



# THE MEMPHIS DEPOT TENNESSEE

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## ADMINISTRATIVE RECORD COVER SHEET

AR File Number 364

## TECHNICAL MEMORANDUM

CH2MHILL

**Final Field Sampling Plan Addendum for Operable Unit (OU) 3**

**TO:** Tennessee Department of Environment and Conservation (TDEC)  
EPA Region IV  
Memphis Depot Caretaker  
US Army Corps of Engineers, Huntsville

**FROM:** CH2M HILL

**DATE:** September 25, 1998

**Introduction**

As part of a continuing program of evaluating its hazardous waste management practices, the United States Army is performing Remedial Investigations/Feasibility Studies (RI/FS) at the Defense Distribution Depot Memphis Tennessee (DDMT). Previously completed site investigations at DDMT have confirmed the existence of contamination, and RI/FS investigations are underway to determine the extent of this contamination and appropriate remedial actions at the Main Installation, which consists of Operable Units 2, 3, and 4 (OU-2, 3 and 4). This Technical Memorandum presents a sampling plan for additional environmental characterization of surface soil, subsurface soil, surface water and sediment, and some site-specific groundwater locations. The environmental sampling proposed herein is based on a review of the initial Main Installation sampling. Additional groundwater characterization of the entire Main Installation Fluvial Aquifer was proposed to the BCT in a Technical Memorandum issued on May 8, 1998, and further discussed in the June, 1998, partnering meeting.

DDMT has initiated a series of environmental contamination investigations and remediation projects under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Base Realignment and Closure Act (BRAC). The sites investigated fall into three categories:

1. Screening Sites where environmental contamination was suspected but not confirmed. The objective of the environmental sampling was to determine if a release to the environment had occurred and therefore sample locations were biased to areas where releases would have been suspected.
2. RI sites where existing environmental contamination was evaluated for nature and extent. The objective of the environmental sampling was to evaluate the type of contamination and its horizontal and vertical extent.

3. Base Relocation and Closure (BRAC) property parcels where environmental sampling was performed to determine if the property was suitable for transfer or lease. The objective of the BRAC sampling was to determine if chemicals existed in the surface soil and subsurface soil in concentrations that might present a concern for industrial and, in the case of Parcel 2, residential uses.

A Field Sampling Plan (FSP) was approved for OU- 3 in 1995, and the field investigation implementing this plan occurred in late 1996 and early 1997. Results of the field investigations were presented in a series of Letter Reports in 1997 and 1998. The data were also reviewed by the BRAC Cleanup Team (BCT) during a series of meetings in the summer and fall of 1997 wherein recommendations on additional characterization were made and documented in the meeting minutes.

During these meetings, the BCT determined that a comprehensive and conservative risk-based approach to evaluating the environmental data was needed. Following EPA Region IV guidance on performing a preliminary risk assessment, a Preliminary Risk Evaluation Report (CH2M HILL, 1998) was prepared on a BRAC parcel and CERCLA site basis. The risks calculated in the Preliminary Risk Evaluation (PRE) were also used as a basis for requiring additional sampling.

A series of sites was proposed for Early Removal (ER) action in the 1995 FSP, prior to inclusion of DDMT in the BRAC program. Most of these sites are in Dunn Field, only three were identified in the Main Installation. The requirements for early action have changed under BRAC, focusing on expedited removals for sites in parcels that are a priority for lease or transfer. Characterization of these sites is proposed prior to ER action.

## Methodology

Data from the Screening Sites and RI Results of the field investigations, the BRAC Sampling Recommendations (Woodward Clyde, 1996) and the results of the Preliminary Risk Evaluation (CH2M HILL, 1998) were reviewed in preparation for updating the FSPs. CH2M HILL's risk assessment staff reviewed the updated risk-based screening levels and all the available data to ensure that enough were available to complete the risk assessment before preparing the revised FSPs for each site presented below.

In addition, CH2M HILL staff field-verified the proposed sampling locations, and staked and photographed each proposed sample location.

The collection of additional data is generically proposed to satisfy one of the following considerations.

**Sufficient Number of Data Points.** The number of usable data points was tabulated to assess whether a sufficient number existed to perform a risk assessment. Specific criteria used were if there was enough of data points to support a statistical estimate of the exposure concentration at each site and if the analytical methods were sufficient to characterize the site. If an insufficient data population existed for a site, additional data has been proposed.

**Definition of the Extent of Contamination.** Results of the field investigations indicated some samples at a site that exceeded the screening criteria for certain parameters. The

configuration of these samples was reviewed to assess whether additional samples were needed to adequately characterize the area exceeding health-based criteria.

**Characterization of the Nature of Contamination.** If earlier sampling at a site indicated the presence of a contaminant in some of the samples, sampling for additional types of contamination may need to occur.

**Assurance of Absence of Contamination.** A sufficiently broad spectrum of analyses is also necessary to fully understand the nature of contamination at each site. If a site is judged free of contamination, the number of samples and the suite of analyses should be reviewed for adequacy. The current knowledge of recent past use may not be an adequate indicator of the potential contaminants at a site.

**Evaluation of Groundwater Contamination.** At some sites, surface and subsurface soil concentrations exceed criteria that signify the potential for transfer from soil to groundwater via leaching. Additional subsurface soil sampling may be proposed or grab samples of groundwater may be obtained to directly determine if an impact to groundwater is occurring.

