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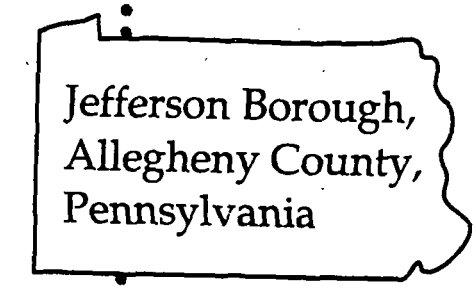

PICCO Resin Landfill Site Remedial Investigation Report

Volume I-1

March, 1991

WESTON® MANAGERS DESIGNERS/CONSULTANTS

Version No.2
3/26/91

PREFACE

The PICCO Resin Landfill Site Report is divided into three separately bound documents (with appendices) entitled as follows:

Part I	:	Remedial Investigation (Five Volumes)
Part II	:	Baseline Risk Assessment
Part III	:	Feasibility Study

Please consult the appropriate volume based on need. All three volumes considered together represent the "Site Report." This Site Report has been prepared in accordance with the terms specified in the Consent Order and Agreement (COA) executed on 2 November 1987 between the Pennsylvania Department of Environmental Resources (PADER) and Hercules, Incorporated.

WESTON

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GLOSSARY OF ACRONYMS

BGS - Feet Below Ground Surface

BHTV - Borehole Geophysical Summary and Borehole Television

BNA - Base/Neutral/Extractable

BTU - British Thermal Units

BTXE - Benzene, Toluene, Xylene, Ethylbenzene

CLP - Contract Laboratory Program

EA - Endangerment Assessment

FS - Feasiblity Study

gpm - gallons per minute

HSL - Hazardous Substance List

MB - Method Blank

mD - millidarcies

mg/kg - milligrams per kilogram

MS/MSD - Matrix Spike/Matrix Spike Duplicate

MSL - Feet above Mean Sea Level

PADER - Pennslyvania Department of Environmental Resources

ppb - parts per billion

QAPP - Quality Assurance Project Plan

RI - Remedial Investigation

GLOSSARY OF ACRONYMS (continued)

SHSC - Site Health and Safety Coordinator

TAL - Target Analyte List

TCL - Target Compound List

TOC - Top of Casing or Top of Well Cap

TPH - Total Petroleum Hydrocarbon

ug/L - micrograms per liter

USEPA - United States Environmental Protection Angency

USLE - Universal Soil Loss Equation

VOC - Volatile Organic Compound

EXECUTIVE SUMMARY

The Pennsylvania Industrial Chemical Corporation (PICCO) Resin Landfill (the site) is currently owned by Hercules Incorporated (Hercules). It is located approximately one half mile west of the town of West Elizabeth in Jefferson Borough, Allegheny County, Pennsylvania. The landfill covers approximately two acres and is located at the head of a narrow valley on the site of a former coal strip mine. According to Hercules Jefferson plant employees, between 1950 and 1964, the site received an estimated 77,000 tons (estimated by Hercules) of production wastes from the PICCO plant located at 120 State Street, Clairton Pennsylvania. The PICCO plant produced resins which were used in adhesives, floor tiles, paint, plastics, chewing gum, tires and other rubber products which were manufactured by PICCO's customers. These wastes are primarily composed of Clay Poly Cakes and Dechlor Cakes which are neutralization agents (lime) clay and other solids removed by filtration of resin solutions. The filter cakes were composed of approximately 80% water, 10% aromatic solvents and 10% solids at the time of deposition. The original coal was strip mined from the valley, sometime prior to 1950, and approximately 20 feet (average) of waste deposited in its place. None of the waste at the PICCO Resin Landfill was deposited by Hercules. Hercules purchased the business and facilities, including the landfill property in 1973 from PICCO.

Prior to 2 November 1987, the date on which Hercules entered into the Consent Order and Agreement with the Pennsylvania Department of Environmental Resources (PADER) to conduct this Remedial Investigation/Feasibility Study

(RI/FS), two field studies of the site were completed by Roy F. Weston, Inc. (WESTON) and one by Murray Associates for Hercules. Hercules voluntarily conducted these studies.

The previous voluntary investigations indicated the following concerning the environmental conditions at the site:

- The soils and perched groundwater downslope of the landfill contained oily non-aqueous phase product containing volatile organic compounds (VOC) and base neutral/acid extractable compounds which were related to the waste deposited in the landfill.

- Groundwater in the Pittsburgh Coal adjacent to the landfill also contained non-aqueous phase product and chemical constituents similar to those downslope of the landfill.

As a result of these early site investigations, Hercules installed in 1983 a subsurface leachate collection trench downslope of the landfill. This trench effectively intercepted the leachate moving downslope from the landfill.

The purpose of the Remedial Investigation (RI) at the PICCO Resin Landfill site was to complete the characterization of the site for potential remediation. This included the development of a comprehensive understanding of the degree and the extent of contamination of soils, groundwater and surface water associated with the landfill and related activities at the site, as well as the development of an understanding of the character and geometry of the landfill waste. These data were collected and used to prepare an Endangerment Assessment (EA) for the protection of human health and the environment. The results of the EA and the RI were then used to conduct a Feasibility Study (FS), wherein potential remedial actions were

evaluated, remedial alternatives were developed and evaluated against the need to mitigate possible adverse effects of the contaminants from the landfill on the environment, and a preferred alternative for site remediation will be selected based on a wide range of criteria.

The RI field work at the site, which was approved by the PADER and United States Environmental Protection Agency (USEPA) in February 1988 was begun on 17 March 1988 involved three separate phases of field investigation. During the phases the landfill waste, site soils, surface water and sediment from the unnamed stream crossing the site, groundwater, ambient air and the site ecosystem were studied. Each of these was evaluated for potential impact from the landfill.

Based upon the results of the RI the following conclusions have been reached relative to the PICCO Resin Landfill site:

- The volume of waste deposited in the landfill is approximately 53,000 cubic yards or 85,000 tons. The waste in the landfill is overlain by a clayey soil cover ranging in thickness from approximately 5 to 10 feet. A layer of clayey soil was found between the waste at the bottom of the landfill and the bedrock. This soil appears to be impacted by the waste material as evidenced by staining.

- The landfill waste is chemically and physically heterogeneous but generally contains concentrations of benzene, toluene, xylene, ethylbenzene, styrene, naphthalene and 2-methylnaphthalene which compose approximately 1% to 5% of the waste material. Total petroleum hydrocarbon compounds compose approximately 6% of the total waste mass. The remaining 94% of the waste material is composed of water, clay, lime, zinc salts and other solids.

- An evaluation of dike stability, based upon limited data, indicates that the application of additional stresses to the lower landfill dike (ie. the use of heavy equipment on the dike) may result in dike failure. A primary factor in the potential for dike failure is the presence of a localized erosional feature near the middle of the dike. An evaluation of long-term static dike conditions indicate that a potential stability problem also exists for the long-term (ie. a factor of safety less than unity).

- Site soils, downslope of the landfill, contain concentrations of landfill related VOC and BNA in the area between the lower landfill dike and borehole BH-7 (which is located immediately downslope of the oil/water separator). The primary compounds detected in this area were toluene, xylene, ethylbenzene, naphthalene and 2-methylnaphthalene.

- The analytical data of surface water and sediment samples from the unnamed stream draining the site indicate that:

  - VOC and BNA constituents were found in the stream surface water during the period of time that a leachate seep was active above the west end of the interception trench and immediately downslope of the landfill. This seepage was eliminated through the installation of the leachate collection basin which was connected to the existing interception trench. The migration of these constituents, from the leachate seep area, into the surface water was virtually eliminated by this action, based on analysis of bi-monthly stream samples of the unnamed tributary which began September 1989.

  - BNA concentrations exceeding 10 mg/kg are present in the sediments of the stream immediately below the leachate oil/water separator (stream sampling locations S-6 and S-7) as well as along the upstream, intermittent section as seen in the sediment sample from stream sampling location S-8. These concentrations decrease significantly (approach concentrations below detection limits) at sampling locations below the site.

- Groundwater in the shallow unconsolidated zone (soils) downgradient of the landfill contains only trace concentrations of VOC and BNA with the exception of monitoring well TW-9 immediately downgradient of the leachate collection trench. This leachate collection trench sentry well contains higher than trace concentrations of VOC and BNA primarily due to the presence of residual non-aqueous phase product in the well, which was present prior to the installation of the collection trench.

- The deep bedrock below the Pittsburgh Coal seam was composed of a sequence of sedimentary rocks which appears to be unfractured and does not yield sustainable quantities of groundwater.

- The Pittsburgh Coal seam was extensively deep mined in the site area and provides a migration pathway for landfill related constituents to the area southwest of the site. Non-aqueous phase floating product has migrated into the area between the landfill and Circle Glenn Drive. The dissolved-phase plume extends at least to the area of monitoring well TW-19, approximately 1,000 feet downgradient of the landfill.

- The sediment sample collected at Seep-2 which flows from the Pittsburgh Coal seam downgradient of the site in Calamity Hollow, indicates that landfill-related constituents may have intermittently reached the surface at the location of Seep-2.

- Analysis of samples from residential wells in the site area indicate that one residential well (RW-2) contained the VOC constituents 2-butanone and 2-hexanone, at trace concentrations, while a sample from a second residential well (RW-3) contained the BNA constituent di-n-butylphthalate, at a trace concentration. These compounds were detected infrequently and/or sporadically at low concentrations in other samples taken from the landfill site. The source of these contaminants is not known and they are not target compounds at the site. In addition, di-n-butylphalate was detected in the upgradient (background) Pittsburgh Coal monitoring well TW-15. Di-n-butylphalate is a common compound found in the environment from the use of plastisizers.

- The site ecological survey indicated that the unnamed stream crossing the site and the disturbed forest community appeared to be slightly impacted. However, it was not possible to determine if the impact was due to the previous mining activities in the valley or activities related to the construction and operation of the PICCO Resin Landfill. No state or federal endangered or threatened species were identified in the site area.

- The ambient air sampling program indicated that although trace concentrations of VOC were detected near the oil/water separator, no organic compounds, above background, were detected on, above or below the PICCO Resin Landfill.

SECTION 1

INTRODUCTION/PROJECT DESCRIPTION

1.1 SITE BACKGROUND

1.1.1 Site History

The Pennsylvania Industrial Chemical Corporation (PICCO) Resin Landfill (the site) is currently owned by Hercules Incorporated (Hercules). It is located approximately one-half mile west of the town of West Elizabeth in Jefferson Borough, Allegheny County, Pennsylvania (Figure 1-1). A plan view schematic of the site is shown in Figure 1-2. The landfill covers approximately 1.8 acres and is located at the head of a narrow valley on the site of a former coal strip mine. According to Hercules Jefferson plant employees, between 1950 and 1964, the site received an estimated 77,000 tons (estimated by Hercules) of production wastes from the PICCO plant located at 120 State Street, Clairton Pennsylvania. These wastes are primarily composed of Clay Poly Cakes and Dechlor Cakes which are neutralization agents (lime), clay and other solids removed by filtration of resin solutions. The filter cakes were composed of approximately 80% water, 10% aromatic solvents and 10% solids at the time of deposition. However, no contemporaneous records exist of the waste deposited. Table 1-1 presents an estimate of total waste mass and waste composition, based on production estimates. None of the waste at the PICCO Resin Landfill was deposited by Hercules. Hercules purchased the business and facilities, including the landfill property in 1973 from PICCO.

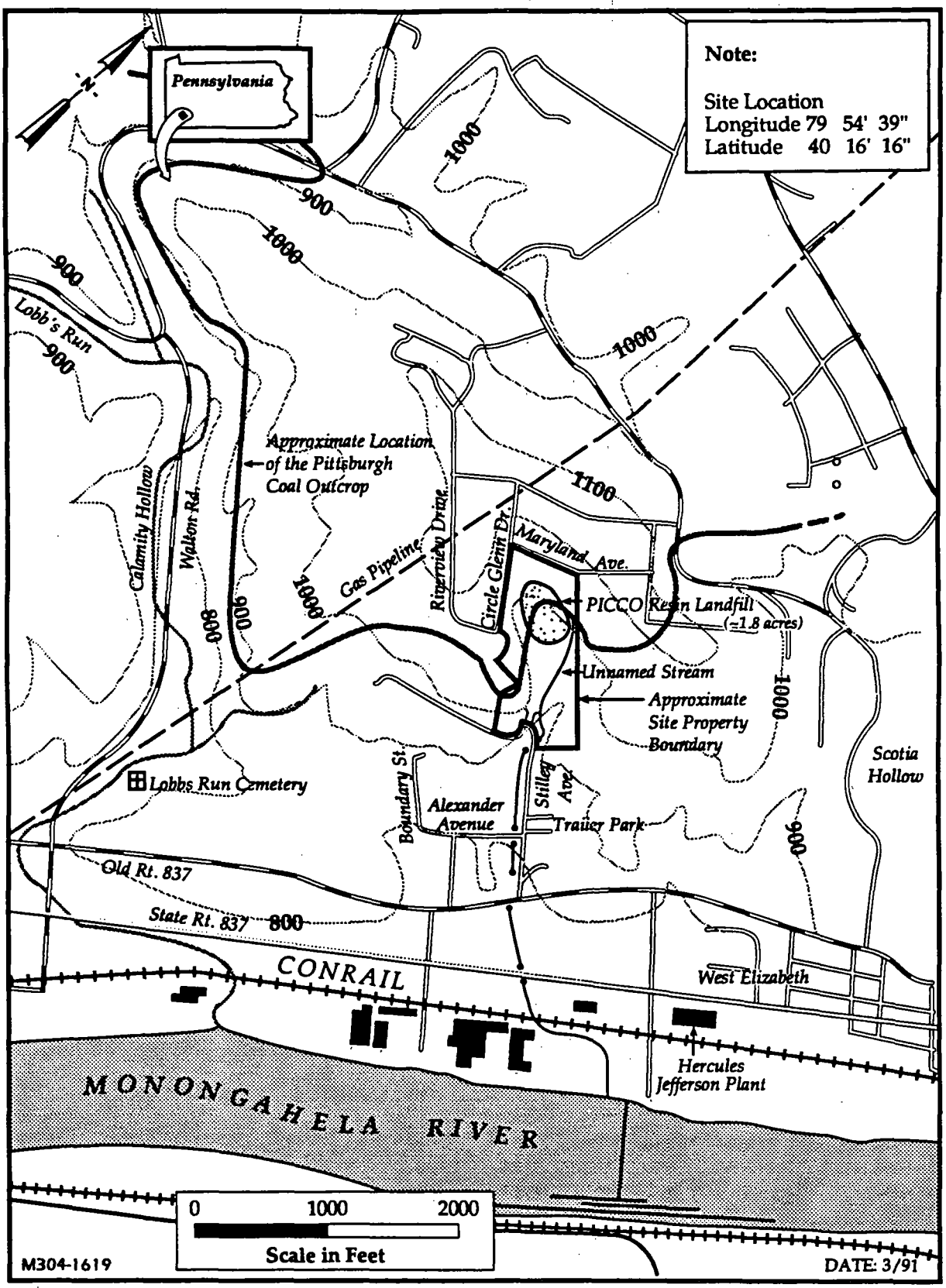

Figure 1-1 Site Location Map for PICCO Resin Landfill, Jefferson Borough, Allegheny, Pennsylvania (Modified from 1979 USGS Topographic Map, Glassport 7.5 minute Quadrangle)

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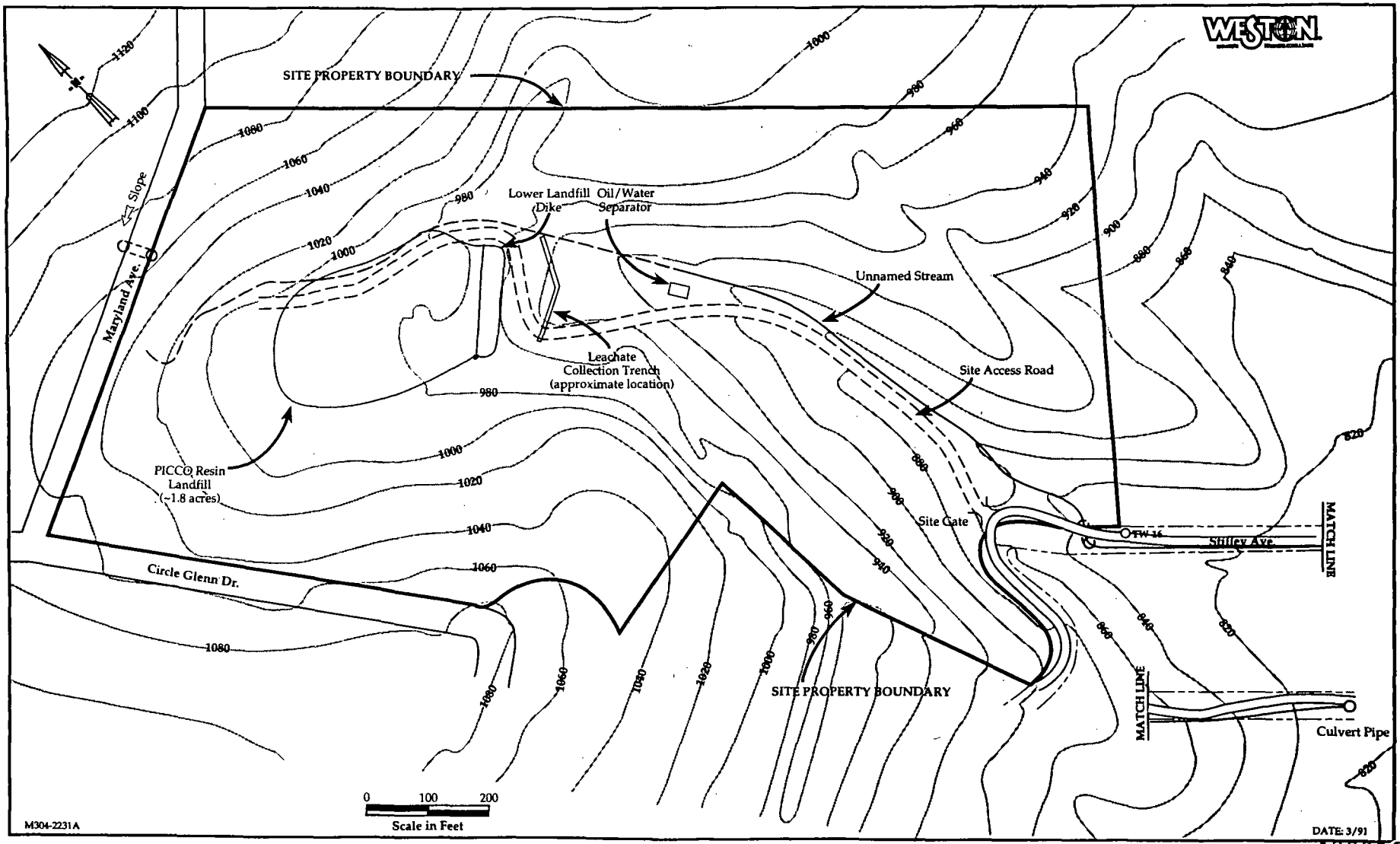

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Figure 1-2 Site Base Map of the PICCO Resin Landfill

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TABLE 1-1

LANDFILL DEPOSITION QUANTITY ESTIMATES

Materials Deposited in PICCO Resin Landfill
Jefferson Borough
1950 - 1964

Material/Composition	Approx. Amount	Description of Process Producing Waste	Quantity Deposited (Tons)
A. Clay Poly Cakes		BF_3 polymerization of hydrocarbon fractions	38,500
Lime			
Filter Aid			
Clay	10%		
Lime Salts of BF_3			
Aromatic Solvent	10%		
Resin			
Water	80%		
B. Dechlor Cake		Residue from treatment of $AlCl_3$ polymerizate to remove residual catalyst.	31,570
Lime			
Clay			
Trace Quantities of Zinc Salts	10%		
Aromatic and Aliphatic Solvents	10%		
Resins			
Water	80%		
C. Emulsion Waste		Resin Emulsification	1,540
Resin			
Emulsifier	30%		
Water	70%		
D. Sludge from Acid Wash		Solvent Refining	1,540
Aryl Sulfonates			
Resins			
Aromatic Solvents			
E. Spent Caustic from Acid Wash		Solvent Refining	3,850
Water			
Sodium Hydroxide			
Sodium Sulfate			
Resins			
Oils			
Aromatic Solvents			
Estimated Total			**77,000 Tons**

The resin products manufactured by PICCO between 1950 and 1964 at their Clairton plant were primarily plasticizers and tackifiers. These resins were used in adhesives, floor tiles, paint, plastics, chewing gum, tires, and other molded rubber products, all manufactured by PICCO's customers.

Products were produced by the polymerization of coal tar chemicals and petroleum distillates (C8 - C10 hydrocarbons) in aromatic naphtha using acid-activated clay, gaseous boron trifluoride or powdered aluminum chloride as catalyst. Resins were also manufactured by polymerization of styrene and styrene derivatives in aromatic or aliphatic naphtha using acid activated clay or gaseous boron trifluoride as the catalyst.

The Pittsburgh Coal was strip mined from the valley, sometime prior to 1949, and approximately 20 feet (on average) of waste deposited in its place. Figure 1-3 presents a schematic cross sectional view of the construction history.

During the period of active landfill use (1950-1964) the waste was deposited by PICCO by dumping down a topographic chute at the corner of Circle Glenn Drive and Maryland Avenue above the landfill, as a wet viscous sludge behind earthen dikes. It was reported that when the area behind the first dike was filled, a second dike was built further downslope, and the area behind it filled (WESTON, 1981a). The existence of this first (upper) dike was not verified in the field. Sometime after the use of the landfill was discontinued, a soil cover, approximately 4-9 feet thick, was placed on top of the landfill. This cover material was apparently derived from native on site soils as evidenced by the presence of coal fragments and the fact that the cover soils type is the same as the other site soils. The cover soils have become vegetated with grasses and volunteer vegetation since its placement.

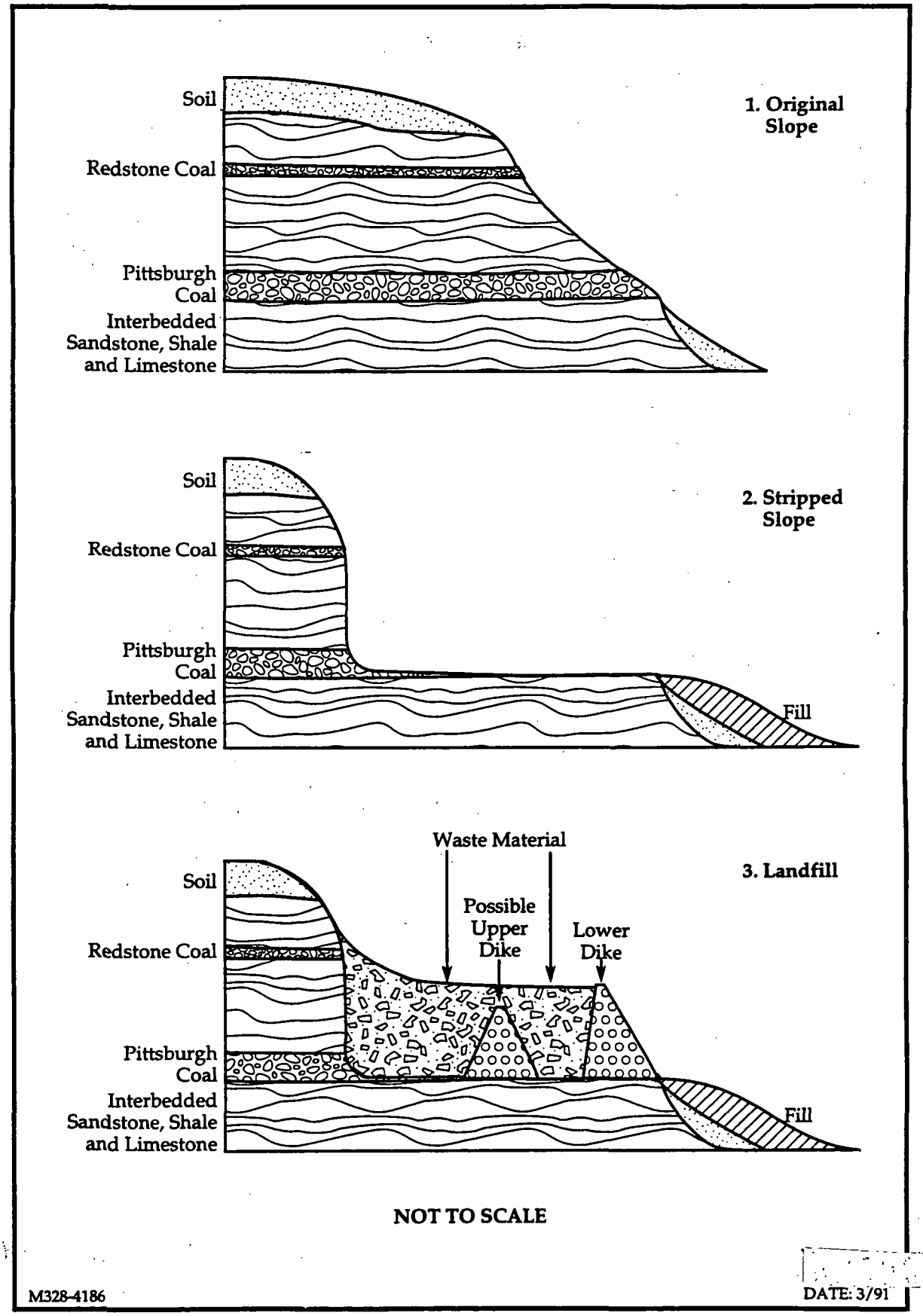


Figure 1-3 Schematic of PICCO Resin Landfill Construction

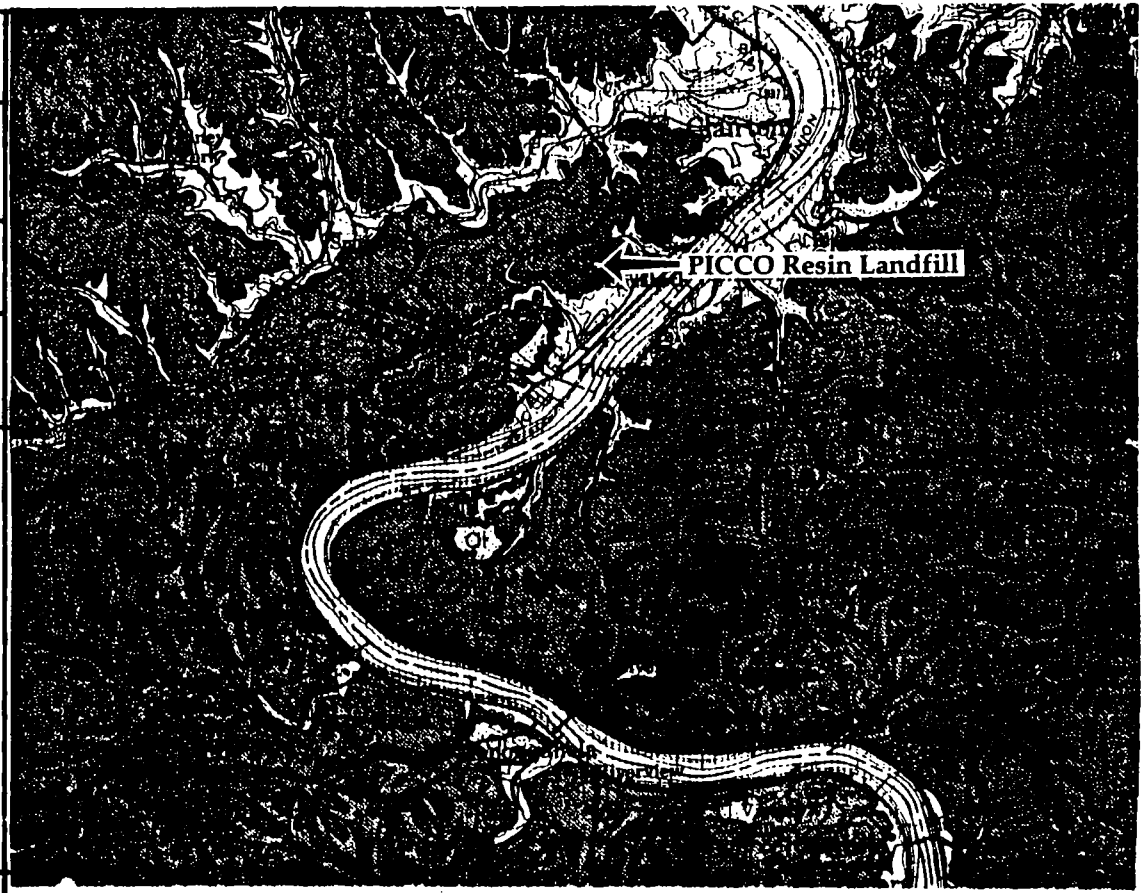
1.1.2 Physiography and Climate

The site is located within the Allegheny Plateau Physiographic Province, in southwestern Pennsylvania in (Socolow, 1962). The topography of the area is characterized as an eroded plateau, with relatively level highlands, dissected by typically narrow, deeply eroded stream valleys. The bedrock underlying the area is sedimentary, consisting of interbedded sandstone, shale, siltstone, limestone and coal. Bedding of these units appears horizontal in outcrop, but is actually gently folded and exhibits dips from one to five degrees in the site area. A geologic map of the site area is presented as Figure 1-4. A detailed stratigraphic column for Pennsylvanian age rocks in Allegheny County is presented in Figure 1-5.

Rocks of the Pennsylvanian age Pittsburgh and Casselman Formations are of primary hydrogeologic interest in the site area. These formations either crop out in the site area or were encountered during drilling. The bottom of the PICCO Resin Landfill is at approximately the same elevation as the base of the Pittsburgh Coal, which was strip-mined from the site prior to 1949 (based upon the aerial photograph review). The Pittsburgh Coal is the marker bed for the bottom of the Pittsburgh Formation and has been extensively deep mined in the area surrounding the site.

The Pittsburgh Coal is the most recognizable geologic unit in the site area. It occurs at an elevation of approximately 950 feet above mean sea level (MSL) in the site area. The unit is gently folded, and lies within the southwest-plunging Murrysville-Roaring Run Anticline (Wagner, et al., 1975). The landfill site is

GROUP	FORMATION		DESCRIPTION
	Alluvium Terrace deposits	Qt	Sand, gravel, clay. Sand, clay, gravel on terraces above present rivers; includes Carmichaels Formation.
DUNKARD	Greene		Cyclic sequences of sandstone, shale, red beds, thin limestones and coals.
	Washington	Pw	Cyclic sequences of sandstone, shale, limestone, and coal; contains Washington coal bed at base.
	Waynesburg		Cyclic sequences of sandstone, shale, limestone and coal; contains Waynesburg coal bed at base.
MONONGAHELA			Cyclic sequences of shale, limestone, sandstone and coal; contains Pittsburgh coal bed at base.
CONEMAUGH	Casselman	Pcc	Cyclic sequence of sandstone, shale, red beds and thin limestone and coal.
	Ames		
	Glenshaw	Pcg	Cyclic sequences of sandstone, shale, red beds and thin limestone and coal; several fossiliferous limestone; Ames limestone bed at top.



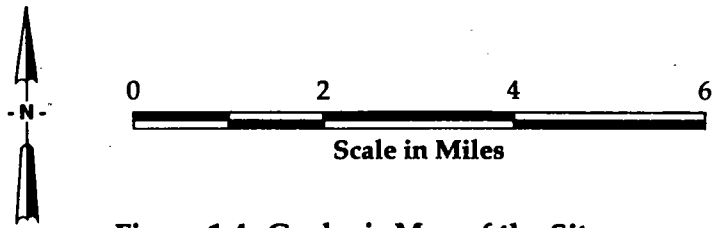


Figure 1-4 Geologic Map of the Site Area, PICCO Resin Landfill (from Wagner, et al., 1975)

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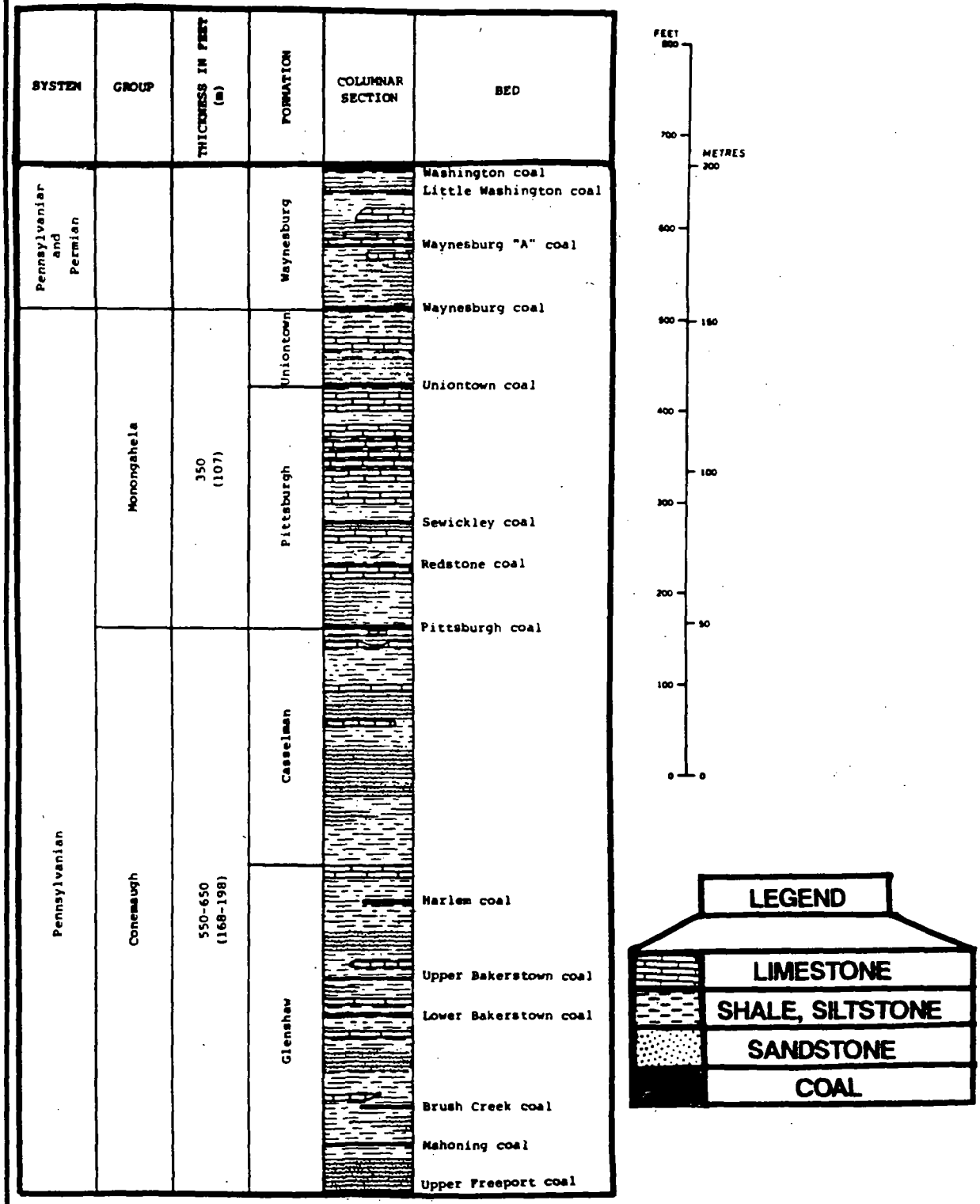

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Figure 1-5 Detailed Stratigraphic Column for a Portion of the Pennsylvanian Rocks in Allegheny County, Pennsylvania (From Davies, et al., 1976)

located near the nose of the anticline where the beds dip to the southwest, as shown on Figure 1-6. Figure 1-6 also shows the outcrop of the Pittsburgh Coal along the valley slopes of the area.

The hills surrounding the site are immediately underlain by a relatively thin (<20 feet thick) mantle of clayey soil lying upon rocks of the lower Pittsburgh Formation and the upper Casselman Formation. Figure 1-7 is a generalized geologic cross-section of the site area. This cross-section was constructed from borehole data and field observations of rock outcrops. Since this cross-section does not cross the axis of the Murraysville-Roaring Run Anticline, the bedding is shown dipping only to the southwest, towards Lobb's Run.

Figure 1-8 illustrates the soil types at the PICCO Resin landfill. The soils at the site consist of both native and strip mine soils. The native soils at the site are classified as the Dormont Silt Loam series, with reported slopes ranging from 8 to 25 percent. A minor amount of Gilpin Silt Loam soils has been mapped in the southern portion of the site area. Reported slopes for these soils are from 8 to 15 percent. The majority of the soils at the site are classified as Strip Mines soil, with high slopes resulting from past strip mining, and are a mixture of disturbed native soils and fragments of excavated bedrock. A qualitative evaluation of soils loss and erosion using the Universal Soil Loss Equation on the site is provided in Section 3.

The climate in the Allegheny Plateau of southwestern Pennsylvania is classified as a humid continental type, with long, hot summers and severe winters. This classification is based on the Modified Koepper Climate Classification System (NOAA, 1974).

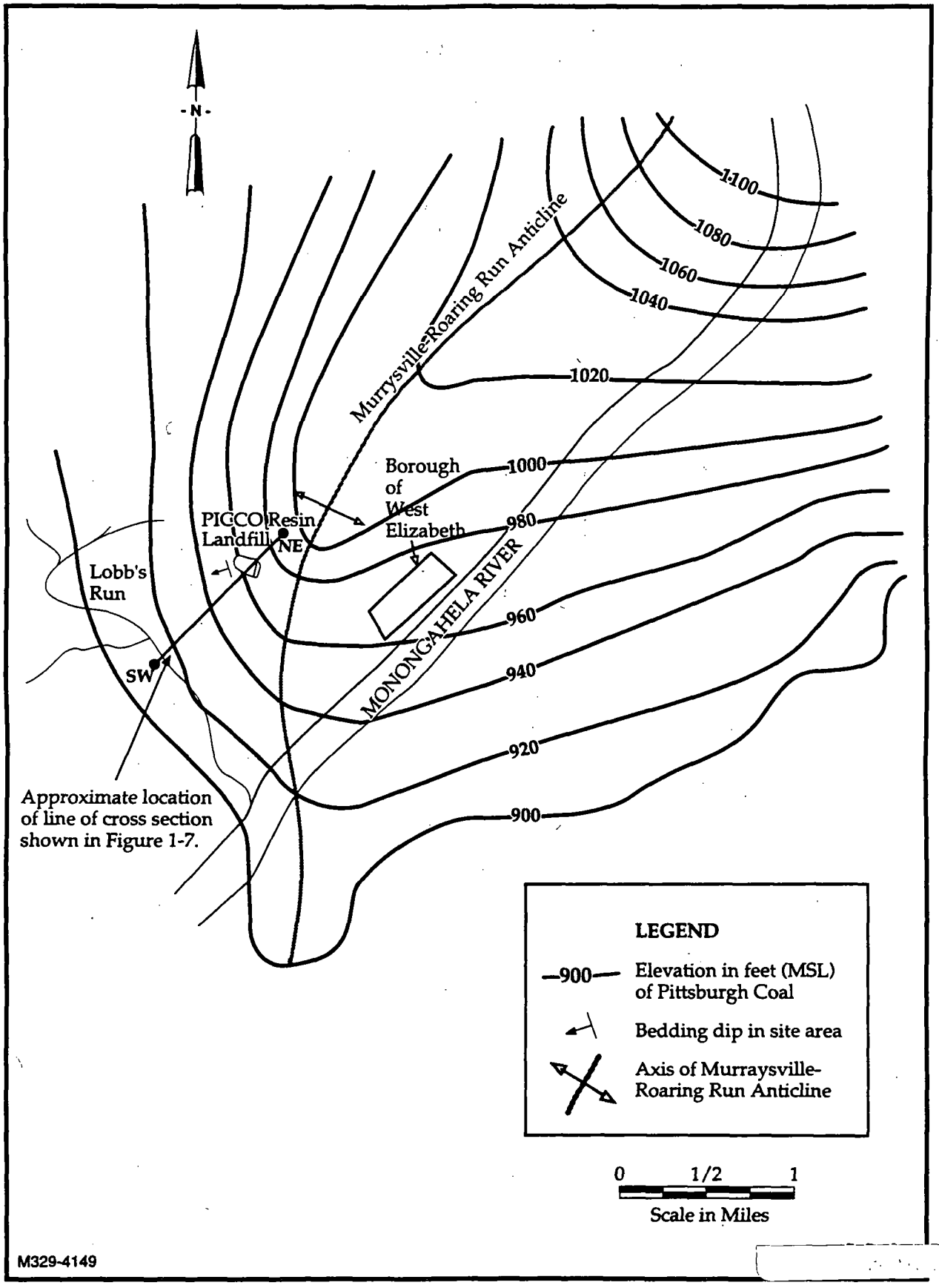

Figure 1-6 Structural Contour of the Top of the Pittsburgh Coal (Modified from Wagner, et al., 1975), PICCO Resin Landfill

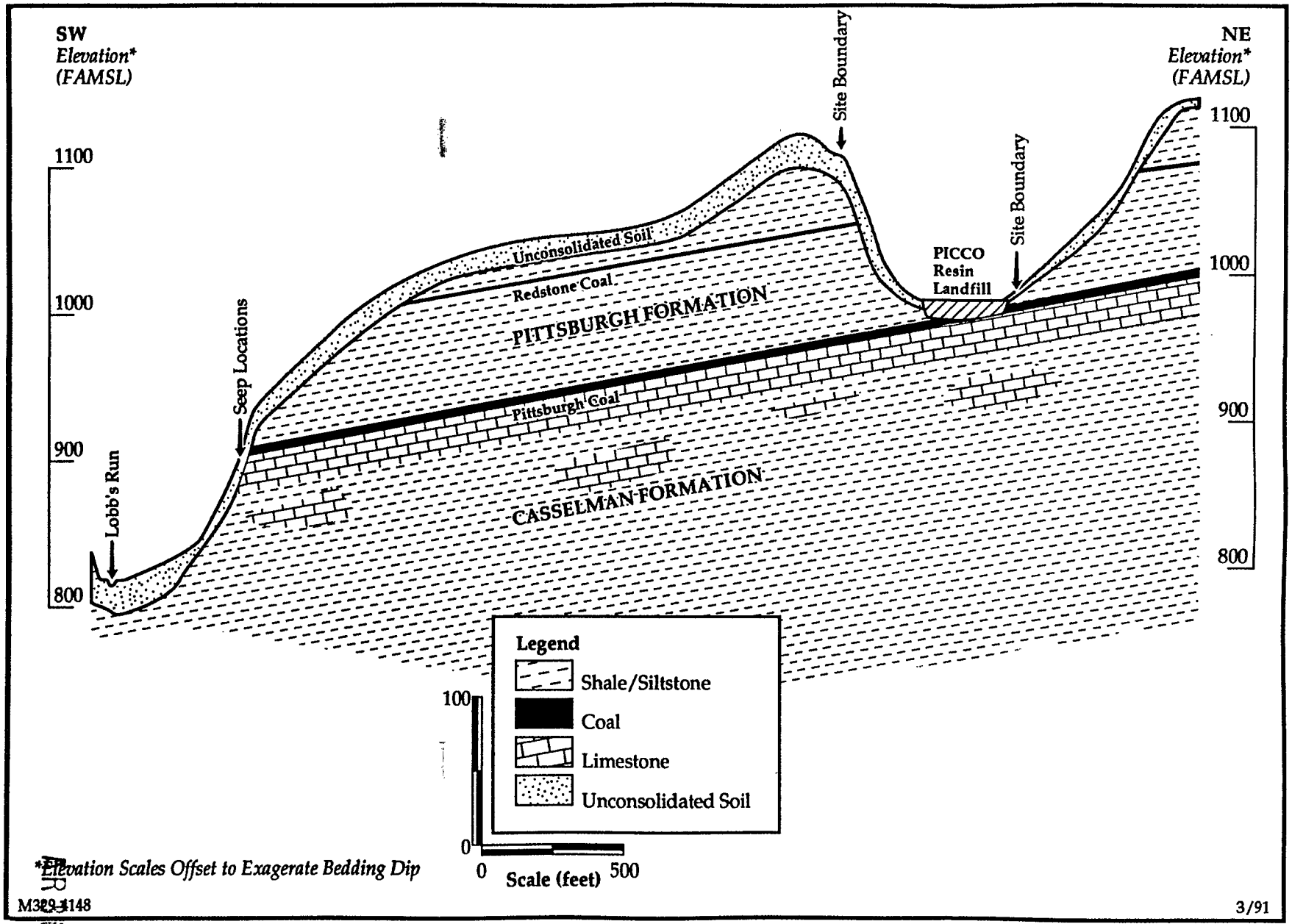

Figure 1-7 Generalized Geologic Cross-Section from Northeast to Southwest Across the: PICCO Resin Landfill Site Area

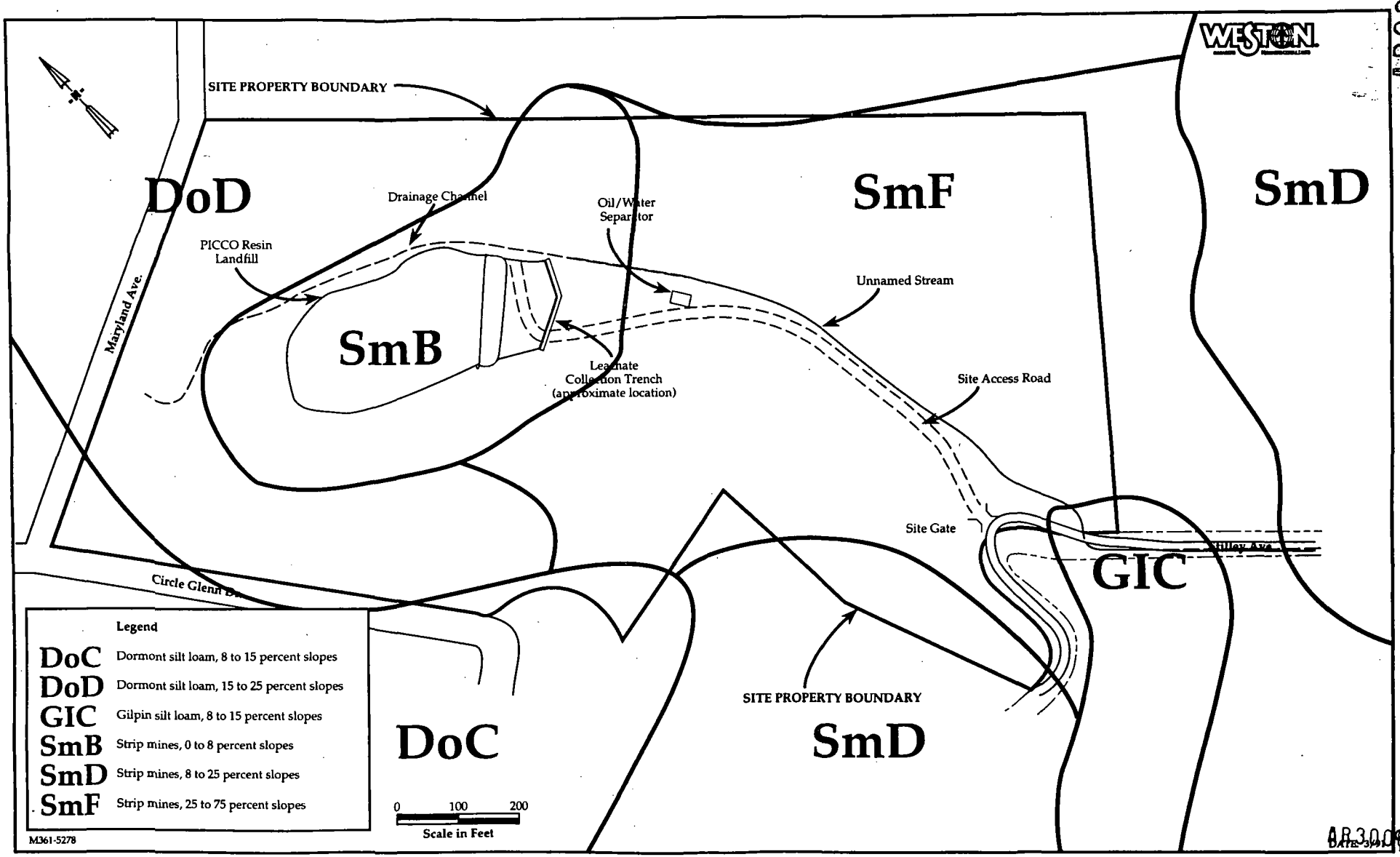

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Figure 1-8 Site Soils Map for the PICCO Resin Landfill (from USDA, SCS, 1981)

Summers are generally warm, averaging about 75° Fahrenheit. High temperatures of 90°F or greater occur on the average of 10 to 20 days per year. Winter temperatures average about 33°F. The first frost generally occurs in late October, with the last frost in mid-April. The greatest amounts of precipitation usually occur during the spring and summer months, while February is the driest month. Total snowfall averages about 45 inches, with total precipitation averaging 37 inches per year.

Prevailing westerly winds carry most of the weather systems that affect western Pennsylvania from the interior of the United States. Storm systems originating over the Atlantic Ocean have only limited influence upon the area. Thunderstorms, which average between 30 to 35 per year, occur mostly in the warm months and are the source of most of the summer rainfall. Dry periods may develop occasionally and persist for several months, reducing monthly precipitation to less than one-quarter inch. These periods are not confined to any particular season of the year (NOAA, 1974).

The site area lies approximately 5/8-mile northwest of the Monongahela River. Surface water drains toward the river by way of an unnamed stream which originates on the site. This stream flows downslope through the town of West Elizabeth, through several culverts and ponds, and crosses Hercules Jefferson Plant, eventually draining into the Monongahela River approximately 5/8-mile from the site boundary. Other streams discharging to the Monongahela River in the site area include Lobb's Run to the west and an unnamed stream in Scotia Hollow to the east. The streams in the site area generally appear to be discolored, probably due to runoff from the area coal mines. Floods along the Monongahela Ri[illegible] occur during any month of the year, although they occur most commonly during [illegible]

the spring months. Generally, the most widespread flooding along the river occurs during the winter and spring as a result of heavy rains and/or snowmelt. The landfill area is not affected by flooding along the river due to its high elevation with respect to the normal river level.

1.1.3 Land and Water Use in the Site Area

The site is surrounded by a suburban residential area to the north and west and by undeveloped property to the south and east. The land east of the site was extensively deep-mined and strip-mined, and was also used by the U.S. Bureau of Mines as an experimental study area for an underground mine fire control project (Irani, et al., 1983). A trailer park and several residential homes are located approximately 1/4-mile southeast and downslope of the site. Further to the southeast and east lies the town of West Elizabeth, a mixed commercial, industrial and residential area. According to U.S. Census Bureau 1990 records, the population within a one-mile radius of the site is approximately 1,819. Current land use in the site area is primarily residential and agricultural/grazing. Much of the land in the immediate site area is either wooded and is not currently used or has been strip-mined and reclaimed. Figure 1-9 illustrates the land use patterns in the site area.

The small streams draining the site area and flowing to the southeast are generally not navigable. Recreational uses of the smaller streams are probably limited, due to the impacts of acid mine drainage in the area. The Monongahela River is commonly used for boating, barge traffic and recreation.

Figure 1-9 Land Use Map for the Site Area
PICCO Resin Landfill

The communities surrounding the site have access to a sanitary sewer and a public water supply. A section of the sanitary sewer line runs along the northeastern edge of the site parallel to the unnamed stream. Most homes in the site vicinity are connected to the public water supply system. Some residents continue to maintain their old wells for an additional supply of water.

The major sources of groundwater in the area are alluvial aquifers in the river and stream valleys. In the site area, groundwater supplies are limited to storage in fractured bedrock or within the unconsolidated soils above the bedrock. Quantities of groundwater in the bedrock at the site are relatively small. Water-bearing zones are generally discontinuous (except within the Pittsburgh Coal), due to the generally unfractured condition of the bedrock in the immediate site area.

The unconsolidated soils at the site contain perched groundwater above the soil/bedrock interface. This perched groundwater unit is approximately two to four feet thick at the site. Movement of groundwater in the unconsolidated zone generally follows the topographic surface.

Quantities of groundwater sufficient for domestic water supplies, apparently exist in the area surrounding the site as evidenced by the presence of drilled wells and a few old hand-dug wells in the site area. Most of the residents in the site vicinity are supplied with public water by the Western Pennsylvania Water Company. A well survey in the site area indicated that four residents were not connected to the public water system at the time of the survey and were using groundwater as their primary source of water. Additional information related to groundwater use in the site vicinity is presented in Section 2 of this report.

The Pittsburgh Coal, being moderately permeable due to cleat (vertical fractures) development and mining activities, also contains groundwater, although groundwater in coal seams is generally considered non-potable due to its acidic nature and high concentration of metals. The groundwater flow in the Pittsburgh Coal tends to be in the direction of bedding dip.

1.1.4 Previous Site Investigations

1.1.4.1 General

Prior to 2 November 1987, the date on which Hercules entered into the Consent Order and Agreement with the Pennsylvania Department of Environmental Resources (PADER) to conduct this RI/FS, two field studies of the site were completed by Roy F. Weston, Inc. (WESTON) and one by Murray Associates for Hercules.

This section summarizes the specific field activities conducted by Hercules to investigate groundwater and soil conditions at the landfill site, prior to the initiation of the RI/FS. A series of field investigations was conducted between 1980 and 1984 that provided information in the following areas:

- Bedrock groundwater conditions in the Pittsburgh Coal water bearing zone.
- Bedrock groundwater conditions in the deep bedrock

- Shallow groundwater conditions in the soils downslope of the landfill toe.

- Soil conditions and the extent of contaminated soil downslope of the lower landfill dike.

Listed below is the chronology for the various stages of site investigation prior to this RI/FS:

1980 - Installation of four ground water monitoring wells (TW-1 through TW-4) (see Appendix A) and preparation of a PADER Module 8 (a module for a hydrogeological study required for facilities of regulatory concern; submitted to PADER October 6, 1980, prepared by Murray Associates).

