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11-1-1992

DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA 47522-5000

IN REPLY REFER TO:

5090
Ser 095/206/H11.9
07 JAN 1993

U.S. Environmental Protection Agency, Region V
Region V Waste Management Division
Attn: Ms. Carol Witt-Smith (HRP-8J)
77 West Jackson Blvd.
Chicago, IL 60604

Dear Ms. Witt-Smith:

Crane Division, Naval Surface Warfare Center (NAVSURFWARCENDIV) submits three copies of the Revised Draft Part 1 RFI Phase III Soils Report for the Ammunition Burning Grounds, Solid Waste Management Unit (SWMU) 03/10, as enclosure (1). Due to the receipt of comments from Northern Division Naval Facilities Engineering Command after the submission of the Draft Report to the U.S. EPA, this Revised Draft was prepared. Enclosure (2) is the required Certification Statement.

NAVSURFWARCENDIV awaits comments from your office on the reports prepared by the U.S. Army Corps of Engineers summarized in enclosure (3). Future work at some of the SWMUs depends on EPA approval of submitted documentation.

NAVSURFWARCENDIV Crane point of contact is Mr. Thomas J. Brent, Code 09510, telephone 812-854-1132.

Sincerely,

G. K. HILL
Deputy Director, Public Works Directorate
By direction of the Commander

Encl:
(1) Revised Draft Part 1 RFI Phase III Soils Report for the Ammunition Burning Grounds, SWMU 03/10
(2) Certification Statement
(3) Summary of ACOE Reports Awaiting EPA Comment

Copy to: (w/o encl)
SOUTHNAVFACENGCOM, (CODE 185ND)
COMNAVSEASYSCOM (SEA 654E)
USAE-WES, BILL MURPHY (GG-YH)

CRANE DIVISION

NAVAL SURFACE WARFARE CENTER

ADMINISTRATIVE RECORDS

CODE 095

#133

THRU

#134

09510

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CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA 47522-5000

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I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

SIGNATURE

G. K. HILL
Deputy Director, Public Works Directorate
By direction of the Commander

TITLE

07 JAN 1993

DATE

Enclosure (2)

SUMMARY OF ACOE REPORTS AWAITING EPA COMMENT

SWMU 02/11 Dye Burial Grounds

Interim Measure (Geophysical Survey). Report submitted to EPA 14 June 1991.

Phase II Groundwater RFI report submitted 4 March 1991.

SWMU 03/10 Ammunition Burning Grounds

Phase III Groundwater RFI Draft Report submitted on 1 September 1992.

Phase III, Part 1 Soils RFI Draft Report submitted on 17 January 1992.

SWMU 07/09 Old Rifle Range

Phase II Soils RFI Draft Report submitted 24 June 1991.

SWMU 10/15 Rockeye

Phase II Soils RFI Draft Report submitted 2 September 1992.

IN5 170 023 498
NOVEMBER 1992

INSTALLATION RESTORATION PROGRAM - CORRECTIVE ACTIONS

REVISED DRAFT

PART 1 RFI PHASE III SOILS
REPORT FOR:
AMMUNITION BURNING GROUND, SWMU #03/10
NAVAL SURFACE WARFARE CENTER, CRANE, INDIANA

PREPARED BY:
U.S. ARMY CORPS OF ENGINEERS
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ACRONYMS

ABG	Ammunition Burning Ground
CAA	Crane Army Ammunition Activity
CAP	Corrective Actions Program
CAR	Corrective Action Requirements
EPA	Environmental Protection Agency
HMTC	Hazardous Materials Technical Center
HW	Hazardous Waste
IRP	Installation Restoration Program
NAD	Naval Ammunition Depot
NEESA	Naval Energy & Environmental Support Activity
NSWC	Naval Surface Warfare Center
NSWCC	Naval Surface Warfare Center Crane
PAH	Polycyclic Aromatic Hydrocarbons
PEP	Propellants, Explosives, and Pyrotechnics
QA/QC	Quality Assurance/Quality Control
RCRA/HSWA	Resource Conservation and Recovery Act/ Hazardous and Solid Waste Amendments
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SWMU	Solid Waste Management Unit
USACE	United States Army Corps of Engineers

ACRONYMS-CONTINUED

USACEWES	United States Army Corps of Engineers Waterways Experiment Station
USATHAMA	Unites States Army Toxic and Hazardous Materials Agency
USCS	Unified Soils Classification System
WES	Waterways Experiment Station

EXECUTIVE SUMMARY

The Naval Surface Warfare Center, Crane, Indiana (NSWC Crane) is a naval facility located in southwestern Indiana. Its mission is to provide material, technical, and logistic support to the Navy. One of its primary and most prominent tasks is to serve as an inland ammunition production, storage, and treatment center.

In 1989 NSWC Crane was given a Final RCRA Storage Permit. The permit contained Corrective Action Requirements (CAR). These requirements are being fulfilled through the Navy's Installation Restoration Program (IRP). The IRP conforms to the scope and purpose of the National Oil and Hazardous Substances Pollution Contingency Plan (March 1980). The requirements included the need for RCRA Facilities Investigations (RFI) to be done at its hazardous waste disposal units. These units are called Solid Waste Management Units (SWMU). RFIs have three phases, a Phase I Environmental Monitoring Report, a Phase II Release Assessment and a Phase III Release Characterization Study. The soils portion of the Phase III study was divided into two parts: a source study (Part 1) and an extent study (Part 2). This study is Part 1 of the Phase III, soils investigation for the Ammunition Burning Ground (ABG) site.

The ABG is one of NSWC Crane's operational units. The intent of the Phase III investigation is to identify the nature, the degree and the extent of the release, and to identify actual and possible receptors. The objectives of the Part 1 study were to investigate background conditions and to characterize the source(s) of contamination in the soils. The derived information is intended to provide data of a quality needed to support the development and evaluation of possible corrective measures.

Soil samples were collected using hollow stem augering and Shelby tube sampling techniques. Samples from areas of contamination were used to determine the chemical character of the waste residues. Samples from the borings located away from the contaminated sites were used to evaluate background conditions. The soil samples were analyzed for the presence of volatile and semivolatile organic compounds, inorganic compounds including heavy metals and phosphorus, explosives compounds, pesticides and herbicides.

Soil descriptions were drawn from 12 auger borings placed in 1990, logged groundwater monitoring wells drilled from 1981 to

1988 (the deepest well in each well cluster was logged), field observations, and physical soil test data. Soils were classified according to the Unified Soil Classification System (USCS). The present day land surface and the uppermost rock surface have been shaped by the erosive and depositional processes attributed to the present day and ancestral Little Sulphur Creek drainage system. Soil thicknesses vary from 0 feet to 18 feet. Soil types are predominately clays (CL, CH), and clayey gravels (GC), with some fine sand (SP, SM), and silt (ML). Groundwater was generally not encountered in the topsoil. Studies of the groundwater conditions at the ABG have described an unconfined water table aquifer composed of two fractured rock zones. The soil horizons were included in the unsaturated (dry) horizon. The water movement in the soil horizon is vertical. The groundwater flow direction in the saturated zone is from the north and west to the east and south.

Based on the analyses of ABG soil samples, releases of hazardous wastes (as defined by 40 CFR Part 300) or hazardous constituents have occurred at the ABG. The waste disposal activities have principally contributed residues of explosives compounds and metals to the soils. Explosives compounds, 2,4-DNT, Tetryl, DNB, TNB, RDX, HMX, and TNT were found in the soils of the ABG. There was no clear pattern of explosive contamination related to the sampling depth. The compounds were found throughout the soil column. Using the explosives as a criterion for contamination, the following arbitrary categories may be assigned to the ABG borings.

Boring #	Total Explosive Concentration Contamination Category
1, 2, 3, 8	none detected
11, 10	≤ 2 mg/kg (ppm)
9, 6	≤ 11 mg/kg
12, 7	≤ 100 mg/kg
4, 5	≤ 1700 mg/kg

Levels of metals, (aluminum, antimony, barium, cadmium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, nickel, silver, sodium, tin, and zinc) and the non-metal phosphorus were detected above control levels in operative areas of the site. These areas correspond to locations where explosives contaminants were also found but not the locations of greatest explosive contamination. The maximum concentrations of inorganic constituents were detected inclusively in boring 7, 9, and 12.

Volatile organics, semivolatile organics, and pesticides and herbicides were detected in ABG soils but at low concentrations. No PCBs were detected. Specifically, concentrations of volatile organic compounds from borings 7 and 12 soils contained trichloroethene and tetrachloroethene at concentrations that were ≤ 2 μg/kg (ppb - parts per billion). Several semivolatile organic compounds, most frequently PAHs, were determined at concentrations that were ≤ 1 mg/kg (ppm - parts per million). Borings 7, 9, and 12 exhibited the characteristic of having numerous semivolatile organic contaminants. Pesticides and herbicides were detected at concentrations that were ≤ 1 mg/kg.

In general, the most significant (in terms of concentration) ABG soil contaminants are explosive compounds including 2,4 DNT, 2,6 DNT, TNT, TETRYL, DNB, TNB, RDX, and HMX, and metals including antimony, cadmium, chromium, copper, lead, mercury nickel, silver, zinc, aluminum, cobalt, magnesium, manganese, and tin. Other contaminants including additional inorganics, PAHs, volatile organics, and pesticides and herbicides were present but at concentrations that were orders of magnitude lower than explosives concentrations. In most cases the non-explosive contaminants were found in samples that also contained explosive contaminants.

It is recommended that the RFI Phase III, Part 2 Soil Study be done. The soil contamination is verified and characterized. The complete limits of the contamination have not been defined. The second part of the Phase III study will define the contaminant limits.

1.0 INTRODUCTION

1.1.0 BACKGROUND. Naval Surface Warfare Center, Crane (NSWCC Crane) is located in southwestern Indiana, approximately 40 miles southwest of Bloomington, Indiana and 74 miles south of Indianapolis, Indiana. The location of NSWC Crane and the Ammunition Burning Ground (ABG) is shown on Figure 1.1. The facility covers approximately 62,463 acres in Davies, Greene, and Martin Counties. It is located in a rural, sparsely populated area. The acreage surrounding the base is either wooded or farmed land. The majority of NSWC Crane is covered by forest. Its surface topography is a rugged plateau dissected by well-defined stream valleys. The surface elevations range from 470' in the valleys to 800' on the ridges.

1.2.0 FACILITY HISTORY. The facility, originally called Naval Ammunition Depot (NAD), Burns City, was opened in 1941 to serve as an inland ammunition production and storage center. The Depot's name was changed to NAD, Crane in 1943. The name was changed again in 1975 to Naval Weapons Support Center, Crane (NWSCC). The name was changed once more in 1992 to Naval Surface Warfare Center, Crane (NSWC Crane). Today Naval Surface Warfare Center, Crane's mission is to "Provide quality and responsive engineering, technical and material support to the Fleet for combat subsystems, equipment and components, Microelectronic Technology, Microwave Components, Electronic Warfare, Acoustic Sensors Tests, Engineering, Pyrotechnics, Small Arms, Electronic Module Test and Systems Command." Under the Single Service Management Program, a segment of the Center's mission is to provide support (including environmental protection) to the Crane Army Ammunition Activity (CAAA). The Army is tasked with the production and renovation of conventional ammunition and related items, the performance of manufacturing, engineering, and product quality assurance to support production; and the storage, shipment, demilitarization, and disposal of conventional ammunition and related components. Because of the nature of the Army's operations, CAAA contributes significant financial support for the environmental program through an Interservice Support Agreement.

Approximately 4,023 people are employed at Crane in eighteen departments and five tenant activities. Of these, about 800 personnel work for the Army. The Center engages these people in a variety of processes and function to accomplish the missions of the Navy and Army.

All environmental activities on the installation, including permitting activities, remain the responsibility of the Navy.

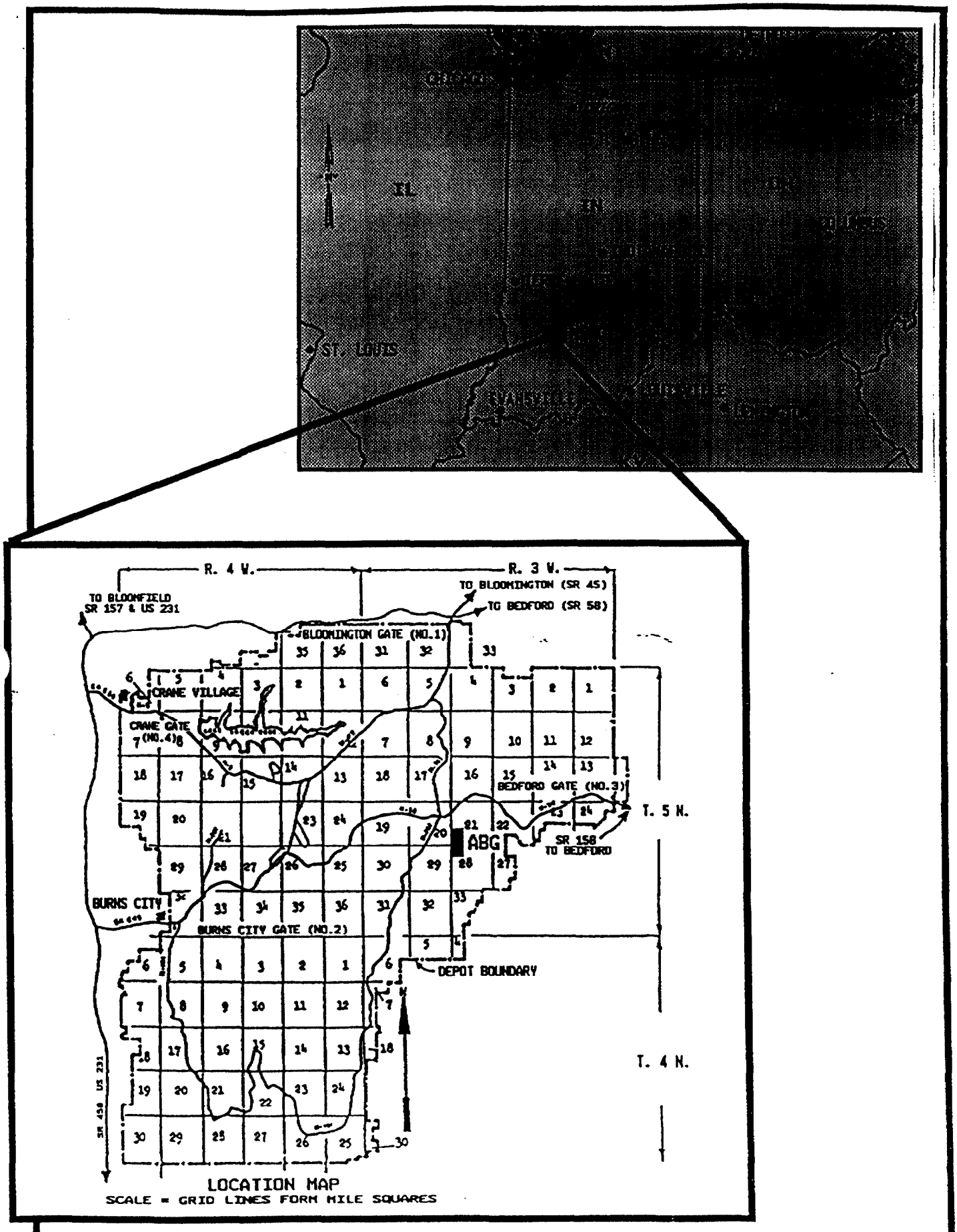


Figure 1.1. Location map for NSWC Crane. The insert is a facility map. The position of the ABG (Ammunition Burning Ground (SWMU# 03/10)) is shown.

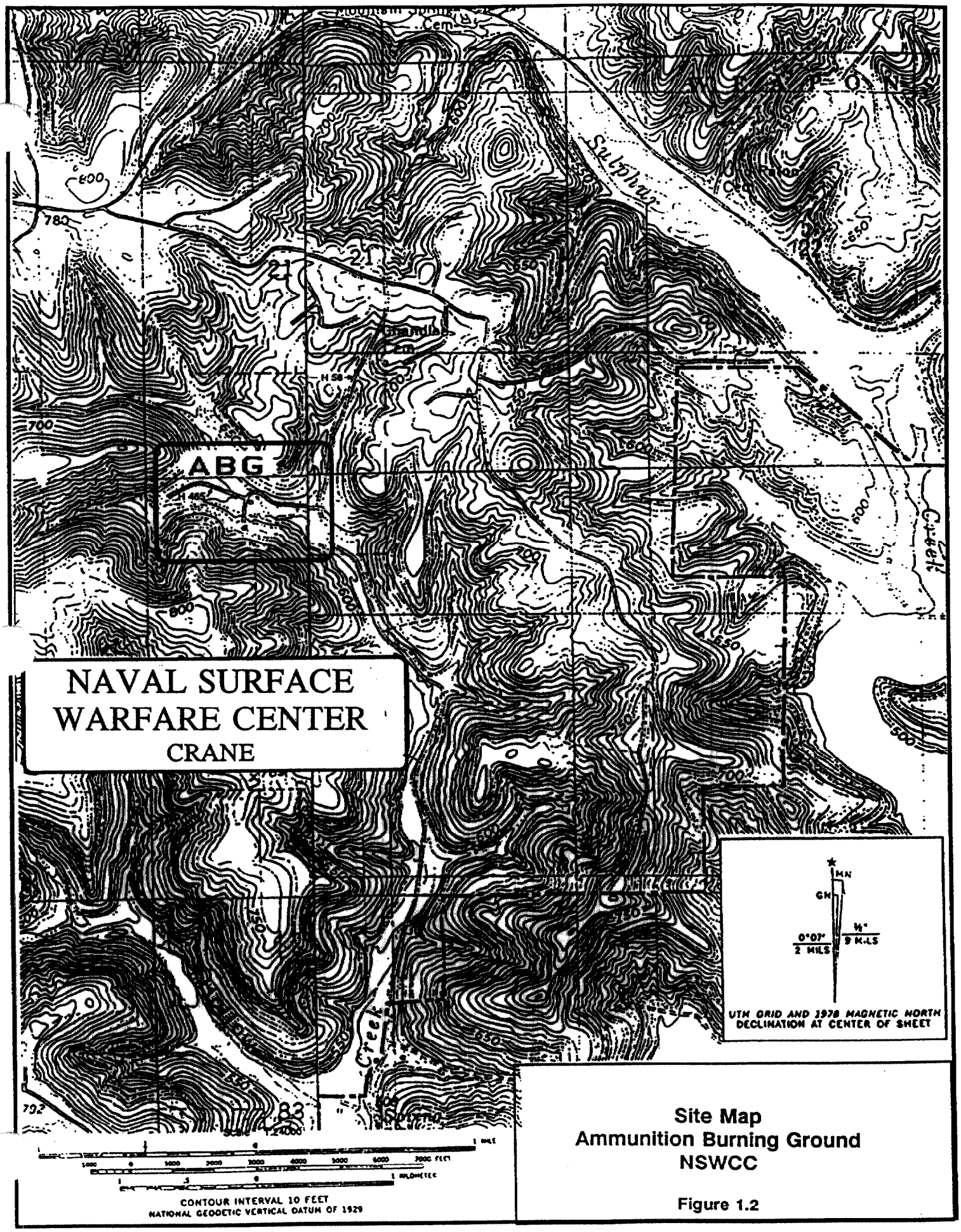
The Navy has applied to Region V of the EPA for a RCRA permit for thermal treatment (open burning/open detonation) of pyrotechnics, explosives, and propellants (PEP) at the ABG Subpart X unit.

Ordnance and ordnance-contaminated materials from NSWC production areas have been taken to the ABG for disposal by burning since the 1940's. The burning ground is used extensively for destroying unwanted materials contaminated with explosives, bare explosives, rocket motors, candles, flares, solvents, detonators, and fuse materials. Several separate burning areas are located within the site proper. The largest quantities of materials were destroyed from 1956 to 1960, when 15,000 lbs per day of smokeless powder was destroyed. In the same period, about 46,000 lbs per day of high explosives were burned. The area is also used for flashing the residue from bombs and projectiles after they have been subjected to melt out or drill out operations for removal of the bulk of the explosive.

Three surface impoundments were constructed in 1975 to remove liquids from otherwise combustible sludges resulting from the blending and loading of munitions. The impoundments were modified in 1982 to include a liner and leachate collection system for each. Surface burning of ordnance was formerly conducted on the ground surface, but burning pans are now used to prevent contact of burn products with the ground. The area labeled "Ash Pile" is the site of a former stockpile of burn residue which has been removed under a RCRA closure plan (Figure 1.3). Surface drainage into and from the ABG is via Little Sulphur Creek, which flows from the north to the southeast through the center of the ABG and formed the valley in which the ABG is situated (Figure 1.2). A small tributary drainage way joins Little Sulphur Creek near the center of the site from the west-southwest.

1.3.0 INVESTIGATION BACKGROUND.

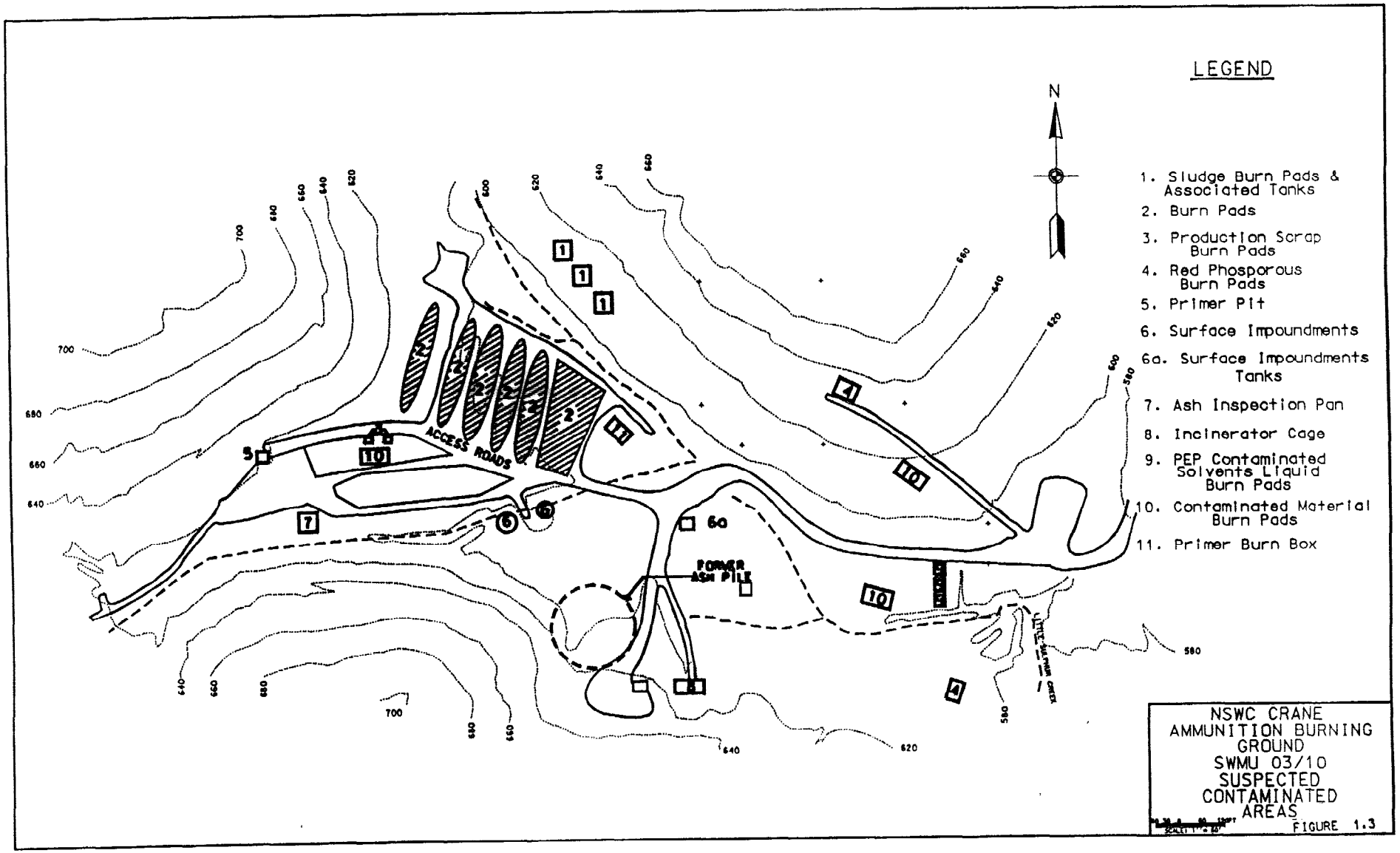
In 1989, the Navy was granted a Final Resource Conservation and Recovery Act (RCRA) Storage Permit for its hazardous waste storage facility. As part of the conditions set forth in the Final Permit, NSWC Crane was to conduct RCRA Facility Investigations (RFI) at thirty Solid Waste Management Units (SWMU). The ABG is considered to be a current hazardous waste operational unit as well as past SWMU. Surface and shallow subsurface soil investigations are part of that RFI process. At ABG, the RFI Phase III Soil Study was divided into two parts. The US Army Corps of Engineers' Waterways Experiment Station (USACEWES) conducted the study. Field work for Part I was done in August 1990, analytical work was done in August, September, and October 1990, and data reduction and report writing was done from November 1990 to May 1991. Report revisions were made in December 1991 and August 1992.



Site Map
Ammunition Burning Ground
NSWCC

Figure 1.2

BASE MAP IS A PORTION OF USGS INDIAN SPRINGS, IND., QUADRANGLE (7.5 MINUTE SERIES, 1951, PHOTOREVISED 1973, EDITED 1979) AND THE WILLIAMS, IND., QUADRANGLE (7.5 MINUTE SERIES, 1956, PHOTOREVISED 1975, EDITED 1978).


LEGEND
N
1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments Tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box
ACCESS ROADS
FORMER ASH PILE
6a
NSWC CRANE
AMMUNITION BURNING GROUND
SWMU 03/10
SUSPECTED CONTAMINATED AREAS
FIGURE 1.3

1.4.0 SITE SETTING. Since the 1940's the ABG has been used extensively for the thermal treatment (open burning/ flashing) of propellants, explosives and pyrotechnics (PEP) and materials contaminated with PEP. PEP includes bulk explosives and munitions contaminated materials.

In the interest of national security, enormous inventories of military ordnance items and bulk PEP are maintained at various military installations around the country. Because the ordnance items and PEP held in this military readiness stockpile are subject to deterioration and obsolescence, action has to be taken to safely remove and thermally treat these items on an ongoing basis. Other explosives wastes are generated at manufacturing facilities. This source of hazardous waste is generally composed of off-specification energetic materials. Off-specification materials are generally composed of the same ingredients that the specification materials are composed of but do not meet all performance specifications. Usable off-specification items are sold as foreign sales to allied countries, reprocessed through a procedure known as renovation, or demilitarized. The term "demilitarize" means to render the item no longer functional for the intended military use and to free it of hazard to the point that materials (i.e., metal parts) may be sold as salvage to the general public. Off-specification materials are usually demilitarized.

The ABG covers approximately twenty acres and is located as shown in Figure 1.2. It is accessed using Facility Roads H274 and H463 off Highway #58. The ABG is located in a remote area near the east center boundary of the facility in the NW 1/4 of Section 28 and SW 1/4 of Section 21, T5N, R3W (Figure 1.1). The site lies in the valley of Little Sulphur Creek. Previously completed RCRA studies and groundwater sampling have documented that the groundwater at ABG is contaminated. (See Section 2.0 PREVIOUS STUDIES).

Figure 1.3 shows the location of the various open burning/ thermal treatment units in the ABG proper. As previously indicated, the existing ABG operation was constructed and placed in operation in the 1940's with modifications made in recent years ('81-90) to bring operations into compliance with military operating procedures. Energetic materials are to be open burned in specially constructed burning pans or concrete pads. Currently, 27 pans are in operation at the ABG. Typically, bulk propellants or other energetic materials are poured into the burning pans to a few inches in depth, primed, and remotely initiated. Examples of these items are:

a. Bulk propellant and high explosives burned (thermally

treated) in clay lined steel pans. Twenty pans are set up for this operation. Two of the pans are specifically set aside for the burning of production scrap;

b. PEP-contaminated solvents and liquids burned in one unlined steel pan;

c. Waste bulk pyrotechnics burned in one unlined steel pan;

d. Waste red phosphorous burned in unlined steel pans. Currently, four pans are set up for this operation;

e. Desensitized black powder (powder that has been stabilized in water) is burned in an unlined steel pan. There is one pan set up for this operation.

The primer pit, incendiary cage and burn box are used for thermal treatment of ammunition components (e.g. small impact-sensitive primers) and pyrotechnic munitions.

Shown on Figure 1.3 are three pads for burning of suspected contaminated material and one ash inspection pan. The items treated on the suspected contaminated material burn pads are not considered by NSWC Crane to be a hazardous waste. NSWC Crane currently uses only two of the three suspected contaminated material burn pads. Two of the three burn pads are concrete-lined and are equipped with run on/run off controls. The third will be upgraded prior to use. The ash inspection pan is used by ABG personnel to cool the ash from the primer pit to allow the personnel to segregate metal parts from the ash.

1.5.0 PROJECT OBJECTIVE. RFI Phase III studies are release characterization studies. The purpose of the RFI is to collect data necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives. The RFI provides information to assess the risks to human health and the environment and to support the development, evaluation, and selection of appropriate response alternatives. This objective will be accomplished in a two-part investigation. Part 1 was a source of contamination study and Part 2 will be an extent of contamination study. This report deals with Part 1.

The first part of this study concentrated on locating probable sites of surface and subsurface releases and contamination. This study described soil samples in two ways. The physical attributes of the soil were characterized and the chemical pollutants in the soil were identified. To gather information about the natural soil conditions, soil samples were

taken from areas thought to be away from the area of operation (referred to as background samples). To try to locate and characterize the sources of contamination, soil samples were collected near ammunition burning sites and the former ash pile. Part I of this investigation was biased toward locations around the ongoing or previous operations.

2.0 PREVIOUS STUDIES.

A sequence of remedial investigations and remedial actions has been performed at the Naval Surface Warfare Center (NSWC) Crane. Indiana. Investigations began at the NSWC Crane after the initial discovery in early 1981 of a potential hazardous substance release from the Center. The investigations have proceeded since 1981 and continue at the time of this writing. In April 1981, the US Navy implemented the Navy Assessment and Control of Installation Pollutants (NACIP) Program, now known as the Installation Restoration Program (IRP), to identify and control environmental contamination from past use and disposal of hazardous substances at the NSWC Crane. The IRP program is designed to conform to the scope and purposes of the National Oil and Hazardous Substances Contingency Plan (NCP) established by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, and amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The IRP consists of 5 major steps; (a) Preliminary Assessment (formerly IAS), (b) Site Inspection (formerly Confirmation Study), (c) Remedial Investigation/Feasibility Study (RI/FS), and (d) Remedial Design/Remedial Action (RD/RA).

An Initial Assessment Study (IAS) for the NSWC Crane began in April 1981 and was completed in May 1983 by the Naval Energy and Environmental Support Agency (NEESA). Assistance was provided by the Ordnance and Environmental Support Agency and the US Army Corps of Engineers Waterways Experiment Station (WES). The IAS recommended site inspections be performed at 14 sites: 9 ordnance sites and 5 non-ordnance sites. The IAS identified the ABG as a site requiring investigation because of past hazardous waste disposal. The on-going hazardous waste management operations at the ABG also mandated compliance with Subtitle C of the Resource Conservation and Recovery Act (RCRA). On 19 May 1980, the United States Environmental Protection Agency (USEPA) finalized Phase I of the RCRA hazardous waste regulatory program, which became effective 19 November 1980. By this date the NSWC Crane had to comply with the codified regulatory sections of the RCRA. In October 1980 the NSWC Crane filed a RCRA Section 3010 notification and a Part A permit application to operate as a treatment, storage, or disposal (TSD) facility. The NSWC Crane was qualified for and obtained Part A "interim status", which allowed the facility to legally operate as though it had a permit. The ABG then became subject to 40 CFR Part 265 (interim status standards). Part 265 (as well as Parts 260 through 280) is divided into Subparts which address the general operating requirements for hazardous waste management facilities and the technical standards applicable to specific units.

In August 1981 the NSWC Crane notified the USEPA of four surface impoundments (dewatering beds) at the ABG and one waste impoundment. A "groundwater monitoring program" was required at the ABG pursuant to (a) 40 CFR Part 265-Subpart F and (b) the IRP. The groundwater monitoring program began at the NSWC Crane in 1981. Through a Military Interservice Procurement Request, the Navy contracted the WES to conduct hydrogeologic investigations at ten sites, eight identified in the IAS, and two new sites. The work was performed under authority provided by NAVCOMPT Document Number N00164-IMP-04575, dated June 1981 and amended October 1981. The WES-installed monitoring wells (Dunbar 1982) from August 1981 to December 1981 at the ABG and provided a report in April 1982. Results of the monitoring program suggested the presence of groundwater contamination at the ABG. Pursuant to 40 CFR 265 Subpart F, WES performed six studies at selected sites from June to October 1983. The ABG was one of the sites. The final report for the 1983-84 studies at the ABG was provided in April 1984 (Dunbar 1984).

The Hazardous and Solid Waste Amendments (HSWA) of RCRA established corrective actions programs (CAP), Section 3004, at TSD facilities. The provision required the NSWC Crane to address past releases of hazardous waste or hazardous constituents at solid waste management units (SWMU's) and regulated units. The first step of the CAP required the NSWC Crane to submit a Hazardous Waste Management Report (known as the SWMU report) to the USEPA. The SWMU report listed the ABG and all of the IAS-identified hazardous waste sites as SWMU's and was submitted to the USEPA in January 1985. The next step of the CAP, a RCRA Facility Assessment (RFA), was conducted by A. T. Kearney, an USEPA contractor. The contractor conducted a file search of the facility and a site visitation and prepared a report in 1987 which characterized possible releases from 100 SWMU's. On 22 June 1987 the USEPA promulgated amendments to allow the information related to detailed corrective action planning to be developed by USEPA Regional Administrators after the issuance of a RCRA permit through the use of compliance schedules included in the permit.

A hydrogeological investigation of the ABG and surrounding area was conducted by the WES in 1986-87. The Hunt (1988) report identified factors influencing or controlling the flow of potentially contaminated groundwater into and out of the ABG. Work included emplacement of 66 exploration borings and monitoring wells in three aquifers, geologic and hydrologic field mapping, literature survey and consultation with geologists at the Indiana Geological Survey, Bloomington. The study area included the area surrounding the ABG, especially that to the south.

The Hunt (1988) hydrogeological investigation and report are

partial fulfillment of the (a) Ground Water Assessment Plan, Ammunition Burning Grounds Hazardous Waste Treatment Site, NWSC, 1986; (b) the 1989 USEPA RCRA Part B Permit's CAP; and (c) the RI phase of the IRP at the ABG. The report by Hunt (1988) concluded that flow through solution passages in the Beech Creek limestone is the primary conduit for groundwater leaving the ABG and that flow through the conduits can be "rapid." The report recommended that increased emphasis be given to monitoring of springs and that injection of tracers (i.e dye tracer test) be considered to confirm direction and rate of movement away from the ABG through solution conduits.

On 3 April 1989 the Navy submitted three documents to the USEPA Region V: (a) an updated Groundwater Assessment Plan for the ABG; (b) a Dye Tracer Test Proposal; and (c) the Hunt (1988) ABG hydrogeologic investigation. Technical review comments, dated 22 June 1989, were submitted by the USEPA Region V to the NSWC Crane for the three documents. After discussions in a May 1989 meeting between the USEPA, WES, and the Navy, the WES installed five additional monitoring wells (July and August 1989) in the vicinity of the ABG. As requested by the USEPA comments, the Dye Tracer Test proposal was rewritten and submitted to the EPA in July 1989.

Final approval of the Dye Tracer Test Proposal and the Hunt (1988) report were established in the Federal portion of the joint RCRA storage permit issued to the US Navy by the USEPA and the State of Indiana. The Federal portion of the RCRA Permit, dated 20 December 1989, established the HSWA Corrective Action Requirements and Compliance Schedules (RCRA Section 3004). The compliance schedules obligated the NSWC Crane to perform RCRA Facility Investigations (RFI) at 30 SWMU's, and, if contamination were found, to conduct Corrective Measures Studies (CMS) and implement Corrective Measures, if needed. The State of Indiana obtained pre-HWSA authorization and issued the State portion of the permit which authorized the NSWC Crane to operate the Central Hazardous Waste Storage Facility, Building No. 2993. The Permit's RFI compliance schedule for the ABG established work plan submittals for the following: (a) Modified RFI Phase III Release Characterization for Groundwater; (b) RFI Phase III Release Characterization for Soil; and (c) RFI Phase II Release Assessment for Surface Water Bodies. In April 1990 the NSWC Crane submitted the Modified RFI Phase III Release Characterization Work Plan for Groundwater. The Work Plan scheduled the submittal of this Draft Dye Tracer Report, the proposal to conduct a second Dye Tracer Test, progress reports, and the RFI Phase III Final Report for Groundwater. The RCRA Section 3004 Corrective Action Requirements of the Storage Permit have incorporated the IRP. RCRA will be the primary vehicle to further investigate and remediate the IRP sites. The NSWC Crane is also pursuing a USEPA,

RCRA operating permit for thermal treatment (open burning/open detonation) of pyrotechnics, explosives, and propellants (PEP) at the following Subpart X units: the ABG, the Demolition Area, and the Old Rifle Range, which are also considered SWMU's.

As a part of the water sampling and chemical analysis program initiated by NSWC Crane in 1987, laboratory analysis and laboratory QA and QC data have been reported to NSWC Crane in a series of reports. The information from these reports formed the basis of a summary report, dated 1 April 1992, and prepared under contract by COMARCO, ESD of Bloomfield, Indiana. The groundwater was tested for a wide range of chemical parameters at various limits during the program. These parameters are discussed in 40 CFR (7-1-89) in sections 265.92, 265.93, and 265.94 Appendix III. (COMARCO, 1992.)

The following summary information is taken directly from the COMARCO summary report. Wells placed prior to 1986 were not included in this report.

Water samples were collected from 40 wells and tested for a range of chemicals and properties. The four indicator parameters utilized by the EPA, Ph, specific conductance, total organic halogens, and total organic carbon were collected during all sampling periods in replicates. The 23 chemicals identified by the EPA, and having national drinking water standards, were also tested, as were six chemicals defining water quality. Tests for three explosives and three volatiles were also conducted from the earliest sampling period.

The data documents the presence of RDX, an explosive, in the water collected from a group of wells centered on a line running NW/SE through the center of the ABG. Chlorinated hydrocarbons, primarily trichloroethylene, are also present under the ABG and some of the adjacent area. The major concentrations are along the same NW/SE line. Significant quantities were also detected north of the ABG on the before-mentioned NW/SE line. Another significant concentration is at the western corner of the ABG. Barium is also present in significant quantities, although values do not approach the drinking water standards. The wells with major contaminants coincide with the major underground water flow detailed in the Hunt reports.

The following wells (Figures 2.1 and 2.2) exhibited values for 3 or more sampling periods which were different from the ambient levels found to exist regionally:

Chemical Contaminant/ Water Parameter	Wells
Ph (1)	03-C20, 03-C29,03-C30
TOX (4)	03-C11, 03-C20, 03-C3P2, 03-C9P2
Barium (22)	03-C12, 03-C2P2, 03-C8P2, 03-C30, 03-C31, 03-B1, 03-B2, 03-B3, 03-B6
Nitrate-N (28)	03-C8P2
Iron (9)	03-C/P2
Mg (47)	03-B3, 03-B4
RDX (15)	03-C20, 03-C3P2, 03-C8P2, 03-C9P2
TCE (18)	03-C11, 03-C13, 03-C14, 03-C15, 03-C3P2, 03-C3P8, 03-C9P2

Many wells exhibited values different from background levels for 1 or 2 sampling periods for the following chemical parameters: cadmium; lead (5 wells); selenium (4 wells); chloride (4 wells); HMX, DNB, and BIS.

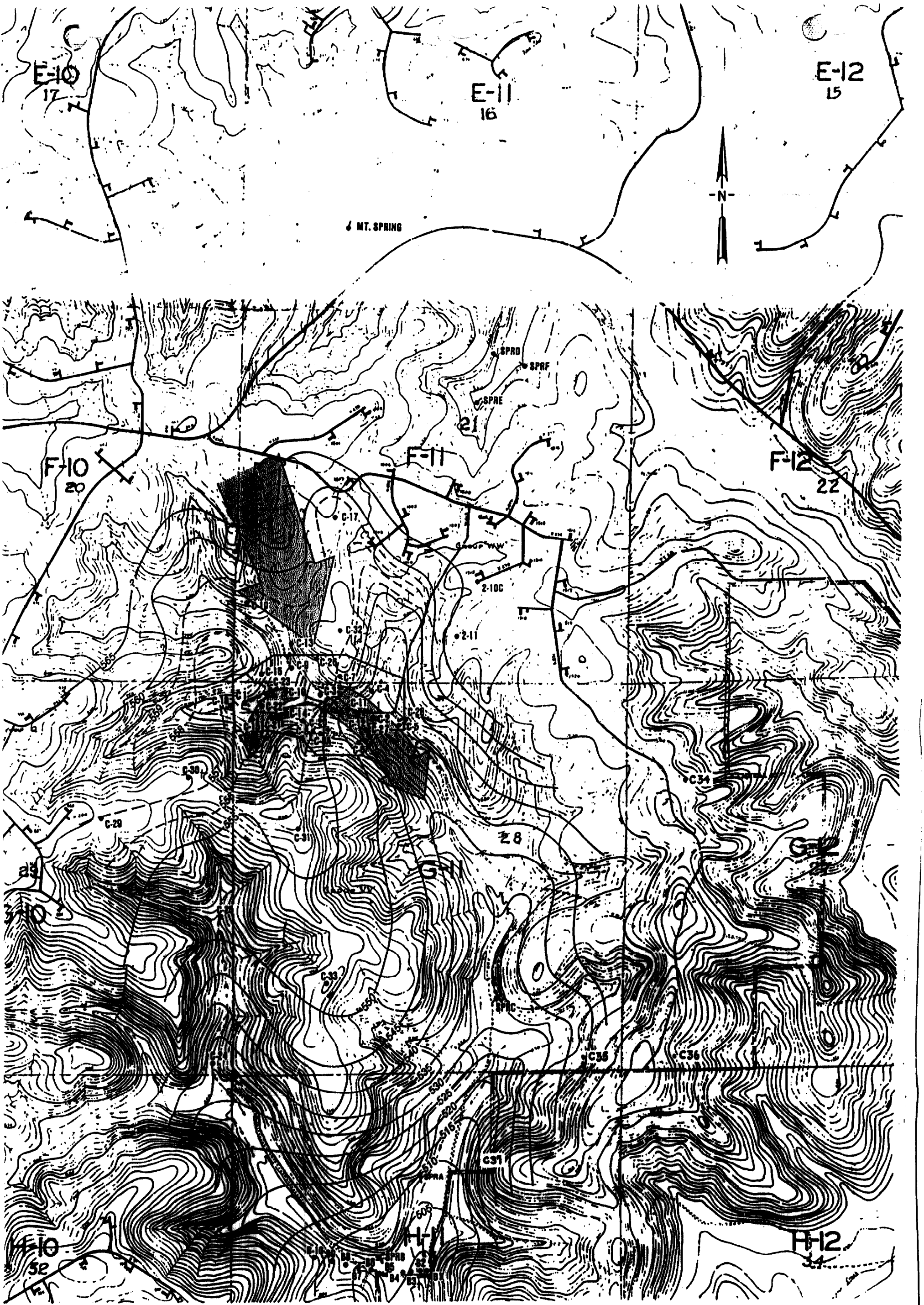
The wells that had groundwater which provided significant amounts of man-made chemicals are centered in the ABG along a northwest/southeast line. Two wells outside the ABG, 03-C13 and 03-C31, also produced samples that had significant amounts of man-made chemicals. Trichloroethylene was present in samples from a number of wells throughout the ABG. Well 03-C9P2 has consistently high values and 03-C11 has extremely high values.

RDX, an explosive, was present in the water samples of a group of wells exiting through the ABG on a northwest/southeast line. Hunt's report details the geology of the area and indicates that the maximum water flow in the Beech Creek aquifer occurs along the general line of these wells. This water flows into the area of solution passages and caverns in the southeast portion of the ABG.

Nitrate values over the drinking water standard were obtained from wells 03-C9P2 and 03-C8P2. Well 03-C8P2, which has high values for four sampling periods, is adjacent to the former location of the ash pile. This material has been removed. It was the probable source of the high nitrate values.

Reports describing the previous studies at the ABG, listed in chronological order, are:

1) Dunbar, Joseph B., Hydrogeological Investigation of Waste Disposal Sites at the Naval Weapons Support Center Crane, Indiana, U.S. Army Corps of Engineers, Waterways Experiment Station, 1982.



TE: ELEVATIONS IN FT MSL

NOTE: ARROWS SHOW PROMINENT FLOW DIRECTIONS THROUGH ABG IN BEECH CREEK AQUIFER.
ARROW WIDTH INDICATES ESTIMATEL RELATIVE FLOW VOLUME.
CONTOUR INTERVAL = 5 FT
(1 FT WHERE DASHED)

Figure 2.1

Location of wells

NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA
PREPARED BY
U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION
VICKSBURG, MISSISSIPPI

ELEVATION OF TOP OF WATER TABLE IN BEECH CREEK AQUIFER
ABG Study Area

PLATE 23

Figure 2.2

ABG well locations and topography

2) Naval Energy and Environmental Support Activity, Initial Assessment Study of Naval Weapons Support Center Crane, Indiana, May, 1983.

3) Dunbar, Joseph B., Hydrogeological Site Characterization of the Ammunition Burning Ground for Hazardous Waste Disposal Facility, Naval Weapons Support Center Crane, Indiana, U.S. Army Corps of Engineers, Waterways Experiment Station, 1984.

4) May, James H., Groundwater Assessment Plan Ammunition Burning Grounds Hazardous Waste Treatment Site, U.S.Army Corps of Engineers Waterways Experiment Station, January, 1986.

5) Woods, Harry K., Hydrogeological Investigation of Selected Areas at the Ammunition Burning Grounds Naval Weapons Support Center Crane, Indiana, Geotechnical Laboratory, U.S. Army Engineers Waterways Experiment Station, January, 1986.

6) Hazardous Material Technical Center, Navy Assessment & Control of Installation Pollutants for Formations Study for Sites 1,3,5 and 8 at the Naval Weapons Support Center Crane, May, 1986.

7) Hunt, Richard W., Geology and Hydrogeology of the Ammunition Burning Ground Crane Naval Weapons Support Center, US. Army Corps of Engineers, Waterways Experiment Station, 1988.

8) Murphy, William L., and Ciocco, Jeffrey, Dye Trace of Beech Creek Aquifer Ammunition Burning Ground, Naval Weapons Support Center Crane, Indiana, September, 1990.

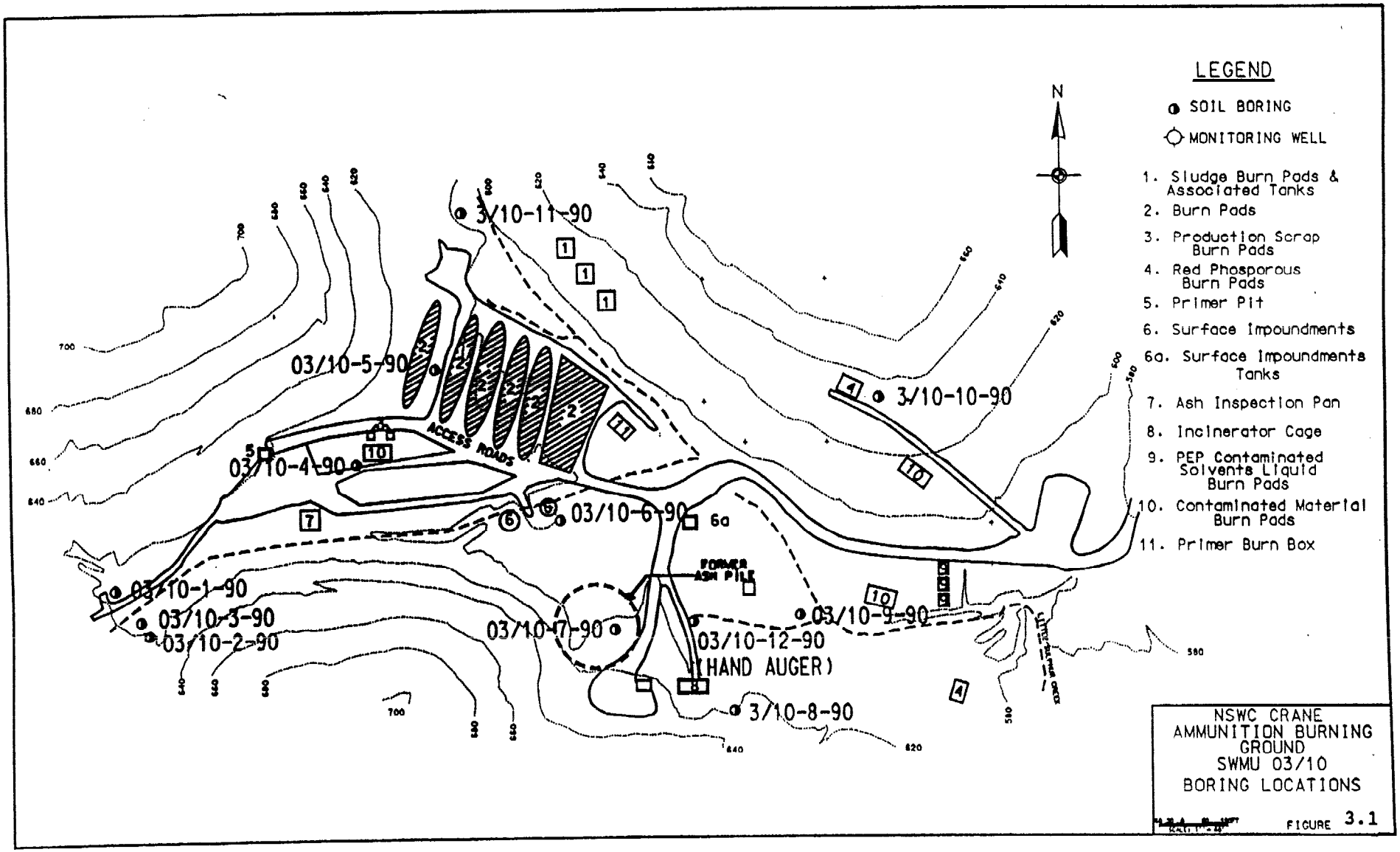
9) COMARCO, ESD, Analysis and Graphic Presentation of the Chemical Parameters of Ground Water from the A.B.G. at the Crane Division Naval Surface Warfare Center Crane, Indiana, Volume I, April, 1992.

3.0 PROCEDURES

3.1.0 APPROACH. The study effort was focused toward confirming the presence of contaminants in the soil column. To characterize the site, two primary tasks were accomplished. Background conditions were examined in three borings away from areas of operations. Borings were placed in an area of unlikely contamination in an attempt to establish uncontaminated (background) criteria. Samples taken from the soils within the ammunition handling areas were used to identify the types and levels of contaminants. For some contaminants, this required developing a contaminant signature. A contaminant signature is a suite of analytes which is used to indicate the presence of a particular contaminant.

The physical and chemical properties were determined using proven methods of analysis. The physical characterization of the soils was accomplished using standard U.S. Army Corps of Engineers' procedures. The chemical characterization was conducted using Environmental Protection Agency (EPA) SW-846 methods, where available.

Stratified samples were taken from vertical soil borings. Two borings were hand augured and ten borings were drilled using a truck mounted drilling rig. The boring locations are shown on Figure 3.1. Soil samples taken from the borings were used to identify contaminant levels and soil characteristics. At least one disturbed soil sample per boring was collected to determine the physical properties of the soil. When soil thickness allowed, soil samples for chemical analyses were taken at the following depth intervals: 3 to 6-in; 12 to 18-in; 18 to 24-in; 36 to 42-in; and 6-in above the top-of-rock. Actual sample depths and their corresponding sample numbers are shown on Figure 3.2. Sample identification included SWMU number, boring number, year sample was taken and sample number (i.e. 03/10-01-90-1). The exact locations (Table 3.1) of the borings were determined by field personnel. Monitoring wells which were previously located by surveyors from the Corps of Engineers, Louisville District were used as reference points. The distance from the wells to the borings were measured and used to establish the bore hole locations.


LEGEND
SOIL BORING
MONITORING WELL
1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments Tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box
N
3/10-11-90
03/10-5-90
3/10-10-90
03/10-4-90
ACCESS ROADS
03/10-6-90
6a
FORMER ASH PILE
03/10-1-90
03/10-3-90
03/10-2-90
03/10-7-90
03/10-9-90
03/10-12-90
(HAND AUGER)
3/10-8-90
NSWC CRANE
AMMUNITION BURNING GROUND
SWMU 03/10
BORING LOCATIONS
FIGURE 3.1

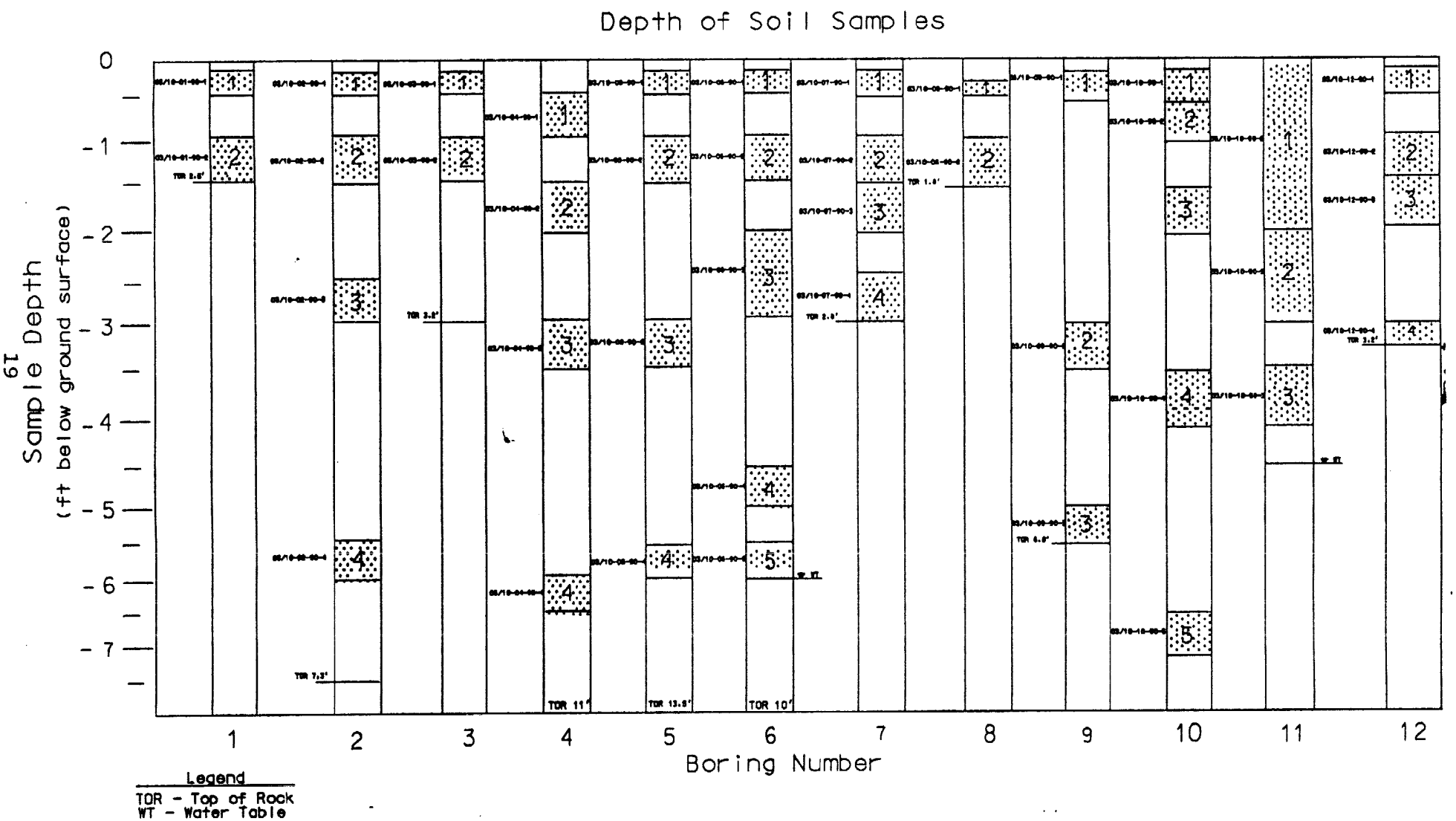


Figure 3.2. Ammunition Burning Ground, NSWCC (SWMU# 03/10). Depth of soil samples.

Table 3.1. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10, bore hole locations.

BORING NO.	NORTHING	EASTING
03/10-01-90	489937.19	593079.61
03/10-02-90	489867.79	593129.56
03/10-03-90	489908.61	593158.81
03/10-04-90	480200.42	593549.96
03/10-05-90	490364.30	593713.94
03/10-06-90	490066.31	593955.24
03/10-07-90	489849.57	594063.09
03/10-08-90	489687.18	594296.90
03/10-09-90	489879.71	594426.64
03/10-10-90	490302.90	594587.98
03/10-11-90	490674.78	593771.86
03/10-12-90	489861.98	594213.35

Coordinates in Indiana State Plane Coordinates.

3.2.0 FIELD METHODS.

Samples were taken from soil borings. Borings were placed using a drilling rig and a hand auger. Samples were collected by Shelby tubes or bucket augers. At the ABG, hand augering was used in places where the terrain was too irregular for the rig to operate. Grab samples were taken using precleaned hand augers. Care was taken to prevent the sampler from contacting the hole walls. Other soil borings were placed using a Failing 1500 drilling rig equipped with a hollow stem auger. Samples were taken at specified depths. All sample depths were above the groundwater table and top-of-rock. Borings were taken to top-of-rock, even though no samples were collected from below the water table.

For borings emplaced by a drilling rig, a Shelby Tube sampler was advanced through a hollow stem auger, pressed to its full length, and then extracted. At the surface the soil was extracted from the sampler, peeled, and bottled in the shortest time possible. Peeling is the process that removes and discards the portion of the sample which is in direct contact with the sampler. Ends of the sample were not used. Samples for volatile analysis were taken, bottled, and capped within 15 seconds from the time the sampler was opened. All other samples were extruded into wide-mouth glass jars or other containers with minimal disturbance of the sample. Two 8 ounce soil samples were collected for explosives, volatile organic, semivolatile organic, pesticide and herbicide, and metal and other inorganic compound detection.

Soil samples were collected and placed into manufacturer pre-cleaned (ICHEM) sample jars, bottles, and vials. The sample jars and bottles were sealed and placed in locked ice chests (coolers) for storage at a temperature of 4 degrees Celsius. Chemical preservatives were not used. The coolers containing the samples with their accompanying Chain of Custody forms were transported to the analytical lab for analysis. Transport was by an overnight, air freight carrier service. A seal was placed on each cooler to ensure that the samples had not been disturbed during transport to the laboratory.

Following sample collection, the hole was backfilled using a cement bentonite grout. Prior to grouting the holes, water levels in the holes were checked and recorded. The cuttings were contained in 55-gallon steel drums. The drums were identified and left on the site and became the responsibility of NSWC Crane. The identification included information describing the contents of the drum and the boring from which the cuttings were taken. NSWC Crane has custody of the drums and is responsible for the disposal of their contents.

3.3.0 CHEMICAL TESTING. The soils were tested for the presence of explosives, inorganic compounds, pesticides and herbicides, PCB's, volatile organics, and semivolatile organic chemicals. A full list of analytical parameters and the method of analysis for each analyte is presented in Table 3.2. The decision to select certain chemical compounds for analysis was based on the probability of the contaminant being found at the site. The area was used to treat explosives (TNT, RDX, and HMX) waste. Flares contain many metals and the burning of flares releases metal contaminants. The burning of phosphorus produces phosphorus oxides. Pesticides and herbicides were in wide usage at NSWC Crane. It is suspected that pesticides and herbicides were used at the ABG and possibly disposed there (IAS, 1983). In each soil boring samples were collected for organic compound analysis. This analysis was determined to be necessary because organic chemicals are commonly used in industry, and they are used in various munitions. Chemical composition of munitions likely burned at the ABG is given in Table 3.3.

Groundwater at the ABG has been monitored for water quality since November 1982. Water quality sampling has been performed on a quarterly basis since 1985. Federal Primary Drinking Water Standards (MCL's) were used to determine groundwater contamination. Groundwater quality testing resulted in the detection of 2-dichloromethane, 1,1,2-Trichloroethene, 1,1,2,2-Tetrachloroethane, Chloroform, 1,1-Dichloroethylene, Trans-1, 2-dichloroethylene, Bromoform, Dibromochloromethane, Tetrachloroethylene and

TABLE 3.2
SUMMARY OF METHODS FOR
DETERMINATION OF CHEMICAL COMPOUND ANALYSES

		SOILS METHODS from SW-846	
	TECHNIQUE*	EXTRACTION**	ANALYSIS
ORGANIC ANALYSES			
Volatiles	GC/MS	INC. #	8240
Semivolatiles	GC/MS	3540/3550	8270
Organochloride Pesticides & PCBs	GC/MS	3540/3550	8080
Organophosphorus Pesticides	GC/MS	3540/3550	8140
Chlorinated Herbicides	GC/MS	INC. #	8150
Explosives HMX, RDX, TNB, DNB, Tetryl, 24DNT, 26DNT, TNT	HPLC	USATHAMA (now 8330)	USATHAMA (now 8330)
INORGANIC ANALYSES			
Aluminum	ICP	3050***	6010
Antimony	ICP	3050	6010
Arsenic	GF	3050	7060
Barium	ICP	3050	6010
Beryllium	ICP	3050	6010
Cadmium	ICP	3050	6010
Calcium	ICP	3050	6010
Chromium	ICP	3050	6010
Cobalt	ICP	3050	6010
Copper	ICP	3050	6010
Iron	ICP	3050	6010
Lead	ICP	3050	6010
Manganese	ICP	3050	6010
Magnesium	ICP	3050	6010
Mercury	CV		7471
Nickel	ICP	3050	6010
Phosphorous	GLC		CRL* 435
Selenium	GF	3050	7740
Silver	ICP	3050	6010
Sodium	ICP	3050	6010
Thallium	ICP	3050	6010
Tin	ICP	3050	6010
Zinc	ICP	3050	6010

* Abbreviations: GF = Graphite Furnace, CV = Cold Vapor, and ICP = Inductively Coupled Plasma, CRL = EPA Central Regional Laboratory - Region V.
**Extraction process, when not noted, is included in the analytical method.
*** Method 3050 is sample preparation, rather than a method of extraction.
# INC.=extraction procedure included in method procedure.

Table 3.3
Ammunition Burning Ground NSWC Crane (SWMU #3/10)
Composition of Materials likely Burned at the ABG

Solid Propellants

Nitrocellulose, Nitroglycerine, Inorganic Nitrates, Metal Salts, Metals, Carbohydrates, Dyes, Ammonium Picrate, Potassium Nitrate

Liquid Propellants

Fuels - Alcohols, Hydrocarbons, Aniline, Hydrazine, Boranes, Liquid Hydrogen, Anhydrous Ammonia

Oxidizers - Nitric Acids, Hydrogen Peroxide, Chlorine Triflouride, Dinitrogen Tetroxide

Low Explosives

Black Powder - Coal or Charcoal, Sulfur, Potassium or Sodium Nitrate

Black Powder Substitutes - Benite, Eimite, Boron - Potassium Nitrate

Pyrotechnics

Oxidizers - Chlorates, Perchlorates, Peroxides, Chromates, Nitrates

Fuels - Aluminium and Magnesium Powder, Barium Chromate - Boron Mixture, Sulfur

Binders - Shellac, Linseed Oil, Paraffin, Resins

Color Intensifiers - Organic Chlorides, Barium and Copper Salts, Strontium Salts, Dyes

Coolants - Magnesium Carbonate, Sodium Bicarbonate

High Explosives

Primer - Potassium Chlorate, Lead Thiocyanate, Calcium Silicide, Antimony Sulfide, Lead Azide, Lead Styphnate, Mercury Fulminate, Diazodinitrophenol

Booster - Tetryl, PETN, RDX

Bursting -Ammonium Nitrate, TNT, Picratol, DBX, HBX, Trinitrophenol, Ammonium Picrate, Nitroglycerin, Nitrostarch, Powdered Aluminium, HMX

Trichloroethylene (Dunbar, 1984). More recent sampling by ANACON has indicated that mainly RDX and TCE are found on a regular basis (see discussion of COMARCO report, section 2.0). The relationship of the ground water conditions, with respect to TCE and RDX (Murphy 1992), to the soil borings are shown in Figures 3.3 and 3.4.

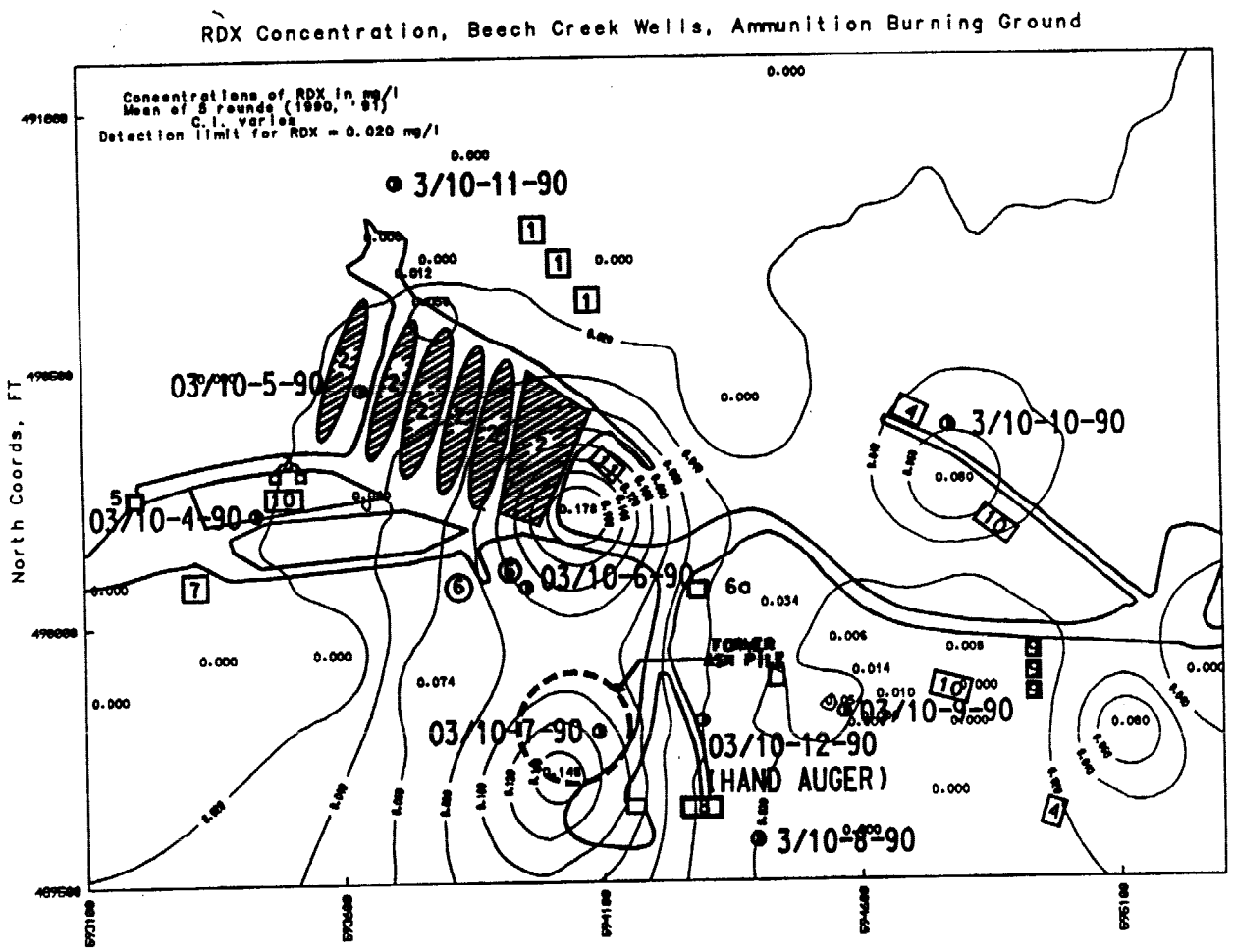
To ensure that the soil samples and the resultant chemical data would be representative of the site conditions, a quality control program was enforced. As part of this quality control program, a sample tracking procedure was used. This process starts in the field with chain of custody procedures and sample isolation and preservation. The tracking procedures were continued in the laboratory. A complete laboratory quality assurance/quality control plan was followed. Document management was started upon the receipt of the samples. Log books, bench sheets, and reports were kept. All data was checked by the analyst, the inorganic team leader or the organic team leader, and the laboratory Chief before the data was released. The data was checked for completeness. The completeness check was to ensure that: (1) all samples and analyses have been processed, (2) complete records including Chain of Custody for each analysis and associated QC samples were used, (3) procedures specified in project planning were followed, and (4) all calibrations were performed.

If data fell outside of acceptable limits as described in the analytical method's procedures, the sample was rerun if the required amount of sample was available. If the rerun results continued to fall outside acceptable limits and the QA check sample data was good, then data was reported with qualifying explanations. Acceptable data was usually defined by the specific procedural method (i.e., SW-846).

Final data reports went through several review and approval levels. The generated data was finally checked for validity. The data was evaluated with respect to:

1. Detection limits,
2. Control limits for duplicates, spikes, blanks, and surrogates,
3. Data control within control limits and corrective actions, and
4. Flagging of consistently out of control data.

A validation report was prepared as a final step in the data preparation process. (See Appendix D.)



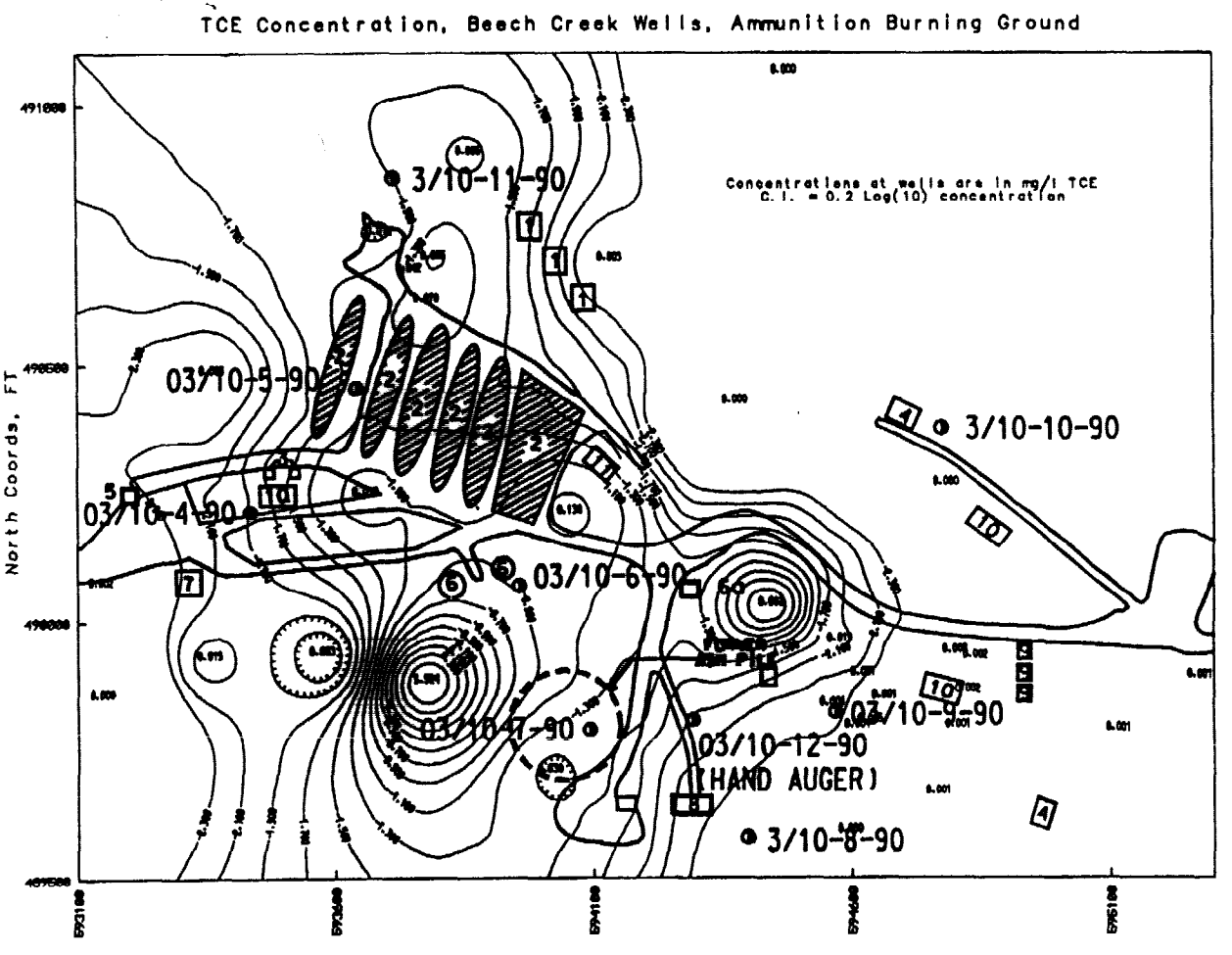
LEGEND

- SOIL BORING

1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments Tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

NSWC CRANE
AMMUNITION BURNING GROUND
SWMU 03/10
GROUNDWATER RDX

FIGURE 3.3



LEGEND

- SOIL BORING

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6a. Surface Impoundments Tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box

NSWC CRANE
AMMUNITION BURNING GROUND
SWMU 03/10
GROUNDWATER TCE

FIGURE 3.4

3.4.0 PHYSICAL PARAMETER ANALYSIS. Soil samples were characterized using standard US Army Corps of Engineers geotechnical methods. These methods are described in Corps of Engineers' Manual EM 1110-2-1906, Laboratory Soils Testing, 1970. The soil samples were described and classified in the field by the field crew and in the laboratory by the technician. The lab classification consisted of a visual classification, a sieve and hydrometer analysis, determination of natural water content, Unified Soil Classification System (USCS) classification, and organic content. The sieve analysis determines the gradation of grain sizes ranging from the number 1 sieve to the number 200 sieve. To determine the percentage of silt and clay in the fine fraction of the sample, hydrometer analytical methods were used.

3.5.0 DATA EVALUATION. The results from the chemical analysis must be checked for representativeness and comparability. Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program. Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. All data is checked by the analyst, the inorganic team leader or the organic team leader, and the laboratory chief, before it leaves the laboratory. The following items are checked:

1. Completeness

2. Duplicate values for precision

3. Recovery of Spikes for accuracy

4. Method blanks for contamination

5. Surrogate recoveries for organic analysis

6. Reasonableness and trends (does the data fit)

Completeness is the percentage of measurements made which are judged to be valid measurements. Completeness can be a subjective parameter based on the study's data quality needs. A percentage of data from any analytical program can be expected to be found to be invalid. Validity of the data is dependent on the level of quality control needed for the study. In this case

NEESA Level C QC was used. Other quality parameters are method-dependent and are described in the EPA's SW-846 Methods manual 3rd edition. Precision is the measure of the reproducibility of a set of replicate results. It refers to the agreement between duplicate or replicate analysis. Good duplicate precision for a soil sample is less than a 30 percent difference between the two samples. Accuracy refers to the agreement between the measured value and the true value. It is assessed by analyzing reference samples or spiked samples. Method blanks are reagent water which is treated the same as a sample and carried through the laboratory analytical process to check for contaminants introduced during the analytical process. Spikes (matrix, method, and method blank) are actual samples to which known quantities of certain analytes are added prior to sample extraction/digestion and are used to determine percent recoveries which tests the appropriateness and recovery efficiencies of specific analytical methods within the actual sample matrices (material). An analyte is a chemical component of a sample to be determined or measured.

The determination of when analytical data is "Out of Control" is an important feature of any analytical program. The determination of an "Out of Control" event is determined from the interpretation of control charts. Control charts are a demonstration of the method's ability to generate acceptable data by measuring its precision and accuracy. These charts are dependent on the analysis of four separate replicates of a check sample containing all parameters of interest. These generated control charts are the basis against which all future data can be compared. Acceptable precision and accuracy are dependent on the data quality needs of the study and the method of detection selected. The interpretation of control charts can reveal shifts, trends, biases, and conditions where parts of the analytical system are "Out of Control". If data fell outside of acceptable limits as described in the analytical method's procedures, the sample was rerun if the required amount of sample was available. If the rerun results continued to fall outside acceptable limits and the QA check sample data was good, then data was reported with qualifying explanations (N, W, or * for inorganic analysis and E for organic analysis). The results of the "Out of Control" events and the corrective actions taken are reported on the Quality Assurance Corrective Action forms included in the ABG Level C data package.

Detection limits were taken from EPA SW-846. The equation for the Method Detection Limit (MDL) is:

$$MDL = KS_B / M$$

where: M = slope of the calibration line
S_B = standard deviation of the average noise level
K = 3

After receiving the data from the laboratory, the data is evaluated to determine to what degree the data is reliable (precision and accuracy) and usable (representative, comparable, and complete). The evaluation process includes comparing the data with the control data. The control data packages are the reports of the results from the analysis of method blanks, blank/spikes, surrogates, matrix spikes, and matrix spike duplicates. The data is evaluated on how it meets the investigation's Data Quality Objectives. This constitutes data validation, summarized in the Data Validation Report in Appendix D.

The following is a discussion of an EXAMPLE DATA SET taken from the ABG data package. The complete chemical data summary tables and an explanation of chemical abbreviations used are presented in Appendix A. The example data set is summarized on Tables 3.4 through 3.11.

Table 3.4 is an example data evaluation for inorganic data. The example data is derived from sample #1 (sample depth 0.2 - 0.5 feet below ground surface) from boring 12. The comparison between the sample analysis and the duplicate digest is important because it indicates the homogeneity of the sampled medium. A duplicate sample is a portion of the soil taken from the same boring and interval as was the control sample, is digested the same as the control sample, and analyzed in the laboratory to test for method reproducibility. If the differences between the results are small, the samples were determined to be similar (homogenous). The rinse data and method blank data are used to indicate if the samples were tainted by a field operation or in the laboratory. A rinse sample is a portion of the reagent water collected during the final rinse of the sampling equipment. Rinse samples are used to establish the effectiveness of the equipment decontamination operation. The blank and rinse results are compared to the sample results to determine to what magnitude an analyte concentration found in the sample can be attributed to some foreign process. Table 3.4 also presents the results of the spiked data. From this data media interferences can be detected.

The % recovery shows how much of the spike was recovered. The control level figures are qualitative indicators of the method's efficiency within the sample (soil) matrix.

For the example sample set, the method and field blanks had little contamination and indicate that the samples were not tainted by the sampling or analytical routines. With few exceptions (indicated by an N qualifier), the spike recoveries were within the control limits for the EPA SW-846 method. The conclusion is that the inorganic data is reliable and usable.

Tables 3.5 to 3.9 present quality control data from the organic and pesticide analysis. Their formats are similar to the format for the inorganic tables. Sample #1 from boring 12 was again used as the example data for all of the analysis excepting the semivolatile organic analysis. For the semivolatile analysis, sample # 3 from boring 12 was used as the example data. Because the analyte concentrations detected were small (µg/kg (ppb)), the % difference between results from the samples and the duplicates were not calculated. Laboratory contaminants are readily seen in nearly all of the blanks and rinses. For the volatiles these are methylene chloride and acetone, for semivolatiles they are mainly phthalates, and for pesticides possibly heptachlor. Field-induced contamination can be determined by evaluating the rinse data. For the volatile analysis, chloroform, 2-butanone, bromodichloromethane, and cis-1,2-dichloroethene where found in the rinsate data. These analytes are considered field induced contaminants found at low concentrations (µg/kg (ppb)) and are not considered to have any effect on the interpretation of the data. Bis(2-ethylhexyl) phthalate, di-N-octyl-phthalate, and butyl benzyl phthalate were detected in specific equipment rinses and regarded as field induced semivolatile organic contaminants. These compounds, generally classed as plasticizers, were probably derived from the plastic devices (gloves and containers) used to hold the rinse waters used in the decontamination process. Of the pesticides only heptachlor was detected in the rinse waters, and it was also detected in the method blanks run with the samples. Heptachlor was thought to be a laboratory contaminant, not a field induced contaminant. This conclusion is based on its occurrence in the method blank which was formulated in the laboratory only and, therefore, never exposed to field conditions.

On Table 3.10, an example data set for soil samples analyzed for the presence of explosives compounds is shown. The method used for detection of explosives compounds in soil has been incorporated in EPA Method 8330, and recovery ranges are

included in the tables. The example sample is again sample #1 from boring 12. The matrix spike recoveries are all nearly 100% indicating that matrix interferences are not a factor in the analysis of the data, and that the results are accurate and precise.

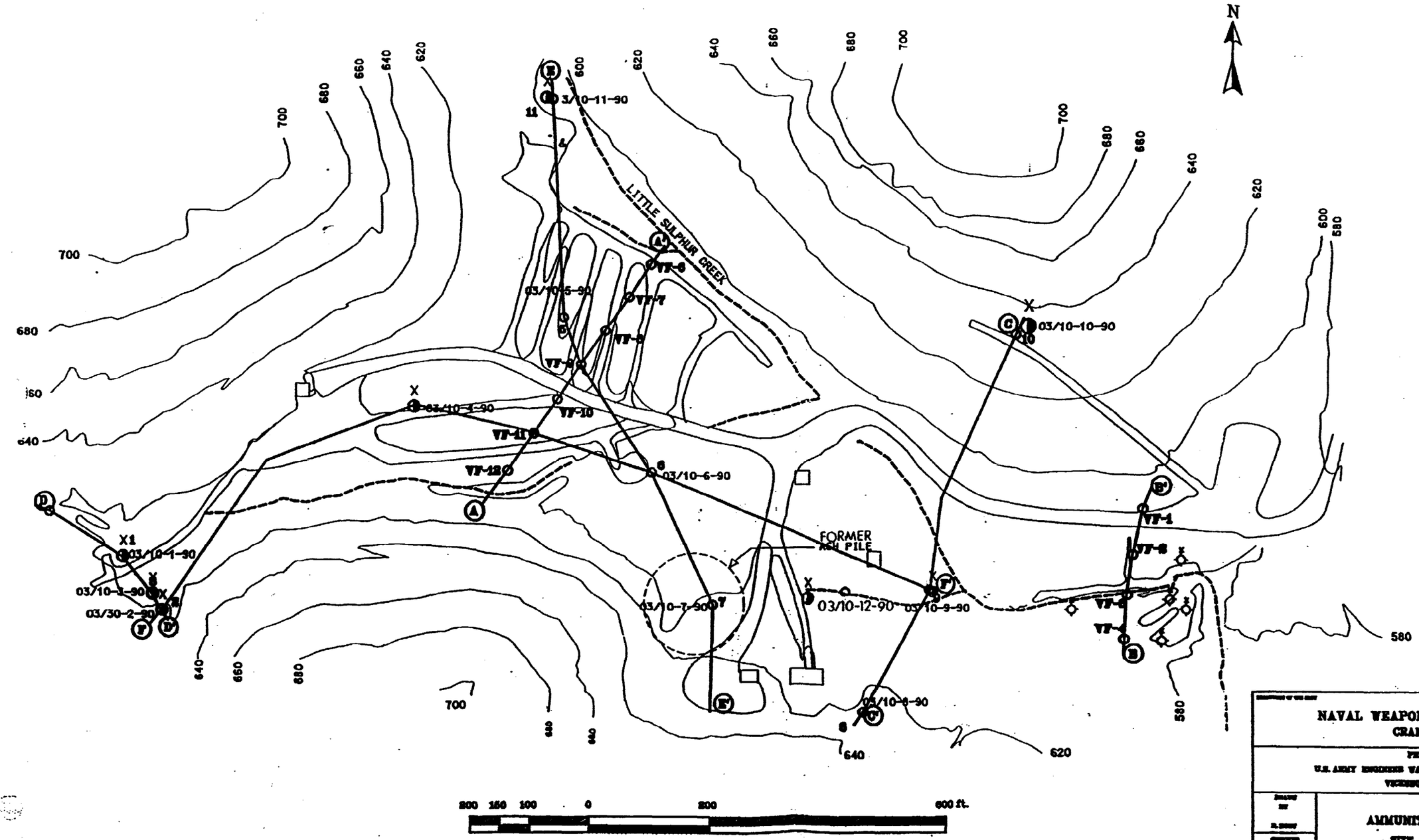
A similar comparative routine is repeated for all of the processed data for all the borings. The data is found to be reliable. Certain organic compounds are interpreted to be induced by either the field technique or the laboratory methodology. For the inorganic data, there are thought to be no induced chemical compounds and the data is reliable.

4.0 SITE CHARACTERIZATION

4.1.0 GEOLOGIC SETTING. The ABG is located on the Crawford Upland, a rugged, dissected plateau formed by differential erosion of Pennsylvanian and Mississippian Age sedimentary rocks. The rock units underlying the ABG consist of limestone, shales and sandstones of the Mississippian Age Stephensport Group. Most of the ABG is situated in the dissected alluvial valley of Little Sulphur Creek. The surrounding hills are formed by shale and sandstone of the Pennsylvanian Age Raccoon Creek Group. The unconsolidated sediments of the ABG site are composed of residual soils formed by weathering of the underlying parent rock, alluvium, and colluvium derived from the hillslopes, and modified soil, which was reworked by man. Modified soil is associated with the ABG activity.

4.2.0 SITE GEOLOGY. The geology of the ABG site was characterized with 39 ground water monitoring wells (Dunbar, 1982 and 1984, and Woods 1986), 48 ground water monitoring and 12 valley floor soil borings (noted VF-## from Hunt 1988), and 12 auger soil borings described in Section 3.0 FIELD METHODS of the ABG work plan. The locations of the borings are presented on Figure 4.1. Geologic sections A-A'and B-B' (Figures 4.2 and 4.3, respectively) are modified from Hunt (1988). Descriptions of the sections and the drilling logs were presented in the Hunt (1988) report. The stratigraphic assignment of the sandstone units underlying the site has been changed from Hardinsburg (Dunbar, 1982) to Big Clifty Formation, following Hunt (1988). Geologic sections C-C', D-D', E-E', and F-F' (Figures 4.4, 4.5, and 4.6, respectively) present the 1990 soil auger borings. The detailed individual soil auger boring logs are presented in Appendix B. Collectively, the sections portray the soil and rock stratigraphic relationships of the ABG.

4.3.0 SOIL. The soil thickness of the ABG site ranges from zero to almost 18 feet. The variability of soil thickness is apparent on Figure 4.7. The thickest soils correspond to the areas of deepest incision into the rock. The thicker (greater than 6 feet) sections of soil are alluvial and colluvial filling of the Little Sulphur Creek Valley. Prior to fluvial incision, a residual soil formed from the weathering of parent rock material. Remnants of the residual soil make up a portion of the soil stratigraphic sequence.



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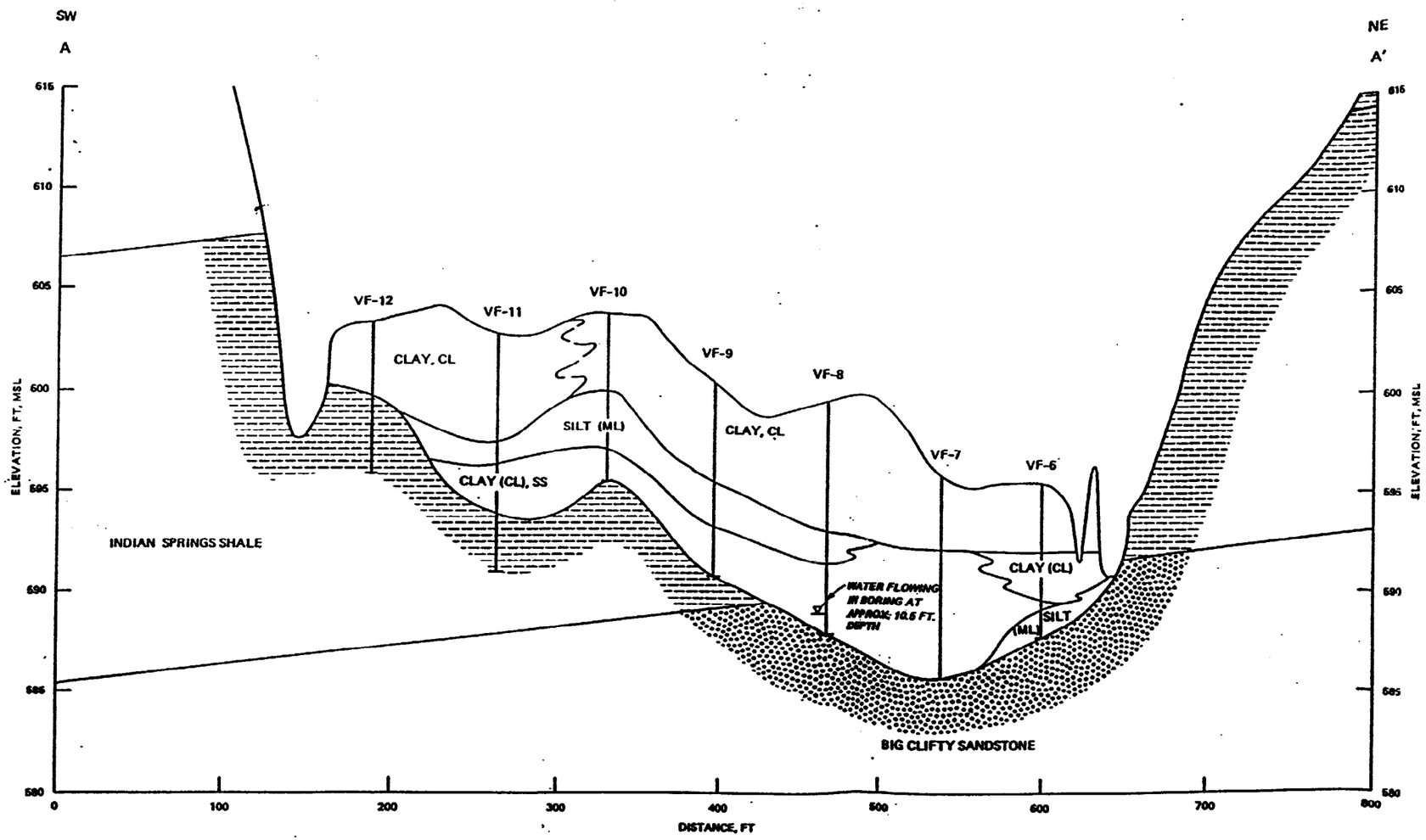
AMMUNITION BURNING GROUND
SITE PLAN OF GEOLOGIC SECTIONS

FIGURE 4.1



LEGEND

- UNDIFFERENTIATED
- CLAY SYMBOL
- SHALE AND SANDSTONE
- SANDSTONE
- SHALE
- LIMESTONE

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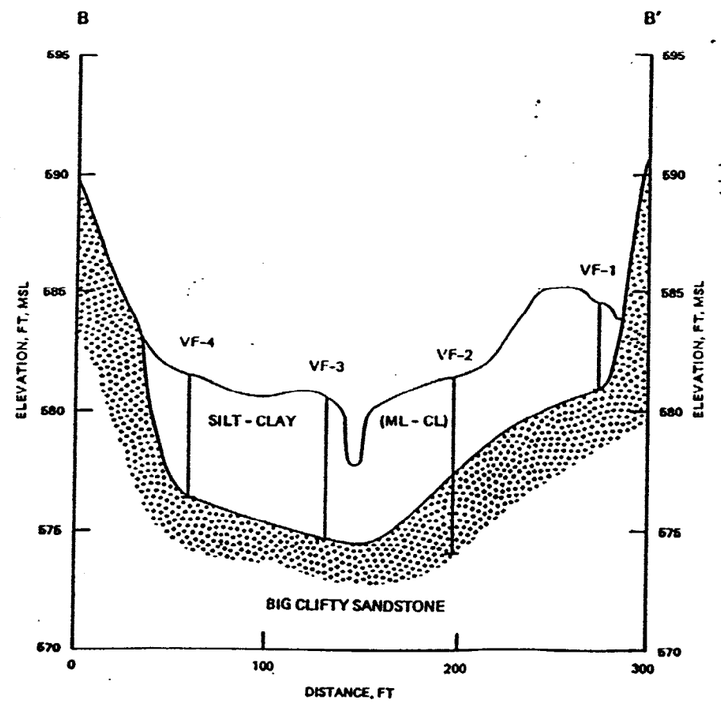
CHECKED BY W. MURPHY

GEOLOGIC SECTION A-A'
AMMUNITION BURNING GR

FIGURE 4.2



LEGEND

- UNDIFFERENTIATED
- CLAY SYMBOL
- SHALE AND SANDSTONE
- SANDSTONE
- SHALE
- LIMESTONE

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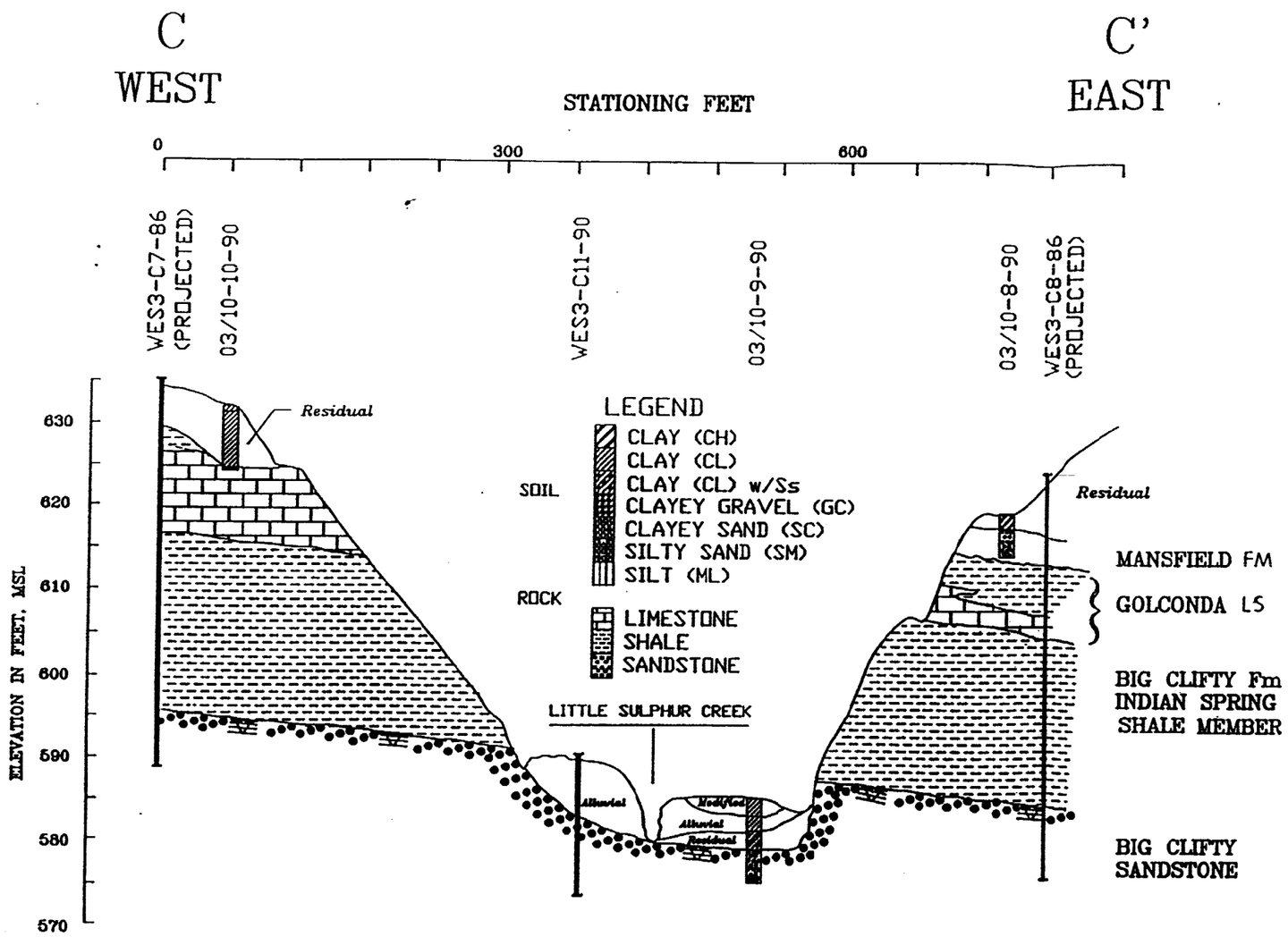
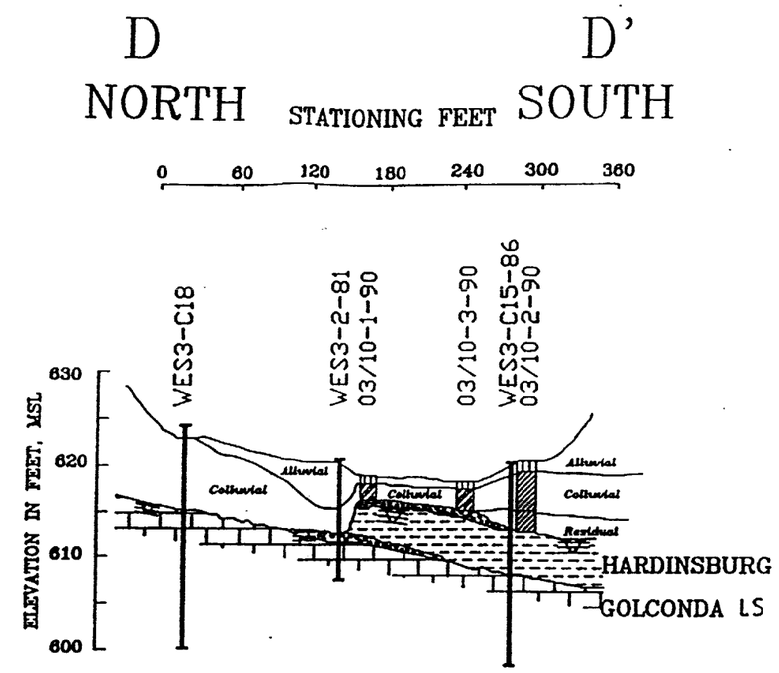
DRAWN BY R. HUNT	GEOLOGIC SECTION B-B' AMMUNITION BURNING GR
CHECKED BY W. MURPHY	

FIGURE 4.3





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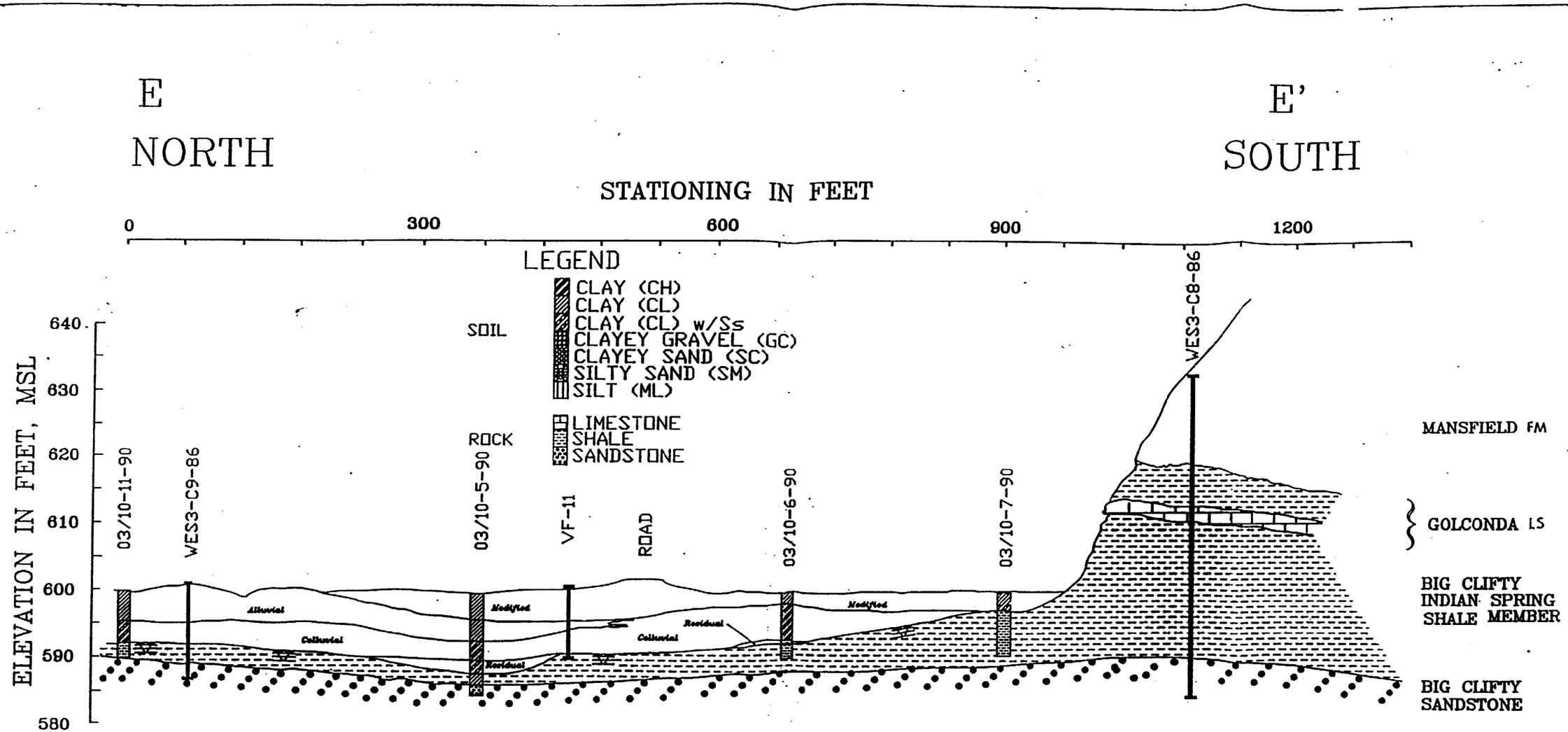
DRAWN BY
P. [illegible]
S. [illegible]

CHECKED BY
W. MURPHY

AMMUNITION BURNING GROUND
GEOLOGIC SECTIONS
C–C' AND D–D'

FIGURE 4-4



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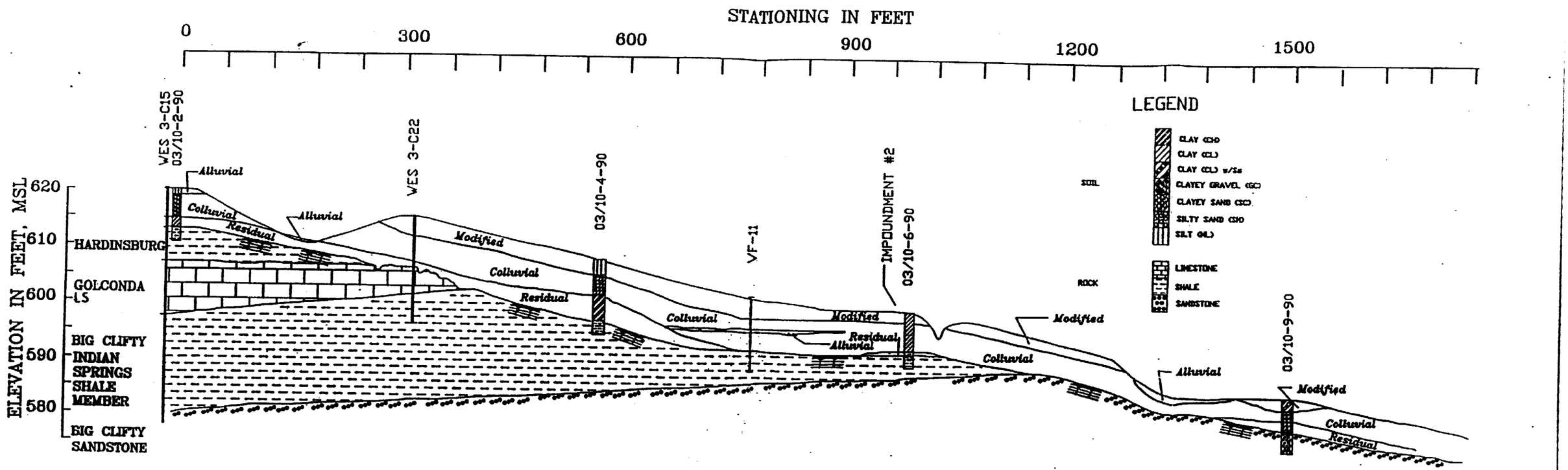
B. WASHINGTON

CHECKED BY
V. MURPHY

AMMUNITION BURNING GROUND
GEOLOGIC SECTION
E–E'

FIGURE 4.8



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D. WASHINGTON

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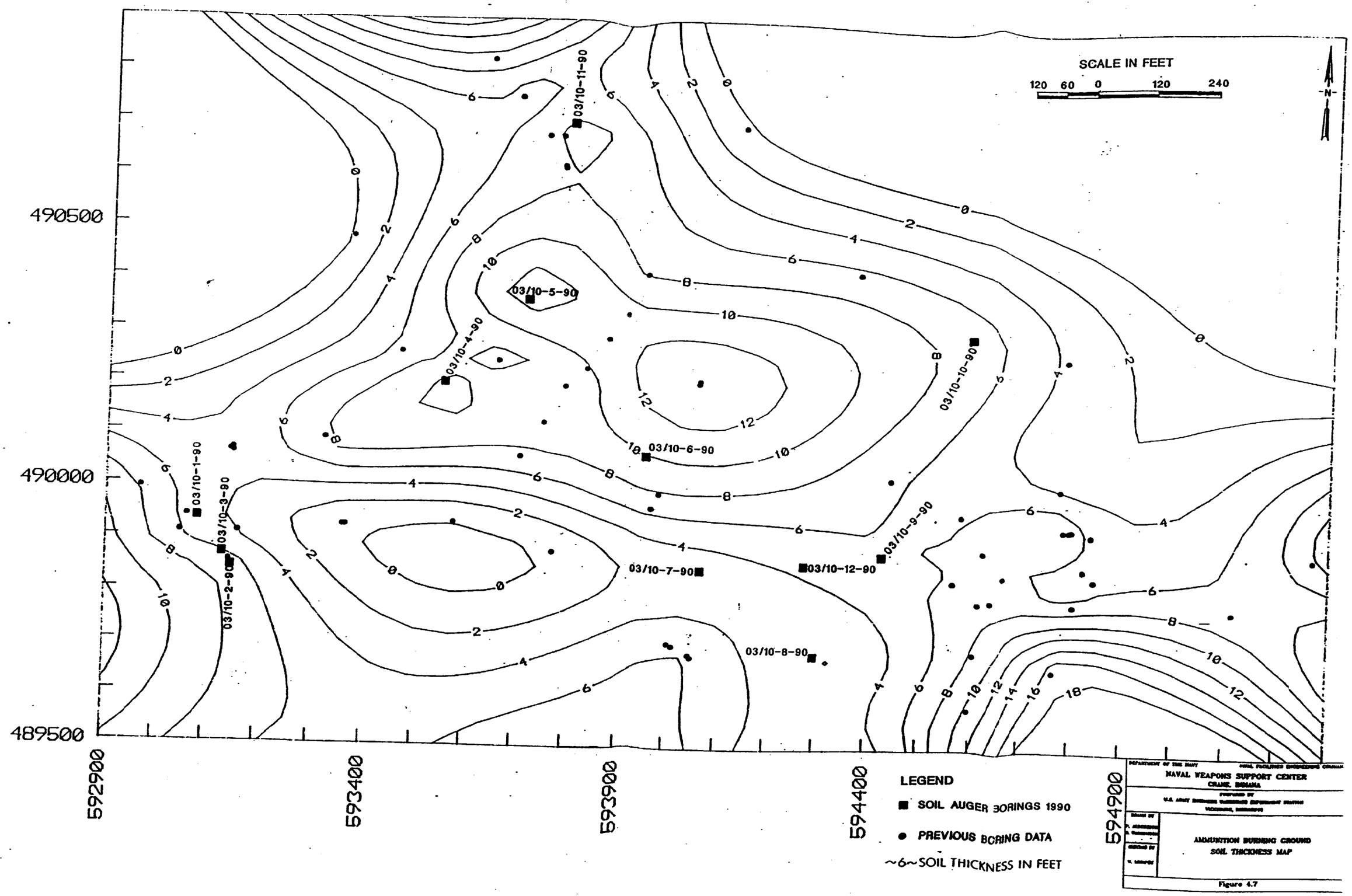
W. MURPHY

AMMUNITION BURNING GROUND
GEOLOGIC SECTION
F–F'

FIGURE 4.6


SCALE IN FEET
120 60 0 120 240
N
490500
490000
489500
592900
593400
593900
594400
594900
03/10-11-90
03/10-5-90
03/10-4-90
03/10-10-90
03/10-6-90
03/10-1-90
03/10-3-90
03/10-2-90
03/10-7-90
03/10-12-90
03/10-9-90
03/10-8-90
LEGEND
SOIL AUGER BORINGS 1990
PREVIOUS BORING DATA
~6~SOIL THICKNESS IN FEET
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA
AMMUNITION BURNING GROUND
SOIL THICKNESS MAP
Figure 4.7

The soil samples from the auger borings were classified in the field according to USCS. Selected soil samples were analyzed later in the laboratory. The soil types which compose the ABG site are predominately clays (CL and CH) and clayey gravel (GC) with lesser amounts of sand (SM and SP) and silt (ML). The gravel portion of the gravelly clay (CL) and clayey gravel (GC) is chiefly gravel sized sandstone fragments. There are some differences between the field classification and the lab results. The friable sandstone fragments probably contributed to the percent sand during rotapping ,i.e., physical rotation and tapping procedure used in the lab to sieve soil sample for gradation. The resulting increased sand percentage produced gravelly clayey sand (SC) designation for these samples. This is the case for several samples (i.e. 03/10/-1-90-1). The lab added a qualifying note that there was insufficient sample for accurate gradation. For the above reasons, the initial field classification is used for all the soil types throughout the report. See Appendix B and C for boring logs and the soil data, respectively.

