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CHARACTERIZATION REPORT FOR THE ELZA GATE SITE, OAK RIDGE, TENNESSEE

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CHARACTERIZATION REPORT FOR THE ELZA GATE SITE, OAK RIDGE, TENNESSEE

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By

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EXECUTIVE SUMMARY

In 1989 and 1990, radiological, chemical, and hydrogeological characterization activities were conducted at the Elza Gate site in Oak Ridge, Tennessee, to determine the boundaries of contamination that is in excess of guidelines set forth by the U.S. Department of Energy (DOE) for its Formerly Utilized Sites Remedial Action Program (FUSRAP) and other applicable regulations. The Elza Gate site is an 8.1-ha (20-acre) area with five concrete pads located on the northern side of the site. Survey activities included near-surface walkover gamma surveys, soil sampling, and gamma logging of the boreholes. In general, these surveys indicate levels of contamination in excess of DOE guidelines around the edges of the concrete pads, the cul-de-sac of the access road, and several other small areas on the site.

Soil sampling results indicate that most of the radiological contamination is around Pads 2 and 4, around the cul-de-sac, south of the road near Pads 1 and 2, and between Pads 1 and 2. The maximum depth of contamination is 1.5 m (5 ft).

Data from radiological surveys performed on the pads indicate that all the pad surfaces have areas of contamination that exceed DOE guidelines and will require remedial action. Pad 2 has the highest levels of surface contamination. Analytical results indicate lower levels of contamination on Pads 1, 3, 4, and 5; radiation measurements were below guidelines over most of the surface of Pad 5.

Results from the 1989 chemical sampling effort indicate the presence of polychlorinated biphenyls (PCBs) at various locations on the site. A more thorough chemical characterization performed in 1990 indicates that PCBs are present primarily in the southeast corner. The maximum depth of PCB contamination is 0.3 m (1 ft). In general, other chemical compounds and metals were not detected or were found in concentrations that approximate background for the area.

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ACRONYMS

AA	atomic absorption
AEC	Atomic Energy Commission
ASTM	American Society for Testing and Materials
BDL	below detection limit
BLR	Bureau of Land Reclamation
BNAE	base/neutral and acid extractable
BNI	Bechtel National, Inc.
DI	deionized
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EP	extraction procedure
FUSRAP	Formerly Utilized Sites Remedial Action Program
GC/EC	gas chromatography/electron capture
GC/MS	gas chromatography/mass spectroscopy
ICPAES	inductively coupled plasma atomic emission spectrophotometry
MED	Manhattan Engineer District
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
PIC	pressurized ionization chamber
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
QC	quality control
TC	toxicity characteristic
TCLP	toxicity characteristics leaching procedure
TMA/E	Thermo Analytical/Eberline
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USRADS	ultrasonic ranging and data system

ABBREVIATIONS

cm	centimeter
cpm	counts per minute
dpm	disintegrations per minute
ft	foot
g	gram
h	hour
ha	hectare
in.	inch
kh	horizontal permeability
kg	kilogram
km	kilometer
kv	vertical permeability
L	liter
m	meter
mi	mile
min	minute
mg	milligram
μR	microroentgen
pCi	picocurie
ppb	parts per billion
ppm	parts per million
s	second
yd	yard

1.0 INTRODUCTION

1.1 BACKGROUND

Radiological, chemical, and hydrogeological characterization activities were conducted at the Elza Gate site in Oak Ridge, Tennessee, as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a U.S. Department of Energy (DOE) effort to identify and clean up or otherwise control sites where residual radioactivity remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy. Under FUSRAP, DOE is also responsible for cleanup of chemical contamination on non-DOE-owned FUSRAP sites and vicinity properties when such chemicals are mixed with radioactive contamination or are associated with activities of DOE (or predecessor organizations). On November 30, 1988, the Elza Gate site was designated for cleanup under FUSRAP.

The primary legislation authorizing FUSRAP is the Atomic Energy Act of 1954. FUSRAP was established in 1974, and major remedial action activities began in 1981, with Bechtel National, Inc. (BNI) as the project management contractor for DOE. Sites were added to the program through the Energy and Water Development Appropriations Acts of 1984 and 1985. FUSRAP, which is administered by the DOE Office of Environmental Restoration and Waste Management, currently includes 33 sites in 13 states. The objectives of FUSRAP are to:

- Identify and assess all sites used to support early Manhattan Engineer District (MED) and Atomic Energy Commission (AEC) nuclear work and other sites with conditions that Congress has authorized DOE to remedy

- Decontaminate and apply controls to these sites so that they conform to current guidelines

- Dispose of or stabilize all residues generated during remedial action in an environmentally acceptable manner

- Accomplish all work in accordance with appropriate landowner agreements and local and state environmental and land-use requirements to the extent permitted by federal law and applicable DOE orders, regulations, standards, policies, and procedures

- Certify the sites for appropriate future use

1.2 SCOPE AND OBJECTIVE

Radiological, chemical, and hydrogeological characterization of the Elza Gate site was performed to obtain data to support selection of a remedial action alternative. The goals of the characterization were to identify the location and extent of contamination, define the characteristics of the contaminated material, investigate potential contaminant migration pathways, determine whether the contaminated material exhibits hazardous characteristics as defined by the Resource Conservation and Recovery Act (RCRA), and assess potential health hazards to workers performing remedial action.

The characterization was performed in two phases. The initial phase, conducted in the spring and summer of 1989, was primarily a radiological characterization; chemical characterization was limited. Survey activities included near-surface walkover gamma scans, soil sampling and analysis, and gamma logging of boreholes. Widespread composite samples were taken for analysis of polychlorinated biphenyls (PCBs) and RCRA characteristics.

The second phase, performed in April 1990, was primarily a chemical characterization; discrete samples were taken and analyzed for PCBs, metals, and other organic compounds. Samples were also taken from beneath the pavement at Antwerp Lane to determine whether radioactive contamination exists beneath the road.

A hydrogeological investigation was also performed in 1990 to establish the distribution and relationships of subsurface geologic materials and to determine the characteristics of site soil. The methodology used is described in Subsection 3.4. These data were used to develop a site-specific uranium remedial action guideline.

2.0 SITE DESCRIPTION AND HISTORY

2.1 LOCATION AND DESCRIPTION

The 8.1-ha (20-acre) Elza Gate site is located in the eastern portion of the City of Oak Ridge, Tennessee, in what is now known as Melton Lake Industrial Park. Access to the site, which is unrestricted, is off Melton Lake Drive near its intersection with the Oak Ridge Turnpike (Figure 2-1). Most of the site is covered with vegetation. The site is divided into nine parcels; the MED warehouses were located on Parcels 1 through 4 (Figure 2-2). None of the original structures remain, but the concrete pads on which the five warehouses were built are still in place. The total surface area of the five concrete pads is 7,421 m^2 (79,884 ft^2). There is one building on the site, erected on an existing and expanded concrete pad on Parcel 1. A second pad adjacent to this building is being used for material storage.

2.2 SITE HISTORY AND PREVIOUS FIELD INVESTIGATIONS

In the early 1940s, the site was developed by MED as a storage area for pitchblende (a high-grade uranium ore from Africa) and ore processing residues. Three of the five warehouses on the site were used to store radioactive materials. In addition, smaller structures may also have been built on the site.

In 1946, ownership of the site was transferred to AEC. It is not known when MED or AEC stopped using the warehouses for storage of the pitchblende ores and residues; however, upon completion of these activities, AEC operated the property as a storage area for Oak Ridge National Laboratory (ORNL) and the Oak Ridge Y-12 Plant. During this period, access to the site was provided by a road off Warehouse Road west of the site and a railroad spur to the southwest. The railroad spur was recently removed, and the access road was closed and replaced by a new access road between the site and Melton Lake Drive.

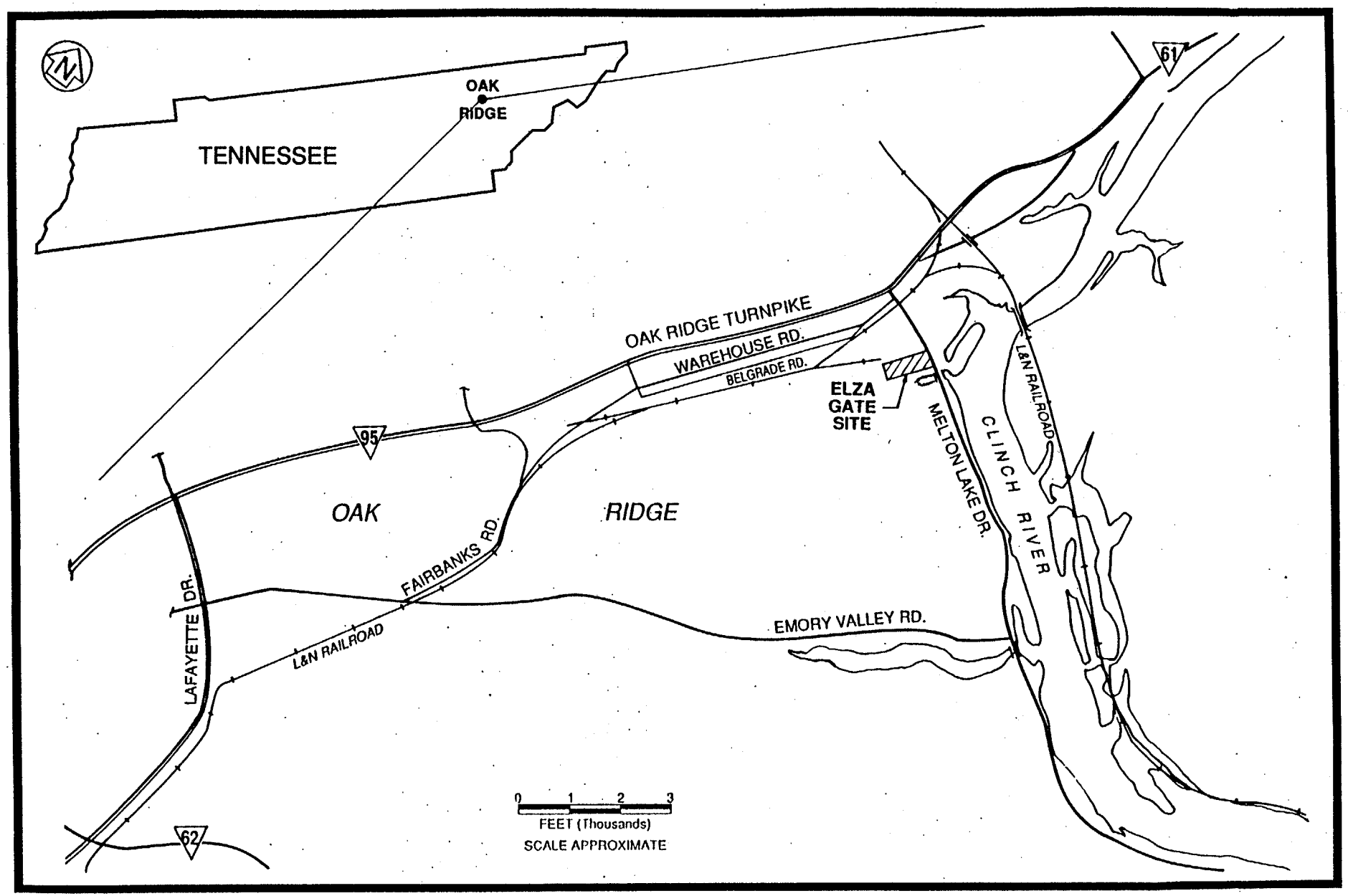

FIGURE 2-1 LOCATION OF THE ELZA GATE SITE

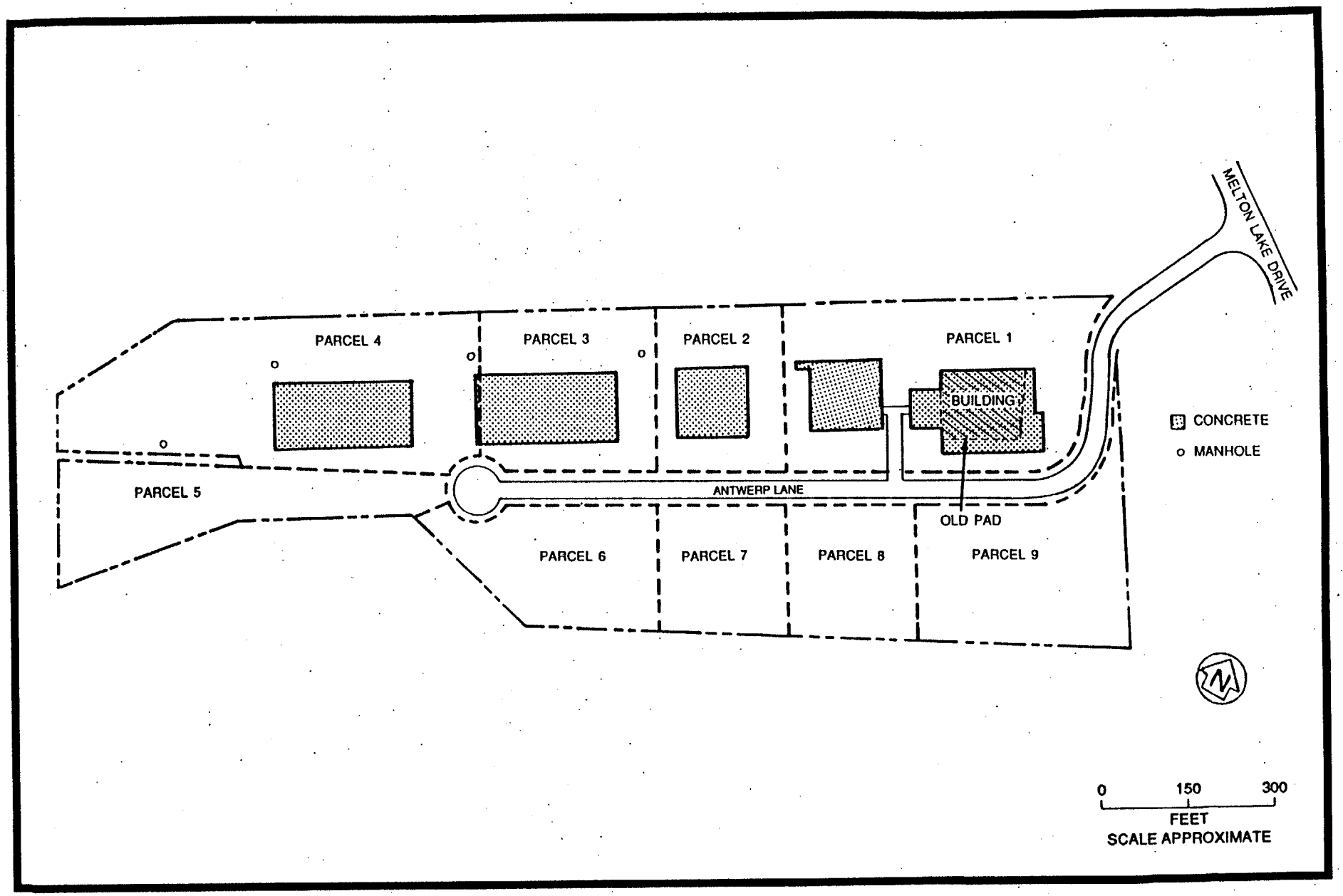

FIGURE 2-2 PLAN VIEW OF THE ELZA GATE SITE

AEC used the site until the early 1970s, at which time it was vacated. After radiological survey and decontamination activities were conducted in 1972, the site was deemed acceptable for use with no radiological restrictions (DOE 1972). At that time, title to the property was transferred to the General Services Administration and then to the City of Oak Ridge. The property was subsequently sold to Jet Air, Inc., which operated a fabricating and metal plating facility on the site.

In 1987, at the request of the Tennessee Department of Health and Environment, Oak Ridge Associated Universities (ORAU) conducted a survey at the site because of the possibility of contamination from the metal plating facility. Samples were analyzed for uranium, metals, and PCBs. Elevated levels of PCBs found during this survey were attributed to the storage of PCB-contaminated electrical equipment at the site (DOE 1988). Above-background concentrations of uranium were found in soil in the southern parcels (Parcels 5 through 9).

A preliminary radiological survey was conducted by ORNL in October and November 1988. The survey included the access road and the northern half of the industrial park, which includes Parcels 1 through 4. All four parcels contained levels of residual radioactivity above the criteria used to determine if a site warrants consideration for remedial action under FUSRAP. Alpha activity on the pads ranged from background to 90,000 dpm/100 cm^2; removable radioactivity levels measured as high as 10,000 dpm/100 cm^2. The pads on Parcels 1 and 2 were the most highly contaminated; measurements on taken Parcels 3 and 4 indicated minimal activity. The pad used as part of the floor of the building on Parcel 1 had surface contamination levels in some areas that averaged over 6,000 dpm/100 cm^2 alpha and maximum beta-gamma concentrations that approached 2 mrad/h. The survey indicated that Parcels 3 and 4 contain residues from MED materials in soil. Radium-226 concentrations were in excess of 600 pCi/g; the maximum uranium-238 concentration was 800 pCi/g.

In 1988, ownership of the property was transferred to MECO, a development company; the site is currently under development for use as an industrial park. At DOE's request in October 1988, ORNL conducted a preliminary radiological survey to determine whether the site met newer, stricter cleanup guidelines (DOE 1988). The survey indicated that contamination exceeds DOE cleanup criteria at Parcels 1 through 4. As a result, on November 30, 1988, the entire Melton Lake Industrial Park was designated for inclusion in FUSRAP (DOE 1988).

2.3 PRESENT SITE CONDITIONS

The only building on site is currently occupied by a manufacturer of metal storage containers. The pad adjacent to this building is being used for material storage. Modification of the property is expected to continue as the parcels are sold or leased.

3.0 FIELD INVESTIGATION METHODOLOGY

3.1 SITE PREPARATION

Before characterization activities began, trailers for equipment storage were installed, a civil survey of the site was completed, and decontamination equipment and facilities were assembled.

3.1.1 Civil Survey

A master 30-m (100-ft) grid, established by a civil surveyor, was used to determine sampling locations (Figure 3-1). The grid can be reestablished during remedial action and is correlated with the City of Oak Ridge and state plane grid systems. The east and north coordinates are given on all diagrams of the site. Independent 3-m (10-ft) survey grids were also established for Pads 1, 3, 4, and 5 to facilitate characterization. Because previous walkover gamma scans indicated widespread contamination on Pad 2, an independent grid was not established for this pad.

3.1.2 Decontamination Procedures

Chemical sampling tools and equipment were decontaminated before each use by following these methods in sequence:

(1) Cleaning with water and Alconox soap
(2) Rinsing with deionized (DI) water
(3) Rinsing with diluted hydrochloric acid (3 to 5 percent)
(4) Rinsing with DI water
(5) Rinsing with reagent-grade methanol
(6) Rinsing with DI water

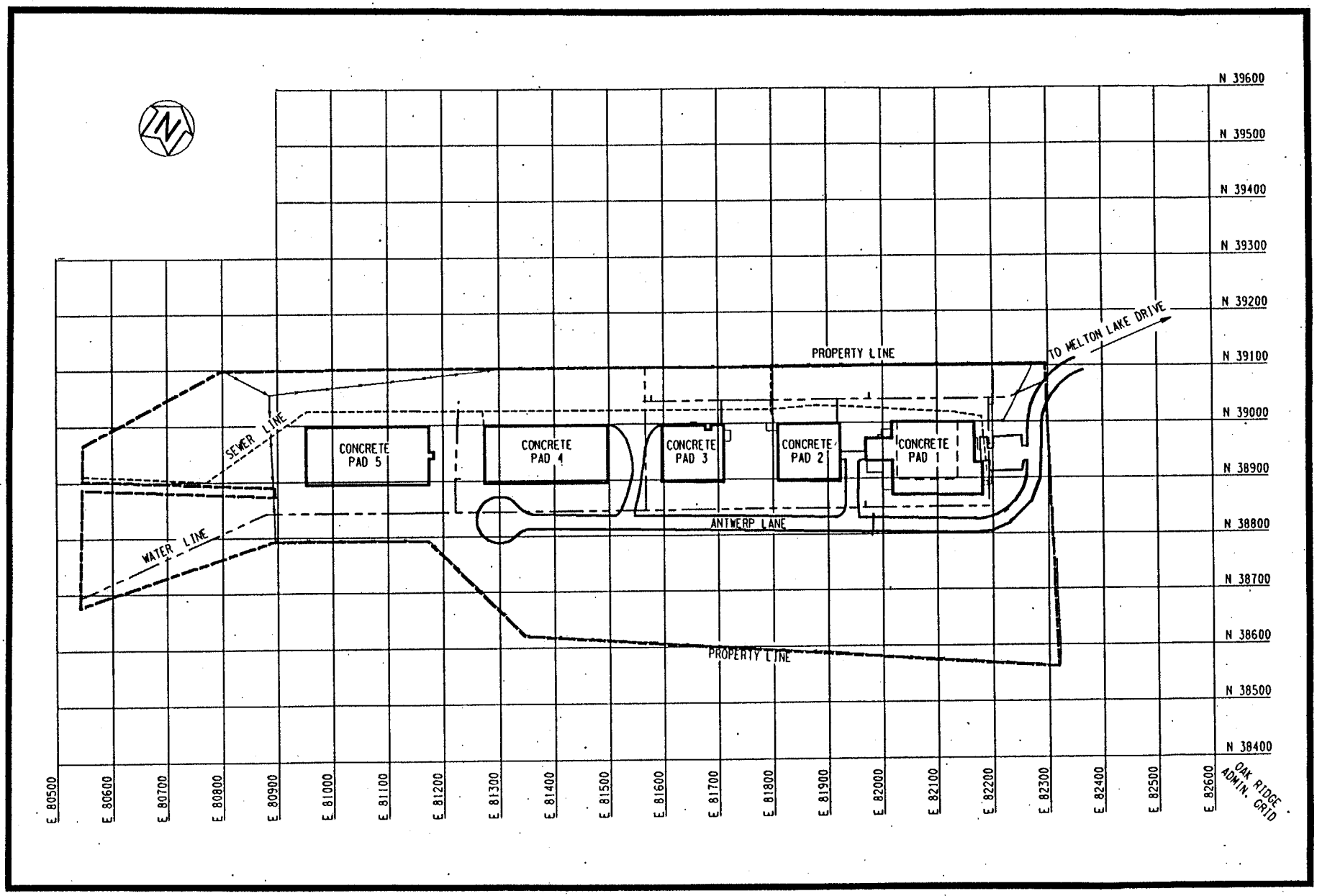

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FIGURE 3-1 MASTER GRID USED AT THE ELZA GATE SITE

Items were air-dried before use. Solvents were handled as flammable material, and the subcontractor kept a fire extinguisher readily available during all operations that required the use of a solvent. Used solvent was collected in containers (Underwriters Laboratory-listed) supplied by the subcontractor for on-site storage until it could be analyzed and disposed of.

Radiological sampling equipment was decontaminated in a similar manner, with emphasis placed on removing all soil remaining from previous samples.

3.2 RADIOLOGICAL INVESTIGATION

The following subsections describe the methodology used to conduct the radiological investigation. The purpose of each survey type and the rationale for selection of particular methods are also discussed.

3.2.1 Background Data

Radiological background data were collected in conjunction with characterization activities to determine the naturally occurring levels of the radionuclides of interest at Elza Gate. Three background sampling locations were selected within the city limits of Oak Ridge and Knoxville, Tennessee. The samples were analyzed for uranium-238, radium-226, thorium-232, and thorium-230; site history indicated that uranium-238 and its decay products were the contaminants of concern. Background data were collected using the same protocols as for the field investigation.

3.2.2 Walkover Gamma Scans

The purpose of the walkover gamma scans was to identify surface areas of elevated gamma radiation. Soil sampling was conducted in areas with high readings.

A PRS-1 scaler coupled with an unshielded Eberline SPA-3 probe was used to scan 15-m (50-ft) subsections of the 30-m (100-ft) grid. The SPA-3 probe used to measure low-level gamma radiation is a sodium iodide, thallium-activated gamma scintillation detector coupled to a photomultiplier tube.

3.2.3 Soil Sampling

For the work in 1989, soil samples were collected at the locations shown in Figure 3-2 to determine concentrations of radionuclides and define the boundaries of radioactivity in soil. All soil samples were analyzed for uranium-238, radium-226, thorium-232, and thorium-230.

Boundaries of surface contamination were determined by collecting systematic soil samples at intersections of the 30-m (100-ft) grid. Biased soil samples were taken at locations selected based on the results of the gamma walkover survey. Surface samples taken at depths of 0 to 15 cm (0 to 6 in.) were collected with a trowel. Subsurface samples were taken with an auger at 0.3-m (1-ft) intervals between 0.3 and 2.4 m (1 and 8 ft). Subsurface sampling locations were selected based on the history of the site and information from the walkover gamma scans.

Borehole locations were selected based on information from walkover gamma scans. One hundred boreholes were drilled using two different techniques. In the first technique, samples were collected from the auger flights of a mechanically powered posthole auger capable of sampling to a depth of 1.2 m (4 ft). The second technique involved using a 3-in.-outer diameter hand auger capable of sampling to a maximum depth of 2.4 m (8 ft). Approximately one-third of the boreholes were drilled to undisturbed soil. Disturbed and undisturbed materials were differentiated by slight texture and color differences.

The boreholes were gamma logged using a BHP-2 probe as a means of rapidly obtaining preliminary results on gamma radiation in subsurface soil. The BHP-2 probe consists of a sodium iodide crystal coupled to a photomultiplier tube. A section of lead is

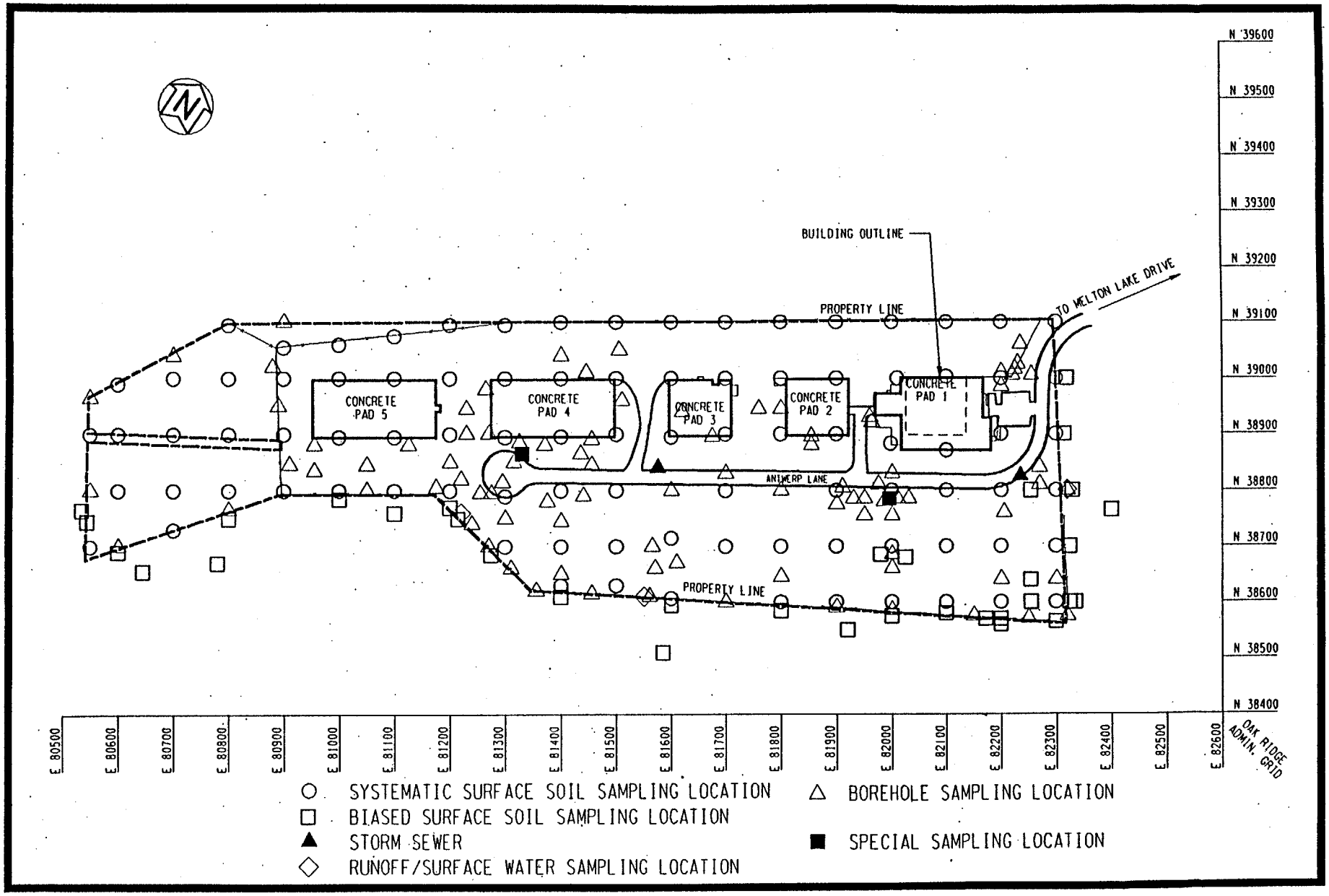

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FIGURE 3-2 SAMPLING LOCATIONS FOR MARCH 1989 RADIOLOGICAL CHARACTERIZATION OF THE ELZA GATE SITE

attached to the bottom of the crystal for geometry compensation at the bottom of the hole. The detector is connected to a portable scaler (MS-2) for determining instrument response at a particular depth in the borehole. Gamma radiation measurements taken at 15-cm (6-in.) intervals in each borehole were used as an aid in determining the depth at which samples should be collected. Gamma logging results are given in Appendix A.

After gamma logging and sampling were completed, the boreholes were backfilled. Boreholes in which contamination was found were backfilled to an area above the zone of contamination with bentonite or clean soil, and the remaining portion of the hole was backfilled with drill spoils. Uncontaminated boreholes were backfilled with drill spoils. Drill spoils were surveyed to ensure that no contaminated soil was placed in uncontaminated areas.

During the 1989 radiological characterization, radioactive contamination was found at several sampling locations at the edge of Antwerp Lane. To determine whether contamination was present under the road, 12 locations were subsequently sampled (in conjunction with the 1990 chemical characterization) at the locations shown in Figure 3-3. Small sections of asphalt were removed to provide access to the soil, and a hand auger was used to collect samples to a depth of 15 cm (0.5 ft).

3.2.4 Pad and Sub-Pad Investigations

Independent 3-m (10-ft) grids were established for Pads 1, 3, 4, and 5 to facilitate characterization. Because previous gamma walkover surveys indicated widespread contamination at Pad 2, an independent grid was not established for this pad, and only a few biased measurements were taken. Direct alpha and beta-gamma surface measurements were taken at each grid intersection, and random locations were surveyed to determine whether contamination was removable.

Surface beta-gamma measurements were taken with pancake geometry Geiger-Mueller tube detectors (EIC model HP-210/HP-260 and Bicron instruments). Surface alpha measurements were taken with

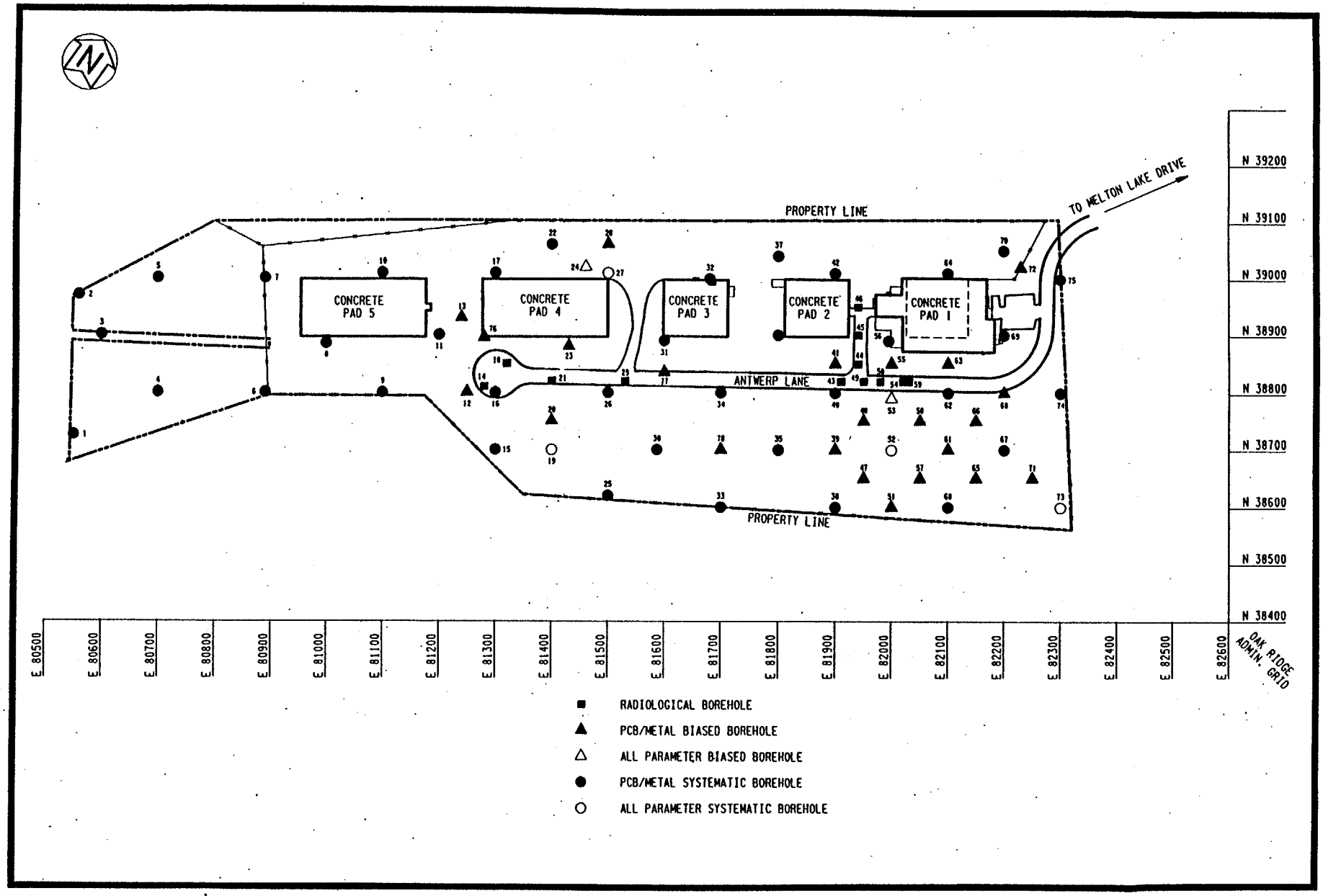

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FIGURE 3-3 SAMPLING LOCATIONS FOR APRIL 1990 RADIOLOGICAL AND CHEMICAL CHARACTERIZATION OF THE ELZA GATE SITE

59-cm^2 zinc sulfide scintillation probes (EIC model AC-3). Both types of probes were coupled to PRS-1 rate meter/scaler instruments. Gamma measurements were taken with 2- by 2-in. sodium iodide detectors (EIC model SPA-3) coupled to PRS-1 rate meter/scaler instruments. Removable alpha measurements were taken on smear paper, and the paper was counted on a zinc sulfide, silver-activated scintillation counter (EIC model SAC-4).

Sub-pad investigations were conducted to determine whether concentrations of radioactivity in excess of DOE guidelines exist beneath the concrete pads (Figure 3-4). Each pad was penetrated six times using standard hand-held drilling equipment. Samples were collected to a depth of 2 m (6 ft) below the pad, but only samples to 1 m (3 ft) were analyzed; the remaining samples were archived. The sub-pad samples were collected at 0.3-m (1-ft) intervals and analyzed for uranium-238, radium-226, thorium-232, and thorium-230.

Additional sampling was conducted at Pad 1. Samples were collected from 5 boreholes adjacent to the original pad, and 15 boreholes around cracks and joints in Pad 1 were opened with a jackhammer (Figure 3-5). Soil samples and material removed from cracks and joints were analyzed for uranium-238, thorium-232, radium-226, and thorium-230. Boreholes were backfilled with bentonite after sampling was completed.

3.2.5 Air Monitoring

Twenty-seven radon flux measurements (the only air monitoring data collected) were taken at the site (Figure 3-6). Charcoal canisters were placed on the ground and left for 1,445 to 2,190 min. The canisters were analyzed using an automated counting system, and the results were converted to a flux rate with units of picocuries per square meter per second (pCi/m^2/s).

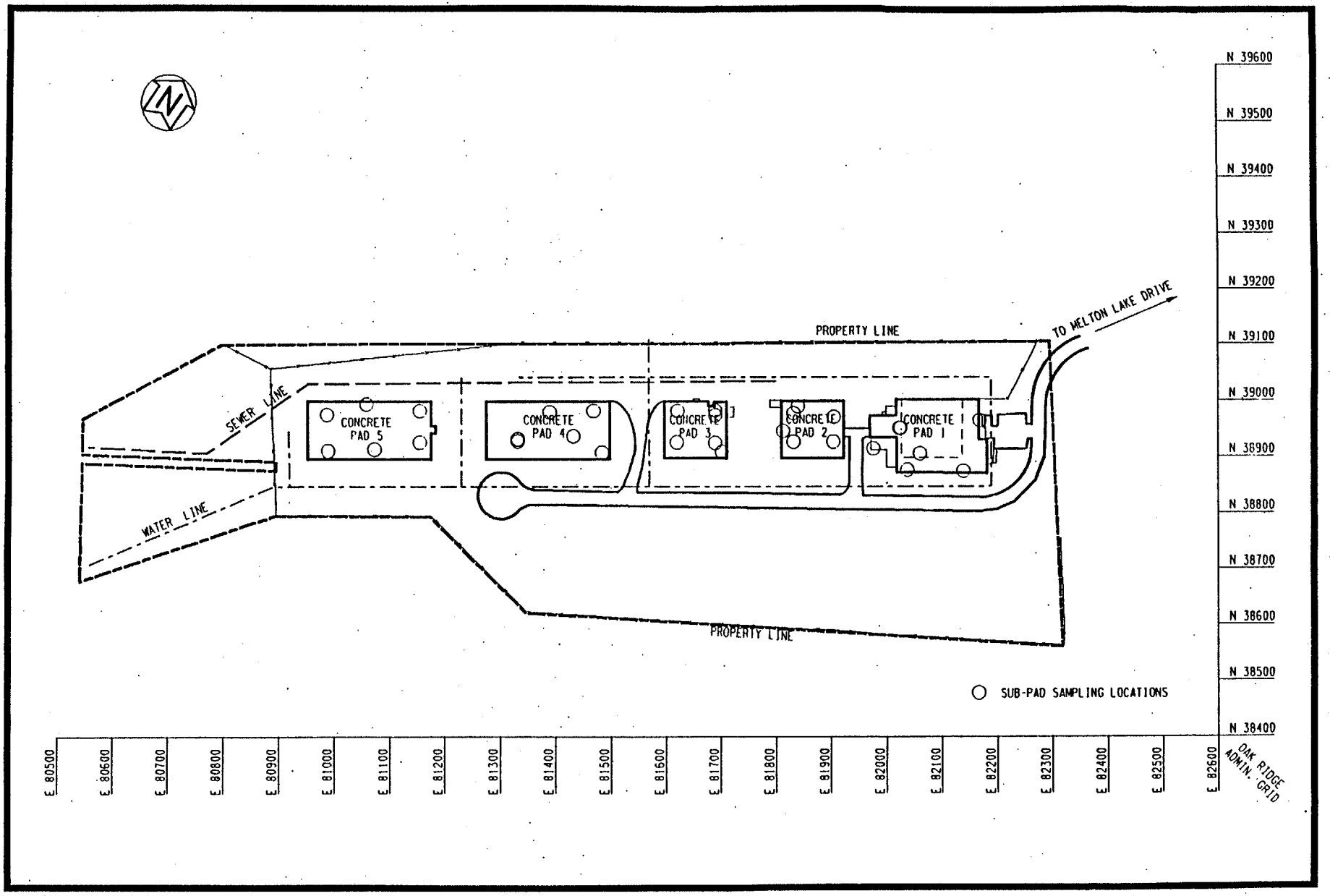

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FIGURE 3-4 SAMPLING LOCATIONS FOR THE 1989 SUB-PAD INVESTIGATION AT THE ELZA GATE SITE

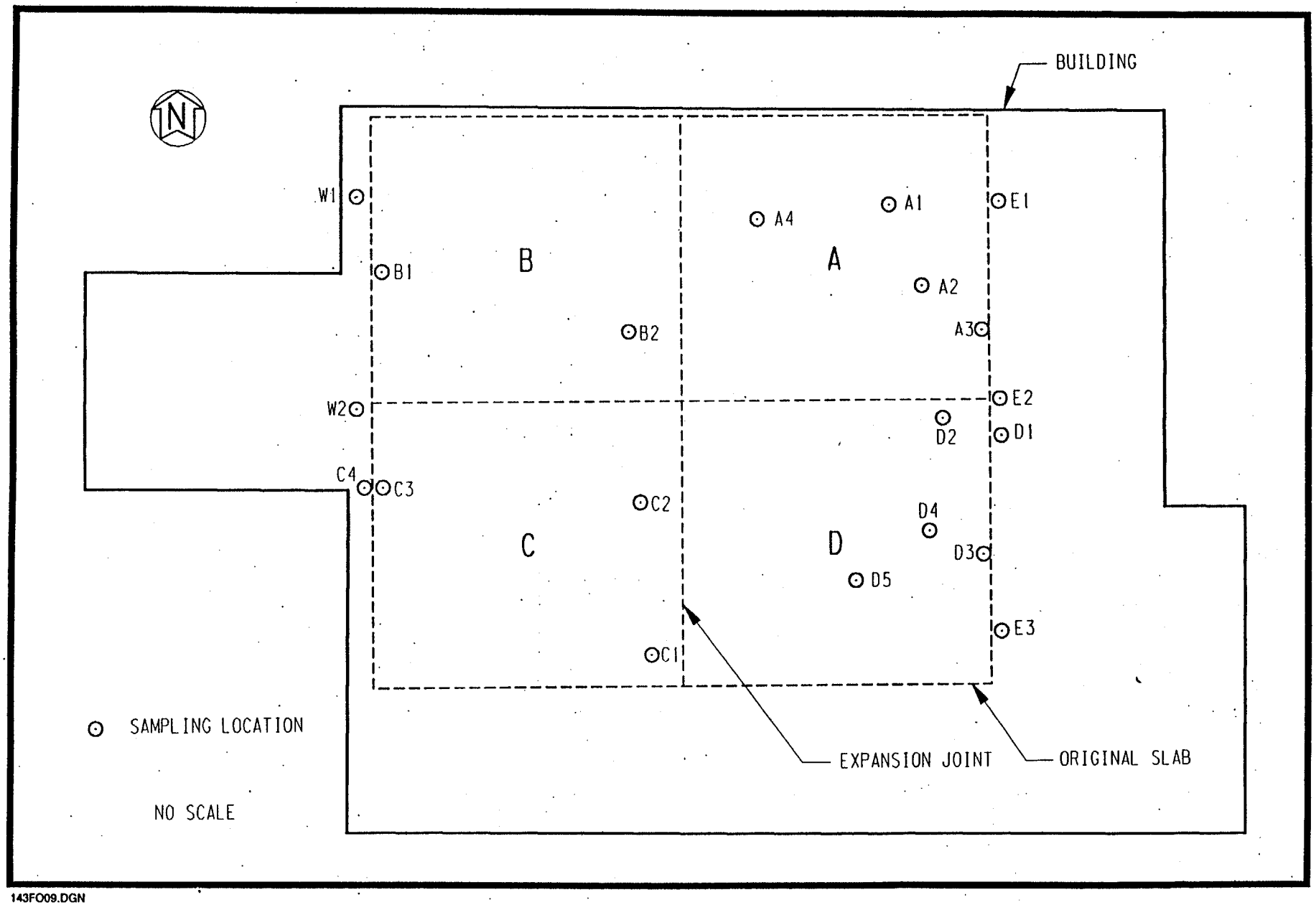

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FIGURE 3-5 SUB-PAD SOIL SAMPLING LOCATIONS AT PAD 1

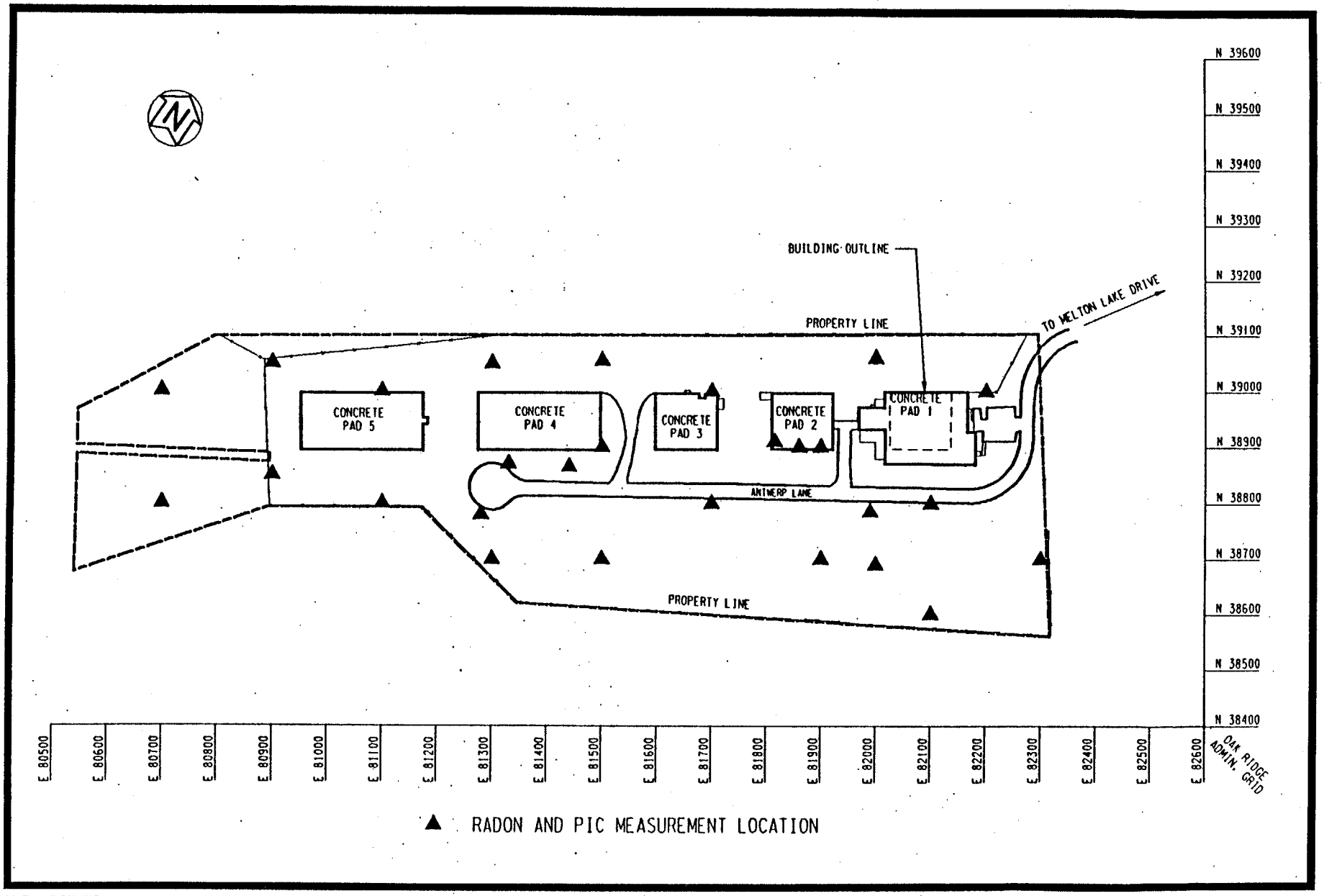

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FIGURE 3-6 GAMMA RADIATION AND RADON FLUX MEASUREMENT LOCATIONS AT THE ELZA GATE SITE

3.3 CHEMICAL INVESTIGATION

The goals of the chemical characterization were to identify the areas and extent of contamination from previous MED and AEC activities, to determine whether the waste exhibits hazardous characteristics as defined by RCRA, and to identify appropriate methods of waste management.