1981 - Soils and groundwater investigation downgradient of the landfill toe and adjacent to the lower dike (WESTON Reports, November and December 1981).

1982 - Installation of deep bedrock monitoring wells TW-5 and TW-6 (see Appendix A) (logs submitted to PADER by WESTON, August 1985). Installation of landfill piezometer P-1.

1983 - Installation of a subsurface leachate collection trench drain system below the landfill dike to intercept and collect any leachate flow or seeps in the overburden below the landfill. Liquids collected by the leachate collection trench are piped to a separation unit where oil is recovered and the aqueous portion of the leachate is discharged to the West Elizabeth Sanitary Authority (WESA) wastewater treatment plant and discharged under NPDES Permit # PA0022331.

1983 - Installation of well TW-8 (see Appendix A) to monitor groundwater quality in bedrock downslope of the interception system.

1984 - Installation of monitoring wells TW-9, TW-10 and TW-11 into the overburden below the leachate collection trench to monitor the performance of the leachate collection trench. Installation of downgradient Pittsburgh Coal monitoring well TW-7 (see Appendix A).

1.1.4.2 Soils and Shallow Groundwater Investigation

During 1981, WESTON conducted a soils investigation in the valley, downslope of the lower landfill dike, to determine the extent of contamination. The investigation consisted of the installation of twelve test pits and eleven soil borings. Temporary PVC ground-water monitoring points were installed in six of the test pits and a temporary oil recovery point was installed at one location (TP-5). Monitoring well TW-1, installed in 1980 downslope of the lower dike below the separation tanks, was also screened in the shallow water table. Monitoring wells TW-9, TW-10 and TW-11 were installed in 1984 into the shallow water table downslope of the lower dike, after the installation of the leachate collection trench, to monitor the performance of the trench. The locations of the test pits and monitoring wells from the previous investigations are shown on Figure 1-10, and a site detail showing the soil boring locations from the previous investigations is presented on Figure 1-11.

1.1.4.3 Bedrock Monitoring Wells

As part of the past field work at the site, seven bedrock monitoring wells were installed at the landfill site. These wells were installed in two stages: TW-2, TW-3 and TW-4 were installed in 1980, and TW-5 through TW-8 were installed between 1982 and 1984. The locations of these wells are shown on Figure 1-10.

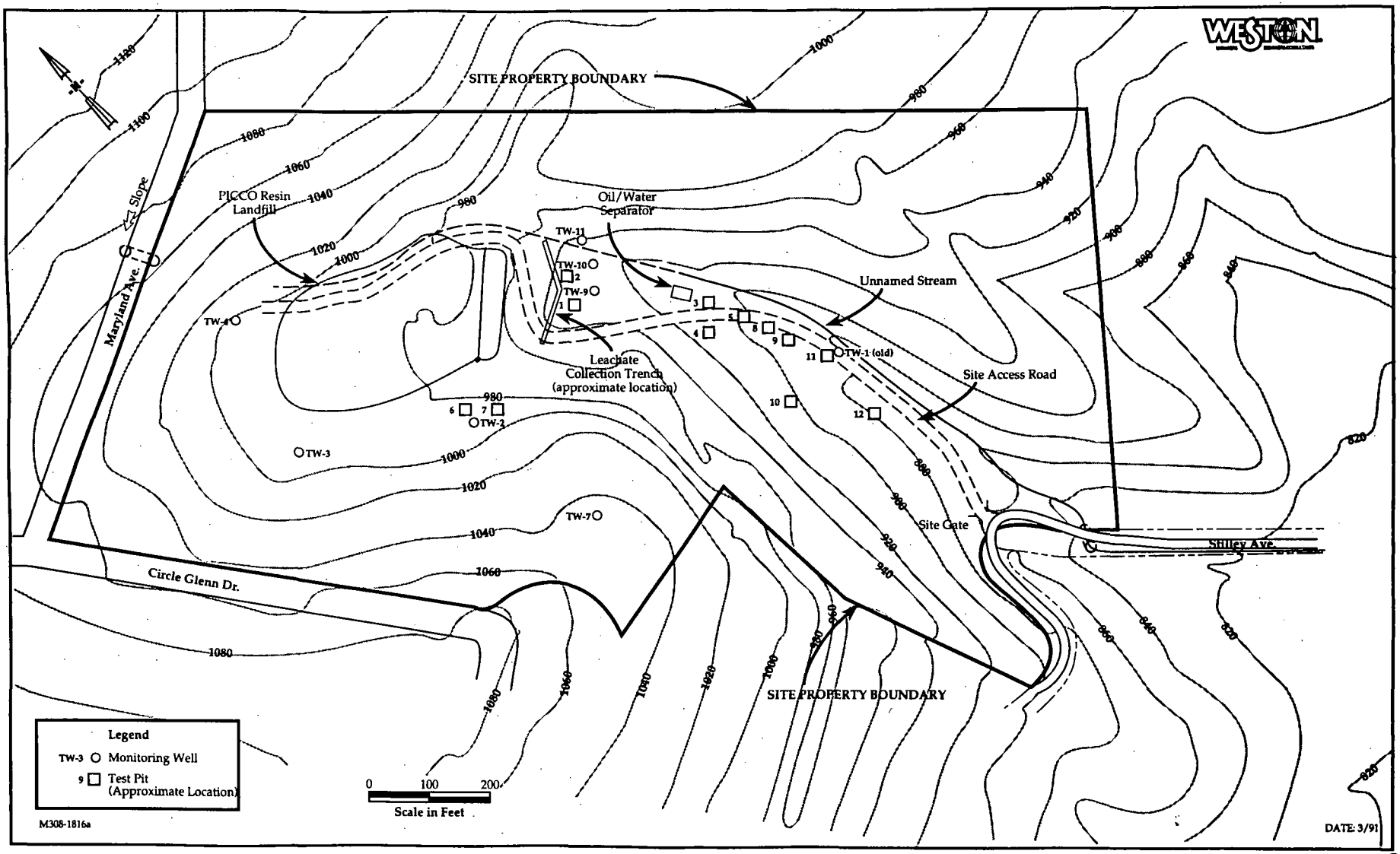

Figure 1-10 Locations of the Test Pits and Groundwater Monitoring Points from Previous Investigations, PICCO Resin Landfill

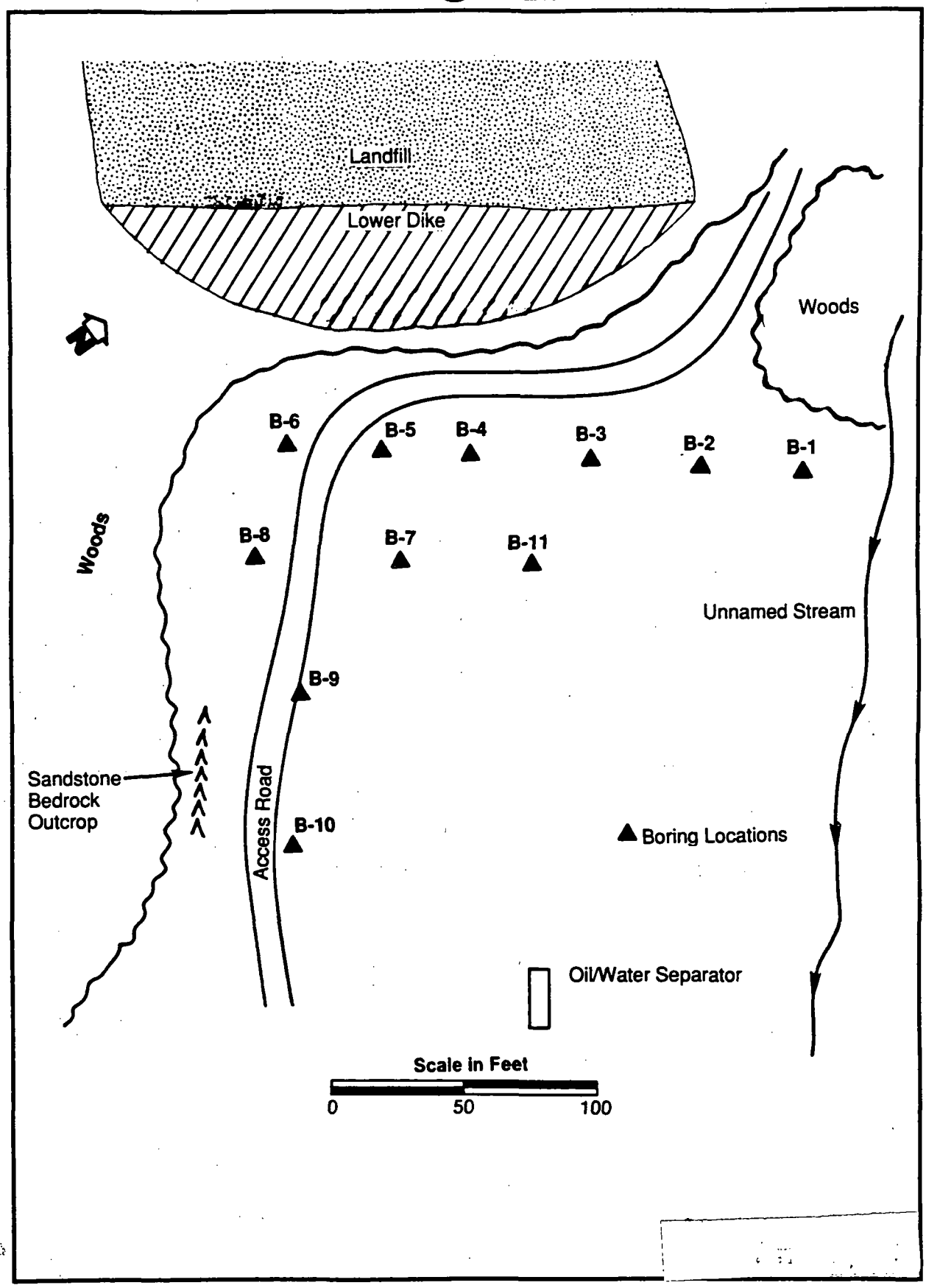

Figure 1-11 Locations of Previous Investigatory Soil Sampling Points (from Weston, 1981b), PICCO Resin Landfill

Monitoring wells TW-2, TW-3, TW-4 and TW-7 are cased and screened in the Pittsburgh Coal, which is the principal water bearing zone within the bedrock. Monitoring wells TW-5 and TW-6 were cased through the Pittsburgh Coal and have open boreholes below the casing to depths of 200 feet and 290 feet, respectively. The bedrock below the Pittsburgh Coal is composed of a hard grey shaley limestone, approximately 30 feet thick, which grades into a sequence of interbedded shale and limestone which is also approximately 30 feet thick. These units are underlain by a sequence of interbedded grey and red shale and siltstone with an occasional thin sandstone interbed. This clastic sequence is at least 225 feet thick below the site area. Both of the deep bedrock wells were dry at completion, although over the period of several weeks, water slowly accumulated in both. Monitoring well TW-8 was located downslope of the landfill (below the Pittsburgh Coal) and was cased through overburden soils: TW-8 is 40 feet deep (completed to 892.04 feet above Mean Sea Level (MSL)) with an open borehole through bedrock, from 26 to 40 feet and was also dry at completion. Monitoring well TW-8 was placed to discover whether fractured bedrock along the valley axis provided a pathway for landfill related contaminants to migrate from the landfill. The results indicated that this was not occurring. Monitoring well TW-8 was properly abandoned, prior to the initiation of the RI/FS, due to the fact that it was a dry well. It was abandoned by filling with a cement grout to the surface as documented in a letter dated 16 May 1989 from Mr. William Beers of WESTON to Mr. William Bailey of PADER.

1.1.4.4 Previous Site Investigation Results

The boring logs associated with well installation provided information on-site lithology and groundwater occurrence. Generally these logs showed that bedrock

consists of interbedded limestone, shale and sandstone with two major coal seams: the Pittsburgh Coal and the overlying Redstone Coal. The base of the landfill is at approximately the same elevation as the Pittsburgh Coal, a relatively permeable unit which is partially saturated. The rock above and below the Pittsburgh Coal contains very little groundwater at the site. No water bearing fractures were observed during the drilling of the two deep bedrock wells TW-5 and TW-6. Frequent pauses were made during the progress of the air rotary drilling of these wells to check for water bearing zones. Water level measurements in monitoring wells TW-2, TW-3 and TW-4 indicate that the 5-foot thick Pittsburgh Coal is only partially saturated and contains from 1 foot to 3 feet of groundwater.

A discussion of valley soil conditions is presented in WESTON's 1981 reports. In general, soils encountered in the valley consist of silty clays overlain by various fill soils of local origin. Most of the soils on-site were disturbed by the mining and construction activities which occurred through the years. The bedrock surface was encountered at depths between 10 and 29 feet below ground surface (BGS) during the 1981 WESTON studies at boreholes B-5 and B-7, respectively. Bedrock crops out at the surface along the steeper sections of the valley wall.

A perched groundwater table occurs in the valley soils below the landfill at depths varying from approximately 2 to 9 feet. This shallow groundwater was believed to be continuous and at approximately the same elevation as the unnamed stream crossing the site. The underlying bedrock contains little or no water as determined by two deep borings into the bedrock below the Pittsburgh Coal.

Oily resin/solvent product was found in both valley soils below the landfill dike and perched groundwater during the initial investigation. The extent of visible

contamination below the landfill was along the valley floor, from the landfill toe to approximately the location of TW-1. Visibly contaminated soils displaying oil staining, were found in test pit 11 but not in test pit 12 (approximately 75 feet downslope of TW-1, see Figure 1-10). Non-aqueous phase floating product was observed in several of the borings and test pits, with the greatest quantity observed found in test pit number 5 (TP-5). Consequently, a 6-inch slotted casing was installed in TP-5 prior to backfilling and several hundred gallons of product were later recovered.

In July 1981 groundwater samples were collected from monitoring wells TW-1, TW-2, TW-3, and TW-4. Complete analyses for USEPA Priority Pollutant compounds were performed on these groundwater samples. Table 1-2 summarizes several organic compounds which were identified at elevated levels in the groundwater samples. Identified were phenolics, the volatile organic compounds (VOC) benzene and toluene, and the base/neutral extractable compound (BNA), naphthalene. The laboratory reports for these analyses are included in the PICCO Resin Landfill RI/FS Work Plan (WESTON, 1987). These compounds were found in all of the wells sampled. Naphthalene and phenanthrene were found in the landfill leachate which was collected from an oil/water separator below the lower landfill dike (WESTON, 1987). Only monitoring well TW-2, which is screened in a mine void, contained separate-phase floating product. The results indicate the presence, in the monitoring wells, of a limited number of dissolved constituents whose probable source was determined to be the landfill. Monitoring well TW-4, which is located adjacent to the landfill on the upgradient side, showed the lowest concentrations of these key constituents.

TABLE 1-2

GROUNDWATER QUALITY SUMMARY FROM PREVIOUS INVESTIGATIONS, PICCO RESINS LANDFILL

	TW-1 7/7/81 (4/28/82)	TW-2 7/7/81 (4/28/82)	TW-3 7/9/81 (4/28/82)	TW-4 7/9/81 (4/28/82)
pH	6.9	6.3	7.4	7.3
Phenolics (ug/l)	40	450	1300	20
VOA (ug/l)				
Benzene	124 (77)	109 (200)	446 (1700)	6 (38)
Toluene	8 (130)	535 (870)	846 (3600)	11 --
B/N (ug/l)				
aphthalene	(170)	(440)	(1900)	(29)

Not detected

Version No. 2
3/26/91

The data collected during the previous investigations indicated that migration of contaminants beyond the buried waste material had occurred via two primary pathways: in groundwater down-dip in the Pittsburgh Coal, and downslope of the landfill toe in the valley soils and the perched water table. The types of migration are as follows:

- Landfill toe-seepage of contaminated water and resin/solvent product into the shallow perched water below the landfill dike. This perched water is currently being collected by the leachate collection trench, the performance of which is monitored by wells TW-9, TW-10 and TW-11.

- Movement of contaminants from the waste material into the groundwater within the Pittsburgh Coal, with possible migration down-dip within the Pittsburgh Coal.

- Solubilization of contaminants from any product or oil in soils downslope of the leachate collection trench; contaminants could then potentially move into the perched water table or stream.

The results of the previous field investigations indicated that the extent of soil and groundwater contamination in the valley by non-aqueous phase product was limited to the area immediately downslope of the lower landfill dike and to an area upslope of monitoring well old TW-1 (this well was replaced during Phase I of the RI/FS). Non-aqueous phase product was also present on the water surface in monitoring well TW-2 (screened in a mine void). The extent of migration of nonaqueous phase product in the Pittsburgh Coal appeared to be limited to mined out areas immediately adjacent to the landfill.

The nature of the waste in the landfill was inferred from the production records of the plant (Table 1-1) since no direct characterization of waste had been made prior

to the RI/FS. Although no chemical analysis of the waste had been performed prior to the RI/FS, the oily leachate being collected by the interception system was analyzed and represented a relatively uniform composite of mobile constituents. An analysis of base/neutral compounds in the leachate non-aqueous phase product indicated the presence of naphthalene and lighter benzene compounds (WESTON, 1987).

1.1.5 Previous Remedial Work

Prior to the 1981 WESTON field studies at the site, an oil/ water separator was installed downslope of the toe of the lower dike in order to treat leachate which was seeping from the soils from below the dike. Leachate, in the form of surface seeps, was directed into the oil/water separator where the non-aqueous phase product (oil) was removed from the leachate and transported from the site.

As a result of the field investigation of 1981, WESTON recommended to Hercules that a leachate collection trench be installed below the lower landfill dike to collect leachate and groundwater downgradient of the lower dike. This trench was subsequently installed (in 1983) and was keyed into the shallow underlying bedrock so that a complete interception of seepage was achieved. Figures 1-12 and 1-13 show the cross sectional design detail of the leachate collection trench and the collection elements of the trench respectively. Liquids collected in the trench were sent through the oil/water separation tanks. Presently, the oil which is collected is burned at the Hercules Jefferson Plant boiler and the water phase collected from the leachate collection system is being discharged through the Jefferson Borough Sanitary Sewer System to the West Elizabeth Sanitary Authority extended aeration treatment plant under a contractual agreement approved by PADER.

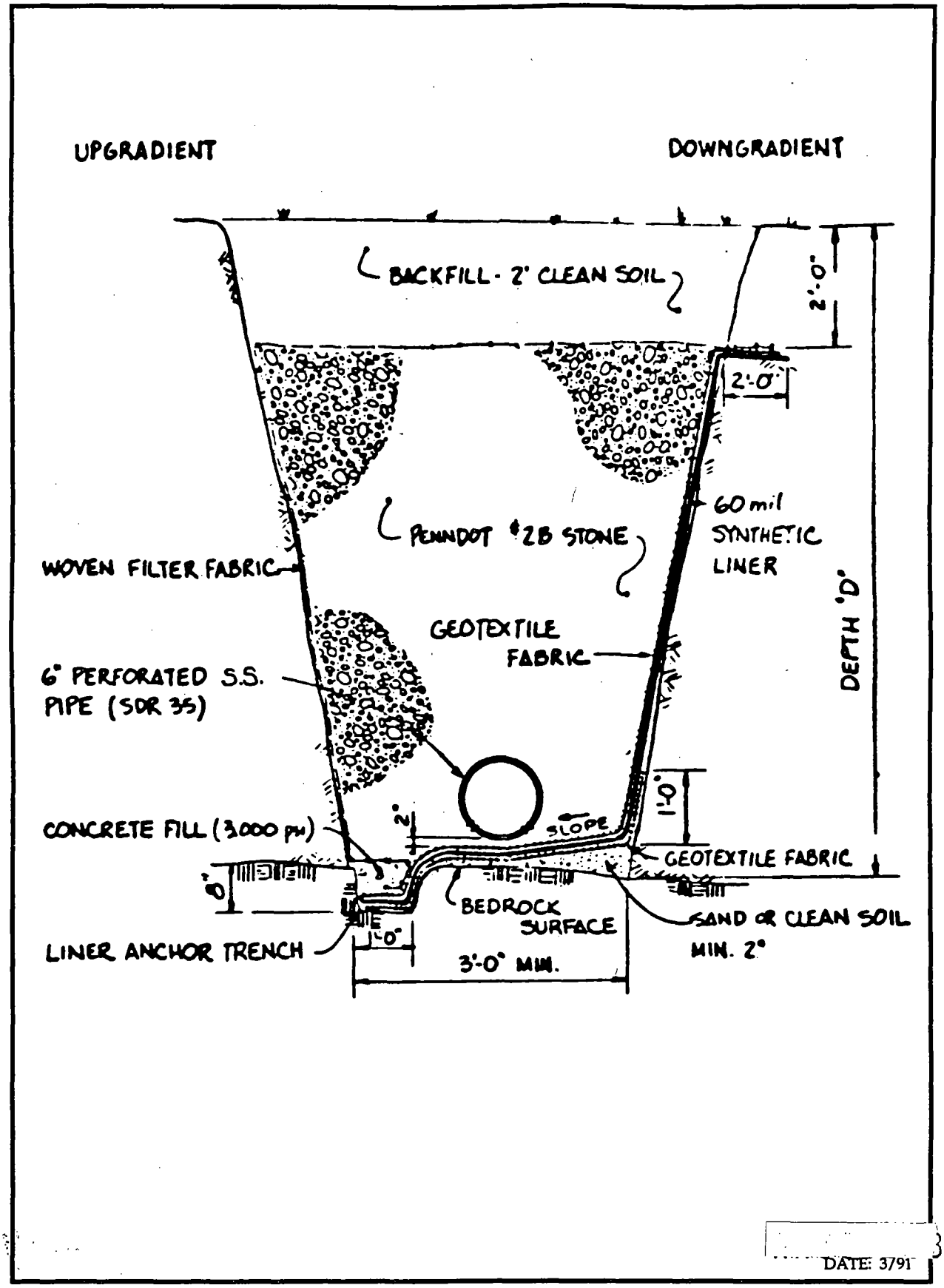

Figure 1-12 Cross Section of Interception Trench Design, PICCO Resin Landfill (From Weston, 1982)

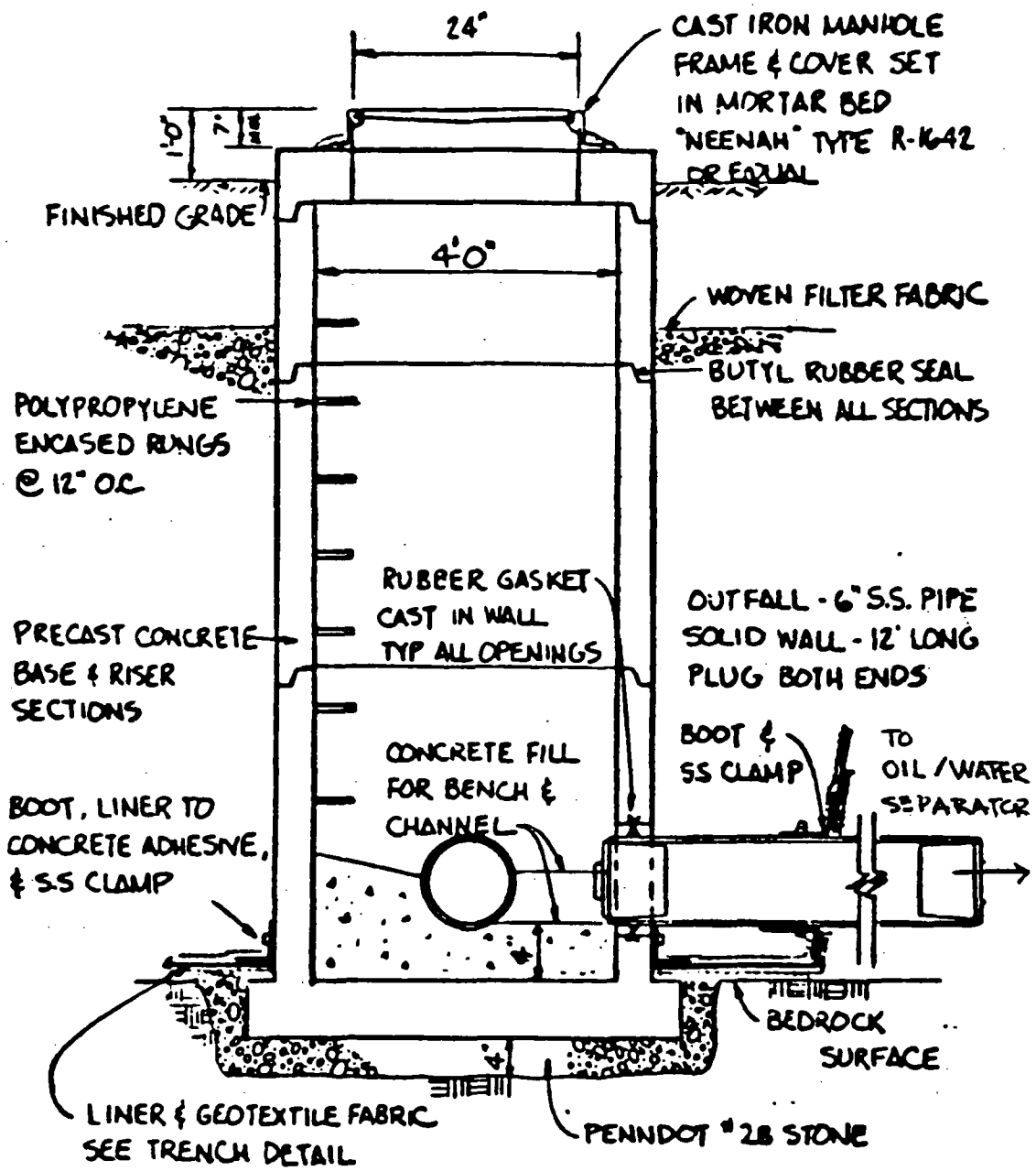

Figure 1-13 Cross Section of Interception Trench Manhole and Outfall Pipe Design, PICCO Resin Landfill (From Weston, 1982)

In August 1989 a collection basin approximately 10 feet by 10 feet by 5 feet deep was installed to accommodate a leachate surface seep which had appeared approximately 10 feet upgradient from the existing leachate collection trench on the west end of the trench. A collection pipe was installed from this basin downslope to the original leachate collection trench. Upon completion of the modification, the surface seep was eliminated. This collection basin was installed in accordance with addendum No. 1 to the RI/FS Work Plan and resulted in the improvement of the water quality of the unnamed stream draining the site. This improvement is documented by the results of the bimonthly stream samples collected subsequent to the addition of the collection basin which are discussed in Section 3.

In addition to the collection trench which passively collects leachate there have been efforts to recover non-aqueous phase product from monitoring wells which were found to contain product. Using a bailer or a pump, small amounts of product have been intermittently recovered from monitoring well TW-9 (downgradient of the collection trench). No product has been observed in well TW-9 since September 1989 and therefore monitoring for the presence of non-aqueous phase product was discontinued in July 1990. Non aqueous phase product was also recovered from the well installed in test pit No. 5 during the early 1980's. It is believed that the non-aqueous phase product which was in TW-9 was a pre-existing condition to the interceptor trench installation and does not indicate a pathway through or around the trench. These efforts appear to have been effective in removing the limited quantities of non-aqueous phase product which were present in the area of these wells prior to the installation of the leachate collection trench.

Prior to the 1981 field investigations a small drainage channel was constructed along the western side of the landfill in order to divert stormwater runon and limit the amount of infiltration which occurs on the landfill. This drainage channel was widened and deepened in early 1989 by Hercules engineering after Hercules discovered the channeled water was entering an underground channel near the landfill.

1.2 PURPOSE AND SCOPE

The purpose of the Remedial Investigation (RI) at the PICCO Resin Landfill site is to complete the characterization of the site for potential remediation. This includes the development of a comprehensive understanding of the degree and the extent of contamination of soils, groundwater and surface water associated with the landfill and related activities at the site, as well as the development of an understanding of the character and geometry of the landfill waste. These data were collected and used to prepare an Endangerment Assessment (EA) for the protection of human health and the environment. The results of the EA and the RI were then used to conduct a Feasibility Study (FS), wherein potential remedial actions were evaluated, remedial alternatives were developed and evaluated against the need to mitigate possible adverse effects of the contaminants from the landfill on the environment, and a preferred alternative for site remediation will be selected based on a wide range of criteria.

1.3 PROJECT ORGANIZATION AND SCOPE DEVELOPMENT

Figure 1-14 provides the overall project organizational chart for the PICCO Resin Landfill RI/FS. This chart includes key individuals from Hercules, Incorporated,

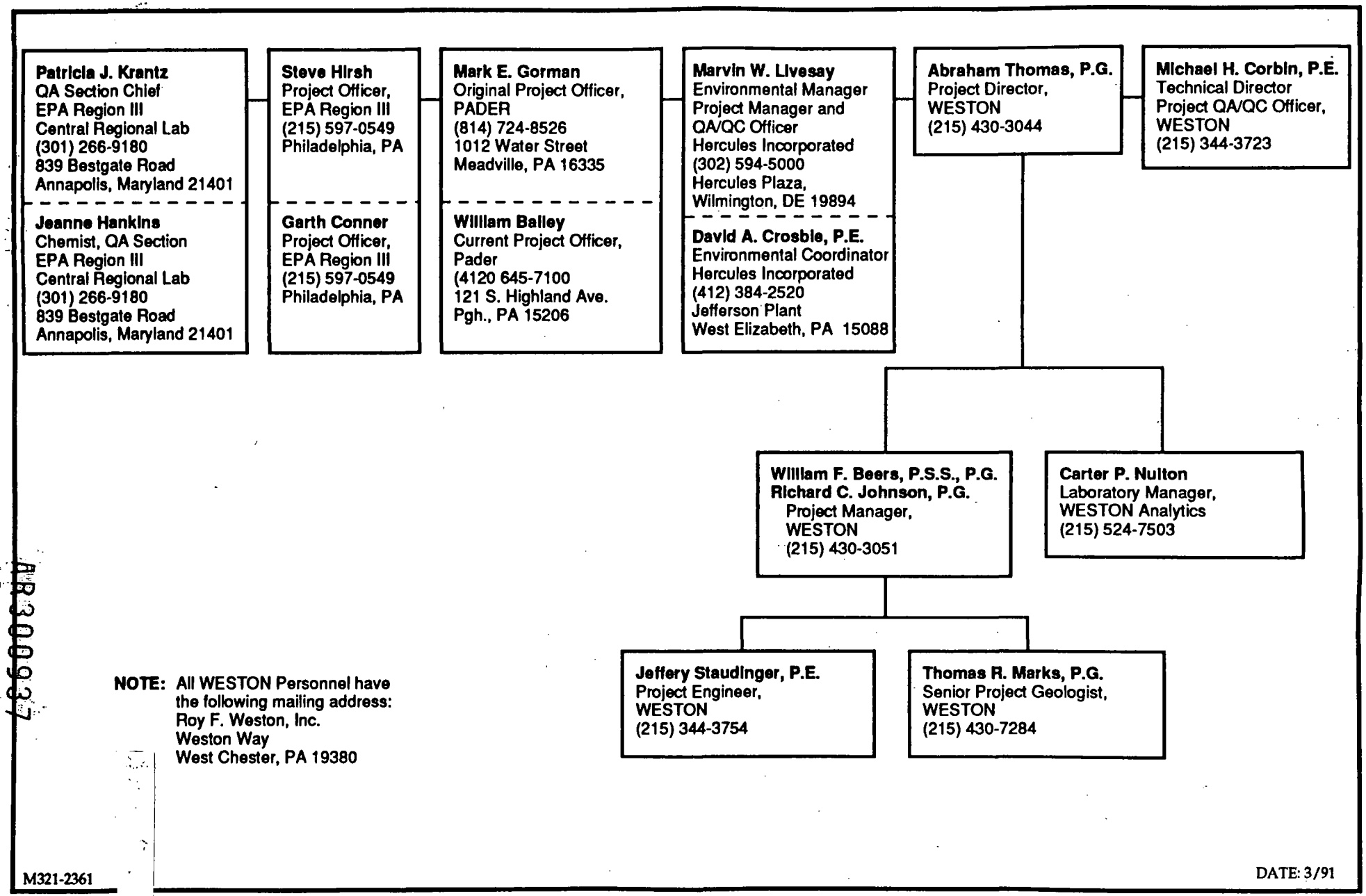

Figure 1-14 Project Organization Chart, PICCO Resin Landfill RI/FS

the prime contractor (Roy F. Weston, Inc.), the lead regulatory agency (PADER), and USEPA (Region III). Telephone numbers and addresses for each person listed are included on the chart.

Roy F. Weston, Inc. (WESTON) was selected by Hercules as the prime RI/FS contractor, and has provided project management, coordination, quality control, laboratory services, technical guidance and technical field support throughout the RI/FS. Drilling, geophysical well logging, surveying and physical and geotechnical laboratory analyses were subcontracted to properly trained and certified subcontractors.

The project organization for WESTON personnel involved in the PICCO Resin Landfill RI/FS was designed to provide a clear line of functional responsibility and authority, supported by a management control structure. This control structure, with responsibilities centered around the Project Manager, the Project Geologist and the Project Engineer, provided for:

- Identification of lines of communication and coordination.
- Monitoring program budget, schedules and financial performance.
- Accessing and managing key technical resources.
- Periodic financial management and progress reports.
- Health and safety monitoring.
- Quality control of all aspects of the RI/FS.

Following is a listing of the key WESTON personnel assigned to this project and their area of responsibility.

NAME	ROLE
Abraham Thomas, P.G	Project Director
Michael H. Corbin, P.E.	Technical Director/Project QA/QC Officer
Carter P. Nulton	Laboratory Manager
William F. Beers, P.S.S., P.G.	Project Manager
Thomas R. Marks, P.G.	Senior Geologist
Jeffrey Staudinger, P.E.	Project Engineer

The WESTON field coordinator of field activities was the Project Geologist, Thomas Marks and, in his absence, the Project Engineer, Jeffrey Staudinger. The field coordinator reported to the Project Manager on a regular basis during field activities. The field coordinator ensured that all field investigation tasks were conducted in strict compliance with the Quality Assurance Project Plan (QAPP) (WESTON, 1988). An additional responsibility of the field coordinator was to ensure that work performed by subcontractors was consistent with contract specifications. A WESTON field team member who is certified as a Health and Safety Supervisor acted as Site Health and Safety Coordinator (SHSC).

The development of the RI/FS Work Plan (WESTON, September 1987) was a cooperative process between Hercules, WESTON, PADER and USEPA. The Phase I RI/FS Work Plan for the PICCO Resin Landfill site was approved by PADER and USEPA in September, 1987, after their initial comments, received in August 1987, were incorporated into a final Work Plan.

Upon completion of the Phase I investigation (with the exception of the geophysical survey and the third round of groundwater and surface water sampling) Hercules recognized the need for additional field and laboratory data (Phase II). A proposed Phase II Work Plan was presented to PADER and USEPA during a meeting at the Hercules PICCO Resin Plant on 15 September 1988. In October 1988 a Technical Memorandum summarizing the Phase I results and detailing the proposed scope of work for the Phase II investigation was submitted to PADER. After addressing comments received from PADER and USEPA in a PADER letter dated 21 November 1988, the Phase II Technical Memorandum/Work Plan was revised, resubmitted and approved by both agencies in December, 1988.

Upon completion of the Phase II field program a meeting was held among Hercules, WESTON, PADER and USEPA on 18 September 1989 to discuss the Phase II results and the need for further data. After agreeing on the need for further definition of the bedrock groundwater system in the site area a Phase III Work Plan was prepared and submitted to PADER and USEPA in October 1989. After addressing comments from PADER and USEPA, received in a PADER letter dated 1 November 1989, the Phase III Work Plan was revised, resubmitted and subsequently approved by both agencies.

1.4 QUALITY ASSURANCE/QUALITY CONTROL

1.4.1 Field Procedures/Subcontractors

The Quality Assurance/Quality Control (QA/QC) procedures for the field investigation at the PICCO Resin Landfill were established through the site QAPP. This document was reviewed and approved by PADER and USEPA and provided

detailed protocols for all of the field activities which were performed as part of the RI/FS. These protocols included sampling procedures, drilling methods, geophysical methods, equipment calibration procedures and well construction methods. Specific quality assurance samples, such as equipment rinse blanks, duplicates and trip blanks, were used to check for cross-contamination which may have occurred in the field or during shipping of samples and to check for representativeness of the samples.

1.4.2 Laboratory Procedures

All analytical samples were analyzed by the Analytics Division of WESTON, which is a USEPA Contract Laboratory Program (CLP) certified laboratory. QA/QC of laboratory samples was accomplished through various types of QA/QC samples. These included method blank spikes (MB), matrix spikes and matrix spike duplicates (MS/MSD), rinse blanks, duplicates and trip blanks. Method blank spikes and MS/MSD samples were used to evaluate the accuracy or error in the analytical methods used. Duplicate samples collected in the field, and the method blank spikes, were used to evaluate the precision and reproducibility of the results. The rinse blank samples were used to check the adequacy of the field decontamination procedure as well as other avenues of cross-contamination, such as laboratory and ambient air at the site. The trip blanks, which are analyzed for volatile organic compounds (VOC) only, were used to evaluate the possibility of cross-contamination between samples, contamination from an outside source during transportation of the samples to the laboratory and, laboratory contamination. The representativeness and comparability of the laboratory data from the RI/FS was evaluated through multiple sampling rounds. All samples were analyzed using USEPA Contract Laboratory Program (CLP) protocols with the stand[illegible]

commercial deliverable data package. For detailed discussion of the project quality assurance objectives, project data uses, analytical levels and frequency of QA/QC samples, refer to Section 1.4 of the QAPP for PICCO Resin Landfill RI/FS.

1.4.3 Regulatory Oversight

Technical oversight of field activities during the RI occurred throughout all phases of field work. Technical oversight was performed by Versar, Inc. (Versar) under contract to the USEPA and by PADER staff personnel.

Representatives of Versar were present on-site during three separate periods of field activity. Table 1-3 summarizes the Versar personnel who performed the technical oversight during various phases of field work, the activities which they observed, the dates which they were present on-site and the types of samples which were split.

Representatives of PADER involved in the on-site work included Mr. Mark Gorman, Ms. Deborah McNaughton and Mr. William Bailey. Generally at least one of these three representatives was present during part of each new field activity or a new phase of field work. Any changes in technical procedures or deviation from the work plan were discussed with PADER prior to initiation. During the Phase II field work, representatives of PADER split soil and sediment samples with WESTON.

Versar issued an oversight report (Versar, 1988) for PICCO Resin Landfill on August 15, 1988. Although the report generally concluded that the protocols outlined in the QAPP were generally adhered to, their report contended that

TABLE 1-3

SUMMARY OF VERSAR TECHNICAL OVERSIGHT AT THE PICCO RESIN LANDFILL

VERSAR Personnel	Oversight Dates	Field Activities	Split Samples
Patricia Watterson Paul Wooldridge	May 26-27, 1988	Waste Borings/Sampling; Collection of Surface Soil Sample	- Waste - Surface Soil
Thomas Chisholm Cinthia Perera	June 20-24, 1988	Groundwater Sampling; Surface Water and Sediment Sampling; Ecological Survey	- Groundwater - Surface Water - Sediment
Brad Staub	March 13-14, 1990	Monitoring Well Installation, Seep Sampling, Residential Well Sampling	- Residential Well Samples - Seep Samples

deviations from field procedures outlined in the QAPP had occurred. Although it had been necessary to deviate from some procedures due to adverse field conditions, the field documentation of WESTON field personnel (including field notes and photographs) in some instances contradicted the allegations of the August 1988 Versar report. These issues were discussed with Virginia Pohlman (Versar) at the 15 September 1988 meeting between Hercules, WESTON, PADER, USEPA and Versar, and it was concluded that the analytical data collected to date were valid.

A second oversight report (Versar, 1990) was issued on 10 May 1990. This report concluded that field procedures were in accordance with the QAPP and that no significant problems were observed during the oversight.

SECTION 2

SITE INVESTIGATIONS

2.1 PHASE I SITE INVESTIGATION

The Phase I site investigation was designed, based on existing site information from previous investigations to enhance the understanding of the PICCO Resin Landfill site and determine its impact on the surrounding environment. Previous investigations indicated that the landfill leachate contained concentrations of BNA and VOC compounds and that certain indicator compounds were present in the soils and groundwater downgradient of the lower landfill dike and the groundwater within the Pittsburgh Coal adjacent to the landfill. A mine void encountered within the Pittsburgh Coal immediately adjacent to the landfill in well TW-2, was found to contain an oily non-aqueous phase floating product. This mine was thought to be a small scale operation which originated at the coal outcrop exposed by the strip mining of the valley in which the landfill is constructed. As such, the extent of this deep mining operation was believed to be limited.

The Phase I investigation was designed to evaluate the following areas:

- The extent and characteristics of the landfill waste.
- The stability of the lower landfill dike.
- The extent of contamination of soils below the lower landfill dike.
- The water and sediment quality of the unnamed stream crossing the site.

- The groundwater quality within the soil below the lower landfill dike.
- The groundwater quality and extent of mining of the Pittsburgh Coal in the site area.
- The quality of water coming from seeps in the Lobb's Run area in the adjacent valley to the southwest of the site.
- The hydrogeologic character of the deep bedrock below the Pittsburgh Coal and the quality of groundwater from this zone (if groundwater is encountered).

2.1.1 Background Information Search and Site Reconnaissance-Phase I

During the Spring of 1988, prior to the initiation of the Phase I field investigation, a background information search was undertaken in order to locate and review existing records pertaining to area mining activities and the existence of residential water supply wells in the PICCO Resin Landfill area.

The background information search included telephone contact and/or office visits to the following organizations:

ORGANIZATION	REQUESTED INFORMATION	CONTACT
Pennsylvania Department of Environmental Resources McMurray, PA	Mine maps, mining records.	Mr. Greg Robertson
Pennsylvania Department of Environmental Resources Uniontown, PA	Mine maps, mining records.	Mr. Thomas McKnight Mr. Jerry Wilder
Pennsylvania Department of Environmental Resources Geological and Topographic Survey Harrisburg, PA	Mine maps, mining records, aerial photographs and water well records.	Ms. Mary Burnhart Ms. Sandra Blust

United States Department of the Interior, Office of Surface Mining Greentree, PA	Mine maps, mining records.	Mr. Jesse Craft
Micon Services, Inc. Pittsburgh, PA.	Mine maps, mining records.	Mr. Jay Popovich
Evanson, Auchmoody and Greenwald Pittsburgh, PA	Mine maps, mining records.	Mr. Edward Greenwald
CEE Incorporated Pittsburgh, PA	Mine maps, mining records.	Mr. Thomas West Mr. Eugene Palowitch
CONSOL Meadowlands, PA	Mine maps, mining records.	Mr. Thomas Shorts Mr. Robert Mike
Allegheny County Health Department Pittsburgh, PA	Water well records.	Mr. Steven Stiengard
Western Pennsylvania Water Company Pittsburgh, PA	Water well records.	Ms. Judy Jeffers Mr. Jack Cypher
Jefferson Borough Jefferson, PA	Water well records, sewage systems.	Mr. William McVickers
West Elizabeth Sanitary Authority West Elizabeth, PA	Water well records, sewage systems.	No record of contact person

In addition to the background information search, a site reconnaissance was conducted in the site area prior to the initiation of the Phase I drilling and sampling program. The purpose of the site reconnaissance was to:

- Select locations for the proposed monitoring wells, soil borings and stream sampling points.
- Locate seeps along the Pittsburgh Coal outcrops in the Lobb's Run area.
- Locate off-site residential water supply wells in the vicinity of the site.

- Evaluate whether or not other potential sources of contamination were present in the site area.

- Document the historical development of the site area.

Historical aerial photographs of the site area, from the PADER Bureau of Topographic and Geological Survey repository in Harrisburg, Pennsylvania, were reviewed on 12 February 1990.

The quality and coverage provided by the photographs varied. The dates of the photographs reviewed are listed below from oldest to most recent:

- 23 October 1949
- 21 September 1956
- 26 May 1967
- 4 March 1969
- 27 March 1973

Due to the initial findings of the RI the site reconnaissance and background information search continued into subsequent phases of the RI/FS. The results of the site reconnaissance and the background information search are presented in the appropriate subsections of Section 3. An aerial photographic survey was conducted at the site on 23 March 1989. A detailed topographic map, with two foot contour intervals, of the site and the area west of the site, was generated from the aerial photographs. Copies of these topographic maps are included in Appendix B.

2.1.2 Characterization of Groundwater - Phase I

Prior to the initiation of the RI/FS, eleven monitoring wells, which initiated characterization of the hydrogeology of the site, had been installed (see Section

1.1.3). Four of these wells were completed in the unconsolidated zone below the lower landfill dike, one well (TW-8) was completed (and abandoned) in the bedrock below the lower landfill dike, four of the wells were completed in the Pittsburgh Coal and two of the wells were completed in the deep bedrock below the Pittsburgh Coal.

It was determined during the development of the RI/FS Work Plan that an additional monitoring well, completed in the Pittsburgh Coal, was necessary to more accurately define the direction of groundwater flow in the site area which, although not definitively identified, was assumed to be toward the southeast. This well, monitoring well TW-12, was installed along Maryland Ave., above the site, using air rotary drilling methods and was intended to be an upgradient monitoring well. The drilling of well TW-12 began on 24 May 1988, and, due to problems encountered during drilling, construction was not completed until 16 June 1988. Well TW-12 was constructed by placing an 8-inch diameter carbon steel outer casing to a depth of 21 feet in order to isolate the lower bedrock borehole from the overlying soils. A 7 7/8-inch hole was extended from the bottom of the 8-inch casing to a depth of 97 feet (956.10 feet MSL). A 10.3 foot long four-inch diameter stainless steel screen was placed at a depth interval of 86.2 feet to 96.5 feet. A four-inch diameter carbon steel riser was attached to the screen and brought to the surface. A sand filter pack was placed around the screen. The filter pack was overlain by a 3.8 foot thick seal composed of bentonite pellets which in turn, was overlain by a cement and bentonite grout slurry which was brought to ground surface. The well construction diagram for TW-12 is included in Appendix C.

During the installation of TW-12, 20 feet of clayey soil and weathered shale bedrock were encountered in the upper portion of the hole. These lithologies were underlain by 74 feet of sedimentary rocks, dominantly composed of shale, before encountering the Pittsburgh Coal at a depth of 94 feet (959.10 feet MSL).

During the drilling of TW-12 only minor amounts of groundwater were encountered above the Pittsburgh Coal, resulting in lost circulation and minimal return of drill cuttings from the lower portion of the hole. After encountering a soft zone at 94 feet and drilling to 97 feet, the drillers extracted drilling tools from the borehole and collected a split-spoon sample from the bottom of the hole in order to confirm the stratigraphy. This sample showed coal fragments underlain by a clay deposit. It was concluded that the Pittsburgh Coal had been penetrated and the well screen was set at 96.5 feet. After sealing off the bedrock zone above the Pittsburgh Coal, and developing the well, the well produced minimal water. It is believed that the coal bed penetrated by well TW-12 is part of a split Pittsburgh Coal seam and therefore represents only the upper part of the Pittsburgh Coal. The lithologic log for well TW-12 is included in Appendix D.

In addition to the installation of well TW-12 it was necessary to replace monitoring well TW-1 because it had been destroyed, presumably during construction activities at the site. This well, which represented the furthest downgradient monitoring point in the unconsolidated zone below the lower landfill dike, was replaced with a well of similar construction at approximately the same location as the previous well. The TW-1 replacement well was drilled to a depth of 14 feet (auger refusal). A ten foot long, 4-inch diameter, stainless steel screen was set at a depth of 4 feet to 14 feet. A 4-inch diameter carbon steel riser pipe was brought from the top of

the screen to the surface. A sand filter pack was placed around the screen. The filter pack was overlain by a 0.75 foot thick seal composed of bentonite pellets which, in turn, was overlain by a cement and bentonite grout slurry which was brought to the ground surface. The well construction diagram for TW-1 is included in Appendix C. The lithologic log for monitoring well TW-1 is included in Appendix D.

Three rounds of groundwater sampling were originally planned for Phase I of the RI/FS in order to collect samples during "dry, wet and normal" conditions. Due to the need for additional wells to be installed during Phase II of the RI/FS the third round of groundwater sampling was postponed based upon a mutual agreement between Hercules, PADER, USEPA and WESTON, until the completion of Phase II drilling activities. This change allowed for the inclusion of the Phase II wells, and wells TW-5 and TW-6, (which were found to be obstructed during the first sampling round) into the third round of groundwater sampling.

Groundwater samples from monitoring wells for all rounds of sampling were collected in accordance with the approved QAPP (WESTON, 1988) except for wells which contained non-aqueous phase product. The standard procedures are listed below:

- Beginning at the upgradient wells, the static water level was measured from the top of inner casing and the total depth of the well was remeasured (Round 1 only) using a decontaminated water level probe.

- Casing radius (ft), total well depth, depth to water (ft), height of the water column (ft) and standing volume (gallons) of water was determined for each well.

- Using a clean submersible pump, a minimum of either three casing volumes, or until the well went dry, was evacuated from each well. Wells which intercepted mine voids were not purged. Pumping began at the top of the water column and the pump was lowered, if necessary, to keep pump submerged.
- The post-pumping water level was measured for each well.
- All equipment was decontaminated between wells and placed on clean polyethylene sheeting.
- The well was allowed to recover to at least 80% of the original water level or for 24 hours, whichever came first.
- Sample bottles were properly labeled.
- Clean surgical gloves were worn while inserting a clean, teflon bailer to the well bottom.
- The VOA bottles were filled first to avoid aeration of the sample.
- The remaining water in first bailer was used to take pH, temperature and specific conductivity measurements.
- The remaining sample bottles were filled from subsequent bailed well water.
- All sample bottles were carefully logged and packed in ice (or blue ice) in their respective coolers and shipped overnight to WESTON Analytical Laboratory with a chain of custody.
- The well was closed with a locking cap.
- Gloves, polyethylene sheet and at least the lower 15 feet of bailer line were disposed of after each well sampling.
- All measurements and well sampling information was recorded on a WESTON field sampling sheet and/or in a bound field notebook.

- Field observations, including the presence of non-aqueous phase floating product and organic vapor readings, were also recorded in the field notebook.

- Samples to be analyzed for soluble metals were filtered in the field immediately after sample collection.

The purge pump and bailers were decontaminated between wells in accordance with the QAPP following the sequences outlined below:

1) Decontamination procedures for bailers, water level indicators, split-spoons, and sample scoops:

   - Tap water and Alconox detergent wash.

   - Tap water rinse.

   - 10 % Nitric Acid rinse.

   - Tap water rinse.

   - Acetone rinse followed by a methanol rinse.

   - Deionized water rinse (demonstrated analyte free).

   - The sampling equipment was then wrapped in aluminum foil, shiny side out, for transport or storage.

2) Purge pumps and discharge hoses were decontaminated using a tap water and Alconox wash followed by a tap water rinse.

All decontamination of equipment occurred in a designated on-site decontamination area which was set up in an area between the landfill dike and the leachate collection trench. Decontamination fluids were disposed of according to procedures

approved by PADER and USEPA during the project start up meeting on 23 May 1988.

The first round of the Phase I groundwater sampling program began on 21 June 1988, one week after the installation of the final Phase I monitoring well (TW-1) and was completed on 24 June 1988. This round of groundwater sampling constituted the "dry" rainfall season sampling event.

Groundwater samples were collected from all accessible monitoring wells at the site (TW-1, 2, 3, 4, 7, 9, 10, 11 and 12) in order to characterize site water quality and to investigate the migration of key compounds from the landfill. Deep bedrock wells, TW-5 and TW-6, were found to be obstructed and were therefore, not sampled during Round 1 and Round 2. (It should also be noted that the Phase I sample which was collected from well TW-12 was probably not groundwater, but development water left in the wellbore.) Figure 2-1 shows the locations of the monitoring wells sampled during Round 1 of groundwater sampling. All Round 1 samples were analyzed for the complete U.S. Environmental Protection Agency (USEPA) Target Compound List (TCL) and Target Analyte List (TAL). These lists include analysis for VOC, BNA, pesticide/PCB, metals (total and soluble for monitoring well samples) and cyanide.

