ENGINEERING REPORT ON CONTAMINATION EVALUATION AT THE FORMER NAVAL AUXILIARY LANDING FIELD CHARLESTOWN, RHODE ISLAND

DELIVERY ORDER 0001
CONTRACT DACA 87-86-D-0050

March 1987

Prepared for:

U. S. ARMY CORPS OF ENGINEERS
Huntsville Division
Huntsville, Alabama

Prepared by:

ecology and environment, inc.
195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491
International Specialists in the Environment

TABLE OF CONTENTS

Table of Contents (Cont.)

Table of Contents (Cont.)

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. EXECUTIVE SUMMARY

This report presents the results of the preliminary determination phase (PDP) investigation which was performed at the former Charlestown Naval Auxiliary Landing Field (NALF) in Charlestown, Rhode Island. Because of concern that contamination may have occurred as the result of Department of Defense (DOD) activities at the former NALF, the Huntsville Division of the U.S. Army Corps of Engineers (COE) authorized the PDP investigation under the Defense Environmental Restoration Account (DERA). Ecology and Environment, Inc., (E & E) was retained to conduct the investigation.

The contract identified four areas of concern on the former NALF where investigations were required to determine the presence or absence of potential DOD-related chemical contamination. Figure 1-1 shows the location of the former NALF and the four areas of concern within it. As Figure 1-1 also illustrates, the former NALF is currently used by the Department of the Interior's Fish and Wildlife Service for a wildlife refuge and by the Town of Charlestown for a parks and recreation area. Of the four areas of concern, Site 1 is on the former NALF currently used as a local park and recreation area; the remaining sites (2, 3, and 4) are on the portion of the property used for the wildlife refuge.

Fieldwork for the site investigation at the NALF began in October 1986 and ended in November 1986. The investigation involved installation and sampling of eight groundwater monitoring wells as well as the sampling and analysis of surface water and soils at the former NALF.

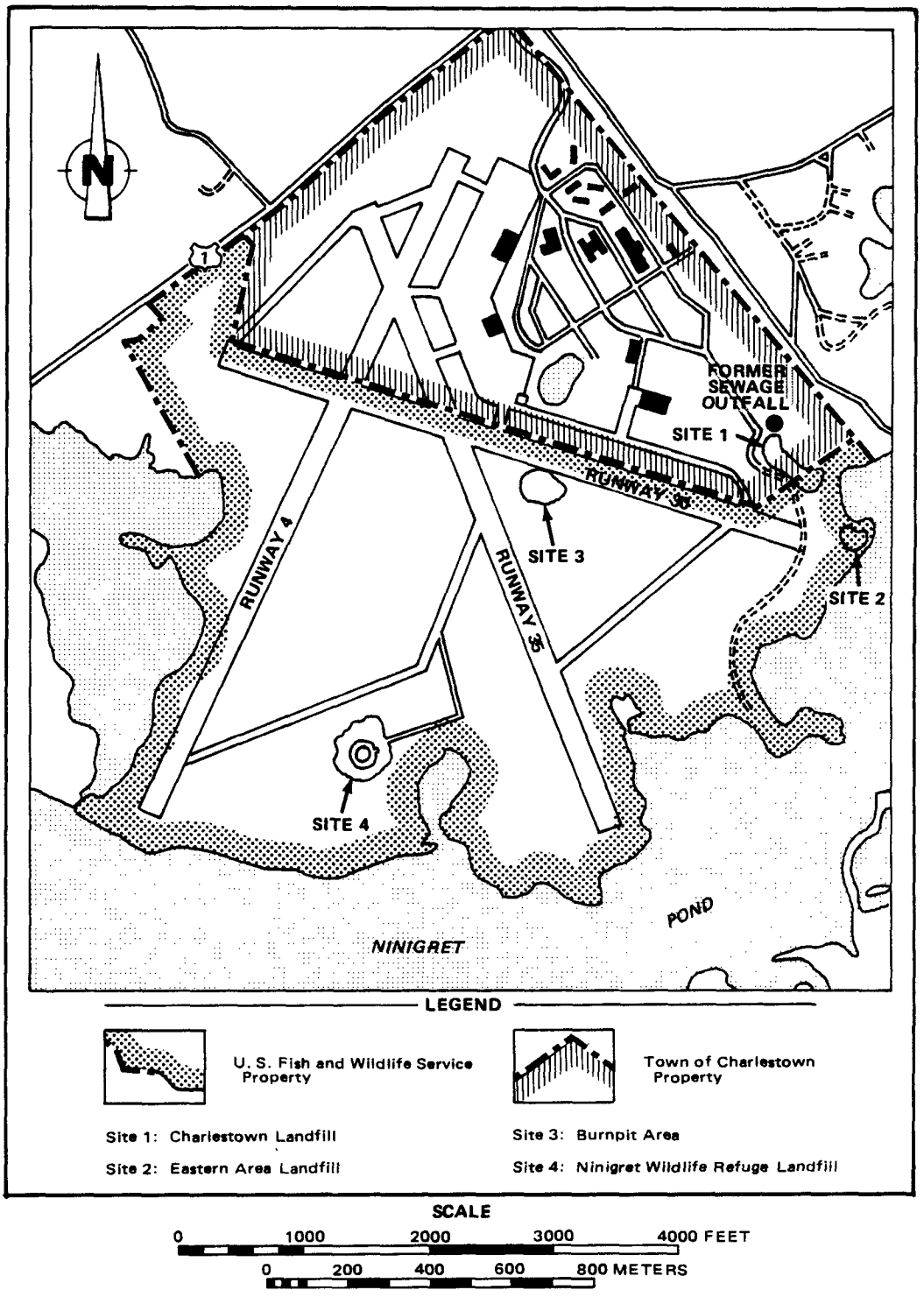


Figure 1–1 FORMER CHARLESTOWN NALF SITE

All samples were analyzed for purgeable organics, base/neutral extractables, PCBs, total metals, pesticides, and petroleum hydrocarbons. In addition, water samples were analyzed for dissolved metals. The analytical data for this inventory study are summarized in Section 4 of this report, and are fully presented in the appendices. These data indicate that probable DOD-related contamination occurs in surface waters, groundwater, and soils at the former NALF, and that further investigation is warranted.

The laboratory testing revealed that groundwater samples from the site contain varying amounts of acetone, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Petroleum hydrocarbons were also found in six of the nine groundwater samples collected.

Surface water samples were found to contain elevated levels of acetone as well as varying amounts of arsenic, cadmium, chromium, copper, lead, mercury, and zinc.

Soil samples from the site contained methylene chloride, acetone, 2-butanone, toluene, pesticides, petroleum hydrocarbons, heavy metals, and the pesticides 4,4'-DDE and 4,4'-DDT.

The most prevalent contaminants detected among all sites were acetone, heavy metals and petroleum hydrocarbons.

Analytical results for groundwater and surface water samples discussed in this report were compared to EPA drinking water standards and criteria [Recommended Maximum Contaminant Limits (RMCLs) or lifetime health advisories]. These standards and criteria were selected for use in this document becuse they represent mandatory drinking water limits or criteria for protection of human health developed under EPA peer-review procedures. If concentrations of contaminations at the NALF exceed these standards or criteria, we have proceeded to divide these concentrations by a dilution/attenuation factor to permit inclusion of transport-related reduction of concentrations from groundwater sampling wells to nearest drinking water wells used for human consumption. A dilution/attenuation factor of 100 was selected as a divisor for the reported well sample concentration to reflect the fact that any contamination would by necessity have to flow at least 500 feet counter to the natural groundwater flow. As the aquifer is characterized by the high permeability and high rate of recharge, this number appears to be an underestimate of dilution/ attentuation.

Consequently, the use of a 100-fold factor can be regarded as a conservative (health-protective) assumption in evaluating the potential threat to human health.

Analytical results for soil samples discussed in this report were compared to normal concentrations of metals in soils by the USGS for the coterminous United States. Organic constituents reported in soils are not naturally occurring and therefore cannot be attributed to background levels. Therefore, concentrations of these chemicals were compared directly to analyze the potential threat to humans or wildlife.

The following summary details the chemical contaminants of concern that were identified at each of the four sites as resulting from former DOD activities, and presents recommended action for each site.

Site 1

Acetone, petroleum hydrocarbons, and the pesticides DDT and DDE were detected at elevated levels at Site 1. These contaminants are considered to be a probable result of former DOD-related activities.

Elevated levels of acetone were detected in the groundwater. There are no federal or state standards for acetone in groundwater. The chemical is regarded as having low chronic toxicity to man (EPA 1984). Since the sampling points where acetone was detected are downgradient of drinking water wells, a dilution of the contaminant would occur before reaching upgradient drinking water intakes; thus acetone does not present a serious health hazard. While acetone does not present a serious health threat in the concentrations detected, higher concentrations could pose a threat. Acetone is not a natural constituent of groundwater; therefore, it is appropriate to identify the source to be certain greater concentrations are not present. Additional sampling and testing is recommended to determine the source and extent of contamination.

Petroleum hydrocarbons were detected in groundwater and soils. No standards or criteria were found for these chemicals. The concentrations detected in groundwater may result in unpalatable water at drinking water wells, even after using a dilution factor.

Overall, petroleum hydrocarbons are not natural constituents of water or soils and may present a hazard to human health and the environment in the concentrations detected. Additional testing is

recommended to determine the source and areal extent. Remedial measures should be discussed with the Rhode Island Department of Environmental Management.

The chemicals 4,4'-DDT and 4,4'-DDE (a breakdown product of DDT) were detected in soil samples. DDT was a widely used pesticide prior to the 1970s. Residual concentrations of DDT are found throughout the United States where DDT was once applied. No soil standards are available to evaluate the concentration detected and no background samples for the NALF site were available for comparison. It is recommended that additional testing be performed to analyze the areal extent and concentrations of DDT and DDE and evaluate the risks to humans and the environment.

Site 2

Acetone and the pesticides DDT and DDE were detected at elevated levels in samples from Site 2. These chemicals are a probable result of former DOD-related activites.

Elevated levels of acetone were detected in the groundwater. There are no federal or state standards for acetone in groundwater. The chemical is regarded as having low chronic toxicity to man (EPA 1984). Since the sampling points where acetone was detected are downgradient of drinking water wells, a dilution of the contaminant would have to occur before reaching upgradient drinking water intakes; thus acetone does not present a serious health hazard. While acetone does not present a serious health threat in the concentrations detected, higher concentrations could pose a threat. Acetone is not a natural constituent of groundwater; therefore, it is appropriate to identify the source to be certain greater concentrations will not be present in the future. Additional sampling and testing is recommended to determine the source and extent of contamination.

The chemicals 4,4'-DDT and 4,4'-DDE also were detected in soil samples at Site 2. As mentioned previously, residual concentrations of these pesticides are found throughout the United States where DDT was once applied. No soil standards are available to evaluate the concentration detected. It is recommended that additional testing be performed to analyze the areal extent and concentrations of DDT and DDE and evaluate the risks to humans and the environment.

Site 3

Acetone and petroleum hydrocarbons were detected at elevated levels in samples from Site 3. These contaminants are the probable result of former DOD activities at the former NALF.

Elevated levels of acetone were detected in the groundwater. As mentioned previously, no federal or state standards are available for acetone in groundwater, but the chemical is regarded as having low chronic toxicity to man (EPA 1984). Acetone in the concentrations detected does not present a serious health hazard, but higher concentrations could pose a health hazard. It is appropriate to identify the source to be sure higher concentrations do not exist. Additional sampling and testing is recommended to determine the source and extent of contamination.

Petroleum hydrocarbons were detected in groundwater and soils. No standards or criteria were found for these chemicals. The concentrations detected in groundwater may result in unpalatable water at drinking water wells, even after using a dilution factor.

Overall, petroleum hydrocarbons are not natural constituents of water or soils and may present a hazard to human health and the environment in the concentrations detected. Additional testing is recommended to determine the source and areal extent. Remedial measures should be discussed with the Rhode Island Department of Environmental Management.

Site 4

The pesticide compound 4,4'-DDT was detected at elevated levels in soil at Site 4. As mentioned previously, residual concentrations of DDT are found throughout the United States where DDT was once applied. No soil standards are available to evaluate the concentrations detected. The application of pesticides probably occurred as a result of former DOD opeations at the former NALF. It is recommended that additional testing be performed to analyze the areal extent and concentrations of DDT and DDE and evaluate the risks to humans and the environment.

The report is organized into five principal sections. Section 1 consists of the Executive Summary; Section 2 describes the project objectives and discusses the NALF site location, physiography, and

prior use. Section 3 details the site investigation, including the installation and survey of monitoring wells and the overall sampling program for groundwater, surface water, and sediment. The results of laboratory analysis of the samples are discussed in Section 4. Section 5 presents and discusses conclusions and recommendations.

2. GENERAL

2.1 INTRODUCTION

As a result of concern for the possible existence of contamination associated with DOD activities at the former Naval Auxiliary Landing Field (NALF) in Charlestown, Rhode Island, the Huntsville Division of the U.S. Army Corps of Engineers implemented a contamination assessment of the site under the Defense Environmental Restoration Account (DERA). E & E was retained to conduct this contamination evaluation. This report presents the results of the investigations of the former Charlestown NALF, including a description of the site investigations, a discussion of the analytical results, and a preliminary determination concerning whether chemical contamination on the site may have been the result of DOD-related activities.

2.2 PROJECT OBJECTIVE

The objective of the overall contamination evaluation is to provide a preliminary determination of the presence or absence of chemical contamination at the former NALF.

This objective was to be achieved by performing the following project tasks, identified in the scope of work (SOW), including: a basic records review and evaluation; a site inspection; development of a site-specific work plan (including a sampling/analysis/quality control plan; a health and safety plan; a monitoring well installation plan; performance of field investigations, including the placement of eight groundwater monitoring wells to facilitate the sampling of groundwater for chemical analysis; the performance of in situ

permeability testing; the analysis of field samples; and completion of this engineering report.

2.3 SITE LOCATION AND PHYSIOGRAPHY

2.3.1 Site Location

The site of the former Charlestown NALF is located in southwestern Rhode Island in the coastal town of Charlestown in Washington County. The site is located southeast of and adjacent to U.S. Route 1 in Charlestown (see Figure 1-1). The site is bordered on the south by Ninigret Pond, East Beach, and ultimately Block Island Sound.

From 1940 until 1972, the 605-acre NALF operated as an annex to Quonsett Point Naval Air Station. In 1974, the U.S. Navy declared the NALF property excess and it was transferred to the Government Services Administration (GSA) for disposition. Part of the NALF was ultimately transferred to the Town of Charlestown while the remainder was transferred to the USFWS. The town is presently developing its portion of the former NALF into a park and a community center. The USFWS incorporated its parcel of the Charlestown NALF into the Ninigret Wildlife Refuge. Figure 1-1 shows the apportionment of the town and the USFWS property on the former NALF.

The former NALF includes three primary asphalt runways, as well as other developed areas. The property owned by the USFWS has not been developed and has been generally reverting back to field indigenous vegetation. The Town of Charlestown property has a senior citizens center, a nature center, as well as storage buildings and recreational areas.

The Town of Charlestown is located in a coastal area in which land-use patterns are dominated by wetlands/open space, recreation uses, and agricultural development. Consequently, land use in the areas immediately surrounding the former NALF consists predominantly of scattered low-density residential uses as well as areas used for agriculture, recreation, wetlands, and open space.

The NALF has an inactive water system consisting of several onsite groundwater wells. The Town of Charlestown Nature Center and Senior Citizens Center rely on groundwater from onsite wells.

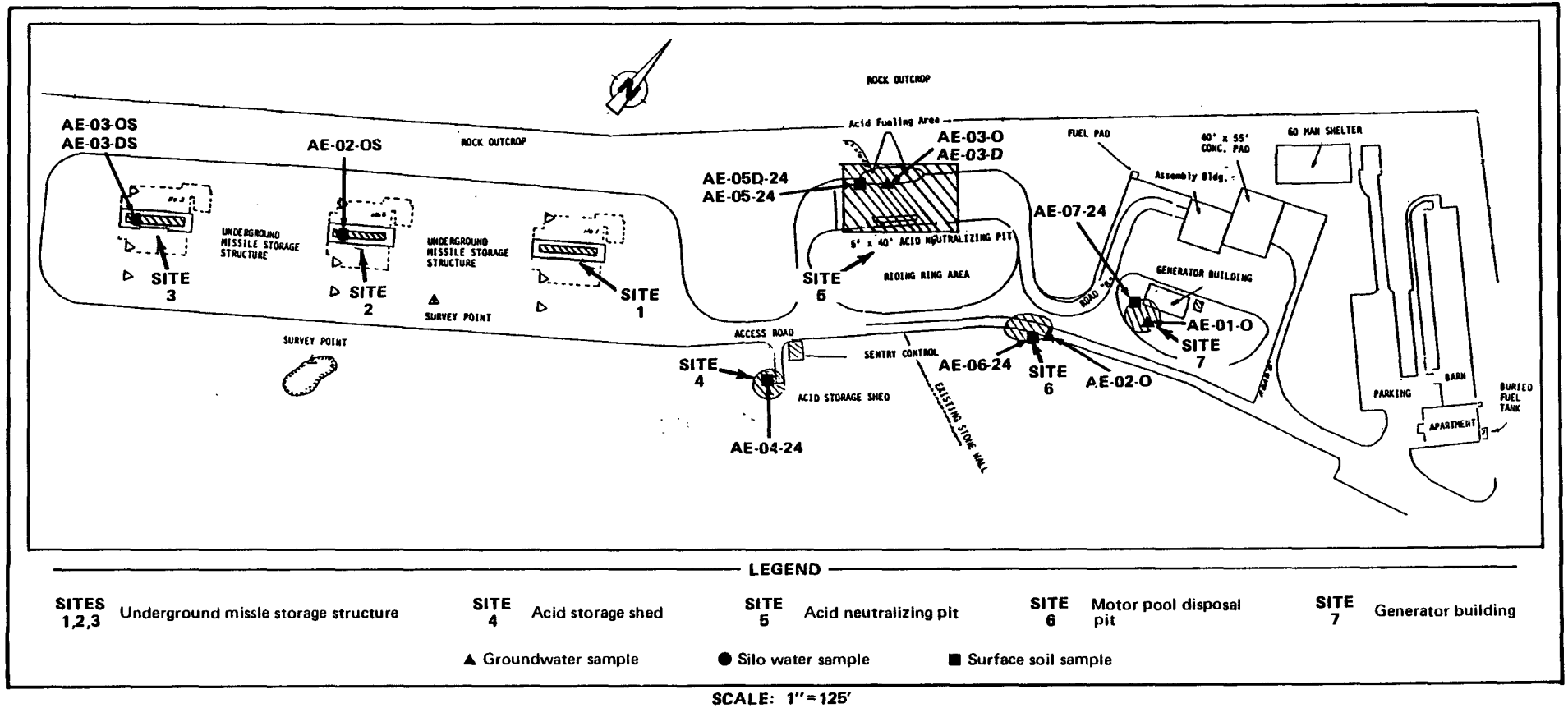


Figure 1–1 SITE MAP/SAMPLING LOCATIONS, FORMER NIKE BATTERY BR-04, LAUNCH AREA, ANSONIA, CONNECTICUT

Prior to the initiation of this study, four sites on the former NALF were identified as areas of possible chemical contamination. These are:

- A disposal area at the site of an abandoned sewage outflow distribution system on Town of Charlestown's Department of Parks and Recreation property (Site 1);

- A disposal area on the eastern side of the NALF installation (Site 2);

- A burn pit along the runway once used to simulate jet crashes for rescue training (Site 3); and .

- A disposal area in a wetland on the Ninigret Wildlife Refuge (Site 4).

These locations, which are shown in Figure 1-1, were identified as containing miscellaneous debris, chemical containers, discarded appliances, furniture, and building demolition rubbish. The burn pit was also thought to potentially contain soil saturated with fuels and their combustion by-products.

2.3.2 Physiography

The Charlestown NALF site is southeast of the Charlestown moraine, which marks the end of continental glacial advance during the Wisconsin Glaciation. This moraine is north of and parallels U.S. Route 1.

As a result of dominant glacial activity, the site contains unconsolidated sediments consisting of till and outwash sands and gravels. Topographic relief is generally low with the eastern boundary of the site at sea level and the northern boundary relief rising to 40 feet above mean sea level (AMSL).

Both the eastern and southern site boundaries are contiguous to the saltwater of Ninigret Pond. Fresh and saltwater wetlands occupy portions of the southwestern side of the site.

The sand and gravel outwash deposits that cover the NALF, as well as other portions of this area of Rhode Island, have exhibited some of the best groundwater potential of any surficial or bedrock units in the area. Within the boundaries of the former NALF, the sand and gravel aquifer is limited hydrogeologically by the till of the Charlestown moraine to the north and by the saltwater that borders to the south, east, and west of the site. The groundwater is recharged primarily by rainfall and to a smaller degree by seepage through the Charlestown moraine. Site groundwater is found under water-table conditions (i.e., unconfined aquifer) and generally discharges into adjacent coastal water bodies.

Groundwater levels at the former NALF have been studied for more than 40 years. The United States Geological Survey (USGS) has maintained an observation well on the site since 1946. In addition, the New England Power Company (NEPCO) installed 25 piezometers on the site in 1974 in order to monitor groundwater levels. Data from these wells are discussed in detail in the 1979 Final Environmental Impact Statement (FEIS) prepared by the GSA concerning the analysis of reuse proposals for the NALF. These data show that groundwater gradients are slight; the areas of steepest gradient are associated with the till body which crosses the northern portion of the site. North of this area the gradient is 0.003, while south of this area the gradient range is between 0.001 and 0.002.

For a detailed description concerning the physiography of the former NALF site, refer to the FEIS (GSA 1979).

2.4 OWNERSHIP AND PRIOR USE

As noted previously, the Charlestown NALF operated as an annex to the Quonsett Point Naval Air Station from 1940 until 1972. The U.S. Navy declared the land excess and it was transferred to the GSA in 1974 for disposition. The site encompasses 605 acres; part of the property was transferred to the Town of Charlestown and the rest was transferred to the USFWS.

Four sites are identified as areas of possible chemical contamination. Three of the four sites investigated under this delivery order are found on the USFWS property. The fourth site is located on the Town of Charlestown property and is adjacent to the USFWS property

boundary. The USFWS prepared the report "Preliminary Survey of Contaminant Issues of Concern on National Wildlife Refuges" and listed the Ninigret NWR in "Category C," which includes refuges where there is no direct evidence of contaminants, but where possible contamination is suspected.

The Charlestown Landfill site is an excavated area adjacent to the former aeration pond and sewage outfall distribution system. The excavated area was used for disposal and burial of military debris, which included airplane and vehicle parts, scrap metal, and inert practice bombs. The Town of Charlestown has recently used the area for disposal of road debris, broken asphalt, and soil. During 1973, and again in 1977, the landfill was excavated in search of airplane parts by a trustee of the Bradley Air Museum. There are unconfirmed reports of various airplane parts and oily water having been found during the excavation.

The second site is the disposal area located on the USFWS at the eastern end of runway 30. A depressed area of the headland that extends into Ninigret Pond was reported to have been used for disposal of construction debris which included concrete, bricks, stones, and metal parts.

The burn pit site was reported to have been used to simulate jet crashes per fire and rescue training exercises. Apparently aircraft fuselages were set up at the site, covered with jet fuel or similar petroleum products, and set afire. Typical fire fighting practices included the use of dry chemical fire extinguisher agents (e.g., "Purple K"), protein or light water foam, carbon dioxide, and water.

The fourth site is located on the USFWS, where a flat wetland area was used for disposal of trash, discarded appliances, tires, cans and bottles, furniture, and miscellaneous debris.

During the visual site inspection and site investigation activities, E & E personnel noticed that the Town of Charlestown had partially removed asphalt from various parts of the town's property. Asphalt was left in small piles along the access roads, and some unknown quantities had been removed and deposited at the area of the Charlestown Landfill, northwest of Site 1.

3. SITE INVESTIGATION

3.1 INTRODUCTION

The objective of the sampling and analysis program at the 605-acre Charlestown NALF site was to determine the presence or absence of chemical contamination.

Eight groundwater monitoring wells were installed for three sites on the NALF property to allow the collection of representative groundwater samples. The drilling and monitoring well installations were performed by New England Boring Contractors of Connecticut, Inc., subcontractors to E & E. The well installation procedure is described in Section 3.2.

Analytical samples were collected in the field utilizing EPA-approved standard operating procedures (SOPs) and sent to E & E's Analytical Services Center (ASC) for analysis. Duplicates, replicates, and spiked samples were used to develop qualitative estimates of the analytical data. Field audits were conducted to verify that proper sampling techniques and chain-of-custody procedures were followed. Field data compilation, tabulation, analysis, and other post-field tasks were reviewed by project personnel and checked for accuracy. The sampling and analyses procedures are described in Section 3.3.

3.2 MONITORING WELL INSTALLATION

The locations for the eight groundwater monitoring wells were determined by E & E following a visual site inspection. The three sites for the eight wells are designated as follows:

Site 1: The disposal area at the old sewage outfall location on Town of Charlestown Department of Parks and Recreation property.

Site 2: The disposal area in the wetland area at the eastern end of runway 30 on Ninigret Wildlife Refuge property.

Site 3: The "burn pit" site south of runway 30, between runway 30 and runway 35, approximately 750 feet east of the intersection of runways 30 and 35.

Four wells were installed along the southern boundary of Site 1. Site 1 is an area that encompasses several areas and is known to have received a wide variety of disposal material. The site encompasses an area of several acres and thus requires multiple sampling locations.

The amount and extent of dumping at Site 2, which is known to have been used as a disposal location, is unknown. Three wells were installed at the eastern boundary of Site 2.

One well was installed at Site 3, approximately 140 feet west of runway 30 and 750 feet east of the intersection of runways 30 and 35.

For groundwater, as well as surface water, sampling locations, see Figure 3-1 and map AE2040-01 in map pocket at back of this report.

3.2.1 Well and Monument Locations

Coordinates and elevations were established for each monitoring well. The coordinates are to the closest 1.0 foot and referenced to a site-specific grid system established by E & E. The basis of the grid system is outlined on drawing AE2040-01 (see map pocket in back of this report). A survey marker (control monument), composed of aluminum alloy, was permanently set in the pad surrounding each well. Elevations to the closest 0.01 foot were provided for the survey marker and the top of the casing at each well. These elevations were referenced to the National Geodetic Vertical Datum of 1929. Two permanent control monuments composed of concrete with aluminum alloy caps were set in accessible locations within the work area. These monuments are no closer than 500 feet to each other. Coordinates and

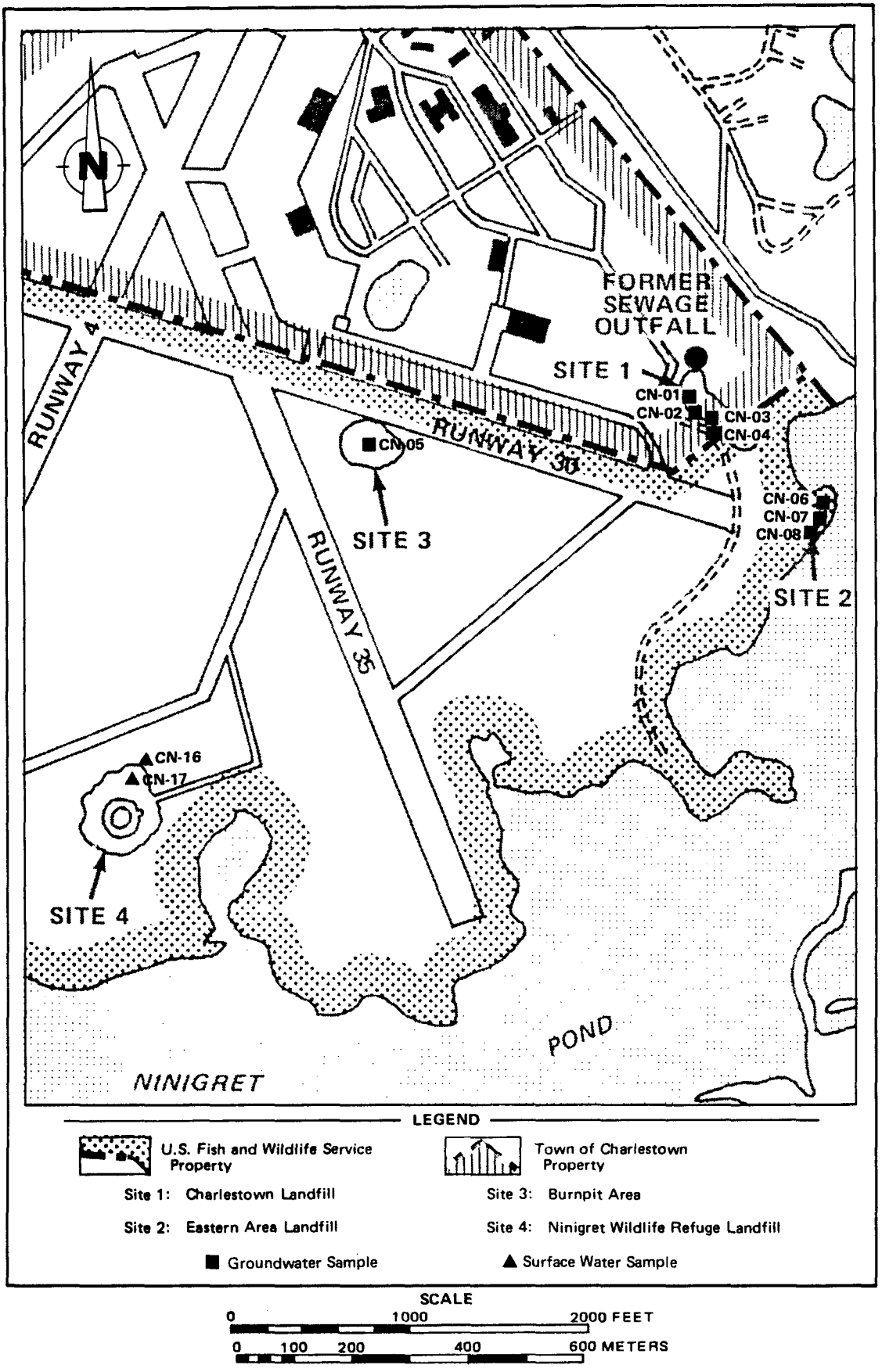


Figure 3–1 GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

elevations were established to the closest 0.01 foot for each monument.

The location, identification, coordinates, and elevations of the wells and monuments were plotted on drawing number AE2040-01 (see map pocket). A tabulated list of the monitoring wells and monuments, including their coordinates and elevations, all field notes, and all computation sheets are documented in Appendix D.

3.2.2 Well Depths

At each well location, monitoring well borings were advanced through the overburden. Total depth for the wells varied between 18 and 30 feet. These locations having slightly higher elevation (3 to 5 feet) have a correspondingly greater thickness of sand and gravel in place. All the well borings with the exception of CN-05 had auger refusal which was attributed to bedrock. Bedrock was encountered in well boring CN-08 at a depth of 17 feet, 7 inches. A six-inch core of the granite was retrieved from the boring and logged. The site is situated on glacially derived outwash sand and gravel deposits. Monitoring wells were located in order to penetrate the unconfined sand and gravel aquifer and to intercept groundwater flow in downgradient positions adjacent to potential source areas on site. The downgradient determination was based upon the FEIS (GSA 1979) report which indicates groundwater contours for the site. All wells were drilled to at least the minimum depth (18 feet) as outlined in the scope of work.

3.2.3 Drilling Equipment and Techniques

The drilling and installation of the monitoring wells was performed using a water-rotary Mobile B-53 drill rig equipped to perform hollow-stem augering using 6 1/4-inch OD, 4-inch ID hollow-stem augers. While drilling, the lead auger was plugged with a pilot bit to prevent material from entering the auger stem. The plug was pulled to perform retrieval of split-spoon samples, and for "NX" diamond-core drilling.

Sampling was conducted using a 2-inch OD, 1 3/8-inch ID split-spoon sampler with an 18-inch collection chamber. Upon encountering refusal, an "NX" diamond-core barrel was used to penetrate and

retrieve samples of bedrock. The "NX" diamond coring was used when refusal depth for auger drilling was less than the desired total depth for the boring.

3.2.4 Drilling Procedures

3.2.4.1 Initial Activities

A temporary decontamination pad was set up prior to drilling to provide for the capture and containment of fluids and solids generated during decontamination of all drilling equipment. Two layers of thick plastic sheeting were placed over the decontamination area. All fluids and solids collected were placed in drums adjacent to the decontamination pad and labeled with the site number, date, and other relevant data.

At each monitoring well location, two layers of thick plastic sheeting were placed over the drilling area to reduce the contamination of surface soils. A plywood sheet was placed around the wells for ease of operation. Soil, water, or other wastes generated during the project were collected and stored in DOT-approved containers.

All drilling fluids and solids were contained within the hole or the mud tank, or removed and placed in DOT-approved containers.

Each monitoring well location was screened for volatile organics using an Organic Vapor Analyzer (OVA) prior to and during drilling.

The use of contaminating additives (bentonite, gels, barite, etc.) in drilling fluids was not permitted. Dispersing agents (such as phosphates, acids, and other toxic substances were not used during any part of the drilling, well installation, or well development. Only clean, nonchlorinated water or formation water from the well being drilled was used as a drilling fluid.

3.2.4.2 Drilling Protocol

At each well location the boring was advanced through overburden using a water-rotary Mobile B-53 drill rig and hollow-stem auger. Soil samples were collected continuously for the first 10 feet and at 5-foot intervals thereafter. Sampling was conducted with a split-spoon sampler. The sampler was driven into the soil using a 140-pound safety hammer having a free fall of 30 inches, in accordance with ASTM-D 1586-84 specifications. The subcontractor provided E & E's supervising geologist with the number of blows required to

drive the sampler each 6 inches of penetration. Split-spoon samples were screened in the field for volatile organic vapors using an organic vapor analyzer (OVA), classified in accordance with Unified Soil Classification System (USCS) specifications, and logged. Samples were stored in glass jars until needed for testing. After reviewing the boring logs, visual classifications were verified by submitting selected soil samples for laboratory analysis of grain size, Atterberg limit determinations, and natural moisture contents. Laboratory analysis information is presented in Appendix C.

Hydrogeologic suitability for well emplacement was determined by the supervising geologist based on thickness and estimated hydraulic conductivity of the saturated zone encountered.

Bedrock encountered during well installation of boring CN-08 was cored by standard diamond core drilling methods using an "NX" size core barrel. All rock cores recovered were logged by a geologist, photographed using a 35-mm camera, and stored in wooden core boxes. The 35-mm slides were submitted, in duplicate, as part of the completed boring logs to the CO. The logs were prepared by a geologist who was present during all drilling operations. One copy of each field boring and well construction log, including color slides of the rock core and groundwater data, were submitted to the CO. A copy of the well logs are provided in Appendix A.

3.2.5 Well Installation

3.2.5.1 Well Casing and Sceen Materials

The well riser consisted of 2-inch internal diameter (ID), threaded, flush joint, polyvinyl chloride (PVC) pipe. All well risers conformed to the requirements of ASTM-D 1785 Schedule 40 pipe.

The well screen was a minimum of 10 feet in length, constructed of the same size and strength PVC material as the well riser and was compatible with the groundwater to be monitored. The screen was non-contaminating, factory-constructed slotted (0.01-inch slot) design as shown in Figure 3-2.

Screen and riser sections were joined by flush-threaded couplings to form watertight unions that retain 100% of the strength of the screen. Solvent PVC glue was not used at any time in the construction of the wells. The bottom of the screen was sealed with a PVC-threaded

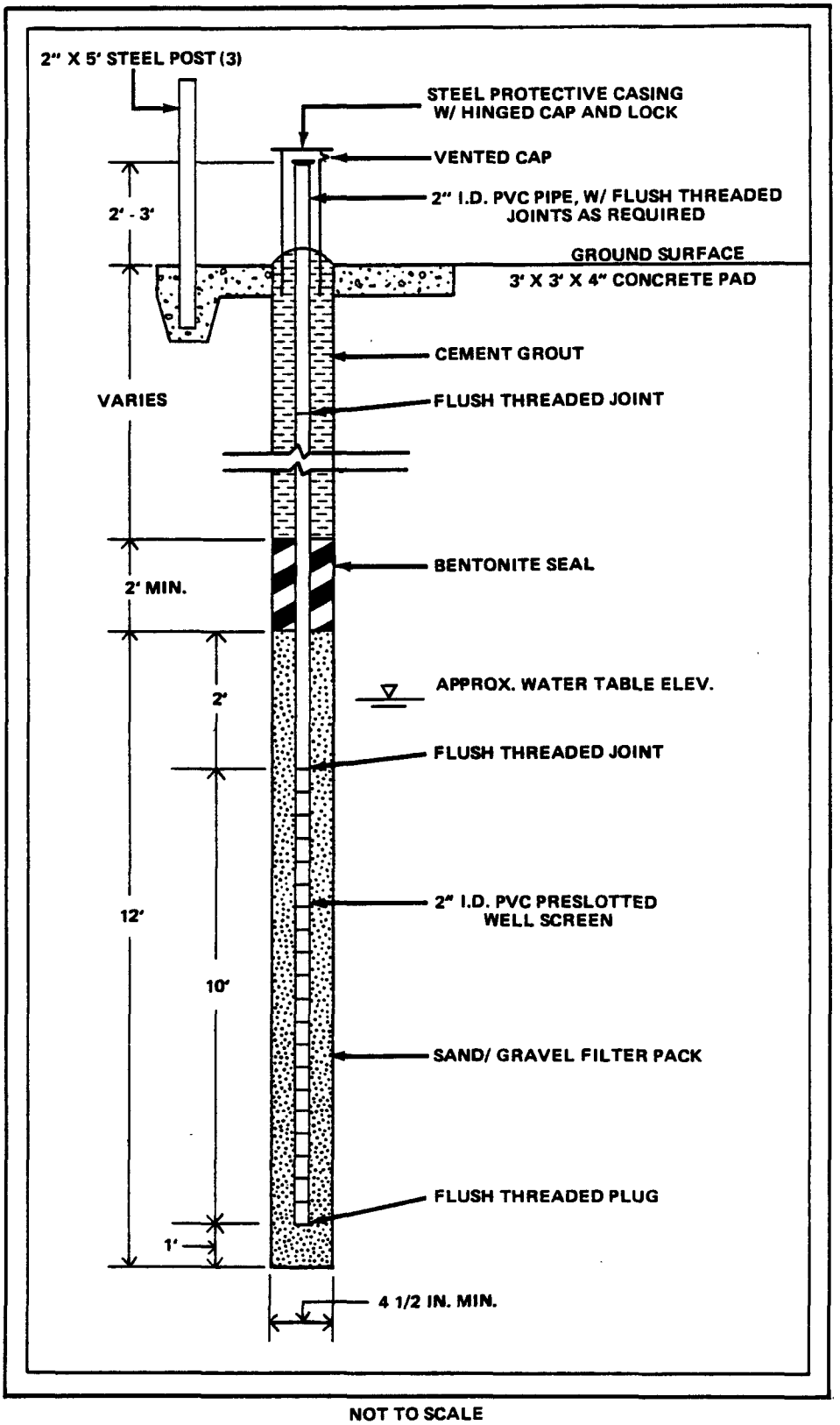


Figure 3–2 MONITORING WELL DESIGN

cap or plug. No lead shot or lead wool was employed in sealing the bottom of the well or for seals at any point in the well.

All risers and screens were set round, plumb, and true to line. Centralizers were used to assure plumbness and alignment of the wells. Centralizers were not installed on the well screen.

3.2.5.2 Artificial Sand Pack

Granular backfill was chemically and texturally clean, inert, siliceous, and of appropriate grain size (No. 2 sand) for the screen slot size and the host environment. Prior to casing and screen insertion, a minimum of 1 foot of gravel-pack bedding was placed in the bottom of the hole. The well screen and riser casing were installed and the sand pack placed via a tremie pipe around the screen and casing to a depth approximately 2 feet above the top of the well screen.

3.2.5.3 Bentonite Seal

A minimum 2-foot thick seal of tamped bentonite pellets was placed directly on top of the pack, and care was taken to avoid bridging. The seal was measured immediately after placement, without allowance for swelling.

3.2.5.4 Grout Mixture

Upon completion of the bentonite seal, the well was grouted with a nonshrinking cement grout mix and placed from the top of the bentonite seal to the ground surface. The cement grout consisted of a mixture of Portland cement (ASTM C 150) and water in the proportion of not more than 7 gallons of clean water per bag of cement (1 cubic foot or 94 pounds).

3.2.5.5 Surface Protection

At all times during the progress of the work the well was kept covered to prevent tampering or the entrance of foreign material into the well. Upon completion of well installation, a vented cap was installed to prevent material from entering the well. The PVC well riser was surrounded by a larger-diameter steel casing rising 24 to 36 inches above ground level and set into a concrete pad. The steel

casing was provided with a cap and lock. A minimum 3-foot-square, 4-inch-thick concrete pad, sloped away from the well, was constructed around the well casing at ground level. A survey marker was permanently placed in each pad. Three 2-inch-diameter or larger steel posts were equally spaced around the well and embedded in the concrete pad. The steel protective casing and posts were painted with permanent high-visibility paint. The ground immediately surrounding the top of the well was sloped away from the well. There were no openings in the protective casing wall below its top.

3.2.6 Well Development

Forty-eight hours after completion of the well, development was accomplished using a centrifugal pump. Development was continued for a period of not less than 4 hours, and until the well water was clean to the unaided eye (i.e., free of sand and drill fluids). No dispersing agents, acids, disinfectants, or other additives were used during development or at any other times introduced to the well. During development, water was removed throughout the entire water column by periodically lowering and raising the pump intake.

Well development included washing the entire well cap and the interior of the well casing above the water table, using only water from the well itself. The result of this operation was a well casing free of extraneous materials (grout, bentonite, and sand) inside the riser, well cap, and blank casing between the top of the well casing and the water table. This washing was conducted before and/or during development--not after development. All development water was properly contained.

After final development of the well, approximately 1 liter of water from the well was collected in a clear glass jar, labeled, and photographed.

3.2.7 Aquifer Permeability

In the preliminary phase of investigation, it was not known whether the site would be found to be highly permeable, as previous data showed that a wide range of permeabilities existed in the area. "Slug" tests of the individual wells were performed to determine

aquifer permeabilities immediately adjacent to each well. The permeability tests were performed for each groundwater monitoring well in accordance with "The Slug Injunction Test for Estimating the Coefficient of Transmissibility of an Aquifer" (Methods of Determining Permeability, Transmissibility, and Drawdown, USGS Water Supply Paper No. 1536-I, 1963). This procedure is applicable to wells that tap the full thickness of the aquifer and are fully developed.

The procedure of the slug-injection test method is as follows: an initial static water level of the well is taken after a tubing connected to a manometer tube has been inserted below the static water level. A manometer U-tube at the surface measures change in static water level. A known volume of water is quickly injected into the well. The changes in water levels are then recorded at the surface by reading the amount of head in feet and inches above the original static water level. Water levels are repeatedly taken at elapsed time intervals of 5 to 10 seconds until the head has lowered to less than 10% of initial rise in water level. The data are plotted as a graph of residual head (above initial water level) against the reciprocal of time (in minutes since injection of the slug). The point on the graph at which the data are used to calculate the transmissibility is the point in time corresponding to the average of the time between injection and return to initial level.

The data points for the water level recession need to include points representative of the entire recession period. If the head decline is so rapid that early data points cannot be obtained, then accurate transmissibilities cannot be calculated; the only fact that can be determined is that the transmissivity is high.

The initial water-level buildup produced by injecting a slug of water disappeared so rapidly that the data curve could not be defined accurately; thus the wells did have moderate to high transmissibilities.

The results for each well are listed in Appendix B.

3.3 SAMPLING PROGRAM

3.3.1 Sampling Locations

Table 3-1 provides a summary of the number of samples collected for all the four sites shown in Figure 3-1 and 3-3. Table 3-2 provides site- specific sample locations for all samples collected.

