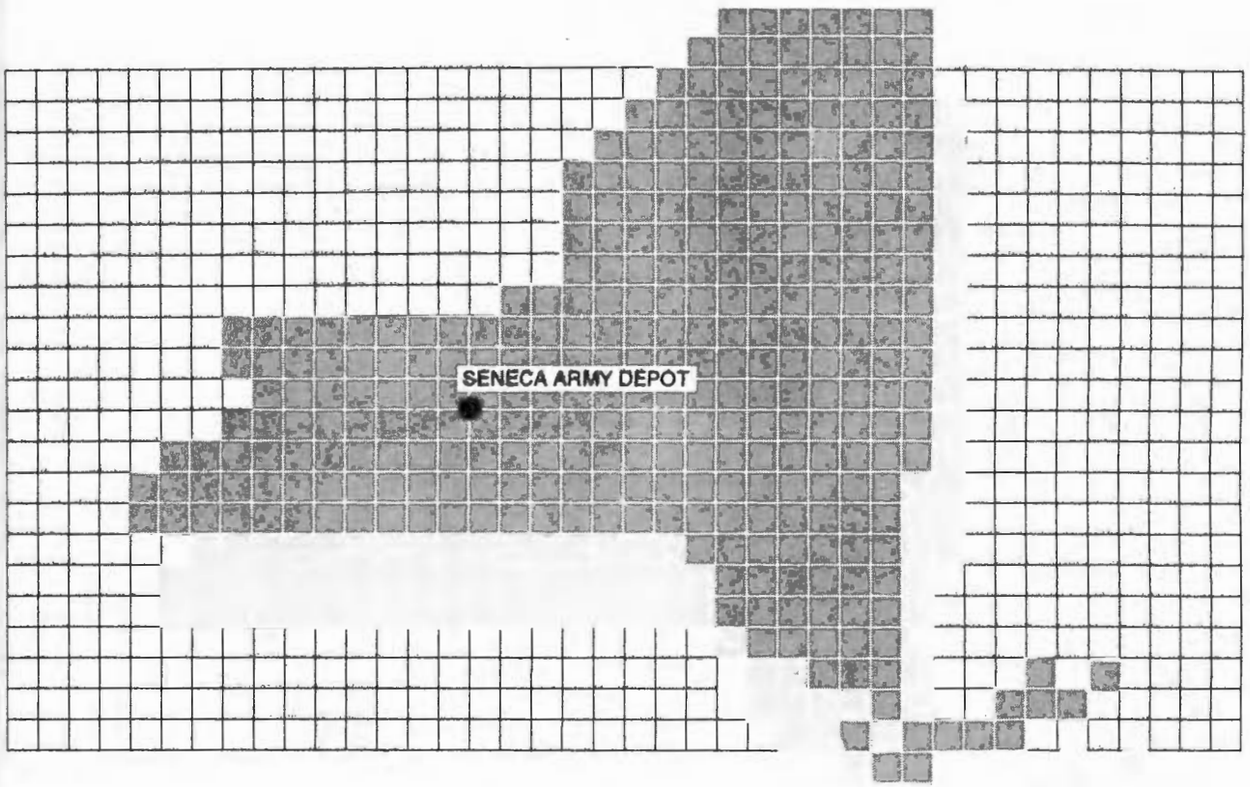
00575

28

U.S ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA

DRAFT



PRELIMINARY SITE CHARACTERIZATION REPORT AT THE ASH LANDFILL

PRELIMINARY SITE CHARACTERIZATION REPORT
ASH LANDFILL
SENECA ARMY DEPOT
ROMULUS, NEW YORK

Prepared For:

Seneca Army Depot
Romulus, New York

Prepared By:

Chas. T Main, Inc.
Prudential Center
Boston, Massachusetts

720229-05000

April 1992

APPROVAL SHEET

The following personnel have reviewed this workplan for accuracy, content, and quality of presentation.

_____

James P. Chaplick
Manager, Environmental Engineering

_____

Michael N. Duchesneau, P.E.
Project Manager

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

TABLE OF CONTENTS (cont'd)

TABLE OF CONTENTS (cont'd)

LIST OF APPENDICES

LIST OF TABLES

LIST OF TABLES (cont'd)

LIST OF FIGURES

LIST OF PLATES

LIST OF ACRONYMS

1,2-DCA	1,2-Dichloroethane
1,2-DCE	1,2-Dichloroethylene (total)
AA	Atomic Adsorption
AB/N's	Acid, base/neutrals
AOC	Areas of Concern
ASTM	American Society for Testing and Materials
B&B	Blasland and Bouck
Ba	Barium
BOD	Biological Oxygen Demand
bp	before present
CEC	Cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
cm	Centimeters
COD	Chemical Oxygen Demand
Cr	Chromium
Cu	Copper
$CaCO_3$	Calcium Carbonate
Cd	Cadmium
DARCOM	Development and Readiness Command
DO	Dissolved oxygen
DOT	Department of Transportation
EM	Electromatic
EPA	Environmental Protection Agency
ESE	Environmental Science and Engineering
ft	Feet
ft/ft	Feet per foot
ft/sec	Feet per second
ft/yr	Feet per year
GAE	Geophysical anomaly excavations
Gc	Gas chromatograph
gpm	Gallons per minute
GPR	Ground penetrating radar
GSSI	Geophysical Survey Systems, Inc.
ICF	ICF Technology, Incorporated
Koc	Organic carbon coefficient
L/min	Liters per minute
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

LIST OF ACRONYMS
(Con.t)

MSL	Mean sea level
MW	Monitor Well
NA	Not analyzed or not available
NBS	National Bureau of Standards
NGVD	National Geologic Vertical Datum
NPL	National Priority List
NSF	National Sanitation Foundation
NTU	Nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
OVM	Organic Vapor Meter
Pb	Lead
PCB	Plychlorinated Biphenyls
PID	Photoionization detector
ppm	parts per million
ppmv	Part Per MIllion Per Volume
PT	Monitoring Well
PVC	Polyvinyl Chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RI	Remedial Investigation
RQD	Rock Quality Designation
SCS	Soil Conservation Service
SEAD	Seneca Army Depot
Sec	Seconds
SIR	Subsurface Interface
SS	Soil sample
SW	Sediment and surface water sample station
SWMU	Solid Waste Management Unit
T1,2-DCE	trans-1,2-Dichloroethylene
TAL	Target analyte list
TCE	Trichloroethylene
TCL	Target compound list
TDS	Total dissolved solids
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TS	Total Solids
ug/g	Micrograms per gram
ug/wp	Micrograms per wipe
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
USACE	United States Army Corps of Engineers

LIST OF ACRONYMS
(Con.t)

USAEHA	United States Army Environmental Hygiene Agency
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VC	Vinyl Chloride
VOA	Volatile organic analyte
VOC	Volatile Organic Compound
Vs	Volt Second
Zn	Zinc

1.0 INTRODUCTION

This Preliminary Site Characterization report is submitted as the first phase of the Remedial Investigation (RI). Chas. T Main, Inc. (MAIN) has been retained by the United States Army Corps of Engineers (USACE) as part of their remedial response activities under the Comprehensive Environmental Responsibility, Compensation and Liability Act (CERCLA) to perform these activities. The purpose of this report is to discuss the physical characteristics of the site, review the analytical results from the investigation programs, and identify sources of potential contamination at the site. The Ash Landfill site is included on the federal facilities National Priorities List (NPL); it has been listed since July 13, 1989.

1.1 SITE BACKGROUND

1.1.1 Site Description

The Ash Landfill site is situated on the western flank of a topographic high between Cayuga and Seneca lakes in the Finger Lakes region of central New York (Figure 1-1). Specifically, the approximately 130 acre Ash Landfill site is located about 2,000 feet east of the northwestern extension of the SEAD airstrip in the southwestern portion of the 10,587-acre Seneca Army Depot (SEAD) in Romulus, New York (Figure 1-2). SEAD was constructed in 1941 and generally consists of an elongated central area for storage of ammunitions and weaponry in quonset-style buildings, an operations and administration area in the eastern portion and an army barracks area at the north end of the depot. The base was expanded to encompass a 1,524-meter airstrip, formerly the Sampson Air Force Base. Currently, SEAD is used for: 1) receiving, storing, and distributing ammunition and explosives, 2) providing receipt, storage, and distribution of items that support special weapons activity; and 3) performing depot-level maintenance, demilitarization, and surveillance on conventional ammunition and special weapons. The depot employs approximately 1,000 civilian and military personnel.

The site consists of an abandoned incinerator building and tower (Building 2207), a former cooling pond, an Ash Landfill, and a nearby Non-Combustible Fill Landfill (Plate 1-1). The site is bound on the north by Cemetery Road, on the east by a SEAD railroad line, on the south by undeveloped SEAD land, and on the west by the depot's boundary. Beyond the depot's western boundary are farmland and residences on Smith Farm Road and along Route 96A. Sampson State Park near Seneca Lake is further to the west.

The Ash Landfill was previously used by the Army for disposal of ash produced from the incineration of solid waste (trash) produced at the depot. A separate, abandoned Non-Combustible Fill Landfill, which is part of the site, is located east of the incinerator building across West Smith Farm Road. This landfill was the repository of materials which could not be combusted in the incinerator.

1.1.1.1 Regional Geologic Setting

The Finger Lakes uplands area is underlain by a broad north-to-south trending series of rock terraces mantled by glacial till. As part of the Appalachian Plateau, the region is underlain by a tectonically undisturbed sequence of Paleozoic rocks consisting of shales, sandstones, conglomerates, limestones and dolostones. Figure 1-3 shows the regional geology of Seneca County. In the vicinity of SEAD, Devonian age (385 million years bp) black shale of the Hamilton group is monoclinally folded and dips gently to the south Figure 1-4. No evidence of faulting or folding of the sediments is present. Figure 1-5 displays the stratigraphic section of Paleozoic rocks of Central New York.

Locally, the shale is soft, grey, and fissile, and is mapped as the upper member of the Hamilton Group. The shale contains interbeds of calcareous shale and limestone. The shale is extensively jointed and weathered at the contact with overlying tills. Joint spacings are 1 inch to 4 feet in surface exposures. Prominent joint directions are N 60° E, N 30° W, and N 20° E, with the joints being primarily vertical. Corings performed on the upper 5 to 8 feet of the bedrock revealed low Rock Quality Designations (RQD's), i.e., < 5% with almost 100% recovery.

Pleistocene age (Wisconsin event, 20,000 bp) glacial till deposits overlie the shales. Figure 1-6 presents an overview of the subsurface sediments present in the area. The site is shown on Figure 1-6 as lying on the western edge of a large glacial till plain between Seneca Lake and Cayuga Lake. The till matrix, the result of glaciation, varies locally but generally consists of horizons of unsorted silt, clay, sand, and gravel. In the Finger Lakes region of New York, the till thickness varies from 1-50 meters. However, on the till plain between Seneca and Cayuga Lake it is near to the surface and generally thin (Muller and Cadwell 1986). In the central and eastern portions of SEAD the till is thin and bedrock is exposed or within 1 meter of the surface in some locations. The soils at the site are classified as unsorted inorganic clays, inorganic silts, and silty sands. Thickness of the glacial till deposits at SEAD range from 1 to 15 feet.

Darien silt-loam soils, 0 to 18 inches thick, have developed in the Wisconsonian age glacial tills on and in the vicinity of the site. The soils are somewhat poorly drained and have a silt clay loam and clay sub soils. These soils are developed in glacial till where they overlie the shale. In general, the topographic relief associated with these soils is 3-8%. Figure 1-7 presents the U.S. Department of Agriculture General Soil map for Seneca County. Figure 1-8 presents the soils map for the area surrounding the Ash Landfill.

Table 1-1 compares average metal content in shale, sandstone, limestone, soil and sediment of the Great Lakes for As, Ba, Cd, Cr, Hg, Pb, and Se. The table shows shales to contain from 2 to more than 10 times the quantity of metals found in other sedimentary rocks. This is due to the cation complexing capacity of the clays that make up the shales. It is probable that soils developed over shales, or over tills derived from shales, would contain metal values greater than those listed for average soils.

1.1.1.2 Regional Hydrogeologic Setting

Regionally, four (4) distinct hydrologic units have been identified within Seneca County. These include two (2) distinct shale formations, a series of limestone units and unconsolidated beds of Pleistocene glacial drift. Overall the groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water. Approximately 95 percent of the wells are used for domestic or farm supply and the average daily withdrawal is approximately 500 gallons (0.35 gpm). About five percent of the wells in the county are used for commercial, industrial, or municipal purposes. Seneca Falls and Waterloo, the two largest communities in the county, are in the hydrogeologic region which is most favorable for the development of a groundwater supply. However, because the hardness of the groundwater is objectionable to the industrial and commercial establishments operating within the villages, both villages utilize surface water as their municipal supplies. The villages of Ovid and Interlaken, both of which are without substantial industrial establishments, utilize groundwater as their public water supplies. Ovid obtains its supply from two shallow gravel-packed wells, and Interlaken is served by a developed seepage-spring area.

Regionally, the pheratic aquifer of the unconsolidated surficial glacial deposits of the region would be expected to flow in a direction consistent with the ground surface elevations. Geologic cross-sections from Seneca Lake and Cayuga Lake have been constructed by the State of New York, (Mozola, A.J., 1951 and Crain, L.J., 1974). This information suggests that a groundwater divide exists approximately half way between the two finger lakes. SEAD is

located on the western slope of this divide and therefore regional surficial groundwater is expected to flow westward, toward Seneca Lake.

A substantial amount of information concerning the hydrogeology in the area has been compiled by the State of New York, (Mazola, A.J., 1951). These reports have been reviewed in order to better understand the hydrogeology of the area surrounding SEAD. The data indicates that within a four (4) mile radius of the site a number wells exist from which geologic and hydrogeologic information has been obtained. This information includes: 1) the depth; 2) the yield; and 3) the geological strata the wells drilled through. Although the information was compiled in the 1950's, these data are useful in providing an understanding and characterization of the aquifers present.

Most of the groundwater in Seneca County is derived from precipitation that falls on the land surface and percolates into surficial deposits (Mazola, 1951). Three (3) geologic strata have been used to produce water for both domestic and agricultural purposes. These include: 1) a bedrock aquifer, which in this area is predominantly shale; 2) an overburden aquifer, which includes Pleistocene deposits (glacial till); and 3) a deep aquifer present within beds of limestone present within the underlying shale. The occurrence of water derived from limestone in the area surrounding SEAD is considered to be unusual and is more commonplace to the north since limestone is between 600 to 700 feet deep. As of 1957, twenty-five wells utilized water from the shale aquifer, six wells tapped the overburden aquifer, and one used the deep limestone as a source of water.

For the six wells which utilized groundwater extracted from the overburden, the average yield was approximately 7.5 gpm. The average depth of these wells was thirty-six feet. The geologic material which comprises this aquifer is generally Pleistocene till, with the exception of one well located to the northeast of the site. This well had penetrated an outwash sand and gravel deposit. The yields from these overburden wells ranged from 4 to 15 gpm. The well located in the outwash sand and gravel deposit, drilled to 60 feet, yielded only 5 gpm. Surprisingly, a 20 foot hand dug well, located southeasterly from the outwash well, yielded 10 gpm. The difference in well yield could be influenced by the difference in the diameter of the two wells.

The geologic information reviewed indicates that the upper portions of the shale formation would be expected to yield small supplies of water, although adequate for domestic use. For mid-Devonian shales such as those of Hamilton group, the average yields, (i.e., less than 15

gpm), are consistent with what would be expected for shales (LaSala, 1968). The deeper portions of the shale formation, (i.e., at depths greater than 235 feet) have provided yields up to 150 gpm due to the occurrence of limestone cavities. In the deep portions of the shale, limestone cavities are encountered which provide substantial quantities of water. This source of water is considered to comprise a separate source of groundwater for the area. Very few wells in the region adjacent to SEAD utilize the limestone as a source of water, which may be due to the drilling depths required to intercept this water. Drilling depths of 600 to 700 feet are required to obtain water from the limestone.

1.1.1.3 Local Hydrogeology

Characterization of the local hydrogeology is based upon slug test information obtained from previous site investigations.

USATHAMA (1989) conducted single-well aquifer tests (slug tests) in the landfill area to estimate the hydraulic conductivity of the water-bearing materials underlying the site. The slug test is applicable for fully or partially penetrating wells in unconfined aquifers.

The slug tests were performed on four shallow groundwater monitor wells (PT-11, PT-12, PT-15, and PT-23) screened in the overburden and upper (weathered) portion of the bedrock and one monitor well (PT-21) that extends approximately 10 feet into the bedrock. Slug test data were analyzed according to the method developed by Bouwer and Rice (1976). The hydraulic conductivity values generated from the slug test analysis were used in conjunction with an estimate of soil porosity and the calculated groundwater flow gradient to develop an estimate for the average groundwater flow rate at the site.

Excluding PT-21, which had an extremely low hydraulic conductivity (slug-out) value of 1.66 x 10^{-7} feet per day (ft/day), the average hydraulic conductivity, as determined by the slug test analysis, was 0.587 ft/day. Typical tight clay soils have hydraulic conductivity values that range from 10^{-2} to 10^{-5} ft/day (Davis, 1969). The low value in well PT-21 is likely because this well is screened in the unweathered portion of the shale (ICF, 1989). During the slug test, little recovery of groundwater was observed in the well. The report further states that the well had yet to fully recovery after 7 days had elapsed. PT-21 is obviously not screened in a water-bearing zone, and the presence of water in the well could be attributed to leakage around the seal from the upper water-bearing zone or extremely slow recharge.

The groundwater flow gradient in the area was calculated using the distance between PT-17 and PT-18 (680 feet), located along the general direction of maximum gradient. The change in piezometric head between the two wells, as measured on October 24, 1988, was 14.8 feet. Thus, the gradient obtained for the area of interest was 2.2×10^{-2} feet per foot (ft/ft.).

The effective porosity of the aquifer was estimated to be 11 percent from typical values for silty clays and shale bedrock.

The average linear velocity of groundwater flow, calculated by USATHAMA using Darcy's law, between PT-17 and PT-18, is 1.18×10^{-6} ft/day or, 43 feet per year (ft.yr). This estimate of groundwater velocity is based on a hydraulic conductivity (2.07×10^{-4} cm/sec or 5.87×10^{-1} ft/day), the gradient measured between PT-17 and PT-18 (2.2×10^{-2}), and an estimate of the aquifer porosity (11 percent).

Data collected from the site from quarterly groundwater sampling and previous field investigations indicate that the saturated thickness of the overburden aquifer is variable, ranging between approximately 1 and 7.5 feet in monitoring well PT-17. From two years of data, the effect appears to be seasonal. The overburden aquifer is thickest during the spring recharge months and thinnest during the summer and early fall. During late fall and early winter, the saturated thickness increases. This cycle of aquifer thickness appears to be consistent with what would be expected from an understanding of the hydrologic cycle.

1.1.2 Site History

The Seneca Army Depot was constructed in 1941 and has been owned by the United States Government and operated by the Department of the Army since this time. Prior to construction of the depot, the site was used for farming.

From 1941 to 1974, uncontaminated trash was burned in a series of burn pits east of the abandoned incinerator building (Building 2207). According to an Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88 (July 1987), during approximately this same period of time (1941 until the late 1950's or early 1960's) the ash from the refuse burning pits was buried in the landfill. According to the U.S. Army Environmental Hygiene Agency (USAEHA) Solid Waste Survey (1975), a former incinerator operator stated that the burning pits were used for refuse that occasionally contained possible hazardous items.

The incinerator was built in 1974. Between 1974 and 1979, materials intended for disposal were transported to the incinerator. The incinerator was a multiple chamber, batch-fed 2 lb/hour capacity unit which burned rubbish and garbage. The incinerator unit contained an automatic ram-type feeder, a refractory lined furnace with secondary combustion and settling chamber, a reciprocating stoker, a residue conveyor for ash removal, combustion air fans, a wet gas scrubber, an induced draft fan, and a refractory-lined stack (USAEHA, 1975).

Nearly all of the approximately 18 tons of refuse generated per week on the depot were incinerated. The source for the refuse was domestic waste from depot activities and family housing. Large items which could not be burned were disposed of at the non-combustible fill landfill.

Ashes and other residues from the incinerator were temporarily disposed of in an unlined cooling pond immediately north of the incinerator building. The cooling pond consisted of an unlined depression approximately 50 feet in diameter and approximately 6 to 8 feet deep. When the pond filled (approximately every 18 months), the fly ash and residues were removed, transported, and buried in the adjacent landfill east of the cooling pond. The refuse was dumped in piles and occasionally spread and compacted. No daily or final cover was applied. The active area of the ash landfill extended at least 500 feet north at the incinerator building near a bend in a dirt road, based on an undated aerial photograph of the incinerator during operation. Parallel groves at the northernmost extent of the filled area are visible in the aerial view of the incinerator and adjacent fill area during active operation and indicate that the fill was spread using a bulldozer or similar equipment. The incinerator was destroyed by a fire on May 8, 1979, and the landfill was subsequently closed. The landfill was reported to have been capped. The landfill was apparently covered with native soils of various thicknesses but has not been closed with an engineered cover or cap.

A grease pit disposal area near the eastern boundary of the site was used for disposal of cooking grease. Evidence of burning of debris and dumping of possible solvents during the operation of the incinerator is evidenced by the areas of blackened soil, charred debris and areas of stressed or dead vegetation.

The approximately 2-acre Non-Combustible Fill Landfill southeast of the incinerator building (immediately south of the SEAD railroad line) was used as a disposal site for non-combustible materials including construction debris from 1969 until 1977.

1.1.3 Previous Investigations

Previous Investigations of the Ash Landfill site are summarized in chronological order in Table 1-2 and are summarized below.

1.1.3.1 Army Pollution Abatement Program Study (USAEHA 1979)

In 1979, a landfill leachate study (No. D-1031-W) was conducted by the USAEHA (1979) to determine the extent of leachate production and contamination caused by activities at the ash landfill site. The study included installation and sampling of monitoring wells. Six borings were advanced around the ash landfill site for the purpose of installing monitoring wells. The wells installed were PT-10, PT-11, PT-12, PT-13, PT-14, and PT-15 (wells PT-13 and PT-14 no longer exist on the site). No soil analyses were performed during the installation of these wells. The direction of groundwater flow was determined to be to the southwest, toward Seneca Lake. The six wells were sampled and analyzed for pH, conductivity, alkalinity, hardness, color, sulfate (SO_4), chloride (Cl), total solids (TS), NO_2/N, NO_3/N, total kjeldahl nitrogen (NH_3/N), eleven metals, chemical oxygen demand (COD), total organic carbon (TOC), and biological oxygen demand (BOD). Wells PT-11 and PT-12, located near the two disposal areas (i.e., the Ash Landfill and the Non-Combustible Fill Landfill), were found to contain elevated sulfates and chlorides. The study concluded that groundwater samples from wells adjacent to the two disposal areas show evidence of leachate. Maximum contaminant levels for drinking water supplies as defined in the New York State Sanitary code were exceeded for sulfate and color. It was also concluded that these contaminants affect aesthetic quality, but did not represent a health hazard. Maximum contaminant levels were not exceeded for wells downgradient from these wells. Recommendations were made to establish a monitoring program for leachate.

1.1.3.2 Installation Assessment Report (USATHAMA 1980)

Areas of known or suspected waste disposal at SEAD were delineated in an Installation Assessment (1980) performed by USATHAMA. The investigation included a records search and interviews with current and former SEAD employees. The report identified the Ash Landfill site as having potential for contaminant migration.

Between 1980 and 1987 USAEHA installed five additional groundwater monitoring wells in the area of the Ash Landfill. The wells were installed to investigate the possibility of leachate entering the groundwater. It was reported that several indicator parameters (i.e., sulfate, chloride, specific conductance) were found in the groundwater samples collected from these wells indicating that the landfill had impacted the groundwater quality. Groundwater monitoring results (1986) submitted by USAEHA found that total organic halogens (TOX) was present in a downgradient well on the Ash Landfill site.

1.1.3.3 Evaluation of SWMU's (USAEHA 1987)

In July 1987, a Groundwater Contamination Survey (No. 38-26-0868-88), was conducted by USAEHA to identify, describe, and evaluate solid waste management units at SEAD. The Ash Landfill site was identified in this report as having a potential for impacting groundwater.

Three SWMUs, (1) SEAD-3, Incinerator Cooling Water Pond; 2) SEAD-6, Abandoned Ash Landfill; and, 3) SEAD-14, Refuse Burning Pits)] were identified as being related to an off-post contamination plume.

Groundwater samples collected from wells PT-12 and PT-14 in March 1987 contained trichloroethylene and 1,2-dichloroethylene. Additional samples collected during this study contained elevated concentrations of trichloroethylene, and trans-1,2-dichloroethylene, and lower concentrations of chloroform, 1,2-dichloroethane, and vinyl chloride. It was speculated that these compounds were probably not due to the ash landfill contents but more likely associated with the refuse burning pits. Groundwater samples from three off-site wells located less than a quarter mile downgradient from the contaminated monitoring wells did not contain volatile organic compounds.

1.1.3.4 Quarterly Groundwater Monitoring (1987-1991)

Two monitoring wells (PT-16 and PT-17) were installed at the ash landfill site in September 1987 by Paratt Wolff, Inc. in order to replace the two wells (PT-13 and PT-14), which were destroyed. Additional monitoring wells (PT-18, PT-19, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, and PT-26) were installed during a geohydrologic study (No. 38-26-0313-88) conducted by USAEHA in October 1987. The study concluded that a plume with two main constituents, trichloroethylene and 1,2-dichloroethylene, was present. Less prominent compounds such as chloroform, 1,2-dichloroethane, and vinyl chloride were also detected.

Subsequent groundwater sampling events from January 1990 through December 1991 have confirmed the presence of these volatile organic compounds in the selected wells on the Ash Landfill site. Monitoring Wells PT-10 through PT-12, PT-15 through PT-18, PT-20 through PT-26 and MW-27 through MW-33 were included in the sampling program (Table 1-2). The prominent volatile organic compounds detected in wells on-site include trichloroethylene, tetrachloroethene, trans-1,2-dichloroethylene, vinyl chloride, 1,2-dichloroethane, and chloroform. Less common compounds are 1,1,1-trichloroethane, 1,1-dichloroethane and chloromethane. Wells PT-18 and PT-12 were the most severely impacted. Historical concentrations of trichloroethylene indicate considerable variation in the concentration of this compound in selected wells on-site (Figure 1-9). Generally trichloroethylene appears to be the predominant compound in the wells where volatiles were detected.

A greater amount of fluctuation in the concentration of trichloroethylene occurs in wells located near the suspected source areas for volatiles (PT-18, PT-12, PT-20, and PT-22) than in wells located farther downgradient (PT-24 and PT-28). From well monitoring logs, well PT-21 is believed to be screened in competent shale and exhibits very slow recharge and has contained significantly less trichloroethylene than its paired well, PT-22, screened in the shallow till/weathered shale aquifer.

In March 1991, trichloroethylene was detected in the hydrologically downgradient farmhouse shallow well at 1 ug/l. In September and December 1991, low concentrations of volatile organic compounds (trichloroethene, and 1,1,1-trichloroethane and trichlorofluoromethane, respectively) were detected in well PT-26, which is hydrologically downgradient of the site near the three private off-site wells at the farm house. Sampling results from December 1991 indicated that a low concentration of 1,1,1-trichloroethane was present in the barn well at the farm house. The presence of low concentrations of these compounds in these offsite downgradient offsite wells is the first in the history of the SEAD monitoring program. Historical groundwater monitoring data are included in Appendix A.

1.1.3.5 Geohydrologic Study (USAEHA 1987)

Analytical results of soil samples from eleven soil borings (BH-16, BH-17, BH-18, BH-19, BH-21, BH-24, BH-25, BH-27, BH-28, BH-29, and BH-30) during the USAEHA October 1987 study indicated that volatile organic compounds were present in the samples. Several volatile

organic compounds were detected in these samples including trichloroethylene, 1-2-dichloroethylene and vinyl chloride. The highest concentration of volatile organics was detected in BH-29, approximately 300 feet north of the incinerator building.

1.1.3.6 RI/FS (USATHMA - 1989)

ICF (1989) undertook a site investigation of the landfill area for USATHMA from September 1988 to February 1989. The scope of the site investigation included:

1. Soil sampling within the landfill area for volatile and metals analyses;
2. Groundwater sampling from 10 existing wells for volatile and metals analyses;
3. Surface water sampling;
4. Slug testing on several of the existing wells;
5. A soil-gas investigation; and
6. Terrain conductivity surveys using low-frequency electromagnetic (EM) induction and ground-penetrating radar (GPR).

The results of the investigation indicated that the landfill contained fill materials and numerous buried metal objects. Relatively high levels of volatile chlorinated compounds such as trichloroethylene, trans-1,2-dichloroethylene, and chloroform were detected in the soils. Low to moderate metals concentrations were detected in the soils. Groundwater within the landfill contains volatile chlorinated hydrocarbons at levels that appear to have caused the formation of a downgradient plume extending at least to the western limits of SEAD property. The groundwater was investigated only in the shallow aquifer extending down to competent bedrock at a depth of approximately 10 ft-bls. The results of the investigation also indicated the potential presence of additional source areas to the north of the projected limits of the landfill.

<u>Soil</u>

Soil samples were collected from seven borings (SS-01 through SS-07) and analyzed for volatiles and metals. Samples were taken at approximately 2 to 3 ft-bls. Low concentrations of 1-2-dichloroethylene were detected in one of the soil samples, however, not all samples were analyzed for the volatile organics shown to be of concern in the past. The concentrations of metals found in the soil samples suggested the metal content of the Ash Landfill Area was above background levels. Four samples were collected from the Ash

Landfill Area: SS-02, SS-03, SS-04, and SS-05. These samples contained concentrations of zinc (ranging from 33,000 μg/g in SS-05 to 350 μg/g in SS-03), lead (ranging from 620 μg/g in SS-05 to 240 μg/g in SS-02), copper (ranging from 230 μg/g in SS-05 to 68 μg/g in SS-03), chromium (ranging from 41 μg/g in SS-05 to 25 μg/g in SS-02), and cadmium (ranging from 13 μg/g in SS-02 to 2.3 μg/g in SS-04). These concentrations were all above the background levels indicated from SS-01.

Groundwater

Analytical results from November 1988 indicated that chlorinated volatile organic compounds were present on-site. As a result of the sampling, trichloroethylene, was determined to have migrated to the western boundary of the Depot at concentrations of 2.4 ug/L and 4.0 ug/L in wells PT-15 and PT-24, respectively. Concentrations of trichloroethylene decreased significantly in nearby downgradient wells, especially PT-20.

Surface Water

Surface water samples were collected from locations near the ash landfill area, including offpost sampling locations. These locations were selected along drainage ditches that flow downgradient from the landfill. Surface seeps downgradient of the landfill were also sampled.

Volatiles (trans-1,2-dichloroethylene and trichloroethylene) and metals (zinc, lead, chromium, cadmium, barium, and copper) were detected in the surface water samples. The concentrations of trans-1,2-dichloroethylene detected ranged from 110 μg/L at surface water sample SW-32 (taken in the drainage ditch approximately 100 feet west of the incinerator building) to 3.01 μg/L at SW-2 (taken in the drainage ditch approximately 800 feet west of the SEAD boundary fence). Concentrations of trichloroethylene detected ranged from 50 μg/L at SW-32 to 12.3 μg/L at SW-4, located in the surface water seep area, approximately 700 feet west of the SEAD boundary fence.

Most samples analyzed for metals were collected offpost. Only one onpost sample was analyzed for metals. Surface water sample SW-10, collected just east of the SEAD boundary fence, had concentrations of metals above detection limits: 23.6 μg/L of zinc and 24.9 μg/L of barium.

Surface water analyses indicate that impacts may extend offpost in surface drainage systems and surface water seeps. The offpost surface water impacts was believed to be due to groundwater seepage to the surface and not as a direct result of surface water flow.

Geophysics

ICF (1989) completed a geophysical survey at the site in October and November 1988 with the following objectives:

1. To detect and delineate the presence and/or absence of buried metal within the landfill, grease pit, and ash pit areas;
2. To determine if the buried metal could be drums or other likely contaminant sources;
3. To correlate with the soil gas survey to determine the location and extent of contamination sources and migration pathways; and
4. To scan areas selected for the soil gas survey for buried metal (e.g., drums) and utilities, so that the soil gas probe would not encounter such items.

To meet these objectives, the EM induction technique, commonly referred to as terrain conductivity, and GPR were used. The EM survey, completed with the Geonics EM-31DL Terrain Conductivity Meter, was used for the majority of the surveillance and locating efforts and for surveying of all gridded portions of the site. GPR was used at selected locations to determine whether buried metal targets would yield container-like signatures and to provide better depth discrimination needed to clear areas for the soil gas survey.

Field measurements were made along a survey grid on 50-foot centers in the landfill, ash pit, and grease pit portions of the site and on 100-foot centers in the portion of the site downgradient from the landfill. EM measurements were made every 20 feet along each 50-foot and 100-foot survey line in the north-south and east-west directions.

EM anomalies, indicating buried metal, occurred on the northernmost original survey line. Therefore, the survey grid was extended along the northern end of the landfill by 100 feet. To establish continuity between the two areas, the survey lines were also extended from the grease pit area into the landfill and ash pit gridded areas. EM readings were taken in the north-south direction. EM readings ranged from 0 to 120 millimhos per meter (mmhos/m) and were contoured with 20-mmhos/m increments. This contour map indicated a buried water line, located in the area trending from east to west past the incinerator building. The

contours also identified the extent of the landfill extended to the north, outside of the survey area. The grease pit area, located in the eastern portion of the plot, did not exhibit significant changes in conductivity readings; therefore, it probably did not contain buried metal or other landfilled materials similar to those observed adjacent to the incinerator.

A map, based on the interpretation of the EM data, shows where buried metal is believed to be located (ICF, 1989). Although the form of individual objects could not be determined from the data, it appears that buried metal is scattered throughout the landfill area, generally being concentrated along the J, K, L, and M survey lines. Further information on the identity of the buried metal was provided by interpretation of the GPR survey data.

Generally, the GPR survey confirmed the existence of buried metal in areas identified by the EM survey. The GPR data provide a variety of signatures and particular patterns characteristic of typical landfilled and buried objects. In some areas, GPR signatures indicated the possible presence of buried drums. However, these signatures could also be produced by cylindrical objects other than drums, such as pipes, cables, or sections of culvert. Correlation of the GPR target locations with the metal signatures from the EM surveys shows that the objects are most likely metallic.

Detection Sciences, Inc. (1990), under the supervision of ESE, completed a geophysical survey at the site in October 1989. In the previous geophysical survey conducted by ICF in October and November 1988, which encompassed the ash landfill area and burning pits, geophysical anomalies were observed along the northern boundary of the survey grid. Based on these results, it was necessary to extend the investigation further north to delineate these anomalies.

The ESE geophysical survey (Hunter/ESE, 1989) overlapped the 1988 ICF survey by two east-west trending survey lines. Originally, the ESE grid was designed to extend the ICF grid by 360 feet to the north before the site was cleared of brush and small trees in preparation for the geophysical survey. After the proposed grid area was cleared, an ash pile was identified on the surface east of the original grid. The grid was then extended to the east to include this area by shortening the northern reach to 310 feet.

The geophysical program included both quadrature and in-phase EM measurements. The quadrature and in-phase EM anomalies correspond well to the features observed on the surface. The quadrature-phase or 90-degree component is linearly proportional to the earth's

conductivity, whereas the in-phase or 180° component is extremely sensitive to high-conductivity objects such as buried metal. The 180° component allows better detection of buried metal where the soils are highly conductive. The correlation between the in-phase and quadrature-phase contours allowed excellent delineation of metallic objects. Good correlation of the two data sets was expected, because background soils consist of relatively resistant non-conductive silt and weathered shale, and the debris areas contain an abundance of metallic objects. Therefore, the background conductivities were resistive enough so that the metallic anomalies were evident.

The GPR survey was based of the field plots of the EM anomalies. Due to wet, soft soil conditions in the northwestern portion of the survey area, the geophysics team was unable to maneuver the survey van close enough to this area to allow hand-pulling of the GPR antenna over the area previously shown to have EM anomalies. In the remainder of the areas where the EM showed anomalous values, GPR also showed evidence of disrupted earth and/or the presence of metals. GPR was operated with a 120 megahertz (MHz) antenna, rendering it functionally blind by the transmit/receive pulse at the start of each scan. Consequently, the data did not show the conditions in the upper 3 feet of the subsurface. Because of this blind zone, GPR was unable to distinguish any shallow buried material from any surface dumping.

As reported by Detection Sciences, Inc. (1990), the GPR signatures within the burial/debris areas were remarkably homogeneous, indicating that the various anomalies contained relatively similar mixes of metals and nonmetals. In general, a busy radar signature indicates the burial of solid waste materials. No radar signatures indicating the presence of intact drums were observed. The ability of GPR to identify drums is based on buried targets having the size, shape, and characteristics of a buried drum (Detection Sciences, Inc., 1990). To the radar, a crushed drum is simply a piece of scrap metal and is not identifiable as a drum.

In general, the radar (GPR) contour map indicates what appears to be normal soil horizons, or background conditions, over the majority of the survey lines. Several small ash mounds were observed during the investigation. The geophysical data collected indicated that the surface piles did not contain buried debris and did not penetrate the surface.

Soil Gas

Target Environmental Services, Inc. (TES), under supervision of ICF, conducted a soil gas survey at SEAD in October and November 1988 (ICF, 1989). The primary objective of the soil gas survey was to provide indications of likely source locations within the landfill area and to correlate the geophysical survey data. This information was used to determine the best locations for subsequent soil sampling. Secondary objectives of the survey were to investigate downgradient contaminant migration patterns in relation to existing monitor well locations and to determine whether the underground diesel fuel tank adjacent to the incinerator building was leaking.

Soil gas sampling was performed across the survey grid established at the onset of the field investigation. Initially, approximately 80 samples were collected from points spanning the entire grid, with greater focus on the suspected areas of the landfill. Samples were collected from the following areas:

1. The underground diesel fuel tank and in the vicinity of boring hole BH-29, where free-floating material had been reported (USAEHA Geohydrologic Study No. 38-26-0313-88);
2. The grease pits east of the landfill area; and
3. Within the former cooling pond.

The soil gas grid and sampling locations were extended farther to the north than originally planned because the geophysical survey detected buried metal in that direction and because of positive soil gas results along the north side of the landfill. The grid was also expanded to the west because volatile constituents were previously detected in groundwater samples taken near the western SEAD boundary. Soil gas provided a screening technique to determine whether the apparent contamination was localized or was associated with groundwater contamination from the landfill. The density of sampling in the downgradient (western) direction was increased to encompass all 100-foot grid points west of the landfill.

Soil gas sample analysis on a portable gas chromatograph revealed elevated hydrocarbon concentrations primarily in the central portion of the survey area. The highest total volatiles levels were detected north of the incinerator building, at station K-6. A compound with an elution time near that of toluene accounts for essentially all of the remaining volatiles measured on the site, outside of the K-6 area. The local anomaly at K-6 reflected the

occurrence of a nonstandardized light (volatile) hydrocarbon. Low concentrations of trichloroethylene and trans-1,2-dichloroethylene were measured on the western half of the site, coinciding with the points of highest total volatiles concentrations. During removal of the steel probe used in the soil gas technique, a liquid substance was observed. Soil gas samples from this location (K-6 and K-8), were sent to the TES laboratory for overnight analysis. Gas chromatography (GC) analysis indicated the presence of typical diesel fuel or kerosene constituents and a wide variety of volatile chlorinated species in these samples. Eight other locations directly surrounding this area were then sampled. These samples showed significantly reduced photoionization detector (PID) readings and levels of volatiles in the field GC analysis, indicating that the incident involved a localized source of contaminants.

1.1.4 Conceptual Site Model

1.1.4.1 Physical Site Characterization

The Ash Landfill site is located on the western slope of a topographic high between Seneca Lake and Cayuga Lake. The area is covered with low lying shrubs and grasses. The area is dominated by the presence of the former incinerator stack and adjacent buildings which are in various stages of deterioration. The upper portions of soil at this site is classified as silty loam which is poorly drained. Underlying the upper soil horizon is unsorted glacial till. This till contains a high degree of fines and is also considered to be poorly drained. Sill thicknesses are generally thin ranging from 1 to 6 feet.

The extent of the former Ash Landfill is not well defined, however, a low lying mound is apparent along a road which traverses the site. The former cooling pond is apparent and is situated adjacent to both the former incinerator and the grass covered ash landfill.

At the eastern portion of the site, at the intersection of two access roads is the former non-combustion debris landfill. The western toe of this landfill is clearly evident since the rise in mound elevation over the surrounding land is 10 to 15 feet. The eastern portion is not apparent since the landfill extent merges with the normal ground slope. No other noticeable ground features is apparent at this landfill.

1.1.4.2 Chemical Characterizations

The chemical constituents of concern at this site is volatile organic compounds, notably trichloroethene, dichloroethene, vinyl chloride, and chloroform. Biotic and abiotic transformation of trichloroethene in groundwater has been shown to occur. The sequence of trichloroethene degradation includes the formation of chlorinated breakdown products such as dichloroethene and vinyl chloride. The occurrence of trichloroethene breakdown products in downgradient wells is considered to be evidence of these transformation mechanisms.

Integration of existing groundwater quality data with hydrologic flow characteristics and monitoring well locations provides evidence that a groundwater plume is emanating from an area consistent with suspected source areas. Although the general source area can be inferred, little information has been obtained which would allow a definition of this source.

1.2 OFF-SITE WELL INVENTORY

Eleven private homes with private drinking water wells were identified within a one-mile radius of the abandoned incinerator building on the site (Figure 1-10.). The wells, all of which are west of the site, were located on a map showing private drinking water well locations provided by SEAD. The nearest location with wells is a farmhouse located approximately 2,400 feet west of the incinerator building (1600 feet from the westernmost boundary of the site) on West Smith Farm Road. The house has three wells on the premises including: 1) a deep farmhouse well (center), 2) a shallow farmhouse well (corner) and 3) a barn well. A well is also located directly across West Smith Farm Road from these farmhouse wells. Another off-site well is located approximately 4,000 feet southwest of the incinerator building near the Seneca Army Airfield. The remaining homes with wells within a one-mile radius are located approximately 5,000 feet northwest of the incinerator building along Route 96A and Kendaia Creek.

1.3 REPORT ORGANIZATION

The remaining sections of this report are organized to describe the investigation programs, the results of the data collected during the RI and to identify the magnitude and extent of constituents.

