</u>	
INSTRUMENT	INTERVAL	BGD	TIME					INSPECTOR: <u>BH/MCB</u>	
<u>GM</u>	<u>0-2000</u>	<u>0</u>	<u>1245</u>						
<u>APC</u>	<u>6-1200</u>	<u>15-20</u>	<u>1245</u>						
<u>DUST</u>	<u>0-.44</u>	<u>0</u>	<u>1245</u>					DATE:	
DEPTH H (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION <small>(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)</small>	USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC			
1	5	⊙		0	9-		Shale organics		
	7	20	20	2	8.1	0 X	Some clay		
2	8	2		2	7-		very clayey sand		
	10	1.8					Some blocks		
3	15	4		4	8.2	0 X			
	20	4		4	4				
4	17	4		4	4				
	32	6	1.9	6	8.3	0 X	Rocks, shale, sand, clay, gravel or clayey layer thick below split spoon refusal 5.6'		
6									
7									
8									
10									
15									
20									

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.				CLIENT:				BORING # <i>SB 4-9</i>			
MONITORING								COMMENTS			
INSTRUMENT	INTERVAL	BGD	TIME								
<i>0-11</i>	<i>0-200</i>	<i>0</i>	<i>0950</i>								
<i>RAW</i>	<i>0-100</i>	<i>20-22</i>	<i>0950</i>								
<i>0-5</i>	<i>0-199</i>	<i>0</i>	<i>0950</i>								
								DRILLER: <i>SCOTT</i>			
								INSPECTOR: <i>BH/MCS</i>			
								DATE: <i>12-5-93</i>			
DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION			USCS CLASS	STRATUM CLASS
	BLOWS PER 6 INCHES	PENE- TRATION RANGE (FEET)	RECOV- ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC	RAD SCRN	(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)			
1	<i>2</i> <i>4</i> <i>5</i>	<i>0</i> <i>2.0</i>	<i>2</i>	<i>4</i> <i>9.1</i>	<i>0</i>	<i>X</i>	<i>organic rock sand</i> <i>Sand, oxidation, sandstone like clay</i> <i>small pieces of shale</i>				
2	<i>14</i> <i>25</i> <i>32</i>	<i>0</i>	<i>L.1</i>	<i>4</i> <i>7.2</i>	<i>0</i>	<i>X</i>	<i>shale layer some sand</i>				
3	<i>38</i> <i>32</i> <i>48</i> <i>28</i>	<i>4</i> <i>4</i>	<i>2.0</i>	<i>4</i> <i>9.3</i>	<i>0</i>	<i>X</i>	<i>dry clay + shale</i> <i>SPLIT SPAN refusal 5.9'</i>				
4	<i>100</i>	<i>6</i>									
5											
6											
7											
8											
9											
10											
15											
20											

950
 0955
 1003

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: <u>USACE</u>	BORING NO.: <u>SB 4-10</u>				
PROJECT: <u>SEAD</u>		JOB NO.: <u>720477</u> EST. GROUND ELEV.: <u>702.275</u> START DATE: <u>12-6-93</u> FINISH DATE: <u>12-6-93</u> CONTRACTOR: <u>EMERF</u> DRILLER: <u>Bos</u> INSPECTOR: <u>SA/1/03</u> CHECKED BY: _____ CHECK DATE: _____				
LOCATION: <u>Romulus, NY</u>						
DRILLING SUMMARY:						
DRILLING METHOD	HOLE DIA.	DEPTH INT.	SAMPLER		HAMMER	
			SIZE	TYPE	TYPE	W/FALL
<u>HSA</u>	<u>8 1/2</u>		<u>2" x 3'</u>	<u>SS</u>	<u>HMB</u>	<u>140 #/30"</u>

DRILLING ACRONYMS:

HSA	HOLLOW-STEM AUGERS	HMR	HAMMER	SS	SPLIT SPOON
DW	DRIVE-AND-WASH	SHR	SAFETY HAMMER	CS	CONTINUOUS SAMPLING
MRS LC	MUD-ROTARY SOIL-CORING	HHR	HYDRAULIC HAMMER	SI	5 FT INTERVAL SAMPLING
CA	CASING ADVANCER	DHR	DOWN-HOLE HAMMER	NS	NO SAMPLING
SPC	SPIN CASING	WL	WIRE-LINE	ST	SHELBY TUBE
				3S	3 INCH SPLIT SPOON

MONITORING EQUIPMENT SUMMARY

INSTRUMENT TYPE	DETECTOR TYPE/ENERGY	RANGE	BACKGROUND			CALIBRATION		WEATHER
			READING	TIME	DATE	TIME	DATE	
<u>DUM</u>	<u>PID</u>	<u>0-2000</u>	<u>0</u>	<u>1125</u>	<u>12-6-93</u>			<u>clearly cold</u>
<u>RAD</u>		<u>0-100</u>	<u>16-17</u>	<u>1125</u>	<u>12-6-93</u>			<u>LT snow</u>
<u>DUST</u>		<u>0-.99</u>	<u>0</u>	<u>1125</u>	<u>12-6-93</u>			
<u>DUM</u>			<u>0</u>	<u>1138</u>	<u>12-6-93</u>			
<u>RAD</u>			<u>15-16</u>	<u>1138</u>	<u>12-6-93</u>			
<u>DUST</u>			<u>0</u>	<u>1138</u>	<u>12-6-93</u>			

