K.08
3/6/95
153641

Brownfield Redevelopment Plan

AND

Feasibility Study Report, Former Moss-American Site, Sauget, Illinois

RECEIVED
MAR 10 1995
IEPA/DLPC

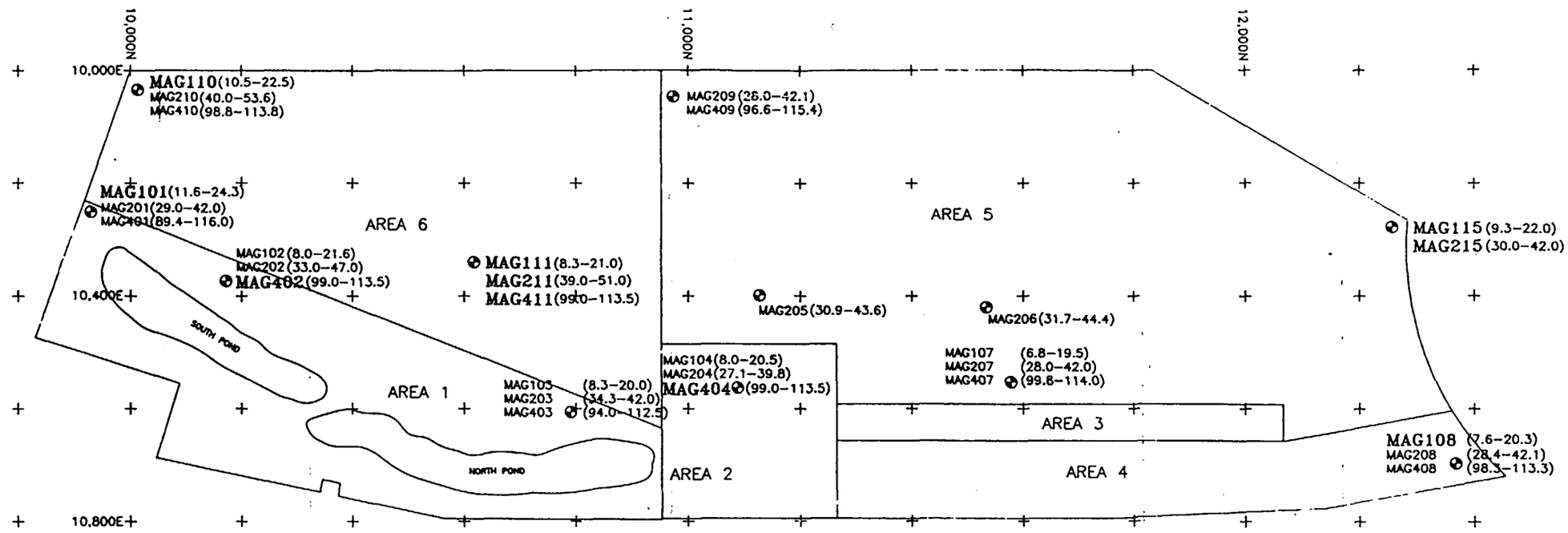
March 6, 1995

Prepared for:

KERR-MCGEE CHEMICAL CORPORATION
Oklahoma City, Oklahoma

ORIGINAL

BURLINGTON ENVIRONMENTAL INC.
A Philip Environmental Company
Columbia, Illinois



EXPLANATION

+	200–FOOT GRID INTERVAL
MAG102 (8.3–20.0)	MONITORING WELL LOCATION, NUMBER, AND SAND PACK INTERVAL IN PARENTHESES (PHASE III MONITORING WELLS IN BOLD LETTERS)

MAG100 SERIES – SHALLOW MONITORING WELLS
MAG200 SERIES – INTERMEDIATE DEPTH MONITORING WELLS
MAG400 SERIES – DEEP MONITORING WELLS

NOTE: All depths are in feet below grade.

0 200 400
SCALE IN FEET

Burlington Environmental Inc.

MONITORING WELL LOCATIONS AND MONITORING INTERVALS

FORMER MOSS–AMERICAN SITE
SAUGET, ILLINOIS

FIGURE 2–4

PROJECT MANAGER
DOCUMENT MANAGER
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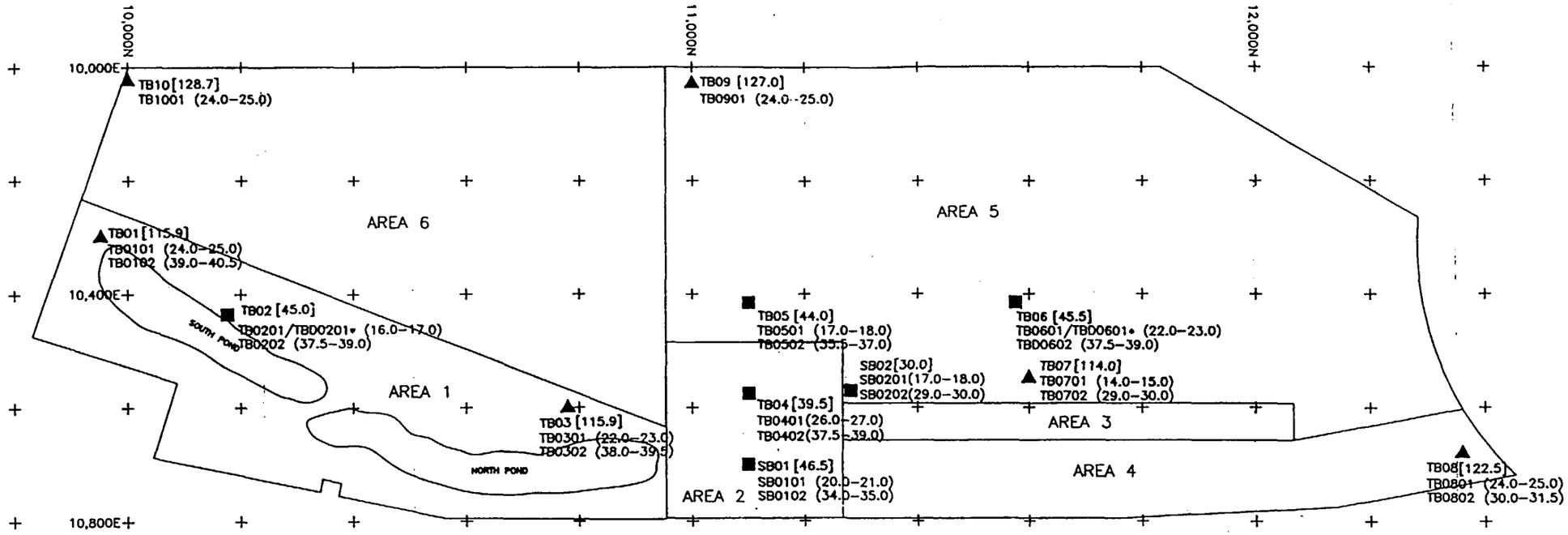
REV. DATE 11/29/89



EXPLANATION

+ 200–FOOT GRID INTERVAL

■ TB02 [35.0] APPROXIMATE SHALLOW TEST BOREHOLE LOCATION, NUMBER, SAMPLE DESIGNATIONS, BOREHOLE DEPTH IN BRACKETS, AND SAMPLE DEPTH INTERVALS IN PARENTHESES
TB0201 (16.0–17.0)
TB0202 (37.5–39.0)

▲ TB01 [125.0] APPROXIMATE DEEP TEST BOREHOLE LOCATION, NUMBER, SAMPLE DESIGNATIONS, BOREHOLE DEPTH IN BRACKETS, AND SAMPLE INTERVALS IN PARENTHESES
TB0101 (24.0–25.0)
TB0102 (39.0–40.5)

TBD0601* DUPLICATE SAMPLE

NOTE: All depths are in feet below grade.

0 200 400
SCALE IN FEET

Burlington Environmental Inc.

GEOLOGIC TEST BOREHOLE LOCATIONS AND DEPTHS

FORMER MOSS–AMERICAN SITE
SAUGET, ILLINOIS
121535

FIGURE 2-3

PROJECT MANAGER
DOCUMENT MANAGER
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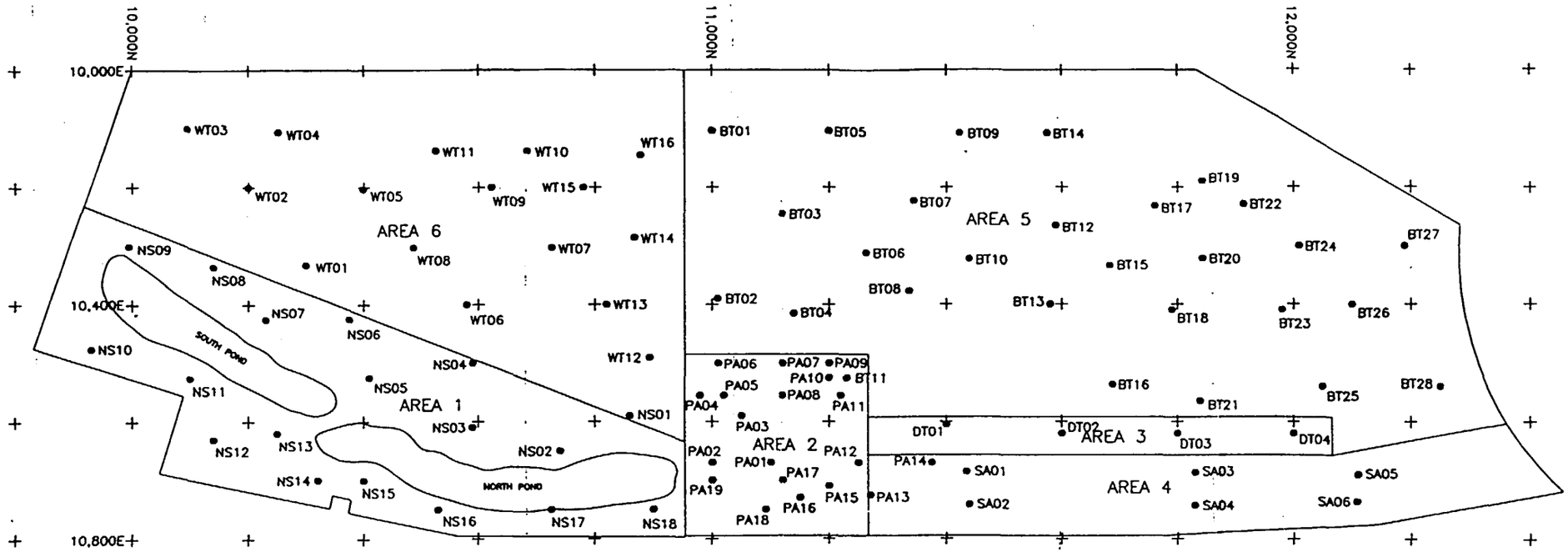