3.3.1 Background Data

Two chemical background samples were collected from locations within the Oak Ridge city limits: one from a cemetery and the other from a private residence. Background samples were collected in conjunction with characterization activities and were analyzed for PCBs and metals. Background samples were collected using the same protocols as used for the field investigation.

3.3.2 Soil Investigation

For the limited chemical characterization performed in 1989, composite soil samples taken from 12 general areas on the Elza Gate site (Figure 3-7) were analyzed for RCRA-hazardous waste characteristics [reactivity, instability, corrosivity, and extraction procedure (EP) toxicity], and PCBs. Composite sampling locations were selected based on the results of a survey performed using the ultrasonic ranging and data system (USRADS).

Additional locations were sampled in April 1990 to further delineate the areas of PCB contamination found in 1989 and to obtain information on the presence of metals in soil (Figure 3-3). PCBs were analyzed at an off-site laboratory using conventional techniques and on site with a Hewlett-Packard 5890 portable gas chromatograph equipped with a capillary column and an electron capture detector. This on-site screening methodology was adapted from a technique called the modified spittler method (Spittler 1984), which was developed by the U.S. Environmental

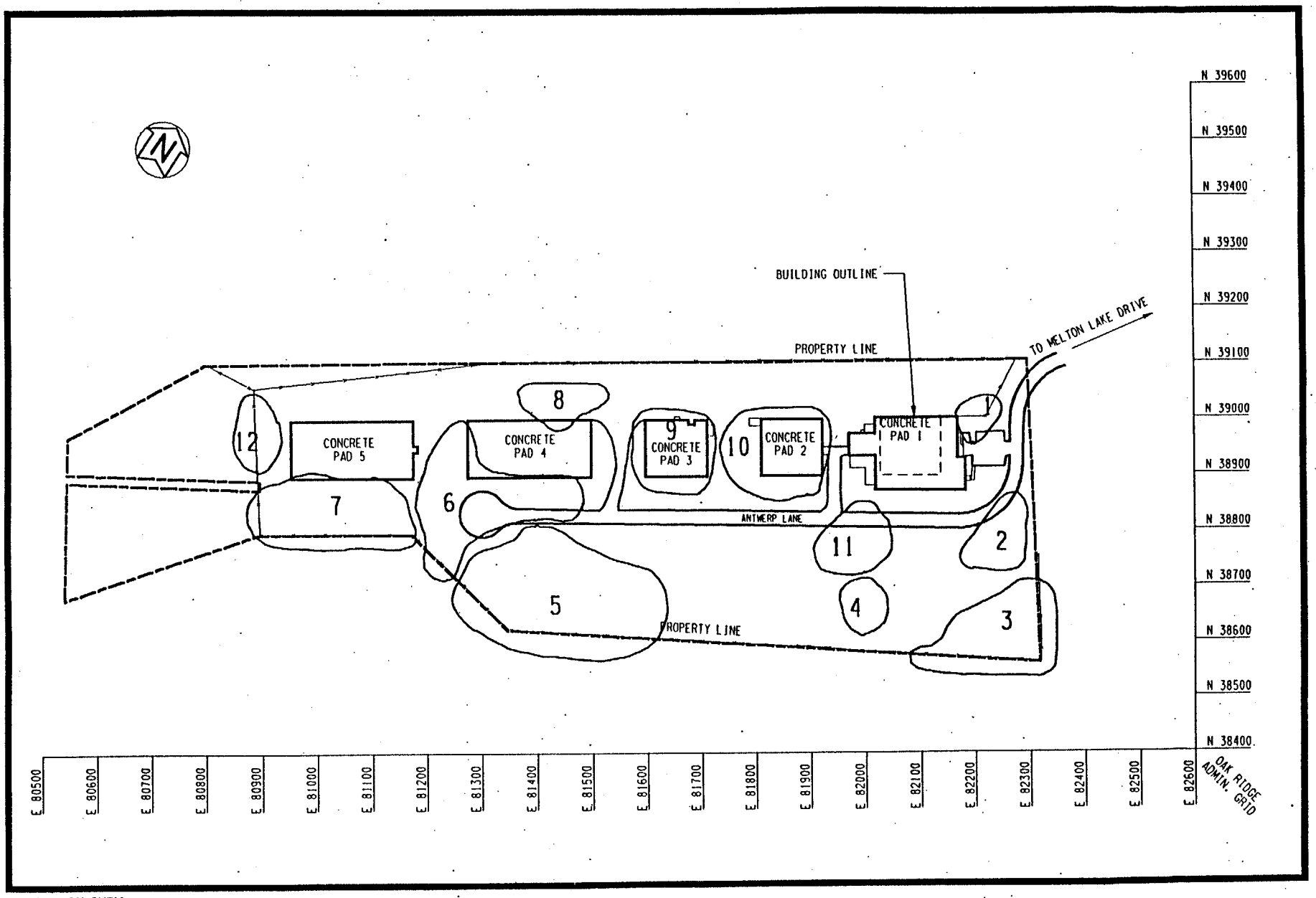

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FIGURE 3-7 COMPOSITE SOIL SAMPLING LOCATIONS FOR THE 1989 LIMITED CHEMICAL CHARACTERIZATION AT THE ELZA GATE SITE

Protection Agency (EPA). The advantage of the field screening method is that on-site analysis can be accomplished while sampling is taking place, and the need for additional samples can be evaluated while the sampling team is still in the field. The primary differences between conventional laboratory analysis and on-site screening are the time and cost required to perform each method; on-site screening is faster and less expensive than traditional methods. Screening results, although generally lower than conventional laboratory results, correlated well with results from laboratory analysis for PCBs (Figure 3-8) and revealed where additional samples should be taken.

For the work in 1990, systematic samples were collected from the corners and center of each 61-m (200-ft) grid block in addition to 17 biased sampling locations selected based on information obtained during the 1989 characterization. A hand auger was used to collect three samples at 0.3-m (1-ft) intervals to a depth of 1 m (3 ft) at each location because results from previous studies indicate that most radiological contamination was no deeper than this level. Samples from six additional locations were analyzed for volatile organics, base/neutral and acid extractable (BNAE) organics, pesticides, and RCRA waste characteristics. These locations were selected based on elevated EP toxicity and PCB levels obtained at composite sampling locations in 1989.

3.4 GEOLOGICAL AND HYDROGEOLOGICAL INVESTIGATION

Geologic and hydrogeologic characterization activities were conducted in June 1990 to obtain data to support development of a site-specific uranium guideline. Data were collected to determine the following:

- The distribution and relationships of subsurface geologic materials
- The characteristics of site soil
- The water table or potentiometric surfaces of the groundwater system at the site

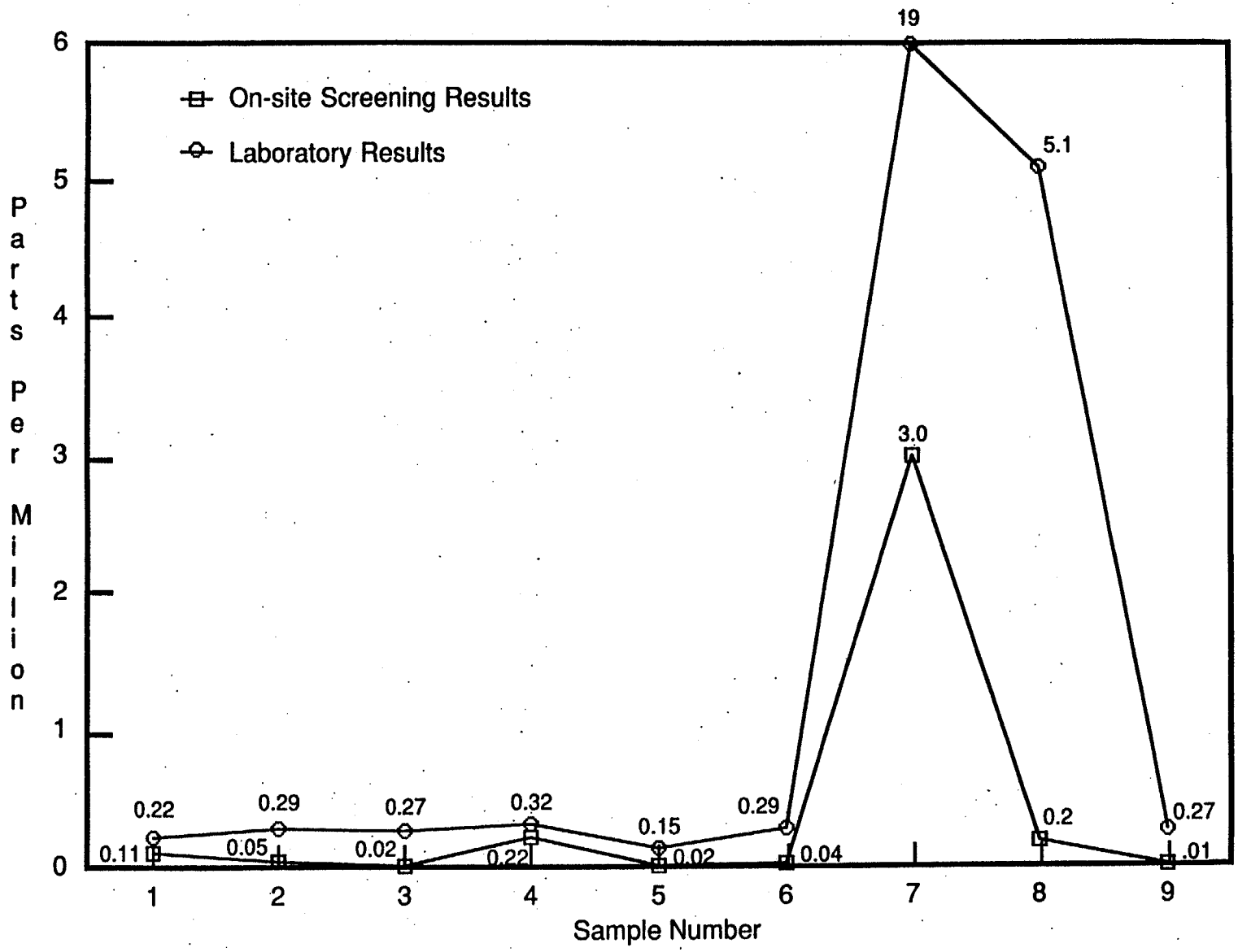

FIGURE 3-8 CORRELATION OF PCB DATA OBTAINED USING CONVENTIONAL LABORATORY ANALYSIS VERSUS ON-SITE SCREENING

4.44 3167.1

3.4.1 Monitoring Wells and Boreholes

Eleven geologic boreholes were drilled by a subcontractor to BNI (Figure 3-9). All boreholes were logged by a BNI geologist; radiological and chemical samples were collected by Thermo Analytical/Eberline (TMA/E) personnel. Boreholes were advanced to bedrock (as determined by the BNI geologist) using a 6-in. hollow-stem auger and cutter head. Continuous 0.6-m (2-ft) samples were collected to refusal on top of the bedrock using either a 3-in. stainless steel split-spoon sampler or a 3-in. Shelby tube sampler. Blow counts were recorded for each interval. Boreholes were reamed to total depth, 4-in. temporary polyvinyl chloride (PVC) casing was installed, and TMA/E personnel performed gamma logging to identify areas of elevated subsurface gamma radiation. At borehole locations B43R201, B43R204, B43R208, and B43R209, the drill hole was advanced to bedrock, and core samples were retrieved using split-barrel tube coring equipment. Drill holes B43R201 and B43R204 were advanced 1.5 m (3.5 ft) into bedrock, B43R208 was cored 3 m (10 ft) into bedrock, and B43R209 was advanced 5.5 m (18 ft) into bedrock. Tap water used as drilling fluid was sampled and analyzed for chemical constituents.

Constant-head packer tests were performed to determine the permeability in the cored intervals of B43R208 and B43R209. The tests were performed using a single inflatable packer placed above the zone of interest. Water was then pumped into the test zone to maintain a constant hydrostatic head, and the volume of water necessary to maintain a constant head was measured over time. Data reduction was performed following the method described in the Bureau of Land Reclamation's Earth Manual (BLR 1968). Falling-head tests were performed to determine the permeability of soils in boreholes B43R201, B43R207, and B43R211. Temporary casing was installed in each borehole down to the zone to be tested. The casing was then filled with water, and the change in hydrostatic head was measured over time. In borehole B43R201, the zone to be tested was backfilled with coarse sand so that water could infiltrate along a continuous wetted front. Data reduction for the

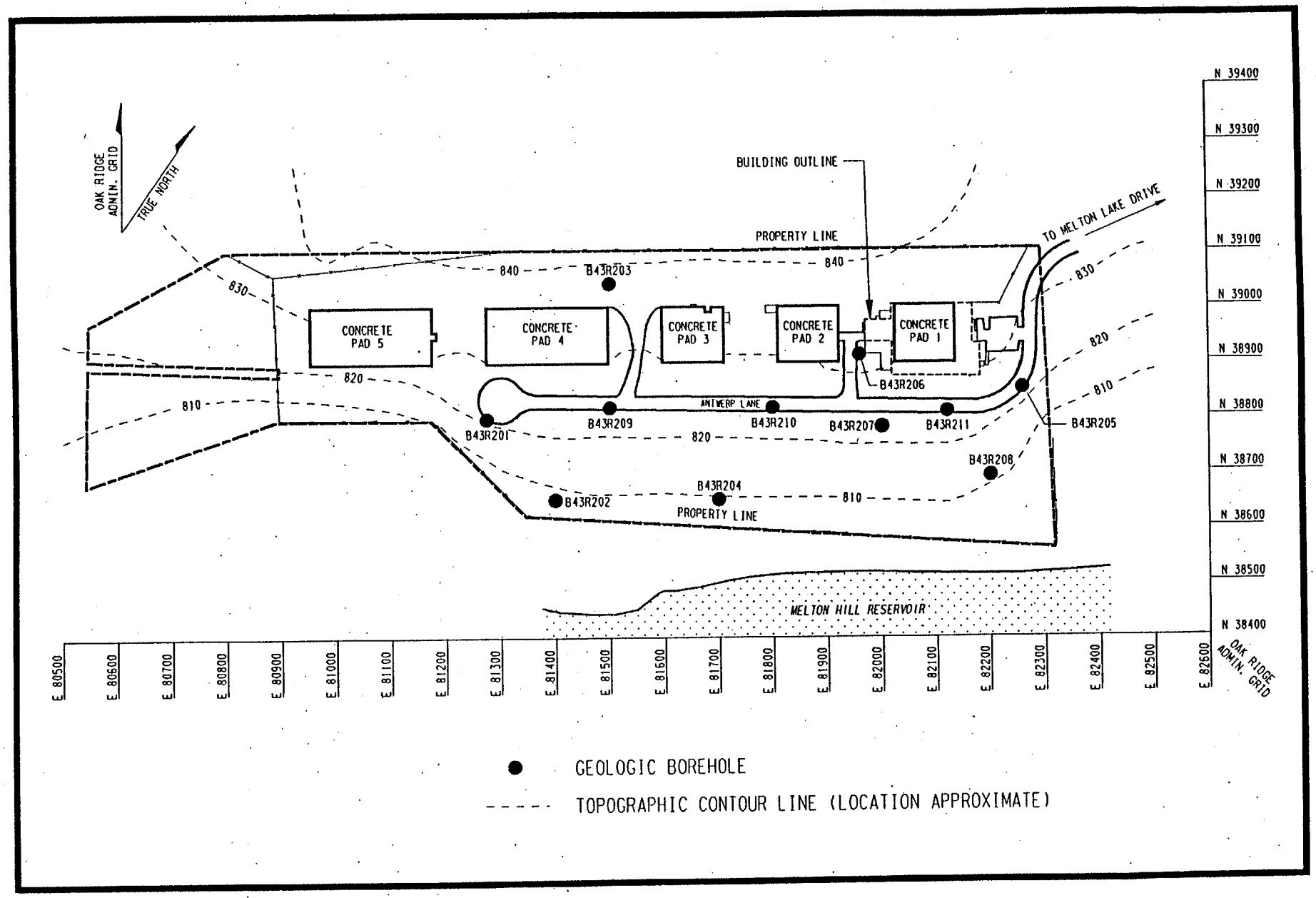

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FIGURE 3-9 GEOLOGIC BOREHOLE LOCATIONS AT THE ELZA GATE SITE

falling-head permeability tests followed the method of Hvorslev (Hvorslev 1951). Water-level measurements were recorded daily during the period in which the boreholes were open.

3.4.2 Soil Investigation

Soil testing was conducted primarily to obtain data for development of a site-specific remedial action guideline for uranium. Particle-size analysis, following the procedure described by American Society for Testing and Materials (ASTM) D422 (ASTM 1990), was performed on 11 samples from across the site to assist in soil classification (Figure 3-9). Samples were analyzed to determine the distribution coefficient for elemental uranium and the effective cation exchange capacity in accordance with ASTM D4319 (ASTM 1990) and ASTM STP805 (ASTM 1983), respectively. The distribution coefficient and the effective cation exchange capacity give an indication of the capacity of the soil to retard uranium migration.

3.5 QUALITY CONTROL PROGRAM

Quality control (QC) samples were used to assess the precision and accuracy of the analytical data and to verify that sampling procedures, such as those for chain of custody, decontamination, packaging, and shipping, were not introducing variables into the sampling process that could render the validity of the samples questionable.

3.5.1 Quality Control Program for Chemical and Radiological Samples

QC samples were regularly prepared in the field and laboratory so that all phases of the sampling process were monitored. The QC program is described in the Radiological and Chemical Characterization Plan for the Elza Gate Site, Oak Ridge, Tennessee (BNI 1990).

3.5.2 Quality Control Program for Hydrogeological Activities

All geotechnical soil testing was performed in accordance with standardized technical specifications, referencing procedures from ASTM, Department of the Army - Engineer Manual, and EPA. BNI requires that subcontractors who perform geotechnical soil testing submit a quality assurance program manual and a summary of labeling procedures before a subcontract is awarded.

All hydrogeological and geological tests, including permeability tests, disturbed and undisturbed soil sampling, standard penetration tests, and all calculations derived from field data were documented and performed in accordance with industry standards and BNI engineering procedures. All sources of design criteria, formulae, and references were reviewed and documented.

3.5.3 Sample Custody and Chain-of-Custody Procedures

Chain-of-custody procedures were implemented at the site to provide for sample labeling and tracking reports and to document the possession history of samples to ensure that the validity of the samples has not been compromised. These procedures are described in the Radiological and Chemical Characterization Plan for the Elza Gate Site, Oak Ridge, Tennessee (BNI 1990).

3.5.4 Calibration Procedures

All equipment and instruments used during the sampling program were maintained and calibrated to operate within manufacturers' specifications and to ensure that the required traceability, sensitivity, and precision of the equipment and instruments were maintained. Manufacturers' instructions were followed for calibration, calibration checks, and maintenance. Any reference calibration standards used were certified traceable to the National Institute of Standards and Technology or other acceptable standards.

4.0 HEALTH AND SAFETY

4.1 TRAINING

All workers at Elza Gate who had a potential for exposure to hazardous conditions during characterization activities were trained in compliance with 29 CFR 1910.120 (BNI 1989a). In addition, all FUSRAP and subcontractor personnel complied with applicable project health and safety requirements during radiological, chemical, and hydrogeological characterization activities.

4.2 SAFETY REQUIREMENTS

BNI is responsible to DOE for ensuring the health and safety of personnel engaged in FUSRAP-related activities at Elza Gate. The Health and Safety Plan for the Formerly Utilized Sites Remedial Action Program (BNI 1989b) serves as the authorizing document for generic health and safety measures for FUSRAP sites. Specific project instructions and information contained in the plan provide guidance in areas such as dosimetry, bioassay, medical surveillance, protective clothing and equipment, and training requirements. In addition, a health and safety plan was developed specifically for conditions at Elza Gate (BNI 1989a). Parameters included in the site-specific plan included toxicity, fire and explosion, and corrosion hazards; locations of underground utilities; and emergency response and notification.

5.0 CHARACTERIZATION RESULTS

5.1 RADIOLOGICAL RESULTS

The following subsections summarize the results of the radiological characterization of the Elza Gate site. Current DOE guidelines governing remedial action for radiological constituents are presented in Table 5-1. Additionally, a site-specific guideline for uranium in soil will be developed by DOE. In this report, a value of 35 pCi/g for uranium-238 in soil is assumed, and all graphical representations of contaminated soil areas are based on the assumption that soil uranium levels exceeding 35 pCi/g exceed DOE guidelines. This value is in the range of uranium cleanup guidelines developed for other FUSRAP sites.

5.1.1 Background Measurements

Background data from three off-site locations in the Oak Ridge area were collected and subtracted from analytical site data to determine whether site radiological measurements were in excess of guidelines. Table 5-2 shows the results of these background measurements.

5.1.2 Walkover Gamma Scans

In general, near-surface walkover gamma scans indicated levels of gamma radiation greater than one and one-half times background near the edges of the pads, the cul-de-sac, and several other areas around the site. Soil sampling was conducted in areas with elevated readings to further delineate the horizontal and vertical extent of contamination. Analytical results for soil are discussed in the following subsections.

TABLE 5-1
SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES

BASIC DOSE LIMITS

The basic limit for the annual radiation dose excluding radon received by an individual member of the general public is 100 mrem/yr. In implementing this limit, DOE applies ALARA principles to set site-specific guidelines.

SOIL GUIDELINES

Radionuclide	Soil Concentration (pCi/g) Above Background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	5 pCi/g when averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer.
Other Radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use.

STRUCTURE GUIDELINES

Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that has no radiological restrictions on its use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL[d]. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restrictions on its use shall not exceed the background level by more than 20 μR/h and will comply with the basic dose limits when an appropriate-use scenario is considered.

Indoor/Outdoor Structure Surface Contamination

Radionuclide[f]	Allowable Surface Residual Contamination[e] (dpm/100 cm²)		
	Average[g,h]	Maximum[h,i]	Removable[h,j]
Transuranics, Ra-226, Ra-228, Th-230, Th-228 Pa-231, Ac-227, I-125, I-129[k]	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224 U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above[l]	5,000 β - γ	15,000 β - γ	1,000 β - γ

TABLE 5-1
(CONTINUED)

[a]These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that (1) the dose for the mixtures will not exceed the basic dose limit, or (2) the sum of ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity").

[b]These guidelines represent allowable residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100-m^2 surface area.

[c]If the average concentration in any surface or below-surface area less than or equal to 25-m^2 exceeds the authorized limit or guideline by a factor of $(100/A)^{1/2}$, where A is the area of the elevated region in square meters, limits for "hot spots" shall also be applicable. Procedures for calculating these hot spot limits, which depend on the extent of the elevated local concentrations, are given in the DOE Manual for Implementing Residual Radioactive Materials Guidelines, DOE/CH/890/. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit for soil, irrespective of the average concentration in the soil.

[d]A working level (WL) is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

[e]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[f]Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

[g]Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[h]The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at a depth of 1 cm.

[i]The maximum contamination level applies to an area of not more than 100 cm^2.

[j]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping tehniques to measure removable contamination levels if direct scan surveys indicate that total residual surface cotamination levels are within the limits for removable contamination.

[k]Guidelines for these radionuclides are not given in DOE Order 5400.5; however, these guidelines are considered applicable until guidance is provided.

[l] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

TABLE 5-2

BACKGROUND RADIATION MEASUREMENTS AND RADIONUCLIDE CONCENTRATIONS IN SOIL IN THE OAK RIDGE AREA

Location[a]	Gamma Exposure Rate at 1 m (μR/h)	Radon Flux Rate (Pci/m^2/s)	Borehole Log (ft)	Borehole Log (cpm)	Walkover Gamma Scan Readings (cpm)	Depth (ft)	Radionuclide Concentration (pCi/g) Uranium-238	Radium-226	Thorium-232	Thorium-230
A	10	0.07	0.0	7,000	4,700	0-0.5	<5.0	1.5 ± 0.4	1.2 ± 0.8	1.4 ± 1.1
			0.5	11,000		0-0.5	<5.0	1.0 ± 0.5	2.0 ± 1.0	<0.9
			1.0	12,000		2.0-3.0	<4.0	2.1 ± 0.7	1.7 ± 0.8	<1.0
			1.5	14,000						
			2.0	16,000						
			2.5	16,000						
			3.0	16,000						
B	8.2	0.3	0.0	7,000	3,200	0-0.5	<2.0	1.2 ± 0.4	<1.0	<0.9
			0.5	8,000		0-0.5	<4.0	<1.0	<1.0	<0.8
			1.0	9,000		0-0.5	<3.0	<1.0	0.9 ± 0.5	<0.6
			1.5	11,000		2.0-3.0	3.0 ± 2.0	0.9 ± 0.4	0.7 ± 0.6	1.4 ± 1.1
			2.0	9,000						
			2.5	10,000						
			3.0	11,000						
C	9.6	0.25	0.0	9,000	4,600	0-0.5	<5.0	1.3 ± 0.6	1.0 ± 0.9	1.0 ± 1.0
			0.5	13,000		0-0.5	<5.0	2.0 ± 0.8	2.0 ± 1.0	<0.8
			1.0	16,000		0-0.5	<5.0	1.0 ± 0.6	3.0 ± 1.0	1.0 ± 1.0
			1.5	18,000		0-0.5	<4.0	1.0 ± 0.6	1.6 ± 0.7	<1.0
			2.0	18,000		2.0-3.0	<4.0	1.7 ± 0.5	1.7 ± 0.7	1.0 ± 1.0
			2.5	18,000						
			3.0	18,000						
Average[b]	9.3	0.2		13,000	4,167		4.1	1.3	1.5	1.0

[a]Location A is 9197 Dunbarton Ct, Knoxville, Tenn. (within a five-mile radius of the Elza Gate site); Location B is Garden of Peace Cemetery, Oak Ridge, Tenn.; and Location C is a cemetery near Cedarbrook Condominiums, Oak Ridge, Tenn.

[b]For the purpose of calculating an average, "less than" values were considered to be the maximum possible value (e.g., <5.0 was considered to be 5.0).

5.1.3 Soil Sampling and Borehole Gamma Logging

All boreholes drilled using the mechanically powered posthole auger and the hand auger were logged by a geologist. None of the boreholes reached the water table, but approximately one-third penetrated to undisturbed materials, indicating that the maximum depth for mechanical emplacement of surface materials had been reached. On the northern perimeter of the site, the undisturbed material is generally indicated by auger refusal, probably bedrock (limestone). For the remainder of the site, the undisturbed material is a clayey silt, and the disturbed material is generally a silty clay.

Results from downhole gamma logging are presented in Appendix A; measurements ranged from 5,000 to 2,056,000 cpm, compared with an average background value of 13,000 cpm. Gamma logging methodology prevents a direct correlation between picocuries per gram and counts per minute.

Analytical results for soil indicated that most of the radioactive contamination is adjacent to Pads 1, 2, and 4, around the cul-de-sac, and across the road from Pads 1 and 2 (Figure 5-1). There are also several smaller areas of contamination scattered around the site. The maximum depth of contamination is 1.5 m (5 ft) in an isolated area between Pad 4 and the cul-de-sac. Radionuclide concentrations obtained from this location ranged from 6 to 12,000 pCi/g for uranium-238, 2.6 to 12,000 pCi/g for radium-226, 1.9 to 82 pCi/g for thorium-232, and 8.1 to 12,000 pCi/g for thorium-230. In general, contamination at the Elza Gate site is shallow [in the upper 0.15 m (0.5 ft) of soil]. Analytical results for soil samples are provided in Appendix B. All direct field measurements and laboratory results in this report represent gross readings; background measurements and concentrations have not been subtracted. Uranium-238 concentrations ranged from <2 to 12,000 pCi/g, thorium-232 ranged from 0.5 to 82 pCi/g, radium-226 ranged from 0.3 to 12,000 pCi/g, and thorium-230 ranged from <1 to 15,000 pCi/g. In general,

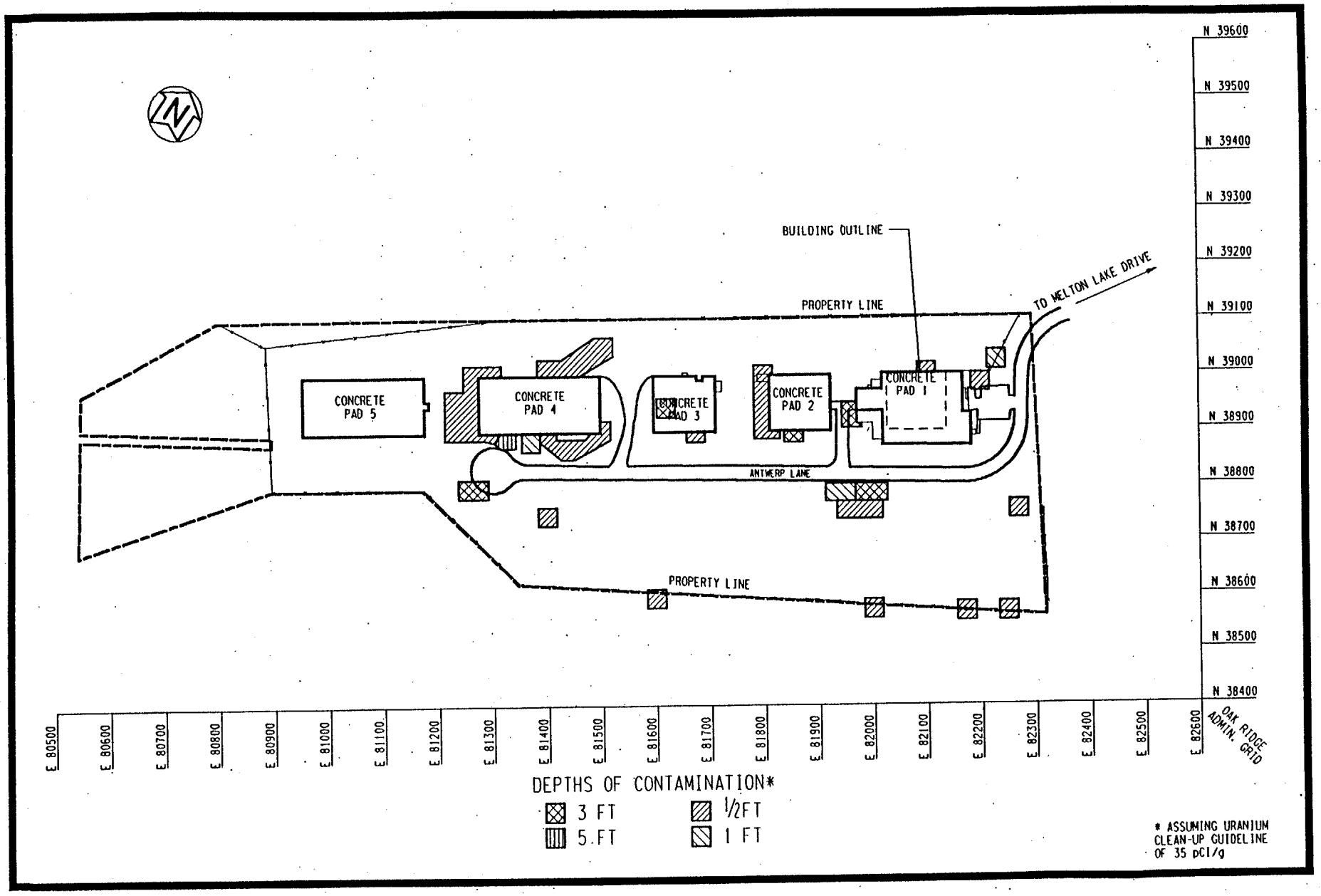

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FIGURE 5-1 EXTENT OF RADIOACTIVE CONTAMINATION AT THE ELZA GATE SITE

results indicating areas of gamma-emitting contamination were consistent with downhole gamma logging and surface walkover gamma scan results.

5.1.4 Radiological Surveys of the Pads

The results of the radiological surveys of the pads are summarized in Tables 5-3 and 5-4 and are shown in Figures 5-2 through 5-6. Data indicate that all pads have areas of contamination that exceed DOE guidelines (Table 5-1).

Pad 2 exhibited the highest single-point and average surface contamination levels. The average direct measurement of total (fixed and removable) activity for Pad 2 was 258,000 dpm/100 cm^2; removable activity averaged 620 dpm/100 cm^2. Results for the samples from Pads 1, 3, 4, and 5 indicate lower levels of contamination (in descending order), with results from Pad 5 indicating levels below applicable guidelines over most of its surface.

Additional study and cleanup performed on Pad 1 included completion of a radiological survey, sampling and analysis of sub-pad soil and concrete, and concrete decontamination. Concrete samples were taken at areas determined by the results of the walkover survey. These areas had maximum uranium-238, radium-226, and thorium-230 concentrations of 270, 200, and 400 pCi/g, respectively.

In July 1989, a portable abrasive blast cleaning system was used to remove the top 1.27-cm (0.5-in.) layer of contaminated concrete from Pad 1. The objectives for using this system were to test its applicability for use on the other on-site pads and to reduce potential exposure to workers in the building. Approximately 11.5 m^3 (15 yd^3) of contaminated concrete dust was generated and transported to DOE's Oak Ridge Reservation for storage. A summary of the radiological conditions of Pad 1 before and after decontamination efforts is shown in Table 5-5.

A radiological survey of Pad 1 was conducted after the decontamination work was completed. With the exception of two

TABLE 5-3

DIRECT RADIATION MEASUREMENTS ON THE PADS AT THE ELZA GATE SITE

Area	Beta-Gamma (dpm/100 cm²)[a]				Alpha (dpm/100 cm²)[a]			
	Maximum	Minimum	Average[b]	Number of Measurements	Maximum	Minimum	Average	Number of Measurements
Pad 1	131,010	<480	12,830	290	17,240	<7	1,350	290
South wall of building	<650	<559	620	11	<50	<20	40	11
East wall of building	<940	<559	690	7	<50	<20	40	7
North wall of building	1,290	<559	660	11	<50	<20	30	11
West wall of building	<990	<559	640	7	<50	<20	30	7
Pad 2	1,643,050	1,590	227,250	47	242,870	390	30,270	47
Pad 3	97,630	<550	4,340	132	6,130	20	120	132
Pad 4	57,510	560	3,280	252	6,530	17	350	252
Pad 5	4,900	<550	970	250	5,370	20	70	250

[a]Measurements taken before decontamination efforts.

[b]All values were used to calculate average.

TABLE 5-4

REMOVABLE RADIOACTIVITY MEASUREMENTS ON THE PADS AT THE ELZA GATE SITE

Area	Beta-Gamma (dpm/100 cm^2)				Alpha (dpm/100 cm^2)			
	Maximum	Minimum	Average	Number of Measurements	Maximum	Minimum	Average	Number of Measurements
Pad 1	230	<85	120	42	22	<2	4	326
Pad 2	1,690	<91	320	47	2,810	10	300	47
Pad 3	<159	<78	100	31	93	<2	8	31
Pad 4	193	<78	110	215	81	<2	7	215
Pad 5	<140	<73	100	12	25	<3	8	12

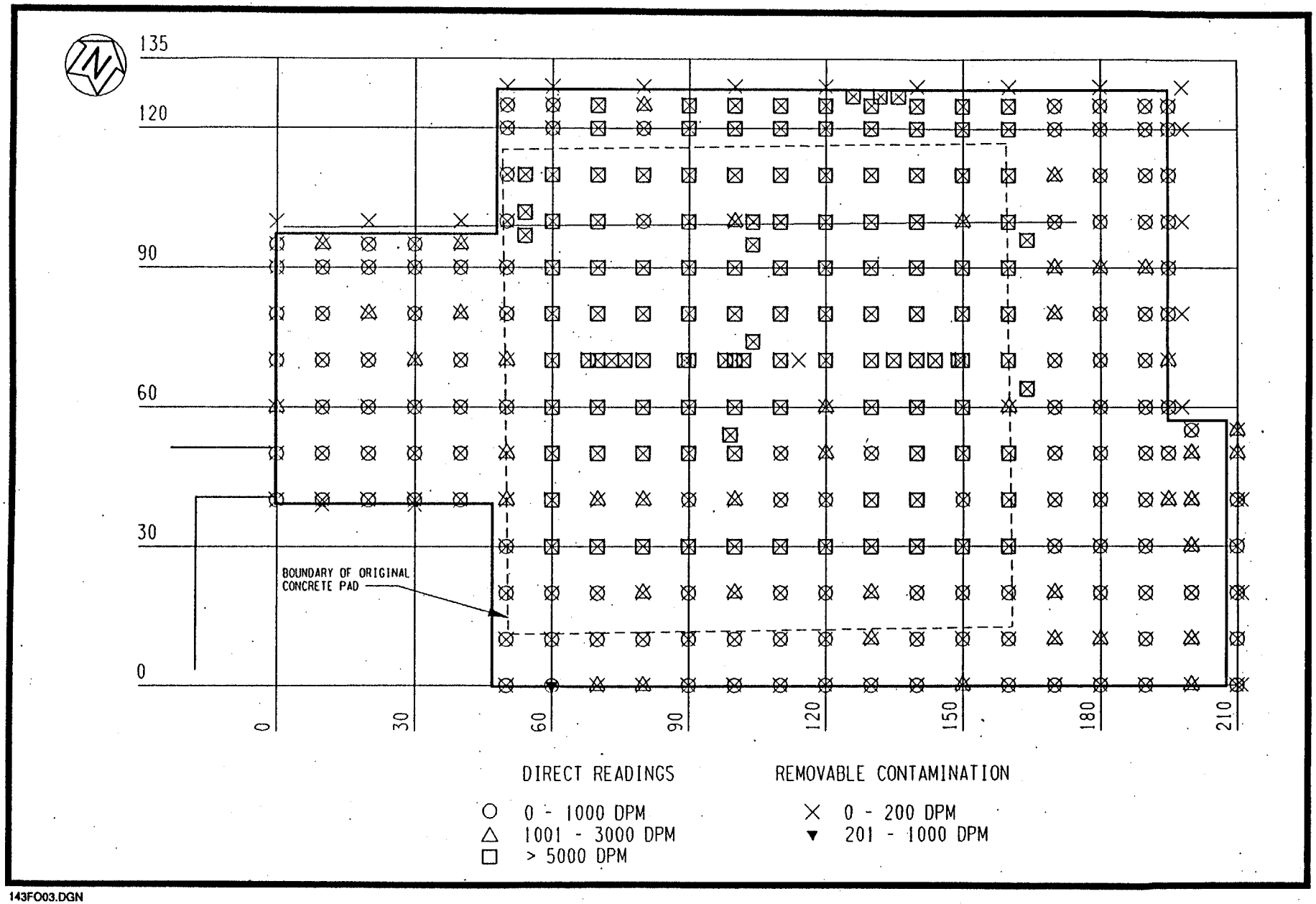

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FIGURE 5-2 SURFACE CONTAMINATI0N ON PAD 1

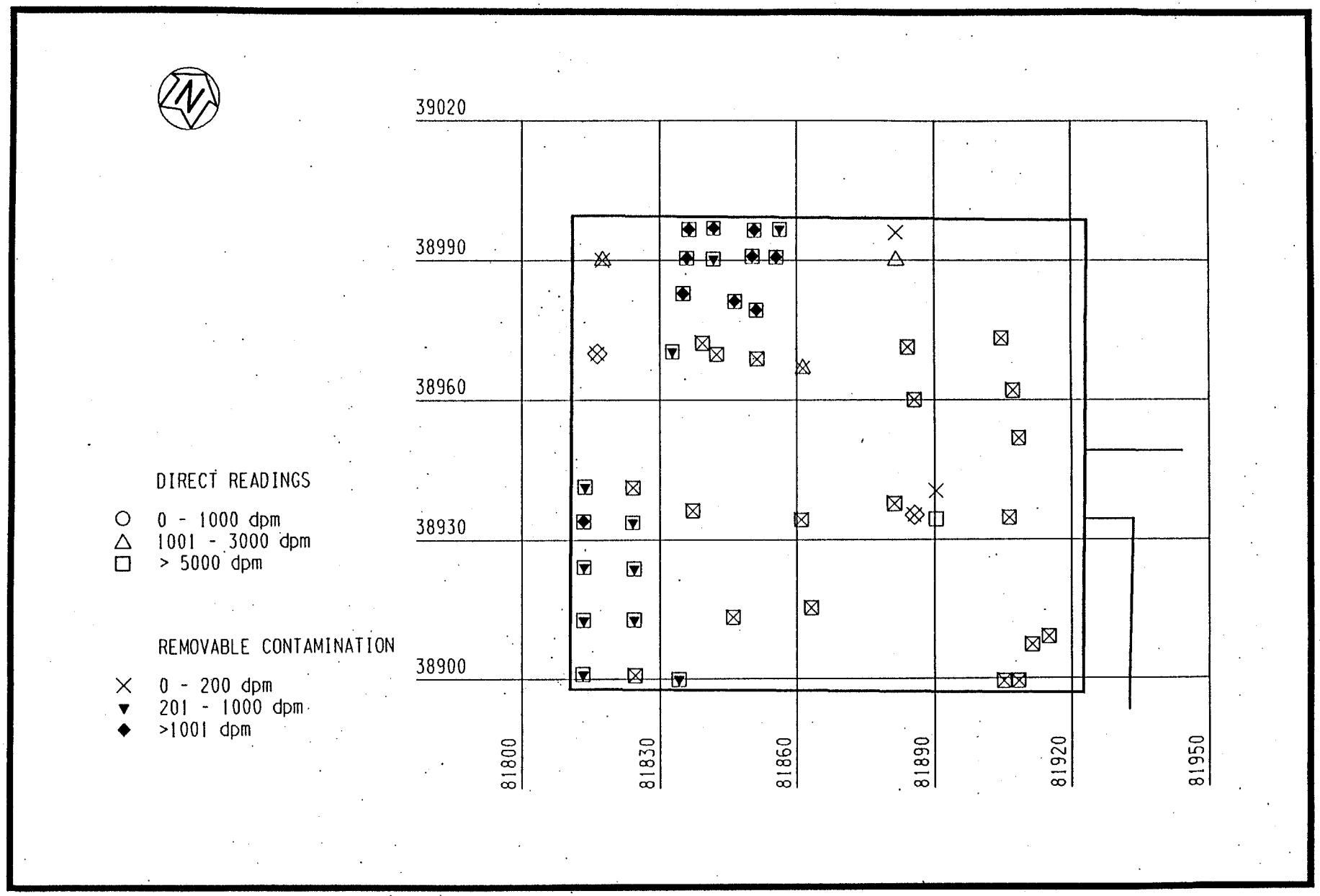

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FIGURE 5-3 SURFACE CONTAMINATION ON PAD 2

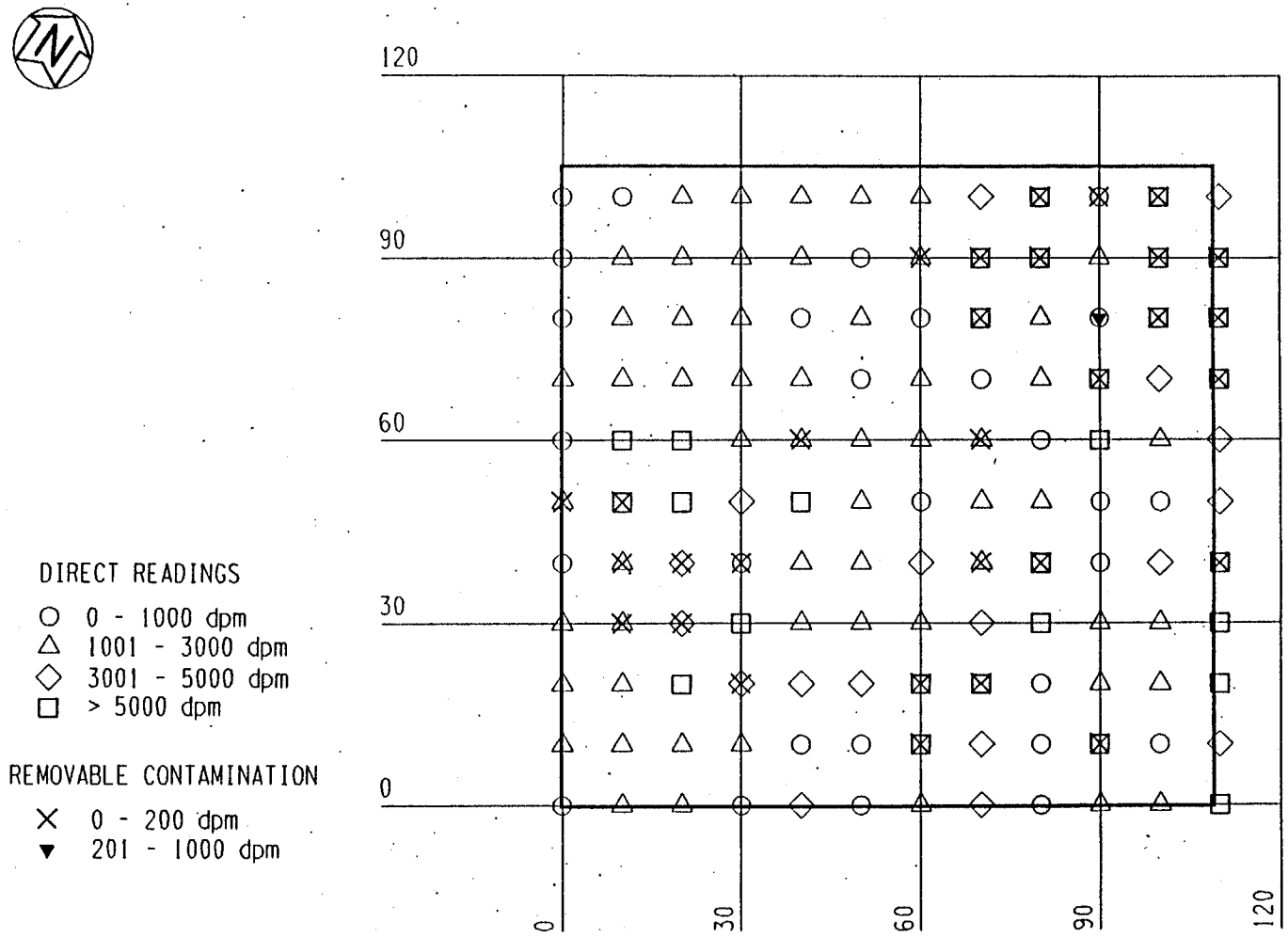

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FIGURE 5-4 SURFACE CONTAMINATI0N ON PAD 3

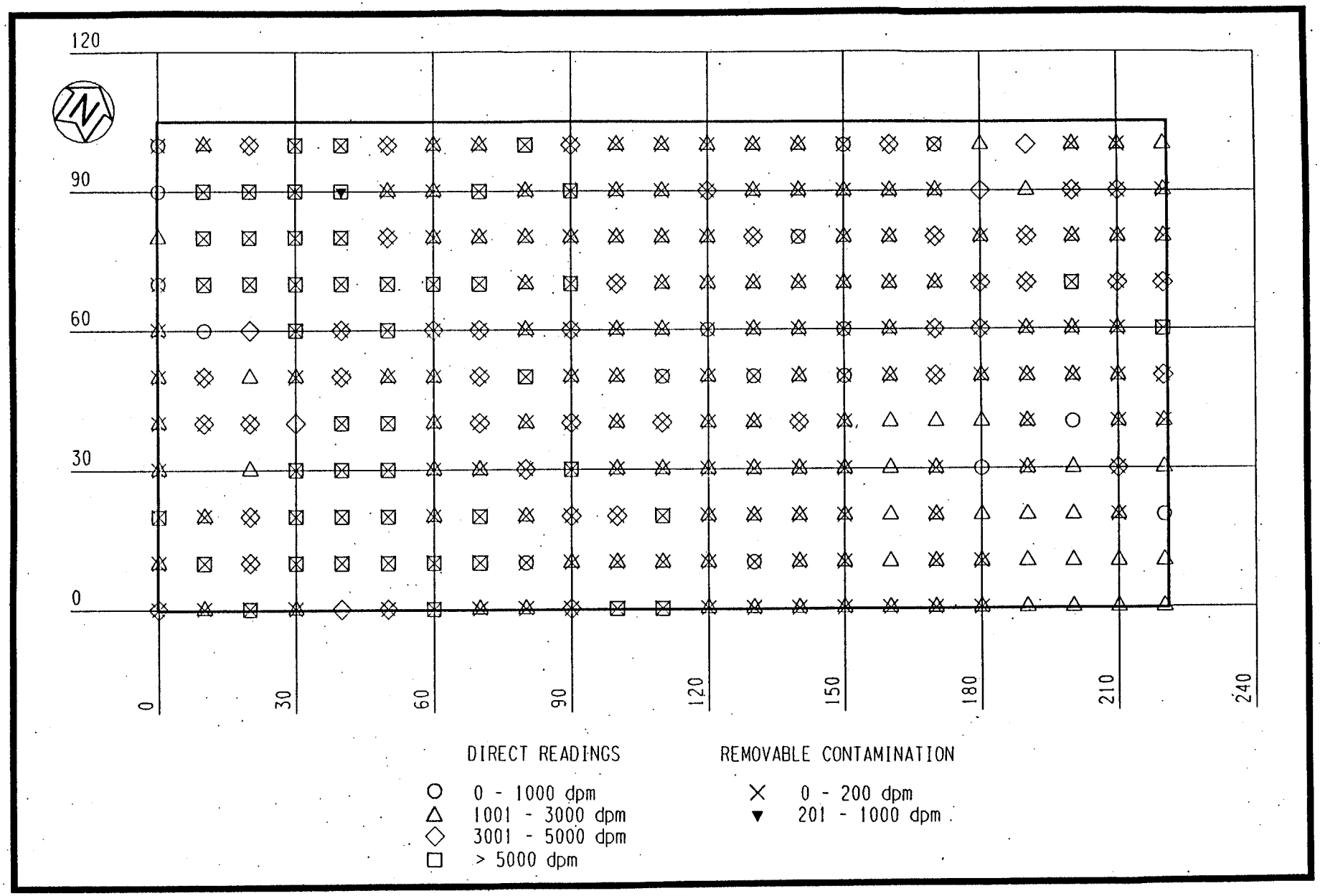

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FIGURE 5-5 SURFACE CONTAMINATION ON PAD 4

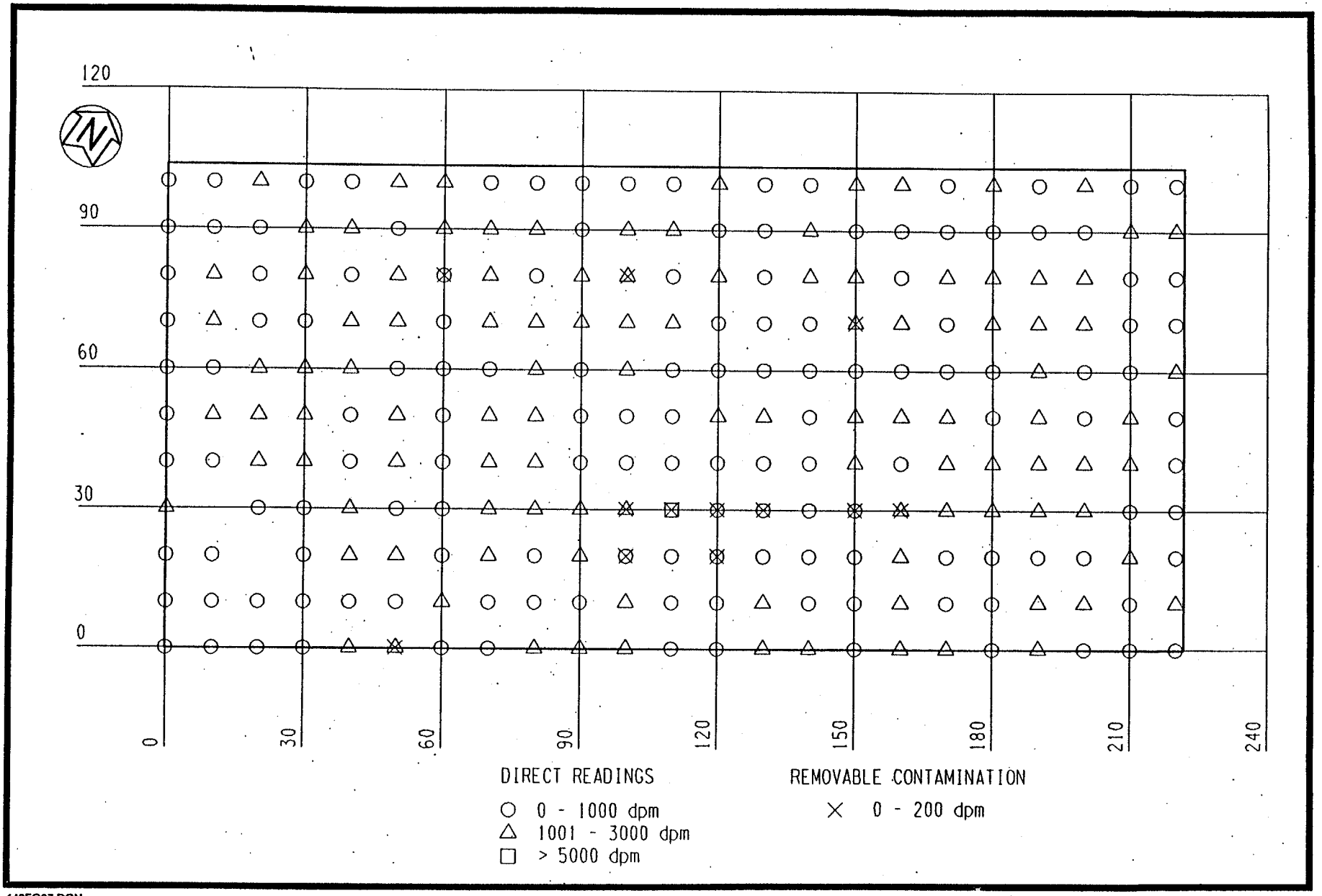

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FIGURE 5-6 SURFACE CONTAMINATION ON PAD 5

TABLE 5-5

COMPARISON OF PAD 1 CONDITIONS BEFORE AND AFTER DECONTAMINATION EFFORTS

Before Decontamination Average (dpm/100 cm^2)		After Decontamination Average (dpm/100 cm^2)	
Alpha	Beta-Gamma	Alpha	Beta-Gamma
1,350	12,830	750	4,600

concrete expansion joints that bisect the pad and scattered, irregular cracks in the pad, all areas of the pad met the allowable total residual surface contamination guideline for uranium (Table 5-1). The average direct reading across the surface of Pad 1 was reduced from 15,000 dpm to 5,000 dpm as a result of the decontamination effort.