The second round of the Phase I groundwater sample was collected between 2 August 1988 and 3 August 1988. This round of groundwater sampling constituted the "normal" rainfall season sampling event. The same wells were sampled during Round 2 that were sampled during Round 1, with the exception of well TW-12 which was dry, and wells TW-2 and TW-9 which contained non-aqueous phase

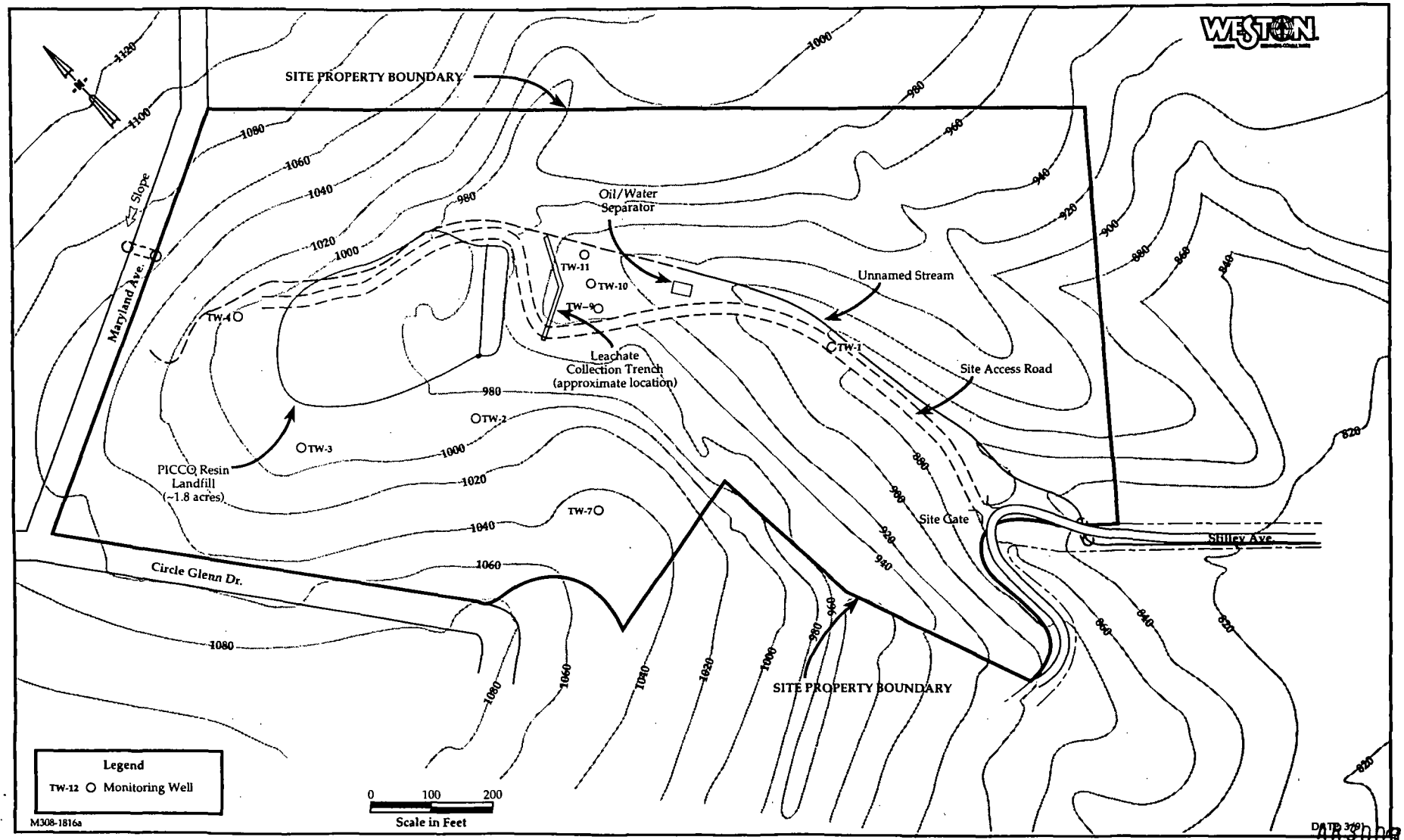

Figure 2-1 Phase I Monitoring Well Sample Locations, PICCO Resin Landfill

product (Figure 2-1). The wells containing non-aqueous phase product were not sampled after Round 1 due to problems decontaminating equipment after sampling these wells. The deep bedrock wells, TW-5 and TW-6, were still obstructed (due to vandalism) during the second sampling round and were therefore not sampled. All Round 2 groundwater samples were analyzed for full TCL and TAL analytes with the exception of pesticide/PCB analysis (no pesticide/PCB were detected during Round 1).

The laboratory reports for the groundwater analyses are included in Appendix E and the analytical data are presented and discussed in Section 3.5

2.1.3 Characterization of Soils-Phase I

Soil samples were collected from 12 locations around the landfill, between 27 May 1988 and 6 June 1988, in order to physically and chemically characterize soils adjacent to the landfill. The primary focus of the Phase I soil samples were the soils downslope of the lower landfill dike since this area had been shown, during previous investigations, to contain some of the constituents from the leachate. The soil sampling locations, shown on Figure 2-2, included boreholes BH-1 through BH-9, borehole BH-22 and shallow soil sample locations HS-1 and HS-2. The Phase I soil sampling program involved the collection of one background shallow soil sample (HS-1) collected from the upper two feet of soil upslope (north) of the landfill, one sample upslope of the landfill near the base of the waste disposal chute (BH-22) and 28 soil samples downslope of the lower landfill dike [three samples from each of nine borings along the site access road (BH-1 through BH-9) and a shallow soil sample (HS-2) on the east side of the unnamed stream].

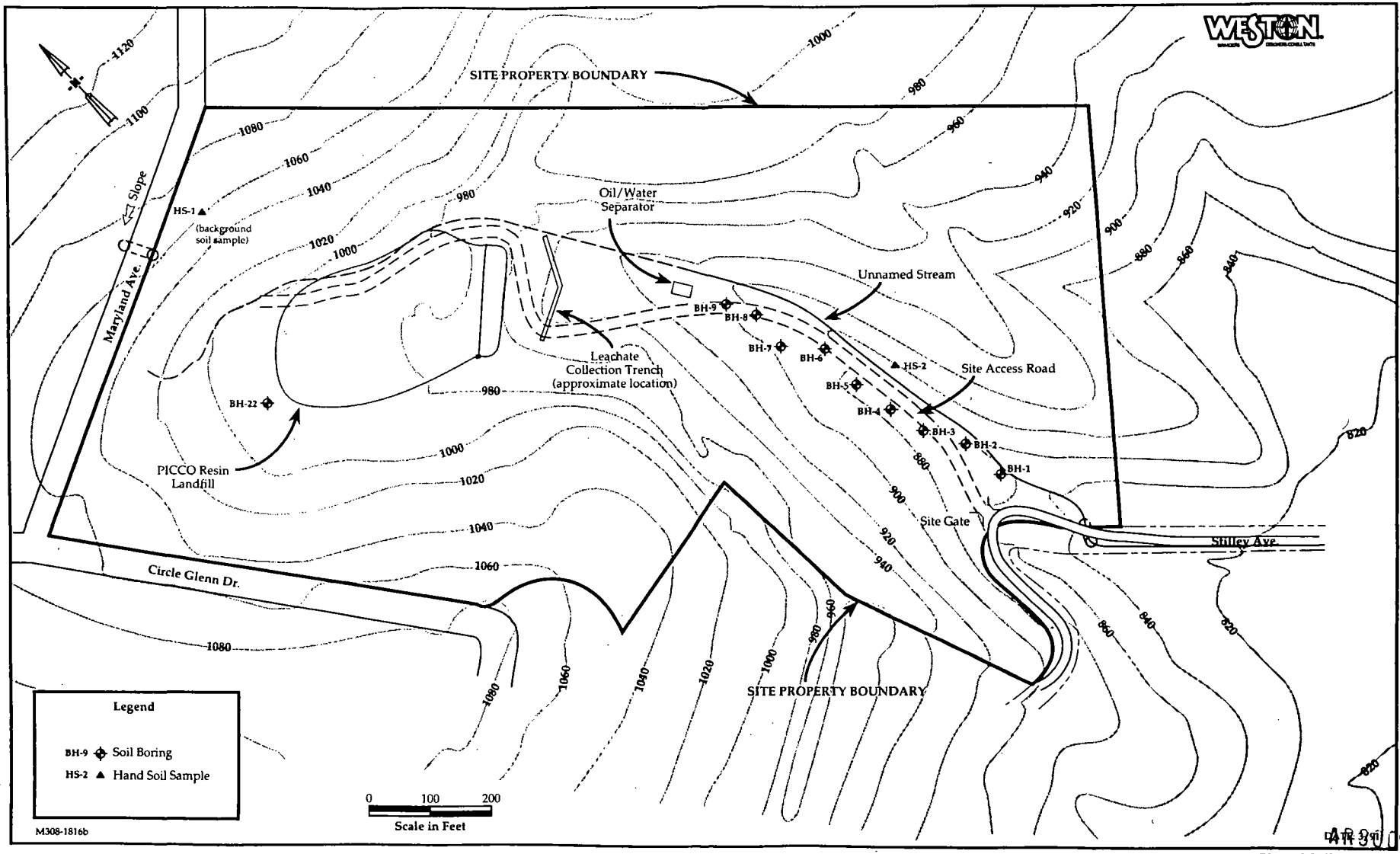

Figure 2-2 Phase I Soil Sampling Locations, PICCO Resin Landfill

The ten soil borings were drilled using an 8-inch hollow stem auger with continuous 2-inch split-spoons samples. Each boring was advanced to bedrock, which was defined by split-spoon refusal. Three sets of samples were collected from each of the downslope soil borings in order to characterize the upper, middle and lower zone of the soils. One soil sample was collected from borehole BH-22. These soil samples were collected using a negative bias: samples within a specific zone displaying the highest vapor readings or those which were the most visibly stained were preferentially selected for sampling.

Each of the soil borings and hand samples was logged by a WESTON scientist. Soil boring logs included a description of physical soil characteristics (i.e. grain size, color, staining, moisture content) as well as split-spoon blow counts, sample recovery, and OVA or HNu organic vapor readings for each interval. Also included in the soil boring logs was a designation of the interval from which each analytical sample was collected. The soil boring logs are included in Appendix F. The background shallow soil sample collected upslope of the landfill, as well as three of the 28 soil samples collected below the lower landfill dike were analyzed for full TCL analytes and TAL metals plus cyanide and total petroleum hydrocarbons (TPH). Full TCL includes analysis for VOC, BNA, and pesticide/PCB analytes. The remaining 25 soil samples from below the lower landfill dike, and the soil sample collected from BH-22 above the landfill, were analyzed for specific target compounds known to be associated with the landfill material. These 26 soil samples were analyzed for TCL VOC, BNA, and TPH. The results of the soils investigation are presented and discussed in Section 3.3 and the laboratory data reports for soil analyses are included in Appendix E.

The soil samples for chemical analysis were collected in accordance with the QAPP as described below:

- Each split-spoon was laid on clean plastic sheeting prior to opening.
- Labeled sample bottles were laid next to the split-spoon.
- Organic vapor readings were taken using an HNu and/or OVA immediately after the split-spoon was opened. The organic vapor readings were measured by placing the intake port less than one centimeter from the sample for at least ten seconds. These readings are documented on the soil boring logs in Appendix F.
- If HNu and/or OVA readings were observed, a set of sample jars was filled using decontaminated stainless steel sampling scoops.

Care was taken during soil sampling to fill the VOC sample jars first and to put on clean surgical gloves between each sample. As each soil boring progressed, samples were selected from the upper, middle, and lower zones based upon the magnitude of the OVA or HNu reading as well as soil staining and heterogeneity of the soils. Extra soil samples, which were collected and not analyzed, were discarded with the soil boring cuttings.

The cuttings from each soil boring were staged on plastic sheeting and placed back in the hole after the completion of the boring. Each hole was then grouted, using a cement/bentonite slurry, to the ground surface. The drilling rig, and any augers or tools which contacted soils, were decontaminated between holes using a pressure steam cleaner. Split-spoons and sampling scoops were decontaminated using the 7-step procedure described in Section 2.1.2. All decontamination of drilling and sampling equipment was done in a designated on-site decontamination area. Solvents used in decontamination were collected and allowed to evaporate or were

containerized. Wash water was either poured directly into the collection trench system below the lower landfill dike or was allowed to infiltrate into the soils above the collection trench and was ultimately collected by the trench system.

Soil samples were sent to the laboratory, via overnight delivery service, at least every two days during the sampling program. Proper chain of custody and shipping procedures were followed.

2.1.4 Characterization of Waste and Landfill - Phase I

During Phase I waste and soil samples were collected from 15 soil boring locations (BH-10 through BH-24) drilled in and around the landfill. Figure 2-3 shows the locations of the landfill borings. Samples from these borings were collected between 26 May 1988 and 16 June 1988 and used to characterize the landfill with respect to:

- Landfill geometry.
- Volume of waste material in landfill.
- Physical and chemical characteristics of the waste material in the landfill.
- Physical characteristics of the cover material on the landfill.
- Physical characteristics of the lower landfill dike.
- Physical characteristics of the bedrock underlying the landfill into which the leachate collection trench was installed.

Fifteen samples were selected from seven borings within the landfill waste, for chemical analysis. These samples were selected based upon distribution within the

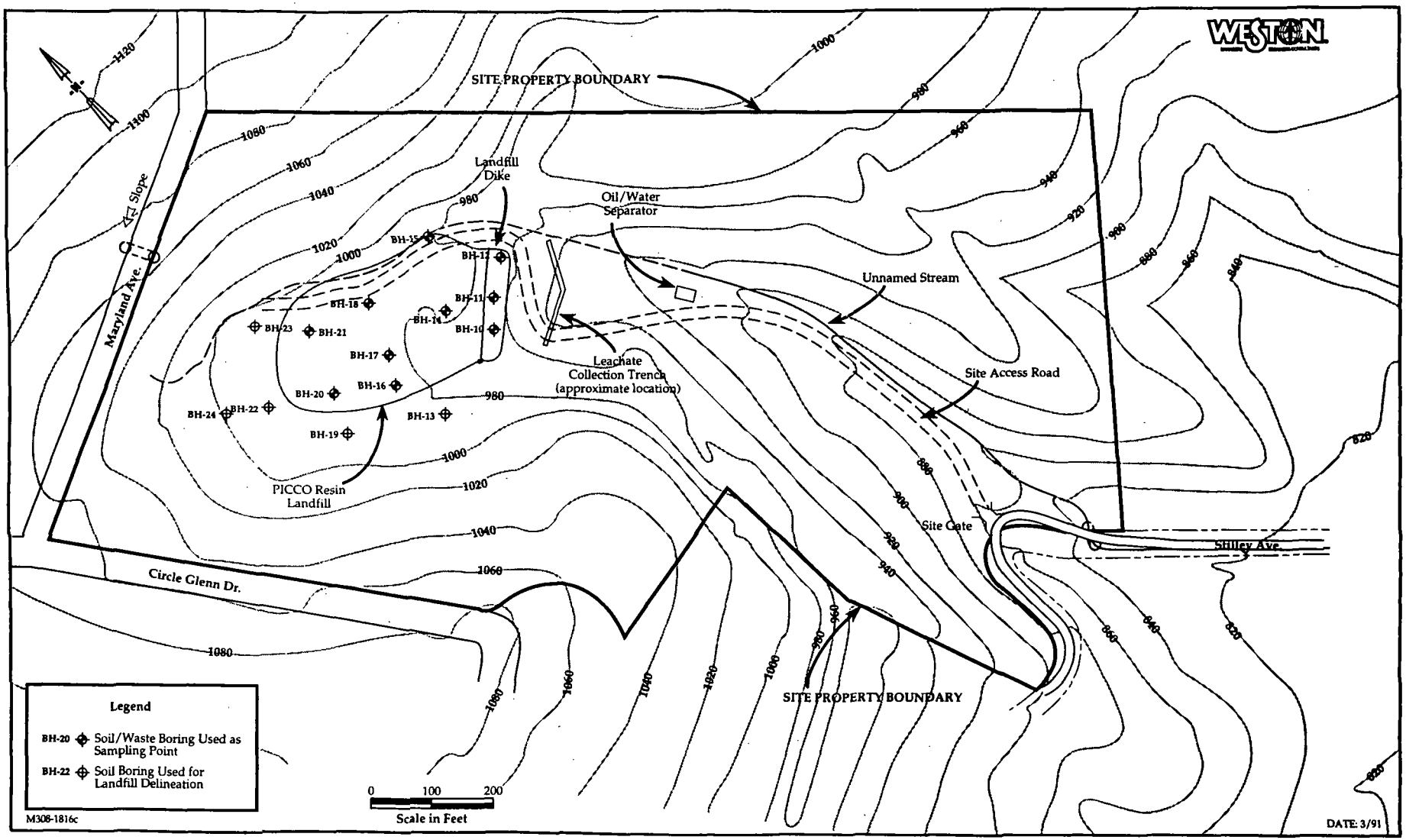

Figure 2-3 Phase I Landfill Soil/Waste Boring and Sampling Locations PICCO Resin Landfill

landfill, OVA or HNu readings and visual inspection of the waste material collected. The purpose of the 15 samples selected for chemical analysis was to define the chemical characteristics of the waste material and the degree of chemical heterogeneity within the landfill. These data were used to define the typical chemical composition of the waste material in order to identify indicator parameters in the waste material and to provide information to be used in the FS for the development and evaluation of remedial options.

Three of the seven borings (BH-14, BH-17 and BH-20) from which waste samples were collected for chemical analysis were aligned along the approximate longitudinal center line of the landfill (see Figure 2-3). Three waste samples (including the upper, middle, and lower zones) were collected from each of the three centerline boreholes. The remaining four landfill borings for chemical analysis (BH-15, BH-16, BH-18, and BH-21) were drilled near the expected perimeter of the landfill. The purpose of this distribution of waste samples was to obtain a clear picture of the chemical characteristics and degree of heterogeneity of the landfill material. These borings were generally shallower in depth than the borings in the center of the landfill and, therefore only one or two zones were sampled from these borings.

Two of the waste samples from each of the three borings along the center line of the landfill were analyzed for TCL VOC, BNA and Pesticide/PCB and TAL analytes (metals and cyanide) plus TPH. The remaining nine waste samples were analyzed for VOC, BNA and TPH.

In addition to samples for chemical analysis of the landfill waste, two sets of samples were taken for physical characterization of the landfill material. Seven samples, from seven different landfill borings, were taken for physical characterization of the waste material. These samples were analyzed for density, moisture content, percent organics and inert materials and energy content (BTU). These data were used to assist in the evaluation of waste treatment options in the Feasibility Study. A second set of samples for physical characterization of the landfill included five Shelby tube samples collected from five different landfill boring locations. These Shelby tube samples were taken from the upper one to two feet of cover soil overlying the waste material in order to provide "undisturbed" soil samples which were used to characterize the existing cover material. These samples were analyzed for permeability, moisture content and density.

All of the landfill borings were drilled using an 8-inch hollow stem auger with continuous split-spoon samples (except where homogeneous soils were encountered). In boreholes where homogeneous soils were encountered split-spoons were collected at 5-foot intervals. All soils and waste material were logged by a WESTON scientist. Boring logs included a description of physical soil and waste characteristics (i.e., grain size, color, staining, moisture content, texture) as well as split-spoon blow counts, sample recovery and OVA or HNu readings for each interval. Copies of the boring logs for the landfill borings are included in Appendix F.

Three borings (BH-10, BH-11 and BH-12) were completed to bedrock along the lower landfill dike. Six samples, two from each of the borings, were collected for physical characterization of the dike. These six samples were analyzed for grain

size, plasticity, moisture content and density. These data and the results of the Standard Penetration Tests (blow counts) were used to perform a preliminary assessment of the stability of the lower landfill dike. The middle dike boring, BH-10, was extended ten feet into bedrock, using a diamond core barrel, in order to obtain a representative sample of the bedrock strata into which the leachate collection trench was installed. This sample was collected from the bedrock approximately 100 feet upslope of the trench. A representative segment of this core sample was tested for permeability and porosity.

In addition to the landfill borings and the borings through the lower dike, five borings (BH-13, BH-19, BH-22, BH-23 and BH-24) were completed to bedrock along the outside edge of the landfill in order to determine the lateral extent of the landfill waste material. None of these borings encountered waste material Although stained soils and organic vapor readings, above background, were observed in boreholes BH-22 and BH-24. Only one chemical sample was collected from the perimeter soil adjacent to the landfill. This sample was collected from BH-22 which was located near the base of the topographic chute where the waste was disposed of, at the corner of Maryland Avenue and Circle Glenn Drive. The results of the landfill investigation are presented and discussed in Section 3.2 and the laboratory data reports for the chemical analysis of waste are included in Appendix E. The geotechnical data reports are included in Appendix G. The analytical results from the sample from BH-22 are discussed in the soil results section (Section 3.3).

The drill cuttings, from each of the landfill borings, were staged on plastic sheeting and were placed back into the borehole after the completion of the borehole to

auger refusal. Excess cuttings which could not be returned to the borehole and plastic sheeting and protective clothing were placed in lined 55-gallon drums and disposed of by a contractor to Hercules. The upper portion of each borehole (at least the upper two feet) was filled with a cement and bentonite grout slurry to the ground surface. The bedrock borehole in BH-10, resulting from the collection of a core sample, was filled immediately with grout in order to prevent contaminants from migrating into the borehole. The cuttings from BH-10 were placed above this grout and the top of the borehole was grouted to the surface.

Samples for chemical analysis were collected in accordance with the QAPP as described below:

- Each split-spoon was laid on clean plastic sheeting prior to opening.
- Labeled sample bottles were laid next to the split-spoon.
- Organic vapor readings were taken with an HNu and/or OVA immediately after the split-spoon was opened and were recorded in the field log book.
- If an interval was selected to be sampled, sample bottles were filled using decontaminated stainless steel sampling scoops.

Care was taken during waste sampling, to fill the VOC sample jars first and to put on clean surgical gloves between samples.

Split-spoons and sample scoops were decontaminated using the seven step procedure described in Section 2.1.2. The drill rig, and any auger or tools which had contacted soil or waste, were decontaminated between samples using a pressure steam cleaner. All decontamination of drilling and sampling equipment was done in the designated on-site decontamination area above the leachate collection trench.

Solvents used in decontamination were collected and allowed to evaporate or were containerized. Wash water was either poured directly into the collection trench system below the lower landfill dike or was allowed to infiltrate into the soils above the collection trench.

2.1.5 Characterization of Surface Water, Sediment and Seeps - Phase I

Eight surface water and sediment sampling locations were established along the unnamed stream which drains surface water along the east side of the site. The purpose of the stream samples was to determine whether or not contaminants related to the landfill had migrated into the on-site stream or had been carried off-site by way of sediment transport or surface water flow. This stream is perennial, although certain reaches are intermittently dry (U.S.G.S., 7.5 minute quadrangle, 1979). Four of the eight surface water and sediment sampling locations (locations S-5, S-6, S-7, and S-8) were located within the site boundary. Sample location number S-8 was located near the origin of the stream. Sample location S-7 was located approximately 50 feet downstream of the oil/water separator for the leachate collection trench. Sample location number S-6 was located near the downstream boundary of the site. Sample location S-5 was located approximately 50 feet downstream of the site gate but within the site property boundary. The remaining four stream sampling locations were located between the site boundary and old Route 837. Sample locations were placed at approximately equal distances along the exposed portion of the steam. Sediment samples were preferentially collected from depositional segments of the stream near the surface water sampling stations. The sampling locations along the unnamed stream crossing the site are shown in Figure 2-4.

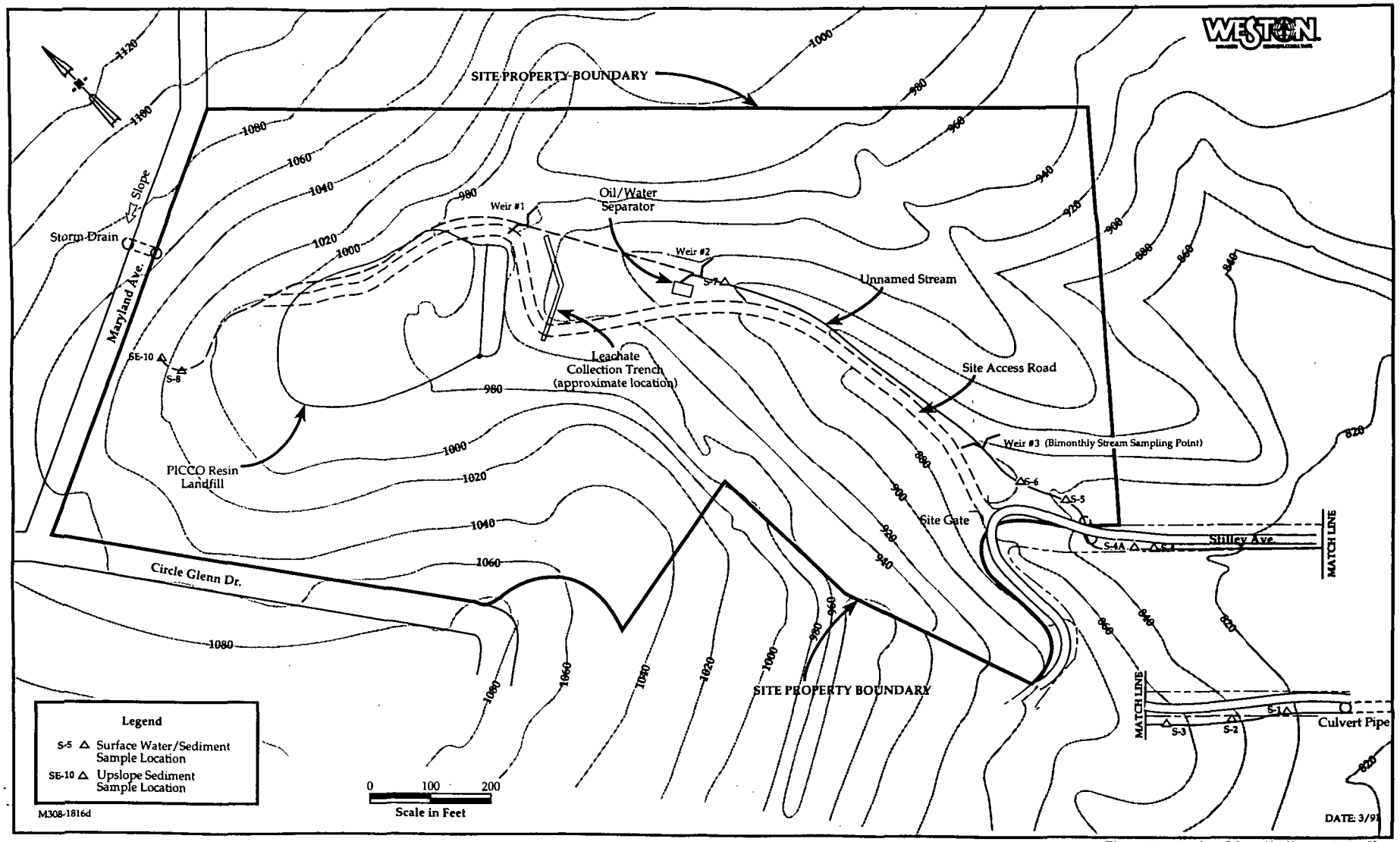

Figure 2-4 Surface Water/Sediment Sampling Locations From the Unnamed Stream Crossing the Site, PICCO Resin Landfill

The results of the residential well sampling and the stratigraphic position of the residential wells are presented and discussed in Section 3.6. The laboratory reports from the analysis of the residential well samples are presented in Appendix E.

The Phase I, Round 1 stream sampling was conducted between 21 and 23 June 1988. During the first round of stream sampling at the site, sediment samples were collected from all eight stream locations. Surface water samples, however, were collected from only six of the eight sampling locations, during Round 1, due to the presence of dry reaches of the stream in the areas of stream sampling locations S-2 and S-8. The sediment and surface water samples collected from the unnamed stream were analyzed for full TCL (VOC, BNA and pesticide/PCB) and TAL metals and cyanide.

The Phase I, Round 2 surface water samples were collected on 2 August 1988. Surface water samples were collected from all eight stream sampling locations. No sediment samples were required by the work plan, to be collected from the unnamed stream during the second round of sampling. The surface water samples were analyzed for TCL VOC and BNA, and TAL metals and cyanide. Analysis for pesticide/PCB was eliminated for the Round 2 samples since there were no detections of these analytes during Round 1.

Surface water samples were collected by directly immersing the sample bottles in the stream and allowing the bottles to fill. If the stream water was too shallow to allow the bottle to be immersed then a decontaminated stainless steel scoop was used to fill the sample bottle. Sediment samples were collected, after the collection

of the surface water samples, using a decontaminated stainless steel sampling scoop. Clean surgical gloves were used at each sampling station.

During the initial site reconnaissance, prior to Round 1 sampling, two seeps were located in the valley southwest of the landfill site in the area of Calamity Hollow and Lobb's Run. These seeps were flowing from the approximate elevation of the downdip Pittsburgh Coal outcrop. The seeps were field located and were not surveyed due to their remoteness and private property access limitations. During Round 1 and Round 2 sampling only one of these seeps (seep number 2) was flowing. Water samples were collected from seep number 2 during both Round 1 and Round 2 of the Phase I investigation. Seep samples were analyzed for full TCL analytes (VOC, BNA and pesticide/PCB) and TAL metals and cyanide and were collected following the same sampling procedures which are described in this section for surface water samples. The results of the stream and seep sampling are presented and discussed in Sections 3.4 and 3.7, respectively. The laboratory data reports for the chemical analysis of surface water, sediment and seep samples are included in Appendix E.

2.1.6 Residential Well Survey - Phase I

Three residential wells were identified as being located in the vicinity of the site during the initial site reconnaissance and record reviews primarily through discussions with local residents. The approximate locations of these wells are shown on Figure 2-5. Table 2-1 presents the available construction information and water use (obtained from personal communication with the well owners) for each of the residential wells identified during Phase I. As seen in Table 2-1, two

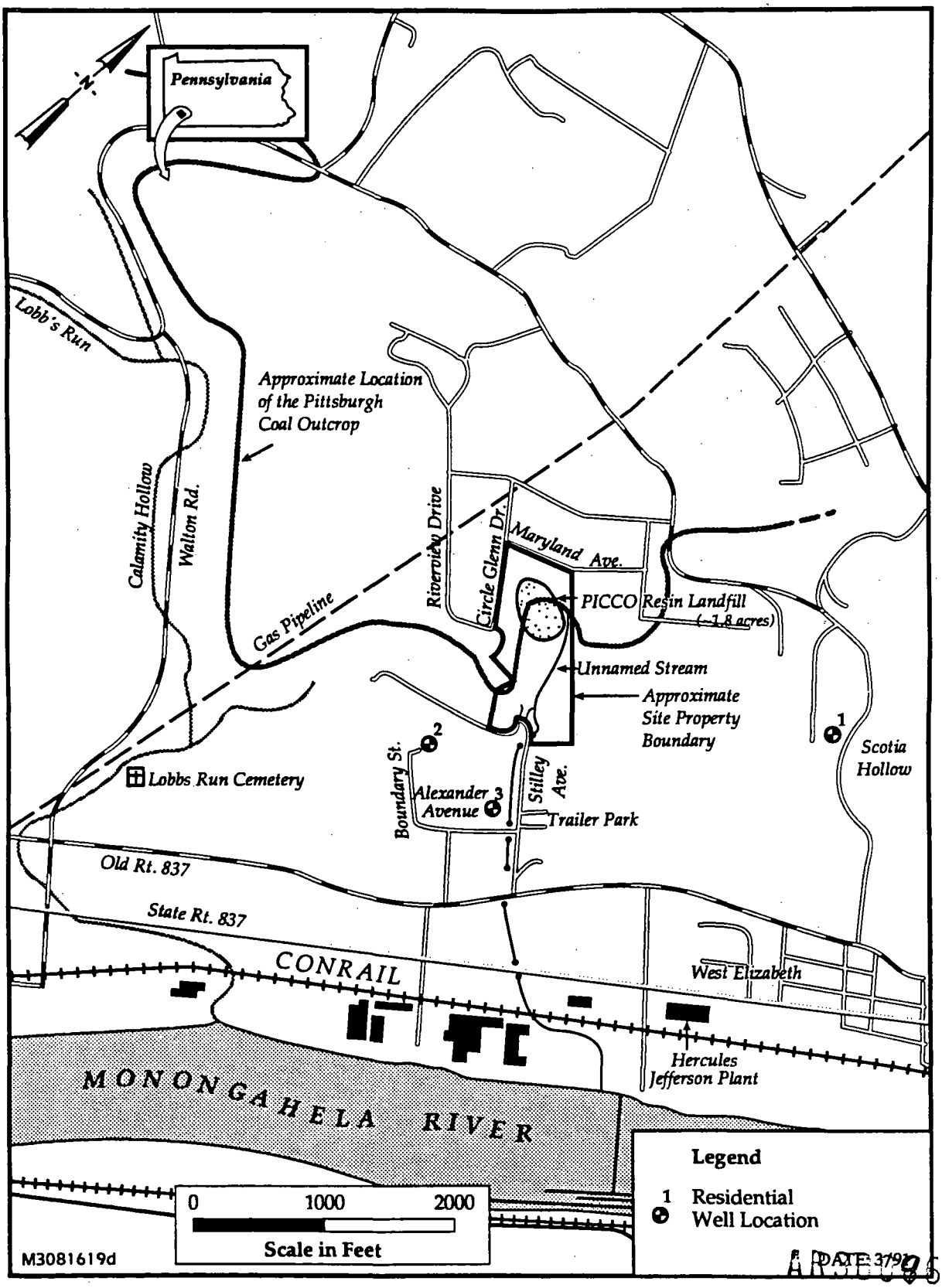

Figure 2 -5 Approximate Phase I Residential Well Locations, PICCO Resin Landfill,

TABLE 2-1

WELL CONSTRUCTION AND WATER USE SUMMARY FOR RESIDENTIAL WELLS IDENTIFIED DURING PHASE I, PICCO RESIN LANDFILL

Residential Well Number	Address	Well Use**	Well Construction
1*	252 Scotia Hollow Road	IU***	Dug well, 25 to 30 feet deep
2*	Boundary Street	IU	Dug well, 30 feet deep
3*	Alexander Avenue	OU	Dug well, 4 feet deep

* Indicates that the well was sampled during Phase II of this study.
** Well use:
IU - Indoor Use including drinking, cooking and/or washing.
OU - Outdoor use including gardening, washing car and/or watering grass.
*** Indicates that residence was not connected to public water at the time of the survey.

of the three wells are used as primary drinking supplies. Sampling of the residential wells occurred during Phase II of the site investigation and is discussed in Section 2.2.

2.1.7 Ecological Survey - Phase I

An ecological survey was conducted on 20 through 24 June 1988 to assess the characteristics of the ecosystem at and in the vicinity of the PICCO Resin Landfill site. The ecological survey began off-site and downslope of the landfill and proceeded upslope along the unnamed stream valley until the landfill area was reached. The landfill area was evaluated from upslope proceeding downslope. Notes on vegetation and wildlife species (birds, mammals, reptiles) observed were recorded as well as indications of obvious signs of stress to the environment. Photographs were taken of major vegetation groupings and plant communities and other subjects during the survey to supplement the site evaluation. Notes were made on the condition of the flora and fauna within the unnamed stream. The condition of the unnamed stream was also recorded photographically. State and Federal fish and wildlife agencies were contacted, prior to the site visit, in order to determine whether or not any endangered species were present in the area of the landfill site. The results of the ecological survey are presented and discussed in Section 3.9.

2.1.8 Ambient Air Sampling - Phase I

Ambient air quality sampling was conducted at the PICCO Resin Landfill site on 25 May 1988. Ambient air samples, to be analyzed for VOC, were collected at ten

of the thirteen monitoring locations represented in Figure 2-6. Samples for semi-volatile analysis were collected at three of the stations: the background site station # 13; station #8 on the landfill and at station #9 near the leachate collection facility (Figure 2-6). EPA Method TO-1 for VOC sampling was employed using enax/Tenax-charcoal tubes through which approximately 100 liters of air were drawn during a 3-hour sampling period using an SKC personal sampling pump. Each VOC sample was analyzed for the Hazardous Substance List (HSL) compounds. Semi-volatile samples, to be analyzed for naphthalene, were collected using NIOSH Method 5515. Air was drawn through a Teflon filter followed by XAD-2 resin during a six hour sampling period, using an SKC personal sampling pump yielding a total volume of approximately 500 liters. Air sampling began at 0700 - 0730 hours, with VOC sampling concluding between 1000-1100 hours, and semi-volatile sampling concluding between 1230-1300 hours.

Atmospheric stability conditions for the sampling period were "moderately unstable" as characterized by Pasquilli's stability conditions (Pasquilli, 1961). Wind speeds were generally 5 mph from the north above the landfill, including Maryland Avenue. On the landfill surface, wind speeds were 3-5 mph and generally from the west with a high degree of variability. Wind direction near the eachate oil/water separator was from the south at times. The decrease of wind speed and the high variability of wind direction was probably due to the topographic setting in the landfill area. The resulting channeling and wind shears, caused by the variable terrain, enhanced atmospheric dispersion. Temperatures were near 60 degrees Fahrenheit at the start of sampling and rose to 70 degrees Fahrenheit by the finish. The weather was generally clear and sunny on the day

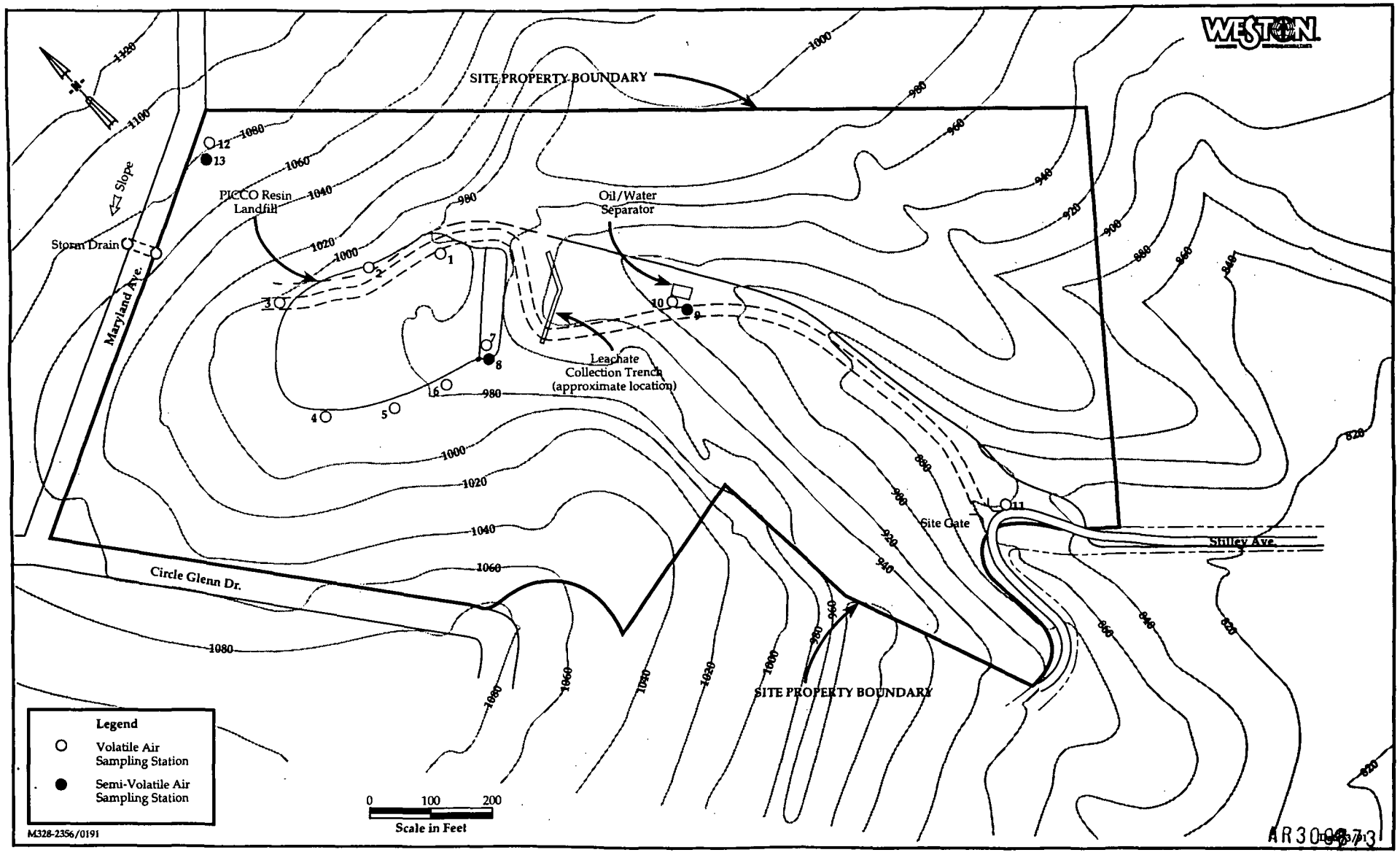

Figure 2-6 Phase I Ambient Air Sampling Locations, PICCO Resin Landfill

of sample collection. The results of the ambient air sampling are presented and discussed in Section 3.8.

2.2 PHASE II SITE INVESTIGATION

After the completion of the Phase I field investigation a joint meeting between Hercules, WESTON, PADER and USEPA was arranged to discuss the Phase I results. This meeting took place on 15 September 1988 at the Hercules Incorporated Jefferson Plant in West Elizabeth, PA. After the presentation of the findings from the Phase I investigation, Hercules proposed a Phase II site investigation which was designed to fill data gaps which remained after the Phase I investigation and would provide confirmation of Phase I findings. The Phase II Work Plan (Addendum No. 2 to the RI/FS Work Plan, October 1988) was submitted to PADER and USEPA during October 1988. Comments from both agencies were received in a letter from PADER dated 21 November 1988 and the plan was conditionally approved following a conference call on 30 November 1988. The Phase II site investigation involved the completion of the following tasks:

- Installation of three additional monitoring wells in the Pittsburgh Coal and the unconsolidated zone below the lower landfill dike.
- Clearing of obstructions in monitoring wells TW-5 and TW-6 so that these wells could be sampled if they contained water.
- Collection of Round 3 groundwater samples (including new monitoring wells).
- Completion of Round 3 surface water, sediment and seep sampling.
- Measurement of surface water flow in the unnamed stream crossing the site.

- Collection of groundwater samples from three known residential wells.
- The expansion of the residential well survey.
- Geophysical logging of monitoring wells TW-5 and TW-6.
- Collection of 16 additional downslope soil samples below the leachate collection trench.
- Installation of five piezometers around the lower landfill dike to further assess the stability conditions.
- Collection of five geotechnical samples from the piezometer borings around the lower landfill dike.

2.2.1 Characterization of Groundwater - Phase II

The results of the Phase I groundwater samples and well installation indicated the need for off-site monitoring wells within the Pittsburgh Coal in order to define the extent of contamination and free product within the Pittsburgh Coal. Groundwater flow direction within the Pittsburgh Coal appeared to be to the southwest (downdip), toward Lobb's Run. There were, however, several ambiguous water level elevations in the area of the landfill, which were assumed to be the result of groundwater mounding caused by the landfill. In order to resolve these uncertainties three additional monitoring wells (one upgradient and two downgradient) where installed into the Pittsburgh Coal during Phase II. The investigation of mine records as part of Phase I did not find detailed mining maps for the areas adjacent to the landfill site. Based on this records search it was initially believed that mining of the Pittsburgh Coal had occurred on a small scale, limited to the area near the coal outcrop. However, due to this lack of information

on the extent of deep mining in the area adjacent to the landfill some uncertainty still existed.

The Phase II Pittsburgh Coal monitoring wells (TW-13, TW-14 and TW-15) were installed between 27 January 1989 and 3 February 1989. The well installations were supervised by a WESTON geologist. Figure 2-7 shows the locations of the Phase II monitoring wells and approximate groundwater flow direction within the Pittsburgh Coal. Two of the three monitoring wells (TW-14 and TW-15) encountered mine voids within the Pittsburgh Coal. The Phase II wells were constructed similarly to the previously installed well TW-12 (see Section 2.1.2). Each well utilized a ten foot long, 4-inch diameter, stainless steel screen and a 4-inch diameter carbon steel riser. The two wells which encountered mine voids (TW-14 and TW-15) utilized a rubber packer to support the bentonite seal and cement/bentonite slurry above the screen. Well construction diagrams and lithologic logs for the three Phase II monitoring wells installed in the Pittsburgh Coal are included in Appendices B and C, respectively.

The installation of the additional monitoring wells allowed for a better definition of groundwater flow in the Pittsburgh Coal. As previously believed, groundwater flow in the Pittsburgh Coal was determined to be parallel to the dip direction of the coal (which is to the west in the site area). The discovery of additional mine voids both downgradient (TW-14) and upgradient (TW-15) of the landfill site, however, indicated that mining in the area was more extensive than had previously been thought, and groundwater flow may be affected by the previous mining activities within the Pittsburgh Coal. The discovery of non-aqueous phase floating

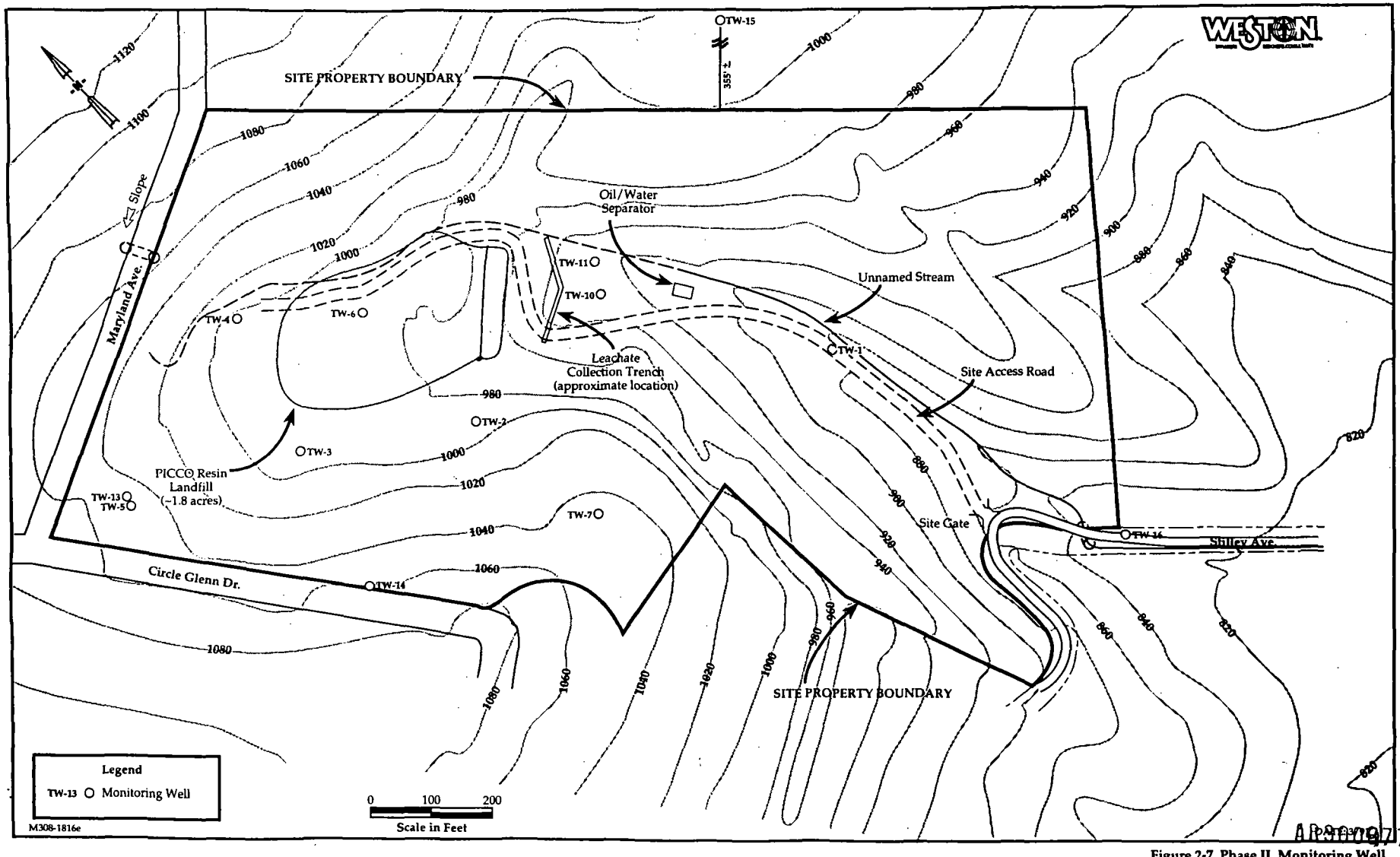

Figure 2-7 Phase II Monitoring Well Sample Locations, PICCO Resin Landfill

product in the downgradient monitoring well TW-14, on the west side of the site, indicated that the movement of non-aqueous phase product may be controlled by the existence, orientation and location of mine voids. The thickness of the floating product in monitoring well TW-14 was estimated to be approximately 1/8 inch. Two-phase water level probes were not effective in measuring product thicknesses due to the highly viscous nature of the product encountered in the subsurface. Therefore, samples of the product and groundwater, collected using a teflon bailer, were used to estimate product thickness.

Contamination of the shallow groundwater below the lower landfill dike was found during Phase I, to be limited to the area above monitoring well TW-1 (Figure 2-1). However, due to the presence of landfill-related contaminants in soils downslope of well TW-1, an additional monitoring well (TW-16) was installed immediately downslope of the site gate, approximately 550 feet downslope of monitoring well TW-1. This well was used to monitor groundwater quality at the downslope site boundary.

Monitoring well TW-16 was constructed in similar fashion to the Phase I monitoring well TW-1. The well was drilled, through the overburden, to the top of bedrock (16 feet). A ten foot long, 4-inch diameter stainless steel screen was placed from sixteen feet to six feet. A carbon steel riser was brought to the surface and fitted with a locking well cap. A sand filter pack was placed in the well annulus around and above the screened interval. The filter pack was overlain by a bentonite seal and a cement/bentonite grout which was brought to the ground surface. The well construction diagram and lithologic log for monitoring well TW-16 are included in Appendices B and C, respectively.

Groundwater samples were collected from twelve monitoring wells during Round 3 of groundwater sampling. Four monitoring wells from the unconsolidated zone downslope of the lower landfill dike were sampled during Round 3. These wells included TW-1, TW-10, TW-11 and TW-16. Monitoring wells TW-2 and TW-9 were not sampled during Round 3 (or during Round 2) due to the presence of non-aqueous phase product found in the wells during Round 1. Six wells, screened in the Pittsburgh Coal, were sampled during Round 3. These wells included TW-3, TW-4, TW-7, TW-13, TW-14 and TW-15. TW-15 was installed in the area believed to be upgradient of the site since the Phase I monitoring well TW-12 had poor yield. Two wells, TW-5 and TW-6, which are screened in the bedrock below the Pittsburgh Coal, were also sampled during Round 3 in order to complete the sampling originally scheduled for Phase I.

The samples collected during the third round of groundwater sampling were analyzed for TCL VOC, BNA and TAL metals (total and dissolved). The Round 3 groundwater samples were collected following the same sampling and decontamination procedures outlined for the Phase I groundwater sampling (Section 2.1.2) and described in the QAPP. The results from the analysis of the groundwater samples are presented and discussed in Section 3.5.

During the Phase II drilling program the drilling rig was positioned over monitoring well TW-5 and TW-6 in order to clear the debris which had obstructed these wells as a result of vandalism. Each well was cleared from top to bottom, using air rotary drilling methods. Rocks, wood and other debris were encountered and blown from the holes, during the clearing of these wells. After reaching the bottom of the each hole, water was added and blown from the hole in order to flush out

the hole. Neither well TW-5 or TW-6 appeared to produce any water during the well rehabilitation.

2.2.2 Borehole Geophysical Characterization - Phase II

A borehole geophysical survey and borehole televiewer (BHTV) inspection were run in monitoring wells TW-5 and TW-6 on 18 March 1989 and 7 July 1989, in order to characterize the deep bedrock below Pittsburgh Coal. The geophysical logs run on wells TW-5 and TW-6 included spontaneous potential, temperature, resistance, resistivity, natural gamma, fluid conductivity, caliper and high resolution density. All logs were run the entire length of each borehole with the exception of the BHTV. The camera in the BHTV developed a leak at a depth of 155 feet during the logging of well TW-5. The BHTV operator was concerned that the leak may have been the result of damage to the seals in the camera by contaminants in the well water. For this reason only the dry portion of well TW-6 (0 to 209.7 feet) was logged with the BHTV. The lower portion (209.7 to 250 feet) was not logged. The interval of well TW-5 which was not logged with the BHTV was 155 to 200 feet. The results of the geophysical logging are discussed in Section 3. The copies of the geophysical logs are presented in Appendix H and a copy of the BHTV video survey is on file at Hercules' corporate office in Wilmington, Delaware.

2.2.3 Soil Characterization - Phase II

The Phase II soils investigation occurred throughout January 1989 and was concentrated in the area downslope of the lower landfill dike. The purposes of the Phase II soils investigation were to determine the extent of soil contamination

downslope of the site gate and to determine the extent of non-aqueous phase product in soils downslope of the lower landfill dike.

Since contaminated soils were detected in on-site borehole BH-1 (Figure 2-2) near the downslope property boundary during Phase I, samples from six soil borings and four shallow soil samples, were collected from the site access gate area during the Phase II Investigation. Figure 2-8 shows the surveyed locations of the Phase II soil borings and hand samples. Each of the soil borings was extended to the top of bedrock, and two samples were collected from each boring, based upon visual observations and organic vapor measurements with an OVA. A negative bias approach was used for the collection of these samples. Hand samples were collected from the upper two feet of soil along the stream flood plain and from an area inaccessible to a drill rig, along the dirt road below the site gate. The soil boring which was furthest downslope from the landfill gate (BH-29) was converted into the downslope shallow monitoring well TW-16. In addition to the samples collected below the landfill gate (BH-25 through BH-29 and HS-3 through HS-6), one soil boring (BH-30) was drilled on the hillside southwest of the site access road immediately above the landfill gate. Two samples were also collected from BH-30. All soil samples collected during the Phase II soils investigation were analyzed for TCL VOC, BNA and TPH. Analysis of soil samples for metals during Phase II was eliminated, after a discussion of the Phase I results with PADER and USEPA. This revision of the analytical target analytes was approved by PADER and USEPA. The results of the analysis of soil samples are presented and discussed in Section 3.3.