MONITORING ACRONYMS

PID	PHOTO - IONIZATION DETECTOR	BGD	BACKGROUND	DGRT	DRAEGER TUBES
FID	FLAME - IONIZATION DETECTOR	CPM	COUNTS PER MINUTE	PPB	PARTS PER BILLION
GMD	GEIGER MUELLER DETECTOR	PPM	PARTS PER MILLION	MDL	METHOD DETECTION LIMIT
SCT	SCINTILLATION DETECTOR	RAD	RADIATION		

COMMENTS:	OTHER REPORTS	DATE/PENDING	N/A
	WELL DEVELOPMENT	_____	_____
	SURVEYOR	_____	_____
	CORE LOG	_____	_____
	WELL INSTALLATION DETAILS	_____	_____
	HYDRAULIC TESTING	_____	_____
GEOPHYSICAL LOGGING		_____	_____

OVERBURDEN BORING REPORT

ENGINEERING-SCIENCE, INC.				CLIENT:				BORING #: SB 4-10					
MONITORING				COMMENTS				DRILLER: <u>Ba3/92</u> INSPECTOR: <u>BH/403</u> DATE: <u>12-6-93</u>					
INSTRUMENT	INTERVAL	BGD	TIME										
DVM	0-2000	0	1725										
R20	0-100	16-17	1125										
2VIT	0-.99	0	1125										
DEPTH (FT)	SAMPLING			SAMPLE			SAMPLE DESCRIPTION				USCS CLASS	STRATUM CLASS	
	BLOWS PER 6 INCHES	PENE-TRATION RANGE (FEET)	RECOV-ERY RANGE (FEET)	DEPTH INT (FEET)	NO.	VOC	RAD SCRIN	(As per Burmeister: color, grain size, MAJOR COMPONENT, Minor Components with amount modifiers and grain-size, density, stratification, wetness, etc.)					
1115	3	0	0	4	0	0	X	C-					
1125	4	1.7	1.7	6.1	0	0	X	clay sand few rocks					
1130	24	0	0	4	0	0	Y	dry shale sand					
1132	82	4	2.0	4	10.2	0	Y						
1137	85	4	4	4	4	0	X	Split Spoon Refusal 5.2'					
1137	102/2	6	1.1	6	10.3	0	X						
10													
15													
20													

TEST PIT LOGS

TEST PIT REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: <u>USACE</u>	TEST PIT #: <u>TP4-1</u>
MONITORING DATA		
INSTRUMENT <u>DR JAE UVM</u> <u>Victoreem</u>	DETECTOR <u>PID</u>	BACKGROUND <u>0</u>
		TIME/DATE <u>11/10/93 0800</u> <u>11/10/93 0830</u>
		DATE START: <u>11/10/93</u>
		DATE FINISH: <u>11/10/93</u>
		INSPECTOR: <u>DMK</u>
		CONTRACTOR: <u>LXB</u>

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
1				topsoil	several inches of topsoil	
2				uniform clay loam	Pit is pretty uniform Clay loam	
3	<1 0/50 or	TP4-1 11/10/93 0850	3 feet		no odd color no foreign material	
4					lt brown dry clay loam few rocks	Photo # 10, 11 Pit located 3' to 6' up berm

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #: TP4-1

TEST PIT REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: <u>USACE</u>	TEST PIT #: <u>TP 4-2</u>		
MONITORING DATA		DATE START: <u>11/8/93</u> DATE FINISH: <u>11/9/93</u> INSPECTOR: <u>DMK</u> CONTRACTOR: <u>UXB</u>		
INSTRUMENT	DETECTOR		BACKGROUND	TIME/DATE
<u>GM</u>	<u>PID</u>		<u>0</u>	<u>11/10/93 08:00</u>
<u>Vickerson 190</u>			<u>CL</u>	<u>11/10/93 09:30</u>

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
1				Topsoil		
2				Uniform clay clay loam		
3	0/CL	TP4-2 11/10/93 0910	3feet	—	Lt brown-clay clay, clay-clay loam some rocks no foreign material	Photos 12 & 13 Pit located 3' to 5' up berm

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #: TP4-2

TEST PIT REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TP4-3
PROJECT: SENECA 10 SWMU INVESTIGATION	JOB NUMBER: 720477-0100	
LOCATION: SEAD 4 TEST PIT TRIPLET LOCATION	EST. GROUND ELEV. _____	
TEST PIT DATA		INSPECTOR: JWC
LENGTH: 6'	WIDTH: 3'	CONTRACTOR: ES/UXB
DEPTH: 4'	EXCAVATION/SHORING METHOD: BACKHOE	START DATE: 12/5/93
		COMPLETION DATE: 12/5/93
		CHECKED BY: _____
		DATE CHECKED: _____

MONITORING DATA			
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE
OVM-580B	10.0eV	✓	10:20 AM 12/5/93
LEL/O ₂ /H ₂ S			

COMMENTS: sample TP4-3.
SHALLOW OVERBURDEN SOILS
WELL DEFINED UNITS
 1 ORGANIC 4 VOC - 40ML
 1 INORGANIC 1 EXPLOSIVE
 1 METALS
 TOTAL SAMPLES: [8]

