Environmental Restoration Program

OPERABLE UNIT 5
NEW PROPERTY PHASE I
FIELD REPORT

MOUND PLANT
MIAMISBURG, OHIO

VOLUME I - TEXT

July 1995

Final (Revision 1)

U.S. Department of Energy
Ohio Field Office

EG&G Mound Applied Technologies

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VOLUME II

ACRONYMS

AOC	Area of Concern
BOA	Basic Ordering Agreement
BVA	Buried Valley Aquifer
CC	Contamination Criteria
CLP	Contract Laboratory Program
DCB	dichlorobenzene
DOE	U.S. Department of Energy
ER	Environmental Restoration
FIDLER	Field Instrument for the Detection of Low-Energy Radiation
Freon-11	trichloroflouromethane
Freon-113	trichlorotriflouroethane
FSP	Field Sampling Plan
MCA	Multi-Channel Analyzer
MDA	Minimum Detectable Activity
MDL	Minimum Detection Limit
mg/kg	milligrams per kilogram
MSL	Mean Sea Level
NERI	Northeast Research Institute
OU	Operable Unit
PCB	Polychlorinated Biphenyl
PCE	tetrachloroethene
pCi/g	picocuries per gram
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QAPjP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RSI	Regional Soil Investigation
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
TCA	trichloroethane
TCE	trichloroethene
TIC	Tentatively Identified Compound
µg/kg	micrograms per kilogram
UNC	Uncertainty Value
VOC	Volatile Organic Compound

ACKNOWLEDGEMENTS

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1. INTRODUCTION

The New Property Phase 1 Field Report is the first in a series of reports that support the U.S. Department of Energy (DOE) and Mound strategy to release the majority of the New Property for non-DOE use, and/or release of DOE ownership, on an expedited basis.

The following sections briefly describe the scope of the New Property Phase 1 Field Report (denoted "Field Report"), provide a site description, and review the site land use history. The closing section presents the organization of the remainder of the report.

1.1. SCOPE

The Field Report presents the results of field work performed and data collected at the New Property in February and March, 1994. This work was performed in accordance with the Operable Unit 5 (OU5) South Property Remedial Investigation/Feasibility Study (RI/FS) Work Plan (DOE 1993a). The Field Report provides a narrative highlighting significant results with available data from previous studies summarized and integrated as appropriate.

1.2. SITE DESCRIPTION

The New Property is located immediately south of the OU5 Operations Area (see Figure 1.1). Its borders are 1/4 mile west of Mound Road and less than 1/4 mile east of Cincinnati-Dayton Pike with Benner Road to the south. The Spoils Disposal Area, located in the northwest corner of this area, is excluded from the New Property.

The New Property is topographically characterized by relatively steep hillsides in the north and east (maximum surface elevation 880 feet mean sea level (MSL)) and flat lying lowlands in the southwest corner of the property (minimum surface elevation 710 feet MSL). The topographic highs are composed of discontinuous bedrock exposures of thinly interbedded Ordovician limestones and shales. The resistant limestones usually form ledges that can be traced for tens of feet while the shale intervals are float-covered slope formers. Thin veneers of unconsolidated Quaternary till and outwash deposits range in thickness from zero feet at bedrock exposures to greater than 195 feet on the western edge of the New Property.

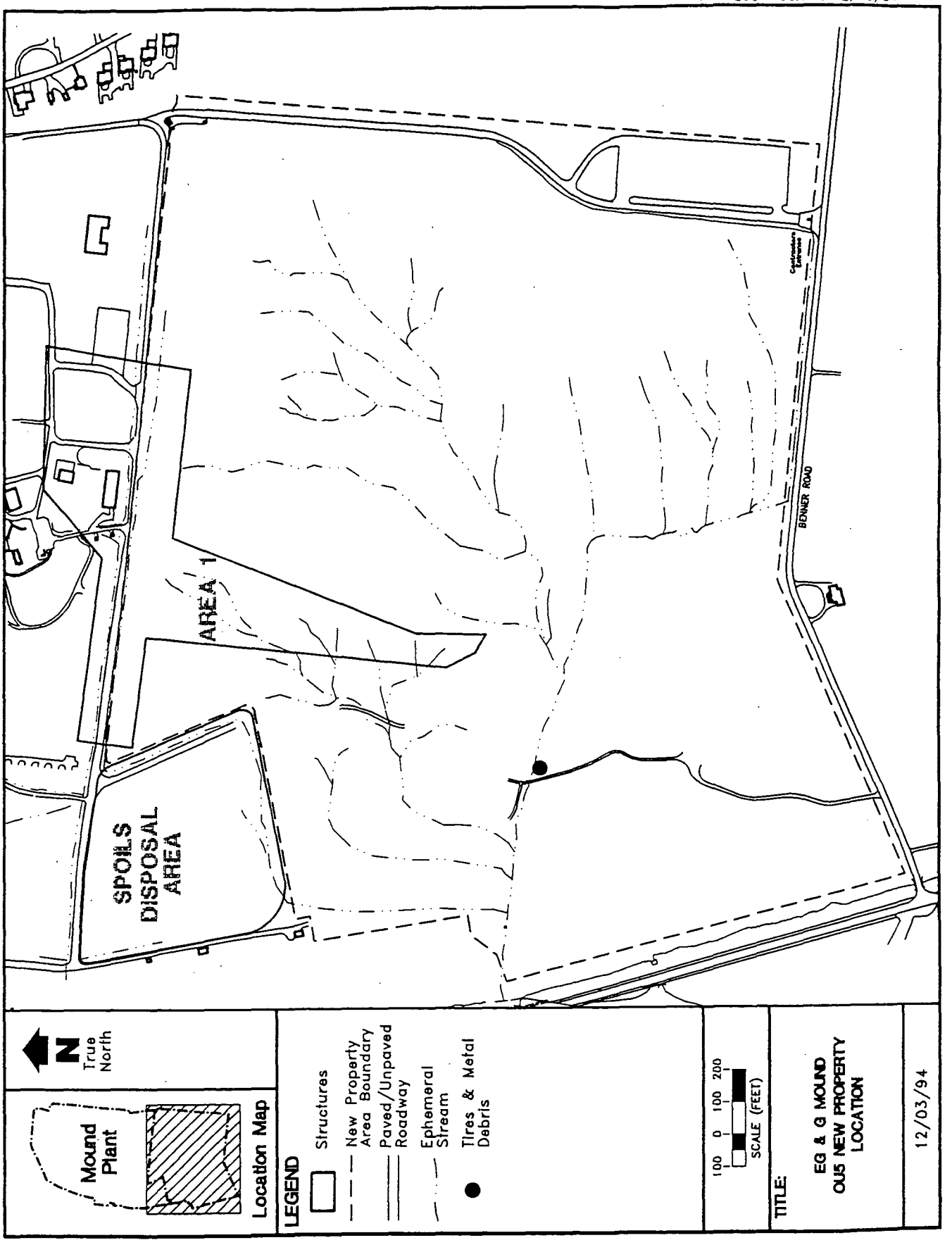

Figure 1.1. OU5 New Property Location

A portion of the Buried Valley Aquifer (BVA) underlies the western edge of the New Property. The topography in this area may allow local ponding of water and sediment. Most of the runoff from the New Property collects in the ephemeral stream that discharges off-plant to the southwest. There are 15 identified seeps in the east central area of the property which serve as discharge points. The degree of interconnection between the bedrock flow system and the BVA has not been determined.

The land, which was historically used for farming, is undeveloped and lies fallow. Vegetation consists of grasses, small trees, and brush. The New Property is accessible by the Mound contractor's entrance road along the eastern boundary of the property and by an undeveloped dirt road in the southwest portion of the property. Surface features include a contractors' parking lot, paved access road to the Mound Plant, above-ground electrical transmission lines, and a small area (approximately 20' x 20') containing some tires and metal debris. This debris was found near the north end of the undeveloped dirt road on its east side, immediately southeast of an ephemeral stream (see Figure 1.1).

1.3. SITE HISTORY

The New Property was purchased by the U.S. Government on August 26, 1981 from previous owners. A portion of the New Property, approximately 80 acres, was purchased from the Penrod estate. The estate property contained a two-story brick house, a barn, a frame tool shed, a costume shop, and an outhouse. At the time of purchase, the Penrod estate was given the option to remove any of the structures from the property; only the costume shop was removed. The other structures became the property of the U.S. Government, and were subsequently either moved or razed.

Aerial photos dated 1938, 1949, 1968, and 1980 indicate that the property was historically used for farming, and, except for the Spoils Disposal Area (Figure 1.1), showed no signs of construction or excavation activities. A preliminary search of Mound Environmental Restoration (ER) program documents indicated that historical and cultural studies have been completed and approved by the Ohio Historical Society, Ohio Historic Preservation Office. Other studies performed to date include assessments of wetlands, threatened and endangered species, biological resources, mineral resources, and demographics.

1.4. REPORT ORGANIZATION

The remainder of this report presents the results of the New Property Phase 1 investigation. Section 2 provides a summary of the historical data from past sampling activities. Section 3 presents field activities and pertinent data from the Phase 1 field program, including the Mound Soil Screening Facility data, radiological soil survey using a field instrument for the detection of low-energy radiation (FIDLER, also known as a multi-channel analyzer [MCA]), soil gas survey, and seep survey. Section 4 summarizes the data by correlating the Phase 1 results with historical data. The references are presented in Section 5, with laboratory data, field log books, the final soil gas survey report, and the site land surveyor's report documented in the appendices.

