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PHASE II WORK PLAN
RCRA FACILITY INVESTIGATION
SUN COMPANY, INC. (R&M)
PHILADELPHIA REFINERY
GIRARD POINT PROCESSING AREA

Prepared for:

Sun Company, Inc. (R&M)
Philadelphia, Pennsylvania
Job No. 25995-029

April 23, 1998

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1.0 INTRODUCTION

This work plan presents a scope of work for the Phase II RCRA Facility Investigation (RFI) at the Sun Company, Inc. (R&M) (SUN) Philadelphia Refinery Girard Point Processing Area (Facility) in Philadelphia, Pennsylvania. The scope of work presented was developed using the results of previous investigation at the Facility, including the Phase I RFI performed in 1993 at the site. The objectives of the work scope is to develop a data-base to delineate the extent and degree of constituents of concern at the site, to support a site-specific risk assessment for worker exposure, and to determine if a corrective measure study is necessary.

1.1 PURPOSE

On September 27, 1989, the United States Environmental Protection Agency (USEPA) issued a Resource Conservation and Recovery Action (RCRA) Corrective Action permit (EPA I.D. No. 049 791 098) to Chevron USA, Incorporated for the Facility. In accordance with Part II, Section (A) subsection (7) (a) of the Corrective Action Permit, Chevron USA, Incorporated submitted a RCRA Facility Investigation Work Plan to the USEPA on July 2, 1991. Following subsequent approval of the Work Plan by the USEPA, Chevron implemented the work scope and submitted an RFI report dated November 24, 1993 to the USEPA. SUN purchased the Facility from Chevron in August 1994. The USEPA provided comments to the RFI report to SUN in a letter dated June 12, 1997. SUN and the USEPA met on February 9, 1998 to discuss the USEPA comment letter and subsequent to the meeting the USEPA presented a second comment letter to SUN, dated February 20, 1998. This Phase II Work Plan was prepared in response to the meeting between SUN and the USEPA and the USEPA's comment letter of February 20, 1998 (Appendix A).

1.2 WORK PLAN ORGANIZATION

Sections 2.0 through 4.0 generally describe the site background, the basis for the Phase II RFI Work Scope, and the soil sampling plan. Section 5.0 provides the Risk Assessment Work Plan. Sections 6.0 through 11.0 describe the Project Management Plan, Quality Assurance Plan, Data Management Plan, Health and Safety Plan, Community Relations Plan, and Project Reporting.

2.0 SITE BACKGROUND

Background information for the site was compiled during previous investigations from the fact sheet of the facility permit, a review of historical site aerial photographs, interviews with facility employees, and previous investigation reports.

2.1 SITE LOCATION

The SUN Facility is located approximately 5 miles southwest of the center of Philadelphia in Philadelphia County, southeastern Pennsylvania. The Facility is located near 30th Street and Penrose Avenue in a heavily industrialized area (primarily petrochemical) adjoining the Schuylkill River. Lanier Avenue runs adjacent to the east boundary of the Facility, and the site boundary to the north, west, and south is formed by the Schuykill River. The Facility occupies approximately 350 acres along the Schuylkill River.

2.2 SITE OPERATIONS

The Facility is a cracking petroleum refinery consisting of basic processes, including crude processing, fluid catalytic cracking, hydrofluoric acid (HF) alkylation, catalytic reforming, catalytic desulfurization, gasoline treating, sulfur recovery, aromatic extraction, thermal hydrodealkylation, and benzene and cumene petrochemical operations. Other facilities include a water treatment unit, wastewater treatment unit, and a sludge incinerator that is currently being closed. The utility plant uses water from the Schuykill River. A portion is treated by coagulation and filtration and part of that is further deionized by ion exchange to make boiler feed water for 680 psig boilers. Generated steam powers electric turbogenerators that produce 200 psig exhaust steam and a majority of the Facility's electrical requirements. Water from the Schuykill River is also used for cooling in tubular non-contact heat exchangers. Water cooling towers circulate approximately 275,000 gpm of water to exchangers in closed circuit cooling operations.

2.3 PREVIOUS INVESTIGATION

In accordance with the RCRA permit and the RFI Work Plan (July 2, 1991), an RFI was performed at the site. The RFI Report was completed November 24, 1993. The RFI consisted of a series of tasks at each of ten Solid Waste Management Units (SWMUs) identified in the RCRA Corrective Action Permit as requiring investigation (Figure A).

The ten SWMUs are divided into three groups, differentiated by physical location and historic operational practices. The groups and associated SWMUs designated in the reference permit, are:

- Northwestern Fill Area (NFA)
  - SWMU No. 87 (Buried Lead Sludge Area No. 1)
  - SWMU No. 88 (Buried Lead Sludge Area No. 2)
  - SWMU No. 89 (Buried Lead Sludge Area No. 3)
- Storage Tank Areas (STAs)
  - SWMU No. 90 (Buried Lead Sludge Area No. 4)
  - SWMU No. 91 (Buried Lead Sludge Area No. 5)
  - SWMU No. 92 (Buried Lead Sludge Area No. 6)
  - SWMU No. 93 (Buried Lead Sludge Area No. 7)
  - SWMU No. 94 (Buried Lead Sludge Area No. 8)
  - SWMU No. 95 (Buried Lead Sludge Area No. 9)
- Bulkhead Seepage Area (BSA)
  - SWMU No. 101 (Bulkhead Seepage Area)

The RFI tasks included soil gas sampling and analysis (SWMU No. 88 and 89), subsurface soil sample collection and analysis, and groundwater sampling and analysis. In addition, bulkhead reconnaissance surveys were conducted in SWMUs No. 87, 88, 89, and 101. The primary purpose of the RFI was to assess the degree and extent of hazardous constituents present, and to evaluate whether further investigation was warranted. A preliminary risk evaluation and a screening risk assessment were performed for each SWMU. The RFI concluded that additional investigation and a site-specific risk assessment was warranted at SWMU Nos. 88, 91, 92, 93, 94, 95, and 101 with regard to lead in soil. The Phase II RFI work scope has been prepared to address these concerns.

3.0 BASIS FOR PHASE II RFI WORK SCOPE

The development of this work plan included a reevaluation of the data presented in the RFI Report dated November 24, 1993. As part of the reevaluation, a preliminary risk assessment screening (PRAS) was performed using current risk assessment reference levels. The PRAS was performed by tabulating the maximum detected concentrations at each SWMU for surface soil and subsurface soil data collected during the 1993 RFI (Table 1). The maximum detected concentrations were compared to risk based concentrations published by the USEPA Region III in a document titled "Risk-based Concentration Table, October 22, 1997". Review of Table 1 indicates that based on the 1993 RFI data and current toxicological data, there are no significant exceedances of risk-based concentrations, except for lead, at several of the SWMUs. There are minor exceedances of beryllium, benzo(a)pyrene, benzo(a)anthracene, benzo(b,j,k)fluoranthene, and dibenz(a,h)anthracene, however not at concentrations considered significant. A further discussion of beryllium is provided in Section 4.1.1.4, Background Soil Samples. Use of the maximum detected concentrations for the preliminary risk assessment screening is conservative relative to the 95 percent upper confidence limit of the arithmetic mean that is often referenced, thus providing increased confidence that minor exceedances are not significant.

The remainder of this section presents the results of the PRAS and the rationale for the planned Phase II RFI scope of work for SWMU Nos. 87, 88, 89, 90, 91, 92, 93, 94, 95, and 101.

SWMU No. 87

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 87 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of benzo(a)pyrene in the one subsurface sample at 1.5 mg/kg (this is an estimated value). The PRAS value for benzo(a)pyrene is 0.78 mg/kg. The subsurface sample set also reportedly contained a maximum lead concentration of 973 mg/kg, close to the PRAS value for lead of 1,000 mg/kg. Note that only one surface (0 – 2 feet deep) and 7 subsurface (greater that 2 feet) samples were collected at this SWMU (see Table 2).

Based on the data reviewed and the limited number of samples collected during the RFI for this SWMU, this work plan includes a work scope to expand the surface and subsurface soil database for lead and benzo(a)pyrene (including other selected polynuclear aromatic hydrocarbons [PAHs]).

SWMU No. 88

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 88 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of benzo(a)pyrene in the subsurface set at a maximum concentration of 4.8 mg/kg (estimated value), lead in the subsurface sample set at a maximum concentration of 5,200 mg/kg, and beryllium in the subsurface sample set at a maximum concentration of 2.4 mg/kg. The PRAS value for benzo(a)pyrene is 0.78 mg/kg, and the PRAS value for lead and beryllium are 1,000 mg/kg and 1.3 mg/kg, respectively. One surface (0 – 2 feet deep) and 5 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for benzo(a)pyrene (including other selected PAHs), lead, and beryllium. Additional background samples will be collected for beryllium, as discussed in Section 4.1.1.4.

SWMU No. 89

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 89 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of lead in the subsurface sample set at a maximum concentration of 1,140 mg/kg, and beryllium in the subsurface sample set at a maximum concentration of 1.9 mg/kg. The PRAS values for lead and beryllium are 1,000 mg/kg and 1.3 mg/kg, respectively. Two surface (0 – 2 feet deep) and 3 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead and beryllium. Additional background samples will be collected for beryllium, as discussed in Section 4.1.1.4.

SWMU No. 90

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 90 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of benzo(a)pyrene in the subsurface sample set at a maximum concentration of 0.81 mg/kg (estimated value). The PRAS value for benzo(a)pyrene is 0.78 mg/kg. Eight surface (0 – 2 feet deep) and 12 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, no further action is recommended for SWMU No. 90. The only exceedance noted is in a subsurface sample and the concentration is slightly greater than the PRAS.

SWMU No. 91

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 91 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of benzo(a)pyrene in the subsurface sample set at a maximum concentration of 1.7 mg/kg, lead in the surface sample set at a maximum concentration of 1,110 mg/kg, and beryllium in the subsurface sample set at a maximum concentration of 1.9 mg/kg. The PRAS value for benzo(a)pyrene is 0.78 mg/kg and the PRAS value for lead and beryllium is 1,000 mg/kg and 1.3 mg/kg, respectively. Seven surface (0 – 2 feet deep) and 18 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead. Benzo(a)pyrene and beryllium are not considered a concern at this SWMU. Numerous surface samples were collected at this SWMU and only lead exceeded the PRAS values. Benzo(a)pyrene and beryllium only exceeded the PRAS values in subsurface samples and the exceedances are marginal. Only one of five subsurface samples analyzed for benzo(a)pyrene exceeded the PRAS and the average concentration of benzo(a)pyrene in the subsurface (0.55 mg/kg) is below the PRAS. A further evaluation of benzo(a)pyrene will be performed in the Risk Assessment to be conducted at the conclusion of the Phase II RFI. Two samples of the five subsurface samples analyzed for beryllium exceeded the PRAS and the average concentration (1.18 mg/kg) is below the PRAS. Beryllium is considered a background compound, as discussed in Section 4.1.1.4. Further, this area has historically been used for the storage of leaded gasoline. Thus, lead is considered the only primary constituent of concern for this SWMU.

SWMU No. 92

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 92 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of benzo(a)pyrene in the subsurface sample set at a maximum concentration of 3.6 mg/kg, lead in the surface sample set at a maximum concentration of 1,980 mg/kg (estimated concentration), lead in the subsurface sample set at a maximum concentration of 3,190 mg/kg, and beryllium in the subsurface sample set at a maximum concentration of 1.8 mg/kg. The PRAS value for Benzo(a)pyrene is 0.78 mg/kg and the PRAS value for lead and beryllium is 1,000 mg/kg and 1.3 mg/kg, respectively. Six surface (0 – 2 feet deep) and 20 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead. Benzo(a)pyrene and beryllium are not considered a concern at this SWMU. Numerous surface samples were collected at this SWMU and only lead exceeded the PRAS value. Benzo(a)pyrene and beryllium only exceeded the PRAS values in subsurface samples and the exceedances are marginal. Benzo(a)pyrene exceeded the PRAS in five of six subsurface samples with an average concentration of 1.32 mg/kg. A further evaluation of benzo(a)pyrene will be performed in the Risk Assessment to be conducted at the conclusion of the Phase II RFI. Beryllium exceeded the PRAS in only two of the six subsurface samples with an average concentration equal to the PRAS of 1.3 mg/kg. Beryllium is considered a background compound, as discussed in Section 4.1.1.4. Further, this area has historically been used for the storage of leaded gasoline. Thus, lead is considered the only primary constituent of concern for this SWMU.

SWMU No. 93

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 93 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of lead in the surface sample set at a maximum concentration of 1,490 mg/kg, lead in the subsurface sample set at a maximum concentration of 373,000 mg/kg, benzo(a)pyrene in the surface sample set at a maximum concentration of 1.8 mg/kg, and benzo(a)pyrene in the subsurface at a maximum concentration of 11 mg/kg, benzo(a)anthracene at a maximum concentration of 14 mg/kg, benzo(b,j,k)fluoranthene at a maximum concentration of 20 mg/kg, and dibenz(a,h)anthracene at a maximum concentration of 6.1 mg/kg (estimated concentration) in the subsurface sample set. The PRAS value for lead is 1,000 mg/kg and the PRAS values for benzo(a)pyrene, benzo(a)anthracene, benzo(b,j,k)fluoranthene, and dibenz(a,h)anthracene are 0.78 mg/kg, 7.8 mg/kg, 7.8 mg/kg, and 0.78 mg/kg, respectively. Twenty-two surface (0 – 2 feet deep) and 30 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead. Benzo(a)pyrene and the other PAHs detected at concentrations greater than the PRAS are not considered a concern at this SWMU. Benzo(a)pyrene exceeded the PRAS in six of eight surface samples and seven of nine of the subsurface samples with average concentrations of 1.07 mg/kg and 2.71 mg/kg, respectively. Benzo(a)anthracene exceeded the PRAS in only one of nine subsurface samples and had an average concentration of 3.44 mg/kg, which is below the PRAS. Benzo(b,j,k)fluoranthene exceeded the PRAS in only one of nine subsurface samples and had an average concentration of 4.47, which is below the PRAS. Dibenz(a,h)anthracene exceeded the PRAS in only one of the nine subsurface samples, although three samples had detection levels higher than the PRAS. A further evaluation of benzo(a)pyrene, benzo(a)anthracene, benzo(b,j,k)fluoranthene, and dibenz(a,h)anthracene will be performed in the Risk Assessment to be conducted at the conclusion of the Phase II RFI. Numerous surface samples were collected at this SWMU and only lead exceeded the PRAS value to any significant degree. The majority of the PAHs detected were in subsurface samples. Further, this area has historically been used for the storage of leaded gasoline. Thus, lead is considered the only primary constituent of concern for this SWMU.

SWMU No. 94

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 94 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of lead in the surface sample set at a maximum concentration of 1,030 mg/kg (this concentration is noted as biased low), lead in the subsurface sample set at a maximum concentration of 1,350 mg/kg, benzo(a)pyrene at a maximum concentration of 3.7 mg/kg in surface sample set and 3.5 mg/kg in the subsurface sample set, and beryllium in the surface sample set at a maximum concentration of 1.4 mg/kg and in the subsurface sample set at a maximum concentration of 2.0 mg/kg. The PRAS values for lead, benzo(a)pyrene, and beryllium are 1,000 mg/kg, 0.78 mg/kg, and 1.3 mg/kg, respectively. Eight surface (0 – 2 feet deep) and 18 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead. Benzo(a)pyrene exceeded the PRAS in one of the two surface samples and three of the five subsurface samples with an average concentration of 1.96 mg/kg and 1.99 mg/kg, respectively. Benzo(a)pyrene concentrations greater than the PRAS are not considered a concern at this SWMU; however, a further evaluation of benzo(a)pyrene will be performed in the Risk Assessment to be conducted at the conclusion of the Phase II RFI. Beryllium exceeded the PRAS in one of two surface samples and three of the five subsurface samples with an average concentrations of 1.16 mg/kg (below the PRAS) and 1.37 mg/kg, respectively. Beryllium is considered a background compound, as discussed in Section 4.1.1.4. Numerous surface samples were collected at this SWMU and only lead exceeded the PRAS values to any significant degree. The majority of the PAHs detected were in subsurface samples. Further, this area has historically been used for the storage of leaded gasoline. Thus, lead is considered the only primary constituent of concern for this SWMU.

SWMU No. 95

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 95 during the 1993 RFI (Table 1) indicates that the preliminary risk assessment screening values are not exceeded with the exception of lead in the surface sample set at a maximum concentration of 2,230 mg/kg, and benzo(a)pyrene at a maximum concentration of 2.2 mg/kg in the surface sample set. The PRAS values for lead, and benzo(a)pyrene are 1,000 mg/kg and 0.78 mg/kg, respectively. Sixteen surface (0 – 2 feet deep) and 12 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the surface and subsurface soil database for lead.

Benzo(a)pyrene concentrations exceeded PRAS in four of six surface samples with an average concentration of 1.27 mg/kg. Benzo(a)pyrene concentrations greater than the PRAS are not considered a concern at this SWMU; however, a further evaluation of benzo(a)pyrene will be performed in the Risk Assessment to be conducted at the conclusion of the Phase II RFI. Numerous surface samples were collected at this SWMU and only lead exceeded the PRAS values to any significant degree. This area has historically been used for the storage of leaded gasoline. Thus, lead is considered the only primary constituent of concern for this SWMU.

SWMU No. 101

Review of the analytical data for the surface and subsurface samples collected at SWMU No. 101 during the 1993 RFI (Table 1) indicates that the PRAS values are not exceeded with the exception of lead in the subsurface sample set at a maximum concentration of 2,120 mg/kg. The PRAS value for lead is 1,000 mg/kg. Two surface (0 – 2 feet deep) and 4 subsurface (greater that 2 feet) samples were collected at this SWMU (Table 2).

Based on the data reviewed for this SWMU and the results of the PRAS, this work plan includes a scope to expand the subsurface soil database for lead in a limited area.

4.0 SCOPE OF WORK

4.1 SOIL SAMPLING

4.1.1 Sample Plan Strategy

The Phase II RFI Work Plan was developed to collect soil samples for analysis of lead (and some PAHs in the Northwest Fill Areas) to provide a sufficient sampling set for assessment of risk to worker health from potential exposure. Worker exposure to affected soil is primary from two pathways: (1) inhalation, ingestion, or dermal contact with surface soil during routine site operation or maintenance tasks, and (2) inhalation, ingestion, or dermal contact with subsurface soil during excavation or construction activities. The soil sampling plan considers soil depth from 0 to 2 feet as surface soil and the 2 to 4 feet depth for the subsurface depth most frequently encountered during excavation activities.

Each SWMU was evaluated to determine the number, location, depth, and lead concentration from soil samples collected during the 1993 RFI. The RFI collected surface and subsurface soil samples based on the results of the previous investigation. The samples were collected with a random biased sampling plan with a bias towards areas of suspected buried tank bottoms. Figures 1-1 through Figures 1-11 present the sample locations and lead concentrations for samples collected during the 1993 RFI. The general proposed sampling strategy for the Phase II RFI is to collect surface samples at all RFI sampling points from which only subsurface samples were collected and to collect subsurface samples (from 2-4 feet) from RFI sample locations from which only surface samples were collected. In addition, the spatial distribution of the RFI soil samples were reviewed and soil samples (surface and subsurface, 2-4 feet) were proposed to fill data "gaps", i.e., representative areas within each SWMU not previously sampled. Generally, an additional soil sample was proposed at soil sample locations that had concentrations exceeding 1,000 mg/kg during the RFI for further delineation of these locations. Sampling locations were selected to provide maximum areal distribution while avoiding physical barriers. These included process unit areas, piperacks, utilities, tank berms, and tank pads remaining from demolished tanks. In a few locations, deeper samples (4-6 or 6-8 feet below grade) have been proposed. These locations are detailed in the description of the sampling plan for each SWMU. Figures 2-1 through 2-10 present the proposed sampling locations. Table 2 summarized the soil samples collected during the 1993 RFI and the soil samples proposed to be collected during the Phase II RFI.

The proposed sampling plan, in combination with the samples collected during the RFI, has been designed to delineate the extent and degree of lead in the surface and subsurface for the performance of risk assessment for worker exposure and to determine whether a Corrective Measure Study is necessary for individual areas.

The ten SWMUs addressed in this Work Plan have been divided into three categories, in accordance with the 1993 RFI Report. Investigative tasks relative to each of the three SWMU categories (the Northwestern Fill Area, the Storage Tank Areas, and the Bulkhead Seepage Area) is provided in Section 4.0. These tasks will be performed in accordance with the Data Collection Quality Assurance Plan, Data Management Plan, and Health and Safety Plan that are incorporated in the RFI Work Plan, July 2, 1991. Each SWMU will be evaluated on an individual basis using the data derived from the implementation of the Work Plan.

4.1.1.1 Northwestern Fill Area (NFA)

The NFA is located in the northwestern corner of the Facility (Figure A). It consists of SWMU Nos. 87, 88, and 89, which are adjacent to each other and separated by streets and avenues. This area is flanked to the north and west by the Schuylkill River and to the south and east by the Facility.

The NFA is designated in the Facility RCRA permit as a buried lead sludge area. This designation resulted from a Chevron submission to USEPA that indicated the area had been used for sludge disposal. Based on historic published documented, this area was formerly a salt marsh. It is believed that the marsh was filled before the development of Facility-related structures. The filling of this area probably occurred before the 1940s, prior to development of this area during World War II. After the filling, cooling tower sludges and tank bottoms are believed to have been placed behind the cooling towers by the bulkhead. The precise placement of tank bottoms and types of waste contained in the tank bottoms are not known. Currently, the waste associated with operation of the units within these SWMUs is handled and disposed of in accordance with applicable federal and state regulations.

The Northwest Fill Area (SWMU Nos. 87, 88, and 89) will be investigated as similar units with regards to soil conditions.

SWMU No. 87

SWMU No. 87 (permit reference: Buried Lead Sludge Area No. 1) includes process units, cooling towers, and storage areas (Figure 1-1). One surface sample was collected during the RFI west of Cooling Tower 303 with a detected lead concentration of 650 mg/kg. The Phase II RFI proposes to collect 12 surface samples at locations indicated on Figure 2-1. Sample locations were selected to provide samples that are spatially distributed across the SWMU, excluding paved process unit areas.

During the RFI, three soil samples were collected from 2-4 feet below grade surface (bgs) with lead concentrations ranging from 204 to 450 mg/kg. The Phase II RFI proposes to collect ten samples from 2-4 ft bgs. RFI sample BNA2 along the western side of the SWMU reported contained 973 mg/kg of lead in a sample collected at 4-6 feet bgs. Samples are proposed to be collected from 4-6 and 6-8 feet bgs, in addition to 0-2 and 2-4 feet bgs, at BNA2 to better delineate lead at that location.

SWMU No. 88

SWMU No. 88 (permit reference: Buried Lead Sludge Area No. 2) includes a cooling tower and process unit area that occupies a large percentage of the SWMU (Figure 1-2). Soil sample collection within the process unit is not practical or deemed necessary due to paving limiting surface soil exposure and the process unit limiting excavation activities within this area. During the RFI one surface soil sample was collected with a detected lead concentration of 32 mg/kg. The Phase II RFI proposes to collect nine surface samples (Figure 2-2). The proposed samples were located to provide a spatial distribution around the SWMU, excluding the process unit area.

During the RFI, four samples were collected from 2-4 ft bgs with detected lead concentrations ranging from 513 to 5,200 mg/kg. Six samples are proposed to be collected during the Phase II RFI, including two along the eastern side of the SWMU near the location of BNA10 from which 5,200 mg/kg of lead was detected in a soil sample collected during the 1993 RFI.

One subsurface sample had been collected from 4-6 feet bgs during the RFI with a detected lead concentration of 576 mg/kg. No samples from 4-6 feet bgs have been proposed for this SWMU.

SWMU No. 89

SWMU No. 89 (permit reference: Buried Lead Sludge Area No. 3) includes Unit 2031 processing area, No. 3 Separator, Unit No. 2031 Flare, Unit No. 433 Flare, and aboveground piperacks along the SWMU southern boundary (Figure 1-3). During the RFI, two surface samples were collected with lead concentrations of 89 and 228 mg/kg. Nine surface samples have been proposed to be collected (Figure 2-3). The samples have been placed to spatially represent the area without interference of the operating units.

Two soil samples from 2-4 feet bgs were collected during the RFI with lead concentrations of 388 and 421 mg/kg. Nine samples have been proposed to be collected from 2-4 feet bgs during the Phase II RFI to be spatially representative of the site.

RFI sample BNA13 reported a lead concentration of 1,140 mg/kg at 6-8 feet bgs. The Phase II RFI proposes to collect soil samples from 4-6 and 6-8 feet bgs, in addition to 0-2 feet bgs, at the location of BNA13 for further delineation of lead at this location.

4.1.1.2 Storage Tank Areas (STA)

The investigation of the Storage Tank Areas involves SWMU Nos. 90 through 95. The STAs under investigation are located in the eastern half of the Facility (Figure A). Groups of tanks have been assigned to each SWMU, primarily based upon divisions by streets and avenues. Leaded sludges (USEPA Hazardous Waste No. K052) from tank bottoms were periodically removed from the tanks (approximately once every 10 years). The sludges were disposed of in areas near the tank cleanout ports by being placed directly on the ground or in shallow excavations approximately 2 to 4 feet in depth. Currently, tank bottom sludge is shipped off-site in accordance with applicable regulations. The disposal areas near the tank cleanout ports also may have received slop oil emulsion solids (USEPA Hazardous Waste No. K049), American Petroleum Institute (API) separator sludge (USEPA Hazardous Waste No. K051), and spent catalysts (spent activated alumina). The storage tanks are located jointly or individually within berm- or dike-enclosed areas.