Section 2.0 (Study Area Investigation) presents a description of the important site features, characteristics, sources of contamination and discusses the investigation programs (i.e., geophysical, surface water and sediment, soils, soil gas, groundwater, ecological and incinerator dust) used during the RI. Section 3.0 discusses the results of the investigation programs. Specifically, surface features, surface water hydrology and sediments, geology and hydrogeology and ecology are discussed. The nature and extent of contamination on- and off-site is discussed in Section 4.0. Appendices are included in a separate volume and contain the data on which the text and conclusions are based.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-1
AVERAGE BACKGROUND CONCENTRATIONS
FOR ROCKS, SOILS, AND SEDIMENTS

	SHALE	SANDSTONE	LIMESTONE	SOILS	SEDIMENT*
As	15	1	2.5	5	12
Ba	700	50	100	500	NA
Cd	0.2	<0.1	0.1	1	2.5
Cr	100	35	10	50	75
Hg	0.5	0.07	0.05	0.03	0.0
Pb	40	7	8	20	55
Se	0.6	NA	0.08	0.2	NA

Source: Levinson, 1980, unless otherwise noted.
All concentrations as total metals in ppm
Values are an average of samples from Earth's crust, which can vary significantly.
*From MOE (1988): upper 95% confidence limit of pre-industrial concentrations in Great Lakes sediments.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-2
SUMMARY OF PREVIOUS SAMPLING AND SITE INVESTIGATIONS

DATE	REPORT	AGENCY/ CONSULTANT	PROGRAM DESCRIPTION
July-August 1979	Army Pollution Abatement Program Study No. D-1031-W Landfill Leachate Study No. 81-26-8020-81	USAEHA	Groundwater contamination study. Installation of wells PT-10, PT-11, PT-12, PT-13, PT-14, PT-15
Jan. 1980	Installation Assessment of Seneca Army Depot Report No. 157	USATHAMA	Initial installation assessment recognized former incinerator and ash landfill as having potential for ground contamination
1986	Groundwater Monitoring Results for Seneca Army Depot	USAEHA	Sampling of wells on ash landfill site
July 1987	Interim Final Report Groundwater Contamination Survey No. 35-26-0568-88 Evaluation of Solid Waste Management Units	USAEHA	Identifies, describes, and evaluates solid waste management units at SEAD, including the ash landfill site
August 1987	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-12, PT-14, PT-15, Farm House Deep, Farm House Shallow, and Barn wells
Sept. 1987	Groundwater Monitoring Well Installation	Paratt Wolff, Inc.	Installation of wells PT-16 and PT-17
Oct. 1987	Geohydrologic Study No. 38-26-0313-88	USAEHA	Installation of wells PT-18, PT-19, PT-20, PT-22, PT-23, PT-24, PT-25, PT-26
Nov. 1987	Groundwater Sampling	Galson Laboratories	Sampling of Farm House Deep, Farm House Shallow and Barn wells at Shaw residence

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-2
SUMMARY OF PREVIOUS SAMPLING AND SITE INVESTIGATIONS
(CONTINUED)

DATE	REPORT	AGENCY/ CONSULTANT	PROGRAM DESCRIPTION
March 1988	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-10, PT-11, PW-12, PT-15, PT-16, PT-17, PT-18, PT-19, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
April 1988	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-10, PT-11, PT-12, PT-15, PT-16, PT-17
August 1988	Update of the Initial Installation Assessment of the Seneca Army Depot	USATHAMA	Summarizes groundwater studies at the Ash Landfill Site. Continued groundwater monitoring is planned
Oct. 1988	Groundwater Sampling	CS Environmental Laboratory, Inc.	Sampling of wells Farm House Deep, Farm House Shallow, and Barn wells
Nov. 1988	Groundwater Sampling	CS Environmental Laboratory, Inc.	Sampling of Farm House Deep, Farm House Shallow, and Barn wells
1988	Site Investigation	ICF, Inc.	Geophysical survey (EM and GPR) of the landfill and burning pit areas
Jan. 1989	Groundwater Sampling	CS Environmental Laboratory, Inc.	Sampling of wells Farm House Deep, Farm House Shallow, and Barn wells
March 1989	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-12 and PT-17
Sept. 1989	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-10, PT-11, PT-12, PT-15, PT-16, and PT-17
Sept. 1989	Groundwater Sampling	Galson Laboratories	Sampling of wells PT-12 and PT-17

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-2
SUMMARY OF PREVIOUS SAMPLING AND SITE INVESTIGATIONS
(CONTINUED)

DATE	REPORT	AGENCY/ CONSULTANT	PROGRAM DESCRIPTION
Nov. 1989	Geohydrologic Study No. 38-26-K928-90	USAEHA	Installation of 7 additional monitoring wells MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, and MW-33
March 1989	Remedial Investigation Feasibility Study	USATHAMA/ICF, Inc.	The Site Investigation included a soil gas survey by Target, EM and GPR surveys, soil samples, slug testing, and groundwater samples from 10 existing wells
1989	Site Investigation	Hunter/ESE	Geophysical survey (EM and GPR) of the northern portion of landfill site
Jan. 1990	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells PT-26, MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25 Farm House Deep, Farm House Shallow, and Barn wells
March, April 1990	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-2
SUMMARY OF PREVIOUS SAMPLING AND SITE INVESTIGATIONS
(CONTINUED)

DATE	REPORT	AGENCY/ CONSULTANT	PROGRAM DESCRIPTION
June 1990	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
Sept. 1990	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
Dec. 1990	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
March 1991	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of wells MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-12, PT-17, PT-18, PT-20, PT-21, PT-22, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
May 1991	RI/FS Work Plan	ESE	

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 1-2
SUMMARY OF PREVIOUS SAMPLING AND SITE INVESTIGATIONS
(CONTINUED)

DATE	REPORT	AGENCY/ CONSULTANT	PROGRAM DESCRIPTION
June 1991	Groundwater Analyses	National Environmental Testing, Inc.	Sampling of MW-27, MW-28, MW-29, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow, and Barn wells
September 1991	Groundwater Analysis	National Environmental Testing, Inc.	Sampling of MW-27, MW-28, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26, Farm House Deep, Farm House Shallow and Barn Wells
December 1991	Groundwater Sampling	National Environmental Testing, Inc.	Sampling of MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, PT-10, PT-11, PT-12, PT-15, PT-16, PT-17, PT-18, PT-20, PT-21, PT-22, PT-23, PT-24, PT-25, PT-26 Farm House Deep, Farm House Shallow, and Barn Wells

FIGURE 1-1

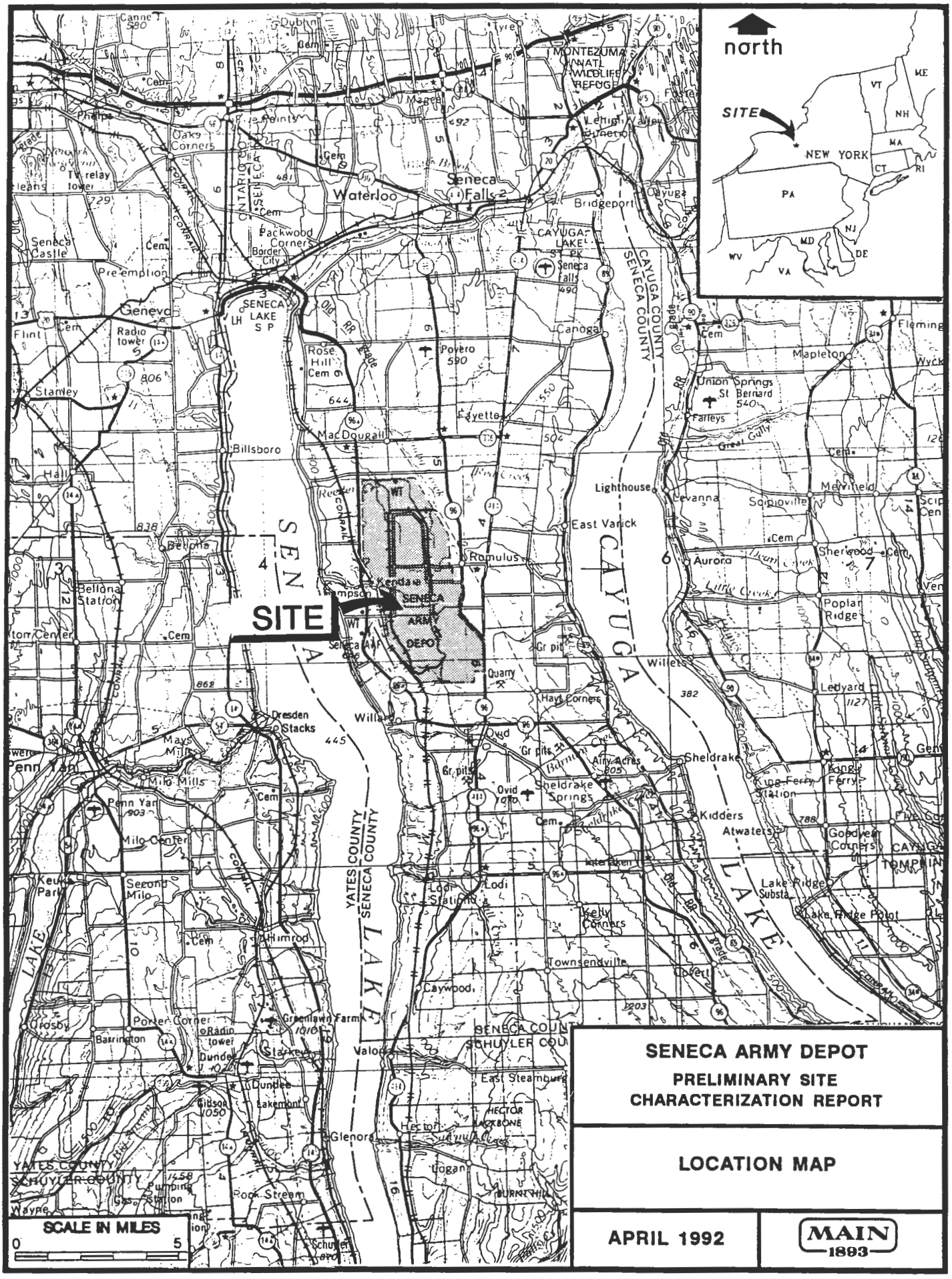
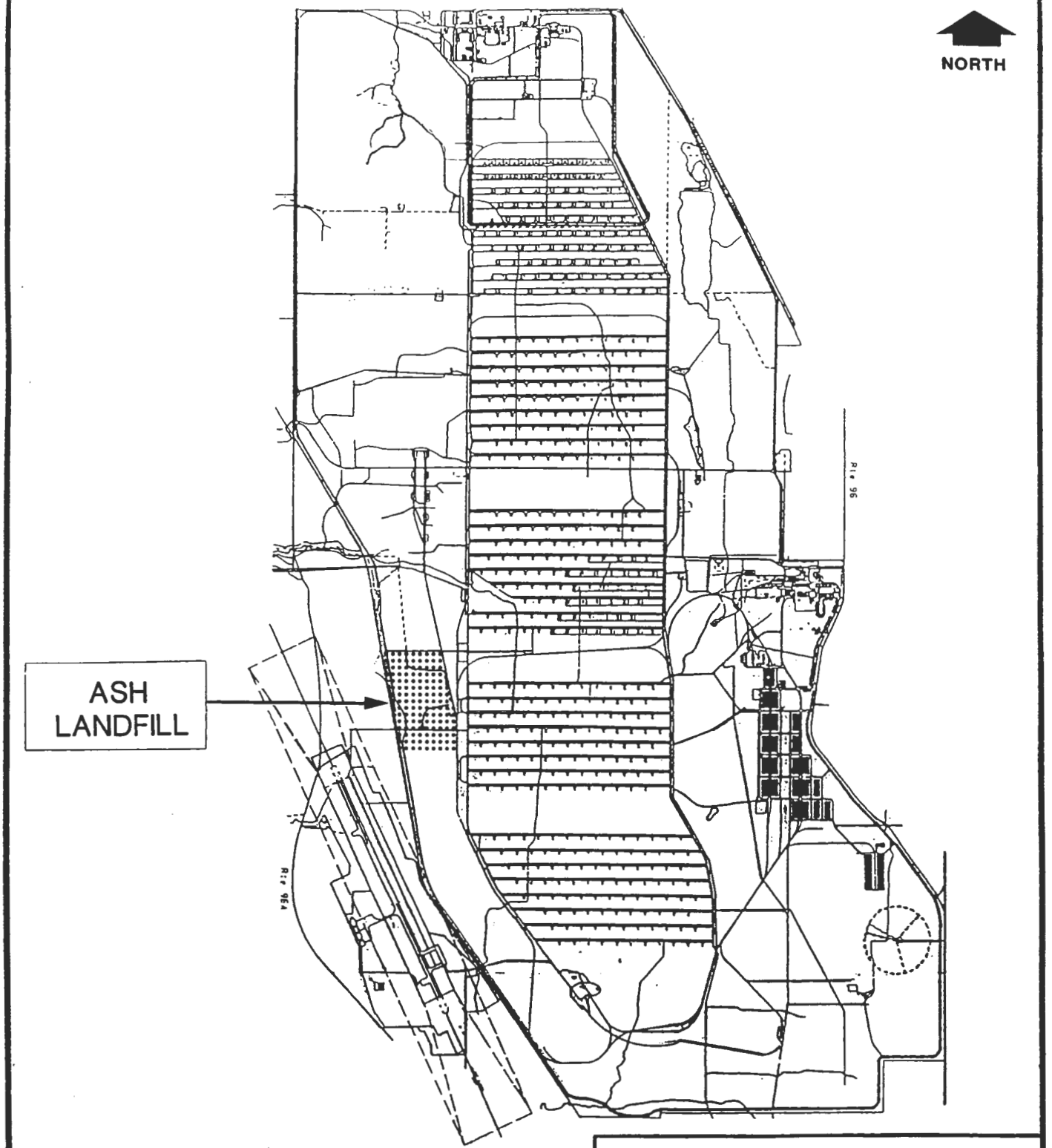

north
SITE
ME
VT
NH
MA
NEW YORK
CT
RI
PA
NJ
MD
DE
WV
VA
SITE
SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT
LOCATION MAP
APRIL 1992
MAIN 1893
SCALE IN MILES
0
5
SENECA LAKE
CAYUGA LAKE
SENECA COUNTY
CAYUGA COUNTY
YATES COUNTY
SCHUYLER COUNTY
TOMPKINS
Waterloo
Seneca Falls
Geneva
Romulus
Ovid
Lodi
Hector
Dundee
Montezuma (Natl Wildlife Refuge)
Seneca Army Depot

FIGURE 1-2



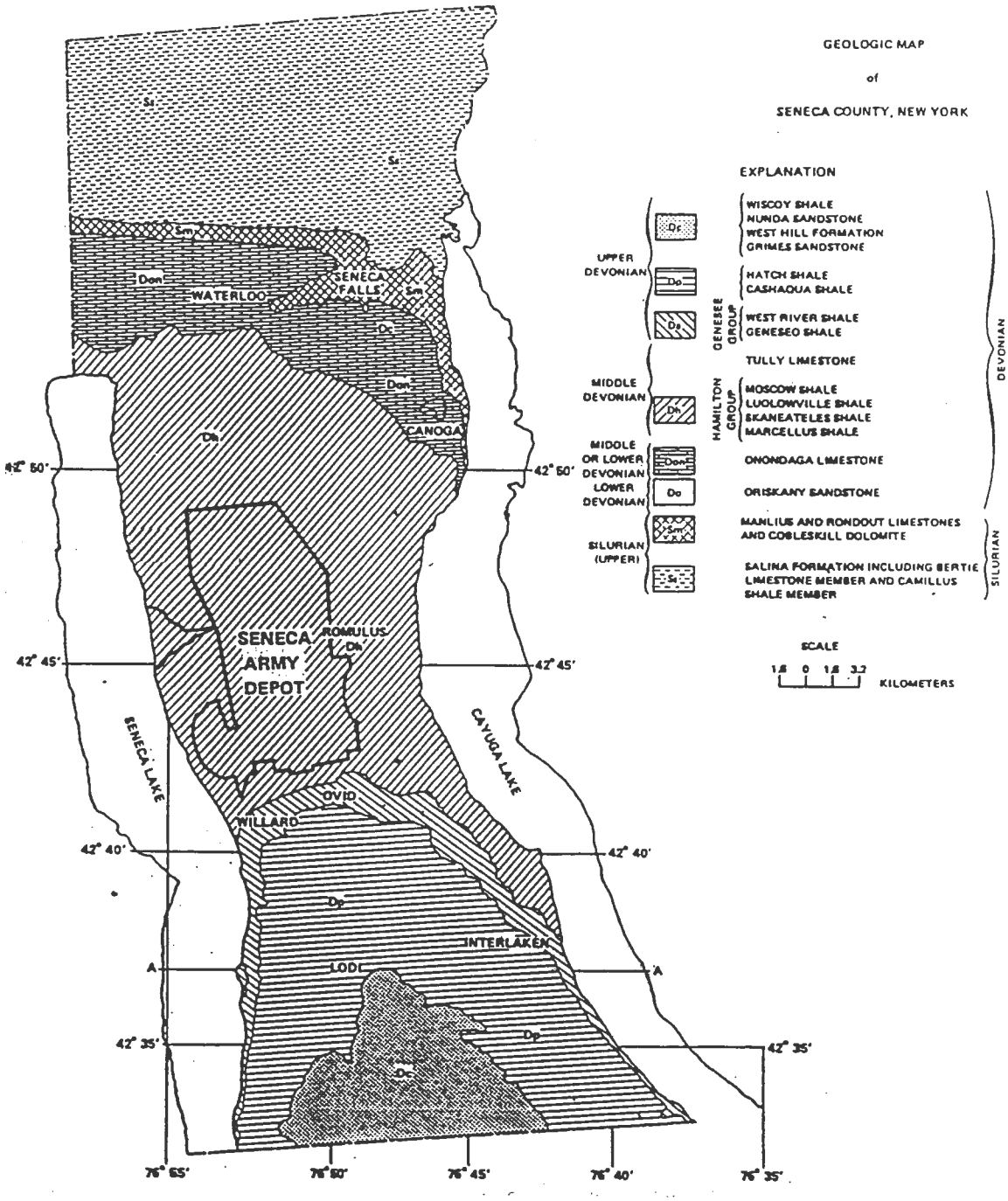
SENECA ARMY DEPOT
PRELIMINARY SITE
CHARACTERIZATION REPORT

SITE PLAN

APRIL 1992

MAIN
1893

NORTH



SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

GEOLOGIC MAP OF SENECA COUNTY

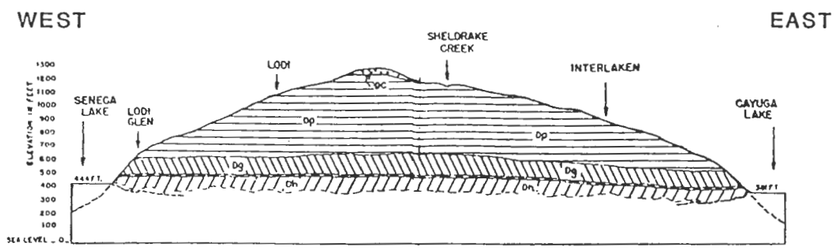
APRIL 1992

MAIN 1893

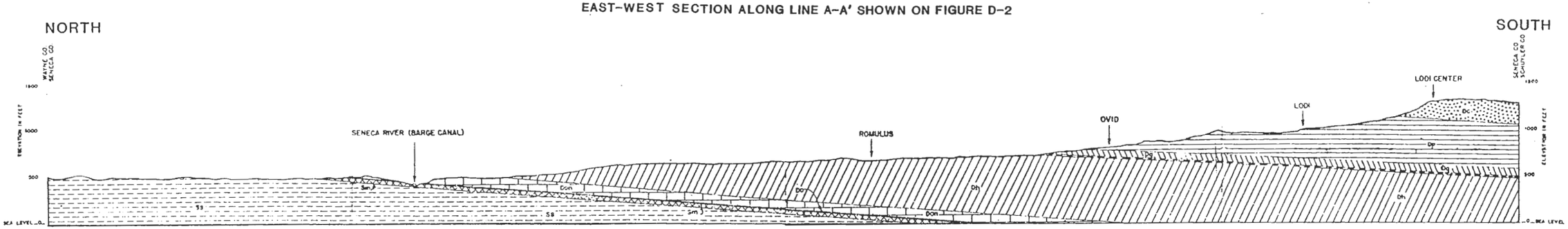
UNITED STATES GEOLOGICAL SURVEY

NEW YORK WATER POWER AND CONTROL COMMISSION

GEOLOGIC SECTIONS ACROSS SENECA COUNTY, NEW YORK



EAST–WEST SECTION ALONG LINE A–A′ SHOWN ON FIGURE D–2



NORTH–SOUTH SECTION ALONG LONGITUDE 76°50′ LINE B–B′ ON FIGURE D–2

EXPLANATION

DEVONIAN

- WISCOY SHALE
- NUNDA SANDSTONE
- WEST HILL FORMATION
- GRIMES SANDSTONE
- HATCH SHALE
- CASHAQUA SHALE
- WEST RIVER SHALE
- GENESEO SHALE

MIDDLE DEVONIAN — HAMILTON GROUP

- TULLY LIMESTONE
- MOSCOW SHALE
- LUDLOWVILLE SHALE
- SKANEATELES SHALE
- MARCELLUS SHALE

MIDDLE OR LOWER DEVONIAN

- ONONDAGA LIMESTONE

LOWER DEVONIAN

- ORISKANY SANDSTONE

SILURIAN (UPPER)

- MANLIUS AND RONDOUT LIMESTONES AND COBLESKILL DOLOMITE
- SALINA FORMATION INCLUDING BERTIE LIMESTONE MEMBER AND CAMILLUS SHALE MEMBER

SILURIAN

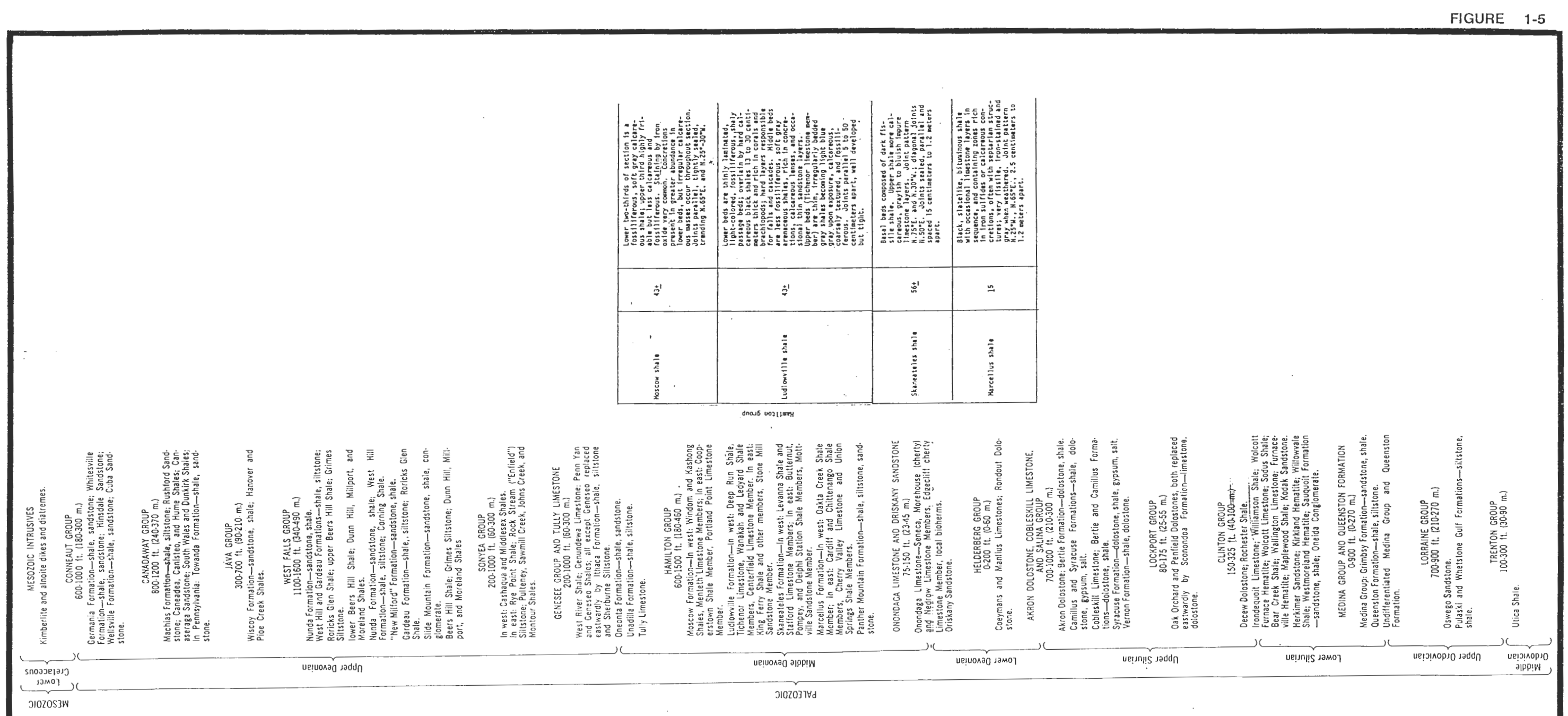
SENECA ARMY DEPOT PRELIMINARY SITE CHARACTERIZATION REPORT

REGIONAL GEOLOGY CROSS SECTIONS

SCALE

0 1 2 3 MILES

MAIN 1893



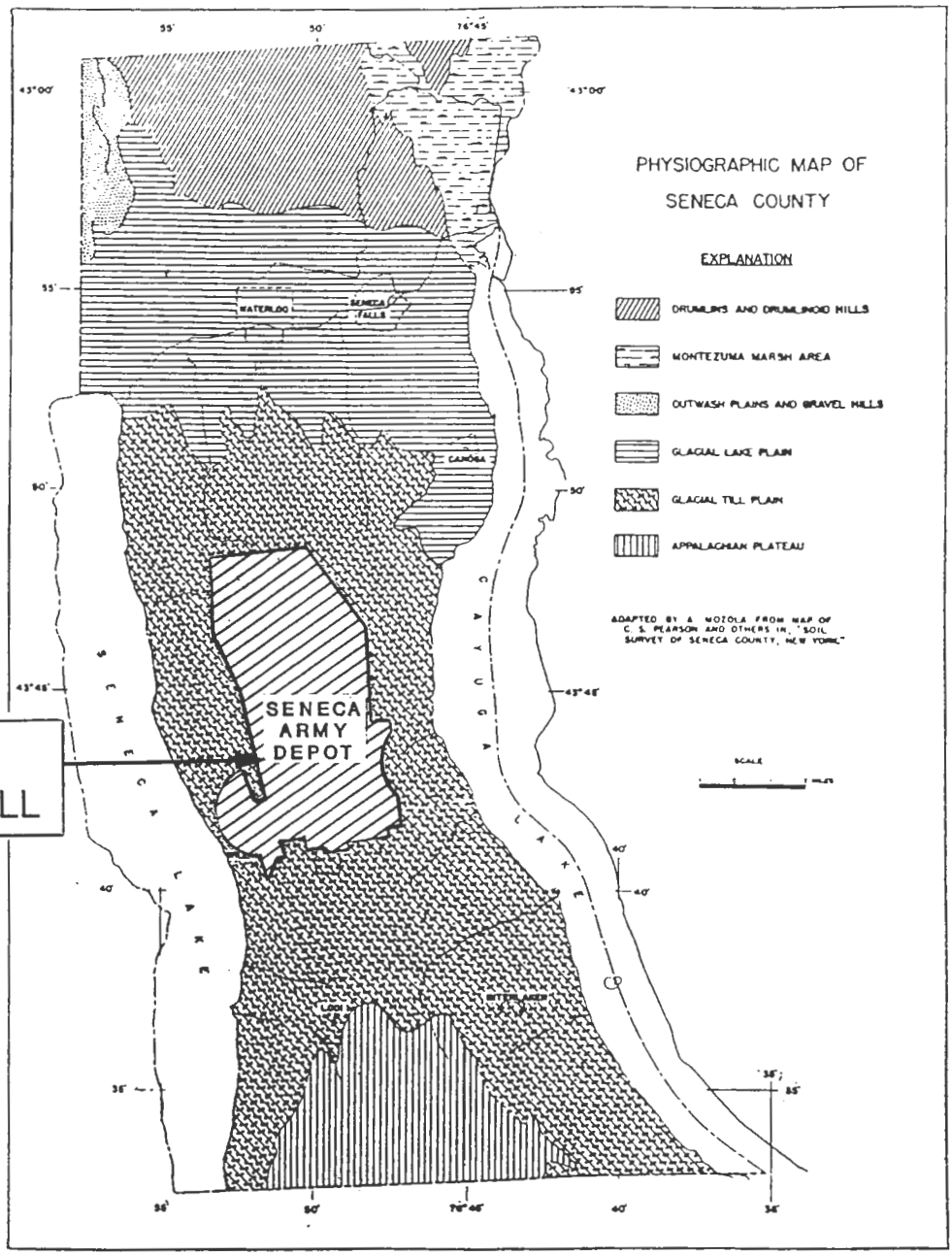
SOURCE: RICKARD AND FISHER
GEOLOGIC MAP OF NEW YORK,
FINGER LAKES SHEET, 1970

SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

BEDROCK STRATIGRAPHIC COLUMN

APRIL 1992

MAIN
1893



SOURCE: The Groundwater Resources of Seneca County, New York; Mozola, A.J., Bulletin GW-26, Albany, NY, 1951

SENECA ARMY DEPOT
THE PHYSIOGRAPHIC MAP OF SENECA COUNTY
FIGURE 1-6 APRIL 1992

MAIN
1893
CHAS. T. MAIN, INC., Engineers
BOSTON . NEW YORK . CHARLOTTE . PORTLAND

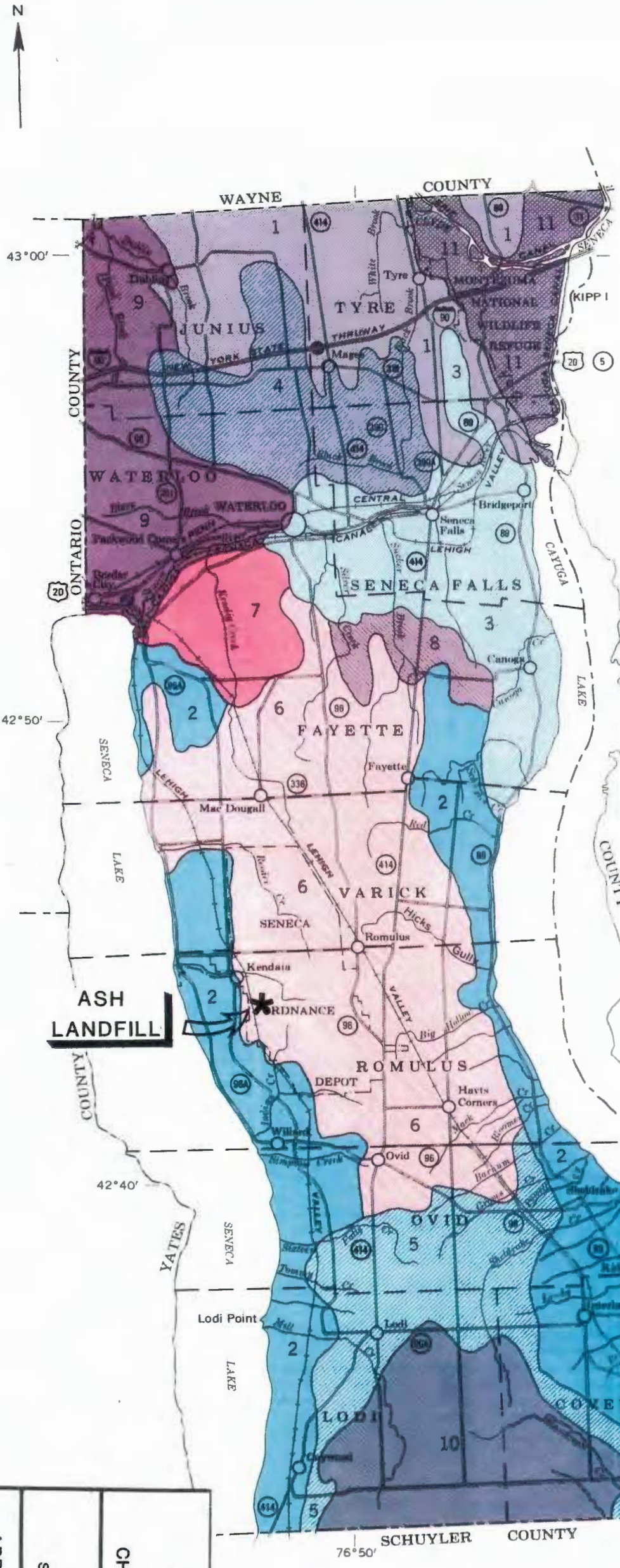
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

SENECA COUNTY, NEW YORK

Scale 1:190,080

1 0 1 2 3 4 Miles



SOIL ASSOCIATIONS

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL TILL

1 — Ontario-Ovid association: Deep, well-drained to somewhat poorly drained soils that have a loam to silty clay loam subsoil

2 — Honeoye-Lima association: Deep, well drained and moderately well drained soils that have a heavy silt loam to heavy loam subsoil

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

3 — Schoharie-Odessa association: Deep, well-drained to somewhat poorly drained soils that have a silty clay loam to clay subsoil

4 — Odessa-Lakemont association: Deep, dominantly somewhat poorly drained and poorly drained soils that have a silty clay loam to silty clay subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL TILL

5 — Conesus-Lansing association: Deep, moderately well drained and well drained soils that have a heavy silt loam to heavy loam subsoil

6 — Darien-Angola association: Deep and moderately deep, somewhat poorly drained soils that have a silty clay loam and clay loam subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

7 — Dunkirk-Collamer association: Deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil

8 — Dunkirk-Cazenovia association: Moderately deep and deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil that overlies limestone

9 — Arkport-Claverack association: Deep, dominantly well drained and moderately well drained soils that are loamy fine sand and fine sandy loam throughout or that have a loamy fine sand subsoil over silty clay or clay

AREAS DOMINATED BY LOW-LIME SOILS DEVELOPED IN GLACIAL TILL

10 — Langford-Erie association: Deep, moderately well drained and somewhat poorly drained soils that have a channery silt loam to channery loam fragipan

AREAS DOMINATED BY SOILS DEVELOPED IN ORGANIC MATERIAL

11 — Muck-Peat-Fresh Water Marsh association: Deep to shallow, very poorly drained organic soils

February 1971

NOTE—
This map is intended for general planning. Each delineation may contain soils having ratings different from those shown on the map. Use detailed soil maps for operational planning.

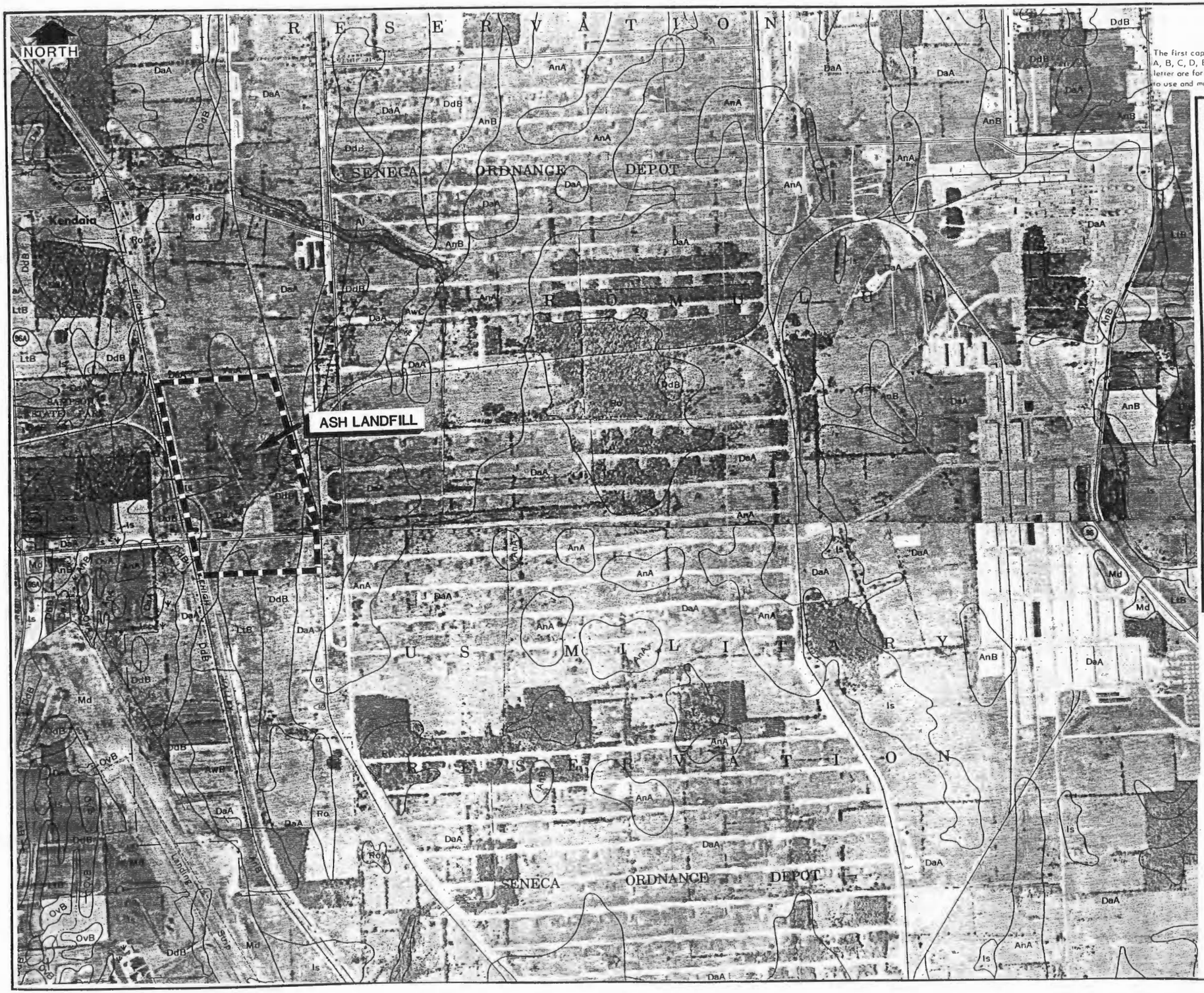
SENECA ARMY DEPOT
PRELIMINARY SITE
CHARACTERIZATION REPORT

GENERAL SOIL MAP
SENECA COUNTY, NEW YORK

APRIL 1992

MAIN 1893

FIGURE 1-7



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, is a general guide to the slope class. Symbols without a slope letter are for those miscellaneous land types or soils where slope is not significant to use and management. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ac	Alden mucky silt loam
Ad	Alden mucky silt loam, till substratum
Al	Alluvial land
AnA	Angola silt loam, 0 to 3 percent slopes
AnB	Angola silt loam, 3 to 8 percent slopes
AoA	Appleton gravelly silt loam, 0 to 3 percent slopes
AoB	Appleton gravelly silt loam, 3 to 8 percent slopes
ApA	Appleton silt loam, 0 to 3 percent slopes
ApB	Appleton silt loam, 3 to 8 percent slopes
ArB	Arkport loamy fine sand, 1 to 6 percent slopes
ArC	Arkport loamy fine sand, 6 to 12 percent slopes
ArD	Arkport loamy fine sand, 12 to 20 percent slopes
AuD	Arnot channery silt loam, 15 to 25 percent slopes
AwB	Aurora silt loam, 3 to 8 percent slopes
AwC	Aurora silt loam, 8 to 15 percent slopes
AwD	Aurora silt loam, 15 to 25 percent slopes
AzF	Aurora and Farmington soils, 25 to 75 percent slopes
Co	Canandaigua silt loam
CeB	Cazenovia silt loam, 3 to 8 percent slopes
CeB3	Cazenovia silt loam, 3 to 8 percent slopes, eroded
CeC	Cazenovia silt loam, 8 to 15 percent slopes
CeC3	Cazenovia silt loam, 8 to 15 percent slopes, eroded
ChD	Cazenovia soils, 15 to 25 percent slopes
ChE	Cazenovia soils, 25 to 40 percent slopes
CkA	Claverack loamy fine sand, 0 to 2 percent slopes
CkB	Claverack loamy fine sand, 2 to 6 percent slopes
ClA	Collamer silt loam, 0 to 2 percent slopes
ClB	Collamer silt loam, 2 to 6 percent slopes
ClC	Collamer silt loam, 6 to 12 percent slopes
CoA	Collamer silt loam, moderately shallow variant, 0 to 2 percent slopes
CoB	Collamer silt loam, moderately shallow variant, 2 to 6 percent slopes
CsA	Conesus gravelly silt loam, 0 to 3 percent slopes
CsB	Conesus gravelly silt loam, 3 to 8 percent slopes
Cu	Cosad loamy fine sand
DaA	Darien silt loam, 0 to 3 percent slopes
DdB	Darien-Danley-Cazenovia silt loams, 3 to 8 percent slopes
DuB	Dunkirk silt loam, 1 to 6 percent slopes
DuC3	Dunkirk silt loam, 6 to 12 percent slopes, eroded
DuD	Dunkirk silt loam, 12 to 20 percent slopes
DwB	Dunkirk silt loam, limestone substratum, 1 to 6 percent slopes

SOURCE:

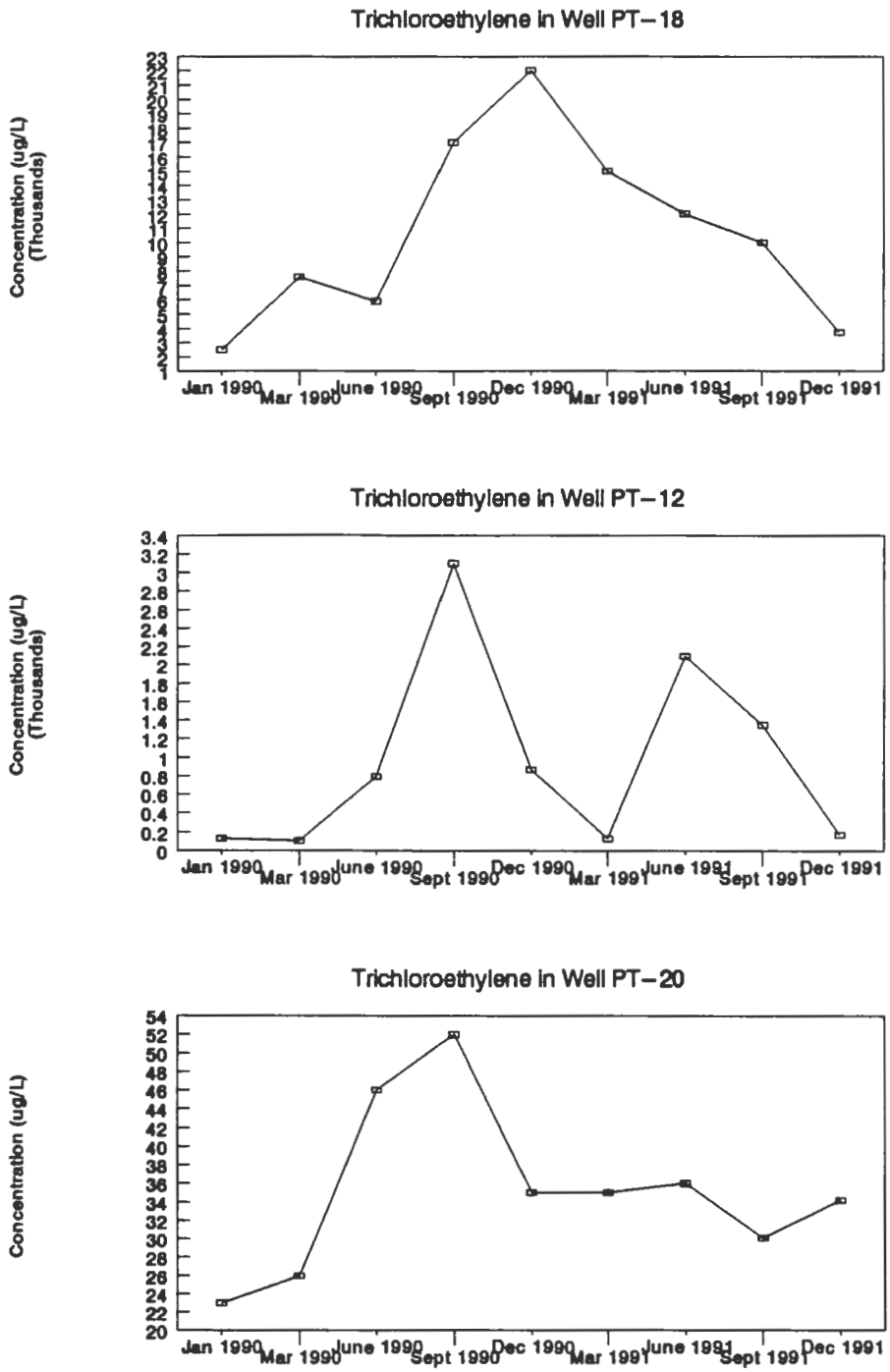
U.S. DEPT. OF AGRICULTURE SOIL SURVEY,
SENECA COUNTY , NEW YORK
APRIL , 1972

SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

SURFICIAL SOIL MAP FOR ASH LANDFILL

APRIL 1992

MAIN 1893

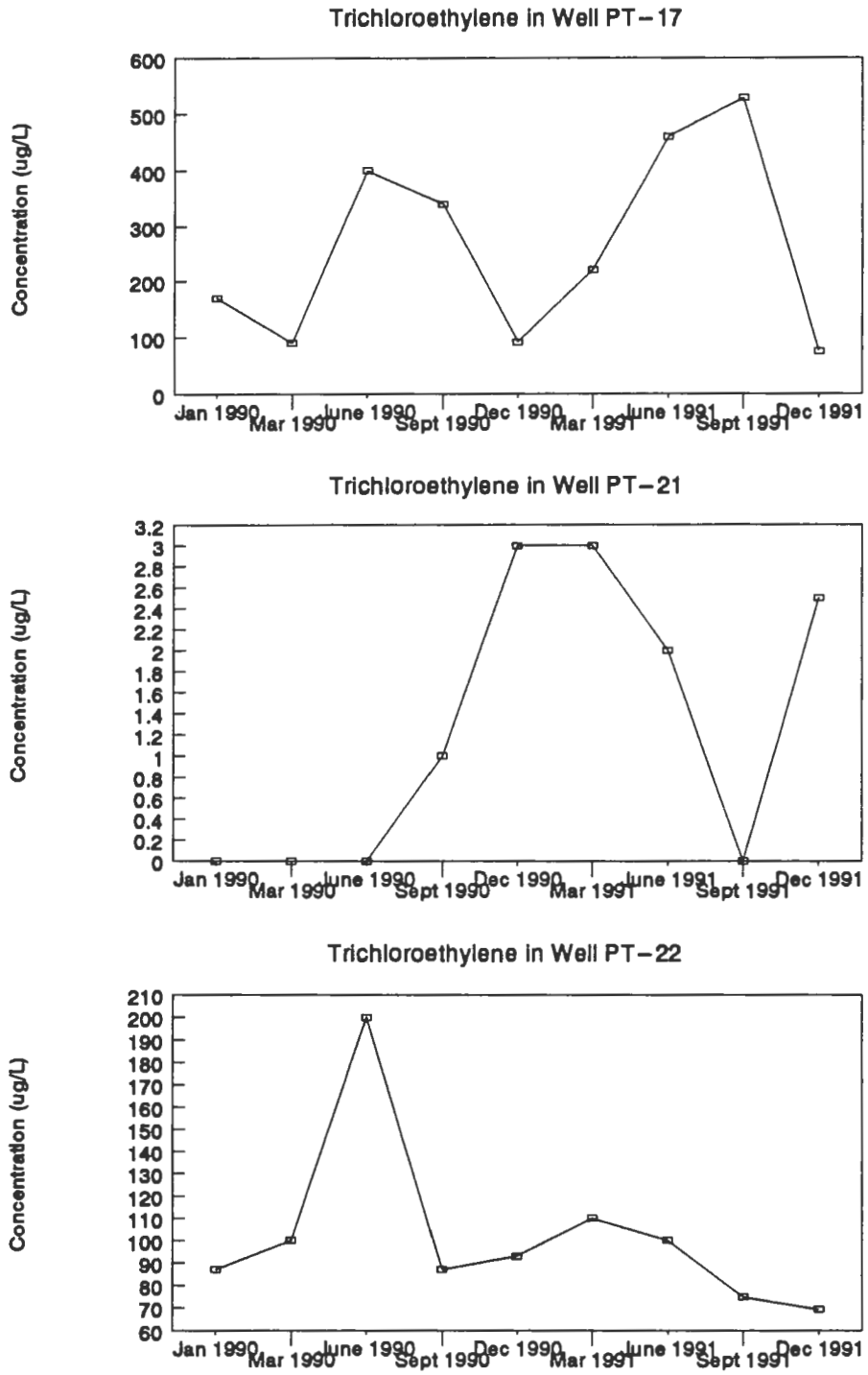


SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

HISTORICAL CONCENTRATIONS OF TRICHLOROETHYLENE IN SELECTED WELLS

APRIL 1992

MAIN 1893

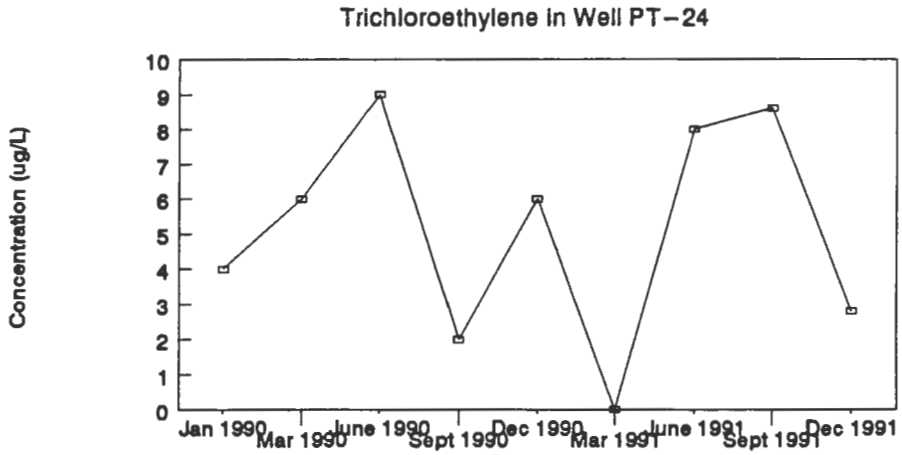


SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

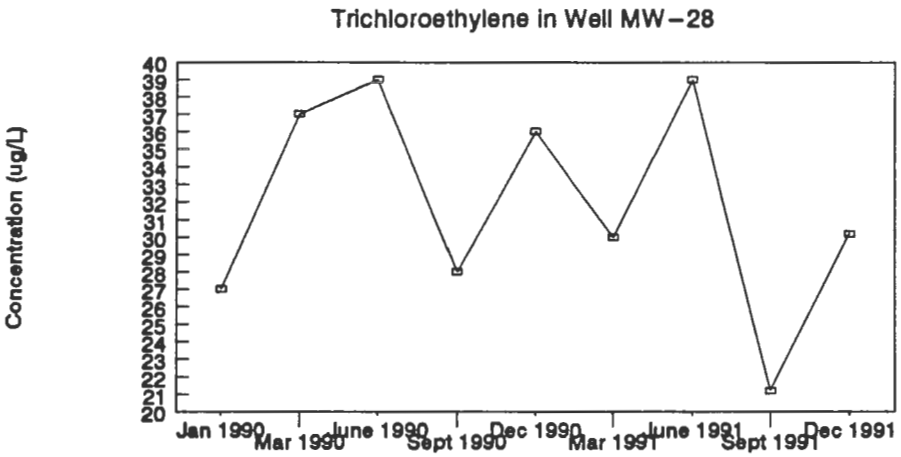
HISTORICAL CONCENTRATIONS OF TRICHLOROETHYLENE IN SELECTED WELLS

APRIL 1992

MAIN 1893



Note: No sample was collected from PT-24 in March 1991

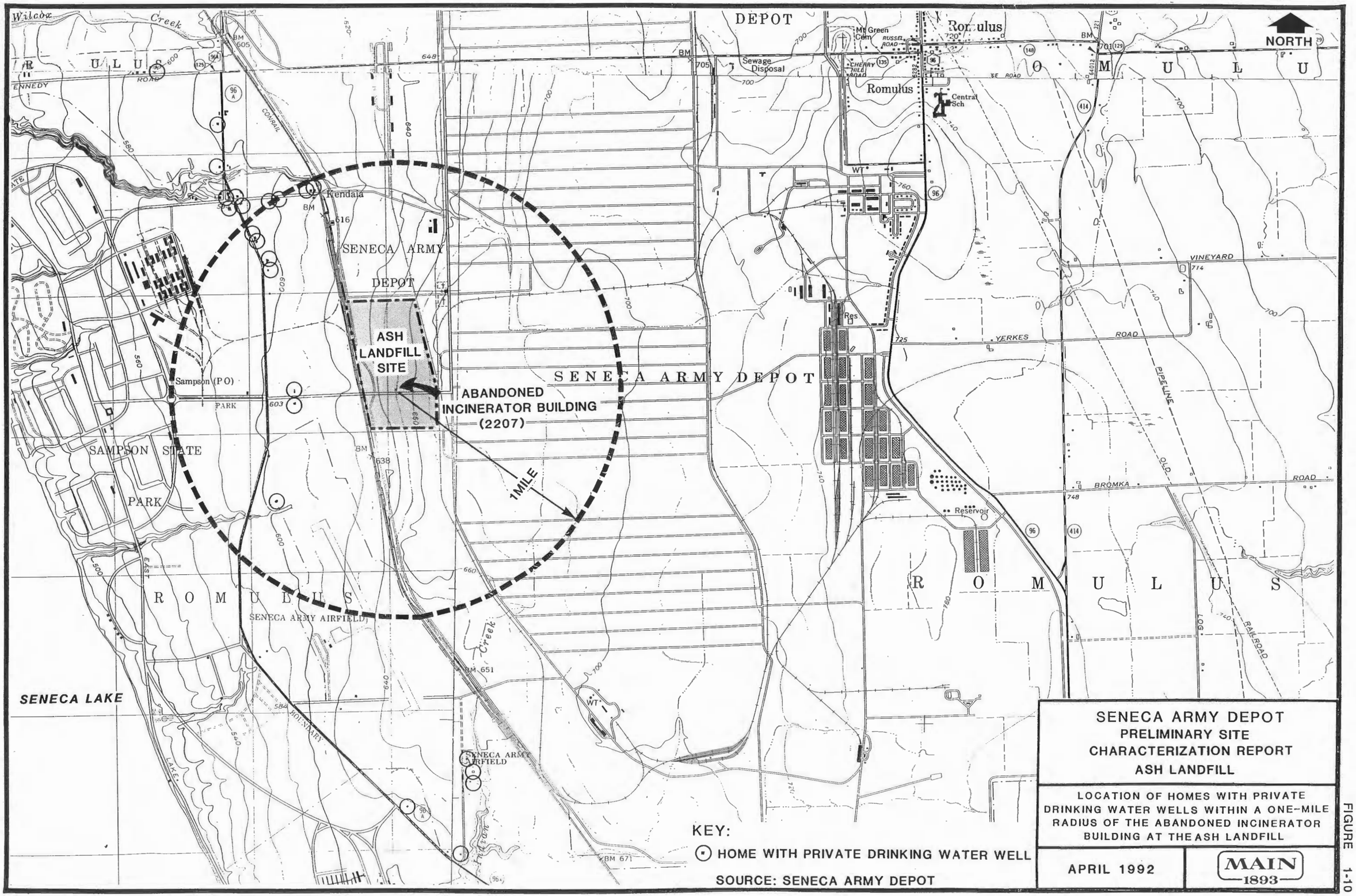


SENECA army DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

HISTORICAL CONCENTRATIONS OF TRICHLOROETHYLENE IN SELECTED WELLS

APRIL 1992

MAIN 1893



SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT
ASH LANDFILL

LOCATION OF HOMES WITH PRIVATE DRINKING WATER WELLS WITHIN A ONE-MILE RADIUS OF THE ABANDONED INCINERATOR BUILDING AT THE ASH LANDFILL

APRIL 1992

MAIN 1893

FIGURE 1-10

2.0 STUDY AREA INVESTIGATION

2.1 INTRODUCTION

Previous geotechnical studies, conducted at the Ash Landfill served as the basis for the planning processes of the current investigation. The initial phase of the planning process involved a development of a conceptual understanding of site conditions, which was derived from the previously described database. The focus of this investigation has been to refine the present understanding of the site. This CERCLA investigation is intended to utilize the existing database and collect addition hydrologic, geologic and ecological information required to perform a comprehensive CERCLA investigation. This additional information has been aquired through the implementation of numerous focused tasks described in the Ash Landfill workplan. The following sections describes in detail the work completed by MAIN to further characterize the environmental setting of the site.