2. SUMMARY OF HISTORICAL DATA

Previous investigations in the OU5 New Property were designed to (1) assess the impacts of contamination released to soils by the site's previous owners or (2) assess the extent of migration of hazardous and radioactive materials off the Operations Area and onto the New Property, if any. Because the New Property (except for the Spoils Disposal Area) has never been used by Mound for waste disposal, previous studies were reconnaissance surveys that emphasized the measurement of a broad array of indicators of radioactivity or organic chemicals in surface and subsurface soils.

Prior to 1994, surveys and sampling activities conducted as part of the Site Survey Project (Stought et al. 1988) included FIDLER surveys, soil screenings, and surface and subsurface soil sampling. Additional soil sampling, reported in the OU3 Limited Field Investigations Report (DOE 1992a), was completed for organic and inorganic compounds. Also, sampling was conducted from seep 609 (Criswell, 1994 personal communication) and lithologic logs were produced in conjunction with ER Program monitoring well installation. Soil gas surveys were not included in these investigations.

The remainder of this section summarizes the published results of the field activities preceding the 1994 field program.

2.1. FIDLER SURVEYS

FIDLER surveys were performed in 1983 in conjunction with soil sampling as part of the Site Survey Project (Stought et al. 1988). A FIDLER was used to screen areas for plutonium contamination in soils. Volume 3 of the OU9 Site Scoping Report (DOE 1992b) states that 4000 FIDLER readings were taken in the New Property during this investigation; however, the report does not present the coordinates of the points surveyed or the results collected.

2.2. SOIL SAMPLING

Surface and subsurface soils were sampled in 1983 and 1984 during the Site Survey Project (Stought et al. 1988). In the New Property, twenty-eight core locations (drilled to a maximum depth of 25 feet) and 24 surface soil sample locations (sampled to a depth of four inches) were analyzed for plutonium-238 and isotopic thorium. Selected samples were also analyzed for tritium, cobalt-60, cesium-137, radium-226,

and americium-241. In Area 1, four core locations and 73 surface soil samples were analyzed for these constituents. Volume 3 of the OU9 Site Scoping Report (DOE 1992b) states that 100 surface soil samples and cores from 200 locations were collected in the New Property. Core (C) and surface soil (S) sampling locations are shown on Figure 2.1.

To identify locations with plutonium-238 in excess of 25 pCi/g and thorium greater than 2 pCi/g (Mound's detection levels), the soil samples were pulverized and screened then analyzed using a Bicron FIDLER at the Soil Screening Facility. Because of the high uncertainty (+/- 75 percent) associated with FIDLER screening, all soils sampled during the Site Survey Project were radiochemically analyzed for plutonium-238. Samples with total thorium in excess of 2.0 pCi/g were radiochemically analyzed for thorium. Table II.1 presents the analytical data for the New Property exclusive of Area 1. Table II.2 presents the analytical data for the New Property within Area 1 (Area 1 is actually part of the Operable Unit 6 D&D Program Areas; however, due to its location as part of the New Property, the analytical results are being reported within this document).

In the New Property (exclusive of Area 1), the results of soil testing during the Site Survey Project indicate levels of plutonium no higher than 3.88 pCi/g (S1048). As reported in Appendix E of the OU9 Site Scoping Report (Volume 3), total thorium results in all cases were recorded as less than or equal to 2 pCi/g. In Area 1, plutonium and thorium were detected in amounts above the Soil Screening Facility's detection level at eight locations (see Table II.2).

Additional soil sampling in the New Property took place at three locations in 1992. These samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and inorganic compounds, but not for radiological constituents. One of these sampling locations (MND 33-0102) produced results above detection limits for metals. The analytical results for this sampling location are presented in the OU3 Limited Field Investigations Report (DOE 1992a).

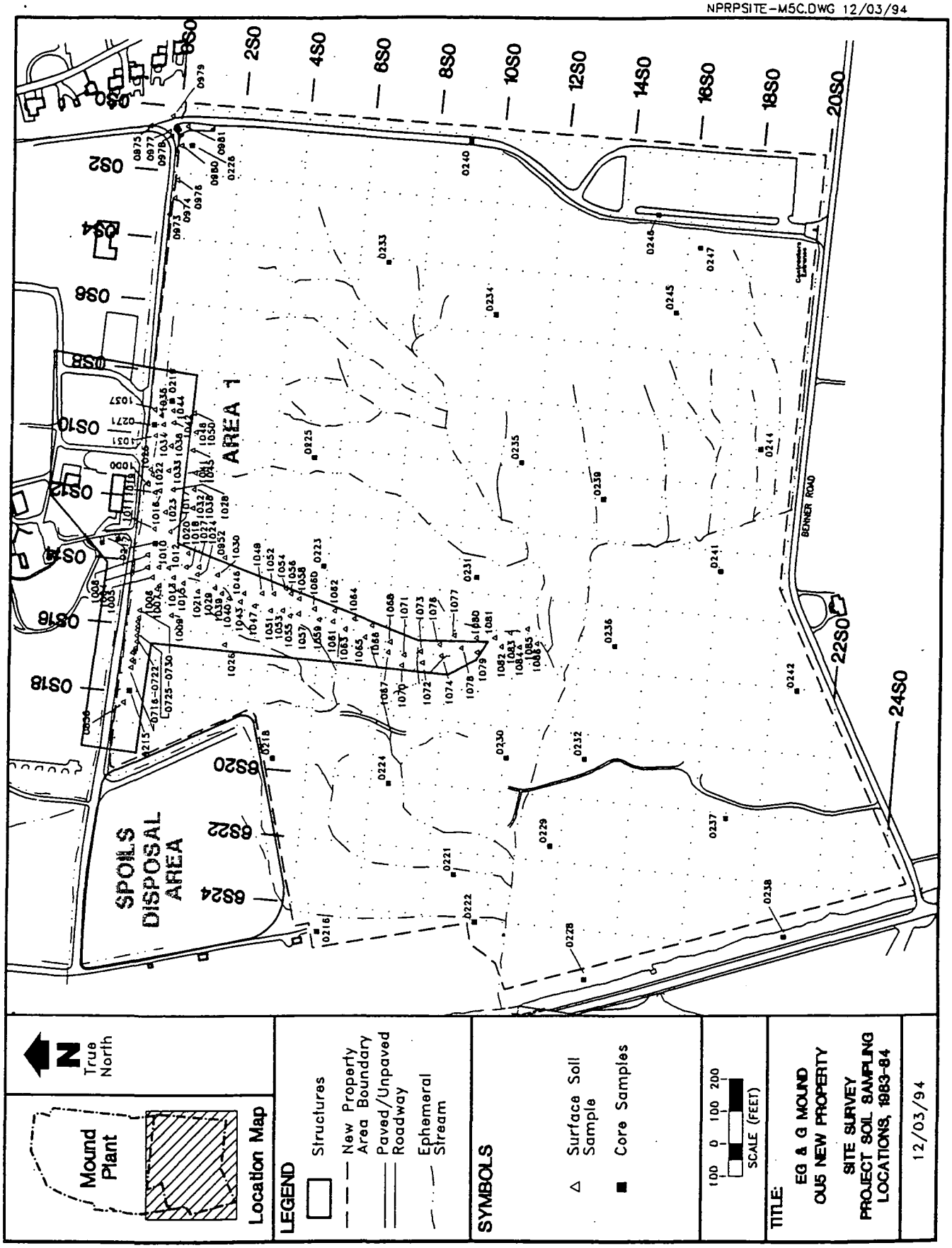

Figure 2.1. Site Survey Project Soil Sampling Locations, 1983-84

Table II.1. Mound Site Survey Project - Analytical Results, OU5 New Property, 1983-84
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Map Location[a]	Mound Plant Coordinates South	Mound Plant Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
C0193	3300	4900	7752	09-84	90	0.89	b					
			7753	09-84	180	0.29	b					
S0952	3925	3870	5951	07-84	0	0.05	b					
S0973	4225	2855	2622	09-83	0	0.02	b					
S0974	4250	2830	5969	07-84	0	0.59	b					
S0975	4275	2580	5964	07-84	0	0.75	b		LDL	LDL	1.1	LDL
S0976	4275	2780	5968	07-84	0	0.30	b					
S0977	4325	2630	5966	07-84	0	0.77	b					
S0978	4325	2635	5967	07-84	0	0.43	b					
S0979	4350	2580	2620	09-83	0	0.40	b					
S0980	4350	2680	5965	07-84	0	1.02	b					
S0981	*4375*	*2630*	*2621*	09-83	0	0.44[c]	b					
C0213	3260	4860	2660	09-83	30	0.18	b					
			2661	09-83	60	0.93[c]	b					
			2662	09-83	240	0.16	b					
C0214	3500	4550	2714	09-83	30	0.01	b					
			2715	09-83	60	0.01[c]	b					
			2716	09-83	180	0.01	b					
C0216	3740	5050	2663	09-83	30	0.24	b					
			2664	09-83	60	0.49	b					
			2665	09-83	240	0.72	b					

