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Remedial Activities at Uncontrolled Hazardous Waste Sites in Region V

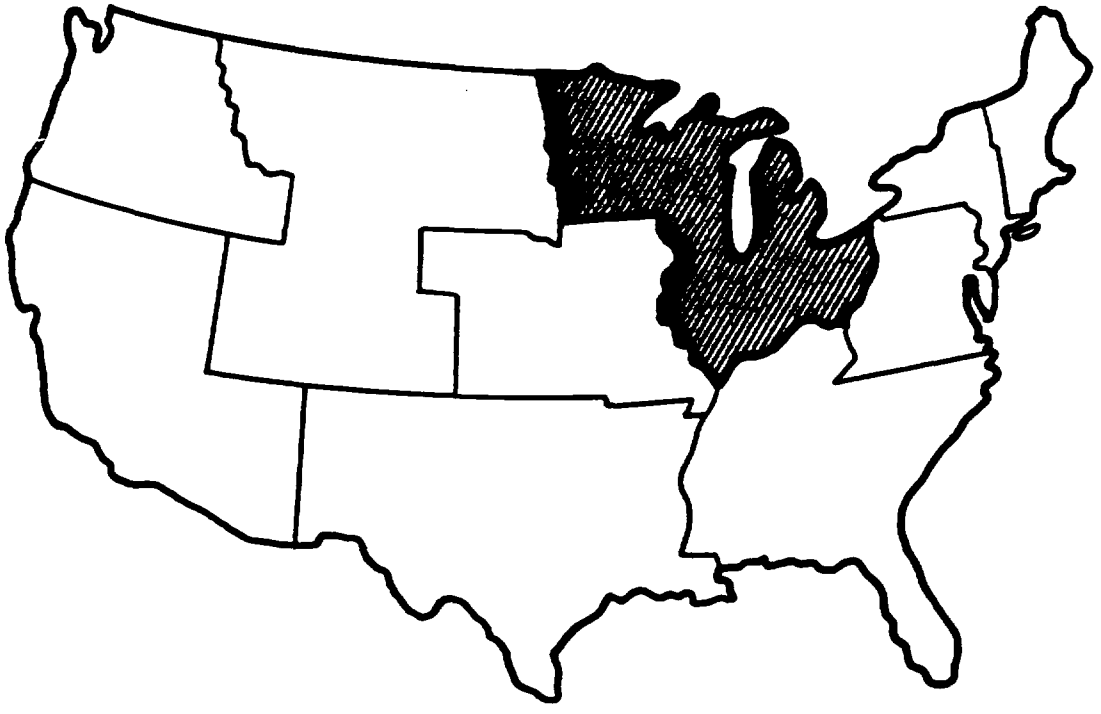
EPA United States Environmental Protection Agency

REMEDIAL INVESTIGATION REPORT
Volume 2

MOSS-AMERICAN SITE
Milwaukee, Wisconsin

WA 15-5LM7.0/Contract No. 68-W8-0040

January 9, 1990



CH2M HILL

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GLT595/066.50

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Appendix A
FIELD MAPPING AND SURVEYING OF THE LITTLE MENOMONEE RIVER

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FIELD MAPPING AND SURVEYING OF THE LITTLE MENOMONEE RIVER

INTRODUCTION

This appendix describes conditions observed during the field mapping of sediment along the Little Menomonee River at and downstream of the Moss-American site (Figure A-1). Data gathered during this field effort were evaluated along with previous information to determine locations suitable for sampling.

OBJECTIVES

The field mapping and surveying task consisted of both river mapping and site mapping. River mapping and surveying were performed before actual sampling so that current information could be used to determine sediment sample locations and also to refine data quality objectives for remaining Remedial Investigation (RI) activities.

PROCEDURES

RECONNAISSANCE

Preliminary reconnaissance of the Little Menomonee River was performed from 500 feet upstream of the site to the confluence with the Menomonee River on November 30 through December 2, 1987. The length of the river was measured with a 100-foot tape; flags were used to mark 300-foot intervals. Downstream lengths were measured from a zero point set halfway between the two railroad bridges that cross the Little Menomonee River north of the site and south of Brown Deer Road. The zero point corresponds to river mile 5.84 (SEWRPC 1986). Soils and bank sediments were uncovered or stirred with a shovel for visual inspection. An HNu was used for preliminary analysis of volatile organic compounds in soils and sediments. All observations were logged and plotted on 1 inch = 400 feet aerial photos taken in 1985 obtained from the Southeastern Wisconsin Regional Planning Commission. These observations are summarized and included in Attachment A-1.

General features of channel width and depth, channel and bank alignment, areas of deposition and erosion, vegetation, log jams, and evidence of dredging were noted as the distance downstream was measured. Discharge points to the river were noted (Table A-1). The information collected was used to describe variations in stream channel configuration and to delineate stream segments.

CHANNEL PROFILES

Based on the results of the stream characterization, 28 typical sections were profiled on December 3 and 4, 1987. The profiles were taken at 1,200-foot intervals using a boat, a 100-foot measuring tape, and a wooden pole marked with 1/4-foot increments. Depth of water was measured at five locations along each profile: 1 to 3 feet from the west bank, at the 1/4, 1/2, and 3/4 points, and 1 to 3 feet from the east bank. Side banks higher than 1 foot above the water surface were noted in the field book. General characteristics of bottom sediments were also recorded.

DATA LIMITATIONS

HNu readings were unstable because of high humidity on the days of river reconnaissance and surveying. On the first day, approximately 8,500 feet downstream of the zero point, use of the HNu was abandoned because of the heavy snowfall. From that point to the confluence with the Menomonee River, no HNu readings were taken.

Dredgings and sediment were sampled at 300-foot intervals on the west bank of the Little Menomonee River. The samples examined were shallow because of the method of excavation.

A surveying error was made between West Silver Spring Drive and State Highway 100 while measuring the length of the Little Menomonee River. A 200-foot length was recorded as being 300 feet.

Channel and inlet depths and widths apply only to the dates and times for which the field data were collected. Variations in volume and depth of flow were clearly visible during the 2 days that channel sections were profiled. Grates draining road runoff directly into the river through bridge structures were not recorded in the field notes.

The release of oily residues from west bank sediments during reconnaissance was erratic. Therefore, a sampler walking to the same locations may not immediately find the same condition, even in areas where significant oily residue was recorded by the survey team.

RESULTS

The results of the river reconnaissance and surveying are shown on the maps in Attachment A-1.

The average width of the Little Menomonee River in the sections profiled is approximately 20 feet; the average depth is 2 feet. The Little Menomonee River flows predominantly through a trapezoidal channel of silty clay. The channel runs through both woods and marsh with few variations in channel alignment.

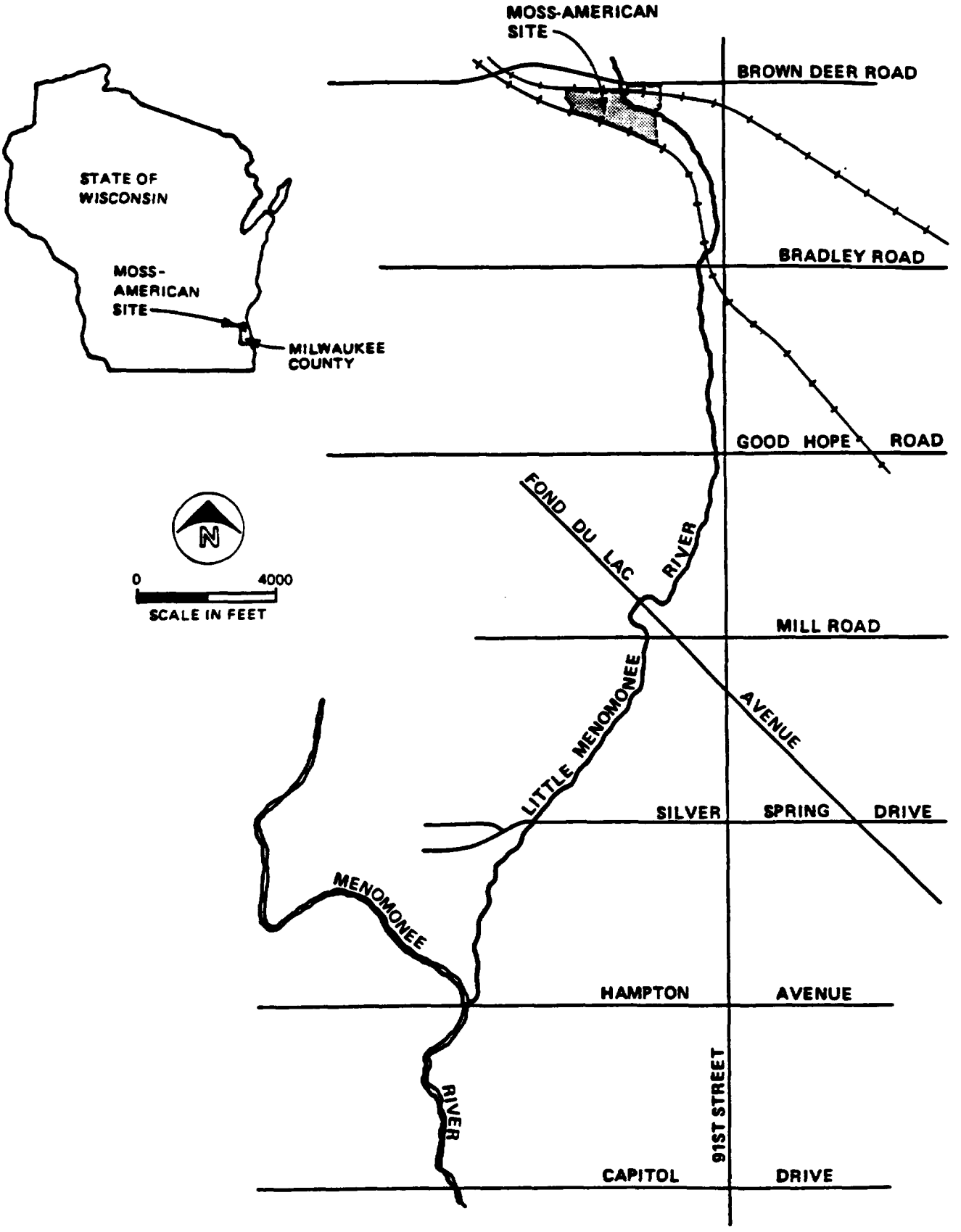


FIGURE A-1
LOCATION MAP
MOSS-AMERICAN RI

Table A-1
INLETS INTO THE LITTLE MENOMONEE RIVER
(12/3/87 and 12/4/87)

Inlet	Width	Depth	Comments
A	4	2	Oil found in inlet sediments.
B	2	0.3	
C	5	2	
D	7	2	
E	13	2	
F	10	1	
G	5	1	
H	4	1	
I	4	0.5	
J	7	0.5	Manmade channel, only shallow flow about 1/2 inch deep in the concrete channel.
K	4	2	
L	4	2	
M	4	1	
N	4	1	
O	15	2	Oil found in inlet sediments.
P	4	1	Only 1/4 inch of flow in culvert itself.
Q	15	1	Backwater.
R	0.3	0.04	
S	3	0.08	
T	2	1	
U	15	2	
V	3	0.25	
W	2	2	
X	4	2	
Y	3	0.2	
Z	2	0.2	
AA	3	1	Oil found in inlet sediments.
AB	10	2	Bluish green water in inlet.
AC	1	1	
AD	0.3	0.02	From culvert 6 to 8 inches in diameter.
AE	wet	wet	From culvert 6 to 8 inches in diameter.
AF	3	0.75	
AG	2	0.2	
AH	3	1	Oil found in inlet sediments.
AI	5	2	From box culvert 8 feet wide, 20 feet from Little Menomonee River.
AJ	2	0.25	Oil found in inlet sediments.
AK	3	1	
AL	7	2	Oil found in inlet sediments. Well developed channel (old bed?).
AM	25	2	Flooded area.
AN	3	1	
AO	4	0.75	Joining of stream west of dredgings.
AP	0.5	1	
AQ	1	0.2	
AR	5	2	
AS	3	2	Culvert about 3/4 submerged.
AT	3	3	Culvert submerged.
AU	1	0.2	
AV	10	3	Coming from 8-foot box culvert.
AW	8	2	
AX	1	0.5	
AY	5	3	Oil found in inlet sediments.
AZ	4	1	
BA	1	0.04	
BB	5	2	
BC	5	0.25	Oily sheen on water.
BD	0.4	0.04	Culvert about 15 inches in diameter.
BE	5	1	
BF	2	0.08	Oily sheen on water.
BG	6	1	

Intermittent meanders are seen south of the Mill Road Bridge to the Lovers Lane bridge. Erosion occurs on the outside of the river curves and deposition occurs on the inside. In the wooded areas of the same stretch, the Little Menomonee River has undercut and toppled large trees rooted in the riverbanks. The river width tends to narrow as it cuts through the sod of the marshy land and as it passes through low wet areas where bushy willows grow into the channel. Slumps occur where the channel banks are steep and composed of clay.

The entire length of the Little Menomonee River has undergone minor channelization for agricultural or other purposes. The dates of those alterations are not known precisely. Major channelization at West Fond du Lac Avenue routes the river through a bridge that passes over both the river and a local road. Dredgings have been deposited over much of the surveyed length of the Little Menomonee River (Attachment A-1). Downstream of the first 3,900 feet, very large trees stand in the dredging piles.

The river occasionally conveys large volumes of water, as indicated by brush and debris caught high on flood plain deposit areas and in trees and bushes adjacent to the channel. No vegetation or wildlife were seen in the channel, although deer, rabbits, mice and birds seem abundant around the river. A muskrat was seen on a flooded part of the flood plain deposit area immediately upstream of the Appleton Avenue bridge, and farther upstream in the woods along the east bank a mink was seen.

At this time, the oily sheens and residues seen during river mapping and surveying are assumed to indicate the presence of creosote. Oily releases from disturbed sediments came almost exclusively from areas of softer sediments. Portions of the stream with a coarse sand and gravel bed yielded no oil when they were stirred.

Oil was released from bottom sediments along the Little Menomonee River from approximately 3,900 feet downstream of the railroad bridge zero point to the confluence with the Menomonee River. Locations where the oily sheens and residue were seen are mapped in Attachment A-1.

CONCLUSIONS

Information gathered during initial river survey activities suggests intermittent creosote contamination in the Little Menomonee River from 3,900 feet downstream of the river mapping zero point to the confluence with the Menomonee River. No contamination was detected either visually or with an HNu for the first 3,900 feet of the river survey, corresponding closely to the 4,000 feet dredged in 1973 by the U.S. EPA. The data are insufficient, however, to state that no contamination exists in that reach.

Contamination was seen predominantly in softer silty sediments. Only a few locations of harder packed clays had signs of creosote contamination; sand, gravel, and rock exhibited no signs of contamination.

Surface runoff is a potential contamination hazard for the Moss-American site. Exposing soils containing creosote to erosion facilitates their transport to the sediments of the Little Menomonee River. River flooding is a concern in that soils inundated with flood water may potentially carry creosote residues and compounds with them as they recede. Site investigation and remedial activities should minimize transport and erosion of sediment materials.

RECOMMENDATIONS

SAMPLE SELECTION

As part of the sediment sampling program, samples will be taken at intervals of approximately 300 feet (see Attachment A-1). At each surveyed cross section, about every 1,200 feet, samples should be taken at several depths and locations across the section. Dredging piles, flood plain deposit areas, and certain inlets will also be sampled. Extractable organics (EO) concentrations will be measured on approximately 265 samples; approximately 60 samples will be sent for GC/FID analysis.

Specific sampling locations will be tailored in the field to best determine the extent of creosote contamination of the Little Menomonee River. The sampling guidelines described here are an outline that will be refined in the field. Visual inspection of samples and initial EO results can help direct subsequent sampling. Most river sampling will focus on sediment depositional areas; that is, at pools and inside curves. Samples will be taken from portions of the river where the deepest sediment deposits can be determined with a probe, particularly for sections where only one sample will be taken. Natural processes of sedimentation are expected to have provided a shallow covering of clean deposits over the sediments of interest.

Sediments will be sampled at either of two intervals. A shallow sample will be taken from a sediment depth of 0 to 1 foot and a deep sample will be taken from a depth of 1 to 2 feet. If sediments appear visually to be contaminated at 2 feet, sampling should extend deeper. If EO screening shows that contamination consistently exists in only the top 4 to 6 inches of sediment, the usefulness of deeper samples should be reevaluated. Deep samples that consistently show no contamination through EO screening should be reassigned to a shallower depth interval or extended horizontally to sample a wider area.

SAMPLE LOCATIONS

Samples will be collected at about 300-foot intervals along the Little Menomonee River from the site to the confluence with the Menomonee River. Cross section sampling locations will be determined, in part, by the EO concentrations and will be more or less evenly distributed along the river. Specific cross sections will be located at the locations of highest EO concentrations when possible.

Since the history of the dredging piles is unknown, they will be spot sampled to see if they contain creosote. Samples will also be taken from other land features and flood plain deposit areas along the Little Menomonee River. Soil samples will be selected from a 2- to 3-foot-deep core. The selection of samples will be based upon representative appearance or a combination of HNu response and visual judgment of contamination.

The inlets to be sampled were selected on the basis of their size or contamination detected within the inlet. Samples will be taken in the Little Menomonee River before and after the inlet, as well as from the inlet itself, in locations most likely to collect sediment. Sampling may include any combination of the three locations, depending upon the characteristics of the inlet. Samples taken near the inlet will be approximately 10 feet from the inlet itself whenever possible. Samples taken in the inlet will be taken within 100 feet of the Little Menomonee River. Approximately 33 inlet samples will be collected.

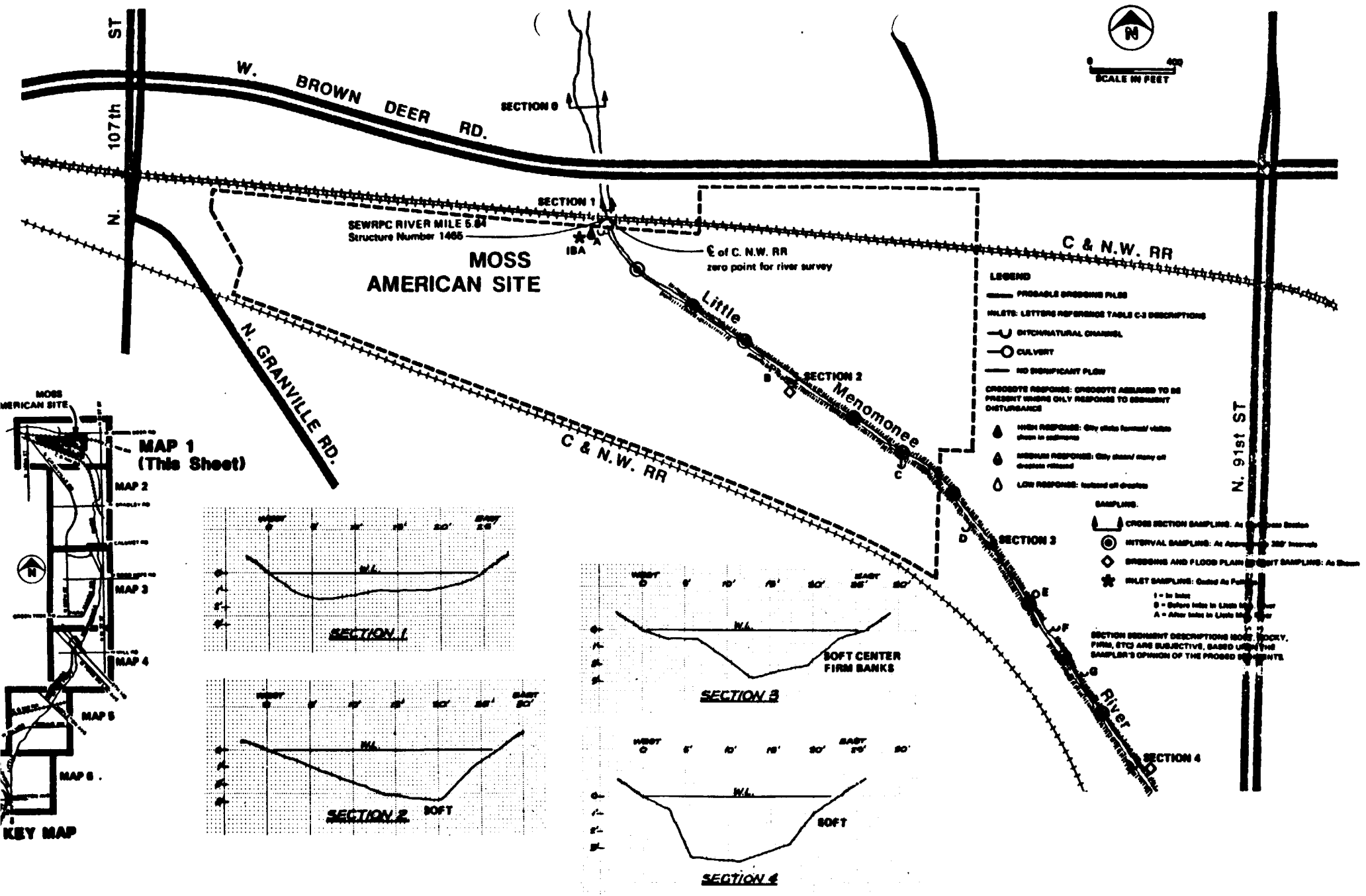
REFERENCES

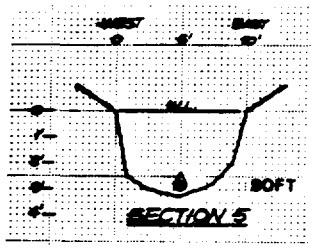
Envirex. *Demonstration of Removal and Treatment of Contaminated River Bottom Muds--Phase II.* Environmental Sciences Division, Envirex, Inc., EPA contract 68-03-0182.

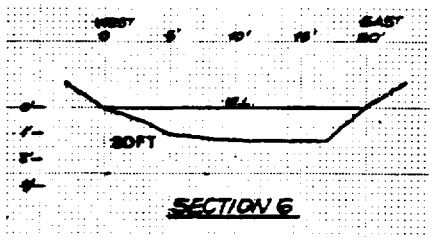
SEWRPC (Southeastern Wisconsin Regional Planning Commission). *A Comprehensive Plan for the Menomonee River Watershed.* Volumes I and II, Planning Report No. 26. October 1986.

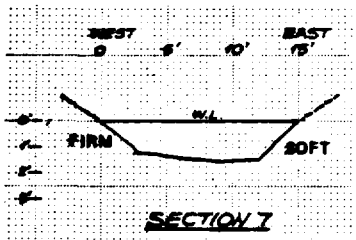
GLT595/054.50

Attachment A-1
LITTLE MENOMONEE RIVER MAPS


W. BROWN DEER RD.
107th ST
N.
SECTION 8
SCALE IN FEET
SECTION 1
SEWRPC RIVER MILE 5.84
Structure Number 1465
ISA
℄ of C. N.W. RR
zero point for river survey
MOSS
AMERICAN SITE
C & N.W. RR
N. GRANVILLE RD.
Little Menomonee River
SECTION 2
SECTION 3
SECTION 4
N. 91st ST
LEGEND
PROBABLE DREDGING PILES
INLETS: LETTERS REFERENCE TABLE C-3 DESCRIPTIONS
DITCH/NATURAL CHANNEL
CULVERT
NO SIGNIFICANT FLOW
CREOSOTE RESPONSE: CREOSOTE ASSUMED TO BE PRESENT WHERE ONLY RESPONSE TO SEDIMENT DISTURBANCE
HIGH RESPONSE:
MEDIUM RESPONSE:
LOW RESPONSE:
SAMPLING:
CROSS SECTION SAMPLING:
INTERVAL SAMPLING:
DREDGING AND FLOOD PLAIN
INLET SAMPLING:
I = In Inlet
B = Before Inlet in Little
A = After Inlet in Little
SECTION SEDIMENT DESCRIPTIONS (SOFT, ROCKY, FIRM, ETC) ARE SUBJECTIVE, BASED UPON THE SAMPLER'S OPINION OF THE PROBED SEDIMENTS
MOSS AMERICAN SITE
MAP 1 (This Sheet)
MAP 2
MAP 3
MAP 4
MAP 5
MAP 6
KEY MAP
W.L.
SECTION 1
SECTION 2
SOFT
SECTION 3
SOFT CENTER
FIRM BANKS
SECTION 4
SOFT







LEGEND

PROBABLE DREDGING PILES

INLETS: LETTERS REFERENCE TABLE 0-5 DESCRIPTIONS

DITCH/NATURAL CHANNEL

CULVERT

NO SIGNIFICANT FLOW

CREOSOTE RESPONSE: CREOSOTE ASSUMED TO BE PRESENT WHERE ONLY RESPONSE TO SEDIMENT DISTURBANCE

HIGH RESPONSE: Oily sheen formed/ visible sheen in sediments

MEDIUM RESPONSE: Oily sheen/ many oil droplets released

LOW RESPONSE: Isolated oil droplets

SAMPLING:

CROSS SECTION SAMPLING: At Each Cross Section

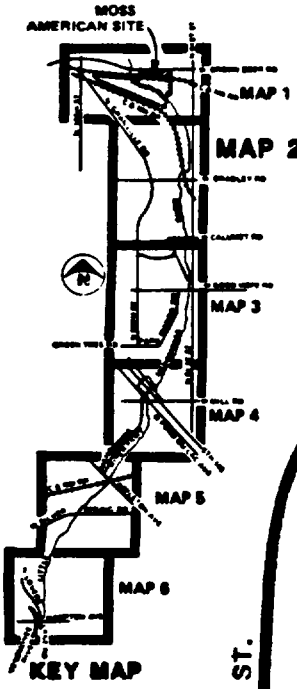
INTERVAL SAMPLING: At Approximate 200' Intervals

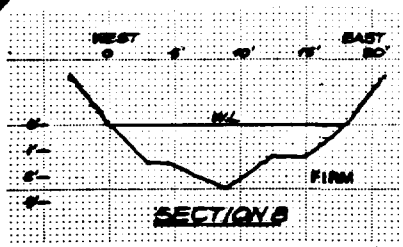
DREDGING AND FLOOD PLAIN DEPOSIT SAMPLING: As Shown

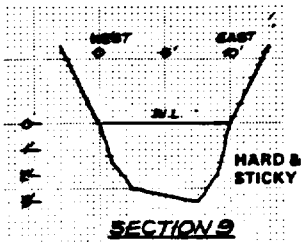
INLET SAMPLING: Coded As Follows

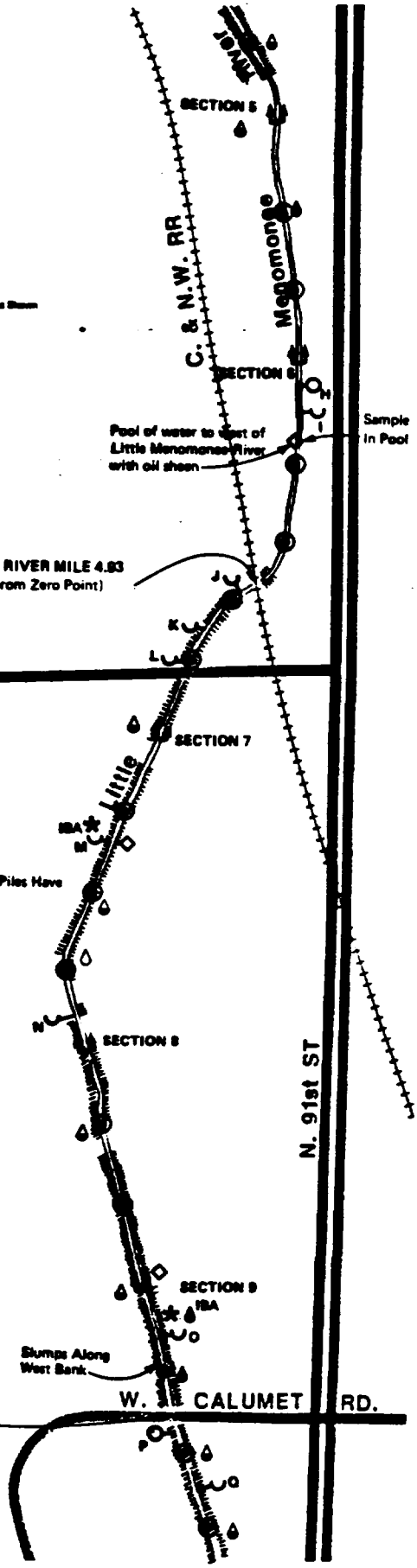
I = In Inlet
B = Before Inlet in Little Men. River
A = After Inlet in Little Men. River

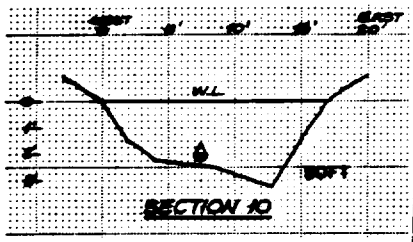
SECTION SEDIMENT DESCRIPTIONS SOFT, ROCKY, FIRM, ETC) ARE SUBJECTIVE, BASED UPON THE SAMPLER'S OPINION OF THE DREDGED SEDIMENTS.

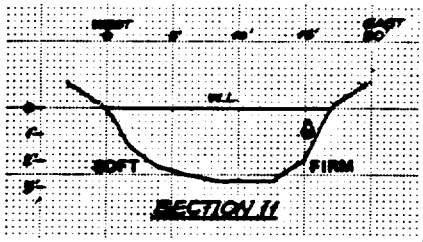


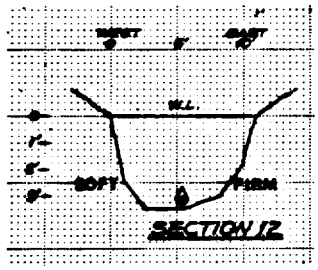







W.L.
SOFT
SECTION 10


W.L.
SOFT
FIRM
SECTION 11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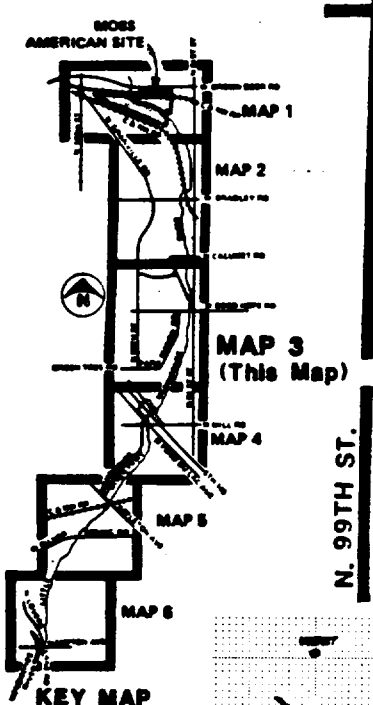
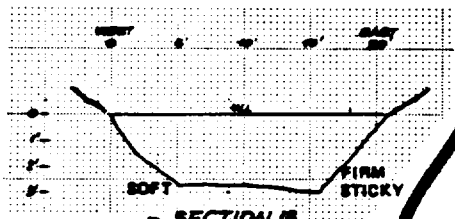
SOFT
FIRM
SECTION 12


MOSES AMERICAN SITE
MAP 1
MAP 2
MAP 3 (This Map)
MAP 4
MAP 5
MAP 6
KEY MAP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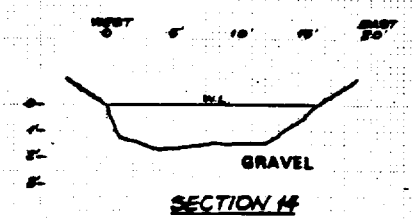
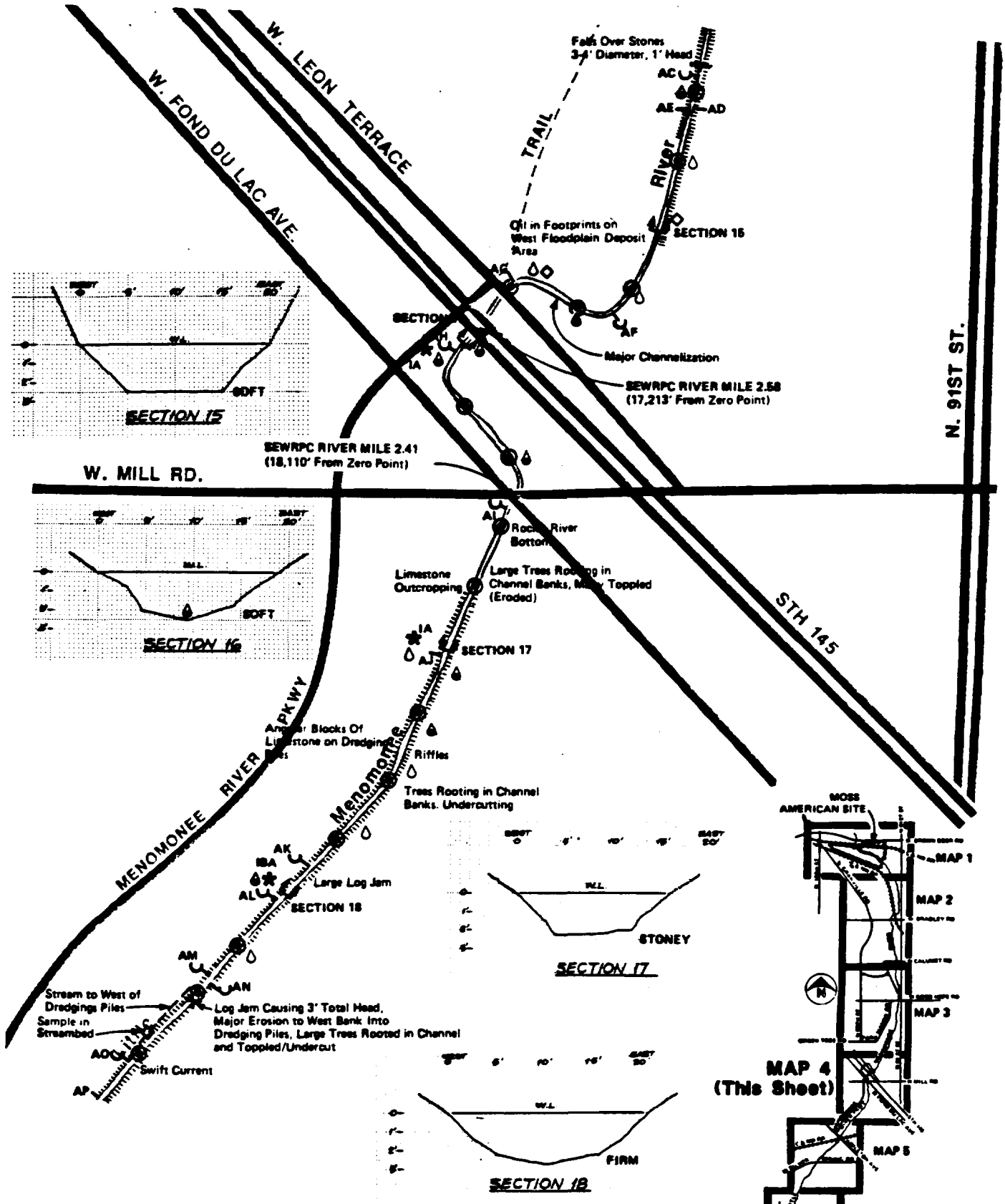
SOFT
FIRM STICKY
SECTION 15


W.L.
GRAVEL
SECTION 14

SCALE IN FEET
W. EVERTS ST.
N. GRANVILLE RD.
W. GOOD HOPE RD.
N. 99TH ST.
GREEN TREE RD.
MANOR DR
PARK
TRAIL
Little
SECTION 10
SECTION 11
SECTION 12
SECTION 13
SECTION 14
SECTION 15
Very Close to Private Property Along West Bank - Did Not Survey
SEWRPC RIVER MILE 3.62 (11,722' From Zero Point)
SEWRPC RIVER MILE 3.33 (13,253' From Zero Point)
Slumps Along West Bank
Water Flowing Over Floodplain Area
Overturned Tree
Oil in Footprints Along West Floodplain Deposit Area
Ponding
Larger Stones in Dredging Piles
Log Jam 1' of Head
Large Mounds of Dirt
Sample On Mounds Of Dirt
Slumps Along West Bank
Bluish-Green Water