The Ash Landfill workplan was considered approved by EPA, Region II on November 14, 1992. The workplan described the following fieldtasks:

1. Geophysical Survey
2. Soil Gas Survey
3. Soil Sampling
4. Monitoring Well Installation and Sampling
5. Surface Water/Sediment Sampling
6. Ecological Investigation
7. Incinerator Ash Sampling

2.2 SITE SURVEY PROGRAM

The site survey program consisted of field reconnaissance of the site and aerial photography. A reconnaissance of the site was performed to locate general site features and confirm the presence of significant features (i.e., incinerator building, cooling pond, filled areas, possible solvent dumping areas, debris pits, monitoring wells, access roads) identified in the workplan. Also, sampling locations were identified and marked during this initial survey.

The site and surrounding area was photographed from the air on December 12, 1991 for the purpose of constructing a photogrammetric site plan with 2 foot contour intervals. This photogrammetric map was also utilized for the ecological survey.

Site survey information was gathered from 16 photographs at a scale of 1" - 500' taken from two east-west trending flight lines (lines 3 and 4). The lines extended from the area of North-South Baseline Road west to the eastern edge of Seneca Lake at Sampson State Park.

2.3 CHARACTERIZATION OF SOURCE AREAS

Known and potential source areas were characterized from previous activities gathered during past site investigation programs. In total, nine source areas were identified (Plate 1-1). They are:

1. Three possible solvent dump sites located approximately 200 feet west of the former ash landfill;
2. Suspected buried debris piles north of the Ash Landfill area;
3. Grease pits northeast of the Ash Landfill, used for the disposal of used kitchen grease;
4. The Ash Landfill extending north and east of the incinerator building, used for disposal of incinerator ash between 1974 and 1979;
5. An abandoned Non-Combustible Fill Landfill south of the incinerator/ash landfill area on the south side of West Smith Farm Road;
6. Burning pits north and west of the incinerator building, and within the landfill area, that were used to burn trash from 1941 to 1974;
7. A cooling pond, adjacent to the incinerator building, used for cooling the incinerator;
8. A diesel fuel underground storage tank located adjacent to the northeastern corner of the incinerator building; and
9. A former incinerator (Building 2207), used to incinerate trash between 1974 and 1979.

2.4 GEOPHYSICAL INVESTIGATION PROGRAM

2.4.1 Objectives

The objective of the geophysical program was to further delineate any additional possible sources of contamination (i.e., geophysical anomalies) outside of the areas already investigated

by ICF (1989) and Hunter/ESE (1989). In some instances this survey overlaped areas previously investigated.

Two geophysical surveys were performed by Blasland & Bouck Engineers, P.C. for Chas. T. Main, Inc., at the Seneca Army Depot Ash Landfill area in October 1991. The geophysical surveys, consisting of an electromagnetic induction (EM) terrain conductivity survey and a ground penetrating radar (GPR) survey, were conducted to identify anomalous areas and provide characterization to the nature of these anomalies.

The areas investigated (Area 1 and Area 2) using these geophysical methods are shown on Plate 2-1. Area 1, located north of the limits of the abandoned Ash Landfill, consists of a rectangular area with approximately 1,500 feet north-south and 1,600 foot east-west dimensions. Area 2, located south of the limits of the abandoned Ash Landfill and West Smith Farm Road, has a 500 foot north-south dimension and a 1,650 foot west-east dimension. These two areas were the focus of the geophysical surveys.

2.4.2 EM-31 Survey

For Area 1, 15 geophysical survey lines were established every 100 feet along West Patrol Road, beginning 100 feet south of Cemetery Road. Endpoints for these 15 geophysical lines were established along the railroad bed located approximately 1,600 feet east of West Patrol Road. In Area 1, geophysical survey lines were numbered 1 through 15, from north to south respectively. For Area 2, five geophysical survey lines were established in a similar fashion, beginning 100 feet south of the West Smith Farm Road. Endpoints for these five geophysical lines were established along the railroad bed located approximately 1,600 feet east of West Patrol Road. In Area 2, geophysical lines were numbered 16 through 20, from north to south.

To conduct the geophysical surveys at the two areas shown on Plate 2-1, survey lines were established and cleared of vegetation to permit access for data collection using geophysical equipment. The 20 geophysical survey lines were cleared of standing vegetation to ground level by SEAD personnel from the Roads and Grounds Department.

EM Data measurements were collected every 50 feet along each survey line. The EM Survey was performed using a Geonics model EM-31 terrain conductivity meter. A digital data logger, Model DL55, was used to record readings taken at stations spaced every 50 feet along each

survey line. Prior to daily collection, the following instrument functional checks and calibration were performed:

- Internal battery condition;
- Instrument zero reading;
- Instrument phasing; and
- Instrument sensitivity.

Instrument sensitivity was performed in an area considered to represent background site conditions; this area is located east and upgradient of the eastern limit of the abandoned Ash Landfill, about 20 feet south of monitoring well PT-10.

The EM survey of Area 1 was performed on October 14 and 16, 1991. A total of 23,650 lineal feet of EM survey was completed with 473 measurements collected for each of the quadrature-phase and in-phase components. Both components were measured at 50-foot intervals along survey lines established in Area 1.

The EM survey of Area 2 was performed on October 17, 1991. A total of 8,050 lineal feet of EM survey was completed with 161 measurements collected for each of the quadrature-phase and in-phase components. The quadrature-phase and in-phase measurements collected from lines 1 through 20 were digitally recorded by the data logger.

2.4.3 GPR Survey

Anomalies defined by the EM-31 survey line plots were investigated using a Geophysical Survey Systems, Inc. (GSSI) subsurface interfacing radar (SIR), System - 3, consisting of a PR-8300 profiling recorder and a 300 megahertz (MHz) transducer (Plate 2-1).

Equipment calibration was performed prior to GPR profiling across potential anomaly areas. Equipment calibration was completed in the same areas as the EM-31 calibration. GPR equipment calibration included the following:

- Adjustment of range setting;
- Adjustment of high and low pass filters;
- Setting of the transmitting rate; number of scans per second and print polarity; and
- Adjustment of range gains.

Once equipment calibration was complete, GPR profiles were performed by hand-pulling the 300 HMz transducer over the anomaly location. Horizontal control was accomplished by measuring with an engineer's tape between marked station locations and encoding the data with a station reference mark every 10 feet along each profile.

The graphical output from the profiling recorder was continuously reviewed by the survey personnel to adjust equipment settings, if necessary, to maximize the resolution of subsurface anomalies. Each profile was annotated in the field with the profile line number, station interval, and anomaly location. During the GPR survey, routine adjustments and maintenance of the profiling recorder were completed in accordance with the manufacturer's operation manual for the SIR System-3.

2.5 SURFACE WATER, SEDIMENT AND SPRING INVESTIGATION PROGRAM

2.5.1 Objectives

The objective of this program was to define the nature and extent of impacts within the site's drainage system by collecting surface water and sediment samples from nine locations on the site. Additionally, a spring survey was conducted for the site and surrounding area.

2.5.2 Surface Water and Sediment

Surface water and/or sediment samples were collected at three stations that were representative of wetlands and areas of standing water on or near the Ash Landfill site (Plate 2-2). Two of these stations (SW-100 and SW-200) were to the north of the incinerator and the third (SW-600) was to the west, off Depot property in an area where a mound of soil was causing surface water to accumulate behind it. The area surrounding this location is an actively farmed hayfield with no evidence of seeps. In addition, four stations in drainage swales on and downgradient of the Ash Landfill site (SW-300, SW-400, SW-700, and SW-900) were sampled to provide an indication of the degree of surface transport of constituents from the Ash Landfill site. A fifth drainage swale station (SW-901) was established beyond the probable influence of contamination from the Ash Landfill site and served as a reference location. One station (SW-800) was also established in nearby Kendaia Creek, downstream of the confluence of a drainage swale that may collect stormwater from the Ash Landfill site.

As a rule, surface water samples were collected first, however, if standing water was not present at the time of sampling, only sediment samples were collected.

Surface water samples were collected from several locations on the site by directly filling the appropriate sample containers (Table 2-1). When the water depth was relatively shallow, sample containers were filled by bailing water into sample containers with a decontaminated glass beaker. Demonstrated anlayte-free water was used for deconatamination of sampling equipment. Preservation of samples, if required, was performed after the samples were collected. Temperature, conductivity and pH of surface water, when present, were measured directly in the field with calibrated meters. Temperature and pH were measured with an Orion pH meter, Model 230A, and conductivity was measured with a YSI Model 33 conductivity meter (Table 2-1).

Sediment samples were collected by scooping sediment into a decontaminated stainless steel bowl with a decontaminated trowel. Volatile organic analyte (VOA) samples were taken first, prior to any mixing of the sediments. Then, the bowl was refilled with additional sediment, if required, thoroughly mixed and the appropriate sample containers filled with sediment. Samples were then placed in coolers containing refrigerants.

Following the collection of surface water and sediment samples, the samples were packed to minimize the potential for breakage, and shipped via overnight courier to the analytical laboratory in coolers containing refrigerants.

Samples that were taken for quality control purposes include VOA trip blanks (each sampling day), rinsate samples (following decontamination events), matrix spike samples, duplicates and split samples which were sent to an independent analytical laboratory.

Stream velocity in Kendaia Creek was measured by clamping the sensor of a Marsh McBirney flowmeter onto a calibrated rod, positioning it so that it was measuring the velocity at approximately 60 percent of the water column depth (e.g., if the stream was one foot deep, velocity would be measured 0.6 feet from the bottom) and recording the value to the nearest hundredth of a foot per second. Velocity measurements were typically taken at 0.2 to 0.4 ft. intervals across the stream, using a transect measuring tape clamped to a heading and tailpin for reference. Distance between measurements was smaller (0.2 ft.) at higher velocity points in the stream. These measurements enabled the stream discharge to be calculated.

2.5.3 Spring Survey

A survey to identify the presence of springs within a one mile radius of the Ash Landfill site was performed by reviewing available mapping and field checking suspected spring locations. Map bases reviewed include 1 inch = 2000 feet USGS topographic maps (Dresden and Ovid quadrangles), Soil Conservation Service mapping for Seneca County (SCS 1972) and a 1 inch = 1200 feet topographic map of the site and surrounding area (5 foot contour interval) prepared by another consultant (Figure 1.1-2, ESE 1991). Potential spring locations were identified as areas near the headwaters of perennial streams, upgradient locations along defined channels (breaks in topography) and "seeps" identified during previous evaluations of this site. Locations of potential springs were marked on a map and investigated in the field. Field reconnaissance within the Seneca Army Depot fenceline required an escort by security personnel.

2.6 SOILS INVESTIGATION PROGRAM

2.6.1 Objectives

A multiphase soil investigation program was used to determine the nature and concentrations of contaminants in the overburden soils and fill. The program involved two phases of soil borings and one phase of test pitting. Soil borings were performed in the previously identified potential source areas in the ash landfill area and at potential source areas identified during the geophysical and soil gas surveys. Test pits (geophysical anomally excavations) were performed in the area of geophysical anomalies identified by Blasland and Bouck on the abandonded Non-Combustible Fill Landfill.

2.6.2 Soil Borings

A total of 30 soil borings were conducted at the site (Plate 2-3). Sixteen (16) were conducted as part of the first phase in locations previously identified as possible source areas or for geographic coverage. These borings were performed in the following locations:

1. One within each of the three possible solvent dumps west of the former ash landfill (B1-91, B2-91 and B17-91);
2. One within each of the three debris piles north of the former ash landfill (B3-91, B4-91 and B5-91);

3. One within the cooking grease pit/disposal area in the northeastern portion of the former ash landfill (B18-91);
4. Two within the former construction debris disposal area southeast of the former ash landfill area (B6-91, B7-91);
5. One within the suspected burning pits in the southern portion of the former ash landfill area (B19-91);
6. One near the former cooling pond at the northeast corner of the former incinerator building (B20-91);
7. One near of the underground diesel storage tank on the northeast side of the former incinerator building (B21-91, B26-91-follow-up boring in the same location);
8. One at the approximate location of existing soil boring BH-29 to investigate further the diesel-like material reportedly encountered at this location (ICF), 1989) (B10-91);
9. One located south of existing soil boring SS-06 (B16-91) and,
10. Two background soil borings northeast and southeast of the site (B8-91 and B9-91).

An additional 16 borings were conducted in selected areas of the site based on the results of the geophysics and soil gas surveys (Plate 2-3). The additional borings were performed in the following locations:

1. Five near B2-91 at the bend in the unpaved road at the northern tip of the Ash Landfill (B15-91, B27-91 through B30-91).
2. Two near B3-91 (B11-91 and B12-91).
3. Two near B4-91 (B13-91 and B14-91).
4. One on geophysical line 4 (B22-91).
5. One on geophysical line 5 (B23-91).
6. Two along geophysical line 17 (B24-91 and B25-91).
7. One near the highest soil gas reading obtained in the Target (1989) soil gas survey (B31-91).
8. Two additional borings (B40A-91 and B40B-91) were performed as potential, but abandoned, locations for monitoring well MW-40. These were abandoned because of a lack of water in the borehole.

Soil borings were performed using an Acker F-800 drilling rig equipped with 4.25-inch hollow stem augers. All borings were advanced to refusal on compentent bedrock. During drilling, soil samples were collected continuously at 2-foot intervals using a decontaminated 2 or 1.5 foot split spoon sampler according to the method described in ASTM-D 1586-84. This

technique involved driving a decontaminated split spoon sampler 2 feet into undisturbed soil with a rig-mounted 140 lb hammer. A larger diameter (3") 1.5' split spoon sampler was used to obtain a large amount of soil for duplicates and QC samples or when sample recoveries were low with a 2" spoon. Once the sample was collected the augers were advanced to the top of the next sample interval. Samples were collected until spoon refusal on competant shale was encountered. Borings logs are included in Appendix C.

Up to four soil samples were collected for level IV anlayses within each boring. Samples were collected from the surface (0-2'), at an intermediate zone (3-4'), from the top of the water table to one foot above the water table, and from the weathered shale zone at the interval from the competent shale unit to two feet above the competent shale unit, except where geologic or water table conditions prevented the collection of these samples (Table 2-2).

All soil samples were screened for VOCs with an OVM 580B immediatley upon opening of the split spoon. Samples were also screened for radiation with a Dosimeter Mini Con Rad Dector.

A designated downwind monitoring station was chosen for each boring location and monitored for volatile organics with an OVM and test and dust and particulates using a MIE Model PDM-3 Miniature Real-Time Aerosol meter (Miniram). A miniram was also positioned on or near the drilling rig. The OVM was programmed to register real time and maximum readings of volatile organics. These meters were checked before drilling and approximately every 15 minutes during drilling.

Upon completion of sampling, all borings were grouted to the surface and the soil brought to the surface by the augers was contanerized in DOT-approved 55-gallon drums. When filled, the drums were transported to the temporary drum storage area immediately west of the abandoned cooling pond. The drilling rig and augers were steam cleaned between borings using potable water from the Depot at the decontamination pad between borings.

2.6.3 Test Pits (Geophysical Anomally Excavations)

Test pits were excavated in locations where GPR characterization of EM-31 anomalies indicated a possible pipe or drum signature. A total of five excavations were performed along lines 16 and 17 on the Non-Combustible Fill Landfill (Plate 2-3). Excavations were

performed at 374 feet, 1252 feet, 1432 and 1446 feet and 1482 feet along line 16 and at 1188 on line 17.

Test pits were excavated to up to five feet deep using a backhoe. Upon completion all excavated material was returned to the pit and covered. Personnel conducting test pitting activities were outfitted in Level B equipment because of the possible presence of chlorinated volatile organic compounds detected in the soil gas investigation. Test pit logs are included in Appendix D.

2.7 SOIL GAS INVESTIGATION PROGRAM

2.7.1 Objectives and Summary

A soil gas sampling and analysis program was performed from November 14, 1991 thru November 22, 1991 at the Ash Landfill.

The objectives of this program were to:

1. Detect the presence of source materials which could be contributing to the impacts observed in several groundwater monitoring wells;
2. Confirm the results from a previous soil gas survey performed in 1987;
3. Provide a basis for locating additional confirmatory soil borings; and
4. Eliminate or confirm previously identified geophysical anomalies as locations of possible leaking drums. Areas which were identified as a geophysical anolmoly and confirmed as a soil gas anolmoly were then subjected to test pitting in order to confirm or deny the presence of leaking buried drums.

Gas samples were obtained following procedures described in the October 1991 MAIN workplan and the November Addendum to this workplan. A drilling subcontractor, under the direction of MAIN personnel, assisted in the installation, decontamination and removal of all soil gas probes. Each probe was steam cleaned prior to reuse. Gas samples were analyzed immediately in the field at the on-site laboratory trailer. A Photovac 10S50 gas chromatgraph was used to detect and quantitate the presence of chlorinated and non-chlorinated solvents in the soil gas samples. The chromatograph was calibrated each day, prior to and during analytical use. Syringes and probes were blanked several times each day to check for carry-over. Syringes were blanked more frequently when detectable quantities of solvents were

encountered. A total of 76 soil gas samples were sampled and analyzed during the field program (Plate 2-4). A total of 30 syringe blanks and 5 probe blanks were performed during the program. All chromatographs and calibration curves generated during the field program are presented in Appendix E.

2.7.2 Introduction

A soil gas investigation was conducted to delineate possible soil source areas of volatile organic compounds. This investigation was performed as a follow-up to a geophysical survey (i.e. at every ground penetrating radar anomaly), and previous soil and groundwater analytical data. Previous soil and groundwater sampling results have shown that volatile organic compounds (i.e. trichloroethylene, trans-1,2-dichloroethene, cis-1,2-dichloroethene and vinyl chloride) are present on the site.

The presence of contaminants in the soil gas provides a strong indication that there is a source of volatile organics either in the soil near the probe or in the groundwater below the probe. The soil gas analysis is performed in the field with a portable gas chromatograph so that sample loss does not occur due to shipment off-site. The analytical results are available immediately and can be used to help direct the investigation regarding the location and density of soil gas samples. The soil gas investigation results were also used to locate additional borings. Results from the soil gas investigation were compared to and supplemented by the results of the previous soil gas survey conducted by Target Environmental Services, Inc. (ICF, 1989).

The analysis of site soil gas is used as a screening tool for rapidly identifying contaminant source soils and, in some cases, can delineate groundwater contamination plumes. In soils above groundwater contamination plumes, the expected soil gas concentrations will be much less than those concentrations which would be expected for source soils. This soil gas program was designed to identify volatile organic concentrations which would indicate the presence of source materials (i.e., soils saturated with solvents). These soils constitute a continual sink for groundwater impacts. However, the boundary between soil gas concentrations representing source soils and soil gas concentrations resulting from a groundwater plume is not well defined. Follow-up soil sampling is a technique to determine the boundary.

The soil gas evaluation program involved three essential elements. These are:

1. Soil Gas Sampling Methods and Materials
2. Analytical Support
3. Data Interpretation

2.7.3 Soil Gas Sampling Methods and Materials

The method involved extracting a small representative sample of soil gas through a hollow steel probe driven a few feet into the ground. The extracted gas was then analyzed for the presence of expected volatile contaminants. A total of 76 soil gas samples were analyzed as part of this investigation (Plate 2-4). Soil gas samples were collected through a hollow steel drilling rod which was driven approximately 48 inches into the vadose zone using a drilling rig (Table 2-3). Soil gas sampling was conducted at locations which were identified by geophysical techniques as anomalies. The remaining sample locations were chosen based on the suspected presence of source areas through past soil and groundwater analytical data and visual evidence of stressed vegetation or surface debris. The intent of the soil gas program was to obtain information confirming the presence of volatile organic compounds in the areas of geophysical anomalies and suspected source areas of groundwater contamination.

All locations of soil gas samples were marked with a yellow flag. The sample number indicated on the flag was driven into the ground at each location. These locations were surveyed and plotted on a site map by a New York State registered land surveyor.

A 1.75 inch, outer diameter, steam-cleaned, hardened hollow carbon steel BW drilling rod fitted with a penetrometer point on the tip was driven below the ground surface using a drilling rig equipped with standard equipment. The rod was driven by an assembly consisting of a 140-pound weight, a driving head, and a guide permitting a free fall of 30 inches. Blow counts for each 6-inch penetration were recorded for each location. The blow counts provide an indication of the relative density of the material. Rod refusal was defined when more than 100 blows were applied for six inches of penetration (Table 2-3).

Once the desired depth of penetration was reached, the drilling rod was withdrawn approximately 6 inches, allowing the penetrometer point to dislodge from the rod, creating a void space through which soil gas was extracted. A metal rod was inserted into the hollow

drilling rod to ensure that the penetrometer point had been dislodged. If it was not dislodged, the point was knocked out with the metal rod.

Bentonite was packed at the ground surface around the probe to prevent influx of atmospheric air into the sample probe.

The hollow drilling rod exposed above the land surface was fitted with a coupling containing evacuation and sampling ports. Teflon tape was used on the threads connecting the coupling to the hollow drilling rod to prevent infiltration of surface gases into the sampling ports. One-half inch latex laboratory tubing connected the evacuation port to the intake of a SKC Aircheck Sampler pump (Model 224-PCXR7). The sampling port was fitted with a septum. A new septum was used at each sampling location.

The probe was purged by creating a slight negative pressure with an SKC air sampling pump through the evacuation line for at least 5 minutes to ensure that the gases flowing through the hollow drilling rod were representative of soil gases. The gases were purged at a rate of approximately 3 liters per minute through the SKC pumps.

The effluent gas from the air sampling pump was monitored continuously with an Organic Vapor Meter (OVM) Model 580B. The soil gas sample was collected from the probe immediately if the effluent monitoring indicated an increase in the concentration of volatiles after 5 minutes of purging. Gas samples were collected in order to coincide, as much as possible, with the highest concentration of gas measured by the OVM. Approximately 3 ml of soil gas was extracted through the sampling port using a Hamilton gas tight sampling syringe. The syringe was immediately transported to the temporary soil gas laboratory. Figure 2-1 illustrates the gas collection probe.

Various amounts of gas soil samples ranging between 0.25 and 5.0 mls, were injected into a calibrated Photovac 10S50 portable gas chromatograph. The amount injected was determined depending on the results of the continuous monitoring with the OVM. High OVM readings, meant that less sample was required to be injected so that the detector response was within the calibration range of the instrument.

Following the collection of soil gas sample, the drilling rod was removed from the ground using the drilling rig or by hand. The probe hole was backfilled with bentonite. Penetrometer points were decontaminated prior to use and drilling rods were steam cleaned

after each use. Other sampling equipment (e.g., drill couplings, sampling syringes, tubing, etc) was decontaminated after each use according to the decontamination procedures outlined in Section 4.6.2 of the Quality Assurance Project Plan. All syringes were decontaminated and blanked prior to field use.

2.7.4 Analytical Support

Soil samples were analyzed in the field using a Photovac 10S50 portable gas chromatograph to facilitate real time data acquisition. The temporary soil gas laboratory was established in the on-site field trailer. A simplified explanation of the analytical procedure is provided in the following paragraphs.

The gas chromatograph instrument separates compounds in a chromatographic column (selected on a site-specific basis) and detects and quantifies the compounds using a detector. After a sample is introduced to the chromatograph, it is carried by a carrier gas through the column. Different compounds pass through the column at different rates, resulting in a characteristic "retention time" for each compound. By comparison with standards, this retention time can be used to identify compounds. The detector responds to the presence of compounds by producing a difference in current from a reference current. The magnitude of this current difference can be used, when compared to standards, to determine concentrations of compounds present in the sample.

The analytical system utilized for this program was the portable Photovac 10S50 gas chromatograph. This instrument is equipped with a heated capillary column and an on-board peak integrator. The detector for this instrument is the Photoionization Detector (PID). The PID is ideal for detecting volatile organic compounds which contain aromatic rings and unsaturated double bonds. Both groundwater and previous soil gas sampling have indicated the presence of trichloroethylene, 1,2-Dichloroethylene and small amounts of benzene, toluene and xylene.

Quantitative analysis of soil gas requires quantitative gas standards. The gas standards used for this project was prepared by a gas standard vendor. The gas standard mixture included trichloroethylene, 1,2-Dichloroethylene, benzene, toluene, and xylene, each at concentrations of approximately 100 ppmv. This standard mixture was certified by the standard manufacturer and a certificate of analysis accompanied the gas standard. This certificate of analysis is presented in Appendix E. The field calibration standard was prepared from this certified gas

standard. Dilutions were made from this standard by injecting a known volume of calibration gas into a clean glass sampling bulb of known volume. The analytical instrument was calibrated each day prior to the analysis of a sample. The gas standard was prepared from certified pre-calibrated compressed gas cylinders. Compressed gas standards offer advantages in time savings and ease of use. However, they are limited to only those compounds within the cylinder.

The cylinder used in MAIN's survey was prepared by National Specialty Gases and is certified by National Specialty Gases to be traceable to the National Bureau of Standards (NBS).

2.7.5 Data Interpretation

Data interpretation is an important element of the soil gas analysis. The acquired vapor phase concentrations are evaluated to determine the relationship between soil gas and source soils.

The interpretation of the soil gas data involved identification of each organic compound by retention time comparison with gas standards. Quantitation of gas concentrations was obtained as the product of the Response Factor (RF) and the obtained detector response for each compound. RF's were obtained from the calibration curves as the slope of the straight line when the integrated area under the curve, expressed in Volt-sec (Vs), was plotted against the concentration of the gas injected. The calibration curves were prepared assuming the injected volume was constant at one milliliter. If necessary, based upon the OVM readings obtained during sample collection, the volume injected was adjusted to assure that the detector response would not exceed the upper calibration range.

The final concentration of the collected sample was determined by applying either a dilution factor or a concentration factor, depending upon the volume injected. For example, if 0.5 mL was injected the obtained concentration was multiplied by 2. The prepared calibration curves and best fit line statistical analyses are presented in Appendix E. Since toluene or xylene were not observed in any soil gas samples these curves were not prepared.

2.8 GROUNDWATER INVESTIGATION PROGRAM

2.8.1 Objectives

The groundwater investigation program was designed to provide additional information on the concentrations and distributions of selected constituents in the shallow and deep aquifers. It involved the installation of five shallow wells (Plate 2-5) screened in the till and weathered shale aquifer and four deep wells screened in the competent shale aquifer (Plate 2-5). In addition, all existing and recently installed monitoring wells were sampled for water quality analyses. Physical characteristics of the aquifers and the general groundwater flow conditions were investigated through well installation, measurements of depth to water and aquifer testing (slug tests and vertical connection tests).

2.8.2 Monitoring Well Installation

Shallow monitoring wells were located in upgradient and downgradient locations relative to areas of known impacts to groundwater to determine the extent of the impacts (Table 2-4). Wells MW-34, MW-36, and MW-37 were installed along the western boundary of the site to monitor the downgradient and lateral extent of the known volatile organics plume (Table 2-4). Two shallow wells (MW-39 and MW-40) were installed in upgradient locations to monitor the eastern extent of impacted groundwater. Four deep monitoring wells were also installed in upgradient and downgradient locations on the site (Table 2-4).

The shallow wells were installed in 7.25-inch borings drilled with an Acker F800 hollow stem auger rig using 4.25 inch augers. The borings were advanced to auger refusal, which for the purposes of this investigation is defined as the contact between weathered shale and competent shale. During drilling, split spoon samples were collected continuously until spoon refusal using the method outlined in ASTM-D 1580-84 to allow characterization of the geology at the well location. The shallow monitoring well construction details are presented in Appendix F. In addition all soil samples were screened with an OVM 580B for volatile organics and a Dosimeter Mini Con Rad Detector for radiation.

The deep wells were installed using an Acker drilling rig equipped with 6.25 inch hollow stem augers and 7 5/8-inch air rotary bit. At each well location 6-inch inner diameter PVC surface casing was set approximately 5 feet into the competent shale using hollow stem auger and air rotary techniques. The annular space between the casing and borehole was grouted and

allowed to set a minimum of 48 hours before drilling was resumed. In all locations groundwater was encountered within 100 feet below the land surface, although during drilling it was very difficult to determine the exact location of the water table for setting the well screen. Weak zones noted during drilling were interpreted to be the locations of fractures, and thus avenues for groundwater movement; well screens were set to intersect these fracture zones. At least 20 feet of well screen was installed and at least 20 feet competent bedrock was penetrated at each well location. The deep monitoring well construction details are provided in Appendix F.

All existing and newly installed shallow and deep monitoring wells were provided with an expandable locking well cap, a locking steel protective casing and concrete pad.

A designated downwind monitoring station was chosen for each well location and monitored for volatile organics with an OVM and test and dust and particulates using a MIE Model PDM-3 Miniature Real-Time Aerosol meter (Miniram). A miniram was also positioned on or near the drilling rig. The OVM was programmed to register real time and maximum readings of volatile organics. These meters were checked before drilling and approximately every 15 minutes during drilling.

2.8.3 Monitoring Well Development

All monitoring wells were developed using a decontaminated Teflon bailer and nylon rope at least 48 hours after their installation (Appendix G). During well development temperature, specific conductance and pH were measured and development continued until these parameters stabilized. All sediment and at least five well volumes were removed from the wells during development. NTU measurements remained high (> 100 NTUs) throughout the development of most of the wells and only in wells MW-38D, MW-39, MW-41D and MW-42D were NTU reading of less than 100 attained.

Surging and removal of water over several days was a required to develop most of the wells as recharge was slow and many wells were bailed to near dryness. Through this surging process every attempt was made to remove excess turbidity, however, as silt and clay are a major component in the till, there was a persistent source material to cause continued turbidity in the shallow wells.

Water removed from the well during development was immediately transferred to DOT - approved 55 gallon drums for storage.

2.8.4 Groundwater Sampling

All existing and newly installed monitoring wells were sampled for this investigation. Privately owned wells at the farmhouse on West Smith Farm Road were sampled by the New York State Department of Environmental Conservation.

Prior to sampling, the depth to water relative to the top of the well casing was measured using an electronic water level meter at each well within a 10 hour period so that this data could be used to construct a groundwater topography map on the site. An attempt was made to measure depth to water using a chalked steel tape, however, extremely dry and windy conditions caused the wetted chalk on the tape to dry affecting the accuracy of the measurement. After several attempts to use this method, it was abandoned and replaced with the electronic water level meter which proved to be more consistent. In addition, all wells heads were screened with OVM or HNU meter for volatile organic compounds immediately after removing the well cap.

All wells were purged of at least three well volumes or bailed until near dryness using a decontaminated Teflon bailer prior to sampling. Sampling equipment was decontaminated using demonstrated analyte-free water. In wells where at least three well volumes were removed, measurements of specific conductance, pH, and temperature were made until these parameters stabilized (Table 2-5). In wells that were bailed to near dryness, these parameters were measured only once. Water removed during purging was placed immediately into a DOT - approved 55-gallon drum for storage.

All existing and newly installed monitoring wells were sampled using a decontaminated Teflon bailer for volatile organics, semi-volatile organics, pesticides and pcb's, herbicides, and total metals including cyanide (Table 2-5). Dedicated PVC bailers in the existing wells (used for on-going quarterly sampling at the site) were removed prior to sampling of these wells. Groundwater samples that exhibited NTU measurements over 50 were also filtered and preserved and submitted for dissolved metals analysis. Three wells (PT-17, PT-23, MW-42D) were also analyzed for alkalinity, BOD, COD, chloride, sulfate, TOC, hardness, total dissolved solids and total suspended solids (Table 2-5).

All samples were preserved and placed on ice immediately after collection for shipment to the laboratory under chain-of-custody.

2.8.5 Aquifer Testing Program

2.8.5.1 Hydraulic Conductivity Testing

Hydraulic conductivity tests were performed on all of the newly installed wells on-site (MW-34, MW-35D, MW-36, MW-37, MW-38D, MW-39, MW-40, MW-41D and MW-42D). Prior to conducting the test in each well the static water level was measured in the well. Then a transducer (rated to 20 PSI), which was attached to a Hermit Environmental Data Logger Model SE1OOOC configure for logarithmic data collection, was lowered to within one foot of the bottom of the well casing. Concurrently, a five foot stainless steel slug was lowered into the well using nylon rope so it was completely emersed, just below the static water level. The electric cord to the transduce was then tapped to the monitoring well exterior to prevent movement during the test.

Simultaneously, the data logger was started and the slug removed from the well so it was above the water level. Changes in head in the well were recorded on the data logger for at least 10 minutes after which the water level was monitored with the data logger to determine if the water level had stabilized. When the test was complete the data was downloaded into a laptop computer in the field. The slug and transducer were decontaminated between tests on each well.

Hydraulic conductivities were calculated using computer programs which analyzed the data by both the Horslev (1951) and Bouwer and Rice (1976) methods.

2.8.5.2 Aquifer Vertical Connection Testing

To assess the possible vertical connection between the shallow till/weathered shale aquifer and the deep competent shale aqufer, vertical connection tests were performed at two paired well locations (1) PT-18 and MW-38D, 2) MW-36 and MW-35D).

The tests were performed by measuring the static water level of the paired shallow wells prior to, during and after purging of the deep wells. The method for preparing the data logger and transducer was similar to that used for the slug tests except a linear scale was programed into

the data logger, as a logarithmic scale was not necessary for this test. More than three well volumes were removed from each of the deep wells for the test during which changes in water levels were recorded on the data logger. The transducer was decontaminated between each well test.

2.9 ECOLOGICAL INVESTIGATION PROGRAM

2.9.1 Objectives

An important component in establishing the environmental risk associated with a hazardous waste site is to identify the potential impacts to the on-site and off-site aquatic and terrestrial communities. The overall objective of this program was to characterize the existing aquatic and terrestrial biotic environment on and near the Ash Landfill Site.

The aquatic biotic assessment focused on Kendaia Creek, which is the only perennial body of water situated near the Ash Landfill Site; it lies 2,500 feet north of Cemetary Road. The measurement endpoints of the aquatic assessment are primarily community oriented and include determining the species composition, relative abundance, species richness and guild (food web) structure of benthic macroinvertebrates and fish that are found in the creek. At an individual level, any suspected overt symptomology, such as tumors or other abnormalities, that could indicate adverse effects of contaminants were also quantified. These measurement endpoints enabled the derivation of the Phase I assessment endpoints used to identify potential aquatic receptors, exposure pathways, and characterize the existing aquatic community. Judgements regarding Kendaia Creek's value as a sport or recreational resource were made and potential interactions with downstream aquatic communities or terrestrial communities were identified.

The measurement endpoints for the terrestrial biotic assessment are also primarily at the community level, focusing on determining the species composition, relative abundance and species richness of the terrestrial floral and faunal communities inhabiting the Ash Landfill Site and adjacent areas. The measurement endpoints are, as well, at the individual level where any overt symptomology, such as plant leaf chlorosis (yellowing) or reduced plant growth, would be qualitatively assessed. These measurement endpoints enabled the derivation of the Phase I assessment endpoints which were used to characterize and evaluate the existing terrestrial biotic community and identify potential terrestrial biotic receptors and interactions with terrestrial communities adjacent to the Ash Landfill Site.

2.9.2 Study Areas And Methods

2.9.2.1 Study Areas

Aquatic Study Area

The only water body in proximity to the Ash Landfill Site that flows on a year round basis is Kendaia Creek which is approximately 4500 feet north of the abandoned incinerator building (Figure 2-2). Near the Ash Landfill Site, this stream is quite small, ranging in width from 3 to 10 feet with typical maximum depths ranging from 1 to 7 inches. Discharge measured during mid-November was only 0.3 cubic feet per second (cfs). Judging from the water surface elevation relative to the stream banks at the time of measurement, this discharge is fairly typical of normal conditions in this segment of Kendaia Creek. The substrate is composed predominantly of gravel-and cobble-sized particles. There are some reaches where the stream flows directly over bedrock. Silt and some sand are typically imbedded in the interstitial spaces of the gravel and cobbles. Flow characteristics of the stream include approximately equal amounts of pool and riffle. The applicable State water quality standard given to Kendaia Creek in its entirety is Class D. Kendaia Creek discharges into Seneca Lake, approximately 2 miles downstream of the fence line of the Seneca Army Depot, at a portion designated as AA(T). The state water index number for Kendaia Creek is ONT 66-12-P369-9.

The only known actively managed fishery within two miles of the Ash Landfill Site is Seneca Lake. Seneca Lake supports a significant fishery for both coldwater and warmwater species. The New York State Department of Environmental Conservation enforces special fishing regulations for the Finger Lakes, of which Seneca Lake is one. These regulations pertain to lake trout, landlocked salmon, rainbow trout, largemouth and smallmouth bass, northern pike and walleye (NYSDEC undated). There are no other known significant aquatic resources, including wild and scenic rivers, within the two miles of the Ash Landfill Site.

Conversations with local residents indicated rainbow smelt migrate from Seneca Lake into the lower reaches of Kendaia Creek to spawn. The NYSDEC Regional Fish Manager (Carl Widmer of Region 8) and his staff have no data regarding the aquatic community of Kendaia Creek and are not aware of any significant resources associated with this stream.

The aquatic biotic sampling location within Kendaia Creek most likely to receive surface water runoff from areas influenced by the Ash Landfill Site, Station SW-800, was immediately downstream of the confluence of a drainage ditch with the Creek near a CONRAIL railroad bridge (Plate 2-2). This station location corresponded with a sediment and water quality sampling point (hence the station prefix "SW")which enabled direct correlations to be made between the aquatic community and chemical constituents of the sediment and water.

A downstream biotic sampling station (SW-802) was established upstream of State Route 96A to characterize Kendaia Creek before it cascades over a falls created by a box culvert at this highway (Plate 2-2). This cascade represents an impassable barrier to upstream movement of most fish under normal circumstances. Station SW-801 was established as a reference station approximately 2000 feet upstream of Station SW-800 at a location beyond the probable influence of the Ash Landfill Site (Plate 2-2). Sediment samples and water quality samples were not collected at these two stations.

There were no aquatic plants observed in Kendaia Creek. However, an accurate assessment of the presence or absence of plants could not be made due to normal seasonal die-off.

Terrestrial Study Area

The terrestrial biotic assessment involved two general study areas (Figure 2-2). Within the broadest study area, which included the Ash Landfill Site and an area 2 miles from the site perimeter, significant resources such as NYSDEC significant habitats, habitats supporting endangered, threatened and rare species, species of concern, and state regulated wetlands, were identified. Also assessed for the 2-mile study area was the terrestrial resources used by humans (for hunting, agriculture, forestry, etc.) that would potentially be affected by Ash Landfill contaminants.

Within the smaller study area, which included the site and an area 0.5 mile from the site perimeter, the major vegetative communities (cover types), wildlife species associated with each cover type, and the value of the habitats (cover types) to the associated wildlife were identified (Figure 2-3). Observations for signs of overt symptomology (stressed or altered terrestrial biota) were conducted in the 0.5 mile study area. Most (70 percent) of this study area is within the depot, including the Depot airfield. The remaining portion is private farmland on the western side.

2.9.2.2 Aquatic Assessment Methods

Benthic Invertebrate Sampling

An optimum technique for collecting benthic macroinvertebrates in a stream such as Reeder Creek is the Surber sampler. This devise is designed to provide quantitative samples in shallow streams where the substrate is predominantly sand, gravel and cobble. Other devises, such as the Ponar grab, cannot effectively sample such streams because the grab sampler cannot close completely when rocks become lodged in the jaws. This allows a portion of the sample to be lost, making quantification of results impossible. The Surber sampler must be used in a portion of the stream where the current is sufficient to carry invertebrates dislodged from the area being sampled into the sampler - usually at least 0.16 feet per second. Therefore, when interpreting the results of macroinvertebrate samples collected with the Surber sampler, it is important to realize that this devise must be used in riffle areas and that the benthic community in pools may be different than that which is represented by these collections. This difference is not believed to be substantial in Kendaia Creek, since the pools are relatively shallow (generally less than a foot deep) with similar substrate to the riffle areas.

The Surber sampler used for sampling Kendaia Creek is designed to sample a one square foot portion of stream bottom. The mesh of the net is 1mm square, therefore, some smaller organisms may have passed through the mesh, although many were still collected. Temperature, pH, dissolved oxygen and conductivity were measured with calibrated meters. Temperature and pH were measured with an Orion pH meter, Model 230A, dissolved oxygen was measured with a YSI Model 57 DO meter, and conductivity was measured with a YSI Model 33 conductivity meter.

Samples were collected by choosing a sampling site that was representative of the stream reach. Depth of water at the sampling site did not exceed one foot. When the site was selected, the sampler was placed flat on the stream bed in such a manner that a minimum of flow was allowed to wash under the sampler. Large rocks within the confines of the sampler were manually lifted from the substrate and scrubbed at the mouth of the sampler to dislodge attached or clinging invertebrates which were then carried downstream into the net by the current. If only a portion of a rock was within the one square foot area, only the portion within the sampling area was scrubbed. When all rocks within the sampling area were scraped, any silt, sand or gravel within the sampling area was disturbed to a depth of

approximately four inches by hand or with a probe (such as a stick) to dislodge burrowing invertebrates and allow them to wash back into the net. After all materials within the sampling area were thoroughly disturbed, the net was quickly lifted out of the water and any debris or organisms adhering to the side of the net were rinsed into the bottom of the net. The net was then carefully inverted and the sample placed into a jar. Subsequent replicates were taken upstream of the previous sample to avoid the possibility of disturbances to the stream bed by sampling personnel influencing the sampling results. Samples were preserved in 70 percent ethanol and returned to the laboratory for sorting and identification.