Table 3-1

SAMPLING LOCATIONS FOR CHARLESTOWN NALF

Sample Medium	Site No.*	Number of Sample Locations	Number of Field and Control Samples	Non-QA/QC Samples for Analysis by E & E	QA Samples	
					E & E Lab	MRDED-L Lab
Groundwater	1	4	6	4	1	1
	2	3	3	3	-	-
	3	1	1	1	-	-
Subtotal	-	8	10	8	1	1
Surface Soil 6" Below Surface	1	2	4	2	1	1
	2	2	2	2	-	-
	3	2	2	2	-	-
	4	1	1	1	-	-
Subtotal	-	7	9	7	1	1
Surface Soil 24" Below Surface	1	2	4	2	1	1
	2	2	2	2		
	3	2	2	2		
	4	1	1	1		
Subtotal	-	7	9	7	1	1
Surface Water	4a	2	2	2	0	0
Water Travel Blank	-	-	2	-	1	1
Water Sample Blank (Rinsate)	-	-	2	-	1	1
Total	-	-	36	24	6	6

*Site numbers correspond to the following locations:
1: Charlestown landfill
2: Eastern area landfill
3: Burnpit area
4: Ninigret Wildlife Refuge disposal area
4a: Submerged marsh area near Site 4

Table 3-2

SITE SPECIFIC SAMPLING LOCATIONS

Site Location	Monitoring Well/Samples Location, Number, Description	E & E Sample Designation
Groundwater		
01	CN-01	CN-01-0 CN-01-D
01	CN-02	CN-02-0
01	CN-03	CN-03-0
01	CN-04	CN-04-0
02	CN-05	CN-05-0
03	CN-06	CN-06-0
03	CN-07	CN-07-0
03	CN-08	CN-08-0
--	Trip Blank	CN-18-0
--	Sample Rinsate	CN-19-0
Surface Water		
04	120' north of east side of disposal area	CN-16-0
04	Marsh, north of Site 4	CN-17-0
Surficial Soil		
01	#9 - 53'-ESE of CN-02 23.3' NNW of CN-03	CN-09-006 CN-09-006* CN-09-024
01	#10 - 27.8' N of CN-02 36.5' SSE of CN-01	CN-10-006 CN-10-024 CN-10-024*
02	#11 - 12.3' SW of CN-07	CN-11-006 CN-11-024
02	#12 - 11.0' S of CN-08	CN-12-006 CN-12-024
03	#13 - 27.5' N of CN-05	CN-13-006 CN-13-024
03	#14 - 27.5' S of CN-05	CN-14-006 CN-14-024
04	#15 - 76' NNW of Quonset hut	CN-15-006 CN-15-024

*Duplicate

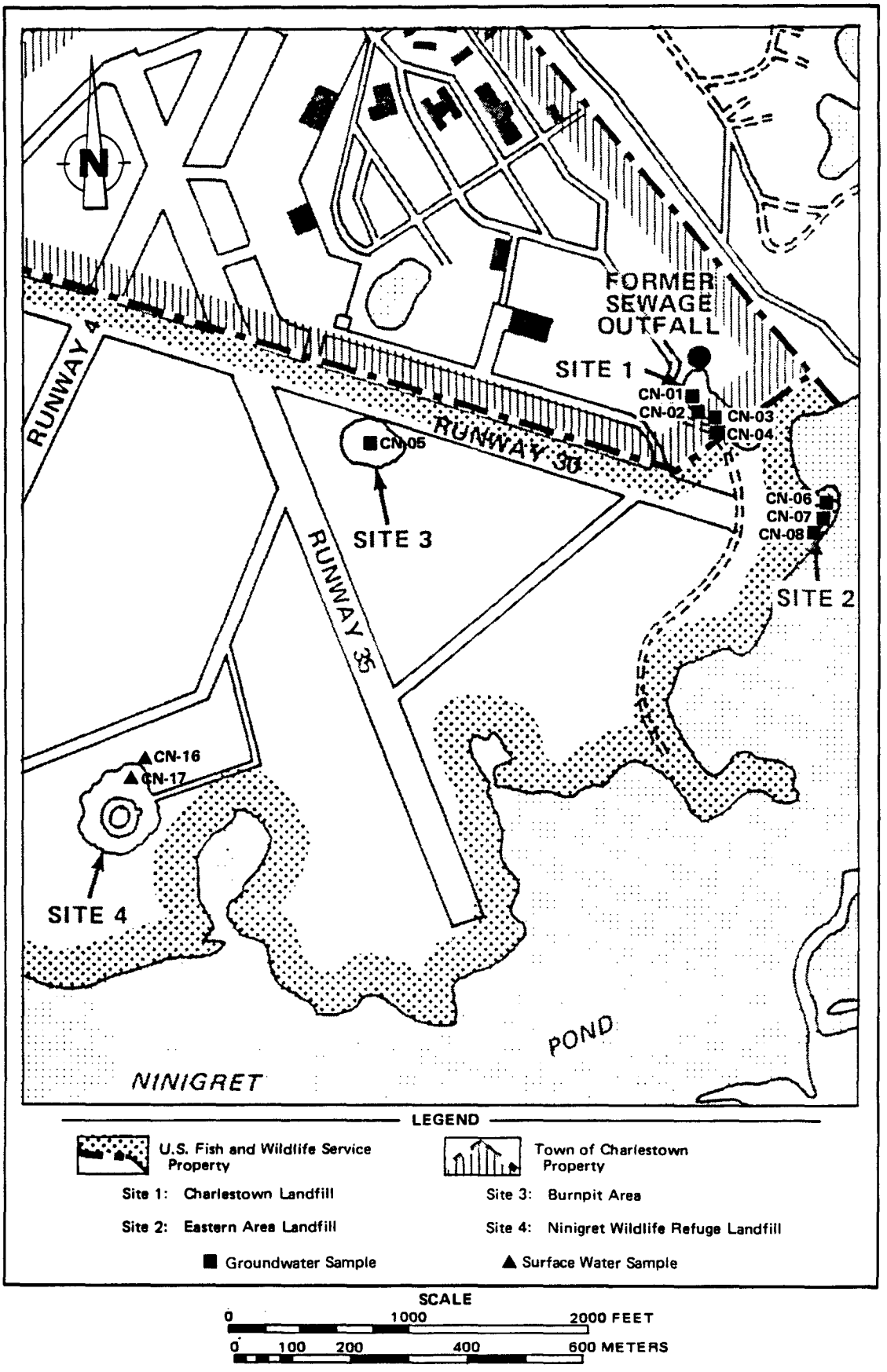


Figure 3–1 GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

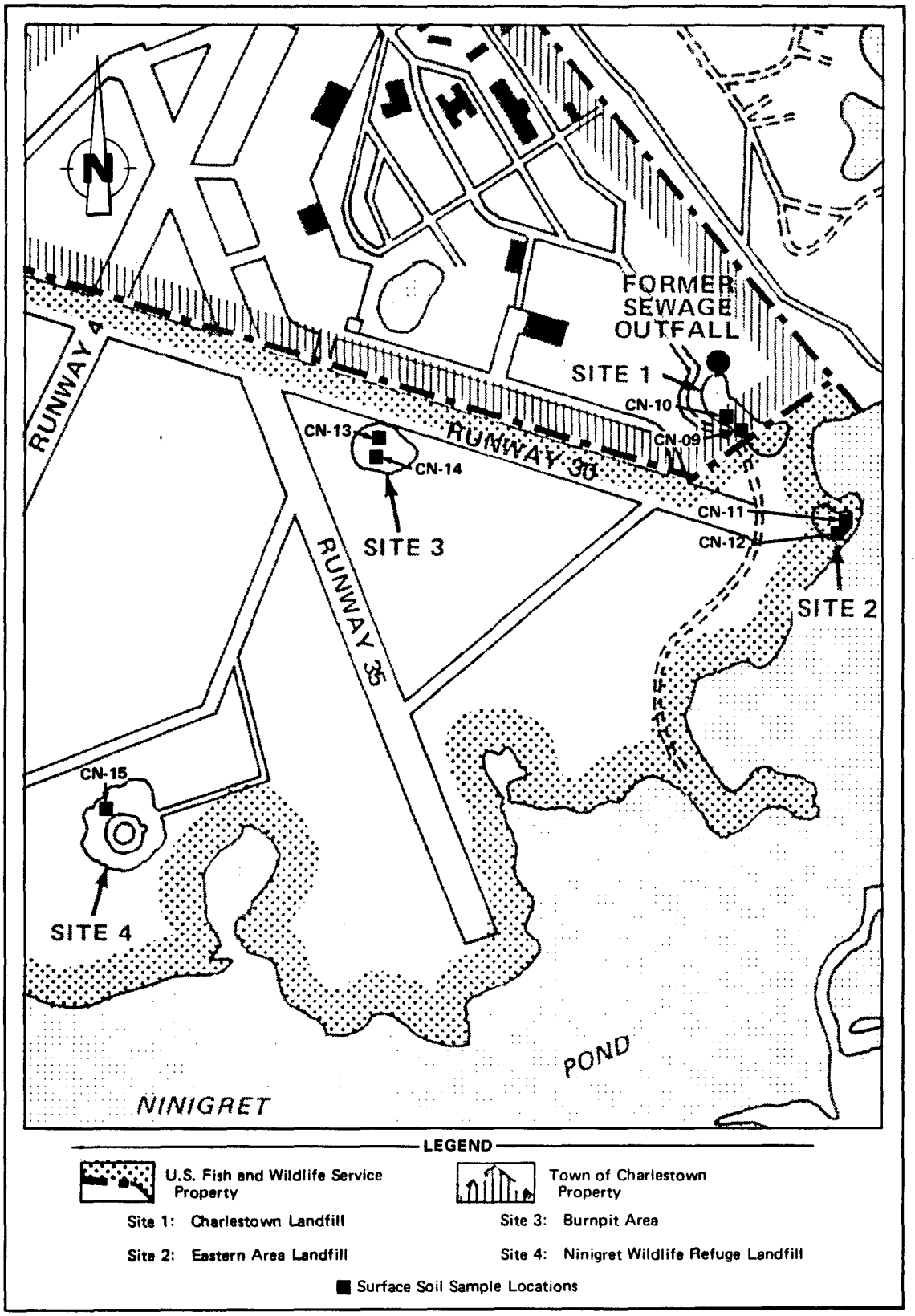


Figure 3–3 SURFACE SOIL SAMPLE LOCATIONS

One groundwater sample was collected from each of the eight wells. One of the wells at the Charlestown Landfill site (Site 1) was collected in triplicate for QA/QC purposes.

Two surface water samples were collected from the submerged marsh area near the Ninigret Wildlife Refuge disposal area (Site 4). As specified in the SOW, no QA/QC sample was collected for surface water.

Representative soil samples were collected and analyzed from areas presenting the greatest potential for contamination within the four sites. Four field samples and four QA/QC samples were taken from two locations at the Charlestown Landfill site. Additional soil sampling included two locations at the eastern area landfill, two locations at the burnpit area, and one location at the Ninigret Wildlife Refuge disposal area. Two samples were taken at each of the specified locations (see Table 3-2), one at an approximate depth of 6 inches below the surface and the other at 2 feet below the surface.

3.3.2 Sample Collection Methods

3.3.2.1 Air Investigation

The air investigation included:

- Surveying of sites for "hot spot" off-gassing;
- Identifying air releases; and
- Determining background contaminant levels.

A baseline volatile organic vapor survey was conducted on the site prior to any sampling effort to identify areas where potential air problems may exist.

Each site then was surveyed with an OVA and a combustible O_2/Explosimeter (MSA 260).

3.3.2.2 Surface Soil Sampling

Surface soil samples were collected at the locations shown on Figure 3-3 according to the procedures described below:

- Samples were collected at a depth of 6 inches and 24 inches using a stainless steel coring device;

- Using a stainless steel coring device, soil samples were collected from the ground surface;

- Each portion of the sample collected was then thoroughly mixed in a sample container using a stainless-steel tablespoon;

- The samples were then transferred to an 8-ounce wide-mouth glass container with a stainless-steel tablespoon until the sampling bottle was filled;

- Tools that were to be reused to collect a new sample (i.e., coring device), were decontaminated to avoid cross-contamination;

- Selected samples were screened in the field using an OVA; and

- All pertinent weather information such as air temperature, pressure, wind velocity, sky conditions, and precipitation were recorded.

3.3.2.3 Subsurface Soil Sampling

Subsurface sampling was conducted using a drill rig with a hollow stem auger. Continuous sampling was done using a 2-inch ID, 18-inch split-spoon advanced by conventional methods. This included attachment of the sampler to an AW rod and a standard 140- pound hammer. Blow counts were recorded at 6-inch intervals to a total sample depth of 18 inches. Upon completion of logging the lithology, the samples were stored in a clean 8-ounce jar.

All drilling and sampling equipment was decontaminated between uses. Where possible and appropriate, disposable equipment was used in order to minimize cross contamination.

3.3.2.4 Groundwater Sampling

Sampling of the newly installed monitoring wells consisted of the following three activities:

- Measurement of depth to static water level and total depth of the well (to calculate well volume);

- Evacuation of static water (purging); and

- Collection of the sample.

Measurement of static water level and well volume was performed as follows:

- Prior to sampling, the static water level and total depth of the well was measured with a calibrated weighted line. Care was taken to decontaminate equipment between each use to avoid cross contamination of wells;

- The number of linear feet of static water (difference between static water level and total depth of well) was calculated;

- The static volume was calculated using the following formula:

$$V = Tr^2(0.163)$$

where:

V = Static volume of well in gallons;

T = Depth of water in the well, measured in feet;

r = Inside radius of well casing in inches; and

0.163 = A constant conversion factor which compensates for r^2 h factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and (pi).

For purging static water, a minimum of five static water volumes were evacuated from the well prior to colleting the samples. Purging and sampling was performed using a teflon bailer.

Before and after each sample was taken, the apparatus was decontaminated (see Section 3.3.3). Sample collection procedures were as follows:

- A teflon bailer (decontaminated according to the procedures presented in this plan) was used to collect the groundwater samples;

- When transferring water from the bailer to sample containers, care was be taken to avoid agitating the sample, which promotes the loss of volatile constituents;

- Samples to be analyzed for dissolved metals were filtered in the field using a 0.45-micron filter. Total metal samples were not filtered. The samples were then preserved with nitric acid prior to shipment for analysis. Filtering equipment was decontaminated between samples to avoid cross contamination;

- Samples to be analyzed for petroleum hydrocarbons were preserved with hydrochloric acid prior to shipment;

- Any observable physical characteristics of the groundwater (e.g., color, sheen, odor, turbidity) during sampling were recorded; and

- Weather conditions at the time of sampling were recorded (e.g., air temperature, sky condition, recent heavy rainfall, drought conditions).

3.3.2.5 Surface Water Sampling

Surface water samples were collected according to the following procedures:

- A wide-mouth glass bottle used for sampling was dipped into the surface water to be sampled and rinsed three times, and the bottle was then dipped to collect the sample;

- The sample was collected in such a manner as to prevent agitation of the water, which promotes the loss of volatile organics and increases the dissolved oxygen content;

- The samples were transferred into 1/2-gallon glass bottles, 1-liter poly, and 40-ml VOA bottles. The wide-mouth bottle was refilled as many times as necessary to fill all required bottles;

- The temperature, pH, and specific conductivity of the water were measured at the time the sample was taken;

- Any observable physical characteristics of the water (e.g., color, odor, turbidity) as it is being sampled was recorded; and

- Weather conditions at the time of sampling were recorded, (e.g., air temperature, sky conditions, recent heavy rainfalls, and drought conditions).

3.3.3 Decontamination

Sampling methods and equipment were chosen to minimize the possibility of cross contamination. Any sampling equipment that was not readily decontaminated, such as sample tubing, rope, rods, etc., was disposed of after each sample was collected. Applicable sampling equipment used on more than one location was decontaminated between locations by following these steps:

- Steam clean (drilling equipment only);

- Scrub with brushes in trisodium phosphate (TSP) solution with a surfactant;

- Rinse with water;

- Rinse with acetone;

- Rinse with hexane;

- Rinse with acetone;

- Rinse with acedic acid; and
- Rinse with deionized water.

4. ANALYTICAL RESULTS

This section discusses analytical results and presents, in table form, summaries of the organic and inorganic data generated for the Charlestown NALF water and soil samples. Appendix E contains the comprehensive analytical reports including the associated quality control information. All references to sample numbers can be found in Table 3-2.

4.1 GROUNDWATER DATA

4.1.1 Organic Analysis of Groundwater

All accuracy and precision for the organic water laboratory quality control samples are within EPA Contract Lab Program (CLP) guidelines for percent recovery and relative percent difference. The field duplicate sample for the organic water analyses is within acceptable limits for precision for all parameters with the exception of acetone. The method blanks and travel and rinsate field blanks are also within acceptable limits, with the exception of methylene chloride detection within the travel blank, which was at 0.083 mg/L. Laboratory contamination is suspect for this unacceptable methylene chloride level within the travel blank.

Table 4-1 includes a summary of all the organic parameters detected in the Charlestown NALF water samples.

Methylene chloride was detected in monitoring well samples CN-07-0, CN-08-0 and the travel blank (CN-18-0) at 0.270, 0.730, and 0.083 mg/L, respectively. The travel blank is considered to be contaminated with methylene chloride. Acetone was detected within all of

Table 4-1

ORGANIC ANALYTICAL SUMMARY
CHARLESTOWN NALF WATER SAMPLES

	CHARLESTOWN PARKS & RECREATION						NINIGRET WILDLIFE REFUGE								
Site Location	01	01	01	01		01	03	02	02		02	04	04	Trip	Sample
Well Location	CN-01	CN-01	CN-02	CN-03		CN-04	CN-05	CN-06	CN-07		CN-08	Surface	Surface	Blank A	Rinsate B
Sample Number	CN-01-0	CN-01-D	CN-02-0	CN-03-0	Method Blank	CN-04-0	CN-05-0	CN-06-0	CN-07-0	Method Blank	CN-08-0	CN-16-0	CN-17-0	CN-18-0	CN-19-0
Parameter															
Purgeable Organics (mg/L)															
Acetone	0.035	0.017	0.043	1.80+	BML	2.70+	2.10+	1.70+	0.018	BML	0.012	BML	ND	BML	BML
trans- 1,2-dichloroethene	ND	ND	ND	ND	ND	ND	BML	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	0.270	ND	0.730	ND	ND	0.083	ND
Base/Neutral Extractables (mg/L)															
Di-n-butyl phthalate	BML	0.011	0.012	0.011	-	0.012	0.017	0.036	0.031	0.011	0.025	0.023	0.021	0.011	0.014
bis (2-ethylhexyl) phthalate	ND	ND	BML	ND	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl phthalate	ND	ND	ND	ND	-	ND	ND	0.048	BML	ND	0.011	ND	ND	ND	ND

A - Travel Blank
B - Rinsate Blank
BML - Below measurable limits
ND - Not Detected

NOTE: Samples CN-01-0 through CN-08-0 are groundwater samples.
Samples CN-16-0 and CN-17-0 are surface water samples.

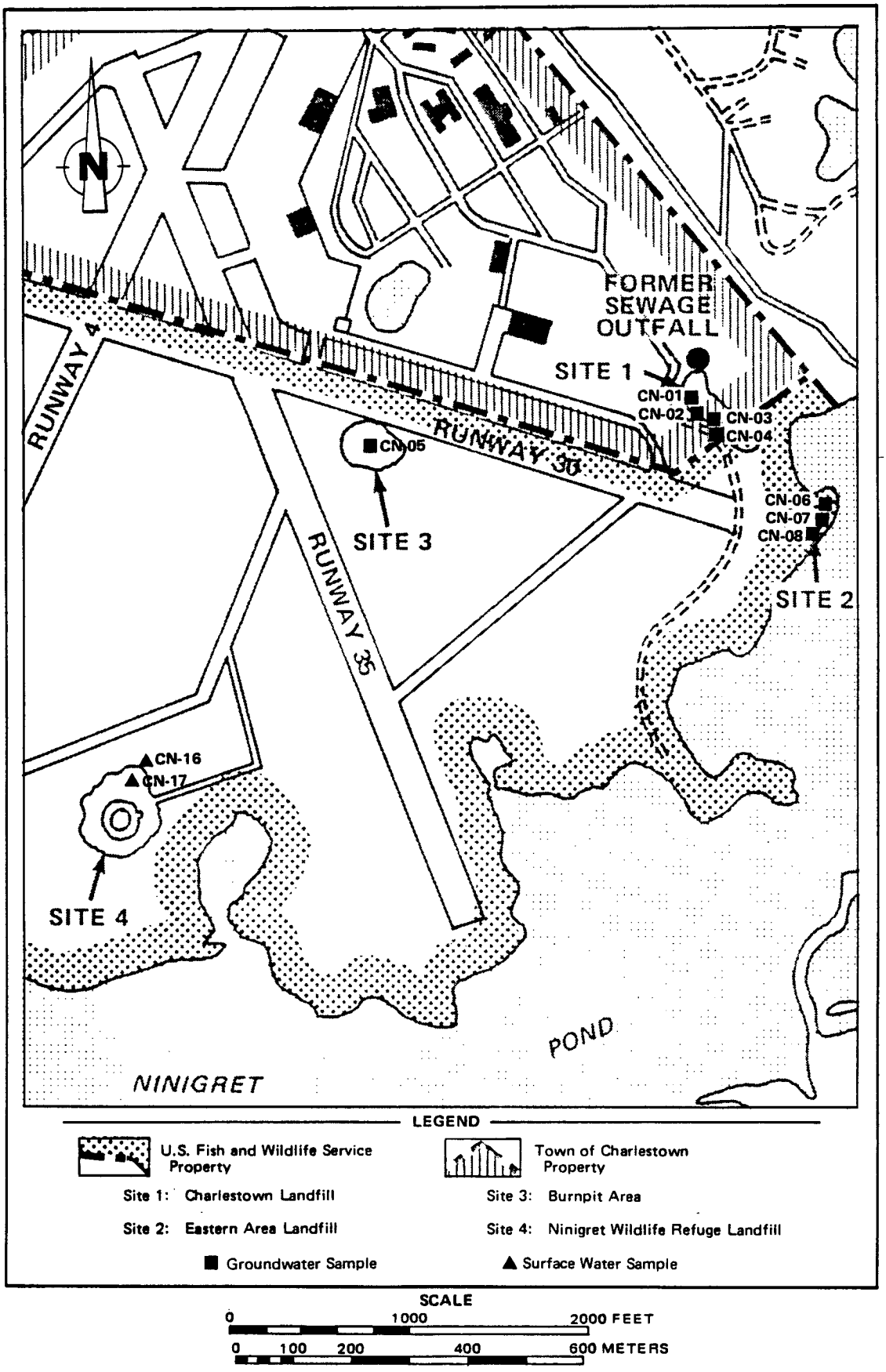


Figure 3–1 GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

the monitoring well samples ranging from 0.012 to 2.7+ mg/L. Amounts of acetone below measurable limits (BML) were found in the travel and rinsate blanks. Trans-1,2-dichloroethene was detected in well sample CN-05-0 but was below measurable limits.

Di-n-butyl phthalate was detected in all of the monitoring well samples ranging from BML amounts to 0.036 mg/L. Di-n-octyl phthalate was detected in well samples CN-06-0 and CN-08-0 at 0.048 and 0.011 mg/L, respectively. BML amounts of bis (2-ethylhexyl) phthalate and di-n-octyl phthalate were detected in samples CN-02-0 and CN-07-0.

No groundwater or surface water samples exhibited chemical contamination by acid extractable compounds, pesticides, or polychlorinated biphenyls (PCBs).

4.1.2 Inorganic Analysis of Groundwater

All accuracy and precision for the inorganic water laboratory quality control samples are within EPA CLP guideline limits for percent recovery and relative percent difference. Travel and rinsate field blanks were also within CLP limits. A few of the metals and the petroleum hydrocarbon run for the field duplicate were not within general precision guidelines. However, because all other quality control was within CLP limits, the inorganic data for the water samples are considered valid for contamination assessment purposes.

Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, and zinc were found to be present within the groundwater samples for total metals. Petroleum hydrocarbons were found to be present in six of the nine groundwater samples collected. Mercury, lead, and zinc were detected as dissolved metals. Petroleum hydrocarbon levels ranged from 1 to 36 mg/L in six out of the nine groundwater samples. Petroleum hydrocarbons are not natural constituents in water and should be <1 mg/L. Table 4-2 includes a summary of the inorganic parameters detected in the Charlestown NALF groundwater samples.

4.2 SURFACE WATER DATA

4.2.1 Organic Analysis of Surface Water

Acetone was detected BML in surface water sample CN-16-0. Acetone BML levels were also detected in the travel blank CN-18-0 and the rinsate blank CN-19-0. Surface water samples CN-16-0 and CN-17-0 were

Table 4-2

INORGANIC ANALYTICAL SUMMARY
CHARLESTOWN NALF WATER SAMPLES

	CHARLESTOWN PARKS & RECREATION					NINIGRET WILDLIFE REFUGE							
Site Location	01	01	01	01	01	03	02	02	02	04	04	Trip	Sample
Well Locations	CN-01	CN-01	CN-02	CN-03	CN-04	CN-05	CN-06	CN-07	CN-08	Surface	Surface	Blank	Rinsate
Sample Number	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-16-0	CN-17-0	CN-18-0	CN-19-0
Parameter													
Total Metals (mg/L)													
Antimony	ND	ND	0.107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	0.006	ND	ND	0.011	0.007	ND	ND
Beryllium	0.005	ND	0.014	ND	ND	ND	ND	ND	0.017	ND	ND	ND	ND
Cadmium	0.015	ND	0.022	ND	ND	ND	0.008	ND	0.040	0.007	ND	ND	ND
Chromium	0.071	ND	0.166	ND	ND	0.023	0.027	ND	0.154	0.037	0.019	ND	ND
Copper	0.096	0.024	0.206	0.073	0.019	0.091	0.054	0.024	0.292	0.108	0.044	ND	ND
Lead	0.086	0.046	0.128	0.040	0.019	0.112	0.035	0.005	0.208	0.170	0.084	ND	ND
Mercury	ND	0.0008	ND	0.0045	ND	0.0037	0.0007	ND	ND	0.0034	0.0007	ND	ND
Nickel	0.041	ND	0.057	0.021	0.019	0.021	ND	ND	0.067	ND	ND	ND	ND
Zinc	0.411	0.115	0.760	1.27	0.367	0.393	0.695	0.078	0.738	0.199	0.112	0.013	ND
Dissolved Metals (mg/L)													
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	ND	ND	ND
Mercury	ND	0.0006	ND	0.0003	ND	ND	ND	ND	ND	ND	0.0007	ND	ND
Zinc	0.016	0.037	0.036	1.34	0.377	0.317	0.912	0.048	0.057	0.169	0.107	ND	ND
Petroleum Hydrocarbons (mg/L)	15	36	1	ND	ND	3	1	ND	ND	ND	ND	ND	ND

A - Travel Blank
B - Rinsate Blank

ND - Not Detected

NOTE: Samples CN-01-0 through CN-08-0 are groundwater samples.
Samples CN-16-0 and CN-17-0 are surface water samples.

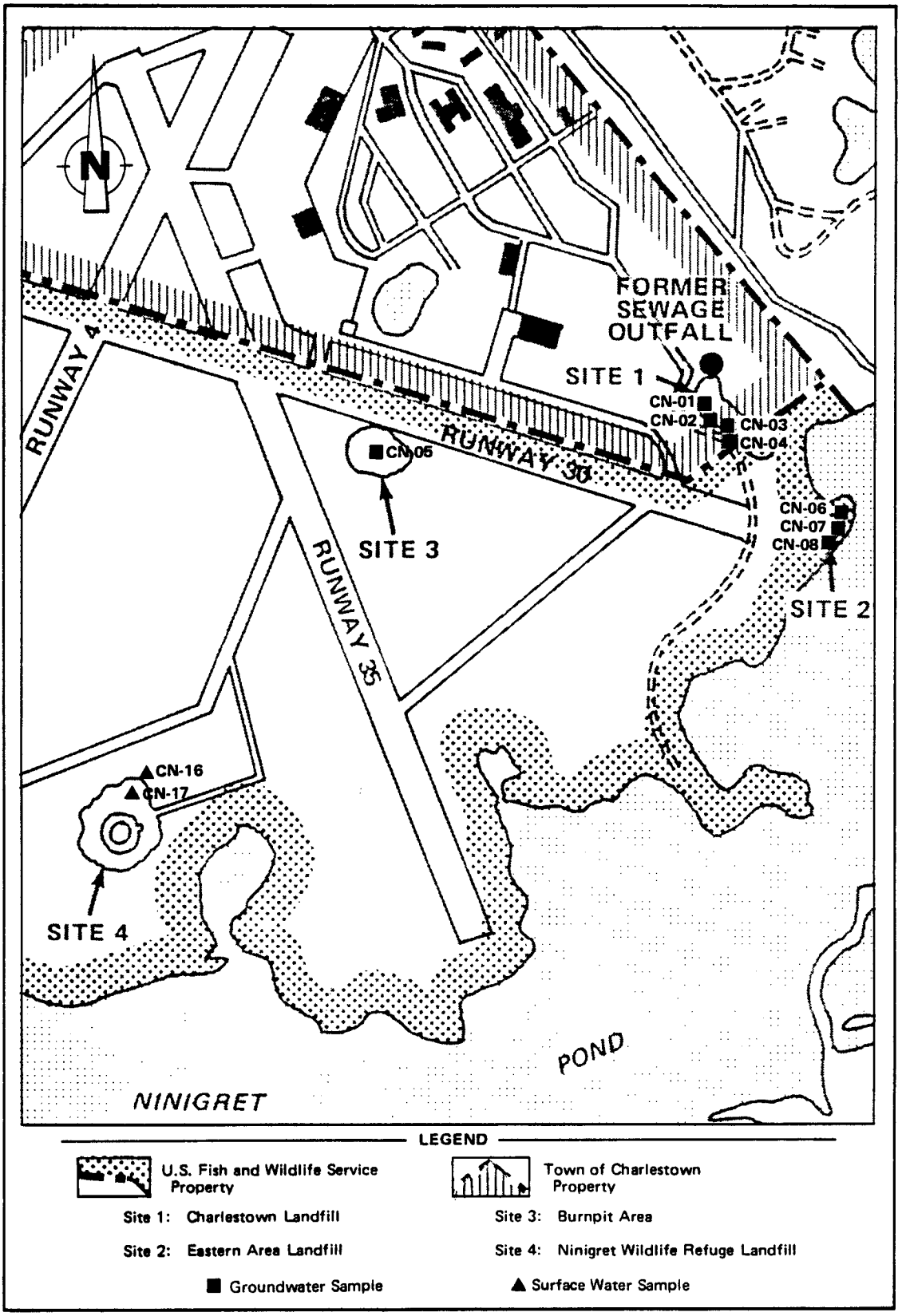


Figure 3–1 GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

found to contain 0.023 and 0.021 mg/L of di-n-butyl phthalate. The travel and rinsate blanks contained 0.011 and 0.014 mg/L of di-n-butyl phthalate. The di-n-butyl phthalate levels in the field blanks are considered to be within CLP limits. Table 4-1 includes a summary of the organic parameters for the surface water samples.

4.2.2 Inorganic Analysis of Surface Water

Arsenic, cadmium, chromium, copper, lead, mercury, and zinc were found to be present within the surface water samples for total metals. Surface water samples CN-16-0 contained lead and mercury levels which exceeded federal drinking water standards. Sample CN-17-0 contained a lead level higher than the drinking water standard. Dissolved metals for lead, mercury, and zinc were detected at very low levels. Petroleum hydrocarbon levels for surface water samples were found to be both <1 mg/L. Table 4-2 includes a summary of the inorganic parameters detected.

4.3 SOILS DATA

4.3.1 Organic Analysis of Soils

All accuracy and precision for the organic soils laboratory quality control samples are within CLP limits for percent recovery and relative percent difference. All field duplicates are within CLP limits for precision for the organic analyses of the Charlestown NALF soil samples. The method blanks are also within CLP limits with the exception of di-n-butyl phthalate and di-n-octyl phthalate for the base/neutral extractable test and methylene chloride within one of the method blanks for volatile organic analysis.

The di-n-butyl and di-n-octyl phthalates were detected in the method blank at 2.6 and 8.5 mg/kg, respectively. These compounds are laboratory contaminants; corrective action was implemented immediately, and the COE was contacted on January 16, 1987, regarding this contamination. The compounds were detected in all of the soil samples ranging from 1.5 to 4.3 mg/kg for the di-n-butyl phthalate and 2.6 to 21.0 for di-n-octyl phthalate. Therefore the data for phthalates should be considered suspect.

Soil sample CN-15-006 exhibited base/neutral extractable organic levels ranging from trace amounts to 1.1 mg/kg excluding di-n-butyl and di-n-octyl phthalates. Compounds detected included phenanthrene,

fluoranthene, pyrene, benzo (a) anthracene, bis (2-ethylhexyl) phthalate, crysene, benzo (b) fluoranthene, benzo (a) pyrene, indeno (1,2,3-cd) pyrene, and benzo (ghi) perylene. In addition, bis (2-ethylhexyl) phthalate was detected in samples CN-12-006, CN-13-024, CN-14-006, and CN-14-024 at levels ranging from 0.470 to 11.0 mg/kg.

Acid extractable organic compounds were not detected in any of the 16 soil samples for the Charlestown NALF site.

Pesticides were detected in 11 of the 16 soil samples. The compounds 4,4'-DDE and 4,4'-DDT were detected from BML to 0.204 mg/kg for 4,4'-DDE and from 0.017 to 0.240 mg/kg for 4,4'-DDT.

Methylene chloride, acetone, 2-butanone, and toluene were found to be present in the samples. Methylene chloride was detected in all the soil samples ranging from BML amounts to 0.06 mg/kg. Four of the 16 soil samples for methylene chloride were detected at levels above the method blank concentration of 0.026 mg/kg. Acetone was found in all the soil samples ranging from BML amounts to 0.063 mg/kg. Within 11 of the 16 soil samples, 2-butanone was detected ranging from trace amounts to 0.015 mg/kg and toluene was present in five of the 16 samples ranging from 0.083 to 0.023 mg/kg.

Table 4-3 includes a summary of all the organic parameters detected in the Charlestown NALF soil samples.

4.3.2 Inorganic Analysis of Soils

All accuracy and precision for the inorganic soils laboratory quality control samples are within CLP limits for percent recovery and relative percent difference.

All field duplicates are within CLP limits for precision for metals and percent solids data for the Charlestown NALF soil samples. Field duplicate samples for petroleum hydrocarbon analysis of the soils were not within general CLP precision guidelines. However, because of the nonhomogeneity of soil samples, the petroleum hydrocarbon analyses are considered valid for contamination assessment purposes.

Arsenic, cadmium, chromium, copper, lead, nickel, and zinc were found to be present within the soil samples. Petroleum hydrocarbons were found to be present in eight of the 16 soil samples. Table 4-4 includes a summary of the inorganic parameters detected in the Charlestown NALF soil samples.

Table 4-3

ORGANIC ANALYTICAL SUMMARY
CHARLESTOWN NALF SOIL SAMPLES

	CHARLESTOWN PARKS & RECREATION							NINIGRET WILDLIFE REFUGE										
Site Location	01	01	01	01	--	01	01	02	02	02	02	03	03	03	--	03	04	04
Sample Number	CN-09-006	CN-09-006 DUP	CN-09-024	CN-10-006	Method Blank	CN-10-024	CN-10-024 DUP	CN-11-06	CN-11-024	CN-12-006	CN-12-024	CN-13-006	CN-13-024	CN-14-006	Method Blank	CN-14-024	CN-15-006	CN-15-024
Parameter																		
Purgeable Organics (mg/kg)																		
Methylene Chloride	BML	BML	BML	BML	BML	0.018	0.015	BML	BML	BML	0.019	0.060	0.030	0.050	0.026	0.032	0.022	0.0064
Acetone	0.014	0.012	BML	BML	BML	BML	BML	0.019	0.063	0.046	BML	0.013	0.014	0.013	BML	0.043	0.012	BML
2-butanone	0.012	ND	0.014	0.011	0.011	0.012	BML	0.015	0.012	ND	ND	ND	0.011	0.011	BML	0.014	ND	0.010
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	0.015	0.019	0.083	ND	0.023	ND	ND	0.021	ND	ND
Base/Neutral Extractables (mg/kg)																		
Phenanthrene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.800	ND
di-n-butyl phthalate	3.40	2.90	3.30	4.30	--	3.00	3.50	2.20	2.40	2.10	2.60	2.10	2.10	1.90	2.60	3.10	2.60	1.50
fluoranthene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND
Pyrene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND
benzo(a)anthracene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.570	ND
bis(2-ethylhexyl) phthalate	ND	ND	ND	ND	--	ND	ND	ND	ND	0.470	ND	ND	0.500	11.0	ND	1.20	BML	ND
Chrysene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.730	ND
di-n-octyl phthalate	14.0	16.0	12.0	11.0	--	12.0	12.0	8.90	13.0	15.0	21.0	12.0	20.0	17.0	8.50	13.0	9.0	2.60
benzo(b)fluoranthene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.10	ND
benzo(a)pyrene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.630	ND
indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.470	ND
benzo(ghi)perylene	ND	ND	ND	ND	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.400	ND
Pesticides (mg/kg)																		
4,4'-DDE	BML	BML	BML	0.022	--	0.036	0.040	0.041	ND	0.204	BML	ND	ND	ND	--	ND	BML	ND
4,4'-DDT	0.031	0.025	0.020	0.017	--	0.044	0.053	0.080	ND	0.240	ND	ND	ND	ND	--	ND	0.075	0.017

ND - Not detected.
BML - Below measurable limits.
Note: Last 3 digits of sample number indicate depth at which the sample was collected (in inches).

Table 4-4

INORGANIC ANALYTICAL SUMMARY
CHARLESTOWN NALF SOIL SAMPLES

	CHARLESTOWN PARKS & RECREATION						NINIGRET WILDLIFE REFUGE									
Site Location	01	01	01	01	01	01	02	02	02	02	03	03	03	03	04	04
Sample Number	CN-09-006	CN-09-006 DUP	CN-09-024	CN-10-006	CN-10-024	CN-10-024 DUP	CN-11-006	CN-11-024	CN-12-006	CN-12-024	CN-13-006	CN-13-024	CN-14-006	CN-14-024	CN-15-006	CN-15-024
Parameter																
Metals (mg/kg)																
Arsenic	ND	ND	2.20	ND	ND	ND	0.55	0.73	1.03	ND	ND	1.50	ND	0.757	ND	ND
Cadmium	0.626	ND	3.83	ND	0.990	0.876	ND	ND	ND	ND	0.698	0.508	2.58	1.21	0.608	ND
Chromium	3.69	2.72	3.87	4.19	3.67	3.27	4.06	4.46	4.23	3.98	38.9	10.9	19.7	10.5	5.89	3.66
Copper	5.06	5.10	16.2	5.91	3.32	3.06	1.78	1.93	3.24	1.44	23.4	8.48	39.7	44.9	11.5	3.86
Lead	7.76	6.68	28.2	8.48	10.7	5.07	8.38	3.50	12.9	3.04	27.4	7.18	128	15.7	12.4	6.24
Nickel	1.48	1.92	2.97	3.03	2.71	ND	2.42	2.95	2.91	3.19	2.45	5.62	2.02	3.76	5.06	2.87
Zinc	20.5	21.1	62.3	25.6	17.0	14.9	14.6	16.3	35.0	12.0	34.3	30.7	53.2	45.2	32.9	16.5
Petroleum Hydrocarbons (mg/kg)	130	ND	3,300	ND	160	68	ND	ND	ND	ND	7,900	150	6,700	470	ND	ND
Solids (%)	92	94	93	93	94	92	80	86	79	88	95	81	94	85	90	91

ND - Not Detected
Note: Last 3 digits of the sample number indicate the depth at which the sample was collected (in inches).

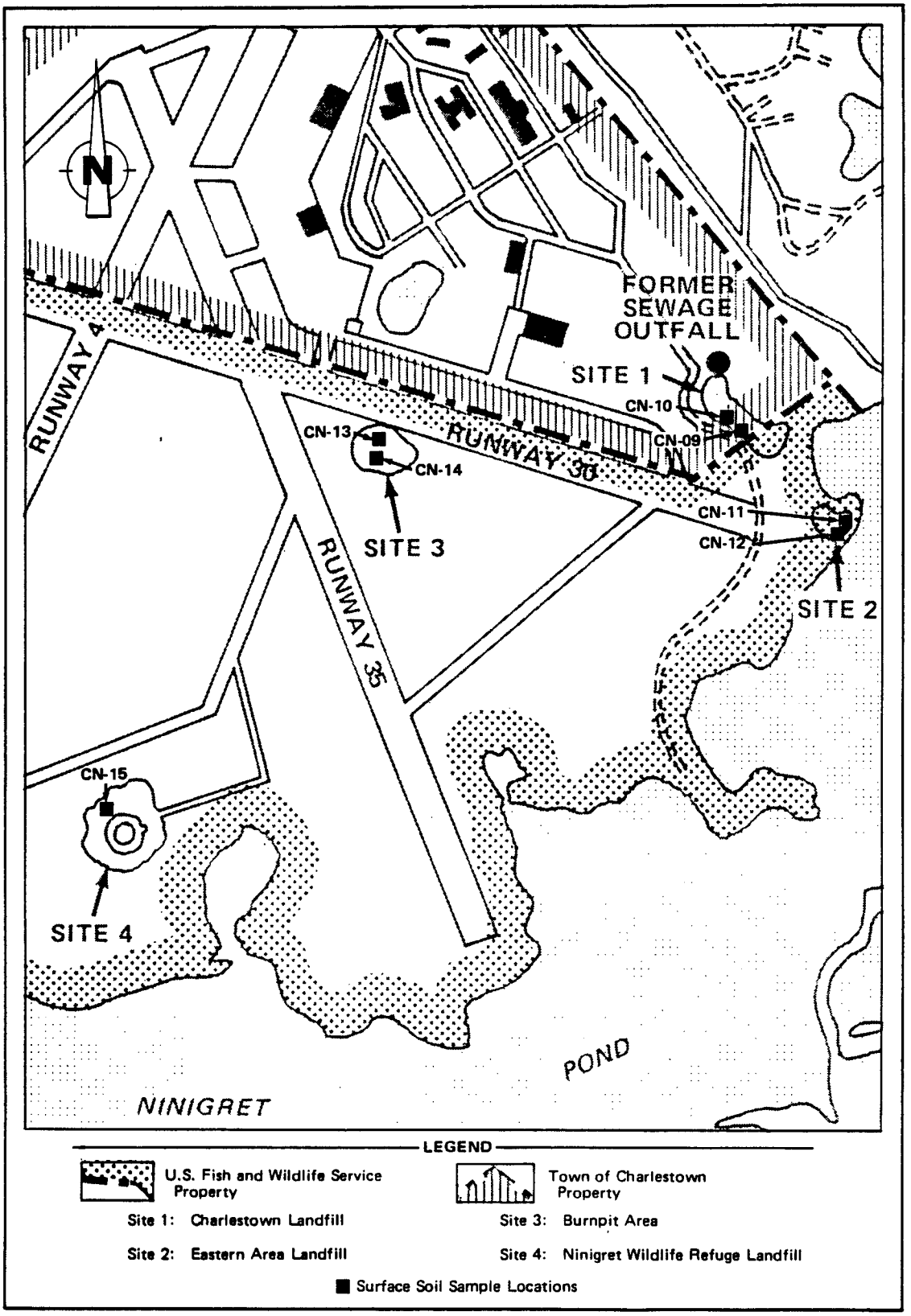


Figure 3–3 SURFACE SOIL SAMPLE LOCATIONS

Nine of the 16 were above the common range for cadmium in the soils. Seven out of 16 soil samples were above the common range for lead and two of 16 samples were above the common range for zinc in the soils (see Table 4-5).

Petroleum hydrocarbon levels ranged from 68 to 7,900 mg/kg for eight of the 16 soil samples. Three soil samples exhibited high petroleum hydrocarbon contamination with levels ranging from 3,300 to 7,900 mg/kg.

4.4 SUMMARY OF CHEMICAL CONTAMINATION

4.4.1 Introduction and Basis for Evaluation

In this section, the concentrations of contaminants found at the site are compared to applicable and relevant federal and state standards germane to current and future use of the site or groundwater transported off the site, natural background concentrations, and toxicological data (see Tables 4-5, 4-6, 4-7 and 4-8).

Specific procedures have been used for evaluating the soil, surface water, and groundwater analytical data. For soils, there are no mandatory standards or criteria applicable to the current uses of the site. Consequently, in the absence of local background samples, concentrations of metals which are natural soil constituents found in the samples were compared to concentrations reported as normal by the United States Geological Service for the coterminous United States (see Table 4-5).

In general, most organic chemicals reported in the soils are not natural soil constituents and therefore should not be attributed to background. Acceptions to this generalization include polycyclic aromatic hydrocarbons. In the absence of background data, it is assumed that all contamination not attributable to laboratory contamination should be considered to be related to site activities. Consequently, concentrations of these chemicals have been subjected directly to analysis of potential threat to humans or wildlife.

For the purposes of analyzing the potential human health risks, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number is extremely conservative (health protective) as it has been based on the soil intake for a small child--that segment of the population with highest soil intake

Table 4-5

INORGANIC CONSTITUENTS OF SOIL
FORMER CHARLESTOWN NALF

Parameter	Concentration Range (mg/kg)	Normal Range*
Arsenic	0.55-2.2	2.8-10.9
Cadmium	0.508-3.83	0.1-0.5
Chromium	2.72-38.9	19-90
Copper	1.44-44.9	10-43
Lead	3.04-1.28	9-31
Nickel	1.48-5.62	7-32
Zinc	12-62.3	31-98

*Shacklette, H. and J. Boerniger, 1984, Element Concentrations in Soils and Other Surficial Material of the Conterminous United States, USGS Professional Paper, 1270.

Table 4-6

ORGANIC CONSTITUENTS OF SOIL
FORMER CHARLESTOWN NALF

Parameter	Concentration Range (mg/kg)	Comments
PURGEABLE ORGANICS		
Methylene chloride	0.0064-0.06	1, 2
2-butanone	0.01-0.015	2
Toluene	0.0083-0.073	2
BASE/NEUTRAL EXTRACTABLES		
di-n-butyl phthalate	1.5-4.3	1, 2
bis(2-ethylhexyl) phthalate	BML - 11.0	1, 2
di-n-octyl phthalate	2.6-2.10	1, 2
Phenanthrene	0.8	2
Fluoranthene	1.0	2
Pyrene	1.0	2
Benzo(a)anthracene	0.57	2
Chrysene	0.73	2
Benzo(b)fluoranthene	1.1	2
Benzo(a)pyrene	0.63	2
Indeno(1,2,3-cd)pyrene	0.47	2
Benzo(ghi)perylene	0.40	2
PESTICIDES		
4,4-DDE	0.006-0.204	2
4,4-DDT	0.017-0.240	2
PETROLEUM HYDROCARBONS	68-7,900	2

[1]See Section 4.8 for discussion regarding these contaminants.
[2]Comparative standards unavailable. See Section 4.1 for discussion regarding these constituents.