The 1993 RFI sampling plan for the Storage Tank Area contained a bias toward sampling at the vessel cleanout ports and known or suspected disposal areas. The Phase II RFI proposes the addition of soil samples at "corners" within the bermed area which were not previously sampled.

SWMU No. 90

SWMU No. 90 (permit reference: Buried Lead Sludge Area No. 4) is located in the northeastern section of the Facility (Figure 1-4). It contains one storage tank and four former tank locations within a berm and two other former tanks outside of the berm. The tank pads remain at all former locations of tanks. During the RFI, eight surface samples were collected with lead concentrations ranging from 16 to 310 mg/kg and twelve subsurface samples from 2-4 feet bgs were collected with lead concentrations ranging from 110 to 464 mg/kg. No additional surface or subsurface samples are proposed as the RFI sampling data provides sufficient spatial distribution across the SWMU.

SWMU No. 91

SWMU No. 91 (permit reference: Buried Lead Sludge Area No. 5) is located in the northeastern section of the Facility (Figure 1-5). SWMU No. 91 contains five tanks within four bermed areas. Seven surface samples were collected during the RFI with lead concentrations ranging from 8 to 1,110 mg/kg. Twenty-two surface soil samples have been proposed to be collected (Figure 1-4). These sample locations are a combination of previous samples at locations where only subsurface samples were collected and new sample points. Also, a surface soil sample will be collected at 1993 RFI sample location B91-19.

During the 1993 RFI, eighteen subsurface samples were collected from 2-4 feet bgs with lead concentrations ranging from 110 to 354 mg/kg. Eight samples from 2-4 feet bgs have been proposed.

SWMU No. 92

SWMU No. 92 (permit reference: Buried Lead Sludge Area No. 6) lies in the east-central section of the Facility (Figure 1-6). SWMU No. 92 contains two tanks, four former tanks with tank pads remaining, and five bermed areas. Six surfaces soil samples were collected during the RFI with lead concentrations ranging from 214 to 1,980 mg/kg. Twenty-three surface samples are proposed, including collection of surface samples at locations that reported lead concentrations over 1,000 mg/kg during the RFI (Figure 2-5).

Seventeen subsurface samples were collected from 2-4 ft bgs during the 1993 RFI during the RFI with lead concentrations ranging from 119 to 3,190 mg/kg. Eleven samples from 2-4 feet bgs have been proposed .

Three subsurface samples were collected from 4-6 feet bgs with lead concentrations ranging from 92 to 357 mg/kg. No soil samples from 4-6 feet have been proposed at this SWMU.

SWMU No. 93

SWMU No. 93 (permit reference: Buried Lead Sludge Area No. 7) lies in the southeastern section of the Facility) (Figure 1-7). SWMU No. 93 contains two tanks, ten former tanks with tank pads remaining, and nine berms. Twenty-two surface samples were collected during the 1993 RFI with lead concentrations ranging from 17 to 1,490 mg/kg. Forty surface samples are proposed to be collected during the Phase II RFI (Figure 2-6).

Twenty-two samples were collected from 2-4 feet bgs with lead concentrations ranging from 14 to 373,000 mg/kg. Forty-two soil samples from 2-4 feet have been proposed, including additional sampling in the vicinity of B93-1 that had a reported lead concentration of 373,000 mg/kg. A sample from 4-6 feet bgs at B93-1 is proposed to further delineate lead at this location.

Eight soil samples were collected from 4-6 feet bgs during the RFI with lead concentrations ranging from 16 to 803 mg/kg. No samples are proposed from 4-6 feet, except at B-93-1.

SWMU No. 94

SWMU No. 94 (permit reference: Buried Lead Sludge Area No. 8) lies in the south-central section of the Facility (Figure 1-8). SWMU No. 94 contains three tanks, six former tanks with pads remaining, and nine berms. Eight surface samples were collected during the RFI with lead concentrations ranging from 5 to 1,030 mg/kg. Twenty-seven surface samples have been proposed to be collected during the Phase II RFI (Figure 2-7).

Seventeen subsurface samples from 2-4 feet were collected during the 1993 RFI with lead concentrations ranging from 3 to 1,350 mg/kg. Twenty samples have been proposed from 2-4 feet bgs.

SWMU No. 95

SWMU No. 95 (permit reference: Buried Lead Sludge Area No. 9) lies in the central section of the Facility (Figure 1-9). The tank area of SWMU No. 95 is a concrete-dike enclosed area that formerly contained 28 tanks from which only the tank pads remain. Sixteen surface samples were collected during the RFI with lead concentrations ranging from 42 to 2,230 mg/kg. Four surface samples are proposed to be collected during the Phase II RFI (Figure 2-8).

Twelve subsurface soil samples were collected from 2-4 feet bgs during the 1993 RFI with lead concentrations ranging from 26 to 650 mg/kg. Seven samples are proposed to be collected from 2-4 feet bgs during the Phase II RFI.

4.1.1.3 Bulkhead Seepage Area (BSA)

The BSA (SWMU No. 101) lies along the southwestern edge of the Facility by the Schuylkill River and extends to south of the Penrose Avenue Bridge in the area of the inactive package and grease plant (Figure 1-10). The bulkhead is comprised of interlocking steel sheet piling. No waste disposal activities are known to have occurred within the BSA. This is supported by the surface and subsurface samples that were collected during the 1993 RFI. The two surface samples had lead concentrations of 143 and 158 mg/kg and two of the three subsurface samples had lead concentrations of 29 and 150 mg/kg. The third subsurface soil sample from 2-4 feet bgs, located at B101-2, reportedly contained a lead concentration of 2,120 mg/kg. Two subsurface soil samples from 2-4 feet bgs are proposed to further delineate lead at B101-2 (Figure 2-9).

4.1.1.4 Background Soil Samples

The entire site is believed to be covered with fill of varying thickness. As such, no natural soils are known to exist near the ground surface at the site. During the RFI, background soil samples were collected at three locations southeast of the Main Office Building (Figure 1-11). This location was selected as the area least likely to have been disturbed by past practices. The three surface samples had lead concentrations ranging from 222 to 797 mg/kg and the three subsurface samples from 2-4 feet bgs had lead concentrations ranging from 40 to 2,800 mg/kg. One surface sample and one subsurface sample were analyzed for beryllium with reported concentrations of 0.76 mg/kg and 0.90 mg/kg, respectively.

Collection of adequate background samples is an important consideration for determining background exposure conditions for calculations during the risk assessment. Therefore, three additional background samples for surface and subsurface soils are proposed for the analysis of lead and beryllium. The background samples are proposed to be placed on the northwest side of the Main Office Building (Figure 2-10).

Beryllium

The maximum beryllium concentrations at several SWMUs narrowly exceed the Region III EPA Risk Based Concentrations presented in Table 1. It is thought that these beryllium detections are background concentrations, rather than site related, as there is nothing in the past or current operations at the facility that would contribute beryllium to soils. Current background sampling is inadequate to allow beryllium to be excluded by comparison to background levels. The three proposed background soil samples will be sampled for beryllium.

4.1.2 Sample Collection Procedures

Sample collection will be accomplished by a combination of two methods: hand-auger and direct-push technique performed by a Geoprobe. The sample collection method will depend on accessibility of sample locations to a drill rig, degree of difficulty in hand-augering, potential underground obstructions, decontamination procedures, and time advantages or constraints. Samples will be collected by hand-auger at locations where only a surface sample is to be collected and at locations that may be inaccessible by a Geoprobe rig. The Geoprobe rig will be used to collect soil samples from 2-4 feet bgs, at locations where samples from multiple depths are to be collected and at locations where soil type makes hand-augering difficult.

Hand-augering will be performed by attaching a clean (decontaminated) auger bucket to the appropriate length of auger stem and T-handle. The auger will be rotated clockwise, applying a light downward pressure, within the depth to be sampled. The auger will then be removed from the borehole and the sample will be gently removed from the bottom of the auger into the sample bottle. Decontamination of the auger bucket between sample depths and between holes will be performed to protect against cross-contamination.

The Geoprobe is equipped with either a two-foot or four-foot split spoon sampler that is lined with a single use, disposable, plastic sleeve to contain the sample. Use of the two-foot or four-foot split-spoon sampler will depend on the depth of sample to be collected. Once the split spoon sampler has been removed from the ground, a geologist will visually describe the sample. The soil samples will be designated with the boring number and sample depth. The visual description of the soil samples and other observations will be recorded on the daily field logs.

The soil boring will be backfilled to grade with drill cuttings, except for borings that exceed four feet that will be filled with bentonite. Geoprobe tools that come in contact with the soil will be decontaminated between sample depths and between soil borings; however, because the samples are contained within the disposable plastic sleeves there is limited required decontamination procedures between sample intervals.

Standard Operating Procedures for hand-augering and Geoprobe sampling are attached in Appendix B.

4.1.3 Analytical Method

Soil samples will be submitted to the laboratory for total lead analysis in accordance with USEPA Method 7421. Selected samples from Northwestern Fill Area (SWMU Nos. 87, 88, and 89) will also be submitted to the laboratory for analysis of beryllium by USEPA Method 7091, and skinner list PAHs including benzo(a)pyrene and dibenze(a,h)anthracene by USEPA Method 8270.

All sampling and laboratory analysis will be conducted in accordance with the most current edition of Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, USEPA, OSWER, Washington, D.C., and all other appropriate protocol and procedures.

4.2 QUALITY ASSURANCE/QUALITY CONTROL

4.2.1 QA/QC Sampling

Quality Assurance/Quality Control (QA/QC) samples will be collected during the soil sampling program. Approximately one duplicate sample and one sample for matrix spike/matrix spike duplicate will be submitted per 20 soil samples collected. One field blank will be collected for every 20 samples collected by non-dedicated equipment (i.e., hand-auger). Trip blanks will not be necessary for analysis of non-volatile parameters.

4.2.2 Data Validation

All sampling and laboratory analysis will be conducted in accordance with the most current edition of Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, USEPA, OSWER, Washington, D.C., and other appropriate protocol and procedures.

Sun's contractor will ensure that the collected data have been validated at the appropriate laboratory Quality Control level to determine whether it is appropriate for its intended use. The data validation will be constructed in accordance with guidelines established by the USEPA. The data validation shall also assess data precision, representativeness, comparability, accuracy, and completeness of specific measurement parameters.

Sun's contractor will present the results of the analyses in an organized and logical manner so that the relationships between results and sampling locations are apparent. Sun's contractor will prepare a summary that describes the quantities and concentrations of the specific contaminants.

The Work performed will adhere to the Quality Assurance Plan included in the RFI Work Plan, July 2, 1991.

4.3 CRITERIA FOR CORRECTIVE ACTION

Data collected in the Phase II RFI will be evaluated by Risk Assessment to determine if there are areas of potential risk to worker health. This data evaluation will involve a phased approach as follows:

- Comparison of concentrations detected in soil with the USEPA Region III Risk-based Concentrations (RBC) Table, (October 22, 1997). Should the concentrations of detected constituents in all samples fall below the respective risk-based concentrations, then no further action is required at that SWMU. These action levels are risk-based, using highly conservative exposure assumptions.
- If concentrations of constituents in any sample from a SWMU fall above the RBC, a risk assessment will be performed based on the 95% upper confidence limit of the arithmetic mean or the highest concentrations detected at the SWMU. Specific Risk Assessment procedures are presented within this Phase II RFI program. The Phase II RFI program is designed such that it provides adequate data to conduct the site specific Risk Assessment for surface and subsurface soil concentrations of lead.

If, based on the criteria developed during the Risk Assessment, it is determined that corrective measures are necessary, then upon approval of the Phase II RFI Report a corrective measures study work plan will be developed and submitted to the EPA. Overall, the scope of the corrective measures will be based on these factors:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and performance
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability

- Cost
- State acceptance
- Community acceptance

4.4 REPORT/DATA INTERPRETATION

A Phase II RFI Report will be prepared after the conclusion of the sampling event. The report will include a discussion of the purpose and objective, field activities, data analysis and interpretation and conclusions. The analytical data will be evaluated for delineation of extent and degree of constituents of concern in surface and subsurface soil. A risk assessment will be completed as described in Section 5.0.

5.0 RISK ASSESSMENT WORK PLAN

5.1 INTRODUCTION

The Phase II RFI Work Plan for the Sun Girard Point facility outlines procedures for surface and subsurface soil sample collection and analysis for lead and other constituents of concern at nine (9) SWMUs. These samples are to supplement subsurface and surface soil sampling results obtained during the Phase I RFI performed in 1993.

USEPA comments to the RFI Report (June 12, 1997) included a request that updated toxicity factors be used in the screening risk assessment. Accordingly, the maximum concentrations of each analyte detected in surface or subsurface soils during the Phase I RFI have been compared to the latest current risk-based concentrations. The results are shown in Table 1. This table indicates that lead concentrations in soils exceed current risk based standards, while other detected concentrations are well below risk-based standards throughout the site, except for scattered incidences where standards are very narrowly exceeded, for example, for PAHs in SWMU No. 93.

Since maximum concentrations are used in place of the 95% upper confidence limit of the arithmetic means, this is a very conservative screen. Use of maximum concentrations supports the conclusion from review of Table 1 that lead is the primary constituent of concern at the site, and supports the decision to limit additional sampling to lead at several of the SWMUs.

Groundwater at the facility is being monitored by the Pennsylvania Department of Environmental Protection (PADEP), as discussed in the attached letter from USEPA dated February 20, 1998 (Appendix A). This letter indicates that groundwater monitoring requirements from the Phase I RFI are being met. The Phase II RFI is concerned with additional surface and subsurface soil sampling and assessment of risks from these media. Groundwater is not considered in this Phase II RFI.

The potential for adverse impacts on human health or the environment due to releases of hazardous constituents from a site is evaluated by the process of risk assessment. This process combines information on potential exposure to site-related hazardous constituents with information on their toxic potency to generate a quantitative estimate of potential cancer risk and non-cancer hazard. The human health risk assessment to be performed for the Phase II RFI at Girard Point will follow the standard steps prescribed in USEPA guidance (data evaluation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis), and will be based on USEPA-approved methodologies. The human health risk assessment will evaluate all the available surface and subsurface soil data from this Phase II RFI and previous investigations, primarily the Phase I RFI.

5.2 CONCEPTUAL APPROACH TO RISK ASSESSMENT FOR THE GIRARD POINT FACILITY

RCRA risk assessments typically evaluate potential impacts associated with the generation, storage, treatment, or disposal of hazardous waste within a facility boundary and adjacent areas "where necessary to protect human health and the environment" (USEPA, 1989a). To ensure that human health is protected in accordance with regulatory requirements, a tiered, risk-based approach will be used to (1) define the areal extent of site-related hazardous constituents of potential concern (COPCs), (2) identify SWMUs that may require further investigation, and (3) as necessary, develop site-specific remedial target levels. This integrated, streamlined approach is based on widely accepted methods described in the USEPA's *Risk Assessment Guidance for Superfund* (USEPA, 1989b, 1991a) as well as more recent guidance (*e.g.*, USEPA, 1990, 1992a, 1993, 1994) and the ASTM's *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM, 1995). It incorporates the following objectives:

- Definition of extent of contamination: use of risk-based criteria to delimit areas affected by releases of COPCs from SWMUs;

- Pathway evaluation: identification of potentially complete exposure pathways linking sources to actual or plausible receptor populations;

- Estimation of exposure point concentrations: calculation of concentrations of site-related COPCs in potential exposure media at possible receptor locations;

- Calculation of a succession of risk-based criteria developed as necessary in the sequential assessment tiers;

- Risk characterization: comparison of exposure point concentrations with risk-based criteria to determine the magnitude of potential risks to defined receptor population; and

- Risk-based decision-making: development of conclusions regarding the need for further investigation or action on the basis of risk results.

5.3 COMPONENTS OF THE RISK ASSESSMENT PROCESS

The human health risk assessment process typically involves five basic elements:

- **Data Review and Evaluation:** review of available data to characterize the site and its SWMUs, define the nature and magnitude of hazardous constituent releases from SWMUs to environmental media (soil, air and water), and identify site-related COPCs (hazardous constituents clearly associated with SWMUs that are present at concentrations higher than background levels), complete exposure pathways, and human and ecological receptors (*i.e.*, the people and/or organisms that could come in contact with site-related COPCs).

- **Exposure Assessment:** estimation of the amount, frequency, duration, and routes of receptor exposure to site-related COPCs. The exposure assessment should consider both current and likely future site uses. For humans, the exposure assessment will be based on receptor scenarios that define the conditions of exposure to site-related COPCs. The potential magnitude of exposure to defined receptors is determined by estimating the exposure point concentrations of COPCs available in environmental media at various portals of entry to the body (*i.e.*, the lungs, gastrointestinal tract, or skin). Exposure scenarios are summarized in the site-wide exposure pathways conceptual site model (CSM) for the Girard Point facility (Figure 3).

- **Toxicity Assessment:** review of available information to (1) identify the nature and degree of toxicity of each COPC, and (2) characterize the dose-response relationship (the relationship between magnitude of exposure and magnitude of adverse health effects) for each COPC. USEPA has developed toxicity criteria for many chemicals for use in human health risk assessment. Two kinds of effects are recognized: (1) non-carcinogenic effects, and (2) carcinogenic effects. The same chemical may exert both kinds of effects. Acceptable intake rates for non-carcinogenic effects of chemicals are called reference doses (RfDs), in units of mg constituent/kg body weight/day. Carcinogenic potency is expressed as a cancer slope or potency factor (SF), in units of (mg constituent/kg body weight/day)$^{-1}$. The SF can be expressed as a risk-specific dose (RSD) in units of mg constituent/kg body weight/day by dividing it into a predetermined cancer risk level. USEPA has defined the acceptable cancer risk range as one-in-ten-thousand (10^{-4}) to one-in-one-million (10^{-6}).

- **Risk Characterization:** synthesis of exposure and toxicity information to (1) determine the nature and magnitude of potential risks at a site, and (2) estimate what residual levels of chemicals may not pose unacceptable risks to receptors. The spatial extent of estimated risks will be described and the magnitude and temporal extent of estimated effects will be documented and discussed. The risk characterization will also discuss sources of constituents and risk from the site and attempt as appropriate to prioritize the on-site sources of risk (*e.g.*, SWMUs) for consideration in developing risk management scenarios for the Facility.

- **Uncertainty Analysis:** qualitative and/or quantitative assessment of the sources, magnitude, and effects of uncertainty and variability in the exposure and toxicity parameter values, assumptions, and models used. An uncertainty analysis accounts for the variability in measured and estimated parameters, allowing decision makers to better evaluate risk estimates in the context of the assumptions and data used in the assessment.

5.4 A TIERED APPROACH TO RISK ASSESSMENT AT THE GIRARD POINT FACILITY

To ensure that human health and beneficial uses of the environment are protected, a tiered, risk-based approach will be used to (1) identify areas that may require further investigation, and (2) develop appropriate risk-based target levels for affected media.

This approach, depicted as a decision tree in Figure 4, follows the standard steps of risk assessment, and is based on USEPA-approved methodologies. As shown in Figure 4, the approach consists of three tiers of increasing level of detail. These tiers are briefly described below.

5.4.1 Tier 1

In Tier 1, concentrations of site-related COPCs at receptor exposure points will be screened against chemical-, pathway, and medium-specific criteria referred to as "risk-based screening levels" (RBSLs). RBSLs are defined as concentrations of COPCs in relevant media that are not expected to produce any adverse health effects under chronic exposure conditions. Tier 1 RBSLs may be identical to or based on promulgated criteria, *e.g.*, OSHA permissible exposure limits (PELs). Alternatively, they may be calculated using USEPA's toxicity criteria, conservative modeling assumptions, and upper-bound exposure assumptions. Such RBSLs are analogous to (and may be identical to) "risk-based concentrations" (RBCs) developed by USEPA Region III (USEPA, 1997) or "soil screening levels" (SSLs) (USEPA, 1994) developed by USEPA for several default exposure scenarios. Procedures described in the ASTM RBCA standard will be used to develop RBSLs for pathways other than those considered in development of RBCs and SSLs. As such, the suite of RBSLs developed for the Facility will provide a particularly useful tool for site assessment and evaluation of corrective action alternatives. Because the Tier 1 RBSLs are protective of all actual and reasonably anticipated receptor populations, they can also be used to define the extent of migration of site-related COPCs.

Because of the conservatism of the Tier 1 criteria, no further action will be considered in areas where concentrations of COPCs are below these levels. "Confirmation monitoring," if warranted, could occur on a short- or long-term basis, depending on conditions at the targeted SWMU or SWMU group. The outcome of the Tier 1 evaluation is a complete suite of preliminary risk estimates, clearly identifying any areas that require further investigation or remedial action. The degree of exceedance of Tier 1 criteria in various areas can be used to prioritize those sites that may require further investigation.

5.4.2 Tier 2

An explicit distinction is drawn between the screening-level criteria such as RBCs and target levels for remediation in USEPA guidance (*e.g.*, USEPA, 1991a, 1994). Indeed, the guidance states that exceedance of screening levels does "not establish that cleanup to meet these goals is warranted." Thus, while exceedance of a Tier 1 RBSL may trigger corrective action if appropriate and practicable, implementation of an "interim" corrective action or calculation of more site-specific (Tier 2) criteria are also options.

Tier 2 assessment is a more detailed, site-specific evaluation focused on actual site conditions, sophisticated fate and transport models, and COPC-specific chemical properties to develop Tier 2 site-specific target levels (SSTLs). The increased degree of focus and level of effort involved in a Tier 2 assessment are manifested at each step in the risk assessment procedure. Although details must be determined on a site-by-site basis, general characteristics of a Tier 2 investigation may include:

- Use of appropriate mathematical techniques to characterize spatial distribution of COPCs (*e.g.*, geostatistics, GIS); and
- Use of site- and receptor-specific exposure parameter values.

No further action will be considered in areas where concentrations of COPCs are below Tier 2 RBSLs. In areas where Tier 2 criteria are exceeded, interim or final corrective action may be considered. If neither is deemed to be appropriate and practicable, then a Tier 3 investigation may be warranted.

5.4.3 Tier 3

Tier 3 assessment involves the use of highly sophisticated analytical techniques to develop Tier 3 SSTLs. Although details must be determined on a site-by-site basis, general characteristics of a Tier 3 investigation may include use of site- and receptor-specific probability distributions for model parameterization where possible, and quantitative analysis of uncertainty using Monte Carlo simulation.

5.5 IDENTIFICATION/CALCULATION OF TIER 1 RISK-BASED SCREENING LEVELS

As mentioned above, RBSLs are defined as concentrations of COPCs in media (*e.g.*, soil, air, and water) that will not result in exposures exceeding acceptable levels (*i.e.*, USEPA's toxicity criteria).

The following simple example demonstrates how RBSLs can be calculated by rearranging standard exposure equations.

$$Daily\ Dose\left[\frac{mg\ X}{kg\ Body\,Weight - day}\right] = \frac{Concentration\ of\ X\ in\ soil\ x\ Soil\ intake\ rate}{Body\,Weight}$$

1. Exposure to a hazardous constituent "X" in soil can be calculated as:
2. Alternatively, if we wish to calculate the concentration of X that corresponds to a particular daily dose, Equation [1] is rearranged as:

$$Concentration\ of\ X\ in\ soil\left[\frac{mg}{kg}\right] = \frac{Daily\,Dose\ x\ Body\,Weight}{Soil\ intake\ rate}$$

3. To calculate an RBSL for hazardous constituent X in soil, we set the "daily dose" parameter equal to its USEPA-approved RfD. The RfD defines an intake level for hazardous constituent X that is not expected to cause any adverse health effects. Thus, when the daily dose is fixed at the RfD, a soil concentration of hazardous constituent X corresponding to the acceptable intake level can be derived (*i.e.*, the RBSL):

$$Risk - Based\ Screening\ Level_X\left[\frac{mg}{kg}\right] = \frac{RfD_X\ x\ Body\,Weight}{Soil\ intake\ rate}$$

The RBSL is thus that concentration of a hazardous constituent in soil (or any other medium) at which USEPA's standard default rate of contact is not expected to result in exposure greater than the RfD (or, in the case of carcinogenic compounds, in cancer risks greater than 10^{-6} (the lower bound of USEPA's acceptable risk range of 10^{-6} - 10^{-4}). RBSLs for all COPCs will be identified or developed for all exposure pathways and receptors identified in the CSM (Figure 3).

Tier 2 RBSLs are calculated in the same manner, with site-specific parameter values or probability distributions replacing upper-bound default estimates.

5.6 DATA REVIEW AND EVALUATION

The first step in the risk assessment process is to evaluate all the data collected during the Phase I and II RFI to ensure adequacy and appropriateness of the data for this purpose. It consists of these major subtasks:

- Site characterization;
- Development of a data set for use in risk assessment; and
- Identification of COPCs.

These subtasks will be coordinated closely with the exposure assessment tasks to ensure that the actual and potential exposure pathways are identified, and realistic concentrations are used in the fate and transport models and exposure calculations.

5.6.1 Site Characterization

A first step in the data review and evaluation process is to evaluate all available site-specific data to obtain information on:

- The physical characteristics of the site;
- The chemicals and processes that were used at this site in the past;
- The level of constituents of concern present in various environmental media;
- Potentially exposed populations; and
- Reliable site-specific data for various human activities and behavior patterns that define exposure domains.