Samples were sorted in the laboratory under magnification provided by a dissecting microscope. All invertebrates were placed in vials and identified to the lowest practicable taxon by an aquatic ecologist.

Fish Sampling

All fish were collected by electroshocking. Electroshocking was accomplished by using a Coffelt BP-2 backpack electroshocker. This unit is most effective when the conductivity of the water does not exceed 500 to 600 micromhos/cm. The conductivity in Kendaia Creek during the fish sampling survey ranged from 550 to 575 micromhos/cm, which is within but near the upper limit of the effective range for this gear. Temperature, pH, dissolved oxygen and conductivity were measured with the same instruments used during benthic sampling.

Electroshocking samples were collected by beginning at the downstream segment of the station and proceeding upstream for a distance of approximately 150 ft. A supplemental collection (collection "B") along a 75 foot section the stream was made at Station SW-800 to allow the sampling of a higher gradient section of the stream, omitted from the primary sampling effort. Both pool and riffle habitat were sampled at all stations. The dip net/electrodes of the electroshocker were swept back and forth across the entire stream, with one crew member occasionally releasing the deadman's switch to interrupt the current field. This "pulsing" procedure reduced the tendency for fish to sense the field at a distance and flee. Stunned fish were netted and placed in a bucket of ambient water for later processing.

Processing of fish collected by electroshocking consisted primarily of identification and enumeration. An indication of the size range of fish in each collection was obtained by measuring at least the smallest and largest individual of each species. If field identification of a specimen was uncertain, which was the case with certain small minnows, voucher

specimens were preserved in formalin and returned to the laboratory for confirmation of the identification. In addition, any individuals with overt symptomology (such as tumors) were preserved for documentation purposes. All other specimens collected were returned alive to the stream at the location that they were collected.

2.9.2.3 Terrestrial Assessment Methods

The presence of significant terrestrial biotic resources within the 2-mile study area was determined by contacting the NYSDEC Information Services for locations of Significant Habitats, rare, threatened and endangered species and species of concern (Figure 2-2). New York State regulated wetland maps were reviewed for the location of these significant wetland resources in the study area. The location of all significant resources occurring in the study area were mapped at a scale of 1" = 2000'. Information on the hunting, agricultural and forestry use of the terrestrial resources in the study area was obtained from the Seneca Army Depot, local residents, field reconnaissances and review of current (1991) aerial photography (scale 1" - 500').

The aforementioned current aerial photography was reviewed to delineate the major upland and wetland vegetative cover types in the 0.5 mile study area (Figure 2-3). These major cover types were mapped at a scale of 1" = 1000'. Existing wetland mapping (NYSDEC Regulated and U.S. Fish and Wildlife Service) were reviewed for freshwater wetland locations. Field surveys were performed on foot to confirm or revise the cover type identification and boundaries and determine plant species composition, relative abundance, and density. Existing information was reviewed to confirm species presence (Cowardin 1965, Seneca Army Depot 1992). Freshwater wetlands on the Ash Landfill Site were identified and delineated using the Unified Federal Routine Method (Federal Interagency Committee for Wetland Delineation 1989). These wetlands were surveyed and mapped at a scale of 1" = 500'.

Wildlife species, including amphibians, reptiles, birds and mammals, expected to inhabit the study areas' identified cover types, were determined primarily from existing information obtained from the Seneca Army Depot and the nearby Montezuma National Wildlife Refuge (U.S. Fish and Wildlife Service 1990, 1991a, 1991b). In addition, all wildlife observed during the course of the late fall ecological and surface water/sediment field programs were recorded to species, when possible. A small mammal live trapping program was conducted in the major habitats of the Ash Landfill and reference areas. A line of Sherman live traps, baited with peanut butter and oatmeal, was set out in a specific cover type at around dusk and checked

the next morning. Any captured animals were identified to species then released. The habitat value of the cover types to wildlife was assessed during these field surveys. Any signs of wildlife and vegetation stress or alterations observed during the above surveys were also noted.

2.10 INCINERATOR DUST SAMPLING PROGRAM

Dust was sampled from two furnaces within the Ash Landfill incinerator building (2207) using the cotton swab technique as specified by EPA Region II. The samples were collected from walls and ledges within two refractory-lined chambers in the building as these areas have a high likelihood of containing the parameters of interest and they were also accessible by the sampling team.

Sample DW1206-1 was collected from the northernmost furnace and sample DW1206-2 was collected a furnace located approximately 30 feet to the south. Moistened cotton swabs prepared according to the standard operating procedure developed by EPA Region II for taking dust wipe samples and contained in the appropriate sample jars were provided directly by Aquatec. The prepared swabs for heavy metals were reviewed from the sample container, wiped over a one square foot wall and ledge surface using latex gloves and immediately replaced in the sample container. The swabs for acid base neutral compounds, pesticides, and Pcbs were treated in a similar fashion except these were wiped over a two foot square foot surface. All swabs were noticeably covered with dust and dirt after sample collection. The dust wipe samples were collected by two personnel in modified Level C protective equipment.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–1
SURFACE WATER AND SEDIMENT SAMPLING SUMMARY

SAMPLE LOCATION	MATRIX	SAMPLE NUMBER	WATER DEPTH (Inches)	TEMPERATURE (Degrees Centigrade)	PH (PH Units)	CONDUCTIVITY (umhos/cm)	CHEMICAL ANALYSIS
SW–100	SEDIMENT	S1511–78	3"	7.6	7.5	398	ABCDE
	WATER	no sample	N/A				N/A
	SEDIMENT	S1012–119	4"				ABCDE
	WATER	W1012–119	4"				ABCDE
	SEDIMENT	S1012–119M^	4"				ABCDE
	WATER	W1012–119M^	4"				ABCDE
SW–200	SEDIMENT	S1511–77	3"	N/A	N/A	N/A	ABCDE
	WATER	no sample	N/A				N/A
SW–300	SEDIMENT	S1511–79	3"	10.2	7.9	465	ABCDE
	WATER	W1511–79	1/2"				ABCDE
SW–400	SEDIMENT	S1511–80	3"	9.3	7.5	413	ABCDE
	WATER	W1511–80	1"				ABCDE
SW–600	SEDIMENT	S1611–85	1"	N/A	N/A	N/A	ABCDE
	WATER	no sample	N/A				N/A
	SEDIMENT	S1611–86*	1"				ABCDE
	WATER	no sample	N/A				N/A
SW–700	SEDIMENT	S2011–88	1"	N/A	N/A	N/A	ABCDE
	WATER	no sample	N/A				N/A
SW–800	SEDIMENT	S1611–83	3"	7.3	7.9	500	ABCDE
	WATER	W1611–83	6"				ABCDE
	WATER	S1611–84*	6"				ABCDE
	WATER	W1911–83A	6"				F
	SEDIMENT	no sample	N/A				N/A
	WATER	W1911–84A*	6"				F
SW–900	SEDIMENT	S2011–87	1"	N/A	N/A	N/A	ABCDE
	WATER	no sample	N/A				N/A
SW–901	SEDIMENT	no sample	N/A	N/A	N/A	N/A	N/A
	WATER	S1511–76	2"				ABCDE

Notes:

SW = Sediment and Water
* = Lab Duplicate
^ = Missouri River Division
"no sample" is indicated when there was not enought sample for collection

Chemical Analyses:
A = Volatile Organics (NYSDEC CLP)
B = Semivolatiles Organics (NYSDEC CLP)
C = Pesticides/Pcb's (NYSDEC CLP)
D = Herbicides (SW8150)
E = Metals–including cyanide (NYSDEC CLP)
F = Cyanide only

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–2
SOIL SAMPLING SUMMARY FOR BORINGS

BORING NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL (FEET)	CHEMICAL ANALYSIS
B1–91	S1030–1	0–2	A B C D E
	S1030–2	2–4	A B C D E
	S1030–3	4–6	B C D E
	no recovery	6–8	none
B2–91	S1031–4	0–2	A B C D E
	S1031–5	2–4	A B C D E
	no sample taken	4–6	none
	S1031–6	6–8	A B C D E
	S1031–7	8–10	A
B3–91	S1031–8	0–2	A B C D E
	S1031–9	2–4	A
	S1031–10	4–6	A B C D E
	S1031–11	6–8	A
B4–91	S1101–12	0–2	A B C D E
	S1101–13	2–4	A B C D E
	S1101–14	4–6	A B C D E
	no recovery	6–8	none
B5–91	S1101–15	0–2	A B C D E
	S1101–16	2–4	A B C D E
	S1101–17	4–6	A B C D E
	no sample taken	6–8	none
	S1101–18	8–10	A
B6–91	S1104–19	0–2	A B C D E
	S1104–20	2–4	A B C D E
B7–91	S1104–21	0–2	A B C D E
	S1104–22	2–4	A B C
	no sample taken	4–6	none
	no sample taken	6–8	none
	no sample taken	8–10	none
	S1104–23	10–12	A B C D E
	no recovery	12–14	none
B8–91	S1105–24	0–2	A B C D E
	S1105–25	2–4	A B C D E
	S1105–26 *	2–4	A B C D E
	no sample taken	4–6	none
	S1105–27	6–8	A B C D E

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–2
SOIL SAMPLING SUMMARY FOR BORINGS

BORING NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL (FEET)	CHEMICAL ANALYSIS
B9–91	S1105–28	0–2	A B C D E
	S1105–29	2–4	A B C D E
	no sample taken	4–6	none
	S1105–30	6–8	A B C D E
	no sample taken	8–10	none
	no sample taken	10–12	none
	no sample taken	12–14	none
	no recovery	14–16	none
B10–91	S1106–31	0–2	A B C D E
	S1106–32	2–4	A B C D E
	S1106–33 *	2–4	A B C D E
	no sample taken	4–6	none
	S1106–34	6–8	none
	no recovery	8–10	none
B11–91	S1106–36	0–2	A B C D E
	S1106–37	2–4	A B C D E
	no sample taken	4–6	none
	S1106–38	6–8	A B C D E
B12–91	S1107–39	0–2	A B C D E
	S1107–40	2–4	A B C D E
	no sample taken	4–6	none
	S1107–41	6–8	A
B13–91	S1107–42	0–2	A B C D E
	S1107–43	2–4	A B C D E
	no sample taken	4–6	none
	S1107–44	6–8	A B C D E
B14–91	S1108–45	0–2	A B C D E
	S1108–46	2–4	A B C D E
	S1108–47 *	2–4	A B C D E
	S1108–48	4–6	A B C D E
	no recovery	6–8	none
B15–91	S1108–49	0–2	A B C D E
	S1108–50	2–4	A B C D E
	S1108–51*	2–4	A B C D E
	no sample taken	4–6	none
	S1108–52	6–8	A B C D E
	no recovery	8–10	none

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2-2
SOIL SAMPLING SUMMARY FOR BORINGS

BORING NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL (FEET)	CHEMICAL ANALYSIS
B16-91	S1112-53	0-2	A B C D E
	S1112-54	2-4	A B C D E
	no sample taken	4-6	none
	S1112-55	6-8	A B C D E
B17-91	S1113-56	0-2	A B C D E
	S1113-57	2-4	A B C D E
	S1113-58	4-6	A B C D E
	S1113-59	6-8	A B C D E
B18-91	S1113-60	0-2	A B C D E
	S1113-61	2-4	A B C D E
	S1113-62	4-6	A B C D E
B19-91	S1113-63	0-2	A B C D E
	S1113-64	2-4	A B C D E
	S1113-65	4-6	A B C D E
B20-91	S1114-66	0-2	A B C D E
	S1114-67	2-4	A B C D E
	S1114-68	4-6	A B C D E
	no recovery	6-8	none
	no recovery	8-10	none
B21-90	S1114-69	0-2	A B C D E
	S1114-70	2-4	A B C D E
	S1114-71 *	2-4	A B C D E
	S1114-72	4-6	A
B22-91	S1202-73	0-2	A B C D E
	S1202-74	2-4	A B C D E
	S1202-75	2-4	A
B23-91	S1202-76	0-2	A B C D E
	S1202-77	2-4	A B C D E
	S1202-78	4-6	A B C D E
	no recovery	6-8	none
B24-91	S1203-79	0-2	A B C D E
	S1203-80	2-4	A B C D E
	S1203-81	4-6	A B C D E
B25-91	S1203-82	0-2	A B C D E
	S1203-83	2-4	A B C D E
	S1203-84	4-6	A B C D E

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–2
SOIL SAMPLING SUMMARY FOR BORINGS

BORING NUMBER	SAMPLE NUMBER	SAMPLE INTERVAL (FEET)	CHEMICAL ANALYSIS
B26–91	no sample taken	0–2	none
	S1203–85	2–4	F
B27–91	S1204–86^	0–2	A B C D E
	S1204–87^	2–4	A B C D E
B28–91	S1204–88^	0–2	A B C D E
	S1204–89	2–4	A B C D E
	S1204–89A *	2–4	A B C D E
	S1204–90^	4–6	A B C D E
B29–91	S1204–91	0–2	A B C D E
	S1204–91A *	0–2	A B C D E
	S1204–92	2–4	A B C D E
	S1204–93	4–6	A B C D E
	S1204–93A *	4–6	A B C D E
B30–91	S1204–94	0–2	A B C D E
	S1204–94A *	0–2	A B C D E
	S1204–95	2–4	A B C D E
	S1204–96	4–6	A B C D E
	S1204–96A *	4–6	A B C D E
B31–91	S1205–97	0–2	A B C D E
	S1205–97A *	0–2	A B C D E
	S1205–98^	2–4	A B C D E
	S1205–99	4–6	A B C D E
	S1205–100	6–8	A B C D E

Notes:

* = Lab Duplicate

^ = Also submitted to Missouri River Division of Army Corps of Engineers

"no sample taken" indicates that no sample was collected for laboratory analysis. However, a sample was collected for stratigraphic information

CHEMICAL ANALYSIS:

A = Volatile Organics (NYSDEC CLP)

B = Semivolatile Organics (NYSDEC CLP)

C = Pesticides/Pcb's (NYSDEC CLP)

D = Herbicides (SW8150)

E = Metals –including cyanide (NYSDEC CLP)

F = Total Recoverable Petroleum Hydrocarbons (SW8476)

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2-3
SOIL GAS PROGRAM SUMMARY

Location	Date	Sample Depth	Blows per 6 inches
SG-01	11/15/91	48 inches	1-2-3-7-15-15-14-16
SG-02	11/15/91	(Duplicate of SG-01)	-
SG-03	11/15/91	48 inches	1-3-9-13-9-13-23-39
SG-04	11/15/91	48 inches	4-4-5-6-13-15-11-11
SG-05	11/15/91	(Duplicate of SG-04)	-
SG-06	11/15/91	48 inches	1-3-3-8-18-16-12-14
SG-07	11/15/91	48 inches	2-2-2-6-21-37-55-94
SG-08	11/18/91	48 inches	2-4-11-15-28-50-52-130
SG-09	11/18/91	48 inches	2-4-4-22-44-40-34-34
SG-10	11/18/91	48 inches	2-2-3-10-39-31-53-53
SG-11	11/18/91	37 inches	2-2-3-11-22-70-100/.1'
SG-12	11/18/91	30 inches	2-3-7-17-27-100/.4'
SG-13	11/18/91	48 inches	4-6-5-4-3-3-4-4
SG-14	11/18/91	48 inches	6-8-7-5-10-12-11-9
SG-15	11/19/91	48 inches	5-8-7-5-4-4-5-8
SG-16	11/19/91	42 inches	2-2-7-13-21-41-100
SG-17	11/19/91	40 inches	2-2-3-6-8-20-40-100/.3'
SG-18	11/19/91	36 inches	2-2-2-3-12-50-100/.3'
SG-19	11/19/91	40 inches	2-2-2-3-9-36-100/.4'
SG-20	11/19/91	38 inches	2-2-3-7-19-65-100/.2'
SG-21	11/19/91	36 inches	2-2-5-25-41-91-100/.1'
SG-22	11/19/91	48 inches	2-3-2-3-6-8-15-9
SG-23	11/19/91	48 inches	3-3-7-11-11-18-18-57
SG-24	11/19/91	48 inches	2-2-3-6-17-23-30-27
SG-25	11/19/91	48 inches	2-2-4-9-11-16-27-34
SG-26	11/19/91	48 inches	3-6-5-2-1-1-1-1
SG-27	11/19/91	48 inches	8-38-26-9-6-5-3-4
SG-28	11/19/91	48 inches	2-3-7-13-16-10-4-7
SG-29	11/19/91	(Duplicate of SG-28)	-
SG-30	11/19/91	48 inches	2-4-7-13-12-9-6-6
SG-31	11/20/91	(Rod Blank)	-
SG-32	11/20/91	48 inches	4-13-22-13-10-3-4-3
SG-33	11/20/91	48 inches	3-3-2-5-6-6-6-10
SG-34	11/20/91	48 inches	3-7-13-12-8-8-6-4
SG-35	11/20/91	48 inches	5-8-7-6-5-4-3-4
SG-36	11/20/91	48 inches	2-3-4-3-3-2-5-10
SG-37	11/20/91	48 inches	1-2-2-8-28-37-64-64
SG-38	11/20/91	45 inches	1-2-4-8-21-42-74-100/.3'
SG-39	11/20/91	48 inches	1-2-2-3-8-22-20-14
SG-40	11/20/91	38 inches	1-3-2-10-26-74-100/.2'
SG-41	11/20/91	45 inches	2-2-4-8-17-31-58-100/.3'
SG-42	11/20/91	42 inches	2-2-2-3-12-36-115
SG-43	11/20/91	48 inches	1-2-3-2-5-11-16-20

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–3
SOIL GAS PROGRAM SUMMARY

Location	Date	Sample Depth	Blows per 6 inches
SG–44	11/20/91	48 inches	2–2–3–9–31–53–43–71
SG–45	11/21/91	40 inches	2–2–2–3–9–40–100/.4'
SG–46	11/21/91	39 inches	2–1–26–27–42–65–100/.3'
SG–47	11/21/91	38 inches	2–2–2–3–12–47–100/.2'
SG–48	11/21/91	48 inches	2–1–2–2–10–18–38–42
SG–49	11/21/91	(Rod Blank)	–
SG–50	11/21/91	48 inches	1–1–2–3–3–2–2–1
SG–51	11/21/91	44 inches	1–3–2–9–19–24–85–100/.2'
SG–52	11/21/91	38 inches	1–2–2–4–7–7–11–12
SG–53	11/21/91	48 inches	1–1–2–3–4–5–8–10
SG–54	11/21/91	48 inches	1–2–2–6–13–19–30–52
SG–55	11/21/91	48 inches	1–2–2–4–5–2–2–2
SG–56	11/21/91	38 inches	2–2–5–11–24–52–100/.2'
SG–57	11/21/91	48 inches	1–2–3–5–8–13–19–16
SG–58	11/21/91	48 inches	2–1–2–2–6–12–14–21
SG–59	11/21/91	48 inches	1–2–1–4–17–29–29–34
SG–60	11/21/91	48 inches	2–6–9–10–9–7–5–3
SG–61	11/21/91	(Reanalysis of SG–60)	–
SG–62	11/21/91	48 inches	5–13–23–16–13–12–7–3
SG–63	11/21/91	48 inches	7–12–18–12–10–4–4–5
SG–64	11/21/91	48 inches	4–7–8–7–9–6–3–19
SG–65	11/21/91	48 inches	3–5–7–6–4–5–6–12
SG–66	11/21/91	48 inches	2–4–5–5–7–5–4–2
SG–67	11/21/91	48 inches	1–2–2–3–23–50–66–23
SG–68	11/22/91	48 inches	4–4–3–3–5–7–11–9
SG–69	11/22/91	48 inches	2–5–7–3–1–5–10–14
SG–70	11/22/91	48 inches	2–2–3–3–2–2–3–6
SG–71	11/22/91	48 inches	1–2–4–5–6–8–8–9
SG–72	11/22/91	(Rod Blank)	–
SG–73	11/22/91	48 inches	3–3–3–3–11–29–44–61
SG–74	11/22/91	48 inches	2–2–3–6–18–34–35–36
SG–75	11/22/91	48 inches	2–2–3–8–8–11–17–29
SG–76	11/22/91	48 inches	1–2–3–7–9–9–11–18

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2-4
LOCATION AND RATIONALE FOR MONITORING WELLS

WELL	LOCATION AND RATIONALE
MW-34	Shallow monitor well downgradient of the area south of the incinerator to evaluate potential offpost contaminants migration
MW-35/MW-36	Deep/shallow monitor wells downgradient of the ash landfill area to evaluate the offpost groundwater quality in the shallow and deep zones. Additionally, this pair of nested wells were used in aquifer characterization in evaluating the potential vertical connection between the shallow and deep groundwater zones.
MW-37	Shallow monitor well downgradient of the burning pits and purposed geophysical/soil gas surveys north of the ash landfill to evaluate potential offpost migration. Water quality data from this well will be used to evaluate potential offpost contamination.
MW-38D	Deep monitor well, nested with existing shallow monitor well PT-16, to evaluate water quality in the deep zone. Additionally, this pair of nested wells will be used to further evaluate potential vertical connection between the shallow and deep groundwater zones.
MW-39	Shallow monitor well downgradient of the anomalies detected from previous geophysical/soil gas surveys to evaluate downgradient water quality from these anomalous areas.
MW-40	Shallow monitor well east of the contaminant plume identified from the previous soil gas survey and groundwater analytical data. This well will be used to help determine the eastern (upgradient) extent of contamination.
MW-41D	Deep monitor well northeast of the ash landfill to evaluate background water quality conditions in the deep zone.
MW-42D	Deep monitor well southeast of the ash landfill to evaluate background water quality conditions in the deep zone.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 2–5
GROUNDWATER SAMPLING SUMMARY

MONITORING WELL NUMBER	SAMPLE DATE	CONDUCTIVITY uMHO (5)	PH pH UNITS (5)	TEMPERATURE °C (5)	CHEMICAL ANALYSES (6)
PT–10 (1)	1/8/92	570, 590	7.4, 7.5	9.0, 8.6	ABCDE*
PT–11 (4)	1/15/92	980	7.2	9.1	ABCDE*
PT–12 (4)	1/17/92	600	7.2	6.5	ABCDE*
PT–15 (4)	1/9/92–1/13/92	349	7.3	7.4	ABCDE*
PT–16	1/8/92	355, 352	6.8, 6.9	6.1, 6.4	ABCDE*
PT–17	1/16/92	433, 441	6.3, 6.5	7.1, 7.1	ABCDE*F
PT–18	1/9/92	1230, 1190	6.8, 6.9	8.2, 8.6	ABCDE*
PT–19	1/17/92	510, 510	7.0, 7.0	6.3, 6.2	ABCDE*
PT–20 (1)(2)	1/17/92	500, 500	7.2, 7.0	6.9, 6.8	ABCDE*
PT–21 (4)	1/17/92	690	7.4	6.4	A
PT–22	1/9/92	620, 610	7.1, 7.3	7.1, 7.0	ABCDE*
PT–23 (4)	1/14/92	391	7.3	8.5	ABCDE*F
PT–24	1/14/92	428, 428	6.9, 7.1	7.5, 7.4	ABCDE*
PT–25	1/15/92	300, 307	7.1, 7.0	6.5, 6.6	ABCDE*
PT–26	1/17/92	510, 510	7.6, 7.6	6.7, 7.5	ABCDE*
MW–27 (4)	1/15/92–1/16/92	413	7.5	5.9	ABCDE*
MW–28	1/15/92	381, 386	7.6, 7.6	5.8, 5.9	ABCDE*
MW–29 (2)	1/15/92	439, 462	7.0, 7.1	5.1, 6.3	ABCDE*
MW–30	1/16/92	384, 387	7.1, 7.2	3.9, 4.2	ABCDE*
MW–31	1/16/92	348, 355	7.3, 7.4	6.9, 7.0	ABCDE*
MW–32	1/16/92	400, 409	7.0, 7.0	5.2, 5.8	ABCDE*
MW–33	1/16/92 & 1/29/92	347, 350	7.0, 7.0	5.2, 5.7	ABCDE*
MW–34	1/10/92	412, 470, 480	7.6, 7.5, 7.6	8.5, 8.7, 9.2	ABCDE*
MW–35D (4)	1/14/92	409	8.5	8.8	ABCDE*
MW–36	1/14/92	490, 496	7.0, 7.1	7.3, 7.7	ABCDE*
MW–37	1/10/92 & 1/16/92	420, 428	6.7, 6.8	7.3, 7.3	ABCDE*
MW–38D	1/8/92	373, 378	7.3, 7.5	9.5, 9.9	ABCDE*
MW–39	1/14/92	361, 359	7.1, 7.2	7.5, 6.9	ABCDE*
MW–40	1/9/92	386, 399	7.3, 7.4	8.3, 8.8	ABCDE*
MW–41D (2) (4)	1/13/92	490, 460	7.2, 7.4	9.8, 10.2	ABCDE
MW–42D (4)	1/13/92	409	7.3	9.3	ABCDE*F
PT–1 (3)	1/10/92	412, 470, 480	7.6, 7.5, 7.6	8.5, 8.7, 9.2	ABCDE*
PT–2 (3)	1/15/92	381, 386	7.6, 7.6	5.8, 5.9	ABCDE*
PT–3 (3) (4)	1/17/92	600	7.2	6.5	ABCDE*

Notes:

(1) Matrix spike and matrix spike duplicate sample collected.

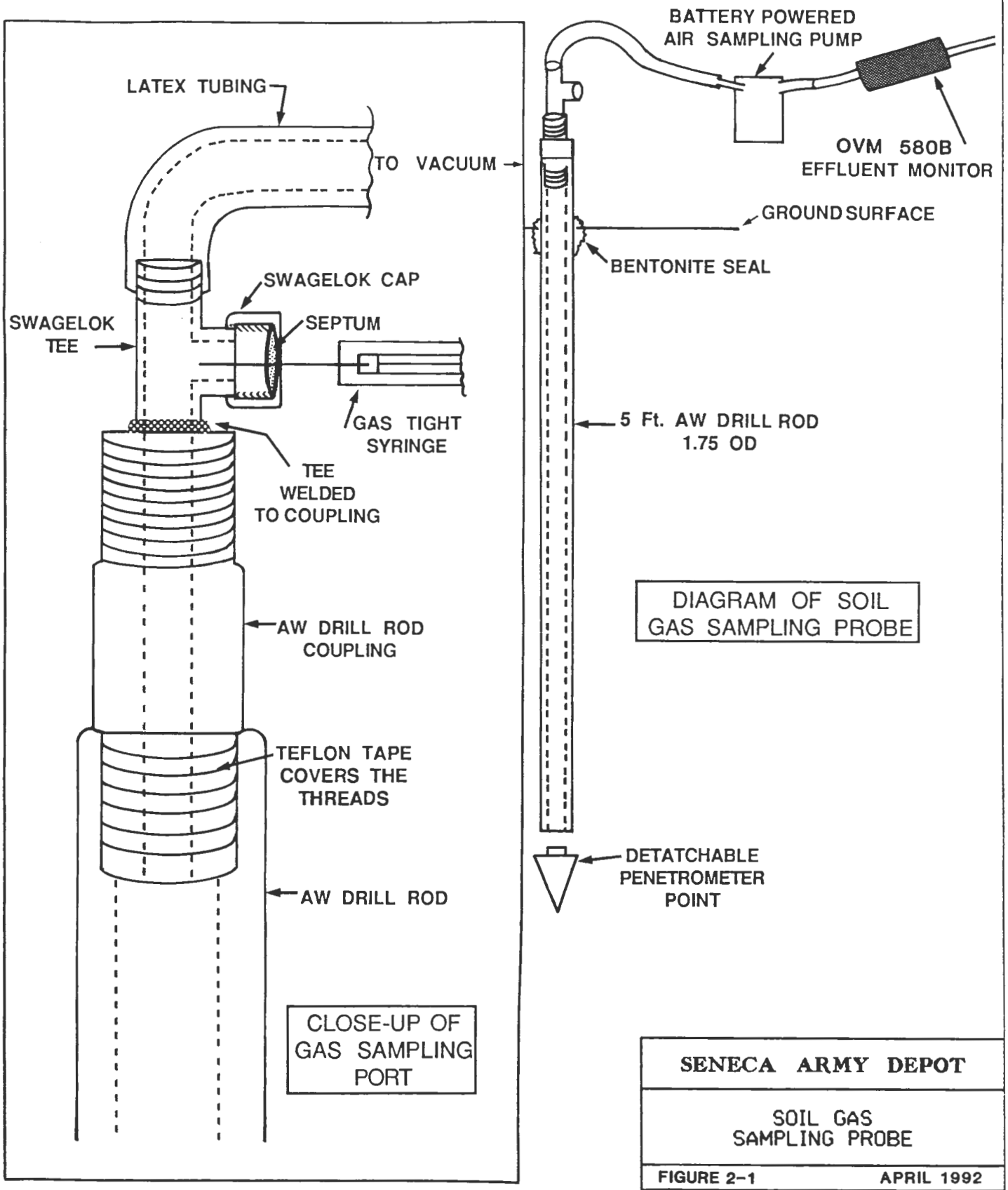
(2) Sample sent to Missouri River Division of the Corps of Engineers.

(3) Duplicate sample collected:
PT–1 is a duplicate of MW–34
PT–2 is a duplicate of MW–28
PT–3 is a duplicate of PT–12

(4) Well bailed to near dryness during sampling.

(5) Two consecutive readings were taken in the wells that were not bailed to near dryness.

(6) Chemical Analyses:
A = Volatile Organics (NYSDEC CLP)
B = Semivolatile Organics (NYSDEC CLP)
C = Pesticides/Pcb's (NYSDEC CLP)
D = Herbicides (SW 8150)
E = Metals – including cyanide (NYSDEC CLP)
* indicates a dissolved metal sample was collected
F = Alkalinity, COD, BOD, chloride, sulfate, TOC, hardness, residue (Total, Dissolved, Suspended)



SENECA ARMY DEPOT

SOIL GAS SAMPLING PROBE

FIGURE 2-1 APRIL 1992

MAIN 1893

CHAS. T. MAIN, INC., Engineers
BOSTON . CHARLOTTE . PASADENA

NORTH

SENECA ARMY DEPOT

ASH LANDFILL

SENECA ARMY DEPOT

SENECA LAKE

Pontius Pt.

Wilcox Creek

Kendaia Creek

Indian Creek

Sampson (PO)

SAMPSON STATE PARK

ROMULUS

SENECA ARMY AIRFIELD

Romulus

Central Sch

Mt Green Cem

Trailer Park

Sewage Disposal

Reservoir

BROMKA

KENNEDY ROAD

RUSSEL ROAD

CHERRY HILL ROAD

YERKES ROAD

SCALE IN FEET

0 2000 4000 6000

SENECA ARMY DEPOT
PRELIMINARY SITE
CHARACTERIZATION REPORT
ASH LANDFILL

STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN TWO MILES OF THE ASH LANDFILL SITE

APRIL 1992

MAIN 1893

FIGURE 2-2

0.5 MILE
STUDY AREA

MILITARY RESERVATION
BOUNDARY

NORTH

ROUTE 96A

Kendaia
Creek

ABANDONED INCINERATOR BUILDING

603

CONRAIL

BM
538

660

SCALE IN FEET
0 500 1000

SENECA ARMY DEPOT
PRELIMINARY SITE
CHARACTERIZATION REPORT
ASH LANDFILL

STUDY AREA OF NATURAL
RESOURCES WITHIN 0.5 MILE
OF THE ASH LANDFILL SITE

APRIL 1992

MAIN
1893

FIGURE 2-3

3.0 DETAILED ENVIRONMENTAL SETTING AND PHYSICAL CHARACTERISTICS OF THE SITE

3.1 DETAILED DESCRIPTION OF THE SITE

The Ash Landfill site is approximately 130-acre site and is composed mostly of undeveloped land with a few areas that contain man-made features or structures related to past site activities. The site is bound on the north by Cemetery Road, on the east by the Seneca Army Depot Railroad, on the south by open grassland and brush, and on the west by a the boundary of the depot (Plate 1-1). Generally, topography on the site slopes gently to the west.

Undeveloped areas are present mostly in the northern and extreme southwestern portions of the site. The area to the north of the ash landfill and debris piles is comprised mostly of low grasses with areas of dense brush and a few trees. South of West Smith Farm Road dense brush with some small open grassy areas dominate.

Major features on the site are an abandoned incinerator building (Building 2207), a cooling pond, the Ash Landfill, and a Non-Combustible Fill Landfill. The abandoned and somewhat dilapidated incinerator building is situated on a small artificially constructed mound and can be accessed via a paved driveway off of West Smith Farm Road. Garage-type entrances are on the east side whereas, doors are on the western, southern or northern sides of the building. An underground fuel oil storage tank is located immediately adjacent to the northeastern corner of the incinerator building. An approximately 70-foot diameter abandoned cooling pond is located 10 feet from the northeastern corner of the incinerator building. The Ash Landfill is located slightly north of this point. The approximately 600 x 300 foot kidney-shaped ash landfill is defined by the 4 foot rise in topography (Plate 1-1). It is mostly vegetated with low grass, however, there are areas void of any vegetative cover.

The Non-Combustible Fill Landfill is located across West Smith Farm Road from the incinerator. This roughly rectangular, wedge-shaped fill area thickens to the west where it reaches a maximum total relief of approximately 14 feet at its toe. The top surface of the filled area is covered with low grassy vegetation.

An asphalt patch area exists in the western portion of the site near the gate at West Smith Farm Road. The former use of this patched area is not known.

Utilities on the site include a water main and overhead utilities for phone and electricity. A 6" diameter underground water main traverses the central portion of the site from Cemetery Road to an area south of the incinerator building, where it branches to the west toward a fire hydrant and to the east toward the incinerator. Approximately 50 feet from the Seneca Army Depot railroad tracks the water main turns to the south where it crosses West Smith Farm Road and exits the site. In addition, there is a water gate immediately west of the cooling pond which is supplied with water.

Access to the site is provided along West Smith Farm Road, West Patrol Road and Cemetery Road. An unpaved road originates on the southern edge of West Smith Farm Road and leads into grassy fields and brush to the south. Another unpaved road originates in two locations east and west of the incinerator building. This road leads north along the western edge of the ash landfill where it bends to the east and loops toward the Seneca Army Depot railroad tracks before returning to the central portion of the site. This road exits the site near the intersection of Cemetery Road and the 6" underground water main.

3.2 TOPOGRAPHY

SEAD, approximately 64 kilometers (km) south of Lake Ontario near Romulus, New York, lies on the western side of a broad north-to-south-trending series of rock terraces mantled by glacial till forming a divide that seperates Cayuga Lake on the east and Seneca Lake on the west. The site is in an uplands area (generally over 600 feet (ft) in elevation).

The Ash Landfill area is located on gently sloping terrain along the western boundary of SEAD, immediately east of the magazine area. The majority of the site, which slopes downward to the west-southwest, is vegetated with grasses and occasional brush thickets (Plate 1-1). Surface runoff from the area is collected in drainage ditches along the east-west roadway (West Smith Farm Road) and the north-south roadway (West Patrol Road).

3.3 CLIMATOLOGY

Table 3-1 summarizes climatological data for the SEAD area. The nearest source of climatological data is in Cornell University, in New York, which is approximately 27 miles southeast of the army depot. However, only precipitation and temperature measurements are available from this location. The remainder of the data reported in Table 3-1 have been taken from isopleth drawings from a climatic atlas, or from data collected at Syracuse, New

York, 40 miles northeast of the SEAD. Meteorological data collected from 1965 to 1974 at Hancock International Airport in Syracuse, New York, were utilized in preparation of the wind rose. The airport is located approximately 60 miles northeast of SEAD, and the data can be considered representative of wind patterns at SEAD. The wind rose is presented in Figure 3-1.

A cool climate exists in the locality of SEAD with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nightime lows during the summer and portions of the transitional seasons. Precipitation is uncommonly well-distributed, averaging approximately 3 inches per month. This precipitation is derived principally from cyclonic storms which pass from the interior of the county through the St. Lawrence Valley. Lakes Seneca, Cayuga, Ontario provide a significant amount of the winter precipitation and moderate the local climate. The annual average snowfalls is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow. The most frequently occurring wind directions are westerly and west-southwesterly.

As Table 3-1 shows, temperature tend to be highest from June through September. Precipitation and relative humididty tend to be rather high throughout the year. The months with the most amount of sunshine are June through September. Mixing heights tend to be lowest in the summer and during the morning hours. Wind speeds also tend to be lower during the morning, which suggests taht dispersion will often be reduced at those times, particularly during the summer. However, no episode-days are expected to occur with low mixinng heights (less than 500 m) and light wind speeds (less than or equal to 2 m/s).

Daily precipitation data measured at the Aurora Research Farm in Aurora, New York (approximately 10 miles east of the site) for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The maximum 24-hour precipitation measured at this station during this period was 3.91 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were already reported in Table 3-1. An independent value of 27 inches for mean annual evaporation from open water surfaces was estimated from an isoplethed figure in "Water Atlas of the United States" (Water Information Center, 1973).

Information on the frequency of inversion episodes for a number of National Weather Service stations is summarized in "Mixing Heights, Wind Speeds, and Potential for Urban Air

Pollution Throughout the Contiguous United States" (George C. Holzworth, US EPA, 1972). The closest stations for which inversion information is available for Albany, New York and Buffalo, New York. The Buffallo station is nearer to SEAD but almost certainly exhibits influences from Lake Erie. These influences would not be expected to be as noticeable at SEAD.

SEAD is located in the Genesse-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as non-attainment for ozone and attainment or unclassified for all other criteria pollutants. Data for existing air quality in the immediate area surround the SEAD, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the army depot (Rochester or Monroe County or Syracuse of Onodaga County). A review of the data for Rochester, which is in the same AQCR as the SEAD, indicates that all monitored pollutants (sulfur dioxide, particulates, carbon monoxide, lead, ozone) are below state and federal limits, with the exception of ozone. In 1987, the maximum ozone concentration observed in Rochester was 0.127 ppm. However, this value may not be representative of the SEAD area which is a more rural environments.

3.4 SURFACE WATER HYDROLOGY AND SEDIMENTS

3.4.1 Surface Water and Sediment

Surface water on-site drains into several wetland areas on-site. Based on topographic expression, several of these wetland areas (W-B, W-D, W-E, and W-F) drain mostly into two small, but clearly developed, drainage swales south of the Ash Landfill and incinerator building (Plate 1-1). These swales drain into a drainage ditch along West Patrol Road. Surface water, when present, drains to the north along West Patrol Road. Wetland W-F also drains into the ditch along West Patrol Road. Drainage along West Patrol Road, and along Cemetery Road, is to the west based on topography.

Precipitation data from the nearest monitoring station (Aurora Research Farm), with comparable precipitation to that in Romulus, N.Y. was reviewed to gain a perspective on the seasonal variations in rainfall which would directly impact surface water flow. This data indicates that, historically, June has had the greatest amount of rainfall, 3.9 inches, and the winter months (January and February) generally have had the least amount of rainfall (Figure 3-2).

3.4.2 Spring Survey

Suspected spring locations within a one mile radius of the Ash Landfill were determined in the field between October 29 and November 1, 1992 (Figure 3-3). There was no rainfall during this period and previous to this time conditions were described as "dry" by local residents; there was also no snow cover. These conditions minimized the potential that any observed water flows during this investigation were due to surface run-off.

The most likely locations of springs within the study area were the headwaters of Kendaia and Indian Creeks. Field observations, however, indicated that the origins of both streams were to the west of the study area. Potential springs associated with a small unnamed stream that originates near the Seneca Army Airfield and passes through Sampson State Park could not be definitively identified due to extensive culverting of the stream under the landing strip. Three locations upgradient of the Airfield were reviewed and found to be dry. These locations were man-made drainage ditches which drain into the culvert system associated with the landing strip.

Field observations made at potential seeps within wetlands in proximity to and downgradient of the Ash Landfill site found no evidence of springs within these wetlands. It appears that low spots with poorly drained soils are enabling surface run-off to collect and form hydric conditions that are conducive to wetland formation.

No evidence of springs within a one mile radius of the Ash Landfill was observed during the field work.

3.5 GEOLOGY

The site geology is characterized by gray Devonian shale with a thin weathered zone where it contacts the overlying mantle of Pleistocene glacial till. This stratigraphy is consistent over the entire site and in the site vicinity.

3.5.1 Competent and Weathered Shale

Gray competent shale was encountered between 6 and 14 feet below the land surface in all existing and newly performed borings on the site and in off-site surrounding areas. A bedrock topographic map (Plate 3-1) shows that topography shapes consistently to the west from an

elevation of 720 feet in the eastern portion of the site to 614 feet in the western portion of the site. Bedrock topographic gradients are steepest in the eastern portion of the site (as is land surface topography) and in the southwestern portion of the site where they shift slightly to the southwest. A low ridge which protrudes from the area of PT-20 to MW-32 and MW-30 is an anomaly in the bedrock topography.

A thin (1.5 to 12 feet thick) zone of gray weathered shale was encountered in almost all locations drilled on-site. This zone is characterized by fissile shale with a large amount of brown intersticial silt and clay. An isopach map for the weathered shale indicates that thickness varies throughout the site (Plate 3-2), with the greatest thickness occurring approximately 260 feet west of the incinerator building and the least thick area occurring approximately 400 feet north of the incinerator building. Differential weathering through geologic time is likely responsible for the variable thicknesses. A small weathered shale trough with a northeast-southeast oriented axis is located south of the ash landfill incinerator building area and culminates at the thickest portion of the weathered shale near PT-20. The transition from the competent weathered shale is sharp based on drilling characteristics. No outcrops of weathered or competent shale are exposed on the site.

3.5.2 Glacial Till

A 2 to 11 foot thick mantle of dense glacial till covers the shale on-site. The till is generally characterized by brown to gray-brown silt, clay and fine sand with few fine to coarse gravel-sized inclusions of weathered shale. Larger diameter weathered shale clasts (as large as 6-inches in diameter) are more prevalent in basal portions of the till and are probably ripped-up clasts removed by the once active glacier. The general Unified Soil Classification System description of the till on-site is as follows: Clay-silt, brown; slightly plastic, small percentage of fine to medium sand, small percentage of fine to coarse gravel-sized gray shale clasts, dense and mostly dry in place, till, (ML).

Darian silt-loam soils, 0 to 18 inches thick, are developed over the till on-site, however, in some locations till is exposed at the surface. The surficial soils are somewhat poorly drained and have a silt clay loam and clay sub soil. In general, the topographic relief associated with these soils is 3-8%.

3.5.3 Cross-Sections

Three geologic cross-sections were constructed for the site. The locations of these sections are shown in Plate 3-3. East-west cross-sections A-A′ and north-south cross-sections B-B′ and C-C′ show the consistent till-weathered shale-competent shale stratigraphy beneath the site based on data from borings and monitoring wells (Plate 3-4). The scale of the sections did not permit identification of the soil horizon. Cross-section A-A′ illustrates the variable thickness of the weathered shale and the relatively uniform thickness of the till, which appears to thicken in the western portion of the site. The Ash Landfill, up to 4 feet-thick, is shown on sections A-A′ and B-B′.

3.5.4 Filled Areas

Several artificially filled areas exist on the site. These include the Ash Landfill, numerous debris piles and the Non-Combustible Fill Landfill. The approximately 600 x 300 foot Ash Landfill is presented in cross-section on Plate 3-4 where it overlies glacial till. This ash fill is defined by the slightly higher elevation in this area. The extent of the fill is confirmed by borings B40A-91, B40B-91, and B19-91 to the east, by B20-91 to the south and by numerous borings (B15-91, B-17-91, B27-91 through B30-91) to the north. The three debris piles north and northeast of the ash landfill and are at slightly higher elevations relative to the surrounding areas; this is especially evident at the easternmost debris pile. The Non-Combustible Fill Landfill, located across West Smith Farm Road, is a wedge of fill that originates south of B6-91 and thickens to the west to a point approximately 150 feet beyond B7-91. It is well defined by the topographic expression of the fill which has a total relief of about 14 feet at the western toe. This fill is underlain by thin horizons of till and weathered shale, below which is competent shale.

3.6 GEOPHYSICS

The tabulated results and maps for the geophysical surveys conducted by Blasland and Bouck Engineers are contained in Appendix B.

3.6.1 EM-31 Survey

The EM-31 terrain conductivity survey identified anomalies within both Area 1 and Area 2 at the Ash Landfill site. Anomalies defined by elevated conductivity and in-phase

measurements were identified by plots of the conductivity and in-phase data collected along survey lines. Survey line plots of measured conductivity and in-phase readings show good correlation along each survey line profile (Appendix B). Anomalies are indicated by the unusually high or low conductivity and/or in-phase measurements. Conductivity anomalies were considered to represent readings above or below the typical background measurements ranging from 10.5 to 13.5 milli Siemens/meter. In-phase anomalies were compared to conductivity anomalies to determine potential locations for buried metallic material along each survey line.

A summary of EM-31 anomaly locations along survey lines are presented on Table 3-2. The EM-31 survey data was also used to prepare conductivity and in-phase contour maps for the two areas investigated at the Ash Landfill. The contoured conductivity data and the contoured in-phase data are presented in Appendix B. The contoured conductivity data clearly shows anomalies in both Areas 1 and 2. In Area 1, several anomalies are distinguishable. The linear north-south trending anomaly at station 550 east of West Patrol Road is caused by a 6-inch water main. Several smaller conductivity anomalies are present on survey lines 3, 4, 5, 10, 13, 14, and 15. In Area 2, several anomalies are evident in both the eastern and western sections. The linear north-south trending anomaly at station 1650 is again caused by a 6-inch water main. The two large anomalies present along survey lines 17, 18, and 19 from stations 1150 to 1450 are caused by the Non-Combustible Fill Landfill. Several small conductivity anomalies are also present along survey lines 16, 17, and 18 from stations 450 to 650. The nature of these anomalies were further characterized by GPR profiling.

3.6.2 GPR Survey

GPR was performed at anomolies identified by the conductivity survey. GPR traverses across EM-31 anomalies were performed to determine the nature (i.e., potential type and length) of these anomalies. The objective of this survey was to identify the presence of buried drums. Table 3-3 summarizes the results of the GPR anomaly review and characterization. About 78 percent of the anomalies defined by GPR, and summarized on Table 3-3, were characteristic of fill areas containing small debris. Nine anomalies had GPR signatures similar to signatures produced by an underground pipe or buried drum. These included anomalies located on survey lines 5, 13, 16, 17, and 18 (see Table 3-3 for anomaly locations along survey lines).