Key

BML - Below Measurable Limits

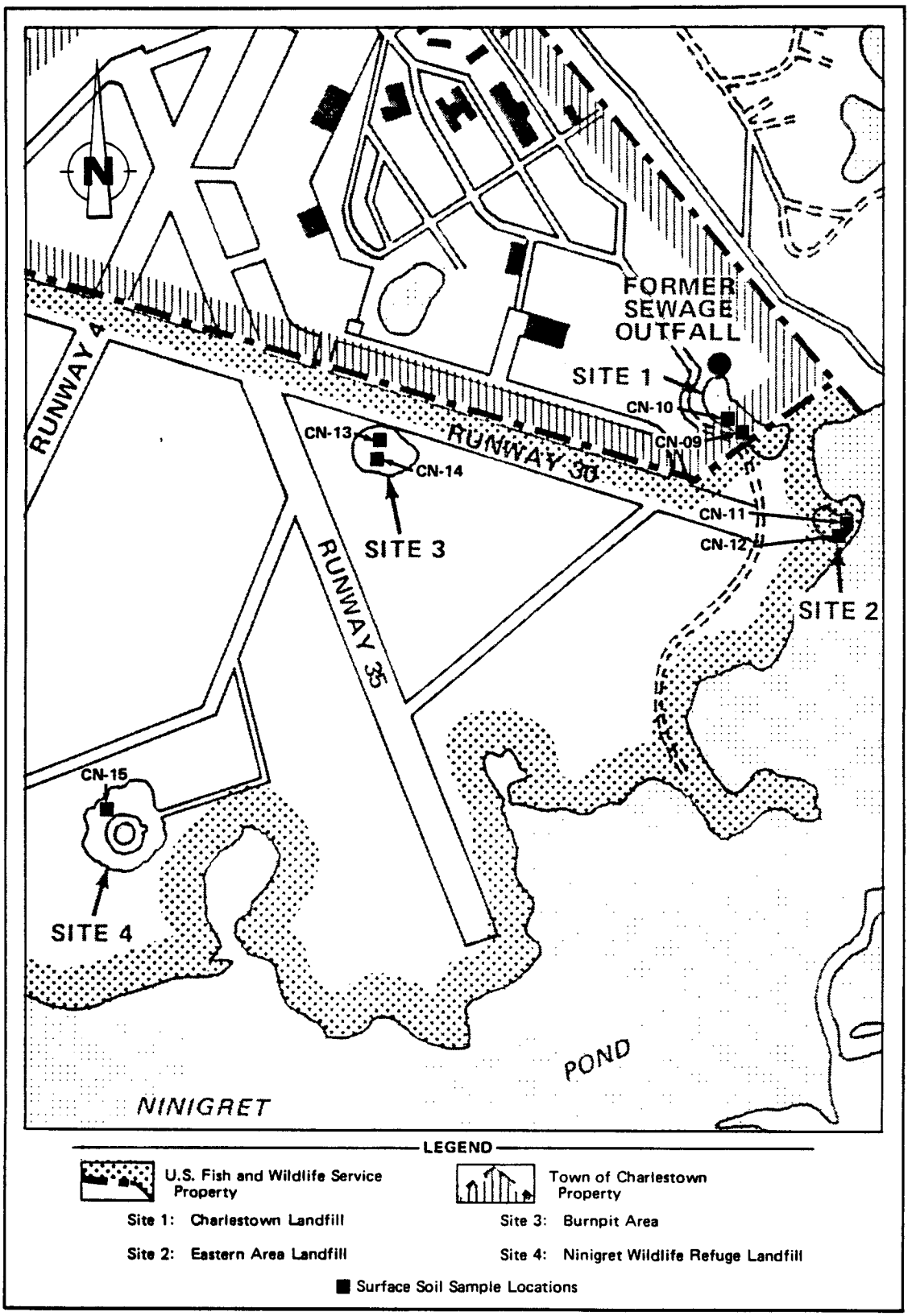


Figure 3–3 SURFACE SOIL SAMPLE LOCATIONS

Table 4-7

ORGANIC CONSTITUENTS OF WATER
FORMER CHARLESTOWN NALF

Parameters	Concentration Range (mg/L)	Drinking Water Standards and Advisories			
		EPA MCL[1]	EPA RMCL[1]	EPA HA[1,2]	Other Criteria
PURGEABLE ORGANICS					
Acetone	BML - 2.7	--	--	--	3
Methylene chloride	0.27-0.73	--	--	0.35	3, 4
BASE/NEUTRAL EXTRACTABLES					
di-n-butylphthalate	BML - 0.036	--	--	--	3, 4
di-n-octylphthalate	BML - 0.048	--	--	--	3, 4
Petroleum hydrocarbons	1 - 36	--	--	--	3

[1]EPA, 1985, National Primary Drinking Water Regulations, Synthetic Organic Chemical, Inorganic Chemicals and Microorganisms, Proposed Rule 50 FR 46935-47022, November 13, 1985.

[2]EPA, 1985, Health Advisories for 52 Chemicals Which Have Been Detected in Drinking Water, Office of Drinking Water, Environmental Protection Agency.

[3]Comparative standards unavailable. See Section 4.1 for discussion regarding these constituents.

[4]See Section 4.6 for discussion regarding these contaminants.

Key

BML - Below Measureable Limits
MCL - Maximum Concentration Limit
RMCL - Recommended Maximum Concentration Limit
HA - Health Advisory

Table 4-8

INORGANIC CONSTITUENTS OF WATER
FORMER CHARLESTOWN NALF

Parameters	Concentration Range (mg/L)	Drinking Water Standards and Advisories			
		EPA MCL[1]	EPA RMCL[1]	EPA HA[1,2]	Other Criteria
TOTAL METALS					
Antimony	0.107	--	--	--	0.146*
Arsenic	0.006-0.011	0.05	0.05(P)	0.05	--
Beryllium	0.005-0.017	--	--	--	--
Cadmium	0.007-0.040	0.010	0.05(P)	0.005	--
Chromium	0.019-0.166	0.050	0.050	0.050	--
Copper	0.019-0.292	--	1.3(P)	--	--
Lead	0.005-0.208	0.050	0.020(P)	0.02	--
Mercury	0.0007-0.0045	0.002	0.003(P)	0.003	--
Nickel	0.019-0.067	--	--	0.350	--
Zinc	0.078-1.27	--	--	--	5.0**
DISSOLVED METALS					
Lead	0.007	--	--	--	--
Mercury	0.0003-0.0007	--	--	--	--
Zinc	0.016-1.34	--	--	--	--
		--	--	--	--

[1]EPA, 1985, National Primary Drinking Water Regulations, Synthetic Organic Chemicals, Inorganic Chemicals and Microorganisms, Proposed Rule 50FR 46935-47022, November 13, 1985.
[2]EPA, 1985, Health Advisories for 52 Chemicals Which Have Been Detected in Drinking Water, Office of Drinking Water, Environmental Protection Agency.
*EPA, 1980, Water Quality Criteria Documents, Availability, 45FR 79318-79379, November 24, 1980.
**WHO, 1984, Guidelines for Drinking Water Quality, World Health Organization.

Key

(P) = Proposed
MCL = Maximum Concentration Limit
RMCL = Recommended Maximum Concentration Limit
HA = Health Advisory

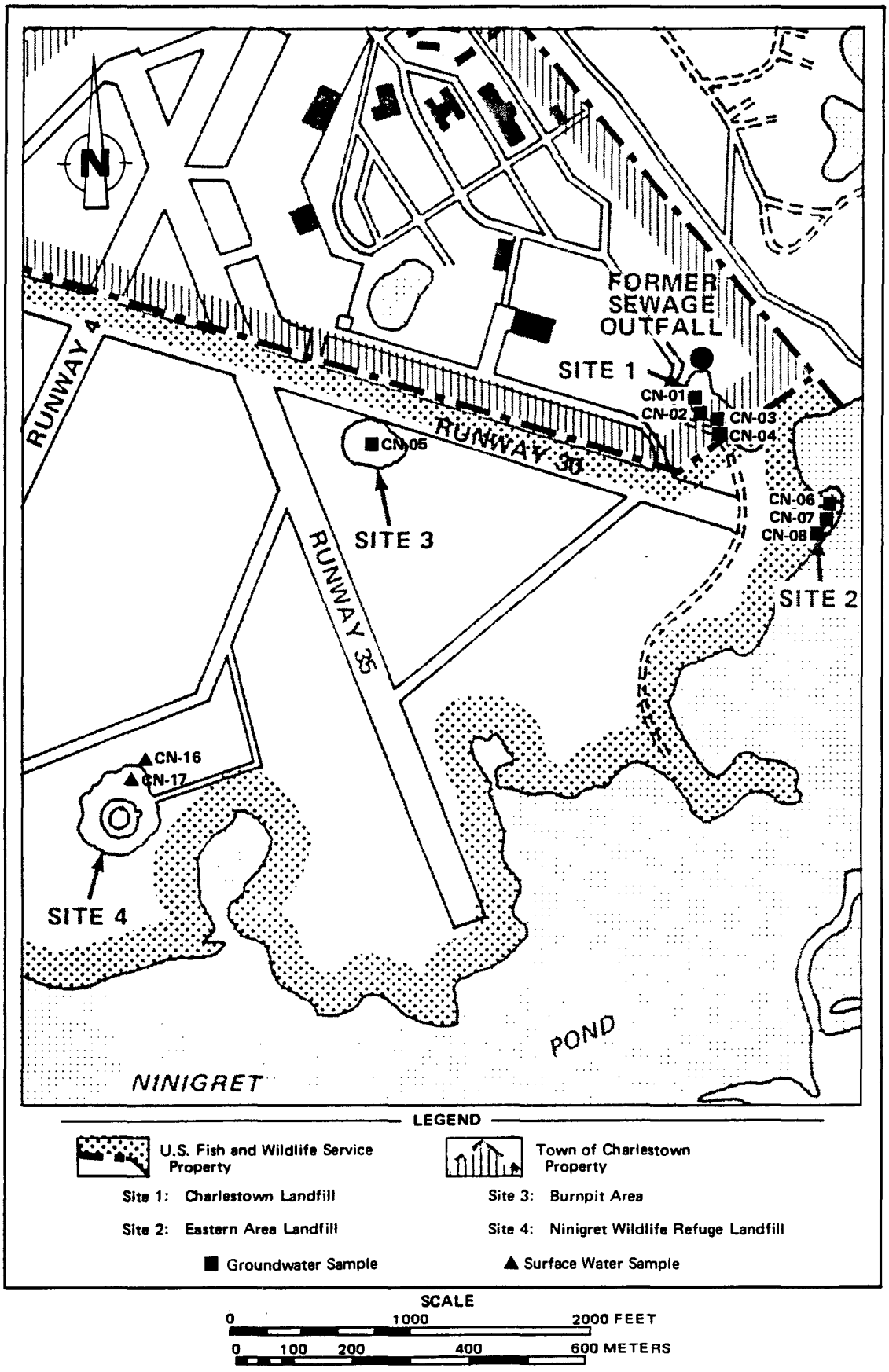


Figure 3–1 GROUNDWATER AND SURFACE WATER SAMPLE LOCATIONS

as estimated by the Agency to Toxic Substances and Disease Registry (ATSDR, 1986). This estimate is based on the segment of the population with highest daily soil intake assuming use of the site for residential purposes. Assuming 100% absorption of soil contaminants in 1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to daily intakes of constituents currently regarded as acceptable to EPA as demonstrated by their use in development of drinking water standards or criteria.

For constituents in groundwater, the principal concern is the potential adverse health hazard related to human consumption at the nearest drinking water wells. As a first step in the analysis, we have therefore compared the concentrations found to EPA drinking water standards and criteria [Recommended Maximum Contamination Limits (RMCLs), Maximum Contamination Limits (MCLs), or lifetime health advisories]. These standards and criteria were selected for use in this document because they represent mandatory drinking water limits or criteria for protection of human health developed under EPA peer-review procedures. If concentrations of contaminations at the NALF exceed these standards or criteria, we have proceeded to divide these concentrations by a dilution/attenuation factor to permit inclusion of transport-related reduction of concentrations from groundwater sampling wells to nearest drinking water wells used for human consumption. The nearest of these wells are 500 feet upgradient to groundwater flow from the sampling wells. A dilution/attenuation factor of 100 was selected as a divisor for the reported well sample concentration to reflect the fact that any contamination would by necessity have to flow at least 500 feet counter to the natural groundwater flow. As the aquifer is characterized by the high permeability and high rate of recharge for the aquifer, this number appears to be an underestimate of dilution/attenuation. Consequently, the use of a 100-fold factor permits can be regarded as a conservative (health-protective) assumption in evaluating the potential threat to human health.

4.4.2 Site 1

Groundwater

Two of the five groundwater samples (CN-03-0 and CN-04-0) exhibited elevated levels of acetone (1.8 and 2.7 mg/L).

There are no relevant federal or state standards or criteria for acetone, a chemical currently regarded as having a low chronic toxicity to man (EPA 1984). Applying the 100-fold dilution factor to the highest concentration measured, 2.7 mg/L, indicates that concentrations at drinking wells would not exceed 0.027 mg/L, significantly below a concentration currently regarded as toxic to man.

Di-n-butyl phthalate (DBP) was detected in three groundwater samples (CN-01-D, CN-02-0, CN-03-0) at levels ranging from 0.011 to 0.012 mg/L. These values are within 10% to 20% of the concentration levels detected in sample blanks; therefore, they are probably the result of laboratory contamination and not DOD site activities.

At least one of four metals (cadmium, chromium, lead, mercury) was detected in three of the five groundwater samples (CN-01-0, CN-02-0 and CN-03-0) above EPA drinking water standards. Cadmium was detected in two samples (0.015, 0.022 mg/L) above the 0.01 mg/L standard; chromium was detected in two samples (0.071 and 0.166 mg/L) above the 0.05 mg/L standard. Lead was detected in two samples (0.086, 0.128 mg/L) above the 0.05 mg/L standard. Mercury was detected in one sample (0.0045 mg/L) above the 0.002 mg/L standard. However, application of the 100-fold factor to reflect dilution/attenuation from the sampling sites to the drinking water wells to the highest concentrations of each of these metals, indicates that the standards will not be exceeded at the drinking water wells.

Petroleum hydrocarbons were detected in three groundwater samples (CN-01-0, CN-01-D and CN-02-0) at levels ranging from 1 to 36 mg/L. Standards do not exist for petroleum hydrocarbons in water. Petroleum hydrocarbons are not natural constituents of groundwater and would present unpleasant taste and odor over 1 mg/L. Applying the 100-fold dilution factor results in concentrations no greater than 0.36 mg/L in drinking water wells. This may result in unpalatable water at these wells.

Soils

Di-n-butyl phthalate (DBP) and di-n-octyl phthalate (DOP) were detected in all six soil samples in concentrations ranging from 2.9 to 4.3 mg/kg and 11 to 16 mg/kg, respectively. Phthalates are a common laboratory contaminant, reported in both laboratory and field blanks.

DBP was reported in a single blank for soils at 2.6 mg/kg and DOP at 8.5 mg/kg. Consequently, it is reasonable to conclude that the DBP and DOP concentrations in soils are not attributable to DOD activities.

Methylene chloride, another common laboratory contaminant was reported in two soil samples at 0.018 and 0.015 mg/kg. These results fall within the range of the method blank (0.026 mg/kg), therefore, methylene chloride concentrations are not attributable to DOD activities.

2-Butanone was reported in 4 of 6 soil samples at concentrations ranging from 0.011 to 0.014 mg/kg. These values fall within the range of the method blank (0.011 mg/kg), therefore, these concentrations are not attributed to DOD activities.

Acetone was reported in two soil samples at very low values (0.012 and 0.014 mg/kg). Using 1 gram soil intake, concentrations ingested would fall considerably below levels presenting a health hazard to humans.

Concentrations of most metals analyzed in the four soil samples fall within the normal ranges. The exception is cadmium for which four samples ranging from 0.6 to 3.8 mg/kg exceed the normal range. Again using the 1 gram soil intake assumption, intakes would not exceed intake levels which would be permitted under EPA drinking water standards. Consequently, cadmium soil concentrations do not appear to represent significant threat to humans.

Petroleum hydrocarbons were reported in four soil samples in concentrations ranging from 0.068 to 3.3 mg/kg. No standards exist for petroleum hydrocarbons in soils. The levels detected would be considered high for soils and may contribute to petroleum hydrocarbons in groundwater. As the site is used for recreational purposes, these contaminated soils should be removed to prevent direct contact.

4.4.3 Site 2

Groundwater

DBP and DOP (phthalates) were reported in low concentrations in site groundwater samples CN-06-0, CN-07-0 and CN-08-0. As phthalates are common laboratory contaminants and the concentrations fall within

the range of the laboratory blank, these concentrations are considered related to laboratory analysis and not DOD site activities.

Acetone was reported in all these groundwater samples in concentrations ranging from 0.012 to 1.7 mg/L. There are no EPA drinking water standards or criteria for acetone. However, application of the 100-fold dilution/attenuation factor would indicate concentrations would not exceed 0.017 mg/L, which is significantly below drinking water concentrations considered to have been toxic to man (EPA, 1984).

Methylene chloride, a common laboratory solvent, was reported in two of the three site 2 groundwater samples at concentrations of 0.27 mg/L and 0.73 mg/L. Application of the 100-fold dilution factor to the highest value indicates that drinking water concentrations would not exceed 0.0073 mg/L, significantly below the EPA lifetime health advisory of 0.35 mg/L.

Concentrations of three metals-cadmium (0.04 mg/L), chromium (0.154 mg/L) and lead (0.208 mg/L) in a single of the three site 2 groundwater sample exceeded the EPA drinking water standards of 0.01, 0.05 and 0.05 mg/L, respectively. Application of the 100-fold dilution/attenuation factor, however, indicates that the concentrations in drinking water wells would not exceed standards.

Petroleum hydrocarbons were detected at a concentration of 1 mg/L in one of three groundwater samples. No standards exist for maximum levels of petroleum hydrocarbons in groundwater. Dilution by the 100-fold factor, however, would result in concentration of 0.01 mg/L, which would probably fall below current concentrations for odor and taste.

Soils

Methylene chloride was detected at a level of 0.019 mg/kg for soil sample CN-12-024. Below the method blank concentration of 0.026 mg/kg and is therefore not a significant value. Acetone was detected at concentration ranging from 0.019 to 0.063 mg/kg in soil samples CN-11-06, CN-11-024, and CN-12-006.

2-butanone was detected in two soil samples at concentrations of 0.012 and 0.015 mg/kg. Again using the 1 gram soil intake, intake of 2-butanone would fall below EPA criteria and these site soils would not be regarded as posing a significant risk to humans.

Toluene was detected in concentrations of 0.083 mg/kg for soil sample CN-12-006, 0.015 ug/kg for soil sample CN-11-024, and 0.019 mg/kg for soil sample CN-12-006. Again assuming 1 gram of soil intake, these concentrations would not be a significant concern to human health.

Phthalates were detected in all soil samples in the range of the method blanks, indicating these concentrations are due to laboratory contamination and not DOD activities.

The pesticide compounds 4,4'-DDE and 4,4'DDT were detected in all 4 site soil samples ranging from BML amounts to 0.204 mg/kg for 4,4'-DDE, and from not detected to 0.240 mg/kg for 4,4'DDT. There are no standards or criteria for maximum acceptable levels of DDT or DDE in soil. The levels detected are considered to be low.

4.4.4 Site 3

Groundwater

Acetone was detected in monitoring well CN-05 at a concentration of 2.1 mg/L. Amounts of acetone below measurable limits (BML) were found in the travel and rinsate blanks. Application of the 100-fold dilution/attenuation, however, indicates that acetone would not be a significant human health risk at drinking water levels.

Lead was detected in the single site 3 monitoring well sample at a concentration (0.112 mg/L) above the EPA drinking water standard (0.05 mg/L). Mercury was also detected (0.037 mg/L) above the EPA standard (0.002 mg/L). Application of the 100-fold dilution/attenuation, however, would result in concentrations in drinking wells below the standards.

Petroleum hydrocarbons were detected in the groundwater sample at a concentration of 3 mg/L. Application of the 100-fold factor, would result in concentration levels considered to pose odor/taste concerns.

Soil

Acetone was detected at concentrations ranging from 0.013 to 0.043 mg/kg in site 3 soils samples. Assuming 1 gram of soil per day these concentrations would not result in material human health risk.

Elevated concentrations of 2-butanone was reported in all soil samples at Site 3 with concentrations ranging from 0.011 to 0.014 mg/kg.

Toluene was detected in concentrations of 23 ug/kg for soil sample CN-13-024 and 21 ug/kg for soil sample CN-14-024. Again assuming 1 gram soil intake, human intakes would fall below intakes permitted under EPA criteria.

Methylene chloride was detected for all soil samples at concentrations in Site 3 falling in the range of the method blank. Consequently these concentrations have not been attributed to DOD activities.

Phthalates were also detected in soil samples from Site 3 within the range of method blanks indicating probable laboratory contamination.

4.4.5 Site 4

Surface Water

The presence of di-n-butyl phthalate was detected in samples CN-16-0 and CN-17-0 at 0.023 and 0.021 mg/L respectively. These concentrations are above 10% to 20% of the sample blank levels and indicate phthalate contamination is due to laboratory contamination and not DOD activities.

Lead and mercury were detected at levels above the FDWS for samples CN-16-0 and CN-17-0. Lead was detected at levels of 0.84 mg/L to 0.170 mg/L. The FDWS for lead is 0.05 mg/L. Mercury was detected at a concentration of 0.0034 mg/L for sample CN-16-0. The FDWS for mercury is 0.002 mg/L.

Background drinking water data for nearby wells, obtained from the Rhode Island Department of Public Health, indicate low or no levels of these metals above dilution limits. Therefore, detected levels from the site are above background and thus clearly above FDWS.

Soils

Methylene chloride was detected at levels within 10% to 20% of method blanks and are therefore attributable to laboratory analysis and not DOD activities. Using the same reasoning as used in previous sectors, 1 gram of soil intake indicates that the concentrations of

acetone (0.012 mg/kg) and 2-butanone (0.01 mg/kg) would not pose a significant risk to humans.

A number of base/neutral extractable compounds were detected in both soil samples. Laboratory contamination is suspected for phthalate detection and therefore is not considered representative of soil condition encountered during sample collection. Other compounds detected range in value from 0.4 mg/kg to 1.1 mg/kg. These include phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)flouranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and benzo(ghi)perylene.

Assuming 1 gram per day intake, these fall within concentrations in American diet, and are not considered to represent a significant incremental risk .

DDT was reported in two samples at concentrations of 0.017 and 0.075 mg/kg. There are no standards or criteria for DDT in soils.

Of the metals, only cadmium exceeded normal concentrations in the soil. Assuming 1 gram soil intake, this concentration, however, would not exceed EPA intake criteria used in the development of drinking water standards.

4.5 QA/QC FOR MEASUREMENT DATA

All measurements were made to ensure that analytical results were representative of the media and conditions measured. All data was calculated and reported in units consistent with other organizations reporting similar data to allow comparability of data bases among organizations. Data was reported in ug/L and mg/L for aqueous samples and ug/kg and mg/kg for soils.

The characteristics of major importance for the assessment of generated data are accuracy, precision, completeness, representativeness, and comparability.

4.5.1 Accuracy

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system. Accuracy determination for this project was accomplished through a systematic analysis of Standard Reference Materials (SRMs) for calibration and spiking solutions.

Obtained values were compared to "true" values using accepted statistical techniques to provide continuing verification of analytical accuracy.

$$\text{Recovery}_{(\text{spike})} = 100 \times \frac{(\text{concentration spike + sample}) - \text{sample}}{\text{concentration spike}}$$

$$\text{Recovery}_{(\text{standard})} = 100 \times \frac{\text{observed value}}{\text{true value}}$$

4.5.2 Precision

Precision is the degree of mutual agreement among individual measurements of a given parameter. Precision determination was accomplished through regular analysis of duplicate or replicate samples. Relative Percent Difference (RPD) was calculated for all duplicates and replicates analyzed. RPD is a measure of the difference between two samples assumed to be identical through dividing (splitting) an original sample, analyzing each portion, identifying the values of the first replicate (X_1) and that of the second replicate (X_2), and dividing the difference by the mean (X) of x_1 and x_2.

$$RPD = 100 \frac{x_1 - x_2}{X}$$

EPA has established acceptable RPDs for many of the parameters to be analyzed in this project. These were compared to obtained RPDs to provide a continuing verification of analytical precision. Generally, RPD limits for inorganic parameters include a limit of less than or equal to 20%.

4.5.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Ninety-five percent completeness was required for each analysis and as an overall project objective.

4.5.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Careful choice and use of appropriate methods ensured that samples were representative. This is relatively easy with water or air samples, since these components are homogeneously dispersed. In soil and sediment, contaminants are unlikely to be evenly distributed, and thus it was important for the sampler to exercise good judgment when removing a sample.

4.5.5 Comparability

Comparability expresses the confidence with which one data set can be compared to another.

4.6 GROUNDWATER DATA QA/QC

4.6.1 Organic Analysis of Groundwater

All accuracy and precision for the organic water laboratory quality control samples are within acceptable EPA Contract Lab Program (CLP) limits for percent recovery and relative percent difference. The field duplicate sample for the organic water analyses is within acceptable CLP limits for precision for all parameters with the exception of acetone. The method blanks and travel and rinsate field blanks are also within acceptable CLP limits, with the exception of methylene chloride detection within the travel blank, which was at 83 ug/L. Laboratory contamination is suspect for this unacceptable methylene chloride level within the travel blank.

4.6.2 Inorganic Analysis of Groundwater

All accuracy and precision for the inorganic water laboratory quality control samples are within acceptable CLP limits for percent recovery and relative percent difference. Travel and rinsate field blanks were also within acceptable CLP limits. A few of the metals and the petroleum hydrocarbon run for the field duplicate were not within general precision guidelines. However, because all other quality control was within acceptable CLP limits, the inorganic data

for the water samples are considered valid for contamination assessment purposes.

4.7 SURFACE WATER DATA QA/QC

4.7.1 Organic Analysis of Surface Water

All accuracy and precision for the organic surface water laboratory quality control samples were within acceptable CLP limits for percent recovery and relative percent difference. All field duplicates were within acceptable CLP limits for precision for the organic analysis of the surface water samples, with the exception of rinsate blank CN-19-0, which contained acetone below measurable limits. The di-n-butyl phthalate levels in the field blanks are considered to be within acceptable CLP limits.

4.7.2 Inorganic Analysis of Surface Water

All accuracy and precision for the inorganic water laboratory quality control samples are within acceptable CLP limits for percent recovery and relative percent difference. Travel and rinsate field blanks were also within acceptable CLP limits. A few of the metals and the petroleum hydrocarbon run for the field duplicate were not within general precision guidelines. However, because all other quality control was within acceptable CLP limits, the inorganic data for the water samples are considered valid for contamination assessment purposes.

4.8 SOILS DATA QA/QC

4.8.1 Organic Analysis of Soils

All accuracy and precision for the organic soils laboratory quality control samples are within acceptable CLP limits for percent recovery and relative percent difference. All field duplicates are within acceptable CLP limits for precision for the organic analyses of the Charlestown NALF soil samples. The method blanks are also within acceptable CLP limits with the exception of di-n-butyl phthalate and di-n-octyl phthalate for the base/neutral extractable test and methylene chloride within one of the method blanks for volatile organic analysis.

The di-n-butyl and di-n-octyl phthalates were detected in the method blank at 2,600 and 8,500 ug/kg, respectively. These compounds are laboratory contaminants; corrective action was implemented immediately, and the COE was contacted on January 16, 1987, regarding this contamination. The compounds were detected in all of the soil samples ranging from 1,500 to 4,300 ug/kg for the di-n-butyl phthalate and 2,600 to 21,000 for di-n-octyl phthalate.

4.8.2 Inorganic Analysis of Soils

All accuracy and precision for the inorganic soils laboratory quality control samples are within acceptable CLP limits for percent recovery and relative percent difference.

All field duplicates are within acceptable CLP limits for precision for metals and percent solids data for the Charlestown NALF soil samples. Field duplicate samples for petroleum hydrocarbon analysis of the soils were not within general precision guidelines. However, because of the nonhomogeneity of soil samples, the petroleum hydrocarbon analyses are considered valid for contamination assessment purposes.

5. CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations based upon the potential threat to humans and wildlife due to contamination at the former NALF site in Charlestown, Rhode Island. The conclusions and recommendations may need to be reevaluated when and if the State of Rhode Island establishes contaminant limits for groundwater. As these standards are established by the state on a case-by-case basis, they cannot be included in evaluations made in this report.

This section also compares the concentrations of contaminants found at each site to applicable and relevant federal and state standards germane to current and future use of the site or of groundwater transported off the site, natural background concentrations, and toxicological data. In addition, this section discusses whether contaminant concentrations reported are attributable to DOD activities, and recommendations are made regarding the potential risks that the contaminants may pose to humans or wildlife. Table 5-1 presents this summary in tabular form.

Specific procedures have been used for evaluating the soil, surface water, and groundwater analytical data. For soils, there are no mandatory standards or criteria applicable to the current uses of the site -- as a wildlife preserve, and as a park and recreational use area. Consequently, in the absence of local background samples, concentrations of metals which are natural soil constituents found in the samples were compared to concentrations reported as normal by the United States Geological Service for the coterminous United States. The objective of this comparison is to assess the degree to which the

Table 5-1

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS BY SITE

Site	Number of Samples	Medium	Parameters Exceeding Standards*	Probable Result of Former DOD Activities	Concentration Range	Recommendation
1 Charles-town Landfill	5	Groundwater (mg/L)	Acetone	Yes	0.017-2.7	Additional testing to determine extent, no immediate threat to human health.***
			Di-n-butyl phthalates	No	**	No action
			Petroleum hydrocarbons	Yes	ND-36	Additional testing to determine source and discuss remedial measures with DEM.
			Metals			
			Cadmium	Yes	0.015-0.022	No action***
			Chromium	Yes	ND-0.166	No action***
			Lead	Yes	0.035-0.128	No action***
			Mercury	Yes	0.0007-0.0045	No action***
	6	Soils (mg/kg)	Acetone	Yes	BML-0.014	No action
			Phthalates	No	**	No action
			Methylene chloride	No	**	No action
			2-butanone	No	ND-0.014	No action
			Petroleum hydrocarbons	Yes	ND-3,300	Additional testing to determine areal extent and discuss remedial measures with DEM
			4,4' DDE	Yes	BML-0.040	Additional testing to determine areal extent and concentrations, develop risk assessment
			4,4' DDT	Yes	0.017-0.053	Additional testing to determine areal extent and concentrations, develop risk assessment

See notes at end of table

Table 5-1 (Cont.)

Site	Number of Samples	Medium	Parameters Exceeding Standards*	Probable Result of Former DOD Activities	Concentration Range	Recommendation
			Metals			
			Cadmium	Yes	ND-3.83	No action
2 Eastern Area Landfill	3	Groundwater (mg/L)	Acetone	Yes	BML-1.7	Additional testing to determine extent and source. No immediate threat to human health.***
			Methylene chloride	No	**	No action
			Phthalates	No	**	No action
			Metals			
			Cadmium	Yes	ND-0.04	No action***
			Chromium	Yes	ND-0.154	No action***
			Lead	Yes	0.005-0.208	No action***
		Soils (mg/kg)	Acetone	Yes	BML-0.063	No action***
			Methylene chloride	No	**	No action
			2-butanone	Yes	ND-0.015	No action***
			Toluene	Yes	ND-0.083	No action***
			Phthalates	No	**	No action
			4,4' DDE	Yes	ND-0.204	Additional testing to determine areal extent and concentrations, develop risk assessment
			4,4' DDT	Yes	ND-0.24	Additional testing to determine areal extent and concentrations, develop risk assessment

See notes at end of table.

Table 5-1 (Cont.)

Site	Number of Samples	Medium	Parameters Exceeding Standards*	Probable Result of Former DOD Activities	Concentration Range	Recommendation
3 Burnpit Area	1	Groundwater	Acetone	Yes	2.10	Additional testing to determine extent and source. No immediate threat to human health.***
			Phthalates	No	**	No action
			Petroleum hydrocarbons	Yes	3	Additional testing to determine source, remove source, and discuss remediation measures with the DEM
			Metals			
			Lead	Yes	0.112	No action***
			Mercury	Yes	0.0037	No action***
	4	Soils	Acetone	Yes	0.013-0.043	No action
			Methylene chloride	No	**	No action
			2-butanone	Yes	ND-0.014	No action
			Toluene	Yes	ND-0.023	No action
			Phthalates	No	--	No action
			Petroleum hydrocarbons	Yes	150-7,900	Additional testing to determine areal extent, remove, and discuss remedial measures with DEM
			Metals			
			Cadmium	Yes	0.508-2.58	No action
			Copper	Yes	8.48-44.9	No action
			Lead	Yes	7.18-128	No action

See notes at end of table.

Table 5-1 (Cont.)

Site	Number of Samples	Medium	Parameters Exceeding Standards*	Probable Result of Former DOD Activities	Concentration Range	Recommendation
4 Ninigret Wildlife Refuge Landfill	2	Surface Water (mg/L)	Phthalates	ND	**	No action
			Metals			
			Lead	Yes	0.084-0.170	No action
			Mercury	Yes	0.0007-0.0034	No action
	2	Soils (mg/kg)	Methylum chloride	No	**	No action
			Acetone	Yes	BML-0.012	No action
			2-butanone	Yes	ND-0.010	No action
			Phthalates	No	**	No action
			PAHs	Possibly	ND-1.10	No action
			4,4' DDT	Yes	0.017-0.075	Additional testing to determine areal extent and concentration, develop risk assessment.

*See Tables 4-2, 4-4, 4-6 for applicable standards.
**Probable laboratory contamination.
***To be confirmed by Rhode Island Department of Environmental Management (DEM).

concentrations of natural metallic constituents in the soil greater than those that can occur naturally can be attributable to DOD activities. If the concentrations exceed the normal range, and they can be attributed to the former DOD use of the site, further analysis of the potential threat to humans and/or wildlife may be required.

In general, most organic chemicals reported in the soils are not natural soil constituents and therefore ought not to be attributed to background. Exceptions to this generalization include polycyclic aromatic hydrocarbons. Background drinking water data were obtained from the Rhode Island Department of Health for several nearby drinking water (groundwater) sources. The analytical data for these sources indicate very low levels or levels below detected limits for metals and purgeable organics (see Appendix G). It is therefore assumed that all contamination not attributable to laboratory contamination is related to former site activities. Consequently, concentrations of these chemicals have been subjected directly to analysis of potential threat to humans or wildlife.

For the purposes of analyzing the potential human health risks, it is assumed that humans ingest a maximum of 1 gram of soil daily during activities at the site. This number, determined by the Agency for Toxic Substances and Disease Registry (ATSDR 1986), is extremely conservative (health protective) as it has been based on the current soil intake for a small child--that segment of the population with the highest daily soil intake assuming use of the site for residential purposes. Assuming 100% absorption of soil contaminants in 1 gram of soil, these intakes attributable to ingestion of onsite soils are then compared to daily intake levels currently regarded as acceptable to EPA, as demonstrated by their use in development of drinking water standards or criteria.

The principal concern for constituents in groundwater is the potential adverse health hazard related to human consumption at the nearest drinking water wells. The analyses of these potential hazards involved two steps. First, the concentrations found at the NALF were compared to EPA drinking water standards and criteria [recommended Maximum Contamination Limits (RMCLs), Maximum Contamination Limits (MCLs), or lifetime health advisories]. These standards and criteria were selected for use in this document because they represent manda-

tory drinking water limits or criteria for protection of human health developed under EPA peer-review procedures. When concentrations of contaminants at the NALF were found to exceed these standards or criteria, these concentrations were then divided by a dilution/attenuation factor to permit inclusion of transport-related reduction of contaminant levels from groundwater sampling wells to the nearest drinking water wells used for human consumption. The closest well is 500 feet upgradient of groundwater flow from the sampling wells. One well is located at the Frosty Drew Nature Center and another at the Senior Citizens Center on the Charlestown Parks and Recreation Property. The nearest sites to these wells are Site 1 and Site 3. A dilution/attenuation factor of 100 was selected as a divisor for the reported well sample concentration to reflect the fact that any contamination would by necessity have to flow at least 500 feet counter to the natural groundwater flow. As the aquifer is characterized by high permeability and a high rate of recharge, this number appears to be an underestimation of dilution/attenuation. Consequently, the use of a 100-fold factor can be regarded as a conservative (health-protective) assumption in evaluating the potential threat to human health.

The laboratory testing revealed that groundwater samples from the site contained varying amounts of acetone, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Petroleum hydrocarbons were also found in six of the nine groundwater samples collected. Surface water samples collected on the site were found to contain acetone below measurable limits (BML) as well as varying amounts of arsenic, cadmium, chromium, copper, lead, mercury, and zinc.

Soil samples from the site were found to contain heavy metals, purgeable organics (methylene chloride, acetone, 2-butanone, toluene), pesticides, and petroleum hydrocarbons.

5.1 ANALYSIS BY SITE

Table 5-1 presents the site-specific contamination exceeding applicable standards for each medium, with a concentration range for each contaminant, probable source, and recommendations for further actions.

5.1.1 Site 1

Elevated levels of metals, acetone, and petroleum hydrocarbons were detected in the groundwater and soil at Site 1 (see Table 5-1). Soils also contained the pesticides 4,4' DDE and 4,4' DDT at low concentrations.

These contaminants are suspected to be a result of DOD-related activities at the site. Future efforts for Site 1 should focus on delineating the extent of contamination; collection of background samples to compare levels of naturally occurring metals; developing a risk assessment for contaminants lacking health and environmental standards or criteria; and negotiation with the state to set appropriate cleanup standards.

DDT and DDE contamination is a nationwide problem as a result of its wide application as a pesticide during the 1950s and 1960s. DDT and DDE are highly persistent and tend to accumulate through the food chain. The degree of DDT and DDE contamination may warrant further investigation to determine its areal extent and potential hazard to the environment.

As petroleum hydrocarbons do not occur naturally in groundwater and soil, petroleum hydrocarbon contamination at the site is suspected to be a result of former DOD activities. It is recommended that sources of petroleum hydrocarbons be identified and removed.

5.1.2 Site 2

Elevated levels of metals, acetone, and petroleum hydrocarbons were found in the groundwater at Site 2; metals, acetone, toluene, 4,4' DDE, and 4,4' DDT were detected in soils (see Table 5-1). These contaminants are suspected to be the result of former DOD-related activities at the site.

There are no specific values set as maximum acceptable levels for petroleum hydrocarbons in groundwater. A level at or above 1 mg/L is detectable by taste and odor and should be considered unacceptable.

There are no specific values set as maximum acceptable levels for toluene in soil; however, it is not a natural constituent. The toluene levels detected are considered low assuming ingestion of contaminated soil. Therefore it does not appear to be a hazard at the concentrations detected.

As mentioned previously, DDT and DDE contamination is a nationwide problem as a result of its widespread application as a pesticide. The degree of DDT and DDE contamination detected may warrant further investigation to determine its areal extent and potential hazard to the environment.

Future efforts for Site 2 should focus on the further investigation of the areal extent of acetone and DDT/DDE contamination; location of potential sources of petroleum hydrocarbons; collection of background samples to compare levels of naturally occurring metals; development of a risk assessment for contaminants lacking health and environmental standards or criteria; and discussion with the state to establish appropriate remedial measures.

5.1.3 Site 3

Elevated levels of metals, acetone, and petroleum hydrocarbons were detected in groundwater samples. Elevated levels of acetone, 2-butanone, toluene, metals, and petroleum hydrocarbons were detected in soil samples (see Table 5-1). These contaminants are suspected as resulting from former DOD-related activities at the site.

The levels of petroleum hydrocarbons in soil samples were significant (see Table 5-1). Petroleum hydrocarbons are not natural constituents of soils. At the levels detected, the contaminated soil may present a hazard and should have its areal extent delineated and removed.

Future efforts at Site 3 should focus on delineating the extent of contamination; the collection of background samples to compare levels of naturally occurring metals; development of a risk assessment for contaminants lacking health and environmental standards or criteria; and discussion with the state to set appropriate remedial measures.

5.1.4 Site 4

The surface water at Site 4 contained elevated levels of lead and mercury. The soil samples contained elevated levels of acetone, polynuclear aromatic hydrocarbons (PAHs), metals, 4,4' DDE, and 4,4' DDT (see Table 5-1). These contaminants are suspected to be the result of former DOD-related activities at the site.

Lead and mercury were detected at elevated levels that could be attributed to suspended solids (soil) in water samples containing normal concentrations of metals that would increase concentrations of metals in surface water. Background soil samples are necessary to properly characterize the natural (ambient) concentrations of metals in soils and surface water.

There are no specific values set as maximum acceptable levels for PAHs in soil. By assuming an ingestion of 1 gram of soil per day, the concentrations detected do not appear to present a significant health hazard.

Future efforts for Site 4 should focus on delineating the extent of contamination and collection of background soil samples to compare levels of naturally occurring metals, and develop a risk assessment for contaminants lacking health and environmental standards or criteria.

5.2 ANALYSIS BY CONTAMINANT

5.2.1 Metals

All nine groundwater samples and all four surface water samples analyzed for total metals contained at least one of the following metals--antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, and zinc. In addition, detectable levels of dissolved lead, mercury, or zinc were found in all nine groundwater samples. Comparison of the sample results with federal drinking water standards indicates that three of nine groundwater samples exceeded limits for federal drinking water standards; three of nine exceeded the chromium standard, four of nine exceeded the lead standards, and two of nine exceeded the mercury standard. However, application of a 100-fold factor to the highest concentrations of each of these metals in order to reflect dilution/attenuation from the sampling site to sites of drinking water wells indicates that the standards will not be exceeded at the nearest drinking water wells (which was upgradient).

Based on the available data, it is difficult to evaluate the surface water samples taken in the marsh on the wildlife preserve (Site 4). In the absence of background samples, it is not possible to evaluate whether the site activities or natural conditions are the source of metals reported in surface water. It is therefore recommended that

additional sampling of marsh surface water be performed with appropriate background samples prior to evaluation of such data for potential risks to wildlife.

Arsenic, cadmium, chromium, copper, lead, nickel, and zinc also were found in all 16 soil samples. Metals occur naturally in soils, and their natural concentration is influenced by the soil origin, transportation history, time of dispersion, climate, and environmental history. Table 4-8 shows the normal range of naturally occurring metals in soil. Specifically, nine of the 16 soil samples on sites 1, 3, and 4 exhibited cadmium levels above the 0.1 to 0.5 mg/kg normal range for cadmium in soils (Schaklette and Boerniger 1984). In one soil sample, lead was detected at a concentration of 128 mg/kg; above the normal range of 9 to 31 mg/kg for lead in soils (Schaklette and Boerniger 1984). Because these two metals are highly toxic to man and animals, the elevated concentrations warrant concern. Future efforts should focus on delineating the extent of contamination, collection of appropriate background soil samples for comparison of results, development of a risk assessment to evaluate quantitatively the potential risks to man and wildlife, development of numerical criteria for cleanup.

5.2.2 Purgeable Organics

Four purgeable organic compounds were found in samples from the NALF--acetone, methylene chloride, 2-butanone, and toluene. Acetone was detected in seven of nine groundwater samples at concentrations ranging from less than 0.005 mg/L, the quantitative limit of the analytical technique, to 2.7 mg/L. Acetone is a common cleaning agent and industrial solvent. A review of available information concerning the use of various chemicals at the former NALF indicated that acetone was not used extensively at the site; however, its general use as a solvent and as a parts cleaning agent may indicate that the presence of acetone in the groundwater could be a result of DOD activities.

There are no federal or state standards or criteria for acetone. A chemical currently regarded as having a low chronic toxicity to man (EPA 1984), acetone is not the subject of either drinking water standards or criteria. Applying the 100-fold dilution factor to the highest concentration measured, 2.7 mg/L, indicates that concentrations at

drinking wells would not exceed 0.027 mg/L, significantly below a concentration currently regarded as toxic to man.

Methylene chloride was detected in two groundwater samples taken from Site 2 in concentrations of 0.27 mg/L and 0.73 mg/L. It is important to note that this contamination was limited to only two groundwater samples taken from wells located in the same general area. Methylene chloride was also found in eight soil samples in concentrations ranging from 0.015 to 0.060 mg/kg. Methylene chloride, a common laboratory solvent, was identified and reported in a groundwater travel blank and in soil method blanks. Since methylene chloride is used in laboratory procedures for gas chromatography/mass spectrometer (GC/MS) analysis, it is strongly suspected as a laboratory-induced contaminant in some samples. However, since detected levels of methylene chloride in soil samples are above method blank values, it cannot be ruled out as a possible contaminant resulting from former DOD activities.

Two other purgeable organics -- 2-butanone and toluene -- were found in soils but not water samples. The concentrations were extremely low with highest concentrations not exceeding 0.025 mg/kg. Again, assuming ingestion of 1 gram of soil per day, no more than 0.25 micrograms per day would be absorbed daily. Using EPA health advisories for 2-butanone (0.86 mg/L) and toluene (10.1 mg/L), and using the EPA standard assumption of 2 liters of drinking water consumed per day per adult, 1.72 and 26.2 mg would be regarded as acceptable by EPA for human consumption. As these health advisories are based on animal data, intake of these two compounds at no more than one-thousandth acceptable daily intakes does not appear to pose a significant threat to man or animals.

5.2.3 Petroleum Hydrocarbons

Petroleum hydrocarbons were reported in five of 11 groundwater samples at concentrations ranging from 1 to 36 mg/L. The concentrations in soil range from 68 to 7,900 mg/kg in seven of 16 soil samples. Although no standards or criteria were found for these chemicals, these concentrations are very significant.

Lacking such standards or criteria, organoleptic (taste and odor) concerns are of major significance regarding petroleum hydrocarbons in

groundwater. For the petroleum hydrocarbon concentrations found in groundwater at the former Charlestown NALF site, dilution by the 100-fold factor would indicate that concentrations no greater than 0.36 mg/L would occur at drinking water wells; these concentrations may result in unpalatable water at drinking water wells.

Overall, petroleum hydrocarbons are not natural constituents of water or soils, and may present a hazard to human health and the environment in the concentrations detected. Consequently, cleanup of the contaminated soils would be appropriate, followed by discussion with the state for cleanup of groundwater.

5.2.4 Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) were reported in soils at levels ranging from 0.40 to 1.1 mg/kg; no PAHs were reported in either groundwater or surface water. Following the previous assumption of 1 gram of soil intake per day, concentrations would remain below estimated current human dietary intakes of PAHs (ADL 1982), indicating that the PAHs found in soils on the former NALF do not represent a significant threat to human health at this time.

5.2.5 Base/Neutral Extractables

Two groups of base-neutral extractable compounds were detected in soils and/or water samples -- phthalates and polycyclic aromatic hydrocarbons (PAHs). Di-n-butyl phthalate (DBP) and di-n-octyl phthalate (DOP) were detected in groundwater at concentrations ranging from 0.011 to 0.036 and 0.011 to 0.048 mg/L, respectively. DBP was reported in surface water in concentrations ranging from 0.021 to 0.023 mg/L. DBP, DOP and bis-(2-ethyl hexyl) phthalate (DEHP) were detected in soil in concentrations ranging from 1.5 to 3.5 mg/kg, 2.6 to 21.0 mg/kg, and <0.33 to 11.0 mg/kg, respectively.

Like methylene chloride, phthalates are common laboratory contaminants. They were reported in laboratory and field blanks: DBP reported in a single blank for soils at 2.6 mg/kg, DOP in a blank for soils at 8.5 mg/kg, and DBP in a method and trip blanks of 0.011 mg/L. Consequently, it is reasonable to conclude that DBP and DOP in soils, and DBP in groundwater and surface water, are not attributable to DOD activities.