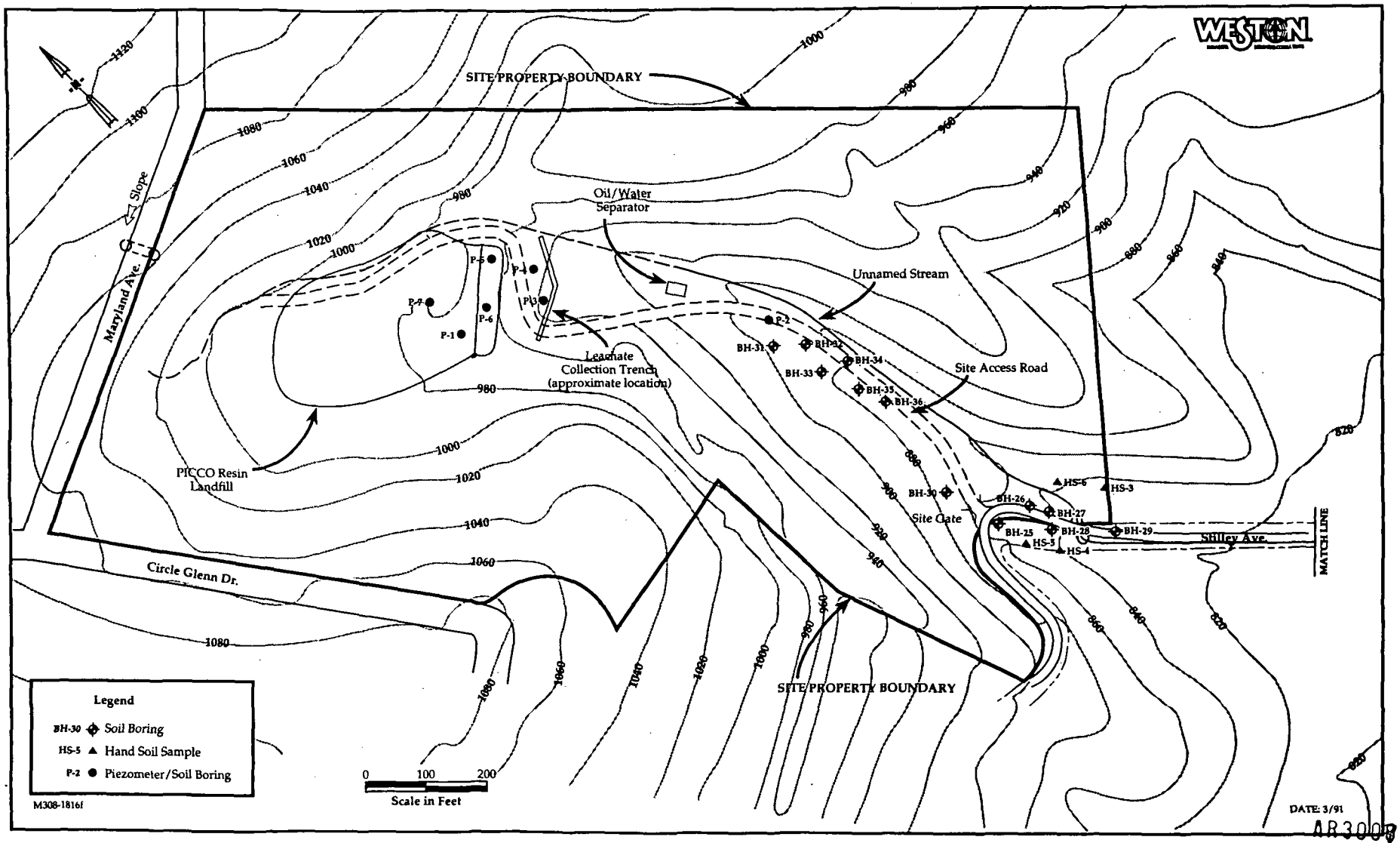

Figure 2-8 *Phase II* Soil Sampling Locations, PICCO Resin Landfill

A second set of eight soil borings was drilled between the landfill gate and the location of monitoring well TW-1. The purpose of these soil borings was to determine the presence and extent of non-aqueous phase product in soils rather than to chemically characterize the soils. Each of these borings was converted to a temporary piezometer in order to monitor for accumulations of non-aqueous phase product. Figure 2-8 shows the surveyed locations of these product monitoring points (P-2 and BH-31 through BH-36).

Piezometer P-2 was constructed using 2-inch diameter PVC. A ten-foot long PVC screen was placed from the top of bedrock (sixteen feet) up to a depth of six feet. A PVC riser pipe was placed from six feet to above the ground surface. A sand pack was placed around and above the screen and was overlain by a 2-foot bentonite seal. The bentonite seal was overlain by a cement/bentonite slurry which was brought to the ground surface. A 6-inch locking steel security casing was grouted into place around the PVC riser pipe. The construction diagram for piezometer P-2 is found in Appendix C.

The piezometers which were placed in boreholes BH-31 through BH-36 were designed for short term investigatory monitoring of free product only. For this reason, they were constructed of 1-inch diameter PVC pipe which was field-slotted with a saw blade. Each piezometer was slotted, from the bottom up, for a length of ten feet. The 1-inch diameter slotted piezometers were placed to the bottom of each boring (to the top of the bedrock surface) and drill cuttings were used to fill the annulus around the temporary piezometer. These piezometers were monitored intermittently over the next week for the presence of free product. The results of this monitoring are discussed in Section 3.3.

2.2.4 Characterization of Surface Water, Sediment and Seeps - Phase II

The third round of surface water and sediment samples was collected from the unnamed stream crossing the site on 3 April 1989. Surface water samples were collected from all eight stream-sampling stations used during the Phase I field investigation as shown in Figure 2-4. Samples were collected by either dipping the sample bottle directly into the stream or by filling the sample bottle with a decontaminated stainless steel sampling scoop. Clean latex surgical gloves were worn during sampling and changed between each sample station.

In addition to the surface water samples, two sediment samples were collected, using a decontaminated stainless steel scoop, during the Phase II investigation in order to confirm the downstream extent of sediment contamination detected in the Phase I sediment samples. One sediment sample was collected from stream sampling location S-5, and a second sediment sample (sample number SE-4A) was collected between sample stations S-4 and S-5 (Figure 2-4). A third sediment sample (SE-10) was collected from the origin of the unnamed stream crossing the site. The three sediment samples and the surface water samples were analyzed for TCL VOC and BNA. The results of the stream sampling and analysis are presented and discussed in Section 3.4.

Surface water flow measurement stations were made, using 60^0 "V-notch" weirs, which were field constructed at three locations on-site along the unnamed stream. The upstream weir (Weir #1) was located in the stream, approximately 100 feet upstream of the oil/water separator. A second weir (Weir #2) was located immediately downstream from the oil/water separators. The downstream weir

(Weir #3) was located in the stream in the area of the site gate. The locations of the weirs are shown on Figure 2-4. Measurements of surface water flow were taken intermittently order to obtain data to aid in the development of the hydrologic site model. These data are discussed in Section 3.4.

Water samples were collected on 7 April 1989, from three seeps (Seeps number 1, 1-A and 2) in the Lobb's Run area. A sediment sample was also collected from Seep number 2. This sample was analyzed for TCL VOC and BNA. The procedures for collecting seep samples were the same as those described for stream sampling. After the completion of the third round of seep sampling, primarily due to the presence of non-aqueous phase product in well TW-14, a larger scale reconnaissance was performed along the north east side of Calamity Hollow (along Walton Road) above Lobb's Run. During this reconnaissance, six additional seeps, along the Pittsburgh Coal outcrop, were discovered. Figure 2-9 shows the locations of the seeps which were sampled during Phase II, as well as the locations of additional seeps discovered but not sampled during Phase II.

2.2.5 Geotechnical Analysis of the Lower Landfill Dike - Phase II

Although the lower landfill dike and the landfill itself have historically been stable and no indication of failure was observed, the strength of the dike material and the hydraulic pressures within and behind the dike were investigated during Phase II in order to allow dike stability to be assessed in the Feasibility Study. This work was not designed to be an in-depth evaluation of the structural stability of the dike but to provide information for a preliminary assessment of dike stability. The dike stability assessment involved the drilling of five soil borings using hollow-stem

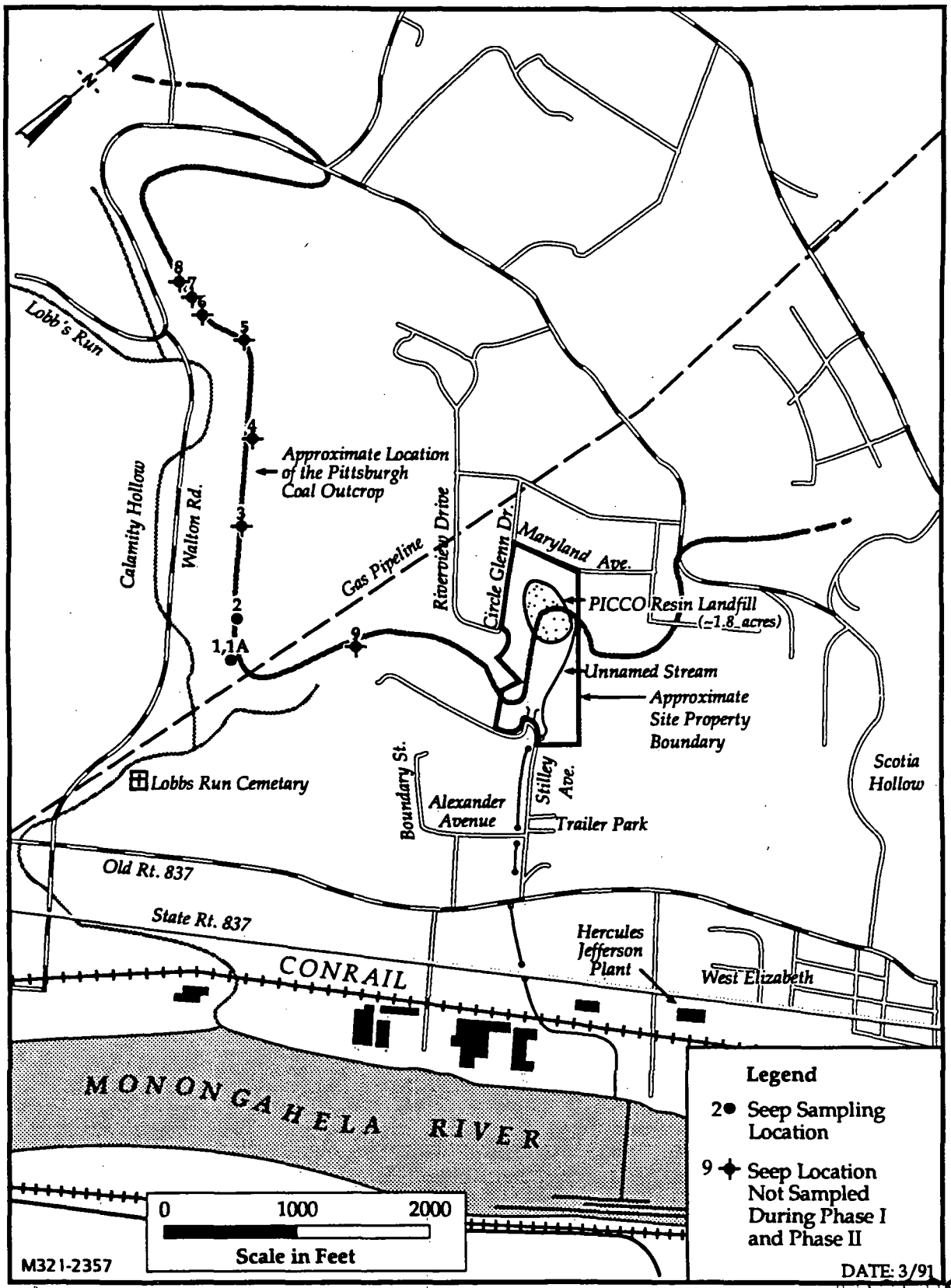

Figure 2-9 Phase I and Phase II Seep Sampling Locations and the Locations of Additional Seeps Discovered but not sampled, PICCO Resin Landfill

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augers. Two borings (P-5 and P-6) were drilled into the lower dike, one boring (P-7) behind the lower dike and two borings (P-3 and P-4) into the soils and immediately below the lower dike. The locations of these borings (P-3 through P-7) are shown on Figure 2-8.

Two Shelby tube samples were collected from the waste material behind the lower landfill dike and were tested for triaxial strength. Three Shelby tube samples were also collected from fine-grained cohesive soil in the lower landfill dike for direct shear testing and unconfined compressive strength testing. The results of the geotechnical analysis of the lower landfill dike are presented and discussed in Section 3.2.

Each of the geotechnical borings were converted to piezometers by placing ten-foot long, two-inch diameter PVC screen and PVC riser pipe in each of the five borings. These piezometers (P-3 through P-7) were used to measure the presence and movement of shallow groundwater behind, within and below the lower landfill dike. These data were used to assess the dike stability conditions as well as potential leachate movement in the dike area. Construction of these five piezometers was similar to the construction of piezometer P-2. Well construction diagrams for the lower dike piezometers are included in Appendix C.

2.2.6 Residential Well Survey and Sampling - Phase II

One round of groundwater samples were collected during Phase II, on 6 April 1989, from the three residential wells which were identified during the Phase I investigation (RW-1, RW-2 and RW-3) (Figure 2-5, Table 2-1). These residential

well samples were collected from the nearest discharge point to the well. Each water system was purged for a period of time necessary to purge one holding tank volume (usually 5 to 15 minutes).

Residential well samples were analyzed for TCL VOC and BNA and TAL metals. Clean latex surgical gloves were worn during sampling. VOC samples were collected first and care was taken not to aerate the sample during the collection of the VOC sample. The results of the residential well sample analysis are presented and discussed in Section 3.6. The laboratory data reports are included in Appendix E.

After the three residential wells were sampled, a second residential well survey, concentrating on areas further downgradient, was undertaken. The expanded residential well survey was conducted during April and July 1989. Figure 2-10 shows the approximate locations of the wells identified during the Phase II residential well survey and also the locations of the three wells identified during Phase I. Table 2-2 summarizes the known well construction and well use information for each well. In general, most of the residents in the area of the site are connected to public water, although several residents maintain their old wells as an additional source of water to be used for gardening, car washing or watering of grass. Four of the residents surveyed were not connected to public water and used their wells as their primary source of water (residential wells No. 1, 4, 9, 13). Two residents who were connected to public water also used their well water for indoor use (residential wells No. 2 and 5) (Table 2-2).

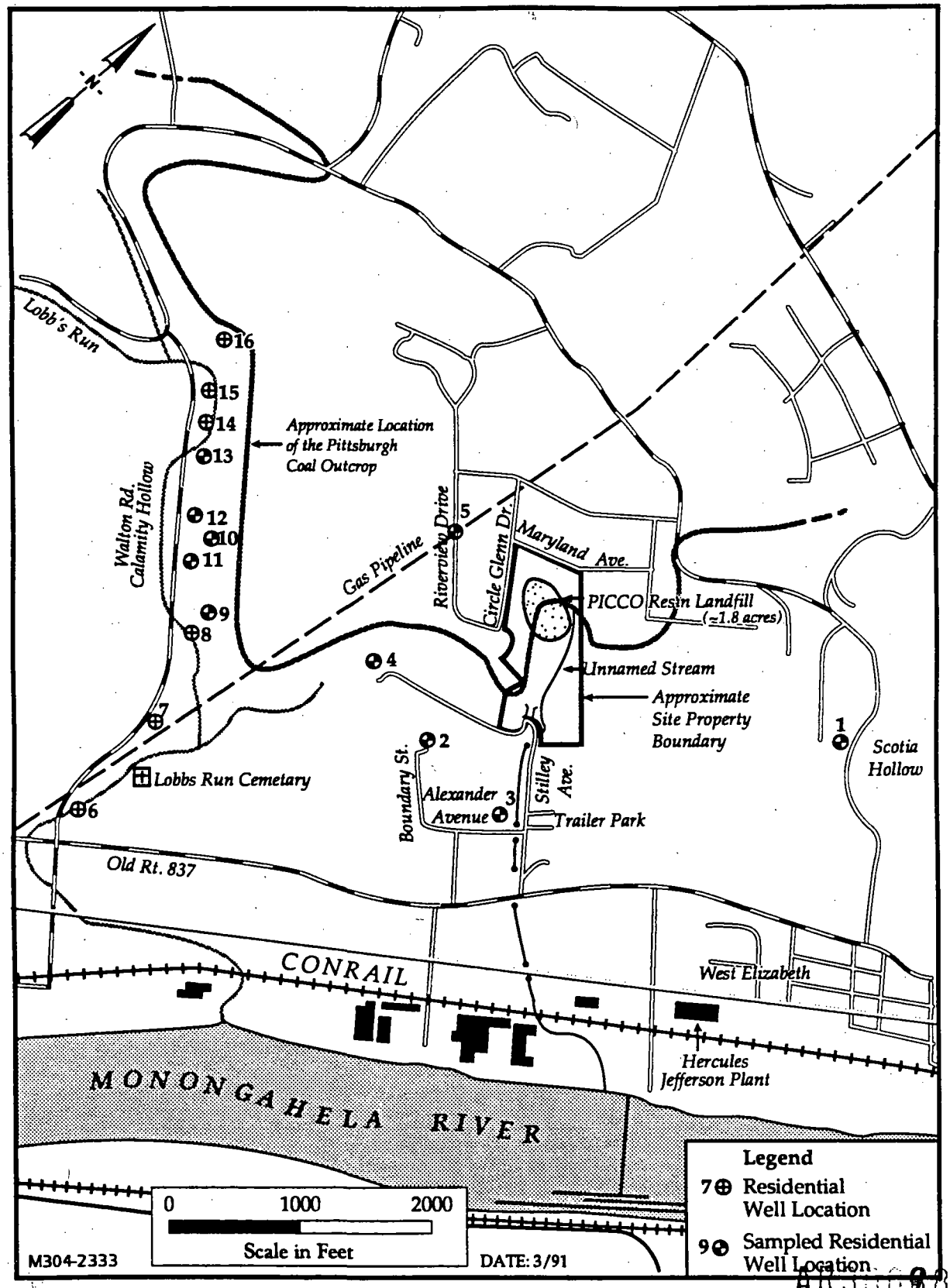


Figure 2-10 Approximate Phase II Residential Well Locations, PICCO Resin Landfill

TABLE 2-2

WELL CONSTRUCTION AND WATER USE SUMMARY FOR ALL RESIDENTIAL WELLS, PICCO RESIN LANDFILL

Residential Well Number	Address	Well Use**	Well Construction
1*	252 Scotia Hollow Road	IU***	Dug well, 25 to 30 feet deep
2*	Boundary Street	IU	Dug well, 30 feet deep
3*	Alexander Avenue	OU	Dug well, 4 feet deep
4*	Stilley Avenue	IU***	Dug well, 60(?) feet deep
5*	Riverview Drive	IU	Drilled well, 99 feet deep into bedrock above Pittsburgh Coal
6	202 Walton Road	NP	Dug well, 8 feet deep
7	400 Walton Road	NP	No information
8	Walton Road	NA	Drilled well, 60 feet deep
9*	Walton Road	IU***	Drilled well, depth unknown
10*	516 Walton Road	OU	Drilled well, 80 feet deep
11*	514 Walton Road	OU	Dug well, 12 feet deep
12*	524 Walton Road	IU	Drilled well, 60 feet deep
13*	532 Walton Road	IU***	No information
14	540 Walton Road	OU	No information
15	548 Walton Road	NP	Dug well, 17 feet deep
16	634 Walton Road	NA	Drilled well, 100 feet deep

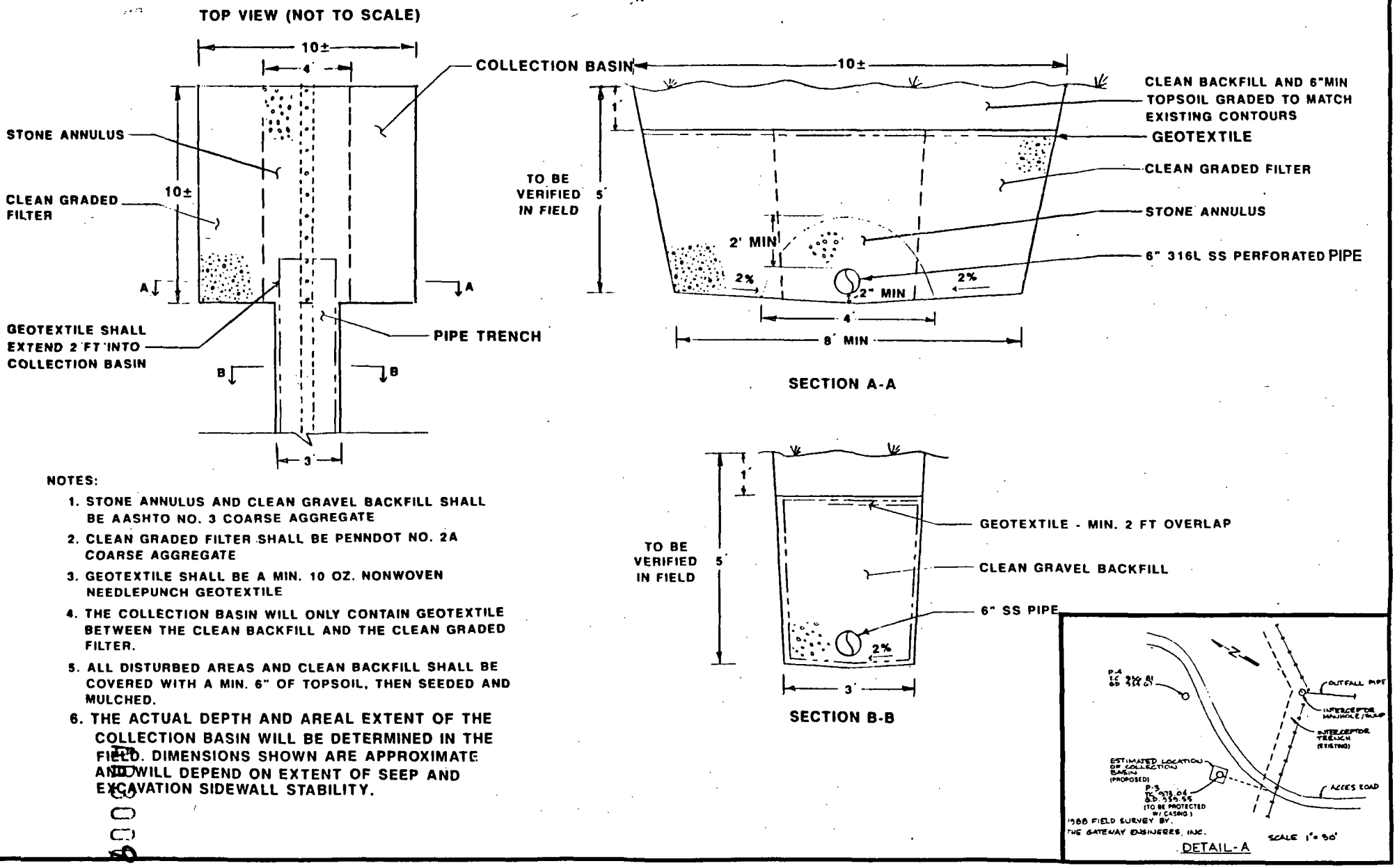
* Indicates that the well was sampled during Phase II or Phase III.
** Well use:
IU - Indoor Use including drinking, cooking and/or washing.
OU - Outdoor use including gardening, washing car and/or watering grass.
NP - No pump in well.
NA - Well buried, abandoned or otherwise not accessible.
*** Indicates that residence was not connected to public water at the time of the survey.

2.2.7 Interim Measures - Seep Collection - Phase II

During Phase II work in the spring of 1989 a small seep of oily leachate was observed at the surface downslope of the lower landfill dike, but upslope of the previously installed collection trench. At the request of Hercules, WESTON designed a collection basin with a drain to the existing collection trench in order to collect this surface seep and convey it into the leachate collection trench system as required by PADER. The design involved the construction of a small gravel filled drain in the area of the surface seepage. This drain was tied into the existing collection trench using a six-inch perforated stainless steel pipe and was completed 20 September 1989. Figure 2-11 illustrates the design drawing for the collection basin which was added to the leachate collection trench. Slight modifications to the design were made during construction to accommodate field conditions. This collection system eliminated the surface seepage of leachate in this area. PADER was aware of this seepage problem and reviewed the interim remedial design prior to construction of the drain. At about the same time a significant improvement to the southwest runon diversion ditch around the landfill was completed.

2.3 PHASE III FIELD INVESTIGATION

The cumulative results of the Phase I and Phase II field investigations, including field observations and analytical data from the analysis of soil, waste, sediment, surface water and groundwater samples, were discussed during a meeting between Hercules, WESTON, PADER and USEPA. This meeting, held on 18 September 1989 at the Hercules PICCO Resin plant in West Elizabeth, Pennsylvania, resulted



NOTES:

1. STONE ANNULUS AND CLEAN GRAVEL BACKFILL SHALL BE AASHTO NO. 3 COARSE AGGREGATE
2. CLEAN GRADED FILTER SHALL BE PENNDOT NO. 2A COARSE AGGREGATE
3. GEOTEXTILE SHALL BE A MIN. 10 OZ. NONWOVEN NEEDLEPUNCH GEOTEXTILE
4. THE COLLECTION BASIN WILL ONLY CONTAIN GEOTEXTILE BETWEEN THE CLEAN BACKFILL AND THE CLEAN GRADED FILTER.
5. ALL DISTURBED AREAS AND CLEAN BACKFILL SHALL BE COVERED WITH A MIN. 6" OF TOPSOIL, THEN SEEDED AND MULCHED.
6. THE ACTUAL DEPTH AND AREAL EXTENT OF THE COLLECTION BASIN WILL BE DETERMINED IN THE FIELD. DIMENSIONS SHOWN ARE APPROXIMATE AND WILL DEPEND ON EXTENT OF SEEP AND EXCAVATION SIDEWALL STABILITY.

Figure 2-11 Leachate Collection Basin, PICCO Resin Landfill

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in a general concurrence and approval of the proposed Phase III field program necessary to complete the Remedial Investigation at the site. The results of the Phase I and Phase II investigations indicated that an adequate understanding of the extent of contamination in soils, sediment and surface water in the vicinity of the site had been obtained.

Three issues required further investigation: 1) the extent of non-aqueous phase floating product in any unknown Pittsburgh Coal mine voids downdip and downgradient of the site; 2) the quality of groundwater from two residential wells recently discovered south and southwest of the landfill site; and 3) the quality of groundwater from the newly identified seeps in Calamity Hollow along Walton Road.

The initial scope for Phase III involved the installation of two downgradient, off-site monitoring wells in the Pittsburgh Coal which would intercept mine voids. Although these wells would be sampled for chemical analysis, the primary purpose of the wells was to define the presence and extent of non-aqueous phase floating product in the Pittsburgh Coal. The area for the initial locations of the off-site wells was approximately 1,000 feet downgradient (down dip) of the southwestern site boundary, southwest of Riverview Drive. In addition to the collection of groundwater samples from the new monitoring wells, groundwater samples were collected from two newly identified residential wells and from all known seeps in the Lobb's Run Area.

After installing three downgradient wells off-site (TW-17, TW-18 and TW-19) (well TW-19 was completed in a boring which did not intercept a mine void) it

was agreed by Hercules and PADER, based upon the findings of the initial drilling, that one additional well, which intercepted a mine void, would be installed between the three new off-site monitoring wells and the site boundary in order to further define the existence of mine voids in the area. It was also agreed at this time that Hercules would sample all known accessible residential wells along Walton Road.

2.3.1 Groundwater Characterization - Phase III

The drilling program for the initially proposed monitoring wells began on 9 January 1990. Three holes were drilled in the area of the first drilling location before a mine void was encountered. The first two test holes were grouted, from the bottom up, to the ground surface with a cement and bentonite grout slurry. The third hole (TW-18) encountered a rubble-filled mine void and was completed as a monitoring well. Chemical odors, and organic vapor readings between 0.5 and 0.8 units were noted during the drilling of the three borings in the area of monitoring well TW-18. Three borings were also drilled into the Pittsburgh Coal at the second drilling location (south of TW-18). The third boring at this location either intersected the edge of a mine void or a fracture zone and was completed as monitoring well TW-17. No chemical odors were noted at the drilling locations in the area of TW-17.

After the completion of well TW-17 a decision was made to drill an additional boring into the Pittsburgh Coal in an area northwest of TW-18, due to the fact that it was not certain whether a mine void was encountered in well TW-17. This seventh off-site boring was drilled to the Pittsburgh Coal and did not encounter a mine void. Chemical odors, and organic vapor readings up to 2.0 units were noted,

by the on-site geologist, when the Pittsburgh Coal was intersected at this location. A third off-site monitoring well, TW-19, was completed at this location.

The final off-site monitoring well (TW-20) was installed on 12 March 1990. Monitoring well TW-20 was installed at the corner of Riverview Drive and Circle Glenn Drive along the right-of-way for the road. A mine void was encountered in the Pittsburgh Coal during the installation of well TW-20. No chemical odors during the drilling and installation of the well were noted by the WESTON scientist. Figure 2-12 shows the locations of the four off-site monitoring wells installed during Phase III.

The first three off-site monitoring wells were originally constructed as open borehole wells below the overburden bedrock (which was cased off using 4-inch diameter carbon steel riser pipe). After a short period of time, however, it became apparent that due to the presence of rubble in the mine voids it was necessary to place a screen through the Pittsburgh Coal zone in order to maintain access to the Pittsburgh Coal groundwater. This was accomplished through the installation of a 2-inch diameter stainless steel screen on a wire cable. The final off-site well, TW-20, was constructed similarly to the previous Pittsburgh Coal monitoring wells. The well construction diagrams for the Phase III monitoring wells are included in Appendix A.

Measurements of water levels using a two-phase oil/water probe during and after drilling as well as grab samples collected from the off-site wells prior to sampling, did not indicate the presence of non-aqueous phase product in any of the new wells.

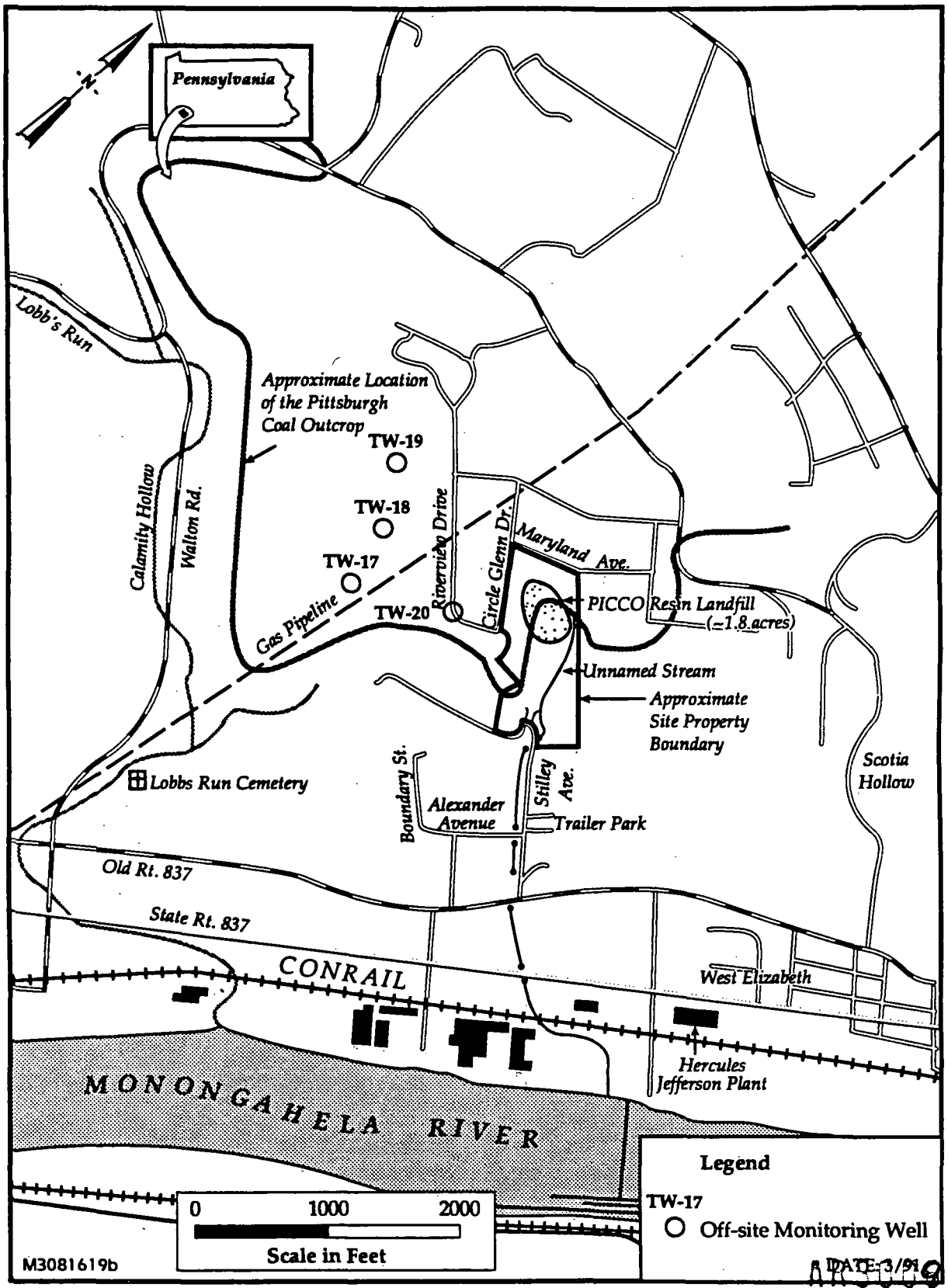

Figure 2-12 Phase III Monitoring Well Sampling Locations, PICCO Resin Landfill

Sampling of the off-site monitoring wells took place on 26 March 1990. Groundwater sampling and decontamination procedures, previously described in Section 2.1.2 and in the QAPP, were followed for the sampling of the off-site wells. The groundwater samples collected from the Phase III wells were analyzed for TCL VOC and BNA. The results of the analysis of groundwater samples are presented and discussed in Section 3.5. The laboratory data reports are included in Appendix E.

2.3.2 Seep Sampling - Phase III

All known seeps in Calamity Hollow along Walton Road were sampled during Phase III. All of the seep samples appear to be flowing from the elevation of the Pittsburgh Coal outcrop. Seep samples were first collected 14 December 1989. On 14 and 15 March 1990 several of the seeps were re-sampled for VOC due to missed holding times from the earlier batch of samples. Two seeps which had been dry during the initial Phase III seep sampling, and one seep which had not been previously identified, were also sampled during March. Figure 2-13 shows the locations of the seep sampled during the Phase III investigation. The result of Phase III seep sampling was that, of the ten seeps identified during the remedial investigation, nine were sampled during the Phase III investigation. All seep samples collected during Phase III were analyzed for TCL VOC and BNA. Seep samples were collected by either dipping the sample bottle directly into the seep pool or by filling the sample bottles using a decontaminated stainless steel scoop. Clean surgical gloves were worn for each seep sampling location. The VOC sample bottle was filled first and care was taken not to aerate the VOC sample.

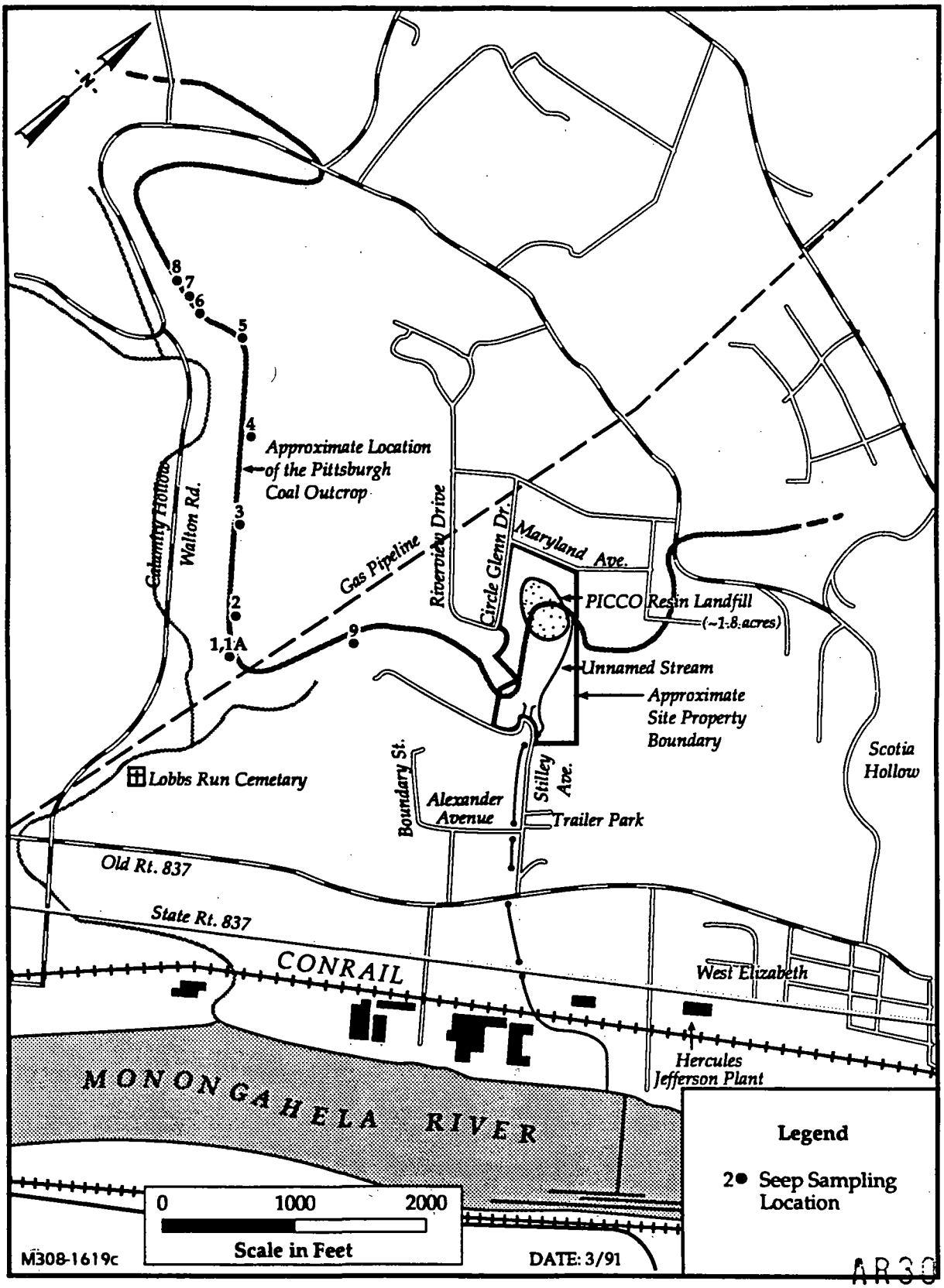

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Figure 2-13 Phase III Seep Sampling Locations, PICCO Resin Landfill

The results of the analysis of the seep samples are presented and discussed in Section 3.7.

Table 2-3 summarizes the seep sampling for all phases of the remedial investigation. Due to different field personnel performing seep sampling during the different phases of field work, the sample identification codes for the various seeps were not consistent between sampling events. In some cases the seep number included in the sample designation was inconsistent due to subsequent seep discoveries and renumbering of seeps. For these reasons Table 2-3 must be used when referring to raw data packages which are included in Appendix E. Table 2-3 also summarizes the sample designation codes for the various seep samples, as they appear on chain of custody forms and the laboratory reports.

2.3.3 Residential Well Sampling - Phase III

Samples were collected from residential wells No. 4 and No. 5 (Figure 2-10) on 14 December 1989. Samples were collected from all accessible residential wells on Walton Road (residential wells No. 9 through No. 13) on 13 March 1990 and 14 March 1990. All residential well samples were collected as described in Section 2.2.6. Each well was sampled for analysis of TCL VOC and BNA. The VOC sample bottle was filled first and waterflow at the discharge was minimized, for the filling of the VOC bottle, in order to minimize aeration of the sample.

The residential wells which were identified during the first and second phases of the RI are summarized in Section 2.2.6 in Table 2-2. Of the sixteen wells identified during the site reconnaissance, only ten of the wells could be sampled

TABLE 2-3

SEEP SAMPLING/SAMPLE DESIGNATION SUMMARY, PICCO RESIN LANDFILL

Seep # (see Figure 2-13)	Phase I Round 1	Phase I Round 2	Phase II Round 3	Phase II (Sediment)	Phase III Round 1	Phase III Round 2
1	Not Flowing	Not Flowing	SW-9	Not Sampled	Not Flowing	Not Flowing
1A	Not Flowing	Not Flowing	SW-10	Not Sampled	Not Flowing	SW-01-SEEP 1A
2	SW-9	SW-9	SW-11	SE-SEEP 1	SW-01-SEEP 2	SW-02-SEEP 2
3	Not Discovered	Not Discovered	Not Discovered	Not Sampled	SW-02-SEEP 3	SW-03-SEEP 3
4	Not Discovered	Not Discovered	Not Discovered	Not Sampled	Not Sampled	SW-09-SEEP 4B
5	Not Discovered	Not Discovered	Not Discovered	Not Sampled	SW-03-SEEP 5	SW-04-SEEP 5
6	Not Discovered	Not Discovered	Not Discovered	Not Sampled	SW-07-SEEP 4	SW-07-SEEP 4
7	Not Discovered	Not Discovered	Not Discovered	Not Sampled	SW-04-SEEP 6	SW-05-SEEP 6
8	Not Discovered	Not Discovered	Not Discovered	Not Sampled	SW-05-SEEP 7	SW-06-SEEP 7
9	Not Discovered	Not Discovered	Not Discovered	Not Sampled	Not Sampled	SW-08-SEEP 8

throughout the remedial investigation. This was primarily due to inaccessibility of the well, or in some cases, refusal of the property owner to allow sampling.

2.3.4 Ongoing Bi-monthly Surface Water Sampling - Phase III

After the collection of the small surface seep downslope of the lower landfill dike as discussed in Section 2.2.7, a bi-monthly surface water sampling program was established. This surface water sampling program was initiated in September 1989 and has continued on a bi-monthly basis since that time. A sampling station was established at the downstream weir (Weir #3) in the unnamed stream draining the site approximately 100 feet above the landfill gate (Figure 2-4). Samples have been collected by Hercules personnel, trained by a WESTON field scientist, using accepted field sampling procedures. This bi-monthly stream sample has been analyzed for benzene, toluene, xylene, ethylbenzene and naphthalene, which have been shown to be indicator parameters for the landfill leachate at the site. The results of the analysis of the bi-monthly stream samples are discussed in Section 3.4.

2.4 SUMMARY OF THE PICCO RESIN LANDFILL FIELD INVESTIGATIONS

Since the field investigations conducted at the site were carried out in three separate phases over the period of approximately 22 months, this section is designed to compile the information presented in the previous three sections for each phase of field investigation. Table 2-4 summarizes the chronology of the various field activities conducted during each of the three phases.

TABLE 2-4

CHRONOLOGIC SUMMARY OF PICCO RESIN LANDFILL REMEDIAL INVESTIGATION FIELD ACTIVITIES

TASK	TIME PERIOD
• **Phase I**	
- Ambient Air Sampling	May 1988
- Soil and Waste Sampling	May - June 1988
- Well Installation	May - June 1988
- Round 1 Groundwater, Surface Water, and Seep Sampling	June 1988
- Residential Well Survey	June 1988
- Ecological Survey	June 1988
- Round 2 Groundwater, Surface Water, and Seep Sampling	August 1988
• **Phase II**	
- Well and Piezometer Installation, Dike Stability Anaysis	January - February 1989
- Soil Sampling	January 1989
- Borehole Geophysical Survey	March, July 1989
- Round 3 Groundwater, Surface Water, Sediment and Seep Sampling	April 1989
- Residential Well Sampling	April 1989
- Expanded Residential Well Survey	April, July 1989
- Installation of Seep Collection Basin below Landfill Dike	September 1989
• **Phase III**	
- Initiation of Bimonthly Stream Sampling	September 1989
- Well Installation	January, March 1990
- Seep Sampling	December 1989, March 1990
- Residential Well Sampling	December 1989, March 1990
- Groundwater Sampling	March 1990

Table 2-4 can be used to cross reference a field activity to a specific phase of the RI in order to locate the detailed description of the field work and sampling procedures. Also, for quick reference between the results section and sample locations, maps which incorporate all sample locations for a given media for which samples were collected during multiple phases, are included in this section. This includes sampling of soil/waste, groundwater, surface water, sediment, residential wells and seeps.

A total of 50 soil samples and 17 waste samples (including duplicate samples) were collected for chemical analysis during the RI. These samples were collected from a total of 29 different sampling locations. Figures 2-2, 2-3, and 2-8 show the locations of soil and waste samples collected for chemical analysis from the PICCO Resin Landfill site and from below the site gate. As described in Sections 2.1 and 2.2, multiple samples, from different zones, were collected at most of the locations. A total of 35 groundwater samples (including duplicate samples) were collected from 20 monitoring wells during the RI. Most of these wells were sampled more than one time during the RI. Table 2-5 summarizes the well construction, and the zone which was monitored, for each of the monitoring wells installed at the site. Figure 2-14 shows the locations of all monitoring wells sampled during the RI.

Originally eight surface water/sediment sampling locations were established along the unnamed stream which drains the site. Two additional sediment sampling locations were established in order to confirm the downstream extent of contamination (location S-4A) and to collect an upslope "background" sediment sample (location SE-10). Figure 2-4 in Section 2.1.5 shows the locations of the stream samples collected from the unnamed stream. A total of 24 surface water

TABLE 2-5
SUMMARY OF WELL CONSTRUCTION DETAILS
FOR MONITORING WELLS AT THE PICCO RESIN LANDFILL

Well	Date Installed	Elevation of top of Well Cap (FAMSL)	Total Well Depth (feet below ground surface)	Bottom of Pittsburgh Coal (feet below ground surface)	Stratigraphic Zone Monitored	Screened Interval (feet below ground surface)
TW-1[old]*	6/24/80	~884	30.0	**	Unconsolidated	10 - 30
TW-1	6/16/88	881.31	14.0	**	Unconsolidated	4 - 14
TW-2	6/24/80	998.13	53.0	34	Pittsburgh Coal	13 - 53
TW-3	6/23/80	992.39	70.0	37	Pittsburgh Coal	20 - 70
TW-4	6/23/80	993.67	60.0	38	Pittsburgh Coal	10 - 60
TW-5	7/29/82	1,053.89	200.0	106	Deep Bedrock	111 - 200
TW-6	7/30/82	982.19	290.0	27	Deep Bedrock	38 - 290
TW-7	6/15/84	1,041.36	96.0	93	Pittsburgh Coal	86 - 96
TW-8*	8/2/83	898.10	40.0	**	Deep Bedrock	26 - 40
TW-9	6/14/84	923.88	25.0	**	Unconsolidated	4 - 22
TW-10	6/14/84	930.38	20.5	**	Unconsolidated	4 - 17.5
TW-11	6/13/84	932.83	18.0	**	Unconsolidated	4 - 15
TW-12	6/16/88	1,054.02	96.5	96.2	Pittsburgh Coal	86.2 - 96.2
TW-13	1/31/89	1,055.89	106.7	105.2	Pittsburgh Coal	95.5 - 105.5
TW-14	2/3/89	1,065.27	114.0	114	Pittsburgh Coal	104 - 114
TW-15	2/10/89	1,057.60	87.0	86	Pittsburgh Coal	76 - 86
TW-16	1/24/89	830.05	16.0	**	Unconsolidated	6 - 16
TW-17	1/19/90	1,031.33	100.5	97	Pittsburgh Coal	89 - 98.7
TW-18	1/12/90	1,073.40	140.9	137	Pittsburgh Coal	125.7 - 140.7
TW-19	1/23/90	1,074.37	146.5	143	Pittsburgh Coal	134.1 - 143.8
TW-20	3/14/90	1,067.14	140.0	126	Pittsburgh Coal	116 - 126.5

* TW-1[old] and TW-8 have been abandoned.
** Well is located below the Pittsburgh Coal outcrop.

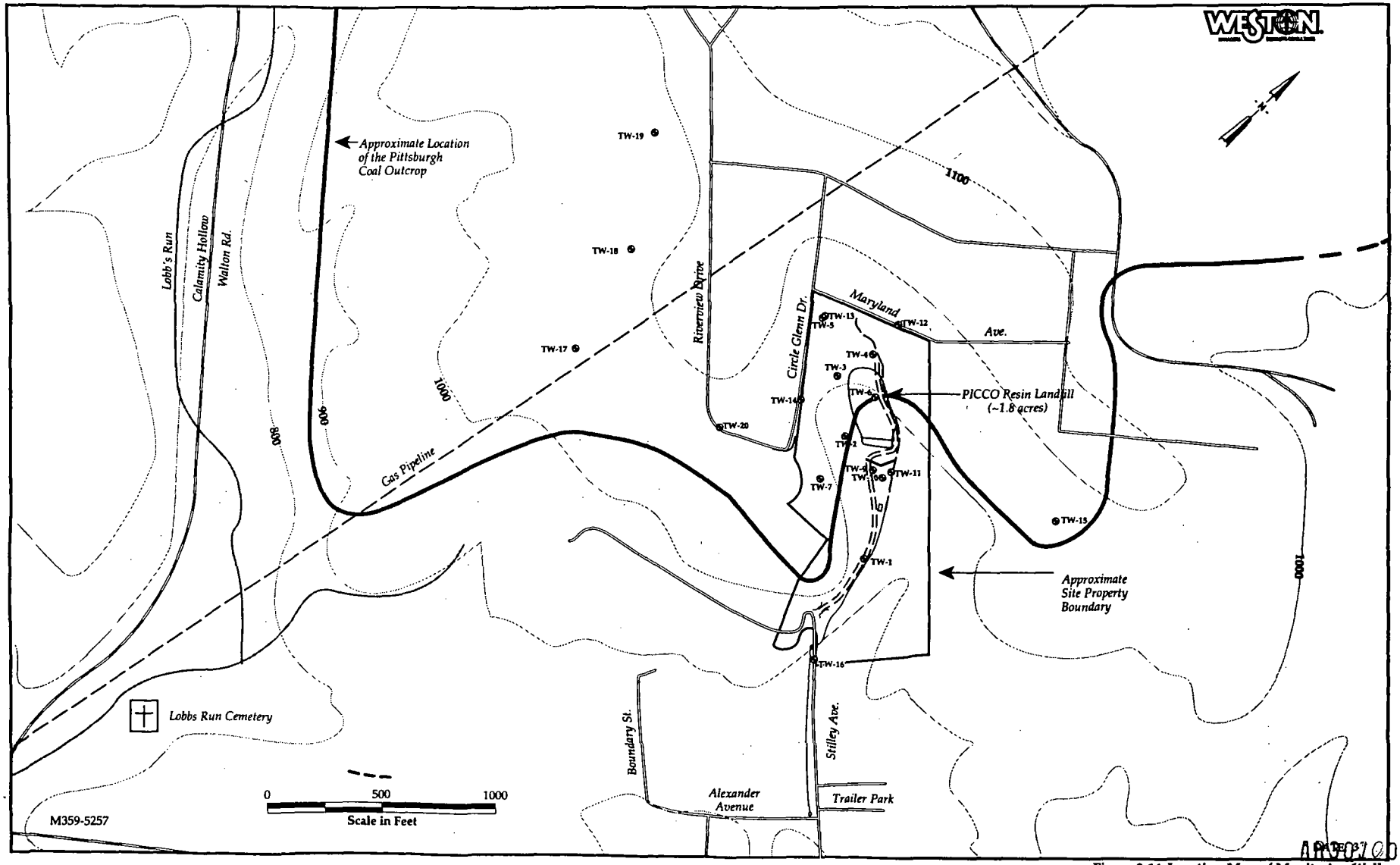

Figure 2-14 Location Map of Monitoring Wells Sampled During the PICCO Resin Landfill Remedial Investigation

samples and 12 sediment samples (including duplicate samples) were collected from the unnamed stream during three rounds of stream sampling conducted throughout the RI.

A total of 10 residential wells were sampled during the RI. Table 2-2 in Section 2.2.6 lists the residential wells which were sampled during the RI (designated with an asterisk) as well as residential wells from which samples could not be collected. Figure 2-10 in Section 2.2.6 shows the locations of all know residential wells in the site area.

A total of 16 seep samples (including duplicate samples) were collected from ten different seeps during the RI. All of the seep samples were aqueous samples with the exception of one sediment sample. Figure 2-13 in Section 2.3.2 shows the locations of the seeps which were sampled. Table 2-3 in Section 2.3.3 summarizes the seep sampling program which was conducted in five sampling rounds during the RI.

A total of 13 ambient air samples were collected from 13 different locations during the RI. The locations of the ambient air samples are shown on Figure 2-6 in Section 2.1.8. The air sampling analytical results are summarized in Section 3.8.

SECTION 3

RESULTS

3.1 ANALYTICAL PROGRAM

The Phase I analytical program outlined in the original work plan was designed to define the extent of waste material within the landfill and the degree of contamination adjacent to the landfill. The Phase I chemical analyses were performed by WESTON Analytics, a certified CLP laboratory. All samples were analyzed following USEPA protocol with standard commercial QA/QC packages. Analysis was, in most cases, for full TAL metals and TCL compounds (VOC, BNA and pesticide/PCB) plus cyanide and TPH during the Phase I investigation. After the Phase I field program had been completed it was agreed, between Hercules, WESTON, PADER and USEPA, that the target compounds of concern at the site were from the VOC and BNA groups. Samples collected during subsequent Phases II and III of the RI were, therefore, generally analyzed for VOC and BNA only. The same protocol and QA/QC requirements which were used during Phase I were also followed during subsequent phases. The laboratory data packages for all analytical results are included in Appendix E.

Discussion of total and mean concentrations of organic compound groups (ie. VOC and BNA) throughout Section 3 include all detections except acetone, methylene chloride and any compounds for which the ratio of the concentration in the method blank to the concentration in the sample was greater than or equal to 0.1 (denoted in the analytical data summary tables with a double asterisk). It is also noted that the totals reported on the tables commonly include data which were ass.

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"J"or "B" qualifiers (see legend from data summary tables) indicating estimated values below the instrument detection limit and possible cross-contamination, respectively.

3.2 WASTE/LANDFILL CHARACTERIZATION

3.2.1 Physical Characteristics, Geometry and Extent

Seven of the fifteen borings which were used to characterize the landfill, were drilled within the area of the landfill which contained waste. Descriptions of the split-spoon samples and auger cuttings indicated that the waste is heterogeneous with respect to physical characteristics. Typical samples of waste material varied from a brown/tan slurry of oily clay and silt to a more cohesive brown/tan, low density, spongy waste material. In some boreholes a milky white oily clay waste sludge was encountered as well as what appeared to be native clayey soils with coal fragments which were saturated with oily product.

The N-value (the total blow count needed to drive the split-spoon for the middle 12 inches of the sample) generally ranged between two and four for the waste material. This is indicative of very soft to soft soils (Bowles, 1982). The interlayered clay, encountered throughout the landfill, generally displayed an N-value between eight and twelve, indicative of medium to stiff soils (Bowles, 1982). The blow counts for each split-spoon collected from the waste material are listed on the boring logs in Appendix F.