Table II.1. Mound Site Survey Project - Analytical Results, OU5 New Property, 1983-84
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Map	Mound Plant Coordinates		MRC ID	Mo-Yr	Depth	Pu-238	Thorium[b]	Tritium	Co-60	Cs-137	Ra-226	Am-241
Location[a]	South	West	No.		(inch)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
C0218	3840	4450	2717	09-83	30	0.02	b		LDL	LDL	1.5	LDL
			2718	09-83	60	0.02	b					
			2719	09-83	180	0.01	b					
S1032	3875	3720	9230	05-85	0	0.28	b					
S1036	3895	3690	9228	05-85	0	0.21	b					
S1041	3920	3640	9226	05-85	0	0.58	b					
S1045	3940	3600	9224	05-85	0	0.23	b					
S1048	3970	3550	9222	05-85	0	3.88	b					
S1050	3990	3510	9220	05-85	0	1.32	b					
C0221	4190	5000	2666	09-83	30	0.33	b					
			2667	09-83	60	0.62	b					
			2668	09-83	240	0.08	b					
C0222	4190	5230	2672	09-83	30	0.09	b					
C0223	4260	4140	2656	09-83	60	0.02	b					
			2657	09-83	90	0.01	b					
C0224	4270	4600	2720	09-83	30	0.03	b					
			2721	09-83	50	0.01	b					
			2722	09-83	180	0.01	b					
C0225	4360	3850	2705	09-83	30	0.02	b					
			2706	09-83	60	0.06	b					
			2707	09-83	180	0.01	b					
C0226	4370	2690	2692	09-83	30	0.07[c]	b					
			2693	09-83	60	0.44	b					
			2694	09-83	84	0.05	b					

Table II.1. Mound Site Survey Project - Analytical Results, OU5 New Property, 1983-84
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Map Location[a]	Mound Plant Coordinates South	Mound Plant Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Pu-238 (pCi/g)	Thorium[b] (pCi/g)	Tritium (pCi/g)	Co-60 (pCi/g)	Cs-137 (pCi/g)	Ra-226 (pCi/g)	Am-241 (pCi/g)
C0228	4480	5530	2732	09-83	30	0.01	b					
			2733	09-83	60	0.01	b					
			2734	09-83	180	0.01[c]	b					
C0229	4500	5200	2729	09-83	30	0.01	b					
			2730	09-83	60	0.01	b					
			2731	09-83	240	0.01	b					
S1077	4540	4430	10573	08-85	0	1.16	b					
S1080	4590	4460	10574	08-85	0	0.08	b					
C0230	4600	4650	2723	09-83	30	0.01	b					
			2724	09-83	60	0.01	b					
			2725	09-83	180	0.01	b					
C0231	4630	4350	2762	09-83	30	0.04	b					
			2763	09-83	60	0.04	b					
			2764	09-83	240	0.01	b					
S1081	4640	4480	10575	08-85	0	0.20	b					
S1082	4640	4520	10550	08-85	0	0.20	b					
S1083	4700	4500	10576	08-85	0	0.28	b					
S1084	4700	4540	10551	08-85	0	0.10	b					
C0232	4720	4930	2726	09-83	30	0.07[c]	b					
			2727	09-83	60	0.03	b		LDL	LDL	0.9	LDL
			2728	09-83	240	0.01	b					
S1085	4750	4530	10577	08-85	0	0.13	b					

Table II.1. Mound Site Survey Project - Analytical Results, OU5 New Property, 1983-84
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Map	Mound Plant Coordinates		MRC ID	Mo-Yr	Depth	Pu-238	Thorium[b]	Tritium	Co-60	Cs-137	Ra-226	Am-241
Location[a]	South	West	No.		(inch)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
C0233	4760	3230	2695	09-83	30	0.20	b					
			2696	09-83	60	0.06	b					
			2697	09-83	120	0.03	b					
S1086	4760	4550	10552	08-85	0	0.18	b					
C0234	4960	3550	2750	09-83	30	0.04	b					
			2751	09-83	60	0.01	b					
			2752	09-83	120	0.01[c]	b					
C0235	4960	3880	2756	09-83	30	0.04	b					
			2757	09-83	60	0.01	b					
			2758	09-83	180	0.01	b		LDL	LDL	0.9	LDL
C0236	4980	4620	2711	09-83	30	0.01	b					
			2712	09-83	60	0.12[c]	b					
			2713	09-83	240	0.01	b					
C0237	5040	5270	2669	09-83	30	0.03	b					
			2670	09-83	60	0.02	b					
			2671	09-83	240	0.06	b					
C0238	5040	5680	2735	09-83	30	0.01	b					
			2736	09-83	60	0.01	b					
			2737	09-83	300	0.01	b					
C0239	5050	4230	2765	09-83	30	0.01	b					
			2766	09-83	60	0.01	b					
			2767	09-83	168	0.01	b					

Table II.1. Mound Site Survey Project - Analytical Results, OU5 New Property, 1983-84
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Map	Mound Plant Coordinates		MRC ID	Mo-Yr	Depth	Pu-238	Thorium[b]	Tritium	Co-60	Cs-137	Ra-226	Am-241
Location[a]	South	West	No.		(inch)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)	(pCi/g)
C0240	5100	3000	2501	09-83	18	0.02[c]	b					
			2502	09-83	36	0.01	b					
			2503	09-83	54	0.01	b					
			2504	09-83	72	0.01	b					
			2505	09-83	90	0.01	b					
			2505	09-83	108	0.01	b					
			2506	09-83	126	0.01	b					
C0244	5500	4325	2637	09-83	30	0.04	b		LDL	0.5	2.8	LDL
			2638	09-83	60	0.04	b					
			2639	09-83	180	0.01	b					
C0245	5520	3830	2759	09-83	30	0.03	b					
			2760	09-83	60	0.02	b		LDL	LDL	0.9	LDL
			2761	09-83	210	0.01	b		LDL	LDL	1	LDL
C0246	5600	3480	2753	09-83	30	0.01	b					
			2754	09-83	42	0.01	b					
			2755	09-83	60	0.03	b					
C0247	5650	3680	2768	09-83	30	0.01	b					
			2769	09-83	96	0.01	b					
			2770	09-83	162	0.01	b					

[a]C denotes core location and S denotes surface sample location.
[b]Thorium results of $\leq$ 2 pCi/g are listed as "b".
[c]Verification sample analyzed for QA/QC.
LDL - The measured concentration was below the lower detection limit, estimated to be 0.5 pCi/g for cobalt-60, cesium-137, and americium-241; 1.0 pCi/g for radium-226; and 0.10 pCi/g for Pu-238
Mo-Yr - month and year
MRC ID - Monsanto Research Corporation identificaiton
None - No MRC ID was assigned because *in situ* gamma spectroscopy for thorium-232 was performed.
pCi/g - picocuries per gram

Table II.2. Mound Site Survey Project Analytical Results - Area 1, 1983-84

Plate 1 Location[a]	Coordinates South	Coordinates West	MRC ID No.	Mo-Yr	Depth (inch)	Plutonium-238 (pCi/g)	Thorium (pCi/g)
SO722	3570	4000	10461	08-85	0	28.30	10.20
SO725	3575	3990	10460	08-85	0	119.00	8.50
SO726	3580	3980	10459	08-85	0	163.00	32.60
SO727	3583	3975	10458	08-85	0	36.80	6.10
SO728	3585	3970	10457	08-85	0	116.00	20.40
S1011	3760	3710	9136	05-85	0	56.20	8.79
S1043	3930	4030	10534	08-85	0	52.30	95.80
S1049	3980	4060	10560	08-85	0	36.90	5.60

Mo-Yr - month and year
MRC ID - Monsanto Research Corporation identificaiton
None - No MRC ID was assigned because *in situ* gamma spectroscopy for thorium-232 was performed.
pCi/g - picocuries per gram

2.3. SEEP SAMPLING

The seep designated 609 in previous documents and shown in Figure 2.2 was sampled in 1987 and 1988 for indicator species (Criswell, 1994 personal communication). Results at or above laboratory instrument detection limits are reported in Table II.3. No organic or radiological constituents were detected in the sampling of this seep in 1988.

2.4. OTHER DATA

Six groundwater monitoring wells have been installed in the New Property in 1983 (see Figure 2.3). All wells were located, installed, and developed in accordance with the DOE work plans and ER Program Standard Operating Procedures (SOPs). These wells are part of the groundwater monitoring network established for several ER Program remedial investigations. Boring logs for the monitoring wells located in the New Property are presented in Appendix A of this report. Additional groundwater data for New Property wells installed in 1994 will be forthcoming in the New Property Extended Phase Report.