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
					TOPSOIL, ROOT SYSTEMS HIGH ORGANIC CONTENT	} ~6"
1					LIGHT BROWN SILTY SAND FINE GRAINED < 200 SIEVE SIZE W/SOME CLAY - GLACIAL TILL	} 7"
2					DARK TO MEDIUM (OLIVE) GREY UNIT DEFINING GLACIAL TILL PHASING INTO WEATHERED SHALE LAYER [WELL-DEFINED SHALE UNIT	} 18"
3					CONSISTENT SHALE UNIT - EXCAVATION TO BACKHOE REFUSAL AND NO INTRUSIVE PRESENCE	} 17-18"
4						
					SHALE CONTINUATION	
5						

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #: TP4-3

TEST PIT REPORT

TIME 10:00 AM

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TP4-4
PROJECT: SENECA 10 SWMU INVESTIGATIONS	JOB NUMBER: 720477-000	EST. GROUND ELEV.:
LOCATION: SEAD 4 TEST PIT TRIPLET LOCATION	INSPECTOR: JWC	CONTRACTOR: ES/UMB
TEST PIT DATA		START DATE: 12/5/93
LENGTH: 65'	WIDTH: 3'	DEPTH: 4'
		EXCAVATION/SHORING METHOD: BACKHOE
		COMPLETION DATE: 12/5/93
		CHECKED BY:
		DATE CHECKED:

MONITORING DATA				COMMENTS:
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE	
OVM-580B	10.0 ^{uv}	∅	12/5/93	SHALLOW OVERBURDEN SOILS WELL DEFINED UNITS 1 ORGANICS - 500ML 1 INORGANICS - 500ML 4 VOC - 40ML 1 EXPLOSIVE - 40ML 1 METALS - 40ML
LEL/02/H ₂ S		-	12/5/93	
TOTAL SAMPLES: [8]				

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
	∅ BGD				TOPSOIL, ROOT SYSTEMS HIGH ORGANIC CONTENT	7"
1	∅ BGD				LIGHT BROWN SILTY SAND FINE with some CLAY-TILL < 200 SIEVE SIZE	7"
2	∅ BGD	FOUR BOWLS AT SIDES OF THE PIT ~ 2 SAMPLE TP4-4	~ 2'		DARK- GREY → OLIVE GREY SOILS/TILL which phase INTO WEATHERED SHALE LAYER [WELL-DEFINED SHALE UNIT]	18"
3	∅ BGD				CONSISTENT SHALE UNIT - LARGE PIECES EXCAVATION TO BACKHOE REFUSAL (NO INTRUSIVE PRESENCE NOTED)	ALL NATURAL WELL SORTED SHALE
4						
5						

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #: TP4-4

TEST PIT REPORT

TIME 9:40 AM

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TP4-5
PROJECT: SENECA 10 SWMU INVESTIGATIONS	JOB NUMBER: 720477-0000	EST. GROUND ELEV.:
LOCATION: SEAD 4 TEST PIT TRIPLET LOCATION	INSPECTOR: JWC	CONTRACTOR: JES
TEST PIT DATA		START DATE: 12/5/93
LENGTH: 6'	WIDTH: 3'	DEPTH: 3.5-4'
		EXCAVATION/SHORING METHOD: BACKHOE
		COMPLETION DATE: 12/5/93
		CHECKED BY:
		DATE CHECKED:

MONITORING DATA			
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE
OVM-580B	10.0EV	φ	12/5/93
LEL/02/425		—	12/5/93

COMMENTS:
 SHALLOW OVERBURDEN SOILS
 WELL DEFINED UNITS

TOTAL SAMPLES: [8]

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
	φ				TOPSOIL, ROOT SYSTEMS	} 6"
1	φ				LIGHT BROWN SILTY SAND FINE W/SOME CLAY - TILL L 200 SIEVE SIZE	} 8"
2	φ	Sample TP4-5 (FOUR) BOWLS AT SIDES OF THE PIT	~ 2'		DARKER GREY SOILS UNIT DEFINING TILL PHASING INTO WEATHERED SHALE LAYER [WELL-DEFINED SHALE UNIT]	} 16"
3	φ				CONSISTENT SHALE UNIT - EXCAVATION TO BACKHOE REFUSAL NO INTRUSIVE PRESENCE NOTED	ALL NATURAL WELL SORTED
4					BACKHOE REFUSAL SHALE CONTINUATION ↓	
5						

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

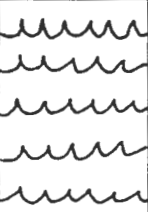

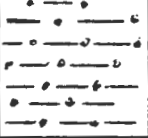
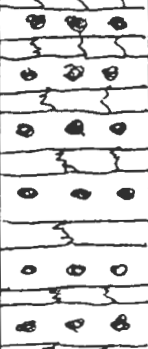

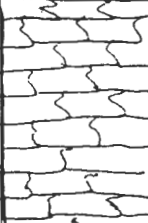
TEST PIT #: TP4-5

TEST PIT REPORT

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TP4-6
PROJECT: <u>SENECA 10 SWMU INVESTIGATION</u>	JOB NUMBER: <u>720477-01000</u>	
LOCATION: <u>SEAD 4 CLAY PIPE TRACE</u>	EST. GROUND ELEV. _____	
TEST PIT DATA		
LENGTH: <u>48'</u>	WIDTH: <u>3'</u>	DEPTH: <u>6'</u>
EXCAVATION/SHORING METHOD: <u>BACKHOE</u>		
INSPECTOR: <u>QMC</u>		
CONTRACTOR: <u>DES/UB</u>		
START DATE: <u>12/5/93</u>		
COMPLETION DATE: <u>12/6/93</u>		
CHECKED BY: _____		
DATE CHECKED: _____		

