FINAL

SAMPLING AND ANALYSIS PLAN

FIELD OPERATIONS PLAN
PART I

DRAFT SAMPLING AND ANALYSIS PLAN

FOR THE

LCP CHEMICALS, INC.
SUPERFUND SITE
LINDEN, NEW JERSEY

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ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Consent Order	Administrative Order on Consent
DOT	United States Department of Transportation
EPA	United States Environmental Protection Agency
FID	Flame Ionization Detector
FOP	Field Operations Plan
FS	Feasibility Study
FT	Feet
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
IATA	International Air Transport Association
ID	Inner Diameter
lb	pound
ml	milliliter
ml/min	milliliter per minute
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MVA	Mercury Vapor Analyzer
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
ORP	Oxidation Reduction Potential
PCB	Polychlorinated Biphenyl
PCNs	Polychlorinated Naphthalenes
PID	Photoionization Detector
PP	Priority Pollutant
ppm	part per million
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan

RI	Remedial Investigation
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
VOC	Volatile Organic Compound

This document is a Sampling and Analysis Plan (SAP), which is Part I of the Field Operations Plan for the Remedial Investigation (RI) and Feasibility Study (FS) at LCP Chemicals, Inc., Linden, Union County, New Jersey. The Field Operations Plan consists of the following three volumes:

Part I - Sampling and Analysis Plan (SAP): describes the field investigation and data collection activities that will be conducted at the site to satisfy the objectives of the LCP Chemicals, Inc. RI/FS.

Part II - Quality Assurance Project Plan (QAPP): presents in specific terms the policies, organization, functions, and quality assurance/quality control (QA/QC) procedures designed to achieve the data quality goals for the LCP Chemicals, Inc. RI/FS.

Part III - Site Health and Safety Plan (HASP): describes the procedures that will be used to protect worker health and safety during the LCP Chemicals, Inc. RI/FS field investigation.

This SAP is submitted by ISP Environmental Services Inc., as part of the Remedial Investigation and Feasibility Study for the LCP Chemicals, Inc. Superfund Site ("site"). This document is submitted in accordance with the requirements of the U.S. Environmental Protection Agency's (EPA) Administrative Order on Consent ("Consent Order"), EPA Order Index No. II CERCLA-02-99-2015 (May 31, 1999).

1.1 PROJECT BACKGROUND

This section presents a brief summary of the background history of the site, the objectives of the project, and a summary of the work that will be conducted for the RI and FS.

1.2 SITE LOCATION

The LCP Chemicals, Inc. Superfund Site (the "site") occupies about 26 acres in an industrial area at the foot of South Wood Avenue in Linden, Union County, New Jersey. The general site vicinity is known as Tremley Point. The site is adjacent to South Branch Creek, a small tidal arm of Arthur Kill. The site is on the United States Geological Survey Arthur Kill, N.Y./N.J. quadrangle map (Figure 1-1).

1.3 SITE HISTORY

The site consists of a former chlorine production plant and ancillary terminalling, packaging, and distribution areas. Between 1955 and 1982, the plant manufactured gaseous chlorine using a technology known as the mercury cell electrolysis process. A by-product of this process was wastewater and sludge that contained residual elemental mercury. Beginning in the early 1980s, both the EPA and the New Jersey Department of Environmental Protection (NJDEP) conducted numerous inspections and limited investigations at the site because of environmental concerns associated with the mercury cell process. The results of their investigations indicated that there were mercury releases to the environment although the magnitude and extent of contamination were not determined. The EPA placed the LCP Chemicals, Inc. site on the National Priorities List (Superfund list) in July 1998 and issued an Administrative Order on Consent (EPA; May 1999) to investigate the nature and extent of contamination in soil, groundwater, surface water, and sediment. The Consent Order required that an RI/FS investigation be conducted in accordance with the requirements of the Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA).

1.4 SITE DESCRIPTION AND OPERATIONS

A detailed description of the site operations and a history of activities and investigations at the site are presented in Section 1.0 of the LCP Chemicals, Inc. RI/FS Work Plan.

1.5 SUMMARY OF AREAS OF CONCERN

Potential sources and areas of concern at the site were identified through previous investigations, including those conducted by the EPA and NJDEP. An overview of the previous inspections and investigations is presented in Section 1.10 of the Work Plan. A discussion of the potential sources of contamination and the potential exposure pathways are discussed in Section 2.0 of the Work Plan. A brief summary of the potential areas of concern is provided in this section. The general locations of the areas described below are shown in Figure 1-2. Detailed drawings showing sampling locations for each area of concern are presented in Appendix A, Figure A-1 through Figure A-22.

1.5.1 East Berm of the Brine Sludge Lagoon and the Leaking Pipe - Building 231 Area

The NJDEP and the EPA documented mercury-contaminated brine spills and releases into South Branch Creek. These releases may have impacted the soil of the east berm, located between South Branch Creek and the brine sludge lagoon.

NJDEP Site Inspection Reports document releases of brine sludge from leaks in the overhead influent and effluent pipes leading from the 500,000 gallon brine tank to the brine sludge lagoon. In addition, brine sludge may have staged on the ground between Building 231 and the brine sludge lagoon. The soil in this area will be investigated, Figures A-1 and A-2.

1.5.2 Chemfix Lagoon

Chemfix Technologies Inc. treated and stored approximately 120,000 gallons of brine sludge (about 460 cubic yards) in a small lagoon just north of the brine sludge lagoon (Figure A-3). The lagoon was reportedly used for only four days in 1976 and has been closed since that time.

1.5.3 Former Sludge Roaster

A roasting system was developed to vaporize mercury from the sludge and render it non-hazardous. The unit was constructed on a bermed and trenched concrete pad just south of the brine sludge lagoon. The unit never worked successfully and was used only intermittently during tests. The unit was dismantled and shipped off site in 1985, but the concrete pad it rested on still remains (Figure A-1).

1.5.4 Building 230 and Building 240-Mercury Cell Rooms

Process wastewater, brine spills, and mercury cell wash water in the buildings drained to concrete floor trenches, collected in sumps in the northeast corner of each cell building, pumped to holding tanks, and eventually pumped to a wastewater treatment system (Figure A-4). Mercury was reportedly recovered from separators in the sumps and returned to the cells.

1.5.5 Building 231 – Purasiv Area

A HCl burner and a commercial hydrogen gas purification unit ("Purasiv") used for the removal of mercury were located south of the building. High concentrations of mercury were detected in soil around the Purasiv unit during an earlier investigation (Figure A-5).

1.5.6 Former Transformer Areas Building 231, Building 230, and Building 240

A former electric substation was located just north of Building 231 and two other substations were located immediately west of Building 230 and Building 240 (Figure A-6). The NJDEP noted stained soils in the area of the substations.

1.5.7 500K Tank

A 500,000 gallon capacity above ground storage tank (500K tank), located west of the brine sludge lagoon, was originally used to store brine but was later used to store wastewater from perimeter drainage swales and the Building 230/Building 240 cell room sumps for treatment (Figure A-7). The tank was reported to have been used to store sludge as well.

1.5.8 Bullet Tanks

The bullet tanks, located north of Building 231, were built sometime in the late 1950s or early 1960s to store pressurized chlorine. They were later equipped with secondary containment berms to store treated wastewater, sodium hydroxide, and methylene chloride. In the early 1980s, the containment area was apparently used to store excess brine sludge (Figure A-8).

1.5.9 Salt Silo No. 4

In the early 1980s the silo, located next to Building 233 (the brine building), was used to store brine sludge. During the process of moving the sludge from the silo to the brine sludge lagoon, some brine sludge was reportedly dropped on the ground (Figure A-7).

1.5.10 Drum Storage Pad

This pad, located on the south central perimeter of the site, was used to temporarily store 55 gallon (or smaller) drums of waste oil, spent solvents, and dewatered brine sludge (Figure A-9).

1.5.11 Concrete Drainage Channel

The concrete drainage channel was constructed around the process area south of building 240 to collect surface water runoff and excess runoff from Building 230 and Building 240 (Figure A-10). The channel conveyed the runoff to a sump near the 500K tank.

1.5.12 Former Waste Water Treatment Area

At the onset of chlorine production, process wastewater was pH neutralized and filtered in a waste water treatment unit east of the main electrical switchyard. The unit consisted of a small pond, which discharged into South Branch Creek (Figure A-11). The use of the pond was reportedly discontinued in the mid 1970s.

1.5.13 Areas Requiring Risk Assessment

Areas of the site with no previous history of potential environmental concerns are required to be investigated to provide data for EPA human health and ecological risk assessments. These areas are listed below with their appropriate Figure number in parentheses. In addition, these sites are described in Sections 5.2.14 through 5.2.24 and 5.2.28 of the Work Plan.

- West of Avenue D and South of 4th Street (Figure A-12)
- West of Avenue D and North of 4th Street (Figure A-12)
- North of Building 223/Cl_2 Truck loading/HCl Storage (Figure A-13)
- South of Building 223/Cl_2 Truck loading/HCl Storage and North of Shops and Services Building (Figure A-13)
- Along Railroad Tracks (Figure A-14)
- Between Building 220 and 230 (Figure A-13)
- Near 250K NaOH Storage Tank (Figure A-15)
- Between Old Chlorine Storage Tank and Avenue B (Figure A-15)
- South of Building 240 (Figure A-13)
- Adjacent to 150K Brine Tank (Figure A-15)
- East of Sludge Roaster Pad (Figure A-16)
- East of South Branch Creek (Figure A-16)
- Along South Branch Creek (South of Creek) (Figure A-16)

1.5.14 Areas of Suspected Past Releases

The EPA (1999) identified areas of suspected releases as part of an evaluation of aerial photographs of the site. Six areas of suspected surface spills were identified at the site. Four areas were identified along the north perimeter of the site, one area was observed north of Building 220, and one area was noted west of the main electrical switchyard (Figure A-17).

1.5.15 Potentially Contaminated Non-Process Areas

The NJDEP has provisions in their Technical Requirements for Site Remediation (7:26E-3.9(f)) to address potentially contaminated areas away from process areas. All areas of the site not addressed as an Area of Concern potentially fall into this category (Figure A-18).

1.5.16 Historic Fill

The site is located in a heavily industrialized area that is known to have been built-up by placing fill material on former marshland. The entire site is underlain by fill brought to the site beginning in the 1920s for the installation of railroad tracks (Figure A-19). Contamination of historic fill material by polynuclear aromatic hydrocarbon compounds and inorganic constituents is recognized by the NJDEP as a problem throughout New Jersey.

1.5.17 South Branch Creek

There were several documented discharges and overflows of caustic and mercury-contaminated materials from the brine sludge lagoon into South Branch Creek (Figure A-20). Potential impacts to South Branch Creek require investigation.

1.5.18 Groundwater

The hydrogeologic regime in terms of groundwater flow direction, gradient, tidal effects, and overall groundwater quality was never established at the site. Therefore, additional monitoring wells will be installed as part of the groundwater characterization program (Figure A-21). To further develop the hydrogeologic framework for the site, stratigraphic borings will be advanced across the site to assess subsurface geologic conditions (Figure A-22).

1.5.19 12,000 Gallon Polyethylene Tank (12K)

During a Interim Removal Action (IRA) conducted for the site in late 2000 (URS, August 14, 2000) the IRA field personnel noted that a 12,000 gallon capacity above ground storage tank, currently located adjacent to the drum storage near the western edge of the property (Figure A-9), had a cracked bottom. Based on this observation, the potential for soil contamination resulting from a leaking tank will be investigated as part of the RI/FS.

Summary

As described above, there are many potential areas of concern at the site that require investigation. Recommendations to address these concerns and procedures for the field investigation are presented in Section 3.0 of this document.

1.6 SAMPLING AND ANALYSIS PLAN DESCRIPTION

This RI/FS SAP is designed to provide guidance for the field work that will be conducted at the LCP Chemicals, Inc. Superfund site. Specifically, this SAP presents detailed procedures for the sampling and data-gathering methods that will be used for the RI. The use of these procedures for the LCP Chemicals, Inc. field investigation will be approved by the EPA before the start of field investigations through the review and approval of this document.

Guidelines followed in the preparation of this RI/FS SAP are described in EPA Quality Assurance Manual (October 1989) and Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988). The field methods described in Section 3.0 are consistent with the Compendium of Superfund Field Operations Methods (EPA, 1987), the NJDEP Field Sampling Procedures Manual (1992), and other regulatory guidance and requirements. Other documents that are cited in this plan are listed in Section 4.0 – References.

The environmental concern at the site is the potential for contamination resulting from mercury-bearing wastes that were generated, stored, or disposed of at the site for a period of about 25 years. Other sources of contamination, such as electric transformers that contained oils with polychlorinated biphenyls (PCBs) and former drum storage areas may also have contributed to site contamination. Accordingly, the overall objective of the remedial investigation is to identify the nature and extent of contamination that may pose risks to human health and environment and to evaluate proposed remedies for the site.

The following items are the site-specific objectives for the remedial investigation:

- Determine the nature and extent of contamination in the soil, groundwater, surface water, and sediment
- Evaluate stratigraphy on a site-wide basis - confirm the distribution of the Tidal Marsh Deposit and evaluate its effectiveness as a confining layer
- Define the hydrogeology on a site-wide basis - confirm groundwater gradients, flow directions, and aquifer properties (e.g., hydraulic conductivity, transmissivity, etc.) to predict the direction and flow rate of groundwater contaminant migration
- Evaluate tidal effects on groundwater and groundwater flow direction
- Evaluate the potential ecological resources of, and impacts to, South Branch Creek
- Characterize historic fill at the site
- Develop a conceptual site model
- Determine risks posed to human health and environment

These data are required to characterize the sources of contamination, to characterize the contaminant pathways (specifically the groundwater and surface water pathways), and to finalize the identification of potential human and ecological receptors.

To meet these objectives, the remedial investigation strategy for site consists of the following tasks:

- Soil sampling and laboratory analyses
- Advancing soil borings
- Sealing soil borings and unused monitoring wells
- Field screening for volatile organic compounds and mercury vapors
- Surface water and sediment sampling and laboratory analyses
- Installing overburden monitoring wells
- Groundwater sampling and laboratory analyses
- Hydrogeological testing (slug tests) of the shallow aquifer
- Tidal monitoring of South Branch Creek
- Conducting building and storage tank evaluations

- Conducting a professional land survey for site boundaries, existing layout, and locations of sampling points

The procedures that will be used to complete these tasks, as well as other ancillary tasks for the LCP Chemicals, Inc. RI/FS, are described in Section 3.0.

This section describes the procedures that will be followed for the LCP Chemicals, Inc. RI. The field activities will be performed by a field team composed of the consultant's field inspectors and subcontractors that are qualified and experienced in conducting RI investigations. The project team organization and the overall project reporting structure is described in Section 7.0 of the RI/FS Work Plan. The methods and procedures used to conduct the field investigation will be in accordance with standard environmental practice and consistent with current EPA and NJDEP guidelines and requirements. The investigation will be consistent with guidance contained in the following regulatory documents:

- EPA Compendium of Superfund Field Operations Methods, 1987
- EPA CERCLA Quality Assurance Manual, October 1989
- EPA Low Stress Purging and Sampling Procedure, March 1998
- NJDEP Field Sampling Procedures Manual, 1992
- NJDEP Field Analysis Manual, July 1994
- NJDEP Alternative Ground Water Sampling Techniques Guide, July 1994 (if required)

Changes to the procedures and protocols described in this section may become necessary based on actual conditions encountered in the field. The EPA will be informed of major changes to the field program through Technical Memoranda or other forms of communication. Major deviations from the field procedures described below will be documented and a rationale supporting the change will be provided. Proposed modifications will not be implemented in the field without EPA approval. A summary of the field activities that will be conducted during the RI/FS is presented in Table 3-1.

3.1 RECONNAISSANCE AND SITE PREPARATION ACTIVITIES

This section describes the activities that will be conducted before the field investigation.

3.1.1 Site Reconnaissance

A reconnaissance of the site was made before the RI to survey the site for potentially hazardous conditions (e.g., exposed waste, overhead obstructions, physical hazards, etc.). Based on the results of the reconnaissance, ISP Environmental Services Inc. developed a work scope to cleanup and remove potential structural and environmental hazards (e.g., presence of potential asbestos containing material, unsafe tank structures, etc.) through an Interim Removal Action (IRA). The IRA began in October 2000 in accordance with an EPA-approved work plan (URS, August 14, 2000). As part of the IRA, the integrity of the cap for the brine sludge lagoon was evaluated. Seven small areas (nominally 5 ft by 5 ft) required erosion control, which consisted of covering the affected area with top soil, seeding, and securing the area with a net. The results of the IRA will be submitted to the EPA under separate cover.

A survey of South Branch Creek will also be conducted before the RI to determine general sampling accessibility and to perform a preliminary assessment of the ecological resources of the area. The general conditions of the site and surrounding areas will be documented and the information will be used to refine the general approach of the RI.

3.1.2 Development of Site Facilities

A storage, lay-down, and decontamination area will be established west of the main switch yard in the former employee parking lot at the west end of the site (Figure 3-1). This location has space for equipment, for a decontamination pad, and for drums or tanks of water that will be used to store decontamination and monitoring well development water.

3.1.3 Subsurface Utility Locations

Before drilling or excavation work, a "call-before-you-dig" service (1-800-272-1000) will be requested to provide utility markouts for the site. In addition, previous site documents and utility maps (where available) will be reviewed to provide clearance for the sampling locations.

3.1.4 Identification of Sampling Locations Before Sampling

The RI/FS sampling points will be measured out in the field relative to building corners or other permanent structures using tape measurements. The sampling points will be established in the field using stakes, flags, surveyors paint, or similar methods before the sampling event. The sampling points will be marked clearly and staked securely until such time that the locations are either surveyed or recorded onto a scaled map of the site.

3.2 SOIL INVESTIGATION PROCEDURES

This section describes the procedures that will be followed when conducting the investigation of soil at the site. Since the subsurface conditions at the site are relatively unknown different drilling methods are described below so that procedures are in place as a contingency.

3.2.1 Collection of Surface Soil Samples

The RI/FS surface soil sampling locations are shown on Figure 1-2. Before collecting a surface soil sample (0-6 inches below the ground surface or 0-12 inches below the ground surface for ecological risk assessment data) the sample location will be carefully cleared by removing any grass layers, surface debris, or upper one-centimeter of soil surface, as applicable. In some areas of the site (e.g., the mercury cell buildings) a jackhammer or a concrete coring device will be needed to penetrate concrete pads or floor slabs to expose the ground surface (see Section 3.2.3.4 – Penetrating Concrete Pads or Floor Slabs). The soil samples will be collected using decontaminated stainless-steel scoops, hand augers, trowels, or equivalent tools.

The collection of surface samples for VOCs shall be conducted using an EnCore™ Sampler in accordance with USEPA requirements. The sampling device is inserted into a freshly exposed soil surface (ground surface or soil core sampler). The 5-gram plug of soil is then capped and sent to the laboratory where it will be preserved, extracted and analyzed. Three EnCore™ vials and one unpreserved 60 ml jar (for percent soil moisture measurement) of soil will be collected per sample location. A description of the EnCore™ Sampler and a detailed sampling procedure are presented in Appendix B.

To satisfy the volume requirements of multiple bottle sets, surface soil samples (other than those collected for VOCs using the EnCore™ sampler) will be homogenized either in situ or in a decontaminated stainless steel mixing bowl or tray before being transferred to bottles. A description of the soil data (e.g., soil description, location, time, etc.) will be recorded on a Surface Soil Description Log or the project field book. A sample Surface Soil Description Log is presented in Appendix C.

3.2.2 Collection of Subsurface Soil Samples from Soil Borings

Soil samples for laboratory analysis will be collected from three general depth intervals. The sampling intervals will be 0.0 to 0.5 ft below the ground surface (bgs), 0.0 to 1.0 ft bgs, and between 1.0 ft bgs and the water table (estimated to be about 6 feet bgs). Surface soil samples collected from the 0.0 to 0.5 ft interval will provide data for the human health risk assessment and surface soil samples collected from the 0.0 to 1.0 ft interval will provide data for the ecological risk assessment. Subsurface soil samples collected from the 1.0 to 6.0 ft interval will provide data to define the vertical extent of potential contamination in any given area. Each soil boring will be advanced through the fill to a minimum depth of the top of the water table. If native soils are not encountered at the water table, then the boring will be advanced until native soils are penetrated. The boring data will provide information on the thickness of the fill layer across the site.

In general, only one subsurface soil sample for organic analysis and one subsurface soil sample for inorganic analysis will be collected from each soil boring at the site because of the reportedly shallow depth to the water table. Locations of soil borings are shown in Figure 1-2. Table 3-2 shows proposed sample designations, sample locations, and analytical parameters. The laboratory analytical method numbers used to measure the analytical parameters are presented in Table 3-3. The preservatives, maximum holding times, and containers for the samples are summarized in Table 3-4.

Continuous split-spoon or direct push samples will be collected from each soil boring as outlined in Section 3.2.3. Upon retrieval of the soil sampling device, each sample shall be screened for organic vapors using a photoionization detector (PID) and for mercury using a mercury vapor analyzer (MVA). Calibrating procedures and instructions for using a PID and MVA are provided in Section 3.9.

For each sample interval, when screening results are above background levels, a soil sample will be collected and temporarily archived for possible chemical analysis. With the exception of soil samples collected for VOC analysis, each sample collected will be stored in one or more "ziplock" bags. Archive samples for VOC anaysis will be collected using the EnCore Sampler. Each sample will be labeled and stored appropriately on ice until all of the screening results are evaluated.

One organic and one inorganic archived sample from each soil boring will be submitted to the laboratory for analysis, based on the screening readings, discoloration, or odor. Archived samples selected for chemical analysis will be immediately transferred to the appropriate laboratory bottles and stored and handled according to procedures outlined in Section 3.8. The remaining archived samples will be handled in the same manner as the drill cuttings from each soil boring. If contamination is not evident from the field screening, soil samples will not be archived and the laboratory sample will be collected from just above the water table and submitted for analysis.

If analysis for volatile organic compounds is to be performed on a soil sample collected from a particular sampling depth, then the sample for VOC analysis will be collected before the other samples using the collection procedure described in Section 3.2.5 – Collection of Soil Samples for the Analysis of Volatile Organic Compounds. The remaining soil will be collected for the other analyses with a decontaminated stainless steel spoon or scoop (or equivalent sampling device), placed in a decontaminated stainless steel pan, and homogenized. The homogenized sample will then be placed in the appropriate sample bottles. In addition, soil samples will be observed for physical properties such as color, sorting, etc. This information will be recorded in a field boring log. Soil logging procedures are provided in Section 3.2.4. Sampling equipment shall be disposed of or decontaminated after the collection of each sample in accordance with the procedures outlined in Section 3.5.

Due to limited knowledge of site conditions, the default drilling method selected for the field investigation is hollow stem auger drilling for each boring location where a monitoring well will be installed and at locations for deeper borings for stratigraphic investigation (Figure A-21 and Figure A-22). Direct push techniques will be used at the other boring locations unless conditions such as difficult drilling conditions warrant using hollow stem auger drilling. In addition, portable drill rigs, such as tripod rigs, may be required to collect soil samples along the steep banks of South Branch Creek. The final decision to change drilling methods will be based on the drilling contractor's and environmental consultant's experience with concurrence by the EPA. A summary of the anticipated drilling methodolgy is provided in Table 3-1.

3.2.3 Soil Borings Procedures

Soil borings will be advanced using either hollow stem auger drilling methods, direct push techniques or both, depending on the site logistics and the sampling objectives at a given area of concern. Soil samples will be collected from the borings using split-spoon samplers (auger rig) or macro-core samplers with dedicated acetate liners (direct-push rig). The project driller will be responsible for obtaining the required drilling permits for the RI/FS investigation. The locations of the RI/FS soil borings are shown in Figure 1-2.

3.2.3.1 Hollow Stem Auger Methods

Drilling with a hollow-stem auger is a standard method of subsurface drilling which allows the recovery of representative subsurface samples for identification and laboratory testing. Continuous 2-ft split-spoon samples will be collected from each soil boring. Samples from each spoon will be screened in the field using an HNU-model PI-101 PID and a Jerome 431-X MVA, or equivalent instruments. PID and MVA readings for each sample interval will be recorded on a field log. The samples that show the greatest signs of contamination (i.e., elevated PID or MVA readings, discoloration, odor, etc.) will be submitted for analyses. If contamination is not evident from the field screening, then the default sampling depth for soil samples submitted for laboratory analyses will be just above the water table. Proposed soil boring locations are indicated on Figure 1-2. Proposed sampling locations, analyses, and quantity of samples are provided in the in Table 3-2.

When advancing borings using the hollow-stem auger drilling method, 4¼-inch inner diameter (ID) augers will be used. This will result in a borehole diameter that is greater than eight inches, or at least four inches larger than the outside diameter of the casing and well screen in the event that a two-inch diameter monitoring well is to be installed. These specifications are in accordance with NJDEP regulations for the installation of monitoring wells. The borings will be advanced by rotating the augers to the desired depth into the subsurface soils. The borings will be advanced incrementally to permit continuous soil sampling, as required. If heaving sands are encountered, clean potable water will be added to maintain a positive hydraulic head inside the auger.

The drilling rig will be set up and operated in accordance with standard drilling practices and in a manner that will promote the safe and efficient operation of the equipment. The project driller will be a certified test borer and New Jersey licensed well driller. Safety considerations during equipment operation are addressed in the RI/FS HASP (Part III of the RI/FS Field Operations Plan).

The equipment used in the drilling operations will be steam cleaned upon arrival at the site. The equipment and tools that come in contact with soil during drilling will be decontaminated before resampling, before moving to the next drilling location, or before leaving the project site. A source of water to be used for decontamination has not been identified yet, but will likely be water supplied by the City of Linden. The water source may include on-site faucets, the neighboring ISP site, or hydrants owned by the city of Linden. Documentation of the quality of clean potable water to be used for drilling will be submitted to the USEPA or a designated USEPA representative prior to use once a source is identified. Decontamination procedures are described in Section 3.5.

Subsurface soil samples will be continuously collected with a two-inch diameter split-spoon in accordance with American Society for Testing and Materials (ASTM) D-1586-99 methods. Specifically, the following steps will be followed during split-spoon sampling:

1) Measure the sampling equipment lengths and diameters to document that they conform to specifications.
2) Remove the center plug from the augers prior to sampling.
3) Lower the sampler to the bottom of the auger column and check the depth against length of the rods and the sampler to ensure the sampler has not penetrated below the augers under its own weight.
4) Attach the drive head sub and hammer to the drill rods without the weight resting on the rods.
5) Lower the weight and allow the sampler to settle up to 6 inches. If it settles more, consider use of another sampler.
6) Mark four 6-inch intervals on the drill rods relative to a drive reference point on the rig. With the sampler resting on the bottom of the hole, drive the sampler with the 140 lb hammer falling freely 30 inches until 24 inches have been penetrated or 100 blows applied.
7) Record the number of blows per 6 inches.

8) Remove the sampler from the augers, open it, and describe the soil according to the procedures described below. Record the length of the sample recovered.
9) The "N" value, if required for geotechnical purposes, can be calculated by adding the blows from the 6-12 inch and the 12-18 inch interval of each sample attempt.
10) Screen the sample with a PID and a MVA and record the readings. Perform head space screening of the sample as described in Section 3.2.6.
11) Collect soil samples. The soil sample selected for laboratory analysis in a given boring will be the sample with the highest PID reading, MVA reading, or visual/olfactory signs of contamination if instrument readings are background. If the field screening readings in the boring are background, then the sample collected directly above the water table will be sent to the laboratory for analysis. Additional detail on the selection of soil sample for analysis is given in Section 3.2.6 – Field Screening (Head Space) of Soil Samples.
12) Decontaminate split spoon sampler before using again as described in Section 3.5.

The drillers will be instructed that the boring must be advanced by drilling with the auger bit between the collection of split spoon samples. This will allow the field inspector to maintain good depth control of samples. The collection of consecutive split spoons samples will not be permitted except in the case of borings advanced through concrete pads or floor slabs (where the small diameter of the opening in the concrete will prevent the use of augers). This will minimize the chance of sampling slough or wash cuttings, which are not representative of subsurface conditions.

3.2.3.2 Direct Push Techniques

Depending on site logistics, a direct push rig may be used to advance borings. Continuous soil samples will be collected from each soil boring using a 4-ft macro core sampler with a dedicated, clean acetate liner. Each 2-ft portion of soil sample in the 4-ft macro core sampler will be treated separately to maintain a 2-ft sampling interval for the direct push boring. Samples from each macro core will be screened in the field and in each area of concern, the samples that show the greatest signs of contamination (i.e., elevated PID or mercury vapor analyzer reading, discoloration, odor, etc.) will be submitted for analyses. If contamination is not evident from the field screening, then the default sampling depth for soil samples submitted for laboratory analyses will be just above the water table. Proposed soil boring locations are shown in Figure 1-2. Proposed sampling locations, analyses, and quantity of samples are provided in Table 3-2.

The direct push rig (e.g., GeoProbe, Hurricane, etc.) will be set up and operated in accordance with standard drilling practices and in a manner that will promote the safe and efficient operation of the equipment. The project driller will be a certified test borer and New Jersey licensed well driller. Safety considerations during equipment operation are addressed in the RI/FS HASP (Part III of the Field Operations Plan).

The equipment used in the direct push operations will be steam cleaned upon arrival at the site. The equipment and tools that come in contact with soil during drilling will be decontaminated before resampling, before moving to the next drilling location, or before leaving the project site. Decontamination procedures are described in Section 3.5.

The general procedures for direct-push sampling are provided below:

1) Clear the area of vegetation and any large surface debris such as rocks that may inhibit sampling and to allow passage of the vehicle on which the equipment is mounted.
2) Before direct-push sampling, a decontaminated trowel may be used to collect a soil sample from the 0 ft to 0.5 ft below ground surface (bgs) interval if required. Insert a dedicated, hollow acetate liner into the tube sampler and attach the tube sampler to the drill rods (or, if appropriate for the site conditions, a decontaminated split-spoon sampler may be used).
3) Push the sampler to the desired depth. If an obstruction is encountered, offset the location and record the exact direction and location in the project field book.
4) Retrieve the sampler.
5) On a level surface spread out plastic sheeting. Slide the plastic liner out of the tube sampler and place it on the plastic sheeting. Split open the plastic liner with a decontaminated knife or razor to expose the sample.
6) Screen the sample for the presence of contamination through visual and olfactory observation, for organic vapors using a PID, and for mercury vapor using a MVA. To obtain the most representative vapor reading, use a decontaminated stainless steel spoon, knife or other appropriately constructed device to score the length of the core surface or make cross sectional slices to a depth that exposes porous soil. Simultaneously, first move the probe of the PID slowly above the lateral scoring (or into the opened areas being careful not to touch the sample) and record the results. Use the MVA next, using the same procedure as for the PID.
7) After the boring is complete, place the soil not used for analyses back into the sampling borehole
8) Decontaminate the direct-push sampling equipment.

3.2.3.3 Stratigraphic Borings

Seven stratigraphic borings will be advanced to provide information about site geology. A soil boring will be advanced to a depth of about 25 feet below ground surface at three areas of concern closest to the brine sludge lagoon. Deeper borings are not required in these areas at this time because bedrock borings were already advanced here and the general stratigraphy is known. Four additional borings will be advanced to bedrock in the west portion of the site (Table 3-5). The data collected from the seven stratigraphic borings will be used to further develop the current geologic model of the site. The distribution of the stratigraphic borings is shown in Figure 1-2 and in Figure A-22.

The general procedures for the stratigraphic borings will be to advance the borings using hollow stem auger techniques to maintain accurate depth information for each sample. Continuous split-spoon samples will be collected through the upper strata (fill material) and through the upper-most layer of native soils, inferred to be marsh-type deposits. Once the marsh deposits are penetrated, split spoon samples will be collected at five foot intervals until a depth of about 25 feet below ground surface or until bedrock is reached, depending on the location of the stratigraphic boring. Refusal of the borer, presence of weathered bedrock in the tip of the spit spoon, and the judgement of the field inspector will be used as indicators that the top of bedrock has been reached. Samples for laboratory analyses will not be collected from the stratigraphic borings. Once completed, the stratigraphic borings will be sealed in accordance with the procedures described in Section 3.2.7 – Borehole Sealing.

3.2.3.4 Penetrating Concrete Pads or Floor Slabs

To collect soil samples beneath concrete pads or the floor slabs of buildings, a portable electric or gas-powered core drilling machine will be used to core an access hole having a minimum diameter of 6 inches. Water will be used to wet the work area as required to prevent the generation of dust. Once the concrete core is removed, the soil beneath the slab will be collected for screening or analysis using a split spoon sampler. Once the sample is collected from the required depth, the hole will be backfilled with the original soil and the core hole in the concrete slab will be grouted, from the bottom of the slab to the top, to seal the hole and to prevent surface water or debris from entering it.

If an electric core drilling machine is not suitable for the job because of excessive slab thickness or because of the presence of metal reinforcing bars within the slab, a jackhammer or similar pneumatic device will be used to penetrate the slab. Regardless of the equipment used, dust generation will be minimized with the application of water and the hole in the slab will be repaired with grout or patched with quick-drying cement.

3.2.4 Logging of Soil Borings

Soil samples will be described by the field inspector. The format for describing a soil sample will be in accordance with ASTM D2488-93: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) and consistent with ASTM D2487-98: Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

A record of significant information related to drilling operations for each boring will be maintained as the boring advances. This information will be recorded on a field boring log. The following information will also be recorded on the log:

- Names of soil materials shall follow the name of the predominant particle size (e.g., clay, silt, sand).
- The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, moisture, density, plasticity, odor, particle angularity, and other characteristics.
- Symbols of the Unified Soil Classification System (USCS) will be included with the description.

A typical Soil Boring Log is shown in Appendix C.

Unified Soil Classification System

Soils are classified for engineering purposes according to the USCS adopted by the U.S. Army Corps of Engineers and Bureau of Reclamation. The following soil properties form the basis for the USCS:

- Percentage of gravel, sand, and fines
- Shape of the grain-size distribution curve
- Plasticity and compressibility characteristics

According to this system, all soils are divided into three major groups: coarse grained, fine grained, and highly organic (peat). The boundary between coarse-grained and fine-grained soils is taken to be the 200-mesh sieve. In the field, this distinction is based on whether the individual particles can be seen with the unaided eye. If more than 50% of the soil by weight is judged to consist of grains that can be distinguished separately, the soil is considered to be coarse-grained.

The coarse-grained soils are divided into gravelly (G) or sandy (S), depending on whether more or less than 50% of the visible grains are larger than the No. 4 sieve (3/16 inch). They are each divided further into four groups:

W: Well graded; fairly clean (<5% finer than 0.074 mm)
P: Poorly graded (gap-graded); fairly clean (<5% finer than 0.074 mm)
C: Clayey (<12% finer than 0.074 mm); plastic (clayey) fines. Fine fraction above a line with plasticity index above 7.
M: Silty (>12% finer than 0.074 mm); non-plastic or silty fines. Fine fraction below a line with plasticity index below 4.

The soils are represented by symbols such as GW or SP. Borderline materials are represented by a double symbol, as GW-GC.

The fine-grained soils are divided into three groups: inorganic silts (M), inorganic clays (C), and organic silts and clays (O). The soils are divided further into those having liquid limits lower than 50% (L), or higher (H).

The distinction between the inorganic clays C and the inorganic silts M, and organic soils O is made on the basis of a modified plasticity chart. Soils CH and CL are represented by points above the line, whereas soil OH, OL and MH correspond to positions below the line. Soil ML, except for a few clayey fine sands, are also represented by points below the line. The organic soils O are distinguished from the inorganic soils M and C by their characteristics odor and dark color.

Visual Identification

Soil properties required to define the USCS are the primary features to be considered in field identification. These properties and other observed characteristics normally identified in describing a soil are:

a. Color

- b. Moisture conditions
- c. Grain size
    1) Estimated maximum grain size
    2) Estimated percent by weight of fines (material passing No. 200 sieve)
- d. Gradation (Sorting)
- e. Grain shape
- f. Plasticity
- g. Predominant soil type
- h. Secondary components of soil
- i. Classification symbol
- j. Other features such as:
    1) Organic, chemical, or metallic content
    2) Compactness
    3) Consistency
    4) Cohesiveness near plastic limit
    5) Dry strength
    6) Source – native or transported (aeolian, waterborne, glacial deposit, etc.)

3.2.5 Collection of Soil Samples for Analyses of Volatile Organic Compounds

Soil samples that will be analyzed for VOCs will be collected in accordance with the procedures outlined in EPA Method 5035. This method allows the use of an air-tight, hermetically-sealed vial to collect the soil sample. The seal of the vial is never broken from the time of sampling to the time of analysis. A patented tool called the EnCore™ Sampler (approved by the EPA) will be used to collect soil samples for VOC analyses. A copy of the EPA Method 5035 sampling procedure using the EnCore™ sampler is presented in Appendix B.

EnCore™ Sampling Procedure

Soil sample collection for VOC shall be performed with the use of the EnCore™ sampler.

The sample collection procedure for soil volatiles using the EnCore™ sampler is as follows:

1) Collect three EnCore™ samples and one percent moisture sample (60ml wide mouth glass container with no head space) for each sample point location.

2) Remove the sampler and cap from the EnCore™ package and attach the T-handle to the sampler body.

3) Turn the handle and coring body down, to position the plunger so that the bottom is flush with the bottom of the freshly exposed surface of soil (ground surface or soil core sample). Quickly push the sampler into the soil until the coring body is completely full. When full, the small o-ring will be centered in the handle viewing hole. Remove the sampler from the soil and scrape any excess soil flush with the edge of the sampler using a dedicated decontaminated stainless steel trowel.

4) Use a paper towel to quickly and carefully wipe the sampler head so that the cap can be tightly attached and sealed.

5) To attach the cap, push the cap on with a twisting motion. The cap is properly sealed when the two locking arms are completely seated over the ridge on the body of the sampler.
6) Record the sample identification and time in the field book or log.
7) Complete the sample label on the EnCore™ zipper lock package.
8) Fill in the sample identification number on the self-adhesive label attached beneath the sample label on the EnCore™ package.
9) Tear the self-adhesive label at the perforation and attach the label to the rim of the sampler cap.
10) Place the sampler back into the EnCore™ zipper lock package and seal the zipper lock. The sample label is placed over the opening of the EnCore™ zipper lock package to ensure sample integrity.
11) Repeat the procedure above for the other two samplers.
12) Once all three samplers have been filled, labeled and packaged, place the three EnCore™ packages into one large zipper lock bag with a completed sample tag.
13) Collect the percent moisture sample in a separate sample container (60ml wide mouth glass container). Label the container with the sample designation.
14) Store the samples in a cooler with bagged ice to maintain 4 degrees Celsius while storing on site and during shipment to the laboratory.
15) Samples must be shipped off site to the laboratory within 24 hours.
16) Samples must be received by the laboratory for preservation and preparation for extraction within 2 days from the date of sample collection.

3.2.6 Field Screening of Soil Samples

Field screening methods will be used to screen soils for VOC or mercury contamination. Soil samples will be screened at 2-ft intervals, regardless of whether a 2-ft split spoon sampler or 4-ft macro core sampler is used. In each area of concern, the sample showing the highest field screening result for VOCs and the sample showing the highest result for mercury will be submitted for laboratory analyses. The field screening procedures are described below.

Volatile Organic Compounds

After a PID (HNU model PI-101, or equivalent) is calibrated (Section 3.9), it is ready to be used. A baseline scan (i.e., scan on "clean air", "clean water" or "clean soil", as appropriate) should be run each day before analyzing site samples and the results recorded.

A background meter reading will be obtained and recorded at the time of field screening. If a concentration above several parts per million (ppm) is detected as background, the source of the reading will be investigated and controlled, if possible, or other appropriate actions taken as provided for in the RI/FS HASP.

The following general procedures will be used to screen for organic vapors using a PID:

- With the calibrated PID turned on, hold the tip of the probe extension approximately one inch from the material being screened. Special care must be exercised not to place the probe extension into the sample or close enough for any soil particles or liquid to be drawn into the probe and contaminate the probe. (Note: For health and safety procedures, the probe is generally located in the breathing zone for determination of the level of personal protection required.)
- Hold the tip of the probe extension above the sample being screened for at least ten seconds or long enough for the instrument readings to stabilize so a reliable reading is obtained.
- Record PID readings either manually on the appropriate field data forms (e.g., sample log, boring log, or the field note book) or electronically (as a data point in the instrument's memory). On newer PID models, data may be stored in the PID memory or downloaded through an external downloading port onto a personal or portable computer.
- Once the PID has been calibrated and turned on, the PID should remain on in the "stand-by" mode when not in use.

PID readings and visual observations will be used to identify the presence or absence of VOC contamination within each split spoon soil sample. The PID reading and visual observations will be recorded on the boring log and in the project field book. The results of the screening surveys will be used to provide a qualitative assessment of subsurface soil contamination.

Mercury

After the MVA (Jerome model 431-X MVA, or equivalent) is calibrated (Section 3.9), it is ready to be used. A baseline scan (i.e., scan on "clean air", "clean water" or "clean soil", as appropriate) should be run each day before analyzing site samples and the results recorded.

A background meter reading will be obtained and recorded at the time of field screening. If a concentration above several ppm is detected as background, the source of the reading will be investigated and controlled, if possible, or other appropriate actions taken as provided for in the site-specific RI/FS HASP.

The following general procedures will be used to screen for mercury vapors using an MVA:

- With the calibrated MVA turned on, hold the tip of the probe extension approximately one inch from the material being screened. Special care must be exercised not to place the probe extension into the sample or close enough for any soil particles or liquid to be drawn into the probe and contaminate the probe.
- Press the sample button and hold the tip of the probe extension above the sample being screened for at least twelve seconds or long enough for the instrument readings to stabilize so a reliable reading is obtained.
- Record MVA readings either manually on the appropriate field data forms (e.g., sample log, boring log, or the field note book).

- Turn the MVA off when not in use and install the zero air filter in the instrument intake during storage.

MVA readings and visual observations will be used to give a preliminary assessment of the presence or absence of mercury contamination within each split spoon soil sample. The MVA reading and visual observations will be recorded on the boring log and in the project field book. The results of the screening surveys will be used to provide a qualitative assessment of subsurface soil contamination.

Note if free elemental mercury is observed in a given sample, the headspace analyses will not be conducted. Instead, the depth interval and nature of the sample will be carefully documented and the sample will be archived for later evaluation. The presence of free mercury indicates that gross contamination is present far above regulatory criteria and consequently, neither headspace screening nor laboratory analyses of that sample would provide useful information.