W. LEON TERRACE
W. FOND DU LAC AVE.
N. 91ST ST.
STH 145
W. MILL RD.
MENOMONEE RIVER PKWY
Menomonee River
TRAIL
River
Falls Over Stones 3-4' Diameter, 1' Head
AC
AE
AD
Oil in Footprints on West Floodplain Deposit Area
SECTION 15
AF
AG
SECTION 16
Major Channelization
SEWRPC RIVER MILE 2.58 (17,213' From Zero Point)
SEWRPC RIVER MILE 2.41 (18,110' From Zero Point)
AL
Rocky River Bottom
Limestone Outcropping
Large Trees Rooting in Channel Banks, Many Toppled (Eroded)
SECTION 17
Angular Blocks Of Limestone on Dredgings
Riffles
Trees Rooting in Channel Banks, Undercutting
AK
Large Log Jam
SECTION 18
AM
AN
Stream to West of Dredgings Piles
Sample in Streambed
Log Jam Causing 3' Total Head, Major Erosion to West Bank into Dredging Piles, Large Trees Rooted in Channel and Toppled/Undercut
AO
Swift Current
AP
SECTION 15
80FT
SECTION 16
80FT
STONEY
SECTION 17
FIRM
SECTION 18
MOSES AMERICAN SITE
MAP 1
MAP 2
MAP 3
MAP 4 (This Sheet)
MAP 5
MAP 6
KEY MAP
LEGEND
PROBABLE DREDGING PILES
INLETS: LETTERS REFERENCE TABLE C-3 DESCRIPTIONS
DITCH/NATURAL CHANNEL
CULVERT
NO SIGNIFICANT FLOW
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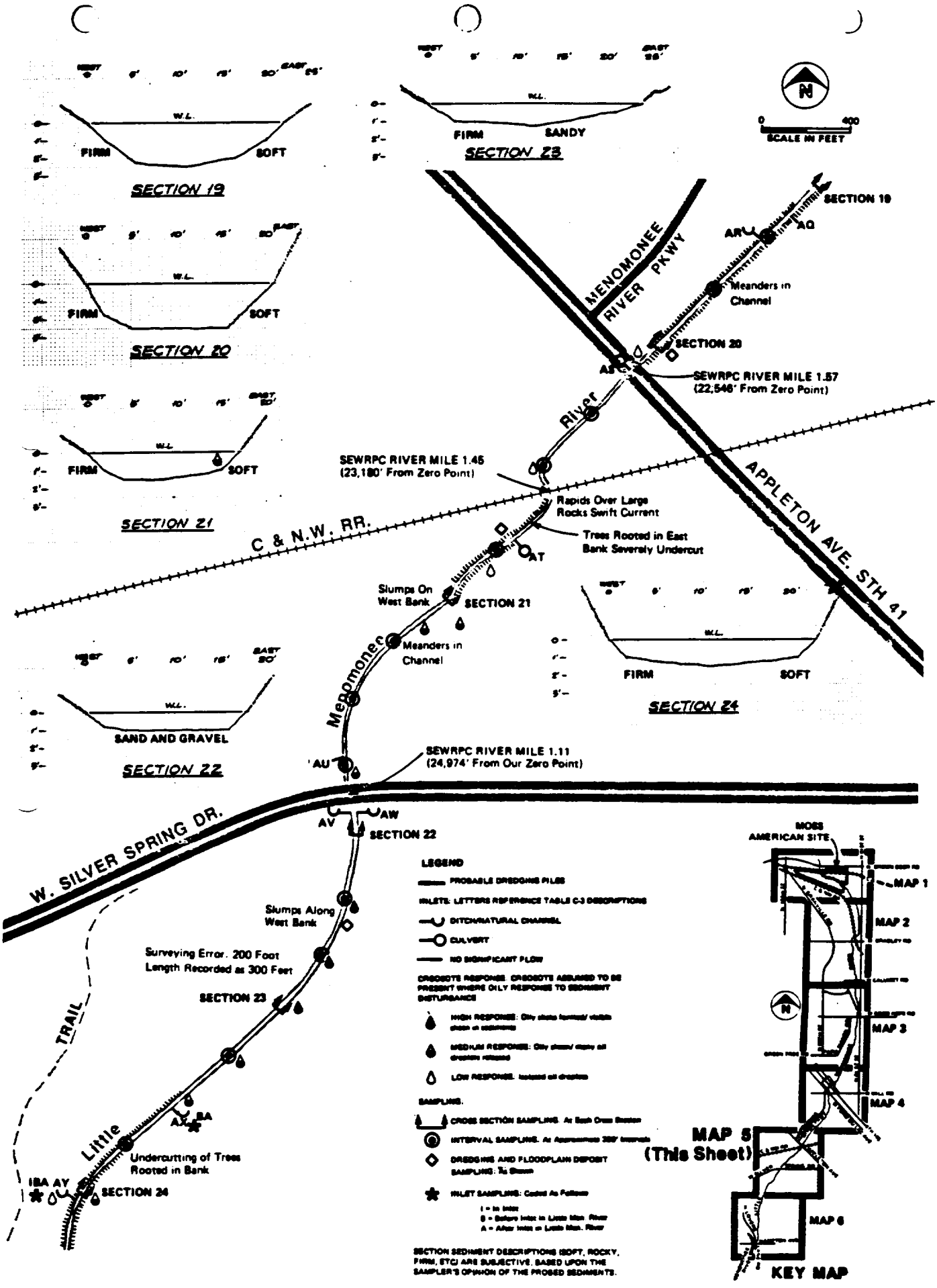
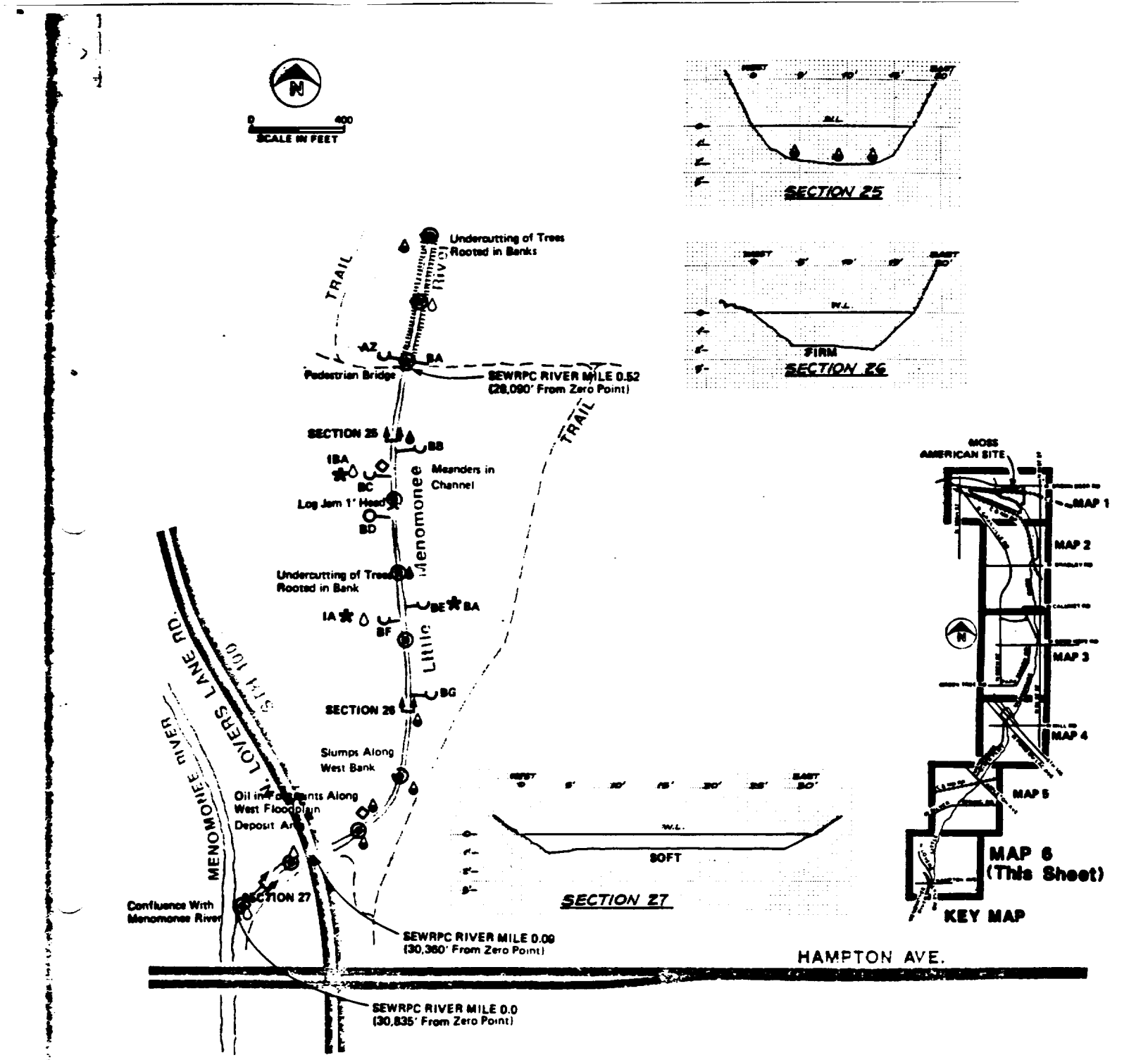
N
0
400
SCALE IN FEET


SECTION 19
FIRM
SOFT
SECTION 20
FIRM
SOFT
SECTION 21
FIRM
SOFT
SECTION 22
SAND AND GRAVEL
SECTION 23
FIRM
SANDY
SECTION 24
SCALE IN FEET
MENOMONEE RIVER PKWY
APPLETON AVE. STH 41
C & N.W. RR.
W. SILVER SPRING DR.
TRAIL
Little Menomonee River
SEWRPC RIVER MILE 1.57
(22,546' From Zero Point)
SEWRPC RIVER MILE 1.45
(23,180' From Zero Point)
SEWRPC RIVER MILE 1.11
(24,974' From Our Zero Point)
Meanders in Channel
Rapids Over Large Rocks Swift Current
Trees Rooted in East Bank Severely Undercut
Slumps On West Bank
Slumps Along West Bank
Surveying Error. 200 Foot Length Recorded as 300 Feet
Undercutting of Trees Rooted in Bank
LEGEND
PROBABLE DREDGING FILES
INLETS: LETTERS REFERENCE TABLE C-3 DESCRIPTIONS
DITCH/NATURAL CHANNEL
CULVERT
NO SIGNIFICANT FLOW
CREOSOTE RESPONSE. CREOSOTE ASSUMED TO BE PRESENT WHERE OILY RESPONSE TO SEDIMENT DISTURBANCE
HIGH RESPONSE: Oily sheen formed/ visible sheen on exposure
MEDIUM RESPONSE: Oily sheen/ slight oil droplets released
LOW RESPONSE: Isolated oil droplets
SAMPLING:
CROSS SECTION SAMPLING: At Each Cross Section
INTERVAL SAMPLING: At Approximately 200' Intervals
DREDGING AND FLOODPLAIN DEPOSIT SAMPLING: As Shown
INLET SAMPLING: Coded As Follows
I = In Inlet
B = Before Inlet in Little Men. River
A = After Inlet in Little Men. River
SECTION SEDIMENT DESCRIPTIONS (SOFT, ROCKY, FIRM, ETC.) ARE SUBJECTIVE, BASED UPON THE SAMPLER'S OPINION OF THE PROBED SEDIMENTS.
MOSS AMERICAN SITE
MAP 1
MAP 2
MAP 3
MAP 4
MAP 5
(This Sheet)
MAP 6
KEY MAP



LEGEND

PROBABLE DREDGING PILES

INLETS LETTERS REFERENCE TABLE C-3 DESCRIPTIONS

DITCH/NATURAL CHANNEL

CULVERT

NO SIGNIFICANT FLOW

CREOSOTE RESPONSE CREOSOTE ASSUMED TO BE PRESENT WHERE OILY RESPONSE TO SEDIMENT DISTURBANCE

HIGH RESPONSE Oily sheen formed/ visible sheen on sediments

MEDIUM RESPONSE Oily sheen/ slight oil droplets released

LOW RESPONSE Isolated oil droplets

SAMPLING

CROSS SECTION SAMPLING At Each Cross Section

INTERVAL SAMPLING At Approximate 300' Intervals

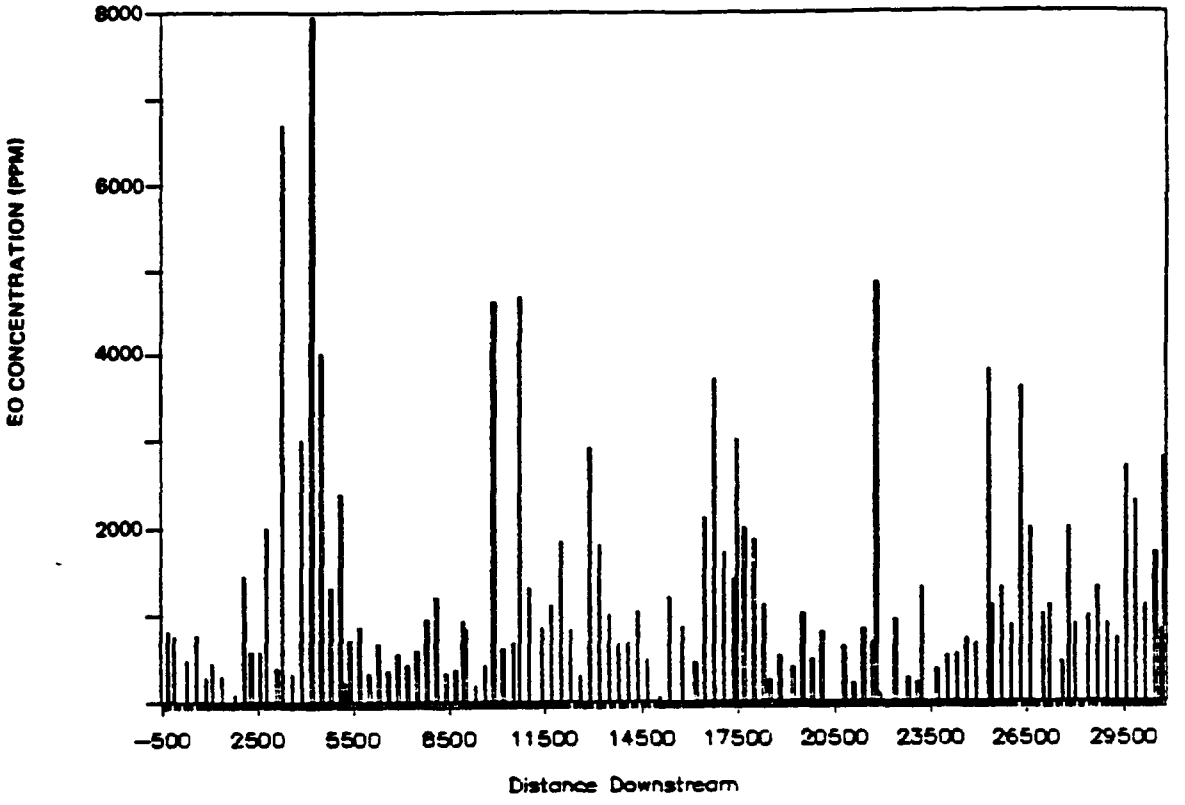
DREDGING AND FLOODPLAIN DEPOSIT SAMPLING As Shown

INLET SAMPLING Coded As Follows

I = In Inlet
B = Before Inlet in Little Men. River
A = After Inlet in Little Men. River

SECTION SEDIMENT DESCRIPTIONS (SOFT, ROCKY, FIRM, ETC) ARE SUBJECTIVE, BASED UPON THE SAMPLER'S OPINION OF THE PROBED SEDIMENTS.

Appendix B
SEDIMENT SAMPLING



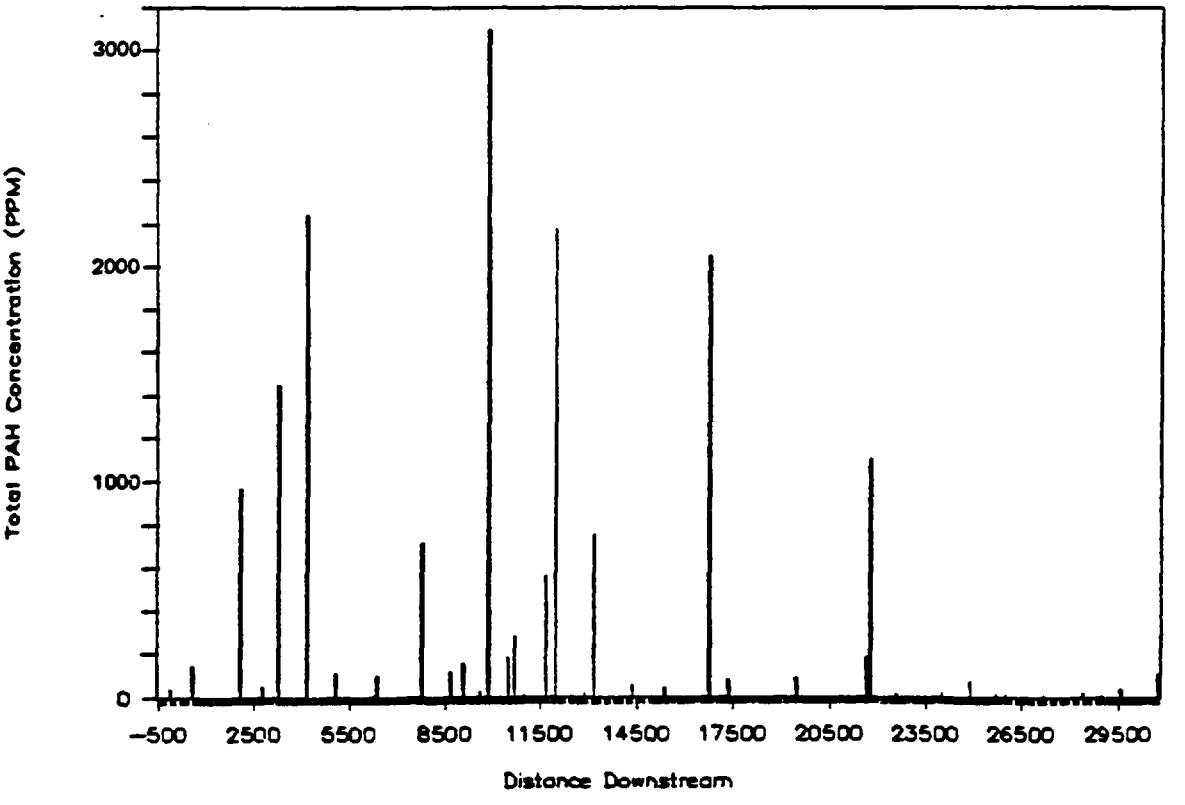


FIGURE B-1
DISTRIBUTION OF EXTRACTABLE ORGANIC (EO) AND TOTAL PAH CONCENTRATIONS ALONG THE LITTLE MENOMONEE RIVER
MOSS-AMERICAN RI

Appendix B
SEDIMENT SAMPLING

INTRODUCTION

This appendix describes the sediment screening and sampling performed at the Moss-American site. Objectives, tasks, results, and observations are presented for:

Task S1--Initial Sediment Screening
Task S2--Confirmatory Sediment Sampling

Sediment sampling proceeded as described in the Quality Assurance Project Plan (September 14, 1987) and the Work Plan (July 23, 1987). Field modifications to the Sampling Plan described in the QAPP are noted in the section following each task description.

INITIAL SEDIMENT SCREENING

The data collected during initial sediment screening will be used to define the volume and extent of contamination in the sediments of the Little Menomonee River adjacent to and downstream of the Moss-American site. A total of 261 sediment samples and 30 bank and flood plain samples were collected.

The Little Menomonee River was sampled in three stages from downstream to upstream. Sampling was performed by Solveig Christenson, Stuart Grubb, and Kevin Olson of CH2M HILL from May 4 to May 19. The first stage of sampling consisted of the collection of samples at 300-foot intervals for the length of the river from the confluence with the Menomonee River to the Chicago and Northwestern (C&NW) Railroad bridge from May 4 to 10, 1988 (samples SD001 to SD104). Samples were analyzed throughout the task in the onsite close support laboratory (CSL) to determine the concentration of extractable organic (EO) compounds. Cross-section sampling and inlet sampling were completed in the second stage from May 11 to 18 (samples SD105 to SD261). Flood plain and bank sampling were performed in the final stage of sampling on May 18 and 19 (samples SS1001 to SS1029). Sample locations are shown in the maps in Attachment B-1.

Representative samples were selected and sent to CH2M HILL's Montgomery laboratory for analysis of polynuclear aromatic hydrocarbons (PAHs) and phenolic compounds using capillary gas chromatography with flame ionization detection (GC/FID). This analysis is used to achieve U.S. EPA Level III data quality objectives. The CSL and GC/FID analytical methods are described in the Sampling Plan.

METHODOLOGY

Environmental Protection

Before sampling began, an oil boom was placed across the Little Menomonee River directly upstream of the confluence with the Menomonee River. During reconnaissance, floating oil frequently appeared when sediments were disturbed. The oil boom was used to catch oil that could float into the Menomonee River beyond the study area. It remained in place until sediment screening was completed. Upon completion of Task S1, the boom was removed and placed onsite for reuse during Task S2.

Sampling

Samples were initially gathered with a 2-inch-diameter, 20-inch-long corer lined with a plastic sleeve and stainless steel, bronze, or plastic sediment catcher. After the sample was collected, the plastic tube was removed from the corer, capped, labeled, and transported to the field trailer. The corer was decontaminated and refilled with another decontaminated plastic sleeve and sediment catcher.

Sediment cores were visually inspected and described in the log; samples were stored in 4-ounce jars. The plastic sleeves, caps, and sediment catchers were decontaminated by washing in a detergent solution, washing in potable water, rinsing with a methanol solution, and rinsing with distilled water.

The softer sediments were not always retained by the corer and the corer was not capable of penetrating to depths sufficient for cross-section sampling. Therefore, a 1-inch auger was substituted for the corer at cross section No. 4 and used for all subsequent sediment sampling. Sediment samples collected with the auger were described and bottled at each sample location. The auger was decontaminated between sample locations using the procedure described above.

Sampling at 300-foot Intervals

Sediment samples were taken along the Little Menomonee River from downstream to upstream at approximately 300-foot intervals from the confluence with the Menomonee River to the north edge of the Moss-American site at the C&NW Railroad bridge. The intervals were adjusted for river characteristics as necessary.

Samples were taken from the portion of the river cross section where sediments were the deepest. If water depth or apparent severity of contamination made wading across the section unadvisable, samples were collected from the bank. When the quantity of sediment remaining in the corer after extraction from the riverbed was insufficient for analysis, more sediment was collected from a series of adjacent cuts until sufficient sediment was collected.

Cross Section and Inlet Sampling

Cross Section Sampling. Cross section locations were chosen from 300-foot interval locations having higher concentrations of EO compounds than neighboring intervals. The average distance between cross sections was about 1,400 feet. Cross section locations are shown on the location map in Attachment B-2.

The width of the channel was measured and water depth at the sampling locations was estimated. Samples were taken from the 1/4, 1/2, and 3/4 points across the cross section. Sediment depth was based on the depth to which the auger could penetrate. Samples were collected at 1-foot intervals to a maximum depth of about 3 feet, depending on auger penetration.

Inlet Sampling. All inlets that potentially carry residential, industrial, and roadway drainage were sampled to investigate other possible sources of contamination. Inlets were defined as flows tributary to the Little Menomonee River (culverts, outfalls, streams, and other drainageways). Ideally, all inlet samples were to be taken from outside (above) the Little Menomonee River flood plain; however, that was usually not possible.

Flood Plain and Bank Sampling

Flood plain and bank sample locations were chosen to provide a representative sampling of river banks, the flood plain, and dredging piles. Samples were collected with a shovel or post hole digger. A hole was dug to a depth of 18 to 24 inches, and a sample of the bottom material was collected from the shovel or post hole digger and put into a sample jar. The shovel or post hole digger was decontaminated between each sample.

LABORATORY SCREENING AND ANALYSIS

Sediment samples were analyzed at the CSL to determine the concentration of EO compounds. Sixty samples were selected to represent ranges of EO concentration and to provide an even distribution of samples along the Little Menomonee River for PAHs and phenolic compounds. The selection process was intentionally biased to include a greater number of samples from contaminated areas. The results of the GC/FID analysis (Attachment B-3) were used to validate the EO screening results, to provide concentrations of specific compounds found in creosote, and to provide a further basis for selection of samples for RAS and SAS analysis by CLP laboratories.

FIELD MODIFICATIONS TO THE SAMPLING PLAN

The three sampling subtasks were not performed in the sequence presented in the Sampling Plan. The cross sections were to be sampled first; then 300-foot intervals were to be sampled between cross sections. It was determined upon completion of Task FM, however, that sampling the river at 300-foot intervals from the confluence to the site would more effectively place cross sections.

Therefore, the 300-foot interval sampling was performed before cross section sampling.

The decision was made not to collect HNu headspace readings from the sediment samples because initial sampling indicated no HNu headspace readings even from visually contaminated sediments. No readings above background were obtained at any time during the sediment sampling or from the sample headspace. Headspace measurements using the OVA were misleading because of methane in the samples, so further OVA headspace readings were not taken.

Only one sample was collected in each inlet, eliminating the samples to be taken immediately above and below each inlet and allowing more inlets to be sampled.

RESULTS AND OBSERVATIONS

Locations and Results

A total of 291 samples were collected. Of these, 210 were collected from the Little Menomonee River sediments, 51 from inlets to the river, and 30 from flood plain and bank areas. Twenty-two cross sections were sampled. Sample locations are shown in Attachment B-1. The distribution of EO concentrations at each cross section is shown in Attachment B-2. Attachment B-3 contains the results of the GC/FID Analyses. Results of analysis for EO compounds are tabulated in Attachment B-4. Figure B-1 shows the concentration of extractable organics and total PAHs plotted against the distance downstream in the Little Menomonee River. Results from locations with more than one sample, such as cross sections, were averaged for the graph.

Observations

The Little Menomonee River sediment contamination is best characterized by its erratic distribution along the length of the channel and within the sediments. Pockets of highly contaminated sediment appear to exist side by side with visibly clean sediments. For example, disturbing sediments during sampling may have caused a surface sheen; however, within a few feet there may have been no response from the disturbed sediments.

The data indicate that contaminated sediments are present from the site to the confluence of the Little Menomonee River at the Menomonee River. EO concentrations apparently do not decrease with distance from the site, although concentrations are higher in some areas than in others.

For most of the inlet samples, it was not possible to sample outside the Little Menomonee River flood plain, particularly when the inlet was a culvert. Therefore, the data obtained for the inlets cannot be attributed to the inlet alone. Most of the inlet samples can be expected to contain sediments deposited there by the Little Menomonee River.

Contaminated sediment may be buried below substantial amounts of clean sediment. For example, north of Bradley Road a large quantity of light brown

silt was entering the river. Three inlets in particular, located 600 to 1,100 feet downstream of the site, appeared to be filled with the silt from a new development area. About 680 feet downstream of the site, a culvert had approximately 70 percent of its area clogged with the silt. Downstream cross section samples showed the same silt in layers up to 14 inches over potentially contaminated silty sand and sandy silt sediments.

The qualitative correlation between visual observations and concentrations of EO compounds was good. Generally, sediments with more than 1,000 ppm (0.1 percent) of EO compounds showed visible signs of contamination. The statistical correlation between EO compounds and total PAHs was also significant (see Figure B-2). The value of the correlation coefficient (R) for a log-log comparison of these data is 0.7. At a significance level of 0.05, the EO and total PAH concentrations are linearly dependent; higher EO concentration correspond to higher PAH concentration. Although a correlation appears to exist, the curve on Figure B-2 was not used for predicting PAH concentrations at specific points. The curve is presented for information only.

CONFIRMATORY SEDIMENT SAMPLING

Following the review of data from Task S1, confirmatory samples were collected at 16 sites (see Figure B-3) on June 16 and 17 by Solveig Christenson and John Gannon. Samples were sent to CLP laboratories for detailed analysis. A list cross-referencing the sample numbers for these samples and earlier samples is given in Table B-1.

The sediment sampling results will be used to confirm the results of the GC/FID analyses with legally defensible analytical results that will be used in the endangerment assessment. In addition, an analysis of Target Compound List substances will be done to determine whether other contaminants are present, and treatment parameters will be analyzed to support the feasibility study.

TASK DESCRIPTION

Environmental Protection

Before confirmatory sediment sampling began, the oil boom was again placed across the Little Menomonee River directly upstream of its confluence with the Menomonee River. Upon completion of the task, the boom was placed in a 55-gallon drum and stored onsite.

Sample Locations

Ten samples were collected from areas representative of the most contaminated soils based on GC/FID and EO results. Six background or noncontaminated samples were also collected from along the length of the Little Menomonee River (see Figure B-3).

Table B-1
SAMPLES COLLECTED FOR CLP ANALYSES

CLP Sample Number	Previous Sample at Same Location
SD301-01	SD110-01
SD302-01	SD116-01
SD303-01	SD131-01
SD304-01	SD031-01
SD305-01	SD154-01
SD306-01	SD164-01
SD307-01	SD062-01
SD308-01	SD197-01
SD309-01	SD204-01
SD310-01	SD076-01
SD311-01	SD227-01
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SD313-01	SD234-01
SD314-01	SD236-01
SD315-01	SD244-01
SD316-01	SD255-01

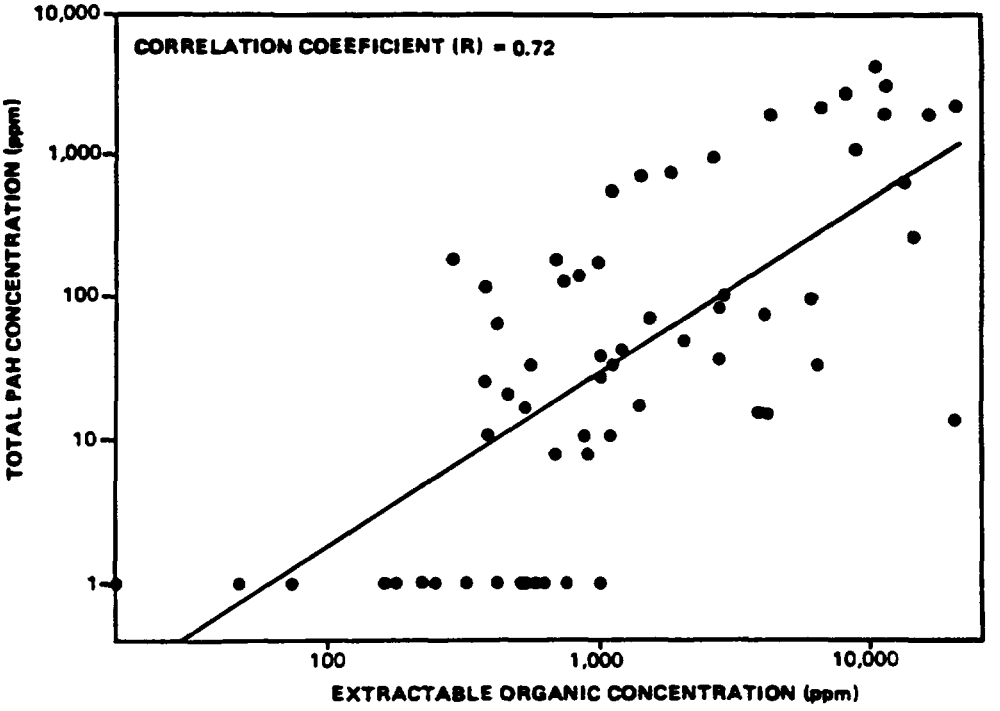


FIGURE B-2
RELATIONSHIP BETWEEN EO AND PAH CONCENTRATIONS
MOSS-AMERICAN RI

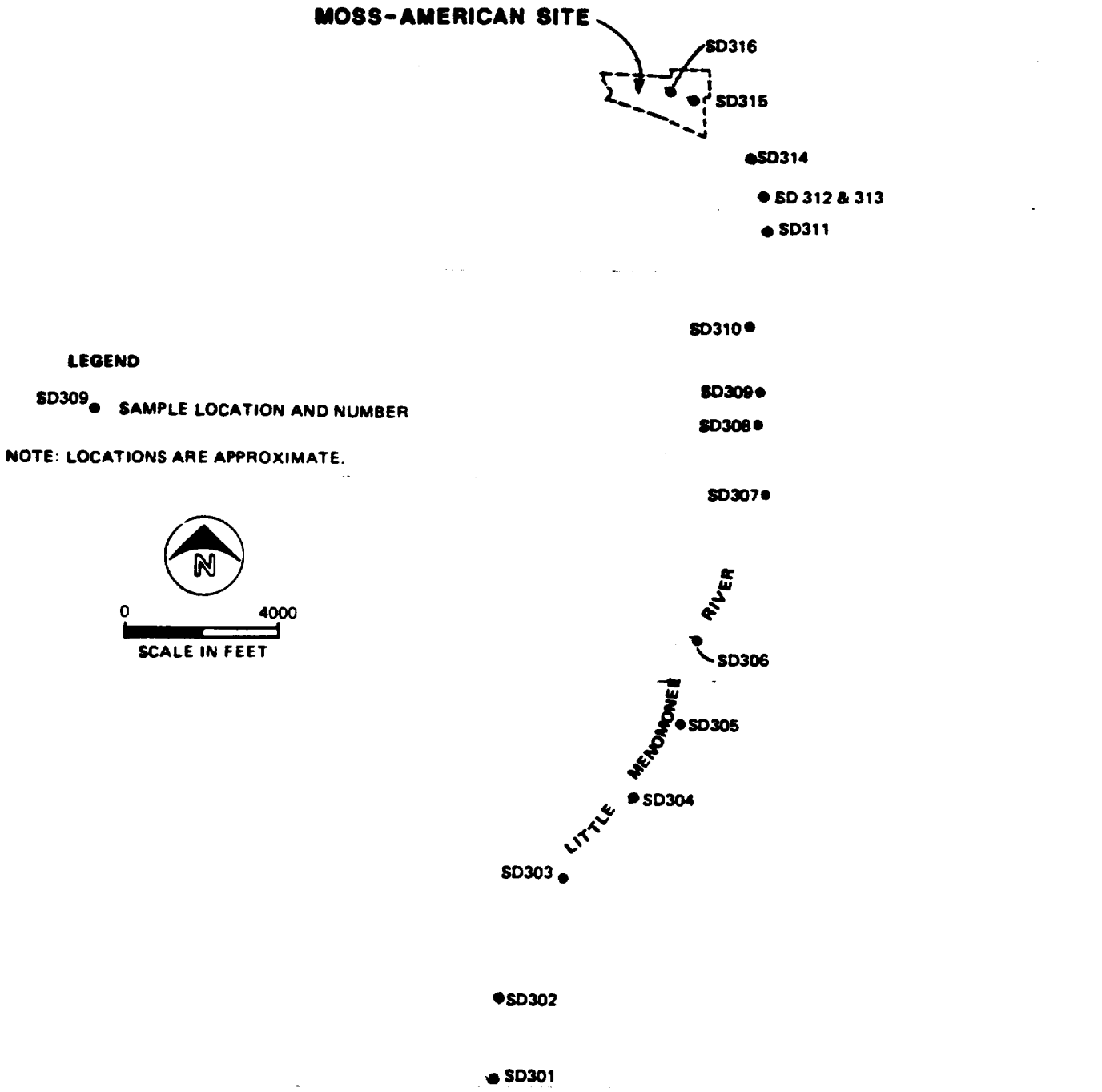


FIGURE B-3
CONFIRMATORY SEDIMENT SAMPLING LOCATIONS (TASK S2)
MOSS-AMERICAN RI

Sample Collection

Samples for this task were taken from the same location as the corresponding EO screening samples taken previously. The sample location within the cross section was measured from the west bank and the sample depth was measured along the auger. For each sample, four 8-ounce jars, one 32-ounce jar, and two 4-ounce VOA vials were filled. Enough sediment was collected by making several adjacent cuts at the specified depth. The sediment was extruded from the auger onto a stainless steel tray and mixed. The jars were then filled using a stainless steel spoon. Implements were decontaminated before the next sample with a detergent wash and freshwater rinse followed by spray rinses of methanol and distilled water.

LABORATORY ANALYSIS

The samples were sent to CLP laboratories for detailed analysis of target compounds and analytes. Additional parameters analyzed to support the feasibility study consisted of carbon, hydrogen, sulfur, oxygen, nitrogen, moisture content, ash content, volatile content, fixed carbon, total organic carbon, water soluble chlorides, heating value, flash point, and pH.

RESULTS AND OBSERVATIONS

Analytical results are not available at this time.

Because of the dry weather during the period between sampling tasks, the Little Menomonee River stage was significantly lower during Task S2 sampling than during previous sampling. Since sample location was keyed to the location of the west bank, the change in water surface elevation may have affected the ability to locate precisely the sampling point to have been replicated from Task S1. Variations in the degree of contamination from S2 and S1 samples may occur because of difficulties in locating the sampling point.

CONCLUSIONS

Based on the observations and results obtained to date, the following conclusions have been reached regarding the sediments in the Little Menomonee River:

- Contaminated sediments are present over the entire length of the river below the Moss-American site.
- Contamination is not evenly distributed along the length of the river, across its width, or with depth.
- No significant decrease in contaminant concentrations was observed at increasing distances from the site.

- Contamination is assumed to have been deposited in the Menomonee River downstream of its confluence with the Little Menomonee River.

Oily sediment is present in varying degrees over the entire length of the Little Menomonee River. At several locations, when sediments were disturbed during sampling, iridescent or silver sheens were produced across the entire width of the river. Visual observations were verified by analytical results. EO concentrations up to approximately 1 percent (by dry weight) were measured in the sediment.

