



SUPPLEMENTAL INVESTIGATION REPORT

Prepared for:

**BLACK & DECKER (U.S.) INC.
Hampstead, Maryland**

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SECTION 1
INTRODUCTION

This Supplemental Investigation Report has been prepared to present the findings of the Supplemental Remedial Work Plan (WESTON, 1995) activities. The Supplemental Remedial Work Plan was prepared to meet the requirements of Condition IV.U of the Administrative Consent Order between the State of Maryland Department of the Environment (MDE) and Black & Decker (U.S.) Inc. (April 1995) (Consent Order). A summary of the Supplemental Remedial Work Plan activities, including the fracture trace analysis, lagoon sampling, and brush pile investigation, is presented in Section 2. The results of these activities are included in Section 3. Conclusions are presented in Section 4. This document will become part of the Administrative Record for the site, which is maintained at the Hampstead Public Library.

SECTION 2

INVESTIGATIVE ACTIVITIES

2.1 FRACTURE TRACE ANALYSIS

As requested by the MDE, a fracture trace analysis was completed at the site in order to identify potential preferred zones of groundwater movement. Fracture traces are "...natural linear features consisting of topographic (including straight stream segments), vegetation, or soil tonal alignment, visible primarily on aerial photographs and expressed continuously for less than one mile." (Lattman, 1958). The significance of fracture traces is that they have often been found to be expressions of zones of higher fracture concentrations, and fracture traces, in some hydrogeologic settings, can be considered to be locations for increased groundwater flow (Parizek, 1976).

The fracture trace analysis was completed using procedures outlined in the Supplemental Remedial Work Plan (WESTON, 1995). In order to perform a fracture trace analysis of the general site area, stereographic pairs of aerial photographs spanning the years 1959 to 1987 were analyzed. Each stereo pair consisted of at least two consecutive aerial photographs with overlapping coverage of an area that created a three-dimensional image when viewed through a stereoscope.

Historical aerial photographs are useful in assessing fracture traces under natural conditions and during different seasons. Aerial photographs taken prior to site development provide useful information on the initial natural conditions in the site area, because cultural features tend to obscure fracture traces. Photographs taken at different seasons allow seasonal effects to be identified. For example, during the summer, vegetation may obscure features that are visible in the winter; conversely, patterns of vegetation growth during the spring or summer can be suggestive of fracture trends.

Aerial photographs differ in their scale and aerial coverage. Aerial photographs at finer scale resolutions tend to show detail that coarser scale resolution aerial photographs do not, and coarser scale resolution aerial photographs tend to show large features that are not observable on finer resolution photographs.

For this analysis, the three-dimensional images of the stereo pairs of photographs were examined to observe features such as tonal changes, vegetative patterns, stream paths and other features that may be indicative of fracture traces. The observed traces were annotated on overlays to the photographs. The overlays were then enlarged or reduced as appropriate to the same approximate scale as a U.S.G.S. 7.5 minute quadrangle map (1:24,000) of the site area and the locations of the identified fracture traces were transferred on to the topographic map. The results of the fracture trace analysis are discussed in Section 3.

2.2 LAGOON SAMPLING

Two surface water impoundments (lagoons) are present at the Hampstead facility. These lagoons, identified as the East and West Lagoons, are shown on Figure 2-1. The East Lagoon is used to hold process water prior to treatment in the plant's physical/chemical treatment system. The West Lagoon is used to hold storm water, cooling water, and treated plant process water for fire protection and cooling purposes.

Surface water and sediments in the East and West Lagoons were originally sampled during 1987. Low concentrations of target compounds were detected in 5 of the 13 samples collected during that event, and, as a result, the lagoons were not considered to represent a source area or to require any additional action. However, based on MDE's request, the recent sampling events (described below) were performed to confirm earlier findings.