**Sufficiency for Feasibility Studies.** Feasibility samples are proposed at sites where remedial activities are likely and data are needed to evaluate the feasibility of different remedial technologies. If, for instance, surface soil at a particular site contains elevated concentrations of arsenic and subsurface soil does not, then samples would be collected from 0 to 6 inches, 6 to 12 inches and 12 to 18 inches to determine if removing the surface soil was a feasible remedial option. TCLP samples may be collected to determine if the surface soil could be covered without the risk of the contaminants leaching to the groundwater. Geotechnical samples may be collected to evaluate if other technologies such as soil vapor extraction, solidification or other engineering control may be applicable at the site. Geotechnical testing will include grain size distribution, moisture content, pH, alkalinity, cation exchange capacity, and total organic carbon.

## Changes to Field or Laboratory Methods

EPA has promulgated a change in the methods for collection and analysis of VOC's in soil. The sampling proposed in this addendum to the FSP incorporates this methodology for VOC analysis of soils. Previous methods have demonstrated a significant low bias in the quantitation of VOC's in soil samples (EPA, 1997).

The samples collected as implementation of the 1995 FSPs were analyzed by the traditional "purge-and-trap" procedures outlined in Update II to SW-846 (Method 5030A, Revision 1, 1992). However, on June 13, 1997, Method 5030B and Method 5035 were promulgated in SW-846 (Update III). This update removed the option to analyze soils / sediments by Method 5030 and replaced it with Method 5035, "Closed- System Purge-and-Trap and Extraction for Volatile Organics in Soil and Water Samples". Method 5035 has several options in sample collection: field preserving with methanol or sodium bisulfite or collecting in EnCore samplers and submitting to the laboratory for preservation within the specified 48 hours.

## Revised Site Sampling and Analysis Plans

For each of the sites in this OU that require additional sampling, a synopsis of the revised sampling plan is presented below. A figure is presented for each site showing both the previous sampling locations (including sampling performed by other firms) and any new sampling proposed in this addendum. A table for each site itemizes each new proposed sample, and provides the rationale and proposed suite of analyses.

Any Screening Sites that occur in this OU are presented in a separate FSP for Screening Sites. Early Removal (ER) and BRAC sites are presented in the OU in which they occur.

### RI Site 25: Golf Course Pond

The COPCs identified for RI Site 25 include DDE in the surface water and DDD, DDT, DDE and lead in the sediment samples. To characterize the extent of contamination at the pond, additional surface water and sediment samples are needed to provide a larger data base, and information on current conditions, upon which to base decisions about this site. Two surface water samples (SW25E and SW25F) and two sediment samples (SD25A and SD25B) are will be collected on the northeast and northwest side of the pond. One surface water sample (SW-25G) and one sediment sample (SD-25C) will be collected from the center of the pond. The samples will be analyzed for target analyte list/target compound list (TAL/TCL) compounds (Table 1) which would be associated with the carrier compounds for pesticides and possible metals associated with these compounds. See Figure 1 for the location of the new samples.

### RI Site 26: Lake Danielson

The COPCs identified for RI Site 26 include arsenic, dissolved arsenic, DDE, DDT, lead and zinc in surface waters. Elevated concentrations of DDD, DDT, DDE and other pesticides were detected in the sediments. Additional surface water and sediment samples are needed to characterize the extent of contamination at the site and to provide a larger data base, and information on current conditions, upon which to base decisions about this site. Four surface water samples (SW26E through SW26H) and four sediment samples (SD26A through SD26D) will be collected along the northern, eastern, southern, and western shoreline of Lake Danielson. One surface water sample (SW-26I) and one sediment sample (SD-26E) will be collected from the center of the lake. The samples will be analyzed for TAL/TCL compounds (Table 2) which would be associated with the carrier compounds for the pesticides and possible metals associated with these compounds. See Figure 2 for the location of the new samples.

### RI Site 58: Pad 267

Previously, nine surface soil samples were collected around the former pesticide storage area. Dieldrin was the only contaminants of potential concern (COPC) identified in the samples. Two additional borings (SB58A and SB58B) will be taken to characterize the vertical extent of contamination at the site. The borings will be located between the previous surface soil sample locations. Three samples will be collected from each boring at

depths of 0 to 1 ft, 2 to 5 ft and 8 to 10 ft and will be analyzed for TAL/TCL compounds (Table 3). See Figure 3 for the new boring locations. Existing data for this site does not include broad enough analytical suites to assess whether or not carrier compounds for the pesticides or other possibly associated metals are present at the site.

#### **RI Site 59: Building 273**

The COPCs at RI Site 59 include polyaromatic hydrocarbons (PAH) compounds, arsenic, DDT, DDE and dieldrin. One additional boring (SB59C) will be taken southwest of Building 273 to characterize the vertical extent of contamination at this location to provide vertical extent data near an area where significant contamination was reported earlier. The sample will be collected at a depth of 10 ft and will be analyzed for TAL/TCL compounds to assess the presence of pesticide carrier compounds and other possibly associated metals (Table 4). See Figure 4 for the new boring location.

#### **BRAC Site: Parcel 20 RR Tracks**

PAH compounds are an environmental concern at this site. Two additional surface soil samples [B(20.6) and C(20.6)] will be collected to evaluate the extent of PAH contamination in the surface soil. The samples will be collected west and east of Sample A (20.6), just south of Building 489 and north of Building 490 on the western edge.

Furthermore, six additional surface soil samples will be collected from two sample locations (FS20.6A and FS20.6B) to provide data for evaluating the extent of soil remediation. The FS samples will be taken at three intervals (0 to 6 inches, 6 to 12 inches and 12 to 18 inches). One FS sample will be analyzed for PAH TCLP and geotechnical parameters from a total depth composite sample. The other FS sample will analyze the same compounds from a 0 to 6 inch depth (Table 5).

See Figure 5 for the new sample locations.