5.1.5 Sub-Pad Investigation

Sub-pad sampling results are presented in Appendix C, and Table 5-6 presents the data from an additional study of Pad 1. Sub-pad sampling results indicated levels below recommended DOE guidelines for soils except those from the additional study of Pad 1, which focused on joints, cracks, and areas immediately adjacent to the original pad. Contamination found in the soil beneath the cracks ranged from <2.0 to 1,300 pCi/g for uranium-238, 0.5 to 45 pCi/g for radium-226, <1.0 to 500 pCi/g for thorium-230, and <0.4 to 4 pCi/g for thorium-232. The data indicate that contamination migrated through the cracks and joints to the soil beneath the pad.

5.1.6 Miscellaneous Sampling

Two sediment samples were collected: one from a storm sewer southwest of Pad 3, north of Antwerp Lane (E 81575, N 38840), the other from a storm sewer southeast of Pad 1, south of Antwerp Lane (E 82235, N 38825). The samples were analyzed for suspended and dissolved total uranium, radium-226, and thorium-230. Results indicated that radionuclide concentrations do not exceed DOE remedial action guidelines for soil (DOE currently has no guidelines for sediment) (Table 5-1).

Three surface rainwater water samples were collected to determine whether runoff from the site was contaminated. The samples were collected east of Antwerp Lane (E 82320, N 38800), south of Pads 3 and 4 on the southern side of the site (E 81550, N 38610), and southwest of the cul-de-sac (E 81220, N 38760). The

TABLE 5-6

RESULTS OF INVESTIGATION BENEATH PAD 1

Sampling Location[a]	Radionuclide Concentration (pCi/g ± 2 sigma)			
	Uranium-238	Radium-226	Thorium-232	Thorium-230
A1	<15.0	2.0 ± 1.0	4.0 ± 2.0	2.5 ± 1.4
A2	640.0 ± 40.0	4.4 ± 0.8	1.0 ± 1.0	150.0 ± 10.0
A3	45.0 ± 18.0	6.0 ± 1.0	<0.8	18.0 ± 3.0
A4	41.0 ± 19.0	5.0 ± 1.0	3.0 ± 1.0	10.0 ± 3.0
B1	150.0 ± 20.0	2.4 ± 0.5	1.6 ± 0.8	8.9 ± 2.8
B2	<5.0	0.6 ± 0.3	0.9 ± 0.5	<1.0
C1	<4.0	1.0 ± 0.4	1.0 ± 0.5	1.2 ± 1.1
C2	53.0 ± 13.0	31.0 ± 2.0	2.0 ± 1.0	77.0 ± 7.0
C3	1300.0 ± 100.0	14.0 ± 2.0	2.0 ± 1.0	500.0 ± 20.0
C4	<2.0	0.5 ± 0.2	0.4 ± 0.3	1.4 ± 1.1
D1	<4.0	1.3 ± 0.4	0.6 ± 0.3	3.3 ± 1.6
D2	25.0 ± 21.0	45.0 ± 3.0	<2.0	140.0 ± 10.0
D3	520.0 ± 30.0	41.0 ± 2.0	3.0 ± 1.0	230.0 ± 10.0
D4	<7.0	1.7 ± 0.5	1.7 ± 0.7	2.0 ± 1.3
D5	68.0 ± 9.0	9.0 ± 1.0	1.6 ± 0.5	27.0 ± 4.0
E1	<8.0	1.6 ± 0.6	3.0 ± 2.0	1.2 ± 1.1
E2	<13.0	7.0 ± 1.0	<3.0	9.6 ± 2.4
E3	<6.0	1.5 ± 0.6	3.0 ± 2.0	2.0 ± 1.3
W1	<5.0	1.0 ± 0.4	2.0 ± 1.0	1.0 ± 1.0
W2	<8.0	1.8 ± 0.7	2.0 ± 1.0	1.5 ± 1.2

[a]See Figure 3-5 for locations.

samples were analyzed for suspended and dissolved total uranium, radium-226, and thorium-230. The sample from the eastern side of the site (E 82320, N 38800) showed the highest readings, with concentrations of 9.8 pCi/L for dissolved total uranium, 12.6 pCi/L for suspended total uranium, 24 pCi/L for suspended thorium-230, and 12 pCi/L for suspended radium-226. These values may be compared to the following guidelines contained in DOE Order 5400.5 for the release of water to an uncontrolled area: 600 pCi/L for natural uranium, 300 pCi/L for thorium-230, and 100 pCi/L for radium-226.

For soil samples taken from beneath the asphalt of Antwerp Lane, analyses for uranium-238, radium-226, thorium-232, and thorium-230 indicated that radionuclide concentrations did not exceed DOE guidelines for concentrations of radioactivity in soil (Table 5-7). In October 1990, 16 soil samples were collected south of the Elza Gate property boundary, between the site and Melton Lake Reservoir. Sampling locations are shown in Figure 5-7. These samples were analyzed for uranium-238, radium-226, thorium-232, and thorium-230. Results from this sampling effort indicated that none of the samples contained concentrations of the radionuclides above DOE guidelines. Sample results are given in Table 5-8.

5.1.7 Gamma Exposure Rate Measurements

Gamma radiation exposure rates were measured 1 m (3 ft) above the ground using a pressurized ionization chamber (PIC). The PIC response to gamma radiation is proportional to exposure in roentgens. PIC background measurements ranged from 8.2 to 10.0 μR/h. Against an average background exposure rate of 9.3 μR/h, 23 of the 40 measurements were below background, ranging from 7 to 571.4 μR/h with an average of 36.3 μR/h. Eight measurements were taken inside the building; all were below the DOE criterion of 20 μR/h above background for habitable structures. Gamma exposure rate results are shown in Table 5-9. Gamma radiation measurement locations are shown in Figure 3-6.

TABLE 5-7

RADIONUCLIDE CONCENTRATIONS IN SOIL

BENEATH ANTWERP LANE AT THE ELZA GATE SITE

Coordinate[a]		Depth	Radionuclide Concentration (pCi/g ± 2 sigma)			
East	North	(ft)	Uranium-238	Radium-226	Thorium-232	Thorium-230
81280.0	38810.0	0.5 - 1.0	<10.0	2.2 ± 1.0	<2.0	1.0 ± 0.6
81320.0	38850.0	0.5 - 1.0	< 7.0	1.7 ± 1.1	2.0 ± 1.1	5.8 ± 1.2
81400.0	38820.0	0.5 - 1.0	<11.0	1.3 ± 0.9	<1.0	1.4 ± 0.6
81530.0	38820.0	0.5 - 1.0	< 5.0	1.1 ± 0.7	2.4 ± 1.0	1.5 ± 0.7
81910.0	38820.0	0.5 - 1.0	< 3.0	2.1 ± 1.6	<2.0	1.6 ± 0.7
81940.0	38850.0	0.5 - 1.0	< 5.0	1.7 ± 0.7	<1.0	0.6 ± 0.5
81940.0	38900.0	0.5 - 1.0	< 4.0	1.5 ± 0.6	3.1 ± 1.3	1.9 ± 0.7
81940.0	38950.0	0.5 - 1.0	< 3.0	<2.0	2.7 ± 1.3	0.9 ± 0.6
81950.0	38820.0	0.5 - 1.0	< 7.0	1.7 ± 1.1	2.0 ± 1.1	1.9 ± 0.7
81980.0	38820.0	0.5 - 1.0	< 7.0	1.6 ± 0.9	2.7 ± 1.1	1.9 ± 0.7
82020.0	38820.0	0.5 - 1.0	< 3.0	1.5 ± 1.4	2.4 ± 1.7	1.4 ± 0.6
82030.0	38820.0	0.5 - 1.0	< 4.0	2.0 ± 1.7	<2.0	0.8 ± 0.5

[a]Sampling locations are shown in Figure 3-3.

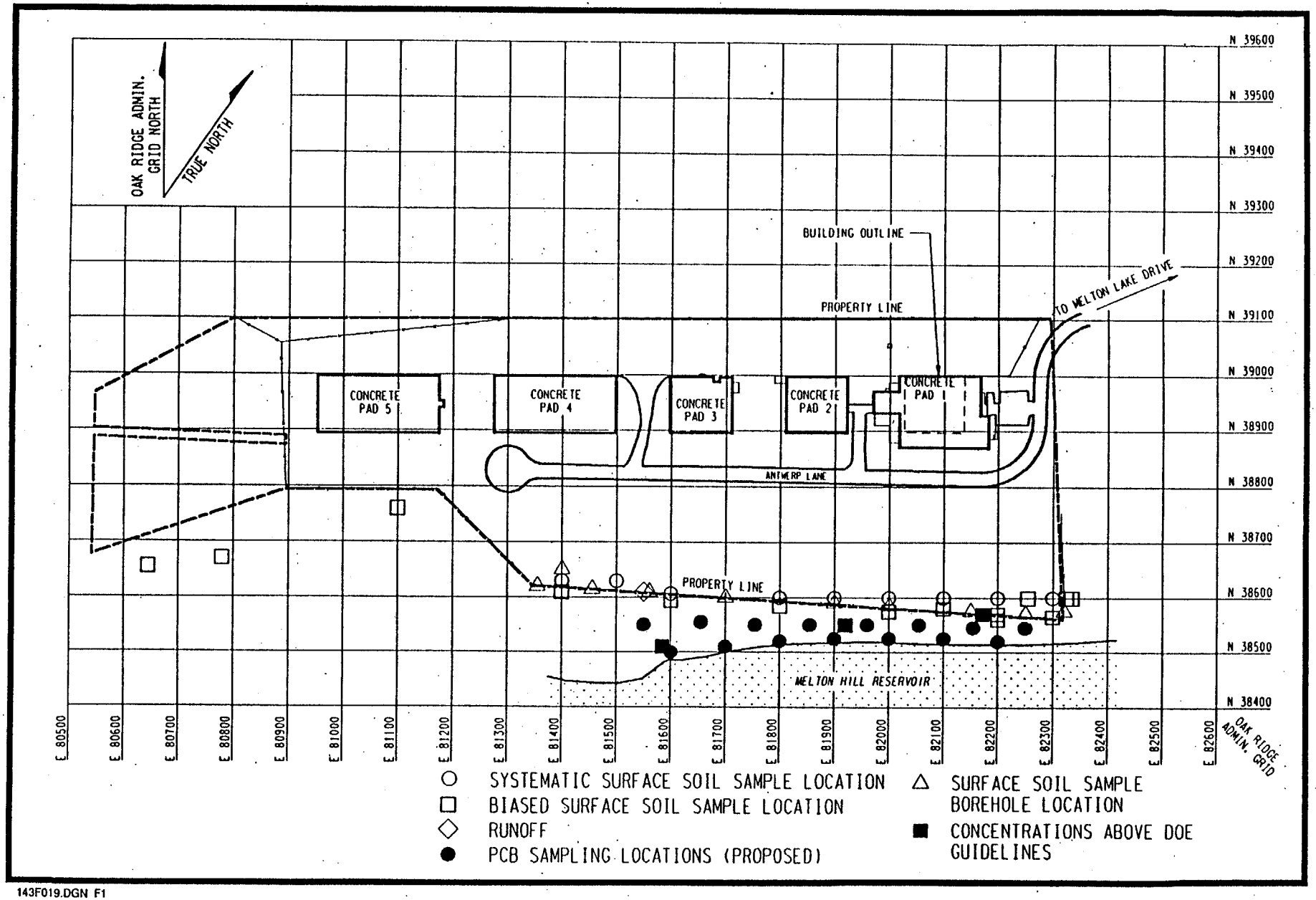

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FIGURE 5-7 SOIL SAMPLING LOCATIONS ON THE SOUTHERN EDGE OF THE ELZA GATE SITE

TABLE 5-8

RADIONUCLIDE CONCENTRATIONS IN SOIL

FROM TENNESSEE VALLEY AUTHORITY PROPERTY

NEAR THE ELZA GATE SITE

Coordinates		Borehole Number	Depth (ft)	Concentration (pCi/g ± 2 sigma)			
				Uranium-238	Radium-226	Thorium-232	Thorium-230
E81500	N38500	1	0-1	<13.0	<0.7	<1.0	<0.5
E81550	N38550	2	0-1	<13.0	1.3 ± 0.2	1.7 ± 0.3	0.7 ± 0.5
E81608	N38506	3	0-1	<8.0	<1.5	2.9 ± 2.5	0.7 ± 0.5
E81650	N38550	4	0-1	<15.0	1.6 ± 0.3	1.7 ± 0.9	1.4 ± 0.6
E81722	N38540	5	0-1	5.7 ± 4.1	<1.1	<1.5	0.9 ± 0.6
E81750	N38550	6	0-1	<4.0	1.3 ± 0.2	1.5 ± 0.6	1.8 ± 0.7
E81812	N38535	7	0-1	<8.0	<1.4	2.6 ± 1.7	2.9 ± 0.9
E81850	N38550	8	0-1	<6.1	1.6 ± 0.1	<1.4	1.2 ± 0.6
E81900	N38550	9	0-1	<14.0	1.2 ± 0.5	1.9 ± 0.6	1.5 ± 0.7
E81950	N38550	10	0-1	<7.0	<1.2	1.9 ± 1.2	1.4 ± 0.7
E82000	N38535	11	0-1	<6.0	1.3 ± 0.5	<1.5	0.8 ± 0.5
E82050	N38550	12	0-1	<6.0	1.3 ± 0.8	<1.5	0.8 ± 0.5
E82100	N38520	13	0-1	<5.0	1.6 ± 0.6	1.5 ± 0.8	1.3 ± 0.6
E82150	N38550	14	0-1	<8.0	<1.4	<1.9	<0.5
E82200	N38520	15	0-1	<7.0	1.4 ± 0.4	<1.8	0.9 ± 0.6
E82250	N38550	16	0-1	<7.0	1.7 ± 0.7	<1.7	0.9 ± 0.6

TABLE 5-9

RADON FLUX AND GAMMA EXPOSURE RATE RESULTS FOR THE ELZA GATE SITE

Coordinate[a] E	N	Radon Flux ($pCi/m^2/s$)	Gamma Exposure Rate[d] ($\mu R/h$)
80700	38800	0.55	7.9
80700	39000	0.13	7.9
80900	38850	0.10	9.2
80900	39050	0.07	8.4
81100	38800	1.07	9.2
81100	39000	0.43	8.3
81280	38780	9.47	12.9
81300	38700	0.17	9.6
81300	39050	0.10	8.3
81330	38870	158.5	571.4
81440	38865	14.62	15.7
81500	38700	0.55	8.4
81500	38900	18.83	7.8
81500	39055	0.37	8.8
81700	38800	0.10	7.3
81700	39000	0.37	8.0
81810	38870	--[b]	40.0
81811	38870	--[b]	60.0
81812	38870	--[b]	80.0
81815	38870	--[b]	99.4
81815	38910	0.35	13.0
81820	38870	--[b]	270.6
81860	38900	4.67	9.8
81900	38700	0.20	7.7
81900	38900	13.58	9.2
81990	38785	0.42	22.6
82000	38690	0.05	7.5
82000	39060	0.23	7.8
82013	38958[c]	--[b]	8.0
82028	38968[c]	--[b]	11.0
82033	38929[c]	--[b]	10.5
82043	38888[c]	--[b]	7.0
82073	38949[c]	--[b]	18.0
82100	38600	0.08	8.9
82100	38800	0.07	7.9
82123	38889[c]	--[b]	7.5
82132	38930[c]	--[b]	9.5
82132	38979[c]	--[b]	11.5
82200	39000	0.55	7.5
82300	38700	0.15	9.1

[a]See Figure 3-6.
[b]No radon flux measurement taken at this location.
[c]Measurements taken inside the building.
[d]Gamma exposure rate measurements include background.

5.1.8 Air Monitoring

Twenty-seven radon flux measurements were taken at the site (Figure 3-6), 11 of which were below average background for the area (0.2 $pCi/m^2/s$). The minimum measurement was 0.05 $pCi/m^2/s$, the maximum was 159 $pCi/m^2/s$, and the average was 7.7 $pCi/m^2/s$. These values can be compared to DOE residual radioactivity guideline of 20 $pCi/m^2/s$. The above-background flux measurements are a result of high concentrations of radium-226 in those areas. Radon flux and PIC measurement results are given in Table 5-9.

5.2 CHEMICAL CHARACTERIZATION RESULTS

The following subsections summarize the results of the chemical characterization of the Elza Gate site.

5.2.1 Background Measurements

Background soil samples from two off-site locations in the Oak Ridge area were analyzed for PCBs and metals to provide a basis for comparison with sample results from the site. Background metals results and sampling locations are given in Table 5-10; no PCBs were detected in the background samples at levels above the detection limit of <160 μ/Kg.

5.2.2 Soil Investigation

Results of chemical analyses performed in 1989 on composite soil samples indicate the presence of PCBs, ranging from 0.39 to 24.0 ppm (Table 5-11). The highest concentrations occurred south of the road in front of Pads 1 and 2.

The results of the chemical analyses performed in 1990 provided additional information on the distribution of PCBs at the site. PCBs were detected in 8 of the 78 locations sampled in 1990, with results ranging from 2.8 to 69 ppm. The results show that the contamination was limited to surface samples; PCBs were found only

TABLE 5-10

BACKGROUND METALS DATA FOR THE OAK RIDGE AREA

	Sampling Location [Concentration (ppm)]						
Parameter	143-B1-0-1	143-B1-1-2	143-B1-2-3	143-B2-0-1	143-B2-1-2	143-B2-2-3	Average
Silver	1.9	2.2	2.4	2.1	2.2	1.5	2.05
Aluminum	6870	22700	18400	12400	16800	8810	14330
Arsenic	19.2	21.9	24.1	21.4	21.9	14.9	20.6
Boron	19.2	21.9	24.1	21.4	21.9	14.9	20.6
Barium	38.3	43.8	48.1	65.6	67.1	35.8	49.8
Beryllium	0.96	1.3	1.4	1.1	1.1	0.75	1.10
Calcium	958	1100	1200	16100	1740	746	3641
Cadmium	0.96	1.1	1.2	1.1	1.1	0.75	1.0
Cobalt	10.5	11	12	10.7	12.1	7.5	14.0
Chromium	11.1	15.4	12.2	13.2	22.5	9.8	15.2
Copper	11.6	17.3	26.9	8.5	17.1	9.5	15.2
Iron	15300	40500	37000	17400	18500	12800	23583
Mercury	0.29	0.14	0.13	0.21	0.13	0.13	0.17
Potassium	1120	3340	2370	1380	2950	1290	2075
Magnesium	958	1910	1450	1440	2350	1040	1525
Manganese	451	36.3	130	958	445	261	380
Molybdenum	19.2	21.9	24.1	21.4	21.9	14.9	20.6
Sodium	958	1100	1200	1070	1090	746	1027
Nickel	8	22.5	24.2	10.2	16.6	6.9	14.7
Lead	19.2	21.9	24.1	21.4	27.8	14.9	21.6
Antimony	11.5	13.1	14.4	12.8	13.1	8.9	12.3
Selenium	19.2	21.9	24.1	21.4	21.9	14.9	20.6
Thallium	28.1	71.8	61.8	39.5	43.4	24.5	44.9
Vanadium	13.4	28	23.7	25.2	26	15.9	22
Zinc	23.7	49.9	57.7	25.4	44.1	18.6	36.6

B1 - Taken at Cedarbrook Cemetery within Oak Ridge, Tennessee, city limits.

B2 - Taken at a private residence within Oak Ridge, Tennessee, city limits.

TABLE 5-11

RESULTS OF 1989 CHEMICAL ANALYSES ON COMPOSITE SOIL SAMPLES FROM THE ELZA GATE SITE

Location[a]	PCBs[b] (ppm)	EP Toxicity[c] Lead (mg/L)
1	6.2	BDL[d]
2	9.6	2
3	10.0	BDL
4	23.0	BDL
5	1.0[e]	BDL
6	6.4	BDL
7	1.3[e]	BDL
8	4.6[e]	16.5
9	7.3	BDL
10	4.7	BDL
11	24.0	BDL
12	0.39[e]	BDL

[a]See Figure 3-7.

[b]PCBs - polychlorinated biphenyls.

[c]EP - extraction procedure.

[d]BDL - below detection limit.

[e]Present in concentration below detection limit.

in the 0- to 0.3-m (0- to 1-ft) sample increment. Approximate sampling locations and PCB concentrations are shown in Figure 5-8, which incorporates positive PCB results of 30 soil samples from the ORAU survey and the 1990 BNI chemical investigation at Elza Gate.

Metals found at concentrations above background (as reported in Table 5-10) included arsenic, copper, potassium, selenium, thallium, cadmium, lead, zinc, manganese, nickel, and barium. A summary of metals results is provided in Table 5-12, which lists metals that exceed background. The results for all metals analyses are provided in Appendix D. Each sample was given a unique identification number: the site identification number is first, followed by the borehole number and the depth from which the sample was collected. For example, 143-01-1-2 indicates that the results are from the Elza Gate site, borehole number 1, at the 1- to 2-ft depth interval. Borehole locations are shown in Figure 3-3. The elevated metals levels were found primarily in the southwestern portion of the site, to the north of Pad 4, and at the end of the cul-de-sac. Samples with levels above background were confined to the 0- to 1-ft increment. Manganese was found at concentrations ranging from 9 to 8,540 ppm. The highest level of manganese was found south of Pad 3, north of the cul-de-sac. Values for lead in discrete samples ranged from 0.5 to 4,050 ppm; the highest level occurred at the end of the cul-de-sac, between the southern ends of Pads 4 and 5. Nickel values ranged from 6.9 to 16,100 ppm; the highest level was found between Pads 4 and 5 north of the cul-de-sac. Average concentrations of metals in soils were calculated using detection limits when positive concentrations were not detected. When this procedure is used, the calculated averages represent a conservative assessment of metal concentrations for the site.

Although other metals were found at concentrations exceeding background values, only lead has been identified at concentrations of potential regulatory concern (Table 5-11). Additional chemical analyses indicated leachable lead in composite samples at 2 of 12 locations; the highest concentrations were found north of the

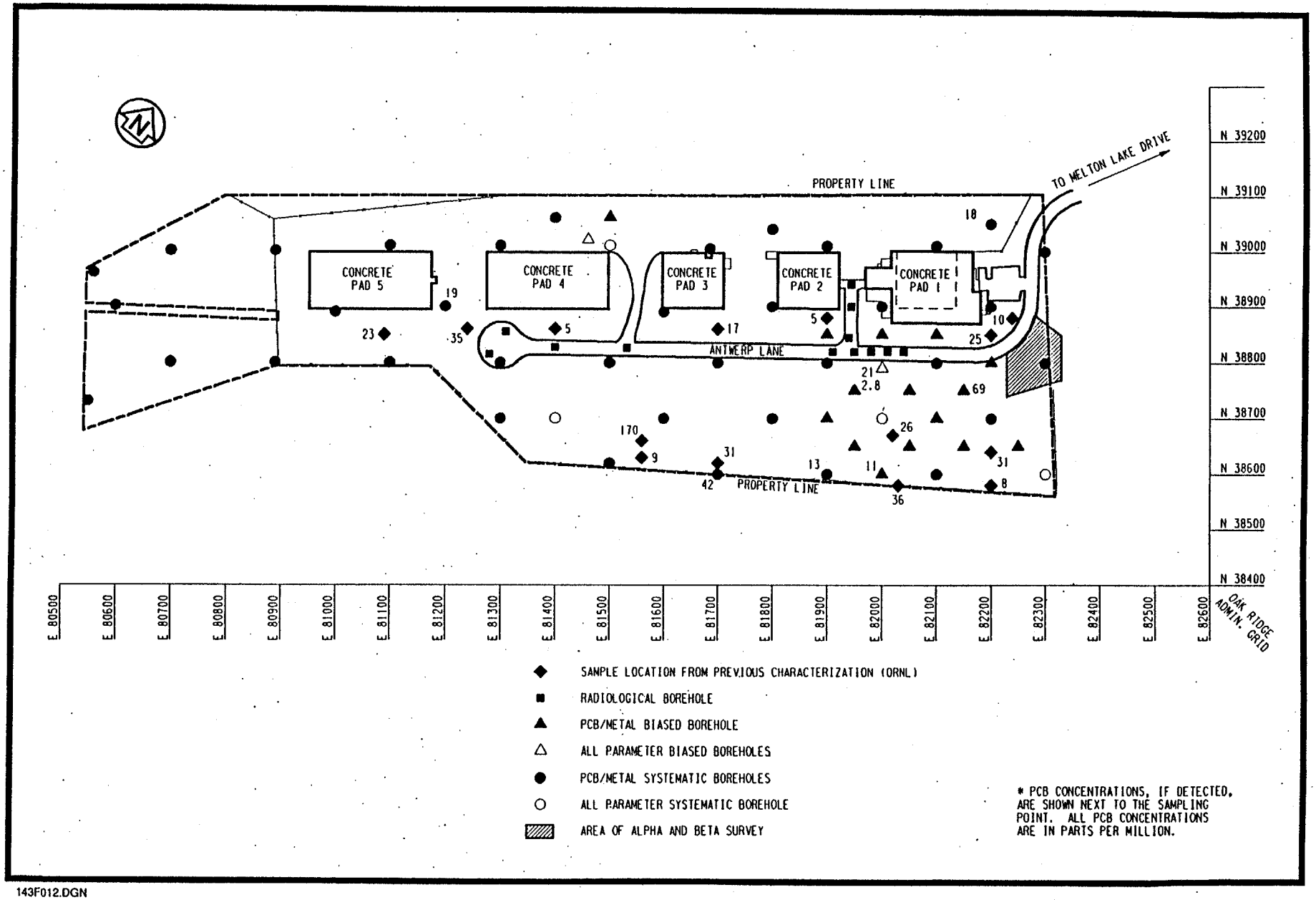

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FIGURE 5-8 APPROXIMATE LOCATIONS OF SAMPLING POINTS AT ELZA GATE SHOWING PCB CONCENTRATIONS

TABLE 5-12

SUMMARY STATISTICS FOR 1990 METALS DATA

FROM THE ELZA GATE SITE

	No. of Samples Analyzed	Concentration (ppm)[a]		
		Mean[b]	Minimum	Maximum
Silver	196	2.5	1	37
Aluminum	196	13,416	200	150,000
Arsenic	196	40.6	2.4	399
Boron	196	26.1	2	102
Barium	196	88.9	4.9	665
Beryllium	196	1.5	0.8	13
Calcium	196	32,683	746	258,000
Cadmium	196	1.8	0.7	18
Cobalt	196	25	1.9	138
Chromium	196	23.3	1.1	183
Copper	196	231	0.7	7,830
Iron	196	27,510	100	222,000
Mercury	196	0.6	0.1	7.7
Potassium	196	1,433	122	14,400
Magnesium	196	3,336	122	36,800
Manganese	196	941	8.7	8,540
Molybdenum	196	25	2	275
Sodium	196	1,361	122	12,300
Nickel	196	153	6.9	16,100
Lead	196	102	0.5	4,050
Antimony	196	15	2	151
Selenium	196	145	3.3	749
Thallium	196	72	3.2	467
Vanadium	196	33	2.2	173
Zinc	196	124	3.2	3,140

[a]Maximum and minimum values include results reported below background values.

[b]All values, including those reported as the sample detection limit, were used to calculate the mean.

road near Pad 4. The composite sample taken from location 8 leached sufficient concentrations of lead to qualify the material sampled as a hazardous waste under RCRA; however, it should be noted that the material is not covered by RCRA regulations until it is in some way managed (for example, by excavation and storage). The EPA Contract Laboratory Program statement of work for organic analysis (SW-846) allows statistical evaluation of analytical results to determine whether waste is regulated by RCRA. Because levels of lead in excess of criteria were found in only one location, it is likely that the material is below applicable regulatory criteria (EPA 1987). Low levels of cyanide were detected in three locations, and leachable mercury was detected at very low concentrations at two locations, which are below regulatory concern.

Eighteen soil samples were analyzed for volatile and BNAE organics, and leachates from the soil samples were analyzed for pesticides and herbicides. Only 2 volatile organic compounds were detected: toluene (in 11 samples) and carbon disulfide (in 5 samples); results are given in Table 5-13. Both compounds are well below applicable regulatory levels.

No samples analyzed for BNAE organics or pesticides and herbicides had concentrations above the analytical method detection limit. Published detection limits for chemical analyses are given in Table 5-14.

5.2.3 Miscellaneous Chemical Sampling

In October 1990, 16 soil samples were collected south of the Elza Gate property boundary, between the site and Melton Lake Reservoir. These sampling locations are shown in Figure 5-7. These samples were analyzed for PCBs to determine if PCB contamination existed off site. The highest PCB concentration detected was 5.8 ppm. PCB concentrations for each sampling location are given in Table 5-15.

TABLE 5-13

ANALYTICAL RESULTS FOR VOLATILE ORGANICS

AT THE ELZA GATE SITE

Site ID[a]	Toluene (ppb)	Carbon Disulfide (ppb)
143-24-0-1	9	BDL[b]
143-24-1-2	240	BDL
143-24-2-3	240	BDL
143-27-0-1	160	BDL
143-27-1-2	BDL	BDL
143-27-2-3	BDL	BDL
143-19-0-1	BDL	BDL
143-19-1-2	BDL	BDL
143-19-2-3	8	42
143-53-0-1	BDL	BDL
143-53-1-2	BDL	BDL
143-53-2-3	170	BDL
143-52-0-1	10	BDL
143-52-1-2	39	9
143-52-2-3	BDL	16
143-73-0-1	8	BDL
143-73-1-2	100	6
143-73-2-3	210	6

[a]See Figure 3-3 for sampling locations.

[b]BDL - below detection limit.

TABLE 5-14

ANALYTICAL METHODS FOR SOIL AND SEDIMENT

Parameter	Analytical Technique	EPA Method No.	Published Detection Limits
Metals	ICPAES[c]	6010	See note
TC			
TCLP - metals	ICPAES	6010	See note
- mercury	AA	7470	See note
- organics	GC/MS & GC/EC	VOA-8240 BNA-8270 Pest-8080 Herb-8150	See note
PCBs	GC/EC	8080	<80 µg/kg for aroclors 1016-1248 <160 µg/kg for aroclors 1254-1260
TOC	Carbonaceous analyzer	9060	100 mg/kg
TPH	Infrared spectrophotometry	9071 (extraction) 418.1 (analysis)	10 mg/kg
Corrosivity-Ph	Electrometric	9045	N/A
Ignitability	Pensky Martins	1010[d]	N/A
Reactivity			
Total cyanide	Titration	9010	1.0 mg/kg
Total sulfide	Titration	9030	0.25 mg/kg
Volatile organics	GC/MS	8240	See note
BNAE	GC/MS	8270	See note
Pesticides	GC	8080	See note

Note: Detection limits for chemical analyses will meet or exceed those required by Environmental Protection Agency Contract Laboratory Program protocols or other regulatory authorities.

[a]Thermo Analytical/Eberline uses laboratory procedures developed by Environmental Measurements Laboratory (EML).

[b]Modified EML procedure to accommodate the matrix.

[c]ICPAES - Inductively coupled plasma atomic emission spectrophotometry; AA - atomic absorption; GC/MS - gas chromatography/mass spectroscopy; GC/EC-gas chromatography/electron capture; TC - toxicity characteristic;

TABLE 5-14

(continued)

TCLP - toxicity characteristics leaching procedure; TOC - total organic carbon; TPH - total petroleum hydrocarbons; PCBs - polychlorinated biphenyls; BNAE - base/neutral and acid extractable.

[d]If sample is too solid for the Pensky Martins test, a flame is applied for ignitability test that has no EPA method number.

TABLE 5-15

PCB RESULTS FOR SAMPLES COLLECTED FROM TENNESSEE VALLEY AUTHORITY PROPERTY NEAR THE ELZA GATE SITE

Borehole Number	Coordinates East	Coordinates North	Concentration parts per million
1	81500	38500	BDL[b]
2	81550	38550	BDL
3	81608	38506	0.3
4	81650	38550	5.8
5	81722	38540	0.6
6	81750	38550	BDL
7	81812	38535	0.5
8	81850	38550	BDL
9	81900	38550	0.4
10	81950	38550	BDL
11	82000	38535	BDL
12	82050	38550	5.5
13	82100	38520	BDL
14	82150	38550	0.5
15	82200	38520	BDL
16	82250	38550	BDL

[a]See Figure 5-7 for sampling locations.
[b]BDL - below detection limit.

5.3 GEOLOGICAL AND HYDROGEOLOGICAL RESULTS

Eleven soil borings were drilled during the geologic investigation at Elza Gate (Figure 3-9). All of the borings extended to bedrock, and four were advanced into bedrock. The data collected during this investigation are the basis for the following assessment.

5.3.1 Geologic Setting

Regional geology

The bedrock underlying the Elza Gate site is part of the Cambro-Ordovician mixed clastic and carbonate sequence present in much of East Tennessee. The stratigraphic sequence from oldest to youngest units at the site consists of shales and sandstones of the lower Cambrian Rome Formation, mixed carbonates and clastics of the middle and upper Cambrian Conasauga Group, and mixed carbonates and clastics of the middle Ordovician Conasauga Group (Haase, Walls, and Farmer 1985).

Elza Gate is located in the Valley and Ridge province of the Southern Appalachians. Thrust faulting in this region during the Appalachian orogeny displaced strata as far as 100 km to the northwest. As a result, older strata commonly overlie younger strata. The regional strike of strata in this area is N50° to E60°, and the dip of the rocks at the surface can be as much as 45° to 55° to the southeast. Figure 5-9 is a regional cross section through the Elza Gate area.

Because the bedrock in the Elza Gate area has a low primary porosity, groundwater is found mainly in fractures and larger cavities. Bedrock permeabilities range from 1×10^{-7} to 2×10^{-2} cm/s (3×10^{-4} to 54.8 ft/day), and well yields are highly variable. In soil and weathered bedrock, permeability is slightly higher than in bedrock, ranging from 1×10^{-6} to 3×10^{-2} cm/s (3×10^{-3} to 82.2 ft/day) (Moore 1988; Webster and Bradley 1988).

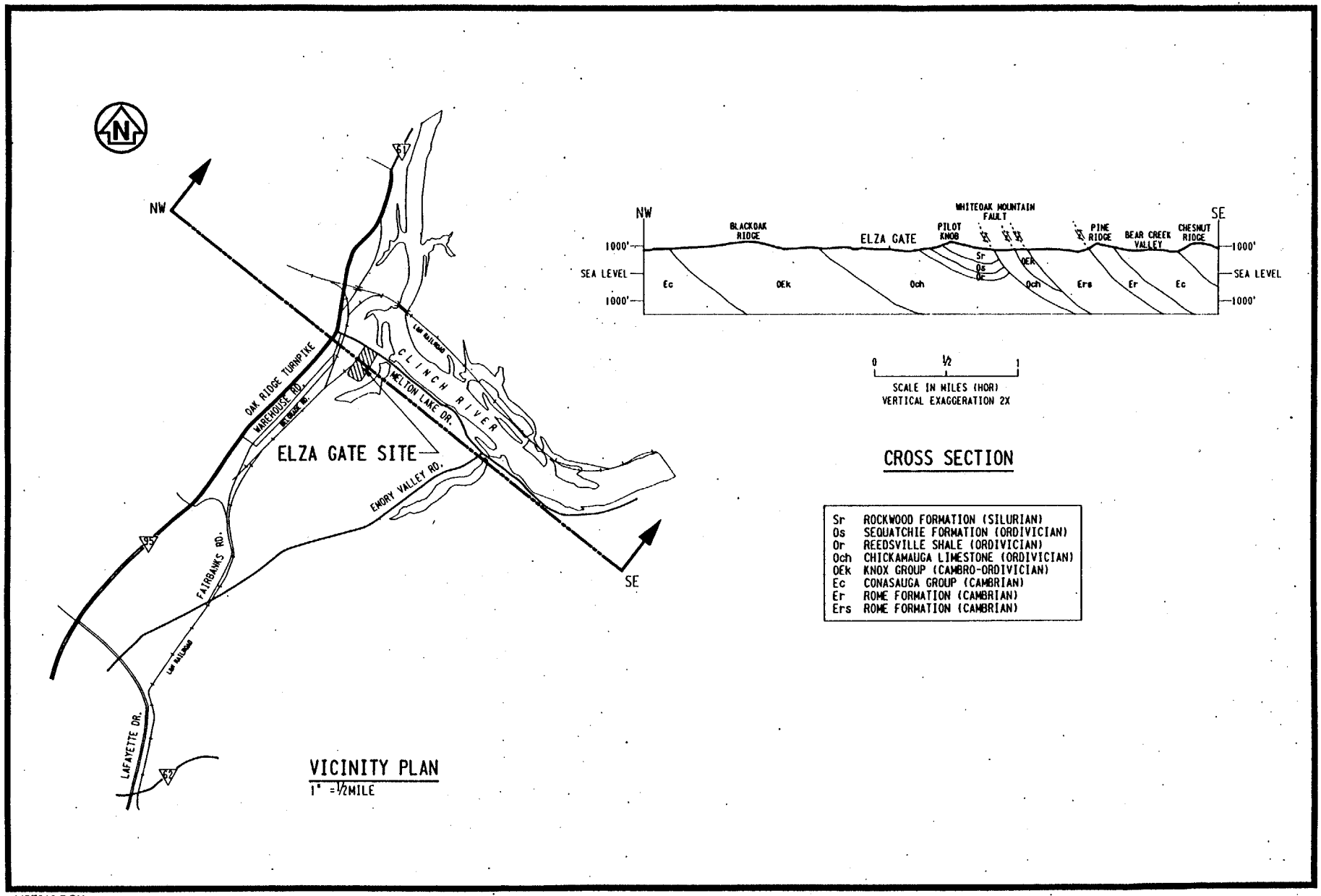

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FIGURE 5-9 REGIONAL GEOLOGIC CROSS SECTION OF THE ELZA GATE AREA

Site geology

The Elza Gate site is located 100 m (350 ft) north of Melton Hill Reservoir at an elevation that ranges from 245 to 253 m (810 to 830 ft) above mean sea level. Melton Hill Reservoir lies at an elevation approximately 5 m (16.4 ft) below the site. The topography of the site slopes gently to the south.

The site is located about 1.5 km (1 mi) north of the Whiteoak Mountain thrust fault and lies on the north flank of a broad syncline that was probably formed by drag folding during motion along the Whiteoak Mountain fault that probably occurred during the Mesozoic era.

Chickamauga limestone of Ordovician age underlies the site. In the Oak Ridge area, the Chickamauga is a gray to grayish blue, fine-grained limestone interspersed with echinoderm-rich layers. The unit may be cherty, silty, or shaly, and characteristically has bedding parallel stylolites as much as 2 cm (0.1 ft) thick. Bedrock at the site dips gently to the southeast. Permeabilities in the Chickamauga range from 1.2×10^{-7} to 2×10^{-2} cm/s (3.3×10^{-4} to 27.4 ft/day); the geometric mean is 3.4×10^{-5} cm/s (9.6×10^{-2} ft/day) (Moore 1988).

5.3.2 Soil

The soil at Elza Gate is divided into two distinct zones: the topmost zone consisting of fill material that is 0.3 to 3 m (1 to 10 ft) thick, and natural soil below the fill material that also ranges from 0.3 to 3 m (1 to 10 ft) in thickness. These units are underlain by weathered and unweathered limestone bedrock. Geologic drill logs for all boreholes are included in Appendix E.

Natural soils at Elza Gate are members of the Collegedale series, which are typically deep, well drained, and acidic, and generally mottled brown, red, or yellowish brown. Although composed predominantly of silt and clay, Collegedale soils have a coarse fraction (usually chert) and typically have a slope of 2° to 30° (Moneymaker 1981). Particle size analyses indicate that the

grain size of both the fill material and natural soil at Elza Gate is similar to that of the Collegedale series. The samples consist mostly of silt and clay with a minor coarse fragment. The sample from the 2.7- to 3-m (8- to 10-ft) interval of borehole B43R210 is the only exception to this description. This sample is probably from the unweathered zone because it is much coarser grained than the other samples.

Weathered bedrock at the site is characterized by interlayered rock and natural soils that may have developed by differential weathering along bedding planes. This process may have formed pockets and layers of soil in areas where the limestone bedrock dissolved and left the insoluble clay and silt fraction behind. The weathered bedrock zone is 0.7 to 3 m (2 to 10 ft) thick.

The bedrock surface at the site is irregular. It is shallow on both the north and south sides of the site and deeper along the road; however, toward the east end of the site, a localized high extends across the entire width of the site. Both the undisturbed soil and the fill material reflect the attitude of the bedrock surface. The thickness of both units is greatest toward the center of the site and decreases to the north and the south. Both units are thinnest above the bedrock high toward the east end of the site.

The permeability of each zone and the bedrock was determined in the field at several locations. Falling-head permeability tests were performed in the fill material at borehole B43R211, in natural soil at borehole B43R207, and in the weathered bedrock at borehole B43R201. Constant-head packer tests were performed in bedrock at boreholes B43R208 and B43R209. The results of the field permeability tests are summarized in Table 5-16.

The values calculated from field permeability tests in bedrock are slightly lower than those reported in other studies of the Oak Ridge area, probably because there are fewer fractures and cavities in the bedrock at the site than are generally found in the area. Field permeabilities for the weathered bedrock are within the range reported by Moore (1988) and by Webster and Bradley (1988).