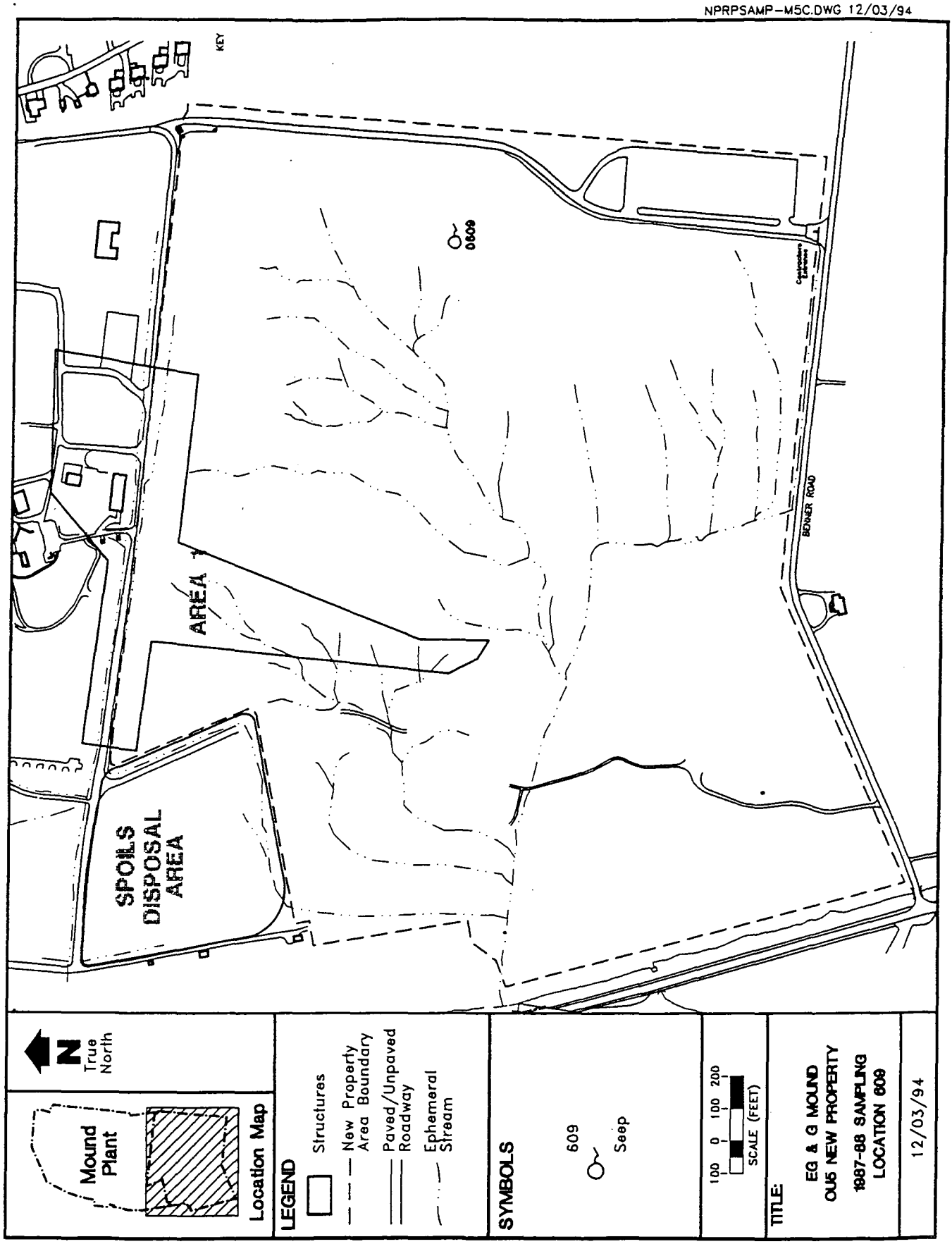

Figure 2.2. Seep Sampling Location 0609

Table II.3. Analytical Results for Seep 0609

Parameter Name	Log Date	Sample ID	Units of Measure	Parameter Value	Detection Limit
Alkalinity	02/26/87 03/04/88	0001 0001	MG/L MG/L	342. 161.	- -
Calcium, Total	02/26/87 03/04/88	0001 0001	UG/L UG/L	41000. 80400.	10000. 5000.
Chloride	02/26/87 03/04/88	0001 0001	MG/L MG/L	47. 26.9	- 5.0
Deuterium	02/26/87 06/24/87	0002 0001	D/Units D/Units	-49. -58.	- -
Fluoride	02/26/87 03/04/88	0001 0001	MG/L MG/L	.150 .018	- .10
Magnesium, Total	02/26/87 03/04/88	0001 0001	UG/L UG/L	28200. 9150.	500. 5000.
Nitrate	03/04/88	0001	MG/L	2.8	.10
Nitrate/Nitrite	02/26/87 03/04/88	0001 0001	MG/L MG/L	.243 2.8	- .10
Oxygen-18	02/26/87 06/24/87	0002 0001	D/Units D/Units	-6.9 -7.6	- -
pH	02/26/87 03/04/88	0001 0001	SU SU	7.09 7.01	- -
Potassium, Total	02/26/87	0001	UG/L	1100.	250.
Silicon, Total	02/26/87	0001	UG/L	3560.	100.
Sodium, Total	02/26/87 03/04/88	0001 0001	UG/L UG/L	600. 5210.	500. 5000.
Specific Conductance	02/26/87 03/04/88	0001 0001	UMHOS/CM UMHOS/CM	493. 22.5	- -
Sulfate	02/26/87	0001	MG/L	77.4	-
Temperature	02/26/87 03/04/88	0001 0001	DEG C DEG C	6.8 4.5	- -
Total Phosphate	02/26/87	0001	MG/L	.037	-
Zinc, Total	02/26/87	0001	UG/L	30.	20.

MG/L - Milligrams per liter
UG/L - Micrograms per liter
DEG C - degress Celsius
D/units - delta units
SU - Standard units
UMHOS/CM - Micro mhos per sq. centimeter
"-" - indicates information was not available

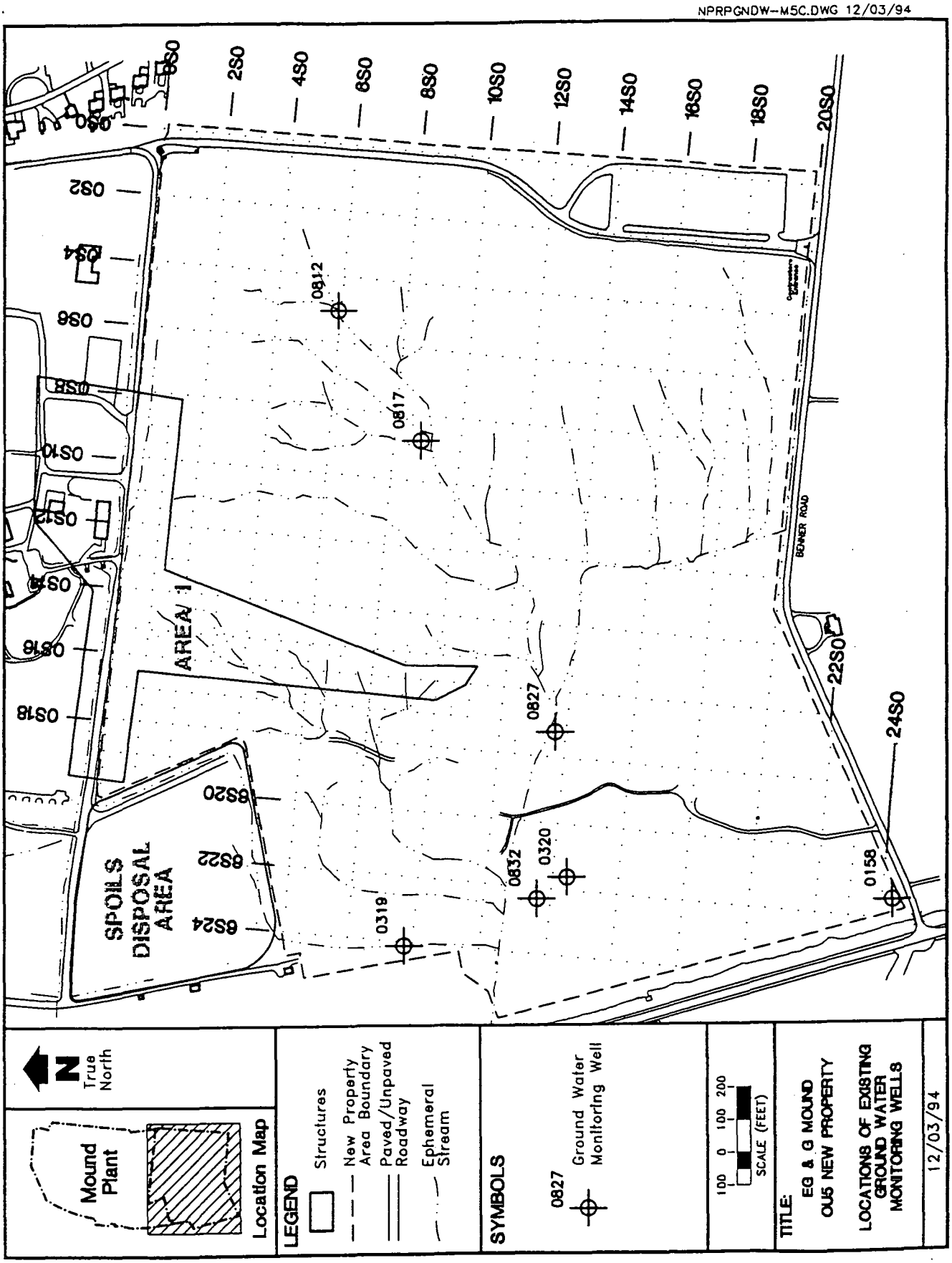

Figure 2.3. Locations of Existing Groundwater Monitoring Wells

3. FIELD ACTIVITIES AND DATA SUMMARY

The purpose of the Phase 1 reconnaissance investigation was to identify areas in which more focused investigations may be warranted. Phase 1 activities in the New Property consisted of soil gas sampling, a FIDLER survey, radiological analysis of soil samples for plutonium-238 and thorium-232 by the Mound Soil Screening Facility, and seep sampling for hazardous and radiological constituents. Under a separate task, six surface soil samples were collected and analyzed, the results of which are included in this report. Additional RI quality data will be included in the forthcoming Extended Phase Field Report.

Data collection points for the soil gas survey, Soil Screening Facility samples, and FIDLER survey were established on a single rectangular grid system. Because the New Property is a large area and widespread contamination is considered unlikely, a 200 x 200 foot grid was established for reconnaissance purposes (DOE 1993a). The grid spacing was reduced to 100 x 100 feet for collecting Soil Screening Facility samples within and around Area 1. The grid is fixed to a standard coordinate system established by a licensed land surveyor, as presented in Appendix F.