The distribution of contamination varies over the length, width, and depth of the river. Several areas of oily sediments are buried under approximately 1 foot of clean sediment between the site and Bradley Road. Samples with low EO concentrations are interspersed between higher values throughout the river. Contaminated sediments are generally present along the banks and other depositional areas. Where the channel has been scoured, the sediments consist primarily of uncontaminated sands and gravels.

Based on the analytical data, no significant decrease in the level and extent of contamination was observed with distance from the site. Two areas between the site and Bradley Road and in the vicinity of Leon Terrace have higher levels of contamination. A trend in the EO data indicated that a slight decrease in contaminant concentration may occur below Leon Terrace. It should be noted, however, that samples were collected at 300-foot intervals. If samples had been collected at more frequent intervals, these trends may or may not have been substantiated. On the basis of the extent of contamination in the Little Menomonee River, it is reasonable to expect that contamination has been deposited in the Menomonee River.

GLT779/030.50

Attachment B-1
SAMPLING LOCATIONS

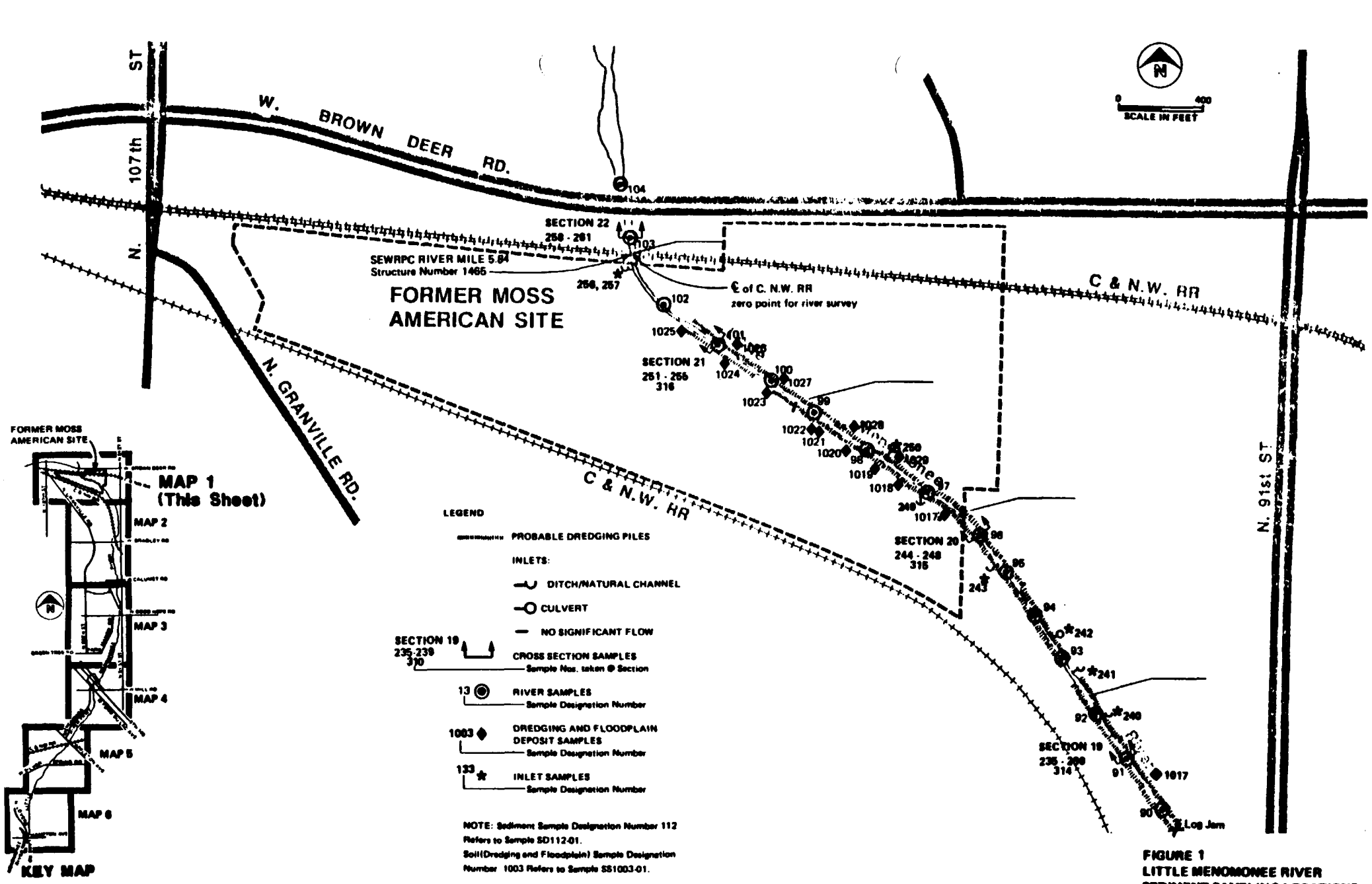


FIGURE 1
LITTLE MENOMONEE RIVER
SEDIMENT SAMPLING LOCATIONS
MAY 4 - 19 AND JUNE 16 - 17, 1988
MOSS-AMERICAN RI

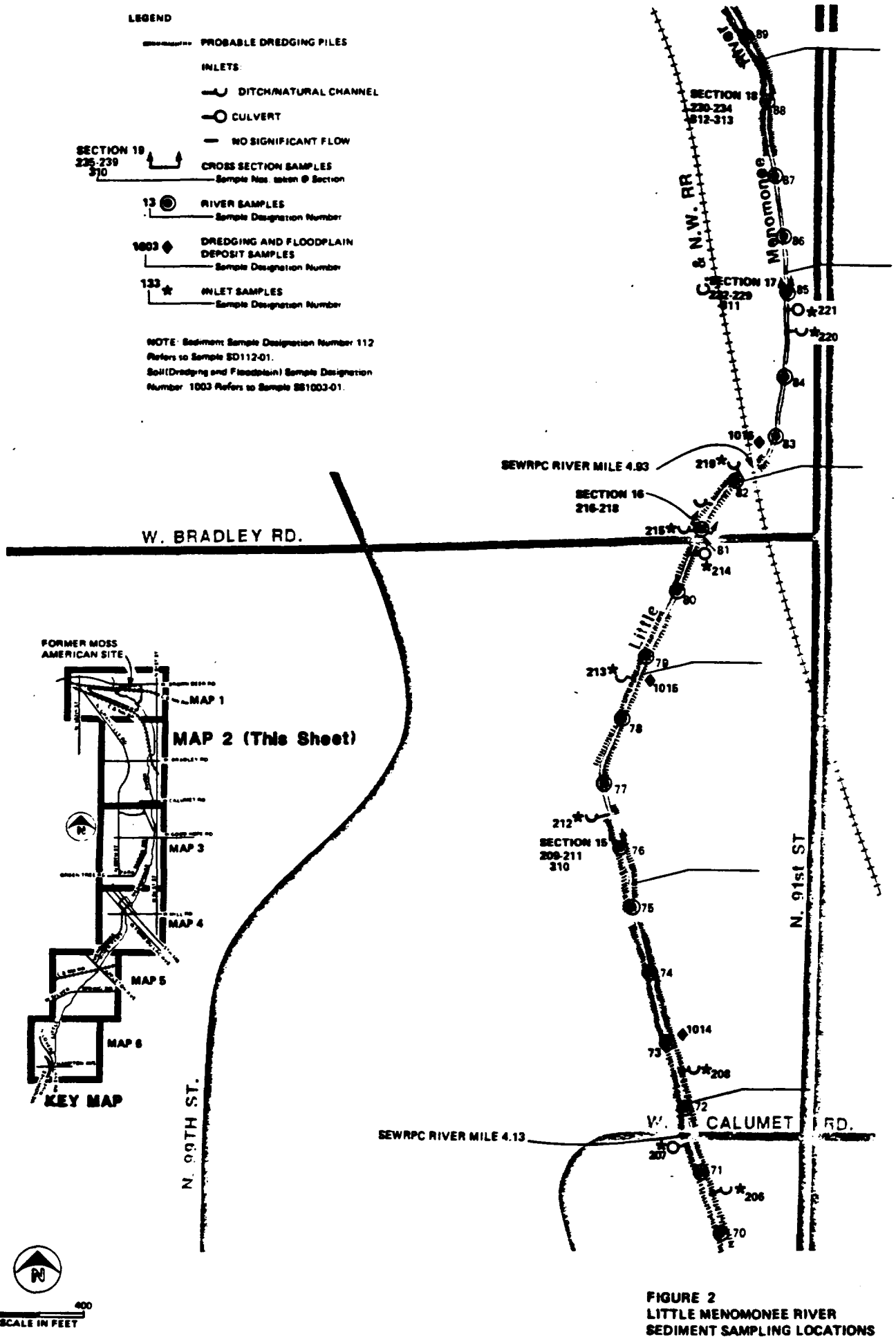


FIGURE 2
LITTLE MENOMONEE RIVER
SEDIMENT SAMPLING LOCATIONS
MAY 4 - 19 AND JUNE 16 - 17, 1988

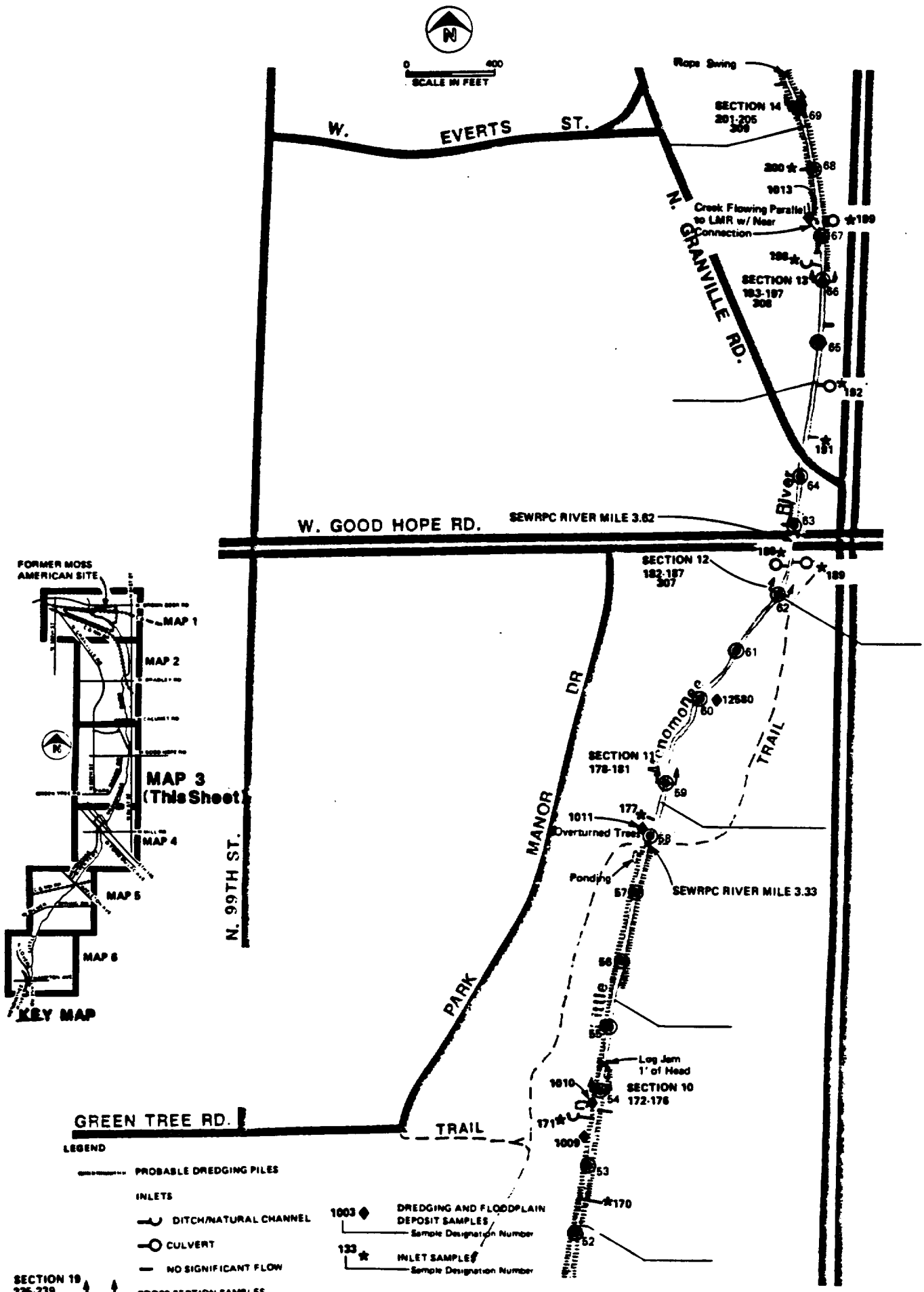


FIGURE 3
LITTLE MENOMONEE RIVER
SEDIMENT SAMPLING LOCATIONS
MAY 4 - 19 AND JUNE 16 - 17, 1988
MOSS-AMERICAN RI

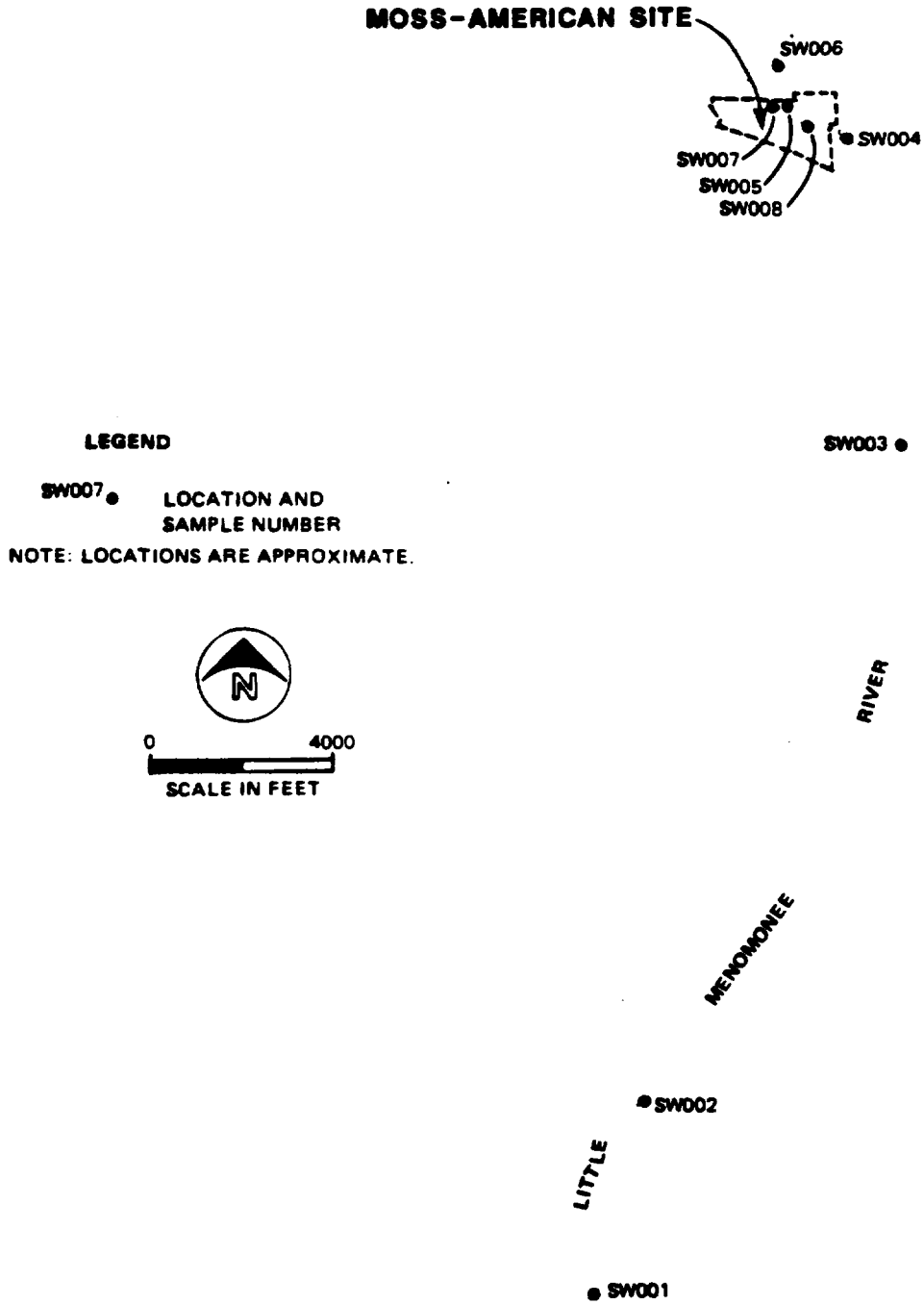
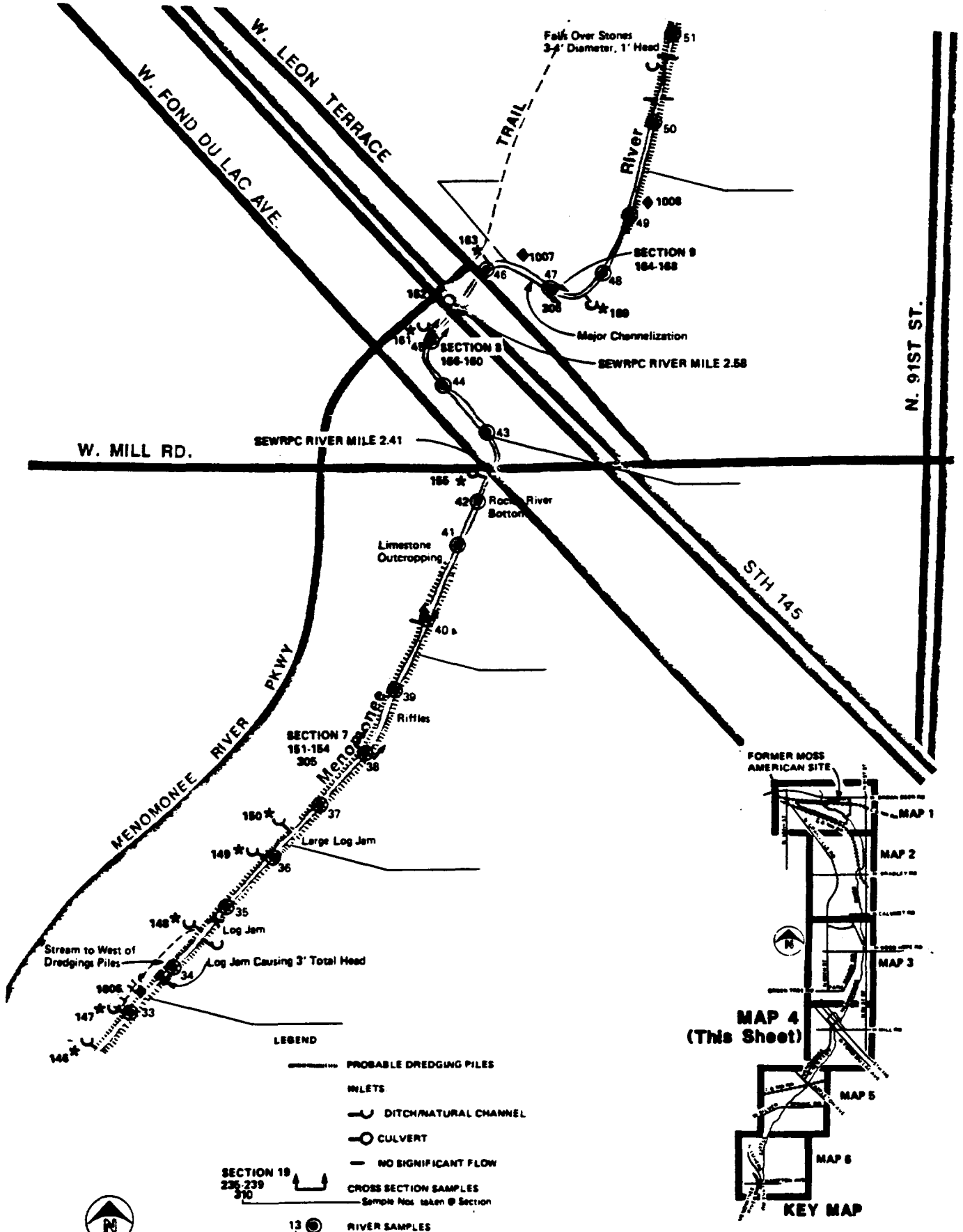


FIGURE C-1
SURFACE WATER SAMPLE LOCATIONS
MOSS-AMERICAN RI



NOTE: Sediment Sample Designation Number 112 Refers to Sample SD112-01. Soil (Dredging and Floodplain) Sample Designation Number 1003 Refers to Sample SS1003-01

FIGURE 4
LITTLE MENOMONEE RIVER SEDIMENT SAMPLING LOCATIONS MAY 4 - 19 AND JUNE 16 - 17, 1988
MOSS-AMERICAN RI

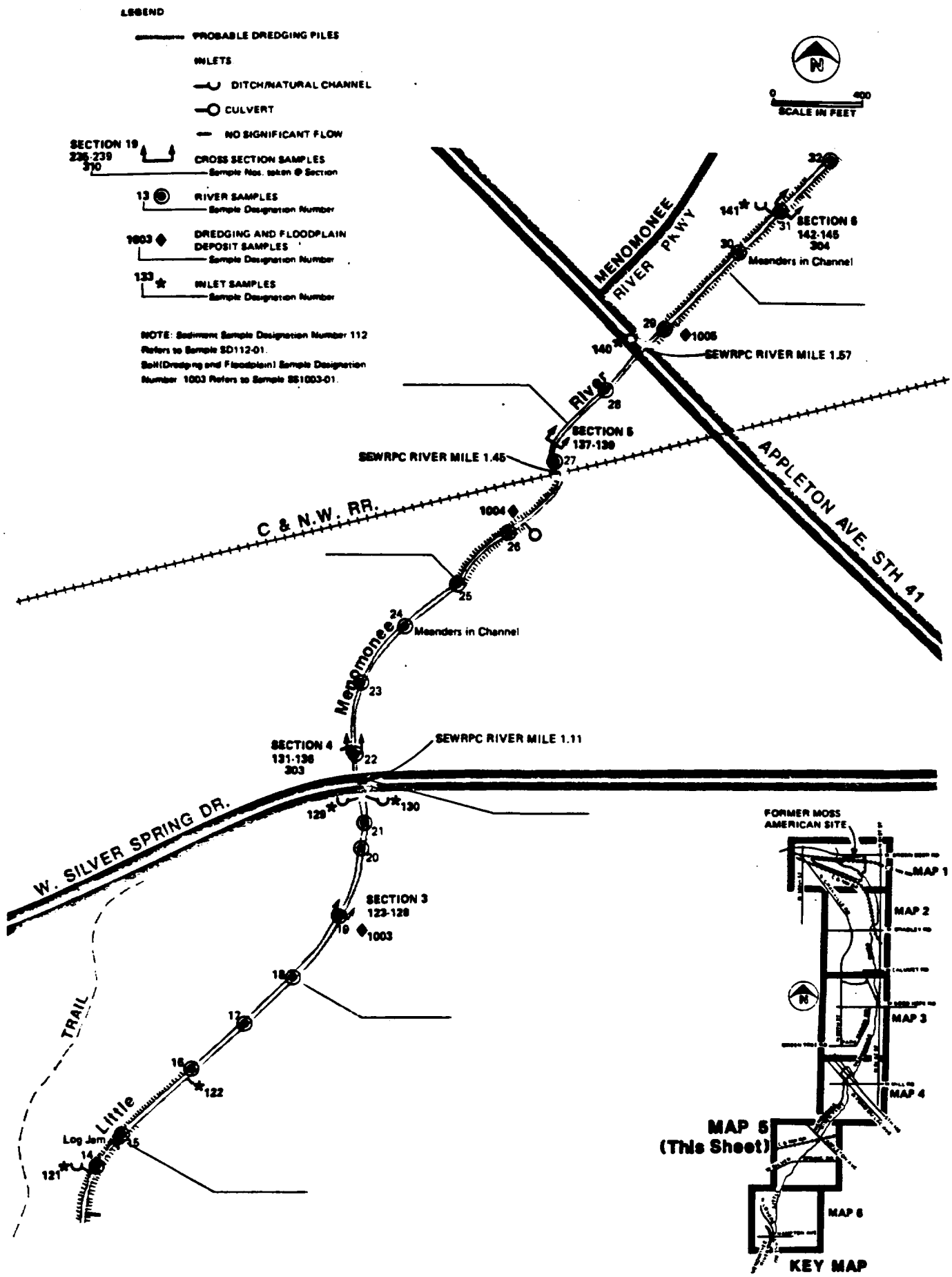
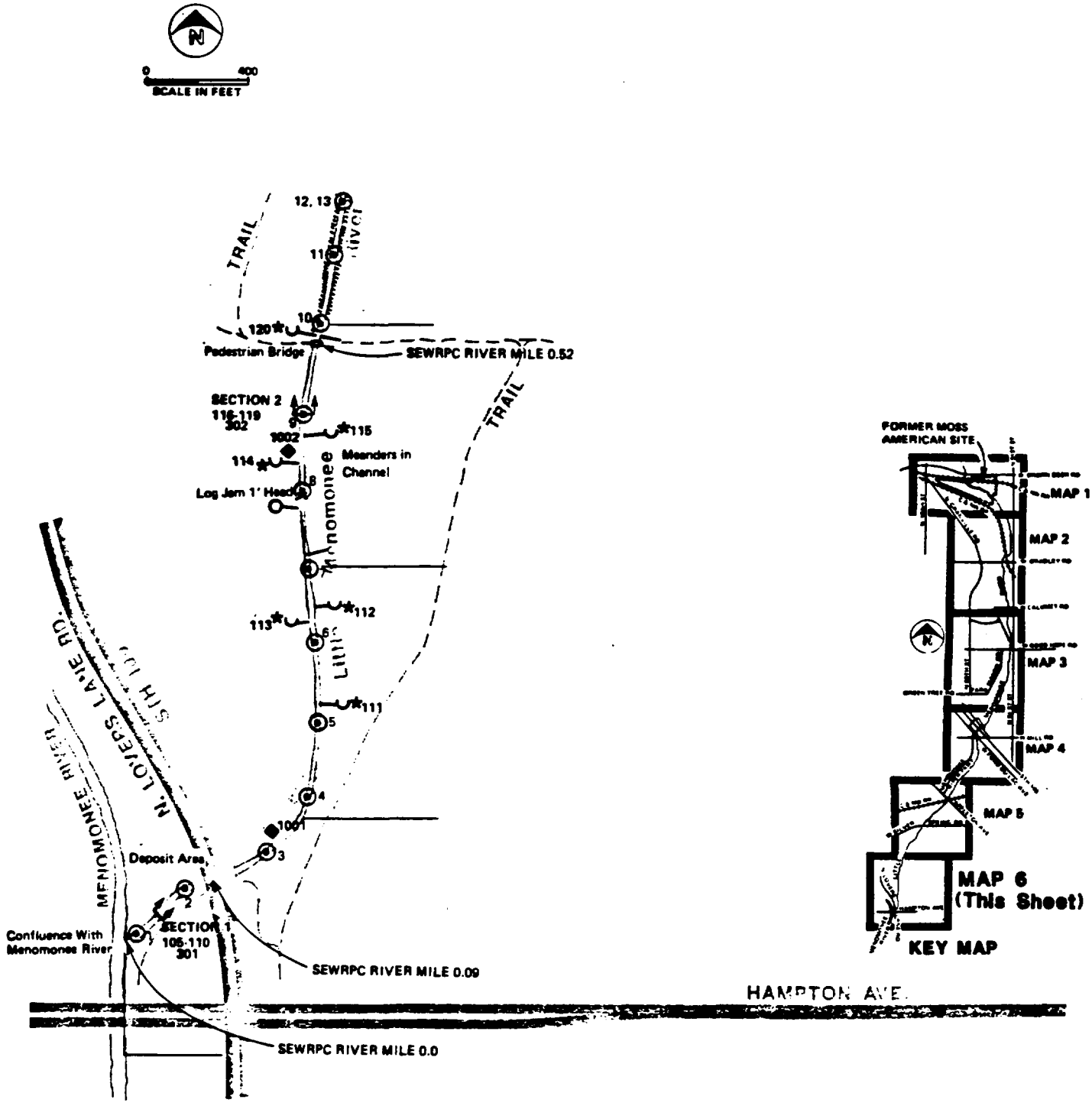


FIGURE 5
LITTLE MENOMONEE RIVER
SEDIMENT SAMPLING LOCATIONS
MAY 4 - 19 AND JUNE 16 - 17, 1988



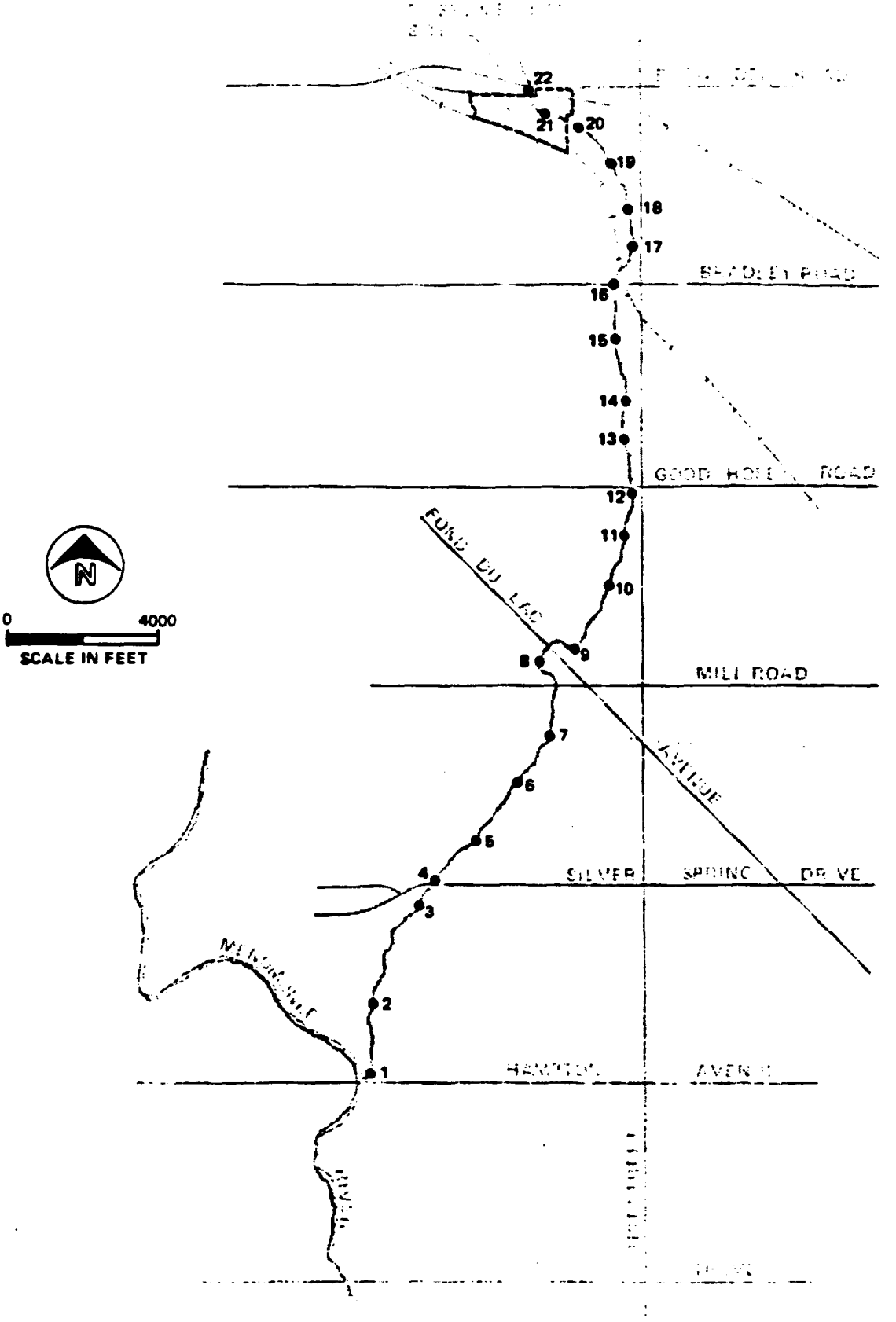
LEGEND

- PROBABLE DREDGING PILES
- INLETS
- DITCH/NATURAL CHANNEL
- CULVERT
- NO SIGNIFICANT FLOW
- SECTION 19, 235-239, 310 — CROSS SECTION SAMPLES — Sample Nos. taken @ Section
- 13 — RIVER SAMPLES — Sample Designation Number
- 1003 — DREDGING AND FLOODPLAIN DEPOSIT SAMPLES — Sample Designation Number
- 133 — INLET SAMPLES — Sample Designation Number

NOTE: Sediment Sample Designation Number 112 Refers to Sample SD112-01. Soil(Dredging and Floodplain) Sample Designation Number 1003 Refers to Sample SS1003-01

FIGURE 6
LITTLE MENOMONEE RIVER
SEDIMENT SAMPLING LOCATIONS
MAY 4 - 19 AND JUNE 16 - 17, 1988
MOSS-AMERICAN RI

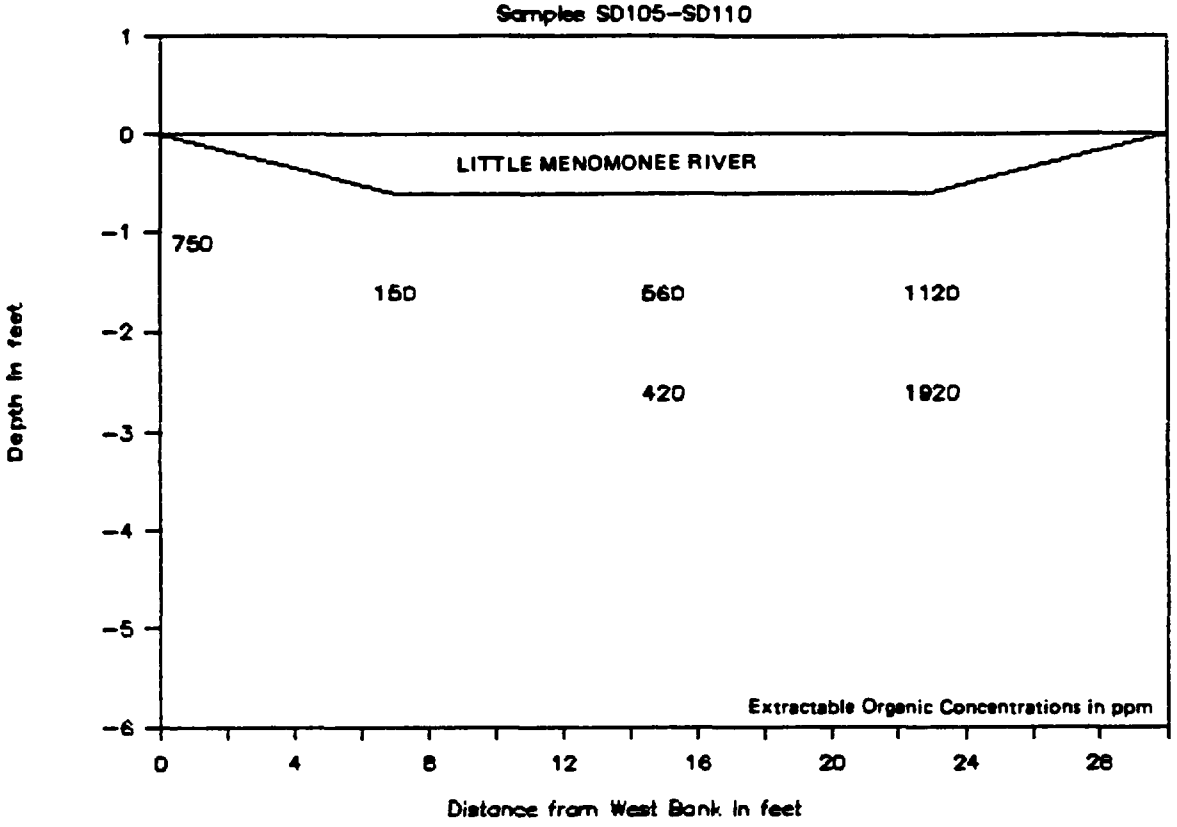
Attachment B-2
RIVER CROSS SECTION EO DATA