TABLE 5-16

RESULTS OF FIELD PERMEABILITY TESTS

AT THE ELZA GATE SITE

Borehole[a]	Medium	Permeability (cm/s)[b]
B43R201	Weathered bedrock	$K_h = 1.51 \times 10^{-3}$
B43R207	Natural soil	$K_v < 1.15 \times 10^{-6}$
B43R208	Bedrock	$K_h < 2.2 \times 10^{-8}$
B43R209	Bedrock	$K_h < 3.7 \times 10^{-8}$
B43R211	Fill	$K_v = 5.9 \times 10^{-6}$

[a]Borehole locations are shown in Figure 3-9.

[b]Because the flow rates recorded in the field were negligible, the values listed in this column represent the lowest probable permeability values calculated for the rock.

Constant-head permeability tests were performed by the laboratory on the fill material in borehole B43R211 and the natural soil in borehole B43R207. The permeability of the fill material, 5.92×10^{-5} cm/s (1.68×10^{-1} ft/day), is one order of magnitude greater than that determined by field tests. The value for the natural soil was 6.08×10^{-4} cm/s (1.73 ft/day), which is greater than that determined by field permeability tests; however, it is still within the range of permeabilities reported by Moore and by Webster and Bradley.

5.3.3 Groundwater

The elevation of the water table at Elza Gate ranges from 243 to 249 m (797 to 816 ft) above mean sea level, at a depth of 2 to 5.3 m (6 to 17.3 ft). Groundwater flows predominantly to the southeast. The hydraulic gradient (measured between boreholes) is about 34.1 m/km (180 ft/mi). Groundwater at Elza Gate probably discharges into Melton Hill Reservoir, the nearest body of surface water. Although no direct link between the lake and groundwater at the site has been established, coincident changes in lake water and groundwater levels have been observed.

The depth to groundwater in the soil underlying the site appears to be controlled by the depth to bedrock. Contours of the water table reflect those of the bedrock (Appendix E), as is the case in other areas in East Tennessee (Webster 1976). Although bedrock permeability is low, groundwater in the lower few meters of the soil column is thought to be hydraulically connected to the underlying limestone (Webster and Bradley 1988). Groundwater is not used in operations on site or between the site and Melton Hill Reservoir.

6.0 SUMMARY

The radiological portion of the Elza Gate characterization consisted of conducting walkover gamma scans, extensive soil sampling, gamma exposure measurements, and air sampling for radon. Results from gamma scans and soil sampling indicated contamination in soil near Pads 1 and 4, around the cul-de-sac, south of the access road near Pads 1 and 2, and near Pads 2 and 3 (Figure 5-1). The maximum depth of contamination was 1.5 m (5.0 ft); most contamination was found at depths less than 0.15 m (0.5 ft). The primary radioactive contaminants in soil were uranium-238 (6 to 12,000 pCi), radium-226 (2.6 to 12,000 pCi/g), and thorium-230 (8.1 to 12,000 pCi/g). Substantially lower concentrations of thorium-232 (1.9 to 82 pCi/g) were indicated.

Radioactive contamination at levels exceeding DOE guidelines was also found on each of the pads; the highest levels were found on Pad 2, with respectively lower levels on Pads 3, 4, and 5. Contamination on Pad 5 was scattered, and radiation measurements were below guidelines over most of the surface. An abrasive blast cleaning system was tested in 1989 on Pad 1. As a result of the blast cleaning, all areas of the pad, except for small cracks, are now below guidelines for residual radioactivity.

Analytical results for soil samples collected beneath Pads 2 and 5 indicated no contamination exceeding guidelines. However, uranium-238 (<2 to 1,300 pCi/g), radium-226 (0.5 to 45 pCi/g), and thorium-230 (<1.0 to 500 pCi/g) contamination were found at shallow depths [<0.15 m (0.5 ft)] beneath portions of Pad 1.

The highest gamma exposure rate was measured at the northern side of the cul-de-sac (E 81330, N 38870). This is the same area in which the highest uranium-238 and radium-220 concentrations were found in soil. Gamma exposure rate measurements ranged from 7.3 to 571 μR/h; however, most measurements were less than 2.5 times background, with the majority being below the average background value.

Radon flux measurements averaged 7.7 $pCi/m^2/s$ across the site. The maximum flux rate was 159 $pCi/m^2/s$, and average background for the Oak Ridge area was 0.2 $pCi/m^2/s$. The highest flux measurement, taken near the cul-de-sac, corresponds to the locations where the highest radium-226 concentrations in soil were observed.

The chemical portion of the characterization consisted of collecting and analyzing soil samples for PCBs, metals, and BNAE and volatile organic compounds. PCBs were detected in shallow soil [<0.15 m (0.5 ft)] west of the cul-de-sac, south of the access road, between Pad 1 and the access road, and between Pad 4 and the access road at concentrations ranging from the detection limit to 69 ppm. These results are generally consistent with those from a previous ORAU survey that indicated a maximum PCB concentration of 170 ppm. Only one sample contained PCBs at levels that are regulated under the Toxic Substances Control Act (50 ppm). Because the site is being developed for future industrial use, a PCB cleanup action level of 25 ppm was chosen. This cleanup level is recommended in EPA's Guidance on Remedial Actions for Superfund Sites with PCB Contamination as a level protective of human health (EPA 1990).

Amounts of the following metals exceeded background concentrations for soil in the Oak Ridge area: silver, arsenic, lead, zinc, manganese, nickel, and barium. These metals were found at shallow depths [0 to 0.3 m (0 to 1 ft)] in the southwestern portion of the site, to the north of Pad 4, and near the cul-de-sac. It is important to note that only one sample failed the EP toxicity test for lead, indicating that leaching of metals from soil is minimal. Therefore, this area will be segregated and resampled if necessary to determine whether samples taken from the area fail the toxicity characteristics leaching procedure.

Two volatile organics, toluene and carbon disulfide, were detected at low concentrations. Analysis for BNAE organics, pesticides, and herbicides did not indicate the presence of these compounds.

The volume of waste to be managed at the site is estimated to be 696.6 m^3 (8,200 yd^3) (assuming a uranium cleanup guideline of 35 pCi/g and a PCB cleanup guideline of 25 ppm). Approximately 59.5 m^3 (700 yd^3) of this total is soil containing PCBs at levels exceeding 50 ppm.

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APPENDIX A

DOWNHOLE GAMMA LOGGING RESULTS FOR THE ELZA GATE SITE

APPENDIX A

DOWNHOLE GAMMA LOGGING RESULTS

FOR ELZA GATE

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R93			
80550	38800	0.0	8000
80550	38800	0.5	10000
80550	38800	1.0	11000
80550	38800	1.5	13000
80550	38800	2.0	14000
80550	38800	2.5	16000
80550	38800	3.0	17000
80550	38800	3.5	18000
Borehole B43R94			
80550	38965	0.0	9000
80550	38965	0.5	12000
80550	38965	1.0	14000
80550	38965	1.5	16000
80550	38965	2.0	16000
80550	38965	2.5	15000
80550	38965	3.0	14000
Borehole B43R92			
80600	38700	0.0	10000
80600	38700	0.5	13000
80600	38700	1.0	15000
80600	38700	1.5	15000
80600	38700	2.0	15000
80600	38700	2.5	14000
80600	38700	3.0	13000
Borehole B43R95			
80700	39040	0.0	7000
80700	39040	0.5	8000
80700	39040	1.0	9000

APPENDIX A

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R91			
80800	38765	0.0	7000
80800	38765	0.5	9000
80800	38765	1.0	10000
80800	38765	1.5	10000
80800	38765	2.0	11000
80800	38765	2.5	11000
Borehole B43R66			
80880	39020	0.0	9000
80880	39020	0.5	13000
80880	39020	1.0	15000
80880	39020	1.5	15000
80880	39020	2.0	14000
80880	39020	2.5	14000
Borehole B43R65			
80890	38950	0.0	8000
80890	38950	0.5	14000
80890	38950	1.0	19000
80890	38950	1.5	16000
80890	38950	2.0	17000
80890	38950	2.5	18000
80890	38950	3.0	18000
80890	38950	3.5	18000
80890	38950	4.0	18000
80890	38950	4.5	17000
80890	38950	5.0	17000
80890	38950	6.0	18000
80890	38950	6.5	19000
Borehole B43R96			
80900	39100	0.0	8000
80900	39100	0.5	11000
80900	39100	1.0	12000

APPENDIX A

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R64			
80910	38840	0.0	8000
80910	38840	0.5	10000
80910	38840	1.0	12000
80910	38840	1.5	12000
80910	38840	2.0	12000
80910	38840	2.5	13000
80910	38840	3.0	14000
80910	38840	3.5	14000
80910	38840	4.0	14000
Borehole B43R62			
80955	38835	0.0	9000
80955	38835	0.5	12000
80955	38835	1.0	13000
80955	38835	1.5	13000
80955	38835	2.0	13000
80955	38835	2.5	13000
80955	38835	3.0	12000
Borehole B43R63			
80955	38880	0.0	7000
80955	38880	0.5	9000
80955	38880	1.0	11000
80955	38880	1.5	13000
80955	38880	2.0	15000
80955	38880	2.5	15000
80955	38880	3.0	14000
80955	38880	3.5	16000
80955	38880	4.0	16000
Borehole B43R61			
80956	38800	0.0	10000
80956	38800	0.5	12000
80956	38800	1.0	14000
80956	38800	1.5	14000
80956	38800	2.0	12000
80956	38800	2.5	11000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R59			
81050	38800	0.0	8000
81050	38800	0.5	11000
81050	38800	1.0	13000
81050	38800	1.5	15000
81050	38800	2.0	15000
81050	38800	2.5	15000
81050	38800	3.0	15000
81050	38800	3.5	15000
Borehole B43R60			
81050	38845	0.0	8000
81050	38845	0.5	10000
81050	38845	1.0	11000
81050	38845	1.5	11000
81050	38845	2.0	11000
81050	38845	2.5	14000
81050	38845	3.0	13000
Borehole B43R58			
81125	38880	0.0	7000
81125	38880	0.5	9000
81125	38880	1.0	11000
81125	38880	1.5	14000
81125	38880	2.0	14000
81125	38880	2.5	16000
81125	38880	3.0	17000
81125	38880	3.5	17000
Borehole B43R67			
81180	38805	0.0	7000
81180	38805	0.5	6000
81180	38805	1.0	6000
81180	38805	1.5	6000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R41			
81200	38850	0.0	8000
81200	38850	0.5	12000
81200	38850	1.0	11000
81200	38850	1.5	10000
Borehole B43R87			
81200	39035	0.0	7000
81200	39035	0.5	8000
81200	39035	1.0	10000
81200	39035	1.5	18000
81200	39035	2.0	19000
81200	39035	2.5	20000
81200	39035	3.0	20000
81200	39035	3.5	19000
81200	39035	4.0	17000
Borehole B43R40			
81220	38820	0.0	8000
81220	38820	0.5	11000
81220	38820	1.0	12000
81220	38820	1.5	14000
81220	38820	2.0	14000
Borehole B43R47			
81230	38900	0.0	8000
81230	38900	0.5	11000
81230	38900	1.0	13000
81230	38900	1.5	15000
81230	38900	2.0	15000
81230	38900	2.5	15000
81230	38900	3.0	15000
81230	38900	3.5	15000
81230	38900	4.0	15000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R48			
81230	38945	0.0	6000
81230	38945	0.5	7000
81230	38945	1.0	8000
81230	38945	1.5	11000
81230	38945	2.0	14000
81230	38945	2.5	15000
81230	38945	3.0	13000
81230	38945	3.5	11000
Borehole B43R33			
81240	38740	0.0	8000
81240	38740	0.5	12000
81240	38740	1.0	13000
81240	38740	1.5	12000
81240	38740	2.0	11000
Borehole B43R39			
81255	38795	0.0	10000
81255	38795	0.5	14000
81255	38795	1.0	40000
81255	38795	1.5	108000
81255	38795	2.0	49000
81255	38795	2.5	15000
81255	38795	3.0	12000
81255	38795	3.5	10000
Borehole B43R49			
81265	38980	0.0	6000
81265	38980	0.5	8000
81265	38980	1.0	11000
81265	38980	1.5	14000
81265	38980	2.0	16000
81265	38980	2.5	14000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R49 (continued)			
81265	38980	3.0	14000
81265	38980	3.5	15000
81265	38980	4.0	15000
Borehole B43R32			
81270	38700	0.0	8000
81270	38700	0.5	9000
81270	38700	1.0	11000
81270	38700	1.5	12000
81270	38700	2.0	14000
81270	38700	2.5	17000
81270	38700	3.0	17000
81270	38700	3.5	17000
81270	38700	4.0	17000
Borehole B43R46			
81270	38900	0.0	8000
81270	38900	0.5	11000
81270	38900	1.0	16000
81270	38900	1.5	16000
81270	38900	2.0	16000
81270	38900	2.5	16000
81270	38900	3.0	15000
81270	38900	3.5	15000
81270	38900	4.0	15000
Borehole B43R38			
81275	38795	0.0	17000
81275	38795	0.5	30000
81275	38795	1.0	68000
81275	38795	1.5	193000
81275	38795	2.0	77000
81275	38795	2.5	26000
81275	38795	3.0	15000
81275	38795	3.5	11000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R98			
81295	38815	0.0	5000
81295	38815	0.5	7000
81295	38815	1.0	12000
81295	38815	1.5	14000
81295	38815	2.0	13000
81295	38815	2.5	13000
81295	38815	3.0	11000
81295	38815	3.5	10000
81295	38815	4.0	9000
81295	38815	4.5	7000
Borehole B43R34			
81300	38750	0.0	7000
81300	38750	0.5	10000
81300	38750	1.0	13000
81300	38750	1.5	13000
Borehole B43R31			
81310	38660	0.0	8000
81310	38660	0.5	11000
81310	38660	1.0	16000
81310	38660	1.5	16000
81310	38660	2.0	17000
81310	38660	2.5	16000
81310	38660	3.0	16000
81310	38660	3.5	17000
81310	38660	4.0	16000
81310	38660	4.5	17000
Borehole B43R97			
81315	38850	0.0	6000
81315	38850	0.5	6000
81315	38850	1.0	11000
81315	38850	1.5	20000
81315	38850	2.0	20000
81315	38850	2.5	20000
81315	38850	3.0	20000
81315	38850	3.5	22000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R97 (continued)			
81315	38850	4.0	20000
81315	38850	4.5	18000
81315	38850	5.0	18000
81315	38850	5.5	18000
Borehole B43R45			
81325	38885	0.0	1372000
81325	38885	0.5	2056000
81325	38885	1.0	1085000
81325	38885	1.5	261000
81325	38885	2.0	96000
81325	38885	2.5	34000
81325	38885	3.0	21000
81325	38885	3.5	19000
81325	38885	4.0	20000
81325	38885	5.0	19000
81325	38885	6.0	23000
Borehole B43R30			
81355	38620	0.0	8000
81355	38620	0.5	13000
81355	38620	1.0	15000
81355	38620	1.5	15000
81355	38620	2.0	15000
81355	38620	2.5	15000
81355	38620	3.0	15000
81355	38620	3.5	15000
81355	38620	4.0	15000
81355	38620	4.5	15000
Borehole B43R44			
81370	38880	0.0	12000
81370	38880	0.5	17000
81370	38880	1.0	19000
81370	38880	1.5	20000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R44 (continued)			
81370	38880	2.0	20000
81370	38880	2.5	20000
81370	38880	3.0	20000
81370	38880	3.5	19000
Borehole B43R37			
81375	38780	0.0	14000
81375	38780	0.5	13000
81375	38780	1.0	13000
81375	38780	1.5	12000
81375	38780	2.0	14000
81375	38780	2.5	15000
81375	38780	3.0	15000
81375	38780	3.5	15000
81375	38780	4.0	15000
Borehole B43R29			
81400	38650	0.0	9000
81400	38650	0.5	12000
81400	38650	1.0	15000
81400	38650	1.5	17000
81400	38650	2.0	19000
81400	38650	2.5	19000
81400	38650	3.0	19000
81400	38650	3.5	18000
81400	38650	4.0	18000
Borehole B43R35			
81400	38745	0.0	7000
81400	38745	0.5	10000
81400	38745	1.0	13000
81400	38745	1.5	15000
81400	38745	2.0	15000
81400	38745	2.5	16000
81400	38745	3.0	16000
81400	38745	3.5	17000
81400	38745	4.0	17000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R57			
81400	39040	0.0	7000
81400	39040	0.5	10000
81400	39040	1.0	10000
81400	39040	1.5	13000
Borehole B43R68			
81435	38865	0.0	185000
81435	38865	0.5	107000
81435	38865	1.0	25000
81435	38865	1.5	45000
81435	38865	2.0	29000
81435	38865	2.5	17000
81435	38865	3.0	17000
81435	38865	3.5	17000
81435	38865	4.0	17000
81435	38865	4.5	17000
81435	38865	5.0	17000
81435	38865	5.5	17000
81435	38865	6.0	17000
81435	38865	6.5	17000
Borehole B43R36			
81440	38790	0.0	6000
81440	38790	0.5	10000
81440	38790	1.0	18000
81440	38790	1.5	14000
81440	38790	2.0	14000
81440	38790	2.5	14000
81440	38790	3.0	14000
81440	38790	3.5	15000
81440	38790	4.0	15000
81440	38790	4.5	16000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R55			
81445	39010	0.0	8000
81445	39010	0.5	9000
81445	39010	1.0	10000
81445	39010	1.5	10000
81445	39010	2.0	15000
81445	39010	2.5	16000
81445	39010	3.0	15000
81445	39010	3.5	14000
Borehole B43R28			
81455	38615	0.0	7000
81455	38615	0.5	11000
81455	38615	1.0	13000
81455	38615	1.5	12000
81455	38615	2.0	16000
81455	38615	2.5	16000
81455	38615	3.0	15000
81455	38615	3.5	13000
81455	38615	4.0	12000
Borehole B43R42			
81455	38845	0.0	6000
81455	38845	0.5	6000
81455	38845	1.0	8000
81455	38845	1.5	13000
81455	38845	2.0	16000
81455	38845	2.5	16000
81455	38845	3.0	16000
81455	38845	3.5	16000
81455	38845	4.0	16000
Borehole B43R43			
81455	38890	0.0	7000
81455	38890	0.5	10000
81455	38890	1.0	14000
81455	38890	1.5	16000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R43 (continued)			
81455	38890	2.0	16000
81455	38890	2.5	18000
81455	38890	3.0	19000
81455	38890	3.5	18000
81455	38890	4.0	18000
Borehole B43R56			
81505	39050	0.0	10000
81505	39050	0.5	13000
81505	39050	1.0	17000
81505	39050	1.5	19000
81505	39050	2.0	18000
81505	39050	2.5	17000
81505	39050	3.0	17000
Borehole B43R50			
81510	38960	0.0	8000
81510	38960	0.5	10000
81510	38960	1.0	13000
81510	38960	1.5	16000
81510	38960	2.0	16000
81510	38960	2.5	15000
81510	38960	3.0	16000
81510	38960	3.5	16000
Borehole B43R24			
81560	38610	0.0	9000
81560	38610	0.5	12000
81560	38610	1.0	15000
81560	38610	1.5	16000
81560	38610	2.0	18000
81560	38610	2.5	19000
81560	38610	3.0	18000
81560	38610	3.5	16000
81560	38610	4.0	14000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R27			
81565	38700	0.0	8000
81565	38700	0.5	12000
81565	38700	1.0	15000
81565	38700	1.5	15000
81565	38700	2.0	18000
81565	38700	2.5	16000
81565	38700	3.0	16000
81565	38700	3.5	16000
81565	38700	4.0	16000
81565	38700	5.0	16000
81565	38700	6.0	16000
81565	38700	7.0	16000
Borehole B43R25			
81570	38660	0.0	8000
81570	38660	0.5	12000
81570	38660	1.0	15000
81570	38660	1.5	16000
81570	38660	2.0	17000
81570	38660	2.5	17000
Borehole B43R103			
81600	38800	0.5	11000
81600	38800	1.0	9000
81600	38800	1.5	11000
81600	38800	2.0	13000
81600	38800	2.5	15000
81600	38800	3.0	15000
Borehole B43R26			
81610	38670	0.0	7000
81610	38670	0.5	11000
81610	38670	1.0	15000
81610	38670	1.5	16000
81610	38670	2.0	15000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R26 (continued)			
81610	38670	2.5	14000
81610	38670	3.0	14000
81610	38670	3.5	14000
81610	38670	4.0	14000
81610	38670	4.5	14000
Borehole B43R112			
81620	38940	0.0	5000
81620	38940	0.5	5000
81620	38940	1.0	6000
81620	38940	1.5	6000
81620	38940	2.0	7000
81620	38940	2.5	7000
Borehole B43R51			
81675	38895	0.0	14000
81675	38895	0.5	17000
81675	38895	1.0	21000
81675	38895	1.5	12000
81675	38895	2.0	10000
81675	38895	2.5	10000
81675	38895	3.0	13000
81675	38895	3.5	15000
81675	38895	4.0	18000
Borehole B43R81			
81700	38600	0.0	7000
81700	38600	0.5	8000
81700	38600	1.0	10000
81700	38600	1.5	10000
81700	38600	2.0	13000
81700	38600	2.5	14000
81700	38600	3.0	15000
81700	38600	3.5	15000
81700	38600	4.0	16000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R90			
81700	38750	0.0	8000
81700	38750	0.5	10000
81700	38750	1.0	15000
81700	38750	1.5	18000
81700	38750	2.0	18000
81700	38750	2.5	18000
81700	38750	3.0	18000
81700	38750	3.5	17000
81700	38750	4.0	18000
Borehole B43R102			
81700	38830	0.0	8000
81700	38830	0.5	13000
81700	38830	1.0	14000
81700	38830	1.5	15000
81700	38830	2.0	15000
81700	38830	2.5	13000
81700	38830	3.0	13000
Borehole B43R53			
81760	38945	0.0	5000
81760	38945	0.5	7000
81760	38945	1.0	8000
Borehole B43R23			
81800	38645	0.0	6000
81800	38645	0.5	9000
81800	38645	1.0	13000
81800	38645	1.5	16000
81800	38645	2.0	17000
81800	38645	2.5	17000
81800	38645	3.0	16000
81800	38645	3.5	16000
81800	38645	4.0	19000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R101			
81800	38800	0.0	7000
81800	38800	0.5	8000
81800	38800	1.0	12000
81800	38800	1.5	15000
81800	38800	2.0	15000
81800	38800	2.5	15000
81800	38800	3.0	15000
81800	38800	3.5	15000
Borehole B43R54			
81800	38945	0.0	9000
81800	38945	0.5	10000
81800	38945	1.0	11000
Borehole B43R88			
81800	39040	0.0	7000
81800	39040	0.5	10000
81800	39040	1.0	11000
81800	39040	1.5	11000
81800	39040	2.0	11000
81800	39040	2.5	10000
Borehole B43R105			
81855	38880	0.0	6000
81855	38880	0.5	9000
81855	38880	1.0	13000
81855	38880	1.5	19000
81855	38880	2.0	21000
81855	38880	2.5	15000
Borehole B43R52			
81855	38895	0.0	98000
81855	38895	0.5	260000
81855	38895	1.0	271000
81855	38895	1.5	95000
81855	38895	2.0	31000

Coordinates[a] East	North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R52 (continued)			
81855	38895	2.5	15000
81855	38895	3.0	13000
81855	38895	3.5	13000
Borehole B43R80			
81900	38590	0.0	5000
81900	38590	0.5	7000
81900	38590	1.0	10000
81900	38590	1.5	13000
81900	38590	2.0	13000
81900	38590	2.5	13000
81900	38590	3.0	13000
81900	38590	3.5	13000
Borehole B43R82			
81900	38775	0.0	6000
81900	38775	0.5	8000
81900	38775	1.0	8000
81900	38775	1.5	12000
81900	38775	2.0	17000
81900	38775	2.5	17000
81900	38775	3.0	16000
81900	38775	3.5	17000
81900	38775	4.0	17000
81900	38775	4.5	17000
81900	38775	5.0	18000
81900	38775	5.5	18000
81900	38775	6.0	19000
Borehole B43R83			
81910	38805	0.0	6000
81910	38805	0.5	8000
81910	38805	1.0	8000
81910	38805	1.5	14000
81910	38805	2.0	15000
81910	38805	2.5	16000
81910	38805	3.0	16000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R83 (continued)			
81910	38805	3.5	17000
81910	38805	4.0	17000
81910	38805	4.5	18000
81910	38805	5.0	18000
81910	38805	5.5	18000
81910	38805	6.0	17000
81910	38805	6.5	17000
81910	38805	7.0	17000
Borehole B43R78			
81930	38785	0.0	12000
81930	38785	0.5	22000
81930	38785	1.0	22000
81930	38785	1.5	32000
81930	38785	2.0	35000
81930	38785	2.5	25000
81930	38785	3.0	20000
81930	38785	3.5	18000
81930	38785	4.0	17000
Borehole B43R18			
81950	38755	0.0	9000
81950	38755	0.5	11000
81950	38755	1.0	10000
81950	38755	1.5	10000
81950	38755	2.0	14000
81950	38755	2.5	17000
81950	38755	3.0	17000
81950	38755	3.5	16000
81950	38755	4.0	17000
81950	38755	4.5	17000
81950	38755	5.0	18000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R22			
81950	38785	0.0	42000
81950	38785	0.5	70000
81950	38785	1.0	51000
81950	38785	1.5	37000
81950	38785	2.0	31000
81950	38785	2.5	24000
81950	38785	3.0	19000
81950	38785	3.5	18000
81950	38785	4.0	17000
Borehole B43R99			
81960	38930	0.0	29000
81960	38930	0.5	89000
81960	38930	1.0	203000
81960	38930	1.5	127000
Borehole B43R100			
81963	38920	0.0	45000
81963	38920	0.5	122000
81963	38920	1.0	120000
81963	38920	1.5	43000
Borehole B43R69			
81975	38810	0.0	7000
81975	38810	0.5	9000
81975	38810	1.0	11000
81975	38810	1.5	13000
81975	38810	2.0	14000
81975	38810	2.5	15000
81975	38810	3.0	16000
81975	38810	3.5	17000
81975	38810	4.0	17000

Coordinates[a] East	North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R21			
81985	38780	0.0	91000
81985	38780	0.5	208000
81985	38780	1.0	278000
81985	38780	1.5	201000
81985	38780	2.0	124000
81985	38780	2.5	83000
81985	38780	3.0	35000
81985	38780	3.5	22000
81985	38780	4.0	20000
Borehole B43R70			
82000	38585	0.0	8000
82000	38585	0.5	11000
82000	38585	1.0	14000
82000	38585	1.5	15000
82000	38585	2.0	16000
82000	38585	2.5	18000
82000	38585	3.0	18000
82000	38585	3.5	18000
82000	38585	4.0	19000
Borehole B43R14			
82000	38660	0.0	7000
82000	38660	0.5	10000
82000	38660	1.0	11000
82000	38660	1.5	11000
Borehole B43R16			
82000	38685	0.0	5000
82000	38685	0.5	5000
82000	38685	1.0	18000
82000	38685	1.5	22000
82000	38685	2.0	24000
82000	38685	2.5	23000
82000	38685	3.0	20000
82000	38685	3.5	19000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R19			
82000	38755	0.0	8000
82000	38755	0.5	10000
82000	38755	1.0	14000
82000	38755	1.5	16000
82000	38755	2.0	17000
Borehole B43R104			
82000	38830	0.0	6000
82000	38830	0.5	8000
82000	38830	1.0	13000
82000	38830	1.5	16000
82000	38830	2.0	16000
82000	38830	2.5	16000
82000	38830	3.0	16000
82000	38830	3.5	16000
82000	38830	4.0	16000
Borehole B43R20			
82010	38785	0.0	14000
82010	38785	0.5	28000
82010	38785	1.0	39000
82010	38785	1.5	60000
82010	38785	2.0	57000
82010	38785	2.5	51000
82010	38785	3.0	44000
82010	38785	3.5	26000
82010	38785	4.0	21000
Borehole B43R79			
82030	38785	0.0	7000
82030	38785	0.5	8000
82030	38785	1.0	11000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R89			
82100	39040	0.0	7000
82100	39040	0.5	8000
82100	39040	1.0	13000
82100	39040	1.5	15000
82100	39040	2.0	14000
82100	39040	2.5	14000
82100	39040	3.0	12000
Borehole B43R13			
82150	38575	0.0	8000
82150	38575	0.5	10000
82150	38575	1.0	14000
82150	38575	1.5	17000
82150	38575	2.0	17000
82150	38575	2.5	17000
82150	38575	3.0	16000
82150	38575	3.5	17000
82150	38575	4.0	17000
Borehole B43R09			
82200	38640	0.0	8000
82200	38640	0.5	11000
82200	38640	1.0	12000
82200	38640	2.0	11000
Borehole B43R109			
82200	38985	0.0	10000
82200	38985	0.5	12000
82200	38985	1.0	14000
82200	38985	1.5	16000
82200	38985	2.0	17000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R111			
82200	39010	0.0	5000
82200	39010	0.5	6000
82200	39010	1.0	10000
82200	39010	1.5	15000
82200	39010	2.0	18000
82200	39010	2.5	17000
82200	39010	3.0	13000
Borehole B43R05			
82205	38760	0.0	7000
82205	38760	0.5	10000
82205	38760	1.0	14000
82205	38760	2.0	16000
82205	38760	3.0	16000
82205	38760	4.0	15000
Borehole B43R01			
82220	39005	0.0	17000
82220	39005	0.5	19000
82220	39005	1.0	13000
82220	39005	2.0	10000
Borehole B43R06			
82225	38800	0.0	5000
82225	38800	0.5	6000
82225	38800	1.0	9000
82225	38800	1.5	11000
82225	38800	2.0	14000
82225	38800	2.5	14000
82225	38800	3.0	12000
82225	38800	3.5	12000
Borehole B43R110			
82225	39015	0.0	5000
82225	39015	0.5	6000
82225	39015	1.0	12000
82225	39015	1.5	9000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R106			
82230	39025	0.0	18000
82230	39025	0.5	86000
82230	39025	1.0	25000
82230	39025	1.5	13000
82230	39025	2.0	14000
82230	39025	2.5	14000
82230	39025	3.0	14000
82230	39025	3.5	14000
82230	39025	4.0	15000
82230	39025	4.5	14000
Borehole B43R107			
82235	39060	0.0	5000
82235	39060	0.5	7000
82235	39060	1.0	11000
82235	39060	1.5	10000
Borehole B43R12			
82250	38570	0.0	10000
82250	38570	0.5	13000
82250	38570	1.0	16000
82250	38570	2.0	17000
82250	38570	3.0	18000
82250	38570	4.0	17000
Borehole B43R108			
82255	39005	0.0	5000
82255	39005	0.5	7000
82255	39005	1.0	8000
82255	39005	1.5	10000
82255	39005	2.0	11000
Borehole B43R05			
82270	38755	0.0	7000
82270	38755	0.5	10000
82270	38755	1.0	13000
82270	38755	2.0	15000
82270	38755	3.0	16000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R03			
82270	38810	0.0	14000
82270	38810	0.5	16000
82270	38810	1.0	16000
82270	38810	2.0	17000
82270	38810	3.0	17000
82270	38810	4.0	17000
Borehole B43R02			
82270	38840	0.0	6000
82270	38840	0.5	8000
82270	38840	1.0	11000
82270	38840	2.0	12000
82270	38840	3.0	13000
82270	38840	4.0	13000
Borehole B43R07			
82300	38640	0.0	7000
82300	38640	0.5	9000
82300	38640	1.0	12000
82300	38640	2.0	12000
Borehole B43R84			
82310	39000	0.0	6000
82310	39000	0.5	9000
82310	39000	1.0	12000
82310	39000	1.5	13000
82310	39000	2.0	13000
Borehole B43R76			
82320	38800	0.0	8000
82320	38800	0.5	14000
82320	38800	1.0	16000
82320	38800	1.5	15000
82320	38800	2.0	14000
82320	38800	2.5	14000
82320	38800	3.0	14000
82320	38800	3.5	14000
82320	38800	4.0	14000

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole B43R76 (continued)			
82320	38800	4.5	14000
82320	38800	5.0	15000
82320	38800	5.5	15000
82320	38800	6.0	14000
82320	38800	6.5	13000
82320	38800	7.0	13000
Borehole B43R11			
82320	38575	0.0	8000
82320	38575	0.5	12000
82320	38575	1.0	15000
82320	38575	2.0	17000
82320	38575	3.0	17000
82320	38575	4.0	18000

[a]See Figure 3-2.

[b]The variations in depths of boreholes and corresponding results given in this table are based on the drill reaching refusal or maximum penetrating depth.

[c]Instrument used was 5- by 5-cm (2- by 2-in.) thallium-activated sodium iodide gamma scintillation detector.

APPENDIX B

RADIONUCLIDE CONCENTRATIONS IN SOIL AT THE ELZA GATE SITE

APPENDIX B

RADIONUCLIDE CONCENTRATIONS IN SOIL

AT THE ELZA GATE SITE

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
80535.0	38765.0	0.0 - 0.5	< 3.0	0.7 ± 0.5	0.8 ± 0.7	< 0.8
80545.0	38745.0	0.0 - 0.5	< 8.0	1.5 ± 0.7	1.7 ± 0.9	1.4 ± 1.1
80550.0	38700.0	0.0 - 0.5	< 3.0	1.2 ± 0.5	1.3 ± 0.7	1.2 ± 1.1
80550.0	38800.0	0.0 - 0.5	< 4.0	1.3 ± 0.5	1.0 ± 0.7	2.0 ± 1.3
80550.0	38800.0	0.5 - 1.0	< 5.0	< 1.0	1.9 ± 0.5	< 0.7
80550.0	38800.0	1.0 - 2.0	< 6.0	< 1.0	0.8 ± 0.5	1.9 ± 1.3
80550.0	38800.0	2.0 - 3.0	< 3.0	< 1.0	1.2 ± 0.8	1.5 ± 1.2
80550.0	38800.0	3.0 - 4.0	< 6.0	< 1.0	1.7 ± 0.6	1.0 ± 1.0
80550.0	38900.0	0.0 - 0.5	< 4.0	0.7 ± 0.5	1.4 ± 0.8	2.4 ± 1.4
80550.0	38965.0	0.0 - 0.5	< 3.0	1.3 ± 0.4	1.0 ± 0.5	2.0 ± 1.3
80550.0	38965.0	0.5 - 1.0	< 6.0	1.0 ± 0.7	1.4 ± 0.5	< 0.8
80550.0	38965.0	1.0 - 2.0	< 6.0	0.9 ± 0.4	1.4 ± 0.6	1.5 ± 1.2
80550.0	38965.0	2.0 - 3.0	< 3.0	1.2 ± 0.4	2.4 ± 0.6	1.0 ± 1.0
80600.0	38690.0	0.0 - 0.5	< 5.0	0.7 ± 0.4	< 1.0	< 1.5
80600.0	38700.0	0.0 - 0.5	< 5.0	0.6 ± 0.5	1.4 ± 0.7	2.4 ± 1.4
80600.0	38700.0	0.5 - 1.0	< 5.0	< 1.0	1.4 ± 0.5	< 0.9
80600.0	38700.0	1.0 - 2.0	< 3.0	1.6 ± 0.5	1.0 ± 1.0	< 0.7
80600.0	38700.0	2.0 - 3.0	< 3.0	< 1.0	1.7 ± 0.7	1.0 ± 1.0
80600.0	38700.0	3.0 - 3.5	< 3.0	1.3 ± 0.6	1.3 ± 0.9	2.0 ± 1.3
80600.0	38800.0	0.0 - 0.5	< 3.0	0.7 ± 0.4	1.3 ± 0.6	1.0 ± 1.0
80600.0	38900.0	0.0 - 0.5	< 6.0	0.8 ± 0.7	2.0 ± 1.0	1.0 ± 1.0
80600.0	38990.0	0.0 - 0.5	< 4.0	1.0 ± 0.5	1.5 ± 0.9	1.2 ± 1.1
80645.0	38655.0	0.0 - 0.5	< 6.0	0.9 ± 0.5	1.0 ± 0.5	2.0 ± 1.3
80700.0	38730.0	0.0 - 0.5	< 5.0	2.3 ± 0.7	1.3 ± 0.8	< 0.9
80700.0	38800.0	0.0 - 0.5	< 4.0	2.5 ± 0.7	2.0 ± 0.9	1.4 ± 1.1
80700.0	38900.0	0.0 - 0.5	< 6.0	1.5 ± 0.6	1.5 ± 0.8	2.7 ± 1.5
80700.0	39000.0	0.0 - 0.5	< 4.0	0.4 ± 0.4	1.5 ± 0.8	2.4 ± 1.4
80700.0	39040.0	0.0 - 0.5	< 8.0	1.3 ± 0.8	4.0 ± 2.0	1.4 ± 1.1
80700.0	39040.0	0.5 - 1.0	< 5.0	1.1 ± 0.5	< 1.0	< 0.8

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
80780.0	38670.0	0.0 - 0.5	< 7.0	0.9 ± 0.6	1.1 ± 0.7	2.0 ± 1.3
80800.0	38750.0	0.0 - 0.5	< 2.0	0.6 ± 0.3	1.1 ± 0.5	< 1.3
80800.0	38765.0	0.0 - 0.5	< 4.0	1.0 ± 0.5	1.2 ± 0.6	< 1.0
80800.0	38765.0	0.5 - 1.0	< 6.0	0.9 ± 0.6	2.6 ± 0.6	2.0 ± 1.3
80800.0	38765.0	1.0 - 2.0	< 9.0	0.6 ± 0.5	0.9 ± 0.5	< 0.8
80800.0	38765.0	2.0 - 3.0	< 5.0	0.7 ± 0.5	< 1.0	< 0.8
80800.0	38800.0	0.0 - 0.5	< 3.0	1.0 ± 0.5	1.7 ± 0.8	< 0.9
80800.0	38900.0	0.0 - 0.5	< 7.0	1.5 ± 0.9	4.0 ± 2.0	< 0.9
80800.0	39000.0	0.0 - 0.5	< 5.0	1.1 ± 0.6	1.7 ± 0.9	1.2 ± 1.1
80800.0	39095.0	0.0 - 0.5	< 6.0	2.2 ± 0.7	< 1.0	< 1.0
80880.0	39020.0	0.0 - 0.5	< 8.0	1.5 ± 0.7	3.0 ± 1.0	< 0.8
80880.0	39020.0	0.5 - 1.0	< 3.0	0.5 ± 0.5	1.8 ± 0.9	1.5 ± 1.2
80880.0	39020.0	1.0 - 2.0	< 5.0	1.0 ± 0.6	3.0 ± 1.0	1.0 ± 1.0
80880.0	39020.0	2.0 - 3.0	< 2.0	0.7 ± 0.3	< 1.1	< 0.7
80890.0	38950.0	0.0 - 0.5	< 13.0	3.0 ± 1.0	< 2.0	3.4 ± 2.0
80890.0	38950.0	0.5 - 1.0	< 7.0	0.9 ± 0.5	1.9 ± 0.8	< 0.9
80890.0	38950.0	1.0 - 2.0	< 3.0	1.0 ± 0.5	1.9 ± 0.9	1.4 ± 1.1
80890.0	38950.0	2.0 - 3.0	< 7.0	0.9 ± 0.4	3.0 ± 1.0	< 1.0
80890.0	38950.0	3.0 - 4.0	< 9.0	1.1 ± 0.6	2.0 ± 1.0	< 0.8
80890.0	38950.0	4.0 - 5.0	< 3.0	0.7 ± 0.5	3.0 ± 0.9	1.4 ± 1.1
80890.0	38950.0	5.0 - 6.0	< 7.0	1.4 ± 0.5	3.0 ± 1.0	1.7 ± 1.2
80890.0	38950.0	6.0 - 7.0	< 4.0	0.6 ± 0.5	1.0 ± 1.0	< 0.8
80900.0	38800.0	0.0 - 0.5	< 9.0	2.1 ± 0.8	3.0 ± 1.0	1.0 ± 1.0
80900.0	38900.0	0.0 - 0.5	< 19.0	< 2.0	< 3.0	2.0 ± 1.3
80900.0	39000.0	0.0 - 0.5	< 10.0	2.0 ± 1.0	3.0 ± 2.0	2.5 ± 1.4
80900.0	39055.0	0.0 - 0.5	< 6.0	1.7 ± 0.7	2.0 ± 1.0	1.4 ± 1.1
80900.0	39100.0	0.0 - 0.5	< 6.0	< 1.0	< 2.0	< 1.0
80910.0	38840.0	0.0 - 0.5	< 6.0	1.3 ± 0.6	1.7 ± 0.8	< 0.6
80910.0	38840.0	0.5 - 1.0	< 5.0	2.3 ± 0.8	2.0 ± 1.0	< 1.2
80910.0	38840.0	1.0 - 2.0	< 4.0	1.5 ± 0.6	2.0 ± 1.0	1.4 ± 1.1

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
80910.0	38840.0	2.0 - 3.0	< 5.0	1.7 ± 0.6	1.5 ± 0.8	1.2 ± 1.1
80910.0	38840.0	3.0 - 4.0	< 4.0	1.1 ± 0.6	2.0 ± 1.0	1.9 ± 1.3
80955.0	38800.0	0.0 - 0.5	< 3.0	1.3 ± 0.5	1.3 ± 0.8	< 1.0
80955.0	38835.0	0.0 - 0.5	< 4.0	1.7 ± 0.7	< 1.0	< 0.9
80955.0	38835.0	0.5 - 1.0	< 5.0	1.9 ± 0.6	2.3 ± 0.9	< 1.4
80955.0	38835.0	1.0 - 2.0	< 4.0	1.4 ± 0.6	< 1.0	2.4 ± 1.7
80955.0	38835.0	2.0 - 3.0	< 5.0	1.3 ± 0.7	2.0 ± 1.0	< 0.9
80955.0	38880.0	0.0 - 0.5	< 7.0	1.5 ± 0.8	1.3 ± 1.0	< 0.8
80955.0	38880.0	0.5 - 1.0	< 10.0	1.2 ± 0.8	2.0 ± 1.0	< 0.9
80955.0	38880.0	1.0 - 2.0	< 3.0	0.7 ± 0.4	1.2 ± 0.9	< 0.9
80955.0	38880.0	2.0 - 3.0	< 8.0	0.9 ± 0.6	3.0 ± 1.0	1.0 ± 1.0
80955.0	38880.0	3.0 - 4.0	< 4.0	0.7 ± 0.3	1.6 ± 0.8	1.5 ± 1.2
80956.0	38800.0	0.5 - 1.0	< 5.0	1.7 ± 0.7	1.9 ± 0.9	< 1.1
80956.0	38800.0	1.0 - 2.0	< 6.0	2.0 ± 0.8	1.6 ± 1.0	< 0.9
80956.0	38800.0	2.0 - 2.5	< 5.0	1.8 ± 0.9	2.0 ± 0.9	< 1.2
81000.0	38785.0	0.0 - 0.5	< 5.0	0.7 ± 0.4	0.6 ± 0.5	< 1.3
81000.0	38800.0	0.0 - 0.5	< 5.0	2.1 ± 0.7	1.7 ± 0.9	1.4 ± 1.1
81000.0	38895.0	0.0 - 0.5	< 19.0	4.0 ± 2.0	< 3.0	1.9 ± 1.3
81000.0	39000.0	0.0 - 0.5	< 6.0	2.0 ± 0.8	2.0 ± 1.0	1.0 ± 1.0
81000.0	39060.0	0.0 - 0.5	< 7.0	2.0 ± 0.7	2.0 ± 1.0	1.9 ± 1.3
81050.0	38800.0	0.0 - 0.5	< 4.0	0.5 ± 0.5	1.1 ± 0.6	< 1.1
81050.0	38800.0	0.5 - 1.0	< 5.0	1.5 ± 0.6	1.8 ± 0.8	< 0.9
81050.0	38800.0	1.0 - 2.0	< 6.0	1.5 ± 0.7	1.5 ± 0.9	< 0.9
81050.0	38800.0	2.0 - 3.0	< 5.0	1.6 ± 0.6	2.0 ± 0.9	< 1.3
81050.0	38800.0	3.0 - 4.0	< 5.0	1.2 ± 0.7	2.5 ± 0.9	< 0.9
81050.0	38845.0	0.0 - 0.5	< 6.0	1.4 ± 0.5	1.3 ± 0.8	< 0.6
81050.0	38845.0	0.5 - 1.0	< 4.0	0.7 ± 0.5	1.1 ± 0.8	1.5 ± 1.2
81050.0	38845.0	1.0 - 2.0	< 5.0	1.0 ± 0.7	2.2 ± 0.9	1.2 ± 1.1
81050.0	38845.0	2.0 - 3.0	< 3.0	1.3 ± 0.5	1.4 ± 0.7	< 0.9
81050.0	38845.0	3.0 - 3.5	< 6.0	2.2 ± 0.8	3.0 ± 1.0	< 1.1