The GPR profiles for the ten anomalies containing possible pipe or drum signatures are presented in Appendix B. The profiles show the characteristic hyperbolic signature typical of a buried cylindrical object. A second characteristic of these signatures is the image duplication or echo, downward through the profile caused by a resonance feature associated with metallic objects. The presence of these two characteristics were evaluated to determine the likelihood of an anomaly containing a buried pipe or drum. Anomalies present on the graphic profiles in Appendix B were considered to have these characteristics and have been annotated to show the location and station of the anomaly.

Geophysical anomalies were further investigated during the soil gas and soil boring and test pit programs.

3.7 HYDROGEOLOGY

3.7.1 Introduction

The hydrogeologic properties of the site were characterized in accordance with the investigation programs described in Section 2.0. This section presents the results of this investigation and addresses topics such as saturated thickness, horizontal and vertical direction of groundwater flow, groundwater gradients, hydraulic conductivities of shallow and deep aquifers, and groundwater velocity on-site.

3.7.2 Saturated Thickness of Shallow Aquifer

Saturated thicknesses in all on-site monitoring wells (based on January 7, 1990 depth to water measurements) are indicated in Table 3-4. The average saturated thickness in the shallow aquifer is 8.7 feet based on January 7, 1992 depth to water measurements. Generally, saturated thicknesses are greatest in the eastern and southwestern portions of the site. Depths to groundwater from three separate rounds of measurements are presented in Table 3-5.

Historically, saturated thickness has fluctuated widely on the site based on depth to water measurements made during past groundwater sampling events, specifically September 1990 (Table 3-4). A comparison of saturated thicknesses from September 1990 and January 1992 yields an average difference of 4.76 feet. The September 1990 data indicate an absence of

a shallow aquifer in the area of MW-29 and aquifer thicknesses of less than 2 feet in many locations on the site.

3.7.3 Groundwater Flow Directions

Shallow Aquifer

A groundwater topography map was constructed based on depth to water measurements made on January 7, 1992 (Plate 3-5). The map indicates that the general direction of groundwater flow in the shallow aquifer is to the west toward Seneca Lake roughly mimicking surface topography. Shallow aquifer elevations are approximately 655 feet in the eastern portion of the site and drop to a low of 630 feet in the western portion of the site.

The groundwater gradient between wells PT-18 and PT-17 was calculated to be 2.13×10^{-2} feet per foot based on depth to water measurements made on January 7, 1992. Groundwater flow contours indicate that there is a consistent gradient over the entire site.

Deep Aquifer

A flow direction for the deep competent shale aquifer can not be accurately determined from the array of wells on the site. However, groundwater elevations in deep wells are higher in the eastern portion of the site (between approximately 680 and 686 feet) than they are in the western portion of the site (between approximately 630 and 634 feet) suggesting that a westerly direction of flow in the deep aquifer is likely.

While these data suggest a westerly direction of groundwater flow, the exact size and orientation of fractures in the shale on the site are unknown and may significantly influence the flow direction. Mazzola (1951) recognized two distinct sets of joints in the area. The main set, termed dip joints, appear to be in the form of two conjugate shear planes that intersect to form acute angles ranging from 10° to 30°. The mean direction of the dip joints ranges from North 15° to 30° East to North 30° to 45° West. Strike joints at right angles to the dip joints trend from North 50° East to North 70° East and are spaced from 1 inch to 4 feet apart. The dip of the joint planes ranges from 46° to nearly vertical. In addition, most of the joints in the beds of the shale are filled with clay or fine silt which may inhibit groundwater flow.

Vertical Connection Between Shallow and Deep Aquifers

Vertical connection tests on paired wells PT-16 and MW-38D, and MW-36 and MW-35D indicate that there is a measurable drawdown in the shallow wells screened in the till and weathered shale when water is purged from their respective paired deep wells screened in competent shale.

Well PT-16 exhibited very small, although constant drawdown throughout the time MW-38D was purged (Figure 3-4). Throughout the time of the test, the depth of water in MW-38D was well below that in PT-16, and at one instance MW-38D was nearly dry. After purging of MW-38D ceased at 17.5 minutes, drawdown in PT-16 continued for another 3.5 minutes and reached a steady maximum of 0.028 feet between 21 and 40 minutes. After 40 minutes, PT-16 began to recover at approximately the same rate of drawdown, although the test was not run until full recovery had occurred due to the length of time expected for this well to fully recover.

Well MW-36 exhibited a similar drawdown in response to purging of MW-35D as PT-16 (Figure 3-4). In this test, purging of MW-35D ceased at 24 minutes after which drawdown in MW-35 continued to increase for several minutes. At 30 minutes, drawdown proceeded at a slower rate with some fluctuations until about 45 minutes when drawdown appears to cease. Total drawdown reached 0.085 feet in MW-36. MW-35D was also purged to near dryness during the test. It is likely that recovery of MW-35 occurred after approximately 45 minutes.

Water level measurements from three different dates indicate that there is a downward vertical gradient in the area of PT-16 and MW-38D well cluster where an average head difference of +0.43 feet was calculated. This suggests that downward component of groundwater flow into the deep aquifer exists (Table 3-6). Topographically and hydrologically downgradient from this location, a weaker upward movement of groundwater was measured in the area of the MW-36 and MW-35D well cluster, where an average head difference of -0.13 feet was calculated (Table 3-6).

Differences in the vertical head (i.e. vertical flow direction) are likely the result of differences in screen interval depth between the two deep wells. The screened intervals in competent shale for deep wells MW-38D and MW-35D are 9.7 to 29.7 feet and 29-54 feet below the

land surface, respectively. Water in deep fractures (29-54 feet) is exist at a greater head than the water in shallower fractures (9.7-29.7 feet).

Based on this limited data, downward movement of groundwater occurs from the shallow till/weathered shale aquifer into the upper portions of the competent shale aquifer. However, in deeper portions of the competent shale aquifer groundwater movement is upward, possibly driven by the topographic highs between Seneca and Cayuga Lakes. It is likely that the size and distribution of fractures ultimately controls the relative movement of groundwater in this aquifer. The maximum topographic high between Seneca and Cayuga lakes in the region of the Ash Landfill is approximately 760 feet MSL; this location is 16,000 feet (3 miles) to the east of the Ash Landfill. Also, there is a 51 foot difference in hydraulic head in the competent shale aquifer between eastern and western portions of the site, based on an average elevation between the two deep wells in each area (MW-38D and MW-35D, and MW-4D and MW-42D) as measured on January 7, 1992.

3.7.4 Hydraulic Conductivities

Hydraulic conductivities were determined for both the shallow and deep aquifers on the Ash Landfill site (Table 3-7). Hydraulic conductivities for wells screened in the shallow till/weathered shale aquifer were determined using the methods of 1) Bouwer and Rice (1976) and 2) Horslev (1951). Generally, the values are similar, however, in several instances the values calculated using the Horslev method are slightly higher.

Average hydraulic conductivity valves for the shallow aquifer range from 2.3×10^{-5} cm/sec to 6.4×10^{-4} cm/sec. Average hydraulic conductivity values for the deep aquifer range from 1.9×10^{-7} to 4.1×10^{-5}. The average hydraulic conductivities for the shallow and deep aquifers are 3.2×10^{-4} and 1.2×10^{-5} cm/sec, respectively (Table 3-7).

Published hydraulic conductivity values for till or representative materials are: 1) 0.49 m/day (5.67×10^{-4} cm/sec) for a repacked predominantly sandy till (Todd 1980), and 2) from 10^{-2} to 10^{-3} m/day (10^{-5} to 10^{-6} cm/sec) for representative materials of silt, sand, and mixtures of sand, silt, and clay (Todd 1980).

3.7.5 Velocity of Groundwater

Using Darcy's Law, the average linear velocity of groundwater in the shallow till/weathered shale aquifer was calculated. The estimate incorporated the average site hydraulic conductivity, till effective porosity estimates, and the on-site groundwater gradient. A porosity estimate for weathered fissile shale with large amounts of silt in the interstices could not be located in the literature, therefore, only a value for the till was used in the calculations. However, the silty weathered shale may resemble the till. For comparison competent shale is reported to have an effective porosity of about 6% (Todd 1980).

High and low end values for velocity were calculated to illustrate the possible range of velocities on-site. The average linear velocities of groundwater flow, using the method described Darcy's Law are based on: 1) an average hydraulic conductivity of 3.2×10^{-4} cm/sec (0.55 ft/day), 2) estimated effective porosities of 11% (.11) from the ICF 1989 study and 25% (.25) from Driscoll 1986, and 3) a groundwater gradient of 2.13×10^{-2} ft/ft. The Darcy equation for the average linear velocity (V) of groundwater flow (Freeze and Cherry 1979) is:

$$V = \frac{K \frac{dh}{dL}}{n}$$

where K is the hydraulic conductivity, n is the estimated effective porosity and dh/dL is the hydraulic gradient. Substituting the above-referenced values into this equation yields an average linear velocity of 1.1×10^{-1} feet/day or 38.9 feet/year for a porosity of 11%, and 4.7×10^{-2} feet/day or 17.1 feet/year for a porosity of 25%. The actual velocity on-site may be locally influenced due to more permeable zones possibly associated with utility lines or differences in the actual porosity of the till/weathered shale aquifer.

3.8 LAND USE

The Seneca Army Depot (SEAD) is situated between Seneca Lake and Cayuga Lake and encompasses portions of Romulus Township and Varick Township. Land use in this region of New York is largely agricultural, with some forestry and public land (school, recreational and state parks).

The most recent land use report is that issued by Cornell University. This report classifies, in further detail, land uses and environments of this region (Cornell 1967). Agricultural land use is categorized as inactive and active use. Inactive agricultural land consists of land committed to eventual forest regeneration, land waiting to be developed, or land presently under construction. Active agricultural land surrounding SEAD consists of largely cropland and cropland pasture. The U.S. Geologic Survey (USGS) quadrangle maps for the Towns of Ovid and Dresden, New York (1970), New York State Department of Transportation (DOT) quadrangles for Romulus, New York (1978) and Geneva South, New York (1978) do not indicate land designated for dairy production in the vicinity of the site.

The SEAD is a government-owned installation under the jurisdiction of the U.S. Army Material Command (AMC). SEAD lies immediately west of the village of Romulus, NY (Figure 1-1) 12 miles south of the villages of Waterloo and Seneca Falls, and 2.5 miles north of the village of Ovid, NY (Figure 1-1). The nearest major cities areRochester, NY and Syracuse, NY located 60 miles northwest and northeast, respectively. The total area of SEAD is 10,587 acres, of which 8,382 are designated storage areas for ammunition, storage and warehouse, and open storage and warehouse. On-post family housing is in two parcels, a 54-acre development adjacent to Route 96 and another 69 acres situated along Seneca Lake. Additionally, troop housing is available for 270 enlisted men (Buildings 703, 704 and 708). Bachelor officer quarters are located in Building 702, which is designated for 18 men. Other land uses include Administration, Community Services and an airfield. SEAD has a swimming pool at the north end of the facililty, along with tennis courts, a gymanasium, and a sports field complex. Picnic and playground areas are found on the installation at Hancock Park, the Lake Area and the Family Housing Area. There is also a skeet and trap range at the field. There are no recreational facilities located within 1,000 feet of the Ash Landfill.

The Ash Landfill is situated in the southwestern corner of SEAD. Land use adjacent to and off-site of the southwestern corner of SEAD is sparse residential areas with some farmland (Figure 3-5).

Forestland adjacent to SEAD is primarily forestland under regeneration with sporadic occurrence of mature forestry. Public and semi-public land use surrounding and within the vicinity of SEAD is Sampson State Park, Willard Psychiatric Center, and Central School (at the Town of Romulus). Sampson State Park entails approximately 1,853 acres of land and includes a boat ramp on Seneca Lake.

Historically, Varick and Romulus Townships within Seneca County has develped as an agricultural center supporting a rural population. However, icreased population occurred in 1941 due to the opening of SEAD. Population has progressed since then largely due to the increased emphasis on promoting tourism and recreation in this area. Records provided by SEAD show approximately 11 residences adjacent to the northwestern border of SEAD which are within 1 mile of the Ash Landfill. These residences all obtain drinking water from private water wells. Detailed information regarding the construction of these wells was not available.

3.9 ECOLOGY

This section presents the results of the aquatic and terrestrial assessment programs. The aquatic assessment program will discuss the benthic invertebrate and fish communities. The terrestrial assessment program will discuss significant resources and resources used by humans, vegetative resources, wildlife resources, stressed or altered terrestrial biota, and potential terrestrial receptors.

3.9.1 Aquatic Assessment Program

3.9.1.1 Benthic Invertebrate Community

Based on the results of the macroinvertebrate Surber sampling program at three stations (SW-800, SW-801, and SW-802) the benthic community of Kendaia Creek is dominated by insects. Insects comprised approximately 72 percent of the 356 organisms collected, whereas the remaining 28 percent was a combination of worms (Turbellaria and Oligochaeta), leeches (Hirudinea), snails (Gastropoda), clams (Bivalvia), seed shrimp (Ostracoda), aquatic sow bugs (Isopoda) and scuds (Amphipoda) (Table 3-8). Insects collected included stoneflies (Plecoptera), caddisflies (Trichoptera), hellgramites (Megaloptera), beetles (Coleoptera), and true flies (Diptera). The fauna collected are characteristic of stoney habitat with equal amounts of pools and riffles, such as Kendaia Creek (Hynes 1979).

The combined relative abundance of all organisms collected indicates that the beetles dominated the collection (35.1 percent), closely followed by true flies (28.9 percent). Subdominate groups, in order of abundance include snails (12.6 percent), aquatic earthworms (7.3 percent), scuds (6.5 percent) and caddisflies (4.9 percent). The remaining six groups collected (flatworms, clams, seed shrimp, aquatic sow bugs, stoneflies, and hellgramites) comprised a total of 4.8 percent of the overall collection. Thus, as frequently occurs in

streams of this nature, the benthic macroinvertebrate taxa in Kendaia Creek are unevenly distributed.

The relative abundance of taxa identified at the station most likely to receive surface water run-off from the areas influenced by the ash landfill site (SW-800), and the downstream station (SW-802), were similar to the reference station (SW-801), in that insects comprised the majority of the collection (58.0 percent at SW-800), (79.8 percent at SW-802) and 75.0 percent at SW-801). However, the distribution of dominant insect taxa at the three stations differed slightly. At stations SW-801 and SW-802 true flies were highest in relative abundance (33.3 percent and 39.4 percent, respectively) followed by beetles (16.7 percent and 31.9 percent, respectively). This relationship is reversed at station SW-800 (beetles are 42 percent and true flies are 11.5 percent). Similarly, at stations SW-801 and SW-802 caddisflies followed beetles as the third most common insect collected (16.7 percent at station SW-801 and 6.6 percent at station SW-802). Stoneflies replaced caddisflies as the third most common insect group at station SW-800 (3.1 percent).

For the remaining major taxonomic groups collected, snails accounted for approximately 16 percent of all organisms collected at both stations SW-801 and SW-802. At station SW-800, snails represented only 6.9 percent of the collection and approximately 16 percent of the collection. No other trends or obvious differences were noted among the three stations.

Species richness between the three stations sampled in Kendaia Creek was variable. Overall 27 different taxa were identified at these stations. The highest number of taxa were identified at station SW-800 (24) followed by station SW-802 (13) and lastly station SW-801 (9). The variability of species identified at these three stations may be attributed to several factors. Among them are natural variability, decreased habitat diversity, and differences in water quality. Any one or a combination of these factors may contribute to the depressed number of species collected at station SW-801. If adverse effects to the macroinvertebrate community were resulting from contaminants in Kendaia Creek emanating from the ash landfill site, a lowered species richness would be expected at station SW-800 rather than SW-801. To the contrary, the highest number of organisms were reported at station SW-800.

The distribution of taxa in Kendaia Creek was also variable. Some of the differences among the three stations are the apparent lack of worms (flatworms and earthworms), scuds and stoneflies at station SW-801, whereas these groups were present at the other two stations. In addition, there was a depressed number of both beetles and true flies at station SW-801

(2 and 4, respectively) when compared to both stations SW-800 (55 and 15, respectively) and SW-802 (68 and 84, respectively).

The number of individuals collected at three stations in Kendaia Creek was also highly variable. Combining three replicates per each station, resulted in a range of individuals collected from a low value of 12 at station SW-801, to a midrange value of 131 at station SW-800 and a high of 213 at station SW-802. Overall 356 organisms were collected.

Although organisms were not identified to the species level, it is possible to discuss guild structure in Kendaia Creek in a generalized manner. Trophic relationships of all insect families identified are presented in Table 3-8. The functional feeding groups of insect families in Kendaia Creek appear varied and incorporate virtually all types of feeding mechanisms. This overall hierarchy (including scrapers, herbivores, detritivores, predators and piercers) suggest that no apparent vacancies in trophic relationships exist in Kendaia Creek.

The macroinvertebrate community in Kendaia Creek is composed of first and second order consumers. These species form the basis for the aquatic food chain. The primary value of the macrobenthic community in Kendaia Creek is as prey items to aquatic species, especially fish. Larval aquatic forms and emergent adult forms of macrobenthos are also primary prey items to certain birds and some small mammals (e.g., water shrew and bats).

The macroinvertebrate community in Kendaia Creek within proximity of the Ash Landfill site offers little direct value to humans since they are not consumed by man. Many of the taxa collected in Kendaia Creek are consumed by fish but, the fish species that occur in the studied stream reach are generally not sought by anglers. The restricted access to the Depot further reduces the value of the fisheries to the general public. However, the benthic community of Kendaia Creek would seem to offer sufficient dietary abundance and diversity to support those fish found in the stream.

The presence or absence of "indicator species" is commonly used to assess adverse effects to ecological communities. Pollution tolerance values for each of the aquatic arthropods identified in Kendaia Creek (Crustacea and Insecta combined) is given in Table 3-9.

The pollution tolerance of the arthropods identified in Kendaia Creek is wide and ranges from pollution tolerant organisms such as the Asellidae, with a tolerance value of 8, to pollution intolerant organisms such as Chloroperlidae and Nemouridae, with a tolerance

values of 1 and 2 respectively. However, most of the individuals identified, are within the facultative classification (4-6). These are organisms that have a wide range of tolerance and are often associated with moderate levels of organic contamination (USEPA 1990). The presence of intolerant groups, specifically Chloroperlidae and Nemouridae, at station SW-800, provides evidence of favorable water quality at this location. The absence of this taxa at stations SW-801 and SW-802 does not necessarily imply degraded water quality at these locations. If the water quality at specific location were consistently degraded, tolerant taxa such as Asellidae would be expected to be especially common. Such was not the case at any Kendaia Creek Station. Most healthy benthic communities have a mixture of tolerant, facultative and intolerant organisms.

An additional measure of pollution sensitivity is the presence and/or absence of mayflies, (Ephemeroptera), stoneflies, (Plecoptera), and caddisflies (Tricoptera) (EPT), because these organisms are generally sensitive or facultative and are often first to suffer in a polluted environment (USEPA 1990, USEPA 1989). The presence of two of these groups (Plecoptera and Tricoptera) in Kendaia Creek is suggestive of good water quality. The total number of taxa within these groups generally increases with improving water quality (USEPA 1990). Only two EPTs were collected at the reference station, SW-801. The relative abundance of EPTs compared to the generally tolerant Chironomidae is also used as a measure of biotic conditions. Chironomids tend to increase in relative abundance along a gradient of increasing enrichment or heavy metals concentration (USEPA 1990). There is no clearly defined trend of EPTs compared to chironomids at the three Kendaia Creek stations based on the limited data collected in 1991.

3.9.1.2 Fish Community

Based on the results of the aquatic sampling program, the fish community of Kendaia Creek is dominated by minnows (Table 3-10). Three of the four species collected were minnows. A single banded killifish was the only non-minnow collected. As is frequently the case in small streams, most of the fish were relatively small. The majority of fish collected were from 30 to 102 mm (1- 4 inches) in length, the largest fish being a 139 mm (5 inch) creek chub.

Overall, central stonerollers were the dominant species in Kendaia Creek, comprising 40.5 percent of the total catch (Table 3.11). Creek chubs and blacknose dace comprised 29.7 and 27.0 percent of the total catch, respectively, and were the only species present in every collection. The most fish (23 in number) were collected at the reference station (SW-801).

This was also the only station where all four species of fish were captured. This station has a fairly deep (3-4 feet) plunge pool below a large culvert that passes under a road, affording cover to resident fish. This culvert forms a barrier to the movement of fish upstream of this location. Such obstructions often cause fish to concentrate below them, which may be the case at this station. The least number of species (2) and individuals (3 per collection) was collected at station SW-800. It should be noted that because the total catch of fish was relatively low (37), caution should be used in drawing conclusions regarding abundance and species richness at specific stations.

Based on published dietary information, the four fish species collected in Kendaia Creek typically are found at lower trophic levels; they are usually secondary consumers. Creek chubs and banded killifish are considered to be omnivorous, with the size of prey limited by the relatively small size of the predator. Creek chubs, the only species in Kendaia Creek which can be considered to be piscivorous (fish eating), also consumes insects, cladocerans, and crayfish (Smith 1955, Lee et al. 1989). At times, creek chubs consume algae and other plant tissue (Smith 1985). Blacknose dace also consume aquatic insects, especially midge larvae, as well as diatoms and desmoids during the fall (Smith 1985). Central stonerollers, are specialized feeders, scraping algae and small invertebrates from the surface of rocks (Smith 1985). Most likely, predation on the population of these four species is minimal. Small fish may occasionally be consumed by large creek chubs and all four species would probably eat fish eggs if they were encountered. Habitat availability, rather than predation, is likely to limit the size of fish populations in Kendaia Creek.

Any abnormalities in the fish collected were documented. There was a degree of subjectivity in these observations, since the time spent examining each fish was, by necessity, brief in an effort to quickly return collected fish to the stream. The blacknose dace was the only species showing an abnormality - tumors which are associated with endoparasitic cysts. Tumors were observed on one of three blacknose dace collected at station SW-802 and two of four blacknose dace collected at reference station SW-801. This distribution pattern makes it extremely unlikely that there is a correlation between these tumors and any contaminants originating from the Ash Landfill site. Many fish at all stations also had varying degrees of infestations of "black spot," thought to be the "black grub" phase of parasitic trematodes. This is a fairly common phenomena in many aquatic ecosystems (Hynes 1970).

The results of this assessment indicate that the fish species in Kendaia Creek are predominantly minnows. No species collected would be considered to be sport fish. Most,

if not all, have fairly localized home ranges. Localized movements of all species collected are expected in response to environmental factors such as low flow conditions or mid-summer heat (movement to pools and/or areas of groundwater discharge).

The significance of the fisheries resources of Kendaia Creek should be considered in terms of its value to associated fauna and its value to humans. It is clear from the species of fish collected, that the community in the evaluated stream segment is essentially non-piscivorous, relying mostly on other food sources. Although small fish may occasionally migrate to downstream stream reaches where more carnivorous fish may be present, it is unlikely that they contribute substantially to the diet of such fish.

The primary value of the fish community in Kendaia Creek near the Ash Landfill site is to fish-eating wildlife. Examples of wildlife that could consume the fish in Kendaia Creek, as well as other aquatic organisms, include the northern water snake, various turtles, wading birds, such as herons and egrets, and occasional ducks that may use pools on this portion of the creek. Use of this area of the creek by such wildlife is considered to be minimal due to the small size of the stream and the availability of more suitable habitat elsewhere (e.g. the created pond/wetland system on Kendaia Creek located on the eastern side of the Depot, as well as Seneca and Canandaigua Lakes).

No sport fish were collected during the survey. The lower reaches of Kendaia Creek may support a limited fishery (SEAD 1992), although no data are available to support this. Dip netting for smelt near the Route 125 bridge (adjacent to Seneca Lake) is reported by local residents to occur during the spring spawning run.

3.9.2 Terrestrial Assessment Program

3.9.2.1 Significant Resources and Resources Used by Humans

Significant Resources

Based on the New York state regulated wetland maps (Geneva South, Romulus, Ovid, and Dresden quads), there are six regulated wetlands within the 2-mile study area, but none are in close proximity to the site perimeter (Figure 3-6). The closest wetland is OV-9 which is approximately 2,000 feet (0.4 mile) northeast of the site perimeter. The other five regulated wetlands are over one mile from the site perimeter. GS-3 and GS-4 are to the north, RO-19

is to the northeast, while OV-7 and OV-8 are to the southeast. None of the eight regulated wetlands are believed to be hydrologically connected to the Ash Landfill area.

The only other significant terrestrial resource known to occur in the 2-mile study area is the rare population of white-pelaged white-tailed deer, which inhabits the fenced Seneca Army Depot (Buffington 1991) (Figure 3-6). Although the normal brown-pelaged deer are also common on the depot, the white deer are predominant. The white deer were not observed on the Ash Landfill area, but were sighted many times in adjacent environments. Several deer tracks and bedding areas were noted on the Ash Landfill area, so undoubtedly both the white- and brown-pelaged deer utilize the Ash Landfill area for resting and feeding.

Resources Used by Humans

In the 2-mile study area, agricultural crops and deciduous forests comprise the vegetative resources used by humans (Figure 3-6). Although no crops are grown on the Depot, farmland is one of the predominant land uses in the surrounding private lands. Crops, including corn, wheat, oats, beans and hay mixtures, are grown primarily for livestock feed (dairy cattle). Active agricultural fields are near and to the west of the Ash Landfill area. There are grape vineyards to the north of the Ash Landfill area, but not within the study area (Seneca Chamber of Commerce 1991).

Deciduous forestland on the depot and surrounding private lands is under active forest management (Morrison 1992, SEAD 1992). Timber and firewood are harvested from the private woodlots (Morrison 1992), however, presently no timber harvesting occurs on the Depot (SEAD 1992). The forestlands off the Depot appear to be in a normal and healthy condition with no apparent impacts.

Within the 2-mile study area, there are several wildlife species which are hunted and trapped on private lands. Game species hunted include the eastern cottontail, white-tailed deer, ruffed grouse, ring-necked pheasant and waterfowl (Canada goose, mallard and wood duck). Gray squirrel and wild turkey are hunted to a lesser extent due to the lack of appropriate wooded habitat. Furbearing species trapped in this study area include red and gray fox and raccoon. Muskrat and beaver are trapped to a lesser extent (Woodruff 1992), but neither would probably occur in or near the Ash Landfill area due to lack of aquatic habitat. On the Depot, deer, waterfowl and small game (squirrel, rabbit) hunting is allowed but regulated by SEAD. Although the designated waterfowl hunting area is outside the study area. A

permitted deer harvest is performed annually during October and November. Trapping is also permitted (SEAD 1992).

Low populations of waterfowl (mallard, wood duck) are expected in the Ash Landfill area. The same holds true for the populations of squirrel, gray fox, and ruffed grouse which are not expected to be high due to the limited forest habitat, all of which is outside the Ash Landfill area. The eastern cottontail, red fox and ring-necked pheasant would utilize the habitats (old fields and shrubland) present on the Ash Landfill area, although pheasant populations on the depot are low (SEAD 1992). Raccoon would be found in all habitats on and adjacent to the Ash Landfill area. Muskrat and beaver may occur in the wetlands and creek habitats within the 2-mile study area. Although deer have an average home range of one square mile (640 acres), the cottontail and raccoon have usually more localized or smaller home ranges. The cottontail's home range is 5-20 acres and the raccoon's is usually less than a square mile, while the red fox's is normally greater than a square mile (Dalrymple 1978).

There are several beehives located off the Depot less than 1,000 feet southwest from the Ash Landfill southern boundary (Figure 3-7). The landfill area could possibly be part of the bee's foraging habitat.

3.9.2.2 Vegetative Resources

The major vegetative communities in the 0.5-mile study area are primarily upland cover types. Some freshwater wetlands occur, principally on the Ash Landfill area. Figure 3-7 shows the location of the major cover types in the study area. The small wetlands and ditches on the Ash Landfill area are not shown on this map.

Upland Cover Types

The upland cover types in the study area include old fields, shrubland, deciduous forests and agricultural fields. Old fields and shrublands are the dominate cover types on the Ash Landfill area and adjacent environs. The old fields are comprised of a mixture of herbaceous and shrub plant species with some small trees (Table 3-12). Queen Anne's-lace, panic grass, teasel, goldenrods, asters and field thistle are the most abundant species in these fields. Shrublands are comprised primarily of shrubs and small trees with some herbaceous species (Table 3-12). Gray-stemmed dogwood, raspberry and blackberry, multiflora rose, buckhorn, black locust, sumacs and wild grape are the most common shrubs and vines in this cover type.

Prior to becoming part of the Seneca Army Depot in 1941, most of the old fields and shrublands were active farmland. When they became part of the Depot and left fallow, these croplands succeeded to old fields and shrubland and were maintained in these cover types by periodic strip mowing and brush cutting for wildlife habitat improvement. The ammunition storage area to the east of the Ash Landfill area, as well as the roadsides, are mowed to maintain the low cover for security purposes (SEAD 1992).

Agricultural fields are the next most prevalent cover type in the study area, however, all occur on the privately owned farms west of the site. Crops typically grown in these cropfields surrounding the Depot include corn, wheat, soybeans, and various hay mixtures.

Deciduous forests comprise a relatively minor cover type in the study area and occur as woodlots and tree rows which line the fields and roads. Various oaks, sugar maple, hickory, black locust, black cherry, and aspens are the major overstory trees in these woodlots and tree rows (Table 3-12).

Wetland Cover Types

Several small freshwater emergent wetlands are located on the Ash Landfill area (W-A, W-B, W-D, W-E, W-F, Plate 3-6). Some of these emergent wetlands may have been created by landfill excavation operations. Several drainage ditches were also constructed to catch surface water run-off from the Ash Landfill area and roads. These ditches are also vegetated with emergent wetland plants. Common reed (Phragmites australis) is the most abundant and widely distributed emergent plant species, comprising 40-95 percent cover. Purple loosestrife (Lythrum salicara), rush (Juncus sp.), broad-leaved cattail (Typha latifolia), sedge (Carex sp.) and spike-rush (Eleocharis sp.) also have wide distribution, but are not as abundant (10-50 percent cover). No standing water was observed in these wetlands when they were surveyed.

There are several other small wetlands in the study area, including a common reed stand, which was the reference wetland (Plate 3-6). None of the other wetlands are large enough to be mapped on this plate.

3.9.2.3 Wildlife Resources

The wildlife species expected to inhabit the 0.5-mile study area would be those typically occurring in the central New York region including some 17 species of amphibians, 13 species

of reptiles, 162 species of birds , and 44 species of mammals (Appendix H). The most prevalent wildlife would be upland species, particularly those preferring old fields and shrublands, since these are abundant habitats in the study area. Such wildlife species would include the American toad, eastern garter snake, northern cardinal, and woodchuck. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for the white-tailed deer which is common throughout the Depot. This combination of habitats is present within the study area, so it is expected that deer populations in the area would be high; numerous deer tracks and several deer bedding areas in the Ash Landfill area and nearby provided evidence of their existence. The mixture of these upland habitats is also excellent for other wildlife such as the red-tailed hawk and raccoon. The agricultural fields outside the Depot would serve as a source of food (grain, vegetation, insects) to many wildlife species, including deer, raccoon, mourning dove, common grackle and ring-billed gull. Since woodland habitat is relatively limited in the study area, populations of strictly forest-dwelling species such as the gray squirrel, blue jay and four-toed salamander would not be overly abundant. However, species richness (total species) is usually high in forested habitats. The series of small emergent wetlands in the study area do not comprise significant wildlife habitat due to their size and quality. Frogs, salamanders, small mammals and a few ducks would use the study area's wetlands. Much larger, higher quality wetland habitats occur on and off the Depot and would provide a greater attraction for waterfowl and other waterbirds.

Overall, the mixture of old fields, shrublands, woodlots, tree rows, and agricultural fields provides valuable wildlife habitat in the study area, although similar habitats are abundant on and surrounding the Depot. Expected wildlife species diversity would be relatively high in the study area due to the variety of habitats present. The numbers and species of wildlife observed during the late fall surveys were actually low, but this was undoubtedly due to the time of year, since many mammals, reptiles and amphibians would have gone into hibernation and only winter resident birds were present. The total survey observation time was limited, as well. During the surveys, the only reptiles observed were a red-bellied snake (roadkill) and garter snakes; no amphibians were noted. White-tailed deer, woodchuck, and mice and voles (Cricetidae) were the only mammals observed or suspected to be present on-site due to signs of their existence (Table 3-13). The white-footed mouse and meadow vole were live-trapped in old field/shrubland and wetlands on the Ash Landfill area, whereas the deer mouse (same habitats) and house mouse (old field/shrubland only) were caught in the nearby reference area off the Depot. The trapping success at the two areas was similar (0.07 catch per trap night for the Ash Landfill area and 0.11 catch per trap night at the reference area). Only 16 bird

species were noted (Table 3-14). Many small bird nests were found in the shrublands south of the ash Landfill area.

3.9.2.4 Stressed or Altered Terrestrial Biota

No signs of stressed or altered terrestrial biota (vegetation and wildlife species) were observed during the surveys in the 0.5-mile study area. Due to late fall period of the surveys, many of the plant species had naturally lost their leaves or had been killed by frost and cold. However, there was no indications of unnatural die-off or stunted vegetation.

3.9.2.5 Potential Terrestrial Receptors

The results of the Phase I terrestrial assessment indicate that five vegetative communities (old fields, shrubland, deciduous woods, agricultural fields, wetlands) are on or nearby the study area. The old fields, shrubland and small wetlands, as well as some drainage ditches, presently occupy the Ash Landfill area and would have the highest potential for being impacted by the site. The other vegetative communities, including deciduous woodlots and tree rows, and agricultural fields (off the Depot), as well as other old fields, shrublands, and small wetlands, would be less likely to be receptors due to their distance from the site. However, a field reconnaissance indicated that the existing vegetative communities are all visibly healthy and appear normal in terms of species composition and density; no community that should be present was missing. The dominance of certain communities in the study area is believed to be due to past disturbances and activities associated with the Ash Landfill area and Depot, as well as wildlife management practices (mowing and cutting).

State regulated wetlands are the only significant vegetative resource in the vicinity of the Ash Landfill area. It is unlikely that these wetlands would be impacted by the site due to the distance away (0.4 miles or greater). This is also likely to be the case for the agricultural crops, one of the two vegetative resources used by man. The other, deciduous woods in the study area, are under SEAD and private forest management, but also appear to be in a healthy, normal condition.

The wildlife communities inhabiting the vegetative communities also appear to be normal. Although no intensive sampling program was conducted, the observations made in the late fall indicated that the seasonal (fall) wildlife species composition and density for the habitats present were normal.

The vegetative and wildlife species inhabiting the old fields, shrublands, wetlands and ditches on the Ash Landfill area would have the highest potential for being impacted by the site. Those having the lowest potential would be the plants and wildlife species inhabiting the deciduous forest and tree rows, and agricultural fields, shrublands, as well as other old fields and small wetlands, beyond the Ash Landfill area. The white-tailed deer is the only big game species hunted in the study area, as well as being the only significant wildlife resource in its rare white-pelaged form. Deer utilize all habitat types in the study area, including those on the Ash Landfill area. Observations of the deer herd in the study area showed this game population to be in healthy condition. Waterfowl and other small game species are hunted on the Depot, although waterfowl are not hunted in or near the Ash Landfill area. In addition, waterfowl usage of the Ash Landfill area and vicinity would be limited due to the lack of waterfowl habitat (large wetlands and streams). The eastern cottontail, red fox, and raccoon are the small game and furbearing species with the most potential as receptors since they would inhabit the Ash Landfill area. Other game and furbearing species with less potential for being impacted include the ruffed grouse, wild turkey, ring-necked pheasant, gray squirrel, muskrat and beaver since these wildlife species would occur in habitats outside the Ash Landfill area. Many non-game wildlife species are potential receptors, in particular those which are permanent residents and have localized (small) home ranges such as amphibians, reptiles, small mammals (e.g., mice), and some small non-migratory birds. Based on the fall 1991 surveys, none of the floral and faunal species observed in the Ash Landfill area and adjacent habitats showed any visible signs of stress or alteration. The Ash Landfill area may also be used by honey bees from nearby beehives.

Generally, there is no evidence that the Ash Landfill area has any outward (visible) adverse affect on the terrestrial biota at the community or individual level.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3–1
CLIMATOLOGICAL DATA FOR SENECA ARMY DEPOT

Month	Temperature (°F)[1] Max.	Min.	Mean	Precip.[1] Mean (in)	RH[3] Mean (%)	Sunshine[3] (%)	Sky Cover[3] (tenths)	Mean No. of Days[4] Clear	Partly Cloudy	Cloudy
Jan.	30.9	14.0	22.5	1.88	70	35	7.5	3	7	21
Feb.	32.4	14.1	23.3	2.16	70	50	7.0	3	6	19
Mar.	40.6	23.4	32.0	2.45	70	50	7.0	4	7	20
Apr.	54.9	34.7	44.8	2.86	70	50	7.0	6	7	17
May	66.1	42.9	54.5	3.17	70	50	6.5	6	10	15
June	76.1	53.1	64.6	3.70	70	60	6.5	8	10	12
July	80.7	57.2	69.0	3.46	70	60	6.0	8	13	10
Aug.	78.8	55.2	67.0	3.18	70	60	6.0	8	11	12
Sept.	72.1	49.1	60.7	2.95	70	60	6.0	7	11	12
Oct.	61.2	39.5	50.3	2.80	70	50	6.0	7	8	16
Nov.	47.1	31.4	39.3	3.15	70	30	7.5	2	6	22
Dec.	35.1	20.4	27.8	2.57	70	30	8.0	2	5	24
Annual	56.3	36.3	46.3	34.33	70	50	6.5	64	101	200

Period	Mixing Height (m)[2]	Wind Speed (m/s)[2]
Morning (annual)	650	6
Morning (winter)	900	8
Morning (spring)	700	6
Morning (summer)	500	5
Morning (autumn)	600	5
Afternoon (annual)	1400	7
Afternoon (winter)	900	8
Afternoon (spring)	1600	8
Afternoon (summer)	1800	7
Afternoon (autumn)	1300	7

Mean Annual Pan Evaporation (in.)[3]: 35

Mean Annual Lake Evaporation (in.)[3]: 28

No. of episodes lasting more than 2 days (No. of episode-days)[2]:
Mixing Height < 500 m, wind speed < 2 m/s: 0 (0)
Mixing Height < 1000 m, wind speed < 2 m/s: 0 (0)

No. of episodes lasting more than 5 days (No. of episode-days)[2]:
Mixing Height < 500 m, wind speed < 4 m/s: 0 (0)

REFERENCES:

[1] Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Ithaca Cornell Univ., NY.

[2] Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States. George C. Holzworth, Jan. 1972

[3] Climatic Atlas of the United States. U.S. Department of Commerce, 1983.

[4] Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Syracuse, NY.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-2
SUMMARY OF EM-31 ANOMALY LOCATIONS

EM-31		GPR	
LINE	ANOMALY LOCATION (ft)	LINE	AREA COVERED (ft)
3	100-250	3	100-250
3	500-600	3	*
3	1,050-1,150	3	1,050-1,150
4	90-250	4	90-250
4	550-600	4	*
5	100-300	5	100-300
5	550-60	5	*
5	1,100-1,170	5	1,100-1,170
6	550-600	6	*
7	550-600	7	*
8	550-600	8	*
9	550-600	9	*
10	500-600	10	*
10	700-900	10	700-900
10	930-1,100	10	930-1,100
11	500-550	11	*
12	500-550	12	*
12	800-1,100	12	800-1,100
13	500,550	13	*
13	800-1,100	13	800-1,100
14	360-550	14	360-550
14	700-800	14	700-800
14	1,350-1,450	14	1,350-1,450

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-2
(Continued)

15	450-500	15	*
15	750-950	15	750-950
15	1,000-1,100	15	1,000-1,100
16	250-850	16	250-850
16	1,100-1,150	16	1,000-1,150
16	1,200-1,650	16	1,200-1,650
17	250-850	17	250-850
17	1,130-1,1550	17	1,130-1,550
18	400-500	18	400-500
18	1,150-1,600	18	1,150-1,600
19	700-850	19	700-850
19	1,150-1,635	19	1,150-1,635
20	450-850	20	450-850

NOTES:

* Anomaly location represent a buried pipeline (6-inch water main).
No GPR profile performed

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-3
GPR CHARACTERIZATION OF EM-31 ANOMALY LOCATIONS

LINE	ANOMALY LOCATION (ft)	CHARACTERIZATION
3	100-200	Fill Area - Small Debris
3	200-250	Fill Area - Small Debris
4	150-250	Fill Area - Small Debris
5	150-200	Fill Area - Small Debris
5	200-250	Fill Area - (1) Possible Pipe or Drum Signature
10	760-780	Fill Area - Small Debris
10	840-860	Fill Area - Small Debris
10	980-1,000	Fill Area - Small Debris
12	910-960	Fill Area - Small Debris
12	980-1,000	Fill Area - Small Debris
13	830-890	Fill Area - Small Debris
13	905-925	Fill Area - Small Debris (1) Possible Pipe Signature
13	945-975	Fill Area - Small Debris (1) Possible Pipe Signature
13	1,000-1,020	Fill Area - Small Debris
14	1,350-1380	Fill Area - Small Debris
16	350-400	Fill Area with (1) Possible Pipe/Drum @ 374
16	460-500	Fill Area - Small Debris
16	580-590	Fill Area - Small Debris
16	600-625	Fill Area - Small Debris
16	625-640	Fill Area - Small Debris
16	665	Fill Area - Small Debris
16	740-780	Fill Area - Small Debris

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-3
(Continued)

16	1,200-1,270	Fill Area - (1) Possible Drum @1,252
16	1,350-1,500	(2) Possible Drums @ 1,432&1,446
16	1,350-1,500	(1) Possible Drums @ 1,482
17	300-370	(4) Small Fill Area - Small Debris
17	500-515	Small Fill Area @ 510
17	590-640	Fill Area - Small Debris
17	690-720	Fill Area - Small Debris
17	740-760	Fill Area - Small Debris
17	1,180-1,210	Fill Area - Fill Area with (1) Possible Drum @ 1,188
17	1,270-1,300	Fill Area - Small Debris
17	1,460-1,520	Fill Area - Possible Concrete Debris
18	440-450	Small Fill Area - Debris
18	1,250-1,290	Fill Area with Possible Concrete with Rebar
18	1,350-1,380	Fill Area - Small Debris
18	1,480-1,510	Fill Area with (2) Possible Pipes
19	750-800	Fill Area - Small Debris
19	1,240-1,25	Fill Area - Small Debris
19	1,830-1,350	Fill Area - Small Debris

Seneca Army Depot
Ash Landfill

Table 3–4
Fluctuation in the Saturated Thickness of the Shallow Till/Weathered Shale Aquifer

Monitoring Well Number	Saturated Thickness September 1990* (Feet)	Saturated Thickness January 1992 (Feet)	Difference (Feet)
PT–10	(bedrock well)	(bedrock well)	N/A
PT–11	10.55	15.07	4.52
PT–12	3.88	8.22	4.34
PT–15	9.45	14.86	5.41
PT–16	4.54	8.16	3.62
PT–17	3.05	7.47	4.42
PT–18	2.50	5.90	3.40
PT–19	(not measured)	8.01	N/A
PT–20	2.60	6.70	4.10
PT–21	(bedrock well)	(bedrock well)	N/A
PT–22	1.41	6.94	5.53
PT–23	4.13	7.79	3.66
PT–24	4.88	7.39	2.51
PT–25	1.58	7.94	6.36
PT–26	3.25	10.16	6.91
MW–27	1.49	6.62	5.13
MW–28	1.24	5.75	4.51
MW–29	0.00	3.91	3.91
MW–30	1.02	6.46	5.44
MW–31	1.14	7.42	6.28
MW–32	1.27	6.19	4.92
MW–33	0.89	6.31	5.42
MW–34	N/A	15.15	N/A
MW–35D	(bedrock well)	(bedrock well)	N/A
MW–36	N/A	14.27	N/A
MW–37	N/A	10.42	N/A
MW–38D	(bedrock well)	(bedrock well)	N/A
MW–39	N/A	10.09	N/A
MW–40	N/A	11.28	N/A
MW–41D	(bedrock well)	(bedrock well)	N/A
MW–42D	(bedrock well)	(bedrock well)	N/A
Average	3.10	8.74	4.76

Note:

* Depth to water measurements made by National Environmental Testing during a September 1990 sampling event

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3–5
MONITORING WELL DEPTH TO GROUNDWATER SUMMARY
(Feet)

MONITORING WELL NUMBER	DEPTH TO GROUNDWATER (TOC) 1–7–92	DEPTH TO GROUNDWATER (TOC) 1–27–92	DEPTH TO GROUNDWATER (TOC) 2–4–92	TOC ELEVATION	GROUND WATER ELEVATION ON 1–7–92
PT–10	6.77	6.00	6.66	681.60	674.83
PT–11	4.48	6.46	5.34	658.45	653.97
PT–12	5.16	5.74	5.74	652.15	646.99
PT–15	4.64	19.44	5.34	637.86	633.22
PT–16	2.88	3.24	3.3	637.65	634.77
PT–17	4.18	4.62	4.74	640.20	636.02
PT–18	5.80	6.38	6.49	656.86	651.06
PT–19	3.55	3.62	3.78	645.44	641.89
PT–20	5.10	5.59	6.22	674.54	669.44
PT–21	5.68	16.69	12.14	647.94	642.26
PT–22	4.87	5.59	5.79	648.74	643.87
PT–23	4.29	4.68	4.70	641.64	637.35
PT–24	4.49	4.69	4.70	636.43	631.94
PT–25	4.09	4.48	4.66	637.13	633.04
PT–26	3.84	4.48	4.42	614.64	610.80
MW–27	3.92	4.15	5.08	639.28	635.36
MW–28	4.64	4.82	4.90	637.22	632.58
MW–29	6.63	6.84	6.88	637.28	630.65
MW–30	4.06	5.66	6.01	640.26	636.20
MW–31	2.92	3.52	3.72	636.65	633.73
MW–32	4.18	4.54	4.99	641.71	637.53
MW–33	4.08	4.08	4.36	639.45	635.37
MW–34	3.00	3.92	4.18	632.89	629.89
MW–35D	2.42	2.88	2.94	631.90	629.48
MW–36	2.31	2.82	2.99	631.73	629.42
MW–37	3.20	3.18	3.16	632.89	629.69
MW–38D	3.44	4.02	4.08	637.93	634.49
MW–39	1.80	2.12	FROZEN	659.76	657.96
MW–40	3.43	3.98	4.15	659.32	655.89
MW–41D	7.32	9.52	7.11	694.02	686.70
MW–42D	2.67	3.58	3.61	683.04	680.37

Note:
TOC = Top of casing

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-6
GROUNDWATER ELEVATION SUMMARY FOR TWO TILL/WEATHERED SHALE AND COMPETENT SHALE MONITORING WELL CLUSTERS