RIVER CROSS SECTION LOCATION MAP
MOSS-AMERICAN RI

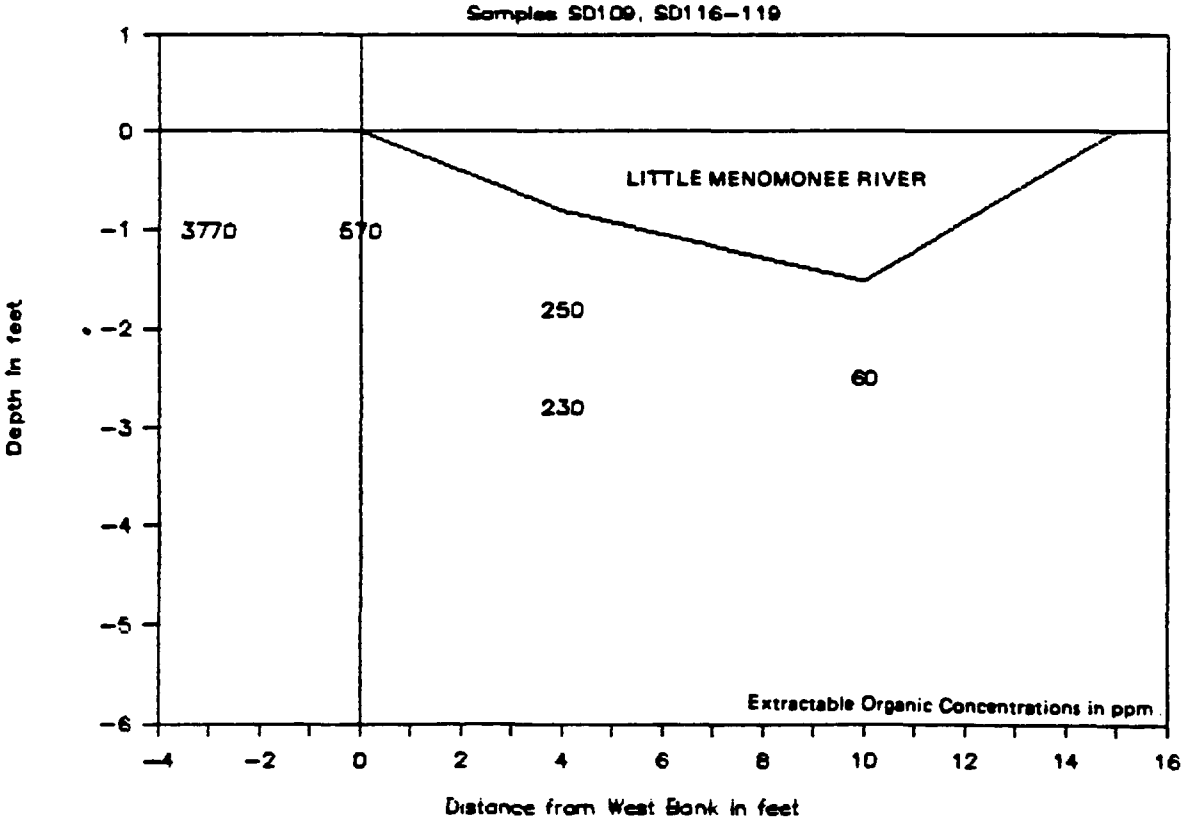
CROSS SECTION 1

Samples SD105–SD110



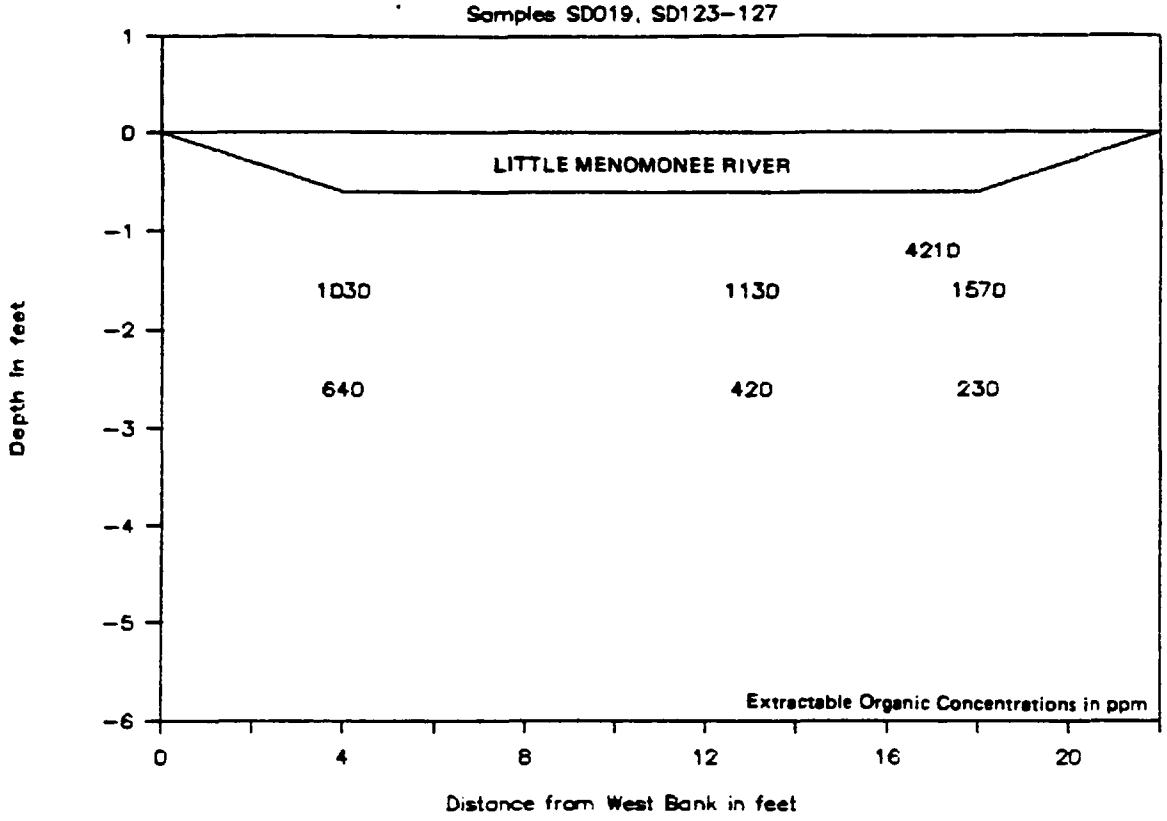
CROSS SECTION 2

Samples SD109, SD116–119



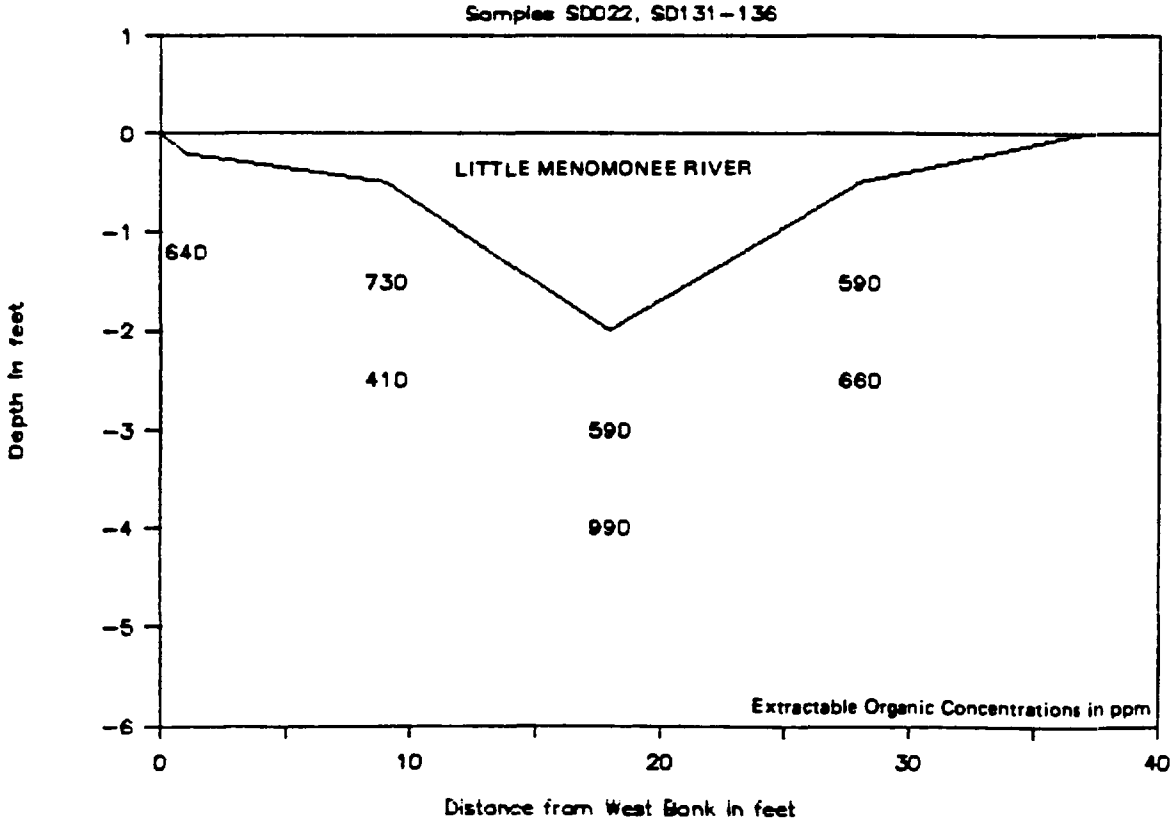
CROSS SECTION 3

Samples SD019, SD123–127



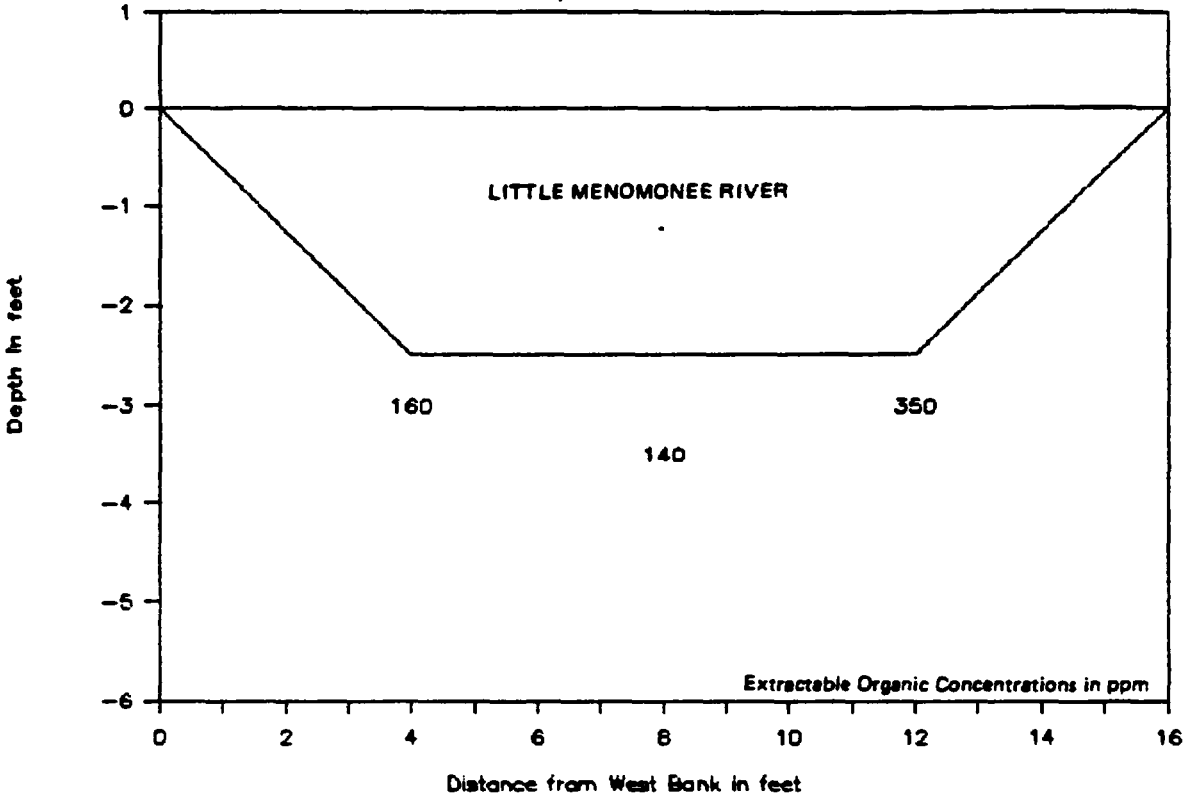
CROSS SECTION 4

Samples SD022, SD131–136



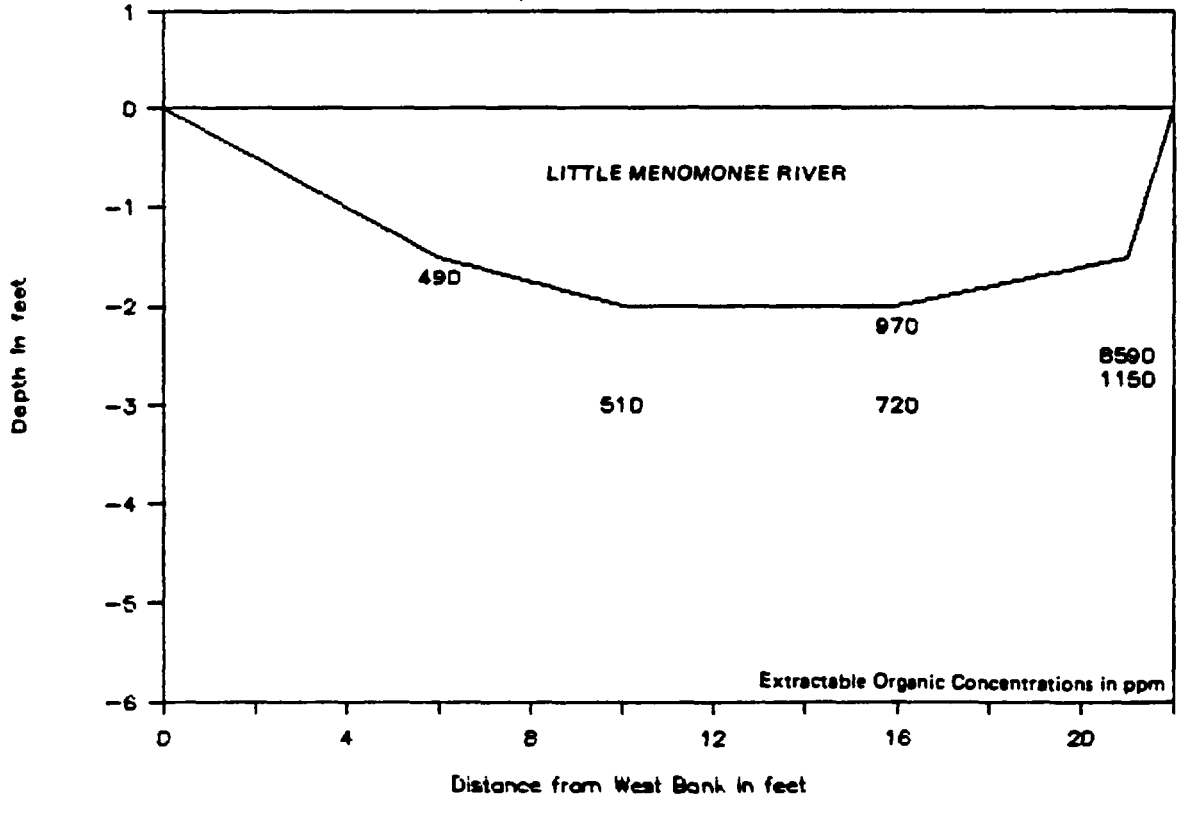
CROSS SECTION 5

Samples SD137–139



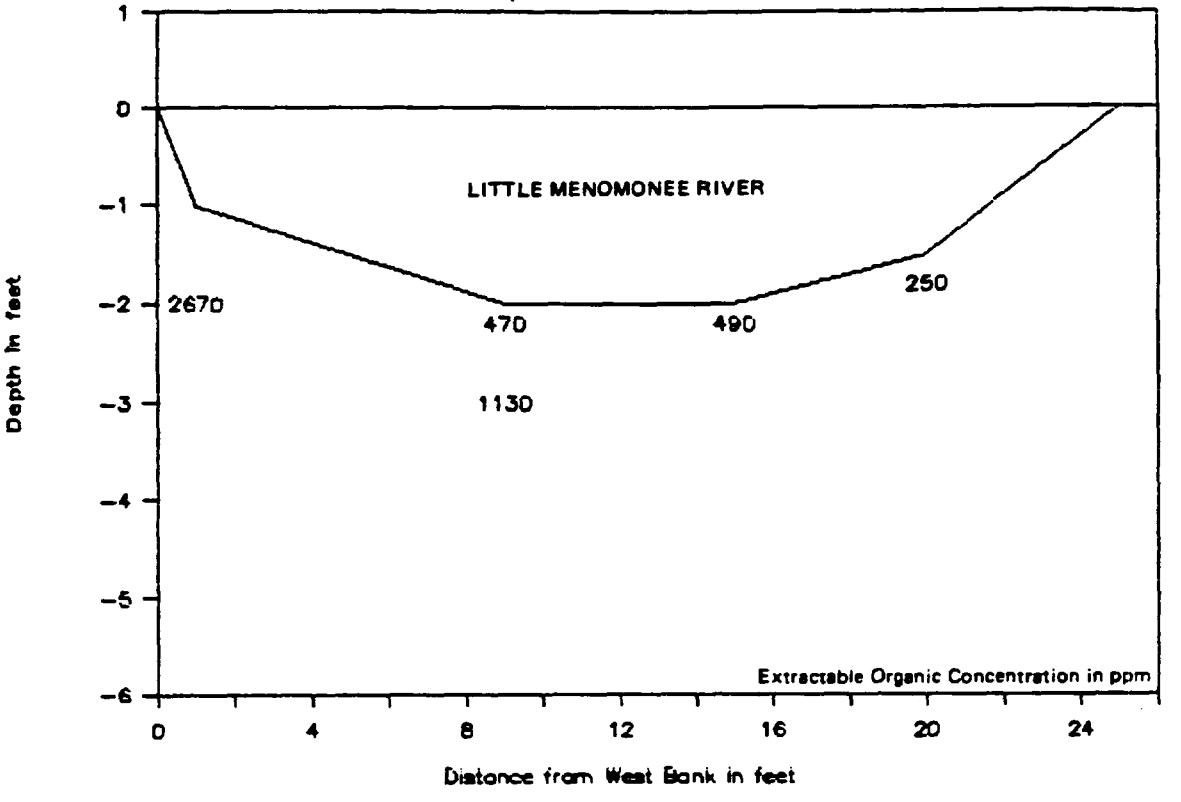
CROSS SECTION 6

Samples SD031, SD142–145



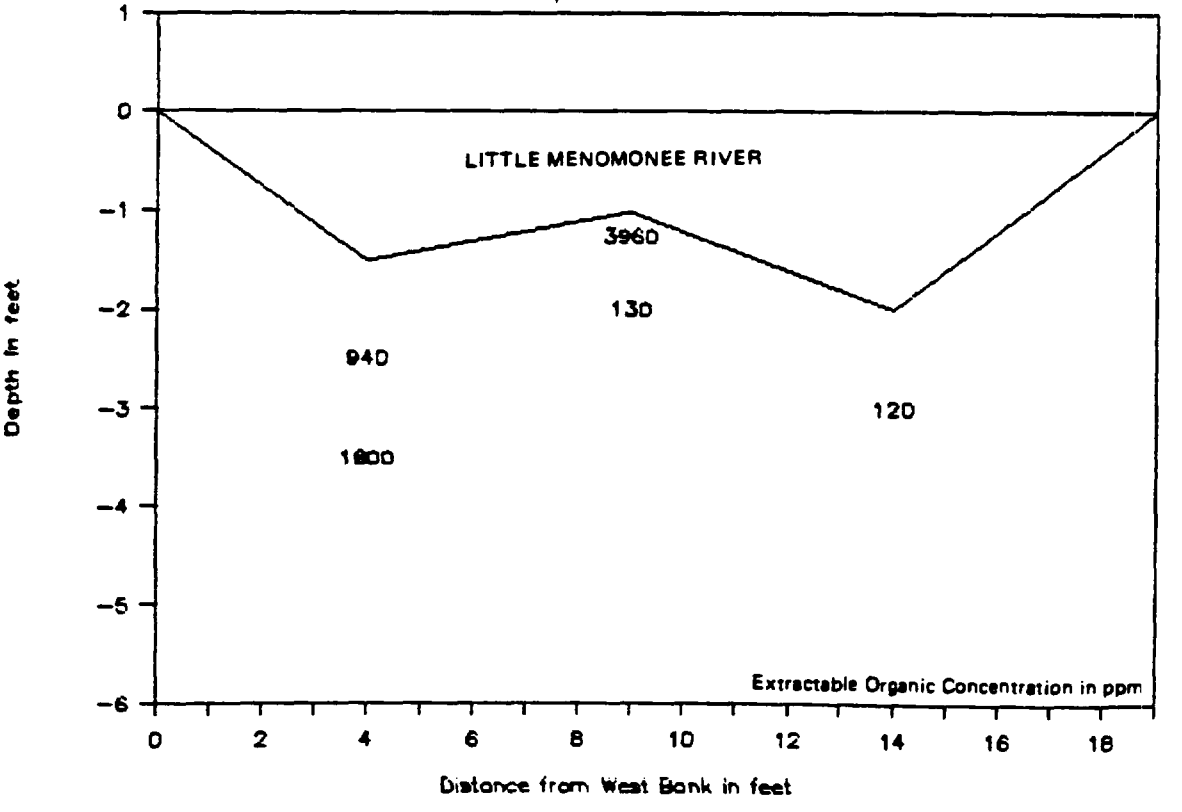
CROSS SECTION 7

Samples SD038, SD151–154



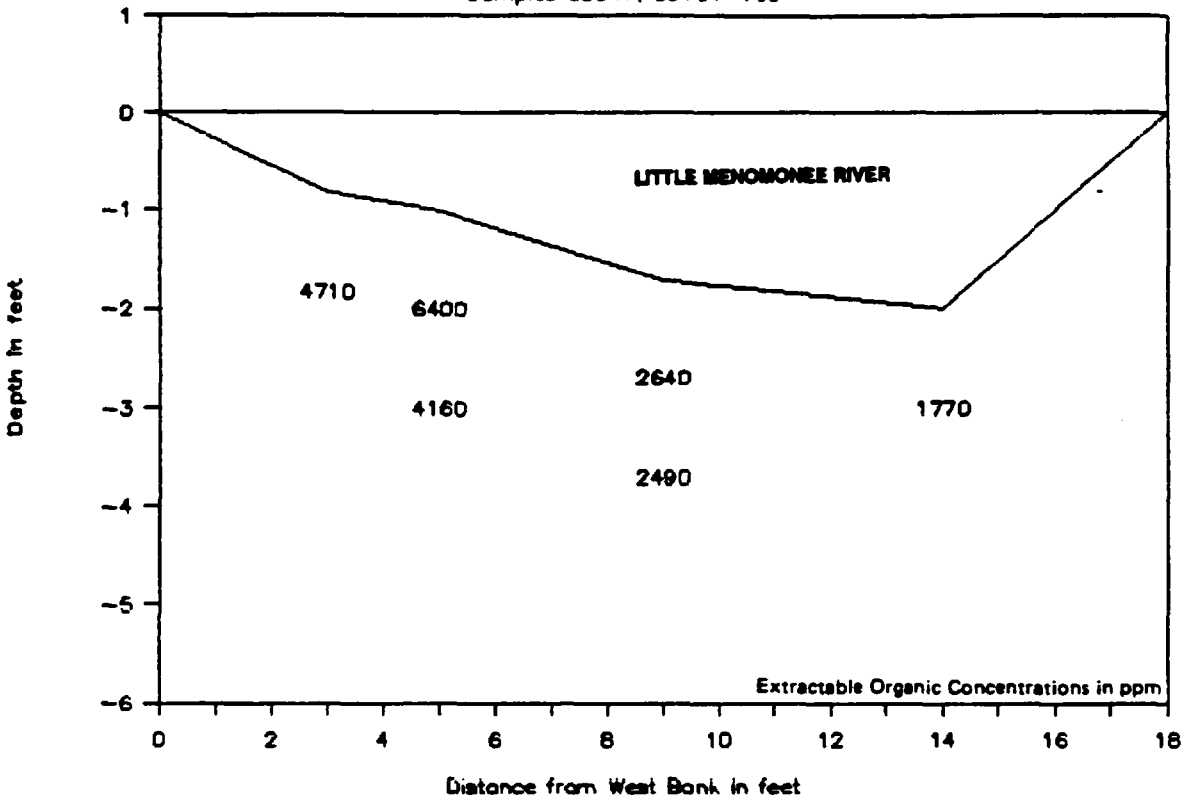
CROSS SECTION 8

Samples SD156–160



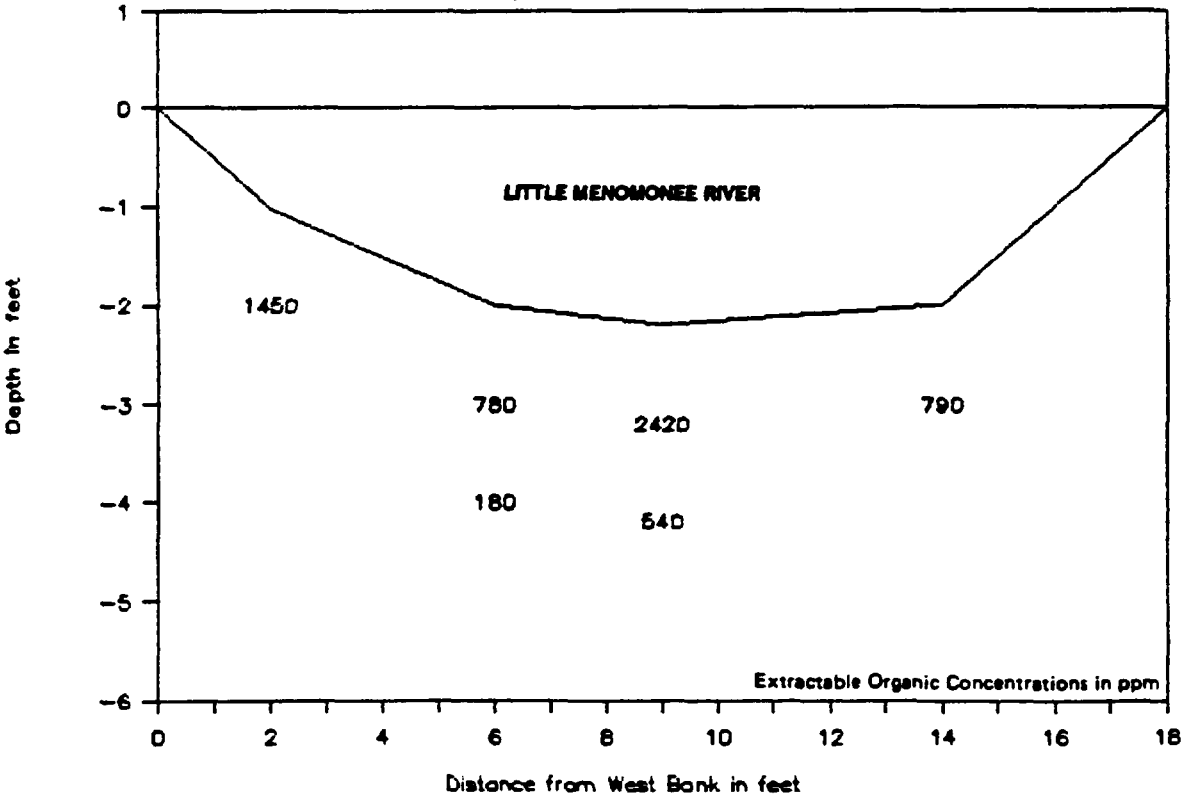
CROSS SECTION 9

Samples SD047, SD164–168



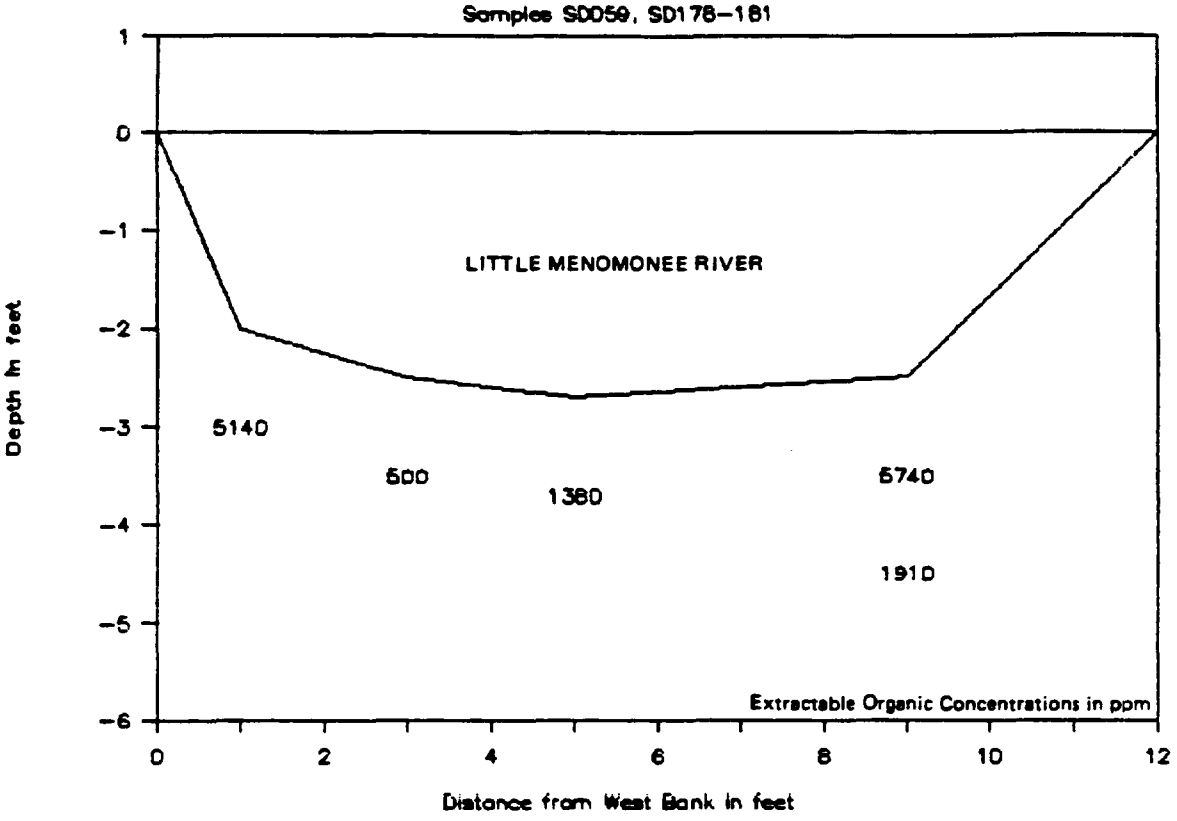
CROSS SECTION 10

Samples SD054, SD172–176



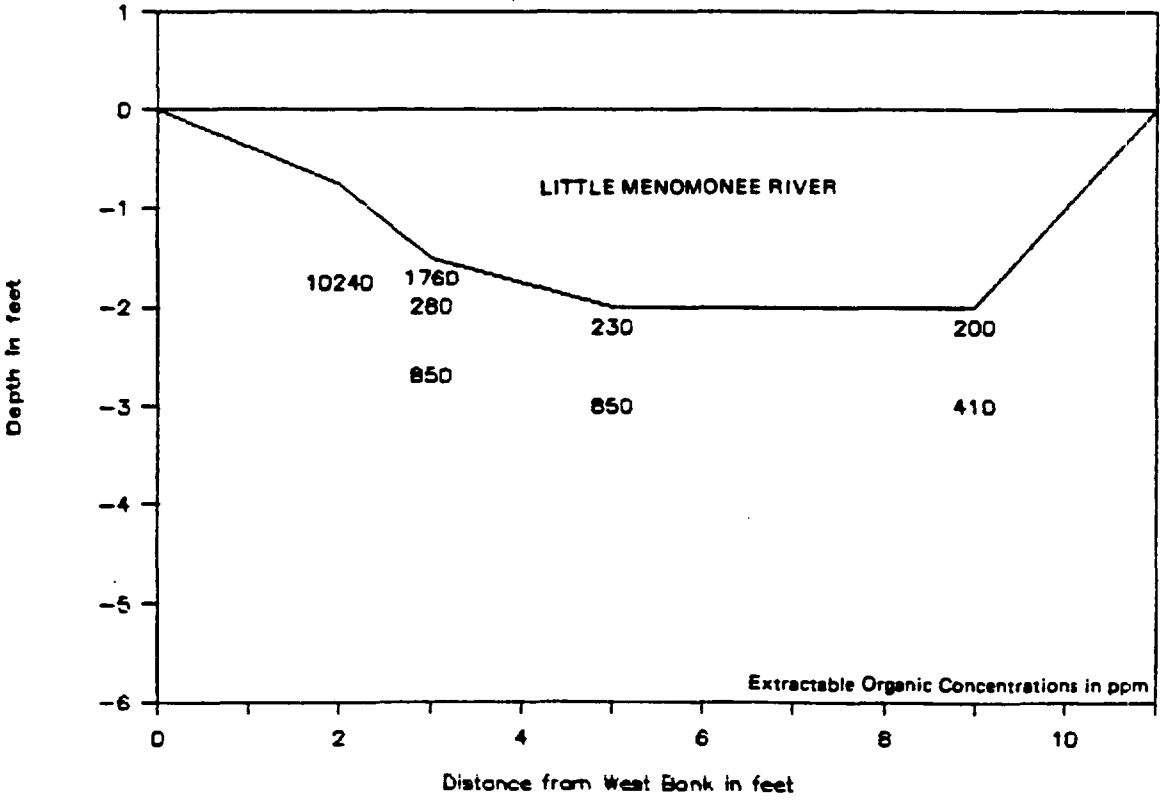
CROSS SECTION 11

Samples SD059, SD178–181



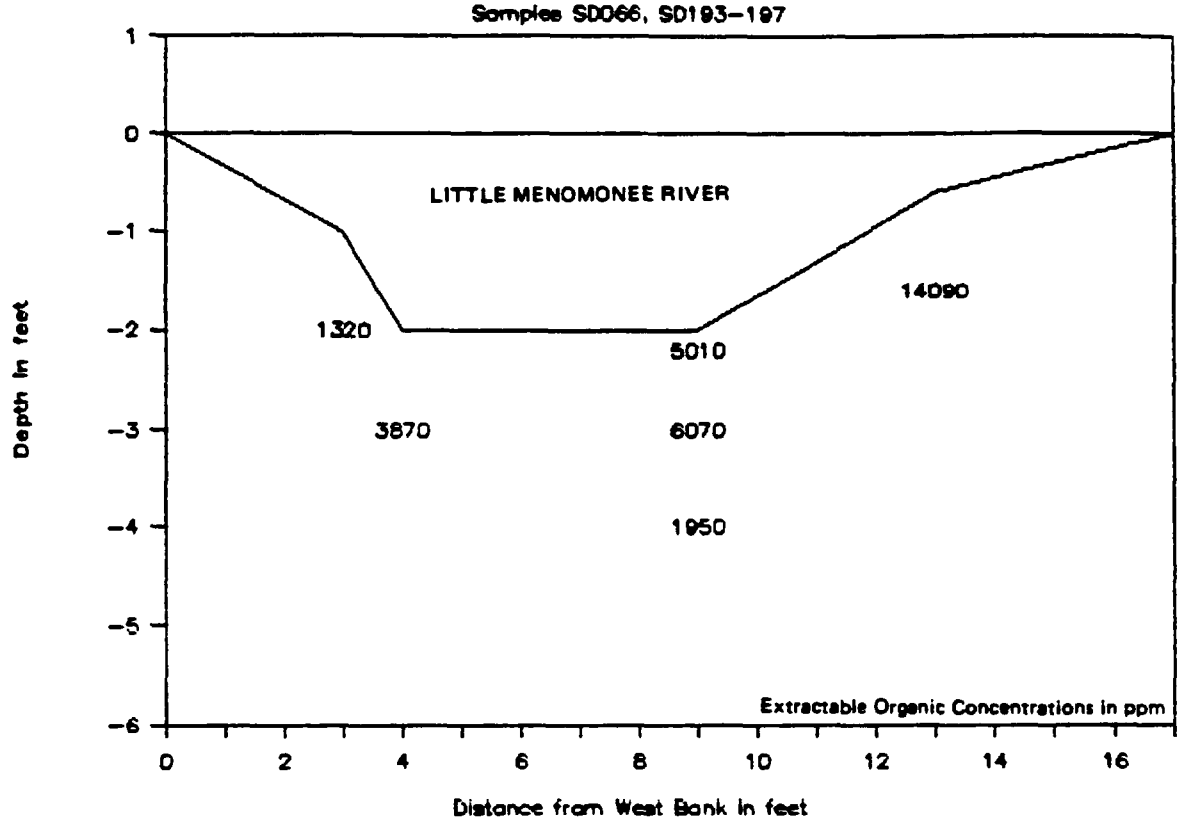
CROSS SECTION 12

Samples SD062, SD182–187



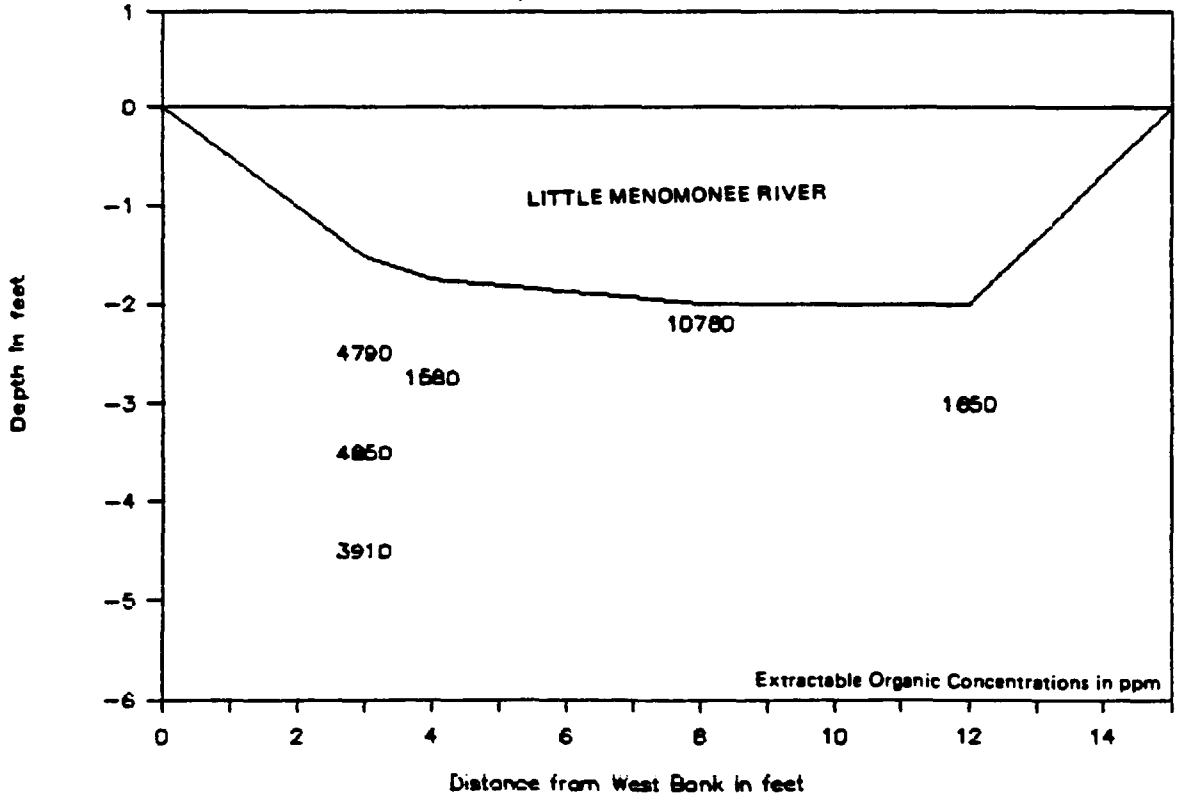
CROSS SECTION 13

Samples SD066, SD193–197



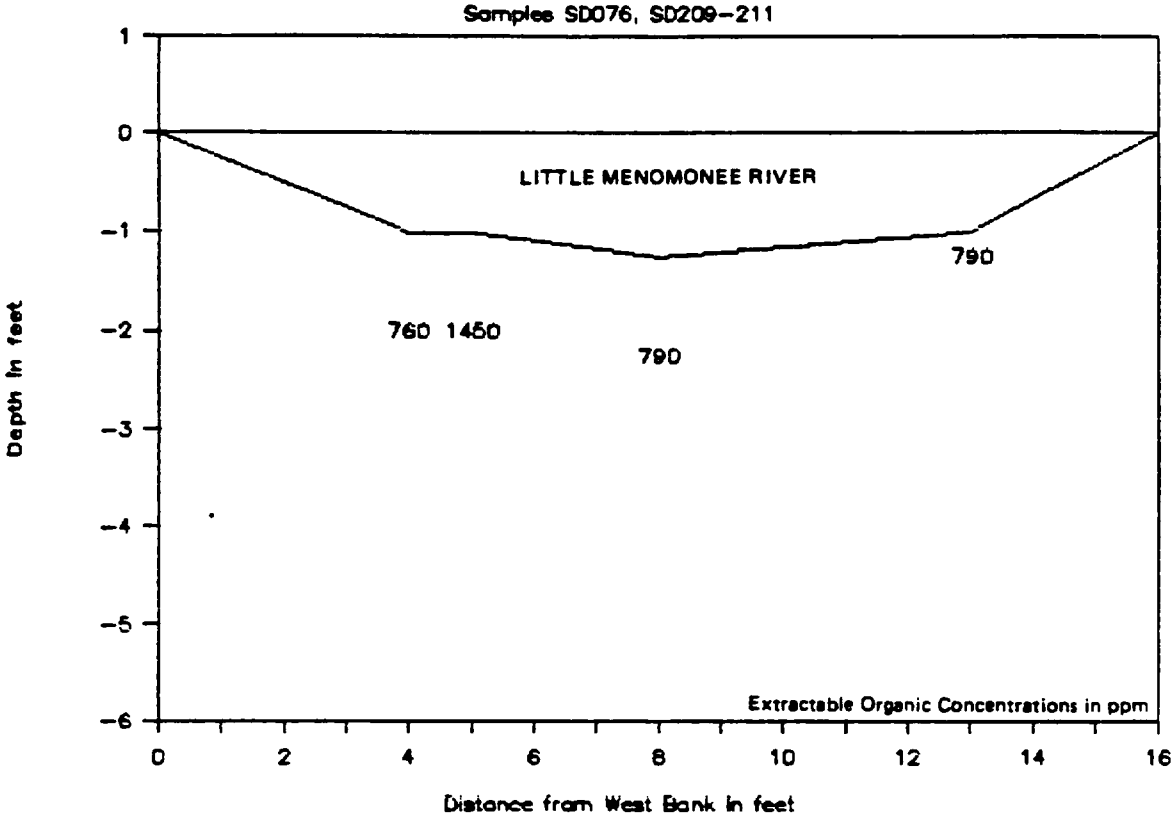
CROSS SECTION 14

Samples SD069, SD201–205



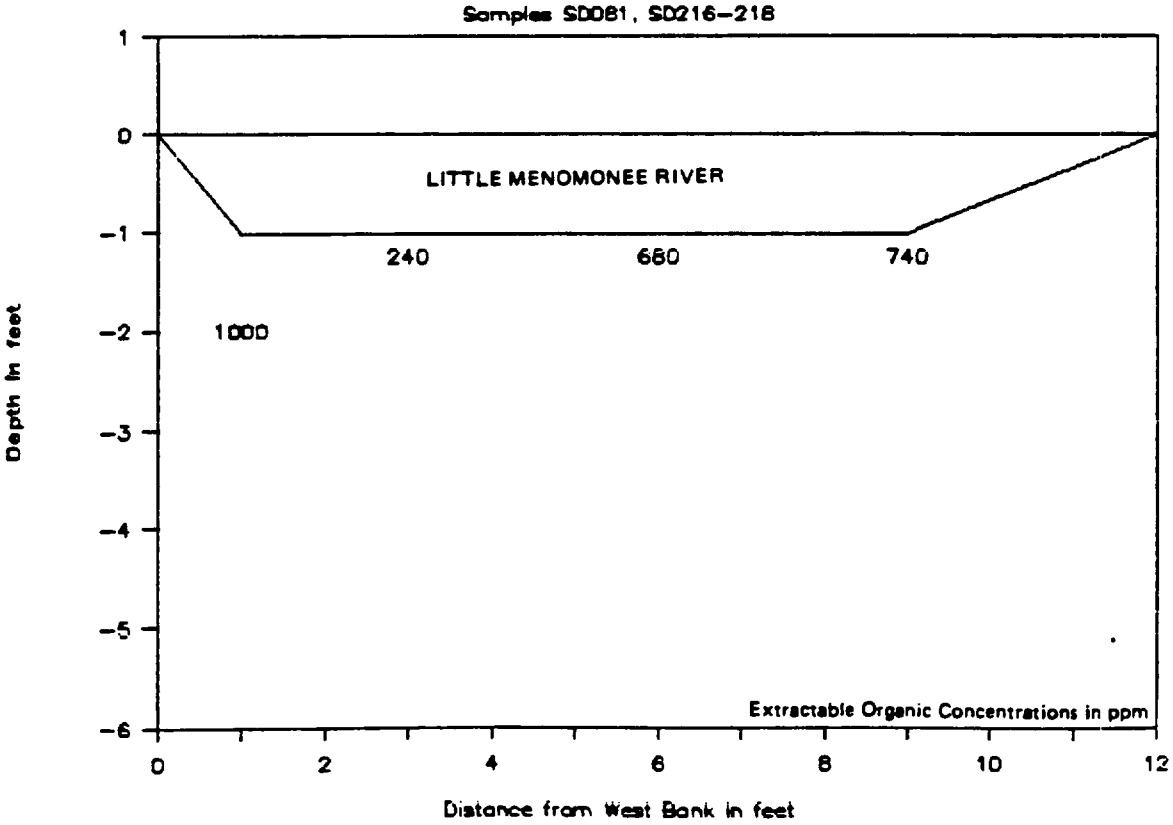
CROSS SECTION 15

Samples SD076, SD209–211



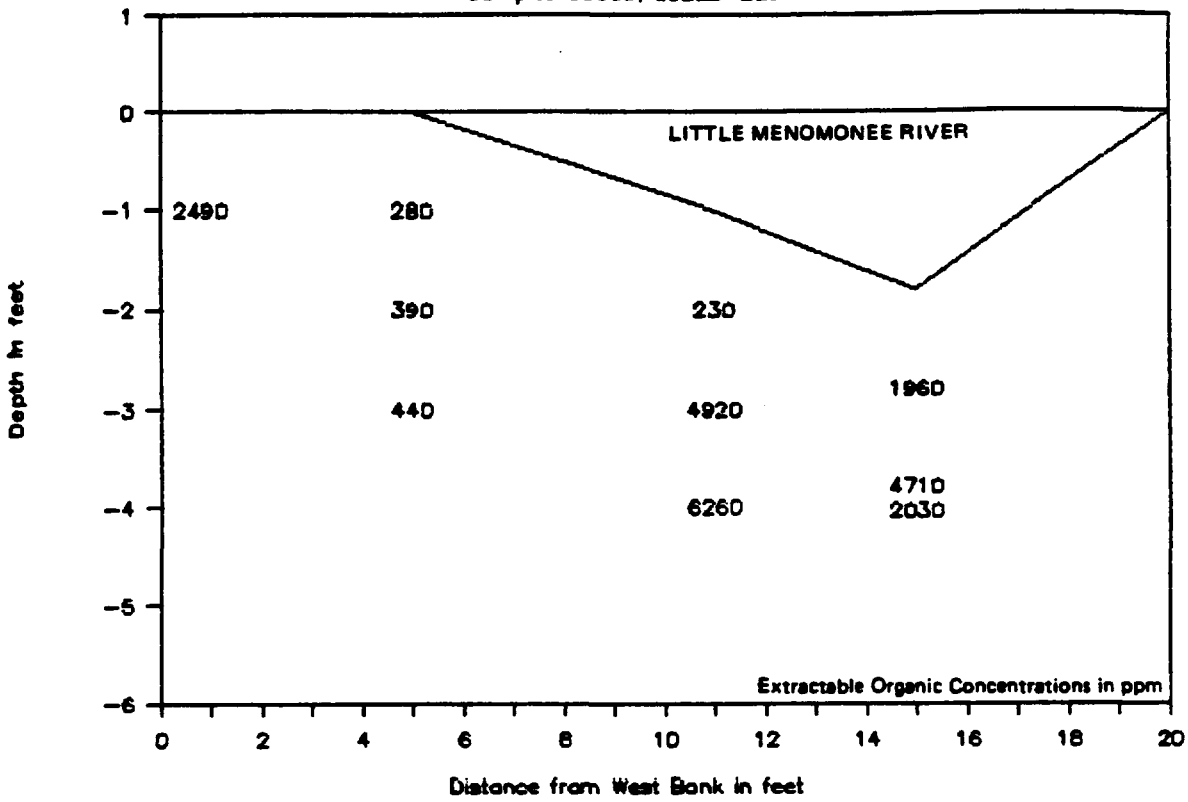
CROSS SECTION 16

Samples SD081, SD216–218



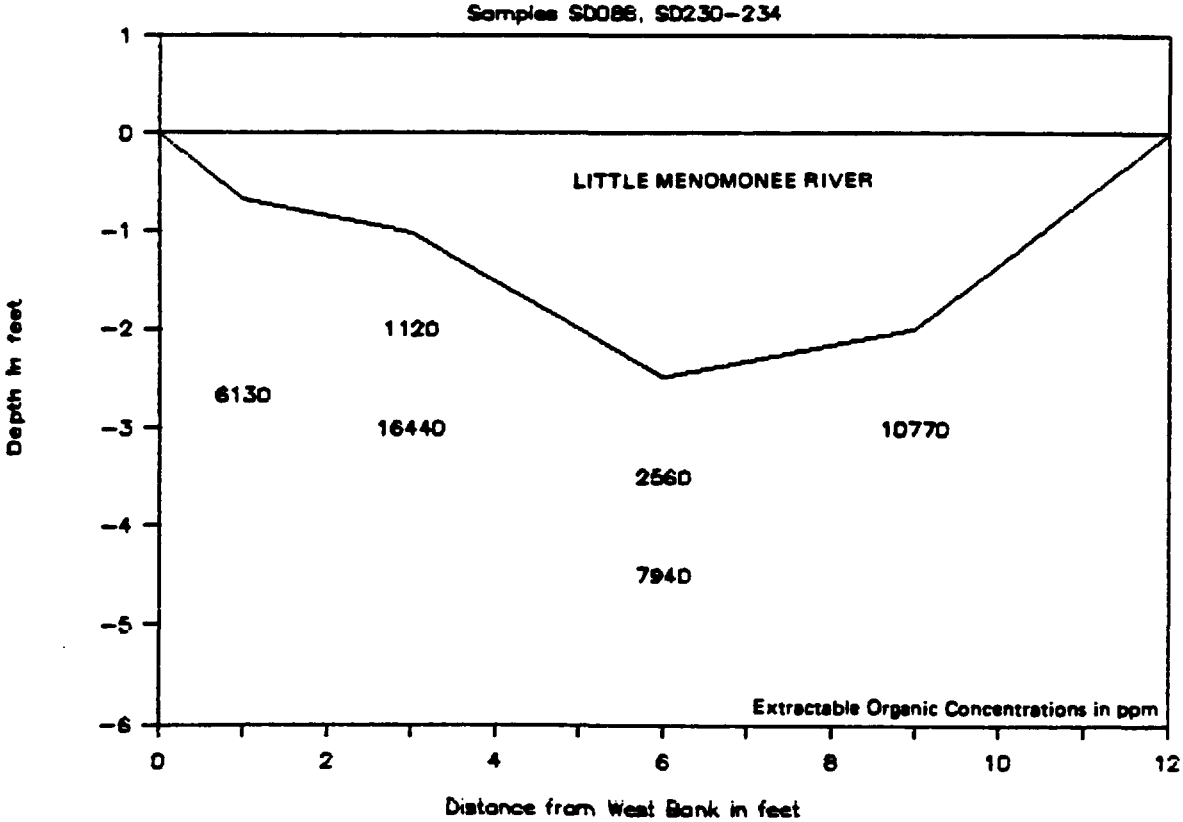
CROSS SECTION 17

Samples SD085, SD222–229



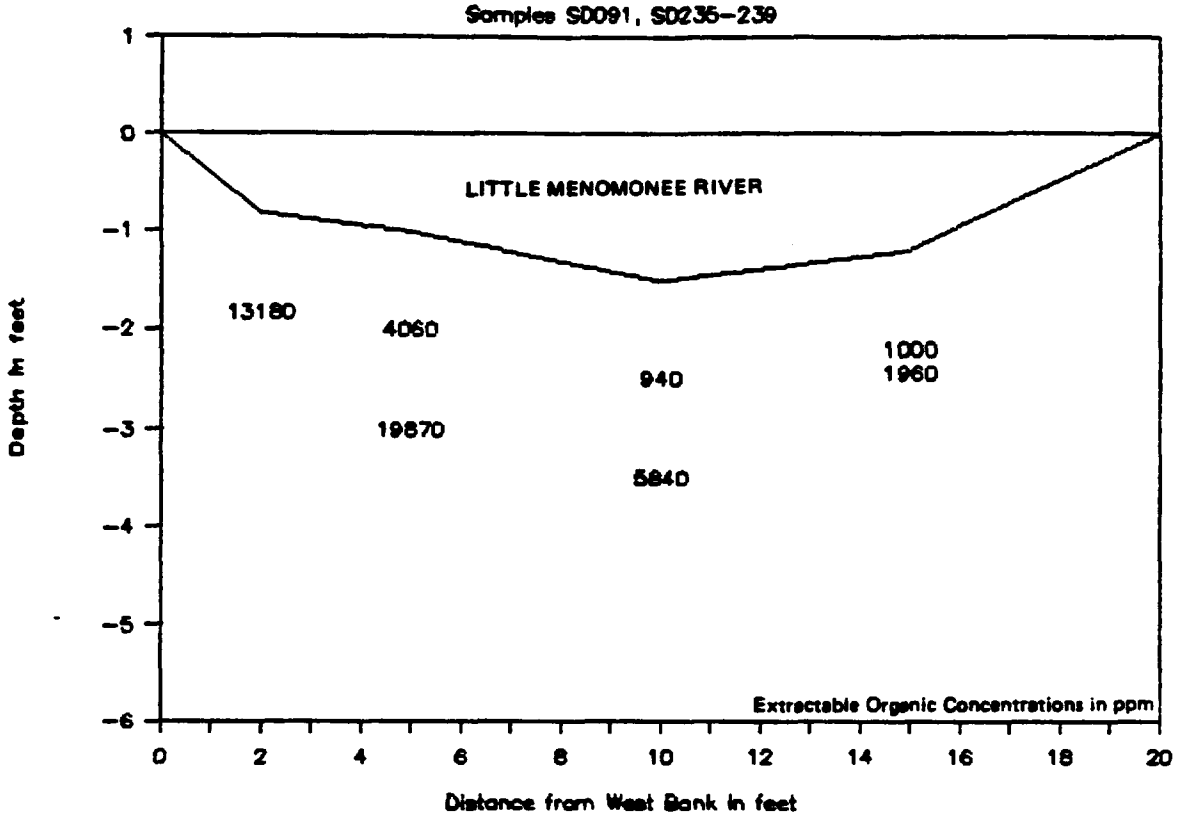
CROSS SECTION 18

Samples SD086, SD230–234



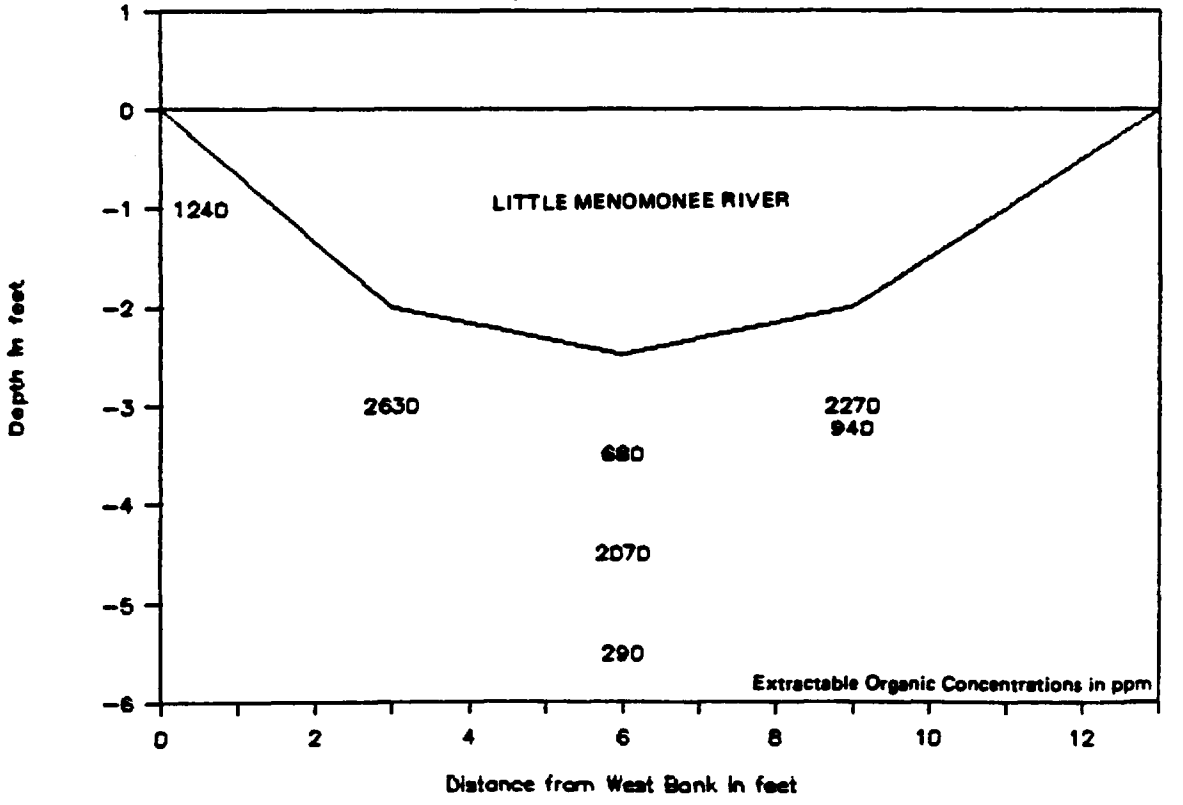
CROSS SECTION 19

Samples SD091, SD235–239



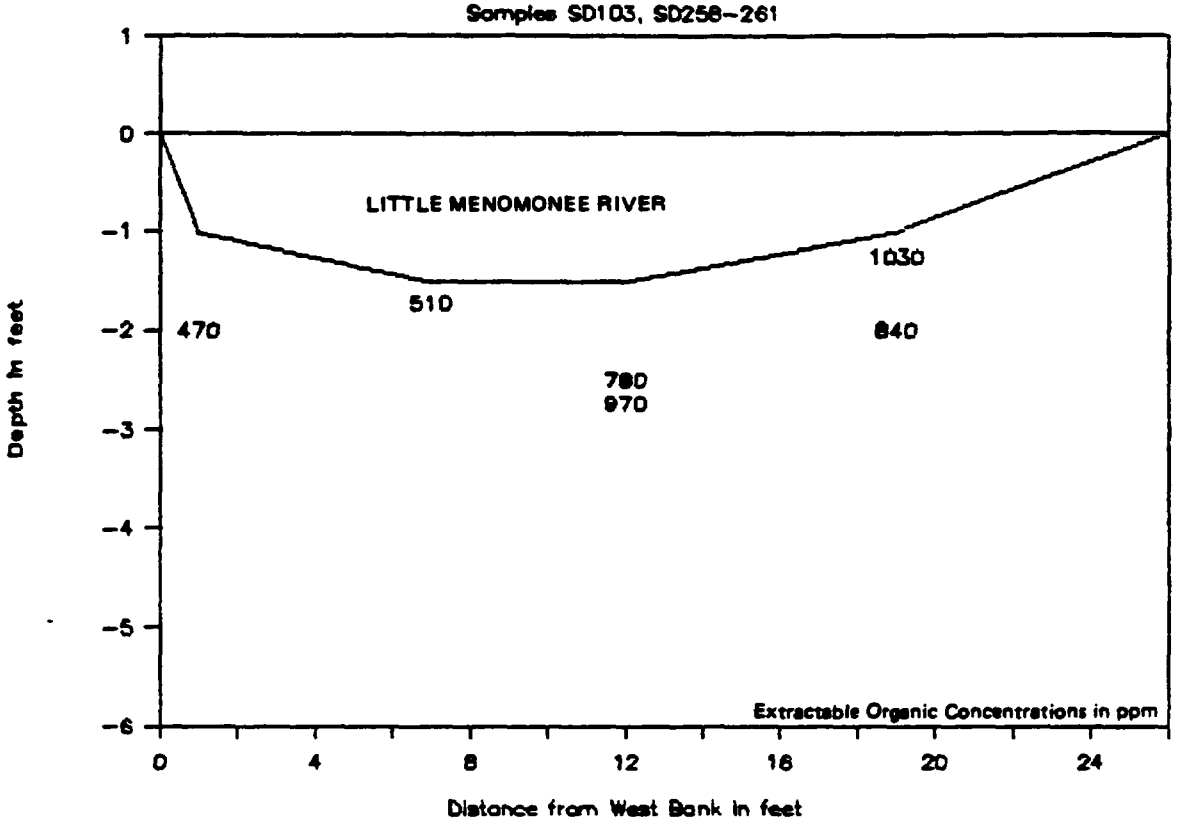
CROSS SECTION 20

Samples SD096, SD244–248



CROSS SECTION 22

Samples SD103, SD258–261



Attachment B-3
GC/FID DATA

Polyaromatic Hydrocarbons (PAH) Concentrations in Sediments
Units: parts per million (ppm) dry weight

SAMPLE	%SOLIDS	NAP	ACY	ACE	FLR	PHEN	ANT	FLN	PYR	BAA	CHR	BBF	BKF	BAP	IDP	DBA	BGHIP	TOTAL PAH	EO
SD001-01	50	2 U	2 U	2 U	2 U	2 U	2 U	4	6	4	2	26	36	28	2 U	2 U	2 U	106	2000
SD005-01	59	2 U	2 U	2 U	2 U	5	2 U	7	5	3	3	3	3	3	3	2 U	3	30	2700
SD007-01	71	1 U	1 U	1 U	1 U	1 U	1 U	1	3	1	3	1 U	1 U	1 U	1 U	1 U	1 U	0	890
SD009-01	65	2 U	2 U	2 U	2 U	2 U	2 U	3	5	3	3	2 U	2 U	2	2 U	2 U	2 U	16	3800
SD014-01	60	2 U	2 U	2 U	2 U	2 U	2 U	3	3	2	3	2 U	2 U	2 U	2 U	2 U	2 U	11	1100
SD018-01	64	2 U	2 U	2 U	2 U	2 U	2 U	3	3	2	3	2 U	2 U	2 U	2 U	2 U	2 U	11	800
SD019-01	69	1 U	1 U	1 U	1 U	3	1 U	4	3	1	3	1	1	1 U	1 U	1 U	1 U	16	4200
SD025-01	78	1 U	1 U	1 U	1 U	1 U	1 U	4	4	3	3	1 U	1 U	3	1 U	1 U	1 U	17	520
SD031-01	58	9 U	9 U	126	97	310	36	241	150	50	38	19	17	17	9 U	9 U	9 U	1101	8600
SD035-01	74	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	1800
SD038-01	68	1 U	1 U	6	4	13	3	24	15	7	6	3	3	3	1 U	1 U	1 U	87	2700
SD051-01	69	1 U	1 U	4	1	4	1	9	9	4	3	3	3	3	1 U	1 U	1 U	44	1200
SD054-01	63	2 U	2 U	3	3	3	2 U	17	13	8	6	5	5	5	3	2 U	2	73	1500
SD058-01	35	2 U	2 U	84	85	56	62	200	127	42	35	16	15	15	9	2 U	4	750	1800
SD062-01	50	186	8 U	661	475	1153	125	712	458	188	146	58	58	54	8 U	8 U	8 U	4274	10000
SD063-01	60	2 U	2 U	45	48	132	18	135	87	32	25	13	12	10	5	2 U	3	557	1100
SD067-01	69	3	1 U	23	17	49	7	39	23	9	7	4	3	3	1 U	1 U	1 U	187	670
SD070-01	73	1 U	1 U	1 U	1 U	1 U	1 U	3	3	7	1 U	3	1	3	3	1 U	3	26	370
SD070-01R	71	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3	4	1	3	1	3	3	1 U	3	21	450
SD073-01	71	1 U	1 U	6	4	8	6	30	21	10	10	7	6	6	4	1 U	3	119	370
SD076-01	72	4	1 U	49	57	167	36	153	100	39	38	18	17	15	11	1 U	6	710	1400
SD078-01	68	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	410
SD091-01	54	9 U	9 U	9 U	9 U	57	17	204	152	70	52	30	30	30	9 U	9 U	9 U	642	13000
SD093-01	64	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	27	8 U	8 U	8 U	8	8 U	8 U	16	51	2000
SD097-01	78	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	73