#### **BRAC Sites: Parcels 1, 2, 6, 8, 9, 11, 16, 17, 18, and 34.**

Historically, the only sampling and analysis work done at each of these BRAC sites was for pesticide and PCBs. No other assessment of possible contaminants has been made. To assess the presence of other associated contaminants, to allow for a reasonable assessment of possible risk at the sites, one surface soil sample (depth 0.0 to 1.0 foot) will be taken adjacent to the historical sample at each site which had either the highest reported concentration of pesticide or PCB or is located closest to the geographic center of each site. These soil samples will each be analyzed for TCL/TAL concentrations (Table 6).

## **New Sampling and Analysis Plan**

A Sampling and Analysis Plan is proposed for new potential sites that were discovered as a result of the *Historical Environmental Aerial Photographic Analysis of the Main Depot Area South of Dunn Avenue* (TEC, 1998). This study reviewed available black and white aerial

photographs and supplemental collateral materials spanning from 1945 to 1990, to identify features that may be of environmental concern. Stereo-paired photography, non-stereo photo maps, and ground photography were available. The observed features include ditches, excavations and ground scars, cleared areas, and open storage areas. Features that disappeared over time (such as an old pond that was drained and filled in) were also noted.

After TEC produced its report, CH2M HILL reviewed the observed features and compared them to known sites or sampling areas. Confirmatory sampling was proposed at several new sites as a result of this review. The sites that are included in this OU are described below.

### **Former Magazine Sites**

Two magazines were formerly located on the eastern side of the Lake Danielson drainage ditch. They are evident on aerial photos from 1945 to 1963, and appear to be about 20 by 30-feet in size. No information is available on how they were demolished, or what type of munitions they stored.

Since it is unknown whether unexploded ordnance may still be in the vicinity, the possibility of a UXO evaluation prior to sampling is being investigated. The sampling plan consists of drilling one 10-foot boring at each magazine site (TEC-92A and TEC-92B) and sampling the soil at the surface and at a 3-5-foot depth. Proposed sample locations are shown on Figure 6. The samples will be analyzed for PPM metals, as shown in Table 7.

### **Container Storage Strip**

A rectangular area oriented east-west in the 1945-1946 aerial photos is shown between what is now Building 670 and 560. The containers do not appear to be drums, as they are rectangular in shape and probably 10 feet wide by less than 20 feet long. Their contents and purpose are not known. It is also not known if they were placed in a trench, or on the ground surface.

One 10-foot boring (TEC-91A) will be obtained in an area of previous concentration of containers, that is still accessible (ie not covered by a building), as shown in Figure 7. Two soil samples will be taken from the boring – one at the surface and one at a fill interface, if it exists. If not, the second sample will be taken at 3-5 feet. Both samples will be analyzed for TCL/TAL, as shown in Table 8.

### **Pistol Range**

A former pistol range was located east of Lake Danielson and south of Building 271, on a 1946 aerial photograph. This area has previously been sampled in conjunction with the Screening Site 69, Former Flamethrower Range, and therefore no additional samples are proposed.

## **References**

CH2M HILL. *Final Preliminary Risk Evaluation*. Prepared for United States Army Engineering Support Center, Huntsville, Alabama. April 1998.

*"Determination of Volatiles in Soil-Directive for Change"*, Memorandum from Norman Niedergang, Director, Waste, Pesticides and Toxics Division, U.S. EPA Region 5, December 22, 1997.

U.S. Army Topographic Engineering Center. *Historical Environmental Aerial Photographic Analysis of the Main Depot Area South of Dunn Avenue*. Prepared for U.S. Army Engineering and Support Center Huntsville, Alabama. September, 1998.

Woodward-Clyde. *Sampling and Analysis Recommendations*. 1996.



Table 1  
 Site 25 - Golf Course Pond  
 Final Addendum to Field Sampling Plan  
 DDMT Delivery Order II - Main Installation  
 September, 1998

Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Beats	Analyses						Comments	
									BTEX	PPM	VOC	PAH	Res/PCB	TAL		TCL
RI	3	3	25	Golf Course Pond	Site Characterization	SW-25E	N/A	Northeast side of pond						1	1	
						Northwest side of pond							1	1		
						Northeast side of pond							1	1	Collected in the same location as SW-25 E	
						Northwest side of pond							1	1	Collected in the same location as SW-25F	
					EPA Comment	SW-25G		Center of Pond					1	1		
						SD-25C		Center of Pond						1	1	

Table 2 Site 25 - Lake Danielson Final Addendum to Field Sampling Plan DDMT Delivery Order 11 - Main Installation September, 1998																	
Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Basis	Analyses							Comments	
									BTEX	PPM	VOC	PAH	Pest/PCB	TAL	TCL		
RI	3	3	28	Lake Danielson	Site Characterization	SW-26E	N/A	northern shoreline							1	1	
						SW-26F		eastern shoreline							1	1	
						SW-26G		southern shoreline							1	1	
						SW-26H		western shoreline							1	1	
						SD-26A		northern shoreline							1	1	
						SD-26B		eastern shoreline							1	1	
						SD-26C		southern shoreline							1	1	
						SW-26I		center of pond							1	1	
					EPA Comment	SD-26D		center of pond						1	1		

Table 3 Site SA - Pad 267 Final Addendum to Field Sampling Plan DONUT Delivery Order 11 - Main Installation September, 1998																
Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Basis	Analytes						Comments	
									BTEX	PPM	VOC	PAH	Pest/PCB	TAL		TCL
RI	3	4	58	Pad 267	Site Characterization	SB-58A	0-1, 3-5, 6-10	Between SS-58A and SS-58I						1	1	
						SB-58B	0-1, 3-5, 6-10	Between SS-58F and SS-58G					1	1		