5.6.2 Development of a Data Set for Risk Assessment

Criteria specified in *RAGS* (Part A) (USEPA, 1989b) and *Guidance for Data Usability in Risk Assessment* (USEPA, 1992b) will be used in the data evaluation process. Raw data, validation results, and statistical analyses will be presented in an appendix. The data set of COPCs to be used in the risk assessment will be developed according to the following specific steps:

- **Evaluation of data qualifiers assigned by the laboratory and the data validators.** Data qualified with an "R," indicating that it was determined to be unusable (rejected in the data validation process), will be removed from the data set.

- **Evaluation of data with respect to blanks.** All associated field and laboratory blanks will be evaluated in the data validation process. Sample results qualified with a “B” qualifier will be reevaluated during the validation process to determine data usability. If the measured concentration of common laboratory contaminants (including methylene chloride, acetone, and 2-butanone) in a given sample is less than ten times greater than the maximum amount detected in any associated method or field blank, then that sample will be excluded from the risk assessment (USEPA, 1989b). Samples containing organic and inorganic compounds not considered common laboratory contaminants will be included if the measured concentration exceeds five times the maximum detected concentration in any associated method or field blank (USEPA, 1989b).

- **Evaluation of sample duplicate analyses.** Results of duplicate sample analyses will be averaged with the results of the original sample analyses. For some samples, either the duplicate or the original sample results are non-detect. In such cases, half the instrument detection limit will be conservatively used for the non-detected value to obtain an average value.

5.6.3 Identification of Constituents of Potential Concern

Potential COPCs at the Girard Point facility include a variety of polycyclic aromatic hydrocarbons and metals. Since the site is located in a heavily industrialized area, it will be important to evaluate the contribution of hazardous constituents from other sources, particularly in off-site areas.

Hazardous constituents that meet the following criteria will be considered COPCs in the risk assessment:

- Positively detected in at least one sample, with no qualifier attached;
- Detected at levels significantly elevated (at the 95% level of confidence) above blanks;
- Detected at levels significantly elevated (at the 95% level of confidence) above natural background; and
- Detected at levels significantly elevated (at the 95% level of confidence) above Region III residential RBCs.

5.7 EXPOSURE ASSESSMENT (CONCEPTUAL SITE MODEL)

The objective of exposure assessment is to estimate the magnitude, frequency, duration, and routes of human exposure to site-related hazardous constituents. The exposure assessment will be based on scenarios that define the conditions of exposure to site-related COPCs. These scenarios will be summarized in the CSM for the Girard Point facility (Figure 3). This model includes:

- Known or potential sources of constituents;
- Environmental media that may be affected by site-related constituents;
- Primary and secondary release mechanisms that may be associated with each affected medium;
- Exposure pathways for receptor populations, based on collected data or expected pathways; and
- Potential receptor populations.

The potential magnitude of exposure is determined by measuring or estimating the exposure point concentrations of COPCs available in various media at "exchange boundaries" (*e.g.*, the lungs, gastrointestinal tract, or skin).

A brief discussion of the components of the CSM is presented in the following sections.

5.7.1 Sources

Potential primary sources at the Girard Point facility include a variety of SWMUs. Both COPCs and release and transport mechanisms may differ among these primary sources. COPCs include metals and PAHs. As indicated in the CSM (Figure 3), potential exposure media for potential receptors at the Facility include surficial and subsurface soil and fugitive dust and vapors. Although no direct contract with groundwater occurs, it may serve as a source of vapors.

5.7.2 Potential Migration Pathways

The concentration and distribution of COPCs at Girard Point may be affected by one or more of the following general mechanisms:

- Leaching of COPCs from surface into subsurface soil underlying SWMUs;
- Suspension and transport of COPCs adsorbed to soil particles in ambient air;
- Transport of COPCs adsorbed to soil particles via surface water runoff; and
- Biological or chemical transformation of COPCs.

The potential for COPCs to migrate from the source media to points of exposure depends on the magnitude and distribution of their concentrations present in soil, climatic conditions, and the physical and chemical properties of the COPCs and soil. Available data will be used to evaluate the likelihood that any of these migration pathways could result in receptor contact with COPCs.

5.7.3 Potential Receptor Populations

Potential human receptor populations may include:

- On-site facility workers (present and future);
- On-site construction workers (future);
- On-site trespassers (present and future);

Because Sun plans to continue Girard Point facility operations for the foreseeable future, land use on-site will be assumed to remain unchanged in the future. Contract laborers or Facility employees excavating underground pipelines or other subsurface features could be exposed to COPCs in subsurface soils in addition to surface soils. Although trespassers could enter the Girard Point facility, the magnitude of their exposure would be much less than that experienced by facility workers.

5.7.4 Potential Exposure Pathways

Exposure pathways consist of four elements:

- A source and mechanism of constituent release to the environment;
- An environmental transport medium (*e.g.*, air, fugitive dust emissions) for the released constituent;
- A point of potential human contact with the affected medium -- this can be air or affected soil; and
- A route of entry into humans (inhalation, ingestion, or dermal contact with the affected medium).

If any of these components is missing, then the pathway is incomplete and does not contribute to receptor exposure.

Potentially complete exposure pathways for Girard Point workers include (Table 3):

- Ingestion, dermal contact, and inhalation of surface soil;
- Inhalation of vapors emanating from subsurface soil.

Groundwater at the facility is being monitored by the PADEP, as discussed in the attached letter from USEPA dated February 20, 1998 (Appendix A). This letter indicates that groundwater monitoring requirements from the Phase I RFI are being met. The Phase II RFI is concerned with additional surface and subsurface soil sampling and assessment of risks from these media. Groundwater is not considered in this Phase II RFI.

The media of concern are subsurface and surface soil. The receptor populations to be considered are facility workers and construction workers.

5.7.5 Estimation of COPC Concentrations at Exposure Points

The final step in the exposure assessment is to estimate representative COPC concentrations in source media. COPC concentrations can be estimated using a combination of techniques. Statistical manipulations of environmental data may include evaluation of the spatial distribution of the data (*i.e.*, the application of geostatistics). Left-censored data sets (non-detects) may be analyzed using one-half the detection limit or standard uncensoring mathematical techniques (USEPA, 1992a). Due to the uncertainty associated with any estimate of exposure concentration, both the arithmetic mean and the one-sided upper 95% confidence limit on the arithmetic mean (95% UCL) of the data will be calculated to represent a reasonable range of potential exposure concentrations in the risk assessment. USEPA considers the 95% UCL to be a reasonable maximum estimate (RME) of the average COPC concentration likely to be contacted over time; the arithmetic mean constitutes a conservative lower-bound estimate of the average exposure concentration (USEPA, 1992a).

5.8 TOXICITY ASSESSMENT

The toxicity assessment determines the relationship between the magnitude of exposure to a COPC and the nature and magnitude of adverse health effects that may result from such exposure. Tier 1 RBSLs or toxicity values used in the development of RBSLs will be obtained from the following hierarchy of USEPA sources:

- The *Integrated Risk Information System* (IRIS), an electronic data base containing health risk and USEPA regulatory information on specific chemicals;
- The *Health Effects Assessment Summary Tables* (HEAST), provisional criteria compiled by the USEPA Office of Solid Waste and Emergency Response (USEPA, 1995a); and
- Permissible Exposure Limits (PELs) promulgated or proposed for promulgation under the OSHA (for vapor inhalation by workers only).

Toxicity values obtained from IRIS will be given priority over those from HEAST, as recommended by USEPA (1989b, 1990). IRIS is the official repository of agency-wide consensus human-health information. Although values from HEAST are supported by Agency reference, they are not necessarily Agency-wide consensus values.

Chemical toxicity is divided into two categories, carcinogenic and non-carcinogenic, based on the type of adverse health effect exerted. Health risks are calculated differently for these two types of effects because their toxicity criteria are based on different mechanistic assumptions and expressed in different units. The two approaches are discussed below.

5.8.1 Toxicity Indicators for Non-Carcinogenic Effects

Non-carcinogenic RBSLs will be calculated using reference doses (RfDs) developed by USEPA. An RfD is an estimate of the daily lifetime exposure level to humans (expressed in units of mg of chemical/kg of body weight/day), including sensitive subgroups, that is likely to be without appreciable risk of deleterious effects (USEPA, 1989b). RfDs are usually derived from oral exposure studies with the most sensitive species, strain and sex of experimental animal known, the assumption being that humans are as sensitive as the most sensitive organism tested. They are based on the assumption that *thresholds* (exposure levels below which no adverse effect is expected) exist for non-carcinogenic effects, and incorporate uncertainty factors to account for the required extrapolations from animal studies and to ensure protection of sensitive human subpopulations.

5.8.2 Toxicity Indicators for Carcinogenic Effects

In contrast to non-carcinogenic effects, USEPA typically assumes that there is no threshold for carcinogenic responses; that is, any dose of a carcinogen is considered to pose some finite risk of cancer. The evidence for human carcinogenicity of a chemical is derived from two sources: chronic studies with laboratory animals, and human epidemiology studies where an increased incidence of cancer is associated with exposure to the chemical. As with the non-cancer toxicity studies, the most sensitive laboratory species is generally used in cancer protocols.

Each tested chemical is assigned a weight-of-evidence classification that expresses its potential for human carcinogenicity. The USEPA's weight-of-evidence classification system is shown in the following table.

USEPA's Weight-of-Evidence Carcinogenicity Classification Scheme

Group	Description
A	Human carcinogen
B1	Probable human carcinogen - limited human data are available
B2	Probable human carcinogen - sufficient evidence in animals and inadequate or no evidence in humans
C	Possible human carcinogen
D	Not classifiable as to human carcinogenicity
E	Evidence of non-carcinogenicity for humans

USEPA recommends that the weight-of-evidence classification be presented for each potential carcinogen to indicate the strength of evidence that it may be a human carcinogen (USEPA, 1986; USEPA, 1989b).

The numerical estimates of cancer potency are termed slope factors (SFs). Under the assumption of dose-response linearity at low doses, the SF defines the "plausible upper bound" lifetime cancer risk per unit of carcinogen (in units of risk per mg of chemical/kg of body weight/day) (USEPA, 1986).

5.8.3 Lead

Lead presents an exception to the paradigm that non-carcinogenic effects of chemicals occur only at exposure levels exceeding some physiological threshold at which natural defense mechanisms are overwhelmed. Some of lead's characteristic effects, particularly changes in the levels of certain blood enzymes, appear to occur at blood lead levels so low as to be essentially without a threshold. As a result, the EPA has deemed it inappropriate to develop either an RfD or a SF for inorganic lead.

Instead of dose-based toxicity criteria, potential risk associated with lead exposure is assessed by means of blood lead levels. The EPA has established a target blood lead level for children of 10 µg/dL for both short- and long-term exposures. Using an integrate uptake exposure model that is specifically designed to evaluate blood lead levels in children, EPA has determined that 400 mg/kg represents the residential soil concentration at which there is no more than a 5% chance that the target blood lead level for children will be exceeded (EPA, 1994). However, due to significant physiological differences between children and adults, the uptake model does not allow estimation of blood lead levels for persons older than eight years of age or for exposures less than 350 days per year (USEPA, 1994). Thus, EPA has recently developed an interim approach to assessing risks to adults (USEPA, 1996). This model will be used to establish a Tier 1 RBSL for adult receptors at the Girard Point facility.

5.8.4 Hazardous Constituents Lacking Toxicity Criteria

Potential risks associated with exposure to any COPCs lacking toxicity criteria will be discussed qualitatively.

5.9 METHODS FOR DEVELOPMENT OF RISK-BASED CRITERIA

5.9.1 Tier 1 RBSLs

As described previously, Tier 1 RBSLs for all COPCs and exposure scenarios will be based on existing medium-specific criteria (*e.g.*, PELs), Region III RBCs, or calculated using the equations presented in the ASTM RBCA standard in accordance with the pathways shown in Figure 3 and Table 3. These equations are similar to those presented in USEPA guidance (USEPA, 1991a, 1994), but allow consideration of inhalation of vapors emanating from groundwater and/or sub-surface soils.

Exposure parameter values used to develop Tier 1 RBSLs will be derived from USEPA guidance (*e.g.*, USEPA, 1989c, 1991a, 1991b) and the ASTM RBCA standard (ASTM, 1995) where applicable. Parameter values based on professional judgment will also be conservative (upper-bound) estimates. Site data (as available) will be used for definition of soil properties, depth to groundwater, and annual wind speed. The target hazard index (HQ) will be 1, and the target cancer risk level will be 10^{-6}, the lower bound of USEPA's acceptable risk range of 10^{-6} - 10^{-4}.

5.9.2 Tier 2 and Tier 3 SSTLs

If warranted by Tier 1 screening results, additional site information can be collected as needed for development of Tier 2 or Tier 3 SSTLs. This process involves derivation of site-specific risk-based corrective action goals that are reflective of actual site conditions and chemical-specific characteristics. SSTLs may be derived from the same equations used to calculate RBSLs, but more realistic parameter values and/or probability distributions will be substituted for the upper-bound default values. In some cases, RBSLs or SSTLs may be applied at more probable points of exposure, incorporating demonstrated or predicted attenuation of COPC concentrations with distance from the source. It is important to note that both all risk-based levels are based on the same toxicity criteria and achievement of the same levels of health protection.

5.10 RISK CHARACTERIZATION

Risk characterization involves estimating the magnitude of the potential adverse health effects of the hazardous constituents under study and making summary judgments about the nature of the health threat to the defined receptor populations. It combines the results of the dose-response (toxicity) and exposure assessments to provide numerical estimates of health risk. Risk characterization also considers the nature and weight of evidence supporting these risk estimates as well as the magnitude of uncertainty surrounding such estimates.

5.10.1 Tier 1 Risk Characterization

In the Tier 1 risk characterization, RBSLs for each COPC, medium, receptor, and pathway combination will be compared with exposure point concentrations in corresponding media to calculate screening level hazard quotients (SLHQs) for non-carcinogenic effects and screening level cancer risks (SLCRs) for carcinogenic effects. RBSLs are defined as concentrations of COPCs in relevant media that are not expected to produce any adverse health effects under chronic exposure conditions. The target hazard quotient (THQ) for non-carcinogenic effects will be 1, and the target cancer risk (TR) will be one-in-a-million (10^{-6}).

5.10.1.1 Calculation of Screening-Level Hazard Quotients and Indices

The degree of exceedance of non-cancer thresholds (*i.e.*, the target hazard quotient of 1) will be estimated by calculating the ratio of COPC concentration in an exposure medium to the corresponding RBSL. In a Tier 1 analysis, this ratio is termed a screening-level hazard quotient (SLHQ):

$$SLHQ = \frac{Exposure\ point\ concentration_{COPC/medium}}{RBSL_{COPC/medium/receptor/pathway}}$$

SLHQs for each COPC/medium/receptor/pathway will be summed to derive non-carcinogenic screening level hazard indices (SLHIs) for each exposure pathway in each receptor scenario:

$$SLHI = \sum \frac{Exposure\ point\ concentration_{COPC/medium}}{RBSL_{COPC/medium/receptor/pathway}}$$

If the HI calculated from Equation [2] exceeds 1, then chemicals will be grouped according to target organs or effects and HIs recalculated.

5.10.1.2 Calculation of Screening-Level Cancer Risks

$$SLCR = \frac{Exposure\ point\ concentration_{COPC/medium}}{RBSL_{COPC/medium/receptor/pathway}} \ x\ Target\ Risk\ Level$$

Screening-level cancer risks (SLCRs) for each receptor/pathway will be calculated as: SLCRs will be summed to calculate a total screening level cancer risk for each receptor/pathway:

$$SLCR_{tot} = \Sigma \frac{Exposure\ point\ concentration_{COPC/medium}}{RBSL_{COPC/medium/receptor}} \times Target\ Risk\ Level$$

The target cumulative incremental cancer risk is one in ten-thousand (10^{-4}).

Because of the conservatism of the Tier 1 criteria, they are useful for screening purposes but do not necessarily provide a realistic representation of potential risks. Thus, risks will be considered negligible for SWMUs/pathways where cumulative screening-level cancer risk is less than or equal to 10^{-4}, and the screening-level non-cancer target hazard index is less than or equal to 1. Such areas will accordingly be eliminated from further consideration. In cases where the target levels are exceeded, Tier 2 risk assessment will be performed in order to develop more realistic, site-specific risk estimates to support decision-making.

5.10.2 Tier 2 and Tier 3 Risk Characterization

Tier 2 and Tier 3 SSTLs will be compared with site data in the manner described above for Tier 1 RBSLs. As in Tier 1, if media concentrations are less than or equal to Tier 2 or Tier 3 SSTLs, then no further action need be taken. A confirmation monitoring program may be implemented if required. If media concentrations exceed the Tier 2 levels and remediation to these levels is judged impracticable, then Tier 3 investigation may be undertaken. If media concentrations exceed the Tier 2 levels but Tier 3 evaluation is judged unnecessary or impracticable, or if Tier 3 SSTLS are exceeded, then alternatives for achievement of target levels will be evaluated. Corrective action options may include interim corrective action, mass removal methods (excavation, treatment, etc.) as well as containment, natural attenuation, and institutional controls (*e.g.*, deed restrictions).

5.11 UNCERTAINTY ANALYSIS

As with all modeling efforts, the risk assessment process relies on a set of assumptions and estimates with varying degrees of accuracy and validity. Major sources of uncertainty in risk assessment include (1) natural variability (*e.g.*, differences in body weight in a group of people), (2) lack of knowledge about basic physical, chemical, and biological properties and processes (*e.g.*, the affinity of a hazardous constituent for soil, its solubility in water), (3) assumptions in the models used to estimate key inputs (*e.g.*, dose-response models), and (4) measurement error. Perhaps the greatest single source of uncertainty in risk-based assessment is the hazardous constituents' dose-response relationships, particularly carcinogenic slope factors. Much uncertainty is also associated with analytical data, which are subject to both systematic error (bias) and random error (imprecision). Other major sources of uncertainty include the COPC identification process, computation of exposure point concentrations using conservative fate and transport assumptions, selection of exposure pathways, and estimation of intake via default exposure assumptions. These and other sources of uncertainty and their anticipated effect on estimated risks will be discussed in detail in this section of the risk assessment.

5.12 REFERENCES

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6.0 PROJECT MANAGEMENT PLAN

6.1 TECHNICAL APPROACH

The objectives of the investigation are to:

- Delineate the extent and degree of constituents of concern in soil that exceed the PRAS.
- Perform a risk assessment on data collected during the RFI and the Phase II RFI.

To accomplish these objectives, a series of tasks will be performed. These tasks are:

- Surface soil sampling and analysis
- Subsurface soil sampling and analysis
- Risk Assessment Analysis

6.1.1 SCHEDULE

A tentative schedule has been developed assuming fair weather and no unforeseeable circumstances. Schedule initiation is contingent on USEPA approval of the Phase II RFI Work Plan.

The schedule is:

• USEPA Approval of Phase II RFI Work Plan	-----
• Contractor Bidding/Review/Award	8 weeks
• Field sampling program mobilization	4 weeks
• Field soil sampling program implementation	4 weeks
• Laboratory analysis of soil samples	4 weeks
• QA/QC and Data Validation	2 weeks
• Preparation of electronic data spreadsheet	1 week
• Risk Assessment Analysis	4 weeks
• Report preparation	4 weeks
Total	31 weeks

6.1.2 PERSONNEL

This section provides project management and organization for performance of the Work Plan.

The Project Coordinator will have overall responsibility for the project and fulfilling regulatory requirements.

Assisting the Project Coordinator will be the Project Director. The Project Director will oversee contractual and technical matters. In conjunction with the Project Director, the Project Manager will oversee personnel, technical, and budgetary concerns. These personnel will also report to and receive input from the Project Coordinator. Health and safety and quality assurance staff will support the project management team with progress reports on program elements.

The Project Manager will be responsible for implementing project plans and managing the day-to-day activities of the project to achieve schedule and technical goals.

The Risk Assessor will analyze the potential site risk to worker exposure based on constituent concentrations and routes of exposure.

The contractors for these services have not been chosen as it is not possible to perform proper bid procedures until the plan is accepted by the USEPA.

7.0 DATA COLLECTION QUALITY ASSURANCE PLAN

Data Collection will be preformed in accordance with the Data Collection Quality Assurance Plan incorporated in the RFI Work Plan, July 2, 1991. This plan will be followed during implementation of field investigation outlined in this work plan.

8.0 DATA MANAGEMENT PLAN

Data Management will be performed in accordance with the Data Management Plan incorporated in the RFI Work Plan, July 2, 1991.

9.0 HEALTH AND SAFETY PLAN

All field activities will be performed in accordance with the project Health and Safety Plan that was included in the RFI Work Plan, July 2, 1991.

10.0 COMMUNITY RELATIONS PLAN

Sun will provide press releases and other information for public review and comment, if requested. Sun will be provided with technical support by the Phase II RFI contractor, as needed. In addition, Sun will issue press releases in the event of unanticipated and/or significant occurrences that warrant public notice.

11.0 PROJECT REPORTING

Quarterly progress reports will be provided to USEPA during the course of the project. These reports may include:

- Description and estimate of the percentage of the Phase II RFI completed
- Summaries of all findings
- Work completed in the previous quarterly period
- Work in progress
- Projected work for the next quarterly period
- Out-of-scope work performed and justification
- Problems encountered and corrective actions
- Personnel changes during the reporting period
- Summary of all communications with USEPA

Table 1A
Risk-Based Evaluation Action Levels for Detected Parameters
RFI Soil Investigation, November 1993
(Surface Soil Samples, 0-2 feet below grade interval)

Analyte	Units	Industrial Ingestion (R)	Residential Ingestion (R)	Basis	Source	Reference	Maximum Concentration Detected									
							SMWU 87	SMWU 88	SMWU 89	SMWU 90	SMWU 91	SMWU 92	SMWU 93	SMWU 94	SMWU 95	SMWU 101
BTEX		Samples Collected					1	1	2	5	5	7	22	8	15	2
Benzene (T)	mg/kg	200	22	C	I	R	0.0057	0.89 U	0.02	2.2	1.7	43 J	17	0.074 U	11 UJ	0.071 U
Toluene (T)	mg/kg	410,000	16,000	N	I	R	0.0027	0.89 U	0.027	6.2 J	1.2	86 J	16	0.098	21 J	0.071 U
Ethylbenzene (T)	mg/kg	200,000	7,800	N	I	R	0.0033	1.3	0.011	3 J	2.5	150 J	1.4 U	0.074 U	17 J	0.75
Total Xylenes (T)	mg/kg	1,000,000	160,000	N	I	R	0.028	2.5	0.014	35 J	6.3	480 J	21	0.33	61 J	0.17
Inorganic Compounds		Samples Collected					1	1	2	8	5	7	22	8	15	2
Cation Exchange Capacity	eq/100g	--	--	--	--	R	14.2 J	4.9 J	10.6 J	15.9	14.1	23.5	20.8	23.2	25.8	14.1 J
Cyanide	mg/kg	41,000	1,600	N	I	R	0.44	0.27 U	2.2	2.7	0.92	2.8	1.9	0.024	1.5	0.28 U
Hexavalent Chromium	mg/kg	10,000	390	N	I	R	0.11 UL	0.21 L	0.09 UL	0.12 U	0.14 UL	0.19	0.16 U	0.17 U	0.15 U	0.11 U
Petroleum Hydrocarbons	mg/kg	--	--	--	--	R	651	11 U	305	3,720 J	1,580 J	12,900 J	14800 J	27,300 J	22,200 L	15,600 L
Phenolics	mg/kg	1,000,000	47,000	N	I	R	6.2	0.52 U	0.53 U	1.4	0.95 L	3.0 L	0.97	0.94	0.74	0.57 U
Sulfide	mg/kg	6,100	230	N	I	R	5.8 U	17.6	27.9	53.1	52.9	53.0 L	16.6 B	16.4 B	17.5 L	22.9 B
Total Organic Carbon	mg/kg	--	--	--	--	R	17,700 J	2,440 J	9,220 J	43,000 J	29,500	33,300	28,500	54,500	35,300 J	33,900
Total Organic Halogens	mg/kg	--	--	--	--	R	29 U	17 U	94.6	38.5	26 U	26 U	29 UL	34 UL	40.5 L	26.6
Metals		Samples Collected ^{2}					1	1	2	2	2	1	8	2	6	1
Antimony	mg/kg	820	31	N	I	R	NA	NA	NA	1.2 UL	2.5 L	2.6 L	1.5 UL	4.6 L	2.60 UL	1.10 UL
Arsenic	mg/kg	610	23	N	I	R	13	4.9	11	12 K	6.5 K	50 L	41	30	19.5 L	7.6
Barium	mg/kg	140,000	5,500	N	I	R	NA	NA	NA	89	160	283	424	619 J	199 J	154
Beryllium	mg/kg	1.3	0.15	C	I	R	NA	NA	NA	0.82	0.69	1.1	1.3	**1.4**	1	0.79
Cadmium	mg/kg	1,000	39	N	I	R	NA	NA	NA	0.59 U	0.57 U	0.59 U	0.75 U	3.1	3.20 U	0.57 U
Chromium	mg/kg	1,000,000	78,000	N	I	R	150 K	30 K	972 K	63	1,730	548 J	125 K	176 K	838 K	157 L
Cobalt	mg/kg	120,000	4,700	N	E	R	NA	NA	NA	11	13	8.2	24 J	22 J	14.2	7.6 J
Lead	mg/kg	1,000	400	--	--	G	650	32	228	310 K	**1,110**	**1,980 J**	**1,490**	**1,030 L**	**2,230**	158
Mercury	mg/kg	610	23	N	W	R	NA	NA	NA	0.62 J	0.13 J	1.0 J	0.62 L	1.6 K	3.7 K	0.71 L
Nickel	mg/kg	41,000	1,600	N	I	R	NA	NA	NA	17	18	45	47	36	25	22
Selenium	mg/kg	10,000	390	N	I	R	NA	NA	NA	0.47 U	0.46 U	0.69	1.6	1.5	0.5	0.45 U
Vanadium	mg/kg	14,000	550	N	H	R	NA	NA	NA	16	195	245	60	116	50	59