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81100.0	38760.0	0.0 - 0.5	8.0 ± 4.0	1.7 ± 0.6	1.6 ± 0.9	2.4 ± 1.4
81100.0	38800.0	0.0 - 0.5	< 11.0	4.0 ± 2.0	2.0 ± 2.0	1.2 ± 1.1
81100.0	38895.0	0.0 - 0.5	< 5.0	1.0 ± 0.7	2.0 ± 1.0	1.7 ± 1.2
81100.0	39000.0	0.0 - 0.5	< 2.0	0.6 ± 0.3	0.7 ± 0.4	< 0.9
81100.0	39075.0	0.0 - 0.5	< 5.0	1.7 ± 0.6	< 1.0	1.5 ± 1.2
81125.0	38880.0	0.0 - 0.5	< 4.0	0.8 ± 0.4	0.8 ± 0.5	2.0 ± 1.6
81125.0	38880.0	0.5 - 1.0	< 9.0	< 1.0	2.0 ± 1.0	< 0.7
81125.0	38880.0	1.0 - 2.0	< 3.0	1.3 ± 0.4	1.3 ± 0.8	< 0.9
81125.0	38880.0	2.0 - 3.0	< 10.0	0.9 ± 0.7	3.0 ± 1.0	1.9 ± 1.3
81125.0	38880.0	3.0 - 4.0	< 5.0	0.8 ± 0.4	1.5 ± 0.8	< 0.9
81175.0	38805.0	0.0 - 0.5	36.0 ± 9.0	1.3 ± 0.6	< 1.0	< 1.2
81175.0	38805.0	0.5 - 1.0	15.0 ± 6.0	0.8 ± 0.7	1.0 ± 1.0	1.4 ± 1.1
81175.0	38805.0	1.0 - 1.5	10.0 ± 3.0	0.7 ± 0.5	< 1.0	< 0.8
81200.0	38770.0	0.0 - 0.5	4.0 ± 2.0	1.6 ± 0.5	2.0 ± 0.8	< 1.5
81200.0	38800.0	0.0 - 0.5	< 7.0	1.1 ± 0.6	2.0 ± 1.0	1.7 ± 1.2
81200.0	38850.0	0.0 - 0.5	10.0 ± 4.0	2.2 ± 0.7	< 1.0	4.1 ± 2.1
81200.0	38850.0	0.5 - 1.0	11.0 ± 4.0	1.2 ± 0.8	1.5 ± 0.8	3.7 ± 1.7
81200.0	38850.0	1.0 - 2.0	< 4.0	2.1 ± 0.5	1.7 ± 0.7	2.4 ± 1.4
81200.0	38900.0	0.0 - 0.5	< 7.0	1.6 ± 0.9	2.0 ± 1.0	1.7 ± 1.2
81200.0	39000.0	0.0 - 0.5	< 7.0	0.9 ± 0.6	1.5 ± 0.9	1.2 ± 1.1
81200.0	39035.0	0.5 - 1.0	< 6.0	0.6 ± 0.5	2.1 ± 0.9	< 0.7
81200.0	39035.0	1.0 - 2.0	< 3.0	0.7 ± 0.4	< 1.0	< 0.6
81200.0	39035.0	2.0 - 3.0	< 5.0	1.1 ± 0.4	2.2 ± 0.6	1.2 ± 1.1
81200.0	39035.0	3.0 - 4.0	< 7.0	1.4 ± 0.4	2.2 ± 0.7	2.8 ± 1.5
81200.0	39095.0	0.0 - 0.5	< 7.0	2.0 ± 0.7	3.0 ± 1.0	1.7 ± 1.2
81215.0	38750.0	0.0 - 0.5	< 5.0	4.3 ± 0.7	1.8 ± 0.7	1.5 ± 1.2
81220.0	38820.0	0.0 - 0.5	32.0 ± 8.0	3.0 ± 1.0	2.0 ± 1.0	2.7 ± 1.5
81220.0	38820.0	0.5 - 1.0	12.0 ± 6.0	1.0 ± 0.8	2.0 ± 1.0	2.5 ± 1.4
81220.0	38820.0	1.0 - 2.0	< 5.0	1.9 ± 0.7	< 1.0	1.9 ± 1.3
81220.0	38820.0	2.0 - 3.0	< 4.0	1.2 ± 0.6	1.7 ± 0.8	1.0 ± 1.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81230.0	38900.0	0.0 - 0.5	< 7.0	4.0 ± 1.0	3.0 ± 1.0	8.1 ± 2.4
81230.0	38900.0	0.5 - 1.0	< 8.0	0.7 ± 0.6	2.0 ± 1.0	< 0.6
81230.0	38900.0	1.0 - 2.0	< 4.0	1.2 ± 0.4	1.4 ± 0.8	< 0.8
81230.0	38900.0	2.0 - 3.0	< 8.0	1.2 ± 0.5	1.8 ± 0.9	1.4 ± 1.1
81230.0	38900.0	3.0 - 4.0	< 3.0	0.8 ± 0.5	1.0 ± 1.0	1.4 ± 1.1
81230.0	38945.0	0.0 - 0.5	< 5.0	4.0 ± 1.0	1.4 ± 0.8	5.1 ± 1.9
81230.0	38945.0	0.5 - 1.0	< 5.0	0.6 ± 0.3	0.5 ± 0.5	< 0.8
81230.0	38945.0	1.0 - 2.0	< 3.0	1.4 ± 0.5	1.2 ± 0.7	< 1.0
81230.0	38945.0	2.0 - 3.0	< 7.0	1.2 ± 0.6	1.9 ± 0.9	1.4 ± 1.1
81230.0	38945.0	3.0 - 4.0	< 4.0	1.3 ± 0.5	1.0 ± 0.9	< 0.4
81240.0	38740.0	0.0 - 0.5	< 5.0	1.2 ± 0.6	2.5 ± 0.9	2.5 ± 1.4
81240.0	38740.0	0.5 - 1.0	< 4.0	1.6 ± 0.6	2.0 ± 1.0	1.4 ± 1.1
81240.0	38740.0	1.0 - 2.0	< 4.0	1.3 ± 0.5	1.0 ± 1.0	< 0.9
81255.0	38795.0	0.0 - 0.5	8.0 ± 3.0	3.0 ± 1.0	2.0 ± 1.0	4.5 ± 2.2
81255.0	38795.0	0.5 - 1.0	10.0 ± 4.0	1.7 ± 0.5	0.8 ± 0.6	1.5 ± 1.2
81255.0	38795.0	1.0 - 2.0	6.0 ± 3.0	1.2 ± 0.4	0.6 ± 0.4	100.0 ± 10.0
81255.0	38795.0	2.0 - 3.0	21.0 ± 6.0	13.0 ± 1.0	0.8 ± 0.6	42.0 ± 5.0
81255.0	38795.0	3.0 - 4.0	8.0 ± 3.0	2.0 ± 0.6	1.1 ± 0.5	7.3 ± 2.3
81265.0	38980.0	0.0 - 0.5	< 8	4.0 ± 1.0	2.0 ± 1.0	4.5 ± 2.2
81265.0	38980.0	0.5 - 1.0	< 7.0	0.8 ± 0.5	1.4 ± 0.9	1.0 ± 1.0
81265.0	38980.0	1.0 - 2.0	< 3.0	1.0 ± 0.3	1.7 ± 0.7	1.4 ± 1.1
81265.0	38980.0	2.0 - 3.0	< 7.0	1.3 ± 0.4	1.4 ± 0.8	< 0.5
81265.0	38980.0	3.0 - 4.0	< 3.0	0.6 ± 0.4	2.0 ± 1.0	< 0.8
81270.0	38700.0	0.0 - 0.5	< 5.0	1.6 ± 0.6	2.0 ± 1.0	1.4 ± 1.1
81270.0	38700.0	0.5 - 1.0	< 4.0	1.7 ± 0.6	2.0 ± 1.0	1.5 ± 1.2
81270.0	38700.0	1.0 - 2.0	< 4.0	1.7 ± 0.7	2.0 ± 1.0	< 0.9
81270.0	38700.0	2.0 - 3.0	< 3.0	0.9 ± 0.4	2.3 ± 0.8	1.5 ± 1.2
81270.0	38700.0	3.0 - 4.0	< 3.0	0.9 ± 0.4	1.3 ± 0.7	1.4 ± 1.1
81270.0	38900.0	0.0 - 0.5	< 7.0	6.0 ± 2.0	< 1.0	3.5 ± 1.6
81270.0	38900.0	0.5 - 1.0	< 5.0	1.0 ± 0.4	1.5 ± 0.6	1.3 ± 1.1

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81270.0	38900.0	1.0 - 2.0	< 3.0	0.8 ± 0.3	0.9 ± 0.6	< 0.8
81270.0	38900.0	2.0 - 3.0	< 5.0	0.7 ± 0.4	1.7 ± 0.6	1.2 ± 1.1
81270.0	38900.0	3.0 - 4.0	< 3.0	0.4 ± 0.3	2.6 ± 0.8	< 0.8
81275.0	38685.0	0.0 - 0.5	9.0 ± 5.0	0.6 ± 0.6	1.0 ± 0.5	5.5 ± 2.0
81275.0	38795.0	0.0 - 0.5	< 4.0	1.6 ± 0.6	1.7 ± 0.9	14.0 ± 3.0
81275.0	38795.0	0.5 - 1.0	< 8.0	7.0 ± 1.0	1.6 ± 0.8	9.0 ± 2.5
81275.0	38795.0	1.0 - 2.0	27.0 ± 10.0	16.0 ± 2.0	2.0 ± 1.0	13.0 ± 3.0
81275.0	38795.0	2.0 - 3.0	9.0 ± 6.0	7.0 ± 1.0	1.2 ± 0.7	11.0 ± 3.0
81275.0	38795.0	3.0 - 4.0	< 6.0	3.7 ± 0.9	2.3 ± 0.8	3.3 ± 1.6
81295.0	38815.0	0.0 - 0.5	< 4.0	< 1.0	< 1.0	1.2 ± 1.1
81295.0	38815.0	0.5 - 1.0	< 3.0	1.8 ± 1.0	1.1 ± 0.6	< 0.6
81295.0	38815.0	1.0 - 2.0	< 5.0	1.4 ± 0.4	< 1.0	1.4 ± 1.1
81295.0	38815.0	2.0 - 3.0	21.0 ± 4.0	1.2 ± 0.4	< 1.0	5.1 ± 1.9
81295.0	38815.0	3.0 - 4.0	38.0 ± 10.0	< 1.0	< 5.0	4.0 ± 1.7
81295.0	38815.0	4.0 - 5.0	18.0 ± 3.0	< 1.0	< 1.0	5.0 ± 1.9
81300.0	38700.0	0.0 - 0.5	< 7.0	< 1.0	3.0 ± 2.0	1.5 ± 1.2
81300.0	38750.0	0.0 - 0.5	< 5.0	5.0 ± 1.0	1.1 ± 0.9	1.7 ± 1.2
81300.0	38750.0	0.5 - 1.0	< 7.0	1.4 ± 0.6	< 1.0	2.7 ± 1.5
81300.0	38750.0	1.0 - 1.5	< 6.0	1.4 ± 0.6	0.7 ± 0.7	1.5 ± 1.2
81300.0	38790.0	0.0 - 0.5	< 6.0	3.8 ± 0.8	2.0 ± 1.0	2.8 ± 1.5
81300.0	38895.0	0.0 - 0.5	< 11.0	7.0 ± 2.0	1.0 ± 1.0	15.0 ± 3.0
81300.0	39000.0	0.0 - 0.5	< 12.0	5.0 ± 2.0	2.0 ± 2.0	6.6 ± 2.2
81300.0	39095.0	0.0 - 0.5	< 7.0	0.9 ± 0.6	2.0 ± 1.0	2.0 ± 1.3
81310.0	38660.0	0.0 - 0.5	< 5.0	1.2 ± 0.6	3.0 ± 1.0	1.7 ± 1.2
81310.0	38660.0	0.5 - 1.0	< 5.0	0.9 ± 0.6	3.0 ± 1.0	2.0 ± 1.3
81310.0	38660.0	1.0 - 2.0	< 3.0	1.5 ± 0.5	1.1 ± 0.7	1.7 ± 1.2
81310.0	38660.0	2.0 - 3.0	< 4.0	0.8 ± 0.5	2.0 ± 1.0	1.0 ± 1.0
81310.0	38660.0	3.0 - 4.0	< 5.0	1.3 ± 0.7	2.0 ± 1.0	1.7 ± 1.2
81310.0	38660.0	4.0 - 5.0	< 4.0	1.8 ± 0.6	2.0 ± 1.0	1.5 ± 1.2
81315.0	38850.0	0.0 - 0.5	< 4.0	< 1.0	< 1.0	< 0.4

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81315.0	38850.0	0.5 - 1.0	< 7.0	1.1 ± 0.4	< 1.0	1.9 ± 1.3
81315.0	38850.0	1.0 - 2.0	10.0 ± 4.0	1.4 ± 0.5	0.9 ± 0.5	4.0 ± 1.7
81315.0	38850.0	2.0 - 3.0	10.0 ± 7.0	1.2 ± 0.5	0.8 ± 0.7	4.2 ± 1.8
81315.0	38850.0	3.0 - 4.0	24.0 ± 5.0	1.6 ± 0.3	1.3 ± 0.5	6.3 ± 2.1
81315.0	38850.0	4.0 - 5.0	9.0 ± 9.0	1.0 ± 0.5	1.1 ± 0.8	4.5 ± 1.8
81315.0	38850.0	5.0 - 6.0	< 6.0	0.7 ± 0.7	1.8 ± 0.5	< 0.9
81325.0	38885.0	0.0 - 0.5	12000.0 ±1000.0	12000.0 ±1000.0	< 82.0	12000.0 ±1000.0
81325.0	38885.0	0.5 - 1.0	300.0 ± 30.0	220.0 ± 10.0	6.0 ± 3.0	930.0 ± 30.0
81325.0	38885.0	1.0 - 2.0	270.0 ± 40.0	250.0 ± 10.0	7.0 ± 3.0	620.0 ± 20.0
81325.0	38885.0	2.0 - 3.0	51.0 ± 12.0	23.0 ± 2.0	2.0 ± 1.0	56.0 ± 6.0
81325.0	38885.0	3.0 - 4.0	20.0 ± 6.0	14.0 ± 2.0	2.0 ± 1.0	24.0 ± 4.0
81325.0	38885.0	4.0 - 5.0	26.0 ± 9.0	26.0 ± 2.0	2.0 ± 1.0	58.0 ± 6.0
81325.0	38885.0	5.0 - 6.0	< 8.0	2.1 ± 0.8	2.0 ± 0.9	8.1 ± 2.3
81325.0	38885.0	6.0 - 7.0	< 6.0	2.6 ± 0.6	1.9 ± 0.8	9.0 ± 2.4
81330.0	38865.0	0.5 - 1.0	9500.0 ± 500.0	11000.0 ±1000.0	< 34.0	15000.0 ±1000.0
81355.0	38620.0	0.0 - 0.5	< 5.0	1.7 ± 0.7	3.0 ± 1.0	2.4 ± 1.4
81355.0	38620.0	0.5 - 1.0	< 4.0	1.9 ± 0.7	1.2 ± 0.8	2.5 ± 1.4
81355.0	38620.0	1.0 - 2.0	< 7.0	1.1 ± 0.5	1.3 ± 0.6	1.2 ± 1.1
81355.0	38620.0	2.0 - 3.0	< 3.0	0.9 ± 0.5	1.7 ± 0.8	1.4 ± 1.1
81355.0	38620.0	3.0 - 4.0	< 3.0	1.0 ± 0.4	1.4 ± 0.7	< 1.0
81355.0	38620.0	4.0 - 5.0	< 4.0	1.6 ± 0.6	2.0 ± 0.9	1.7 ± 1.2
81370.0	38880.0	0.0 - 0.5	11.0 ± 5.0	8.0 ± 1.0	< 1.0	-a-
81370.0	38880.0	0.5 - 1.0	< 5.0	0.7 ± 0.4	1.8 ± 0.7	16.0 ± 3.0
81370.0	38880.0	1.0 - 2.0	< 11.0	< 0.7	3.0 ± 1.0	< 0.8
81370.0	38880.0	2.0 - 3.0	< 3.0	0.5 ± 0.4	1.2 ± 0.7	< 0.8
81370.0	38880.0	3.0 - 4.0	< 4.0	1.1 ± 0.5	3.0 ± 1.0	1.2 ± 1.1
81375.0	38780.0	0.0 - 0.5	< 6.0	0.9 ± 0.8	1.0 ± 1.0	4.0 ± 1.9
81375.0	38780.0	0.5 - 1.0	12.0 ± 4.0	1.0 ± 0.6	1.4 ± 0.9	2.8 ± 1.5
81375.0	38780.0	1.0 - 2.0	9.0 ± 3.0	0.9 ± 0.5	1.5 ± 0.7	3.5 ± 1.6
81375.0	38780.0	2.0 - 3.0	9.0 ± 5.0	1.5 ± 0.7	3.0 ± 1.0	1.2 ± 1.1

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81375.0	38780.0	3.0 - 4.0	< 3.0	0.8 ± 0.5	0.9 ± 0.7	1.2 ± 1.1
81400.0	38610.0	0.0 - 0.5	< 5.0	0.9 ± 0.4	1.2 ± 0.7	2.2 ± 1.8
81400.0	38630.0	0.0 - 0.5	< 5.0	0.9 ± 0.5	1.5 ± 1.0	1.2 ± 1.1
81400.0	38650.0	0.0 - 0.5	< 4.0	1.2 ± 0.6	2.0 ± 1.0	2.2 ± 1.4
81400.0	38650.0	0.5 - 1.0	< 3.0	1.0 ± 0.4	2.1 ± 0.8	1.7 ± 1.2
81400.0	38650.0	1.0 - 2.0	< 3.0	1.0 ± 0.4	2.2 ± 0.9	1.2 ± 1.1
81400.0	38650.0	2.0 - 3.0	< 3.0	0.9 ± 0.5	1.7 ± 0.8	< 0.8
81400.0	38650.0	3.0 - 4.0	< 5.0	2.0 ± 0.7	1.0 ± 1.0	1.2 ± 1.1
81400.0	38700.0	0.0 - 0.5	< 5.0	0.9 ± 0.5	0.8 ± 0.7	1.4 ± 1.1
81400.0	38745.0	0.0 - 0.5	< 6.0	2.3 ± 0.6	7.0 ± 1.0	1.5 ± 1.2
81400.0	38745.0	0.5 - 1.0	< 4.0	1.3 ± 0.6	2.1 ± 0.9	1.4 ± 1.0
81400.0	38745.0	1.0 - 2.0	< 6.0	1.4 ± 0.6	2.2 ± 0.9	< 0.8
81400.0	38745.0	2.0 - 3.0	< 4.0	0.9 ± 0.5	1.9 ± 0.7	< 0.2
81400.0	38745.0	3.0 - 4.0	< 4.0	1.0 ± 0.6	3.0 ± 1.0	1.7 ± 1.1
81400.0	38800.0	0.0 - 0.5	< 5.0	1.1 ± 0.5	1.6 ± 0.8	2.5 ± 1.4
81400.0	38896.0	0.0 - 0.5	< 8.0	5.0 ± 2.0	2.0 ± 1.0	8.7 ± 2.5
81400.0	39000.0	0.0 - 0.5	< 4.0	1.9 ± 0.6	1.1 ± 0.5	10.0 ± 3.0
81400.0	39040.0	0.0 - 0.5	< 5.0	1.4 ± 0.5	1.6 ± 0.7	4.3 ± 2.2
81400.0	39040.0	0.5 - 1.0	< 9.0	1.0 ± 0.5	1.9 ± 0.9	1.4 ± 1.1
81400.0	39040.0	1.0 - 1.5	< 3.0	0.7 ± 0.4	2.1 ± 0.7	1.2 ± 1.1
81400.0	39100.0	0.0 - 0.5	< 4.0	< 1.0	1.7 ± 0.7	1.5 ± 1.2
81435.0	38865.0	0.0 - 0.5	18.0 ± 4.0	22.0 ± 2.0	1.0 ± 0.6	-a-
81435.0	38865.0	0.5 - 1.0	< 7.0	2.0 ± 1.0	3.0 ± 1.0	5.5 ± 2.0
81435.0	38865.0	1.0 - 2.0	12.0 ± 4.0	10.0 ± 2.0	< 1.0	18.0 ± 4.0
81435.0	38865.0	2.0 - 3.0	< 4.0	1.2 ± 0.4	1.0 ± 0.5	2.0 ± 1.3
81435.0	38865.0	3.0 - 4.0	< 7.0	1.3 ± 0.5	1.6 ± 0.8	1.9 ± 1.3
81435.0	38865.0	4.0 - 5.0	< 2.0	1.1 ± 0.5	1.1 ± 0.7	< 0.8
81435.0	38865.0	5.0 - 6.0	< 2.0	0.9 ± 0.4	1.6 ± 0.7	1.4 ± 1.1
81435.0	38865.0	6.0 - 7.0	< 2.0	1.1 ± 0.5	1.7 ± 0.8	1.0 ± 1.0
81435.0	38865.0	7.0 - 7.5	< 2.0	1.5 ± 0.5	2.0 ± 0.7	2.7 ± 1.5

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81440.0	38790.0	0.0 - 0.5	< 5.0	1.2 ± 0.6	1.4 ± 0.9	2.5 ± 1.9
81440.0	38790.0	0.5 - 1.0	< 3.0	1.5 ± 0.5	1.0 ± 0.8	1.9 ± 1.3
81440.0	38790.0	1.0 - 2.0	< 3.0	1.2 ± 0.5	1.1 ± 0.7	1.7 ± 1.2
81440.0	38790.0	2.0 - 3.0	< 2.0	1.0 ± 0.4	0.8 ± 0.6	< 0.5
81440.0	38790.0	3.0 - 4.0	< 3.0	0.9 ± 0.4	1.6 ± 0.8	1.7 ± 1.2
81440.0	38790.0	4.0 - 5.0	< 3.0	0.8 ± 0.4	1.4 ± 0.7	1.5 ± 1.2
81445.0	39010.0	0.0 - 0.5	81.0 ± 18.0	120.0 ± 10.0	3.0 ± 2.0	-a-
81445.0	39010.0	0.5 - 1.0	< 7.0	1.7 ± 0.6	1.1 ± 0.6	3.3 ± 1.6
81445.0	39010.0	1.0 - 2.0	< 5.0	1.1 ± 0.5	1.3 ± 0.8	2.4 ± 1.4
81445.0	39010.0	2.0 - 3.0	< 3.0	0.8 ± 0.4	1.5 ± 0.8	1.0 ± 1.0
81445.0	39010.0	3.0 - 4.0	< 5.0	1.5 ± 0.6	2.0 ± 0.9	< 0.6
81455.0	38615.0	0.0 - 0.5	< 9.0	< 1.0	2.0 ± 2.0	2.4 ± 1.4
81455.0	38615.0	0.5 - 1.0	< 8.0	0.8 ± 0.5	1.5 ± 0.5	< 0.8
81455.0	38615.0	1.0 - 2.0	< 2.0	0.8 ± 0.4	1.0 ± 0.5	1.0 ± 1.0
81455.0	38615.0	2.0 - 3.0	< 2.0	1.0 ± 0.4	1.4 ± 0.7	2.0 ± 1.3
81455.0	38615.0	3.0 - 4.0	< 3.0	0.7 ± 0.4	2.1 ± 0.9	< 1.0
81455.0	38845.0	0.0 - 0.5	< 4.0	0.8 ± 0.5	0.9 ± 0.6	1.5 ± 1.5
81455.0	38845.0	0.5 - 1.0	< 3.0	0.9 ± 0.4	0.8 ± 0.7	< 1.0
81455.0	38845.0	1.0 - 2.0	< 4.0	1.2 ± 0.5	1.9 ± 0.7	2.0 ± 1.3
81455.0	38845.0	2.0 - 3.0	< 4.0	1.2 ± 0.5	1.4 ± 0.8	< 1.0
81455.0	38845.0	3.0 - 4.0	< 4.0	1.2 ± 0.5	1.2 ± 0.7	1.5 ± 1.2
81455.0	38890.0	0.0 - 0.5	< 10.0	0.9 ± 0.7	< 1.0	4.0 ± 1.7
81455.0	38890.0	0.5 - 1.0	< 5.0	1.5 ± 0.5	2.2 ± 0.7	< 1.0
81455.0	38890.0	1.0 - 2.0	< 3.0	1.2 ± 0.4	1.6 ± 0.7	1.0 ± 1.0
81455.0	38890.0	2.0 - 3.0	< 4.0	1.3 ± 0.5	1.0 ± 0.7	1.4 ± 1.1
81455.0	38890.0	3.0 - 4.0	< 4.0	1.4 ± 0.5	2.2 ± 0.8	< 1.0
81500.0	38630.0	0.0 - 0.5	< 5.0	0.9 ± 0.5	0.8 ± 0.5	1.9 ± 1.3
81500.0	38700.0	0.0 - 0.5	< 4.0	1.0 ± 0.6	2.1 ± 0.9	2.0 ± 1.3
81500.0	38800.0	0.0 - 0.5	< 4.0	1.0 ± 0.5	0.9 ± 0.5	2.2 ± 1.3
81500.0	38900.0	0.0 - 0.5	< 9.0	7.0 ± 2.0	2.0 ± 2.0	21.0 ± 4.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81500.0	39000.0	0.0 - 0.5	< 7.0	2.0 ± 1.0	1.0 ± 1.0	4.0 ± 1.7
81500.0	39100.0	0.0 - 0.5	< 5.0	1.2 ± 0.6	1.7 ± 0.9	2.5 ± 1.4
81505.0	39050.0	0.0 - 0.5	< 4.0	1.2 ± 0.5	1.4 ± 0.6	25.0 ± 5.0
81505.0	39050.0	0.5 - 1.0	< 10.0	1.4 ± 0.6	< 1.0	< 0.8
81505.0	39050.0	1.0 - 2.0	< 3.0	0.9 ± 0.5	1.5 ± 0.8	1.4 ± 1.1
81505.0	39050.0	2.0 - 3.0	< 10.0	1.2 ± 0.7	2.0 ± 1.0	1.4 ± 1.1
81505.0	39050.0	3.0 - 3.5	< 4.0	1.0 ± 0.6	1.0 ± 1.0	< 0.9
81510.0	38960.0	0.0 - 0.5	< 5.0	2.1 ± 0.7	1.0 ± 0.6	3.8 ± 2.1
81510.0	38960.0	0.5 - 1.0	< 6.0	2.0 ± 0.8	2.0 ± 1.0	2.7 ± 1.5
81510.0	38960.0	1.0 - 2.0	< 4.0	1.0 ± 0.4	1.4 ± 0.7	< 0.8
81510.0	38960.0	3.0 - 4.0	< 5.0	1.4 ± 0.5	1.9 ± 0.6	1.9 ± 1.3
81560.0	38610.0	0.0 - 0.5	< 4.0	1.2 ± 0.5	1.8 ± 0.7	4.1 ± 2.1
81560.0	38610.0	0.5 - 1.0	< 3.0	0.9 ± 0.4	1.2 ± 0.6	< 1.0
81560.0	38610.0	1.0 - 2.0	< 3.0	1.2 ± 0.5	1.6 ± 0.8	1.9 ± 1.3
81560.0	38610.0	2.0 - 3.0	< 4.0	1.5 ± 0.6	3.0 ± 1.0	< 0.9
81560.0	38610.0	3.0 - 4.0	< 4.0	1.2 ± 0.5	1.8 ± 0.8	1.7 ± 1.2
81565.0	38700.0	0.0 - 0.5	< 4.0	1.0 ± 0.5	2.1 ± 0.8	3.4 ± 2.0
81565.0	38700.0	0.5 - 1.0	< 5.0	1.2 ± 0.5	1.7 ± 0.9	2.2 ± 1.3
81565.0	38700.0	1.0 - 2.0	< 4.0	1.5 ± 0.5	2.4 ± 0.9	< 0.9
81565.0	38700.0	2.0 - 3.0	< 7.0	1.2 ± 0.4	1.4 ± 0.7	2.0 ± 1.3
81565.0	38700.0	3.0 - 4.0	< 5.0	2.0 ± 0.7	2.0 ± 1.0	1.5 ± 1.2
81565.0	38700.0	4.0 - 5.0	< 5.0	1.4 ± 0.6	3.0 ± 1.0	1.4 ± 1.1
81565.0	38700.0	5.0 - 6.0	< 4.0	1.3 ± 0.5	2.2 ± 0.8	1.9 ± 1.3
81565.0	38700.0	6.0 - 7.0	< 4.0	1.1 ± 0.4	1.4 ± 0.6	< 0.7
81565.0	38700.0	7.0 - 8.0	< 3.0	0.7 ± 0.4	1.6 ± 0.7	< 0.8
81570.0	38660.0	0.0 - 0.5	15.0 ± 4.0	0.9 ± 0.4	1.2 ± 0.7	3.1 ± 1.3
81570.0	38660.0	0.5 - 1.0	9.0 ± 6.0	1.2 ± 0.5	1.3 ± 0.5	1.9 ± 1.3
81570.0	38660.0	1.0 - 2.0	< 6.0	0.8 ± 0.4	0.9 ± 0.7	1.7 ± 1.2
81570.0	38660.0	2.0 - 3.0	< 4.0	1.5 ± 0.7	< 1.0	1.5 ± 1.2
81570.0	38660.0	3.0 - 4.0	< 3.0	1.2 ± 0.4	1.6 ± 0.7	1.9 ± 1.3

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81575.0	38840.0	0.0 - 0.0	< 5.0	0.6 ± 0.3	0.8 ± 0.5	1.7 ± 1.2
81585.0	38510.0	0.0 - 0.5	< 7.0	0.8 ± 0.6	2.0 ± 1.0	5.1 ± 1.9
81600.0	38595.0	0.0 - 0.5	< 8.0	3.0 ± 1.0	1.0 ± 0.8	52.0 ± 6.0
81600.0	38607.0	0.0 - 0.5	< 5.0	2.1 ± 0.6	2.0 ± 1.0	2.4 ± 1.4
81600.0	38715.0	0.0 - 0.5	< 9.0	2.4 ± 1.0	2.0 ± 1.0	3.2 ± 1.6
81600.0	38800.0	0.0 - 0.5	< 5.0	1.0 ± 0.5	1.7 ± 0.7	2.2 ± 1.3
81600.0	38800.0	0.5 - 1.0	< 3.0	0.7 ± 0.5	1.5 ± 0.7	2.4 ± 1.4
81600.0	38800.0	1.0 - 2.0	< 8.0	1.8 ± 0.7	1.7 ± 0.9	1.7 ± 1.2
81600.0	38800.0	2.0 - 3.0	< 3.0	0.6 ± 0.3	1.0 ± 0.7	1.4 ± 1.1
81600.0	38895.0	0.0 - 0.5	< 4.0	1.3 ± 0.7	1.4 ± 0.8	2.5 ± 1.4
81600.0	39000.0	0.0 - 0.5	< 8.0	3.0 ± 1.0	2.0 ± 2.0	2.0 ± 1.3
81600.0	39100.0	0.0 - 0.5	< 6.0	2.2 ± 0.7	1.8 ± 0.9	3.0 ± 1.5
81610.0	38670.0	0.0 - 0.5	15.0 ± 4.0	0.6 ± 0.3	< 1.0	3.1 ± 1.9
81610.0	38670.0	0.5 - 1.0	6.0 ± 4.0	1.5 ± 0.5	2.4 ± 0.9	1.4 ± 1.1
81610.0	38670.0	1.0 - 2.0	< 4.0	1.0 ± 0.5	1.7 ± 0.9	1.5 ± 1.2
81610.0	38670.0	2.0 - 3.0	< 3.0	1.0 ± 0.4	1.3 ± 0.6	1.4 ± 1.1
81610.0	38670.0	3.0 - 4.0	< 3.0	0.8 ± 0.5	1.5 ± 0.6	1.2 ± 1.1
81610.0	38670.0	4.0 - 5.0	< 3.0	1.5 ± 0.5	1.1 ± 0.7	2.7 ± 1.5
81620.0	38940.0	0.0 - 0.5	< 6.0	0.6 ± 0.4	1.0 ± 0.6	< 0.9
81620.0	38940.0	0.5 - 1.0	5.0 ± 3.0	0.4 ± 0.3	0.9 ± 0.7	< 0.9
81620.0	38940.0	1.0 - 2.0	< 8.0	< 1.0	0.9 ± 0.6	< 1.0
81620.0	38940.0	2.0 - 2.5	11.0 ± 4.0	< 1.0	0.6 ± 0.5	60.0 ± 6.0
81675.0	38895.0	0.0 - 0.5	< 11.0	2.0 ± 1.0	2.0 ± 2.0	5.9 ± 2.1
81675.0	38895.0	0.5 - 1.0	< 14.0	2.0 ± 1.0	< 2.0	< 0.8
81675.0	38895.0	1.0 - 2.0	< 9.0	1.1 ± 0.9	< 1.0	2.4 ± 1.4
81675.0	38895.0	2.0 - 3.0	< 4.0	1.9 ± 0.5	0.9 ± 0.6	5.5 ± 2.0
81675.0	38895.0	3.0 - 4.0	< 5.0	1.2 ± 0.5	1.3 ± 0.6	1.5 ± 1.2
81700.0	38600.0	0.0 - 0.5	< 7.0	1.5 ± 0.7	1.8 ± 0.9	1.5 ± 1.2
81700.0	38600.0	0.5 - 1.0	< 5.0	0.8 ± 0.4	1.3 ± 0.5	< 0.8
81700.0	38600.0	1.0 - 2.0	< 3.0	0.7 ± 0.3	0.8 ± 0.5	< 0.9

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Uranium-238	Radium-226	Thorium-232	Thorium-230
			Concentration (pCi/g ± 2 sigma)			
81700.0	38600.0	2.0 - 3.0	< 6.0	1.2 ± 0.5	< 1.0	< 0.9
81700.0	38600.0	3.0 - 4.0	< 3.0	0.8 ± 0.3	1.8 ± 0.8	< 0.8
81700.0	38700.0	0.0 - 0.5	< 3.0	0.8 ± 0.4	< 1.0	2.7 ± 1.5
81700.0	38750.0	0.5 - 1.0	< 5.0	< 1.0	< 2.0	< 0.9
81700.0	38750.0	1.0 - 2.0	< 4.0	< 1.0	< 1.0	< 0.7
81700.0	38750.0	2.0 - 3.0	< 6.0	0.9 ± 0.7	1.4 ± 0.8	< 1.0
81700.0	38750.0	3.0 - 4.0	< 4.0	< 1.0	1.5 ± 0.8	1.2 ± 1.1
81700.0	38800.0	0.0 - 0.5	< 3.0	0.9 ± 0.4	0.7 ± 0.5	1.7 ± 1.2
81700.0	38830.0	0.0 - 0.5	< 10.0	1.3 ± 0.7	< 1.0	4.5 ± 1.8
81700.0	38830.0	0.5 - 1.0	< 4.0	1.1 ± 0.5	1.0 ± 1.0	2.8 ± 1.5
81700.0	38830.0	1.0 - 2.0	< 7.0	0.9 ± 0.6	2.0 ± 1.0	2.7 ± 1.5
81700.0	38830.0	2.0 - 3.0	< 2.0	0.7 ± 0.3	1.1 ± 0.5	2.4 ± 1.4
81700.0	38830.0	3.0 - 3.5	< 4.0	0.5 ± 0.4	1.0 ± 0.5	< 0.4
81700.0	38890.0	0.0 - 0.5	< 6.0	0.9 ± 0.5	1.8 ± 0.9	4.0 ± 1.7
81700.0	39000.0	0.0 - 0.5	< 5.0	1.2 ± 0.9	< 1.0	2.8 ± 1.5
81700.0	39100.0	0.0 - 0.5	< 3.0	0.8 ± 0.4	1.3 ± 0.5	< 0.4
81760.0	38945.0	0.0 - 0.5	< 5.0	1.4 ± 0.6	1.3 ± 0.7	5.5 ± 2.4
81760.0	38945.0	0.5 - 1.0	< 6.0	1.5 ± 0.7	< 1.0	1.4 ± 1.1
81800.0	38585.0	0.0 - 0.5	< 4.0	1.4 ± 0.5	1.3 ± 0.8	3.7 ± 1.7
81800.0	38600.0	0.0 - 0.5	< 5.0	1.0 ± 0.5	1.2 ± 0.7	< 1.0
81800.0	38645.0	0.0 - 0.5	< 4.0	1.0 ± 0.6	1.9 ± 0.8	2.9 ± 1.8
81800.0	38645.0	0.5 - 1.0	< 3.0	0.7 ± 0.4	1.2 ± 0.6	2.5 ± 1.4
81800.0	38645.0	1.0 - 2.0	< 4.0	0.6 ± 0.4	1.5 ± 0.7	< 0.7
81800.0	38645.0	2.0 - 3.0	< 3.0	0.5 ± 0.4	1.4 ± 0.6	1.4 ± 1.1
81800.0	38645.0	3.0 - 4.0	< 4.0	0.9 ± 0.5	3.0 ± 1.0	1.4 ± 1.1
81800.0	38700.0	0.0 - 0.5	< 3.0	1.1 ± 0.7	< 1.0	2.0 ± 1.3
81800.0	38800.0	0.0 - 0.5	< 9.0	1.0 ± 0.8	2.0 ± 1.0	2.4 ± 1.4
81800.0	38800.0	0.5 - 1.0	< 5.0	1.0 ± 0.9	1.3 ± 0.7	11.0 ± 3.0
81800.0	38800.0	1.0 - 2.0	< 3.0	< 1.0	1.0 ± 0.9	5.5 ± 2.0
81800.0	38800.0	2.0 - 3.0	< 6.0	0.6 ± 0.3	1.2 ± 0.7	1.0 ± 1.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81800.0	38800.0	3.0 - 4.0	< 3.0	1.2 ± 0.5	1.9 ± 0.8	< 1.0
81800.0	38900.0	0.0 - 0.5	< 4.0	2.2 ± 0.6	1.4 ± 0.7	5.1 ± 1.9
81800.0	38945.0	0.0 - 0.5	< 5.0	2.8 ± 0.7	1.2 ± 0.6	21.0 ± 4.0
81800.0	38945.0	0.5 - 1.0	< 5.0	1.2 ± 0.6	< 1.0	2.0 ± 1.3
81800.0	39000.0	0.0 - 0.5	< 3.0	1.0 ± 0.4	1.2 ± 0.5	8.2 ± 2.4
81800.0	39040.0	0.5 - 1.0	< 5.0	0.9 ± 0.5	1.8 ± 0.7	< 1.0
81800.0	39040.0	1.0 - 2.0	< 5.0	1.0 ± 0.3	< 1.0	1.4 ± 1.1
81800.0	39040.0	2.0 - 2.5	< 5.0	1.0 ± 0.4	1.5 ± 0.5	2.2 ± 1.3
81800.0	39100.0	0.0 - 0.5	< 3.0	1.2 ± 0.7	1.4 ± 0.8	3.7 ± 1.7
81855.0	38880.0	0.0 - 0.5	< 8.0	1.6 ± 0.9	2.0 ± 1.0	< 0.9
81855.0	38880.0	0.5 - 1.0	< 6.0	0.6 ± 0.4	1.6 ± 0.6	1.9 ± 1.3
81855.0	38880.0	1.0 - 2.0	< 3.0	2.7 ± 0.6	1.6 ± 0.8	4.0 ± 1.7
81855.0	38880.0	2.0 - 3.0	< 6.0	0.5 ± 0.5	0.7 ± 0.5	< 1.0
81855.0	38895.0	0.0 - 0.5	< 13.0	28.0 ± 3.0	4.0 ± 1.0	-a-
81855.0	38895.0	0.5 - 1.0	71.0 ± 20.0	360.0 ± 10.0	< 2.0	370.0 ± 20.0
81855.0	38895.0	1.0 - 2.0	31.0 ± 9.0	29.0 ± 2.0	2.0 ± 1.0	31.0 ± 5.0
81855.0	38895.0	2.0 - 3.0	9.0 ± 6.0	11.0 ± 1.0	1.6 ± 0.9	14.0 ± 3.0
81855.0	38895.0	3.0 - 4.0	< 5.0	1.8 ± 0.5	< 1.0	4.6 ± 1.8
81900.0	38590.0	0.0 - 0.5	7.0 ± 5.0	0.7 ± 0.5	< 1.0	3.5 ± 1.6
81900.0	38590.0	0.5 - 1.0	< 8.0	0.9 ± 0.5	1.2 ± 0.8	< 0.8
81900.0	38590.0	1.0 - 2.0	< 5.0	0.8 ± 0.4	1.8 ± 0.8	2.5 ± 1.4
81900.0	38590.0	2.0 - 3.0	< 5.0	0.8 ± 0.6	2.0 ± 1.0	< 1.0
81900.0	38590.0	3.0 - 4.0	< 4.0	0.7 ± 0.5	1.1 ± 0.9	1.2 ± 1.1
81900.0	38600.0	0.0 - 0.5	< 2.0	0.3 ± 0.3	1.2 ± 0.5	< 0.9
81900.0	38700.0	0.0 - 0.5	< 3.0	0.7 ± 0.3	0.7 ± 0.5	1.2 ± 1.1
81900.0	38775.0	0.0 - 0.5	< 5.0	1.0 ± 0.5	< 1.0	1.9 ± 1.3
81900.0	38775.0	0.5 - 1.0	< 11.0	1.6 ± 0.8	< 1.0	2.0 ± 1.3
81900.0	38775.0	1.0 - 2.0	< 3.0	1.3 ± 0.4	1.6 ± 0.8	< 0.8
81900.0	38775.0	2.0 - 3.0	< 7.0	1.4 ± 0.7	1.8 ± 0.9	< 1.0
81900.0	38775.0	3.0 - 4.0	< 3.0	1.0 ± 0.4	0.7 ± 0.4	1.7 ± 1.2

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
81900.0	38775.0	4.0 - 5.0	< 5.0	0.6 ± 0.3	1.3 ± 0.6	1.2 ± 1.1
81900.0	38775.0	5.0 - 6.0	< 3.0	1.0 ± 0.4	1.4 ± 0.6	1.0 ± 1.0
81900.0	38800.0	0.0 - 0.5	< 3.0	1.1 ± 0.5	1.5 ± 0.7	3.3 ± 1.6
81900.0	38900.0	0.0 - 0.5	< 2.0	0.6 ± 0.3	0.9 ± 0.4	2.0 ± 1.3
81900.0	39000.0	0.0 - 0.5	< 3.0	1.0 ± 0.5	< 1.0	3.7 ± 1.7
81900.0	39100.0	0.0 - 0.5	< 3.0	0.9 ± 0.4	1.3 ± 0.6	1.0 ± 1.0
81910.0	38805.0	0.0 - 0.5	< 5.0	0.8 ± 0.5	1.1 ± 0.6	1.2 ± 1.1
81910.0	38805.0	0.5 - 1.0	< 5.0	0.8 ± 0.5	< 1.0	< 1.0
81910.0	38805.0	1.0 - 2.0	< 5.0	0.8 ± 0.4	1.4 ± 0.7	< 0.8
81910.0	38805.0	2.0 - 3.0	< 4.0	1.2 ± 0.5	1.2 ± 0.8	1.0 ± 1.0
81910.0	38805.0	3.0 - 4.0	< 2.0	0.9 ± 0.3	1.4 ± 0.6	1.5 ± 1.2
81910.0	38805.0	4.0 - 5.0	< 6.0	0.9 ± 0.5	1.2 ± 0.7	< 0.8
81910.0	38805.0	5.0 - 6.0	< 2.0	0.8 ± 0.4	1.5 ± 0.6	1.7 ± 1.2
81910.0	38805.0	6.0 - 7.0	< 5.0	1.2 ± 0.4	1.2 ± 0.7	< 0.9
81920.0	38550.0	0.0 - 0.5	< 6.0	0.9 ± 0.5	1.4 ± 0.8	1.7 ± 1.2
81930.0	38785.0	0.0 - 0.5	< 7.0	4.0 ± 1.0	1.0 ± 1.0	9.0 ± 2.5
81930.0	38785.0	0.5 - 1.0	< 9.0	7.0 ± 2.0	2.0 ± 1.0	11.0 ± 3.0
81930.0	38785.0	1.0 - 2.0	< 9.0	6.0 ± 1.0	1.0 ± 0.7	2.9 ± 2.0
81930.0	38785.0	2.0 - 3.0	< 5.0	1.5 ± 0.5	1.5 ± 0.7	1.5 ± 1.2
81930.0	38785.0	3.0 - 4.0	< 6.0	1.3 ± 0.6	3.0 ± 1.0	4.0 ± 1.7
81950.0	38755.0	0.0 - 0.5	< 5.0	3.0 ± 1.0	3.0 ± 1.0	5.3 ± 2.0
81950.0	38755.0	0.5 - 1.0	< 2.0	1.8 ± 0.5	1.2 ± 0.5	4.6 ± 1.8
81950.0	38755.0	1.0 - 2.0	< 4.0	0.8 ± 0.6	2.0 ± 1.0	1.5 ± 1.2
81950.0	38755.0	2.0 - 3.0	< 2.0	1.2 ± 0.4	0.9 ± 0.6	1.0 ± 1.0
81950.0	38755.0	3.0 - 4.0	< 2.0	0.9 ± 0.5	1.1 ± 0.6	1.7 ± 1.2
81950.0	38755.0	4.0 - 5.0	< 3.0	1.2 ± 0.5	1.8 ± 0.8	2.5 ± 1.4
81950.0	38755.0	5.0 - 6.0	< 3.0	0.9 ± 0.6	1.6 ± 0.9	2.2 ± 1.3
81950.0	38785.0	0.0 - 0.5	< 4.0	4.0 ± 1.0	2.0 ± 1.0	12.0 ± 3.0
81950.0	38785.0	0.5 - 1.0	9.0 ± 4.0	6.0 ± 1.0	< 1.0	12.0 ± 3.0
81950.0	38785.0	1.0 - 2.0	16.0 ± 7.0	7.0 ± 1.0	2.0 ± 1.0	5.0 ± 1.9