The following sections describe the field activities and analyses performed, and the results of the Phase 1 investigation.

3.1. SOIL GAS SURVEY

3.1.1. Field Work Performed and Procedures

A soil gas survey was performed over the New Property from February 21, 1994 through March 8, 1994 per the OU5 Quality Assurance Project Plan (QAPjP), Attachment 1, *SOP for Petrex Environmental Surveys* (DOE 1993b). The survey was completed over the grid system established for the New Property, which is shown in Figure 3.1. Field activities were documented in the Soil Gas log book (see Appendix B.2).

On the first day of the soil gas survey, a senior consultant from Northeast Research Institute (NERI) was onsite to administer training and assist in the survey. Five soil gas time sampler sets were placed on the first day with a total of 141 soil gas samplers placed during the next three days. Sample locations were monitored using a FIDLER and soil samples collected from each location for analysis at the Mound Soil

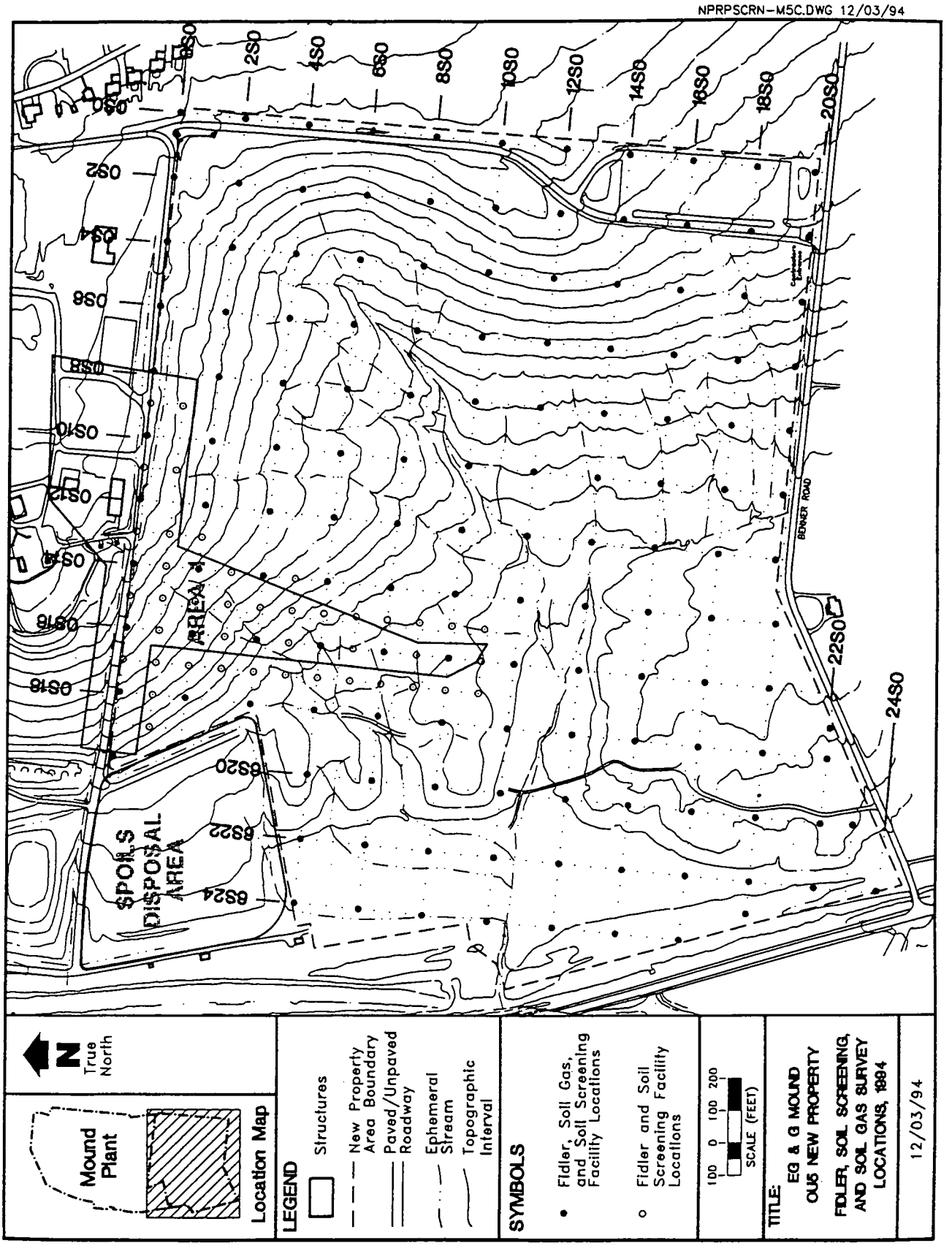

Figure 3.1. FIDLER, Soil Screening, and Soil Gas Survey Locations, 1994

Screening Facility. The locations of the samplers are shown in Appendix C, Plate 1. Results of the soil screening analyses are summarized in Section 3.2.1 and presented in their entirety in Appendix D.

On February 28, 1994, one unit from each set of soil gas time calibration samplers (timers) was retrieved and sent to NERI for analysis. On March 4, 1994, NERI instructed the field teams to begin retrieving the soil gas samplers beginning March 7, 1994.

From March 7, 1994 through March 8, 1994, the remaining timers and all of the soil gas samplers were retrieved. Samplers were wiped, screened, and released for shipment. On March 9, 1994, the samplers were packaged and sent to NERI for analysis.

3.1.2. Quality Assurance Summary

The field and data analysis variances are summarized in the following subsections.

3.1.2.1. Field Variance Report

The OU5 QAPjP, Attachment 1, *SOP for Petrex Environmental Surveys* (DOE 1993b) was followed in its entirety. There were no variances from the procedure.

3.1.2.2. Data Analysis Variance Report

Petrex analytical data were not formally validated. On March 23, 1994 a preliminary report was submitted by NERI. On April 6, 1994, review of the report data and accompanying text was performed. Sample locations shown on Plate 1 of the report were checked against the field map to confirm that all sampling locations were correctly plotted; no errors were found. Twenty percent of the ion count values for aromatic hydrocarbons and cycloalkanes/alkenes as reported in Table 1 of the NERI report were checked for plot accuracy on Plates 2 and 3 (see Appendix C); no errors were found.

3.1.3. Data Presentation

The report of findings of the Petrex soil gas survey is presented in Appendix C. The report discusses the Petrex method, scope of work, quality assurance/quality control (QA/QC) methods, and results. One hundred forty-one sample locations were investigated (including Area 1) throughout the New Property, on a grid spacing of 200 feet. Based upon a review of historical information for the New Property and vicinity, analytical data were provided for three general classes of compounds: total aromatic hydrocarbons; total volatile halogenated compounds; and total cycloalkanes/alkenes. In addition, because of the past farming and current land use, the samplers were also analyzed for total light oils and greases. The response values of the compounds are reported as ion counts. Ion count values are the unit of measure assigned by the mass spectrometer to the relative intensities associated with each compound. These intensity levels do not represent actual concentrations. Soil gas data are considered qualitative in that multiple sources in soil and/or groundwater cannot be differentiated.

Total aromatic hydrocarbons are reported as the combined levels of C_6 to C_{15} aromatic (benzene-based) hydrocarbon compounds detected in the soil gas samples. Predominantly light and medium-weight compounds (benzene, toluene, ethylbenzene, xylene) were detected among the aromatic hydrocarbons. The compounds were detected in 19 sampling locations and are mapped in Appendix C, Plate 2. Aromatic hydrocarbons occur at the highest levels in the southwest corner of the New Property, and at slightly lower levels in the southeast corner. Three samples were elevated because of interference associated with terpene compounds. Terpenes may be naturally occurring in vegetation, or may originate in refined hydrocarbons such as turpentine.

The distribution of C_4 to C_8 cycloalkanes/alkenes is shown on Plate 3 of Appendix C. These non-aromatic hydrocarbons occur at the greatest intensities along the eastern site boundary and along the eastern boundary of Area 1. Additional occurrences are located randomly throughout the southern half of study area.

Total halogenated hydrocarbons are reported as the combined levels of tetrachloroethene (PCE), trichloroethene (TCE), trichloroethane (TCA), dichlorobenzene (DCB), trichlorofluoromethane (Freon-11), and trichlorotrifluoroethane (Freon-113). These compounds are volatile liquids commonly used as solvents, cleaning agents, and refrigerants. PCE was confirmed on samplers 4, 13, and 23. TCE was detected on sampler 13. These occurrences appeared to be random and discrete, and were not mapped.

Total oil and grease range hydrocarbons (C_{13}, C_{14}, C_{15} alkanes; cycloalkanes; alkenes; cycloalkenes; dienes; and alkynes) were not detected in the soil gas in the New Property. A few soil gas samples showed only low relative levels (trace amounts) of semi-volatile organic compounds (SVOCs).

3.2. SOIL SCREENING FACILITY DATA

3.2.1. Field Work Performed and Procedures

During placement of the soil gas samplers from February 21, 1994 though February 24, 1994, emplacement holes were monitored with a FIDLER and surface soil samples were collected for analysis at the Mound Soil Screening Facility. On February 28, 1994, soil samples were collected at additional locations in Area 1 (see Figure 3.1).