Notes and Explanations are attached

Table 1A
Risk-Based Evaluation Action Levels for Detected Parameters
RFI Soil Investigation, November 1993
(Surface Soil Samples, 0-2 feet below grade interval)

Analyte	Units	Industrial Ingestion (R)	Residential Ingestion (R)	Basis	Source	Reference	Maximum Concentration Detected									
							SMWU 87	SMWU 88	SMWU 89	SMWU 90	SMWU 91[1]	SMWU 92	SMWU 93	SMWU 94	SMWU 95	SMWU 101
Semivolatile Organic Compounds		Samples Collected[2]					1	1	2	2	2	1	8	2	6	1
1-Methylnaphthalene	mg/kg	--	--	--	--	R	NA	NA	NA	1.30	0.77 U	0.79 U	3.9 J	0.89 U	16	17
Anthracene	mg/kg	610,000	23,000	N	I	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.79	0.61 J	0.98 J	1.9 U
Benzo(a)anthracene	mg/kg	7.8	0.88	C	E	R	NA	NA	NA	0.2 J	0.38 U	0.29 J	1.6	2.5	1.9	1.9 U
Benzo(a)pyrene	mg/kg	0.78	0.088	C	I	R	NA	NA	NA	0.22 J	0.38 U	0.39 U	1.8	3.7	2.2	1.9 U
Benzo(b,j,k)fluoranthene	mg/kg	7.8	0.88	C	E	R	NA	NA	NA	0.42 J	0.32 J	0.56 J	3.3	7.8	2.4 J	6.8 U
Bis(2-ethylhexyl) phthalate	mg/kg	410	46	C	I	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.49 U	5	2.1 U	1.9 U
Chrysene	mg/kg	780	88	C	E	R	NA	NA	NA	0.26	0.29	0.24 U	1.9	3.8	4	1.4
Dibenz(a,h)anthracene	mg/kg	0.78	0.088	C	E	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.49 U	0.78	2.1 U	1.9 U
Diethyl phthalate	mg/kg	1,000,000	63,000	N	I	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.49 U	0.51 UJ	2.1 U	1.9 U
Dimethyl phthalate	mg/kg	1,000,000	780,000	N	W	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.49 U	0.51 UJ	1.6 B	1.9 U
Di-n-butylphthalate	mg/kg	200,000	7,800	N	I	R	NA	NA	NA	0.34 J	0.82 B	0.58 B	0.48 B	0.48 BJ	1.7 J	1.9 U
Fluoranthene	mg/kg	82,000	3,100	N	I	R	NA	NA	NA	0.26 J	0.16 J	0.59	3.1	2.8 J	3.2	1.9 U
Indeno(1,2,3-cd)pyrene	mg/kg	7.8	0.88	C	E	R	NA	NA	NA	0.26 J	0.38 U	0.39 U	0.63	1.9	2.1 U	1.9 U
Naphthalene	mg/kg	82,000	3,100	N	W	R	0.17 J	0.35 U	0.37 U	13 J	2.3	39 J	2.4	0.57	11 R	1.9 U
p-Cresol	mg/kg	--	--	--	--	R	NA	NA	NA	1.2 U	1.1 U	1.2 U	1.5 U	1.5 U	6.4 U	5.7 U
Phenanthrene	mg/kg	--	--	--	--	R	NA	NA	NA	0.2 J	0.38 U	0.28 J	3	1.2 J	5.7	5.1
Phenol	mg/kg	1,000,000	47,000	N	I	R	NA	NA	NA	0.39 U	0.38 U	0.39 U	0.49 U	0.44 U	2.1 U	1.9 U
Pyrene	mg/kg	61,000	2,300	N	I	R	NA	NA	NA	0.23 J	0.38 U	0.49	2.6	1.4 J	4.3 U	1.2 J
Pyridine	mg/kg	2,000	78	N	I	R	NA	NA	NA	0.79 U	0.77 U	0.79 U	1 U	1 U	2.6	3.8 U
Volatile Organic Compounds		Samples Collected					0	0	0	2	2	1	8	2	6	1
1,1,1-Trichlorethane	mg/kg	41,000	1,600	N	E	R	NA	NA	NA	0.74 U	0.006 U	0.006 UJ	0.8 U	0.008 U	2.8 U	0.71 U
2-Butanone	mg/kg	1,000,000	47,000	--	--	R	NA	NA	NA	1.5 U	0.011 U	0.012 UJ	1.6 U	0.015 U	5.6 U	1.4 U
Benzene	mg/kg	200	22	C	I	R	NA	NA	NA	0.74 U	0.008 U	0.006 UJ	0.8 U	0.008 U	2.8 U	0.71 U
Carbon Disulfide	mg/kg	200,000	78,000	N	I	R	NA	NA	NA	0.74 U	0.006 U	0.008 J	0.8 U	0.008 U	2.8 U	0.71 U
Formaldehyde	mg/kg	410,000	16,000	N	I	R	NA	NA	NA	1.1 UL	1.1 UL	1.00 UL	1.4 U	1.2 U	1.2 UL	0.88 U
Isopropylbenzene (Cumene)	mg/kg	200,000	7,800	N	I	R	NA	NA	NA	1.5 U	0.072	0.012 UJ	1.6 U	0.015 U	39	0.7 J
Methylene Chloride	mg/kg	760	85	C	I	R	NA	NA	NA	0.74 U	0.006 U	0.009 B	0.8 U	0.008 U	2.8 U	0.71
N-Propylbenzene	mg/kg	20,000	780	N	E	R	NA	NA	NA	1.5 U	0.036	0.012 UJ	1.6 U	0.015 U	5.1 J	0.61 J
Toluene	mg/kg	410,000	16,000	N	I	R	NA	NA	NA	4.8	0.007	0.006 U	0.8 U	0.011	93	0.71 U
Xylene (Total)	mg/kg	1,000,000	160,000	N	I	R	NA	NA	NA	30	0.011	0.003 J	0.8 U	0.008 U	140	0.71 U

Notes and Explanations are attached

Table 1B
Risk-Based Evaluation Action Levels for Detected Parameters
RFI Soil Investigation, November 1993
(Subsurface Soil Samples, 2-8 feet below grade interval)

Analyte	Units	Industrial Ingestion	Residential Ingestion	Basis	Source	Reference	Maximum Concentration Detected									
							SMWU 87	SMWU 88	SMWU 89	SMWU 90	SMWU 91	SMWU 92	SMWU 93	SMWU 94	SMWU 95	SMWU 101
BTEX	Samples Collected						7	5	3	12	18	20	32	18	19	4
Benzene (T)	mg/kg	200	22	C	I	R	0.012	4.8 J	5.7	84	1.5 U	12 J	91	130	280	1.4
Toluene (T)	mg/kg	410,000	16,000	N	I	R	0.0082 U	1.2 U	1.1 U	130 J	4.4	6.3 J	18	24	59 J	1.7
Ethylbenzene (T)	mg/kg	200,000	7,800	N	I	R	0.02	22 J	11	75 J	3.6	6.4 J	54	50	100	2.6
Total Xylenes (T)	mg/kg	1,000,000	160,000	N	I	R	0.007	7.8 J	5.6	500 J	14	14	280	240	57	8.1
Inorganic Compounds	Samples Collected						7	5	3	12	18	20	32	18	19	4
Cation Exchange Capacity	eq/100g	--	--	--	--	R	23 J	14.5 J	12.5 J	17.6	20.4	21.2	29.9	45.5	24.7 J	28.2
Cyanide	mg/kg	41,000	1,600	N	I	R	2.5	4.8	2.5	5.6	6.8	11.3	10	9.2	3.3	2.4
Hexavalent Chromium	mg/kg	10,000	390	N	I	R	0.12 UL	0.23	0.14 U	0.15 U	0.18 UL	0.34	0.18 U	0.18 U	1.14 U	0.13 U
Petroleum Hydrocarbons	mg/kg	--	--	--	--	R	26,900	96,800	16,800	4,740 J	15,100 L	22,500 J	36,600	25,400 L	18,300	45,100 J
Phenolics	mg/kg	1,000,000	47,000	N	I	R	6.8	1.2	0.93	3	0.88 UL	0.96	1.4	0.95 U	0.64 UL	0.69 U
Sulfide	mg/kg	6,100	230	N	I	R	121	51.2 U	57.1	80.2	109	59.2 BL	47.5 B	72.2 L	37.9 L	5.4 U
Total Organic Carbon	mg/kg	--	--	--	--	R	55,700 J	93,200 J	62,600 J	49,500 J	65,400	61,000	61,000	67,300	31,700 L	59,900
Total Organic Halogens	mg/kg	--	--	--	--	R	89	144	167	38.6	43.4	45.7	33 UL	37 UL	27.6 L	26 U
Metals	Samples Collected[2]						1	2	1	2	4	6	8	5	13	4
Antimony	mg/kg	820	31	N	I	R	1.2 UL	104	1.4 UL	1.9	1.7 L	3 L	2.7 L	3.7 UL	NA	NA
Arsenic	mg/kg	610	23	N	I	R	28	25	23 K	31 K	23 K	49 L	57	50	7.6 L	15
Barium	mg/kg	140,000	5,500	N	I	R	162	830	370	159	208	449	385	324 J	NA	NA
Beryllium	mg/kg	1.3	0.15	C	I	R	0.58	**2.4**	**1.9**	1.2	**1.9**	**1.8**	1.1	**2**	NA	NA
Cadmium	mg/kg	1,000	39	N	I	R	0.58	2.2	1.6	0.93	1.5	0.78 U	1.8	3	NA	NA
Chromium	mg/kg	1,000,000	78,000	N	I	R	869 K	157 K	180 K	77 L	588 L	389 K	723 K	223 K	118 K	79 K
Cobalt	mg/kg	120,000	4,700	N	E	R	11	25	17	16	27	24 J	23 J	26	NA	NA
Lead	mg/kg	1,000	400	--	--	G	973	**5,200**	**1,140**	464 L	369	**3,190**	**373,000**	**1,360**	650	**2,120**
Mercury	mg/kg	610	23	N	W	R	3.1 J	25 J	2.0 J	0.78	2.1	1.9 L	2.2 L	2.4 K	NA	NA
Nickel	mg/kg	41,000	1,600	N	I	R	21	67	41	28	48	48	39	42	NA	NA
Selenium	mg/kg	10,000	390	N	I	R	0.7	1.7	2.6	1	3.8	2	2.7	1.4	NA	NA
Vanadium	mg/kg	14,000	550	N	H	R	44	43	40	19	67	47	38	56	NA	NA

Notes and Explanations are attached

Table 1B
Risk-Based Evaluation Action Levels for Detected Parameters
RFI Soil Investigation, November 1993
(Subsurface Soil Samples, 2-8 feet below grade interval)

Analyte	Units	Industrial Ingestion	Residential Ingestion	Basis	Source	Reference	Maximum Concentration Detected									
							SMWU 87	SMWU 88	SMWU 89	SMWU 90	SMWU 91	SMWU 92	SMWU 93	SMWU 94	SMWU 95	SMWU 101
Semivolatile Organic Compounds		Samples Collected^{2}					1	2	1	2	4	6	8	5	13	4
1-Methylnaphthalene	--	--	--	--	--	R	0.78 UJ	1.5 J	0.24 J	5	2	1 U	36 J	0.99 U	NA	NA
Anthracene	mg/kg	610,000	23,000	N	I	R	0.27	3.6	0.38 J	0.88 U	0.65	2	15	4.7	NA	NA
Benzo(a)anthracene	mg/kg	7.8	0.88	C	E	R	1.4 J	4.9	0.53	1.1	1.6	5.6	14	4.7	NA	NA
Benzo(a)pyrene	mg/kg	0.78	0.088	C	I	R	1.5 J	3.8	0.59	0.81 J	1.7	3.6	11	3.5	NA	NA
Benzo(b,j,k)fluoranthene	mg/kg	7.8	0.88	C	E	R	0.89 J	7 J	1 J	1.8 U	3.4 J	4.2	20	7	NA	NA
Bis(2-ethylhexyl) phthalate	mg/kg	410	46	C	I	R	0.38 UJ	1 U	0.47 U	0.88 U	0.49 U	0.52 U	6.1 U	0.61 U	NA	NA
Chrysene	mg/kg	780	88	C	E	R	1.4 J	4.8	0.63	0.91	1.7	5	15	5.1	NA	NA
Dibenz(a,h)anthracene	mg/kg	0.78	0.088	C	E	R	0.38 UJ	1 U	0.47 U	0.88 U	0.49 U	0.52 U	6.1 U	0.61 U	NA	NA
Diethyl phthalate	mg/kg	1,000,000	63,000	N	I	R	0.38 UJ	1 U	0.47 U	0.88 U	0.49 U	0.52 U	6.1 U	0.61 U	NA	NA
Dimethyl phthalate	mg/kg	1,000,000	780,000	N	W	R	0.38 UJ	1 U	0.47 U	0.88 U	0.49 U	0.52 U	6.1 U	0.61 U	NA	NA
Di-n-butylphthalate	mg/kg	200,000	7,800	N	I	R	0.69 B	1.1 B	1.1 B	0.73 J	1.1 B	0.67 B	6.1 U	0.71 U	NA	NA
Fluoranthene	mg/kg	82,000	3,100	N	I	R	1.4 J	12 J	0.82	1.3	3.7	10 J	31	9.6	NA	NA
Indeno(1,2,3-cd)pyrene	mg/kg	7.8	0.88	C	E	R	0.72 J	1.6	0.39 J	0.67 J	0.74	1.4	6.1 U	1.6	NA	NA
Naphthalene	mg/kg	82,000	3,100	N	W	R	2.9 J	2.4 UJ	1.7	67	3.7	8.8 J	26 J	1.9	14	0.48 J
p-Cresol	mg/kg	--	--	--	--	R	1.2 UJ	3 U	1.4 U	2.7 U	1.5 U	1.6 U	19 U	1.9 U	NA	NA
Phenanthrene	mg/kg	--	--	--	--	R	0.75 J	9.2 J	0.84	0.79 J	2.3	12 J	47	16 J	NA	NA
Phenol	mg/kg	1,000,000	47,000	N	I	R	0.38 UJ	1 U	0.47 U	0.88 U	0.49 U	0.52 U	6.1 U	0.61 U	NA	NA
Pyrene	mg/kg	61,000	2,300	N	I	R	1.3 J	8.8 J	0.58	1.1	2.7	7.3 J	27	9.6 J	NA	NA
Pyridine	mg/kg	2,000	78	N	I	R	0.78 UJ	2 U	0.96 U	1.8 U	1 U	1 U	12 U	1.2 U	NA	NA
Volatile Organic Compounds		Samples Collected					1	2	1	2	4	6	8	5	0	0
1,1,1-Trichlorethane	mg/kg	41,000	1,600	N	E	R	0.006 U	0.95 U	0.007 U	8.3 U	0.87 U	0.73 U	1.2 U	0.045 U	NA	NA
2-Butanone	mg/kg	1,000,000	47,000	--	--	R	0.055	1.9 U	0.17	17 U	1.7 U	1.5 U	2.3 U	0.091 U	NA	NA
Benzene	mg/kg	200	22	C	I	R	0.004 J	0.95 U	0.007 U	8.3 U	0.87 U	0.73 U	1.2 U	0.045 U	NA	NA
Carbon Disulfide	mg/kg	200,000	78,000	N	I	R	0.004 J	0.95 U	0.007 U	8.3 U	0.87 U	0.073 U	1.2 U	0.045 U	NA	NA
Formaldehyde	mg/kg	410,000	16,000	N	I	R	1.3 U	1.5 L	1.40 UL	1.5 UL	2.2 L	1.5 U	2.5	2.2 L	NA	NA
Isopropylbenzene (Cumene)	mg/kg	200,000	7,800	N	I	R	0.012 U	3	0.014 UJ	13 J	7.3	1.5 U	4	0.09 J	NA	NA
Methylene Chloride	mg/kg	760	85	C	I	R	0.013 B	0.9 J	0.011 B	8.3 U	0.85 J	0.73 U	1.2 U	0.058	NA	NA
N-Propylbenzene	mg/kg	20,000	780	N	E	R	0.012 U	1 J	14 UJ	18	7.3	1.1 J	7.1	0.088 J	NA	NA
Toluene	mg/kg	410,000	16,000	N	I	R	0.004	0.95	0.007	64	0.71	0.73	1.2 U	0.045	NA	NA
Xylene (Total)	mg/kg	1,000,000	160,000	N	I	R	0.012	0.95 U	0.007 U	24	18	0.73 U	1.2 U	0.06	NA	NA

Notes and Explanations are attached

Risk-Based Evaluation Action Levels for Detected Parameters
RFI Soil Investigation, November 1993
Table 1A and Table 1B Notes and Explanations

Explanation:

SWMU - Solid Waste Management Unit
mg/kg - Milligrams per Kilogram
meq/gm - milliequivalents per gram
NA - Not Analyzed
C - carcinogenic effects
N - non-carcinogenic effects
I - IRIS
H - HEAST
W - Withdrawn from IRIS or HEAST
E - EPA-NCEA Regional Support provisional value
-- - RBC not available for this Analyte

Risk-Based Concentration (RBC) Reference

R - USEPA Region III Risk-Based Concentration Table, October 22, 1997
G - PA Act 2 - Appendix A, PA Bulletin Rules and Regulations, Vol. 27, No. 33, Aug. 16, 1997
USEPA, 1994. Revised Interim Soil Lead Guidance for CERCLA Sites
and RCRA Corrective Action Facilities. OSWER Directive 9355.4-12.

Qualifiers:

U - Laboratory analysis was conducted for the corresponding compound, but the compound was not detected. Numerical value is the sample detection limit.
UJ - Laboratory analysis was conducted for the corresponding compound, but the compound was not detected. Numerical value is the sample detection limit. Hower, due to discrepancies identified during the data validation process, the detection limit is estimated.
UL - Laboratory analysis was conducted for the corresponding compound, but the compound was not detected. Numerical value is the sample detection limit. Hower, due to discrepancies identified during the data validation process, the detection limit is biased low.
J - The associated numerical value is an estimated quantity.
K - The associated numerical value is biased high.
L - The associated numerical value is biased low.
B - The result is qualitatively suspect because the compound was detected in a field blank, trip blank, and/or a laboratory method blank sample at a similar concentration.

Notes:

1) One (1) sample collected from SWMU 91 (surface samples) was collected from the 1-4 feet below grade interval.
2) Number of samples collected for analyses of Arsenic, Chromium, Lead and Naphthalene is equal to the Number of samples collected for Benzene (T).
3) X.XXX Indicates Analyte was detected at a concentration above the Industrial Ingestion Limit (Value listed may be the sample detection limit).

TABLE 2a
SURFACE SOIL SAMPLE SUMMARY

RCRA FACILITY INVESTIGATION
SUN COMPANY, INC. (R&M)
GIRARD POINT REFINERY

UNIT	NUMBER OF SURFACE SAMPLES COLLECTED (Depth Interval: 0-2 ft)	NUMBER OF PROPOSED **SURFACE** SAMPLES TO BE COLLECTED	TOTAL DATA SET EXISTING/PROPOSED (Depth Interval: 0-2 ft)	**SURFACE SAMPLES** MAXIMUM LEAD CONC. (mg/kg)
SWMU 87	1	12	13	650
SWMU 88	1	9	10	32
SWMU 89	2	9	11	228
SWMU 90	8	0	8	310
SWMU 91	7	22	29	**1,110**
SWMU 92	6	23	29	**1,980**
SWMU 93	22	40	62	**1,490**
SWMU 94	8	27	35	**1,030**
SWMU 95	16	4	20	**2,230**
SWMU 101	2	0	2	143
Background	3	3	6	797
	Existing	Proposed		
Total	76	149	225	

Values in bold that exceed 1,000 mg/kg for surface or subsurface.
SWMUs in bold that exceed risk numbers for either surface or subsurface samples.

TABLE 2b
SUBSURFACE SOIL SAMPLE SUMMARY

RCRA FACILITY INVESTIGATION
SUN COMPANY, INC. (R&M)
GIRARD POINT REFINERY

UNIT	NUMBER OF **SUBSURFACE** SAMPLES COLLECTED (Depth Interval: 2-4 ft)	NUMBER OF **PROPOSED** **SUBSURFACE** SAMPLES (Depth Interval: 2-4 ft)	TOTAL DATA SET EXISTING/PROPOSED (Depth Interval: 2-4 ft)	NUMBER OF **SUBSURFACE** SAMPLES COLLECTED (Depth Interval: 4-6 ft)	NUMBER OF **PROPOSED** **SUBSURFACE** SAMPLES COLLECTED (Depth Interval: 4-6 ft)	NUMBER OF **SUBSURFACE** SAMPLES COLLECTED (Depth Interval: 6-8 ft)	NUMBER OF **PROPOSED** **SUBSURFACE** SAMPLES COLLECTED (Depth Interval: 6-8 ft)	**SUBSURFACE** SAMPLES MAXIMUM LEAD CONC. (mg/kg)
SWMU 87	3	10	13	3	1	1	1	973
SWMU 88	4	6	10	1	0	0	0	**5,200**
SWMU 89	2	9	11	0	1	1	1	**1,140**
SWMU 90	12	0	12	0	0	0	0	464
SWMU 91	18	8	26	0	0	0	0	369
SWMU 92	17	11	28	3	0	0	0	**3,190**
SWMU 93	22	42	64	8	1	0	0	**373,000**
SWMU 94	17	20	37	1	0	0	0	**1,350**
SWMU 95	12	7	19	0	0	0	0	650
SWMU 101	3	2	5	1	0	0	0	**2,120**
Background	3	3	6	0	0	0	0	**2,800**
	Existing	Proposed		Existing	Proposed	Existing	Proposed	
Total	113	118	231	17	3	2	2	

Values in bold that exceed 1,000 mg/kg for surface or subsurface.
SWMUs in bold that exceed risk numbers for either surface or subsurface samples.

TABLE 3

Summary of Potential Exposure Pathways to be Considered in Development of Tier 1 Risk-Based Screening Levels for Workers at the Girard Point Processing Area of the Sun Philadelphia Refinery

Source Medium	Exposure Medium	Potential Exposure Route	Will Pathway be Used to Develop RBSL?	Rationale/Comment
Groundwater, surface soil, subsurface soil	Air	Vapor inhalation	No	Refinery workers are OSHA regulated and are trained and monitored as appropriate.
Groundwater	Groundwater	Inhalation	No	Direct exposure pathway is incomplete as site groundwater is not a current or potential source of potable water. For this reason and in the presence of abundant existing potable water, RBSLs for groundwater direct contact pathways will not be developed.
		Ingestion		
		Dermal contact		
Surface soil, Subsurface soil	Surface soil, subsurface soil	Inhalation	Yes	Surface and subsurface soils affected by releases from SWMUs may be contacted by workers.
		Ingestion		
		Dermal contact	No	Dermal contact pathway is highly uncertain and not considered in calculation of EPA Region III RBCs.

LEGEND

— - - —	PROPERTY BOUNDARY
A137 ⊕	VI MONITORING WELL LOCATION
A120 ●	RFI MONITORING WELL LOCATION
BF90D ○	EXISTING MONITORING WELL LOCATION
WP-1 ▲	RFI WELL POINT LOCATION
B101-5 ●	RFI SOIL BORING LOCATION
▫	SEWER BOXES
——	PROCESS SEWERS, SANITARY SEWERS, AND OUTFALLS
▨	RFI SOLID WASTE MANAGEMENT UNIT

NOTE:

200 FOOT GRID BASED ON PENNSYLVANIA STATE RECTANGULAR COORDINATE SYSTEM, SOUTH ZONE 1927 N.A. DATUM.

(3) H:\SUN\25995029\RCRA-FI 04/16/98 19:30

REFERENCE:
BASE MAP PROVIDED BY CHEVRON REFINERY, PHILADELPHIA, PENNSYLVANIA.