During August 1996 and February 1997, surface water and sediment samples were collected from the East and West Lagoons. During each round, three surface water and three sediment samples were collected from each of the two surface impoundments. A

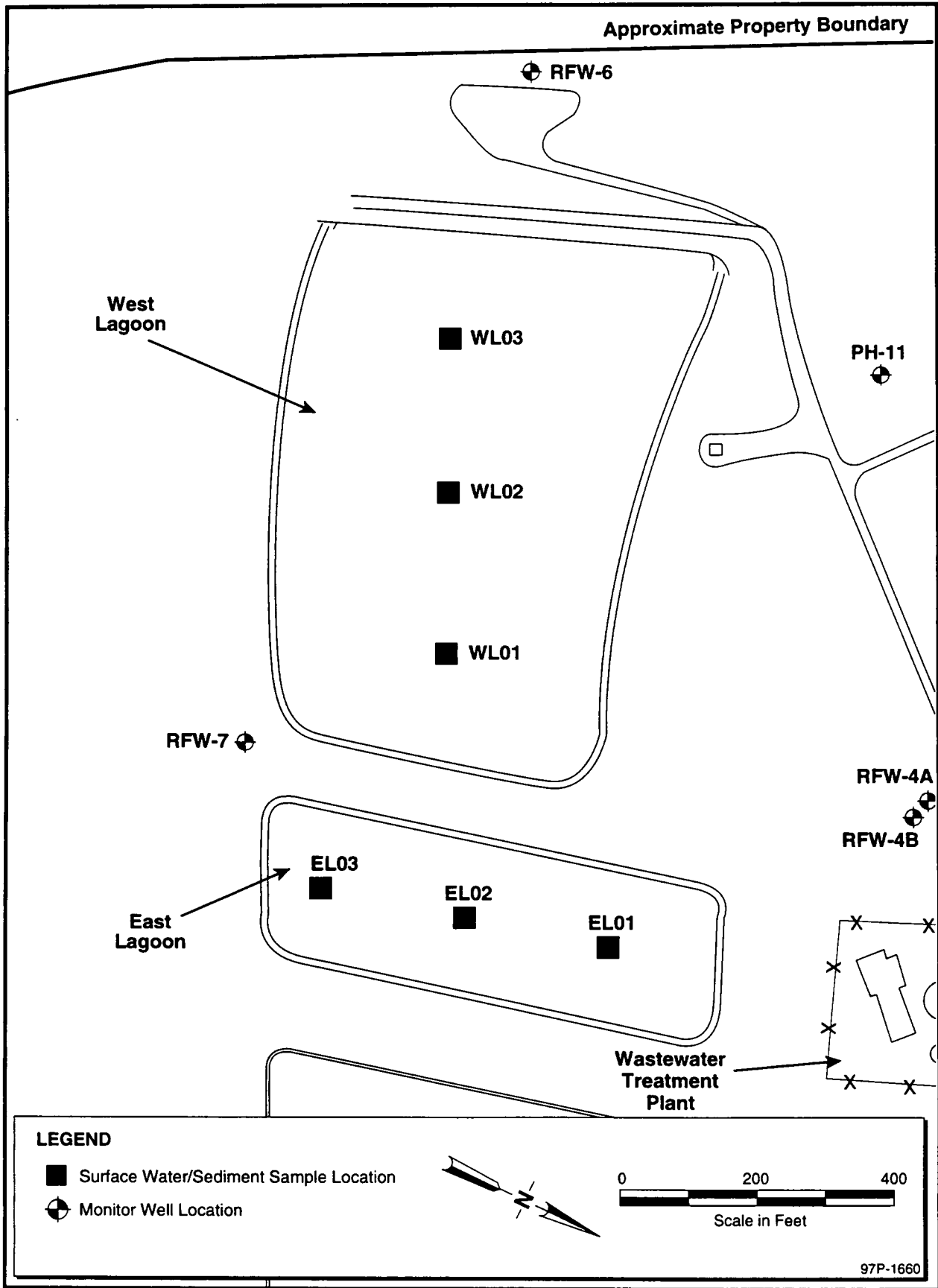


FIGURE 2-1 LAGOON SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
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summary of the lagoon samples is presented in Table 2-1. The sampling locations were evenly spaced within each lagoon and the approximate locations are presented on Figure 2-1. Samples were collected following procedures described in the Sampling and Analysis Plan (SAP) (WESTON, 1995) and are described in the following subsections.