3.2.7 Borehole Sealing

The RI/FS borings that penetrate the Tidal Marsh Deposit (TMD), described in the RI/FS Work Plan (Section 1.9.2), or are greater than 25 feet in depth will be sealed prior to abandonment to prevent downhole contamination. Sealing will be achieved by backfilling the borehole with bentonite or with a cement/bentonite grout. The grout will be pumped into the boring from bottom to top using either a tremie pipe or the drill rods. Borings with depths of less than 25 feet or which do not penetrate the TMD will be backfilled with the original soil and tamped. It is also anticipated that the monitoring wells MW-1 through MW-6 (Figure 1-2) installed in 1981 (Geraghty & Miller, 1982) will be sealed because of poor construction, pending approval from the EPA.

The boreholes will be sealed by a NJ licensed well sealer in accordance with N.J.A.C. 7:9-9, Sealing of Observation Wells. The following procedure will be used when sealing boreholes:

1) The grout slurry composition to be used is as follows:

Pounds of Bentonite:	5.0
Pounds of Cement:	94.0
Gallons of Water:	8.3

2) Calculate the volume of the borehole based on the bit or auger head diameter plus 10%, and determine the volume of grout to be injected. Generally, the total mixed volume is the borehole volume plus 20%.
3) Identify the equipment to be used for the preparation and mixing of the grout. Document that the volume of the tanks to be used for mixing is appropriate for the borehole sealing work.
4) Identify the source of the water to be used for the grout. Water with high sulfate or chloride levels, or heated water, should not be used. These types of waters can cause operational difficulties or modify the set-up time for the grout.
5) Identify the equipment to be used for injecting the grout. Confirm with the driller that the pump to be used has adequate pressure to enable complete return to surface.

6) Identify the volumes to be pumped at each stage or in total if only one stage is to be used.
7) Begin mixing the grout to be injected using a grout mixture specified in 1), above.
8) Record the type and amount of materials used during the mixing operation. Document that the ratios are within specification tolerance. Ensure the grout is thoroughly mixed and free of lumps. Record the consistency of the mixture.
9) Begin pumping the grout through the return line bypass system to confirm that all pump and surface fittings are secure.
10) Begin pumping the grout into the boring. Leave rods or tremie pipes in borehole (and withdraw slowly as pumping, if required) until grout level reaches the surface. Record the times and volumes injected.
11) Top off the grout level in the borehole after the rods or tremie pipe is removed.
12) Clear and clean the surface near the borehole. Level the ground to approximately the pre-existing grade. Add grout or cement as necessary to the area near the borehole. If feasible, document the setup time of the of the mixture.

Note: In most cases there may be some settling of the grout which takes place over several days. If settling occurs, the natural soils from the immediate vicinity or additional grout will be used to restore the area to grade. If a survey of the location has not yet been performed, the location will be staked prior to filling with natural soils so that it could be surveyed at a later time.

3.3 GROUNDWATER INVESTIGATION PROCEDURES

Eleven new monitoring wells will be installed for the RI/FS (Table 3-6). Monitoring well locations are shown in Figure A-21 (Appendix A). The monitoring wells will be installed by a New Jersey licensed well driller. The project driller will be responsible for obtaining the required NJDEP well permits for the RI/FS investigation. NJDEP well permits will be obtained for borings extending beyond 25 feet below the ground surface or for shallow temporary borings with temporary casing left in the ground for a period longer than 48 hours.

3.3.1 Monitoring Well Installation

Overburden monitoring wells with screens positioned across the water table will be installed during the RI. The well materials will be steam cleaned before installation. Well casings will consist of 2-inch ID, Schedule 40, polyvinyl chloride (PVC) pipe with flush mount threaded joints. The well screens will typically be a 5-ft long section of 2-inch diameter PVC. In no case will the screen length exceed 10 feet. The slot size will correlate to the particle size of the material being screened. If the well is screened in clay, the smallest slot size available will be used with the appropriate size sand for the filter pack. If the well is screened in sand and/or gravel, a 0.010-inch slot screen will be used with a No. 1 filter pack. The filter pack material shall be certified clean, inert, and well-rounded, containing less than two percent flat particles or fines. The bentonite seal shall consist of 100% sodium bentonite. Details of the anticipated monitoring well construction are presented in Table 3-7.

The overburden monitoring wells will be screened across the water table. As-built monitoring well logs (Appendix C) will be prepared by the field inspector after each well is completed. Specifically, the procedure described below will be followed during the installation of groundwater monitoring wells.

1) Advance the subsurface boring to the desired depth in accordance with ASTM D-1586-99 procedures, by means of hollow-stem auger drilling (Section 3.2.3).
2) Remove the center plug from the augers and measure the borehole depth using a weighted measuring tape.
3) Add approximately one foot of appropriately sized filter media to the base of the borehole.
4) Insert a 2-inch diameter PVC well screen and riser pipe into the borehole through the hollow stem augers. The well screens will be capped with threaded caps at the bottom.
5) Add sand to screen section of well while slowly removing the augers. The sand pack should extend at least two feet above the screen section within the borehole. Measure with a weighted tape.
6) Slowly add bentonite slurry to the borehole as the augers are slowly removed. The bentonite seal should extend at least two feet above the top of the sand pack section. Measure with a weighted tape.

   Note: The rate of removal of the auger from the borehole should closely follow the rate that the sand pack and bentonite fill the borehole.
7) The remainder of the borehole will be grouted to the ground surface using grouting materials through a tremie pipe as described below.
8) A cement/bentonite grout mixture will be prepared according to Table 1, Table 2, or Table 3 of the NJDEP Field Sampling Procedures Manual, 1992 for monitoring well specifications.
9) Pump cement/bentonite grout to the borehole through a side-discharge tremie pipe (i.e., pipe with a short, 90 degree elbow attached) from the top of the bentonite seal to the ground surface. The side discharge will avoid disturbing the bentonite seal.
10) Remove the tremie pipe and remaining augers from the borehole.
11) Top off grout in the borehole. Grout should extend to approximately two feet below the ground surface.
12) Cut the well riser pipe to about two feet above the ground surface where a stickup casing will be used or just below the ground surface for a flush-mounted well.
13) Backfill the remaining two feet of borehole with concrete.
14) The top of the riser will be notched to be used as a reference point for water level measurements. A well cap will be installed.

15) Install a protective 6-inch diameter steel casing equipped with a locking cap or a flush-mounted manhole cap over the well riser pipe and set it into the concrete backfill. Label the casing permanently with the well identification.
16) Lock the protective casing cap.
17) Construct a 2-ft by 2-ft by 4-inch concrete pad around the protective casing. Slope the pad away from the protective casing.

A diagram showing typical monitoring well construction details is presented in Appendix D. Allow the grout for the protective casing to set for at least 24 hours before developing the new monitoring well.

3.3.2 Well Development

After drilling, and no sooner than 24 hours after well installation to allow the grout for the protective casing to cure, each new monitoring well will be developed by pumping or bailing until the discharged water is visually free of suspended particles, and if possible, achieves a nephelometric turbidity unit (NTU) of less than 5.0. Well development is the process of flushing the interface between the aquifer and the well. In addition, the filter pack and screen slots are cleaned, allowing ground water to flow into the monitoring well with a minimum of retardation. Development is required to (1) restore the natural permeability of the formation adjacent to the borehole, (2) remove clay, silt and other fines from the filter pack and well screen so that subsequent water samples will not contain excessive suspended matter; and (3) remove remnant drilling fluids and contaminants potentially introduced during drilling activities.

The development process is best accomplished by causing the natural formation water inside the well screen to be moved vigorously in and out through the screen in order to agitate the clay and silt. This causes clay and silt particles to be moved into the well where they can be removed or lodged into the sand pack and/or formation. Formation water will be used for surging the well. As required by the EPA (October 24, 2000) for this RI/FS, well development will be in accordance with the RCRA Ground Water Monitoring Draft Technical Guidance, November 1992 – Section 6.7, Well Development. If the well goes dry during development, it will then be developed with alternating cycles of purging and recovery. If, after reasonable repeated attempts, a turbidity reading of 5.0 NTUs is not achieved at any given well, then the EPA will be informed and recommendations for additional action will be presented.

Equipment used for well development will be cleaned before each use to prevent possible cross contamination of the wells. Decontamination procedures are described in Section 3.5.

Development of each well will be performed by pumping or bailing. Either of these methods will remove silt-laden water. A bailer which is heavy enough to sink rapidly through the water can be raised and lowered through the water column to produce an agitating action that is similar to that caused by a surge block. The bailer has the added capability of removing turbid water and fines each time it is brought to the surface.

A submersible pump can be used effectively where recharge is rapid. Surging can be accomplished by switching the power source on and off while pumping, causing ground water to move in and out through the screen, achieving the desired cleaning action. The size of the pump used is dependent upon the well design and associated recharge rate.

An inertial lift pump may also be used for development. This is a reciprocating pump, which recovers groundwater through a tube and foot valve assembly, utilizing the inertial lift principle. This method is especially effective for pumping water heavily laden with silt and clay.

The well development procedure selected for use by the field inspector will be based on conditions encountered during well installation and the construction details of a given monitoring well. The well development water recovered from each well will be handled as described in Section 3.6 – Investigation Derived Waste Handling.

Specific development procedures are as follows:

- Well development equipment will be assembled, decontaminated, as outlined in Section 3.5, and installed in the monitoring well. Care will be taken not to introduce contaminants to the equipment during installation.
- Monitoring wells will be developed using pumps with dedicated tubing. If a well yield is very low and is pumped dry, a dedicated bailer may be used to continue development after each recovery. No air or water will be injected into the well during development. The development will continue until the field inspector determines that the water is clear and free of solids based on NTU readings of 5.0 or less.
- Field observations, including the volume of water removed and the discharge water color will be recorded on a Well Development Log and also in the field log book. An example of a Well Development Log is shown in Appendix C. Field measurement of pH, temperature, and conductivity will be recorded periodically during well development.

ISP Environmental Services Inc. will make every reasonable attempt to develop the monitoring wells in accordance with the RCRA groundwater monitoring guidance (EPA, November 1992). As noted in Section 1.9.3 of the RI/FS Work Plan (Hydrogeology), however, the groundwater appears to exist in overburden under perched conditions over the Tidal Marsh Deposit, with a saturated thickness of only 1-2 feet,. Compliance with the 5.0 NTU criterion may not be possible if the yield of a given well is poor. Other factors may prevent achievement of low turbidity such as natural turbidity in pore water or tidal influences. In these cases, the attempts made to develop the well will be documented, the EPA will be notified, and recommendations for additional action will be presented.

3.3.3 Groundwater Level Measurement

Groundwater levels will be measured in each monitoring well at the site within a short time period (i.e., synoptic water level round) to determine the elevation of the water table across the site. These measurements will be collected after a period of two weeks or more after the last well was installed and developed to allow the water table aquifer to stabilize. An example of a Groundwater Level Measurement Log is shown in Appendix C.

Water level measurements will be collected with electric sounders, interface probes, pressure transducers, or water level recorders. The measuring device will be decontaminated according to the specifications in Section 3.5.

Groundwater levels will be measured to the nearest 0.01 foot from a referenced point, usually the top of the riser pipe or inner casing. Static water levels will be measured each time a well is sampled and before equipment is introduced into the well.

3.3.4 Collection of Groundwater Samples

Groundwater samples will be collected from the 11 new RI/FS monitoring wells (i.e., groundwater sampling of the Geraghty and Miller piezometers will not be conducted) and the 4 wells installed by Eder (1992). The monitoring well locations are shown on Figure A-21 (Appendix A) and their specifications summarized in Table 3-7. Before sampling the new wells, at least two weeks will be allowed to elapse after well development for aquifer stabilization. The low-flow method of sampling (EPA, 1998) will be used to collect groundwater samples for laboratory analysis.

3.3.4.1 Monitoring Well Purging – Low Flow Technique

Well purging for groundwater analyses will be performed by the low flow (or low stress) purging and sampling method described by the EPA (1998) using an appropriate pump such as a low-flow submersible pump or bladder pump. Peristaltic pumps will not be used because of the potential for volatile loss or alteration of pH because of degassing (Puls and Barcelona, 1996). Low flow purging and sampling methods result in the collection of groundwater samples that are representative of groundwater conditions in the geological formation. By setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing, the stress on the geological formation, as well as the disturbance of sediment that has collected inside the well, is minimized. This slow purge rate also approaches the natural flow rate of groundwater in the formation and the sample collected is most representative of the total mobile inorganic load in the aquifer. Dedicated Teflon tubing will be used for each sampled monitoring well.

If preliminary contamination information is provided by the boring data, then the least contaminated monitoring well will be purged and sampled first with remaining monitoring wells purged and sampled in the order of least contamination. Discharged water will be handled as described in Section 3.6. The general purging procedures are provided below:

1) Confirm the identification number of the monitoring well and record the security and integrity of the monitoring well
2) Unlock and remove the well cap
3) Obtain headspace vapor readings using a PID
4) Measure the depth to groundwater
5) Assemble the pump and set the intake to the mid-point of the saturated portion of the well screen. Record the length of saturated screen and the depth of the intake. Attach a "flow-through" water quality meter to the discharge end of the tubing to continuously monitor water quality parameters of pH, temperature,

specific conductance, oxidation reduction potential (ORP), dissolved oxygen, salinity, and turbidity.

6) Begin purging the monitoring well and record the time.

7) Start purging the monitoring well at a flow rate of 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level.

8) Observe drawdown levels in the pumping well. Drawdown, when incurred, will not exceed 0.3 ft. Should it appear that this maximum is being approached, the flow rate will be decreased to further minimize drawdown.

9) Measure the pumping rate and water elevations every five minutes over the first 15 minutes and then every 15 minutes using a graduated cylinder, flow meter, or equivalent device, and a stopwatch. The purpose of these measurements is to collect monitoring data to be used as a quality control check on pumping rate and maintenance of a minimal drawdown (less than 0.3 ft drawdown). Should the flow rate be different than that specified, the speed of the pump will be slowly adjusted, as appropriate.

10) Monitor and record field parameters directly from the flow through meter during purging approximately every one to five minutes to provide an indication of ground water equilibration and stabilization. Field parameters to be monitored are: pH, temperature, specific conductance, salinity, ORP, dissolved oxygen, and turbidity.

11) Purging will continue until field parameters stabilize (values remain within + 0.1 for pH, + 3 percent for specific conductance, + 10 mv for ORP and + 10 percent for dissolved oxygen and turbidity for three consecutive measurements) or for a maximum of four hours. Dissolved oxygen and turbidity usually require the longest time to achieve stabilization.

12) After purging, the sampling discharge rate should be decreased to a flow rate between 100 ml/min and 250 ml/min while: (a) maintaining a constant water column level in the monitoring well; (b) maintaining stabilization of each of the required field parameters; and, (c) allowing for pumping without introducing any air bubbles in the Teflon sample tubing.

13) If the water quality parameters have not stabilized after 4 hours (EPA, 1998), discontinue purging, collect samples, and document attempts to reach stabilization in the field log book.

3.3.4.2 Monitoring Well Sampling

Sampling will follow purging without interruption of the pump operation to minimize the disturbance of the overlying stagnant water column in the monitoring well. Static water levels in the monitoring well are to be maintained with minimal drawdown during sampling. General sampling procedures are provided below:

1) Fill the sample containers directly from the discharge line.
2) The sample container should be filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.
3) Record the field measurements (e.g., pH, temperature, specific conductivity, ORP, dissolved oxygen, salinity, and turbidity) and relevant information on low flow purging rate and sampling in the field logbook.
4) After collection of the groundwater sample, add preservatives to the sample containers (if required and not already placed in the appropriate sample containers by the laboratory) and verify and adjust the pH, if necessary.
5) Record all appropriate data (including monitoring well identification number, time of sampling, description of sample, field measurements, etc.) in the field logbook.
6) After collection of the ground water samples, the tubing will be properly discarded.

The water level will be measured in the well after the samples are taken. The well cap will be replaced and the steel casing will be closed and locked. The relevant sampling equipment will be decontaminated as described in Section 3.5.

3.3.5 Field Permeability Testing (Slug Tests)

In-situ permeability tests using the slug test method will be conducted on the monitoring wells. The data will be recorded using an electric pressure transducer and digital data recorder (e.g., Hermit Data Logger). Slug tests will be conducted to determine the hydraulic characteristics of the water table and bedrock aquifer. Slug testing generally involves quickly submerging a solid cylinder of known volume (the "slug") into the water column (falling-head test). After the slug is inserted and as the water column drops to reach equilibrium, the change in water level versus time is recorded by an electric pressure transducer and data processor. After the water level has recovered, the slug is removed (rising-head test) and the response is recorded. The procedures to be followed during slug testing are described below.

Slug In – Falling Head Test

1) Record well number, time, and date; unlock protective casing
2) Check the well headspace with a PID immediately upon opening the well cap
3) Obtain an accurate static water level

4) Place the pressure transducer near the bottom of the well and hook up data logger

5) Place slug (solid PVC or equivalent cylinder) in the well and quickly lower the slug below static water level.

6) The electronic data logger will record the water levels under the Standard Log Schedule. Manual water levels, if used to support the digital data, will be measured according to the following time schedule:

Time since beginning of slug test, in minutes	Intervals between measurement, in minutes
0 - 2	0.5 (30 sec.)
2 - 5	1.0
5 - 30	5.0

7) Leave the slug in place until the well has recovered to within at least 90 percent of its original static water level. In cases of very slow recharge, a 90 percent recovery is not practical, and the test will be run for a minimum of ½ hour to attempt to accumulate sufficient test data

The falling head or "slug in" method is suitable only for a well in which the screen is fully submerged. If the screen is partially submerged, the test data will overestimate the hydraulic conductivity of the aquifer. After the drawdown phase of the slug test has recovered to within 90 percent; the "slug out" test is initiated.

Slug Out – Rising Head Test

1) Quickly remove slug from the well.

2) Allow the water level to recover to at least 90 percent of the original static water level or until the requirements of paragraph seven above have been met.

3) Clean and dry all equipment (slug, rope, tape) used in the test.

The data results of the permeability tests are interpreted based on the Bouwer and Rice Method (Bouwer and Rice, 1976, Bouwer, 1989). The following formula (Bouwer and Rice, 1976) will be used to calculate hydraulic conductivity (K):

$$K = \frac{r_e^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln \frac{y_o}{y_t}$$

Where:

r_e = well radius (ft)
R_e = effective radial distance over which the head difference is dissipated (ft)
r_w = radial distance between well center and undisturbed aquifer (ft)
L_e = length of saturated screen (ft)
y_o = water level y at time zero (ft)
y_t = water level y at time t ((ft))
t = time since y_o (minutes).

As stated above, falling head tests are suitable only for those wells with a completely saturated screen interval. Therefore, only rising head tests will be performed on the shallow wells because they will be screened across the water table.

3.3.6 Tide Investigation

It was noted during RI-scoping site reconnaissances that surface water is not present along the entire length of South Branch Creek at all times. Surface water is periodically absent from the LCP bulk head area, presumably during low tide. South Branch Creek is apparently more of a drainage channel than an established, perennial, flowing stream. The effects of Arthur Kill tides on South Branch Creek will be assessed and documented through the installation and periodic monitoring of a staff gauge. A commercial staff gauge (e.g., Ben Meadows Company graduated model) will be affixed to the bridge that spans South Bridge Creek between the two tank farms (Figure 3-2).

The groundwater levels of 9 monitoring wells will be monitored to compare tidal variations in surface water and groundwater, determine the tide fluctuations in groundwater across the site, and determine mean groundwater elevations and hydraulic gradients at the site. The nine monitoring wells will be monitored for an approximate one-week period to record a range of daily tidal cycles. The locations of the monitoring wells in the tide investigation (MW-6 through MW-10, MW-14 through MW-17) are shown in Figure A-21 (Appendix A). The staff gauge installed in South Branch Creek will be surveyed so that surface water levels and tidal variations can be monitored and compared to groundwater levels at the site.

The groundwater measurements will be collected from the wells and from the staff gauge using In-Situ brand Troll model pressure transducers and data loggers (or equivalent equipment). The transducers will be programmed to collect and record a time and pressure head reading once per hour during the monitoring time period. Three additional transducers will be placed along the channel of South Branch Creek (bulkhead area, mid stream, and by Arthur Kill) to monitor the amount of water that actually inundates the channel during high and low tides (Figure 3-2).

Tidal fluctuations in surface water bodies produce progressive pressure waves in adjacent aquifers. As these pressure waves propagate inland, groundwater levels and hydraulic gradients continuously fluctuate, creating a situation where a single set of water level measurements cannot be used to accurately characterize groundwater flow. At any measuring point (e.g., monitoring well) where groundwater fluctuates because of tides, the magnitude and direction of the hydraulic gradient fluctuates about the mean or regional hydraulic gradient. The net effect of these fluctuations on groundwater flow can be determined calculating the mean hydraulic gradient for that measuring point. This is done by filtering groundwater level measurements recorded over a period of time to obtain a mean groundwater elevation for that measuring point. A filtering method, described by Serfes (1991), using 71 consecutive hourly water level observations will be used on the data to calculate the mean water level for each monitoring point.

The filtering method (Serfes, 1991) removes the diurnal and semidiurnal lunar and solar harmonics from 71 consecutive hourly observations. Using moving averages it yields a filtered mean level for the median time of the 71 hours. First, a sequence of mean is computed for 24 observations, starting with observation one for the first mean and observation 48 for the last, yielding a total of 48 means. Second, a similar series of means is computed for 24 of those means yielding 25 means. Last, the mean of those 25 means is computed yielding the mean level at hour 36.

The filtering method can be expressed mathematically as:

Let the consecutive hourly water level values be O (1), O (2), O (3)..., O(71):

The first sequence of means (Xi) is

$$X_i = \sum_{K=0}^{23} \frac{O(K+i)}{24}$$

where I = 1, 2, 3, ..., 48;

the second sequence of means (Yj) is

$$Y_j = \sum_{i=0}^{23} \frac{X_i + j}{24}$$

where j = 1, 2, 3, ...,25;

then the mean level (M) at hour 36 is

$$M = \sum_{j=1}^{25} \frac{Y_j}{25}$$

The mean groundwater elevations from the 71-hour period will be used to construct groundwater elevation contour maps for the site. Recommendations for or against additional tide investigations will be made on the basis of an evaluation of the data and presented in the RI report.

3.4 SURFACE WATER AND SEDIMENT INVESTIGATIONS

Surface water and sediment sampling of South Branch Creek is proposed at six locations (Figure 1-2). When sampling for both surface water and sediment at the same location, the surface water sample will be taken first with care not to disturb bottom sediments. When possible, surface water grab samples will be collected in the actual container to be used to transport the sample to the laboratory. Therefore, pre-preserved containers are not to be used as collection vessels. Required preservatives will be added after the samples are collected. Surface water samples will be collected at mid-depth of the water column. A horizontal sample collector, such as a pond sampler, may be used to access a surface water sampling location otherwise inaccessible. The samples will be collected following the guidelines described in the NJDEP Field Sampling Procedures manual (NJDEP, 1992). Surface water and sediment samples will be collected in a "downstream" to "upstream" direction (i.e., in a direction opposite the flow direction of the Arthur Kill tides), to minimize the chance of spreading disturbed sediment to unsampled locations.

Surface Water

The following procedure will be used to collect surface water directly in sample containers provided by the project laboratory:

1) Don a clean pair of latex gloves.
2) Estimate sampling depth by visual observation (for shallow samples) or measure depth using a weighted, flexible measuring tape or a rigid gage.
3) Invert the laboratory-supplied sample container (without preservatives), insert the sample container into the water to the desired level, and then turn the mouth of the sample container up and towards the upstream direction thus allowing the container to fill.
4) Cap sample container while container is still underwater, if possible.
5) Remove sample container from water body and cap if not already capped.
6) Rinse the exterior of the sample container thoroughly with deionized water and label container.
7) Add preservatives and check for appropriate pH.

Record all appropriate data (including sampling location, sampling depth, time of sampling, and description of sample) in field logbook or the Surface Water Sampling Log (Appendix C).

Sediment

The procedures for collecting surface and subsurface sediment samples for analytical and physical parameters are provided below. Based on stream characteristics and logistics, a hand corer (or equivalent device) is selected as the default sampling method for sampling sediment because this method can be used to collect a relatively undisturbed sample that shows a profile of stratification. The procedure to collect a sample using a hand corer is described below.

1) Record the sample location on a site map and in the field logbook.
2) Decontaminate stainless steel sampling equipment in accordance with the procedures outlined in Section 3.5.
3) Don a clean pair of latex gloves.
4) Push core tube into the surface of sediment.
5) Measure length of core tube above surface of water.
6) Manually push or hammer the core tube into the sediment to the two-ft depth.
7) Fill core tube with water (to remove air above sediment/water interface) and cap top of core tube.

8) Pull core tube out of sediment, as bottom tube breaks water surface, cap bottom of core.
9) Measure the sediment in the core tube to determine depth of penetration and recovery.
10) Transfer (using a decontaminated spoon) each selected depth interval of sediment into separate stainless steel bowls.
11) Decontaminate stainless steel sampling equipment in accordance with the procedures outlined in Section 3.5.

Repeat the steps for pushing and retrieving the core tube to obtain a sufficient quantity of sediment for all chemical and physical analyses. Sediment samples may also be collected using decontaminated stainless steel sampling scoops, trowels, or petit ponar samplers.

The following steps will be performed once the sample is collected:

- Label the sampling jars
- Homogenize sediment from each depth interval and transfer the sediment into appropriate sample containers using the decontaminated spoon.
- Store and document sample. A sample form is included in Appendix C.
- Mark sampling location with a buoy, stake, or other indicator for subsequent surveying of sample locations.

Sampling equipment shall be decontaminated after the collection of each sample in accordance with the procedures outlined in Section 3.5. Record all appropriate data (including sampling location, sampling depth, time of sampling, and description of sample) in field logbook or the Sediment Sampling Log (Appendix C).

3.5 EQUIPMENT DECONTAMINATION

To minimize the chance of cross contamination, the equipment used during the field investigation will be decontaminated in accordance with NJDEP guidelines (May 1992). The decontamination water will be collected and containerized in 55-gallon drums or in a larger portable storage tank or tote. The cleaning procedures described in the following sections will be used for the RI/FS. The equipment used to collect samples for laboratory analyses will be precleaned in a laboratory (e.g., sampling spoons, etc.) and dedicated for that sampling point. Whenever feasible, all field sampling equipment will be laboratory cleaned, wrapped, and dedicated to a particular sampling point. For this RI, stainless steel sampling spoons and trowels that are used to collect soil or sediment samples submitted for chemical analysis will be laboratory decontaminated whenever possible. Disposable Teflon bailers, if used to collect water samples (although not likely with the use of low-flow sampling techniques), will also be dedicated, vendor decontaminated, and wrapped in autoclaved aluminum foil. The field-cleaning of sampling equipment used to collect samples for analyses will be avoided to the extent possible.

The decontamination water will be sent for disposal in accordance with the analytical results of the waste characterization tests that will be performed at the end of the field investigation.

If approved by the EPA, the decontamination water will be treated at the storm water treatment unit located on site.

3.5.1 Large Equipment

Large equipment, such as backhoes, drill rigs, and ancillary equipment, will be decontaminated upon arrival at the site, between borings, and before demobilization. Decontamination will consist of a high pressure hot water or "steam" wash and brushing to remove encrusted material. Potable water obtained from fire hydrants or a local source located near the site will be used. The drill rig equipment and tools used during these activities will be pressure cleaned after the completion of each soil boring to minimize the potential for cross contamination.

3.5.2 Soil Sampling Equipment

Nondedicated soil sampling equipment, with the exception of the Direct-push samplers, used for collecting samples for laboratory analysis (i.e., split spoon samplers, specialized soil samplers, spoons, and scoops) will be decontaminated using the nine-step decontamination procedure as follows:

1) Alconox or low-sudsing detergent scrub and potable water wash
2) Generous tap water rinse in a second wash tub
3) Distilled and deionized (ASTM Type II) water rinse
4) Ten percent nitric acid rinse (only if sample is to be analyzed for metals)
5) Distilled and deionized (ASTM Type II) water rinse (only if sample is to be analyzed for metals)
6) Acetone (pesticide grade) rinse (only if sample is to be analyzed for organics)
7) Distilled and deionized (ASTM Type II) water rinse (only if sample is to be analyzed for organics)
8) Total air dry
9) Aluminum foil wrap equipment (if not reused immediately)

Soil sampling equipment used for stratigraphic soil sampling only (i.e., split spoon samplers, Shelby tubes, and specialized soil samplers) will be decontaminated using the following procedure:

1) Alconox or low-sudsing detergent scrub and potable water wash
2) Generous tap water rinse in a second wash tub
3) Distilled and deionized (ASTM Type II) water rinse
4) Total air dry
5) Place equipment in aluminum foil or wrap in plastic (if not reused immediately)

Grossly contaminated soil sampling equipment will be decontaminated using the nine-step procedure described above.

3.5.3 Water Sampling Equipment

If field cleaning of aqueous sampling equipment is required, then the following nine-step decontamination procedure shall be used:

1. Alconox or low-sudsing detergent scrub and potable water wash
2. Generous tap water rinse in a second wash tub
3. Distilled and deionized (ASTM Type II) water rinse
4. Ten percent nitric acid rinse (only if sample is to be analyzed for metals)
5. Distilled and deionized (ASTM Type II) water rinse (only if sample is to be analyzed for metals)
6. Acetone (pesticide grade) rinse (only if sample is to be analyzed for organics)
7. Distilled and deionized (ASTM Type II) water rinse (only if sample is to be analyzed for organics)
8. Total air dry
9. Aluminum foil wrap equipment (if not reused immediately)

3.5.4 Monitoring Well Riser and Screen

Before installation, field cleaning of PVC well riser and screen will consist of a manual scrubbing to remove foreign material and steam cleaning, inside and out. The PVC riser and screen will then be handled and stored in such a manner so as to prevent cross contamination prior to installation.

3.5.5 Pumps and Lines

Pumps and lines are the most difficult items to clean because they are awkward to handle in the field and require large volumes of cleaning agents. It is important that contaminants not be carried from well to well. If the wells are found to contain only "clear" water with no observable organic film or phase, decontamination will be accomplished between each well as described below. Grossly contaminated pumps will not be reused at the site and an alternate sampling approach for the well containing free product will be considered.

To decontaminate submersible pumps the coiled lines and pump will be drained of water as best as possible. The pump and lines will be placed in a large bucket and scrubbed with dilute non-phosphate detergent. The pump will then be placed in a plastic overpack drum or plastic garbage can (metal drums should be avoided if using electric pumps) and a minimum of 20 gallons of water will be flushed through it. After the flush, the outside of the pump will be rinsed with distilled and deionized water. Pump tubing cleaned in this manner will be used solely for well purging, not for sample collection.

Surface pumps (e.g., centrifugal, inertial lift, etc.) used at the site for well purging or well development will not require decontamination because dedicated tubing will be used together with a dedicated foot valve, to prevent backflow of water from the pump into the well.

3.6 INVESTIGATION DERIVED WASTE HANDLING

The disposal of wastes generated during the RI/FS, such as soil cuttings and groundwater development water, will follow the guidelines in the NJDEP Field Sampling Procedures Manual (NJDEP, 1992).

For monitoring well development and purge water, if there is no obvious contamination observed during drilling and well installation, if the development water does not have an observable sheen or odor, and if the PID readings of the water remain at background levels, the development/purge water will be discharged to the ground surface and allowed to percolate back to the groundwater system. In general, the water will be discharged to the ground upgradient of each monitoring well and not in areas where it may run off the site. If development/purge water has signs of gross contamination, it will be collected in U.S. Department of Transportation (DOT) approved (or equivalent) 55-gallon drums and stored at the site staging area. These suspected fluids would be analyzed to determine their toxicity characteristics. After the analytical results are received, these fluids will be disposed of in accordance with applicable local, state, and federal regulations. EPA will be informed before wastewater generated at the site is removed off site for disposal.

Other disposable materials such as personnel protective gear (e.g., gloves, Tyveks) will be collected in plastic bags or DOT-approved 55-gallon drums for subsequent disposal.

The unused shallow soil drill cuttings and soil samples will either be drummed for disposal (if visually grossly contaminated or exhibiting high field screening results), stockpiled at the staging area under tarps and plastic for later characterization (if samples appear uncontaminated), or saved and archived for soil description and stratigraphic identifications.

Containerized materials will be transported to the site storage area (Figure 3-1), placed on pallets, and the contents labeled with weather-resistant labels or markers on the drum exteriors. The field inspector will maintain a log of the drums, their contents, and associated analytical data.

The project consultant will coordinate disposal of investigation-derived waste with a disposal contractor. These materials will be handled, transported, and disposed of according to requirements mandated by applicable federal, state, and/or local hazardous waste regulations. The disposal of non-hazardous waste materials generated at the site will be the responsibility of the each subcontractor that generated that material (e.g., drilling and sampling disposables, grout bags, excess monitoring well materials, etc.).

3.7 SURVEYING

A land survey will be performed by a New Jersey State licensed surveyor to horizontally and vertically locate the sampling points established during the RI (i.e., monitoring wells, soil borings, sediment sample locations, etc.). The inner casing (riser) of monitoring wells, as well as the ground elevation and elevation of the outer casing, will be surveyed for both horizontal and vertical control, to a degree of accuracy of 0.01 foot. The survey data will be referenced to the 1983 New Jersey State Coordinate System (North American Datum of 1983) and to the North American Vertical Datum of 1988.

3.8 SAMPLE HANDLING

Numerous environmental samples will be collected during the RI/FS and submitted for laboratory analyses. The matrix of the samples will consist of soil, sediment, groundwater, and surface water. The general locations of the samples, the sample designations, and the analytical parameters are described in Table 3-2. The distribution of the sampling points across the site is shown in Figure 1-2. The requirements for sample containers, identification of samples and packaging and shipping of samples are described below.

3.8.1 Quality Control Samples

An important aspect of the field investigation is to document and preserve the quality of the analytical data that will be generated through sample collection and laboratory analyses. Therefore, field QA/QC samples will be collected at regular intervals during the sampling program to partly satisfy this objective. The QA/QC samples will be collected in such a way that a clear association between the environmental samples and the associated QA/QC sample is established. Field records of the association will be documented and maintained. Definitions, sampling requirements, and frequency of collection of the QA/QC samples are described below. A summary of the laboratory analyses by matrix, the number of QA/QC samples, and total number of samples that will be collected at the site is presented in Table 3-8, Table 3-9 and Table 3-10.

3.8.1.1 Field Blanks

A field blank is deionized water that is poured into or pumped through the dedicated or field decontaminated sampling device, transferred to the appropriate sample containers, and transported to the laboratory for analysis. Field blanks will be prepared on sampling equipment used to collect aqueous and soil samples. Sampling equipment for aqueous samples include tubing. Sampling equipment for soil samples include stainless steel trowels and split spoons, but not EnCore™ samplers. Field blanks are not required for EnCore™ samplers (EPA Region II, personal communication to URS, Telecon November 1, 2000). The field blank samples will be analyzed for the same parameters as the samples being collected at the time of the preparation of the field blank, with the exception of VOCs that are associated with EnCore™ sampling. At a minimum, one field blank sample will be prepared per matrix for each day that samples are collected, in accordance with the NJDEP guidelines (May 1992, February 1997).

3.8.1.2 Duplicate Samples

A duplicate sample is a second sample collected independently at the same location as the original sample during a single sampling event. Duplicate sample results are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. Five percent of the samples collected shall be field duplicates (one duplicate for every 20 samples). Both the duplicate and the sample shall be analyzed for the same parameters in the laboratory.

The duplicate sample will be submitted to the laboratory without their knowledge of the sample designation (i.e., "blind" duplicate sample). The field logbook shall identify the duplicate sample locations. This information will not be indicated on the label, the chain of custody, or any other documents that accompany the sample to the laboratory so that the laboratory cannot establish the association of a duplicate sample.

3.8.1.3 Trip Blanks

This section describes the trip blank procedures for the collection and shipment of samples that are collected for the laboratory analysis of VOCs. Trip blanks will not be used if VOC samples are not collected on a given day.

For aqueous samples, a trip blank is a volatile sample vial filled in the laboratory with organic-free water (Type II, reagent grade water), transported to the site, handled like a sample, and returned to the laboratory for analysis. Trip blanks are used only for aqueous volatile samples and are subjected to the same handling as other samples. Trip blanks are not required for samples collected with EnCore™ sampler (EPA, October 24, 2000). Trip blanks will be prepared and preserved with Hydrochloric Acid (HCl) to pH less than 2.0 by the laboratory and will arrive on-site within one day of their preparation. Trip Blanks will not be held on-site longer than two calendar days. Trip blanks will not be opened in the field. Trip blanks serve to identify contamination from sample containers or transportation and storage procedures. For every cooler containing water samples collected for VOC analysis, one trip blank will be added to the cooler and analyzed for the presence of VOCs.

3.8.1.4 Temperature Blank

A temperature blank will be used in each sample shuttle to measure the temperature of the samples upon shipment arrival to the laboratory. The temperature blank consists of a small vial filled with water. The vial will be labeled Region II Temperature Blank. If, upon arrival to the laboratory, the temperature of the blank is below 10 degrees Celsius, the samples will be accepted for analysis. If the temperature is at or greater than 10 degrees Celsius, the laboratory will notify the Project Manager or the designated Project Chemist immediately. The potential impacts to data usability of those samples will be discussed with the project chemist to decide whether or not additional samples would be required.

3.8.1.5 Matrix Spike and Matrix Spike Duplicate Samples

An aliquot of a matrix (water or soil) is fortified (spiked) with a known concentration of compounds of interest. The matrix spike and matrix spike duplicate (MS/MSD) are subjected to the entire analytical procedure in order to indicate both accuracy and precision of the method for the matrix by measuring the percent recovery and the relative percent difference (RPD) of the two spiked samples. These samples are used to assess matrix interference effects on the method, as well as to evaluate instrument performance. The MS/MSD data are used to evaluate the matrix effect, not to control the analytical process. MS/MSDs are analyzed for each matrix for every 20 environmental samples (five percent) or one per batch in order to maintain continuous surveillance of acceptable method performance. No extra field samples (just triple volume) are required for MS/MSDs.

3.8.2 Sample Container, Preservatives, and Holding Time Requirements

The selection of sample containers is based on both the media being sampled and the analytes of interest. The sample preservatives and laboratory holding times before analyses are also based on media and analytes of interest. The NJDEP four-day handling time requirement for laboratory blanks (NJDEP, 1992) will be adhered to during this investigation. A table summarizing the RI/FS sample bottle requirements for various media and analytical parameters is presented in Table 3-4. In general, the minimum preservation requirement for any sample is to store it at 4 degrees Celsius immediately after collection. A temperature blank (a vial filled with clean water) will be included with each cooler so that the project laboratory can document compliance with the temperature-preservation requirements immediately upon receipt of the samples.

3.8.3 Sample Designation and Labeling

The following procedures will be used to identify and track environmental samples collected during the field investigation. An unremovable and waterproof label will be affixed to each sample container. The following information will be written on the label with permanent marker:

- Site name
- Sample identification
- Consultant Project number
- Date/time
- Sampler's initials
- Sample preservation
- Analysis required

Typically, a label is filled out with the above information, affixed to the bottle, and then covered with wide clear tape for additional protection against accidental erasure.

3.8.4 Field Sample Numbering

The groundwater, surface water, and sediment samples collected at the site will be assigned the following, relatively standard designations:

- MW-XXX for groundwater monitoring well samples
- SW-XXX for surface water samples
- SED-XXX for sediment samples

The "XXX" shown above represents a numerical suffix that will be assigned to each sample in consecutive order.

Soil samples will be assigned a designation based on the name of the area of concern that they are associated with. For example, a sample collected from the former Waste Water Treatment Unit will be designated WWT-XXX while a sample collected from the area of the Bullet Tanks will be designated BT-XXX. Table 3-10 summarizes the sample designation scheme for the environmental samples.

Field QA/QC samples will consist of field blanks, trip blanks, blind duplicate samples, matrix spike samples and matrix spike duplicate samples. The following designations will be used to identify these samples following a "year (xx)-month (xx)-day (xx)" scheme:

- **FB**01-000415: First field blank prepared for the RI/FS on April 15, 2000.
- **TB**02-001115: Second trip blank used for the RI/FS on November 15, 2000.

- **DUP-1**: First blind duplicate sample of the RI/FS field investigation. The actual sample designation of the blind duplicate will be tracked by the field inspector through his or her field notes and recorded in the daily inspection report.

Matrix Spike and Matrix Spike Duplicate samples will be identified as needed by adding letters "MS" and "MSD", respectively to the end of the sample identification code (e.g., MW-1MS, MW-1MSD, etc.).

3.8.5 Sample Custody

At the time of the sampling, the field inspector will record the sample information in the field book and on a chain-of-custody form, noting on each any difficulties encountered in sampling. The label, logbook, and chain-of-custody form entries shall be made in waterproof ink. The sample information recorded in the logbooks should be at least as detailed as that recorded on labels, and should indicate the type of sample (e.g., groundwater, soil, waste, etc.), preservation technique, and sampling location, with sufficient detail as to allow resampling at the same location, if necessary.

Immediately after a sample is collected and transferred to the appropriate laboratory-supplied container, the field inspector will place the filled container in ice chests or coolers that contain ice for preservation. The field inspector will maintain custody of the samples until they are shipped or hand delivered to the laboratory. Samples submitted to the laboratory will be accompanied by a chain-of-custody form to provide documentation of the sampling event. These forms will be completed and sealed inside the cooler sent to the project laboratory. The following information will be included on the chain-of-custody form:

- Date and Time Sample was Collected
- Client or Consultant
- Project Name
- Sample Identification Number
- Sample Description
- Sample Container Numbers and Volumes
- Cooler Identification Number (if applicable)
- Analysis Required
- Preservatives (if applicable)
- Signatures of Persons Involved in Chain-of-Custody
- Date and Time of Possession
- Date and Time of Relinquishing Sample Custody

The entries on the chain-of-custody form will correspond to the field logbook and sample labels. Custody seals will be used to detect tampering with the samples before laboratory acceptance. Custody seals will be affixed to the cooler in a manner that requires seal breakage in order to open the cooler as discussed in Section 3.8.6. Unauthorized seal breakage indicates possible tampering and may render the analytical results of a sample suspect.

3.8.6 Sample Packaging and Shipping

This section describes the packaging and shipping procedures that will be used for the RI field samples.