EXPLANATION

+ 200-FOOT GRID INTERVAL

● NS12 APPROXIMATE SHALLOW SOIL SAMPLING LOCATION AND NUMBER

0 200 400
SCALE IN FEET

Burlington Environmental Inc.

SHALLOW SOIL INVESTIGATION
BOREHOLE LOCATIONS

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS
121535

FIGURE 2-2

PROJECT MANAGER
DOCUMENT MANAGER
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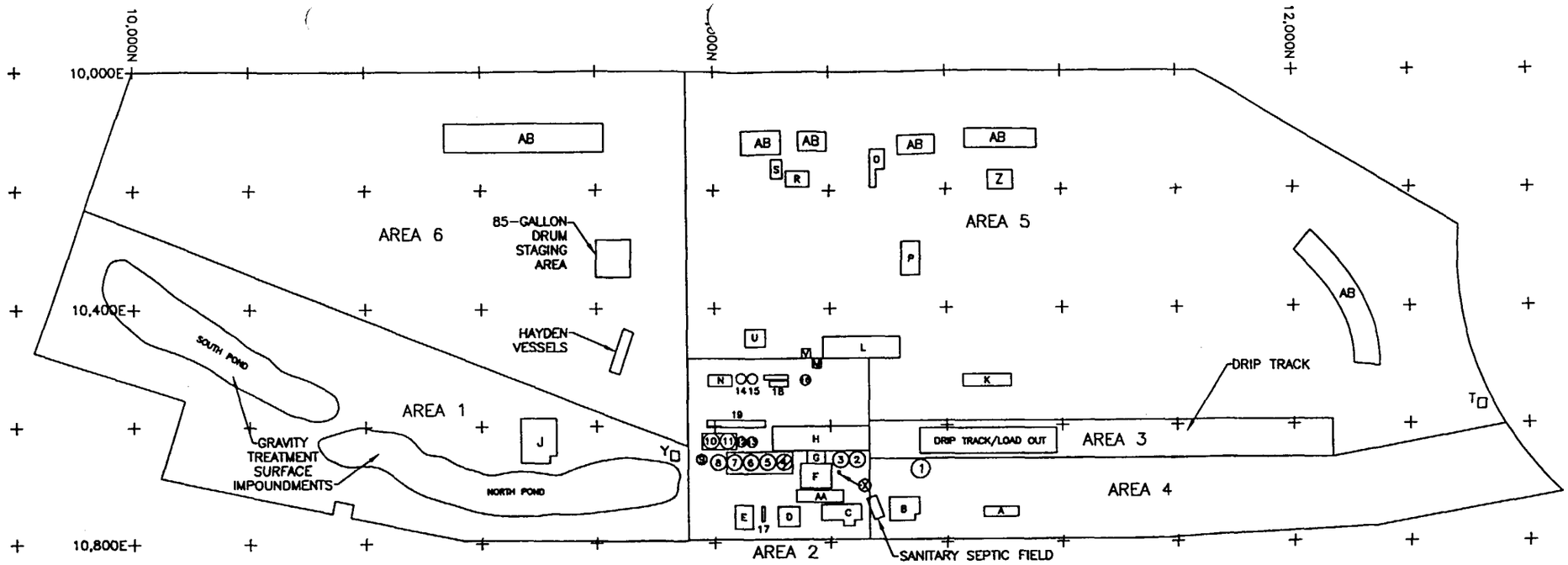

TANKS ○

NO.	DESCRIPTION
1	WATER TOWER
2	CREOSOTE WORK TANK
3	CREOSOTE WORK TANK
4	CREOSOTE/PETROLEUM WORK TANK
5	CREOSOTE/COAL TAR STORAGE
6	CREOSOTE/COAL TAR STORAGE
7	CREOSOTE/COAL TAR STORAGE
8	CREOSOTE/COAL TAR STORAGE
9	CREOSOTE/COAL TAR STORAGE
10	CREOSOTE/COAL TAR STORAGE
11	CREOSOTE/COAL TAR STORAGE
12	CREOSOTE/COAL TAR STORAGE
13	CREOSOTE/COAL TAR STORAGE
14	CREOSOTE/COAL TAR STORAGE
15	CREOSOTE/COAL TAR STORAGE
16	PENTA WORK TANK
17	CREOSOTE UNLOADING STATION
18	AIR RECEIVERS (2)
19	VACUUM TANK

STRUCTURES □

NO.	DESCRIPTION
A	AUTO GARAGE
B	PLANT OFFICE
C	WASH ROOM
D	PLANT MAINTENANCE
E	PENTA STORAGE SHED
F	BOILER BUILDING
G	PUMP HOUSE
H	RETORT BUILDING
J	ADZING AND BORING MILL
K	LOCOMOTIVE SHED
L	FRAMING MILL
M	DOWELLING/INCISOR
N	PENTA MIX TANK
P	STORAGE SHED
Q	FRAMING STATION
R	INCISOR/DOWELLING
S	WHITE TIE STACKER
T	FIRE HOUSE
U	DOWELLING MACHINE
V	INCISOR
X	ON-SITE SUPPLY WELL
Y	HOT WELL
Z	SEEPAGE SUMP
AA	COAL STORAGE BUILDING
AB	RAILROAD TIE PILE

EXPLANATION

+ 200-FOOT GRID INTERVAL

EXISTING FEATURES

NOTE:
1. Feature locations are approximate.
2. Modified from RI Work Plan, (Burlington, 1987).
3. The letters I, O, and W were not referenced in the Source.

0 200
FEET

BURLINGTON ENVIRONMENTAL
– A Philip Environmental Company –

TITLE: Former and Existing Site Features

DWN: TMM	DES: KDO	PROJECT NO: 121535
CHKD: KDO	APPD: KDO	FORMER MOSS-AMERICAN SITE SAUGET, ILLINOIS
DATE: 1/31/95	REV:	FIGURE 2-1

COL 121535AC-001

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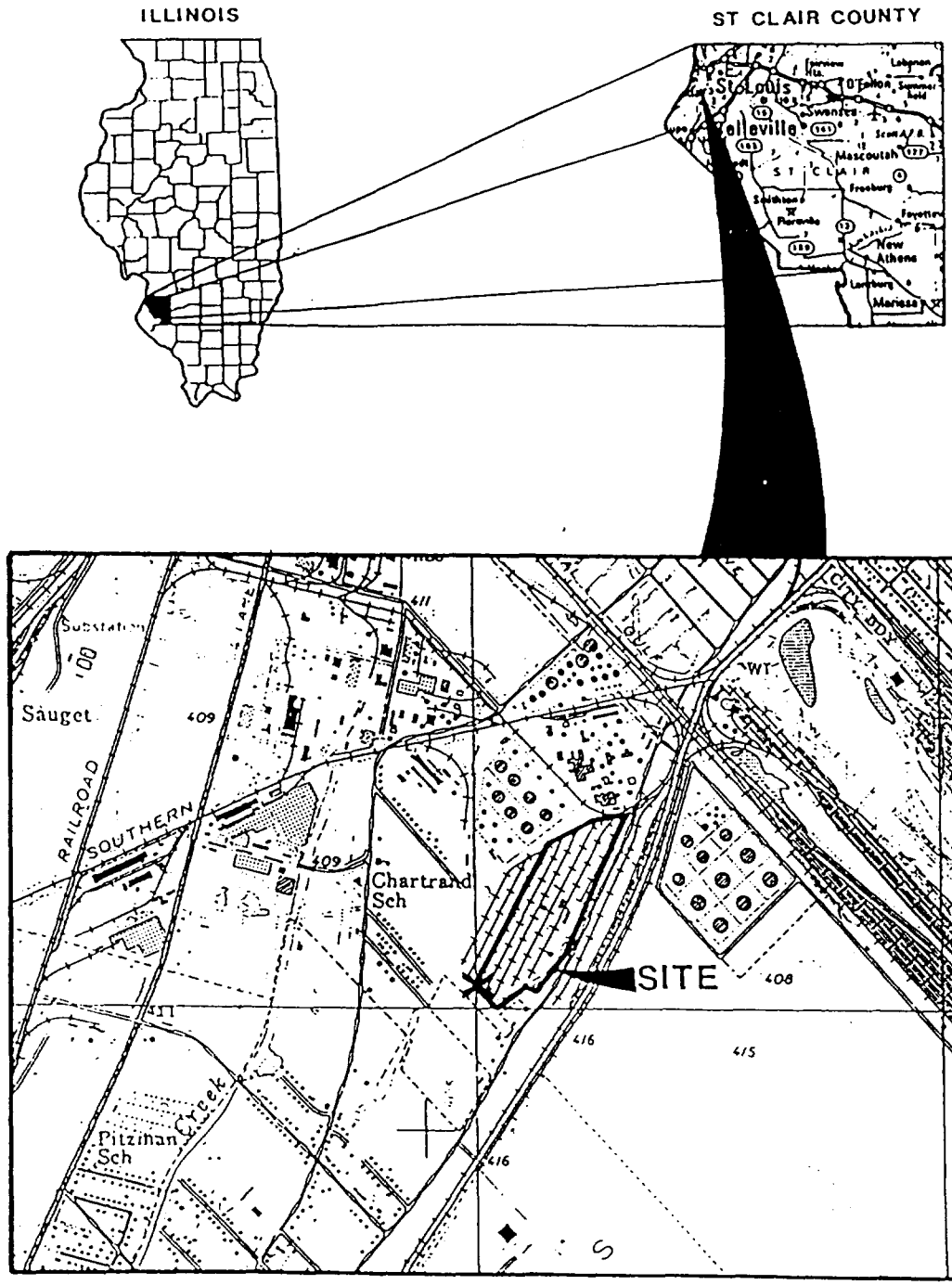