5.2.6 Pesticides

DDT and DDE (a breakdown product of DDT) were reported in soils from nondetectable concentrations to 0.08 mg/kg, and nondetectable to 0.240 mg/kg, respectively. Pesticides were detected in eight of the 16 soil samples from the former Charlestown NALF site (both the Ninigret Wildlife Refuge and the Charlestown Parks and Recreation Area). DDT was a widely used pesticide prior to the 1970s. The concentrations reported represent low residual concentrations which fall in the range of concentrations found throughout the United States where DDT was once applied. No soil standards are available to evaluate these concentrations. It would be appropriate to further analyze the extent and degree of DDT and DDE contamination and evaluate the risks to wildlife and man.

5.3 RECOMMENDATIONS

Based on the results of the sampling and analysis program, recommendations have been developed concerning the former Charlestown NALF and are listed site-by-site on Table 5-1. A general summary of these recommendations follows:

- Collection of sufficient local background samples to permit definition evaluation of background levels in soils and surface water;

- Further analysis of site contamination of petroleum hydrocarbons. Determine all sources affecting groundwater and all visible contamination of the surficial soil layer and remove; and

- For those contaminants lacking specific standards or criteria, develop a risk assessment to determine the threat to health and environment. Delineate areal extent of such contaminants and take appropriate action.

6. BIBLIOGRAPHY

Blair, Charles, October 1986 - January 1987, personal communication, Refuge Manager - Ninigret NWR, Charlestown, Rhode Island.

Blivin, George, October 1986 - January 1987, personal communication, Park Commissioner, Charlestown, Rhode Island.

Brown, R.H., et al., Methods of Determining Permeability, Transmissibility, and Drawdown, USGS Water Supply Paper No. 1536-I, 1963.

Freeze, R.A. and J.A. Cherry, Groundwater, Prentice Hall, 1979.

General Services Administration, 1978. Final Environmental Impact Statement - Naval Auxiliary Landing Field, Charlestown, Rhode Island.

Narragansett Times, February 13, 1986, News Article

Narragansett Times, February 20, 1986, News Article

Narragansett Times, May 22, 1986, News Article

Providence Journal, February 25, 1986, News Article

State of Rhode Island, Pollution Discharge Elimination System Rules, 1986.

University of Rhode Island Coastal Resources Center, "An Environmental Study of a Nuclear Power Plant at Charlestown, Rhode Island," Marine Technical Report 33, September 1974 (Revised October 1974).

U.S. Department of the Interior, "Preliminary Survey of Contaminant Issues of Concern on National Wildlife Refuges," 1986.

U.S. Environmental Protection Agency, Protection of Environment, 40CFR Parts 129-268, July 1985.

U.S. Environmental Protection Agency, Hazardous Waste Land Treatment, BW-874 (revised), 1983.

Westerly Sun, February 6, 1986, News Article

Westerly Sun, February 13, 1986, News Article

APPENDIX A

BORING LOGS

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 1 of 2

Project: Charleston NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Augar
Logged by: D. Palmerton
Date Completed: 22 October 1986

Job No: AE-2040 Boring No: CN-01
Location: Charlestown, RI
Surface Elev: 6' Datum: MSL
Casing Elev: 8'1" Datum: MSL
Total Depth: 23'9" Datum: MSL
Groundwater: 9'6"

WELL DETAILS	DEPTH (Feet)	SYMBOL		LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Cement 3% Bentonite Seal	0	SM		Coarse Sand; dark olive gray (5Y-3Y/2) well graded, subangular to subrounded moist, soft, no cementation; homogenous contains 1-2 cm rounded pebbles	SS#1	soil	BC, 5/12/16/18 100% recovery
		SP	SM	Very Fine Sand; 5 YR-7/1) moist homogenous, pebbles 2-4 cm	SS#2	soil	BC, 20/19/16/17 50% recovery
	5	SW	SM	Well Graded Sand with Silt; (10 YR-4/2) subangular to sunrounded, moist, homogenous, contains fragments of granite 2-3 cm	SS#3	soil	BC, 13/26/20/24 90% recovery
2" PVC Riser		SM		Silty Sands; (10 YR-4/2), subangular to subrounded, moist, very soft, no cementation, contains fines and medium to coarse pebbles (2-3 cm)	SS#4	soil	BC, 27/39/37/46 100% recovery
Bentonite Pellet Seal		GP	GM	Poorly Graded Gravel with Silt and Sand; Gravel; subangular to subrounded, moist to wet, no cementation sand subangular to subrounded, soft, no cementation, non-plastic, lensed colors-7.5 YR-6/6-12%, 10YR-4/3-25%, 10YR-7/1-63%	SS#5	soil	BC27/33/18/16 95% recovery
	10						
Sand Pack	15	SP	SM	Poorly Graded Sand with Silt and Gravel; (10 YR-6/4, silt size to very coarse sand and gravel. Subrounded to rounded wet, soft t o firm, weak cementation, non plastic.	SS#6	soil	BC, 11/36/37/35 50% recovery
2" PVC .010 Slotted Screen							
	20	SP	SC	Poorly Graded Sand with Clay and Gravel; (10 YR-6/2) Sand is angular to subrounded, wet firm	SS#7	soil	BC, 36/36/24/31 30% recovery

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown NALF Job No: AE-2040 Boring No: CN-01

WELL DETAILS		DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack	2" PVC .010 Slotted Screen			Total Depth 23'9"			
		25		Hollow stem augar and spoon refusal at 23'9" water table at 9'6"			

ecology and environment, inc. DRILLING AND SAMPLE LOG

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Augar
Logged by: D. Palmerton
Date Completed: 23 October 1986

Job No: AF-2040 Boring No: CN-02
Location: Charlestown, RI
Surface Elev: 9' Datum: MSL
Casing Elev: 11'5" Datum: MSL
Total Depth: 25" Datum: MSL
Groundwater: 12'5"

WELL DETAILS	DEPTH (Feet)	SYMBOL		LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
	0			Gravelly Organic Soil with Sand --(10YR 5/8), 60% gravel, 30% sand, 5% fines, 5% organic. Pebbles rounded to well rounded, sand subangular to subrounded, soft, moist, non plastic	SS#1	soil	BC. 1/2/2/2 10% recovery
Cement, 3% Bentonite Seal		OL	OH	Organic Soil with Sand and Clay. 10YR 5/8 to 7.5YR 4/4, organic clay and sand, medium plasticity, soft, moist subangular to subrounded	SS#2	soil	BC. 2/4/11/12 30% recovery
2" PVC Riser	5	OL	OH	Organic Soil with Sand and Clay 7.5 YR-4/4, soft to firm, wet, medium plasticity.	SS#3	soil	BC. 13/24/31/41 60% recovery
		SP	SM	Poorly Graded Sand with Silt and Gravel 60% sand, 7.5 YR-6/4 to 5 YR 8/1, angular to subangular, moist, firm, 40% gravel (10YR 7/1) pebbles 2-3 cm subrounded to rounded	SS#4	soil	BC 19/35/47/45 60% Recovery
		SP	SM	Poorly Graded Sand with Silt and Gravel 5 YR-5/6, yellow red mixed with 7.5 YR 1/4 light brown, pebbles 1-2 cm.	SS#5	soil	BC 19/35/47/45 60% recovery
Bentonite Pellet Seal.	10						
sand pack 2" PVC .01 slotted screen	15	SP	SW	Poorly Graded Sands, gravelly with little or no fines, some well graded sands. Very wet, soft, no plasticity, subangular to subrounded, pebbles 2-3 cm.	SS#6	soil	BC 20/24/26/32 50% recovery
	20	SW	SP	Poorly Graded to Well Graded Sands, coarse with little fines, 10YR 5/3, brown subrounded to rounded, wet, soft	SS#7	soil	BC 25/26/13/16 50% recovery

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown NALF Job No: AF-2040 Boring No: CN-02

WELL DETAILS		DEPTH (Feet)	SYMBOL		LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack	2" PVC .010 slotted screen	25	SW	SP	Total Depth 25'	SS#7	(cont.)	
					Hollow steam auger and spoon refusal at 25'. Water table at 12'8"			

ecology and environment, inc. DRILLING AND SAMPLE LOG

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Auger
Logged by: D. Palmerton
Date Completed: 27 October 1986

Job No: AE-2040 Boring No: CN-04
Location: Charlestown, RI
Surface Elev: 10' Datum: MSL
Casing Elev: 12'10" Datum: MSL
Total Depth: 30'6" Datum: MSL
Groundwater: 12'.0"

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
	0	OL OH	Sandy Organics Soil, 5Y 2.5/1, Black, moist, angular to subrounded, contains organic matter	SS#1	soil	BC, 3/11/15/17 80% recovery
		OH/ OL SP	Organic Soil mixed with poorly sorted sand.			
Cement 3% Bentonite Grout Seal		OL OH	Sandy Organic Soil, 5 Y-2.5/1 black firm, moist, medium plasticity, sub-angular to subrounded, 10% gravel	SS#2	soil	BC, 17/18/13/12 70% recovery
		SP	Poorly Graded Sand, 5Y 4/2, subangular to subrounded, moist, soft			
	5	SM SC	Clayey, Silty Sand, 50% silty sand 5Y 6/1, 40% clayey sand 5Y 3/1, 10% gravel moist, soft to firm, medium plasticity	SS#3	soil	BC, 7/6/5/4 40% recovery
			Poorly Graded Sands, no or 5% fines, 5Y 5/1, moist to wet, very soft, no plasticity, subangular to rounded	SS#4	soil	BC, 3/3/4/4 50% recovery
2" PVC Riser		SP	Well Graded Sands with less than 5% gravel, 2.5Y 5/2 gray, subrounded to subangular, very soft, moist, no cementation, some discoloration			
		SW		SS#5	soil	BC, 5/4/3/2 40% recovery
	10					
Bentonite Pellet Plug						
	15		Well Graded Sands, 2.5Y 5/2 gray, sub-angular to rounded, wet, very soft, less than 5% subrounded gravel	SS#6	soil	BC, 6/7/6/8 30% recovery
Sand Pack						
2" PVC .010 slot screen			Well Graded Sands with less than 5% gravel and fines, wet, very soft, no cementation, 2.5Y 5/2 Gray	SS#7	soil	BC, 8/10/12/37 95% recovery
	20					

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 1 of 2

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Auger
Logged by: D. Palmerton
Date Completed: 24 October 1986

Job No: AE-2040
Location: Charlestown, RI
Surface Elev: 6' Datum: MSL
Casing Elev: 8' 2" Datum: MSL
Total Depth: 23' Datum: MSL
Groundwater: 9'7"

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Cement 3% Bentonite seal	0	OL/OH SW/SP	Well Graded Sands (w/30% Gravel) to Poorly Graded Sands; (5% pass through 200 sieve, 7.5 yr 5/2, soft moist, 10% organic material.	SS#1	soil	B.C. 5/9/11/9 30% recovery
		OL/OH SW/SP	Well Graded to Poorly Graded Sand with 30% gravel, 10% organic material sand, subangular to subrounded, 2.5 yr, 3/2, soft, pebbles 1-2 cm, subrounded	SS#1	soil	B.C. 9/11/11/14 30% recovery
2" PVC Riser	5	SW SP	Well Graded to Poorly Graded Sand 10 yr 6/3, subangular to subrounded, soft, moist, fragments of quart pebbles 1-2 cm, subrounded, 10% gravel	SS#3	soil	B.C. 9/17/15/17 60% recovery
		SP	Poorly Graded Sand with 30% gravel 10 yr 7/2, angular to subrounded, soft, moist, gravel contains 1-2cm pebbles, subrounded.	SS#4	soil	B.C. 13/14/15/17 60% recovery
Bentonite Pellet seal		SP	Poorly Graded Sand, 10 yr 4/4, wet soft, no plasticity, angular to subrounded.	SS#5	soil	B.C. 12/15/11/11 50% recovery
Sand Pack 2" PVC .01 Slotted screen	15	SP	Poorly Graded Sands, 7.5 yr 5/2, fine sands, subrounded, soft, wet, trace amounts of gravel.	SS#6	soil	B.C. 9/12/15/21 40% Recovery
	20	SW SM	Well Graded Sands 2.5 y 6/4, subangular to subrounded, very soft, no cementing Wet, homogeneous	SS#7	soil	B.C. 13/11/12/31 100% recovery

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown NALF Job No: AE-2040 Boring No: CN-03

WELL DETAILS		DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack	2" PVC .010 slotted screen	25		Well Graded Sands, 2.5y 6/4, sub-angular to rounded, very soft, no cementation, homogenous Hollow stem auger and spoon refusal at 25' 5-1/2" Water at 9.7'	SS#8	soil	B C 24/100 10% Recovery

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown, Job No: AE-2040 Boring No: CN-04

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack; 2" PVC .010 slot screen	21'4"	SW	2" section of 2-3 mm sands, very clean subangular to subrounded, some pebbles 2-3 cm	SS#7	soil	Ibid
		SW	Well Graded Sands with 5-10% fines, sand is subrounded to rounded, wet, medium to very stiff, 2.5Y 5/2 gray some coarse well graded sands at 26' 1-2 cm.	SS#8	soil	BC, 8/15/28/100 90% recovery
	30		Split spoon was collected, but no recovery of competent material - Total depth 30'	SS#9		BC 100 0 Recovery
			Hollow stem auger and spoon refusal at 30' water at 12.0''			
	0					

ecology and environment, inc. DRILLING AND SAMPLE LOG

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Augar
Logged by: D. Palmerton
Date Completed: 28 October 1986

Job No: AE-2040
Location: Charlestown, R.I.
Surface Elev: approx. 10 Datum: MSL
Casing Elev: 12'7" Datum: MSL
Total Depth: 23' Datum: MSL
Groundwater: 10'

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
	0		Asphalt material - 2.5y 2/0 black crumbled, mixed with sand and silt particles - homogenous in color	SS#1	soil	B.C. 4/5/5/5 10% recovery
ement 3% Bentonite Grout		CL	Lean Clay - moist, soft, medium dry 5y 2.5/2			
		ML, SC	Inorganic Silts - moist, soft, medium dry, some clayey sands with few large gravel 1-3 cm	SS#2	soil	B.C. 3/6/18/ 50% recovery
2" P riser	5	SP	Poorly Graded Sands - 2.5 yr 4/8 red. less than 5% gravel and fines, moist, very soft, no or little compensation	SS#3	soil	B.C. 23/33/38/ 50% recovery
		SW	Well Graded Gravelly Sands - 2.5 y 6/4 with various pink and white, angular to subrounded, very stiff, moist, no cementation, gravel is subangular to subrounded			
Bentonite Pellet eal				SS#4	soil	B.C. 47/48/55/ 80% recovery
		SW	Well Graded Gravelly Sands - same as above with more pink quartz pebbles.	SS#5	soil	B.C. 20/31/26/ 80% recovery
	10					
Sand Pack						
	15					
2" P .01 slot screen		GP GM	Poorly Graded Gravels Silty/Sand gravels angular to subrounded, various colors, pink, white, gray, quartz and feldspar gravels mixed with sand (35%) fines (5%), wet, no cementation and soft.	SS#6	soil	B.C. 16/30/31/ 50% recovery
			A-10			
	20	SM SP	Silty Sands to Poorly Graded Sands -			B.C. 9/only)

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown NALF Job No: AE-2040 Boring No: CN-05

WELL DETAILS		DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack	2" PVC .010 slot screen	22					
		25		Total depth 23.0' water at 10.0'			

ecology and environment, inc. DRILLING AND SAMPLE LOG

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Auger
Logged by: D. Palmerton
Date Completed: 29 October 1986

Job No: AE-2040
Location: Charlestown, Rhode Island
Surface Elev: 5-6' Datum: MSL
Casing Elev: 7-8'.6" Datum: MSL
Total Depth: 20' Datum: MSL
Groundwater: 7.6"

Boring No: CN-06

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
	0	P+/ OL SP	Peat - Organic Silts to Poorly Graded-- sand, first 4" organic soil, black 5y 2.5/1, moist, soft, sand 40-50%, 2.5y 3/2, gravel less than 5%	SS#1	soil	B.C. 2/5/41/11 40% recovery
Cement 3% Bentonite Grout Seal		P+/ OL SP	Peal - Organic Silts - Poorly Graded Sands -2.5Y 5/2 dk grayish brown to 2.5y 5/2 grayish brown, moist, soft, gravel 5-10%, few roots.	SS#2	soil	B.C. 7/8/8/9 50% recovery
2" PVC riser			Organic Silts - Poorly Graded Sands - organic matter 5% gravel 5-10% sands and silts 80-85%, top 8" 2.5y dk grayish brown, grading into 2.5Y 6/10 light gray clay, clayish lean and silty, wet, firm, medium plasticity.	SS#3	soil	B.C. 4/8/4/2 50% recovery
	5	OL				
Bentonite Pelle Seal		OL	Silty Sandy Organic Soil - black 5y 2.5/1 firm, moist grading into 5y 5/2 olive gray silty sands, wet firm with rapid dilatancy	SS#4	soil	B.C. 1/2/2/1 80% recovery
		SM				
	10		Silty Sands - no gravel, ilive gray, firm wet, rapid dilatency, some rusty color (2.5y 5/6) stained patches, sticky and non-plastic	SS#5	soil	B.C. 2/2/2/2 50% recovery
Sand Pack 2" PVC .010 slot screen						
	15	SP	Poorly Graded Sands - with less than 5% gravel, 5y 6/4 pale olive, sub-rounded to rounded sands, well sorted coarse grain 1/2 - 1 mm	SS#6		B.C. 19/48/20/2 100% recovery
			Well Graded Sands with Gravel - pale olive (5y 6/4) wet, firm, 10% fines, 10% gravel, gravel subrounded Borehole drilled to 20' Water at 7'6"	SS#7	soil	B.C. 26/14/10/1 50% Recovery
	20	SW				

ecology and environment, inc. DRILLING AND SAMPLE LOG

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow stems auger
Logged by: D. Palmerton
Date Completed: 30 October 1986

Job No: AE-2040 Boring No: CN-07
Location: Charlestown, Rhode Island
Surface Elev: 5-6' Datum: MSL
Casing Elev: 7-8' Datum: MSL
Total Depth: 22.0' Datum: MSL
Groundwater: 7.0'

WELL DETAILS	DEPTH (Feet)	SYMBOL		LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Cement 3% Bentonite Seal; 2" PVC Riser	0	PT	OL	Peat - Sandy Organic Soil - roots and organic material present in top 10% of the spoon, sand 30-50%, black 5y 2.5/1 firm, moist, low dry strength no plasticity	SS#1	soil	B.C. 3/4/5/3 10% recovery
		OL		Sandy Organic Soil - as above			
		SM		Silty Sand - yellowish brown (10 yr.5/6) moist, soft, no plasticity, no cementation, subangular to rounded, small amount of gravel (1cm)	SS#2	soil	B.C. 1/1/1/2 55% recovery
	5	OL	SM	Sandy Organic Soil and Silty Sands - (90%) yellowish brown, subangular to rounded, moist, soft, no cementation	SS#3	soil	B.C. 3/4/5/3 10% recovery
Bentonite Pellet Seal		SP		Poorly Graded Sand - Gray (5y 4/1), wet, very soft, some cementation, 5% fines and gravel	SS#4	soil	B.C. 100 for 1
		SP		Poorly Graded Sand - less than 5% fines or gravel sands (95%) gray (5y4/1), subangular to sub rounded, wet, soft, some cementation, broken pieces of b otite.	SS#5	soil	B.C. 13/10/8/6 40% recovery
Sand Pack; 2" PVC .010 slot screen	15	SP		Poorly Graded Sands - 5% fines, less than 5% gravel, very soft, wet, no cementation, subangular to subrounded, gray 5y 4/1 with small amounts of pink and white quartz.	SS#6	soil	B.C. 7/12/14/20 50% recovery
	20	SP		Poorly Graded Sands - same as 15" sampl	SS#7	soil	B.C. 11/12/7/17 50% recovery

ecology and environment, inc. DRILLING AND SAMPLE LOG Sheet 2 of 2

Project: Charlestown NALF Job No: AE-2040 Boring No: CN-07

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Sand Pack	22		Borehole drilled to 22' water at 7.0'			

ecology and environment, inc. DRILLING AND SAMPLE ...

Project: Charlestown NALF
Boring Contr.: New England Boring
Boring Method: Hollow Stem Auger
Logged by: D. Palmerton
Date Completed: 30 October 1986

Job No: AE-2040 Boring No: CN-08
Location: Charlestown, RI
Surface Elev: 5'6" Datum: MSL
Casing Elev: 6-7'10" Datum: MSL
Total Depth: 18'4" Datum: MSL
Groundwater: 5.0'

WELL DETAILS	DEPTH (Feet)	SYMBOL	LITHOLOGICAL DESCRIPTION	SAMPLE NO.	SAMPLE TYPE	REMARKS
Cement 3% Bentonite Grout Seal	0	Pt/OL	Peat-Organic Soil, roots 10%, 20-30% sand, moist, firm, black 5Y 3/1, medium dry strength NO/low plasticity.	SS#1	soil	BC 1/2/2/3 20% Recovery
		ML SP	Inorganic Silts and Fine Sands 2.5Y, 5/4 grayish brown Poorly graded sands, 1/2-1mm, grayish to yellowish brown			
2" PVC Riser Pipe		SP	Poorly Graded Sands, yellow brown staining 10 YR 5/7 and 10 YR 5/1 gray. Subrounded to rounded, well sorted, soft, moist. Some organic particles	SS#2	soil	BC 3/2/2/9 50% Recovery
Bentonite Pellet Seal	5	SW	Well Graded Sands, with 30% gravel, wet, soft, no cementation, gravel contains pieces of broken cobbles, yellowish brown, 2-3 cm.	SS#3	soil	BC 12/12/11/ 20% Recovery
		SW	Well Graded Sands with 20%-30% gravel, angular to subrounded sands, very soft, wet, no cementation, yellow-brown, longest gravel (pebble size 1-2-1/2 cm)	SS#4	soil	B.C.13/14/21/ 50% Recovery
		SP	Poorly Graded Sands - gray 10YR 5/1, subangular to subrounded, rapid dilatency, 10% gravels, 10% fines, wet soft.	SS#5	soil	B.C.24/36/27/ 50% Recovery
Sand Pack 2" PVC .010 slot screen	10					
	15	SP	Poorly Graded Sands with 5-10% gravel, largest size 1-2 cm, wet, soft to very soft, no plasticity, no cementation	SS#6	soil	BC 16/48/14/ 50% recovery
		BR	Pink, coarse grain, granite. Borehole cored to 18'4-1/2" Water at 5.0'			Bedrock 17'7" 6" Recovery
	20					

APPENDIX B

PERMEABILITY DATA

Table B-1

FORMER CHARLESTOWN NALF
PERMEABILITY DATA

Well Number	CN-01		CN-02		CN-03		CN-04		CN-05		CN-06		CN-07		CN-08	
Well Depth (feet)	23.8		25.0		23.0		30.5		23.0		20.0		22.0		18.3	
Static Water Level (feet)	11.1		15.5		12.4		14.8		12.5		8.5		7.5		7.4	
Test Data	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)	Time (Sec)	Level (Ft)
	0	11.1	0	15.5	0	12.4	0	14.8	0	12.5	0	8.5	0	7.5	0	7.4
	10	12.2	10	17.1	10	14.1	5	15.1	5	12.9	60	9.4	5	8.7	5	8.8
	15	12.0	15	16.2	15	12.7	10	16.1	10	12.7	90	9.3	10	8.4	10	8.4
	20	11.5	20	15.8	20	12.5	15	14.5	15	12.5	120	9.2	15	7.7	15	8.3
	25	11.2	25	15.7	25	12.4	20	14.8	20	12.5	150	9.1	20	7.5	20	8.2
	30	11.2	30	15.7	30	12.4	25	14.8	25	12.5	180	9.1	25	7.5	25	8.1
	35	11.1	35	15.6	35	12.4	30	14.8	30	--	210	9.0	30	--	30	8.0
	40	11.1	40	15.5	40	12.4	35	14.8	35	--	240	8.9	35	--	35	8.0
	--	--	--	--	--	--	40	14.8	40	--	270	8.8	40	--	40	7.8
	--	--	--	--	--	--	--	--	--	--	330	8.7	--	--	45	7.7
	--	--	--	--	--	--	--	--	--	--	390	8.5	--	--	60	7.6
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	75	7.6
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	90	7.5
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	120	7.5
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	150	7.5
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	180	7.4

APPENDIX C

GEOTECHNICAL SOILS ANALYSIS

LABORATORY TEST PROCEDURES

Ecology & Environment
File No. L-7973

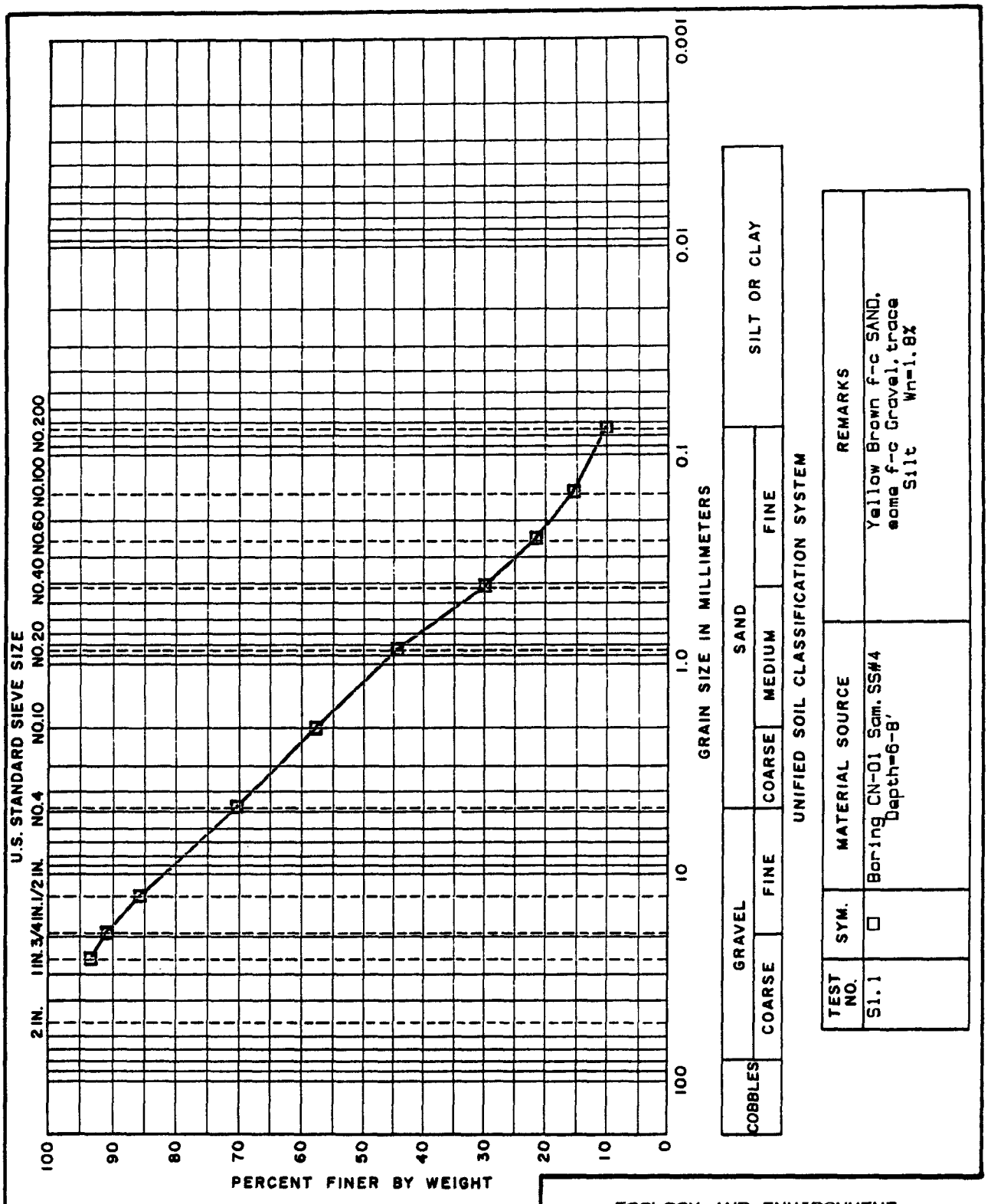
1. The following tests were performed with the noted ASTM test designation:

TEST	ASTM DESIGNATION
Grain Size	D422-63 (see Item 1)

2. Test Procedures for Combined Sieve and Hydrometer Analysis

When both sieve and hydrometer analysis are required, a combined mechanical analysis is performed. This procedure is, in part, similar to ASTM's 2217-66 (wet preparation of soil sample for grain-size analysis and determination of soil constants-B).

A representative portion of the minus No. 4 material was mixed with water so as to form a thin homogeneous slurry. The fines suspended in this slurry were then decanted into an empty hydrometer jar, and the mixing-decanting process repeated until most of the fines had been removed. Coarser fractions remaining after the decantation were then oven dried and sieved through a nest of screens (Nos. 10, 20, 40, 60, 100, and 200). Any material passing the No. 200 screen was added to the hydrometer jar containing the fine fraction. Hydrometer analysis of these fines was performed in the conventional manner.



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

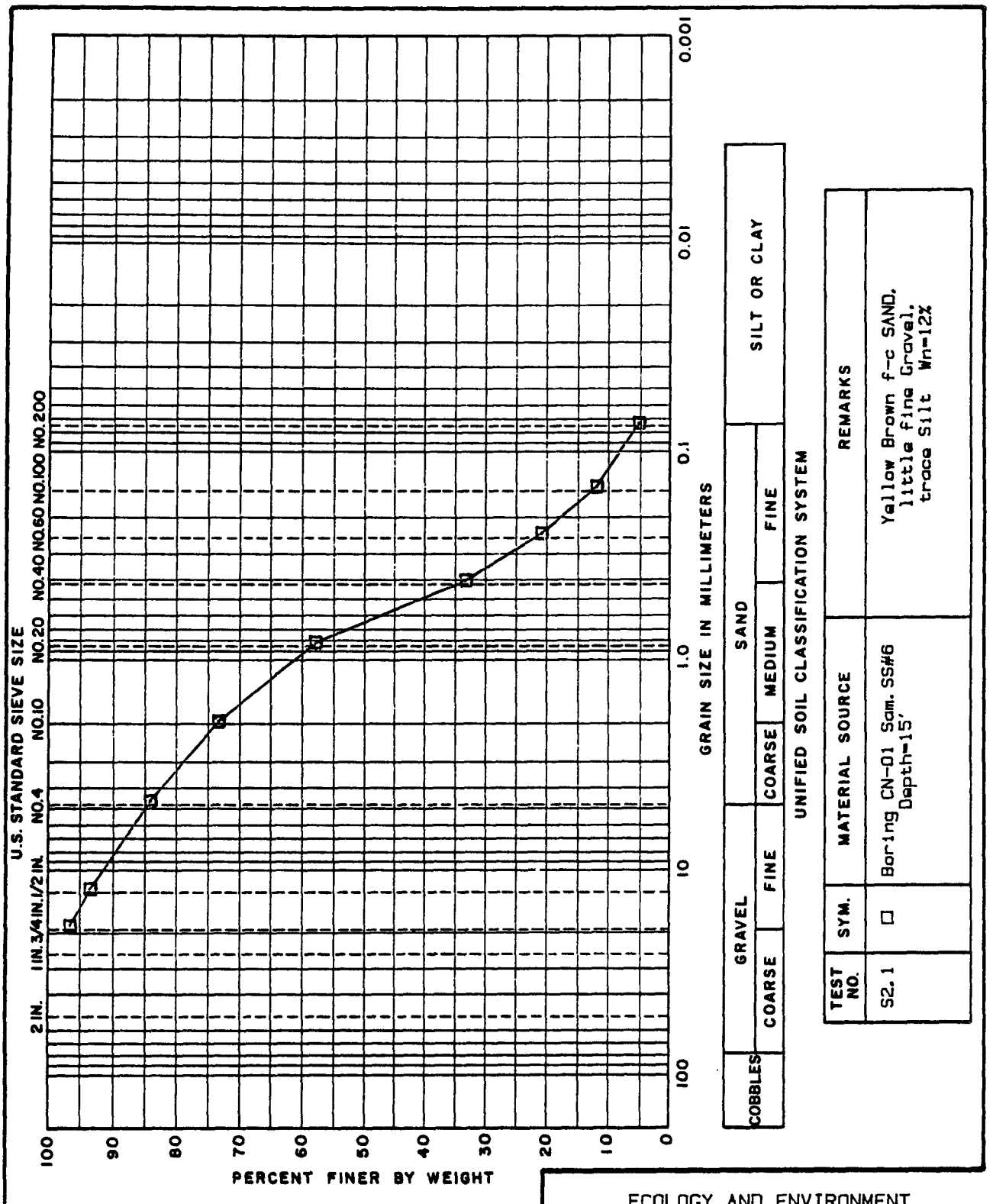
BORING NO. CN-01
SAMPLE SS#4
DEPTH 6-8'
TECH. M. M.
REVIEWER

TEST SERIES NO. 1
DATE Dec. 86
L7973

FILE S.3

APPENDIX E-9

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-01
SAMPLE SS#6
DEPTH 15'
TECH. M. M>
REVIEWER

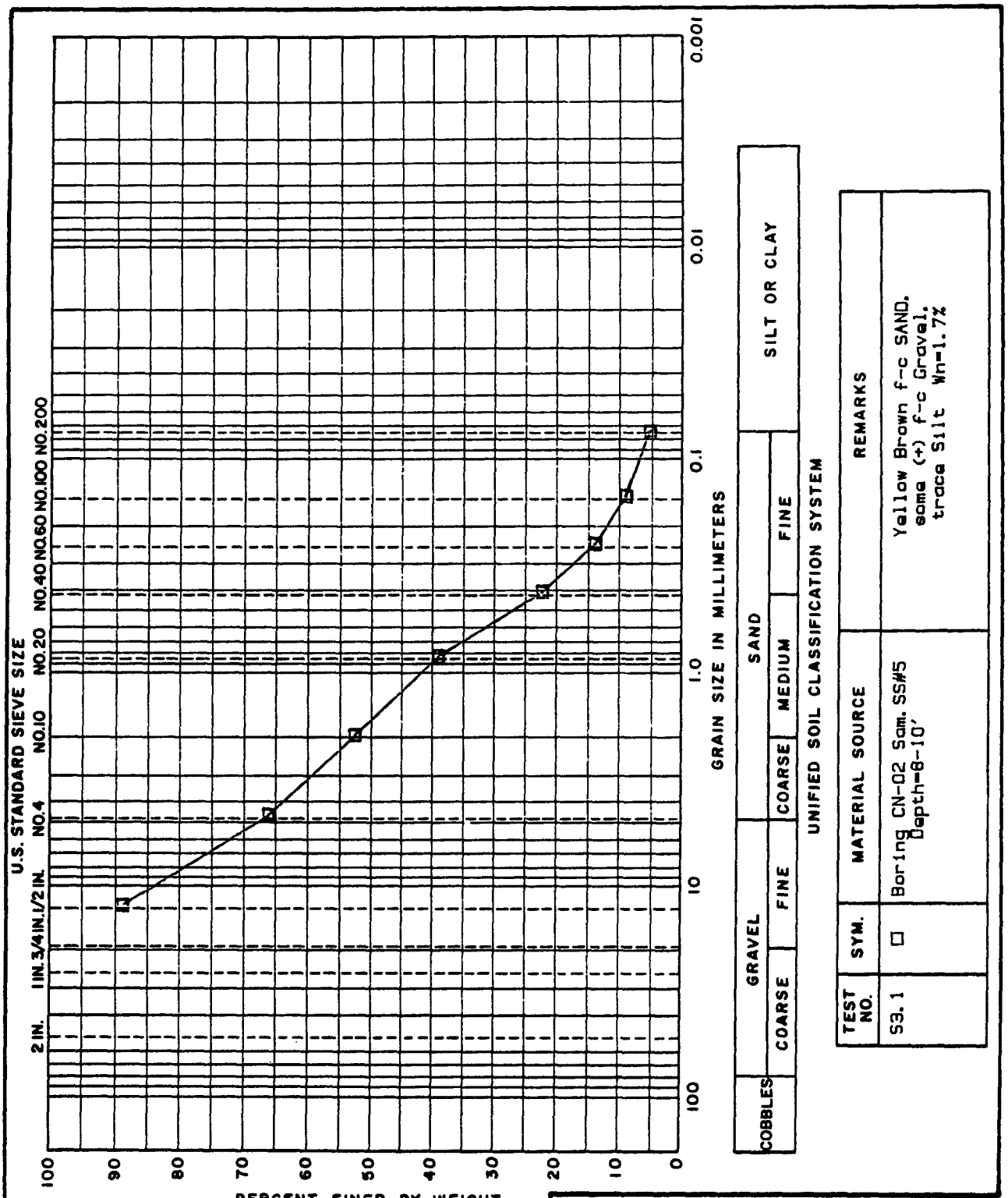
TEST SERIES NO. 2
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-02
SAMPLE SS#5
DEPTH 8-10'
TECH. M. M.
REVIEWER

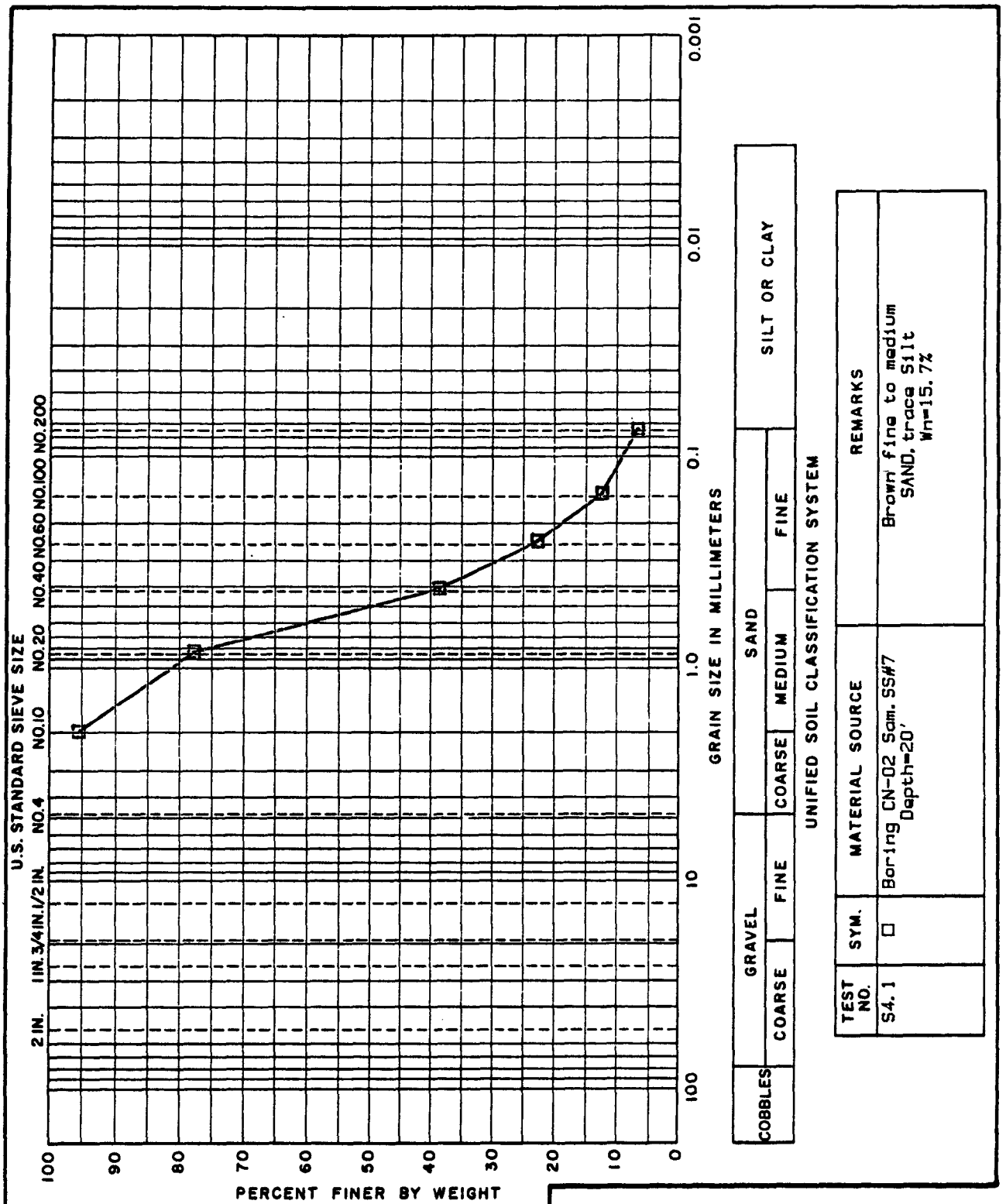
TEST SERIES NO. 3
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-02
SAMPLE SS#7
DEPTH 20'
TECH. M. M.
REVIEWER

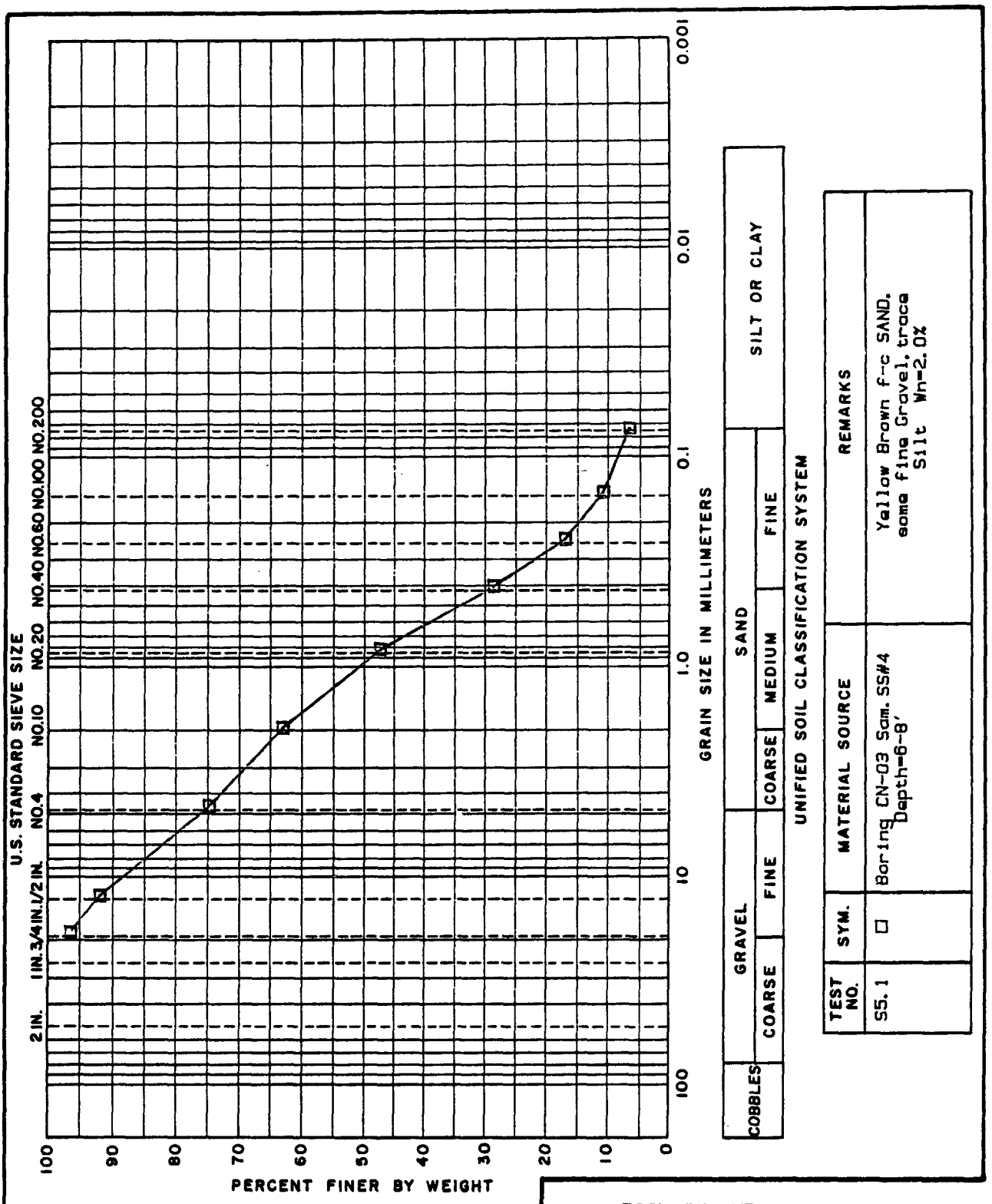
TEST SERIES NO. 4
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-03
SAMPLE SS#4
DEPTH 6-8'
TECH. M. M.
REVIEWER