Well Number	Well Screen Media	Date Measured	Elevation (ft)	Date Measured	Elevation (ft)	Date Measured	Elevation (ft)	Average Head difference
PT-16	Till/Weathered shale	1/7/92	634.77	1/27/92	634.41	2/4/91	634.35	
MW-38D	Competent shale	1/7/92	634.49	1/27/92	633.91	2/4/91	633.85	
			0.28		0.5		0.5	0.43
MW-36	Till/Weathered shale	1/7/92	629.42	1/27/92	628.91	2/4/91	628.74	
MW-35D	Competent shale	1/7/92	629.48	1/27/92	629.02	2/4/91	628.96	
			-0.06		-0.11		-0.22	-0.13

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-7
HYDRAULIC CONDUCTIVITY VALUES FOR RISING HEAD SLUG TESTS
(cm/sec)

Monitoring Well	Bouwer and Rice (1976)	Horslev (1951)	Average
MW-34*	5.507E-05	3.000E-04	1.775E-04
MW-35D^	2.270E-06	8.000E-06	5.135E-06
MW-36*	1.737E-04	6.000E-04	3.869E-04
MW-37*	1.421E-04	6.000E-04	3.710E-04
MW-38D^	1.305E-05	7.000E-05	4.153E-05
MW-39*	2.990E-04	1.000E-03	6.495E-04
MW-40*	6.633E-06	4.000E-05	2.332E-05
MW-41D^	4.110E-07	3.000E-06	1.705E-06
MW-42D^	8.992E-08	3.000E-07	1.950E-07
Average for Till & Weathered Shale	1.353E-04	5.080E-04	3.216E-04
Average for Competent Shale	3.956E-06	2.033E-05	1.214E-05

Notes:

* Well screened in both weathered shale and till

^ Well screened in only competent shale

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-8
TOTAL NUMBER AND RELATIVE ABUNDANCE OF MACROINVERTEBRATES IN KENDAIA CREEK

CLASS Order Family Genus species	STATION SW-800 REPLICATE					STATION SW-801 REPLICATE					STATION SW-802 REPLICATE					GRAND ORDINAL TOTAL	COMBINED RELATIVE ABUNDANCE
	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance		
TURBELLARIA (flatworms)																	
Tricladida				1	0.76				0	0.00				1	0.47	2	0.56
Planaridae			1										1				
ANNELIDA																	
Oligochaeta (aquatic earthworms)				20	15.27				0	0.00				6	2.82	26	7.30
Lumbriculidae		8	12									5	1				
MOLLUSCA																	
Gastropoda (snails)				9	6.87				2	16.67				34	15.96	45	12.64
Lymnaeidae A	1		1														
Planorbidae A			2										3				
Physidae	1		4					2			11	4	16				
Bivalvia (clams)				2	1.53				0	0.00				0	0.00	2	0.56
Sphaeridae			2														
CRUSTACEA																	
Ostracoda (seed shrimps)				0	0.00			1	1	8.33				0	0.00	1	0.28
Isopoda (aquatic sow bugs)				1	0.76				0	0.00				1	0.47	2	0.56
Asellidae			1										1				
Amphipoda (scuds, sideswimmers)				22	16.79				0	0.00				1	0.47	23	6.46
Gammaridae																	
Gammarus sp.	7	9	6									1					
INSECTA																	
Plecoptera (stoneflies)				4	3.05				0	0.00				4	1.88	8	2.25
* UNID Plecoptera												4					
Nemouridae	3																
Chloroperlidae			1														
INSECTA (CONTINUED)																	
Trichoptera (caddisflies)				1	0.76				2	16.67				14	6.57	17	4.78
Hydropsychidae A							2				9	2					
Limnephilidae			1									3					
Megaloptera (hellgrammites)				1	0.76				1	8.33				0	0.00	2	0.56
Sialidae																	
Sialis sp.			1				1										
Coleoptera (beetles)				55	41.98				2	16.67				68	31.92	125	35.11
* UNID Coleoptera (larvae)			3			1											
Elmidae A (adult)		1															
Elmidae A (larvae)			2														
Elmidae B (adult)	9		7				1				10	9	42				
Elmidae B (larvae)	4		25														
Elmidae C (larvae)			1														
Psephenidae																	
Psepherus herricki (larvae)			1								3	3	1				
Ectopria nervosa (larvae)			2														
Diptera (true flies)				15	11.45				4	33.33				84	39.44	103	28.93
Chironomidae (midge larvae)	3	4	2								17	50	16				
Tabanidae (horsefly larvae)			3					2									
Culicidae (mosquito larvae)			2														
Tipulidae A (crane fly larvae)							1				1						
Empididae A (dance fly larvae)		1						1									
Total Specimens	28	23	80	131	100.00	1	5	6	12	100.00	51	81	81	213	100.00	356	100.00
Total Taxa	7	5	21	24		1	4	4	9		6	9	8	13		27	

* UNID: unidentified

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-9
POLLUTION TOLERANCE VALUES FOR
SELECTED MACROBENTHIC ARTHROPODS

ORDER FAMILY	TOLERANCE VALUE
Isopoda	
Asellidae	8*
Amphipoda	
Gammaridae	4*
Plecoptera	
Nemouridae	2
Chloroperlidae	1
Trichoptera	
Hydropsycidae	4
Limnephleidae	4
Megaloptera	
Salidae	4
Coleoptera	
Elmidae	4
Psephenidae	4
Ephemeroptera	
Baetidae	4
Heptageniidae	4
Diptera	
Chironomidae	6
Empididae	6
Tabanidae	6
Tipulidae	3

*ranking from 0-10 with 0 being least tolerant

Source: USEPA 1990

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-10
COMMON AND SCIENTIFIC NAMES OF FISH
COLLECTED FROM KENDAIA CREEK

Common Name	Scientific Name	Length Range (MM)
Central Stoneroller	Campostoma anomalum	42-78
Creek Chub	Semotilus atromaculatus	32-139
Blacknose Dace	Rhinichthys atratulus	30-76
Banded Killifish	Fundulus diaphanus	49

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-11
TOTAL CATCH AND RELATIVE ABUNDANCE OF FISH
COLLECTED BY ELECTROSHOCKER IN KENDAIA CREEK

SPECIES	SW-802[1]	SW-800[1]			SW-801[1]	TOTAL
		A[2]	B[2]	A&B		
Central Stoneroller	2 (25.0)[3]				13(56.5)	15(40.5)
Creek Chub	3(37.5)	2(66.7)	1(33.3)	3(50.0)	5(21.7)	11(29.7)
Blacknose Dace	3(37.5)	1(33.3)	2(66.7)	3(50.0)	4(17.4)	10(27.0)
Banded Killifish					1(4.3)	1(2.7)
TOTAL	8(100.0)	3(100.0)	3(100.0)	6(100.0)	23(99.9)	37(99.9)
Salamander					1	1
Temperature (°C)	7.7	8.7			8.3	
Dissolved Oxygen (mg/l)	11.0	10.2			13.4	
Conductivity (micromhos) (not corrected to 25°C)	570	575			550	
pH	8.2	7.8			7.9	

1 Stations arranged sequentially with downstream - most station to the left. Station SW801 is upstream of site influence.
2 Collection A taken along a 150 ft. stream reach immediately downstream of railroad bridge. Collection B was taken along a 75 ft. stream reach downstream of collection A.
3 Relative abundance values are presented in parenthesis after the total catch values.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
PLANT SPECIES RECORDED IN THE VEGETATIVE
COVER TYPES IN THE 0.5-MILE STUDY AREA

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
TREES				
Eastern Red Cedar *Juniperus virginiana*		X	X	
Big-toothed Aspen *Populus grandidenta*			X	
Quaking Aspen *Populus tremuloides*	X	X	X	X
Black Willow *Salix niger*				X
Staghorn Sumac *Rhus typhina*	X	X	X	
Smooth Sumac *Rhus glabra*	X	X	X	
American Elm *Ulmus americana*				X
Slippery Elm *Ulmus rubra*	X	X	X	
Sugar Maple *Acer saccharum*	X		X	
Red Maple *Acer rubrum*			X	X
Boxelder Acer *Acer negundo*		X	X	
Common Buckthorn *Rhamnus cathartica*		X		

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
(Con't)

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
Shagbark Hickory *Carya ovata*			X	
Bitternut Hickory *Carya cordipormis*			X	
Choke Cherry *Prunus virginiana*		X		
Domestic Apple *Pyrus malus*		X	X	
Crabapple *Pyrus coronaria*		X		
Common Pear *Pyrus communis*		X		
Black Locust *Robinia pseudo-acacia*		X	X	
Honey Locust *Gleditsia triacanthos*	X			
Gray Dogwood *Cornus racemosa*	X	X		
Blue Beech *Carpinus carolinana*			X	
Yellow Birch *Betula lutea*	X	X	X	
Northern Red Oak *Quercus rubra*			X	
Black Oak *Quercus velutina*			X	

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
(Con't)

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
White Oak *Quercus alba*			X	
Chestnut Oak *Quercus prinus*			X	
White Ash *Fraxinus americana*	X	X	X	
Hawthorn *Crataegus* sp.	X	X	X	
SHRUBS AND VINES				
Willow *Salix* sp.	X	X		X
Poison-ivy *Rhus radicans*			X	
Wild Grape *Vitis* sp.		X	X	
Red Raspberry *Rubus idaeus*	X	X	X	
Blackberry *Rubus* sp.	X	X	X	
Multiflora Rose *Rosa multiflora*	X	X	X	
Wild Rose *Rosa* sp.	X	X		
Red-osier Dogwood *Cornus stolonifera*				X

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
(Con't)

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
Arrow-wood Viburnum recognition	X	X	X	
Bush Honeysuckle Lonicera sp.	X	X	X	
HERBACEOUS				
Sphagnum Moss Sphagnum sp.				X
Sensitive Fern Onodea sensibilis				X
Marsh Fern Dryopteris Thelypteris				X
Woodfern Dryopteris sp.			X	
Horsetail Equisetum pratense			X	
Narrow-leaved Cattail Typha angustifolia				X
Broad-leaved Cattail Typha latifolia			X	
Panic Grass Panicum sp.	X	X		X
Common Reed Phragmites australis				X

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
(Con't)

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
Spike-rush *Eleocharis* sp.				X
Long Sedge *Carex lonchocarpa*				X
Sedge *Carex* sp.			X	X
Rush *Juncus* sp.				X
Wild Garlic *Allium* sp.	X		X	
Curled Dock *Rumex Crispus*	X			
Sicklepod *Arabis canadensis*	X		X	
Treade Mustard *Erysimum cheiranthoides*	X			
Indian Strawberry *Duchesnea indica*	X		X	
Red Clover *Trifolium pratense*	X			
Purple Loosestrife *Lythrum salicaria*				X
Common Evening-primrose *Oenothera biennis*	X			
Queen Anne's-lace *Daucus carota*	X			

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-12
(Con't)

PLANT SPECIES	VEGETATIVE COVER TYPE			
	Old Field	Shrubland	Deciduous Wood/ Tree Rows	Freshwater Wetland/ Creek Edge
Spreading Dogbane *Apocynum androsaemifolium*	X			
Blue Vervain *Verbena hastala*	X			
Common Mullein *Verbascum thapsus*	X			
Teasel *Dipsacus sylvestris*	X			
King Devel *Hieracium pratense*	X			
Canada Goldenrod *Solidago canadensis*	X			
Goldenrod *Solidago* sp.	X	X	X	
New England aster *Aster noval-angliae*	X			
Heath Aster *Aster ericoides*	X			
Beggerticks *Bidens frontosa*	X		X	
Yarrow *Achillea millefolium*	X			
Field Thistle *Cirsium discolor*	X	X		
Spotted Knapweed *Centaurea maculosa*	X			

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 3-13
MAMMAL SPECIES OBSERVED AND/OR EVIDENCE OF THEIR EXISTANCE IN THE 0.5-MILE STUDY AREA

Species	HABITAT				
	Old Field	Shrubland	Deciduous Woods/Tree Row	Wetland	Argicultural Fields
Woodchuck	x (burrows)	x (burrows)	x (burrows)		
Mouse/Vole (Cricetidae)	x	x		x (scat)	
White-tailed Deer	x	x	x	x	x

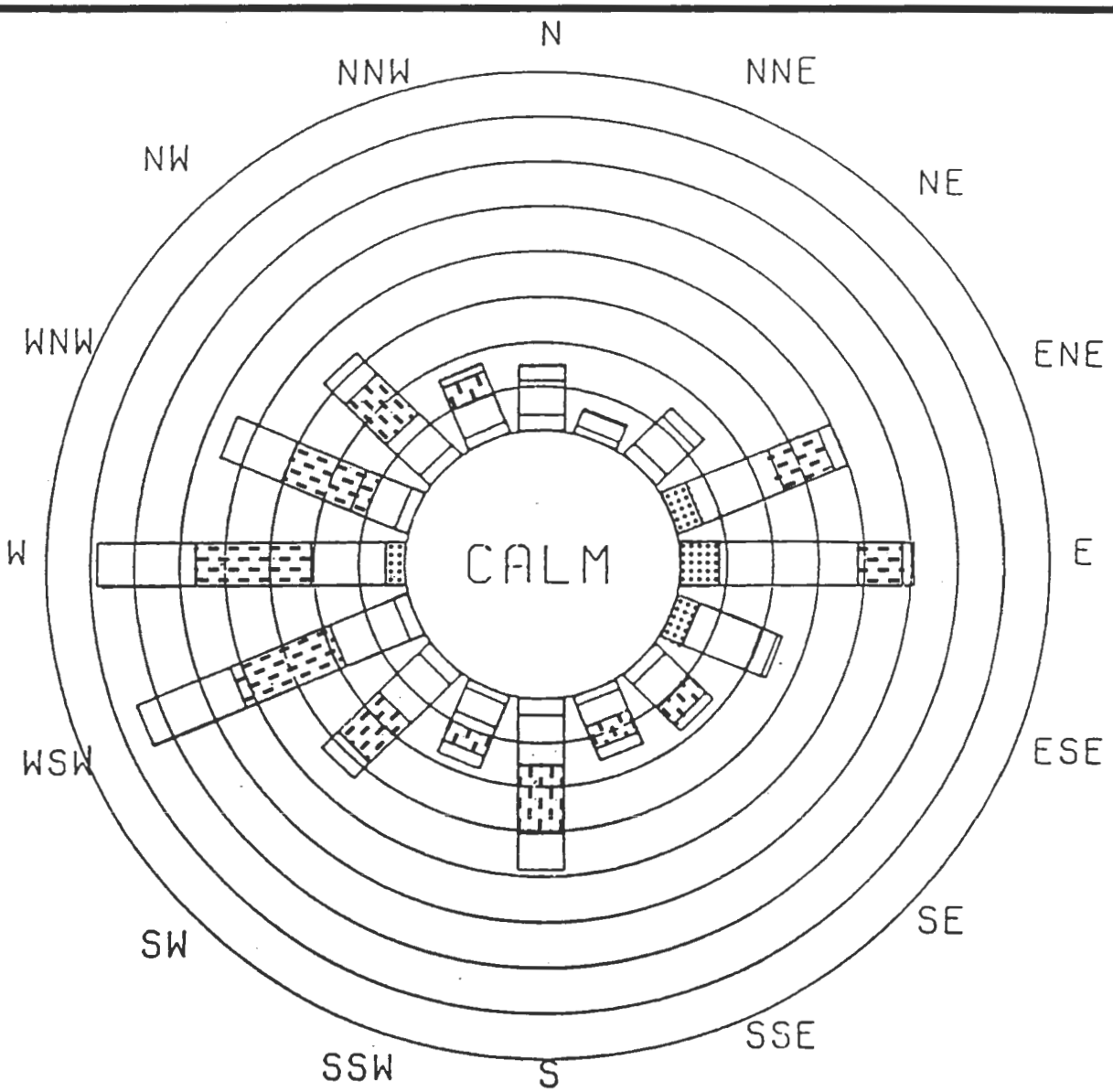
SENECA ARMY DEPOT
ASH LANDFILL

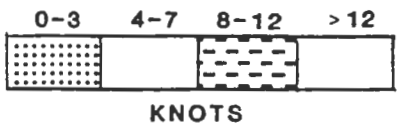
TABLE 3-14
BIRDS OBSERVED IN THE 0.5-MILE STUDY AREA

Bird Species	Number Observed by Habitat			
	Old Field	Deciduous Wood/Tree Row	Shrubland	Other*
Northern Harrier	1			
Red-tailed Hawk	2*			
Rock Dove	5			3
Common Flicker		1		
Downy Woodpecker	1**			
Hairy Woodpecker		1		
Blue Jay		4	2	
Common Crow		1		1
Black-capped Chicadee			4	
European Starling	30		2	
Northern Mockingbird	2	3	1	
American Robin			1	
Northern Junco			1	
House Finch			20	
American Goldfinch		10		
Field Sparrow			2	

* Flying over area.
** In tree within old field.

FIGURE 3-1





Installation:
Seneca Army Depot, NY
Location of Data:
Syracuse, NY
Source:
US Army Environmental Hygiene Agency

NOTE : EACH DIVISION IS 2% OF TOTAL TIME .

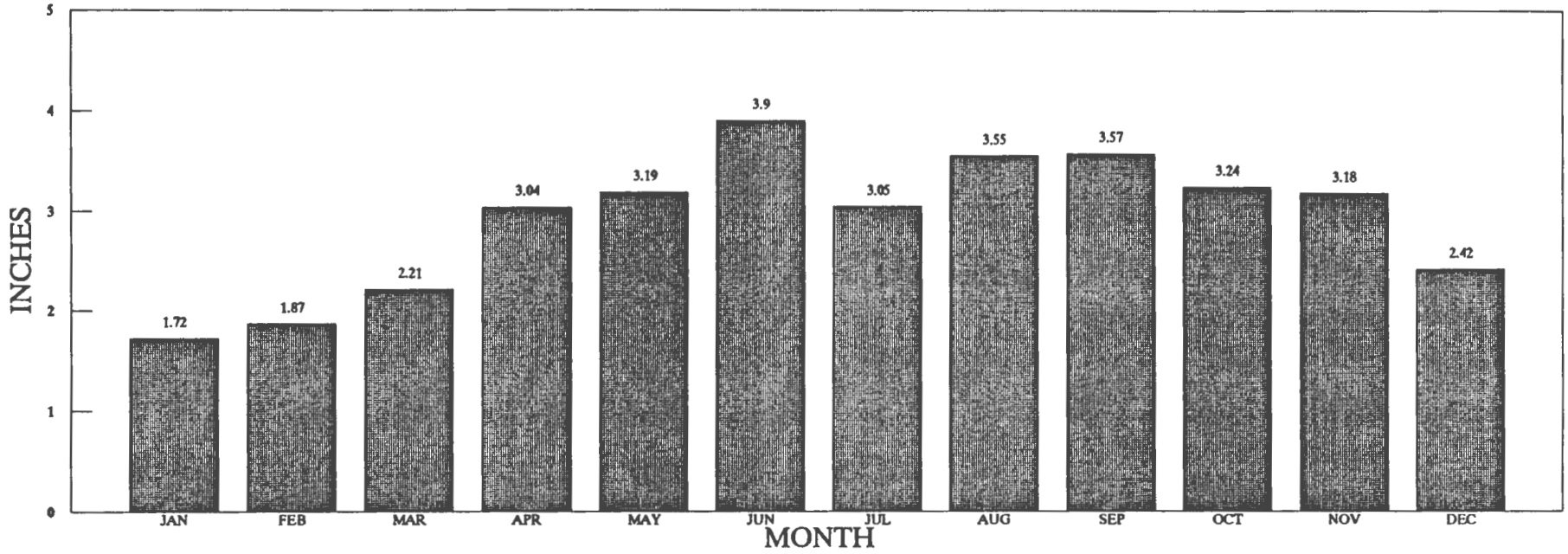
SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT

WIND ROSE
SYRACUSE, N.Y.

APRIL 1992

MAIN 1893

AVERAGE MONTHLY PRECIPITATION IN PROXIMITY OF SENECA ARMY DEPOT (1958–1991)[1]



Notes:

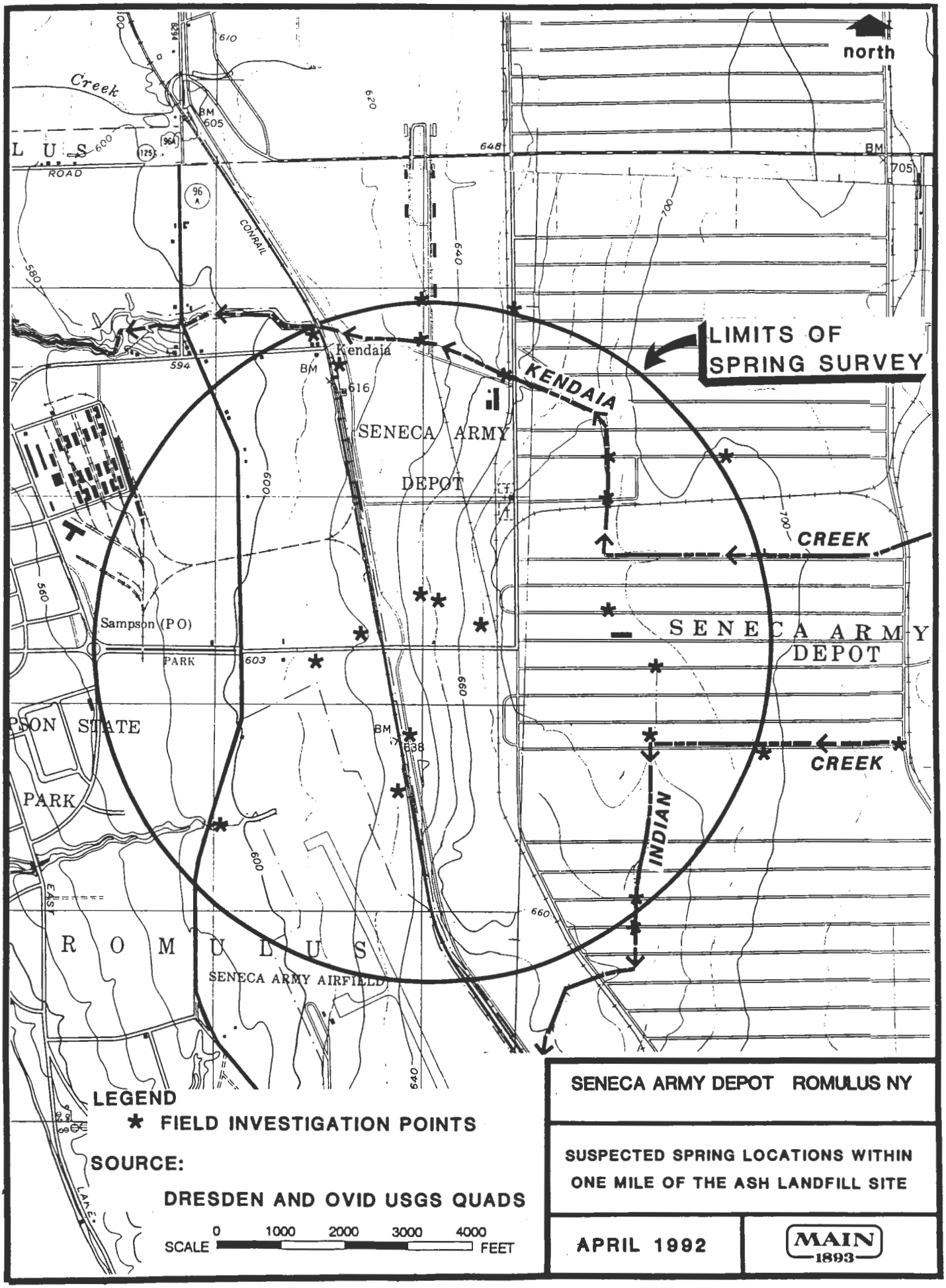
Source: Northeast Regional Climate Center, Cornell University, Ithica, New York

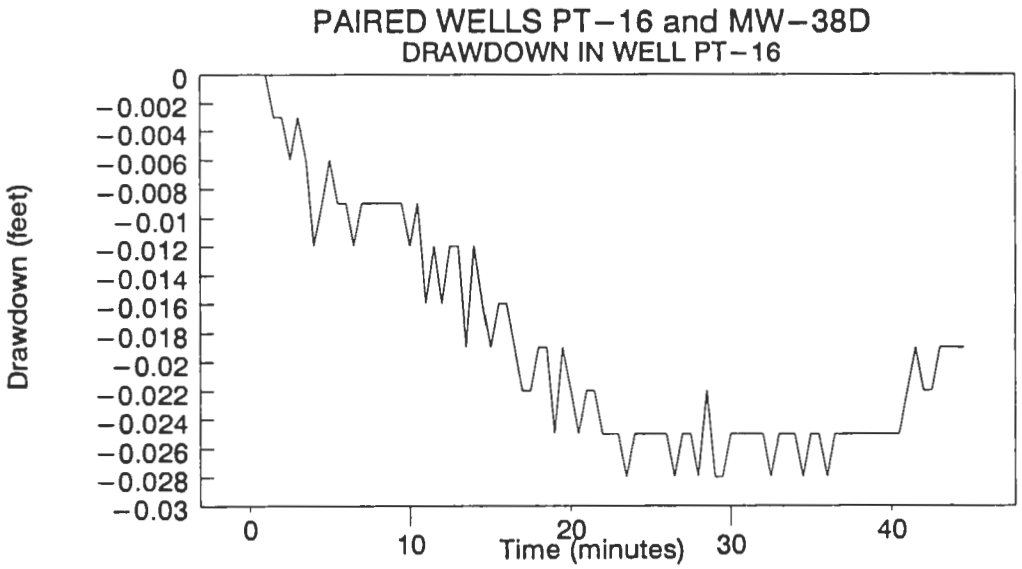
[1] The data are from the Aurora Research Farm in Aurora, New York

SENECA ARMY DEPOT PRELIMINARY SITE CHARACTERIZATION REPORT	
AVERAGE MONTHLY PRECIPITATION 1958-1991	
APRIL 1992	MAIN 1893

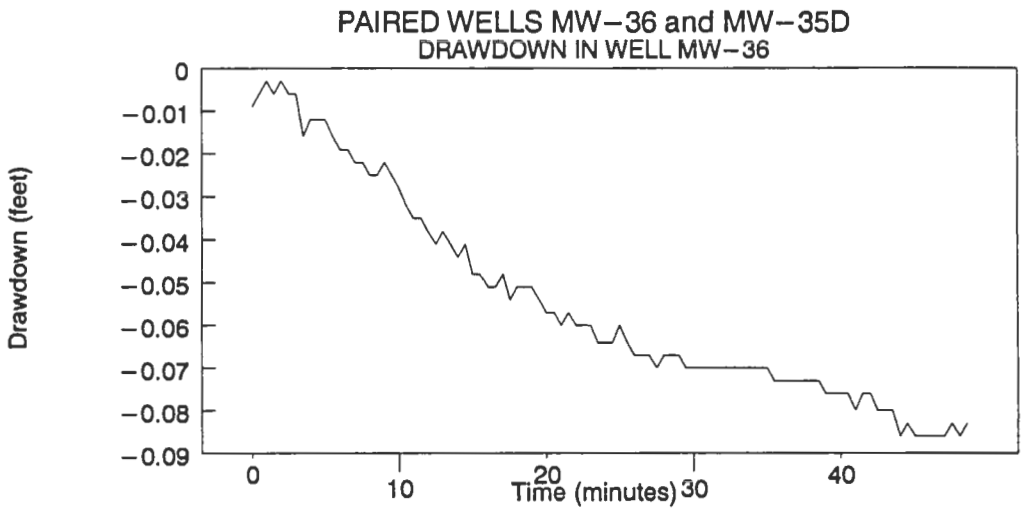
FIGURE 3-2

FIGURE 3-3


north
LIMITS OF SPRING SURVEY
KENDAIA
CREEK
CREEK
INDIAN
SENECA ARMY DEPOT
SENECA ARMY DEPOT
SENECA ARMY AIRFIELD
Kendaia
Sampson (PO)
PARK
PARK
ROMULUS
ROAD
CONRAIL
Creek
LEGEND
* FIELD INVESTIGATION POINTS
SOURCE:
DRESDEN AND OVID USGS QUADS
SCALE 0 1000 2000 3000 4000 FEET
SENECA ARMY DEPOT ROMULUS NY
SUSPECTED SPRING LOCATIONS WITHIN ONE MILE OF THE ASH LANDFILL SITE
APRIL 1992
MAIN 1893

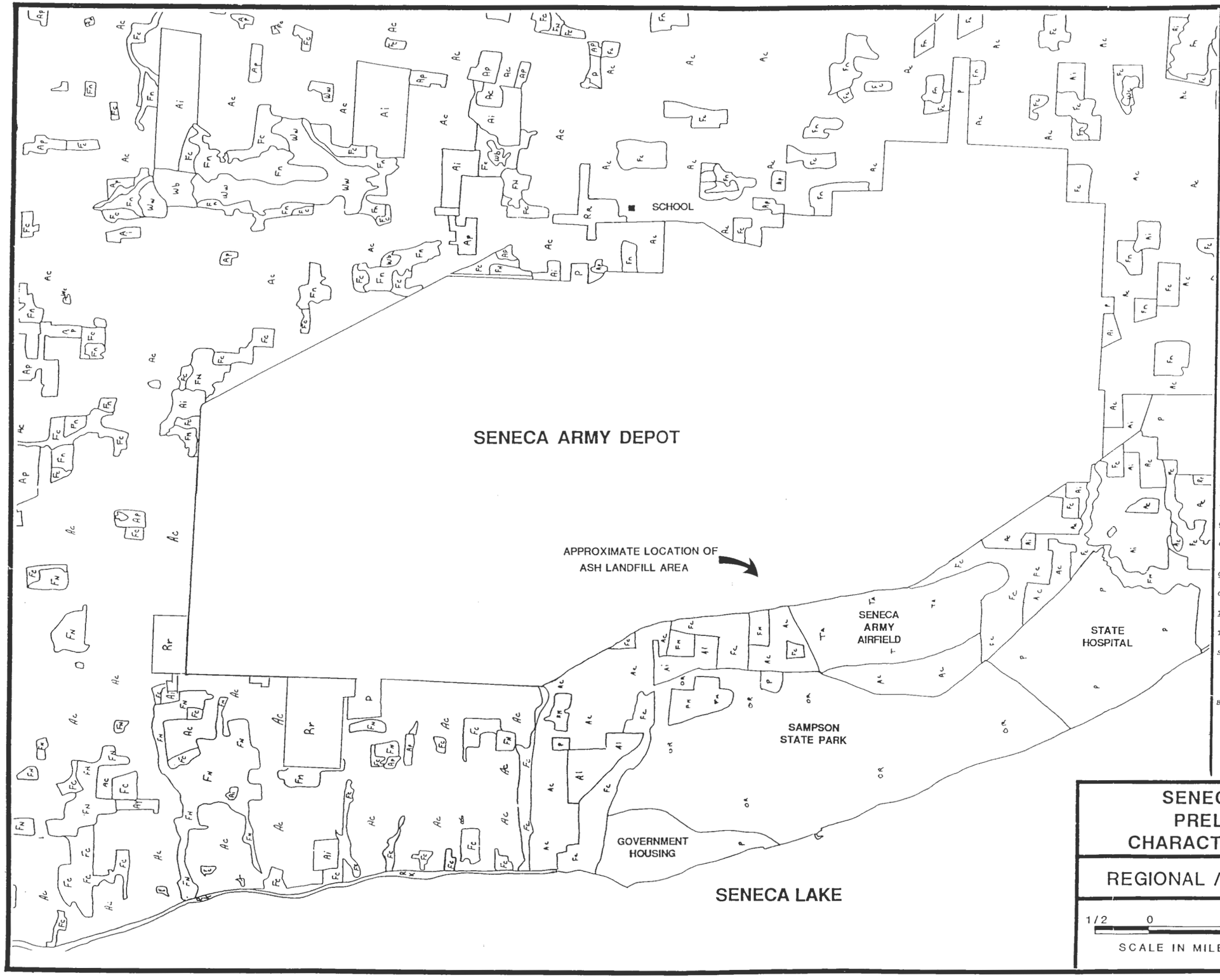


Notes:
1) Start purge of MW-38D at 1.5 minutes, 2) 5 gallons removed at 7.5 minutes, 3) 10 gallons removed at 12.5 minutes, 4) 15 gallons removed at 17.5 minutes, 5) Stop purge at 17.5 minutes



Notes:
1) Start purge of MW-35D at 1.5 minutes, 2) 5 gallons removed at 4 minutes, 3) 10 gallons removed at 11 minutes, 4) 15 gallons removed at 20 minutes, 5) Stop purge at 24 minutes

SENECA ARMY DEPOT PRELIMINARY SITE CHARACTERIZATION REPORT	
VERTICAL CONNECTION TESTS	
APRIL 1992	MAIN 1893



NORTH

LEGEND

Active

Ao Orchard
Av Vineyard
Ac Cropland/cropland pasture
Ap Permanent pasture

Inactive

Ai Agriculture Inactive

Forestland

Fc Brush cover up to fully stocked poles less than 30 feet
Fn Forest over 30 feet
Fp Plantations, any size

Water

Wn Natural, any size
Wc Artificial, one acre

Wetlands

Wb Bogs, shrub wetlands
Ww Wooded wetlands

Public

P All categories

Residential

Rh High density, 50 feet frontage
Rm Medium density, 50-100 feet frontage
Rs Strip with max of 1/3 intermixture of Cs commercial
Rr Rural hamlet

Shoreline

Rk Shoreline developed

Commercial

Cs Commercial strip with max of 1/3 intermixture of Rs or density housing

Outdoor Recreation

OR All categories

Transportation

Ta Airport

Source: New York State Land Use and Natural Resources Inventory

Base Maps: U.S.G.S. Quadrangles:Ovid, NY 1970 & Dresden, NY - Photorevised 1978
NYS DOT Quadrangles:Romulus, NY 1978 & Geneva South, NY 1978

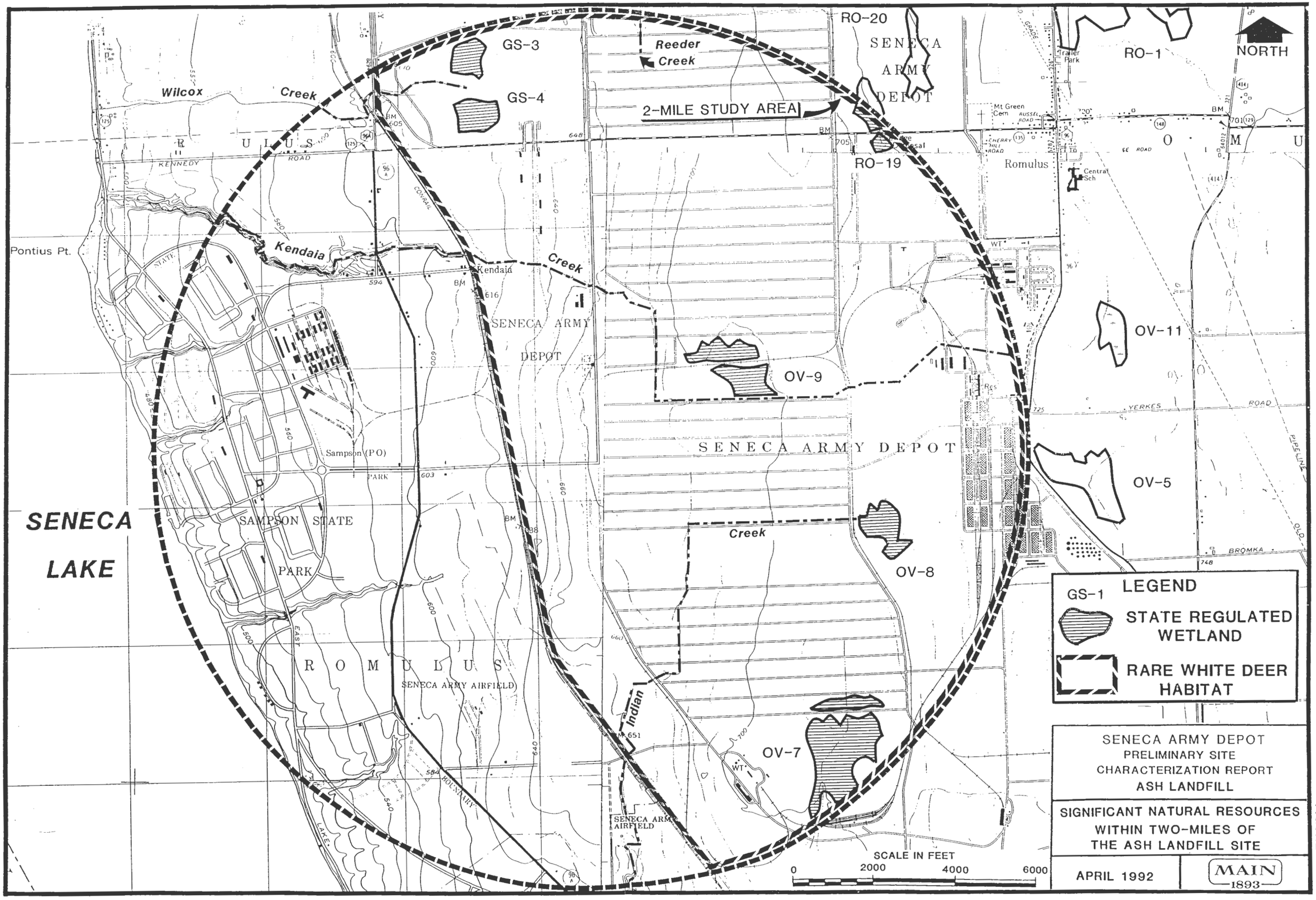
SENECA ARMY DEPOT PRELIMINARY SITE CHARACTERIZATION REPORT

REGIONAL / LOCAL LAND USE MAP

1/2 0 1
SCALE IN MILES

MAIN 1893

FIGURE 3-5


NORTH
2-MILE STUDY AREA
Wilcox Creek
Reeder Creek
Kendaia Creek
Pontius Pt.
SENECA LAKE
SENECA ARMY DEPOT
SAMPSON STATE PARK
ROMULUS
SENECA ARMY AIRFIELD
Sampson (PO)
Kendaia
Romulus
Mt Green Cem
Central Sch
Trailer Park
RO-1
RO-19
RO-20
GS-3
GS-4
OV-5
OV-7
OV-8
OV-9
OV-11
Indian Creek
KENNEDY ROAD
CHERRY HILL ROAD
RUSSEL ROAD
YERKES ROAD
PARK
EAST
LAKE
BOUNDARY
CONRAIL
PIPELINE
OLD
BROMKA
SCALE IN FEET
0 2000 4000 6000
LEGEND
GS-1
STATE REGULATED WETLAND
RARE WHITE DEER HABITAT
SENECA ARMY DEPOT
PRELIMINARY SITE CHARACTERIZATION REPORT
ASH LANDFILL
SIGNIFICANT NATURAL RESOURCES WITHIN TWO-MILES OF THE ASH LANDFILL SITE
APRIL 1992
MAIN 1893
FIGURE 3-6

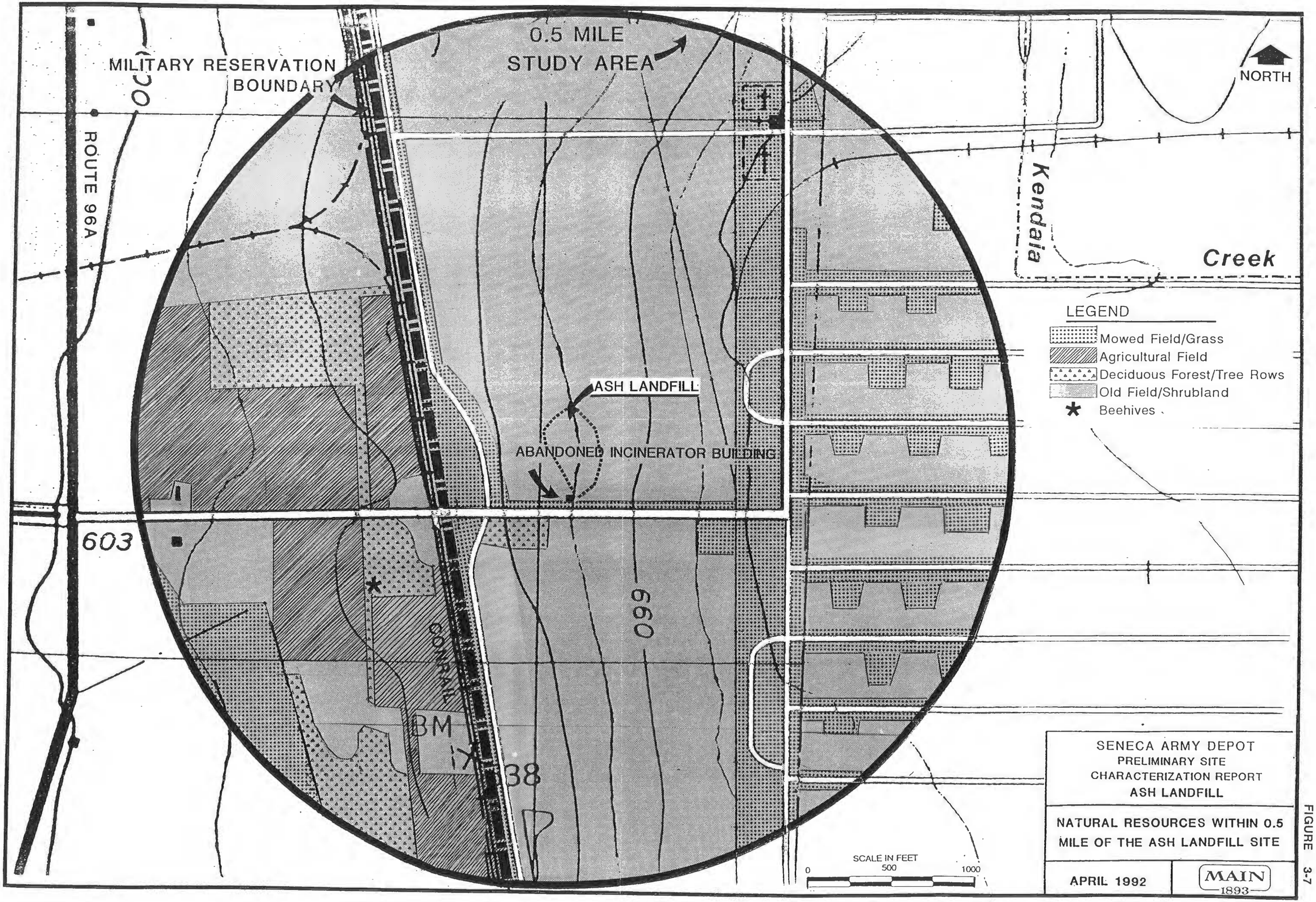

0.5 MILE
STUDY AREA
MILITARY RESERVATION
BOUNDARY
ROUTE 96A
NORTH
Kendaia
Creek
ASH LANDFILL
ABANDONED INCINERATOR BUILDING
603
660
CONRAIL
BM
1X
38
LEGEND
Mowed Field/Grass
Agricultural Field
Deciduous Forest/Tree Rows
Old Field/Shrubland
Beehives
SCALE IN FEET
0
500
1000
SENECA ARMY DEPOT
PRELIMINARY SITE
CHARACTERIZATION REPORT
ASH LANDFILL
NATURAL RESOURCES WITHIN 0.5
MILE OF THE ASH LANDFILL SITE
APRIL 1992
MAIN
1893

FIGURE 3-7

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 INTRODUCTION

This section presents the results of analyses of all media sampled for this investigation. Soil gas results are discussed first, followed by results for volatile organic compounds, semi-voatile, organic compounds, pesticides and PCBs, metals and cyanide, and herbicides in groundwater, soil, dust wipe samples, sediment and surface water. Where possible, the extent of these parameters in the various media is presented.

4.2 SOIL GAS

4.2.1 Soil Gas Summary

The most notable result of the soil gas program was the detection of an area near the bend in the unpaved road, north of the old incinerator building, which has been identified as a likely source of solvent impacted soil. Confirmatory soil borings in this area were then performed to delineate this source area.

In addition, low levels of solvents was detected at the Non-Combustible Fill Landfill, located south/southwest of the old incinerator building. The concentrations of solvents detected in the soil gas extracted from the Non-Combustible Fill Landfill were substantially less than the levels detected at the bend in the road. Nonetheless, test pitting was performed in the areas where geophysical techniques indicated the presence of metal objects. The metal object responsible for the geophysical anomoly was identified. None of the anomolies were identified as drums during the test pitting process.

Results of the soil gas investigation are tabulated in Table 4-1, Soil Gas Summary Data. Soil gas identification numbers and locations are presented on Plate 4-1. Detector responses were used in conjunction with calibration curve data to calculate corresponding concentrations of 1,1,-dichloroethylene and trichloroethylene. Total volatile concentrations, determined as the sum of all detectable peaks, expressed as trichloroethylene, and OVM readings are also provided on the table. Additionally, syringe and probe blanks are included on the table.

The spatial distribution of this soil gas data is shown on Plates 4-1. These locations are mostly at locations where geophysical anomalies were identified. Additional locations were

investigated and included areas where volatile organic compounds were detected during field screening of initial split spoon soil samples. Plate 4-1 does not provide results of the two areas which have relatively higher concentrations and high density of soil gas sampling locations. The results for these two areas are provided on Plate 4-2 which, for clarity, shows enlarged plans of these areas of concern. The two areas where total volatile organic compounds exceed 1 ppmv are: 1) at the bend in the unpaved road north of the incinerator building and 2) in the central portion of the Non-Combustible Fill Landfill (Plate 4-2).

4.2.2 Bend in the Road

Near the bend in the road total volatile organics in soil gas are as high as 86.6 ppmv at SG-70. A 1 ppmv total volatile organics isocontour encompasses an area approximately 250 feet by 175 feet (Plate 4-2, enlarged Plan A). Based on the concentration detected at SG-14 and the recreated data from a previous soil gas investigation performed by the Target Environmental Services (1989) this area may extend to the south toward the Ash Landfill and incinerator building. Trichloroethylene concentrations in soil gas are also provided on Plate 4-2 (enlarged Plan B).

The soil gas survey clearly identifies a source area for volatile organic compounds in soil (i.e., area encompassed by 1 ppmv isocotour).

Areas identified in the Target (1989) soil gas survey with soil gas concentrations of over 100 ug/l are identified on enlarged plans A and B. In the southeasternmost location, a total volatile organics concentration of approximately 11,000 ug/l (approximately 11 ppmv) was detected. This was the highest concentration detected in the Target (1989) survey. As a basis for comparison, this location was sampled during MAIN's soil gas survey (SG-14) and a concentration of approximately 50 ppmv was determined. Differences in concentration are not unexpected using soil gas techniques, and at this location this difference is not substantial. However, soil gas concentrations determined by MAIN are higher near the bend in the unpaved road (up to 86.6 ppmv) than was previously identified by Target. In this case, the differences are one to two orders of magnitude different.