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Table 4 Site 59 - Building 273 Final Addendum to Field Sampling Plan DDMT Delivery Order 11 - Main Installation September, 1998																
Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Basis	Analytes						Comments	
									BTEX	PPM	VOC	PAH	Pest/PCB	TAL		TCL
RI	3	4	59	Building 273	Need to sample for all related compounds to characterize the site	SB-59C	8-10	Near SS-50, just southeast of Building 273						1	1	

Table 3 Parcel 20 - Parcel 20 RR Tracks Final Addendum to Field Sampling Plan DDMT Delivery Order 11 - Main Installation September, 1993																
Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Basis	Analyses							Comments
									BTEX	PPM Metals	VOC	PAH	Pest/PCB	TAL	TCL	
BRAC	3	20	N/A	Parcel 20 RR Tracks	Evaluate extent of PAH in surface soil	B(20.6)	0-1	most of A(20.6) to evaluate PAH extent				1				
						C(20.6)	0-1	east of A(20.6) to evaluate PAH extent				1				
					FS information	FS-20.6A	0.0-0.5, 0.5-1.0, 1.0-1.5	west of A(20.6) to evaluate PAH extent				3				collect geotechnical suite and PAH TCLP from 0-1.5 ft composite.
						FS-20.6B	0-1	east of A(20.6) to evaluate PAH extent				3				collect geotechnical suite and PAH TCLP from 0-0.5 ft composite.





Table 2  
TEC Site—Former Container Storage Strip  
Final Addendum to Field Sampling Plan  
ODMT Delivery Order 11 - Main Installation  
September, 1988

Type of Site	OU No.	Parcel No.	Site No.	Description	Sampling Objective	Proposed Sample ID	Sample Interval (ft)	Sample Location/Basis	Analyses							Comments
									BTEX	PPM	VOC	PAH	Pest/PCB	TAL	TCL	
TEC	3	3	N/A	Former Container Storage Strip	Need to sample for all related compounds to characterize the site	TEC-61A	0-1	Between Bldgs. 670 and 560						1	1	Take second sample at (ii) interface, if it exists.
							3-5							1	1	