At each of the soil gas emplacement locations, grass and organic debris were removed to an approximate depth of three to six inches. The locations were monitored using a Bicron FIDLER, set to Channel 1 and Channel 2. Readings were recorded in the site logbook (see Appendix B). Field personnel then augered a 1.5 inch diameter hole to an approximate depth of 18 inches. A composite soil sample was collected from the augerings and placed in a sample container. At those locations in Area 1 where soil gas samplers were not placed, grass and organic debris were removed to an approximate depth of three to six inches. The location was monitored as described above, and a surface soil sample was collected. All sample containers were labeled with pertinent sampling information and chain-of-custody documentation was prepared. Samples were transported to the Soil Screening Facility where they were analyzed for thorium-232 and plutonium-238.

3.2.2. Quality Assurance Summary

Soil sampling and monitoring procedures for the soil analyses followed the Mound Standard Operating Procedures (SOPs); no variances were noted.

3.2.3. Data Presentation

Results of the Soil Screening Facility analyses are displayed in Figure 3.2. The detection limits at the Soil Screening Facility for thorium-232 and plutonium-238 are 2 pCi/g and 25 pCi/g, respectively.

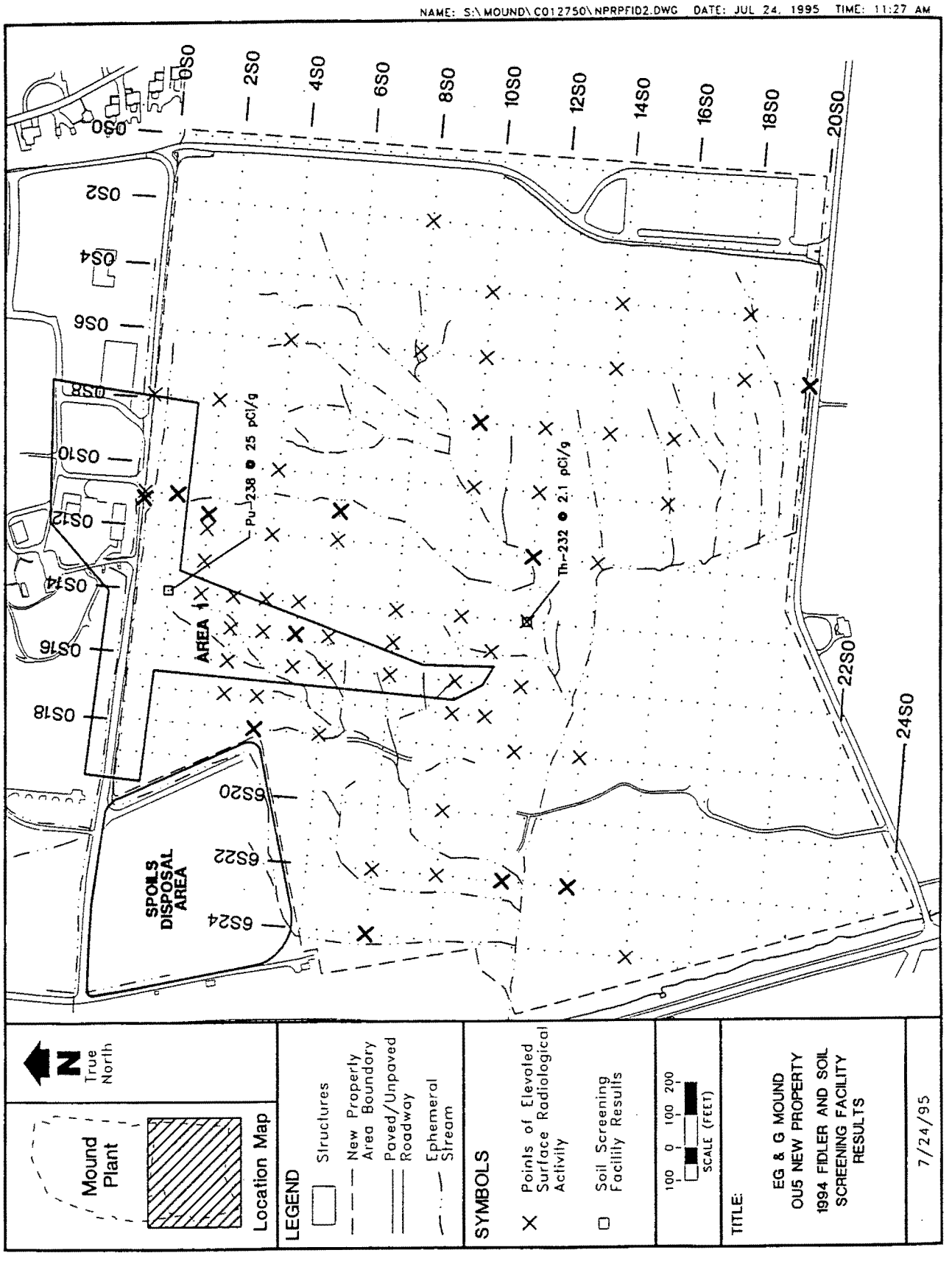

Figure 3.2. 1994 FIDLER and Soil Screening Facility Results

Measurements of radioactive elements at or in excess of the detection limits were observed in two locations: plutonium-238 was measured at 25 pCi/g at one sample location in Area 1, and thorium-232 was encountered at 2.1 pCi/g in one sample immediately southeast of Area 1. The complete Soil Screening Facility data set is presented in Appendix D. Figure 3.2 shows the locations of sampling points with measured values above detection limits.

3.3. RADIOLOGICAL (FIDLER) SURVEY

3.3.1. Field Work Performed and Procedures

A FIDLER survey was performed over the New Property from March 2, 1994 through March 3, 1994 following SOP 6.7 (DOE 1993a). The survey was completed over the grid system established for the New Property, which is shown in Figure 3.1. The field work was recorded in the FIDLER logbook (see Appendix B.3).

Two FIDLERS were calibrated and supplied by Mound Health Physics. FIDLER #1 was instrument #3677 and probe #3679; FIDLER #2 was instrument #3175 and probe #3613. Before the survey began on the first day, a background station was selected near the junction of Benner Road and the contractors' entrance. Due to anamalously low background data recorded at the background station, it was determined that the background station did not accurately reflect overall background levels for the New Property. As a result, the background station was relocated to grid point 20S4 for the second day's activities to better reflect background values for the New Property. For the period of time the survey was conducted, daily plutonium and thorium standard checks were performed, the readings recorded on the cards attached to the FIDLERs, and Out Channel standard deviations, as well as contamination criteria (CC) calculated. The Out Channel was selected for its ability to detect a wider range of radioactive isotopes.

At every grid location, Channel 1 and Channel 2 readings were recorded in the field logbook after a one-minute stabilization period. The survey operator walked between grid points, east to west or west to east along the Northing grid lines, at a rate of 20 feet per minute, with the FIDLER tuned to the Out Channel. If the Out Channel CC was exceeded during the walk between grid points, that location was identified as showing elevated activity and Channel 1 and Channel 2 readings were recorded. FIDLER readings were then taken radially from that point until the extent of the elevated activity was determined.

3.3.2. Quality Assurance Summary

The field and data analysis variances are summarized in the following subsections.

3.3.2.1. Field Variance Report

Field personnel performed Section 3.2.3, Part D of the Mound SOP 6.7, and all subsequent applicable sections, with the following exception: Section 3.3.2 Parts G and H describe a method for "serpentining" over a grid block at a specified rate and recording an integrated count. This method was not applied over the New Property. A scan rate of 20 feet per minute was used, which is standard for surveying large areas at the Mound Plant.

3.3.2.2. Data Analysis Variance Report

FIDLER data were not formally validated. However, all logbook entries were checked for correctness, completeness, and format. One error was discovered in the calculations used to determine the FIDLER CC. The CC were recalculated and compared to the already collected data. After reviewing the data, several additional points on the New Property were identified as having elevated surface radiological activity based on the revised Channel 1 and Channel 2 CC. Because the Out Channel data were not recorded in the logbook and these corrections were made following the completion of the survey, no additional "hot spots" located between grid points could be identified.

3.3.3. Data Presentation

The FIDLER survey grid showing data collection locations is presented in Figure 3.1. Appendix B.3 presents a listing of all readings. FIDLER readings that exceed the CC for the day of measurement are considered readings above background. The FIDLER survey located points of elevated surface radiological activity within and proximate to Area 1. Points of elevated surface radiological activity were also measured over the remainder of the New Property as shown in Figure 3.2 and summarized in Table III.1. The majority were measured near background levels. At eight points, elevated surface radiological activity was notably higher than background.