SD100-01	56	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0	320
SD110-01	68	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	750
SD116-01	77	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	570
SD131-01	68	1 U	1 U	1 U	1 U	3	1 U	7	15	4	6	44	6	37	3	1 U	3	128	730
SD134-01	66	2 U	2 U	2 U	2 U	5	2 U	6	5	3	3	3	3	2 U	2 U	2 U	2 U	28	1000
SD137-01	82	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	160
SD140-01	63	2 U	2 U	2 U	2 U	2 U	2 U	3	3	2	2	2	2	2 U	2 U	2 U	2 U	14	20000
SD144-01	69	1 U	1 U	20	13	38	4	36	14	9	9	12	7	9	4	1 U	3	178	1000
SD147-01	76	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	16
SD154-01	87	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	250
SD155-01	59	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	8 U	0	530
SD158-01	67	4	1 U	9	7	15	9	18	7	4	4	3	1	3	3	1 U	1 U	79	4800
SD164-01	65	58	8 U	323	231	554	68	369	262	114	95	35	35	34	8 U	8 U	8 U	2178	6400
SD165-01	65	28	8 U	277	200	523	60	323	231	95	77	31	31	31	8 U	8 U	8 U	1907	4200
SD175-01	67	1 U	1 U	1 U	1 U	4	1	12	7	4	4	1	1	1 U	1 U	1 U	1 U	34	540
SD179-01	67	1 U	1 U	1 U	1 U	1	1 U	6	4	4	1	1	1 U	1	1 U	1 U	1 U	18	1400
SD187-01	66	2 U	2 U	2 U	2 U	6	2	15	11	5	5	5	3	8	3	2 U	2	65	410
SD192-01	76	1 U	1 U	1 U	1 U	3	1 U	3	4	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	11	380
SD197-01	64	2 U	2 U	5	3	13	2	8	8	73	2 U	38	53	67	5	2 U	2 U	275	14000
SD204-01	65	3	2 U	431	300	892	106	631	385	97	82	49	29	37	26	2 U	14	3090	11000
SD207-01	71	1 U	1 U	1 U	1 U	3	1 U	4	6	3	3	3	3	3	3	1 U	4	35	1000
SD207-01R	69	38	2 U	400	323	862	95	477	292	83	66	38	25	29	14	2 U	8	275	--
SD214-01	63	2 U	2 U	2 U	2 U	10	3	19	14	8	13	11	11	10	14 U	2 U	10	99	5900
SD217-01	67	1 U	1 U	1 U	1 U	1 U	1 U	1	3	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	8	600
SD221-01	82	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	47
SD221-01R	86	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	220
SD222-01	86	1 U	1 U	40	5	16	7	35	27	8	7	1 U	40	29	2	1 U	1	187	280
SD227-01	93	1 U	1 U	2	2	5	4	9	5	2	1	3	2	1 U	1 U	1 U	1 U	35	6300
SD231-01	57	135	2 U	263	193	456	75	351	228	74	56	40	35	37	23	2 U	12	1978	16000
SD233-01	58	59	2 U	328	293	655	328	448	328	97	81	43	41	41	21	5	16	2782	7900
SD234-01	56	9	2 U	268	214	500	179	339	214	73	63	25	25	30	11	4	7	1961	11000
SD236-01	55	105	2 U	345	258	618	120	345	236	67	58	29	27	27	11	4	7	2257	20000
SD244-01	55	2 U	4	91	69	165	49	218	145	49	42	35	35	33	15	2 U	13	963	2600
SD255-01	58	2	2 U	12	10	33	5	29	21	9	7	5	5	3	2 U	2 U	2 U	141	830
SD257-01	52	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0	620
SD258-01	76	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	510
SD260-01	66	2 U	2 U	2 U	2 U	2 U	2 U	11	9	5	5	5	3	2	2 U	2 U	2 U	40	1000
SS1003-01	98	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	180
SD001-01FB	98	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	--
SD002-01FB	99	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	--
SD003-01FB	99	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0	--

NOTES:
U = Not detected (detection limit listed)

ABBREVIATIONS:
NAP = Naphthalene
ACY = Acenaphthylene
ACE = Acenaphthene
FLR = Fluorene
PHEN = Phenanthrene
ANT = Anthracene
FLN = Fluoranthene
PYR = Pyrene
BAA = Benzo(a)anthracene
CHR = Chrysene
BBF = Benzo(b)fluoranthene
BKF = Benzo(k)fluoranthene
BAP = Benzo(a)pyrene
IDP = Indeno(1,2,3-cd)pyrene
DBA = Dibenz(a,h)anthracene
BGHIP = Benzo(g,h,i)perylene
EO = Extractable Organics

PHENOLIC COMPOUNDS ANALYZED BY GC/FID AND MINIMUM DETECTABLE CONCENTRATIONS

Phenol	2
2-Chlorophenol	2
2-Nitrophenol	2
2,4-Dimethylphenol	2
2,4-Dichlorophenol	2
4-Chloro-3-methylphenol	2
2,4,6-Trichlorophenol	2
2,4-Dinitrophenol	5
4-Nitrophenol	5
4,6-Dinitro-2-methylphenol	5
Pentachlorophenol	5

Sample locations are the same as those listed for the PAH results. No phenolic compounds were detected.