3.8.6.1 Sample Packing

The samples collected for laboratory analysis will be shipped or hand delivered to the laboratory within 48 hours of the sample collection. Sample packaging and shipping procedures are summarized as follows:

1) Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the laboratory, or to/from a secure storage area. Commercial, overnight carriers (e.g., Federal Express Corporation) will not be involved in the Chain-of-Custody procedures because the custody form will be sealed inside the cooler at the time of shipment. An example of the Chain-of-Custody Form is included in Appendix C.
2) Samples will be properly packaged to avoid breakage, stored on ice at 4 degrees Celsius for shipment and dispatched to the appropriate laboratory for analysis. A separate signed custody record will be enclosed and secured to the inside top of each sample box or cooler. The chain-of-custody and any additional paperwork will be placed in a plastic "ziplock" bag to prevent them from getting wet.
3) Shipping containers will be secured with strapping tape and custody seals for delivery to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.
4) Courier or overnight carrier will transport samples to the laboratory.

For this investigation, it is anticipated that the laboratory samples collected at the site will be hand delivered to the laboratory by courier.

3.8.6.2 Hazardous Sample Shipping

The DOT and the International Air Transport Association (1998) have promulgated regulations for the packaging and shipping of DOT-defined hazardous materials under 49 Code of Federal Regulations (CFR) Parts 171 through 179 and IATA-defined dangerous goods. The EPA established three categories for samples:

<u>Low-Concentration Samples</u> - samples containing less than 10 ppm of any known contaminant. Examples include background soil, sediment, surface water, and groundwater samples that are collected from locations not expected to have been grossly impacted by or come in contact with hazardous materials. Low-concentration samples are considered environmental samples and are not regulated by the DOT or IATA since they do not pose a transportation hazard.

Medium-Concentration Samples - samples containing greater than 10 ppm but less than 15 percent (150,000 ppm) of the contaminant of highest concentration. Special regulations govern the shipment of medium-concentration samples; the field inspector will contact the environmental consultant's project manager for further instructions if medium-concentration samples require shipment.

High-Concentration Samples - samples containing greater than 15 percent of at least one contaminant. Special regulations govern the shipment of high-concentration samples; the field inspector will contact the environmental consultant's project manager for further instructions if high-concentration samples require shipment.

For this investigation, it is anticipated that the laboratory samples collected at the site will be low-concentration samples and that special shipping arrangements will not be required for the RI. The field inspector will notify the environmental consultant's project manager for instructions in the event that medium- or high-concentration samples are collected and require overnight shipment.

3.9 FIELD MEASUREMENTS AND EQUIPMENT CALIBRATION

Electronic instruments that are anticipated to be used during this field investigation include the following equipment (or equivalent equipment):

- Photoionization detector (e.g., HNU PI-101 with a 10.2 electron volt lamp)
- Flow-through water quality meter (e.g., YSI model 6820)
- Particulate dust monitor (e.g., MIE Miniram PDM-3)
- Water level indicator (e.g., Solinst water level meter)
- Slug test probes and data recorder (e.g., In-Situ, Inc. Hermit data logger and pressure transducers)
- Mercury Vapor Analyzer (Jerome 431-X)

Quality assurance requires that the devices and equipment used to perform field testing or data recording be calibrated before use. Calibration documentation will include identification of the instrument, serial number, date, reference standard, adjustments or repairs made, and the signature of the person performing the calibration. The calibration data will be recorded in the project field book or in an appropriate field calibration log (Appendix C). The calibration procedures will follow the manufacturer's guidance. Procedural summaries are also included in Appendix E.

On-site field calibration activities include the use of calibration standards and field equipment checks, as appropriate, for the equipment being used. Field calibration and/or field checking of each meter will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed both prior to and after equipment use. Field calibration will be documented in the field notebook.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to approved standards by qualified personnel. Equipment that cannot be repaired will be replaced.

Results of activities performed using field equipment that has failed recalibration will be evaluated by the environmental consultant's Project Manager or his/her designee. If the activity results are adversely affected, the results of the evaluation will be documented, appropriate personnel notified, and a decision made of the validity of the results.

Off-site calibration and maintenance of field instruments will be the responsibility of the owners of their respective instruments (i.e., subcontractors, the EPA, or any group working on site) and will be performed by the owners as appropriate throughout the duration of project activities. The field instrumentation, sampling equipment, and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled maintenance and unscheduled maintenance.

3.10 FIELD DOCUMENTATION

The details of field investigations will be recorded in a waterproof field book. The project field book will be a controlled, formal document that will record the events of the field investigation. Ancillary field data may be recorded on field logs specific to a given task. The subsurface borings will be logged on a Soil Boring Log, monitoring well construction will be logged on a Monitoring Well Construction Log, and purging and development of wells will be logged on Well Development/Purging Log. Soil boring logs will include descriptions of subsurface material encountered during drilling, sample numbers, types of samples recovered from the borehole, water elevation data, and PID/MVA (headspace and sample screening) information. Other examples of field logs are presented in Appendix C.

3.10.1 Field Book and Field Logs

They following types of information will be recorded in the field book:

1) Location of sample
2) Date and time of sample collection
3) Identity of people performing activities
4) Weather conditions
5) Boring identification
6) Location of borings in relation to easily identifiable landmark
7) Sampling intervals
8) Blow counts
9) Sample descriptions (Based upon USCS)
10) Identity and calibration of field instruments
11) Depth at which saturated conditions were encountered
12) Field instrument readings, background, borehole, and samples
13) Drilling method
14) Size of downhole equipment
15) Drilling rates
16) Materials used to backfill the boreholes and quantities
17) Personnel present on site

18) Visitors to the site
19) Chronology of daily events
20) Level of personnel protection
21) Field problems, solutions, and corrective actions

The field inspector, or person making entries on a given day, will date and sign each completed page of the project field book. The field book will be completed using indelible, water proof ink. The pages of the field book will be consecutively numbered and the pages will not be removed.

If changes in the field book are necessary, changes will be indicated by a single line drawn through the affected text. The individual responsible for the change will initial and date the entry. Each day's activities or separate sampling episodes will be signed. The logbook will be protected, stored in a safe file or other repository, and retained as a permanent record.

Upon completion of daily field activities, the field inspector will complete a daily inspection record form and initiate chain of custody on any samples collected for geotechnical or chemical laboratory testing. After the RI drilling program, the field team will transfer information from the field logs onto standard boring log forms for the Remedial Investigation Report. The field notes will be kept in the project files.

The following types of logs, forms, and field books will be used to document activities during the field investigation (Appendix C).

1) Field Book - weatherproof bound field book
2) Daily Inspection Record - will be filled out by the field inspector to provide a daily chronology of site events
3) Soil Boring Log – one log will be completed for each boring advanced at the site
4) Monitoring Well Construction Log - one log will be completed for each monitoring well installed at the site
5) Well Development/Purging Log- one log will be completed for each well developed or purged at the site
6) Well Sampling Form – one form will be completed for each monitoring well sampled at the site
7) Surface Soil Sampling Log – will record the location and physical description of the soil sample
8) Surface water/sediment sampling log - will record the location and description of the surface water and sediment sample
9) Equipment Calibration Log – will document the calibration of a given measuring instrument
10) Log of Photographs – will provide a description of photographs taken at the site
11) Slug Test Data Sheet – will record the data generated during a slug test

12) Chain-of-Custody Form – will accompany each set of coolers sent to the project laboratory on a given day
13) Water level log – the water level in each well will be recorded on these sheets.

The field book and field logs will provide QA/QC documentation for the general adherence to the sampling and data collection procedures established for the LCP Chemicals, Inc. RI and will also serve to document deviations from the anticipated scope of work. This information will be used for the Data Usability Summary report discussed in Section 14.0 of the RI/FS QAPP.

3.10.2 Photographic Documentation

Pertinent field activities and sample locations may be documented with photographs, subject to approval by ISP Environmental Services, Inc. The picture number and roll number will be logged in the field book to identify the area and activity depicted in the photograph. A separate photographic documentation log form (Appendix C) will be maintained by the Site Manager or designee. The log of photographs will include the date, the roll number, the picture number and a description of the area and activity depicted in the photograph. For cameras that use film, this information, exclusive of the description, will also be recorded on the back of each photograph and the photographs will be stored in the project file. For digital cameras, the photographic image will be stored in the project consultant's project computer directory and backed up during routine maintenance of their computer network system.

Videotape recording cameras may also be used during some field activities to provide an additional type of documentation. Videotapes will be labeled with pertinent project information and stored in the project file.

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TABLES

Table 3-1
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Releases near the Brine Sludge Lagoon **A.) East Berm** (Figure A-1)	Collect 18 soil samples from 12 borings based on field screening results and submit for laboratory analysis	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
B.) Leaking Pipe and Building 231 Area (Figure A-2)	Collect 24 soil samples from 16 borings based on field screening results and submit for laboratory analysis Install one water table monitoring well Collect groundwater samples from new monitoring well Submit for laboratory analysis	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well location Equipment decontamination Sample handling -chain of custody Field documentation
Chemfix Lagoon (Figure A-3)	Collect 14 soil samples from 9 borings based on field screening results and submit for laboratory analysis	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Former Sludge Roaster (Figure A-1)	Collect two surface soil samples from around the concrete pad biased toward areas of potential spills or releases	Collection of surface soil samples Subsurface soil borings (< 1 ft) - Hand corer or equivalent PID/Mercury vapor field screening of soil Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Building 230 and Building 240 Mercury Cell Rooms (Figure A-4)	Collect 12 soil samples from 25 nodes based on field screening results and submit for laboratory analysis	Collection of surface soil samples Subsurface utility locations Removal of concrete slab above boring location Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil soil (6 in. below slab) Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Building 231 (Purasiv area) (Figure A-5)	Collect 12 soil samples from 8 borings based on field screening results and submit for laboratory analysis Advance 1 of the 8 borings to 25 ft below ground surface for area stratigraphy Install one water table monitoring well Collect groundwater samples from new monitoring well Submit for laboratory analysis	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Collection of surface soil samples Surveying of sampling locations Boring sealing with Tremie grout Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well location Equipment decontamination Sample handling -chain of custody Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Former Transformers **A.) Building 231** (Figure A-6)	Collect 9 soil samples from 6 borings based on field screening results and submit for laboratory analysis.	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of surface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Former Transformers **B.) Building 230 and Building 240 Transformer Areas** (Figure A-6)	Collect 22 soil samples from 11 borings based on field screening results and submit for laboratory analysis. Advance 1 of the 11 borings to bedrock to evaluate stratigraphy.	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation
500K Tank (Figure A-7)	Collect 7 soil samples from 5 borings based on field screening results and submit for laboratory analysis. Install one water table monitoring well Collect groundwater sample from new monitoring well and submit for laboratory analysis.	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Collection of surface soil samples Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well location Equipment decontamination Sample handling -chain of custody Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Bullet Tanks (Figure A-8)	Collect 9 soil samples from 6 borings based on field screening results and submit for laboratory analysis. Advance 1 of the 6 borings to 25 ft below ground surface for area stratigraphy.	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Collection of surface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation
Salt Silo No. 4 (Figure A-7)	Collect 6 soil samples from 4 borings based on field screening results and submit for laboratory analysis. Install one water table monitoring well Collect groundwater samples from new monitoring well Submit for laboratory analysis.	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of surface soil samples Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well location Equipment decontamination Sample handling -chain of custody Field documentation
Drum Storage Pad (Figure A-9)	Collect 6 soil samples from 4 borings based on field screening results and submit for laboratory analysis. Advance 1 of the 4 borings to bedrock for area stratigraphy.	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Boring sealing with Tremie grout

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Drum Storage Pad (continued) (Figure A-9)	Install one water table monitoring well Collect groundwater samples from new monitoring well	Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well location Equipment decontamination Sample handling -chain of custody Field documentation
Concrete Drainage Channels (Figure A-10)	Collect 11 soil samples from 20 borings based on field screening results and submit for laboratory analysis. Advance 1 of the 20 borings to 25 ft below ground surface for area stratigraphy.	Collection of surface soil samples Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of surface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation Equipment calibration Field documentation
Former Waste Water Treatment Unit (Figure A-11)	Collect 6 soil samples from 3 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 1 ft) - Hand corer or equivalent Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
West of Avenue D and South of 4th Street (Figure A-12)	Collect 18 soil samples from 12 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
West of Avenue D and North of 4th Street (Figure A-12)	Collect 3 soil samples from 2 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
North of Building 223/Cl_2 Truck loading/HCl Storage (Figure A-13)	Collect 9 soil samples from 6 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
South of Building 223/CL2 Truck loading/HCl Storage and North of Shops and Services Building (Figure A-13)	Collect 16 soil samples from 11 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Along Railroad Tracks (Figure A-14)	Collect 22 soil samples from 14 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Between Building 220 and 230 (Figure A-13)	Collect 3 soil samples from 2 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Near 250K NaOH Storage Tank (Figure A-15)	Collect 4 soil samples from 3 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Between Old Chlorine Storage Tank and Avenue B (Figure A-15)	Collect 3 soil samples from 2 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
South of Building 240 (Figure A-13)	Collect 2 soil sample from 1 boring based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push or hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Adjacent to 150K Brine Tank (Figure A-15)	Collect 2 soil sample from 1 boring based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
East of Sludge Roaster Pad (Figure A-16)	Collect 2 soil sample from 1 boring based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Areas of Suspected Past Releases (Figure A-17)	Collect 2 surface soil samples from each of six areas of suspected past releases for a total of 12 surface soil samples.	Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push PID/Mercury vapor field screening of soil Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Potentially Contaminated Areas Away From Process Areas (Figure A-18)	Collect 9 soil samples from 6 borings based on field screening results and submit for laboratory analysis.	Collection of surface soil samples Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of subsurface soil samples Collection of soil sampes analysis Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation
Historic Fill (Figure A-19)	Collect 6 soil samples from 3 borings based on field screening results and submit for laboratory analysis. Advance 1 of the 3 borings to bedrock for area stratigraphy	Subsurface utility locations Subsurface soil borings (< 10 ft) - Direct push Subsurface soil borings (> 10 ft) - Hollow stem auger rig Logging of soil borings PID/Mercury vapor field screening of soil Collection of surface soil samples Collection of soil sampes analysis Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation
South Branch Creek (Figure A-20)	Collect 6 surface water samples from 6 sampling locations. Submit for laboratory analysis. Collect 18 sediment samples from 6 locations. Submit for laboratory analysis.	Field measurements Collection of surface water samples Surveying of sampling locations Installation of staff gauge Logging of sediment cores PID/Mercury vapor field screening of sediment Collection of sediment samples using hand corer or equivalent Surveying of sample locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation Tidal Study

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (continued)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
East of South Branch Creek (Figure A-16)	Collect 9 soil samples from 9 borings based on field screening results and submit for laboratory analysis.	Subsurface soil borings (< 2 ft) - Hand corer or equivalent Logging of soil borings Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration
Along South Branch Creek (South of Creek) (Figure A-16)	Collect 3 soil samples from 3 borings based on field screening results and submit for laboratory analysis.	Subsurface soil borings (< 2 ft) - Hand corer or equivalent Logging of soil borings Collection of subsurface soil samples Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Equipment calibration Field documentation
Site-Wide Groundwater Monitoring Wells (Figure A-21)	Install 6 water table monitoring wells Collect groundwater samples from 5 new AOC monitoring wells, 6 new site-wide wells, and from 4 existing wells. Submit for laboratory analysis. Advance 1 of the borings to bedrock for area stratigraphy.	Subsurface utility locations Subsurface soil borings (> 10 ft) - Hollow stem auger rig Groundwater monitoring well installation and development Groundwater purging and sampling through low-flow procedure Field measurements and equipment calibration Collection of groundwater samples Investigation derived waste handling Surveying of well locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Field documentation
Stratigraphy (Figure A-22)	Advance three borings to approximately 25 ft below ground surface and advance four borings to bedrock.	Subsurface utility locations Investigation derived waste handling Subsurface soil borings (> 10 ft) - Hollow stem auger rig Stratigraphic borings Logging of soil borings Surveying of sampling locations Boring sealing with Tremie grout Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-1 (concluded)
LCP Chemicals, Inc.
Summary of Remedial Investigation and Feasibility Study Activities

Site	Field Sampling Activities	Field Sampling Plan Procedures
Hydraulic Conductivity Tests	Conduct slug tests on 15 monitoring wells	Field permeability testing Field documentation
Tide investigation	Investigate the effects of Arthur Kill tides on site groundwater in wells MW-6, MW-7, MW-8, MW-9, MW-10 MW-14, MW-15, MW-16, and MW-17	Tide investigation Field documentation
Storage Tank and Building Survey	Survey the tanks and buildings at the site for potential releases to the environment.	Field documentation
12K Tank (Figure A-9)	Collect 4 soil samples from 2 borings based on field screening results and submit for laboratory analysis.	Subsurface utility locations Collection of surface soil samples Subsurface soil borings (< 10 ft) - Direct push Logging of soil borings PID/Mercury vapor field screening of soil Collection of surface soil samples Collection of soil sampes analysis Surveying of sampling locations Equipment decontamination Sample handling -chain of custody Boring sealing with Tremie grout Equipment calibration Field documentation

Note: See Appendix A for sampling location maps, Figure A-1 through Figure A-22

Table 3-2
LCP Chemicals, Inc.
RI/FS Sampling Locations and Analytical Protocols

Site	Sample Location	Matrix	Analytical Parameter
Releases Near Brine Sludge Lagoon East Berm	BSL-1 to BSL-12	Soil	dioxin & PCNs TCL/TAL Parameters
Leaking Pipe and Building 231 Area	LP-1 to LP-16	Soil	dioxin & PCNs TCL/TAL Parameters
Chemfix Lagoon	CF-1 to CF-9	Soil	dioxin & PCNs TCL/TAL Parameters
Sludge Roaster	SR-1 and SR-2	Soil	TCL/TAL Parameters
Building 230 and Building 240 Mercury Cell Rooms	MCR-1 to MCR-6	Soil	dioxin & PCNs TCL/TAL Parameters
Building 231 (Purasiv area)	231-B1 to 231-B8	Soil	dioxin & PCNs TCL/TAL Parameters
Former Transformers Building 231	231-B9 to 231-B14	Soil	dioxin & PCNs TCL/TAL Parameters
Building 230 and Building 240	230-B1 to 230-B11	Soil	TCL/TAL Parameters
500K Tank	5K-B1 to 5K-B5	Soil	TCL/TAL Parameters
Bullet Tanks	BT-1 to BT-6	Soil	TCL/TAL Parameters

Table 3-2 (continued)
LCP Chemicals, Inc.
RI/FS Sampling Locations and Analytical Protocols

Site	Sample Designations	Matrix	Analytical Parameter
Salt Silo No. 4	Silo-B1 to Silo-B4	Soil	TCL/TAL Parameters
Drum Storage Pad	DSP-B1 to DSP-B4	Soil	TCL/TAL Parameters
Concrete Drainage Channels	DC-SS1 to DC-SS10	Soil	TCL/TAL Parameters
Former Waste Water Treatment Unit	WWT-1 to WWT-3	Soil	TCL/TAL Parameters
Borings South of 4th Street	ADS-1 to ADS-12	Soil	TCL/TAL Parameters
Borings North of 4th Street	ADN-1 and ADN-2	Soil	TCL/TAL Parameters
Borings North of Building 223	TLN-1 to TLN-6	Soil	TCL/TAL Parameters
Building 223	TLS-1 to TLS-11	Soil	TCL/TAL Parameters
Borings Along Railroad Tracks	RR-1 to RR-14	Soil	TCL/TAL Parameters

Table 3-2 (continued)
LCP Chemicals, Inc.
RI/FS Sampling Locations and Analytical Protocols

Site	Sample Designations	Matrix	Analytical Parameter
Borings **Between Building 220 & 230**	220-1 and 220-2	Soil	dioxin & PCNs TCL/TAL Parameters
Borings Near 250K NaOH Storage Tank	ST-1 to ST-3	Soil	TCL/TAL Parameters
Area Between Old Chlorine Storage Tank and Avenue B	AB-1 and AB-2	Soil	TCL/TAL Parameters
Borings **South of Building 240**	SB-1	Soil	TCL/TAL Parameters
Borings **Adjacent to 150K Brine Tank**	BT-1	Soil	TCL/TAL Parameters
Borings **East Of Sludge Roaster Pad**	ESR-1	Soil	TCL/TAL Parameters
Areas of Suspected Past Releases	SPR-1 to SPR-6	Soil	TCL/TAL Parameters
Potentially Contaminated Areas Away from Process Areas	PCA-1 to PCA-6	Soil	TCL/TAL Parameters
Historic Fill	HF-B1 to HF-B3	Soil	TCL/TAL Parameters

Table 3-2 (concluded)
LCP Chemicals, Inc.
RI/FS Sampling Locations and Analytical Protocols

Site	Sample Designations	Matrix	Analytical Parameter
South Branch Creek	SW-1 to SW-6	Surface water	TCL/TAL Parameters Hardness
	SED-1 to SED-6	Sediment	TCL/TAL Parameters Grain Size TOC pH
East of South Branch Creek	EC-1 to EC-9	Soil	dioxin & PCNs TCL/TAL Parameters
South of South Branch Creek	SC-1 to SC-3	Soil	dioxin & PCNs TCL/TAL Parameters
Site-Wide Groundwater Monitoring Wells	MW-6 through MW-20	Groundwater	TCL/TAL Parameters
12K Tank	12K-B1 and 12K-B2	Soil	TCL/TAL Parameters

Notes:
TCL=Target Compound List
TAL=Target Analyte List
PCNs=Polychlorinated Naphthalenes
TOC=Total Organic Carbon

Table 3-3
LCP Chemicals, Inc.
Analytical Parameter and Laboratory Method Number

Soil

Analytical Parameter	Compound Analyte	Method Number
Target Compound List (TCL)	VOCs	5035/8260B
	SVOCs	8270C
	Pesticides	8081A
	PCBs	8082
Target Analyte List (TAL)	Aluminum Antimony Arsenic Barium Beryllium cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Nickel Potassium Selenium Silver Sodium Thallium Vanadium Zinc	6010B
	Mercury	7471A
	Cyanide	9012A
Miscellaneous	Dioxin	1613B
	Polychlorinated Naphthalenes (PCNs)	CLPSOW OLM04.2

Aqueous

Analytical Parameter	Compound Analyte	Method Number
Target Compound List (TCL)	VOCs	8260B
	SVOCs	8270C
	Pesticides	8081A
	PCBs	8082
Target Analyte List (TAL)	Aluminum Antimony Arsenic Barium Beryllium cadmium Calcium Chromium Cobalt Copper Iron Lead Magnesium Manganese Nickel Potassium Selenium Silver Sodium Thallium Vanadium Zinc	6010B
	Mercury	7470A
	Cyanide	9012A
Hardness	-	130.2

Sediment

pH	-	9045C
Grain Size	-	ASTM-D422
Total Organic Carbon	-	Kahn 1988

Table 3-4
LCP Chemicals, Inc.
Sample Container, Preservation, and Holding Time Requirements

Laboratory Analyses AQUEOUS	Holding Time	Recommended Container	Preservative
VOC (Method 8260B)	10 days of VTSR	40 ml glass with Teflon-lined septum	pH < 2 HCl, <4 deg. C
SVOC (Method 8270C)	5 days of VTSR for extraction 40 days for analysis	1 liter amber glass with Teflon-lined septum	<4 degrees Celsius
PCBs (Method 8082)	5 days of VTSR for extraction 40 days for analysis	1 liter amber glass with Teflon-lined septum	<4 degrees Celsius
Metals (Method 6010B, Mercury 7470A)	26 days of VTSR (for mercury) 180 days VTSR (for other metals)	0.5 liter plastic	pH < 2 HNO3, <4 deg. C
Cyanide (Method 9012A)	12 days of VTSR	1 liter plastic	pH > 12 NaOH, <4 deg. C
Hardness (Method 0130.2)	6 months of VTSR for extraction	0.25 liter plastic	pH < 2 HNO3, <4 deg. C

Table 3-4
LCP Chemicals, Inc.
Sample Container, Preservation, and Holding Time Requirements

Laboratory Analyses SOIL	**Holding Time**	**Recommended Container**	**Preservative**
VOC (Method 5035/8260B)	48 hours of VTSR	5 gram disposable En Core Sampler	<4 degrees Celsius
SVOC (Method 8270C)	10 days of VTSR for extraction 40 days for analysis	8 ounce glass	<4 degrees Celsius
PCBs (Method 8082)	10 days of VTSR for extraction 40 days for analysis	8 ounce glass	<4 degrees Celsius
Metals (Method 6010B, Mecury 7471A)	26 days of VTSR (for mercury) 180 days VTSR (for other metals)	8 ounce glass	<4 degrees Celsius
Cyanide (Method 9012A)	12 days of VTSR	8 ounce glass	<4 degrees Celsius
Pesticides (Method 8081A)	14 days of VTSR for extraction 40 days VTSR for analysis	300 ml bottle	<4 degrees Celsius
Dioxin (Method 1613B)	30 days of VTSR for extraction 45 days for analysis	250 ml amber glass	<4 degrees Celsius
PCNs (Method 8270C/ CLP SOW OLM04.2)	14 days of VTSR for extraction 45 days for analysis	250 ml amber glass	<4 degrees Celsius
TOC (Kahn 1988)	28 days of VTSR	8 ounce glass	<4 degrees Celsius
pH (Method 9045C)	Immediately upon VTSR	8 ounce glass	<4 degrees Celsius

VTSR = Validate Time of Sample Receipt (the date of sample receipt by the laboratory)

Table 3-5
LCP Chemicals, Inc.
Summary of RI/FS Stratigraphic Borings

Boring Designation	Identification	Nominal Depth	Location
231-B8	STRAT-1	25 ft	South of Bldg. 231
230-B1	STRAT-2	50 ft	Building 230 Transformers
BT-B1	STRAT-3	25 ft	Bullet Tanks
DSP-B1	STRAT-4	50 ft	Former Drum Storage Pad
DC-B12	STRAT-5	25 ft	Southern Drainage Channel
HF-B3	STRAT-6	50 ft	Location of western Historic Fill Sample
MW-B16	STRAT-7	50 ft	Location of proposed MW-16

Table 3-7
LCP Chemicals, Inc.
Summary of Proposed Well Construction Data

Well Number	Depth of Well	Well Diameter	Well Casing	Length of Screen	Slot Size	Strata Monitored	Filter Pack	Seal Type
MW-6 through MW-20	Nominally 10-feet	2-inch	Schedule 40 PVC Pipe with flush mount threaded joints	Nominally 5-feet	0.01-inch Diameter (10 slot)	Fill	#1 Morie Sand or equivalent	bentonite

Table 3-8
LCP Chemicals, Inc.
Summary of RI/FS Sample Analysis by Matrix

SOIL

SITE LOCATION	TAL/TCL Parameters	dioxins/PCNs	Grain Size TOC pH
Releases Near Brine Sludge Lagoon			
East Berm	18	3	0
Leaking Pipe and Building 231 Area	24	4	0
Chemfix Lagoon	14	2	0
Sludge Roaster	2	0	0
Building 230 and Building 240 Mercury Cell Rooms	12	6	0
Building 231	12	2	0
Former Transformers			
Building 231	9	2	0
Building 230 and Building 240	22	0	0
500K Tank	7	0	0
Bullet Tanks	9	0	0
Salt Silo No. 4	6	0	0
Drum Storage Pad	6	0	0
Concrete Drainage Channels	11	0	0
Former Waste Water Treatment Unit	6	0	0
Borings South of 4th Street	18	0	0
Borings North of 4th Street	3	0	0
Borings North of Building 223	9	0	0
Borings South of 4th Street Building 223	16	0	0
Railroad Tracks	22	0	0
Between Building 220&230	3	1	0
Near 250K Storage Tank	4	0	0
Near Old Chlorine Storage Tank	3	0	0
South of Building 240	2	0	0
150K Brine Tank	2	0	0
East of Sludge Roaster Pad	2	0	0

Table 3-8 (continued)
LCP Chemicals, Inc.
Summary of RI/FS Sample Analysis by Matrix

SOIL

SITE LOCATION	TAL/TCL Parameters	dioxins/PCNs	Grain Size TOC pH
Areas of Suspected Past Releases	12	0	0
Potentially Contaminated Areas Away from Processes	9	0	0
Historic Fill	6	0	0
South Branch Creek (sed.)	18	0	18
East of South Branch Creek	9	2	0
South of South Branch Creek	3	1	0
12K Tank	4	4	0
Total	303	27	18

Quality Assurance and Quality Control Samples *

Trip Blank	0	0	0
Field Blank	30	3	0
Duplicate	15	2	0
Matrix Spike	15	2	0
Matrix Spike Duplicate	15	2	0
Total	75	9	0
Estimated Grand Total	378	36	18

Table 3-8 (concluded)
LCP Chemicals, Inc.
Summary of RI/FS Sample Analysis by Matrix

GROUNDWATER AND SURFACE WATER

SITE LOCATION	TAL/TCL Parameters	dioxins/PCNs	Hardness pH
Site-Wide Groundwater Monitoring Wells MW-6 through MW-20	15	0	0
South Branch Creek	6	0	6
Total	21	0	6

Quality Assurance and Quality Control Samples *

Trip Blank	3	0	0
Field Blank	2	0	0
Duplicate	1	0	0
Matrix Spike	1	0	0
Matrix Spike Duplicate	1	0	0
Total	8	0	0

Estimated Grand Total	29	0	6

* QA/QC Sample Assumptions:

One trip blank for each cooler containing VOC samples.

One field blank for each day of sampling for each matrix.

One duplicate sample for every 20 samples of each matrix.

One MS sample and one MSD sample for every 20 samples of each matrix.

TCL= Target Compound List

TAL= Target Analyte list

TOC = Total organic carbon

PNC = Polychlorinated naphthalenes

Table 3-9
LCP Chemicals, Inc.
Summary of RI/FS Sample Analysis by Analytical Parameter

Matrix	TCL/TAL Parameters	dioxins/PCNs	Grain Size TOC pH	Hardness
Soil	285	27	0	0
Groundwater	15	0	0	0
Surface Water	6	0	0	6
Sediment	18	0	18	0
QA/QC Soil	75	9	0	0
QA/QC Water	8	0	0	0
TOTAL	**407**	**36**	**18**	**6**

Notes:

PCNs	Polychlorinated Naphthalenes
QA/QC	Quality Assurance/Quality Control
TOC	Total organic Carbon
TAL	Target Analyte List
TCL	Target Compound List

Table 3-10
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Releases Near Brine Sludge Lagoon **A.) East Berm** (Figure A-1)	Soil	BSL-1	0-12 inch	TCL/TAL dioxins & PCNs	**12 soil borings** Collect 4 samples from the 0-6 inch depth interval and 8 samples from the 0-12 inch depth interval submit for TCL/TAL analysis. Collect 6 samples from the 1-6 foot depth interval (unsaturated zone) based on field screening, submit for TCL/TAL analysis. Submit 3 of the 8 surface samples for dioxin/PCN analyses.
			1-6 foot	TCL/TAL	
		BSL-2	0-12 inch	TCL/TAL	
		BSL-3	0-6 inch	TCL/TAL	
		BSL-4	0-12 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		BSL-5	0-6 inch	TCL/TAL	
		BSL-6	0-12 inch	TCL/TAL dioxins & PCNs	
			1-6 foot	TCL/TAL	
		BSL-7	0-6 inch	TCL/TAL	
		BSL-8	0-12 inch	TCL/TAL	
		BSL-9	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		BSL-10	0-12 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		BSL-11	0-12 inch	TCL/TAL	
		BSL-12	0-12 inch	TCL/TAL dioxins & PCNs	
			1-6 foot	TCL/TAL	

TAL=Target Analyte List -list of inorganic constituents as contained in the EPA Contract laboratory Program ILM04.0.

TCL=Target Compound List=list of organic compounds as contained in the EPA Contract Laboratory Program OLM04.2, including volatiles, semivolatiles, pesticides and polychlorinated biphenyls.

PCNs= Polychlorinated Naphthalenes

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Releases Near Brine Sludge Lagoon **B.) Leaking Pipe and Building 231 Area** (Figure A-2)	Soil	LP-1	0-6 inch	TCL/TAL dioxins/ PCNs	**16 soil borings** Collect 16 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 8 samples from the 1-6 foot depth interval (unsaturated zone) based on field screening, submit for TCL/TAL analysis. Submit 4 of the 16 surface samples and submit for dioxin/PCN analysis.
		LP-2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-3	0-6 inch	TCL/TAL	
		LP-4	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-5	0-6 inch	TCL/TAL	
		LP-6	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-7	0-6 inch	TCL/TAL dioxins/ PCNs	
		LP-8	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-9	0-6 inch	TCL/TAL	
		LP-10	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		LP-11	0-6 inch	TCL/TAL	
		LP-12	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-13	0-6 inch	TCL/TAL	
		LP-14	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		LP-15	0-6 inch	TCL/TAL	
		LP-16	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Chemfix Lagoon (Figure A-3)	Soil	CF-1	0-6 inch	TCL/TAL dioxins/ PCNs	**9 soil borings** Collect 9 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 5 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis. Submit 2 of the 9 surface samples and submit for dioxin/PCN analysis.
			1-6 foot	TCL/TAL	
		CF-2	0-6 inch	TCL/TAL	
		CF-3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		CF-4	0-6 inch	TCL/TAL	
		CF-5	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		CF-6	0-6 inch	TCL/TAL	
		CF-7	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		CF-8	0-6 inch	TCL/TAL	
		CF-9	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
Former Sludge Roaster (Figure A-1)	Soil	SR-1	0-6 inch	TCL/TAL	**2 soil borings** Collect 2 soil samples from the 0-6 inch depth interval biased toward area of potential spills or releases
		SR-2	0-6 inch	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Building 230 and Building 240 Mercury Cell Rooms (Figure A-4)	Soil	MCR-1	0-6 inch	TCL/TAL dioxins/ PCNs	**25 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 6 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis. Submit 6 of the surface samples for dioxin/PCN analysis.
			1-6 foot	TCL/TAL	
		MCR-2	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		MCR-3	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		MCR-4	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		MCR-5	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	
		MCR-6	0-6 inch	TCL/TAL dioxins/ PCNs	
			1-6 foot	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Building 231 (Purasiv area) (Figure A-5)	Soil	231-B1	0-6 inch	TCL/TAL dioxins/ PCNs	**8 soil borings** Collect 8 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 4 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis. Submit 2 of the 8 surface samples for dioxin/PCN analysis.
		231-B2	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	
		231-B3	0-6 inch	TCL/TAL	
	E97819	231-B4	0-6 inch ~~1-6 foot~~ Do	TCL/TAL TCL/TAL	
		231-B5	0-6 inch	TCL/TAL dioxins/ PCNs	
		231-B6	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	
		231-B7	0-6 inch	TCL/TAL	
		231-B8	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	
Former Transformers **A.) Building 231** (Figure A-6)	Soil	231-B9	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	**6 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 3 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis. Submit 2 of the 6 surface samples for dioxin/PCN analysis.
		231-B10	0-6 inch	TCL/TAL dioxin & PCNs	
		231-B11	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	
	E98917	231-B12	0-6 inch	TCL/TAL	
		231-B13	0-6 inch 1-6 foot	TCL/TAL TCL/TAL	
		231-B14	0-6 inch	TCL/TAL dioxin & PCNs	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Former Transformers **B.) Building 230 and Building 240 Transformer Areas** (Figure A-6)	Soil	230-B1	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	**11 soil borings** Collect 11 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 11 samples from the 1.5-2.0 ft depth interval based on field screening, submit for TCL/TAL analysis.
		230-B2	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B3	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B4	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B5	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B6	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B7	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B8	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B9	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B10	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	
		230-B11	0-6 inch 1.5-2.0 foot	TCL/TAL TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
500K Tank (Figure A-7)	Soil	5K-B1	0-6 inch	TCL/TAL	**5 soil borings** Collect 5 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 2 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		5K-B2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		5K-B3	0-6 inch	TCL/TAL	
		5K-B4	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		5K-B5	0-6 inch	TCL/TAL	
Bullet Tanks (Figure A-8)	Soil	BT-B1	0-6 inch	TCL/TAL	**6 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 3 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		BT-B2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		BT-B3	0-6 inch	TCL/TAL	
		BT-B4	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		BT-B5	0-6 inch	TCL/TAL	
		BT-B6	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
Salt Silo No. 4 (Figure A-7)	Soil	Silo-B1	0-6 inch	TCL/TAL	**4 soil borings** Collect 4 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 2 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		Silo-B2	0-6 inch	TCL/TAL	
		Silo-B3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		Silo-B4	0-6 inch	TCL/TAL	
Drum Storage Pad (Figure A-9)	Soil	DSP-B1	0-6 inch	TCL/TAL	**4 soil borings** Collect 4 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 2 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		DSP-B2	0-6 inch	TCL/TAL	
		DSP-B3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		DSP-B4	0-6 inch	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Concrete Drainage Channels (Figure A-10)	Soil	DC-SS1	0-6 inch	TCL/TAL	**20 soil borings** Collect 10 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		DC-SS2	0-6 inch	TCL/TAL	
		DC-SS3	0-6 inch	TCL/TAL	
		DC-SS4 11	0-6 inch	TCL/TAL	
		DC-SS5 13	0-6 inch	TCL/TAL	
		DC-SS6	0-6 inch	TCL/TAL	
		DC-SS7	0-6 inch	TCL/TAL	
		DC-SS8 15	0-6 inch	TCL/TAL	
		DC-SS9	0-6 inch	TCL/TAL	
		DC-SS10 17	0-6 inch	TCL/TAL	
		DC-B12	1-6 foot	TCL/TAL	Stratigraphic Boring
Former Waste Water Treatment Unit (Figure A-11)	Soil	WWT-1	0-6 inch	TCL/TAL	**3 soil borings** Collect 1 sample from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 12-14 foot depth interval based on field screening, submit for TCL/TAL analysis. (Bas of WWT unit)
			12-14 foot	TCL/TAL	
		WWT-2	0-6 inch	TCL/TAL	
			12-14 foot	TCL/TAL	
		WWT-3	0-6 inch	TCL/TAL	
			12-14 foot	TCL/TAL	
West of Avenue D and South of 4th Street (Figure A-12)	Soil	ADS-1	0-6 inch	TCL/TAL	**12 soil borings** Collect 12 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 6 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		ADS-2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		ADS-3	0-6 inch	TCL/TAL	
		ADS-4	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		ADS-5	0-6 inch	TCL/TAL	
		ADS-6	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		ADS-7	0-6 inch	TCL/TAL	
		ADS-8	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		ADS-9	0-6 inch	TCL/TAL	
		ADS-10	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		ADS-11	0-6 inch	TCL/TAL	
		ADS-12	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
West of Avenue D and North of 4th Street (Figure A-12)	Soil	ADN-1	0-6 inch	TCL/TAL	**2 soil borings** Collect 2 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		ADN-2	0-6 inch	TCL/TAL	
North of Building 223/Cl_2 Truck loading/HCl Storage (Figure A-13)	Soil	TLN-1	0-6 inch	TCL/TAL	**6 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 3 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		TLN-2	0-6 inch	TCL/TAL	
		TLN-3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		TLN-4	0-6 inch	TCL/TAL	
	E97941	TLN-5	0-6 inch	TCL/TAL	
			1-6 foot X2	TCL/TAL	
		TLN-6	0-6 inch	TCL/TAL	
South of Building 223/CL2 Truck loading/HCl Storage and North of Shops and Services Building (Figure A-13)	Soil	TLS-1	0-6 inch	TCL/TAL	**11 soil borings** Collect 11 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 5 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		TLS-2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		TLS-3	0-6 inch	TCL/TAL	
		TLS-4	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		TLS-5	0-6 inch	TCL/TAL	
		TLS-6	0-6 inch	TCL/TAL	
			*1-6 foot	TCL/TAL	
		TLS-7	0-6 inch	TCL/TAL	
		TLS-8	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		TLS-9	0-6 inch	TCL/TAL	
		TLS-10	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		TLS-11	0-6 inch	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Along Railroad Tracks (Figure A-14)	Soil	RR-1	0-6 inch	TCL/TAL	**14 soil borings** Collect 14 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 8 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		RR-2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		RR-3	0-6 inch	TCL/TAL	
		RR-4	0-6 inch	TCL/TAL	
			1-6 foot Good	TCL/TAL	
		RR-5	0-6 inch	TCL/TAL	
		RR-6	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		RR-7	0-6 inch	TCL/TAL	
		RR-8	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		RR-9	0-6 inch	TCL/TAL	
		RR-10	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		RR-11	0-6 inch	TCL/TAL	
		RR-12	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		RR-13	0-6 inch	TCL/TAL	
		RR-14	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
Between Building 220 and 230 (Figure A-13)	Soil	220-1	0-6 inch	TCL/TAL	**2 soil borings** Collect 2 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis. Submit 1of the 2 surface samples for dioxin/PCN analysis.
		220-2	0-6 inch	TCL/TAL dioxin & PCNs	
			1-6 foot	TCL/TAL	
Near 250K NaOH Storage Tank (Figure A-15)	Soil	ST-1	0-6 inch	TCL/TAL	**3 soil borings** Collect 3 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		ST-2	0-6 inch	TCL/TAL	
		ST-3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	

Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Between Old Chlorine Storage Tank and Avenue B (Figure A-15)	Soil	AB-1	0-6 inch	TCL/TAL	**2 soil borings** Collect 2 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
		AB-2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
South of Building 240 (Figure A-13)	Soil	SB-1	0-6 inch	TCL/TAL	**1 soil boring** Collect 1 sample from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
Adjacent to 150K Brine Tank (Figure A-15)	Soil	BT-1	0-6 inch	TCL/TAL	**1 soil boring** Collect 1 sample from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
East of Sludge Roaster Pad (Figure A-16)	Soil	ESR-1	0-12 inch	TCL/TAL	**1 soil boring** Collect 1 sample from the 0-12 inch depth interval and submit for TCL/TAL analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
Areas of Suspected Past Releases (Figure A-17)	Soil E95302	SPR-1	0-6 inch	TCL/TAL	**6 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 6 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		SPR-2 A B	0-6 inch	TCL/TAL	
		A B	1-6 foot	TCL/TAL	
		SPR-3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		SPR-4	0-6 inch	TCL/TAL	
			1-6 foot x 3	TCL/TAL	
		SPR-5	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		SPR-6	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	