Table III.1. Summary of Elevated Radiological Activity (FIDLER Survey)
Page 1 of 3

Location	Channel 1		Channel 2	
	RDG (cpm)	CC (cpm)	RDG (kcpm)	CC (kcpm)
0S8	190	273	12.0	11.1
0S11	200	262	11.5	11.1
0S11.2	210	262	**14.5**	**11.1**
1S11	200	262	**15.0**	**11.1**
2S8	230	273	12.0	11.1
2S11.55	220	273	**14.0**	**11.1**
2S12	220	273	12.0	11.1
2S13	210	273	12.0	11.1
2S14	200	273	12.0	11.1
3S14	200	273	12.0	11.1
3S15	210	273	12.0	11.1
3S16	190	273	12.0	11.1
3S17	220	273	12.0	11.1
4S6	220	273	12.0	11.1
4S10	220	273	12.0	11.1
4S12	200	273	12.0	11.1
4S14	210	273	12.0	11.1
4S15	200	273	12.0	11.1
4S17	190	273	12.0	11.1
4S18	190	273	**13.0**	**11.1**
5S14	180	273	12.0	11.1
5S15	220	273	**13.0**	**11.1**
5S16	200	273	12.0	11.1
6S11.1	210	262	**13.0**	**11.1**
6S12	200	262	11.5	11.1
6S15	180	262	11.5	11.1

Table III.1. Summary of Elevated Radiological Activity (FIDLER Survey)
Page 2 of 3

Location	Channel 1		Channel 2	
	RDG (cpm)	CC (cpm)	RDG (kcpm)	CC (kcpm)
6S16	200	262	11.5	11.1
6S18	200	262	12.0	11.1
8S2	210	262	12.0	11.1
8S6	200	262	11.5	11.1
8S14	230	262	12.0	11.1
8S15	225	262	11.5	11.1
8S16	240	262	12.0	11.1
8S22	**270**	**262**	11.5	11.1
8S24	240	262	11.5	11.1
10S4	240	273	12.0	11.1
10S6	230	273	12.0	11.1
10S8	220	273	**13.0**	**11.1**
10S10	260	273	12.0	11.1
10S14	220	273	12.0	11.1
10S16	250	273	12.0	11.1
10S17	220	273	12.0	11.1
10S20	230	273	12.0	11.1
10S22	220	273	12.0	11.1
11S15	220	273	12.0	11.1
11S17	230	273	12.0	11.1
12S8	245	262	11.5	11.1
12S10	235	262	12.0	11.1
12S12	**270**	**262**	11.0	11.1
12S14	210	273	12.0	11.1
12S16	270	273	12.0	11.1
12S18	230	273	12.0	11.1

Table III.1. Summary of Elevated Radiological Activity (FIDLER Survey)
Page 3 of 3

Location	Channel 1		Channel 2	
	RDG (cpm)	CC (cpm)	RDG (kcpm)	CC (kcpm)
12S22	**280**	**273**	12.0	11.1
14S4	260	273	12.0	11.1
14S6	230	273	12.0	11.1
14S8	230	273	12.0	11.1
14S12	190	273	12.0	11.1
14S18	220	273	12.0	11.1
14S22	**280**	**273**	12.0	11.1
16S8	220	262	11.5	11.1
16S10	220	262	11.5	11.1
16S24	240	262	12.0	11.1
18S4	220	262	11.5	11.1
18S6	260	262	11.5	11.1
20S6	260	273	**14.0**	**11.1**

CC contamination criteria
cpm counts per minute
kcpm counts per minute X 1000

3.4. SEEP SAMPLING

3.4.1. Field Work Performed and Procedures

The seep survey was conducted at the New Property from March 22, 1994 through April 1, 1994 in accordance with Mound SOPs 2.2, 2.8, and 2.9. The purpose of the survey was to investigate whether the intermittent streams in the New Property were being potentially impacted by migration of any contaminants from the Mound Plant. Field activities during seep sampling are documented in the Seep logbook (see Appendix B.4).

On March 22, 1994, field personnel located and staked 15 potential seeps. At this time, 12 of the seeps had adequate flow for sampling. The eight seeps that were determined representative of the New Property assessment were sampled from March 29, 1994 through March 30, 1994 (see Figure 3.3). No seep sampling was conducted in the 500 foot zone parallel to Benner Road. Based on topography of the New Property, it was not expected that groundwater originating on the Operational Area would be able to migrate south of the ephemeral drainage.

Small catchment basins were fashioned to provide adequate depth for seep sampling. Seep samples were collected by dipping the sample containers in the catchment basins. Flow and clarity were estimated. All parameters were then measured in the field with the exception of alkalinity; an alkalinity sample was collected and transported to the field trailer for titration. At the end of each day of sampling, sample containers were packaged and shipped to the analytical laboratories. No wipe samples were collected or required by Mound Health Physics during seep sampling.

3.4.2. Quality Assurance Summary

The field and data analysis variances are summarized in the following subsections.

3.4.2.1. Field Variance Report

Seep sampling was conducted in accordance with the OU9 QAPjP (DOE 1993c), OU5 QAPjP (DOE 1993b), and Mound SOPs 2.2, 2.8, and 2.9. Section 3.3.4 of SOP 2.2 calls for testing field techniques by performing alkalinity tests on three known standard solutions, at the start of field sampling. These

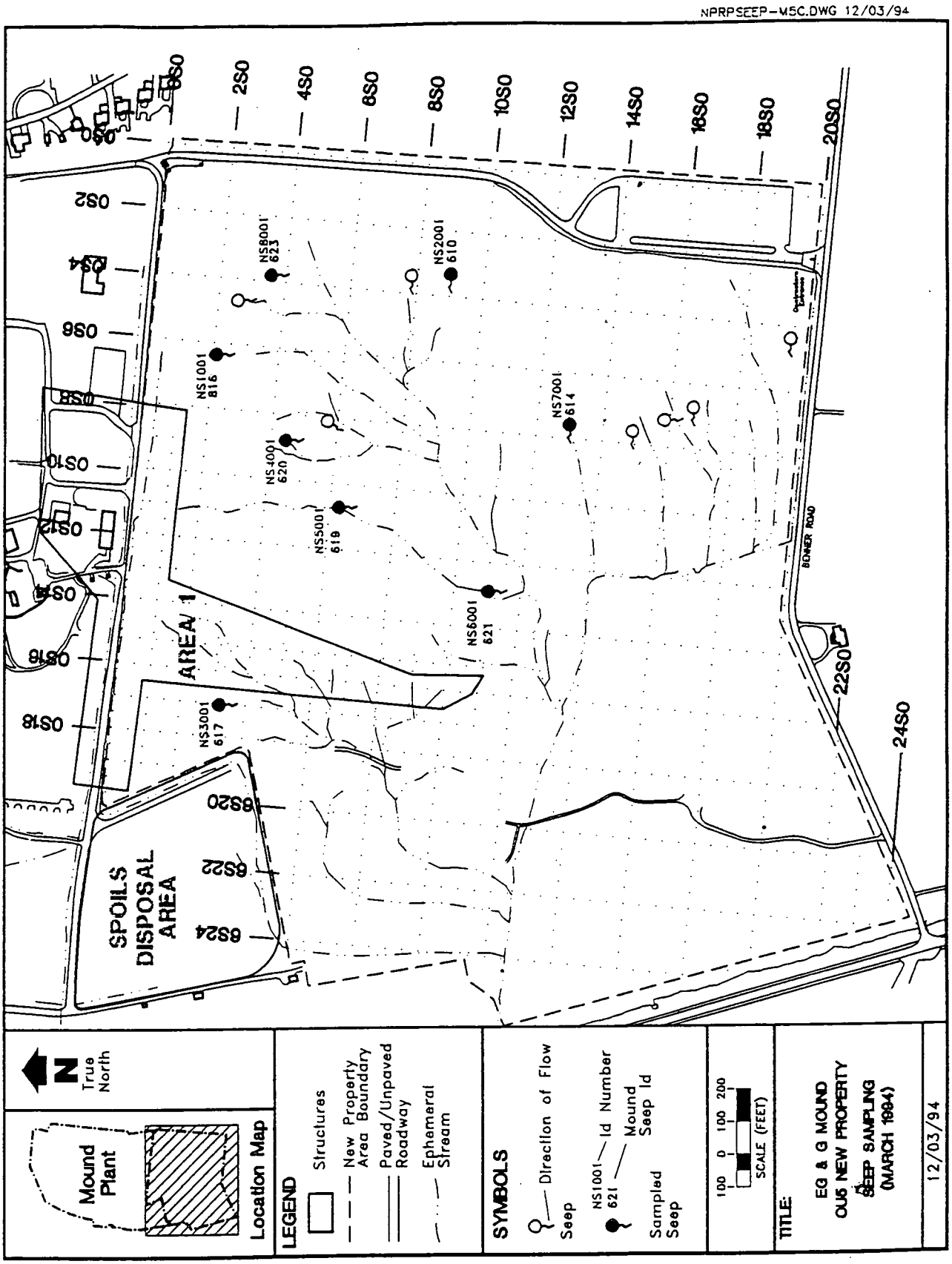

Figure 3.3. Seep Sampling Locations (March 1994)

standards were not available from the vendor. As a result, field techniques were checked at the conclusion of sampling per the instruction manual supplied by the alkalinity titrator vendor. The quality control (QC) check, which yielded an accuracy of 96.4%, verified the methodology used by personnel in the field as well as the accuracy of the Hach titrator. One duplicate sample was collected at Seep NS2001 for QC purposes.

3.4.2.2. Data Analysis Variance Report

Seep water samples were validated per the OU9 QAPjP (DOE 1993c) and the OU5 QAPjP (DOE 1993b); no variances were reported.

3.4.3. Data Presentation

Validated data is presented in Appendix E. Surface water from eight seeps was analyzed for inorganic compounds, organic compounds, and radioactive constituents.

Radiological data are provided as values that are the center of a range represented by the uncertainty value (UNC) and a +\- symbol. Those measurements that exceed the minimum detectable activity (MDA) of the instruments and have readings greater than the UNC are considered readings above laboratory background.

Four of the eight seeps sampled in the New Property were found to have radioactive contamination meeting or exceeding laboratory detection limits or background. Traces of plutonium-238 were detected in concentrations ranging from 0.22 to 0.35 pCi/L. Traces of uranium-234 were found in concentrations ranging from 0.48 to 0.53 pCi/L. Uranium-238 is present in concentrations from 0.29 to 0.33 pCi/L.