MONITORING DATA			
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE
<u>OVM-580B</u>	<u>10.φ</u>	<u>φ</u>	<u>12/5/93 13:00</u>
<u>LEL/O2/H2S</u>	<u>—</u>	<u>—</u>	

COMMENTS:
EXCAVATED PERPENDICULAR TO 6" CLAY PIPE DIRECTION BUT WERE UNABLE TO LOCATE INTERSECTION
 Sample: TP4-6
 TOTAL SAMPLES [8]

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
1	φ				TOPSOIL	} 12"
	φ				DARK GREY CLAYEY SAND WITH SOME INTERBEDDED SHALE CLASTS	} 11"
2	φ				SMALL REGION OF Hematitic SOIL MEDIUM-FINE	} 7"
3	φ				WEATHERED SHALE UNIT W/DARK GREY TILL	} 18"
4	φ					
5	φ				MORE COMPETENT SHALE UNIT	

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #: TP4-6

TEST PIT REPORT

TIME 17:30

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TPA-7
PROJECT: SEAD 10 SWMU INVESTIGATION	LOCATION: SEAD 4 CLAY PIPE TRACE	JOB NUMBER: 720477-01000
TEST PIT DATA		EST. GROUND ELEV.:
LENGTH: 6'	WIDTH: 3'	DEPTH: 5'
EXCAVATION/SHORING METHOD: BACKHOE		INSPECTOR: JWC
		CONTRACTOR: ES/VXB
		START DATE: 12/5/93
		COMPLETION DATE: 12/5/93
		CHECKED BY:
		DATE CHECKED:

MONITORING DATA			
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE
OVM-580B	10.0 ev	∅	12/5/93
LEL/O ₂ /H ₂ S		—	12/5/93

COMMENTS:
 ~ 200' NE of the POND
 T.P. WAS EXCAVATED UNTIL
 CLAY PIPE WAS DISCOVERED
 Sample: TP4-7
 TOTAL SAMPLES: [8]

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
1	∅ BGD				TOPSOIL W/ ROOT SYSTEM HIGH ORGANIC CONTENT EVIDENCE OF INTRUSIVE LIGHT BROWN - GREY SOILS SMALL SHALE FRAGMENTS	HIGH GROUND - ALMOST BERM-LIKE 22"
2 3	∅ BGD	2 BOWL SAMPLES			DARK GREY SILTY CLAYEY SAND WITH SOME SHALE CLASTS SURROUNDING SHALE UNIT WAS HIGHER THAN AREA OF PIPE! This implied that the pipe was trenched into the OVERBURDEN SHALE UNIT!	21" →
4	∅ BGD	2 BOWL SAMPLES			FINE LIGHT GREY SILTY SAND LAYER!	SAMPLED CLAY PIPE
5						

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #:

TEST PIT REPORT

TIME 12:15 PM

ENGINEERING-SCIENCE, INC.	CLIENT: SEAD	TEST PIT #: TP4-8
PROJECT: SEAD 10 SWMU INVESTIGATION	JOB NUMBER: 720477-0100	
LOCATION: SEAD 4	EST. GROUND ELEV.	
TEST PIT DATA		INSPECTOR: JWC
LENGTH: 6'	WIDTH: 3'	DEPTH: 3'
EXCAVATION/SHORING METHOD: BACKHOE		
		CONTRACTOR: SES/EXB
		START DATE: 12/5/93
		COMPLETION DATE: 12/5/93
		CHECKED BY:
		DATE CHECKED:

MONITORING DATA			
INSTRUMENT	DETECTOR	BACKGROUND	TIME/DATE
OVM-580B	10-001	Ø	12/5/93
LED/02/142S		—	12/5/93

COMMENTS:
 ~75' NE of the pond
 T.P. WAS EXCAVATED UNTIL
 CLAY PIPE WAS DISCOVERED
 TOTAL SAMPLES: [8]

SCALE (FT)	VOC/RAD.	SAMPLE		STRATA SCHEMATIC	DESCRIPTION OF MATERIALS (BURMEISTER METHODOLOGY)	REMARKS
		NUMBER	DEPTH RANGE			
1	Ø BGD.				TOPSOIL WITH SMALL SHALE FRAGMENTS INTERBEDDED EVIDENCE OF INTRUSION LIGHT BROWN - GREY SOILS	12"
2	Ø				DRK. GREY SILTY CLAYEY SAND WITH SOME CLASTS OF SHALE	14"
					SHALE FRAGMENTS LARGE 4-6" PIECES	3"
3	Ø BGD.	4 BOWLS TAKEN AROUND PIPE Sample TP4-8	~32"		CLAY PIPE	7"
4					WATER FLOWING THROUGH TO THE POND	
5						

SEE MASTER ACRONYM LIST FOR COMPLETE LISTING OF ABBREVIATIONS

TEST PIT #:

MONITORING WELL INSTALLATION DIAGRAMS

OVERBURDEN MONITORING WELL COMPLETION REPORT & INSTALLATION DETAIL PROTECTIVE RISER COMPLETION

ENGINEERING-SCIENCE, INC.		CLIENT: <u>ACOE</u>	WELL #: <u>MW4-1</u>	
PROJECT: <u>10 SWMU</u>	LOCATION: <u>SEAP 4</u>		PROJECT NO: <u>720477</u>	INSPECTOR: <u>ES/EB</u>
			CHECKED BY: _____	
DRILLING CONTRACTOR: <u>Empire</u>	DRILLER: <u>Scott</u>		POW DEPTH: <u>10.5'</u>	INSTALLATION STARTED: <u>12-6-93</u>
DRILLING COMPLETED: <u>12-6-93</u>	BORING DEPTH: <u>10.5'</u>		INSTALLATION COMPLETED: <u>12-6-93</u>	SURFACE COMPLETION DATE: <u>12-6-93</u>
DRILLING METHOD(S): <u>HSA</u>	BORING DIAMETER(S): <u>8 1/2"</u>		COMPLETION CONTRACTOR/CREW: <u>Empire</u>	BEDROCK CONFIRMED (Y/N?): <u>Y</u>
ASSOCIATED SWMU/AOC: <u>4</u>			ESTIMATED GROUND ELEVATION: <u>698.392</u>	
PROTECTIVE SURFACE CASING:				
DIAMETER: <u>4" x 4" steel</u>		LENGTH: _____		
RISER:				
TR: _____	TYPE: <u>PVC-p</u>	DIAMETER: <u>2"</u>	LENGTH: _____	
SCREEN:				
TSC: <u>5.4'</u>	TYPE: <u>PVC 40</u>	DIAMETER: <u>2"</u>	LENGTH: <u>4'</u>	SLOT SIZE: <u>0.01"</u>
POINT OF WELL: (SILT SUMP)				
TYPE: <u>PVC point</u>	BSC: <u>9.4'</u>	POW: <u>10.5'</u>		
GROUT:				
TG: <u>Ground</u>	TYPE: <u>Cement-bentonite</u>	LENGTH: <u>2.5'</u>		
SEAL: _____	TBS: <u>2.5'</u>	TYPE: <u>bentonite pellets</u>	LENGTH: <u>2'</u>	
SAND PACK: _____	TSP: <u>4.5' #1 5.0' #1</u>	TYPE: <u>#39 #1</u>	LENGTH: <u>6.0'</u>	
SURFACE COLLAR:				
TYPE: _____	RADIUS: <u>2' x 2'</u>	THICKNESS CENTER: <u>1'</u>	THICKNESS EDGE: <u>1'</u>	
CENTRALIZER DEPTHS				
DEPTH 1: _____	DEPTH 2: _____	DEPTH 3: _____	DEPTH 4: _____	
COMMENTS:				
* ALL DEPTH MEASUREMENTS REFERENCED TO GROUND SURFACE				