Seven waste samples were collected, from seven different landfill borings, (BH-14, BH-15, BH-16, BH-17, BH-18, BH-20, and BH-21) to be analyzed in the

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laboratory for physical characteristics. These samples were analyzed for moisture content, percent organics/inert material and heating value (BTU). The landfill waste physical characteristics data are summarized in Table 3-1. The physical characteristics laboratory data reports are included in Appendix G. The heating value of the seven waste samples which were tested ranged from 2,510 to 3,880 BTU/lb. Percent moisture ranged from 39.6% to 48.8%. Percent ash ranged from 65.4% to 74.9%. Conversely, percent organics ranged from 25.1% to 34.6%.

A second set of samples for physical characterization of the landfill, were collected from the existing cover material of the landfill from BH-14, BH-17, BH-18, BH-20 and BH-21. These five samples were taken from the upper two feet of cover soil overlying the waste material using Shelby tubes, in order to provide relatively undisturbed soil samples. Each Shelby tube sample was analyzed for permeability, moisture and density. The results of the analysis of the cover material are presented in Table 3-2. The laboratory test data reports are included in Appendix G. As seen in Table 3-2 the cover material is composed of soils which range from clay to silty clay and display permeability ranging from 5.11×10^{-8} cm/sec to 2.51×10^{-5} cm/sec.

Figure 3-1 shows the locations of the longitudinal and transverse cross sections (A to A' and B to B', respectively) which were constructed using borehole descriptions of the cover material, waste, soils and bedrock. Figure 3-2 shows the longitudinal cross section, A to A', which shows the area from the lower dike (southeast) to the lower section the topographic chute (northwest), where waste was deposited. The longitudinal cross section indicates that a lense of waste material approximately twenty feet thick, is underlain by layer of clayey soil which varies in thickness from approximately ten feet to one or two feet. This underlyi

TABLE 3-1

SUMMARY OF LANDFILL WASTE PHYSICAL CHARACTERISTICS TEST DATA, PICCO RESIN LANDFILL

Sample ID	Heating Value (BTU/lb.)	Percent Moisture	Percent Ash	Percent Organics
WA-BH14-002 Depth: 22'-24'	3880	39.6	67.6	32.4
WA-BH15-001 Depth: 8'-12'	3710	41.1	65.4	34.6
WA-BH16-001 Depth: 14'-18'	2510	44.6	74.9	25.1
WA-BH17-002 Depth: 20'-24'	2560	39.9	74.8	25.2
WA-BH18-002 Depth: 16'-20'	2800	48.8	72.2	27.8
WA-BH20-002 Depth: 20'-22'	2510	46.9	74.9	25.1
WA-BH21-001 Depth: 14'-16'	2980	46.7	72.3	27.7

TABLE 3-2

SUMMARY OF LANDFILL COVER PHYSICAL CHARACTERISTICS
TEST DATA FROM ANALYSIS OF SHELBY TUBE SAMPLES, PICCO RESIN LANDFILL

Borehole	Depth (feet)	Permeability (cm/sec)	Percent Moisture	Density (1 lbs/ft^3)	Grain Size Classification	Approximate Cover Thickness (feet)
BH 14	0-2	2.51×10^{-5}	22.4	109.4	silty clay	6
BH 17	0-2	6.68×10^{-8}	16.1	102.2	silty clay	8
BH 18	0-2	5.11×10^{-8}	14.1	104.6	clay	6
BH 20	0-2	8.54×10^{-7}	17.8	98.7	clay with some silt	4
BH 21	0-2	3.06×10^{-6}	21.2	101.1	clay	6

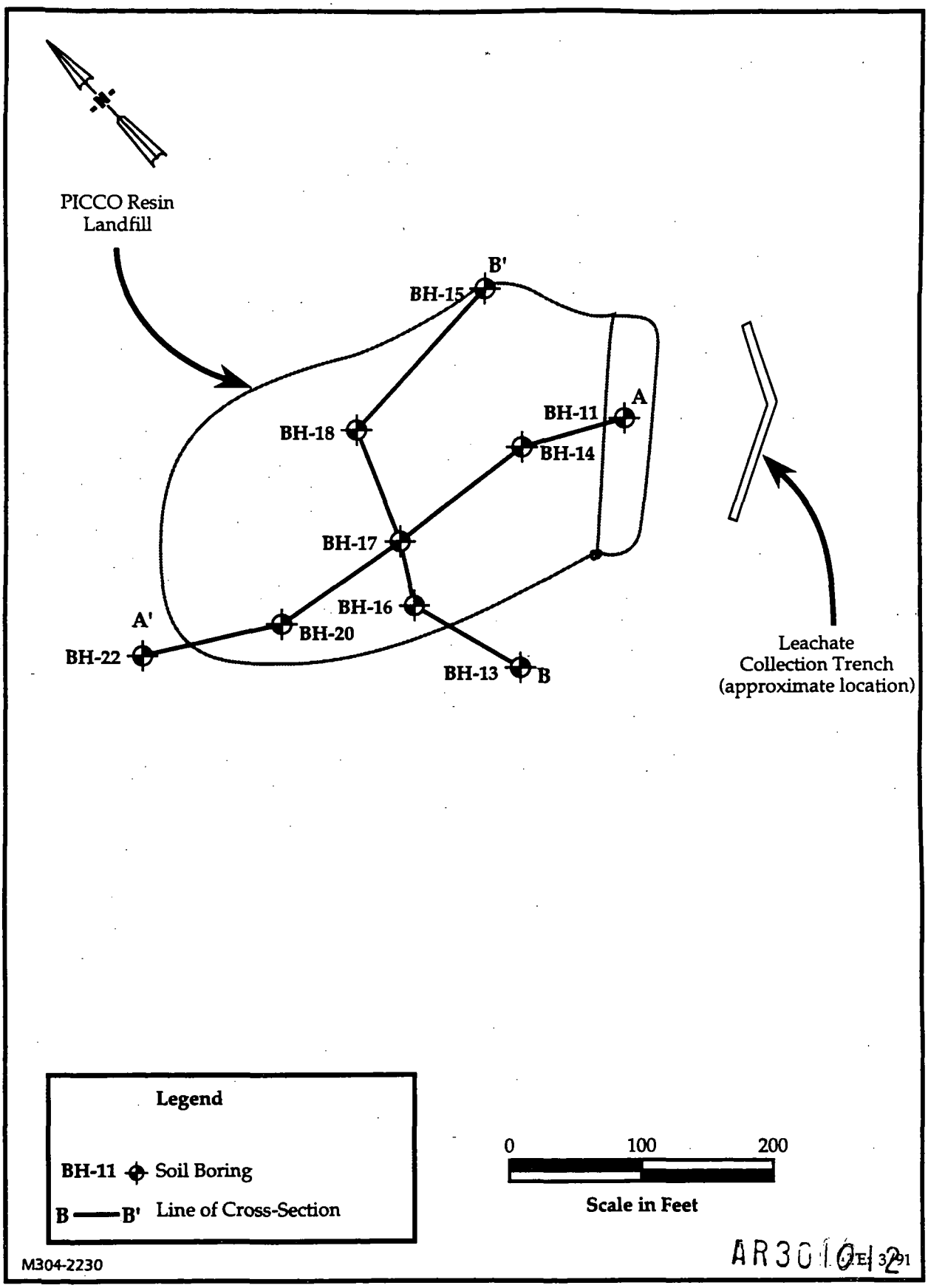

Figure 3-1 Map Showing Location of Landfill Cross-Sections

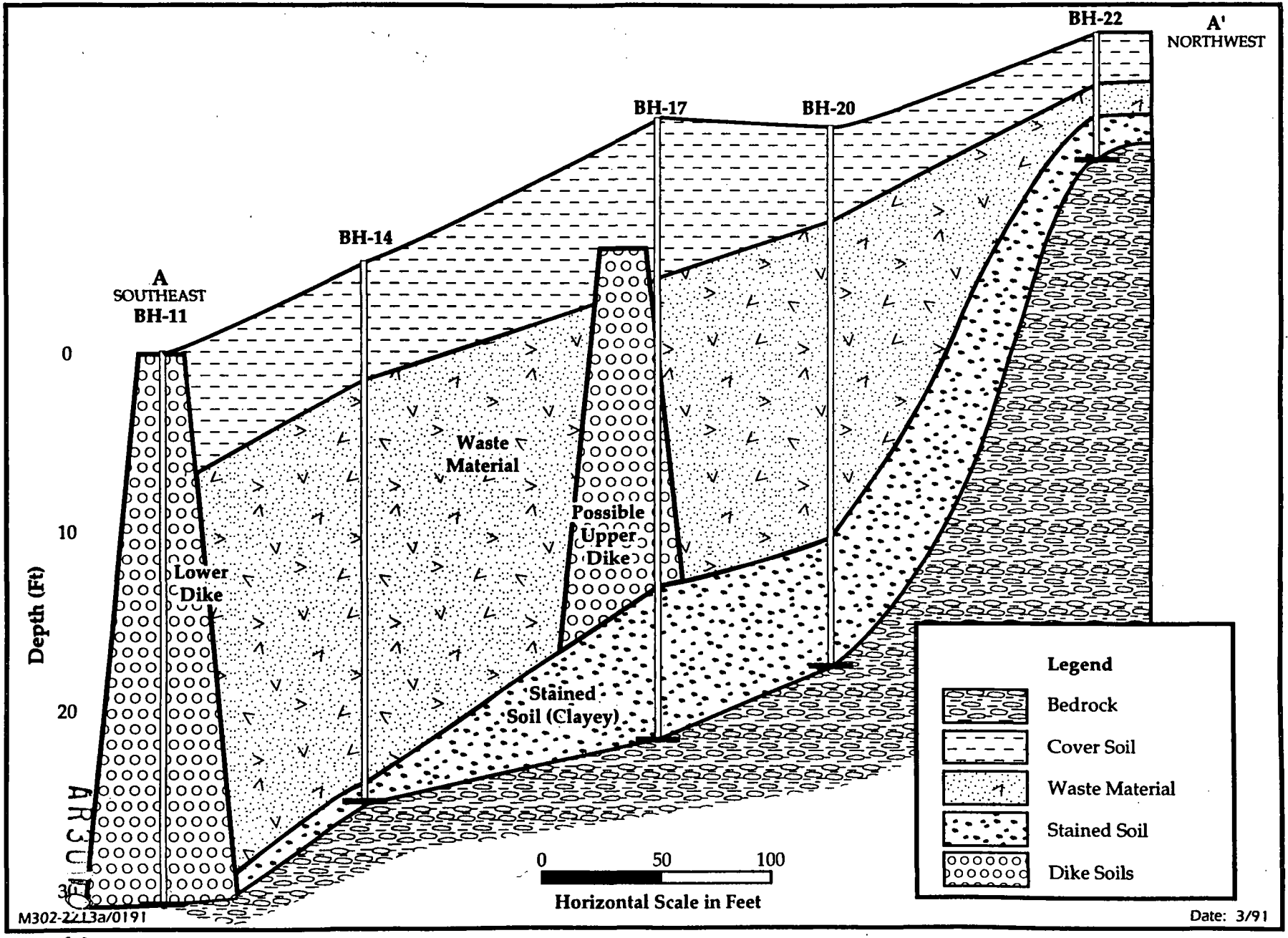

Figure 3-2 Longitudinal Landfill Cross Section A-A', PICCO Residual Landfill

clayey layer was generally oil stained and was resting on bedrock. The bedrock under this clayey layer was either shale or the underclay of the Pittsburgh Coal. Boreholes through the deep bedrock beneath and adjacent to the landfill (TW-5 and TW-6) as well as a ten foot core sample collected from the bedrock below the lower dike in BH-11 did not encounter water bearing fractures. A fracture analysis of the core sample revealed no natural fractures. These data indicate that the bedrock underlying the Pittsburgh Coal does not contain significant water bearing fractures is not an aquifer. A clay rich layer of cover soil, approximately four to eight feet thick, overlies the waste material. The approximate locations of the upper and lower dike are also shown on the longitudinal landfill cross section.

Figure 3-3 shows a transverse cross section, B to B', across the landfill. This cross section shows that the waste material thins towards the northeast edge of the landfill and a bedrock low, possibly associated with a historical location of the valley stream, exists under the approximate center line of the landfill. This bedrock low is also found to be present below the lower dike during earlier soils investigation (WESTON, 1981b).

Figure 3-1 shows the approximate landfill footprint, based upon the waste and perimeter soil borings. This landfill footprint indicates that the landfill is approximately 350 feet long and 225 feet wide. In order to estimate volumes of waste material and contaminated soils within the landfill, estimates of average thicknesses of the cover soil, waste material and contaminated soils within the landfill were made, based upon cross sections A to A' and B to B' (Figures 3-1, 3-2 and 3-3). The volume of waste material, based on an estimated average thickness of 18 feet, is approximately 1,418,000 cubic feet (53,000 cubic yards) or 85,000 tons (assuming a density of 120 lbs/ft^3). The volume of soils below the

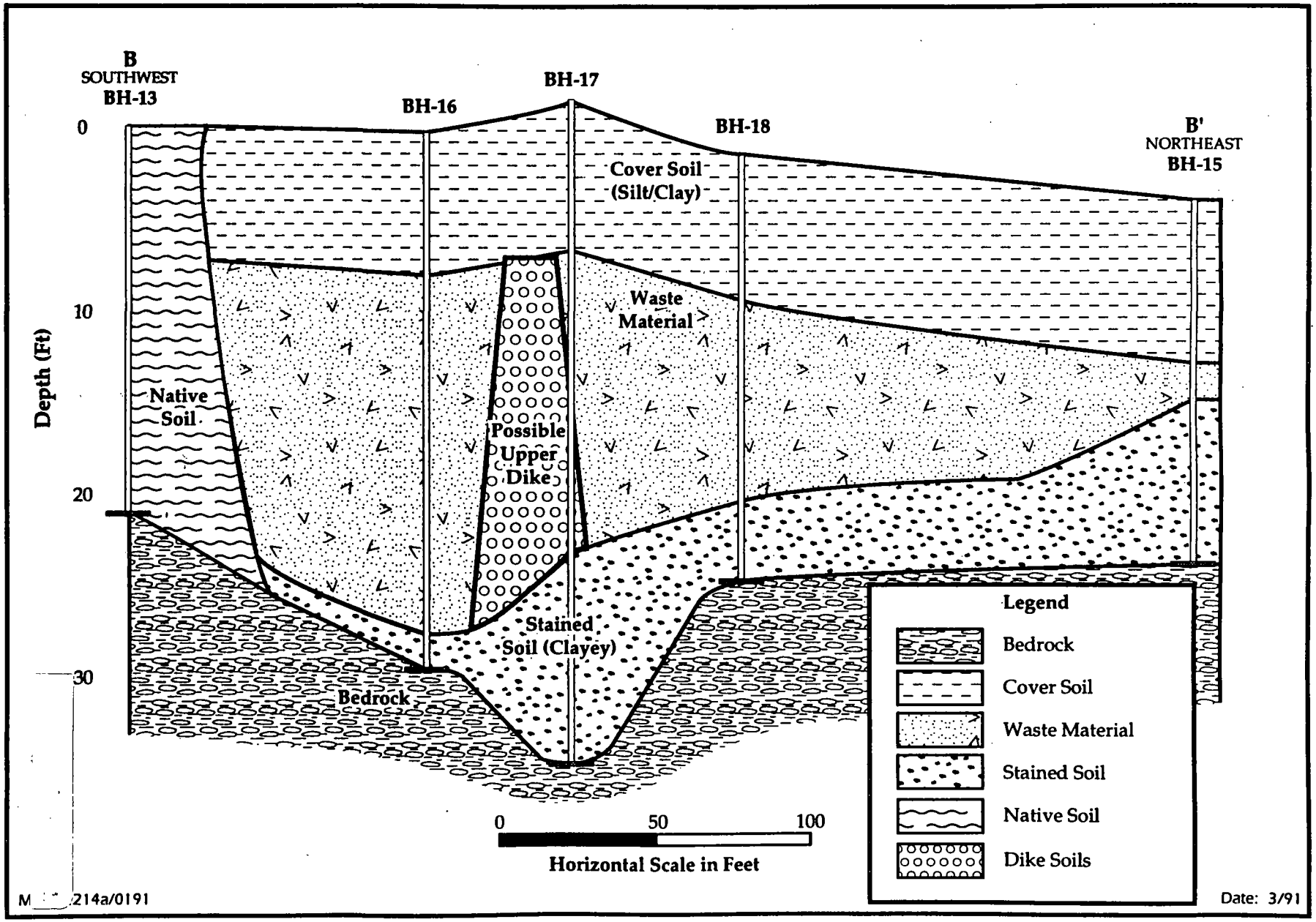

Figure 3-3 Transverse Landfill Cross Section B-B'
PICCO Resin Landfill

landfill waste, (which may contain waste constituents) based on an estimated average thickness of six feet, is approximately 473,000 cubic feet (17,500 cubic yards) or 28,000 tons (assuming a density of 120 lb/ft^3). The volume of cover material, based on an estimated average thickness of 6 feet, is approximately 473,000 cubic feet (17,500 cubic yards) or 24,000 tons (assuming a density of 100 lb/ft^3).

3.2.2 Chemical Characteristics of the Waste Material

A total of seventeen samples (including two duplicates) for chemical analysis were collected from various depth intervals from seven of the landfill waste/soil borings (BH-14 through BH-18, BH-20, and BH-21). Samples were collected from two or three depth intervals from most of these landfill borings. Table 3-3 summarizes the detected compounds from the laboratory analysis of the waste samples and also the depth interval represented by each sample. A legend for this table (and all subsequent analytical data tables) is found on the page following the table.

Seven of the seventeen waste samples were analyzed for TAL metals and cyanide. All seventeen of the samples were analyzed for TCL VOC, BNA and pesticide/PCB compounds. The pesticide/PCB analysis detected no compounds. The results of the inorganic analysis (metals and cyanide), VOC, BNA and TPH are presented in Table 3-3. Throughout Section 3 the analytical data summaries list only the compounds for which at least one detection in a particular media was reported. Also provided in Table 3-3, is a total for each of the organic compound categories (i.e., total VOC and total BNA).

An initial review of the inorganic analyses, by Hercules, WESTON, PADER and USEPA, during a meeting on 18 September 1988, resulted in the conclusion that

Table 3-3
Analytical Data Summary for Waste Material Samples, PICCO Resin Landfill

	BH14-1 6'-14'	BH14-2 16'-24'	BH14-3 24'-30'	BH15-1 8'-12'	BH16-1 14'-18'	BH16-2 24'-28'	BH17-1 8'-10'	BH17-2 20'-24'	BH17-2D 20'-24'	BH17-3 32'-34'	BH18-1 10'-12'	BH18-2 16'-20'	BH20-1 10'-14'	BH20-2 20'-22'
INORGANICS (mg/kg)														
Antimony		ND	ND				ND	ND	ND					ND
Arsenic		9.4	23.5				5.4	14.5	15.5					14
Barium		135	90				81.8	90.2	84.7					94.5
Beryllium		1.4	ND				ND	ND	ND					ND
Cadmium		ND	1.8				ND	ND	ND					3.5
Calcium		16400	41900				38000	32000	21000					120000
Chromium		31.4	31.1				33.1	29.1	28.7					41.9
Cobalt		14.1	ND				ND	ND	ND					ND
Copper		89.4	125				118	90.7	72.1					162
Cyanide		ND	ND				ND	ND	ND					ND
Lead		27.5	76.5				23.5	38.8	36					49.4
Magesium		5590	8650				10500	6230	4880					20100
Manganese		1200	479				177	474	572					160
Mercury		0.4	0.3				0.5	0.4	0.39					0.3
Nickel		31	17.3				25.4	24.3	27					ND
Potassium		2050	1440				2390	2190	1880					2100
Selenium		ND	ND				ND	ND	ND					ND
Sodium		5600	6320				12800	5340	4190					2710
Thallium		ND	ND				ND	ND	ND					ND
Vanadium		36.5	31.8				28.2	31.5	30.1					34.9
Zinc		822	1900				1350	793	566					1610
VOC (mg/kg)														
Acetone	940 B	3100 B	3800 B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	290 J	260 J	62	60	70	220	120	120 J	1.1	170	230	190	140
Carbon Disulfide	ND	ND	ND	ND	9.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	140	3100	2400	340	310	180	3400	1500	1800	11	1700	3000	2000	2000
Methylene Chloride	250 B	1700 B	1800 B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	61 J	2800	ND	210	490	290	1800	1200	1500	3.1	1800	4600	1900	2200
Toluene	120	4200	3600	620	400	430	3900	1500	1800	8.3	1900	4800	2500	2400
Total Xylenes	1000	21000	17000	2100	1800	1100	19000	9200	12000	53	12000	20000	13000	12000
TOTAL VOC*	1321	31390	23260	3332	3069.2	2070	30340	13520	17220	76.5	17570	32630	19590	18740
BNA (mg/kg)														
2-Methylnaphthalene	490 DB	150 DB	770 D	1200	990 J	3700	800 JBD	1500 DB	2000 DB	2.4 B	920 B	450 B	1500 DB	1700 DB
Acenaphthene	ND	ND	6.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	3.5	ND	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	19 JB	22 JB	ND	ND	20 JB	ND	22 JB
Naphthalene	8300 DB	2800 DB	12000 DB	18000	19000	23000	20000 DB	27000 DB	33000 DB	38 DB	15000 DB	12000 DB	30000 DB	28000 DB
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	48 B	ND	ND
TOTAL BNA	8790	2950	12770	18120	19990	26700	20800	28519	35022	40.4	15920	12518	31500	29722
PET. HYDROCARBON (mg/kg)														
Total Petroleum Hydrocarbon	130000	200000	81000	73000	43000	33000	51000	40000	54000	28	69000	46000	54000	30000

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

Table 3-3 (Continued)
Analytical Data Summary for Waste Material Samples, PICCO Resin Landfill

	BH20-3 26'-28'	BH21-1 10'-14'	BH21-1D 10'-14'
INORGANICS (mg/kg)			
Antimony	ND		
Arsenic	3.2		
Barium	ND		
Beryllium	ND		
Cadmium	ND		
Calcium	3380		
Chromium	11.9		
Cobalt	ND		
Copper	21.2		
Cyanide	ND		
Lead	31.4		
Magesium	ND		
Manganese	732		
Mercury	0.13		
Nickel	ND		
Potassium	1490		
Selenium	1.2		
Sodium	ND		
Thallium	ND		
Vanadium	ND		
Zinc	71.5		
VOC (mg/kg)			
Acetone	ND	ND	ND
Benzene	34 J	170	140
Carbon Disulfide	ND	ND	ND
Ethylbenzene	380	1900	1400
Methylene Chloride	ND	ND	ND
Styrene	490	1400	1500
Toluene	750	2300	1800
Total Xylenes	2700	12000	9800
TOTAL VOC*	4354	17770	14640
BNA (mg/kg)			
2-Methylnaphthalene	230 DBJ	430 B	1500 B
Acenaphthene	ND	ND	ND
Dibenzofuran	ND	ND	ND
Fluoranthene	ND	22 JB	ND
Naphthalene	3400 DB	13000 DB	25000 B
Phenanthrene	ND	ND	ND
Phenol	ND	ND	ND
TOTAL BNA	3630	13452	26500
PET. HYDROCARBON (mg/kg)			
Total Petroleum Hydrocarbon	9400	54000	43000

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are consisdered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

no inorganics were present in the waste which were of significant concern. The analytical results indicated that certain VOC and BNA were the primary constituents of concern regarding the landfill waste. Consequently future phases of sampling and analysis were focused on defining the presence and extent of these organic compounds.

The primary VOC detected in the landfill waste were benzene, toluene, xylene, ethylbenzene and styrene. Acetone and methylene chloride were disregarded from consideration in the waste because it has been determined to be attributable to laboratory and/or field cross-contamination. The very high concentrations of these compounds detected in waste samples from BH-14 are due to high dilution factors (ranging from 19,000 to 200,000) (Appendix E) and the presence of these compounds in the water used to dilute these samples. When the concentrations of acetone and methylene chloride in the samples are divided by the dilution factor they are less than ten times the concentrations detected in the laboratory method blanks indicating that the concentrations detected in the samples are the result of laboratory contamination. The only secondary VOC (a VOC which occurs at relatively low concentrations and/or in a low number of samples) detected in the waste samples was carbon disulfide. This compound was detected in a single sample, BH16-1. Total concentrations of VOC in the waste samples ranged from 76.5 milligrams per kilogram (mg/kg) in sample BH17-3 to the maximum of 32,630 mg/kg in sample BH18-2. The mean concentration of total VOC in the waste samples is 14,761 mg/kg or approximately 1.5 percent.

The primary BNA detected in the waste material were naphthalene, and 2-methyl naphthalene. The secondary BNA detected in the waste samples were acenaphthalene, dibenzofuran, fluoranthene and phenol. Total concentration of BNA in the waste samples ranged from 40.4 mg/kg in BH17-3 to 35,022 mg/kg

in sample BH17-2D. The mean concentration of BNA in the waste sample 16,642 mg/kg or approximately 1.7 percent.

Also included in Table 3-3 is the result of analysis for TPH. This parameter includes many of the VOC and BNA however, also includes other hydrocarbon compounds not reported for TCL VOC and BNA. The TPH concentrations ranged from 200,000 milligram per kilogram (mg/kg) in sample BH14-2 to 28 mg/kg in sample BH17-3. The mean concentration of TPH in the waste samples was 59,437 mg/kg or approximately 5.9 percent.

The chemical analysis of the waste material (as well as samples from other media) during the Phase I investigation allowed the key landfill related constituents to be identified and for additional sampling and analysis efforts be focused on these compounds. The laboratory reports for the waste sample analyses are included in Appendix E.

3.2.3 Geotechnical Stability Analysis

A limited field program was performed during February 1989 to collect data for a preliminary geotechnical analysis of dike stability conditions. The objective of this analysis was not to perform a comprehensive dike stability analysis using an extensive field program but to perform a preliminary assessment on the existing condition of the lower landfill dike. This structure has been stable since its construction prior to May 1967 (based on the analysis of historical aerial photographs).

A slope stability analysis was performed for three cross sections through the lower earthen dike at the PICCO Resin Landfill. The locations of the cross sections, and

the topography of the dike area, are shown on Figure 3-4. The cross sections were developed using the following information:

- One foot contour interval topographical map (1962) taken from the Pollution Abatement Plan for the PICCO Resins Landfill prepared by WESTON (1982). The topographic features of the 1962 map were compared to the recent 1989 topography map by Eastern Mapping Co. The 1962 map was comparable to the 1989 map in the dike area and provided greater detail (heavy tree cover may have affected the level of the detail on the 1989 map).

- Boring logs for borings BH-10, BH-11, BH-12, P-2, P-3, P-4, P-5, P-6, and P-7 (Appendix F, Figures 2-3 and 2-8).

- Water level readings taken by WESTON from piezometers P-2 through P-7 on April 4, 1989.

- Boring and piezometers location survey completed by Gateway Engineers, Inc. dated April 1989 and entitled "Plan of Property."

Other site data used for the stability analysis included:

- Grain size distribution analysis of the following test boring samples:
  - BH10 (7-13 ft.)
  - BH10 (15-30 ft.)
  - BH11 (10-12 ft.)
  - BH12 (5-10 ft.)
  - BH12 (20-24 ft.)

- Triaxial shear strength analysis on the following Shelby tube samples:
  P-5 (15.2 - 15.8 ft.) - (2)
  P-5 (15.8 - 16.4 ft.) - (2)
  P-5 (16.4 - 17.0 ft.) - (2)
  P-6 (10.0 - 10.5 ft.) - (1)
  P-6 (10.5 - 11.0 ft.) - (1)
  P-7 (12.0 - 14.0 ft.) - (1)

  (1) Unconsolidated - Undrained Test

  (2) Consolidated - Undrained Test w/pore water pressure measurements

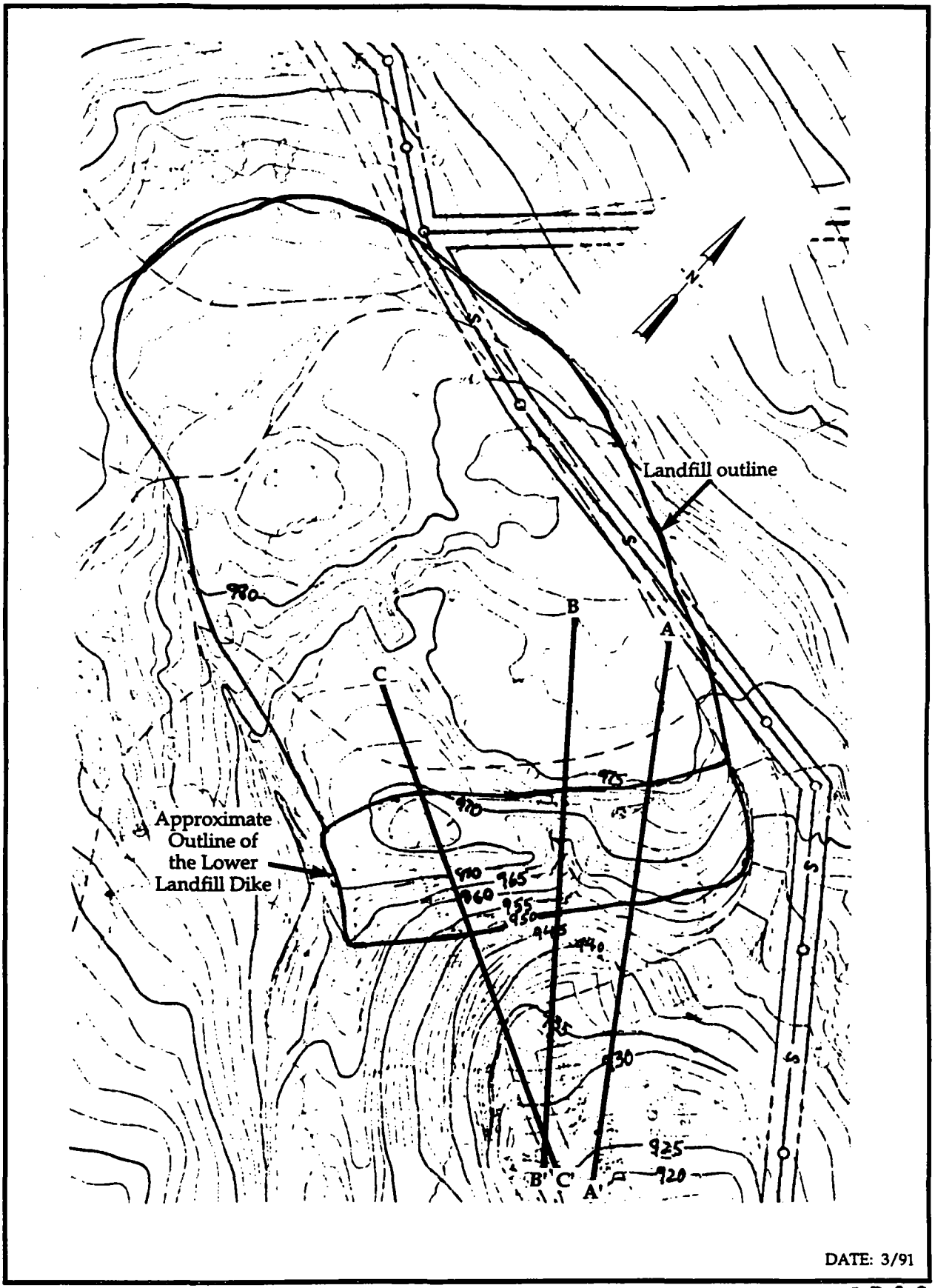

Figure 3-4 Locations of the PICCO Resin Landfill Stability Analysis Cross Section, PICCO Resin Landfill

AR301023

Soil/waste material boundaries, for the three cross sections that were analyzed, were estimated using available data from the soil boring logs and geotechnical laboratory analysis of boring and piezometer samples. Further information on the extent of the dike on the uphill (waste) side of the dike is needed, as well as additional shear strength data on the dike materials, to better define the extent and nature of the soil state. Five distinct soil/material layers were identified. The physical characteristics and shear strength parameters of the soil and waste layers used for the stability analysis are provided in the attached table (Table 3-4). Strength parameters are based on laboratory data and published values using soil classification and standard penetration resistance N-values recorded on the boring logs.

Slope stability analysis using the GEOSLOPE® computer software program was performed on each of the three cross sections under both total stress (short term) and effective stress (long term) conditions. Due to the age of the dike, the effective stress conditions may be a better estimate of the actual dike conditions. Both effective and total stress conditions were investigated due to the saturated conditions in the dike and the estimated low permeability of the clayey dike materials. Total stress conditions may be applicable if any regrading or disturbance of the dike area is planned to be performed resulting in excess pore water pressures in the fine-grained dike material.

The GEOSLOPE® program is based on the Modified Bishop Method of slice analysis. It assumes a circular arc failure mode and calculates the factor of safety of the slope for the assumed failure arc by dividing the slope into an appropriate number of slices and statically analyzing the overall moment equilibrium and vertical force equilibrium of each slice.

TABLE 3-4

SOIL PARAMETERS
USED FOR LOWER LANDFILL DIKE SLOPE STABILITY ANALYSIS, PICCO RESIN LANDFILL

MATERIAL BOUNDARY NO.	MATERIAL TYPE	SAMPLE NO.	WET UNIT WEIGHT (PCF)	SATURATED UNIT WEIGHT (PCF)	TOTAL STRESS PARAMETERS		EFFECTIVE STRESS PARAMETERS	
					COHESION C (PSF)	FRICTION ANGLE 0	COHESION C' (PSF)	FRICTION ANGLE 0'
1	WASTE	P-7 (12'-14')	120[1]	122[1]	100[2]	0[2]	0	34[1]
2	CLAYEY FILL W/COAL FRAGMENTS N> 15	P-6 (10'-11')	116[1]	125[1]	175[1]	12[1]	0	6[2]
3	CLAYEY FILL W/COAL FRAGMENTS N< 15	P-6 (19'-21') P-5 (15'-17')	120[1]	128[1]	375[1]	10[1]	0	32[1]
4	WEATHERED SHALE		130[2]	135[2]	---	---	0	38[3]
5	SHALE BEDROCK		135[2]	138[2]	---	---	200,000[3]	38[3]

N - Standard Penetration Resistance Value

(1) Based on Geotechnical laboratory testing by Earth Technology Corp.
(2) Based on grain size distribution analysis, Standard Penetration Resistance and published values in Bowles, Foundation Analysis and Design, Third Edition and Department of the Navy Design Manual - NAVFAC DM-7, March 1971, Table 9-1.
(3) Jumick[illegible]. "Rock Mechanics," Table 4-1-0.

The ten most critical circular arc failure surfaces computed by the GEOSLOPE program and the minimum factor of safety is presented on the computer generated cross sections shown in Figures 3-5 through 3-10. These cross sections present the results of the stability analysis for the three cross sections for both total and effective stress conditions. The results of the computer analysis are also summarized on Table 3-5.

The results of the slope stability analysis on the earthen dike indicate that the factor of safety determined for both total and effective stress conditions for the cross sections A to A' and C to C' are at or above the minimum acceptable values. The minimum acceptable factor of safety values for total (short-term) and effective (long-term) stress conditions are 1.3 and 1.5, respectively (Federal Register, "Part II, Title 30-Mineral Resources," office of Surface Mining Reclamation and Enforcement, US Dept, of Interior, Chapter VII, Part 715, Dec. 1977).

The factor of safety determined for the total stress condition for the cross section B to B' was 1.1 which is below the accepted minimum value of 1.3. Total stress conditions may occur if any regrading activities are conducted on the dike. The computed factor of safety of 1.1 for cross section B to B' does not represent a scenario under which there is a high probability of imminent failure. The factor of safety determined for the effective stress, or long term condition, for cross section B to B' was 0.9 which is below unity. This represents a scenario under which there is a much higher likelihood of failure. The ten most critical failure surfaces for this condition were shallow failures occurring in the top several feet of dike material along the slope. Shallow surface failures of this nature would not result in immediate major damage to the dike. However, if no action is taken to correct this situation it could lead to a major deep failure of the dike. It is important to note that due to the presence of vegetation, which may greatly

Roy F. Weston, Inc.
West Chester, PA

HERCULES RESIN LANDFILL DIKE STABILITY

101SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.519

AR300027

Figure 3-5 Landfill Stability Analysis Cross Section A-A'; Total Stress Condition, PICCO Resin Landfill

Version No.2
3/26/91

3-21

DATE: 3/91

Roy F. Weston, Inc.
West Chester, PA

HERCULES RESIN LANDFILL DIKE STABILITY

101SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.813

AR301028

Figure 3-6 Landfill Stability Analysis Cross Section A-A'; Effective Stress Condition, PICCO Resin Landfill

DATE: 3/91

Roy F. Weston, Inc.
West Chester, PA

PICCO RESINS LANDFILL DIKE STABILITY

500SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.157

Figure 3-7 Landfill Stability Analysis Cross Section B-B'; Total Stress Condition, PICCO Resin Landfill

AR301029

DATE: 3/91

Version No.2
3/26/91

Roy F. Weston, Inc.
West Chester, PA

PICCO RESINS LANDFILL DIKE STABILITY

500SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = .887

AR301030

Figure 3-8 Landfill Stability Analysis Cross Section B-B'; Effective Stress Condition, PICCO Resin Landfill

DATE: 3/91

Roy F. Weston, Inc.
West Chester, PA

PICCO RESINS LANDFILL DIKE STABILITY–RUN
5
500SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.283

Figure 3-9 Landfill Stability Analysis
Cross Section C-C', Total
Stress Condition, U/D
PICCO Resin Landfill

DATE: 3/91

Roy F. Weston, Inc.
West Chester, PA

PICCO RESINS LANDFILL DIKE STABILITY RUN
6
101SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 2.418

Figure 3-10 **Landfill Stability Analysis Cross Section C-C', Effective Stress Condition, PICCO Resin Landfill**

DATE: 3/91

TABLE 3-5

SUMMARY OF THE PRELIMINARY LOWER LANDFILL DIKE SLOPE STABILITY ANALYSIS USING GEOSLOPE COMPUTER PROGRAM, PICCO RESIN LANDFILL

Figure Number	Cross Section	Slope Condition	Stress Condition	Minimum Factor of Safety	Type of Circular Failure
3-5	A-A'	Existing	Total	1.5	Deep
3-6	A-A'	Existing	Effective	1.8	Deep
3-7	B-B'	Existing	Total	1.1	Deep
3-8	B-B'	Existing	Effective	0.9	Shallow
3-9	C-C'	Existing	Total	1.3	Shallow-Deep
3-10	C-C'	Existing	Effective	2.4	Deep

improve the shear strength of the soils due to interlocking of plant root systems, the actual factor of safety may be greater than the computed value.

Referring to the topographic map of the earthen dike (Figure 3-4), cross section B to B' was taken along the steepest profile of the dike along an existing erosional feature. Cross section B to B', therefore, represents what may be a worse case scenario. The sensitivity of the slope stability analysis was also evaluated by increasing the soil shear strength properties and altering the geometry of the slope, separately. The conclusion of the evaluation was that the geometry of the slope for cross section B to B' was the dominant factor in the determination of the factor of safety. Increasing the shear strength values to the high end of the laboratory and published data values did not significantly alter the factor of safety. Therefore, the conditions represented by cross sections B to B' are localized to the portion of the dike which displays the erosional feature.

3.3 SITE SOIL CHARACTERIZATION

3.3.1 Physical Characteristics of Site Soils

Soils in the areas below the lower dike and adjacent to the landfill were sampled in twenty-five soil borings using a hollow-stem auger and split-spoon sampler. Each of the soil borings on the landfill site, were extended to the top of bedrock as defined by split-spoon refusal. The depth to bedrock in the area outside of the perimeter of the landfill, ranged from 8 feet (980.94 feet MSL) (BH-22) to 22 feet (959.50 feet MSL) (BH-13). The depth to bedrock in the area along the site access road below the lower dike ranged from 11.3 feet (873.41 feet MSL) (BH-31) to 26.5 feet (829.80 feet MSL) (BH-1).

Descriptions of the split-spoon soil samples showed that soils within the site area, and immediately below the site gate, are relatively homogenous and dominantly composed of brown clay with some silt and sand. Rock fragments, ranging in size from less than an inch to several inches in size, were commonly encountered, especially in the lower soil zones above the soil/bedrock interface. The soils along the hillsides adjacent to the landfill generally appeared to be undisturbed, native soil. However, the soils below the lower dike often showed evidence within the upper zones, of being disturbed. The soils below the lower dike did not generally exhibit layering or other features indicative of native soils.

The split-spoon samples, collected from the borings along the site access road below the lower dike, commonly showed visible oil staining. This staining was especially evident in the borings along the upper section of this road below the oil/water separator. OVA and HNu readings, taken during the drilling program, indicate that contamination of the soils is present in discrete pockets and is not isolated to a particular soil zone. The second phase of soils investigation was designed to delineate the extent of non-aqueous phase product within the soils downslope of the oil/water separator.

The N-values for the site soils generally range between fifteen and thirty although occasional zones with N-values greater than fifty were encountered (Appendix F). This is indicative of dense to very dense soils (Bowles, 1982). Generally, N-values increased with depth, indicating that a lower zone of soils, which are derived from weathered bedrock, exists at the site. No laboratory testing for physical characteristics was performed or required in the Work Plan for the site soil samples.

Figure 3-11 is a cross section oriented approximately north (oil/water separator area) to south (site gate) which shows the soil thicknesses along the site access road and the configuration of the bedrock/soil interface. Also shown in Figure 3-11 are the locations of piezometers which were found to contain non-aqueous phase product and those which did not detect non-aqueous phase product. As seen in Figure 3-11 a subtle bedrock high in the area of BH-31 and BH-7 appears to act as a barrier to the migration of non-aqueous phase product below this point, since none was observed in the piezometers downslope of borehole BH-31.

3.3.2 Chemical Characteristics of Site Soils

A total of forty-five samples for chemical analysis were collected from fifteen soil borings and six shallow hand soil samples along the site access road below the lower dike and below the site gate (Figure 3-12). Discrete samples were collected from two or three depth intervals in each of the soil borings. Table 3-6 summarizes the compounds detected by the laboratory analysis of the soil samples and the depth interval represented by each sample. Generally the deepest sample from each borehole represents soils from below the vadose zone (within the saturated soils which generally comprise the two to eight feet of soil immediately above the top of bedrock).

All forty-five of the soil samples (plus duplicates) were analyzed for TCL VOC and BNA plus TPH. In addition to these specific compounds, four of the forty-five cyanide, TPH and pesticides/PCB. The pesticide/PCB analysis detected none of these compounds. The results of the inorganic analysis (metals and cyanide), VOC, BNA, and TPH are presented in Table 3-6. Also provided in Table 3-6 is a total for each of the organic categories.

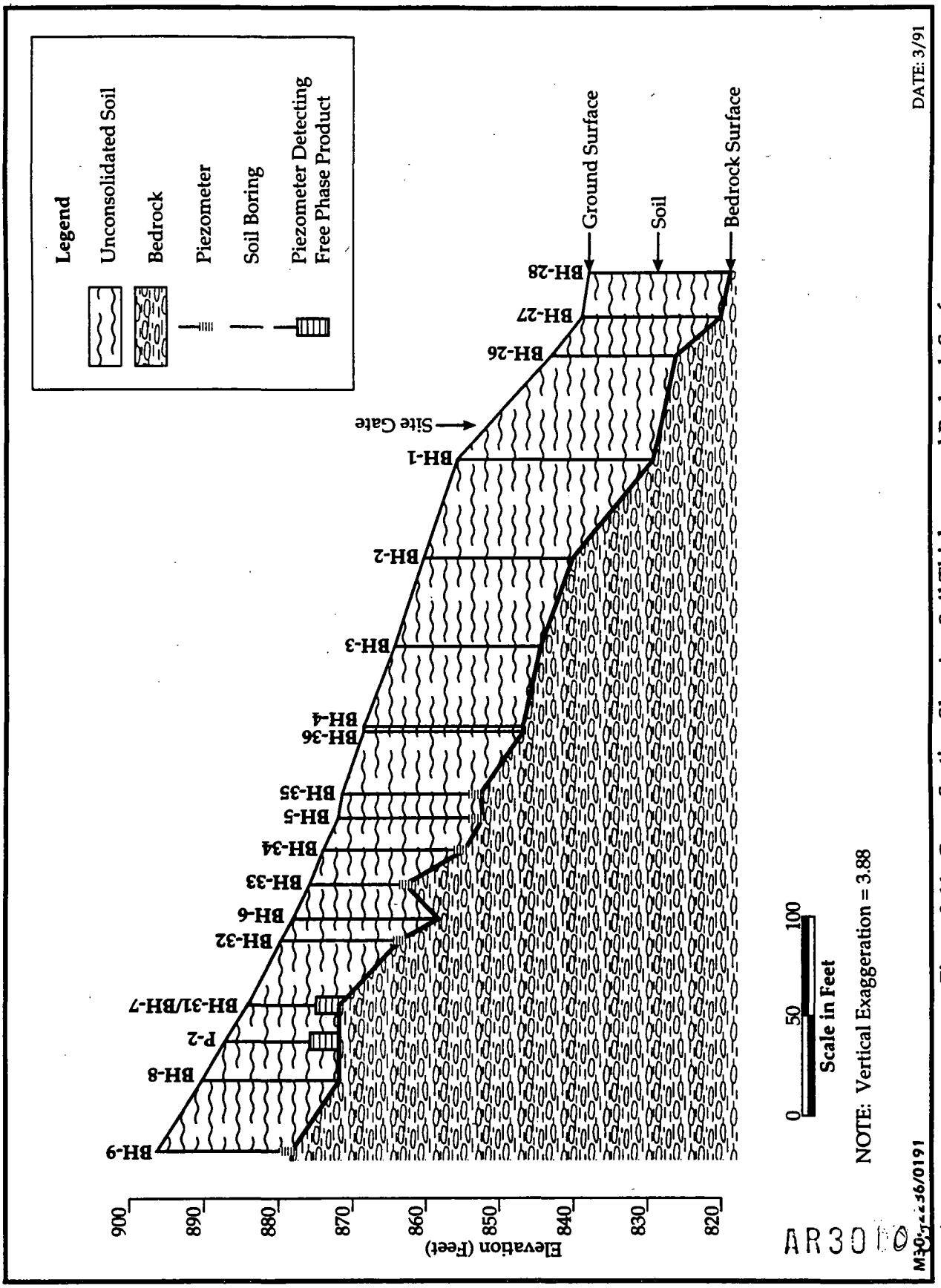

Figure 3-11 Cross Section Showing Soil Thickness and Bedrock Surface along Site Access Road Below the Oil/Water Separator, PICCO Resin Landf

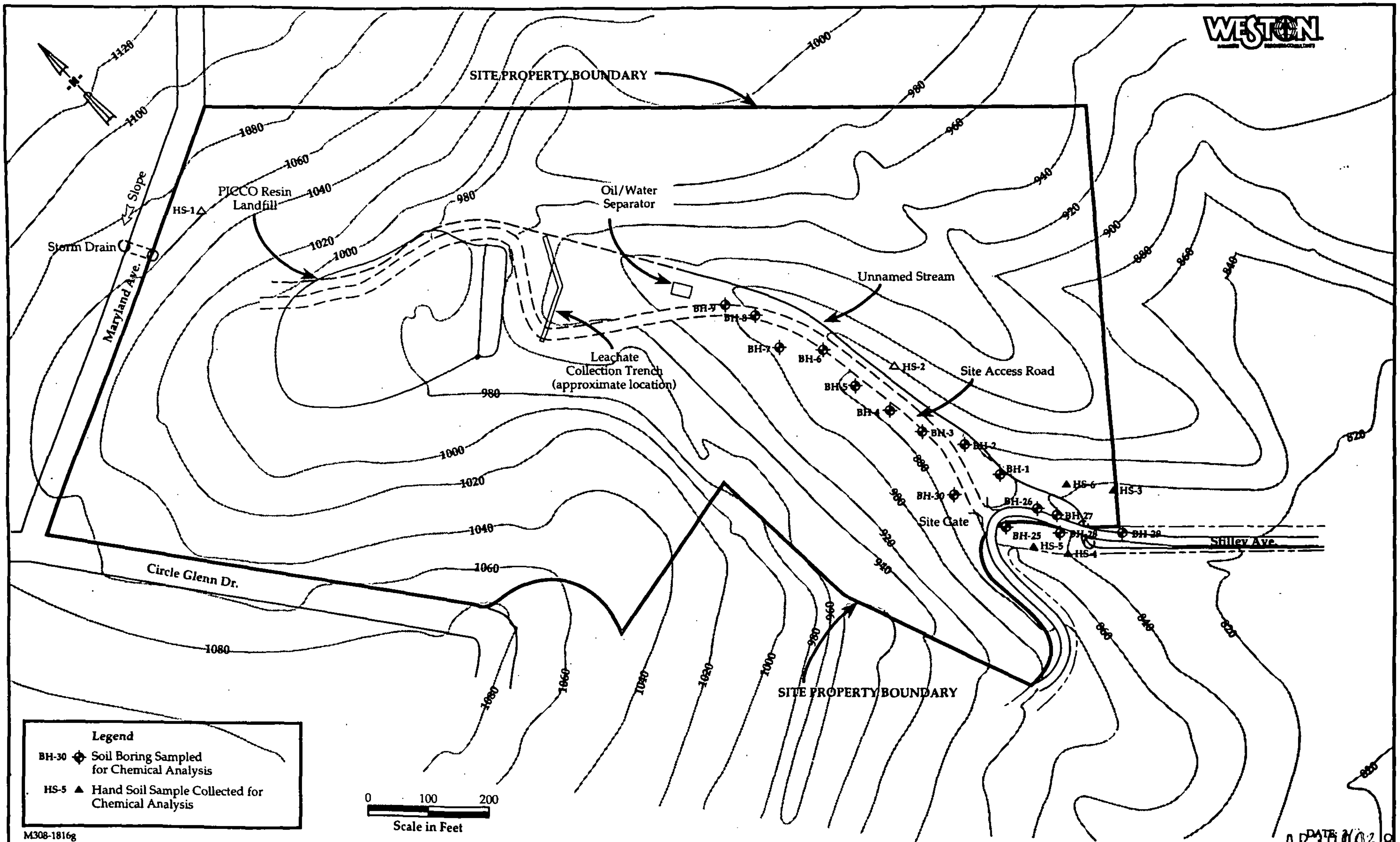

Figure 3-12 Soil Sampling Locations for Chemical Characterization of Site Soils

Table 3-6
Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	HS1 0'-1'	HS2 0'-1'	HS3 0'-1'	HS4 0'-1'	HS5 0'-1'	HS6 0'-1'	BH1-1 0'-6'	BH1-1D 0'-6'	BH1-2 10'-12'	BH1-3 16'-20'	BH1-3D 16'-20'	BH2-1 0'-4'	BH2-2 10'-14'	BH2-3 16'-18'	BH3-1 0'-4'	BH3-2 8'-12'	BH3-3 16'-20'	BH4-1 2'-4'
INORGANICS (mg/kg)																		
Antimony	ND																	
Arsenic	12.6																	
Barium	44.1																	
Beryllium	ND																	
Cadmium	ND																	
Calcium	1460																	
Chromium	24																	
Cobalt	ND																	
Copper	29																	
Cyanide	ND																	
Lead	23.5																	
Magesium	4140																	
Manganese	181																	
Mercury	ND																	
Nickel	24.8																	
Potassium	ND																	
Selenium	ND																	
Sodium	ND																	
Thallium	ND																	
Vanadium	23.8																	
Zinc	85.4																	
VOC (mg/kg)																		
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	.003 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.002 J	ND
Acetone	.027 B	.024 B	ND	.120 B	.031 B	.039 B	.029 B	.055 B	.095 B	.064 B	.110 B	.040 B	.240 B	1.2 B	.045 B	1.4	.710 B	.072 B
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	.025 B	.021 B	.009 B	.023 B	.009 B	.010 B	.021 B	.023 B	.014 B	.018 B	.017 B	.029 B	.018 B	.018 B	.034 B	0.029	.036 B	.033 B
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.002 J
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001 J	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL VOC*	0	0	0	0	0	.003	0	0	0	0	0	0	0	0	.001	0	.002	.002
BNA (mg/kg)																		
1,2 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	.520 B	.170 J	ND	ND	.110 J	.130 J	4	6.2	ND	4.7	5.4	.59 J	ND	ND	.28 J	ND	ND	4.6
2-Methyphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	.89 J	1 J	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	1.5 J	ND	ND	1.8 J	2.1 J	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	3.7	6.1 J	ND	5.7	6.5	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.1 J	3.6	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND	1.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthrace	ND	ND	ND	ND	ND	ND	2	3.3 J	ND	2.8 J	3.2 J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	.064 J	1.4 J	2.3 J	ND	1.9 J	2.2 J	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranth	ND	ND	ND	ND	ND	.07 J	1.4 J	2.2 J	ND	1.5 J	1.9 J	ND	ND	ND	ND	ND	ND	ND

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank

Table 3-6 (Continued)

Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	HS1 0'-1'	HS2 0'-1'	HS3 0'-1'	HS4 0'-1'	HS5 0'-1'	HS6 0'-1'	BH1-1 0'-6'	BH1-1D 0'-6'	BH1-2 10'-12'	BH1-3 16'-20'	BH1-3D 16'-20'	BH2-1 0'-4'	BH2-2 10'-14'	BH2-3 16'-18'	BH3-1 0'-4'	BH3-2 6'-12'	BH3-3 16'-20'	BH4-1 2'-4'
BNA (mg/kg) (Cont'd)																		
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	.071 J	.85 J	1.9 J	ND	1.7 J	1.6 J	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	ND	ND	.14 J	.069 J	.14 J	1.8 J	3.1 J	ND	ND	ND	ND	ND	ND	ND	ND	.11 J	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4 J	2.8 J	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	1.8 J	3.1 J	ND	2.6 J	3 J	.16 J	ND	ND	ND	ND	ND	.12 J
Di-n-Butylphthalate	ND	.15 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.14 J	.15 J	ND	ND
Fluoranthene	ND	.093 J	ND	ND	.048 J	ND	ND	7.9	ND	5.6	7.3	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	ND	2.4 J	4.2 J	ND	3.7	4.2	ND	ND	ND	ND	ND	ND	ND
Naphthalene	7.1 B	0.7	ND	ND	ND	.19 J	21	33	ND	27	31	1.2 B **	.45 JB	.31 JB	.44 JB **	.34 JB	.31 JB	41 DB
Phenanthrene	ND	ND	ND	ND	ND	.16 J	ND	11	ND	11	12	.37 J	ND	ND	.24 J	ND	ND	ND
Phenol	ND	ND	ND	ND	ND	ND	1.5 J	2.1 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	.098 J	ND	ND	.051 J	.095 J	ND	5.3 J	ND	5.8	6.2	ND	ND	ND	ND	ND	ND	ND
TOTAL BNA	7.62	1.21	0	.14	0.278	2.12	43.35	91.7	0	81.99	94	1.12	.45	.31	0.64	.49	.42	45.72
PET. HYDROCARBON (mg/kg)																		
Total Petroleum Hydrocarbon	21	64	30	29	59	1800	2300	4700	17	8	12	75	6	4	10	7	11	1500