An additional 45 soil samples were analyzed for grain size classification. These samples were collected during an earlier investigation (Hunt, 1988). The locations of those borings are shown on Figure 4.1 as the Valley Fill (VF) borings.

The surface clays and silts contain roots and natural organic debris. Throughout the clay soil profile are iron oxide concentrations and manganese stains. The clay (CH) represents the residual soil, a weathering product of the shale and limestone as observed in borings 03/10-2 and 4, 5, and 6-90 (Figures 4.4, 4.5, and 4.6). Residual soils are also found as clay (CL) with scattered sandstone fragments in borings 8-90 and 10-90 (Figure 4.4).

The alluvial and colluvial soil zones of the ABG are visible on the geologic sections (Figures 4.4, 4.5, 4.6 and 4.7). The gravelly clay (CL w/ G) and clayey gravel (GC) units are colluvial infilling and alluvial reworking of sediments derived from the surrounding hillslopes. The clay (CL) and silt (ML) were deposited from hillslope sheetwash and/or Little Sulphur Creek overbank processes. A thin (2 to 3 feet) layer of silty sand (SM) was found in boring 03/10-12-90 (Figure 4.7). This silty sand (SM) bed represents alluvial infilling.

An anthropogenic soil unit is recognized on the geologic cross sections as "modified". Anthropogenic describes soils which have been modified by human activity associated with

burning ground activity. This modified soil is chiefly colluvium and alluvium with cultural debris. Examination of boring logs 4, 5, 7, and 9 (Appendix B) shows soil containing debris such as red-stained rags, slag, brass shell casings and rusty nails. The above physical evidence was use to supplement the chemical analyses in finding areas of potential contamination. The modified soil is shown on the cross-sections as a continuous unit. Review of the site's history indicates that the modified soil is reworked to a depth of 2 to 3 feet. The area and depth of actual contamination will require additional borings for accurate delineation.

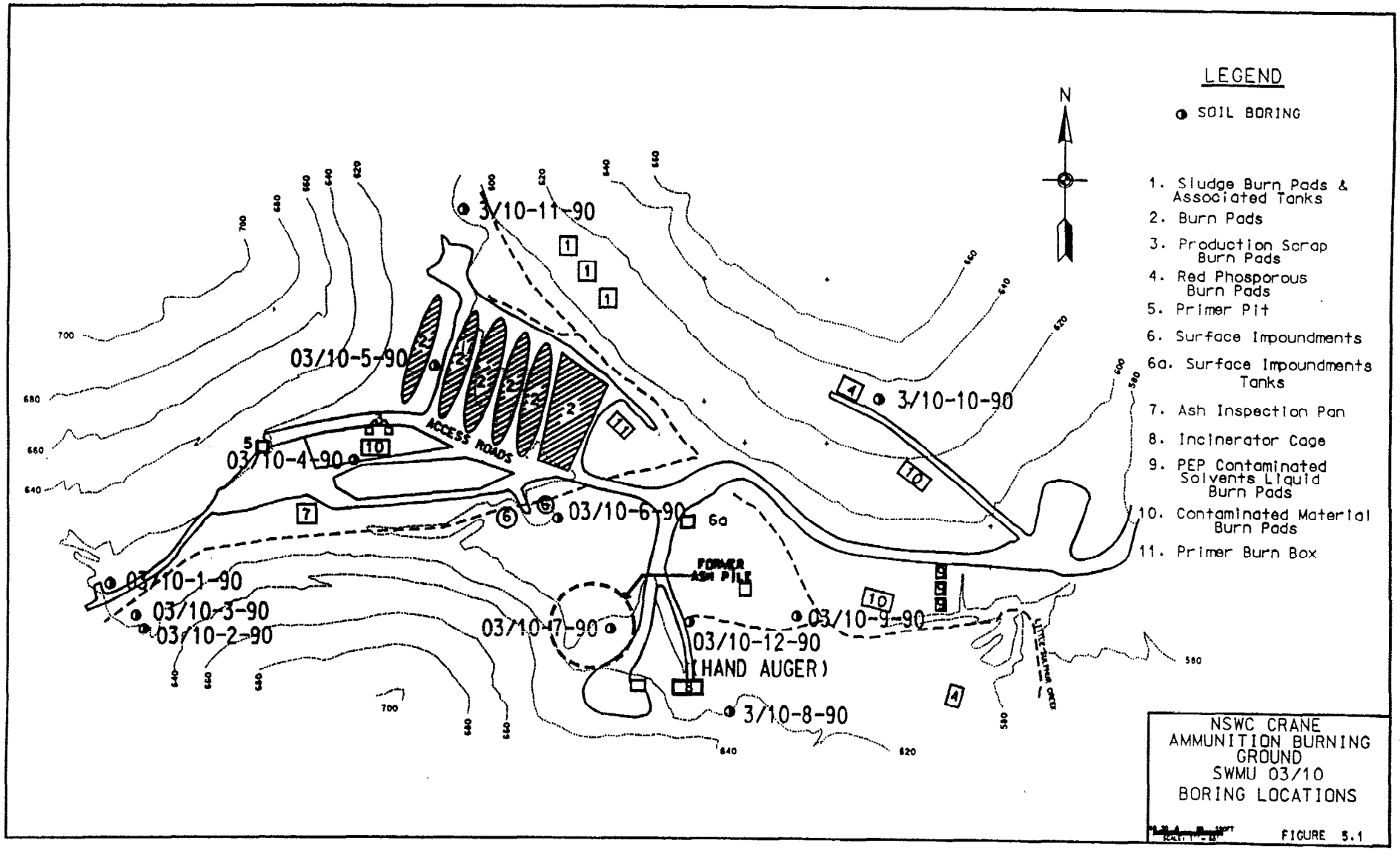
4.4.0 HYDROGEOLOGY. The soil auger borings were left open prior to grouting to measure water levels. Water was encountered in boring 03/10-6-90 (Appendix B) during drilling but the hole was dry before it was grouted. All the other soil auger borings were dry holes. Previous investigations (Dunbar 1982, and Hunt 1987) also found the soil to be unsaturated with the exception of valley fill boring VF-8 (Figure 4.2) where water flowed in the hole when the Big Clifty Sandstone was encountered. Dunbar (1982) presents laboratory permeabilities on the order of 5×10^{-5} and 5×10^{-6} cm/sec. The soil is relatively impermeable with most rainfall exiting the site as surface runoff except in the channel of Little Sulphur Creek, where the Big Clifty is exposed and infiltration can occur. Vertical infiltration occurs in Little Sulphur Creek below about the center of the ABG site, since the alluvium is partially permeable. During periods of infiltration the soil acts as a very slow conduit for groundwater and any contaminants. Movement of ground water at the ABG site probably flows along the top of rock surface. Hunt (1987) depicts the ground water moving along the top of rock surface until it intersects the fractured Big Clifty Sandstone and eventually the water flows into the Beech Creek Limestone. Ground water moves through the soil very slowly by downward vertical infiltration, then laterally along the soil/rock interface until it reaches the fractured rock interval where the ground water enters the aquifer system.

5.0 CHEMICAL ANALYTICAL RESULTS

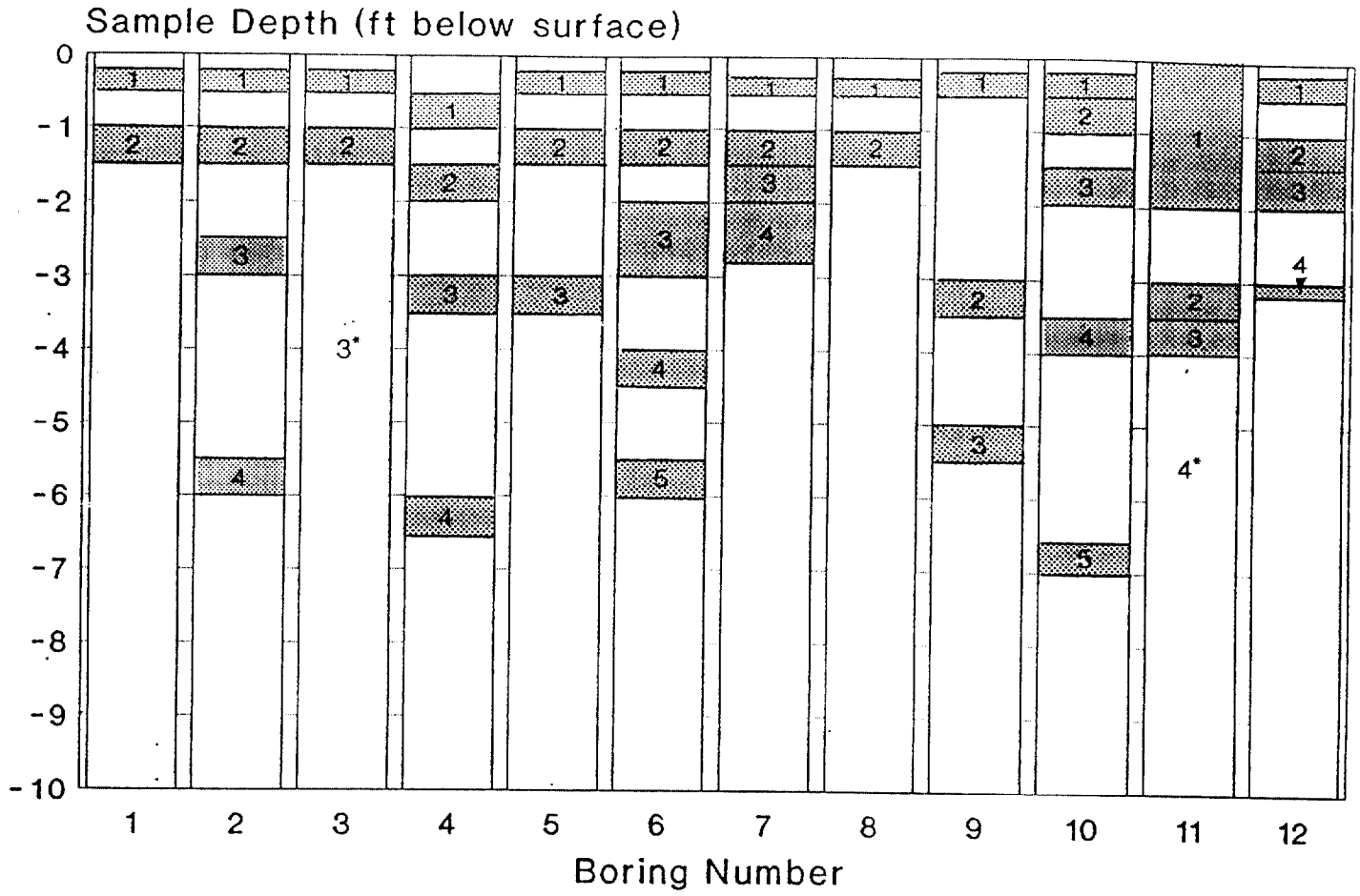
5.1.0 INTRODUCTION. Twelve test borings were made at the ABG between August 8 and August 20, 1990. Figure 5.1 shows the location of the test borings and the ABG layout. Soil samples were taken from specific layers within the sample borings using Shelby Tubes having a 3-inch interior diameter. The depth from which each soil sample was taken is indicated in Figure 5.2. Also provided on Figure 5.2 are the dates of sample collection.

For the purposes of data analyses, the following sample groupings are made. Borings 1, 2, and 3 were selected to be "background" borings. These borings were located several hundred feet to the southwest of the ammunition handling activities in the ABG area. These borings were located adjacent to groundwater monitoring wells in which contamination was not detected during previous investigations (Section 2.0 PREVIOUS STUDIES). Soils from borings 1, 2, and 3 were sampled to identify characteristics of soils in the vicinity of the ABG area as if no ammunition burning activities had occurred at those facilities, but all other influences on soil characteristics had taken place. Soils from borings 4 through 12 (inclusive) were sampled to identify characteristics of soils in the vicinity of specific ABG activities. Table 5.1 is a list of ammunition disposal activities or features associated with a sample boring location. (Refer to Appendix A for all Section 5.0 Tables.) If contaminants are being released from the ABG solid waste management unit, borings 4 through 12 should provide some indication of that occurrence. A release is defined as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, dumping or disposing into the environment (definition set forth in 40 CFR 302.3).

To assist in data interpretation and to determine sources of error, the results of the analyses of method blanks and equipment rinses are given. Method blanks are determined by following the analytical procedure step by step including all of the reagents and solvents, in the quantity required by the analytical method. Method blanks are a measure of cumulative interferences from the laboratory or the analytical method. Equipment rinses are samples obtained by running analyte-free water over/through sample equipment after it has been cleaned. Analyses of equipment rinses are used to evaluate equipment cleaning procedures and determine if sampling equipment contributed to cross-contamination of field samples.


LEGEND
SOIL BORING
1. Sludge Burn Pads & Associated Tanks
2. Burn Pads
3. Production Scrap Burn Pads
4. Red Phosporous Burn Pads
5. Primer Pit
6. Surface Impoundments
6a. Surface Impoundments Tanks
7. Ash Inspection Pan
8. Incinerator Cage
9. PEP Contaminated Solvents Liquid Burn Pads
10. Contaminated Material Burn Pads
11. Primer Burn Box
N
3/10-11-90
03/10-5-90
3/10-10-90
03/10-4-90
03/10-6-90
6a
ACCESS ROADS
FORMER ASH PILE
03/10-1-90
03/10-3-90
03/10-2-90
03/10-7-90
03/10-12-90
(HAND AUGER)
03/10-9-90
3/10-8-90
LITTLE SANDY CREEK
NSWC CRANE
AMMUNITION BURNING
GROUND
SWMU 03/10
BORING LOCATIONS
FIGURE 5.1

Depth of Soil Samples



Ammunition Burning Ground - NWSC Crane, Indiana
Dates Samples Collected

Boring 1	08 AUG 90	Boring 4	10 AUG 90	Boring 7	17 AUG 90	Boring 10	15 AUG 90
Boring 2	09 AUG 90	Boring 5	11 AUG 90	Boring 8	15 AUG 90	Boring 11	13 AUG 90
Boring 3	09 AUG 90	Boring 6	18 AUG 90	Boring 9	16 AUG 90	Boring 12	20 AUG 90

Note: * - sample depth not identified on boring log.

Figure 5.2. Ammunition Burning Ground - NWSC Crane, Indiana. SWMU# 03/10. Depth of soil samples and dates of collection. Sample numbers are indicated in shaded areas.

To ensure validity of the chemical data obtained, a chemical data quality control program was followed during the ABG soil sampling and subsequent laboratory analyses. Quality Control Level "C", as explained in the NEESA guidance 20.2-047b "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program", was followed. In summary, the NEESA Quality Control Level C plan requires the use of U.S. EPA approved methods when available, a duplication of at least 10% of the samples, the collection and analysis of equipment rinse blanks (samples of final equipment rinses) on a daily basis, the collection and analysis of field blanks (samples of organic-free water exposed to the sample environment), and the use of trip blanks with all samples specified for volatile organic analyses. The intent of the plan is to ensure that sources of extraneous contamination can be determined and that decisions made using the data are meaningful and supported. An exception to Quality Control Level C for the ABG soils investigations was that no field blanks were collected.

Because inorganic analytes are naturally occurring crustal elements, the identification of soil contaminants which are also naturally occurring soil constituents required statistical comparisons between background or "uncontaminated" soil concentrations and those of the test soil. The use of whole boring or soil column mean constituent concentrations provided a method, using available data, to identify constituent concentrations which may represent possible soil contamination. The statistical comparisons required the computation of a mean and variance. In order to have a sufficient number of samples for these computations ($n > 3$), all samples from a particular boring were used. As only one sample was taken from each specified elevation within the boring, statistical comparisons of mean constituent concentrations between specific soil boring sample elevations were not possible. Mean concentrations of inorganic constituents from test borings were compared to those of background borings using a one-tailed t-test with $p = 0.05$ (95 percent level of confidence). Means were computed from all samples from a specific boring; however, background means were computed using all samples taken from borings 1, 2, and 3. Assumptions were made that both means were obtained from random samples and that both means were obtained from normal populations. The first hypothesis tested, using an F-test with a 95% confidence interval, was whether the variances of the two means being compared were equal. Based on the results of the first tests of hypotheses, a common population variance was or was not computed and appropriate degrees of freedom computed. Subsequently, a second hypothesis tested using

a t-test was if the test and background mean constituent concentrations were equal or alternately if the test mean was greater than the background mean.

The statistical comparison of the means of all samples from a specific boring with that from another boring is intended only as a descriptive tool. The specific information obtained from each sample is presented and qualitative observations made from that data. Statistical comparisons of constituent concentrations between specific soil boring elevations or between samples in the same boring were not possible because only one sample was taken from each specified elevation. Also, as indicated on Figure 5.2, specific soil samples were not taken at the same elevation within each boring. Even if the specific soil samples were taken from the same elevation in the boring, that elevation may not correspond to the same soil strata from one boring location to the next. Thus comparison of a specific depth sample from boring to boring may not be relevant. However, the boring logs do indicate that the soils sampled were generally similar, being predominantly clay and clayey gravel with lesser amounts of sand and silt. The general similarity of the soils at different depths makes averaging the soils data at least a conservative descriptor of the contaminant characteristics of the soils.

5.2.0 DISCUSSION OF ANALYTICAL RESULTS.

5.2.1 Metals and Inorganics. The results of analyses of ABG soils for selected inorganic analytes are given in Table 5.2. Table 5.3 is a statistical analysis of the results of inorganic soils analyses. Table 5.4 reports the maximum concentrations of selected inorganic analytes determined for the ABG soils sampled. Analyte concentrations in the soils are given as mg/kg (ppm) on a dry weight basis. The contract required detection limit is provided (following the < symbol) where specific metals in the soils were not detected. The results for specific inorganic constituents are also given graphically in Figures 5.3 through 5.13. These bar charts provide constituent concentrations for each sample taken from a boring. The bars are oriented from shallowest sample in the boring, on the left, to deepest sample in the boring, on the right. Figures 5.3A through 5.13A show the mean constituent concentrations for all samples from each boring. Graphs are not provided for thallium as all soil analyses results were either 0.3 mg/kg, 0.2 mg/kg, or <0.2 mg/kg. Beryllium spike recoveries were not within control limits, probably because only very low levels of the analyte were found. Based on the composition of explosives burned at the ABG, beryllium would not

be expected.

As stated previously, borings 1, 2, and 3 were selected to be "background" borings. These borings were located several hundred feet to the southwest of the ammunition burning activities in the ABG area (Figure 5.1). The validity of those borings being labeled as background borings is difficult to assess with the available information. However, the following statements (from Table 5.3) give an indication of the chemical nature of the soils from the background borings: with the exception of beryllium and iron, the greatest mean concentration of a specific inorganic constituent was obtained from "non-control" borings 4 through 12; similarly, with the exception of arsenic, beryllium, thallium, and iron, the maximum inorganic constituent concentrations were determined from borings 4 through 12; the minimum concentrations determined, or concentrations equal to the minimum, for antimony, mercury, silver, thallium, aluminum, barium, magnesium, tin, and sodium were obtained from borings 1, 2, and 3. As maximum concentrations of lead, aluminum, magnesium, and barium, common constituents of explosive and pyrotechnic compounds, and zinc, chromium, and cadmium, common constituents of projectile casings (NSWC 1992), in the background borings (borings 1, 2, and 3) were generally orders of magnitude less than the maximum for borings 4 - 12, the background borings are believed to be appropriate for inorganic constituent comparisons with respect to waste disposal activities at ABG.

The results of analyses of soil samples from borings 7, 9, and 12 indicate that a release of metal constituents has probably occurred in those locations. Soils from these borings contained antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, barium, magnesium, manganese, tin, and sodium at concentrations which were greater than concentrations in the soil samples from the background borings (borings 1, 2, and 3). The maximum concentrations of these metal constituents for the ABG soils tested were obtained from either boring 7, 9 or 12 (See Table 5.4). These metals are common constituents of materials burned at the ABG.

As indicated in Table 5.3, the boring 7 mean concentrations (mean of all samples taken at that boring) of lead, nickel, zinc, aluminum, barium, magnesium, and manganese were significantly greater ($P < .05$) than corresponding mean concentrations for the background samples (borings 1, 2, and 3). This means that for those borings, the probability (P) of obtaining a mean soil sample which has greater concentrations of the specified constituents than the background is more than 95%. Similarly, for

boring 12, mean cadmium, copper, lead, nickel, zinc, aluminum, barium, magnesium, and manganese concentrations were significantly greater (P <.05) than background means. However, for boring 9, none of the mean metal concentrations were significantly greater than corresponding background sample means. It should be noted, however, that the variance for the sample means for borings 7 and 9 were often very high, approximately equal to or greater than the sample means. For that situation, a large difference between the mean concentrations for background and "test" borings may exist and not be statistically significant. The differences may, however, represent important characteristics of the samples. An example of the calculations used for cadmium follow.

For cadmium (Cd); Background (Borings 1,2,3) vs Boring 7:

Background	Boring 7
Mean U_1 = 0.5	Mean U_2 = 28.8
Variance (σ_1^2) = 0.01	Variance (σ_2^2) = 1664
n = 9	n = 4

Test to see if variances are significantly different at 95% level of confidence, α =.05

Null Hypothesis Ho : $\sigma_1^2 = \sigma_2^2$ F= s_1^2/s_2^2 = 1664/0.01 = 166400
Alt Hypothesis Ha : $\sigma_1^2 \neq \sigma_2^2$
Use F test => Critical value F_α= 4.07 with 3 & 8 degrees of freedom.

166400 > 4.07; therefore we reject Ho and accept Ha. $\therefore \sigma_1^2 \neq \sigma_2^2$
$n_1 \neq n_2$.
Now test sample mean to see if means are significantly different.
Ho : $\mu_1 - \mu_2 = 0$ α =.05 Use t as test statistic
Ha : $\mu_2 - \mu_1 > 0$ t = $(x_1 - x_2)$ /sd =(0.5-28.8)/20.4
= -1.38
sd = sqrt(s_1^2 / n_1 + s_2^2 / n_2)
|-1.38| < |±1.86| & |-1.38|< y|2.35|
= sqrt(.01/9 + 1664/4)
= 20.4
Critical values of t =±1.86 or ±2.35 with 8 or 3 degrees of freedom. Therefore accept Ho; no significant difference.

ABG borings 4, 5, 6, 8, 10, and 11 also produced soil samples with mean metals concentrations that were greater than those determined for the background borings (borings 1, 2, and

3). Generally, the maximum metals concentrations reported from soils from borings 4, 5, 6, 8, 10 and 11 were not in the same magnitude as those reported for borings 7, 9, and 12 (Table 5.4). For some metal constituents, the mean concentrations for borings 4, 5, 6, 8, and 10 were significantly greater (P <0.5) than the background means (Table 5.2). The statistical comparisons of the control (1, 2, and 3) with waste unit borings are summarized as follows:

Boring No.	Constituent(s) Significantly Greater (P <0.5) in Test Than Background
4	magnesium
5	lead, barium
6	copper, lead, barium, magnesium, phosphorous
7	lead, nickel, zinc, aluminum, barium, manganese, magnesium phosphorus
8	magnesium
9	none
10	magnesium
11	none
12	cadmium, copper, lead, nickel, zinc, aluminum, barium, magnesium, manganese, phosphorous

Arsenic, beryllium, selenium, thallium, cobalt, and iron were present in borings 4 through 12 in concentrations comparable to or less than the background borings (Table 5.2). In no case was a mean concentration (mean of all samples taken from a specific boring) for borings 4 through 12 significantly (P <.05) greater than the respective mean concentration for the backgrounds (Table 5.3) for these analytes. The maximum concentrations reported for these analytes were either found in soils from the background borings or were concentrations within 0.5 ppm of those reported for the background borings. Based on these soils data, the operations at the ABG have not left these analytes as residues in the soils or contributed them as contaminants to nearby soils. There is a possibility that borings 1, 2, and 3 are contaminated with these metal analytes as a result of unknown anthropogenic activities, i.e., they are not true backgrounds. However, as discussed previously, the background borings were positioned away from the ABG waste disposal activities and adjacent to groundwater monitoring wells in which groundwater contamination was not detected.

Figures 5.3 through 5.13 illustrate that metal contaminants, if present, were generally scattered vertically in the soil profile. No clear trends of increasing or decreasing concentrations with sample depth were evident. The factors contributing to the patterns of metals concentrations in the soils, or the lack of them, cannot be determined from available data.

Soils from borings 6, 7, 8, 9, and 12 contained mean phosphorus concentrations that were greater than those found in the background boring soils; significantly greater (P <.05) for borings 6, 7, and 12. Maximum total phosphorus concentrations reported were 2230, 2070, and 1770 mg/kg in soils from borings 7, 12, and 9, respectively. Based on these soils data, the ammunition burning activities at the ABG have produced observable phosphorus residues in the soils of that area. As with the metals constituents discussed previously, the soils at borings 7, 9, and 12 had contaminant concentrations, in this case phosphorus, that were much higher than the background borings and the other borings tested.

In summary, maximum concentrations of antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, barium, magnesium, manganese, tin, sodium, and phosphorus were generally higher in soils from borings 4 through 12 than soils from the background borings 1, 2, and 3. Highest concentrations of these inorganic constituents were usually found in either boring 7, 9, or 12. For borings 4, 5, 6, 7, 8, 10, and 12, some of the differences between the mean concentrations for background soils and test soils were significant (P <.05). The variance of inorganic constituents from individual borings was often very high, approximately equal to or greater than the sample means. Where the data is very disperse, a large difference between the mean concentrations for background and "test" borings may exist but not be statistically significant. Based on these soils data, a release of antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, barium, magnesium, manganese, tin, sodium, and phosphorus is likely to have occurred at specific locations within the ABG.

Arsenic, beryllium, selenium, thallium, cobalt, and iron were present in borings 4 through 12 in concentrations comparable to or less than the background borings. In no case was a mean concentration (mean of all samples taken from a specific boring) for borings 4 through 12 significantly (P <.05) greater than the respective mean concentration for the backgrounds for these analytes. Based on these soils data, no release of these analytes was detected.

The physical examination of the soils as reported in the boring logs indicated that borings 4, 5, 7, and 9 contained anthropogenic components or debris, including slag, brass shell casings, rust, nails, and red-stained rags. (See Section 4.3.0.) Of these borings with debris reported, only boring 9 did not have a chemical constituent which was significantly greater than the

background borings.

Method Blanks. The results of analysis of method blanks used in association with the inorganic analyses of ABG soils are provided in Table 5.5. The concentration of constituents in the method blanks was 100 to 1000 times less than the concentrations determined for the soil samples. These method blank analyses do not change the interpretation of inorganic constituent data previously presented.

Equipment Rinses. Inorganic analytes were found in all equipment rinses analyzed (Table 5.6). However, the concentrations of inorganic constituents in the rinses were not great enough to change the interpretation of data as previously discussed.

5.2.2 Explosives in ABG (EPA Method 8330). The results of analyses of ABG soils for selected explosives compounds are given in Tables 5.7 and 5.8. No explosives compounds were found in soil samples from the "control or background" borings, borings 1, 2, and 3. Explosives compounds were found in soils from all other borings (4, 5, 6, 7, 8, 9, 10 11, and 12).

The borings with explosives compounds are summarized as follows:

Maximum Concentration of Specific Explosives Compound Reported	Boring Number
< 2.2 mg/kg (ppm)	11, 10, 8
< 11.0 mg/kg (ppm)	9, 6
< 100.0 mg/kg (ppm)	12, 7
< 1700.0 mg/kg (ppm)	4, 5.

Soil samples were analyzed for the explosive compounds HMX, RDX, TNB, DNB, Tetryl, 2,4 DNT, 2,6 DNT, and TNT. All of the explosives compounds tested for were found in measurable quantities. DNB was found only in boring 7 and only in a concentration below accurate quantification limits (0.128 mg/kg).

In Table 5.7 the total explosive concentration was determined by summing all of the concentrations of explosive compounds detected during the analysis of a specific soil sample. Borings 11, 10, and 8 had total explosive concentrations of less than 2 mg/kg (ppm). Borings 9 and 6 had maximum total explosive concentrations of less than 11 mg/kg. Borings 12 and 7 had maximum total explosive concentrations of less than 100 mg/kg.

Borings 4 and 5 contained maximum total explosive concentrations which were less than 1700 mg/kg. A TNT concentration of 1640.0 mg/kg was found at Boring 4. This was the highest explosives compound concentration found in ABG samples. An RDX concentration of 1070.0 mg/kg was measured at boring 5.

Table 5.8 indicates that the explosive contamination often extended into the deeper samples within the borings, but not always. In summary, a release of explosives compounds has occurred as a result of ammunition burning activities at the ABG.

Method Blanks. No explosives compounds tested were detected in the method blanks analyzed in association with the ABG soils analyses (Table 5.9). These method blanks analyses do not change the interpretation of explosives compound data previously presented.

Equipment Rinses. No explosives compounds tested were detected in equipment rinses (Table 5.10). Therefore contamination of field samples by the sample equipment is not evident.

5.2.3 Volatile Organics (EPA Method 8240). The results of analyses of ABG soils for volatile organic compounds (EPA Method 8240 in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods SW-846, Third Edition, November 1986 with December 1988 revisions) are given in Table 5.11. Methylene chloride and acetone were found in all soil samples taken. These constituents were also found in the associated method blanks (Table 5.11). Soil from a boring 10 sample was reported to contain 1,1,2,2-tetrachloroethane. However, the method blank analyzed with the boring 10 samples also had similar concentrations of 1,1,2,2-tetrachloroethane. These results likely indicate sample contamination from the laboratory environment rather than processes associated with the field conditions. Volatiles which may not be solely associated with laboratory environment contaminants were also detected. The following volatile organic compounds were detected:

Volatile Organic	Boring/Sample #(Sample Depth - feet below surface)
2-butanone	1/#1 and 2/#1 (.2 -.5); 6/#3 (2.0 -3.0); 11/#2 (3.0 - 3.5); 11/#3 (3.5 - 4.0)
trichloroethene	7/#2 (1.0 - 1.5) and 12/#3 (1.5 - 2.0)
tetrachloroethene	12/#2 (1.0 - 1.5) and 12/#3 (1.5 - 2.0)

The reported concentrations of 2-butanone, trichloroethene,

and tetrachloroethene were 2 to 39 µg/kg dry weight (ppb) and were all "J" values, that is, detected by the analytical instrumentation but not in sufficient amounts to accurately quantify. Therefore, those concentrations are estimated. The volatile organic analyte 2-butanone was not detected in any soil analysis method blanks; therefore, a determination that 2-butanone in the ABG soils is due to laboratory contamination cannot be made. However, 2-butanone was detected in equipment rinses taken at borings 2, 10, 11, and 12. The presence of 2-butanone in the low concentrations reported in the soil samples and in several equipment rinses suggests that the presence of this compound may be due to contamination during the cleaning procedure.

Volatile organic compounds were found in ABG soils from background (borings 1 and 2) and waste unit vicinity (borings 6, 7, 10, 11, and 12) locations. However, only trichloroethene and tetrachloroethene from the waste unit vicinity locations at borings 7 and 12 were not conditioned by presence of volatile organic analytes in the equipment rinses or the method blanks. The maximum concentrations found for trichloroethene and tetrachloroehtene were 2.9 and 1.3 µg/kg (ppb), respectively.

Volatile organic compounds that were tentatively identified during the volatile organic soils analysis are provided in Table 5.14. It should be noted that the assigned identity and estimates of concentrations of tentatively identified compounds (TICS) are in most cases highly uncertain. The concentration estimates could be in orders of magnitude higher or lower than the actual concentration. In view of these uncertainties, information on TICs is provided primarily to complete the presentation of data.

Method Blanks. Acetone and methylene chloride were reported in the method blanks for the volatile organic analyses (Table 5.12) and indicate a laboratory contamination source for these constituents. The volatile organic compounds 1,1,2,2-tetrachloroethane and 2-hexanone were also found in some method blanks. These method blank analysis results were considered in the interpretation of the volatile organic soils analyses.

Equipment Rinses. Acetone and methylene chloride were reported in most of the sampling equipment rinses (Table 5.13). As acetone and methylene chloride were detected in the method blank associated with the analyses of these rinses, these constituents are believed to be laboratory contaminants. Chloroform was detected in four equipment rinses (rinses for borings 12, 11, 8, and 5). This volatile organic compound may have been derived

from the initial washing with potable water. Chloroform was not detected in any of the ABG soil samples.

In addition to chloroform, other volatile organics were found in equipment rinses but at concentrations which were below accurate quantitation limits ("J" values). The volatile organic, 2-butanone, was found in 4 equipment rinses (rinses for borings 12, 11, 10, and 2). Soil samples from borings 11, 6, 2, and 1 were reported to contain 2-butanone (Table 5.11) in concentrations which were below the practical quantitation limits. Cross-contamination of soil samples with 2-butanone was likely not a problem as none of the soil samples which immediately followed the borings where equipment rinses with 2-butanone had occurred were found to contain the volatile organic compound. However, the presence of 2-butanone in low concentrations (J values) in the soil samples and in several equipment rinses suggests that the presence of this compound in soils may be due to contamination during the cleaning procedure. Bromodichloromethane and cis-1,2-dichloroethene were reported from the one equipment rinse for borings 12 and 10, respectively. None of the soil samples tested and reported in Table 5.11 contained bromodichloromethane and cis-1,2-dichloroethene, thus, sample cross-contamination with those compounds as a result of sampling equipment did not occur.

Method blanks analyzed in association with equipment rinses were reported to contain 2-hexanone (method blanks for boring 11 and 10 and for boring 8,7, and 6) and 1,1,2,2 tetrachloroethane (method blanks for boring 12, borings 8,7, and 6, and borings 5,4,3, and 2). Vinyl acetate was reported in the trip blank for boring 12.

5.2.4 Semivolatile Organics (EPA Method 8270). The results of analyses of ABG soils for semivolatile organic compounds (EPA Method 8270 in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods SW-846, Third Edition, November 1986 with December 1988 revisions) are given in Table 5.15 and summarized in Table 5.16. Dibutylphthalate and bis(2-ethylhexyl)phthalate were found in most and all of the soil samples taken, respectively. The results also indicate that these constituents were frequently found in the associated method blanks as well as the sample (Table 5.18). Thus, dibutylphthalate and bis(2-ethylhexyl)phthalate are likely sample contaminants from the laboratory environment rather than processes associated with the ammunition burning activities at the ABG.

Borings 12, 11, 9, 8, 7, 6, and 5 produced soils with semivolatile organic analytes in sub-mg/kg (ppm) concentrations Table 5.15). The most frequent type of semivolatile organic compounds present were PAHs. With the exception of concentrations of 2,4-dinitrotoluene in soils from borings 5 and 6, all other semivolatile organic compounds were found in concentrations that were below 1.0 mg/kg (ppm) and were only detected by the analytical instrumentation in insufficient amounts to accurately quantify. The highest concentrations of 2,4-dinitrotoluene reported for borings 5 and 6 were 7.80 mg/kg and 1.20 mg/kg, respectively. It should be noted, however, that Test Methods for Evaluating Organic and Inorganic Waste, Physical/ Chemical Methods, SW-846, Third Edition, November 1986 with December 1988 revisions recognizes neither EPA Method 8270 nor any other methods as appropriate for analysis of 2,4-dinitrotoluene. Borings 12 and 7 were very similar in terms of the suite of semivolatile organic compounds found at those sites and different from soils from other borings. Soils from borings 12 and 7 contain greater numbers of semivolatile organic compounds than the other borings tested. Based on these soils data, an unknown activity has contributed semivolatile organic constituents to some ABG soils. However, the concentrations of the individual compounds detected are in the one to sub-mg/kg (ppm) range.

Table 5.17 provides a list of tentatively identified semivolatile organic compounds detected in ABG soil samples. This list is provided primarily to complete the presentation of data, since, as mentioned previously, assigned identity and estimates of concentration of TICs are in most cases highly uncertain.

Method Blanks. As discussed previously, method blanks analyzed for semivolatile organic compounds contained dibutylphthalate and bis(2-ethylhexyl) phthalate at estimated concentrations below the instrument detection limits ("J" Values) (Table 5.18). Other phthalates, di-N-octylphthalate and diethylphthalate were found in method blanks associated with analyses of soils from borings 9, 7, and 6. These method blank analysis results were considered in the interpretation of the semivolatile organic soils analyses.

Equipment Rinses. Analyses of equipment rinses for semivolatile organics detected several phathalates including dibutylphthalate, bis(2-ethylhexyl) phthalate, di-N-octylphthalate, dimethyl phthalate, butylbenzylphthalate, and diethyl phthalate (Table 5.19). Because dimethyl phthalate, diethyl phthalate, and dibutyl phthalate were consistently found in the

method blanks analyzed with the rinses, those phthalates are likely the result of a laboratory contamination and not the result of actual occurrence of those materials in the equipment rinses. Bis(2-ethylhexyl) phthalate, di-N-octylphthalate, and butylbenzylphthalate were detected in specific equipment rinses and not in associated method blanks. With regard to the presence of those three phthalates in ABG soils, bis(2-ethylhexyl) phthalate was a found in all method blanks associated with soil sample analyses. Therefore the actual presence of that phthalate in the tested soils is suspect. Di-N-octylphthalate was reported only in soils from boring 12 and only in the equipment rinse from boring 12. Butylbenzylphthalate, while detected in the boring 11 equipment rinse, was not detected in any of the ABG soils analyzed. Therefore, cross-contamination of ABG soil samples with di-N-octylphthalate and butylbenzylphthalate was not likely.

The results of analyses of equipment rinses for semivolatile organic compounds indicate that cross-contamination of samples or equipment contamination did not occur and was not a factor in the results obtained from the analyses of ABG soils for semivolatile organic compounds.

5.2.5 Pesticides, Herbicides and PCBs. The results of analyses of ABG soils for selected pesticide, herbicide, and PCB compounds are given in Table 5.20. The pesticides and herbicides found in the tested soils and not in associated method blanks are summarized in Table 5.21. Pesticides and herbicides were found in soils from borings 12, 10, 7, 6, and 5 as well as in the background borings 1, 2, and 3. With the exception of methoxychlor in soils from boring 12, all other pesticides and herbicides were found in concentrations below 1.0 mg/kg dry weight (ppm). The maximum concentration of methoxychlor was 1.4 mg/kg in a soil sample from boring 12. No PCBs were detected in any of the ABG soils. Based on the soil analyses performed, pesticides and herbicides were found in ABG soils but only at one to sub-mg/kg (ppm) concentrations. It cannot be determined from available information if the low concentration (sub-ppm) pesticide and herbicide residues detected are the result of recent or past waste disposal activities or insect and vegetation control activities by NSWC Crane or others.

Method Blanks. Method blanks analyzed for pesticides, herbicides and PCBs contained heptachlor, a-chlordane, and endrin at estimated concentrations below the instrument detection limits (below accurate quantitation limits-"J" values) (Table 5.22). These method blank analysis results were considered in the inter-

pretation of the soils analyses for pesticides, herbicides, and PCBs.

Equipment Rinses. Equipment rinses made after sampling at borings 12, 11, 10, 8, and 6 were analyzed for pesticides, herbicides, and PCBs and the results are given in Table 5.23. Heptachlor and PPDDT were detected in low concentrations (below quantification limits - "J" values) in the rinses from borings 12 and 8, respectively. However, these analytes were also found in associated method blanks. Therefore, heptachlor and PPDDT in these rinses are believed to be laboratory artifacts and not rinse contaminants.

5.3.0 SUMMARY OF ANALYTICAL RESULTS.

Metals and Inorganics. The soils analyses conducted indicate that the ammunition burning activities at the ABG have released residues of antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, barium, magnesium, manganese, tin, sodium, and phosphorus to soils. This conclusion is based on comparison of soils from "test" borings with those of background borings (those removed from influences of the ammunition burning activities). Releases of arsenic, beryllium, selenium, thallium, cobalt, and iron are not evident based on similar comparison methods.

Soil samples from borings 7, 9, and 12 had particularly high concentrations of metal constituents when compared to background soils as well as when compared to soils from the other test borings. Borings 4, 5, 6, 8, 10, and 11 also produced soil samples with metals concentrations that were higher than those determined for the background borings, however, those concentrations were generally not as high as those reported for borings 7, 9, and 12.

Explosives Compounds. Explosives compounds were found in soils from all ABG borings except the background borings (borings 1, 2, and 3). Thus, a release of these compounds has occurred as a result of the ammunition disposal activities. With respect to the maximum total (sum of all seven explosive compounds analyzed for) explosive concentrations for any one soil sample, borings 11, 10, and 8 had total explosive concentrations of less than 2 mg/kg (ppm). Borings 9 and 6 had maximum total explosive concentrations of less than 11 mg/kg. Borings 12 and 7 had maximum total explosive concentrations of less than 100 mg/kg. Borings 4 and 5 contained maximum total explosive concentrations which

exceeded 1000 mg/kg. A TNT concentration of 1640.0 mg/kg was found at Boring 4. This was the highest explosives compound concentration found in ABG samples. An RDX concentration of 1070.0 mg/kg was measured at boring 5.

Volatile Organics. Several volatile organic compounds (as determined by EPA method 8240) were found in the ABG soils sampled. However, only trichloroethene and tetrachloroethene from the waste unit vicinity locations at borings 7 and 12 were not conditioned by presence of volatile organic analytes in the equipment rinses or the method blanks. The maximum concentrations found for trichloroethene and tetrachloroehtene were 2.9 and 1.3 μg/kg (ppb), respectively.

Semivolatile Organics. Borings 12, 11, 9, 8, 7, 6, and 5 produced soils with semivolatile organic analytes in sub-mg/kg (ppm) concentrations. The most frequent type of semivolatile organic compounds present were PAHs. With the exception of concentrations of 2,4-dinitrotoluene in soils from borings 5 and 6, all other semivolatile organic compounds were found in concentrations that were below 1.0 mg/kg (ppm) and were only detected by the analytical instrumentation in insufficient amounts to accurately quantify. The highest concentrations of 2,4-dinitrotoluene reported for borings 5 and 6 were 1.20 mg/kg and 7.20 mg/kg, respectively. Based on these soils data, an unknown activity has contributed semivolatile organic constituents to some ABG soils. However, the concentrations of the individual compounds detected are in the one to sub- mg/kg (ppm) range.

Borings 12 and 7 were very similar in terms of the suite of semivolatile organic compounds found at those sites and different from soils from other borings. Soils from borings 12 and 7 contain greater numbers of different semivolatile organic compounds than the other borings tested.

Pesticides, Herbicides, and PCB's. With the exception of methoxychlor in soils from boring 12, all other pesticides and herbicides were found in concentrations below 1.0 mg/kg dry weight (ppm). The maximum concentration of methoxychlor was 1.4 mg/kg in a soil sample from boring 12. No PCBs were detected in any of the ABG soils. Based on the soil analyses performed, pesticides and herbicides were found in ABG soils but only at one to sub-mg/kg (ppm) concentrations. It cannot be determined from available information if the low concentration (sub-ppm) pesticide and herbicide residues detected are the result of recent or past waste disposal activities or insect and vegetation control activities by NSWC Crane or others.

6.0 CONCLUSIONS

The first part of a RFI Phase III Soil Investigation was done at the ABG. The intent of the investigations was to establish background conditions, determine the physical properties of the soil, and to investigate the character of the contamination. Twelve soil borings were drilled. These borings were used to collect soil samples for physical characterization and chemical pollutant identification. Soil samples were tested for the presence of metal and non-metal inorganic compounds, volatile and semivolatile organic compounds, explosives compounds, pesticides, herbicides, and polychlorinated biphenyl compounds (PCBs). The physical soil properties described were grain size, organic content, natural water content, and a combined visual and analytical description.

The soils are fine grained and predominately clay (CL, CH, and GC) with lesser amounts of sands (SM and SP) and silt (ML). The soil thickness varied from 0 to 18-feet. The thickest soil is in the areas of deepest valley incision. The soils resulted from colluvial and alluvial processes. Some soils represent residual soils derived from underlying rock by erosional processes. The soils within the active area are routinely disturbed to a depth of 3'. These soils, termed "Modified Soils" cover much of the ABG and are identified by its inclusion of "Cultural Debris". Cultural debris describes materials such as red-stained rags, slag, iron nails, and brass shell casings which were found in the soil column and are artifacts of man.

All soil borings except #6 were dry. During the drilling of boring #6, a water zone was encountered at a depth of 6' below the ground surface. The following day the hole was checked for groundwater, but the hole was dry. Prior to grouting, the auger holes were checked for water levels. No water was found in the holes. Reported soil permeabilities are 5×10^{-5} and 5×10^{-6} cm/sec. (Dunbar, 1984). These soils have low permeablity. Much of the rain falling on the ABG does not enter the groundwater system but rather leaves the site via surface drainage routes. Groundwater movement within the soil is thought to be very slow and in a vertical direction. The groundwater that does reach the rock surface moves along the upper surface of the rock until a fractured zone is encountered. At the fracture zone the water again moves vertically downward into the rock (Beech Creek) aquifer (Hunt, 1988). The groundwater movement in the Beech Creek aquifer is bimodal. It flows from the west to the east into Little Sulfur Creek Valley and south into Johnson Hollow (Hunt, 1988).

Soil samples were taken from each boring at the depths indicated in Figure 5.2. The soils were tested for the presence of contamination. Analysis to detect the presence of inorganic, explosives, pesticides, herbicides, volatile and semivolatile organic compounds was performed. EPA SW-846 analytical methods were used when available. This data was used to determine the chemical characteristics and distribution of the soil contamination. The inorganic elements are "crustal elements", which can be naturally occurring soil constituents. To establish contaminant levels for the crustal elements, their concentration levels are compared with control (background) soil concentration levels. Three control (background) borings (#1, 2, and 3) were placed in a more remote part of the ABG valley. Groundwater samples from a nearby groundwater monitoring well were comparatively free of chemical contaminants. The soils at this location were free of cultural debris.

Based on the analyses of ABG soil samples, releases of hazardous wastes or hazardous constituents have occurred at the ABG. The waste disposal activities have principally contributed residues of explosives compounds and metal contaminants to the soils. Explosives compounds, 2,4-DNT, Tetryl, DNB, TNB, RDX, HMX, and TNT were found in the soils of the ABG. The explosive contamination often extended to deeper samples from the soil borings, but not always. Using the explosives as a criteria for contamination, the following arbitrary categories may be assigned to the ABG borings.

Boring #	Total Explosive Concentration Contamination Category
1, 2, 3	none detected
11, 10, 8	≤ 2 mg/kg (ppm)
9, 6	≤ 11 mg/kg
12, 7	≤ 100 mg/kg
4, 5	≥ 1000 mg/kg

Levels of metals, (antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, cobalt, magnesium, manganese, tin, and sodium) and non-metals (barium and phosphorus) above control levels were detected in operative areas of the site. These areas correspond to locations where explosives contaminants were also found but not the locations of greatest explosive contamination. The maximum concentrations of inorganic constituents were detected in borings 7, 9, or 12.

Volatile organics, semivolatile organics, and pesticides and herbicides were detected in ABG soils but at low concentrations.

No PCBs were detected. Specifically, concentrations of volatile organic compounds (EPA method 8240) from boring 7 and 12 soils contained trichloroethene and tetrachloroethene at concentrations that were ≤ 2 μg/kg (ppb - parts per billion). To put these low concentrations of volatile organic compounds into perspective, the drinking water MCL (EPA promulgated 1987) for 1,1,1 trichlororethene is 200 μg/l (ppb). Several semivolatile organic compounds, most frequently PAHs, were determined at concentrations that were ≤ 1 mg/kg (ppm - parts per million). Borings 7, 9, 12 exhibited the characteristic of having numerous semivolatile organic contaminants. Pesticide and herbicides were detected at concentrations that were ≤ 1 mg/kg.

In general, the most significant (in terms of concentration) ABG soil contamination can be defined by looking for the presence of explosive compounds including 2,4 DNT, 2,6 DNT, TNT, TETRYL, DNB, TNB, RDX, and HMX and metals including antimony, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, aluminum, cobalt, magnesium, manganese, and tin. Other contaminants including, other inorganics, PAHs, volatile organics, and pesticides and herbicides were present but at concentrations that were orders of magnitude lower than explosives and metals concentrations. In most cases the non-explosive contaminants were found in samples that also contained explosive contaminants.

7.0 RECOMMENDATIONS

1. Continue the Phase III soils investigation. The Part 2 study should concentrate on analyzing explosive target compounds and metals. The explosive compounds include 2,4 DNT, 2,6 DNT, TNT, TETRYL, DNB, TNB, RDX, and HMX. The metals include antimony, aluminum, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, cobalt, magnesium, manganese, tin, and sodium.

2. The areas in the vicinity of borings 4 and 5 should be given priority for further investigation to further characterize the releases of explosive compounds evident at those locations. Soils in the vicinities of borings 12, 9, 6, and 7 should also be investigated. No further soils investigations are recommended for the areas addressed by borings 11, 10, and 8.

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APPENDIX A

CHEMICAL NAMES & ABBREVIATIONS
EXAMPLE CHEMICAL DATA SET - SECTION 3.0 TABLES
CHEMICAL DATA - SECTION 5.0 TABLES
CHEMICAL DATA - SECTION 5.0 FIGURES

Table A-1. EPA method 8240, Volatile compounds. (Test Methods for Evaluating Organic and Inorganic Wastes. Physical/Chemical Methods. SW846. Third Edition. November 1986. with December 1988 revisions). Abbreviations used in report tables along with full analyte names.

ClMETH - Chloromethane
BrMETH - Bromomethane
VnlCl - Vinyl Chloride
ClETHA - Chloroethane
MeCl - Methylene Chloride
11DClETE - 1,1-Dichloroethene
11DClETA - 1,1-Dichloroethane
t-DClETE - Trans-1,2-Dichloroethene
c-DClETE - cis-1,2-Dichloroethene
CHCl3 - Chloroform
12DClETA - 1,2-Dichloroethane
111TCA - 1,1,1-Trichloroethane
CCl4 - Carbon Tetrachloride
BrDClMe - Bromodichloromethane
12DClPR - 1,2-Dichloropropane
t13ClPRE - Trans-1,3-Dichloropropene
TCE - Trichloroethene
DBrClMe - Dibromochloromethane
c13ClPRE - Cis-1,3-Dichloropropene
112TCA - 1,1,2-Trichloroethane
BENZENE - Benzene
CHBR3 - Bromoform
1122TClA - 1,1,2,2,-Tetrachloroethane
TEClETE - Tetrachloroethene
TOLUENE - Toluene
ClBEN - Chlorobenzene
ETBEN - Ethylbenzene
ACETONE - Acetone
BUTANO - 2-Butanone
CS2 - Carbondisulfide
2HEXANO - 2-Hexanone
4Me2PE - 4-Methyl-2-Pentanone
STYRENE - Styrene
VnACETA - Vinyl Acetate
T-XYLENE - T-Xylene

Table A-2. EPA method 8270 semivolatile compounds, (Test Methods for Evaluating Organic and Inorganic Wastes, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions). Abbreviations used in report tables along with full analyte names.

PHENOL - Phenol
2ClPHEN - 2-Chlorophenol
2NIPHE - 2-Nitrophenol
24DMePHE - 2,4-Dimethylphenol
24DClPHE - 2,4-Dichlorophenol
4Cl3MePH - 4-Chloro-3-Methylphenol
246TClPH - 2,4,6-Trichlorophenol
24DNPH - 2,4-Dinitrophenol
4NPHE - 4-Nitrophenol
2M46DNPH - 2-Methyl-4,6-Dinotrophenol
PClPHE - Pentachlorophenol
BENZOAC - Benzoic Acid
2MEPHE - 2-Methylphenol
4MEPHE - 4-Methylphenol
245TClPH - 2,4,5-Trichlorophenol
BZLAL - Benzyl Alcohol
NNDMEAM - N-Nitrosodimethylamine
BClIPrE - Bis(2-Chloroisopropyl)Ether
NNDNPAM - N-Nitroso-Di-N-Propylamine
NITROBEN - Nitrobenzene
ISOPHOR - Isophorone
BClEtoME - Bis(2-Chloroethoxy)Methane
26DNTOL - 2,6-Dinitrotoluene
24DNTOL - 2,4-Dinitrotoluene
12DPHYD - 1,2-Diphenylhydrazine
BENZIDI - Benzidine
33DClBEZ - 3,3'Dichlorobenzidine
BClEtE - Bis(2-Chloroethyl)Ether
13DClB - 1,3-Dichlorobenzene
14DCLB - 1,4-Dichlorobenzene
12DClB - 1,2-Dichlorobenzene
HClETA - Hexachloroethane
124TClB - 1,2,4-Trichlorobenzene
NAPHTH - Naphthalene
HClBU - Hexachlorobutadiene
HClCYPD - Hexachlorocyclopentadiene
2ClNAPH - 2-Chloronaphthalene
ACENAY - Acenaphthylene
DMePHTH - Dimethyl Phthalate
ACENAP - Acenaphthene
FLUORE - Fluorene
DEtPHTH - Diethyl Phthalate
4ClPHPHE - 4-Chlorophenyl Phenyl Ether
NNDPHAM - N-Nitrosodiphenyl Amine
4BrPHET - 4-Bromophenyl Ether
HClBEN - Hexachlorobenzene
PHENAN - Phenanthrene
ANTRAC - Anthracene
DBuPHTH - Dibutylphthalate
FLANTHE - Fluoranthene
PYRENE - Pyrene
BuBePHTH - Butylbenzylphthalate
CHRYSE - Chrysene
BAANTHR - Benzo(a)Anthracene
B2EHPH - Bis(2-Ethylhexyl)Phthalate
DNOcPHT - Di-N-Octylphthalate
BBFLANT - Benzo(b)Fluoranthene
BKFLANT - Benzo(k)Fluoranthene
BAPYRE - Benzo(a)Pyrene
I123PYR - Indeno(1,2,3-C,D)Pyrene
B-GHI-PY - Benzo(G,H,I)Perylene
ANILINE - Aniline
4ClANIL - 4-Chloroaniline
DBENZOFU - Dibenzofuran
2MeNAPH - 2-Methylnaphthalene
2NANIL - 2-Nitroaniline
3NANIL - 3-Nitroaniline
4NANIL - 4-Nitroaniline

Table A-3. EPA method 8330, Nitroaromatics and nitramines by High Performance Liquid Chromatography (HPLC), (Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846. Third Edition, November 1986, with December 1988 revisions). Abbreviations used in report tables along with full analyte names.

Abbreviation	Compound Name
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
RDX	Hexahydro-1,3,5-trinitro-1,3,5,7-triazine
TNB	1,3,5-Trinitrobenzene
DNB	1,3-Dinitrobenzene
TETRYL	Methyl-2,4,6-trinitrophenylnitramine
NB	Nitrobenzene
2,4DNT	2,4-Dinitrotoluene
2,6DNT	2,6-Dinitrotoluene
2NT	o-Nitrotoluene
3NT	m-Nitrotoluene
4NT	p-Nitrotoluene

Table 3.4. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 05/10. Example data evaluation set - results of soil analyses for inorganic analytes sample data, duplicate anlayses, method blanks, and matrix spike recoveries for sample #1 from boring 12 (sample depth 0.2 - 0.5 feet). Data are reported in mg/kg (ppm) dry weight except for the rinse data which is mg/l (ppm).

	Sample/Sample Duplicate			Sample Matrix Spike						Rinse Matrix Spike			
Analyte SAMPLE	Sample 12#1	Dup 12#1	RPD(a) (%)	Spike Added	MS Conc	(a) PR	Rinse Sample	Rinse Duplicate	RPD(a) (%)	Spike Added	MS Conc	(a) PR	MB
Sb	4.78	5.56	3.7	NS	NA	NA	<0.003U	<0.003U	0	*	*	116.0	<0.003U
As	26.6	24.0	8.7	4.00	22.5	102.5	<0.002U	<0.002U	0	*	*	112.5	<0.002U
Be	0.700N	0.699N	0.1	5.0	3.00	46.0	<0.002U	<0.002U	0	0.025	0.026	104.0	<0.002UN
Be (P)	-	-	-	5.0	5.60	98.0	-	-	-	-	-	-	-
Cd	13.0	11.8	9.2	5.0	17.3	86.0	<0.013U	<0.005U	0	0.250	0.247	98.8	<0.0044U
Cr	39.1N	39.3N	0.5	20.0	68.7	148.0	<0.011U	<0.011U	0	0.250	0.256	102.4	0.331N
Cr (P)	-	-	-	10.0	49.6	105.0	-	-	-	-	-	-	-
Cu	391.0	365.0	6.7	25.0	386.0	-20.0	<0.006U	<0.006U	0	0.250	0.245	98.0	0.007
Pb	453.0	459.0	1.3	50.0	528.0	150.0	<0.003U	<0.003U	0	*	*	105.0	<0.114U
Hg	1.17	ND	NC	NS	NA	NA	<0.0002U	<0.0004	0	0.00092	0.001	92.0	<0.100U
Ni	36.8	37.7	2.4	50.0	90.0	106.4	<0.011U	<0.011U	0	0.250	0.244	97.6	0.233
Se	<0.30U	<0.30U	NC	1.00	1.00	100	<0.003U	<0.003U	0	*	*	100	<0.003U
Ag	2.02	2.02	0.0	5.0	6.53	90.2	<0.013U	<0.013U	0	0.250	0.254	101.0	<0.0128U
Tl	0.20	<0.20U	NC	5.00	4.69	89.8	<0.002U	<0.002U	0	*	*	88.0	<0.002U
Zn	2380.0	2420.0	1.7	50.0	2400.0	40.0	0.012	0.011	1.15	0.250	0.257	102.8	<0.0083U
Al	16600.0	17200.0	3.6	NS	NA	NA	1.431	1.416	1.05	2.000	3.318	94.3	0.0048
Ba	1130.0	1110.0	1.7	NS	NA	NA	0.014	0.014	0	0.250	0.250	87.2	<0.0011U
Co	15.7	18.1	15.2	NS	NA	NA	<0.30U	<0.30U	0	0.250	0.264	105.6	<0.030U
Fe	23600.0	24200.0	2.5	NS	NA	NA	0.055	0.050	9.52	1.000	0.890	83.5	0.397
Mg	4100.0	4300.0	4.8	NS	NA	NA	3.08	3.04	1.31	NS	NA	NA	<0.748U
Mn	1870.0	1780.0	0.0	50.0	1840.0	-60.0	<0.005U	<0.005U	0	0.250	0.241	96.4	0.014
Na	134.0	136.0	1.5	NS	NA	NA	4.76	4.66	2.12	NS	NA	NA	<0.489U
TP	2070.0	1330.0	35.8	NS	NA	NA	<0.050U	<0.050U	0	NS	NA	NA	0.13
Sn	11.2	8.0	28.7	NS	NA	NA	<0.076U	<0.076U	0	NS	NA	NA	<0.762U

Note: ND and NS - ND indicates no duplicate analyzed. NS indicates no spike added for this analyte.
NA - Not applicable. For example, if no MS was added then it is NA to report MS concentration or calculate a PR.
PR - percent recovery of the matrix spike.
RPD - relative percent difference calculated for differences in concentration between duplicate analyses.
* - Spike amount added and sample plus spike concentration not reported on lab data sheet but PR was reported.
MS and MB - MS is matrix spike; MB is method blank.
MS Conc - analyte concentration determined from spiked sample.
P and (-) - Post digestion spike results reported. All other data is the same as preceeding line.
N - Spiked sample recovery not within control limits (75-125%); U - analyte not detected at associated value.
B - A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit
(a) - QC limits; RPD (± 20%) and PR (75-125%).

Table 3.5. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8240* (volatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in bold. Analytes are given as abbreviations; see Appendix A for full compound names.

ANALYTE/SAMPLE	12#3	Duplicate 12#3	MB1 12	MB2 12	RINSE 12	TRIP BLK 12	MB(RINSE &TB) 12
C1METH	<0.011U	<0.011U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.011U	<0.011U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
Vn1C1	<0.011U	<0.011U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.011U	<0.011U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MeC1	**0.14B**	**0.11B**	**0.020**	**0.0054**	**0.0041BJ**	**0.0023B**	**0.0033J**
11DC1ETE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DC1ETA	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DC1ETE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DC1ETE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHC13	<0.0063U	<0.0063U	<0.005U	<0.005U	**0.0290**	<0.005U	<0.005U
12DC1ETA	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111TCA	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CC14	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1Me	<0.0063U	<0.0063U	<0.005U	<0.005U	**0.0024J**	<0.005U	<0.005U
12DC1PR	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	**0.0023J**	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1Me	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBR3	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TC1A	<0.0063U	<0.0063U	<0.005U	**0.0015J**	<0.005U	<0.005U	**0.0015J**
TEC1ETE	**0.0013J**	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.17B**	**0.13BJ**	**0.020J**	**0.020J**	**0.0013BJ**	<0.100U	**0.0029**
BUTANO	<0.13U	<0.13U	<0.10U	<0.10U	**0.0063J**	<0.100U	<0.100U
CS2	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2HEXANO	<0.063U	<0.063U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
4Me2PE	<0.063U	<0.063U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.063U	<0.063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VnACETA	<0.063U	<0.063U	<0.050U	<0.050U	<0.050U	**0.0019J**	0.050U
T-XYLENE	<0.0063U	<0.0063U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: Method Blank ID is as follows - MB1 12, 1 - method blank #1 associated with analyses of soils from borings 12

J - Estimated value below the accurate quantitation limit

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

B - Indicates that the analyte was found in associated blank as well as in the sample.

* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 3.6. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Soil volatile surrogate recoveries, EPA Method 8240* (volatile organics) analyses for sample #3 from boring 12. Matrix spike/matrix spike duplicate recoveries for a sample from boring 12 (sample number not given).

Surrogate Recoveries

Surrogate	% Recovery	QC Limits
Toluene-d8	101	81-117
Bromofluorobenzene	80.0	74-121
1,2-Dichloroethane-d4	107	70-121

Matrix Spike/Matrix Spike Duplicates (ug/kg)

Analyte	Spike Added	Sample Conc	MS Conc	MS REC	MSD Conc	MSD REC	%RPD
1,1-Dichloroehtene	59.0	0.00	76.00	129	64.00	108	17
Trichloroethene	59.0	0.00	68.00	115	63.00	107	7
Benzene	59.0	0.00	66.00	112	64.00	108	3
Toluene	59.0	0.00	62.00	105	62.00	106	0
Chlorobenzene	59.0	0.00	64.00	108	65.00	110	1

Notes:
Spike Added - Units are ug/kg(ppb). Same spike amount added to MS and MSD.
MS Conc - Matrix Spike concentration - concentration of sample plus spike.
MS REC - Matrix spike recovery
MSD Conc - Matrix spike duplicate concentration
MSD REC - Matrix spike duplicate recovery
RPD - Relative percent difference

Analyte	QC Limits REC	QC Limits RPD
1,1-Dichloroehtene	59-172	<22
Trichloroethene	62-137	<24
Benzene	66-142	<21
Toluene	59-139	<21
Chlorobenzene	60-133	<21

Table 3.7. Ammunition Burning Ground, NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organic) analyses. Example control data set. Concentrations are mg/kg (ppm) dry weight except for rinses which are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix A for full compound names.

ANALYTE/SAMPLE	12#1	MB1 12#1	MB2 12#1	RINSE 12#1	MB RINSE 12
PHENOL	1.1U	0.66U	0.66U	0.0097U	0.010U
2ClPHEN	1.1U	0.66U	0.66U	0.0097U	0.010U
2NIPHE	1.1U	0.66U	0.66U	0.0097U	0.010U
24DMePHE	1.1U	0.66U	0.66U	0.0097U	0.010U
24DClPHE	1.1U	0.66U	0.66U	0.0097U	0.010U
4Cl3MePH	2.2U	1.3U	1.3U	0.0190U	0.020U
246TClPH	1.1U	0.66U	0.66U	0.0097U	0.010U
24DNPH	5.5U	3.3U	3.3U	0.0480U	0.050U
4NPHE	5.5U	3.3U	3.3U	0.0480U	0.050U
2M46DNPH	5.5U	3.3U	3.3U	0.0480U	0.050U
PClPHE	5.5U	3.3U	3.3U	0.0480U	0.050U
BENZOAC	5.5U	3.3U	3.3U	0.0480U	0.050U
2MEPHE	1.1U	0.66U	0.66U	0.0097U	0.010U
4MEPHE	1.1U	0.66U	0.66U	0.0097U	0.010U
245TClPH	1.1U	0.66U	0.66U	0.0097U	0.010U
BZLAL	2.2U	1.3U	1.3U	0.0190U	0.020U
NNDMEAM	1.1U	0.66U	0.66U	0.0096U	0.010U
BClIPrE	1.1U	0.66U	0.66U	0.0097U	0.010U
NNDNPAM	1.1U	0.66U	0.66U	0.0097U	0.010U
NITROBEN	1.1U	0.66U	0.66U	0.0097U	0.010U
ISOPHOR	1.1U	0.66U	0.66U	0.0097U	0.010U
BClEtoME	1.1U	0.66U	0.66U	0.0097U	0.010U
26DNTOL	1.1U	0.66U	0.66U	0.0097U	0.010U
24DNTOL	1.1U	0.66U	0.66U	0.0097U	0.010U
12DPHYD	1.1U	0.66U	0.66U	0.0097U	0.010U
BENZIDI	5.5U	3.3U	3.3U	0.0480U	0.050U
33DClBEZ	2.2U	1.3U	1.3U	0.0190U	0.020U
BClEtE	1.1U	0.66U	0.66U	0.0097U	0.010U
13DClB	1.1U	0.66U	0.66U	0.0097U	0.010U
14DCLB	1.1U	0.66U	0.66U	0.0097U	0.010U
12DClB	1.1U	0.66U	0.66U	0.0097U	0.010U
HClETA	1.1U	0.66U	0.66U	0.0097U	0.010U
124TClB	1.1U	0.66U	0.66U	0.0097U	0.010U

Note: See page 2 for Table notes.

ANALYTE/SAMPLE	12#1	MB1 12#1	MB2 12#1	RINSE 12#1	MB RINSE 12#1
NAPHTH	0.03J	0.66U	0.66U	0.0097U	0.010U
HClBU	1.1U	0.66U	0.66U	0.0097U	0.010U
HClCYPD	1.1U	0.66U	0.66U	0.0097U	0.010U
2ClNAPH	1.1U	0.66U	0.66U	0.0097U	0.010U
ACENAY	1.1U	0.66U	0.66U	0.0097U	0.010U
DMePHTH	1.1U	0.66U	0.66U	**0.0013BJ**	**0.003J**
ACENAP	1.1U	0.66U	0.66U	0.0097U	0.010U
FLUORE	1.1U	0.66U	0.66U	0.0097U	0.010U
DEtPHTH	0.04J	0.66U	0.66U	**0.0250B**	**0.035**
4ClPHPHE	1.1U	0.66U	0.66U	0.0097U	0.010U
NNDPHAM	0.06J	0.66U	0.66U	0.0097U	0.010U
4BrPHET	1.1U	0.66U	0.66U	0.0097U	0.0100U
HClBEN	0.19J	0.66U	0.66U	0.0097U	0.0100U
PHENAN	0.07J	0.66U	0.66U	0.0097U	0.0100U
ANTRAC	0.03J	0.66U	0.66U	0.0097U	0.0100U
DBuPHTH	0.11J B	0.66U	**0.18J**	**0.00097BJ**	**0.00096J**
FLANTHE	1.1U	0.66U	0.66U	0.0097U	0.0100U
PYRENE	1.1U	0.66U	0.66U	0.0097U	0.0100U
BuBePHTH	1.1U	0.66U	0.66U	0.0097U	0.0100U
CHRYSE	1.1U	0.66U	0.66U	0.0097U	0.0100U
BAANTHR	1.1U	0.66U	0.66U	0.0097U	0.0100U
B2EHPH	0.18J B	**0.04J**	**0.02J**	**0.0015J**	0.0100U
DNOcPHT	1.1U	0.66U	0.66U	**0.0014J**	0.0100U
BBFLANT	1.1U	0.66U	0.66U	0.0097U	0.0100U
BKFLANT	1.1U	0.66U	0.66U	0.0097U	0.0100U
BAPYRE	1.1U	0.66U	0.66U	0.0097U	0.0100U
I123PYR	1.1U	0.66U	0.66U	0.0097U	0.0100U
B-GHI-PY	1.1U	0.66U	0.66U	0.0097U	0.0100U
ANILINE	2.2U	1.3U	1.3U	0.0190U	0.0200U
4ClANIL	2.2U	1.3U	1.3U	0.0190U	0.0200U
DBENZOFU	1.1U	0.66U	0.66U	0.0097U	0.0100U
2MeNAPH	0.03J	0.66U	0.66U	0.0097U	0.0100U
2NANIL	5.5U	3.3U	3.3U	0.0480U	0.0500U
3NANIL	5.5U	3.3U	3.3U	0.0480U	0.0500U
4NANIL	5.5U	3.3U	3.3U	0.0480U	0.0500U

Note: Method Blank ID is as follows - MB1 - method blank #1 associated with analyses of soils from borings 2 and 1
J - Estimated value below accurate quantitation limits
B - Analyte was also found in the associated method blank.
U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 3.8. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Soil semivolatile surrogate recoveries, EPA Method 8270 analyses for sample #3 from boring 12.

Surrogate Recoveries

Surrogate	% Recovery	QC Limits
Nitrobenzene-d5	87.3	23-120
2-fluorobiphenyl	88.3	30-11521
Terphenyl-d14	134	18-137
Phenol-d6	76.8	24-113
2-Fluorophenol	87.8	25-121
2,4,6-Tribromophenol	116	19-122

Table 3.9. (Page 1 of 2). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU# 03/10. Example data evaluation set - results of soil analyses for pesticides and herbicides including sample data, duplicate anlayses, method blanks, and matrix spike recoveries for sample #1 from boring 12. Data are reported in mg/kg (ppm) dry weight except for the rinse data which is mg/l (ppm). No spikes or duplicates were reported for the rinse data.

ANALYTE/SAMPLE	Soil Sample 12#1	Duplicate 12#1	RPD(%)	Spike Added*	MS Conc	PR (QC Limits)	Duplicate MS conc	Duplicate MS PR	MS/MS Duplicate RPD (QC Limits)
aldrin	<0.0047U	<0.0047U	0	1.00	0.90	90 (34-132)	1.10	110	20.0 (<50)
A-BHC	<0.0036U	<0.0036U	0	NS	NA	NA	NA	NA	NA
B-BHC	<0.0071U	<0.0071U	0	NS	NA	NA	NA	NA	NA
G-BHC (lindane)	<0.0047U	<0.0047U	0	1.00	0.55	55 (46-127)	6.30	63	14.0 (<50)
D-BHC	<0.011U	<0.011U	0	NS	NA	NA	NA	NA	NA
PPDDD	<0.013U	<0.013U	0	NS	NA	NA	NA	NA	NA
PPDDE	<0.0047U	<0.0047U	0	NS	NA	NA	NA	NA	NA
ppDDT	<0.014U	<0.014U	0	2.50	1.40	56 (23-134)	1.60	64	13.3 (<50)
heptachlor	<0.0036U	<0.0036U	0	1.00	0.40	40 (35-130)	0.44	44	9.5 (<31)
dieldrin	<0.0024U	<0.0024U	0	2.50	2.90	116 (31-134)	2.20	88	27.4 (<38)
a-endosulfan	<0.017U	<0.017U	0	NS	NA	NA	NA	NA	NA
b-endosulfan	<0.0047U	<0.0047U	0	NS	NA	NA	NA	NA	NA
endosulf sulfate	<0.078U	<0.078U	0	NS	NA	NA	NA	NA	NA
endrin	<0.0071U	<0.0071U	0	2.50	2.20	88 (42-134)	1.60	64	13.3 (<50)
endrin aldehyde	<0.027U	<0.027U	0	NS	NA	NA	NA	NA	NA
heptachlor epox	<0.098U	<0.098U	0	NS	NA	NA	NA	NA	NA
methoxychlor	<0.21U	<0.21U	0	NS	NA	NA	NA	NA	NA
toxaphene	<0.29U	<0.29U	0	NS	NA	NA	NA	NA	NA
diazinon	<0.18U	<0.18U	0	1.14	0.84	74 (40-120)a	0.79	70	6 (<30)a
ethyl parathion	<0.053U	<0.053U	0	1.52	1.08	71 (40-120)a	1.15	76	7 (a)
ethyl trithion	<0.057U	<0.057U	0	NS	NA	NA	NA	NA	NA
ethion	<0.046U	<0.046U	0	NS	NA	NA	NA	NA	NA
malathion	<0.098U	<0.098U	0	1.26	0.88	70 (40-120)a	1.00	79	8 (<30)a
methyl parathion	<0.11U	<0.11U	0	1.00	0.73	73 (40-120)a	0.77	77	5 (<30)a
2,4-D	<0.48U	ND	NA	NS	NA	NA	NA	NA	NA
2,4-DP	<0.26U	ND	NA	NS	NA	NA	NA	NA	NA
2,4,5-T	<0.08U	ND	NA	NS	NA	NA	NA	NA	NA
2,4,5-TP	<0.68U	ND	NA	NS	NA	NA	NA	NA	NA

Note: See page 2 for Table Notes.

Table 3.9. (Page 2 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Example data evaluation set - results of soil analyses for pesticides and herbicides including sample data, duplicate anlayses, method blanks, and matrix spike recoveries for sample #1 from boring 12. Data are reported in mg/kg (ppm) dry weight except for the rinse data which is mg/l (ppm). No spikes or duplicates were reported for the rinse data.

ANALYTE/SAMPLE	MB 12#1	MB Duplicate 12#1	RPD(%)	Spike Added*	MS Conc	PR (QC Limits)	Rinse (mg/l)
aldrin	<0.0027U	ND	NA	0.10	0.099	99 (34-132)	<0.00004U
A-BHC	<0.0020U	ND	NA	NS	NA	NA	<0.00003U
B-BHC	<0.0040U	ND	NA	NS	NA	NA	<0.00006U
G-BHC (lindane)	<0.0027U	ND	NA	0.10	0.086	86 (46-127)	<0.00004U
D-BHC	<0.0060U	ND	NA	NS	NA	NA	<0.00009U
PPDDD	<0.0074U	ND	NA	NS	NA	NA	<0.00011U
PPDDE	<0.0027U	ND	NA	NS	NA	NA	<0.00004U
ppDDT	<0.0080U	ND	NA	0.25	0.32	128 (23-134)	<0.00012U
heptachlor	0.008 J	ND	NA	0.10	0.095	87 (35-130)	0.00001BJ
dieldrin	<0.0013U	ND	NA	0.25	0.30	120 (31-134)	<0.00002U
a-endosulfan	<0.0094U	ND	NA	NS	NA	NA	<0.00014U
b-endosulfan	<0.0027U	ND	NA	NS	NA	NA	<0.00004U
endosulf sulfate	<0.044U	ND	NA	NS	NA	NA	<0.00064U
endrin	<0.0040U	ND	NA	0.25	0.22	88 (42-134)	<0.00006U
endrin aldehyde	<0.015U	ND	NA	NS	NA	NA	<0.00022U
heptachlor epox	<0.056U	ND	NA	NS	NA	NA	<0.00081U
methoxychlor	<0.12U	ND	NA	NS	NA	NA	<0.0017U
toxaphene	<0.16U	ND	NA	NS	NA	NA	<0.0002U
diazinon	<0.18U	ND	NA	**	**	90.9 (40-120)a	<0.0019U
ethyl parathion	<0.030U	ND	NA	**	**	35 (40-120)a	<0.0006U
ethyl trithion	<0.032U	ND	NA	NS	NA	NA	<0.0006U
ethion	<0.026U	ND	NA	**	**	57 (40-120)a	<0.0005U
malathion	<0.055U	ND	NA	NS	NA	NA	<0.0011U
methyl parathion	<0.060U	ND	NA	**	**	38 (40-120)a	<0.0012U
2,4-D	<0.24U	ND	NA	**	**	9.3 (40-120)a	<0.012U
2,4-DP	<0.13U	ND	NA	**	**	60 (40-120)a	<0.0065U
2,4,5-T	<0.04U	ND	NA	**	**	54 (40-120)a	<0.002U
2,4,5-TP	<0.034U	ND	NA	**	**	132.5 (40-120)a	<0.0017U

Note: ND and NS - ND means no duplicate analyzed. NS means no spike added for this analyte.

NA - Not applicable. For example, if no MS was added then it is NA to report MS concentration or calculate a PR.

PR - percent recovery of the matrix spike.

RPD - relative percent difference calculated for differences in concentration between duplicate analyses.

* - Spike was added to sample indicated (sample 12#1) in first column of this table

** - Spike amount added and sample plus spike concentration not reported on lab sheet but PR was reported.

MS and MB - MS is matrix spike. MB is method blank.

MS Conc - analyte concentration determined from sample plus spike.

J - Reported concentration was below limits to accurately quantify; U - analyte not detected at associated value.

B - Analyte was found in the associated blank as well as the indicated sample.

(a) - QC limits not indicated by WES ALG, QC limits shown are generally accepted limits.

Table 5.10. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU 15/16. Example data evaluation set - results of soil analyses (explosives) including sample data, duplicate anlayses, method blanks, and matrix spike recoveries for sample #1 from boring 12. Data are reported in mg/kg (ppm) dry weight except for the rinse data which is mg/l (ppm). No spikes or duplicates were reported for the rinse data.

ANALYTE/SAMPLE	Soil Sample 12#1	Duplicate 12#1	RPD(%)	Spike Added*	MS Conc	PR (%)	MB 12#1	Spike Added	MS Conc	PR (%)	Rinse 12#1
HMX	6.84J	6.21J	9.6	NS	NA	NA	<2.2U	NS	NA	NA	<0.020U
RDX	0.259J	0.294J	12.6	NS	NA	NA	<1.0U	NS	NA	NA	<0.020U
TNB	0.277	0.290	4.6	2.50	2.68	96.2	<0.250U	2.44	2.54	104.1	<0.020U
DNB	<0.250U	<0.250U	0	NS	NA	NA	<0.250U	NS	NA	NA	<0.020U
TETRYL	<0.650U	<0.650U	0	2.65	2.63	99.2	<0.650U	2.58	2.91	112.8	<0.050U
TNT	0.417	0.362	14.1	2.50	2.89	98.8	<0.250U	2.44	2.54	104.1	<0.020U
2,4-DNT**	<0.250U	0.250U	0	NS	NA	NA	<0.250U	NS	NA	NA	<0.020U

Note: NS - No spike added for this analyte.
NA - Not applicable. For example, if no matrix spike was added then it is not applicable to report matrix spike concentration or calculate a percent recovery.
PR - Percent recovery of the matrix spike.
RPD - Relative percent difference.
* - Spike was added to sample indicated (sample 12#1) in first column of this table
** - Laboratory reported that 2,4-DNT could not be separated from 2,6-DNT.
MS - Matrix spike.
MB - Method blank.
MS Conc - Matrix spike concentration.

Table 5.1 Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Activities or features at boring locations.

Boring Number	Activity or Feature
Boring 1	Control site
Boring 2	Control site
Boring 3	Control site
Boring 4	Burn pads, composition B burning
Boring 5	Burn pads, composition A, B, etc. acetone, solvent and phosphorus burning
Boring 6	Surface impoundment - red water ponds
Boring 7	Waste pile (ash) - now removed
Boring 8	Incendiary cage - flare burning
Boring 9	Burning Pans - solvents and pyrotechnics, box burning
Boring 10	Open burning of phosphorus and boxes
Boring 11	Miscellaneous burning, red water ponds
Boring 12	Burn boxes, drainage from waste pile (now removed) area

TABLE 5.2 (Page 1 of 4). Ammunition Burning Ground - NWSC Crane, Indiana, SWMU# 03/10. Results of inorganic analyses of soil samples collected in the vicinity of SWMU#03/10. Concentrations are mg/kg (ppm) dry weight.

Sample ID*/ Analyte	Sb	As	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag
- 01/#1 (.2 - .5)	<1.20U	9.2	2.2N	<0.5U	25.6	7.7	26.4	<0.10U	19.2	0.3W	<1.3UN
01/#2 (1.0 - 1.5)	<1.20U	30.1	7.5N	<0.5U	41.4	13.6	40.8	<0.10U	26.9	0.4W	<1.3UN
- 02/#1 (.2 - .5)	<1.20U	9.4	2.2N	0.7	22.5	11.5	23.4	0.28	16.8	0.3W	<1.3UN
02/#2 (1.0 - 1.5)	<1.20U	16.0	4.4N	<0.5U	41.0	9.9	33.0	<0.10U	16.9	0.5	<1.3UN
02/#3 (2.5 - 3.0)	<1.20U	28.4	5.8N	<0.5U	39.7	14.0	35.6	<0.10U	25.1	0.7	<1.3UN
02/#4 (5.5 - 6.0)	<1.20U	13.4	3.0N	<0.5U	22.1	10.0	19.7	<0.10U	24.9	<0.3U	<1.3UN
- 03/#1 (.2 - .5)	<1.50UW	7.5	2.8N	<0.4U	21.9	18.5	23.1	0.26	23.5	0.5	<1.3U
03/#2 (1.0 - 1.5)	<1.50UW	35.4	9.1N	<0.4U	35.6	17.0	52.1	<0.10U	37.1	0.4	<1.3U
03/#3 (not ident)	<1.50U	19.2	6.0N	<0.4U	45.7	12.0	32.5	<0.10U	21.1	0.4	<1.3U
- 04/#1 (.5 - 1.0)	1.70	9.3	2.2N	3.8	22.9	131.0	138.0	1.9	19.7	0.3	<1.3U
04/#2 (1.5 - 2.0)	<1.50U	15.9	3.3N	<0.4U	28.2	37.6	40.2	0.18	17.1	0.7	<1.3U
04/#3 (3.0 - 3.5)	<1.50UW	21.7	5.8N	<0.4U	39.6	15.7	41.2	<0.10U	26.6	0.4	<1.3U
04/#4 (6.0 - 6.5)	<1.50UW	2.0	2.8N	<0.4U	44.5	11.4	11.6	<0.10U	26.4	<0.3U	<1.3U
- 05/#1 (.2 - .5)	<1.50U	5.5	1.3N	2.0	20.1	142.0	301.0	<0.10U	14.7	0.3	1.4
05/#2 (1.0 - 1.5)	<1.50U	8.2	2.9N	<0.4U	23.4	173.0	426.0	<0.10U	81.0	0.3	5.5
05/#3 (3.0 - 3.5)	1.50W	7.4	2.5N	<0.4U	21.1	17.9	66.5	<0.10U	19.5	0.3	<1.3U
- 06/#1 (.2 - .5)	<1.50U	7.2N	1.9N	2.0	25.4	50.5	73.4	0.13	23.3	0.3	<1.3U
06/#2 (1.0 - 1.5)	5.22	5.7N	1.6N	9.5	17.8	43.1	303.0	<0.10U	19.8	0.3	<1.3U
06/#3 (2.0 - 3.0)	<1.50U	8.0N	1.9N	<0.4U	20.3	15.4	24.3	0.27	14.2	0.5	<1.3U
06/#4 (4.0 - 4.5)	<1.50U	7.2N	1.8N	<0.4U	19.4	23.9	33.9	0.16	16.6	0.5	<1.3U
06/#5 (5.5 - 6.0)	<1.50U	8.1N	1.9N	<0.4U	21.2	27.5	36.4	0.46	16.4	0.5	<1.3U

Note:

* Sample ID is as follows - Boring Number/Sample Number (sample depth in feet below the surface). See Figures 1 and 2.

U Analyte was analyzed for but not detected

B A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

N Spiked sample recovery not within control limits

D Duplicate analysis not within control limits

(not ident) - The sample depth for this sample was not identified on the drilling logs

TABLE 5.2 (Page 2 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of inorganic analyses of soil samples collected in the vicinity of SWMU#03/10. Concentrations are mg/kg (ppm) dry weight.

Sample ID*/ Analyte	Sb	As	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag
- 07/#1 (.3 - .5)	12.4	15.2N	2.4N	7.7	30.9	42.8	781.0	1.53	35.4	0.3W	2.3
07/#2 (1.0 - 1.5)	13.8	16.4N	2.5N	17.8	42.1	793.0	1020.0	3.32	46.5	0.4	6.6
07/#3 (1.5 - 2.0)	48.4	21.7N	2.6N	89.0	52.5	2370.0	1840.0	12.5	67.1	0.8	15.3
07/#4 (2.5 - 2.8)	<1.50U	8.9N	2.1N	0.5	18.8	25.5	44.5	0.47	23.3	0.4	<1.3U
- 08/#1 (.3 - .5)	<1.50U	7.5	2.6N	0.9	22.7N	17.3	19.2	0.42	25.7	<0.3U	<1.3UND
08/#2 (1.0 - 1.5)	<1.50U	10.0	2.1N	<0.4U	21.3N	21.1	21.4	0.56	26.1	0.3W	<1.3UND
- 09/#1 (.2 - .5)	42.3	11.9N	4.0N	18.1	215.0	1290.0	1570.0	10.2	109.0	0.4	17.4
09/#2 (3.0 - 3.5)	5.22	10.0N	2.6N	2.3	31.0	341.0	369.0	<0.10U	24.3	0.4	15.9
09/#3 (5.0 - 5.5)	5.56	12.6N	3.6N	1.6	25.1	56.4	82.0	<0.10U	23.0	<0.3UW	1.3
- 10/#1 (.2 - .5)	<1.50U	9.5	1.7N	0.8	26.0N	37.5	54.8	<0.10U	12.3	<0.3U	<1.3UND
10/#2 (.5 - 1.0)	<1.50U	8.1	2.1N	<0.4U	22.4N	14.8	18.1	<0.10U	12.6	<0.3U	<1.3ND
10/#3 (1.5 - 2.0)	<1.50U	9.7	2.0N	<0.4U	21.3N	13.6	18.9	<0.10U	13.7	0.3W	<1.3UND
10/#4 (3.5 - 4.0)	<1.50U	7.5	2.5N	<0.4U	20.9N	9.7	13.6	<0.10U	17.9	<0.3U	<1.3UND
10/#5 (6.5 - 7.0)	<1.50U	23.6	3.8N	1.2	20.9N	69.4	24.6	<0.10U	46.4	<0.3U	<1.3UND
- 11/#1 (0.0 - 2.0)	1.80W	7.9	2.5N	<0.4U	23.5	69.5	96.4	<0.10U	17.5	<0.3U	<1.3U
11/#2 (3.0 - 3.5)	<1.50U	5.0	1.3N	<0.4U	13.3	8.8	15.6	<0.10U	11.8	0.3	<1.3U
11/#3 (3.5 - 4.0)	<1.50U	9.3	2.4N	<0.4U	21.3	11.9	23.4	<0.10U	16.5	0.5	<1.3U
11/#4 (not ident)	<1.50U	4.9	1.8N	<0.4U	17.1	7.5	13.4	<0.10U	12.5	0.3	<1.3U
- 12/#1 (.2 - .5)	4.78	26.6	0.7N	13.0	39.1N	391.0	453.0	1.17	36.8	<0.3U	2.0
12/#2 (1.0 - 1.5)	7.77	17.6	0.7N	9.9	48.2N	473.0	848.0	0.96	34.6	0.3	1.6
12/#3 (1.5 - 2.0)	5.11	34.8	0.7N	10.5	39.4N	451.0	491.0	0.74	32.5	0.3W	2.7
12/#4 (3.0 - 3.2)	16.2	15.4	0.7N	37.6	58.8N	1000.0	1030.0	1.34	43.8	0.3	12.5

Note:

* Sample ID is as follows - Boring Number/Sample Number (sample depth in feet below the surface). See Figures 1 and 2.

U Analyte was analyzed for but not detected

B A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

N Spiked sample recovery not within control limits

D Duplicate analysis not within control limits

(not ident) - The sample depth for this sample was not identified on the drilling logs

TABLE 5.2 (Page 3 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of inorganic analyses of soil samples collected in the vicinity of SWMU#03/10. Concentrations are mg/kg (ppm) dry weight.

Sample ID*/ Analyte	Tl	Zn	Al	Ba	Co	Fe	Mg	Mn	Sn	Na	TP
- 01/#1 (.2 - .5)	<0.2U	60.6	10300	109	15.6	46400	860	1240	<7.6U	<48.9U	252
01/#2 (1.0 - 1.5)	<0.2U	88.8	10200	82.5	21.3	96500	775	1330	<7.6U	<48.9U	128
- 02/#1 (.2 - .5)	0.3	102	12000	115	14.8	25400	1000	1220	<7.6U	<48.9U	174
02/#2 (1.0 - 1.5)	0.2	64.0	10400	69	22.3	62400	763	1270	<7.6U	<48.9U	187
02/#3 (2.5 - 3.0)	0.2	78.6	11100	47.6	21.5	92400	865	1070	<7.6U	50.0	120
02/#4 (5.5 - 6.0)	<0.2U	69.2	8060	45.2	11.9	37100	821	538	<7.6U	<48.9U	94.0
- 03/#1 (.2 - .5)	0.2	73.3	12200	135	18.5	30600	1080	1490	<7.6U	<48.9U	124
03/#2 (1.0 - 1.5)	<0.2U	115	10800	73.7	29.0	113000	775	1730	<7.6U	<48.9U	104
03/#3 (not ident)	<0.2U	71.3	11000	53.4	10.5	87100	885	435	<7.6U	<48.9U	50.4
- 04/#1 (.5 - 1.0)	<0.2U	518	14700	317	10.9	30600	5230	1420	13.4	79.0	326
04/#2 (1.5 - 2.0)	<0.2U	80.2	15800	101	15.4	47300	2390	862	<7.6U	71.5	27.8
04/#3 (3.0 - 3.5)	0.2	87.4	12200	62.5	19.0	87300	1090	1080	<7.6U	52.9	41.1
04/#4 (6.0 - 6.5)	<0.2UW	97.7	34000	100	3.9	26300	4620	57.6	<7.6U	238	32.9
- 05/#1 (.2 - .5)	<0.2U	471	19700	490	7.4	17200	10900	460	<7.6U	162	119
05/#2 (1.0 - 1.5)	<0.2U	284	21900	506	11.3	36800	4380	644	<7.6U	140	121
05/#3 (3.0 - 3.5)	<0.2U	56.3	16800	182	11.1	28800	2460	1120	<7.6U	75.6	79.2
- 06/#1 (.2 - .5)	0.3	255	14900	157	13.4	20900	2760	569	<7.6U	124	402
06/#2 (1.0 - 1.5)	<0.2U	203	14500	156	13.8	17000	4000	715	<7.6U	165	416
06/#3 (2.0 - 3.0)	<0.2U	57.1	18900	91.7	11.0	23400	3160	555	<7.6U	51.5	147
06/#4 (4.0 - 4.5)	<0.2	125	18200	101	12.2	22000	3280	577	<7.6U	68.4	163
06/#5 (5.5 - 6.0)	<0.2	140	19500	112	11.0	23600	3300	516	<7.6U	101	344

Note:

* Sample ID is as follows - Boring Number/Sample Number (sample depth in feet below the surface). See Figures 1 and 2.