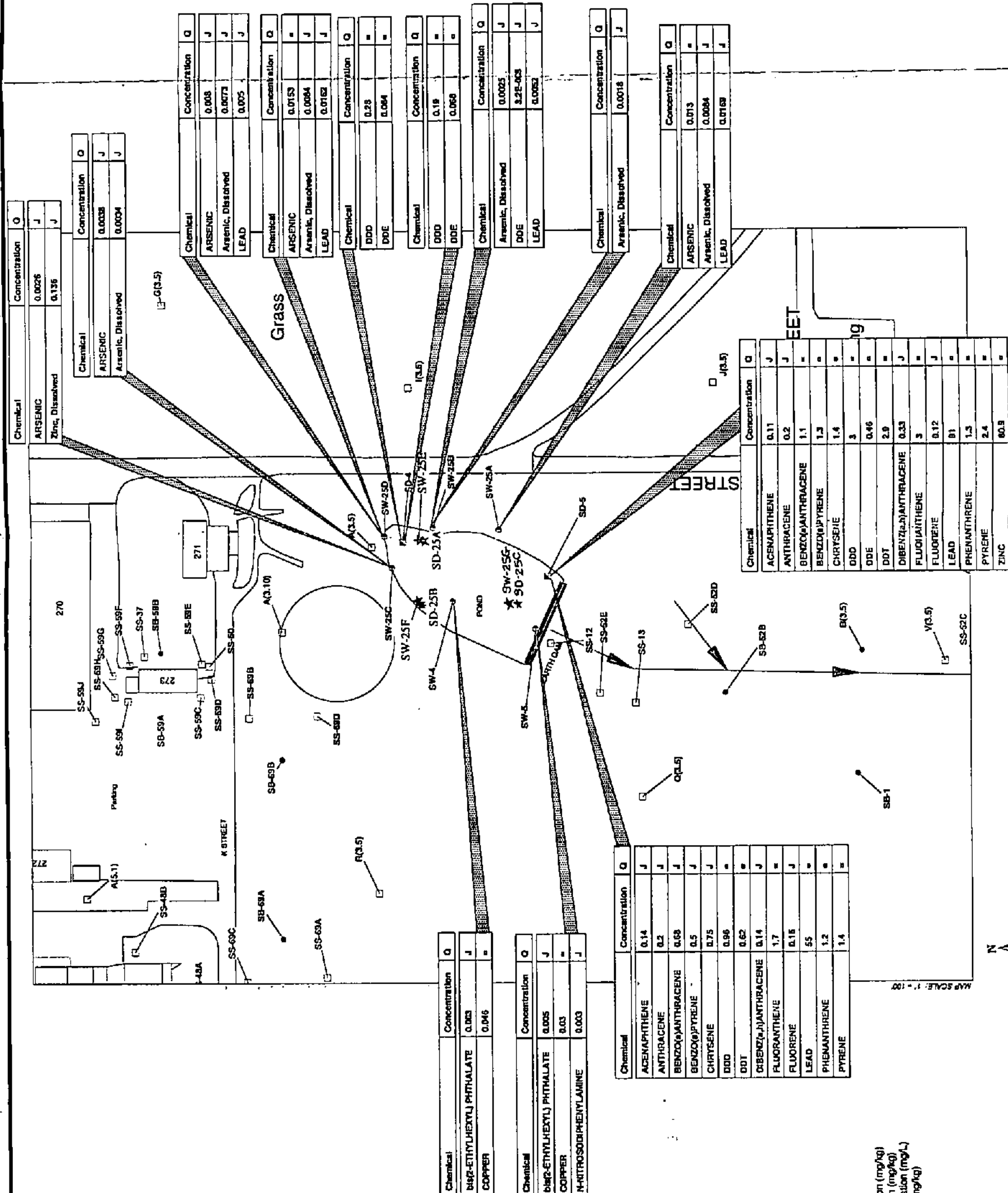
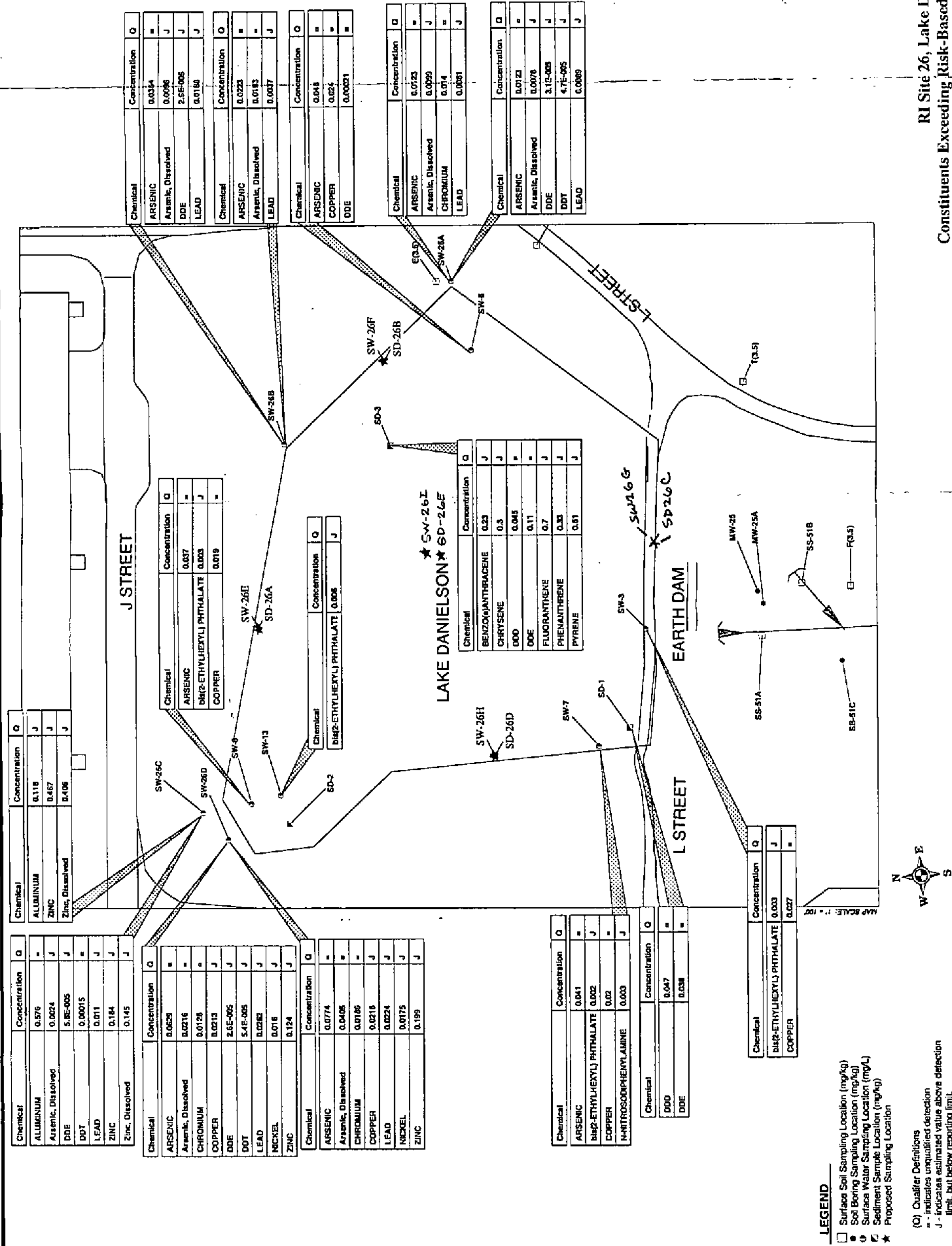