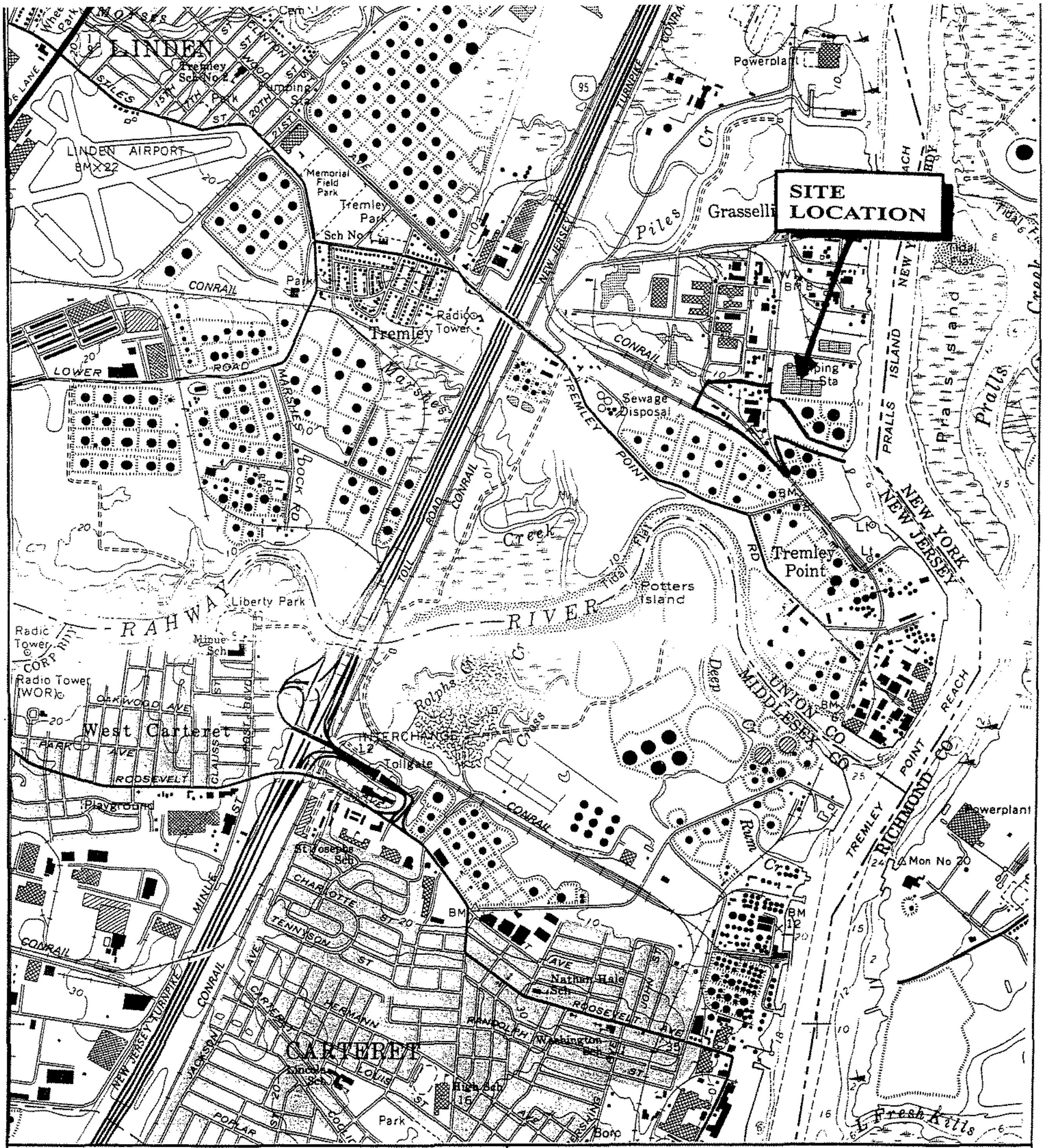
Table 3-10 (continued)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
Potentially Contaminated Areas Away From Process Areas (Figure A-18)	Soil	PCA-1	0-6 inch	TCL/TAL	**6 soil borings** Collect 6 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 3 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		PCA-2	0-6 inch	TCL/TAL	
		PCA-3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		PCA-4	0-6 inch	TCL/TAL	
		PCA-5	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		PCA-6	0-6 inch	TCL/TAL	
Historic Fill (Figure A-19) 5.27	Fill	HF-B1	0-6 inch	TCL/TAL	**3 soil borings** Collect 3 samples from the 0-6 inch depth interval and submit for TCL/TAL analysis. Collect 3 samples from the 1-6 foot depth interval based on field screening, submit for TCL/TAL analysis.
			1-6 foot	TCL/TAL	
		HF-B2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
		HF-B3	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	
South Branch Creek (Figure A-20) 5.28	Sediment	SED-1	0-1.0 ft below mud line	TCL/TAL	**6 sampling locations** Collect 3 sediment samples from each of 6 locations 0-0.5 ft, 0.5-1.0 ft, 1.0-1.5ft. submit for TCL/TAL, Grian Size, TOC, and pH analysis.
			0-0.5,0.5-1, 1-1.5	Grain Size, TOC, pH	
		SED-2	0-1.0 ft below mud line	TCL/TAL	
			0 - 1.5	Grain Size, TOC, pH	
		SED-3	0-1.0 ft below mud line	TCL/TAL	
			0 - 1.5	Grain Size, TOC, pH	
	E97444	SED-4	0-1.0 ft below mud line	TCL/TAL	
			0 - 1 1-1.5	Grain Size, TOC, pH	
		SED-5	0-1.0 ft below mud line	TCL/TAL	
			0 - 1.5	Grain Size, TOC, pH	
		SED-6	0-1.0 ft below mud line	TCL/TAL	
				Grain Size, TOC, pH	

Table 3-10 (concluded)
LCP Chemicals, Inc.
RI/FS Sample Designations

Site	Matrix	Sample Designation	Nominal Depth	Analysis	Comments
East of South Branch Creek (Figure A-16) 5.19	Soil	EC-1	0.0-1.0 ft	TCL/TAL	**9 soil borings** Collect 9 samples from the 0-12 inch depth interval and submit for TCL/TAL analysis. Submit 2 of the 9 surface samples for dioxin/PCN analysis.
		EC-2	0.0-1.0 ft	TCL/TAL	
		EC-3	0.0-1.0 ft	TCL/TAL,dioxin, & PCN	
		EC-4	0.0-1.0 ft	TCL/TAL	
		EC-5	0.0-1.0 ft	TCL/TAL	
		EC-6	0.0-1.0 ft	TCL/TAL	
		EC-7	0.0-1.0 ft	TCL/TAL,dioxin, & PCN	
		EC-8	0.0-1.0 ft	TCL/TAL	
		EC-9	0.0-1.0 ft	TCL/TAL	
Along South Branch Creek (South of Creek) 5.19 (Figure A-16)	Soil	SC-1	0.0-1.0 ft	TCL/TAL	**3 soil borings** Collect 3 samples from the 0-12 inch depth interval and submit for TCL/TAL analysis. Submit 1 of the 3 surface samples for dioxin/PCN analysis.
		SC-2	* 0.0-1.0 ft	TCL/TAL	
		SC-3	0.0-1.0 ft	TCL/TAL dioxin & PCNs	
Site-Wide Groundwater Monitoring Wells 5.31 (Figure A-21)	groundwater	MW-6	water table	TCL/TAL	**15 groundwater samples** Collect samples from 4 existing wells and from 11 new wells
		through	water table	TCL/TAL	
		MW-20	water table	TCL/TAL	
South Branch Creek Surface Water (Figure A-20) 5.28	Surface Water	SW-1	mid-stream depth	TCL/TAL, Hardness	**6 surface water samples** Submit for TCL/TAL and Hardness analysis Collected concurrently and at the same locations as SED-1 through SED-6. Hardness?
		SW-2	mid-stream depth	TCL/TAL, Hardness	
		SW-3	mid-stream depth	TCL/TAL, Hardness	
		SW-4	mid-stream depth	TCL/TAL, Hardness	
		SW-5	mid-stream depth	TCL/TAL, Hardness	
		SW-6	mid-stream depth	TCL/TAL, Hardness	
12K Tank (Figure A-9)	Soil	12K-B1	0-6 inch	TCL/TAL	**2 soil borings** Collect 1 sample from the 0-6 inch depth interval and submit for TCL/TAL and PCN analysis. Collect 1 sample from the 1-6 foot depth interval based on field screening, submit for TCL/TAL and PCN analysis.
			1-6 foot	TCL/TAL	
		12K-B2	0-6 inch	TCL/TAL	
			1-6 foot	TCL/TAL	

FIGURES



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SCALE (FEET)

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MAP SOURCE:

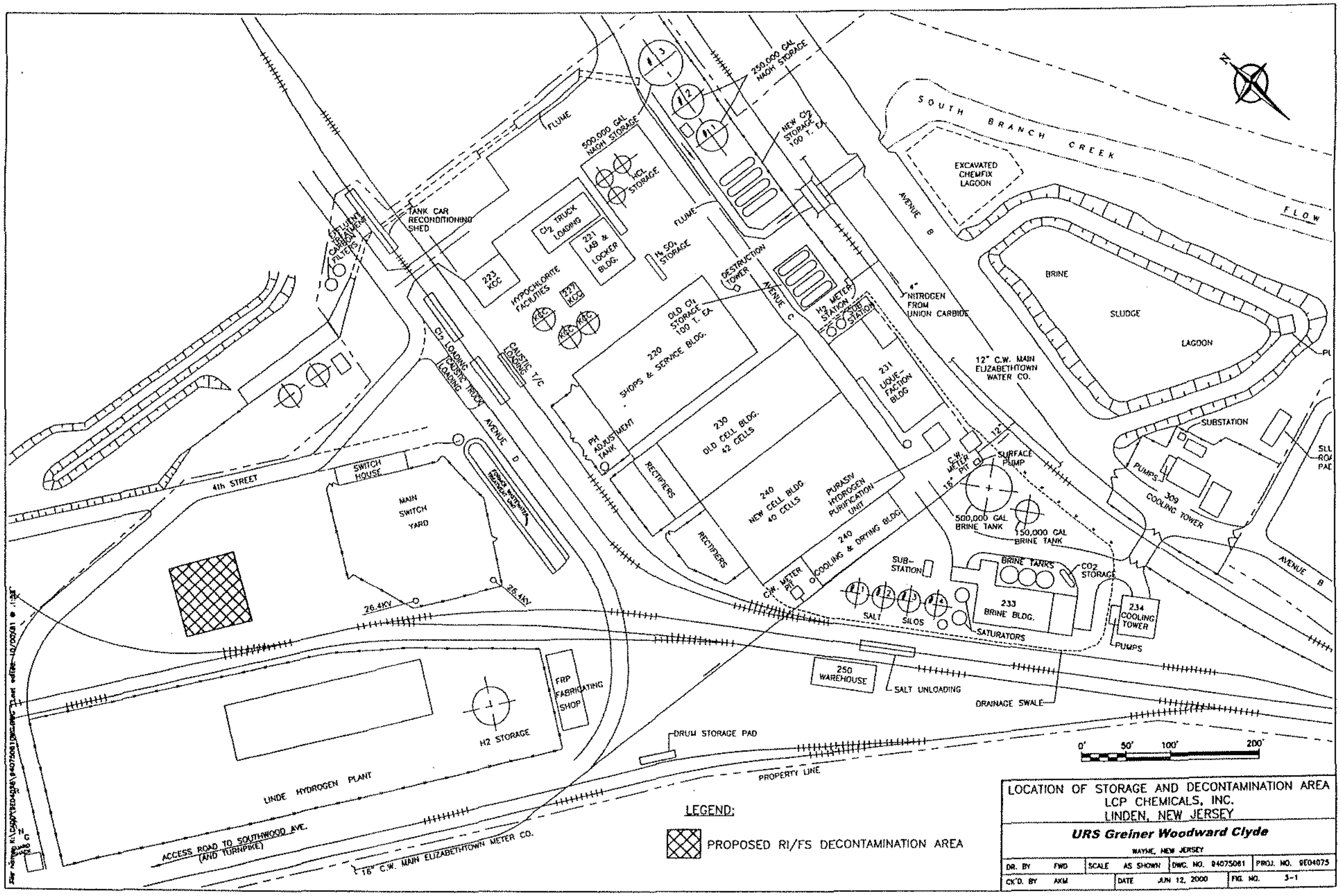
U.S.G.S. 7.5 MINUTE SERIES QUADRANGLE OF ARTHUR KILL, N.Y.–N.J., DATE 1966, PHOTOREVISED 1981.

File name: K:\CADD\9E04075\94075002.DWG

SITE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY	SCALE AS SHOWN	DWG. NO. 94075002	PROJ. NO. 9E04075
CK'D. BY AKM	DATE JULY 28, 1999	FIG. NO. 1-1	



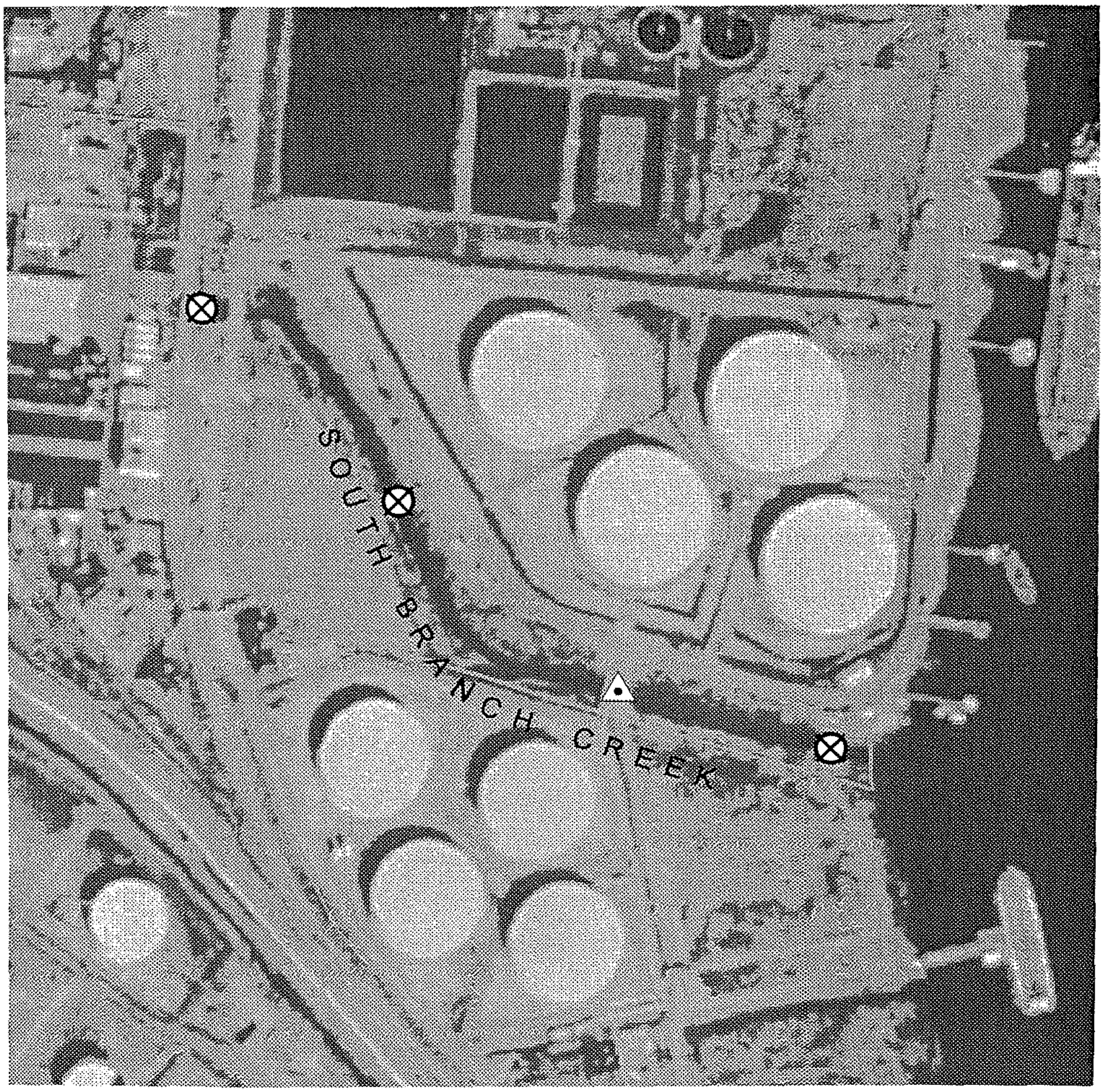
LEGEND:

▨ PROPOSED RI/FS DECONTAMINATION AREA

LOCATION OF STORAGE AND DECONTAMINATION AREA
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 04075061	PROJ. NO. 9E04075
CK'D. BY AKM	DATE JUN 12, 2000	FIG. NO. 3-1	



200 0 200 400 Feet

N

△ Proposed Location of Staff Gauge

⊗ Channel Transducer Location

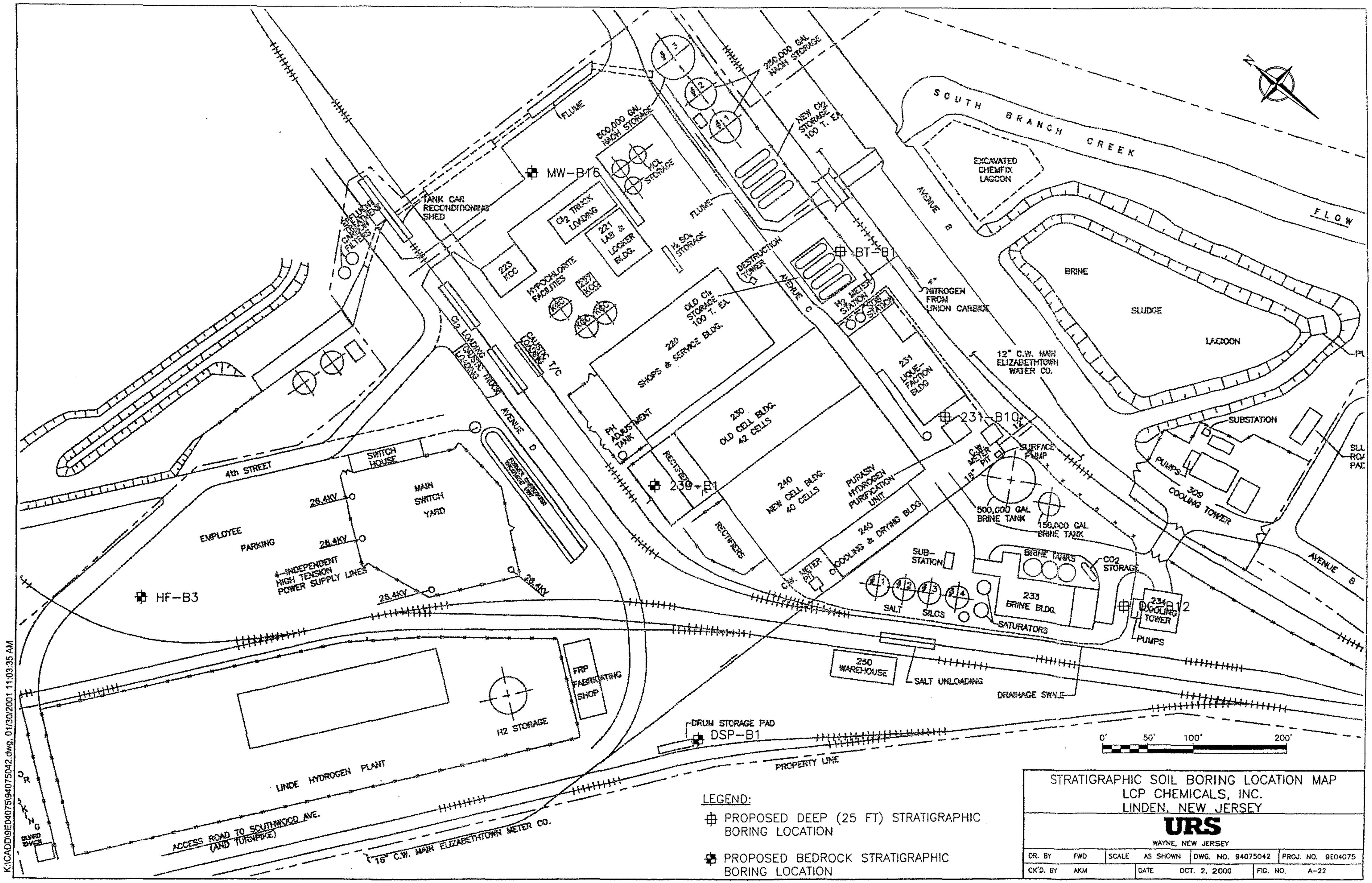
PHOTO SOURCE:
NJDEP GIS CD-ROM

TIDE INVESTIGATION
LOCATION OF TRANSDUCERS
AND STAFF GAUGE

LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
Wayne, New Jersey

DR. BY DMK	CK'D. BY PN	DWG. NO.	FIG. NO. 3 - 2
SCALE AS SHOWN	DATE 6-5-00	PROJ. NO. 4709E04075	



LEGEND:

⌖ PROPOSED DEEP (25 FT) STRATIGRAPHIC BORING LOCATION

⌖ PROPOSED BEDROCK STRATIGRAPHIC BORING LOCATION

STRATIGRAPHIC SOIL BORING LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075042	PROJ. NO. 9E04075
CK'D. BY AKM	DATE OCT. 2, 2000	FIG. NO. A-22	

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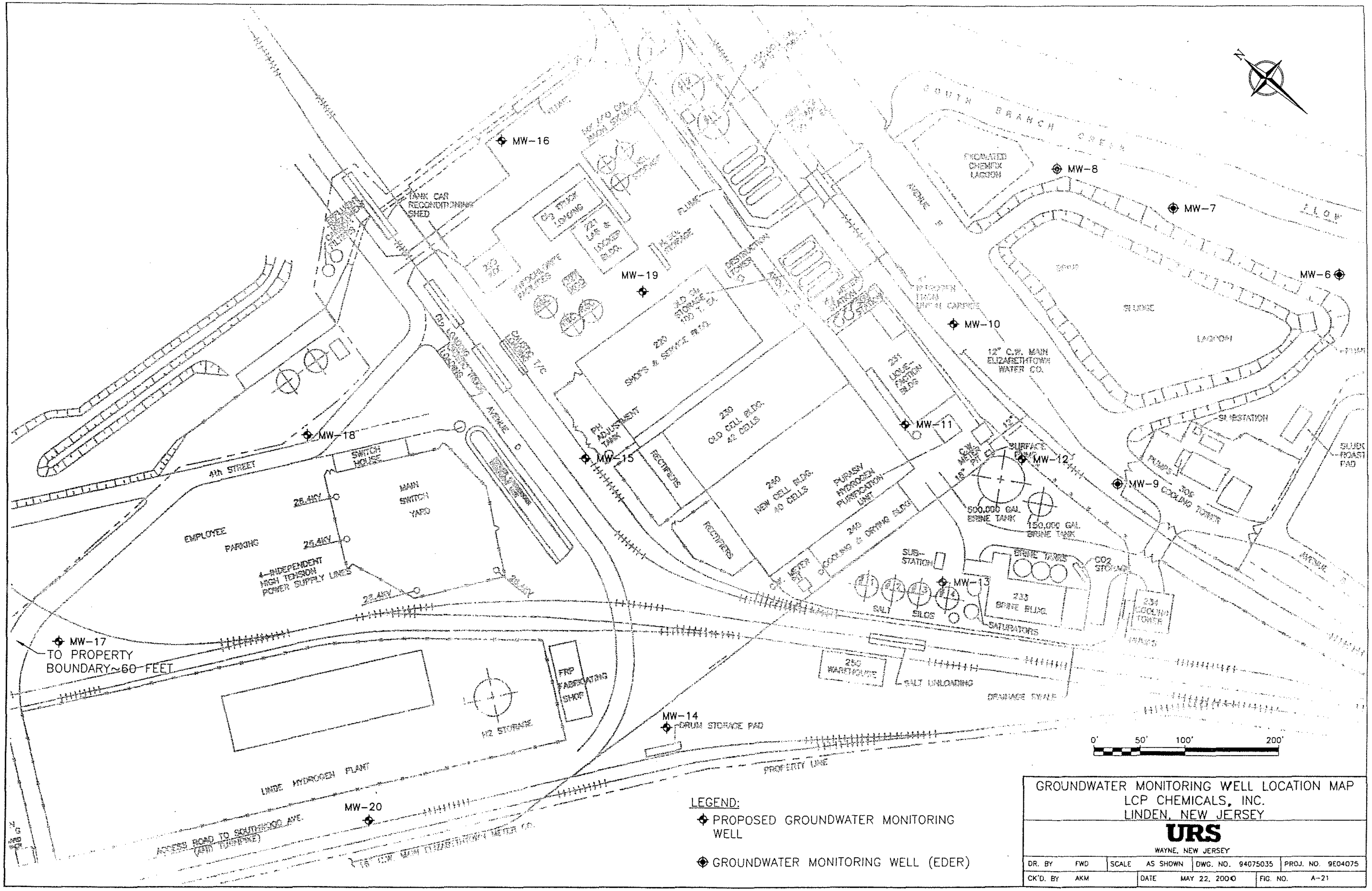

LEGEND:
- ⯁ PROPOSED GROUNDWATER MONITORING WELL
- ⯁ GROUNDWATER MONITORING WELL (EDER)

GROUNDWATER MONITORING WELL LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075035	PROJ. NO. 9E04075
CK'D. BY AKM	DATE MAY 22, 2000	FIG. NO. A-21	

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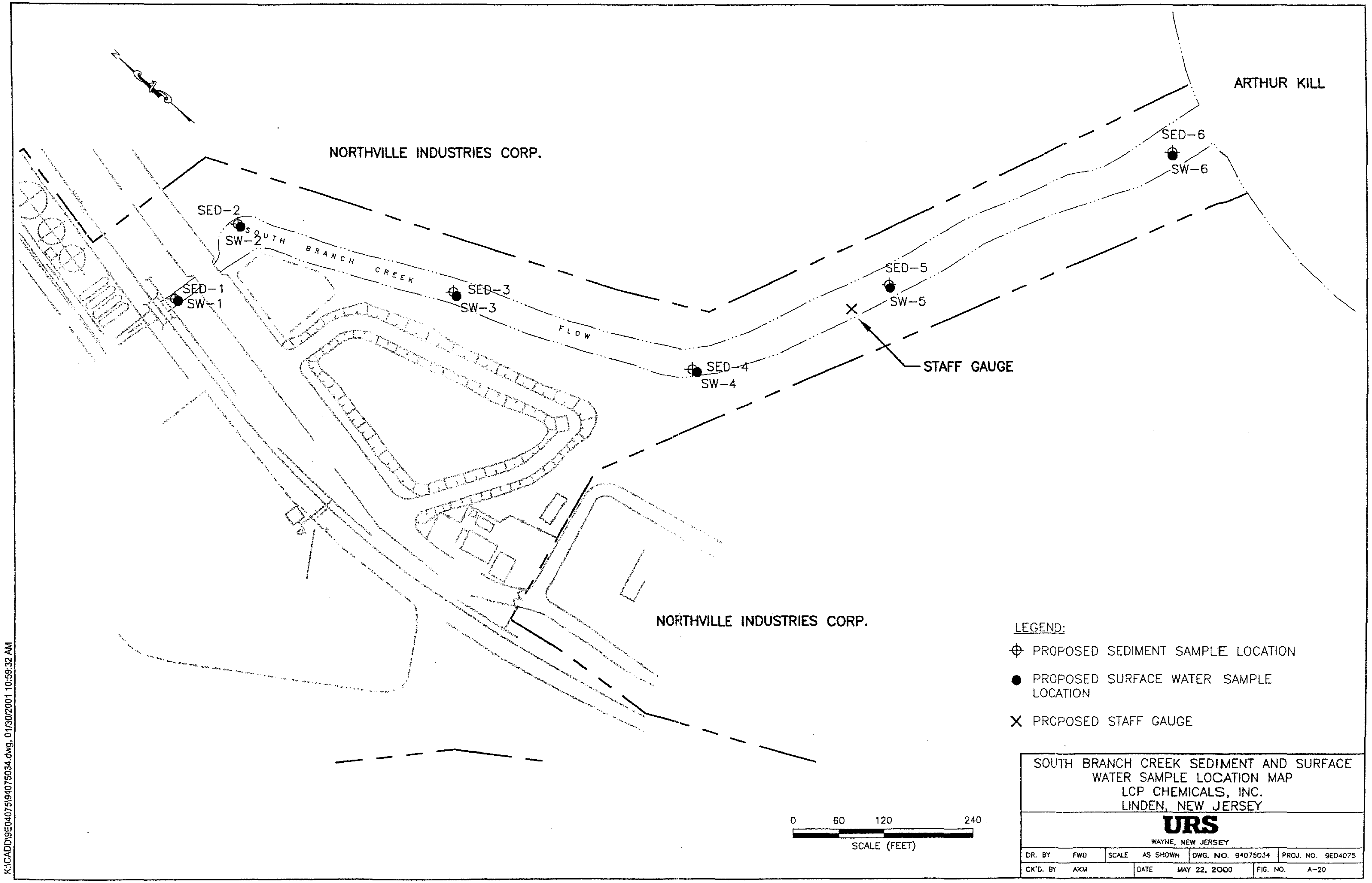

SOUTH BRANCH CREEK SEDIMENT AND SURFACE WATER SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY	FWD	SCALE	AS SHOWN	DWG. NO.	94075034	PROJ. NO.	9E04075
CK'D. BY	AKM	DATE	MAY 22, 2000	FIG. NO.	A-20		

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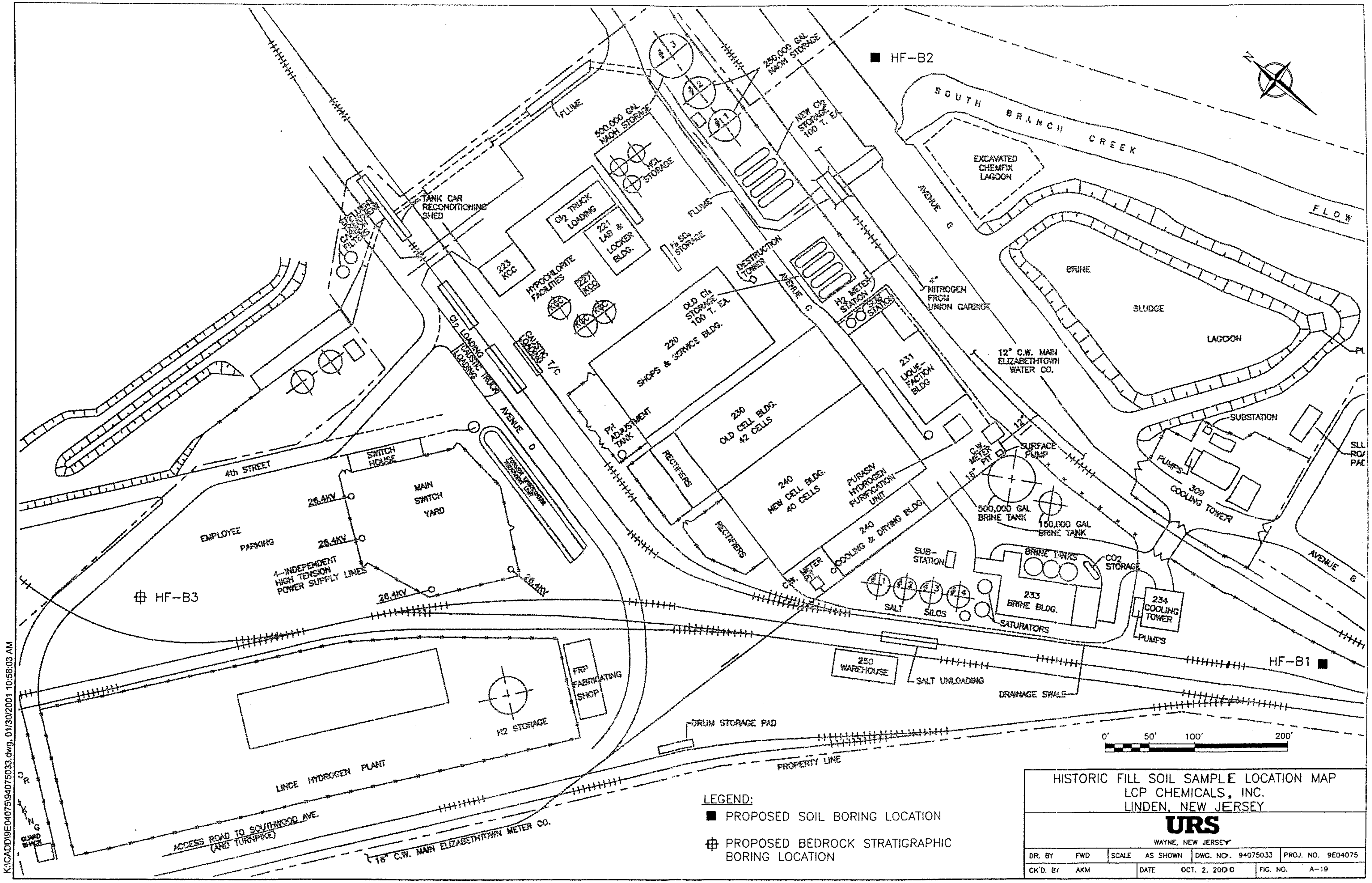

LEGEND:

■ PROPOSED SOIL BORING LOCATION

⊕ PROPOSED BEDROCK STRATIGRAPHIC BORING LOCATION

HISTORIC FILL SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075033	PROJ. NO. 9E04075
CK'D. BY AKM	DATE OCT. 2, 2000	FIG. NO. A-19	

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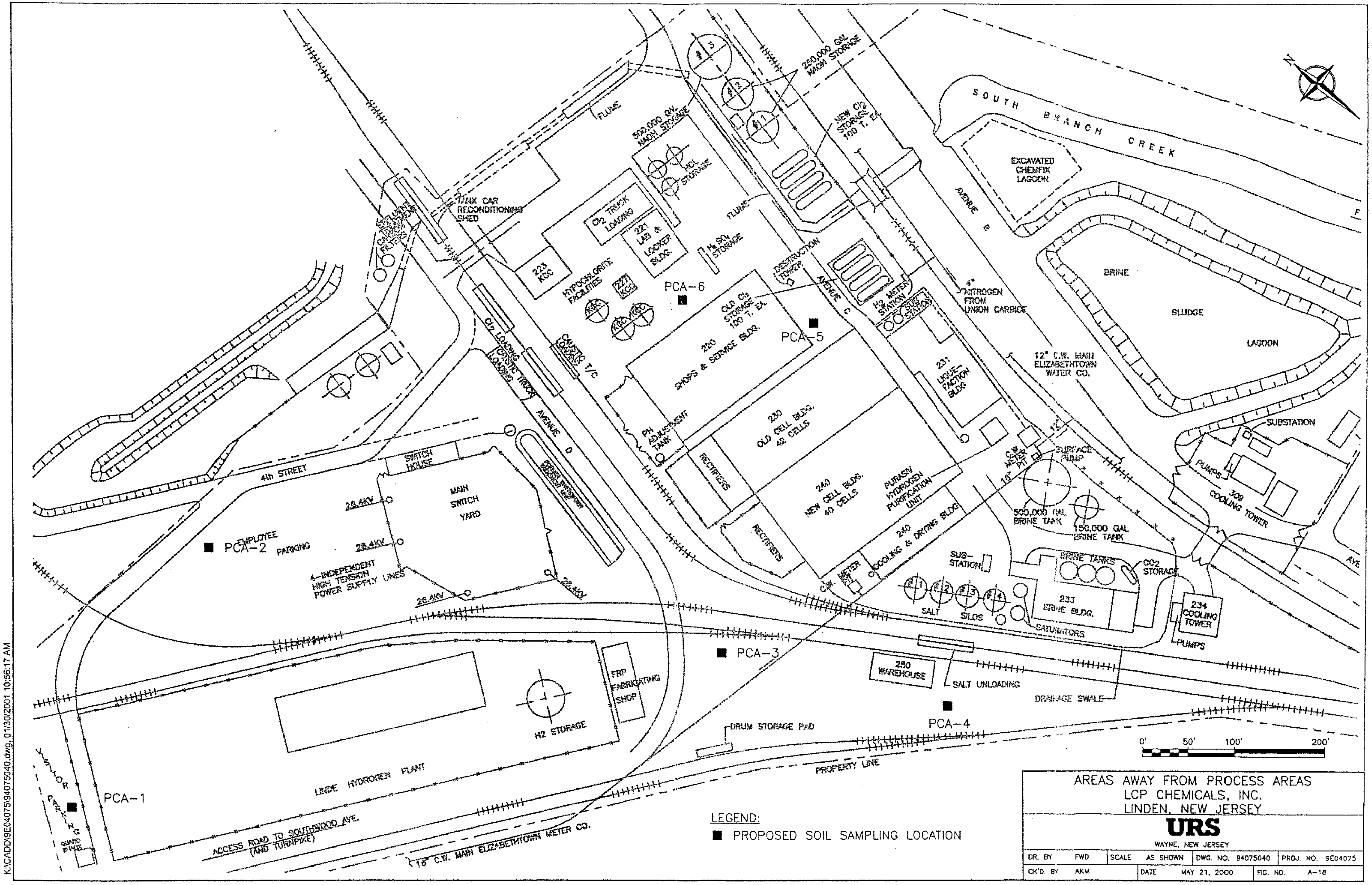


LEGEND:

■ PROPOSED SOIL SAMPLING LOCATION

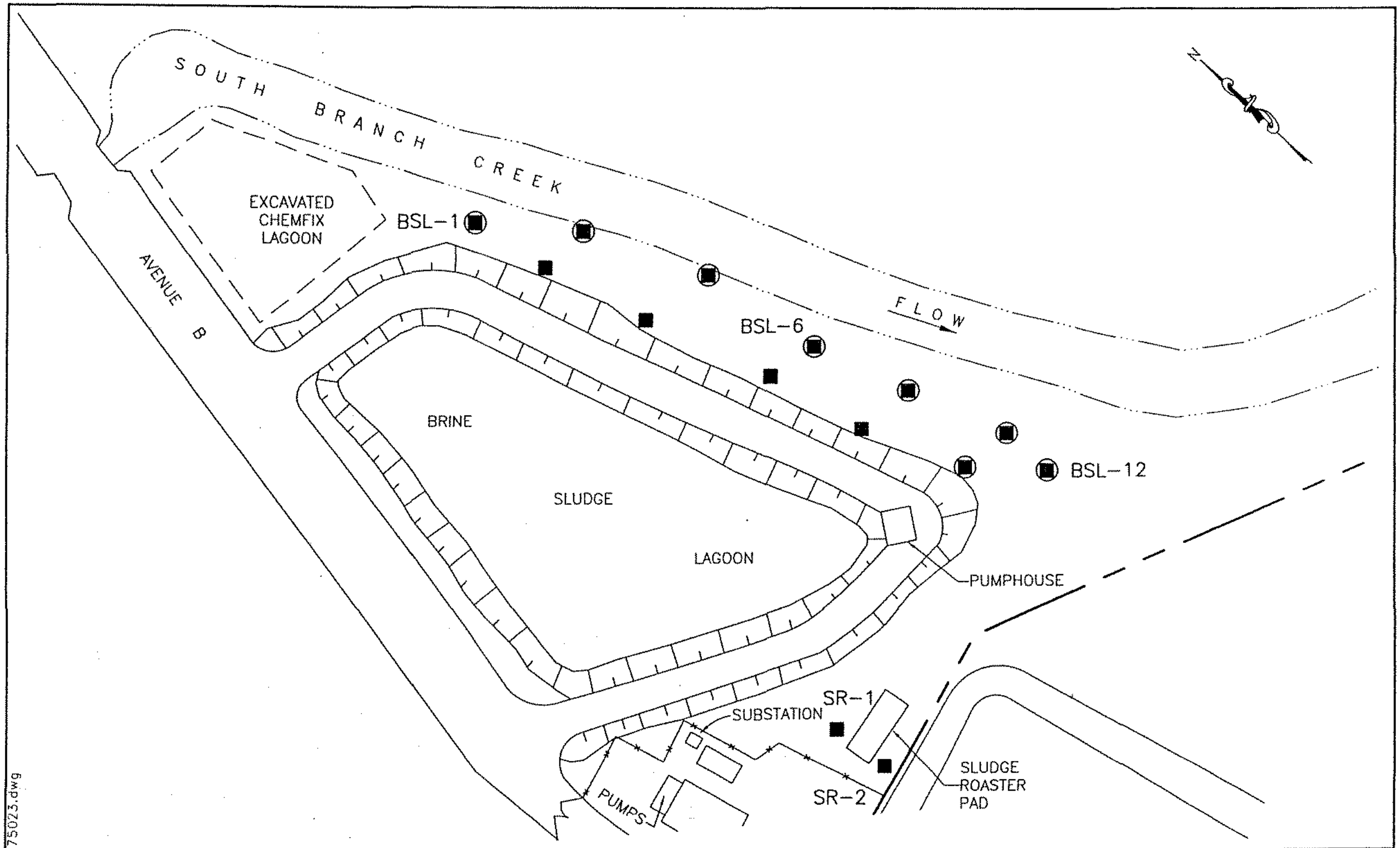
AREAS AWAY FROM PROCESS AREAS
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075040	PROJ. NO. 9E04075
CK'D. BY AKM	DATE MAY 21, 2000	FIG. NO. A–18	

APPENDIX A

Sample Location Maps



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LEGEND:

■ PROPOSED 0-6 INCH SAMPLE LOCATION

◉ PROPOSED 0-12 INCH SAMPLE LOCATION

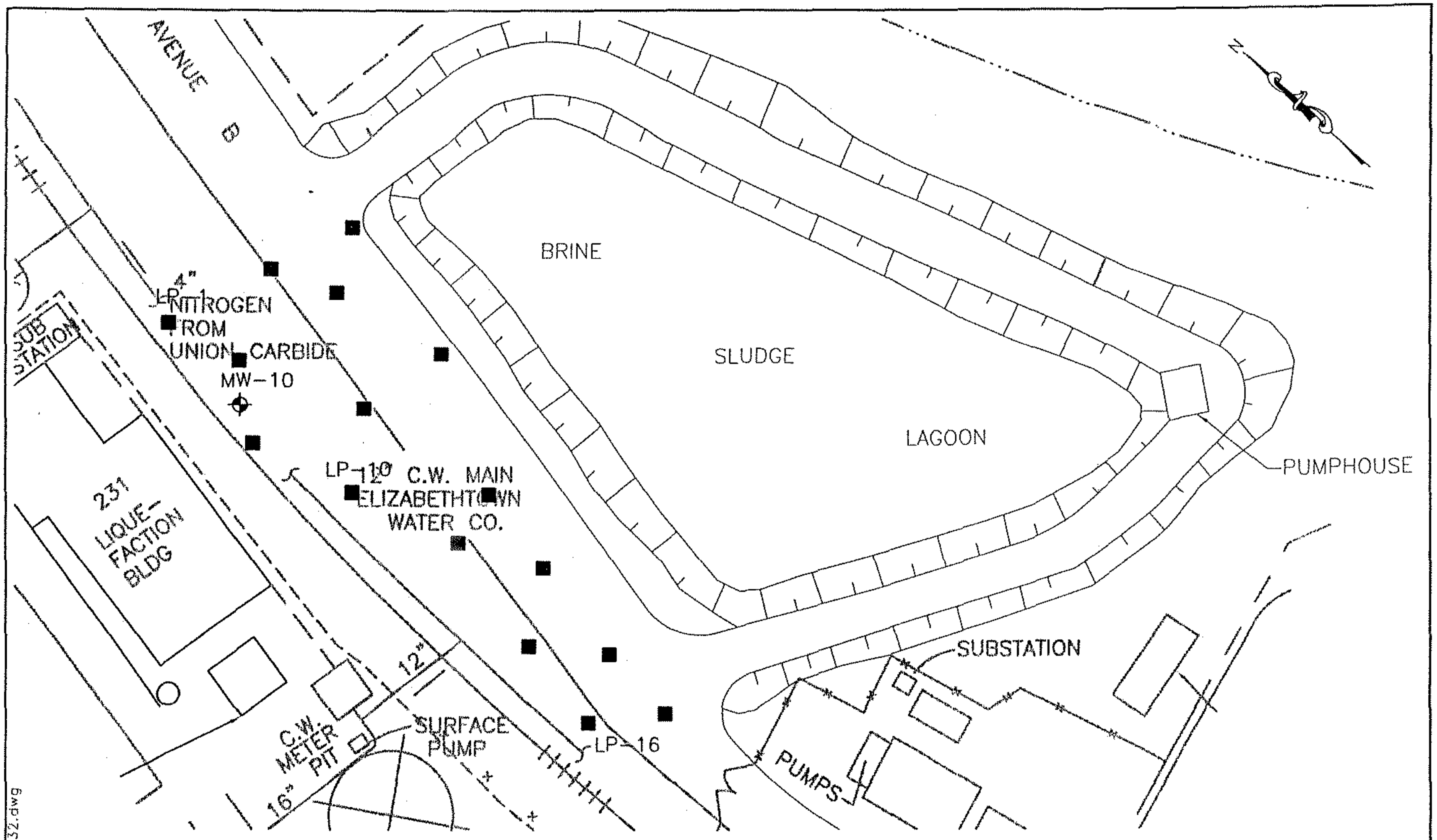
0 40 80 160

SCALE (FEET)

BRINE SLUDGE LAGOON RELEASE
EAST BERM AREA SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075023	PROJ. NO. 9E04075
CK'D. BY AKM	DATE OCT. 2, 2000	FIG. NO. A-1	



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LEGEND:

■ PROPOSED SOIL BORING LOCATION

⊕ PROPOSED GROUNDWATER MONITORING WELL LOCATION

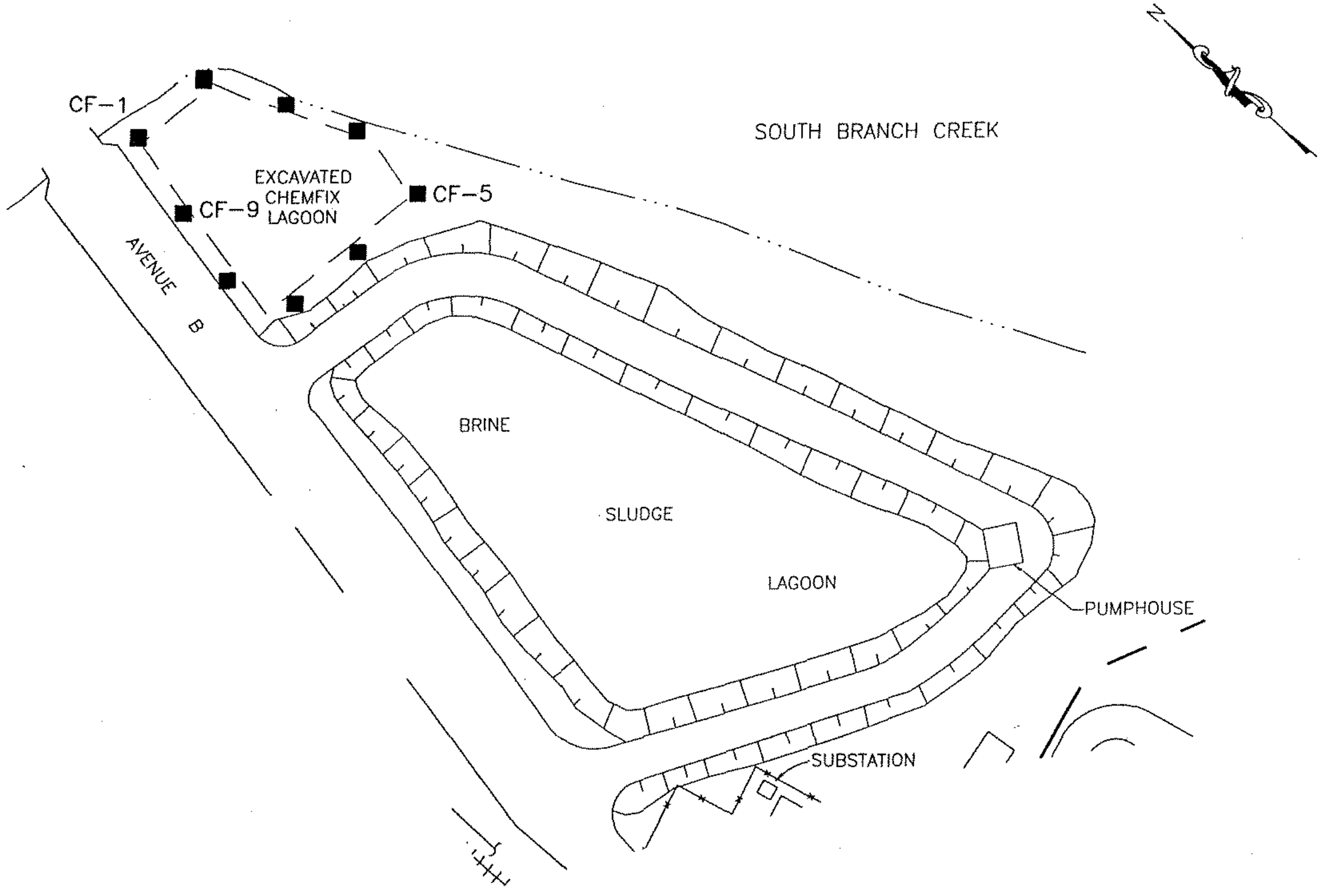
0 30 60 120

SCALE (FEET)

BRINE SLUDGE LAGOON RELEASE
LEAKING PIPE AND BUILDING 231 AREA
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075032	PROJ. NO. 9E04075
CK'D. BY AKM		DATE NOV 1, 2000	FIG. NO. A-2



LEGEND:

■ PROPOSED SOIL BORING LOCATION

0 40 80 160

SCALE (FEET)

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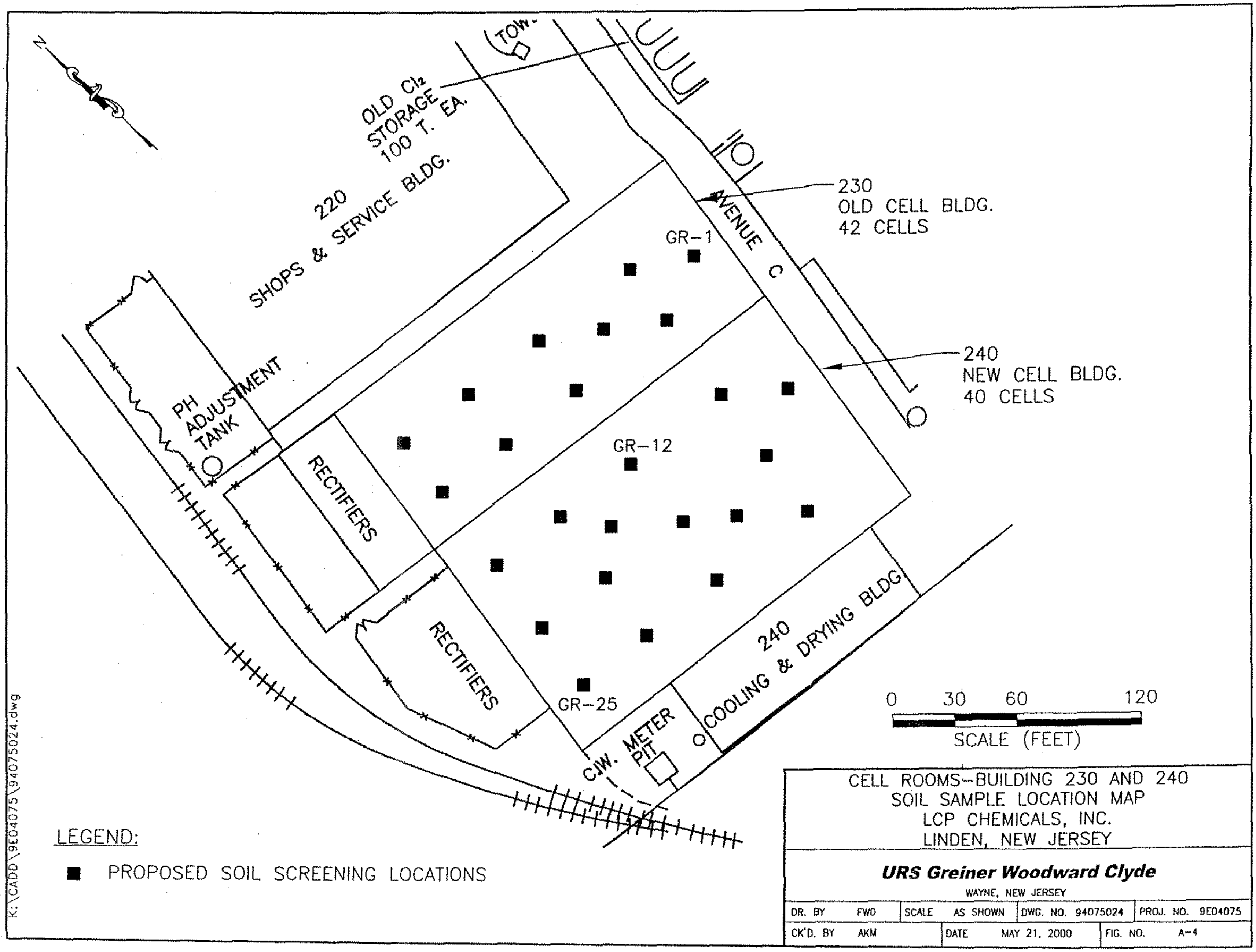
CHEMFIX LAGOON SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075022	PROJ. NO. 9E04075
CK'D. BY AKM	DATE AUG 10, 1999	FIG. NO. A-3	



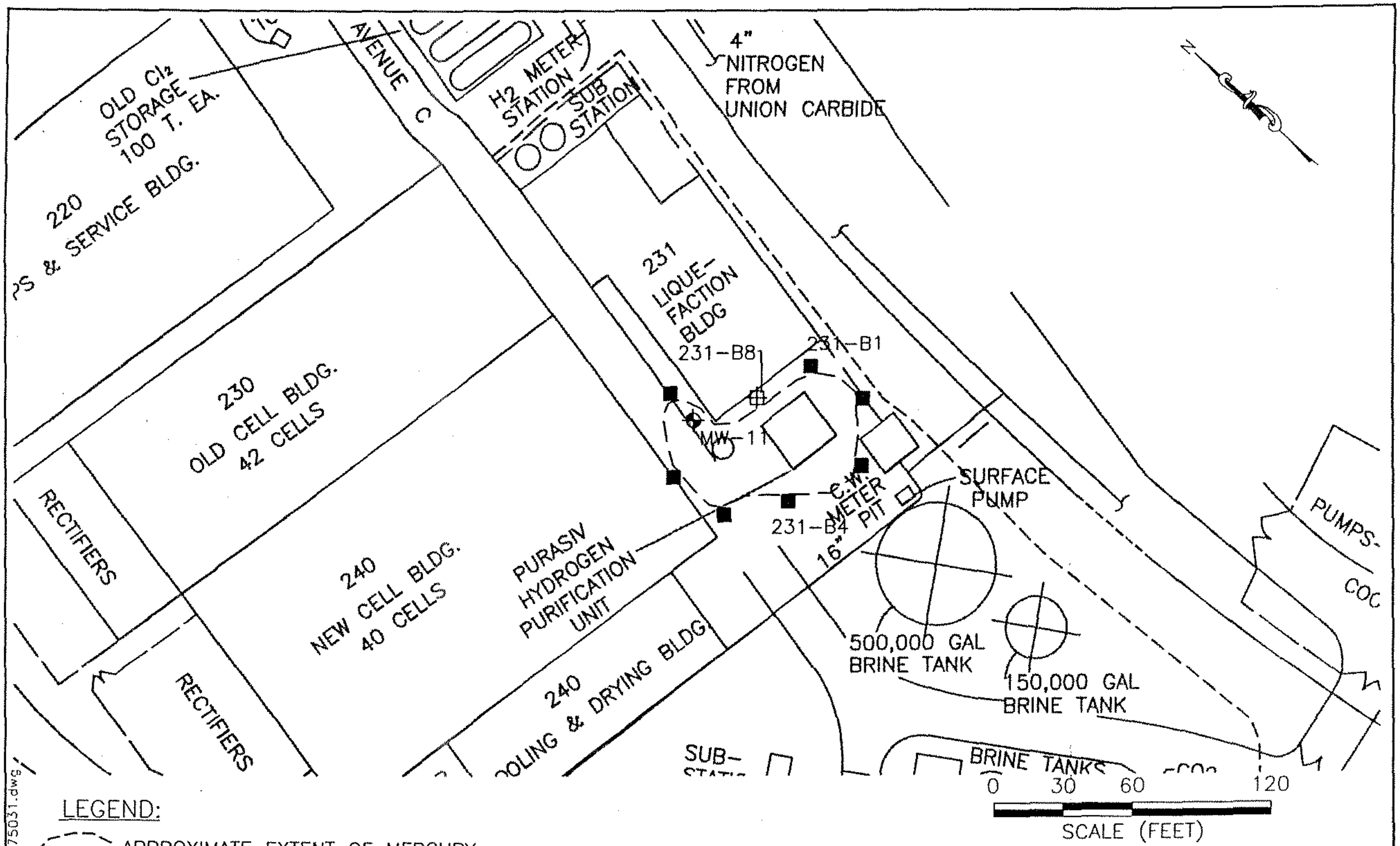
LEGEND:

■ PROPOSED SOIL SCREENING LOCATIONS

CELL ROOMS—BUILDING 230 AND 240
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075024	PROJ. NO. 9E04075
CK'D. BY AKM	DATE MAY 21, 2000	FIG. NO. A-4	



LEGEND:

- - - APPROXIMATE EXTENT OF MERCURY SOIL CONTAMINATION (BB & L, 1988)

■ PROPOSED SOIL BORING LOCATION

⊞ PROPOSED DEEP (25 FT) STRATIGRAPHIC BORING LOCATION

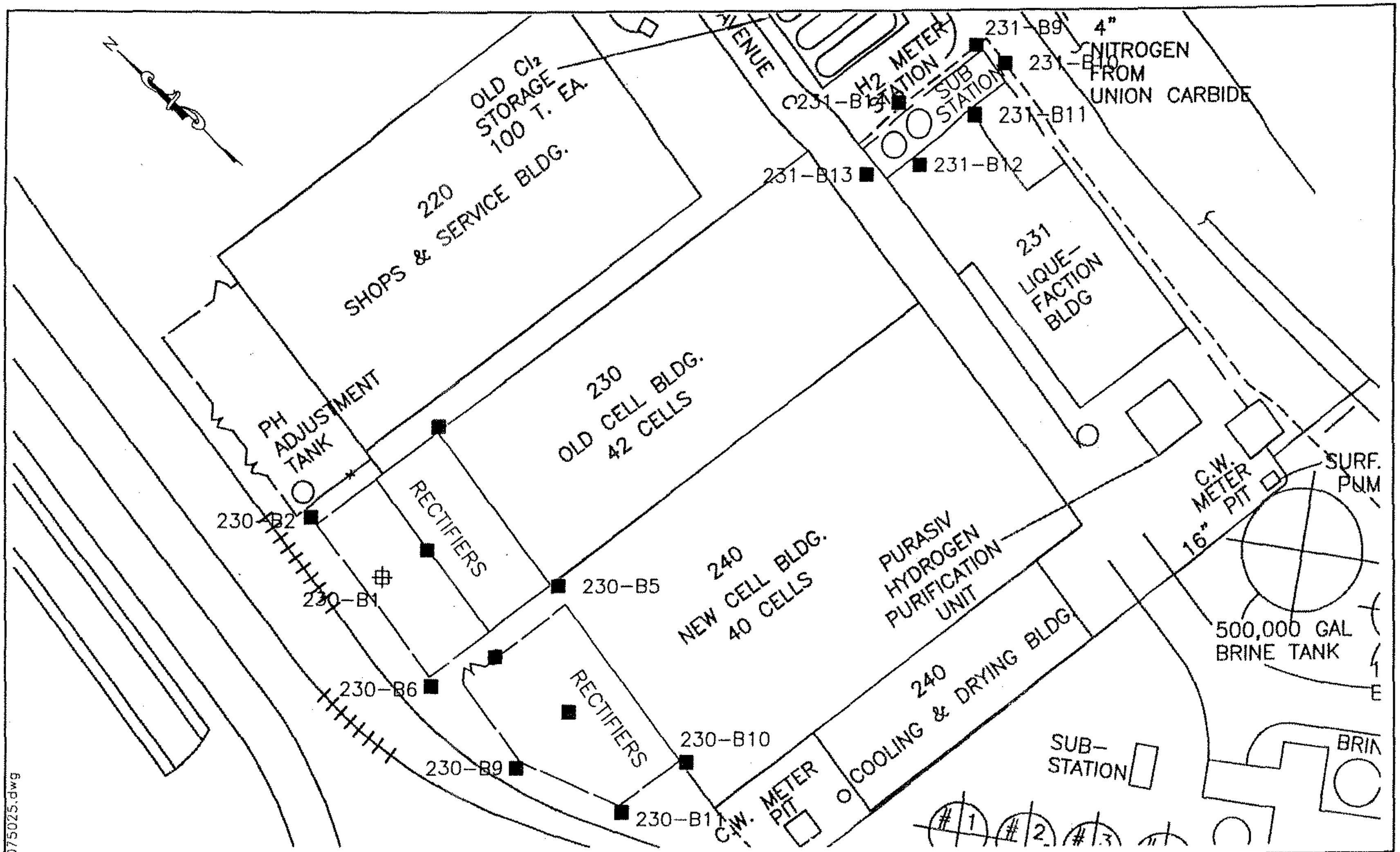
⌖ PROPOSED GROUNDWATER MONITORING WELL LOCATION

K:\CADD\9E04075\94075031.dwg

BUILDING 231 SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075031	PROJ. NO. 9E04075
CK'D. BY AKM	DATE OCT 20, 1999		FIG. NO. A–5



LEGEND:

■ PROPOSED SOIL BORING LOCATION

⌗ PROPOSED BEDROCK STRATIGRAPHIC BORING LOCATION

0 30 60 120

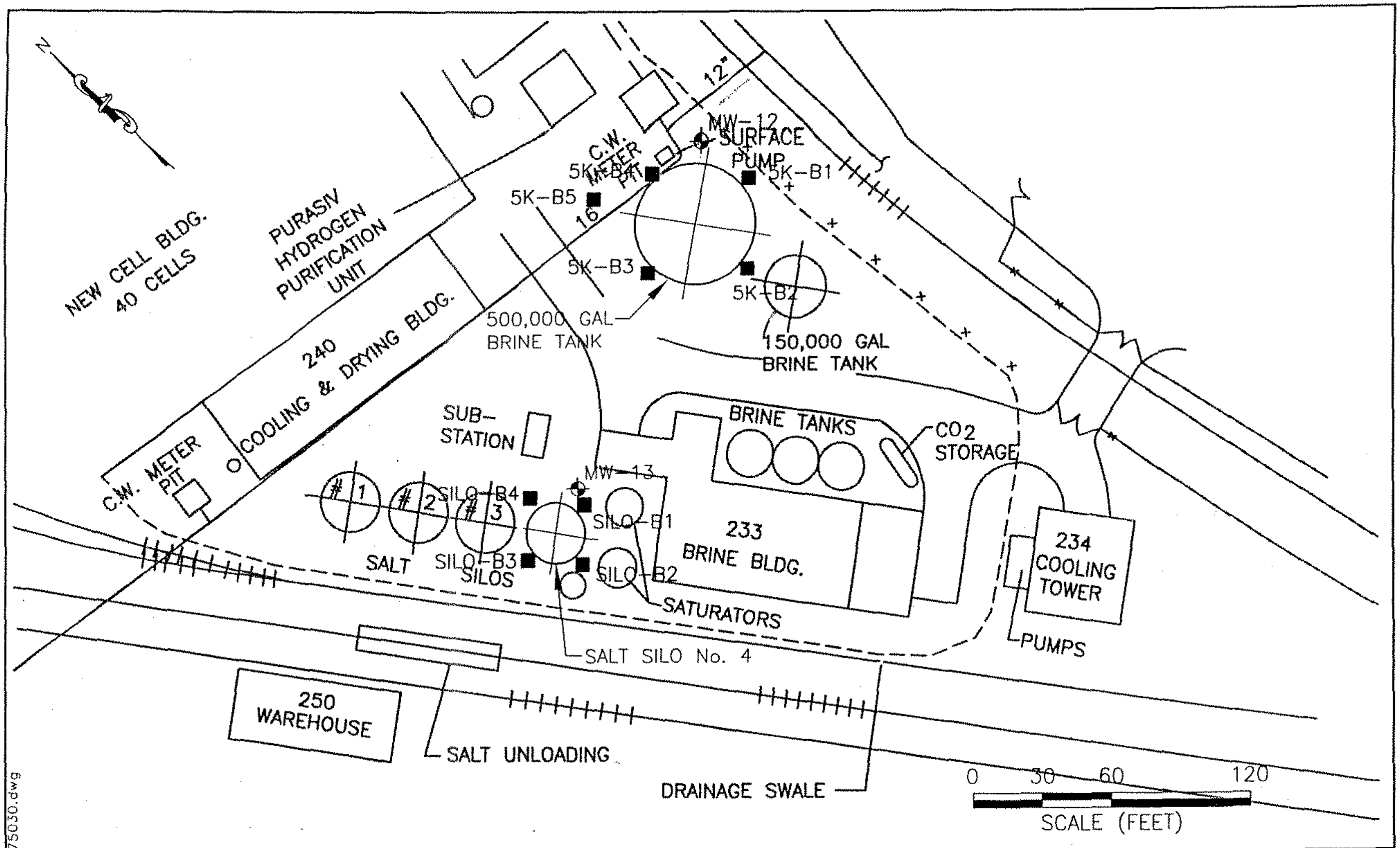
SCALE (FEET)

K:\CADD\9E04075\94075025.dwg

FORMER TRANSFORMER AREAS
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075025	PROJ. NO. 9E04075
CK'D. BY AKM	DATE NOV 1, 2000	FIG. NO. A-6	



LEGEND:

■ PROPOSED SOIL BORING LOCATION

⌖ PROPOSED GROUNDWATER MONITORING WELL LOCATION

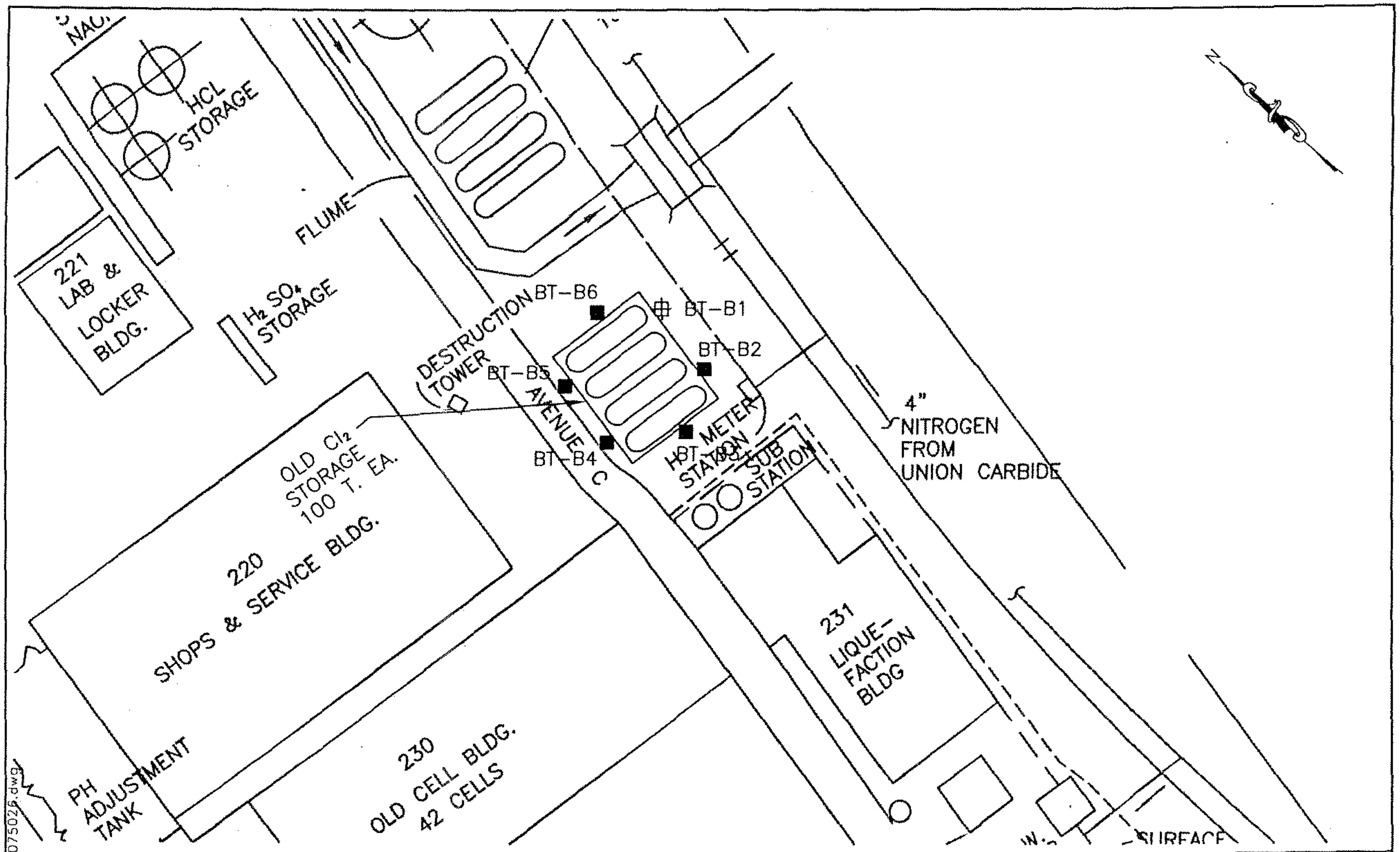
— — — — DRAINAGE SWALE/TRENCH

K:\CADD\9E04075\94075030.dwg

500K TANK AND SALT SILO No. 4
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075030	PROJ. NO. 9E04075
CK'D. BY AKM	DATE NOV 1, 2000	FIG. NO. A-7	



LEGEND:

■ PROPOSED SOIL BORING LOCATION

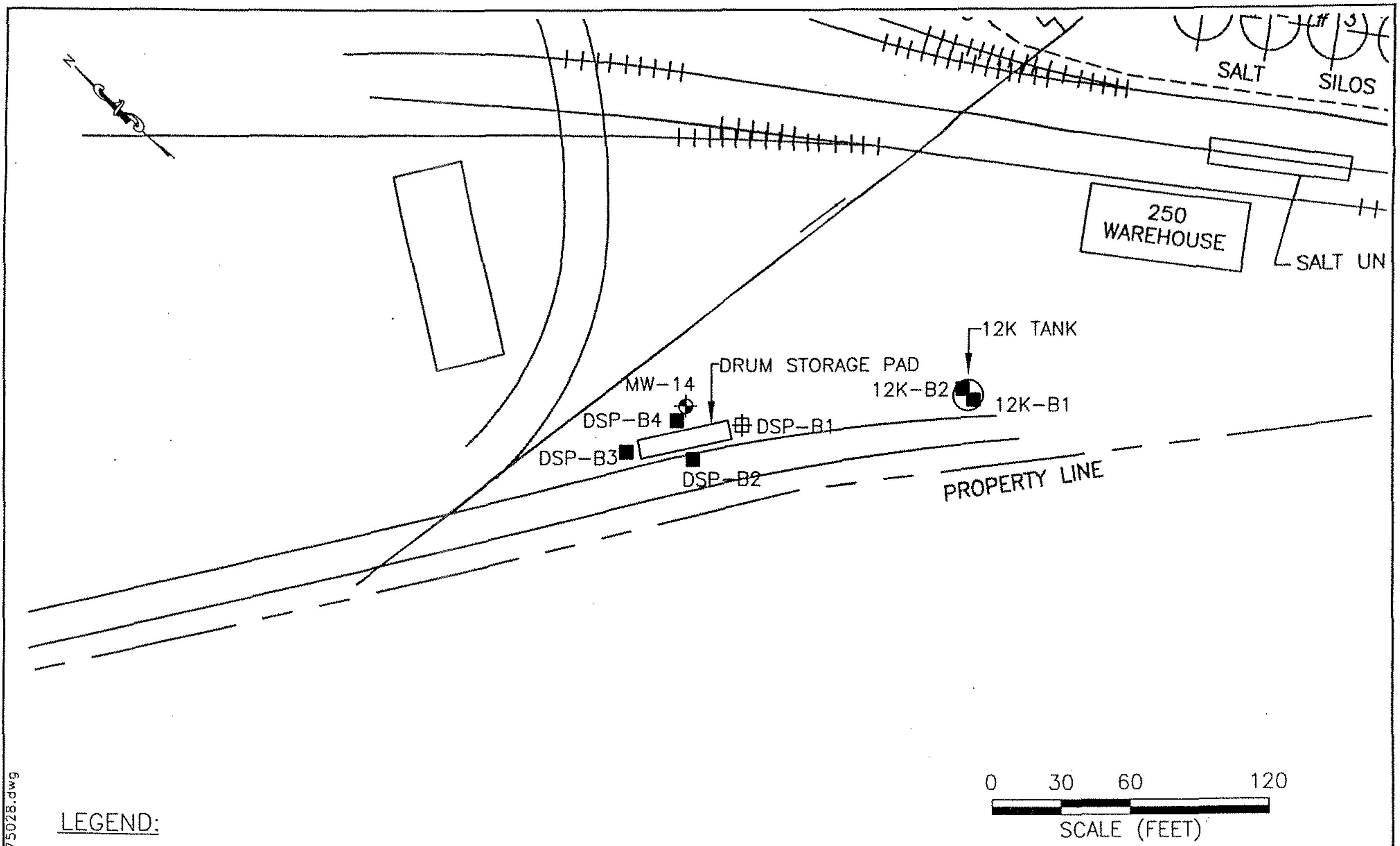
⌖ PROPOSED DEEP (25 FT) STRATIGRAPHIC BORING LOCATION

0 30 60 120
SCALE (FEET)

BULLET TANKS SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075026	PROJ. NO. 9E04075
CK'D. BY AKM	DATE NOV 1, 2000		FIG. NO. A-8



LEGEND:

■ PROPOSED SOIL BORING LOCATION

⌗ PROPOSED BEDROCK STRATIGRAPHIC BORING LOCATION

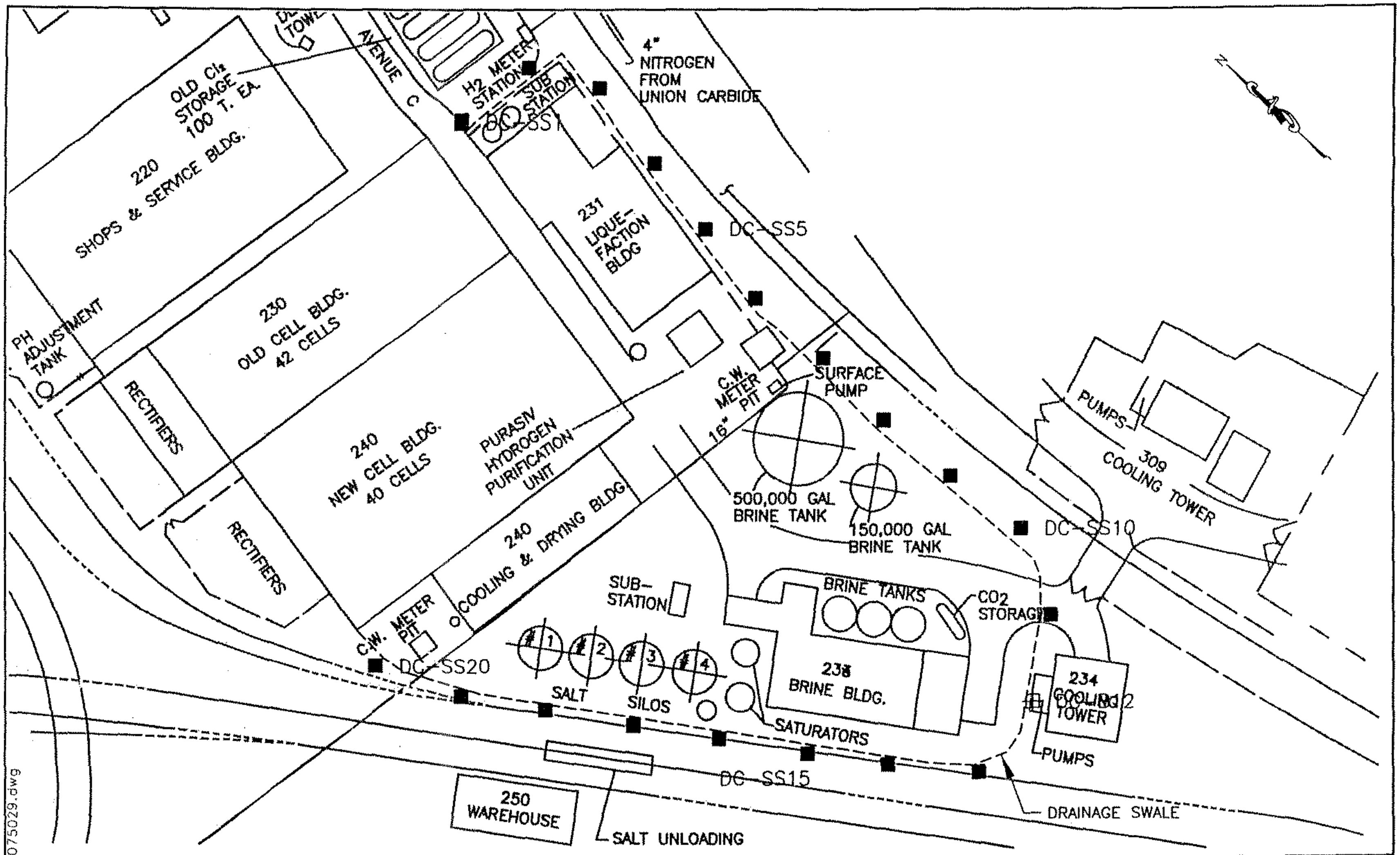
⌖ PROPOSED GROUNDWATER MONITORING WELL LOCATION

K:\CADD\9E04075\94075028.dwg

DRUM STORAGE PAD AND 12K TANK SOIL SAMPLE
LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075028	PROJ. NO. 9E04075
CK'D. BY AKM	DATE NOV 1, 2000	FIG. NO. A-9	



LEGEND:

■ PROPOSED SOIL BORING LOCATION

⌖ PROPOSED DEEP (25 FT) STRATIGRAPHIC BORING LOCATION

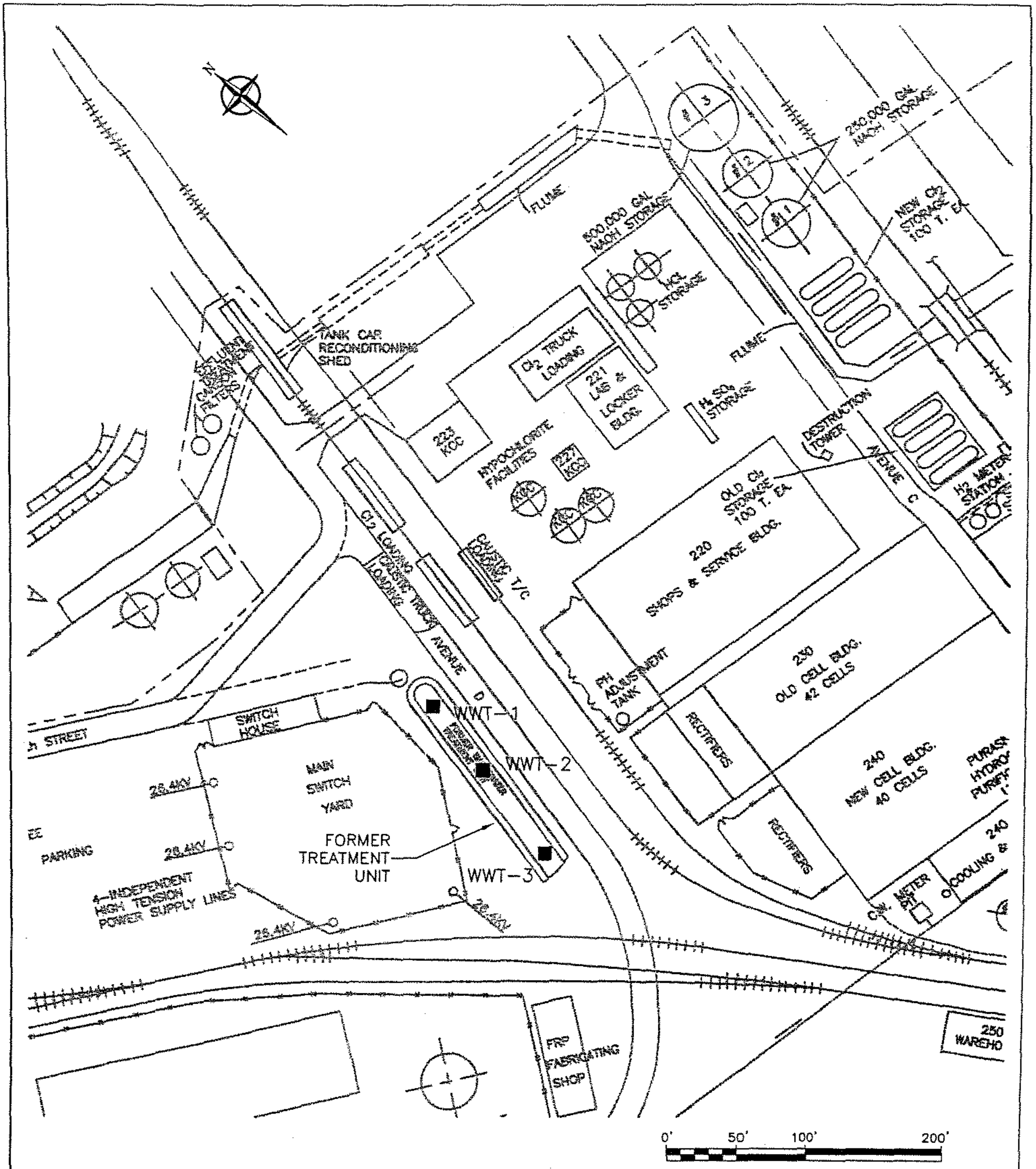
0 40 80 140

SCALE (FEET)

CONCRETE DRAINAGE CHANNEL
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075029	PROJ. NO. 9E04075
CK'D. BY AKM	DATE NOV 1, 2000	FIG. NO. A-10	



LEGEND:

■ PROPOSED SOIL BORING LOCATION

FORMER WASTEWATER TREATMENT UNIT
SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS Greiner Woodward Clyde

WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075038	PROJ. NO. 9E04075
CK'D. BY AKM	DATE MAY 21, 2000		FIG. NO. A-11

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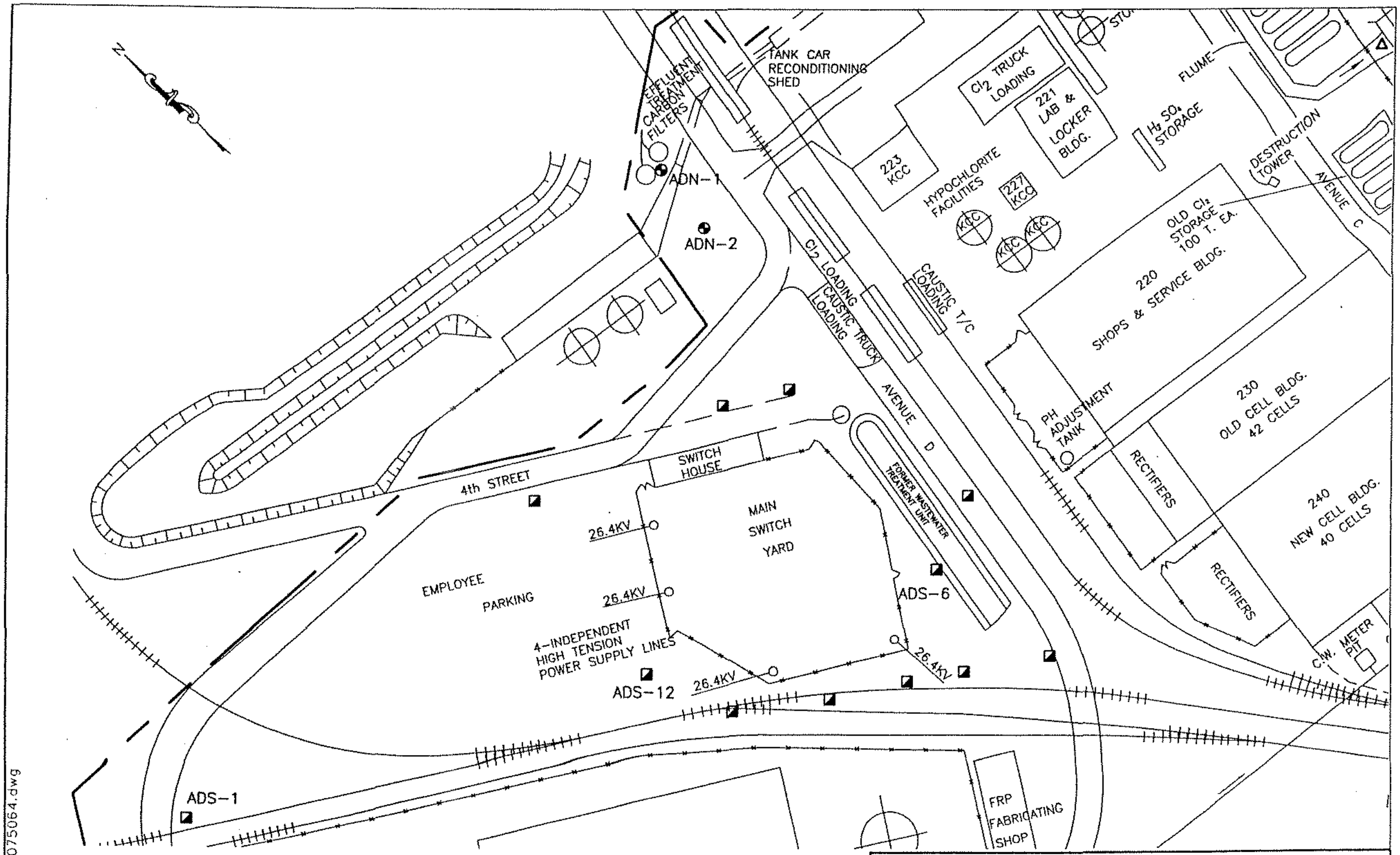