2.2.1 Surface Water Sampling

Surface water samples were collected by use of a Kemmerer Sampler, permitting the collection of water samples from discrete depths in the water column. Samples were collected at depths of approximately two-thirds of the distance from the surface to the bottom of the lagoon. Each location was sampled for volatile organic compounds (VOCs). All sampling equipment was decontaminated between sampling locations following procedures described in the SAP.

2.2.2 Sediment Sampling

Sediment samples were collected using a Ponar dredge sampler. This sample device allows for the collection of discrete samples of sediment with minimal disturbance. Each sample was analyzed for VOCs. All sampling equipment was decontaminated between sampling locations following procedures described in the SAP.

2.3 BRUSH PILE INVESTIGATION

At the request of the MDE, as set forth in the Consent Order, on 5 August 1996, representatives from the MDE and WESTON met with Mr. Carol Leister at the 'brush pile' area along the western property boundary of the site. The brush pile is a location away from plant operations, adjacent to a wooded area, where deadfalls and vegetative debris from routine trimming of overgrowth has been stockpiled and allowed to decompose. Mr. Leister indicated several locations adjacent to the brush pile where he believed buried materials were located. These areas were marked and staked for the test pitting operations. On 8 August 1996, the

Table 2-1
Summary of Lagoon Surface Water and Sediment Samples
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Sample Location	Surface Water Sample ID	Sediment Sample ID	Sample Date	Analysis
				VOC
East Lagoon				
EL01	EL01-01-SW	EL01-01-SED	7-Aug-96	X
	EL01-02-SW	EL01-02-SED	20-Feb-97	X
EL02	EL02-01-SW	EL02-01-SED	7-Aug-96	X
	EL02-02-SW	EL02-02-SED	20-Feb-97	X
EL03	EL03-01-SW	EL03-01-SED	7-Aug-96	X
	EL03-02-SW	EL03-02-SED	20-Feb-97	X
West Lagoon				
WL01	WL01-01-SW	WL01-01-SED	7-Aug-96	X
	WL01-02-SW	WL01-02-SED	20-Feb-97	X
WL02	WL02-01-SW	WL02-01-SED	7-Aug-96	X
	WL02-02-SW	WL02-02-SED	20-Feb-97	X
WL03	WL03-01-SW	WL03-01-SED	7-Aug-96	X
	WL03-02-SW	WL03-02-SED	20-Feb-97	X

VOC - Volatile organic compounds

surficial brush pile material was removed and staged in the open field east of the brush pile area.

2.3.1 Geophysical Survey

On 13 August 1996, a geophysical investigation was conducted at the brush pile area using a combination of electromagnetic (EM) terrain conductivity and magnetometry (MAG) methods. The objective of the investigation was to locate and delineate (if present) the location of buried ferrous material, within the general area identified by Mr. Leister, to supplement the specific locations at which Mr. Leister believed disposal had been performed in the past.

Prior to the start of the survey, a 200- by 150-foot survey grid was established over the site to provide a means of surface control during data collection. The survey grid was established based on a relative coordinate system using existing monuments and land features. EM and MAG measurements were taken at least every 5 feet along grid lines spaced every 10 feet.

2.3.1.1 Electromagnetic (EM) Terrain Conductivity Methods

Description

The EM survey was conducted using a Geonics, Ltd. EM-31™ terrain conductivity meter. The EM-31 is battery-powered and operates at a frequency of 9.8 kilohertz (kHz). This system consists of a transmitting coil (primary field source), receiving coil (sensor), phase sensing circuits, and an amplifier. A fixed 3.7-meter intercoil spacing is standard for the EM-31. The instrument measures apparent conductivity in units of millisiemens per meter (mS/m) in materials with true conductivities ranging up to 1,000 mS/m.