Locationally, MAIN's soil gas results correlate well with the northernmost "hot spot" (i.e., concentrations 100 ug/l) defined by Target (Plate 2-4), although MAIN's soil gas results suggests that the source area for volatile organic compounds extends farther north than was previously defined by Target's (1989) soil gas survey. However, the concentrations of volatile

organics in soil gas are higher than the values previously investigated by Target. This is significant since the levels detected by Target did not indicate the degree of impacts.

4.2.3 Non-Combustible Fill Landfill

A small area of total volatile organics in soil gas is defined by a 1 ppmv isocontour on Plate 4-2 (Enlarged Plan C). Here concentrations of total VOCs are only as high as 8.38 ppmv. Concentrations of trichloroethylene in soil gas, which are significantly less than 1 ppmv, are also shown on Plate 4-2 (Enlarged Plan D). Comparatively, the Non-Combustible Fill Landfill contains much lower concentrations of total volatile organics and TCE in soil gas when compared to those near the Ash Landfill and is not considered to be a major source of VOC's.

4.3 SOIL

4.3.1 Volatile Organic Compounds

Volatile organic compounds were detected in most of the soil samples collected during drilling (Plate 4-3). The volatile organics include tetrachloroethylene, trichloroethylene, 1,2-dichloroethylene (total), 1,2-dichloroethane (only one occurrence of an estimated value below the detection limit), 1,1,1-trichloroethane, chloroform, 2-butanone, benzene, toluene, ethylbenzene, xylene, methylene chloride and acetone. The latter two compounds were found at low levels in borings B6-91, B8-91, B9-91, B2-91 and B23-91 and are believed to laboratory contaminants. Borings B8-91 and B9-91 are background borings.

The highest concentrations of volatile organic compounds were detected in samples from varying depths (2 to 8 feet) in the fill of the Ash Landfill and immediately northwest of this filled area, near the bend in an unpaved road. The highest concentration of volatile organic compounds (669,000 ug/kg of mostly trichloroethylene) was found in the 2-4 foot sample in B15-91 (Plate 4-3). Generally, concentrations of total volatile organic compounds decrease in a westward direction between boring B15-91 and B25-91 (on the western side of wetland B). The highest concentrations of total volatiles from two borings in the central-western portion of the Ash Landfill (B10-92 and B31-91) were between approximately 1600 and 1700 ug/kg (Plate 4-3). The western portion of the Ash Landfill and areas near the bend in the road and wetland B are believed to be likely source areas for volatile organic compounds. Total VOC highs in borings B20-91 and B21-91 near the abandoned cooling pond and fuel

oil underground storage tank were 13 and 39 ug/kg, respectively, all of which is methylene chloride and acetone.

At the Non-Combustible Fill Landfill the highest concentration of volatile organics (45 ug/kg of mostly 1,2-dichloroethylene) was found in the 2-4 foot sample of fill from boring B6-91 (Plate 4-3). The 0-2 sample from B6-91, upgradient of the filled area, contained 7 ug/kg (all acetone & methylene chloride) of volatile organic compounds.

Samples collected from three debris piles contained significantly lower concentrations of total volatile organic compounds than the Ash Landfill (Plate 4-3). The higher concentrations of volatiles, other than methylene chloride and acetone, were found in samples from the approximate center of these debris piles. At the two northernmost debris piles, samples from borings performed outside these visiblyfilled areas did not detect significant levels of volatiles, suggesting that the distribution of the volatiles found in the center of the debris piles (mostly trichloroethylene) is localized.

Samples from other borings performed near the cooking grease pits (B18-91), a suspected Ash Landfill burning pit (B19-91), a possible solvent dump area (B1-91), and near the western boundary of the site (B16-91) contained relatively low concentrations of total VOC's. Compounds found in these samples include tetrachloroethylene, xylene, toluene, methylene chloride and acetone.

A comparison of VOCs (including 1,2-DCE and TCE) in selected soil samples from borings at areas of high soil gas is presented in Table 4-2. In most instances when VOCs are found in the soil gas they are also found in the soil, supporting the use of soil gas techniques to locate source area for volatile organic compounds.

4.3.2 Semi-Volatile Organic Compounds

Semi-volatile organics compounds were detected in 23 borings on the site (Table 4-3). The highest total semi-volatile concentrations and widest variety of compounds were found in samples from B4-91 and B7-91 where 0-2 foot samples from both locations contained 107,520 and 117,690 ug/kg, respectively. B4-91 is located in the north-westernmost debris pile and B7-91 is located in the Non-Combustible Fill Landfill.

Borings in the Ash Landfill and in the area near the bend in the road near wetland W-B generally contain semi-volatiles from the surface to the bottom of the boring, although the concentrations in this area are not as high as those from the debris pile and Non-Combustible Fill Landfill. Detectable concentrations of semi-volatiles from this area range between 61 ug/kg in boring B28-91 and 31, 970 ug/kg in B10-91. The highest concentration of semi-volatiles in this area are both from two borings on the Ash Landfill, B10-91 and B31-91 (Table 4-3).

Semi-volatile concentrations as high as 107,520 ug/kg are present at the surface as well as at depth (except in B5-91) in borings located in the centers of the three debris piles (B3-91, B4-91 and B5-91). Semi-volatiles were found at a concentration of 423 ug/kg in only one sample (0-2 feet from B11-91) from the perimeter borings drilled to the east and west of the debris pile containing B3-91. Near the debris pile which contains B4-91, semi-volatiles at concentrations up to 2000 ug/kg were found in perimeter borings (B13-91 and B14-91).

No semi-volatiles organic compounds were found in outlier borings B6-91, B9-91, B22-91, B23-91 and B24-91. One sample from outlier borings B8-91 and B25-91 contained 90 ug/kg of Pyrene (an estimated value which was also found in the laboratory blank) and 510 ug/kg of bis-(2-ethylhexyl) phthalate (an estimated value), respectively.

Relatively low concentrations of total semi-volatiles (concentrations between 88 and 400 ug/kg) were found between 2 and 8 feet in both B18-91 (at the cooking grease pits disposal area) and B19-91 (with suspected butning pits), east of the Ash Landfill. Near asphalt patch in the western perimeter of the site (B16-91) semi-volatile concentrations are up to 11,360 ug/kg.

4.3.3 Pesticides and PCBs

Five pesticides and two PCBs were detected in several soil samples on-site (Table 4-4). The pesticides include heptachlor, dieldrin, 4,4-DDE, 4,4-DDD, and 4,4-DDT. The PCBs are Aroclor-1242 and Aroclor-1260.

Relatively low concentrations of pesticides (18 to 250 ug/kg) were found in borings B7-91, B10-91, B12-91, B15-91, B16-91, B17-91, B20-91, B30-91 and B31-91. The compounds 4,4-DDE, 4-4-DDD and 4,4-DDT are the most common pesticides found on-site, but of these, 4,4-DDE is the most widespread. The highest concentration of total pesticides was found in

B15-91 which had a concentration of 250 ug/kg (exclusively 4,4-DDE). Heptachlor and dieldrin were found in only the 0-2 foot sample from B12-91.

PCBs Aroclor-1242 and 1260 were found only in borings B2-91, B15-91, B28-91, B30-91 and B31-91 located in the Ash Landfill and the immediately to the northwest of the fill near the bend in the road. The highest total PCB concentration (1000 ug/kg of Aroclor 1242) was detected in the 2-4 foot sample in boring B31-91. Aroclor 1260 is prevalent from the surface to 8 feet below the land surface in borings B2-91 and B15-91, located near the northern extent of the Ash Landfill.

4.3.4 Metals and Cyanide

A summary of the results for the metals and cyanide is presented in Table 4-5. In this table minimum, maximum average and standard deviation for metals and cyanide in on-site soil samples are compared to average concentrations of these parameters in 7 samples from two background borings (B8-91 and B9-91). The number of on-site samples which have concentrations below and above the background average for the respective parameters is shown on the right portion of the table.

Several parameters were found above detection limits in only a few of the soil samples. These include: antimony (9 detections), selenium (2 detections), silver (15 detections) and cyanide (1 detection) (Table 4-5); thallium was not found above the detection limit in any of the samples. In all of these instances, except for thallium, the detections were above the average background concentration. The highest concentrations of these parameters were found at the following locations: antimony at B3-91, selenium of B31-91 (also found in laboratory blank), silver at B10-91, and cyanide at B3-91.

Beryllium, cobalt and mercury are in a group of metals in which half of the concentrations are below the average for background samples, and half are above. For beryllium and cobalt the background and on-site maximums and averages are nearly identical. For mercury, the on-site maximum and average are only slightly higher than that determined for background.

A significant number of samples are below the background average and include barium, calcium, magnesium, and manganese. The maximum for barium is several times higher on the site than for background. This maximum occurs at boring B3-91. In addition, the on-site average for barium is higher than that for the background. For calcium, magnesium and

manganese the maximum concentrations on-site are only slightly above those for background samples. Also, for these latter three metals the average background concentrations are greater than on-site average concentrations.

For the remaining group of metals the number of on-site samples above the background average exceeds the number below this average. These metals include: aluminum, arsenic, cadmium, chromium, copper, iron, lead, nickel, potassium, sodium, vanadium and zinc. On-site and background maximum and average concentrations are generally similar for aluminum, iron, nickel and vanadium. However, for arsenic, cadmium, chromium, copper, lead, potassium, sodium and zinc the maximum concentrations are significantly higher in than the background samples (Table 4-5).

The maximum concentrations for metals occur at the following locations: B3-91 for arsenic, cadmium, copper and zinc; B4-91 for chromium and lead; B11-91 for potassium; and B10-91 for sodium. Borings B3-91 and B4-91 are in debris piles north of the Ash Landfill. In general, samples from the Ash Landfill and its immediate area contain high concentrations of metals.

4.3.5 Herbicides

Three herbicides 2,4-DB, MCPP, and 2,4,5-TP (Silvex) were detected in several samples on the site, however, 2,4-DB and MCPP are more prevalent (Table 4-6). These herbicides are found only in locations where dumping of suspected solvents, debris and ash has taken place on the site. Specifically, they were found in suspected solvent dump areas, in all three borings in and near the three debris piles, and in the Ash Landfill area.

The highest concentrations of 2,4-DB, MCPP, and 2,4,5-TP (Silvex), detected were 410 ug/kg (at B29-91), 24,000 ug/kg (at B11-91), and 10 ug/kg (at B10-91), respectively.

4.3.6 Total Recoverable Petroleum Hydrocarbons

The 2-4 foot sample from boring B26-91 near the underground fuel oil tank contained 13.6 mg/kg of total recoverable petroleum hydrocarbons. However, during drilling no VOCs or visual or olfactory evidence of petroleum hydrocarbons were detected in the soil from this boring.

4.4 GROUNDWATER

4.4.1 Volatile Organic Compounds

Volatile organic compounds were detected in nine of the 31 monitoring wells sampled on and off-site. The VOCs detected included trichloroethylene, 1,2-dichloroethylene (total), vinyl chloride, chloroform, 2-Butanone, xylene (total), methylene chloride, and acetone. The latter two compounds are believed to be laboratory contaminants in most instances. Trichloroethylene and 1,2-dichloroethylene are the dominant volatile organics on the site. Complete tables of analytical results are included in Appendix J.

The geographic distribution of total volatile organic compounds is shown in Plate 4-4). Ten, 100 and 10,000 ug/l isocontours define a total volatiles plume that originates in the western portion of the Ash Landfill and extends to the west in the direction of groundwater flow. The plume is believed to extend beyond the fence near the Conrail railroad line onto the adjacent property based on the 104 ug/l concentration of total volatiles in well PT-24.

As shown on Plate 4-4 the plume is relatively long and narrow, however, based on soil gas results and soil analyses, the source area for this plume is believed to extend as much as 300 feet north of PT-18, which has a total volatiles concentration of 11,580 ug/l. Because the source area is suspected to be wider than shown, the north and northeastern portions of the plume are bound by dashed or (inferred) 10 and 100 ug/l isocontours. Well MW-40 in the eastern portion of the Ash Landfill clearly defines the eastern extent of the plume while wells PT-19, MW-32 and MW-31 define its southern extent.

Trichloroethylene (TCE) is considered as the dominant volatile organic compound on-site. The geographic distribution of this compound is presented on (Plate 4-5). Concentrations of trichloroethylene are up to 11,000 ug/l in the source area (PT-18) and are as low as 4 and 1 ug/l near the western boundary of the site. A slug of higher concentrations of trichloroethylene is present in the southwestern portion of the plume.

Several daughter products of the breakdown of trichloroethylene have been observed at the site. The include 1,2-dichloroethylene and vinyl chloride.

At the downgradient, western end of the plume, 1,2-dichloroethene is the dominant volatile organic compound where it is found at 100 and 71 ug/l in wells PT-24 and MW-29,

respectively. The shift from trichloroethylene as the predominant volatile organic compound near the source areas to the dominance of the breakdown daughter compound 1,2-dichloroethylene at downgradient locations is consistent with the environmental chemistry of trichloroethylene.

4.4.2 Semi-Volatile Organic Compounds

No semi-volatile organic compounds were detected in any of the wells on and off-site. One well (PT-20) was reported to contain semi-volatile organics, but were suspected to be laboratory contaminants. None of these compounds were detected in a reanalysis of this sample.

4.4.3 Pesticides and PCBs

No pesticides or PCBs were detected in any of the well samples collected on and off-site. A very low concentration of Anclor-1260 (3.6 ug/l) was found in MW-28, however, a reanalysis of the sample did not detect this compound above 1 ug/l.

4.4.4 Metals and Cyanide

Unfiltered and filtered metals results for groundwater are presented in Table 4-7. Generally, filtered metals concentrations are less than concentrations in unfiltered samples, and most metals concentrations are below the detection limit in the filtered samples.

Some of the highest unfiltered metals concentrations were obtained in an off-site well, PT-26, near the Seneca airfield. PT-18 in the Ash Landfill also exhibits some high unfiltered concentrations of metals especially lead (17.8 ug/L), zinc (496 ug/l), manganese (1,530 ug/l) and mercury (0.42 ug/l). Elevated concentrations of barium, beryllium, cadmium, chromium, lead, manganese, vanadium and zinc occur in unfiltered samples from wells MW-29 and MW-31.

Cyanide concentrations in unfiltered samples are all below the detection limit except in PT-10 where 11.2 ug/l (just above the detection limit) was detected.

Aluminum and iron show the greatest difference between unfiltered and filtered concentrations.

4.4.5 Herbicides

Results for herbicides in groundwater are presented in Appendix J. No herbicides were detected in any of the samples above the detection limit.

4.4.6 Additional Parameters

The results for the nine additional parameters tested for in well PT-17, PT-23, and MW-42D are presented in Table 4-8. Generally, most the concentrations of similar parameters are not very different from well to well. However, anomallously high concentrations are noted in wells PT-17 (chloride) and PT-23 (Chemical Oxygen Demand and Total Suspended Solids).

4.5 SURFACE WATER AND SEDIMENT

4.5.1 Volatile Organic Compounds

Surface water samples from SW-100, SW-300, SW-400 and SW-800 contained only low concentrations acetone and methylene chloride; chloroform was detected only in SW-400 (Plate 2-2). No other volatile organic compounds were detected in these samples. As discussed in Section 2.0, surface water was not available from SW-200, SW-600, SW-700, SW-900 and SW-901.

Sediment samples from most of the stations contained low concentrations of volatile organic compounds including acetone, methylene chloride and chloroform. No volatile organics were found at stations SW-100, SW-600 and SW-800. The types and concentrations of volatiles found in both the surface water and sediment samples indicate that they are likely laboratory contaminants.

4.5.2 Semi-Volatile Organic Compounds

Surface water samples from the four locations which contained water SW-100, SW-300, SW-400 and SW-800 did not contain semi-volatile organic compounds above the detection limits.

Semi-volatiles were found in all sediment samples collected on and off of the site, however, the highest concentrations were found off-site (Table 4-9). Total semi-volatile concentrations at two sample locations (SW-100 and SW-200) in wetland W-D are each approximately 200

ug/kg. At locations SW-300 and SW-400 in the drainage channel north of West Smith Farm Road total semi-volatile concentrations are 954 and 4970 ug/kg, respectively. The highest total semi-volatile concentration was found at SW-600 in off-site wetland W-G where 48,340 ug/kg was detected. The remaining off-site locations (SW-700, SW-800, SW-900 and SW-901) have concentrations ranging between 78 and 873 ug/kg.

4.5.3 Pesticides and Pcb's

No pesticides or PCBs were found in surface water samples collected from locations SW-100, SW-300, SW-400 and SW-800.

No PCBs were found in any of the sediment samples collected. One pesticide (4,4-DDE) was found at a concentration of 63 ug/kg in a sediment sample from location SW-400 in the ditch on the north side of West Smith Farm Road. No other locations contained this compound or any other pesticides.

4.5.4 Metals and Cyanide

Generally, metals concentrations in surface water samples from locations SW-100, SW-300, SW-400, and SW-800 are below the detection limit and in some instances a value less than the contract required detection limit is given Table 4-10. Elevated concentrations of antimony, iron, lead, manganese and zinc were detected in at SW-300, along the north side of West Smith Farm Road. Cyanide was not detected above the detection limit.

Results for metals and cyanide in sediment are shown in Table 4-11. No anomalous concentrations of metals or cyanide are present within the sample group.

4.5.5 Herbicides

No herbicides were detected above the method detection limit in the four surface water samples collected from SW-100, SW-300, SW-400, and SW-800. In addition, no herbicides were detected in any of the sediment samples (Appendix J).

4.6 DUST WIPES

4.6.1 Semi-Volatile Organic Compounds

Only two estimated concentrations of two semi-volatile organic compounds were detected in the samples. Benzoic acid (3 ug/wp) and Dimethylphthalate (16 ug/wp) were detected in DW1206-1 and Dimethylphthlate (7 ug/wp) was detected in DW1206-2 (Appendix J). A two square foot area was wiped to collect these samples

4.6.2 Pesticides and PCBs

No pesticides or PCBs were detected in either of the samples (Appendix J). A two square foot area was wiped to collect these samples.

4.6.3 Metals

Metals results are presented in Table 4-12. Elevated (relative to the other sample) concentrations of antimony and lead are present in DW1206-1. Additionally, DW1206-2 contained elevated barium, copper, iron, manganese, silver and sodium. A one square foot area was wiped to collect these samples.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–1
SOIL GAS SUMMARY DATA[1]

Soil Gas ID	Soil Gas Location	DCE Area Vs	DCE Conc. PPMV	TCE Area Vs	TCE Conc. PPMV	TOTAL Area Vs	TOTAL Conc.[2] PPMV	OVM Reading[3] PPMV
	Nov. 15, 1991							
SG–01	Line 16, 1482 Ft.	< 0.10	< 0.02	< 0.10	< 0.01	2.80	0.45	<1
SG–02	Dup. of SG–01	< 0.10	< 0.02	< 0.10	< 0.01	4.46	0.71	<1
SG–03	Line 16, 1446 Ft.	< 0.10	< 0.02	< 0.10	< 0.01	0.56	0.09	<1
	Syringe Blank	< 0.10	< 0.02	< 0.10	< 0.01	0.24	0.04	–
SG–04	Line 16, 1432 Ft.	< 0.10	< 0.02	< 0.10	< 0.01	5.50	0.88	<1
SG–05	Dup. of SG–04	< 0.10	< 0.02	< 0.10	< 0.01	5.45	0.87	<1
SG–06	Line 16, 1252 Ft.	< 0.10	< 0.02	< 0.10	< 0.01	4.50	0.72	<1
	Nov. 18, 1991							
SG–07	Line 16, 765 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.21	0.03	<1
SG–08	Line 16, 665 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.78	0.22	<1
SG–09	Line 16, 630 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.10	0.14	<1
SG–10	Line 16, 610 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.36	0.17	<1
SG–11	Line 16, 585 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.97	0.12	<1
SG–12	Line 16, 480 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.65	0.08	<1
SG–12A	Dup. of SG–12	< 0.10	< 0.03	< 0.10	< 0.01	< 0.10	< 0.01	<1
SG–13	Near B2–91	< 0.10	< 0.03	< 0.10	< 0.01	1.25	0.16	<1
SG–14	Near Old Hot Spot.	16.90	4.76	36.80	4.60	400.00	49.99	12
SG–14A	Dup. of SG–14	26.00	7.33	36.20	4.52	377.00	47.11	12
	Syringe #4 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.40	0.17	–
	Nov. 19, 1991							
SG–15	Near B2–91	< 0.10	< 0.03	< 0.10	< 0.01	2.94	0.39	2
SG–16	Line 16,374 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	2.00	0.27	<1
SG–17	Line 17, 340 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	2.00	0.27	<1
	Syringe #3 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.20	0.16	–
SG–18	Line 17, 510 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	3.12	0.42	4
SG–19	Line 17, 610 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.85	0.25	<1
SG–20	Line 17, 700 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.39	0.05	<1
SG–21	Line 17, 750 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.32	0.04	<1
	Syringe #4 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.24	0.03	–
SG–22	Line 17, 1188 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.78	0.10	<1
SG–23	Line 17, 1285 Ft.	< 0.10	< 0.03	0.31	0.04	41.06	5.46	<1
SG–23A	Dup. of SG–23	< 0.10	< 0.03	0.25	0.03	43.25	5.75	<1
SG–24	Line 17, 1490 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.52	0.07	<1
SG–25	Line 18, 1490 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.86	0.11	<1
SG–26	Line 18, 1365 Ft.	< 0.10	< 0.03	5.10	0.68	6.30	0.84	2
	Syringe #3 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.28	0.04	–
SG–27	Line 17, 1320 Ft.	< 0.10	< 0.03	1.40	0.19	4.37	0.58	1
SG–28	Line 17, 25' N of SG–23	< 0.10	< 0.03	< 0.10	< 0.01	55.00	7.32	2
SG–29	Dup. of SG–28	< 0.10	< 0.03	< 0.10	< 0.01	61.85	8.23	2
SG–30	Line 17, 25' S of SG–23	1.15	0.32	0.80	0.11	63.00	8.38	<1
	Syringe #3 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.38	0.05	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–1
SOIL GAS SUMMARY DATA[1]

Soil Gas ID	Soil Gas Location	DCE Area Vs	DCE Conc. PPMV	TCE Area Vs	TCE Conc. PPMV	TOTAL Area Vs	TOTAL Conc.[2] PPMV	OVM Reading[3] PPMV
	Nov. 20, 1991							
	Syringe #4 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.70	0.24	–
SG–31	Probe Blank	< 0.10	< 0.03	< 0.10	< 0.01	2.12	0.30	<1
SG–32	Line 17, 20' S of SG–27	0.19	0.06	2.30	0.33	3.17	0.45	2
SG–33	Line 16, 1285 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.65	0.09	<1
SG–34	Line 17, 67' S of SG–23	< 0.10	< 0.03	0.08	0.01	23.83	3.37	<1
	Syringe #4 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.12	0.02	–
SG–35	Line 19, 1340 Ft.	< 0.10	< 0.03	0.05	0.01	0.37	0.05	<1
SG–36	Line 19, 1245 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.50	0.21	<1
	Syringe #5 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.94	0.13	–
	Syringe #3 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.77	0.11	–
SG–37	Line 18, 445 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.42	0.06	<1
SG–38	Line 19, 770 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.73	0.10	<1
SG–39	Line 3, 150 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.47	0.07	<1
SG–40	Line 3, 225 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.25	0.18	<1
SG–41	Line 4, 200 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	1.51	0.21	<1
SG–42	Line 5, 225 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.78	0.11	<1
SG–43	Line 5, 175 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.55	0.08	<1
	Syringe #3 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.24	0.03	–
SG–44	Line 10, 770 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.67	0.09	<1
SG–45	Line 10, 850 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	2.63	0.37	<1
SG–46	Line 10, 990 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.74	0.10	<1
SG–47	Line 12, 930 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.46	0.07	<1
SG–48	Line 12, 990 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	2.65	0.38	<1
	Nov. 21, 1991							
SG–49	Probe Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.33	0.19	–
SG–50	Line 14, 1370 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.46	0.07	<1
SG–51	Line 13, 1010 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.41	0.06	<1
SG–52	Line 13, 960 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.20	0.03	<1
SG–53	Line 13, 915 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.47	0.07	<1
SG–54	Line 13, 850 Ft.	< 0.10	< 0.03	< 0.10	< 0.01	0.54	0.08	<1
SG–55	Near Boring B3–91	< 0.10	< 0.03	0.39	0.06	0.75	0.11	<1
SG–56	South of Boring B3–91	< 0.10	< 0.03	< 0.10	< 0.01	1.37	0.19	<1
	Syringe #5 Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.33	0.05	<1
SG–57	South of Boring B4–91	< 0.10	< 0.03	< 0.10	< 0.01	0.63	0.09	<1
SG–58	Near Boring B4–91	< 0.10	< 0.03	1.35	0.19	1.77	0.25	<1
SG–59	North of Boring B4–91	< 0.10	< 0.03	< 0.10	< 0.01	0.83	0.12	<1
SG–60	Near Bend in Road	429.00	127.04	83.00	11.75	530.00	75.02	32
SG–61	Dup. of SG–60	99.60	29.49	372.00	52.66	514.00	72.76	32
	Syringe #5 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.74	0.25	–
SG–62	Near Bend in Road	24.80	7.34	5.50	0.78	33.30	4.71	11
	Syringe #4 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.50	0.21	–
SG–63	Near B15–91	4.30	1.27	12.40	1.76	18.79	2.66	4
	Syringe #3 Blank	< 0.10	< 0.03	0.31	0.04	2.11	0.30	–
SG–64	Near Bend in Road	< 0.10	< 0.03	0.50	0.07	5.70	0.81	5
SG–65	Near Bend in Road	< 0.10	< 0.03	0.10	0.01	54.00	7.64	<1
SG–66	Near Bend in Road	< 0.10	< 0.03	< 0.10	0.01	0.61	0.09	2
SG–67	Near Bend in Road	0.28	0.08	1.90	0.27	2.83	0.40	<1

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–1
SOIL GAS SUMMARY DATA[1]

Soil Gas ID	Soil Gas Location	DCE Area Vs	DCE Conc. PPMV	TCE Area Vs	TCE Conc. PPMV	TOTAL Area Vs	TOTAL Conc.[2] PPMV	OVM Reading[3] PPMV
	Nov. 22, 1991							
	Syringe #5 Blank	< 0.10	< 0.03	< 0.10	< 0.01	1.10	0.16	–
SG–68	Near Bend in Road	140.20	41.52	< 0.10	< 0.01	546.20	77.31	129
SG–69	Near B28–91	6.20	1.84	2.20	0.31	14.60	2.07	75
SG–70	Near B30–91	312.00	92.39	28.40	4.02	612.00	86.63	132
SG–71	Near Bend in Road	4.60	1.36	2.10	0.30	7.56	1.07	8
SG–72	Probe Blank	< 0.10	< 0.03	< 0.10	< 0.01	0.58	0.08	–
SG–73	Near Bend in Road	20.80	6.16	24.10	3.41	48.20	6.82	10
SG–74	Near B27–91	14.80	4.38	16.45	2.33	32.10	4.54	25
SG–75	Near Bend in Road	1.05	0.31	2.90	0.41	7.10	1.01	6
SG–76	Near Bend in Road	< 0.10	< 0.03	< 0.10	< 0.01	1.38	0.20	2

Notes:
PPMV – Parts Per Million Volume

[1] – Soil Gas analyses were performed with a Photovac 10S50 Gas Chromatograph; Peak identification was based upon retention time matching of a soil gas sample with a known compound from a ,certified, calibrated gas standard.

[2] – Total Volatile Organic Compounds (VOC) was determined as the sum of all detectable peaks, expressed as Trichloroethene (TCE).

[3] – This value represents the highest Total Organic Vapor Meter (OVM) Reading observed during the purging of the soil gas probe. Sample collection corresponded to this observed value as much as possible. The OVM was calibrated daily against a 60 PPMV isobutylene standard.

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-2
COMPARISION OF VOLATILES DETECTED IN SOIL AND SOIL GAS FOR SELECTED LOCATIONS

Boring Location	Sample Number	Depth (feet)	1,2-DCE in Soil	1,2-DCE in Soil Gas	TCE in Soil	TCE in Soil Gas	Total VOCs in Soil	Total VOCs in Soil Gas
B2-91*								
	S1031-4	0-2	12000		28000		45800	
	S1031-5	2-4	19000	<0.03	4400	<0.01	8190	0.39
	S1031-6	6-8	21000	(SG-15)	120000	(SG-15)	143580	(SG-15)
	S1031-7	8-10	<1400		69000		69000	
B3-91								
	S1031-8	0-2	<6		23		41	
	S1031-9	2-4	<6	<0.03	<6	0.06	8	0.11
	S1031-10	4-6	<6	(SG-55)	<6	(SG-55)	13	(SG-55)
	S1031-11	6-8	<6		5		21	
B4-91								
	S1101-12	0-2	<6		130		136	
	S1101-13	2-4	<6	<0.03	<6	0.19	8	0.25
	S1101-14	6-8	<5	(SG-58)	2	(SG-58)	10	(SG-58)
B6-91								
	S1104-19	0-2	<6	<0.03	<6	<0.01	7	0.07
	S1104-20	2-4	<6	(SG-24)	<6	(SG-24)	6	(SG-24)
B15-91								
	S1106-49	0-2	29000		110000		143977	
	S1106-50	2-4	40000	1.27	470000	1.76	534100	2.66
	S1106-51	2-4	79000	(SG-63)	540000	(SG-63)	669000	(SG-63)
	S1106-52	6-8	11000		38000		57190	
B25-91								
	S1203-82	0-2	<6		<6		2	
	S1203-83	2-4	<6	<0.03	<6	<0.01	BDL	0.42
	S1203-84	4-6	<5	(SG-18)	<5	(SG-18)	15	(SG-18)
B27-91								
	S1204-86	0-2	100	4.38	10	2.33	114	4.54
	S1204-87	2-4	250	(SG-74)	13	(SG-74)	263	(SG-74)
B28-91								
	S1204-88	0-2	160		18		190	
	S1204-89	2-4	440	1.84	83	0.31	2602	2.07
	S1204-89A	2-4	1600	(SG-69)	74	(SG-69)	1745	(SG-69)
	S1204-90	4-6	20000		2600		22980	
B30-91								
	S1204-94	0-2	45		5		51	
	S1204-94A	0-2	31		5		42	
	S1204-95	2-4	1400	92.4	110	4.02	1828	86.6
	S1204-96	4-6	18000	(SG-70)	450	(SG-70)	20180	(SG-70)
	S1204-96A	4-6	16000		390		25390	
B31-91								
	S1205-97	0-2	<6		23		34	
	S1205-97A	0-2	<6		110		119	
	S1205-98	2-4	5	4.76, 7.33	5	4.60, 4.52	12	49.99, 47.11
	S1205-99	4-6	660	(SG-14)	2400	(SG-14)	3454	(SG-14)
	S1205-100	6-8	630		640		1708	

Notes:

Soil gas locations are shown in parentheses beneath the concentration

Concentrations for soil analyses are ug/Kg

Concentrations for soil gas analyses are in ppmv

Seneca Army Depot
Ash Landfill

Table 4–3
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.:	B1–91	B2–91	B2–91	B2–91	B3–91	B4–91	B4–91	B4–91
	Sample No.:	S1030–3	S1031–4	S1031–5	S1031–6	S1031–8	S1101–12	S1101–13	S1101–14
	Depth (feet):	4–6	0–2	2–4	6–8	0–2	0–2	2–4	4–6
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene		BDL	270J	210J	360J	BDL	2400	BDL	BDL
2–Methylnaphthalene		BDL	280J	BDL	240J	BDL	610J	BDL	BDL
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		BDL	BDL	BDL	BDL	BDL	2200	BDL	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dibenzofuran		BDL	BDL	BDL	BDL	BDL	1400	BDL	BDL
2,4–Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	2000	BDL	BDL
Fluorene		BDL	BDL	BDL	BDL	BDL	2000	BDL	BDL
N–Nitrosodilphenylamine (1)		BDL	BDL	BDL	BDL	BDL	450J	BDL	BDL
Phenanthrene		BDL	170J	62J	BDL	420J	13000	130J	120J
Anthracene		BDL	BDL	BDL	BDL	BDL	4200	BDL	BDL
Di–n–butylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene		BDL	BDL	BDL	BDL	BDL	14000	160J	150J
Pyrene		BDL	130J	BDL	BDL	550J	12000	140J	120J
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		BDL	BDL	BDL	BDL	290J	8800	110J	86J
Chrysene		BDL	BDL	BDL	BDL	350J	8000	110J	90J
bis(2–Ethylhexyl)phthalate		530J	BDL	BDL	BDL	BDL	160J	BDL	BDL
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		BDL	BDL	BDL	BDL	220J	8800	91J	BDL
Benzo(k)fluoranthene		BDL	BDL	BDL	BDL	180J	6700	85J	BDL
Benzo(a)pyrene		BDL	BDL	BDL	BDL	BDL	9000	110J	78J
Indeno(1,2,3–cd)pyrene		BDL	BDL	BDL	BDL	BDL	4800	BDL	BDL
Dibenzo(a,h)anthracene		BDL	BDL	BDL	BDL	BDL	2000	BDL	BDL
Benzo(g,h,i)perylene		BDL	BDL	BDL	BDL	BDL	5000	BDL	BDL
Total		530	850	272	600	2010	107,520	936	644

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4–3 (continued)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: Sample No.: Depth (feet):	B5–91 S1101–15 0–2	B5–91 S1101–16 2–4	B5–91 S1101–17 4–6	B7–91 S1104–21 0–2	B7–91 S1104–22 2–4	B7–91 S1104–23 10–12	B8–91 S1105–24 0–2	B8–91 S1105–26 2–4
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	500J	BDL	BDL	BDL
Naphthalene		210J	BDL	BDL	830J	440J	BDL	BDL	BDL
2–Methylnaphthalene		120J	BDL	BDL	430J	360J	BDL	BDL	BDL
Acenaphthylene		310J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		190J	BDL	BDL	2200	1000	BDL	BDL	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dibenzofuran		160J	BDL	BDL	960J	400J	BDL	BDL	BDL
2,4–Dinitrotoluene		320J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		310J	BDL	BDL	2000	880	BDL	BDL	BDL
N–Nitrosodiphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		3900	BDL	BDL	15000B	5200B	BDL	BDL	BDL
Anthracene		790J	BDL	BDL	3500	1300	150BJ	BDL	BDL
Di–n–butylphthalate		BDL	BDL	BDL	BDL	630J	BDL	BDL	BDL
Fluoranthene		6200	73J	89J	22000B	6700B	210BJ	BDL	BDL
Pyrene		5100	69J	73J	16000B	4800B	190BJ	90BJ	BDL
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		3000	BDL	75J	9600	3000	BDL	BDL	BDL
Chrysene		3100	BDL	76J	9900	3200	BDL	BDL	BDL
bis(2–Ethylhexyl)phthalate		BDL	3600	BDL	870JB	260JB	210BJ	BDL	BDL
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		2600	BDL	74J	9500	2900	BDL	BDL	BDL
Benzo(k)fluoranthene		2300	BDL	70J	6100	1700	BDL	BDL	BDL
Benzo(a)pyrene		2100	BDL	81J	8400	2500	BDL	BDL	BDL
Indeno(1,2,3–cd)pyrene		1300	BDL	BDL	4600	1200	BDL	BDL	BDL
Dibenzo(a,h)anthracene		BDL	BDL	BDL	1800J	620J	BDL	BDL	BDL
Benzo(g,h,i)perylene		1400	BDL	BDL	4000	1200	BDL	BDL	BDL
Total		33,410	3742	538	117,690	38,790	760	90	0

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4–3 (continued)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: / Sample No.: / Depth (feet):	B10–91 S1106–31 0–2	B10–91 S1106–32 2–4	B10–91 S1106–33 2–4	B10–91 S1106–34 6–8	B11–91 S1106–36 0–2	B13–91 S1107–42 0–2	B14–91 S1108–45 0–2	B14–91 S1108–46 2–4
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene		310J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Methylnaphthalene		140J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		640J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dibenzofuran		310J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4–Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		570J	BDL	BDL	BDL	BDL	BDL	BDL	BDL
N–Nitrosodiphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		4400	160J	180J	BDL	67J	250J	310J	BDL
Anthracene		1200	BDL	BDL	BDL	BDL	BDL	71J	BDL
Di–n–butylphthalate		BDL	77J	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene		5400	280J	300J	BDL	110J	240J	290J	BDL
Pyrene		5000	250J	240J	BDL	91J	260J	BDL	BDL
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		2700	160J	150J	BDL	76J	130J	160J	BDL
Chrysene		2200	160J	160J	BDL	79J	130J	150J	BDL
bis(2–Ethylhexyl)phthalate		600J	100J	360J	100J	BDL	BDL	BDL	290J
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		2500	160J	140J	BDL	BDL	140J	110J	BDL
Benzo(k)fluoranthene		1400	110J	140J	BDL	BDL	96J	140J	BDL
Benzo(a)pyrene		2200	170J	150J	BDL	BDL	130J	140J	BDL
Indeno(1,2,3–cd)pyrene		1200	110J	96J	BDL	BDL	BDL	BDL	BDL
Dibenzo(a,h)anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene		1200	120J	99J	BDL	BDL	BDL	BDL	BDL
Total		31,970	1857	2015	100	423	1376	1371	290

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4–3 (contiuned)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: / Sample No.: / Depth (feet):	B14–91 S1108–47 2–4	B15–91 S1108–49 0–2	B15–91 S1108–50 2–4	B15–91 S1108–50RE 2–4	B15–91 S1108–51 2–4	B15–91 S1108–51RE 2–4	B15–91 S1108–52 6–8	B16–91 S1112–53 0–2
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene		BDL	BDL	1900	2000	2500	2400	1200	BDL
2–Methylnaphthalene		BDL	BDL	2000	2000	2700	2600	950J	BDL
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	510J
Acenaphthene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dibenzofuran		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4–Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
N–Nitrosodilphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		BDL	BDL	300J	290J	420J	400J	170J	170J
Anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Di–n–butylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene		BDL	96J	BDL	BDL	BDL	BDL	BDL	800
Pyrene		BDL	100J	180J	160J	230J	BDL	150J	1800
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		BDL	97J	BDL	BDL	BDL	BDL	BDL	1300
Chrysene		BDL	120J	BDL	BDL	BDL	BDL	BDL	1800
bis(2–Ethylhexyl)phthalate		2000	460J	450J	360J	940J	790J	110J	BDL
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		BDL	140J	BDL	BDL	BDL	BDL	BDL	740J
Benzo(k)fluoranthene		BDL	140J	BDL	BDL	BDL	BDL	BDL	870
Benzo(a)pyrene		BDL	150J	BDL	BDL	BDL	BDL	BDL	1500
Indeno(1,2,3–cd)pyrene		BDL	180J	BDL	BDL	BDL	BDL	BDL	660J
Dibenzo(a,h)anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	330J
Benzo(g,h,i)perylene		BDL	190J	BDL	BDL	BDL	BDL	BDL	880
Total		2000	1673	4830	4810	6790	6190	2580	11,360

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4–3 (continued)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: / Sample No.: / Depth (feet):	B16–91 S1112–55 6–8	B18–91 S1113–61 2–4	B18–91 S1113–62 4–6	B19–91 S1113–64 2–4	B19–91 S1113–65 4–6	B20–91 S1114–66 0–2	B21–91 S1114–69 0–2	B25–91 S1203–84 4–6
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	9J	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Methylnaphthalene		BDL	BDL	BDL	88J	BDL	BDL	BDL	BDL
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		BDL	BDL	BDL	6J	BDL	BDL	220J	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dibenzofuran		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4–Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		BDL	BDL	BDL	BDL	BDL	BDL	160J	BDL
N–Nitrosodiphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		BDL	BDL	BDL	BDL	BDL	290J	1700	BDL
Anthracene		BDL	BDL	BDL	BDL	BDL	84J	460J	BDL
Di–n–butylphthalate		BDL	BDL	BDL	BDL	BDL	86J	BDL	BDL
Fluoranthene		BDL	BDL	BDL	BDL	BDL	270J	2000	BDL
Pyrene		BDL	BDL	BDL	BDL	BDL	300J	2100	BDL
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		BDL	BDL	BDL	BDL	BDL	150J	830	BDL
Chrysene		BDL	BDL	BDL	BDL	BDL	160J	880	BDL
bis(2–Ethylhexyl)phthalate		700J	400J	110J	BDL	88J	BDL	630J	510J
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		BDL	BDL	BDL	BDL	BDL	93J	670J	BDL
Benzo(k)fluoranthene		BDL	BDL	BDL	BDL	BDL	160J	700J	BDL
Benzo(a)pyrene		BDL	BDL	BDL	BDL	BDL	120J	760J	BDL
Indeno(1,2,3–cd)pyrene		BDL	BDL	BDL	BDL	BDL	BDL	350J	BDL
Dibenzo(a,h)anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene		BDL	BDL	BDL	BDL	BDL	BDL	370J	BDL
Total		700	400	110	103	88	1713	11,830	510

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4–3 (continued)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: / Sample No.: / Depth (feet):	B27–91 S1204–86 0–2	B28–91 S1204–89A 2–4	B28–91 S1204–90 4–6	B29–91 S1204–91 0–2	B29–91 S1204–91A 0–2	B30–91 S1204–94A 0–2	B30–91 S1204–95RE 2–4	B30–91 S1204–96 4–6
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
bis(2–Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2–Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzoic acid		BDL	BDL	BDL	BDL	BDL	120J	BDL	BDL
Naphthalene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	240J
2–Methylnaphthalene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	250J
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4–Nitrophenol		BDL	BDL	BDL	BDL	BDL	81J	BDL	BDL
Dibenzofuran		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4–Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
N–Nitrosodiphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Di–n–butylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluoranthene		110J	BDL	BDL	72J	100J	BDL	BDL	BDL
Pyrene		90J	BDL	BDL	BDL	120J	BDL	BDL	BDL
Butylbenzylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(a)anthracene		BDL	BDL	BDL	BDL	160J	85J	BDL	BDL
Chrysene		BDL	BDL	BDL	BDL	160J	79J	BDL	BDL
bis(2–Ethylhexyl)phthalate		BDL	310J	61J	86J	110J	120J	120J	BDL
Di–n–octylphthalate		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene		BDL	BDL	BDL	BDL	140J	BDL	BDL	BDL
Benzo(k)fluoranthene		BDL	BDL	BDL	BDL	210J	BDL	BDL	BDL
Benzo(a)pyrene		BDL	BDL	BDL	BDL	190J	70J	BDL	BDL
Indeno(1,2,3–cd)pyrene		BDL	BDL	BDL	BDL	BDL	81J	BDL	BDL
Dibenzo(a,h)anthracene		BDL	BDL	BDL	BDL	BDL	81J	BDL	BDL
Benzo(g,h,i)perylene		BDL	BDL	BDL	BDL	BDL	84J	BDL	BDL
Total		200	310	61	158	1190	801	120	490

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

Seneca Army Depot
Ash Landfill

Table 4-3 (continued)
Semivolatile Organic Compounds Detected in Soil
(ug/Kg)

Compound	Boring No.: / Sample No.: / Depth (feet):	B30-91 S1204-96A 4-6	B31-91 S1205-97 0-2	B31-91 S1205-97A 0-2	B31-91 S1205-98 2-4	B31-91 S1205-99 4-6	B31-91 S1205-99RE 4-6	B31-91 S1205-100 6-8
Phenol		BDL	BDL	BDL	BDL	BDL	BDL	14000
bis(2-Chloroethyl) ether		BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-Methylphenol		BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	1300J
Benzoic acid		BDL	BDL	94J	BDL	BDL	BDL	BDL
Naphthalene		240J	BDL	BDL	BDL	180J	200J	BDL
2-Methylnaphthalene		220J	78J	BDL	BDL	BDL	BDL	BDL
Acenaphthylene		BDL	BDL	BDL	BDL	BDL	BDL	BDL
Acenaphthene		BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol		BDL	BDL	BDL	BDL	BDL	BDL	1600J
Dibenzofuran		BDL	BDL	BDL	BDL	110J	BDL	BDL
2,4-Dinitrotoluene		BDL	BDL	BDL	BDL	BDL	BDL	BDL
Fluorene		BDL	BDL	BDL	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine (1)		BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenanthrene		BDL	180J	120J	BDL	110J	110J	BDL
Anthracene		BDL	BDL	BDL	BDL	BDL	BDL	BDL
Di-n-butylphthalate		BDL	BDL	150J	BDL	BDL	BDL	BDL
Fluoranthene		BDL	250J	250J	150J	120J	110J	BDL
Pyrene		BDL	190J	250J	110J	140J	130J	BDL
Butylbenzylphthalate		BDL	BDL	140J	BDL	390J	BDL	BDL
Benzo(a)anthracene		BDL	140J	260J	100J	BDL	BDL	BDL
Chrysene		BDL	150J	210J	100J	83J	110J	BDL
bis(2-Ethylhexyl)phthalate		BDL	83J	230J	170J	220J	210J	BDL
Di-n-octylphthalate		BDL	BDL	150J	BDL	250J	BDL	BDL
Benzo(b)fluoranthene		BDL	130J	240J	100J	BDL	BDL	BDL
Benzo(k)fluoranthene		BDL	99J	160J	82J	BDL	BDL	BDL
Benzo(a)pyrene		BDL	110J	200J	86J	BDL	BDL	BDL
Indeno(1,2,3-cd)pyrene		BDL	82J	200J	BDL	BDL	BDL	BDL
Dibenzo(a,h)anthracene		BDL	BDL	170J	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene		BDL	83J	220J	72J	BDL	BDL	BDL
Total		460	1575	3044	970	1603	870	16,900

Notes:

For an explanation of the data qualifiers see Appendix J

BDL = below detection limit

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-4
PESTICIDES AND PCBs DETECTED IN SOIL
(ug/Kg)