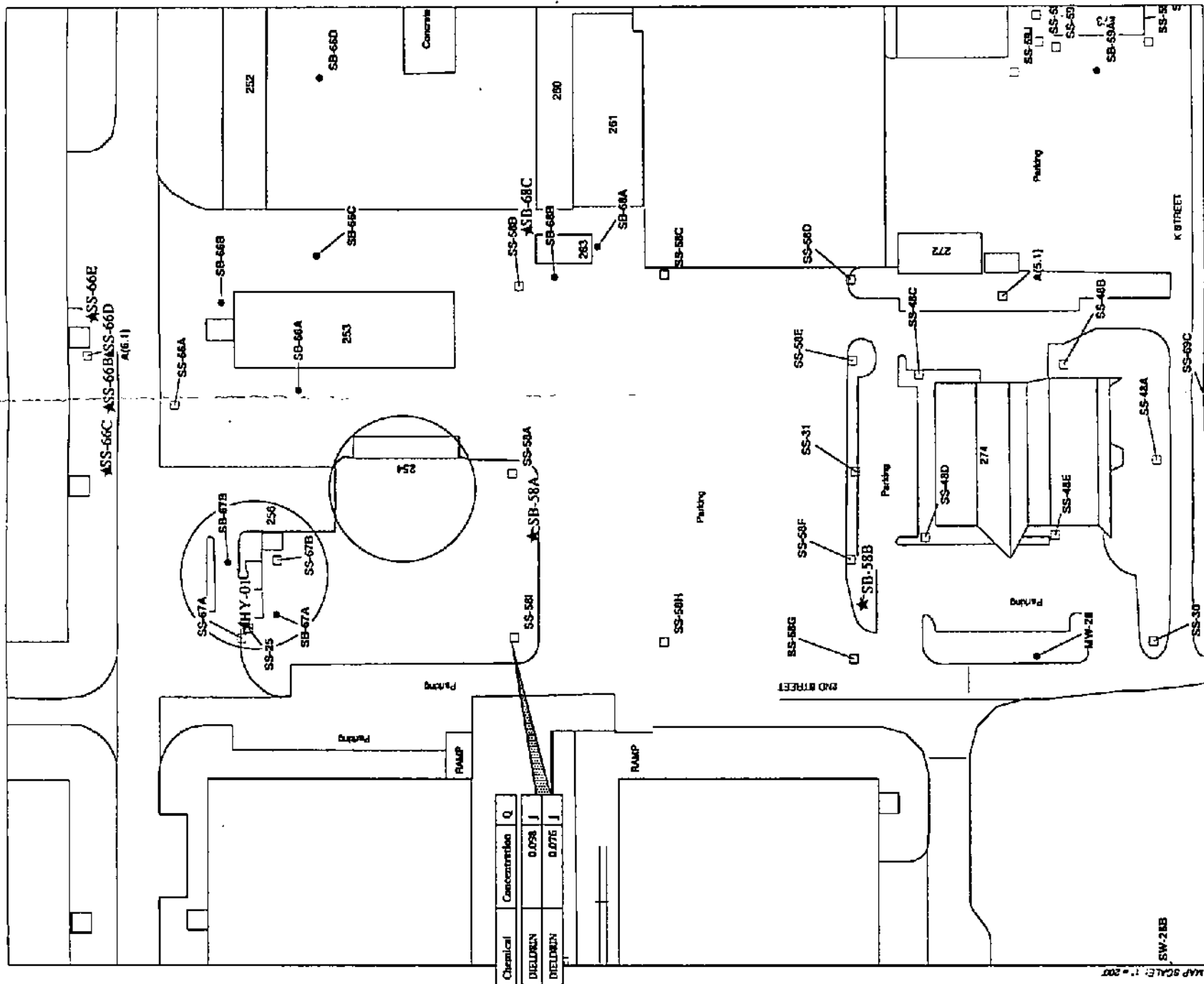