EXPLANATION

SCALE IS VARIABLE

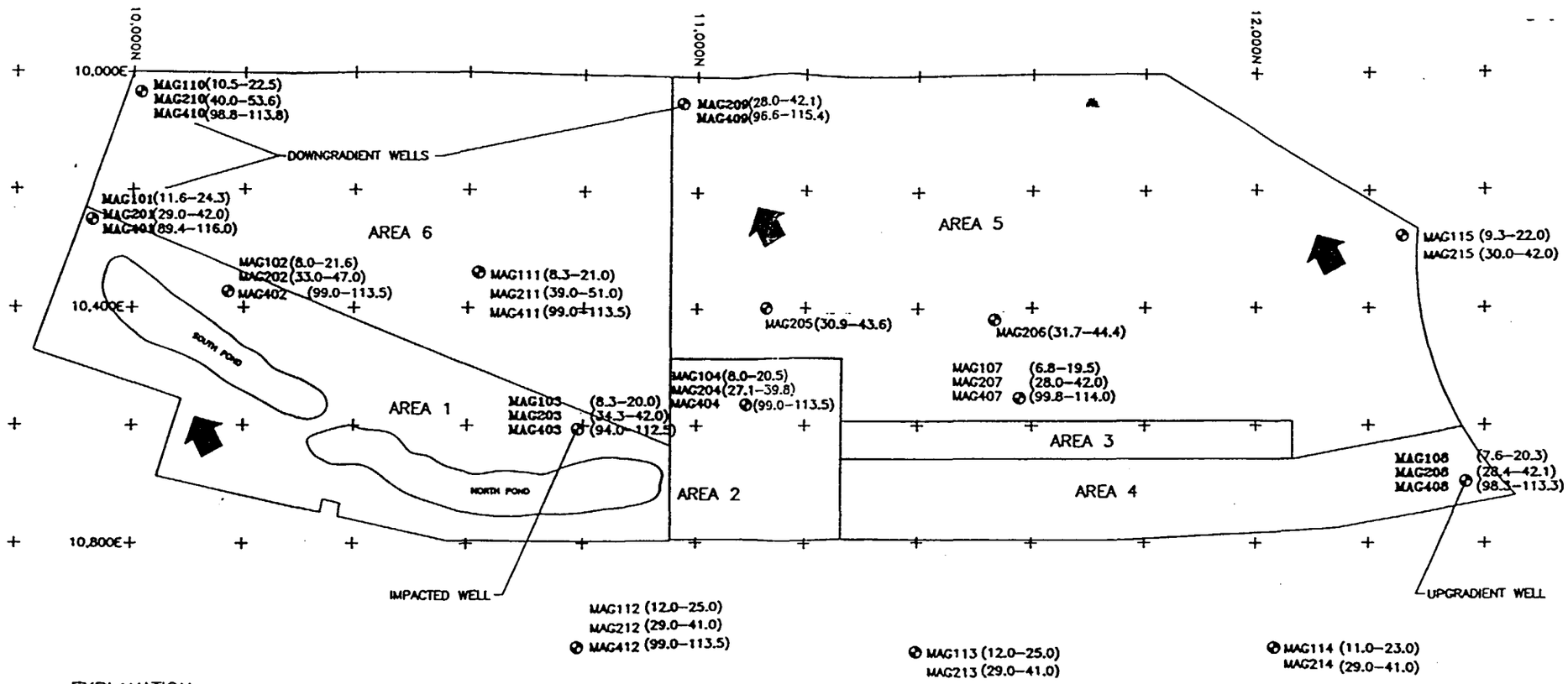
N

✕ GRID COORDINATE 10,000 N, 10,000 E

Modified from U.S. Geological Survey, Cahokia, Illinois, 1968.

John Mathes & Associates, Inc.	
SITE LOCATION MAP	
FORMER MOSS-AMERICAN SITE SAUGET, ILLINOIS 121535	FIGURE 1-1

REV.	DATE	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
0	8/10/91	6-14-91	6/14/91	6/14/91	6/14/91



EXPLANATION

+	200–FOOT GRID INTERVAL
↖	GENERALIZED GROUNDWATER FLOW DIRECTION
MAG102 (8.3–20.0)	MONITORING WELL LOCATION AND IDENTIFICATIONS WITH (SAND PACK INTERVAL) (THE LAST TWO DIGITS REFER TO THE MONITORING WELL CLUSTER NUMBER)
MAG110	MONITORING WELL LOCATION FOR ANALYTICAL TESTING

MAG100 SERIES – SHALLOW MONITORING WELLS
MAG200 SERIES – INTERMEDIATE–DEPTH MONITORING WELLS
MAG400 SERIES – DEEP MONITORING WELLS

NOTE: All depths are in feet below grade.

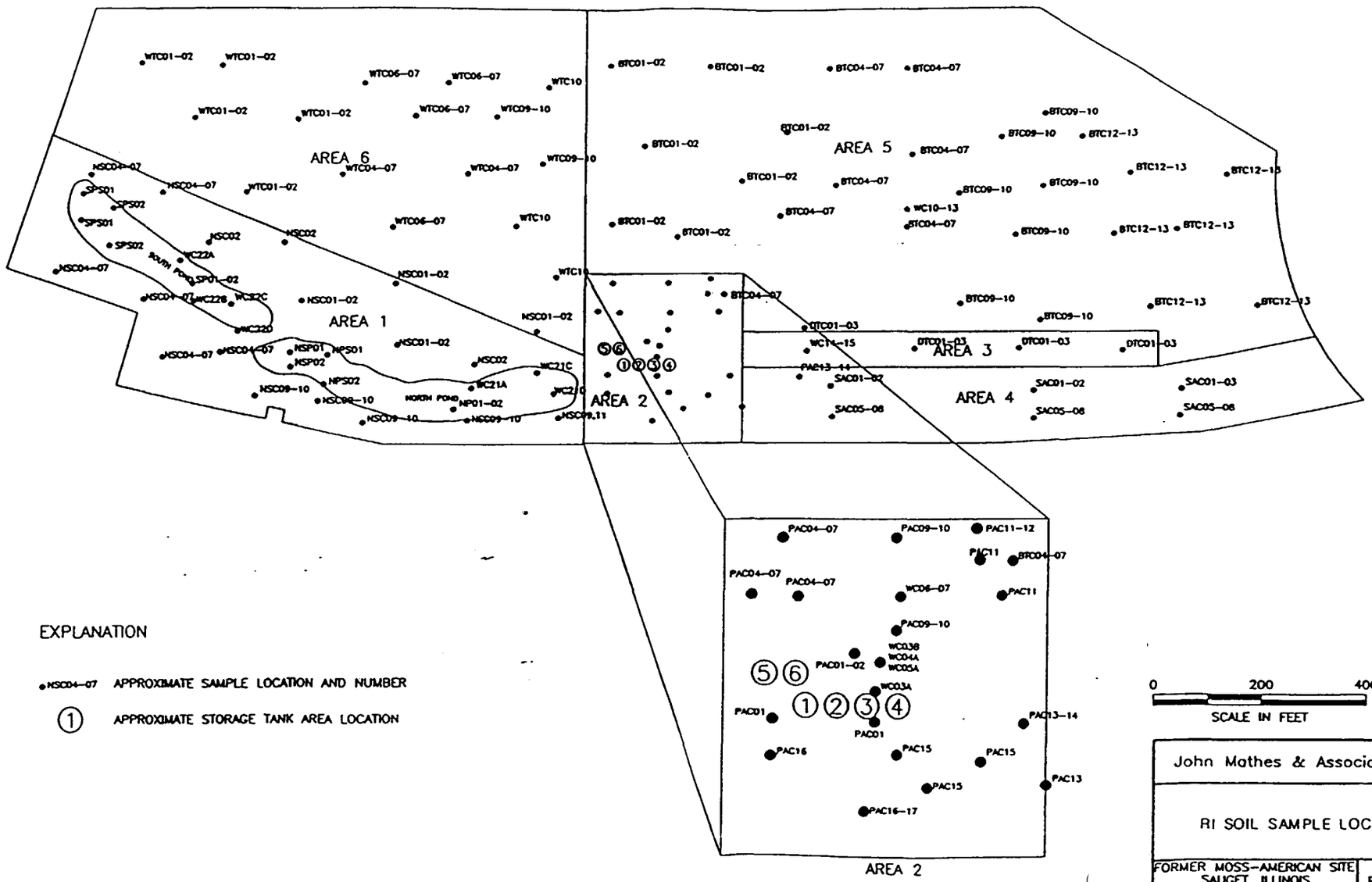
0 200 400
SCALE IN FEET

John Mathes & Associates, Inc.