GLT779/34-2

Attachment B-4
FIELD DATA BY SAMPLE NUMBER
AND
EXTRACTABLE ORGANIC CONCENTRATIONS

MOSS-AMERICAN SEDIMENT SCREENING AND
EXTRACTABLE ORGANIC CONCENTRATIONS

SAMPLE	X	Y	Z	W	S	DEPTH	EO	COMMENTS
SD001-01	30780	4	1.5	24	0.7	1	2800	Oil sheen during sample
SD002-01	30500	15	0.0	30	1.0	1	1700	Slight sheen on water
SD003-01	30200	5	0.5	25	2.0	1	1100	Sheen on water
SD004-01	29900	5	0.8	20	0.5	1	2300	Sheen on water
SD005-01	29600	-1	0.0	20	0.5	1	2700	Sheen on water
SD006-01	29300	14	1.5	18	0.8	1	730	No sheen
SD007-01	29000	12	1.5	15	0.5	1	890	Sheen on water
SD008-01	28650	14	0.5	15	1.0	1	1300	Sheen on water
SD009-01	28400	-3	0.0	10	0.5	1	3800	Sheen on water
SD010-01	28010	1	1.5	20	0.5	1	890	No sheen
SD011-01	27750	3	1.5	25	0.8	1	2000	Sheen on water
SD012-01	27600	1	1.5	15	0.8	1	210	Slight sheen on water
SD013-01	27600	-1	0.0	15	0.5	1	710	No visible sheen
SD014-01	27200	3	1.0	20	1.3	1	1100	Large sheen on water
SD015-01	27000	12	3.0	25	1.5	1	1000	Large oil sheen on water
SD016-01	26600	3	2.0	12	2.5	1	2000	Sheen on water
SD017-01	26300	18	0.0	17	2.5	1	3600	Sheen on water
SD018-01	26000	15	1.0	15	0.7	1	880	Slight sheen on water
SD019-01	25670	12	1.0	17	40.0	1	4200	Oil sheen on water and sample
SD020-01	25370	1	0.7	11	0.8	1	1100	No sheen
SD021-01	25270	0	0.0	25	1.5	1	3800	Sheen on water
SD022-01	24900	1	0.3	22	2.5	1	640	Slight sheen on water
SD023-01	24610	1	1.0	16	2.0	1	720	No sheen
SD024-01	24300	1.5	2.0	12	1.0	1	540	No sheen
SD025-01	24000	12	0.0	12	0.5	1	520	No sheen
SD026-01	23700	14	0.5	14	0.5	1	370	No sheen
SD027-01	23190	23	0.0	25	2.5	1	1300	No sheen
SD028-01	22800	17	2.5	18	0.3	1	270	No sheen
SD029-01	22410	1	1.0	20	2.0	1	940	Slighy sheen on water
SD030-01	21920	1	1.0	15	0.3	1	75	Sheen on water
SD031-01	21750	16	1.5	17	2.5	1	8600	Sheen on water and sample
SD031-01R	21750	16	1.5	17	0.5	1	1100	Field id RPSD001
SD032-01	21400	14.5	1.0	16	1.5	1	830	No sheen
SD033-01	21100	1	0.7	16	0.5	1	200	No sheen
SD034-01	20760	1.5	0.5	18	1.5	1	630	No sheen
SD035-01	20100	-0.5	0.0	16	0.8	1	1000	No sheen
SD036-01	20100	1	0.5	17	0.8	1	590	Sheen on water
SD037-01	19800	2	1.0	16	2.0	1	480	Sheen on water
SD038-01	19500	1.5	1.0	12	1.0	1	2700	Sheen on water and sample
SD039-01	19200	0	1.0	15	0.8	1	380	Slight sheen on water
SD040-01	18800	1	1.0	20	1.5	1	520	Sheen on water
SD041-01	18500	15	1.0	20	0.7	1	250	Slight sheen on water
SD042-01	18300	-1	0.0	9	2.5	1	1100	No sheen
SD043-01	18000	1	1.0	20	2.5	1	1400	Sheen on water and sample
SD043-01R	18000	1	1.0	20	2.5	1	2300	Field id RPSD002
SD044-01	17700	3	2.0	20	2.5	1	2000	Sheen on water and sample
SD045-01	17450	.3	2.5	20	2.5	1	3000	Sheen on water
SD046-01	17100	4	2.5	12	0.5	1	1700	Sheen on water and sample
SD047-01	16800	3	2.0	12	2.5	1	4700	Heavy sheen on water & sample
SD048-01	16500	2	1.0	15	2.5	1	2100	Sheen on water and sample
SD049-01	16200	2	1.0	15	2.0	1	450	Sheen on water
SD050-01	15800	4	1.5	15	0.7	1	860	No sheen
SD051-01	15400	2	2.5	17	1.0	1	1200	Sheen on water
SD052-01	15050	2	2.0	15	2.5	1	46	Sheen on sample
SD053-01	14700	1	2.0	15	2.5	1	480	No sheen
SD054-01	14400	2	1.0	15	0.5	1	1500	Slight sheen on sample
SD055-01	14100	1	2.0	15	0.5	1	680	Sheen on water and sample
SD056-01	13800	8	2.5	16	0.5	1	660	Sheen on water and sample
SD057-01	13450	7	2.5	14	1.0	1	1000	Sheen on water
SD058-01	13200	3	2.0	17	1.0	1	1800	Slight sheen on water & sample
SD059-01	12920	1	3.0	8	2.5	1	5100	Heavy sheen, water and sample
SD060-01	12580	1	2.5	8	2.5	1	290	Sheen on water
SD061-01	12300	2	2.0	12	1.0	1	830	Sheen on water and sample
SD062-01	12000	2	2.0	10	1.5	1	10000	Heavy sheen, water and sample
SD063-01	11700	2	2.5	12	1.0	1	1100	Sheen on water and sample
SD064-01	11400	13	2.5	18	0.7	1	840	Sheen on water and sample
SD065-01	10950	5	2.0	18	1.5	1	1300	Sheen on water and sample
SD066-01	10670	3	2.0	14	1.5	1	3900	Heavy sheen, water and sample

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SAMPLE	X	Y	Z	W	S	DEPTH	EO	COMMENTS
SD067-01	10500	4	2.0	15	2.0	1	670	Sheen on water
SD068-01	10200	6	2.0	16	2.0	1	600	Sheen on water
SD069-01	9900	4	2.0	16	2.5	1	1600	Heavy sheen, water and sample
SD070-01	9600	-1	0.0	14	2.5	1	370	Sheen on water
SD070-01R	9600	-1	0.0	14	2.5	1	450	Field id RPSD003
SD071-01	9300	1	1.5	15	1.0	1	190	Slight sheen on water
SD072-01	9000	3	2.0	10	1.0	1	830	Sheen on water
SD073-01	8700	6	3.0	8	1.0	1	370	Slight sheen on water
SD074-01	8400	15	0.0	15	0.8	1	330	Slight sheen on water
SD075-01	8100	4	2.0	15	2.5	1	1200	Sheen on water and sample
SD076-01	7800	5	2.0	18	2.0	1	1400	Sheen on water and sample
SD077-01	7500	6	2.0	10	2.0	1	590	Sheen on sample and water
SD078-01	7200	2	2.0	10	0.7	1	410	No sheen, OVA methane perhaps
SD079-01	6900	2	1.5	12	0.7	1	550	No sheen
SD080-01	6600	2	1.5	11	0.7	1	350	Sheen on water
SD081-01	6300	1	1.5	10	0.3	1	1000	Sheen on water and sample
SD082-01	6000	1	1.0	14	1.5	1	330	Slight sheen on water
SD083-01	5700	1	2.0	12	2.0	1	860	Sheen on water and sample
SD084-01	5400	0	1.0	10	2.5	1	700	Sheen on water
SD085-01	5100	0.5	1.0	14	2.5	1	2500	Sheen on water and sample
SD086-01	4800	1	2.0	10	2.5	1	1300	Sheen on water and sample
SD087-01	4500	1	2.0	12	1.0	1	4500	Sheen on water and sample
SD087-01R	4500	1	2.0	12	1.0	1	3500	Field id RPSD004
SD088-01	4200	1	1.0	10	3.5	2	6100	Heavy sheen, water and sample
SD089-01	3900	2	3.0	10	3.0	1	3000	Very oily sample, water sheen
SD090-01	3600	2	1.0	15	2.5	1	330	No sheen, soil structure
SD091-01	3300	2	1.0	0	2.5	1	13000	No sheen, soil structure
SD092-01	3070	5	0.5	22	0.5	1	390	No sheen, soil structure
SD093-01	2770	6	0.5	25	1.5	1	2000	No sheen, soil structure
SD094-01	2550	1	2.0	15	0.5	1	560	No sheen, soil structure
SD095-01	2310	2	0.5	12	1.0	1	570	Slight sheen on water
SD096-01	2100	0.5	1.0	12	0.5	1	1200	Slight sheen on water
SD097-01	1800	0	0.5	13	0.3	1	73	Slight sheen on water
SD098-01	1400	1	0.5	20	0.7	1	290	Sheen on water
SD099-01	1050	3	0.5	20	2.5	1	450	Slight sheen in water
SD100-01	900	3	0.5	20	1.5	1	320	Sheen on water
SD100-01R	900	3	0.5	20	1.5	1	250	Field id RPSD005
SD101-01	600	2	0.5	20	2.0	1	270	Sheen on water
SD102-01	300	2	0.5	15	2.0	1	480	Sheen on water
SD103-01	-70	1	1.0	17	1.0	1	470	No sheen
SD104-01	-300	2	2.0	35	2.0	1	820	No sheen
SD105-01	30650	7	0.7	30	1.0	1	150	Section 1, no sheen
SD106-01	30650	15	0.7	30	1.7	2	420	Section 1, no sheen
SD107-01	30650	15	0.7	30	1.7	1	560	Section 1, no sheen
SD108-01	30650	23	0.7	30	2.0	2	1900	Section 1, no sheen
SD109-01	30650	23	0.7	30	2.0	1	1100	Section 1, no sheen
SD110-01	30650	0	0.0	30	1.2	1	750	Section 1, no sheen
SD111-01	29530	20	0.3	3	0.3	1	530	East inlet BC, some sheen
SD112-01	29160	20	0.3	3	0.3	1	230	East inlet BE, sheen on water
SD113-01	29170	-15	0.0	0	0.7	1	1000	West inlet BF, no sheens
SD114-01	28570	-20	0.1	0	2.5	1	570	West inlet BC, sheen on water
SD115-01	28460	30	0.1	3	0.5	1	340	East inlet BB, no sheen
SD116-01	28400	-0.5	0.0	15.5	3.0	1	570	Section 2, sheen on water
SD117-01	28400	4.5	0.8	15.5	0.5	1	250	Section 2, no sheen
SD118-01	28400	4.5	0.8	15	0.5	2	230	Section 2, no sheen
SD119-01	28400	10.5	1.5	15.5	0.1	1	62	Section 2, no sheen
SD120-01	28060	-30	0.1	2	0.2	1	650	West inlet AZ, sheen on water
SD121-01	27240	-40	0.5	4	0.3	1	390	West inlet AY, sheen on water
SD122-01	26630	20	0.1	1	0.1	1	380	East inlet AX, no sheen
SD123-01	25670	4	0.7	22	1.7	1	1000	Section 3, sheen on water
SD124-01	25670	4	0.7	22	1.7	2	640	Section 3, sheen on water
SD125-01	25670	13	0.7	22	1.7	1	1100	Section 3, sheen on water
SD126-01	25670	13	0.7	22	1.7	2	420	Section 3, sheen on water
SD127-01	25670	18	0.7	22	1.7	1	1600	Section 3, sheen on water
SD128-01	25670	18	0.7	22	1.7	2	230	Section 3, sheen on water
SD129-01	25050	-10	0.5	9	0.3	1	280	West inlet AV, sheen on water
SD130-01	25050	20	2.0	5	0.3	1	2800	East inlet AW, sheen on water
SD131-01	24900	9	0.5	37	2.5	1	730	Section 4, no sheen

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SAMPLE	X	Y	Z	W	S	DEPTH	EO	COMMENTS
SD132-01	24900	9	0.5	37	2.5	2	410	Section 4, no sheen
SD133-01	24900	18	2.0	37	1.2	1	590	Section 4, no sheen
SD134-01	24900	18	2.0	37	1.2	2	1000	Section 4, no sheen
SD135-01	24900	28	0.5	37	2.2	1	590	Section 4, no sheen
SD136-01	24900	28	0.5	37	2.2	2	660	Section 4, no sheen
SD137-01	23100	4	2.5	16	0.5	0	160	Section 5, some sheen
SD138-01	23100	8	2.5	16	0.7	1	140	Section 5, some sheen
SD139-01	23100	12	2.5	16	0.5	0	350	Section 5, some sheen
SD140-01	22550	-5	0.1	2	0.4	1	20000	West inlet AS, no sheen
SD141-01	21750	-60	0.3	4	0.4	1	87	West inlet AR, no sheen
SD142-01	21745	6	1.5	22	0.5	0	490	Section 6, no sheen
SD143-01	21745	10.5	2.0	22	1.0	1	510	Section 6, no sheen
SD144-01	21745	16	2.0	22	1.5	0	1000	Section 6, oily
SD145-01	21745	16	2.0	22	1.5	1	720	Section 6, oily
SD146-01	21350	-40	0.2	1	0.8	1	380	West inlet AP, no sheen
SD147-01	21150	-30	0.0	4	0.3	1	16	West inlet AO, no sheen
SD148-01	20600	-120	0.5	7	0.7	1	630	West inlet AM, no sheen
SD149-01	20140	-25	0.2	3	0.3	1	80	West inlet AL, no sheen
SD150-01	19970	-70	0.2	5	0.5	1	180	West inlet AK, no sheen
SD151-01	19500	9	2.0	25	1.2	0	470	Section 7, some sheen
SD152-01	19500	9	2.0	25	1.2	1	1100	Section 7, some sheen
SD153-01	19500	15	2.0	25	0.5	0	490	Section 7, very oily
SD154-01	19500	20	1.5	25	0.3	0	250	Section 7, no sheen
SD155-01	18115	-70	0.0	5	0.5	1	530	West inlet AI, no sheen
SD156-01	17400	4	1.5	19	2.0	1	940	Section 8, some oil
SD157-01	17400	4	1.5	19	2.0	2	1800	Section 8, very oily
SD158-01	17400	9	1.0	19	1.5	0	4000	Section 8, some oil
SD159-01	17400	9	1.0	19	1.5	1	130	Section 8, some oil
SD160-01	17400	14	2.0	19	0.7	1	120	Section 8, no sheen
SD161-01	17440	-200	0.5	3	0.5	1	440	West inlet AH, no sheen
SD162-01	17210	-6	0.2	2	0.3	1	1200	West inlet ACA, no sheen
SD163-01	17995	-40	0.1	1	0.4	1	370	West inlet AC, no sheen
SD164-01	16800	5	1.0	18	1.0	1	6400	Section 9, oily
SD165-01	16800	5	1.0	18	2.0	2	4200	Section 9, oily
SD166-01	16800	9	1.8	18	1.5	1	2600	Section 9, no sheen
SD167-01	16800	9	1.8	18	1.5	2	2500	Section 9, some oil
SD168-01	16800	14	2.0	18	1.0	1	1800	Section 9, no sheen
SD169-01	16630	30	0.2	1.5	0.3	1	290	East inlet AF, sheen on water
SD170-01	14900	50	0.3	10	0.3	1	390	East inlet AB, no sheen
SD171-01	14560	-30	0.1	1	0.3	1	590	West inlet AA, no sheen
SD172-01	14400	6	2.0	18	2.0	1	780	Section 10, no sheen
SD173-01	14400	6	2.0	18	2.0	2	180	Section 10, no sheen
SD174-01	14400	9	2.3	18	2.5	1	2400	Section 10, no sheen
SD175-01	14400	9	2.3	18	2.5	2	540	Section 10, some sheen
SD176-01	14400	14	2.0	18	1.0	1	790	Section 10, no sheen
SD177-01	13200	-45	0.0	3	0.3	1	140	West inley Y, no sheen
SD178-01	12920	3	2.5	12	0.8	1	500	Section 11, very oily
SD179-01	12920	5	2.8	12	0.7	1	1400	Section 11, some sheen
SD180-01	12920	9	2.5	12	1.5	1	5700	Section 11, oily
SD181-01	12920	9	2.5	12	1.5	2	1900	Section 11, oily
SD182-01	12000	3	1.5	11	1.0	0	1800	Section 12, oily
SD182-01R	12000	3	1.5	11	1.0	0	280	Field id RPSD006
SD183-01	12000	3	1.5	11	1.0	1	850	Section 12, oily
SD184-01	12000	5	2.0	11	0.8	0	230	Section 12, no sheen
SD185-01	12000	5	2.0	11	0.8	1	850	Section 12, no sheen
SD186-01	12000	9	2.0	11	1.0	0	200	Section 12, no sheen
SD187-01	12000	9	2.0	11	1.0	1	410	Section 12, no sheen
SD188-01	11880	-30	1.0	12	0.5	1	300	West inlet X, no sheen
SD189-01	11870	40	0.4	5	0.4	1	1200	East inlet WA, no sheen
SD190-01	11705	-30	0.3	1	0.5	1	560	West inlet W, no sheen
SD191-01	11220	40	0.0	4	0.4	1	420	East inlet V, sheen on water
SD192-01	11000	5	0.3	3	0.2	0	380	East inlet UB, no sheen
SD193-01	10670	3	1.0	17	0.7	1	1300	Section 13, oily
SD194-01	10670	9	2.0	17	2.2	0	5000	Section 13, very oily
SD195-01	10670	9	2.0	17	2.2	1	6100	Section 13, very oily
SD196-01	10670	9	2.0	17	2.2	2	1900	Section 13, very oily
SD197-01	10670	13	0.7	17	0.7	1	14000	Section 13, very oily
SD198-01	10610	-100	0.3	2	0.5	1	390	West inlet U, no sheen

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SAMPLE	X	Y	Z	W	S	DEPTH	EO	COMMENTS
SD199-01	10430	5	0.0	3	0.1	1	1000	West inlet T, no sheen
SD200-01	10180	-40	0.0	3	0.5	1	380	West inlet S, no sheen
SD201-01	9900	3	1.5	15	3.0	1	4800	Section 14, some oil
SD202-01	9900	3	1.5	15	3.0	2	4900	Section 14, oily
SD203-01	9900	3	1.5	15	3.0	3	3900	Section 14, oily
SD204-01	9900	8	2.0	15	0.5	0	11000	Section 14, some sheen
SD205-01	9900	12	2.0	15	0.7	1	1600	Section 14, oily
SD206-01	9450	40	0.2	4	0.5	1	670	East inlet Q, sheen on water
SD207-01	9080	-10	0.0	3	0.2	0	1000	West inlet P, no sheen
SD208-01	8880	100	1.0	14	0.7	1	490	East inlet O, sheen on water
SD208-01R	8880	100	1.0	14	0.7	1	920	Field id RPSD007
SD209-01	7800	4	1.0	16.5	0.8	1	760	Section 15, some oil
SD210-01	7800	8	1.0	16.5	0.7	1	790	Section 15, no sheen
SD211-01	7800	13	1.0	16.5	0.5	0	790	Section 15, no sheen
SD212-01	7660	-45	0.0	4	0.3	0	120	West inlet N, no sheen
SD213-01	7020	-70	0.3	3	0.3	0	140	West inlet M, no sheen
SD214-01	6380	20	0.0	1.5	0.2	0	5900	East inlet LA, no sheen
SD215-01	6320	-30	0.7	3	0.3	0	650	West inlet L, some sheen
SD216-01	6300	3	1.0	12	0.3	0	240	Section 16, no sheen
SD217-01	6300	6	1.0	12	0.3	0	680	Section 16, no sheen
SD218-01	6300	9	1.0	12	0.3	0	740	Section 16, oily below surface
SD219-01	5960	-4	2.0	7	0.5	0	150	West inlet J, no sheen
SD220-01	5260	35	0.0	3	0.8	1	100	East inlet I, no sheen
SD221-01	5160	4	0.0	4	0.7	1	47	East culvert H, no sheen
SD221-01R	5160	4	0.0	4	0.7	1	220	Field id RPSD008
SD222-01	5100	5	0.0	20	3.0	1	280	Section 17, no sheen
SD223-01	5100	5	0.0	20	3.0	2	390	Section 17, some oil
SD224-01	5100	5	0.0	20	3.0	3	440	Section 17, no sheen
SD225-01	5100	11	1.0	20	3.2	1	230	Section 17, no sheen
SD226-01	5100	11	1.0	20	3.2	2	4900	Section 17, very very oily
SD227-01	5100	11	1.0	20	3.2	3	6300	Section 17, oily
SD228-01	5100	15	1.8	20	1.8	1	2000	Section 17, no sheen
SD229-01	5100	15	1.8	20	1.8	2	4700	Section 17, some oil
SD229-01R	5100	15	1.8	20	1.8	2	2000	Field id RPSD009
SD230-01	4200	3	1.0	12	2.0	1	1100	Section 18, oily underneath
SD231-01	4200	3	1.0	12	2.0	2	16000	Section 18, very oily
SD232-01	4200	6	2.5	12	2.0	1	2600	Section 18, oily underneath
SD233-01	4200	6	2.5	12	2.0	2	7900	Section 18, very very oily
SD234-01	4200	9	2.0	12	1.0	1	11000	Section 18, oily underneath
SD235-01	3300	5	1.0	20	2.5	1	4100	Section 19, oily underneath
SD236-01	3300	5	1.0	20	2.5	2	20000	Section 19, very oily
SD237-01	3300	10	1.5	20	2.0	1	940	Section 19, no sheen
SD238-01	3300	10	1.5	20	2.0	2	5800	Section 19, very oily
SD239-01	3300	15	1.3	20	1.0	1	1000	Section 19, very oily
SD239-01R	3300	15	1.3	20	1.0	1	2000	Field id RPSD010
SD240-01	3110	40	0.2	3	0.5	0	270	East inlet G, no sheen
SD241-01	2860	40	0.0	20	0.2	0	150	East inlet F, no sheen
SD242-01	2680	70	0.2	4	2.5	1	100	East culvert E, no sheen
SD243-01	2250	-20	0.1	2	0.5	0	29	West inlet D, no sheen
SD244-01	2100	3	2.0	13	1.0	1	2600	Section 20, oily
SD245-01	2100	6	2.5	13	3.0	1	680	Section 20, no sheen
SD246-01	2100	6	2.5	13	3.0	2	2100	Section 20, oily
SD247-01	2100	6	2.5	13	3.0	3	290	Section 20, oil sheen
SD248-01	2100	9	2.0	13	1.0	1	2300	Section 20, oil underneath
SD248-01R	2100	9	2.0	13	1.0	1	940	Field id RPSD011
SD249-01	1780	-25	0.1	2	0.3	0	400	West inlet C, no sheen
SD250-01	1500	20	0.0	2	0.4	0	220	East inlet BAA, no sheen
SD251-01	600	5	1.0	21	0.8	1	890	Section 21, no sheen
SD252-01	600	11	1.0	21	3.0	1	760	Section 21, very oily
SD253-01	600	11	1.0	21	3.0	2	1000	Section 21, very oily
SD254-01	600	11	1.0	21	3.0	3	880	Section 21, some oil
SD255-01	600	16	0.8	21	0.8	1	830	Section 21, oily
SD256-01	50	-30	0.7	4	0.5	1	270	West inlet A, no sheen
SD257-01	50	-150	0.5	4	0.3	0	620	West inlet A, no sheen
SD258-01	-70	7	1.5	26	0.5	0	510	Section 22, no sheen
SD259-01	-70	12	1.5	26	0.8	1	740	Section 22, no sheen
SD259-01R	-70	12	1.5	26	0.8	1	1000	Field id RPSD012
SD260-01	-70	19	1.0	26	1.5	0	1000	Section 22, no sheen

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SAMPLE	X	Y	Z	W	S	DEPTH	EO	COMMENTS
SD261-01	-70	19	1.0	26	1.5	1	840	Section 22, no sheen
SS1001-01	30130	-20	--	--	--	2	640	Floodplain
SS1002-01	28500	-15	--	--	--	2	190	Floodplain
SS1003-01	25580	15	--	--	--	2	180	Grassy slope
SS1004-01	23550	-30	--	--	--	2	20	Circular mound in woods
SS1005-01	22370	15	--	--	--	2	20	Tall dredging piles
SS1005-01	22370	15	--	--	--	2	110	Field id RPSS1001
SS1006-01	21030	-20	--	--	--	2	170	Dredging piles
SS1007-01	16950	-10	--	--	--	2	3600	Wide floodplain, oily
SS1008-01	16190	20	--	--	--	2	120	Small dredging piles
SS1009-01	14630	-20	--	--	--	1	90	Small dredging piles
SS1010-01	14470	-100	--	--	--	2	60	Large mounds of dirt
SS1011-01	13180	-15	--	--	--	2	8400	Floodplain, oily
SS1012-01	12580	20	--	--	--	1	450	Floodplain
SS1013-01	10400	-50	--	--	--	2	50	In ponded area
SS1014-01	8700	20	--	--	--	2	30	Dredging piles
SS1015-01	7010	30	--	--	--	0	50	Dredging piles, many rocks
SS1016-01	5840	-10	--	--	--	2	6500	Floodplain
SS1017-01	3430	40	--	--	--	2	130	In piles of dirt
SS1017A-0	1910	-40	--	--	--	2	0	Dredging pile, C1 task sample
SS1018-01	1670	-40	--	--	--	1	0	Dredging pile, C1 task sample
SS1019-01	1500	-40	--	--	--	1	450	C1 task sample
SS1020-01	1295	-40	--	--	--	2	10	C1 task sample
SS1021-01	1105	-40	--	--	--	2	790	C1 task sample
SS1022-01	1095	-45	--	--	--	2	300	Dirt mound, C1 task sample
SS1023-01	915	-50	--	--	--	2	720	Dirt pile, C1 task sample
SS1023-01	905	-50	--	--	--	2	890	Replicate, C1 task sample
SS1024-01	700	-40	--	--	--	1	20	Grassy area, C1 task sample
SS1025-01	455	-40	--	--	--	2	2400	C1 task sample
SS1026-01	700	40	--	--	--	2	0	Dredging pile, C1 task sample
SS1027-01	925	40	--	--	--	1	0	High organics, C1 task sample
SS1028-01	1240	20	--	--	--	2	30	C1 task sample
SS1029-01	1570	40	--	--	--	1	20	C1 task sample
SS1029-01	1570	40	--	--	--	1	0	Replicate, C1 task sample

NOTES: SAMPLE = SD, SEDIMENT SAMPLES, OR SS, BANK OR FLOODPLAIN SAMPLES, R, FIELD REPLICATE
X = DISTANCE DOWNSTREAM OF LITTLE MENOMINEE RIVER ZERO POINT, IN FEET
X = 0 AT CENTERLINE OF C & NW RAILROAD NORTH OF MOSS AMERICAN SITE.
Y = DISTANCE FROM WEST BANK, IN FEET.
FOR INLETS, DISTANCE FROM LITTLE MENOMINEE RIVER EITHER EAST(+) OR WEST(-)
Z = DEPTH OF WATER, IN FEET
W = WIDTH OF RIVER OR INLETS, IN FEET
S = TOTAL SEDIMENT DEPTH, IN FEET
DEPTH = DEPTH INTERVAL FROM WHICH SAMPLE WAS TAKEN.
EO = EXTRACTABLE ORGANICS IN SAMPLE.

Appendix C
SURFACE WATER SAMPLING

Appendix C
SURFACE WATER SAMPLING

INTRODUCTION

This appendix describes the surface water sampling performed in the Little Menomonee River (Task FW) as part of the Moss-American Remedial Investigation (RI). The data collected will be used to assess the nature and extent of surface water contamination and to evaluate the potential for endangerment of public health and the environment. These analyses and an examination of contaminant loading to the Little Menomonee River from surface water routes or groundwater recharge will be presented in the RI report. Surface water sampling proceeded as described in the Quality Assurance Project Plan (September 14, 1987) and the Work Plan (July 23, 1987). Changes to the Site Sampling Plan are noted after the task description.

SURFACE WATER SAMPLING COLLECTION

Eight surface water samples were taken on the Little Menomonee River. Sampling was performed by Solveig Christenson and Gerald Bills of CH2M HILL on May 2, 1988. At each sampling location, seven 1-liter polyethylene bottles, two 1/2-gallon amber glass bottles, and two 40-milliliter VOA vials were filled. Each was labeled with the sample number and stored in a cooler. Two sets of bottles were filled at SW003-01 for matrix spike analysis, a field replicate was taken at SW005-01, and a field blank was prepared using distilled water.

Sample bottles were filled directly from the Little Menomonee River and the drainage ditches. Samples were taken at the approximate midpoint of the river or ditches at mid-depth. Water temperature and conductivity were measured in the field with a conductivity meter (Table C-1). Filtering and sample preservation were performed at the site trailer. Samples were labeled and shipped the same day to designated EPA Contract Laboratory Program (CLP) laboratories.

Sample locations (Figures C-1 and C-2) were chosen as outlined in the Sampling Plan. Distances were measured downstream from the Chicago and Northwestern (C&NW) Railroad Bridge that crosses the Little Menomonee River at the northern edge of the site.

- **SW001** was taken about 40 feet upstream of the confluence of the Little Menomonee River with the Menomonee River (30,800 feet) to determine the quality of the water leaving the Little Menomonee River.

- **SW002** and **SW003** were collected to represent general water quality conditions in the Little Menomonee River downstream of the site and upstream of the confluence with the Menomonee

Table C-1
FIELD MEASUREMENTS OF SURFACE WATER SAMPLES

Sample Number	Conductivity (µmhos)	Temperature (°C)
SW001	780	14.0
SW002	780	14.5
SW003	700	15.0
SW004	730	17.0
SW005	720	17.0
SW006	710	17.5
SW007	930	14.0
SW008	NR	NR

NR--No reading taken; inlet too shallow.

GLT779/032.50

River. They were collected about 750 feet south of Silver Spring Drive (25,720 feet) and 250 feet north of West Calumet Road (8,780 feet).

- **SW004** was taken to evaluate water quality where the Little Menomonee River exited the Moss-American site (2,100 feet).
- **SW005** was taken where the Little Menomonee River enters the site (40 feet), just north of an unnamed drainage ditch.
- **SW006** was taken upstream of the site (350 feet) about 100 feet north Brown Deer Road as a background sample.
- **SW007** was taken in the drainage ditch that flows from the northern boundary of the site to the Little Menomonee River. It was collected about 60 feet from the Little Menomonee River (50 feet) to evaluate the quality of water flowing to the northern boundary of the site.
- **SW008** was taken at a drainage ditch that drains a wet area on the south end of the site into the Little Menomonee River. It was taken about 40 feet from the river (1,800 feet) to determine the quality of the water from the ditch.

FIELD MODIFICATIONS TO THE SAMPLING PLAN

Samples SW008 and SW005 were collected from locations different from those presented in the Sampling Plan. The planned location for SW008 was dry, so the sample was collected in a ditch that drains a wet area on the south side of the site. Sample SW005 was taken upstream of a drainage ditch instead of downstream to provide a water quality sample where the river entered the site.

According to the Sampling Plan, surface water samples were to have been collected using a stainless steel laboratory beaker. Instead, sample bottles were filled directly from the river. The pH of the water not measured in the field, but was measured as part of the CLP laboratory's analysis.

OBSERVATIONS

No visible evidence of surface water contamination was noted during the sampling effort, except that oil sheens were produced in several areas when sediments were disturbed during the collection process.

Later in the summer, however, a continuous streamer of oil was observed on the surface of the Little Menomonee River adjacent to the Moss-American site where the outfall of the settling ponds had previously existed. The discharge was most notable during the low flow condition that resulted from the summer drought. The discharge was not noted during the original surface water

sampling or during a site visit on October 18, 1988. At both times flow in the river appeared to be near normal, based on observations of the banks and channel width.

CONCLUSIONS

Oil from the site is being discharged to the river and transported downstream. The discharge is visible during low flow conditions. During normal flow conditions, the discharge is either not noticeable (possibly because of dilution) or it does not occur. This conclusion is based upon observations during the field investigation. A final conclusion will, of course, include the analytical results from the samples and will be reported in the Remedial Investigation reports.

GLT779/029.50

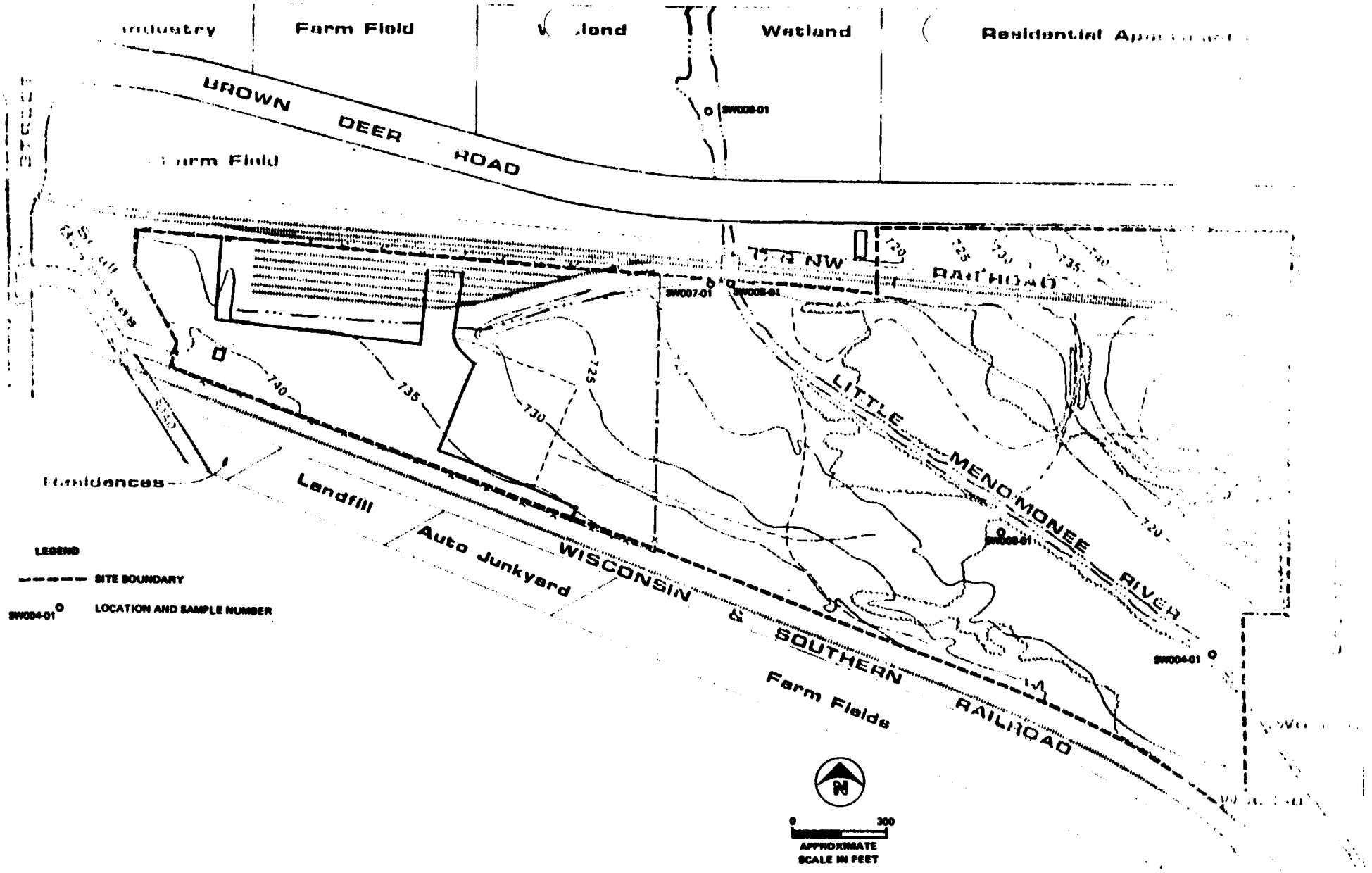


FIGURE C-2
SURFACE WATER SAMPLE LOCATIONS
MOSS-AMERICAN RI

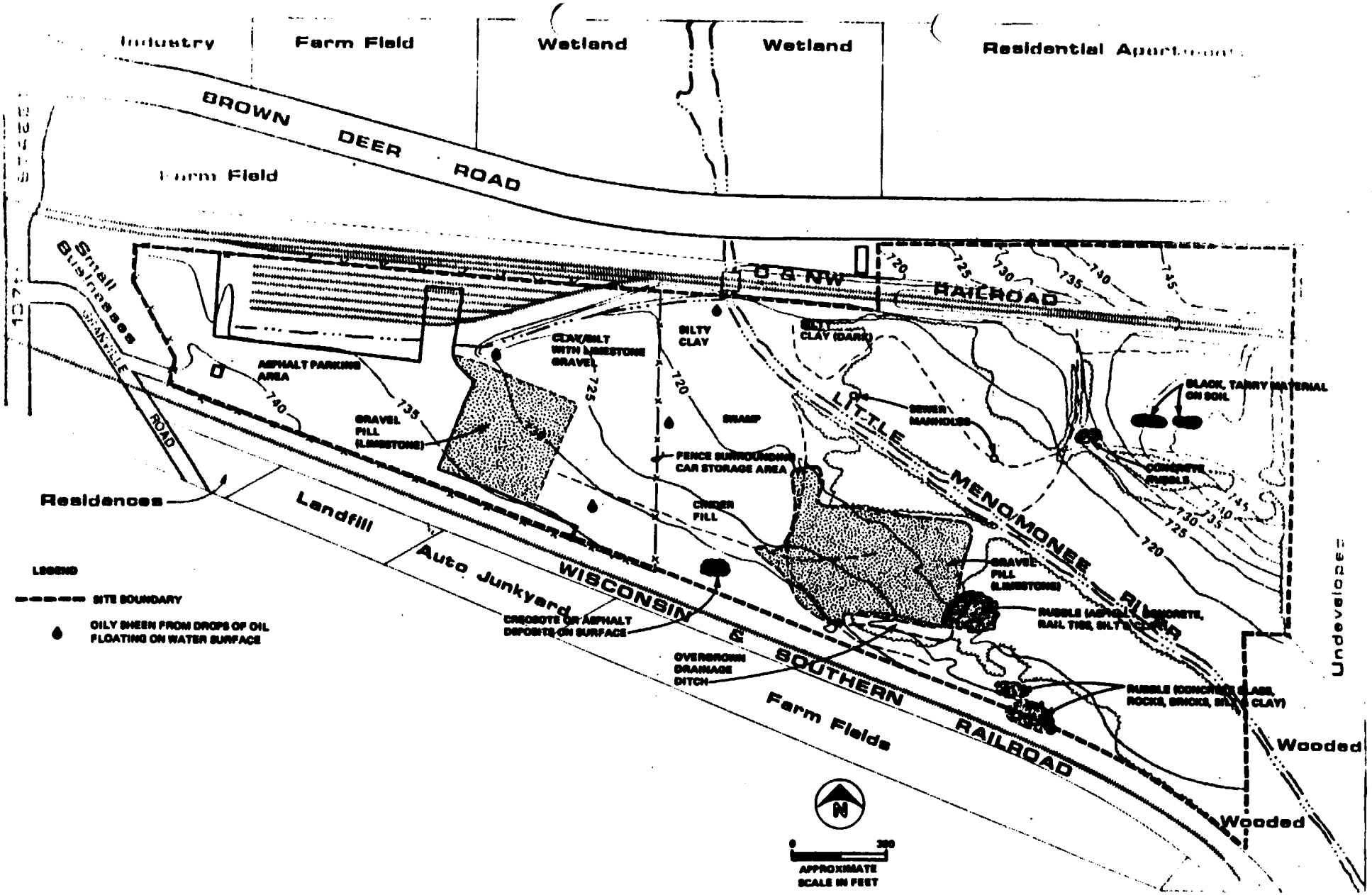


FIGURE D-2
EXISTING CONDITIONS: 1987
MOSS-AMERICAN RI

Appendix D
MAPPING AND SURVEYING

Appendix D
MAPPING AND SURVEYING

INTRODUCTION

This appendix describes the field work and related investigation associated with mapping and surveying for the remedial investigation of the Moss-American Superfund site. It also describes the methods and field procedures that were employed and recommendations made for the next phase of the investigation, initial soil screening. Appendix A describes the mapping and surveying along the Little Menomonee River from the southern boundary of the site to its confluence with the Menomonee River.

OBJECTIVES

The objectives of the surveying and mapping task (Task FM) were to inspect existing conditions at the site and to establish sample locations in preparation for the initial soil sampling program.

METHODOLOGY

SITE RECONNAISSANCE

The site was inspected by Don Johnson, Kevin Olson, and Solveig Christenson of CH2M HILL on November 19, 1987. The purpose of the inspection was to gain familiarity with the site and develop a strategy for completing Task FM.