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank

Table 3-6 (Continued)

Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	BH4-2 4'-6'	BH4-3 16'-18'	BH5-1 2'-4'	BH5-2 10'-12'	BH5-3 14'-18'	BH6-1 0'-6'	BH6-2 8'-12'	BH6-3 14'-16'	BH7-1 2'-4'	BH7-2 8'-10'	BH7-3 10'-14'	BH8-1 0'-2'	BH8-2 6'-8'	BH8-3 12'-16'	BH9-1 2'-6'	BH9-2 6'-10'	BH9-3 10'-12'	BH22-1 4'-6'
INORGANICS (mg/kg)																		
Antimony			ND	ND	ND													
Arsenic			5.7	12.4	4.2													
Barium			127	277	283													
Beryllium			1.5	1.5	ND													
Cadmium			ND	1.7	ND													
Calcium			6410	1570	3430													
Chromium			16	21.2	24.5													
Cobalt			ND	26.4	16.1													
Copper			28.4	33	29.9													
Cyanide			ND	ND	ND													
Lead			9.2	12.6	10.4													
Magesium			2530	2750	5270													
Manganese			569	2700	867													
Mercury			ND	ND	ND													
Nickel			29.8	36.8	40.4													
Potassium			1230	ND	1420													
Selenium			ND	ND	ND													
Sodium			ND	ND	ND													
Thallium			ND	ND	ND													
Vanadium			22.8	31	23													
Zinc			87.7	91.1	94.3													
VOC (mg/kg)																		
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	.062 B	.22 B	.028 B	.25 B	36 B	.037 B	.047 B	.065 B	.11 B	185 B	4.1 B	12 B	.64 B	4.3 B	.021 B	2.7 B	1.7 B	ND
Benzene	ND	.13	ND	ND	ND	ND	ND	.032	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.001 J	ND	ND	ND	ND	ND
Ethylbenzene	ND	.003 J	ND	ND	18	ND	ND	.13	ND	34 J	1.5	ND	.027	3.9	ND	.83	2.7	ND
Methylene Chloride	.032 B	.034 B	.027 B	.029 B	30 B	.038 B	.029 B	.036 B	.024 B	74 B	1.5 B	.025 B	.024 B	1.4 B	.023 B	1.4 B	1.1 B	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.33 J	ND	ND	.61 J	ND	ND	.42 J	ND
Toluene	ND	.007	ND	ND	1.7 J	ND	ND	.008	ND	ND	.19 J	ND	.002 J	1.2	ND	ND	.29 J	ND
Total Xylenes	ND	.063	ND	ND	46	ND	ND	.069	ND	260	8.9	ND	.022	19	ND	5.2	5.7	ND
TOTAL VOC*	0	.207	0	0	65.7	0	0	.239	0	294	10.92	0	.052	24.71	0	6.03	9.11	0
BNA (mg/kg)																		
1,2 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.6
1,3 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.7
1,4 Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.8
2-Methylnaphthalene	ND	.18 J	ND	ND	11	ND	ND	ND	ND	ND	6.2	1.4 J	ND	12	1.3 J	8.8	3.1 J	.7 J
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.
** Data point precluded from total due to concentration in method blank

Table 3-6 (Continued)

Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	BH4-2 4'-6'	BH4-3 16'-18'	BH5-1 2'-4'	BH5-2 10'-12'	BH5-3 14'-16'	BH6-1 0'-6'	BH6-2 8'-12'	BH6-3 14'-16'	BH7-1 2'-4'	BH7-2 8'-10'	BH7-3 10'-14'	BH8-1 0'-2'	BH8-2 6'-8'	BH8-3 12'-16'	BH9-1 2'-6'	BH9-2 6'-10'	BH9-3 10'-12'	BH22-1 4'-6'
BNA (mg/kg) (Cont'd)																		
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND	.37 B **	ND	.28 JB	ND	.21 JB	ND	ND	1.5 JB	ND	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	.24 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	.52 J	ND	ND	.4 J
Di-n-Butylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	.33 J
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	1.2 B	1.8 B	ND	ND	94 D	1.1 B **	.15 JB	4.7 B	1.5 B **	19 B	46 DB	2.8 JB **	1.5 B	110 B	2.4 J	89 D	26	1.6
Phenanthrene	ND	.14 J	.48 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3 J	ND	ND	2.4
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL BNA	1.2	2.12	.48	0	105.24	0	.15	4.7	0	19	52.48	1.4	1.71	122	5.52	99.3	29.1	18.53
PET. HYDROCARBON (mg/kg)																		
Total Petroleum Hydrocarbon	10	12	5	6	900	58	7	10	20	560	1100	1700	22	840	1800	2700	720	61

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank

Table 3-6 (Continued)

Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	BH25-1 2'-4'		BH25-2 12'-14'	BH26-1 2'-4'	BH26-2 8'-10'	BH27-1 6'-10'	BH27-2 12'-19'	BH28-1 2'-6'	BH28-1D 2'-6'	BH28-2 16'-19'	BH29-1 6'-8'	BH29-2 10'-14'	H29-2D 10'-14'	BH30-1 0'-2'	BH30-2 26'-28'
INORGANICS (mg/kg)															
Antimony															
Arsenic															
Barium															
Beryllium															
Cadmium															
Calcium															
Chromium															
Cobalt															
Copper															
Cyanide															
Lead															
Magesium															
Manganese															
Mercury															
Nickel															
Potassium															
Selenium															
Sodium															
Thallium															
Vanadium															
Zinc															
VOC (mg/kg)															
1,1,1-Trichloroethane	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	.003 JB	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND		ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND	ND
2-Hexanone	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	.94 BD		.52 B	1.2 B	.59 B	1.1 B	4.7	1.6 B	1.4 B	.64 B	1 B	.3 B	.82 B	.14 B	.26 B
Benzene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	.006 B		.044 B	.11 B	.099 B	.021 JB	.033	.1 B	.049 B	.13 B	.076 B	.016 JB	.013 JB	.019 JB	.019 JB
Styrene	.02 JB	**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL VOC	0		0	0	0	0	0	0	0	1.4	0	0	0	0	0
BNA (mg/kg)															
1,2 Dichlorobenzene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3 Dichlorobenzene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4 Dichlorobenzene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	.39		ND	1.1	.45	ND	.076 J	ND	ND	ND	ND	ND	ND	1.4	ND
2-Methyphenol	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND		ND	ND	.3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	.086 J		ND	.11 J	.065 J	ND	ND	ND	ND	ND	ND	ND	ND	.24 J	ND
Benzo(a)pyrene	.064 J		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	.12 J		ND	.098 J	.068 J	ND	ND	ND	ND	ND	ND	ND	ND	.073 J	ND

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank

Table 3-6 (Continued)

Analytical Data Summary for Soil Samples, PICCO Resin Landfill

	BH25-1 2'-4'	BH25-2 12'-14'	BH26-1 2'-4'	BH26-2 8'-10'	BH27-1 6'-10'	BH27-2 12'-19'	BH28-1 2'-6'	BH28-1D 2'-6'	BH28-2 16'-19'	BH29-1 6'-8'	BH29-2 10'-14'	H29-2D 10'-14'	BH30-1 0'-2'	BH30-2 26'-28'
BNA (mg/kg) (Cont'd)														
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	.33 JB **	.59 B	.36 JB **	.79 B	1.2 B	1.5 B	.61 B **	.42 B	.51 B	.89 B	.75 B	.69 B	.82 B	.96 B
Butylbenzylphthalate	ND	ND	ND	ND	.1 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	.13 J	ND	.24 J	.099 J	ND	.083 J	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	.12 J	ND	.45	.051 J	ND	ND	ND	ND	ND	ND	ND	ND	.27 J	ND
Di-n-Butylphthalate	.11 J	.057 J	ND	1.3 J	.14 J	ND	.082 J	.047 J	.073 J	ND	.062 J	ND	.062 J	ND
Fluoranthene	.15 J	ND	.11 J	.098 J	ND	ND	ND	ND	ND	ND	ND	ND	.09 J	ND
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	.35 J	ND	.41	4.1	ND	ND	ND	ND	ND	ND	ND	ND	.23 J	ND
Phenanthrene	.32 J	ND	.95	.2	.054 J	.14 J	ND	ND	ND	ND	ND	ND	.91	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	.041 J	ND	ND	ND	ND	ND	ND	.16 J	ND
TOTAL BNA	1.84	.647	3.468	6.349	1.494	1.84	0.082	.467	.583	.89	.812	.69	4.255	.96
PET. HYDROCARBON (mg/kg)														
Total Petroleum Hydrocarbon	73	4.6	26	46	46	38	65	4.1	4.0	5.8	6.6	2.4	9.6	26

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

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The primary VOC detected in the site soils were ethylbenzene, toluene and xylene. Each compound was detected at concentrations above 1 mg/kg in at least one sample. The concentrations of VOC in the soils at the site were generally many orders of magnitude less than concentrations in the waste samples. The acetone and methylene chloride detected in the soil samples has been determined to be the result of cross contamination of samples in the laboratory and/or in the field and is therefore disregarded in the analysis of the soils data. The basis upon which this conclusion, regarding acetone and methylene chloride, was drawn is as follows:

- There are no records or knowledge of the deposition of these compounds at the site.

- The detection of these compounds in samples from one of the seven landfill waste borings has been attributed to laboratory contamination since the concentrations detected in the sample, divided by the dilution factor are less than ten times the concentrations detected in the laboratory method blank.

- Throughout the field program these compounds were consistently detected in the rinse blanks, trip blanks, laboratory method blanks, and in otherwise uncontaminated samples.

Secondary VOC (detected in a low number of soil samples at relatively low concentrations above the instrument detection limit) include 2-butanone and benzene. Total concentrations of VOC in the soil samples ranged from not detected to 294 mg/kg in sample BH7-2.

The primary BNA detected in the soil samples were naphthalene and 2-methylnaphthalene. Each was detected in many of the samples and at concentrations above 10 mg/kg in at least one sample. Secondary BNA (detected in at least one sample above the instrument detection limit) including various polynuclear aromatic hydrocarbons (acenaphthalene, anthracene, benzo(a)anthracene, fluoranthene, phenanthrene, fluorene and pyrene) along with

bis(2-ethylehexyl) phthalate and dibenzofuran. These compounds were detected at relatively low concentrations (always less than 10 mg/kg with the exception of phenanthrene in one sample). Total concentrations of BNA in the soils ranged from not detected to 122 mg/kg in sample BH8-3. Concentrations of TPH in the soil samples ranged from 2.4 mg/kg (BH29-2) to 47,000 mg/kg (BH1-1D).

The organic compounds detected in the soils generally tended to decrease in concentration with an increase in distance from the landfill. Total VOC concentrations exceeding 1.5 mg/kg were detected, only in samples taken at depth, from the soil borings located immediately below the oil/water separator (BH-7, BH-8 and BH-9) with the exception of the deep sample from BH-5. Total BNA concentrations exceeding 10 mg/kg were mainly detected in samples taken at depth from the area immediately below the oil/water separator. In addition, total BNA levels exceeding 10 mg/kg were also noted in selected samples located further downslope (BH1-1, BH1-3, BH4-1, BH5-3). Finally, total petroleum hydrocarbon concentrations exceeding 100 mg/kg were mainly detected in samples taken from the area immediately below the oil/water separator (BH-7, BH-8 and BH-9). In addition, concentrations of TPH exceeding 100 mg/kg were noted in selected samples taken further downslope (BH1-1, BH4-1, BH5-3).

Overall, the results of the chemical analysis did not indicate laterally continuous zones of elevated VOC and/or BNA concentrations within the downslope site soils, but rather, discrete pockets of elevated concentrations which may be related to past construction activities at the site. These pockets of contaminated soil, containing the same constituents as the waste, occur within all depth zones and appear to be distributed somewhat randomly within the soils downslope of the oil/water separator. In general, the area yielding samples with the highest levels of total organic compounds was found to be immediately below the oil/water separator

(BH-7, BH-8 and BH-9). Figures 3-13, 3-14 and 3-15 illustrate for each boring, the distribution of key indicator compounds (benzene and naphthalene) as well as the total concentration of VOC and BNA. Figures 3-13, 3-14 and 3-15 represent data summaries for the upper, middle and lower soil zones, respectively. The total volume of site soils which have been targeted for potential remedial action as part of the Site Feasibility Study is 31,725 cubic yards or 42,829 tons.

The heterogenous distribution of the target organic compounds in the site soils indicate that the contaminants did not move through the soils but rather were mixed or deposited with the soils during earthmoving or construction activities and have remained relatively immobile since deposition. The results of analysis of groundwater samples collected from wells constructed in the site soils supports this conclusion. The laboratory reports for the site soil sample analyses are included in Appendix E.

3.3.3 Soil Loss and Erosion

A calculation of soil loss and sediment yield from the landfill and the area between the lower landfill dike and the oil/water separator was made, in order to estimate the current soil loss from these specific areas. This estimate was made using the Universal Soil Loss Equation (USLE) (Borah, 1987).

In order to calculate sediment yield the following assumptions were made:

1. All site soils correspond to the Dormont soil series. Dormont soils are highly erodible silt loams. The grain size analyses of the landfill cover (Appendix G) and field observations, indicate that this assumption is valid.

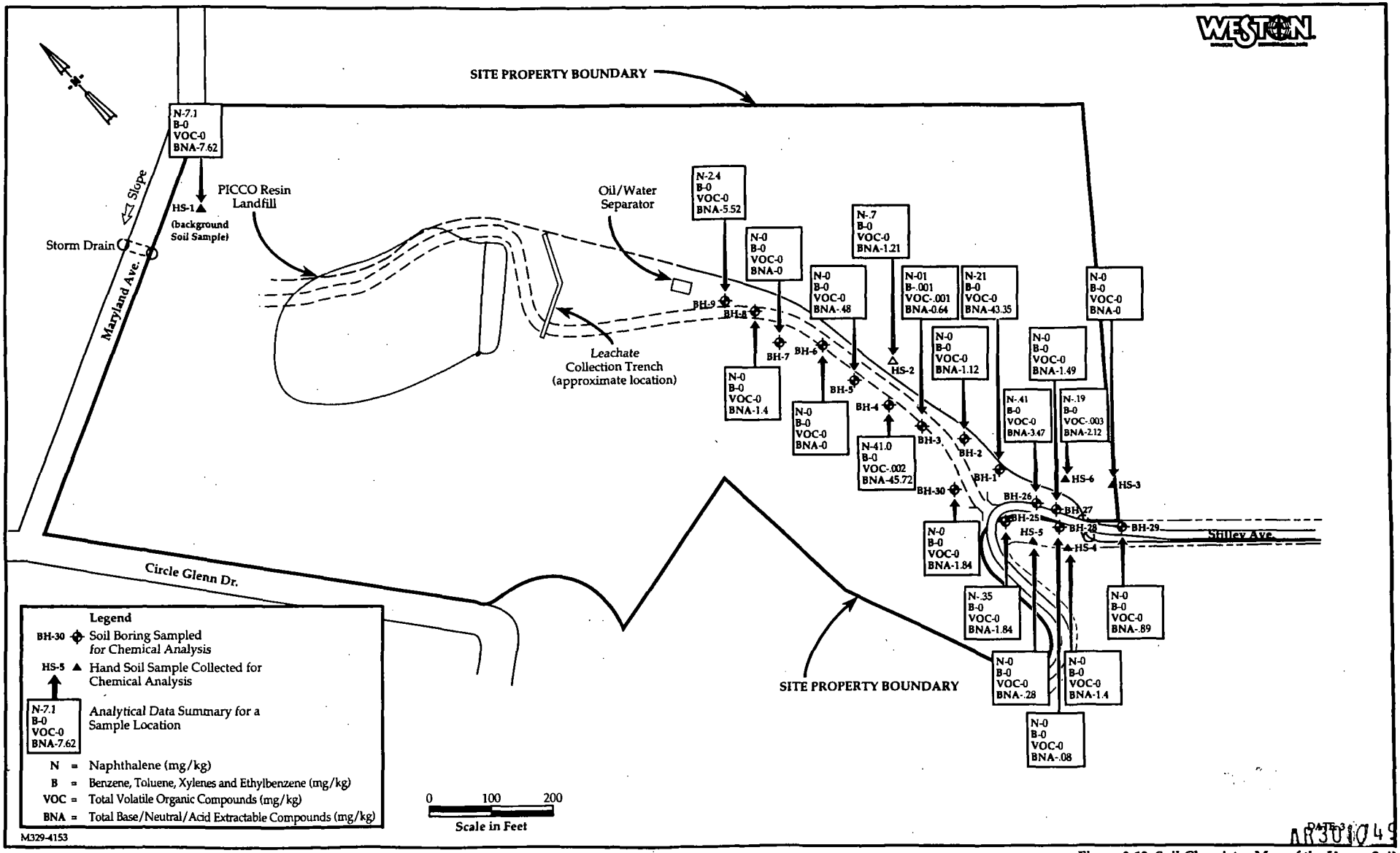

Figure 3-13 Soil Chemistry Map of the Upper Soil Zone, PICCO Resin Landfill

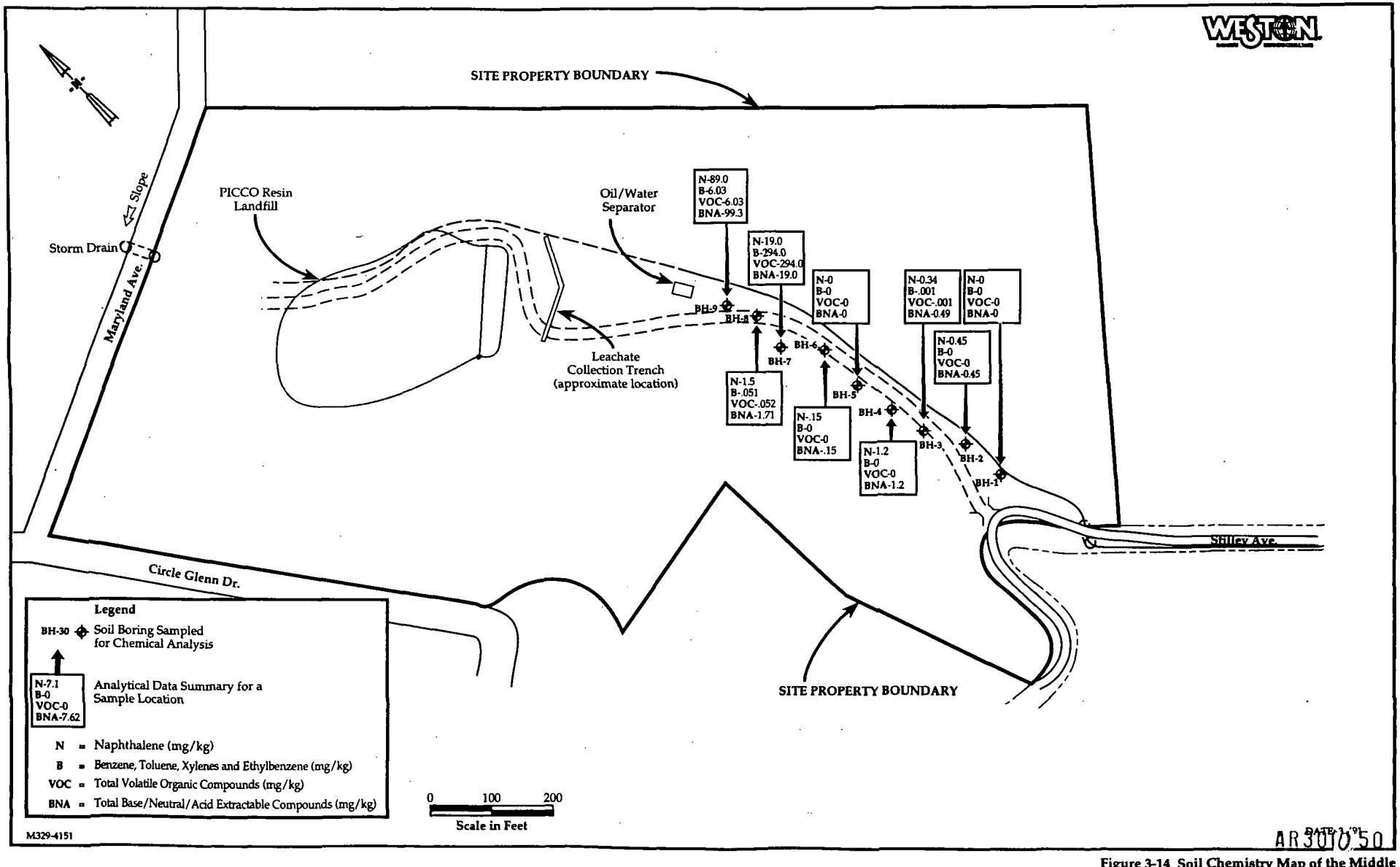

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Figure 3-14 Soil Chemistry Map of the Middle Soil Zone, PICCO Resin Landfill

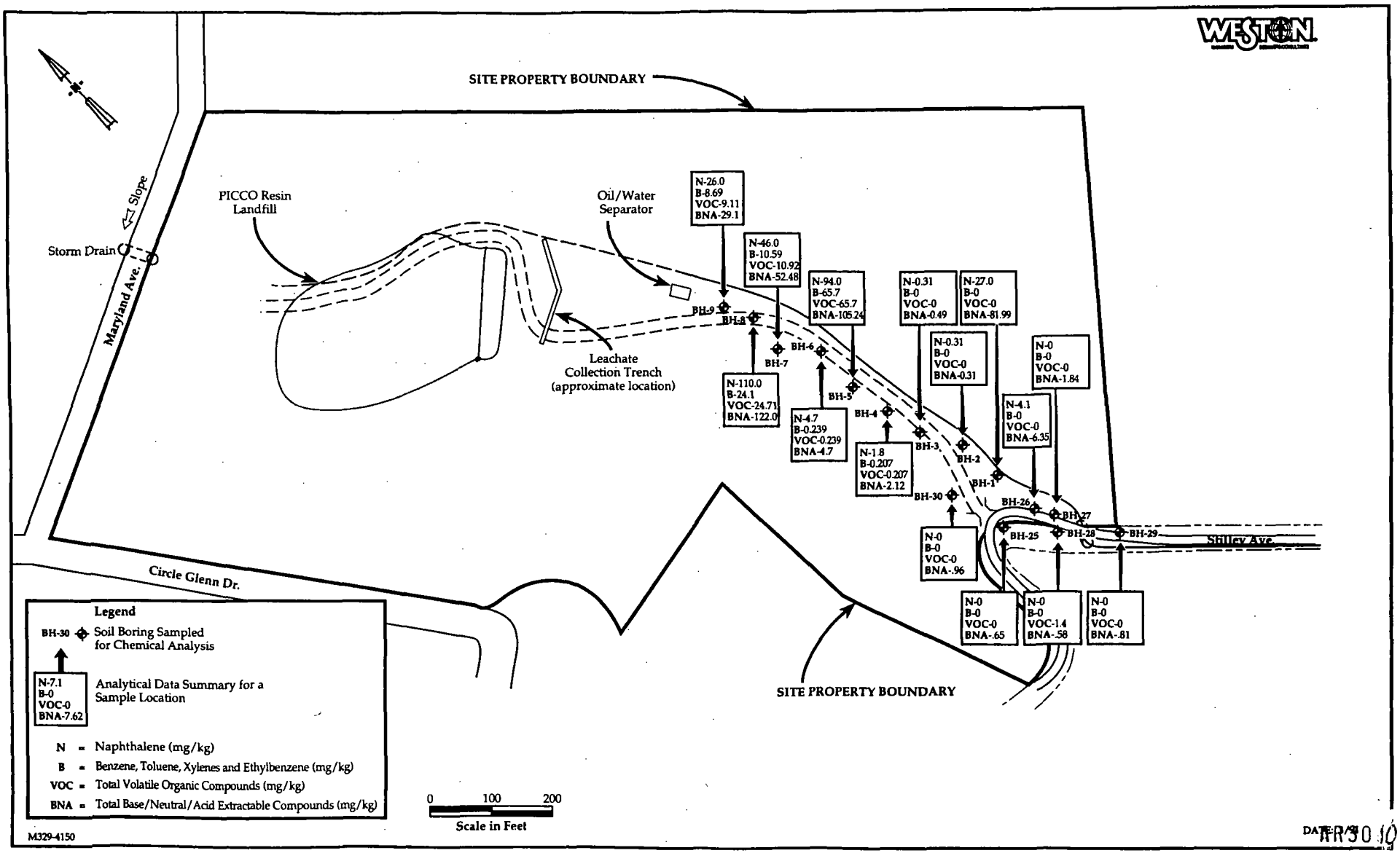

Figure 3-15 Soil Chemistry Map of the Lower Soil Zone, PICCO Resin Landfill

2. Contribution of runoff and sediment from upslope areas was not considered due to the drainage diversion ditches around the landfill perimeter which are assumed to prevent runon to the landfill from upslope areas. Sediment yield from the landfill and areas immediately downslope of the landfill dike only, was calculated.

3. Existing cover was characterized as "permanent seeding, 2nd year" which is representative of a good stand of grass cover. Variability of vegetative cover is not considered.

The results of the sediment transport modeling per the Universal Soil Loss Equation (USLE) indicate that approximately 5.2 tons of soil per year would be lost from the landfill and the areas immediately downslope of the landfill. This corresponds to 1.7 tons per acre of soil lost per year. Soil lost during a 10 year storm event is estimated to be 2.6 tons per storm. An estimated 3.6 tons per year of sediment generated at the landfill would reach the site property line at Stilley Avenue. Note that this quantity of sediment would not be deposited in its entirety at the property line but would continue to be transported downstream. The calculations used to derive the sediment loss are presented below:

Objective: Estimate Soil Loss from the PICCO Resin Landfill using USLE.

Initial Assumptions:

- Neglect upslope runoff and soil loss
- Strip Mine Soils = Dormont Soils (i.e. highly erodible silt loam) (SCS, 1981)
- Rainfall Erosivity Factor (R) = 125 (ASCE, 1977)
- Soil Erodibility Factor (K) = 0.43 for Dormont silt loam (NCSS, 1990)

- Area of interest = 3 acres (approximately 1.8 acres of which is the landfill)
- Slope length factor (LS): (from site topographic map, adjusted for variable slope using five slope segments) = 3.22
- C = 0.01 for permanent seeding
- Practice Factor (Pc): Use 1.0

Therefore, using the Universal Soil Loss Equation:

$$E = RK\ LS\ C\ P$$
$$= (125)\ (0.43)\ (4.78)\ (0.01)\ (1.0)$$
$$= 1.7 \text{ tons/acre/yr}$$

Total Soil Loss = 5.2 tons/yr (for 3 acre area of interest)

During a 10 year storm 50% of the annual soil loss would occur during the storm (Borah, 1987)

$$5.2 \times .5 = 2.6 \text{ tons}$$

Sediment Delivery to Property Line at Stilley Avenue, Approximately 700 ft from landfill area approximately 70% of the sediment would be delivered to the property line (Borah, 1987).

$$5.2 \times .7 = 3.6 \text{ ton/yr}$$

It should be noted, that due to the relatively low slope of the landfill surface, the majority of the estimated sediment load originates from the steeper portions of the area of interest. Most of the erosion is expected to occur on the lower landfill dike and the steeper area below the landfill dike.

3.4 SURFACE WATER AND SEDIMENT OF THE UNNAMED STREAM

A small stream, which is perennial, except in the upper reaches of the stream, flows from above the landfill, along the east side of the site, to the south toward the landfill gate area. This stream flows along Stilley Avenue below the landfill gate, through a residential area below the site. At this point it is diverted into culvert pipe and flows through the borough of West Elizabeth and into the Monongahela River.

The approximate drainage area for the site (above the landfill gate) is 1,975,000 square feet. The approximate drainage area above the lower landfill dike is 1,430,000 square feet.

Eight sampling points (S-1 through S-8) were established along the unnamed stream. Three rounds of surface water samples were collected during the RI at the landfill site. Surface water samples were collected from all sampling points which were flowing during the field sampling. Some sections of the stream were dry during the first and second round of stream sampling. An initial round of sediment samples was collected from all eight stream sampling points and a second set of confirmatory sediment samples was collected in order to determine the extent of landfill related compounds in the stream sediments downstream of the site gate. An upslope background sediment sample (SE-10) was collected at the origin of the S-8). During the three rounds of stream sampling observations as to the physical characteristics of the stream (including temperature, pH, and specific conductivity) were noted in the field notebook.

3.4.1 Physical Characteristics of the Unnamed Stream

The unnamed stream crossing the site was generally between 1 inch and 6 inches deep and between 1 foot and 3 feet wide. The pH, specific conductivity, and temperature of the surface water samples are summarized in Table 3-7. The surface water samples had pH values which ranged from 4.0 to 5.7, specific conductivity ranged from 1,090 umhos to 1,850 umhos and temperature ranged from 20.0° C to 25.5° C. The ecological survey of the stream noted no reptiles, amphibians, or fish in the stream, however green algae was noted at several locations along the stream.

The stream bedload was generally composed of sand, silt and clay with the coarser grained sediment being deposited below several small water falls which exist along the stream. The unnamed stream crossing the site is a gaining stream, that is, a stream which is fed by groundwater discharging from the shallow aquifer (site soils). This is evidenced by the fact the stream originates as a spring in the area of the leachate collection tanks and flows throughout most of the year, even when no precipitation or runoff is occurring. During rainy periods the stream is also fed by storm runoff and exhibits a rapid response to rainfall.

Three V-Notch weirs were installed in the unnamed stream. The upper weir, Weir #1 was installed at a point in the stream adjacent to the lower landfill dike. Weir #2 was installed immediately below the oil/water separator. Weir #3 was installed about 100 feet upstream of the site gate (Figure 2-4). Measurements of the weirs were generally made on a daily basis from August 1989 to August 1990. These weir measurements indicated that flow in the unnamed stream is generally less than 1 gallons per minute (GPM) and that the stream becomes dry during certain time of the year. The measurements also indicate that there is a near immediate rise in

TABLE 3-7

PHYSICAL CHARACTERISTICS OF THE SURFACE WATER SAMPLES, PICCO RESIN LANDFILL

Location	pH	Specific Conductivity (umhos)	Temperature (°C)
SW-01*	4.9	1,090	20.5
SW-02*	5.0	1,850	25.5
SW-03*	5.7	1,305	20.3
SW-04*	5.6	1,420	21.6
SW-05*	5.3	1,570	21.3
SW-06*	5.3	1,675	21.8
SW-07*	4.0	1,840	20.0
SW-08	---	---	---
Average	5.1	1,536	21.6

- Indicates no measurements taken
* Average of 2 Rounds

stream water level resulting from a significant rainfall event. The water level in the stream gradually decreases in the days following a rainfall event as runoff ceases and infiltration and groundwater discharge, from the shallow aquifer to the stream occurs and then wanes. After a significant rainfall event (.5 inches or greater) there is generally a period of several days to weeks, during which the stream water level gradually decreases as the system reaches equilibrium. The weir measurements, and the calculated stream flow rates, are included in Appendix I.

3.4.2 Chemical Characterization of Stream Surface Water

The surface water samples were collected from all stream sampling points which were flowing at the time of sample collection. During round one of stream sampling, sampling points S-2 and S-8 (Figure 2-4, page 2-23) were dry. During round two of stream sampling, sampling point S-8 was dry. During the third round of surface water sampling water was flowing at all eight stations. Table 3-8 summarizes the detected compounds from the laboratory analysis of surface water samples from the unnamed stream. All of the round one samples were analyzed for full TCL compounds and TAL metals plus cyanide. Since no pesticide/PCB were detected in round one, analysis for this parameter was eliminated from round two. After the second round stream sampling analytical data were reviewed, it was agreed by WESTON, Hercules, PADER, and USEPA, to eliminate sampling for metals from the final round of surface water sampling. Surface water samples are designated by an "SW" term in the sample number.

No VOC were detected in the Round 1 surface water samples and total VOC were detected at a single location (S-7) at a relatively low concentration of 15 micrograms/liter (ug/l) during Round 2. VOC were detected, during Round 3, at all stream sampling points except S-8 (the farthest upstream sample location at the

Table 3-8

Analytical Data Summary for Surface Water Samples from the Unnamed Stream, PICCO Resin Landfill

	SW1 (Round 1)	SW1 (Round 2)	SW1 (Round 3)	SW2 (Round 2)	SW2 (Round 3)	SW3 (Round 1)	SW3 (Round 2)	SW3 (Round 3)	SW4 (Round 1)	SW4 (Round 2)	SW4 (Round 3)	SW-5 (Round 1)	SW5 (Round 2)	SW5-D (Round 2)	SW5 Round 3)	SW6 (Round 1)
INORGANICS (ug/l)																
Aluminum	49600	784		646		83500	388		586	277		396	411	355		941
Antimony	57	ND		ND		ND	ND		ND	40.9		ND	ND	ND		53.3
Arsenic	12.1	ND		ND		11.6	ND		ND	ND		ND	ND	ND		ND
Barium	644	ND		ND		642	ND		ND	ND		ND	ND	ND		ND
Beryllium	7.4	ND		ND		5.4	ND		ND	ND		ND	ND	ND		ND
Cadmium	ND	ND		ND		5.2	ND		ND	ND		ND	ND	ND		ND
Calcium	186000	211000		275000		103000	287000		69000	304000		307000	329000	320000		303000
Chromium	77.5	ND		ND		33.9	ND		ND	ND		ND	ND	ND		ND
Cobalt	84.8	ND		ND		ND	ND		ND	ND		ND	ND	ND		ND
Copper	142	ND		ND		117	ND		ND	ND		28.8	31.3	25.8		ND
Cyanide	ND	ND		ND		14.6	ND		ND	ND		ND	ND	ND		ND
Iron	82100	662		781		38600	341		636	341		3560	1780	1820		958
Lead	134	ND		ND		120	ND		ND	5.3		ND	5.4	ND		ND
Magesium	53500	59900		60500		90200	84400		68700	98500		107000	110000	108000		110000
Manganese	14800	488		535		14800	506		440	919		2470	4000	3930		1860
Mercury	ND	ND		ND		ND	ND		ND	ND		ND	ND	ND		ND
Nickel	208	ND		ND		179	ND		ND	ND		ND	ND	74.2		ND
Potassium	7480	ND		ND		31700	ND		21300	5760		ND	8110	ND		ND
Selenium	ND	ND		ND		ND	ND		ND	ND		ND	ND	ND		ND
Silver	ND	47.8		11.8		ND	ND		ND	ND		ND	ND	ND		ND
Sodium	23400	49000		65100		155000	68300		154000	80100		37700	89300	92400		36800
Thallium	ND	ND		ND		ND	ND		ND	ND		ND	ND	ND		ND
Vanadium	97.5	ND		ND		ND	ND		ND	ND		ND	ND	ND		ND
Zinc	804	ND		56.9		797	26.5		ND	24.2		38.6	25.5	52.3		53.1
VOC (ug/l)																
Acetone	8 JB	6 JB	ND	8 JB	ND	6 JB	8 JB	ND	ND	8 JB	ND	6 JB	10 B	8 JB	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	ND	ND	ND	37	ND
Methylene Chloride	4 JB	5 B	ND	4 JB	ND	5 B	3 JB	ND	5 B	4 JB	ND	8 B	4 JB	5 B	1 J	6 B
Toluene	ND	ND	2 J	ND	ND	ND	ND	2 J	ND	ND	4 J	ND	2 JB **	ND	12	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	20	ND	ND	ND	49	ND
TOTAL VOC*	0	0	2	0	0	0	0	8	0	0	32	0	0	0	99	0
BNA (ug/l)																
2-4 Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 J	ND
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J	ND
2-Methyphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 J	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	ND	ND	ND	3 J	ND
Benzoic Acid	ND	ND	42 J	2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	60	ND
Bis(2-Ethylhexyl)phthalate	6 JB *	ND	2 J	1 J	ND	2 JB **	ND	ND	2 JB **	ND	ND	2 JB **	ND	ND	50	10 B **
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	5 J	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-Butylphthalate	ND	1 J	1 J	2 J	ND	ND	2 J	2 J	ND	1 J	ND	ND	1 J	2 J	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4 J	ND	ND	ND	30	ND
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	ND	ND	ND	4 J	ND
TOTAL BNA	0	1	45	5	0	0	2	7	0	1	6	0	1	2	154	0

Note: See attached le... or explanation of qualifiers and sample designation

* Total VOC does no... acetone or methylene chloride because they are considered to be the result of cross-contamination.
** Data point precluded f... otal due to concentration in method blank.

Table 3-8 (Continued)

Analytical Data Summary for Surface Water Samples from the Unnamed Stream, PICCO Resin Landfill

	SW6 (Round 2)	SW6 (Round 3)	SW-6D (Round 3)	SW7 (Round 1)	SW7-D (Round 1)	SW7 (Round 2)	SW7 (Round 3)	SW8 (Round 3)
INORGANICS (ug/l)								
Aluminum	261			17700	14000	26300		
Antimony	67.0			70.3	ND	313		
Arsenic	ND			ND	ND	ND		
Barium	ND			ND	ND	ND		
Beryllium	ND			ND	ND	9.7		
Cadmium	ND			ND	ND	9.0		
Calcium	413000			314000	314000	381000		
Chromium	ND			ND	ND	ND		
Cobalt	ND			ND	ND	125		
Copper	ND			26.5	31.3	92.0		
Cyanide	ND			ND	ND	ND		
Iron	417			1930	1580	896		
Lead	ND			5.3	11	ND		
Magesium	157000			124000	119000	251000		
Manganese	7410			22800	21300	71600		
Mercury	ND			ND	ND	ND		
Nickel	ND			138	134	428		
Potassium	ND			ND	ND	17400		
Selenium	ND			ND	ND	ND		
Silver	ND			ND	ND	29.5		
Sodium	45700			37700	36100	38600		
Thallium	ND			ND	ND	ND		
Vanadium	ND			ND	ND	ND		
Zinc	23.3			273	264	750		
VOC (ug/l)								
Acetone	6 JB	ND	ND	14 B	5 JB	8 JB	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	6	ND
Ethylbenzene	ND	10	9	ND	ND	ND	130	ND
Methylene Chloride	2 JB	ND	ND	11 B	ND	3 JB	ND	ND
Toluene	ND	5 J	5	ND	ND	4 JB **	45	ND
Total Xylenes	ND	15	14	ND	ND	15	98	ND
TOTAL VOC*	0	30	28	0	0	15	279	0
BNA (ug/l)								
2-4 Dimethylphenol	ND	2 J		ND	ND	ND	3 J	ND
2-Methylnaphthalene	ND	3 J		ND	ND	ND	4 J	ND
2-Methyphenol	ND	ND		ND	ND	ND	6 J	ND
2-Nitrophenol	ND	1 J		ND	ND	ND	2 J	ND
4-Methylphenol	ND	3 J		ND	ND	ND	5 J	ND
Benzoic Acid	ND	20 J		ND	ND	ND	170	13 J
Bis(2-Ethylhexyl)phthalate	ND	ND		8 JB *	5 JB **	ND	ND	2 J
Dimethylphthalate	ND	ND		ND	ND	ND	ND	ND
Di-n-Butylphthalate	2 J	ND		ND	ND	ND	ND	ND
Naphthalene	ND	43		ND	ND	ND	75	ND
Phenol	ND	3 J		ND	ND	ND	7 J	ND
TOTAL BNA	2	75		0	0	0	272	15

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

head of the stream). The total concentrations of VOC detected in the surface water during Round 3 were generally very low (at or below 32 ug/l except in SW-5 and SW-7). The higher concentrations found at SW-5 and SW-7 are believed to be the result of migration of contaminants from a leachate seep, located upgradient of the southern end of the leachate collection trench in the area of the lower dike, which became apparent between Round 2 and Round 3 of stream sampling. Round 3 results were highest at point S-7 (in the vicinity of the oil/water separator) and decreased downstream to trace (less than 10 ug/l) levels by point S-3. The primary VOC detected in the surface water were ethylbenzene, toluene and xylene. Benzene was a secondary VOC, detected above the instrument detection limit at sampling station S-7 only. Total concentration of VOC in the surface water ranged from not detected to 279 ug/l at point S-7 during Round 3. Stream sampling point S-7 is in the vicinity of the oil/water separator.

The BNA sampling results generally mimicked those found for VOC sampling. Not detected to trace concentrations (less than 10 ug/l) of BNA were observed in surface water samples from all of the stream sampling points during Rounds 1 and 2. The concentration of BNA detected in the surface water increased during Round 3. The total BNA detected during Round 3 were generally low (at or below 45 ug/l except at SW-5, 6 and 7) and like the VOC, were believed to be the result of the leachate seep downgradient of the lower dike. Round 3 results were highest at point S-7 (in the vicinity of the oil/water separator) and decreased downstream. The primary BNA detected were naphthalene, benzoic acid, and bis(2-ethylhexyl) phthalate. No secondary BNA (detected at or above the instrument detection limit in at least one sample) were identified. Total concentrations of BNA in the surface water samples ranged from not detected to 272 ug/l at point S-7 during Round 3.

In general, the analysis of surface water samples from the unnamed stream indicates that BNA and VOC above the instrument detection limit, below sampling point S-5, are not typically found, indicating limited migration of these organic compounds.

Shortly after the third round of surface water samples were collected, a collection basin with a pipe connected to the existing collection trench below the lower dike was constructed (described in Section 2.2.7), in order to correct the leachate seep problem above the west end of the collection trench. After the successful elimination of the leachate seep, a bimonthly stream sampling program was established in the unnamed stream near stream sampling point S-6. Bimonthly sampling of the stream water at Weir No. 3 began in September 1989 and has continued since that time. These bimonthly stream samples have been analyzed for benzene, toluene, xylene, ethlybenzene and naphthalene. The bimonthly stream water analyses have detected only two compounds, at trace concentrations, since the program was initiated. The analysis for naphthalene has detected naphthalene (at 3 ug/l) only once and total xylene at 1.4 ug/l only once since September 1989. These analytical data indicate that the corrective action taken by Hercules to eliminate the leachate seep near the lower landfill dike has eliminated the migration, from this area, of VOC and BNA to the surface water in the unnamed stream. The laboratory reports for the bimonthly stream samples can be found in Appendix E.

3.4.3 Chemical Characterization of the Stream Sediment

During Round 1 stream sampling, sediment samples were collected from all eight stream sampling points. These Round 1 sediment samples were analyzed for full TCL compounds, TAL metals, cyanide, and TPH. The Round 1 sediment samples

detected no pesticide/PCB and the concentrations of metals detected in the sediment did not indicate that metals from the landfill waste were contaminating stream sediment. Therefore, the confirmatory sediment samples (taken at three locations during Round 3 of the stream sampling) were analyzed for VOC and BNA only. Table 3-9 summarizes the detected compounds from the laboratory analysis of the sediment samples.

During the full round of sediment sampling conducted during Round 1, no VOC were detected. During confirmatory sampling, in Round 3, no VOC were detected at location S-10, while at locations S-4A and S-5 (Figure 2-4) VOC compounds, mainly toluene and xylene, were detected in low concentrations (less than 0.5 mg/kg). At such low levels, these VOC are considered of secondary concern. Total VOC were detected in these samples at 0.481 mg/kg at S-5 and 0.095 mg/kg at S-4A. The detection of VOC during the third round of sampling is believed to be related to the previously described leachate seep problem upgradient of the leachate collection trench in the area of the lower landfill dike, which was not present during Round 1 sediment sampling.

During the full round of sediment sampling conducted during Round 1, BNA were detected at each of the eight stream locations sampled. The samples did not exceed total BNA levels of 10 mg/kg except at locations S-6 (26.0 mg/kg), S-7 (36.5 mg/kg based on averaging of duplicate samples taken), and upstream sample S-8 (21.2 mg/kg). In general levels decreased as distance downstream from the landfill increased. During confirmatory sampling in Round 3, total BNA did not exceed 10 mg/kg at the three locations sampled. Primary BNA detected (exceeding 10 mg/kg in at least one sample) consist of naphthalene and anthracene. Secondary BNA (detected at or above the corresponding detection limit in at least one sample) include the following eleven compounds: 2-methylnaphthalene, benzo(a)anthracene,

Table 3-9

Analytical Data Summary for Sediment Samples from the Unnamed Stream, PICCO Resin Landfill

	SE1 (Round 1)	SE2 (Round 1)	SE3 (Round 1)	SE4 (Round 1)	SE4A (Round 3)	SE5 (Round 1)	SE5 (Round 3)	SE6 (Round 1)	SE7 (Round 1)	SE7-D (Round 1)	SE8 (Round 1)	SE10 (Round 3)
INORGANICS (mg/kg)												
Antimony	9.4	12.3	ND	ND		ND		ND	ND	ND	ND	ND
Arsenic	2.9	6.8	4.5	9.1		5		7.5	ND	2.3	12.2	13.2
Barium	138	262	130	142		108		138	ND	ND	164	113
Beryllium	2.3	1.9	1.6	1.4		2.4		3.1	14.4	2.7	1.4	ND
Cadmium	ND	1.7	ND	1.1		ND		1.4	ND	ND	ND	ND
Calcium	58500	10000	15300	11900		18000		27500	ND	ND	17300	5640
Chromium	95.3	30.4	38.2	21.1		22.1		19.7	ND	ND	21	17.6
Cobalt	ND	52.6	19.2	21.6		27		39.5	ND	ND	14.2	15.7
Copper	21.1	32.1	22.2	31.1		36		34.3	52.3	10.7	36.6	26.7
Cyanide	5.9	ND	4.6	ND		5.4		ND	ND	ND	ND	ND
Lead	20.8	18.8	13.8	26.9		22.8		21.2	209	13.0	30.9	14.2
Magesium	11000	3310	4100	3400		5320		6800	ND	ND	4720	3920
Manganese	4240	17300	3970	5540		6120		10800	4220	683	991	1200
Mercury	ND	ND	ND	ND		ND		ND	ND	ND	ND	ND
Nickel	17.3	106	42	49.8		55.4		79.8	77.6	ND	31.4	29.4
Potassium	ND	ND	ND	ND		ND		14100	10800	2400	19400	1020
Selenium	ND	ND	ND	ND		ND		ND	7.1	ND	ND	ND
Sodium	ND	ND	ND	ND		ND		ND	ND	ND	ND	261
Thallium	ND	ND	ND	ND		ND		ND	ND	ND	ND	ND
Vanadium	50.6	26.9	24.3	20.5		21.3		15.6	ND	ND	22.6	17.8
Zinc	75.7	217	114	145		150		212	142	38.2	116	85.5
VOC (mg/kg)												
1,1,1-Trichloroethane	ND	ND	ND	ND	.003 J	ND	ND	ND	ND	ND	ND	ND
Acetone	.014 B	.014 B	.014 B	.015 B	.026 B	.008 JB	.04 B	ND	.091	.016	.066	.007 JB
Benzene	ND	ND	ND	ND	ND	ND	.004 J	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	.002 J	ND	ND	ND	ND	ND
Methylene Chloride	.028	ND	ND	ND	.014 B	ND	.02 B	ND	ND	ND	ND	.001 JB
Toluene	ND	ND	ND	ND	.012	ND	.025	ND	ND	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	.08	ND	.45	ND	ND	ND	ND	ND
TOTAL VOC*	0	0	0	0	.095	0	.481	0	0	0	0	0
BNA (mg/kg)												
2-Methylnaphthalene	ND	.19 J	ND	.15 J	.25 J	.8	1.1	2.4	5.2	0.82	.089 J	ND
Acenaphthene	ND	ND	ND	ND	ND	.075 JB **	ND	.15 JB **	2 JB	ND	.3 JB	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	.12 J	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	.13 J	.32 JB **	ND	4.3 B	20 B	.19 JB **	9.8 B	ND
Benzoic Acid	ND	1.1 J	ND	.72 J	ND	1.6 J	ND	ND	ND	2.2 J	ND	.67 J
Benzo(a)anthracene	ND	ND	ND	ND	.26 J	.24 J	ND	.5 J	ND	ND	0.6	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	.39 J	ND	ND	.36	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	.28 J	.26 J	ND	.26 J	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	.31 J	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	.24 J	ND	.12 J	ND	ND	ND	ND	1.2 B
Butylbenzylphthalate	ND	ND	ND	ND	.093 J	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	.32 J	.35 J	ND	.76	ND	ND	1.1	ND
Dibenzofuran	ND	ND	ND	.068 J	ND	.33 J	.3 J	1.2	3.3	ND	.16 J	ND

Note: See attached legend for explanation of qualifiers and sample designation; no sampling point SE-9 was established on the unnamed stream.

* Total VOC do... include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point ... from total due to concentration in method blank.

Table 3-9 (Continued)
Analytical Data Summary for Sediment Samples from the Unnamed Stream, PICCO Resin Landfill

	SE1 (Round 1)	SE2 (Round 1)	SE3 (Round 1)	SE4 (Round 1)	SE4A (Round 3)	SE5 (Round 1)	SE5 (Round 3)	SE6 (Round 1)	SE7 (Round 1)	SE7-D (Round 1)	SE8 (Round 1)	SE10 (Round 3)
BNA (mg/kg) (Cont'd)												
Dibenzo(a,h)anthracene	ND	ND	ND	ND	.16 J	ND	ND	ND	ND	ND	ND	ND
Di-n-Butylphthalate	.46 J	ND	.09 J	ND	.12 J	.16 JB **	ND	ND	ND	.25 JB **	.12 JB **	.099 J
Di-n-Octyl phthalate	ND	ND	ND	ND	.1 J	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	.2 J	ND	ND	.35 J	.48	.12 JB **	ND	ND	.35 JB **	ND	4.9 B	.12 J
Fluorene	ND	ND	ND	ND	ND	.22 JB **	.49 J	1.9 B	3.2 B	.26 JB **	.28 JB **	ND
Indeno(1,2,3cd)pyrene	ND	ND	ND	ND	.24 J	ND	ND	ND	ND	ND	.15 J	ND
Naphthalene	.16 J	.75	.12 J	ND	.98	3.1	5.5	6.8	22	4.7	.2 J	ND
N-Nitrosodiphenylamine(1)	ND	ND	ND	ND	ND	.079 J	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2 JB	ND
Phenanthrene	ND	ND	.052 J	.26 J	.21 J	1.2 B **	.37 J	6.1 B	9.6 B	.56 JB **	1.2 B **	.15 J
Phenol	ND	ND	ND	ND	ND	ND	ND	.34 J	ND	ND	ND	ND
Pyrene	.23 J	ND	.055 J	.31 J	.32 J	.29 JB **	ND	.96 B	ND	.13 JB	2.2 B	.093 J
TOTAL BNA	1.05	2.04	.317	1.858	4.863	6.759	7.88	26.0	65.3	7.72	21.279	2.332
PETROLEUM HYDROCARBON (mg/kg)												
Petroleum Hydrocarbons												

Note: See attached legend for explanation of qualifiers and sample designation, no sampling point SE-9 was established on the unnamed stream.

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.
** Data point precluded from total due to concentration in method blank.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

benzo(b)flouranthene, bis(2-ethylhexyl) phthalate, chrysene, dibenzofuran, fluoranthene, fluorene, phenanthrene, and pyrene. Total BNA detected in the sediment samples ranged from not detected to 65.3 mg/kg at station S-7 in Round 1. Considering all samples taken, the mean concentration of the total BNA in the sediment samples is 12.7 mg/kg. Considering sampling at locations S-6, S-7, and S-8, the mean concentration was 28.8 mg/kg. Considering results from all other locations, the mean BNA concentration was 3.7 mg/kg. The total volume of sediment from the unnamed stream targeted for potential remedial action in the Site Feasibility Study is 80 cubic yards or 108 tons.

3.5 GROUNDWATER CHARACTERIZATION

Three distinct hydrogeologic zones were studied at the PICCO Resin Landfill site. Each of these zones was investigated using monitoring wells designed to isolate a specific hydrogeologic zone. The three hydrogeologic zones investigated during the RI study were, from shallow to deep, the unconsolidated soils, the mined out Pittsburgh Coal and the deep bedrock below the Pittsburgh Coal.

The soils in the site area contain minor amounts of perched groundwater, commonly encountered near the soil/bedrock interface. Groundwater within the Pittsburgh Coal partially saturates the coal seam and partially fills mine voids downgradient of the site. Deep monitoring wells drilled into the bedrock below the Pittsburgh Coal did not encounter significant groundwater and a core sample collected from this bedrock zone encountered no fractures. These data, relating to the bedrock below the Pittsburgh Coal, indicate that the deep bedrock below the site is unfractured and contains only miniscule amounts of groundwater. Areas to

the southwest (Lobbs Run) and to the northeast (Scotia Hollow) may have higher groundwater potential in the deep bedrock due to higher fracture intensities.

Deep bedrock monitoring wells TW-5 and TW-6 were installed to depth of 200 and 290 feet, respectively. No groundwater was observed during the drilling of these wells and attempted water level measurements several weeks after the installation of the wells, indicated no water in well TW-5 and that TW-6 was "producing" water at a rate of approximately 0.001 GPM. Subsequent water level measurements, during the RI, indicate very low yields for these wells.

Zones of fractured bedrock commonly develope as topographic lows (or valleys) due to preferential erosion of these zones. The depth of the valley at the site, relative to the depths of the adjacent valleys of Lobbs Run and Scotia Hollow, indicated that fracture developement is more pronounced in adjacent areas than beneath the PICCO Resin Landfill site.