U Analyte was analyzed for but not detected

B A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

(not ident) - The sample depth for this sample was not identified on the drilling logs

TABLE 5.2 (Page 4 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of inorganic analyses of soil samples collected in the vicinity of SWMU#03/10. Concentrations are mg/kg (ppm) dry weight.

Sample ID*/ Analyte	Tl	Zn	Al	Ba	Co	Fe	Mg	Mn	Sn	Na	TP
- 07/#1 (.3 - .5)	<0.2U	2650	18800	1190	15.6	31500	4290	3030	19.3	93.6	880
07/#2 (1.0 - 1.5)	0.2	4040	25900	1570	15.4	31700	7880	2760	37.3	157	1850
07/#3 (1.5 - 2.0)	0.2	5070	34500	2340	17.3	35300	17600	3810	70.1	262	2230
07/#4 (2.5 - 2.8)	0.2	90.8	13600	522	15.4	22600	2970	497	<7.6U	94.2	182
- 08/#1 (.3 - .5)	<0.2U	64.5	14900	97.5	12.9	30700	3090	828	<7.6U	70.5	441
08/#2 (1.0 - 1.5)	<0.2U	129	15700	121	13.1	23500	3460	378	<7.6U	76.3	222
- 09/#1 (.2 - .5)	<0.2U	2910	51200	1640	29.4	60800	7010	2520	128	1610	1770
09/#2 (3.0 - 3.5)	0.2	475	14800	1620	14.6	37100	3140	910	65.3	251	540
09/#3 (5.0 - 5.5)	0.3	731	9130	223	18.8	52400	1240	1180	<7.6U	74.0	133
- 10/#1 (.2 - .5)	<0.2U	137	13700	61.6	10.7	21700	2880	421	<7.6U	126	140
10/#2 (.5 - 1.0)	0.3	40.3	21000	51.8	7.3	29600	2440	198	<7.6U	87.7	65.1
10/#3 (1.5 - 2.0)	<0.2U	43.6	22800	55.7	9.1	27400	2510	269	<7.6U	96.0	51.9
10/#4 (3.5 - 4.0)	<0.2U	26.6	16800	73.7	18.5	17500	1890	168	<7.6U	80.0	119
10/#5 (6.5 - 7.0)	0.2	31.5	24700	123	24.3	31700	4180	317	<7.6U	181	282
- 11/#1 (0.0 - 2.0)	0.2	119	20100	329	13.6	30500	2330	857	<7.6U	61.2	40.0
11/#2 (3.0 - 3.5)	0.2	40.8	10600	66.3	9.5	14000	1100	238	<7.6U	<48.9U	99.1
11/#3 (3.5 - 4.0)	<0.2U	61.5	9990	79.3	14.0	25300	893	473	<7.6U	<48.9U	99.9
11/#4 (not ident)	<0.2U	59.0	15900	69.2	9.7	19600	1590	914	<7.6U	50.8	67.1
- 12/#1 (.2 - .5)	0.2	2380	16600	1130	15.7	23600	4100	1870	11.2D	134	2070
12/#2 (1.0 - 1.5)	<0.2U	3550	19600	1200	16.5	31100	3980	1980	20.6D	136	543
12/#3 (1.5 - 2.0)	0.2	2350	16800	1320	15.9	21800	4540	1970	16.4D	132	1070
12/#4 (3.0 - 3.2)	<0.2U	4670	27900	1910	18.2	26800	8940	2750	42.9D	244	1200

Note:

* Sample ID is as follows - Boring Number/Sample Number (sample depth in feet below the surface). See Figures 1 and 2.

U Analyte was analyzed for but not detected

B A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

N Spiked sample recovery not within control limits

D Duplicate analysis not within control limits

(not ident) - The sample depth for this sample was not identified on the drilling logs

TABLE 5.3 (Page 1 of 5). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Statistical analysis of results of inorganic analyses of soil samples. Statistics were computed using all samples from each boring. For samples with concentrations reported as < a specific detection limit, the detection limit was used to compute the statistics.

		Analyte Concentration mg/kg dry weight (ppm)										
Sample Type	Statistic	Sb(a)	As	Be	Cd(a)	Cr	Cu	Pb	Hg(a)	Ni	Se	Ag(a)
Control	mean	(1.5)	18.7	4.7N	(0.5)(1)	32.8	12.7	31.8	(0.1)(2)	23.5	0.4W	(1.3)
n=9	s.d.	-	10.3	1.1	-	13.6	4.8	12.1	-	13.5	0.04	-
Borings 1,2,3	max	-	35.4	9.1N	0.7	45.7	18.5	52.1	0.3	37.1	0.7W	-
	min	-	7.5	2.2N	<0.5	21.9	7.7	19.7	<0.1	16.8	0.3	-
Boring 4	mean	**1.6** (1)	12.2	3.5N	(1.3)(1)	33.8	**48.9#**	**57.8**	(0.6)(2)	22.5	0.4	(1.3)
n=4	s.d.	-	8.5	1.6	-	10.0	55.9	55.2	-	4.8	0.2	-
	max	1.7	21.7	5.8N	3.8	44.5	131.0	138.0	1.9	26.6	0.7	-
	min	<1.5	2.0	2.2N	<0.4	22.9	11.4	11.6	<0.1	17.1	<0.3	-
Boring 5	mean	(1.5)	7.0	2.2N	(0.9)(1)	21.5	**111.0**	**264.5***	(0.1)	**38.4**	0.3	(2.7)(2)
n=3	s.d.	-	1.4	0.8	-	1.7	82.1	182.5	-	37.0	-	-
	max	-	8.2	2.9N	2.0	23.4	173.0	426.0	-	81.0	0.3	5.5
	min	-	5.5	1.3N	<0.4	20.1	17.9	66.5	-	14.7	0.3	<1.3
Boring 6	mean	2.2(1)	7.2	1.8N	(2.5)(2)	20.8	**32.1***	**94.2***	**0.2**	18.1	0.4	(1.3)
n=5	s.d.	-	1.0	0.1	-	2.9	14.4	11.0	0.2	3.5	0.1	-
	max	5.2	8.1	1.9N	9.5	25.4	50.5	303.0	0.5	23.3	0.5	-
	min	<1.5	5.7	1.6N	<0.4	17.8	15.4	24.3	<0.10	14.2	0.3	-
Boring 7	mean	**19.4#**	15.6	2.4	**28.8#**	**36.1**	**807.8#**	**921.4***	**4.5#**	**43.1***	**0.5W**	**6.4**
n=4	s.d.	20.3	5.3	0.2	40.8	14.5	1101.2	739.9	5.5	18.6	0.2	6.4
	max	48.4	21.7	2.6	89.0	52.5	2370.0	1840.0	12.5	67.1	0.8	15.3
	min	<1.5	8.9	2.1	0.5	18.8	25.5	44.5	0.5	23.3	0.3W	<1.3
Boring 8	mean	(1.5)	8.8	2.4	(0.7)(1)	22.0	19.2	20.3	**0.5**	**25.9**	(0.3)W	(1.3)ND
n=2	s.d.	-	1.8	0.4	-	1.0	2.7	1.6	0.1	0.3	-	-
	max	-	10.0	2.6	0.9	22.7	21.1	21.4	0.6	26.1	-	-
	min	-	7.5	2.1	<0.4	21.3	17.3	19.2	0.4	25.7	-	-
Boring 9	mean	**17.7#**	11.5N	3.4N	**7.3#**	**90.4#**	**562.5#**	**673.7#**	(3.5)(1)	**52.1**	0.4	**11.5**
n=3	s.d.	21.3	1.3	0.7	9.3	107.9	645.9	789.4	-	49.3	0.1	8.9
	max	42.3	12.6N	4.0N	18.1	215.0	1290.0	1570.0	10.2	109.0	0.4	17.4
	min	5.2	10.0N	2.6N	1.6	25.1	56.4	82.0	<0.1	23.0	<0.3	1.3

Note: See page 5 for Table notes and data qualifiers.

TABLE 5.3 (Page 2 of 5). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Statistical analysis of results of inorganic analyses of soil samples. Statistics were computed using all samples from each boring. For samples with concentrations reported as < a specific detection limit, the detection limit was used to compute the statistics.

		Analyte Concentration mg/kg dry weight (ppm)										
Sample Type	Statistic	Sb(a)	As	Be	Cd(a)	Cr	Cu	Pb	Hg(a)	Ni	Se	Ag(a)
Boring 10	mean	(1.5)	11.7	2.4N	(0.6)(2)	22.3	**29.0**	26.0	(0.1)	20.5	(0.3)(1)W	(1.3)ND
n=5	s.d.	-	6.7	0.8	0.4	2.2	25.1	16.6	-	14.6	-	-
	max	-	23.6	3.8N	1.2	26.0	69.4	54.8	-	46.4	0.3W	-
	min	-	7.5	1.7N	<0.4	20.9	9.7	13.6	-	12.3	<0.3	-
Boring 11	mean	(1.6)(1)BW	6.7	2.0N	(0.4)	18.8	**24.4#**	**37.2#**	(0.1)	14.6	0.4	(1.3)
n=4	s.d.	-	2.2	0.6	-	4.5	30.1	39.7	-	2.8	-	-
	max	1.8BW	9.3	2.5N	-	23.5	69.5	96.4	-	17.5	0.5	-
	min	<1.5	4.9	1.3N	-	13.3	7.5	13.4	-	11.8	<0.3	-
Boring 12	mean	**8.5**	**23.6**	0.7N	**17.8***	**46.4N**	**579.0***	**706.0***	1.1	**36.9***	0.3W	**4.9#**
n=4	s.d.	5.3	8.9	-	13.3	9.3	283.0	280.0	0.3	4.9	-	5.2
	max	16.2	34.8	0.7N	37.6	58.8N	1000.0	1030.0	1.3	43.8	0.3W	12.5
	min	4.8	15.4	0.7N	9.9	39.1N	391.0	453.0	0.7	32.5	<0.3	1.6

Note: See page 5 for table notes and data qualifiers.

TABLE 5.3. (Page 3 of 5). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Statistical analysis of results of inorganic analyses of soil samples. Statistics were computed using all samples from each boring. For samples with concentrations reported as < a specific detection limit, the detection limit was used to compute the statistics.

		Analyte										
Sample Type	Statistic	Tl(a)	Zn	Al	Ba	Co	Fe	Mg	Mn	Sn(a)	Na(a)	TP
Control	mean	0.2	80.3	10673	81.2	18.4	65655	869	1147	(7.6)	(48.9)(1)	137.0
n=9	s.d.	0.04	18.2	1207	32.0	5.8	32431	108	419	-	-	59.2
Borings 1,2,3	max	0.3	115.0	12200	135.0	29.0	113000	1080	1730	-	50.0	187.0
	min	<0.2	60.6	8060	45.2	10.5	25400	763	435	-	<48.9	50.4
Boring 4	mean	(0.2)(2)W	**195.8#**	**19175**	**145.1**	12.3	47875	**3333***	855	(9.1)(1)	**110.4**	107.0#
n=4	s.d.	-	214.5	9997	116.0	6.5	27800	1930	579	-	85.8	146.1
	max	0.2	518.0	34000	317.0	19.0	87300	5230	1420	13.4	238.0	326.0
	min	<0.2W	80.2	12200	62.5	3.9	26300	1090	58	<7.6	52.9	27.8
Boring 5	mean	(0.2)	**270.4**	**19467**	**392.7***	9.9	27600	**5913**	741	(7.6)	**125.9**	106.4
n=3	s.d.	-	207.7	2558	182.6	2.2	9855	4424	341	-	44.9	23.6
	max	-	471.0	21900	506.0	11.3	36800	10900	1120	-	162.0	119.0
	min	-	56.3	16800	182.0	7.4	17200	2460	460	-	75.6	79.2
Boring 6	mean	(0.2)(1)	**156.0**	**17200**	**123.5***	12.3	21380	**3300***	586	(7.6)	**102.0**	**294.4***
n=5	s.d.	-	75.8	2332	30.9	1.3	2684	448	76	-	45.1	130.2
	max	0.3	255.0	19500	157.0	13.8	23600	4000	715	-	165.0	416.0
	min	<0.2	57.1	14500	91.7	11.0	17000	2760	516	-	51.5	147.0
Boring 7	mean	0.2	**2963.0***	**23200***	**1405.5***	15.9	30275	**8185***	**2524***	**33.6**	**151.7**	**1285.5***
n=4	s.d.	-	2156.0	9064	758.8	0.9	5406	6611	1423	27.2	79.3	929.7
	max	0.2	5070.0	34500	2340.0	17.3	35300	17600	3810	70.1	262.0	2230.0
	min	<0.2	90.8	13600	522.0	15.4	22600	2970	497	<7.6	93.6	182.0
Boring 8	mean	(0.2)	**96.8**	**15300**	**109.3**	13.0	27100	**3275***	603	(7.6)	**73.4**	**331.5**
n=2	s.d.	-	45.6	566	16.6	0.1	5091	262	318	-	4.1	154.8
	max	-	129.0	15700	121.0	13.1	30700	3460	828	-	76.3	441.0
	min	-	64.5	14900	97.5	12.9	23500	3090	378	-	70.5	222.0
Boring 9	mean	(0.2)(1)	**1372.0**	**25043**	**1161.0**	**20.9**	50100	**3796**	**1537**	**67.0**	**645.0#**	**814.0#**
n=3	s.d.	-	1338.0	22829	812.0	7.6	12016	2941	862	60.2	840.0	852.0
	max	0.3	2910.0	51200	1640.0	29.4	60800	7010	2520	128.0	1610.0	1770.0
	min	<0.2	475.0	9130	223.0	14.6	37100	1240	910	<7.6	74.0	133.0

Note: See page 5 for Table notes and data qualifiers.

TABLE 5.3. (Page 4 of 5). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Statistical analysis of results of inorganic analyses of soil samples. Statistics were computed using all samples from each boring. For samples with concentrations reported as < a specific detection limit, the detection limit was used to compute the statistics.

		Analyte										
Sample Type	Statistic	Tl(a)	Zn	Al	Ba	Co	Fe	Mg	Mn	Sn(a)	Na(a)	TP
Boring 10	mean	(0.2)(1)	55.8	**19800**	73.1	14.0	25580	**2780***	275	(7.6)	**114.1**	131.6
n=5	s.d.	-	45.9	4491	29.1	7.2	5858	859	101	-	41.2	91.7
	max	0.3	137.0	24700	123.0	24.3	31700	4180	317	-	181.0	282.0
	min	<0.2	26.6	13700	51.8	7.3	17500	1890	168	-	80.0	51.9
Boring 11	mean	(0.2)(2)	70.1	**14148**	**136.0**	11.7	22350	**1478**	621	(7.6)	52.5	76.5
n=4	s.d.	-	33.9	4774	128.8	2.4	7128	639	322	-	5.9	28.7
	max	0.2	119.0	20100	329.0	14.0	30500	2330	914	-	61.2	99.9
	min	<0.2	40.8	9990	66.3	9.5	14000	893	238	-	<48.9	40.0
Boring 12	mean	(0.2)	**3238.0***	**20225***	**1390.0***	16.6	25825	**5390***	**2143***	**22.8D**	**162.0**	**1221.0***
n=4	s.d.	-	1106.0	5297	355.0	1.1	4080	2379	408	14.0	55.0	633.0
	max	0.2	4670.0	27900	1910.0	18.2	31100	8940	2750	42.9D	244.0	2070.0
	min	<0.2	2350.0	16600	1130.0	15.7	21800	3980	1870	11.2D	132.0	543.0

Note: See page 5 for Table notes and data qualifiers.

TABLE 5.3. (Page 5 of 5). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Statistical analysis of results of inorganic analyses of soil samples. Statistics were computed using all samples from each boring. For samples with concentrations reported as < a specific detection limit, the detection limit was used to compute the statistics.

Table Notes:

(a) - No statistical comparisons between control and "test" boring was conducted for the indicated analyte because no meaningful variance statistic could be computed for the control group.

(mean) - Mean reported in parentheses. The following 2 situations may exist:
(a) all data was reported as < detection limits and detection limit is given in ()
(b) only 1 or 2 concentrations ≥ than the detection limits were reported. The second number in () is the number of observations ≥ the detection limits. Means are computed using all samples from boring including using the detection limit for those samples with results reported as < detection limits.

mean - Mean is indicated in **bold**. Concentration is greater than the corresponding mean concentration for the control group.

* - Concentration of soil analyte reported is significantly different (greater) (P > .05) than the concentration of that analyte in the control group.

\# - Standard deviation is greater than the sample mean. When this occurs, the ability to distinguish a statistically significant difference between the control and specific boring means is reduced.

n - Number of Samples.

Inorganic Data Qualifiers

D, W, and N - These qualifiers were reported by the analytical lab. If one soil sample result was qualified, that qualifier was carried to the the mean statistic for that boring. The B qualifier, which was reported by the lab indicates that the reported value is less than the Contract Required Detection Limit (CRDL) but less than the Instrument Detection Limit. As EPA SW846 procedures were followed, the Contract Laboratory Procedures (CLP) CRDL is not applicable and the B does not indicate estimated data or questionable data. Therefore the B was not reported on this table.

D - Duplicate analysis not within control limits.

W - Indicates post-digestion spike for furnace AA is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

N - Spiked sample recovery not within control limits.

Table 5.4. Ammunition Burning Ground - NSWC Crane, Indiana. SWMU[illegible]/10. Comparison of maximum concentrations of selected metal analytes determined for Ammunition Burning Ground soil samples. Data from borings 7, 9, and 12 are grouped together because of the high concentrations of metals found in those soils as compared to the other borings.

	Max. Concentration Determined mg/kg dry weight							
Analyte	Boring 4	Boring 5	Boring 6	Boring 8	Boring 10	Boring 11	Boring 1, 2, 3	All Borings
antimony	1.7	<1.5	5.2	<1.5	<1.5	1.8	<1.5	48.4
arsenic	21.7	8.2	8.1	10.0	23.6	9.3	35.4	35.4
cadmium	3.8	2.0	9.5	0.9	1.2	<0.4	0.7	89.0
chromium	44.5	23.4	25.4	22.7	26.0	23.5	45.7	215.0
copper	131.0	173.0	50.5	21.1	69.4	69.5	18.5	2370.0
lead	138.0	426.0	303.0	21.4	54.8	96.4	52.1	1840.0
mercury	1.9	<0.1	0.5	0.6	<0.1	<0.1	0.3	12.5
nickel	26.6	81.0	23.3	26.1	46.4	17.5	37.1	109.0
silver	<1.3	5.5	<1.3	<1.3	<1.3	<1.3	<1.3	17.4
zinc	518.0	471.0	255.0	129.0	137.0	119.0	115.0	5070.0
aluminum	34000.0	21900.0	19500.0	15700.0	24700.0	20100.0	12200.0	51200.0
barium	317.0	506.0	157.0	121.0	123.0	329.0	135.0	2340.0
magnesium	5230.0	10900.0	4000.0	3460.0	4180.0	2330.0	1080.0	17600.0
manganese	1420.0	1120.0	715.0	828.0	317.0	914.0	1730.0	3810.0
tin	13.4	<7.6	<7.6	<7.6	<7.6	<7.6	<7.6	128.0
sodium	238.0	162.0	165.0	76.3	181.0	<48.9	50.0	1610.0

	Max. Concentration Determined mg/kg dry weight				All
Analyte	Boring 7	Boring 9	Boring 12	Boring 1, 2, 3	Borings
antimony	48.4	42.3	16.2	<1.5	48.4
arsenic	21.7	12.6	34.8	35.4	35.4
cadmium	89.0	18.1	37.6	0.7	89.0
chromium	52.5	215.0	58.8	45.7	215.0
copper	2370.0	1290.0	1000.0	18.5	2370.0
lead	1840.0	1570.0	1030.0	52.1	1840.0
mercury	12.5	10.2	1.3	0.3	12.5
nickel	67.1	109.0	43.8	37.1	109.0
silver	15.3	17.4	12.5	<1.3	17.4
zinc	5070.0	2910.0	4670.0	115.0	5070.0
aluminum	34500.0	51200.0	27900.0	12200.0	51200.0
barium	2340.0	1640.0	1910.0	135.0	2340.0
magnesium	17600.0	7010.0	8940.0	1080.0	17600.0
manganese	3810.0	2520.0	2750.0	1730.0	3810.0
tin	70.1	128.0	42.9	<7.6	128.0
sodium	262.0	1610.0	244.0	50.0	1610.0

TABLE 5.5. Ammunition Burning Ground - NWSC Crane, Indiana, SWMU#03/10. Results of inorganic analyses of method blanks associated with analyses of soil samples. Concentrations are mg/kg (ppm) dry weight. Detectable concentrations are shown in **bold**.

Method Blank ID*/Analyte	Sb	As	Be	Cd	Cr	Cu	Pb	Hg	Ni	Se	Ag
MB/Boring 12	<0.003U	<0.002U	<0.002UN	<0.0044U	**0.331N**	**0.007**	<0.114U	<0.100U	**0.233**	<0.30U	<0.013U
MB/Borings 11,5,4,3	<0.003U	<0.002U	<0.002UN	<0.0044UN	<0.011U	<0.006U	<0.114U	<0.100U	<0.011U	<0.003U	**0.017**
MB/Borings 10,8	<0.003U	<0.002U	<0.002UN	<0.0044U	<0.011U	<0.006U	<0.114U	<0.100U	<0.011U	<0.003U	<0.013U
MB/Borings 9,7,6	<0.003U	<0.002U	<0.002UN	<0.0044U	**0.015**	<0.006U	<0.114U	<0.100U	<0.011U	<0.003U	<0.013U
MB/Borings 2,1	<0.012U	<0.002U	<0.002UN	<0.005U	<0.011U	<0.006U	<0.114U	<0.100U	<0.011U	<0.003U	<0.013U

Method Blank ID*/Analyte	Tl	Zn	Al	Ba	Co	Fe	Mg	Mn	Sn	Na	TP
MB/Boring 12	<0.002U	<0.008U	**0.048**	<0.011U	<0.030U	**0.397**	<0.748U	**0.014**	<0.076UD	<0.489U	**0.13**
MB/Borings 11,5,4,3	<0.002U	**0.038**	**0.060**	<0.011U	<0.030U	**0.202**	<0.748U	<0.005U	<0.076U	<0.489U	**0.13**
MB/Borings 10,8	<0.002U	<0.008U	<0.038U	<0.011U	<0.030U	**0.0278**	<0.748U	<0.005U	<0.076U	<0.489U	**0.26**
MB/Borings 9,7,6	<0.002U	<0.008U	**0.193**	<0.011U	<0.030U	**0.0204**	<0.748U	<0.005U	<0.076U	<0.489U	**0.26**
MB/Borings 2,1	<0.002U	**0.105**	<0.038U	<0.011U	<0.030U	**0.098**	<0.748U	<0.005U	<0.076U	<0.489U	**0.26**

Note:

* - Sample ID - MB (Method Blank)/Boring numbers associated with that method blank. See Figure 5.1 for boring locations.

U - Analyte was analyzed for but not detected.

B - A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W - Post-digestion spike for furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.

N - Spiked sample recovery not within control limits.

D - Duplicate analysis not within control limits.

Table 5.6. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Results of inorganic analysis of water collected from final equipment rinses. Results are in mg/l (ppm). Results in **bold** are concentrations greater than detection limits. Detection limits are given after the < symbol.

Sample ID Analyte/Boring	RINSE 12	RINSE 11	RINSE 10	RINSE 8	RINSE 6	RINSE 3	RINSE 2
Sb	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U
As	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Be	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Cd	<0.013U	**0.008**	**0.008**	**0.010**	<0.004U	<0.004U	<0.004U
Cr	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
Cu	<0.006U	<0.006U	<0.006U	**0.038**	**0.030**	<0.006U	<0.006U
Pb	<0.003U	<0.003U	<0.003U	<0.003U	**0.020**	<0.003UW	<0.003UW
Hg	<0.0002U	<0.0002U	<0.0002U	<0.0002U	<0.0002U	<0.0002U	<0.0002U
Ni	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
Se	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U	<0.003U
Ag	<0.013U	<0.013U	<0.013U	<0.013U	<0.013U	<0.013U	<0.013U
Tl	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
Zn	**0.012**	**0.024**	**0.304**	**0.574**	**0.651**	<0.008U	**0.154**
Al	**1.43**	<0.038U	**0.136**	**0.153**	**1.80**	<0.038U	<0.038U
Ba	**0.014**	<0.011U	<0.011U	<0.011U	**0.020**	<0.011U	<0.011U
Co	<0.030U	<0.030U	<0.030U	<0.030U	<0.030U	<0.030U	<0.030U
Fe	**0.055**	**0.061**	**0.854**	**0.256**	**1.69**	**0.123**	**2.718**
Mg	**3.08**	**0.843**	<0.748U	<0.748U	**3.10**	<0.748U	<0.748U
Mn	<0.005U	**0.005**	**0.008**	<0.005U	**0.059**	<0.005U	<0.005U
Na	**4.76**	**2.05**	**2.06**	**3.12**	**5.05**	-	-
TP	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	IS	<0.050U
Sn	-	-	-	-	**0.125**	<0.076	<0.076

Note:

U - Analyte was analyzed for but not detected

B - A qualifier reported on the lab data sheets but not in this table. The B qualifier indicates that the analyte value was reported as less than the Contract Required Detection Limit (a Contract Laboratory Procedure term which was not applicable to these analyses) but more than the Instrument Detection Limit

W - Post-detection spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance

IS - Insufficient sample supplied to conduct analyses

(-) - No analysis reported for this constituent

Table 5.7. (Page 1 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Results of analyses of soil samples for explosive compounds. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	12#1	12#2	12#3	12#4	11#1	11#2	11#3	11#4	10#1	10#2
2,4 DNT*	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNT	**0.417**	**0.420**	**0.474**	**1.00**	**0.167J**	<0.250U	<0.250U	**0.164J**	<0.65U	**0.115J**
TETRYL	<0.65U	**0.650**	**0.679**	**0.776**	<0.65U	<0.65U	<0.65U	<0.65U	<0.25U	<0.65U
DNB	<0.25U	<0.25U	<0.25U	<0.25U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNB	**0.277**	**0.218J**	**0.466**	**0.519**	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
RDX	**0.259J**	**0.136J**	**20.7**	**0.590J**	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U	**0.215J**
HMX	**6.84**	**10.4**	**8.95**	**5.05**	**0.338J**	<2.2U	<2.2U	**1.16J**	<2.2U	<2.2U
Total Explosive	**7.79**	**11.82**	**31.26**	**7.94**	**0.505**	-	-	**1.324**	-	**0.330**

ANALYTE/SAMPLE	10#3	10#4	10#5	09#1	09#2	09#3	08#1	08#2	07#1	07#2	07#3	07#4
2,4 DNT*	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNT	<0.65U	<0.65U	<0.65U	<0.250U	<0.250U	<0.250U	<0.65U	<0.65U	**2.57**	**0.686**	**69.1**	<0.250U
TETRYL	<0.25U	<0.25U	<0.25U	<0.65U	<0.65U	<0.65U	<0.25U	<0.25U	<0.65U	<0.65U	**0.568**	<0.65U
DNB	<0.25U	<0.25U	<0.25U	<0.250U	<0.250U	<0.250U	<0.25U	<0.25U	<0.250U	<0.250U	**0.128J**	<0.250U
TNB	<0.25U	<0.25U	<0.25U	**0.172J**	<0.250U	<0.250U	<0.25U	<0.25U	**1.29**	**0.708**	**3.44**	<0.250U
RDX	<1.0U	<1.0U	<1.0U	**2.17**	<1.0U	<1.0U	<1.0U	<1.0U	**0.856J**	**0.762J**	**0.129J**	<1.0U
HMX	<2.2U	<2.2U	<2.2U	**8.47**	<2.2U	<2.2U	**0.265J**	<2.2U	**41.9**	**8.87**	**23.8**	<2.2U
Total Explosive	-	-	-	**10.81**	-	-	**0.265**		**46.62**	**11.03**	**97.16**	-

ANALYTE/SAMPLE	06#1	06#2	06#3	06#4	06#5	05#1	05#2	05#3	04#1	04#2	04#3	04#4
2,4 DNT*	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	**1.41**	**0.530**	<0.250U	**16.7**	<0.250U	<0.250U	<0.250U
TNT	**0.141J**	**0.126J**	**0.104J**	<0.250U	<0.250U	**0.435**	**3.93**	**56.2**	**1.82**	**1640.0**	**0.262**	<0.250U
TETRYL	<0.650U	<0.650U	<0.650U	<0.650U	<0.650U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U
DNB	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNB	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	**0.241J**	**0.347**	**0.358**	**1.37**	**12.6**	<0.250U	<0.250U
RDX	**0.761J**	**0.450J**	<1.0U	**0.354J**	**0.276J**	**214.0**	**1070.0**	**0.282J**	**0.325J**	**4.44**	<1.0U	<1.0U
HMX	**9.66**	**2.58**	**0.341J**	**0.956**	**0.232J**	**27.2**	**128.0**	<2.2U	**2.23**	**1.19J**	<2.2U	<2.2U
Total Explosive	**10.56**	**3.16**	**0.445**	**1.31**	**0.508**	**243.3**	**1202.8**	**56.84**	**22.44**	**1658.2**	**0.262**	-

Note. See page 2 for Table Notes.

Table 5.7. (Page 2 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Results of analyses of soil samples for explosive compounds. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	03#1	03#2	03#3	02#1	02#2	02#3	02#4	01#1	01#2
2,4 DNT*	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNT	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TETRYL	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U
DNB	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNB	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
RDX	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U
HMX	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U
Total Explosive	-	-	-	-	-	-	-	-	-

Note:

Sample ID is as follows - 12#4, boring 12/sample 4. See Figures 5.1 and 5.2.

J - Estimated value below the statistical quantitation limits

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

* - Lab reports indicate that 2,4-DNT could not be separated from 2,6-DNT.

Total Explosive - A total of all explosive compounds determined for that sample. A (-) indicates no explosives found.

Table 5.8. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Summary of analyses of soil samples for explosive compounds. The samples from each boring are indicated below each list of explosive analytes and samples with a detectable concentration of analyte are indicated in **bold** type. See notes below for depth in boring of each sample.

Boring 12	Boring 11	Boring 10	Boring 9	Boring 8	Boring 7	Boring 6
TNT	TNT(J)	TNT(J)	TNB(J)	HMX(J)	TNT	TNT(J)
TETRYL	HMX(J)	RDX(J)	RDX	(**1**, 2)	DNB(J)	RDX(J)
TNB	(**1**, 2, 3, **4**)	(1, **2**, 3, 4, 5)	HMX		TNB	HMX
RDX			(**1**, 2, 3)		RDX(J)	2,4,DNT(J)**
HMX					HMX	(**1**, **2**, **3**, **4**, **5**)
2,4 DNT(J)**					2,4 DNT(J)**	
(**1**, **2**, **3**, **4**)					(**1**, **2**, **3**, 4)	

Boring 5	Boring 4	Boring 3	Boring 2	Boring 1
2,4 DNT*	2,4,DNT*	None Detected	None Dectected	None Dectected
2,6, DNT(J)***	TNT	(1, 2, 3)	(1, 2, 3, 4)	(1, 2)
TNT	TNB			
TNB	RDX			
RDX	HMX			
HMX	(**1**, **2**, **3**, 4)			
(**1**, **2**, **3**)				

Note: * Lab conducting explosives analysis reports that 2,4 DNT could not be separated from 2,6 DNT
** 2,4 DNT in these cases was reported as a semivolatile organic analyte (EPA Method 8270 compound).
*** 2,6 DNT in this case was reported a a semivolatile organic analyte (EPA Method 8270 compound).
(J) - Detected by the analytical instrumentation but not in sufficient amounts to accurately quantify. All the J qualified data represents concentrations that are less than 1 mg/kg (ppm) except for the J associated with HMX at boring 4 sample # 1 which is 1.19 mg/kg.

Sample numbers and sample depths in feet below the surface. The notation Not ident means that the sample depth was not identified in the drilling logs.

Boring 12	Boring 11	Boring 10	Boring 9	Boring 8	Boring 7	Boring 6
1 (.2 - .5)	1 (0.0 - 2.0)	1 (.2 - .5)	1 (.2 - .5)	1 (.3 - .5)	1 (.3 - .5)	1 (.2 - .5)
2 (1.0 - 1.5)	2 (3.0 - 3.5)	2 (0.5 - 1.0)	2 (3.0 - 3.5)	2 (1.0 - 1.5)	2 (1.0 - 1.5)	2 (1.0 - 1.5)
3 (1.5 - 2.0)	3 (3.5 - 4.0)	3 (1.5 - 2.0)	3 (5.0 - 5.5)		3 (1.5 - 2.0)	3 (2.0 - 3.0)
4 (3.0 - 3.2)	4 (not ident)	4 (3.5 - 4.0)			4 (2.5 - 2.8)	4 (4.0 - 4.5)
		5 (6.5 - 7.0)				5 (5.5 - 6.0)

Table 5.9. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of analyses of method blanks associated with analyses of soils for explosive compounds. No detectable concentrations of indicated explosive analytes were found. Detection limits are given after the < symbol and are in mg/kg (ppm) dry weight units.

Sample ANALYTE/Boring #	MB 6,7,9	MB 3,4,5,11	MB1 12	MB 1,2	MB 8,10
2,4 DNT*	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
TNT	<0.250U	<0.025U	<0.250U	<0.250U	<0.250U
TETRYL	<0.65U	<0.65U	<0.65U	<0.65U	<0.65U
DNB	<0.25U	<0.25U	<0.25U	<0.25U	<0.250U
TNB	<0.250U	<0.250U	<0.250U	<0.250U	<0.250U
RDX	<1.0U	<1.0U	<1.0U	<1.0U	<1.0U
HMX	<2.2U	<2.2U	<2.2U	<2.2U	<2.2U

Note:

Sample ID is as follows - MB - method blank for analyses of samples from the borings indicated.

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

* - Lab reports indicate that 2,4-DNT could not be separated from 2,6-DNT.

Ta. 3.10. Ammunition Burning Ground - NSWC Crane, Indiana, SW. /10. Results of analyses of sampling equipment rinses and associated method blanks for explosive compounds. No detectable concentrations of indicated explosive analytes were found. Detection limits are given after the < symbol and are in mg/l.

Sample ID	RINSE	MB	RINSE	MB	RINSE	MB	RINSE	RINSE	MB
Analyte/Boring	12	12	11	11	10	10	8	6	8,6
2,4 DNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
2,6 DNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TETRYL	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
DNB	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TNB	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
RDX	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
HMX	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U

Sample ID	RINSE	RINSE	RINSE	RINSE	MB
Analyte/Boring	5	4	3	2	5,4,3,2
2,4 DNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
2,6 DNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TNT	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TETRYL	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
DNB	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
TNB	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
RDX	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U
HMX	<0.020U	<0.020U	<0.020U	<0.020U	<0.020U

Note: U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.

Table 5.11. (Page 1 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8240* (volatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	12#1	12#2	12#3	12#4	11#2	11#3	10#2	10#3	10#4	10#5
ClMETH	<0.011U	<0.013U	<0.011U	<0.022U	<0.013U	<0.013U	<0.012U	<0.012U	<0.012U	<0.012U
BrMETH	<0.011U	<0.013U	<0.011U	<0.022U	<0.013U	<0.013U	<0.012U	<0.012U	<0.012U	<0.012U
VnlCl	<0.011U	<0.013U	<0.011U	<0.022U	<0.013U	<0.013U	<0.012U	<0.102U	<0.012U	<0.012U
ClETHA	<0.011U	<0.013U	<0.011U	<0.022U	<0.013U	<0.013U	<0.012U	<0.012U	<0.012U	<0.012U
MeCl	**0.15B**	**0.16B**	**0.14B**	**0.47B**	**0.18B**	**0.10B**	**0.096B**	**0.083B**	**0.057B**	**0.070B**
11DClETE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
11DClETA	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
t-DClETE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
c-DClETE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
CHCl3	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
12DClETA	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
111TCA	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
CCl4	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
BrDClMe	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
12DClPR	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
t13ClPRE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
TCE	<0.0061U	<0.0067U	**0.0023J**	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
DBrClMe	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
c13ClPRE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
112TCA	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
BENZENE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
CHBR3	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
1122TClA	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	**0.0014J**	<0.0059U	<0.0058U	<0.0062U
TEClETE	<0.0061U	**0.0008J**	**0.0013J**	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
TOLUENE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
ClBEN	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
ETBEN	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
ACETONE	**0.084BJ**	**0.13B**	**0.17B**	**0.34B**	**0.15B**	**0.0083BJ**	**0.047BJ**	**0.049BJ**	**0.04BJ**	**0.035BJ**
BUTANO	<0.12U	<0.13U	<0.13U	<0.22U	**0.039J**	**0.012J**	<0.12U	<0.12U	<0.12U	<0.0062U
CS2	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
2HEXANO	<0.061U	<0.067U	<0.063U	<0.011U	<0.063U	<0.063U	<0.058U	<0.059U	<0.058U	<0.062U
4Me2PE	<0.061U	<0.067U	<0.063U	<0.011U	<0.063U	<0.063U	<0.058U	<0.059U	<0.058U	<0.062U
STYRENE	<0.0061U	<0.0067U	<0.063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U
VnACETA	<0.0061U	<0.067U	<0.063U	<0.011U	<0.063U	<0.063U	<0.058U	<0.059U	<0.058U	<0.062U
T-XYLENE	<0.0061U	<0.0067U	<0.0063U	<0.0011U	<0.0063U	<0.0063U	<0.0058U	<0.0059U	<0.0058U	<0.0062U

Note: See page 4 for Table notes.

Table 5.11. (Page 2 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8240* (volatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	09#1	09#2	09#3	08#1	08#2	07#1	07#2	07#3	07#4	06#1	06#2	06#3
ClMETH	<0.012U	<0.011U	<0.011U	<0.010U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
BrMETH	<0.012U	<0.011U	<0.011U	<0.010U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
VnlCl	<0.012U	<0.011U	<0.011U	<0.010U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
ClETHA	<0.012U	<0.011U	<0.011U	<0.010U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U	<0.011U
MeCl	**0.20B**	**0.11B**	**0.096B**	**0.073B**	**0.066B**	**0.11B**	**0.077B**	**0.22B**	**0.12B**	**0.10B**	**0.081B**	**0.015**
11DClETE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
11DClETA	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
t-DClETE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
c-DClETE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
CHCl3	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
12DClETA	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
111TCA	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
CCl4	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
BrDClMe	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
12DClPR	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
t13ClPRE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
TCE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	**0.0029J**	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
DBrClMe	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
c13ClPRE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
112TCA	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
BENZENE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
CHBR3	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
1122TClA	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
TEClETE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
TOLUENE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
ClBEN	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
ETBEN	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
ACETONE	**0.09BJ**	**0.08BJ**	**0.057BJ**	**0.029BJ**	**0.043BJ**	**0.047BJ**	**0.039BJ**	**0.48B**	**0.37B**	**0.034BJ**	**0.028BJ**	**0.089BJ**
BUTANO	<0.12U	<0.11U	<0.11U	<0.10U	<0.11U	<0.11U	<0.12U	<0.28U	<0.11U	<0.11U	<0.11U	**0.002J**
CS2	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
2HEXANO	<0.060U	<0.056U	<0.054U	<0.052U	<0.056U	<0.057U	<0.059U	<0.14U	<0.057U	<0.056U	<0.055U	<0.055U
4Me2PE	<0.060U	<0.056U	<0.054U	<0.052U	<0.056U	<0.057U	<0.059U	<0.14U	<0.057U	<0.056U	<0.055U	<0.055U
STYRENE	<0.006U	<0.0056U	<0.054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U
VnACETA	<0.060U	<0.056U	<0.054U	<0.052U	<0.058U	<0.057U	<0.059U	<0.14U	<0.057U	<0.056U	<0.055U	<0.055U
T-XYLENE	<0.006U	<0.0056U	<0.0054U	<0.0052U	<0.0056U	<0.0057U	<0.0059U	<0.014U	<0.0057U	<0.0056U	<0.0055U	<0.0055U

Note: See page 4 for Table notes.

Table 5.11. (Page 3 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8240* (volatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	06#4	06#5	05#1	05#2	05#3	05#4	04#2	04#3	04#4	03#1	03#2
ClMETH	<0.012U	<0.012U	<0.011U	<0.011U	<0.012U	<0.012U	<0.011U	<0.011U	<0.013U	<0.011U	<0.011U
BrMETH	<0.012U	<0.012U	<0.011U	<0.011U	<0.012U	<0.012U	<0.011U	<0.011U	<0.013U	<0.011U	<0.011U
VnlCl	<0.012U	<0.012U	<0.011U	<0.011U	<0.012U	<0.012U	<0.011U	<0.011U	<0.013U	<0.011U	<0.011U
ClETHA	<0.012U	<0.012U	<0.011U	<0.011U	<0.012U	<0.012U	<0.011U	<0.011U	<0.013U	<0.011U	<0.011U
MeCl	**0.011B**	**0.14B**	**0.23B**	**0.078B**	**0.056B**	**0.16B**	**0.096B**	**0.071B**	**0.067B**	**0.11B**	**0.21B**
11DClETE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
11DClETA	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
t-DClETE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
c-DClETE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
CHCl3	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
12DClETA	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
111TCA	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
CCl4	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
BrDClMe	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
12DClPR	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
t13ClPRE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
TCE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
DBrClMe	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
c13ClPRE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
112TCA	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
BENZENE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
CHBR3	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
1122TClA	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
TECl ETE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
TOLUENE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
ClBEN	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
ETBEN	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
ACETONE	**0.097BJ**	**0.077BJ**	**0.063BJ**	**0.078BJ**	**0.0019BJ**	**0.047BJ**	**0.051BJ**	**0.042BJ**	**0.013BJ**	**0.053BJ**	**0.043BJ**
BUTANO	<0.12U	<0.12U	<0.11U	<0.11U	<0.12U	<0.12U	<0.11U	<0.11U	<0.13U	<0.11U	<0.11U
CS2	<0.0061U	<0.0061U	<0.0053U	<0.0050U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
2HEXANO	<0.061U	<0.061U	<0.053U	<0.057U	<0.060U	<0.060U	<0.053U	<0.053U	<0.063U	<0.057U	<0.057U
4Me2PE	<0.061U	<0.061U	<0.053U	<0.057U	<0.060U	<0.060U	<0.063U	<0.063U	<0.063U	<0.057U	<0.057U
STYRENE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U
VnACETA	<0.0061U	<0.061U	<0.053U	<0.057U	<0.060U	<0.060U	<0.053U	<0.053U	<0.063U	<0.057U	<0.057U
T-XYLENE	<0.0061U	<0.0061U	<0.0053U	<0.0057U	<0.0060U	<0.0060U	<0.0053U	<0.0053U	<0.0063U	<0.0057U	<0.0057U

Note: See page 4 for Table notes.

Table 5.11. (Page 4 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8240* (volatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	02#1	02#2	02#3	02#4	01#1	01#2
ClMETH	<0.011U	<0.012U	<0.011U	<0.013U	<0.011U	<0.011U
BrMETH	<0.011U	<0.012U	<0.011U	<0.013U	<0.011U	<0.011U
VnlCl	<0.011U	<0.012U	<0.011U	<0.013U	<0.011U	<0.011U
ClETHA	<0.011U	<0.012U	<0.011U	<0.013U	<0.011U	<0.011U
MeCl	**0.061B**	**0.35B**	**0.20B**	**0.13B**	**0.12B**	**0.084B**
11DClETE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
11DClETA	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
t-DClETE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
c-DClETE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
CHCl3	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
12DClETA	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
111TCA	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
CCl4	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
BrDClMe	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
12DClPR	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
t13ClPRE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
TCE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
DBrClMe	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
c13ClPRE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
112TCA	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
BENZENE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
CHBR3	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
1122TClA	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
TEClETE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
TOLUENE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
ClBEN	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
ETBEN	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
ACETONE	**0.079BJ**	**0.047BJ**	**0.09BJ**	**0.07BJ**	**0.021BJ**	**0.056BJ**
BUTANO	**0.0032J**	<0.12U	<0.11U	<0.13U	**0.0029J**	<0.11U
CS2	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
2HEXANO	<0.054U	<0.059U	<0.056U	<0.063U	<0.053U	<0.054U
4Me2PE	<0.054U	<0.059U	<0.056U	<0.063U	<0.053U	<0.054U
STYRENE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U
VnACETA	<0.0054U	<0.059U	<0.056U	<0.063U	<0.053U	<0.054U
T-XYLENE	<0.0054U	<0.0059U	<0.0056U	<0.0063U	<0.0053U	<0.0054U

Note: Sample ID is as follows - 12#4, boring 12/sample 4. See Figures 1 and 2.

J - Indicates an estimated value below accurate quantification limits

U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.

B - Indicates analyte is found in the associated blank as well as in the sample.

* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.12. (Page 1 of 2). Ammunition Burning Ground, NSWC Crane, Indiana, SWMU# 03/10. Results of volatile organic* analyses of method blanks associated with soils analyses. Concentrations are mg/kg (ppm) dry weight. Detectable concentrations of organic analyte are shown in bold. Analytes are given as abbreviations; see appendix C for full compound names.

METHOD BLANK	MB1	MB2	MB3	MB4	MB5	MB6	MB1	MB2	MB3	MB1	MB2	MB1
ANALYTE/BORING #	9,7,6	9,7,6	9,7,6	9,7,6	9,7,6	9,7,6	3,4,5,11	3,4,5,11	3,4,5,11	8,10	8,10	1,2
ClMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VnlCl	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
ClETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MeCl	<0.005U	**0.0046J**	**0.0044J**	<0.005U	**0.011**	<0.005U	**0.0067**	**0.0078**	**0.0036J**	**0.0078**	**0.0033J**	**0.009**
11DClETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DClETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DClETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DClETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCl3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DClETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCl4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDClMe	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DClPR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13ClPRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrClMe	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13ClPRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBR3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TClA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	**0.0019J**	<0.005U	<0.005U	<0.005U	**0.0015J**	<0.005U
TEClETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ClBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.011J**	**0.013J**	**0.016J**	**0.025J**	**0.0078J**	**0.019J**	**0.019J**	<0.10U	**0.013J**	**0.021J**	**0.0029J**	**0.0073J**
BUTANO	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U	<0.10U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2HEXANO	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	**0.003J**	<0.050U	**0.0014J**	**0.0010J**	**0.0038J**	**0.0018J**
4Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VnACETA	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-XYLENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: See page 2 for Table notes.

Table 5.12. (Page 2 of 2). Ammunition Burning Ground, NSWC Crane, Indiana, SWMU# 03/10. Results of volatile organic* analyses of method blanks associated with soils analyses. Concentrations are mg/kg (ppm) dry weight. Detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

METHOD BLANK	MB1	MB2
ANALYTE/BORING #	12	12
C1METH	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U
Vn1C1	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U
MeC1	**0.020**	**0.0054**
11DC1ETE	<0.005U	<0.005U
11DC1ETA	<0.005U	<0.005U
t-DC1ETE	<0.005U	<0.005U
c-DC1ETE	<0.005U	<0.005U
CHC13	<0.005U	<0.005U
12DC1ETA	<0.005U	<0.005U
111TCA	<0.005U	<0.005U
CC14	<0.005U	<0.005U
BrDC1Me	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U
TCE	<0.005U	<0.005U
DBrC1Me	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U
112TCA	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U
CHBR3	<0.005U	<0.005U
1122TC1A	<0.005U	**0.0015J**
TEC1ETE	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U
ACETONE	**0.020J**	**0.020J**
BUTANO	<0.10U	<0.10U
CS2	<0.005U	<0.005U
2HEXANO	<0.050U	<0.050U
4Me2PE	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U
VnACETA	<0.050U	<0.050U
T-XYLENE	<0.005U	<0.005U

Note: Method Blank ID is as follows - MB1 2, 1 - method blank #1 associated with analyses of soils from borings 2 and 1

J - Estimated value below the accurate quantitation limit

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.13. (Page 1 of 2). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU# 03/10. Results of volatile organic analyses * of sampling equipment rinses and trip and method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

Sample ID	RINSE	TRIP BLK	MB	RINSE	RINSE	TRIP BLK	MB	RINSE	RINSE	TRIP BLK	MB
Analyte/Boring	12	12	12	11	10	11,10	11,10	8	6	7	8,7,6
CLMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VNLCL	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U	0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MECL	**0.0041BJ**	**0.0023B**	**0.0033J**	**0.0031BJ**	<0.005U	**0.028B**	**0.0036**	**0.0064B**	**0.0053B**	**0.015B**	**0.0033J**
11DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	**0.0049J**	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCL3	**0.0290**	<0.005U	<0.005U	**0.0054J**	<0.005U	<0.005U	0.005U	**0.0019J**	**0.057**	<0.005U	<0.005U
12DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111tCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCL4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1ME	**0.0024J**	<0.005U	<0.005U	<0.005U	<0.0062U	<0.005U	0.005U	<0.005U	<0.0062U	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBr3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112ZTC1A	<0.005U	<0.005U	**0.0015J**	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	**0.0015J**
TECLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.0013BJ**	<0.100U	**0.0029**	<0.100U	**0.023BJ**	0.100U	**0.014J**	**0.0043BJ**	<0.100U	<0.100U	**0.0029J**
BUTANO	**0.0063J**	<0.100U	<0.100U	**0.0073J**	**0.0079J**	0.100U	0.100U	<0.100U	<0.100U	<0.100U	<0.100U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2 HEXANO	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	**0.0014**	<0.050U	<0.050U	<0.005U	**0.0038J**
4 Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U	0.050U	<0.050U	<0.050U	<0.005U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VNACETA	<0.050U	**0.0019J**	0.050U	<0.050U	<0.050U	<0.050U	0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-Xylene	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U	0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: See page 2 for Table notes.

Table 5.13. (Page 2 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of volatile organic analyses * of sampling equipment rinses and trip and method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

Sample ID Analyte/Boring	RINSE 2	RINSE 3	RINSE 4	RINSE 5	MB 2,3,4,5
CLMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
BrMETH	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
VNLCL	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
C1ETHA	<0.010U	<0.010U	<0.010U	<0.010U	<0.010U
MECL	**0.0035B**	**0.0068B**	**0.0024B**	**0.0072B**	**0.0230**
11DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
11DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c-DCLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHCL3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DCLETA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
111tCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CCL4	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BrDC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
12DC1PR	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
t13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TCE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
DBrC1ME	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
c13C1PRE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
112TCA	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
BENZENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
CHBr3	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
1122TC1A	<0.005U	<0.005U	<0.005U	<0.005U	**<0.0012J**
TECLETE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
TOLUENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
C1BEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ETBEN	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
ACETONE	**0.0360J**	**0.0570J**	**0.0032J**	**0.0270J**	0.100U
BUTANO	**0.0043J**	<0.100U	<0.100U	<0.100U	<0.100U
CS2	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
2 HEXANO	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
4 Me2PE	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
STYRENE	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U
VNACETA	<0.050U	<0.050U	<0.050U	<0.050U	<0.050U
T-Xylene	<0.005U	<0.005U	<0.005U	<0.005U	<0.005U

Note: J - Indicates an estimated value below accurate quantification limits
U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Indicates analyte is found in the associated blank as well as in the sample.
* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.14. (Page 1 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Volatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
12#1	unknown compound	5.55		.0066
12#3	unknown compound	6.68		.015
12#4	1,6-heptadiene	7.91	3070539	.012
11#2	methylcyclopentane	7.96	96377	.020
11#3	ethylcyclobutane	7.92	4806615	.017
10#2	unknown Hydrocarbon	6.73		.018
10#3	unknown compound	3.96		.0076
10#5	unknown compound	4.13		.052
	unknown compound	6.70		.011
9#2	methylcyclopentane	7.87	96377	.055
	3,5,5-trimethyl-1-hexene	22.71	4316658	.012
9#3	unknown hydrocarbon	6.68		.0084
8#1	unknown compound	5.94		.0085
	unknown compound	6.92		.0093
	ethylcyclobutane	7.87	4806615	.049
8#2	methylcyclopentane	7.91	96377	.015
7#3	unknown compound	7.88		.018
7#4	2-hexanamine	4.42	5329793	.014
7#2	unknown compound	3.24		.0076
	ethylether	3.58	60297	.0065
	unknown hydrocarbon	4.16		.022
7#1	unknown compound	3.22		.0067
6#2	unknown compound	4.18		.020
	2,4-dimethylpentane	6.64	108087	.006
6#5	unknown compound	4.26		.034
	3,7-dimethyl-1,3,6-octatriene	18.75	3779611	.013
	2,2-dimethyl-3-methylene-bicyclo [2,2.1] heptane	20.1	5794036	.030
5#1	2,4 dimethylpentane	6.03	108087	.0068
	methylcyclopentane	7.92	96377	.031
5#2	unknown compound	7.98		.011
5#3	2-piperedinimethanamine	5.41	22990778	.071
	methylcyclopentane	7.96	96377	.020
5#4	unknown compound	4.24		.032
	unknown compound	5.08	4806615	.017

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers

Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.

* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.14. (Page 2 of 2). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Volatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
4#2	unknown compound	4.96		.0074
	unknown compound	6.75		.049
4#3	3-methylpentane	5.94	96140	.270
	unknown compound	7.35		.015
4#4	unknown compound	4.38		.011
	ethylcyclobutane	7.91	4806615	.011
3#1	methycyclopentane	7.91	96377	.031
3#2	unknown compound	7.84		.012
2#1	2-hexanamine, 4-methyl	1.10	105419	.084
	cyclopropane,propyl	6.18	2415727	.020
	cyclopentane, methyl	8.04	96377	.072
2#2	1h-tetrazole, 5 methyl	7.86	4076362	.028
2#3	2-hexanamine, 4 methyl	1.08	105419	.092
	cyclopropane, (1-methylethyl)	7.87	3638355	.018
2#4	2-hexanamine, 4 methyl	1.11	105419	.180
	cyclopropane, (1-methylethyl)	7.88	3638355	.028
1#1	2-hexanamine, 4 methyl	1.08	105419	.190
	cyclopentane, methyl	7.95	96377	.024
1#2	2-hexanamine, 4 methyl	1.08	105419	.070
	cyclopropane, propyl	7.88	2415727	.016

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers

Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.

* - EPA Method 8240 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.15. (Page 1 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	12#1	12#2	12#3	12#4	11#1	11#2	11#3	11#4	10#1	10#2
PHENOL	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
2C1PHEN	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
2NIPHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
24DMePHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.1U	<1.1U	<1.1U	<1.1U
24DC1PHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
4C13MePH	<2.2U	<2.2U	<2.4U	<2.4U	<2.0U	<2.6U	<2.6U	<2.2U	<2.2U	<2.2U
246TC1PH	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
24DNPH	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
4NPHE	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
2M46DNPH	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
PC1PHE	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
BENZOAC	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
2MEPHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
4MEPHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
245TC1PH	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BZLAL	<2.2U	<2.2U	<2.4U	<2.4U	<2.0U	<2.6U	<2.6U	<2.2U	<2.2U	<2.2U
NNDMEAM	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BC11PrE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
NNDNPAM	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
NITROBEN	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
ISOPHOR	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BC1EtoME	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
26DNTOL	<1.1U	<1.1U	<1.12U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
24DNTOL	<1.1U	<1.1U	**0.01J**	**0.14J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
12DPHYD	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BENZIDI	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
33DC1BEZ	<2.2U	<2.2U	<2.4U	<2.4U	<2.0U	<2.6U	<2.6U	<2.2U	<2.2U	<2.2U
BC1EtE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
13DC1B	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
14DCLB	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
12DC1B	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
HC1ETA	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
124TC1B	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U

Note: See page 8 for Table notes:

Table 5.15. (Page 2 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

ANALYTE/SAMPLE	12#1	12#2	12#3	12#4	11#1	11#2	11#3	11#4	10#1	10#2
NAPHTH	**0.03J**	**0.02J**	**0.07J**	**0.12J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
HC1BU	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
HC1CYPD	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
2C1NAPH	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
ACENAY	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
DMePHTH	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
ACENAP	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
FLUORE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
DEtPHTH	**0.04J**	**0.07J**	**0.79J**	**0.06J**	**0.05J**	**0.03J**	**0.03J**	**0.03J**	<1.1U	<1.1U
4C1PHPHE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
NNDPHAM	**0.06J**	<1.1U	**0.19J**	**0.16J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
4BrPHET	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
HC1BEN	**0.19J**	**0.22J**	**0.24J**	**0.16J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
PHENAN	**0.07J**	**0.04J**	**0.11J**	**0.15J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
ANTRAC	**0.03J**	**0.06J**	**0.06J**	**0.05J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
DBuPHTH	**0.11J**	**0.81BJ**	**0.46BJ**	**0.27J**	**0.15BJ**	**0.14BJ**	**0.14BJ**	**0.13BJ**	**0.43J**	**0.24J**
FLANTHE	<1.1U	<1.1U	**0.20J**	**0.08J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
PYRENE	<1.1U	<1.1U	**0.20J**	**0.12J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BuBePHTH	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
CHRYSE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BAANTHR	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
B2EHPH	**0.18J**	**0.28BJ**	**0.18BJ**	**1.60B**	**0.21J**	**0.10BJ**	**0.06BJ**	**0.10BJ**	**0.87BJ**	**1.10B**
DNOcPHT	<1.1U	<1.1U	<1.2U	**0.08J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BBFLANT	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BKFLANT	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
BAPYRE	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
I123PYR	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
B-GHI-PY	<1.1U	<1.1U	<1.2U	<1.2U	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
ANILINE	<2.2U	<2.2U	<2.4U	<2.4U	<2.0U	<2.6U	<2.6U	<2.2U	<2.2U	<2.2U
4C1ANIL	<2.2U	<2.2U	<2.4U	<2.4U	<2.0U	<2.6U	<2.6U	<2.2U	<2.2U	<2.2U
DBENZOFU	<1.1U	<1.1U	<1.2U	**0.03J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
2MeNAPH	**0.03J**	**0.02J**	**0.07J**	**0.12J**	<1.0U	<1.3U	<1.3U	<1.1U	<1.1U	<1.1U
2NANIL	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
3NANIL	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U
4NANIL	<5.5U	<5.5U	<6.0U	<6.0U	<5.0U	<6.5U	<6.5U	<5.5U	<5.5U	<5.5U

Note: See page 8 for Table notes:

Table 5.15. (Page 3 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see Appendix C for full compound names.

ANALYTE/SAMPLE	10#3	10#4	10#5	09#1	09#2	09#3	08#1	08#2	07#1	07#2	07#3	07#4
PHENOL	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
2C1PHEN	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
2NIPHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
24DMePHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
24DC1PHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
4C13MePH	<2.4U	<2.4U	<2.4U	<2.4U	<2.0U	<2.2U	<2.2U	<2.2U	<2.2U	<2.4U	<2.0U	<2.0U
246TC1PH	<1.2U	<1.2U	<1.2U	<1.2U	<2.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
24DNPH	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
4NPHE	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
2M46DNPH	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
PC1PHE	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
BENZOAC	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
2MEPHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
4MEPHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
245TC1PH	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BZLAL	<2.4U	<2.4U	<2.4U	<2.4U	<2.0U	<2.2U	<2.2U	<2.2U	<2.2U	<2.4U	<2.0U	<2.0U
NNDMEAM	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	**0.05J**	<1.2U	<0.98U	<1.0U
BC1IPrE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
NNDNPAM	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
NITROBEN	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
ISOPHOR	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BC1EtoME	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
26DNTOL	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
24DNTOL	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	**0.73J**	<1.2U	**0.23J**	<1.0U
12DPHYD	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BENZIDI	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
33DC1BEZ	<2.4U	<2.4U	<2.4U	<2.4U	<2.0U	<2.2U	<2.2U	<2.2U	<2.2U	<2.4U	<2.0U	<2.0U
BC1EtE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
13DC1B	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
14DCLB	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
12DC1B	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
HC1ETA	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
124TC1B	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U

Note: See page 8 for Table notes:

Table 5.15. (Page 4 of 8). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

ANALYTE/SAMPLE	10#3	10#4	10#5	09#1	09#2	09#3	08#1	08#2	07#1	07#2	07#3	07#4
NAPHTH	<1.2U	<1.2U	<1.2U	**0.14J**	**0.02J**	<1.1U	<1.1U	<1.1U	**0.02J**	**0.05J**	**0.14J**	**0.04J**
HC1BU	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
HC1CYPD	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
2C1NAPH	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
ACENAY	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
DMePHTH	<1.2U	<1.2U	<1.2U	**0.10J**	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
ACENAP	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
FLUORE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
DEtPHTH	<1.2U	<1.2U	<1.2U	**1.60B**	**0.35BJ**	**0.37BJ**	<1.1U	<1.1U	**0.38BJ**	**0.32BJ**	**0.22B**	**0.21BJ**
4C1PHPHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
NNDPHAM	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	**0.20J**	<1.0U
4BrPHET	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
HC1BEN	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	**0.26J**	**0.19J**	**0.11J**	<1.0U
PHENAN	<1.2U	<1.2U	<1.2U	**0.17J**	**0.09J**	<1.1U	**0.06J**	**0.07J**	**0.05J**	**0.06J**	**0.35J**	**0.09J**
ANTRAC	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	**0.03J**	**0.04J**	**0.05J**	**0.46J**
DBuPHTH	<1.2U	<1.2U	**0.13BJ**	<1.2U	**0.11BJ**	**0.06BJ**	**0.21J**	<1.1U	**0.12BJ**	**0.11BJ**	**0.24BJ**	**0.09BJ**
FLANTHE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	**0.16J**	<1.0U
PYRENE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	**0.29J**	<1.0U
BuBePHTH	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
CHRYSE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BAANTHR	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
B2EHPH	**0.87BJ**	**0.16BJ**	**1.10BJ**	**0.32BJ**	**0.37BJ**	**2.40B**	**0.28BJ**	**0.14BJ**	**2.70B**	**0.16BJ**	**0.24BJ**	**0.18BJ**
DNOcPHT	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BBFLANT	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BKFLANT	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
BAPYRE	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
I123PYR	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
B-GHI-PY	<1.2U	<1.2U	<1.2U	<1.2U	<1.0U	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	<0.98U	<1.0U
ANILINE	<2.4U	<2.4U	<2.4U	<2.4U	<2.0U	<2.2U	<2.2U	<2.2U	<2.2U	<2.4U	<2.0U	<2.0U
4C1ANIL	<2.4U	<2.4U	<2.4U	<2.4U	<2.0U	<2.2U	<2.2U	<2.2U	<2.2U	<2.4U	<2.0U	<2.0U
DBENZOFU	<1.2U	<1.2U	<1.2U	**0.03J**	**0.02J**	<1.1U	<1.1U	<1.1U	<1.1U	<1.2U	**0.04J**	<1.0U
2MeNAPH	<1.2U	<1.2U	<1.2U	**0.06J**	**0.05J**	<1.1U	<1.1U	<1.1U	<1.1U	**0.04J**	**0.20J**	**0.07J**
2NANIL	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
3NANIL	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U
4NANIL	<6.0U	<6.0U	<6.0U	<6.0U	<5.0U	<5.5U	<5.5U	<5.5U	<5.5U	<6.0U	<4.9U	<5.0U

Note: See page 8 for Table notes:

Table 5.15. (Page 5 of 8). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see Appendix C for full compound names.

ANALYTE/SAMPLE	06#1	06#2	06#3	06#4	06#5	05#1	05#2	05#3	04#1	04#2	04#3	04#4
PHENOL	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
2ClPHEN	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
2NIPHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
24DMePHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
24DClPHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
4Cl3MePH	<2.0U	<1.9U	<2.2U	<2.2U	<2.4U	<2.0U	<2.2U	<2.2U	<2.4U	<2.2U	<2.4U	<2.4U
246TClPH	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
24DNPH	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
4NPHE	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
2M46DNPH	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
PClPHE	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
BENZOAC	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
2MEPHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
4MEPHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
245TClPH	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BZLAL	<2.0U	<1.9U	<2.2U	<2.2U	<2.4U	<2.0U	<2.2U	<2.2U	<2.4U	<2.2U	<2.4U	<2.4U
NNDMEAM	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BClIPrE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
NNDNPAM	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
NITROBEN	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
ISOPHOR	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BClEtoME	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
26DNTOL	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	**0.10J**	<1.1U	**0.61J**	<1.2U	<1.1U	<1.2U	<1.2U
24DNTOL	**1.20**	<0.95U	<1.1U	<1.1U	<1.2U	**1.00**	**0.17J**	**7.80**	<1.2U	<1.1U	<1.2U	<1.2U
12DPHYD	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BENZIDI	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
33DClBEZ	<2.0U	<1.9U	<2.2U	<2.2U	<2.4U	<2.0U	<2.2U	<2.2U	<2.4U	<2.2U	<2.4U	<2.4U
BClEtE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
13DClB	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
14DCLB	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
12DClB	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
HClETA	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
124TClB	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U

Note: See page 8 for Table notes:

Table 5.15. (Page 6 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

ANALYTE/SAMPLE	06#1	06#2	06#3	06#4	06#5	05#1	05#2	05#3	04#1	04#2	04#3	04#4
NAPHTH	**0.02J**	**0.03J**	<1.1U	**0.20J**	**0.05J**	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
HC1BU	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
HC1CYPD	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
2C1NAPH	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
ACENAY	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
DMePHTH	<1.0U	<0.95U	<1.1U	**0.07J**	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
ACENAP	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
FLUORE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
DEtPHTH	**0.04J**	**0.04J**	**0.03J**	**0.04J**	<1.2U	<1.0U	<1.1U	**0.05J**	<1.2U	<1.1U	<1.2U	<1.2U
4C1PHPHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
NNDPHAM	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	**0.05J**	<1.1U	**0.93J**	<1.2U	<1.1U	<1.2U	<1.2U
4BrPHET	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
HC1BEN	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
PHENAN	**0.04J**	**0.04J**	<1.1U	<1.1U	<1.2U	<1.0U	**0.03J**	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
ANTRAC	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
DBuPHTH	**2.2B**	**0.08J**	**0.08J**	**0.07J**	**0.07J**	**0.52J**	**0.13BJ**	**0.22BJ**	**0.07BJ**	**0.09BJ**	<1.2U	<1.2U
FLANTHE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
PYRENE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BuBePHTH	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
CHRYSE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BAANTHR	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
B2EHPH	**0.08BJ**	**0.07BJ**	**0.09BJ**	**0.12BJ**	**0.13BJ**	**0.18BJ**	**0.07BJ**	**0.27BJ**	**1.00BJ**	**0.38BJ**	**1.20B**	**0.24BJ**
DNOcPHT	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BBFLANT	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BKFLANT	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
BAPYRE	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
I123PYR	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
B-GHI-PY	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
ANILINE	<2.0U	<1.9U	<2.2U	<2.2U	<2.4U	<2.0U	<2.2U	<2.2U	<2.4U	<2.2U	<2.4U	<2.4U
4C1ANIL	<2.0U	<1.9U	<2.2U	<2.2U	<2.4U	<2.0U	<2.2U	<2.2U	<2.4U	<2.2U	<2.4U	<2.4U
DBENZOFU	<1.0U	<0.95U	<1.1U	<1.1U	<1.2U	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
2MeNAPH	**0.03J**	**0.05J**	<1.1U	**0.02J**	**0.06J**	<1.0U	<1.1U	<1.1U	<1.2U	<1.1U	<1.2U	<1.2U
2NANIL	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
3NANIL	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U
4NANIL	<5.0U	<4.8U	<5.5U	<5.5U	<6.0U	<5.0U	<5.5U	<5.5U	<6.0U	<5.5U	<6.0U	<6.0U

Note: See page 8 for Table notes:

Table 5.15. (Page 7 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see Appendix C for full compound names.

ANALYTE/SAMPLE	03#1	03#2	03#3	02#1	02#2	02#3	02#4	01#1	01#2
PHENOL	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
2C1PHEN	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
2NIPHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
24DMePHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
24DC1PHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
4C13MePH	<2.6U	<2.2U	<2.4U	<2.2U	<1.7U	<2.0U	<1.6U	<1.6U	<1.6U
246TC1PH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
24DNPH	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
4NPHE	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
2M46DNPH	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
PC1PHE	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
BENZOAC	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
2MEPHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
4MEPHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
245TC1PH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BZLAL	<2.6U	<2.2U	<2.4U	<2.2U	<1.7U	<2.0U	<1.6U	<1.6U	<1.6U
NNDMEAM	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BC1IPrE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
NNDNPAM	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
NITROBEN	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
ISOPHOR	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BC1EtoME	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
26DNTOL	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
24DNTOL	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
12DPHYD	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BENZIDI	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
33DC1BEZ	<2.6U	<2.2U	<2.4U	<2.2U	<1.7U	<2.0U	<1.6U	<1.6U	<1.6U
BC1EtE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
13DC1B	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
14DCLB	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
12DC1B	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
HC1ETA	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
124TC1B	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U

Note: See page 8 for Table notes:

Table 5.15. (Page 8 of 8). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of EPA Method 8270 * (semivolatile organics) soil analyses. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

ANALYTE/SAMPLE	03#1	03#2	03#3	02#1	02#2	02#3	02#4	01#1	01#2
NAPHTH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
HC1BU	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
HC1CYPD	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
2C1NAPH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
ACENAY	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
DMePHTH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
ACENAP	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
FLUORE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
DEtPHTH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
4C1PHPHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
NNDPHAM	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
4BrPHET	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
HC1BEN	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
PHENAN	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
ANTRAC	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
DBuPHTH	<1.3U	<1.1U	<1.2U	**0.19BJ**	**0.20BJ**	**0.21BJ**	**0.16BJ**	**0.16BJ**	**0.20BJ**
FLANTHE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
PYRENE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BuBePHTH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
CHRYSE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BAANTHR	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
B2EHPH	**0.13BJ**	**0.97BJ**	**0.43BJ**	**1.1B**	**0.52BJ**	**0.34BJ**	**0.25BJ**	**0.29J**	**0.86B**
DNOcPHT	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BBFLANT	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BKFLANT	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
BAPYRE	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
I123PYR	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
B-GHI-PY	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
ANILINE	<2.6U	<2.2U	<2.4U	<2.2U	<1.7U	<2.0U	<1.6U	<1.6U	<1.6U
4C1ANIL	<2.6U	<2.2U	<2.4U	<2.2U	<1.7U	<2.0U	<1.6U	<1.6U	<1.6U
DBENZOFU	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
2MeNAPH	<1.3U	<1.1U	<1.2U	<1.1U	<0.87U	<1.0U	<0.79U	<0.79U	<0.81U
2NANIL	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
3NANIL	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U
4NANIL	<6.5U	<5.5U	<6.0U	<5.5U	<4.4U	<5.0U	<4.0U	<4.0U	<4.0U

Note: Sample ID is as follows - 12#4, boring 12/sample 4. See Figures 1 and 2.

J - Estimated value below accurate quantitation limits

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

B - Analyte is found in the associated blank as well as in the sample.

* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.16. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU 03/10. Summary of semivolatile organic analytes (EPA Method 8270 compounds) found in soil analyses. Semivolatile analytes also found in method blanks are not included. A (J) is indicated after the compound name where the analyte was detected at concentrations below accurate quantitation limits. Analyte concentrations greater than 1 mg/kg (ppm) are shown, all others were less than 1 ppm.

Boring 12	Boring 11	Boring 9	Boring 8	Boring 7
2,4-Dinitrotoluene (J)	Diethyl phthalate (J)	Napthalene (J)	Phenanthrene (J)	N-Nitrosodimethylamine (J)
Napthalene (J)		Dimethyl phthalate (J)		2,4-Dinitrotoluene (J)
Diethyl phthalate (J)		Phenanthrene (J)		Napthalene (J)
N-Nitrosodiphenyl amine (J)		Dibenzofuran (J)		N-Nitrosodiphenyl amine (J)
Hexachlorobenzene (J)		2-Methylnaphthalene (J)		Hexachlorobenzene (J)
Phenanthrene (J)				Phenanthrene (J)
Anthracene (J)				Anthracene (J)
Fluoranthene (J)				Fluoranthene (J)
Pyrene (J)				Pyrene (J)
Di-N-Octylphthalate (J)				Dibenzofuran (J)
Dibenzofuran (J)				2-Methylnaphthalene (J)
2-Methylnaphthalene (J)				

Boring 6	Boring 5
2,4-Dinitrotoluene (7.80 mg/kg)	2,4-Dinitrotoluene (1.20 mg/kg)
Napthalene (J)	2,6-Dinitrotoluene (J)
Dimethyl phthalate (J)	Diethyl phthalate (J)
Phenanthrene (J)	N-Nitrosodiphenyl amine (J)
2-Methylnaphthalene (J)	Phenanthrene (J)

Borings with No Detectable Semivolatile Analytes

Boring 10
Boring 4
Boring 3
Boring 2
Boring 1

Table 5.17. (Page 1 of 4) Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Semivolatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
12#1	tetrachloroethene	4.35	184	1.20
	unknown compound	4.94		41.00
	unknown compound	6.44		2.10
	unknown compound	7.11		1.30
	2-methylpentanone	7.39	565695	1.10
	1-(3-ethyloxiranyl) ethanone	7.70	17257817	2.80
	unknown compound	7.96		3.40
	3-hexen-2-one		763939	7.70
12#2	unknown compound	4.92		37.00
	not legible on data sheet	6.52	5076200	1.20
	2,5-dimethyl-1,5-heptadiene-3,4-dial	7.06	22607165	1.30
	unknown compound	7.65		2.90
	unknown compound	7.93		3.50
	3-hexen-2-one	8.16	763939	8.30
12#3	unknown compound	4.81		23.00
	unknown compound	6.42		2.90
	2,3,3,3-tetramethylpentane	7.07	16747389	1.60
	1-(3-ethyloxiranyl) ethanone	7.68	17257817	3.50
	unknown compound	7.94		4.20
	3-hexen-2-one	8.17	763939	9.90
	tetradecanoic acid	29.76	544638	2.20
12#4	unknown compound	5.50		30.00
	3-hexen-2-one	8.18	763939	2.40
11#1	unknown compound	4.99		31.00
	unknown compound	6.51		2.70
	2,3,3,4-tetramethylpentane	7.20	16747389	1.20
	1-(3-ethyloxiranyl) ethanone	7.80	17257817	2.70
	3-ethyl-2,4-dimethylpentane	8.06	1068877	3.20
	bromocyclohexane	8.29	108850	7.50
11#2	unknown compound	5.13		37.00
	unknown compound	6.73		2.60
	1-(3-ethyloxiranyl) ethanone	7.97	17257817	1.70
	3-ethyl-3-methylpentane	8.23	1067089	1.80
	3-hexen-2-one	8.46	763939	5.00
11#3	unknown compound	5.40		50.00
	3-hexen-2-one	8.44	763939	2.60
	sulfur, mol (5g)	30.53	10544500	1.40
11#4	unknown compound	5.34		23.00
	dicyclohexylpropanedinitrite	8.48	74764286	2.10
10#1	unknown compound	5.25		14.00
	bromocyclohexane	8.45	108850	2.20
10#2	unknown compound	4.46		1.70
	unknown compound	7.31		1.30
	2,3,3,4-tetramethylpentane	7.90	16747389	2.70
	3-ethyl-3-methylpentane	8.16	1067089	3.30
	bromocyclohexane	8.41	108850	8.50

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.17. (Page 2 of 4) Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Semivolatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
10#3	unknown compound	5.28		18.00
	bromocyclohexane	8.42	108850	2.30
10#4	2-methoxy-1 propanol	5.50	1589475	41.00
	1-(3-ethyloxiranyl) ethanone	7.88	17257817	2.60
	3-ethyl-3-methylpentane	8.14	1067089	3.10
	3-hexen-2-one	8.37	763939	7.50
10#5	unknown compound	5.05		42.00
	2,3,3,4-tetramethylpentane	7.31	16747389	2.00
	1-(3-ethyloxiranyl) ethanone	7.92	17257817	4.60
	2,3,3,4-tetramethylpentane	8.18	16747389	5.50
	3-hexen-2-one	8.41	763939	14.00
	cyclohexanecarboxylic acid, ethenyl ester	9.00	4840760	1.40
9#1	unknown compound	4.97		38.00
	4-methyl-4-penten-2-one	6.49	3744023	2.10
	1-(3-ethyloxiranyl) ethanone	7.77	17257817	2.10
	unknown hydrocarbon	8.03		2.30
	3-hexen-2-one	8.26	763939	6.40
9#2	unknown compound	4.94		34.00
	1-(3-ethyloxiranyl) ethanone	7.69	17257817	1.40
	2,3,3,4-tetramethylpentane	7.93	16747389	1.60
	3-hexen-2-one	8.16	763939	4.80
9#3	unknown compound	5.04		18.00
	bromocyclohexane	8.18	108850	2.20
8#1	unknown compound	5.17		10.00
	bromocyclohexane	8.46	108850	2.20
8#2	unknown compound	5.07		40.00
	2-methyl-2-pentyloxirane	7.32	53907758	1.70
	1-(3-ethyloxiranyl) ethanone	7.90	17257817	4.00
	unknown hydrocarbon	8.20		4.70
	3-hexen-2-one	8.43	763939	11.00
7#1	unknown compound	5.00		23.00
	dicyclohexylpropanedinitrite	8.16	74764286	2.10
	TNT	24.25		exceeded range
7#2	unknown compound	5.04		20.00
	3-hexen-2-one	8.18	763939	2.20
	2,4,6-trinitrotoluene	23.92	118967	**330 J**
7#3	unknown compound	5.00		35.00
	2,3,3,4-tetramethylpentane	7.70	16747389	1.40
	unknown compound	7.94		1.60
	dimethyl-1H-1,2,4-triazole	8.17	6086211	4.40
7#4	unknown compound	5.00		32.00
	3-hexen-2-one	8.15	763939	2.00
	TNT	23.93		**240 J**
6#1	unknown compound	4.88		37.00
	unknown compound	7.63		1.90
	unknown compound	7.89		2.10

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.17. (Page 3 of 4) Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Semivolatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
6#1	3-hexen-2-one	8.10	763939	4.60
6#2	unknown compound	4.97		17.00
	3-hexen-2-one	8.15	763939	1.90
6#3	unknown compound	4.92		32.00
	2,3,3,4-tetramethylpentane	7.12	16747389	1.40
	unknown compound	7.72		3.20
	unknown compound	8.00		3.80
	3-hexen-2-one	8.23	763939	9.50
6#4	unknown compound	4.97		31.00
	1,3-dioxane	6.45	505226	1.90
	2,3,3,4-tetramethylpentane	7.70	16747389	2.00
	unknown compound	7.97		2.40
	3-hexen-2-one	8.20	763939	5.90
6#5	unknown compound	5.01		44.00
	3-hexen-2-one	8.10	763939	2.50
5#1	3-ethylhexane	4.53	619998	1.30
	unknown compound	5.02		35.00
	unknown compound	5.12		9.40
	4-methyl-4-penten-2-one	6.66	3744023	2.20
	hexylisopropylether	7.36	18636652	1.60
	1-bethyloxiranyl ethanone	8.23	17257817	4.60
	3,3-dietroxy-1-propene	7.97	3054953	3.90
	bromocyclohexane	8.46	108850	10.00
	unknown compound	9.05		1.10
5#2	unknown compound	5.16		18.00
	3-hexen-2-one	8.30	763939	2.20
5#3	unknown compound	5.08		14.00
	3-hexen-2-one	8.29	763939	2.30
	TNT	24.12		520 J
4#1	unknown compound	5.13		33.00
	unknown compound	8.02		2.80
	2,3,3,4-tetramethylpentane	8.28	16747389	3.10
	3-hexen-2-one	8.51	763939	6.80
4#2	unknown compound	5.15		37.00
	unknown compound	7.98		2.30
	3-ethyl-3-methylpentane	8.25	1067089	2.50
	bromocyclohexane	8.48	108850	5.40
4#3	unknown compound	5.07		15.00
	bromocyclohexane	8.44	108850	2.40
4#4	1-cyclopentylethanone	4.57	6004600	1.80
	unknown compound	5.04		42.00
	hexylisopropylether	7.38	18636652	2.10
	1-(3-ethyloxiranyl) ethanone	7.99	17257817	5.30
	1-(3-ethyloxiranyl) ethanone	8.23	17257817	5.90
	bromocyclohexane	8.48	108850	13.00
	3-hexen-2-one	9.05	763939	1.30
3#1	unknown compound	5.03		46.00

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.17. (Page 4 of 4) Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Semivolatile organic compounds* tentatively identified from soil samples. Estimated concentrations are mg/kg (ppm) dry weight.

Sample #	Compound	RT	CAS No	Est. Conc. (mg/kg)
3#1	unknown compound	6.60		3.00
	2-methyl-3 propyloxirane	7.93	6124910	3.00
	2,3,3,4-tetramethylpentane	8.19	16747389	3.40
	unknown compound	8.42		8.10
3#2	unknown compound	5.14		12.00
	bromocyclohexane	8.44	108850	1.80
3#3	unknown compound	5.17		24.00
	3-hexen-2-one	8.42	763939	2.30
2#1	unknown compound	5.14		11.00
	2,2-dimethylpentanal	8.21	14250885	1.10
	3-hexen-2-one	8.46	763939	2.00
2#2	unknown compound	5.08		5.20
	unknown compound	8.24		1.00
	3-hexen-2-one	8.48	763939	1.60
2#3	unknown compound	5.15		12.00
	2,2-dimethylpentanal	8.24	14250885	1.20
	3-hexen-2-one	8.49	763939	1.90
2#4	unknown compound	5.10		5.60
	unknown compound	8.24		0.91
	3-hexen-2-one	8.49	763939	1.50
1#1	unknown compound	5.02		5.10
	unknown compound	8.21		0.91
	3-hexen-2-one	8.44	763939	1.50
1#2	unknown compound	5.09		7.70
	2,2-dimethylpentanal	8.18	14250885	0.89
	3-hexen-2-one	8.42	763939	1.50

Note: RT - Retention Time; CAS No - Chemical Abstract Service Registry numbers
Sample Number - 12#4 Boring 12/sample 4. See Figures 5.1 and 5.2.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.18. (Page 1 of 2). Ammunition Burning Ground, NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic* analyses of method blanks associated with soils analyses. Concentrations are mg/kg (ppm) dry weight. Detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

METHOD BLANK	MB1	MB2	MB3	MB4	MB1	MB2	MB1	MB1	MB1	MB2
ANALYTE/BORING #	9,7,6	9,7,6	9,7,6	9,7,6	3,4,5,11	3,4,5,11	10,8	2,1	12	12
PHENOL	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
2C1PHEN	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
2N1PHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
24DMePHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
24DC1PHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
4C13MePH	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U
246TC1PH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
24DNPH	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
4NPHE	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
2M46DNPH	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
PC1PHE	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
BENZOAC	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
2MEPHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
4MEPHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
245TC1PH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BZLAL	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U
NNDMEAM	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BC1IPrE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
NNDNPAM	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
NITROBEN	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
ISOPHOR	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BC1EtoME	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
26DNTOL	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
24DNTOL	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
12DPHYD	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BENZIDI	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
33DC1BEZ	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U
BC1EtE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
13DC1B	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
14DCLB	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
12DC1B	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
HC1ETA	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
124TC1B	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
NAPHTH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
HC1BU	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U

Note: See page 2 for Table notes.

Table 5.18. (Page 2 of 2). Ammunition Burning Ground, NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic* analyses of method blanks associated with soils analyses. Concentrations are mg/kg (ppm) dry weight. Detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see appendix C for full compound names.

METHOD BLANK	MB1	MB2	MB3	MB4	MB1	MB2	MB1	MB1	MB1	MB2
ANALYTE/BORING #	9,7,6	9,7,6	9,7,6	9,7,6	3,4,5,11	3,4,5,11	10,8	2,1	12	12
HC1CYPD	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
2C1NAPH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
ACENAY	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
DMePHTH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
ACENAP	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
FLUORE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
DEtPHTH	**0.52J**	**0.72**	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
4C1PHPHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
NNDPHAM	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
4BrPHET	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
HC1BEN	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
PHENAN	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
ANTRAC	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
DBuPHTH	**0.06J**	<0.66U	<0.66U	**0.18J**	**0.01J**	**0.08J**	<0.66U	**0.21J**	<0.66U	**0.18J**
FLANTHE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
PYRENE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BuBePHTH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
CHRYSE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BAANTHR	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
B2EHPH	**0.13J**	**0.03J**	**0.04J**	**0.02J**	**0.06J**	**0.06J**	**0.06J**	**0.06J**	**0.04J**	**0.02J**
DNOcPHT	**0.03J**	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BBFLANT	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BKFLANT	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
BAPYRE	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
I123PYR	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
B-GHI-PY	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
ANILINE	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U
4C1ANIL	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U	<1.3U
DBENZOFU	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
2MeNAPH	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U
2NANIL	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
3NANIL	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U
4NANIL	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U	<3.3U

Note: Method Blank ID is as follows - MB1 2, 1 - method blank #1 associated with analyses of soils from borings 2 and 1

J - Estimated value below accurate quantitation limits

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.19. (Page 1 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic analyses * of sampling equipment rinses and associated method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations; see appendix C for full compound names.

Sample ID	RINSE	MB	RINSE	MB	RINSE	MB	RINSE	RINSE	MB
Analyte/Boring	12	12	11	11	10	10	8	6	8,6
PHENOL	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
2C1PHENOL	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
2NIPHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
24DMePHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
24DC1PHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
4C13MePHE	0.0190U	0.020U	0.0190U	0.020U	0.0240U	0.020U	0.0190U	0.0190U	0.02U
246TC1PH	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
24DNPH	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
4NPHE	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
2M46DNPH	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
PC1PHE	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
BENZOAC	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
2MEPHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
4MEPHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
245TC1PH	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
BZLAL	0.0190U	0.020U	0.0190U	0.020U	0.0240U	0.020U	0.0190U	0.0190U	0.02U
NNDMEAM	0.0096U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
BC1IPRE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
NNDNPAM	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
NITROBEN	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
ISOPHOR	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
BC1EtoME	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
26DNTOL	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
24DNTOL	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
12DPHYD	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
BENZIDI	0.0480U	0.050U	0.0480U	0.050U	0.0600U	0.050U	0.0480U	0.0480U	0.05U
33DC1BEZ	0.0190U	0.020U	0.0190U	0.020U	0.0240U	0.020U	0.0190U	0.0190U	0.02U
BC1ETE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
13DC1B	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
14DC1B	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
12DC1B	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
HC1ETA12	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
124TC1B	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U

Note: See page 4 for Table notes.

Table 5.19. (Page 2 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic analyses * of sampling equipment rinses and associated method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see appendix C for full compound names.

Sample ID	RINSE	MB	RINSE	MB	RINSE	MB	RINSE	RINSE	MB
Analyte/Boring	12	12	11	11	10	10	8	6	8,6
NAPHTH	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
HClBu	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
HClCYPD	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
2ClNAPH	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
ACENAY	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
DMePHTH	**0.0013BJ**	**0.003J**	**0.0031BJ**	**0.003J**	0.0120U	**0.003J**	0.0096U	0.0097U	0.01U
ACENAP	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
FLUORE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
DEtPHTH	**0.0250B**	**0.035**	**0.0400B**	**0.035**	**0.0490B**	**0.035**	**0.034B**	**0.029B**	**0.035**
4ClPHPHE	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
NNDPHAM	0.0097U	0.010U	0.0096U	0.010U	0.0120U	0.010U	0.0096U	0.0097U	0.01U
4BrPHET	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
HCLBEN	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
PHENAN	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
ANTRAC	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
DBuPHTH	**0.00097BJ**	**0.00096J**	**0.0025BJ**	**0.0010J**	**0.0016BJ**	**0.0096J**	**0.0012BJ**	**0.0011BJ**	**0.0096J**
FLANTHE	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
PYRENE	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
BuBePHTH	0.0097U	0.0100U	**0.0025J**	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
CHRYSE	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
BAANTHR	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
B2EHPH	**0.0015J**	0.0100U	0.0096U	0.0100U	0.0140U	0.0100U	**0.013**	**0.0027J**	0.0100U
DNOcPHT	**0.0014J**	0.0100U	0.0096U	0.0100U	**0.0053J**	0.0100U	0.0096U	0.0097U	0.0100U
BBFLANT	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
BKFLANT	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
BAPYRE	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
I123PYR	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
DBAHANT	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
B-GHI-PYR	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
ANILINE	0.0190U	0.0200U	0.0190U	0.0200U	0.0240U	0.0200U	0.0190U	0.0190U	0.0200U
4CLANIL	0.0190U	0.0200U	0.0190U	0.0200U	0.0240U	0.0200U	0.0190U	0.0190U	0.0200U
DBENZOFOU	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
2MeNAPH	0.0097U	0.0100U	0.0096U	0.0100U	0.0120U	0.0100U	0.0096U	0.0097U	0.0100U
2NANIL	0.0480U	0.0500U	0.0480U	0.0500U	0.0600U	0.0500U	0.0480U	0.0480U	0.0500U
3NANIL	0.0480U	0.0500U	0.0480U	0.0500U	0.0600U	0.0500U	0.0480U	0.0480U	0.0500U
4NANIL	0.0480U	0.0500U	0.0480U	0.0500U	0.0600U	0.0500U	0.0480U	0.0480U	0.0500U

Note: See page 4 for Table notes.

Table 5.19. (Page 3 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic analyses * of sampling equipment rinses and associated method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see appendix C for full compound names.

Sample ID	RINSE	RINSE	RINSE	RINSE	MB
Analyte/Boring	5	4	3	2	5,4,3,2
PHENOL	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
2C1PHENOL	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
2NIPHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
24DMePHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
24DC1PHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
4C13MePHE	0.0260U	0.0220U	0.0220U	0.0220U	0.0200U
246TC1PH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
24DNPH	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
4NPHE	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
2M46DNPH	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
PC1PHE	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
BENZOAC	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
2MEPHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
4MEPHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
245TC1PH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BZLAL	0.0260U	0.0220U	0.0220U	0.0220U	0.0200U
NNDMEAM	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BC1IPRE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
NNDNPAM	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
NITROBEN	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
ISOPHOR	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BC1EtoME	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
26DNTOL	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
24DNTOL	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
12DPHYD	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BENZIDI	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
33DC1BEZ	0.0260U	0.0220U	0.0220U	0.0220U	0.0200U
BC1ETE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
13DC1B	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
14DC1B	**0.0008J**	**0.0006J**	**0.0007J**	**0.0006J**	0.0100U
12DC1B	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
HC1ETA12	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
124TC1B	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U

Note: See page 4 for Table notes.

Table 5.19. (Page 4 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of semivolatile organic analyses * of sampling equipment rinses and associated method banks. Concentrations are mg/l (ppm). Samples with detectable concentrations of organic analyte are shown in **bold**. Analytes are given as abbreviations: see appendix C for full compound names.

Sample ID	RINSE	RINSE	RINSE	RINSE	MB
Analyte/Boring	5	4	3	2	5,4,3,2
NAPHTH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
HC1Bu	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
HC1CYPD	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
2C1NAPH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
ACENAY	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
DMePHTH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
ACENAP	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
FLUORE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
DEtPHTH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
4C1PHPHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
NNDPHAM	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
4BrPHET	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
HCLBEN	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
PHENAN	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
ANTRAC	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
DBuPHTH	0.0130U	**0.00068J**	0.0110U	**0.0013BJ**	**0.0010J**
FLANTHE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
PYRENE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BuBePHTH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
CHRYSE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BAANTHR	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
B2EHPH	**0.0130B**	**0.00258J**	**0.0021BJ**	**0.0030BJ**	**0.0018J**
DNOcPHT	**0.0069BJ**	**0.00258J**	**0.0051BJ**	**0.0024BJ**	**0.0012J**
BBFLANT	0.0130U	0.0100U	0.0100U	0.0100U	0.0100U
BKFLANT	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
BAPYRE	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
I123PYR	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
DBAHANT	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
B-GHI-PYR	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
ANILINE	0.0260U	0.0220U	0.0220U	0.0220U	0.0200U
4CLANIL	0.0260U	0.0220U	0.0220U	0.0220U	0.0200U
DBENZOFOU	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
2MeNAPH	0.0130U	0.0110U	0.0110U	0.0110U	0.0100U
2NANIL	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
3NANIL	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U
4NANIL	0.0650U	0.0550U	0.0550U	0.0550U	0.0500U

Note: J - Indicates an estimated value below the statistical quantification limits
U - Indicates compound was analyzed for but not detected. Detection limits are given after the < symbol.
B - Indicates analyte is found in the associated blank as well as in the sample.
* - EPA Method 8270 -in Test Methods for Evaluating Organic and Inorganic Waste, Physical/Chemical Methods, SW846, Third Edition, November 1986, with December 1988 revisions.

Table 5.20. (Page 1 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Results of soil analyses for pesticides, herbicides, and PCBs. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	12#1	12#2	12#3	12#4	11#1	11#2	11#3	11#4	10#1	10#2
ALDRIN	<0.0047U	<0.0043U	<0.0052U	<0.0052U	<0.0042U	<0.0052U	<0.0052U	<0.0047U	<0.0045U	<0.0046U
A-BHC	<0.0036U	<0.0032U	<0.0039U	<0.0039U	<0.0031U	<0.0039U	<0.0039U	<0.0036U	<0.0033U	<0.0034U
B-BHC	<0.0071U	<0.0065U	<0.0079U	<0.0079U	<0.0062U	<0.0079U	<0.0079U	<0.0071U	<0.0067U	<0.0068U
G-BHC	<0.0047U	<0.0043U	<0.0052U	<0.0052U	<0.0042U	<0.0052U	<0.0052U	<0.0047U	<0.0045U	<0.0046U
D-BHC	<0.011U	<0.0097U	<0.012U	<0.012U	<0.0094U	<0.0012U	<0.12U	<0.011U	<0.010U	<0.010U
PPDDD	<0.013U	<0.012U	<0.014U	<0.014U	<0.011U	<0.014U	<0.014U	<0.013U	**0.0020J**	<0.013U
PPDDE	<0.0047U	<0.0043U	**0.11J**	<0.012U	<0.0042U	<0.0052U	<0.0052U	<0.0047U	**0.0012J**	**0.0046J**
PPDDT	<0.014U	<0.013U	<0.016U	<0.016U	<0.012U	<0.016U	<0.016U	<0.014U	**0.0054J**	**0.0041J**
Heptachlor	<0.0036U	<0.0032U	<0.0039U	<0.0039U	**0.0036BJ**	<0.0039U	**0.0019BJ**	**0.0014BJ**	**0.0019BJ**	**0.0023BJ**
Dieldrin	<0.0024U	<0.0022U	<0.0026U	<0.0026U	<0.0021U	<0.0026U	<0.0026U	<0.0024U	<0.0022U	<0.0023U
A-Endosulfan	<0.017U	<0.015U	<0.018U	<0.018U	<0.015U	<0.018U	<0.018U	<0.017U	<0.016U	<0.016U
B-Endosulfan	<0.0047U	<0.0043U	<0.0052U	<0.0052U	<0.0042U	<0.0052U	<0.0052U	<0.0047U	<0.0046U	<0.0046U
ENDOSU	<0.078U	<0.071U	<0.087U	<0.087U	<0.069U	<0.086U	<0.086U	<0.078U	<0.074U	<0.075U
Endrin	<0.0071U	<0.0065U	<0.0079U	<0.0079U	<0.0062U	<0.0079U	<0.0079U	<0.0071U	<0.0067U	<0.0068U
Endrin Aldehyde	<0.027U	<0.025U	<0.030U	<0.030U	<0.024U	<0.030U	<0.030U	<0.027U	<0.026U	<0.026U
HPTCLE	<0.098U	<0.089U	<0.11U	<0.11U	<0.086U	<0.11U	<0.11U	<0.098U	<0.093U	<0.094U
Methoxychlor	<0.21U	<0.19U	**1.4**	<0.23U	<0.18U	<0.23U	<0.23U	<0.21U	<0.20U	<0.20U
Toxaphene	<0.29U	<0.26U	<0.32U	<0.31U	<0.25U	<0.31U	<0.31U	<0.28U	<0.27U	<0.27U
PCB-1016	<0.077U	<0.070U	<0.085U	<0.085U	<0.067U	<0.085U	<0.085U	<0.077U	<0.073U	<0.074U
PCB-1221	<0.077U	<0.070U	<0.085U	<0.085U	<0.067U	<0.085U	<0.085U	<0.077U	<0.073U	<0.074U
PCB-1232	<0.077U	<0.070U	<0.085U	<0.085U	<0.067U	<0.085U	<0.085U	<0.077U	<0.073U	<0.074U
PCB-1242	<0.077U	<0.070U	<0.085U	<0.085U	<0.067U	<0.085U	<0.085U	<0.077U	<0.073U	<0.074U
PCB-1248	<0.077U	<0.070U	<0.085U	<0.085U	<0.067U	<0.085U	<0.085U	<0.077U	<0.073U	<0.074U
PCB-1254	<0.15U	<0.14U	<0.17U	<0.17U	<0.14U	<0.17U	<0.17U	<0.15U	<0.15U	<0.15U
PCB-1260	<0.15U	<0.14U	<0.17U	<0.17U	<0.14U	<0.17U	<0.17U	<0.15U	<0.15U	<0.15U
Diazinon	<0.18U	<0.16U	<0.020U	<0.033U	<0.16U	<0.20U	<0.20U	<0.18U	<0.17U	<0.17U
Ethyl Parathion	<0.053U	<0.048U	<0.059U	<0.058U	<0.047U	<0.059U	<0.059U	<0.053U	<0.050U	<0.051U
Ethyl Trithion	<0.057U	<0.051U	<0.063U	<0.059U	<0.050U	<0.062U	<0.062U	<0.056U	<0.053U	<0.054U
Ethion	<0.046U	<0.042U	<0.051U	<0.051U	<0.040U	<0.051U	<0.051U	<0.046U	<0.043U	<0.044U
Malathion	<0.098U	<0.088U	<0.11U	<0.11U	<0.085U	<0.11U	<0.11U	<0.097U	<0.092U	<0.093U
Methyl Parathion	<0.11U	<0.096U	<0.12U	<0.12U	<0.093U	<0.12U	<0.12U	<0.12U	<0.10U	<0.10U
2,4-D	<0.48U	<0.46U	<0.46U	<0.54U	<0.42U	<0.52U	<0.050U	<0.045U	IS	IS
2,4-DP	<0.26U	<0.25U	<0.25U	<0.29U	<0.23U	<0.28U	<0.27U	<0.24U	IS	IS
2,4,5-T	<0.08U	<0.08U	<0.08U	<0.09U	<0.07U	<0.08U	<0.08U	<0.08U	IS	IS
2,4,5-TP	<0.68U	<0.65U	<0.065U	<0.075U	<0.059U	<0.073U	<0.070U	<0.068U	IS	IS
a-chlordane	<0.0059U	<0.0059U	<0.0066U	<0.0065U	<0.0052U	**0.0011BJ**	<0.0066U	**0.00071BJ**	<0.0056U	**0.0022BJ**
g-chlordane	<0.0059U	<0.0054U	<0.0066U	<0.0065U	<0.0052U	<0.0065U	<0.0066U	<0.0059U	<0.0056U	<0.0057U

Note: See page 4 for Table notes.