Recent aerial photographs were compared to existing conditions to identify and correlate landforms and other surface features. Reference points found both in the field and on the photographs were identified for subsequent use in laying out a grid for field mapping. The general locations of potential sources of contaminants and other features that existed before the creosoting facility was closed were established in the field. Visible evidence of contamination at these and other locations was noted. The presence and general location of dredgings along the river were noted and an attempt was made to identify the general location of the dredgings landfill in the northeast corner of the site.

SITE SURVEY AND MAPPING

Onsite field work was conducted from November 20 to 24, 1987, by Don Johnson, Kevin Olson and Solveig Christenson, and on December 10 by Don Johnson and Solveig Christenson.

A rectangular grid (200 by 100 feet) was established and existing surface features were observed and mapped. Surface soils were evaluated at intersecting grid lines by digging test holes approximately 2 feet deep with a hand shovel (Figure D-1). The freshly disturbed soil was screened for organic vapor using an

HNu photoionization detector. The type of soil or fill material was then described and visually evaluated for evidence of contamination.

The reference line for the grid west of the Little Menomonee River is a north-south fence that is the eastern boundary of an automobile storage lot on the site. Starting at the northeast corner of the fence, 200-foot intervals were marked in a southerly direction along the fence line. Transects perpendicular to the fence line (roughly east-west) were flagged at 100-foot intervals both east and west of the fence line. The grid included the open area between the paved portion of the automobile storage area on the west and either the Little Menomonee River or a wooded area on the east. The area includes potentially contaminated areas previously used for processing and storage of lumber treated with creosote. Test holes were dug along extensions of the grid within the wooded areas to evaluate dredging piles along the river.

Two areas east of the Little Menomonee River were evaluated. Test holes were dug in a small open area immediately southeast of the railroad bridges crossing the river, which may have contained standing liquid according to previous interpretations of aerial photographs. The other area was the field in the northeast corner of the site. Dredgings from the settling ponds and river are reportedly buried in a landfill within the field. The reference point for the grid east of the river is the intersection of two one-lane dirt roads in the northwest corner of the field. Intervals of 100 feet were flagged along three north-south transects, starting at 100, 300, and 500 feet east of the reference point.

COMPARISON OF CURRENT AND HISTORICAL CONDITIONS

Information obtained during the site survey, recent topographic maps, and aerial photographs of the site were compared to older maps and aerial photographs to identify changes to the site. In particular, changes that would affect the sampling strategy were identified, such as the addition of fill or pavement. Cross sections were constructed of the landfill area using current and historical maps to delineate potential areas of deposition or fill and to identify the general location of the landfill. Cross sections of the settling ponds and the automobile storage area were constructed to estimate the depth and lateral extent of the fill covering those areas.

DATA LIMITATIONS

Organic vapor concentrations in the disturbed soil measured with the HNu photoionization detector were erratic and unreliable, presumably because of high humidity and cold temperatures. HNu readings ranging from background to as high as 190 ppm were recorded; however, it was also noted that the standby meter reading increased along with the normal meter reading, indicating considerable drift in background levels during sample measurement. In addition, the response time for these measurements was on the order of 1 to 2 minutes. During measurement at test holes in which visible evidence of contamination was present, the response time was less than 5 seconds. Remeasurement at several test holes resulted in significant variation in the meter readings. Therefore, the HNu readings are suspect and will not be used for analytical purposes.

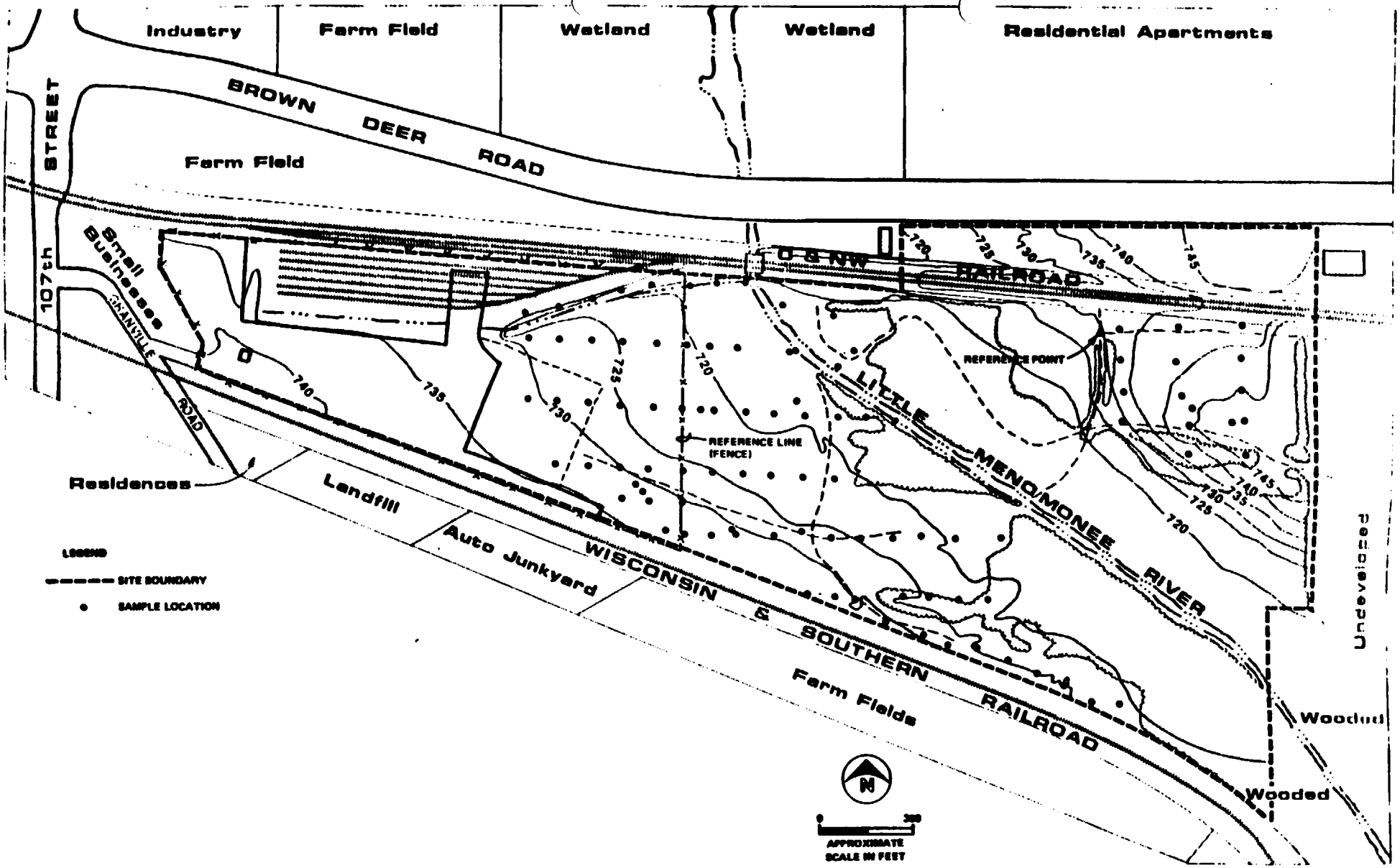


FIGURE D-1
SAMPLING POINTS USED DURING TASK FM, MAPPING AND SURVEYING
MOSS-AMERICAN RI

Crushed limestone fill prevented digging test holes to the desired depth in several areas (see Figure D-2). If the limestone fill was not laterally extensive, such as at the abandoned railroad bed, then the test hole was offset to the edge of the fill. In laterally extensive limestone fill areas, an attempt was made to dig through the bed to determine its thickness and observe the underlying soil for evidence of contamination. This was particularly important for one large gravelly area that, according to previous interpretations, was used as a sludge disposal area. In all cases, however, it was not possible to penetrate the gravel with a shovel. Test holes in those areas ranged from approximately 6 inches to 1 foot.

RESULTS

The results of the site and soil survey are presented in Figure D-2. Figure D-3 is a map of the Moss-American facility as it appeared in 1962. The delineations shown on Figure D-3 divide the site according to the different land uses occurring during site operation. Most of the changes to the site occurred between 1976 and 1978 after Moss-American ceased the creosoting operations. All buildings, storage tanks, and process vessels were demolished and contaminated residue was shipped offsite. The surface of the process area was reportedly backfilled and leveled. The western part of the site was graded with new fill and paved sometime after March 1980, when Kerr-McGee sold this portion of the site to the Chicago and North Western (C&NW) Railroad Company.

PROCESSING AREA, DRIP TRACKS, AND UNTREATED STORAGE AREA

The processing area, drip tracks, and untreated storage area are roughly coincident with the portion of the site currently owned by the C&NW railroad and used for automobile storage. The locations of three cross sections in those areas are shown in Figure D-4. Figure D-5 illustrates the extent of the fill material in those areas. The previous topography is superimposed on the present topography to show the minimum depth of fill and the location of borrow (cut) areas.

Cross section A-A' (Figure D-5) shows a small cut and fill area, presumably for leveling the area currently used for parking rail cars. In addition, a drainage ditch that previously paralleled the tracks on the northern edge of the site has been filled with at least 4 feet of material.

At cross section B-B', it appears that a wedge of fill ranges in thickness from 2 feet on the south side to approximately 8 feet on the north. At least 3 or 4 feet of material covers what used to be the foundation of a building. However, according to documents in EPA files, buildings demolished during closure were excavated to a depth of 18 inches, backfilled with clean fill and leveled. Inasmuch as episodes of cut and fill occurring between 1962 and 1987 may not be shown in the cross sections, it is possible that more than 5 feet of fill (18 inches from site closure and 3 to 4 feet from redevelopment) covers the old building along cross section B-B'. At the northern end of the cross section,

the old drainage on the northern edge of the site is covered with approximately 7 feet of fill.

Cross section C-C' shows little if any change in topography along the southern half of the area. The existing land surface in the vicinity of what was previously a building and storage tank along C-C' is fairly close to the elevation of the land surface in 1962. However, according to Kerr-McGee documents in EPA files approximately 18 inches of backfill may exist there. Part of one building foundation was observed along the paved road near the eastern part of the processing area. Therefore, the fill added near the foundation during and after site closure appears to be minimal.

During the site survey an oily sheen was observed on ponded surfaces in the area previously used for storing untreated railroad ties. The oil appeared to emanate from the fill material below the asphalt surface. It was not possible to determine if the oil was a remnant of past creosoting activity or the result of current activity at the site.

Three patches of black, dried, tarry deposits were noted in the eastern part of the processing area. The area is littered with railroad ties that appear to be remnants of abandoned railroad beds.

TREATED STORAGE AREA

No significant changes are evident in the treated storage area. The surface materials consist of either cinder fill mixed with varying amounts of silt, sand, and wood chips, or an organic rich silty sandy material. The variability in the silty sandy material indicates that it is probably fill material or reworked soil. Remnants of abandoned railroad beds are present throughout the area.

The settling ponds that previously drained this area (see Figure D-3) were reportedly dredged and backfilled with clean fill in 1971. Figure D-6 shows a cross section through the ponds (from 1962) superimposed on the existing topography. The thickness of fill in that area is shown as 2 to 6 feet in Figure D-6, but the actual depth of fill includes the depth to which the ponds were dredged before backfilling, which is not known.

A clay wall 75 feet long and 12 feet deep was reportedly constructed between the settling ponds and Little Menomonee River in 1971. Its exact location was not determined during the field investigation.

SLUDGE DISPOSAL AREA

The sludge disposal area consists of coarse limestone or dolomite gravel. No evidence of contamination was observed; however, it was not possible to dig to the base of the gravel to evaluate the interface between the gravel and underlying soil.

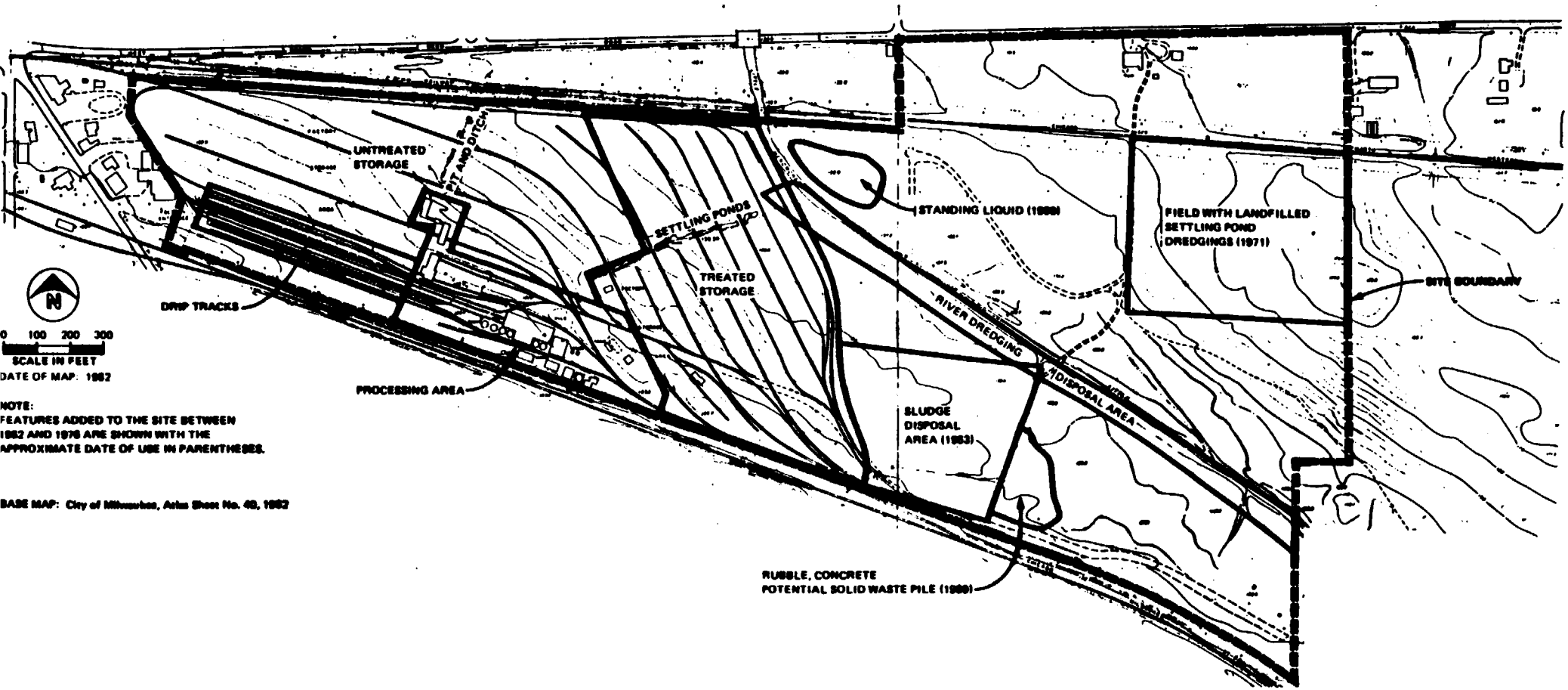


FIGURE D-3
AREAS OF POTENTIAL CONCERN
MOSS-AMERICAN RI

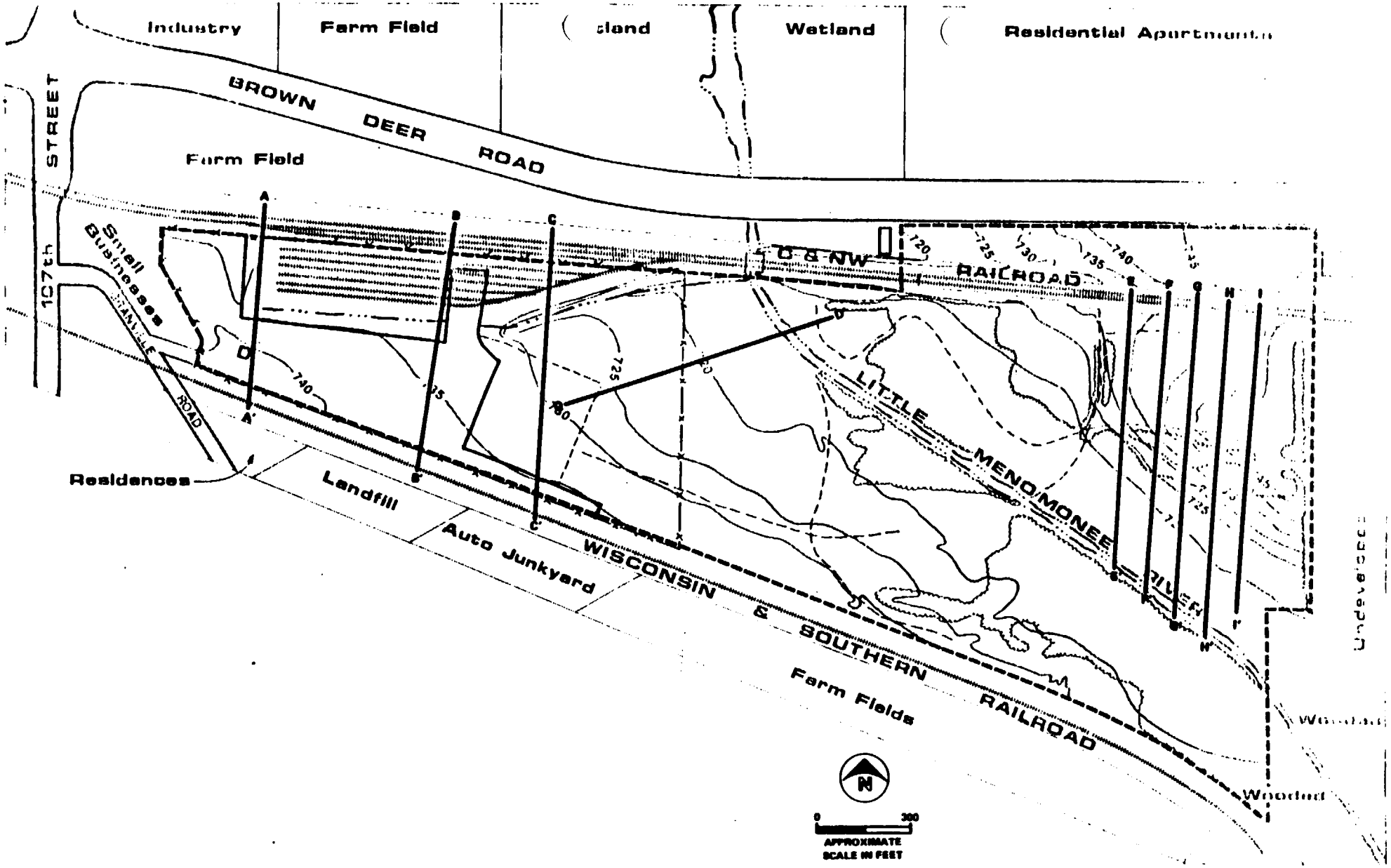


FIGURE D-4
CROSS SECTION LOCATIONS
MOSS-AMERICAN RI

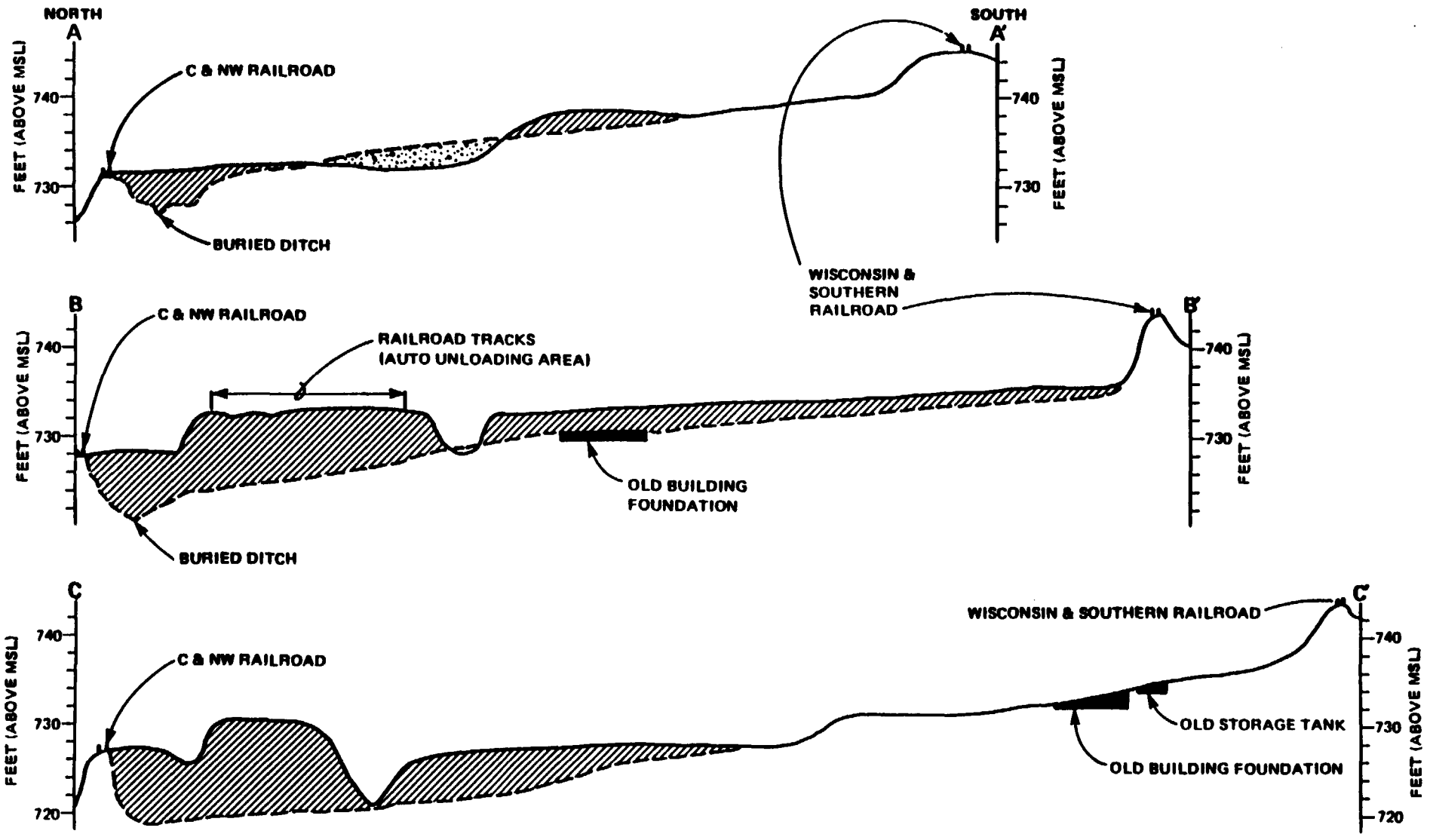


FIGURE D-5
CROSS SECTIONS THROUGH THE EXISTING AUTO STORAGE LOT
MOSS-AMERICAN RI

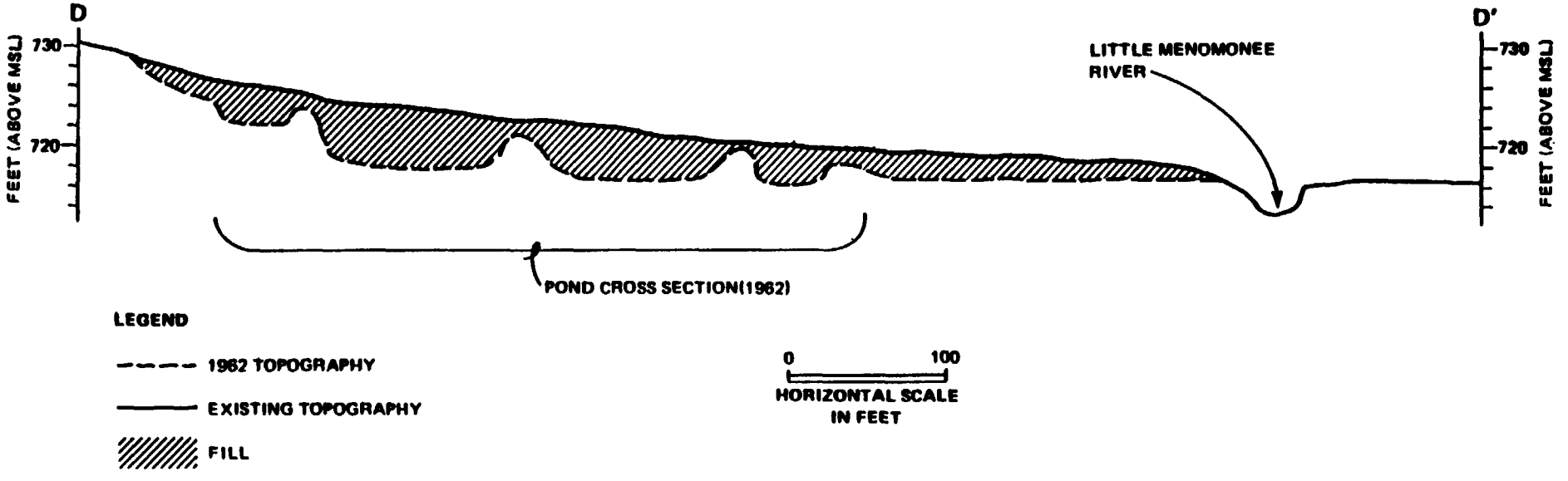


FIGURE D-6
CROSS SECTION THROUGH
SETTLING PONDS
MOSS-AMERICAN RI

SOLID WASTE PILES

A mound of rubble was observed in the area of the solid waste piles. The mound consisted of concrete and asphalt slabs, rocks, bricks, and dirt. No other evidence of solid waste disposal was observed near the areas delineated as solid waste piles, but trash disposal areas were observed in low-lying wooded areas along the river. Trash consisting of old bottles, cans, and automobile parts appeared to have been dumped on the surface. No signs of industrial or hazardous waste were observed in the trash disposal areas. One area, interpreted from an aerial photograph as a solid waste pile, was an overgrown drainage ditch.

DREDGINGS PILES

Piles of dredgings were observed along both banks of the river. River dredging was performed at least twice in this area. Although not documented, it appears from observing old river channels meandering through the woods onsite and from the straightness of the existing river channel that the channel was dredged and straightened before 1950, the date of the earliest aerial photograph. In 1971, Moss-American dredged parts of the river to remove creosote deposits. According to Kerr-McGee's "Notification of Hazardous Waste Site" (June 4, 1985), 6 inches of creosote contaminated dredgings, 50 feet wide and 1,700 feet long, are deposited on the south bank of the river. During the field investigation it was not possible to distinguish the source or age of the dredging piles.

STANDING LIQUID AREA

The standing liquid area was identified in an aerial photograph taken in 1969. Dredging piles along the river have created a dike that traps water and possibly other fluids in the area behind the dredgings. The aerial photograph showed a new road connecting the sludge disposal area and the standing liquid area that may have been used to transport liquids to the standing liquid area. During the field investigation, however, it was noted that the road connects two manholes on a sewer in the Metropolitan Interceptor Sewer System.

DREDGINGS LANDFILL

Kerr-McGee's "Notification of Hazardous Waste Site" describes a landfill in the northeast corner of the site that was created around 1971 to dispose of creosote contaminated soil (K001) generated by the closure of the impoundment area. Land-fill construction included four trenches measuring 8 feet wide, 8 feet deep and 100 feet long each. Approximately 8,100 cubic feet of residue was mixed with clean clay soil in a ratio of approximately 2:1 clean clay soil to residue. The trenches were filled to a depth of approximately 6 feet and then covered with a 2-foot clean clay soil cap.

The "impoundment area" is a series of settling ponds west of the river. Other reports have suggested that river dredgings may also be landfilled. The exact locations of the trenches and trench arrangement were not given.

During the site survey black, dried, tarry deposits were observed on the land surface along the 2-track road on the south side of the field (see Figure D-2). Two deposits were observed. The combined surface dimensions of the deposits (including a middle area with no visual evidence of contamination) are approximately 200 by 50 feet. Four trenches with the dimensions given in the hazardous waste site notification could easily fit within that area.

Figure D-7 shows a comparison of the existing topography in the vicinity of the landfill and the topography as of 1962. Borrow areas are clearly shown on the cross sections as large cuts from the eastern part of the field. Areas of potential fill, which could indicate the location of the landfill or other material spread on the surface, are shown on the three easternmost cross sections in Figure D-7 (G-G', H-H', and I-I').

RECOMMENDATIONS

This section summarizes the recommendations made regarding sample locations and sampling methodology for initial soil screening. The use of a backhoe in place of a hollow-stem auger was recommended for most samples, as were location refinements to the sampling plan described in the work plan and QAPP (Figure D-8). Proposed sample locations for the initial soil sampling based on these recommendations are shown in Figure D-9.

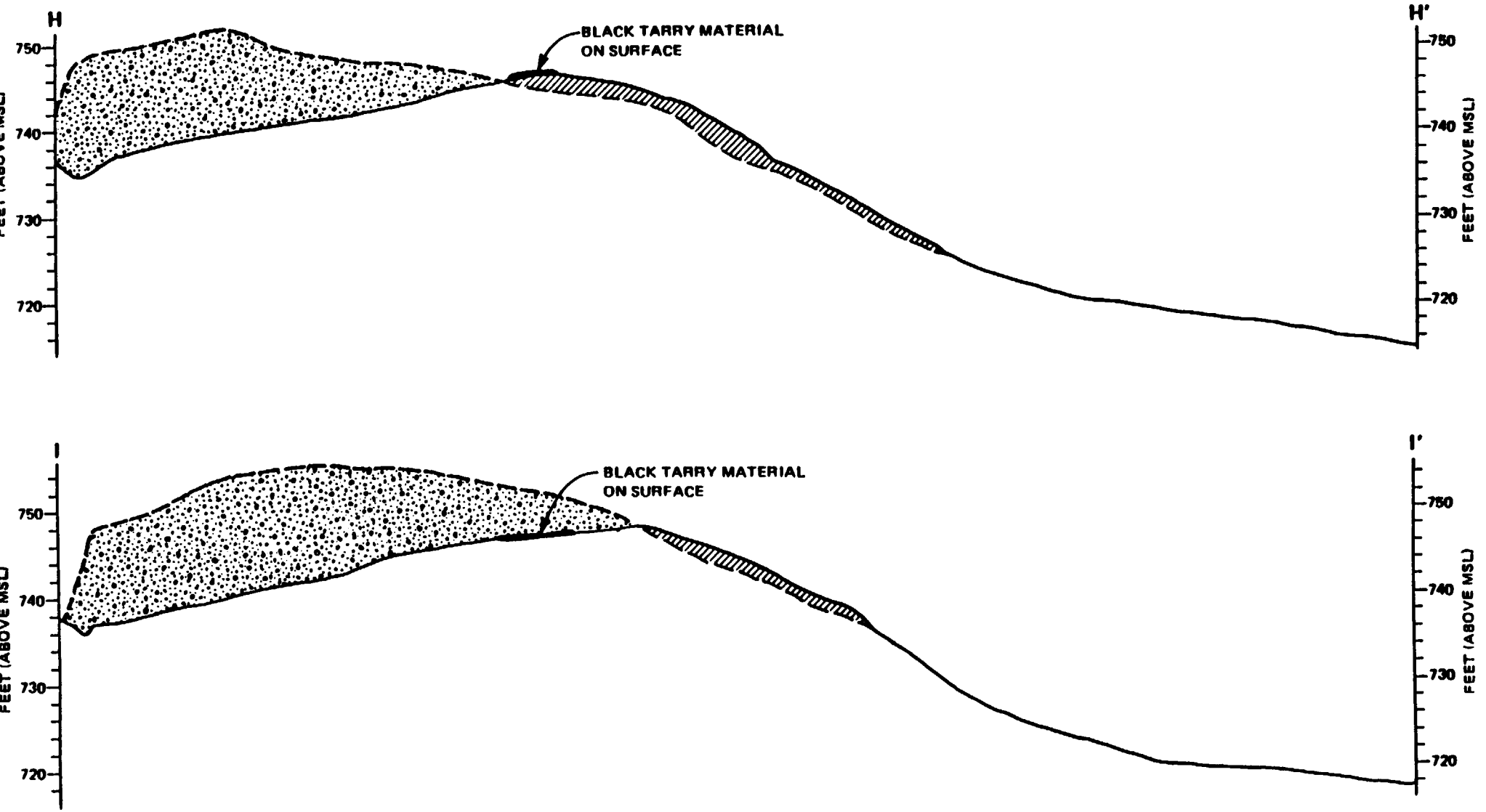
BACKHOE VERSUS AUGER

A backhoe, rather than a trailer-mounted auger, was recommended for digging test holes in all areas except the paved automobile storage area for the following reasons:

- Augering in coarse gravel areas could be difficult.
- Abandoned railroad beds and the sludge disposal area, which are composed of coarse gravel, should be visually evaluated because of their potential significance as conduits for contaminant transport.
- Test holes dug by backhoe would allow visual inspection of the subsurface, improving the quality and accuracy of observation and interpretations.
- Subsurface samples obtained from discrete layers would provide more meaningful data than compositing samples over a particular depth, which is often necessary to obtain sufficient sample volume from split spoons.

Test holes dug by backhoe would follow the same general sampling plan prepared for augering except the hole would be dug rather than augered. The number of test holes and samples would remain unchanged. Auger samples are

FIGURE D-7 (SHEET 1 OF 2)
CROSS SECTIONS THROUGH THE FIELD IN THE NORTHEAST CORNER
MOSS-AMERICAN RI



LEGNED

1962 TOPOGRAPHY

EXISTING TOPOGRAPHY

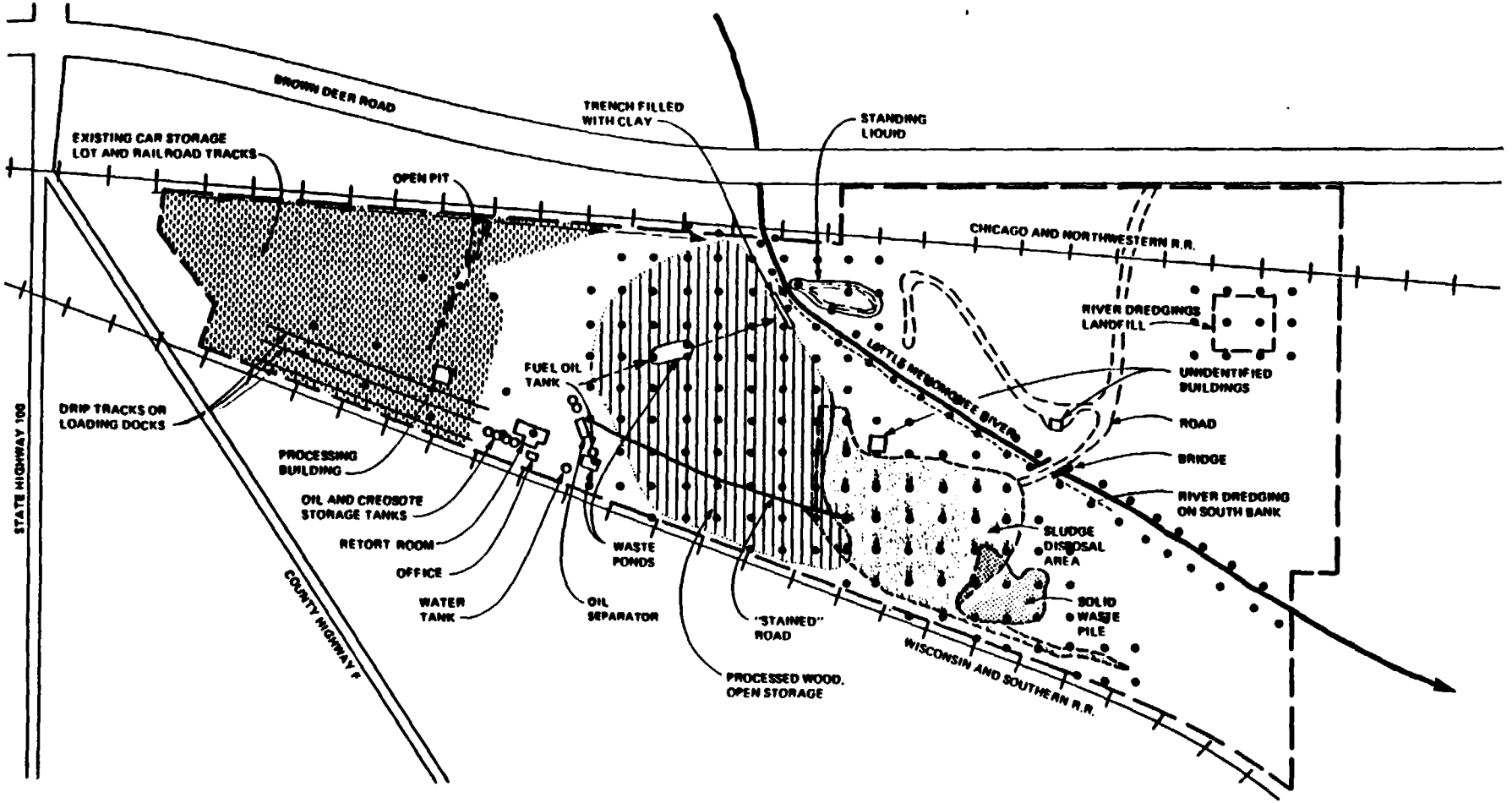
FILL

CUT

0 100'

HORIZONTAL SCALE
IN FEET

FIGURE D-7 (SHEET 2 OF 2)
CROSS SECTIONS THROUGH THE FIELD IN THE NORTHEAST CORNER
MOSS-AMERICAN RI



LEGEND

- DRAINAGE DITCH
- SITE BOUNDARY
- SAMPLING LOCATIONS

N

0 500

SCALE IN FEET

NOTE: This is a composite map of features that at one time had been on the site. Many of these have since been dismantled or covered.