3.5.1 Perched Groundwater in the Unconsolidated Zone

3.5.1.1 Movement and Distribution of Perched Groundwater

Water level measurements in monitoring wells TW-1, TW-9, TW-10, TW-11, and TW-16 and in piezometers P-1 through P-7 were used to characterize groundwater flow in the unconsolidated zone at the site. Figure 3-16 is a groundwater contour map for the unconsolidated zone at the site. This figure indicates that shallow groundwater in the unconsolidated zone, and within the landfill, waste moves downslope from the landfill, under the lower dike, and toward the landfill gate. Much of this shallow groundwater is intercepted by the leachate collection trench as discussed in the water budget (Section 3.5.5). Downslope of the leachate

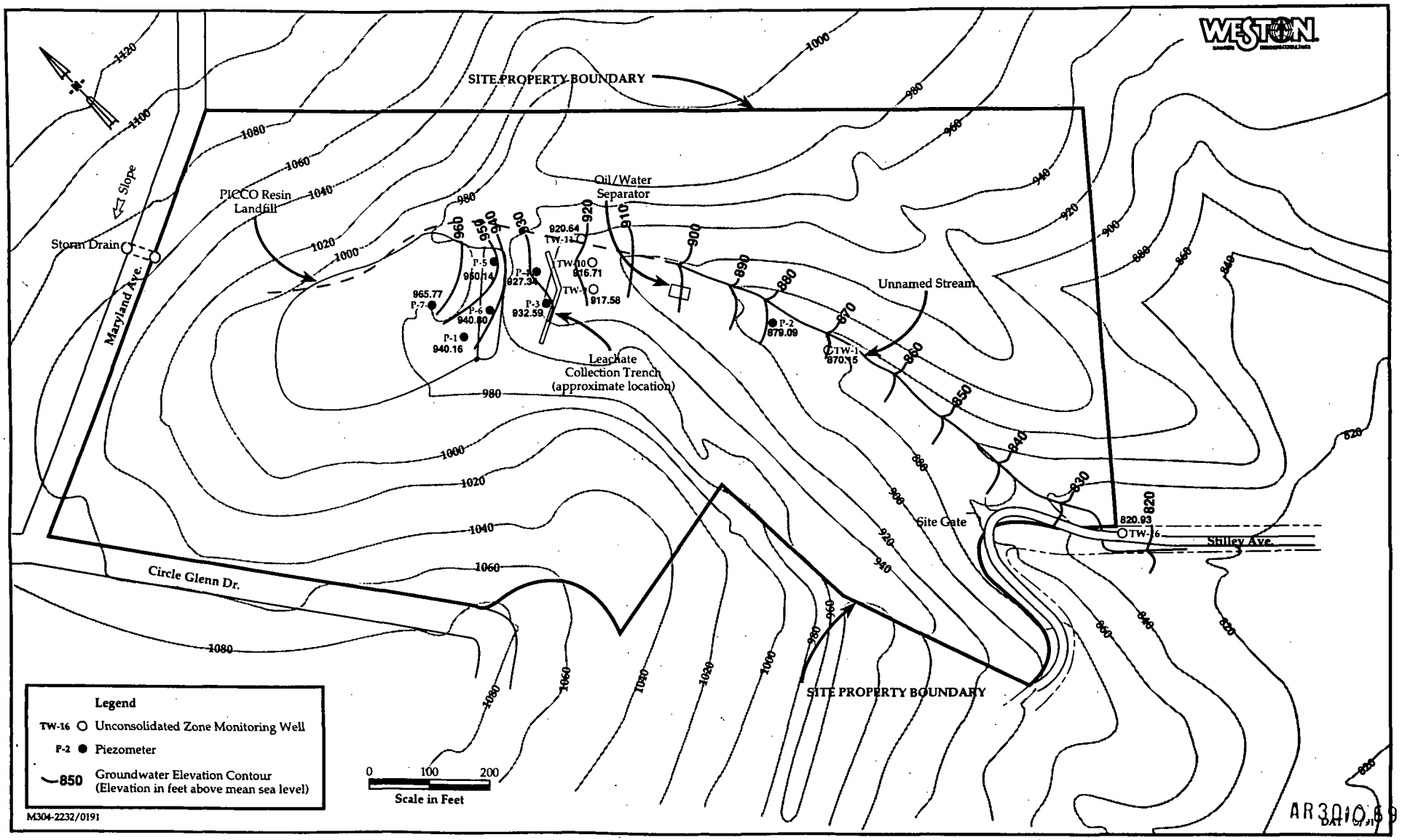

Figure 3-16 Groundwater Elevation Contour Map of the Perched Groundwater Table in the Unconsolidated Zone, PICCO Resin Landfill

collection trench groundwater moves to the south/southeast along the valley bottom. During most of the year the unnamed stream is a gaining stream and a component of groundwater flows toward, and discharges to, the stream. The unnamed stream originates, during periods of low flow from a spring near the oil/water separator.

Observations by WESTON scientists during the installation of the piezometers, monitoring wells and soil borings in the unconsolidated zone, indicate that shallow groundwater in the soils below the landfill is generally encountered two to four feet above the soil/bedrock interface. Some soil borings encountered saturated zones which were perched well above the soil/bedrock interface and apparently were not laterally continuous based upon observations from adjacent borings. The saturated zones in the soil borings ranged from 2.5 feet (BH26) to 11 feet (BH27) in thickness. Some soil borings, drilled to the top of bedrock, encountered no apparent saturated zones. Soil borings which were drilled and encountered no obvious groundwater may have been drilled through saturated clay-rich soils, which did not immediately yield water due to relatively low permeabilities.

The pH, specific conductivity and temperature of the groundwater samples from the unconsolidated zone are summarized in Table 3-10. The samples had pH values which ranged from 6.4 to 7.3, specific conductivity ranged from 340 umhos to 1060 umhos and temperature ranged from 11.0 °C to 22.5 °C.

3.5.1.2 Chemical Characteristics of the Perched Groundwater

Groundwater samples were collected from five monitoring wells in the unconsolidated zone on-site (TW-1, TW-9, TW-10, and TW-11) and immediately below the site gate (TW-16). Monitoring wells TW-1 and TW-16 were installed during Phase I and Phase II, respectively, and were designed to monitor the

TABLE 3-10

PHYSICAL CHARACTERISTICS OF THE PERCHED GROUNDWATER FROM THE UNCONSOLIDATED ZONE, PICCO RESIN LANDFILL

Well	pH	Specific Conductivity (umhos)	Temperature (°C)
TW-1	6.4*	655*	22.5*
TW-9	6.5	340	14.5
TW-10	7.1*	1,060*	14.2*
TW-11	7.3**	820**	14.3**
TW-16	7.0	600	11.0
Average	6.9	600	15.2

* Average of 2 Rounds
** Average of 3 Rounds

groundwater quality in the unconsolidated zone below the landfill. Monitoring wells TW-9, TW-10, and TW-11 were installed, immediately downgradient of the leachate collection trench, at the time of its construction, in order to monitor the effectiveness of the leachate collection system. The purpose of these three sentry Groundwater samples were collected from TW-1, TW-10 and TW-11 during all three rounds of groundwater sampling. Monitoring well TW-9 was sampled only during Round 1 due to the presence of a layer of floating non-aqueous phase product in the well. Monitoring well TW-16, installed during Phase 2, was sampled only during Round 3 of groundwater sampling.

All Round 1 groundwater samples were analyzed for full TCL compounds and TAL metals plus cyanide and TPH. All groundwater samples were analyzed for total (unfiltered) and soluble (filtered) metals. Since no pesticide/PCB were detected in the Round 1 samples, analysis for these parameters was dropped in subsequent sampling rounds.

Table 3-11 summarizes the detected compounds from the laboratory analysis of groundwater samples from the shallow unconsolidated zone. In general, metals concentrations commonly vary from one sampling round to the next (ie: lead in well TW-10) and most metals are detected primarily in the unfiltered (total) samples. The filtered (soluble) metals concentration is shown in parentheses in Table 3-11 (or not presented if no detection of that particular metal was reported). This indicates that the metals detected in the shallow groundwater were the result of the detection of metals which had adsorbed to particulate matter (i.e., clay particles) or were naturally occurring metals in the soils. VOC were not detected in the farthest downslope (off-site) monitoring well, TW-16 or TW-1. In the leachate collection trench sentry wells TW-10 and TW-11 VOC were detected

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

Table 3-11

Analytical Data Summary for Groundwater Samples from the Unconsolidated Zone Below the Lower Landfill Dike, PICCO Resin Landfill

	TW1 (Round 1)	TW1 (Round 2)	TW-1 (Round 3)	TW9 (Round 1)	TW10 (Round 1)	TW10 (Round 2)	TW-10 (Round 3)	TW11 (Round 1)	TW11 (Round 2)	TW-11 (Round 3)	TW-16 (Round 3)
INORGANICS (ug/l)											
Aluminum	10500	19500	11700	5130	8670	1620	568 (200)	4080	4420 (281)	1660 (203)	11300
Antimony	ND	ND	184	ND	522	ND (56)	196	116	ND (54.5)	549 (299)	302
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	274	488	219	200 (224)	579	ND	ND	ND	ND	ND	425
Beryllium	ND	ND	ND	ND	10.1	ND	ND	5.8	ND	ND	ND
Cadmium	ND	ND	ND	ND	14.1	ND	ND	16.2	ND	ND	ND
Calcium	33100 (182000)	195000 (171000)	175000 (165000)	105000 (117000)	301000 (229000)	225000 (227000)	193000 (208000)	273000 (257000)	304000 (293000)	244000 (256000)	148000 (86000)
Chromium	203	86.7	63	10.4	25.6	ND	ND	22.6	ND	ND	41.9
Cobalt	ND	ND	ND	ND	51.7	ND	ND	118	95.4	ND	ND
Copper	89.6	90.3	76.2	49.4	294	26.6	ND	125	44.2	26.1	49.9
Cyanide	ND	ND		ND	30.3	ND		34.4	ND		
Iron	39100	54100 (340)	24000 (108)	8140 (4500)	2550000 (1990)	78700 (2230)	26900 (1620)	409000 (41200)	148000 (55700)	82600 (41600)	45400 (121)
Lead	116 (8)	113	24.8	14.9 (5.4)	9520	224	7.6	33.6	ND	ND	21
Magesium	32700 (30700)	36400 (28800)	35300 (31700)	21500 (27100)	70400 (74100)	59200 (60500)	47200 (50900)	82400 (87900)	89900 (87500)	77200 (81300)	26900 (20400)
Manganese	2660 (2000)	6730 (4720)	5940 (3840)	241 (5000)	36000 (7610)	8640 (7770)	952 (788)	18700 (14800)	19200 (17800)	18600 (16000)	3280 (1450)
Mercury	ND	ND	ND	ND	ND	ND	ND	1.5	0.68	0.54	ND
Nickel	207 (40.8)	271 (106)	173	ND	167	ND	ND	316	357	53.9	247
Potassium	6810	ND	ND	ND	7070	ND	ND	8080	ND	ND	7170
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	21.1	ND	ND	ND	ND	ND	ND
Sodium	21100 (27400)	23600 (21400)	15500 (15000)	ND (85600)	26700 (39100)	29500 (29000)	11800 (12500)	12100 (17400)	19500 (17900)	13900 (14400)	36400 (34200)
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	ND	56.7	ND	ND	150	ND	ND	ND	ND	ND	ND
Zinc	294 (76.2)	377 (99.9)	426 (86.7)	92 (52)	606 (59.1)	42.2	148 (57.2)	862 (30.6)	599	193 (59.4)	2540 (52.3)
VOC (ug/l)											
Acetone	ND	220 B	45	240 B	760 DB	17 B	29	250 DB	2600 B	29	ND
Benzene	ND	ND	ND	230	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	12	ND	ND	ND	22	ND	ND
Ethylbenzene	ND	ND	ND	610	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	ND	4 JB	1 JB	ND	51	20 B	ND	ND	7 B	ND	ND
Styrene	ND	ND	ND	320	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	3 JB **	ND	150	ND	ND	ND	ND	2 JB	ND	ND
Total Xylenes	ND	ND	ND	6400	ND	ND	ND	ND	4 J	ND	ND
TOTAL VOC*	0	0	0	7710	12	0	0	0	28	0	0
BNA (ug/l)											
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	9 J	ND	ND	ND
4-Chloro-3-Methylphenol	130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	23 B **	ND	1 J	10 B	13 B	ND	ND	11 B	5 J	ND	ND
Di-n-Butylphthalate	1 J	1 J	3 J	ND	ND	1 J	ND	ND	1 J	1 J	ND
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	4 J	ND	ND	ND
Naphthalene	ND	ND	ND	ND	ND	ND	ND	98	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	2 J	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	ND	3 J	ND	ND	ND
TOTAL BNA	131	1	4	10	13	1	0	125	6	1	0

Note: See attached le... explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.
** Data point precluded from total due to concentration in method blank.

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only one of the three sampling rounds, and were detected at low concentrations (12-28 ug/l) in Round 1 or Round 2. Averaging the results for the three rounds of sampling yielded trace VOC levels concentrations from 4 to 9 ug/l for these wells. A relatively high concentration of VOC was detected in the trench sentry well TW-A9 (sampled only during Round 1), due to the presence of a floating product layering this well. Primary VOC detected in the groundwater from TW-9 include benzene, ethylbenzene, styrene, toluene and xylene. These compounds are identical to the primary VOC identified in the landfilled waste material. It should be noted that acetone and methylene chloride were also detected in groundwater samples, but as discussed earlier, have been interpreted as being the result of cross contamination and therefore have been disregarded from the analysis of the data.

The results of VOC monitoring in the unconsolidated zone indicate that:

- The highest VOC concentrations were detected in TW-9 and probably represents the affect of non-aqueous phase product in the soils below the trench which pre-date the installation of the trench.

- There does not appear to be significant downgradient migration of contaminants from the area of TW-9.

BNA were not detected in the farthest downslope (off-site) monitoring well TW-16. In the on-site downslope monitoring well TW-1, BNA was detected at a total of 131 ug/l during Round 1. BNA were detected at trace concentrations in well TW-1 (less than 5 ug/l) during Rounds 2 and 3.

The results indicate that significant BNA concentrations are not present in the groundwater within the downslope unconsolidated zone. It appears, from the data collected to date, that relatively low concentrations of BNA and VOC may be present on-site, intermittently, in the groundwater within the unconsolidated zone.

The results of the analysis of the TW-1 and TW-16 groundwater samples indicate that these constituents are relatively immobile and are not present below the site gate. The continued bi-monthly sampling of the stream water (begun in September 1989), has indicated that the landfill indicator compounds for VOC and BNA are not now present in the surface water at the bimonthly stream sampling point (Figure 2-4). The bimonthly stream sampling data are included in Appendix E.

3.5.2 Groundwater in the Pittsburgh Coal

3.5.2.1 Movement and Distribution of the Groundwater in the Pittsburgh Coal

Water level measurements in eleven Pittsburgh Coal monitoring wells were used to characterize groundwater flow in the Pittsburgh Coal. Figure 3-17 is a groundwater elevation contour map of the Pittsburgh Coal groundwater table. This figure indicates that groundwater is flowing toward the west in the direction of the dip of the Pittsburgh Coal (Figure 1-5). Some mounding of the groundwater table occurs in the area of the landfill, probably due to differences in permeability between the landfill material and the Pittsburgh Coal and also due to the topographic location of the landfill within a small valley and the flat surface of the landfill. Table 3-12 summarizes the pH, specific conductivity and temperature of the Pittsburgh Coal groundwater samples. The Pittsburgh Coal groundwater samples had pH values which ranged from 5.4 to 7.7, specific conductivity ranged from 760 to 2,100 umhos and temperature ranged from 11.0°C to 16.0°C.

Groundwater in the Pittsburgh Coal is recharged through fractures in the overlying soils and bedrock. This water enters the Pittsburgh Coal and, due to the relatively high Groundwater in the Pittsburgh Coal is recharged through fractures in the

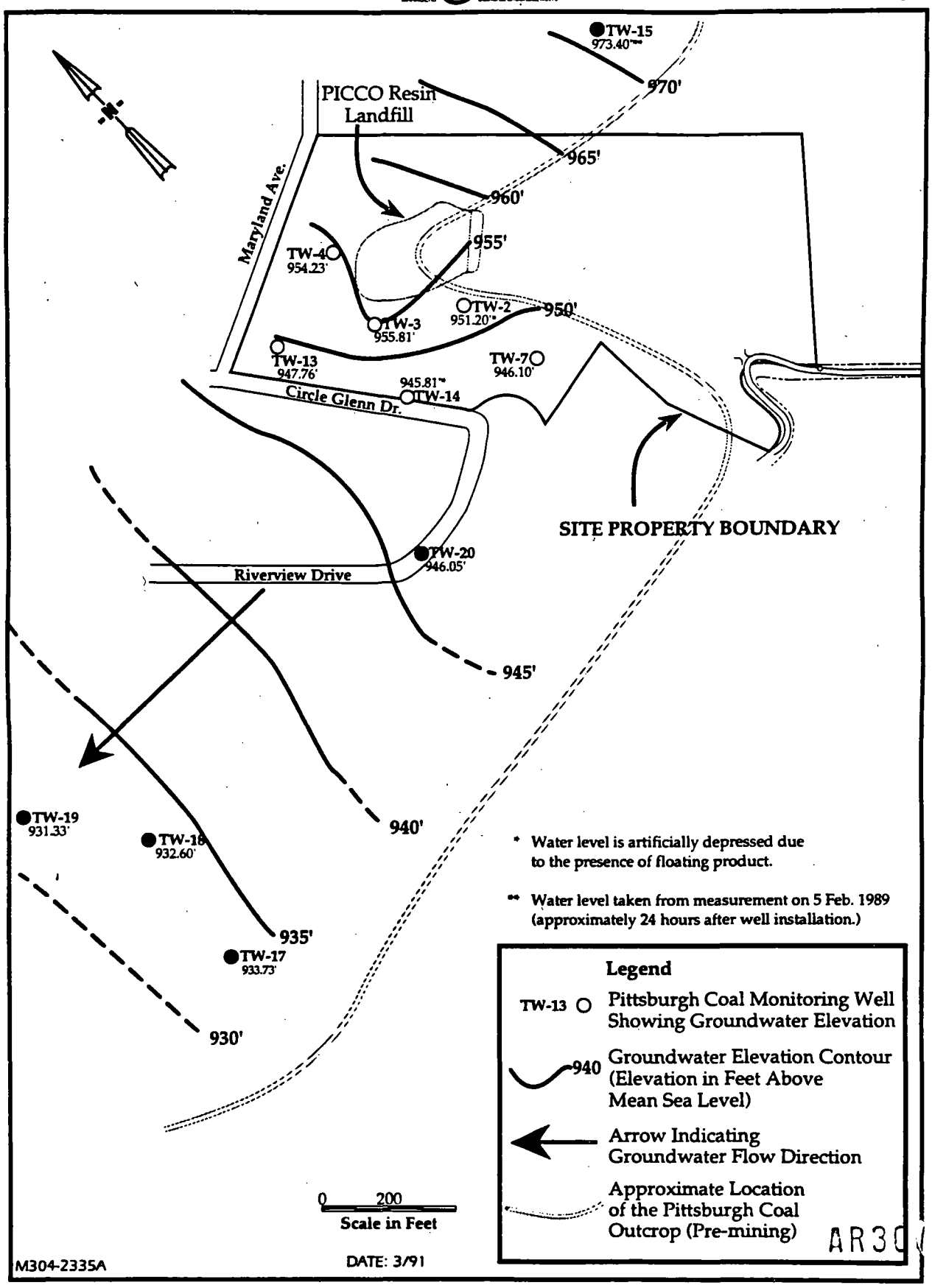

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Figure 3-17 Groundwater Elevation Contour Map of the Pittsburgh Coal Groundwater Table (Water Level Measurements taken on 28 March 1990), PICCO Resin Landfill

TABLE 3-12

PHYSICAL CHARACTERISTICS OF THE GROUNDWATER FROM THE PITTSBURGH COAL ZONE, PICCO RESIN LANDFILL

Well No.	pH	Specific Conductivity (umhos)	Temperature (°C)
TW-2	---	---	---
TW-3	6.6*	760*	14.5*
TW-4	6.7*	917*	14.3*
TW-7	6.0*	837*	14.8*
TW-13	7.7	1,700	16.0
TW-14	---	---	---
TW-15	5.4	1,700	16.0
TW-17	6.3	1,100	11.0
TW-18	6.6	2,100	15.0
TW-19	6.2	1,700	15.0
TW-20	6.8	1,300	15.0
Average	6.6	1,227	15.1

* Average of 3 Rounds
-- Indicates no measurement taken due to the presence of non-aqueous phase product.

overlying soils and bedrock. This water enters the Pittsburgh Coal and, due to permeability of the coal, and the presence of a relatively impermeable underclay, the groundwater moves laterally downdip through the coal.

Groundwater flow on a smaller scale within the Pittsburgh Coal is complicated by the existence of mine voids upgradient and downgradient of the site. Although no known to have been extensively deep mined during the late 1800's and early 1900's. The common mining practice during that aera was room and pillar mining. This method of mining coal involves a series of rooms separated by pillars of coal which have been left to aid in roof support of the mine. Typically a 50% recovery of coal was obtained by this mining method. Figure 3-18 shows a typical Pittsburgh Coal room and pillar mine (modified from Irani, et al., 1983). In this area of the Appalachian Plateau, the rows of mined coal (rooms) were generally oriented north 23° east (parallel to the face cleats).

Of the twelve Pittsburgh Coal monitoring wells, five wells (TW-2, TW-14, TW-15, TW-18, and TW-20) definitely intercepted mine voids and a sixth well (TW-17) probably intercepted a mine void (although it was difficult to determine for certain possibly due to caving of overburden materials above the mine). Figure 3-19 shows the distribution of the Pittsburgh Coal monitoring wells and also indicates the monitoring wells which intercepted mine voids. Sometime after the deep mining of the Pittsburgh Coal, the seam was strip mined along the outcrop around the sides of the site valley. After the strip mining was completed the overburden spoils may have been used to construct the two earthen berms behind which waste was deposited. The construction of these berms allowed waste material to fill the valley to an elevation above the Pittsburgh Coal outcrop.

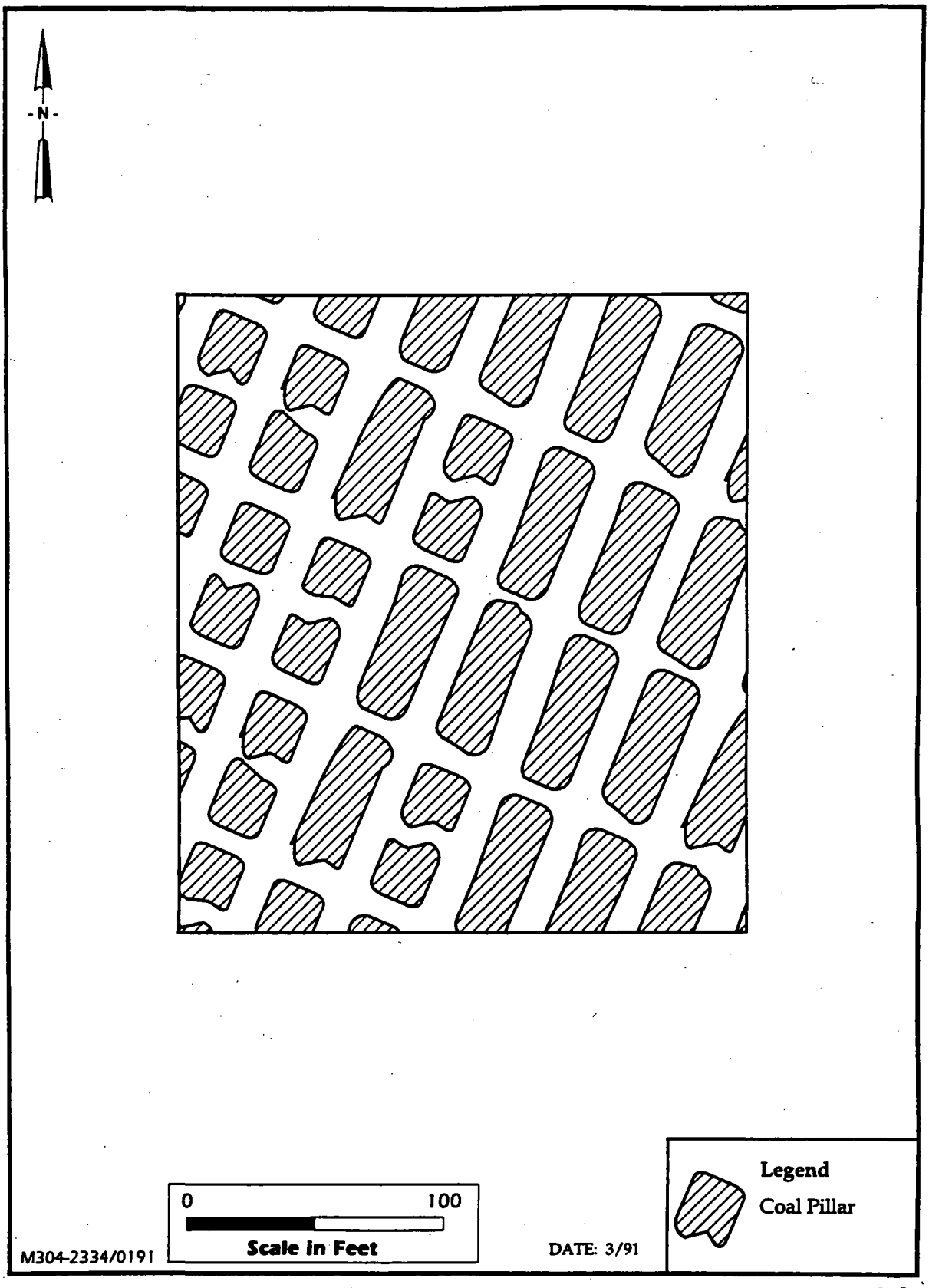

Figure 3-18 Typical Pittsburgh Coal Mine Layout

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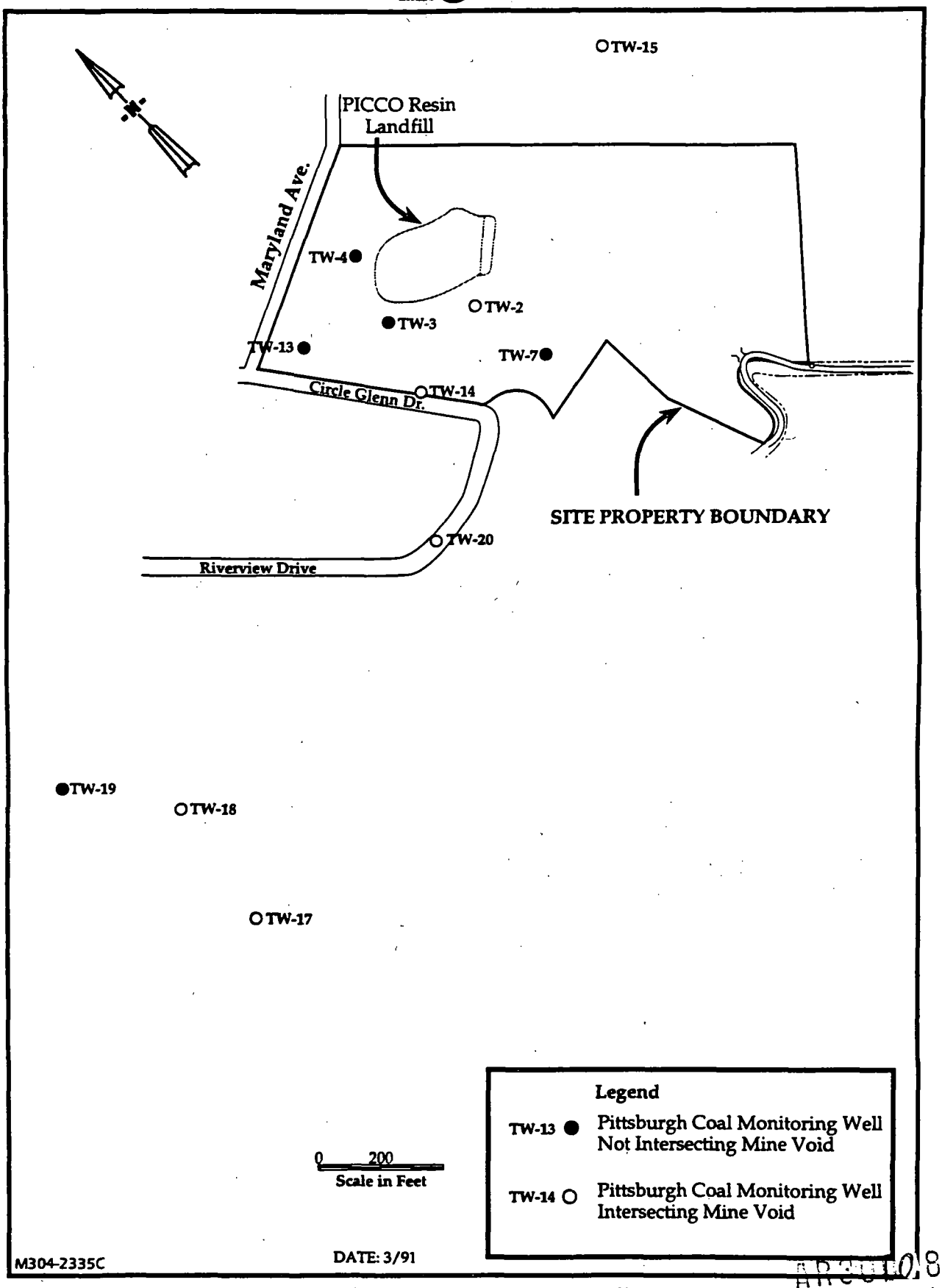

Figure 3-19 Pittsburgh Coal Monitoring Well Map Showing Wells Which Intersect Mine Voids, PICCO Resin Landfill

The apparent result of the mining activities was the migration of non-aqueous phase product into the mine voids. This product has been detected in two monitoring wells, TW-2 and TW-14, both of which have intersected mine voids. Other wells close to the landfill such as TW-3 do not detect non-aqueous phase product apparently because they did not intersect mine voids. Wells which intersected mine voids further downgradient or upgradient of the site did not detect non-aqueous phase floating product. These data indicate however, that the mine voids act as preferential flow paths for groundwater through the Pittsburgh Coal. Estimates of the thickness of the free phase floating product indicate that the product layer has not moved a significant distance from the site boundary. TW-2 has an approximate layer thickness of 4-6 inches of product in the well. TW-14, which is approximately 300 feet downgradient of TW-2, contains approximately 1/4 to 1/2 inch of product. Figure 3-20 shows an approximation of the extent of the free product plume in the area downgradient of the site. Additional data may be necessary to refine the plume map if recovery of free product is undertaken.

3.5.2.2 Chemical Characteristics of the Groundwater in the Pittsburgh Coal

Groundwater samples were collected from all twelve Pittsburgh Coal monitoring wells. Three rounds of groundwater samples were originally planned for the RI, however the installation of additional Pittsburgh Coal monitoring wells during Phase III necessitated a fourth round of groundwater sampling. All of the Pittsburgh Coal monitoring wells, except TW-2 and TW-12, which were sampled during the first round of groundwater sampling, where sampled also during Rounds 2 and 3. Monitoring wells sampled during Round 1 included TW-2, TW-3, TW-4, TW-7 and TW-12. Pittsburgh Coal monitoring wells TW-2 and TW-12 were

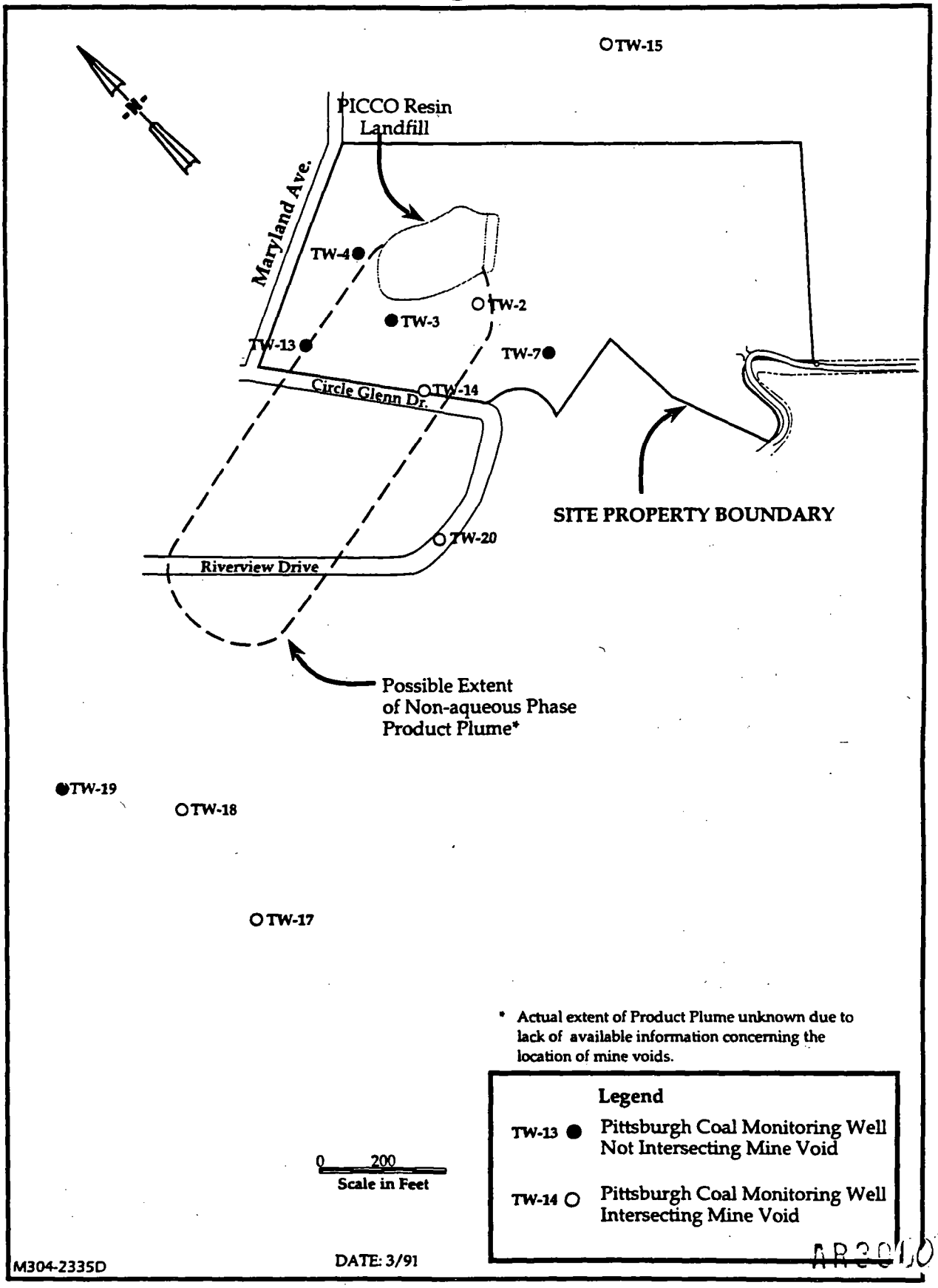

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Figure 3-20 Possible Extent of Non-aqueous Phase Floating Product, PICCO Resin Landfill

sampled during subsequent phases due to the presence of free phase floating product in TW-2 and the lack of a sampleable quantity of water in TW-12. Phase II Pittsburgh Coal monitoring wells (TW-13, TW-14, TW-15) were sampled during Round 3 only. The Phase III Pittsburgh Coal monitoring wells (TW-17, TW-18, TW-19, TW-20) were sampled after Round 3 during the Phase III field program. All monitoring wells sampled during Rounds 1, 2 and 3 were analyzed for full TCL compounds and TAL metals (total and soluble). Groundwater samples from Rounds 1 and 2 were also analyzed for cyanide. The Phase III groundwater samples were analyzed for TCL, VOC and BNA only. Table 3-13 summarizes the detected compounds from the laboratory analyses of groundwater samples from the Pittsburgh Coal monitoring wells.

As seen in Figure 3-19, monitoring wells in the Pittsburgh Coal were installed and sampled upgradient of the site (TW-15), within the site boundaries (TW-2, TW-3, TW-4, TW-7, TW-12, TW-13 and TW-14) and downgradient of the site (TW-17, TW-18, TW-19 and TW-20). For metals sampling a comparison of the upgradient (background) monitoring well (TW-15) analytical data to the data from downgradient monitoring wells and wells adjacent to the landfill indicated the following:

- Monitoring wells TW-2 and TW-3, located adjacent and directly downgradient of the landfill (Figure 3-17) generally had metal concentrations consistent with those found in the upgradient well TW-15. The only exceptions were elevated lead concentrations noted in TW-2, and an elevated barium concentrations noted in TW-3.

- Monitoring wells TW-4, TW-7, and TW-13 generally have metal concentrations consistent with those found in the upgradient well TW-15. The only exceptions were elevated iron and zinc concentrations in TW-7, and elevated iron concentration in TW-13.

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Table 3-13

Analytical Data Summary for Groundwater Samples from Pittsburgh Coal, PICCO Resin Landfill

	TW2 (Round 1)	TW3 (Round 1)	TW3 (Round 2)	TW-3 (Round 3)	TW4 (Round 1)	TW4-D (Round 1)	TW4 (Round 2)	TW-4D (Round 2)	TW-4 (Round 3)	TW7 (Round 1)	TW7 (Round 2)	TW-7 (Round 3)	TW12 (Round 1)
INORGANICS (ug/l)													
Aluminum	ND	418	236	600	401	493	268	242	340	13600	22600 (7190)	16700 (10300)	NA
Antimony	45.5	41.2	ND	ND	ND	ND	ND	ND	ND	81.1	ND	ND (299)	NA
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Barium	ND	1130 (1300)	1330 (1270)	669 (734)	ND	ND	ND	ND	ND	ND	ND	ND	NA
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.6	ND	ND	NA
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	9.1	6.2	ND	NA
Calcium	33100 (8350)	9860 (92300)	126000 (117000)	68500 (66500)	46100 (161000)	47200	153000 (160000)	158000 (161000)	160000 (174000)	190000 (46900)	174000 (167000)	147000 (136000)	NA
Chromium	16.3	ND	ND	ND	ND	ND	ND	ND	ND (96)	16.6	12.1	ND	NA
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	71.7 (59.7)	69.4 (68.8)	NA
Copper	89.4	ND	ND	ND	ND	ND	ND	ND	ND	82.2	96.3	55.3	NA
Cyanide	ND	ND	ND		ND	ND	ND	ND		12.3	ND		NA
Iron	47000 (227)	1270	950	2360 (422)	732 (337)	917	1580 (286)	1060 (327)	1760 (1130)	189000 (20900)	86400 (41300)	69000 (41000)	NA
Lead	223	14.6	31.8 (18)	6.6	9	10.6	35.3 (8.2)	14.8 (5.9)	ND (12.4)	36.7	34.8	8.6	NA
Magesium	9820(9090)	20300 (22000)	25500 (24000)	16300 (15200)	32500 (36000)	30500	34600 (34900)	35400 (35100)	36400 (38600)	49000 (43600)	53400 (51400)	48800 (46300)	NA
Manganese	3620 (921)	1290 (1200)	2420 (2170)	851 (640)	148 (398)	144	333 (276)	333 (325)	351 (407)	4510 (514)	2280 (1740)	1760 (1480)	NA
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Nickel	62.9	ND	ND	ND	ND	ND	ND (133)	ND	ND (113)	127	168 (156)	185 (184)	NA
Potassium	7150 (24200)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Sodium	69700 (335000)	170000 (228000)	169000 (160000)	172000 (150000)	314000 (69300)	274000	79000 (67800)	81100 (71700)	78700 (80900)	32300 (173000)	49000 (47800)	25700 (23500)	NA
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Vanadium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA
Zinc	96.6	128	60.6	285 (170)	ND	26.7	76.9	41.9	22.9 (53.8)	62100 (683)	11200 (1660)	4130 (655)	NA
VOC (ug/l)													
1,1 Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	7 JD	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl 2 Pentanone	ND	4 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	1700 DB	230 DB	640 B	67 D	110 B	37 B	8 JB	10 B	16	12	96 B	15000	ND
Benzene	73	190 D	400 D	67 D	5	2 J	ND	ND	3 J	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	2 J	ND	4 JB
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3 J
Ethylbenzene	210	2 J	62	12 JD	14	5	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	ND	7 B	13 B	ND	8 B	18 B	4 JB	4 JB	ND	ND	8 B	330 JB	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	610	130 D	720 D	120	ND	ND	1 JB	ND	3 J	ND	2 JB	ND	ND
Total Xylenes	9500 D	1800 D	2700 D	420 D	4 J	5	2 J	3 J	24	ND	ND	ND	ND
TOTAL VOC*	10393	2126	3882	626	38	12	3	3	30	0	4	0	7
BNA (ug/l)													
2-4 Dimethylphenol	ND	81 J	350	110	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	220	ND	53 J	26	ND	ND	ND	ND	ND	9 J	ND	ND	19 J
2-Methylphenol	ND	150 J	260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	700	130 J	230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	330 B	ND	ND	ND	2 JB	12 B	5 J	ND	ND	26 JB	4 J	ND	60 B
Di-n-Butylphthalate	ND	ND	12 J	2 J	ND	ND	2 J	2 J	1 J	ND	2 J	1 J	ND
Dimethylphtalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6 J	ND	ND
Naphthalene	2300 D	ND	730	170	1 J	2 J	ND	ND	2 J	99	11	8 J	9 J
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8 J
Phenol	240	ND	140	13	ND	ND	ND	ND	2 J	ND	ND	ND	ND
TOTAL BNA	3790	361	1775	321	3	14	7	2	5	134	23	9	96

Note: See attached legend fror explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

Table 3-13 (Continued)

Analytical Data Summary for Groundwater Samples from the Pittsburgh Coal, PICCO Resin Landfill

	TW-13 (Round 3)	TW-14 (Round 3)	TW-14D (Round 3)	TW-15 (Round 3)	TW-17 (Phase III)	TW-18 (Phase III)	TW-19 (Phase III)	TW-19D (Phase III)	TW-20 (Phase III)
INORGANICS (ug/l)									
Aluminum	12200	74900 (519)	83500 (693)	15000 (1360)					
Antimony	ND	749 (178)	782 (215)	ND					
Arsenic	ND	67.6	56.6	ND					
Barium	240	225	230	ND					
Beryllium	ND	11.4	11.5	ND					
Cadmium	ND	10.3	7.1	ND					
Calcium	204000 (174000)	170000 (148000)	178000 (157000)	295000 (271000)					
Chromium	34.9	387	461	121					
Cobalt	ND	213 (99.9)	189 (106)	ND					
Copper	72.3	389	319	101					
Cyanide									
Iron	77500 (15000)	118000 (23900)	117000 (28700)	32300 (2690)					
Lead	46	52.2	63.6	21.5					
Magesium	45500 (39500)	45300 (36400)	40400 (39100)	85100 (82800)					
Manganese	3110 (993)	2690 (1860)	2750 (1980)	1830 (1170)					
Mercury	ND	0.45	0.21	ND					
Nickel	88.5	728 (252)	760 (305)	192 (98.1)					
Potassium	46300 (53500)	15800 (11800)	15500 (11700)	19400 (17300)					
Selenium	ND	ND	ND	ND					
Silver	14	ND	ND	ND					
Sodium	179000 (164000)	78400 (71900)	70400 (75900)	45000 (43100)					
Thallium	ND	ND	ND	ND					
Vanadium	66.6	119	109	ND					
Zinc	346 (43.2)	1610 (122)	1460 (138)	1670 (1180)					
VOC (ug/l)									
1,1 Dichloroethane	ND	ND	ND	ND	1 J	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl 2 Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	700	1100 D	3500 J	430	190	1700	4200	1000	10 B
Benzene	ND	110 JD	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	23 J	4300 D	ND	ND	ND	ND	17	ND	ND
Methylene Chloride	17 JB	750 JBD	620 JB	ND	2 J	ND	5 J	6 J	3 J
Styrene	ND	210 JD	ND	ND	ND	ND	ND	ND	ND
Toluene	18 J	740 D	650 J	ND	ND	ND	7 J	ND	ND
Total Xylenes	58	3000 D	3400	ND	ND	6	60	ND	ND
TOTAL VOC*	99	8360	4050	0	1	6	84	0	0
BNA (ug/l)									
2-4 Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	80 D	23000	ND	ND	ND	8 J	4 J	4 J	ND
2-Methylphenol	ND	ND	12000	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzoic Acid	ND	ND	ND	12 J	ND	ND	ND	ND	13 J
Bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	6 JD	ND	ND	ND	ND	ND	ND	1 J	ND
Di-n-Butylphthalate	ND	ND	ND	14	ND	ND	ND	ND	ND
Dimethylphtalate	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	490 D	110000	76000	ND	ND	15	230	470	ND
Phenanthrene	7 JD	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	5 J	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL BNA	588	133000	88000	26	0	23	234	472	13

Note: See attached legend fror explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.
** Data point precluded from total due to concentration in method blank.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

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- Monitoring well TW-14, located downgradient from wells TW-2 and TW-3 (Figure 3-17), did have elevated concentration of several metals when compared to the upgradient well TW-15 although these elevated concentrations are primarily seen in the unfiltered sample indicating that the metals are bound to clay particles.

For VOC sampling, a nondetect was reported for upgradient well TW-15, as expected analysis of VOC data from the downgradient monitoring wells and wells adjacent to the landfill indicated the following:

- Monitoring wells TW-2, TW-3, and TW-14, located adjacent to the landfill directly downgradient had average total VOC concentrations ranging from 0.6-10.4 mg/l. The primary VOC detected were benzene, toluene, ethylbenzene, and xylene. Average VOC concentrations were 10.4 mg/l for TW-2, 2.2 mg/l for TW-3, and 6.2 mg/l for TW-14.

- The other on-site monitoring wells, TW-4, TW-7, TW-12, and TW-13, had low concentrations of VOC. Average VOC were 0.03 mg/l for TW-4, 0.001 mg/l for TW-7, 0.007 mg/l for TW-12, and 0.1 mg/l for TW-13. The primary VOC detected were benzene, toluene, xylene and ethylbenzene (BTXE).

- Monitoring wells TW-17, TW-18, TW-19, and TW-20, the off-site downgradient wells, had trace concentrations (less than 0.01 mg/l) of total VOC except in the sample from TW-19 which contained 0.084 mg/l of total VOC. It should be noted that for this particular well, a duplicate sample was collected in which no VOC were detected.

For BNA sampling a low concentration of 0.026 mg/l was detected in the upgradient well TW-15. Analysis of BNA data from the other monitoring wells indicates the following:

- Monitoring wells TW-2, TW-3, and TW-14, located adjacent to the landfill and directly downgradient had total BNA ranging from 0.32 to 13.3 mg/l. The primary BNA detected were naphthalene, 2-methylnaphthalene and several phenolic compounds. Average BNA concentrations were 3.8 mg/l from TW-2, 0.82 mg/l for TW-3, and 11.1 mg/l for TW-14.

- The other on-site monitoring wells TW-4, TW-7, TW-12, and TW-13, contained low concentrations of BNA. Average BNA concentration were 0.006 mg/l for TW-4, 0.055 mg/l for TW-7, 0.096 mg/l for TW-12 and 0.59 mg/l for TW-13. The primary BNA detected in these wells was naphthalene.

- Monitoring wells TW-17, TW-18, TW-19, and TW-20, off-site downgradient wells, contained low concentrations of BNA. Monitoring well TW-19 had an average BNA concentration of0.35mg/l, while the remaining wells averaged 0.012 mg/l total BNA which is less than the concentration detected in the upgradient well TW-15.

Overall, BNA in the Pittsburgh Coal monitoring wells showed a very similar trend to the presence of VOC. The concentrations of both are highest in the area of the landfill and decrease rapidly in a downgradient direction. The highest concentrations in a downgradient on-site well is found in TW-14, while the highest concentrations in a downgradient off-site well are found in monitoring well TW-19 (Table 3-13). The primary VOC detected in the Pittsburgh Coal monitoring wells are BTXE while the primary BNA is naphthalene. Secondary BNA detected consist of various phenolics. The relatively high concentrations of organic compounds in monitoring well TW-14 (at the downgradient site boundary) and in TW-19 (west/southwest of the site) indicates that the primary direction of contaminant transport is the same as the direction of groundwater flow, to the west, toward well TW-19.

Generally, concentrations of organic compounds in the Pittsburgh Coal were highest in the monitoring wells which intersected mine voids in the immediate vicinity of the site area and decreased in concentration downgradient of the site. There appears to be a general difference in the groundwater which is within an unmined section of the Pittsburgh Coal and groundwater in the Pittsburgh Coal

mine voids. The groundwater in the mine voids generally contains higher concentrations of organic contaminants than groundwater within unmined sections. This may be related to infiltration of groundwater into the unmined pillars of coal (pillars commonly underlay fracture zones since they were left in place for roof support). The infiltrating water would effectively flush groundwater from the unmined section of Pittsburgh Coal into the mine voids thus replacing or diluting potentially contaminated groundwater with fresh water from above.

3.5.3 Groundwater in the Deep Bedrock Below the Pittsburgh Coal

3.5.3.1. Presence of Groundwater in the Deep Bedrock

Three monitoring wells, TW-5, TW-6 and TW-8 were installed into the deep bedrock below the Pittsburgh Coal. TW-5 is located adjacent to the landfill at the corner of Maryland Ave. and Circle Glenn Drive, while TW-6 is located along the valley axis within the landfill (Figure 2-12). Monitoring well TW-8 is located immediately below the oil/water separator, along the valley axis, below the lower landfill dike. The Pittsburgh Coal and the bedrock/soils overlying the coal were cased off in TW-5, TW-6 and TW-8 in order to isolate the bedrock below the Pittsburgh Coal seam. Monitoring wells TW-5 and TW-6 were drilled to a total depth of 200 (853.05 feet MSL) and 290 (690.99 feet MSL) feet, respectively. These wells have 89 and 254 feet of open borehole, respectively. Well TW-8 is installed to a depth of 40 feet and was constructed to monitor 14 feet of open bedrock.

During the installation of these wells in the summer of 1982, no groundwater was observed during drilling. The wells were completed to their present depth after discussing the field observations with PADER and obtaining their concurrence on the final well depths. Water levels were checked in the deep bedrock wells periodically after well installation. After thirty days, monitoring well TW-5 was still dry. After twenty seven days monitoring well TW-6 contained approximately 30 gallons of water and was continuing to rise at a rate of about 1/2 foot per day. The daily production of TW-6 is estimated at 1.1 gallons per day or less than 0.001 GPM. There is no record of well TW-8 ever producing water. TW-8 was later abandoned (Section 1.1.4.3).

Prior to the beginning of the RI deep bedrock monitoring wells TW-5 and TW-6 were vandalized and debris was thrown into the wells. It was, therefore, necessary to clear the obstructions in the wells using a drilling rig. This was done on 1 February 1989 during Phase II of the RI using an air rotary drilling rig. The drilling rig was set up over each of the deep bedrock wells and a tri-cone bit was used to clear the obstructions. Each hole was also flushed with water in order to clear the debris from the well and clean out any cuttings which resulted from the rehabilitation.

Approximately one month after well rehabilitation, the water level in TW-5 was measured at thirty feet below the top of casing (TOC). This water has been determined to have been water left in the well from the rehabilitation. This is based on the fact that the water level in TW-5 on 28 March 1990, about twelve months after purging the well for sampling, was 110.09 feet below TOC. This water level (110.09 feet) is approximately the depth of the Pittsburgh Coal seam

at this point and may be indicative of poor integrity of the annular seal around the casing.

Monitoring well TW-6 contained 53.5 feet of water approximately one month after well rehabilitation and contained 155 feet of water fourteen months after rehabilitation. It appears that this well continues to produce water at less than 0.001 GPM.

A rock permeability test (vertical and horizontal) was performed on a representative section of shale rock core from the bedrock below the lower landfill dike in BH-10. This bedrock is stratigraphically below the Pittsburgh Coal and exhibited very low permeability. The horizontal permeability was reported as 3.2 millidarcies (mD) which converts to 6.4×10^{-2} gal/day/ft^2. The vertical permeability (which is considered to be more pertinent to the site evaluation) was reported as 0.003 mD which converts to 6.0×10^{-4} gal/day/ft^2. Since no natural fractures were observed in the core sample and the two deep wells (TW-5 and TW-6) contain no significant water producing zones, these permeabilities are considered to be representative of the deep bedrock zone. The laboratory data reports from the rock permeability tests are included in Appendix G.

After the deep bedrock wells were rehabilitated, a geophysical survey and a borehole televiewer survey (BHTV) were run in each hole. These geophysical surveys indicated a zone of minor fracturing between the depths of 130 and 140 feet (923.05 to 913.05 feet MSL), in well TW-5. These fracture traces were generally irregular and appeared to be drilling induced. Deflection of sediment particles in well TW-5 was observed in the BHTV survey at the location of a fracture at a depth of 136 feet. This phenomena may indicate that this fracture is

a water bearing fracture or may be the result of convection currents induced in the water by the light on the downhole camera. Other fractures observed, during the BHTV survey in wells TW-5 and TW-6, did not show any evidence of groundwater flow. The geophysical logs confirmed the interbedded lithologies (shale, siltstone, sandstone and limestone) which were logged during well installation.

There is still some uncertainty as to water producing capability of well TW-5. No recharge was observed during or after purging of this well for sampling on 4 April 1989, however, some recharge apparently occurred between this date and 28 March 1990 when the water level was measured at 110.09 feet below TOC. It is WESTON's opinion that this well is a very low yield well, similar to well TW-6, which may also be experiencing some slow leakage around the casing.

The pH, specific conductivity, and temperature of the deep bedrock groundwater samples are summarized in Table 3-14. The samples had pH values which ranged from 7.4 to 7.8, specific conductivity ranged from 1,000 umhos to 6,000 umhos and temperature ranged from 13.0 °C to 16.0 °C.

The hydrogeologic data discussed above indicated that the deep bedrock, below the site, is generally unfractured and produces miniscule amounts of groundwater. Therefore vertical migration of groundwater (and contaminants) into the deep bedrock at the site is considered unlikely.