MONITORING WELL NETWORK

FORMER MOSS–AMERICAN SITE
SAUGET, ILLINOIS
121535

FIGURE 3–1



John Mathes & Associates, Inc.	
RI SOIL SAMPLE LOCATIONS	
FORMER MOSS-AMERICAN SITE SAUGET, ILLINOIS 121535	FIGURE A-1

REV. DATE	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
8/4/91	TAM 6-16-9	BR 6/14/91	6/14/91	6/14/91

APPENDIX A

October 16, 1991, Report to the IEPA

SOIL, GROUNDWATER, AND FREE PRODUCT REMEDIAL ACTION OBJECTIVES FORMER MOSS-AMERICAN SITE SAUGET, ILLINOIS

October 16, 1991

Prepared for:

KERR-MCGEE CHEMICAL CORPORATION
Oklahoma City, Oklahoma

Project 121535

JOHN MATHES & ASSOCIATES, INC.
210 West Sand Bank Road
Post Office Box 330
Columbia, Illinois 62236-0330

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Appendix A Diminishing Returns Soil Removal Efficiency Documentation

Appendix B Remedial Investigation Groundwater Level/Analytical Testing Documentation

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SOIL, GROUNDWATER, AND FREE PRODUCT
REMEDIAL ACTION OBJECTIVES
FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

1 INTRODUCTION

Kerr-McGee Chemical Corporation (KMCC) has updated the soil and groundwater monitoring remedial action objectives proposal, for the Former Moss-American Site (the site), in Sauget, Illinois, (Figure 1-1). This update reflects modifications approved by the Illinois Environmental Protection Agency's (IEPA) approval letter dated July 29, 1991. The agreed upon remedial action objectives include the application of the concept of diminishing returns for soil excavation, the continued groundwater monitoring and deferral of groundwater feasibility studies, and the recovery of free product below the water table. KMCC will use these remedial action objectives as the basis for a Feasibility Study (FS).

1.1 Background

Following completion of the site remedial investigation (RI) in July 1990, KMCC met with the IEPA on two occasions to discuss remedial action and cleanup objectives for the site. The initial meeting, held January 31, 1991, was primarily a FS kickoff meeting. The agenda included a review of RI findings and a discussion of the need to establish agreed upon remedial action and cleanup objectives. The IEPA issued draft soil and groundwater cleanup objectives for KMCC's review on April 17, 1991. The second meeting was held May 13, 1991, to discuss the IEPA draft soil and cleanup objectives and specific remedial action objectives. During this meeting, Bob O'Hara requested that KMCC develop this proposal for soil and groundwater remediation objectives for the IEPA's consideration. The following is a brief summary of the RI and Site Hazard Assessment (SHA) results, which were used for developing the remedial action objectives.

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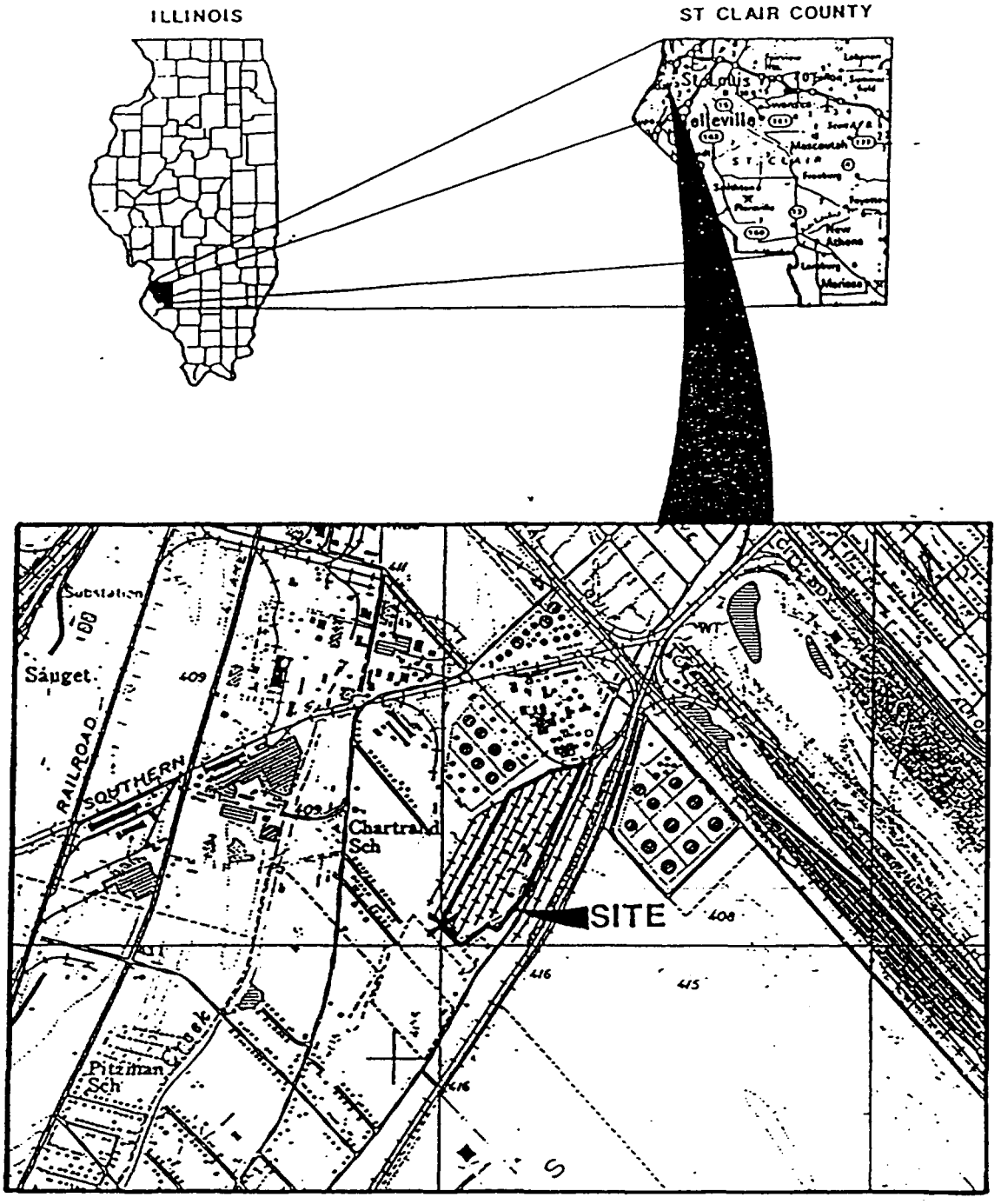

EXPLANATION

SCALE IS VARIABLE

N

✕ GRID COORDINATE 10,000 N, 10,000 E

Modified from U.S. Geological Survey, Cahokia, Illinois, 1968.

John Mathes & Associates, Inc.	
SITE LOCATION MAP	
FORMER MOSS-AMERICAN SITE SAUGET, ILLINOIS 121535	FIGURE 1-1

1.2 RI and SHA Overview

The site was the location of a creosote and pentachlorophenol wood-treating facility between 1927 and 1968, and is currently owned by the Lefton Land and Development Company (Lefton). Lefton performed some facility decommissioning prior to the site investigation. The site was listed in the Illinois Register in March 1986 as a state remedial action priority list (SRAPL) site. On February 29, 1988, KMCC entered into a consent order with the Illinois Attorney General's Office (IAGO) to perform a RI/FS on the site under the guidance of the IEPA. KMCC performed a RI to assess environmental conditions and a SHA to evaluate potential health and environmental risks associated with the site. The final RI and SHA reports were approved by the IEPA in April and November 1990, respectively.

The findings of the RI indicated soil and groundwater impact primarily in the Pond, Process, and Drip Track Areas along the southeastern and eastern half of the site. The primary constituents detected included the volatile organic compounds (VOCs) benzene, toluene, ethylbenzene, and total xylenes; the acid extractable semivolatile organic compounds (SVOCs) phenol and pentachlorophenol; and the base/neutral extractable SVOCs total cresols, naphthalene, and polycyclic aromatic hydrocarbons (PAHs). Free product was encountered in four shallow monitoring wells adjacent the ponds, process, and drip track areas, and in the deep monitoring wells adjacent to the north pond and process area.

The findings of the SHA indicated the site in its current condition does not present an imminent hazard to human health, although potential long-term risks are associated with the site, primarily with regards to human contact with impacted surface soils. The off-site risk analysis suggested the risk associated with nearby irrigation wells was negligible.

2 SOIL REMEDIATION OBJECTIVES

Excavation and treatment of impacted soil at the site will be conducted to accomplish two goals. The first goal is to reduce risk to human health and the environment. The major objective of this goal is to reduce the likelihood of casual human contact with impacted soil at the site. The other goal of a soil remediation program is to remove the primary source of groundwater impact. Treatment of soil that contains leachable constituents will reduce the potential for additional groundwater impact at the site.