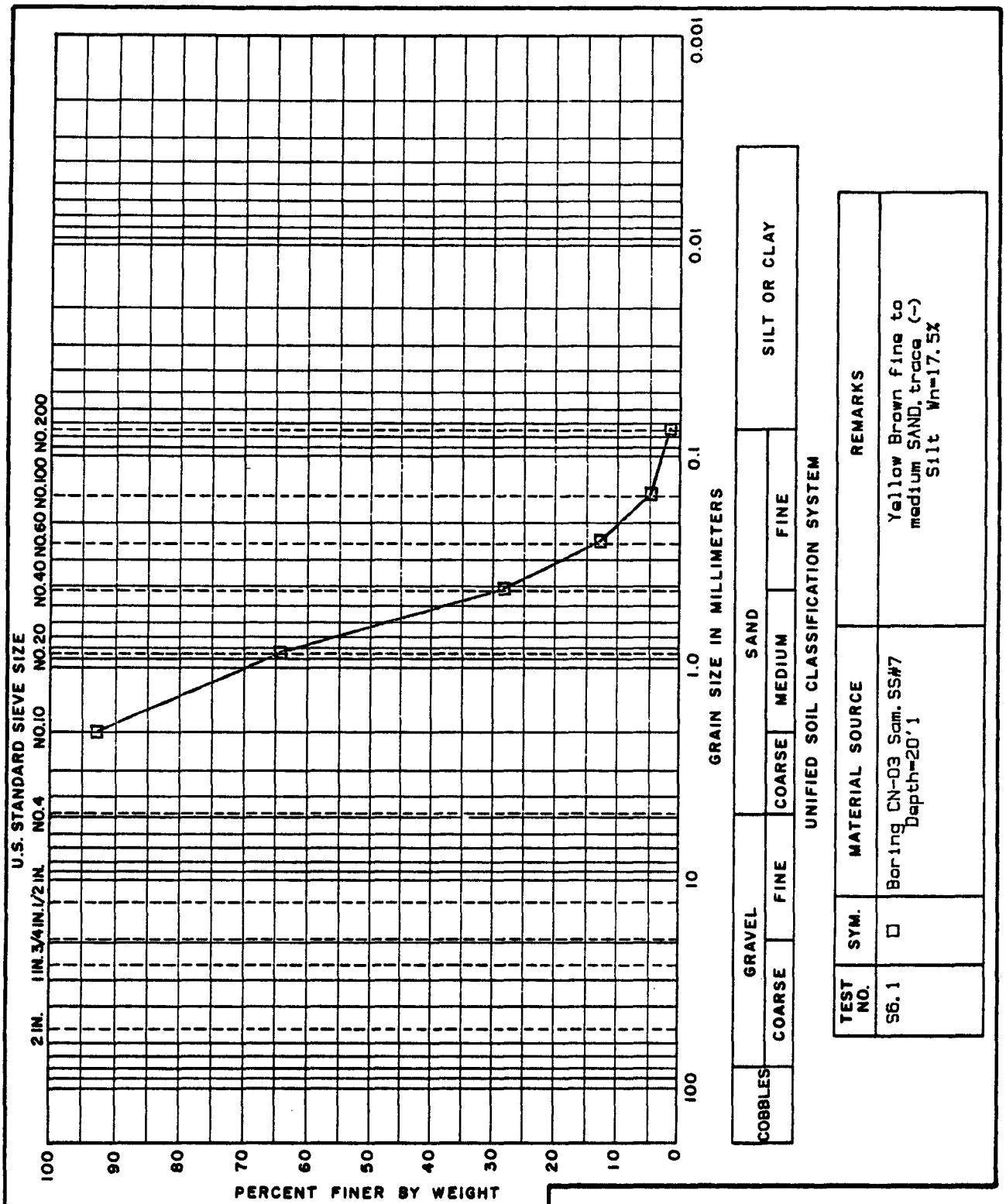
TEST SERIES NO. 5
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

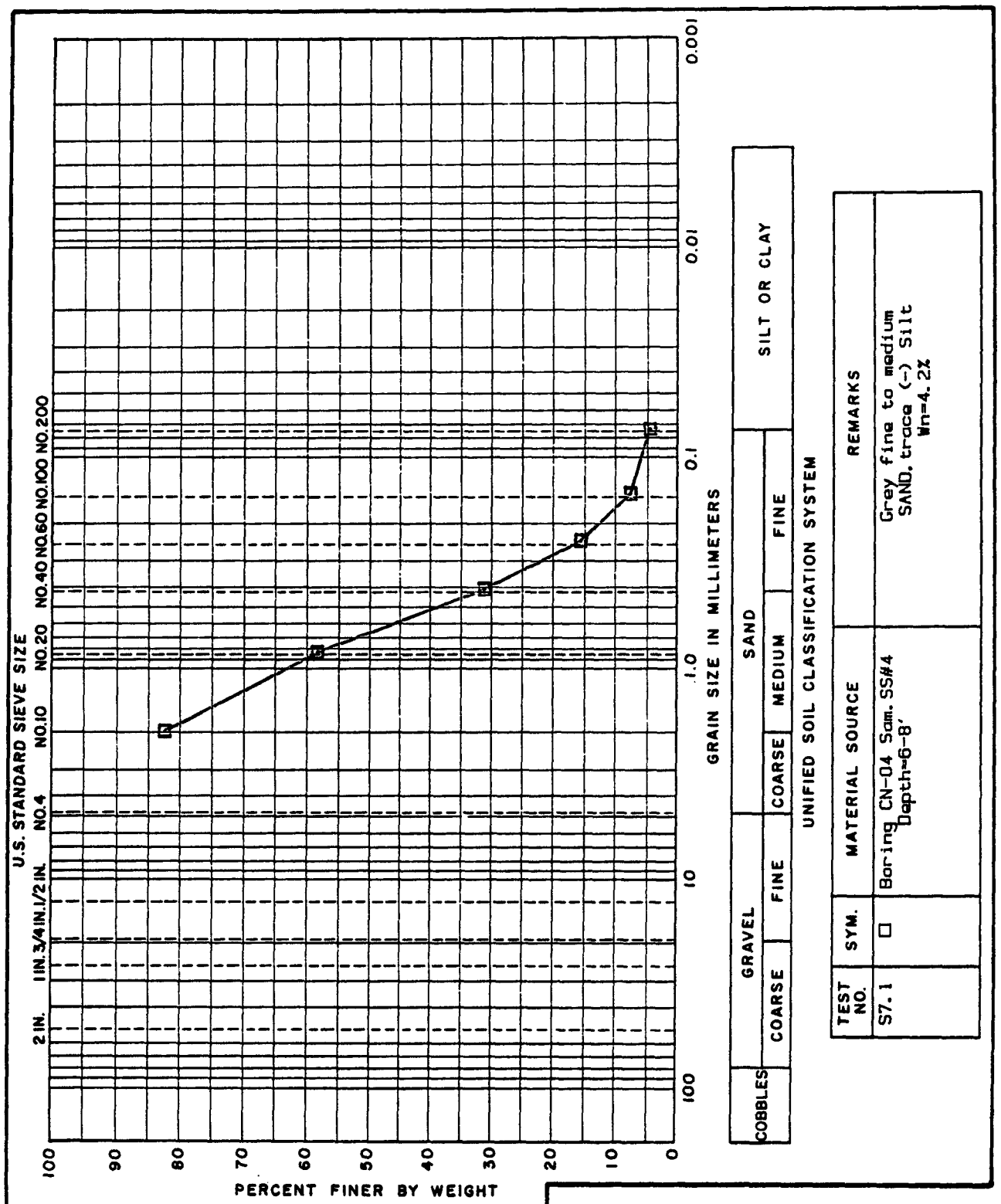


ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO.	CN-03	TEST SERIES NO.	6
SAMPLE	SS#7		
DEPTH	20'	DATE	Dec. 86
TECH.	M. M.		L7973
REVIEWER			
APPENDIX E-9		FILE	S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-04
SAMPLE SS#4
DEPTH 6-8'
TECH. M. M.
REVIEWER

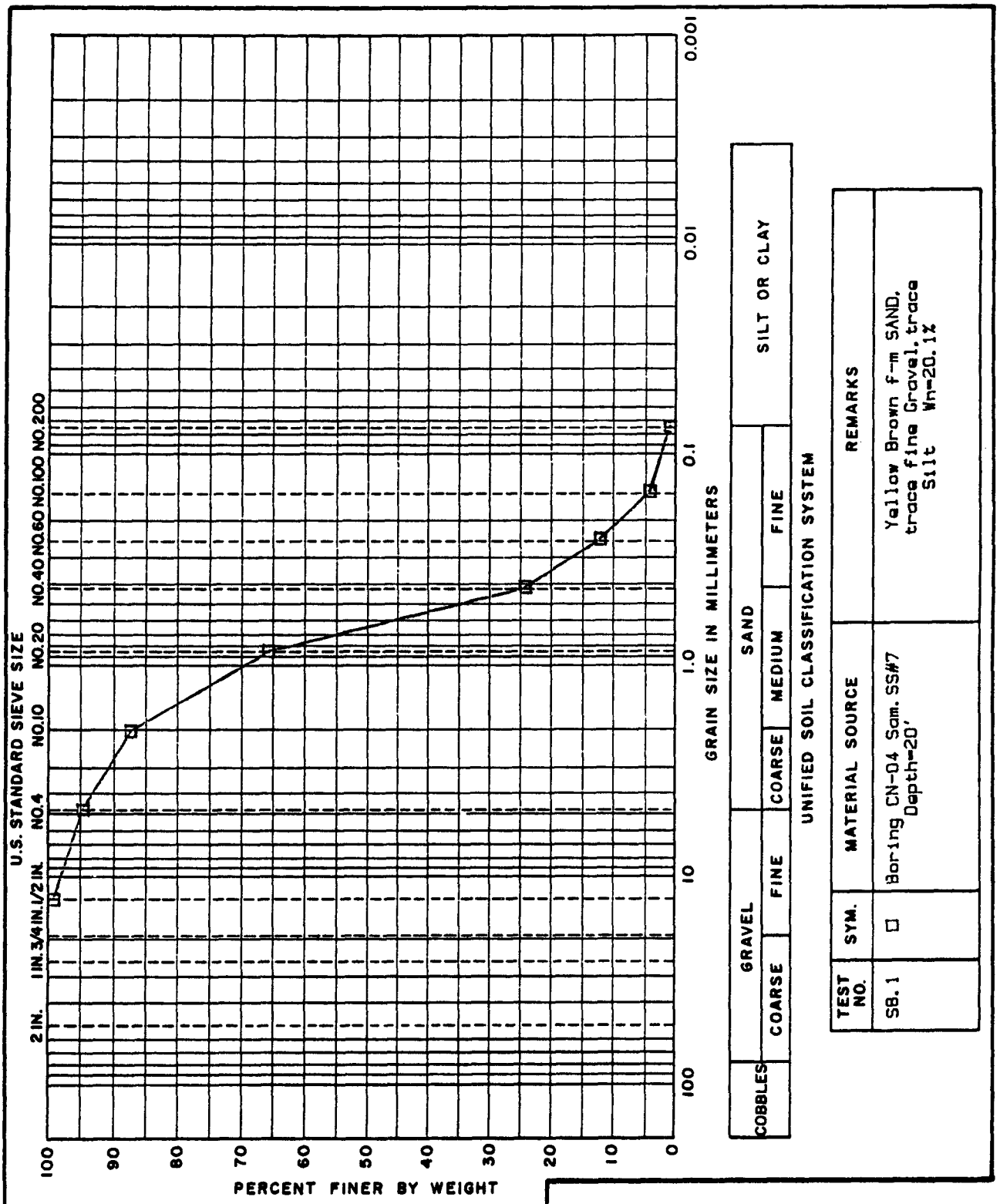
TEST SERIES NO. 7
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

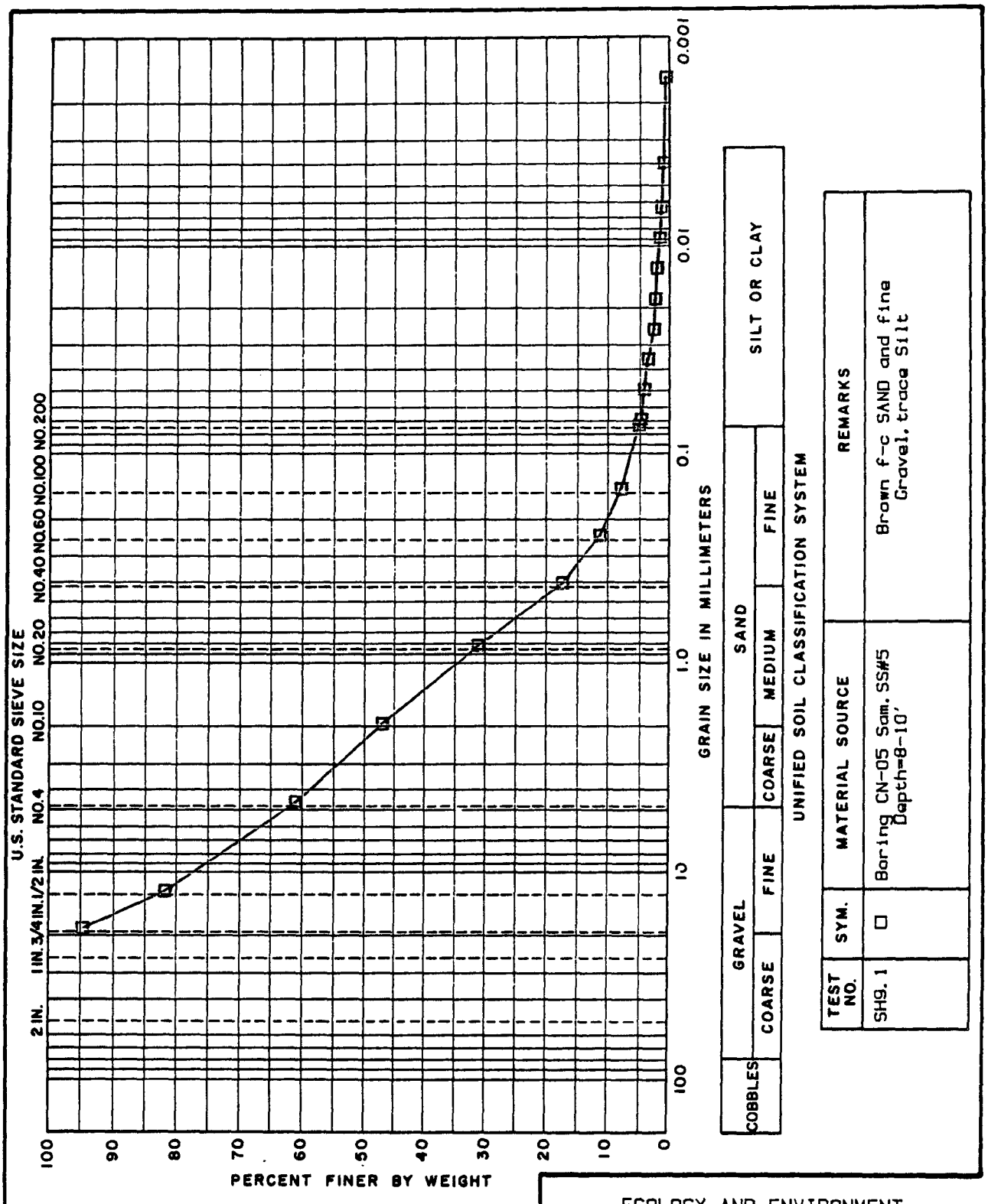
BORING NO.	CN-04	TEST SERIES NO.	8
SAMPLE	SS#7		
DEPTH	20'	DATE	Dec. 86
TECH.	M. M.		L7973
REVIEWER			

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

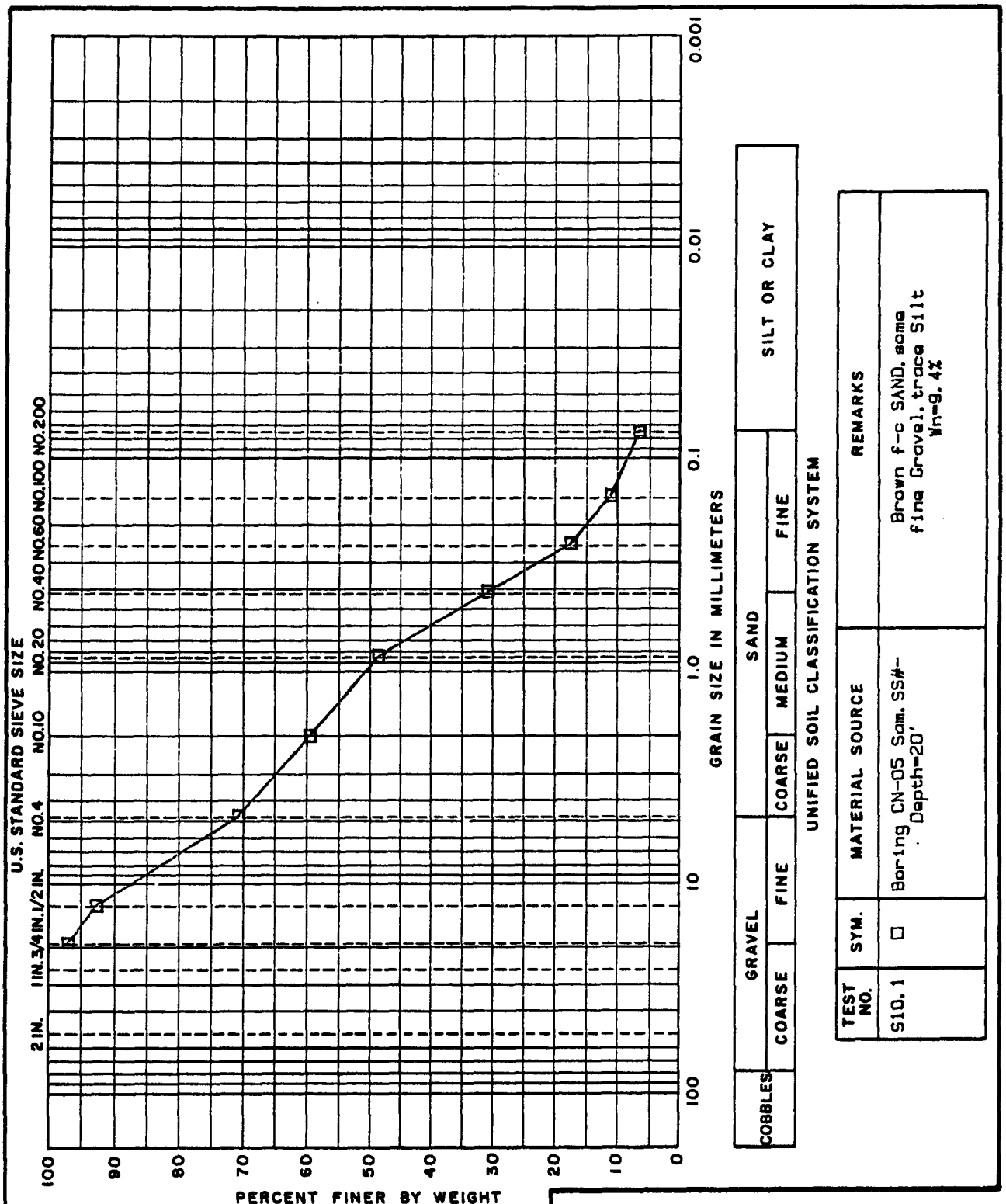
BORING NO. CN-05
SAMPLE SS#5
DEPTH 8-10'
TECH. M. M.
REVIEWER

TEST SERIES NO. 9
DATE Dec. 86
L7973

APPENDIX E-9

FILE S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-05
SAMPLE SS#-
DEPTH 20'
TECH. M. M.
REVIEWER

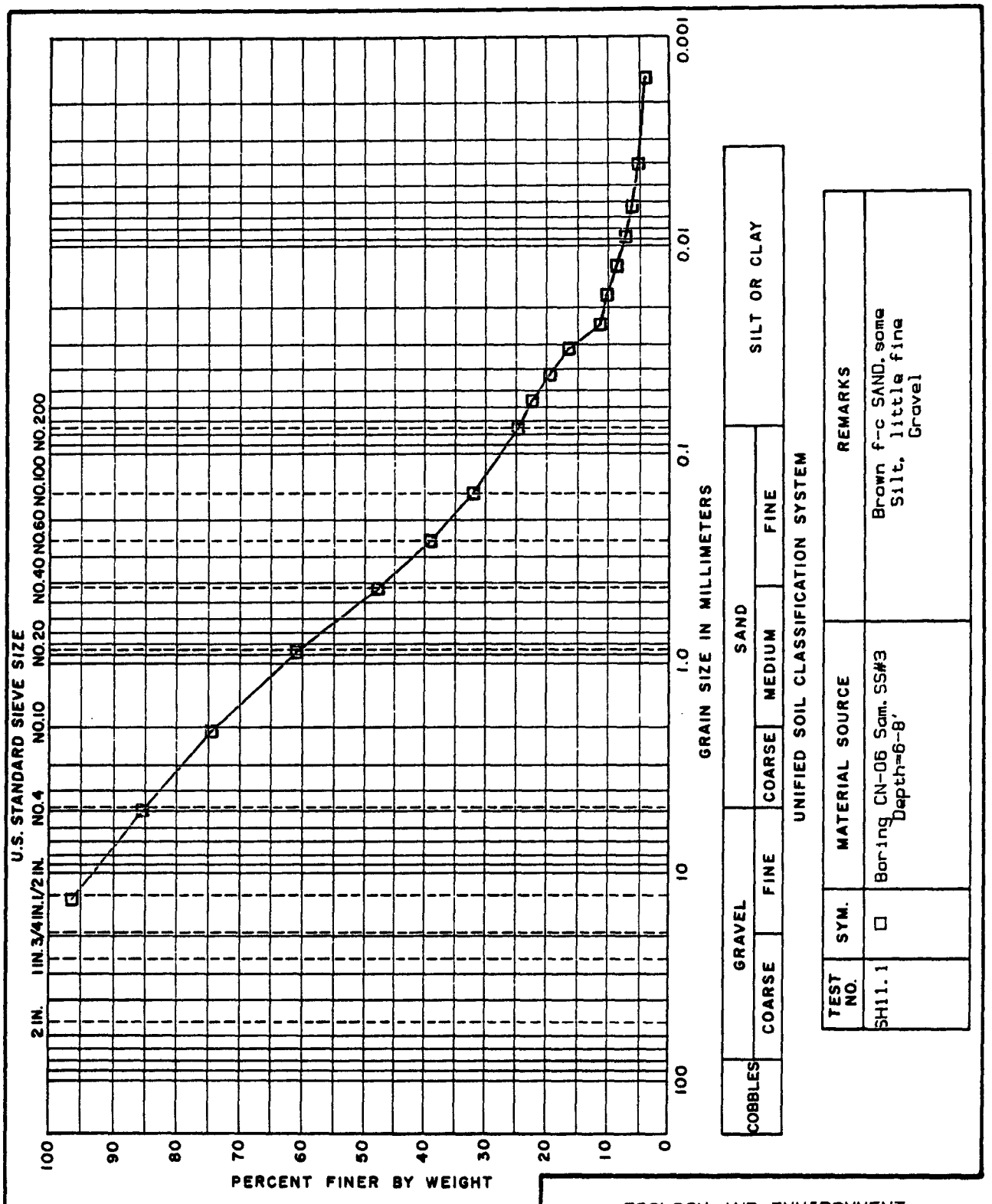
TEST SERIES NO. 10
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-06
SAMPLE SS#3
DEPTH 6-8'
TECH. M. M.
REVIEWER

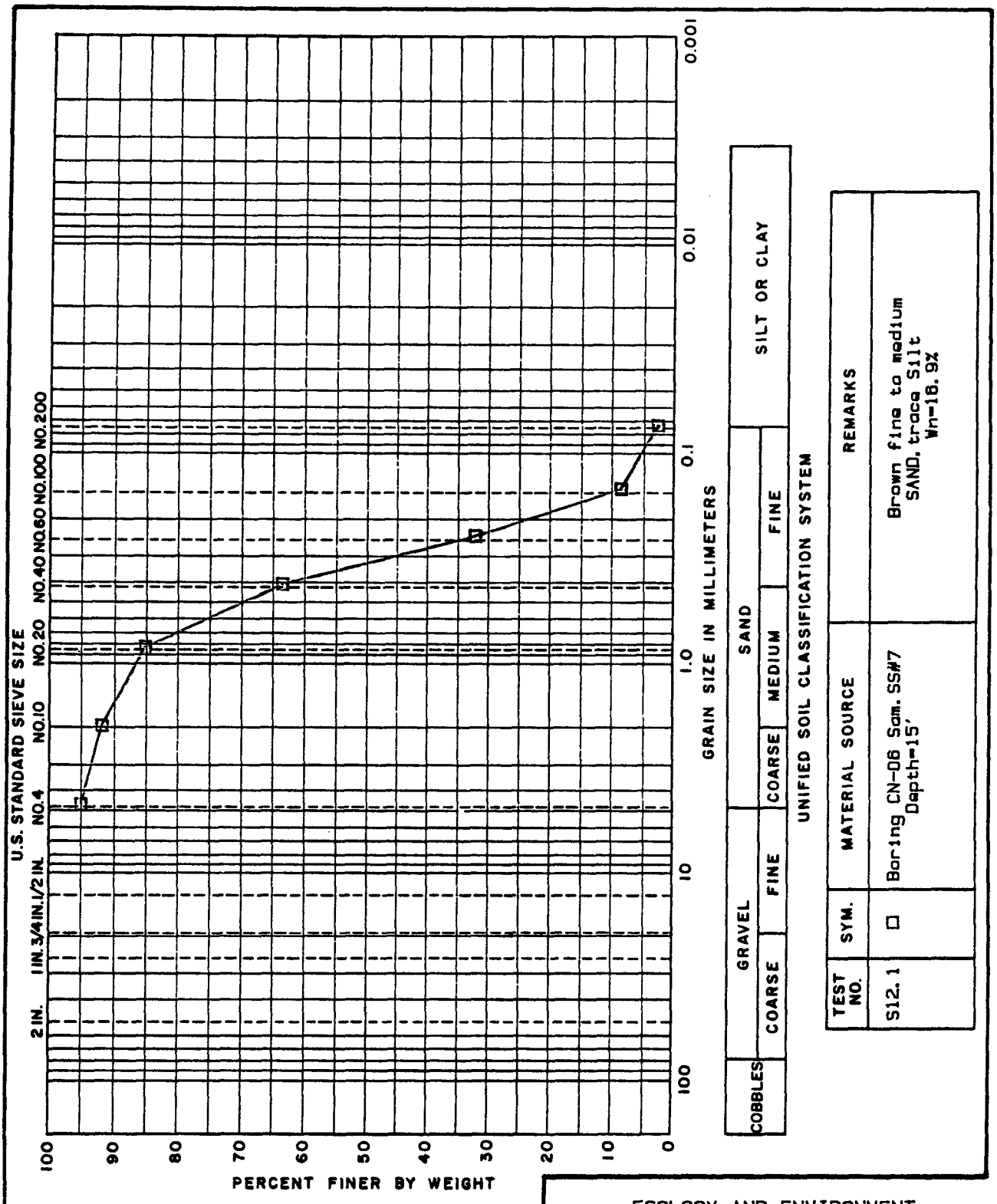
TEST SERIES NO. 11
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

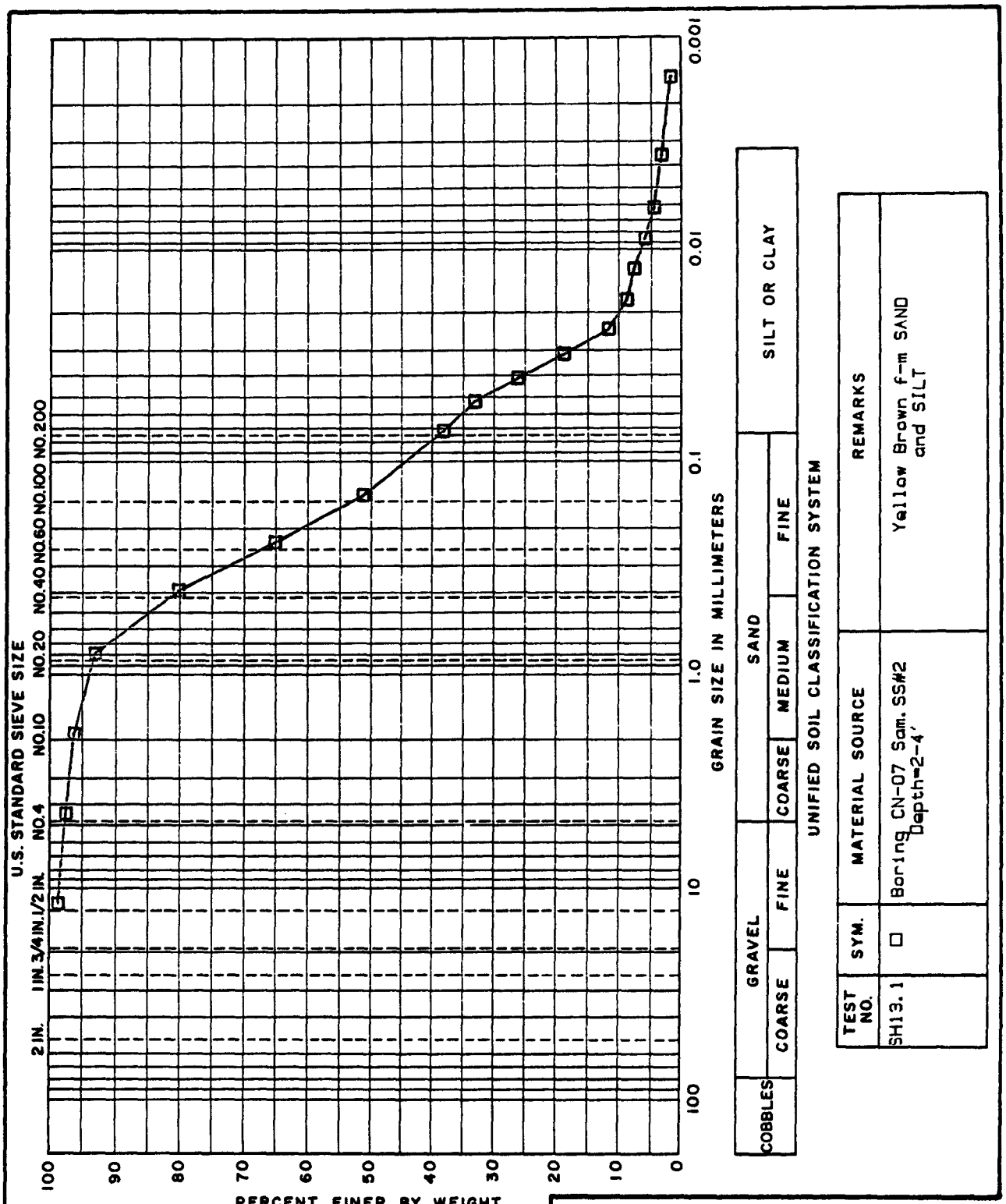


ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO.	CN-06	TEST SERIES NO.	12
SAMPLE	SS#7		
DEPTH	15'	DATE	Dec. 86
TECH.	M. M.		L7973
REVIEWER		FILE	
APPENDIX E-9			S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



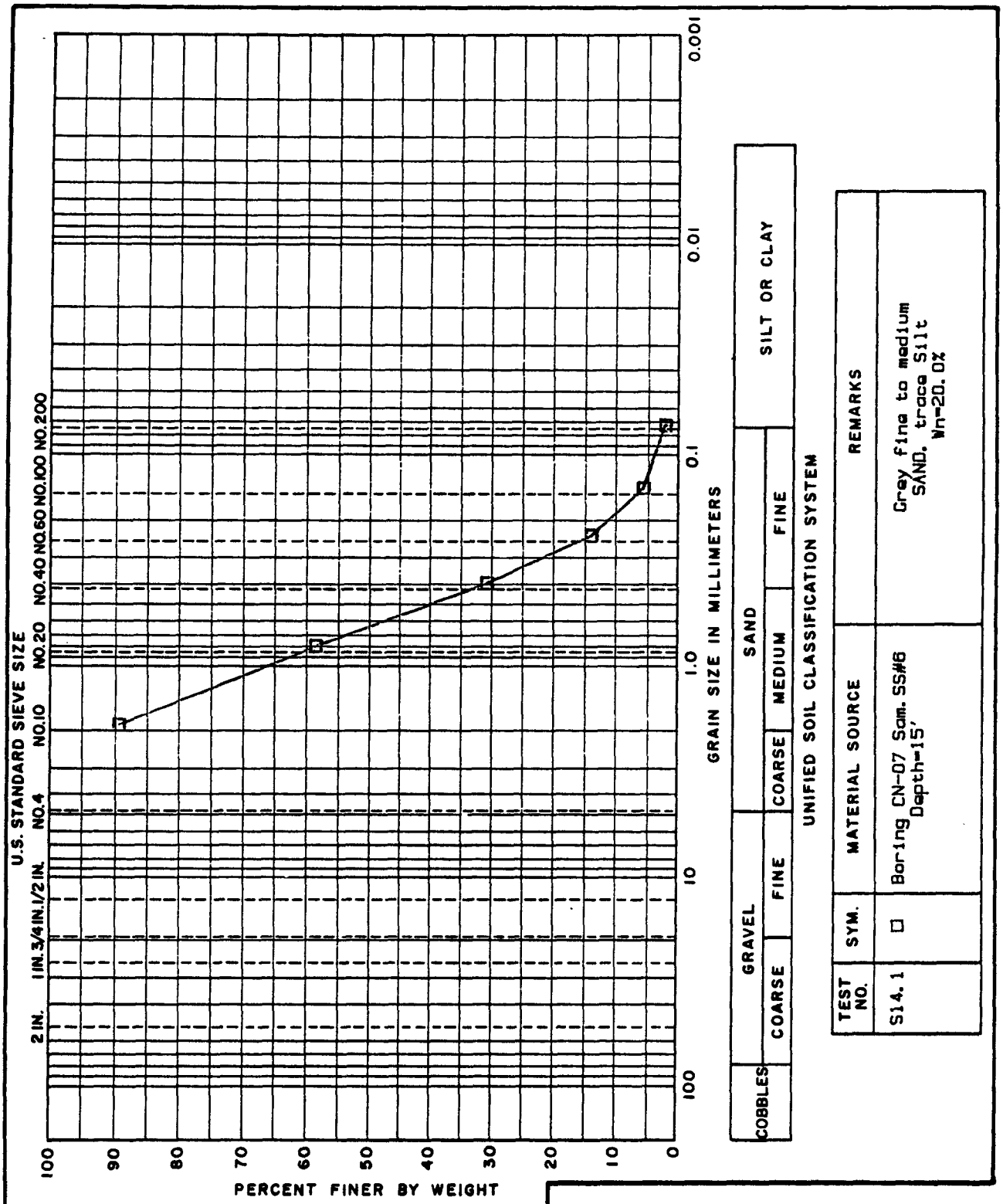
ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-07
SAMPLE SS#2
DEPTH 2-4'
TECH. M. M.
REVIEWER
APPENDIX E-9

TEST SERIES NO. 13
DATE Dec. 86
L7973
FILE
S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

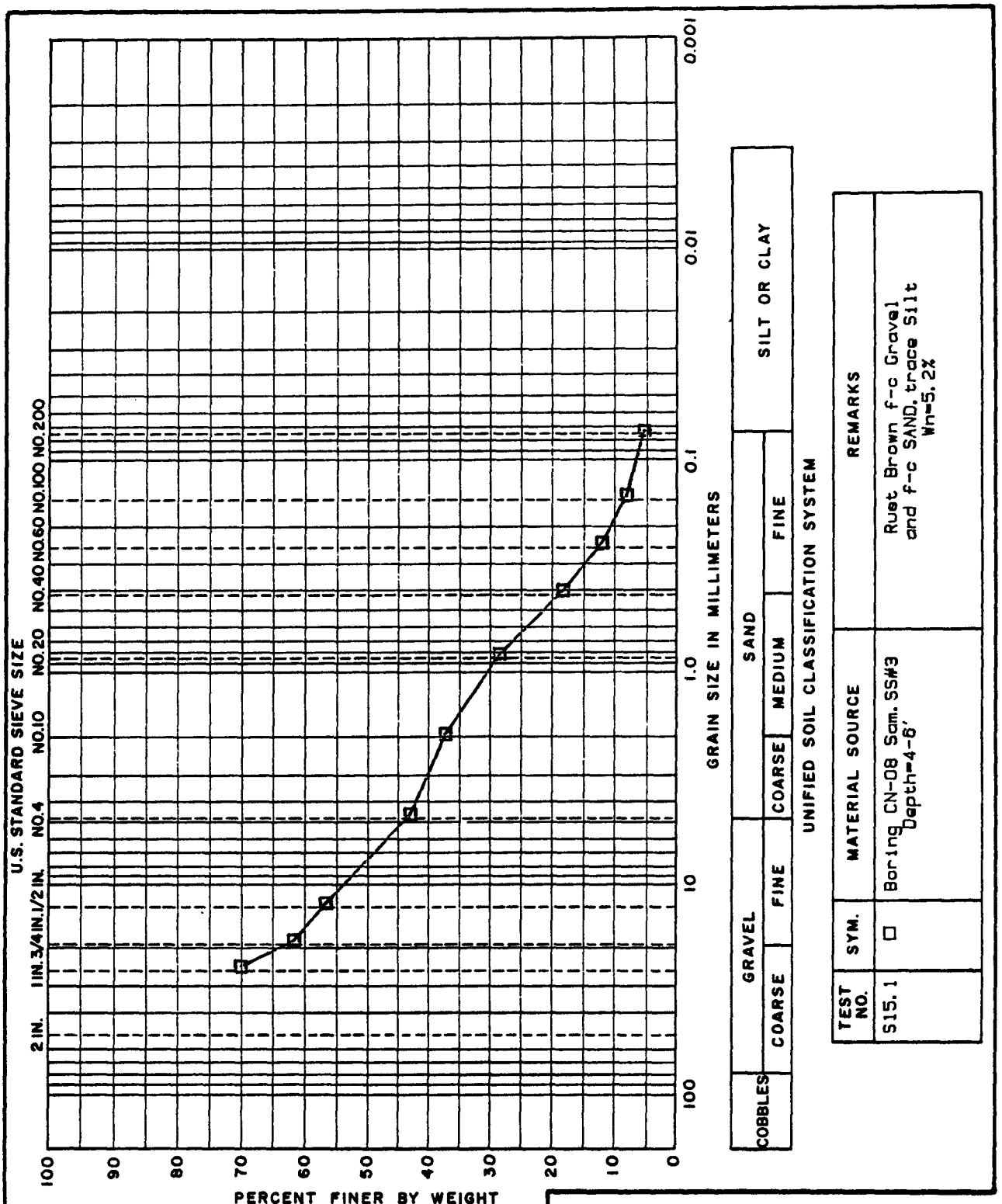
BORING NO.	CN-07	TEST SERIES NO.	14
SAMPLE	SS#6		
DEPTH	15'	DATE	Dec. 86
TECH.	M. M.		L7973
REVIEWER			

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-08
SAMPLE SS#3
DEPTH 4-6'
TECH. M. M.
REVIEWER

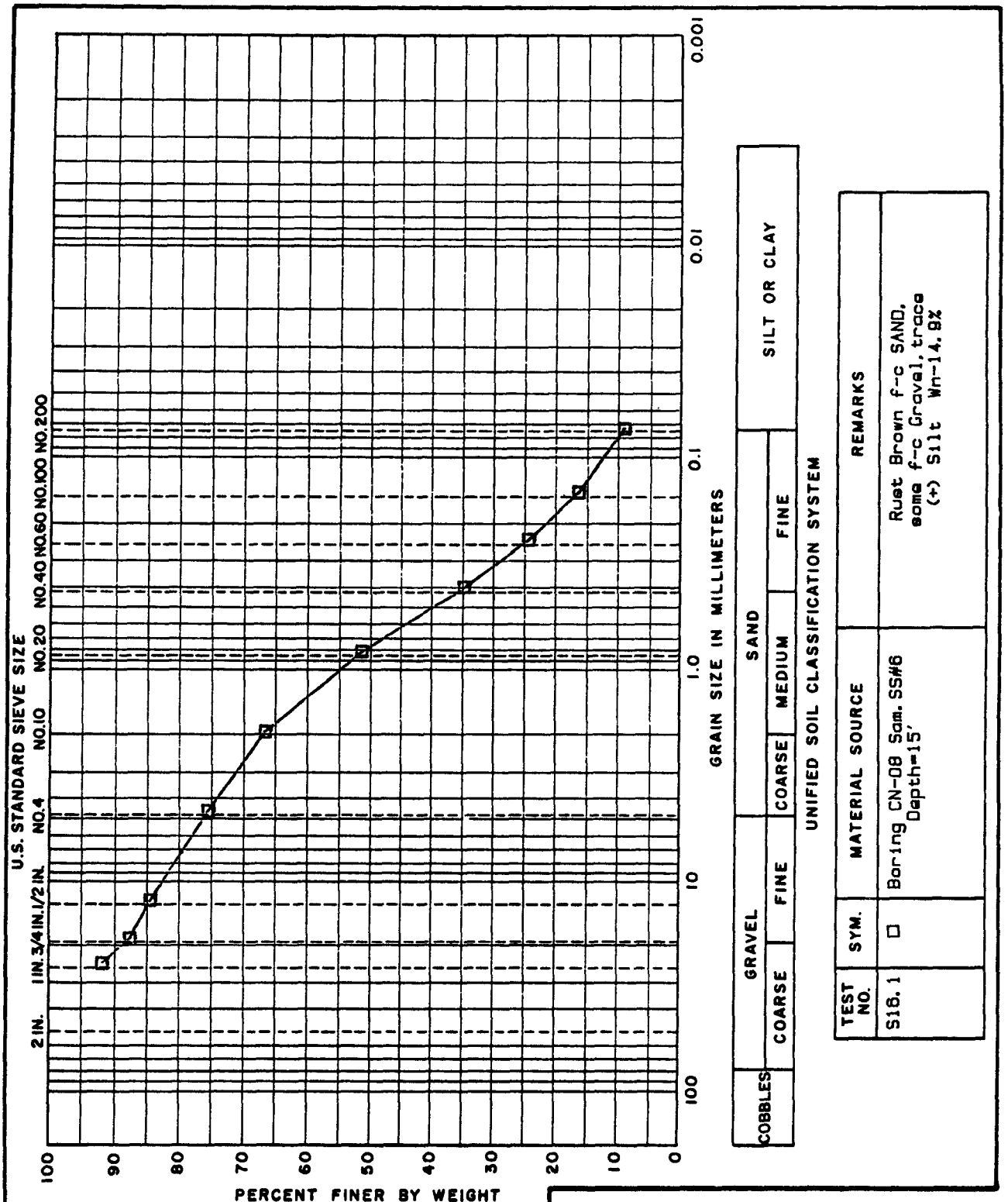
TEST SERIES NO. 15
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS



ECOLOGY AND ENVIRONMENT

GRADATION TESTS

BORING NO. CN-08
SAMPLE SS#6
DEPTH 15'
TECH. M. M.
REVIEWER

TEST SERIES NO. 16
DATE Dec. 86
L7973

FILE

APPENDIX E-9

S.3

GOLDBERG-ZOINO & ASSOCIATES, INC.
GEOTECHNICAL-GEOHYDROLOGICAL CONSULTANTS

APPENDIX D

SURVEYING LOG AND MAP

Table D-1

SUMMARY OF SURVEY DATA

Station	Coordinates		Elevations (ft.)		Remarks
	Northern	Eastern	Marker	Top of Casing	
CN-01	2912.00	5446	10.26	11.88	
CN-02	2857.00	5473	14.22	16.31	
CN-03	2877.00	5546	11.01	12.81	PVC well casing inaccessible, top of stl. protective casing was used
CN-04	2832.00	5606	13.27	15.58	
CN-05	2692.00	3670	13.48	15.67	Same as CN-03 above
CN-06	2626.00	6056	6.81	9.42	Same as CN-03 above
CN-07	2584.00	6061	6.25	7.98	
CN-08	2544.00	6013	5.94	7.51	
MON-A	3000.00	3000	17.15		Assumed coordinates
MON-B	2234.06	5582.75	10.28		

MAP AE 2040-01:

MONITORING WELL LOCATIONS

(See map pocket at back of this report)

APPENDIX E

ANALYTICAL RESULTS

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420

Compound	E & E Lab. No. 86-	9597	9598	9599	9600	Method Blank
	Site Location	01	01	01	01	
	Well Number	CN-01	CN-01	CN-02	CN-03	
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		<5	<5	<5	<5	<5
acetone		35	17	43	1800+	BML
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		<10	<10	<10	<10	<10
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		<5	<5	<5	<5	<5
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

+Approximate value, concentration exceeds calibrated range.

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.1

Compound	E & E Lab. No. 86-	9601	9602	9603	9604	Method Blank
	Site Location	01	03	02	02	
	Well Number	CN-04	CN-05	CN-06	CN-07	
	Sample Identity	CN-04-0	CN-05-0	CN-06-0	CN-07-0	
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		<5	<5	<5	270	<5
acetone		2700+	2100+	1700+	18	BML
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5*	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		<10	<10	<10	<10	<10
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		<5	<5	<5	<5	<5
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

+Approximate value, concentration exceeds calibrated range.