The EM-31 was operated in both the quadrature and in-phase components. The quadrature component is sensitive to conductors with low induction numbers (i.e., low conductivity materials). Relative conductivity values associated with in-phase measurements have a greater

sensitivity to buried metal objects. Negative in-phase and quadrature conductivity values were observed at areas of the site. This phenomenon occurred as a result of the transmitting and receiving coils of the instrument straddling a metallic conductor (e.g., surface debris or buried metal). Once out of the influence of the metallic interference, the conductivity again returned to that of the normal soil (background).

Methodology

Prior to conducting the survey, the EM-31 was calibrated in accordance with the instrument operating manual. No anomalies were observed in the calibration data. When calibration was completed, both the quadrature and in-phase components were measured at the site. Conductivity measurements were obtained in the vertical dipole mode of operation for single layer mapping. The effective depth of exploration associated with this mode of operation is approximately 18 feet (McNeill, 1980).

The EM-31 was operated in a "continuous" mode along pre-established survey grid lines. Measurements were recorded continuously at 5-foot intervals as the operator traversed the line. These measurements were digitally recorded and stored in memory in an Omni Data Logger™. Random QA/QC readings were obtained from the EM-31 analog meter and manually recorded in the field notebook. The data in memory were downloaded from the data logger to a field computer. The computer-generated output files were formatted, then compared against the random QA/QC readings recorded in the field logbook. Based on the QA/QC review of the data, no deficiencies were observed in the digitally recorded data.

Conductivity contour plots were prepared from the field data using Geosoft™ contour plotting software. The contour plots were interpreted with regard to site soil characteristics, site-specific geology, and the suspected presence of buried waste materials. The results of the EM survey were used to direct test pit operations and are discussed in Section 3.

2.3.1.2 Magnetic (MAG) Methods

Description

The MAG survey was performed using a GEOMETRICS G-858 cesium vapor Gradiometer/Magnetometer. The instrument operates on the principle of a self oscillating split-beam cesium vapor (non radioactive CS133) source. This magnetometer generates a small signal whose frequency is proportional to the intensity of the total magnetic field. Local perturbation (induced magnetization) generated by anthropogenic (i.e., buried ferrous debris) and natural (i.e., magnetic mineral deposits) features add to the intensity of the ambient magnetic field. The magnetometer measures the vector sum of the earth's magnetic field and the anomalous induced magnetic field in standard nanoTesla (nT) units.

The G-858 Magnetometer/Gradiometer system is comprised of a console with an LCD screen connected to a cesium sensor mounted on a counterbalanced staff. The console displays the magnetic field and horizontal position data, stores high volumes of data in memory; and transmits the data at high speed to a processing computer for detailed analysis. The G-858 allows for data acquisition at either continuous or discrete station recording. The continuous mode was utilized for this survey and provides both a rapid sampling rate and high data quality.

Methodology

Consistent with the EM-31 survey, the magnetometer was operated in a "continuous" mode along the same pre-established survey grid lines. In the continuous mode, MAG measurements were recorded on approximately 2-foot spacing intervals as the operator traversed the line. Both the total field and magnetic gradient were measured at each station point throughout the survey area. MAG measurements were digitally recorded and stored in memory in the instrument's data logger.

The data in memory were downloaded from both data loggers to a field computer. Diurnal effects were considered negligible relative to the overall range of magnetic data and short time duration of the survey. Therefore, a base station magnetometer was not needed to monitor variations in the Earth's magnetic field.