As discussed during the May 13, 1991, IEPA meeting, KMCC will excavate soil at the site based on a diminishing returns approach. The concept of excavation to a point of diminishing returns is removal of PAH-containing soil until the efficiency of the removal activities decreases significantly. As previously agreed to by IEPA, excavation depth at a maximum will stop at the depth of the groundwater surface in the Cahokia Alluvium.

2.1 Areas of Soil Impact

The areas of the highest relative PAH soil impact are located in four main parts of the site: the North Pond, the South Pond, the Process Area, and the Drip Track Area. Soil samples collected from boreholes during the RI indicated that PAH concentrations were highest in these areas. Other areas of the site are significantly less impacted.

The percentage of the total PAHs at the entire site in each of these areas is shown in Table 2-1. These results indicate that the amount of impacted soil is much greater in and around the ponds than anywhere else at the site, and that removal of soil from the Ponds Area will significantly reduce the volume of PAHs remaining at the site.

Table 2-1

DISTRIBUTION OF PAHs AT THE SITE

Area	Approximate Percent of Total PAHs at Site
Ponds	82%
Process Area	7%
Drip Track	4%
Remainder of Site	7%
	100%

RI data supporting the numbers in this table are included in Table A-1 (Appendix A). Sample locations corresponding to the sample composites are shown in Figure A-1 (Appendix A).

2.2 Results of the Diminishing Returns Evaluation

Figure 2-1 is a graphical representation of the removal efficiency for excavation at the site based on the diminishing returns evaluation. The curve in Figure 2-1 indicates that a decrease in PAH removal efficiency takes place after approximately 16,000 cubic yards (yd^3) of soil are removed. This volume correlates to about 81 percent of the PAHs on the site. This point where the curve flattens is the point of diminishing return.

Table 2-2 is a further indication of the decreasing incremental efficiency of soil excavation. This table represents excavation of the most highly impacted soil first, and lists the percent PAH removal for each 4,000-yd^3 increment of soil removed.

DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
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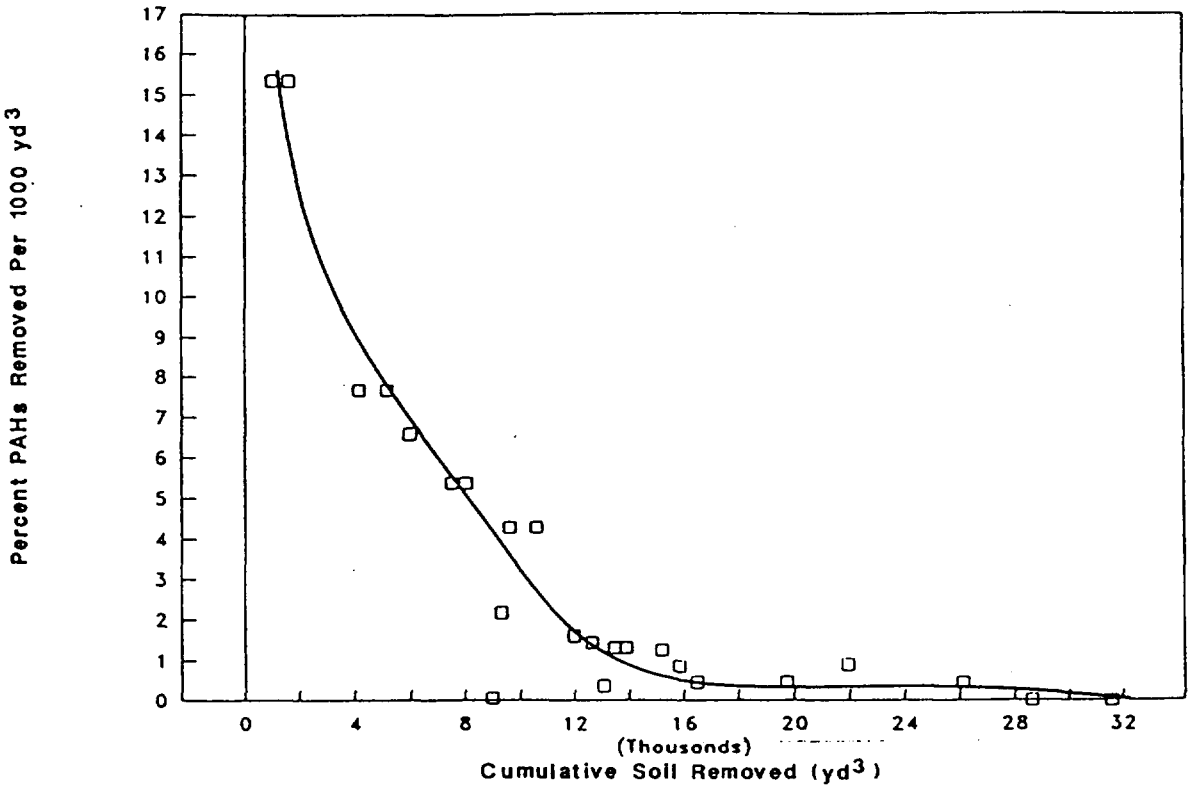
6/10/91



John Mathes & Associates, Inc.

PERCENT PAHs REMOVED PER 1,000 yd3 vs. CUMULATIVE SOIL REMOVED

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS
121535

FIGURE 2-1

Table 2-2

INCREMENTAL EXCAVATION EFFICIENCY

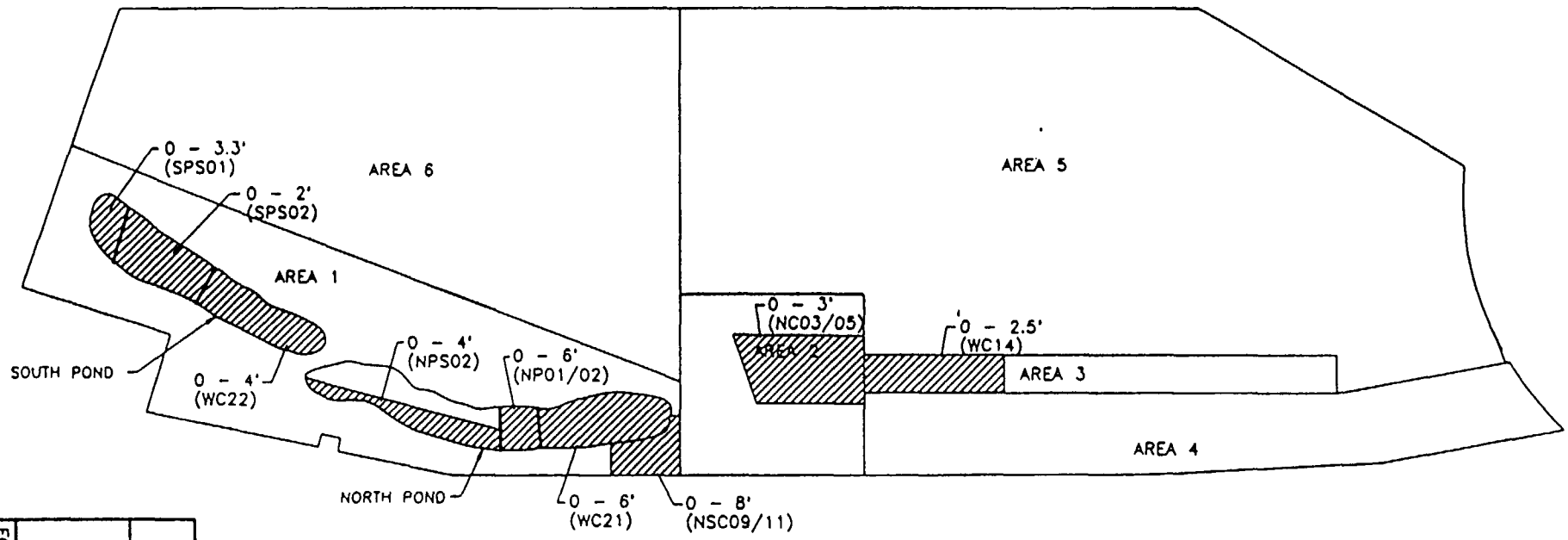
Incremental Excavation Quantity (yd^3)	Approximate Percent of Total PAHs on Site Removed per Incremental Excavation Quantity
0 - 4,000	43.1
4,000 - 8,000	25.2
8,000 - 12,000	8.8
12,000 - 16,000	4.3
	81.4

Based on this diminishing returns evaluation, the areas and depths for excavation are shown in Figure 2-2. The volumes to be excavated are tabulated in Table 2-3. The areas and depths of excavation will be field verified by a registered Illinois surveyor.

2.3 Diminishing Returns Evaluation Summary

After removal of the volume of soil, approximately 81 percent of the PAHs in the Cahokia Alluvium at the site will have been removed. KMCC believes that removal of this percentage of the PAHs at the site will lower the risk associated with human contact and diminish the threat of PAHs in the soil serving as a source of groundwater impact.

REV. DATE 8/30/91	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
B	8-30-91	8-30-91	8/30/91	8/30/91



EXPLANATION

0 - 4' (NPS02) AREA AND DEPTH OF EXCAVATION
Representative Sample Composite Designation in Parentheses.

0 280 560
SCALE IN FEET

NOTE: Areas are approximate.

John Mathes & Associates, Inc.