Table 5.20. (Page 2 of 4). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Results of soil analyses for pesticides, herbicides, and PCBs. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	10#3	10#4	10#5	09#1	09#2	09#3	08#1	08#2	07#1	07#2	07#3	07#4
ALDRIN	<0.0047U	<0.0049U	<0.0047U	<0.0048U	<0.0045U	<0.0045U	<0.0046U	<0.0044U	<0.0044U	<0.0049U	<0.0047U	<0.0045U
A-BHC	<0.0035U	<0.0036U	<0.0035U	<0.0036U	<0.0033U	<0.0034U	<0.0035U	<0.0033U	<0.0033U	<0.0036U	<0.0035U	<0.0034U
B-BHC	<0.0070U	<0.0073U	<0.0070U	<0.0072U	<0.0067U	<0.0068U	<0.0070U	<0.0065U	<0.0066U	<0.0072U	<0.0070U	<0.0068U
G-BHC	<0.047U	<0.0049U	<0.0047U	<0.0048U	<0.0045U	<0.0045U	<0.0046U	<0.0044U	<0.0044U	<0.0048U	<0.0047U	<0.0045U
D-BHC	<0.010U	<0.011U	<0.010U	<0.011U	<0.010U	<0.010U	<0.010U	<0.0098U	<0.0099U	<0.011U	<0.010U	<0.010U
PPDDD	<0.013U	<0.013U	<0.013U	<0.013U	<0.012U	<0.012U	<0.013U	<0.012U	<0.012U	<0.013U	<0.013U	<0.012U
PPDDE	<0.0014U	**0.0020J**	<0.0047U	<0.0048U	<0.0045U	<0.0045U	<0.0046U	<0.0044	<0.0044U	<0.0048U	<0.0047U	<0.0045U
PPDDT	<0.014U	<0.015U	**0.0021J**	<0.014U	<0.013U	<0.014U	<0.014U	<0.013U	<0.013U	<0.014U	<0.014U	<0.014U
Heptachlor	**0.0020BJ**	**0.0023BJ**	**0.0014BJ**	<0.0036U	**0.002BJ**	**0.0008BJ**	**0.0014BJ**	**0.0017BJ**	<0.0033U	<0.0037U	<0.0035U	<0.0034U
Dieldrin	<0.0023U	<0.0024U	<0.0023U	<0.0024U	<0.0022U	<0.0023U	<0.0023U	<0.0022U	<0.0022U	<0.0024U	<0.0023U	<0.0023U
A-Endosulfan	<0.016U	<0.017U	<0.016U	<0.016U	<0.016U	<0.016U	<0.016U	<0.015U	<0.016U	<0.017U	<0.016U	<0.016U
B-Endosulfan	<0.0047U	<0.0049U	<0.0047U	<0.0048U	<0.0045U	<0.0045U	<0.0046U	<0.0044U	<0.0044U	<0.0048U	<0.0047U	<0.0045U
ENDOSU	<0.0077U	<0.080U	<0.077U	<0.080U	<0.074U	<0.075U	<0.077U	<0.072U	<0.073U	<0.079U	<0.077U	<0.075U
Endrin	<0.0070U	<0.0073U	<0.0070U	<0.0072U	<0.0067U	<0.0068U	<0.0070U	<0.0065U	<0.0067U	<0.0072U	<0.0070U	<0.0068U
Endrin Aldehyde	<0.027U	<0.028U	<0.027U	<0.028U	<0.026U	<0.026U	<0.027U	<0.025U	<0.026U	<0.028U	<0.027U	<0.026U
HPTCLE	<0.097U	<0.10U	<0.096U	<0.10U	<0.092U	<0.094U	<0.096U	<0.091U	<0.092U	<0.10U	<0.096U	<0.094U
Methoxychlor	<0.21U	<0.21U	<0.20U	<0.21U	<0.20U	<0.20U	<0.20U	<0.19U	<0.20U	<0.21U	<0.20U	<0.20U
Toxaphene	<0.28U	<0.29U	<0.28U	<0.024U	<0.027U	<0.027U	<0.28U	<0.26U	<0.027U	<0.029U	<0.028U	<0.027U
PCB-1016	<0.076U	<0.079U	<0.076U	<0.065U	<0.072U	<0.074U	<0.075U	<0.071U	<0.072U	<0.078U	<0.076U	<0.074U
PCB-1221	<0.076U	<0.079U	<0.076U	<0.065U	<0.072U	<0.074U	<0.075U	<0.071U	<0.072U	<0.078U	<0.076U	<0.074U
PCB-1232	<0.076U	<0.079U	<0.076U	<0.065U	<0.072U	<0.074U	<0.075U	<0.071U	<0.072U	<0.078U	<0.076U	<0.074U
PCB-1242	<0.076U	<0.079U	<0.076U	<0.065U	<0.072U	<0.074U	<0.075U	<0.071U	<0.072U	<0.078U	<0.076U	<0.074U
PCB-1248	<0.076U	<0.079U	<0.076U	<0.065U	<0.072U	<0.074U	<0.075U	<0.071U	<0.072U	<0.078U	<0.076U	<0.074U
PCB-1254	<0.15U	<0.16U	<0.15U	<0.16U	<0.14U	<0.15U	<0.15U	<0.14U	<0.14U	<0.16U	<0.15U	<0.15U
PCB-1260	<0.15U	<0.16U	<0.15U	<0.16U	<0.14U	<0.15U	<0.15U	<0.14U	<0.14U	<0.16U	<0.15U	<0.15U
Diazinon	<0.17U	<0.18U	<0.17U	<0.18U	<0.17U	<0.17U	<0.17U	<0.16U	<0.17U	<0.18U	<0.17U	<0.17U
Ethyl Parathion	<0.052U	<0.054U	<0.052U	<0.054U	<0.050U	<0.051U	<0.052U	<0.049U	<0.050U	<0.054U	<0.052U	<0.051U
Ethyl Trithion	<0.056U	<0.058U	<0.056U	<0.058U	<0.053U	<0.054U	<0.055U	<0.049U	<0.053U	**0.020J**	**0.052J**	<0.054U
Ethion	<0.045U	<0.047U	<0.045U	<0.047U	<0.043U	<0.044U	<0.045U	<0.042U	<0.043U	<0.047U	<0.045U	<0.044U
Malathion	<0.096U	<0.10U	<0.095U	<0.099U	<0.091U	<0.093U	<0.095U	<0.090U	<0.091U	<0.099U	<0.095U	<0.093U
Methyl Parathion	<0.10U	<0.11U	<0.10U	<0.11U	<0.10U	<0.10U	<0.10U	<0.098U	<0.099U	<0.11U	<0.10U	<0.10U
2,4-D	IS	IS	IS	<0.49U	<0.47U	<0.46U	IS	IS	IS	<0.47U	<0.49U	<0.48U
2,4-DP	IS	IS	IS	<0.26U	<0.25U	<0.24U	IS	IS	IS	<0.25U	<0.26U	<0.26U
2,4,5-T	IS	IS	IS	<0.08U	<0.08U	<0.08U	IS	IS	IS	<0.08U	<0.08U	<0.08U
2,4,5-TP	IS	IS	IS	<0.069U	<0.066U	<0.064U	IS	IS	IS	<0.066U	<0.069U	<0.067U
a-Chlordane	**0.0020BJ**	<0.0061U	**0.0012BJ**	<0.0060U	<0.0056U	<0.0057U	**0.0010BJ**	**0.0012BJ**	<0.0055U	<0.0060U	<0.0058U	<0.0057U
g-Chlordane	<0.0058U	<0.0061U	<0.0058U	<0.0060U	<0.0056U	<0.0057U	<0.0058U	<0.0055U	<0.0055U	<0.0060U	<0.0058U	<0.0057U

Note: See page 4 for Table notes.

Table 5.20. (Page 3 of 4). Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Results of soil analyses for pesticides, herbicides, and PCBs. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	06#1	06#2	06#3	06#4	06#5	05#1	05#2	05#3	04#1	04#2	04#3	04#4
ALDRIN	<0.0044U	<0.0045U	<0.0046U	<0.0045U	<0.0050U	<0.0040U	<0.0045U	<0.0046U	<0.0049U	<0.0046U	<0.0050U	<0.0049U
A-BHC	<0.0033U	<0.0034U	<0.0035U	<0.0034U	<0.0038U	<0.0030U	<0.0034U	<0.0034U	<0.0037U	<0.0034U	<0.0037U	<0.0037U
B-BHC	<0.0067U	<0.0067U	<0.0069U	<0.0068U	<0.0075U	<0.0060U	<0.0067U	<0.0069U	<0.0073U	<0.0068U	<0.0074U	<0.0073U
G-BHC	<0.0044U	<0.0045U	<0.0046U	<0.0045U	<0.0050U	<0.0040U	<0.0045U	<0.0046U	<0.0049U	<0.0046U	<0.0050U	<0.0049U
D-BHC	<0.010U	<0.010U	<0.010U	<0.010U	<0.011U	<0.0091U	<0.010U	<0.010U	<0.011U	<0.010U	<0.011U	<0.011U
PPDDD	<0.012U	<0.012U	<0.013U	<0.012U	<0.014U	<0.011U	<0.012U	<0.013U	<0.013U	<0.013U	<0.014U	<0.013U
PPDDE	<0.0044U	<0.0045U	<0.0046U	<0.0046U	<0.0050U	<0.0040U	<0.0045U	<0.0046U	<0.0049U	<0.0046U	<0.0050U	<0.0049U
PPDDT	<0.013U	<0.013U	<0.014U	<0.014U	**0.0050J**	<0.012U	**0.0083J**	<0.014U	<0.015U	<0.014U	<0.015U	<0.015U
Heptachlor	<0.0033U	**0.0022BJ**	<0.0035U	<0.0034U	**0.0019BJ**	<0.0030U	<0.0034U	<0.0035U	<0.0037U	<0.0034U	**0.0007BJ**	<0.0037U
Dieldrin	<0.0022U	<0.0022U	<0.0023U	<0.0023U	<0.0025U	<0.0020U	<0.0022U	<0.0023U	<0.0024U	<0.0023U	<0.0025U	<0.0024U
A-Endosulfan	<0.016U	<0.016U	<0.016U	<0.016U	<0.018U	<0.014U	<0.016U	<0.016U	<0.017U	<0.016U	<0.017U	<0.017U
B-Endosulfan	<0.0044U	<0.0045U	<0.0046U	<0.0046U	<0.0050U	<0.0040U	<0.0045U	<0.0046U	<0.0050U	<0.0046U	<0.0050U	<0.0049U
ENDOSU	<0.073U	<0.074U	<0.076U	<0.075U	<0.083U	<0.067U	<0.074U	<0.076U	<0.081U	<0.075U	<0.082U	<0.080U
Endrin	<0.0067U	<0.0067U	<0.0069U	<0.0068U	<0.0075U	<0.0061U	<0.0067U	<0.0069U	<0.0073U	<0.0068U	<0.0074U	<0.0073U
Endrin Aldehyde	<0.026U	<0.026U	<0.026U	<0.026U	<0.029U	<0.023U	<0.026U	<0.027U	<0.028U	<0.026U	<0.029U	<0.028U
HPTCLE	<0.092U	<0.093U	<0.096U	<0.094U	<0.10U	<0.084U	<0.093U	<0.096U	<0.10U	<0.094U	<0.10U	<0.10U
Methoxychlor	<0.20U	<0.20U	<0.20U	<0.20U	<0.22U	<0.18U	<0.20U	<0.20U	<0.22U	<0.20U	<0.22U	<0.21U
Toxaphene	<0.027U	<0.027U	<0.028U	<0.027U	<0.030U	<0.24U	<0.27U	<0.28U	<0.29U	<0.27U	<0.30U	<0.29U
PCB-1016	<0.072U	<0.073U	<0.075U	<0.073U	<0.081U	<0.066U	<0.073U	<0.075U	<0.080U	<0.074U	<0.081U	<0.079U
PCB-1221	<0.072U	<0.073U	<0.075U	<0.073U	<0.081U	<0.066U	<0.073U	<0.075U	<0.080U	<0.074U	<0.081U	<0.079U
PCB-1232	<0.072U	<0.073U	<0.075U	<0.073U	<0.081U	<0.066U	<0.073U	<0.075U	<0.080U	<0.074U	<0.081U	<0.079U
PCB-1242	<0.072U	<0.073U	<0.075U	<0.073U	<0.081U	<0.066U	<0.073U	<0.075U	<0.080U	<0.074U	<0.081U	<0.079U
PCB-1248	<0.072U	<0.073U	<0.075U	<0.073U	<0.081U	<0.066U	<0.073U	<0.075U	<0.080U	<0.074U	<0.081U	<0.079U
PCB-1254	<0.14U	<0.15U	<0.15U	<0.15U	<0.16U	<0.13U	<0.15U	<0.15U	<0.16U	<0.15U	<0.16U	<0.16U
PCB-1260	<0.14U	<0.15U	<0.15U	<0.15U	<0.16U	<0.13U	<0.15U	<0.15U	<0.16U	<0.15U	<0.16U	<0.16U
Diazinon	<0.17U	<0.17U	<0.17U	<0.17U	<0.19U	<0.15U	<0.17U	<0.17U	<0.18U	<0.17U	<0.18U	<0.18U
Ethyl Parathion	<0.051U	<0.050U	<0.052U	<0.050U	<0.056U	<0.045U	<0.050U	<0.052U	<0.055U	<0.051U	<0.056U	<0.055U
Ethyl Trithion	<0.053U	<0.053U	<0.055U	<0.054U	<0.060U	<0.048U	<0.054U	<0.055U	<0.058U	<0.054U	<0.059U	<0.058U
Ethion	<0.043U	<0.043U	<0.045U	<0.044U	<0.048U	<0.039U	<0.044U	<0.045U	<0.047U	<0.044U	<0.048U	<0.047U
Malathion	<0.091U	<0.092U	<0.094U	<0.093U	<0.10U	<0.083U	<0.092U	<0.095U	<0.10U	<0.093U	<0.10U	<0.10U
Methyl Parathio	<0.10U	<0.10U	<0.10U	<0.10U	<0.11U	<0.090U	<0.100U	<0.10U	<0.11U	<0.10U	<0.11U	<0.11U
2,4-D	<0.45U	<0.46U	<0.40U	<0.47U	<0.48U	<0.42U	<0.54U	<0.46U	<0.43U	<0.39U	<0.39U	<0.48U
2,4-DP	<0.24U	<0.24U	<0.21U	<0.25U	<0.26U	<0.23U	<0.29U	<0.24U	<0.23U	<0.21U	<0.21U	<0.26U
2,4,5-T	<0.07U	<0.08U	<0.06U	<0.08U	<0.08U	<0.07U	<0.09U	<0.08U	<0.07U	<0.06U	<0.06U	<0.08U
2,4,5-TP	<0.063U	<0.064U	<0.056U	<0.066U	<0.067U	<0.059U	<0.076U	<0.064U	<0.060U	<0.054U	<0.055U	<0.067U
a-Chlordane	<0.0056U	**0.0028J**	<0.0058U	<0.0056U	<0.0063U	<0.0051U	<0.0056U	<0.0058U	<0.0061U	<0.0057U	<0.0062U	**0.0014BJ**
g-Chlordane	<0.0056U	<0.0056U	<0.0058U	<0.0056U	<0.0059U	<0.0051U	<0.0056U	<0.0058U	<0.0061U	<0.0057U	<0.0062U	<0.0061U

Note: See page 4 for Table notes.

Table 5.20. (Page 4 of 4). Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Results of soil analyses for pesticides, herbicides, and PCBs. Concentrations are mg/kg (ppm) dry weight. Samples with detectable concentrations of organic analyte are shown in **bold**.

ANALYTE/SAMPLE	03#1	03#2	03#3	02#1	02#2	02#3	02#4	01#1	01#2
ALDRIN	<0.0055U	<0.0044U	<0.0046U	<0.0049U	<0.0051U	<0.0047U	<0.0043U	<0.0044U	<0.0043U
A-BHC	<0.0041U	<0.0033U	<0.0035U	<0.0037U	<0.0038U	<0.0035U	<0.0032U	<0.0033U	<0.0032U
B-BHC	<0.0082U	<0.0066U	<0.0069U	<0.0073U	<0.0076U	<0.0070U	<0.0065U	<0.0066U	<0.0065U
G-BHC	<0.0055U	<0.0044U	<0.0046U	<0.0049U	<0.0051U	<0.0047U	<0.0043U	<0.0044U	<0.0043U
D-BHC	<0.012U	<0.0099U	<0.010U	<0.011U	<0.011U	<0.011U	<0.0096U	<0.0098U	<0.0097U
PPDDD	<0.015U	<0.012U	<0.013U	<0.013U	<0.014U	<0.013U	<0.012U	<0.012U	<0.012U
PPDDE	<0.0055U	<0.0044U	<0.0046U	<0.0049U	<0.0051U	<0.0047U	<0.0043U	<0.0044U	<0.0043U
PPDDT	<0.016U	**0.0009J**	<0.014U	<0.015U	<0.015U	<0.014U	<0.013U	<0.013U	**0.010J**
Heptachlor	**0.0016BJ**	<0.0034U	<0.0035U	**0.0022J**	<0.0038U	**0.0031J**	**0.0020J**	<0.0033U	**0.0018J**
Dieldrin	<0.0027U	<0.0022U	**0.0026J**	<0.0024	**0.0079J**	<0.0023U	<0.0021U	<0.0022U	<0.0022U
A-Endosulfan	<0.019U	<0.015U	<0.016U	<0.017U	<0.018U	<0.016U	<0.015U	<0.015U	<0.015U
B-Endosulfan	<0.0055U	<0.0044U	<0.0046U	<0.0049U	<0.0051U	<0.0047U	<0.0043U	<0.0044U	<0.0043U
ENDOSU	<0.090U	<0.073U	<0.076U	<0.080U	<0.083U	<0.077U	<0.071U	<0.072U	<0.071U
Endrin	<0.0082	**0.0011BJ**	**0.0022BJ**	<0.0073U	**0.0007J**	<0.0070U	**0.0018J**	**0.0006J**	<0.0065U
Endrin Aldehyde	<0.031U	<0.025U	<0.026U	<0.028U	<0.029U	<0.027U	<0.025U	<0.025U	<0.025U
HPTCLE	<0.11U	<0.091U	<0.095U	<0.10U	<0.10U	<0.097U	<0.089U	<0.091U	<0.090U
Methoxychlor	<0.24U	<0.19U	<0.20U	<0.21U	<0.22U	<0.21U	<0.19U	<0.19U	<0.19U
Toxaphene	<0.32U	<0.26U	<0.28U	<0.029U	<0.030U	<0.028U	<0.026U	<0.026U	<0.026U
PCB-1016	<0.089U	<0.071U	<0.075U	<0.079U	<0.082U	<0.076U	<0.070U	<0.071U	<0.070U
PCB-1221	<0.089U	<0.071U	<0.075U	<0.079U	<0.082U	<0.076U	<0.070U	<0.071U	<0.070U
PCB-1232	<0.089U	<0.071U	<0.075U	<0.079U	<0.082U	<0.076U	<0.074U	<0.071U	<0.070U
PCB-1242	<0.089U	<0.071U	<0.075U	<0.079U	<0.082U	<0.076U	<0.070U	<0.071U	<0.070U
PCB-1248	<0.089U	<0.071U	<0.075U	<0.079U	<0.082U	<0.076U	<0.070U	<0.071U	<0.070U
PCB-1254	<0.18U	<0.14U	<0.15U	<0.16U	<0.16U	<0.15U	<0.14U	<0.14U	<0.14U
PCB-1260	<0.18U	<0.14U	<0.15U	<0.16U	<0.16U	<0.15U	<0.14U	<0.14U	<0.14U
Diazinon	<0.20U	<0.17U	<0.17U	<0.18U	<0.19U	<0.18U	<0.16U	<0.16U	<0.16U
Ethyl Parathion	<0.061U	<0.050U	<0.052U	<0.054U	<0.057U	<0.052U	<0.048U	<0.049U	<0.048U
Ethyl Trithion	<0.065U	<0.053U	<0.055U	<0.058U	<0.060U	<0.056U	<0.051U	<0.052U	<0.052U
Ethion	<0.053U	<0.043U	<0.045U	<0.047U	<0.049U	<0.046U	<0.042U	<0.042U	<0.042U
Malathion	<0.11U	<0.092U	<0.094U	<0.10U	<0.10U	<0.096U	<0.088U	<0.098U	<0.089U
Methyl Parathion	<0.12U	<0.10U	<0.10U	<0.11U	<0.11U	<0.10U	<0.096U	<0.098U	<0.097U
2,4-D	<0.69U	<0.44U	<0.47U	**0.0050J**	<0.46U	<0.44U	<0.45U	<0.53U	<0.51U
2,4-DP	<0.37U	<0.24U	<0.25U	<0.27U	<0.25U	<0.24U	<0.24U	<0.28U	<0.27U
2,4,5-T	<0.11U	<0.07U	<0.08U	**0.0069J**	<0.080U	<0.080U	<0.080U	**0.010J**	<0.080U
2,4,5-TP	<0.097U	<0.062U	<0.066U	<0.070U	<0.064U	<0.062U	<0.063U	<0.074U	<0.071U
a-Chlordane	<0.0068U	**0.00082B**	<0.0058U	<0.0061U	**0.0019BJ**	**0.0023BJ**	**0.0014BJ**	<0.0055U	0.0023BJ
g-Chlordane	<0.0068U	<0.0056U	<0.0058U	<0.0061U	<0.0063U	<0.0059U	<0.0054U	<0.0055U	<0.0054U

Note: Sample ID is as follows - 12#4, boring 12/sample 4. See Figures 1 and 2.

J - Estimated value below accurate quantitation limits.

U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.

B - Analyte is found in the associated blank as well as in the sample.

IS - Insuffucient sample supplied for analyses.

Table 5.21. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Summary of results of soil analyses for pesticides, herbicides, and PCBs. A (J) is indicated after the compound name where the analyte was detected at concentrations below accurate quantitation limits. All concentrations found were less than 1 mg/kg (ppm) except for methoxychlor from boring 12. See Figure 5.1 and 5.2 for sample location and sample depth, respectively.

Boring Number
Constituent (J) (Sample Number)

Boring 12
PPDDE (J)(#1, and #2)
Methoxychlor (#3)

Boring 10
PPDDD (J)(#1)
PPDDE (J)(#1, #2, #4)

Boring 7
Ethyl trithion (J)(#2 and #3)

Boring 6
PPDDT (J)(#5)
a-chlordane* (J) #2)

Boring 5
PPDDT (J) (#2)

Boring 3
PPDDT (J) (#2)
Dieldrin (J) (#3)

Boring 2
Endrin (J)(#2)
Heptachlor* (J)(#1, #2, and #4)
Dieldrin (J)
Endrin (J)(#2)
2,4-D (J)(#1)
2,4,5-T (J)(#1)

Boring 1
PPDDT (J)(#2)
Heptachlor* (J)(#2)
Endrin (J)(#1)
2,4,5-T (J) (#1)

Note: * - These compounds were frequently found in method blanks associated with other borings (See Table 5.21). While the method blanks associated with the specific borings indicated did not contain these compounds, the entire analytical data package tends to raise the question if these compounds are actually present in the soils.

Table 5.22. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of analyses of method blanks associated with analyses of soils for pesticide, herbicide, and PCBs. Concentrations and detection limits are mg/l (ppm). Samples with detectable concentrations of analyte are shown in **bold**.

Method Blank	MB	MB	MB1	MB2	MB3	MB1	MB2	MB
ANALYTE/Boring	12	10,8	9,7,6	9,7,6	9,7,6	11,5,4,3	11,5,4,3	2,1
ALDRIN	<0.0027U	<0.0040U	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
A-BHC	<0.0020U	<0.0030U	<0.0020U	<0.0020U	-	<0.0020U	<0.0020U	<0.0020U
B-BHC	<0.0040U	<0.0060U	<0.0040U	<0.0040U	-	<0.0040U	<0.0040U	<0.0040U
G-BHC	<0.0027U	<0.0040U	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
D-BHC	<0.0060U	<0.0090U	<0.0060U	<0.0060U	-	<0.0060U	<0.0060U	<0.0060U
PPDDD	<0.0074U	<0.011U	<0.0074U	<0.0074U	-	<0.0074U	<0.0074U	<0.0074U
PPDDE	<0.0027U	<0.0040U	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
PPDDT	<0.0080U	<0.012U	<0.0080U	<0.0080U	-	<0.0080U	<0.0080U	<0.0080U
Heptachlor	**0.008J**	**0.0026J**	**0.0011J**	**0.0008J**	-	**0.0009J**	<0.0020U	<0.0020U
Dieldrin	<0.0013U	<0.0020U	<0.0013U	<0.0013U	-	<0.0013U	<0.0013U	<0.0013U
A-Endosulfan	<0.0094U	<0.014U	<0.0094U	<0.0094U	-	<0.0094U	<0.0094U	<0.0094U
B-Endosulfan	<0.0027U	<0.0040U	<0.0027U	<0.0027U	-	<0.0027U	<0.0027U	<0.0027U
ENDOSU	<0.044U	<0.066U	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.044U
Endrin	<0.0040U	<0.0060U	<0.0040U	<0.0040U	-	**0.0021J**	<0.0040U	<0.0040U
Endrin Aldehyde	<0.015U	<0.023U	<0.015U	<0.015U	-	<0.015U	<0.015U	<0.015U
HPTCLE	<0.056U	<0.083U	<0.0020U	<0.0020U	-	<0.0020U	<0.0020U	<0.056U
Methoxychlor	<0.12U	<0.18U	<0.12U	<0.12U	-	<0.12U	<0.12U	<0.12U
Toxaphene	<0.16U	<0.24U	<0.016U	<0.016U	-	<0.016U	<0.016U	<0.042U
PCB-1016	<0.044U	<0.065U	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.042U
PCB-1221	<0.044U	<0.065U	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.042U
PCB-1232	<0.044U	<0.065U	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.042U
PCB-1242	<0.044U	<0.065U	<0.044U	<0.044U	-	<0.044U	<0.044U	<0.042U
PCB-1248	<0.044U	<0.065U	<0.044U	<0.044U	-	<0.087U	<0.087U	<0.042U
PCB-1254	<0.087U	<0.13U	<0.087U	<0.087U	-	<0.087U	<0.087U	<0.20U
PCB-1260	<0.087U	<0.13U	<0.087U	<0.087U	-	<0.087U	<0.087U	<0.20U
Diazinon	<0.10U	<0.10U	<0.1U	<0.1U	-	<0.10U	<0.10U	<0.10U
Ethyl Parathion	<0.030U	<0.030U	<0.030U	<0.030U	-	<0.030U	<0.030U	<0.030U
Ethyl Trithion	<0.032U	<0.032U	<0.032U	<0.032U	-	<0.032U	<0.032U	<0.032U
Ethion	<0.026U	<0.026U	<0.026U	<0.026U	-	<0.026U	<0.026U	<0.026U
Malathion	<0.055U	<0.055U	<0.055U	<0.055U	-	<0.055U	<0.055U	<0.055U
Methyl Parathion	<0.060U	<0.060U	<0.060U	<0.060U	-	<0.060U	<0.060U	<0.060U
2,4-D	<0.24U	-	-	-	<0.24U	<0.24U	<0.24U	<0.24U
2,4-DP	<0.13U	-	-	-	<0.13U	<0.13U	<0.13U	<0.13U
2,4,5-T	<0.04U	-	-	-	<0.04U	<0.04U	<0.04U	<0.040U
2,4,5-TP	<0.034U	-	-	-	<0.034U	<0.034U	<0.034U	<0.034U
a-Chlordane	**0.00079J**	**0.0022J**	<0.0050U	<0.0050U	-	<0.0034U	**0.00043J**	**0.0013J**
g-Chlordane	<0.0050U	<0.0050U	<0.0050U	<0.0050U	-	0.0034U	<0.0050U	<0.0050U

Note: MB - Method Blank for the borings indicated.
J - Estimated value below the statistical quantitation limits
U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
(-) - No analysis conducted.

Table 5.23. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU# 03/10. Results of analyses of sampling equipment rinses and associated method blanks for pesticide, herbicide, and PCBs. Concentrations and detection limits are mg/l (ppm). Samples with detectable concentrations of analyte are shown in bold.

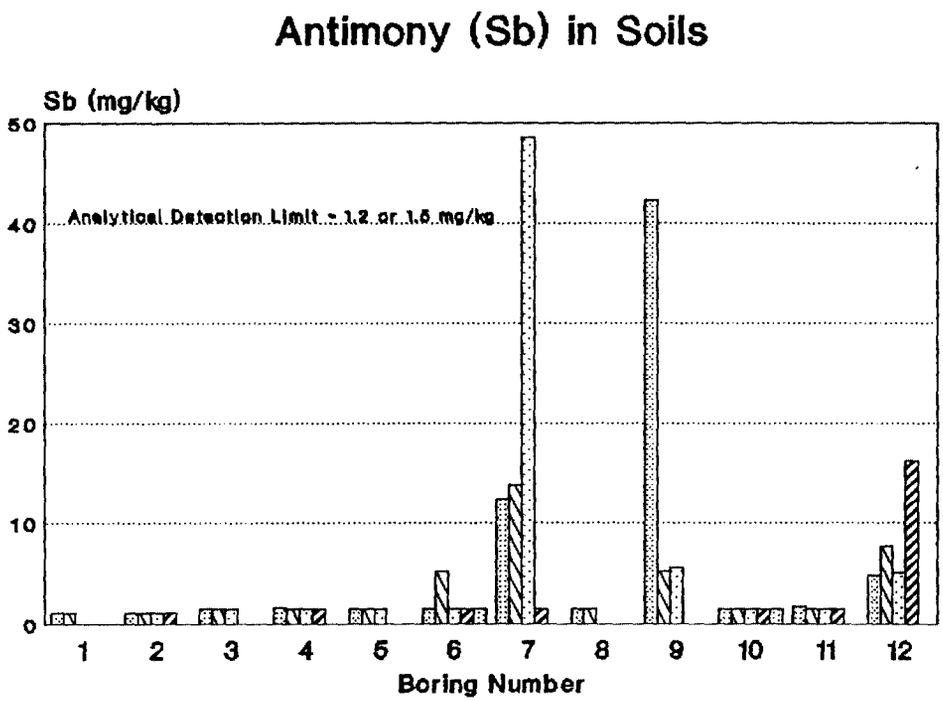
Method Blank	RINSE	MB	RINSE	MB	RINSE	MB	RINSE	RINSE	MB
ANALYTE/Boring	12	12	11	11	10	10	8	6	8,6
ALDRIN	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U
A-BHC	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00003U	<0.00003U
B-BHC	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00006U	<0.00006U
G-BHC	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U
D-BHC	<0.00009U	<0.00009U	<0.00009U	<0.00009U	<0.00010U	<0.00009U	<0.00010U	<0.00010U	<0.00009U
PPDDD	<0.00011U	<0.00011U	<0.00012U	<0.00012U	<0.00012U	<0.00011U	<0.00012U	<0.00012U	<0.00011U
PPDDE	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U
PPDDT	<0.00012U	<0.00012U	<0.00013U	**0.00005J**	<0.00013U	**0.00005J**	**0.00003BJ**	<0.00013U	**0.00005J**
Heptachlor	**0.00001BJ**	**0.00001BJ**	<0.00003U	**0.00002J**	<0.00003U	**0.00002J**	<0.00003U	<0.00003U	**0.00002J**
Dieldrin	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00002U	<0.00002U
A-Endosulfan	<0.00014U	<0.00014U	<0.00015U	<0.00014U	<0.00015U	<0.00014U	<0.00015U	<0.00015U	<0.00014U
B-Endosulfan	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U	<0.00004U
ENDOSU	<0.00064U	<0.00064U	<0.00069U	<0.00066U	<0.00069U	<0.00066U	<0.00069U	<0.00069U	<0.00066U
Endrin	<0.00006U	<0.00006U	<0.00006U	<0.00004U	<0.00006U	**0.00004J**	<0.00006U	<0.00006U	**0.00004J**
Endrin Aldehyde	<0.00022U	<0.00022U	<0.00024U	<0.00023U	<0.00024U	<0.00023U	<0.00024U	<0.00024U	<0.00023U
HPTCLE	<0.00081U	<0.00081U	<0.00087U	<0.00083U	<0.00087U	<0.00083U	<0.00087U	<0.00087U	<0.00083U
Methoxychlor	<0.0017U	<0.0017U	<0.0019U	<0.0018U	<0.0019U	<0.0018U	<0.0019U	<0.0019U	<0.0018U
Toxaphene	<0.0002U	<0.0002U	<0.0005U	<0.001U	<0.0025U	<0.0024U	<0.0025U	<0.0025U	<0.0024U
PCB-1016	<0.0006U	<0.0006U	<0.0005U	<0.0005U	<0.0007U	<0.0007U	<0.0007U	<0.0007U	<0.0007U
PCB-1221	<0.0006U	<0.0006U	<0.0005U	<0.0005U	<0.0007U	<0.0007U	<0.0007U	<0.0007U	<0.0007U
PCB-1232	<0.0006U	<0.0006U	<0.0005U	<0.0005U	<0.0007U	<0.0007U	<0.0007U	<0.0007U	<0.0007U
PCB-1242	<0.0006U	<0.0006U	<0.0005U	<0.0005U	<0.0007U	<0.0007U	<0.0007U	<0.0007U	<0.0007U
PCB-1248	<0.0006U	<0.0006U	<0.0005U	<0.0005U	<0.0007U	<0.0007U	<0.0007U	<0.0007U	<0.0007U
PCB-1254	<0.0013U	<0.0013U	<0.001U	<0.001U	<0.0014U	<0.0013U	<0.0014U	<0.0014U	<0.0013U
PCB-1260	<0.0013U	<0.0013U	<0.001U	<0.001U	<0.0014U	<0.0013U	<0.0014U	<0.0014U	<0.0013U
Diazinon	<0.0019U	<0.0019U	<0.0019U	<0.002U	<0.002U	<0.002U	<0.0021U	<0.0021U	<0.002U
Ethyl Parathion	<0.0006U	<0.0006U	<0.0011U	<0.0012U	<0.0013U	<0.0012U	<0.0013U	<0.0013U	<0.0012U
Ethyl Trithion	<0.0006U	<0.0006U	<0.0006U	<0.0006U	<0.00067U	<0.00064U	<0.0007U	<0.0007U	<0.0006U
Ethion	<0.0005U	<0.0005U	<0.0005U	<0.0005U	<0.0005U	<0.00052U	<0.0006U	<0.0006U	<0.0005U
Malathion	<0.0011U	<0.0011U	<0.0006U	<0.0006U	<0.0006U	<0.0006U	<0.0006U	<0.0007U	<0.0006U
Methyl Parathion	<0.0012U	<0.0012U	<0.001U	<0.0011U	<0.0012U	<0.0011U	<0.0012U	<0.0012U	<0.0011U
2,4-D	<0.012U	<0.012U	IS	IS	<0.0012U	<0.0012U	<0.0012U	<0.0012U	<0.0012U
2,4-DP	<0.0065U	<0.0065U	IS	IS	<0.0065U	<0.0065U	<0.0065U	<0.0065U	<0.0065U
2,4,5-T	<0.002U	<0.002U	IS	IS	<0.002U	<0.002U	<0.002U	<0.002U	<0.002U
2,4,5-TP	<0.0017U	<0.0017U	IS	IS	<0.0017U	<0.0017U	<0.0017U	<0.0017U	<0.0017U
a-Chlordane	<0.00005U	<0.00005U	<0.00005U	<0.00005U	<0.0005U	<0.0005U	<0.00005U	<0.00005U	<0.00005U
g-Chlordane	<0.00005U	<0.00005U	<0.00005U	<0.00005U	<0.0005U	<0.0005U	<0.00005U	<0.00005U	<0.00005U

Note: MB - Method Blank for the borings indicated.
J - Estimated value below the statistical quantitation limits
U - Compound was analyzed for but not detected. Detection limits are given after the < symbol.
IS - Insufficient sample to conduct analyses.

Table 5.24. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Summary of organic analytes found in sampled soils. The occurrence of organic analyte categories in particular borings (not a sampling or lab contaminant as evidenced by presence in blanks or rinses) is indicated by an "X" (also see notes below). See specific sections of Part 5.0 CHEMICAL ANALYTICAL RESULTS for specific methods and analytes found.

Boring No.	Semivolatile	Volatile	Explosives	Pesticides Herbicides & PCBs
Control Borings				
1	-	-	-	2 X(J)
2	-	-	-	3 X(J)
3	-	-	-	2 X(J)
Waste Disposal Borings				
4	-	-	5 X	-
5	5 X(J) / 1 X	-	5 X	1 X(J)
6	4 X(J) / 1 X	-	2 X(J) / 1 X	1 X(J)
7	11 X(J)	X(J)	2 X(J) / 4 X	1 X(J)
8	1 X(J)	-	-	-
9	5 X(J)	-	1 X(J) / 2 X	-
10	-	-	1 X(J)	3 X(J)
11	1 X(J)	-	2 X(J)	-
12	12 X(J)	X(J)	5 X(J)	1 X(J) / 1 X

Notes:
- \- no organic analytes of that type found in samples from boring
- 5 X 5 different analytes of a indicated organic category determined in samples from specified boring
- X(J) all concentrations reported were estimated values below accurate quantitation limits. Estimated (J) concentrations were generally below 1 ppm.



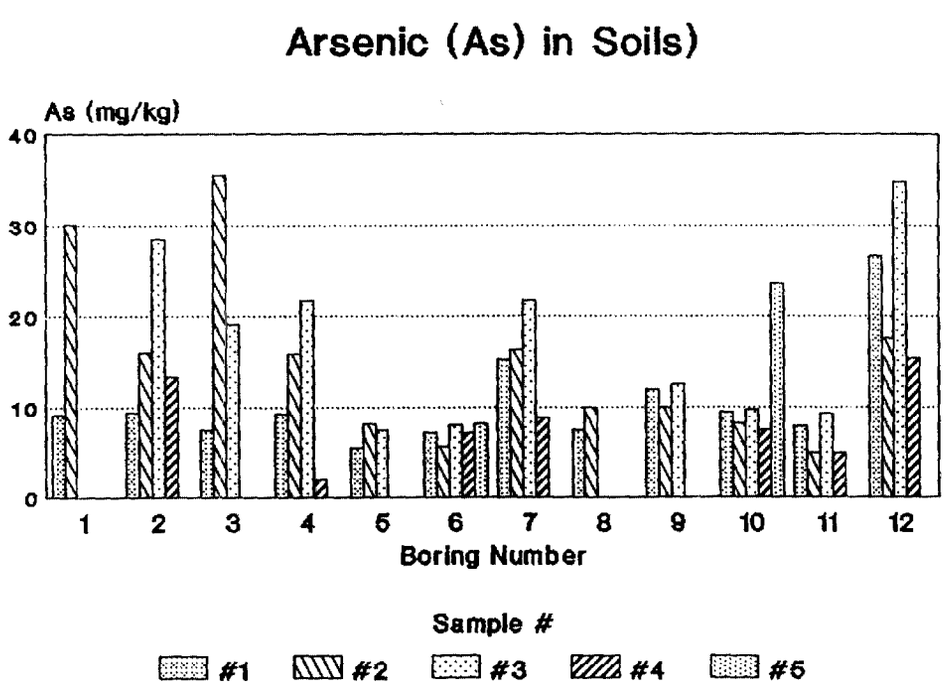
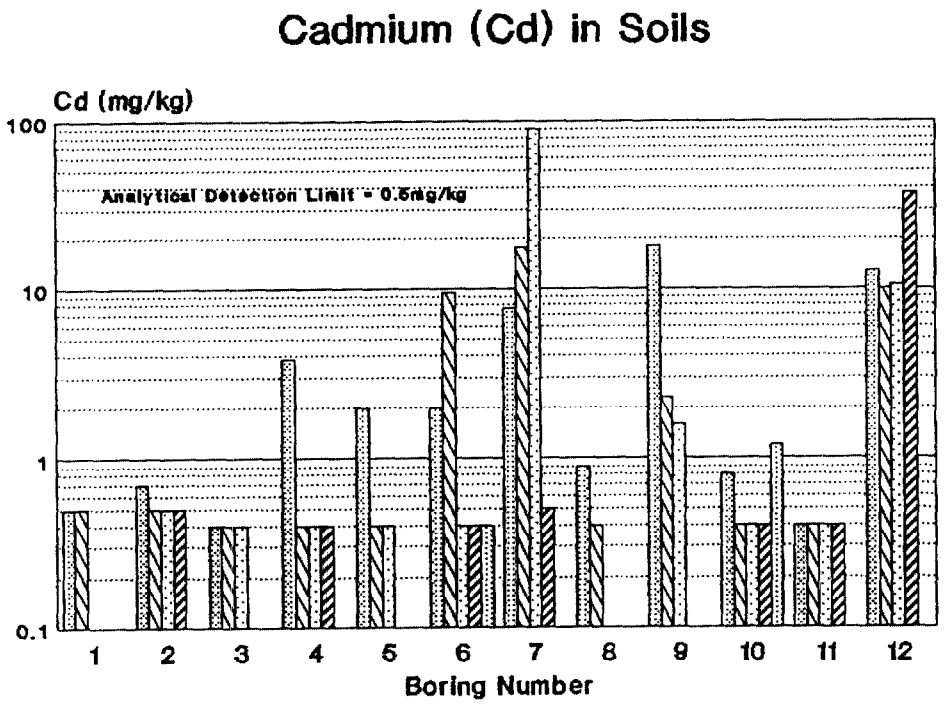


Figure 5.3. Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Antimony and arsenic concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



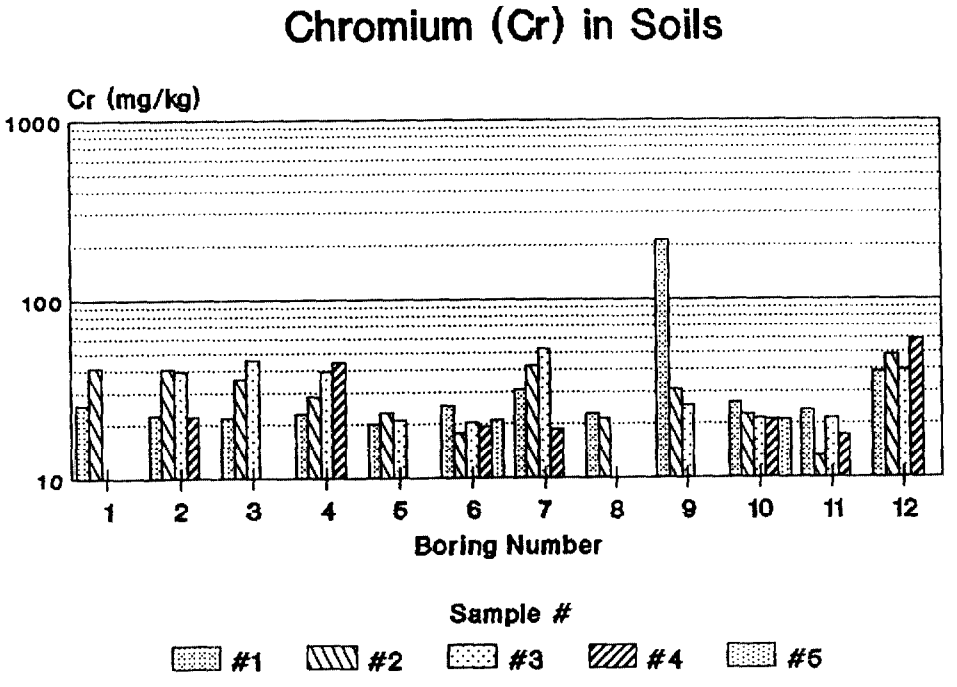
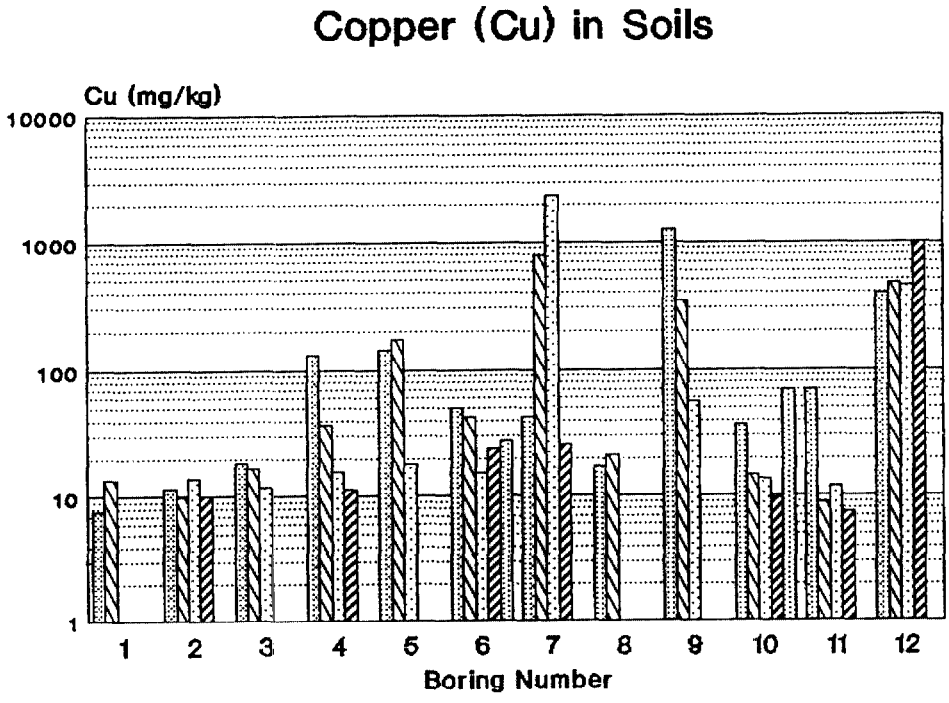


Figure 5.4. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Cadmium and chromium concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



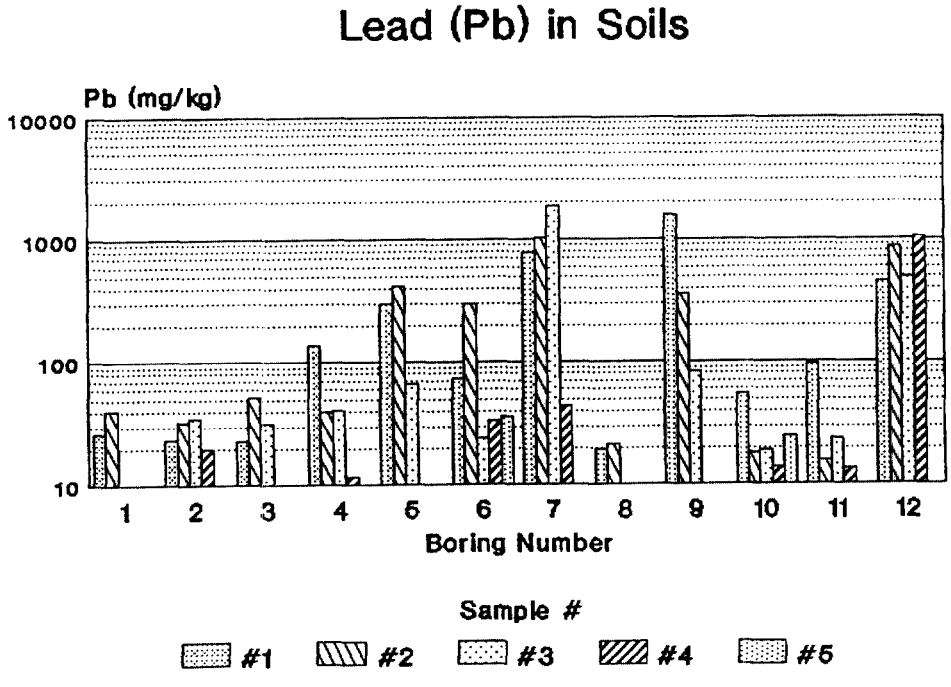
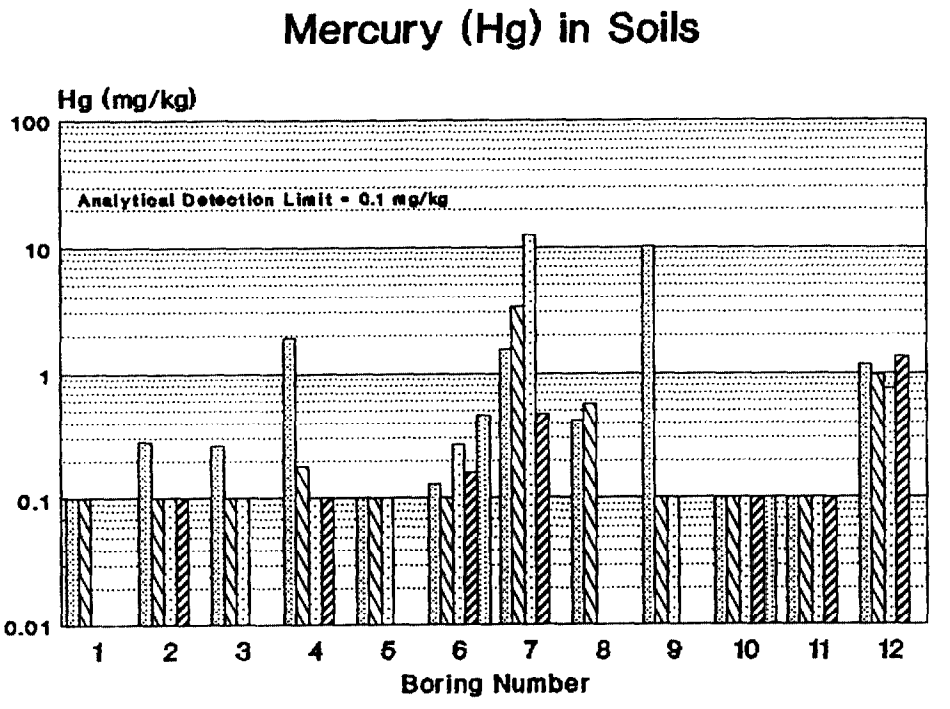


Figure 5.5. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Copper and lead concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



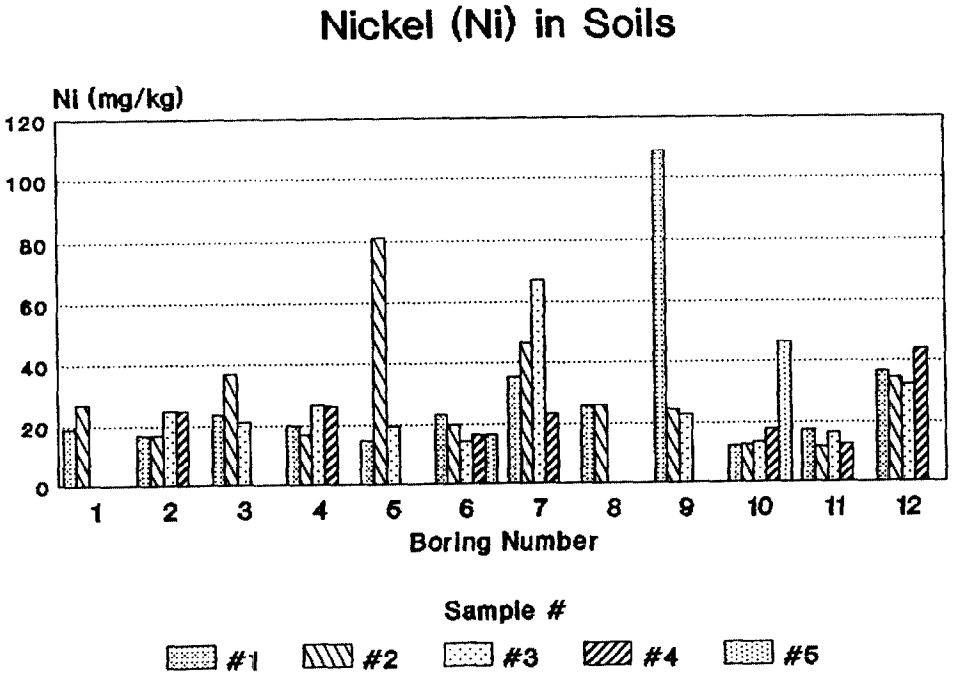
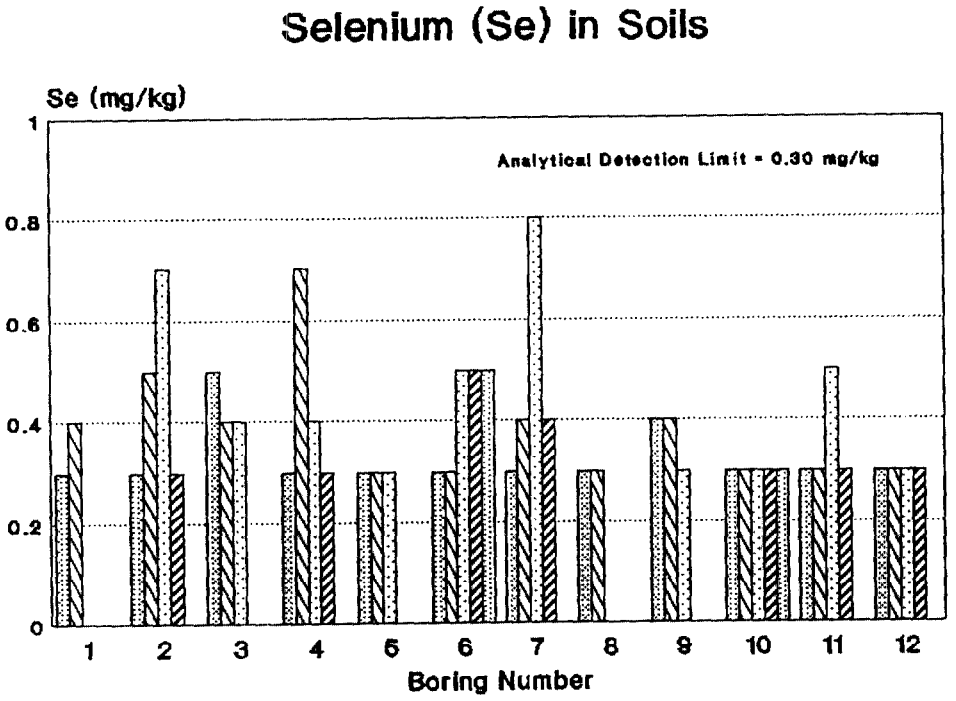


Figure 5.6. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mercury and nickel concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



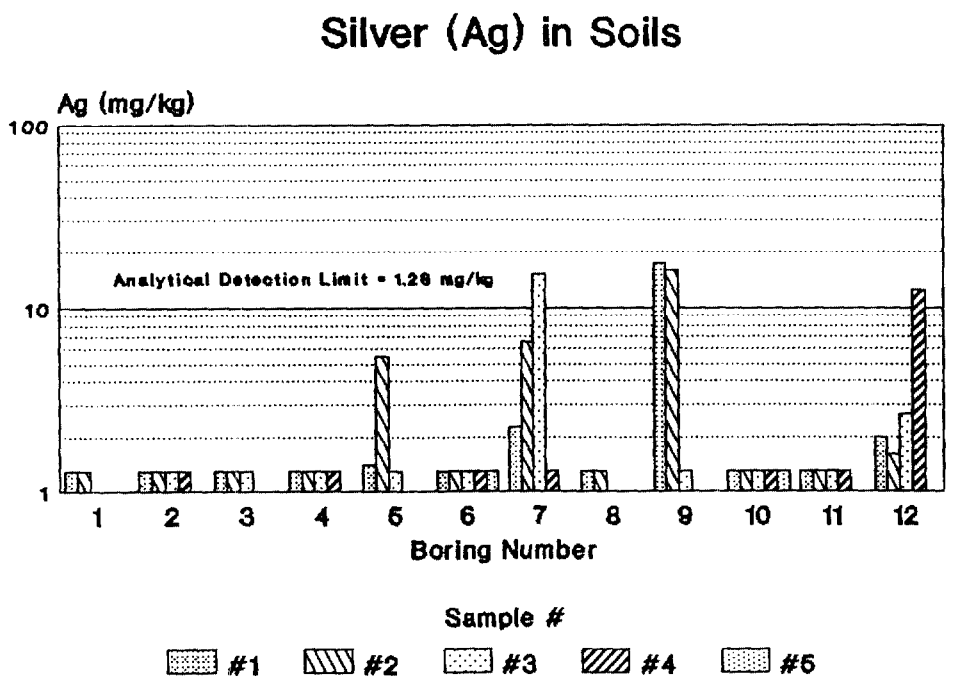
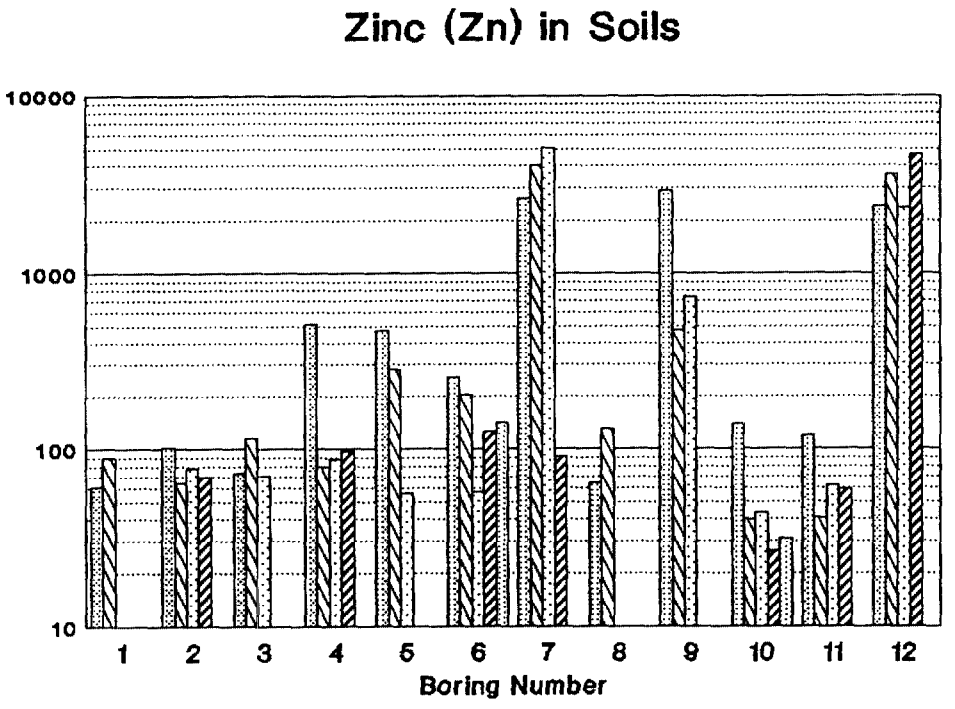


Figure 5.7. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Selenium and silver concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



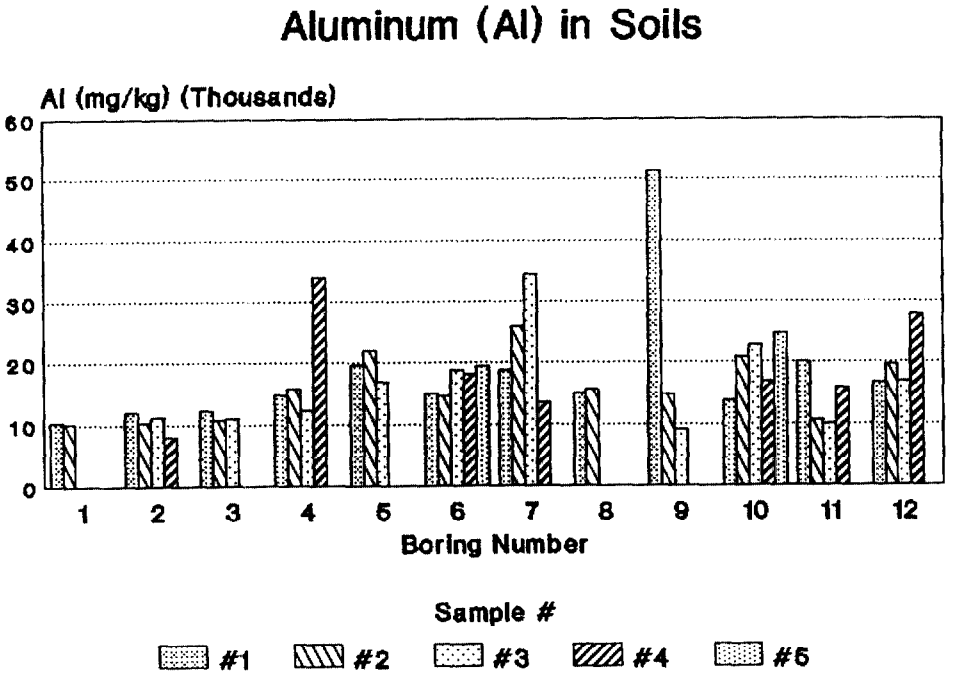
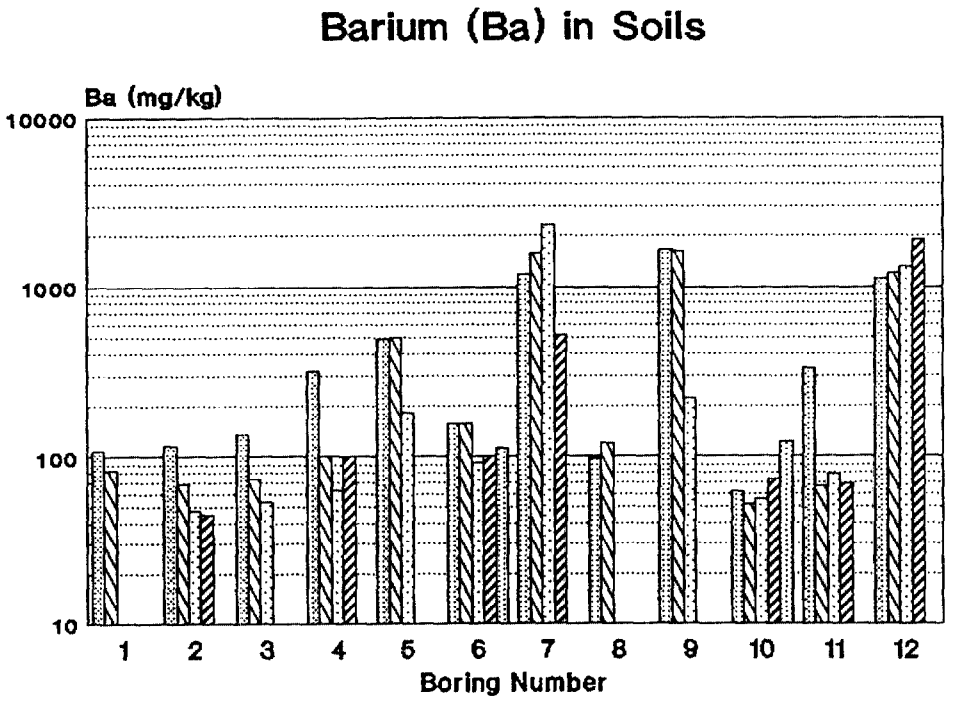


Figure 5.8. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Zinc and aluminum concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



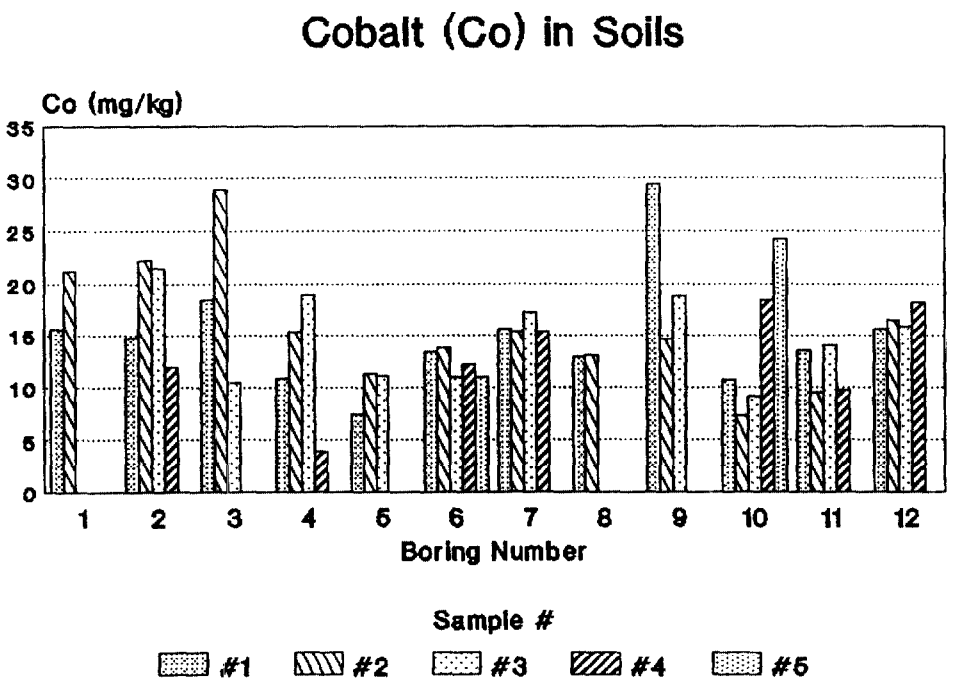
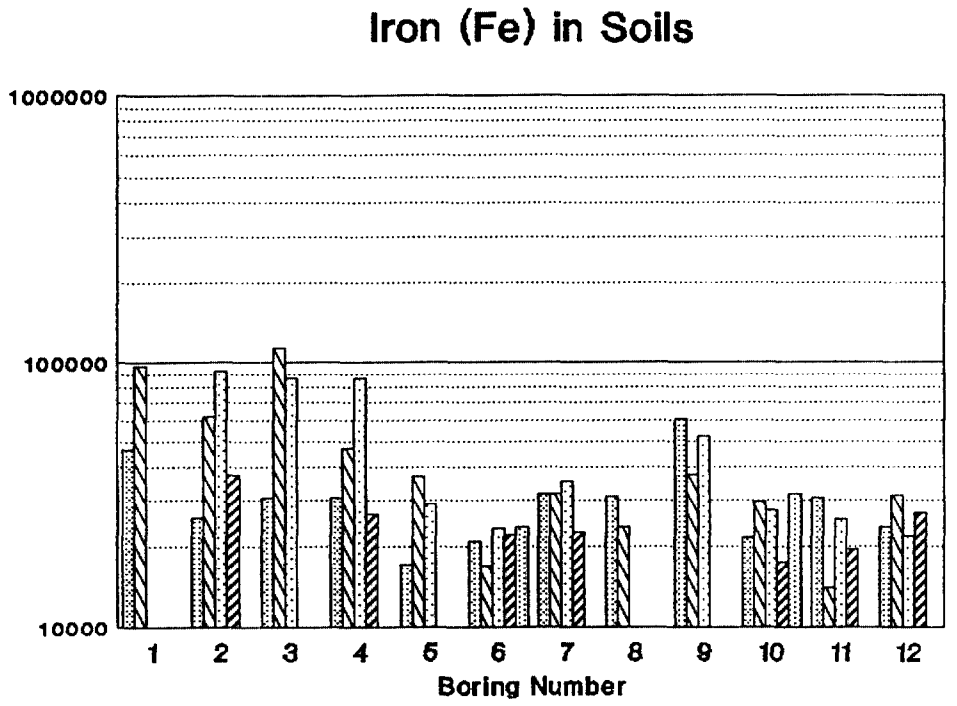


Figure 5.9. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Barium and cobalt concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



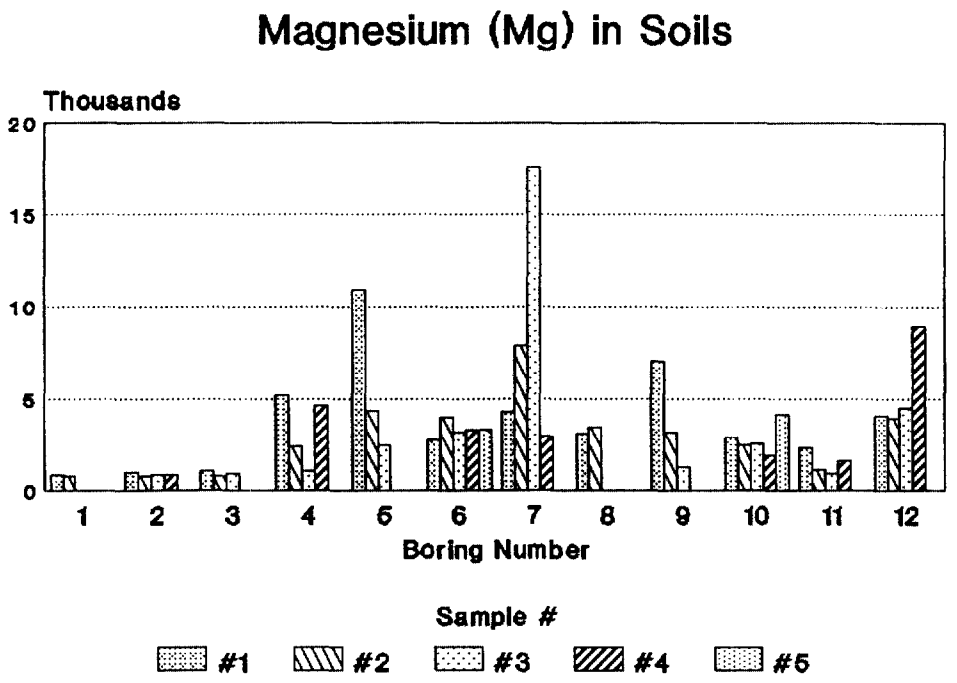
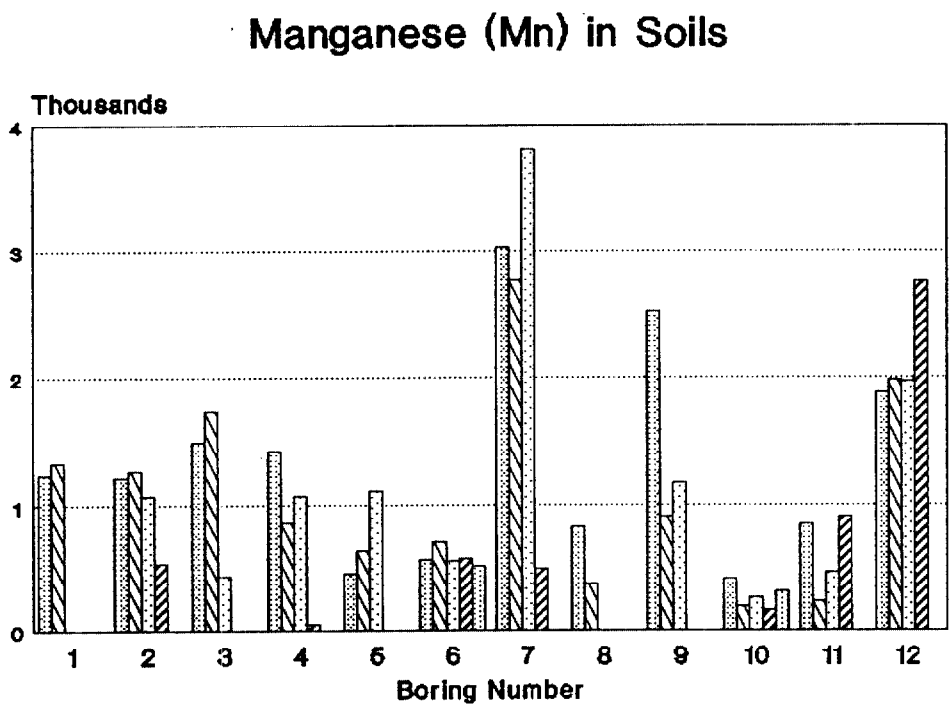


Figure 5.10. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Iron and magnesium concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



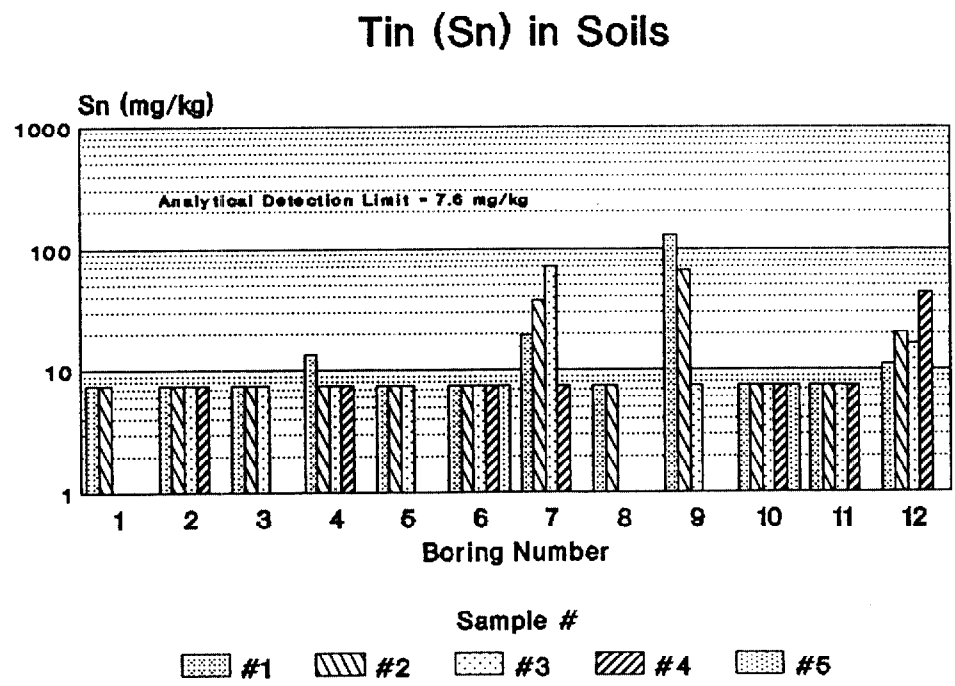
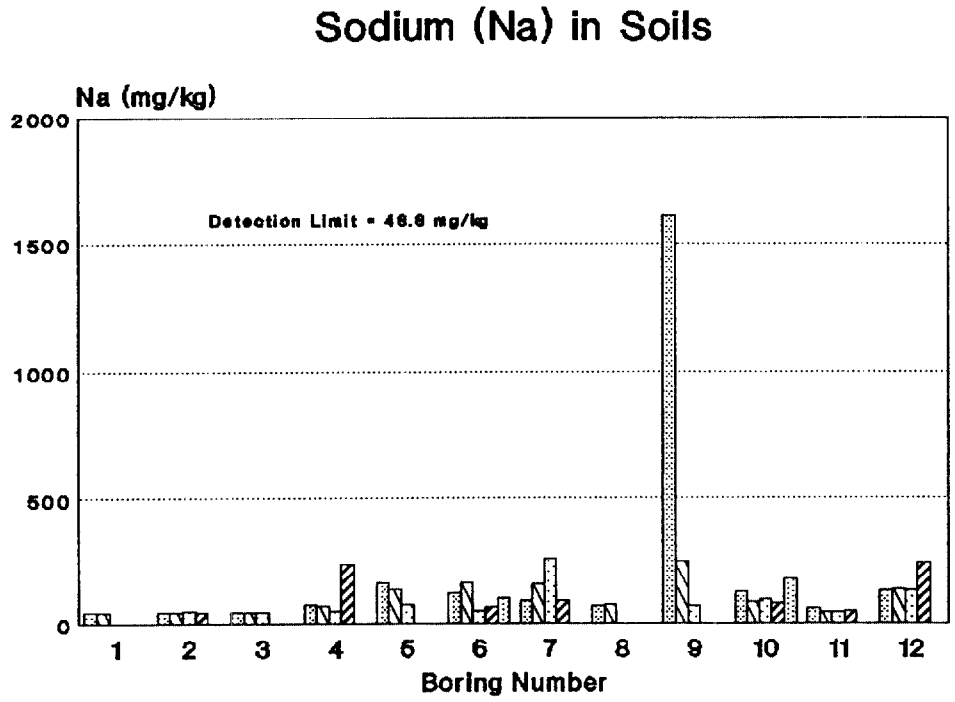


Figure 5.11. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Manganese and tin concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



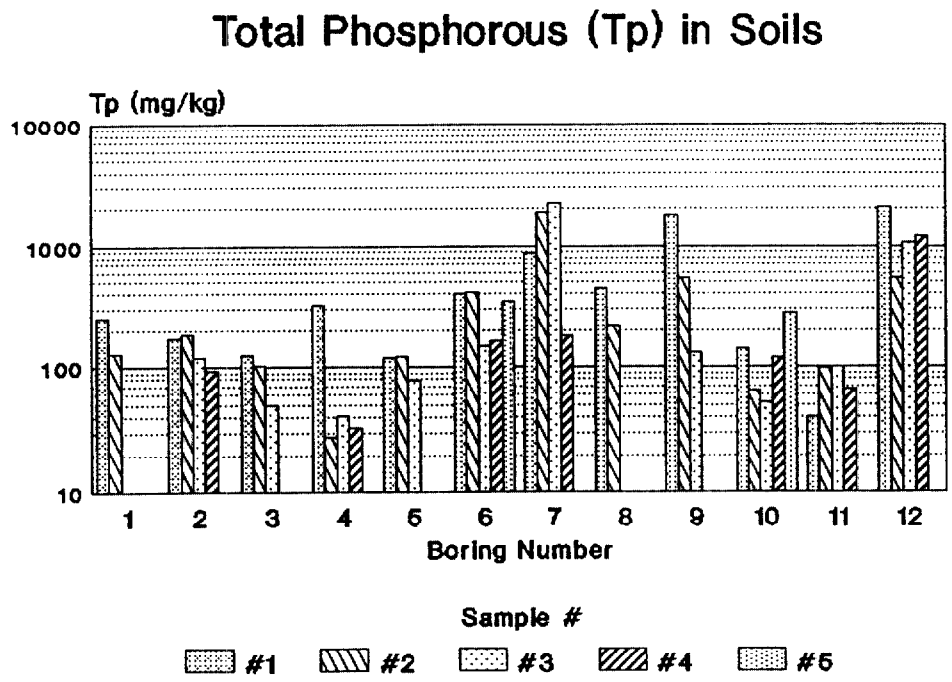


Figure 5.12. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Sodium and total phosphorus concentrations in individual soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.

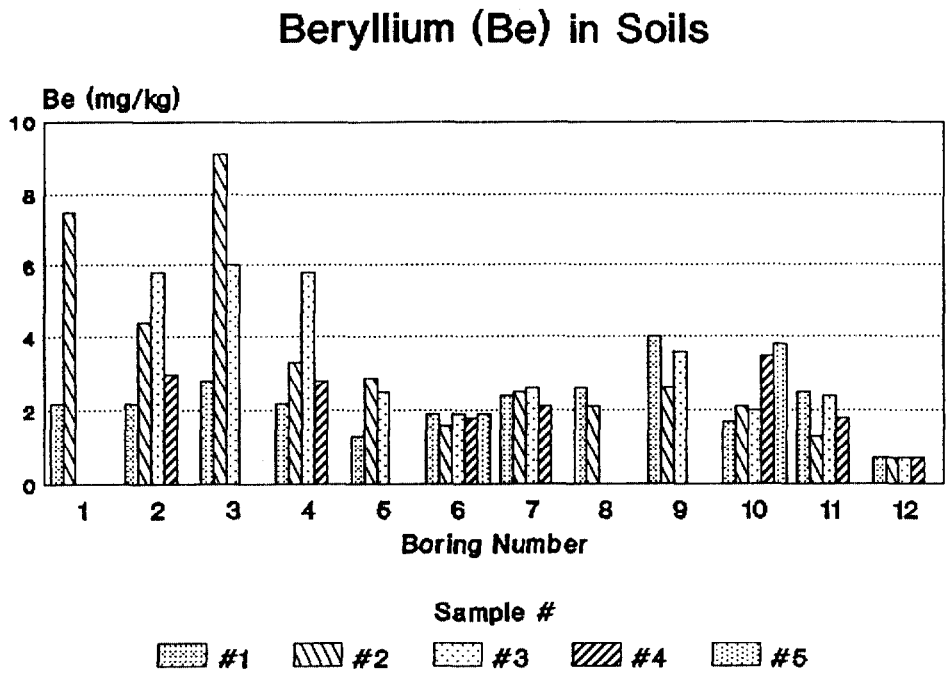
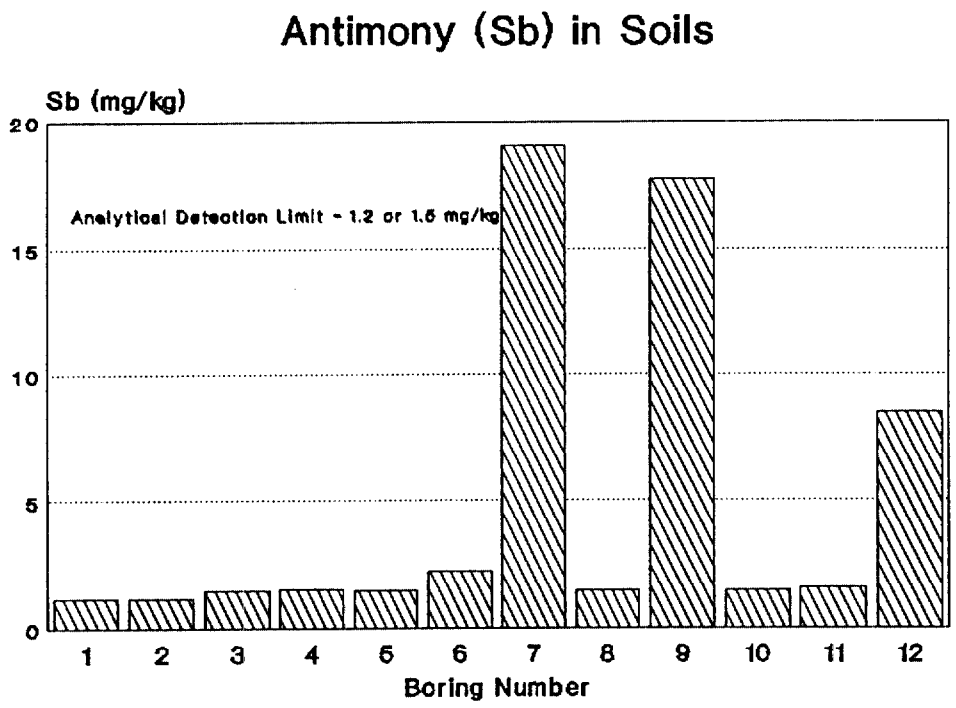


Figure 5.13. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Beryllium concentrations in individual soil samples. All laboratory results for beryllium are qualified in that spike sample recoveries were not within control limits. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.



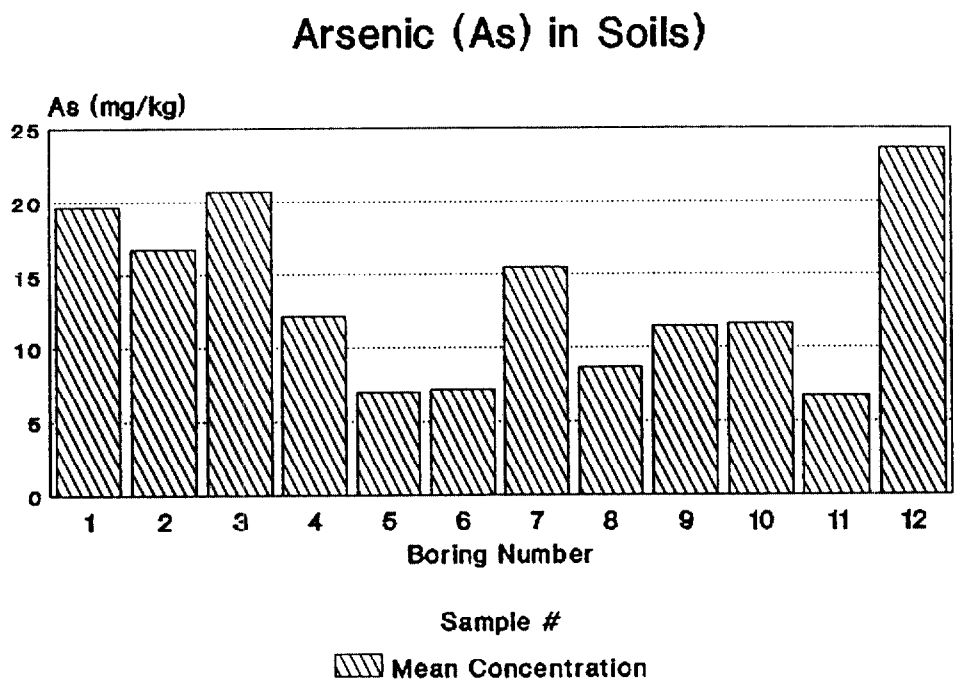
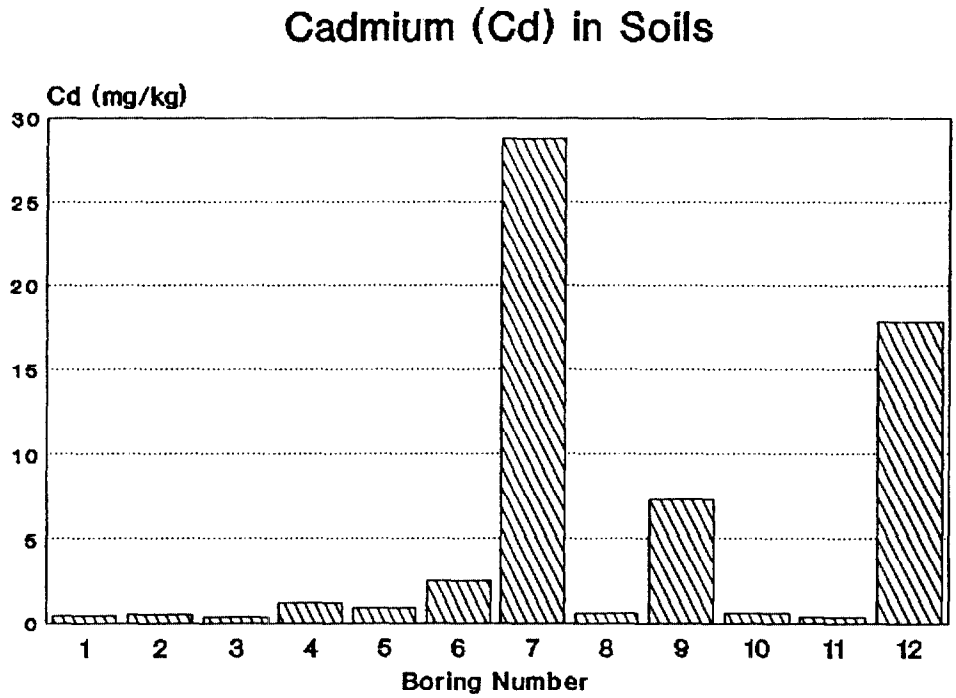


Figure 5.3A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of antimony and arsenic in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



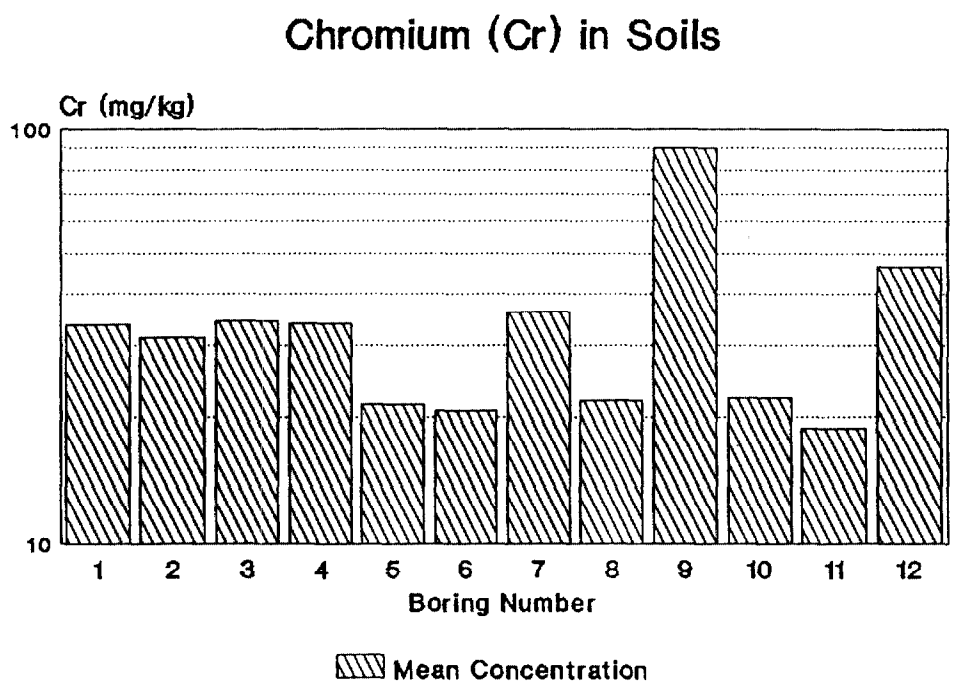
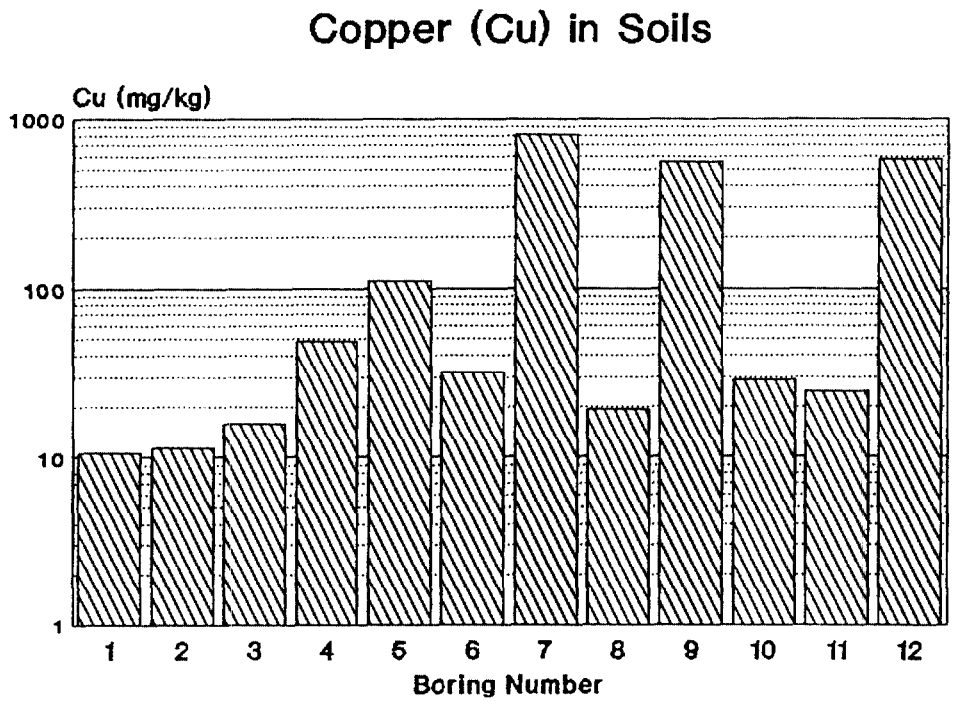


Figure 5.4A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of cadmium and chromium in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



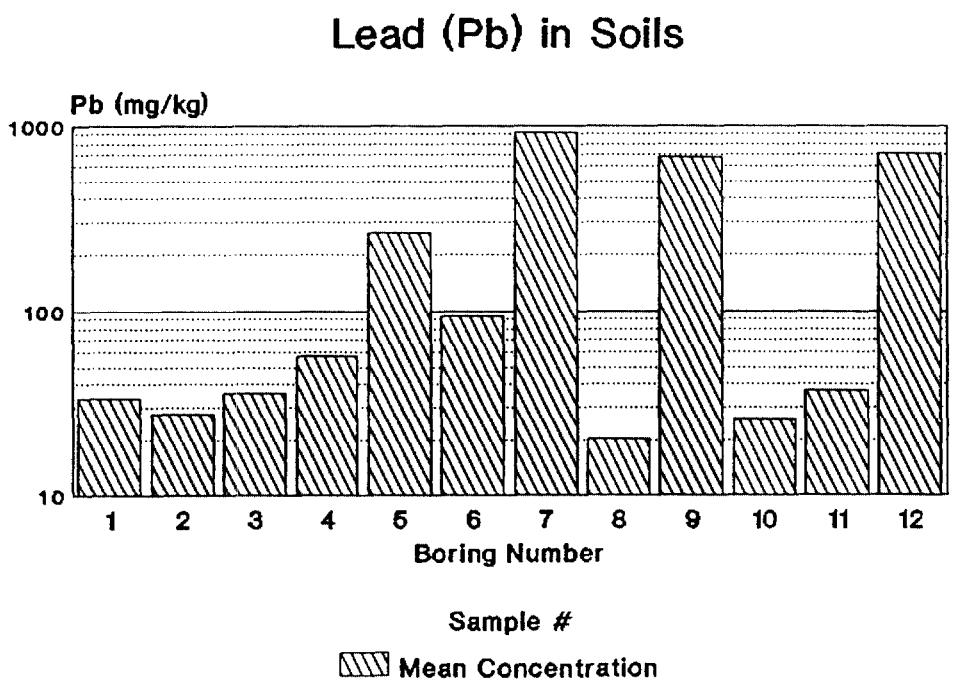
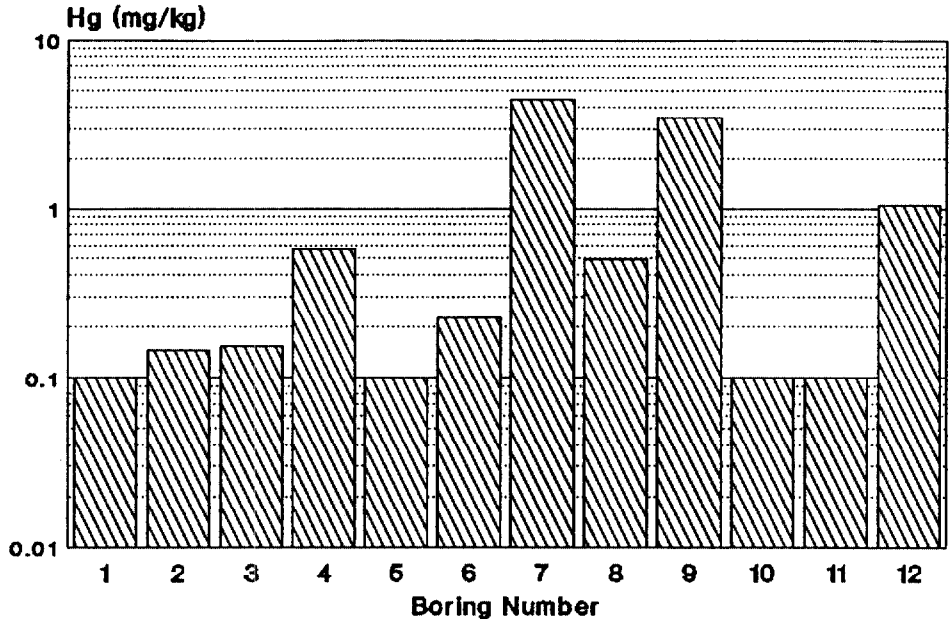
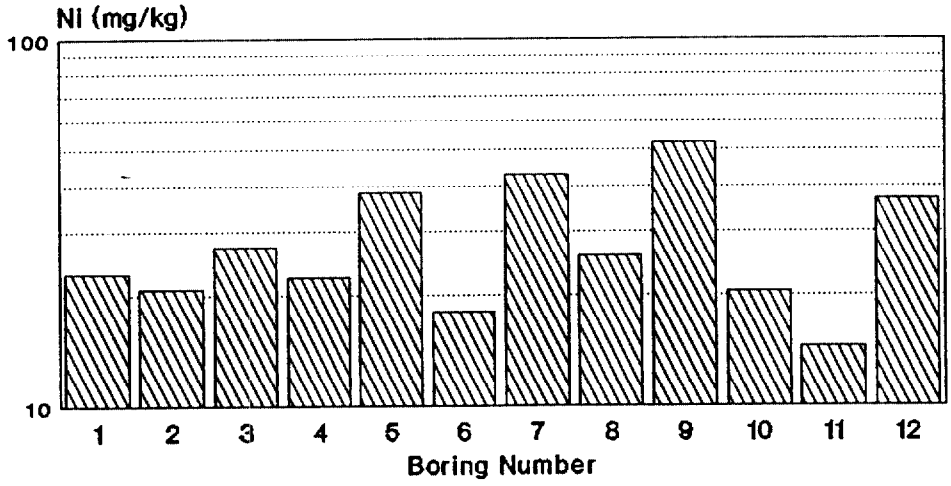


Figure 5.5A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of copper and lead in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.