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Uranium-238	Radium-226	Thorium-232	Thorium-230
			Concentration (pCi/g ± 2 sigma)			
81950.0	38785.0	2.0 - 3.0	7.0 ± 4.0	2.7 ± 0.7	1.4 ± 0.8	1.9 ± 1.3
81950.0	38785.0	3.0 - 4.0	12.0 ± 5.0	3.6 ± 0.9	1.6 ± 0.8	7.4 ± 2.3
81960.0	38930.0	0.0 - 0.5	< 9.0	20.0 ± 3.0	< 7.0	-a-
81960.0	38930.0	0.5 - 1.0	25.0 ± 12.0	10.0 ± 1.0	2.0 ± 0.7	39.0 ± 5.0
81963.0	38920.0	0.0 - 0.5	22.0 ± 16.0	53.0 ± 2.0	< 3.0	-a-
81963.0	38920.0	0.5 - 1.0	< 7.0	7.4 ± 0.9	< 1.0	160.0 ± 10.0
81975.0	38810.0	0.0 - 0.5	< 9.0	2.2 ± 0.8	3.0 ± 1.0	1.7 ± 1.5
81975.0	38810.0	0.5 - 1.0	< 4.0	1.1 ± 0.4	0.9 ± 0.6	1.2 ± 1.1
81975.0	38810.0	1.0 - 2.0	< 4.0	1.2 ± 0.5	1.6 ± 0.7	1.2 ± 1.1
81975.0	38810.0	2.0 - 3.0	< 5.0	1.2 ± 0.5	1.2 ± 0.7	2.5 ± 1.4
81975.0	38810.0	3.0 - 4.0	< 6.0	1.3 ± 0.5	1.5 ± 0.8	< 0.8
81980.0	38685.0	0.0 - 0.5	< 4.0	< 1.0	2.0 ± 1.0	2.2 ± 1.3
81985.0	38780.0	0.0 - 0.5	57.0 ± 11.0	110.0 ± 10.0	< 2.0	-a-
81985.0	38780.0	0.5 - 1.0	110.0 ± 20.0	130.0 ± 10.0	3.0 ± 2.0	240.0 ± 10.0
81985.0	38780.0	1.0 - 2.0	58.0 ± 9.0	45.0 ± 3.0	2.0 ± 1.0	15.0 ± 3.0
81985.0	38780.0	2.0 - 3.0	< 9.0	10.0 ± 2.0	2.0 ± 1.0	67.0 ± 7.0
81985.0	38780.0	3.0 - 4.0	< 5.0	1.6 ± 0.6	1.4 ± 0.8	2.2 ± 1.2
81995.0	38785.0	0.5 - 1.0	47.0 ± 15.0	77.0 ± 5.0	< 2.0	230.0 ± 40.0
81998.0	38883.0	0.0 - 0.5	< 2.0	1.3 ± 0.6	0.7 ± 0.7	4.5 ± 1.8
82000.0	38575.0	0.0 - 0.5	< 12.0	3.0 ± 1.0	4.0 ± 2.0	4.8 ± 1.9
82000.0	38585.0	0.0 - 0.5	< 4.0	0.9 ± 0.5	1.4 ± 0.7	3.8 ± 1.7
82000.0	38585.0	0.5 - 1.0	< 6.0	1.3 ± 0.7	3.0 ± 1.0	< 0.6
82000.0	38585.0	1.0 - 2.0	< 10.0	1.1 ± 0.7	1.0 ± 1.0	1.2 ± 1.1
82000.0	38585.0	2.0 - 3.0	< 5.0	1.2 ± 0.6	2.0 ± 1.0	2.0 ± 1.3
82000.0	38585.0	3.0 - 4.0	< 8.0	1.0 ± 0.6	< 1.0	2.0 ± 1.3
82000.0	38600.0	0.0 - 0.5	< 3.0	< 1.0	1.4 ± 0.8	< 1.4
82000.0	38660.0	0.0 - 0.5	< 2.0	1.7 ± 0.7	< 1.0	2.4 ± 1.7
82000.0	38660.0	0.5 - 1.0	< 2.0	0.6 ± 0.3	1.3 ± 0.5	2.2 ± 1.3
82000.0	38660.0	1.0 - 1.5	< 2.0	0.7 ± 0.4	1.6 ± 0.8	1.9 ± 1.3
82000.0	38685.0	0.0 - 0.5	< 4.0	1.6 ± 0.8	2.0 ± 1.0	< 1.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
82000.0	38685.0	0.5 - 1.0	< 2.0	0.8 ± 0.4	1.5 ± 0.7	2.7 ± 1.5
82000.0	38685.0	1.0 - 2.0	< 3.0	1.2 ± 0.5	1.8 ± 0.7	2.4 ± 1.4
82000.0	38685.0	2.0 - 3.0	< 2.0	1.1 ± 0.4	2.2 ± 0.8	2.7 ± 1.5
82000.0	38685.0	3.0 - 4.0	< 2.0	1.3 ± 0.4	1.2 ± 0.6	1.7 ± 1.2
82000.0	38700.0	0.0 - 0.5	< 5.0	0.7 ± 0.5	< 1.0	3.8 ± 2.1
82000.0	38755.0	0.0 - 0.5	< 4.0	2.6 ± 0.8	< 1.0	7.3 ± 2.3
82000.0	38755.0	0.5 - 1.0	< 15.0	3.0 ± 2.0	< 2.0	5.5 ± 2.0
82000.0	38755.0	1.0 - 2.0	< 8.0	1.2 ± 0.8	1.6 ± 0.8	4.5 ± 1.8
82000.0	38800.0	0.0 - 0.5	< 3.0	0.5 ± 0.3	1.1 ± 0.5	2.0 ± 1.3
82000.0	38830.0	0.0 - 0.5	< 12.0	< 1.0	< 1.0	2.5 ± 1.4
82000.0	38830.0	0.5 - 1.0	< 2.0	0.7 ± 0.3	1.1 ± 0.6	2.0 ± 1.3
82000.0	38830.0	1.0 - 2.0	< 7.0	1.3 ± 0.6	< 1.0	< 1.0
82000.0	38830.0	2.0 - 3.0	< 3.0	1.5 ± 0.8	1.5 ± 0.8	1.2 ± 1.1
82000.0	38830.0	3.0 - 4.0	< 5.0	0.8 ± 0.3	1.5 ± 0.6	< 0.8
82000.0	39100.0	0.0 - 0.5	< 2.0	1.0 ± 0.5	1.6 ± 0.7	2.2 ± 1.3
82010.0	38785.0	0.0 - 0.5	< 6.0	3.0 ± 1.0	2.0 ± 2.0	5.2 ± 2.5
82010.0	38785.0	0.5 - 1.0	< 11.0	3.0 ± 2.0	< 2.0	4.3 ± 1.8
82010.0	38785.0	1.0 - 2.0	< 9.0	11.0 ± 2.0	2.0 ± 1.0	22.0 ± 4.0
82010.0	38785.0	2.0 - 3.0	8.0 ± 5.0	10.0 ± 2.0	2.0 ± 1.0	14.0 ± 3.0
82010.0	38785.0	3.0 - 4.0	< 7.0	1.6 ± 0.5	1.2 ± 0.6	3.0 ± 1.5
82010.0	39000.0	0.0 - 0.5	< 3.0	0.8 ± 0.4	1.1 ± 0.5	3.3 ± 1.6
82025.0	38680.0	0.0 - 0.5	< 6.0	2.0 ± 0.8	2.0 ± 0.9	4.3 ± 2.2
82030.0	38785.0	0.0 - 0.5	< 8.0	2.0 ± 1.0	2.0 ± 2.0	1.7 ± 1.2
82030.0	38785.0	0.5 - 1.0	< 10.0	2.0 ± 1.0	< 1.0	5.2 ± 1.9
82100.0	38580.0	0.0 - 0.5	< 6.0	1.5 ± 0.7	3.0 ± 1.0	1.9 ± 1.3
82100.0	38600.0	0.0 - 0.5	< 4.0	0.9 ± 0.5	1.2 ± 0.7	< 1.4
82100.0	38700.0	0.0 - 0.5	< 5.0	0.8 ± 0.4	< 1.0	2.2 ± 1.7
82100.0	38800.0	0.0 - 0.5	< 3.0	1.6 ± 0.7	0.8 ± 0.6	4.1 ± 2.1
82100.0	38871.0	0.0 - 0.5	< 5.0	1.5 ± 0.7	1.4 ± 0.7	2.2 ± 1.3
82100.0	39003.0	0.0 - 0.5	< 6.0	2.7 ± 0.8	< 1.0	5.8 ± 2.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
82100.0	39040.0	0.5 - 1.0	< 3.0	< 1.0	1.0 ± 0.5	1.0 ± 1.0
82100.0	39040.0	1.0 - 2.0	< 6.0	< 1.0	1.7 ± 0.5	1.7 ± 1.2
82100.0	39040.0	2.0 - 3.0	< 9.0	< 1.0	< 1.0	1.0 ± 1.0
82100.0	39100.0	0.0 - 0.5	< 4.0	1.0 ± 0.4	1.6 ± 0.7	2.7 ± 1.8
82150.0	38575.0	0.0 - 0.5	< 4.0	0.7 ± 0.5	1.8 ± 0.7	2.2 ± 1.7
82150.0	38575.0	0.5 - 1.0	< 4.0	1.2 ± 0.5	2.0 ± 0.8	1.5 ± 1.2
82150.0	38575.0	1.0 - 2.0	< 8.0	0.8 ± 0.5	2.0 ± 1.0	< 0.8
82150.0	38575.0	2.0 - 3.0	< 3.0	1.1 ± 0.4	1.9 ± 0.8	< 0.8
82150.0	38575.0	3.0 - 4.0	< 6.0	0.9 ± 0.6	1.8 ± 0.8	< 0.8
82172.0	38570.0	0.0 - 0.5	< 8.0	1.2 ± 0.5	1.5 ± 0.7	6.4 ± 2.1
82200.0	38560.0	0.0 - 0.5	< 4.0	1.1 ± 0.6	2.1 ± 0.9	3.2 ± 1.6
82200.0	38570.0	0.0 - 0.5	< 3.0	1.3 ± 0.5	1.2 ± 0.7	2.5 ± 1.4
82200.0	38600.0	0.0 - 0.5	< 11.0	2.0 ± 1.0	3.0 ± 2.0	2.0 ± 1.6
82200.0	38640.0	0.0 - 0.5	< 4.0	2.3 ± 0.6	1.1 ± 0.8	4.8 ± 2.3
82200.0	38640.0	0.5 - 1.0	< 5.0	1.7 ± 0.7	1.7 ± 0.9	2.0 ± 1.3
82200.0	38640.0	1.0 - 1.5	< 5.0	0.8 ± 0.6	1.2 ± 0.9	< 0.9
82200.0	38700.0	0.0 - 0.5	< 10.0	1.3 ± 0.9	2.0 ± 1.0	< 1.4
82200.0	38800.0	0.0 - 0.5	< 6.0	1.4 ± 0.5	1.4 ± 0.7	< 1.4
82200.0	38900.0	0.0 - 0.5	< 5.0	1.2 ± 0.5	1.0 ± 0.7	1.5 ± 1.5
82200.0	38985.0	0.0 - 0.5	< 3.0	3.7 ± 0.7	1.6 ± 0.6	11.0 ± 3.0
82200.0	38985.0	0.5 - 1.0	< 6.0	0.5 ± 0.4	0.9 ± 0.6	2.7 ± 1.5
82200.0	38985.0	1.0 - 2.0	< 7.0	1.0 ± 0.6	1.3 ± 0.8	1.7 ± 1.2
82200.0	38985.0	2.0 - 2.5	< 2.0	0.8 ± 0.4	1.5 ± 0.8	1.7 ± 1.2
82200.0	39000.0	0.0 - 0.5	< 4.0	1.5 ± 0.6	< 1.0	2.4 ± 1.7
82200.0	39010.0	0.0 - 0.5	< 2.0	0.9 ± 0.3	0.7 ± 0.4	1.2 ± 1.1
82200.0	39010.0	0.5 - 1.0	< 5.0	0.8 ± 0.5	1.4 ± 0.6	< 0.8
82200.0	39010.0	1.0 - 2.0	< 4.0	1.8 ± 0.6	2.0 ± 1.0	1.9 ± 1.3
82200.0	39010.0	2.0 - 3.0	< 4.0	1.3 ± 0.5	1.3 ± 0.7	1.0 ± 1.0
82200.0	39010.0	3.0 - 3.5	< 3.0	1.0 ± 0.4	1.5 ± 0.7	< 0.7
82200.0	39100.0	0.0 - 0.5	< 7.0	1.4 ± 0.6	1.9 ± 0.9	1.7 ± 1.5

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
82205.0	38760.0	0.0 - 0.5	< 5.0	0.8 ± 0.5	1.2 ± 0.8	1.9 ± 1.3
82205.0	38760.0	0.5 - 1.0	< 3.0	1.1 ± 0.4	1.5 ± 0.7	< 1.2
82205.0	38760.0	1.0 - 2.0	< 4.0	1.4 ± 0.5	1.1 ± 0.6	< 0.6
82205.0	38760.0	2.0 - 3.0	< 5.0	1.5 ± 0.6	3.0 ± 1.0	< 0.7
82205.0	38760.0	3.0 - 4.0	< 3.0	1.3 ± 0.5	1.0 ± 0.7	< 0.9
82220.0	39005.0	0.0 - 0.5	< 6.0	5.0 ± 1.0	1.4 ± 0.7	< 1.3
82220.0	39005.0	0.5 - 1.0	< 5.0	7.0 ± 1.0	1.0 ± 0.7	9.1 ± 3.0
82220.0	39005.0	1.0 - 2.0	< 4.0	5.0 ± 1.0	1.2 ± 0.7	3.6 ± 2.0
82225.0	38800.0	0.5 - 1.0	< 4.0	0.8 ± 0.4	1.7 ± 0.6	1.2 ± 1.1
82225.0	38800.0	1.0 - 2.0	< 5.0	1.1 ± 0.5	1.1 ± 0.7	1.2 ± 1.1
82225.0	38800.0	2.0 - 3.0	< 3.0	1.4 ± 0.5	2.3 ± 0.8	< 1.0
82225.0	38800.0	3.0 - 4.0	< 4.0	1.5 ± 0.6	1.5 ± 0.8	2.2 ± 1.3
82225.0	39015.0	0.0 - 0.5	< 2.0	0.5 ± 0.3	0.5 ± 0.4	1.0 ± 1.0
82225.0	39015.0	0.5 - 1.0	< 3.0	1.4 ± 0.5	1.0 ± 0.6	2.8 ± 1.5
82225.0	39015.0	1.0 - 2.0	< 5.0	1.1 ± 0.4	0.7 ± 0.5	2.7 ± 1.5
82230.0	39025.0	0.0 - 0.5	23.0 ± 9.0	49.0 ± 3.0	< 1.0	-a-
82230.0	39025.0	0.5 - 1.0	17.0 ± 15.0	22.0 ± 3.0	< 1.0	-a-
82230.0	39025.0	1.0 - 2.0	< 3.0	1.8 ± 0.6	1.3 ± 0.7	5.5 ± 2.0
82230.0	39025.0	2.0 - 3.0	< 6.0	1.1 ± 0.5	1.7 ± 0.7	1.7 ± 1.2
82230.0	39025.0	3.0 - 4.0	< 3.0	1.0 ± 0.4	1.5 ± 0.7	1.2 ± 1.1
82230.0	39025.0	4.0 - 5.0	< 6.0	< 1.0	2.6 ± 0.8	< 0.8
82235.0	38825.0	0.0 - 0.0	< 2.0	0.7 ± 0.3	0.9 ± 0.8	1.9 ± 1.3
82235.0	39060.0	0.0 - 0.5	< 2.0	0.8 ± 0.4	1.0 ± 0.6	1.5 ± 1.2
82235.0	39060.0	0.5 - 1.0	< 7.0	0.8 ± 0.4	1.2 ± 0.6	1.0 ± 1.0
82235.0	39060.0	1.0 - 1.5	< 2.0	0.6 ± 0.3	1.7 ± 0.7	1.5 ± 1.2
82250.0	38570.0	0.0 - 0.5	< 3.0	1.2 ± 0.5	2.0 ± 0.7	9.2 ± 3.0
82250.0	38570.0	0.5 - 1.0	< 4.0	1.5 ± 0.6	2.0 ± 0.9	1.4 ± 1.1
82250.0	38570.0	1.0 - 2.0	< 5.0	1.8 ± 0.7	2.0 ± 1.0	1.2 ± 1.1
82250.0	38570.0	2.0 - 3.0	< 6.0	1.0 ± 0.4	1.2 ± 0.6	1.0 ± 1.0
82250.0	38570.0	3.0 - 4.0	< 5.0	1.6 ± 0.6	2.0 ± 1.0	< 1.0

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
82255.0	38600.0	0.0 - 0.5	< 11.0	2.0 ± 1.0	3.0 ± 2.0	< 1.1
82255.0	38640.0	0.0 - 0.5	< 6.0	1.5 ± 0.5	1.1 ± 0.9	2.2 ± 1.3
82255.0	38800.0	0.0 - 0.5	< 4.0	0.7 ± 0.6	3.0 ± 1.0	2.4 ± 1.4
82255.0	39005.0	0.0 - 0.5	< 7.0	0.7 ± 0.5	1.5 ± 0.7	1.2 ± 1.1
82255.0	39005.0	0.5 - 1.0	< 3.0	0.7 ± 0.4	1.2 ± 0.7	1.0 ± 1.0
82255.0	39005.0	1.0 - 2.0	< 2.0	0.9 ± 0.4	1.1 ± 0.5	1.5 ± 1.2
82270.0	38755.0	0.0 - 0.5	< 9.0	1.2 ± 0.9	7.0 ± 2.0	4.9 ± 2.5
82270.0	38755.0	0.5 - 1.0	< 3.0	1.1 ± 0.5	1.3 ± 0.7	< 1.1
82270.0	38755.0	1.0 - 2.0	< 5.0	1.2 ± 0.4	1.6 ± 0.7	< 1.3
82270.0	38755.0	2.0 - 3.0	< 3.0	1.0 ± 0.3	1.4 ± 0.6	2.0 ± 1.6
82270.0	38755.0	3.0 - 4.0	< 3.0	0.6 ± 0.3	1.1 ± 0.6	1.7 ± 1.5
82270.0	38810.0	0.0 - 0.5	< 6.0	2.0 ± 0.6	2.1 ± 0.9	2.0 ± 1.7
82270.0	38810.0	0.5 - 1.0	< 3.0	0.7 ± 0.3	0.6 ± 0.5	< 1.4
82270.0	38810.0	1.0 - 2.0	< 2.0	1.1 ± 0.3	0.7 ± 0.3	3.4 ± 2.0
82270.0	38810.0	2.0 - 3.0	< 3.0	1.2 ± 0.4	1.5 ± 0.8	< 1.3
82270.0	38810.0	3.0 - 4.0	< 3.0	1.2 ± 0.5	1.4 ± 0.7	< 1.0
82270.0	38840.0	0.0 - 0.5	< 8.0	1.0 ± 1.0	3.0 ± 2.0	2.5 ± 1.9
82270.0	38840.0	0.5 - 1.0	< 5.0	0.9 ± 0.6	< 1.0	< 1.4
82270.0	38840.0	1.0 - 2.0	< 3.0	0.7 ± 0.4	1.1 ± 0.5	< 1.1
82270.0	38840.0	2.0 - 3.0	< 3.0	0.7 ± 0.4	0.9 ± 0.5	< 0.9
82270.0	38840.0	3.0 - 4.0	< 3.0	0.9 ± 0.4	1.4 ± 0.7	< 1.3
82300.0	38565.0	0.0 - 0.5	< 5.0	1.0 ± 0.4	2.3 ± 0.8	< 1.1
82300.0	38600.0	0.0 - 0.5	< 12.0	3.0 ± 1.0	< 2.0	2.0 ± 1.6
82300.0	38640.0	0.0 - 0.5	< 8.0	2.0 ± 1.0	3.0 ± 2.0	< 0.9
82300.0	38640.0	0.5 - 1.0	< 3.0	0.9 ± 0.3	1.0 ± 0.5	1.0 ± 1.0
82300.0	38640.0	1.0 - 2.0	< 8.0	< 1.0	< 1.0	< 0.9
82300.0	38700.0	0.0 - 0.5	< 9.0	0.8 ± 0.8	2.0 ± 1.0	3.1 ± 1.9
82300.0	38800.0	0.0 - 0.5	< 9.0	2.7 ± 0.3	3.0 ± 1.0	2.9 ± 1.8
82300.0	38900.0	0.0 - 0.5	< 7.0	1.5 ± 0.7	2.0 ± 1.0	< 1.3
82300.0	39000.0	0.0 - 0.5	< 9.0	< 1.0	2.0 ± 1.0	2.0 ± 1.6

APPENDIX B

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232	Thorium-230
82300.0	39100.0	0.0 - 0.5	< 6.0	1.6 ± 0.6	1.9 ± 0.9	1.7 ± 1.5
82310.0	39000.0	0.0 - 0.5	< 3.0	< 1.0	< 1.0	< 0.9
82310.0	39000.0	0.5 - 1.0	< 7.0	1.1 ± 0.4	1.5 ± 0.7	1.7 ± 1.2
82310.0	39000.0	1.0 - 2.0	< 2.0	0.7 ± 0.3	0.9 ± 0.4	< 0.8
82310.0	39000.0	2.0 - 2.5	< 6.0	0.9 ± 0.5	1.2 ± 0.6	1.2 ± 1.1
82315.0	38900.0	0.0 - 0.5	< 2.0	1.1 ± 0.3	0.9 ± 0.5	2.0 ± 1.3
82320.0	38575.0	0.0 - 0.5	< 4.0	2.6 ± 0.8	1.6 ± 0.9	2.4 ± 1.7
82320.0	38575.0	0.5 - 1.0	< 5.0	1.7 ± 0.8	3.0 ± 1.0	1.0 ± 1.0
82320.0	38575.0	1.0 - 2.0	< 7.0	2.1 ± 0.8	2.0 ± 1.0	1.0 ± 1.0
82320.0	38575.0	2.0 - 3.0	< 4.0	2.0 ± 0.6	2.0 ± 0.8	< 0.4
82320.0	38575.0	3.0 - 4.0	< 5.0	2.6 ± 0.8	3.0 ± 1.0	1.9 ± 1.3
82320.0	38800.0	0.0 - 0.5	< 6.0	2.4 ± 0.7	3.0 ± 1.0	2.8 ± 1.5
82320.0	38800.0	0.5 - 1.0	< 4.0	1.1 ± 0.5	2.0 ± 0.9	1.5 ± 1.2
82320.0	38800.0	1.0 - 2.0	< 8.0	1.2 ± 0.5	1.4 ± 0.8	1.2 ± 1.1
82320.0	38800.0	2.0 - 3.0	< 3.0	1.3 ± 0.5	1.4 ± 0.8	1.7 ± 1.2
82320.0	38800.0	3.0 - 4.0	< 5.0	1.1 ± 0.4	1.2 ± 0.7	< 1.0
82320.0	38800.0	4.0 - 5.0	< 4.0	1.5 ± 0.5	2.2 ± 0.9	1.0 ± 1.0
82320.0	38800.0	5.0 - 6.0	< 6.0	1.2 ± 0.5	0.8 ± 0.7	1.2 ± 1.1
82320.0	38800.0	6.0 - 7.0	< 4.0	1.1 ± 0.6	< 1.0	< 0.8
82320.0	38800.0	7.0 - 8.0	< 8.0	1.0 ± 0.6	2.1 ± 0.9	1.5 ± 1.2
82320.0	39000.0	0.0 - 0.5	< 14.0	1.0 ± 1.0	3.0 ± 1.0	1.4 ± 1.1
82325.0	38600.0	0.0 - 0.5	< 5.0	1.9 ± 0.6	2.0 ± 1.0	2.0 ± 1.3
82325.0	38700.0	0.0 - 0.5	< 4.0	1.2 ± 0.4	1.0 ± 0.7	1.5 ± 1.2
82330.0	38800.0	0.0 - 0.5	< 4.0	1.4 ± 0.6	< 1.0	1.0 ± 1.0
82335.0	38600.0	0.0 - 0.5	< 6.0	0.9 ± 0.4	0.7 ± 0.7	1.4 ± 1.1
82400.0	38765.0	0.0 - 0.5	< 6.0	< 1.0	3.0 ± 2.0	1.0 ± 1.0

-a- Analysis for Thorium-230 not performed

APPENDIX C

RADIONUCLIDE CONCENTRATIONS IN SUB-PAD SOILS AT THE ELZA GATE SITE

APPENDIX C

RADIONUCLIDE CONCENTRATIONS IN SUBPAD SOILS

AT THE ELZA GATE SITE

Coordinates		Depth	Concentration (pCi/g ± 2 sigma			
East	North	(ft)	Uranium-238	Radium-226	Thorium-232	Thorium-230
80987.0	38973.0	0.0 - 1.0	<13.0	1.7 ± 0.8	4.0 ± 2.0	1.7 ± 1.2
80987.0	38973.0	1.0 - 2.0	<21.0	2.0 ± 1.0	4.0 ± 2.0	1.0 ± 1.0
80987.0	38973.0	2.0 - 3.0	<11.0	2.0 ± 2.0	4.0 ± 3.0	<0.9
80989.0	38909.0	0.0 - 1.0	< 6.0	0.6 ± 0.5	2.0 ± 1.0	<0.8
80989.0	38909.0	1.0 - 2.0	<10.0	1.1 ± 0.6	3.0 ± 2.0	1.7 ± 1.2
80989.0	38909.0	2.0 - 3.0	<24.0	< 1.0	<2.0	<0.9
81058.0	38992.0	0.0 - 1.0	< 7.0	1.3 ± 0.8	4.0 ± 2.0	1.9 ± 1.3
81058.0	38992.0	1.0 - 2.0	<12.0	1.2 ± 0.6	2.0 ± 2.0	1.7 ± 1.2
81072.0	38912.0	0.0 - 0.5	< 8.0	2.5 ± 0.9	3.0 ± 1.0	1.4 ± 1.1
81072.0	38912.0	2.0 - 3.0	<14.0	3.0 ± 1.0	5.0 ± 2.0	1.5 ± 1.2
81154.0	38924.0	0.0 - 1.0	<13.0	2.1 ± 0.8	4.0 ± 2.0	1.9 ± 1.3
81154.0	38924.0	1.0 - 1.5	< 6.0	3.0 ± 1.0	3.0 ± 2.0	1.7 ± 1.2
81154.0	38980.0	0.0 - 1.0	<17.0	< 1.0	<1.0	<1.0
81154.0	38980.0	1.0 - 2.0	< 7.0	1.7 ± 0.7	3.0 ± 2.0	1.2 ± 1.1
81154.0	38980.0	2.0 - 3.0	<14.0	< 1.0	2.0 ± 1.0	1.4 ± 1.1
81331.0	38926.0	0.0 - 1.0	<14.0	1.3 ± 0.9	3.0 ± 2.0	<1.0
81331.0	38926.0	1.0 - 2.0	<11.0	1.0 ± 1.0	<2.0	<0.9
81331.0	38926.0	2.0 - 3.0	< 8.0	2.0 ± 1.0	3.0 ± 3.0	<0.8
81331.0	38926.0	3.0 - 4.0	<14.0	1.7 ± 0.9	5.0 ± 2.0	<0.8
81331.0	38926.0	4.0 - 5.0	< 8.0	1.4 ± 0.8	4.0 ± 2.0	<1.0
81331.0	38930.0	0.0 - 1.0	34.0 ± 9.0	6.0 ± 1.0	4.0 ± 2.0	4.2 ± 1.8
81331.0	38930.0	1.0 - 2.0	<13.0	2.3 ± 0.9	3.0 ± 1.0	2.4 ± 1.4
81331.0	38930.0	2.0 - 2.5	< 7.0	1.7 ± 0.8	4.0 ± 2.0	1.9 ± 1.3
81389.0	38978.0	0.0 - 1.0	11.0 ± 6.0	1.3 ± 0.8	2.0 ± 1.0	<1.0
81389.0	38978.0	1.0 - 2.0	< 7.0	1.6 ± 0.8	3.0 ± 2.0	<0.8
81389.0	38978.0	2.0 - 3.0	<14.0	1.0 ± 1.0	3.0 ± 2.0	2.0 ± 1.3
81432.0	38935.0	0.0 - 1.0	<12.0	1.4 ± 0.8	<2.0	<0.6
81432.0	38935.0	1.0 - 2.0	< 5.0	1.0 ± 0.8	4.0 ± 2.0	<0.9
81432.0	38935.0	2.0 - 3.0	<20.0	2.0 ± 1.0	<2.0	<1.0
81432.0	38935.0	3.0 - 4.0	< 8.0	1.1 ± 0.8	4.0 ± 2.0	<0.8

APPENDIX C

(continued)

Coordinates East	Coordinates North	Depth (ft)	Concentration (pCi/g ± 2 sigma Uranium-238	Radium-226	Thorium-232	Thorium-230
81432.0	38935.0	4.0 - 5.0	<15.0	2.0 ± 1.0	<2.0	<0.4
81432.0	38935.0	5.0 - 6.0	< 9.0	1.9 ± 0.9	<1.0	1.7 ± 1.2
81468.0	38980.0	0.0 - 1.0	<12.0	1.5 ± 0.9	5.0 ± 2.0	<0.8
81468.0	38980.0	1.0 - 2.0	< 7.0	< 1.0	3.0 ± 2.0	<0.8
81468.0	38980.0	2.0 - 3.0	< 6.0	1.9 ± 0.9	4.0 ± 2.0	<0.9
81483.0	38906.0	0.0 - 1.0	<14.0	1.8 ± 0.8	4.0 ± 2.0	<1.0
81483.0	38906.0	1.0 - 2.0	< 5.0	< 1.0	3.0 ± 2.0	<1.0
81483.0	38906.0	2.0 - 3.0	< 7.0	4.0 ± 1.0	5.0 ± 2.0	<0.9
81619.0	38924.0	0.0 - 1.0	<12.0	1.1 ± 0.7	3.0 ± 2.0	1.4 ± 1.1
81619.0	38924.0	1.0 - 2.0	< 6.0	1.6 ± 0.7	<1.0	<0.7
81619.0	38924.0	2.0 - 3.0	<12.0	1.2 ± 0.7	4.0 ± 2.0	<0.8
81620.0	38980.0	0.0 - 1.0	< 4.0	1.2 ± 0.5	0.9 ± 0.7	<1.0
81620.0	38980.0	1.0 - 2.0	< 7.0	0.8 ± 0.5	2.0 ± 1.0	<0.8
81620.0	38980.0	2.0 - 3.0	< 7.0	< 1.0	<2.0	<0.8
81689.0	38923.0	0.0 - 1.0	< 6.0	1.7 ± 0.7	2.0 ± 1.0	<0.8
81689.0	38923.0	1.0 - 2.0	<11.0	1.1 ± 0.8	3.0 ± 2.0	<1.0
81689.0	38923.0	2.0 - 3.0	< 7.0	2.0 ± 1.0	4.0 ± 2.0	<1.0
81689.0	38972.0	0.0 - 1.0	< 7.0	1.7 ± 0.7	3.0 ± 1.0	1.2 ± 1.1
81689.0	38972.0	1.0 - 2.0	<13.0	1.2 ± 0.8	1.0 ± 1.0	1.7 ± 1.2
81689.0	38972.0	2.0 - 3.0	< 9.0	1.0 ± 0.5	3.0 ± 2.0	<0.6
81689.0	38981.0	0.0 - 1.0	<13.0	1.0 ± 0.7	4.0 ± 2.0	<0.9
81689.0	38981.0	1.0 - 2.0	< 8.0	1.3 ± 0.7	<1.0	1.0 ± 1.0
81689.0	38981.0	2.0 - 3.0	< 6.0	1.0 ± 0.7	3.0 ± 1.0	1.2 ± 1.1
81701.0	38907.0	0.0 - 1.0	<15.0	1.8 ± 0.8	<2.0	<0.8
81701.0	38907.0	1.0 - 2.0	< 6.0	< 1.0	<2.0	1.5 ± 1.2
81701.0	38907.0	2.0 - 3.0	<11.0	1.5 ± 0.8	<2.0	1.2 ± 1.1
81812.0	38944.0	0.0 - 1.0	< 6.0	0.9 ± 0.4	2.0 ± 0.9	1.2 ± 1.1
81812.0	38944.0	1.0 - 2.0	<11.0	1.8 ± 0.9	4.0 ± 1.0	<0.9
81812.0	38944.0	2.0 - 3.0	< 8.0	< 1.0	4.0 ± 2.0	<0.7
81831.0	38925.0	0.0 - 1.0	< 7.0	1.6 ± 0.7	3.0 ± 2.0	<0.9
81831.0	38976.0	0.0 - 0.5	< 8.0	2.0 ± 1.0	4.0 ± 3.0	<0.6

APPENDIX C

(continued)

Coordinates		Depth	Concentration (pCi/g ± 2 sigma			
East	North	(ft)	Uranium-238	Radium-226	Thorium-232	Thorium-230
81839.0	38988.0	0.0 - 1.0	88.0 ± 17.0	3.0 ± 1.0	2.0 ± 2.0	3.2 ± 1.7
81839.0	38988.0	1.0 - 2.0	< 7.0	0.7 ± 0.5	3.0 ± 2.0	2.0 ± 1.3
81839.0	38998.0	2.0 - 3.0	11.0 ± 8.0	1.8 ± 0.6	3.0 ± 1.0	2.2 ± 1.3
81903.0	38925.0	0.0 - 1.0	<10.0	1.8 ± 0.7	2.0 ± 1.0	<0.9
81903.0	38925.0	1.0 - 2.0	<11.0	< 1.0	5.0 ± 2.0	<0.9
81904.0	38969.0	0.0 - 1.0	<12.0	0.9 ± 0.8	2.0 ± 1.0	1.5 ± 1.2
81904.0	38969.0	1.0 - 2.0	< 6.0	1.3 ± 0.7	4.0 ± 2.0	<0.8
81904.0	38969.0	2.0 - 3.0	<16.0	3.0 ± 2.0	<4.0	1.0 ± 1.0
81975.0	38913.0	0.0 - 1.0	< 5.0	0.8 ± 0.4	1.5 ± 0.8	1.1 ± 1.0
81975.0	38913.0	1.0 - 2.0	< 3.0	0.7 ± 0.4	1.2 ± 0.7	<0.8
82022.0	38949.0	0.0 - 1.0	< 2.0	1.2 ± 0.5	0.9 ± 0.6	<0.8
82023.0	38949.0	0.0 - 1.0	40.0 ± 9.0	9.0 ± 1.0	2.0 ± 1.0	8.7 ± 2.5
82023.0	38949.0	1.0 - 2.0	< 7.0	1.2 ± 0.4	1.7 ± 0.9	6.3 ± 2.1
82023.0	38949.0	2.0 - 3.0	< 3.0	0.7 ± 0.4	<1.0	1.7 ± 1.2
82024.0	38949.0	0.0 - 1.0	< 6.0	0.9 ± 0.6	3.0 ± 1.0	<0.8
82024.0	38949.0	1.0 - 2.0	< 3.0	1.3 ± 0.6	2.0 ± 2.0	1.5 ± 1.2
82024.0	38949.0	2.0 - 3.0	< 4.0	1.0 ± 0.6	5.0 ± 2.0	<0.8
82036.0	38875.0	0.0 - 1.0	< 5.0	0.8 ± 0.6	3.0 ± 2.0	1.1 ± 1.0
82036.0	38875.0	1.0 - 2.0	< 5.0	1.2 ± 0.6	2.0 ± 1.0	<0.7
82036.0	38875.0	2.0 - 3.0	< 6.0	1.0 ± 0.8	2.0 ± 1.0	2.4 ± 1.4
82059.0	38904.0	0.0 - 1.0	< 4.0	0.9 ± 0.4	<1.0	1.7 ± 1.2
82059.0	38904.0	1.0 - 2.0	< 5.0	0.3 ± 0.2	0.6 ± 0.4	<0.8
82059.0	38904.0	2.0 - 3.0	< 6.0	0.6 ± 0.4	1.2 ± 0.8	1.2 ± 1.1
82138.0	38873.0	0.0 - 1.0	< 5.0	0.7 ± 0.6	1.0 ± 1.0	5.3 ± 2.0
82168.0	38963.0	0.0 - 0.5	< 5.0	1.6 ± 0.7	2.0 ± 1.0	1.2 ± 1.1
82168.0	38963.0	1.0 - 2.0	< 2.0	0.6 ± 0.3	0.5 ± 0.3	1.1 ± 1.0
82168.0	38963.0	2.0 - 3.0	< 4.0	1.4 ± 0.8	1.0 ± 1.0	1.1 ± 1.0

APPENDIX D

CHEMICAL CHARACTERIZATION METALS DATA FOR THE ELZA GATE SITE

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE

Units = uG/Liter

site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-78-2-3	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	21.4
143-B1-0-1	1.9	6870	19.2	19.2	38.3	0.96	958	0.96	10.5	11.1	11.6	15300	0.29	1120	958	451	19.2	958	8	19.2	11.5	19.2	28.1	13.4	23.7
143-B1-1-2	2.2	22700	21.9	21.9	43.8	1.3	1100	1.1	11	15.4	17.3	40500	0.14	3340	1910	36.3	21.9	1100	22.5	21.9	13.1	21.9	71.8	28	49.9
143-B1-2-3	2.4	18400	24.1	24.1	48.1	1.4	1200	1.2	12	12.2	26.9	37000	0.13	2370	1450	130	24.1	1200	24.2	24.1	14.4	24.1	61.8	23.7	57.7
143-B2-0-1	2.1	12400	21.4	21.4	65.6	1.1	16100	1.1	10.7	13.2	8.5	17400	0.21	1380	1440	958	21.4	1070	10.2	21.4	12.8	21.4	39.5	25.2	25.4
143-B2-1-2	2.2	16800	21.9	21.9	67.1	1.1	1740	1.1	12.1	22.5	17.1	18500	0.13	2950	2350	445	21.9	1090	16.6	27.8	13.1	21.9	43.4	26	44.1
143-B2-2-3	1.5	8810	14.9	14.9	35.8	0.75	746	0.75	7.5	9.8	9.5	12800	0.13	1290	1040	261	14.9	746	6.9	14.9	8.9	14.9	24.5	15.9	18.6
AVERAGE	3.19	12311	31.9	31.9	71.2	1.66	3835	1.6	16.3	13.5	16.6	20229	0.18	2493	2021	328	31.9	1595	18.3	32.8	19.1	31.9	52.7	26	34.4
US Average	0	71000	6	10	500	6	137000	0.1	8	100	20	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE

Units = uG/Liter

Site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-76-0-1	2	11200	22.4	40.5	139	1.1	51500	1.2	13.3	22.1	395	33800	0.25	1120	4500	669	22.4	1120	22	4050	13.4	22.4	53.2	27.4	520
143-76-1-2	2	11400	17.8	23.9	63	0.9	26300	1.1	20.7	154	376	39600	0.22	892	2100	998	17.8	892	591	467	10.7	17.8	29.9	33.6	309
143-76-2-3	2	14800	22.2	22.2	54.3	1.1	1980	1.1	25.7	24.7	10	26800	0.2	1110	1110	1270	22.2	1110	9.5	40.3	13.3	22.2	29	37.4	35.9
143-77-0-1	2	8940	20	20	62.7	1	134000	2.1	18.7	29.5	711	27000	1.5	998	4990	1420	20	998	421	210	12	20	42	29.2	396
143-77-1-2	2	13200	21.7	21.7	43.5	1.1	2330	1.1	18.5	31.4	11.9	32000	0.2	1090	1090	751	21.7	1090	9.5	21.7	13	21.7	24.3	37.6	30.7
143-77-2-3	2	14000	18.8	21.9	53.7	0.9	4060	0.9	22.3	27.6	20	33300	0.22	942	942	8540	18.8	942	23.1	18.8	11.3	18.8	81.4	37.9	42.6
143-78-0-1	2	11800	21.6	21.6	103	1.1	13600	1.1	51.2	28.8	1040	28900	0.75	1080	1410	3120	21.6	1080	887	124	12.9	21.6	51.4	33.4	137
143-78-1-2	2	15100	21.1	21.1	67.8	1.1	2100	1.1	35.4	21.3	14.9	33400	0.13	1060	1060	1850	21.1	1060	361	39.5	12.7	21.1	37.5	33.6	41.2
143-78-2-2.5	2	22000	20.8	21.4	100	2.1	5250	1	10.7	18.7	24.2	37400	0.23	1300	2010	545	20.8	1040	99.2	20.8	12.5	20.8	40.6	33.1	44.3
143-70-0-1	2	11700	19.3	27.4	72.9	1	77600	1	12.9	23.6	98.8	22600	0.53	1040	18200	620	19.3	967	20.4	63.4	11.6	19.3	50	35.5	124
143-70-1-2	2	12400	21.6	29.7	66.3	1.1	91100	1.1	15.4	15.8	44.6	21000	0.24	1080	10400	714	21.6	1080	18.2	39.3	13	21.6	49.6	31.3	105
143-70-2-2.5	2	9330	16.7	30.9	96.7	0.8	159000	0.8	8.3	8.7	36.6	12200	0.12	996	36800	441	16.7	833	11.2	25.3	10	28.3	24.6	27.6	57.5
143-64-0-1	2	16700	21.4	25.9	42.8	1.1	47900	1.1	14.3	24.9	12	28900	0.13	1350	10100	453	21.4	1070	14.1	21.4	12.8	21.4	52.2	40.1	38.4
143-64-1-2	2	21000	22.4	23.8	45.5	1.1	7960	1.1	19.1	29.5	12.8	35100	0.13	1520	2510	551	22.4	1120	12.9	24.2	13.4	22.4	35.6	43.3	38.5
143-64-2-3	2	20600	21.6	23.7	77.2	1.1	54800	1.1	15.7	31.2	14.2	33400	0.13	1690	3710	841	21.6	1080	16.9	21.6	12.9	21.6	45.9	36.6	46.9
143-72-0-1	2	11300	21.3	21.3	42.6	1.1	105000	1.1	13.1	16.3	12.1	20500	0.12	1060	5130	607	21.3	1060	10.8	21.3	12.8	21.3	38.4	29.1	62.2
143-72-1-2	2	7450	20	20	40	1	194000	1	10	8.8	6.4	14700	0.11	1000	6310	359	20	1000	12.5	20	12	20	29.9	21.3	36.7
143-63-0-1	2	11900	16.1	23.8	54.5	0.8	168000	0.8	11.2	14.9	328	20000	6.9	1550	7980	487	16.1	804	170	83.7	9.6	16.1	42.9	25.7	216
143-63-1-2	2	16400	20	32.1	81.3	1	164000	1	12.7	15.1	23.5	24400	0.12	2310	4910	489	20	1000	25.7	20	12	20	39.3	27.3	53.5
143-69-0-1	2	7410	21.4	21.4	42.7	1.1	25600	1.1	10.7	10.5	339	9990	0.28	1070	1850	248	21.4	1070	30.3	30.6	12.8	21.4	21.4	24.8	102
143-69-1-2	2	17700	20.6	26.4	106	1	55700	1	22.9	22.6	104	28500	0.28	1530	7410	1230	20.6	1030	34.3	35.7	12.3	20.6	48.3	34.1	62.8
143-55-0-1	2	11300	20.1	34	56.7	1	171000	1	10	13.9	605	18400	0.41	1790	7490	488	20.1	1000	32.6	84.9	12	20.1	46.6	24.6	319
143-56-0-1	2	5130	18.3	26.7	37.4	0.9	195000	2	9.1	17.3	188	24000	3.2	914	16100	302	18.3	914	62.3	158	11	18.3	37	19.7	313
143-56-1-2	2	21400	20.5	24.1	50.8	1	16200	1	10.8	28.3	68.8	33200	0.2	1740	2430	500	20.5	1030	12.2	39.8	12.3	20.5	46.1	41.2	85.5
143-56-2-3	2	12700	20.1	22.8	46.6	1	91600	1	13.5	27.5	89.6	24500	0.9	1180	7660	493	20.1	1000	40.7	42.5	12.1	20.1	41.7	32.6	102
143-64-2-3	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	21.1
AVERAGE	2	12964	23.4	28	71	1.2	71945	1.3	18.3	26	177	25527	0.68	1400	6662	1077	23.4	1169	115	224	14	23.8	43.8	32.6	128
US Average	0.1	71000	6	10	500	6	137000	0.1	8	100	20	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE

Units = uG/Liter

site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-33-1-2	3	10800	26	26	130	1	2570	1.3	33	22	31.7	19300	0.13	1290	1290	4460	26	1290	10.3	48.9	15	26	51.2	24.2	105
143-33-2-3	37	12500	21	21	101	1	3670	8.1	34	27	91.6	33300	0.13	1020	1020	3260	21	1020	11	41.9	151	205	39.1	34	95.3
143-23-0-1	1	1250	14	14	29	1	23900	0.7	7.2	12	157	12900	1.7	718	1830	154	14	718	52	103	9	14	14.4	7.2	107
143-23-1-2	3	13000	25	25	51	1	6610	1.2	28	25	43.4	40000	0.31	1240	1240	654	25	1240	12.7	56.3	15	25	29.7	38.4	44.3
143-23-2-3	3	15500	26	26	52	1	6010	1.3	14	23	3390	43200	0.14	1300	1300	424	26	1300	35.8	275	16	26	26.1	36.2	162
143-31-0-1	2	9060	20	26	54	1	138000	1.1	10	10	518	16100	4.9	1250	14100	455	20	1000	93.1	245	12	20	50.3	21.1	476
143-31-1-2	2	10300	19	19	53	1	37500	1	21	41	184	32700	0.92	948	2590	771	19	948	37.6	95.1	11	19	20.5	36.7	184
143-31-2-3	3	10800	25	25	90	1	1430	1.2	39	28	10.5	21900	0.12	1250	1250	2410	25	1250	10	25	15	25	57.7	30	23.3
143-34-0-1	2	4410	15	15	30	1	24000	0.7	8.2	8.1	148	8860	1.6	786	6710	305	15	744	130	32.3	9	15	31.2	16.5	65.9
143-34-1-2	2	7170	23	23	47	1	9720	1.2	20	18	68	18800	0.12	1170	1170	806	23	1170	30	23.4	14	23	26.1	21.6	25
143-34-2-3	3	25700	21	24	77	1	4330	1	12	22	44.7	49600	0.14	1580	2140	130	21	1030	17.7	24.5	12	21	40	34.9	74.9
143-35-0-1	3	20700	22	22	85	1	4390	1.1	47	28	29.9	39400	0.12	1160	1230	2780	22	1080	15.1	63.3	13	22	48.1	47.5	50.4
143-35-1-2	3	17700	25	25	68	1	2830	1.3	41	22	12.2	38100	0.13	1270	1270	2300	25	1270	20.7	49.1	15	25	73.6	38.7	28.9
143-35-2-3	2	150000	24	24	52	1	1960	1.2	34	28	10	31200	0.13	1190	1190	1700	24	1190	9.6	29.5	14	24	40	29.3	37.9
143-38-0-1	2	17200	21	21	49	1	2290	1	20	26	12.8	36000	4.5	1040	1040	1070	21	1040	11.3	20.9	13	21	32	37	41.5
143-38-1-2	2	15700	23	23	57	1	15400	1.1	12	25	40.9	31600	0.65	1150	1960	618	23	1150	17.6	36.7	14	23	30.3	34	66.4
143-38-2-2.5	2	21900	22	22	215	2	12100	1.1	18	30	34.9	34000	0.2	1630	4440	1560	22	1080	23.9	22.3	13	22	46.5	31.6	66.8
143-39-0-1	2	11400	23	23	92	1	8190	1.3	38	36	89.7	29100	0.13	1160	1160	3030	23	1160	38.6	93.8	14	23	42.2	32.7	86.6
143-39-1-2	2	12300	24	24	68	1	19100	1.2	26	34	515	32300	0.12	1180	1430	1710	24	1180	11.2	189	14	24	32.1	40	540
143-39-2-3	2	24500	24	24	119	7	8940	1.2	17	20	17.3	31100	0.19	1240	2350	551	24	1180	17.9	29.1	14	24	44.6	32	44.7
143-40-0-1	19	9090	189	102	67	1	25100	9.4	41	183	601	222000	5.1	944	9440	2430	19	9440	91.9	189	113	189	189	94.4	563
143-40-1-2	2	8680	20	20	138	2	10600	1	44	31	216	21900	0.72	998	998	5020	20	998	15.2	100	12	36	55.3	29.1	171
143-40-2-3	2	14800	20	20	72	1	3380	1	34	35	24.9	32500	0.12	990	990	977	20	990	8.8	33.4	12	20	27.5	38.5	45.8
143-58-0-1	2	4960	16	17	53	1	258000	0.8	7.9	9.5	117	16900	2.2	791	6650	579	16	791	47.9	25.8	10	34	33.1	18	113
143-58-1-2	2	16600	18	18	50	1	29000	0.9	20	15	125	22900	0.12	884	2890	646	18	884	9.1	17.7	11	19	35.1	30	43.6
143-58-2-3	.24	1410	2.4	2	4.9	.1	1360	0.1	1.2	1.1	0.69	1830	0.13	122	122	8.7	2	122	0.98	2.4	2	3.3	3.2	2.2	3.2
143-48-0-1	2	6680	22	22	49	1	128000	1.6	15	19	547	42000	2.7	1080	4140	664	22	1080	107	113	13	22	30.4	25.2	363
143-48-1-2	2	10200	18	18	42	1	1660	0.9	23	22	10.1	20300	0.12	900	900	901	18	900	8	27	11	18	22.8	24.6	35.4
143-48-2-3	2	17000	17	17	37	1	1750	0.9	8.5	16	7.6	23700	0.13	1400	1310	199	17	850	8.6	17	10	31	34.5	24.7	35.7
143-47-0-1	2	13600	20	20	133	2	5140	1	23	18	10.3	20000	0.12	1410	1950	2530	20	1010	10.4	32.6	12	40	46.3	21.5	35.3
143-41-0-1	2	10600	18	18	87	1	111000	0.9	18	38	750	27200	0.19	1120	5030	1380	18	896	19.6	69.1	11	18	34.8	28.7	167
143-41-1-2	2	11300	21	21	61	1	211000	1	14	13	772	24400	0.11	1250	5540	837	21	1050	19.8	47.3	13	21	40.9	25.8	131
143-41-2-3	2	9740	22	22	47	1	177000	1.1	13	11	133	17100	0.11	1130	4760	558	22	1090	16.6	26	13	36	41.8	20	79.5
143-42-0-1	2	8550	22	22	43	1	126000	1.1	11	16	9.8	17200	0.11	1070	6180	443	22	1070	8.6	21.5	13	30	37.4	29.5	48.3
143-42-1-2	2	13300	20	20	40	1	2610	1	18	28	7.7	34400	0.12	1010	1010	1080	20	1010	8.1	20.2	12	46	33.9	40	37.4
143-42-2-2.5	2	5380	19	19	39	1	1250	1	9.7	9	4.9	11600	0.13	971	971	414	19	971	7.8	19.4	12	19	19.4	15.6	16.9
143-37-0-1	2	7140	22	22	44	1	90600	1.1	11	15	14.4	15100	0.12	1090	7700	179	22	1090	8.7	21.7	13	31	34.1	26.8	46.3
143-37-1-2	2	13000	17	17	89	1	11000	0.9	8.6	20	13.5	27000	0.28	916	4140	209	17	855	7.9	17.1	10	42	37.7	32.5	42.1
143-36-0-1	2	7550	21	21	42	1	1670	1.1	16	31	13.1	19800	0.19	1050	1050	707	21	1050	8.4	21.1	13	26	23.1	32	33.2
143-36-1-2	2	13700	18	18	49	1	2410	0.9	26	37	6.6	32200	0.12	920	920	716	18	920	7.4	19.8	11	48	33	36.2	26.7
143-36-2-3	2	8210	20	20	49	1	1420	1	33	36	5	25600	0.12	997	997	1600	20	997	8	23.4	12	34	28.8	33.1	19.4
143-67-0-1	2	9070	19	19	57	1	32500	0.9	18	11	624	16300	0.12	923	2510	1130	19	923	210	210	11	27	36	20.1	616
143-68-1-2	2	7230	17	17	34	1	838	0.8	25	5	21.5	17700	0.19	838	838	848	17	838	9.8	16.8	10	23	20.6	14.8	35.7
AVERAGE	3	14876	24	20	66	1	36423.91	1.4	21	26	221	30444	0.69	1065	2563	1237	20	1206.16	29.179	60.4	18	33	38.9	29.9	117
US Average	0.1	71000	6	10	500	6	137000	0.1	8	100	20	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE

Units = uG/Liter

site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-68-2-3	2	9530	22	22	43	1	13800	1.1	24	5.7	25.4	21300	0.15	1080	1080	690	22	1080	22.6	21.6	13	31	29.6	19.7	58.2
143-75-0-1	2	9300	17	17	81	1	47700	1	13	18	3220	16200	0.25	846	2800	786	17	846	11.2	334	10	28	42	26.3	86
143-75-1-2	2	15500	18	18	70	1	34400	0.9	20	21	35.5	28500	0.12	898	1890	1190	18	898	10.4	22.6	11	41	50.4	34.3	37
143-65-0-1	2	18800	22	22	303	3	8080	1.1	39	18	34	31300	0.14	1100	2000	4340	22	1100	39.6	40.9	13	41	70	31.7	41.5
143-67-2-2.5	2	9290	22	22	44	1	25700	1.1	11	9.1	30.4	16200	0.13	1110	4810	496	22	1110	14.6	22.2	13	26	41	21.2	47.6
143-66-0-1	2	7360	16	16	38	1	29300	0.8	27	15	49.5	16800	0.12	791	2910	1230	16	791	171	39.4	10	27	35.4	24.4	34.4
143-66-1-2	2	13700	23	23	45	1	2220	1.1	11	19	8.4	30200	0.13	1120	1120	166	23	1120	9	22.5	14	37	39.1	36.2	21.3
143-66-2-3	2	16900	17	28	38	1	2520	0.9	9	18	10.3	34900	0.13	859	1010	224	17	859	14.6	17.2	10	48	47.1	37.2	23.5
143-61-0-1	2	9860	17	17	47	1	4520	0.9	27	22	11.6	17200	0.12	864	1120	1420	17	864	6.9	43.1	10	23	368	25.1	30.4
143-61-1-2	3	27000	28	28	56	1	2090	1.4	14	8.7	9.2	19200	0.15	1410	3290	353	28	1390	11.1	30.6	17	35	60.6	25	26.8
143-61-2-3	3	26000	27	27	55	1	2520	1.4	14	2.7	9	11000	0.15	1360	2530	48.2	27	1360	10.9	36.3	16	27	51.1	13.6	21.2
143-71-0-1	2	21800	21	23	206	2	11300	1	24	21	27.9	31500	0.13	2100	3610	3550	21	1040	28.2	79.2	13	38	73.7	29.1	64.1
143-71-1-2	2	21600	18	18	181	2	36300	0.9	11	18	22.6	28800	0.13	1520	3190	884	18	839	22.5	17.9	11	36	55.4	25.6	59
143-74-0-1	2	9920	22	22	89	1	1760	1.1	33	23	1980	22700	0.12	1110	1110	1750	22	1110	13.5	361	13	29	35.5	28.3	981
143-74-1-2	2	10500	17	17	284	1	1320	0.8	38	26	577	26800	0.12	823	823	4540	16	823	8.6	66.1	10	37	61	30.9	110
143-74-2-3	2	14700	24	24	64	1	1210	1.2	19	30	782	33600	0.12	1210	1210	1100	24	1210	9.7	45	15	43	47.8	32.8	130
143-68-0-1	2	14000	24	24	49	1	1290	1.2	18	9.5	18.8	31300	0.14	1290	1220	836	24	1220	24.5	24.4	15	46	36.3	23.3	73.1
143-65-1-2	2	20000	19	19	230	2	8890	0.9	18	18	16.7	30100	0.14	936	2120	1010	19	936	22.1	18.7	11	46	50.3	27	40.8
143-65-2-3	2	2400	21	21	171	2	9040	1.1	13	18	17.7	32500	0.13	1320	3450	423	21	1060	22.2	21.2	13	43	58.5	27.4	57.1
143-60-0-1	2	19400	21	21	247	4	6860	1	19	17	16.6	25500	0.14	1230	2600	965	21	1050	21.7	25.3	13	36	51.2	23.3	37.6
143-60-1-2	3	24000	26	26	236	9	5940	1.3	14	16	17.5	27900	0.14	1990	4920	607	26	1290	29.8	25.9	16	37	59.2	21.8	56.5
143-57-0-1	2	7420	17	17	79	1	152000	0.8	24	12	64	12800	0.12	840	4490	1270	17	840	780	47.9	10	23	41.3	19.6	69.6
143-51-0-1	4	8850	24	24	75	1	16200	1.2	18	17	39	15300	2.7	1220	1840	1620	24	1220	14.8	37.2	15	24	32.7	18.5	73.2
143-51-1-2	2	7510	22	22	68	1	3760	1.1	13	8.7	8.8	12300	0.13	1100	1220	1250	22	1100	13.7	22.1	13	22	31.5	12.9	26.4
143-15R-2-3	10	200	100	100	200	5	5000	5	50	10	25	122	0.2	5000	5000	18.1	100	5000	40	100	60	100	100	50	83.5
143-23R-2-3	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	20
143-41R-2-3	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	66.8
143-62R-2-3	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	42.8
143-67-1-2	2	17700	24	24	665	1	2120	1.2	12	7.1	17.8	13700	0.14	1740	1960	87.5	24	1190	14.4	23.8	14	24	29	13.8	34.9
143-67-2-3	2	21100	24	24	65	1	3610	1.2	12	5.3	69.1	12100	0.14	1210	1510	151	24	1210	67.1	42.7	15	24	37.1	13	74.4
143-62-0-1	2	7620	20	20	39	1	12800	1	17	8.3	148	13300	1.9	979	4010	509	20	979	21.6	38.9	12	20	35.8	16.4	117
143-62-1-2	3	20200	25	25	126	2	43200	1.2	20	21	29.7	36000	0.13	1380	3390	811	25	1240	31.2	24.8	15	54	55.6	31.1	855
AVERAGE	3	12899	31	32	140	2	15951.56	1.6	23	15	231	20294	0.28	1670	2726	1012	31	1555.47	50.859	61	19	42	63.3	27.8	109
US Average	0.1	71000	6	10	500	6	137000	0.1	8	100	20	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE PARCEL 4

Units = uG/Liter

site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-01-0-1	3	15700	26	26	177	2	7870	1.3	25	24	15.8	38600	0.14	1320	1680	2160	26	1320	18.1	26.4	16	26	39.1	28.1	74.3
143-01-1-2	2	12800	24	24	167	1	11000	1.2	19	23	9.8	34200	0.13	1190	1400	1870	238	1190	13.8	23.8	14	24	34.6	25.4	60.8
143-01-2-3	2	15500	17	21	107	1	4380	0.9	15	39	10.2	44400	0.12	965	871	1080	17	851	11.5	17	10	17	35.8	31.8	20.2
143-04-0-1	2	7030	19	19	38	1	954	1	23	20	4.8	15500	0.13	954	954	805	19	954	7.6	19.1	12	19	19.1	19.1	14.4
143-04-1-2	2	14900	22	22	45	1	1770	1.1	12	26	5.9	38300	0.12	1120	1120	316	22	1120	8.9	22.3	13	22	28.1	37.7	21.1
143-04-2-3	2	10100	19	19	46	1	1490	1	9.6	24	5.5	40000	0.11	965	965	460	19	965	8	19.3	12	19	25.2	27	12.7
143-06-0-1	2	6900	20	20	47	1	1440	1	36	21	5.7	20300	0.13	1020	1020	1680	20	1020	8.1	20.3	12	20	28.3	20.7	22.6
143-06-1-2	2	7320	21	21	43	1	1100	1.1	34	24	5.3	20800	0.12	1070	1070	1550	21	1070	8.5	21.4	13	21	26	23.6	12.8
143-06-2-3	2	6690	19	19	38	1	1250	0.9	27	23	4.7	19800	0.12	942	942	1100	19	942	7.5	18.8	11	19	19	21.8	12
143-09-0-1	2	17200	21	21	138	2	2620	1	38	35	11.1	34000	0.13	1120	1050	3480	21	1050	14.2	20.9	13	21	53.1	29	69.7
143-09-1-2	2	16500	24	24	108	1	1780	1.2	21	21	11.6	31800	0.14	1210	1210	1160	24	1210	10	24.2	15	24	45.3	25.6	26.5
143-09-2-3	3	20600	25	25	132	1	1930	1.3	19	25	16.7	39800	0.13	1260	1450	879	25	1260	13.1	25.1	15	25	85.7	40.3	38.9
143-12-0-1	2	3950	19	19	39	1	50700	1	9.7	11	524.0	10300	0.46	970	5660	236	19	970	96	26.2	12	19	23.9	16	183
143-12-1-2	2	11900	17	17	141	1	5870	0.9	25	32	39.6	28700	1.70	872	856	1330	17	856	16.1	17.1	10	17	32.4	30.1	116
143-12-2-3	2	10100	24	24	243	1	9070	1.2	19	26	42.7	31300	0.20	1190	1190	1370	24	1190	18.8	23.8	14	24	31.6	21.1	33
143-15-0-1	2	12500	22	22	45	1	1530	1.1	17	32	7.9	32900	0.20	1110	1110	496	22	1110	8.9	22.2	13	22	28.3	30.5	17.9
143-15-1-2	2	13900	23	23	47	1	1180	1.2	12	29	9.1	37400	0.21	1170	1170	292	23	1170	9.3	23.3	14	23	33.8	30	14.8
143-15-2-3	3	12000	26	26	51	1	1280	1.3	13	25	9.4	38100	0.21	1280	1280	91.9	26	1280	10.2	25.5	15	26	28.4	25.6	9.9
143-20-0-1	2	13100	22	22	44	1	18800	1.1	11	25	23.9	34000	0.42	1110	1400	290	22	1110	14.2	22.1	13	22	37.9	24.6	21.1
143-20-1-2	2	11800	22	22	45	1	2830	1.1	11	24	10.4	31000	0.16	1120	1120	176	22	1120	8.9	22.4	13	22	27.4	21.1	14.4
143-20-2-1	2	18300	22	22	59	1	3670	1.1	11	21	19.8	44800	0.32	1080	1120	184	22	1080	14.2	21.7	13	22	43.6	20.1	23.1
143-25-0-1	2	6890	22	22	62	1	36800	1.1	25	23	18.7	15500	0.60	1100	1590	2150	22	1100	9.3	22	13	22	38	20.9	64.7
143-25-1-2	2	15300	19	19	47	1	8010	1	9.5	20	7.7	23000	0.15	949	1060	233	19	949	8.6	19	11	19	36.8	22.4	22.2
143-25-2-3	2	21000	23	23	47	1	4250	1.2	12	11	9.5	26200	0.28	1160	1240	81.8	23	1160	9.3	23.2	14	23	38.3	23.7	31.2
143-26-0-1	2	7730	17	17	59	1	82800	2.2	14	31	2850.0	22300	6.00	832	3760	708	17	832	121	299	10	17	35.6	23	1030
143-26-1-2	2	9710	16	16	127	1	3120	0.8	31	41	37.6	24100	0.65	812	812	3890	16	812	9	16.2	10	16	50.8	25.3	34.8
143-26-2-3	2	29900	22	23	187	2	7270	1.1	28	24	88.3	40800	0.33	1340	3040	670	22	1110	32.4	22.3	13	22	64.3	21	82
143-32-0-1	2	10300	19	19	90	1	107000	1	9.6	22	143.0	14800	2.00	1100	10600	520	19	961	25.1	39.3	12	19	37.9	25.5	262
143-32-1-2	2	14000	19	19	69	6	12000	1	13	19	27.6	24600	2.70	1050	1270	839	19	967	20.8	19.3	12	19	42.6	21.4	46.2
143-32-2-3	2	14700	24	24	51	1	2370	1.2	34	21	15.3	33600	0.61	1190	1190	1920	24	1190	12.5	32.8	14	24	61.3	38.9	34.3
143-28-0-1	3	16600	28	28	55	1	3230	1.4	14	24	28.3	57100	0.21	1550	1370	127	275	1370	13.1	27.5	17	28	75.8	47.3	40.8
143-28-1-2	2	20100	21	22	43	1	2510	1.1	11	21	24.9	46500	0.27	1140	1060	125	21	1060	13.6	21.3	13	21	43.5	28.3	31.5
143-28-2-3	2	15900	21	21	65	2	3080	1	83	17	25.3	40200	0.23	1060	1050	745	21	1050	20.4	21	13	21	45.3	23.2	36.7
143-22-0-1	2	14200	24	24	49	1	2760	1.2	17	26	39.1	45200	0.13	1310	1220	192	24	1220	12.1	24.4	15	24	63.6	41	42.9
143-22-1-2	3	16800	25	26	109	5	3450	1.3	22	18	31.0	42500	0.13	1590	2260	481	25	1250	38.3	25	15	25	74.4	25.6	93.7
143-22-2-3	3	21300	26	26	135	3	5070	1.3	23	22	30.9	51500	0.13	2010	4500	653	26	1280	49.9	25.5	15	26	92.2	31.5	100
143-17-0-1	2	7790	17	17	34	1	5360	0.8	11	16	12.7	19900	0.17	838	3900	306	17	838	9	16.8	10	17	26.2	19.4	22.5
143-17-1-2	2	13000	18	18	36	1	3960	0.9	13	20	156.0	36300	0.25	910	910	281	18	910	10.4	18.2	11	18	33.1	24.8	26
143-17-2-3	2	14800	19	24	113	2	9710	0.9	17	15	31.2	36000	0.21	1740	3710	351	19	930	26.9	18.6	11	19	68.6	20.8	70
143-30-0-1	2	9730	22	31	107	1	7440	2.7	37	39	425.0	25100	1.00	1110	1110	2960	22	1110	36.2	152	13	22	59.5	33.1	305
143-30-1-2	2	16300	22	24	89	1	1790	2.1	34	27	74.7	24300	1.10	1090	1090	2220	22	1090	21.2	63.3	13	22	50.4	36.6	216
143-30-2-3	2	17800	20	20	109	1	2070	1	54	30	20.0	35000	0.19	1000	1000	4080	20	1000	9.3	77.8	12	20	46.7	47.4	52.3
143-33-0-1	2	4200	24	24	119	1	156000	18	16	33	5020	19500	7.70	1200	13900	868	24	1200	186	1500	14	24	37.5	23.3	3140
AVERAGE	2	13031	22	22	83	1	15132	1.6	22	25	230.5	31860	0.71	1141	1588	1056	21	1075	23.7	68.5	13	21	43	27.3	154
US Average	0.1	71000	6	10	500	6	137000	0.1	8	100	20.0	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE PARCEL 4

Units = uG/Liter

site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-24-0-1	1.5	7800	15	24	32	1	180000	0.8	7.6	9.2	375	14500	0.38	1090	8300	188	15.3	763	17.1	77.4	9.2	15.3	45.4	21.6	101
143-24-1-2	2.5	22900	399	29	541	13	17600	13	138	76	85.5	46500	0.14	14400	14600	471	196	12300	141	153	15.2	453	119	173	185
143-24-2-3	2.3	31600	228	28	46	1	1740	1.1	15	20	23.7	44900	0.13	1940	1580	212	22.8	1140	17.8	128	13.7	22.8	64.7	36.3	57.6
143-27-0-1	1.7	8980	17	17	34	1	166000	0.9	13	14	124	14800	0.11	862	8860	748	17	851	8.1	31.4	10.2	17	48.6	26.3	54.5
143-27-1-2	1.8	12400	18	18	368	1	1040	0.9	25	25	8.8	21900	0.18	920	920	1120	18.4	920	7.4	30.4	11	18.4	40.3	34.4	22.3
143-27-2-3	2.2	16300	22	22	44	1	3550	1.1	22	28	10.1	26100	0.13	1090	1090	1100	21.8	1090	8.7	38.5	13.1	21.8	45.5	42.4	37.1
143-19-0-1	1.8	14200	18	19	87	1	45000	0.9	28	28	40.1	24600	0.17	1190	4500	1700	18	900	16.6	62.8	10.8	18	55.8	35.3	131
143-19-1-2	1.8	18700	18	22	39	1	1280	0.9	18	58	10.1	35200	0.11	1410	1050	647	18.1	904	8.6	18.1	10.9	18.1	53.7	42.5	41.4
143-19-2-3	2.4	18700	377	28	512	12	13300	13	130	85	73.4	40700	0.12	13300	13100	424	209	12200	125	0.52	44.3	472	92.2	167	154
143-53-0-1	2.0	13100	20	25	62	1	72700	1.2	51	28	654	29100	1.3	1340	3810	728	19.8	991	375	203	11.9	19.8	71.3	39.5	457
143-53-1-2	2.5	14600	25	25	116	1	85800	1.2	19	23	1500	27500	0.33	1510	3910	443	24.9	1250	68.5	274	14.9	24.9	53	35.5	557
143-53-2-3	2.0	13300	20	20	79	1	20900	1	35	26	1060	24500	0.18	988	4110	1380	19.8	988	23.6	184	11.8	19.8	51.6	28.8	683
143-52-0-1	2.0	6160	20	20	39	1	42200	1.3	9.8	20	274	12300	0.6	980	3100	365	19.6	980	161	81	11.8	19.6	22.9	15.9	238
143-52-1-2	1.9	14000	19	19	38	1	5180	1	9.6	18	44.4	17600	0.13	961	1540	310	19.2	961	16.4	27.9	11.5	19.2	4.4	25.2	53.3
143-52-2-3	2.4	12400	238	24	48	1	1650	1.2	12	9.4	13.1	12700	0.16	1190	1190	49.9	23.8	1190	9.5	23.8	14.3	23.8	27.7	17.5	31.0
143-73-0-1	2.0	16200	20	20	68	1	10800	1	18	18	39.2	21600	0.23	1690	2030	1300	20.2	1010	16.2	62.5	12.1	20.2	47.7	27.9	123
143-73-1-2	1.9	21200	19	19	72	2	1470	0.9	10	13	8.1	31600	0.15	1620	1880	368	18.8	940	9.8	18.8	11.3	18.8	51.3	25.1	48.5
143-73-2-3	1.8	20800	18	19	69	1	2410	0.9	13	16	11.4	30200	0.12	1420	1710	593	18.3	916	8.8	18.3	11	18.3	51.8	32.4	48
143-1R-1	10	200	100	100	200	5	5000	5	50	16	26.6	147	0.2	5000	5000	15.4	100	5000	45.9	100	60	100	100	50	26.8
143-FR-1	10	200	100	100	200	5	5000	5	50	10	25	100	0.2	5000	5000	15	100	5000	40	100	60	100	100	50	20
AVERAGE	2.8	14187	86	30	135	3	34131	2.6	34	27	220	23827	0.25	2895	4364	609	46	2514.7	56.3	81.7	18.5	72.04	57.3	46.3	159.9
U.S. AVERA	0.1	71000	6	10	500	6	******	0.1	8	100	20	38000	0.03	14k	5000	850	2	6300	40	10	6	0.2	0.1	100	50

CHEMICAL CHARACTERIZATION METALS DATA FOR ELZA GATE PARCEL 4

Units = uG/liter

Site ID	Ag	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Tl	V	Zn
143-02-0-1	1.9	12200	137	28	83	1.0	6170	0.97	26	28	17	42900.0	0.13	972	1030	903	19.4	972	118.0	60.0	11.7	510	334	51.3	78.0
143-02-1-2	2.0	14500	183	32	191	2.0	5010	0.98	30	40	15	63700.0	0.13	976	976	3100	19.5	976	21.0	72.0	11.7	749	467	68.0	63.0
143-02-2-3	2.2	15400	150	23.2	169	1.0	5270	1.1	39	36	13	45200.0	0.12	1100	1370	2650	22.1	1100	22.0	67.0	13.3	538	355	56.0	63.0
143-03-0-1	1.9	8720	96	19	38	.95	6790	0.95	12	29	8	30200.0	0.12	950	950	339	19.0	950	7.6	41.0	11.4	362	221	49.0	31.0
143-03-1-2	1.7	6620	68	17.4	34.8	.87	3370	0.87	42	19	6	20400.0	0.10	871	871	730	17.4	871	8.0	34.0	10.5	249	167	30.0	31.0
143-03-2-3	2.3	7960	86	22.5	45.1	1.1	10400	1.1	25	32	5.6	24000.0	0.12	1130	1130	860	22.5	1130	9.0	40.0	13.5	289	199	43.0	35.0
143-05-0-1	2.2	8370	61	22.1	44.1	1.1	202000	1.1	11	8	11	16100.0	0.12	1100	4410	286	22.1	1100	12.0	33.0	13.2	183	191	30.0	43.0
143-07-0-1	2.6	19600	189	28	83	1.3	7240	1.3	30	34	22	58800.0	0.13	1310	1310	287	26.2	1310	12.0	72.0	15.7	721	441	69.0	64.0
143-07-1-2	2.4	12100	112	24.3	48.6	1.2	2030	1.2	66	22	8	36700.0	0.12	1220	1220	479	24.3	1220	9.7	68.0	14.6	442	279	46.0	34.0
143-07-2-3	2.2	11400	115	22	51	1.1	1700	1.1	105	24	8	39300.0	0.13	1100	1100	705	22.0	1100	8.8	76.0	13.2	480	288	48.0	41.0
143-08-0-1	2.7	7280	77	27	54	1.3	3880	1.3	13.5	18	21	19200.0	0.40	1350	1350	234	27.0	1350	16.0	1250.0	16.2	240	135	49.0	283.0
143-08-1-2	1.7	7680	77	16.7	33.4	.83	1540	0.83	8.3	15	10	20700.0	0.11	834	834	111	16.7	834	8.0	385.0	10.0	248	136	45.0	94.0
143-08-2-3	2.4	12400	119	23.6	50	1.0	2490	1.2	16	21	14	29600.0	0.14	1180	1180	278	23.6	1180	12.0	72.0	14.2	350	208	46.0	90.0
143-10-0-1	1.8	11300	105	18.3	48	1.0	108000	0.91	17	17	18	28700.0	0.13	914	5190	309	18.3	914	13.0	90.0	11.0	328	240	42.0	68.0
143-10-1-2	2.4	11300	87	24.4	60	2.0	3430	1.2	86	23	26	33900.0	0.13	1220	1220	429	24.4	1220	17.0	37.0	14.7	420	216	36.0	51.0
143-10-2-3	2.3	12700	116	23	84	4.0	3960	1.2	22	27	27	48400.0	0.13	1150	1150	417	23.0	1150	25.0	50.0	13.8	579	309	50.0	79.0
143-11-0-1	2.3	9910	99	23.4	69	1.2	67300	3.3	11.7	25	216	24500.0	2.00	1170	9410	389	23.4	1170	66.0	1760.0	14.1	281	256	40.0	344.0
143-11-1-2	1.7	5070	43	17	34	.85	218000	0.85	8.5	10	12	16000.0	0.90	849	3680	257	17.0	849	8.9	35.0	10.2	197	146	30.4	174.0
143-11-2-3	2.3	9100	89	23.1	46.3	1.2	2370	1.2	16	35	11	36200.0	0.13	1160	1160	650	23.1	1160	9.3	59.8	13.9	451	221	50.7	27.4
143-13-0-1	2.2	5760	65	21.7	43.4	1.1	169000	2.4	145	19	7830	20600.0	0.12	1080	6320	477	21.7	1080	16100.0	57.6	13.0	254	234	37.9	147.0
143-13-1-2	2.2	10900	87	22.2	44.4	1.1	3740	1.1	15	23	35	30200.0	0.12	1110	1130	403	22.2	1110	12.0	63.9	13.3	361	195	40.2	36.9
143-13-2-3	2.0	9120	70	20.5	46	1.0	2680	1.0	31	33	23	26000.0	0.12	1020	1020	1260	20.5	1020	8.7	51.5	12.3	310	170	41.2	24.7
143-16-0-1	2.1	10500	98	21.1	42.1	1.1	27500	1.1	10.5	11	26	27400.0	0.13	1050	4010	314	21.1	1050	14.3	69.4	12.6	337	206	32.3	71.1
143-16-1-2	2.0	7100	55	19.8	39.6	.99	215000	2.5	13	17	138	16400.0	0.45	990	5280	781	20.0	990	23.3	63.2	11.9	204	166	34.5	94.5
143-16-2-3	2.3	8710	60	23.2	46.5	1.2	19600	1.2	15	25	472	26600.0	1.40	1160	1520	922	23.2	1160	53.7	117.0	14.0	333	184	31.2	242.0
Average	2.2	10228.0	97.8	29.0	82.3	1.4	43938.8	2.7	40.0	23.6	374.5	31268.0	0.7	834	4539	703	22	1079	872	189	13	377	239	44	92
US Average	0	71000	6	10	500	6	137000	0.1	8	100	20	38000	0.03	14K	5000	850	2	6300	40.0	10.0	6	0.2	0.1	100.0	50.0

APPENDIX E

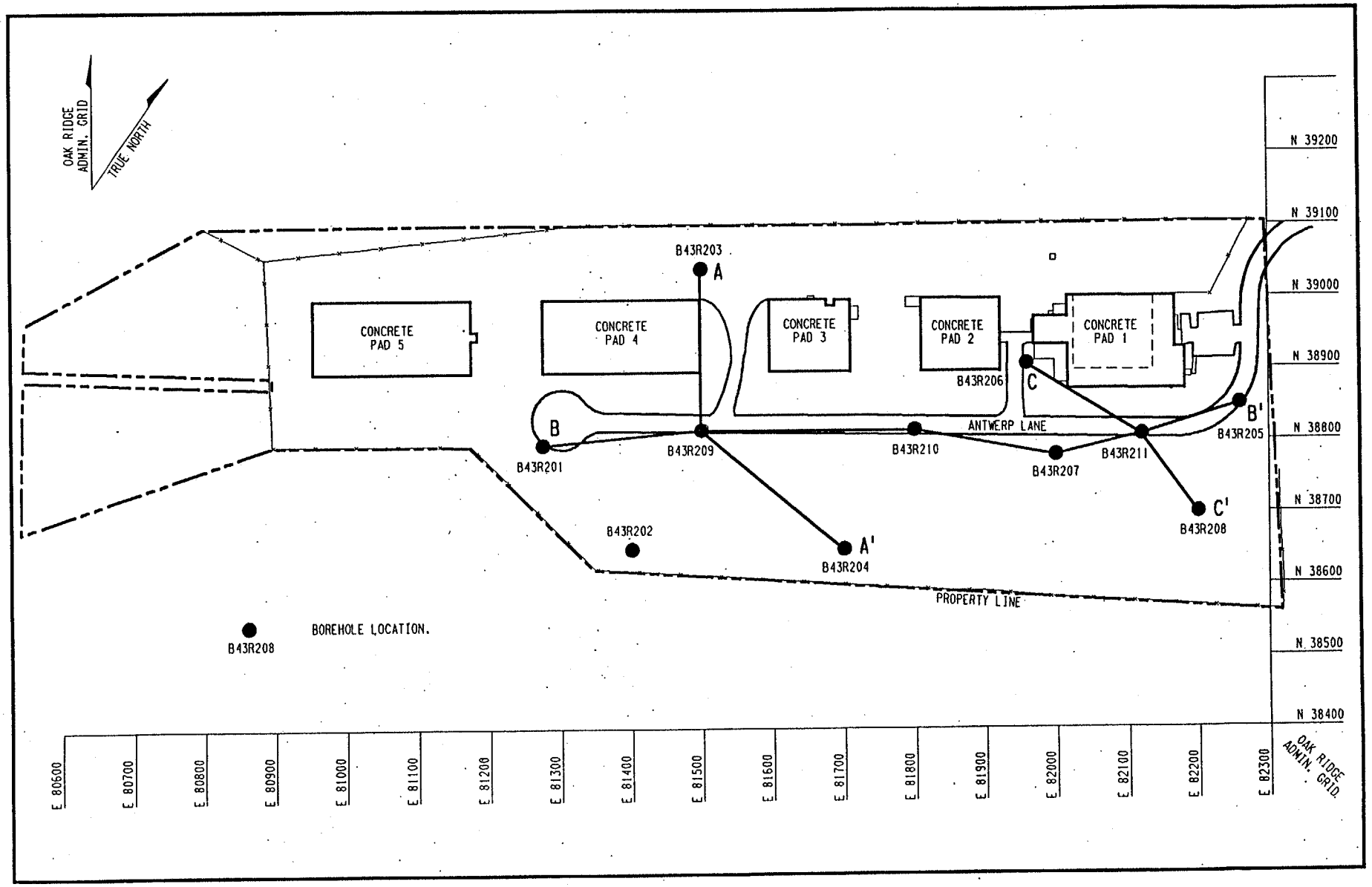
DRILLING LOGS FOR GEOLOGIC INVESTIGATION OF THE ELZA GATE SITE

UNIT	GRAPHIC SECTION	APPROX. THICKNESS (FT)	DESCRIPTION[1]
FILL MATERIAL		0-10	FILL - Brown (5YR4/6) to dark yellowish brown (10YR4/2) or yellowish orange brown (10YR7/6). Dry to moist. Cohesiveness varies with depth. Contains angular chert and limestone fragments, gravel, trash, metal shavings, cable, nails, and glass. May be mottled in appearance.
NATURAL SOIL		1-14	SILTY CLAY - Red (5YR4/6) to moderate reddish brown (10R4/6) or moderate reddish orange (19R5/6). Dry to moist. Cohesiveness and density vary with depth. Low to moderate plasticity. Contains angular fragments of limestone, chert, and siltstone, and nodules of manganese. Mottled to tan (10Y7/6), dark yellowish orange (10YR6/6), and moderate brown (5YR4/6). May be intercalated with argillaceous limestone or calcareous siltstone.
		0-2.5	CLAYEY SILT - Medium bluish gray (5B5/1) to pale blue (5B6/2). Dry to wet. Mostly calcareous, but contains zones of angular chert. Grades to dolomitic limestone at base.
BEDROCK			ARGILLACEOUS LIMESTONE - Medium bluish gray (5B5/1) to light bluish gray (5B7/1), weathers to clayey silt. Well-developed stylolites oriented at 60 degrees to long axis of the core and spaced at 1- to 3-inch intervals are common. Fossiliferous zones containing echinoderm fragments and shells are present. Calcite-filled fractures are also present. Crystals are micritic at the top and increase in size toward the base.

[1] Rock color codes from Geological Society of America Rock Color Chart.

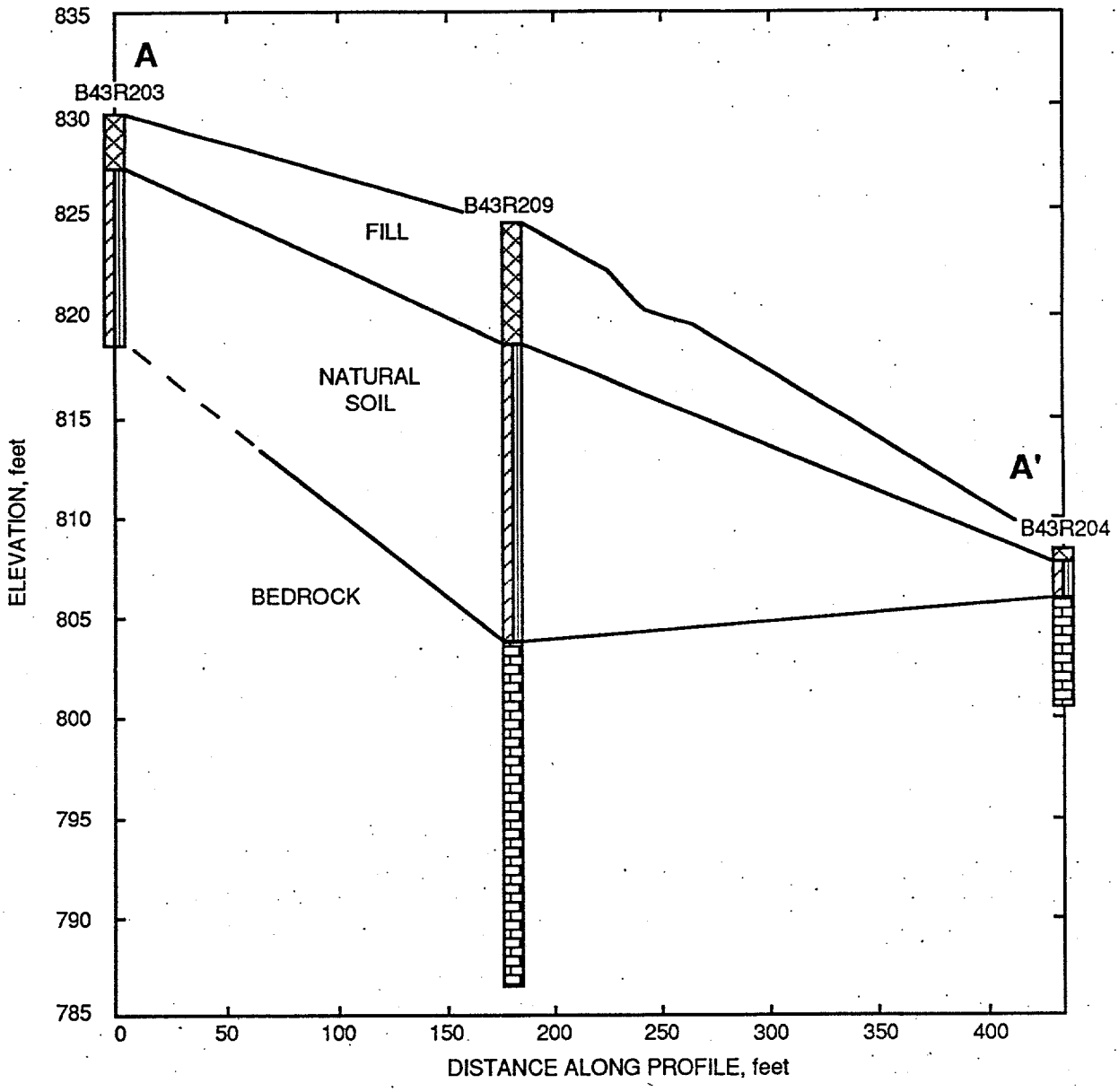
GENERALIZED SOIL PROFILE AND STRATIGRAPHIC COLUMN

4.49 3876.A.4



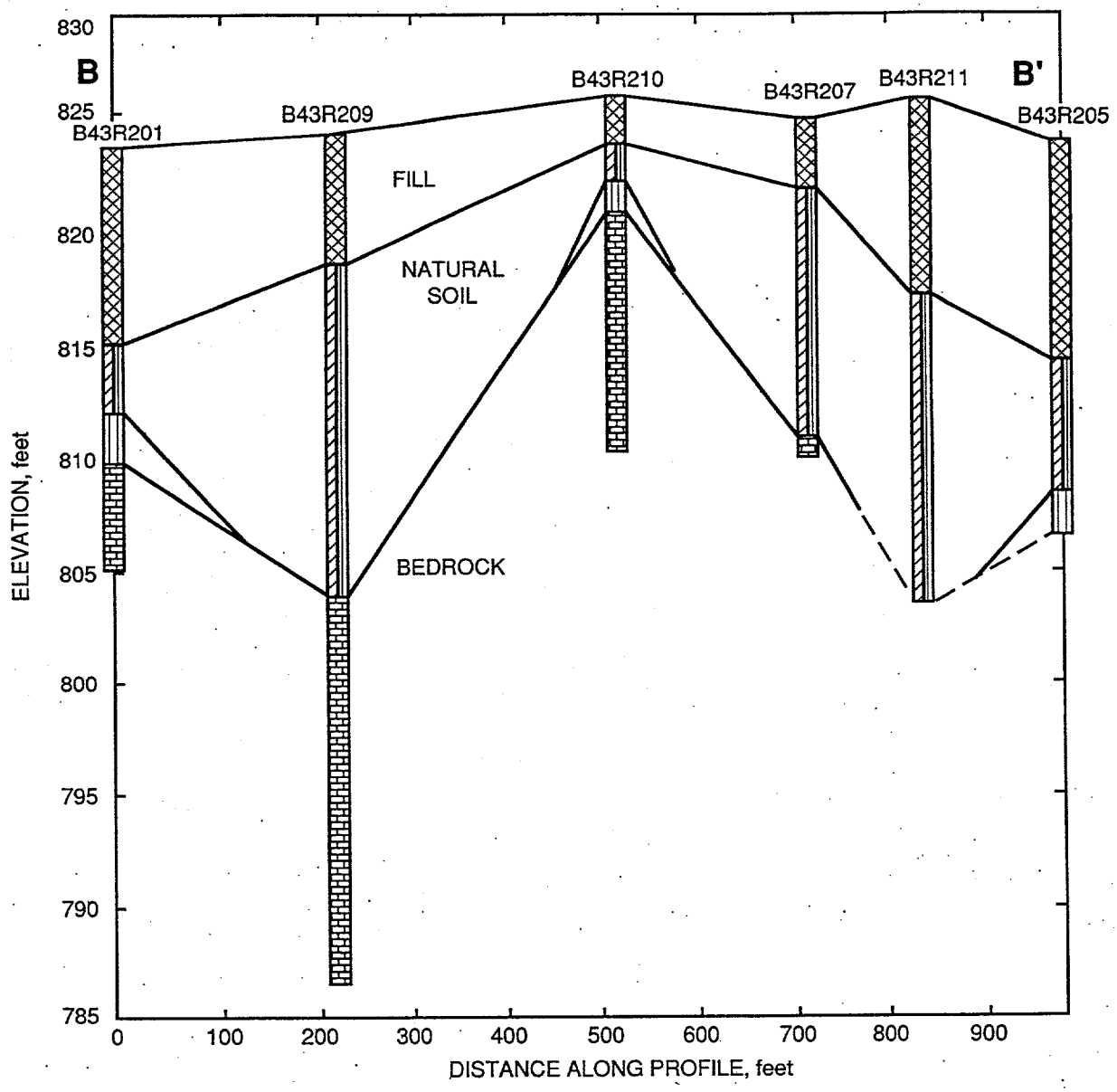
143F023.DGN F2

LOCATIONS OF CROSS SECTIONS AT THE ELZA GATE SITE



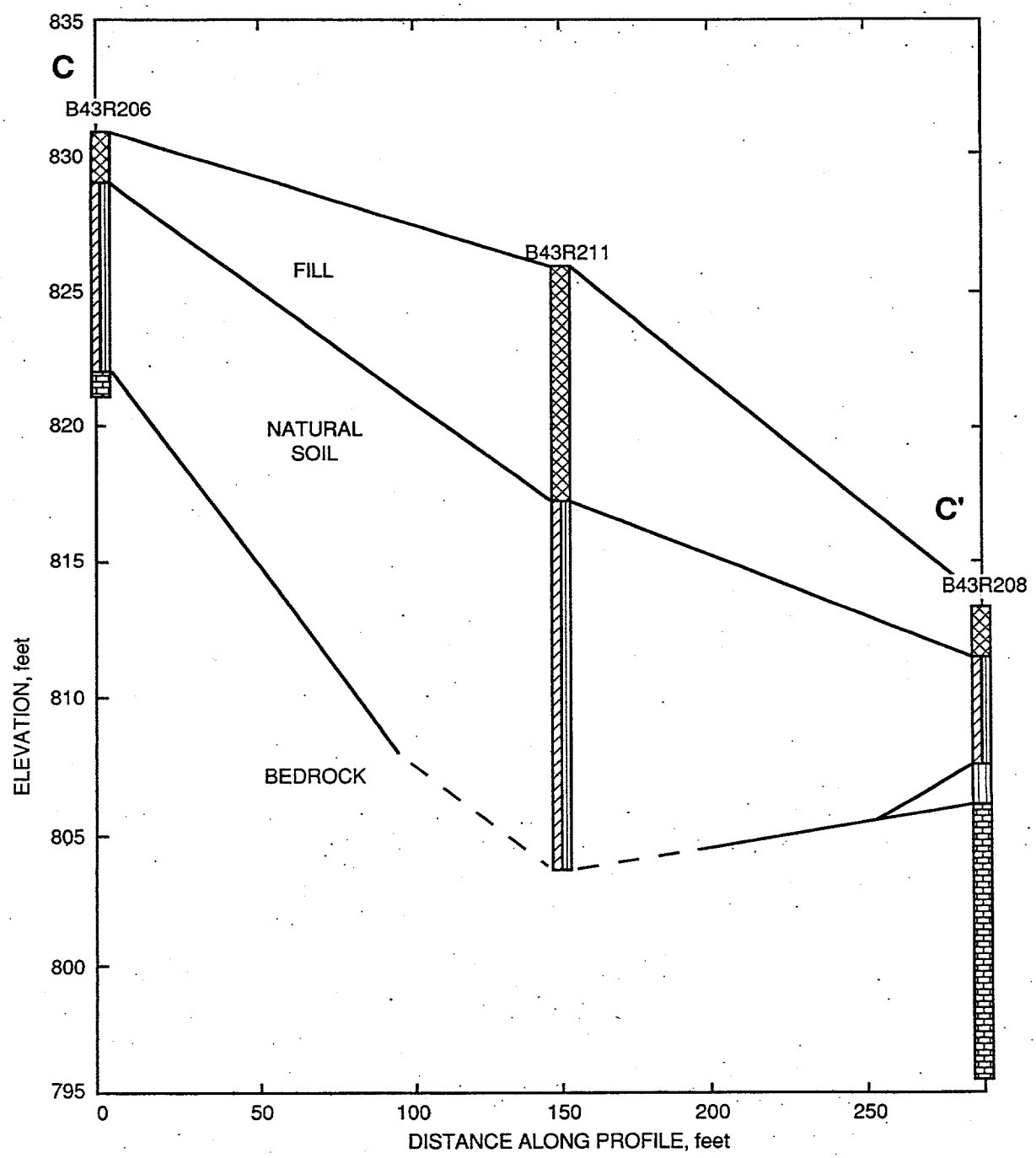
CROSS SECTION A-A'

4.49 3876.A.3



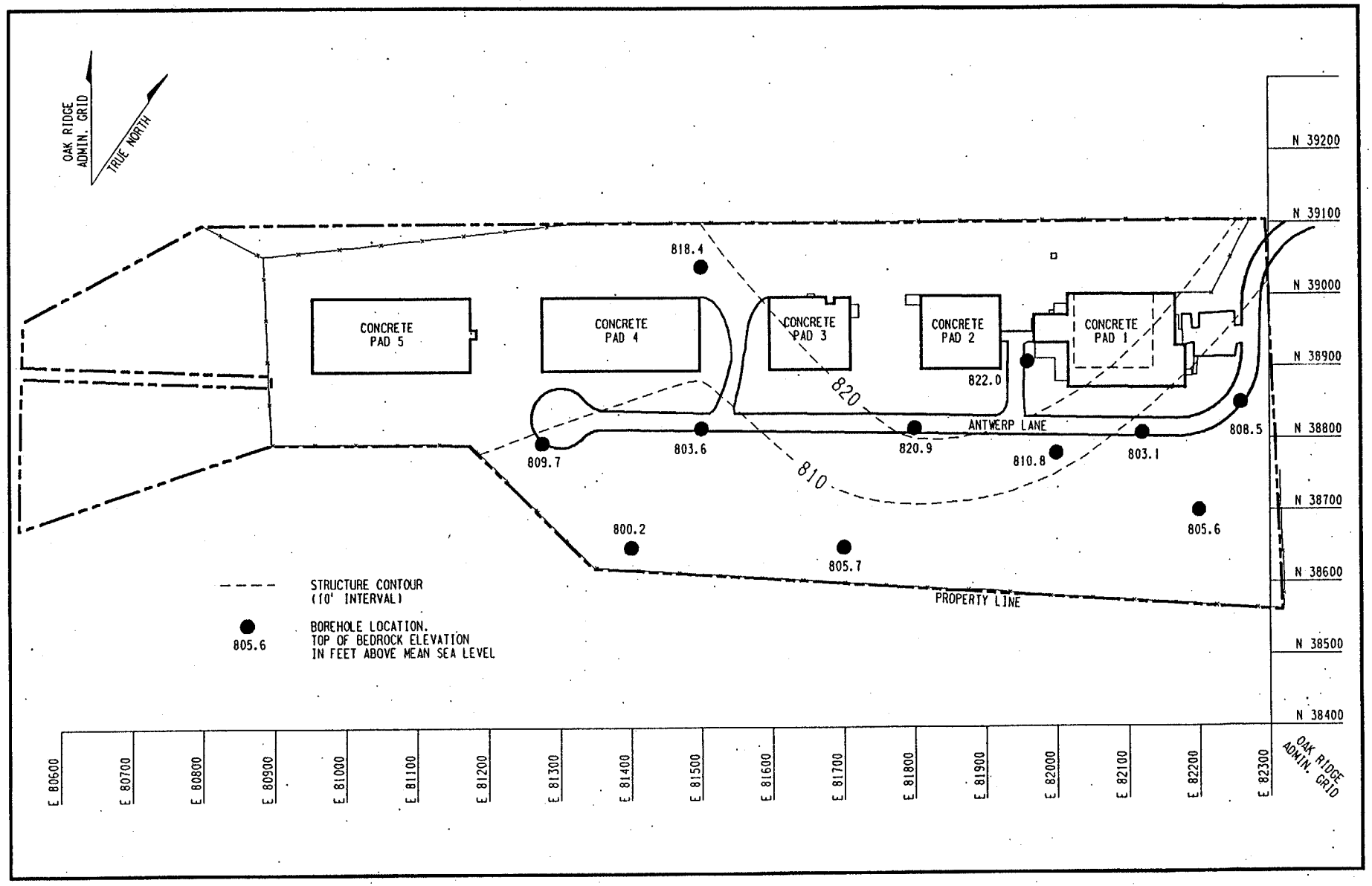
CROSS SECTION B-B'

4.49 3876.A.2



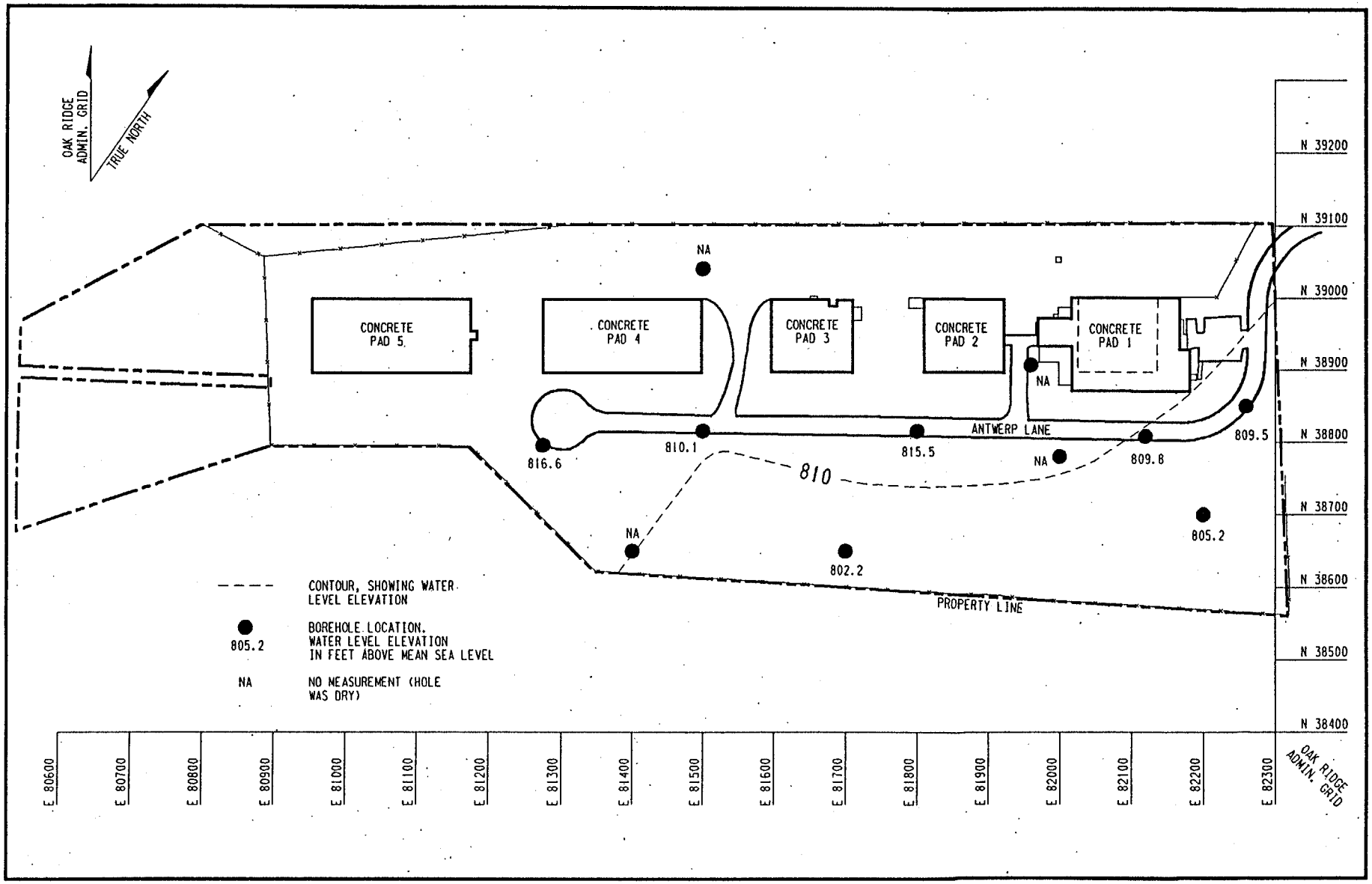
CROSS SECTION C-C'