SEE PAGE 2 FOR SCHEMATIC

PAGE 1 OF 2

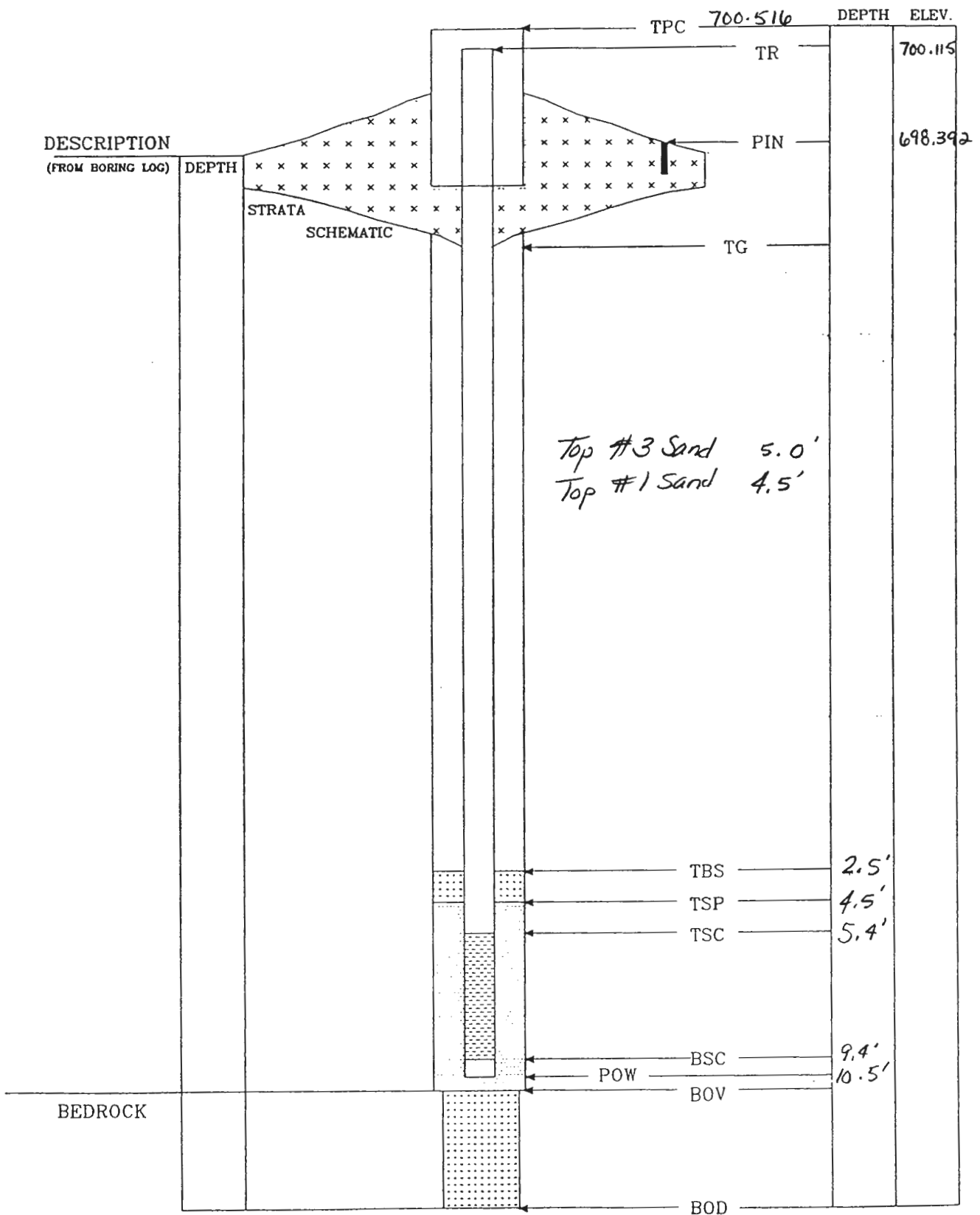
OVERBURDEN MONITORING WELL PROTECTIVE RISER INSTALLATION DETAIL

ENGINEERING-SCIENCE, INC.

CLIENT:

WELL #: MW4-1

DATE: 12-6-83



* NOT TO SCALE

OVERBURDEN MONITORING WELL COMPLETION REPORT & INSTALLATION DETAIL ROADWAY BOX - SURFACE COMPLETION

ENGINEERING-SCIENCE, INC.		CLIENT: <u>ACOE</u>	WELL #: <u>MW4-2</u>	
PROJECT: <u>10 SWMU</u>			PROJECT NO: <u>720477</u>	
LOCATION: <u>SEAD 4</u>			INSPECTOR: <u>ES</u>	
			CHECKED BY: _____	
DRILLING CONTRACTOR: <u>Empire</u>			POW DEPTH: <u>4.0'</u>	
DRILLER: <u>Bob</u>			INSTALLATION STARTED: <u>11/10/93</u>	
DRILLING COMPLETED: <u>11/10/93</u>			INSTALLATION COMPLETED: <u>11/10/93</u>	
BORING DEPTH: <u>4.0'</u>			SURFACE COMPLETION DATE: <u>11/10/93</u>	
DRILLING METHOD(S): <u>HSA</u>			COMPLETION CONTRACTOR/CREW: <u>Empire</u>	
BORING DIAMETER(S): <u>8 1/2"</u>			BEDROCK CONFIRMED (Y/N?) <u>Y</u>	
ASSOCIATED SWMU/AOC: <u>4</u>			ESTIMATED GROUND ELEVATION: <u>699.448</u>	
PROTECTIVE SURFACE CASING:				
DIAMETER: <u>4" x 4" Steel</u>		LENGTH: _____		
RISER:				
TR: _____	TYPE: <u>PVC 40</u>	DIAMETER: <u>2"</u>	LENGTH: _____	
SCREEN:				
TSC: <u>2.2</u>	TYPE: <u>PVC-40</u>	DIAMETER: <u>1 1/2"</u>	LENGTH: <u>1.0'</u>	SLOT SIZE: <u>0.01"</u>
POINT OF WELL: (SILT SUMP)				
TYPE: <u>PVC point</u>	BSC: <u>3.2'</u>	POW: <u>4.0'</u>		
GROUT:				
TG: <u>ground</u>	TYPE: <u>Cem.-bentonite</u>	LENGTH: _____		
SEAL:	TBS: <u>1.0'</u>	TYPE: <u>bentonite pellets</u>	LENGTH: <u>0.5'</u>	
SAND PACK:	TSP: <u>1.5' - #1 1.6' - #3</u>	TYPE: <u>#3 + #1</u>	LENGTH: <u>2.5'</u>	
SURFACE COLLAR:				
TYPE: <u>Cement</u>	RADIUS: <u>2' x 3'</u>	THICKNESS CENTER: <u>1</u>	THICKNESS EDGE: <u>1'</u>	
CENTRALIZER DEPTHS				
DEPTH 1: _____	DEPTH 2: _____	DEPTH 3: _____	DEPTH 4: _____	
COMMENTS:				