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.2

Compound	E & E Lab. No. 86-	9605	9606	9607	9608	9609
	Site Location	02	04	04	Trip	Sample
	Well Number	CN-08	Surface	Surface	Blank	Rinsate
	Sample Identity	CN-08-0	CN-16-0	CN-17-0	CN-18-0	CN-19-0
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		730	<5	<5	83	<5
acetone		12	BML	<10	BML	BML
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		<10	<10	<10	<10	<10
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		<5	<5	<5	<5	<5
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.3

Compound	E & E Lab. No. 86-	9597	9598	9599	9600	9601
	Site Location	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0
phenol		<10	<10	<10	<10	<10
2-chlorophenol		<10	<10	<10	<10	<10
2-nitrophenol		<10	<10	<10	<10	<10
2,4-dimethylphenol		<10	<10	<10	<10	<10
2,4-dichlorophenol		<10	<10	<10	<10	<10
4-chloro-3-methylphenol		<10	<10	<10	<10	<10
2,4,6-trichlorophenol		<10	<10	<10	<10	<10
2,4-dinitrophenol		<50	<50	<50	<50	<50
4-nitrophenol		<50	<50	<50	<50	<50
4,6-dinitro-2-methylphenol		<50	<50	<50	<50	<50
pentachlorophenol		<50	<50	<50	<50	<50

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.4

Compound	E & E Lab. No. 86-	9602	9603	9604	9605	9606
	Site Location	03	02	02	02	04
	Well Number	CN-05	CN-06	CN-07	CN-08	Surface
	Sample Identity	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-16-0
phenol		<10	<10	<10	<10	<10
2-chlorophenol		<10	<10	<10	<10	<10
2-nitrophenol		<10	<10	<10	<10	<10
2,4-dimethylphenol		<10	<10	<10	<10	<10
2,4-dichlorophenol		<10	<10	<10	<10	<10
4-chloro-3-methylphenol		<10	<10	<10	<10	<10
2,4,6-trichlorophenol		<10	<10	<10	<10	<10
2,4-dinitrophenol		<50	<50	<50	<50	<50
4-nitrophenol		<50	<50	<50	<50	<50
4,6-dinitro-2-methylphenol		<50	<50	<50	<50	<50
pentachlorophenol		<50	<50	<50	<50	<50

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.5

Compound	E & E Lab. No. 86-	9607	9608	9609	Method Blank	
	Site Location	04	Trip	Sample		
	--	Surface	Blank	Rinsate		
	Sample Identity	CN-17-0	CN-18-0	CN-19-0		
phenol		<10	<10	<10	<10	
2-chlorophenol		<10	<10	<10	<10	
2-nitrophenol		<10	<10	<10	<10	
2,4-dimethylphenol		<10	<10	<10	<10	
2,4-dichlorophenol		<10	<10	<10	<10	
4-chloro-3-methylphenol		<10	<10	<10	<10	
2,4,6-trichlorophenol		<10	<10	<10	<10	
2,4-dinitrophenol		<50	<50	<50	<50	
4-nitrophenol		<50	<50	<50	<50	
4,6-dinitro-2-methylphenol		<50	<50	<50	<50	
pentachlorophenol		<50	<50	<50	<50	

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.6

	E & E Lab. No. 86-	9597	9588	9599	9600	9601
	Site Location	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04
Compound	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0
bis(2-chloroethyl)ether		<10	<10	<10	<10	<10
1,3-dichlorobenzene		<10	<10	<10	<10	<10
1,4-dichlorobenzene		<10	<10	<10	<10	<10
1,2-dichlorobenzene		<10	<10	<10	<10	<10
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10
N-nitrosodipropylamine		<10	<10	<10	<10	<10
hexachloroethane		<10	<10	<10	<10	<10
nitrobenzene		<10	<10	<10	<10	<10
isophorone		<10	<10	<10	<10	<10
bis(2-chloroethoxy)methane		<10	<10	<10	<10	<10
1,2,4-trichlorobenzene		<10	<10	<10	<10	<10
naphthalene		<10	<10	<10	<10	<10
hexachlorobutadiene		<10	<10	<10	<10	<10
hexachlorocyclopentadiene		<10	<10	<10	<10	<10
2-chloronaphthalene		<10	<10	<10	<10	<10
dimethyl phthalate		<10	<10	<10	<10	<10
acenaphthylene		<10	<10	<10	<10	<10
fluorene		<10	<10	<10	<10	<10
acenaphthene		<10	<10	<10	<10	<10
2,4-dinitrotoluene		<10	<10	<10	<10	<10
2,6-dinitrotoluene		<10	<10	<10	<10	<10
diethylphthalate		<10	<10	<10	<10	<10
4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10
N-nitrosodiphenylamine		<10	<10	<10	<10	<10
4-bromophenyl phenyl ether		<10	<10	<10	<10	<10
hexachlorobenzene		<10	<10	<10	<10	<10
phenanthrene		<10	<10	<10	<10	<10
anthracene		<10	<10	<10	<10	<10
di-n-butyl phthalate		BML	11	12	11	12
fluoranthene		<10	<10	<10	<10	<10
benzidine		<50	<50	<50	<50	<50
pyrene		<10	<10	<10	<10	<10
butyl benzyl phthalate		<10	<10	<10	<10	<10
3,3'-dichlorobenzidine		<20	<20	<20	<20	<20
benzo(a)anthracene		<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate		<10	<10	BML	<10	<10
chrysene		<10	<10	<10	<10	<10
di-n-octyl phthalate		<10	<10	<10	<10	<10
benzo(b)fluoranthene		<10	<10	<10	<10	<10
benzo(k)fluoranthene		<10	<10	<10	<10	<10
benzo(a)pyrene		<10	<10	<10	<10	<10
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10
dibenzo(a,h)anthracene		<10	<10	<10	<10	<10
benzo(ghi)perylene		<10	<10	<10	<10	<10

*BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.7

Compound	E & E Lab. No. 86-	9602	9603	9604	9605	9606
	Site Location	03	02	02	02	04
	Well Number	CN-05	CN-06	CN-07	CN-08	Surface
	Sample Identity	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-160
bis(2-chloroethyl)ether		<10	<10	<10	<10	<10
1,3-dichlorobenzene		<10	<10	<10	<10	<10
1,4-dichlorobenzene		<10	<10	<10	<10	<10
1,2-dichlorobenzene		<10	<10	<10	<10	<10
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10
N-nitrosodipropylamine		<10	<10	<10	<10	<10
hexachloroethane		<10	<10	<10	<10	<10
nitrobenzene		<10	<10	<10	<10	<10
isophorone		<10	<10	<10	<10	<10
bis(2-chloroethoxy)methane		<10	<10	<10	<10	<10
1,2,4-trichlorobenzene		<10	<10	<10	<10	<10
naphthalene		<10	<10	<10	<10	<10
hexachlorobutadiene		<10	<10	<10	<10	<10
hexachlorocyclopentadiene		<10	<10	<10	<10	<10
2-chloronaphthalene		<10	<10	<10	<10	<10
dimethyl phthalate		<10	<10	<10	<10	<10
acenaphthylene		<10	<10	<10	<10	<10
fluorene		<10	<10	<10	<10	<10
acenaphthene		<10	<10	<10	<10	<10
2,4-dinitrotoluene		<10	<10	<10	<10	<10
2,6-dinitrotoluene		<10	<10	<10	<10	<10
diethylphthalate		<10	<10	<10	<10	<10
4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10
N-nitrosodiphenylamine		<10	<10	<10	<10	<10
4-bromophenyl phenyl ether		<10	<10	<10	<10	<10
hexachlorobenzene		<10	<10	<10	<10	<10
phenanthrene		<10	<10	<10	<10	<10
anthracene		<10	<10	<10	<10	<10
di-n-butyl phthalate		17	36	31	25	23
fluoranthene		<10	<10	<10	<10	<10
benzidine		<50	<50	<50	<50	<50
pyrene		<10	<10	<10	<10	<10
butyl benzyl phthalate		<10	<10	<10	<10	<10
3,3'-dichlorobenzidine		<20	<20	<20	<20	<20
benzo(a)anthracene		<10	<10	<10	<10	<10
bis(2-ethylhexyl)phthalate		<10	<10	<10	<10	<10
chrysene		<10	<10	<10	<10	<10
di-n-octyl phthalate		<10	48	BML	11	<10
benzo(b)fluoranthene		<10	<10	<10	<10	<10
benzo(k)fluoranthene		<10	<10	<10	<10	<10
benzo(a)pyrene		<10	<10	<10	<10	<10
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10
dibenzo(a,h)anthracene		<10	<10	<10	<10	<10
benzo(ghi)perylene		<10	<10	<10	<10	<10

*BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/L)

U-4420.8

Compound	E & E Lab. No. 86-	9607	9608	9609	Method Blank	
	Site Location	04	Trip	Sample		
	--	Surface	Blank	Rinsate		
	Sample Identity	CN-17-0	CN-18-0	CN-19-0		
bis(2-chloroethyl)ether		<10	<10	<10	<10	
1,3-dichlorobenzene		<10	<10	<10	<10	
1,4-dichlorobenzene		<10	<10	<10	<10	
1,2-dichlorobenzene		<10	<10	<10	<10	
bis(2-chloroisopropyl)ether		<10	<10	<10	<10	
N-nitrosodipropylamine		<10	<10	<10	<10	
hexachloroethane		<10	<10	<10	<10	
nitrobenzene		<10	<10	<10	<10	
isophorone		<10	<10	<10	<10	
bis(2-chloroethoxy)methane		<10	<10	<10	<10	
1,2,4-trichlorobenzene		<10	<10	<10	<10	
naphthalene		<10	<10	<10	<10	
hexachlorobutadiene		<10	<10	<10	<10	
hexachlorocyclopentadiene		<10	<10	<10	<10	
2-chloronaphthalene		<10	<10	<10	<10	
dimethyl phthalate		<10	<10	<10	<10	
acenaphthylene		<10	<10	<10	<10	
fluorene		<10	<10	<10	<10	
acenaphthene		<10	<10	<10	<10	
2,4-dinitrotoluene		<10	<10	<10	<10	
2,6-dinitrotoluene		<10	<10	<10	<10	
diethylphthalate		<10	<10	<10	<10	
4-chlorophenyl phenyl ether		<10	<10	<10	<10	
N-nitrosodiphenylamine		<10	<10	<10	<10	
4-bromophenyl phenyl ether		<10	<10	<10	<10	
hexachlorobenzene		<10	<10	<10	<10	
phenanthrene		<10	<10	<10	<10	
anthracene		<10	<10	<10	<10	
di-n-butyl phthalate		21	11	14	11	
fluoranthene		<10	<10	<10	<10	
benzidine		<50	<50	<50	<50	
pyrene		<10	<10	<10	<10	
butyl benzyl phthalate		<10	<10	<10	<10	
3,3'-dichlorobenzidine		<20	<20	<20	<20	
benzo(a)anthracene		<10	<10	<10	<10	
bis(2-ethylhexyl)phthalate		<10	<10	<10	<10	
chrysene		<10	<10	<10	<10	
di-n-octyl phthalate		<10	<10	<10	<10	
benzo(b)fluoranthene		<10	<10	<10	<10	
benzo(k)fluoranthene		<10	<10	<10	<10	
benzo(a)pyrene		<10	<10	<10	<10	
indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	
dibenzo(a,h)anthracene		<10	<10	<10	<10	
benzo(ghi)perylene		<10	<10	<10	<10	

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/L)

U-4420.9

Compound	E & E Lab. No. 86-	9597	9598	9599	9600	9601
	Site Location	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0
benzyl alcohol		<10	<10	<10	<10	<10
2-methylphenol		<10	<10	<10	<10	<10
4-methylphenol		<10	<10	<10	<10	<10
benzoic acid		<10	<10	<10	<10	<10
4-chloroaniline		<10	<10	<10	<10	<10
2-methylnaphthalene		<10	<10	<10	<10	<10
2,4,5-trichlorophenol		<50	<50	<50	<50	<50
2-nitroaniline		<50	<50	<50	<50	<50
3-nitroaniline		<50	<50	<50	<50	<50
dibenzofuran		<10	<10	<10	<10	<10
4-nitroaniline		<50	<50	<50	<50	<50

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/L)

U-4420.10

Compound	E & E Lab. No. 86-	9602	9603	9604	9605	9606
	Site Location	03	02	02	02	04
	Well Number	CN-05	CN-06	CN-07	CN-08	Surface
	Sample Identity	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-16-0
benzyl alcohol		<10	<10	<10	<10	<10
2-methylphenol		<10	<10	<10	<10	<10
4-methylphenol		<10	<10	<10	<10	<10
benzoic acid		<10	<10	<10	<10	<10
4-chloroaniline		<10	<10	<10	<10	<10
2-methylnaphthalene		<10	<10	<10	<10	<10
2,4,5-trichlorophenol		<50	<50	<50	<50	<50
2-nitroaniline		<50	<50	<50	<50	<50
3-nitroaniline		<50	<50	<50	<50	<50
dibenzofuran		<10	<10	<10	<10	<10
4-nitroaniline		<50	<50	<50	<50	<50

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/L)

U-4420.11

	E & E Lab. No. 86-	9607	9608	9609	Method Blank	
	Site Location	04	Trip	Surface	--	
	--	Surface	Blank	Rinsate	--	
Compound	Sample Identity	CN-17-0	CN-18-0	CN-19-0		
benzyl alcohol		<10	<10	<10	<10	
2-methylphenol		<10	<10	<10	<10	
4-methylphenol		<10	<10	<10	<10	
benzoic acid		<10	<10	<10	<10	
4-chloroaniline		<10	<10	<10	<10	
2-methylnaphthalene		<10	<10	<10	<10	
2,4,5-trichlorophenol		<50	<50	<50	<50	
2-nitroaniline		<50	<50	<50	<50	
3-nitroaniline		<50	<50	<50	<50	
dibenzofuran		<10	<10	<10	<10	
4-nitroaniline		<50	<50	<50	<50	

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES AND PCBs BY GC

(all results in ug/L)

U-4420.12

Compound	E & E Lab. No. 86-	9597	9598	9599	9600	9601	9602	9603
	Site Location	01	01	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04	CN-05	CN-06
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0	CN-05-0	CN-06-0
Aldrin		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
a-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
b-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
g-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
d-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlordane		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
4,4'-DDD		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
4,4'-DDE		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
4,4'-DDT		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dieldrin		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endosulfan I		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan II		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endosulfan sulfate		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endrin		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endrin aldehyde		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Heptachlor		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB - 1016		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1221		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1232		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1242		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1248		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1254		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PCB - 1260		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toxaphene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES AND PCBs BY GC

(all results in ug/L)

U-4420.13

Compound	E & E Lab. No. 86-	9604	9605	9606	9607	9608	9609	
	Site Location	02	02	04	04	Trip	Sample	
	Well Number	CN-07	CN-08	Surface	Surface	Blank	Rinsate	
	Sample Identity	CN-07-0	CN-08-0	CN-16-0	CN-17-0	CN-18-0	CN-19-0	
Aldrin		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
a-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
b-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
g-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
d-BHC		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Chlordane		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
4,4'-DDD		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
4,4'-DDE		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
4,4'-DDT		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Dieldrin		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Endosulfan I		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Endosulfan II		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Endosulfan sulfate		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Endrin		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Endrin aldehyde		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	
Heptachlor		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Heptachlor epoxide		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
PCB - 1016		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
PCB - 1221		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
PCB - 1232		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
PCB - 1242		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
PCB - 1248		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
PCB - 1254		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
PCB - 1260		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Toxaphene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES FOR METALS

U-4420.14

Parameter	E & E Laboratory No. 86-	(mg/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Antimony	9598*	<0.06	<0.06	--
Arsenic	9598*	<0.005	<0.005	--
Beryllium	9598*	<0.005	<0.005	--
Cadmium	9598*	<0.005	<0.005	--
Chromium	9598*	<0.01	<0.01	--
Copper	9598*	<0.01	0.017	--
Lead	9598*	<0.005	<0.005	--
Mercury	9599	<0.0002	<0.0002	--
Nickel	9598*	<0.015	0.016	--
Selenium	9598*	<0.005	<0.005	--
Silver	9598*	<0.01	<0.01	--
Thallium	9598*	<0.005	<0.005	--
Zinc	9598*	0.037	0.072	64.2

*replicate performed for dissolved metals

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR TOTAL PRIORITY POLLUTANT METALS AND PETROLEUM HYDROCARBONS

(all results in mg/L)

U-4420.15

	E & E Lab. No. 86-	9597	9598	9599	9600	9601
	Site Location	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0
Antimony		<0.06	<0.06	0.107	<0.06	<0.06
Arsenic		<0.005	<0.005	<0.005	<0.005	<0.005
Beryllium		0.005	<0.005	0.014	<0.005	<0.005
Cadmium		0.015	<0.005	0.022	<0.005	<0.005
Chromium		0.071	<0.01	0.166	<0.01	<0.01
Copper		0.096	0.024	0.206	0.073	0.019
Lead		0.086	0.046	0.128	0.040	0.019
Mercury		<0.0002	0.0008	<0.0002	0.0045	<0.0002
Nickel		0.041	<0.015	0.057	0.021	0.019
Selenium		<0.05	<0.05	<0.05	<0.05	<0.05
Silver		<0.01	<0.01	<0.01	<0.01	<0.01
Thallium		<0.005	<0.005	<0.005	<0.5	<0.005
Zinc		0.411	0.115	0.760	1.27	0.367
Petroleum Hydrocarbons		15	36	1	<1	2

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR TOTAL PRIORITY POLLUTANT METALS AND PETROLEUM HYDROCARBONS

(all results in mg/L)

U-4420.16

	E & E Lab. No. 86-	9602	9603	9604	9605	9606
	Site Location	03	02	02	02	04
	Well Number	CN-05	CN-06	CN-07	CN-08	Surface
	Sample Identity	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-16-0
Antimony		<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic		<0.005	0.006	<0.005	<0.5	0.011
Beryllium		<0.005	<0.005	<0.005	0.017	<0.005
Cadmium		<0.005	0.008	<0.005	0.040	0.007
Chromium		0.023	0.027	<0.01	0.154	0.037
Copper		0.091	0.054	0.024	0.292	0.108
Lead		0.112	0.035	0.005	0.208	0.170
Mercury		0.0037	0.0007	<0.0002	<0.0002	0.0034
Nickel		0.021	<0.015	<0.015	0.067	<0.015
Selenium		<0.05	<0.05	<0.05	<0.05	<0.05
Silver		<0.01	<0.01	<0.01	<0.01	<0.01
Thallium		<0.005	<0.005	<0.5	<0.005	<0.005
Zinc		0.393	0.695	0.078	0.738	0.199
Petroleum Hydrocarbons		3	1	<1	<1	<1

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR TOTAL PRIORITY POLLUTANT METALS AND PETROLEUM HYDROCARBONS

(all results in mg/L)

U-4420.17

	E & E Lab. No. 86-	9607	9608	9609		
	Site Location	04	Trip	Sample		
	--	Surface	Blank	Rinsate		
	Sample Identity	CN-17-0	CN-18-0	CN-19-0		
Antimony		<0.06	<0.06	<0.06		
Arsenic		0.007	<0.005	<0.005		
Beryllium		<0.005	<0.005	<0.005		
Cadmium		<0.005	<0.005	<0.005		
Chromium		0.019	<0.01	<0.01		
Copper		0.044	<0.01	<0.01		
Lead		0.084	<0.005	<0.005		
Mercury		0.0007	<0.0002	<0.0002		
Nickel		<0.015	<0.015	<0.015		
Selenium		<0.05	<0.005	<0.005		
Silver		<0.01	<0.01	<0.01		
Thallium		<0.005	<0.005	<0.005		
Zinc		0.112	0.013	<0.01		
Petroleum Hydrocarbons		<1	<1	<1		

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR DISSOLVED PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4420.18

	E & E Lab. No. 86-	9597	9598	9599	9600	9601
	Site Location	01	01	01	01	01
	Well Number	CN-01	CN-01	CN-02	CN-03	CN-04
	Sample Identity	CN-01-0	CN-01-D	CN-02-0	CN-03-0	CN-04-0
Antimony		<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic		<0.005	<0.005	<0.005	<0.005	<0.005
Beryllium		<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium		<0.005	<0.005	<0.005	<0.005	<0.005
Chromium		<0.01	<0.01	<0.01	<0.01	<0.01
Copper		<0.01	<0.01	<0.01	<0.01	<0.01
Lead		<0.005	<0.005	<0.005	<0.005	<0.005
Mercury		<0.0002	0.0006	<0.0002	0.0003	<0.0002
Nickel		<0.015	<0.015	<0.015	<0.015	<0.015
Selenium		<0.05	<0.005	<0.05	<0.05	<0.05
Silver		<0.01	<0.01	<0.01	<0.01	<0.01
Thallium		<0.005	<0.005	<0.005	<0.005	<0.005
Zinc		0.016	0.037	0.036	1.34	0.377

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR DISSOLVED PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4420.19

	E & E Lab. No. 86-	9602	9603	9604	9605	9606
	Site Location	03	02	02	02	04
	Well Number	CN-05	CN-06	CN-07	CN-08	Surface
	Sample Identity	CN-05-0	CN-06-0	CN-07-0	CN-08-0	CN-16-0
Antimony		<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic		<0.005	<0.005	<0.05	<0.005	<0.005
Beryllium		<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium		<0.005	<0.005	<0.005	<0.005	<0.005
Chromium		<0.01	<0.01	<0.01	<0.01	<0.01
Copper		<0.01	<0.01	<0.01	<0.01	<0.01
Lead		<0.005	<0.005	<0.05	<0.025	0.007
Mercury		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel		<0.015	<0.015	<0.015	<0.015	<0.015
Selenium		<0.05	<0.05	<0.05	<0.05	<0.05
Silver		<0.01	<0.01	<0.01	<0.01	<0.01
Thallium		<0.005	<0.05	<0.5	<0.05	<0.005
Zinc		0.317	0.912	0.048	0.057	0.169

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF WATER ANALYSES
FOR DISSOLVED PRIORITY POLLUTANT METALS

(all results in mg/L)

U-4420.20

	E & E Lab. No. 86-	9607	9608	9609		
	Site Location	04	Trip	Sample		
	--	Surface	Blank	Rinsate		
	Sample Identity	CN-17-0	CN-18-0	CN-19-0		
Antimony		<0.06	<0.06	<0.06		
Arsenic		<0.005	<0.005	<0.005		
Beryllium		<0.005	<0.005	<0.005		
Cadmium		<0.005	<0.005	<0.005		
Chromium		<0.01	<0.01	<0.01		
Copper		<0.01	<0.01	<0.01		
Lead		<0.005	<0.005	<0.005		
Mercury		0.0007	<0.0002	<0.0002		
Nickel		<0.015	<0.015	<0.015		
Selenium		<0.05	<0.005	<0.005		
Silver		<0.01	<0.01	<0.01		
Thallium		<0.05	<0.005	<0.005		
Zinc		0.107	<0.01	<0.01		

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4420.21

Compound	E & E Lab. No. 86-9598	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chloromethane		<10	<10	--
bromomethane		<10	<10	--
vinyl chloride		<10	<10	--
chloroethane		<10	<10	--
methylene chloride		<5	<5	--
1,1-dichloroethene		<5	<5	--
1,1-dichloroethane		<5	<5	--
trans-1,2-dichloroethene		<5	<5	--
chloroform		<5	<5	--
1,2-dichloroethane		<5	<5	--
1,1,1-trichloroethane		<5	<5	--
carbon tetrachloride		<5	<5	--
bromodichloromethane		<5	<5	--
1,2-dichloropropane		<5	<5	--
trans-1,3-dichloropropene		<5	<5	--
trichloroethene		<5	<5	--
chlorodibromomethane		<5	<5	--
1,1,2-trichloroethane		<5	<5	--
benzene		<5	<5	--
cis-1,3-dichloropropene		<5	<5	--
2-chloroethylvinyl ether		<10	<10	--
bromoform		<5	<5	--
tetrachloroethene		<5	<5	--
1,1,2,2-tetrachloroethane		<5	<5	--
toluene		<5	<5	--
chlorobenzene		<5	<5	--
ethylbenzene		<5	<5	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4420.22

Compound	E & E Lab. No. 86-9606	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chloromethane		<10	<10	--
bromomethane		<10	<10	--
vinyl chloride		<10	<10	--
chloroethane		<10	<10	--
methylene chloride		<5	<5	--
1,1-dichloroethene		<5	<5	--
1,1-dichloroethane		<5	<5	--
trans-1,2-dichloroethene		<5	<5	--
chloroform		<5	<5	--
1,2-dichloroethane		<5	<5	--
1,1,1-trichloroethane		<5	<5	--
carbon tetrachloride		<5	<5	--
bromodichloromethane		<5	<5	--
1,2-dichloropropane		<5	<5	--
trans-1,3-dichloropropene		<5	<5	--
trichloroethene		<5	<5	--
chlorodibromomethane		<5	<5	--
1,1,2-trichloroethane		<5	<5	--
benzene		<5	<5	--
cis-1,3-dichloropropene		<5	<5	--
2-chloroethylvinyl ether		<10	<10	--
bromoform		<5	<5	--
tetrachloroethene		<5	<5	--
1,1,2,2-tetrachloroethane		<5	<5	--
toluene		<5	<5	--
chlorobenzene		<5	<5	--
ethylbenzene		<5	<5	--

QUALITY CONTROL FOR PRECISION
RESULTS OF REPLICATE ANALYSIS

U-4420.24

Compound	E & E Lab. No. 86-9608	ug/L		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
bis(2-chloroethyl)ether		<10	<10	--
1,3-dichlorobenzene		<10	<10	--
1,4-dichlorobenzene		<10	<10	--
1,2-dichlorobenzene		<10	<10	--
bis(2-chloroisopropyl)ether		<10	<10	--
N-nitrosodipropylamine		<10	<10	--
hexachloroethane		<10	<10	--
nitrobenzene		<10	<10	--
isophorone		<10	<10	--
bis(2-chloroethoxy)methane		<10	<10	--
1,2,4-trichlorobenzene		<10	<10	--
naphthalene		<10	<10	--
hexachlorobutadiene		<10	<10	--
hexachlorocyclopentadiene		<10	<10	--
2-chloronaphthalene		<10	<10	--
dimethyl phthalate		<10	<10	--
acenaphthylene		<10	<10	--
fluorene		<10	<10	--
acenaphthene		<10	<10	--
2,4-dinitrotoluene		<10	<10	--
2,6-dinitrotoluene		<10	<10	--
diethylphthalate		<10	<10	--
4-chlorophenyl phenyl ether		<10	<10	--
N-nitrosodiphenylamine		<10	<10	--
4-bromophenyl phenyl ether		<10	<10	--
hexachlorobenzene		<10	<10	--
phenanthrene		<10	<10	--
anthracene		<10	<10	--
di-n-butyl phthalate		11	10	9.5
fluoranthene		<10	<10	--
benzidine		<50	<50	--
pyrene		<10	<10	--
butyl benzyl phthalate		<10	<10	--
3,3'-dichlorobenzidine		<20	<20	--
benzo(a)anthracene		<10	<10	--
bis(2-ethylhexyl)phthalate		<10	<10	--
chrysene		<10	<10	--
di-n-octyl phthalate		<10	<10	--
benzo(b)fluoranthene		<10	<10	--
benzo(k)fluoranthene		<10	<10	--
benzo(a)pyrene		<10	<10	--
indeno(1,2,3-c,d)pyrene		<10	<10	--
dibenzo(a,h)anthracene		<10	<10	--
benzo(g,h,i)perylene		<10	<10	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4420.25

Parameter	E & E Laboratory No. 86-9608	(ug/L)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Aldrin		<0.05	<0.05	--
a-BHC		<0.05	<0.05	--
b-BHC		<0.05	<0.05	--
g-BHC		<0.05	<0.05	--
d-BHC		<0.05	<0.05	--
Chlordane		<0.50	<0.50	--
4,4'-DDD		<0.10	<0.10	--
4,4'-DDE		<0.10	<0.10	--
4,4'-DDT		<0.10	<0.10	--
Dieldrin		<0.10	<0.10	--
Endosulfan I		<0.05	<0.05	--
Endosulfan II		<0.10	<0.10	--
Endosulfan sulfate		<0.10	<0.10	--
Endrin		<0.10	<0.10	--
Endrin aldehyde		<0.10	<0.10	--
Heptachlor		<0.05	<0.05	--
Heptachlor epoxide		<0.05	<0.05	--
PCB - 1016		<0.50	<0.50	--
PCB - 1221		<0.50	<0.50	--
PCB - 1232		<0.50	<0.50	--
PCB - 1242		<0.50	<0.50	--
PCB - 1248		<0.50	<0.50	--
PCB - 1254		<1.0	<1.0	--
PCB - 1260		<1.0	<1.0	--
Toxaphene		<1.0	<1.0	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

U-4420.26

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L)			
Antimony	9598 Rep*	<0.06	0.500	0.490	98.0
Arsenic	9598 Rep*	<0.005	0.080	0.072	90.0
Beryllium	9598 Rep*	<0.005	0.051	0.050	98.0
Cadmium	9598 Rep*	<0.005	0.050	0.046	92.0
Chromium	9598 Rep*	<0.01	0.199	0.198	99.5
Copper	9598 Rep*	0.017	0.249	0.241	90.0
Lead	9598 Rep*	<0.005	0.020	0.015	75.0
Mercury	9599 Rep	<0.0002	0.004	0.004	100
Nickel	9598 Rep*	0.016	0.400	0.365	87.2
Selenium	9598 Rep*	<0.005	0.040	0.031	77.5
Silver	9598 Rep*	<0.01	0.050	0.043	86.0
Thallium	9598 Rep*	<0.005	0.040	0.037	92.5
Zinc	9598 Rep*	0.072	0.199	0.220	74.4
Petroleum Hydrocarbon	DI Spike	--	8.2	9.0	110

*Spike performed on dissolved metals replicate

QUALITY CONTROL FOR ACCURACY:
PERCENT RECOVERY OF WATER MATRIX SPIKE
(Sample #9597)

U-4420.27

Compound	(ug/L)			Percent Recovery	EPA QC Limits (advisory)
	Original Result	Amount Added	Amount Determined		
1,1-Dichloroethene	<10	50	38	76	61 - 145
Trichloroethene	<10	50	46	92	71 - 120
Chlorobenzene	<10	50	46	92	75 - 130
Toluene	<10	50	46	92	76 - 125
Benzene	<10	50	47	94	76 - 127

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4420.28

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent
1,2-dichloroethane-D4	9597	50	48	96
	9598	50	45	90
	9599	50	43	86
	9600	50	49	98
	9601	50	49	98
	9602	50	44	88
	9603	50	44	88
toluene-D8	9597	50	48	96
	9598	50	47	94
	9599	50	48	96
	9600	50	48	96
	9601	50	49	98
	9602	50	44	88
	9603	50	49	98
4-bromofluorobenzene	9597	50	49	98
	9598	50	47	94
	9599	50	47	94
	9600	50	48	96
	9601	50	50	100
	9602	50	43	86
	9603	50	48	96

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4420.29

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
1,2-dichloroethane-D4	9604	50	46	92
	9605	50	47	94
	9606	50	45	90
	9607	50	46	92
	9608	50	47	94
	9609	50	47	94
toluene-D8	9604	50	45	90
	9605	50	45	90
	9606	50	46	92
	9607	50	48	96
	9608	50	50	100
	9609	50	48	96
4-bromofluorobenzene	9604	50	43	86
	9605	50	44	88
	9606	50	47	94
	9607	50	49	98
	9608	50	51	102
	9609	50	50	100

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY OF SURROGATE SPIKES

U-4420.30

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
Nitrobenzene-D5	9597	100	70	70
	9598	100	68	68
	9599	100	72	72
	9600	100	102	102
	9601	100	94	94
	9602	100	92	92
	9603	100	102	102
	9604	100	88	88
	9605	100	76	76
	9606	100	67	67
	9607	100	70	70
	9608	100	87	87
	9609	100	82	82
2-Fluorobiphenyl	9597	100	76	76
	9598	100	82	82
	9599	100	71	71
	9600	100	92	92
	9601	100	83	83
	9602	100	78	78
	9603	100	90	90
	9604	100	81	81
	9605	100	79	79
	9606	100	65	65
	9607	100	72	72
	9608	100	88	88
	9609	100	84	84

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4420.31

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
Terphenyl-D14	9597	100	104	104
	9598	100	105	105
	9599	100	102	102
	9600	100	91	91
	9601	100	89	89
	9602	100	45	45
	9603	100	108	108
	9604	100	105	105
	9605	100	101	101
	9606	100	67	67
	9607	100	80	80
	9608	100	108	108
	9609	100	105	105
Phenol-D5	9597	200	44	22
	9598	200	48	24
	9599	200	35	17.5
	9600	200	36	18
	9601	200	31	15.5
	9602	200	44	22
	9603	200	45	22.5
	9604	200	*	*
	9605	200	24	12
	9606	200	28	14
	9607	200	34	17
	9608	200	54	27
	9609	200	54	27

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

*No phenol surrogates were observed in Sample 9604. The sample was reextracted and yielded no recovery again. Therefore the absence of phenol surrogates is attributed to a matrix effect.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4420.32

Compound	E & E Laboratory No. 86-	Amount Added (ug/L)	Amount Determined (ug/L)	Percent Recovery
2-Fluorophenol	9597	200	68	34
	9598	200	70	35
	9599	200	70	35
	9600	200	104	52
	9601	200	101	50.5
	9602	200	76	38
	9603	200	70	35
	9604	200	*	*
	9605	200	34	17
	9606	200	48	24
	9607	200	56	28
	9608	200	97	48.5
	9609	200	87	43.5
2,4,6-Tribromophenol	9597	200	139	69.5
	9598	200	130	65
	9599	200	94	47
	9600	200	99	49.5
	9601	200	99	49.5
	9602	200	80	40
	9603	200	72	36
	9604	200	*	*
	9605	200	69	34.5
	9606	200	111	55.5
	9607	200	139	69.5
	9608	200	173	86.5
	9609	200	168	84

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

*No phenol surrogates were observed in Sample 9604. The sample was reextracted and yielded no recovery again. Therefore, the absence of phenol surrogates is attributed to a matrix effect.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

U-4420.33

Compound	E & E Lab. No. 86-9608	ug/L		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
phenol		<10	<10	--
2-chlorophenol		<10	<10	--
2-nitrophenol		<10	<10	--
2,4-dimethylphenol		<10	<10	--
2,4-dichlorophenol		<10	<10	--
4-chloro-3-methylphenol		<10	<10	--
2,4,6-trichlorophenol		<10	<10	--
2,4-dinitrophenol		<50	<50	--
4-nitrophenol		<50	<50	--
4,6-dinitro-2-methylphenol		<50	<50	--
pentachlorophenol		<50	<50	--

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408

Compound	E & E Lab. No. 86-	9560	9561	9562	9563	Method Blank
	Site Location	01	01	01	01	--
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		BML	BML	BML	BML	BML
acetone		14	12	BML	BML	BML
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		12	<10	14	11	11
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		<5	<5	<5	<5	<5
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.1

Compound	E & E Lab. No. 86-	9564	9565	9566	9567	9568
	Site Location	01	01	02	02	02
	Sample Identity	CN-10-024	CN-10-024 Dup	CN-11-006	CN-11-024	CN-12-006
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		18	15	BML	BML	BML
acetone		BML	BML	19	63	46
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		12	BML	15	12	<10
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		<5	<5	<5	15	19
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408.2

Compound	E & E Lab. No. 86-	9569	9570	9571	9572	Method Blank
	Site Location	02	03	03	03	
	Sample Identity	CN-12-024	CN-13-006	CN-13-024	CN-14-006	
chloromethane		<10	<10	<10	<10	<10
bromomethane		<10	<10	<10	<10	<10
vinyl chloride		<10	<10	<10	<10	<10
chloroethane		<10	<10	<10	<10	<10
methylene chloride		19	60	30	50	26
acetone		BML	13	14	13	BML
carbon disulfide		<5	<5	<5	<5	<5
1,1-dichloroethene		<5	<5	<5	<5	<5
1,1-dichloroethane		<5	<5	<5	<5	<5
trans-1,2-dichloroethene		<5	<5	<5	<5	<5
chloroform		<5	<5	<5	<5	<5
1,2-dichloroethane		<5	<5	<5	<5	<5
2-butanone		<10	<10	11	11	BML
1,1,1-trichloroethane		<5	<5	<5	<5	<5
carbon tetrachloride		<5	<5	<5	<5	<5
vinyl acetate		<10	<10	<10	<10	<10
bromodichloromethane		<5	<5	<5	<5	<5
1,2-dichloropropane		<5	<5	<5	<5	<5
trans-1,3-dichloropropene		<5	<5	<5	<5	<5
trichloroethene		<5	<5	<5	<5	<5
dibromochloromethane		<5	<5	<5	<5	<5
1,1,2-trichloroethane		<5	<5	<5	<5	<5
benzene		<5	<5	<5	<5	<5
cis-1,3-dichloropropene		<5	<5	<5	<5	<5
2-chloroethylvinyl ether		<10	<10	<10	<10	<10
bromoform		<5	<5	<5	<5	<5
4-methyl-2-pentanone		<10	<10	<10	<10	<10
2-hexanone		<10	<10	<10	<10	<10
tetrachloroethene		<5	<5	<5	<5	<5
1,1,2,2-tetrachloroethane		<5	<5	<5	<5	<5
toluene		8.3	<5	23	<5	<5
chlorobenzene		<5	<5	<5	<5	<5
ethylbenzene		<5	<5	<5	<5	<5
styrene		<5	<5	<5	<5	<5
total xylenes		<5	<5	<5	<5	<5

BML - Below measurable limit.

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
PURGEABLE ORGANIC COMPOUNDS AND HSL COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408.3

Compound	E & E Lab. No. 86-	9573	9574	9575		
	Site Location	03	04	04		
	Sample Identity	CN-14-024	CN-15-006	CN-15-024		
chloromethane		<10	<10	<10		
bromomethane		<10	<10	<10		
vinyl chloride		<10	<10	<10		
chloroethane		<10	<10	<10		
methylene chloride		32	22	6.4		
acetone		43	12	BML		
carbon disulfide		<5	<5	<5		
1,1-dichloroethene		<5	<5	<5		
1,1-dichloroethane		<5	<5	<5		
trans-1,2-dichloroethene		<5	<5	<5		
chloroform		<5	<5	<5		
1,2-dichloroethane		<5	<5	<5		
2-butanone		14	<10	10		
1,1,1-trichloroethane		<5	<5	<5		
carbon tetrachloride		<5	<5	<5		
vinyl acetate		<10	<10	<10		
bromodichloromethane		<5	<5	<5		
1,2-dichloropropane		<5	<5	<5		
trans-1,3-dichloropropene		<5	<5	<5		
trichloroethene		<5	<5	<5		
dibromochloromethane		<5	<5	<5		
1,1,2-trichloroethane		<5	<5	<5		
benzene		<5	<5	<5		
cis-1,3-dichloropropene		<5	<5	<5		
2-chloroethylvinyl ether		<10	<10	<10		
bromoform		<5	<5	<5		
4-methyl-2-pentanone		<10	<10	<10		
2-hexanone		<10	<10	<10		
tetrachloroethene		<5	<5	<5		
1,1,2,2-tetrachloroethane		<5	<5	<5		
toluene		21	<5	<5		
chlorobenzene		<5	<5	<5		
ethylbenzene		<5	<5	<5		
styrene		<5	<5	<5		
total xylenes		<5	<5	<5		

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408.4

Compound	E & E Lab. No. 86-	9560	9561	9562	9563	9564
	Site Location	01	01	01	01	01
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	CN-10-024
bis(2-chloroethyl)ether		<330	<330	<330	<330	<330
1,3-dichlorobenzene		<330	<330	<330	<330	<330
1,4-dichlorobenzene		<330	<330	<330	<330	<330
1,2-dichlorobenzene		<330	<330	<330	<330	<330
bis(2-chloroisopropyl)ether		<330	<330	<330	<330	<330
N-nitrosodipropylamine		<330	<330	<330	<330	<330
hexachloroethane		<330	<330	<330	<330	<330
nitrobenzene		<330	<330	<330	<330	<330
isophorone		<330	<330	<330	<330	<330
bis(2-chloroethoxy)methane		<330	<330	<330	<330	<330
1,2,4-trichlorobenzene		<330	<330	<330	<330	<330
naphthalene		<330	<330	<330	<330	<330
hexachlorobutadiene		<330	<330	<330	<330	<330
hexachlorocyclopentadiene		<330	<330	<330	<330	<330
2-chloronaphthalene		<330	<330	<330	<330	<330
dimethyl phthalate		<330	<330	<330	<330	<330
acenaphthylene		<330	<330	<330	<330	<330
fluorene		<330	<330	<330	<330	<330
acenaphthene		<330	<330	<330	<330	<330
2,4-dinitrotoluene		<330	<330	<330	<330	<330
2,6-dinitrotoluene		<330	<330	<330	<330	<330
diethylphthalate		<330	<330	<330	<330	<330
4-chlorophenyl phenyl ether		<330	<330	<330	<330	<330
N-nitrosodiphenylamine		<330	<330	<330	<330	<330
4-bromophenyl phenyl ether		<330	<330	<330	<330	<330
hexachlorobenzene		<330	<330	<330	<330	<330
phenanthrene		<330	<330	<330	<330	<330
anthracene		<330	<330	<330	<330	<330
di-n-butyl phthalate		3,400	2,900	3,300	4,300	3,000
fluoranthene		<330	<330	<330	<330	<330
benzidine		<1,700	<1,700	<1,700	<1,700	<1,700
pyrene		<330	<330	<330	<330	<330
butyl benzyl phthalate		<330	<330	<330	<330	<330
3,3'-dichlorobenzidine		<660	<660	<660	<660	<660
benzo(a)anthracene		<330	<330	<330	<330	<330
bis(2-ethylhexyl)phthalate		<330	<330	<330	<330	<330
chrysene		<330	<330	<330	<330	<330
di-n-octyl phthalate		14,000	16,000	12,000	11,000	12,000
benzo(b)fluoranthene		<330	<330	<330	<330	<330
benzo(k)fluoranthene		<330	<330	<330	<330	<330
benzo(a)pyrene		<330	<330	<330	<330	<330
indeno(1,2,3-cd)pyrene		<330	<330	<330	<330	<330
dibenzo(a,h)anthracene		<330	<330	<330	<330	<330
benzo(ghi)perylene		<330	<330	<330	<330	<330

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408.5

Compound	E & E Lab. No. 86-	9565	9566	9567	9568	9569
	Site Location	01	02	02	02	02
	Sample Identity	CN-10-024 Dup	CN-11-006	CN-11-024	CN-12-006	CN-12-024
bis(2-chloroethyl)ether		<330	<330	<330	<330	<330
1,3-dichlorobenzene		<330	<330	<330	<330	<330
1,4-dichlorobenzene		<330	<330	<330	<330	<330
1,2-dichlorobenzene		<330	<330	<330	<330	<330
bis(2-chloroisopropyl)ether		<330	<330	<330	<330	<330
N-nitrosodipropylamine		<330	<330	<330	<330	<330
hexachloroethane		<330	<330	<330	<330	<330
nitrobenzene		<330	<330	<330	<330	<330
isophorone		<330	<330	<330	<330	<330
bis(2-chloroethoxy)methane		<330	<330	<330	<330	<330
1,2,4-trichlorobenzene		<330	<330	<330	<330	<330
naphthalene		<330	<330	<330	<330	<330
hexachlorobutadiene		<330	<330	<330	<330	<330
hexachlorocyclopentadiene		<330	<330	<330	<330	<330
2-chloronaphthalene		<330	<330	<330	<330	<330
dimethyl phthalate		<330	<330	<330	<330	<330
acenaphthylene		<330	<330	<330	<330	<330
fluorene		<330	<330	<330	<330	<330
acenaphthene		<330	<330	<330	<330	<330
2,4-dinitrotoluene		<330	<330	<330	<330	<330
2,6-dinitrotoluene		<330	<330	<330	<330	<330
diethylphthalate		<330	<330	<330	<330	<330
4-chlorophenyl phenyl ether		<330	<330	<330	<330	<330
N-nitrosodiphenylamine		<330	<330	<330	<330	<330
4-bromophenyl phenyl ether		<330	<330	<330	<330	<330
hexachlorobenzene		<330	<330	<330	<330	<330
phenanthrene		<330	<330	<330	<330	<330
anthracene		<330	<330	<330	<330	<330
di-n-butyl phthalate		3,500	2,200	2,400	2,100	2,600
fluoranthene		<330	<330	<330	<330	<330
benzidine		<1,700	<1,700	<1,700	<1,700	1,700
pyrene		<330	<330	<330	<330	<330
butyl benzyl phthalate		<330	<330	<330	<330	<330
3,3'-dichlorobenzidine		<660	<660	<660	<660	<660
benzo(a)anthracene		<330	<330	<330	<330	<330
bis(2-ethylhexyl)phthalate		<330	<330	<330	470	<330
chrysene		<330	<330	<330	<330	<330
di-n-octyl phthalate		12,000	8,900	13,000	15,000	21,000
benzo(b)fluoranthene		<330	<330	<330	<330	<330
benzo(k)fluoranthene		<330	<330	<330	<330	<330
benzo(a)pyrene		<330	<330	<330	<330	<330
indeno(1,2,3-cd)pyrene		<330	<330	<330	<330	<330
dibenzo(a,h)anthracene		<330	<330	<330	<330	<330
benzo(ghi)perylene		<330	<330	<330	<330	<330

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg, as received)

U-4408.6

Compound	E & E Lab. No. 86-	9570	9571	9572	9573	9574
	Site Location	03	03	03	03	04
	Sample Identity	CN-13-006	CN-13-024	CN-14-006	CN-14-024	CN-15-006
bis(2-chloroethyl)ether		<330	<330	<330	<330	<330
1,3-dichlorobenzene		<330	<330	<330	<330	<330
1,4-dichlorobenzene		<330	<330	<330	<330	<330
1,2-dichlorobenzene		<330	<330	<330	<330	<330
bis(2-chloroisopropyl)ether		<330	<330	<330	<330	<330
N-nitrosodipropylamine		<330	<330	<330	<330	<330
hexachloroethane		<330	<330	<330	<330	<330
nitrobenzene		<330	<330	<330	<330	<330
isophorone		<330	<330	<330	<330	<330
bis(2-chloroethoxy)methane		<330	<330	<330	<330	<330
1,2,4-trichlorobenzene		<330	<330	<330	<330	<330
naphthalene		<330	<330	<330	<330	<330
hexachlorobutadiene		<330	<330	<330	<330	<330
hexachlorocyclopentadiene		<330	<330	<330	<330	<330
2-chloronaphthalene		<330	<330	<330	<330	<330
dimethyl phthalate		<330	<330	<330	<330	<330
acenaphthylene		<330	<330	<330	<330	<330
fluorene		<330	<330	<330	<330	<330
acenaphthene		<330	<330	<330	<330	<330
2,4-dinitrotoluene		<330	<330	<330	<330	<330
2,6-dinitrotoluene		<330	<330	<330	<330	<330
diethylphthalate		<330	<330	<330	<330	<330
4-chlorophenyl phenyl ether		<330	<330	<330	<330	<330
N-nitrosodiphenylamine		<330	<330	<330	<330	<330
4-bromophenyl phenyl ether		<330	<330	<330	<330	<330
hexachlorobenzene		<330	<330	<330	<330	<330
phenanthrene		<330	<330	<330	<330	800
anthracene		<330	<330	<330	<330	<330
di-n-butyl phthalate		2,100	2,100	1,900	3,100	2,600
fluoranthene		<330	<330	<330	<330	1,000
benzidine		<1,700	<1,700	<1,700	<1,700	<1,700
pyrene		<330	<330	<330	<330	1,100
butyl benzyl phthalate		<330	<330	<330	<330	<330
3,3'-dichlorobenzidine		<660	<660	<660	<660	<660
benzo(a)anthracene		<330	<330	<330	<330	570
bis(2-ethylhexyl)phthalate		<330	500	11,000	1,200	BML
chrysene		<330	<330	<330	<330	730
di-n-octyl phthalate		12,000	20,000	17,000	13,000	9,000
benzo(b)fluoranthene		<330	<330	<330	<330	1,100
benzo(k)fluoranthene		<330	<330	<330	<330	<330
benzo(a)pyrene		<330	<330	<330	<330	630
indeno(1,2,3-cd)pyrene		<330	<330	<330	<330	470
dibenzo(a,h)anthracene		<330	<330	<330	<330	<330
benzo(ghi)perylene		<330	<330	<330	<330	400