Mercury (Hg) in Soils



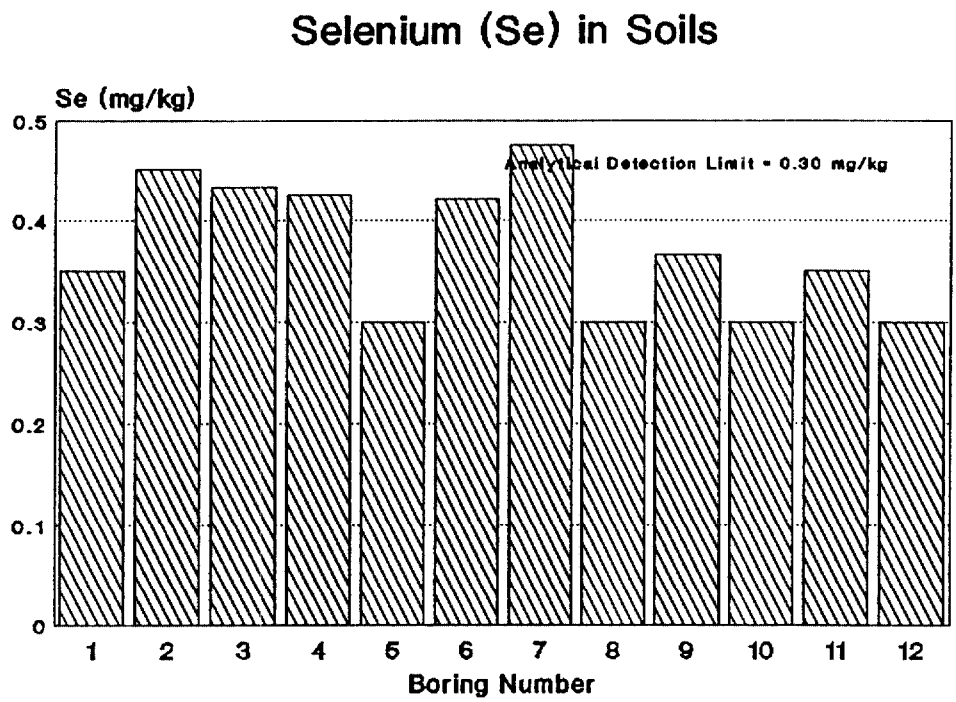
Nickel (Ni) in Soils



Sample #

Mean Concentration

Figure 5.6A. Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Mean concentration of mercury and nickel in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



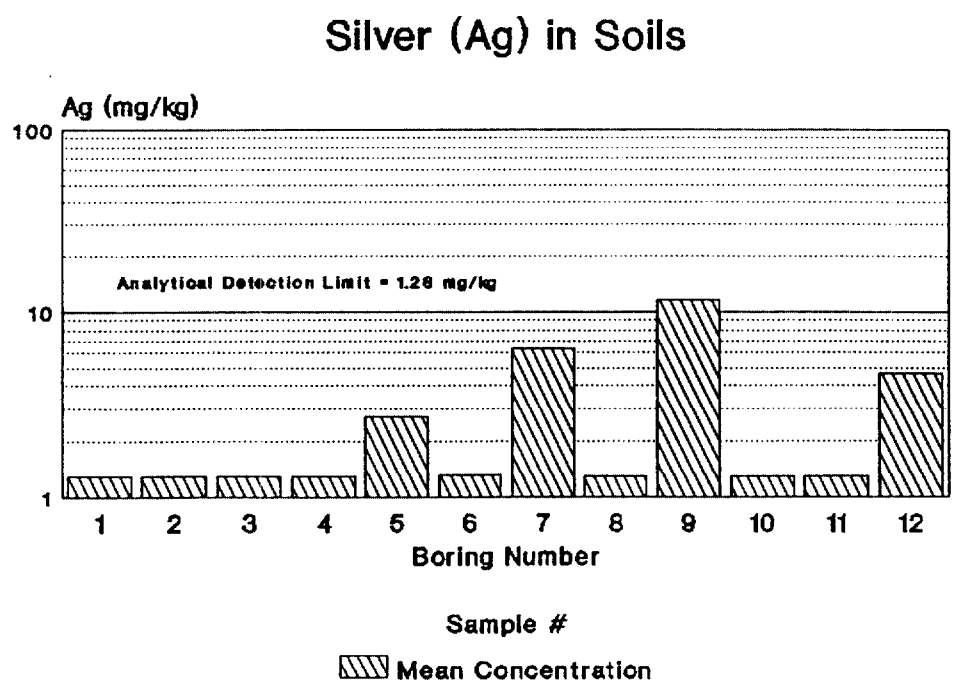
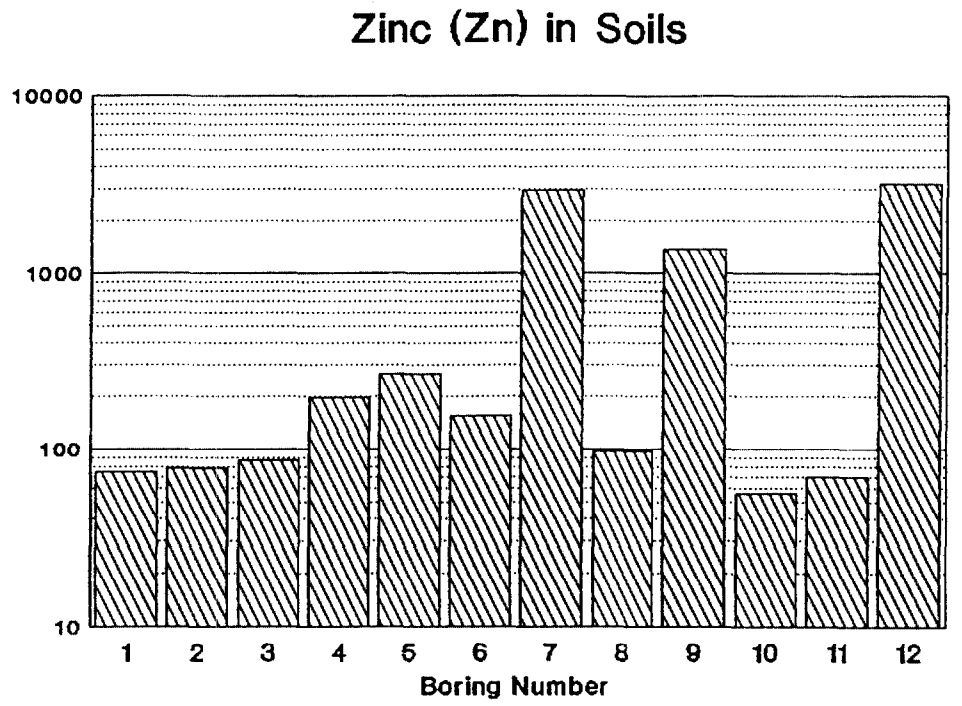


Figure 5.7A. Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Mean concentration of selenium and silver in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



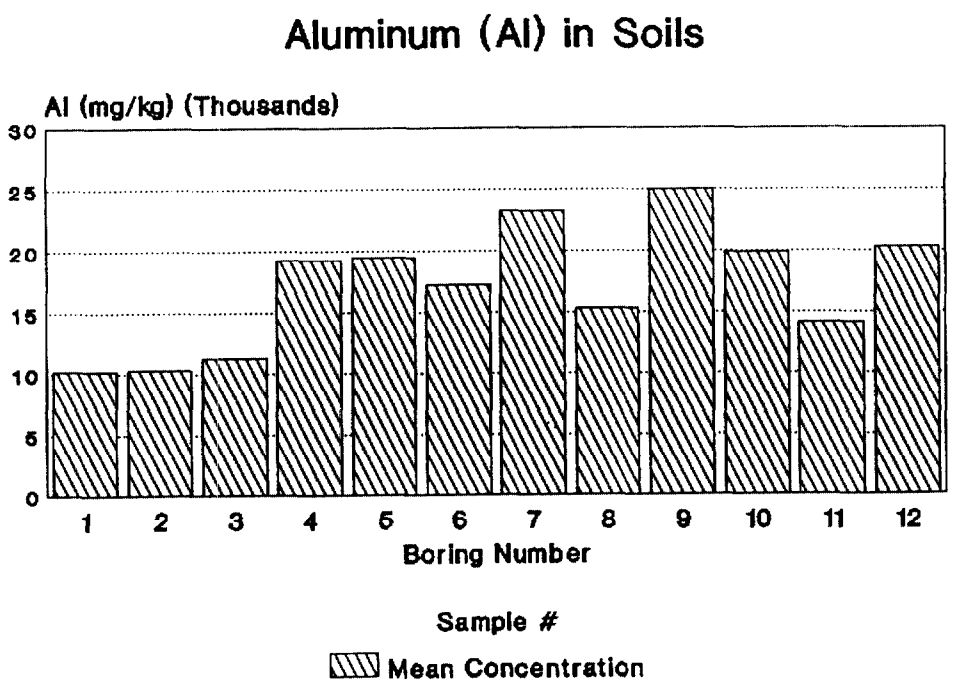
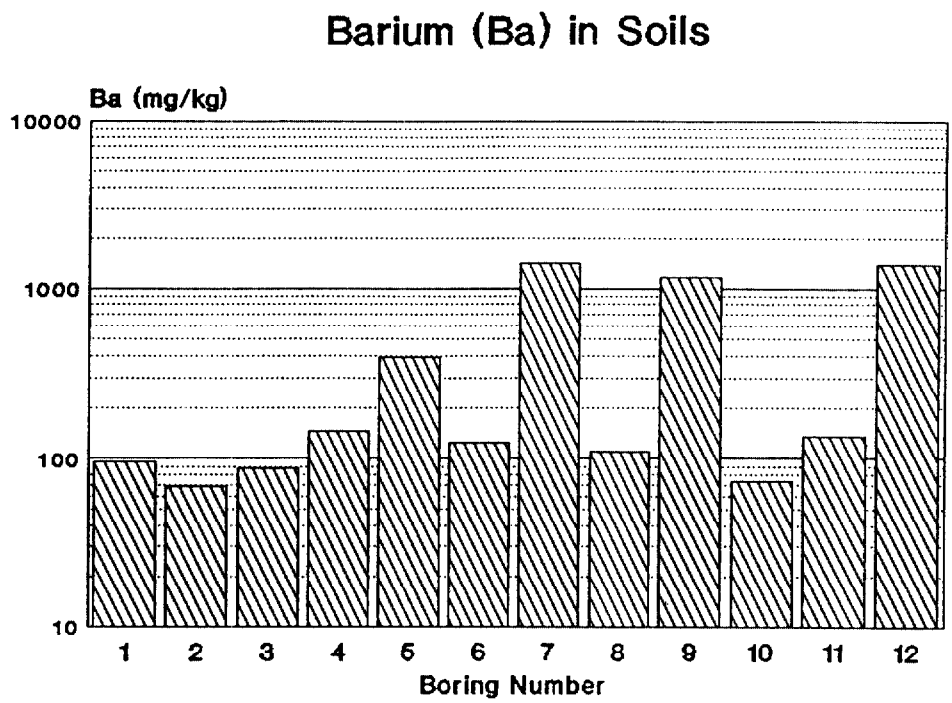


Figure 5.8A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of zinc and aluminum in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



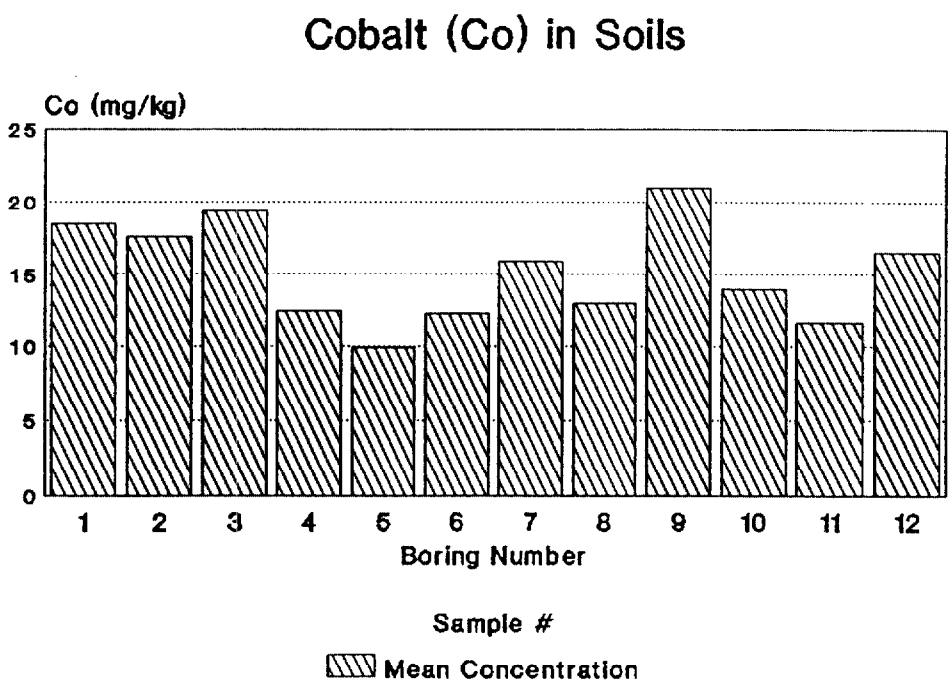
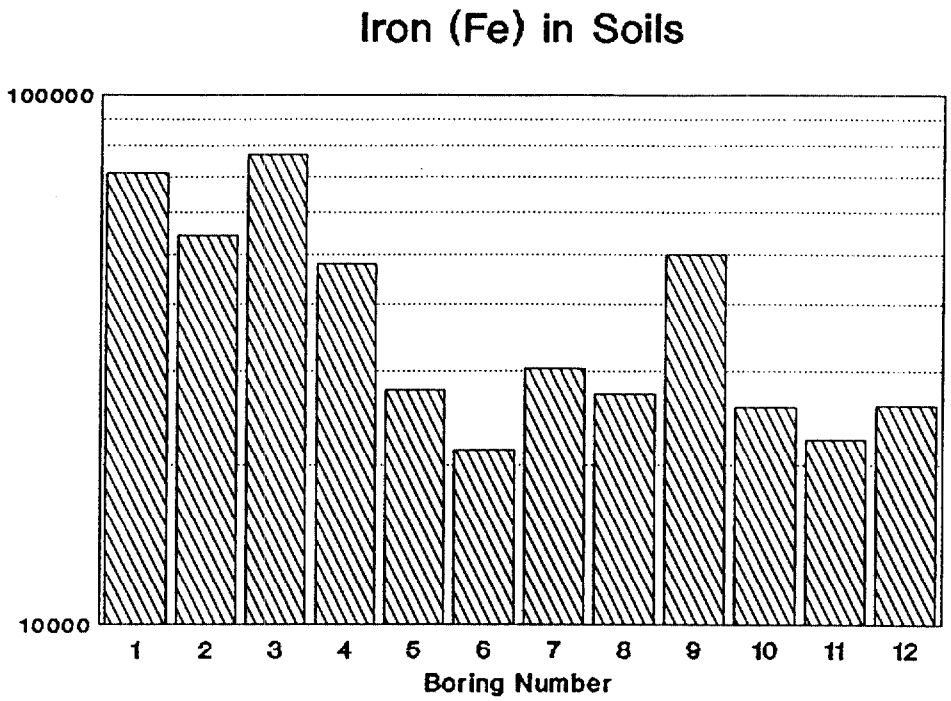


Figure 5.9A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of barium and cobalt in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



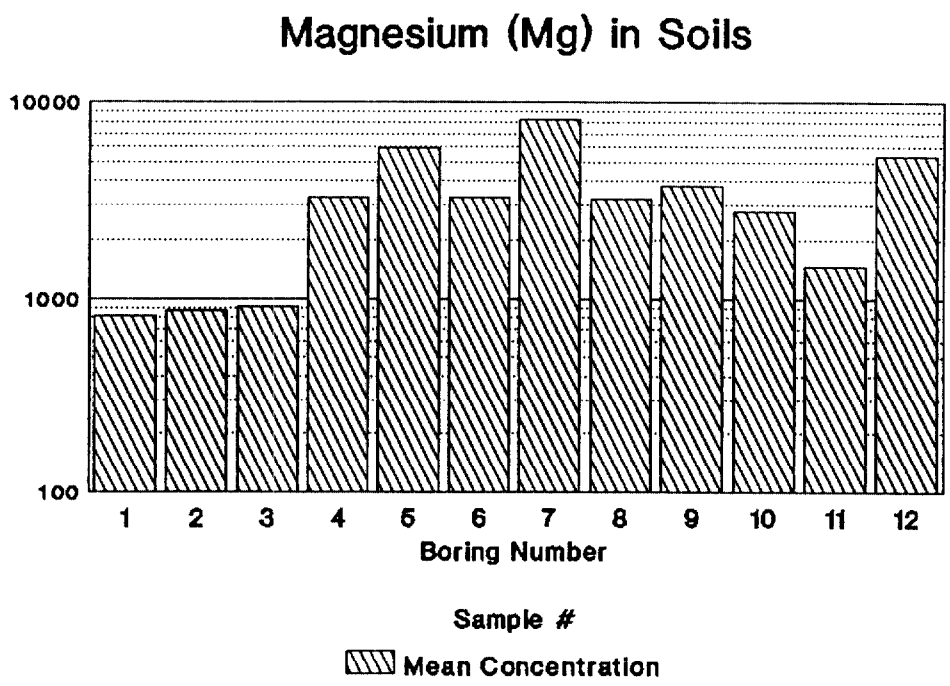
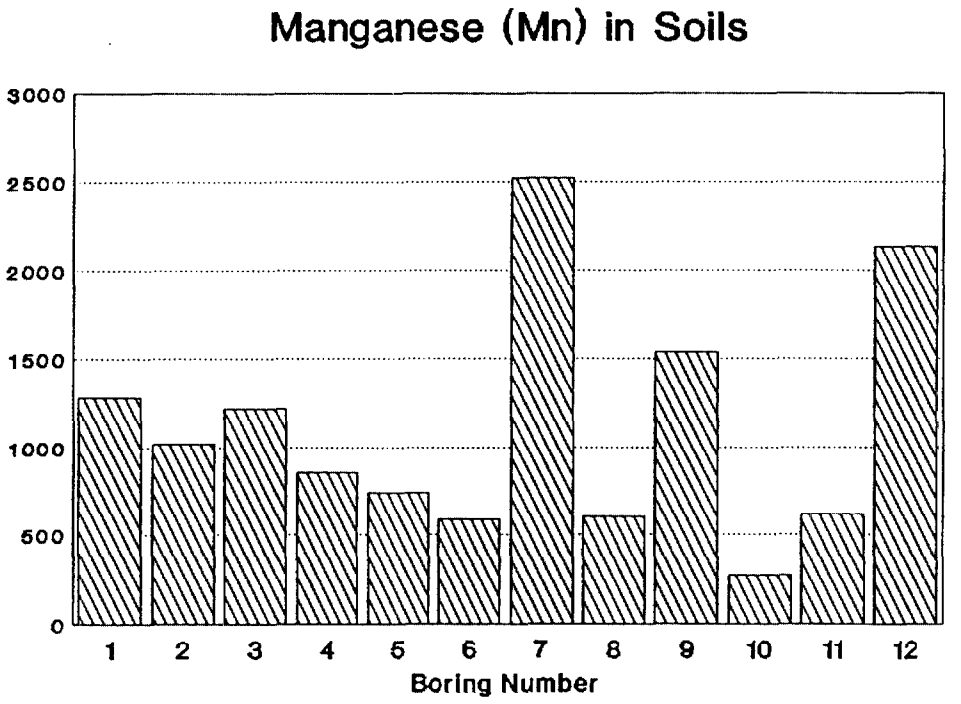


Figure 5.10A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of iron and magnesium in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



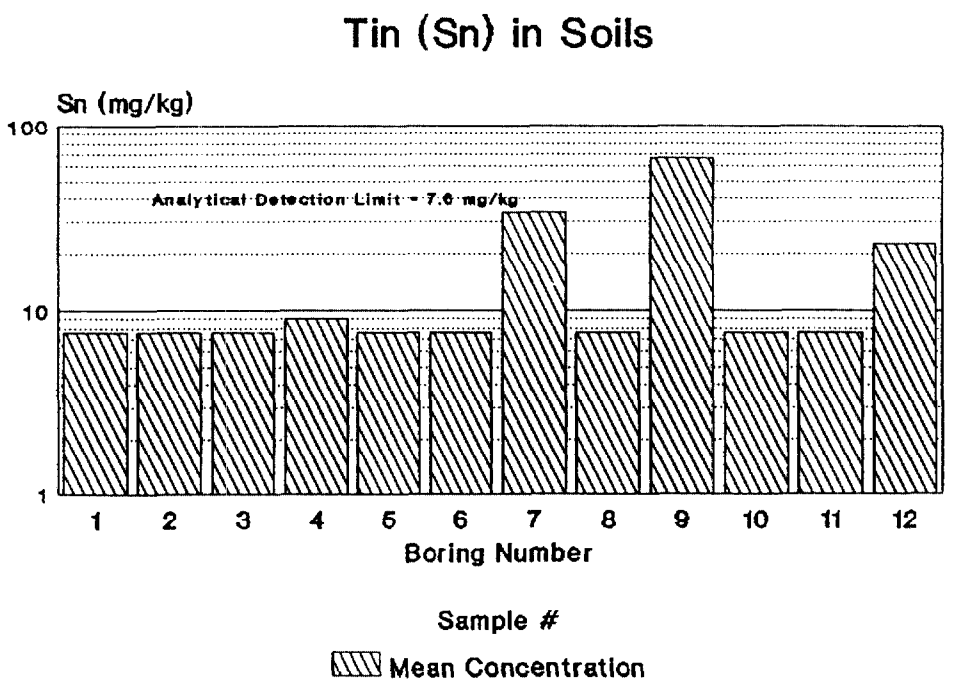
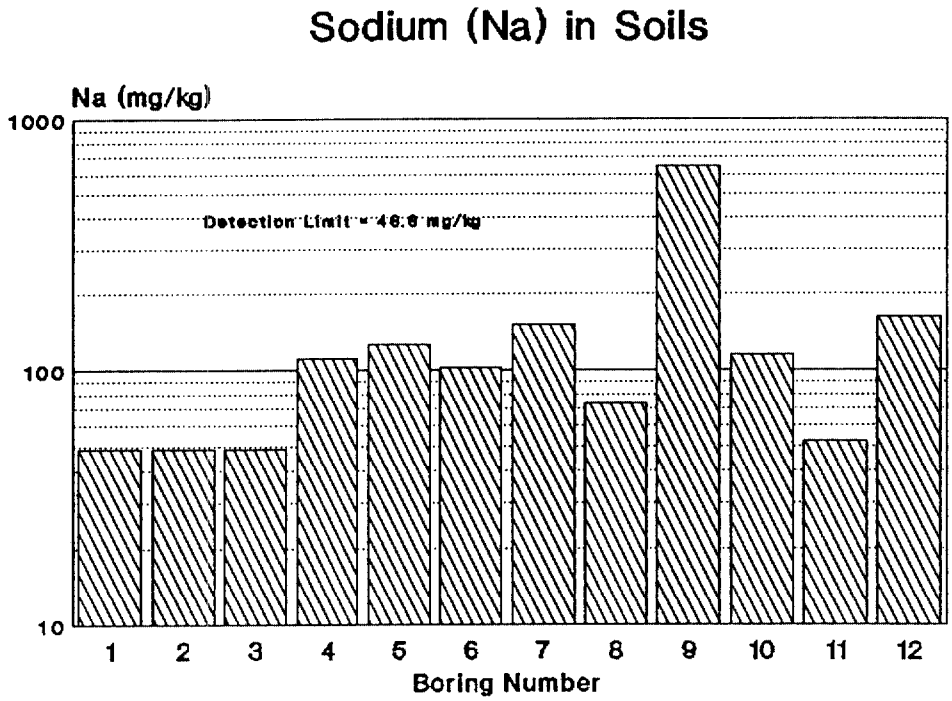


Figure 5.11A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean concentration of manganese and tin in soil samples by boring. See Figures 5.1 and 5.2 for boring location and sample depth.



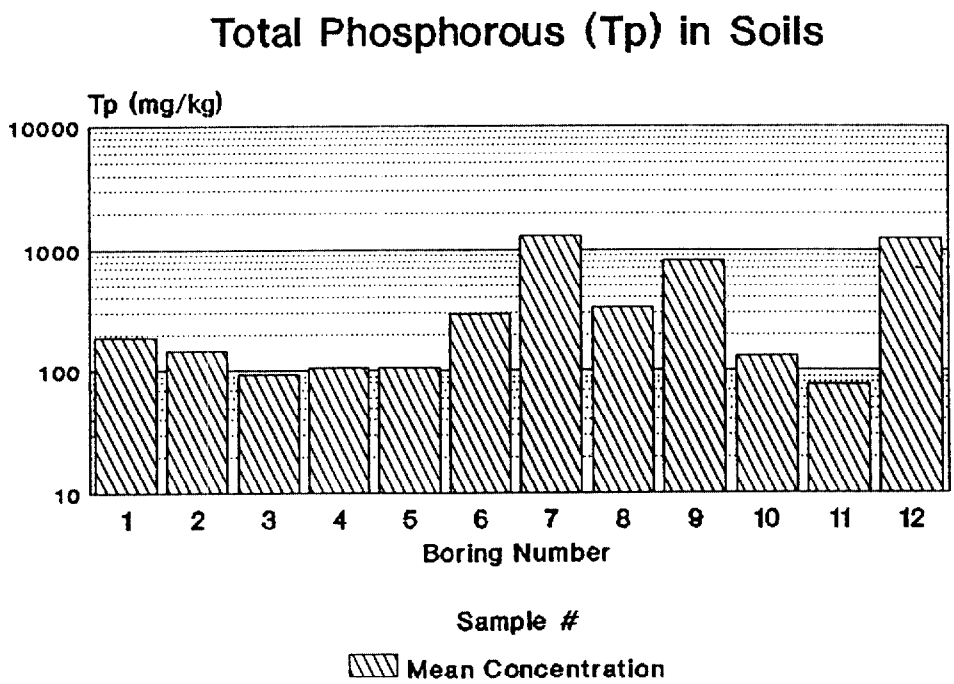


Figure 5.12A. Ammunition Burning Ground - NSWC Crane, Indiana. SWMU#03/10. Mean concentrations of sodium and total phosphorus in soil samples. All samples are shown in depth sequence for each boring. See Figures 5.1 and 5.2 for boring location and sample depth.

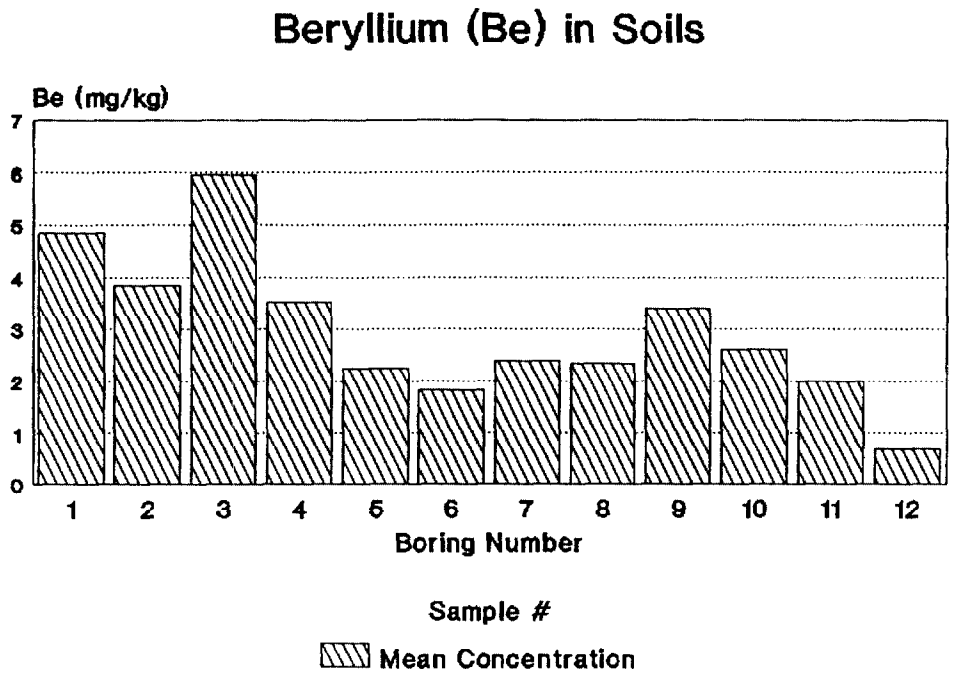


Figure 5.13A. Ammunition Burning Ground - NSWC Crane, Indiana, SWMU#03/10. Mean beryllium concentrations in individual soil samples. All laboratory results for beryllium are qualified in that spike sample recoveries were not within control limits. See Figures 5.1 and 5.2 for boring location and sample depth.

APPENDIX B

BORING LOGS

Hole No. 03/10-1-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION CRANE	SHEET 1 OF 1 SHEETS

1. PROJECT CRANE ABG	10. SIZE AND TYPE OF BIT 3" SHELBY
2. LOCATION (Coordinates or Station) (SEE MAP)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USACE WES	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-1-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: ~~DISTURBED~~ ALG 2; ~~UNDISTURBED~~ SOIL 1
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 8 August 90; COMPLETED 8 August 90
7. THICKNESS OF OVERBURDEN 2.6	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 2.6	19. SIGNATURE OF ~~INSPECTOR~~ Geologist Paul E Albritton

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SILT (ML), L.BR, CLAYEY, W/ ROOTS DRY, BAKED HARD		1 / 1 V	SAMPLED W/ 3" SHELBY. PUSH 2.0 REC 1.1
	1		CLAY (CL), D.BR, DRY. V.STIFF-HARD W/ NUM. ROCK SS Frags		2 / 2 V; 1A	✓ HNU = 0
	2					ADVANCED W/ 3" HOLLOW STEM AUGER
	2.6					REFUSAL
			TOP OF ROCK PROB. Sandstone			SCRAPING SOUND
	3					
	4					
	5					

B-1

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT CRANE ABG HOLE NO. 03/10-1-90

Hole No. 03/10-2-90

DRILLING LOG	DIVISION Nor Div	INSTALLATION NWSC Crane	SHEET 1 OF 1 SHEETS

1. PROJECT Crane ABG	10. SIZE AND TYPE OF BIT 3" Shelby
2. LOCATION (Coordinates or Station) (SEE MAP)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USACEMAP	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-2-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ALG 4; UNDISTURBED SOIL 2
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 9 Aug 90; COMPLETED 9 Aug 90
7. THICKNESS OF OVERBURDEN 7.3	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 7.3	19. SIGNATURE OF INSPECTOR Paul Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SILT(ML), L BR CLAYEY, w/ Roots DRY, STIFF		1 V	SAMPLED w/ 3" SHELBY TUBE PUSH 2.5' REC 1.3
	1		CLAY (GC), BR w/ NUM. GRAVEL SIZE Sandstone Frags.		2 V	
	2				1A	w/ 3" Hollow Stem Auger CLEAN OUT
					3 V	PUSH 0.6' REC 0.6
	3					AUGERED
	4					
	5					✓HNU 0
						AUGER 1.9 REC 1.9
	6		CLAY (CL) BR w/ BK SPOTS "LEOPARD SKIN LOOK" SANDY, SILTY MOIST & STIFF		4 V	
					2A	
	7		w/ Ss FRAGS BOTTOM OF HOLE			Augered
			TOP OF ROCK PROB. SANDSTONE			SCRAPING SOUND

B-2

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT Crane ABG HOLE NO. 03/10-2-90

Hole No. 03/10-3-90

DRILLING LOG	DIVISION NOR DIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF 1 SHEETS

1. PROJECT CRANE ABG	10. SIZE AND TYPE OF BIT 3" Shelby & Auger
2. LOCATION (Coordinates or Station) SEE MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USA CE MAP	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-3-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: ~~DISTURBED~~ ALG 2; ~~UNDISTURBED~~ SOIL 1
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 9 Aug 90; COMPLETED 9 Aug 90
7. THICKNESS OF OVERBURDEN 3.2	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 3.2	19. SIGNATURE OF INSPECTOR Geologist Paul E Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SILT (ML) BR CLAYEY, W/ ROOTS DRY, CRUMBLY		1. 1V	SAMPLED W/ 3" SHELBY TUBE PUSH 2.5 REC 1.5
	1		CLAY (GC) BR W/ GRAVEL SIZE Sandstone Frags		2 2V	
	2				1A	CLEAN OUT W/ 3" HOLLOW STEM AUGER
	3					PUSH 0.5 JACKED UP RIG AUGERED ↓
	3.2		BOTTOM OF HOLE			
			TOP OF ROCK (ALEAST FLOATING BOULDER			SCRAPING SOUND
	4					
	5					

B-3

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT CRANE ABG HOLE NO. 03/10-3-90

Hole No. 03/10-4-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION CRANE ABG	SHEET 1 OF 2 SHEETS

1. PROJECT - CRANE ABG	10. SIZE AND TYPE OF BIT SEE REMARKS
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USA CE WES	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-4-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ALG 4; UNDISTURBED SOIL 1
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 10 Aug 90; COMPLETED 10 Aug 90
7. THICKNESS OF OVERBURDEN 11.0	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 1.0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 12.0	19. SIGNATURE OF INSPECTOR Geologist Paul Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SILT (ML), L.BR. DRY, POWDERY PROB. REWORKED BY BULLDOZER		1 V	SAMPLED w/ 3" SHELBY TUBE PUSH 2.5' REC 1.0 due to compaction
	1		CLAY (GC) BR w/ GRAVEL SIZE SANDSTONE FRAGS		2V	
			note Red Rock (SS)		2	
	2					CLEAN OUT w/ 3" HOLLOW STEM AUGER
	3				3 3 V	PUSH 1.7' REC 1.0
	4					AUGERS SMOKING DUE TO SANDSTONE ✓HNU=0 CLEAN OUT
	5		- w/ ONLY OCC. ROCK FRAGS		1A	PUSH 2.5 REC 1.5
	6		CLAY (CH) BR w/ L.BR & RED MOTTLING MOIST, GUMMY STIFF		4 4 V	
	7					
	8					AUGER

B-4

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT CRANE ABG HOLE NO. 03/10-4-90

DRILLING LOG (Cont Sheet) ELEVATION TOP OF HOLE

Hole No. 03/10-4 -90

PROJECT CRANE ABG | INSTALLATION CRANE | SHEET 2 OF 2 SHEETS

ELEVATION	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10		CLAY GR CON'T			
	11.0		TOP OF ROCK			
			Shale, GR, FISSILE DRY, CRUMBLY			
			BOTTOM OF HOLE			
	12					

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ENG FORM 1836-A JUN 67 (ER 1110-1-1801) GPO 1969 OF-628-603

PROJECT CRANE ABG | HOLE NO. 03/10-4-9

Hole No. 03/10-5-90

DRILLING LOG	DIVISION NOR DIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF 2 SHEETS

1. PROJECT: CRANE ARG
2. LOCATION (Coordinates or Station): SEE MAP
3. DRILLING AGENCY: USA CE WES
4. HOLE NO. (As shown on drawing title and file number): 03/10-5-90
5. NAME OF DRILLER: ELASTIC BROWN
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 13.7
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 13.7
10. SIZE AND TYPE OF BIT: 3" Shelby & Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: 4 | UNDISTURBED: 3 E
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 11 Aug 90 | COMPLETED 11 Aug 90
17. ELEVATION TOP OF HOLE: ✓
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: GEOLOGIST = Paul Albston

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SAND (SP) M-C GRAINED MIX W/ CLAY		1 | 1	SAMPLED W/ 3" SHELBY TUBE
	1		CLAY (CL), BR, SILTY, DRY-DAMP W/ SCAT GRAVEL		2 | 2 V	PUSH 2.5 REC 1.0 due to compaction
			W/ RED STRAIN Prob Phosphurus cloth			
	2		ALSO white flash stain			CLEANED OUT W/3" HOLLOW STEM AUGER
	3		CLAY (CL) CON'T MOIST, BR			✓ HNU = 0
			W/ BR BURNT CRUMBLES & white Flash stains		3 | 3 V	PUSH 2.5 REC 1.0
	4				1A	
	5					CLEAN OUT
					4 | 4 V	PUSH 2.5 REC 2.5
	6				2A	✓ HNU = 0
	7		CLAY (CL), BR SOFT IN JOINTS BETWEEN Sandstone, L. BR. Slightly weathered F. Grained FRAGS			CLEAN OUT
	8		CLAY (CL) GR W/ GRN SILTY, DAMP, STIFF W/ SS Frags FeOX YELLOW to RED			PUSH 0.9 REC 0.9
	9					AUGERED
	10					

B-6

ENG FORM 1971 | PROJECT | HOLE NO.

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE | Hole No. 03/10-5-90

PROJECT | INSTALLATION CRANE | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc.) g
	10		CLAY (CL) GR CONT			AUGERED
	11					
	12		CLAY, WEATHERED SHALE PRODUCT			
	13		BOTTOM OF HOLE			REFUSAL
	14		SANDSTONE, YEL. HARD. BIG CLIFTY SS			SCRAPING SOUND

ENG FORM 1836-A (ER 1110-1-1801) GPO 1960 OF-638-603 | PROJECT | HOLE NO.

Hole No. 03/10-6-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION NWSC CRANE IN	SHEET 1 OF 1 SHEETS

1. PROJECT CRANE ABS	10. SIZE AND TYPE OF BIT 3"
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USA CE WES	12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500
4. HOLE NO. (As shown on drawing title and file number) 03/10-6-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: ~~DISTURBED~~ ALL 5; UNDISTURBED
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER ✓
	16. DATE HOLE: STARTED 18 AUG 90; COMPLETED 18 AUG 90
7. THICKNESS OF OVERBURDEN 10.0'	17. ELEVATION TOP OF HOLE ✓
8. DEPTH DRILLED INTO ROCK 0.0'	18. TOTAL CORE RECOVERY FOR BORING N/A %
9. TOTAL DEPTH OF HOLE 10.0'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		CL Sandy lean Clay dry, Stiff, Trace of gravel with occasional sandy seams and pockets.		1 ✓	Sampled with 3" Shelby Tube. PUSH 3.0'
	1				2 ✓	W.L. during drilling 6.0' 48 hrs. DRY
						Skinned Samples w/Stainless Steel Knifes.
	2		CH Very lean Clay, Hard, moist.		3 ✓	Clean out w/3" Hollow Stem Auger
	3					PUSH 2.5
	4				4 ✓	
	5				1A	Clean out 5.5'
					5 ✓	PUSH 2.0'
	6					
	7		weather slate fragments Poor - Dense			
	8		Probably weather Shale.			Clean out w/3" Hollow Stem Auger From 7.5' to 10.0'
	10.2		TOP OF ROCK 10.0'			AUGER Refusal with scraping sound.
			BOTTOM OF HOLE 10.0'			Left hole open to measure W.L.

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ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.
JAN 71

Hole No. 03/10-7-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF 1 SHEETS

1. PROJECT CRANE ABG	10. SIZE AND TYPE OF BIT 3" SHELBY & AUGER
2. LOCATION (Coordinates or Station) SEE MAP	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USA CE WES	12. MANUFACTURER'S DESIGNATION FAIL
4. HOLE NO. (As shown on drawing title and file number) 03/10-7-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 8
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER ✓
	16. DATE HOLE: STARTED 17 Aug 90; COMPLETED 17 Aug 90
7. THICKNESS OF OVERBURDEN 2.8	17. ELEVATION TOP OF HOLE ✓
8. DEPTH DRILLED INTO ROCK 0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 2.8	19. SIGNATURE OF INSPECTOR Geologist Paul E Albritton

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		CLAY (CL) w/ SS FRAGS			
			CLAY (CL) D.BR. to GR MOIST, SOFT w/ Scat SS FRAGS		1 ✓	PUSH 2.0 REC 2.0
	1				2 ✓	
			FILL, CLAY MIX w/ AL-MN SLAG NODS. CU Bullets, Burnt wood & Sandstone frags		3 ✓	
	2		shell frags		4 ✓	PUSH 0.3
	3		TOP OF ROCK			SCRAPING SOUND
	4					
	5					
	6					

B-9

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. 03/10-8-90

DRILLING LOG	DIVISION WORDIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF 1 SHEETS

1. PROJECT: CRANE ABG
2. LOCATION (Coordinates or Station): (SEE MAP)
3. DRILLING AGENCY: USA CE WES
4. HOLE NO. (As shown on drawing title and file number): 03/10-8-90
5. NAME OF DRILLER: ELASTIC BROWN
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 1.7
8. DEPTH DRILLED INTO ROCK: 0
9. TOTAL DEPTH OF HOLE: 1.7
10. SIZE AND TYPE OF BIT: 3" SHELBY & AUGER
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): ASSU
12. MANUFACTURER'S DESIGNATION: FAILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: ~~Disturbed~~ ALG ~~Undisturbed~~ SALT
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: ✓
16. DATE HOLE: STARTED 15 AUG 90 COMPLETED 15 AUG 90
17. ELEVATION TOP OF HOLE: ✓
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: GEOLOGIST = Paul Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		BULL DOZED RUBBLE			SCRAPED OFF P-0.7'
			CLAY (CH) BR & GR MOTTLED. DAMP, V. STIFF W/ SCAT. ROCK FRAGS		1 1✓ / 1A / 2 2✓	SAMPLED W/ 3" SHELBY TUBE PUSH-1.8 REC-1.0
	1					
	2		TOP OF ROCK SANDSTONE HARD			SCRAPING
	3					
	4					
	5					
	6					
	7					
	8					
	9					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. 03/10-9-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION NWSC CRANE, IN	SHEET 1

1. PROJECT	CRANE ABG
2. LOCATION (Coordinates or Station)	SEE MAP
3. DRILLING AGENCY	USACE WES
4. HOLE NO. (As shown on drawing title and file number)	03/10-9-90
5. NAME OF DRILLER	ELASTIC BROWN
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	6.0'
8. DEPTH DRILLED INTO ROCK	0
9. TOTAL DEPTH OF HOLE	6.0'
10. SIZE AND TYPE OF BIT	3"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	~~DISTURBED~~ ALL 3 ; ~~UNDISTURBED~~ 3 SOIL
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	✓
16. DATE HOLE	STARTED 16 Aug 90 ; COMPLETED 16 Aug 90
17. ELEVATION TOP OF HOLE	✓
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	Geologist Paul E Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		FILL, CLAY (CL) BK MIX W/ GRAVEL SIZE SS FRAGS & SCAT. RUSTY NAILS		1 / 1 ✓ / 1A	SAMPLED W/ PUSH 0.8 REC 0.8
	1					
	2		CLAY (CL), BR, DAMP, STIFF W/ SCAT. SS FRAGS & SH CRUMBES			CLEAN OUT W/ 3" HOLLOW STEM
	3				2 / 2 ✓	PUSH 2.2 REC 1.1 DUE TO COMPACTION
	4		CLAY FILLED JOINTS W/ SANDSTONE CHUNKS ∴ PROB. WEA. ROCK		2A	
	5		WATER ALONG SS FRAGS		3 / 3 ✓	PUSH 1.0 REC 1.0
	6		TOP OF ROCK		3A	REFUSAL

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ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT CRANE ABG HOLE NO.

Hole No. 03/10-10-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF 1 SHEETS

1. PROJECT: CRANE ABG.
2. LOCATION (Coordinates or Station): SEE MAP
3. DRILLING AGENCY: USA CE WES
4. HOLE NO. (As shown on drawing title and file number): 03/10- -90
5. NAME OF DRILLER: ELASTIC BROWN
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.2
8. DEPTH DRILLED INTO ROCK: 0.3
9. TOTAL DEPTH OF HOLE: 7.5
10. SIZE AND TYPE OF BIT: 3" SHELBY & AUGER
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: 5 DISTURBED, 2 UNDISTURBED
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 15 AUG 90 COMPLETED 15 Aug 90
17. ELEVATION TOP OF HOLE: ✓
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Paul Allston

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		FILL, CLAY (CL) BR w/ CRUSHED LS ROCKS		1	SAMPLED w/ ← STAINLESS STEEL SCOOP
	1		CLAY (CL), BR, DAMP, V. STIFF w/ SCAT BK DOTS PROB. Fe OR Mn stains		2 2; 3 3V	w/ 3" SHELBY TUBE PUSHED 2.0 REC 1.0 due to COMPACTION
	2		w/ SCAT Ss FRAGS			CLEANOUT w/ 3" HOLLOW STEM AUGER
	3		CLAY, CONT REDDISH BR		1A	PUSH 2.5 REC 1.5
	4		CLAY, GR w/ Fe ox Red-BR stains & white & BK concretions		4 4V	
	5					PUSH 2.5 REC 1.2
	6		ZONE OF chemical precipation w/ Fe ox stains & white concretions		5 5V	
	7		Shale, wea. TAN w/ BR leaf imprints		2A	
	8					

Hole No. 03/10-11-90

DRILLING LOG	DIVISION NOR DIV	INSTALLATION CRANE ABG	SHEET 1 OF 1 SHEETS

1. PROJECT: CRANE ABG
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: USA CE WES
4. HOLE NO. (As shown on drawing title and file number): 03/10-11-90
5. NAME OF DRILLER: ELASTIC BROWN
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.6
8. DEPTH DRILLED INTO ROCK: 2.4
9. TOTAL DEPTH OF HOLE: 10.0
10. SIZE AND TYPE OF BIT: 3" AUGER & SHELBY
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: [illegible]
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 1 SHE
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 13 AUG 90; COMPLETED 13 AUG 90
17. ELEVATION TOP OF HOLE: ✓
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Geologist: Paul Albertson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		FILL: CLAY (CL) BR w/ SANDSTONE FRAGMENTS		JAR 1	SAMPLED w/ 3" SHELBY TUBE. PUSH 2.5 REC 0.5 DUE TO SS COMPACTING CLAY
	1					
	2		CLAY (CL) (GR) MOIST, SOFT. "CREEK BOTTOM MUD"			CLEANED OUT w/ 3" HOLLOW STEM AUGER
	3		w/ SANDY SEAMS		2 / 2V	PUSH 2.5 REC 2.5
			& NUM ORG BK FRAGS		3 / 3V	
	4				1A	
			← VISIBLE WATER ALONG SS FRAGS			
	5					AUGERED
	6					
	7					
	8		SHALE, GR. SOFT CRUMBLY INDIAN SPRING MEM OF BIG CLIFTY FM			
	9					
	10		BOTTOM OF HOLE			

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ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: CRANE ABG | HOLE NO. 03/10-11-0.

Hole No. 03/10-12-90

DRILLING LOG	DIVISION NORDIV	INSTALLATION NWSC CRANE, IN	SHEET 1 OF SHEETS

1. PROJECT CRANE ABG	10. SIZE AND TYPE OF BIT 3" HAND AUGER
2. LOCATION (Coordinates or Station) SEE PLAN	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL
3. DRILLING AGENCY USA CE WES	12. MANUFACTURER'S DESIGNATION OF DRILL HAND AUGER
4. HOLE NO. (As shown on drawing title and file number) 03/10-12-90	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ALG 4; UNDISTURBED
5. NAME OF DRILLER ELASTIC BROWN	14. TOTAL NUMBER CORE BOXES N/A
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 20 Aug 90; COMPLETED 20 Aug 90
7. THICKNESS OF OVERBURDEN 3.2'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 0.0	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 3.2'	19. SIGNATURE OF INSPECTOR LARRY BENJAMIN

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		SM Gray Fine Silty Sand T/ Roots and Clay	3" 6"	1	Sampled with 3" Hand Auger
	1		CL Gray, Sandy Lean Clay, T/ Roots Moist	1.0 1.5	2 3	W.L. During drilling 3.2 24 hrs DRY
	2		NO ROOTS	2.0		NOTE. Auger Refusal with scraping sound. AT 3.2'
	3		TOP OF ROCK 3.2'	3.0	4	
			BOTTOM OF HOLE 3.2'			
	4					
	5					
	6					
	7					
	8					
	9					
	10					

ENG FORM 1836 PROJECT

Hole No. WES-3-VFI-87

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane Ind.	SHEET 1 OF 1 SHEETS
1. PROJECT Hydrogeologic Studies ABG		10. SIZE AND TYPE OF BIT 3" Splitspoon + Auger	
2. LOCATION (Coordinates or Station) ABG Valley Fill		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY WES		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
4. HOLE NO. (As shown on drawing title and file number) 3-VFI		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER Don Taylor		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED 6/23/87 / COMPLETED 6/23/87
7. THICKNESS OF OVERBURDEN 3.5		17. ELEVATION TOP OF HOLE 584.5	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 3.5		19. SIGNATURE OF ~~INSPECTOR~~ Geologist R.W. Hunt	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silt, w/ss frags, grBr, slightly moist		1 (1.0)	Samples put in Qt Jars
	1		Clayey Silt-Silty Clay, rBr-yBr w/ss frags, mod firm, moist		2 (3.5)	
	3					
	4		Bot Depth- 3.5' (Refusal on Top of Big Cliffy SS)			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF2-81

DRILLING LOG	DIVISION US Navy	INSTALLATION Nuse	SHEET 1 OF 1 SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG Valley Fill
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): 3-VF2
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.5
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 7.5
10. SIZE AND TYPE OF BIT: 7" Splitspoon + Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/23/87 COMPLETED 6/23/87
17. ELEVATION TOP OF HOLE: 581.5
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Geologist R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Clayey silt, w/ ss pebbles + frags, m-d Br, firm, sli moist - dry		1	Samples were put in qt Jars
	1				1.5	
	2				2	
	3				3.0	
	4		Increase in ss frags below 3.0', + moist Blk coal? flakes between 4.0 + 4.5		3 4.5	
	5		Weathered Big cliffy ss w/ silty clay + clayey silt in eroded open jts, moist		4	
	6				6.0	
	7				5	
	8		Bot. Depth 7.5' (Refusal on Top of Big cliffy ss)			

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ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT | HOLE NO.

Hole No. WES-3-VF3-87

DRILLING LOG	DIVISION US Navy	INSTALLATION Muse, Crane Ind.	SHEET 1 OF 1 SHEETS

1. PROJECT Hydrogeologic Studies, ABG	10. SIZE AND TYPE OF BIT 3" Splitspoon + Auger
2. LOCATION (Coordinates or Station) ABG Valley Fill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) 3-VF3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER Dan Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 6/23/87 COMPLETED 6/23/87
	17. ELEVATION TOP OF HOLE 580.5
7. THICKNESS OF OVERBURDEN 4.8	18. TOTAL CORE RECOVERY FOR BORING %
8. DEPTH DRILLED INTO ROCK	19. SIGNATURE OF ~~INSPECTOR~~ Geologist R.W. Hunt
9. TOTAL DEPTH OF HOLE 4.8	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Clayey silt - silty clay, w/ss frags + pebbles (SS frags increase w/depth), Br-dy-rBr, sli moist-dry		1	Samples put in jars
	1				1.5	
	2				2	
	3				3.0	
	4				3	
					4.5	
	5		Bot. Depth - 4.8' (Refusal on Top of Big clifty SS)			

B-17

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE PROJECT HOLE NO.

Hole No. WES-3-VF4-87

DRILLING LOG	DIVISION US Navy	INSTALLATION NWGC, Crane, Ind	SHEET 1 OF 1 SHEETS

1. PROJECT Hydrogeologic Studies, ABG	10. SIZE AND TYPE OF BIT 3" Split Spoon + Auger
2. LOCATION (Coordinates or Station) ABG Valley Fill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) 4-VF4	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED:
5. NAME OF DRILLER Dan Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED 6/23/87 — COMPLETED 6/23/87
7. THICKNESS OF OVERBURDEN 5.2	17. ELEVATION TOP OF HOLE 581.5
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 5.2	19. SIGNATURE OF INSPECTOR Geologist R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Clayey silt-silty clay, w/ss frags increasing w/depth, Br-yBr, mod firm, moist		1	Samples put in qt jars
	1				1.5	
	2				2	
	3				3.0	
	4				3	
					4.5	
	5				4	
					5.2	
	6		Bot. Depth 5.2' (Refusal on Top of Big Clifty SS)			

B-18

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF5-87

DRILLING LOG	DIVISION US Navy	INSTALLATION Newse, Crane Ind.	SHEET 1 OF 1 SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG Valley fill
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): 3-VF5
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 9.8
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 9.8
10. SIZE AND TYPE OF BIT: 3" Splitspoon & Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/23/87 COMPLETED 6/23/87
17. ELEVATION TOP OF HOLE: 591.4
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF ~~INSPECTOR~~ Geologist: R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silty Clay, Br-yBr w/Gr mottling, firm, sli moist, w/occ SS frags & pebbles, Blk Carbonaceous (coal flakes) inclus.		1	Samples put in qt jars
	1	Δ			1.5	
	2				2	
	3	Δ			3.0	
	4				3	
					4.5	
	5	Δ			4	
	6				6.0	
	7				5	
	8				6	
	9	Δ	Increase in SS frags in bot ft.		9.0	
		Δ			7	(Refusal on top of Big Clifty SS)
		Δ			9.8	
	10		Bot Depth - 9.8'			

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ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF6-87

DRILLING LOG	DIVISION US Navy	INSTALLATION Nuse, Crane, Ind	SHEET 1 OF 1 SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG, Valley Fill
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): 3-VF6
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 7.8'
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 7.8'
10. SIZE AND TYPE OF BIT: 3" Splitspoon + Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/24/87 COMPLETED 6/24/87
17. ELEVATION TOP OF HOLE: 595.5
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		silty clay w/num SS frags + pebbles, Br-yBr, firm-vfirm, sli moist		1	Samples put in qt jars.
	1				1.5	
	2				2	
	3				3.0	
	4		silty Clay-clayey silt dGr, w/ss frags + pebbles, rootlets, soft, v moist,		3	
					4.5	
	5				4	
	6		num ss frags mixed in clay		6.0	
	7		silt, clayey-sandy, th bd, [illegible] Br-olive, [illegible]		5	
	8		Bot. Depth - 7.8' (Refusal on Top of Big Cliffy SS)			
	9					
	10					

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ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF7-ET

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, Ind	SHEET 1 OF 1 SHEETS

1. PROJECT Hydrogeologic Studies, ABG	10. SIZE AND TYPE OF BIT 3" Splitspoon + Auger
2. LOCATION (Coordinates or Station) ABG Valley Fill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) 3-VF7	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED:
5. NAME OF DRILLER Dan Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED 6/24/87 — COMPLETED 6/24/87
7. THICKNESS OF OVERBURDEN 10.0	17. ELEVATION TOP OF HOLE 596.3
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 10.0	19. SIGNATURE OF ~~INSPECTOR~~ Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silty clay, yBr-Br, w/ss frags + pebbles, v firm, sli moist, occ dGr shale inclus.	1 / 1.5 / 2 / 3.0		Samples put in jars
	4		Silty clay + ss frags, Br, yBr + Gr, mod firm, moist	3 / 4.5 / 4 / 6.0 / 5 / 7.5		
	8		more sandy + v moist in bot 1½'	6 / 9.0		
	10		Bot. Depth - 10.0	10.0		Refusal at 10.0' on Top of Big Clifty SS.

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ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF 8 87

DRILLING LOG	DIVISION U.S Navy	INSTALLATION NWSC Crane Ind	SHEET 1 OF 2 SHEETS

1. PROJECT: Hydrogeologic Studies ABG
2. LOCATION (Coordinates or Station): ABG Valley Fill
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): 3-VF8
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 11.7
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 11.7
10. SIZE AND TYPE OF BIT: 3" Split Spoon + Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/24/87 COMPLETED 6/24/87
17. ELEVATION TOP OF HOLE: 599.5
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF ~~INSPECTOR~~ Geologist: R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–6		Silty clay, Br-yBr + Gr, w/ss frags, firm, sli moist; Becomes soft and v moist below 2.0'		1, 1.5, 2, 3.0, 3, 4.5, 4, 6.0	Samples put in qt jars
	6–8		Silty clay - Clayey silt, d Gr, w/ss frags [illegible] soft, moist		5	
	8–10		Silty clay + SS frags, Br-yBr, firm-mod firm, moist-v moist		6, 9.0, 7	

B-22

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. WES-3-VF9-87

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane, Ind.	SHEET 1 OF 1 SHEETS

1. PROJECT Hydrogeologic Studies, ABG	10. SIZE AND TYPE OF BIT 3" Splitspoon & Auger
2. LOCATION (Coordinates or Station) ABG Valley Fill	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) 3-VF9	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED: — UNDISTURBED:
5. NAME OF DRILLER Dan Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN 9.6	16. DATE HOLE — STARTED 6/25/87 — COMPLETED 6/25/87
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE 600.4
9. TOTAL DEPTH OF HOLE 9.6	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF ~~INSPECTOR~~ Geologist R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silty Clay, yBr-Brt Gr, w/ss frags, firm, sli moist in top foot becoming more moist w/depth		1 (1.5)	Samples put in qt Jars
	1					
	2				2 (3.0)	
	3				3 (4.5)	
	4		Soft + moist in Bot zone			
	5		Clayey silt, dGr, ss frags, organics, soft, sli moist-moist		4 (6.0)	
	6		olive Br toward bot.		5	
	7		Silty [illegible] frags, soft-firm, moist		6 (9.0)	
	8				7 (9.6)	Refusal on Top of shale
	9					
	10		Bot. Depth - 9.6'			

B-23

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane Ind.	SHEET 1 OF SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG Valley Fill
3. DRILLING AGENCY:
4. HOLE NO. (As shown on drawing title and file number): 3-VF10
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 8.3
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 8.3
10. SIZE AND TYPE OF BIT: 3" Splitspoon + Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/25/87 COMPLETED 6/25/87
17. ELEVATION TOP OF HOLE: 603.7
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF ~~INSPECTOR~~: Geologist R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–3		Silty clay, yBr, v firm, sli moist-dry, w/ss frags + dGr Sh inclus.		1, 1.5, 2, 3.0	Samples put in qt jars
	4–7		Clayey Silt, dGr-Br, w/organics, changing to silty clay w/ss frags w/depth, soft-mod firm, sli moist-moist		3, 4.5, 4, 6.0, 5, 7.5	
	8		yBr, firm, sli moist		6, 8.3	
	9		Bot. Depth - 8.3 (Refusal on Top of shale)			

B-24

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC Crane Ind	SHEET 1 OF 2 SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG Valley Fill
3. DRILLING AGENCY:
4. HOLE NO. (As shown on drawing title and file number): 3-VF11
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 9.0
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 11.8
10. SIZE AND TYPE OF BIT: 3" Splitspoon + Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/25/87 COMPLETED 6/25/87
17. ELEVATION TOP OF HOLE: 602.8
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF ~~INSPECTOR~~ Geologist: R.W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–3		Silty Clay, d gr Br, w/sh frags + occ ss frags, firm, sli moist		1; 3.0	Samples put in Qt Jars
	3–6		Silty Clay, olive gr Br, w/ss frags + sh inclus, firm, sli moist		2; 4.5; 3	
	6		Clayey Silt, d Gr, moist, firm-soft		6.0	
	6–9		Silty Clay + SS frags, y Br, firm, moist		4; 5; 9.0	
	9–10		Shale, wea, (Indian spring mem)		6	

B-25

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 2 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
HOLE NO. (As shown on drawing title and file number) 3-VF11	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
4. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10				10.5	
	11				7	
					11.8	
	12		Bot Depth - 11.8'			

B-26

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC, Crane Ind	SHEET 1 OF 1 SHEETS

1. PROJECT: Hydrogeologic Studies, ABG
2. LOCATION (Coordinates or Station): ABG Valley Fill
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): 3-VF12
5. NAME OF DRILLER: Dan Taylor
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 3.5
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 7.5
10. SIZE AND TYPE OF BIT: 3" Splitspoon & Auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: ; UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 6/25/87; COMPLETED 6/25/87
17. ELEVATION TOP OF HOLE: 603.3
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF ~~INSPECTOR~~: Geologist R. W. Hunt

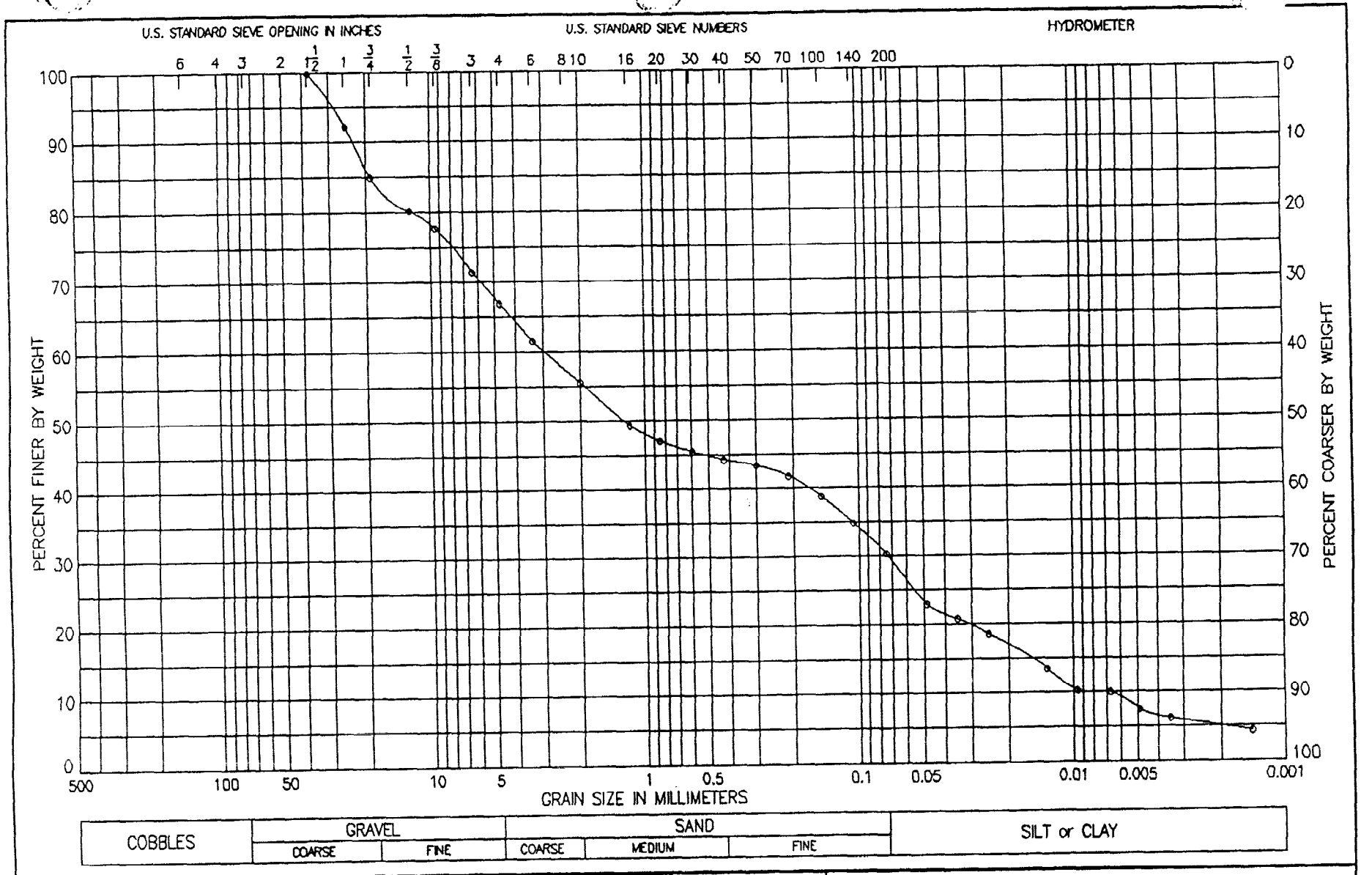
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silty clay, d olive Br, w/rock frags, sli moist, firm		1 (0–1.5)	Samples put in qt jars
	1					
	2				2 (1.5–3.0)	
	3					
	4		Weathered Shale, d olive Gr, firm. (Indian Springs mem)		3 (3.0–4.5)	
	5				4 (4.5–6.0)	
	6				5 (6.0–7.5)	
	7					
	8		Bot. Depth – 7.5 (Boring bottomed in Indian Springs Sh)			

B-27

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

APPENDIX C

SOILS DATA



LL	PL	PI	GS	NAT W,%	ORG,%
28	19	9	2.70 EST	7.8	2.6

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

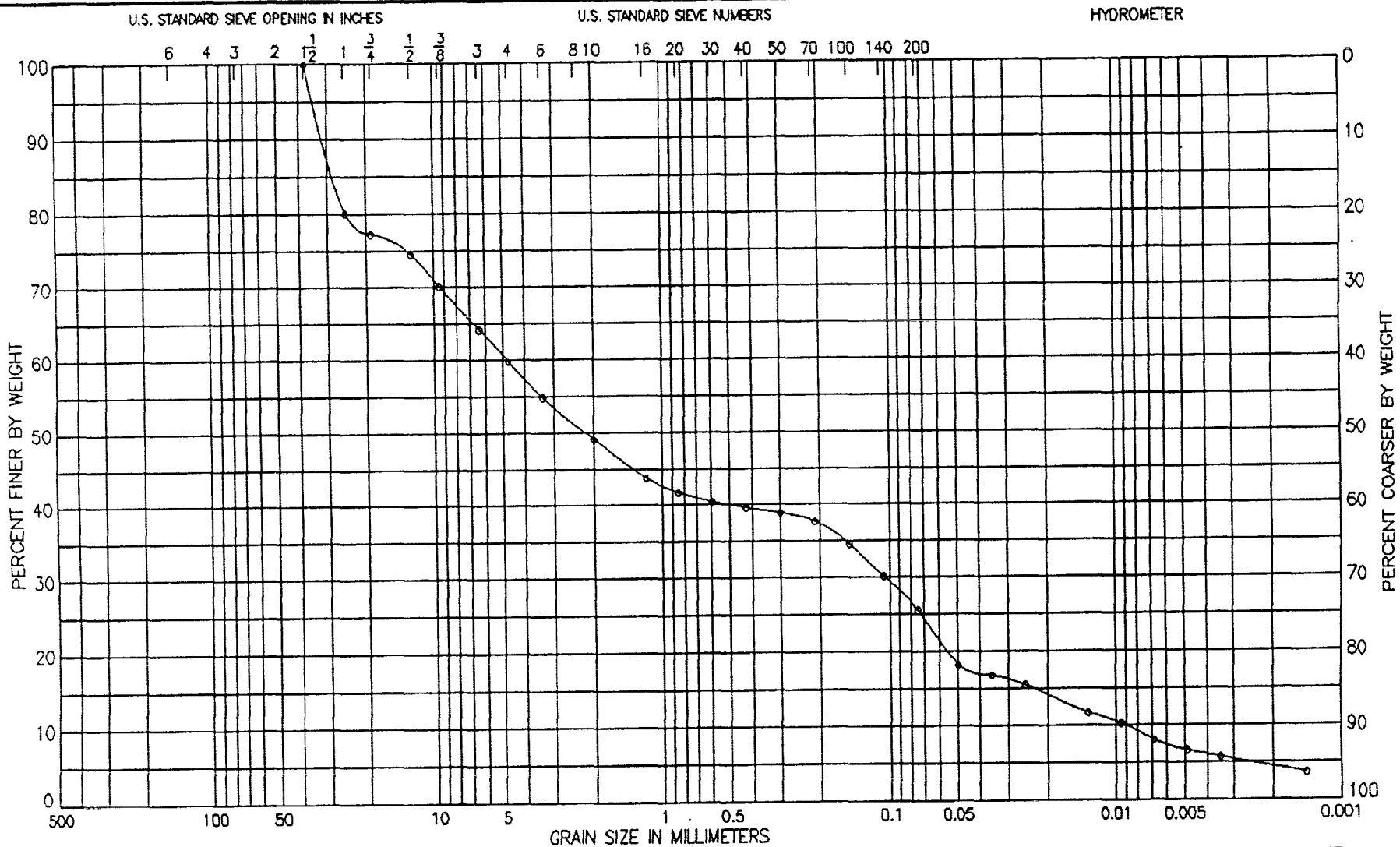
PROJECT CRANE ABG

BORING NO. 03/10-1-90 SAMPLE NO. 1A

DEPTH/ELEV 1.5-2.0 DATE 01 OCT 90

GRADATION CURVE

LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
26	17	9	2.70 EST	9.8	3.2

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

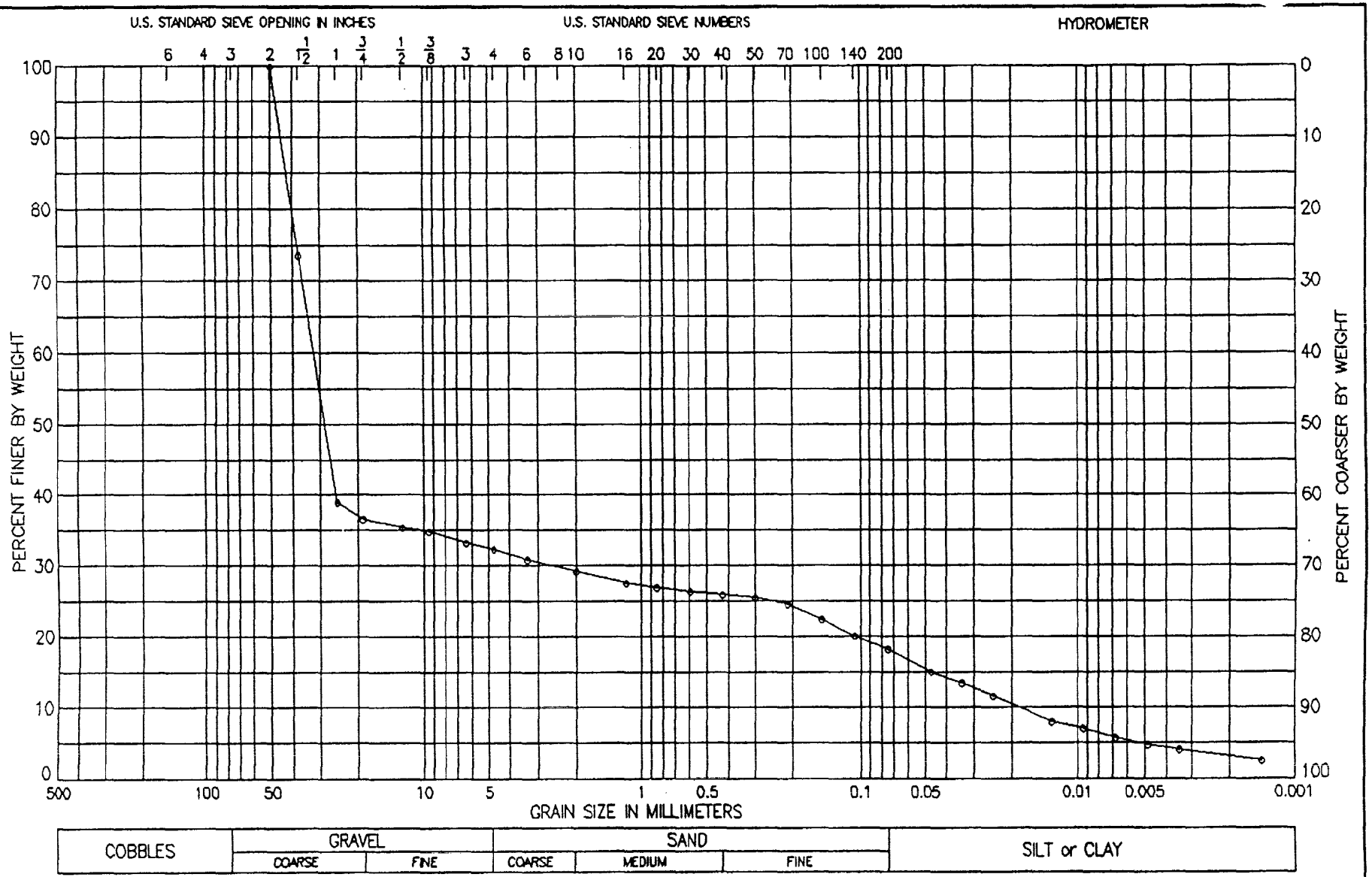
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. SAMPLE NO. 1A

DEPTH/ELEV 1.5–2.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES – STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
33	20	13	2.70 EST	14.8	3.7

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

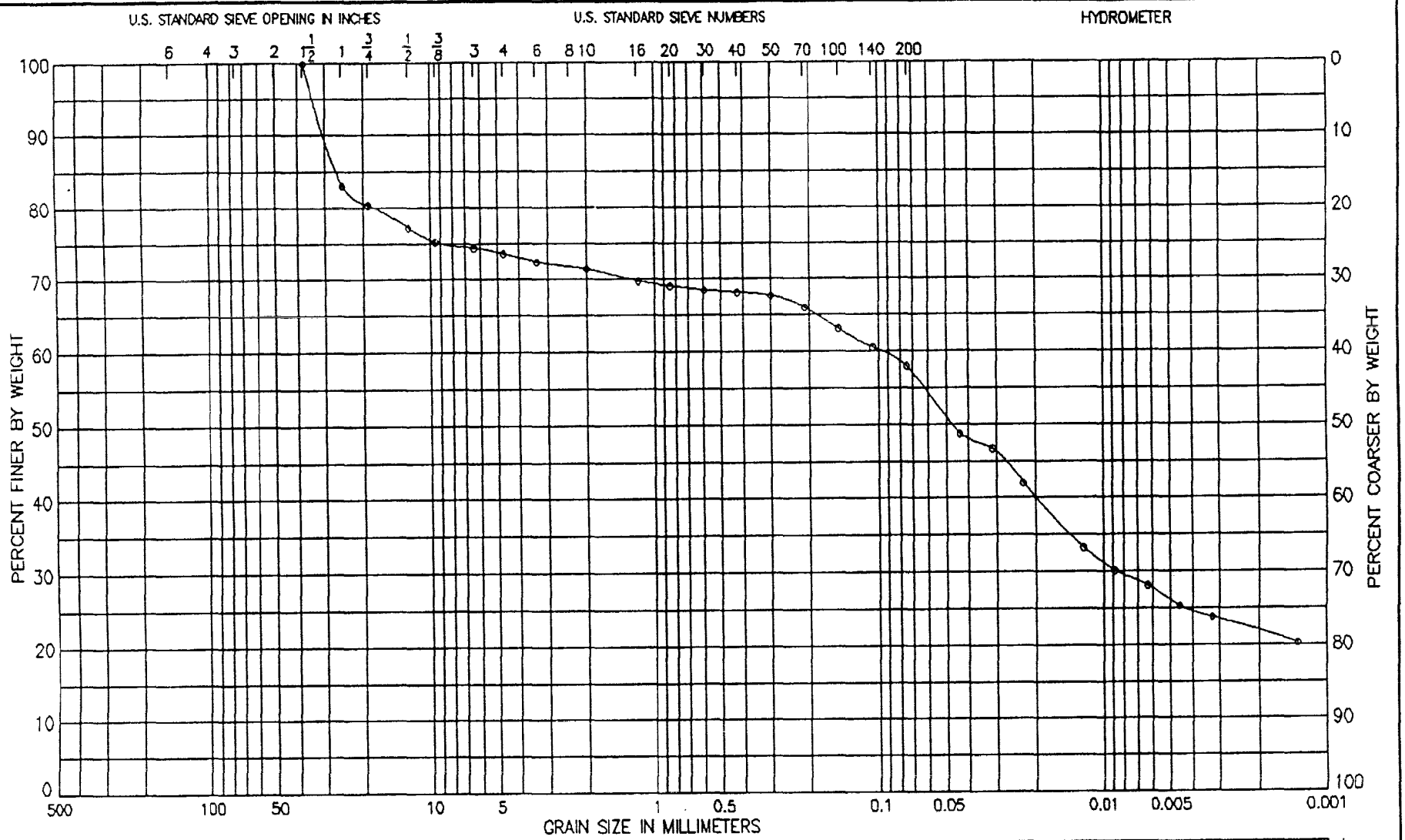
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-3-90 SAMPLE NO. 1A

DEPTH/ELEV 1.5-2.5 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
36	17	19	2.70 EST	16.3	2.0

CLASSIFICATION

SANDY GRAVELLY CLAY (CL), BROWN

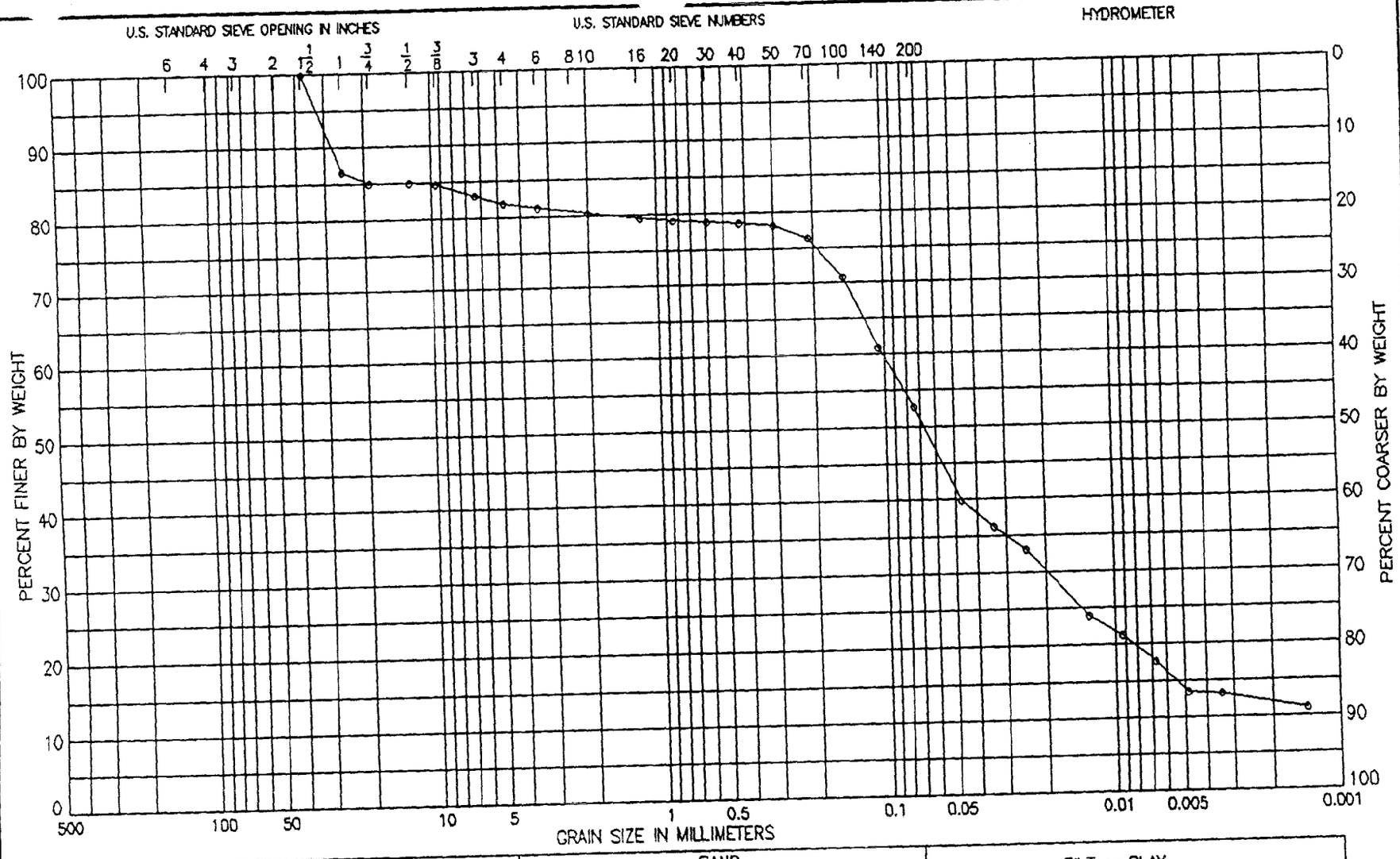
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-4-90 SAMPLE NO. 1A

DEPTH/ELEV 5.0-6.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
29	16	13	2.70 EST	18.7	1.6

CLASSIFICATION
GRAVELLY SANDY CLAY (CL), BROWN

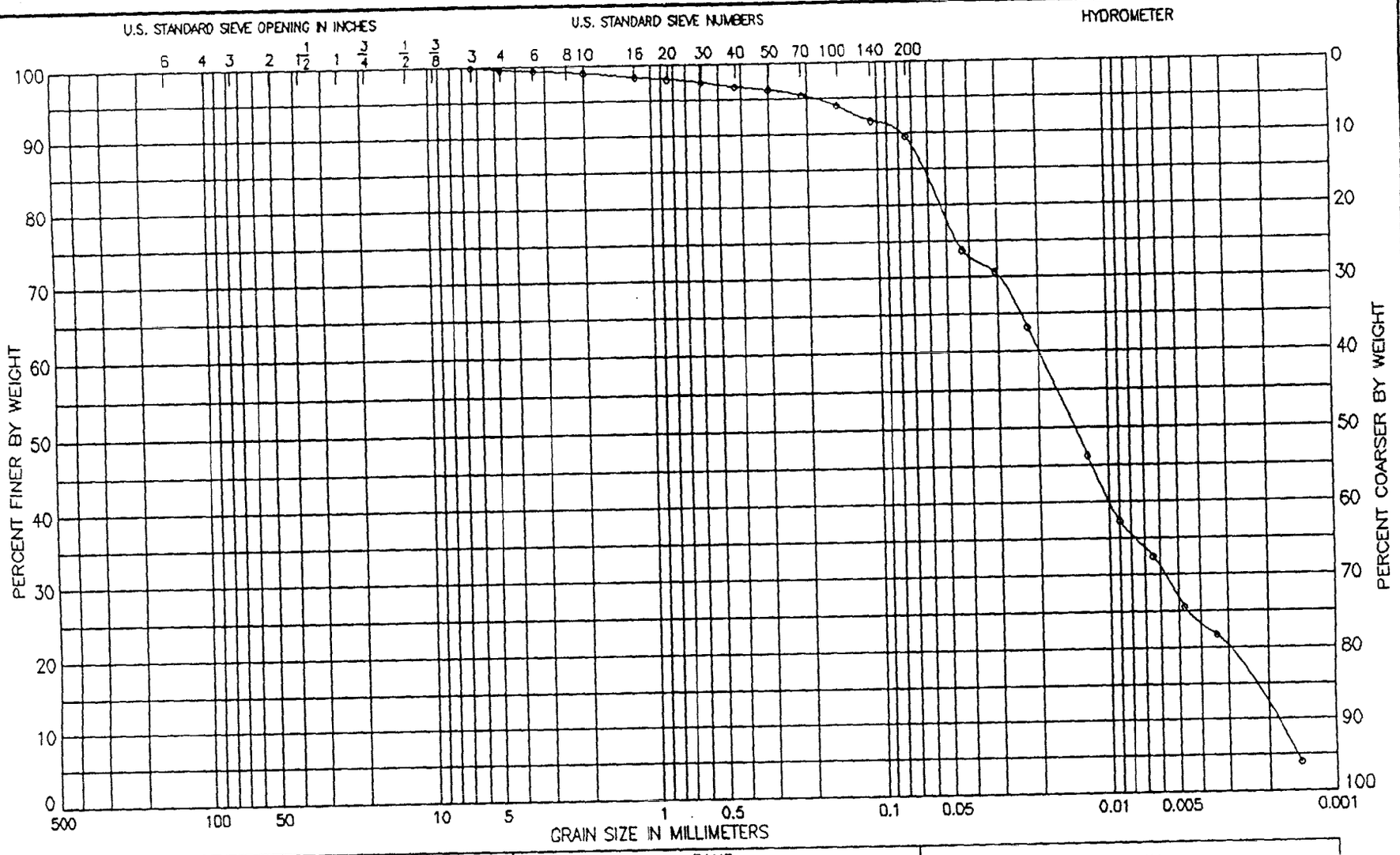
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-5-90 SAMPLE NO. 2A

DEPTH/ELEV 6.0-7.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
40	20	20	2.70 EST	25.0	3.1

CLASSIFICATION
CLAY (CL), BROWN; WITH SAND

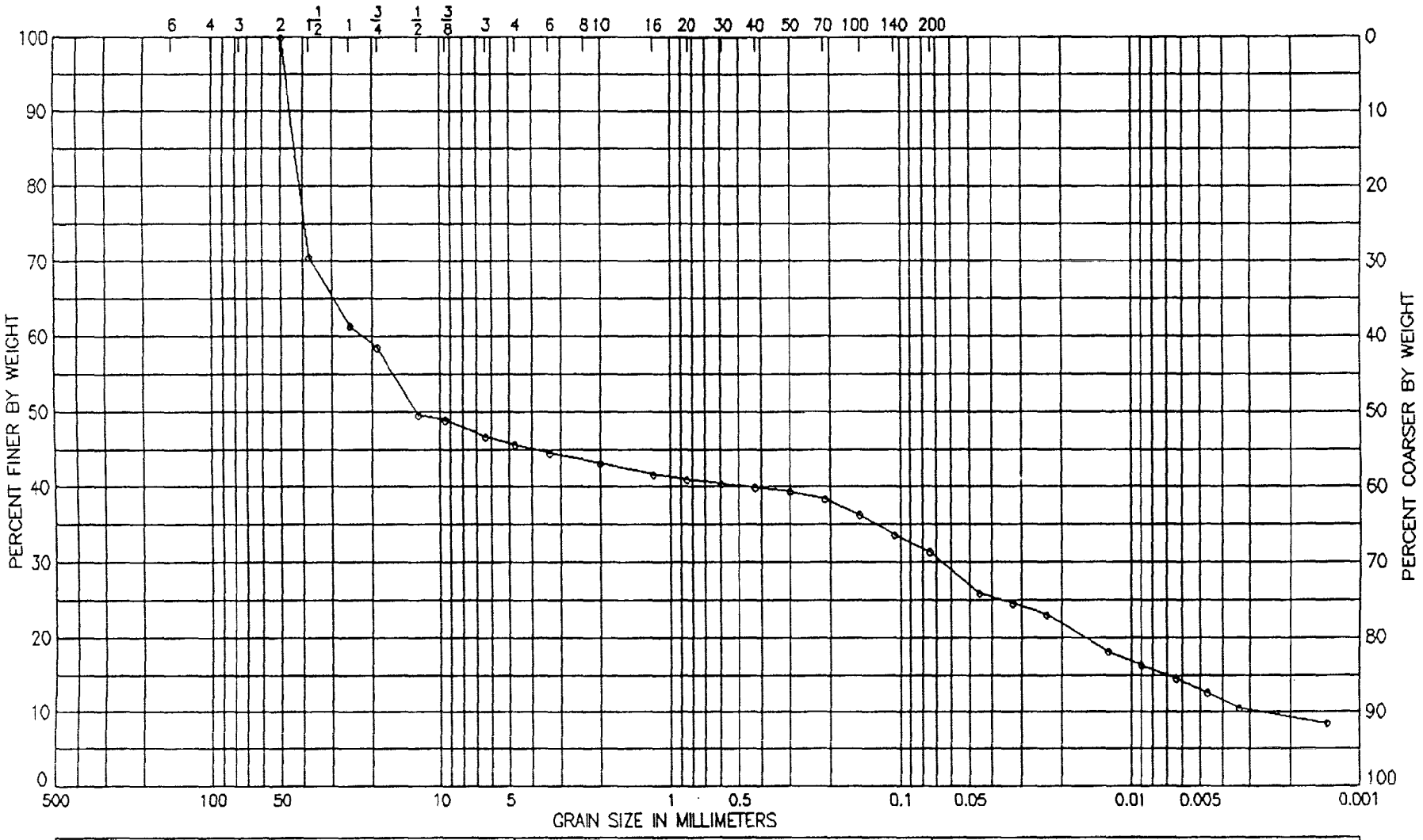
PROJECT CRANE ABG

BORING NO. 03/10-6-90 SAMPLE NO. 1A

DEPTH/ELEV 5.0-5.5 DATE 01 OCT 90

GRADATION CURVE

LABORATORY USAE WES – STF/GL



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS	NAT W,%	ORG,%
37	17	20	2.70 EST	11.0	3.2

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), GRAY

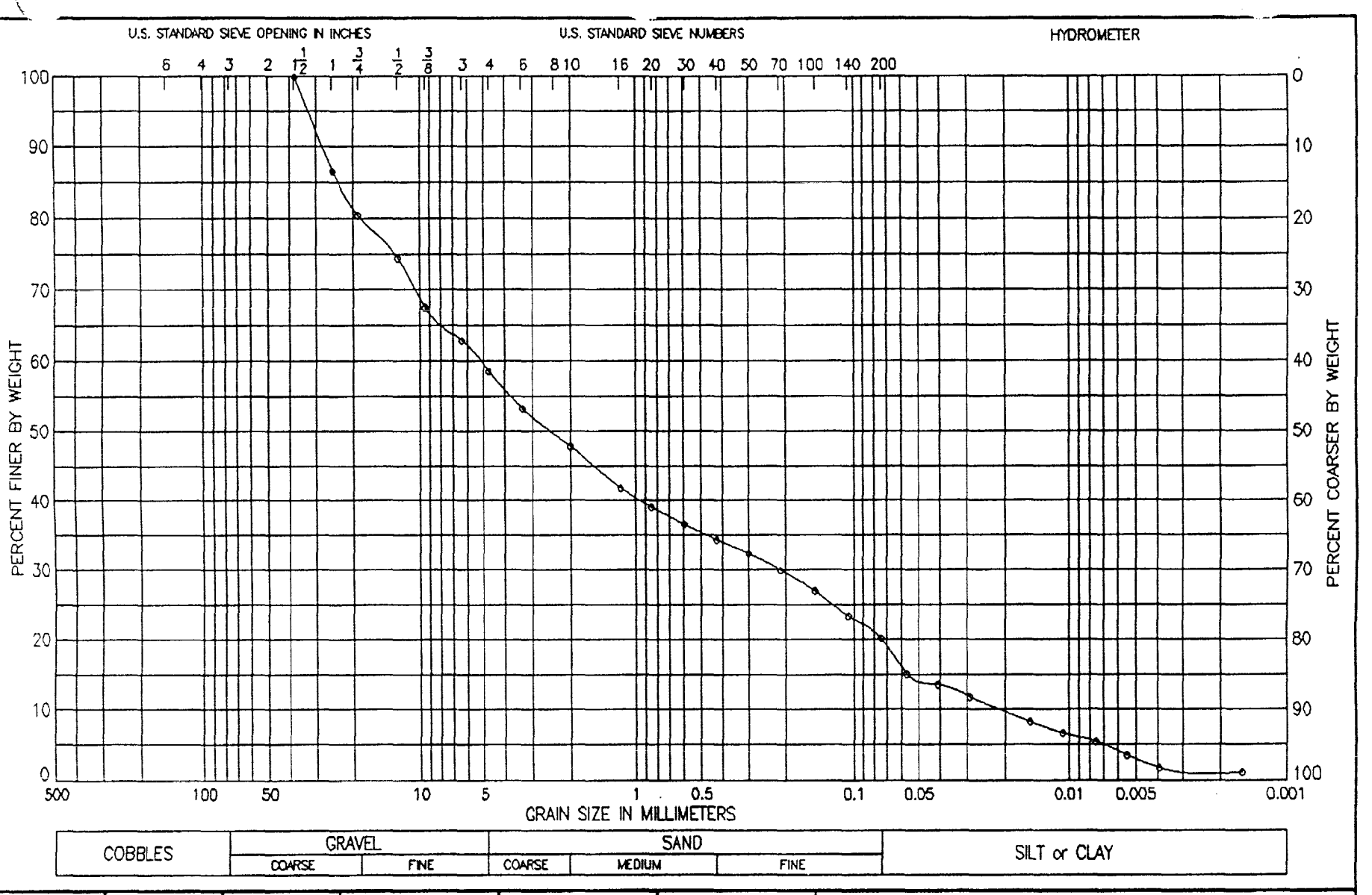
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-8-90 SAMPLE NO. 1A

DEPTH/ELEV 0.5-1.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
47	36	11	2.40 EST	17.7	7.1

CLASSIFICATION

SANDY SILTY GRAVEL (GM), DARK BROWN

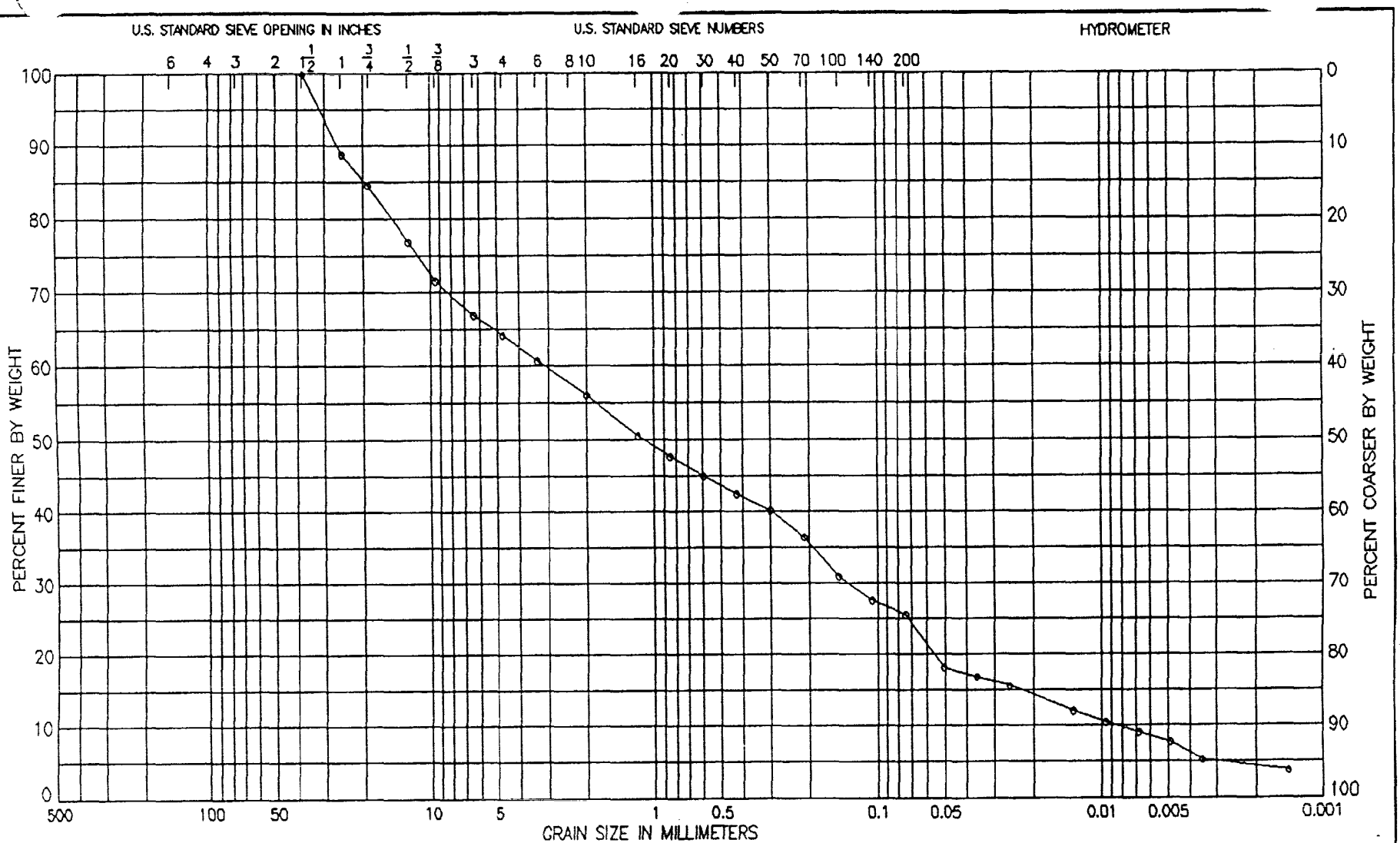
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-9-90 SAMPLE NO. 1A

DEPTH/ELEV 0.5-0.8 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES – STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
47	21	26	2.70 EST	19.9	6.0

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

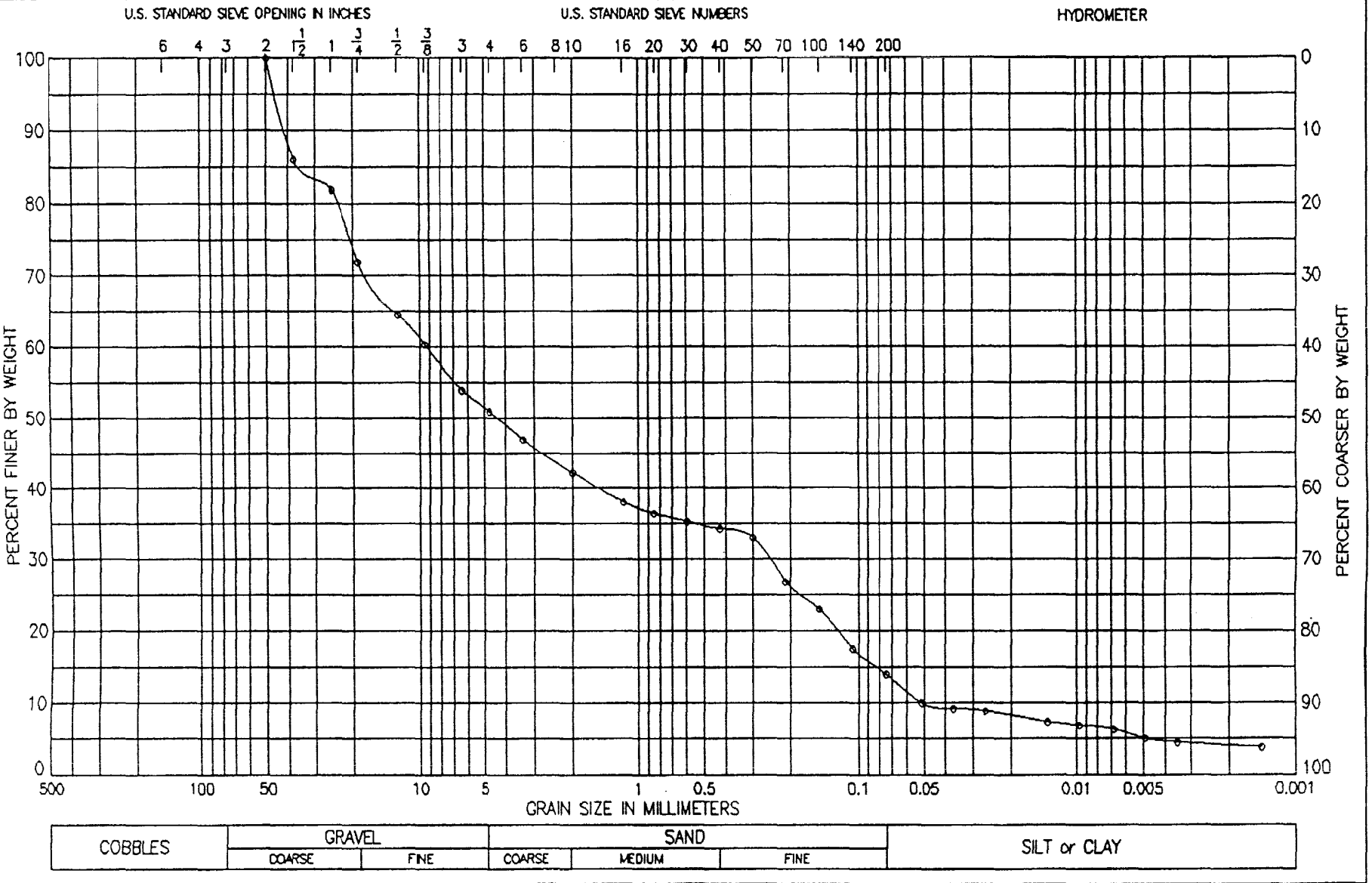
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-9-90 SAMPLE NO. 2A

DEPTH/ELEV 4.0-4.5 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
27	15	12	2.70 EST	11.8	4.6

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

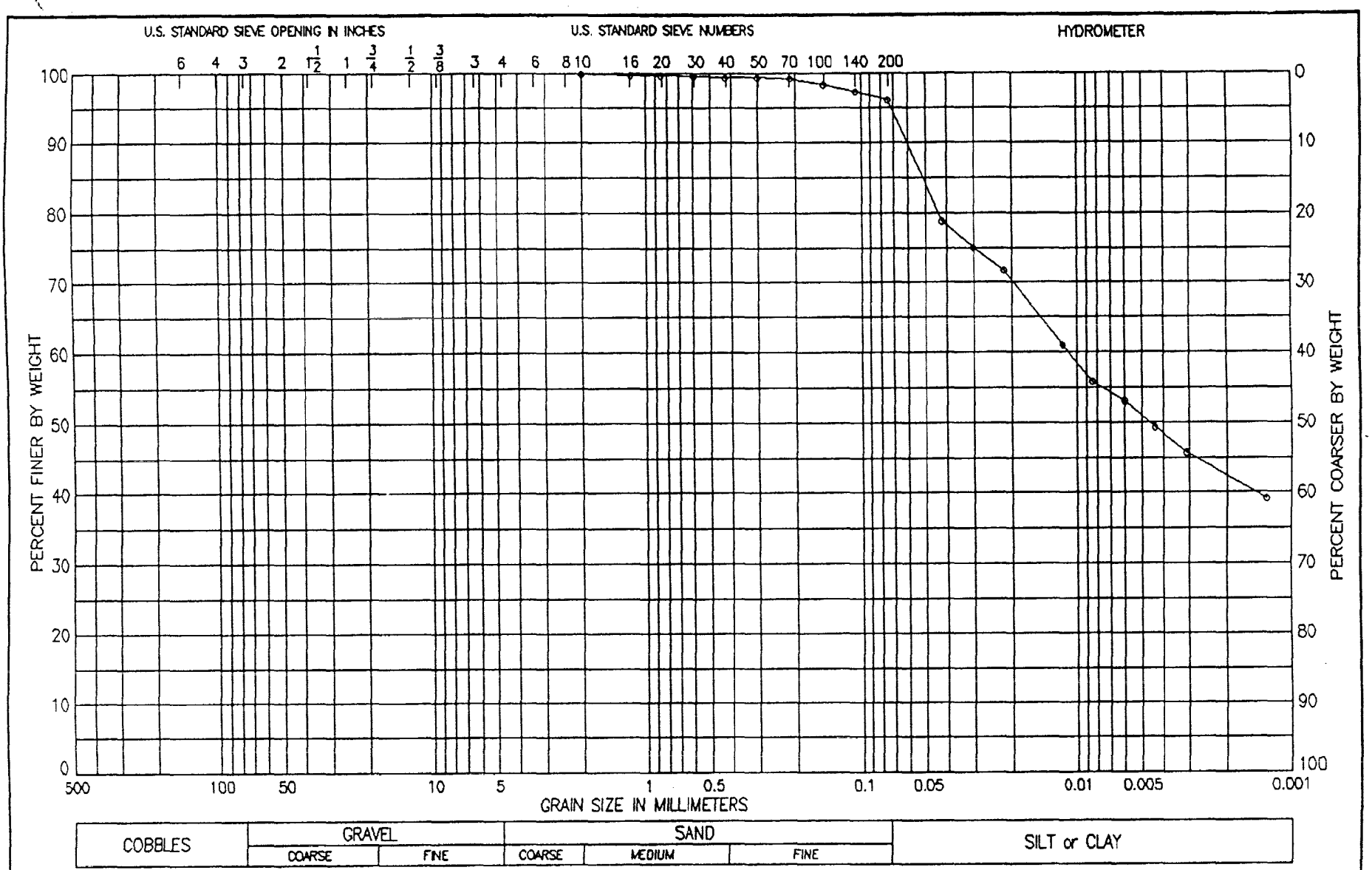
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-9-90 SAMPLE NO. 3A

DEPTH/ELEV 5.5-6.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
58	23	35	2.70 EST	23.3	4.0

CLASSIFICATION
CLAY (CH), BROWN; TRACE OF SAND

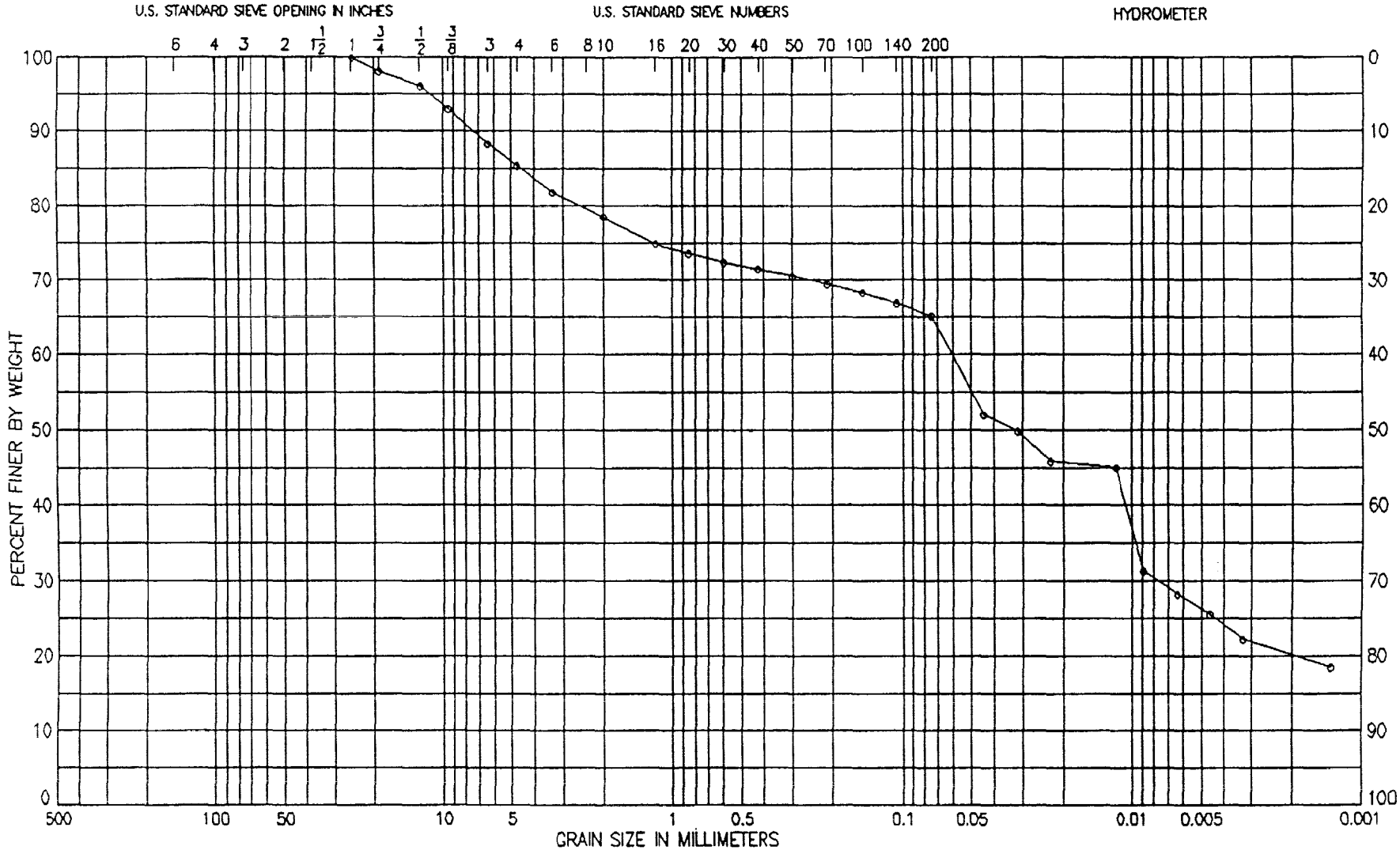
PROJECT CRANE ABG

BORING NO. 03/10-10-90 SAMPLE NO. 1A

DEPTH/ELEV 3.0-3.5 DATE 01 OCT 90

GRADATION CURVE

LABORATORY USAE WES - STF/GL



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS	NAT W,%	ORG,%
47	20	27	2.70 EST	11.6	3.0