Figure 1  
RI Site 25, Golf Course Pond  
Constituents Exceeding Risk-Based Criteria  
Defense Distribution Depot Memphis, TN

Sampling locations without data boxes had no constituents exceeding risk-based criteria



**Figure 2**  
**RI Site 26, Lake Danielson**  
**Constituents Exceeding Risk-Based Criteria**  
*Defense Distribution Depot Memphis, TN*

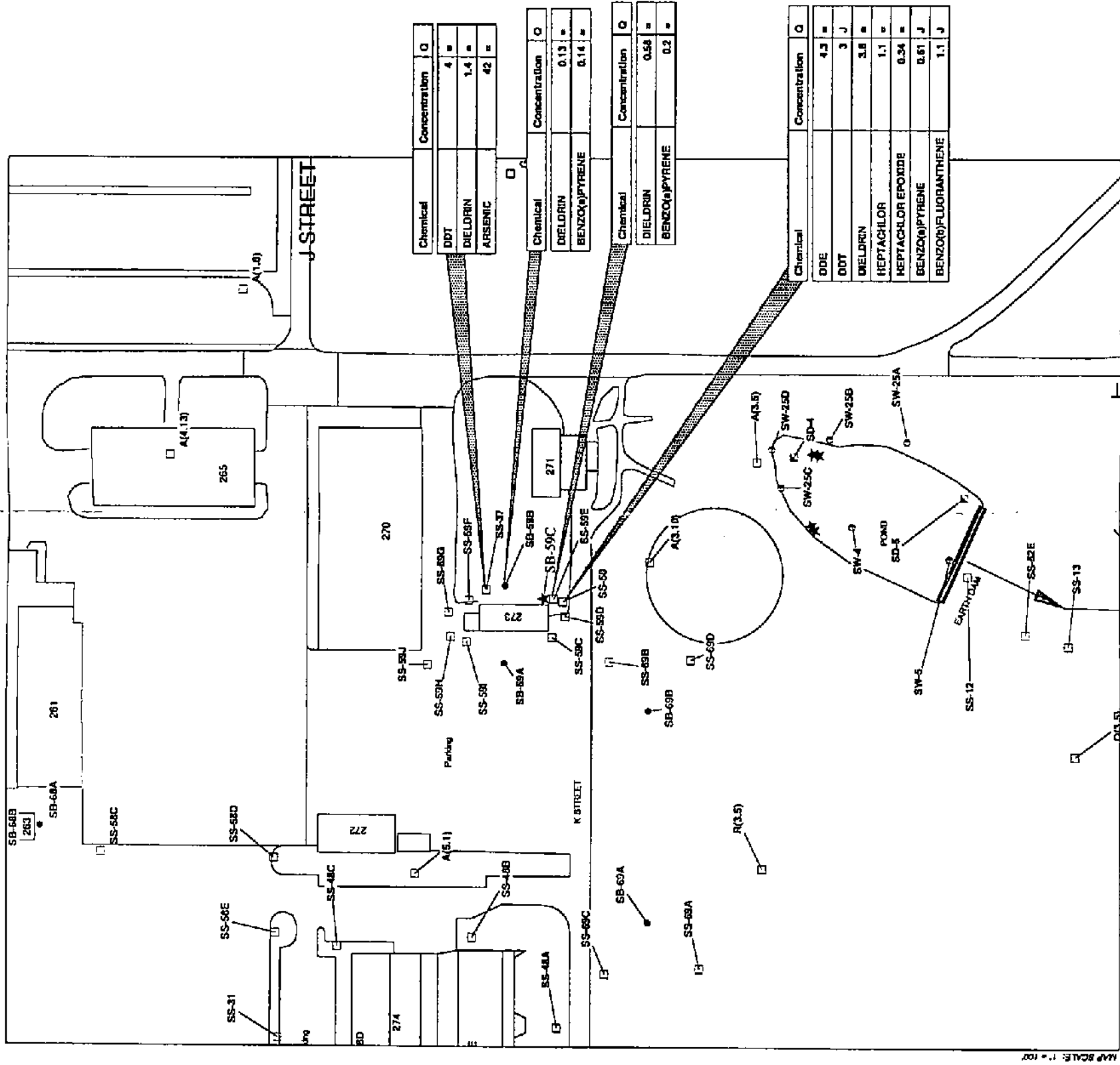


- LEGEND**
- Surface Soil Sampling Location (mg/kg)
  - Soil Boring Sampling Location (mg/kg)
  - Surface Water Sampling Location (mg/L)
  - Sediment Sample Location (mg/kg)
  - ★ Proposed Sampling Location
- (Q) Qualifier Definitions**
- indicates unqualified detection
  - J - indicates estimated value above detection limit, but below reporting limit



Figure 3  
RI Site 58, Pad 267  
Constituents Exceeding Risk-Based Criteria  
Deferre Distribution Depot Memphis, TN

Sampling locations without data boxes had no constituents exceeding risk-based criteria



**LEGEND**

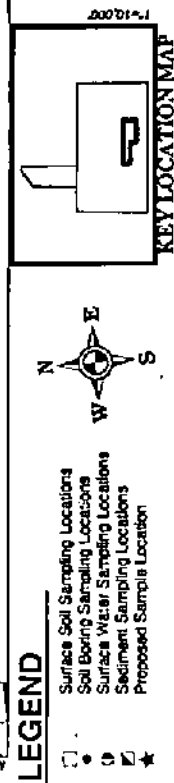
- Surface Soil Sampling Location (mg/kg)
- Soil Boring Sampling Location (mg/kg)
- ◇ Surface Water Sampling Location (mg/L)
- ★ Sediment Sample Location (mg/kg)
- ★ Proposed Sampling Locations
- (Q) Qualifier Definitions
  - = Indicates unqualified detection
  - J - Indicates estimated value above detection limit, but below reporting limit



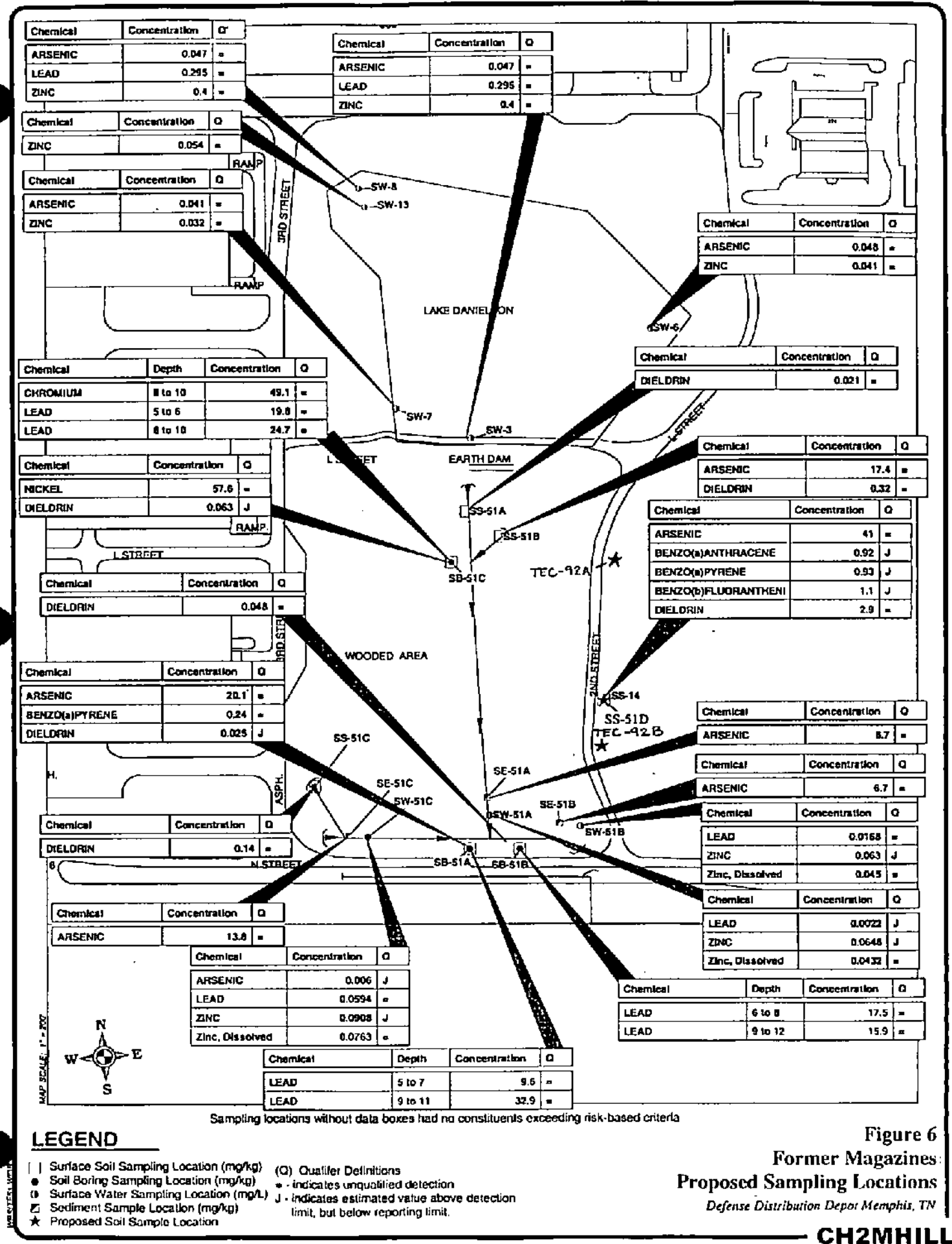
Sampling locations without data boxes had no constituents exceeding risk-based criteria