Contour plots of both the total magnetic field and magnetic gradient were prepared from the field data using Geosoft™ contour plotting software. Each magnetic anomaly (high gradient area) was analyzed with respect to cultural features present on the surface, and the potential ferrous magnetic sources buried in the subsurface. The expected configuration of a magnetic anomaly associated with a buried ferrous magnetic sources or other dipole sources is a magnetic 'high' and 'low' pair with almost concentric contours. Strong anomalies of this type were identified on the magnetic contour plots and are discussed in Section 3.

2.3.2 Test Pit Excavations

On 14 August 1996, eight test pits were excavated at the brush pile area. Test pit excavations were performed using a backhoe and were excavated to either the water table, to refusal, or to the maximum reach of the backhoe, whichever was encountered first. An OVM photoionization meter was used for air monitoring and a combustible gas meter was used to monitor gas emissions from the test pits. A summary of the soil and groundwater samples collected from the test pit excavations is presented in Table 2-2. The backhoe deposited the material to be sampled on plastic sheeting, and samples were collected using decontaminated stainless steel trowels and/or scoopulas. Complete logs, including visual descriptions of lithology, observations of groundwater occurrence, and instrument readings, were completed and are included in Appendix A. In addition, photographs were taken of each test pit during excavation and/or upon completion and are included in Appendix B.

Test pit locations are presented in Figure 2-2. Test pits TP-1 and TP-2 were excavated at locations based on Mr. Leister's observations. Test pits TP-6, TP-7, and TP-8 were located in the center of the brush pile area based on the anomalies observed during the geophysical

Table 2-2
Summary of Test Pit Soil and Groundwater Samples
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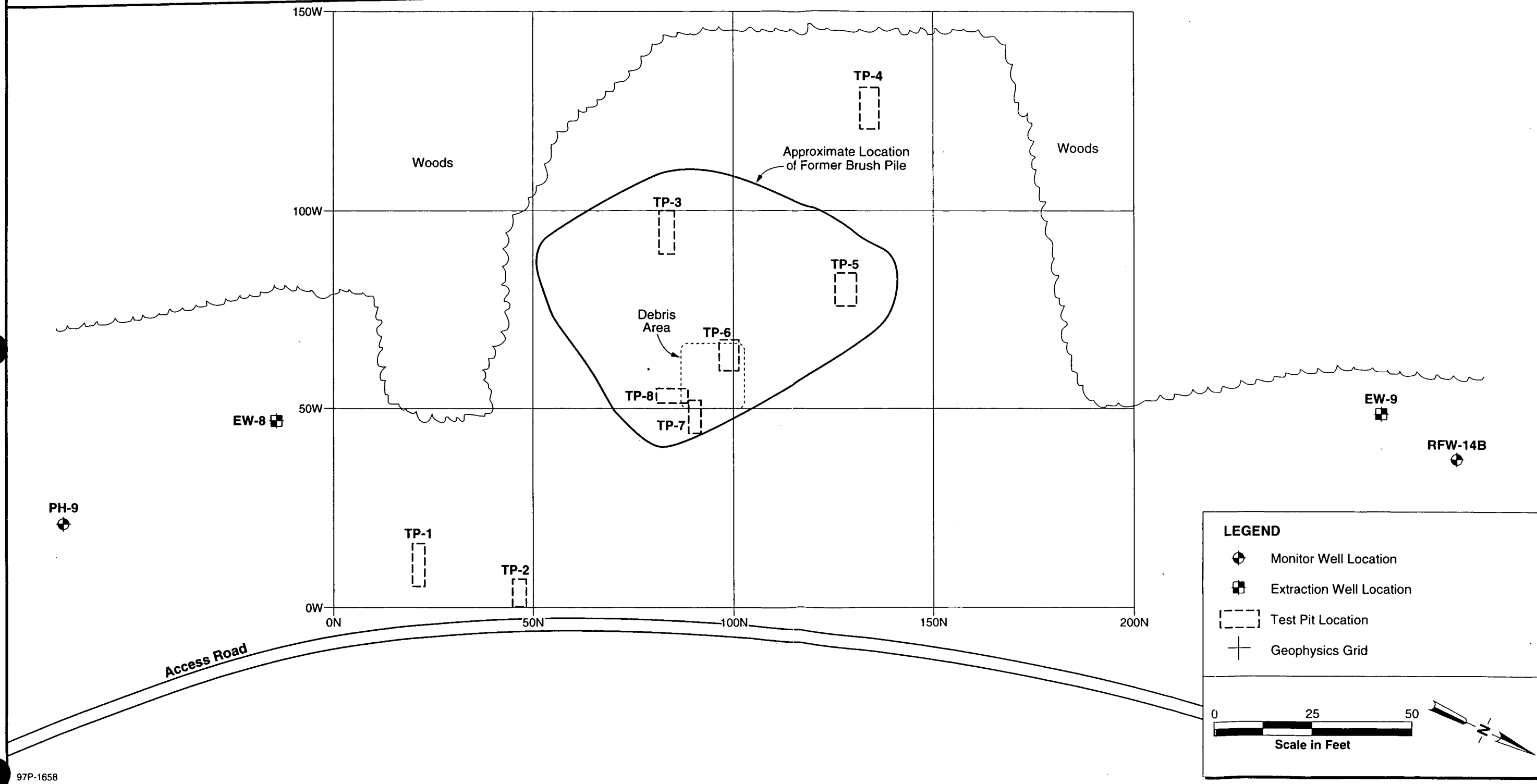
Test Pit ID	Soil Sample ID	Groundwater Sample ID	Sample Date	Analysis
				VOC
TP-1	NS	NS	--	--
TP-2	TP-96-2	NS	14-Aug-96	X
TP-3	TP-96-3	NS	14-Aug-96	X
TP-4	TP-96-4	NS	14-Aug-96	X
TP-5	TP-96-5	NS	14-Aug-96	X
TP-6	TP-96-6	TP-96-6	14-Aug-96	X
TP-7	TP-96-7	NS	14-Aug-96	X
TP-8	NS	NS	--	--