* ALL DEPTH MEASUREMENTS REFERENCED TO GROUND SURFACE

SEE PAGE 2 FOR SCHEMATIC

PAGE 1 OF 2

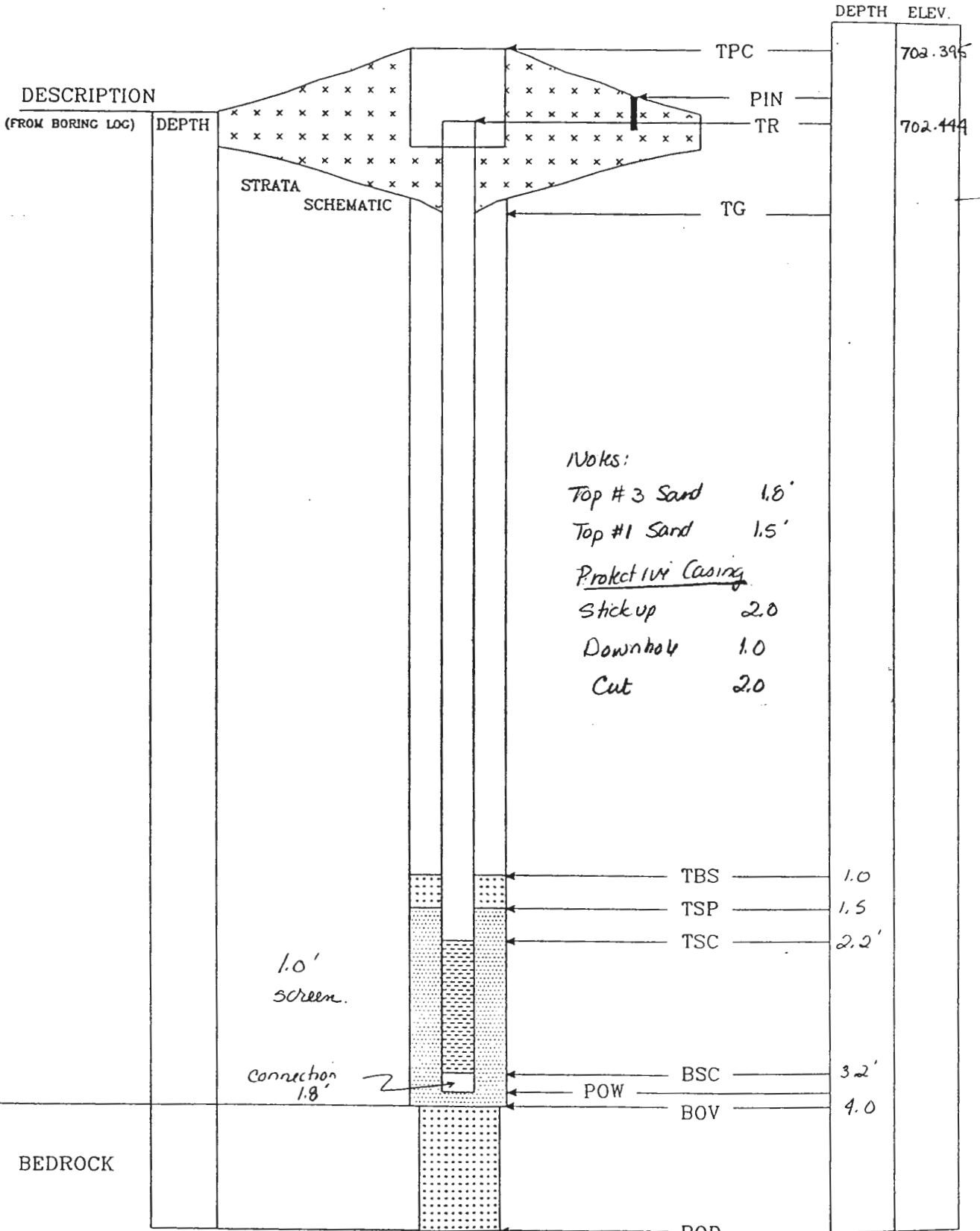
OVERBURDEN MONITORING WELL
ROADWAY BOX INSTALLATION DETAIL

ENGINEERING-SCIENCE, INC.

CLIENT: *ACOT*

WELL #: *MW4-2*

DATE: *11/10/93*



Notes:

Top #3 Sand 1.8'

Top #1 Sand 1.5'

Protective Casing

Stickup 2.0

Downhole 1.0

Cut 2.0

1.0' screen.

Connection 1.8'

BEDROCK

*Note: All depths meas. from ground surface * NOT TO SCALE*

OVERBURDEN MONITORING WELL COMPLETION REPORT & INSTALLATION DETAIL ROADWAY BOX - SURFACE COMPLETION

ENGINEERING-SCIENCE, INC. CLIENT: <u>ACOE</u>		WELL #: <u>MW4-3</u>	
PROJECT: <u>10 SWMU</u>		PROJECT NO: <u>720477</u>	
LOCATION: <u>SEAD 4</u>		INSPECTOR: <u>ES</u>	
		CHECKED BY: _____	
DRILLING CONTRACTOR: <u>Empire</u>		POW DEPTH: <u>9.0'</u>	
DRILLER: <u>Bob</u>		INSTALLATION STARTED: <u>11/10/93</u>	
DRILLING COMPLETED: <u>11/10/93</u>		INSTALLATION COMPLETED: <u>11/10/93</u>	
BORING DEPTH: <u>9.0'</u>		SURFACE COMPLETION DATE: <u>11/10/93</u>	
DRILLING METHOD(S): <u>HSA</u>		COMPLETION CONTRACTOR/CREW: <u>Empire</u>	
BORING DIAMETER(S): <u>8 1/2"</u>		BEDROCK CONFIRMED (Y/N?): <u>Y</u>	
ASSOCIATED SWMU/AOC: <u>4</u>		ESTIMATED GROUND ELEVATION: <u>697.669</u>	
PROTECTIVE SURFACE CASING:			
DIAMETER: <u>4" x 4" Steel</u>		LENGTH: _____	
RISER:			
TR: _____	TYPE: <u>PVC-40</u>	DIAMETER: <u>2"</u>	LENGTH: _____
SCREEN:			
TSC: <u>3.9'</u>	TYPE: <u>PVC-40</u>	DIAMETER: <u>1 1/2"</u>	LENGTH: <u>4.0'</u> SLOT SIZE: <u>.01"</u>
POINT OF WELL: (SILT SUMP)			
TYPE: <u>PVC point</u>	BSC: <u>7.9'</u>	POW: <u>9.0'</u>	
GROUT:			
TG: <u>Ground</u>	TYPE: <u>Cem-bentonite</u>	LENGTH: <u>14'</u>	
SEAL:	TBS: <u>1.4</u>	TYPE: <u>bentonite pellets</u>	LENGTH: <u>10'</u>
SAND PACK:	TSP: <u>#3-2.9'</u> <u>#1-2.9'</u>	TYPE: <u>#3 + #1</u>	LENGTH: <u>6.6'</u>
SURFACE COLLAR:			
TYPE: <u>Cement</u>	RADIUS: <u>2' x 2'</u>	THICKNESS CENTER: <u>1'</u>	THICKNESS EDGE: <u>1'</u>
CENTRALIZER DEPTHS			
DEPTH 1: _____	DEPTH 2: _____	DEPTH 3: _____	DEPTH 4: _____
COMMENTS:			
* ALL DEPTH MEASUREMENTS REFERENCED TO GROUND SURFACE			