CLASSFICATION

GRAVELLY SANDY CLAY (CL), BROWN

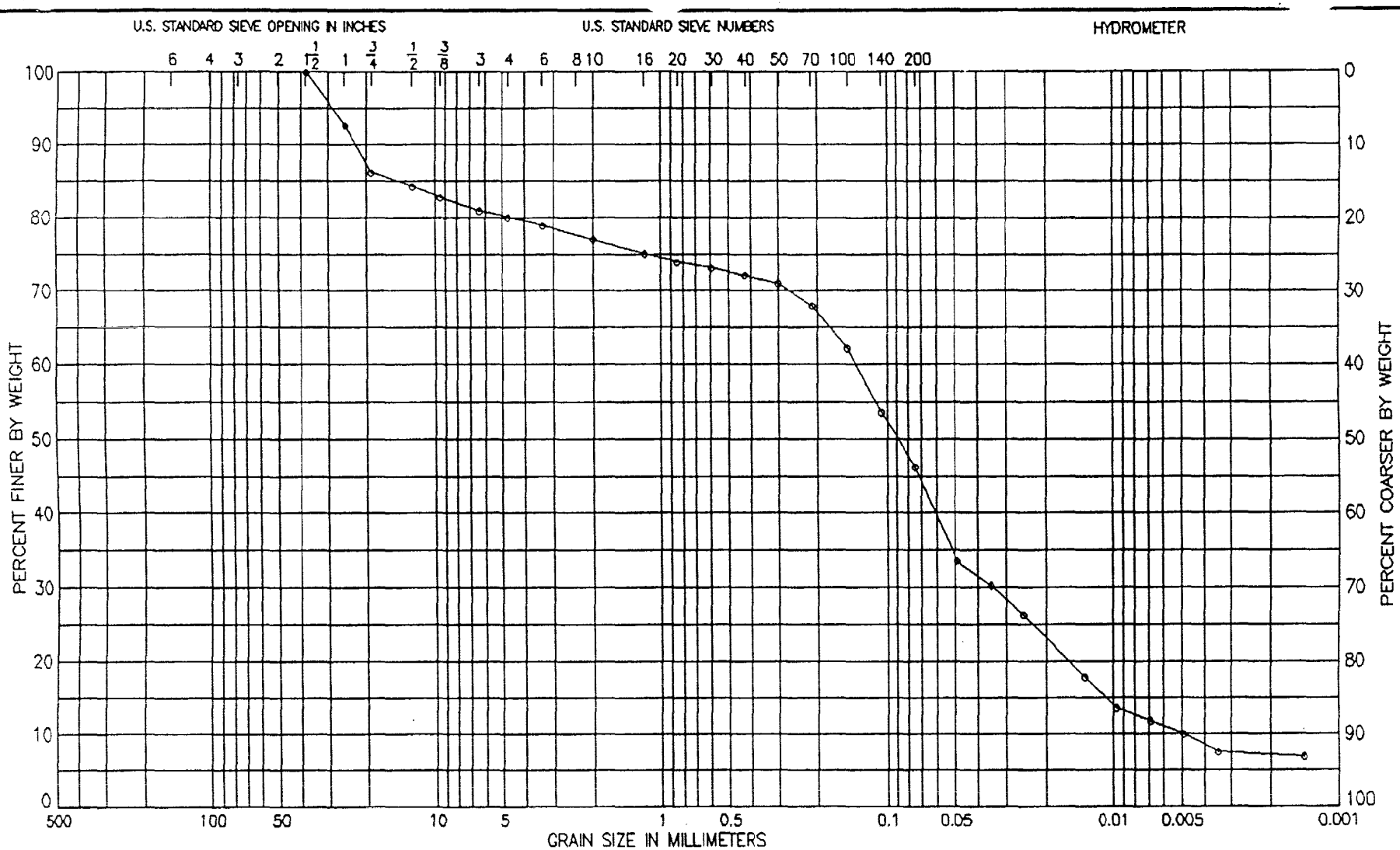
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE | LABORATORY USAE WES – STF/GL

PROJECT CRANE ABG

BORING NO. 03/10-10-90 SAMPLE NO. 2A

DEPTH/ELEV 7.0-7.5 DATE 01 OCT 90



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS	NAT W,%	ORG,%
31	19	12	2.70 EST	28.4	3.0

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), GRAY

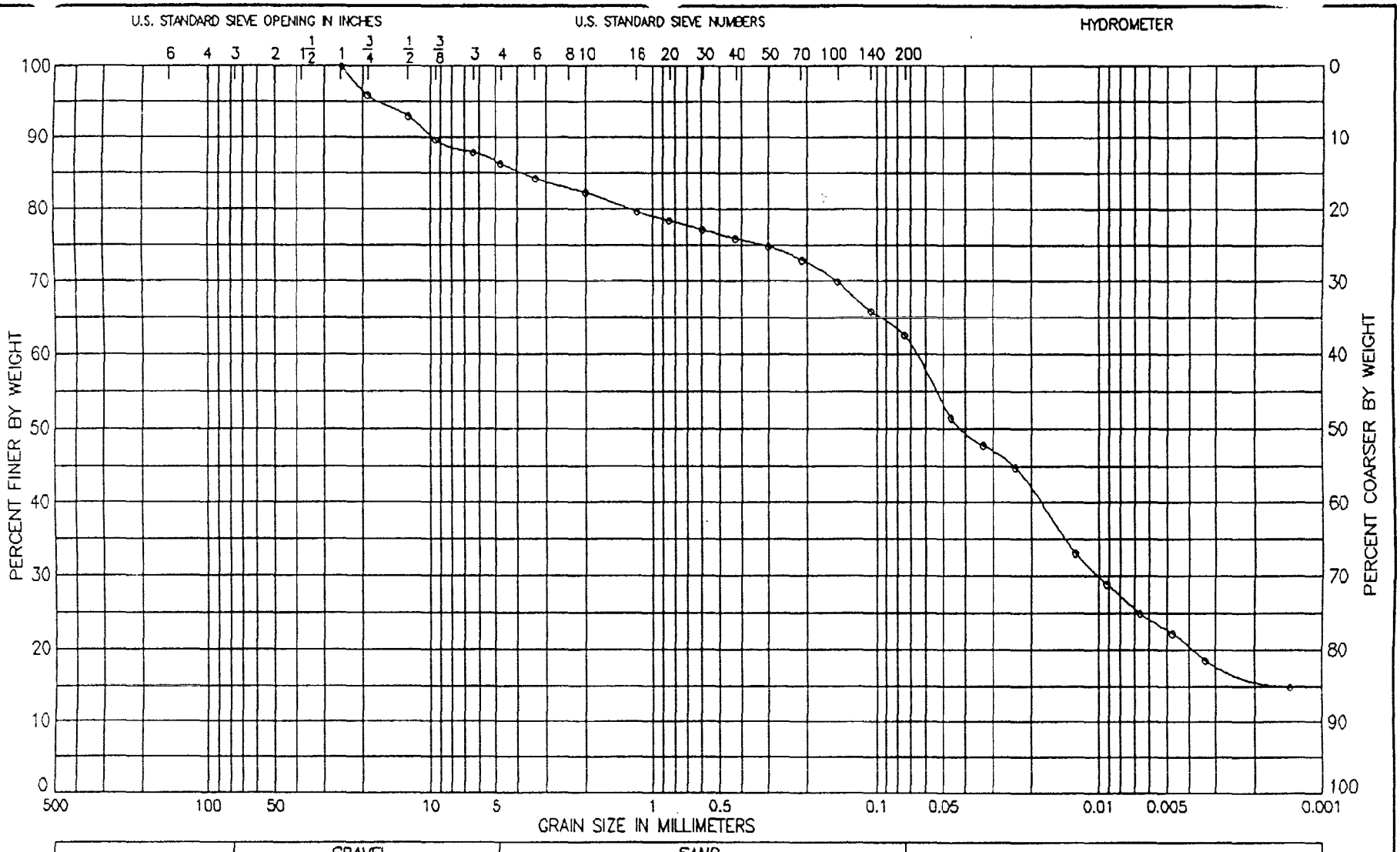
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10-11-90 SAMPLE NO. 1A

DEPTH/ELEV 4.0-4.5 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES – STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
35	18	17	2.70 EST	21.1	3.5

CLASSIFICATION

GRAVELLY SANDY CLAY (CL), BROWN

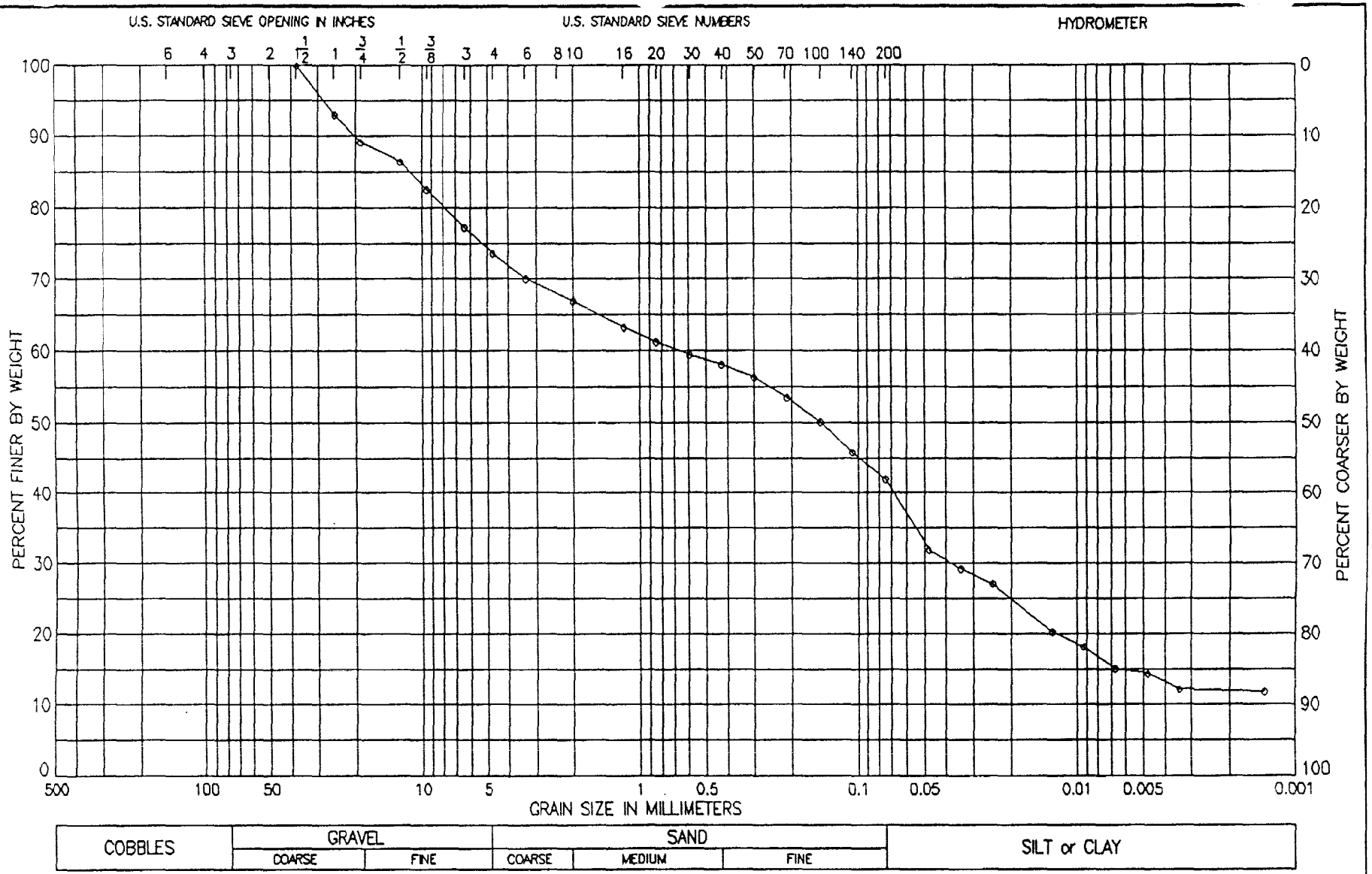
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10 SAMPLE NO. 1A

DEPTH/ELEV 3.5-4.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES – STF/GL



LL	PL	PI	GS	NAT W,%	ORG,%
27	18	9	2.70 EST	16.8	2.9

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

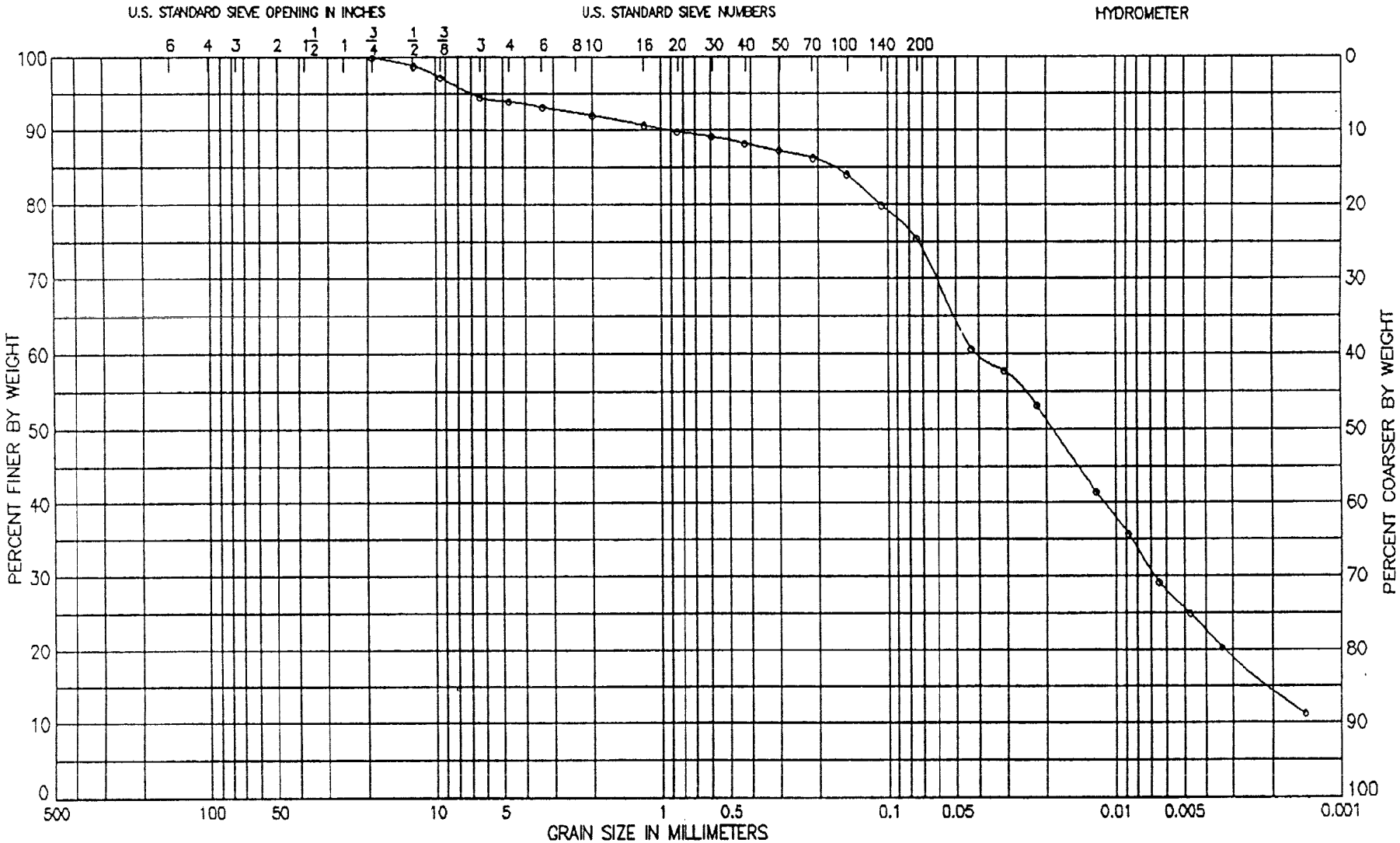
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT CRANE ABG

BORING NO. 03/10- -90 SAMPLE NO. 2A

DEPTH/ELEV 6.0-7.0 DATE 01 OCT 90

GRADATION CURVE | LABORATORY USAE WES - STF/GL



LL	PL	PI	GS 2.70 EST	NAT W,% 23.4	ORG,% 3.6

CLASSIFICATION
SANDY CLAY (CL), GRAY; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-VF1-87 SAMPLE NO. 1

DEPTH/ELEV 1.0' - 1.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF1-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 1.0' - 1.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 23.40 OC: 3.60
CLASSIFICATION: 108
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 462.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 66.3 gms.

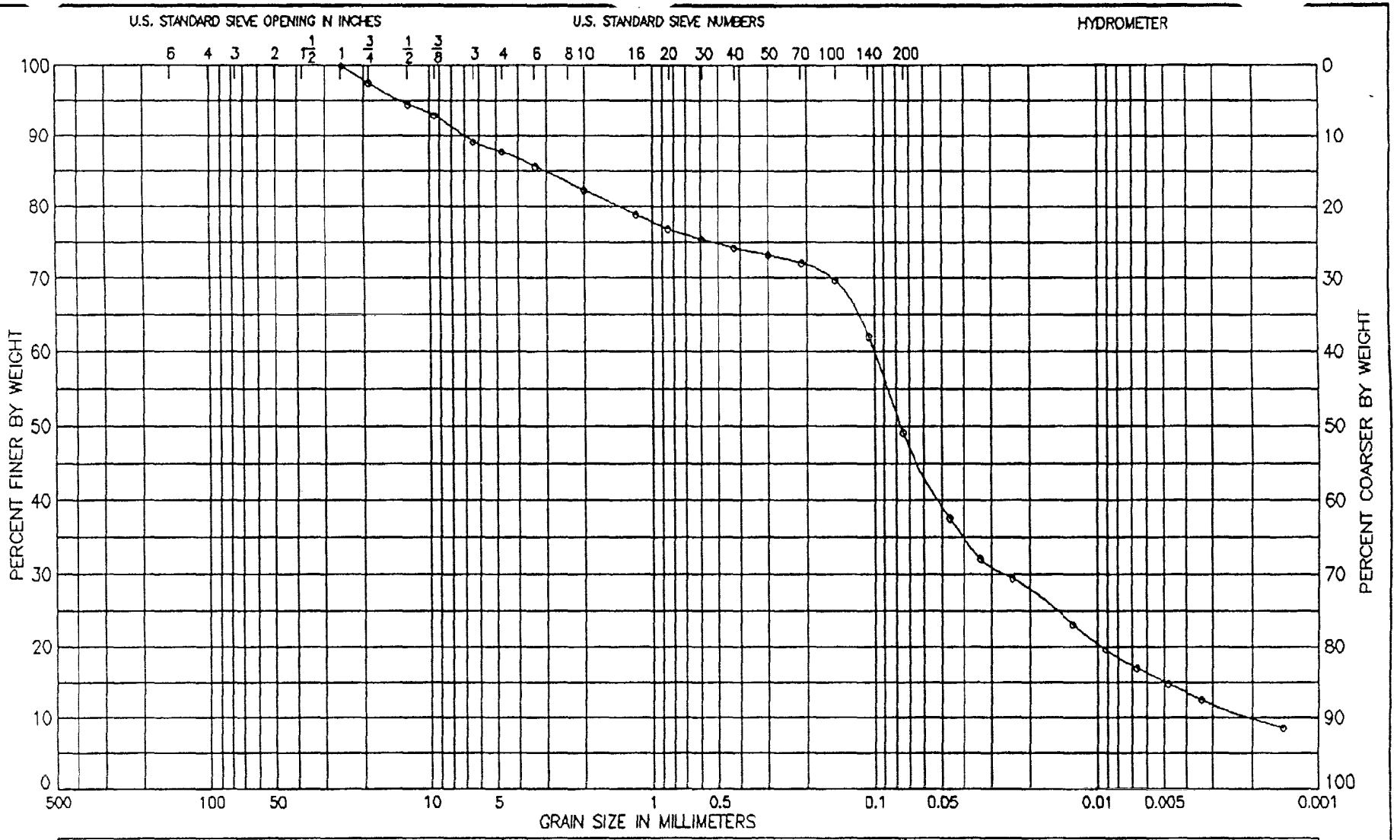
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
5.2	1/2 in	12.500	98.9	1.1
7.4	3/8 in	9.500	97.3	2.7
12.6	No 3	6.350	94.6	5.4
2.5	No 4	4.750	94.0	6.0
3.7	No 6	3.350	93.2	6.8
5.3	No 10	2.000	92.1	7.9
1.0	No 16	1.180	90.7	9.3
1.6	No 20	.850	89.8	10.2
2.1	No 30	.600	89.2	10.8
2.8	No 40	.425	88.2	11.8
3.5	No 50	.300	87.2	12.8
4.2	No 70	.212	86.2	13.8
5.8	No 100	.150	84.0	16.0
8.8	No 140	.106	79.8	20.2
12.0	No 200	.075	75.4	24.6

HYDROMETER:

RDGS	TEMP			
27.3	23.5	.0430	60.7	39.3
26.0	23.5	.0309	57.8	42.2
23.9	23.5	.0224	53.2	46.8
18.6	23.5	.0122	41.5	58.5
16.0	23.5	.0089	35.7	64.3
13.0	23.5	.0065	29.1	70.9
11.3	22.5	.0047	24.9	75.1
9.3	22.0	.0034	20.3	79.7
5.3	21.5	.0014	11.2	88.8

PERCENT GRAVEL = 6.0
PERCENT SAND = 18.6
PERCENT FINES = 75.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 14.1	ORG,% 1.3

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-VF1-87 SAMPLE NO. 2

DEPTH/ELEV 1.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF1-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 1.5' - 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 14.10 OC: 1.30
CLASSIFICATION: 126
GRAVELLY CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 871.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 74.0 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

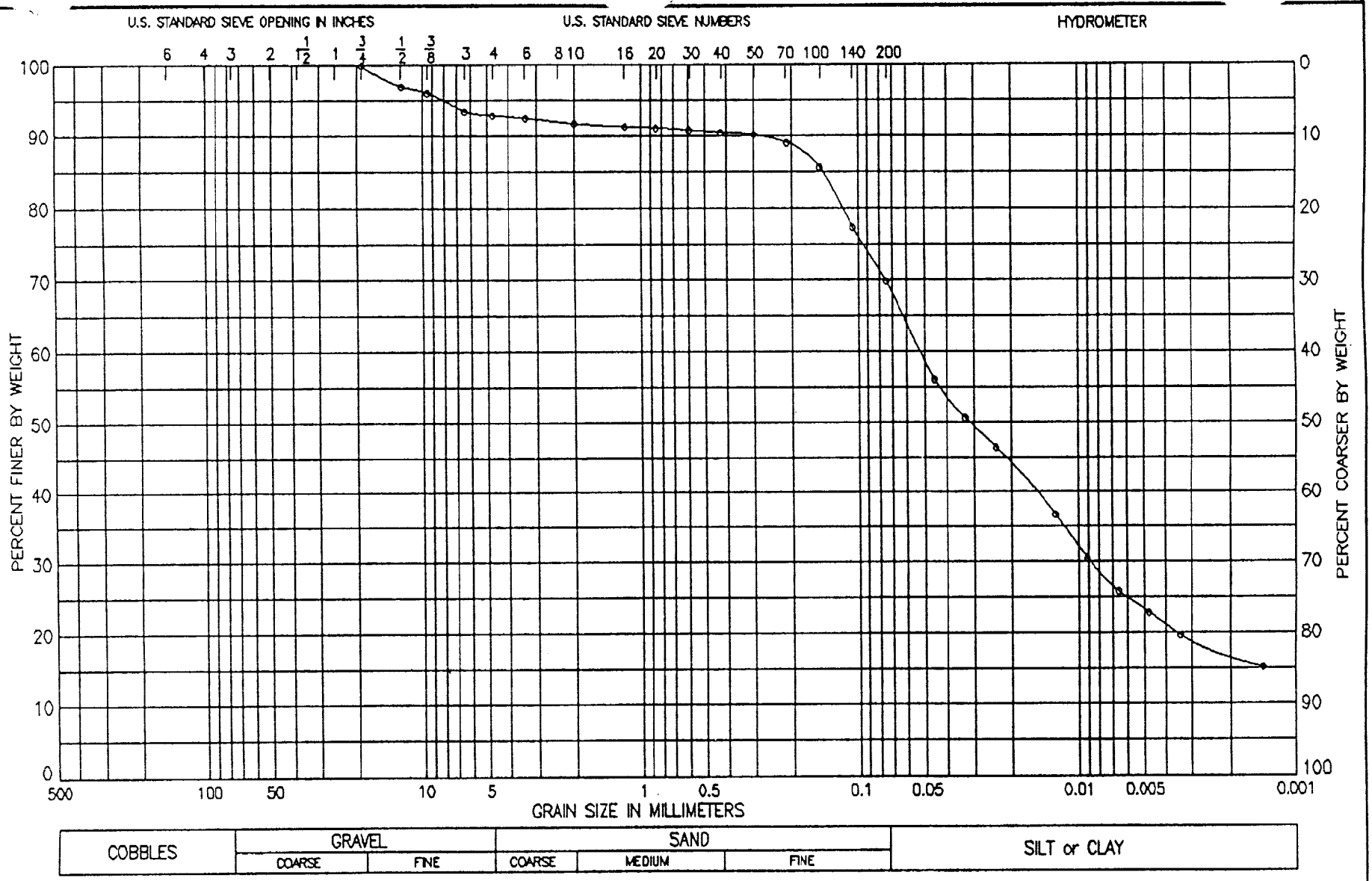
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
20.7	3/4 in	19.100	97.6	2.4
27.3	1/2 in	12.500	94.5	5.5
13.4	3/8 in	9.500	93.0	7.0
33.0	No 3	6.350	89.2	10.8
12.2	No 4	4.750	87.8	12.2
18.1	No 6	3.350	85.7	14.3
29.4	No 10	2.000	82.3	17.7
3.1	No 16	1.180	78.9	21.1
4.9	No 20	.850	76.9	23.1
6.2	No 30	.600	75.4	24.6
7.3	No 40	.425	74.2	25.8
8.2	No 50	.300	73.2	26.8
9.2	No 70	.212	72.1	27.9
11.3	No 100	.150	69.7	30.3
18.2	No 140	.106	62.1	37.9
29.8	No 200	.075	49.2	50.8

HYDROMETER:

RDGS	TEMP			
21.1	23.5	.0462	37.6	62.4
18.0	23.5	.0337	32.2	67.8
16.5	23.5	.0242	29.5	70.5
12.9	23.5	.0129	23.1	76.9
11.0	23.0	.0093	19.6	80.4
9.5	23.0	.0067	17.0	83.0
8.4	22.5	.0048	14.8	85.2
7.2	22.0	.0034	12.5	87.5
5.1	21.5	.0014	8.7	91.3

PERCENT GRAVEL = 12.2
PERCENT SAND = 38.6
PERCENT FINES = 49.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 16.6	ORG,% 2.3

CLASSIFICATION
SANDY CLAY (CL), BROWN; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-VF2-87 SAMPLE NO. 1

DEPTH/ELEV 0.5' - 1.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF2-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 0.5' - 1.0' DATE: 04 MAR 91

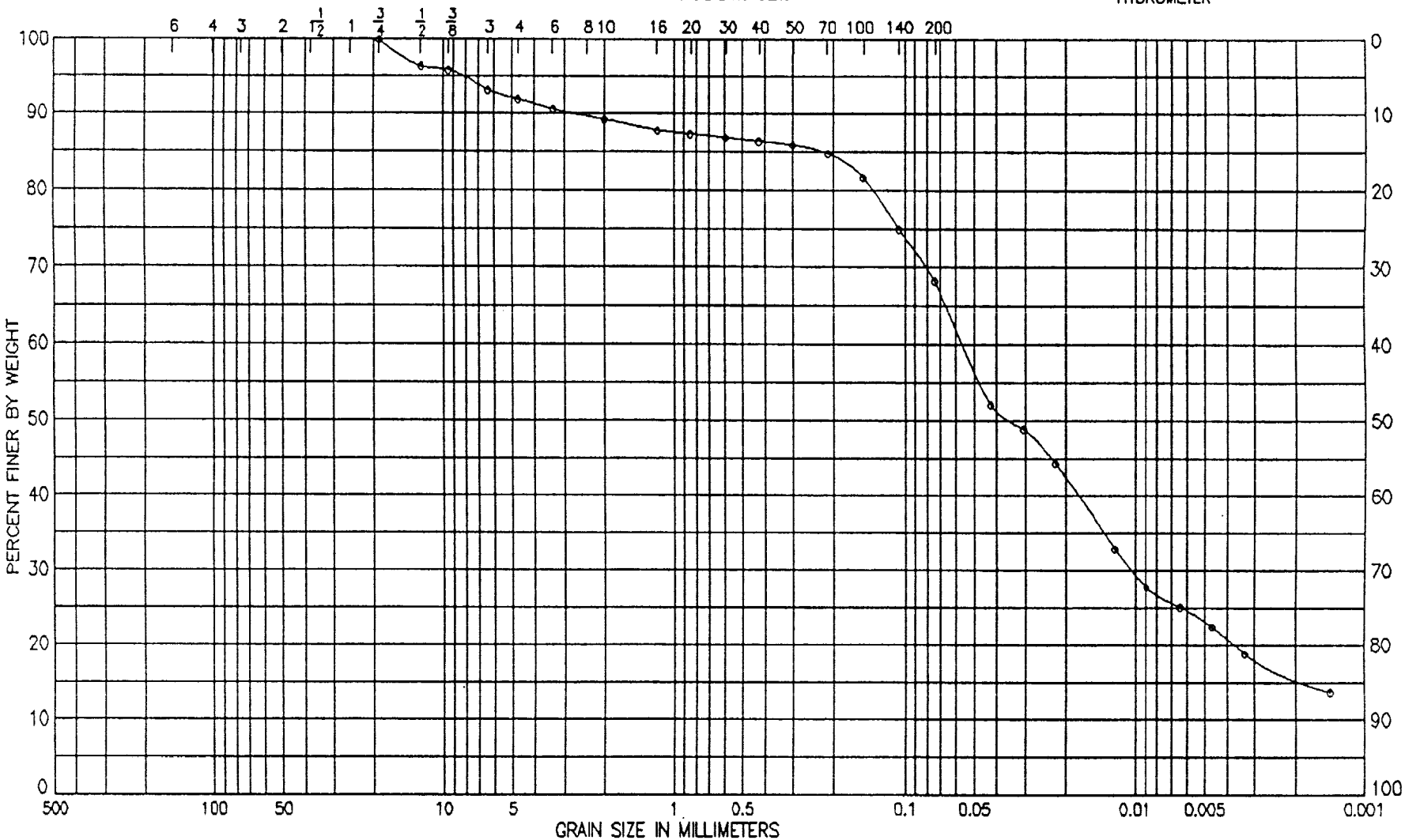
NO-LIMITS-RAN GS: 2.70 est WC: 16.60 OC: 2.30
CLASSIFICATION: 144
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 567.9 gms.
PARTIAL WEIGHT AFTER SPLIT: 58.7 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
16.9	1/2 in	12.500	97.0	3.0
5.2	3/8 in	9.500	96.1	3.9
14.8	No 3	6.350	93.5	6.5
3.2	No 4	4.750	92.9	7.1
2.4	No 6	3.350	92.5	7.5
4.3	No 10	2.000	91.8	8.2
.3	No 16	1.180	91.3	8.7
.4	No 20	.850	91.1	8.9
.6	No 30	.600	90.8	9.2
.8	No 40	.425	90.5	9.5
1.0	No 50	.300	90.2	9.8
1.7	No 70	.212	89.1	10.9
3.9	No 100	.150	85.7	14.3
9.2	No 140	.106	77.4	22.6
14.0	No 200	.075	69.9	30.1
HYDROMETER:				
RDGS	TEMP			
22.4	23.5	.0456	56.1	43.9
20.2	23.5	.0330	50.6	49.4
18.5	23.5	.0237	46.4	53.6
14.6	23.5	.0127	36.7	63.3
12.1	23.5	.0092	30.5	69.5
10.3	23.0	.0066	25.8	74.2
9.2	22.5	.0048	22.8	77.2
8.0	22.0	.0034	19.6	80.4
6.2	22.0	.0014	15.1	84.9

PERCENT GRAVEL = 7.1
PERCENT SAND = 23.1
PERCENT FINES = 69.9

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS	NAT W,%	ORG,%
			2.70 EST	11.3	2.5

CLASSIFICATION
SANDY CLAY (CL), BROWN; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-VF2-87 SAMPLE NO. 2
DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF2-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 11.30 OC: 2.50
CLASSIFICATION: 162
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 541.0 gms.
PARTIAL WEIGHT AFTER SPLIT: 74.5 gms.

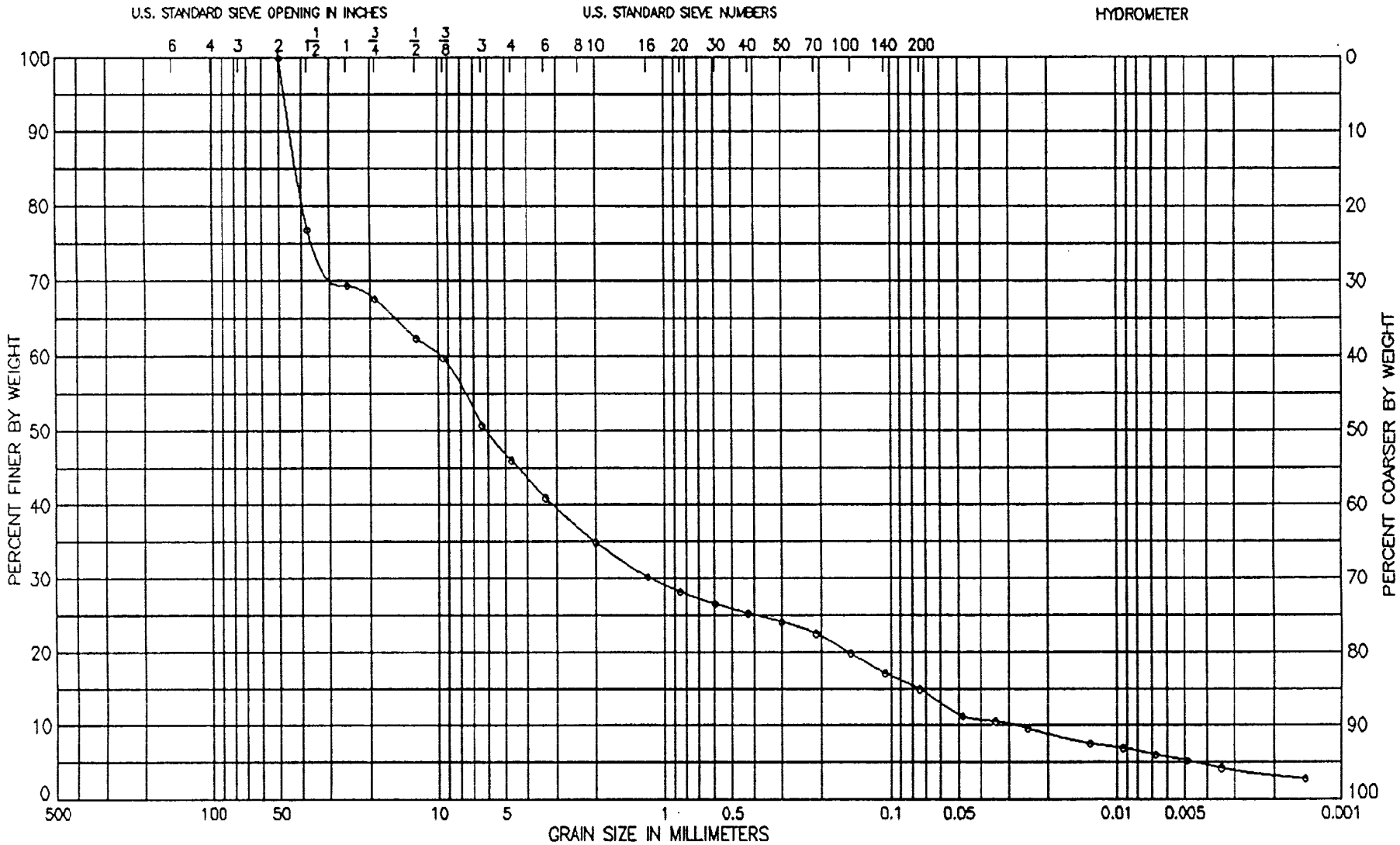
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
19.6	1/2 in	12.500	96.4	3.6
2.6	3/8 in	9.500	95.9	4.1
14.8	No 3	6.350	93.2	6.8
6.7	No 4	4.750	91.9	8.1
7.1	No 6	3.350	90.6	9.4
7.4	No 10	2.000	89.2	10.8
1.2	No 16	1.180	87.8	12.2
1.6	No 20	.850	87.3	12.7
2.0	No 30	.600	86.8	13.2
2.4	No 40	.425	86.4	13.6
2.8	No 50	.300	85.9	14.1
3.7	No 70	.212	84.8	15.2
6.3	No 100	.150	81.7	18.3
11.9	No 140	.106	75.0	25.0
17.5	No 200	.075	68.3	31.7

HYDROMETER:

RDGS	TEMP			
27.1	24.0	.0426	52.1	47.9
25.4	24.0	.0308	48.9	51.1
23.0	24.0	.0224	44.3	55.7
17.0	24.0	.0123	32.9	67.1
14.4	23.5	.0090	27.8	72.2
13.1	23.0	.0065	25.1	74.9
11.8	22.5	.0047	22.4	77.6
10.0	22.0	.0034	18.8	81.2
7.4	21.5	.0014	13.7	86.3

PERCENT GRAVEL = 8.1
PERCENT SAND = 23.6
PERCENT FINES = 68.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 10.8	ORG,% 2.0

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG
CRANE, IN

BORING NO. WES-VF2-87 SAMPLE NO. 3

DEPTH/ELEV 3.8' – 4.3' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF2-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 3.8' - 4.3' DATE: 04 MAR 91

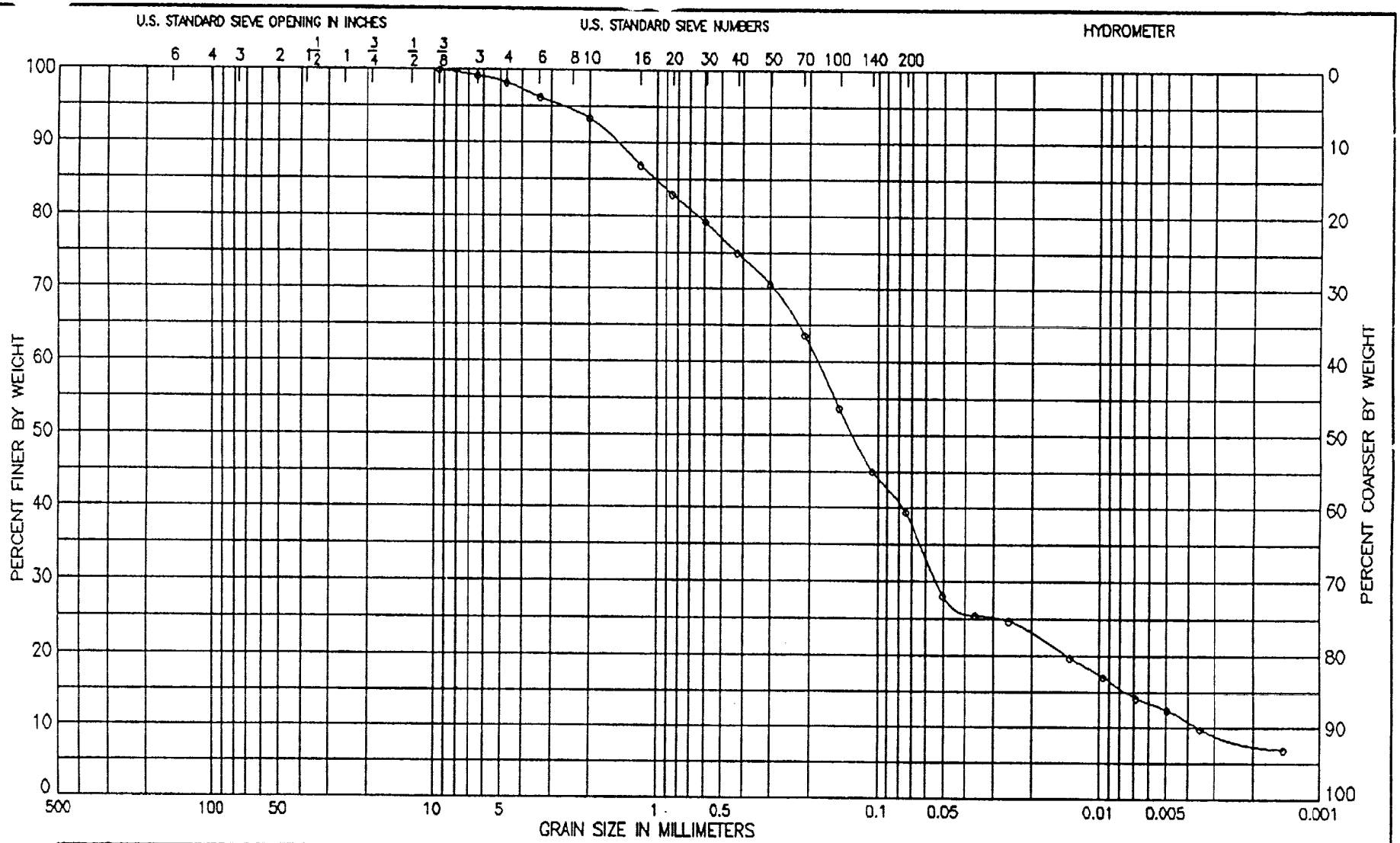
NO-LIMITS-RAN GS: 2.70 est WC: 10.80 OC: 2.00
CLASSIFICATION: 180
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 725.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 77.4 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	2 in	50.000	100.0	.0
168.3	1.5 in	37.500	76.8	23.2
53.4	1 in	25.000	69.5	30.5
12.7	3/4 in	19.100	67.7	32.3
38.6	1/2 in	12.500	62.4	37.6
18.8	3/8 in	9.500	59.8	40.2
65.8	No 3	6.350	50.7	49.3
34.3	No 4	4.750	46.0	54.0
36.3	No 6	3.350	41.0	59.0
44.1	No 10	2.000	34.9	65.1
10.4	No 16	1.180	30.2	69.8
15.0	No 20	.850	28.2	71.8
18.5	No 30	.600	26.6	73.4
21.4	No 40	.425	25.3	74.7
23.9	No 50	.300	24.1	75.9
27.4	No 70	.212	22.6	77.4
33.4	No 100	.150	19.9	80.1
39.5	No 140	.106	17.1	82.9
44.2	No 200	.075	15.0	85.0
HYDROMETER:				
RDGS	TEMP			
15.5	24.0	.0483	11.3	88.7
14.5	24.0	.0345	10.6	89.4
13.1	24.0	.0247	9.6	90.4
10.2	24.0	.0131	7.5	92.5
9.5	23.5	.0094	7.0	93.0
8.3	23.0	.0067	6.0	94.0
7.3	22.5	.0049	5.2	94.8
6.0	22.0	.0035	4.2	95.8
4.1	21.5	.0015	2.8	97.2

PERCENT GRAVEL = 54.0
PERCENT SAND = 31.0
PERCENT FINES = 15.0

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 17.3	ORG,% 3.3

CLASSIFICATION
CLAYEY SAND (SC), BROWN

PROJECT ABG
CRANE, IN

BORING NO. WES-3-VF2-87 SAMPLE NO. 3A

DEPTH/ELEV 4.3' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF2-87 SAMPLE: 3A DF: MD2791 .DAT
DEPTH: 4.3' - 4.5' DATE: 04 MAR 91

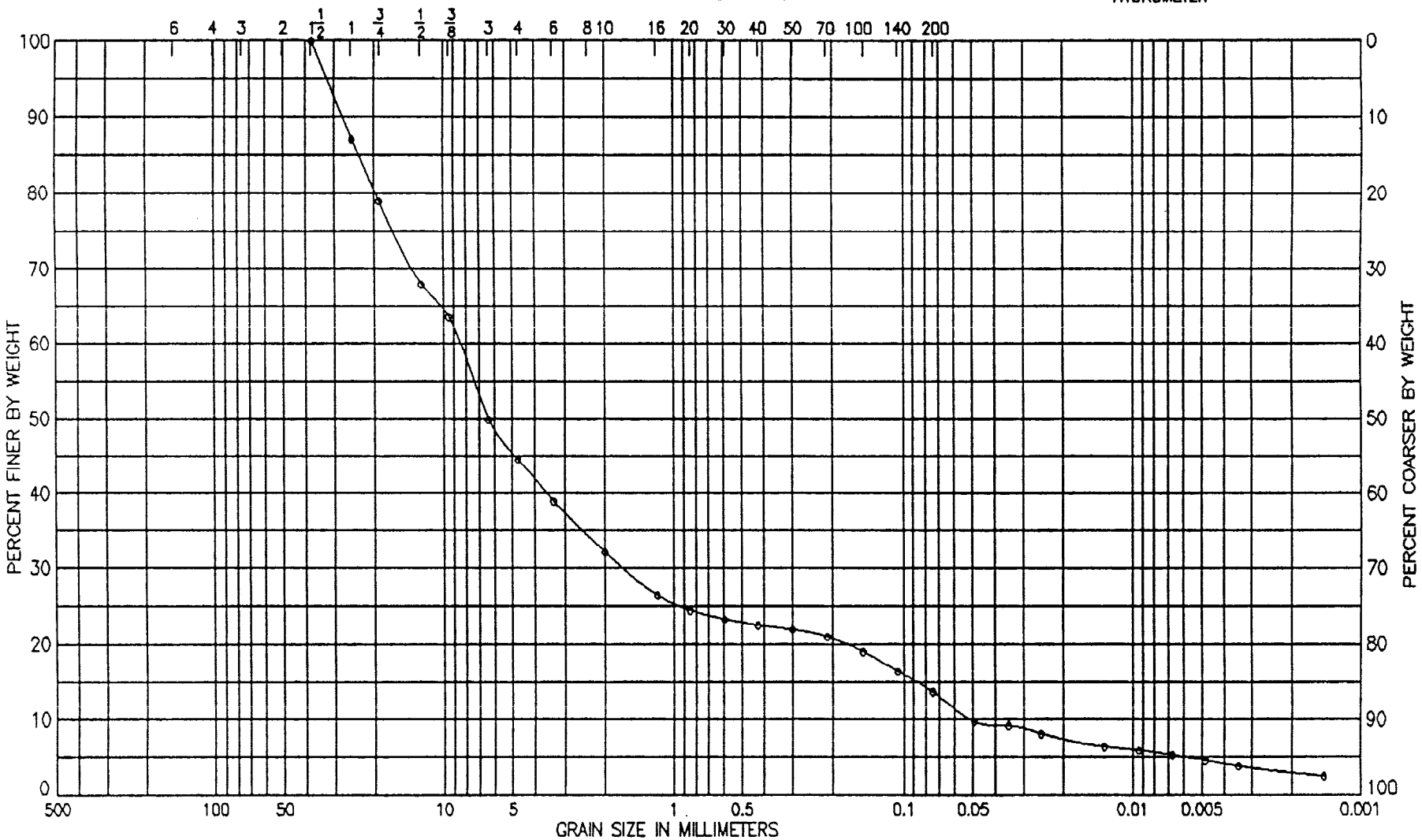
NO-LIMITS-RAN GS: 2.70 est WC: 17.30 OC: 3.30
CLASSIFICATION: 198
CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 154.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.8 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/8 in	9.500	100.0	.0
1.2	No 3	6.350	99.2	.8
1.4	No 4	4.750	98.3	1.7
3.2	No 6	3.350	96.3	3.7
4.4	No 10	2.000	93.4	6.6
4.3	No 16	1.180	86.9	13.1
6.9	No 20	.850	83.0	17.0
9.4	No 30	.600	79.2	20.8
12.2	No 40	.425	75.0	25.0
15.1	No 50	.300	70.6	29.4
19.7	No 70	.212	63.6	36.4
26.3	No 100	.150	53.7	46.3
32.0	No 140	.106	45.0	55.0
35.7	No 200	.075	39.4	60.6
HYDROMETER:				
RDGS	TEMP			
11.5	23.5	.0507	28.1	71.9
10.4	23.5	.0362	25.4	74.6
10.1	23.5	.0257	24.7	75.3
8.0	23.5	.0135	19.7	80.3
7.0	23.0	.0096	17.0	83.0
5.8	23.0	.0069	14.2	85.8
5.2	22.5	.0049	12.5	87.5
4.2	22.0	.0035	9.8	90.2
3.1	21.5	.0015	7.0	93.0

PERCENT GRAVEL = 1.7
PERCENT SAND = 58.9
PERCENT FINES = 39.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 11.4	ORG,% 1.6

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF2-87 SAMPLE NO. 4

DEPTH/ELEV 5.5' - 6.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF2-87 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.5' - 6.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 11.40 OC: 1.60
CLASSIFICATION: 216
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 638.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 77.4 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

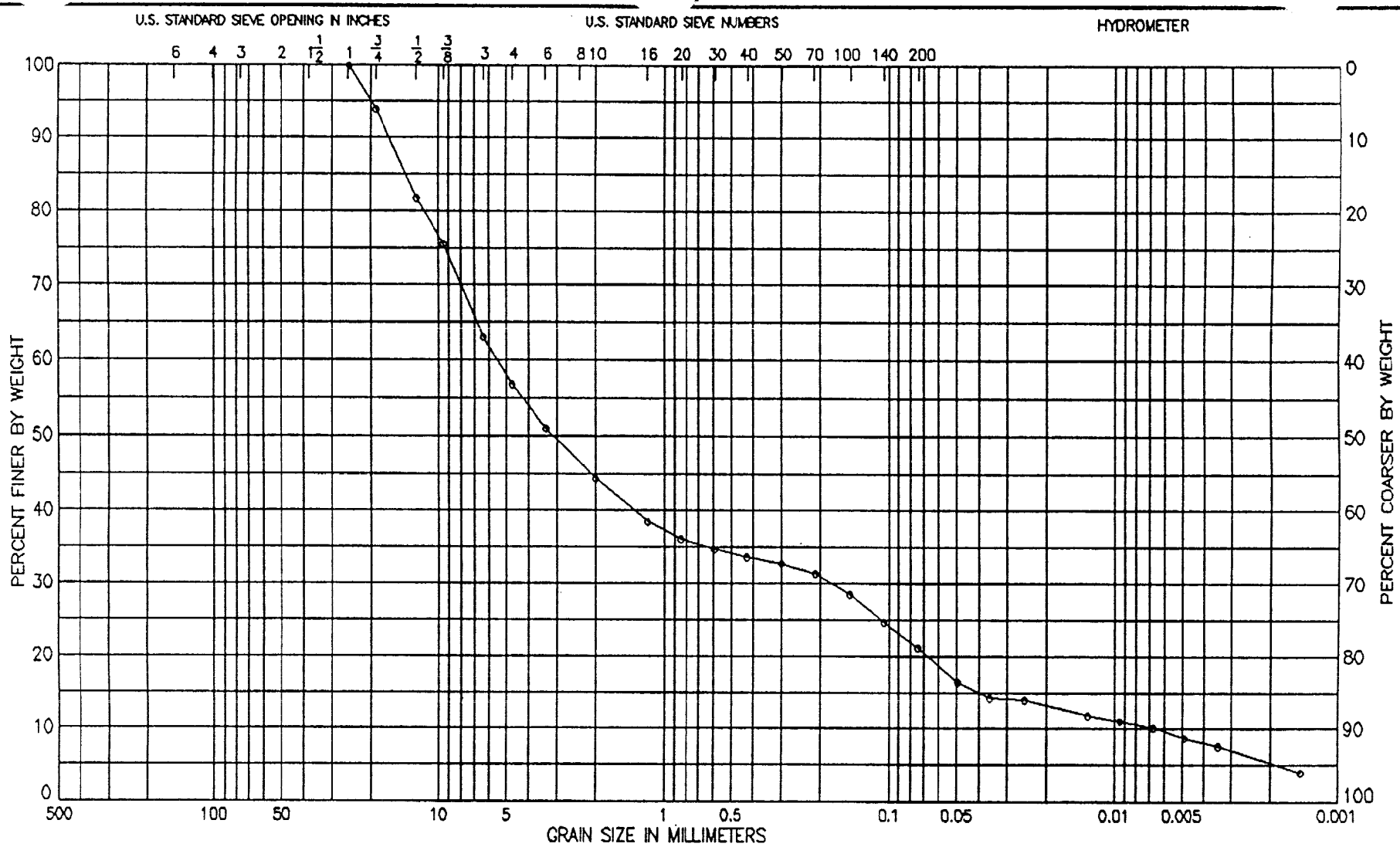
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
82.0	1 in	25.000	87.2	12.8
52.4	3/4 in	19.100	79.0	21.0
70.1	1/2 in	12.500	68.0	32.0
28.2	3/8 in	9.500	63.6	36.4
87.4	No 3	6.350	49.9	50.1
34.3	No 4	4.750	44.5	55.5
35.1	No 6	3.350	39.0	61.0
44.0	No 10	2.000	32.1	67.9
13.8	No 16	1.180	26.4	73.6
18.4	No 20	.850	24.5	75.5
21.2	No 30	.600	23.3	76.7
23.1	No 40	.425	22.5	77.5
24.6	No 50	.300	21.9	78.1
26.9	No 70	.212	21.0	79.0
31.5	No 100	.150	19.0	81.0
37.9	No 140	.106	16.4	83.6
44.4	No 200	.075	13.7	86.3

HYDROMETER:

RDGS	TEMP			
14.5	23.5	.0494	9.7	90.3
13.8	23.5	.0351	9.2	90.8
12.2	23.5	.0252	8.2	91.8
9.5	23.5	.0133	6.4	93.6
8.9	23.0	.0095	5.9	94.1
7.9	23.0	.0068	5.3	94.7
7.0	22.5	.0049	4.6	95.4
6.0	22.0	.0035	3.9	96.1
4.1	21.5	.0015	2.6	97.4

PERCENT GRAVEL = 55.5
PERCENT SAND = 30.8
PERCENT FINES = 13.7

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS 2.70 EST	NAT W,% 13.3	ORG,% 2.0

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG
CRANE, IN

BORING NO. WES-VF2-87 SAMPLE NO. 5

DEPTH/ELEV 7.0' - 7.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF2-87 SAMPLE: 5 DF: MD2791A .DAT
DEPTH: 7.0' - 7.5' DATE: 04 MAR 91

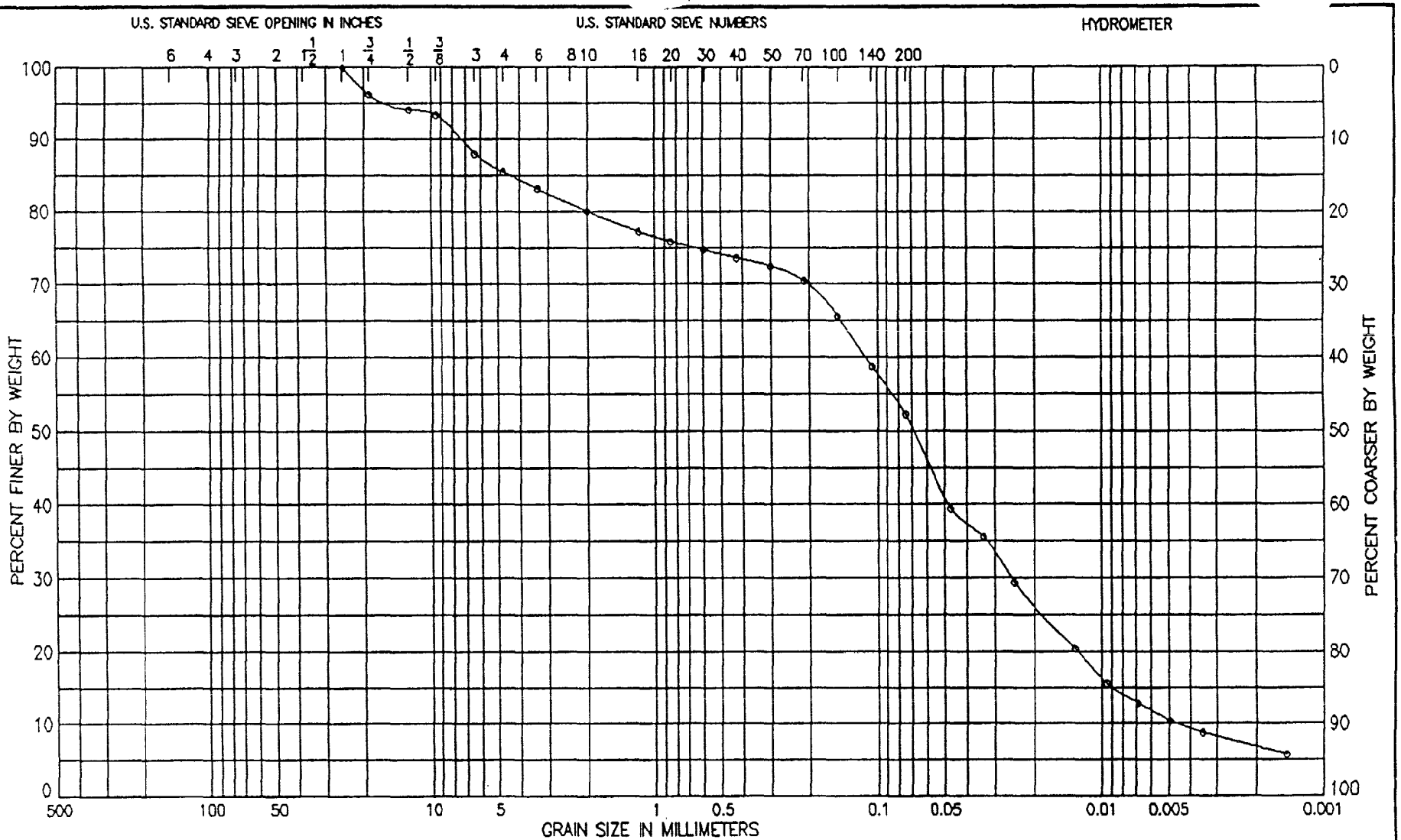
NO-LIMITS-RAN GS: 2.70 est WC: 13.30 OC: 2.00
CLASSIFICATION: 234
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 566.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 54.8 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
34.4	3/4 in	19.100	93.9	6.1
68.9	1/2 in	12.500	81.8	18.2
35.3	3/8 in	9.500	75.5	24.5
70.8	No 3	6.350	63.0	37.0
35.5	No 4	4.750	56.8	43.2
32.9	No 6	3.350	51.0	49.0
37.6	No 10	2.000	44.3	55.7
7.2	No 16	1.180	38.5	61.5
10.2	No 20	.850	36.1	63.9
11.9	No 30	.600	34.7	65.3
13.2	No 40	.425	33.7	66.3
14.3	No 50	.300	32.8	67.2
16.0	No 70	.212	31.4	68.6
19.6	No 100	.150	28.5	71.5
24.3	No 140	.106	24.7	75.3
28.6	No 200	.075	21.2	78.8
HYDROMETER:				
RDGS	TEMP			
12.5	24.0	.0497	16.5	83.5
10.8	24.0	.0357	14.3	85.7
10.6	24.0	.0253	14.0	86.0
8.9	24.0	.0132	11.8	88.2
8.5	23.0	.0095	11.1	88.9
7.8	23.0	.0068	10.2	89.8
6.8	22.5	.0049	8.7	91.3
6.0	22.0	.0035	7.6	92.4
3.3	21.5	.0015	4.0	96.0

PERCENT GRAVEL = 43.2
PERCENT SAND = 35.6
PERCENT FINES = 21.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 10.0	ORG,% 3.4

CLASSFICATION

GRAVELLY SANDY CLAY (CL), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF3-87 SAMPLE NO. 1

DEPTH/ELEV 0.5' – 1.0' DATE 04 MAR 91

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF3-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 0.5' - 1.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 10.00 OC: 3.40
CLASSIFICATION: 252
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 468.4 gms.
PARTIAL WEIGHT AFTER SPLIT: 63.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

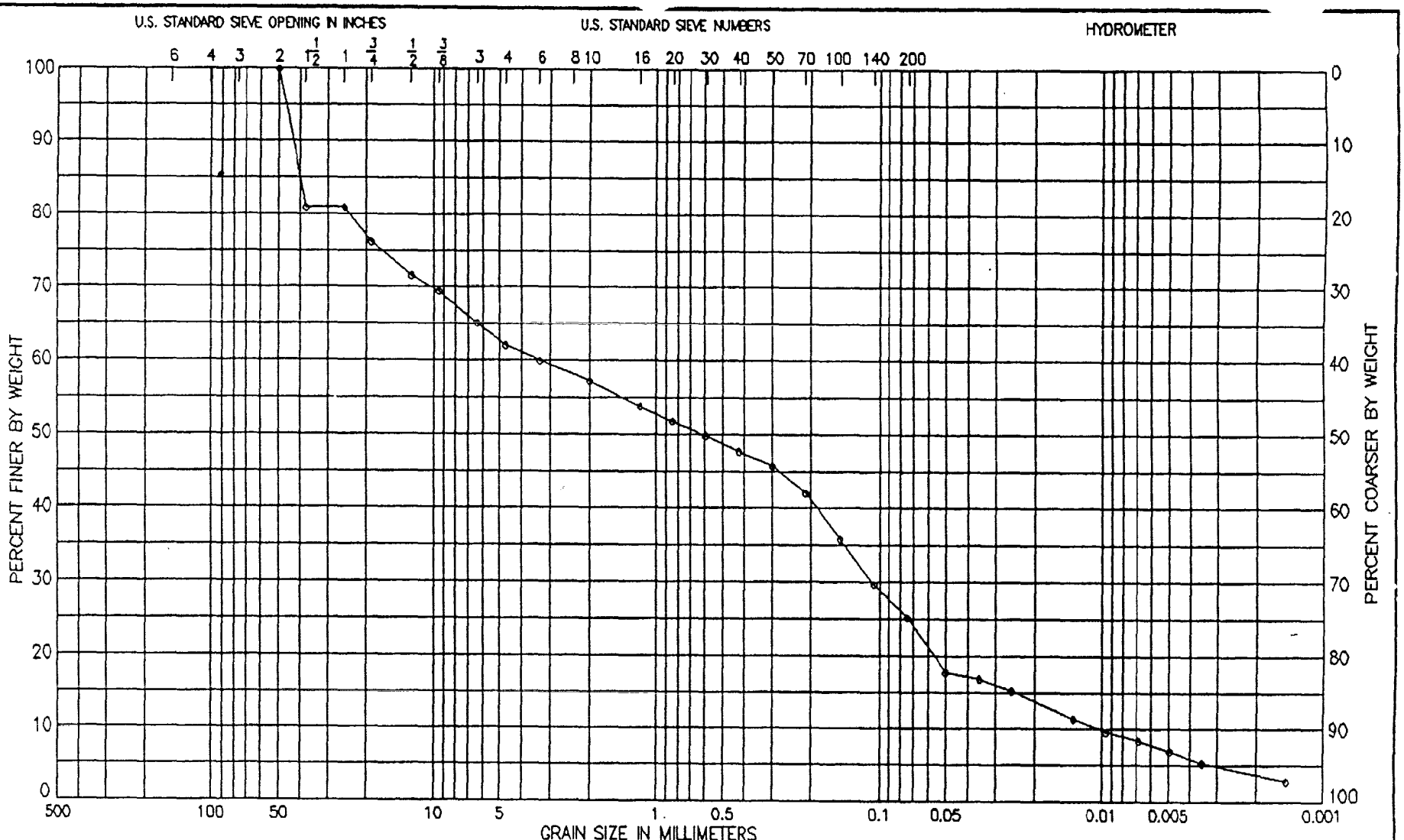
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
17.3	3/4 in	19.100	96.3	3.7
10.0	1/2 in	12.500	94.2	5.8
3.6	3/8 in	9.500	93.4	6.6
25.3	No 3	6.350	88.0	12.0
11.6	No 4	4.750	85.5	14.5
10.9	No 6	3.350	83.2	16.8
14.9	No 10	2.000	80.0	20.0
2.2	No 16	1.180	77.2	22.8
3.3	No 20	.850	75.9	24.1
4.2	No 30	.600	74.7	25.3
5.1	No 40	.425	73.6	26.4
6.0	No 50	.300	72.5	27.5
7.6	No 70	.212	70.4	29.6
11.4	No 100	.150	65.7	34.3
16.9	No 140	.106	58.7	41.3
22.0	No 200	.075	52.3	47.7

HYDROMETER:

RDGS	TEMP			
19.5	23.5	.0470	39.4	60.6
17.6	23.5	.0339	35.6	64.4
14.5	23.5	.0247	29.4	70.6
10.0	23.5	.0133	20.4	79.6
7.7	23.0	.0096	15.6	84.4
6.3	23.0	.0068	12.8	87.2
5.2	22.5	.0049	10.4	89.6
4.5	22.0	.0035	8.8	91.2
3.1	21.5	.0015	5.8	94.2

PERCENT GRAVEL = 14.5
PERCENT SAND = 33.2
PERCENT FINES = 52.3

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS 2.70 EST	NAT W,% 12.7	ORG,% 2.3

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF3-87 SAMPLE NO. 2

DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF3-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 12.70 OC: 2.30
CLASSIFICATION: 270
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 594.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 67.0 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

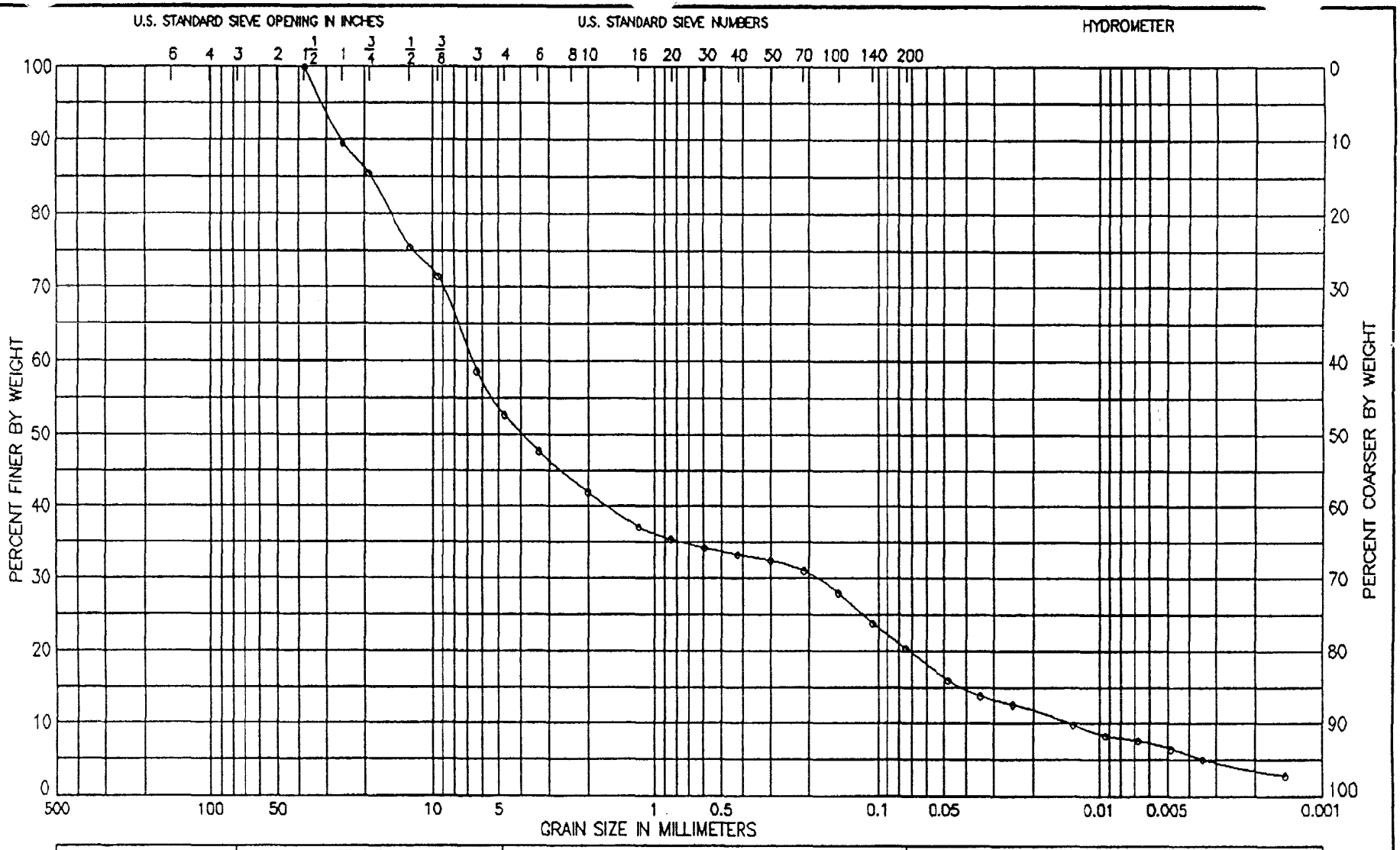
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	2 in	50.000	100.0	.0
113.8	1.5 in	37.500	80.9	19.1
.0	1 in	25.000	80.9	19.1
27.8	3/4 in	19.100	76.2	23.8
27.7	1/2 in	12.500	71.5	28.5
12.5	3/8 in	9.500	69.4	30.6
25.9	No 3	6.350	65.1	34.9
18.2	No 4	4.750	62.0	38.0
12.3	No 6	3.350	60.0	40.0
16.1	No 10	2.000	57.2	42.8
4.0	No 16	1.180	53.8	46.2
6.4	No 20	.850	51.8	48.2
8.7	No 30	.600	49.8	50.2
11.2	No 40	.425	47.7	52.3
13.5	No 50	.300	45.7	54.3
17.8	No 70	.212	42.0	58.0
25.0	No 100	.150	35.9	64.1
32.3	No 140	.106	29.6	70.4
37.5	No 200	.075	25.2	74.8

HYDROMETER:

RDGS	TEMP			
13.0	23.0	.0501	17.8	82.2
12.3	23.0	.0356	16.8	83.2
11.1	23.0	.0255	15.2	84.8
8.3	23.0	.0135	11.4	88.6
7.0	23.0	.0096	9.6	90.4
6.1	23.0	.0069	8.4	91.6
5.1	22.5	.0049	6.9	93.1
4.0	22.0	.0035	5.3	94.7
2.3	21.5	.0015	2.8	97.2

PERCENT GRAVEL = 38.0
PERCENT SAND = 36.8
PERCENT FINES = 25.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 10.9	ORG,% 2.2

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF3-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' – 4.5' DATE 04 MAR 91

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF3-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 10.90 OC: 2.20
CLASSIFICATION: 288
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 658.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 73.2 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

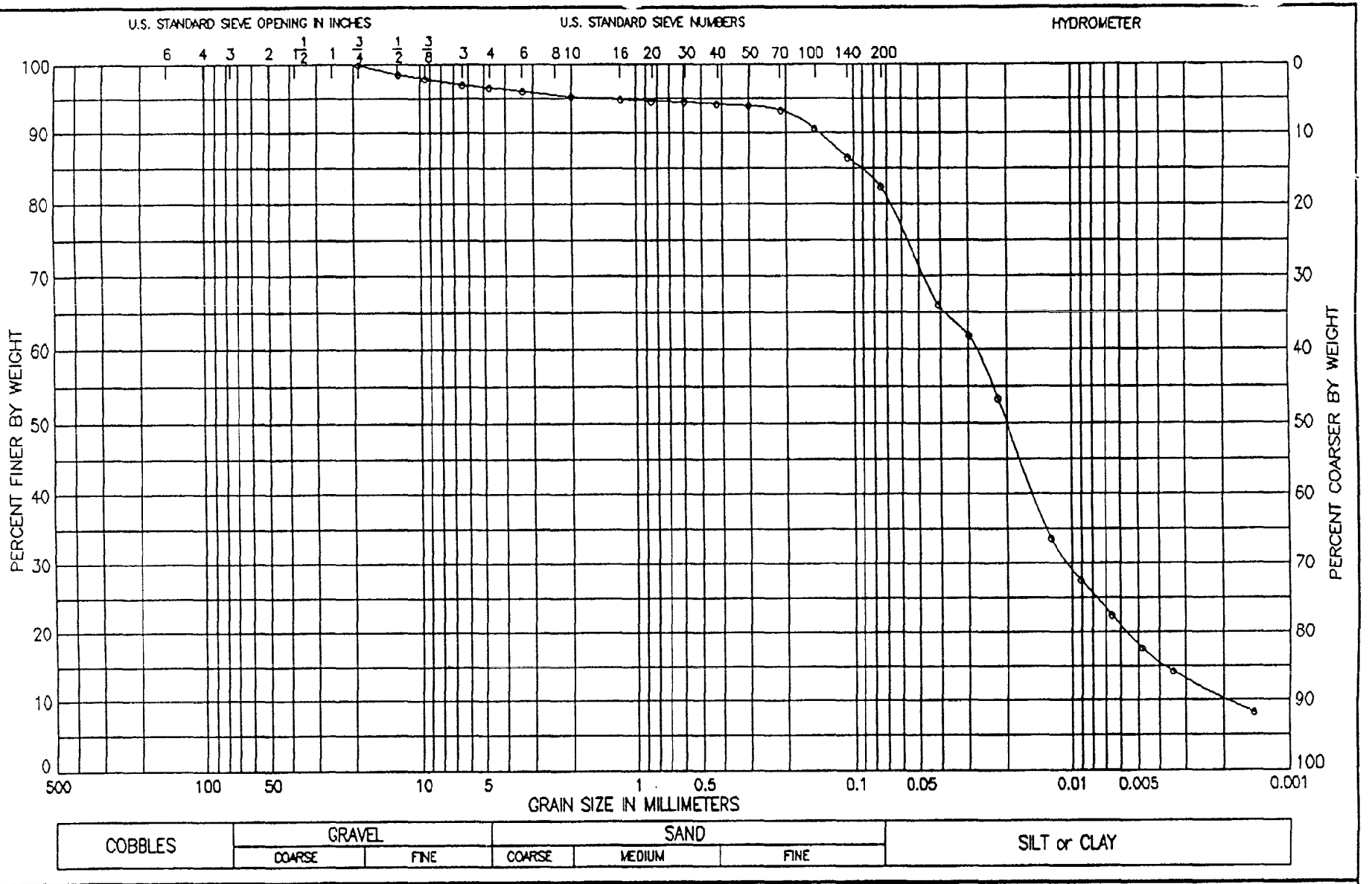
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
68.7	1 in	25.000	89.6	10.4
27.1	3/4 in	19.100	85.5	14.5
66.2	1/2 in	12.500	75.4	24.6
25.7	3/8 in	9.500	71.5	28.5
84.8	No 3	6.350	58.6	41.4
39.0	No 4	4.750	52.7	47.3
33.4	No 6	3.350	47.6	52.4
37.4	No 10	2.000	42.0	58.0
8.4	No 16	1.180	37.2	62.8
11.4	No 20	.850	35.4	64.6
13.4	No 30	.600	34.3	65.7
15.1	No 40	.425	33.3	66.7
16.5	No 50	.300	32.5	67.5
19.0	No 70	.212	31.1	68.9
24.4	No 100	.150	28.0	72.0
31.6	No 140	.106	23.9	76.1
37.5	No 200	.075	20.5	79.5

HYDROMETER:

RDGS	TEMP			
17.3	23.5	.0481	15.9	84.1
15.0	23.5	.0347	13.8	86.2
13.7	23.5	.0249	12.7	87.3
10.6	23.5	.0132	9.8	90.2
9.1	23.0	.0095	8.4	91.6
8.3	23.0	.0067	7.6	92.4
7.2	22.5	.0049	6.6	93.4
5.7	22.0	.0035	5.1	94.9
3.3	21.5	.0015	2.8	97.2

PERCENT GRAVEL = 47.3
PERCENT SAND = 32.2
PERCENT FINES = 20.5

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 21.2	ORG,% 4.2

CLASSFICATION
SANDY CLAY (CL), GRAY; TRACE OF GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-3-VF4-87 SAMPLE NO. 1

DEPTH/ELEV 0.5' - 1.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-3-VF4-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 0.5' - 1.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 21.20 OC: 4.20
CLASSIFICATION: 306
SANDY CLAY (CL), GRAY; TRACE OF GRAVEL

TOTAL WEIGHT OF SAMPLE: 593.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 71.5 gms.

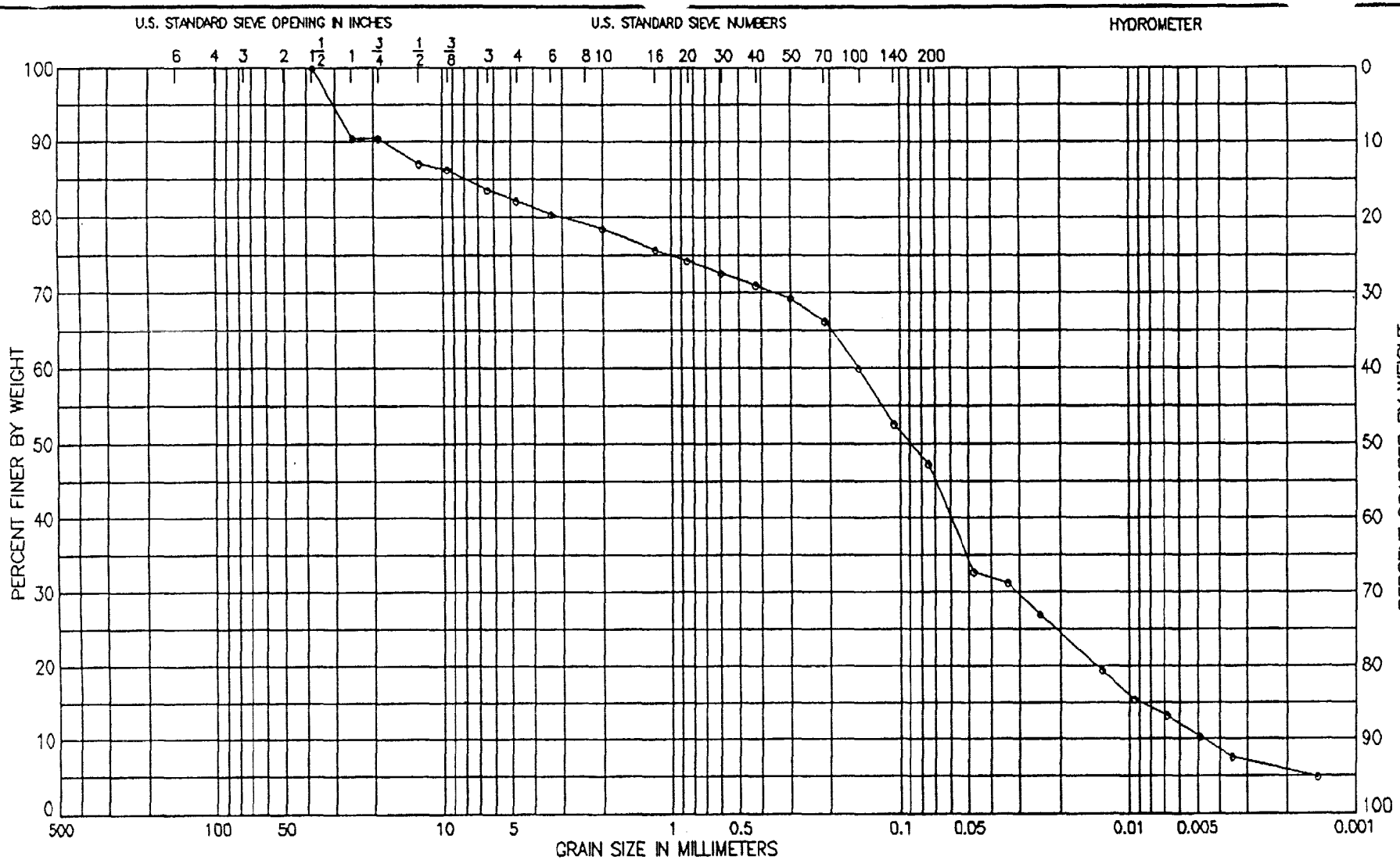
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
8.3	1/2 in	12.500	98.6	1.4
3.6	3/8 in	9.500	98.0	2.0
5.6	No 3	6.350	97.1	2.9
2.2	No 4	4.750	96.7	3.3
3.4	No 6	3.350	96.1	3.9
4.7	No 10	2.000	95.3	4.7
.3	No 16	1.180	94.9	5.1
.5	No 20	.850	94.7	5.3
.6	No 30	.600	94.5	5.5
.8	No 40	.425	94.3	5.7
1.0	No 50	.300	94.0	6.0
1.5	No 70	.212	93.3	6.7
3.5	No 100	.150	90.7	9.3
6.6	No 140	.106	86.5	13.5
9.7	No 200	.075	82.4	17.6

HYDROMETER:

RDGS	TEMP			
31.0	23.5	.0410	66.1	33.9
29.0	23.5	.0298	61.8	38.2
25.0	23.5	.0221	53.4	46.6
15.7	23.5	.0126	33.7	66.3
12.8	23.5	.0092	27.5	72.5
10.5	23.0	.0066	22.4	77.6
8.3	22.5	.0048	17.6	82.4
6.8	22.0	.0035	14.2	85.8
4.1	21.5	.0015	8.3	91.7

PERCENT GRAVEL = 3.3
PERCENT SAND = 14.3
PERCENT FINES = 82.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.1	ORG,% 2.2

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), GRAY

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF4-87 SAMPLE NO. 2

DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF4-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 19.10 OC: 2.20
CLASSIFICATION: 324
GRAVELLY CLAYEY SAND (SC), GRAY

TOTAL WEIGHT OF SAMPLE: 555.4 gms.
PARTIAL WEIGHT AFTER SPLIT: 68.9 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

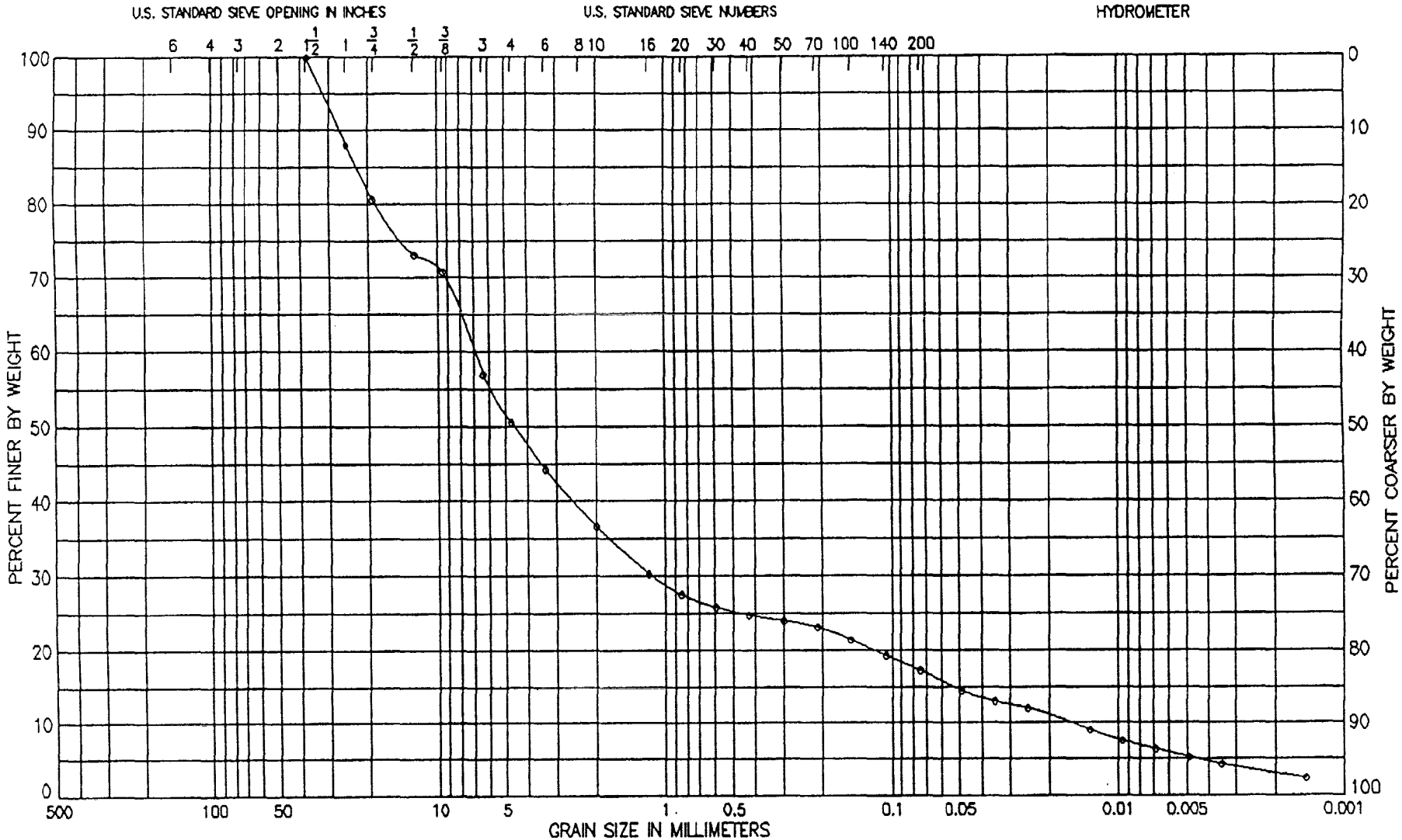
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
53.2	1 in	25.000	90.4	9.6
.0	3/4 in	19.100	90.4	9.6
18.6	1/2 in	12.500	87.1	12.9
4.5	3/8 in	9.500	86.3	13.7
14.9	No 3	6.350	83.6	16.4
8.0	No 4	4.750	82.1	17.9
10.1	No 6	3.350	80.3	19.7
10.6	No 10	2.000	78.4	21.6
2.4	No 16	1.180	75.7	24.3
3.7	No 20	.850	74.2	25.8
5.1	No 30	.600	72.6	27.4
6.5	No 40	.425	71.0	29.0
8.0	No 50	.300	69.3	30.7
10.7	No 70	.212	66.2	33.8
16.2	No 100	.150	60.0	40.0
22.7	No 140	.106	52.6	47.4
27.4	No 200	.075	47.2	52.8

HYDROMETER:

RDGS	TEMP			
18.0	23.0	.0477	32.7	67.3
17.2	23.0	.0340	31.3	68.7
14.8	23.0	.0246	26.9	73.1
10.6	23.0	.0132	19.3	80.7
8.4	23.0	.0095	15.4	84.6
7.2	23.0	.0068	13.2	86.8
5.7	22.5	.0049	10.3	89.7
4.3	22.0	.0035	7.6	92.4
2.9	21.5	.0015	4.9	95.1

PERCENT GRAVEL = 17.9
PERCENT SAND = 34.9
PERCENT FINES = 47.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 11.9	ORG,% 3.3

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG
CRANE, IN

BORING NO. WES-3-VF4-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF4-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 11.90 OC: 3.30
CLASSIFICATION: 342
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 631.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 66.4 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

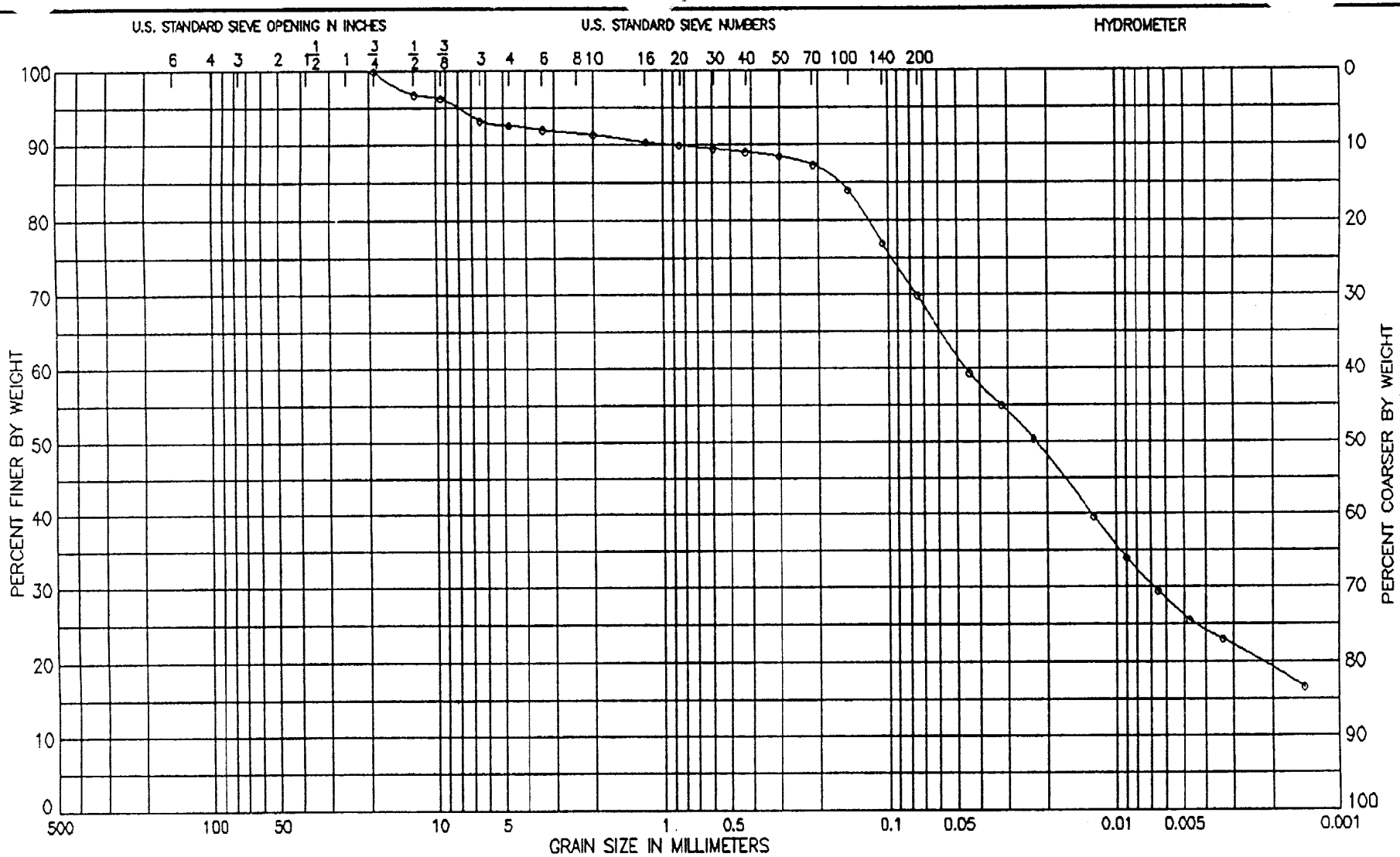
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
75.6	1 in	25.000	88.0	12.0
46.7	3/4 in	19.100	80.6	19.4
47.5	1/2 in	12.500	73.1	26.9
14.6	3/8 in	9.500	70.8	29.2
87.4	No 3	6.350	57.0	43.0
40.6	No 4	4.750	50.6	49.4
39.9	No 6	3.350	44.2	55.8
47.9	No 10	2.000	36.7	63.3
11.5	No 16	1.180	30.3	69.7
16.5	No 20	.850	27.5	72.5
19.6	No 30	.600	25.8	74.2
21.5	No 40	.425	24.8	75.2
22.9	No 50	.300	24.0	76.0
24.5	No 70	.212	23.1	76.9
27.6	No 100	.150	21.4	78.6
31.5	No 140	.106	19.3	80.7
35.1	No 200	.075	17.3	82.7

HYDROMETER:

RDGS	TEMP			
16.6	22.0	.0490	14.5	85.5
15.0	22.0	.0352	13.1	86.9
13.9	22.0	.0251	12.1	87.9
10.4	22.0	.0134	9.0	91.0
8.7	22.0	.0096	7.5	92.5
7.4	22.0	.0069	6.4	93.6
6.1	22.0	.0049	5.3	94.7
5.0	22.0	.0035	4.3	95.7
3.0	21.0	.0015	2.4	97.6

PERCENT GRAVEL = 49.4
PERCENT SAND = 33.3
PERCENT FINES = 17.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 15.6	ORG,% 4.1

CLASSIFICATION
SANDY CLAY (CL), BROWN; WITH GRAVEL

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG
CRANE, IN
BORING NO. WES-3-VF5-87 SAMPLE NO. 1
DEPTH/ELEV 0.5' – 1.0' DATE 04 MAR 91

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF5-87 SAMPLE: 1 DF: MD2791A .DAT
DEPTH: 0.5' - 1.0' DATE: 04 MAR 91

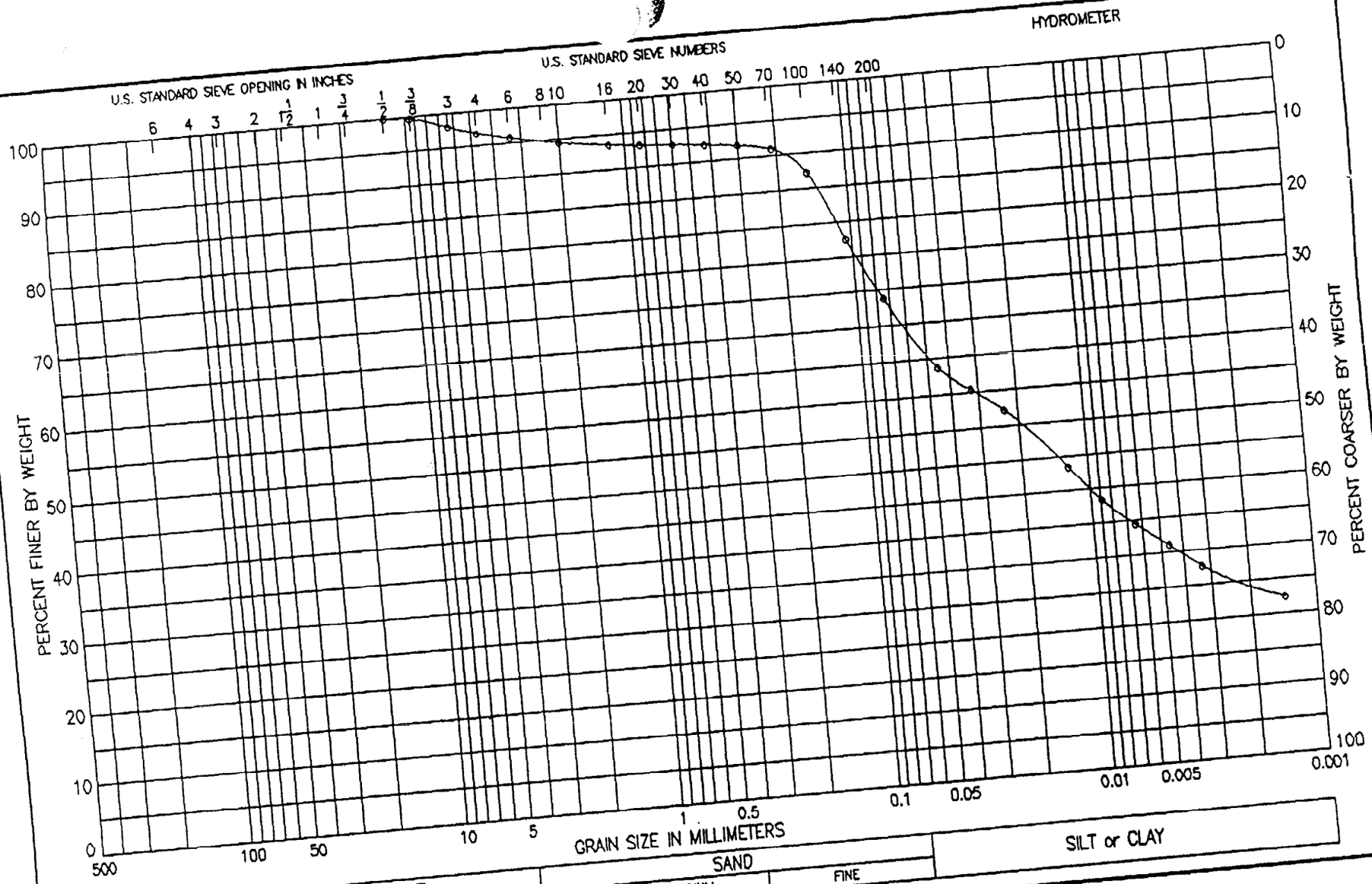
NO-LIMITS-RAN GS: 2.70 est WC: 15.60 OC: 4.10
CLASSIFICATION: 360
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 584.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 63.1 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
18.5	1/2 in	12.500	96.8	3.2
3.0	3/8 in	9.500	96.3	3.7
17.7	No 3	6.350	93.3	6.7
3.7	No 4	4.750	92.7	7.3
3.6	No 6	3.350	92.0	8.0
3.9	No 10	2.000	91.4	8.6
.7	No 16	1.180	90.4	9.6
1.0	No 20	.850	89.9	10.1
1.3	No 30	.600	89.5	10.5
1.6	No 40	.425	89.1	10.9
2.0	No 50	.300	88.5	11.5
2.8	No 70	.212	87.3	12.7
5.1	No 100	.150	84.0	16.0
10.0	No 140	.106	76.9	23.1
14.8	No 200	.075	69.9	30.1
HYDROMETER:				
RDGS	TEMP			
25.9	22.0	.0443	59.3	40.7
24.0	22.0	.0320	55.0	45.0
22.0	22.0	.0232	50.4	49.6
17.3	22.0	.0126	39.6	60.4
14.9	22.0	.0091	34.0	66.0
12.9	22.0	.0065	29.4	70.6
11.2	22.0	.0047	25.5	74.5
10.1	22.0	.0034	23.0	77.0
7.6	20.5	.0014	16.6	83.4

PERCENT GRAVEL = 7.3
PERCENT SAND = 22.7
PERCENT FINES = 69.9

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS 2.70 EST	NAT W.% 19.6	ORG.% 1.9

CLASSIFICATION
SANDY CLAY (CL), BROWN; TRACE OF GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-3-VF5-87 SAMPLE NO. 2

DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE

LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-3-VF5-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