4.49 3876.A.1



143F023.DGN F3

STRUCTURE CONTOUR MAP OF THE TOP OF BEDROCK AT ELZA GATE



143F023.DGN F4

WATER TABLE MAP FOR ELZA GATE

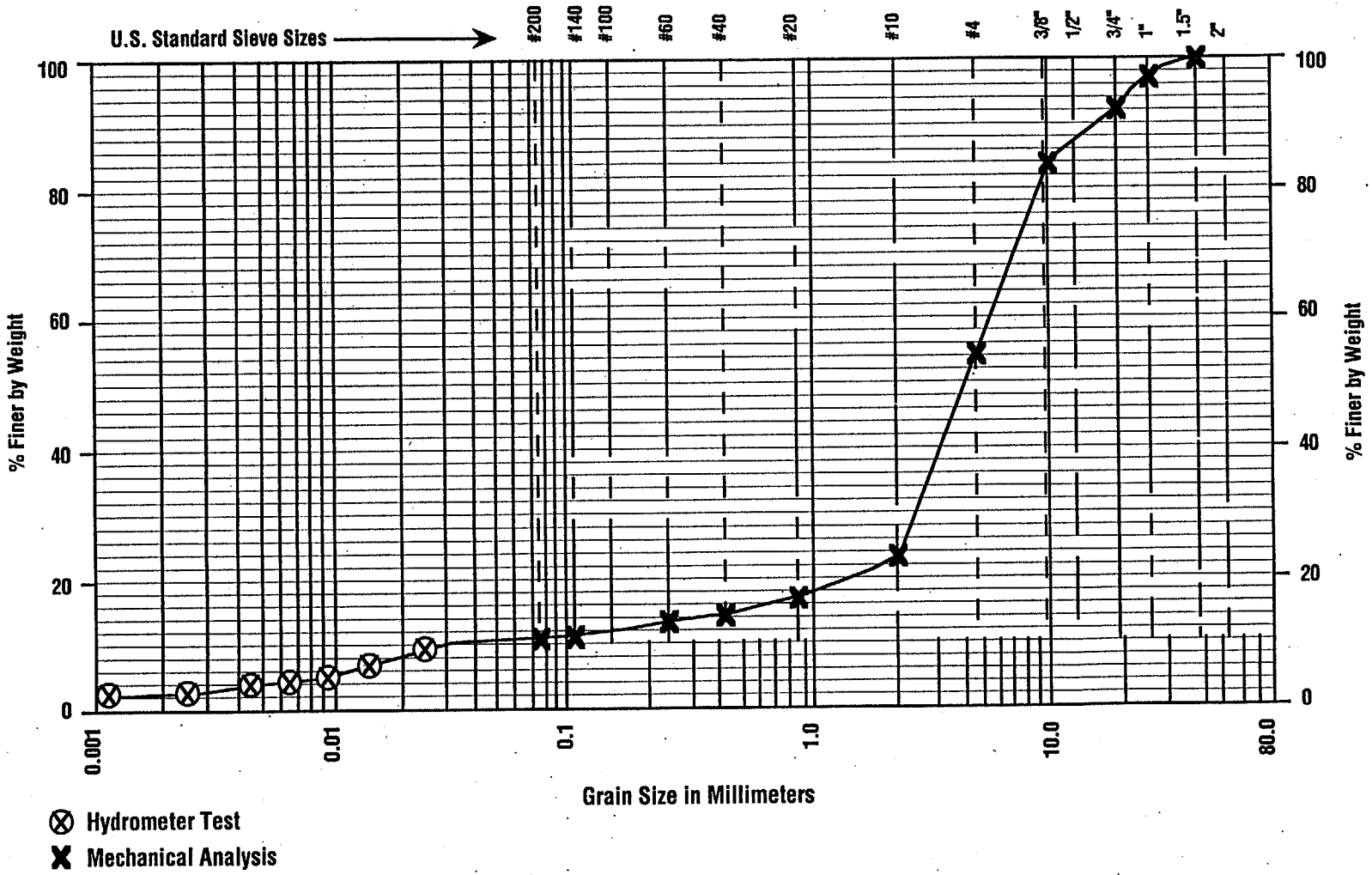
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-23A Tested By JPC Party _____ Date 08/27/90

B43R210 (8'-9') D_{10} 0.04 D_{60} 5.0 U_c 1.25



4.49 3876.1

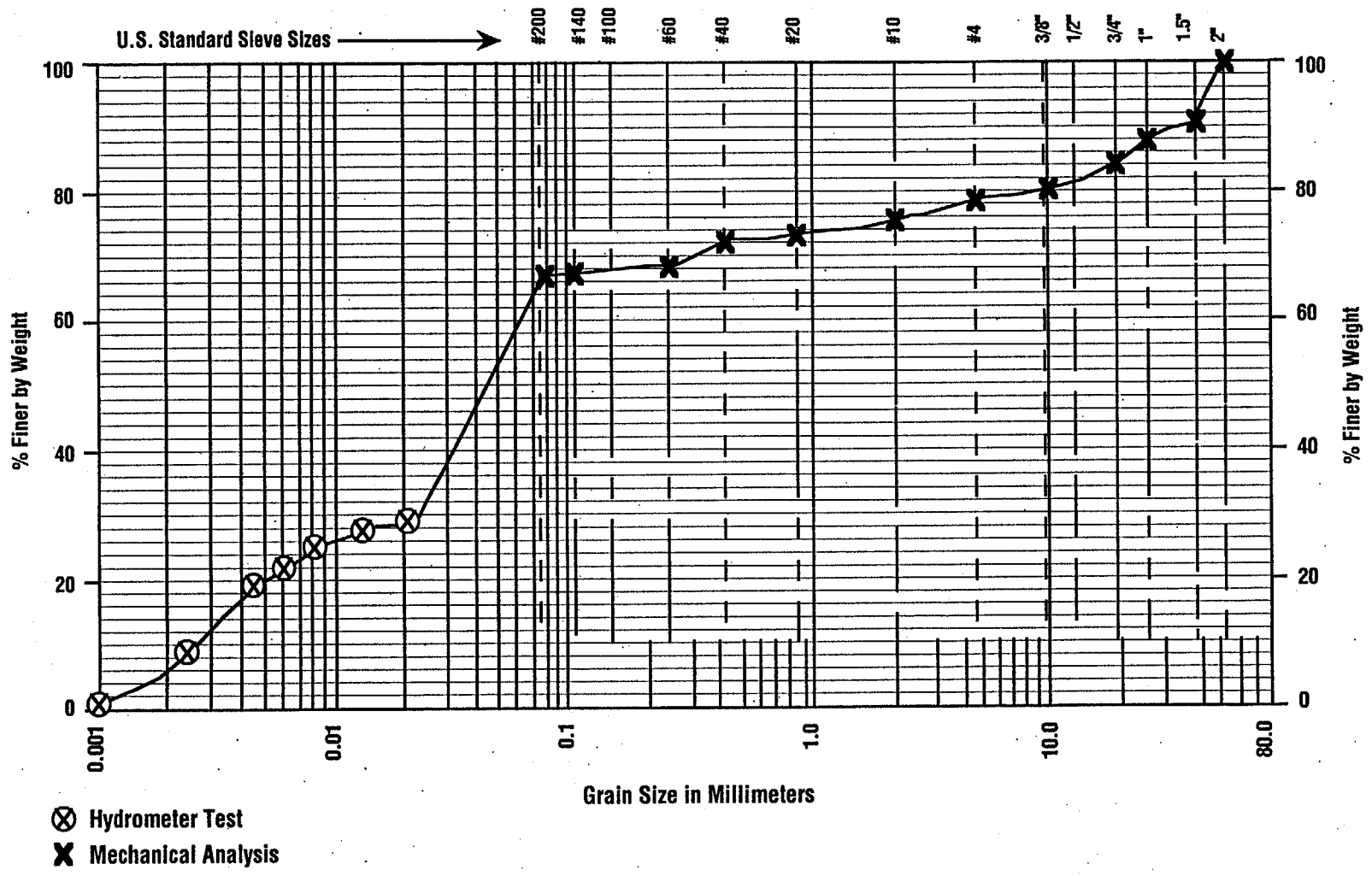
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-01A Tested By JPC Party _____ Date 08/23/90

B43R201 (10'-12') D_{10} 0.0026 D_{60} 0.06 U_c 23.08



⊗ Hydrometer Test

✖ Mechanical Analysis

4.49 3676.2

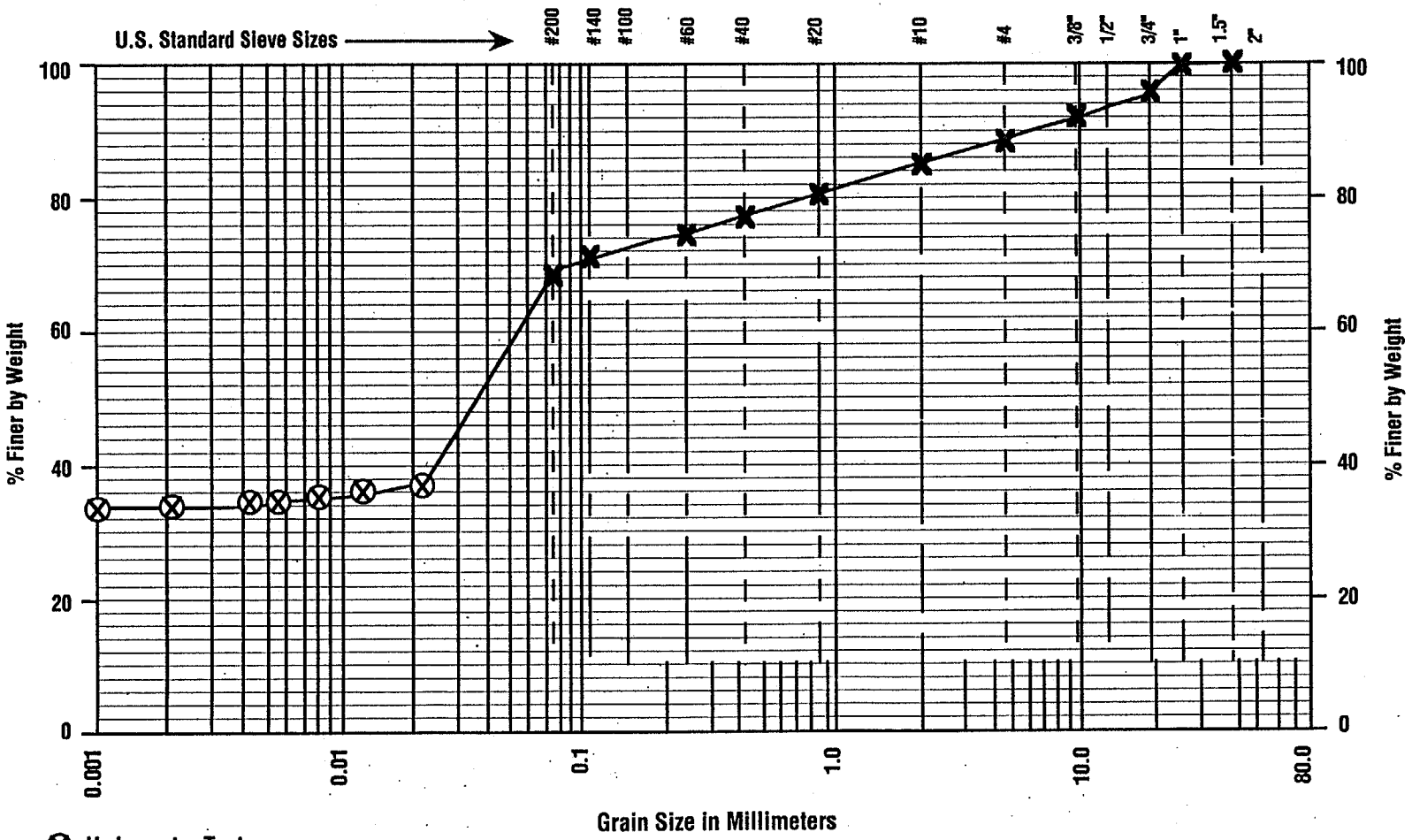
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-03A Tested By JPC Party _____ Date 08/23/90

B43R202 (0'-2') D_{10} N/A D_{60} 0.051 U_c N/A



⊗ Hydrometer Test

✖ Mechanical Analysis

4.49 3876.3

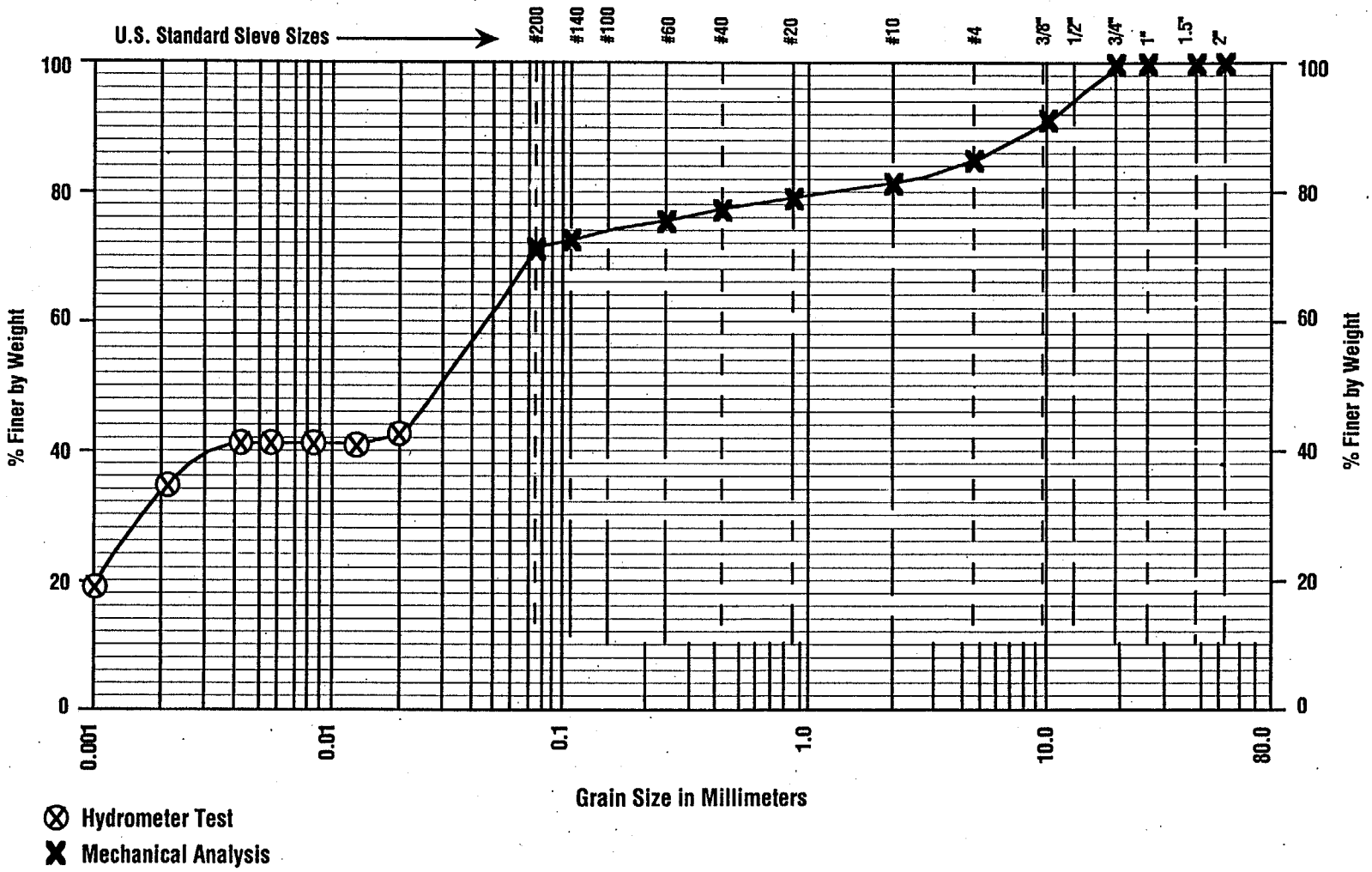
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-04A Tested By JPC Party _____ Date 08/23/90

B43R203 (0'-2') D_{10} N/A D_{60} 0.045 U_c N/A



4.49 3876.4

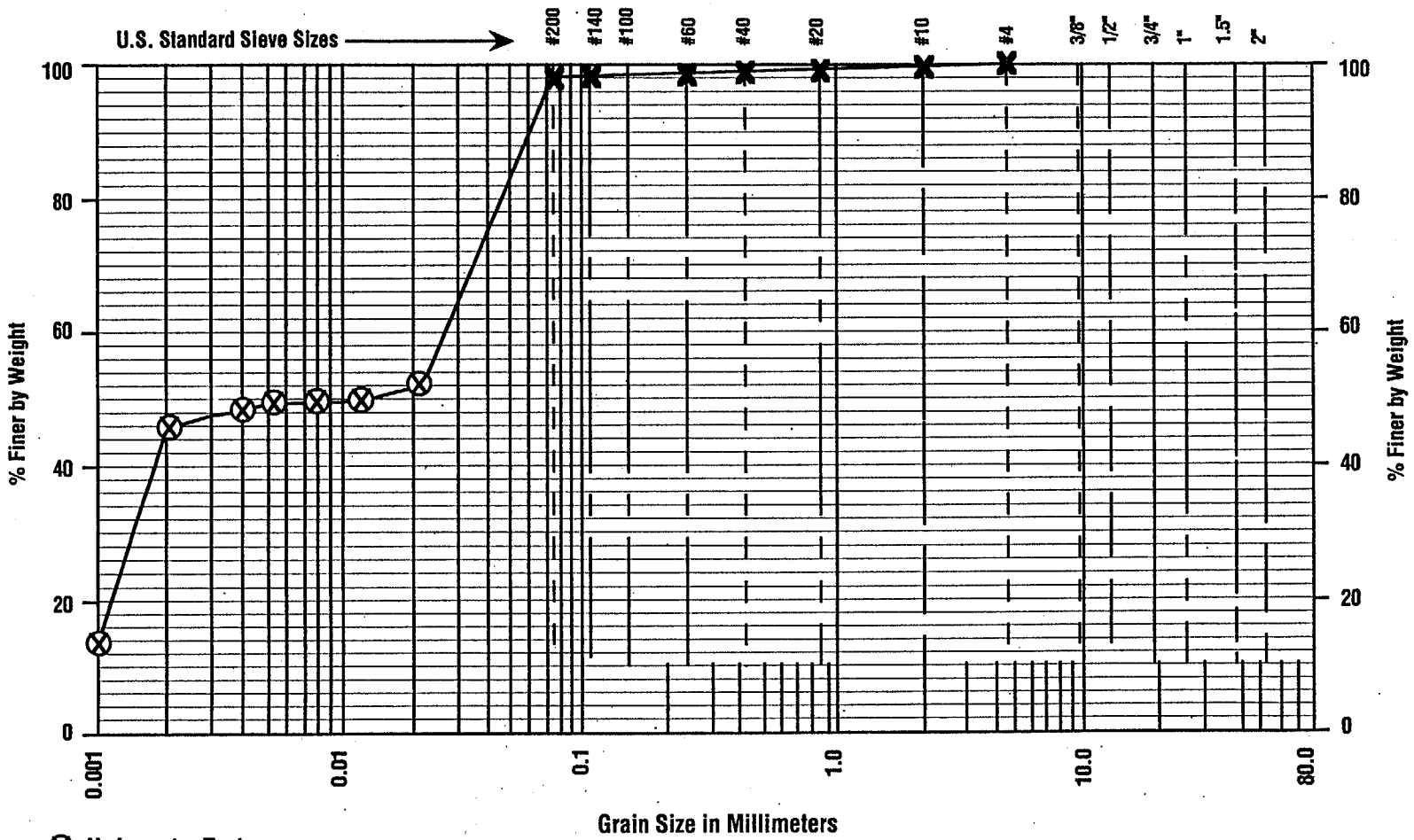
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-05A Tested By JPC Party _____ Date 08/27/90

B43R203 (2'-3') D_{10} N/A D_{60} 0.018 U_c N/A



⊗ Hydrometer Test

✖ Mechanical Analysis

4.49 3876.5

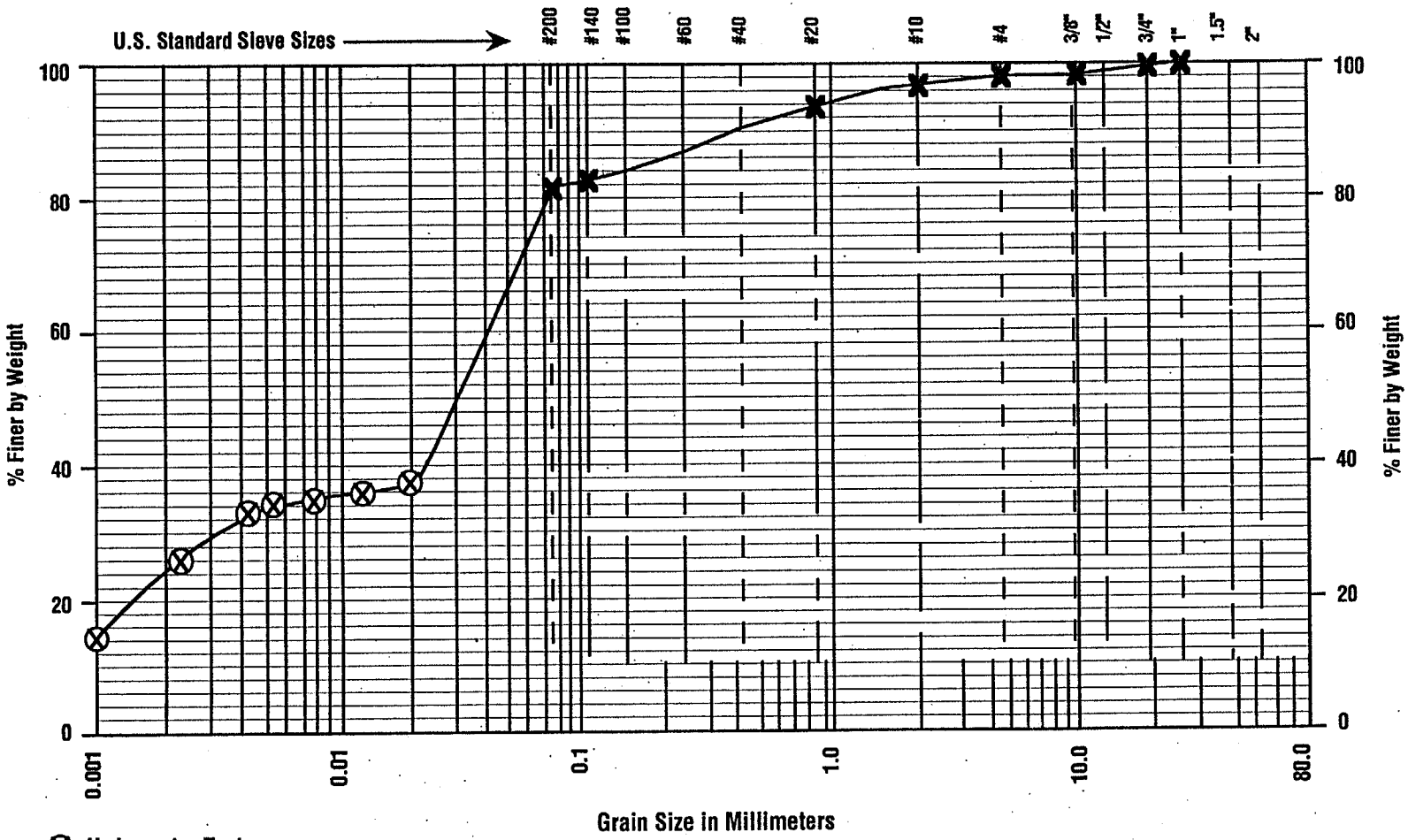
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-07A Tested By JPC Party _____ Date 08/27/90

B43R211 (3'-5') D_{10} N/A D_{60} 0.031 U_c N/A



⊗ Hydrometer Test

✖ Mechanical Analysis

4.49 3876.6

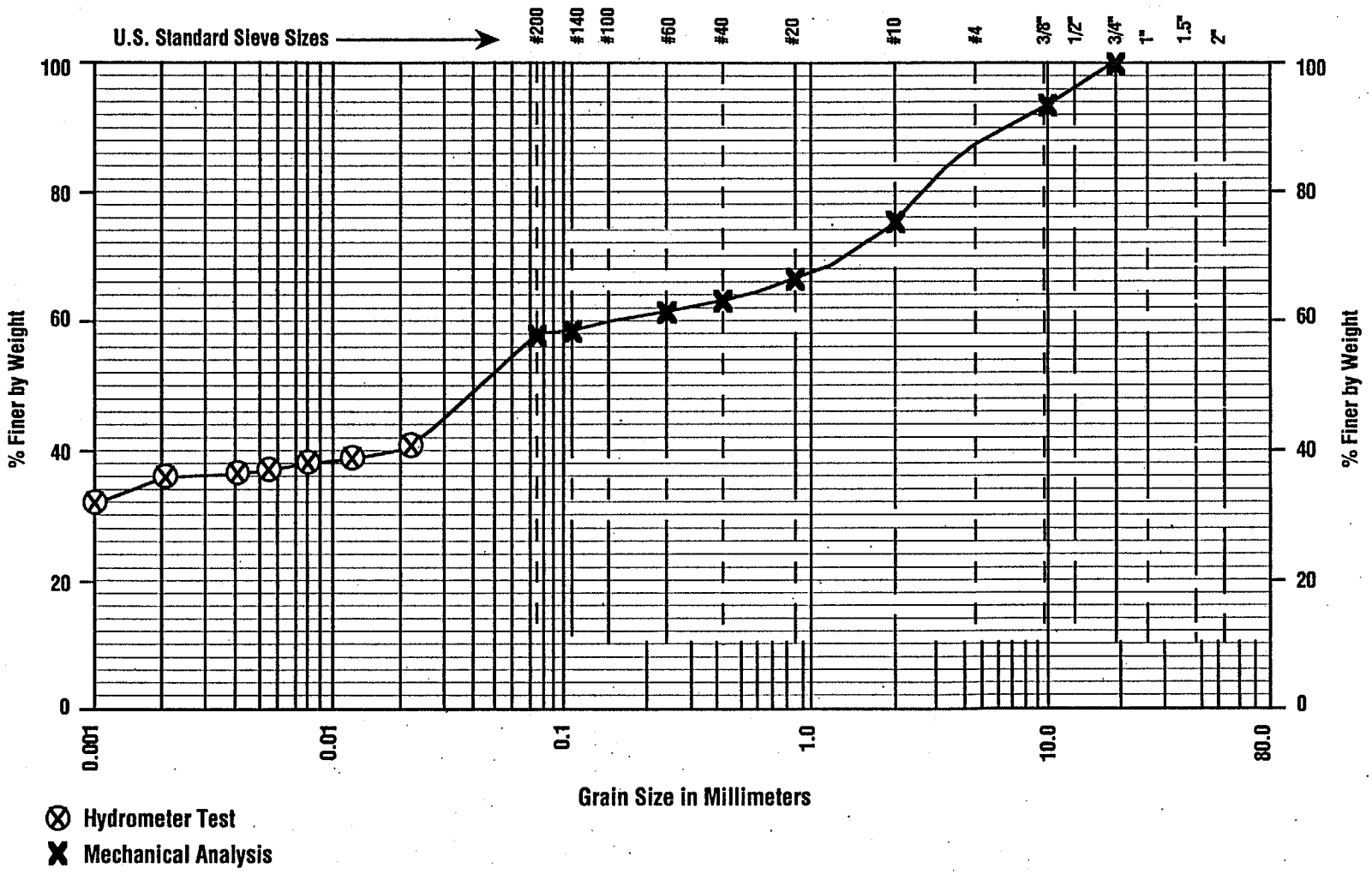
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-10A Tested By JPC Party _____ Date 08/30/90

B43R206 (4'-5') D_{10} N/A D_{60} 0.15 U_c N/A



⊗ Hydrometer Test

✖ Mechanical Analysis

4.49 3876.7

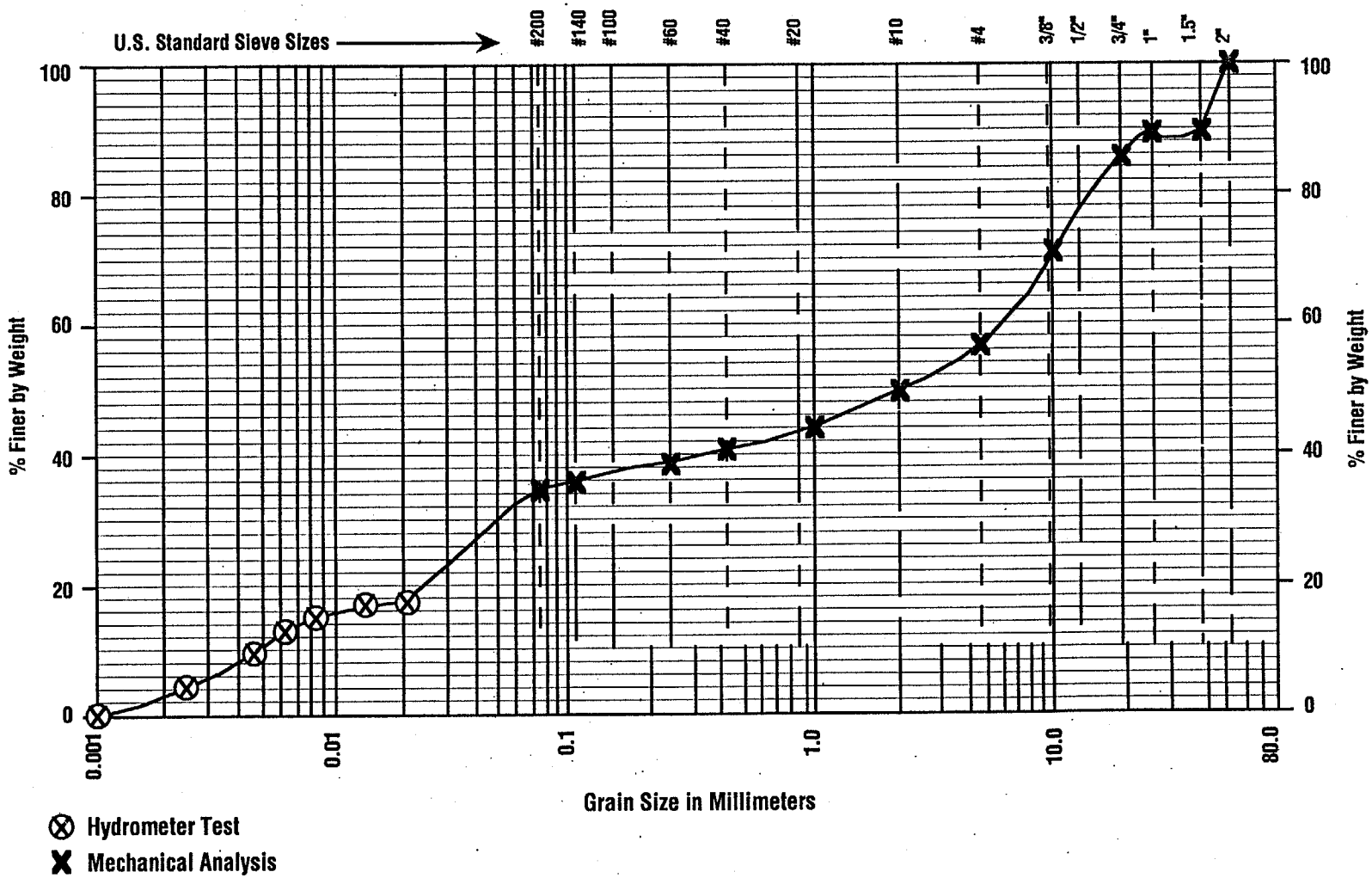
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-12A Tested By JPC Party _____ Date 08/30/90

B43R207 (0'-2') D_{10} 0.0045 D_{60} 0.6 U_c 133.3



4.49 3876.8

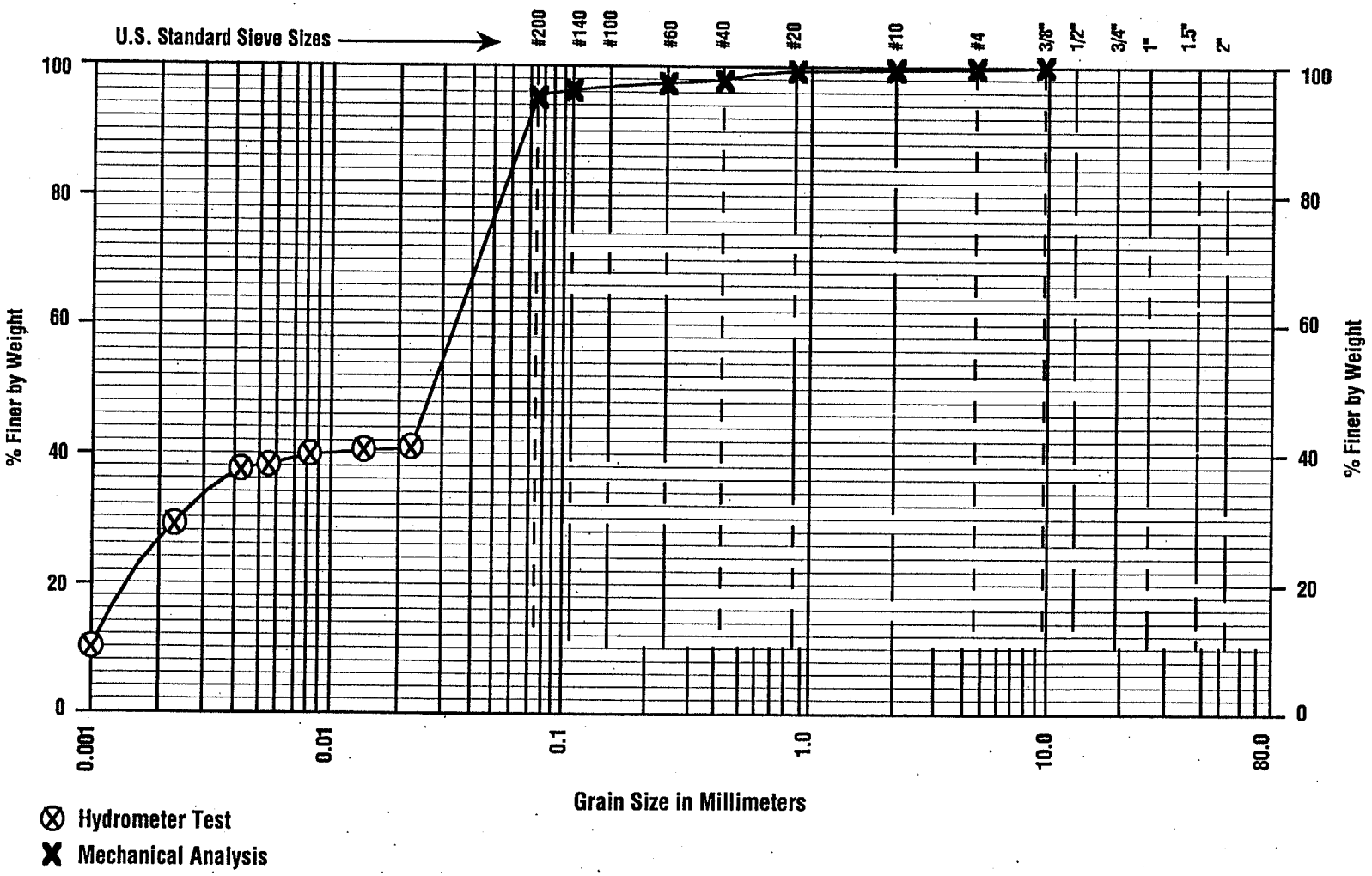
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-13A Tested By JPC Party _____ Date 09/06/90

B43R207 (6'-8') D_{10} 0.001 D_{60} 0.034 U_c 34



4.49 3876.9

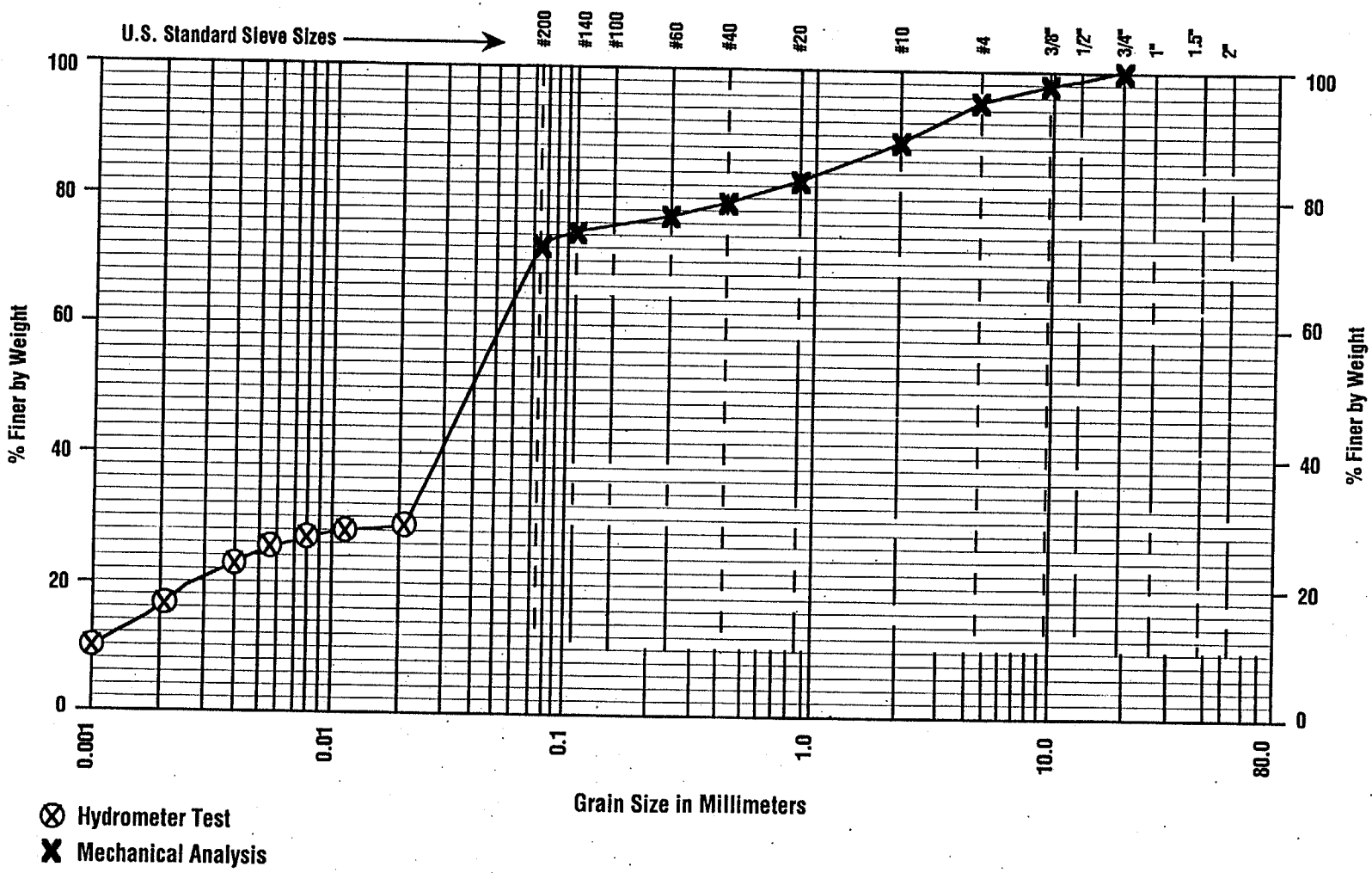
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-14A Tested By JPC Party _____ Date 08/27/90

B43R207 (4'-6') D_{10} 0.0009 D_{60} 0.054 U_c 60



4.49 3876.10

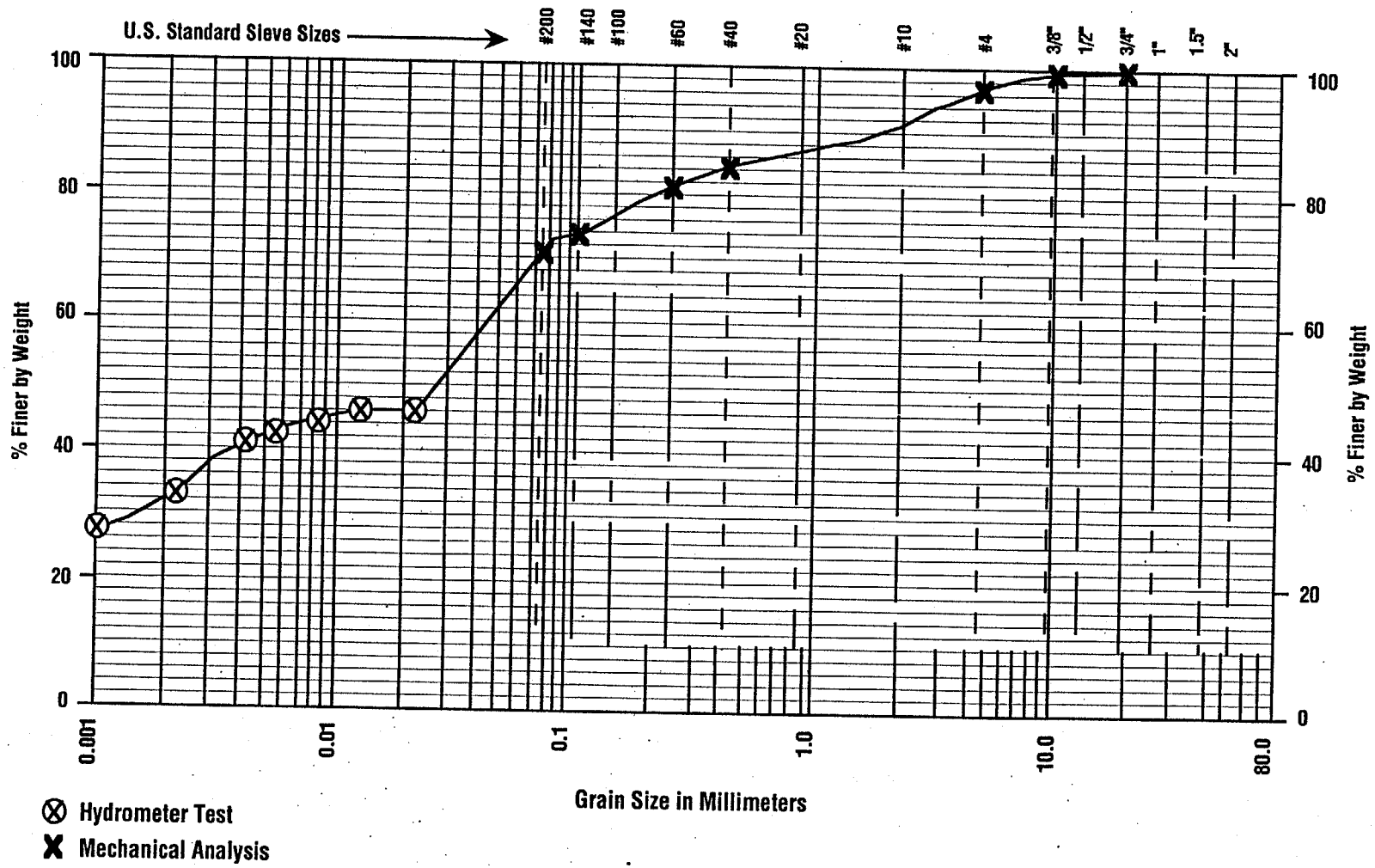
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-18A Tested By JPC Party _____ Date 08/30/90

B43R209 (1'-2') D_{10} N/A D_{60} 0.035 U_c N/A



4.49 3876.11

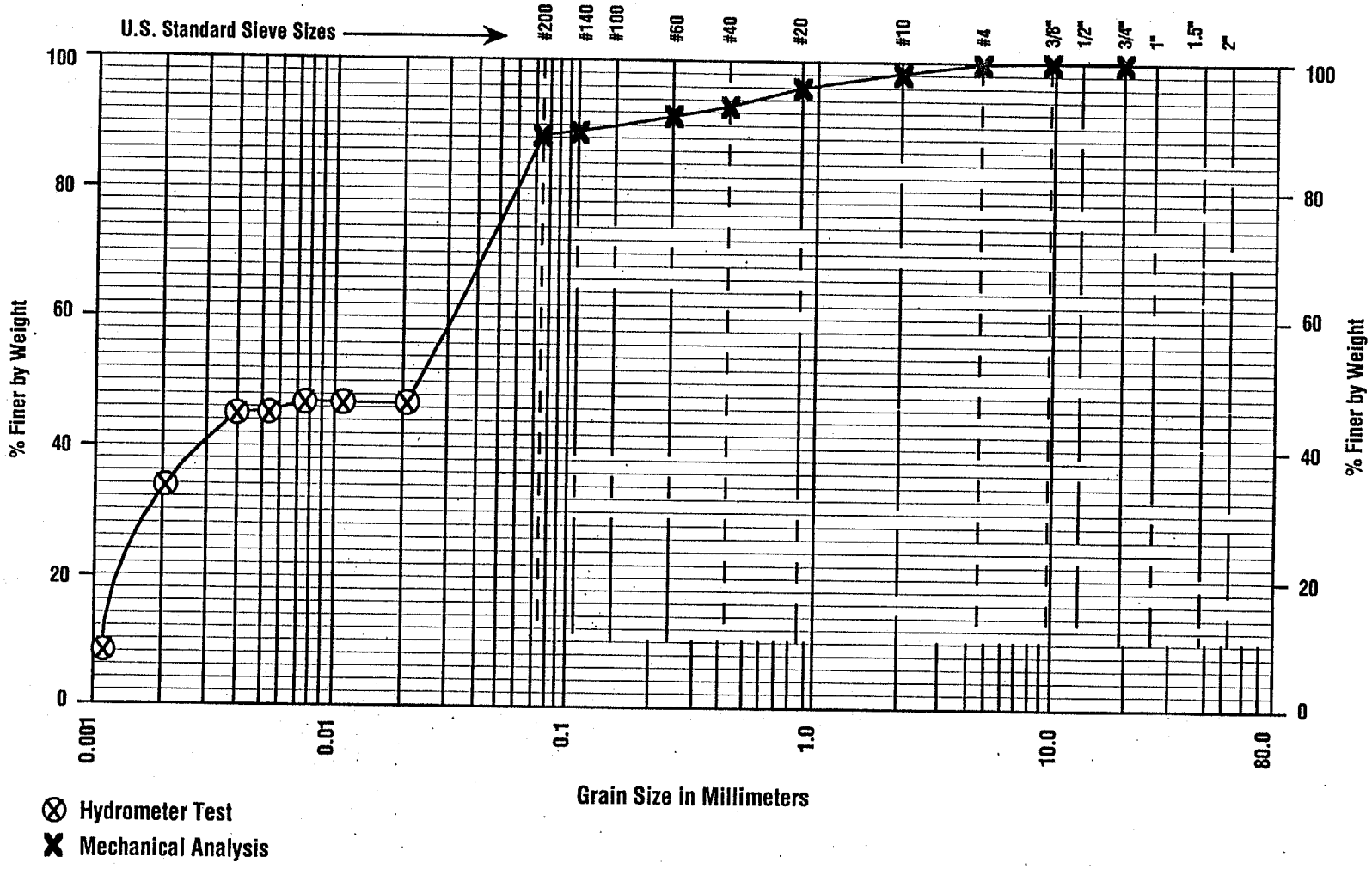
CONTROLS FOR ENVIRONMENTAL POLLUTION, INC.

Grain Size Distribution Curve

Test No. _____

Sample 9007504-26A Tested By JPC Party _____ Date 08/27/90

B43R211 (21'-22.5') D_{10} 0.001 D_{60} 0.031 U_c 28.2



4.49 3876.12