EXCAVATION AREAS AND DEPTHS

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS
121535

FIGURE 2-2

Table 2-3

AREAS OF SOIL EXCAVATION

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Area	Representative Sample	Depth (Feet)	Volume of Soil to be Excavated (yd^3)
North Pond	NPS02	4	1,600
	WC21	6	3,600
	NP01/02	6	1,300
	NSC09/11	8	2,600
		North Pond Area Subtotal	9,100
South Pond	SPS02	2	800
	WC22	4	2,000
	SPS01	3.3	700
		South Pond Area Subtotal	3,500
Process Area Subtotal	WC03/05	3	2,000
Drip Track Area Subtotal	WC14	2.5	1,400
		Total	16,000

3 GROUNDWATER REMEDIATION OBJECTIVES

KMCC will defer groundwater treatment while implementing a groundwater monitoring program. The purpose of the monitoring program will be to evaluate the impact of the soil removal program discussed in Chapter 2 on groundwater quality and plume migration. Details of the groundwater monitoring program are presented below.

3.1 Monitoring Well Network

The monitoring well network installed during the RI is shown in Figure 3-1. The general groundwater flow direction in the Cahokia and Henry Formation is to the west. The monitoring well network will be used for monitoring groundwater quality and flow characteristics as discussed below.

For the groundwater flow evaluation, KMCC will monitor groundwater levels in all existing monitoring wells on site and in the three off-site upgradient Monitoring Well Clusters No. 12, 13, and 14. For the groundwater quality evaluation, KMCC will monitor three well clusters downgradient of impacted areas, one well cluster upgradient of the impacted areas, and one well cluster in the impacted area. The downgradient wells are Monitoring Well Clusters No. 1, 9, and 10. The upgradient well cluster is Monitoring Well Cluster No. 8. Monitoring Well Cluster No. 3 is the well cluster located in the area of greatest impact.

3.2 Monitoring Procedures

Groundwater sampling-related activities will include water level monitoring, well development, and sample collection. The groundwater development sampling procedures previously developed in

the RI work plan (as modified to date with IEPA approval) will be followed.

For analytical testing, standard Contract Laboratory Program quality assurance and reporting procedures outlined in the RI quality assurance project plan will be maintained. The analytical parameter list and their respective test methods are presented in Table 3-1.

3.3 Monitoring Schedule

The frequency of monitoring will initially occur quarterly for the first year of monitoring, and semiannually thereafter. KMCC will review the status of the groundwater monitoring program after source control measures have been implemented.

3.4 Reporting

Within 60 days of each sampling event, KMCC will submit to the IEPA a brief Groundwater Quality Assessment Report presenting a quality assurance review, and current period and historical comparison of the groundwater analytical data.

TABLE 3-1

GROUNDWATER MONITORING PROTOCOLS

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Parameter	Groundwater Reporting Limit (mg/L)	Test Method	
VOC			
Benzene	0.005	SW-846	8240
Ethylbenzene	0.005	SW-846	8240
Toluene	0.005	SW-846	8240
Xylene (Total)	0.015	SW-846	8240
SVOC - Acid Extractable Organic Compounds			
Pentachlorophenol	0.05	SW-846	8270
Phenol	0.01	SW-846	8270
SVOC - Base/Neutral Extractable Organic Compounds			
Non-PAHs			
Cresols (total)	0.01	SW-846	8270
Naphthalene	0.01	SW-846	8270
PAHs			
Noncarcinogenic			
Acenaphthene	0.01	SW-846	8310
Acenaphthylene	0.01	SW-846	8310
Anthracene	0.01	SW-846	8310
Benzo(g,h,i)perylene	0.01	SW-846	8310
Fluoranthene	0.01	SW-846	8310
Fluorene	0.01	SW-846	8310
Phenanthrene	0.01	SW-846	8310
Pyrene	0.01	SW-846	8310
Potentially Carcinogenic			
Benzo(a)anthracene	0.01	SW-846	8310
Benzo(a)pyrene	0.01	SW-846	8310
Benzo(b)fluoranthene	0.01	SW-846	8310
Benzo(k)fluoranthene	0.01	SW-846	8310
Chrysene	0.01	SW-846	8310
Dibenzo(a,h)anthracene	0.01	SW-846	8310
Indeno(1,2,3-c,d)pyrene	0.01	SW-846	8310

mg/L Milligrams per liter.
PAH Polycyclic aromatic hydrocarbon.
SVOC Semivolatile organic compound.
VOC Volatile organic compound.
SW-846 USEPA Test Method For Evaluating Solid Waste, September 1986.

4 FREE PRODUCT REMEDIATION OBJECTIVES

The recovery of free product from below the water table will be a remedial action objective. The selection of a remedial alternative to meet this objective will be addressed in the FS. In general, the FS will focus on alternatives for free product recovery from the Cahokia Alluvium and the Lower Henry Formation atop bedrock. For the Cahokia Alluvium, free product mixed with water was observed in Monitoring Wells MAG102 and MAG103 (Ponds Area), MAG104 (Process Area), MAG107 (Drip Track Area) (Figure 3-1). For the Lower Henry Formation, approximately two- to three feet of free product were observed above the top of bedrock in Monitoring Wells MAG403 (North Pond) and MAG404 (Process Area). Based on the RI data, the top of bedrock appears to slope to the west-northwest across the site.

APPENDIX A

Diminishing Returns Soil Removal Efficiency Docum

TABLE A-1

POINT OF DIMINISHING RETURNS EXCAVATION ANALYSIS - 1991

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

DRA No.	Priority of Excavation: Area	Priority of Excavation: Sample Location	Ground Water Depth (ft.)	Top Sample Depth (ft.)	Bottom Sample Depth (ft.)	Area Represented (sq.ft.)	Incremental Soil Volume (yd3)	TPAH Concent. (mg/kg)	Pounds of TPAHs	Pounds of TPAHs/c.y.	% of TPAHs	Removal Efficiency of % TPAHs/ 1,000 yd3	Cumul. Soil Removed (yd3)	Cumul. % TPAHs Removed
1	1N	NPS02	--	0	2.5	10,850	1,005	146,886	398,428	397	15.42	15.35	1,005	15.4
2	1N	NPS02	4	2.5	4	10,850	603	146,886	239,057	397	9.25	15.35	1,607	24.7
3	1N	WC21	--	0	4.3	16,103	2,565	73,602	509,640	199	19.72	7.69	4,172	44.4
4	1N	WC21	6	4.3	6	16,103	1,014	73,602	201,485	199	7.80	7.69	5,186	52.2
5	1S	SPS02	2	0	2	11,013	816	63,264	139,344	171	5.39	6.61	6,002	57.6
6	1S	WC22	--	0	3	13,718	1,524	51,625	212,456	139	8.22	5.39	7,526	65.8
7	1S	WC22	4	3	4	13,718	508	51,625	70,819	139	2.74	5.39	8,034	68.5
8	1	NSC09/11	--	0	3	8,600	956	465	1,200	1	0.05	0.05	8,989	68.6
9	1	NSC09/11	--	3	4	8,600	319	20,782	17,873	56	0.69	2.17	9,308	69.3
10	1	NSC09/11	--	4	5	8,600	319	41,099	35,345	111	1.37	4.29	9,627	70.7
11	1	NSC09/11	8	5	8	8,600	956	41,099	106,036	111	4.10	4.29	10,582	74.8
12	3	WC14	--	0	2.5	14,950	1,384	15,333	57,308	41	2.22	1.60	11,966	77.0
13	1S	SPS01	2	0	3.3	5,506	673	13,702	24,896	37	0.96	1.43	12,639	77.9
14	1N	NP01/02	--	0	2	5,600	415	3,404	3,813	9	0.15	0.36	13,054	78.1
15	1N	NP01/02	--	2	4	5,600	415	12,542	14,047	34	0.54	1.31	13,469	78.6
16	1N	NP01/02	6	4	6	5,600	415	12,542	14,047	34	0.54	1.31	13,884	79.2
17	2	WC03-05	--	0	2	17,500	1,296	11,954	41,838	32	1.62	1.25	15,180	80.8
18	2	WC03-05	--	2	3	17,500	648	8,148	14,259	22	0.55	0.85	15,828	81.3
19	2	WC03-05	--	3	4	17,500	648	4,342	7,599	12	0.29	0.45	16,476	81.6
									[illegible]	12	1.47	0.45	19,717	83.1