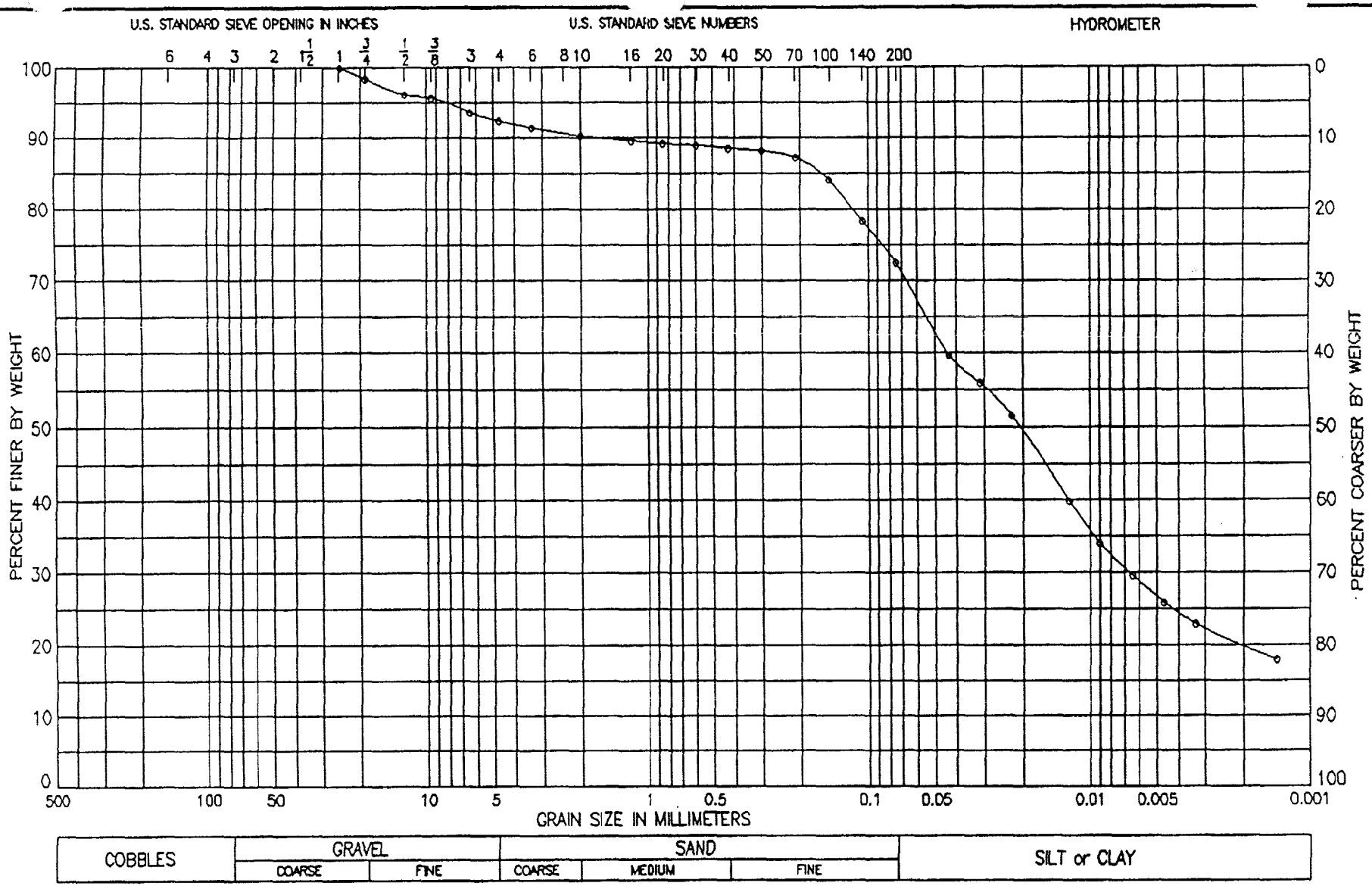
NO-LIMITS-RAN GS: 2.70 est WC: 19.60 OC: 1.90
CLASSIFICATION: 378
SANDY CLAY (CL), BROWN; TRACE OF GRAVEL

TOTAL WEIGHT OF SAMPLE: 565.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.8 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1/2 in	12.500	100.0	.0
1.2	3/8 in	9.500	99.8	.2
9.6	No 3	6.350	98.1	1.9
6.7	No 4	4.750	96.9	3.1
6.0	No 6	3.350	95.8	4.2
7.6	No 10	2.000	94.5	5.5
.6	No 16	1.180	93.6	6.4
.9	No 20	.850	93.1	6.9
1.1	No 30	.600	92.8	7.2
1.4	No 40	.425	92.4	7.6
1.7	No 50	.300	91.9	8.1
2.3	No 70	.212	91.0	9.0
4.7	No 100	.150	87.3	12.7
11.1	No 140	.106	77.5	22.5
16.8	No 200	.075	68.8	31.2
HYDROMETER:				
RDGS	TEMP			
24.3	22.0	.0451	58.8	41.2
22.9	22.0	.0324	55.4	44.6
21.6	22.0	.0233	52.2	47.8
18.0	22.0	.0125	43.5	56.5
15.9	22.0	.0090	38.4	61.6
14.3	22.0	.0065	34.5	65.5
12.9	22.0	.0046	31.1	68.9
11.5	22.0	.0033	27.7	72.3
9.6	20.5	.0014	22.3	77.7

PERCENT GRAVEL = 3.1
PERCENT SAND = 28.1
PERCENT FINES = 68.8

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 15.9	ORG,% 2.9

CLASSIFICATION

SANDY CLAY (CL), BROWN; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-VF5-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-VF5-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 15.90 OC: 2.90
CLASSIFICATION: 396
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 639.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 68.7 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

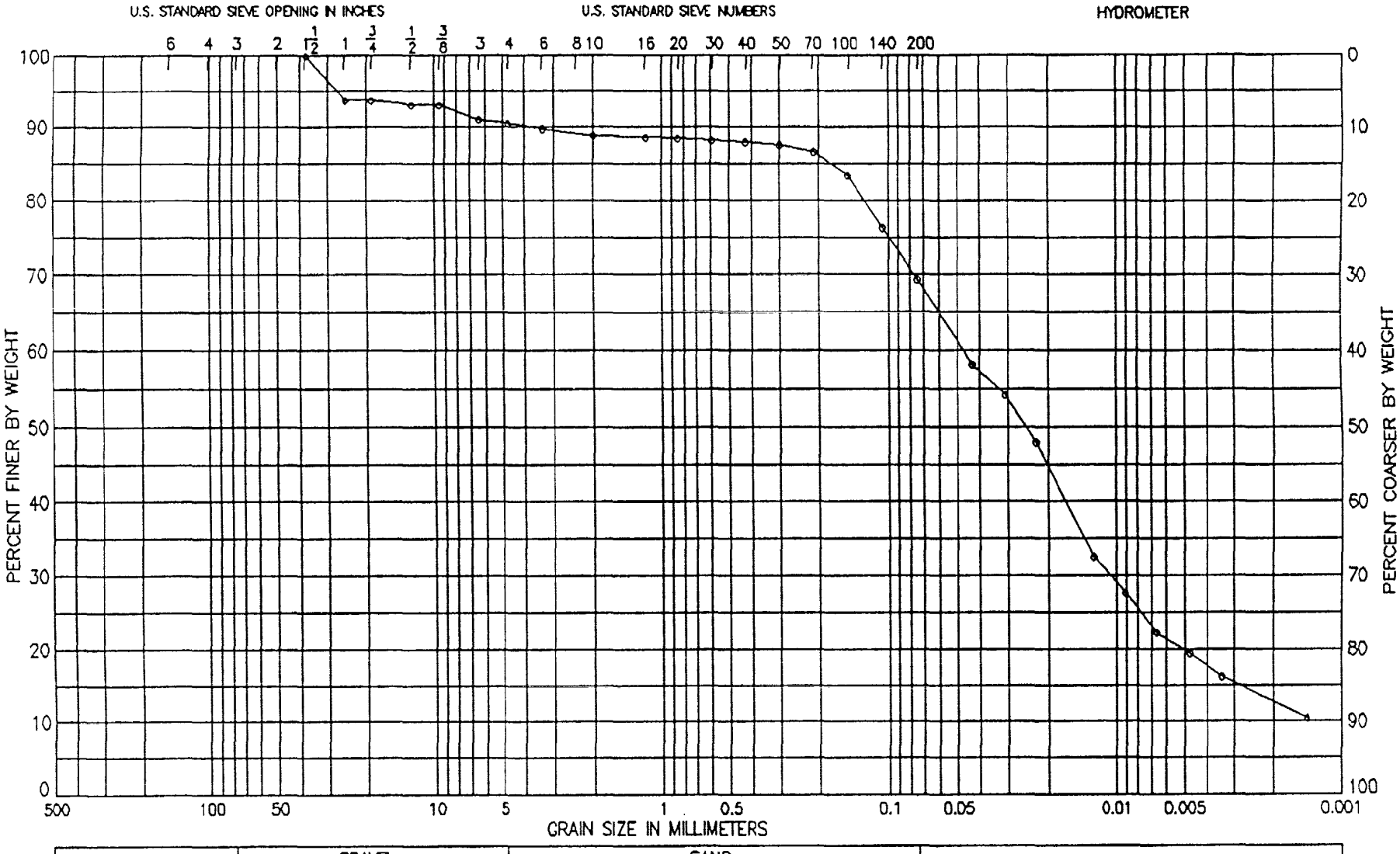
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
9.9	3/4 in	19.100	98.5	1.5
14.5	1/2 in	12.500	96.2	3.8
2.8	3/8 in	9.500	95.7	4.3
13.4	No 3	6.350	93.7	6.3
7.7	No 4	4.750	92.4	7.6
6.4	No 6	3.350	91.4	8.6
7.5	No 10	2.000	90.3	9.7
.5	No 16	1.180	89.6	10.4
.8	No 20	.850	89.2	10.8
1.0	No 30	.600	89.0	11.0
1.3	No 40	.425	88.6	11.4
1.6	No 50	.300	88.2	11.8
2.3	No 70	.212	87.3	12.7
4.7	No 100	.150	84.1	15.9
9.1	No 140	.106	78.3	21.7
13.5	No 200	.075	72.5	27.5

HYDROMETER:

RDGS	TEMP			
28.8	21.5	.0433	59.7	40.3
27.0	21.5	.0313	55.9	44.1
24.9	21.5	.0227	51.5	48.5
19.3	21.5	.0125	39.9	60.1
16.5	21.5	.0091	34.0	66.0
14.3	22.0	.0065	29.6	70.4
12.5	22.0	.0046	25.9	74.1
11.1	22.0	.0033	23.0	77.0
9.0	20.5	.0014	17.9	82.1

PERCENT GRAVEL = 7.6
PERCENT SAND = 19.9
PERCENT FINES = 72.5

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 25.3	ORG,% 2.4

CLASSIFICATION

SANDY CLAY (CL), BROWN; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-VF5-87 SAMPLE NO. 4

DEPTH/ELEV 5.5' - 6.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-VF5-87 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.5' - 6.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 25.30 OC: 2.40
CLASSIFICATION: 414
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 473.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 68.9 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

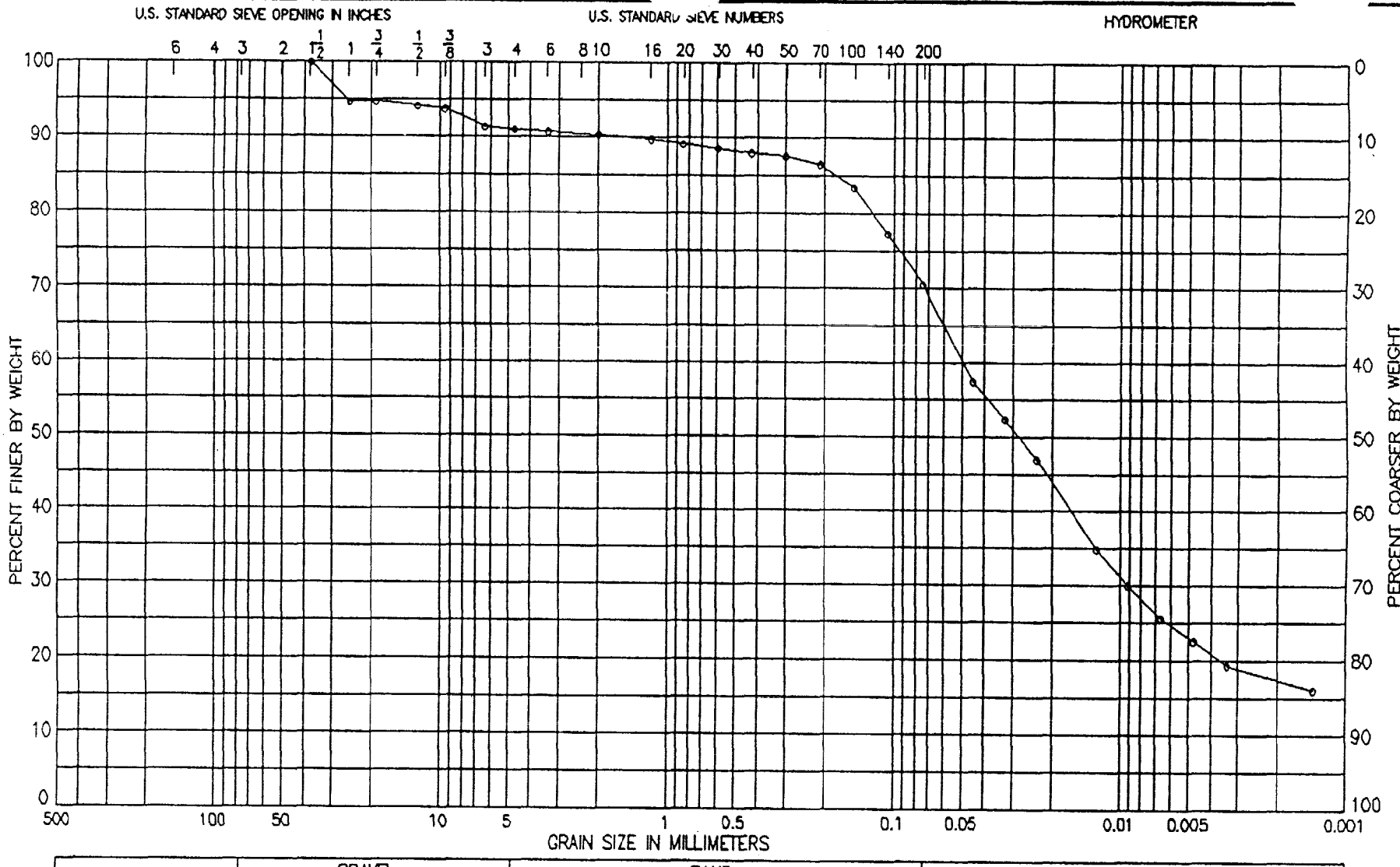
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
29.5	1 in	25.000	93.8	6.2
.0	3/4 in	19.100	93.8	6.2
3.3	1/2 in	12.500	93.1	6.9
.0	3/8 in	9.500	93.1	6.9
9.7	No 3	6.350	91.0	9.0
2.4	No 4	4.750	90.5	9.5
3.5	No 6	3.350	89.8	10.2
4.4	No 10	2.000	88.9	11.1
.2	No 16	1.180	88.6	11.4
.3	No 20	.850	88.5	11.5
.5	No 30	.600	88.2	11.8
.7	No 40	.425	88.0	12.0
1.0	No 50	.300	87.6	12.4
1.7	No 70	.212	86.7	13.3
4.2	No 100	.150	83.4	16.6
9.7	No 140	.106	76.3	23.7
15.1	No 200	.075	69.4	30.6

HYDROMETER:

RDGS	TEMP			
28.5	22.0	.0429	58.2	41.8
26.6	22.0	.0311	54.3	45.7
23.5	22.0	.0228	47.9	52.1
16.0	22.0	.0127	32.6	67.4
13.6	22.0	.0092	27.7	72.3
11.0	22.0	.0067	22.3	77.7
9.6	22.0	.0048	19.5	80.5
8.0	22.0	.0034	16.2	83.8
5.2	22.0	.0014	10.4	89.6

PERCENT GRAVEL = 9.5
PERCENT SAND = 21.1
PERCENT FINES = 69.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.4	ORG,% 1.5

CLASSIFICATION

SANDY CLAY (CL), BROWN; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF5-87 SAMPLE NO. 5

DEPTH/ELEV 7.0' – 7.5' DATE 04 MAR 91

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-3-VF5-87 SAMPLE: 5 DF: MD2791 .DAT
DEPTH: 7.0' - 7.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 19.40 OC: 1.50
CLASSIFICATION: 432
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 580.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.7 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

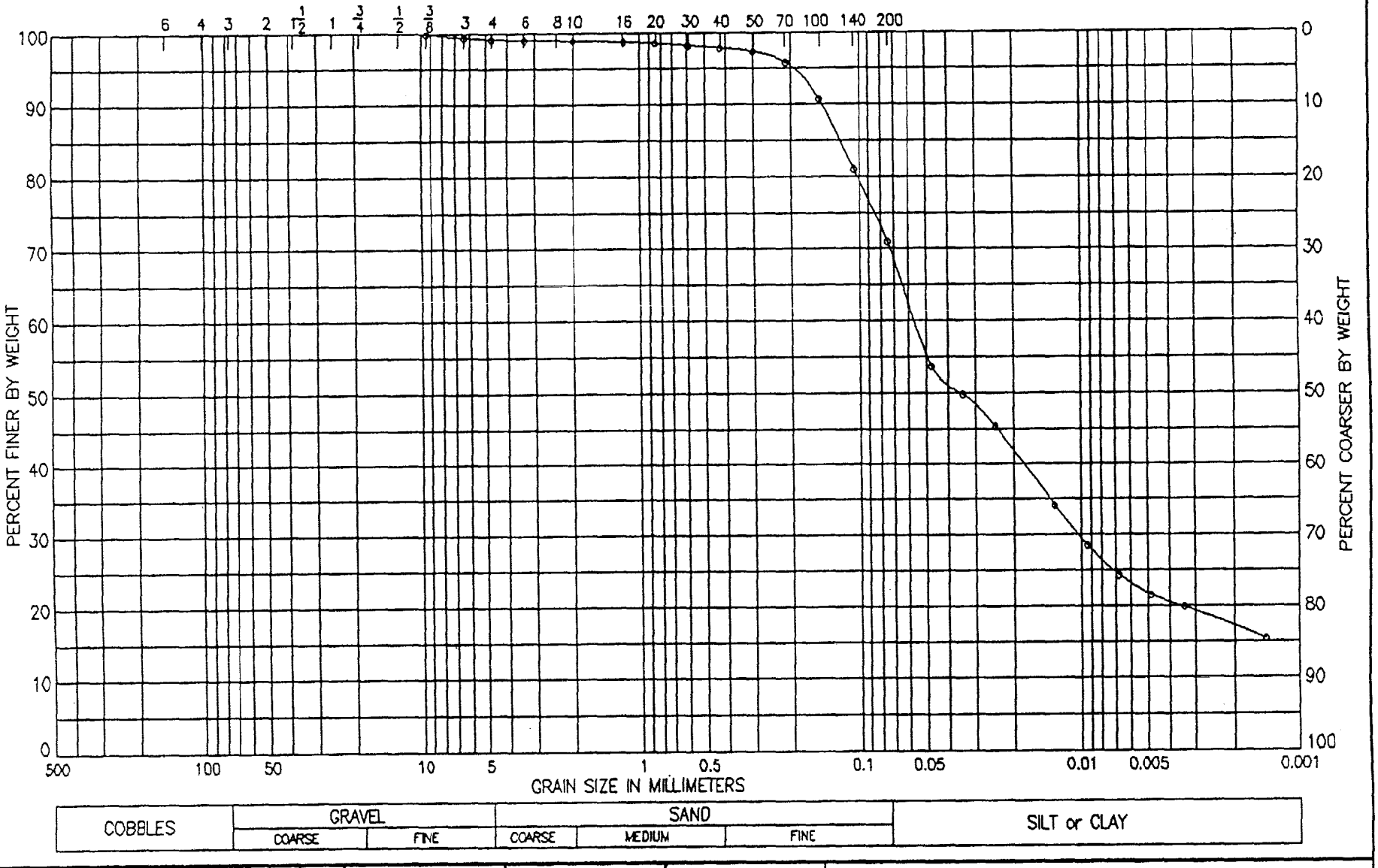
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
30.7	1 in	25.000	94.7	5.3
.0	3/4 in	19.100	94.7	5.3
3.1	1/2 in	12.500	94.2	5.8
2.0	3/8 in	9.500	93.8	6.2
14.6	No 3	6.350	91.3	8.7
1.7	No 4	4.750	91.0	9.0
1.7	No 6	3.350	90.7	9.3
2.3	No 10	2.000	90.3	9.7
.4	No 16	1.180	89.7	10.3
.8	No 20	.850	89.2	10.8
1.2	No 30	.600	88.6	11.4
1.6	No 40	.425	88.0	12.0
1.9	No 50	.300	87.5	12.5
2.6	No 70	.212	86.5	13.5
4.7	No 100	.150	83.4	16.6
8.9	No 140	.106	77.3	22.7
13.5	No 200	.075	70.6	29.4

HYDROMETER:

RDGS	TEMP			
24.8	22.0	.0449	57.4	42.6
22.6	22.0	.0325	52.3	47.7
20.3	22.0	.0236	47.0	53.0
15.1	22.0	.0128	34.9	65.1
13.0	22.0	.0093	30.0	70.0
11.1	22.0	.0067	25.6	74.4
9.8	22.0	.0048	22.6	77.4
8.4	22.0	.0034	19.3	80.7
7.0	22.0	.0014	16.0	84.0

PERCENT GRAVEL = 9.0
PERCENT SAND = 20.5
PERCENT FINES = 70.6

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 20.5	ORG,% 2.5

CLASSIFICATION
SANDY CLAY (CL), BROWN

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG
CRANE, IN

BORING NO. WES-VF5-87 SAMPLE NO. 6

DEPTH/ELEV 8.5' – 9.0' DATE 04 MAR 91

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-VF5-87 SAMPLE: 6 DF: MD2791 .DAT
DEPTH: 8.5' - 9.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 20.50 OC: 2.50
CLASSIFICATION: 450
SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 542.0 gms.
PARTIAL WEIGHT AFTER SPLIT: 56.2 gms.

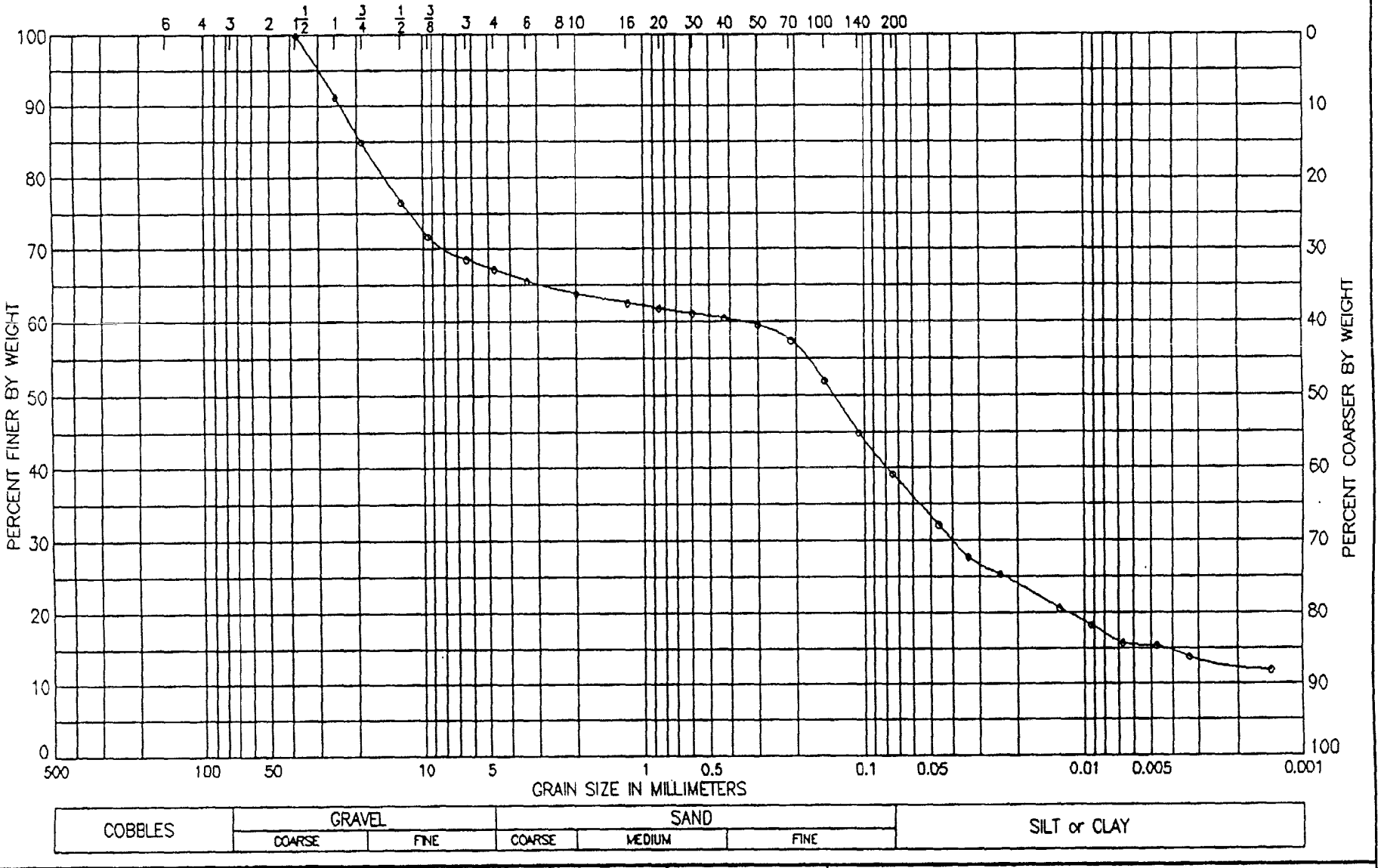
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/8 in	9.500	100.0	.0
2.6	No 3	6.350	99.5	.5
1.4	No 4	4.750	99.3	.7
.8	No 6	3.350	99.1	.9
.5	No 10	2.000	99.0	1.0
.1	No 16	1.180	98.8	1.2
.2	No 20	.850	98.7	1.3
.4	No 30	.600	98.3	1.7
.6	No 40	.425	98.0	2.0
.9	No 50	.300	97.4	2.6
1.8	No 70	.212	95.9	4.1
4.7	No 100	.150	90.7	9.3
10.2	No 140	.106	81.1	18.9
15.9	No 200	.075	71.0	29.0

HYDROMETER:

RDGS	TEMP			
19.3	22.0	.0477	53.7	46.3
17.8	22.5	.0342	49.8	50.2
16.2	22.5	.0246	45.3	54.7
12.2	22.5	.0132	34.1	65.9
10.2	22.5	.0095	28.5	71.5
8.8	22.0	.0068	24.3	75.7
7.8	22.0	.0048	21.5	78.5
7.2	22.0	.0034	19.9	80.1
5.7	21.5	.0014	15.4	84.6

PERCENT GRAVEL = .7
PERCENT SAND = 28.3
PERCENT FINES = 71.0

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 18.7	ORG,% 1.7

CLASSIFICATION
SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG
CRANE, IN

BORING NO. WES-VF5-87 SAMPLE NO. 7

DEPTH/ELEV 9.3' - 9.8' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-VF5-87 SAMPLE: 7 DF: MD2791 .DAT
DEPTH: 9.3' - 9.8' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 18.70 OC: 1.70
CLASSIFICATION: 468
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 571.4 gms.
PARTIAL WEIGHT AFTER SPLIT: 72.8 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

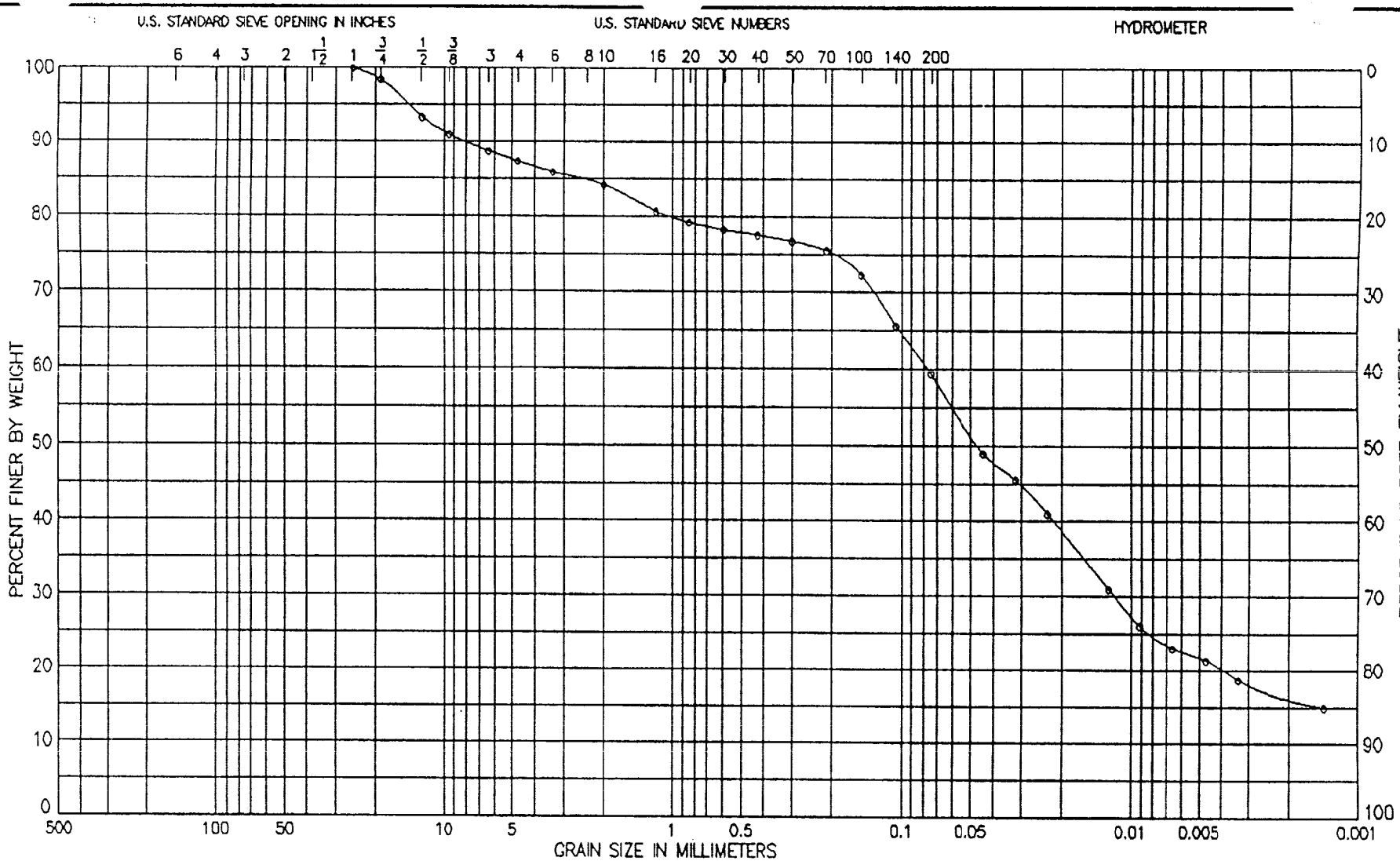
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1.5 in	37.500	100.0	.0
50.2	1 in	25.000	91.2	8.8
36.0	3/4 in	19.100	84.9	15.1
48.0	1/2 in	12.500	76.5	23.5
27.0	3/8 in	9.500	71.8	28.2
18.3	No 3	6.350	68.6	31.4
7.7	No 4	4.750	67.2	32.8
9.3	No 6	3.350	65.6	34.4
10.1	No 10	2.000	63.8	36.2
1.4	No 16	1.180	62.6	37.4
2.3	No 20	.850	61.8	38.2
3.1	No 30	.600	61.1	38.9
3.8	No 40	.425	60.5	39.5
4.9	No 50	.300	59.5	40.5
7.3	No 70	.212	57.4	42.6
13.6	No 100	.150	51.9	48.1
21.6	No 140	.106	44.9	55.1
28.1	No 200	.075	39.2	60.8

HYDROMETER:

RDGS	TEMP			
23.3	21.5	.0462	32.2	67.8
20.1	21.5	.0338	27.7	72.3
18.4	21.5	.0243	25.3	74.7
15.0	21.5	.0130	20.6	79.4
13.3	21.5	.0093	18.2	81.8
11.5	21.5	.0067	15.7	84.3
11.1	22.0	.0047	15.3	84.7
10.0	22.0	.0034	13.8	86.2
8.8	21.5	.0014	12.0	88.0

PERCENT GRAVEL = 32.8
PERCENT SAND = 28.0
PERCENT FINES = 39.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 13.9	ORG,% 2.6

CLASSIFICATION

GRAVELLY SANDY CLAY (CL), GRAY

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-VF6-87 SAMPLE NO. 1

DEPTH/ELEV 1.0' - 1.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF6-87 SAMPLE: 1 DF: MD2791A .DAT
DEPTH: 1.0' - 1.5' DATE: 04 MAR 91

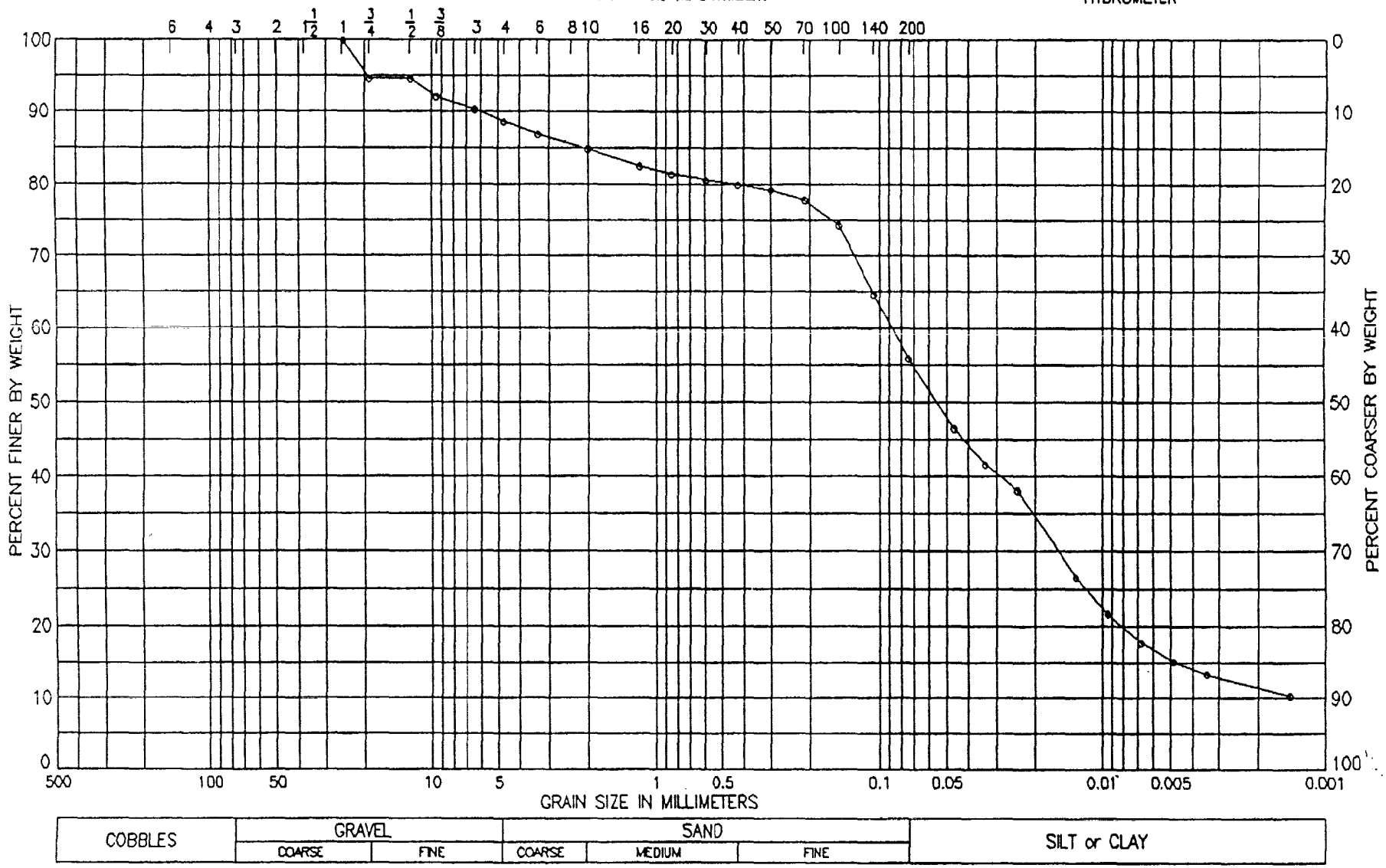
NO-LIMITS-RAN GS: 2.70 est WC: 13.90 OC: 2.60
CLASSIFICATION: 486
GRAVELLY SANDY CLAY (CL), GRAY

TOTAL WEIGHT OF SAMPLE: 521.9 gms.
PARTIAL WEIGHT AFTER SPLIT: 70.8 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
8.0	3/4 in	19.100	98.5	1.5
26.9	1/2 in	12.500	93.3	6.7
12.1	3/8 in	9.500	91.0	9.0
11.8	No 3	6.350	88.7	11.3
7.2	No 4	4.750	87.4	12.6
7.6	No 6	3.350	85.9	14.1
8.8	No 10	2.000	84.2	15.8
3.0	No 16	1.180	80.6	19.4
4.2	No 20	.850	79.2	20.8
5.0	No 30	.600	78.3	21.7
5.6	No 40	.425	77.6	22.4
6.3	No 50	.300	76.7	23.3
7.3	No 70	.212	75.5	24.5
10.0	No 100	.150	72.3	27.7
15.6	No 140	.106	65.7	34.3
20.8	No 200	.075	59.5	40.5
HYDROMETER:				
RDGS	TEMP			
26.0	22.0	.0443	48.9	51.1
24.2	22.0	.0320	45.5	54.5
21.8	22.0	.0232	41.0	59.0
16.5	22.0	.0127	31.0	69.0
14.0	21.5	.0093	26.1	73.9
12.3	22.0	.0066	23.0	77.0
11.4	22.0	.0047	21.3	78.7
10.0	22.0	.0034	18.7	81.3
8.1	21.5	.0014	14.9	85.1

PERCENT GRAVEL = 12.6
PERCENT SAND = 27.9
PERCENT FINES = 59.5

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 14.8	ORG,% 2.6

CLASSIFICATION

SANDY CLAY (CL), GRAY; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF6-87 SAMPLE NO. 2

DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-3-VF6-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 14.80 OC: 2.60
CLASSIFICATION: 504
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 595.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

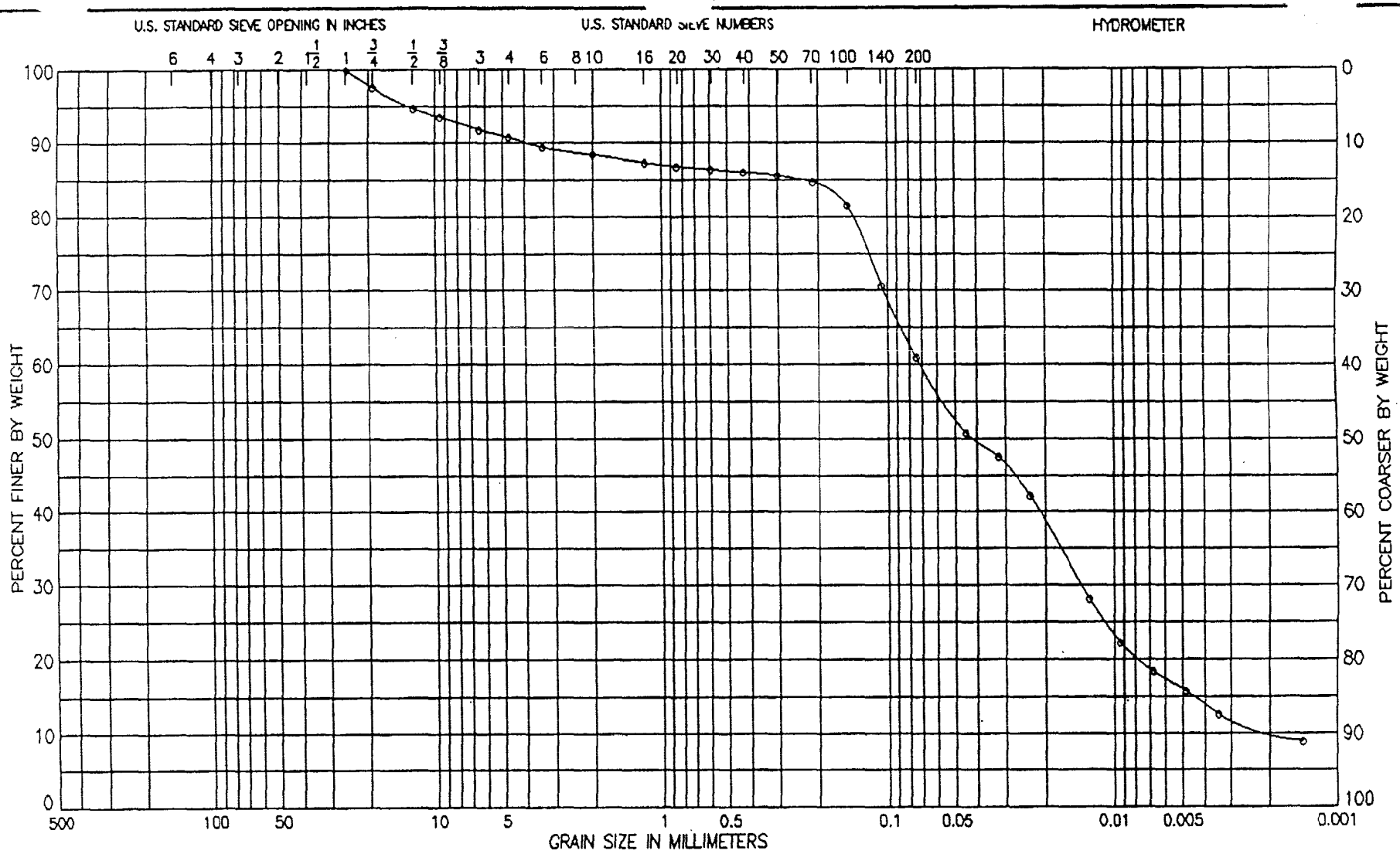
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
32.3	3/4 in	19.100	94.6	5.4
.0	1/2 in	12.500	94.6	5.4
14.9	3/8 in	9.500	92.1	7.9
10.5	No 3	6.350	90.3	9.7
10.2	No 4	4.750	88.6	11.4
10.4	No 6	3.350	86.9	13.1
11.8	No 10	2.000	84.9	15.1
1.7	No 16	1.180	82.5	17.5
2.5	No 20	.850	81.4	18.6
3.1	No 30	.600	80.6	19.4
3.6	No 40	.425	79.9	20.1
4.1	No 50	.300	79.2	20.8
5.1	No 70	.212	77.8	22.2
7.7	No 100	.150	74.2	25.8
14.7	No 140	.106	64.6	35.4
21.0	No 200	.075	55.9	44.1

HYDROMETER:

RDGS	TEMP			
21.3	22.0	.0467	46.5	53.5
19.1	22.0	.0338	41.6	58.4
17.5	22.0	.0243	38.1	61.9
12.2	22.0	.0132	26.5	73.5
10.0	22.0	.0095	21.7	78.3
8.2	22.0	.0068	17.8	82.2
7.0	22.0	.0049	15.1	84.9
6.2	22.0	.0035	13.4	86.6
4.9	21.5	.0014	10.3	89.7

PERCENT GRAVEL = 11.4
PERCENT SAND = 32.7
PERCENT FINES = 55.9

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.4	ORG,% 2.4

CLASSIFICATION

SANDY CLAY (CL), BROWN; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF6-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-VF6-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 19.40 OC: 2.40
CLASSIFICATION: 522
SANDY CLAY (CL), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 550.2 gms.
PARTIAL WEIGHT AFTER SPLIT: 68.9 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
13.0	3/4 in	19.100	97.6	2.4
15.8	1/2 in	12.500	94.8	5.2
6.6	3/8 in	9.500	93.6	6.4
9.6	No 3	6.350	91.8	8.2
5.7	No 4	4.750	90.8	9.2
7.4	No 6	3.350	89.4	10.6
5.5	No 10	2.000	88.4	11.6
.9	No 16	1.180	87.3	12.7
1.3	No 20	.850	86.8	13.2
1.6	No 30	.600	86.4	13.6
1.9	No 40	.425	86.0	14.0
2.2	No 50	.300	85.6	14.4
2.9	No 70	.212	84.7	15.3
5.4	No 100	.150	81.5	18.5
13.9	No 140	.106	70.6	29.4
21.4	No 200	.075	61.0	39.0

HYDROMETER:

RDGS	TEMP			
25.0	22.0	.0448	50.8	49.2
23.4	22.0	.0323	47.5	52.5
20.8	22.0	.0235	42.2	57.8
13.9	22.0	.0130	28.1	71.9
11.0	22.0	.0094	22.2	77.8
9.1	22.0	.0068	18.3	81.7
7.8	22.0	.0048	15.7	84.3
6.3	22.0	.0035	12.6	87.4
4.5	22.0	.0014	9.0	91.0

PERCENT GRAVEL = 9.2
PERCENT SAND = 29.8
PERCENT FINES = 61.0

EDE

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-VF6-87 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.5' - 6.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 15.10 OC: 4.20
CLASSIFICATION: 108
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 592.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 70.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	2 in	50.000	100.0	.0
92.4	1.5 in	37.500	84.4	15.6
30.8	1 in	25.000	79.2	20.8
38.6	3/4 in	19.100	72.7	27.3
17.0	1/2 in	12.500	69.8	30.2
39.3	3/8 in	9.500	63.2	36.8
35.5	No 3	6.350	57.2	42.8
22.6	No 4	4.750	53.4	46.6
27.7	No 6	3.350	48.7	51.3
29.0	No 10	2.000	43.8	56.2
2.0	No 16	1.180	42.6	57.4
2.9	No 20	.850	42.0	58.0
3.6	No 30	.600	41.6	58.4
4.1	No 40	.425	41.3	58.7
4.7	No 50	.300	40.9	59.1
5.4	No 70	.212	40.5	59.5
7.1	No 100	.150	39.4	60.6
9.2	No 140	.106	38.1	61.9
11.1	No 200	.075	36.9	63.1

HYDROMETER:

RDGS	TEMP			
16.6	21.5	.0496	16.2	83.8
15.0	21.5	.0356	14.6	85.4
13.4	21.5	.0255	13.0	87.0
10.3	21.5	.0136	10.0	90.0
8.9	21.5	.0097	8.6	91.4
7.3	22.0	.0069	7.1	92.9
6.8	22.0	.0049	6.6	93.4
6.1	22.0	.0035	5.9	94.1
4.8	21.5	.0014	4.5	95.5

PERCENT GRAVEL = 46.6
PERCENT SAND = 16.5
PERCENT FINES = 36.9

EDE

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-VF6-87 SAMPLE: 5 DF: MD2791 .DAT
DEPTH: 7.0' - 7.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 17.90 OC: 2.80
CLASSIFICATION: 126
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 532.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 66.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

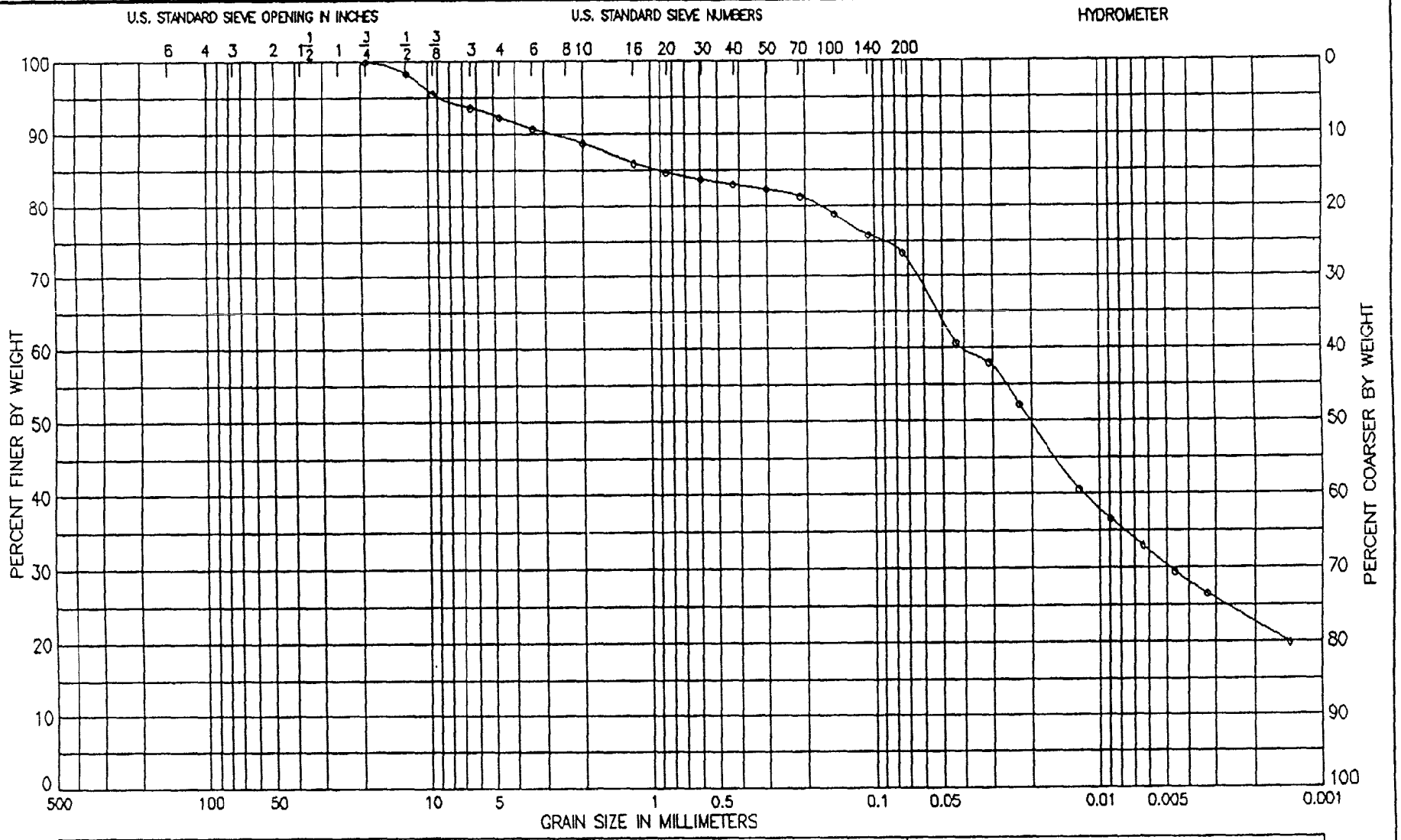
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
20.1	3/4 in	19.100	96.2	3.8
3.8	1/2 in	12.500	95.5	4.5
10.0	3/8 in	9.500	93.6	6.4
25.5	No 3	6.350	88.8	11.2
11.4	No 4	4.750	86.7	13.3
12.4	No 6	3.350	84.4	15.6
11.6	No 10	2.000	82.2	17.8
1.7	No 16	1.180	80.1	19.9
3.3	No 20	.850	78.1	21.9
4.4	No 30	.600	76.8	23.2
5.3	No 40	.425	75.6	24.4
6.1	No 50	.300	74.7	25.3
6.8	No 70	.212	73.8	26.2
7.8	No 100	.150	72.6	27.4
9.0	No 140	.106	71.1	28.9
10.4	No 200	.075	69.3	30.7

HYDROMETER:

RDGS	TEMP			
26.1	22.0	.0442	51.0	49.0
21.0	22.0	.0331	41.0	59.0
17.1	22.0	.0244	33.4	66.6
14.0	22.0	.0130	27.3	72.7
12.5	22.0	.0093	24.3	75.7
11.2	22.0	.0066	21.8	78.2
10.5	22.0	.0047	20.4	79.6
10.0	22.0	.0034	19.4	80.6
8.1	21.5	.0014	15.5	84.5

PERCENT GRAVEL = 13.3
PERCENT SAND = 17.4
PERCENT FINES = 69.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 16.9	ORG,% 2.9

CLASSIFICATION
SANDY CLAY (CL), GRAY; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-VF7-87 SAMPLE NO. 1

DEPTH/ELEV 1.0' - 1.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-VF7-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 1.0' - 1.5' DATE: 04 MAR 91

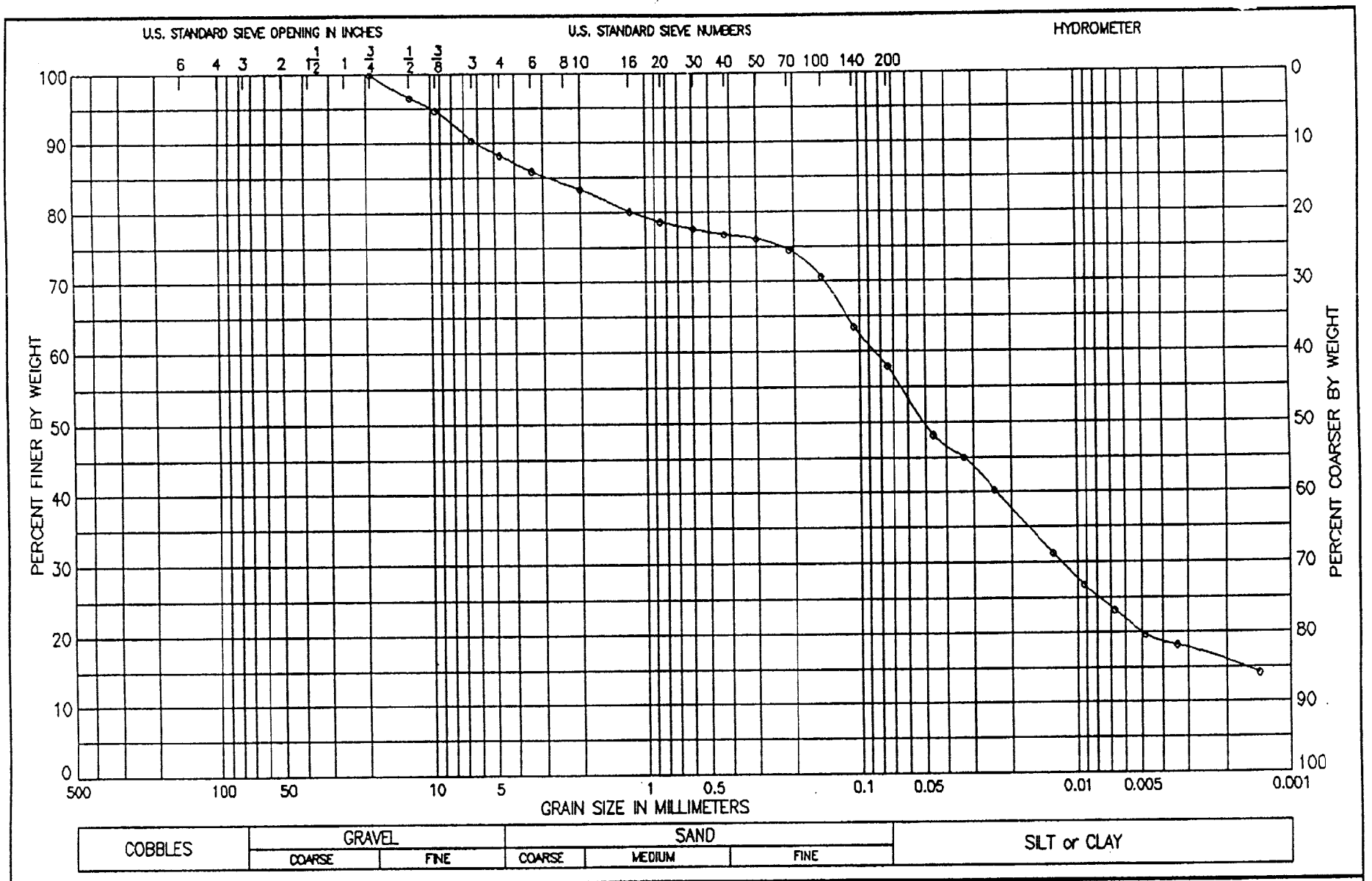
NO-LIMITS-RAN GS: 2.70 est WC: 16.90 OC: 2.90
CLASSIFICATION: 144
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 581.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 63.2 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
9.5	1/2 in	12.500	98.4	1.6
16.3	3/8 in	9.500	95.6	4.4
10.9	No 3	6.350	93.7	6.3
7.4	No 4	4.750	92.4	7.6
9.4	No 6	3.350	90.8	9.2
11.7	No 10	2.000	88.8	11.2
2.0	No 16	1.180	86.0	14.0
2.9	No 20	.850	84.7	15.3
3.6	No 30	.600	83.7	16.3
4.1	No 40	.425	83.0	17.0
4.6	No 50	.300	82.3	17.7
5.3	No 70	.212	81.3	18.7
7.1	No 100	.150	78.8	21.2
9.2	No 140	.106	75.9	24.1
11.0	No 200	.075	73.3	26.7
HYDROMETER:				
RDGS	TEMP			
27.3	22.0	.0436	60.7	39.3
26.1	22.0	.0313	58.0	42.0
23.5	22.0	.0228	52.2	47.8
18.3	22.0	.0124	40.6	59.4
16.5	22.0	.0090	36.6	63.4
14.9	22.0	.0064	33.0	67.0
13.3	22.0	.0046	29.5	70.5
12.0	22.0	.0033	26.6	73.4
9.1	21.5	.0014	19.9	80.1

PERCENT GRAVEL = 7.6
PERCENT SAND = 19.1
PERCENT FINES = 73.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 15.9	ORG,% 2.5

CLASSIFICATION
SANDY CLAY (CL), GRAY; WITH GRAVEL

PROJECT ABG
CRANE, IN
BORING NO. WES-3-VF7-87 SAMPLE NO. 2
DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

)JECT: ABG
CRANE, IN

BORING: WES-3-VF7-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

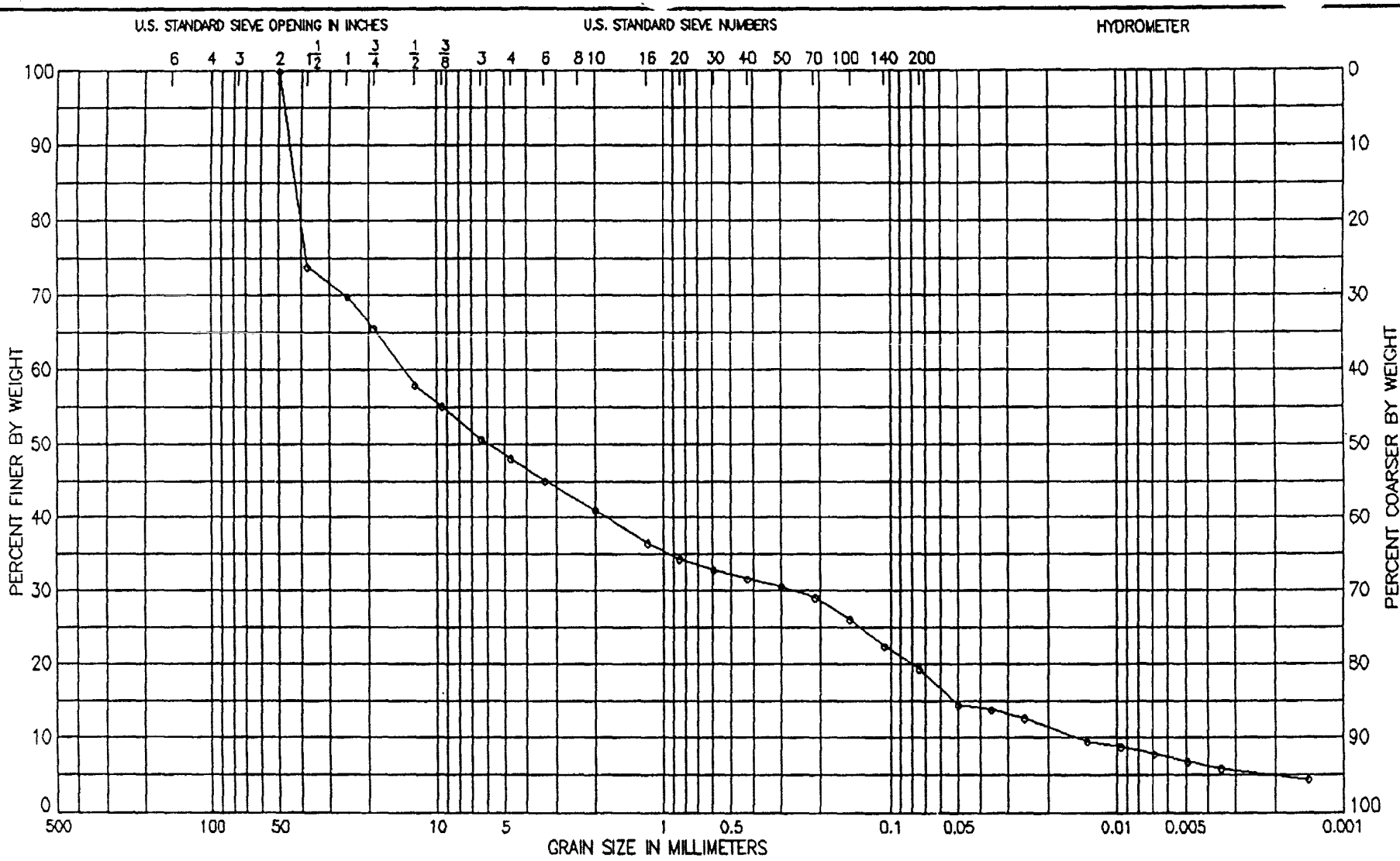
IO-LIMITS-RAN GS: 2.70 est WC: 15.90 OC: 2.50
:LASSIFICATION: 162
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 555.6 gms.
'ARTIAL WEIGHT AFTER SPLIT: 62.6 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
18.9	1/2 in	12.500	96.6	3.4
10.2	3/8 in	9.500	94.8	5.2
24.3	No 3	6.350	90.4	9.6
11.7	No 4	4.750	88.3	11.7
13.1	No 6	3.350	85.9	14.1
14.6	No 10	2.000	83.3	16.7
2.4	No 16	1.180	80.1	19.9
3.5	No 20	.850	78.6	21.4
4.3	No 30	.600	77.6	22.4
4.9	No 40	.425	76.8	23.2
5.4	No 50	.300	76.1	23.9
6.6	No 70	.212	74.5	25.5
9.5	No 100	.150	70.7	29.3
14.9	No 140	.106	63.5	36.5
19.1	No 200	.075	57.9	42.1
HYDROMETER:				
RDGS	TEMP			
23.0	21.5	.0464	48.2	51.8
21.5	21.5	.0333	45.0	55.0
19.3	21.5	.0241	40.4	59.6
15.0	21.5	.0130	31.3	68.7
13.0	21.0	.0094	26.8	73.2
11.2	21.5	.0067	23.2	76.8
9.5	21.5	.0048	19.7	80.3
8.8	21.5	.0034	18.2	81.8
6.8	22.0	.0014	14.2	85.8

PERCENT GRAVEL = 11.7
PERCENT SAND = 30.4
PERCENT FINES = 57.9

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 12.9	ORG,% 2.4

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), GRAY

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF7-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

)JECT: ABG
CRANE, IN

BORING: WES-3-VF7-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

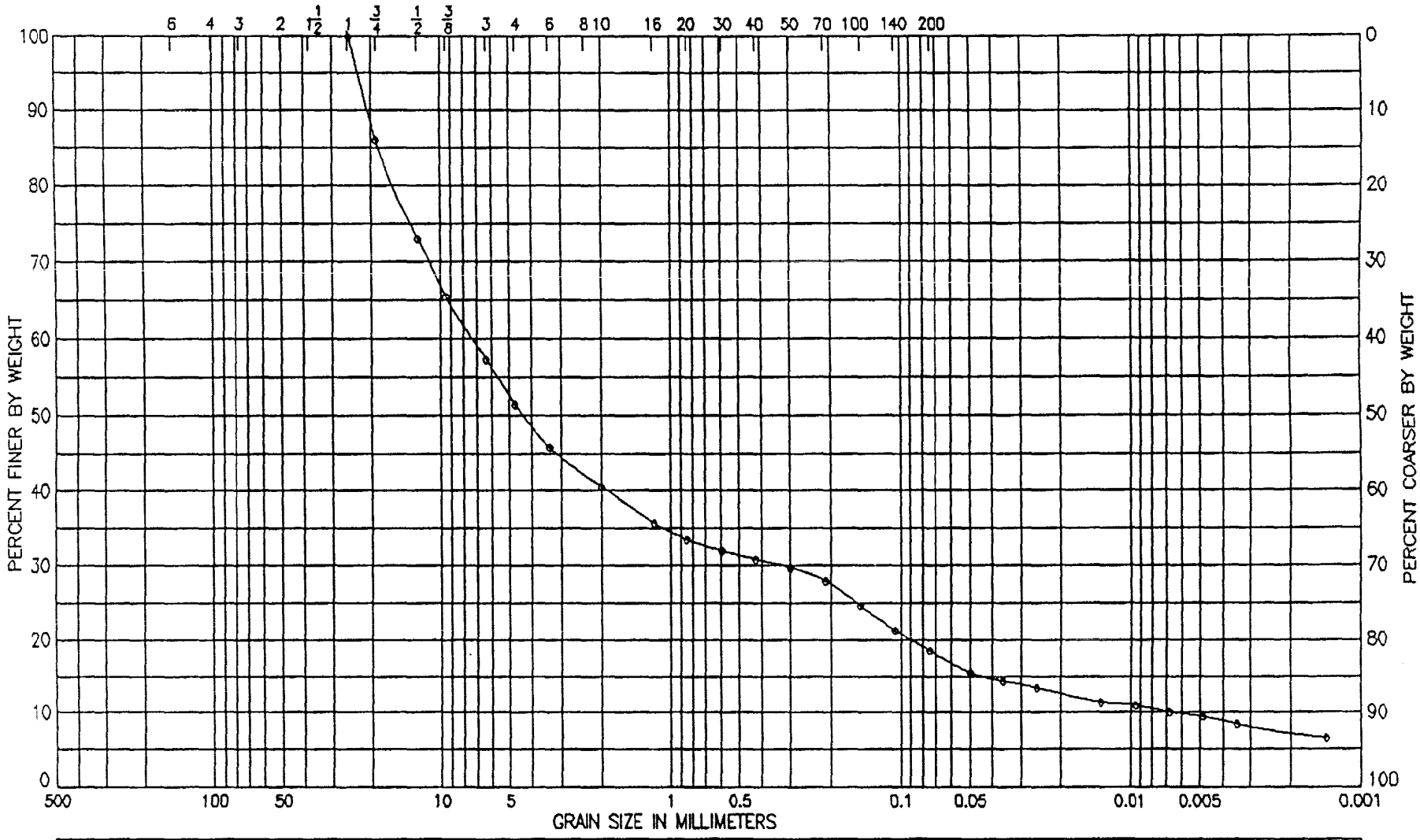
:O-LIMITS-RAN GS: 2.70 est WC: 12.90 OC: 2.40
:LASSIFICATION: 180
SANDY CLAYEY GRAVEL (GC), GRAY

TOTAL WEIGHT OF SAMPLE: 707.7 gms.
'ARTIAL WEIGHT AFTER SPLIT: 66.5 gms.
:NSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	2 in	50.000	100.0	.0
185.4	1.5 in	37.500	73.8	26.2
27.7	1 in	25.000	69.9	30.1
30.4	3/4 in	19.100	65.6	34.4
54.3	1/2 in	12.500	57.9	42.1
19.9	3/8 in	9.500	55.1	44.9
31.2	No 3	6.350	50.7	49.3
18.7	No 4	4.750	48.1	51.9
21.4	No 6	3.350	45.0	55.0
28.3	No 10	2.000	41.0	59.0
7.3	No 16	1.180	36.5	63.5
10.8	No 20	.850	34.4	65.6
13.3	No 30	.600	32.8	67.2
15.3	No 40	.425	31.6	68.4
16.9	No 50	.300	30.6	69.4
19.4	No 70	.212	29.1	70.9
24.3	No 100	.150	26.0	74.0
30.3	No 140	.106	22.3	77.7
35.3	No 200	.075	19.3	80.7
HYDROMETER:				
RDGS	TEMP			
15.0	21.0	.0503	14.4	85.6
14.4	21.0	.0358	13.8	86.2
13.2	21.0	.0256	12.6	87.4
10.0	21.0	.0136	9.5	90.5
9.3	21.0	.0097	8.8	91.2
8.2	21.5	.0069	7.8	92.2
7.1	21.5	.0049	6.8	93.2
6.2	21.5	.0035	5.9	94.1
4.6	22.0	.0014	4.4	95.6

PERCENT GRAVEL = 51.9
PERCENT SAND = 28.8
PERCENT FINES = 19.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 14.3	ORG,% 3.9

CLASSIFICATION

SANDY CLAYEY GRAVEL (GC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF7-87 SAMPLE NO. 4

DEPTH/ELEV 5.5' - 6.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

.OJECT: ABG
CRANE, IN

BORING: WES-3-VF7-87 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.5' - 6.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 14.30 OC: 3.90
CLASSIFICATION: 198
SANDY CLAYEY GRAVEL (GC), BROWN

TOTAL WEIGHT OF SAMPLE: 654.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.4 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

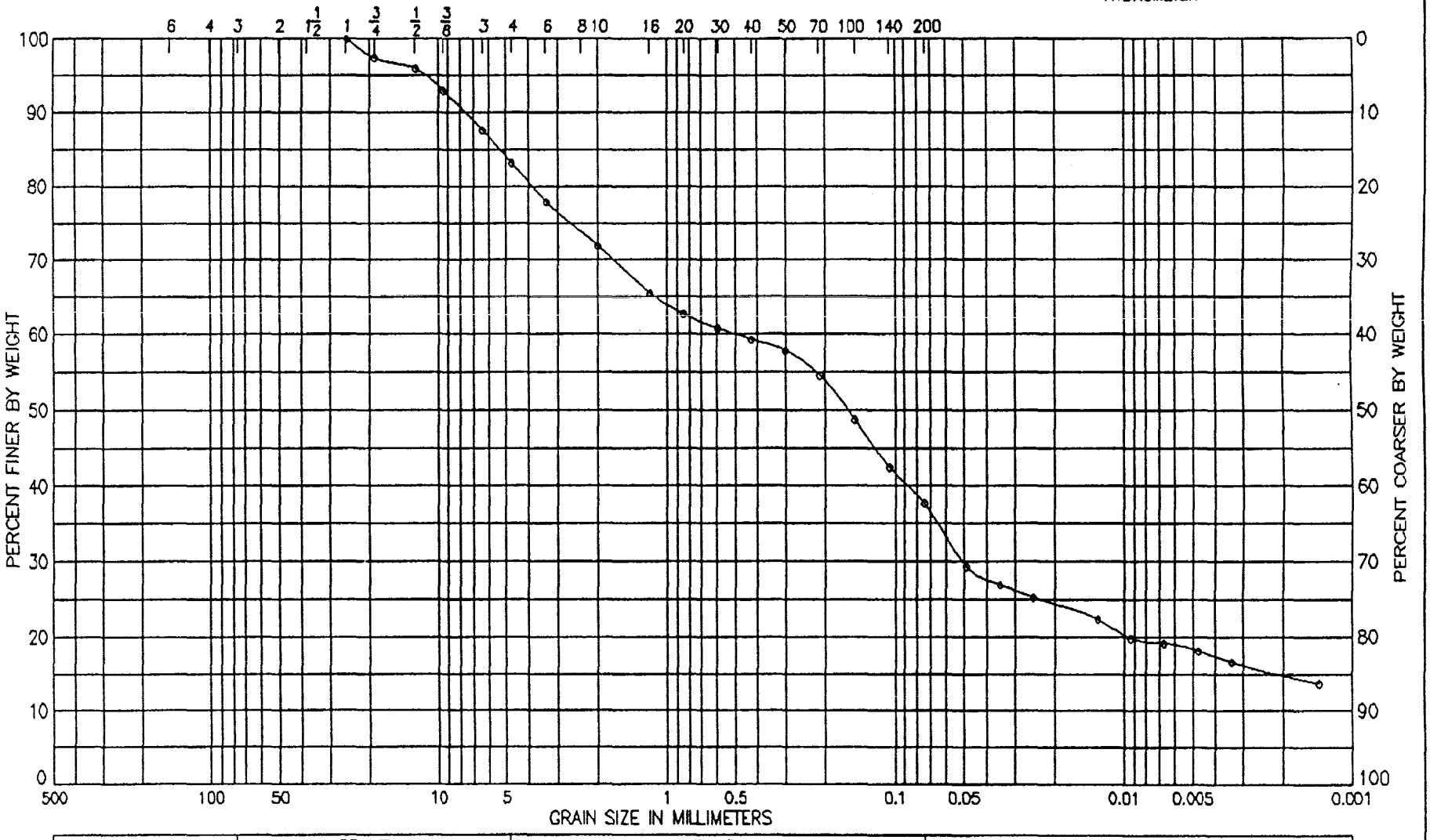
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
91.3	3/4 in	19.100	86.1	13.9
85.4	1/2 in	12.500	73.0	27.0
49.2	3/8 in	9.500	65.5	34.5
53.4	No 3	6.350	57.3	42.7
38.5	No 4	4.750	51.5	48.5
37.0	No 6	3.350	45.8	54.2
34.3	No 10	2.000	40.6	59.4
7.3	No 16	1.180	35.7	64.3
10.6	No 20	.850	33.6	66.4
12.9	No 30	.600	32.0	68.0
14.7	No 40	.425	30.8	69.2
16.4	No 50	.300	29.7	70.3
19.1	No 70	.212	27.9	72.1
24.1	No 100	.150	24.6	75.4
29.2	No 140	.106	21.3	78.7
33.3	No 200	.075	18.6	81.4

HYDROMETER:

RDGS	TEMP			
15.1	21.0	.0503	15.5	84.5
14.0	21.0	.0359	14.4	85.6
13.1	21.0	.0256	13.4	86.6
11.2	21.0	.0135	11.4	88.6
10.8	21.0	.0095	11.0	89.0
9.8	21.5	.0068	10.1	89.9
9.2	21.5	.0048	9.4	90.6
8.2	21.5	.0035	8.4	91.6
6.3	22.0	.0014	6.5	93.5

PERCENT GRAVEL = 48.5
PERCENT SAND = 32.9
PERCENT FINES = 18.6

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 21.5	ORG,% 3.0

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF7-87 SAMPLE NO. 5

DEPTH/ELEV 6.0' – 7.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WF – STF/GL

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-VF7-87 SAMPLE: 5 DF: MD2791 .DAT
DEPTH: 6.0' - 7.5' DATE: 04 MAR 91

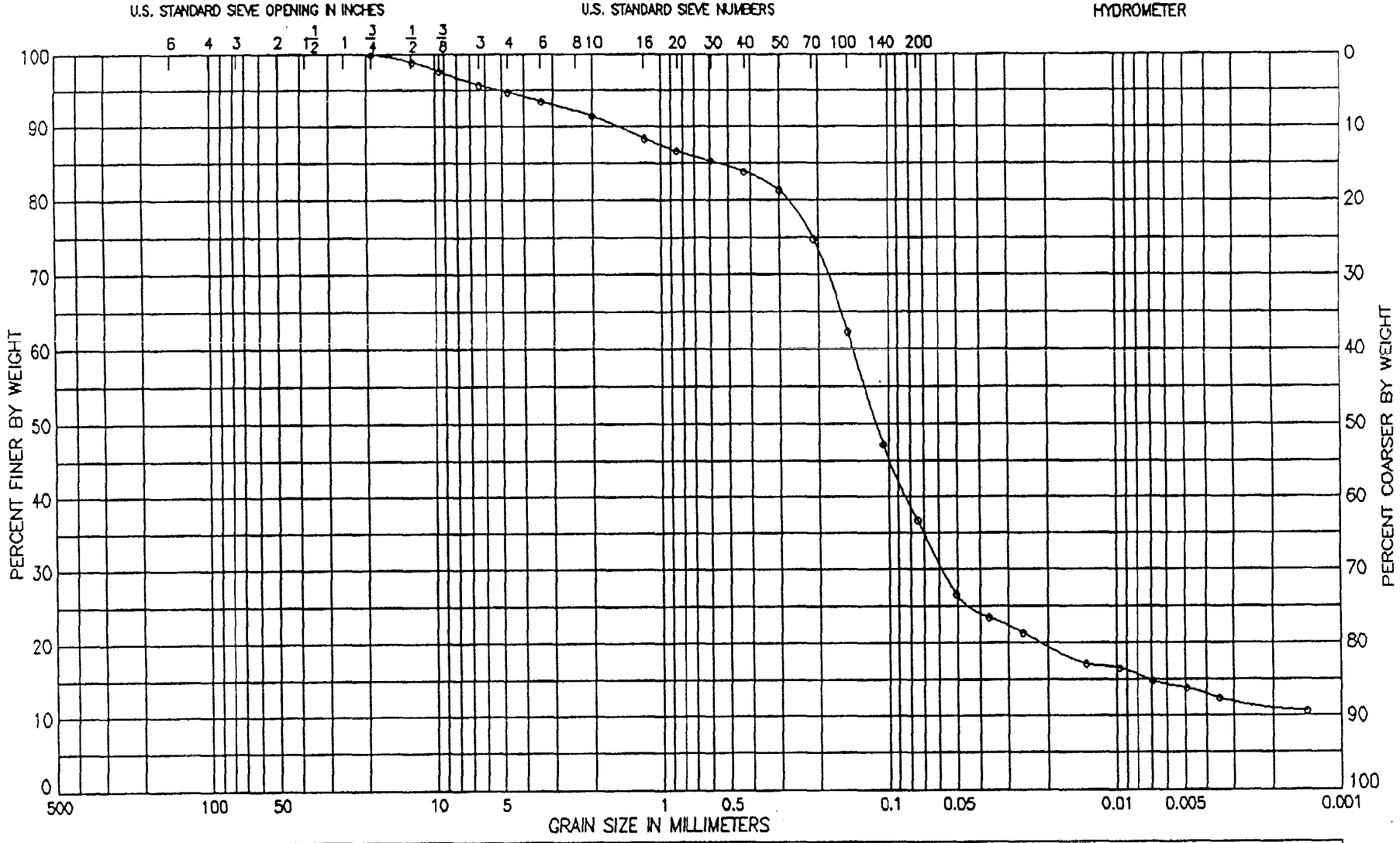
O-LIMITS-RAN GS: 2.70 est WC: 21.50 OC: 3.00
LASSIFICATION: 216
GRAVELLY CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 575.3 gms.
ARTIAL WEIGHT AFTER SPLIT: 67.3 gms.
NSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
14.6	3/4 in	19.100	97.5	2.5
8.5	1/2 in	12.500	96.0	4.0
17.2	3/8 in	9.500	93.0	7.0
30.8	No 3	6.350	87.6	12.4
25.5	No 4	4.750	83.2	16.8
30.6	No 6	3.350	77.9	22.1
34.4	No 10	2.000	71.9	28.1
6.0	No 16	1.180	65.5	34.5
8.6	No 20	.850	62.7	37.3
10.4	No 30	.600	60.8	39.2
11.8	No 40	.425	59.3	40.7
13.2	No 50	.300	57.8	42.2
16.2	No 70	.212	54.6	45.4
21.7	No 100	.150	48.7	51.3
27.5	No 140	.106	42.5	57.5
32.0	No 200	.075	37.7	62.3
YDROMETER:				
RDGS	TEMP			
17.6	21.0	.0491	29.4	70.6
16.2	21.0	.0352	27.0	73.0
15.2	21.0	.0251	25.3	74.7
13.5	21.0	.0132	22.4	77.6
12.0	21.0	.0094	19.9	80.1
11.5	21.5	.0067	19.2	80.8
10.9	21.5	.0048	18.2	81.8
10.0	21.5	.0034	16.6	83.4
8.2	22.0	.0014	13.7	86.3

PERCENT GRAVEL = 16.8
PERCENT SAND = 45.5
PERCENT FINES = 37.7

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 20.3	ORG,% 2.3

CLASSIFICATION
CLAYEY SAND (SC), BROWN; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-3-VF7-87 SAMPLE NO. 6

DEPTH/ELEV 7.5' – 9.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE W – STF/GL

SIEVE ANALYSIS

JECT: ABG
CRANE, IN

BORING: WES-3-VF7-87 SAMPLE: 6 DF: MD2791 .DAT
DEPTH: 7.5' - 9.0' DATE: 04 MAR 91

)-LIMITS-RAN GS: 2.70 est WC: 20.30 OC: 2.30
LASSIFICATION: 234
CLAYEY SAND (SC), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 499.1 gms.
ARTIAL WEIGHT AFTER SPLIT: 74.8 gms.

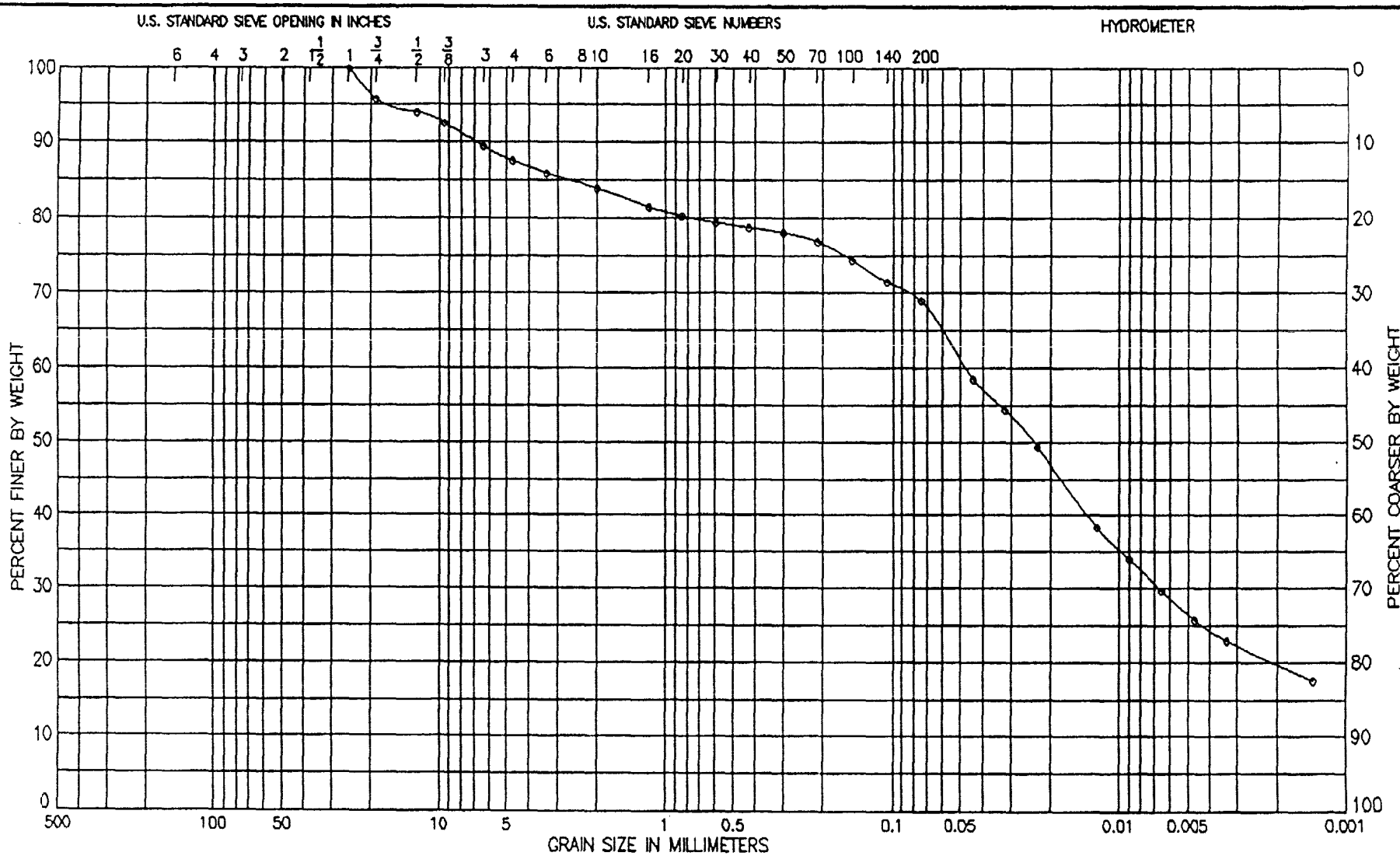
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
4.9	1/2 in	12.500	99.0	1.0
6.7	3/8 in	9.500	97.7	2.3
9.6	No 3	6.350	95.8	4.2
4.7	No 4	4.750	94.8	5.2
6.7	No 6	3.350	93.5	6.5
10.1	No 10	2.000	91.4	8.6
2.5	No 16	1.180	88.4	11.6
3.9	No 20	.850	86.7	13.3
5.0	No 30	.600	85.3	14.7
6.2	No 40	.425	83.9	16.1
8.3	No 50	.300	81.3	18.7
13.6	No 70	.212	74.8	25.2
23.8	No 100	.150	62.3	37.7
36.2	No 140	.106	47.2	52.8
44.7	No 200	.075	36.8	63.2

YDROMETER:

RDGS	TEMP			
14.0	21.0	.0508	26.6	73.4
12.4	21.0	.0365	23.5	76.5
11.3	21.0	.0260	21.4	78.6
9.1	21.0	.0137	17.1	82.9
8.8	21.0	.0097	16.5	83.5
7.8	21.5	.0069	14.8	85.2
7.3	21.5	.0049	13.8	86.2
6.7	21.0	.0035	12.4	87.6
5.6	22.0	.0014	10.7	89.3

PERCENT GRAVEL = 5.2
PERCENT SAND = 58.0
PERCENT FINES = 36.8

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 17.0	ORG,% 2.2

CLASSIFICATION

GRAVELLY SANDY CLAY (CL), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF8-87 SAMPLE NO. 1

DEPTH/ELEV 1.0' - 1.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

:OJECT: ABG
CRANE, IN

BORING: WES-3-VF8-87 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 1.0' - 1.5' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 17.00 OC: 2.20
CLASSIFICATION: 251
GRAVELLY SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 564.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

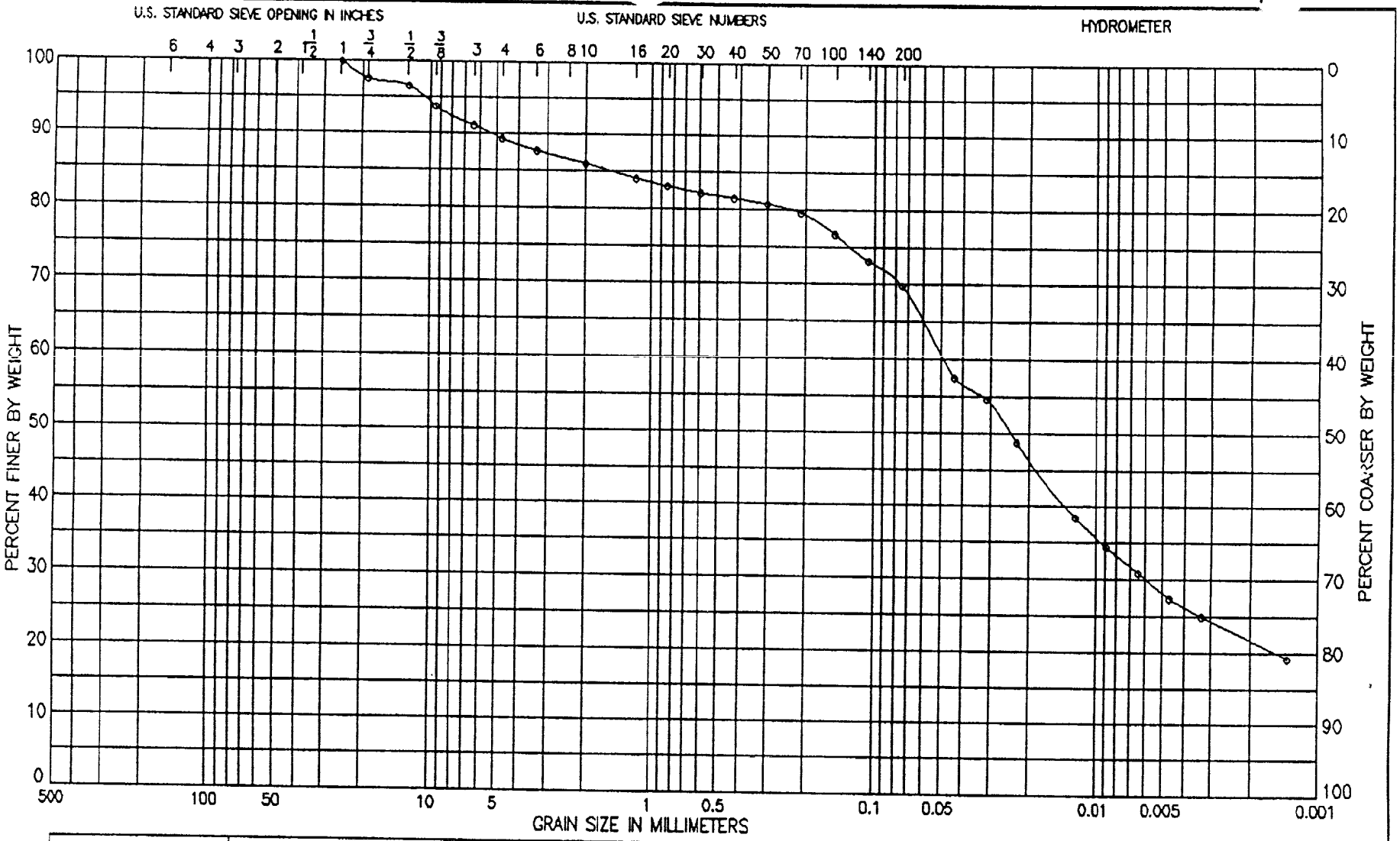
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
23.6	3/4 in	19.100	95.8	4.2
10.3	1/2 in	12.500	94.0	6.0
8.1	3/8 in	9.500	92.6	7.4
17.9	No 3	6.350	89.4	10.6
10.2	No 4	4.750	87.6	12.4
9.4	No 6	3.350	85.9	14.1
11.2	No 10	2.000	83.9	16.1
1.8	No 16	1.180	81.5	18.5
2.7	No 20	.850	80.2	19.8
3.3	No 30	.600	79.4	20.6
3.8	No 40	.425	78.7	21.3
4.3	No 50	.300	78.1	21.9
5.2	No 70	.212	76.8	23.2
7.0	No 100	.150	74.4	25.6
9.1	No 140	.106	71.5	28.5
10.9	No 200	.075	69.0	31.0

HYDROMETER:

RDGS	TEMP			
27.3	21.0	.0441	58.5	41.5
25.4	21.0	.0319	54.4	45.6
23.1	21.0	.0232	49.4	50.6
18.0	21.0	.0126	38.4	61.6
16.0	21.0	.0091	34.0	66.0
14.0	21.0	.0066	29.7	70.3
12.2	21.0	.0047	25.8	74.2
10.9	21.0	.0034	23.0	77.0
8.2	22.0	.0014	17.6	82.4

PERCENT GRAVEL = 12.4
PERCENT SAND = 18.5
PERCENT FINES = 69.0

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS	NAT W,%	ORG,%
			2.70 EST	18.6	2.3

CLASSIFICATION

SANDY CLAY (CL), GRAY; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF8-87 SAMPLE NO. 2

DEPTH/ELEV 2.5' - 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

)JECT: ABG
CRANE, IN

BORING: WES-3-VF8-87 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 2.5' - 3.0' DATE: 04 MAR 91

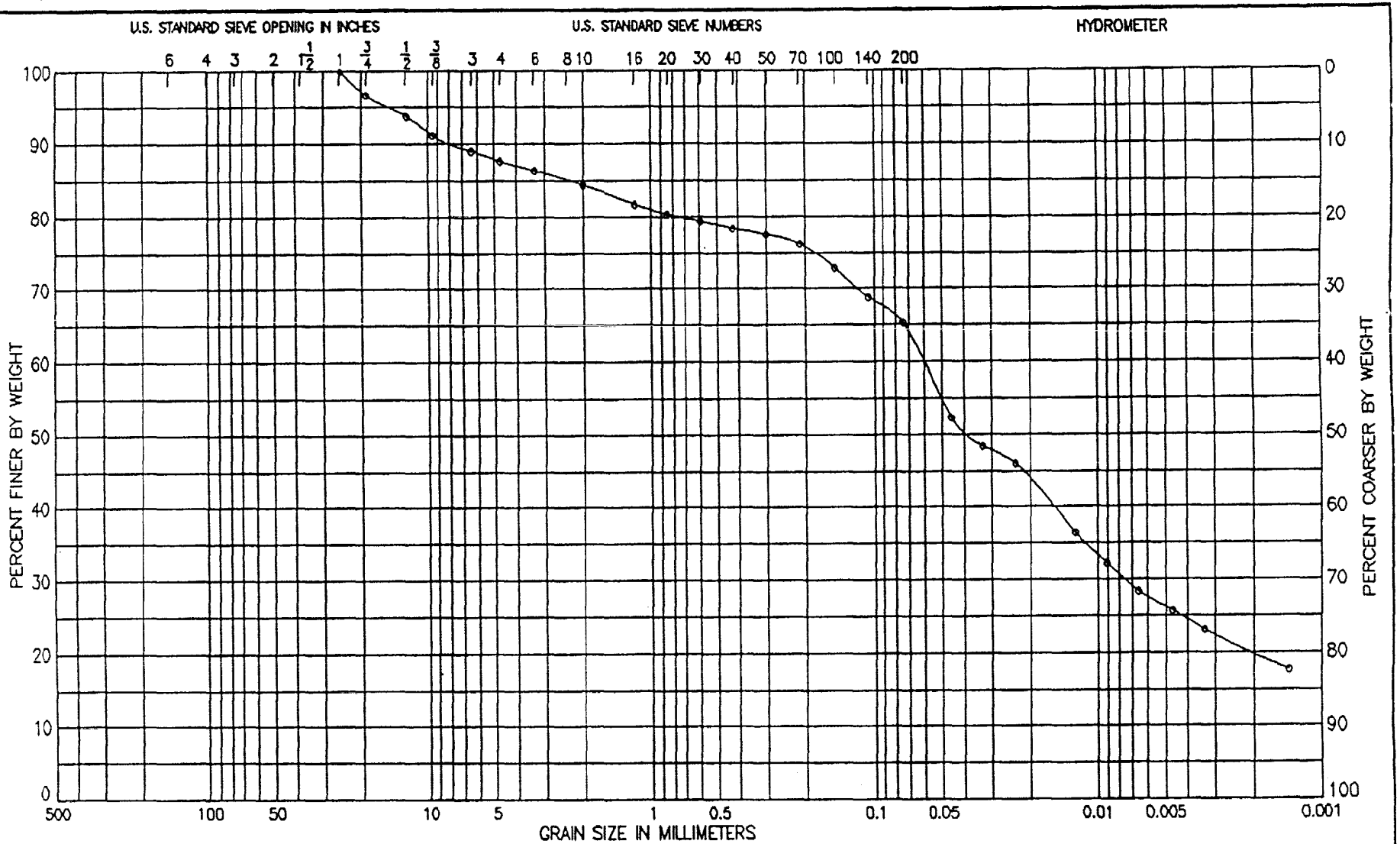
'O-LIMITS-RAN GS: 2.70 est WC: 18.60 OC: 2.30
:LASSIFICATION: 264
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 714.9 gms.
'ARTIAL WEIGHT AFTER SPLIT: 66.7 gms.
:NSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
17.0	3/4 in	19.100	97.6	2.4
7.4	1/2 in	12.500	96.6	3.4
20.2	3/8 in	9.500	93.8	6.2
18.9	No 3	6.350	91.1	8.9
12.9	No 4	4.750	89.3	10.7
11.5	No 6	3.350	87.7	12.3
12.3	No 10	2.000	86.0	14.0
1.5	No 16	1.180	84.1	15.9
2.3	No 20	.850	83.0	17.0
3.0	No 30	.600	82.1	17.9
3.5	No 40	.425	81.5	18.5
4.1	No 50	.300	80.7	19.3
5.0	No 70	.212	79.5	20.5
7.2	No 100	.150	76.7	23.3
10.0	No 140	.106	73.1	26.9
12.5	No 200	.075	69.9	30.1
:YDROMETER:				
RDGS	TEMP			
28.4	21.0	.0435	57.5	42.5
27.0	21.0	.0313	54.7	45.3
24.1	21.0	.0229	48.7	51.3
19.1	21.0	.0125	38.5	61.5
17.1	21.0	.0090	34.4	65.6
15.4	21.0	.0065	30.9	69.1
13.7	21.0	.0047	27.4	72.6
12.5	21.0	.0033	25.0	75.0
9.5	22.0	.0014	19.2	80.8

PERCENT GRAVEL = 10.7
PERCENT SAND = 19.4
PERCENT FINES = 69.9

EDE



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

LL	PL	PI	GS 2.70 EST	NAT W,% 20.4	ORG,% 2.5

CLASSFICATION

GRAVELLY SANDY CLAY (CL), GRAY

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF8-87 SAMPLE NO. 3

DEPTH/ELEV 4.0' - 4.5' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-VF8-87 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' - 4.5' DATE: 04 MAR 91

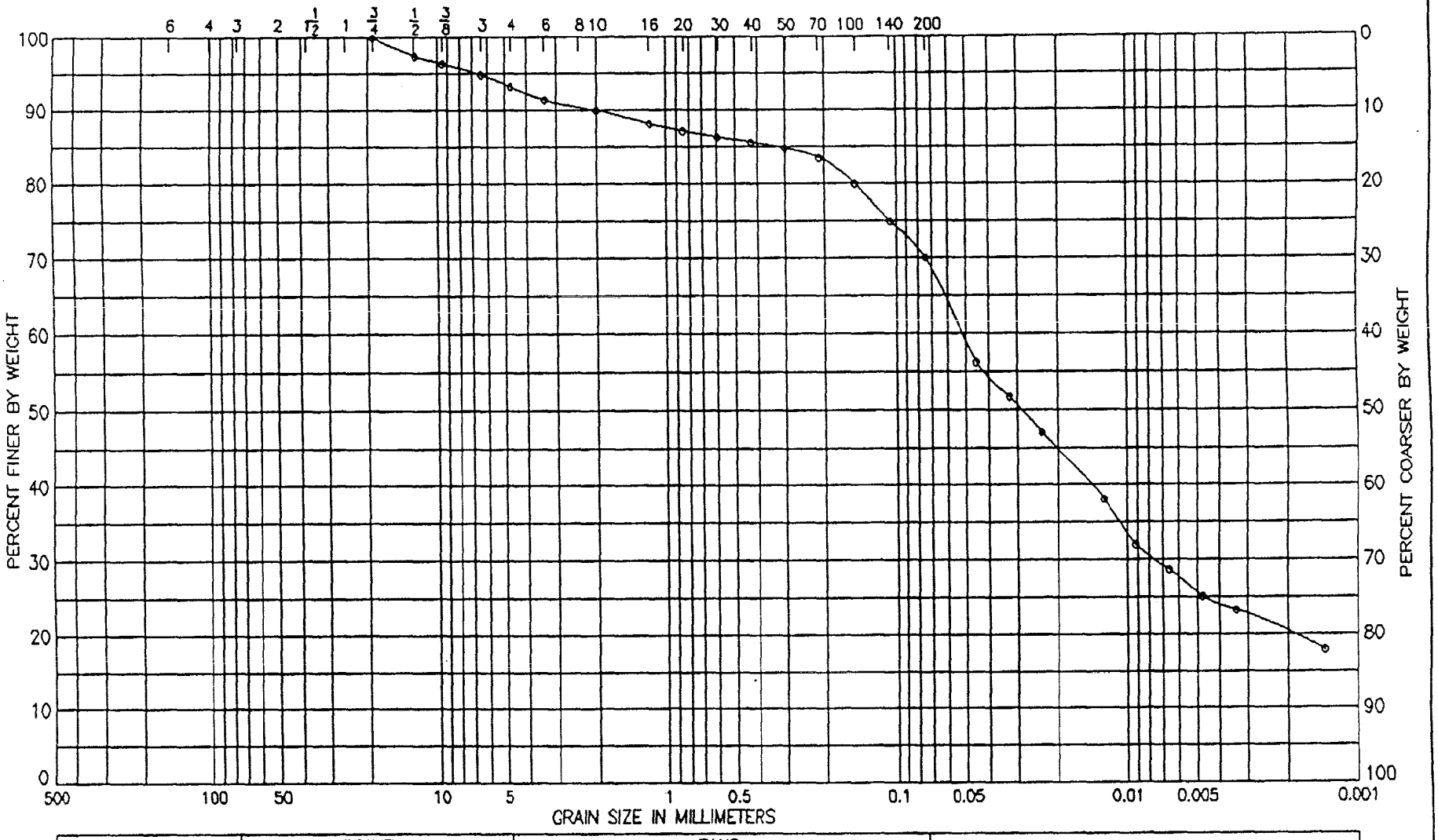
NO-LIMITS-RAN GS: 2.70 est WC: 20.40 OC: 2.50
CLASSIFICATION: 282
GRAVELLY SANDY CLAY (CL), GRAY

TOTAL WEIGHT OF SAMPLE: 664.7 gms.
PARTIAL WEIGHT AFTER SPLIT: 61.5 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
21.8	3/4 in	19.100	96.7	3.3
19.1	1/2 in	12.500	93.8	6.2
17.8	3/8 in	9.500	91.2	8.8
14.0	No 3	6.350	89.1	10.9
9.1	No 4	4.750	87.7	12.3
8.5	No 6	3.350	86.4	13.6
12.8	No 10	2.000	84.5	15.5
2.0	No 16	1.180	81.7	18.3
3.0	No 20	.850	80.4	19.6
3.7	No 30	.600	79.4	20.6
4.4	No 40	.425	78.4	21.6
5.0	No 50	.300	77.6	22.4
6.0	No 70	.212	76.2	23.8
8.4	No 100	.150	72.9	27.1
11.4	No 140	.106	68.8	31.2
13.9	No 200	.075	65.4	34.6
HYDROMETER:				
RDGS	TEMP			
24.2	21.5	.0457	52.4	47.6
22.4	21.5	.0330	48.4	51.6
21.3	21.5	.0236	46.0	54.0
16.9	21.5	.0128	36.4	63.6
15.0	21.5	.0092	32.3	67.7
13.3	21.0	.0066	28.4	71.6
12.1	21.0	.0047	25.7	74.3
10.9	21.0	.0034	23.1	76.9
8.2	22.0	.0014	17.7	82.3

PERCENT GRAVEL = 12.3
PERCENT SAND = 22.3
PERCENT FINES = 65.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.7	ORG,% 2.7

CLASSIFICATION

SANDY CLAY (CL), GRAY; WITH GRAVEL

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

GRADATION CURVE	LABORATORY USAE WES – STF/GL

PROJECT ABG

CRANE, IN

BORING NO. WES-3-VF8-87 SAMPLE NO. 4

DEPTH/ELEV 5.5' – 6.0' DATE 04 MAR 91

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-VF8-87 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.5' - 6.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 19.70 OC: 2.70
CLASSIFICATION: 300
SANDY CLAY (CL), GRAY; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 279.0 gms.
PARTIAL WEIGHT AFTER SPLIT: 63.8 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

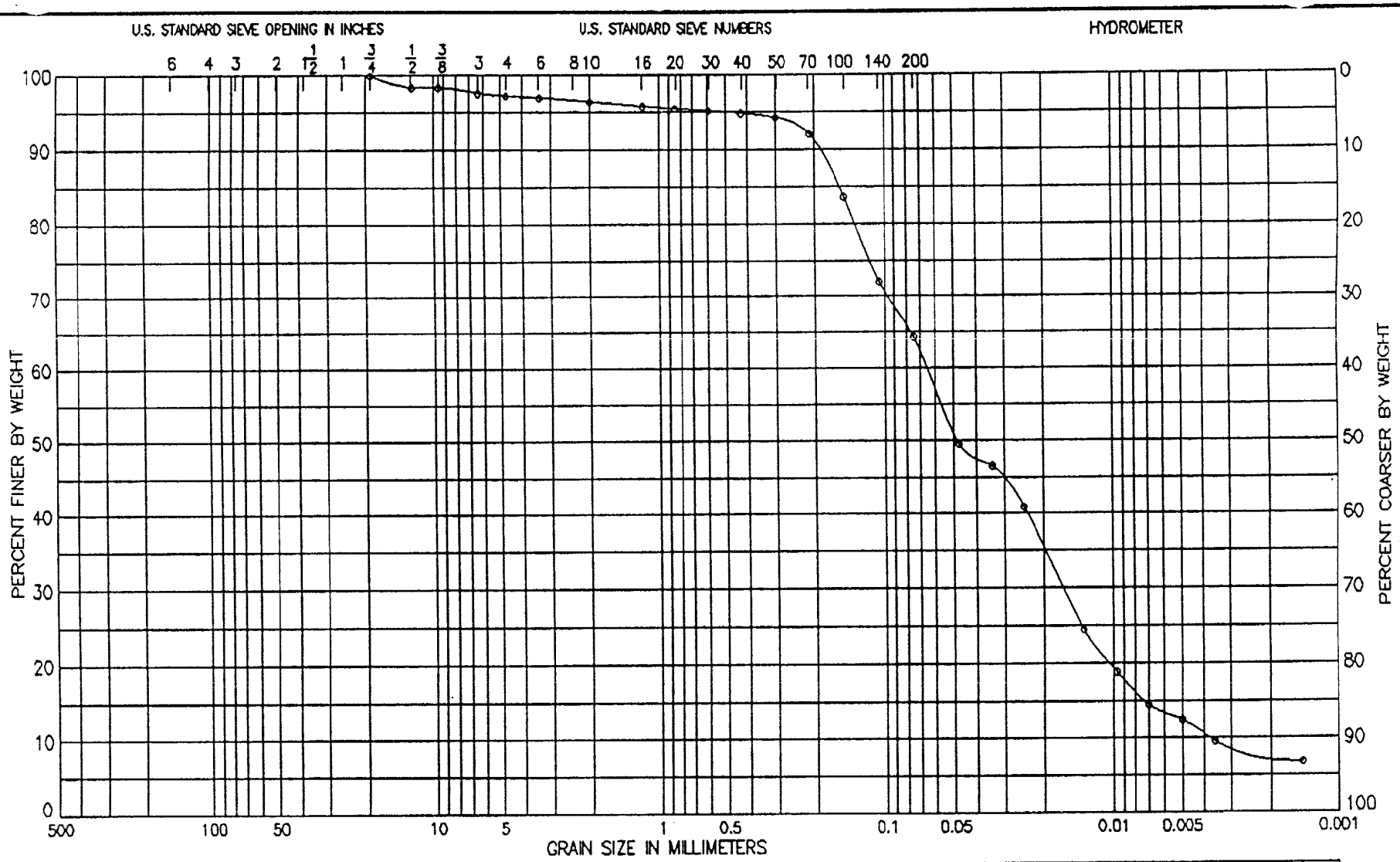
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
7.1	1/2 in	12.500	97.5	2.5
3.0	3/8 in	9.500	96.4	3.6
4.2	No 3	6.350	94.9	5.1
4.5	No 4	4.750	93.3	6.7
5.1	No 6	3.350	91.4	8.6
4.0	No 10	2.000	90.0	10.0
1.3	No 16	1.180	88.2	11.8
2.0	No 20	.850	87.2	12.8
2.6	No 30	.600	86.3	13.7
3.1	No 40	.425	85.6	14.4
3.7	No 50	.300	84.8	15.2
4.6	No 70	.212	83.5	16.5
7.1	No 100	.150	80.0	20.0
10.7	No 140	.106	74.9	25.1
14.1	No 200	.075	70.1	29.9

HYDROMETER:

RDGS	TEMP			
25.3	21.5	.0452	56.2	43.8
23.3	21.5	.0327	51.8	48.2
21.2	21.5	.0236	47.0	53.0
17.2	21.5	.0127	38.1	61.9
14.6	21.0	.0092	32.0	68.0
13.1	21.0	.0066	28.7	71.3
11.4	21.5	.0047	25.1	74.9
10.6	21.5	.0034	23.3	76.7
8.1	22.0	.0014	17.9	82.1

PERCENT GRAVEL = 6.7
PERCENT SAND = 23.2
PERCENT FINES = 70.1

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 18.0	ORG,% 2.0

CLASSIFICATION
SANDY CLAY (CL), GRAY

PROJECT ABG
CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 1

DEPTH/ELEV 2.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 1 DF: MD2791 .DAT
DEPTH: 2.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 18.00 OC: 2.00
CLASSIFICATION: 318
SANDY CLAY (CL), GRAY

TOTAL WEIGHT OF SAMPLE: 587.1 gms.
PARTIAL WEIGHT AFTER SPLIT: 62.5 gms.