0 100 200 300 400 FEET

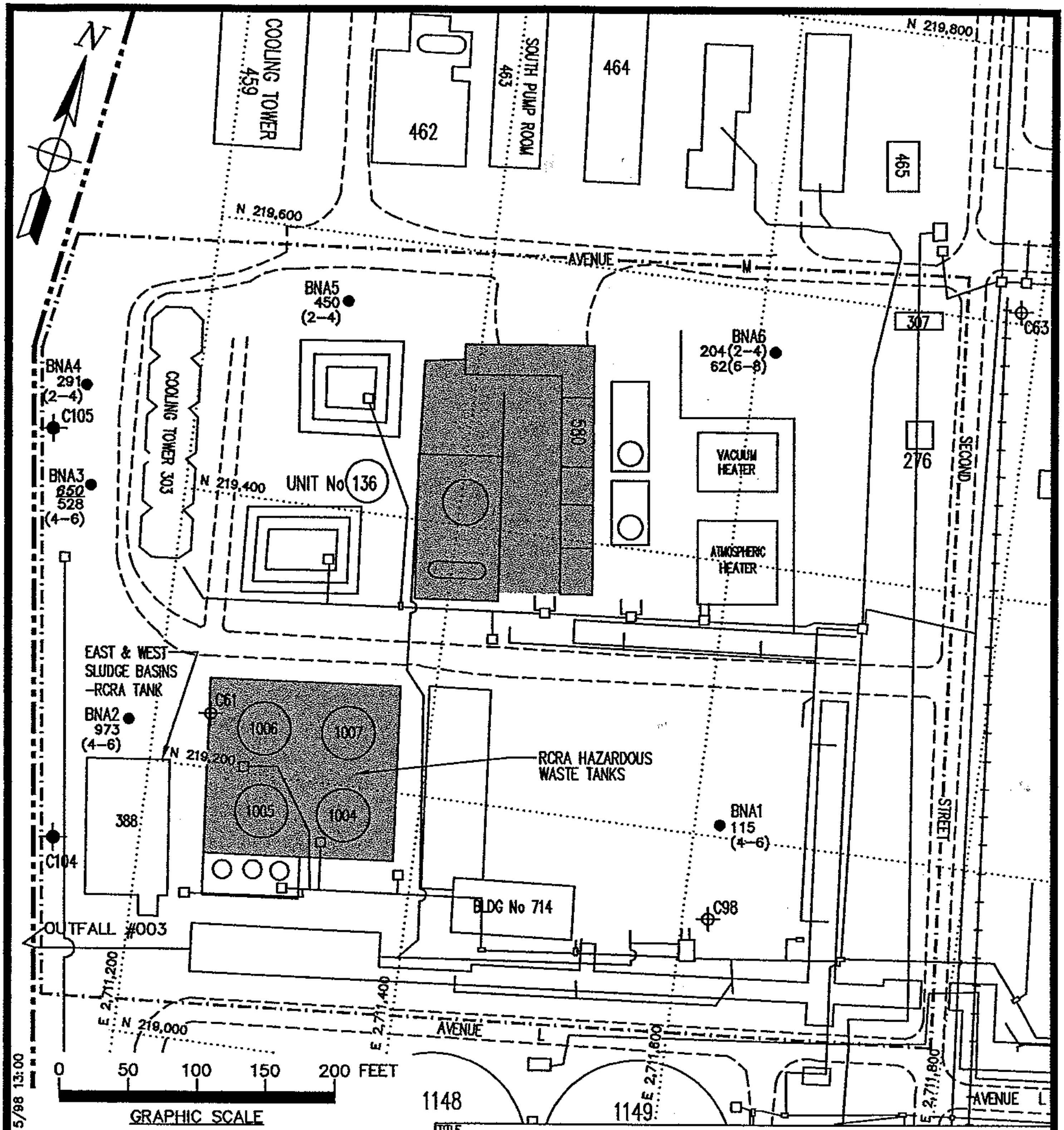
GRAPHIC SCALE

TITLE
LOCATIONS AND EXTENTS OF
RCRA FACILITY INVESTIGATION
SOLID WASTE MANAGEMENT UNITS

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE	AS SHOWN	DWN. BY	R.G.B.	JOB NO.	25995-029
DATE	4/16/97	APPR. BY	S.R.	FIG. NO.	A



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EXPLANATION:

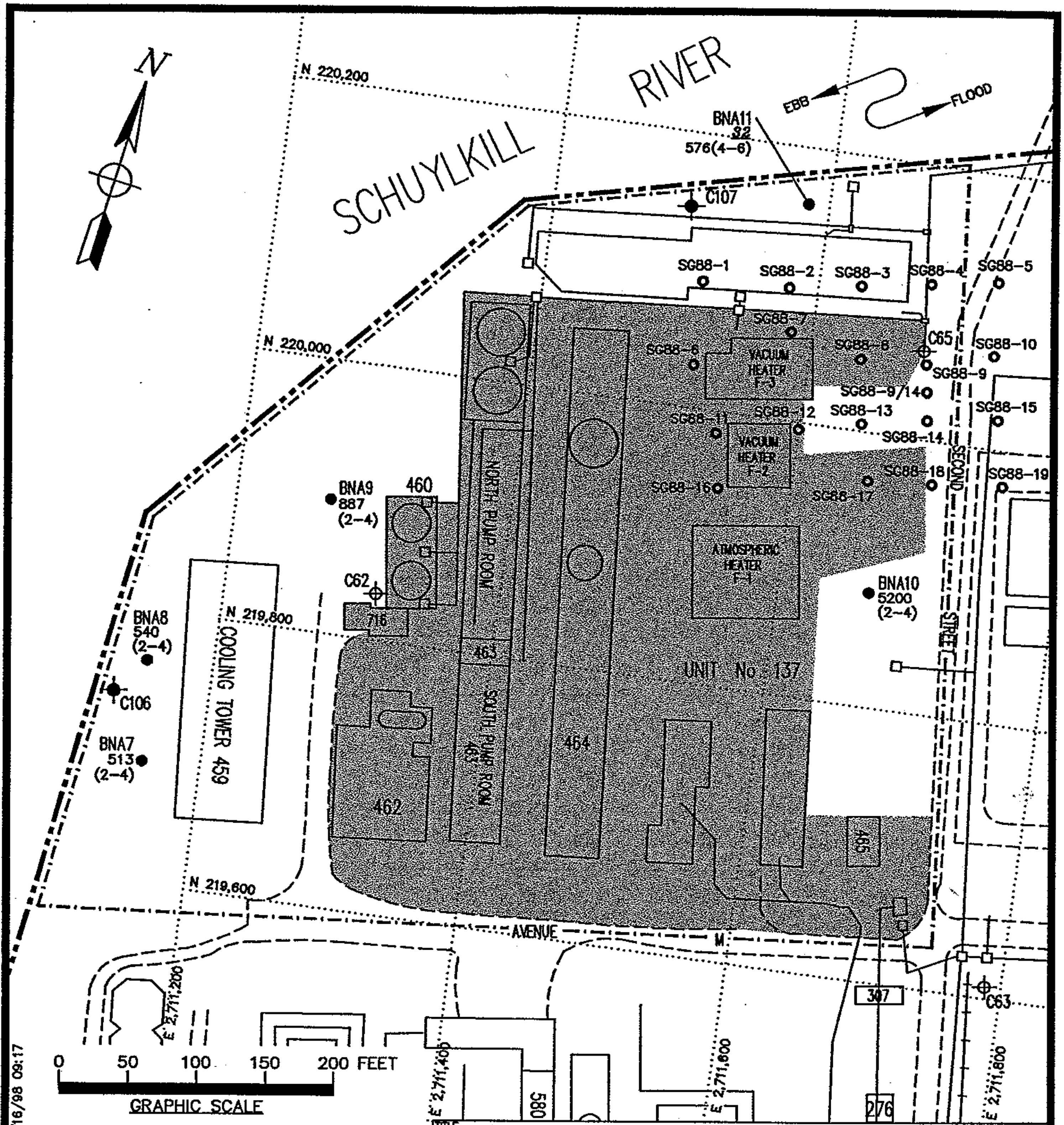
C98 ⊕ EXISTING MONITORING WELL LOCATION
C104 ● RFI MONITORING WELL LOCATION
BNA2 ● RFI SOIL BORING LOCATION
—·—·— DESIGNATED SWMU EXTENT
━━━ REFINERY PROPERTY LINE
▨ PAVED AREA/PROCESS UNIT
650 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
291 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2–4) DEPTH OF SAMPLE IN FEET BGS

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 87

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995–029	
DATE 4/15/98	APPR. BY S.R.	FIG. NO. 1–1	



EXPLANATION:

C62 ⌖ EXISTING MONITORING WELL LOCATION
C106 ● RFI MONITORING WELL LOCATION
BNA7 ● RFI SOIL BORING LOCATION
— · — · DESIGNATED SWMU EXTENT
━━━ REFINERY PROPERTY LINE
▨ PAVED AREA/PROCESS UNIT
32 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
540 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION RFI, NOVEMBER 1993 – SWMU No. 88

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-2

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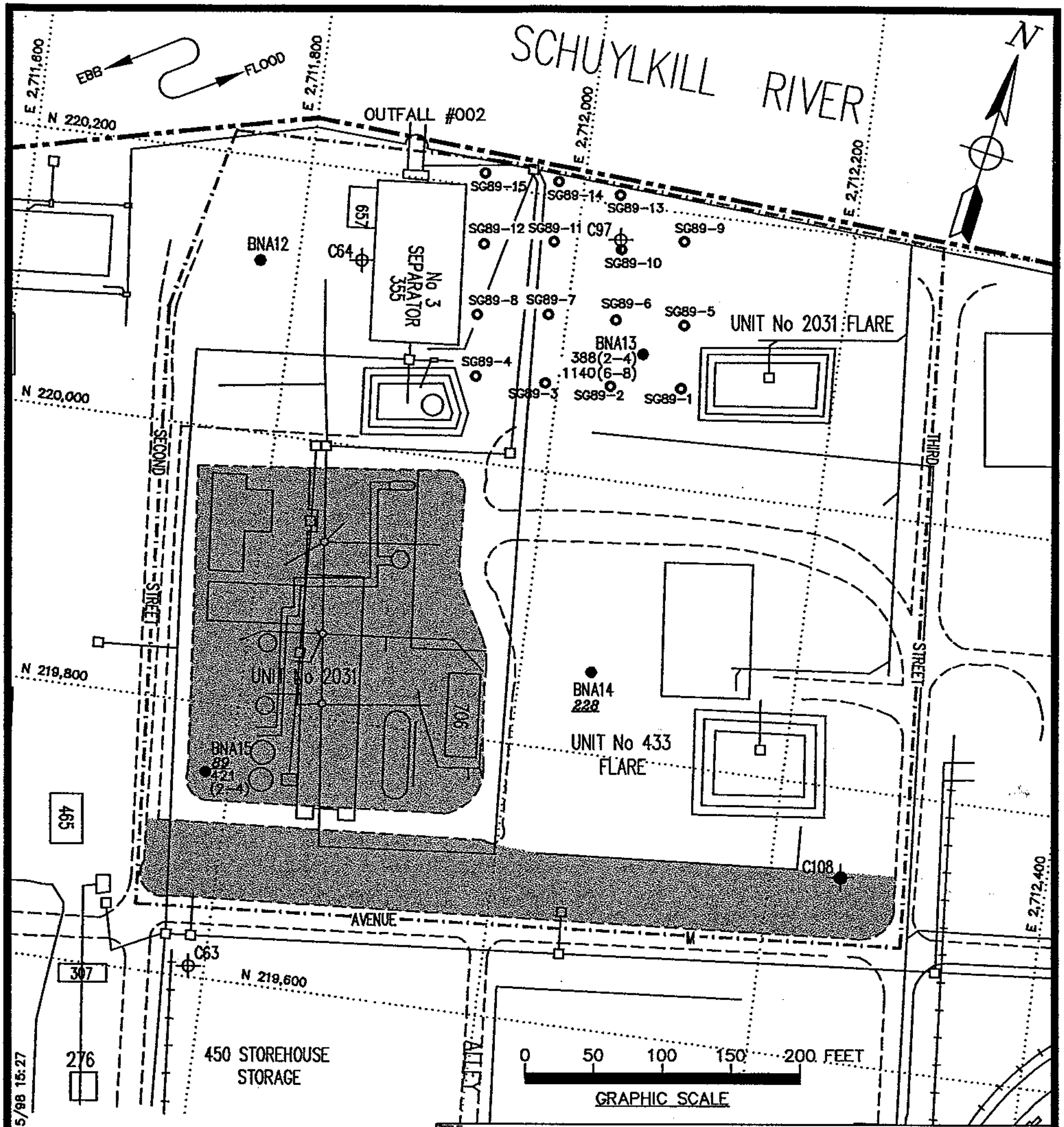

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EXPLANATION:

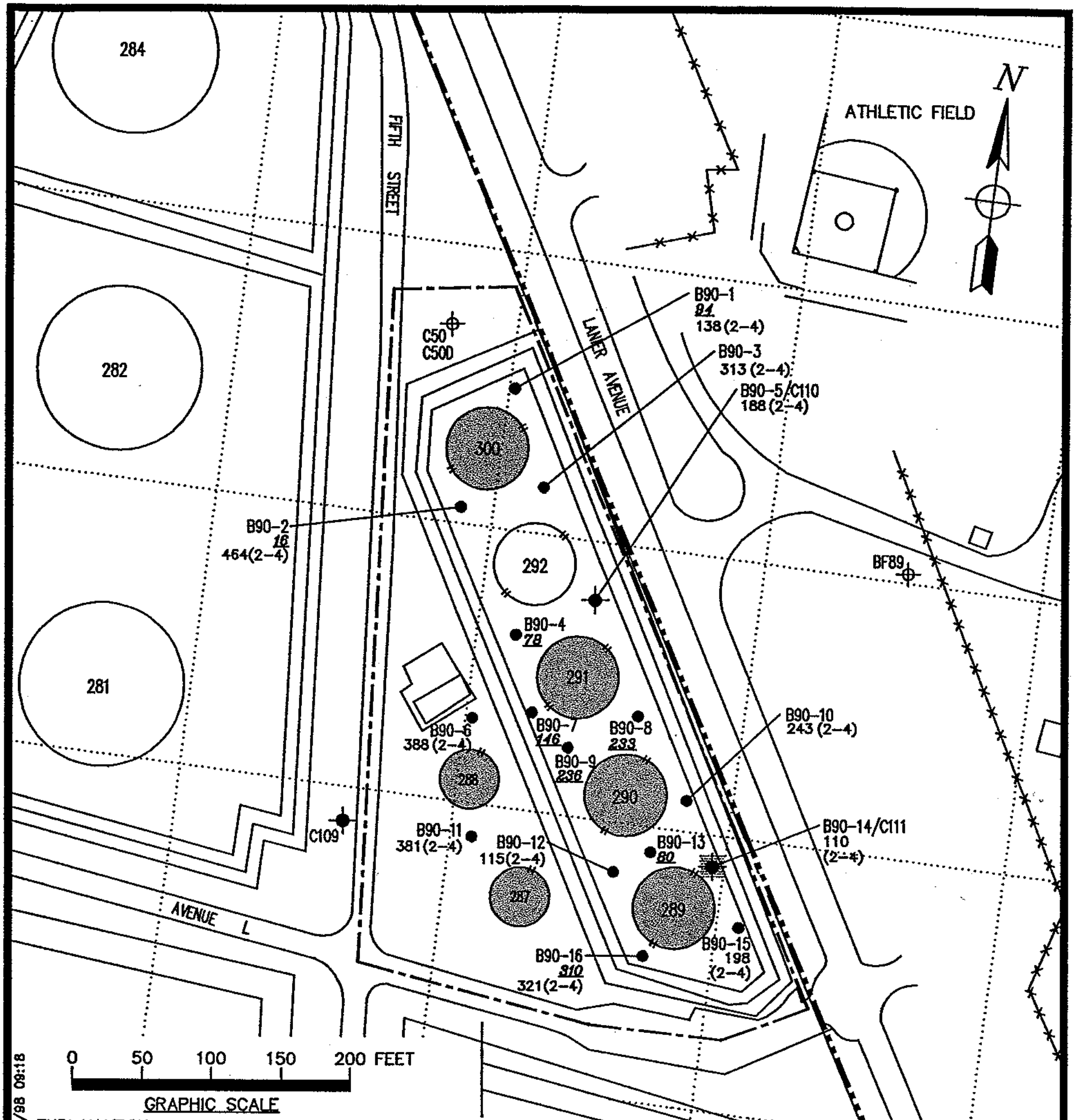
B42 ⊕	EXISTING MONITORING WELL LOCATION
C108 ●	RFI MONITORING WELL LOCATION
BNA11 ●	RFI SOIL BORING LOCATION
—·—·—	DESIGNATED SWMU EXTENT
——	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
<u>89</u>	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
421	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 89

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/15/98	APPR. BY S.R.	FIG. NO. 1-3



EXPLANATION:

C95-⊕ EXISTING MONITORING WELL LOCATION
C109-● RFI MONITORING WELL LOCATION
B90-2 ● RFI SOIL BORING LOCATION
DESIGNATED SWMU EXTENT
REFINERY PROPERTY LINE
▨ TANK REMOVED, TANK PAD REMAINS
16 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
388 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS
▤ KNOWN DISPOSAL AREA

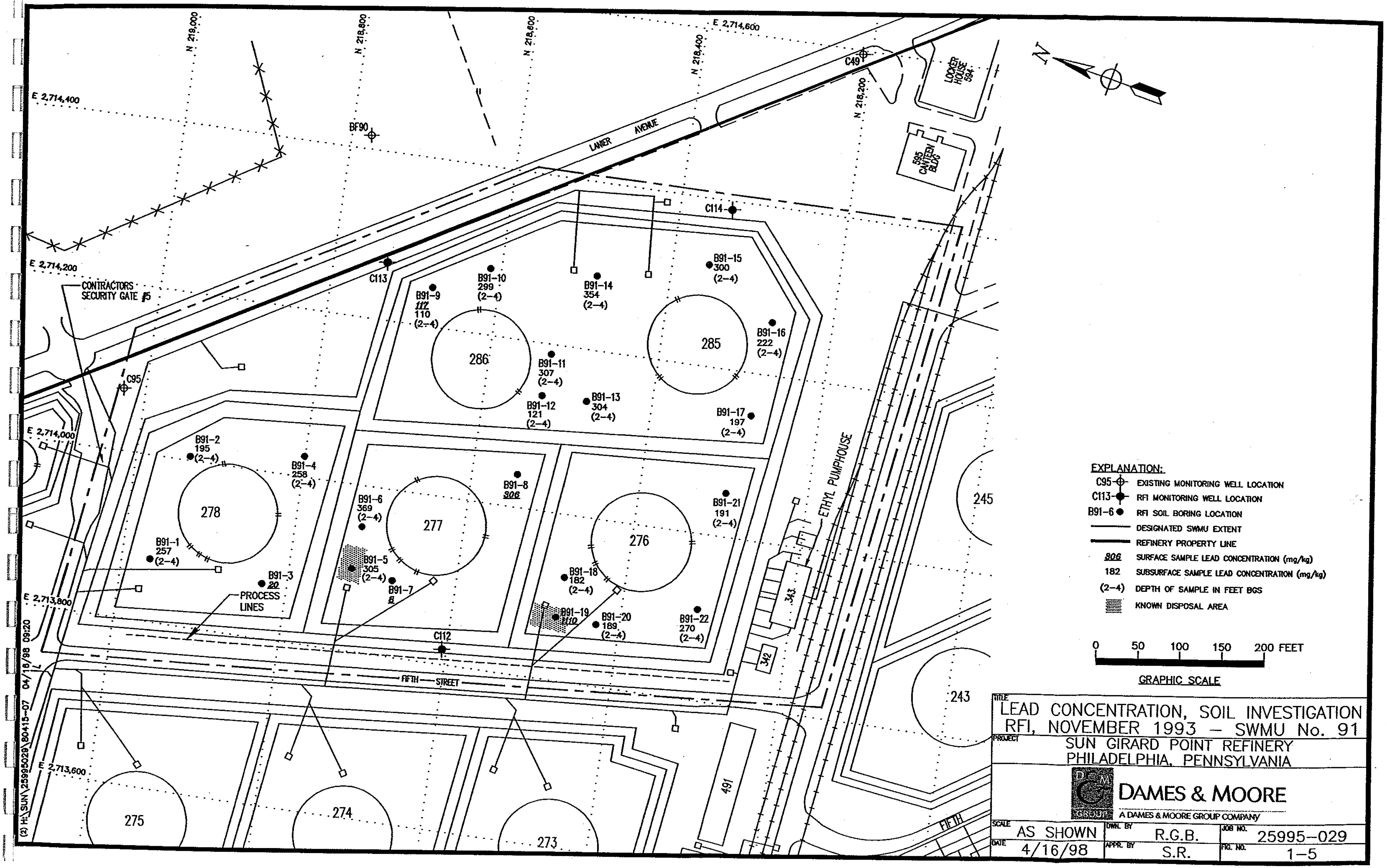
(2) H:\SUN\25995029\80415-06 04/16/98 09:18

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 - SWMU No. 90

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

D&M GROUP
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-4



EXPLANATION:

C95 ⌖ EXISTING MONITORING WELL LOCATION
C113 ⊕ RFI MONITORING WELL LOCATION
B91-6 ● RFI SOIL BORING LOCATION
── DESIGNATED SWMU EXTENT
━━ REFINERY PROPERTY LINE
306 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
182 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS
▨ KNOWN DISPOSAL AREA

0 50 100 150 200 FEET
GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 91

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-5

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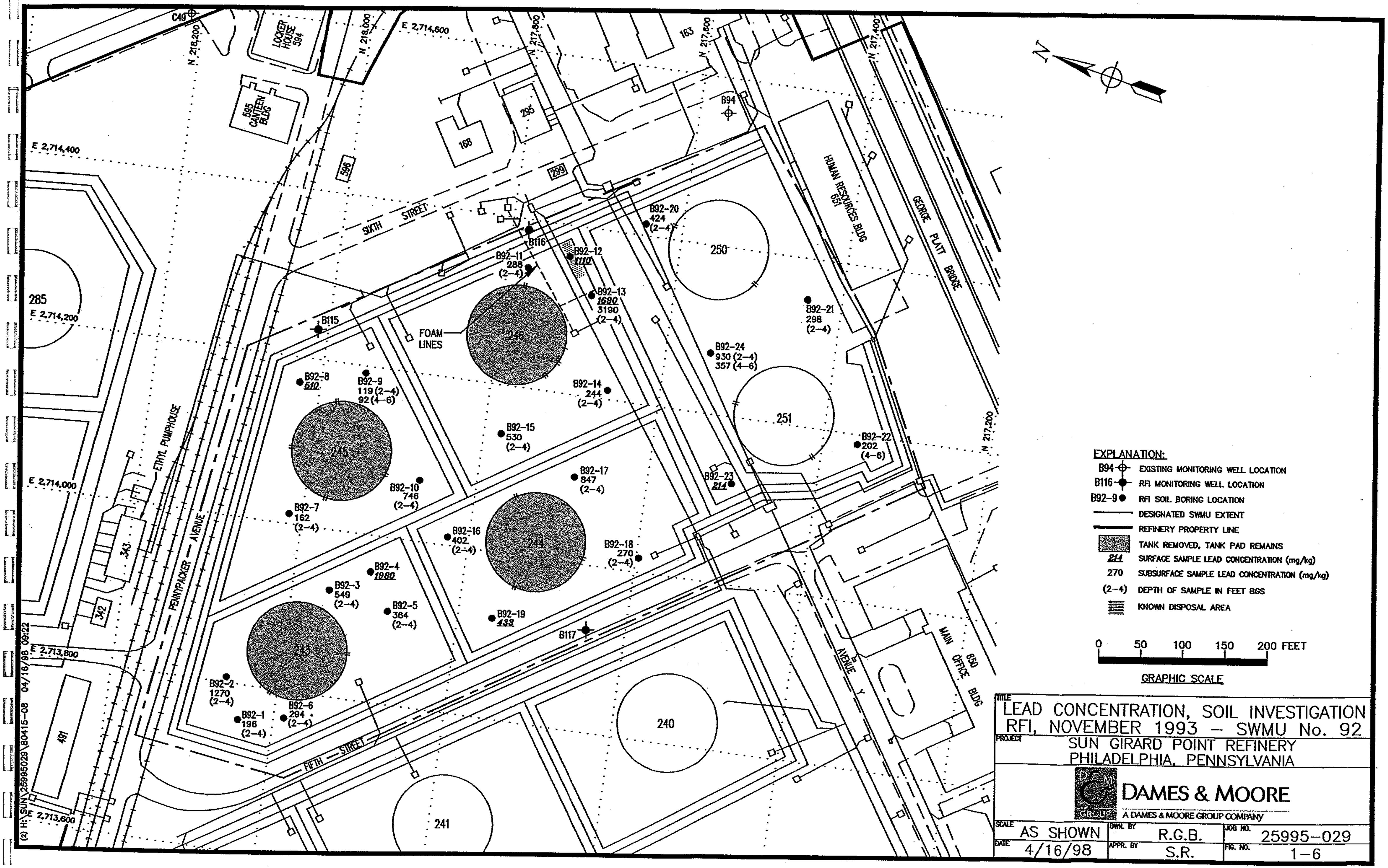


EXPLANATION:

B94 ⊕	EXISTING MONITORING WELL LOCATION
B116 ●	RFI MONITORING WELL LOCATION
B92-9 ●	RFI SOIL BORING LOCATION
—	DESIGNATED SWMU EXTENT
━	REFINERY PROPERTY LINE
▨	TANK REMOVED, TANK PAD REMAINS
214	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
270	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS
▤	KNOWN DISPOSAL AREA