K:\CADD\9E04075\94075064.dwg

LEGEND:

◪ PROPOSED BORINGS SOUTH OF 4th STREET

◉ PROPOSED BORINGS NORTH OF 4th STREET

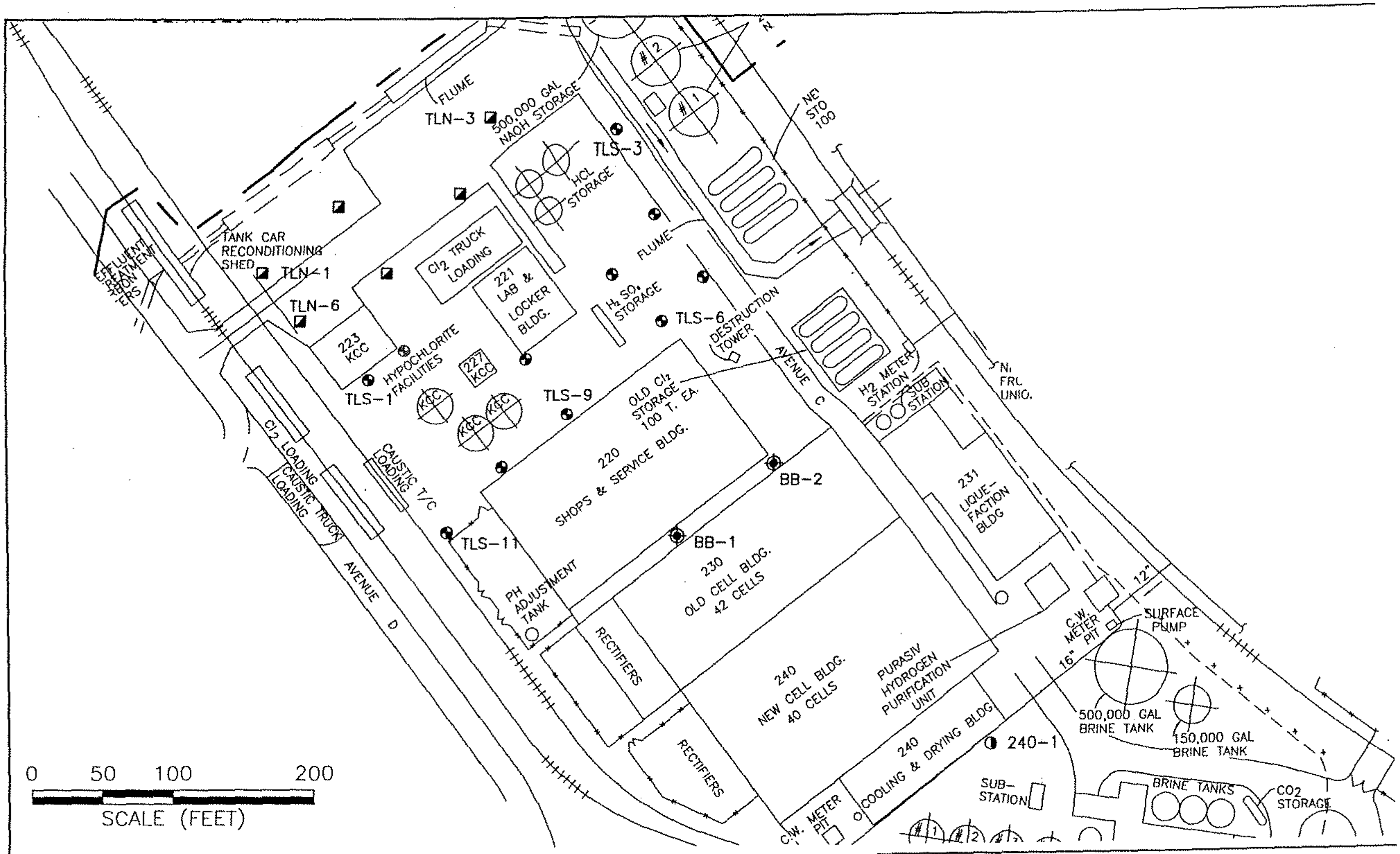
0 50 100 200

SCALE (FEET)

WEST OF AVENUE D
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075064	PROJ. NO. 9E04075
CK'D. BY JF	DATE SEPT. 27, 2000	FIG. NO. A-12	



K:\CADD\9E04075\94075066.dwg

LEGEND:

TLN-1 ◩ PROPOSED BORINGS NORTH OF BUILDING 223

TLS-1 ◒ PROPOSED BORINGS SOUTH OF BUILDING 223

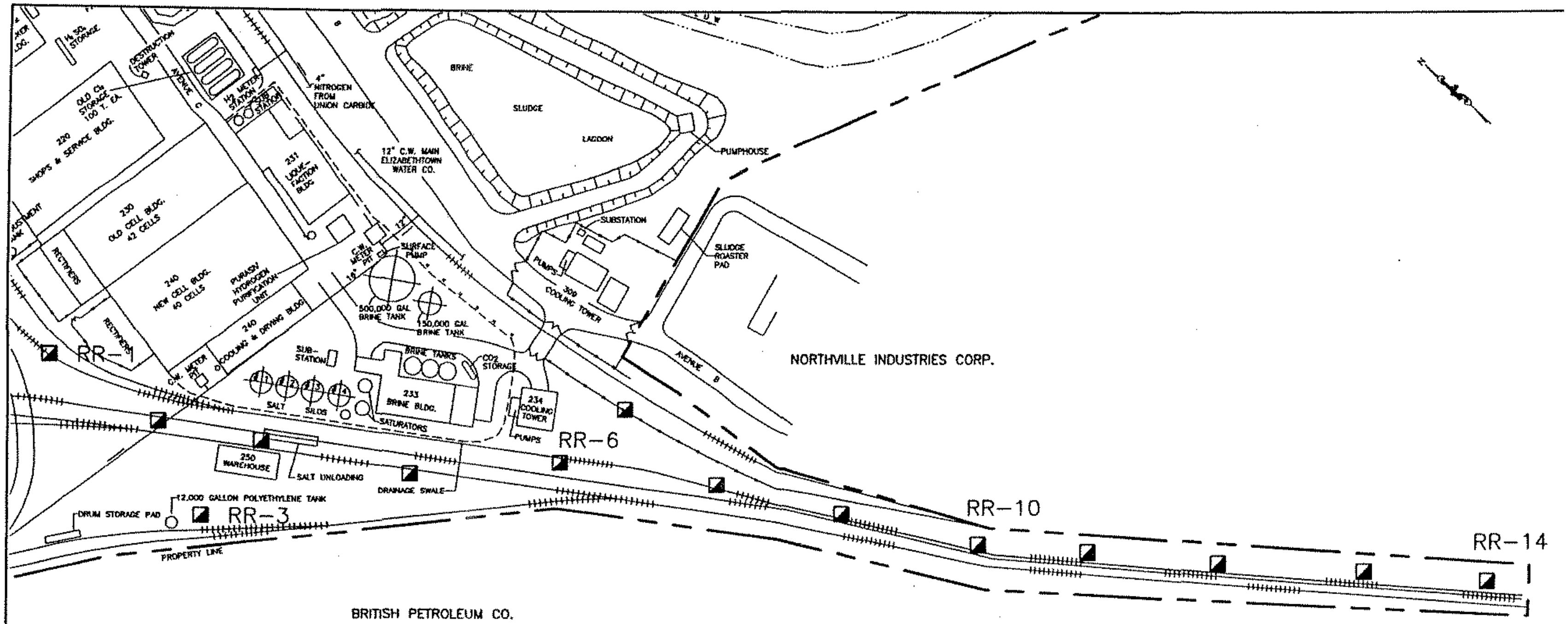
BB-1 ⊕ PROPOSED BORINGS BETWEEN BUILDING 220 & 230

240-1 ◑ PROPOSED BORINGS SOUTH OF BUILDING 240

BUILDINGS 220, 223, 230 & 240
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075066	PROJ. NO. 9E04075
CK'D. BY JF	DATE SEPT. 27, 2000	FIG. NO. A-13	



K:\CADD\9E04075\94075068.dwg

LEGEND:

RR-1 ◪ RAILROAD TRACK SOIL SAMPLES

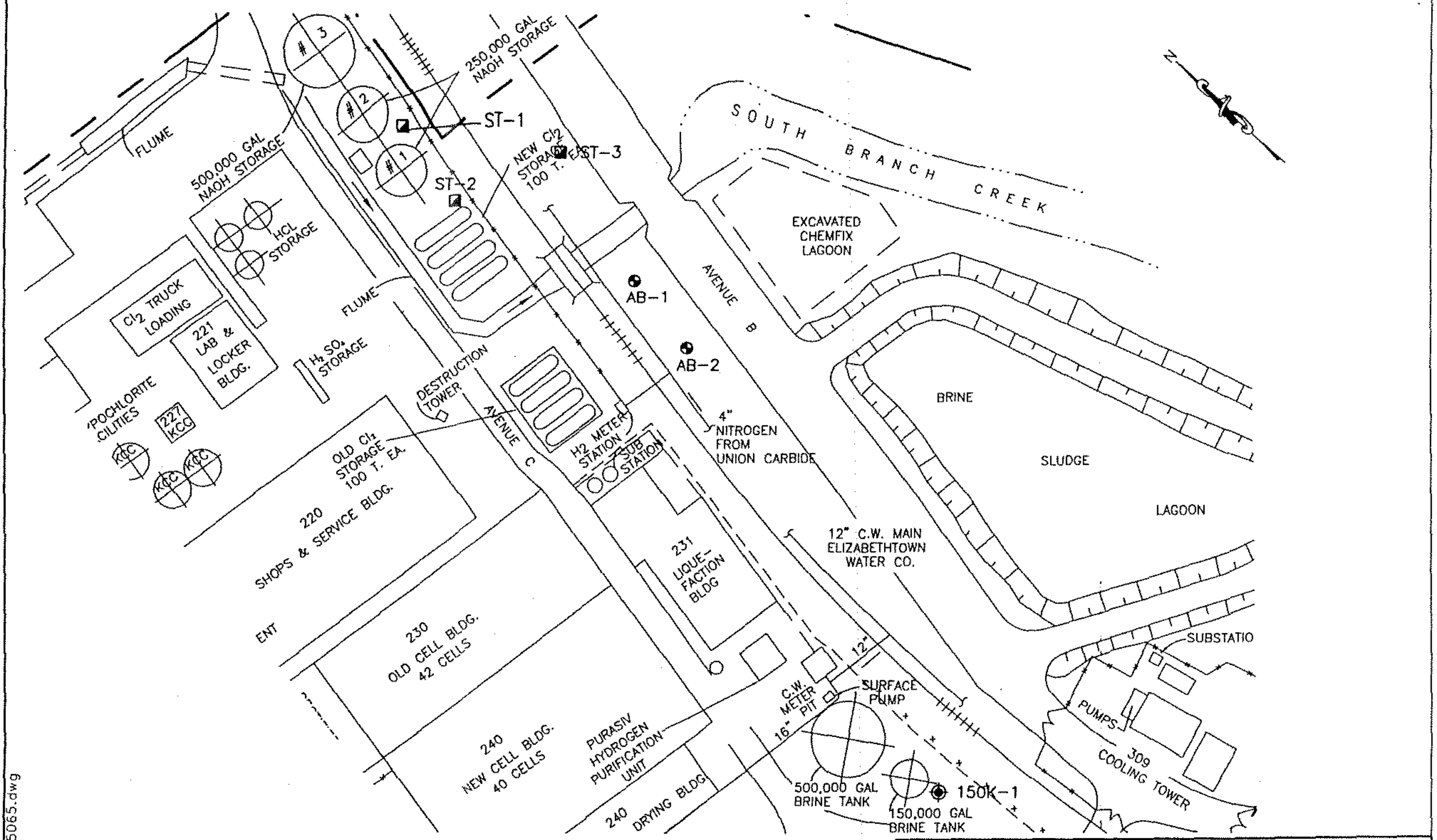
0 90 180 360

SCALE (FEET)

RAILROAD TRACKS
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075068	PROJ. NO. 9E04075
CK'D. BY JF	DATE OCT. 2, 2000	FIG. NO. A-14	



LEGEND:

ST-1 ◪ PROPOSED BORINGS NEAR 250K STORAGE TANK

AB-1 ◉ PROPOSED BORINGS NEAR OLD CHLORINE STORAGE

150K-1 ⊕ PROPOSED BORINGS 150K BRINE TANK

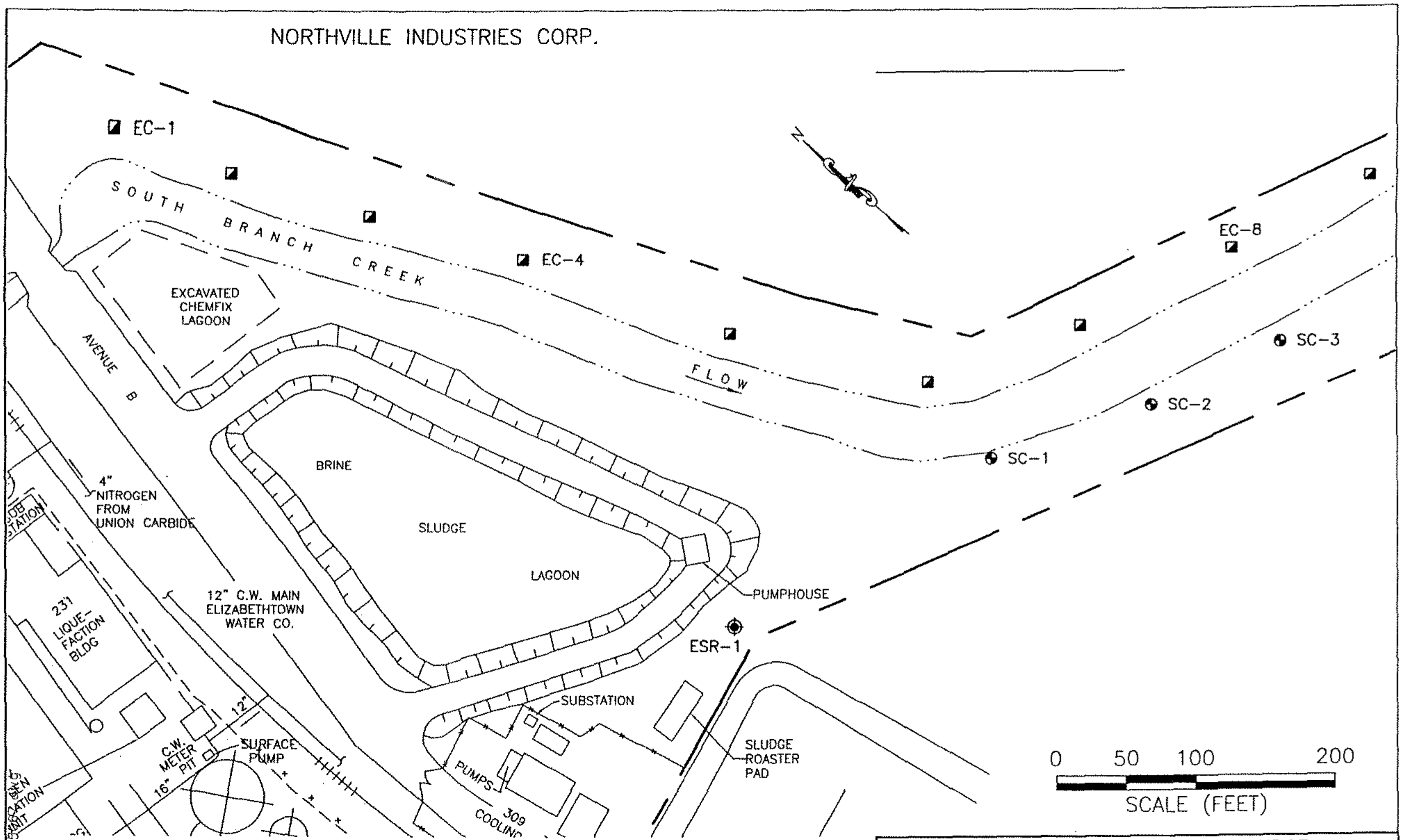
0 50 100 200
SCALE (FEET)

K:\CADD\9E04075\94075065.dwg

250K, CHLORINE & 150K BRINE
STORAGE TANKS
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075065	PROJ. NO. 9E04075
CK'D. BY JF	DATE SEPT. 27, 2000	FIG. NO. A-15	



LEGEND:

EC-1 ◩ PROPOSED BORINGS EAST OF SOUTH BRANCH CREEK

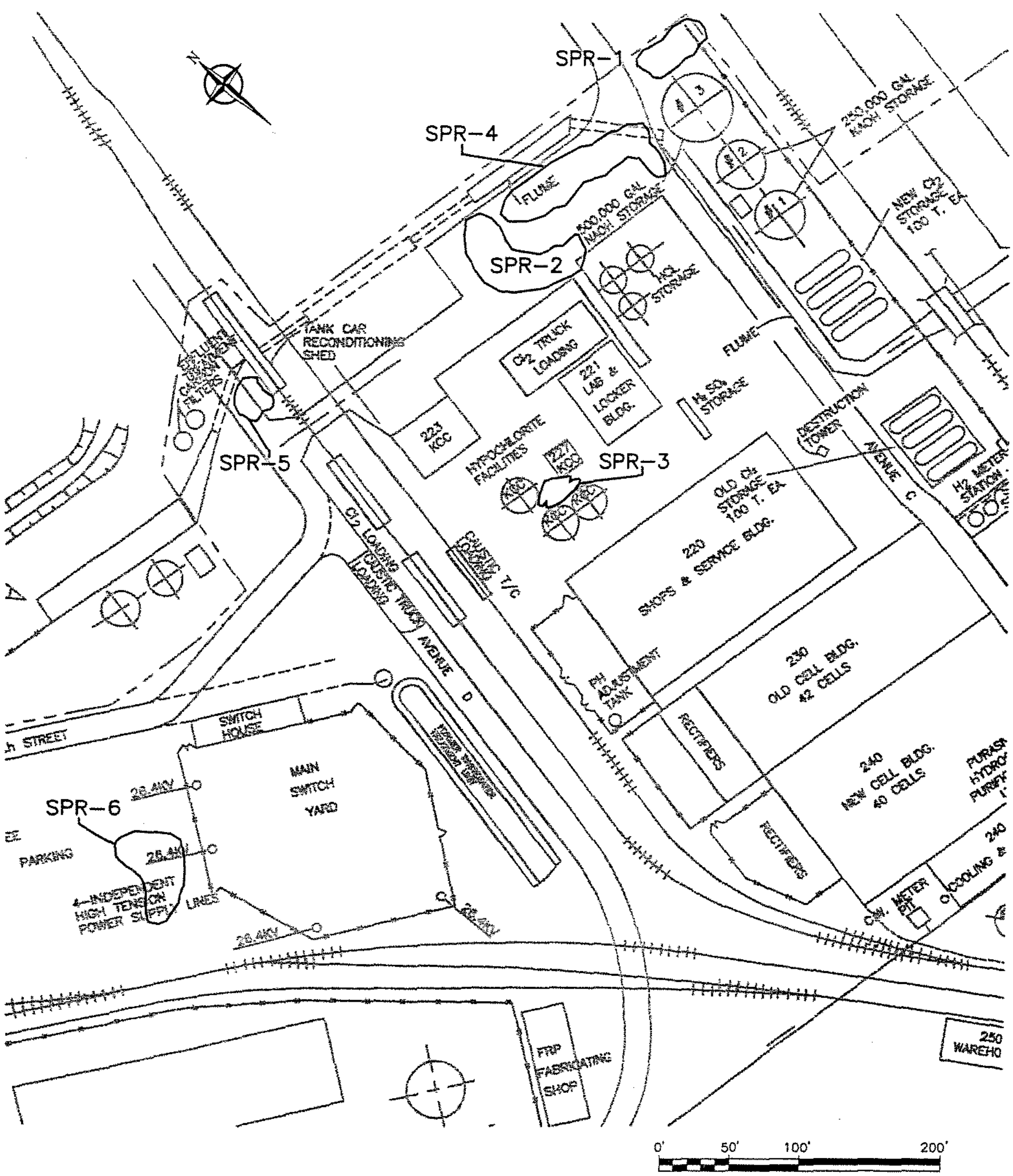
SC-1 ● PROPOSED BORINGS SOUTH OF SOUTH BRANCH CREEK

ESR-1 ⊕ PROPOSED BORINGS EAST OF SLUDGE ROASTER PAD

SOUTH BRANCH CREEK & SLUDGE
ROASTER PAD
SOIL SAMPLE LOCATION MAP
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY FWD	SCALE AS SHOWN	DWG. NO. 94075067	PROJ. NO. 9E04075
CK'D. BY JF	DATE SEPT. 27, 2000		FIG. NO. A-16



LEGEND:

⬭ PROPOSED SOIL SAMPLING LOCATION

AREAS OF SUSPECTED PAST RELEASES
LCP CHEMICALS, INC.
LINDEN, NEW JERSEY

URS
WAYNE, NEW JERSEY

DR. BY	FWD	SCALE	AS SHOWN	DWG. NO.	94075039	PROJ. NO.	9E04075
CK'D. BY	AKM	DATE	MAY 21, 2000			FIG. NO.	A-17

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APPENDIX B

Sample Procedures and Methodologies

The EnCore^{TM} Sampling Procedure – EPA, 2000

The EnCore^{TM} Sampler is a disposable volumetric sampling device developed to assist in taking soil samples with minimal handling and maximum accuracy. It eliminates the need for sample preservatives and it avoids many sources for lab discrepancies. The EnCore^{TM} sampler consists of a one-time use coring body, a removable and re-useable Core T-handle and a sample cap.

Equipment

- EnCore^{TM} Samplers (5g).
- 60ml wide mouth soil sample containers for dry weight.
- T-handle.
- Stainless steel spoon or spatula.
- Paper Towels.

Sampling Procedures

1. Collect three EnCore^{TM} samples and one (1) percent moisture sample (60ml wide mouth glass container with no head space) for each sample point location.
2. Remove the sampler and cap from the EnCore^{TM} package and attach the T-handle to the sampler body.
3. Quickly push the sampler into a freshly exposed surface of soil (ground surface or soil core sampler) until the sampler is full.
4. Check to see whether the sampler is full by looking into the viewing hole in the T-handle. The back o-ring on the plunger will show in the viewing window when soil has fully pushed the plunger back. The plunger can only be rotated when it is completely pushed to the back of the sampler body. If the plunger can be twisted, this indicates that soil has completely filled the sampler and the back o-rings have sealed.
5. Scrape any excess soil flush with the edge of the sampler using a dedicated or decontaminated stainless steel trowel.
6. Use a paper towel to quickly and carefully wipe the sampler head so that the cap can be tightly attached and sealed.
7. To attach the cap, push the cap on with a twisting motion. The cap is properly sealed when the two locking arms are completely seated over the ridge on the body of the sampler.
8. Complete the sample label on the EnCore^{TM} zipper lock package.
9. Fill in the sample identification number on the self-adhesive label attached beneath the sample label on the EnCore^{TM} package.
10. Tear the self-adhesive label at the perforation and attach the label to the rim of the sampler cap.
11. Place the sampler back into the EnCore^{TM} zipper lock package and seal the zipper lock.
12. The Sample label may be used as a custody seal to be placed over the opening of the EnCore^{TM} zipper lock package to ensure sample integrity. If the Sample label is not used as a custody seal, the Sample label must be attached to the exterior of the EnCore^{TM} package and a custody seal placed over the opening of the package.

13. Repeat the procedure above for the other two samplers.
14. Once all three samplers have been filled, labeled and packaged, place the three EnCore™ packages into one large zipper lock bag with a completed sample tag.
15. Collect the percent moisture sample in a separate sample container (60ml wide mouth glass container).
16. Double volume is required for the collection of the MS/MSD samples. This includes six EnCore™ samplers and one 60ml wide mouth glass container.
17. Store all samples in a cooler with bagged ice to maintain 4 degrees Celsius while storing on site and during shipment to the laboratory.
18. Samples must be shipped off site to the laboratory within 24 hours.
19. Samples must be received by the laboratory for preservation and preparation for extraction within 2 days from the date of sample collection.

What is the En Core Sampler?
En Core Sampler Kit
Pricing
Sample Collection
Sampling Procedures
Extrusion Procedures
Authorized Resellers
FAQ's
Performance Data
Validation of Hold Times for En Core
Additional Hold Time Studies

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En Core® Sampler

Disposable En Core® Sampler
Sampling Procedures

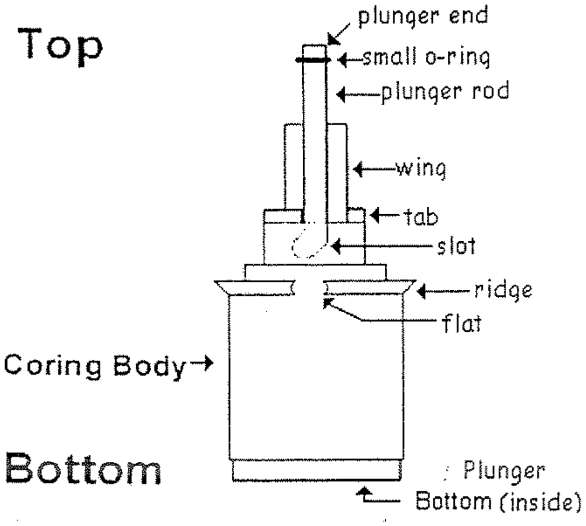
- *NOTE:*

1. En Core Sampler is a Single Use device. It cannot be cleaned and/or reused.

2. En Core Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)

Using The En Core® T-Handle



Before Taking Sample:

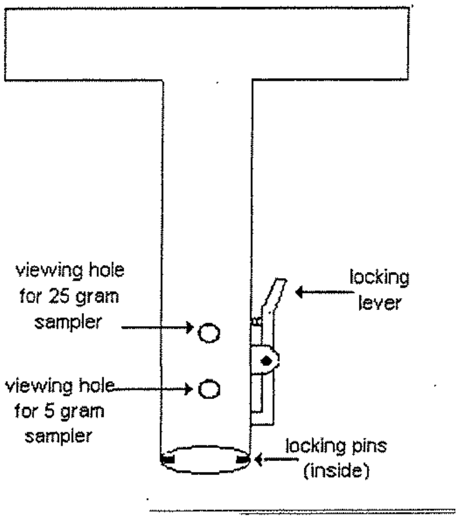
1. Hold coring body and push plunger rod down until small o-ring rests against tabs. This will assure that plunger moves freely.

2. Depress locking lever on En Core T- Handle. Place coring body, plunger end first, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2) locking pins in the T-Handle.* Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

Taking Sample:

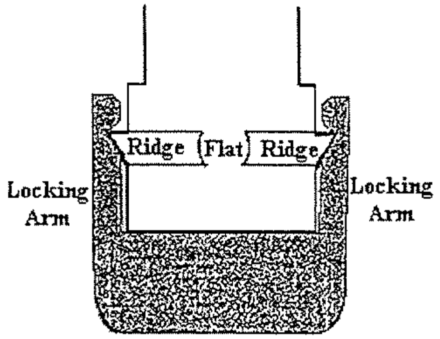
3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle viewing hole. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. Push cap over flat area of ridge. ***Push and twist cap to lock arm in place. Cap must be seated to seal sampler (see diagram below).***



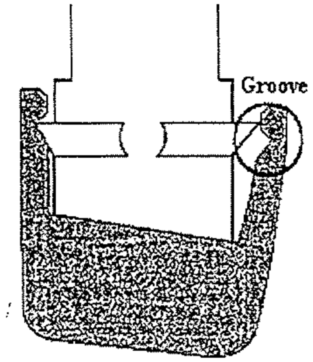
Sampler Correctly Capped

Locking arm grooves seated over coring body ridge.



Sampler Incorrectly Capped

Cap appears crooked; locking arm grooves not fully seated over coring body ridge



Preparing Sampler For Shipment:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs (see plunger diagram at right).

7. Attach completed label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

En Novative Technologies, Inc.
Phone:(920)465-3960 Fax: (920)465-3963
Toll Free: 888-411-0757

Last modified: January 09, 2001

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[News & Information][Feedback Form][Contact Us]

Volatile Organic Compounds Field Screening Procedure

The screening procedure for VOCs is based on field analysis procedures described by the NJDEP (February 1997). For any given sample, field screening for VOCs shall be conducted before field screening for mercury.

After a PID is calibrated (Section 3.9), it is ready to be used. A baseline scan (i.e., scan on "clean air", "clean water" or "clean soil", as appropriate) should be run each day prior to analyzing any site samples and the results recorded.

A background meter reading will be obtained and recorded at the time of field screening. If a concentration above several ppm is detected as background, the source of the reading will be investigated and controlled, if possible, or other appropriate actions taken as provided for in the site-specific RI/FS HASP.

PID readings and visual observations will be used to identify the portion of the soil sample with the greatest amount of VOC contamination within each soil sampler (i.e., split spoon or macro core). If only background readings are registered by the sampler, than a soil sample will not be collected from that depth interval. If volatile organic vapor readings above background concentrations are detected, then a sample of this portion of the soil sample will be collected using an EnCore™ sampler as described in the EnCore™ procedures and preserved on ice to maintain a temperature of 4 degrees Celsius. A duplicate sample of this portion of the soil sample will be placed in a plastic "ziplock" bag and the bag will be vigorously shaken for 15 seconds. The sample will then be set aside and left undisturbed for at least 10 minutes to allow headspace development. (If the ambient temperatures are below 32 degrees Fahrenheit, headspace development will take place within a heated vehicle or building.)

After headspace development, the plastic "ziplock" bag will be vigorously shaken again for 15 seconds and the probe of the PID will be inserted into the bag. The highest meter response will be recorded as the headspace concentration for that sample. Maximum response for a typical PID should occur between 5 and 10 seconds. This procedure will be repeated for each sample collected for screening. After the boring is completed, the EnCore™ duplicate sample of the screening sample that showed the highest VOC reading will submitted to the project laboratory for analyses.

If none of the samples register VOC readings above background, then the sample collected from just above the water table will be submitted for laboratory analysis of VOCs. The unused samples will be either drummed for disposal, returned as backfill to the boring, or saved and archived for soil description and stratigraphic identifications.

METHOD 5035

CLOSED-SYSTEM PURGE-AND-TRAP AND EXTRACTION FOR VOLATILE ORGANICS IN SOIL AND WASTE SAMPLES

1.0 SCOPE AND APPLICATION

1.1 This method describes a closed-system purge-and-trap process for the analysis of volatile organic compounds (VOCs) in solid materials (e.g., soils, sediments, and solid waste). While the method is designed for use on samples containing low levels of VOCs, procedures are also provided for collecting and preparing solid samples containing high concentrations of VOCs and for oily wastes. For these high concentration and oily materials, sample collection and preparation are performed using the procedures described here, and sample introduction is performed using the aqueous purge-and-trap procedure in Method 5030. These procedures may be used in conjunction with any appropriate determinative gas chromatographic procedure, including, but not limited to, Methods 8015, 8021, and 8260.

1.2 The low soil method utilizes a hermetically-sealed sample vial, the seal of which is never broken from the time of sampling to the time of analysis. Since the sample is never exposed to the atmosphere after sampling, the losses of VOCs during sample transport, handling, and analysis are negligible. The applicable concentration range of the low soil method is dependent on the determinative method, matrix, and compound. However, it will generally fall in the 0.5 to 200 µg/kg range.

1.3 Procedures are included for preparing high concentration samples for purging by Method 5030. High concentration samples are those containing VOC levels of >200 µg/kg.

1.4 Procedures are also included for addressing oily wastes that are soluble in a water-miscible solvent. These samples are also purged using Method 5030..

1.5 Method 5035 can be used for most volatile organic compounds that have boiling points below 200°C and that are insoluble or slightly soluble in water. Volatile, water-soluble compounds can be included in this analytical technique. However, quantitation limits (by GC or GC/MS) are approximately ten times higher because of poor purging efficiency.

1.6 Method 5035, in conjunction with Method 8015 (GC/FID), may be used for the analysis of the aliphatic hydrocarbon fraction in the light ends of total petroleum hydrocarbons, e.g., gasoline. For the aromatic fraction (BTEX), use Method 5035 and Method 8021 (GC/PID). A total determinative analysis of gasoline fractions may be obtained using Method 8021 in series with Method 8015.

1.7 As with any preparative method for volatiles, samples should be screened to avoid contamination of the purge-and-trap system by samples that contain very high concentrations of purgeable material above the calibration range of the low concentration method. In addition, because the sealed sample container cannot be opened to remove a sample aliquot without compromising the integrity of the sample, multiple sample aliquots should be collected to allow for screening and reanalysis.

1.8 The closed-system purge-and-trap equipment employed for low concentration samples is not appropriate for soil samples preserved in the field with methanol. Such samples should be analyzed using Method 5030 (see the note in Sec. 6.2.2).

1.9 This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

2.1 Low concentration soil method - generally applicable to and soils and other solid samples with VOC concentrations in the range of 0.5 to 200 µg/kg.

Volatile organic compounds (VOCs) are determined by collecting an approximately 5-g sample, weighed in the field at the time of collection, and placing it in a pre-weighed vial with a septum-sealed screw-cap (see Sec. 4) that already contains a stirring bar and a sodium bisulfate preservative solution. The vial is sealed and shipped to a laboratory or appropriate analysis site. The entire vial is then placed, unopened, into the instrument carousel. Immediately before analysis, organic-free reagent water, surrogates, and internal standards (if applicable) are automatically added without opening the sample vial. The vial containing the sample is heated to 40°C and the volatiles purged into an appropriate trap using an inert gas combined with agitation of the sample. Purged components travel via a transfer line to a trap. When purging is complete, the trap is heated and backflushed with helium to desorb the trapped sample components into a gas chromatograph for analysis by an appropriate determinative method.

2.2 High concentration soil method - generally applicable to soils and other solid samples with VOC concentrations greater than 200 µg/kg.

The sample introduction technique in Sec. 2.1 is not applicable to all samples, particularly those containing high concentrations (generally greater than 200 µg/kg) of VOCs which may overload either the volatile trapping material or exceed the working range of the determinative instrument system (e.g., GC/MS, GC/FID, GC/EC, etc.). In such instances, this method describes two sample collection options and the corresponding sample purging procedures.

2.2.1 The first option is to collect a bulk sample in a vial or other suitable container without the use of the preservative solution described in Sec. 2.1. A portion of that sample is removed from the container in the laboratory and is dispersed in a water-miscible solvent to dissolve the volatile organic constituents. An aliquot of the solution is added to 5 mL of reagent water in a purge tube. Surrogates and internal standards (if applicable) are added to the solution, then purged using Method 5030, and analyzed by an appropriate determinative method. Because the procedure involves opening the vial and removing a portion of the soil, some volatile constituents may be lost during handling.

2.2.2 The second option is to collect an approximately 5-g sample in a pre-weighed vial with a septum-sealed screw-cap (see Sec 4) that contains 5 mL of a water-miscible organic solvent (e.g., methanol). At the time of analysis, surrogates are added to the vial, then an aliquot of the solvent is removed from the vial, purged using Method 5030 and analyzed by an appropriate determinative method.

2.3 High concentration oily waste method - generally applicable to oily samples with VOC concentrations greater than 200 µg/kg that can be diluted in a water-miscible solvent.

Samples that are comprised of oils or samples that contain significant amounts of oil present additional analytical challenges. This procedure is generally appropriate for such samples when they are soluble in a water-miscible solvent.

2.3.1 After demonstrating that a test aliquot of the sample is soluble in methanol or polyethylene glycol (PEG), a separate aliquot of the sample is spiked with surrogates and diluted in the appropriate solvent. An aliquot of the solution is added to 5 mL of reagent water in a purge tube, taking care to ensure that a floating layer of oil is not present in the purge tube. Internal standards (if applicable) are added to the solution which is then purged using Method 5030 and analyzed by an appropriate determinative method.

2.3.2 Samples that contain oily materials that are not soluble in water-miscible solvents must be prepared according to Method 3585.

3.0 INTERFERENCES

3.1 Impurities in the purge gas and from organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running method blanks. The use of non-polytetrafluoroethylene (non-PTFE) plastic coating, non-PTFE thread sealants, or flow controllers with rubber components in the purging device must be avoided, since such materials out-gas organic compounds which will be concentrated in the trap during the purge operation. These compounds will result in interferences or false positives in the determinative step.

3.2 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal of the sample vial during shipment and storage. A trip blank prepared from organic-free reagent water and carried through sampling and handling protocols serves as a check on such contamination.

3.3 Contamination by carryover can occur whenever high-concentration and low-concentration samples are analyzed in sequence. Where practical, samples with unusually high concentrations of analytes should be followed by an analysis of organic-free reagent water to check for cross-contamination. If the target compounds present in an unusually concentrated sample are also found to be present in the subsequent samples, the analyst must demonstrate that the compounds are not due to carryover. Conversely, if those target compounds are <u>not</u> present in the subsequent sample, then the analysis of organic-free reagent water is not necessary.

3.4 The laboratory where volatile analysis is performed should be completely free of solvents. Special precautions must be taken to determine methylene chloride. The analytical and sample storage area should be isolated from all atmospheric sources of methylene chloride, otherwise random background levels will result. Since methylene chloride will permeate through PTFE tubing, all GC carrier gas lines and purge gas plumbing should be constructed of stainless steel or copper tubing. Laboratory workers' clothing previously exposed to methylene chloride fumes during common liquid/liquid extraction procedures can contribute to sample contamination. The presence of other organic solvents in the laboratory where volatile organics are analyzed will also lead to random background levels and the same precautions must be taken.

4.0 APPARATUS AND MATERIALS

4.1 Sample Containers

The specific sample containers required will depend on the purge-and-trap system to be employed (see Sec. 4.2). Several systems are commercially available. Some systems employ 40-mL clear vials with a special frit and equipped with two PTFE-faced silicone septa. Other systems permit the use of any good quality glass vial that is large enough to contain at least 5 g of soil or solid material and at least 10 mL of water and that can be sealed with a screw-cap containing a PTFE-faced silicone septum. Consult the purge-and-trap system manufacturer's instructions regarding the suitable specific vials, septa, caps, and mechanical agitation devices.

4.2 Purge-and-Trap System

The purge-and-trap system consists of a unit that automatically adds water, surrogates, and internal standards (if applicable) to a vial containing the sample, purges the VOCs using an inert gas stream while agitating the contents of the vial, and also traps the released VOCs for subsequent desorption into the gas chromatograph. Such systems are commercially available from several sources and shall meet the following specifications.

4.2.1 The purging device should be capable of accepting a vial sufficiently large to contain a 5-g soil sample plus a magnetic stirring bar and 10 mL of water. The device must be capable of heating a soil vial to 40°C and holding it at that temperature while the inert purge gas is allowed to pass through the sample. The device should also be capable of introducing at least 5 mL of organic-free reagent water into the sample vial while trapping the displaced headspace vapors. It must also be capable of agitating the sealed sample during purging, (e.g., using a magnetic stirring bar added to the vial prior to sample collection, sonication, or other means). The analytes being purged must be quantitatively transferred to an absorber trap. The trap must be capable of transferring the absorbed VOCs to the gas chromatograph (see 4.2.2).

NOTE: The equipment used to develop this method was a Dynatech PTA-30 W/S Autosampler. This device was subsequently sold to Varian, and is now available as the Archon Purge and Trap Autosampler. See the Disclaimer at the front of this manual for guidance on the use of alternative equipment.

4.2.2 A variety of traps and trapping materials may be employed with this method. The choice of trapping material may depend on the analytes of interest. Whichever trap is employed, it must demonstrate sufficient adsorption and desorption characteristics to meet the quantitation limits of all the target analytes for a given project and the QC requirements in Method 8000 and the determinative method. The most difficult analytes are generally the gases, especially dichlorodifluoromethane. The trap must be capable of desorbing the late eluting target analytes.

NOTE: Check the responses of the brominated compounds when using alternative charcoal traps (especially Vocarb 4000), as some degradation has been noted when higher desorption temperatures (especially above 240 - 250°C) are employed. 2-Chloroethyl vinyl ether is degraded on Vocarb 4000 but performs adequately when Vocarb 3000 is used. The primary criterion, as stated above, is that all target analytes meet the sensitivity requirements for a given project.

4.2.2.1 The trap used to develop this method was 25 cm long, with an inside diameter of 0.105 inches, and was packed with Carbopack/Carbosieve (Supelco, Inc.).

4.2.2.2 The standard trap used in other EPA purge-and-trap methods is also acceptable. That trap is 25 cm long and has an inside diameter of at least 0.105 in. Starting from the inlet, the trap contains the equal amounts of the adsorbents listed below. It is recommended that 1.0 cm of methyl silicone-coated packing (35/60 mesh, Davison, grade 15 or equivalent) be inserted at the inlet to extend the life of the trap. If the analysis of dichlorodifluoromethane or other fluorocarbons of similar volatility is not required, then the charcoal can be eliminated and the polymer increased to fill 2/3 of the trap. If only compounds boiling above 35°C are to be analyzed, both the silica gel and charcoal can be eliminated and the polymer increased to fill the entire trap.

4.2.2.2.1 2,6-Diphenylene oxide polymer - 60/80 mesh, chromatographic grade (Tenax GC or equivalent).