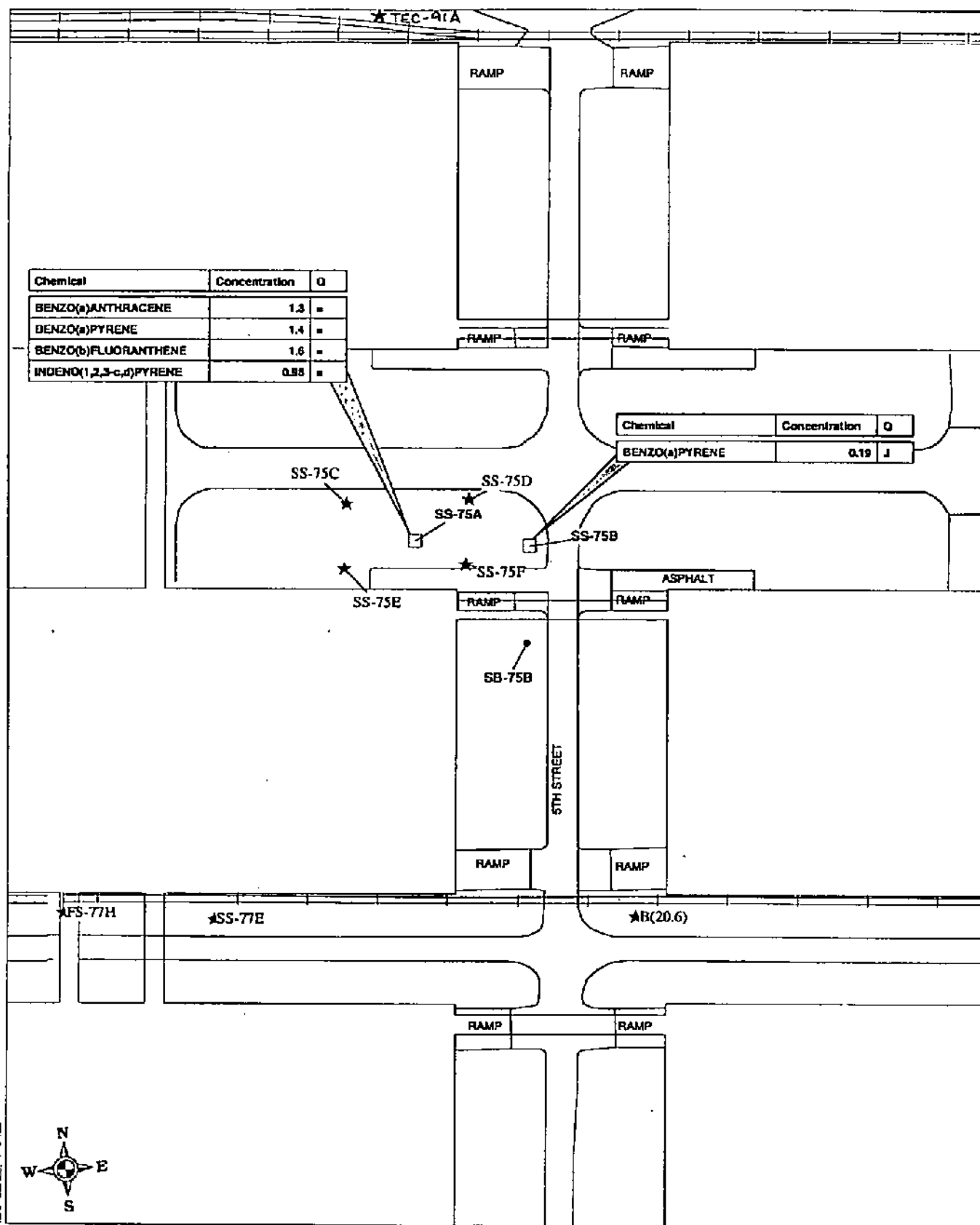
Figure 4  
RI Site 59, Building 273  
Constituents Exceeding Risk-Based Criteria  
Defense Distribution Depot Memphis, TN

*Defense Distribution Depot Memphis, TN*



## LEGEND





Sampling locations without data boxes had no constituents exceeding risk-based criteria

### LEGEND

- Surface Soil Sampling Location (mg/kg)
- Soil Boring Sampling Location (mg/kg)
- ★ Proposed Sampling Location
- (Q) Qualifier Definitions
  - = - indicates unqualified detection
  - J - indicates estimated value above detection limit, but below reporting limit.

**Figure 7**  
**Container Storage Strip**  
**Proposed Sampling Location**  
 Defense Distribution Depot Memphis, TN

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