SEE PAGE 2 FOR SCHEMATIC

PAGE 1 OF 2

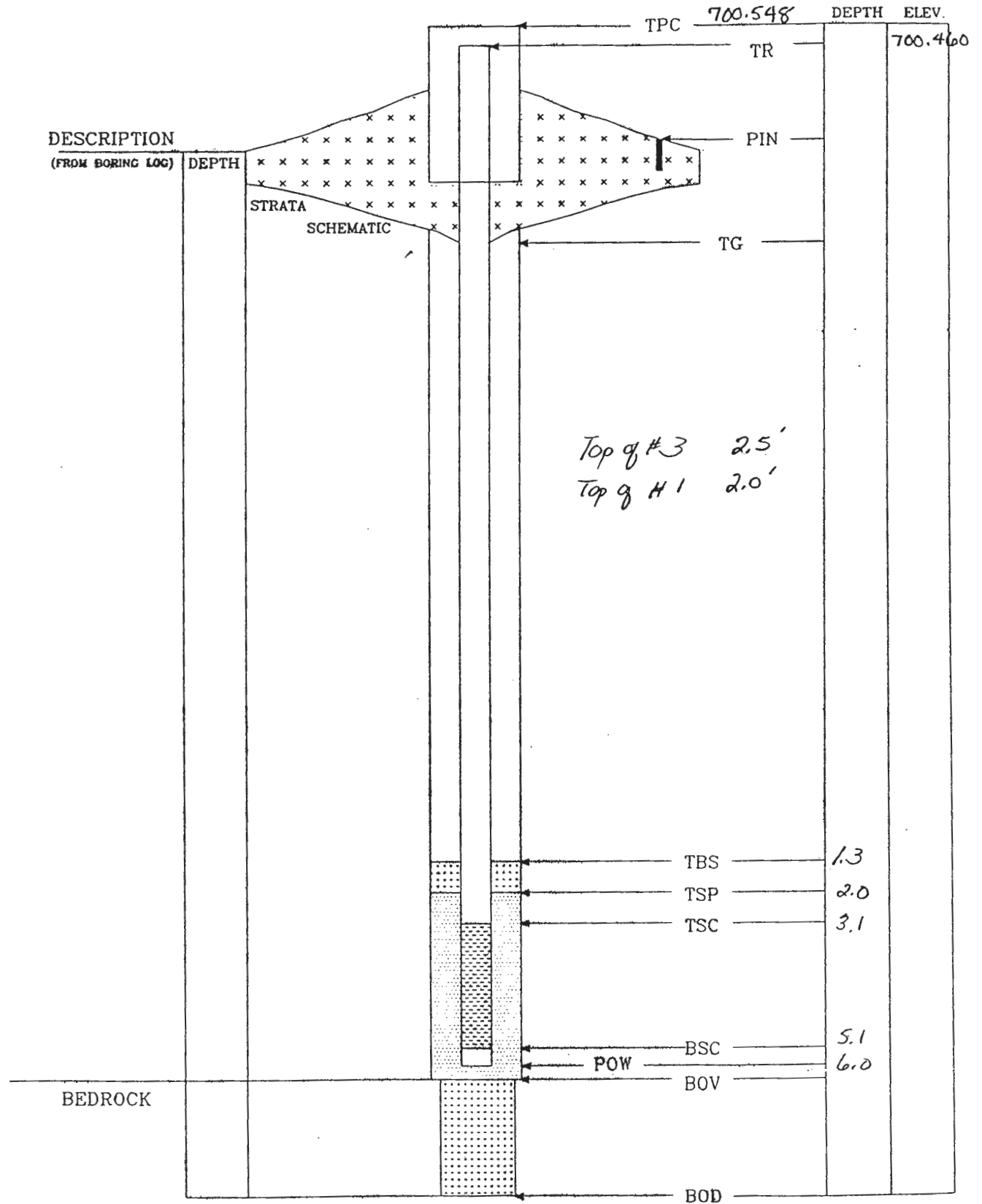
OVERBURDEN MONITORING WELL PROTECTIVE RISER INSTALLATION DETAIL

ENGINEERING-SCIENCE, INC.

CLIENT:

WELL #: *MW4-5*

DATE: *12-5-93*



* NOT TO SCALE