GRAPHIC SCALE

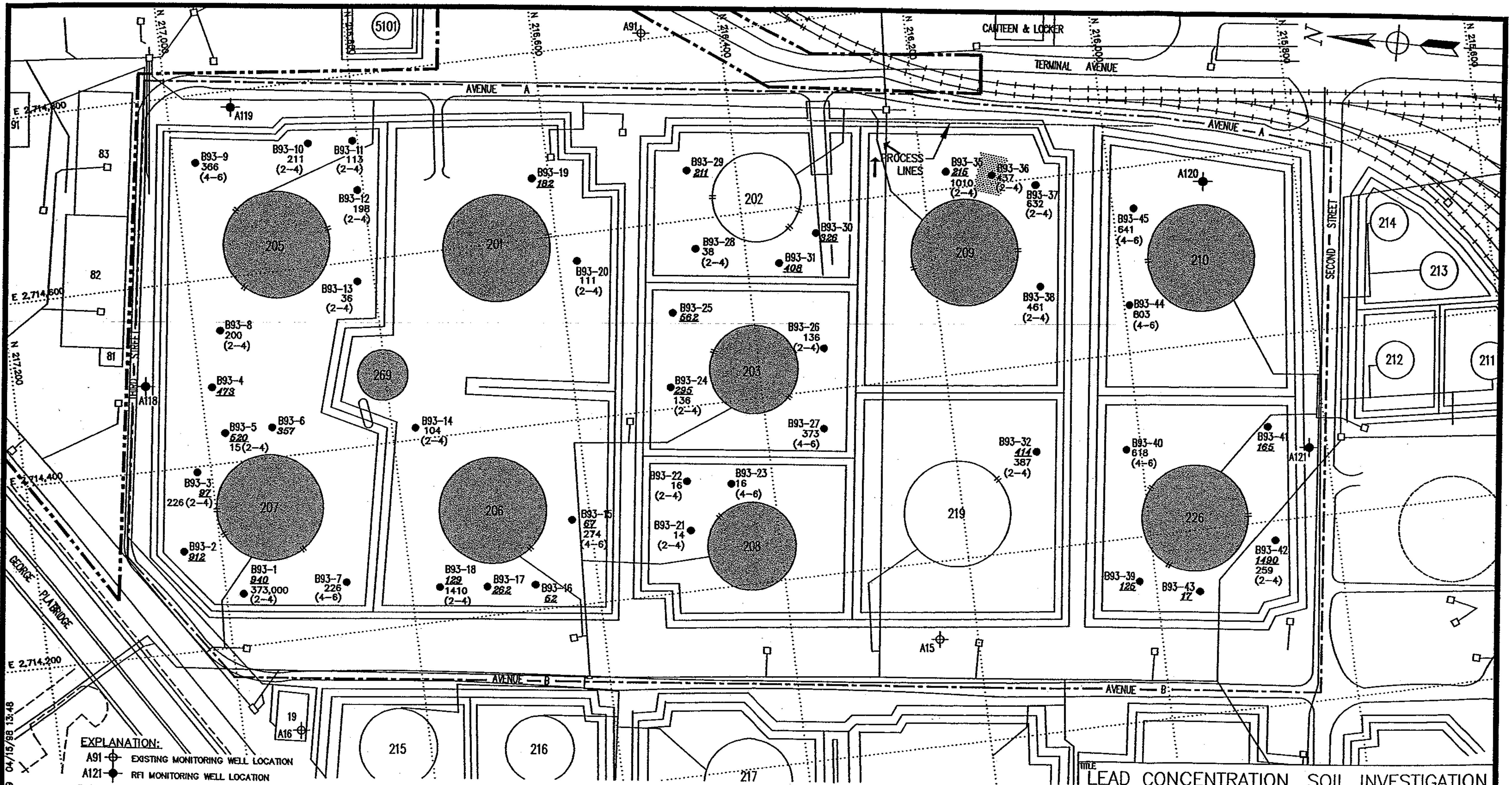
TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 92

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-6

(2) H:\SUN\25995029\80415-08 04/16/98 09:22



EXPLANATION:

A91 ⊕ EXISTING MONITORING WELL LOCATION
A121 ● RFI MONITORING WELL LOCATION
B93-51 ● RFI SOIL BORING LOCATION
— DESIGNATED SWMU EXTENT
— REFINERY PROPERTY LINE
▨ TANK REMOVED, TANK PAD REMAINS
129 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
1410 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS
▤ KNOWN DISPOSAL AREA

0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 93

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/15/98	APPR. BY S.R.	FIG. NO. 1-7

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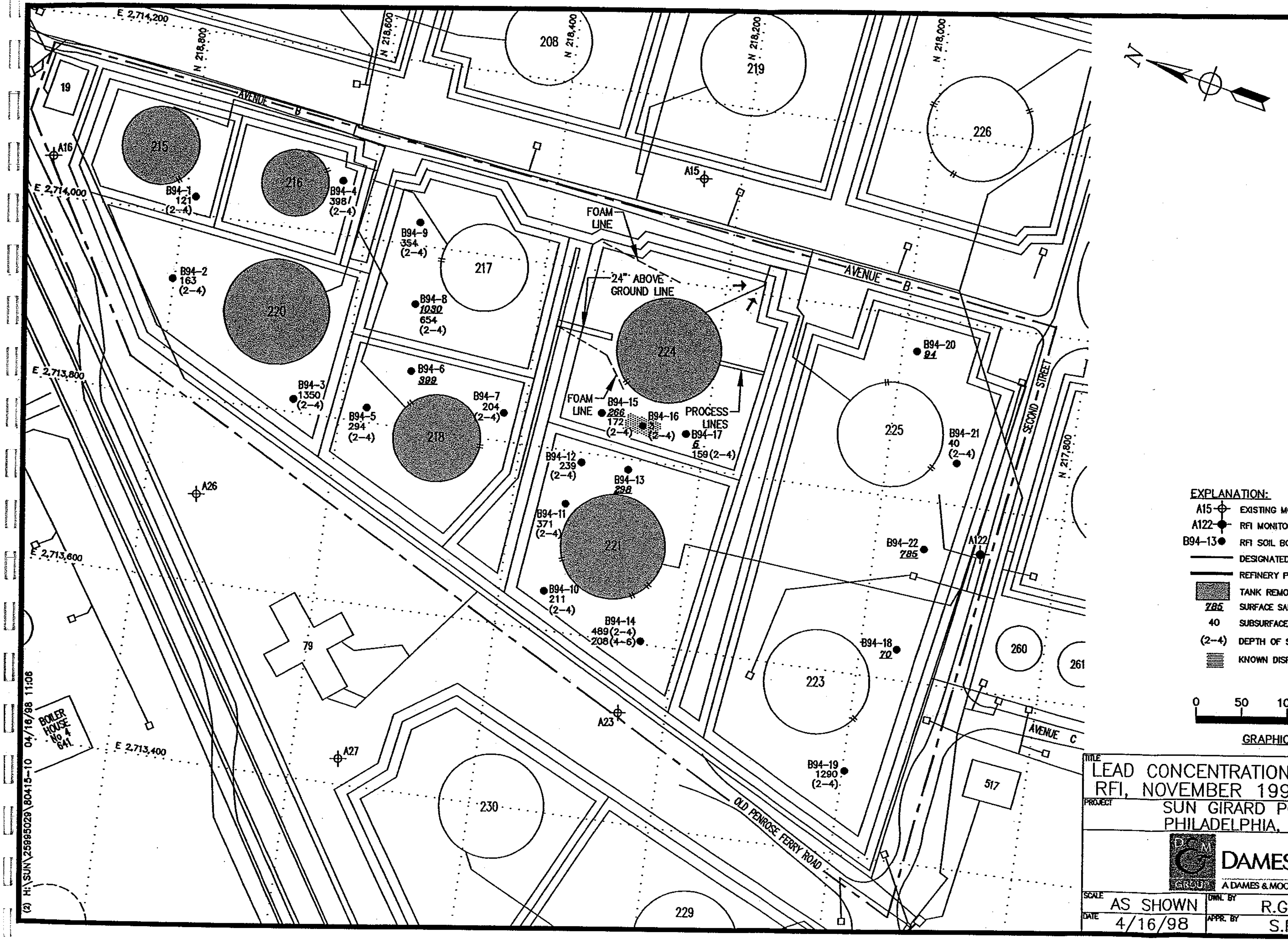

EXPLANATION:

A15 ⊕ EXISTING MONITORING WELL LOCATION
A122 ⊕ RFI MONITORING WELL LOCATION
B94-13 ● RFI SOIL BORING LOCATION
——— DESIGNATED SWMU EXTENT
▬▬▬ REFINERY PROPERTY LINE
▨ TANK REMOVED, TANK PAD REMAINS
785 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
40 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS
▤ KNOWN DISPOSAL AREA

0 50 100 150 200 FEET

GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 94

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-8

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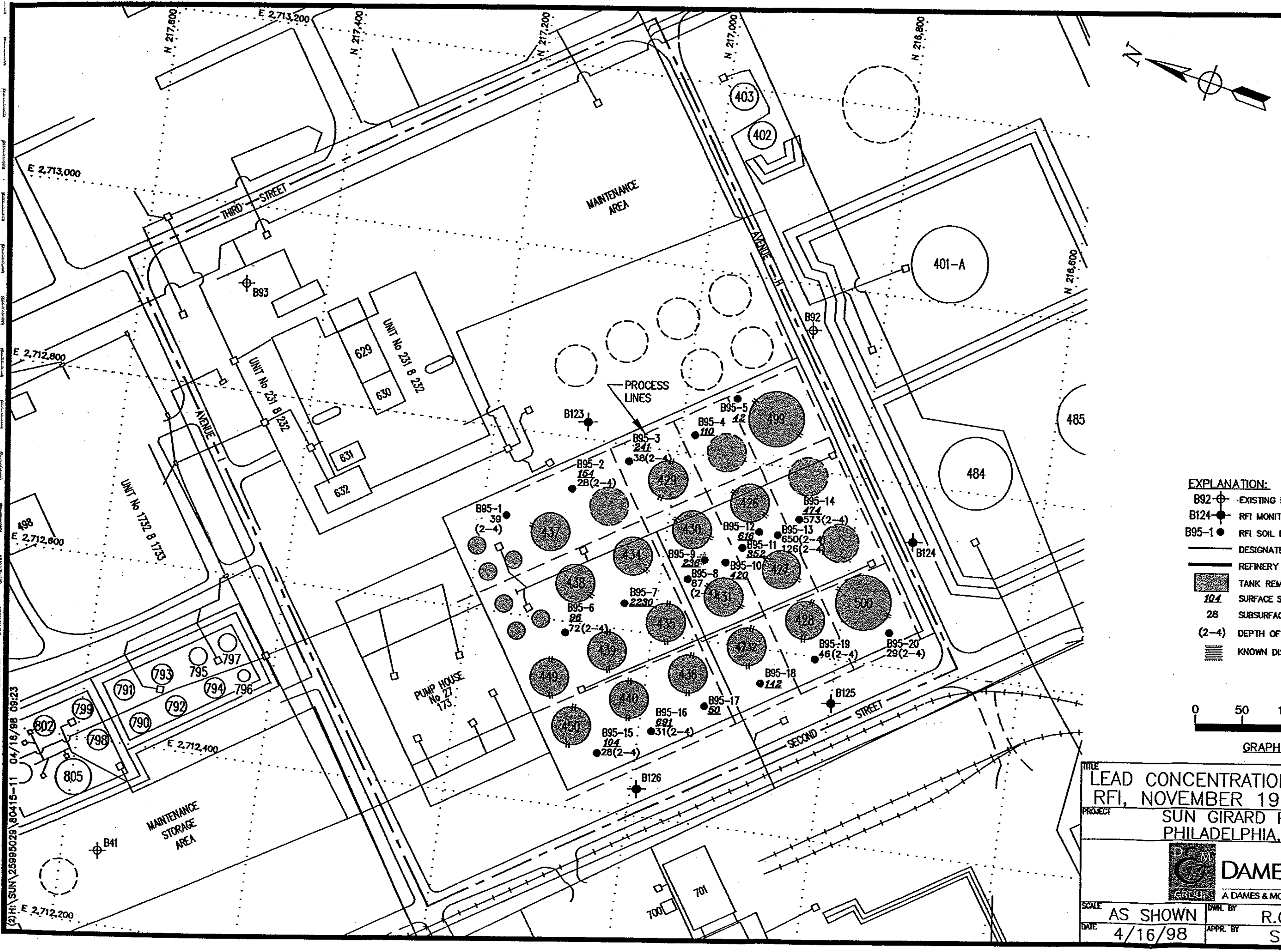

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EXPLANATION:

B92-⌖	EXISTING MONITORING WELL LOCATION
B124-⌖	RFI MONITORING WELL LOCATION
B95-1 ●	RFI SOIL BORING LOCATION
───	DESIGNATED SWMU EXTENT
━━━	REFINERY PROPERTY LINE
▨	TANK REMOVED, TANK PAD REMAINS
104	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
28	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS
▤	KNOWN DISPOSAL AREA

0 50 100 150 200 FEET

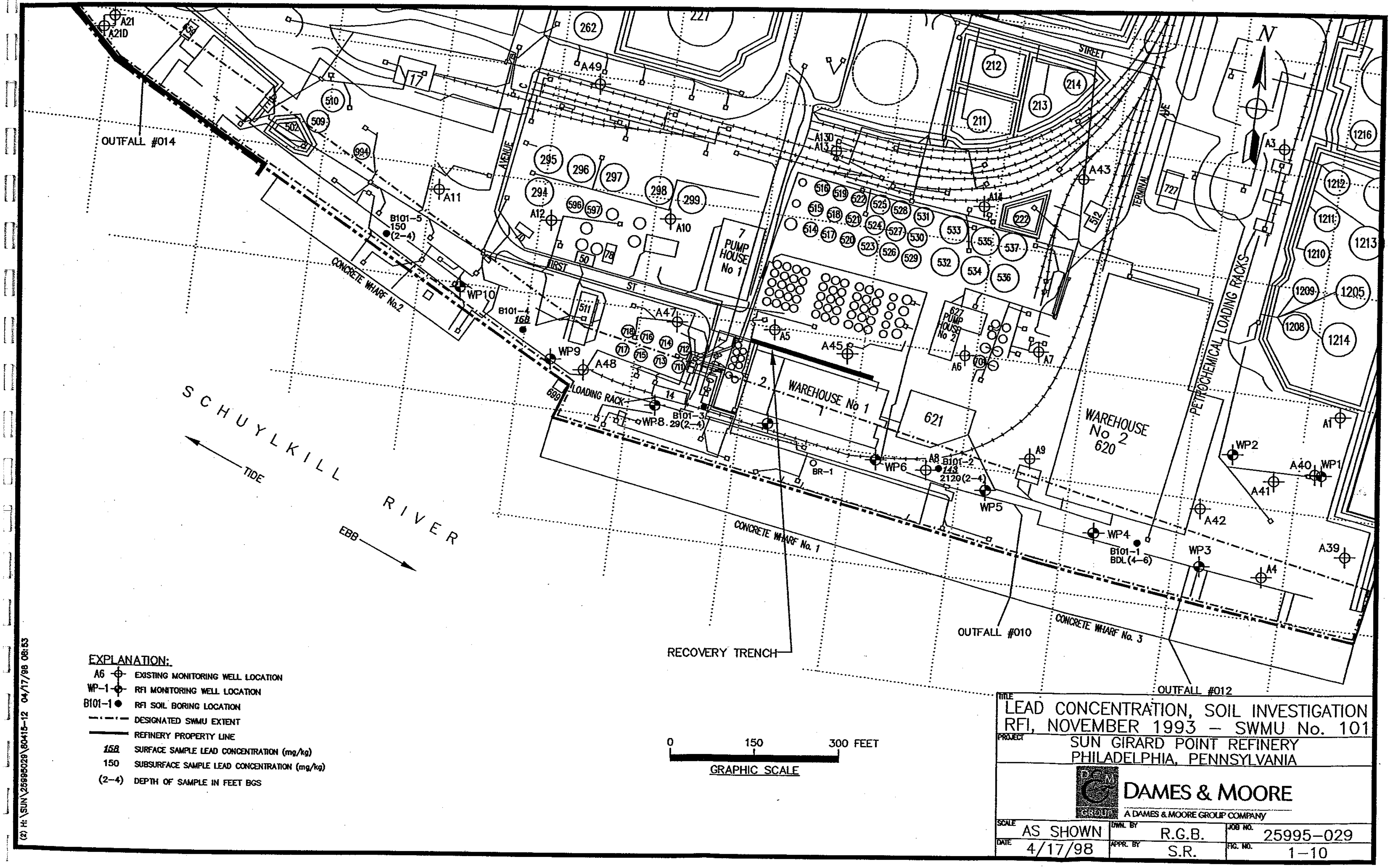
GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 95

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 1-9



EXPLANATION:

A6 ⌖	EXISTING MONITORING WELL LOCATION
WP-1 ⌖	RFI MONITORING WELL LOCATION
B101-1 ●	RFI SOIL BORING LOCATION
—·—·—	DESIGNATED SWMU EXTENT
━━━	REFINERY PROPERTY LINE
158	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
150	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS

0 150 300 FEET

GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – SWMU No. 101

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 1-10

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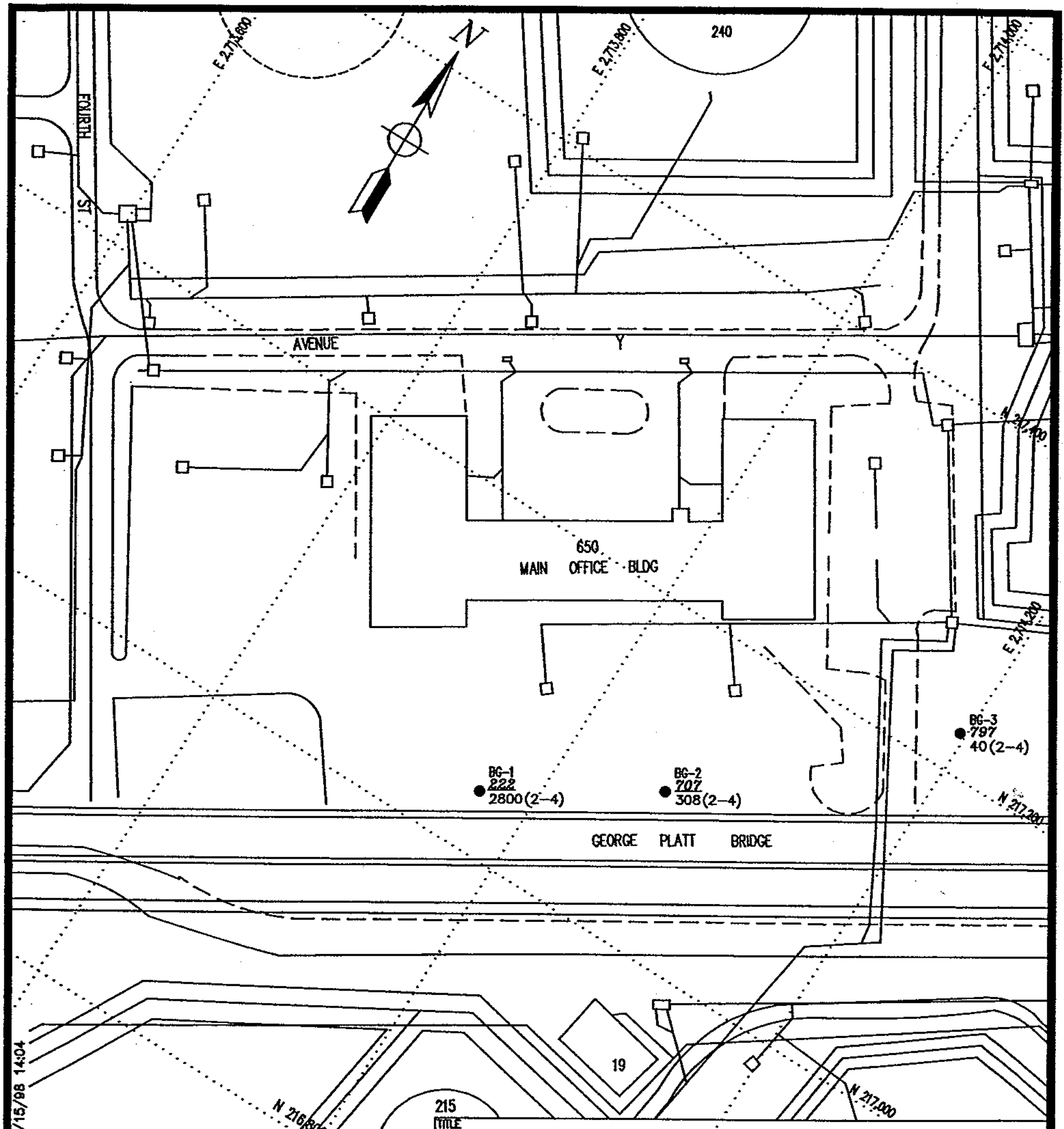

EXPLANATION:

BG-1 ●	BACKGROUND SOIL BORING LOCATION
———	DESIGNATED SWMU EXTENT
━━━	REFINERY PROPERTY LINE
222	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
2800	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS

0 50 100 FEET

GRAPHIC SCALE

TITLE
LEAD CONCENTRATION, SOIL INVESTIGATION
RFI, NOVEMBER 1993 – MAIN OFFICE BUILDING

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/15/98	APPR. BY S.R.	FIG. NO. 1-11

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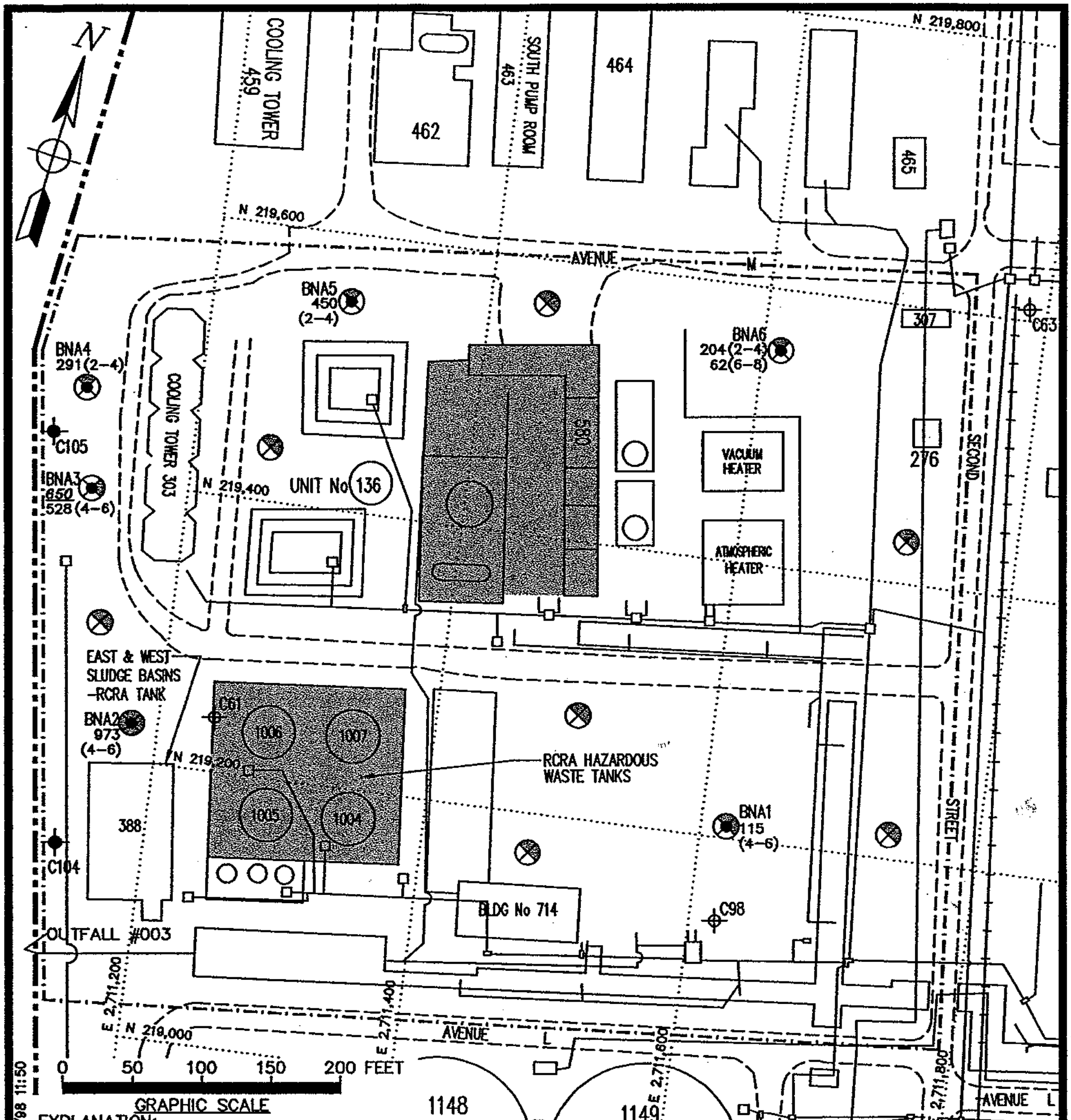

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EXPLANATION:

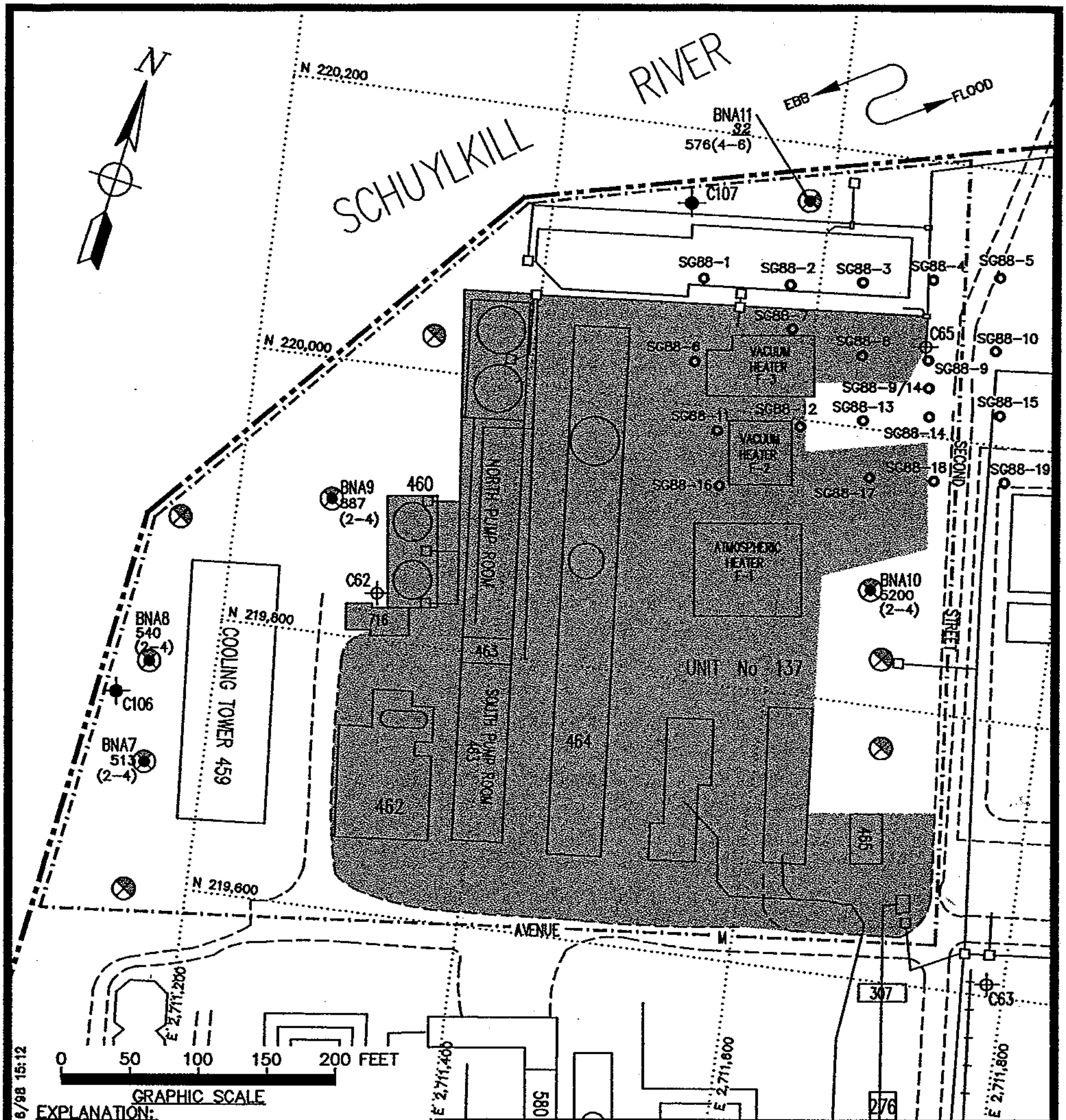
C98-⊕-	EXISTING MONITORING WELL LOCATION
C104-●	RFI MONITORING WELL LOCATION
BNA2 ●	RFI SOIL BORING LOCATION
-·-·-	DESIGNATED SWMU EXTENT
—	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
850	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
291	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS
⊗	PROPOSED SURFACE SOIL SAMPLE (0-2 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (2-4 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (4-6 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (6-8 FEET)

TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 87

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 2-1



EXPLANATION:

- C62 ⊕ EXISTING MONITORING WELL LOCATION
- C106 ● RFI MONITORING WELL LOCATION
- BNA7 ● RFI SOIL BORING LOCATION
- —·— DESIGNATED SWMU EXTENT
- ━━ REFINERY PROPERTY LINE
- ▨ PAVED AREA/PROCESS UNIT
- 32 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
- 540 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
- (2-4) DEPTH OF SAMPLE IN FEET BGS
- ⊗ PROPOSED SURFACE SOIL SAMPLE (0-2 FEET)
- ⊗ PROPOSED SUBSURFACE SOIL SAMPLE (2-4 FEET)

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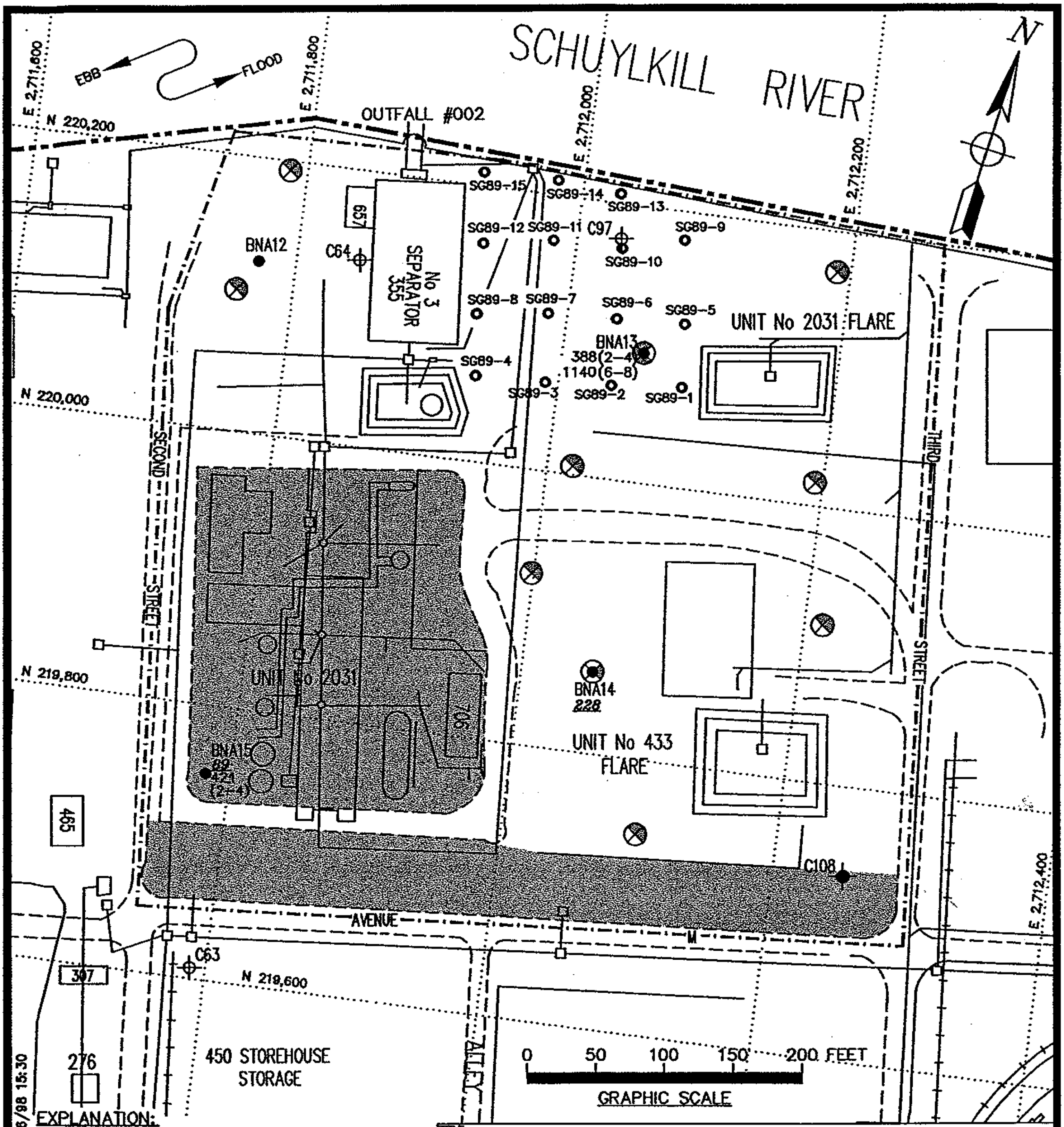
TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 88

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/16/98	APPR. BY S.R.	FIG. NO. 2-2



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EXPLANATION:

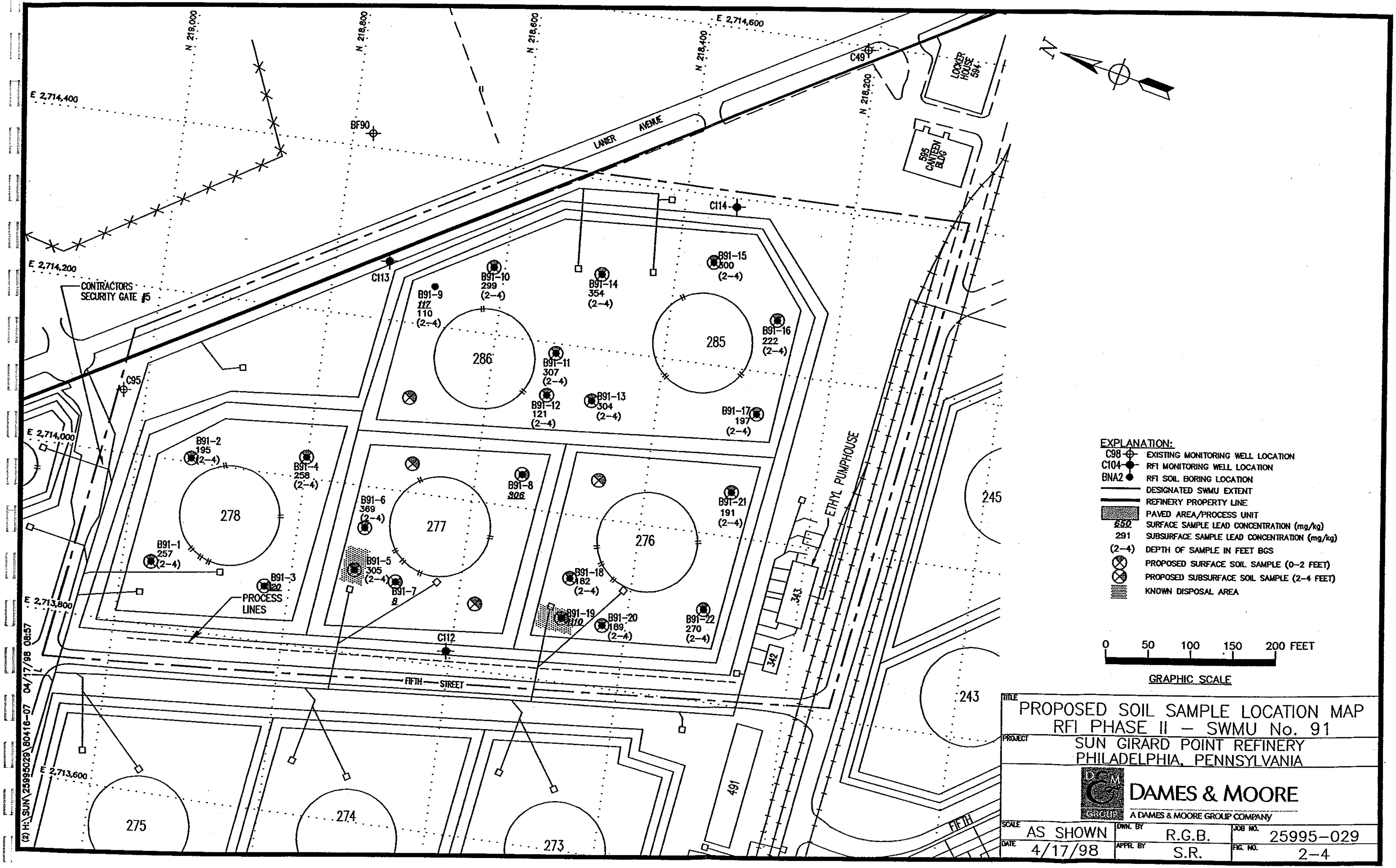
C42-⊕	EXISTING MONITORING WELL LOCATION
C108-●	RFI MONITORING WELL LOCATION
BNA11●	RFI SOIL BORING LOCATION
-·-·-	DESIGNATED SWMU EXTENT
—	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
89	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
421	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2–4)	DEPTH OF SAMPLE IN FEET BGS
⊗	PROPOSED SURFACE SOIL SAMPLE (0–2 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (2–4 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (4–6 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (6–8 FEET)

TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 89

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE	DWN. BY	JOB NO.
AS SHOWN	R.G.B.	25995–029
DATE	APPR. BY	FIG. NO.
4/16/98	S.R.	2–3

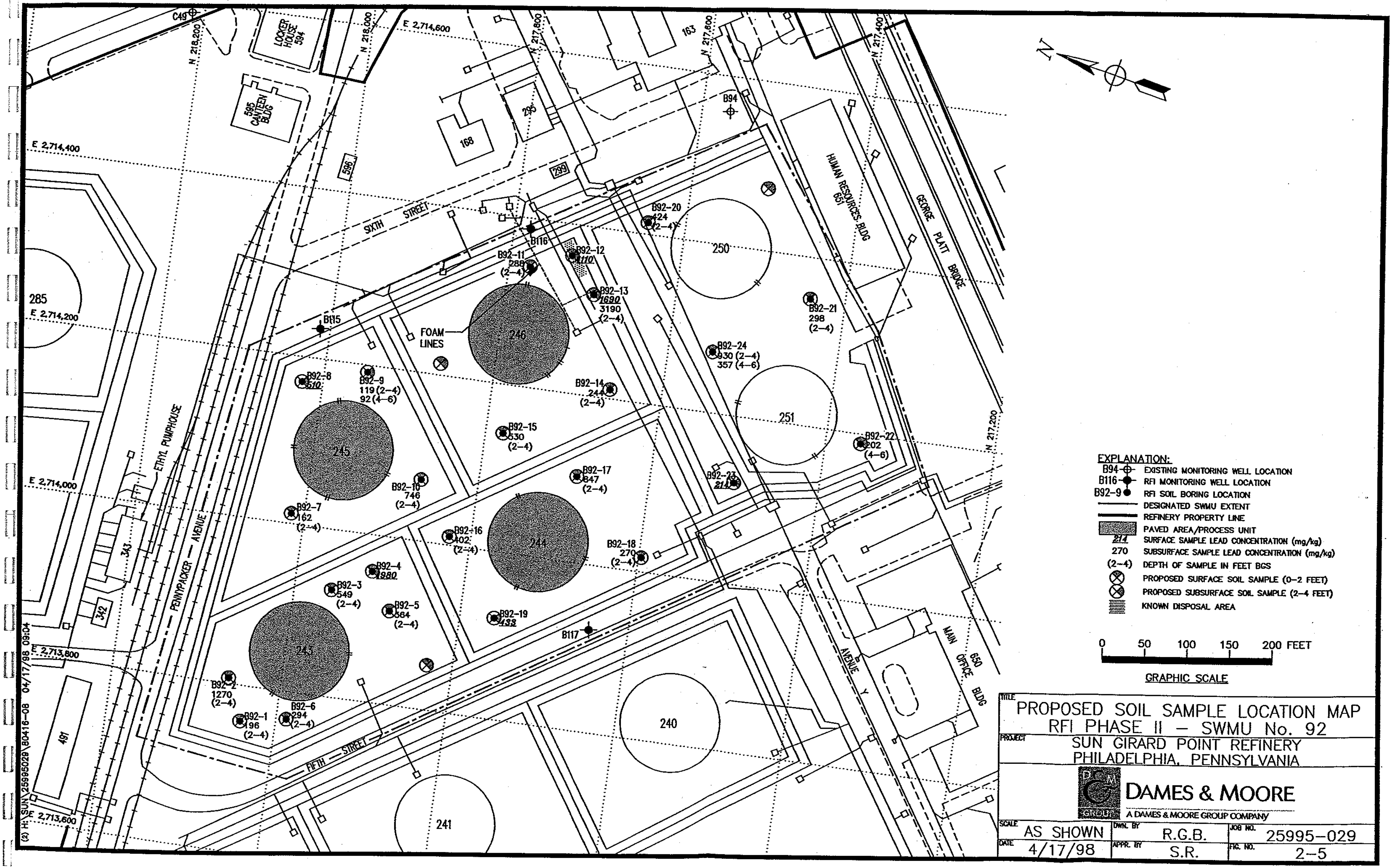


TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 91

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 2-4



EXPLANATION:

B94 ⊕	EXISTING MONITORING WELL LOCATION
B116 ●	RFI MONITORING WELL LOCATION
B92-9 ●	RFI SOIL BORING LOCATION
──	DESIGNATED SWMU EXTENT
━━	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
<u>*214*</u>	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
270	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4)	DEPTH OF SAMPLE IN FEET BGS
⊗	PROPOSED SURFACE SOIL SAMPLE (0-2 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (2-4 FEET)
▤	KNOWN DISPOSAL AREA

0 50 100 150 200 FEET

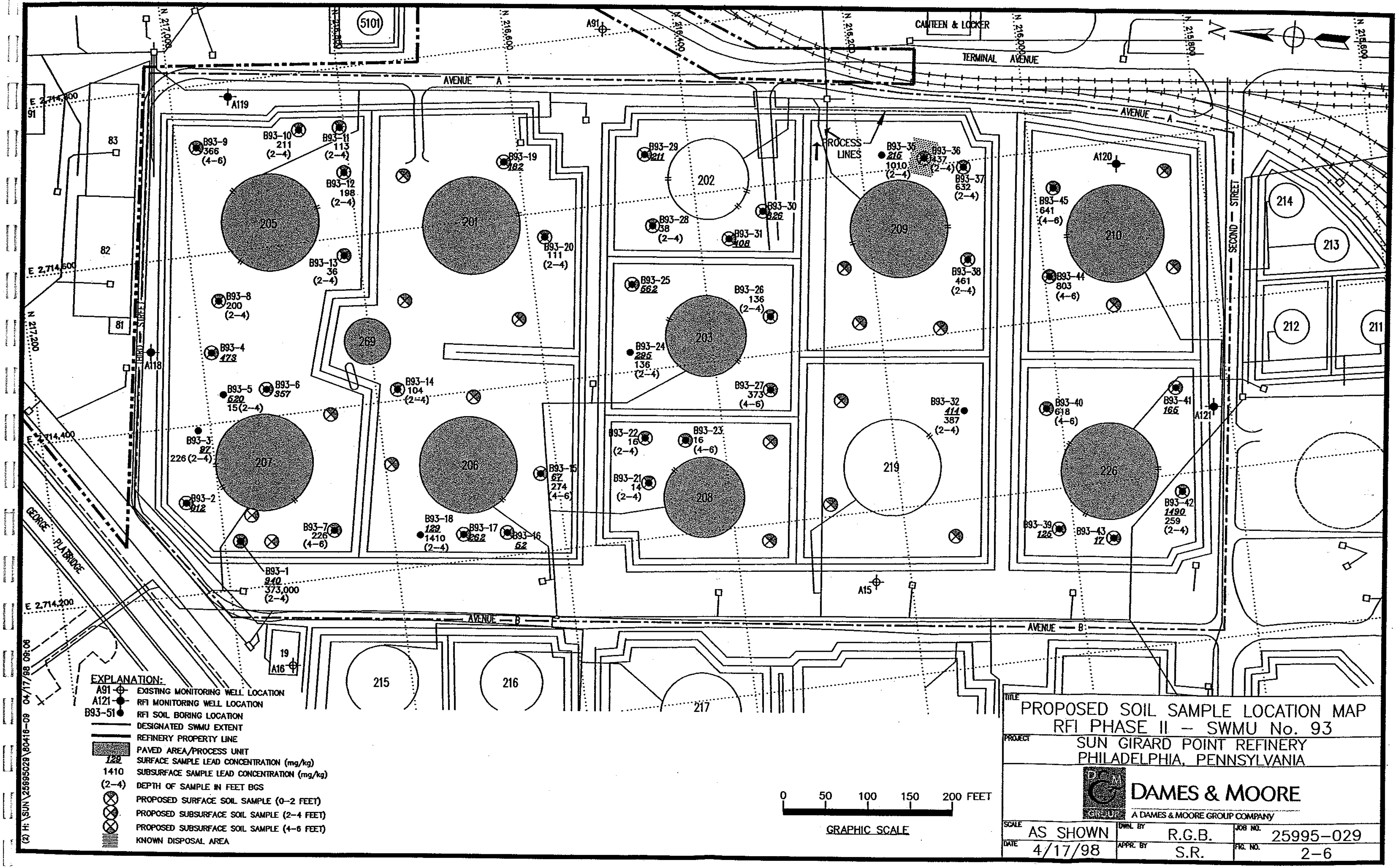
GRAPHIC SCALE

TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 92

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 2-5



TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 93

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE	DWN. BY	JOB NO.
AS SHOWN	R.G.B.	25995-029
DATE	APPR. BY	FIG. NO.
4/17/98	S.R.	2-6

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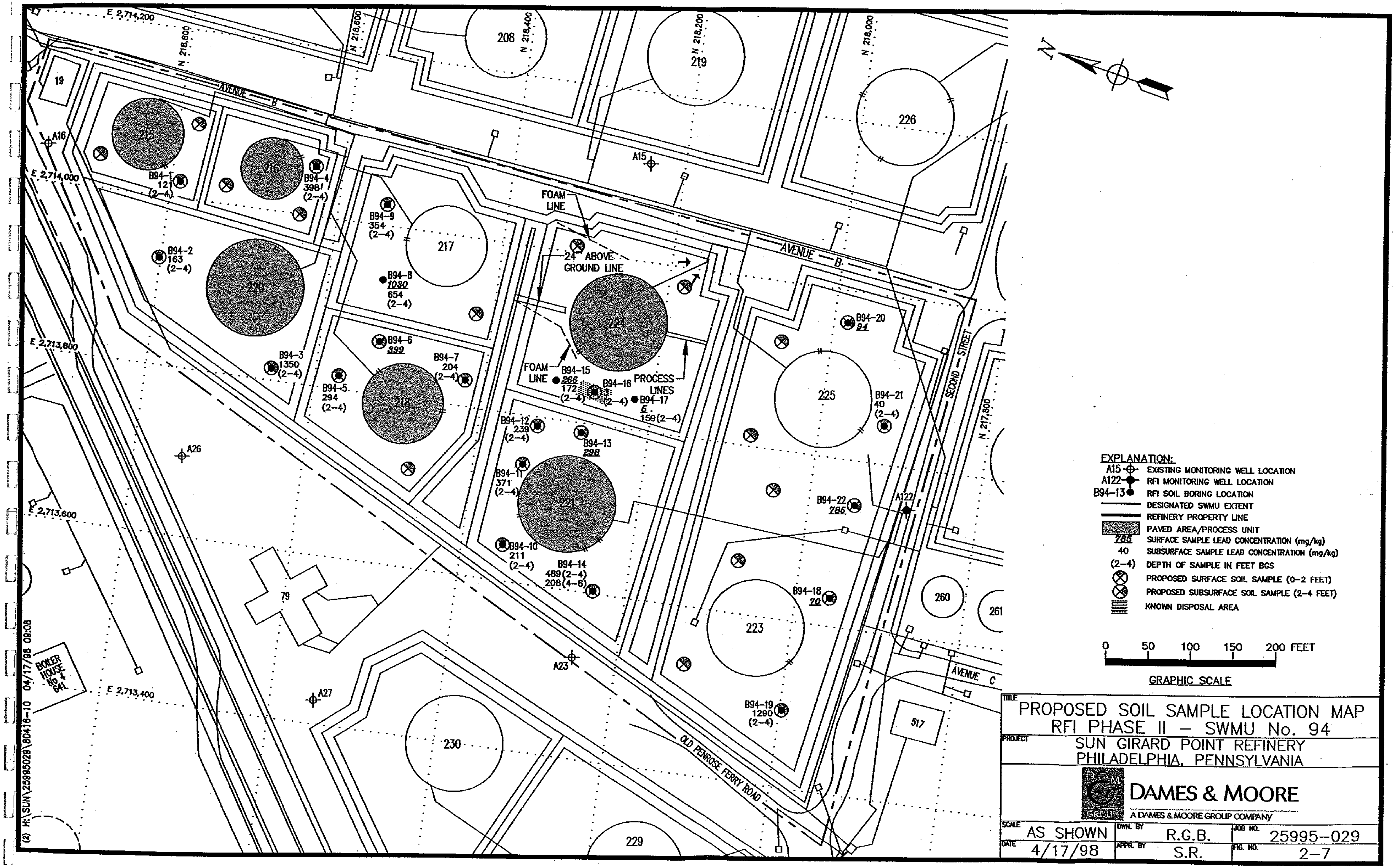
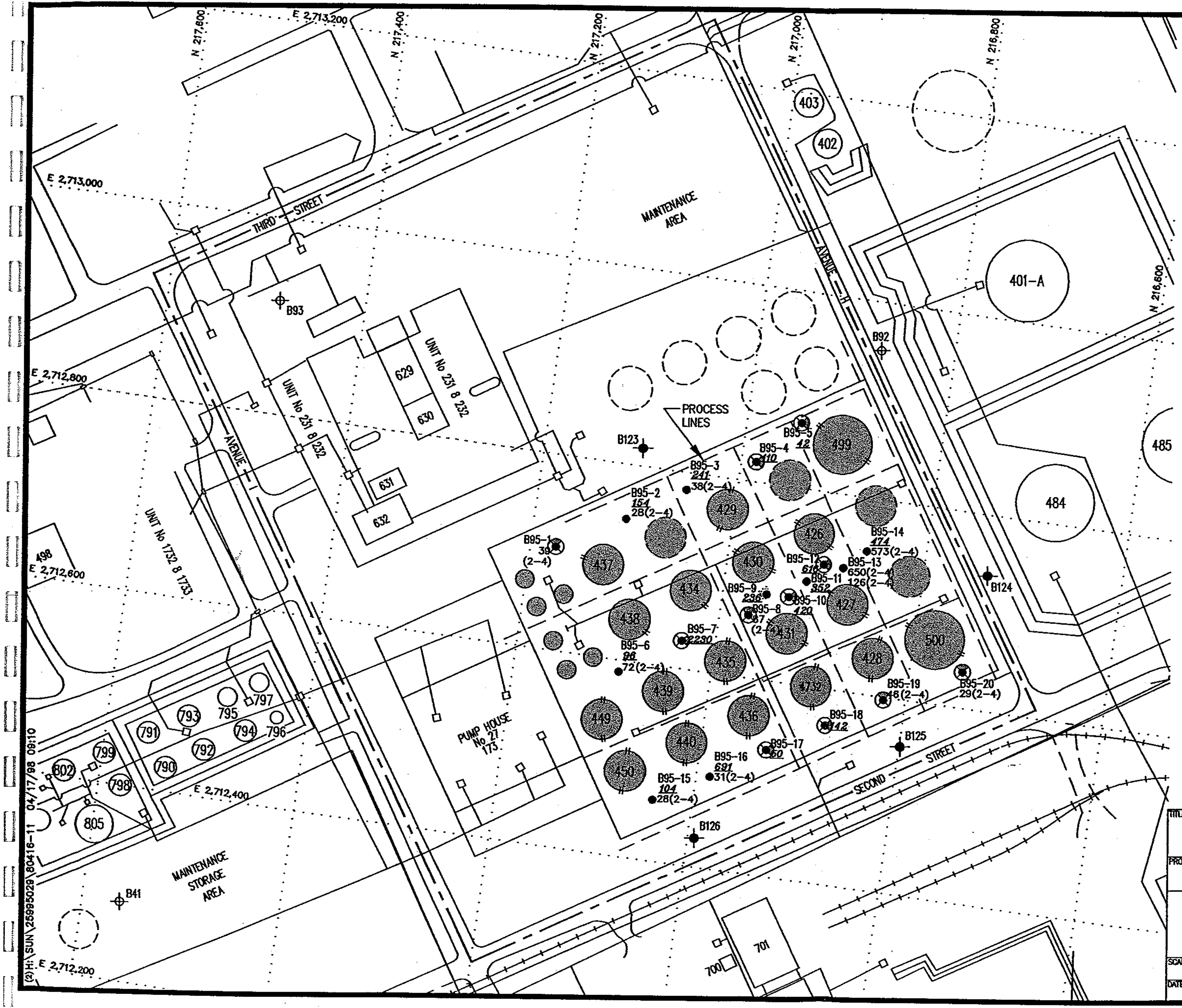


TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 94

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 2-7



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EXPLANATION:

B92-⊕-	EXISTING MONITORING WELL LOCATION
B124-●-	RFI MONITORING WELL LOCATION
B95-1 ●	RFI SOIL BORING LOCATION
───	DESIGNATED SWMU EXTENT
━━━	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
<u>104</u>	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
28	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2–4)	DEPTH OF SAMPLE IN FEET BGS
⊗	PROPOSED SURFACE SOIL SAMPLE (0–2 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (2–4 FEET)
▤	KNOWN DISPOSAL AREA

0 50 100 150 200 FEET

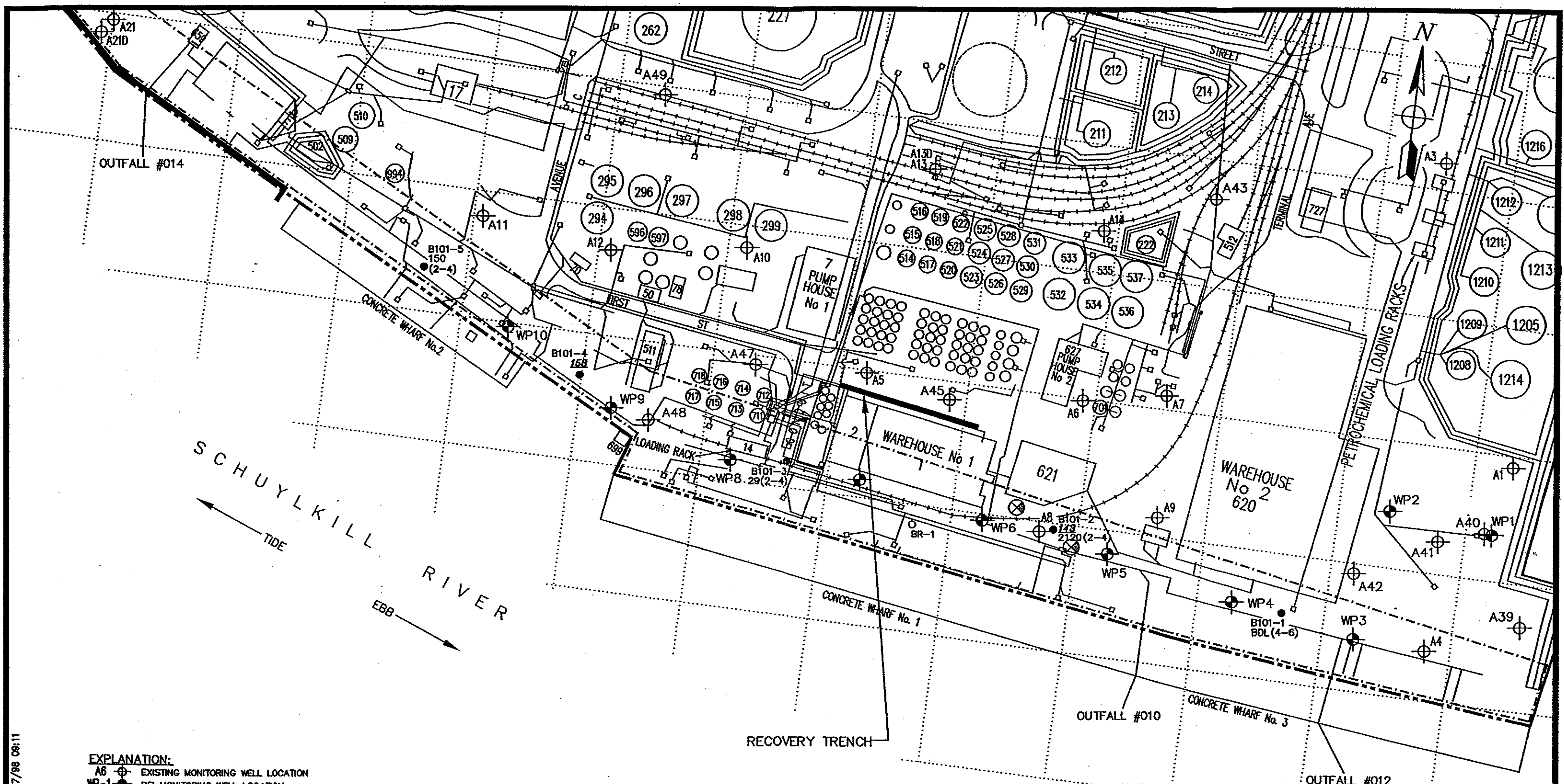
GRAPHIC SCALE

TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 95

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995–029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 2–8



EXPLANATION:

A6 ⊕ EXISTING MONITORING WELL LOCATION
WP-1 ● RFI MONITORING WELL LOCATION
B101-1 ● RFI SOIL BORING LOCATION
—·—·— DESIGNATED SWMU EXTENT
━━━ REFINERY PROPERTY LINE
▨ PAVED AREA/PROCESS UNIT
168 SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
150 SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2-4) DEPTH OF SAMPLE IN FEET BGS
⊗ PROPOSED SUBSURFACE SOIL SAMPLE (2-4 FEET)

0 150 300 FEET
GRAPHIC SCALE

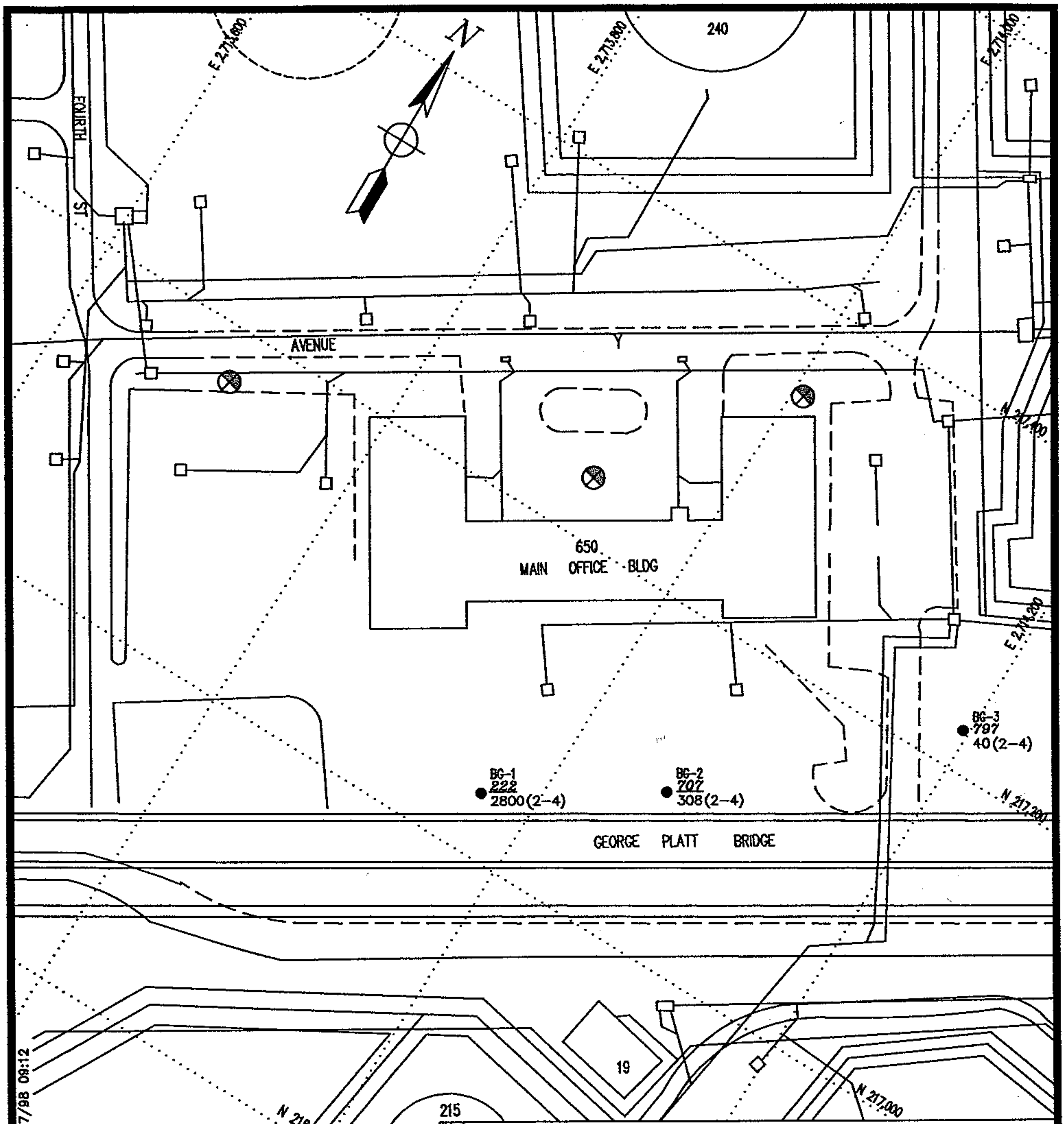
TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – SWMU No. 101

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE	DWN. BY	JOB NO.
AS SHOWN	R.G.B.	25995-029
DATE	APPR. BY	FIG. NO.
4/17/98	S.R.	2-9

(2) H:\SUN\25995029\80416-12 04/17/98 09:11



EXPLANATION:

BG-1 ●	RFI SOIL BORING LOCATION
—	DESIGNATED SWMU EXTENT
—	REFINERY PROPERTY LINE
▨	PAVED AREA/PROCESS UNIT
<u>222</u>	SURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
2800	SUBSURFACE SAMPLE LEAD CONCENTRATION (mg/kg)
(2–4)	DEPTH OF SAMPLE IN FEET BGS
⊗	PROPOSED SURFACE SOIL SAMPLE (0–2 FEET)
⊗	PROPOSED SUBSURFACE SOIL SAMPLE (2–4 FEET)

0 50 100 FEET

GRAPHIC SCALE

TITLE
PROPOSED SOIL SAMPLE LOCATION MAP
RFI PHASE II – MAIN OFFICE BUILDING

PROJECT
SUN GIRARD POINT REFINERY
PHILADELPHIA, PENNSYLVANIA

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

SCALE AS SHOWN	DWN. BY R.G.B.	JOB NO. 25995-029
DATE 4/17/98	APPR. BY S.R.	FIG. NO. 2-10

(2) H:\SUN\25995029\80416-13 04/17/98 09:12

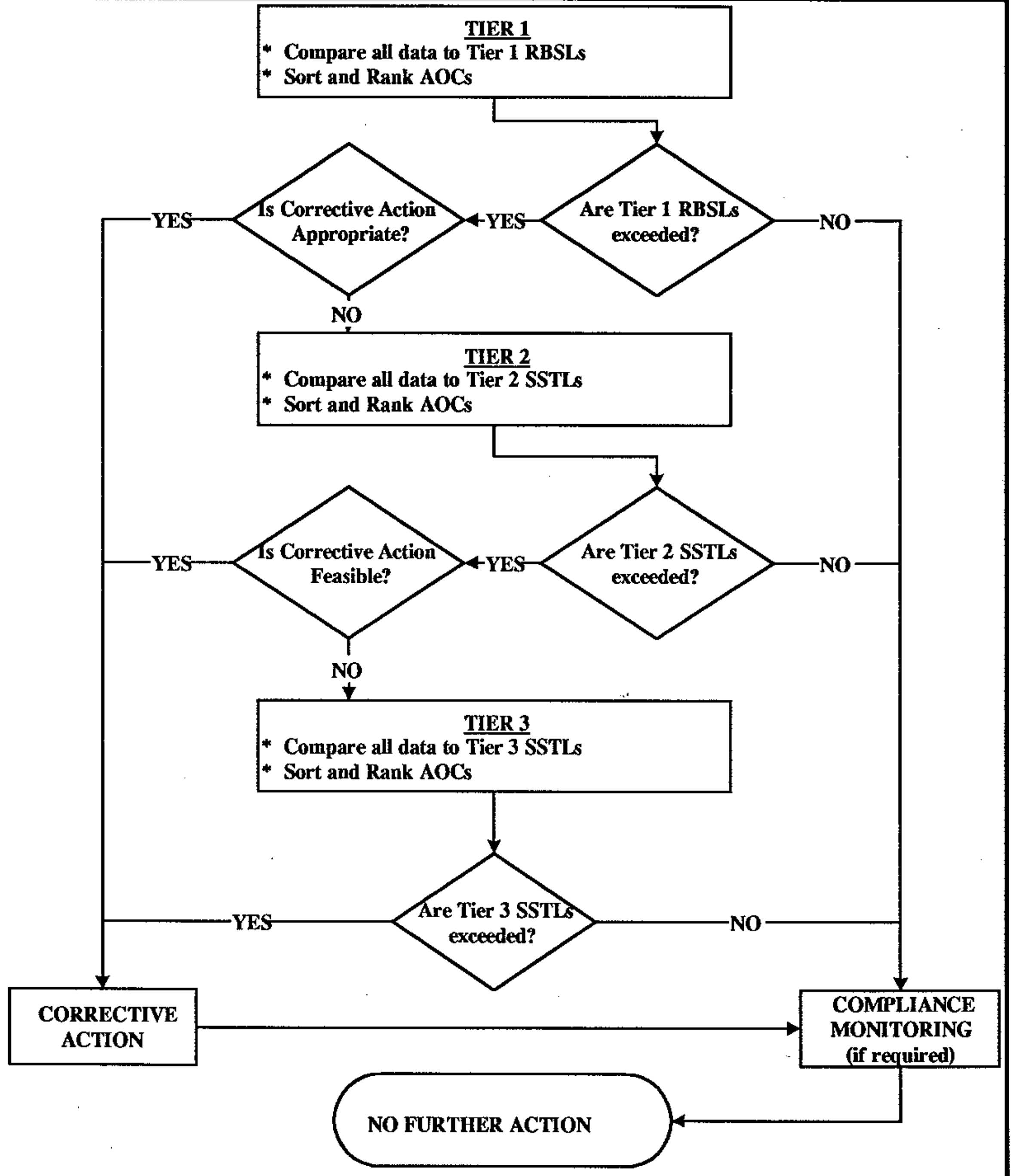


FIGURE 4

Conceptual Decision Tree for Risk-Based Corrective Action at the Sun Girard Point Refinery

Philadelphia, Pennsylvania

Dames & Moore

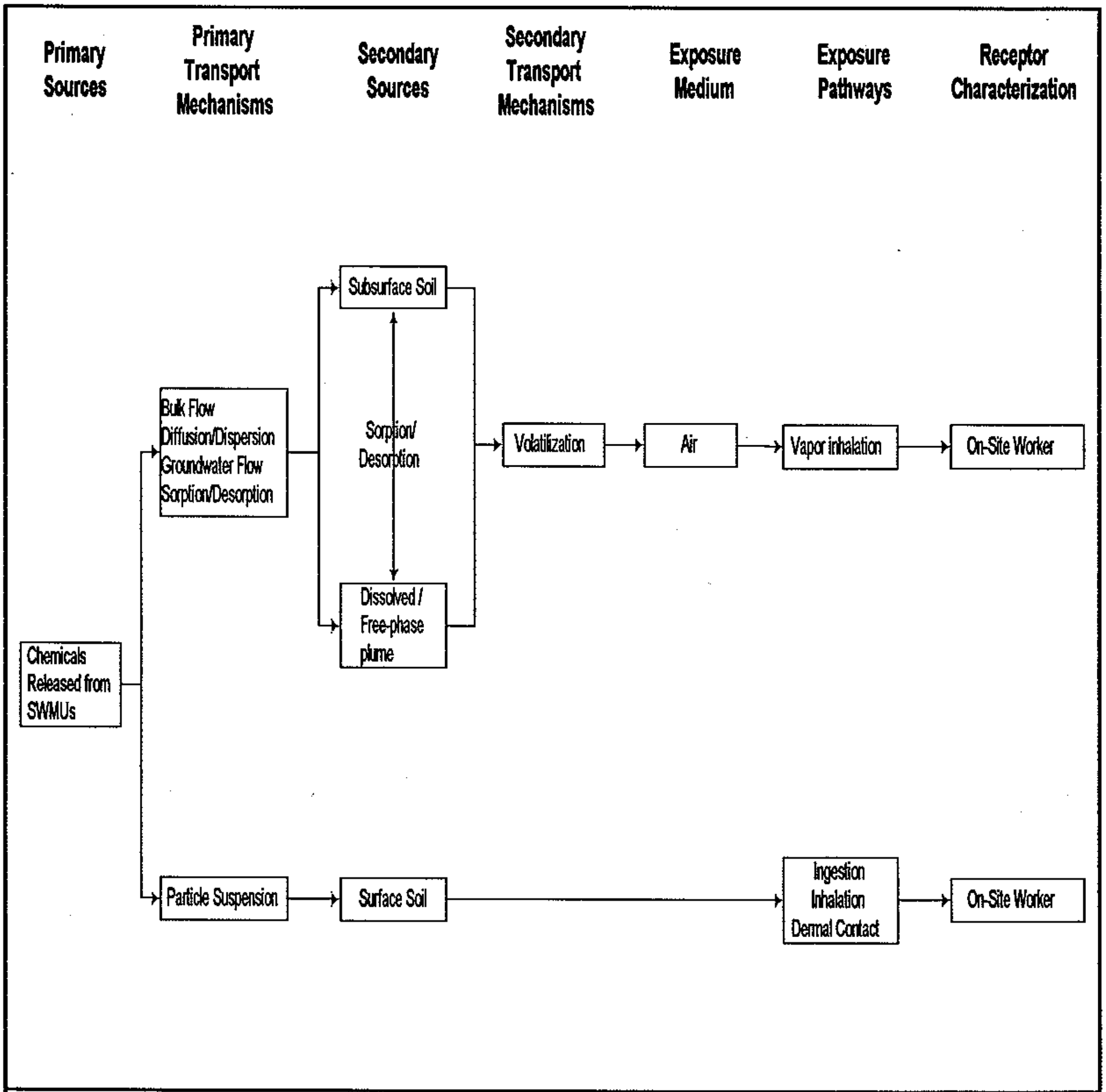


FIGURE 3
Preliminary Exposure Pathway Conceptual Site Model for the Sun Girard Point Refinery
Philadelphia, Pennsylvania
DAMES & MOORE

Received 2/25/98
CB

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107-4431

FEB 20 1998

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Charles D. Barksdale Jr., P.E.
Manager Environmental Projects
Remediation Services
Sun Company, Inc.
Ten Penn Center
1801 Market Street
Philadelphia, PA 19103-1699

Re: Sun Company, Inc. (R&M) Philadelphia Refinery Girard Point Processing
Area RCRA Corrective Action Permit No. PAD 049 791 098

Dear ~~Mr. Barksdale~~ Chuck:

This letter is in response to our February 9, 1998, meeting concerning the RCRA Facility Investigation (RFI) and the Pennsylvania Department of Environmental Resources (PADEP) Clean Stream Law Storage Tank Groundwater Monitoring Program activities that are being implemented concurrently at the referenced facility (Sun).

The purposes of the PADEP's Ground Water Monitoring Program are to evaluate for the presence of free phase hydrocarbon (NAPL), determine ground water flow patterns, remove the NAPL to the greatest extent practicable from the subsurface beneath the refinery and off-site, evaluate contamination concentration trends at the facility perimeter and determine the need for additional investigation of dissolved hazardous waste and constituents.

The U.S. Environmental Protection Agency (EPA) has determined that the above groundwater monitoring activities, along with the additional RCRA Corrective Action activities such as risk assessment, surface and subsurface soil characterization that you proposed during the indicated meeting, will satisfy and meet the RFI groundwater monitoring requirements. EPA now considers the RFI-Phase I (i.e., groundwater monitoring requirements) complete. The RFI-Phase I is hereby approved subject to the following conditions:

1. EPA reserves the right to request additional information if necessary to clarify, modify, or supplement previously submitted materials. (40 C.F.R. §124.3)

2. Sun will continue to work with PADEP on the evaluation and any necessary remedial action concerning the migration of off-site groundwater constituents that significantly impact human health and the environment.

3. All documents concerning the activities performed pursuant to the terms and conditions of the indicated PADEP's Storage Tank Ground Water Monitoring Program, including plans, reports, approvals and other correspondence shall be directed to the Project Manager, Mr. Hon Lee (3WC22).

Accordingly, Sun shall submit a Girard Point Processing Area RFI-Phase II Work Plan that will provide the interpretation of release characterization data against established health and environmental criteria to determine whether Corrective Measures Study (CMS) if necessary to this office for approval within 60 calendar days from the receipt of this letter.

If you have any questions concerning this letter, please contact Mr. Hon Lee of my staff at 215-566-3419.

Sincerely,

Paul Gotthold

Paul J. Gotthold
Chief, Pennsylvania Operations Branch

cc: H: Lee (3WC22)

APPENDIX B

STANDARD OPERATING PROCEDURES
SOIL SAMPLING

The following subsections detail the procedures that may be used for soil sampling, as necessary. These procedures will be employed during the field sampling program.

1.0 SOIL SAMPLING

Standard field equipment will be used for collecting all soil samples, regardless of the specific collection method, including the following:

- Field logbook
- Decontamination and cleaning supplies
- Distilled/deionized water
- Sample bottles and labels
- Surgical gloves
- Chain-of-custody forms
- Cooler and ice
- Aluminum foil
- Stainless steel trowel
- Stainless-steel mixing bowl or Teflon tray

2.0 SAMPLING PROCEDURES FOR A HAND AUGER

Stainless-steel augers can provide high quality samples of depths of 10 feet. Stainless-steel hand-auger samplers can be easily cleaned (decontaminated) in the field under controlled conditions. Bucket augers provide a fast and accurate sample collection method for field evaluations or laboratory analyses.

<u>Procedures</u>

1. Locate the sample point and document the location in the field logbook.
2. Attach a clean auger head to the appropriate length of auger stem and T-handle.
3. Auger to just above the depth to be sampled.
4. Field clean the auger head.
5. Lower the hand auger to the bottom of the hole. Mark the ground surface on the auger handle. Measure up 6 inches and mark again.

6. Rotate the hand auger clockwise, applying a light downward pressure, until the upper mark is level with the ground surface (6-inches).
7. Remove the hand auger from the borehole. Collect samples from the bottom of the hand auger using a stainless-steel scoop. Gently tap the hand auger to remove the sample directly into the sample bottles. A stainless-steel scoop or trowel can be used to remove the sample if tapping is ineffective.
8. Fill all appropriate containers and record the date, time, analysis parameters, and sampler's name on labels. Immediately place samples in a cooler maintained at 4°C. Complete the chain-of-custody forms and record the sample location, date of collection, field observations and measurements in the field log book.

3.0 SAMPLING PROCEDURES FOR GEOPROBE

1. Position the Geoprobe rig over the sampling location. Push the two-foot or four-foot split spoon sampler to a depth of two or four feet. Extract the sampler.
2. Place the sampler on a level surface and open. Remove the plastic sleeve containing the soil sample. Split the sleeve using a decontaminated knife or other sharp implement.
3. Section the soil sample into one-foot samples. Describe and note the soil texture, color, odors and other qualitative observations. The samples will be described in accordance with the Unified Soil Classification System (USCS). The information will be recorded on boring logs.
4. After logging the sample, place 50 to 100 grams of soil from each one-foot interval in separate plastic bags. The remaining soil can be stored in glass containers for future reference.
5. Label each sample bag with the sample designation, date, and site name. Place the bags in a cooler with ice.
6. Allow the borehole to collapse. Mark the location with a flag.
7. Replace the dedicated plastic sleeve in the split spoon sampler. Decontaminate the cutting tool in accordance with the procedures in the Quality Assurance Project Plan.