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.7

Compound	E & E Lab. No. 86-	9575	Method Blank			
	Site Location	04				
	Sample Identity	CN-15-024				
bis(2-chloroethyl)ether		<330	<330			
1,3-dichlorobenzene		<330	<330			
1,4-dichlorobenzene		<330	<330			
1,2-dichlorobenzene		<330	<330			
bis(2-chloroisopropyl)ether		<330	<330			
N-nitrosodipropylamine		<330	<330			
hexachloroethane		<330	<330			
nitrobenzene		<330	<330			
isophorone		<330	<330			
bis(2-chloroethoxy)methane		<330	<330			
1,2,4-trichlorobenzene		<330	<330			
naphthalene		<330	<330			
hexachlorobutadiene		<330	<330			
hexachlorocyclopentadiene		<330	<330			
2-chloronaphthalene		<330	<330			
dimethyl phthalate		<330	<330			
acenaphthylene		<330	<330			
fluorene		<330	<330			
acenaphthene		<330	<330			
2,4-dinitrotoluene		<330	<330			
2,6-dinitrotoluene		<330	<330			
diethylphthalate		<330	<330			
4-chlorophenyl phenyl ether		<330	<330			
N-nitrosodiphenylamine		<330	<330			
4-bromophenyl phenyl ether		<330	<330			
hexachlorobenzene		<330	<330			
phenanthrene		<330	<330			
anthracene		<330	<330			
di-n-butyl phthalate		1,500	2,600			
fluoranthene		<330	<330			
benzidine		<1,700	<1,700			
pyrene		<330	<330			
butyl benzyl phthalate		<330	<330			
3,3'-dichlorobenzidine		<660	<660			
benzo(a)anthracene		<330	<330			
bis(2-ethylhexyl)phthalate		<330	<330			
chrysene		<330	<330			
di-n-octyl phthalate		2,600	8,500			
benzo(b)fluoranthene		<330	<330			
benzo(k)fluoranthene		<330	<330			
benzo(a)pyrene		<330	<330			
indeno(1,2,3-cd)pyrene		<330	<330			
dibenzo(a,h)anthracene		<330	<330			
benzo(ghi)perylene		<330	<330			

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.8

Compound	E & E Lab. No. 86-	9560	9561	9562	9563	9564
	Site Location	01	01	01	01	01
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	CN-10-024
phenol		<330	<330	<330	<330	<330
2-chlorophenol		<330	<330	<330	<330	<330
2-nitrophenol		<330	<330	<330	<330	<330
2,4-dimethylphenol		<330	<330	<330	<330	<330
2,4-dichlorophenol		<330	<330	<330	<330	<330
4-chloro-3-methylphenol		<330	<330	<330	<330	<330
2,4,6-trichlorophenol		<330	<330	<330	<330	<330
2,4-dinitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4-nitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4,6-dinitro-2-methylphenol		<1,700	<1,700	<1,700	<1,700	<1,700
pentachlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.9

Compound	E & E Lab. No. 86-	9565	9566	9567	9568	9569
	Site Location	01	02	02	02	02
	Sample Identity	CN-10-024 Dup	CN-11-006	CN-11-024	CN-12-006	CN-12-024
phenol		<330	<330	<330	<330	<330
2-chlorophenol		<330	<330	<330	<330	<330
2-nitrophenol		<330	<330	<330	<330	<330
2,4-dimethylphenol		<330	<330	<330	<330	<330
2,4-dichlorophenol		<330	<330	<330	<330	<330
4-chloro-3-methylphenol		<330	<330	<330	<330	<330
2,4,6-trichlorophenol		<330	<330	<330	<330	<330
2,4-dinitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4-nitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4,6-dinitro-2-methylphenol		<1,700	<1,700	<1,700	<1,700	<1,700
pentachlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.10

Compound	E & E Lab. No. 86-	9570	9571	9572	9573	9574
	Site Location	03	03	03	03	04
	Sample Identity	CN-13-006	CN-13-024	CN-14-006	CN-14-024	CN-15-006
phenol		<330	<330	<330	<330	<330
2-chlorophenol		<330	<330	<330	<330	<330
2-nitrophenol		<330	<330	<330	<330	<330
2,4-dimethylphenol		<330	<330	<330	<330	<330
2,4-dichlorophenol		<330	<330	<330	<330	<330
4-chloro-3-methylphenol		<330	<330	<330	<330	<330
2,4,6-trichlorophenol		<330	<330	<330	<330	<330
2,4-dinitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4-nitrophenol		<1,700	<1,700	<1,700	<1,700	<1,700
4,6-dinitro-2-methylphenol		<1,700	<1,700	<1,700	<1,700	<1,700
pentachlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
ACID EXTRACTABLE COMPOUNDS BY GC/MS

(all results in ug/kg as received)

U-4408.11

Compound	E & E Lab. No. 86-	9575	Method Blank			
	Site Location	04				
	Sample Identity	CN-15-024				
phenol		<330	<330			
2-chlorophenol		<330	<330			
2-nitrophenol		<330	<330			
2,4-dimethylphenol		<330	<330			
2,4-dichlorophenol		<330	<330			
4-chloro-3-methylphenol		<330	<330			
2,4,6-trichlorophenol		<330	<330			
2,4-dinitrophenol		<1,700	<1,700			
4-nitrophenol		<1,700	<1,700			
4,6-dinitro-2-methylphenol		<1,700	<1,700			
pentachlorophenol		<1,700	<1,700			

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/kg as received)

U-4408.12

Compound	E & E Lab. No. 86-	9560	9561	9562	9563	9564
	Site Location	01	01	01	01	01
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	CN-10-024
benzyl alcohol		<330	<330	<330	<330	<330
2-methylphenol		<330	<330	<330	<330	<330
4-methylphenol		<330	<330	<330	<330	<330
benzoic acid		<1,700	<1,700	<1,700	<1,700	<1,700
4-chloroaniline		<330	<330	<330	<330	<330
2-methylnaphthalene		<330	<330	<330	<330	<330
2,4,5-trichlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700
2-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
3-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
dibenzofuran		<330	<330	<330	<330	<330
4-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/kg as received)

U-4408.13

Compound	E & E Lab. No. 86-	9565	9566	9567	9568	9569
	Site Location	01	02	02	02	02
	Sample Identity	CN-10-024 Dup	CN-11-006	CN-11-024	CN-12-006	CN-12-024
benzyl alcohol		<330	<330	<330	<330	<330
2-methylphenol		<330	<330	<330	<330	<330
4-methylphenol		<330	<330	<330	<330	<330
benzoic acid		<1,700	<1,700	<1,700	<1,700	<1,700
4-chloroaniline		<330	<330	<330	<330	<330
2-methylnaphthalene		<330	<330	<330	<330	<330
2,4,5-trichlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700
2-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
3-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
dibenzofuran		<330	<330	<330	<330	<330
4-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/kg as received)

U-4408.14

Compound	E & E Lab. No. 86-	9570	9571	9572	9573	9574
	Site Location	03	03	03	03	04
	Sample Identity	CN-13-006	CN-13-024	CN-14-006	CN-14-024	CN-15-006
benzyl alcohol		<330	<330	<330	<330	<330
2-methylphenol		<330	<330	<330	<330	<330
4-methylphenol		<330	<330	<330	<330	<330
benzoic acid		<1,700	<1,700	<1,700	<1,700	<1,700
4-chloroaniline		<330	<330	<330	<330	<330
2-methylnaphthalene		<330	<330	<330	<330	<330
2,4,5-trichlorophenol		<1,700	<1,700	<1,700	<1,700	<1,700
2-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
3-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700
dibenzofuran		<330	<330	<330	<330	<330
4-nitroaniline		<1,700	<1,700	<1,700	<1,700	<1,700

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR EXTRACTABLE HAZARDOUS SUBSTANCE LIST (HSL)† COMPOUNDS

(all results in ug/kg, as received)

U-4408.15

Compound	E & E Lab. No. 86-	9575	Method Blank			
	Site Location	04				
	Sample Identity	CN-15-024				
benzyl alcohol		<330	<330			
2-methylphenol		<330	<330			
4-methylphenol		<330	<330			
benzoic acid		<1,700	<1,700			
4-chloroaniline		<330	<330			
2-methylnaphthalene		<330	<330			
2,4,5-trichlorophenol		<1,700	<1,700			
2-nitroaniline		<1,700	<1,700			
3-nitroaniline		<1,700	<1,700			
dibenzofuran		<330	<330			
4-nitroaniline		<1,700	<1,700			

†In addition to the Priority Pollutant Compounds.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES AND PCBs BY GC

(all results in mg/kg as received)

U-4408.16

Compound	E & E Lab. No. 86-	9560	9561	9562	9563	9564	9565	9566
	Site Location	01	01	01	01	01	01	02
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	CN-10-024	CN-10-024 Dup	CN-11-006
Aldrin		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
a-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
b-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
g-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
d-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Chlordane		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
4,4'-DDD		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
4,4'-DDE		BML	BML	BML	0.022	0.036	0.040	0.041
4,4'-DDT		0.031	0.025	0.020	0.017	0.044	0.053	0.080
Dieldrin		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan I		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Endosulfan II		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan sulfate		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin aldehyde		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Heptachlor		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Heptachlor epoxide		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
PCB - 1016		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1221		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1232		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1242		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1248		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1254		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160
PCB - 1260		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160
Toxaphene		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES AND PCBs BY GC

(all results in mg/kg as received)

U-4408.17

Compound	E & E Lab. No. 86-	9567	9568	9569	9570	9571	9572	9573
	Site Location	02	02	02	03	03	03	03
	Sample Identity	CN-11-024	CN-12-006	CN-12-024	CN-13-006	CN-13-024	CN-14-006	CN-14-024
Aldrin		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
a-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
b-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
g-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
d-BHC		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Chlordane		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
4,4'-DDD		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
4,4'-DDE		<0.016	0.204	BML	<0.016	<0.016	<0.016	<0.016
4,4'-DDT		<0.016	0.240	<0.016	<0.016	<0.016	<0.016	<0.016
Dieldrin		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan I		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Endosulfan II		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan sulfate		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin aldehyde		<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Heptachlor		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Heptachlor epoxide		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
PCB - 1016		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1221		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1232		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1242		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1248		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
PCB - 1254		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160
PCB - 1260		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160
Toxaphene		<0.160	<0.160	<0.160	<0.160	<0.160	<0.160	<0.160

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSIS FOR
PRIORITY POLLUTANT PESTICIDES AND PCBs BY GC

(all results in mg/kg as received)

U-4408.18

Compound	E & E Lab. No. 86-	9574	9575					
	Site Location	04	04					
	Sample Identity	CN-15-006	CN-15-024					
Aldrin		<0.008	<0.008					
a-BHC		<0.008	<0.008					
b-BHC		<0.008	<0.008					
g-BHC		<0.008	<0.008					
d-BHC		<0.008	<0.008					
Chlordane		<0.080	<0.080					
4,4'-DDD		<0.016	<0.016					
4,4'-DDE		BML	<0.016					
4,4'-DDT		0.075	0.017					
Dieldrin		<0.016	<0.016					
Endosulfan I		<0.008	<0.008					
Endosulfan II		<0.016	<0.016					
Endosulfan sulfate		<0.016	<0.016					
Endrin		<0.016	<0.016					
Endrin aldehyde		<0.016	<0.016					
Heptachlor		<0.008	<0.008					
Heptachlor epoxide		<0.008	<0.008					
PCB - 1016		<0.080	<0.080					
PCB - 1221		<0.080	<0.080					
PCB - 1232		<0.080	<0.080					
PCB - 1242		<0.080	<0.080					
PCB - 1248		<0.080	<0.080					
PCB - 1254		<0.160	<0.160					
PCB - 1260		<0.160	<0.160					
Toxaphene		<0.160	<0.160					

BML - Below measurable limit.

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSES FOR PRIORITY
POLLUTANT METALS, PETROLEUM HYDROCARBONS, AND SOLIDS

(all results in mg/kg as received) U-4408.19

	E & E Lab. No. 86-	9560	9561	9562	9563	9564
	Site Location	01	01	01	01	01
	Sample Identity	CN-09-006	CN-09-006 Dup	CN-09-024	CN-10-006	CN-10-024
Antimony		<6	<6	<6	<6	<6
Arsenic		<2.5	<2.5	2.20	<0.55	<0.55
Beryllium		<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium		0.626	<0.5	3.83	<0.5	0.990
Chromium		3.69	2.72	3.87	4.19	3.67
Copper		5.06	5.10	16.2	5.91	3.32
Lead		7.76	6.68	28.2	8.48	10.7
Mercury		<0.1	<0.1	<0.1	<0.1	<0.1
Nickel		1.48	1.92	2.97	3.03	2.71
Selenium		<55	<55	<55	<55	<55
Silver		<1	<1	<1	<1	<1
Thallium		<0.55	<0.55	<0.55	<0.55	<0.55
Zinc		20.5	21.1	62.3	25.6	17.0
Petroleum Hydrocarbons		130	<50	3,300	<50	160
Solids, %		92	94	93	93	94

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSES FOR PRIORITY
POLLUTANT METALS, PETROLEUM HYDROCARBONS, AND SOLIDS

(all results in mg/kg as received)

U-4408.20

	E & E Lab. No. 86-	9565	9566	9567	9568	9569
	Site Location	01	02	02	02	02
	Sample Identity	CN-10-024 Dup	CN-11-006	CN-11-024	CN-12-006	CN-12-024
Antimony		<6	<6	<6	<6	<6
Arsenic		<0.55	0.55	0.73	1.03	<0.55
Beryllium		<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium		0.876	<0.5	<0.5	<0.5	<0.5
Chromium		3.27	4.06	4.46	4.23	3.98
Copper		3.06	1.78	1.93	3.24	1.44
Lead		5.07	8.38	3.50	12.9	3.04
Mercury		<0.1	<0.1	<0.1	<0.1	<0.1
Nickel		<1.5	2.42	2.95	2.91	3.19
Selenium		<55	<55	<55	<55	<55
Silver		<1	<1	<1	<1	<1
Thallium		<0.55	<0.55	<0.55	<0.55	<0.55
Zinc		14.9	14.6	16.3	35.0	12.0
Petroleum Hydrocarbons		68	<50	<50	<50	<50
Solids, %		92	80	86	79	88

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSES FOR PRIORITY
POLLUTANT METALS, PETROLEUM HYDROCARBONS, AND SOLIDS

(all results in mg/kg as received)

U-4408.21

	E & E Lab. No. 86-	9570	9571	9572	9573	9574
	Site Location	03	03	03	03	04
	Sample Identity	CN-13-006	CN-13-024	CN-14-006	CN-14-024	CN-15-006
Antimony		<6	<6	<6	<6	<6
Arsenic		<0.55	1.50	<2.5	0.757	<0.55
Beryllium		<0.5	<0.5	<0.5	<0.5	<0.5
Cadmium		0.698	0.508	2.58	1.21	0.608
Chromium		38.9	10.9	19.7	10.5	5.89
Copper		23.4	8.48	39.7	44.9	11.5
Lead		27.4	7.18	128	15.7	12.4
Mercury		<0.1	<0.1	<0.1	<0.1	<0.1
Nickel		2.45	5.62	2.02	3.76	5.06
Selenium		<55	<55	<55	<55	<55
Silver		<1	<1	<1	<1	<1
Thallium		<0.55	<0.55	<0.55	<0.55	<0.55
Zinc		34.3	30.7	53.2	45.2	32.9
Petroleum Hydrocarbons		7900	150	6700	470	<50
Solids, %		95	81	94	85	90

ECOLOGY AND ENVIRONMENT'S, INC.
A N A L Y T I C A L S E R V I C E S C E N T E R

RESULTS OF SOIL ANALYSES FOR PRIORITY
POLLUTANT METALS, PETROLEUM HYDROCARBONS, AND SOLIDS

(all results in mg/kg as received)

U-4408.22

	E & E Lab. No. 86-	9575				
	Site Location	04				
	Sample Identity	CN-15-024				
Antimony		<6				
Arsenic		<2.5				
Beryllium		<0.5				
Cadmium		<0.5				
Chromium		3.66				
Copper		3.86				
Lead		6.24				
Mercury		<0.1				
Nickel		2.87				
Selenium		<55				
Silver		<1				
Thallium		<0.55				
Zinc		16.5				
Petroleum Hydrocarbons		<50				
Solids, %		91				

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4408.23

Compound	E & E Lab. No. 86-9563	(ug/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
chloromethane		<10	<10	--
bromomethane		<10	<10	--
vinyl chloride		<10	<10	--
chloroethane		<10	<10	--
methylene chloride		<5*	<5*	--
1,1-dichloroethene		<5	<5	--
1,1-dichloroethane		<5	<5	--
trans-1,2-dichloroethene		<5	<5	--
chloroform		<5	<5	--
1,2-dichloroethane		<5	<5	--
1,1,1-trichloroethane		<5	<5	--
carbon tetrachloride		<5	<5	--
bromodichloromethane		<5	<5	--
1,2-dichloropropane		<5	<5	--
trans-1,3-dichloropropene		<5	<5	--
trichloroethene		<5	<5	--
chlorodibromomethane		<5	<5	--
1,1,2-trichloroethane		<5	<5	--
benzene		<5	<5	--
cis-1,3-dichloropropene		<5	<5	--
2-chloroethylvinyl ether		<10	<10	--
bromoform		<5	<5	--
tetrachloroethene		<5	<5	--
1,1,2,2-tetrachloroethane		<5	<5	--
toluene		<5	<5	--
chlorobenzene		<5	<5	--
ethylbenzene		<5	<5	--

*Compound present below measurable detection limit.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4408.24

Compound	E & E Lab. No. 86-9561	ug/kg		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
bis(2-chloroethyl)ether		<330	<330	--
1,3-dichlorobenzene		<330	<330	--
1,4-dichlorobenzene		<330	<330	--
1,2-dichlorobenzene		<330	<330	--
bis(2-chloroisopropyl)ether		<330	<330	--
N-nitrosodipropylamine		<330	<330	--
hexachloroethane		<330	<330	--
nitrobenzene		<330	<330	--
isophorone		<330	<330	--
bis(2-chloroethoxy)methane		<330	<330	--
1,2,4-trichlorobenzene		<330	<330	--
naphthalene		<330	<330	--
hexachlorobutadiene		<330	<330	--
hexachlorocyclopentadiene		<330	<330	--
2-chloronaphthalene		<330	<330	--
dimethyl phthalate		<330	<330	--
acenaphthylene		<330	<330	--
fluorene		<330	<330	--
acenaphthene		<330	<330	--
2,4-dinitrotoluene		<330	<330	--
2,6-dinitrotoluene		<330	<330	--
diethylphthalate		<330	<330	--
4-chlorophenyl phenyl ether		<330	<330	--
N-nitrosodiphenylamine		<330	<330	--
4-bromophenyl phenyl ether		<330	<330	--
hexachlorobenzene		<330	<330	--
phenanthrene		<330	<330	--
anthracene		<330	<330	--
di-n-butyl phthalate		2,900	3,100	6.7
fluoranthene		<330	<330	--
benzidine		<1,700	<1,700	--
pyrene		<330	<330	--
butyl benzyl phthalate		<330	<330	--
3,3'-dichlorobenzidine		<660	<660	--
benzo(a)anthracene		<330	<330	--
bis(2-ethylhexyl)phthalate		<330	<330	--
chrysene		<330	<330	--
di-n-octyl phthalate		16,000	11,000	37
benzo(b)fluoranthene		<330	<330	--
benzo(k)fluoranthene		<330	<330	--
benzo(a)pyrene		<330	<330	--
indeno(1,2,3-c,d)pyrene		<330	<330	--
dibenzo(a,h)anthracene		<330	<330	--
benzo(g,h,i)perylene		<330	<330	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4408.25

Compound	E & E Lab. No. 86-9561	ug/kg		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
phenol		<330	<330	--
2-chlorophenol		<330	<330	--
2-nitrophenol		<330	<330	--
2,4-dimethylphenol		<330	<330	--
2,4-dichlorophenol		<330	<330	--
4-chloro-3-methylphenol		<330	<330	--
2,4,6-trichlorophenol		<330	<330	--
2,4-dinitrophenol		<1700	<1700	--
4-nitrophenol		<1700	<1700	--
4,6-dinitro-2-methylphenol		<1700	<1700	--
pentachlorophenol		<1700	<1700	--

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4408.26

Compound	E & E Laboratory No. 86-9561	(mg/kg)		Relative Percent Difference (RPD)
		Original Analysis	Replicate Analysis	
Aldrin		<0.008	<0.008	--
a-BHC		<0.008	<0.008	--
b-BHC		<0.008	<0.008	--
g-BHC		<0.008	<0.008	--
d-BHC		<0.008	<0.008	--
Chlordane		<0.080	<0.080	--
4,4'-DDD		<0.016	<0.016	--
4,4'-DDE		0.014*	0.012*	15
4,4'-DDT		0.025	0.033	28
Dieldrin		<0.016	<0.016	--
Endosulfan I		<0.008	<0.008	--
Endosulfan II		<0.016	<0.016	--
Endosulfan sulfate		<0.016	<0.016	--
Endrin		<0.016	<0.016	--
Endrin aldehyde		<0.016	<0.016	--
Heptachlor		<0.008	<0.008	--
Heptachlor epoxide		<0.008	<0.008	--
PCB - 1016		<0.080	<0.080	--
PCB - 1221		<0.080	<0.080	--
PCB - 1232		<0.080	<0.080	--
PCB - 1242		<0.080	<0.080	--
PCB - 1248		<0.080	<0.080	--
PCB - 1254		<0.160	<0.160	--
PCB - 1260		<0.160	<0.160	--
Toxaphene		<0.160	<0.160	--

*Estimated value; below measurable detection limit.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

U-4408.27

Parameter	E & E Laboratory No. 86-	(mg/kg) Original Analysis	(mg/kg) Replicate Analysis	Relative Percent Difference (RPD)
Antimony	9564	<6	<6	--
Arsenic	9564	<0.55	<0.55	--
Beryllium	9564	<0.5	<0.5	--
Cadmium	9564	0.990	1.08	8.7
Chromium	9564	3.67	3.22	13.0
Copper	9564	3.32	2.87	14.5
Lead	9564	10.7	6.59	47.5
Nickel	9564	2.71	2.11	24.9
Selenium	9564	<55	<55	--
Silver	9564	<1	<1	--
Thallium	9564	<0.55	<0.55	--
Zinc	9564	17.0	14.3	17.2
Solids	9569 9575	88 91	88 93	0 2.2
Petroleum Hydrocarbons	9567	<50	<50	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

U-4408.28

Parameter	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/L*)			
Antimony	9570	<0.06	0.500	0.369	73.8
Arsenic	9570	<0.005	0.040	0.037	92.5
Beryllium	9570	<0.005	0.050	0.050	100
Cadmium	9570	0.006	0.050	0.057	114
Chromium	9570	0.362	0.200	0.537	87.5
Copper	9570	0.218	0.250	0.532	126
Mercury	9574	<0.0002	0.004	0.0041	102
Nickel	9570	0.023	0.500	0.480	91.4
Selenium	9570	<0.005	0.025	0.026	104
Silver	9570	<0.01	0.050	0.045	90.0
Thallium	9570	<0.005	0.050	0.046	92.0
Zinc	9570	0.318	0.500	0.856	108
Petroleum Hydrocarbons	9575	<50 mg/kg	790 mg/kg	850 mg/kg	108

*Results in mg/L because spiking performed during digestion procedure.

QUALITY CONTROL FOR ACCURACY:
PERCENT RECOVERY OF SOIL MATRIX SPIKE
(Sample #9574)

U-4408.29

Compound	(ug/kg)			Percent Recovery	EPA QC Limits (advisory)
	Original Result	Amount Added	Amount Determined		
1,1-Dichloroethene	<5	50	44	88	59 - 172
Trichloroethene	<5	50	41	82	62 - 137
Chlorobenzene	<5	50	45	90	60 - 133
Toluene	<5	50	53	106	59 - 139
Benzene	<5	50	46	92	66 - 142

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4408.30

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
1,2-dichloroethane-D4	9560	50	55	110
	9561	50	46	92
	9562	50	50	100
	9563	50	50	100
	9564	50	45	90
	9565	50	44	88
	9566	50	54	108
toluene-D8	9560	50	50	100
	9561	50	53	106
	9562	50	62	124*
	9563	50	52	104
	9564	50	52	104
	9565	50	51	102
	9666	50	48	96
4-bromofluorobenzene	9560	50	49	98
	9561	50	52	104
	9562	50	54	108
	9563	50	52	104
	9564	50	49	98
	9565	50	54	108
	9566	50	48	96

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

*High toluene-D8 recovery determined to be due to matrix effect.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4408.31

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
1,2-dichloroethane-D4	9567	50	55	110
	9568	50	54	108
	9569	50	44	88
	9570	50	47	94
	9571	50	42	84
	9572	50	44	88
toluene-D8	9567	50	49	98
	9568	50	51	102
	9569	50	54	108
	9570	50	54	108
	9571	50	49	98
	9572	50	54	108
4-bromofluorobenzene	9567	50	49	98
	9568	50	42	84
	9569	50	51	102
	9570	50	43	86
	9571	50	51	102
	9572	50	51	102

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY OF SURROGATE SPIKES

U-4408.32

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
1,2-dichloroethane-D4	9573	50	44	88
	9574	50	46	92
	9575	50	54	108
toluene-D8	9573	50	52	104
	9574	50	53	106
	9575	50	55	110
4-bromofluorobenzene	9573	50	50	100
	9574	50	47	94
	9575	50	55	110

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4408.33

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
Nitrobenzene-D5	9560	3300	3600	109
	9561	3300	3600	109
	9562	3300	3500	106
	9563	3300	3300	100
	9564	3300	3600	109
	9565	3300	3700	112
	9566	3300	3400	103
	9567	3300	3300	100
	9568	3300	3500	106
	9569	3300	3600	109
	9570	3300	3400	103
	9571	3300	3500	106
	9572	3300	3500	106
	9573	1700	1500	88
	9574	1700	1400	82
	9575	1700	1800	106
2-Fluorobiphenyl	9560	3300	3300	100
	9561	3300	3300	100
	9562	3300	3900	118
	9563	3300	3200	97
	9564	3300	3400	103
	9565	3300	3700	112
	9566	3300	3400	103
	9567	3300	3400	103
	9568	3300	3500	106
	9569	3300	3600	109
	9570	3300	4500	136
	9571	3300	3800	115
	9572	3300	3900	118
	9573	1700	1600	94
	9574	1700	1600	94
	9575	1700	1900	111

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4408.34

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
Terphenyl-D14	9560	3300	3200	97
	9561	3300	4300	130
	9562	3300	3000	91
	9563	3300	3800	115
	9564	3300	3600	109
	9565	3300	3600	109
	9566	3300	3600	109
	9567	3300	4100	124
	9568	3300	4000	121
	9569	3300	3400	103
	9570	3300	3000	91
	9571	3300	3500	106
	9572	3300	2800	85
	9573	1700	1400	82
	9574	1700	1500	88
	9575	1700	1900	112
Phenol-D5	9560	6600	6000	91
	9561	6600	7400	112
	9562	6600	4600	70
	9563	6600	4600	70
	9564	6600	6100	92
	9565	6600	7000	106
	9566	6600	5900	89
	9567	6600	6100	92
	9568	6600	5500	83
	9569	6600	6600	100
	9570	6600	5000	76
	9571	6600	6500	98
	9572	6600	4100	62
	9573	3300	2700	82
	9574	3300	2300	70
	9575	3300	3200	97

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

QUALITY CONTROL FOR ACCURACY: PERCENT
RECOVERY OF SURROGATE SPIKES

U-4408.35

Compound	E & E Laboratory No. 86-	Amount Added (ug/kg)	Amount Determined (ug/kg)	Percent Recovery
2-Fluorophenol	9560	6600	7400	112
	9561	6600	6400	97
	9562	6600	5900	89
	9563	6600	7500	114
	9564	6600	6800	103
	9565	6600	7500	114
	9566	6600	7400	112
	9567	6600	6400	97
	9568	6600	6100	92
	9569	6600	6400	97
	9570	6600	7400	112
	9571	6600	6800	103
	9572	6600	7100	108
	9573	3300	2700	82
	9574	3300	2800	85
	9575	3300	3400	103
2,4,6-Tribromophenol	9560	6600	6100	92
	9561	6600	4900	74
	9562	6600	3800	58
	9563	6600	5100	77
	9564	6600	4500	68
	9565	6600	5400	82
	9566	6600	6000	91
	9567	6600	4800	73
	9568	6600	5500	83
	9569	6600	5300	80
	9570	6600	3800	58
	9571	6600	4800	73
	9572	6600	3800	58
	9573	3300	1900	58
	9574	3300	1600	48
	9575	3300	2600	79

These recoveries are acceptable to EPA Contract Lab Program (CLP) guidelines.

APPENDIX F

DERP INVENTORY REPORT AND HAZARDOUS RANKING FORM

DERP

INVENTORY REPORT AND HAZARDOUS RANKING SYSTEM EVALUATION

Preliminary General Information

1. DERP Code Number. (11) .....

2. Site Name (current). (35) .F.O.R.M.E.R. .N.A.V.A.L. .A.U.X.I.L.I.A.R.Y .L.A.N.D.I.N.G. .F.I.E.L.D. .

3. Site Name when used by DOD. (35) .....

4. Street/Route Number. (25) .R.O.U.T.E. .1. .....

5. City. (16) .C.H.A.R.L.E.S.T.O.W.N. .....

6. County. (15) .W.A.S.H.I.N.G.T.O.N. .....

7. State. (2) .R.I.

8. Zip Code. (9) .0.2.8.1.3. ....

9. Congressional District Code Number. (2) .0.2.

10. Latitude: degrees, minutes, seconds. (6) .4.1°.2.1'.3.0". N

11. Longitude: degrees, minutes, seconds. (7) .7.1°.4.0'.0". W.

12. Is a large scale, greater than 1 inch equals 200 feet, topograhic map of the site area available to attach to this inventory report? (1) .Y.
Y = YES N = NO

13. Are site maps or sketches on file with the inventory? (1) .Y.
Y = YES N = NO

14. Are there photographs on file with the inventory? (1) .Y.
Y = YES N = NO

15. Current Owners Name(s). (45) .T.O.W.N. .O.F. .C.H.A.R.L.E.S.T.O.W.N./ .U.S. .F.I.S.H .A.N.D. .W.I.L.D.L.I.F.E. .S.E.R.V.I.C.E

16. Owner's Street Address. (25) .R.O.U.T.E. .2. /. .P.O. B.O.X. .3.0.7 .....

17. Owner's City. (16) .C.H.A.R.L.E.S.T.O.W.N. ....

18. Owner's State. (2) RI

19. Owner's Zip Code. (9) 02813

20. Number of Years Owned. (2) 6

21. What is the current owner's use of the site? (50) TOWN PARK/ WILDLIFE REFUGE

REAL ESTATE SEARCH INFORMATION

22. Give chronological list of owners or lessees since termination of DOD ownership or lease; include dates of ownership and brief description of use. (240)

DEPARTMENT OF DEFENSE ?
GENERAL SERVICES ADMINISTRATION 1973
TOWN OF CHARLESTOWN 1982
U.S. FISH AND WILDLIFE SERVICE 1982

23. Was property leased out to others by DOD? (Y or N), describe and match owner/lessee with use(s). (51)

NO

24. Was property leased-out to others by subsequent owners? (Y or N) Describe. (51)

NO

25. Type of problem(s) listed in claim documents, check as many as applicable: (3) N/A

Hazardous and Toxic = H (if listed complete questions 100 to 399).

Ordnance and Explosive = O (if listed complete questions 400-499).

Debris/Structures = D (if listed complete questions 500 to 599).

26. Has Right of Entry Permit been obtained? (Y or N). (1) Y

27. Are copies of lease agreements or deeds or other instruments conveying title on file? (Y or N). (1) N.

28. Does deed(s) or lease agreement(s) contain any disclaimers or restoration requirements? (Y or N). If yes, decribe. (161)

UNKNOWN.

29. Date field inspection completed. (6) 11/5/86

30. Agency performing inspection. (25)

ECOLOGY & ENVIRONMENT, INC.

31. Inspection team leader's name. (20) DAVID L. PALMERTON

32. Title. (25) GEOSCIENTIST

33. Organization (office symbol). (10) BUFFALO E+E

34. Telephone number(s): Commercial. (10) 716 632 4491

35. Telephone number(s): FTS. (7) N/A

36. Telephone number(s): AUTOVON. (7) N/A

37. Site Status: A = Active I = Inactive (1) I.

38. Years of operation in current status. (2) 06.

39. Type(s) of problems found by inspection team. (3) H., D.

USE:
H = H&T
O = OEW
D = Deoris

40. Enter the number of buildings on the site. (3) 07.

41. Describe. (80)

GATE HOUSE, NATURE CENTER, SENIOR CITIZEN CENTER, BOILER HOUSE, STORAGE BUILDING 150, PARTIALLY STANDING CONTROL TOWER, QUANSETT HUT

42. What is the major land use for a one mile radius around the site? (20) (e.g., agriculture, industry, residential).

RESIDENTIAL

43. What is the estimated population within a one mile radius around the site? (use 3.8 persons/house). (6)

3000

44. Describe the security of the site. (120)

CHAIN LINK FENCE AND WATER BOUNDARY ON EAST AND SOUTH

45. Describe the best access to the site from the nearest public road. (120)

TAKE NINIGRET PARK EXIT OFF U.S. #1 ONTO OLD POST RD. 1/4 MILE TO PARK MAIN ENTRANCE FOLLOW PARK RD. PAST DREW NATURE CENTER. TAKE FIRST DIRT ROAD PAST NATURE CENTER.

LIST CURRENT AND/OR PAST POLLUTION ABATEMENT PERMITS

PERMIT INFORMATION				
TYPE OF PERMIT ISSUED PAST AND/OR PRESENT	PRESENT NO.	DATE ISSUED	EXPIRATION DATE	COMMENTS

46. NPDES. (72) (PERMIT #, DATE ISSUED, EXPIRATION DATE, COMMENTS)

N/A

47. UIC. (72) (SAME AS 46)

N/A

48. AIR. (72) (SAME AS 46)

N/A

49. RCRA. (72) (SAME AS 46)

N/A

---

50. Describe any pertinent environmental protection response actions previously taken at the site. (240)

N/A

51. Describe any environmental protection remediation actions previously taken at the site. (240)

N/A

52. List any court orders, lawsuits, fines or other legal actions that have been taken against any owners/operators of the site since DOD ownership/ lease. (160)

UNKNOWN

53. Determination of Responsible Party for restoration: (1) N.

DOD Other Not yet determined

54. Contract 1. (13)

55. Contract 2. (13)

56. Contract 3. (13)

57. Contract 4. (13) . . . . . .

58. Contract 5. (13) . . . . . .

59-98. (Reserved)

99. Preliminary Information remarks. (80)

. . . . . .
. . . . . .
. . . . . .

DESCRIPTION OF WASTE AREAS WITH HRS OF WASTE STORAGE AT THE SITE

CONTAINMENT

100. Types of containment found in the individual waste areas: (4) .L.

Surface impoundment / / (I) Waste piles, including contaminated surface soils / / (P)

Containers / / (C) Landfill, including contaminated subsoils /✓/ (L)

101. Present integrity of containment: (25) (Use TABLES 1, 2 or 3 phrases)

.N.O.N.E. . . . . .

102. Evaluation of the integrity of containment versus potential groundwater release, before any remedial actions (see TABLE 1 for evaluation considerations). HRS Value - (Groundwater Containment). (1) 3.

103. Evaluation of the integrity of containment versus potential surface water release, before any remedial actions (see TABLE 2 for evaluation considerations). HRS Value - (Surface Water Containment). (1) .N/A

QUANTITY

104. Total quantity of hazardous waste, as deposited and capable of migrating. (Having a non-zero containment value (TABLE 3). The air pathway quantity is to include only those quantities that can be transported by the air: (10) .50.-.100. .GALS

105. Total quantity of waste now present: CY, drums and gallons (use only one common unit). (10) .50.-.100. .GALS

106. Quantity with the potential to migrate by groundwater. (10)

.50.-.100. .GALS

107. HRS Value (groundwater quantity). (1) (TABLE 3) .1.

108. Quantity with the potential to migrate by surface water. (10)

.N/A . . . . . .

109. HRS Value (Surface Water Quantity). (1) (TABLE 3) .0.

110. Quantity with the potential to migrate by air. (10)

N/A

111. HRS Value (Air Quantity). (1) (TABLE 3) 0.

HAZARDOUS SUBSTANCES

112. Hazardous substances in this area. (360)

Name(s)	Chemical Abstract System (CAS) Number
ACETONE	CAS-67-64-1

113. Highest scoring substance for Groundwater Migration Route. (25)

ACETONE

114.* *Toxicity ranking number. (1) 2

115.* Persistence ranking number. (1) 0

116.** HRS Matrix Value. (2) 0.6

117. Highest scoring substance for Surface Water Migration Route. (25)

N/A

118.* Toxicity (ranking number). (1) N/A

119.* Persistence (ranking number). (1) N/A

120.** HRS Matrix Value. (2) N/A

* Use TABLES 4, 5, or 6
**Use TABLE 7

121. Highest scoring substance for Air Migration Route. (25)

N/A

122.* Toxicity (ranking number). (1) N/A

123.** HRS Value. (2) N/A

PHYSICAL STATE

124. Physical state of waste as deposited: (1)

	HRS Value		HRS Value
Solid consoidated or stabilized:	0	Powder or fine material:	2
Solid, unconsolidated or unstabilized:	1	Liquid, sludge or gas:	(3)

HRS value from item 124. 3.

125. Description of current physical state of waste. (15)

LIQUID

GROUNDWATER MIGRATION ROUTE

HYDROGEOLOGY

126. Description of strata from surface to the deepest aquifer or concern (names, thickness, type of material). (Refer to TABLE 8) (200)

FILL 0-5'. OUTWASH COARSE GRAVEL AND SAND 1-10'. GRADED SANDS AND GRAVELS 2-30'. SOME SILTS AND CLAYS

127. Direction of regional groundwater flow. (3) S.W.

128. Are there barriers to horizontal migration of groundwater within 3 miles downgradient of the site (e.g., rivers). These barriers should be identified on a map of the site. (1) Y/N Y

* Use TABLES 4, 5, or 6
**Use TABLE 7

129. Are there discharge and/or recharge areas within 3 miles of the site? (These areas should be identified on a map of the site). (1) Y/N .Y.

COMPARATIVE DOCUMENTATION OF AQUIFERS

(All questions on this page refer to surficial aquifer).

130. Name of aquifer. (25)

.GLACIAL.OUTWASH.....

131. Designation of aquifer use. (10) .WATER.SUPPLY

132. Depth to highest seasonal level. (3) .2-3'

Circle the HRS value corresponding to the use of groundwater drawn from within 3 miles from the source of contamination:

	VALUE
Unusable	0
Commmercial, irrigation, or not used but usable	1
Drinking water with alternate source available	2
Sole source, drinking water supply	(3)

133. The HRS Value circled. (1) 3.

134. Location of nearest drinking or irrigation well within 3 miles downgradient of the source of contamination, give direction. (20)

Redacted-Privacy Act

.1.0.0.0'..N.O.R.T.H.-.N.O.R.T.H.E.A.S.T.

135. Depth of the nearest well (ft). (3) .22'.

136. Distance to the well from nearest point of contamination (critical distances that require careful measurement for HRS purposes of 2000', 1 mile, 2 miles and 3 miles). (5) .<.2.0.0.0'

137. Population served by groundwater drawn from aquifer within 3 miles of contamination. (6) .3.0.0.0...

138. Basis of population figure (e.g., census, house count). (10)

.C.E.N.S.U.S. . . . .

139. HRS value from Distance/Population Matrix (TABLE 9). (2) . .3.0.

140. Acres of cropland/pastureland irrigated by water drawn from the aquifer within 3 miles of contamination. (4) .N.O.N.E.

COMPARATIVE DOCUMENTATION OF AQUIFERS

(All questions on this page refer to Deeper Aquifer)

141. Name of aquifer. (25)

.U.N.K.N.O.W.N. . . . . .

142. Designation of aquifer use. (10) .N.O.T. .U.S.E.D. . .

143. Distance from ground surface (elevation) to highest seasonal water level. (3) .2.-.3.'

Circle the HRS value corresponding to the use of groundwater drawn from within 3 miles from the source of contamination:

	VALUE
Unusable	(0)
Commercial, irrigation, or not used but usable	1
Drinking water with alternate source available	2
Sole source, drinking water supply	3

144. HRS value circled. (1) .0.

145. Location of nearest drinking or irrigation well within 3 miles downgradient of the source of contamination, give direction. (20)

.U.N.K.N.O.W.N. . . . . .

146. Depth of the nearest well (ft). (3) .N/A .

147. Distance to the well from nearest point of contamination (critical distance that require careful measurement for HRS purposes are 2000', 1 mile, 2 miles and 3 miles). (5) .N/A. . .

148. Population served by groundwater drawn from aquifer within 3 miles of contamination. (6) N/A

149. Basis of population figure (e.g., census, house count). (10)

N/A

150. HRS value from Distance/Population Matrix (TABLE 9). (2) 0.

151. Acres of cropland/pastureland irrigated by water drawn from the aquifer within 3 miles of contamination. (4) 0.

RELEASE TO AQUIFER OF CONCERN

Select from the comparative documentation of aquifers, the aquifer that yields the highest HRS groundwater score. Document and evaluate this aquifer.

152. Name of aquifer. (25)

GLACIAL OUTWASH

153. Is it the surficial (S) or deeper (D) of the aquifers? (1) S.

154. Is there an observed release of contaminants to this aquifer: (1) Y.

Y (YES), Value = 45
N (NO), Value = 0

155. HRS Value. (2) 45.

156. Are there any analytical findings that document observed release to groundwater above background? (1) Y = YES N = NO Y.

157. Date of Analysis. (6) 12/22/86

158. Reference. (60)

ENGINEERING REPORT ON CONTAMINATION AT THE FORMER NAVAL AUXILLARY LANDING FIELD, CHARLESTOWN, RI APPENDIX E, U-4420

159. Identification of background well(s). (25)

CN-01. CN-02. CN-07. CN-08.

160. Identification of contaminated well(s). (25)

CN-03. CN-04. CN-05. CN-06.

161. Contaminants detected. (150)

ACETONE

162. Depth of contamination. (3) .5-3.0'

163. Distance from ground surface to highest seasonal water level in this aquifer. (3) .2-3.'

164. Depth below ground surface of deepest documented waste or of intake of of a contaminated well. (3) .3.0.

165. Depth from deepest point of documented contamination to the aquifer of concern. (3) (Question 163 minus 164) N/A

166. HRS Value. (1)

DEPTH	VALUE
0 - 20	(3)
21 - 75	2
76 -150	1
150	0

.3.

167. Inches of normal annual total precipitation (Figure 1). (2) + .4.7.

168. Inches of mean annual lake evaporation (Figure 2). (2) - .2.5.

169. Net precipitation, in inches (if seasonal data is used, show month(s) represented). (2) .2.2.

-10 inches = 0 15 inches = 3
-10 to + 5 = 1
+ 5 to +15 = 2

170. HRS Value (Precipitation). (1) 3.

171. Permeability of the least permeable layer between documented contamination and the highest seasonal water level of this aquifer of concern (TABLE 10). (6) N/A

172. HRS Value (Permeability) (1) 3.

GROUNDWATER USE

173. Write the number for the highest-valued actual use of this aquifer within a 3-mile radius as shown on the comparative evaluation. (1) 3.

USE	VALUE	USE	VALUE
Unusable	0	Drinking water with with alternate source	2
Commercial or irrigation	1	Without alternate source	(3)

DISTANCE TO NEAREST WELL

174. Distance to the nearest drinking water or irrigation well in this aquifer (comparative evaluation between surficial and deeper). (3) 420.00

POPULATION SERVED

175. Total population served by groundwater drawn from the aquifer within 3 miles of contamination (comparative evaluation between surficial and deeper).

Population (3.3 persons/house) (5) + 3.0.0.0.

176. Acres irrigated times 1.5 (4) persons/acre + ...0.

177. Total Population (5) 3.0.0.0.

178. Determine the worst case from distance/population Matrix (TABLE 9) and enter HRS value. (2) 3.0.

SURFACE WATER MIGRATION

A topographical map is to be attached showing the migration path that run-off would follow from the areas of waste storage to surface waters and thence to targets within 5 miles downstream. All distances are to be measured along the migration path rather than by a straight line.

Indicate sampling points, the most downstream point (or point along migration path) of documented contamination, all water intakes by use, and sensitive environments and critical habitats that lie contiguous to the migration path. Show names of water bodies.

OBSERVED RELEASE

179. Is there analytical evidence of contamination of surface waters above background? (1) N, Go to Item 185 Y, Go to Item 180 — N.

180. Date of Evidence: (6) — N/A

181. Reference: (60)

N/A

182. Background sampling points (list well identification): (80)

N/A

183. Downstream sampling points (list well identification): (80)

N/A

184. Contaminants detected (5 maximum): (100)

N/A

185. HRS Value. Direct evidence of release of surface water (evidence must be quantitative) - HRS value = 45; no evidence - HRS value = 0 (2) — 0.

186. Check if drinking water intakes have been contaminated. (1) 0 = NO
1 = YES, Public
2 = YES, Private
3 = BOTH

.0.

Questions 187 to 193 MUST BE COMPLETED ONLY IF EVIDENCE OF AN OBSERVED RELEASE TO SURFACE WATER IS LACKING:

ROUTE CHARACTERISTICS

187. Does this facility lie in a topographical depression with no surface water migration route? If YES, assign a surface water migration score of zero. If NO, continue with Item 188. (1)

.N.

SLOPE

188. Slope of the facility. (2)

<3%

189. Slope of intervening terrain from nearest point of documented contamination to surface water (Use TABLE 11): (2)

<3%

190. HRS Value (Slope Matrix). (1)

.0.

191. 1 year 24 hour rainfall as indicated for the site on Figure 3 (inches). (2)

<1.0

192. HRS Value (Rainfall). (1)

.0.

193. Distance along migration path from most downstream point of documented contamination to surface waters. (7) Distances of 2 miles and less are classifiable.

<1000. . .

*DISTANCE - Assign a value as follows:

Distance	Assigned Value
2 miles	0
1 to 2 miles	1
1000 feet to 1 mile	2
1000 feet	(3)

194. HRS Value (Distance of Surface Water). (1)

.3.