4.2.2.2.2 Methyl silicone packing - OV-1 (3%) on Chromosorb-W, 60/80 mesh or equivalent.

4.2.2.2.3 Coconut charcoal - Prepare from Barnebey Cheney, CA-580-26, or equivalent, by crushing through 26 mesh screen.

4.2.2.3 Trapping materials other than those listed above also may be employed, provided that they meet the specifications in Sec. 4.2.3, below.

4.2.3 The desorber for the trap must be capable of rapidly heating the trap to the temperature recommended by the trap material manufacturer, prior to the beginning of the flow of desorption gas. Several commercial desorbers (purge-and-trap units) are available.

4.3 Syringe and Syringe Valves

4.3.1 25-mL glass hypodermic syringes with Luer-Lok (or equivalent) tip (other sizes are acceptable depending on sample volume used).

4.3.2 2-way syringe valves with Luer ends.

4.3.3 25-µL micro syringe with a 2 inch x 0.006 inch ID, 22° bevel needle (Hamilton #702N or equivalent).

4.3.4 Micro syringes - 10-, 100-µL.

4.3.5 Syringes - 0.5-, 1.0-, and 5-mL, gas-tight with shut-off valve.

4.4 Miscellaneous

4.4.1 Glass vials

4.4.1.1 60-mL, septum-sealed, to collect samples for screening, dry weight determination.

4.4.1.2 40-mL, screw-cap, PTFE lined, septum-sealed. Examine each vial prior to use to ensure that the vial has a flat, uniform sealing surface.

4.4.2 Top-loading balance - Capable of accurately weighing to 0.01 g.

4.4.3 Glass scintillation vials - 20-mL, with screw-caps and PTFE liners, or glass culture tubes with screw-caps and PTFE liners, for dilution of oily waste samples.

4.4.4 Volumetric flasks - Class A, 10-mL and 100-mL, with ground-glass stoppers.

4.4.5 2-mL glass vials, for GC autosampler - Used for oily waste samples extracted with methanol or PEG.

4.4.6 Spatula, stainless steel - narrow enough to fit into a sample vial.

4.4.7 Disposable Pasteur pipettes.

4.4.8 Magnetic stirring bars - PTFE- or glass-coated, of the appropriate size to fit the sample vials. Consult manufacturer's recommendation for specific stirring bars. Stirring bars may be reused, provided that they are thoroughly cleaned between uses. Consult the manufacturers of the purging device and the stirring bars for suggested cleaning procedures.

4.5 Field Sampling Equipment

4.5.1 Purge-and-Trap Soil Sampler - Model 3780PT (Associated Design and Manufacturing Company, 814 North Henry Street, Alexandria, VA 22314), or equivalent.

4.5.2 EnCore™ sampler - (En Chem, Inc., 1795 Industrial Drive, Green Bay, WI 54302), or equivalent.

4.5.3 Alternatively, disposable plastic syringes with a barrel smaller than the neck of the soil vial may be used to collect the sample. The syringe end of the barrel is cut off prior to sampling. One syringe is needed for each sample aliquot to be collected.

4.5.4 Portable balance - For field use, capable of weighing to 0.01 g.

4.5.5 Balance weights - Balances employed in the field should be checked against an appropriate reference weight at least once daily, prior to weighing any samples, or as described in the sampling plan. The specific weights used will depend on the total weight of the sample container, sample, stirring bar, reagent water added, cap, and septum.

5.0 REAGENTS

5.1 Organic-free reagent water - All references to water in this method refer to organic-free reagent water, as defined in Chapter One.

5.2 Methanol, CH_3OH - purge-and-trap quality or equivalent. Store away from other solvents.

5.3 Polyethylene glycol (PEG), $H(OCH_2CH_2)_nOH$ - free of interferences at the detection limit of the target analytes.

5.4 Low concentration sample preservative

5.4.1 Sodium bisulfate, $NaHSO_4$ - ACS reagent grade or equivalent.

5.4.2 The preservative should be added to the vial prior to shipment to the field, and must be present in the vial prior to adding the sample.

5.5 See the determinative method and Method 5000 for guidance on internal standards and surrogates to be employed in this procedure.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Refer to the introductory material in this chapter, Organic Analytes, Sec. 4.1, for general sample collection information. The low concentration portion of this method employs sample vials that are filled and weighed in the field and never opened during the analytical process. As a result, sampling personnel should be equipped with a portable balance capable of weighing to 0.01 g.

6.1 Preparation of sample vials

The specific preparation procedures for sample vials depend on the expected concentration range of the sample, with separate preparation procedures for low concentration soil samples and high concentration soil and solid waste samples. Sample vials should be prepared in a fixed laboratory or other controlled environment, sealed, and shipped to the field location. Gloves should be worn during the preparation steps.

6.1.1 Low concentration soil samples

The following steps apply to the preparation of vials used in the collection of low concentration soil samples to be analyzed by the closed-system purge-and-trap equipment described in Method 5035.

6.1.1.1 Add a clean magnetic stirring bar to each clean vial. If the purge-and-trap device (Sec. 4.2) employs a means of stirring the sample other than a magnetic stirrer (e.g., sonication or other mechanical means), then the stir bar is omitted.

6.1.1.2 Add preservative to each vial. The preservative is added to each vial prior to shipping the vial to the field. Add approximately 1 g of sodium bisulfate to each vial. If samples markedly smaller or larger than 5 g are to be collected, adjust the amount of preservative added to correspond to approximately 0.2 g of preservative for each 1 g of sample. Enough sodium bisulfate should be present to ensure a sample pH of ≤2.

6.1.1.3 Add 5 mL of organic-free reagent water to each vial. The water and the preservative will form an acid solution that will reduce or eliminate the majority of the biological activity in the sample, thereby preventing biodegradation of the volatile target analytes.

6.1.1.4 Seal the vial with the screw-cap and septum seal. If the double-ended, fritted, vials are used, seal both ends as recommended by the manufacturer.

6.1.1.5 Affix a label to each vial. This eliminates the need to label the vials in the field and assures that the tare weight of the vial includes the label. (The weight of any markings added to the label in the field is negligible).

6.1.1.6 Weigh the prepared vial to the nearest 0.01 g, record the tare weight, and write it on the label.

6.1.1.7 Because volatile organics will partition into the headspace of the vial from the aqueous solution and will be lost when the vial is opened, surrogates, matrix spikes, and internal standards (if applicable) should only be added to the vials after the sample has been added to the vial. These standards should be introduced back in the laboratory, either manually by puncturing the septum with a small-gauge needle or automatically by the sample introduction system, just prior to analysis.

6.1.2 High concentration soil samples collected without a preservative

When high concentration samples are collected without a preservative, a variety of sample containers may be employed, including 60-mL glass vials with septum seals (see Sec. 4.4).

6.1.3 High concentration soil samples collected and preserved in the field

The following steps apply to the preparation of vials used in the collection of high concentration soil samples to be preserved in the field with methanol and analyzed by the aqueous purge-and-trap equipment described in Method 5030.

6.1.3.1 Add 10 mL of methanol to each vial.

6.1.3.2 Seal the vial with the screw-cap and septum seal.

6.1.3.3 Affix a label to each vial. This eliminates the need to label the vials in the field and assures that the tare weight of the vial includes the label. (The weight of any markings added to the label in the field is negligible).

6.1.3.4 Weigh the prepared vial to the nearest 0.01 g, record the tare weight, and write it on the label.

<u>NOTE</u>: Vials containing methanol should be weighed a second time on the day that they are to be used. Vials found to have lost methanol (reduction in weight of >0.01 g) should not be used for sample collection.

6.1.3.5 Surrogates, internal standards and matrix spikes (if applicable) should be added to the sample after it is returned to the laboratory and prior to analysis.

6.1.4 Oily waste samples

When oily waste samples are <u>known</u> to be soluble in methanol or PEG, sample vials may be prepared as described in Sec. 6.1.3, using the appropriate solvent. However, when the solubility of the waste is unknown, the sample should be collected without the use of a preservative, in a vial such as that described in Sec. 6.1.2.

6.2 Sample collection

Collect the sample according to the procedures outlined in the sampling plan. As with any sampling procedure for volatiles, care must be taken to minimize the disturbance of the sample in order to minimize the loss of the volatile components. Several techniques may be used to transfer a sample to the relatively narrow opening of the low concentration soil vial. These include devices such as the EnCore™ sampler, the Purge-and-Trap Soil Sampler ™, and a cut plastic syringe. Always wear gloves whenever handling the tared sample vials.

6.2.1 Low concentration soil samples

6.2.1.1 Using an appropriate sample collection device, collect approximately 5 g of sample as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere: generally within a few minutes at most. Carefully wipe the exterior of the sample collection device with a clean cloth or towel.

6.2.1.2 Using the sample collection device, add about 5 g (2 - 3 cm) of soil to the sample vial containing the preservative solution. Quickly brush any soil off the vial threads and immediately seal the vial with the septum and screw-cap. Store samples on ice at 4°C.

NOTE: Soil samples that contain carbonate minerals (either from natural sources or applied as an amendment) may effervesce upon contact with the acidic preservative solution in the low concentration sample vial. If the amount of gas generated is very small (i.e., several mL), any loss of volatiles as a result of such effervescence may be minimal if the vial is sealed quickly. However, if larger amounts of gas are generated, not only may the sample lose a significant amount of analyte, but the gas pressure may shatter the vial if the sample vial is sealed. Therefore, when samples are known or suspected to contain high levels of carbonates, a test sample should be collected, added to a vial, and checked for effervescence. If a rapid or vigorous reaction occurs, discard the sample and collect low concentration samples in vials that do not contain the preservative solution.

6.2.1.3 When practical, use a portable balance to weigh the sealed vial containing the sample to ensure that 5.0 ± 0.5 g of sample were added. The balance should be calibrated in the field using an appropriate weight for the sample containers employed (Sec. 4.5.5). Record the weight of the sealed vial containing the sample to the nearest 0.01 g.

6.2.1.4 Alternatively, collect several trial samples with plastic syringes. Weigh each trial sample and note the length of the soil column in the syringe. Use these data to determine the length of soil in the syringe that corresponds to 5.0 ± 0.5 g. Discard each trial sample.

6.2.1.5 As with the collection of aqueous samples for volatiles, collect at least two replicate samples. This will allow the laboratory an additional sample for reanalysis. The second sample should be taken from the same soil stratum or the same section of the solid waste being sampled, and within close proximity to the location from which the original sample was collected.

6.2.1.6 In addition, since the soil vial cannot be opened without compromising the integrity of the sample, at least one additional aliquot of sample must be collected for screening, dry weight determination, and high concentration analysis (if necessary). This third aliquot may be collected in a 60-mL glass vial or a third 40-mL soil sample vial. However, this third vial must *not* contain the sample preservative solution, as an aliquot will be used to determine dry weight. If high concentration samples are collected in vials containing methanol, then two additional aliquots should be collected, one for high concentration analysis collected in a vial containing methanol, and another for the dry weight determination in a vial without either methanol or the low concentration aqueous preservative solution.

6.2.1.7 If samples are known or expected to contain target analytes over a wide range of concentrations, thereby requiring the analyses of multiple sample aliquots, it may be advisable and practical to take an additional sample aliquot in a low concentration soil vial containing the preservative, but collecting only 1-2 g instead of the 5 g collected in Sec. 6.2.1.1. This aliquot may be used for those analytes that exceed the instrument calibration range in the 5-g analysis.

6.2.1.8 The EnCore™ sampler has not been thoroughly evaluated by EPA as a sample storage device. While preliminary results indicate that storage in the EnCore™ device may be appropriate for up to 48 hours, samples collected in this device should be transferred to the soil sample vials as soon as possible, or analyzed within 48 hours.

6.2.1.9 The collection of low concentration soil samples in vials that contain methanol is not appropriate for samples analyzed with the closed-system purge-and-trap equipment described in this method (see Sec. 6.2.2).

6.2.2 High concentration soil samples preserved in the field

The collection of soil samples in vials that contain methanol has been suggested by some as a combined preservation and extraction procedure. However, this procedure is not appropriate for use with the low concentration soil procedure described in this method.

NOTE: The use of methanol preservation has not been formally evaluated by EPA and analysts must be aware of two potential problems. First, the use of methanol as a preservative and extraction solvent introduces a significant dilution factor that will raise the method quantitation limit beyond the operating range of the low concentration direct purge-and-trap procedure (0.5-200 µg/kg). The exact dilution factor will depend on the masses of solvent and sample, but generally exceeds 1000, and may make it difficult to demonstrate compliance with regulatory limits or action levels for some analytes. Because the analytes of interest are volatile, the methanol extract cannot be concentrated to overcome the dilution problem. Thus, for samples of unknown composition, it may still be necessary to collect an aliquot for analysis by this closed-system procedure and another aliquot preserved in methanol and analyzed by other procedures. The second problem is that the addition of methanol to the sample is likely to cause the sample to fail the ignitability characteristic, thereby making the unused sample volume a hazardous waste.

6.2.2.1 When samples are known to contain volatiles at concentrations high enough that the dilution factor will not preclude obtaining results within the calibration range of the appropriate determinative method, a sample may be collected and immediately placed in a sample vial containing purge-and-trap grade methanol.

6.2.2.2 Using an appropriate sample collection device, collect approximately 5 g of sample as soon as possible after the surface of the soil or other solid material has been exposed to the atmosphere: generally within a few minutes at most. Carefully wipe the exterior of the sample collection device with a clean cloth or towel.

6.2.2.3 Using the sample collection device, add about 5 g (2 - 3 cm) of soil to the vial containing 10 mL of methanol. Quickly brush any soil off the vial threads and immediately seal the vial with the septum and screw-cap. Store samples on ice at 4°C.

6.2.2.4 When practical, use a portable balance to weigh the sealed vial containing the sample to ensure that 5.0 ± 0.5 g of sample were added. The balance should be calibrated in the field using an appropriate weight for the sample containers employed (Sec. 4.5.5). Record the weight of the sealed vial containing the sample to the nearest 0.01 g.

6.2.2.5 Alternatively, collect several trial samples with plastic syringes. Weigh each trial sample and note the length of the soil column in the syringe. Use these data to determine the length of soil in the syringe that corresponds to 5.0 ± 0.5 g. Discard each trial sample.

6.2.2.6 Other sample weights and volumes of methanol may be employed, provided that the analyst can demonstrate that the sensitivity of the overall analytical procedure is appropriate for the intended application.

6.2.2.7 The collection of at least one additional sample aliquot is required for the determination of the dry weight, as described in Sec. 6.2.1.6. Samples collected in methanol should be shipped as described in Sec. 6.3, and must be clearly labeled as containing methanol, so that the samples are not analyzed using the closed-system purge-and-trap equipment described in this procedure.

6.2.3 High concentration soil sample <u>not</u> preserved in the field

The collection of high concentration soil samples that are not preserved in the field generally follows similar procedures as for the other types of samples described in Secs. 6.2.1 and 6.2.2, with the obvious exception that the sample vials contain neither the aqueous preservative solution nor methanol. However, when field preservation is not employed, it is better to collect a larger volume sample, filling the sample container as full as practical in order to minimize the headspace. Such collection procedures generally do not require the collection of a separate aliquot for dry weight determination, but it may be advisable to collect a second sample aliquot for screening purposes, in order to minimize the loss of volatiles in either aliquot.

6.2.4 Oily waste samples

The collection procedures for oily samples depend on knowledge of the waste and its solubility in methanol or other solvents.

6.2.4.1 When an oily waste is <u>known</u> to be soluble in methanol or PEG, the sample may be collected in a vial containing such a solvent (see Sec. 6.1.4), using procedures similar to those described in Sec. 6.2.2.

6.2.4.2 When the solubility of the oily waste is <u>not</u> known, the sample should either be collected in a vial without a preservative, as described in Sec. 6.2.3, or the solubility of a trial sample should be tested in the field, using a vial containing solvent. If the trial sample is soluble in the solvent, then collect the oily waste sample as described in Sec. 6.2.2. Otherwise, collect an unpreserved sample as described in Sec. 6.2.3.

6.3 Sample handling and shipment

All samples for volatiles analysis should be cooled to approximately 4°C, packed in appropriate containers, and shipped to the laboratory on ice, as described in the sampling plan.

6.4 Sample storage

6.4.1 Once in the laboratory, store samples at 4°C until analysis. The sample storage area should be free of organic solvent vapors.

6.4.2 All samples should be analyzed as soon as practical, and within the designated holding time from collection. Samples not analyzed within the designated holding time must be noted and the data are considered minimum values.

6.4.3 When the low concentration samples are strongly alkaline or highly calcareous in nature, the sodium bisulfate preservative solution may not be strong enough to reduce the pH of the soil/water solution to below 2. Therefore, when low concentration soils to be sampled are known or suspected to be strongly alkaline or highly calcareous, additional steps may be required to preserve the samples. Such steps include: addition of larger amounts of the sodium bisulfate preservative to non-calcareous samples, storage of low concentration samples at -10°C (taking care not to fill the vials so full that the expansion of the water in the vial breaks the vial), or significantly reducing the maximum holding time for low concentration soil samples. Whichever steps are employed, they should be clearly described in the sampling and QA project plans and distributed to both the field and laboratory personnel. See Sec. 6.2.1.2 for additional information.

7.0 PROCEDURE

This section describes procedures for sample screening, the low concentration soil method, the high concentration soil method, and the procedure for oily waste samples. High concentration samples are to be introduced into the GC system using Method 5030. Oily waste samples are to be introduced into the GC system using Method 5030 if they are soluble in a water-miscible solvent, or using Method 3585 if they are not.

7.1 Sample screening

7.1.1 It is highly recommended that all samples be screened prior to the purge-and-trap GC or GC/MS analysis. Samples may contain higher than expected quantities of purgeable organics that will contaminate the purge-and-trap system, thereby requiring extensive cleanup and instrument maintenance. The screening data are used to determine which is the appropriate sample preparation procedure for the particular sample, the low concentration closed-system direct purge-and-trap method (Sec. 7.2), the high concentration (methanol extraction) method (Sec. 7.3), or the nonaqueous liquid (oily waste) methanol or PEG dilution procedure (Sec. 7.4).

7.1.2 The analyst may employ any appropriate screening technique. Two suggested screening techniques employing SW-846 methods are:

7.1.2.1 Automated headspace (Method 5021) using a gas chromatograph (GC) equipped with a photoionization detector (PID) and an electrolytic conductivity detector (HECD) in series, or, 7.1.2.2 Extraction of the sample with hexadecane (Method 3820) and analysis of the extract on a GC equipped with a FID and/or an ECD.

7.1.3 The analyst may inject a calibration standard containing the analytes of interest at a concentration equivalent to the upper limit of the calibration range of the low concentration soil method. The results from this standard may be used to determine when the screening results approach the upper limit of the low concentration soil method. There are no linearity or other performance criteria associated with the injection of such a standard, and other approaches may be employed to estimate sample concentrations.

7.1.4 Use the low concentration closed-system purge-and-trap method (Sec. 7.2) if the estimated concentration from the screening procedure falls within the calibration range of the selected determinative method. If the concentration exceeds the calibration range of the low concentration soil method, then use either the high concentration soil method (Sec. 7.3), or the oily waste method (Sec. 7.4).

7.2 Low concentration soil method (Approximate concentration range of 0.5 to 200 µg/kg - the concentration range is dependent upon the determinative method and the sensitivity of each analyte.)

7.2.1 Initial calibration

Prior to using this introduction technique for any GC or GC/MS method, the system must be calibrated. General calibration procedures are discussed in Method 8000, while the determinative methods and Method 5000 provide specific information on calibration and preparation of standards. Normally, external standard calibration is preferred for the GC methods (non-MS detection) because of possible interference problems with internal standards. If interferences are not a problem, or when a GC/MS method is used, internal standard calibration may be employed.

7.2.1.1 Assemble a purge-and-trap device that meets the specification in Sec. 4.2 and that is connected to a gas chromatograph or a gas chromatograph/mass spectrometer system.

7.2.1.2 Before initial use, a Carbopack/Carbosieve trap should be conditioned overnight at 245°C by backflushing with an inert gas flow of at least 20 mL/minute. If other trapping materials are substituted for the Carbopack/Carbosieve, follow the manufacturers recommendations for conditioning. Vent the trap effluent to the hood, not to the analytical column. Prior to daily use, the trap should be conditioned for 10 minutes at 245°C with backflushing. The trap may be vented to the analytical column during daily conditioning; however, the column must be run through the temperature program prior to analysis of samples.

7.2.1.3 If the standard trap in Sec. 4.2.2.2 is employed, prior to initial use, the trap should be conditioned overnight at 180°C by backflushing with an inert gas flow of at least 20 mL/min, or according to the manufacturer's recommendations. Vent the trap effluent to the hood, not to the analytical column. Prior to daily use, the trap should be conditioned for 10 min at 180°C with backflushing. The trap may be vented to the analytical column during daily conditioning; however, the column must be run through the temperature program prior to analysis of samples.

7.2.1.4 Establish the purge-and-trap instrument operating conditions. Adjust the instrument to inject 5 mL of water, to heat the sample to 40°C, and to hold the sample at 40°C for 1.5 minutes before commencing the purge process, or as recommended by the instrument manufacturer.

7.2.1.5 Prepare a minimum of five initial calibration standards containing all the analytes of interest and surrogates, as described in Method 8000, and following the instrument manufacturer's instructions. The calibration standards are prepared in organic-free reagent water. The volume of organic-free reagent water used for calibration must be the same volume used for sample analysis (normally 5 mL added to the vial before shipping it to the field plus the organic-free reagent water added by the instrument). The calibration standards should also contain approximately the same amount of the sodium bisulfate preservative as the sample (e.g., ~1 g), as the presence of the preservative will affect the purging efficiencies of the analytes. The internal standard solution must be added automatically, by the instrument, in the same fashion as used for the samples. Place the soil vial containing the solution in the instrument carousel. In order to calibrate the surrogates using standards at five concentrations, it may be necessary to disable the automatic addition of surrogates to each vial containing a calibration standard (consult the manufacturer's instructions). Prior to purging, heat the sample vial to 40°C for 1.5 minutes, or as recommended by the manufacturer.

7.2.1.6 Carry out the purge-and-trap procedure as outlined in Secs. 7.2.3. to 7.2.5.

7.2.1.7 Calculate calibration factors (CF) or response factors (RF) for each analyte of interest using the procedures described in Method 8000. Calculate the average CF (external standards) or RF (internal standards) for each compound, as described in Method 8000. Evaluate the linearity of the calibration data, or choose another calibration model, as described in Method 8000 and the specific determinative method.

7.2.1.8 For GC/MS analysis, a system performance check must be made before this calibration curve is used (see Method 8260). If the purge-and-trap procedure is used with Method 8021, evaluate the response for the following four compounds: chloromethane; 1,1-dichloroethane; bromoform; and 1,1,2,2-tetrachloroethane. They are used to check for proper purge flow and to check for degradation caused by contaminated lines or active sites in the system.

7.2.1.8.1 Chloromethane is the most likely compound to be lost if the purge flow is too fast.

7.2.1.8.2 Bromoform is one of the compounds most likely to be purged very poorly if the purge flow is too slow. Cold spots and/or active sites in the transfer lines may adversely affect response.

7.2.1.8.3 Tetrachloroethane and 1,1-dichloroethane are degraded by contaminated transfer lines in purge-and-trap systems and/or active sites in trapping materials.

7.2.1.9 When analyzing for very late eluting compounds with Method 8021 (i.e., hexachlorobutadiene, 1,2,3-trichlorobenzene, etc.), cross-contamination and memory effects from a high concentration sample or even the standard are a common problem.

Extra rinsing of the purge chamber after analysis normally corrects this. The newer purge-and-trap systems often overcome this problem with better bakeout of the system following the purge-and-trap process. Also, the charcoal traps retain less moisture and decrease the problem.

7.2.2 Calibration verification

Refer to Method 8000 for details on calibration verification. A single standard near the mid-point of calibration range is used for verification. This standard should also contain approximately 1 g of sodium bisulfate.

7.2.3 Sample purge-and-trap

This method is designed for a 5-g sample size, but smaller sample sizes may be used. Consult the instrument manufacturer's instructions regarding larger sample sizes, in order to avoid clogging of the purging apparatus. The soil vial is hermetically sealed at the sampling site, and MUST remain so in order to guarantee the integrity of the sample. Gloves must be worn when handling the sample vial since the vial has been tared. If any soil is noted on the exterior of the vial or cap, it must be carefully removed prior to weighing. Weigh the vial and contents to the nearest 0.01 g, even if the sample weight was determined in the field, and record this weight. This second weighing provides a check on the field sampling procedures and provides additional assurance that the reported sample weight is accurate. Data users should be advised on significant discrepancies between the field and laboratory weights.

7.2.3.1 Remove the sample vial from storage and allow it to warm to room temperature. Shake the vial gently, to ensure that the contents move freely and that stirring will be effective. Place the sample vial in the instrument carousel according to the manufacturer's instructions.

7.2.3.2 Without disturbing the hermetic seal on the sample vial, add 5 mL of organic-free reagent water, the internal standards, and the surrogate compounds. This is carried out using the automated sampler. Other volumes of organic-free reagent water may be used, however, it is imperative that all samples, blanks, and calibration standards have exactly the same final volume of organic-free reagent water. Prior to purging, heat the sample vial to 40°C for 1.5 minutes, or as described by the manufacturer.

7.2.3.3 For the sample selected for matrix spiking, add the matrix spiking solution described in Sec. 5.0 of Method 5000, either manually, or automatically, following the manufacturer's instructions. The concentration of the spiking solution and the amount added should be established as described in Sec. 8.0 of Method 8000.

7.2.3.4 Purge the sample with helium or another inert gas at a flow rate of up to 40 mL/minute (the flow rate may vary from 20 to 40 mL/min, depending on the target analyte group) for 11 minutes while the sample is being agitated with the magnetic stirring bar or other mechanical means. The purged analytes are allowed to flow out of the vial through a glass-lined transfer line to a trap packed with suitable sorbent materials.

7.2.4 Sample Desorption

7.2.4.1 Non-cryogenic interface - After the 11 minute purge, place the purge-and-trap system in the desorb mode and preheat the trap to 245°C without a flow of desorption gas. Start the flow of desorption gas at 10 mL/minute for about four minutes (1.5 min is normally adequate for analytes in Method 8015). Begin the temperature program of the gas chromatograph and start data acquisition.

7.2.4.2 Cryogenic interface - After the 11 minute purge, place the purge-and-trap system in the desorb mode, make sure that the cryogenic interface is at -150°C or lower, and rapidly heat the trap to 245°C while backflushing with an inert gas at 4 mL/minute for about 5 minutes (1.5 min is normally adequate for analytes in Methods 8015). At the end of the 5-minute desorption cycle, rapidly heat the cryogenic trap to 250°C. Begin the temperature program of the gas chromatograph and start the data acquisition.

7.2.5 Trap Reconditioning

After desorbing the sample for 4 minutes, recondition the trap by returning the purge-and-trap system to the purge mode. Maintain the trap temperature at 245°C (or other temperature recommended by the manufacturer of the trap packing materials). After approximately 10 minutes, turn off the trap heater and halt the purge flow through the trap. When the trap is cool, the next sample can be analyzed.

7.2.6 Data Interpretation

Perform qualitative and quantitative analysis following the guidance given in the determinative method and Method 8000. If the concentration of any target analyte exceeds the calibration range of the instrument, it will be necessary to reanalyze the sample by the high concentration method. Such reanalyses need only address those analytes for which the concentration exceeded the calibration range of the low concentration method. Alternatively, if a sample aliquot of 1-2 g was also collected (see Sec. 6.2.1.7), it may be practical to analyze that aliquot for the analytes that exceeded the instrument calibration range in the 5-g analysis. If results are to be reported on a dry weight basis, proceed to Sec. 7.5

7.3 High concentration method for soil samples with concentrations generally greater than 200 µg/kg.

The high concentration method for soil is based on a solvent extraction. A solid sample is either extracted or diluted, depending on sample solubility in a water-miscible solvent. An aliquot of the extract is added to organic-free reagent water containing surrogates and, if applicable, internal and matrix spiking standards, purged according to Method 5030, and analyzed by an appropriate determinative method. Wastes that are insoluble in methanol (i.e., petroleum and coke wastes) are diluted with hexadecane (see Sec. 7.3.8).

The specific sample preparation steps depend on whether or not the sample was preserved in the field. Samples that were not preserved in the field are prepared using the steps below, beginning at Sec. 7.3.1. If solvent preservation was employed in the field, then the preparation begins with Sec. 7.3.4.

7.3.1 When the high concentration sample is not preserved in the field, the sample consists of the entire contents of the sample container. Do not discard any supernatant liquids. Whenever practical, mix the contents of the sample container by shaking or other mechanical means without opening the vial. When shaking is not practical, quickly mix the contents of the vial with a narrow metal spatula and immediately reseal the vial.

7.3.2 If the sample is from an unknown source, perform a solubility test before proceeding. Remove several grams of material from the sample container. Quickly reseal the container to minimize the loss of volatiles. Weigh 1-g aliquots of the sample into several test tubes or other suitable containers. Add 10 mL of methanol to the first tube, 10 mL of PEG to the second, and 10 mL of hexadecane to the third. Swirl the sample and determine if it is soluble in the solvent. Once the solubility has been evaluated, discard these test solutions. If the sample is soluble in either methanol or PEG, proceed with Sec. 7.3.3. If the sample is only soluble in hexadecane, proceed with Sec. 7.3.8.

7.3.3 For soil and solid waste samples that are soluble in methanol, add 9.0 mL of methanol and 1.0 mL of the surrogate spiking solution to a tared 20-mL vial. Using a top-loading balance, weigh 5 g (wet weight) of sample into the vial. Quickly cap the vial and reweigh the vial. Record the weight to 0.1 g. Shake the vial for 2 min. If the sample was not soluble in methanol, but was soluble in PEG, employ the same procedure described above, but use 9.0 mL of PEG in place of the methanol. Proceed with Sec. 7.3.5.

NOTE: The steps in Secs. 7.3.1, 7.3.2, and 7.3.3 must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory free from solvent fumes.

7.3.4 For soil and solid waste samples that were collected in methanol or PEG (see Sec. 6.2.2), weigh the vial to 0.1 g as a check on the weight recorded in the field, add the surrogate spiking solution to the vial by injecting it through the septum, shake for 2 min, as described above, and proceed with Sec. 7.3.5.

7.3.5 Pipet approximately 1 mL of the extract from either Sec. 7.3.3 or 7.3.4 into a GC vial for storage, using a disposable pipet, and seal the vial. The remainder of the extract may be discarded. Add approximately 1 mL of methanol or PEG to a separate GC vial for use as the method blank for each set of samples extracted with the same solvent.

7.3.6 The extracts must be stored at 4°C in the dark, prior to analysis. Add an appropriate aliquot of the extract (see Table 2) to 5.0 mL of organic-free reagent water and analyze by Method 5030 in conjunction with the appropriate determinative method. Proceed to Sec. 7.0 in Method 5030 and follow the procedure for purging high concentration samples.

7.3.7 If results are to be reported on a dry weight basis, determine the dry weight of a separate aliquot of the sample, using the procedure in Sec. 7.5, after the sample extract has been transferred to a GC vial and the vial sealed.

7.3.8 For solids that are not soluble in methanol or PEG (including those samples consisting primarily of petroleum or coking waste) dilute or extract the sample with hexadecane using the procedures in Sec. 7.0 of Method 3585.

7.4 High concentration method for oily waste samples

This procedure for the analysis of oily waste samples involves the dilution of the sample in methanol or PEG. However, care must be taken to avoid introducing any of the floating oil layer into the instrument. A portion of the diluted sample is then added to 5.0 mL of organic-free reagent water, purged according to Method 5030, and analyzed using an appropriate determinative method.

For oily samples that are not soluble in methanol or PEG (including those samples consisting primarily of petroleum or coking waste), dilute or extract with hexadecane using the procedures in Sec. 7.0 of Method 3585.

The specific sample preparation steps depend on whether or not the sample was preserved in the field. Samples that were not preserved in the field are prepared using the steps below, beginning at Sec. 7.4.1. If methanol preservation was employed in the field, then the preparation begins with Sec. 7.4.3.

7.4.1 If the waste was not preserved in the field and it is soluble in methanol or PEG, weigh 1 g (wet weight) of the sample into a tared 10-mL volumetric flask, a tared scintillation vial, or a tared culture tube. If a vial or tube is used instead of a volumetric flask, it must be calibrated prior to use. This operation must be performed prior to opening the sample vial and weighing out the aliquot for analysis.

7.4.1.1 To calibrate the vessel, pipet 10.0 mL of methanol or PEG into the vial or tube and mark the bottom of the meniscus.

7.4.1.2 Discard this solvent, and proceed with weighing out the 1-g sample aliquot.

7.4.2 Quickly add 1.0 mL of surrogate spiking solution to the flask, vial, or tube, and dilute to 10.0 mL with the appropriate solvent (methanol or PEG). Swirl the vial to mix the contents and then shake vigorously for 2 minutes.

7.4.3 If the sample was collected in the field in a vial containing methanol or PEG, weigh the vial to 0.1 g as a check on the weight recorded in the field, add the surrogate spiking solution to the vial by injecting it through the septum. Swirl the vial to mix the contents and then shake vigorously for 2 minutes and proceed with Sec. 7.4.4.

7.4.4 Regardless of how the sample was collected, the target analytes are extracted into the solvent along with the majority of the oily waste (i.e., some of the oil may still be floating on the surface). If oil is floating on the surface, transfer 1 to 2 mL of the extract to a clean GC vial using a Pasteur pipet. Ensure that no oil is transferred to the vial.

7.4.5 Add 10 - 50 µL of the methanol extract to 5 mL of organic-free reagent water for purge-and-trap analysis, using Method 5030.

7.4.6 Prepare a matrix spike sample by adding 10 - 50 µL of the matrix spike standard dissolved in methanol to a 1-g aliquot of the oily waste. Shake the vial to disperse the matrix spike solution throughout the oil. Then add 10 mL of extraction solvent and proceed with the extraction and analysis, as described in Secs. 7.4.2 - 7.4.5. Calculate the recovery of the spiked analytes as described in Method 8000. If the recovery is not within the acceptance limits for the application, use the hexadecane dilution technique in Sec. 7.0 of Method 3585.

7.5 Determination of % Dry Weight

If results are to be reported on a dry weight basis, it is necessary to determine the dry weight of the sample.

NOTE: It is highly recommended that the dry weight determination only be made after the analyst has determined that no sample aliquots will be taken from the 60-mL vial for high concentration analysis. This is to minimize loss of volatiles and to avoid sample contamination from the laboratory atmosphere. There is no holding time associated with the dry weight determination. Thus, this determination can be made any time prior to reporting the sample results, as long as the vial containing the additional sample has remained sealed and properly stored.

7.5.1 Weigh 5-10 g of the sample from the 60-mL VOA vial into a tared crucible.

7.5.2 Dry this aliquot overnight at 105°C. Allow to cool in a desiccator before weighing. Calculate the % dry weight as follows:

$$\% \text{ dry weight} = \frac{\text{g of dry sample}}{\text{g of sample}} \times 100$$

<u>WARNING</u>: The drying oven should be contained in a hood or vented. Significant laboratory contamination may result from a heavily contaminated hazardous waste sample.

8.0 QUALITY CONTROL

8.1 Refer to Chapter One for specific quality control procedures and Method 5000 for sample preparation QC procedures.

8.2 Before processing any samples, the analyst should demonstrate through the analysis of an organic-free reagent water method blank that all glassware and reagents are interference free. Each time a set of samples is extracted, or there is a change in reagents, a method blank should be processed as a safeguard against chronic laboratory contamination. The blank samples should be carried through all stages of the sample preparation and measurement.

8.3 Initial Demonstration of Proficiency - Each laboratory must demonstrate initial proficiency with each sample preparation and determinative method combination it utilizes, by generating data of acceptable accuracy and precision for target analytes in a clean matrix. The laboratory must also repeat this demonstration whenever new staff are trained or significant changes in instrumentation are made. See Sec. 8.0 of Methods 5000 and 8000 for information on how to accomplish this demonstration.

8.4 Sample Quality Control for Preparation and Analysis - See Sec. 8.0 in Method 5000 and Method 8000 for procedures to follow to demonstrate acceptable continuing performance on each set of samples to be analyzed. These include the method blank, either a matrix spike/matrix spike duplicate or a matrix spike and duplicate sample analysis, a laboratory control sample (LCS), and the addition of surrogates to each sample and QC sample.

8.5 It is recommended that the laboratory adopt additional quality assurance practices for use with this method. The specific practices that are most productive depend upon the needs of the laboratory and the nature of the samples. Whenever possible, the laboratory should analyze standard reference materials and participate in relevant performance evaluation studies.

9.0 METHOD PERFORMANCE

9.1 Single laboratory accuracy and precision data were obtained for the method analytes in three soil matrices, sand, a soil collected 10 feet below the surface of a hazardous landfill, called the

C-Horizon, and a surface garden soil. Each sample was fortified with the analytes at a concentration of 20 ng/5 g, which is equivalent to 4 µg/kg. These data are listed in tables found in Method 8260.

9.2 Single laboratory accuracy and precision data were obtained for certain method analytes when extracting oily liquid using methanol as the extraction solvent. The data are presented in a table in Method 8260. The compounds were spiked into three portions of an oily liquid (taken from a waste site) following the procedure for matrix spiking described in Sec. 7.4. This represents a worst case set of data based on recovery data from many sources of oily liquid.

10.0 REFERENCES

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TABLE 1

QUANTITY OF METHANOL EXTRACT REQUIRED FOR ANALYSIS OF HIGH CONCENTRATION SOILS/SEDIMENTS

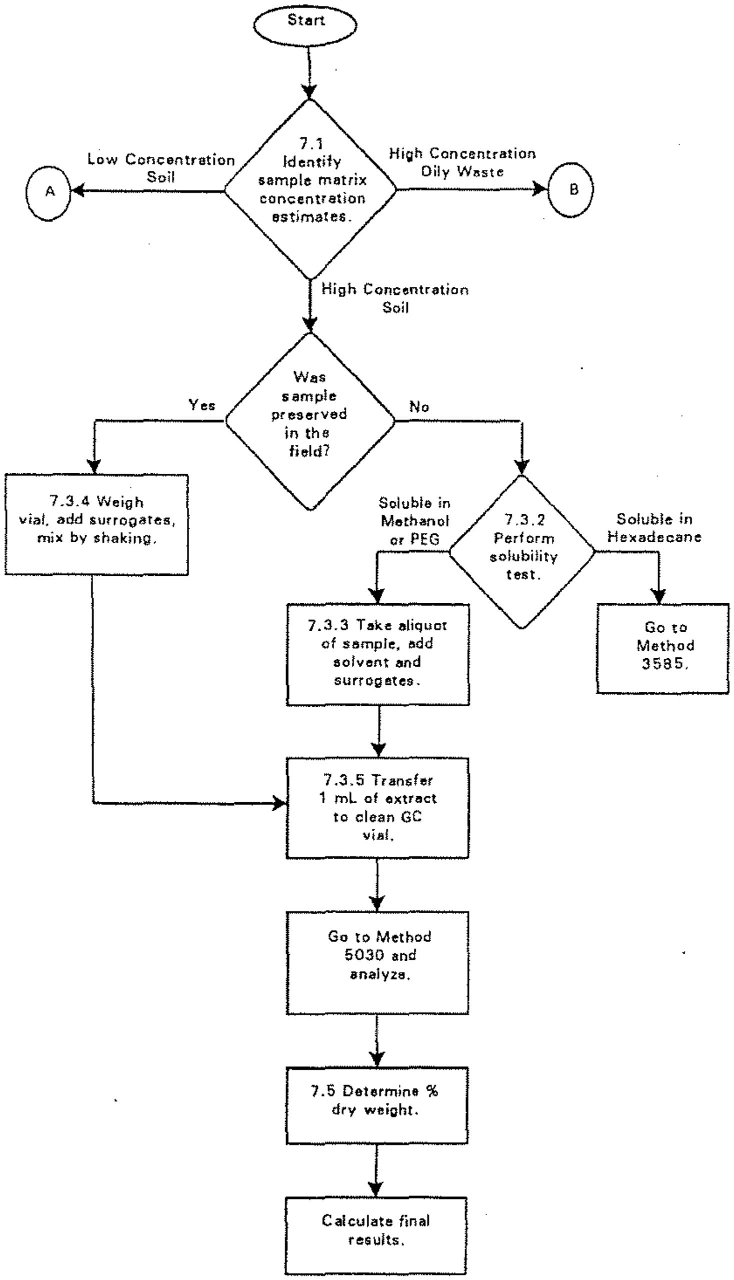
Approximate Concentration Range	Volume of Methanol Extract[a]
500 - 10,000 µg/kg	100 µL
1,000 - 20,000 µg/kg	50 µL
5,000 - 100,000 µg/kg	10 µL
25,000 - 500,000 µg/kg	100 µL of 1/50 dilution[b]

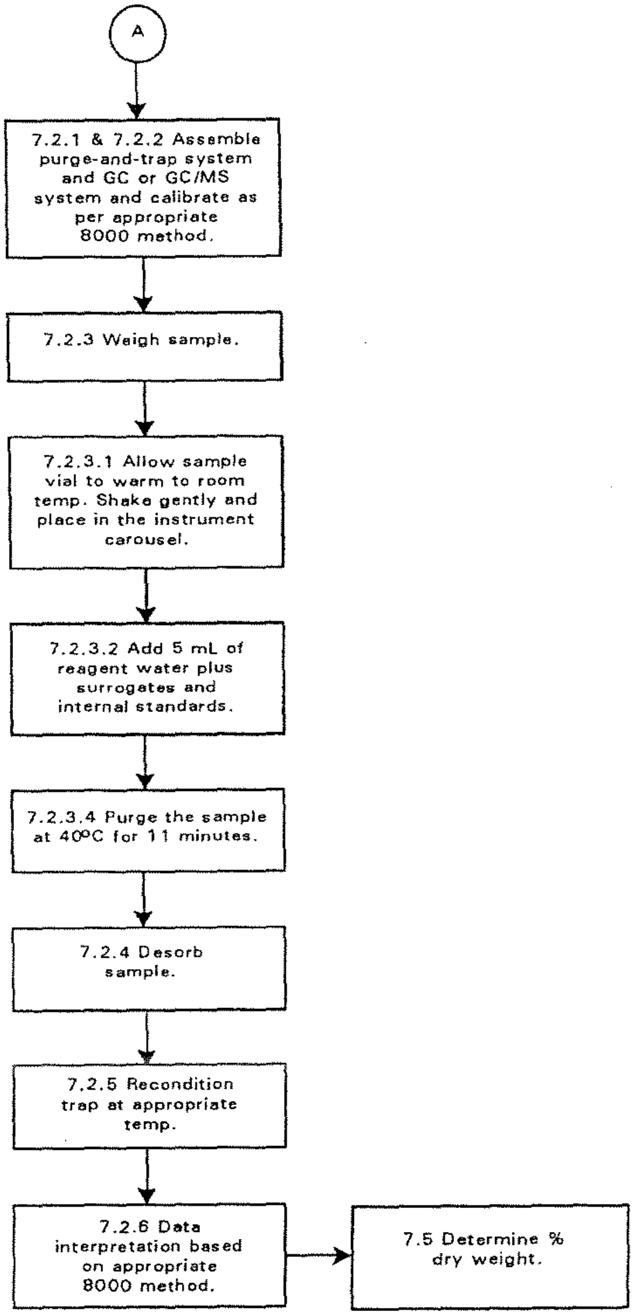
Calculate appropriate dilution factor for concentrations exceeding those in this table.