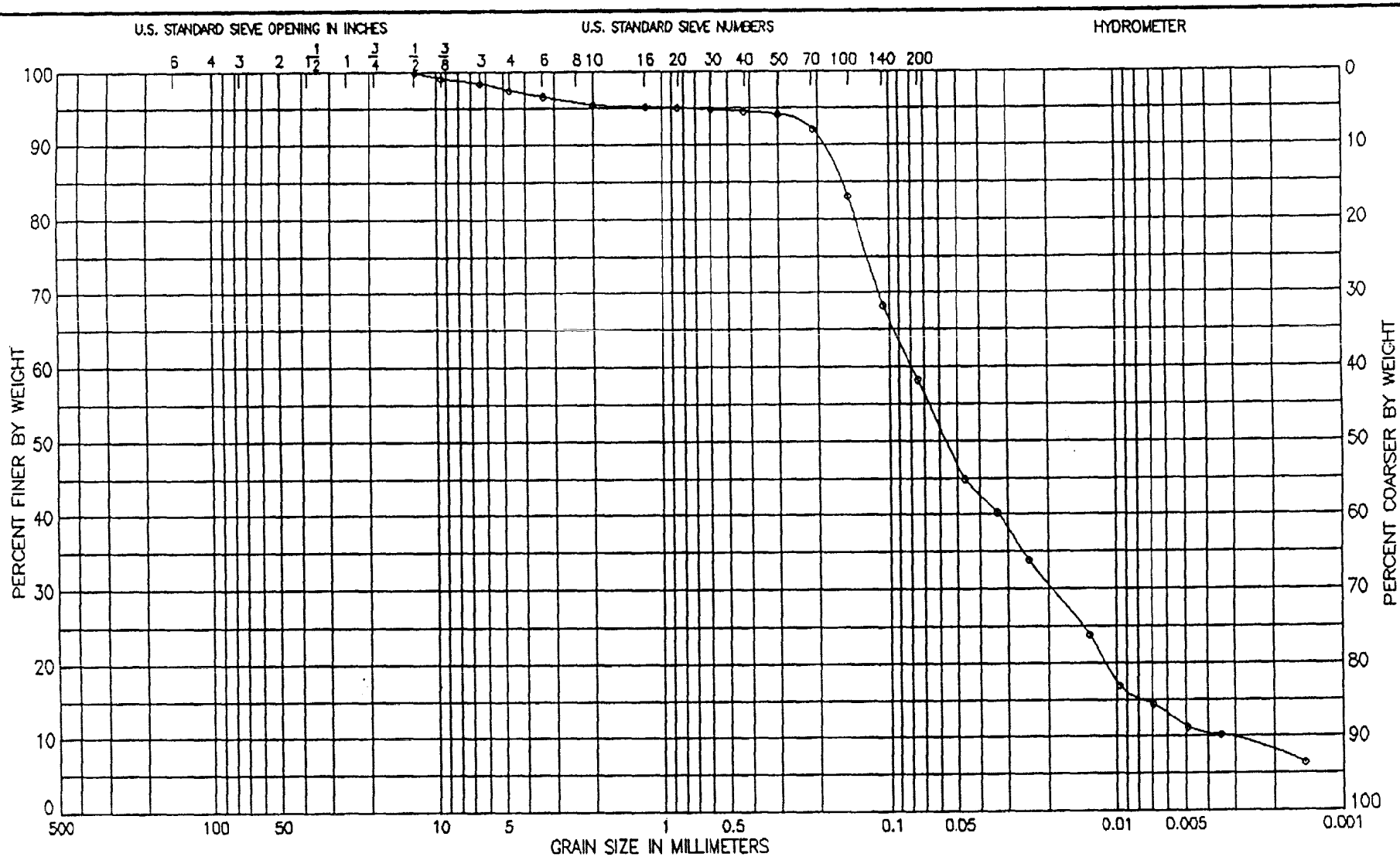
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
9.3	1/2 in	12.500	98.4	1.6
.0	3/8 in	9.500	98.4	1.6
4.5	No 3	6.350	97.6	2.4
2.3	No 4	4.750	97.3	2.7
1.5	No 6	3.350	97.0	3.0
3.2	No 10	2.000	96.5	3.5
.4	No 16	1.180	95.8	4.2
.6	No 20	.850	95.5	4.5
.8	No 30	.600	95.2	4.8
1.0	No 40	.425	94.9	5.1
1.4	No 50	.300	94.3	5.7
2.8	No 70	.212	92.1	7.9
8.3	No 100	.150	83.6	16.4
15.8	No 140	.106	72.1	27.9
20.8	No 200	.075	64.4	35.6

HYDROMETER:

RDGS	TEMP			
20.5	21.0	.0476	49.5	50.5
19.3	21.0	.0341	46.6	53.4
17.0	21.0	.0247	40.9	59.1
10.3	21.0	.0136	24.5	75.5
8.0	21.0	.0098	18.9	81.1
6.2	21.0	.0070	14.5	85.5
5.3	21.5	.0050	12.5	87.5
4.2	21.0	.0036	9.6	90.4
2.9	22.0	.0015	6.9	93.1

PERCENT GRAVEL = 2.7
PERCENT SAND = 32.9
PERCENT FINES = 64.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 16.7	ORG,% 2.0

CLASSIFICATION
SANDY CLAY (CL), BROWN

PROJECT ABG
CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 2

DEPTH/ELEV 3.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 2 DF: MD2791 .DAT
DEPTH: 3.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 16.70 OC: 2.00
CLASSIFICATION: 108
SANDY CLAY (CL), BROWN

TOTAL WEIGHT OF SAMPLE: 741.6 gms.
PARTIAL WEIGHT AFTER SPLIT: 72.6 gms.

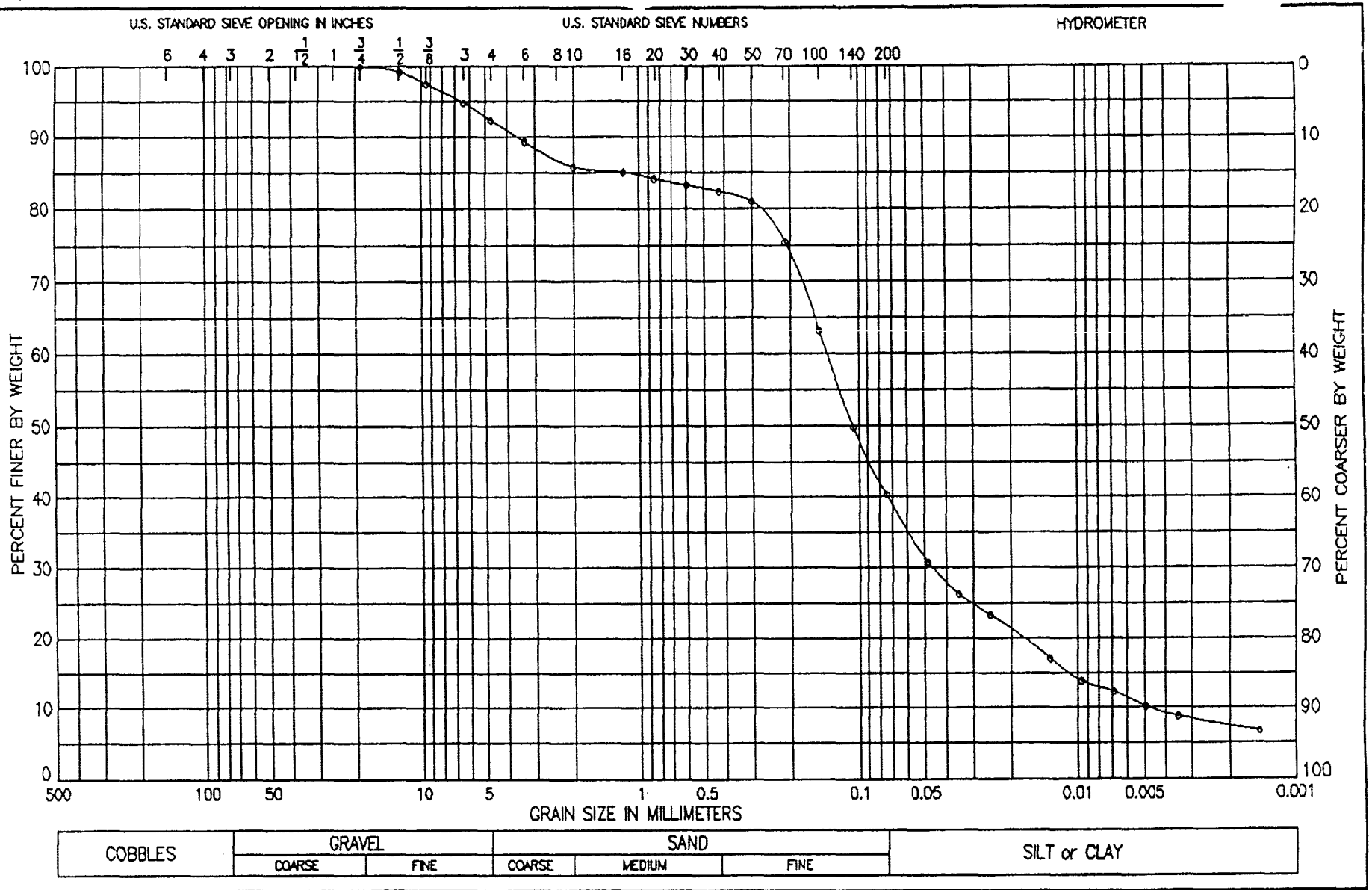
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1/2 in	12.500	100.0	.0
5.8	3/8 in	9.500	99.2	.8
5.4	No 3	6.350	98.5	1.5
6.7	No 4	4.750	97.6	2.4
6.9	No 6	3.350	96.7	3.3
8.4	No 10	2.000	95.5	4.5
.2	No 16	1.180	95.3	4.7
.3	No 20	.850	95.1	4.9
.5	No 30	.600	94.9	5.1
.7	No 40	.425	94.6	5.4
1.0	No 50	.300	94.2	5.8
2.6	No 70	.212	92.1	7.9
9.5	No 100	.150	83.0	17.0
20.7	No 140	.106	68.3	31.7
28.3	No 200	.075	58.3	41.7

HYDROMETER:

RDGS	TEMP			
21.6	22.0	.0465	44.9	55.1
19.4	22.0	.0337	40.3	59.7
16.3	22.0	.0246	33.9	66.1
11.5	22.0	.0133	23.8	76.2
8.3	21.5	.0098	16.9	83.1
7.1	21.5	.0070	14.4	85.6
5.5	22.0	.0049	11.3	88.7
5.0	22.0	.0035	10.2	89.8
3.3	21.5	.0015	6.5	93.5

PERCENT GRAVEL = 2.4
PERCENT SAND = 39.3
PERCENT FINES = 58.3

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.0	ORG,% 2.0

CLASSIFICATION
CLAYEY SAND (SC), BROWN; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 3

DEPTH/ELEV 4.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

PROJECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 3 DF: MD2791 .DAT
DEPTH: 4.0' DATE: 04 MAR 91

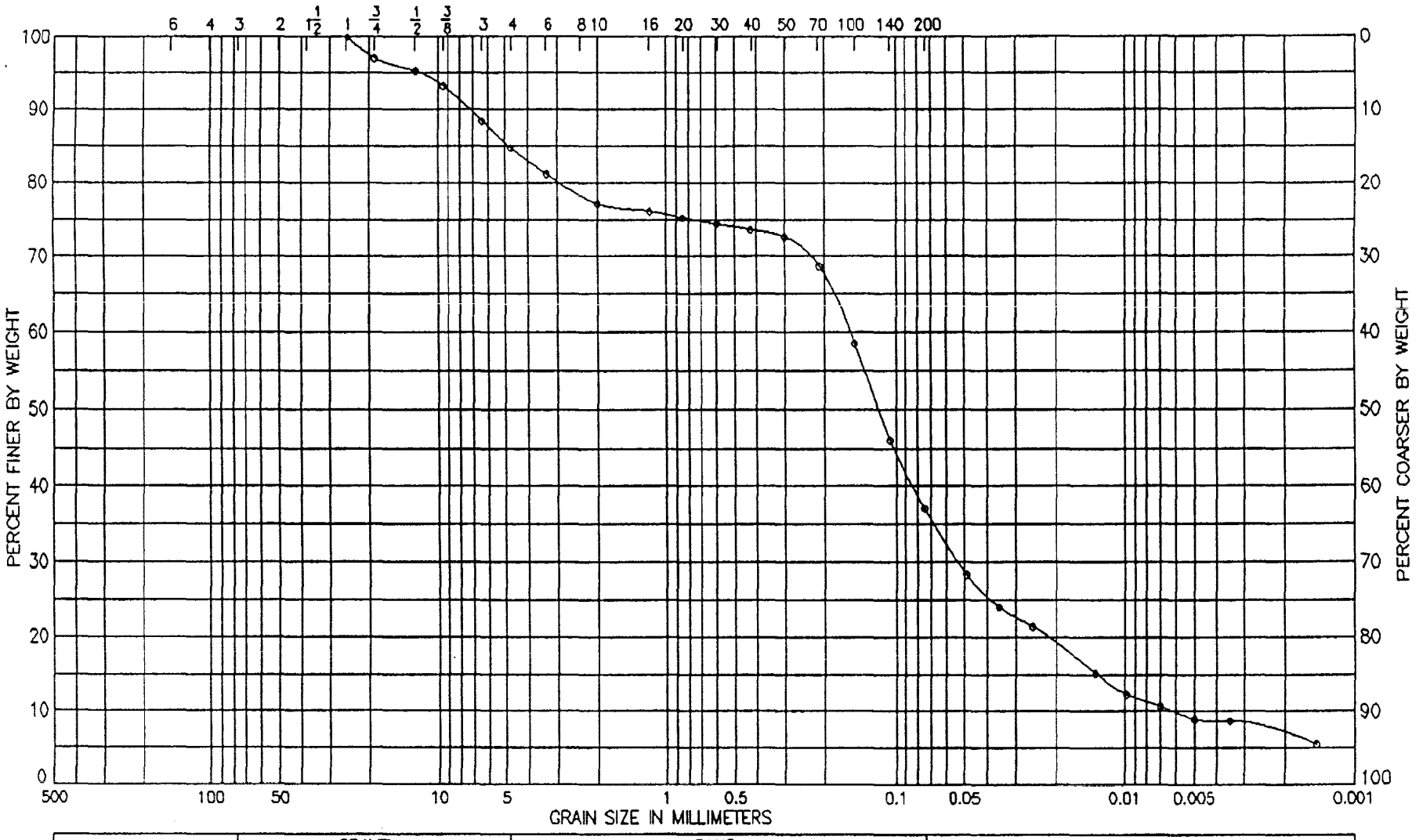
NO-LIMITS-RAN GS: 2.70 est WC: 19.00 OC: 2.00
CLASSIFICATION: 126
CLAYEY SAND (SC), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 721.5 gms.
PARTIAL WEIGHT AFTER SPLIT: 78.8 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
5.2	1/2 in	12.500	99.3	.7
12.3	3/8 in	9.500	97.6	2.4
19.7	No 3	6.350	94.8	5.2
17.5	No 4	4.750	92.4	7.6
22.0	No 6	3.350	89.4	10.6
25.8	No 10	2.000	85.8	14.2
.6	No 16	1.180	85.1	14.9
1.5	No 20	.850	84.2	15.8
2.3	No 30	.600	83.3	16.7
3.1	No 40	.425	82.4	17.6
4.4	No 50	.300	81.0	19.0
9.5	No 70	.212	75.5	24.5
20.7	No 100	.150	63.3	36.7
33.1	No 140	.106	49.8	50.2
41.7	No 200	.075	40.4	59.6
HYDROMETER:				
RDGS	TEMP			
17.9	22.0	.0484	30.8	69.2
15.3	22.0	.0351	26.3	73.7
13.6	22.0	.0252	23.3	76.7
10.0	22.0	.0134	17.1	82.9
8.1	22.0	.0097	13.8	86.2
7.2	22.0	.0069	12.3	87.7
6.1	21.5	.0050	10.2	89.8
5.2	22.0	.0035	8.8	91.2
4.1	21.5	.0015	6.7	93.3

PERCENT GRAVEL = 7.6
PERCENT SAND = 52.0
PERCENT FINES = 40.4

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 15.2	ORG,% 2.6

CLASSFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 4

DEPTH/ELEV 5.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

JECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 4 DF: MD2791 .DAT
DEPTH: 5.0' DATE: 04 MAR 91

O-LIMITS-RAN GS: 2.70 est WC: 15.20 OC: 2.60
LASSIFICATION: 144
GRAVELLY CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 735.8 gms.
PARTIAL WEIGHT AFTER SPLIT: 68.6 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

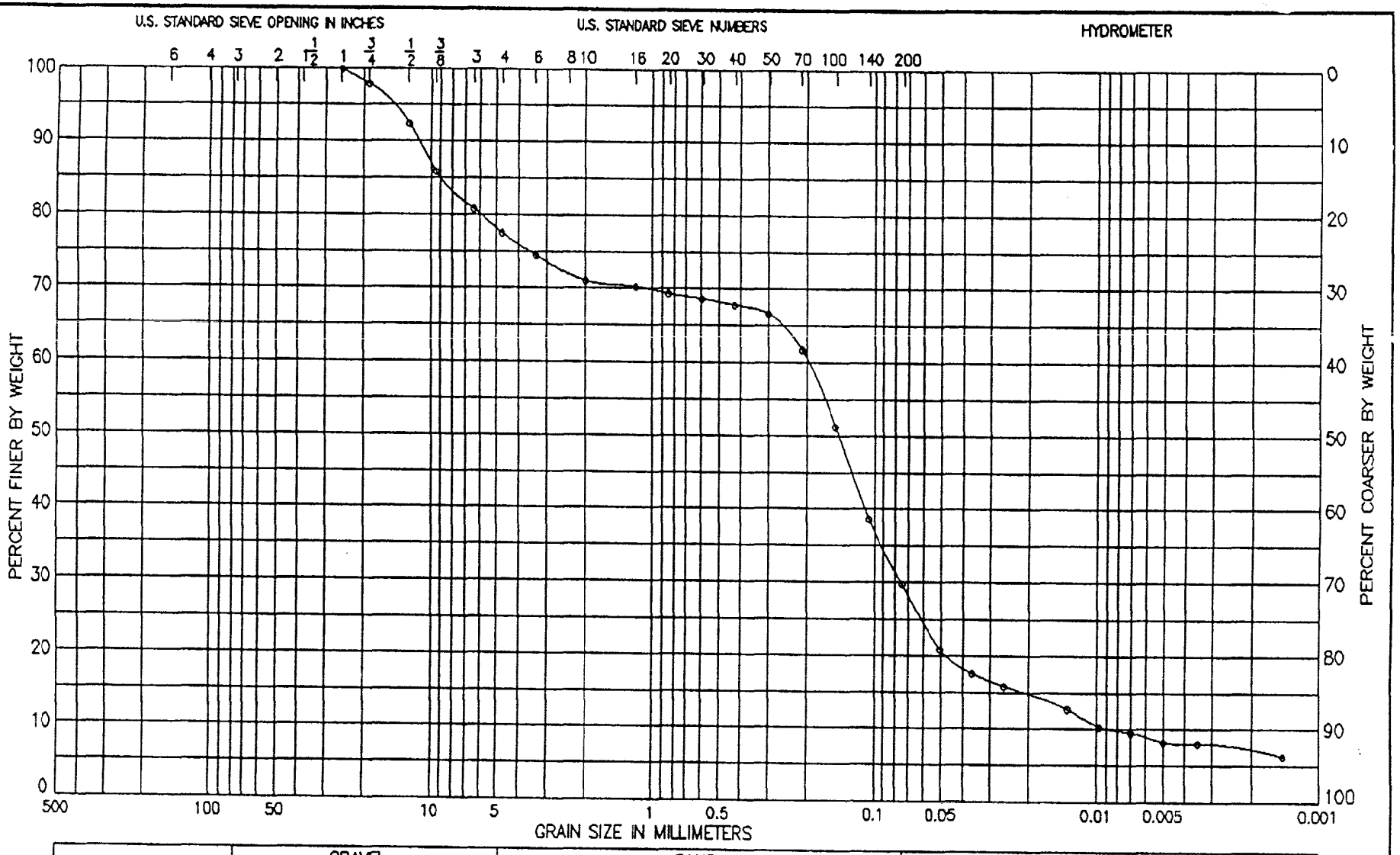
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
21.2	3/4 in	19.100	97.1	2.9
13.2	1/2 in	12.500	95.3	4.7
15.3	3/8 in	9.500	93.2	6.8
35.4	No 3	6.350	88.4	11.6
26.7	No 4	4.750	84.8	15.2
26.4	No 6	3.350	81.2	18.8
29.7	No 10	2.000	77.2	22.8
.9	No 16	1.180	76.2	23.8
1.7	No 20	.850	75.3	24.7
2.4	No 30	.600	74.5	25.5
3.1	No 40	.425	73.7	26.3
4.0	No 50	.300	72.7	27.3
7.5	No 70	.212	68.7	31.3
16.5	No 100	.150	58.6	41.4
27.6	No 140	.106	46.1	53.9
35.6	No 200	.075	37.1	62.9

HYDROMETER:

RDGS	TEMP			
16.0	22.0	.0493	28.4	71.6
13.6	22.0	.0356	24.1	75.9
12.1	22.0	.0255	21.4	78.6
8.6	22.0	.0136	15.2	84.8
7.1	21.5	.0099	12.3	87.7
6.2	21.5	.0070	10.7	89.3
5.2	21.5	.0050	8.9	91.1
5.0	22.0	.0035	8.8	91.2
3.3	21.5	.0015	5.5	94.5

PERCENT GRAVEL = 15.2
PERCENT SAND = 47.7
PERCENT FINES = 37.1

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 19.6	ORG,% 1.5

CLASSIFICATION

GRAVELLY CLAYEY SAND (SC), BROWN

INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

PROJECT ABG

CRANE, IN

BORING NO. WES-3-C26-87 SAMPLE NO. 5

DEPTH/ELEV 6.0' - 7.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

.OJECT: ABG
CRANE, IN

BORING: WES-3-C26-87 SAMPLE: 5 DF: MD2791 .DAT
DEPTH: 6.0' - 7.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: 19.60 OC: 1.50
CLASSIFICATION: 162
GRAVELLY CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 783.9 gms.
PARTIAL WEIGHT AFTER SPLIT: 69.8 gms.
INSUFFICIENT SAMPLE FOR ACCURATE GRADATION

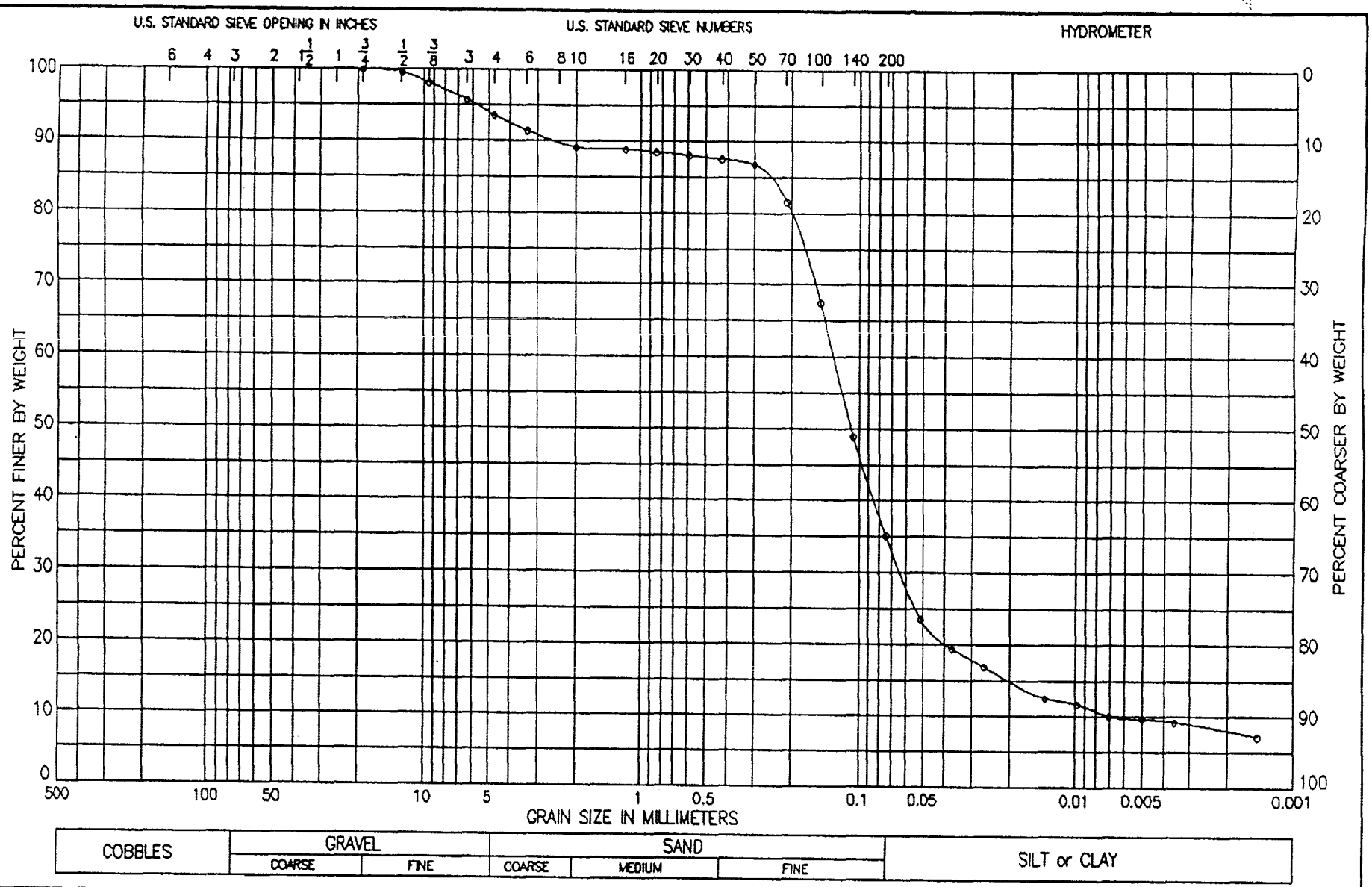
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1 in	25.000	100.0	.0
16.0	3/4 in	19.100	98.0	2.0
43.5	1/2 in	12.500	92.4	7.6
51.1	3/8 in	9.500	85.9	14.1
40.1	No 3	6.350	80.8	19.2
25.5	No 4	4.750	77.5	22.5
23.9	No 6	3.350	74.5	25.5
27.2	No 10	2.000	71.0	29.0
.7	No 16	1.180	70.3	29.7
1.6	No 20	.850	69.4	30.6
2.3	No 30	.600	68.7	31.3
3.1	No 40	.425	67.9	32.1
4.3	No 50	.300	66.6	33.4
9.1	No 70	.212	61.7	38.3
19.4	No 100	.150	51.3	48.7
31.8	No 140	.106	38.7	61.3
40.5	No 200	.075	29.8	70.2

HYDROMETER:

RDGS	TEMP			
13.0	22.0	.0507	20.8	79.2
11.0	22.0	.0365	17.6	82.4
9.9	22.0	.0260	15.8	84.2
8.0	22.0	.0137	12.8	87.2
6.5	22.0	.0098	10.3	89.7
6.1	21.5	.0070	9.5	90.5
5.3	21.5	.0050	8.2	91.8
5.1	22.0	.0035	8.1	91.9
4.1	21.5	.0015	6.3	93.7

PERCENT GRAVEL = 22.5
PERCENT SAND = 47.7
PERCENT FINES = 29.8

EDE



LL	PL	PI	GS 2.70 EST	NAT W,% 22.3	ORG,% 1.9

CLASSIFICATION
CLAYEY SAND (SC), BROWN; WITH GRAVEL

PROJECT ABG
CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 6

DEPTH/ELEV 8.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES - STF/GL

SIEVE ANALYSIS

OJECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 6 DF: MD2791 .DAT
DEPTH: 8.0' DATE: 04 MAR 91

O-LIMITS-RAN GS: 2.70 est WC: 22.30 OC: 1.90
LASSIFICATION: 180
CLAYEY SAND (SC), BROWN; WITH GRAVEL

TOTAL WEIGHT OF SAMPLE: 1015.0 gms.
ARTIAL WEIGHT AFTER SPLIT: 68.7 gms.

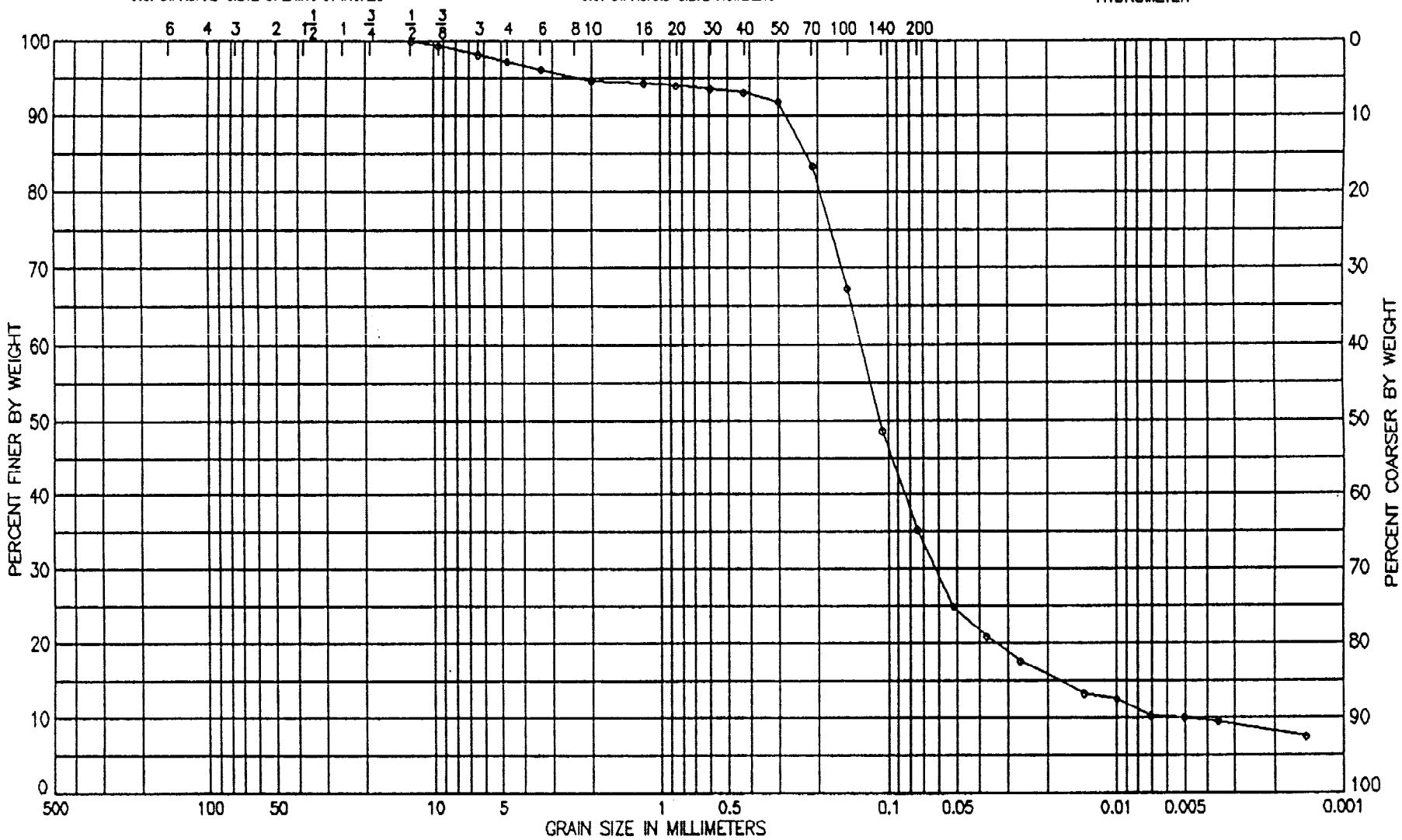
WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	3/4 in	19.100	100.0	.0
4.0	1/2 in	12.500	99.6	.4
14.4	3/8 in	9.500	98.2	1.8
24.3	No 3	6.350	95.8	4.2
22.5	No 4	4.750	93.6	6.4
22.0	No 6	3.350	91.4	8.6
23.0	No 10	2.000	89.1	10.9
.2	No 16	1.180	88.9	11.1
.5	No 20	.850	88.5	11.5
.8	No 30	.600	88.1	11.9
1.2	No 40	.425	87.6	12.4
1.8	No 50	.300	86.8	13.2
5.8	No 70	.212	81.6	18.4
16.7	No 100	.150	67.5	32.5
31.0	No 140	.106	48.9	51.1
41.6	No 200	.075	35.2	64.8

HYDROMETER:

RDGS	TEMP			
11.5	22.0	.0514	23.5	76.5
9.5	22.0	.0370	19.4	80.6
8.3	22.0	.0264	16.9	83.1
6.2	22.0	.0139	12.6	87.4
5.8	22.0	.0098	11.7	88.3
5.1	21.5	.0071	10.1	89.9
4.9	21.5	.0050	9.7	90.3
4.7	21.5	.0036	9.3	90.7
3.7	21.5	.0015	7.2	92.8

PERCENT GRAVEL = 6.4
PERCENT SAND = 58.4
PERCENT FINES = 35.2

EDE



LL	PL	PI	GS 2.70 EST	NAT W,%	ORG,% 1.5

CLASSIFICATION
CLAYEY SAND (SC), BROWN

PROJECT ABG
CRANE, IN

BORING NO. WES-3-C26-86 SAMPLE NO. 7

DEPTH/ELEV 9.0' DATE 04 MAR 91

GRADATION CURVE | LABORATORY USAE WES – STF/GL

SIEVE ANALYSIS

ROJECT: ABG
CRANE, IN

BORING: WES-3-C26-86 SAMPLE: 7 DF: MD2791 .DAT
DEPTH: 9.0' DATE: 04 MAR 91

NO-LIMITS-RAN GS: 2.70 est WC: .00 OC: 1.50
CLASSIFICATION: 198
CLAYEY SAND (SC), BROWN

TOTAL WEIGHT OF SAMPLE: 1095.0 gms.
PARTIAL WEIGHT AFTER SPLIT: 59.8 gms.

WEIGHTS gm.	SIEVE SIZE or NUMBER	OPENING mm	PERCENT FINER	CUMULATIVE PERCENTS
.0	1/2 in	12.500	100.0	.0
6.7	3/8 in	9.500	99.4	.6
13.2	No 3	6.350	98.2	1.8
10.1	No 4	4.750	97.3	2.7
11.9	No 6	3.350	96.2	3.8
16.4	No 10	2.000	94.7	5.3
.2	No 16	1.180	94.4	5.6
.4	No 20	.850	94.0	6.0
.7	No 30	.600	93.6	6.4
1.0	No 40	.425	93.1	6.9
1.8	No 50	.300	91.8	8.2
7.2	No 70	.212	83.3	16.7
17.3	No 100	.150	67.3	32.7
29.1	No 140	.106	48.6	51.4
37.5	No 200	.075	35.3	64.7
HYDROMETER:				
RDGS	TEMP			
10.0	22.0	.0520	24.9	75.1
8.4	22.0	.0373	20.9	79.1
7.1	22.0	.0267	17.6	82.4
5.4	22.0	.0140	13.3	86.7
5.2	21.5	.0100	12.6	87.4
4.3	21.5	.0071	10.3	89.7
4.3	21.0	.0050	10.1	89.9
4.0	21.5	.0036	9.6	90.4
3.2	21.5	.0015	7.5	92.5

PERCENT GRAVEL = 2.7
PERCENT SAND = 62.0
PERCENT FINES = 35.3

EDE

APPENDIX D

DATA VALIDATION REPORT

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

4 February 1991

CEWESEE-A

MEMORANDUM FOR MR. ROBERT MAGEE, US ARMY ENGINEER DISTRICT, WILMINGTON, 69 DARLINGTON AVENUE, WILMINGTON, NC 28403

SUBJECT: Data validation for Site 2 (ABG), Crane samples collected 8/09/90 - 8/20/90

1. Completeness check
   a. All samples and analyses have been processed
   b. Data reported included copies of all chain-of-custody records received from the field. QC results for blanks, spikes, duplicates, and standard reference materials were included in the data report.
   c. Procedures specified in the project planning were followed with the exception of Tin. An explanation of deviation was given with site 1 data.
   d. A review of raw data sheets shows that all calibrations were performed in accordance with SW-846 procedures.

2. Data were evaluated with respect to detection limits. All data were reported at or below contract required detection limits.

3. Data were evaluated with respect to control limits for duplicates, spikes, blanks, and surrogates. Corrective action forms were included where appropriate.

On several samples for Base Neutral/acid extractables, the p-Terphenyl-d_{14} surrogate was high outside the acceptable range. Reruns yielded the same results and matrix spikes also. Reagent blank samples were within range. The high surrogate values were attributed to matrix effects. This same problem was encountered at site 1.

4. All samples were analyzed within acceptable holding times.

5. Data for QA samples were within acceptable limits.

ANN B. STRONG
Chief, Analytical
Laboratory Group

APPENDIX E

SAMPLE CUSTODY FORMS

COOLER RECEIPT FORM

Project: CRANE- ABG

Cooler received on 8/10/90 and opened on 8/10/90 by Linda K Stevenson

Linda K. Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- (YES) NO
   If YES, how many and where? 1 on the front of each cooler
   Were signature and date correct? (YES) NO

2) Were custody papers taped to lid inside cooler? ---------- (YES) NO

3) Were custody papers properly filled out (ink, signed, etc.)? --------- (YES) NO

4) Did you sign custody papers in the appropriate place? ---------- (YES) NO

5) Did you attach shipper's packing slip to this form? ---------- (YES) NO

6) What kind of packing material was used? Bubble plastic

7) Was sufficient ice used (if appropriate)? ---------- (YES) NO

8) Were all bottles sealed in separate plastic bags? ---------- (YES) NO

9) Did all bottles arrive in good condition (unbroken)? ---------- (YES) NO

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- (YES) NO

11) Did all bottle labels and tags agree with custody papers? ---------- YES (NO)

12) Were correct bottles used for the tests indicated? ---------- (YES) NO

13) Were VOA vials checked for absence of air bubbles and noted if found? --- (YES) NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES NO ?

Explain any discrepancies --->

#11. Samples labeled 03/10-1-90 #4 + 03/10-1-90 #1V were not on C-o-C sheet. Samples were logged into system as labels were intact on sheet.

#14. Need more samples, lot of rocks make usable portion of sample smaller.

COOLER RECEIPT FORM

2 coolers, only applies to both coolers

Project: CRANE-ABS

Cooler received on 8/14/90 and opened on 8/14/90 by Linda K. Stevenson

Linda K. Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- (YES) NO
   If YES, how many and where? 1-front
   Were signature and date correct? (YES) NO

2) Were custody papers taped to lid inside cooler? ---------- (YES) NO

3) Were custody papers properly filled out (ink, signed, etc.)? ---------- (YES) NO

4) Did you sign custody papers in the appropriate place? ---------- (YES) NO

5) Did you attach shipper's packing slip to this form? ---------- (YES) NO

6) What kind of packing material was used? Ice, cardboard & straw mat

7) Was sufficient ice used (if appropriate)? ---------- (YES) NO

8) Were all bottles sealed in separate plastic bags? ---------- (YES) NO

9) Did all bottles arrive in good condition (unbroken)? ---------- (YES) NO

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- (YES) NO

11) Did all bottle labels and tags agree with custody papers? ---------- YES (NO)

12) Were correct bottles used for the tests indicated? ---------- (YES) NO

13) Were VOA vials checked for absence of air bubbles and noted if found? ---- (YES) NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES (NO)

Explain any discrepancies --->

#11. two samples not on COC sheet & one sample on COC sheet we did not received, indicated on COC sheet

#14. Spoke with Paul Albutson & told him we need 4 liters of water for organic parameters & 1 plastic bottle for metals + TP.

USAE WATERWA XPERIMENT STATION

CHAIN OF C TODY RECORD

PROJECT NAME: Crane ABG

SAMPLERS: (Signature) Paul Albertson

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS							REMARKS
8-9-90	1400	03/10-2-90 FINAL RINSE	4							Bubbles in VOA's
	1410	03/10-3-90 # 1V	2							
	1415	# 1	1							
	1416	# 2V	2							
	1445	# 2	1							
8-10-90	0830	03/10-3-90 FINAL RINSE	4							Bubbles in VOA's
	0915	03/10-4-90 #2V	2							
	0920	#1	1							
	0927	3V	2							
	0925	2	1							
	0935	3	1							
	1000	4V	2							
	1005	4	1							#03/10-3-90 #3 not on COC
										sheet, seals intact

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Paul Albertson	8-13-90 / 1212	Linda K. Stevenson			
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM R Nov 1996 PREVIOUS EDITIONS OBSOLETE

E-3

USAE WATERWA PERIMENT STATION

CHAIN OF C TODY RECORD

PROJECT NAME: Crane ABG

SAMPLERS: (Signature) Paul Albritton

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
8-11-90	0900	03/10-5-90 1V	2	
	0905	1	1	
	0901	2V	2	
	907	2	2	
	0850	03/10-4-90 Final Rinse	3	Bubbles in VOA's
	0930	03/10-5-90 3V	2	
	0935	03/10-5-90 3	2	
	1000	4V	2	
	1005	4	2	#3/10-5-90 #4, did not receive
				~~#3/10-5-90 # final Rinse not on COC sheet. lbs~~

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Paul Albritton	8-13-90 / 1212	Linda K. Stevenson			
Relinquished by: (Signature)	**Date /Time**	**Received by: (Signature)**	**Relinquished by: (Signature)**	**Date /Time**	**Received by: (Signature)**
Relinquished by: (Signature)	**Date /Time**	**Received by: (Signature)**	**Date /Time**	**Remarks**	

WES FORM R Nov 1 ...96 PREVIOUS EDITIONS OBSOLETE

USAE WATERW[illegible] EXPERIMENT STATION

CHAIN OF [illegible]TODY RECORD

PROJECT NAME: CRANE ABG

SAMPLERS: (Signature) Paul [illegible]

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
				LAB ID 6986-7034
8-13-90	900	03/10-5-90 FINAL RINSE	3	Bubbles in VOA's
	920	03/10-11-90 #1	1	
	933	2V	2	
	935	3V	2	
	940	2	2	
	945	3	2	
				#3/10-11-90 #4 not on COC sheet, seals intact

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Paul [illegible]	8-13-90 1212	Linda K. Stevenson			
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM R Nov 96 PREVIOUS EDITIONS OBSOLETE

2 coolers

COOLER RECEIPT FORM

Project: CRAWE -ABG

Cooler received on 8/17/90 and opened on 8/17/90 by Linda K. Stevenson

Linda K. Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- (YES) NO
   If YES, how many and where? 1 front on each Cooler
   Were signature and date correct? (YES) NO

2) Were custody papers taped to lid inside cooler? ---------- (YES) NO

3) Were custody papers properly filled out (ink, signed, etc.)? --------- (YES) NO

4) Did you sign custody papers in the appropriate place? ---------- (YES) NO

5) Did you attach shipper's packing slip to this form? ---------- (YES) NO

6) What kind of packing material was used? Cardboard, bubble plastic, straw mat

7) Was sufficient ice used (if appropriate)? ---------- (YES) NO

8) Were all bottles sealed in separate plastic bags? ---------- (YES) NO

9) Did all bottles arrive in good condition (unbroken)? ---------- YES (NO)

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- (YES) NO

11) Did all bottle labels and tags agree with custody papers? ---------- (YES) NO

12) Were correct bottles used for the tests indicated? ---------- (YES) NO

13) Were VOA vials checked for absence of air bubbles and noted if found? --- (YES) NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES (NO)

Explain any discrepancies --->

#9. Two 1-liter bottles arrived broken + 1 VOA vial was broken.

#14. Small jars were sent for sediments with no duplicates.

USAE WATERWA' PERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: CRANE ABG

SAMPLERS: (Signature) Paul E Allinton

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
				LABID - 7049 - 7066
8-15-90	0800	03/10-11-90 Final RINSE	7	VOA - DUP Broke, 2 1-liter broken
	0815	03/10-10-90 #1	1	
	0830	2V	2	
	0832	3V	2	
	0835	2	1	
	0838	3	1	
	0901	4V	2	
	0909	4	1	
	0950	5V	2	
	0938	5	2	
	1400	FINAL RINSE	7	Bubbles in VOA
	1445	03/10-8-90 1V	2	
	1500	2V	2	
	1510	1	1	
	1515	2	1	
	1600	TRIP BLANK	2	

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Paul E Allinton	16 Aug 90 / 0900	Linda K. Stevenson			
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM 2196 (Nov)

PREVIOUS EDITIONS OBSOLETE

2 Coolers

COOLER RECEIPT FORM

Project: CRANE - ABG

Cooler received on 8/21/90 and opened on 8/21/90 by Linda K. Stevenson

Linda K. Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- (YES) NO
   If YES, how many and where? 2 Seals on each Cooler
   Were signature and date correct? (YES) (NO) lks

2) Were custody papers taped to lid inside cooler? ---------- (YES) NO

3) Were custody papers properly filled out (ink, signed, etc.)? --------- YES (NO)

4) Did you sign custody papers in the appropriate place? ---------- (YES) NO

5) Did you attach shipper's packing slip to this form? ---------- (YES) NO

6) What kind of packing material was used? Styrofoam peanuts + straw mat

7) Was sufficient ice used (if appropriate)? ---------- (YES) NO

8) Were all bottles sealed in separate plastic bags? ---------- (YES) NO

9) Did all bottles arrive in good condition (unbroken)? ---------- (YES) NO

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- (YES) NO

11) Did all bottle labels and tags agree with custody papers? ---------- (YES) NO

12) Were correct bottles used for the tests indicated? ---------- (YES) NO

13) Were VOA vials checked for absence of air bubbles and noted if found? ---- (YES) NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES (NO)

Explain any discrepancies --->

#1. ~~Jackson did not sign paper relinquishing the samples.~~ lks

#3. ~~Same as #1~~ Jackson did not sign paper relinquishing the samples.

#14. One sample was not sent in duplicate.

USAE WATERW/ XPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: CRAWS ABG

SAMPLERS: (Signature) Larry Benjamin, Paul Allison

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS 7073-7115
8-17-90	1036	TRIP BLANK 03/10-7-90 1	2	
8-13-90	1034 1030	03/10-6-90 1 ✓	2 2	
"	1041	" 2	2	
"	1037	" 2 ✓	2	
"	1054	" 3	2	
"	10:52	" 3 ✓	2	
"	1119	" 4	2	
"	1112	" 4 ✓	2	
"	1137	" 5	2	
"	1136	" 5 ✓	2	Bubbles
"	1400	03/10-6-90 RINSE	7	

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-20-90 0930	Jackson		8/21/90 1:15	Linda K. Stevenson
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM 2196 R Nov PREVIOUS EDITIONS OBSOLETE

USAE WATERW. XPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: CRANE ABG

SAMPLERS: (Signature) Paul E Albertson

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
8-16-90	0909	03/10-8-90 Rinse	7	Bubbles in VOA's
	0930	03/10-9-90 1V	2	
	0935	1	2	
	945	2V	2	
	950	2	2	
	1030	3V	2	
	1035	3	2	
8-17-90	0907	03/10-7-90 1V	2	
	0908	1	1	
	0917	2V	2	
	0921	2	2	lid broken but sealed, no leakage
	0927	3V	2	
	0930	3	2	
	0934	4V	2	
	0938	4	2	
	1000	03/10-9-90 RINSE	7	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Larry Benjamin	8-20-90 0930	[illegible]		8/21/90 1:15	Linda K Stevenson
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	Remarks	

WES FORM R Nov '96 PREVIOUS EDITIONS OBSOLETE

one cooler

COOLER RECEIPT FORM

Project: CRAVE - ABG

Cooler received on 8/22/90 and opened on 8/22/90 by Linda K. Stevenson

Linda K. Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- (YES) NO
   If YES, how many and where? 2 on front
   Were signature and date correct? (YES) NO

2) Were custody papers taped to lid inside cooler? ---------- (YES) NO

3) Were custody papers properly filled out (ink, signed, etc.)? --------- YES (NO)

4) Did you sign custody papers in the appropriate place? ---------- (YES) NO ?

5) Did you attach shipper's packing slip to this form? ---------- (YES) NO

6) What kind of packing material was used? Bubble plastic

7) Was sufficient ice used (if appropriate)? ---------- (YES) NO

8) Were all bottles sealed in separate plastic bags? ---------- (YES) NO

9) Did all bottles arrive in good condition (unbroken)? ---------- (YES) NO

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- (YES) NO

11) Did all bottle labels and tags agree with custody papers? ---------- YES (NO)

12) Were correct bottles used for the tests indicated? ---------- (YES) NO

13) Were VOA vials checked for absence of air bubbles and noted if found? ---- (YES) NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES (NO)

Explain any discrepancies --->

#3. Jackson did not sign paper relinquishing the sample

#11. Sample # 03/10-12-90#4 was just 1 container.

#14. Sample noted above is insufficient amount therefore Herbs were dropped from this sample

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CU DY RECORD

PROJECT NAME: CRANE ABG

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS	REMARKS
				LABID 7116 - 7126
8-20-90	1055	03/10-12-90 1	2	
"	1053	1V	2	
"	1102	2	2	
"	1100	2V	2	
"	1112	3	2	
"	1108	3V	2	
"	1125	4	2	only one for
"	1120	4V	2	~~only one for the~~
"	1400	RINSE	7	
"	1619	TRIP BLANK	1	Should be in Dup!

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	8-21-90 0916	[illegible]		8/22/90 11:15	Linda K. Stevenson
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM 2196 R Nov 89

PREVIOUS EDITIONS OBSOLETE

COOLER RECEIPT FORM

Project : CRAVE-ABG

Cooler received on 8/24/90 and opened on 8/24/90 by Linda K. Stevenson

Linda K Stevenson
(signature)

1) Were custody seals on outside of cooler? ---------- YES NO
   If YES, how many and where? 1 front
   Were signature and date correct? YES NO

2) Were custody papers taped to lid inside cooler? ---------- YES NO

3) Were custody papers properly filled out (ink, signed, etc.)? --------- YES NO

4) Did you sign custody papers in the appropriate place? ---------- YES NO

5) Did you attach shipper's packing slip to this form? ---------- YES NO

6) What kind of packing material was used? Peanuts + bubble plastic

7) Was sufficient ice used (if appropriate)? ---------- YES NO

8) Were all bottles sealed in separate plastic bags? ---------- YES NO

9) Did all bottles arrive in good condition (unbroken)? ---------- YES NO

10) Were all bottle labels complete (No., date, signed, anal., pres, etc.)? ---- YES NO

11) Did all bottle labels and tags agree with custody papers? ---------- YES NO

12) Were correct bottles used for the tests indicated? ---------- YES NO

13) Were VOA vials checked for absence of air bubbles and noted if found? ---- YES NO

14) Was a sufficient amount of sample sent in each bottle? ---------- YES NO

Explain any discrepancies --->

USAE WATERWAYS EXPERIMENT STATION

CHAIN OF CUSTODY RECORD

PROJECT NAME: CRANE ABG

SAMPLERS: (Signature) Larry Benjamin

DATE	TIME	SAMPLE ID	NO. OF CONTAINERS							REMARKS
										#: 7/16-7/26
8-20-90	1125	03/10-12-90 #4	1							~~This~~ sample omitted from Shipment
8-23-90	0800	TRIP BLANK	1							received 8/22/90. Will be
										added to proper files, they
										are duplicate samples

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Larry Benjamin	08-23-90 0800	[illegible]			
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Date /Time	Remarks	

WES FORM 2196 R Nov 80 — PREVIOUS EDITIONS OBSOLETE

APPENDIX F

RESPONSE TO NAVY/CRANE COMMENTS

Northern Division
Naval Facilities Engineering Command

1. Northern Division reviewed the internal draft version of this report last summer. Comments were submitted on the internal draft to the USAE-WES on July 07, 1991; the Wilmington District was copied. We have not yet received a written response to those comments yet this draft was prepared and distributed. Is this another internal draft or a draft that was distributed to all TRC members? In any case, it appears this report did not incorporate all of Northern Division's comments. Is the USAE-WES reviewing the Wilmington reports, before or after distribution to the Navy?

Response: This is an Internal Draft that was sent to WES and the Navy. WES reviewed this report concurrently with the Navy, and we are responding to their comments, also.

2. The report does not possess a cover page. A cover page must be included, without headers. A copy of the Army Corps transmittal letter and accompanying distribution list should be <u>bound</u> in the report before the cover page. The transmittal letter, attached to each report, should be a reproduction of the original cover letter bound in one of the copies sent to the Northern Division. The letter will be From: Army... To: Northern Division...

Response: The Report will be so formatted.

3. The TABLE OF CONTENTS presented in the report <u>DOES NOT CORRESPOND TO THIS REPORT!</u>. Revise! Place the executive summary after the Table of Contents, preceding the "LIST OF ACRONYMS/ABBREVIATIONS." Page 67 should be labelled with a section number. The Section-8 title should be renamed "REFERENCES" OR "REFERENCES CITED." It is not a bibliography. The page numbers are not complete on page ii. Include an additional APPENDIX for the Chain of Custody forms.

Response: The Table of Contents will match the report, and the other changes will be made.

4. There is an adequate assessment of the quality of the chemical data.

o The analysis of the organic data should be improved. In

particular, the comparisons of the background (control) and sample boring results are not adequate.

o The analysis of the inorganic data is much better than that for the organic data but requires improvement. The statistical analysis of the inorganic data requires a more detailed discussion. Furthermore, the statistical analysis of the metal data fails to adequately address data quality. The report has good graphic presentations of the metal results, but some improvements are recommended. The comparison of metal concentrations for the sample and control borings reflects a relatively high level of effort.

o The results of the chemical analyses should be better related to the disposal activities at the ABG. In particular, chemical compositions of the hazardous materials burned at the ABG should be listed in tables.

o The rationale for the soil sampling efforts (e.g., sample frequency and location) is not well explained.

o At a minimum, order of magnitude ARARs (or typical cleanup levels) should be presented for the analytes being tested. The reader is not presented with enough information to determine whether detected concentrations of analytes are hazardous.

o Blank contamination was well assessed. However, detection limits should be adjusted for blank contamination.

Response: Changes made throughout the Report should improve the discussion of the chemical data. A Table has been added giving the composition of hazardous materials burned at ABG. The report has been amended to clearly explain the investigation objective and purpose. Soil sampling was done to determine what contaminants were found in the soils and in what general locations (see Section 5.1.0). The full extent of contamination and typical cleanup levels will be explored in the next phase of the study. We do not feel it is correct to adjust the detection limits for blank contamination. The blank contamination data were taken into consideration during the interpretation of chemical analyses.

5. The EXECUTIVE SUMMARY is verbose. Include the details in the body of the report, not in the EXECUTIVE SUMMARY. The following is a concise format for the EXECUTIVE SUMMARY: purpose, background, findings, conclusions, and recommendations. We would also prefer if the report did not use right justification format.

Response: The Executive Summary has been made more concise and right justification has been removed.

6. (First paragraph.) The report states: "Part 1 of the Phase III, soils investigation was performed at...." The reader should be told that this report <u>is</u> Part 1 of the Phase III soils investigation for the ABG (Ammunition Burning Ground).

Response: So revised.

7. (Second paragraph.) The report should specify the environmental matrix that is being investigated; that is, the report should state that the goal of the Phase III investigation is to assess contamination in the <u>soils</u>. The term "plume" typically refers to ground water contamination and should not be used in reference to soils contamination. (The source area is actually a portion of the plume.) Perhaps the Part I is a source area study and the Part II would define the limits of contamination.

Response: The report has been rewritten to say that Part I is a source area study and Part II will define the limits of contamination. References to plume with respect to soils have been removed.

8. (Third paragraph.) The report states that the work plan for this study was submitted to EPA for approval. The report does not state whether or not the work plan was approved.

Response: The work plan was submitted to EPA but was never formally approved.

9. (Fourth paragraph.) The report states: "Samples from treatment were used to determine the chemical character of the waste residues." Please explain the phrase "samples from treatment"--samples from treatment of what? The preceding sentence also makes reference to "...treatment sites..."

Response: References to "treatment sites" have been removed.

10. (1st paragraph.) The dates referenced for the Dunbar reports and the Hunt report are incorrect throughout the report. Dunbar's first report was 1982 and Hunt's report was 1988. Revise throughout the text, include page 8 and page 27.

Response: These dates have been corrected.

11. (Second paragraph.) Revise the second sentence of this paragraph to: "Releases of hazardous wastes (as defined by 40 CFR Part 300) have occurred at the ABG."

Response: So revised.

12. (4th paragraph.) Concentrations should be singular, Concentration. What and where is the waste pile area stated in the second sentence.

Response: Concentration is now singular and the waste pile area is now correctly referred to as the former ash pile.

13. Two pages are labelled as "page ii" (Table of Contents and EXECUTIVE SUMMARY).

Response: Corrected.

14. The ACRONYM "NAD" on page 68 should be Naval Ammunition Depot, not Naval Army Depot.

Response: Corrected.

15. (4th paragraph.) Specify the codified hazardous waste regulations required in the second sentence. I don't think the Subpart X permit application submitted to the USEPA was a "...Part B permit application."

Response: This information has been rewritten and should be correct.

16. (Section 1.3.0) Why did the EXECUTIVE SUMMARY present more background information than did this section? The ABG has a long and complex environmental regulatory history. It is essential that the readers, and authors, understand the complete history of the ABG. The findings of the reports listed in Section 2 should be summarized in this section. The third sentence stated the ABG was a "...past SWMU..." but did not explain why. Some of the elements of the ABG background include 1) closure of the ABG Ash Pile (approximately 12,200 tons of ash was removed in 1986-87 and disposed of at an off-site landfill), 2) RFI Phase III ground water, 3) RFI Phase II surface water, 4) closure of the 3 surface impoundments and subpart F ground water monitoring, etc.. Listed are some of the Federal CFR's pertinent to the ABG:

RCRA - Releases from Solid Waste Management Units (40 CFR 264.90-264.109)

RCRA - Closure and Post-closure
(40 CFR 264.110-264.120)

RCRA - Waste Piles
(40 CFR 264.250-264.269)

RCRA - Miscellaneous Units (Subpart X)
(40 CFR 264.600-264.999)

Response: This section has been entirely rewritten based on information contained in the dye tracer study by Bill Murphy.

17. (1st paragraph.) "Setforth" should be two words.

Response: Corrected.

18. Please explain what "desensitized black powder" is in the report.

Response: The report has been changed to say that desensitized black powder is black powder that has been placed in water to stabilize it.

19. (4th paragraph.) The ABG is located near the east-center boundary of the NWSCC, not the "southeast boundary."

Response: Corrected.

20. (4th paragraph.) All of the studies listed did not document that the "...groundwater at the ABG is contaminated." In particular, the Hunt study was geology and hydrogeology. The report does need to discuss the ground water contamination at the ABG; contaminants, concentrations, and locations (monitoring wells and springs). USAE-WES Bill Murphy has a good handle on the ground water contamination plume and can provide Wilmington with the information for this report. The soils contamination will have to be evaluated against the ground water contamination and visa versa, at some point.

Response: The studies cited have been corrected by listing what they actually found. Groundwater contamination maps have been added to the report. In addition, the main items of a summary report dated April 1, 1992 on groundwater at the ABG (COMARCO report) have been included.

21. Figure 1.2 must include a source: BASE MAP IS A PORTION OF USGS INDIAN SPRINGS, IND., QUADRANGLE (7.5 MINUTE SERIES, 1951,

PHOTOREVISED 1973, EDITED 1979) AND THE WILLIAMS, IND., QUADRANGLE (7.5 MINUTE SERIES, 1956, PHOTOREVISED 1975, EDITED 1978).

Response: The source has been added to Figure 1.2.

22. The larger scale ABG topographic map used by Bill Murphy (plate 2, revised 9/23/91) would provide much more detail than the figure(s) used in the report. The boring locations should be co-located with the monitoring well locations. Bill Murphy also has isoconcentration maps for TCE and explosives with the wells plotted. If the borings were located on that map, the reader could correlate ground water contamination with soils contamination.

Response: This map has been included in the report as requested.

23. This paragraph is not consistent with the <u>PROJECT OBJECTIVE</u>.

Response: The paragraph has been rewritten for consistency.

24. It is fine to list, in chronological order, previous studies, but a summary must be included in Section 1.3.0 of these previous studies. Most readers of this report do not have easy access to the previous studies.

Response: Information on previous studies has been rewritten.

25. (1st paragraph.) Do not use the term "disposal areas."

Response: The term "disposal areas" is removed, but a few references to "disposal" in the sense that ammunition was burned or detonated to dispose of it remain.

26. (Figure 3.1) The dashed lines should be extended for the tributary past areas 6 and 7.

Response: Figure 3.1 has been corrected.

27. Table 3.1 should be combined with Tables 3.2 and 3.3 to avoid redundancy.

Response: These tables have been combined.

28. The list of parameters in Table 3.1 is incomplete. There is an inconsistency between the explosive compounds listed in the table and those presented in the Tables 5.7-5.9. Most of the

tables (5.-5.9) have 8 compounds. Table 3.1 lists only 7 compounds (DNB omitted). Please explain why the method used for explosive analysis (<u>USATHAMA Reversed-Phase HPLC Method for Determination of Nitroaromatics and Nitroamines</u>) includes 12 compounds but only 8 or 7 are reported. The complete acronyms should be used in this report; TNT should be 2,4,6-TNT, DNB should be 1,3-DNB, etc.

Response: Table 3.1 has been rewritten. Analyses were conducted for eight explosives compounds now listed in all the pertinent tables. In certain instances, only seven were reported because the lab could not distinguish between 2,4 DNT and 2,6 DNT.

29. The report should justify the chemical analyses that were performed at the ABG. For example, the report justifies the TAL metal analyses by stating (on page 13) that "flares contain many metals." What metals in particular? Which of these metals are TAL metals? What is the relative abundance of the metals in the flares? The report should specify the chemical composition of the materials that are typically burned at the ABG.

Response: The chemical composition of materials typically burned at ABG have been given in the report. Analyses that were done were to look for a broad spectrum of materials that may be by-products of burning at the ABG.

30. Provide a reference for the USATHAMA method for explosive (state where the method may be found and date of revision used).

Response: The USATHAMA method for explosives has been incorporated in EPA SW-846 as Method 8330.

31. The ground water contaminants presented in the 1st paragraph were referenced from the Dunbar, 1984. Please contact USAE-WES Bill Murphy for a contamination assessment (i.e., contaminated wells, levels of contaminants, isoconcentration maps, etc.).

Response: Updated groundwater contaminants from the 1992 COMARCO report have been included in the Report.

32. Where is the validation report referenced in the second to last paragraph?

Response: The validation report is in the Appendices.

33. (Next to last paragraph.) Please revise the definition of a blank. This is the definition of a method blank only.

For example, this definition is appropriate for rinsate blanks or GC injection blanks.)

Response: The definition has been revised.

34. I requested a copy of the EM 1110-2-1906 manual with my internal draft comments. Would you please send a copy?

Response: A copy will be sent.

35. The report defines duplicated precision for field samples on page 17. It then states that if differences between the sample results "are small, the samples were determined to be similar." Sample results with the "% Differences" are listed in Table 3.4. However, the report does not discuss the duplicate precision of the sample results. Based on these results, was soil sample "12/#1" homogeneous? State what is believed to be good duplicate precision for soil sample (e.g., a percent difference of less than 30%).

Response: The report now states that good duplicate precision is within 30 percent.

36. (Second paragraph.) The report states that "blank data indicates that the samples were not tainted by the sampling or analytical routines." The report should elaborate. How does the blank data indicate this?

Response: The report now says that since method and field blanks do not show contamination, the samples are not expected to be tainted.

37. (Second paragraph.) List the control limits for the analytes in Table 3.5 and state where they come from. Inform the reader that most of the recoveries are close to 100%--ideal recovery. Please explain why certain recoveries (e.g., lead) were omitted from Table 3.5. At what depth was the sample of Table 3.5 taken?

Response: The control limits for the analytes in Table 3.5 are the method detection limits and are given beside the less than sign (<) in the tables. Some analytes don't require recovery, so no recovery is given. The sample depth in feet is given beside the sample number in the table.

38. (Table 3.4.) What does "file sample absorbance" refer to in the key of Table 3.4? State whether the "N-flag" refers to the

post- or predigestion spike. Explain the term "(not ident)." The key states the Contract Required Detection Limits (CRDLS) were used. Please explain why Contract Required Detection Limits were used for SW-846 methods?

Response: File sample absorbance is the base reading without the spike. The N-flag is the post-digestion spike. The term "not ident." is explained in the footnote. Contract required detection limits are the same as SW-846 methods.

39. (Table 3.4) Assuming it is appropriate to use CRDLs for SW-846 methodology, Table 3.4 should list the instrumental detection limits (IDLs) and CRDLs for each of the analytes. Otherwise, Table 3.4 should list method detection limits (MDLs) for the analytes.

Response: Table 3.4 lists the method detection limits beside the less than sign (<). Only in the few cases where values are listed lower than the MDLs are instrument detection limits different. The values in those cases are listed for precision purposes, but are not significant.

39.1 The text should explain how all types of detection limits (e.g., IDLs and MDLs) were determined. When sample results are summarized in a table, MDLs should be listed in a separate column of the table. Results below the MDLs should be left blank to increase the readability of the table. MDL studies should have been performed for the organic analyses. The MDLs for the organic analyses should be presented in tables summarizing the sample results. State how these MDL studies were performed and the date that they were performed. Define the MDL using statistical concepts.

Response: Detection limits were taken from EPA SW-846. The equation for the MDL is:

$$MDL = KS_B / M$$

where: M = slope of the calibration line
S_B = standard deviation of the average noise level
K = 3

40. (Table 3.6) Specify the depth of the soil sample. Explain the term "statistical quantitation limit." Explain (in the body of the text) what type of detection limits are given in the table (method detection limits at 95% confidence level, instrumental

detection limits at 99% confidence level, CRDLs, etc.).

Response: The depth of the soil sample is given in Figure 3.2 and beside the sample number in most tables. The proper detection limits are method detection limits as defined above. The term "statistical" has been removed from any reference to quantitation limits.

41. The report states that the analytes found in the rinse blanks "are considered field induced contaminants...and [are] not considered to have any effect on the interpretation of the data." This is not completely accurate; the presence of certain analytes in the rinse blanks increases the detection limits for these analytes. For example, because of blank contamination, the detection limit of heptachlor is higher than the method detection limit. The report should specify the increased detection limit for heptachlor.

Response: We do not feel that detection limits should be changed for blank contamination on the order found in these analyses.

42. (Table 3.7.) Why are there blank spaces in the last column of the table?

Response: The data for the blanks in the last column has been added to the Table.

43. (Table 3.9.) Specify the sample depth. Explain why some data was omitted from the tables. List the ranges for acceptable recoveries for the first six analytes. Page 27 states that the results of the pesticide, herbicide, and PCB analyses are listed in Table 3.9. No PCB results are listed. Recoveries and percent differences for the PCB analyses should be presented and discussed.

Response: Table 3.9 has been revised as requested.

44. (Table 3.10.) List the percent differences for the duplicate analyses. Why is the 2,6-DNT analysis omitted? List the method detection limits for the explosive analyses and explain how they were determined. Abbreviations (e.g., "RDX") should be defined in a key at the bottom of the table.

Response: A column for percent difference has been added to the table. The lab could not separate 2,6 DNT from 2,4 DNT, so results are given as 2,4 DNT. The method detection limits are to the right of the less than sign in the table and are from Method

8330. Abbreviations are defined in the report.

45. (Table 3.11.) Explain why some information is omitted. List the ranges of acceptable recoveries for the explosive analyses.

Response: Table 3.11 has been revised as requested.

46. (Next to last paragraph.) The reports states:

> **The method used for the detection of explosive compounds in the soil is not an EPA method. Therefore, no recovery ranges are presented.**

(i) The punctuation of this sentence is incorrect; the comma after the word "method" should be a semicolon.

(ii) The rationale for not presenting recoveries is inadequate. NEESA Level C QA/QC protocol specifies the use of control charts to establish acceptable percent recovery ranges.

Response: The punctuation has been corrected. Since the method has been incorporated in SW-846, recovery ranges can be found in Method 8330 and are given in Table 3.11.

47. The report should discuss the data of Table 3.9 (e.g., the significance of the reported spike recoveries for the soils and water data.)

Response: The spike recoveries for the data was generally good, although 2 spiked samples fell outside the control limits.

48. (Table 3.8.) Define the abbreviations used in this table or refer the reader to a section of the report where the abbreviations are defined.

Response: A table of names and abbreviations is included in the report.

48.1 Section 3.5.0, "Data Evaluation," enhances the report in that it attempts to illustrate method of approach for the assessment of data quality. However, data validation is not adequately addressed. Data validation is discussed in rather general terms (e.g., see the second paragraph of page 17). For example, it states that data is evaluated with respect to precision, but it does not state what guidelines are used to determine if precision is acceptable (e.g., acceptable ranges of

relative percent differences are not listed. Many factors used to assess laboratory data quality are not addressed. Hence, the extent of the data review is not clear. For example, the report does not state if continuing calibration standards were assessed; if the "tuning" for the GC/MS analyses were examined and so forth. The flags for the data listed in the tables of Appendix D indicates some type of data review was performed; very few data points are flagged for problems. Was the data that good or was the data reviewed with respect to limited criteria? For example, there are no J-flags to indicated holding times were exceeded, problems with initial or continuing calibrations, etc. Furthermore, the report does not state that any data validation summary reports were generated to assess data quality. Data validation summary reports are generated when data is thoroughly reviewed. These reports presented a detailed assessment of data quality: list holding times that were exceeded, continuing calibrations that were not performed, unacceptable matrix spike recoveries, etc. Data validation summary reports indicate what data is usable (e.g., for a statistical analysis such as a t-test). EPA's Functional Guidelines for Organic and Inorganic data contain specific criteria for the validation of CLP data, but the data in this report was generated using SW-846 methodology. Were these guidelines used for the validation of the SW-846 data? If not, the report should reference the guidelines that were used or it should state discuss them in more detail. (If necessary, please forward these comments to the USAEWES-ALG and coordinate a response. We are available to meet and discuss the data validation with Wilmington and ALG.)

Response: Data validation summary reports were done and are included in the Appendix. Any problems with the data are flagged in the tables. All data were reported at or below contract required detection limits. Data for QA samples were within acceptable limits.

48.2 Section 3.5.0 states that "all data is checked...before it leave the laboratory" (with respect to six criteria that are listed on page 16). The report also states the data was reviewed after it was received from the laboratory. The report should state that the latter constitutes data validation--the systematic review of analytical data using predetermined quality criteria by an independent party (by definition, a laboratory cannot validate its own data).

Response: See the data validation summary report in the Appendix. Data validation was performed by the ALG.

49. Figure 4.7 is a good representative of the ABG soil thickness. Can site features be included on this Surfer(?) contour map? It would give much more perception.

Response: Site features have been added to the map.

50. (First paragraph.) The "3-inch Shelby Tubes" refers to Shelby Tubes with a 3-inch inner diameter?

Response: The text has been changed to say "Shelby tubes with a three-inch inside diameter".

51. (2nd paragraph.) A sentence referred the reader to "...See Section 2.0 PREVIOUS STUDIES). Section 2.0 provides only a chronological listing of bibliography, no specific information.

Response: Section 2.0 has been rewritten to provide this information.

52. Delete the term "disposal" from the last paragraph. The ABG is not a disposal facility.

Response: All references to disposal areas and many references to disposal have been deleted from the text. Since burning and detonating are methods of disposing of explosive materials, disposal in that sense remains.

53. (Table 5.1.) Explain terms "compound B" and "compound A."

Response: Composition A is 91% RDX and 9% wax. Composition B is 60% RDX, 39% TNT and 1% wax.

54. (Figure 5.1.) Explain the notation "VF" (e.g., what is "VF-11").

Response: The locations "VF" are for valley floor and are from previous WES borings.

55. The second paragraph of this page is redundant; these QA/QC samples were previously discussed.

Response: The redundant paragraph has been removed.

56. The rationale for the soil sample locations and frequencies should be discussed. Table 5.1 is inadequate. For example, only one soil boring (boring #5) was collected for the "Burn Pads." Figure 5.1 indicates there are five of them--why is only one

sample sufficient to determine the presence of contamination for the soil around five structures?

Response: Project objectives are discussed in section 5.1.0. This part I study was a source contamination study for the variety of waste units found within the ABG. Representative borings (9) were placed in locations most likely to be contaminated. Three control borings were placed in locations believed removed from contamination (based on groundwater sampling and analyses).

58. (Second paragraph.) State the confidence level of the F-test.

Response: The confidence interval of the F-test is the 95% confidence interval.

59. The report should present statistical equations and sample calculations to illustrate the statistical analysis of the data. The report should explain how the data was assessed based on the F-test results. For example, how was the data assessed when the variances of the control means were significantly different from the sample means? The null and alternative hypothesis should be stated in mathematical terms.

Response: The text has been revised to illustrate the statistical analysis.

60. The report states:

In order to have a sufficient number of samples for these computations...all samples from a particular boring were used.

Hence, the report states that analyte concentrations at different soil depths within a particular boring are averaged only because a limited number of samples were obtained. Homogeneity of the soils would strengthen the justification for averaging the data in this manner. The boring logs seem to indicate the soils at the ABG are relatively homogeneous even at different elevations.

Response: The statistical comparison of the means of all samples from a specific boring with that from another boring is intended only as a descriptive tool. The specific comparison of chemical content of identical soil strata would be desirable but was not possible with the available data. The boring logs indicate that the soils sampled were generally similar, being predominantly clay and clayey gravel with lesser amounts of sand and silt.

This soils similarity made averaging the soils data at least a conservative description of the contaminant characteristics of the soils.

61. Literature values for regional background concentrations of metals should be qualitatively compared to the background metal concentrations obtained in this study.

Response: We have searched for regional metals data but cannot find any. We did compare control boring for the ABG with other Crane control borings.

62. Please rephrase the statement: "Thus comparison of a specific sample from boring to boring may not be relevant." This could mislead the reader. Does not a t-test involving a sample mean and corresponding control mean amount to a "boring to boring" comparison?

Response: This sentence has been corrected by adding a missing word, "comparison of a specific depth sample".

63. DATA QUALITY SHOULD BE DISCUSSED BEFORE THE STATISTICAL ANALYSIS OF THE DATA IS PRESENTED! Data quality is assessed to omit invalid results from statistical analyses.

Response: Only valid data were used in the statistical analyses.

64. (Table 5.3.) Does "s.d." in Table 5.3 refer to the standard deviation for an individual value or the standard deviation for the mean (the latter is equal to the former divided by the square root of the number of data points)?

Response: The abbreviation "s.d." refers to standard deviation, the square root of the variance or the root-mean-square deviation from the mean, in either population or sample. It is a measure of the dispersion or spread in the probability or frequency distribution of the observed chemical data. As the s.d. is used in the denominator of the t-test, an increase in the s.d. reduces the "t" value, moving the value away from the critical region. Flagging the situation where the sample mean was less than the s.d. was arbitrary and was only intended to show where disperse data distributions occurred.

65. (Table 5.3.) What is the purpose of reporting means that are not statistically different from control means in bold print? For example, the mean Cr concentration for boring 7 is in bold print even though it is not statistically different from the

control mean. This seems to defeat the purpose of the statistical analysis.

Response: The bold print showed the analyst which analytes to test for significant difference.

66. (Table 5.3.) Please explain the use of the symbol "#." The key states:

Standard deviation is greater than the sample mean. When this occurs, the ability to distinguish a statistically significant difference between the control and specific boring means is reduced.

State what statistical criteria (e.g., F-test using 95% confidence level) was used to determine if the "standard deviation is greater than the sample mean." How was the data analyzed when there was significant difference between the control and boring means? This is not explained in the body of the report.

Response: The only criteria used was a determination that the standard deviation was greater than the mean. This was simply observed and noted in the tables. This situation occurred because of the small sample size and high variability of the data.

67. (Table 5.3.) The comparison of the sample boring results with the control boring results would have been more effective if confidence intervals were reported for the background (control) samples. (When control and sample variances are equal, sample means that fall outside the confidence limits for the control means are statistically different.)

Response: This would be a valid comparison, but was not done because of the difference in variance.

68. (Table 5.3.) The statistical analysis of the data presented in Table 5.3 does not adequately take data quality into account. For example, Table 5.2 uses an "N-flag" for all the As results for boring 6. An N-flag indicates that a spike recovery is not within control limits. Because this is true, the mean As concentration for boring 6 is qualitatively different than the mean As concentration for a boring with unflagged As concentrations--the mean As concentration for boring 6 is estimated (it may be biased high or low, depending upon the bias of the individual As concentrations listed in Table 5.2). Table

5.3 should indicate that the mean As concentration for boring 6 is estimated (e.g., is biased high).

Response: A flag for estimated data has been added to Table 5.3.

69. When possible, the flags used in the tables of Appendix A should address data bias. (For example, low matrix spike recoveries indicate data is biased low.)

Response: See response to comment 68 above.

70. The table presented on page 44 well summarizes analytes significantly greater than background. Why isn't a similar table presented for borings 7, 9, and 12? Why aren't the TP analyses listed? At a minimum, <u>the report should try to relate the metal contaminants found at borings 7, 9, and 12 with the waste disposal activities near these soil borings</u>. (The report simply states that a release of a particular metal at a particular boring has occurred because a statistical difference for the mean was observed.)

Response: Borings 7, 9, and 12 are discussed in the text, but have been added to the table. Total phosphorous has also been added to the table. The text discusses the waste disposal practices at the ABG, but no analyses of wastes are available thus no correlation with soils data can be made.

71. The report should explain the following statement:

There is a possibility that borings 1, 2, and 3 are contaminated with these metal analytes as a result of unknown anthropogenic activities...

(i) What analytes are being discussed--all the TAL inorganics or only arsenic, beryllium, selenium, thallium, cobalt, or iron?

(ii) Yes, the selection of poor background samples is always a possibility. However, one of the objectives of a soils investigation is to minimize this possibility (e.g., the selection of multiple background samples from different locations and the comparison of background results with literature values for regional background concentrations of metals). The report should address the reliability of its background data instead of simply presenting a disclaimer.

Response: Only the listed metals are discussed in the referenced statement. Because no regional metals data is available,

background borings from other sites have been examined.

72. It is recommended that mean concentrations also be plotted in Figures 5.4 - 5.12. For example, the mean Cd concentration for the control samples could have been compared to the mean Cd concentration for boring 7. If each plot were to occupy the entire page, the readability of the bar graphs would be improved.

Response: We feel that the individual values are more meaningful than the mean. They are a visual representation of all the data rather than a measure of data tendency. Two figures per page seemed like a good compromise between readability and report length.

72.1 (Third paragraph.) Please amend the use of the term "total phosphorus." "Total phosphorus" refers to analytical methodology not to an analyte: It is correct to refer to a release of phosphorus, but it is not correct to refer to a release of "total phosphorus."

Response: The references to phosphorous and total phosphorous have been corrected.

72.2 There is little attempt to relate the geophysical data (presented in Section 4) to the analytical data (presented in Section 5). For example, the report states (page 33):

Examination of the boring logs 4, 5, 7, and 9...shows soil containing debris such as...copper shells and rusty nails. The above physical evidence was correlated with the chemical analysis to describe the areas of the potential contamination.

Where was this correlation performed? The results of the metal analyses for these borings (Section 5) were not related to the chemical composition of the cultural debris (e.g., the presence of copper shells giving rise to high copper concentrations at one of these borings). As a second example, the soil data of Section 4 was not used to justify the statistical analysis of the metal data presented in Section 5 (e.g., see comment 35).

Response: The text has been modified to include a discussion of chemical and physical data. The study did not analyze the cultural debris, but only analyzed the soil, so the data cannot be statistically correlated.

73. (First paragraph.) The report should revise the detection limits for the inorganics based on the results for the blank

analyses.

Response: We do not feel it is correct to revise the detection limits for the minor blank contamination encountered in this study.

74. Salient problems with the analytical results for the metals should have been discussed here. For example, the report should address the poor matrix spike recoveries for the Be analyses.

Response: Discussion of analytical problems has been added to the text.

75. The report should explain how the results of the explosive analyses relate to the disposal activities. For example, the report states that "tetryl was the only explosive found at boring 10." Is this consistent with the disposal activities near boring 10. According to Figure 5.1, boring 10 was performed near the "red phosphorous burn pads." Was tetryl ever burned there?

Response: We only know that phosphorous and boxes were burned there, but tetryl may have been burned but not reported.

76. The quality of the explosive analyses should be discussed in general terms. A full validation summary report of the explosive analyses is not required; however, the information pertaining to the QA/QC for these analyses is inadequate. For example, the report should discuss the detection limits for the analyses (For example, how were they determined and when?). Was accuracy and precision generally acceptable? Did any problems with these analyses affect data interpretation? In short, the reader must know the reliability of the data. The discussion presented in Section 3.4.0 of the report describes method of approach for the assessment of data quality. However, a data quality assessment for each set of analyses must still be reported and justified in some fashion. Discussion of the results of the blank analyses alone is not sufficient.

Response: The explosives analysis followed the USATHAMA method now incorporated as Method 8330. A discussion of data quality has been added to the text.

77. Please explain the phrase "not in sufficient amounts to statistically quantify." What are the quantitation limits? Define them using statistical concepts.

Response: This has been rewritten. Method detection limits from

8330 are now used for explosives.

78. The report states that "a release of trichloroethane and tetrachloroethane [PCA] may have occurred at the ABG."

(i) Detections of TCE--trichloroethene (not trichloroethane)--are reported (see Table 5.10) at soil borings 7 and 12. Please clarify this discrepancy.

(ii) Since TCE and PCA are the only VOCs that could have been released at the ABG, the report should discuss the quality of the TCE and PCA analyses more thoroughly. Blank contamination is adequately assessed but other data quality criteria are not. For example, if matrix spike and surrogate spike results indicate a high bias, low detected concentrations may be false positives. Unacceptable results for the continuing calibration may also indicate false positives. The precision and accuracy of the TCE and PCA analyses should be addressed in more depth.

(iii) If the laboratory data does indicate that these two compounds have been released, the report should emphasize that the detected levels of the two VOCs are extremely low. The halogenated VOC concentrations appear to be too low to be hazardous. For <u>drinking water</u> the NCL for 1,1,1-trichloroethane is .2 mg/L; that for trichloroethylene is .005 mg/L. Action levels for soils should be considerably higher. For example, a soil clean-up level of 55 mg/kg (ppm) has been used in EPA Region I for trichloroethylene (This value was calculated using OSWER Directive exposure factors for dermal contact and ingestion). The state of New Jersey has a draft surface soil cleanup standard of 23 ppm for trichloroethylene. Concentrations of TCE and PCA of less than 3 ppb were detected at the ABG--lower than most drinking water standards for volatile halogenated alkanes. The report should make an attempt to list ARARs for the contaminants of concern. At a minimum, order-of-magnitude estimates should be given. The detection of a compound is not significant unless it is present at a hazardous concentration. However, the reader is not presented with enough information to determine whether detected concentrations of analytes are high enough to be hazardous (which will determine if further investigation is warranted).

Response: References the Trichloroethene have been corrected. The precision and accuracy of the TCE and PCA analyses is discussed in more detail in the text. Lists of ARARs are beyond the scope of this study. Discussion of the significance of the levels of TCE and PCA found has been added to the text.

79. The discussion of the VOC TICs is very superficial. The report simply states:

A release of several tentatively volatile organic compounds may have occurred at the ABG.

Can the TICs detected be related to the disposal activities at the ABG? How do the TICs found in the background samples compare to the TICs found in borings 4-12. For example, methylcyclopentane at an estimated concentration of 0.02 mg/kg was found in boring 5. A methylcyclopentane concentration of 0.07 mg/kg was found in boring 2--a control boring. How can the release of methylcyclopentane be attributed to disposal activities at the ABG? Were TICs found in any of the blanks?

Response: The discussion of VOC TICs has been expanded. No significant release of VOC TICs can be shown.

80. The results of the semivolatile analyses should be related to the waste treatment activities at the ABG. For example, describe if the detection of 2,4-dinitrotoluene at soil borings 5 and 6 is consistent with the disposal operations near these borings. (For example, if TNT was burned at these soil borings could 2,4-dinitrotoluene be combustion product of TNT?) Discuss a probable source of the PAH contamination.

Response: Borings 5 and 6 were in the vicinity of burn pads and red water disposal, so the PAH contamination could be a combustion product of TNT.

81. Table 5.15 should be presented here since it summarizes the discussion on page 59.

Response: Table 5.15 is the tabular part of section 5 and will be referenced in this section.

82. The discussion of the TIC results is not sufficient. The report simply states that a "release of tentatively identified semivolatile organic compounds" occurred. No justification is presented. In particular, the report should compare TICs found in the control and sample borings. For example, 3-hexen-2-one was found in both sample and control borings. Hence, the conclusion that a release of this compound can be related to ABG treatment activities is not justified. The possibility that some of the TICs detected are decomposition products from the disposal of explosives should be addressed. Where any TICs found in blanks?

Response: The text has been modified to say that TICs may have come from the decomposition of explosives compounds. The discussion of TICs in the text has been expanded, but it is difficult from the data collected to determine the source of the TICs. The statement regarding the release of TICs has been omitted.

83. See comment 51, part (iii), last three sentences.

Response: Discussion of the significance of the semivolatile TICs has been added to the report.

84. The pesticide results should be more thoroughly discussed. Pesticides not found in associated blanks should be summarized in a table. The report states:

However, it cannot be determined from available information if the pesticide and herbicide residues detected are the result of waste disposal activities or the result of insect and vegetation control activities.

To address this issue, the report should list (in a table) the pesticides that were not found in the background samples (or associated blanks).

Response: The report now lists pesticides and herbicides detected and not detected in a table.

85. Why do the RECOMMENDATIONS include 9 explosive compounds to be included in the Part II study when only 8 compounds were reported in the tables and page 13 only listed 7. Please revise.

Response: The part II study probably should include all 12 explosives compounds included in Method 8330, even though this study only looked for 8 compounds and of those could only separate out 7 compounds.

86. The report should minimize repetition of information. In particular, the discussion presented at the end of Section 5 (pages 61 - 62) is somewhat redundant; the analytical data is discussed again in Section 6. For example, Section 5 states that a "TNT concentration of 1640 mg/kg was found at boring 4. Section 6 states that the "highest level of TNT (1640 ppm) was found in boring #4." Furthermore, much of information presented in Appendix D and Appendix E is repetitive.

Response: The report has been revised to eliminate repetition.

Naval Surface Warfare Center, Crane, Indiana

1. **p.12. ¶ 1 of §3.2.0**
"...used in places where..."

Response: Correction made in text.

2. **p.12. ¶4 of §3.2.0**
Explain why cuttings from greater than 5 feet were not drummed.

Response: Paragraph has been rewritten to indicate that all drill cuttings were drummed.

3. **p.12. ¶4 of §3.2.0**
Why was there water in the holes if the sample depths were, according to §3.2.0 ¶1, taken above the groundwater table?

Response: All soil samples were taken above the groundwater table. However, the borings may have been extended deeper following the soil sampling in order to gain additional geologic information.

4. **§3.3.0 ¶1 on p.15.**
As written this paragraph seems out of place. It either needs a qualifier or moved to §1.3.0.

Response: The paragraph has been rewritten to eliminate redundant or out of place elements.

5. **§3.3.0 ¶2 on p.15.**
Verb tense disagreement: "...tracking procedures are continued..."; "...control plan was followed."; "...management was started..."; "...reports were kept."; "data is checked..."; etc.

Response: The paragraph has been rewritten.

6. **p.18. ¶3, and p.22.**
"For semivolatile analysis, sample number 12#3 was used as the example data." Sample number 12#3 was used for an example of the volatile analysis.

Why was sample number 12#3 used for volatile analysis instead of sample number 12#1, which was used for the other example data sets?

Response: The text has been corrected. Chemical data from soil boring 12 sample number 3 were used as example data for volatile analyses and data from soil boring 12, sample number 1 were used for as an example data for semivolatile analyses.

For volatile analyses, the analyses of boring 12 sample 3 provided a better illustrative example than did sample 1 of the same boring.

7. p.24. Table 3.7
Why are the results for DBuPHTH and B2EHPH not reported with a B-qualifier? Is there any difference between page 2 of 3 and page 3 of 3, besides typographical errors?

Response: Table 3.7 has been corrected.

8. p.28. Table 3.10.
For HMX, why is 6.24 mg/kg a J-value, but 6.21 is not?

Response: The table has been corrected.

9. §5.2.1
Looking at the metals and inorganics data presented for the borings, borings 1, 2, and 3 appear contaminated. From the following Tables 1, 2, and 3, it is apparent that the background samples have:

1. **2nd highest Be minimum**
2. **3rd highest FE minimum**
3. **Highest Be and Fe means**
4. **2nd highest As and Co means**
5. **Highest As, Be, and Fe maximums**

Thus, the background borings appear contaminated and perhaps should not be used for comparison purposes. However we know a good deal about the operations at the ABG. For example, we know that open burning of phosphorus might cause phosphorus contamination. Furthermore, Pb, Al, Mg, and Ba are common constituents of explosive and pyrotechnic compounds, and projectile casings may cause contamination with Zn, Cr, and Cd. Therefore, the contaminants found in the background are not typically those that you would expect to find from open burning operations.

The point is that what is needed in the report is some sort of description of what types of contaminants are expected from our

knowledge of the operations, otherwise, the background borings appear contaminated and unusable. Even a statement to the effect that contaminants found in the background borings should not occur as a result of open burning operations would greatly help the reader to interpret the data.

Response: Table 3.3, which indicates the composition of materials likely burned at the ABG, has been added to the report. The interpretation of inorganic constituent data is complicated by the fact that these compounds are natural crustal components of soils. Therefore, the presence of these elements does in itself not comprise a contamination. Of the elements mentioned in the comment as likely contaminants produced by open burning and from projectile casings, Pb, Al, Mg, and Ba and Zn, Cr, and Cd, respectively, borings 1, 2, and 3 were generally orders of magnitude less in concentration than waste activity or test borings.

Based on other chemical data obtained, i.e., analyses for semivolatile organic compounds, volatile organics, and explosive compounds, the selection of borings 1, 2, and 3 as background borings is believed to be appropriate.

10. p.56. ¶2 of §5.2.2

According to Drum Inventory For: Naval Weapons Support Center Crane, Indiana, Boring 8#1 was reported as a J-value for HMX at 0.265 mg/kg. The inventory also reports J-values for boring 10#2 of 0.115 and 0.215 (mg/kg) for TNT and RDX, respectively. Tetryl was not listed.

Response: Corrections have been made to tables and text of the report.

11. p.57. ¶1 of §5.2.3 and Table 5.10

Should the result for 1122TClA at boring 10#2 be reported as a B-value?

Response: The Table has been corrected.

12. §5.2.3

A summary table listing all the compounds that were tentatively identified in Table 5.10 would be helpful for interpretation purposes.

Response: A summary table of tentatively identified compounds (TICs) was not prepared as the assigned identity and estimated concentrations of tentatively identified compounds (TICs) are in most cases uncertain. In view of these uncertainties, TIC

information was not analyzed in detail. The TIC data is presented to simply document all information available from the lab.

13. <u>§5.2.4</u>

The following sample results were greater than 10 times the concentrations found in the associated blanks:

DEtPHTH	**12#3**								
DBuPHTH	**10#1**	**10#2**	**10#5**	**6#1**					
B2EHPH	**12#4**	**10#1**	**10#2**	**10#3**	**10#5**	**9#3**	**7#1**	**4#1**	**4#3**
	3#2	**2#1**	**1#2**						

<u>Response</u>: All these phthalates were determined in estimated quantities (below accurate quantitation limits) (J-values). Additionally, as all these phthalates were found in method blanks and not uniquely in samples, there is evidence that these constituents are laboratory contaminants.

14. <u>p.59. ¶5 of §5.2.4</u>

"only diethyl phthalate was detected in soils from boring 11..." DEtPHTH found in boring 11 was reported as a J-value. DEtPHTH was also found in the associated equipment rinse at a similar concentration. Furthermore, considering comment 13, and the fact that most concentrations are not statistically quantifiable, is the statement that "Borings 12, 9, 8, 7, 6, and 5 produced soils with semivolatile organic analytes" justifiable, and so shouldn't borings 10, 4, 3, 2, and 1 be included?

<u>Response</u>: The report text has been modified and a new table (Table 5.16) has been added to help put the semivolatile constituents into perspective. It is believed that the interpretation that phthalates found in blanks and samples are laboratory contaminants (see comment 13).

15. <u>Tables 5.13 and 5.16</u>

Is there any knowledge as to whether any of the compounds tentatively identified in these tables might be decomposition products of explosive compounds, particularly HMX and RDX?

<u>Response</u>: It is likely that many of the TICs are decomposition products. However, as discussed in comment 12, the assigned identity and estimated concentrations of tentatively identified compounds (TICs) are in most cases uncertain. In view of these uncertainties, TIC information was not analyzed in detail. The TIC data is presented to simply document all information available from the lab.