SURFACE WATER USE

195. Surface water use within 3 miles (1 mile maximum in static waters) along the migration path from the most downstream point of documented contamination. (1)

HRS Value

Not currently used for reasons unrelated to contamination from site:	------ 0	Irrigation recreation, etc:	---- 2
Commercial or industrial use.	------ 1	Drinking water:	---- 3

HRS Value (Surface Water Use) (Values may be added if water has more than one use). .0.

DISTANCE TO A SENSITIVE ENVIRONMENT

196. Name of nearest sensitive environment that is within 2 miles. (20)

N.I.N.I.G.R.E.T. .W.I.L.D.L.I.F.E. .R.E.FUGE

197. Type of Sensitive Environment. (3) 1 = Coastal Wetland . . .3.
2 = Freshwater Wetland
(3) = Critical Habitat (S - State or (F) - Federal)

198. Distance to a wetland (5 acre minimum) or a critical habitat of a Federal list endangered species that lies contiguous to the migration path. Measure distance from the nearest point of documented surface contamination along the migration path. (6) <1000. . .

199. HRS Value (Distance to Sensitive Environment). (1) Use TABLE 12 .3.

DISTANCE TO WATER INTAKE

200. Distance to drinking water or irrigation intake, measured from probable point of entry of migration path to surface water. (6) .N.O.N.E. . .

POPULATION SERVED

Total Population served by water drawn from surface water within the 3 mile limit:

201. Population (assume 3.8 persons/house). (5) ....0.

202. Acres irrigated times 1.5 persons/acre. (4) ...0.

203. Total HRS population: (5) ....0.

204. HRS, Value (Dist/Pop Matrix). (2) ..0
(The distance (question 200) and population (question 203) are used in TABLE 9 to determine HRS value.

AIR MIGRATION ROUTE

OBSERVED RELEASE - AIR

205. Is there any reason to suggest that air sampling should be done? (80)

NO ✓ YES ____

Narrative Summary:

SCREENING INDICATES NO ORGANICS ABOVE BACKGROUND . . NO WASTE ABOVE SURFACE . . . . . .

206. Is there analytical evidence confirming an observed released air above background? (1) ..

NO ✓ Go to Item 212 YES ____ Continue with Item 207

207. Date: (6) .N/A . . . .

208. Reference: (60)

N/A . . . . . .

209. Location of upwind and downwind sampling points: (80)

N/A . . . . . .

210. Method and equipment: (80)

N/A

211. Contaminants detected above background: (150)

N/A

212. Analytical evidence of contaminants. (2) . . .

HRS value - 45 if yes NO evidence - HRS value = 0

REACTIVITY & INCOMPATABILITY

See TABLE 13 and TABLE 14

Most reactive materials onsite are: (List)

213. (25) A.C.E.T.O.N.E

214. (25)

215. (25)

216. (25)

217. (25)

218. (25)

Most incompatible pairs of material onsite are: (List)

219. (25) N.O.N.E.

220. (25)

221. (25)

222. (25)

223. (25)

224. (25) . . . . . .

INCOMPATIBILITY	VALUE and TABLE 13
No incompatible materials are present	(0)
Present but do not pose a hazard	1
Present & may pose a future hazard	2
Present & posing an immediate hazard	3

225. HRS Value (R/I). (1) .0

POPULATION EXPOSED

Population exposed to risk of air release, (fill in population information for all distances from the volatilizing source):

Indicate in each box (a, b, c and d) the total population for the given radius.

		Total Population
226.	0 - 1/4 mile (7)	N/A . . . . .
227.	0 - 1/2 mile (7)	N/A . . . . .
228.	0 - 1 mile (7)	N/A . . . . .
229.	0 - 4 miles (8)	N/A . . . . .
230.	Use insert *** to determine HRS value. (2)	. .0

***Select the highest valuefor this rating factor as follows: Distance to Population from Hazardous Substance

Population	0-4 Mile	0-1 Mile	0-1/2 Mile	0-1/4 Mile
0	0	0	0	0
1-100	9	12	15	18
101-1000	12	15	18	21
1001-3000	15	18	21	24

DISTANCE TO A SENSITIVE ENVIRONMENT

Coastal wetland Freshwater wetland Critical habitat

231. Location and description of wetlands (5 acre minimum): (200)

N/A

Location of critical habitat of endangered species, including notation of whether the species is on the Federal list.

232. Distance from volatile substance to the sensitive environment. (6) N/A

233. HRS Value - See TABLE 12. (1) N/A

LAND USE within 2 miles - See TABLE 14

		DISTANCE/VALUE
234.	Commercial/industrial area. (5)	1 MILE / .
235.	Residential area. (5)	½ - 1 MILE
236.	National/State park, forest, wildlife reserves. (5)	< ½ MILE
237.	Prime agricultural land. (5)	.0 . . / .
238.	Agricultural land in production within the past 5 years. (5)	.0. . . / .

239. Is a historic landmark site within view of the facility or like to be subject to significant impacts from air release? YES (NO) (80)
If so, identify, locate and describe expected impacts:

240. HRS Value (use TABLE 14, Land Use). (1) N/A

FIRE AND EXPLOSION FROM HAZARDOUS OR TOXIC MATERIALS

FIRE AND EXPLOSION POTENTIAL:

241. Based on field observation and measurement, is there a demonstrated fire and explosion threat at this site? (41) NO/YES Describe:

Narrative summary:

N.O. . .N.O. .A.I.R. .C.O.N.T.A.M.I.N.A.T.I.O.N. - ACETONE IN GROUNDWATER

242. Has state or local fire marshal certified that site presents a significant hazard of fire or explosion: (41)

Narrative summary:

N.O.

IF ANY QUESTIONS IN ITEMS 241 and 242 HAVE BEEN CHECKED "YES" FOR FIRE AND EXPLOSION POTENTIAL, COMPLETE ITEMS (243 TO 284)

CONTAINMENT

Substances found onsite that are individually ignitable.

243. (25)

244. (25)

245. (25)

246. (25)

247. (25)

Substances found onsite that are incompatible.

248. (25)

249. (25)

250. (25)

251. (25)

252. (25)

253. Are any of the substances that are onsite hazardous in combination and are not segregated or isolated so as to prevent the formation of incompatible mixtures: Y OR N (1) N/A

ISOLATED/SEGREGATED	VALUE
YES	1
NO	3

254. HRS Value (Containment). (1) N/A

WASTE CHARACTERISTICS:

255. Direct evidence of ignitability or explosion potential, as measured: Y = YES N = NO (1) N.

256. HRS Value (Direct Evidence). VALUE: YES 3 NO 0 (1) 0.

257. Ignitability: List the most ignitable substance onsite and indicate the National Fire Protection Agency (NFPA) level assigned this substance (TABLE 15): (25)

ACETONE

258. HRS Value (Ignitable). (1) 3.

259. Most reactive materials onsite are: See TABLE 16 (25)

ACETONE

260. HRS Value (Reactive): (1) 0.

261. Most incompatible pairs of material onsite are: See TABLE 13 (40)

N/A

262. HRS Value (Incompatible). (1) 0.

263. Quantity of materials onsite that are flammable or explosive, including hazardous materials that are flammable or explosive alone or in combination: (9) N/A

264. HRS (Quantity) - See TABLE 3. (1) N/A

DISTANCE TO TARGETS:

265. Distance to nearest persons like to be at risk to fire or explosion (critical distances that require careful measurement for HRS purposes are 0 feet, 200 feet, 1/2 mile, 1 mile and 2 miles): (6) ½-1 MILE.

266. HRS Value (Population) - See TABLE 15A. (1) .2

267. Distance to the nearest building from the hazardous substance (critical distances that require careful measurement for HRS purposes are 50 feet, 200 feet and 1/2 mile): (6) ½ MILE.

DISTANCE	VALUE
1/2 mile	0
201'-1/2 mile	1
51'-200'	2
0-50'	3

268. HRS Value (Buildings). (1) .0.

269. Distance to nearest wetland from the hazardous substance? (6) . . . < 100'.

DISTANCE	VALUE
100'	0
100'	3

270. HRS Value (Wetlands). (1) 3.

271. Distance to a critical habitat from the hazardous substance (critical distances that require careful management of HRS purposes are 100 feet, 1000 feet and 1/2 mile): (6) < 100' . . .

DISTANCE	VALUE
>1/2 mile	0
1001 -1/2 mile	1
101-1000'	2
0-100'	3

272. HRS Value (Habitat). (1) .3.

273. Is a fire like to spread to this critical habitat, regardless of distance? YES or NO (1) N.

TARGETS FOR FIRE AND EXPLOSION:

Land use within 2 miles (note that this item is identical to the air migration pathway, providing the location of the volatilizing substances and the flammable or explosive substance is the same):

(Critical distances requiring measurement for HRS purposes are 1/4 mile, 1/2 mile, 1 mile and 2 miles): See TABLE 14

		DISTANCE/VALUE
274.	Commercial/industrial area. (5)	1 MILE / .
275.	Residential area. (5)	½ - 1 MILE.
276.	National/State park, forest, wildlife reserves. (5)	< ½ MILE.
277.	Prime agricultural land. (5)	. 0 . / .
278.	Agricultural land in production within the past 5 years. (5)	. 0 . / .

279. Is a historic landmark site within view of the facility or like to be subject to significant impacts from fire or explosion? YES OR (NO) Describe (81)

. . . . . .

TABLE 14 is used to determine the HRS value. The highest value is to be chosen.

280. HRS Value (Land Use). (1) N/A

281. Population with 2 mile radius. (If areial photography is used in making the count, assume 3.8 individuals per dwelling). (6) 3.000. . .

POPULATION	VALUE
0	0
1-100	1
101-1000	2
1001-3000	3
3001-10,000	4
>10,000	5

282. HRS Value (Population). (1) 3.

283. Buildings within a 2-mile radius (measures from the hazardous substance). (4) . . . . .

NO OF BUILDINGS	VALUE
0	0
1-26	1
27-60	2
261-790	3
791-2600	4
>2600	5

284. HRS Value (Buildings). (1) 3.

DIRECT CONTACT

285. Is there a confirmed instance in which contact caused injury, illness or death to humans or to domestic or wild animals? (100)

Narrative summary:

NO. . . . . .

286. HRS Values: YES - 45, NO - 0 (2) 0

IF ITEM 285 FOR DIRECT CONTACT IS CHECKED "YES" SKIP TO LINE 292 - IF NO, COMPLETE ITEMS 287 TO 291

Accessibility to where the hazardous material is deposited - evaluate the following aspects: (1)

287. Surveillance system:

	VALUE
YES	0
NO	1

1.

288. Artificial or natural barriers to entry: (1)

	VALUE
YES	0
NO	1

1.

289. Control of entry points: (1)

	VALUE	
YES	0	
NO	1	.0.

Add values from lines 287, 288 and 289 to mark in 291.

290. Have any changes in accessibility been made since the confirmed instance of direct contact? (1) Y/N N/A

291. HRS Value (Access). (1) .3.

292. Indicate if there is Containment of the hazardous materials against direct contact: (6)

CONTAINMENT	VALUE	Y OR N
Surface impound.	15	. .
Sealed or unsealed containers	15	. .
Tanks	15	. .
Landfill with less than 2' cover	15	. .
Spills	15	. .
Otherwise	(0)	.Y.

293. HRS Value (Containment) from item 292. (2) . .0

294. Toxicity of the most hazardous materials that are not adequately contained against direct contact: Refer to TABLES 4 & 5 (60)

Storage Area #

N/A . . . . . (20)

Material

N/A . . . . . (20)

Toxicity

N/A . . . . . (20)

295. HRS Value (Toxicity). (1) .0.

296. Population within one mile of hazardous materials: (7) 3000...

POPULATION WITHIN 1 MILE	VALUE
0	0
1-100	1
101-1000	2
1001-3000	3
3001-10,000	4
>10,000	5

Basis for this estimate: CENSUS

297. HRS Value (Population): (1) 3.

Location of critical habitat of endangered species, including notation of whether species is on the federal list: BALD EAGLE < 100'

298. Circle the appropriate Distance to the critical habitat (critical distance that require measurement for HRS purposes are 1/4 mile, 1/2 mile and 1 mile): (6)

< 1/4 MILE

DISTANCE	VALUE
>1 mile	0
1/2 mile - 1 mile	1
1/4 mile - 1/2 mile	2
<1/4 mile	(3)

299. Indicate if the critical habitat is on the State S, Federal F, or both B list(s). (1) F.

300. HRS Value (Distance to critical habitat) from Item 298. (1) 3.

301-398. Reserved

399. Remarks. (80)

ORDNANCE AND EXPLOSIVE WASTE (OEW)

OEW RISK ASSESSMENT:

The OEW risk assessment is based on records searches, reports of Explosive Ordnance Detachment actions, and field observations and measurements. These data are used to assess the risk involved based upon the hazards identified at the site. The risk assessment is composed of two factors, hazard severity and hazard probability.

Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel error, environmental conditions, or other pertinent factors.

Description	Category	Mishap Definition
CATASTROPHIC	1	Explosion, Death, Life-threatening or other injury causing total permanent disability, or Property damage in excess of $500,000.
CRITICAL	2	Major fire, Severe injury which requires doctor or hospital care for 1 or more persons, or Property damage between $100K and $500K.
MARGINAL	3	Minor fire, Minor injury which would require any medical or Property damage between $700 and $100,000.
NEGLIGIBLE	4	No injuries or Property damage less than $700.

400. The Hazard Category assigned for this site is. (1) N/A

401. This is based primarily upon the following: (160)

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Hazard probability. The probability that a hazard has been or will be created due to the presence of unexploded ordnance or explosive materials on a formerly used DOD site.

Description	Level	Probability Definition
FREQUENT	A	Has already occurred more than once or has the potential to occur at least every 1 or 2 years.
PROBABLE	B	Has already occurred once or has the potential to occur more than once in the next 10 to 20 years.
OCCASIONAL	C	Is likely to occur sometime in the next 10 to 20 years.
REMOTE	D	Unlikely but possible due to the nature of past DOD use of the site.
IMPROBABLE	E	So unlikely that it can be assumed that it will not occur.

402. The hazard probability level assigned for this site is. (1) UNKNOWN

403. This is based upon the following: (160)

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Risk Assessment. The risk assessment value for this site is to be found by using the following table. Enter with the results of items 400 & 402.

Probability Level	A	B	C	D	E
Severity Category:					
I	20	20	18	14	10
II	20	18	14	10	6
III	18	14	10	6	2
IV	14	10	6	2	0

404. The risk assessment value for this site is. (3) . . . .

405. Ordnance and Explosive Waste Characteristics. Is there any direct or other evidence that OEW is present or could be present based upon former DOD uses of the site? This evidence can be based upon direct observation of the site survey team, reports received from individuals, government agencies, or news media, review of drawings or archive documents relating to DOD operations at the site, or any other pertinent source.

YES (Complete the rest of this question).

NO (Continue starting with Question 422).

If the answer to this question is YES describe briefly the type of evidence and where that evidence is available for detailed review. (161)

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

(For Questions 406 through 442 underline, check, circle or otherwise indicate each appropriate answer.)

406. High Explosives. (4)

	YES VALUE	NO VALUE	Y OR N
Primary or Initiating Explosives (Lead Styphnate, Lead Azide, Nitroglycerin, Mercury Azide, Mercury Fulminate, etc.)	10	0	. .
Booster or Bursting Explosives (PETN, Compositions A, B, C, Tetryl, TNT, RDX, HMX, HBX, Black Powder, etc.)	5	0	. .
Military Dynamite	5	0	. .
Less Sensitive Explosives (Ammonium Nitrate, Favier Explosives, etc.)	3	0	. .

407. High Explosives Ordnance Ranking System (ORS) Value (Maximum value of 10). (2) . . .

408. Propellants. (5)

	YES VALUE	NO VALUE	Y OR N
Single Base Propellant (M10, M12, etc.)	3	0	. .
Double Base Propellant (M2, M5, M9, M13, etc.)	4	0	. .
Triple Base Propellant (M15, M17, etc.)	4	0	. .
Liquid Propellant	4	0	. .
Large Rocket Motors	5	0	. .

409. Other (describe). (15) . . . . . .

410. Propellants HRS Value from item 408. (1) . .

411. Conventional Ordnance and Ammunition. (11)

	YES VALUE	Y OR N
Small Arms (.22 cal - 20mm)	1	. .
Medium/Large Caliber (over 20mm)	5	. .
Ammunition, Inert	0	. .
Ammunition, Blank or Practice	2	. .
Bombs, Explosive	5	. .
Bombs, Practice, Fuzed	2	. .
Grenades, Mines	5	. .
Grenades, Mines, Practice, Fuzed	2	. .
Detonators, Blasing Caps	5	. .
Rockets, Missiles	5	. .
Demolition Charges	4	. .

412. Other. (15) . . . . . .

413. Conventional Ordnance and Ammunition ORS Value from item 411 (Maximum of 5). (1) . .

414. Pyrotechnics. (4)

	YES VALUE	Y OR N
White Phosphorus	5	. .
Pyrolusite	4	. .
Flares	3	. .
Smoke Rounds and Bombs	3	. .

415. Other Pyrotechnic Devices. (15) . . . . . .

416. Pyrotechnics ORS Value (Maximum of 5). (1) . .

417. Chemical Weapons/Agents. (3)

	YES VALUE	Y OR N
Toxic Chemical Warfare Agents (GB, VX, H, HD, BZ, __, etc.)	40	. .
Vomiting Agents (DA, DM, DC, etc.)	20	. .
Tear Agents (CNS, CNB, BBC, CS, etc.)	10	. .

418. Other Chemical Warfare Agents. (15) . . . . . .

419. Chemical Weapons ORS Value. (2) . . .

420. Total Ordnance and Explosive Waste Characteristics ORS Value (Total = 407 + 410 + 413 + 416 + 419 with a Maximum value of 55). (2) . . .

421. Provide a detailed description on any and all chemical weapons or chemical agents present at the site. (400)

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

422. Locations of Contamination. (6)

	VALUE	Y OR N
Within Tanks, Pipes, Vessels or Other confined locations.	5	. .
On the surface or within 3 feet.	5	. .
Inside walls, ceilings, or other parts of Buildings or Structures.	4	. .

423. Other (describe). (22) . . . . . .

424. Locations of Contamination ORS Value (Maximum of 5). (1) . .

425. Area Contaminated. (6) . . . . . .

	VALUE
None	0
Less than 1 acre	1
1 to 5 acres	2
5 to 50 acres	3
50 to 250 acres	4
Over 250 acres	5

426. Area Contaminated ORS Value (Maximum of 5). (1) . .

427. Extent of Contamination ORS Value Sum of items (424 + 426) - (Maximum of 10). . (2) . . .

428. Weight of OEW materials on site. (7) . . . . . .

429. Number of rounds (from 428). (7) . . . . . .

Weight of Bulk Explosives in Rounds	No. of Rounds, Containers, etc.	Value
0	0	0
Less than 10	1 to 9	2
10 to 100	10 to 100	4
101 to 500	101 to 500	6
501 to 1000	501 to 1000	8
Over 1000	Over 1000	10

430. Quantity of OEW ORS Value (Maximum of 10). (2) . . .
Two valves may be figured (e.g., 8 lbs TNT gives value of 2 & 200 rounds a value of 6. Then the ORS value would be 8).

431. Provide a detailed description and the types and amounts of ordnance and explosive materials previously removed from the site by EOD forces, currently at the site, or suspected to be at the site. (800)

432. Distance to nearest persons or normally inhabited structures likely to be at risk from OEW site. (6)

Distance to Nearest Target	VALUE
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.6 miles to 1.0 mile	3
1.1 mile to 2.0 miles	2
2.1 miles to 5.0 miles	1
Over 5.0 miles	0

433. Distance to Persons ORS Value (Maximum of 5). (1)

434. Distance to nearest utility system (power, water, or gas) or public highway likely to be at risk from OEW site. (6) . . . . . .

Distance to Nearest Target	VALUE
Less than 1250 feet	5
1251 feet to 1 mile	3
11 mile to 2 miles	1
Over 2 miles	0

435. Distances to Public Utilities/Highways ORS Value (Maximum of 5). (1) . .

436. Distances ORS Value (433 + 435) - (Maximum of 10). (2) . . .

437. Numbers and types of Buildings within a 2 mile radius measured from the hazardous area, not the installation boundary. (6) . . . . . .

Numbers of Buildings	VALUE
0	0
1 to 10	1
11 to 50	2
51 to 100	3
101 to 250	4
251 or Over	5

438. Numbers of Buildings ORS Value (Maximum of 5). (1) . .

439. Types of Buildings. (30)

. . . . . .

	VALUE
Educational, Child Care, etc.	5
Residential, Hospitals, Hotels, etc.	5
Commercial, Shopping Centers, etc.	5

Industrial, Warehouse, etc.	4
Agricultural, Forestry, etc.	3
Detention, Correctional	2
Military	1
No Buildings	0

440. Types of Buildings ORS Value (Maximum of 5). (1) . .

441. Numbers and Types of Buildings ORS Value (438 + 440) - Maximum of 10). (2) . . .

442. Accessibility to site refers to the measures taken to limit access by humans or animals to ordnance and explosive wastes. Assign a value using the following guidance: Describe. (40)

. . . . . .

Barrier	Assigned Value
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility;	0
or	
An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0
Security guard, but no barrier	1
A barrier, but no separate means to control entry	2
Barriers do not completely surround the facility	3
No barrier or security system	5

443. ORS Value (Maximum of 5). (1) . .

444-498. Reserved

499. Remarks. (80)

. . . . . .
. . . . . .
. . . . . .

DEBRIS

Debris description:

500. Type of Debris. (150)

DEMOLITION AND CONSTRUCTION DEBRIS: ASPHALT, CINDER, BLOCK, CEMENT, WOOD, HOUSEHOLD TRASH, BOTTLES, CANS, METAL SCRAPS, PRACTICE BOMBS

501. Type of construction for structures. (100)

CINDER BLOCK, WOOD

502. Quantity. (80)

100,000 - 200,000 SQ FT.

503. Condition, etc. (15)

STABLE

504. List underground structures or items. (80)

NONE KNOWN

505. DOD use of debris items. (80)

FILL MATERIAL, TRAINING EXERCISE

506. List buildings or other items that owner(s), after DOD disposal, have used for their benefit. Give use. (150)

1st PETTY OFFICER'S HOUSE - GUARD HOUSE; 2nd PETTY OFFICER'S HOUSE - NATURE CENTER; BUILDING 150 - STORAGE BUILDING; C.O.'S HOUSE - SENIOR CITIZEN CENTER

DEBRIS (CONTINUED)

507. List items onsite that were not constructed or used by DOD or DOD contractor. (80)

N.O.N.E. .K.N.O.W.N

508. List items owner wants to retain. (80)

A.L.L. .B.U.I.L.D.I.N.G.S.

509. List items that may have salvage value. (100)

M.E.T.A.L. .S.C.R.A.P. .A.T. .S.E.W.A.G.E. .O.U.T.F.A.L.L. .S.I.T.E. .A.N.D .S.T.O.R.A.G.E. .B.U.I.L.D.I.N.G

510. Give location of nearest or most economical disposal location. (80)

N.O.N. .H.A.Z.A.R.D.O.U.S. .M.A.T.E.R.I.A.L .T.O. .M.U.N.I.C.I.P.A.L .L.A.N.D.F.I.L.L.

511. Give special labor, equipment or methods that will be required for project. (100)

512. List any restrictions on methods of demolition or disposal. (80)

O.L.D. .B.O.I.L.E.R. .H.O.U.S.E. .M.A.Y. .C.O.N.T.A.I.N. .A.S.B.E.S.T.O.S.

513. Describe site grading that will be required for restoration: (include any special requirements or adverse foundation conditions). (40)

514. Give location for borrow material if required. (40)

B.O.W. .P.I.T. .L.E.S.S. .T.H.A.N. .1/4. .M.I.L.E. .O.N.-.S.I.T.E.

DEBRIS (CONTINUED)

515. List and give location of underground items that need to be preserved. (60)

ABANDONED SEPTIC SYSTEM AND WATER SUPPLY SYSTEM

516. Give requirements for seeding and mulching or other erosion measures. (80)

517. Describe unsightly debris (UD). If no unsightly debris exists, enter NONE for this item, and do not complete items 518 thru 529. (160)

TRASH DUMP - CANS, BOTTLES, BEDSPRINGS, ASPHALT, AND OTHER MATERIAL

518. Size of Debris Area (UD): (2)

	alue	
		.2
Debris covers area 5 acres or less in size.	(2)	
Debris covers area 6-25 acres in size.	5	
Debris covers area over 25 acres in size.	10	

519. Debris Above Ground Level (UD): (2) .4

(Include structures, miscellaneous debris items or piles 3' or more in height. Structures larger than 12,000 SF in area or more than two-story height to count as two structures. Groups of individual items wioll be considered one structure).

Number of Structures or Piles:	Value
0	0
1-2	2
3-6	(4)
7-15	6
16-30	8
31 or more	10

DEBRIS (CONTINUED)

520. Describe unusual items that require transformation to structure comparison in Item 519. (100)

N/A

521. Ground level debris (less than 3' high) (UD). Foundations, slabs, small piles, etc: (1)

Area Covered by Debris Items	Value
No Ground Level Debris	0
0-20,000 SF	1
20,000 - 100,000 SF	3
Over 100,000 SF	(5)

5.

522. Briefly describe Item 521 (concrete foundation, rubble etc). (80)

CONCRETE, RUNWAY. ASPHALT, TRASH.

523. Condition of Debris (UD): (2)

	Value
Building or structures very unsightly, such as partially demolished or collapsed or deteriorated beyond any reasonable renovation.	10
Structures that are in need of considerable maintenance, very large foundations, piles of building rubble, etc.	5
Small foundations, small debris piles or buildings in good condition that are not compatible with surrounding area.	(2)

.2

524. Give basis for value selected in Item 523. (100)

VISUAL INSPECTION

525. Location (UD): (2) — Value — .2

Rural	(2)
Small Town or Community	5
Urban or densely populated residential area	10

526. Effect on Surrounding Area (UD): (1) — Value — .2

Contributes highly to general area being slum or very desirable for use.	5
Serves as a deterent to development of general area or has slight bearing on above choice.	(2)
No effect.	0

527. Briefly describe effect in Item 526. (80)

MINOR PHYSICAL HAZARD AND EYESORE

528. Public Use or Exposure (UD): (2) — Value — .1.

Isolated from public exposure.	0
Located in area with little public exposure.	(1)
Located in area that receives heavy public use or exposure of seasonal or other varying nature.	6
Located in area that receives heavy year round use.	10

529. Give basis for value seleced in Item 528. (80)

MOST OF AREA AWAY FROM PUBLIC ACCESS

DEBRIS (CONTINUED)

530. Describe Hazardous Debris (HD): (160)

If there is no debris that represents a potential physical or health hazard to persons or is a potential source of damage to surrounding property, enter NONE for this item and 0 for item 540 and do not complete items 531 thru 537.

BROKEN GLASS, METAL SCRAP, WOOD WITH NAILS HIDDEN DEBRIS, CONCRETE WITH REBAR

531. Probability of Injury or Health Hazard (HD): (2) Value 6.

Has occurred frequently or has potential to occur at least annually.	10
Has occurred once and has potential to occur at least once every two years.	8
Has potential to occur every 2-10 years.	(6)
Has potential to occur every 10-25 years.	4
Unlikely to occur once every 25 years.	2

532. List past occurrences or give basis for value selected in Item 531. (100)

BEST ESTIMATE BASED UPON SITE CONDITIONS

533. Severity of Potential Hazard (HD): (2) (Most probable results from incident involving debris) Value .3.

Totally disabling or death.	10
Loss of limb, partial sight, hearing, etc.	8
Would require hospitalization or repeated medical treatment.	6
Would require minor medical care.	(3)
Minor cuts and bruises.	1
No injury.	0

534. Give information on past incidents or describe conditions that would contribute to value selected in Item 533. (100)

BROKEN GLASS, AREAS OF DROP OFF, RUSTY AND BROKEN METAL OBJECTS

535. Hazard to Property Other Than Owner (HD): (2) (Damage resulting from fire, collapse, etc.) Value .0.

Potential for damage in excess of $250,000.	10
Potential for damage of $75,000 to $250,000.	5
Potential for damage of less than $75,000.	1
No damage potential.	0

536. List hazard and property that would be exposed to hazard in Item 535. (80)

N/A

537. Probability of Damage Occurring (HD): (1) Value .2

In next two years.	5
In 2-10 years.	4
In 10-25 years.	(2)
Beyond 25 years.	1

538. Has site been coordinated for demolition and/or removal under Section 106 of the National Preservation Act? ___Yes ✓No (1) .N.

542-598. Reserved.

599. Remarks (80)

DEBRIS WORKSHEET

539. Unsightly Debris Score:

A. Item No.	Value
518	2
519	4
521	5
523	2
525	2
526	2

TOTAL

B. If value for item 528 is 0, multiply total in A. by 0.5 _____.

If value for items 528 is 1, multiply totasl in A. by 0.9 15.3.

If value for item 528 is 6 to 10, add value selected to Total in A. _____.

C. Divide B. by 2.10 for Unsightly Debris Score 7 (Round to nearest whole number).

540. Hazard Debris Score:

Item No.	Value
531	6
533	3
535	0
537	2

A. Multiply Item 531 value by Item 533 = 18

B. Multiply Item 535 value by Item 537 = 0

TOTAL A + B = 18

Hazardous Debris Score = Total A+B = 18
(Round to nearest whoe number)

DEBRIS WORKSHEET (CONTINUED)

541. Total Score for Ranking.

Total Score = Unsightly Debris Score (Item 538) + Hazardous Debris Score (Item 539) = 25.

APPENDIX G

BACKGROUND WATER QUALITY

The following data, obtained by the Rhode Island Department of Health, Division of Water Supply, represent background levels of metals and volatile organic compounds of relevance to the former NALF site in Charlestown, Rhode Island. Those public water systems relevant to this report are underlined.

SYSTEM	SAMPLING POINT																															
Canob Park	Nayatt TPE	<1	<1	4	12	16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<30
	Well	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<10	<30
Canonchet Cliffs Housing	Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<15	<15	<15	<15	<15
Central Beach Fire Dist.	Well #1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Cumberland-Town of	Sneech Pond-Raw	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Manville Well #1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Manville Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Abbott Run Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Abbott Run Well #3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30

Micrograms per liter

SYSTEM / SAMPLING POINT	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Total Trihalomethanes	1,1,1-Trichloroethane	Carbon Tetrachloride	Trichloroethylene	1,1,2-Trichloroethane	Tetrachloroethylene	Dichloromethane	1,1-Dichloroethene	1,2-Dichloroethene	1,1-Dichoroethane	1,2-Dichloroethane	1,3-Dichloropropene(cis&trans)	1,2-Dichloropropane	Chlorobenzene	1,1,2,2-Tetrachloroethane	Benzene	Toluene	Ethylbenzene	Xylene
East Beach Landing Condo. Tap /	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
East Beach Water Co. Well #1/	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Well #2 /	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Glendale-Davis Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Glendale Water Assn. Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Harrisville Fire District Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Well #3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Hem. Vill. Hous./Elderly Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
Jamestown-Town of Raw-North Pond	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Raw-South Pond	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
TPE	46	6	<1	<1	52	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30

Micrograms per liter

recycled paper

Micrograms per liter

SYSTEM	SAMPLING POINT	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Total Trihalomethanes	1,1,1-Trichloroethane	Carbon Tetrachloride	Trichloroethylene	1,1,2-Trichloroethane	Tetrachloroethylene	Dichloromethane	1,1-Dichloroethene	1,2-Dichloroethene	1,1-Dichoroethane	1,2-Dichloroethane	1,3-Dichloropropene (cis&trans)	1,2-Dichloropropane	Chlorobenzene	1,1,2,2-Tetrachloroethane	Benzene	Toluene	Ethylbenzene	Xylene
Kent Co. Water Auth./E.G.	Well #1	<1	<1	<1	<1	<1	8	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Kent Co. Water Auth./W.W.	Spring Lake Well	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Mishnock Well #1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Mishnock Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Kingsland Village Apts.	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Kingsland Village Condo.	Well #1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Kingston Fire District	Well #1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30

Micrograms per liter

SYSTEM	SAMPLING POINT	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Total Trihalomethanes	1,1,1-Trichloroethane	Carbon Tetrachloride	Trichloroethylene	1,1,2-Trichloroethane	Tetrachloroethylene	Dichloromethane	1,1-Dichloroethene	1,2-Dichloroethene	1,1-Dichoroethane	1,2-Dichloroethane	1,3-Dichloropropene (cis&trans)	1,2-Dichloropropane	Chlorobenzene	1,1,2,2-Tetrachloroethane	Benzene	Toluene	Ethylbenzene	Xylene
Seaconnet Point Farm	Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Shady Harbor Fire Dist.	Well #3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Shannock Village Part.	Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
Slatersville	Dug Well	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
	Driven Well	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
	Halliwell Sch. Well	1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<3

Micrograms per liter

SYSTEM	SAMPLING POINT	Chloroform	Bromodichloromethane	Dibromochloromethane	Bromoform	Total Trihalomethanes	1,1,1-Trichloroethane	Carbon Tetrachloride	Trichloroethylene	1,1,2-Trichloroethane	Tetrachloroethylene	Dichloromethane	1,1-Dichloroethene	1,2-Dichloroethene	1,1-Dichoroethane	1,2-Dichloroethane	1,3-Dichloropropene (cis&trans)	1,2-Dichloropropane	Chlorobenzene	1,1,2,2-Tetrachloroethane	Benzene	Toluene	Ethylbenzene	Xylene
	Pacheco Park Well	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<3
Sonquipaug	Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
South Kingstown-S.Shore	Well #1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Stone Bridge Fire Dist.	Raw-Stafford Pond	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
Touisset Point	Coggeshall St. Well	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
	George St. Well	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
U.S. Army-N. Smithfield	Tap	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<5	<5	<15
University of RI	Well #2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30
	Well #4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10	<10	<30

Milligrams per liter

System	Sampling Point	·Arsenic	·Barium	·Cadmium	·Chromium	·Copper	·Lead	·Mercury	·Nickel	·Selenium	·Silver	·Zinc
Canob Park	Well	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Canonchet Cliffs Housing	Tap	<0.005	0.11	<0.001	<0.005	0.41	0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Central Beach Fire Dist.	Well #1	<0.005	<0.02	<0.001	<0.005	0.03	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Charbert Inc.	Tap	<0.005	0.06	<0.001	<0.005	0.08	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Collyer Wire Co.	Well #1	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	0.03	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Coventry ANG Station	Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	0.007	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.03
	Well #3	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Crest Mfg. Co.	Tap	<0.005	0.02	<0.001	<0.005	0.45	0.006	<0.001	<0.02	<0.005	<0.001	<0.02
Cumberland-Town of	Sneech Pond TPE	<0.005	0.028	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Manville Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Manville Well #2	<0.005	<0.02	<0.001	<0.005	0.11	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
	Abbott Run Well #2	<0.005	0.058	<0.001	<0.005	0.11	0.015	<0.001	<0.02	<0.005	<0.001	<0.02

Milligrams per liter

System	Sampling Point	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
	Abbott Run Well #3	<0.005	0.088	<0.001	<0.005	0.16	0.011	<0.001	<0.02	<0.005	<0.001	<0.02
East Beach Land, Condos.	Tap	<0.005	0.07	<0.001	<0.005	0.37	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
East Beach Water Co.	Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	0.006	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Glas Kraft, Inc.	Tap	<0.005	0.03	<0.001	<0.005	0.83	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Glendale-Davis	Tap	<0.005	0.02	<0.001	<0.005	0.05	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Glendale Water Assn.	Tap	<0.005	<0.02	<0.001	<0.005	0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Greene Plastics	Tap	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Hadron Inc.	Tap	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Harrisville Fire Dist.	Well #2	<0.005	0.04	<0.001	<0.005	0.03	0.006	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #3	<0.005	<0.02	<0.001	<0.005	0.02	0.006	<0.001	<0.02	<0.005	<0.001	<0.02
Hemlock Village	Tap	<0.005	<0.02	<0.001	<0.005	0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Imperial Wallpaper Co.	Well #2	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #3	<0.005	0.02	<0.001	<0.005	0.04	0.011	<0.001	<0.02	<0.005	<0.001	<0.02
Indus. Park Water Co.	Tifft Rd. Well	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
Jamestown-Town of	North Pond	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02

Milligrams per liter

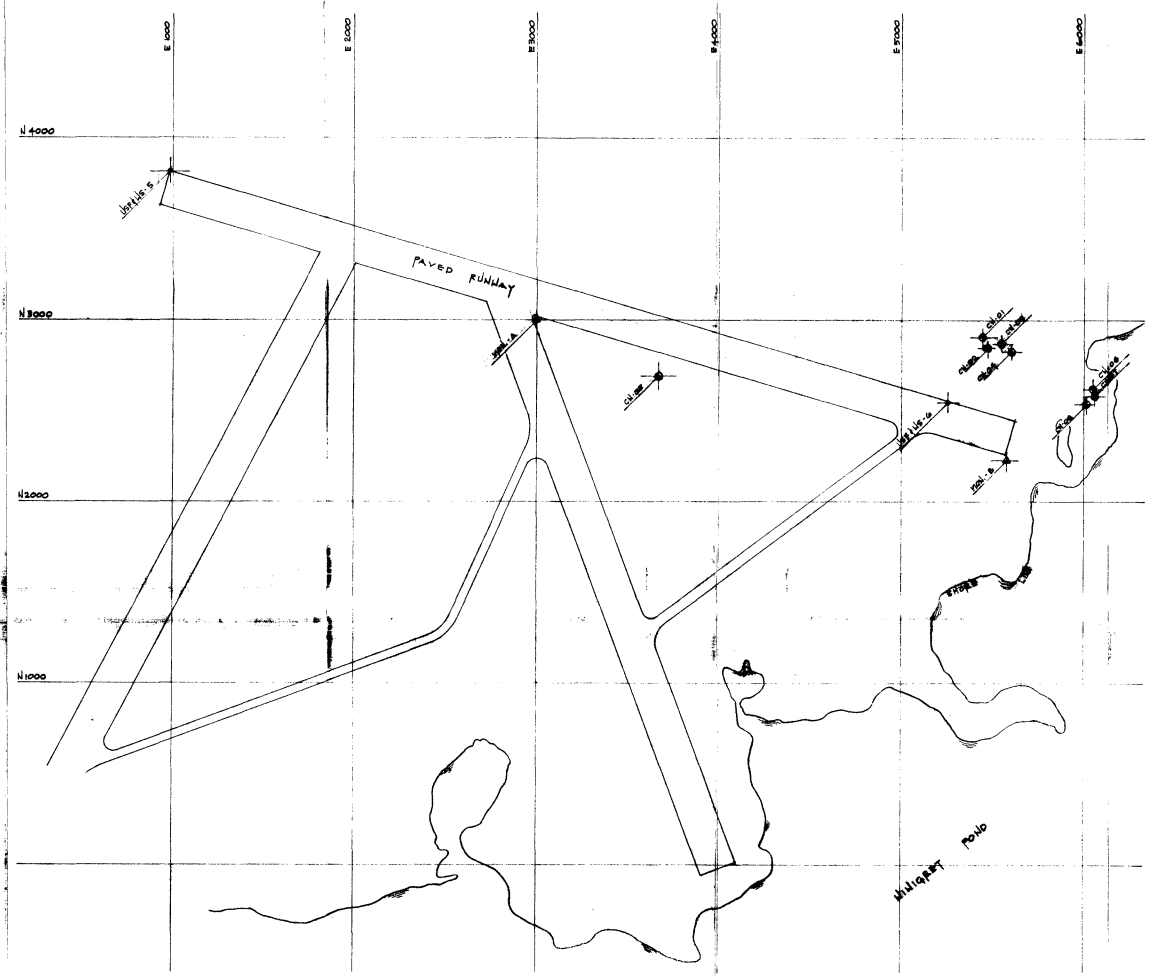
System	Sampling Point	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
	South Pond	<0.005	0.03	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
	TPE	<0.005	<0.02	<0.001	<0.005	0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Kent County Water Auth.	Well #1 (Warwick)	0.009	<0.02	<0.001	<0.005	<0.02	0.007	<0.001	<0.02	<0.005	<0.001	<0.02
	Spring Lake Well	<0.005	<0.02	<0.001	<0.005	0.14	0.009	<0.001	<0.02	<0.005	<0.001	0.02
	Mishnock Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
	Mishnock Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Kenyon Piece Dye Co.	Well #2	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
	Well #3	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
Kingsland Village Apts.	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #3	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Kingsland Village Condo.	Well #1	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	<0.02	<0.001	<0.005	0.07	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Kingston Fire District	Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Ladd School	Well #1	<0.005	0.05	<0.001	<0.005	0.10	0.005	<0.001	<0.02	<0.005	<0.001	0.03

Milligrams per liter

System	Sampling Point	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
Prudence Park	Well	<0.005	<0.02	<0.001	<0.005	0.05	0.011	<0.001	<0.02	<0.005	<0.001	<0.02
RI Carbide Tool Co.	Tap	<0.005	0.03	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
RI Port Authority	Well #9A	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #14A	<0.005	0.02	<0.001	<0.005	0.05	<0.005	<0.001	<0.02	<0.005	<0.001	0.04
	Well #3	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Scituate Housing/Elderly	Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Seaconnet Point Farm	Tap	<0.005	<0.02	<0.001	<0.001	0.36	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
Shady Harbor Fire Dist.	Well #3	0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #4	<0.005	<0.02	<0.001	<0.005	0.03	0.005	<0.001	<0.02	<0.005	<0.001	0.09
	Well #5	<0.005	<0.02	<0.001	<0.005	0.14	0.006	<0.001	<0.02	<0.005	<0.001	0.02
	Well #6	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #7	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Shannock Village	Tap	<0.005	<0.02	<0.001	<0.005	0.35	<0.005	<0.001	<0.02	<0.005	<0.001	0.03
Shannon Boat Co.	Tap	<0.005	<0.02	<0.001	<0.005	0.10	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02

Milligrams per liter

System	Sampling Point	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc
Slatersville	Dug Well	<0.005	0.05	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.0054	0.009	0.03
	Driven Well Field	<0.005	0.06	<0.001	<0.005	0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.09
	Halliwell Sch. Well	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.14
	Pacheco Park Well	<0.005	0.06	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.14
Tonquipaug	Tap	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.02
South Kingstown-S. Shore	Well #1	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	Well #2	0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Stone Bridge Fire Dist.	TPE	<0.005	0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Touisset Point	Coggeshall Well	0.005	<0.02	<0.001	<0.005	0.03	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
	George St. Well	<0.005	<0.02	<0.001	<0.005	0.03	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02
Tupperware-Blackstone	Well #1	<0.005	0.06	<0.001	<0.005	<0.02	0.02	<0.001	<0.02	<0.005	<0.001	0.32
	Well #2	<0.005	0.05	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.04
	Well #3	<0.005	0.03	<0.001	<0.005	<0.02	0.005	<0.001	<0.02	<0.005	<0.001	0.06
Tupperware-Branch	Well #2	<0.005	<0.02	<0.001	<0.005	<0.02	<0.005	<0.001	<0.02	<0.005	<0.001	0.06
	Well #3	<0.005	<0.02	<0.001	<0.005	<0.02	0.012	<0.001	<0.02	<0.005	<0.001	0.72
Turex	Tap	<0.005	0.02	<0.001	<0.005	0.04	<0.005	<0.001	<0.02	<0.005	<0.001	<0.02



SUMMARY - SURVEY DATA

STATION	COORDINATES		ELEVATIONS		REMARKS
	NORTHERN	EASTERN	MARKER	TOP OF CASING	
CN-01	2912.01	5446.40	10.26'	11.88'	
CN-02	2857.19	5473.80	14.22'	16.31'	
CN-03	2877.11	5546.56	11.01'	12.81'	PVC WELL CASING INACCESSIBLE, ∴ TOP OF STL. PROTECTIVE CASING WAS USED
CN-04	2832.00	5605.59	13.27'	15.58'	
CN-05	2692.11	3669.98	13.48'	15.67'	SAME AS CN-03 ABOVE
CN-06	2625.84	6056.84	6.61'	9.42'	SAME AS CN-03 ABOVE
CN-07	[illegible]	[illegible]	[illegible]	[illegible]	
CN-08	[illegible]	[illegible]	[illegible]	7.21'	
MON-A	3000.00	3000.00	17.15'		ASSUMED COORDINATES
MON-B	2234.06	5481.75	16.59'		
USP&LIS-5	3814.51	[illegible]			EXIST. PROPERTY CORNER MARKER
USP&LIS-6	2554.64	5288.92			EXIST. PROPERTY CORNER MARKER

LEGEND

- PVC MONITORING WELL WITHIN PROTECTIVE STL. CASING
- PRECAST CONC. MONUMENT W/ ALUM. CAP
- EXIST. (HORIZ.) SURVEY MARKERS (FOUND IN GOOD CONDITION - 12/18/86)

NOTES

- LOCATION OF ELEVATION READING INDICATED ON WELL CASING BY: PVC. - BLACK MARK @ TOP/INTERIOR OF CASING; STEEL - CHISELED NOTCH @ TOP OF CASING
- HORIZONTAL CONTROL OF WELLS SHOT TO APPROXIMATE CENTER OF TOP OF PROTECTIVE STEEL CASING.
- ALL COORDINATE DATA AND GRID SHOWN ON SITE PLAN ARE BASED UPON THE ASSUMPTION THAT MONUMENT-A'S COORDINATES ARE [illegible], EAST 3000.00 AND DATA SUPPLIED TO E&E BY USP&LIS INDICATING THAT THE BEARING OF THE LINE FORMED BETWEEN EXISTING POINTS USP&LIS-5 AND USP&LIS-6 IS S 73°38'27"E
- SURVEY CONDUCTED 12-18-86 & 12-19-86

MAR 19 1987

NO.	DATE	DWN	APPD	DESCRIPTION

REVISIONS

ecology and environment, inc.
International Specialists in the Environment

DESIGNED BY	DATE	CHECKED BY	DATE
DRAWN BY	DATE	APPROVED BY	DATE
T. GUIGLIANO			

FORMER NAVAL AUXILIARY LANDING FIELD - CHARLESTOWN RI

MONITORING WELL LOCATIONS