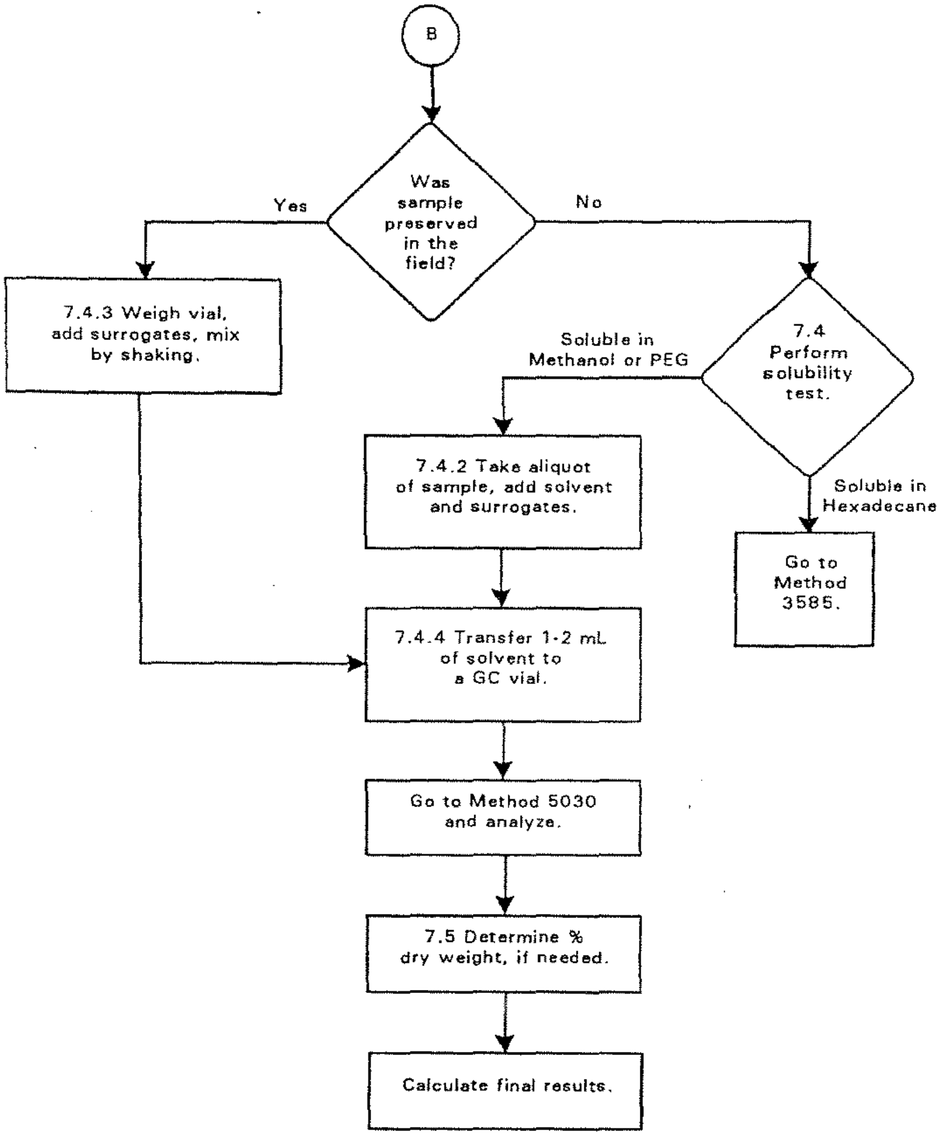
[a] The volume of methanol added to 5 mL of water being purged should be kept constant. Therefore, add to the 5-mL syringe whatever volume of methanol is necessary to maintain a total volume of 100 µL of methanol.

[b] Dilute an aliquot of the methanol extract and then take 100 µL for analysis.

METHOD 5035
CLOSED-SYSTEM PURGE-AND-TRAP AND EXTRACTION FOR VOLATILE ORGANICS IN SOIL AND WASTE SAMPLES




A
7.2.1 & 7.2.2 Assemble purge-and-trap system and GC or GC/MS system and calibrate as per appropriate 8000 method.
7.2.3 Weigh sample.
7.2.3.1 Allow sample vial to warm to room temp. Shake gently and place in the instrument carousel.
7.2.3.2 Add 5 mL of reagent water plus surrogates and internal standards.
7.2.3.4 Purge the sample at 40°C for 11 minutes.
7.2.4 Desorb sample.
7.2.5 Recondition trap at appropriate temp.
7.2.6 Data interpretation based on appropriate 8000 method.
7.5 Determine % dry weight.


B
Was sample preserved in the field?
Yes
No
7.4.3 Weigh vial, add surrogates, mix by shaking.
7.4 Perform solubility test.
Soluble in Methanol or PEG
Soluble in Hexadecane
7.4.2 Take aliquot of sample, add solvent and surrogates.
Go to Method 3585.
7.4.4 Transfer 1-2 mL of solvent to a GC vial.
Go to Method 5030 and analyze.
7.5 Determine % dry weight, if needed.
Calculate final results.

APPENDIX C

Sample Field Logs and Forms

Daily Record

Project Name	Date	Project No.: Task No.:
Equipment	Weather/Temperature	
Field Inspector		

Description of Work Performed
(specifiy location, nature of work, etc)

Start Time (On-Site):

End Time (Off-Site):

Summary if Delays, if any:

Visitors

h:\template\record.xls

LOG OF BORING ________________

SHEET 1 of 1

PROJECT NAME LOCATION			GROUND ELEVATION (FT. MSL)		PROJECT NUMBER	
DRILLING CONTRACTOR		FOREMAN	DATE STARTED		DATE COMPLETED	
DRILLING EQUIPMENT			COMPLETION DEPTH (FT)		ROCK DEPTH (FT)	
TYPE BIT		SIZE AND TYPE CORE BARREL	NO. SAMPLES	DIST.	UNDIST.	CORE
CASING			WATER LEVEL	FIRST	COMPL.	24HR
CASING HAMMER	WEIGHT	DROP	BORING LOCATION			
SAMPLER						
SAMPLER HAMMER	WEIGHT	DROP	INSPECTOR			

DESCRIPTION	Sample Interval	Depth (ft)	Water Table	Samples				HNU / PID READINGS (PPM)					REMARKS
				Number	Recov. (ft)	Penetr. Resist. BL/6in	Time	Sample	Ambient Air	Time	Head Space	Time Date	
		- 0 -											
		- -											
		- 1 -											
		- -											
		- 2 -											
		- -											
		- 3 -											
		- -											
		- 4 -											
		- -											
		- 5 -											
		- -											
		- 6 -											
		- -											
		- 7 -											
		- -											
		- 8 -											
		- -											
		- 9 -											
		- -											
		- 10 -											

i:\projects\4E04159.01\Boring log.xls,blank

03/14/2000 9:36 AM

PROJECT:	PAGE: 1 OF
PROJECT NO:	CLIENT:
STAFF:	BOREHOLE NO.:
ORGINIAL DEPTH:	**WELL NO.:**
SCREEN INTERVAL:	AQUIFER:

DRILLING SUMMARY

Geologist:

Drilling Contractor:

Driller:

Date:

Technique:

Auger Size & Type:

Casing Diameter ______

Casing Elevation ______

Riser Elevation ______

Ground Elevation ______

DEPTHS:

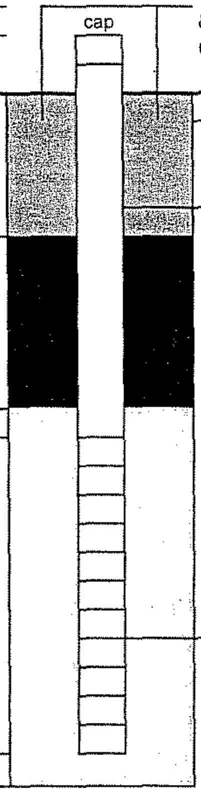
Top of Bentonite Seal ______

Top of Filter Pack ______

Top of Screen ______

Well Base ______

Borehole ______



Protective Steel Casing
& Lockable Cap

Concrete Collar Depth ______

BOREHOLE
______ inch dia.
______ feet length

WELL RISER
______ inch dia.
______ feet length

WELL SCREEN
______ inch dia.
______ feet length

NOT TO SCALE

GEOLOGIC LOG

Depth (ft.)	Lithology
0 - 5	Dark brown fine - medium SAND
5 - 15	Black fine sandy clay with some sewer odor

WELL DESIGN

CAP INFORMATION

Type of Well Cap:

Type of End Cap:

SCREEN MATERIAL

Type:

Diameter

Slot Size:

Screened Interval:

FILTER MATERIAL

Type:

Size:

Gradiation:

Amount Used:

ROCK CORING

Cored Interval: N

Core Diameter: O

Reamed Diameter: N

E

CASING MATERIAL

Surface:

Material:

Diameter:

Monitor:

Security Casing Dimensions:

SEAL MATERIAL

Seal Type #1:

Setting:

Amount Used:

Seal Type #2:

Setting:

Amount Used:

LEGEND

▨	Cement/Bentonite Grout
■	Bentonite Seal
□	Silica Sandpack

Monitoring Well Construction Details

Well No.:

LOW FLOW RATE PURGING AND SAMPLING DATA SHEET

Sheet _____ of _____

SITE: ______________________

DATE: ______________________

WEATHER: ______________________

MONITORING WELL NO.: ________ WELL PERMIT NUMBER: ________

ENVIRONMENTAL CONSULTING FIRM: ______________________

FIELD PERSONNEL: ______________________

TIME	Purging	Sampling	pH (pH units)		Temperature (degrees C)		Specific Conductivity (mS/cm)		Redox Potential (mv)		Dissolved Oxygen (mg/L)		Turbidity (NTU)		Volume Water Removed (ml)	Pumping Rate (ml/min)	Water Elevation (ft BGS)
			Reading	±0.1	Reading	±3%	Reading	±3%	Reading	±10 mv	Reading	±10%	Reading	±10%			
				NA		NA		NA		NA		NA		NA	NA	NA	

N:9E04075 (LCP)\workplan\sap\LowFlowPurg2

LOW FLOW RATE PURGING AND SAMPLING DATA SHEET

Sheet ______ of ______

SITE: ________________________

DATE: ________________________

WEATHER: ________________________

MONITORING WELL NO.: ________ WELL PERMIT NUMBER: ________

ENVIRONMENTAL CONSULTING FIRM: ________________________

FIELD PERSONNEL: ________________________

WELL DEVELOPMENT/PURGING LOG

PROJECT TITLE: ____________________

PROJECT NO.: ____________________

STAFF: ____________________

DATE: ____________________

WELL NO.:

① TOTAL CASING AND SCREEN LENGTH (FT.): ________

② CASING INTERNAL DIAMETER (in.): ________

③ WATER LEVEL BELOW TOP OF CASING (FT.) ________

④ VOLUME OF WATER IN CASING (GAL.) ________

$V = 0.0408\,(\textcircled{2})^2 \times (\textcircled{1}-\textcircled{3}) =$ ________ GAL.

WELL I.D.	VOL. GAL./FT.
1"	0.04
2"	0.17
3"	0.38
4"	0.66
5"	1.04
6"	1.50
8"	2.60

PARAMETERS	ACCUMULATED VOLUME PURGED (GALLONS)										

COMMENTS:

A-2341/C

EXHIBIT A-4

WELL NO.:

WELL PURGING/SAMPLING LOG

SITE:

GENERAL INFORMATION

Date: ________

Project: ________

Inspector(s): ________

Project No: ________

PURGING INFORMATION

Well Condition: ________

Well Type: ________

Screened Interval: ________

Lock No.: ________

Reference Point: ________

Well Depth / Diam. (ft/in): ________

Depth to Water (ft): ________

Water Column (ft /gal): ________

Min. Purge Volume (gal): ________

Purged Volume (gal): ________

Purge Date / Time: ________

Purge Method: ________

Approx. Purge Depth (ft): ________

Approx. Purge Rate (gpm): ________

DTW After Purging: ________

Purge Observations (Ullage Readings, Odor):

____

____

____

____

____

SAMPLING INFORMATION

DTW Before Sampling: ________

Sample Date / Time(s): ________

Sample Method: ________

____

Approx. Sample Depth (ft): ________

Sample Analysis: ________

____

____

Analytical Lab: ________

Sampling Observations: ________

Sample Chemistry:

	After Purge	Before Sampling
Temp.(°C):		
pH:		
Cond(ms/cm):		
Turb(NTU):		
D.O.(mg/l):		

Air Temperature / Weather Conditions: ________

Air Quality Data (ppm):

Background: ________

Well Head: ________

Purge Water: ________

Comments: ________

____

Meters Used:

Temperature: ________

pH: ________

Conductivity: ________

D.O.: ________

HNU: ________

GROUNDWATER SAMPLING DATA SHEET

SITE NAME: ______________________ **PROJECT NUMBER:** __________

DATE: ______________________

WEATHER: ______________________

FIELD PERSONNEL: ______________________

ITORING WELL NUMBER: ______________________

INITIAL DATA

Well Diameter ________ in..

Total Depth of Well: ________ ft

Depth to Water: ________ ft

Height of water Column: ________ ft

Gallons/Lin. Ft.: ________

Vol. of Water Column: ________ gallons

Min. Purge Volume: ________ gallons (3 volumes)

Depth to Top of Screen ________ ft.

Ambient PID/FID Reading: ________ ppm

Wellbore PID/FID Reading: ________ ppm

LNAPL / DNAPL ________ ft

PURGE DATA

Purge Method: Submersible electric pump and dedicated, disposable tubing.

Purge Interval	Time	Depth to Water (ft)	Color	Clarity	Odor	Cum. Vol. (gals)	Temp (cent.)	pH pHu	Conductivity (ms/cm)	Turbidity (NTUs)	DO (mg/l)	Eh (mv)
Initial												
1st well volume												
2nd well volume												
3rd well volume												
Post-Sampling												

urge Start Time: ________ Purge Stop Time: ________ Elapsed Time: ________ Mins. Total Volume Purged ________ Gals.

Overall Average Purge Rate ________ Gals./Min.

SAMPLING DATA

Sampling method: Stainless Steel bailer equipped with teflon check valve, teflon coated stainless steel bridle, and disposable polypropylene cord.

Start Time ________ Stop Time: ________ Elapsed Time: ________ minutes

COMMENTS:

____

____

____

____

____

SURFACE SOIL SAMPLING LOG

PROJECT NAME:					
PROJECT NO.:					
DATE:					
WEATHER:					
INSPECTOR (S):					
LOCATION	SAMPLE DEPTH	TIME (hrs)	SAMPLE PARAMETERS	VISUAL CLASSIFICATION	COMMENTS

SEDIMENT SAMPLING LOG

SITE LOCATION: FIELD INSPECTOR:

SAMPLE ID	DATE / TIME	WATER DEPTH (ft)	CORE ADVANCEMENT (ft)	SAMPLE RECOVERY (ft)	PID READINGS	DESCRIPTION / COMMENTS

PID CALIBRATION LOG

SITE NAME: ______________________

ENVIRONMENTAL INSPECTOR: ______________________

PID TYPE: ______________________

PID SERIAL NO.: ______________________

LAMP IONIZATION POTENTIAL (eV): ______________

DATE	TIME	Person Performing Calibration	Expected Value @ Span Setting (from calibration gas cylinder)		Actual Value @ Span Setting (PPM)	Span Setting Required to Calibrate to Expected Value	Remarks
			PPM @	SPAN			

N:|9E04075 (LCP)\workplan\sap\PIDCAL.xls

PHOTOGRAPH LOG

Project Name:

Roll No.:

Film Type:

Project No:

Task No:

Photographer:

Date Film In:

Date Film Out:

Frame	Date	Location	Caption or Comments				

SLUG TEST DATA SHEET

SITE: ______
TYPE OF TEST: ______
WELL ID.: ______
TEST DATE /TIME: ______
MEASURING POINT/ ELEV.: ______
DATA LOGGER TEST RUN NO.: ______
SAND/FILTER PACK INTERVAL: ______
LITHOLOGY TESTED: ______
DEPTH OF WELL PENETRATION: ______

WEATHER: ______
DEPTH TO WATER: ______
HEIGHT OF WATER COLUMN: ______
TOTAL CASING DEPTH: ______
BOREHOLE DIAMETER: ______
CASING DIAMETER: ______
SCREENED INTERVAL: ______
SATURATED THICKNESS: ______

TRANSDUCER DATA

SERIAL NO.: ______
LINEARITY.: ______
RANGE (psi): ______
SCALE FACTOR: ______
OFFSET: ______
DEPTH BELOW MEASURING PT.: ______
INPUT CHANNEL/PORT: ______

SLUG DATA

TYPE: ______
LENGTH (ft): ______
DIAMETER (ft): ______
VOLUME (cu. ft): ______
H_0 (initial max. displacement): ______

MANUAL MEASUREMENTS

DATE/TIME	ELAPSED TIME (min)	DEPTH TO WATER FROM TOP OF MEASURING POINT (ft)

Recorded by: ______
Title: ______
Firm: ______

GROUND WATER ELEVATION LOG

SITE: ____________________

DATE: ____________________

ENVIRONMENTAL CONSULTING FIRM: ____________________

FIELD PERSONNEL: ____________________

Monitoring Well Data			Elevation Data		
Well ID	PID Reading Time	PID Reading	Depth to water Measurement Time	Reference Point (Note 1)	Remarks

NOTE 1: Point of measurement at each well is referenced to surveyed mark on inner casing (IC) or other (O) and explained in Remarks section.

N:\9E04075 (LCP)\workplan\sap\H2OLEVEL.xls

CHAIN OF COUSTODY RECORD

PROJECT NO.

SITE NAME

SAMPLERS (PRINT/SIGNATURE)

TESTS

BOTTLE TYPE AND PRESERVATIVE

LAB ____________

COOLER ________ of ________

PAGE ________ of ________

DELIVERY SERVICE: ____________ AIRBILL NO.: ____________

LOCATION IDENTIFIER	DATE	TIME	COMP/ GRAB	SAMPLE ID	MATRIX	TOTAL NO.# OF CONTAINERS									REMARKS	SAMPLE TYPE	BEGINNING DEPTH (IN FEET)	ENDING DEPTH (IN FEET)	FIELD LOT NO.# (IRPIMS ONLY)

MATRIX CODES

- AA - AMBIENT AIR
- SE - SEDIMENT
- SH - HAZARDOUS SOLID WASTE
- SL - SLUDGE
- WP - DRINKING WATER
- WW - WASTE WATER
- WG - GROUND WATER
- SO - SOIL
- DC - DRILL CUTTINGS
- WL - LEACHATE
- GS - SOIL GAS
- WC - DRILLING WATER
- WO - OCEAN WATER
- WS - SURFACE WATER
- WQ - WATER FIELD QC
- LH - HAZARDOUS LIQUID WASTE
- LF - FLOATING/FREE PRODUCT ON GW TABLE

SAMPLE TYPE CODES

- TB# - TRIP BLANK
- SD# - MATRIX SPIKE DUPLICATE
- RB# - RINSE BLANK
- FR# - FIELD REPLICATE
- N# - NORMAL ENVIRONMENTAL SAMPLE
- MS# - MATRIX SPIKE

(# - SEQUENTIAL NUMBER (FROM 1 TO 9) TO ACCOMMODATE MULTIPLE SAMPLES IN A SINGLE DAY)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY (SIGNATURE)	DATE	TIME

SPECIAL INSTRUCTIONS

Distribution: Original accompanies shipment, copy to coordinator field files

URSF-075C/1 OF 1/CofCR/GM

LABORATORY DATA TRACKING

Sample ID	Sample Location	Date Sampled	Analyses Requested	Date Sent To Lab	Date Lab Report Due	Date Lab Report Received	Type of Data Package (Full, Reduced, TCLP)	Date Disk Deliverable Received	File Name (w/path)	Lab Sample ID	Data Package ID	Date Sent to Reg. Agency (pre Data Valid.)	Date Submitted for Data Validation	Date Data Validation Report Received	Invoice Number	Date Invoice Approve

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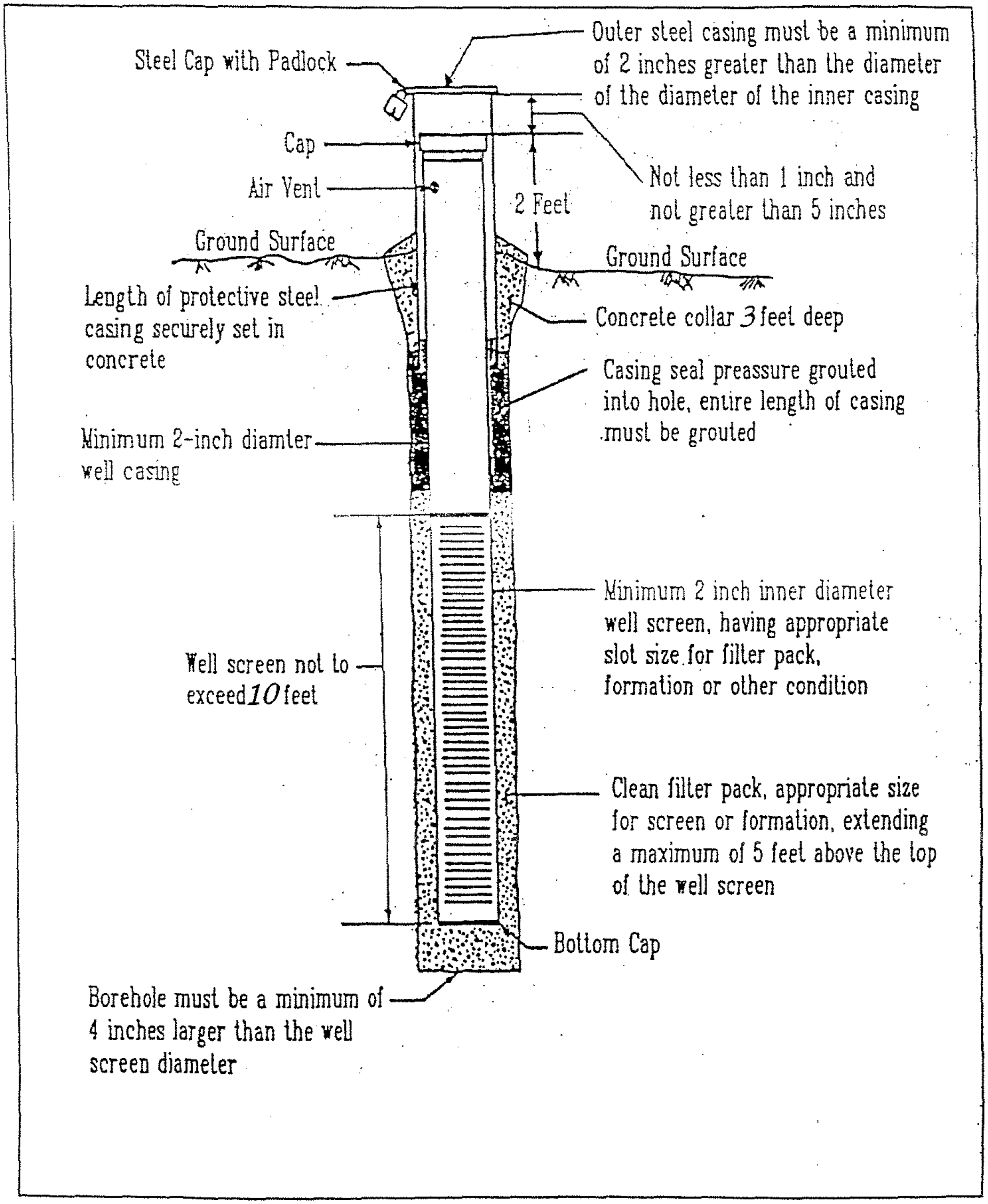
APPENDIX D

Monitoring Well Installation Diagram

Unconsolidated Aquifer Well



APPENDIX E

Instrumentation Calibration Procedures

HNU Model PI-101 Calibration Procedure

1. Attach the probe to the readout module. Insert the connector into the receptacle and turn the connector clockwise until you hear and feel a distant click

2. Turn the function switch to the BATT position. The meter needle should deflect to the green area at the right-hand side of the meter scale plate. Listen to the probe and make sure that the fan is operating; it makes a humming sound. Look briefly directly into the probe inlet and observe the lamp glow, which appears as a purple light.

3. Turn the function switch to the STANDBY position. The fan operates and the lamp is off. The meter needle moves to the left out of the green area on the meter scale plate. Turn the zero knob until the meter needle rests at 0.

4. Check the span setting (1.0 for 9.5eV lamps, 9.8 for 10.2eV lamps, 5.0 for 11.7eV lamps) and adjust as necessary using the span control. Connect the regulator to the calibration gas canister. Using flexible tubing (3inches long is sufficient, one quarter inch diameter), connect the calibration gas to the probe inlet and open the valve on the regulator. Recheck the electronic zero and adjust as necessary.

5. Once the PI-101 is electronically zeroed, turn the function switch to the 0-2000 range position (X100). HNU calibration gas consists of approximately 100 ppm isobutylene in an air matrix; it is referenced to benzene. The meter reading that should be obtained during calibration is marked on the gas canister label. With the function switch at the 0-2000 range position, the meter needle should move slightly to the right.

6. Turn the function switch to the 0-200 range position (X10). The meter should read very close to the ppm number on the calibration gas canister. Adjust the span pot until an exact reading is obtained. The span setting used to obtain an accurate reading in this procedure is the reference point from which all other readings are determined.

7. Turn the functional switch to the 0-20 range position (X1). The meter needle should deflect fully to the right.

8. Turn the function switch back to the 0-200 range position and recheck the meter reading to ensure that an accurate reading has held. Make any needed adjustments to the span control and if necessary, recheck the accuracy by turning the function switch to the 0-20 range position and then back to the 0-200 range position.

9. Turn the function switch to the OFF position. Close the valve on the calibration gas regulator and disconnect it from the probe inlet: The PI-101 is now ready for field use.

SECTION 3

CALIBRATION

3.1 INTRODUCTION

The PI 101 Analyzer is designed for trace gas analysis in ambient air and is calibrated at HNU with certified standards of benzene, vinyl chloride and isobutylene. Other optional calibrations are available (e.g., ammonia, ethylene oxide, H2S, etc.). Calibration data is given in the data sheet. If a special calibration has been done, the data is given in the Application Data Sheet, which notes the sample source, type of calibration (see Section 8, Appendix), and other pertinent information.

Good instrumentation practice calls for calibration on the species to be measured in the concentration range to be used. This procedure assures the operator that the analyzer is operating properly and will generate reliable data.

Some general points to consider when calibrating the PI 101 are that the analyzer is designed for operation at ambient conditions and therefore the gas standards used for calibration should be delivered to the analyzer at ambient temperatures and pressure and at the proper flow rates.

WARNING:

The PI 101 is a non-destructive analyzer; calibrations using toxic or hazardous gases must be done in a hood.

The frequency of calibration should be dictated by the usage of the analyzer and the toxicity of the species measured. If the analyzer has been serviced or repaired, calibration should be done to verify operation and performance. It is recommended that calibration be checked frequently at first (daily or every other day) and then regularly based on the confidence level developed.

The normal meter scaleplate is 0 to 20. If the scaleplate is different, refer to the Application Data Sheet. If there are questions, consult the HNU representative before proceeding with calibration check.

An accurate and reliable method of calibration check is to use an analyzed gas cylinder in a test setup as shown in Figure 3-1 and described below. Additional material on calibration is given in Section 8, Appendix.

3.2 ANALYZED GAS CYLINDER

a. Concentration - The calibration gas cylinder is to contain the species of interest made up in an air matrix at or near the concentration to be analyzed. If the component is unstable in air, another matrix is to be used. The final calibration mixture should be similar to the sample the PI 101 will analyze. If the expected concentration is not known then a concentration should be chosen that will cause a scale displacement of 50 to 80% on the X10 range. Calibration on X10 range will provide accurate values on the X1 range as well.

For use on the 0-2000 range, a two-standard calibration is preferred: one at 70 to 85% of the linear range and the other at 25 to 35% of the linear range. With the linear range of approximately 600 ppm for most compounds these points would lie between 420 to 510 ppm and 150 to 210 ppm, respectively.

b. Stability - The calibration gas must be stable within the cylinder during the period of use. If the calibration is required in the field, then use of a small cylinder is recommended. In addition, the choice of cylinder material in contact with the gas must be considered (steel, aluminum or teflon). If there are any questions, the operator should request stability and usage information from the gas supplier.

WARNING

Extreme care must be taken in the handling of gas cylinders. Contents are under high pressure. In some cases, the contents may be hazardous. Many gas suppliers will provide data sheets for the mixtures upon request.

c. Delivery - The cylinder containing the calibration mixture must be connected to a proper regulator.

WARNING

Never open the valve on a gas cylinder container without a regulator attached.

Leak test all tank/regulator connections as well as the main cylinder valve to prevent toxic or hazardous materials from leaking into the work area. Care must be taken that the materials of construction of the regulator will not interact with the calibration gas.

One method of sampling the calibration gas is illustrated in Figure 3-1. Connect the cylinder to one leg of the tee, a flow meter to the opposite leg, and the probe to the third leg. The flow meter does not require a valve. If there is a valve, it must be left wide open. the flowmeter is only to indicate excess flow. Adjust the flow from the regulator such that only a little excess flow is registered at the flowmeter.

This insures that the PI 101 sees the calibration gas at atmospheric pressure and ambient temperature.

d. Usage - Generally, a gas cylinder should not be used below 200-300 psi as pressure effects could cause concentration variations. The cylinder should not be used past the recommended age of the contents as indicated by the manufacturer. In case of difficulty, verify the contents and concentration of the gas cylinder.

e. Alternate means of calibration are possible. For more information, contact the HNU Service Department.

3.3 PROBE

a. Identify the probe by the lamp label. If a question exists, disassemble the probe and inspect the lamp. The energy of the lamp is etched into the glass envelope.

b. Connect the probe to the readout assembly, making sure the red interlock switch is depressed by the ring on the connector.

c. Set the SPAN pot to the proper value for the probe being calibrated. Refer to the calibration memo accompanying the probe.

d. Check the Ionization Potential (IP) of the calibration gas to be used. The IP of the calibration gas must be at or below the IP of the lamp.

e. Proceed with the calibration as described in Section 3.4. Check the calibration memo for specific data. If any questions develop, call the HNU representative.

f. NOTE: The 11.7eV lamp has a special cleaning compound. Do not use water or any other cleaning compound with the 11.7 eV lamp. Do not interchange ion chambers, amplifier boards or lamps between probes. (See Section 5.2).

3.4 PROCEDURE

a. Battery check - Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.

b. Zero set - Turn the function switch to STANDBY. In this position the lamp is OFF and no signal is generated. Set the zero point with the ZERO set control. The zero can also be set with the function switch on the X1 position and using a "Hydrocarbon-free" air. In this case "negative" readings are possible if the analyzer measures a cleaner sample when in service.

c. 0-20 or 0-200 range - For calibrating on the 0-20 or 0-200 range only one gas standard is required. Turn the function switch to the range position and note the meter reading. Adjust the SPAN control setting as required to read the ppm concentration of the standard. Recheck the zero setting (step b.). If readjustment is needed, repeat step c. This gives a two-point calibration; zero and the gas standard point. Additional calibration points can be generated by dilution of the standard with zero air if desired (see Section 8).

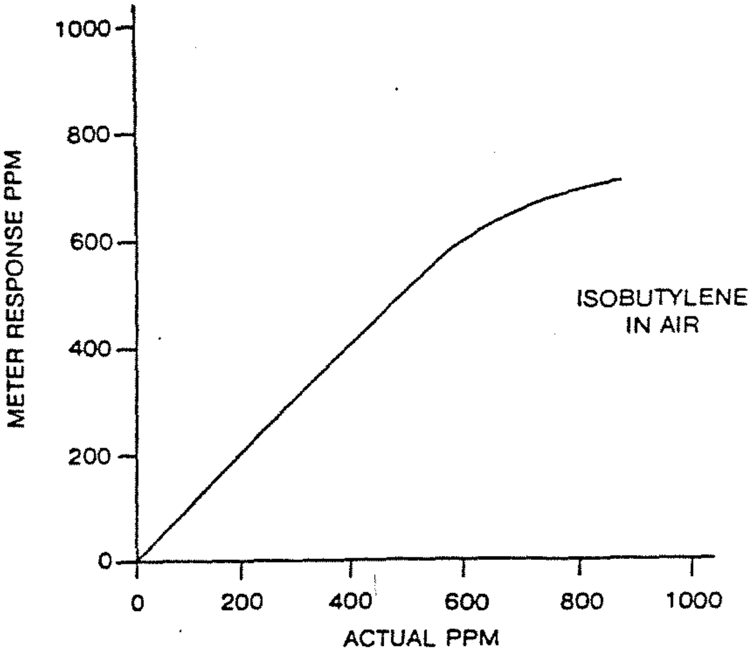
d. 0-2000 range - For calibrating on the 0-2000 range, use of two standards is recommended as cited in Section 3.2a. First calibrate with the higher standard using the SPAN control for setting. Then calibrate with the lower standard using the ZERO adjustment. Repeat these several times to ensure that a good calibration is obtained. The analyzer will be appoximately linear to better than 600 ppm, (see Figure 3-2). If the analyzer is subsequently to be used on the 0-20 or 0-200 range, it must be recalibrated as described in steps b. and c. above.

e. Lamp cleaning - If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned (see Section 5.2).

f. Lamp replacement - If the lamp output is too low or if the lamp has failed, it must be replaced (see Section 5.3).

3.5 CALIBRATION CHECKING

Rapid calibration checking in the field can be accomplished by use of a small disposable cylinder containing isobutylene. Immediately after a calibration has been completed, a reading is taken on a special isobutylene standard. This provides a reference concentration measurement for later checking in the field. This can be done at any time with a portable cylinder containing this same special standard, using this reference reading as a check, and making adjustments to the analyzer if necessary. In effect, this is an indirect method of calibration, one maintaining the calibration to give direct readings for the original gas mixture, but using the portable isobutylene cylinder. Details are given in Section 8.2 of the Appendix.



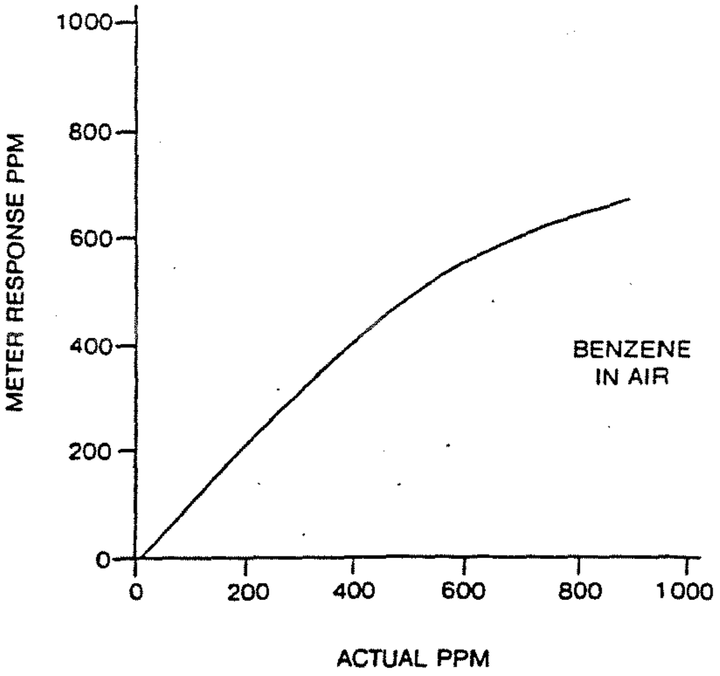


FIGURE 3-2
TYPICAL CALIBRATION CURVES (10.2 eV)

Calibration and Quality Control of the Jerome 431-X Mercury Vapor Analyzer

In order to determine whether the instrument is within calibration tolerances between recommended annual factory calibrations a functional test kit produced by the instrument manufacturer is used. This test verifies that the instrument is within an acceptable calibration range. The verification test is performed through the introduction of a known mass of mercury into the Jerome analyzer. For specific procedures, the manufacturer's user manual will be utilized. Results are recorded in an MVA log in order to provide a quality control/quality assurance record of the instrument function.

A summary of the steps used for verification of calibration and quality control are listed below.

1. Remove the calibration vessel from the Functional Test Kit.
2. Under a hood or in a well-ventilated area remove the mercury from its vial, carefully pour it into the calibration vessel opening and install the stopper assembly.
3. Allow the vessel to adjust to room temperature for at least two (2) hours.
4. After 2 hours, turn the power button of Jerome 431-x MVA to the ON position.
5. Take 3 samples, the average reading should be under 0.005 to continue the verification process.
6. Record the temperature of the calibration vessel by reading the thermometer inside the vessel body.
7. Take the syringe and following the technique described in the user manual, insert the syringe into the calibration vessel and fill the syringe with mercury vapor.
8. Press the sample button on the Jerome meter; wait 2 seconds and when the display flashes inject 1cc of mercury vapor into the instrument's intake tube.
9. Record the meter reading and repeat the last two steps three times.
10. The three injection readings should be within +/- 5% of each other.
11. Average the three readings and compare that value to the Temperature Conversion Chart provided in the User Manual. The average value should fall within the range shown on the chart if the Jerome 431-X is functioning properly.

AZI Arizona Instrument

Jerome 431-X Mercury Vapor Analyzer

The **Jerome 431-X Mercury Vapor Analyzer** uses a gold film sensor for the detection and accurate measurement of toxic mercury vapor in the air.

A portable hand-held unit, the Jerome 431-X can easily be carried to locations of mercury concerns. Simple, push-button operation allows users to measure mercury levels in just seconds. The range of the 431-X is from *0.000 to 0.999* mg/m^3 *Hg*. The gold film sensor is inherently stable and selective to mercury, eliminating interference common to ultraviolet analyzers, such as water vapor and hydrocarbons.

The 431-X includes features not available in older Jerome models. When attached to either a data logger or computer, the analyzer automatically regenerates the sensor when it becomes saturated and then resumes sampling. An improved film regeneration circuit makes the sensor last even longer.

For more information on the Jerome 431-X, contact a technical sales representative at **800.528.7411 or 602.470.1414**

Features

◈Portable, rugged and easy to operate
◈13 second response
◈Automated sample cycle
◈Inherently stable gold film sensor
◈Operates up to six hours on fully charged nickel-cadmium batter
◈Digital display in either mg/m^3 or ng
◈One year limited parts and labor warranty

Applications

- Mercury surveys
- Spill response
- Hazardous waste sites
- Mercury exclusion tests

Specifications

- Accuracy: +/- 5% at 0.100 mg/m^3 Hg
- Sensitivity: 0.003 mg/m^3 Hg
- Range 0.000 to 0.999 mg/m^3 Hg
- Precision: 5% relative standard deviation at 0.100 mg/m^3 Hg
- Environmental Operating Range: 0-40 degrees C. non-condensing, non-explosive
- Response Time: Sample mode - 13 seconds; Survey mode - 4 seconds
- Flow Rate: 750cc/min.
- Weight: 7 pounds
- Dimensions: 6"W x 13"L x 4"H
- Case Design: Enform
- Power Requirements: 115VAC or 230VAC, 115 watts maximum

Call Today: For more information, contact a technical sales representative at **1-800-290-1414.**

Arizona Instrument Corp.
Phone: (800)528-7411; (602)470-1414; Fax: (480)281-1744
Sales@azic.com

ARIZONA INSTRUMENT
USER'S MANUAL

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JEROME 431-X MERCURY VAPOR
ANALYZER OPERATION MANUAL,
AZI P/N SS-086

Document Number: 6J21-0001
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Research and Development Manager

Approved: Kathy Reed
Marketing Manager

Approved: Carolyn Gardner
Customer Service Manager

CHANGE RECORD

Rev	Date	Responsible Person	Description of Change
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B	May, 1996	Carolyn Gardner	Regeneration of electronic file from Rev. A hard copy
C	July, 1996	Carolyn Gardner	Edit, correct and update information and graphics.

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JEROME 431-X

Mercury Vapor Analyzer

Operation Manual

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SOP for Superfund site

6 CALIBRATION

The Jerome 431-X's gold film sensor is inherently stable and does not require frequent calibration. The interval between calibrations depends upon the application and frequency of use; however, the recommended minimum or maximum interval is every 12 months.

The Jerome 431-X has been factory calibrated using NIST traceable permeation tubes. These permeation tubes have a rated accuracy of +/- 2%. In order to calibrate the Jerome 431-X, a sophisticated calibration system is required that ensures stability of the calibration gas source, eliminates any pressure in the calibration gas stream and controls the temperature of the calibration environment. Calibration also requires special proprietary software.

We strongly recommend you take advantage of our calibration and maintenance service at Arizona Instrument. Call Customer Service at 800-235-3360 OR 602-470-1414 to arrange re-calibration. A certificate of calibration is issued from AZI when your instrument is factory calibrated.

6.1 VERIFICATION OF CALIBRATION AND QUALITY CONTROL

The Functional Test Kit (AZI P/N 4431-0902) is used to determine if your instrument is within calibration tolerances between recommended annual factory calibrations. It allows you to have complete confidence in the sample results. This test verifies proper instrument operation through the introduction of a known mass of mercury into the Jerome analyzer.

If your application requires frequent verification of instrument function, this test demonstrates the unit's operation, calibration, and function. Recording Functional Test Kit results in an instrument log provides a quality control/quality assurance record of instrument function between regular calibrations. If test results fall within the expected range, you may assume the instrument is functioning correctly. **THIS TEST DOES NOT CALIBRATE THE INSTRUMENT.**

See page 37 in Appendix A, for complete Functional Test Kit procedures.

To order the kit, contact AZI Customer Service at 800-235-3360 or 602-470-1414.