NS - Not Sampled

ft bgs - feet below ground surface

VOC - Volatile organic compounds

Approximate Property Boundary



97P-1658

FIGURE 2-2 TEST PIT LOCATIONS
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investigation. Test pits TP-3, TP-4, and TP-5 were located throughout the remainder of brush pile area to provide complete geographic coverage of the area.

SECTION 3

RESULTS OF INVESTIGATIVE ACTIVITIES

3.1 FRACTURE TRACE ANALYSIS

Identified fracture traces were transferred to a topographic map of the site and surrounding area and are presented on Figure 3-1. Figure 3-2 presents the azimuths of the fracture traces plotted on a rose diagram to assess the preferred orientations for fracture traces. The azimuths of the traces were measured and tallied for each 20° arc of the compass. The total number of traces for each arc is represented by the distance the shading extends from the center of the circle. As seen in Figure 3-2, the primary set (most number of traces) trends N20°W to N20°E. The other sets of traces trend N80°E to S80°E, N40°E to N60°E, and N40°W to N60°W.

Meyer (1958) reports that for Carroll County, Maryland, the principal strike of the schistosity ranges from N36°E to N46°E. The N40°E to N60°E set of traces in the site area probably represents the strike of the schistosity. The N40°W to N60°W set of traces which is 90° from the N40°E to N60°E set of traces probably represent the dip of the schistosity. The other two sets, N20°W to N20°E and N80°E to S80°E, are approximately 90° from each other.

Field checking of the identified fracture traces was performed during August 1996 and involved determining if the photolineations mapped from the aerial photographs were actually cultural features (e.g., pipelines or plow lines) or natural features (e.g., stream alignments or shallow depressions) by attempting to locate and walk the features tentatively identified as fracture traces. Field checking also included observing whether there are other surface expressions of the fracture traces, such as slight depressions, swales or vegetation changes. The fracture traces located in the site area that were confirmed by the field checking are presented on Figure 3-3.