POINT OF DIMINISHING RETURNS EXCAVATION ANALYSIS - 1991

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

DRA No.	Priority of Excavation: Area	Priority of Excavation: Sample Location	Ground Water Depth (ft.)	Top Sample Depth (ft.)	Bottom Sample Depth (ft.)	Area Represented (sq.ft.)	Incremental Soil Volume (yd3)	TPAH Concent. (mg/kg)	Pounds of TPAHs	Pounds of TPAHs/c.y.	% of TPAHs	Removal Efficiency of % TPAHs/ 1,000 yd3	Cumul. Soil Removed (yd3)	Cumul. % TPAHs Removed
27	2	WC06-07	--	3.5	4.5	3,200	119	7,529	2,409	20	0.09	0.79	32,138	87.2
28	2	WC06-07	9	4.5	9	3,200	533	7,529	10,842	20	0.42	0.79	32,671	87.6
29	2	PAC09-10	--	0	0.5	6,400	119	6,556	2,098	18	0.08	0.69	32,790	87.7
30	2	PAC09-10	--	0.5	2	6,400	356	6,556	6,294	18	0.24	0.69	33,146	88.0
31	2	PAC09-10	--	2	4	6,400	474	3,292	4,214	9	0.16	0.34	33,620	88.1
32	2	PAC09-10	--	4	5	6,400	237	28	18	0	0.00	0.00	33,857	88.1
33	2	PAC09-10	9	5	9	6,400	948	28	71	0	0.00	0.00	34,805	88.1
34	2	PAC01-02	--	0	1	11,952	443	6,015	7,189	16	0.28	0.63	35,247	88.4
35	2	PAC01-02	--	1	3	11,952	885	6,015	14,378	16	0.56	0.63	36,133	89.0
36	1S	SP01/02	4	0	4	2,800	415	5,648	6,326	15	0.24	0.59	36,548	89.2
37	2	PAC04-07	--	0	0.5	8,500	157	3,510	1,492	9	0.06	0.37	36,705	89.3
38	2	PAC04-07	--	0.5	2	8,500	472	3,510	4,476	9	0.17	0.37	37,177	89.4
39	4	SAC01-03	--	0	0.5	64,380	1,192	3,468	11,162	9	0.43	0.36	38,369	89.9
40	4	SAC01-03	--	0.5	3	64,380	5,961	3,468	55,810	9	2.16	0.36	44,331	92.0
41	4	SAC01-03	--	3	5	64,380	4,769	1,167	15,023	3	0.58	0.12	49,099	92.6
42	2	PAC11-12	--	0	1	6,800	252	3,208	2,181	9	0.08	0.34	49,351	92.7
43	2	PAC11-12	--	1	3	6,800	504	3,208	4,363	9	0.17	0.34	49,855	92.9
44	2	PAC11-12	--	3	4	6,800	252	1,608	1,093	4	0.04	0.17	50,107	92.9
45	1N	NPS01	--	0	2.5	10,850	1,005	1,904	5,165	5	0.20	0.20	51,111	93.1
46	1N	NPS01	4	2.5	4	10,850	603	1,904	3,099	5	0.12	0.20	51,714	93.2
47	5	WC10	--	0	0.25	5,000	46	1,884	235	5	0.01	0.20	51,761	93.2
48	1	NSC09-10	--	0	2	35,200	2,607	465	3,275	1	0.13	0.05	54,368	93.4
49	1	NSC09-10	--	2	3	35,200	1,304	864	3,040	2	0.12	0.09	55,672	93.5
50	1	NSC09-10	--	3	4.5	35,200	1,956	1,262	6,663	3	0.26	0.13	57,627	93.7
51	1	NSC09-10	8	4.5	8	35,200	4,563	1,262	15,546	3	0.60	0.13	62,190	94.3
52	3	DTC01	--	0	3	34,939	3,882	1,101	11,542	3	0.45	0.12	66,072	94.8
67	4	PAC13-14	--	0	2	17,550	1,300	296	1,037	1	0.04	0.03	167,732	98.8
68	2	PAC13-14	--	0	2	3,600	267	296	213	1	0.01	0.03	167,999	98.8
69	2	PAC13-14	--	2	3	3,600	133	296	106	1	0.00	0.03	168,132	98.8
70	4	PAC13-14	--	2	3	17,550	650	296	519	1	0.02	0.03	168,782	98.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0.00	0.01	168,916	98.8

TABLE A-1, continued

POINT OF DIMINISHING RETURNS EXCAVATION ANALYSIS - 1991

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

DRA No.	Priority of Excavation Area	Priority of Excavation Sample Location	Ground Water Depth (ft.)	Top Sample Depth (ft.)	Bottom Sample Depth (ft.)	Area Represented (sq.ft.)	Incremental Soil Volume (yd3)	TPAH Concent. (mg/kg)	Pounds of TPAHs	Pounds of TPAHs/c.y.	% of TPAHs	Removal Efficiency of % TPAHs/ 1,000 yd3	Cumul. Soil Removed (yd3)	Cumul. % TPAHs Removed
79	6	WTC01-02	--	3	4	160,743	5,953	48	767	0	0.03	0.00	210,133	99.4
80	1	NSC04-07	--	0	1	92,819	3,438	73	680	0	0.03	0.01	213,571	99.4
81	1	NSC04-07	--	1	2	92,819	3,438	73	680	0	0.03	0.01	217,009	99.4
82	1	NSC04-07	--	2	4	92,819	6,875	43	799	0	0.03	0.00	223,884	99.4
83	6	WTC06/07	--	0	2	115,500	8,556	44	1,013	0	0.04	0.00	232,440	99.5
84	6	WTC06/07	--	2	7.8	115,500	24,811	44	2,939	0	0.11	0.00	257,251	99.6
85	6	WTC06/07	15	7.8	15	115,500	30,800	44	3,648	0	0.14	0.00	288,051	99.7
86	4	SAC05-08	--	0	1	64,380	2,384	39	253	0	0.01	0.00	290,435	99.7
87	4	SAC05-08	--	1	5	64,380	9,538	39	1,011	0	0.04	0.00	299,973	99.8
88	2	PAC15	--	0	2	18,000	1,333	28	102	0	0.00	0.00	301,306	99.8
89	2	PAC15	--	2	3	18,000	667	28	51	0	0.00	0.00	301,973	99.8
90	2	PAC15	9	3	9	18,000	4,000	28	307	0	0.01	0.00	305,973	99.8
91	4	SAC05-08	--	5	6	64,380	2,384	20	127	0	0.00	0.00	308,358	99.8
92	4	SAC01-03	10	5	10	64,380	11,922	16	526	0	0.02	0.00	320,280	99.8
93	1	NSC04-07	--	4	7	92,819	10,313	13	357	0	0.01	0.00	330,593	99.8
94	1	NSC04-07	10	7	10	92,819	10,313	13	357	0	0.01	0.00	340,906	99.9
95	1	NSC02	--	0	1.5	60,903	3,384	13	116	0	0.00	0.00	344,290	99.9
96	1	NSC02	--	1.5	6	60,903	10,151	13	349	0	0.01	0.00	354,440	99.9
97	1	NSC02	8	6	8	60,903	4,511	13	155	0	0.01	0.00	358,952	99.9
98	5	BTC09-10	--	2.5	5	156,350	14,477	11	433	0	0.02	0.00	373,428	99.9
							[illegible]	11	1,558	0	0.06	0.00	425,545	100.0

TABLE A-1, continued

POINT OF DIMINISHING RETURNS EXCAVATION ANALYSIS - 1991

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

DRA No.	Priority of Excavation Area	Priority of Excavation Sample Location	Ground Water Depth (ft.)	Top Sample Depth (ft.)	Bottom Sample Depth (ft.)	Area Represented (sq.ft.)	Incremental Soil Volume (yd3)	TPAH Concent. (mg/kg)	Pounds of TPAHs	Pounds of TPAHs/c.y.	% of TPAHs	Removal Efficiency of % TPAHs/ 1,000 yd3	Cumul. Soil Removed (yd3)	Cumul. % TPAHs Removed
105	5	BTC12-13	--	4.5	6.5	171,625	12,713	3	91	0	0.00	0.00	447,155	100.0
106	5	BTC12-13	14	6.5	14	171,625	47,674	3	340	0	0.01	0.00	494,828	100.0
107	2	PAC04-07	--	2	3.5	8,500	472	2	3	0	0.00	0.00	495,301	100.0
108	2	PAC04-07	9	3.5	9	8,500	1,731	2	10	0	0.00	0.00	497,032	100.0
109	6	WTC09-10	--	2.2	3.6	24,200	1,255	2	6	0	0.00	0.00	498,287	100.0
110	6	WTC10	--	2.2	9	105,600	26,596	2	118	0	0.00	0.00	524,883	100.0
111	6	WTC09-10	--	4.8	9	24,200	3,764	2	17	0	0.00	0.00	528,647	100.0
112	6	WTC09-10	15	9	15	24,200	5,378	2	24	0	0.00	0.00	534,025	100.0
113	6	WTC10	--	0	2.2	105,600	8,604	2	38	0	0.00	0.00	542,629	100.0
114	6	WTC09-10	--	0	2.2	24,200	1,972	2	9	0	0.00	0.00	544,601	100.0
115	6	WTC10	15	9	15	105,600	23,467	2	104	0	0.00	0.00	568,068	100.0
116	2	PAC13-14	--	4	5	3,600	133	1	0	0	0.00	0.00	568,201	100.0
117	4	PAC13-14	--	4	5	17,550	650	1	1	0	0.00	0.00	568,851	100.0
118	2	PAC13-14	9	5	9	3,600	533	1	1	0	0.00	0.00	569,384	100.0
119	4	PAC13-14	10	5	10	17,550	3,250	1	6	0	0.00	0.00	572,634	100.0
120	5	BTC04-07	--	3.6	5	175,550	9,103	0	12	0	0.00	0.00	581,737	100.0
121	5	BTC04-07	14	5	14	175,550	58,517	0	78	0	0.00	0.00	640,254	100.0
122	5	BTC01-02	14	5	14	186,725	62,242	0	39	0	0.00	0.00	702,495	100.0
123	5	BTC01-02	--	3.3	5	186,725	11,757	0	7	0	0.00	0.00	714,252	100.0

TABLE A-1, continued

POINT OF DIMINISHING RETURNS EXCAVATION ANALYSIS - 1991

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

DRA No.	Priority of Excavation: Area	Priority of Excavation: Sample Location	Ground Water Depth (ft.)	Top Sample Depth (ft.)	Bottom Sample Depth (ft.)	Area Represented (sq.ft.)	Incremental Soil Volume (yd3)	TPAH Concent. (mg/kg)	Pounds of TPAHs	Pounds of TPAHs/c.y.	% of TPAHs	Removal Efficiency of % TPAHs/ 1,000 yd3	Cumul. Soil Removed (yd3)	Cumul. % TPAHs Removed
				Areas 1-6 Totals		1,725,377	788,190		2,584,030		100.0		782,840	100.0

Note: 1. Calculations have been rounded as shown above. Area and sample locations are shown in Figure A-1.