TABLE 3-14

PHYSICAL CHARACTERISTICS OF THE GROUNDWATER FROM THE DEEP BEDROCK ZONE, PICCO RESIN LANDFILL

Well No.	pH	Specific Conductivity (umhos)	Temperature (°C)
TW-5	7.8*	1,000	16.0
TW-6	7.4*	6,000	13.0
Average	7.6	3,500	14.5

* Average of 2 Rounds

3.5.3.2 Chemical Characteristics of the Groundwater in the Deep Bedrock

Groundwater samples were collected from monitoring wells TW-5 and TW-6 during the third round of sampling. The sample collected from monitoring well TW-6 was collected without purging the well since it had been established that this well would not recover for a considerable period of time after purging. For this reason the validity of the analytical data from well TW-6 is questionable and the results should be considered as estimates.

Approximately one well volume was purged from TW-5 before the well went dry. The groundwater sample from TW-5 was collected approximately one hour after purging one well volume. No monitoring wells were installed in the deep bedrock southeast of the site because analysis of the shallow groundwater in monitoring wells TW-1 and TW-16 indicates that the migration of landfill related compounds is not occurring within the shallow aquifer. Additionally, monitoring well TW-8, installed in 1983 immediately below the oil/water separator, was drilled 18 feet into bedrock, along the valley axis, and was a dry well, confirming the unfractured character of the bedrock below the Pittsburgh Coal.

Table 3-15 summarizes the detected compounds from the laboratory analysis of groundwater samples from the deep bedrock monitoring wells. The metals analysis shows generally higher concentrations in well TW-6 than in well TW-5.

No VOC were detected in either of the deep bedrock monitoring wells. No BNA were detected in TW-6. A low concentration (0.1 mg/l) of BNA was detected in monitoring well TW-5. The BNA primarily detected was phenol which is not one of the key constituents detected at the site (although it was detected in some

Table 3-15
Analytical Data Summary for Groundwater Samples from the Deep Bedrock Below the Pittsburgh Coal, PICCO Resin Landfill

	TW5 (Round 3)	TW6 (Round 3)
Inorganics (ug/l)		
Aluminum	633	46800 (216)
Antimony	ND	419
Arsenic	ND	18.2
Barium	347	ND
Beryllium	ND	ND
Cadmium	7.2	ND
Calcium	101000 (109000)	59900 (22200)
Chromium	ND	87.3
Cobalt	ND	ND
Copper	34.2	149
Iron	39800 (16200)	64300 (148)
Lead	20.3	59
Magnesium	47800 (52200)	23400 (5600)
Manganese	1030 (1050)	1070 (25.8)
Mercury	ND	0.26
Nickel	ND	110 (55.4)
Potassium	ND	8550
Selenium	ND	ND (9.7)
Silver	ND	ND
Sodium	196000 (240000)	518000 (518000)
Thallium	ND	ND
Vanadium	ND	113
Zinc	226 (44.1)	359 (364)
VOC (ug/l)		
Acetone	22	ND
TOTAL VOC*	0	0
BNA (ug/l)		
Benzoic Acid	15 J	ND
Benzyl alcohol	2 J	ND
Di-n-Butylphthalate	4 J	ND
Phenol	79	ND
TOTAL BNA	100	0

Note: See attached legend for explanation of qualifiers and sample designation

* Total VOC does not include acetone or methylene chloride because they are considerred to be the result of cross-contamination.
** Data point precluded from total due to concentration in method blank.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

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Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

Pittsburgh Coal monitoring wells). The other detected BNA compounds included benzoic acid, benzyl alcohol and di-n-butylphthalate. Benzoic acid, which was detected in TW-5 at a concentration below the instrument detection limit, was also detected in the upgradient Pittsburgh Coal monitoring well TW-15. Benzyl alcohol was not detected in any other sample collected during the RI. No naphtha- lene or 2-methylnaphthalene (the key site indicator compounds) was detected in well TW-5.

As discussed in the previous section (Section 3.5.3.1) the origin of the water in monitoring well TW-5 is not fully understood. It is likely that some of the water in the well at the time of sampling represents water which was added to the hole during rehabilitation and/or water leaking from around the upper casing. In this case the low concentration of BNA detected in monitoring well TW-5 is probably representative of cross contamination from the drilling rig or from the upper zone above the deep bedrock.

The hydrogeologic data concerning the deep bedrock, as well as the analytical data from well TW-6 (albeit of questionable validity) indicate that vertical movement of groundwater (and contaminants) into the deep bedrock beneath the site is not occurring. The potential for vertical movement of groundwater in the deep bedrock in other areas, such as Lobbs Run and Scotia Hollow may be higher due to the possible presence of fracture zones in these areas.

3.5.4 Summary of Groundwater Quality

Figure 3-21 presents the concentrations of key indicator compounds (benzene and naphthalene) as well as the total concentration of VOC and BNA for all monitori

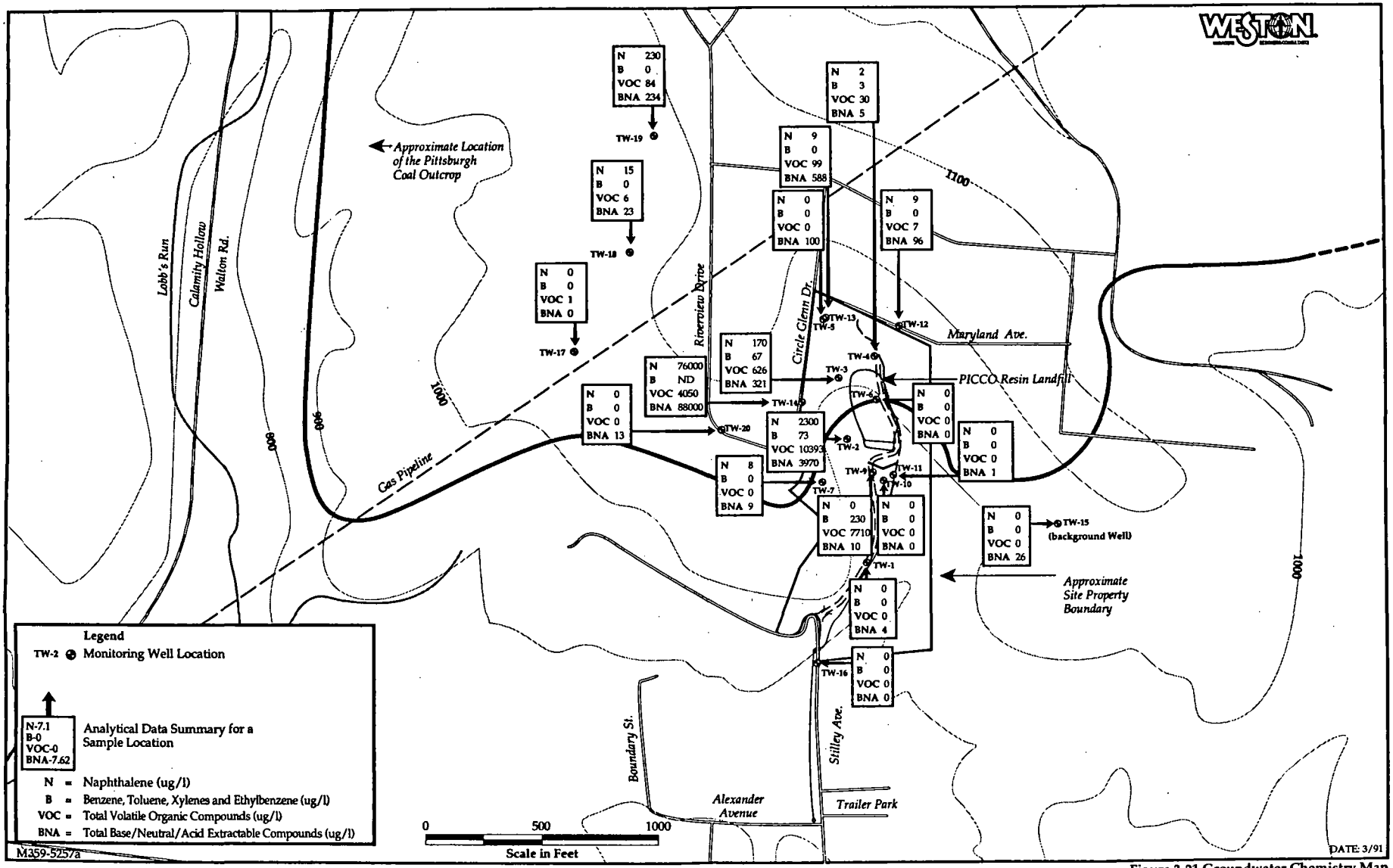

Figure 3-21 Groundwater Chemistry Map, PICCO Resin Landfill

wells sampled during the RI. These data represent samples from all threehydrogeologic zones which were investigated. For wells which were sampled more than once, the most recent data are shown on Figure 3-21.

3.5.5 Site Water Budget

The purpose of this water budget analysis is to estimate the potential annual leachate generation due to infiltration of precipitation into the landfill and flow of groundwater from the Pittsburgh Coal through the landfill. This analysis is intended to provide a broad brushed, semi quantative picture of landfill hydraulics resulting in leachate generation from the landfill. The simplified system considered in the following analysis includes: Groundwater flow from the Pittsburgh Coal through the landfill; infiltration resulting from direct precipitation in the site basin; and flow exiting the landfill into the interception trench. Regional average precipitation values were used along with general estimates of potential annual infiltration. Site specific data included flow records from the leachate collection trench below the landfill to estimate the volume of leachate intercepted by the trench, and groundwater monitoring data to estimate the flow from the Pittsburgh Coal into the landfill and the volume of leachate moving laterally from the landfill into the downgradient Pittsburgh Coal. Upon review, daily stream flow measurements from the three weirs on the unnamed stream were judged to be only partially representative of runoff from the drainage basin and are therefore not used in the development of the site water budget.

The surface area of the site drainage basin, above the site gate, is approximately 1,975,000 square feet (45.3 acres). The area of the drainage basin above the lower landfill dike is approximately 1,430,000 square feet (32.8 acres).

Mean annual precipitation for this area is 37 inches per year (NOAA, 1974). It is assumed that 10% of the total precipitation above the landfill dike infiltrates intothe shallow aquifer and eventually into the landfill. The rest of the precipitation leaves the site by way of runoff or evapotranspiration. This includes precipitation which falls on the sides of the valley around the landfill.

The annual volume of precipitation which infiltrates into this area of the upper basin is determined by multiplying the mean annual precipitation (3.08 feet) by the infiltration factor (0.1) by the area of the upper basin (1,430,000 square feet). This calculation results in an estimated annual infiltration of 3,280,000 gallons.

Billing records from West Elizabeth Sanitary Authority (WESA) for the Hercules Jefferson Plant, indicate that for the years of 1988 through 1990 the volume of water collected by the leachate collection trench and treated by WESA ranged from approximately 690,000 gallons in 1989 to approximately 830,000 gallons in 1988. These volumes represent approximately 21% to 25% of the estimated total infiltration (3,280,000 gallons) in the upper drainage basin above the landfill dike. It is therefore assumed that the remainder of the infiltration flows laterally into the downgradient portion of the Pittsburgh Coal near the base of the landfill. These data indicate that 2.5 to 2.6 million gallons per year of leachate, generated due to infiltration, flow into the Pittsburgh Coal adjacent to the landfill.

In order to estimate the potential leachate generated by the flow of the Pittsburgh Coal groundwater from the upgradient Pittsburgh Coal seam through the landfill the following equation (Darcys Law) was used:

$$Q = KA\,i$$

Where:

Q = groundwater discharge

K = hydraulic conductivity

A = saturated area of the aquifer being considered

i = hydraulic gradient

Due to the effects of mining and collapse of roof material into the mine voids the hydraulic conductivity (K) of the Pittsburgh Coal is assumed to be similar to a gravel or a cavernous limestone. A hydraulic conductivity of 1 X 10^4 gallons/day/foot^2 is assigned for Pittsburgh Coal aquifer based upon published representative hydraulic conductivity values (Heath, 1982). The probable difference in the hydraulic conductivity of the coal and the landfill waste is not considered in this calculation. The expected lower conductivity of the waste material would cause a portion of the groundwater to flow around, rather than through the landfill. For the purpose of this estimate all Pittsburgh Coal groundwater along the length of the landfill is assumed to flow through the waste material. The area of the aquifer (A) for which discharge is being estimated is determined by multiplying the length of the landfill (350 feet) by the saturated thickness of the aquifer, which is approximately 2-feet. Therefore, A is calculated to be 700 feet^2. The hydraulic gradient is calculated from the groundwater flow map for the Pittsburgh Coal shown in Figure 3-17 and is calculated to be 0.017. Based upon these parameters discharge or flow through the landfill from the Pittsburgh Coal is calculated to be 4.34 X 10^7 gallons per year, or approximately 17 times the volume of leachate generated by infiltration.

Groundwater flow velocity is calculated by the equation:

$$V = \frac{K\,i}{n}$$

Where:

V = actual velocity of groundwater through the aquifer

n = effective porosity

i = hydraulic gradient

Porosity is estimated to be relatively high in the Pittsburgh Coal due to the net effect of the mining of the coal and the porosity of collapse piles and coal left in place. Porosity is estimated to be 40% for the Pittsburgh Coal aquifer. Based on this value, along with those previously established for hydraulic conductivity and hydraulic gradient, the groundwater flow velocity calculated for the Pittsburgh Coal is 56.8 feet per day or 3.9 miles per year. It should be noted, however, that depending on the configuration and degree of interconnection of the mine voids, groundwater flow velocity could be lower or potentially much higher (approximating stream flow) than the calculated value.

3.6 RESIDENTIAL WELLS

3.6.1 Use of Groundwater in the Site Area

An extensive door to door survey was conducted in the site area in order to determine area groundwater use. This survey concentrated on three general areas, the residential area to the southeast downslope of the site, the residential area to the

northwest, west and southwest of the site, on the hill above the site and the residential area in Calamity Hollow, west and southwest of the site.

The results of the residential well survey indicated that all of the residents in these areas, with four exceptions, are connected to public water supply. Many of the residents, however, continue to use and maintain their old well for various purposes including watering of lawns, watering of gardens, washing cars, showering and washing clothes. Table 2-2 summarizes the residents who continue to maintain use of their well and designates the use of the water for each well.

3.6.2 Chemical Characteristics of Residentially Used Groundwater

Samples were collected from each of the residential wells which were accessible. The residential well sampling program resulted in the collection of ten groundwater samples as indicated on Table 2-2. Each of the residential well samples was analyzed for either TCL VOC or USEPA 601/602 Method VOC and TCL BNA.

Table 3-16 summarizes the analytical results of the residential well samples. The results of these residential well samples showed trace levels of VOC and BNA detected in three residential wells (residential wells number 1, 2 and 3) as follows:

- Residential well number 1: Bromodichloromethane and dibromochloromethane were detected at trace concentrations of 3 ug/l and 2 ug/l, respectively.

- Residential well number 2: 2-butanone and 2-hexanone, were detected at trace concentrations of 14 ug/l and 3 ug/l, respectively.

- Residential well number 3: di-n-butylphthalate was detected at a trace concentration of 1 ug/l.

Table 3-16

Analytical Data Summary for Residential Well Samples*

	RW1	RW2	RW3	RW4	RW5	RW9	RW10	RW11	RW12	RW13
VOC (ug/l)										
2-Butanone	ND	14	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	3	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	2	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL VOC	5	17	0	0	0	0	0	0	0	0
BNA (ug/l)										
Di-n-butylphthalate	ND	ND	1	ND	ND	ND	ND	ND	ND	ND

* Residential Wells RW-6, RW-7, RW-8, RW-14, RW-15 and RW-16 were not sampled.

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

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None of these compounds were found to be primary compounds of concern from other RI sampling results. Sampling results from the other RI samples which detected these specific compounds are summarized below:

- Bromodichloromethane and dibromochloromethane: Not detected in any other RI sample taken.

- 2-butanone: Detected in a single downslope soil sample (BH28-2) at a low concentration (1.4 mg/kg). Detected at a trace concentration (0.007 mg/l) in a single groundwater sample from the Pittsburgh Coal monitoring well TW-3 during Round 3 of sampling. The TW-3 result was below the instrument detection limit for that particular sample.

- 2-hexanone: Detected at a trace concentration (0.002 mg/kg) in a single downslope soil sample (BH3-3). This analytical result is below the instrument detection limit for that particular sample.

- Di-n-butylphathalate: Detected in 11 downslope soil sample locations at trace concentrations up to 0.15 mg/kg. Detected periodically at trace concentrations up to 0.002 mg/l in surface water samples taken from the unnamed stream, and up to 0.46 mg/kg in corresponding stream sediment samples. Detected periodically at trace concentrations up to 0.014 mg/l in various groundwater monitoring wells. It should be noted that, with one exception, all these results were below the instrument detection limit. The single exception is a detection of 0.014 mg/l found in the upgradient (background) Pittsburgh Coal monitoring well TW-15. Given that the compound was detected in the background well, its source appears to be non-landfill related. The laboratory data reports for the residential well samples are included in Appendix E.

3.7 SEEPS

3.7.1 Locations and Origin of Seeps

Nine surface seeps, representing groundwater discharge points,were located during the RI in the area west and southwest of the site. The locations of these seeps

corresponded, approximately, with the location of the Pittsburgh Coal outcrop and represented mine drainage groundwater. The seep water commonly emitted a sulphurous odor and deposited white and/or rust colored precipitates at the point of discharge and downstream. The pH, specific conductivity and temperature of the seep samples are summarized in Table 3-17. Also listed in Table 3-17 are field observations for each seep including flow rates, odors and precipitates. The seep samples had pH values which ranged from 3.0 to 7.6, specific conductivity ranged from 360 umhos to 1,600 umhos and temperature ranged from 15.0 °C to 22.0 °C. The flow from the Pittsburgh Coal seeps ranged from less than one gallon per minute to high flow rates up to approximately 20 gallons per minute. These flow rates, summarized in Table 3-17, varied between seep locations and also seasonally. Several of the seeps were dry during certain times of the year. The seeps which displayed higher flow rates appeared to be flowing from old mine entries which were caved and filled with rock and soil. The seeps which had higher discharge rates flowed down the hillside into Calamity Hollow and joined the stream at the valley floor along Walton Road.

3.7.2 Chemical Characteristic of the Seeps

Seep water samples were collected for all nine seeps at least one time during the RI, and more than once from some of the seeps which were discovered early in the study. A soil/sediment sample was also collected at the origin of Seep-2. Table 2-3 summarizes the seep sampling program which was conducted during the RI.

Table 3-18 summarizes the detected compounds seen in the seep samples. The seep water samples detected trace concentrations of several VOC including benzene, carbon disulfide, chlorobenzene, ethylbenzene, toluene, trichloroethe

TABLE 3-17

PHYSICAL CHARACTERISTICS OF THE GROUNDWATER FROM THE SEEPS, PICCO RESIN LANDFILL

Seep No.	pH	Specific Conductivity (umhos)	Approximate Rate of Temperature (°C)	Approximate Discharge (GPM)	Seep Discharge Observations
1	--	--	--	--	
1A	7.6	380	15.0	1/2	
2*	6.7	360	19.5	1/4-1	No odor
3	6.6	1,450	16.0	1-5	Strong sulphur odor, purple and white precipitate.
4	4.6	1,600	22.0	1/2	Clear
5	3.4	1,600	18.0	2-20	No odor, white precipitate
6	7.6	1,000	17.0	2	No odor, no precipitate
7	3.0	1,600	19.0	2-15	Slight sulphur odor, white precipitate
8	4.0	1,200	18.0	15-20	
9	6.9	700	16.0	1/2	
Average	5.6	1,099	17.8	NA	

* Average of 3 Rounds

Table 3-18

Analytical Data Summary for Seep Samples Downgradient of the PICCO Resin Landfill

	SEEP-1 (ROUND 3)	SEEP-1D (ROUND 3)	SEEP-1A (ROUND 3)	SEEP-1A (PHASE III)	SEEP-2 (ROUND 1)	SEEP-2 (ROUND 2)	SEEP-2 (ROUND 3)	SEEP-2 (PHASE II) (Sediment)	SEEP-2 (PHASE III)	SEEP-3 (PHASE III)	SEEP-4 (PHASE III)	SEEP-5 (PHASE III)	SEEP-6 (PHASE III)	SEEP-7 (PHASE III)
INORGANICS (ug/l)														
Aluminum	783	817	483		ND	2880	ND							
Antimony	ND	ND	ND		ND	ND	ND							
Arsenic	ND	ND	ND		11.1	ND	ND							
Barium	ND	ND	ND		232	ND	ND							
Beryllium	ND	ND	ND		ND	ND	ND							
Cadmium	ND	ND	ND		ND	ND	ND							
Calcium	52700	55800	37600		123000	105000	67200							
Chromium	ND	ND	ND		ND	ND	ND							
Cobalt	ND	ND	ND		ND	ND	ND							
Copper	ND	ND	ND		37.5	ND	ND							
Iron	1510	1490	887		10400	4060	144							
Lead	6	ND	ND		8.6	ND	ND							
Magesium	14600	15500	7760		26000	22100	17100							
Manganese	40.5	47.4	48.4		5180	172	ND							
Mercury	ND	ND	ND		0.59	ND	ND							
Nickel	ND	ND	ND		ND	ND	ND							
Potassium	ND	ND	ND		5170	ND	ND							
Selenium	ND	ND	ND		6.5	ND	ND							
Silver	ND	ND	ND		ND	ND	ND							
Sodium	ND	ND	ND		67200	7840	ND							
Thallium	ND	ND	ND		ND	ND	ND							
Vanadium	ND	ND	ND		ND	ND	ND							
Zinc	169	22.1	79.4		56.2	101	24.3							
VOC (ug/l)														
Acetone	230 D	620 B	21 B	ND	ND	17 B	1090 BD	42 B	ND, [ND]	1 JB, [ND]	ND	41 B, [ND]	ND, [ND]	ND, [ND]
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND, [3 J]	ND, [1 J]	ND	ND, [2 J]	ND, [ND]	ND, [ND]
Carbon Disulfide	ND	3 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND, [7]	ND, [1 J]	ND	ND, [3 J]	ND, [ND]	ND, [ND]
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND, [2 J]	ND, [ND]	ND	ND, [ND]	ND, [ND]	ND, [ND]
Methylene Chloride	8 B	3 JB	2 JB	1 JB	ND	5 B	6 JBD	24 B	ND, [ND]	ND, [ND]	ND	ND, [ND]	ND, [ND]	ND, [ND]
Toluene	ND	ND	ND	4 JB **	ND	5 B **	ND	ND	3 JB, [ND] **	3 JB, [1 J] **	ND	28 B, [2 J] **	ND, [ND]	ND, [ND]
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND, [1 J]	ND, [2 J]	ND	ND, [2 J]	ND, [ND]	ND, [ND]
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	11	ND, [ND]	ND, [ND]	ND	ND, [ND]	ND, [ND]	ND, [ND]
TOTAL VOC*	0	9	0	0	0	0	0	11	0 [13]	0 [4]	0	0 [9]	0, [0]	0, [0]
BNA (ug/l)														
2-Methylnaphthalene	ND	ND	ND	ND	1700 JD	ND	ND	97 J	ND	ND	ND	ND	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	860	ND	ND	ND	ND	ND	140 J	ND	2 JB **	ND	1 JB **	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	51 J	ND	ND	ND	ND	ND	ND
Di-n-Butylphthalate	ND	ND	2 J	ND	ND	ND	ND	99 J	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	ND	ND	19000 D	ND	ND	56 J	ND	ND	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	130 J	ND	ND	ND	ND	ND	ND
TOTAL BNA	0	860	2	0	20700	0	0	573	0	0	0	0	0	0

Note - There were ... nds of VOA samples collected from some seeps during Phase III. The first round of samples (in brackets) were analysed outside of the analysis method holding time, but within ten days after the expired holding time, therefore these first round results are estimated values.

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

Table 3-18 (Continued)
Analytical Data Summary for Seep Samples
Downgradient of the PICCO Resin Landfill

	SEEP-7D (PHASE III)	SEEP-9 (PHASE III)
INORGANICS (ug/l)		
Aluminum		
Antimony		
Arsenic		
Barium		
Beryllium		
Cadmium		
Calcium		
Chromium		
Cobalt		
Copper		
Iron		
Lead		
Magesium		
Manganese		
Mercury		
Nickel		
Potassium		
Selenium		
Silver		
Sodium		
Thallium		
Vanadium		
Zinc		
VOC (ug/l)		
Acetone	ND, [ND]	ND
Benzene	ND, [ND]	ND
Carbon Disulfide	ND, [ND]	ND
Chlorobenzene	ND, [ND]	ND
Ethylbenzene	ND, [ND]	ND
Methylene Chloride	ND, [ND]	ND
Toluene	ND, [ND]	ND
Trichloroethene	ND, [ND]	ND
Xylene (total)	ND, [ND]	ND
TOTAL VOC*	0, [0]	0
BNA (ug/l)		
2-Methylnaphthalene	ND	ND
Bis(2-Ethylhexyl)phthalate	ND	ND
Dibenzofuran	ND	ND
Di-n-Butylphthalate	ND	ND
Naphthalene	ND	ND
Phenanthrene	ND	ND
TOTAL BNA	0	0

Note - There were ___ rounds of VOA samples collected from some seeps during Phase III. The first round of samples (in brackets) were analysed outside of the analysis method holding time, but within ten days after the expired holding time, therefore these first round results are estimated values.

* Total VOC does not include acetone or methylene chloride because they are considered to be the result of cross-contamination.

** Data point precluded from total due to concentration in method blank.

WESTON

LEGEND FOR ANALYTICAL DATA SUMMARY SHEETS

Sample Desingation

TW __ = Monitoring well designation, groundwater sample.

BH __-__ = Soil boring designation, soil or waste sample; Second term indicates zone from which sample was collected (1 indicates upper zone, 2 indicates lower or middle zone, 3 (if collected) indicates lower zone).

SE ___ = Sediment sample location; sediment sample from the unnamed stream crossing the site or from a seep.

SW ___ = Surface water sample the location; Surface water sample from the unnamed stream crossing the site or from a seep.

Note: "DUP" following a sample designation indicates a field duplicate sample.

Data Qualifiers

ND = Non detect

J = Indicates an estimated value which is below the detection limit.

B = Indicates the compound was found in the blank as well as the sample.

D = Indicates the compound was identified in an analysis at a secondary dilution factor.

Notes:

1. Blank space on data summary sheet indicates parameter was not analyzed for a given sample(s).

2. For metals in groundwater the first value represents total metals (unfiltered) and the value in parentheses represents soluble metals (filtered); If no value in parentheses is given the soluble fraction is a non-detect. Residential well samples were analyzed for total metals only.

3. Units are indicated for each type of analysis and are dependent on type of analysis and matrix.

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and xylene. Total VOC in the water samples ranged from not detected to 13 ug/l (Seep-2, Phase III). The mean concentration of VOC in the seep water samples is2 ug/l. The detection of toluene in the Phase III seep water appears to be the result of sample cross-contamination. Toluene was detected in seven of the seep samples at concentrations up to 28 ug/l, but all reported values except two had "B" qualifiers. Most of the toluene detections were eliminated from consideration due to the concentrations detected in the method blanks. This compound was detected in the laboratory method blank at 6 ug/l, in the trip blank at 91 ug/l and in the field rinse blank at 3 ug/l. The results of these QA quality assurance samples indicate that the toluene in the samples are likely the result of laboratory contamination and/or cross-contamination of samples during transit from the field to the laboratory.

BNA were not detected in the seep water samples with the exception of the duplicate sample taken at Seep-1 during Round 3 and the Round 1 sample taken at Seep-2. It should be noted that the Seep-1 result can be questioned, since the duplicate result was nondetect. The very high concentration of naphthalene and 2-methylnaphthalene detected in the Seep-2 sample are considered to be erroneous for several reasons. Since these BNA have odor thresholds (the concentration in air at which the odor is detectable) which are in the low part per billion range, it would be expected that this sample would have had an odor detectable by the field person who collected the sample. No odors were noted during sample collection. These concentrations of naphthalene and methylnaphthalene are higher than those detected, for the same BNA, in monitoring wells TW-2 and TW-9, which contained free phase floating product layers. Also, the analysis of three subsequent water samples Seep-2 detected no BNA. The source of this probable error is unclear, but may be the result of mislabeling of the sample in the field or laboratory.

Analysis of the seep sediment sample, collected from Seep-2, detected trace concentrations of VOC (xylene) at 0.011 mg/kg and BNA at 573 mg/kg. The BNA detected in the sediment sample include 2-methylnaphthalene, bis(2-ethylhexl)phthalate, dibenzofuran, di-n-butylphthlate, naphthalene and phenanthrene. These BNA are all landfill related compounds which were detected in the soils and/or sediment and groundwater on-site.

3.8 AMBIENT AIR QUALITY

Ambient are quality sampling was conducted during Phase I at the PICCO Resin Landfill site on 25 May 1988. Ambient air samples, to be analyzed for VOC, were collected at ten of the thirteen monitoring locations represented in Figure 2-6. Samples for semi-volatile analysis were collected at three of the stations: the background site station #13; station #8 on the landfill and station #9 near the leachate collection facility (Figure 2-6). EPA Method TO-1 for VOC sampling was employed using Tenax/Tenax-charcoal tubes through which approximately 100 liters of air were drawn during a 3-hour sampling period using an SKC personal sampling pump. Each VOC sample was analyzed for Hazardous Substance List (HSL) compounds. Semi-volatile samples, to be analyzed for naphthalene, were collected using NIOSH Method 5515.

All VOC samples detected methylene chloride and acetone, including the laboratory blank and field blank samples. Both of these compounds are common laboratory solvents which probably resulted in contamination of the samples. Table 3-19 shows the compounds for which positive results were obtained. Of these compounds most concentrations were less than 1 part per billion (ppb) and many were detected at less than the detection limit of the instrument, annotated by a "J".

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TABLE 3-19

AMBIENT AIR SAMPLING
ANALYTICAL RESULTS SUMMARY, PICCO RESIN LANDFILL

SAMPLE NUMBER		ONE Downwind		TWO Downwind		THREE Downwind		FOUR Downwind		FIVE Upwind		SIX Upwind		SEVEN Upwind		TEN Leachate		ELEVEN Access Rd.		TWELVE Background	
		Sample Volume (liters)																			
		129.8		122.0		102.0		107.6		138.2		53.9		128.6		76.8		75.7		134.7	
COMPOUND	MOLECULAR WEIGHT	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb	ng/m3	ppb
Chloromethane	50.49	362.1	0.17 J	385.2	0.18 J	715.7	0.34	3159.9	1.51	332.9	0.16 J	964.7	0.46	482.1	0.23	572.9	0.27 J	885.1	0.42	118.8	0.06 J
Methylene Chloride	84.94	9245.0	2.62 B	2786.9	0.79 B	7254.9	2.06 B	3252.8	0.92 B	15919.0	4.51 B	8905.4	2.52 B	5676.5	1.61 B	2604.2	0.74 B	2509.9	0.71 B	735.0	0.21 B
Acetone	58.08	755.0	0.31 B	426.2	0.18 B	647.1	0.27 B	566.9	0.23 B	398.0	0.16 B	834.9	0.35 B	357.7	0.15 B	833.3	0.35 B	554.8	0.23 B	512.2	0.21 B
Carbon Disulfide	76.13	146.4	0.05 J	0.0	0.00	0.0	0.00	0.0	0.00	36.2	0.01 J	92.8	0.03 J	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Chloroform	119.39	92.4	0.02 J	57.4	0.01 J	68.6	0.01 J	55.8	0.01 J	50.7	0.01 J	111.3	0.02 J	85.5	0.02 J	0.0	0.00	0.0	0.00	0.0	0.00
2-Butanone	72.1	439.1	0.15	0.0	0.00	147.1	0.05 J	0.0	0.00	0.0	0.00	872.0	0.29 J	116.6	0.04 J	0.0	0.00	0.0	0.00	0.0	0.00
1,1,1-Trichloroethane	133.42	624.0	0.11	500.0	0.09	500.0	0.09	399.6	0.07	542.7	0.10	556.6	0.10	482.1	0.09	325.5	0.06	462.4	0.08	311.8	0.06
Carbon Tetrachloride	153.84	369.8	0.06	311.5	0.05	313.7	0.05	0.0	0.00	361.8	0.06	334.0	0.05 J	303.3	0.05	0.0	0.00	0.0	0.00	0.0	0.00
Trichloroethene	131.4	92.4	0.02 J	0.0	0.00	68.6	0.01 J	0.0	0.00	36.2	0.01 J	111.3	0.02	70.0	0.01 J	0.0	0.00	0.0	0.00	0.0	0.00
Benzene	78.11	624.0	0.19	573.8	0.18	627.5	0.19	483.3	0.15	723.6	0.22	1428.6	0.44	645.4	0.20	833.3	0.26	554.8	0.17	705.3	0.22
4-Methyl-2-Pentanone	100.16	0.0	0.00	0.0	0.00	166.7	0.04 J	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
2-Hexanone	100.16	0.0	0.00	0.0	0.00	588.2	0.14	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Tetrachloroethene	165.85	261.9	0.04	270.5	0.04	294.1	0.04	232.3	0.03	246.0	0.04	296.8	0.04 J	326.6	0.05	208.3	0.03 J	224.6	0.03 J	252.4	0.04
Toluene	92.13	1648.7	0.43	1229.5	0.32	1372.5	0.36	1022.3	0.27	1157.7	0.30	1855.3	0.48	1399.7	0.37	11067.7	2.89	1453.1	0.38	1484.8	0.39
Ethylbenzene	106.16	308.2	0.07	286.9	0.07	294.1	0.07	278.8	0.06	311.1	0.07	538.0	0.12	311.0	0.07	6510.4	1.48	396.9	0.08	267.3	0.06
Styrene	104.14	215.7	0.05	24.6	0.01	0.0	0.00	111.5	0.03	86.8	0.02	241.2	0.06	46.7	0.01	2083.3	0.48	0.0	0.00	66.8	0.02 J
Xylenes	106.16	1926.0	0.44	1557.4	0.35	1862.7	0.42	2137.5	0.48	1736.6	0.39	3896.1	0.88	1944.0	0.44	80729.2	18.30	2906.2	0.66	1930.2	0.44

NOTES: NAPHTHALENE - Samples Number 8, 9 and 13 Reported Not Detectable. B = Present in Blank J = Present at Less than Detection Limit

Samples collected 25 May 1988

There was no discernible difference between upwind samples, samples along access road and samples from background stations. Only the VOC sampling station at the leachate oil/water separator (sampling station number 10) (Figure 2-6) showed any significant positive results. At this sampling station toluene, ethylbenzene, styrene and xylene were detected at low part per billion concentrations. Though meteorological conditions provided for excellent dispersion, no VOC or BNA, above background, were noted at the sampling locations around the landfill perimeter.

These data indicate that the area for the greatest potential emissions is the leachate collection system and the leachate interception trench. Exposed leachate was observed at both areas and odors were noted during sampling. During hot weather, it is probable that the evolution of VOC from the exposed areas under "stable" atmospheric conditions would increase. The emissions contribution of the leachate collection area is likely to be greater than the contribution of the landfill surface to the overall concentration of the VOC in the landfill basin.

3.9 ECOLOGICAL SURVEY

The ecological survey conducted between 20 and 24 June 1988 identified four major plant communities within and adjacent to the property boundary at the landfill site. These included the following plant community types: second growth hardwood forest, disturbed forest, old field, and wetlands. Dominant plant species within each community type were noted and are described below beginning downslope to upslope. No pristine/undisturbed plant communities were observed.

Second growth hardwood forest was observed downslope of the landfill and leachate collection system, extending off-site to the power line corridor just above the trailer park. Common tree species observed were Northern red oak, white oak, shagbark hickory, sugar maple and American beech. Other tree species observed included; sassafras, staghorn sumac, honey locust, American elm, black cherry, white ash and hackberry. Common herbaceous plant species were poison ivy, Virginia creeper, may apple, wild grape and jewelweed. This plant community extended along the stream valley up to and just above the leachate treatment facility, where it was replaced by the disturbed forest community.

The disturbed forest community was observed on and above the strip mined portion of the site and was the dominant plant community type observed. Common tree species included honey locust, staghorn sumac, tree of heaven and American elm.

Other tree species observed were black cherry, Northern red oak, sugar maple, white ash, black willow and box elder. Common herbaceous vegetation observed included multiflora rose, blackberry, poison ivy, wind grape, yellow sweet clover, Japanese honeysuckle, teasel, and goldenrod. This plant community was distributed on the old strip mine and adjacent disturbed areas on the landfill site. The old field plant community was observed on and above the landfill and between the lower dike and the leachate treatment facility. This community was dominated by herbaceous plant species including yellow sweet clover, nut sedge, grammine, white clover, poison ivy, goldenrod, thistle, plantain, daisy fleabane, blackberry, multiflora rose, and teasel. Tree species observed included honey locust, hawthorne, American elm and staghorn sumac. This plant community was distributed on top

of the landfill and on more recently disturbed areas not yet colonized by woody vegetation above and below the landfill.

Several small poorly drained areas supporting wetland vegetation were observed in low areas on top of the landfill and along the upper portion of the unnamed stream. Plant species observed included teasel, sedges, planta, reed canary grass, smartweed, cattail, water hemlock, jewelweed, black willow, American elm and box elder. These wetland areas were small in size with a total area of less than one-half acre.

Observations of mammals, birds, and reptiles were made during the ecological site survey. Several mammals were observed during the survey and included whitetail deer, gray squirrel, eastern chipmunk, woodchuck, shorttail weasel and domestic cat. The shorttail weasel was found dead on top of the landfill. The cause of death was not determined. A total of thirty bird species were observed. Table 3-20 lists all bird species observed. No reptiles or amphibians were observed during the ecological survey, however, a black snake was observed by WESTON field personnel prior to the ecological survey.

Observations of aquatic communities in the unnamed stream were made during the ecological survey in conjunction with the first round of surface water sampling. No aquatic organisms (i.e. fish and/or aquatic invertebrate) were observed at any location sampled and therefore no invertebrate samples were collected. Algae (filamentous green) was observed at several of the sample locations growing only in isolated pools. Stream flow at the time of the survey was extremely low and several locations along the stream were dry. No state or Federal endangered/threatened plant or animal species were observed during the site survey.

TABLE 3-20

Bird species observed during the 20-24 June 1988 PICCO Resins Landfill ecological survey.

Common Name	Scientific Name
Mourning dove	Zenaida macroura
Yellow billed cuckoo	Coccyzus americanus
Chimney swift	Chaetura pelagica
Ruby-throated hummingbird	Archolochus colubris
Northern Flicker	Colaptes auratus
Redheaded woodpecker	Melanerpes erythocephalus
Eastern wood-pewee	Contopus virens
Blue jay	Cyanocitta cristata
American crow	Corvus brachyrhynchos
Blue-capped chickadee	Parus atricapillus
Tufted titmouse	Parus bicolor
House wren	Troglodytes aedon
Northern mockingbird	Mimus polyglottus
American robin	Turdus migratorius
Wood thrush	Hylocichla mustelina
European starling	Sturnus vulgaris
White-eyed vireo	Vireo griseus
Red-eyed vireo	Vireo loivaceous
Common yellowthroat	Geothlypis trichas
House sparrow	Passer domesticus
Common grackle	Quiscalus quiscula
Northern oriole	Icterus galbula
Northern cardinal	Cardinalis cardinalis
Indigo bunting	Passerina cyanea
Purple finch	Carpodacus purpureus
American goldfinch	Carduelis tristis
Rufous-sided towhee	Pipilo erythropthalmus
Field sparrow	Spizella pusilla
White-throated sparrow	Zonotrichia albicollis
Song sparrow	Melospiza melodia

Contacts with state and federal fish and wildlife agency's were made after conducting the field survey. No endangered species were identified in the site area by any of the agencies which were contacted.

No major ecological impacts to terrestrial biota were observed during the site survey which could be directly attributed to the materials deposited in the landfill. Several small areas of bare soil (unvegetated) were observed on top of the landfill and along the access road downslope from the lower dike. No sign of stressed vegetation adjacent to these bare areas was observed. The only sign of plant stress observed on the site were dead or dying American elm trees. These were not restricted to the landfill area but were scattered throughout the site both upslope and downslope of the landfill. The probable cause of the dead elm trees is assumed to be Dutch Elm Disease, however no samples were collected to verify the cause. The plant community on this landfill and adjacent areas are characteristic of the stressed systems in the area resulting from strip mining. Since the landfill and adjacent areas were strip mined prior to the landfill construction, it is difficult to determine the extent to which the presence of the landfill has affected the terrestrial plant communities on-site.

The unnamed stream appeared to be impacted as evidence by the lack of any observed fauna, such as aquatic insects, crustacea or fish. The watershed was strip mined prior to construction of the landfill and most likely resulted in a stream devoid of aquatic life due to the effects of siltation, surface disturbance and runoff water constituents (i.e. low pH, metals, etc).

According to the Pennsylvania Fish Commission (Clark Shiffer, Pers. Comm., 1991) no studies have ever been conducted on the unnamed stream which drains

to the site. Stream flow also appears to be a primary factor limiting habitation of the stream by reducing the stream to only a few isolated flowing sections during dry periods, as observed during the site survey. The degree to which the landfill may have impacted the stream is difficult to separate from the historical strip mine impacts.

3.10 SUMMARY OF SITE CHEMICAL CHARACTERIZATION

Table 3-21 provides a summary of the identified primary and secondary compounds of concern for the PICCO Resin Landfill site, based on the RI sampling results.

3.11 SITE MODEL

The cumulative results of the RI have allowed for the development of a site model which is used to design a remediation plan to mitigate the site. The source of contamination at the site is the PICCO Resin Landfill which is a clay lined landfill composed of very soft to medium-stiff waste material containing organic chemicals. These wastes contain high concentrations of benzene, toluene, xylene, ethylbenzene, styrene, naphthalene and 2-methylnaphthalene. The total amount of material in the landfill is estimated to be 88,000 cubic yards (137,000 tons). This includes an estimate that approximately 28,000 tons (17,500 cubic yards) of potentially contaminated soil and 24,000 tons (17,500 cubic yards) of cover soil are present within the landfill. Although the waste material has been shown to be physically and chemically heterogeneous, relatively high concentrations (percent level concentrations) of VOC, BNA and TPH compounds are present throughout the landfill.

TABLE 3-21

SUMMARY OF THE PRIMARY AND SECONDARY VOC AND BNA COMPOUNDS FOR THE PICCO RESIN LANDFILL SITE

Media	Primary VOA	Primary BNA	Secondary VOC	Secondary BNA
Landfill Waste	BTXE Styrene	Naphthalene 2-Methylnaphthalene	Carbon Disulfide	Acenaphthalene Dibenzofuran Fluoranthene Phenol
Downslope Soils	TXE	Naphthalene 2-Methylnaphthalene	Benzene 2-Butanone	Acenaphthalene Anthracene Benzo(a)anthracene Bis(2-ethylhexyl) phalate Dibenzofuran Fluoranthene Fluorene Pyrene Phenanthrene
Stream Surface Water[1]	TXE	Naphthalene Benzoic Acid Bis(2-ethylhexyl) phthalate	Benzene	---
Stream Sediment	---	Naphthalene	Toluene	2 - Methylnaphthalene
		Anthracene	Xylene	Benzo(a)anthracene Bis(2-ethylhexyl) phthalate Chrysene Dibenzofuran Fluoranthene Fluorene Phenanthrene Pyrene
Groundwater				
Perched Unconsolidated Zone (Floating Layer in TW-9)	---	---	BTXE Styrene	Naphthalene 4-Chloro-3-methylphenol
Pittsburgh Coal (Floating Layer)	BTXE	Naphthalene 2-Methyl-naphthalene	---	Bis(2-ethylhexyl) phthalate Various phenolics
Deep Bedrock[2]	---	---	---	---
Seeps water/sediment	---	---	---	Naphthalene 2-Methylnaphthalene Bis(2-ethylhexyl) phthalate
Residential Wells	---	---	2-butanone 2-hexanone	di-n-butylphthalate

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(1) Following correction of leachate seep problem, bimonthly stream sampling since 9/89 has indicated elimination of the presence of these compounds in the stream surface water.

(2) A low level of phenol detected was attributed to cross contamination from the Pittsburgh Coal.

The presence of landfill-related compound was documented in the site soils primarily along the site access road in the area between the lower landfill dike and the site gate. The soils in this area are dense to very dense clay silts which contain discreet pockets of landfill leachate. Chemical analyses of the downslope soils below the lower dike indicate the presence of toluene, xylene, ethylbenzene, naphthalene and 2-methylnaphthalene. These landfill-related compounds occur at the highest concentrations in the area between the lower landfill dike and the oil-water separator. The lower soil layers in this area appears to have higher concentrations of landfill-related constituents than the upper layers. These constituents also occur between the oil/water separator and the site gate, but generally occur at lower concentrations within the soils in this lower area.

The surface water from the unnamed stream draining the site contains only trace concentrations of landfill-related constituents. The stream sediment contains higher concentrations of landfill-related VOC and BNA than the surface water. Concentrations of total BNA in the stream sediment were commonly in the range of 10 to 20 mg/kg in the upper portion of the stream.

In order to characterize potential movement of landfill-related constituents in groundwater, three distinct hydrogeologic zones were investigated at the PICCO Resin Landfill site. The three hydrogeologic zones were, from shallow to deep, the subsurface unconsolidated soils, the Pittsburgh Coal and the deep bedrock below the Pittsburgh Coal.

The unconsolidated soils at the site contained a limited amount of groundwater near the soil/bedrock interface. This groundwater moved along the soil/bedrock interface, downslope, in a direction roughly perpendicular to topographic contours.

This groundwater also recharges the unnamed stream draining the site. Chemical analyses of groundwater samples from the unconsolidated soils both on-site and below the site boundary indicated that minimal contaminant transport was occurring in this groundwater system.

The evaluation of the deep bedrock below the Pittsburgh Coal indicates that this zone is not a significant water-bearing zone and, therefore, does not provide a pathway for contaminant transport.

The Pittsburgh Coal appears to be the major groundwater pathway for contaminant transport. This water table aquifer is characterized by mine voids throughout the coal seam and groundwater movement through the landfill and into the Pittsburgh Coal has allowed non-aqueous phase product to migrate into the mine voids in the area immediately downgradient of the site. The presence of this non-aqueous phase product on the groundwater table has acted as a source for a dissolved phase plume which extends downgradient of the site for a distance of at least 1,000 feet.

The sediment sample collected at Seep-2 which flows from the Pittsburgh Coal seam downgradient of the site in Calamity Hollow, indicates that landfill-related constituents may have intermittently reached the surface at the location of Seep-2. Sampling of residential wells in Calamity Hollow below the Pittsburgh Coal seeps indicates that landfill-related constituents have not impacted the groundwater in the areas below the Pittsburgh Coal seeps.

3.12 CONCLUSIONS OF THE REMEDIAL INVESTIGATION

Based upon the results of the RI the following conclusions have been reached relative to the PICCO Resin Landfill site:

- The volume of waste deposited in the landfill is approximately 53,000 cubic yards or 85,000 tons. The waste in the landfill is overlain by a clayey soil cover ranging in thickness from approximately 4 to 9 feet. A layer of clayey soil was found between the waste at the bottom of the landfill and the bedrock. This soil appears to be impacted by the waste material as evidenced by staining.

- The landfill waste is chemically and physically heterogeneous but generally contains elevated concentrations of benzene, toluene, xylene, ethylbenzene, styrene, naphthalene and 2-methylnaphthalene which compose approximately 1% to 5% of the waste material.

- An evaluation of dike stability, based upon limited data, indicates that the application of additional stresses to the lower landfill dike (ie. the use of heavy equipment on the dike) may result in dike failure. An evaluation of long-term static dike conditions indicate that a potential stability problem also exists for the long-term (ie. a factor of safety less than unity).

- Site soils, downslope of the landfill, contain elevated concentrations of landfill related VOC and BNA in the area between the lower landfill dike and borehole BH-7 (which is located immediately downslope of the oil/water separator). The primary compounds detected in this area were toluene, xylene, ethylbenzene, naphthalene and 2-methylnaphthalene.

- The analytical data of surface water and sediment samples from the unnamed stream draining the site indicate that:

  - VOC and BNA constituents were found in the stream surface water during the period of time that a leachate seep was active above the west end of the interception trench and immediately downslope of the landfill. This seepage was eliminated

through the installation of the leachate collection basin. The migration of these constituents from the seepage area into the surface water was virtually eliminated by this action, based on analysis of bi-monthly sampling at Weir No. 3, sof the unnamed tributary which began September 1989.

- BNA concentrations exceeding 10 mg/kg are present in the sediments of the stream immediately below the leachate oil/water separator (stream sampling locations S-6 and S-7) as well as along the upstream, intermittent section as seen in the sediment sample from stream sampling location S-8. These concentrations decrease significantly (approach non-detect) at sampling locations below the site.

- The site ecological survey concluded that the unnamed stream appeared to be impacted but that the degree to which the landfill may have impacted the stream is difficult to discern due the impact of the strip mining which occurred in the valley prior to the landfill operation.

- Groundwater in the shallow unconsolidated zone (soils) downgradient of the landfill contains only trace concentrations of VOC and BNA with the exception of monitoring well TW-9 immediately downgradient of the leachate collection trench. This leachate collection trench sentry well contains higher than trace concentrations of VOC and BNA primarily due to the presence of residual non-aqueous phase product in the well, which was present prior to the installation of the collection trench.

- The deep bedrock below the Pittsburgh Coal seam appears to have been composed of a sequence of sedimentary rocks which appears to be unfractured and does not yield sustainable quantities of groundwater.

- The Pittsburgh Coal seam appears to have been extensively deep mined in the site area and provides a migration pathway for landfill related constituents to the area southwest of the site. Non-aqueous phase floating product has migrated into the area between the landfill

and Circle Glenn Drive. The dissolved-phase plume extends at least to the area of monitoring well TW-19, approximately 1,000 feet downgradient of the landfill.

- The sediment sample collected at Seep-2 which flows from the Pittsburgh Coal seam downgradient of the site in Calamity Hollow, indicates that landfill-related constituents may have intermittently reached the surface at the location of Seep-2.

- Analysis of samples from residential wells in the site area indicate that one residential well (RW-2) contained the VOC constituents 2-butanone and 2-hexanone, at trace concentrations, while a sample from a second residential well (RW-3) contained the BNA constituent di-n-butylphthalate, at a trace concentration. These compounds were detected infrequently and/or sporadically at low concentrations in other samples taken from the landfill site. The source of these contaminants is not known and they are not target compounds at the site. In addition, di-n-butylphalate was detected in the upgradient (background) Pittsburgh Coal monitoring well TW-15. Di-n-butylphalate is a common compound found in the environment from the use of plastisizers.

- The site ecological survey indicated that the unnamed stream crossing the site and the disturbed forest community appeared to be slightly impacted. However, it was not possible to determine if the impact was due to the previous mining activities in the valley or activities related to the construction and operation of the PICCO Resin Landfill. No state or federal endangered or threatened species were identified in the site area.

- The ambient air sampling program indicated that although trace concentrations of VOC were detected near the oil/water separator, no organic compounds, above background, were detected on, above or below the PICCO Resin Landfill.

REFERENCES CITED

ASCE Manuals and Reports on Engineering Practice, 1977, No. 54, Sedimentation Engineering, Vito A. Vanoni (Editor).

Borah, Devah, 1987, Sediment and Erosion Control Short Course, Rutgers University, Spring 1986 (Revised April 1987).

Bowles, J.E., 1982, Foundation Analysis and Design, 3rd Edition, McGraw Hill Publishing Co.

Davies, William E., Pomeroy, John S., and Kohl, William R., 1976, Map of Coal Mining Features, Allegheny County, Pennsylvania, USGS Miscellaneous Field Studies Map MF-685C, United Stated Department of the Interior.

Heath, R.C., 1982, Basic Groundwater Hydrology, USGS Water Supply Paper 2220, United States Department of the Interior.

Irani, M.C., Chaiken, R.F., Dalverny, L.E., Molinda, M.M., Soroka, K.E., Divers, E.F., and Kim, A.G., 1983-1986, Calamity Hollow Mine Project (Five Parts), United States Department of the Interior, Bureau of Mines.

National Oceanic and Atmospheric Administration (NOAA), 1974, Climates of the States, U.S. Dept. of Commerce, Water Information Center Inc.

NCSS, National Cooperative Soil Survey Data Sheets, 1990.

Pasquill F., 1961, The Estimation of Dispersion of Windborne Material, Meterol. Mag., 90 (1063):33-49.

Roy F. Weston, Inc., 1981a, Soils Investigation of the Hercules Disposal Area, Jefferson Borough, Pennsylvania, November, 1981.

Roy F. Weston, Inc., 1981b, Supplemental Soils and Geologic Investigation of the Hercules Disposal Area, Jefferson Borough, Pennsylvania, December, 1981.

Roy F. Weston, Inc., 1982, Pollution Abatement Plan for the Picco Resin Disposal Site, Map and Drawings Only.

Roy F. Weston, Inc., 1987, Final Work Plan for a Remedial Investigation and Feasibility Study of Picco Resin Landfill, Jefferson Borough, Allegheny County, Pennsylvania, September 1987.

Roy F. Weston, Inc. 1988, Quality Assurance Project Plan for Picco Resins Landfill RI/FS, Jefferson Borough, Allegheny County, Pennsylvania, May 1988.

Socolow, A.A., 1962, Physiographic Provinces of Pennsylvania, Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey, Map #13.

SCS, Soil Conservation Service, United States Department of Agriculture, Soil Survey of Allegheny County, Pennsylvania, August, 1981.

Versar, Inc., 1990, Oversight and Split Sampling Trip Report, Picco Resin Landfill, Allegheny County, Pennsylvania.

Versar, Inc., 1988, Oversight Report, Picco Resin Disposal Landfill, Allegheny County, Pennsylvania.

Wagner, W.R., Heyman L., Craft, J.L., Edmunds, W.E., and Harper J.A., 1975, Greater Pittsburgh Region Structure Contour Map, Pennsylvania Bureau of Topographic and Geologic Maps in cooperation with the United States Department of the Interior, Geologic Survey.