Boring Number	Sample Number	Depth (feet)	Pesticides					Total	Pcb's		Total
			Heptachlor	Dieldrin	4,4-DDE	4,4-DDD	4,4-DDT		Aroclor-1242	Aroclor-1260	
B2-91	S1031-4	0-2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	340	340
B2-91	S1031-5	2-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	190Y	190
B2-91	S1031-6	6-8	BDL	BDL	BDL	BDL	BDL	BDL	BDL	390	390
B7-91	S1104-21	0-2	BDL	BDL	27Y	27Y	36	90	BDL	BDL	BDL
B7-91	S1104-22	2-4	BDL	BDL	18Y	29Y	19Y	68	BDL	BDL	BDL
B10-91	S1106-31	0-2	BDL	BDL	30Y	23Y	BDL	53	BDL	BDL	BDL
B10-91	S1106-32	2-4	BDL	BDL	28Y	36	BDL	64	BDL	BDL	BDL
B10-91	S1106-33	2-4	BDL	BDL	30Y	34Y	BDL	64	BDL	BDL	BDL
B12-91	S1107-39	0-2	14Y	46	BDL	BDL	BDL	60	BDL	BDL	BDL
B15-91	S1108-49	0-2	BDL	BDL	250	BDL	BDL	250	BDL	330Y	330
B15-91	S1108-50	2-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	370Y	370
B15-91	S1108-51	2-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	430	430
B15-91	S1108-52	6-8	BDL	BDL	69	BDL	BDL	69	BDL	230Y	230
B16-91	S1112-53	0-2	BDL	BDL	21Y	BDL	BDL	21	BDL	BDL	BDL
B17-91	S1113-56	0-2	BDL	BDL	39	BDL	BDL	39	BDL	BDL	BDL
B20-91	S1114-66	0-2	BDL	BDL	26Y	BDL	BDL	26	BDL	BDL	BDL
B20-91	S1114-67	2-4	BDL	BDL	190X	BDL	29Y	190	BDL	BDL	BDL
B20-91	S1114-67DL	2-4	BDL	BDL	140YD	BDL	BDL	140	BDL	BDL	BDL
B20-91	S1114-68	4-6	BDL	BDL	18Y	BDL	BDL	18	BDL	BDL	BDL
B28-91	S1204-90	4-6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	390	390
B28-91	S1204-90RE	4-6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	230Y	230
B30-91	S1204-95	2-4	BDL	BDL	BDL	BDL	BDL	BDL	170	580	750
B30-91	S1204-95RE	2-4	BDL	BDL	BDL	BDL	BDL	BDL	BDL	770	770
B30-91	S1204-96	4-6	BDL	BDL	BDL	BDL	BDL	BDL	200	370	570
B30-91	S1204-96RE	4-6	BDL	BDL	BDL	36	BDL	36	BDL	490	490
B30-91	S1204-96A	4-6	BDL	BDL	BDL	BDL	BDL	BDL	160Y	270Y	430
B30-91	S1204-96ARE	4-6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	280Y	280
B31-91	S1205-97	0-2	BDL	BDL	BDL	BDL	36Y	36	400	BDL	400
B31-91	S1205-97A	0-2	BDL	BDL	41	BDL	43	84	220	BDL	220
B31-91	S1205-97RE	0-2	BDL	BDL	43	BDL	100	143	BDL	BDL	BDL
B31-91	S1205-97ARE	0-2	BDL	BDL	43	BDL	72	115	BDL	BDL	BDL
B31-91	S1205-98	2-4	BDL	BDL	57	BDL	BDL	57	1000	BDL	1000
B31-91	S1205-98RE	2-4	BDL	BDL	71	BDL	BDL	71	BDL	BDL	BDL
B31-91	S1205-99	4-6	BDL	BDL	BDL	BDL	BDL	BDL	570	BDL	570
B31-91	S1205-99RE	4-6	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
B31-91	S1205-100	6-8	BDL	BDL	BDL	BDL	BDL	BDL	450	BDL	450

Notes:

For an explanation of the data qualifiers see Appendix J

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–5
SUMMARY OF METALS AND CYANIDE IN SOIL
(mg/Kg)

	Background*		On–site Samples				Number Below Average Background	Number Above Average Background	Total Number Detections
PARAMETER	Maximum	Average	Minimum	Maximum	Average	Standard Deviation			
Aluminum	20500	14420	8610	25500	17098.99	3058.05	18	71	89
Antimony	0	0	7.4	78.3	18.37	21.40	0	9	9
Arsenic	6.1	4.8	2.6	66.3	6.62	7.98	38	50	88
Barium	136	89.8	34.8	1010	105.88	117.48	55	34	89
Beryllium	1.4	0.97	0.59	1.4	0.94	0.16	44	40	84
Cadmium	2.9	2.2	1.7	43.1	3.74	4.40	9	80	89
Calcium	104000	50046	1980	134000	30784.16	28848.85	72	17	89
Chromium	30.1	21.7	15.9	62	27.94	7.45	12	77	89
Cobalt	18.4	13.3	5.8	19.7	13.36	2.95	42	47	89
Copper	27.6	22.2	12	836	47.30	103.75	31	58	89
Iron	37200	28729	16500	642000	43239.33	65595.25	17	72	89
Lead	14.5	11.2	3.5	2890	108.10	394.05	39	50	89
Magnesium	17000	9260	3930	24900	8010.34	3272.67	73	16	89
Manganese	1130	828	330	2740	750.76	335.24	62	27	89
Mercury	0.09	0.06	0.04	1.1	0.16	0.24	26	29	55
Nickel	48.7	35.3	17.5	74.8	39.81	9.62	23	66	89
Potassium	2110	1523	938	19000	2150.31	1845.76	13	76	89
Selenium	0	0	0.18	0.24	0.21	0.03	0	2	2
Silver	0	0	0.45	5.6	2.14	1.63	0	15	15
Sodium	116	55.4	40	708	151.82	129.96	1	59	60
Thallium	0	0	0	0	N/A	N/A	0	0	0
Vanadium	32.2	21.7	14.5	36.8	24.33	4.45	25	64	89
Zinc	126	89.2	56	55700	1185.14	6501.48	27	62	89
Cyanide	0	0	1.6	1.6	1.60	0.00	0	1	1

Notes:

* Four samples from B8–91 and three samples from B9–91

0 Indicates that the concentrations are below the detection limit and qualified with a "U" (applies only to left portion of table)

All values in the table pertain to samples for which metals were quantified without the use of a "U" qualifier

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–6
HERBICIDES DETECTED IN SOIL
(ug/Kg)

Boring Number	Sample Number	Depth (feet)	Compounds			Total
			2,4–DB	MCPP	2,4,5–TP (Silvex)	
B1–91	S1030–2	2–4	350	BDL	BDL	350
B2–91	S1031–4	0–2	250	BDL	BDL	250
B3–91	S1031–8	0–2	BDL	7500	BDL	7500
B3–91	S1031–10	4–6	100	BDL	BDL	100
B4–91	S1101–13	2–4	140	BDL	BDL	140
B4–91	S1101–14	4–6	230	BDL	BDL	230
B5–91	S1101–17	4–6	180	BDL	BDL	180
B10–91	S1106–31	0–2	BDL	13000	10	13010
B11–91	S1106–36	0–2	BDL	24000	BDL	24000
B12–91	S1106–39	0–2	BDL	18000	BDL	18000
B14–91	S1108–45	0–2	BDL	8800	BDL	8800
B29–91	S1204–93	4–6	410	BDL	BDL	410

Notes:

BDL – Below Dection Limit

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	PT-10	PT-10	PT-11	PT-11	PT-12	PT-12	PT-12	PT-12
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/08/92	01/08/92	01/13/92	01/13/92	01/17/92	01/17/92	01/17/92	01/17/92
	MAIN ID	PT-10(2)	PT-10(2)	PT-11	PT-11	PT-12	PT-12	PT-3(1)	PT-3(1)
	LAB ID	152156	152199	152574	152593	152704	152711	152709	152710
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	98.1 U	24.4 U	2960	24.4 U	27300	24.5 U	18400	24.4 U
Antimony	ug/L	55.9 U	53 U	53.3 U	52.9 U	53.2 U	53.2 U	53.1 U	53 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	4.5 B	3.5 U	7.5 B	3.5 U
Barium	ug/L	196 B	203	121 B	77 B	258	55.7 B	255	53.2 B
Beryllium	ug/L	1.4 B	2.6 B	2 B	1.3 B	2.3 B	1.1 U	1.9 B	1.1 U
Cadmium	ug/L	2.9 U	3 U	3 U	3 U	4.5 B	3 U	3.8 B	3 U
Calcium	ug/L	86500	86900	124000	114000	274000	180000	246000	175000
Chromium	ug/L	6.2 U	6.2 U	6.6 B	6.1 U	36.8	6.2 U	28.3	6.1 U
Cobalt	ug/L	20 U	20.3 U	20.5 U	20.3 U	20.4 U	20.4 U	20.4 U	20.3 U
Copper	ug/L	14.5 U	10.1 U	10.2 U	10.1 U	32.6	10.2 U	24.7 B	10.1 U
Iron	ug/L	109	6.9 U	3270	6.9 U	36400	7 U	28900	6.9 U
Lead	ug/L	1.2 U	1.4 B	1.2 U	1.2 U	16.9	1.2 U	10	1.2 U
Magnesium	ug/L	32700	39600	37300	33600	41800	20800	37000	20000
Manganese	ug/L	99.6	43.8	59.1	4.8 U	1270	4.8 U	970	4.8 U
Mercury	ug/L	0.13 B	0.09 B	0.09 B	0.1 B	0.03 U	0.03 U	0.03 U	0.03 U
Nickel	ug/L	16 U	14.7 U	14.8 U	14.7 U	46.3	14.7 U	30 B	14.7 U
Potassium	ug/L	1300 B	1830 B	3480 B	1880 B	8120	1800 B	5690	1430 B
Selenium	ug/L	1 U	1 U	1.3 U	1 U	1 U	1.7 B	1.3 B	1 U
Silver	ug/L	9.1 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Sodium	ug/L	37700	35900	40300	37600	33900	34900	33800	27200
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	30.5 U	9.4 U	9.5 U	9.4 U	35.6 B	9.5 U	25.3 B	9.4 U
Zinc	ug/L	19.2 B	8.4 U	18.5 B	8.4 U	201	22.3	159	24.5
Cyanide	ug/L	11.2	–	10 U	–	10 U	–	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	PT-15	PT-15	PT-16	PT-16	PT-17	PT-17	PT-18	PT-18
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/11/92	01/10-13/92	01/08/92	01/08/92	01/16/92	01/16/92	01/09/92	01/09/92
	MAIN ID	PT-15	PT-15	PT-16	PT-16	PT-17	PT-17	PT-18	PT-18
	LAB ID	152260	152293	152158	152200	152647	152671	152159	152201
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	389	24.6 U	1520	24.4 U	14200	24.6 U	1510	24.4 U
Antimony	ug/L	55.8 U	53.4 U	53.4 U	53 U	53.3 B	53.4 U	55.5 U	52.9 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	3.5 B	3.5 U	3.5 U	3.5 U
Barium	ug/L	93.5 B	79.7 B	75 B	36.6 B	131 B	69.5 B	53.9 B	37.4 B
Beryllium	ug/L	1.7 B	2.4 B	2.1 B	2.3 B	2.5 B	1.1 U	2.1 B	2.5 B
Cadmium	ug/L	2.9 U	3 U	2.9 U	3 U	3 U	3 U	2.9 U	3 U
Calcium	ug/L	58500	59700	129000	100000	115000	106000	329000	271000
Chromium	ug/L	6.2 U	6.2 U	7.2 B	6.2 U	20	6.2 U	6.1 U	6.1 U
Cobalt	ug/L	19.9 U	20.5 U	19.9 U	20.4 U	20.3 U	20.5 U	19.8 U	20.3 U
Copper	ug/L	14.5 U	10.2 U	14.5 U	10.1 U	11.9 B	10.2 U	14.4 U	10.1 U
Iron	ug/L	673	7 U	2780	6.9 U	21500	7 U	2270	6.9 U
Lead	ug/L	1.2 U	1.2 U	4.2	1.2 U	6.3	1.2 U	17.8	1.2 U
Magnesium	ug/L	16000	17600	14300	14300	15700	10700	37000	39400
Manganese	ug/L	60.8	6 B	483	4.8 U	520	4.8 U	1530	964
Mercury	ug/L	0.13 B	0.1 B	0.12 B	0.1 B	0.1 B	0.03 U	0.42	0.12 B
Nickel	ug/L	15.9 U	14.8 U	16 U	14.7 U	21.3 B	14.8 U	15.9 U	14.7 U
Potassium	ug/L	1620 B	2030 B	633 U	287 U	3200 B	289 U	2280 B	2010 B
Selenium	ug/L	1 U	1 U	1 U	1 U	1.3 U	1 U	1 U	1 U
Silver	ug/L	9.1 U	3.4 U	9.1 U	3.4 U	3.4 U	3.4 U	9 U	4.3 B
Sodium	ug/L	29900	29800	5930	5890	29400	27800	114000	109000
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	30.5 U	9.5 U	30.5 U	9.4 U	21.6 B	9.5 U	30.3 U	9.4 U
Zinc	ug/L	17.4 B	8.5 U	24.1	8.4 U	69.4	20.5	496	120
Cyanide	ug/L	10 U	-	10 U	-	10 U	-	10 U	-

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	PT-19	PT-19	PT-20	PT-20	PT-21	PT-21	PT-22	PT-22
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/17/92	01/17/92	01/17/92	01/17/92	01/23/92	01/23/92	01/09/92	01/09/92
	MAIN ID	PT-19	PT-19	PT-20(2,5)	PT-20(2,5)	PT-21	PT-21	PT-22	PT-22
	LAB ID	152705	152712	152706	152713	153059	153060	152180	152202
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	36100	24.5 U	10800	24.4 U	14200	24.4 U	4090	24.4 U
Antimony	ug/L	53.3 U	53.1 U	53.1 U	52.9 U	52.9 U	52.9 U	55.8 U	53 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
Barium	ug/L	217	59.4 B	124 B	85.3 B	230	108 B	148 B	42.4 B
Beryllium	ug/L	2.5 B	1.1 U	1.8 B	1.1 U	1.7 B	1.1 U	2.3 B	2.4 B
Cadmium	ug/L	6.1	3 U	3 U	3 U	4 B	3 U	2.9 U	3 U
Calcium	ug/L	110000	95300	145000	125000	185000	130000	197000	128000
Chromium	ug/L	47.2	6.2 U	16.5	6.1 U	18.6	6.1 U	8.5 B	6.2 U
Cobalt	ug/L	20.5 U	20.4 U	20.4 U	20.3 U	20.3 U	20.3 U	19.9 U	20.4 U
Copper	ug/L	41.3	10.1 U	11.8 B	10.1 U	17.9 B	10.1 U	14.4 U	10.1 U
Iron	ug/L	48300	7 U	16000	8.1 B	20100	25.2 B	6010	6.9 U
Lead	ug/L	12.6	1.2 U	3.8	1.2 U	7	1.2 U	10.5	1.2 U
Magnesium	ug/L	24700	12900	17400	13600	34300	25800	18200	16600
Manganese	ug/L	543	8.8 B	378	4.8 U	666	68.8	1140	4.8 U
Mercury	ug/L	0.04 B	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.18 B	0.12 B
Nickel	ug/L	60.7	14.7 U	17.1 B	14.7 U	19.6 B	14.7 U	15.9 U	14.7 U
Potassium	ug/L	7550	288 U	3440 B	655 B	8300	4780 B	632 U	380 B
Selenium	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Silver	ug/L	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	9.1 U	3.4 U
Sodium	ug/L	19700	18300	35100	33900	47800	44400	52800	54100
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	45.4 B	9.5 U	18.3 B	9.4 U	21.1 B	9.4 U	30.5 U	9.4 U
Zinc	ug/L	154	17.1 B	60.7	16.7 B	773	170	76.6	8.4 U
Cyanide	ug/L	10 U	-	10 U	-	10 U	-	10 U	-

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	PT-23	PT-23	PT-24	PT-24	PT-25	PT-25	PT-26	PT-26
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/14/92	01/14/92	01/14/92	01/14/92	01/15/92	01/15/92	01/17/92	01/17/92
	MAIN ID	PT-23	PT-23	PT-24	PT-24	PT-25	PT-25	PT-26	PT-26
	LAB ID	152306	152311	152307	152312	152375	152994	152708	152714
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	2000	24.4 U	18600	24.4 U	24000	24.5 U	306000	24.5 U
Antimony	ug/L	53 U	53 U	53.1 U	53 U	52.9 U	53.3 U	83.8	53.1 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
Barium	ug/L	45.4 B	34 B	132 B	45.7 B	135 B	50.9 B	1600	97.8 B
Beryllium	ug/L	2.1 B	1.4 B	2.7 B	1.3 B	3 B	1.1 U	12.2	1.1 U
Cadmium	ug/L	3 U	3 U	3 U	3 U	3.2 B	3 U	64.6	3 U
Calcium	ug/L	98200	85200	135000	106000	75300	72100	1790000	93700
Chromium	ug/L	6.6 B	6.2 U	27.1	6.2 U	32.2	6.2 U	418	6.2 U
Cobalt	ug/L	20.4 U	20.4 U	20.4 U	20.4 U	20.3 U	20.4 U	196	20.4 U
Copper	ug/L	10.1 U	10.1 U	11.1 B	10.1 U	22.5 B	10.2 U	412	10.1 U
Iron	ug/L	2510	7 U	26000	7 U	39000	7 U	610000	7 U
Lead	ug/L	1.2 U	1.2 U	9	1.2 U	5.6	1.2 U	103	1.2 U
Magnesium	ug/L	11200	9510	19100	12200	16800	8220	267000	37600
Manganese	ug/L	80.4	4.8 U	423	4.8 U	595	4.8 U	11400	4.8 U
Mercury	ug/L	0.11 B	0.08 B	0.12 B	0.1 B	0.11 B	0.03 U	0.05 B	0.03 U
Nickel	ug/L	14.7 U	14.7 U	28.1 B	14.7 U	40.6	14.8 U	622	14.7 U
Potassium	ug/L	1080 B	904 B	4530 B	500 B	4620 B	289 U	23200	1080 B
Selenium	ug/L	1.3 U	1 U	1.3 U	1.7 B	1.3 U	1 U	5 U	1.4 B
Silver	ug/L	3.4 U	3.4 U	3.4 U	4.1 B	3.4 U	3.4 U	5.8 B	3.4 U
Sodium	ug/L	4780 B	4940 B	14900	13600	15900	15000	40600	36800
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	32 U	3.2 U
Vanadium	ug/L	9.4 U	9.4 U	25.5 B	9.4 U	31.4 B	9.5 U	358	9.4 U
Zinc	ug/L	47.8	14.7 B	92.9	8.4 U	119	19 B	1750	18 B
Cyanide	ug/L	10 U	–	10 U	–	10 U	–	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	MW-27	MW-27	MW-28	MW-28	MW-28	MW-28	MW-29	MW-29
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92
	MAIN ID	MW-27	MW-27	MW-28	MW-28	FT-2(1)	FT-2(1)	MW-29	MW-29
	LAB ID	152641	152664	152571	152590	152573	152592	152572	152591
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	8590	24.4 U	41100	24.5 U	27000	24.5 U	85700	24.4 U
Antimony	ug/L	53.4 U	52.9 U	54.3 B	53.3 U	53 U	53.3 U	53.3 U	53 U
Arsenic	ug/L	3.5 U	3.5 U	4.4 B	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
Barium	ug/L	90.8 B	59.9 B	200	41.1 B	154 B	39.4 B	418	46.8 B
Beryllium	ug/L	2.4 B	1.1 U	3.7 B	1.4 B	3.2 B	1.4 B	5.8	1.3 B
Cadmium	ug/L	3 U	3 U	6.1	3 U	5.2	3 U	17	3 U
Calcium	ug/L	102000	85300	170000	111000	152000	111000	248000	124000
Chromium	ug/L	10.4	6.1 U	53.1	6.2 U	34.6	6.2 U	122	6.2 U
Cobalt	ug/L	20.5 U	20.3 U	20.5 U	20.5 U	20.3 U	20.5 U	63.8	20.4 U
Copper	ug/L	10.2 U	10.1 U	33.9	10.2 U	27.6	10.2 U	111	10.1 U
Iron	ug/L	10500	6.9 U	60300	7 U	46500	7 U	159000	7 U
Lead	ug/L	3.2	1.2 U	10.7	1.2 U	8.9	1.2 U	39.4	1.2 U
Magnesium	ug/L	13800	10800	26600	123000	23400	11800	59400	14700
Manganese	ug/L	355	88	1510	4.8 U	1100	4.8 U	4110	4.8 U
Mercury	ug/L	0.11 B	0.03 U	0.11 B	0.11 B	0.11 B	0.1 B	0.14 B	0.09 B
Nickel	ug/L	14.8 U	14.7 U	72.5	14.8 U	62.9	14.8 U	182	14.7 U
Potassium	ug/L	4160 B	2400 B	6910	347 B	4020 B	289 U	10800	563 B
Selenium	ug/L	1.3 U	1 U	1.3 U	1 U	1.3 U	1 U	13 U	1.4 B
Silver	ug/L	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	4.5 B
Sodium	ug/L	28300	27200	9460	8580	9250	8570	26200	25000
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	10 B	9.4 U	46.7 B	9.5 U	32.7 B	9.5 U	98.3	9.4 U
Zinc	ug/L	35.9	22.1	165	8.5 U	124	8.5 U	503	8.4 U
Cyanide	ug/L	10 U	-	10 U	-	10 U	-	10 U	-

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	MW–30	MW–30	MW–31	MW–31	MW–32	MW–32	MW–33	MW–33
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92	01/16/92
	MAIN ID	MW–30	MW–30	MW–31	MW–31	MW–32	MW–32	MW–33	MW–33
	LAB ID	152642	152667	152643	152668	152644	152669	152645	152670
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	11200	24.5 U	83400	24.6 U	35600	24.6 U	33700	24.5 U
Antimony	ug/L	53.3 U	53.2 U	53.3 U	53.3 U	53.2 U	53.3 U	53 U	53.1 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
Barium	ug/L	93.3 B	63.1 B	397	56.5 B	193 B	60.3 B	162 B	52.7 B
Beryllium	ug/L	2.4 B	1.1 U	5.7	1.1 U	3.8 B	1.1 U	3.4 B	1.1 U
Cadmium	ug/L	30 U	3 U	13.9	3 U	5.4	3 U	3.8 B	3 U
Calcium	ug/L	105000	102000	171000	92300	156000	102000	103000	95600
Chromium	ug/L	13.2	6.2 U	109	6.2 U	51.3	6.2 U	42	6.2 U
Cobalt	ug/L	20.5 U	20.4 U	46.2 B	20.5 U	20.4 U	20.5 U	20.3 U	20.4 U
Copper	ug/L	10.5 B	10.2 U	88.1	10.2 U	33.6	10.2 U	32.8	10.1 U
Iron	ug/L	15600	7 U	147000	7 U	63800	7 U	56800	7 U
Lead	ug/L	3.5	1.2 U	20.9	1.2 U	12.1	1.2 U	9.8	1.2 U
Magnesium	ug/L	18900	147000	48000	11900	31000	13400	22400	9960
Manganese	ug/L	250	4.8 U	2530	4.8 U	1190	72.4	953	4.8 U
Mercury	ug/L	0.1 B	0.03 U	0.14 B	0.03 U	0.14 B	0.03 U	0.11 B	0.03 U
Nickel	ug/L	16.8 B	14.7 U	157	14.8 U	67.3	14.8 U	69.2	14.7 U
Potassium	ug/L	3450 B	1120 B	11700	497 B	6240	1250 B	4500 B	288 U
Selenium	ug/L	1.3 U	1 U	13 U	1 U	1.3 U	1.1 B	1.3 U	1 U
Silver	ug/L	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Sodium	ug/L	18400	17800	15600	14700	22200	21600	15700	14700
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	18.5 B	9.5 U	97.3	9.5 U	46.8 B	9.5 U	41.8 B	9.4 U
Zinc	ug/L	55.4	20.1	412	18.8 B	174	20.4	162	21.2
Cyanide	ug/L	10 U	–	10 U	–	10 U	–	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	MW–34	MW–34	MW–34	MW–34	MW–35D	MW–35D	MW–36	MW–36
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/10/92	01/10/92	01/08/92	01/10/92	01/14/92	01/14/92	01/14/92	01/14/92
	MAIN ID	MW–34	MW–34	FT–1(1)	FT–1(1)	MW–35D	MW–35D	MW–36	MW–36
	LAB ID	152257	152290	152259	152292	152303	152308	152304	152309
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	8250	24.4 U	7310	24.5 U	23200	24.5 U	15900	24.4 U
Antimony	ug/L	55.9 U	53 U	55.9 U	53.2 U	53.2 U	53.1 U	53.1 U	52.9 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	8.6 B	4.3 B	3.5 U	3.5 U
Barium	ug/L	225	51.9 B	191 B	45.7 B	318	104 B	167 B	59.2 B
Beryllium	ug/L	2.7 B	2.5 B	2.7 B	2.5 B	3.2 B	1.2 B	2.6 B	1.4 B
Cadmium	ug/L	2.9 U	3 U	2.9 U	3 U	5.4	3 U	3.6 B	3 U
Calcium	ug/L	352000	108000	268000	114000	41100	14600	182000	117000
Chromium	ug/L	10.3	6.2 U	12	6.2 U	34.9	6.2 U	27.1	6.1 U
Cobalt	ug/L	20 U	20.3 U	20 U	20.4 U	20.4 U	20.4 U	20.4 U	20.3 U
Copper	ug/L	14.5 U	10.1 U	14.9 B	10.2 U	22.5 B	10.1 U	19.8 B	10.1 U
Iron	ug/L	10600	6.9 U	11300	7 U	33800	7 U	29000	6.9 U
Lead	ug/L	8.2	1.2 U	7.4	1.2 U	5	1.2 U	5	1.2 U
Magnesium	ug/L	32100	20200	26300	20500	13300	4590 B	31000	17400
Manganese	ug/L	2200	132	1680	127	662	110	658	44.9
Mercury	ug/L	0.16 B	0.11 B	0.14 B	0.1 B	0.1 B	0.12 B	0.1 B	0.11 B
Nickel	ug/L	17.6 B	14.7 U	18 B	14.7 U	49.7	14.7 U	39.1 B	14.7 U
Potassium	ug/L	8910	7980	9760	7210	6230	2760 B	3310 B	1620 B
Selenium	ug/L	1 U	1 U	1 U	1 U	1.3 U	1 U	1.3 U	1 U
Silver	ug/L	9.1 U	4.3 B	9.1 U	3.4 U	3.4 U	3.4 U	3.4 U	3.4 U
Sodium	ug/L	24900	31200	36500	25100	130000	110000	21300	19600
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	30.5 U	9.4 U	30.5 U	9.5 U	32.7 B	9.4 U	23.2 B	9.4 U
Zinc	ug/L	51.9	8.4 U	47.6	8.5 U	72.7	8.5 U	120	8.4 U
Cyanide	ug/L	10 U	–	10 U	–	10 U	–	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	MW-37	MW-37	MW-38D	MW-38D	MW-39	MW-39	MW-40	MW-40
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	01/10/92	01/10/92	01/08/92	01/08/92	01/14/92	01/14/92	01/09/92	01/09/92
	MAIN ID	MW-37	MW-37	MW-38D	MW-38D	MW-39	MW-39	MW-40	MW-40
	LAB ID	152254	152291	152154	152197	152305	152310	152155	152198
ANALYTE	UNITS	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	19100	24.5 U	2110	24.4 U	7930	24.5 U	2730	24.6 U
Antimony	ug/L	55.9 U	53.2 U	55.6 U	52.9 U	53.3 U	53.1 U	56 U	53.4 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U
Barium	ug/L	329	32.3 B	187 B	105 B	80.9 B	33.8 B	77.8 B	32.4 B
Beryllium	ug/L	3.8 B	2.4 B	2.1 B	2.6 B	2.6 B	1.3 B	2.1 B	2.6 B
Cadmium	ug/L	2.9 U	3 U	2.9 U	3 U	3.1 B	3 U	2.9 U	3 U
Calcium	ug/L	279000	109000	123000	93500	97900	83500	154000	101000
Chromium	ug/L	29.8	6.2 U	6.6 B	6.1 U	12.5	6.2 U	19.7	6.2 U
Cobalt	ug/L	28 B	20.4 U	19.9 U	20.3 U	20.4 U	20.4 U	20 U	20.5 U
Copper	ug/L	25.3	10.2 U	14.4 U	10.1 U	33.3	10.2 U	14.5 U	10.2 U
Iron	ug/L	27800	7 U	3630	6.9 U	11400	7 U	6040	7 U
Lead	ug/L	8	1.2 U	4.1	1.2 U	2.3 B	1.2 U	2.1 B	1.2 U
Magnesium	ug/L	28600	17900	16700	18400	15800	12400	14300	13800
Manganese	ug/L	2190	84.9	508	130	229	21	931	454
Mercury	ug/L	0.15 B	0.11 B	0.15 B	0.11 B	0.1 B	0.09 B	0.14 B	0.1 B
Nickel	ug/L	36.9 B	14.8 U	15.9 U	14.7 U	21.1 B	14.7 U	16 U	14.8 U
Potassium	ug/L	4470 B	1330 B	4960 B	4830 B	3720 B	1770 B	2810 B	2610 B
Selenium	ug/L	1 U	1 U	1 U	1 B	1.3 U	1 U	1 U	1 U
Silver	ug/L	9.1 U	3.4 U	9 U	3.4 U	3.4 U	3.6 B	9.1 U	3.4 U
Sodium	ug/L	11900	11200	5480	5540	15100	14000	7540	7270
Thallium	ug/L	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	30.6 U	9.5 U	30.4 U	9.4 U	13.3 B	9.5 U	30.6 U	9.5 U
Zinc	ug/L	58.8	8.5 U	17.7 B	8.4 U	39.8	8.5 U	34.1	8.5 U
Cyanide	ug/L	10 U	–	10 U	–	10 U	–	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-7
GROUNDWATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER
	LOCATION	MW-41D	MW-42D	MW-42D
	DEPTH	N/A	N/A	N/A
	DATE	01/13/92	01/13/92	01/13/92
	MAIN ID	MW-41D	MW-42D	MW-42D
	LAB ID	152409	152410	152430
ANALYTE	UNITS	UNFILTERED	UNFILTERED	FILTERED
Aluminum	ug/L	146 B	209	24.5 U
Antimony	ug/L	77.3	55.5 U	53.2 U
Arsenic	ug/L	3.5 U	3.5 U	3.5 U
Barium	ug/L	97 B	112 B	96.3 B
Beryllium	ug/L	1.9 B	2.1 B	2.5 B
Cadmium	ug/L	2.9 U	2.9 U	3 U
Calcium	ug/L	45800	67300	58000
Chromium	ug/L	6.2 U	8.7 B	6.2 U
Cobalt	ug/L	19.9 U	19.8 U	20.4 U
Copper	ug/L	14.4 U	14.4 U	10.2 U
Iron	ug/L	398	683	7 U
Lead	ug/L	1.2 U	1.2 U	1.2 U
Magnesium	ug/L	17300	28200	32600
Manganese	ug/L	113	169	112
Mercury	ug/L	0.12 B	0.15 B	0.12 B
Nickel	ug/L	15.9 U	15.8 U	14.8 U
Potassium	ug/L	2530 B	9470	11200
Selenium	ug/L	1 U	1 U	1 U
Silver	ug/L	9.1 U	9 U	4.4 B
Sodium	ug/L	77600	18700	19700
Thallium	ug/L	3.2 U	3.2 U	3.2 U
Vanadium	ug/L	30.5 U	30.3 U	9.5 U
Zinc	ug/L	13.4 U	13.4 U	8.5 U
Cyanide	ug/L	10 U	10 U	–

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4–8
CONCENTRATIONS OF ADDITIONAL PARAMETERS
IN GROUNDWATER
(mg/L)

Parameter	Monitoring Wells		
	PT–17	PT–23	MW–42D
	(till/weathered shale)		(bedrock)
Biological Oxygen Demand	1.9	4.6	1.2
Alkalinity (as CaCO3)	234	220	280
Chloride	40	10.5	2.7
Sulfate	73	41	38
Total Hardness (as CaCO)	322	346	308
Chemical Oxygen Demand	4.4	22	9.1
Total Dissolved Solids	405	282	600
Total Suspended Solids	180	2370	150
Total Organic Carbon	1.9	1.9	1.6

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-9
SEMIVOLATILE ORGANIC COMPOUNDS DETECTED IN SEDIMENT
(ug/Kg)

Compound	Sample Locations									
	SW-100	SW-200	SW-300	SW-400	SW-600	SW-600*	SW-700	SW-800	SW-900	SW-901
4-Methylphenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	100J	BDL
Acenaphthene	BDL	BDL	BDL	BDL	120J	170J	BDL	BDL	BDL	BDL
Phenanthrene	BDL	BDL	BDL	270J	720J	1200	BDL	BDL	BDL	99J
Anthracene	BDL	BDL	BDL	BDL	180J	270J	BDL	BDL	BDL	BDL
Fluoranthene	120J	BDL	130J	830J	5500	7400	95J	78J	BDL	130J
Pyrene	94J	130J	180J	740J	4400	6700	110J	BDL	BDL	140J
Benzo(a)anthracene	BDL	BDL	97J	410J	3300	4900	59J	BDL	BDL	88J
Chrysene	BDL	BDL	130J	520J	3600	5300	84J	BDL	BDL	120J
bis(2-Ethylhexyl)phthalate	BDL	100J	210J	BDL	BDL	4300	BDL	BDL	BDL	100J
Benzo(b)fluoranthene	BDL	BDL	BDL	450J	3100	4500	80J	BDL	BDL	96J
Benzo(k)fluoranthene	BDL	BDL	97J	450J	2400	3700	66J	BDL	BDL	BDL
Benzo(a)pyrene	BDL	BDL	110J	460J	2600	3900	71J	BDL	BDL	100J
Indeno(1,2,3-cd)pyrene	BDL	BDL	BDL	340J	1700	2400	BDL	BDL	BDL	BDL
Dibenzo(a,h)anthracene	BDL	BDL	BDL	160J	690J	1300	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene	BDL	BDL	BDL	340J	1600	2300	BDL	BDL	BDL	BDL
Total	214	230	954	4970	29910	48340	565	78	100	873

Notes:
For an explanation of data qualifiers see Appendix J
BDL = below detection limit
* = Duplicate analysis

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-10
SURFACE WATER INORGANICS ANALYSIS RESULTS

	MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	WATER
	LOCATION	SW-106	SW-300	SW-400	SW-806	SW-800	SW-900	SW-860
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	12/10/91	11/13/91	11/13/91	11/16/91	11/16/91	11/16/91	12/16/91
	MAIN ID	W10121119(3)	W1311-79	W1311-80	W1611-83(2)	W1611-84(1)	W1911-85A(2)	W2911-84A(1)
	LAB ID	149729	149139	149121	149255	149237	149454	149453
ANALYTE	UNITS							
Aluminum	ug/l	203	2410	97.8 U	97.6 U	97.4 U	-	-
Antimony	ug/l	53.2 U	141	55.7 U	55.6 U	55.5 U	-	-
Arsenic	ug/l	2.9 U	3.7 U	3.7 U	3.7 U	3.7 U	-	-
Barium	ug/l	35.4 B	84.8 B	24.9 B	44.6 B	46.9 B	-	-
Beryllium	ug/l	1.2 B	1.2 U	1.2 U	1.2 U	1.2 U	-	-
Cadmium	ug/l	3 U	2.9 U	2.9 U	2.9 U	2.9 U	-	-
Calcium	ug/l	104000	125000	45800	71700	73400	-	-
Chromium	ug/l	6.2 U	7.6 B	6.2 U	6.2 B	6.1 U	-	-
Cobalt	ug/l	20.4 U	19.9 U	19.9 U	19.9 U	19.8 U	-	-
Copper	ug/l	15.7 B	14.5 U	14.4 U	14.4 U	14.4 U	-	-
Iron	ug/l	218	2080	17 U	17 U	16.9 U	-	-
Lead	ug/l	1.2 U	14.4	0.7 U	0.7 U	0.7 U	-	-
Magnesium	ug/l	13200	11800	353 U	9950	9960	-	-
Manganese	ug/l	6.3 B	488	3.2 U	3.2 U	3.2 U	-	-
Mercury	ug/l	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	-	-
Nickel	ug/l	14.7 U	16 U	15.9 U	15.9 U	15.9 U	-	-
Potassium	ug/l	828 B	3850 B	4690 B	1830 B	1650 B	-	-
Selenium	ug/l	1 U	1.7 U	1.7 U	1.7 U	1.7 U	-	-
Silver	ug/l	3.4 U	9.1 U	9.1 U	9 U	9 U	-	-
Sodium	ug/l	9470	19400	2180000	83400	84200	-	-
Thallium	ug/l	2.8 U	2.8 U	28 U	2.8 U	2.8 U	-	-
Vanadium	ug/l	16.3 B	30.5 U	30.5 U	30.4 U	30.3 U	-	-
Zinc	ug/l	28.6	187	16.6 B	13.4 U	19.6 B	-	-
Cyanide	ug/l	10 U	10 U	10 U	-	-	10 U	10 U

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-11
SEDIMENT INORGANICS ANALYSIS RESULTS

	MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	LOCATION	SW-100	SW-100	SW-200	SW-300	SW-400	SW-600	SW-600	SW-700
	DEPTH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DATE	11/15/91	12/10/91	11/15/91	11/15/91	11/15/91	11/16/91	11/16/91	11/20/91
	MAIN ID	SS11-78	SS012119(3)	SS11-77	SS11-79	SS11-86	SS11-85	SS11-86(1)	SS11-88
	LAB ID	149253	150727	149115	149116	149117	149235	149234	149452
ANALYTE	UNITS								
Aluminum	mg/Kg	17400	17400	14200	7340	12100	17400	20900	12700
Antimony	mg/Kg	13.9 U	10.8 U	12.9 U	9.1 U	11.1 U	9.4 U	12.6 U	11.8 U
Arsenic	mg/Kg	3	3.5	7.9	3.4	8.7	8	10.5	7.3
Barium	mg/Kg	129	126	110	52.7	79	157	227	120
Beryllium	mg/Kg	1.1 B	1 B	0.9 B	0.45 B	0.75 B	1.1	1.2	0.73 B
Cadmium	mg/Kg	3.5	3.3	2.3	2	2.3	3	3.9	2.4
Calcium	mg/Kg	10600	13600	11400	229000	37300	9860	14200	46900
Chromium	mg/Kg	26	25.4	20.7	13.2	21.8	26.5	33.4	21.3
Cobalt	mg/Kg	8.7 B	11.7	7.8 B	6.6 B	9.1 B	11.7	12.9	12.5
Copper	mg/Kg	58	58.6	41.2	14.9	31.2	39.2	43	22.6
Iron	mg/Kg	26300	27900	23600	16200	22900	33100	36400	28200
Lead	mg/Kg	85.4	100	26.7	23.9	63.7	219	197	37.3
Magnesium	mg/Kg	5000	5250	4790	7240	11000	5460	6400	14900
Manganese	mg/Kg	466	511	462	1040	383	837	999	913
Mercury	mg/Kg	0.11 B	0.08 B	0.1 B	0.06 B	0.12 B	0.12	0.07 B	0.05 U
Nickel	mg/Kg	28.1	28	24.8	22	32	29.6	35.8	27.9
Potassium	mg/Kg	2150	1670	2020	750 B	1740	1850	2510	1470
Selenium	mg/Kg	0.66 B	0.52 B	2 U	0.48 U	0.39 U	0.38 U	2.1 U	1.8 U
Silver	mg/Kg	2.1 U	0.69 B	2.1 U	1.5 U	1.8 U	1.5 U	2 U	1.9 U
Sodium	mg/Kg	106 U	106 B	74.6 U	140 B	97.9 B	54.4 U	80.2 B	68.3 U
Thallium	mg/Kg	0.71 U	0.52 U	0.65 U	0.78 U	0.65 U	0.62 U	0.69 U	0.6 U
Vanadium	mg/Kg	26.1	23.6	23.1	10.7	21.8	29	30.7	20.6
Zinc	mg/Kg	495	523	144	276	661	448	600	255
Cyanide	mg/Kg	0.86 U	0.89 U	0.92 U	0.85 U	1 U	0.7 U	0.82 U	0.83 U

SENECA ARMY DEPOT
ASH LANDFILL

TABLE 4-11
SEDIMENT INORGANICS ANALYSIS RESULTS

	MATRIX	SOIL	SOIL	SOIL
	LOCATION	SW-900	SW-900	SW-901
	DEPTH	N/A	N/A	N/A
	DATE	11/18/91	11/20/91	11/15/91
	MAIN ID	S1611-85	S2011-87	S1511-76
	LAB ID	149251	149451	149114
ANALYTE	UNITS			
Aluminum	mg/Kg	13500	13900	13000
Antimony	mg/Kg	11.3 U	35.4 U	15.4 U
Arsenic	mg/Kg	5.7	9	6.6
Barium	mg/Kg	81.8	139	100
Beryllium	mg/Kg	0.81 B	1.1 B	0.98 B
Cadmium	mg/Kg	4.1	2.5 B	2.6
Calcium	mg/Kg	42900	105000	24100
Chromium	mg/Kg	22.8	22.6	24.1
Cobalt	mg/Kg	17	12.7 U	8.8 B
Copper	mg/Kg	16.7	24.3	33.9
Iron	mg/Kg	36800	23900	26800
Lead	mg/Kg	8.5	21.5	31.3
Magnesium	mg/Kg	7090	6280	4920
Manganese	mg/Kg	1050	447	340
Mercury	mg/Kg	0.04 U	0.12 U	0.05 B
Nickel	mg/Kg	37.8	22.8 B	28.3
Potassium	mg/Kg	975 B	1690 B	1710
Selenium	mg/Kg	0.27 U	0.95 U	1.8 U
Silver	mg/Kg	1.7 U	5.8 U	2.5 U
Sodium	mg/Kg	195 B	205 U	89 U
Thallium	mg/Kg	0.45 U	1.6 U	0.58 U
Vanadium	mg/Kg	20.3	29.1 B	21.6
Zinc	mg/Kg	100	339	370
Cyanide	mg/Kg	0.65 U	1.9 U	0.82 U

SENCA ARMY DEPOT
ASH LANDFILL

TABLE 4-12
METALS IN DUST WIPE SAMPLES

	MATRIX:	SOIL	SOIL
	SITE:	ASH	ASH
	DATE:	12/07/91	12/07/91
	MAIN ID:	DW1206-1	DW1206-2
	LAB ID:	150424	150425
ANALYTE	UNITS		
Aluminum	ug/wp	10600	23400
Antimony	ug/wp	90	11.2 U
Arsenic	ug/wp	4.3	3.9
Barium	ug/wp	64.2	351
Beryllium	ug/wp	0.22 U	0.22 U
Cadmium	ug/wp	14.9	10.6
Calcium	ug/wp	17500	21700
Chromium	ug/wp	44.8	65.2
Cobalt	ug/wp	6 B	11.6
Copper	ug/wp	67	190
Iron	ug/wp	2070	11600
Lead	ug/wp	3020	454
Magnesium	ug/wp	2340	3900
Manganese	ug/wp	104	888
Mercury	ug/wp	0.75	1.8
Nickel	ug/wp	10.6	29.5
Potassium	ug/wp	1540	3960
Selenium	ug/wp	1.8	0.4 B
Silver	ug/wp	1.6 B	8.2
Sodium	ug/wp	716 B	4990
Thallium	ug/wp	0.48 U	0.48 U
Vanadium	ug/wp	7.7 B	22
Zinc	ug/wp	1340	1150

Notes:

Units are ug per dust wipe (wp) area of one square foot
For an explantation of data qualifiers see Appendix J

REFERENCES

American Society for Testing and Materials, (ASTM) 1984 Methods for Penetration Test and Split-Barrel Sampling of Soils: D-1586-84. Volume 04.08.

Bouwer H. and Rice R.C., 1976, A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, Vol. 12, No. 3 pp. 423-428.

Buffington, B., 1991, Significant Habitat Unit, N.Y.S. Dept. Envir. Conservation. Personal communications with R.B. Olsen, Chas. T. Main, Inc. October 8, 1991, Seneca Chamber of Commerce 1991, Seneca County Vineyards.

Coward, L.M., 1965, Annotated list of the vascular plants of the Montezuma National Wildlife Refuge, Seneca Falls, New York Final Report 3. New York Cooperative Wildlife Research Unit. 59 pp.

Cowardin, L.M., et. al., December, 1979, Classification of Wetlands and Deepwater Habitats of the United States, U.S. Fish and Wildlife Service, U.S. Department of the Interior.

Crain, L.J., "Groundwater Resources of the Western Oswego River Basin, New York, "U.S. Geological Survey and State of New York Basin Planning Report ORB-5, 1974.

CS Environmental Laboratory, Inc., Groundwater Sampling Results, Seneca Army Depot: Ash Landfill, 1988.

Dalrylmple, B.W., 1978, North American game animals, Times Mirror Magazines, Inc., 516 pp.

Driscoll, F.G., 1986, Groundwater and Wells, Johnson Division, St. Paul Minnesota 55112.

Environmental Science and Engineering, Inc., 1991, Workplan, Remedial Investigation Feasibility Study, Seneca Army Depot, Romulus, New York.

Federal Interagency Committee for Wetland Delineation, 1989, Unified Federal Method for Wetland Delineation.

Freeze, R.A. and Cherry, J.A., 1979, Groundwater, Prentice-Hall, Inc. Englewood Cliffs, New Jersey 07632, 604 pp.

Galson Laboratories, Groundwater Sampling Results, Seneca Army Depot: Ash Landfill 1987-1989.

REFERENCES
(Con't)

Horslev, M.J., 1951, Time Lag and Soil Permeability in Ground-water Observations, Bulletin No. 36, Waterways Experiment Station, Corps of Engineers, U.S. Army.

Hynes, H.B.N., 1979, The Ecology of Running Waters, The University of Toronto Press Ontario, Canada, 555 pps.

LaSala, A.M. Jr., 1968, Groundwater Resources of the Erie-Niagara Basin, New York: Basic Planning Report ENB-3, State of New York Conservation Department with Resources Commission.

Lee, D.S, C.R. Gilbert, C.H. Hocult, R.E. Jenkins, D.E. McAllister and J.K. Stauffer, Jr., 1980, Atlas of North American freshwater fishes; North Carolina State Museum National History Raleigh. X + 854 pp.

Merritt, R.W. and Cummins, K.W., 1978, An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Company Dubuque, Iowa 441 pps.

Morrison, R., 1992, Forest Resource Management Bureau, N.Y.S.Dept. Envir. Conservation, Personal Communication with R.B. Olson, Chas. T. Main, Inc.

Mozola, A.J., 1951, The Groundwater Resources of Seneca County, New York, Bulletin GW-26. Water, Power and Control Commission, Department of Conservation, State of New York, Albany, New York.

Muller E.H. and Cadwel D.H., 1986, Surficial Geologic Map of New York State Finger Lakes Sheet. Survey, Map and Chart Series No. 40.

National Environmental Testing, Inc. Groundwater Sampling Seneca Army Depot: Ash Landfill, 1990-1991.

New York State Department of Environmental Conservation (NYSDEC), Undated, New York State 1989-90 Fishing Regulations Guide.

Northeast Regional Climate Center, Monthly Precipitation Data (1958-1992) Aurora Research Farm, Cornell University, Ithica, New York.

Paratt Wolff, Inc., 1987, Groundwater Monitoring Well Logs Seneca Army Depot: Ash Landfill.

Peterson, R.J., 1980, A field guide to the birds of eastern and central North America.