-- Not applicable.
c.y. Cubic Yards.
ft. Feet.
sq.ft. Square feet.
TPAH Total polycyclic aromatic hydrocarbon.

APPENDIX B

Remedial Investigations
Groundwater Level/Analytical Testing Documenta

TABLE B-1

GROUNDWATER LEVELS

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Monitoring Well	Elevation (Feet above National Geodetic Vertical Datum)							
	Ground Surface	Measuring Point	October 1988	December 1988	August 1989	Future Monitoring Well Rounds		
Shallow Monitoring Wells								
MAG101	411.90	414.48	--	--	399.55			
MAG102	411.20	413.74	399.40	401.71	401.40			
MAG103	410.10	412.50	400.70	403.60	402.70			
MAG104	410.60	413.06	398.20	400.51	401.47			
MAG107	409.50	412.06	398.60	402.76	402.43			
MAG108	410.10	412.32	--	--	398.31			
MAG110	411.20	413.72	--	--	394.90			
MAG111	410.30	412.77	--	--	395.57			
North Pond	--	Water Surface	--	--	405.84			
South Pond	--	Water Surface	--	--	403.38			
Intermediate-Depth Monitoring Wells								
MAG201	412.10	414.48	395.40	395.21	395.29			
MAG202	411.10	413.82	395.40	395.34	395.42			
MAG203	410.00	412.47	396.00	395.84	396.06			
MAG204	410.40	412.89	396.10	395.87	396.14			

TABLE B-1, CONTINUED

GROUNDWATER LEVELS

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Monitoring Well	Elevation (Feet above National Geodetic Vertical Datum)							
	Ground Surface	Measuring Point	October 1988	December 1988	August 1989	Future Monitoring Well Rounds		
Deep Monitoring Wells								
MAG401	411.80	414.20	394.98	395.18	395.14			
MAG402	411.30	414.02	--	--	395.43			
MAG403	409.90	412.25	393.90	395.85	396.10			
MAG404	410.50	412.66	--	--	396.02			
MAG407	410.10	412.33	395.85	395.88	396.03			
MAG408	409.40	412.21	395.60	396.01	396.00			
MAG409	410.20	413.01	395.05	395.04	395.20			
MAG410	411.20	413.74	394.85	394.91	395.07			
MAG411	410.20	412.34	--	--	395.35			
Upgradient Off-Site Monitoring Wells								
MAG112	413.30	415.85	--	--	396.47			
MAG113	413.80	416.41	--	--	396.51			
MAG114	411.40	413.82	--	--	396.62			
MAG115	409.70	412.27	--	--	395.80			
MAG212	413.30	416.07	--	--	396.40			
MAG213	413.80	416.49	--	--	396.55			
MAG214	411.70	414.21	--	--	396.68			
MAG215	409.70	412.04	--	--	395.68			
MAG412	413.40	416.06	--	--	396.32			

TABLE B-2

GROUNDWATER RESULTS
OCTOBER 1988 SAMPLING EVENT

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Monitoring Well	Concentration (mg/L)									
	Benzene	Ethylbenzene	Toluene	Xylene (Total)	Pentachlorophenol	Phenol	Cresols	Naphthalene	TNCPAH	TCPAH
Shallow Monitoring Wells										
MAG101	--	--	--	--	--	--	--	--	--	--
MAG103	0.182	0.0325	0.146	0.1362	1.180J	0.0466J	1.382	9.380	1.0286	ND(1.0)
MAG108	--	--	--	--	--	--	--	--	--	--
MAG110	--	--	--	--	--	--	--	--	--	--
Intermediate-Depth Monitoring Wells										
MAG201	0.170	0.0512	0.0892	0.0711	ND(0.100)	ND(0.020)	0.589	6.920	0.33366	ND(0.020)
MAG203	1.170	0.188	0.552	0.506	ND(1.1)	0.130J	3.010	10.800	0.3459	ND(0.021)
MAG208	0.00779	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG209	0.00445J	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.100)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
MAG210	0.0101	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Deep Monitoring Wells										
MAG401	0.0224	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.110)	ND(0.022)	ND(0.022)	ND(0.022)	0.0096	ND(0.022)
MAG403	ND(0.025)	0.267	0.087	0.585	ND(1.000)	ND(0.200)	ND(0.200)	20.900	9.576	1.4828
MAG408	ND(0.0044)	ND(0.0072)	ND(0.0060)	ND(0.020)	ND(0.100)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)	ND(0.020)
MAG409	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.050)	ND(0.010)	ND(0.010)	0.0044J	0.0400	ND(0.010)
MAG410	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Reference: Former Moss-American Site Remedial Investigation Report, Sauget, Illinois, April 1990.

-- Not Analyzed.
TCPAH Total carcinogenic PAH.
mg/L Milligrams per liter.
J Estimated value below method detection limit.
TNCPAH Total noncarcinogenic PAH.
ND Not detected at the detection limit shown in parentheses.
PAH Polycyclic aromatic hydrocarbon.

TABLE B-3

GROUNDWATER RESULTS
DECEMBER 1988 SAMPLING EVENT

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Monitoring Well	Concentration (mg/L)									
	Benzene	Ethylbenzene	Toluene	Xylene (Total)	Pentachlorophenol	Phenol	Cresols	Naphthalene	TNCPAH	TCPAH
Shallow Monitoring Wells										
MAG101	--	--	--	--	--	--	--	--	--	--
MAG103	0.507	0.129	0.488	0.476	ND(2.9)	2.500	16.770	22.700	13.718	0.685
MAG108	--	--	--	--	--	--	--	--	--	--
MAG110	--	--	--	--	--	--	--	--	--	--
Intermediate-Depth Monitoring Wells										
MAG201	0.241	0.0557	0.117	0.1188	ND(0.051)	ND(0.010)	2.247	11.700	0.49289	ND(0.010)
MAG203	1.140	0.177	0.67	0.568	ND(2.6)	1.5	25.570	19.400	7.3730	0.4
MAG208	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	0.0061	ND(0.010)	ND(0.010)
MAG209	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG210	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Deep Monitoring Wells										
MAG401	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG403	ND(0.025)	0.281	0.0955	0.637	ND(0.520)	ND(0.100)	0.1508	31.8	20.191	3.0463
MAG408	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG409	ND(0.005)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.051)	ND(0.010)	ND(0.010)	0.00764J	0.0384	ND(0.010)
MAG410	ND(0.002)	ND(0.0050)	ND(0.0050)	ND(0.010)	ND(0.050)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)

Reference: Former Moss-American Site Remedial Investigation Report, Sauget, Illinois, April 1990.

-- Not Analyzed.
TCPAH Total carcinogenic PAH.
mg/L Milligrams per liter.
J Estimated value below method detection limit.
TNCPAH Total noncarcinogenic PAH.
ND Not detected at the detection limit shown in parentheses.
PAH Polycyclic aromatic hydrocarbon.

TABLE B-4

GROUNDWATER RESULTS
AUGUST 1989 SAMPLING EVENT

FORMER MOSS-AMERICAN SITE
SAUGET, ILLINOIS

Monitoring Well	Concentration (mg/L)									
	Benzene	Ethylbenzene	Toluene	Xylene (Total)	Pentachlorophenol	Phenol	Cresols	Naphthalene	TNCPAH	TCPAH
Shallow Monitoring Wells										
MAG101	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.051)	ND(0.01)	ND(0.01)	0.301	0.7784	ND(0.010)
MAG103	0.204	0.0714	0.189	0.2307	ND(1.0)	3.340	12.130	24.200	12.07	1.224
MAG108	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.054)	ND(0.011)	ND(0.011)	ND(0.011)	0.002J	ND(0.011)
MAG110	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.052)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Intermediate-Depth Monitoring Wells										
MAG201	0.241	0.0667	0.109	0.1042	ND(0.053)	ND(0.011)	0.207	6.200	0.2876	ND(0.011)
MAG203	0.778	0.124	0.353	0.3469	ND(5.2)	2.690	29.180	19.100	2.150	ND(1.000)
MAG208	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.052)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG209	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.050)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG210	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.052)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
Deep Monitoring Wells										
MAG401	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG403	0.0150	0.173	0.11	0.4132	ND(0.500)	ND(0.100)	ND(0.100)	21.300	4.217	0.350
MAG408	ND(0.001)	ND(0.001)	0.0015	ND(0.003)	ND(0.051)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)	ND(0.010)
MAG409	0.00475	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.053)	ND(0.011)	ND(0.011)	ND(0.011)	0.0374	ND(0.011)
MAG410	ND(0.001)	ND(0.001)	ND(0.001)	ND(0.003)	ND(0.053)	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)	ND(0.011)

Reference: 1. Former Moss-American Site Remedial Investigation Report, Sauget, Illinois, April 1990.

.. Not Analyzed.
TCPAH Total carcinogenic PAH.
mg/L Milligrams per liter.
J Estimated value below method detection limit.
TNCPAH Total noncarcinogenic PAH.
ND Not detected at the detection limit shown in parentheses.
PAH Polycyclic aromatic hydrocarbon.