3.5. VERIFICATION SOIL SAMPLING

To provide corroboration with the OU5 New Property soil gas survey results that showed higher response levels of organic compounds, verification soil samples were collected on May 5, 1994 at six locations under the Regional Soils Investigation task (see Figure 3.4). All were analyzed by an off-site laboratory for CLP VOCs, SVOCs, pesticides, PCBs, metals, common anions, radium-226, tritium, and isotopic gamma, strontium, plutonium-238, isotopic thorium, and uranium.

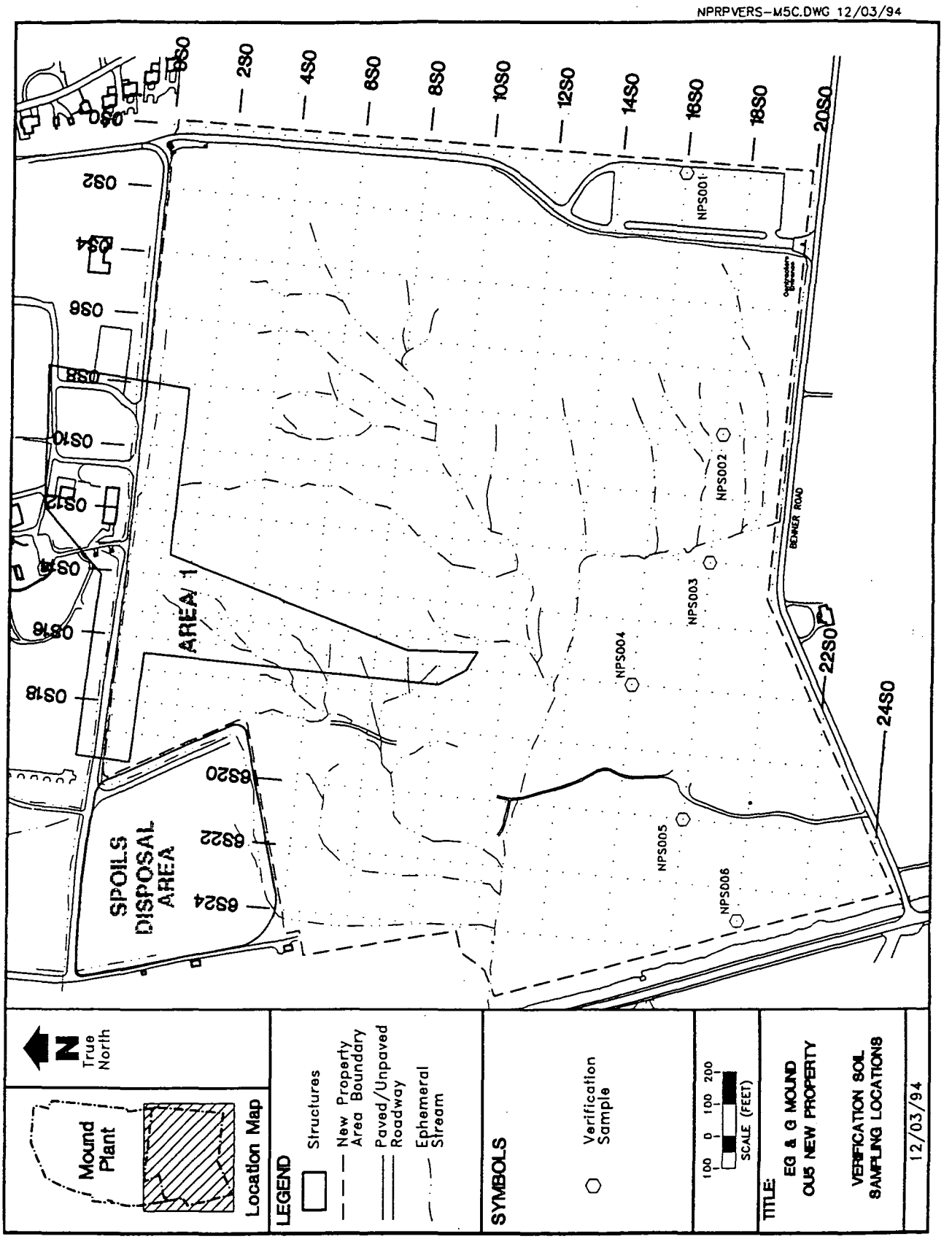

Figure 3.4. Verification Soil Sampling Locations

3.5.1. Field Work Performed and Procedures

The SOPs used for surface soil sampling are presented in Appendix A of the OU9 QAPjP (DOE 1993c). In general, shovels and scoops were used in collecting surface soil samples from the upper 12 inches of the soil column. A shovel was used to remove surficial material and a stainless steel scoop was used to collect samples. All samples were placed in appropriate sample bottles with teflon-lined lids. Samples were cooled to 4°C with ice and transported to the laboratory the day of collection. All equipment was decontaminated between sample locations.

3.5.2. Quality Assurance Summary

The field and data analysis variances are summarized in the following subsections.

3.5.2.1. Field Variance Report

Soil sampling was conducted in accordance with the OU9 QAPjP (DOE 1993c). No variances were noted. Logbook entries were reviewed for completeness, accuracy, and format.

3.5.2.2. Data Analysis Variance Report

Data validation was conducted according to the OU9 QAPjP, Appendix H (DOE 1993c) and completed July 25, 1994; no variances were noted.

3.5.3 Data Presentation

The validated analytical results for the six verification soil samples in the New Property are provided in Appendix G. VOCs or SVOCs that could be associated with cycloalkanes, cycloalkenes, or aromatic hydrocarbons detected during the soil gas survey were detected in NPS003, NPS004, and NPS005 in low or estimated concentrations. NPS003 exhibited the largest number of compounds present in any soil sample: 97 µg/kg methylene chloride, and estimated quantities of di-n-butylphthalate (240J µg/kg), toluene (4.7 J µg/kg), xylenes (21 J µg/kg), 2-butanone (8.5 J µg/kg), carbon tetrachloride (9.6 J µg/kg), and ethylbenzene (2.1 J µg/kg). A "J" following the concentrations indicates that the concentration is an

estimated value. NPS004 contained 180 J µg/kg di-n-butylphthalate. The concentration of this compound at NPS005 was 420 µg/kg. No other detections of VOCs or SVOCs were noted. An evaluation of chemical concentrations above background will be made in the course of the forthcoming New Property Remedial Investigation (RI) Report.

Tentatively identified compounds (TICs) were found in all six samples. SVOC TICs were present in every soil sample, and VOC TICs were identified in NPS001, NPS004, and NPS005. TICs may account, in part, for the elevated responses observed in the soil gas survey data.

4. CORRELATION WITH HISTORICAL DATA

Previous investigations in the OU5 New Property consisted of groundwater monitoring well drilling; surface and subsurface soil sampling for radiological contamination; FIDLER soil screening; and sampling of seep 609. FIDLER data from the Site Survey Project (Stought et al. 1988) has not been published. Published results for seep 609 are for inorganic compounds only. Therefore, the only previous data set that is comparable to data collected under the Phase 1 field investigation is the surface and subsurface soil analytical data.

The quality of the 1983-1984 soil data from the Site Survey Project suffers from inaccuracies in reporting the coordinates of the sampling points. However, general inferences can be drawn from the results: (1) none of the stations sampled at that time in the New Property (exclusive of Area 1) exceeded Mound Plant detection levels for plutonium-238 or thorium-232; and (2) eight points in Area 1 exceeded Mound detection levels for both plutonium and thorium.

These findings are not inconsistent with the 1994 Mound Soil Screening Facility analytical results showing that elevated radiological activity is present in and near Area 1. The 1994 Phase 1 Soil Screening Facility analytical results do not indicate a defined Area 1 location. The two samples indicated on Figure 3.2 were at or very near the laboratory minimum detection limits (MDLs). The FIDLER survey, however, indicated elevated surface radiological activity within and proximate to Area 1. Points of elevated surface radiological activity were also measured over the remainder of the New Property. Those points of elevated radiological activity not confirmed by the Soil Screening Facility analytical results may indicate the possible presence of radionuclides other than Pu-238 and Th-232.

Surface soil sample NPS001 taken at the extreme southeast and surface sample NPS006 taken at the extreme southwest of the New Property (Figure 3.4) exhibit concentrations of radium-226 ranging from 0.83 to 2.42 pCi/g respectively. Validated but currently unpublished data from a Regional Soils Investigation (RSI) confirm radium occurrences in the New Property. Gamma-spectroscopy analyses were conducted on surface soil samples (NPS001 through NPS006), and results are provided in Appendix G. The results of the RSI will be forthcoming in the New Property Extended Phase Report.

The 1994 field program in the New Property consisted of soil gas sampling for organic compounds, seep sampling for radiological and chemical compounds, a FIDLER survey, and soil sampling for radiological

constituents. The results from these field activities indicate that: (1) the verification sampling indicated concentrations of organic contaminants at low levels in the southeast and southwest of the New Property, which are consistent with soil gas detections of aromatic hydrocarbons or cycloalkanes/alkenes in these areas; (2) radium-226 and general radionuclides levels in the New Property are not inconsistent with the known background and (3) trace amounts of chemical and radiological contaminants have been found in the seep water. These data, in conjunction with the New Property Extended Phase field program and the Regional Soils Investigation results, will be further discussed and evaluated in the New Property RI Report.

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