FIGURE D-8
SURFACE SOIL SAMPLE LOCATIONS AS SHOWN IN THE WORK PLAN
MOSS-AMERICAN RI

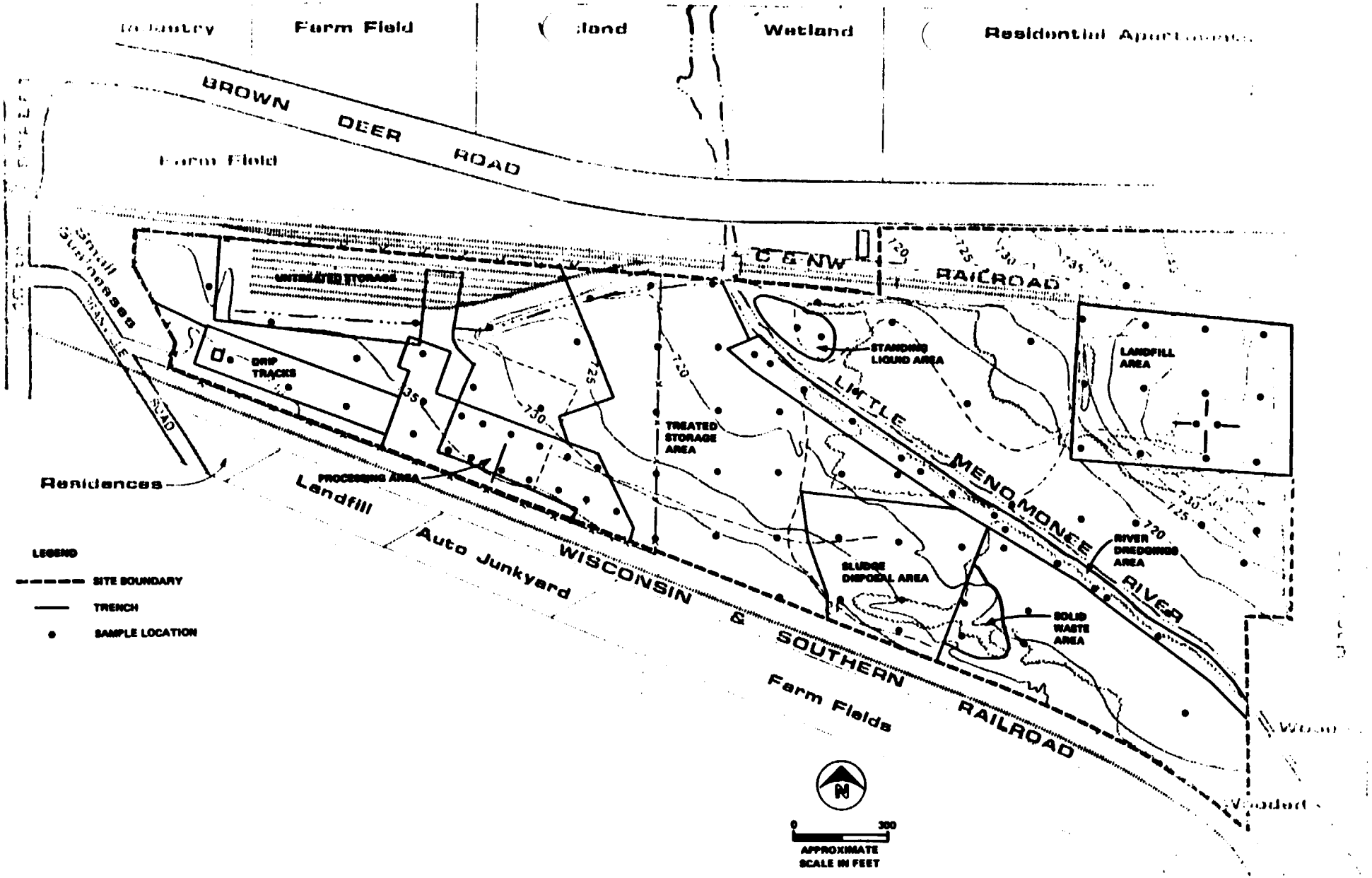


FIGURE D-9
PROPOSED SAMPLE LOCATIONS FOR INITIAL SOIL SCREENING
MOSS-AMERICAN RI

still recommended for the paved area to minimize damage and interference to the facility and operations at the auto storage lot.

UNTREATED STORAGE AREA

Contamination is not expected in the untreated storage area. Figure D-8 shows five sample locations in that area, in addition to four samples along a trench and pit that previously drained the area.

Because of extensive redevelopment and the addition of significant amounts of fill over the northern half of the area, the following recommendations were made:

- Arrange the five spot samples at regular intervals along the southern and eastern boundaries of the untreated storage area, approximately 50 feet inside the area boundary. This would avoid areas of new fill and should help delineate the actual boundary between contaminated and uncontaminated areas.

- Because of the thickness of the fill, samples near the pit and trench should be limited to the existing drainageway. The drainageway is perpendicular to the previous drainage. The intersection of the two ditches is near the culvert that passes under the paved area. Surface samples should be taken at each end of the culvert of the existing drainageway.

- If additional sampling in the pit and ditch area is warranted, precise surveying techniques should be used to locate the buried pit and trench before sampling. Sampling should be done to the necessary depth with soil borings using a hollow-stem auger.

- Samples in the pit and ditch area should be carefully screened so the clean new fill is properly logged but not sampled. Sampling depth should be adjusted from 0 to 4 feet (the current plan) to 0 to 12 feet to identify the top of the original land surface and then to evaluate the next 4 feet.

DRIP TRACK AREA

Six samples were proposed for the drip track area on a grid of approximately 100 by 200 feet. The following clarification was recommended:

- The samples down the center of the drip track area from the first round of sampling should be adequate to determine the degree of contamination.

- Four samples should be considered for the second round--two on each side of the centerline, staggered, and at different distances from the centerline. These, in conjunction with the samples taken in the

untreated storage area along the boundary, should focus on determining the lateral extent of contamination.

PROCESSING AREA

The processing area was considered the most difficult to characterize. Unlike most of the other areas, which should be fairly uniform, the processing area contained buildings, railroad beds, aboveground storage tanks, waste piles, and an oil separator. The area around the retort room was probably one of the most contaminated areas during site operation. Although the processing area was reportedly excavated and backfilled during site closure, thorough investigation of the area was still warranted. The following recommendations were made:

- A trench should be excavated through the retort area using a backhoe. Visual observations of the trench wall should provide information about the extent of removal operations occurring during site closure. The observations on the trench should also improve the interpretations of subsequent split-spoon samples from the paved part of the processing area west of the retort building.

- Instead of collecting samples on a 200-foot grid, samples should be collected on a 100-foot grid during the first round of sampling. Additional locations should be for a selected the second round of sampling on the basis of the initial results.

- The sampling depth should be adjusted to a maximum of 5 feet in areas where clean fill is obviously present.

TREATED STORAGE AREA

The treated storage area should be fairly uniform except for the area previously containing settling ponds. No changes or refinements, other than the use of a backhoe, were recommended for that area.

SLUDGE DISPOSAL AREA

No changes or refinements to the sampling plan were recommended for the sludge disposal area.

SOLID WASTE AREA

No changes or refinements to the sampling plan were recommended for the solid waste area.

RIVER DREDGINGS

The following strategy was recommended for sampling the south bank of the river:

- Collect samples at regular intervals to identify dredgings that were leveled and may blend with the topography.

- Collect spot samples from representative areas where dredgings have been placed in piles.

Contaminated soil was not expected on the north bank of the river, but verification with random samples along the bank and spot samples of representative piles of dredgings and in clearings along the bank was considered appropriate.

STANDING LIQUID AREA

The dimensions of the standing liquid area, measured from an aerial photograph taken June 13, 1969, are approximately 130 by 70 feet. Because of the limited size of the area, the following recommendations were made:

- Dig two test holes approximately 40 feet apart in the center of the area for the first round of sampling.

- If contamination is detected, collect additional samples to identify the extent of the contamination.

LANDFILL AREA

The following strategy was recommended to identify the location and verify the extent of the landfill area:

- Collect one sample from the center of each of the patches of tarry deposits to determine the depth and general character of the deposits. It was not considered necessary or desirable to go deeper than 4 feet for these samples. Four-foot holes would verify whether the deposits were entrenched or merely spread on the surface. If the deposits were entrenched, then the shallow soil boring planned for the area would identify the vertical extent of the creosote contaminated fill.

- Construct four trenches or a series of closely spaced test pits extending radially outward from the edge of the tarry deposits in the four compass directions. Again, the intention was to identify the lateral extent of the deposits. Once tarry substances were encountered it would not be necessary to dig deeper. The maximum depth of the trench should not exceed 4 feet.

- If the tarry deposits were determined to be the landfill, samples should be taken from a 200-foot grid for random evaluations of the rest of the field. If the tarry deposits are not the landfill, samples should be collected on a 100-foot grid.

Appendix E
SURFACE SOIL INVESTIGATIONS

Appendix E
SURFACE SOIL INVESTIGATIONS

INTRODUCTION

TASK SUMMARY

This appendix describes the field work and results of Tasks G1 and G2, Initial Soil Screening and Confirmatory Soil Analysis, for the Moss-American site. The objective of the tasks was to provide the data necessary to determine the native and lateral extent of contamination at the site.

Soil samples were collected at depths of 0 to 4 feet from clean and contaminated areas onsite and from background locations offsite. Samples were generally collected from test pits dug with a backhoe. However, offsite samples and samples from wooded and swampy areas onsite were collected from holes dug with a hand-held post hole digger, and samples beneath paved areas onsite were collected using split-spoon samplers in auger borings advanced with a truck-mounted drill rig.

All test pits and holes were screened in the field for evidence of contamination by visual observation, odor detection, and organic vapor monitoring. Total extractable organics of at least one sample from each location was measured by the onsite close support laboratory (CSL). Following an evaluation of results from the initial screening, 40 samples were sent to an offsite laboratory to determine the concentration of polyaromatic hydrocarbons (PAHs) and phenolic acids. On the basis of the results from the offsite laboratory, 16 sites were resampled and samples were submitted to CLP laboratories for analysis of Target Compound List parameters, dioxin, and several treatment parameters.

TASK SCHEDULE AND PERSONNEL

Surface soil sampling began on May 18 and continued through May 31. Sampling in the paved area was performed on June 29. Confirmatory soil sampling was (Task G2) done on June 30.

Test pit excavation by backhoe and augering in the paved area was subcontracted to Exploration Technology, Inc., of Madison, Wisconsin. Samples were collected and logged by CH2M HILL personnel. Kevin Olson, Stu Grubb, Ned Pennock, John Gannon, and Don Johnson performed field work under these tasks. Brian Laude and Dave Shekoski analyzed samples in the CSL for extractable organic compounds. Results from the onsite screening and priority pollutant PAH and phenolic acid determination are included in this memorandum. Analytical results from the confirmatory sampling will be presented in the remedial investigation report.

OBJECTIVES

The overall objective of these tasks was to determine the nature and extent of contamination on the site. In addition, geologic and other factors affecting contaminant migration at the site were identified, and organic vapor concentrations were monitored for assessment of air quality.

METHODS

STRATEGY

Based on past site activities and a site inspection, an initial set of sample locations was identified as part of Task FM. A 100-foot-square grid was established over most of the site to locate sampling points in the field. Samples were generally collected at 200-foot intervals. Samples were collected at 100-foot intervals from the processing area and other areas of high contaminant levels. In addition, 14 offsite samples were collected: 7 near active railroad beds and 7 from areas with physical characteristics similar to those on the site. The samples near the railroad beds were collected to compare the compounds present near offsite railroad tracks with those found where tracks once existed on the site. Figure E-1 shows the sampling locations.

Samples taken from the test pits were assumed to be representative of the material surrounding the pit. However, localized areas of high contamination were expected near the processing building, in the landfill east of the river, and possibly surrounding the old settling ponds. The test pits were lengthened into trenches in those areas to better define the limits of contamination.

Each location was screened in the field for evidence of contamination. Field screening consisted of making visual observations, detecting odors, and monitoring with an HNu during soil disturbance. The sample from each pit was collected in a plastic bag and a 4-ounce glass jar. The most visibly contaminated soil was collected at each pit. Organic vapors in the headspace of the plastic bag were measured with the HNu. The CSL analyzed each jarred sample for extractable organic compounds. A site map was kept up-to-date with data on extractable organic compounds, field screening data, and pertinent field observations. Additional sample locations were then selected, as necessary, to further define the limits of contamination. Generally, additional sample locations were on the 100-foot grid nodes.

Upon completion of sampling and evaluation of results from the CSL, about 30 percent of the samples were sent to an offsite laboratory and analyzed for priority pollutant PAHs and phenolic acid compounds. A total of 40 samples were analyzed: 30 from areas with high concentrations of extractable organic compounds and 10 from areas with concentrations less than 1,000 ppm (Figure E-2). CH2M HILL's Montgomery laboratory performed the GC/FID analyses.

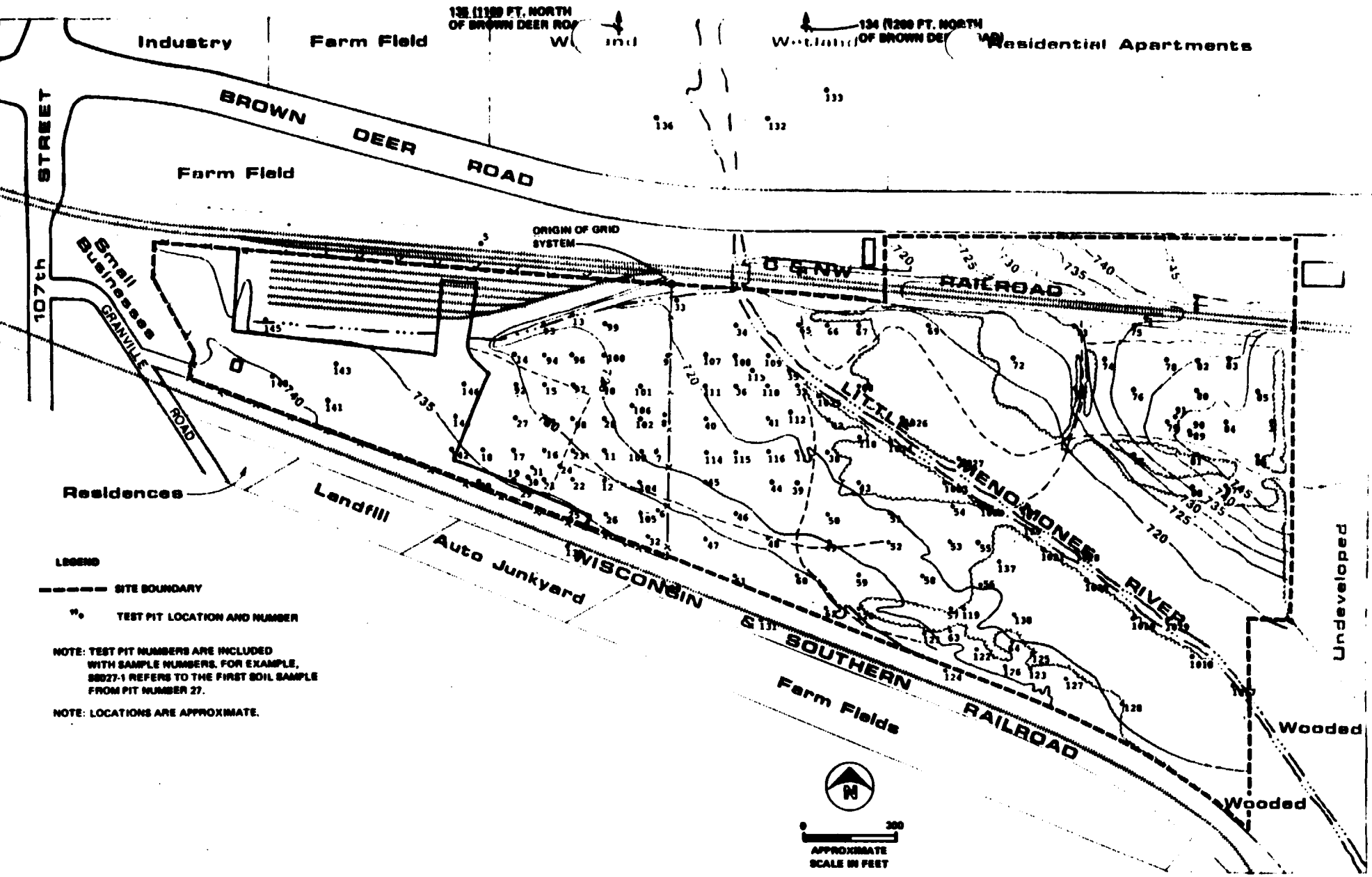


FIGURE E-1
SOIL SAMPLING LOCATIONS
FOR EXTRACTABLE ORGANIC ANALYSIS
MOSS-AMERICAN RI

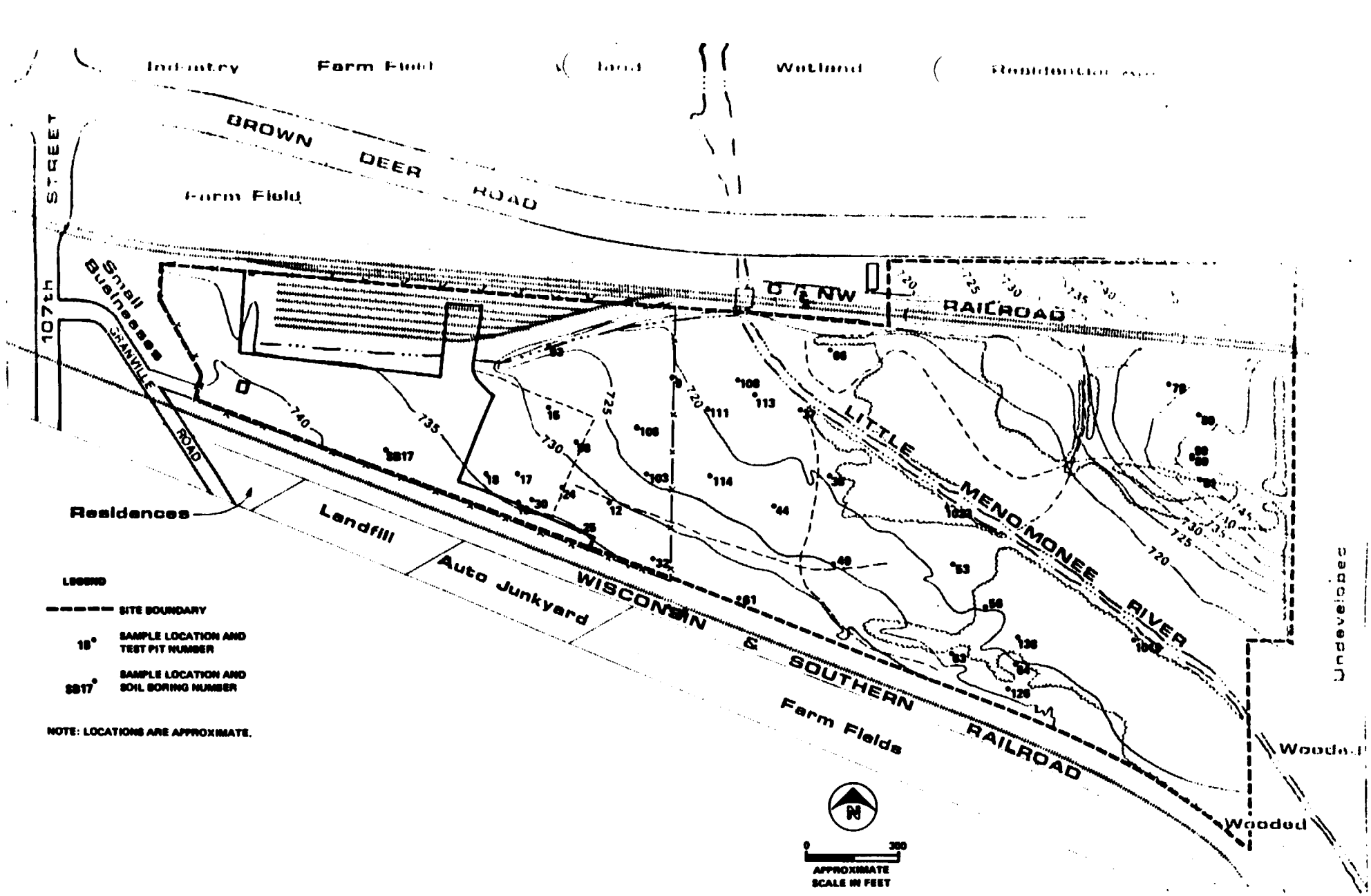


FIGURE E-2
SAMPLING LOCATIONS FOR PAH AND PHENOLIC ACID COMPOUND ANALYSIS
MOSS-AMERICAN RI

Following receipt of laboratory results, 16 locations were resampled for submittal to CLP laboratories for more extensive analyses. Ten sample locations representative of contaminated areas and six in clean areas were selected for this phase of sampling (Figure E-3). Samples were collected using the same procedures as before. New test pits were dug adjacent to the original test pits at each location. Samples were collected from the same depth and soil horizon as the original samples. Samples were analyzed for the Target Compound List of organic compounds, dioxin, and several treatment parameters. The treatment parameters consisted of the proximate and ultimate analysis for coal and coke, heating value, flash point, total organic carbon, and water soluble chlorides.

SAMPLING PROCEDURES

Three methods were used to excavate surface soils to screen and collect samples during this task: 1) tractor-mounted backhoe; 2) post hole digger; and 3) truck-mounted auger. Most of the onsite samples were collected with the backhoe. The post hole digger was used where backhoe access was difficult and offsite. Truck-mounted augers were used in the paved area to minimize destruction of private property and interference with the existing business.

Backhoe

Backhoe excavation was preferred because it allowed observation of the near-surface stratigraphy and contamination at each location. Each test pit was dug to a depth of about 4 feet, which was adjusted as necessary at the direction of the field engineer. Generally, the depth was increased if it was felt the additional depth could aid estimation of volume of contaminated soil. The depth was decreased when contamination was obvious and additional depth information was not warranted. The test pit area and disturbed soil were monitored for organic vapor using an HNu.

Samples from each pit were collected from the backhoe bucket, from the pile of excavated material, or directly from the wall of the excavated pit. Samples were collected in glass jars using a stainless steel spoon and in plastic bags using either a spoon or by hand (sampler wearing gloves). In most cases the sample was from an identifiable soil horizon or depth, and care was taken to avoid sampling material in contact with the backhoe bucket and other soil horizons. However, when no contaminated material was identified, a representative sample was taken from the excavated spoils. In those cases, the depth of the sample was estimated on the basis of the depth of similar material in the pit.

The backhoe bucket and sampling equipment were decontaminated between each pit. The bucket was scraped and brushed to remove dirt. When oily soils were encountered, the backhoe was steam-cleaned before the next pit was excavated. Other sampling equipment (spoons, gloves, pans) was washed and rinsed in a detergent solution and potable water followed by spray rinses with methanol and distilled water.

Following excavation and sample collection, the soils were described on test pit logs along with other pertinent information regarding the extent of contamination in each pit.

Test pits were backfilled before the team left for lunch and at the end of each day. Spoils were returned to the pit as closely as possible to their original position. Each pit was covered with either the original vegetation, clean spoils, or clean gravel fill.

Post Hole Digger

A post hole digger was used to collect samples from piles of dredgings along the river, from other wooded areas onsite, and for all offsite samples. All sampling and logging procedures were identical to those used with the backhoe, except that decontamination of the post hole digger consisted of a detergent wash, freshwater rinse, methanol rinse, and distilled water rinse.

Truck-Mounted Auger

Samples from under the asphalt were collected by drilling a 4-inch hole with continuous flight augers and then driving a 2.5-inch I.D. split-spoon sampler 2 feet into the undisturbed soil at the bottom of the hole. Flight augers were steam cleaned between each hole. Split-spoon samplers were cleaned with a detergent solution and rinsed with water, methanol, and distilled water between each sample interval. Samples were transferred from the split spoons to the sample containers using a stainless steel spoon. Boreholes were backfilled with spoils and capped with approximately 2 feet of concrete.

RESULTS

DATA

Sample locations, extractable organic concentrations and field observations are given in Tables E-1 and E-2. Table E-1 is arranged according to sample number; Table E-2 in order of decreasing extractable organic concentration. Values for offsite extractable organic measurements are given in Table E-3.

The distribution of extractable organic concentrations across the site is shown in Figure E-4. The distribution of total PAH concentrations is shown in Figure E-5. The results of the PAH analysis for individual compounds are given in Table E-4. No phenols were detected in any of the samples.

The correlation between extractable organics (measured onsite) and the sum of the 16 priority pollutant PAH concentrations is shown in Figure E-6. The correlation coefficient (r) is 0.89. A test of significance was performed on the correlation coefficient to determine if it is spuriously high by assuming that no relationship exists between the EO and PAH concentrations. The test concluded that a linear relationship does exist and that higher EO concentrations correspond to higher total PAH contractions.

Table E-1
SOIL SCREENING RESULTS
(arranged by sample number)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS001-1	1540	-65	210	NR	Offsite-RR, between tracks, silt
SS002-1	1700	-55	140	NR	Offsite-RR, below ballast, clay
SS003-1	1950	-400	220	NR	Offsite, Fence row, silty clay
SS004-1	400	60	140	NR	Offsite-RR, edge of ballast, sand
SS005-1	-600	130	210	NR	Offsite-RR, natural peaty soil
SS006-1	-40	-680	17	.0	
SS007-1	-50	-500	2,600	.0	
SS008-1	-15	-390	21	.5	Oil floating on water at 1.2'
SS009-1	-15	-200	220	.0	
SS010-1	-200	-300	130	1.0	Odor, .1 ppm HNu, oily water at 3'
SS011-1	-200	-500	140	.0	
SS012-1	-200	-600	1,200	.0	Oil floating at 1.3', odor
SS013-1	-300	-70	170	.0	
SS014-1	-500	-200	3,600	.0	Black, appears tarry, no odors
SS015-1	-400	-300	19,000	10.0	Creosote odor, slightly tarry
SS016-1	-400	-500	180	.2	
SS017-1	-500	-500	87	.2	Possibly tarry soils at 4'
SS017-2	-500	-500	930	NR	Tarry soil w/ wood & ties at 2'
SS018-1	-600	-500	39,000	.5	Creosote odor, tarry
SS019-1	-500	-600	13,000	1.0	Creosote odor
SS020-1	-600	-620	160	.0	
SS021-1	-400	-600	1,100	.0	Creosote odor, rubble in pit
SS022-1	-300	-600	1,200	.0	
SS023-1	-300	-500	540	.0	
SS023-2	-300	-500	620	.0	More contaminated than SS023-1
SS024-1	-350	-550	41,000	1.2	Tarry seam at 1', creosote odor
SS025-1	-300	-680	460	.0	Rubble
SS026-1	-200	-700	400	.0	
SS027-1	-500	-400	140	.0	Slight creosote odor
SS028-1	-200	-400	9	.2	
SS029-1	-470	-630	1,400	.4	Creosote odor, foundation at 2'
SS030-1	-460	-590	108,000	20.0	Free product under foundation
SS031-1	-450	-550	54	6.0	Contm. less just N. of foundation
SS032-1	-80	-790	2,400	.0	
SS033-1	20	-25	160	.5	
SS034-1	200	-100	30	.4	
SS035-1	360	-230	36,000	2.0	Odor, oily luster on soil
SS036-1	200	-300	430	.4	
SS037-1	400	-300	39,000	1.3	Trash and wood chips, v. oily
SS038-1	500	-500	57,000	1.0	Strong creosote odor
SS039-1	400	-600	60	.0	
SS040-1	100	-400	11	.2	
SS041-1	300	-400	110	.0	
SS042-1	500	-400	7,200	.0	Trash and rubble
SS043-1	600	-600	35	NR	
SS044-1	300	-590	1,200	.4	

Table E-1
SOIL SCREENING RESULTS
(arranged by sample number)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS045-1	100	-600	42	.0	
SS046-1	200	-700	190	.0	
SS047-1	100	-800	56	1.0	
SS048-1	300	-800	33	.0	
SS049-1	500	-800	8,900	5.0	Creosote odor
SS050-1	500	-700	25	.2	Slight creosote odor
SS051-1	700	-700	0	.0	
SS052-1	700	-800	17	.0	
SS053-1	900	-800	8	.5	
SS054-1	910	-670	20	.0	
SS055-1	1000	-8000	120	.0	
SS056-1	1010	-930	570	.0	
SS057-1	900	-1000	38	.0	
SS058-1	800	-900	59	.0	
SS059-1	600	-900	140	NR	
SS060-1	400	-900	140	NR	
SS061-1	200	-900	140	NR	
SS062-1	500	-1000	510	NR	
SS063-1	900	-1060	24,000	NR	Slight creosote odor
SS064-1	1100	-1100	38,000	1.0	Creosote odor, RR ties at 3'
SS065-1	400	-100	430	.0	
SS066-1	500	-100	900	.0	
SS067-1	600	-100	310	NR	
SS068-1	600	-300	300	.0	
SS069-1	820	-100	160	.0	
SS070-1	1160	-570	46	.0	
SS071-1	1300	-300	45	.0	
SS072-1	1100	-200	0	.0	
SS073-1	1300	-100	0	.0	
SS074-1	1400	-200	0	.0	
SS075-1	1500	-100	0	.0	
SS076-1	1500	-300	24	.0	
SS077-1	1500	-500	8	.0	
SS078-1	1600	-200	24	.0	
SS079-1	1600	-400	23	.0	
SS080-1	1700	-300	920	4.0	Oil coating in fractures
SS080-2	1700	-300	11,000	1.0	Black tarry, HNU=1 ppm in pit
SS081-1	1700	-500	0	.0	Sheen on cobbles and some soil
SS082-1	1700	-200	29	0.0	
SS083-1	1800	-200	69	.0	
SS084-1	1800	-400	65	.0	
SS085-1	1900	-300	34	.0	
SS086-1	1900	-500	42	.0	
SS087-1	1800	-600	24	.0	
SS088-1	1700	-620	56	.0	
SS089-1	1680	-440	63,000	.0	Very oily, tarry, 2 ppm HNu in pit

Table E-1
SOIL SCREENING RESULTS
(arranged by sample number)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS089-2	1680	-440	17,000	11.0	Free product in pit
SS090-1	1670	-430	112	.0	
SS091-1	1630	-380	44,000	13.0	
SS092-1	-500	-300	63	.0	Slight odor
SS093-1	-400	-100	32	.0	
SS094-1	-400	-200	200	.0	
SS095-1	-400	-400	100	.0	
SS096-1	-300	-200	14,000	.5	Odor, tarry silt at 3'
SS097-1	-300	-300	790	.5	Creosote odor
SS098-1	-300	-400	22,000	.5	Odor, sheen on soil/chips at 4'
SS098-2	-300	-400	7,400	.0	Wood chips and cable at 4'
SS099-1	-200	-100	340	.0	Possibly tarry
SS100-1	-200	-200	66	.0	
SS101-1	-100	-300	540	2.0	Oil sheen on water at 3'
SS102-1	-100	-400	730	.0	
SS103-1	-100	-500	3,300	5.0	Slight odor
SS104-1	-100	-600	5,000	1.0	Oil mixed w/water at 3', odor
SS105-1	-100	-700	530	.5	
SS106-1	-130	-360	100	.0	Oil stringers in water at 1'
SS106-2	-130	-360	170	.0	Oily water flowing from culvert
SS107-1	100	-200	320	.0	
SS108-1	200	-200	3,700	.4	
SS109-1	300	-200	20,000	5.5	Oily water at 2', odor
SS110-1	300	-300	310	.0	Oily odor
SS111-1	100	-300	71	NR	
SS112-1	370	-370	4,300	NR	Slight odor
SS113-1	250	-250	98,000	4.5	Odor and oil in hay and wood chips
SS114-1	100	-500	1,200	.0	
SS115-1	200	-500	30	.0	
SS116-1	300	-500	160	.0	
SS117-1	400	-500	440	.0	
SS118-1	600	-450	580	.0	Slight odor
SS119-1	950	-1000	300	.0	Dump site, rubbish
SS120-1	600	-1000	140	.0	
SS121-1	800	-1060	61	.0	
SS122-1	1000	-1130	420	.0	Dump
SS123-1	1160	-1200	2,200	6.0	Dump, creosote odor, sheen at 3'
SS124-1	870	-1110	120	.0	
SS125-1	1180	-1120	19,000	.0	Dump
SS126-1	1070	-1180	2,000	.0	Dump
SS127-1	1275	-1230	55	.0	Dump
SS128-1	1460	-1300	130	.0	
SS129-1	0	-900	10	NR	Offsite-RR, Organic Silt
SS130-1	-300	-800	27	NR	Offsite-RR, ditch by ballast, silt
SS131-1	270	-1000	17	NR	Offsite-RR, Silty sand
SS132-1	300	550	18	NR	Offsite, cattails, silt loam

Table E-1
SOIL SCREENING RESULTS
(arranged by sample number)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS132-2	300	550	6	NR	Offsite, cattails, alluvial clay
SS133-1	500	650	10	NR	Offsite, grassy, org. silty clay
SS134-1	550	1450	0	NR	Offsite, grassy meadow, silt-sand
SS135-1	-500	1350	22	NR	Offsite, woods, lowland, org. clay
SS136-1	-50	550	270	NR	Offsite, cattail marsh, org. silt
SS137-1	1060	-850	14	NR	
SS138-1	1110	-1030	0	NR	
SS139-1	1150	-790	0	NR	
SS140-1	-1270	-280	22	.0	
SS141-1	-1100	-350	1,500	.0	
SS141-2	-1100	-350	15	.0	
SS142-1	-700	-500	28	.0	
SS143-1	-1070	-240	0	.0	
SS144-1	-690	-400	0	.0	Tarry seam at 3'
SS145-1	-1300	-100	24	.0	
SS146-1	-660	-300	41	.0	Tarry seam at 3'
SS1017A-1	1880	-1220	0	NR	
SS1018-1	1730	-1100	0	NR	
SS1019-1	1550	-995	450	NR	
SS1020-1	1370	-880	14	NR	
SS1021-1	1220	-770	790	NR	
SS1022-1	1040	-660	300	NR	
SS1023-1	980	-560	720	NR	
SS1024-1	710	-440	0	NR	
SS1025-1	510	-310	2,400	NR	Scrap metal in fill on bank
SS1026-1	740	-395	7	NR	Dredging pile
SS1027-1	930	-520	0	NR	
SS1028-1	1370	-795	31	NR	
SS1029-1	1640	-980	21	NR	

NOTES: (1) Grid Location:
X = distance east (+) or west (-) of the origin,
Y = distance north (+) or south (-) of the origin.
The origin is the north east corner of the auto storage lot. It is shown on Figure E-1

(2) EO = Extractable Organic Concentration

(3) HEADSPACE = Organic vapor concentration of the air in a plastic bag containing the soil sample. Concentrations are reported in parts per million of benzene equivalents

Table E-2
SOIL SCREENING RESULTS
(arranged by descending EO concentration)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS030-1	-460	-590	108,000	20.0	Free product under foundation
SS113-1	250	-250	98,000	4.5	Odor and oil in hay and wood chips
SS089-1	1680	-440	63,000	.0	V. oily and tarry, 2 ppm (HNu pit)
SS038-1	500	-500	57,000	1.0	Strong creosote odor
SS091-1	1630	-380	44,000	13.0	
SS024-1	-350	-550	41,000	1.2	Tarry seam @ 1', creosote odor
SS089-2	1680	-440	41,000	11.0	Free product in hole
SS018-1	-600	-500	39,000	.5	Creosote odor, tarry
SS037-1	400	-300	39,000	1.3	Trash and wood chips, v. oily
SS064-1	1100	-1100	38,000	1.0	Creosote odor, RR ties @ 3'
SS035-1	360	-230	36,000	2.0	Odor, oily luster on soil
SS063-1	900	-1060	24,000	.0	Slight creosote odor
SS098-1	-300	-400	22,000	.5	Odor, sheen on soil/chips @ 4'
SS109-1	300	-200	20,000	5.5	Oily water at 2', odor
SS015-1	-400	-300	20,000	10.0	Creosote odor
SS125-1	1180	-1120	19,000	.0	Dump
SS089-2	1680	-440	17,000	11.0	Free product in hole
SS096-1	-300	-200	14,000	.5	Odor, black silt at 3' is tarry
SS019-1	-500	-600	13,000	1.0	Creosote odor
SS080-2	1700	-300	11,000	1.0	Black tarry, 1 ppm in pit
SS049-1	500	-800	8,900	5.0	Creosote odor
SS098-2	-300	-400	7,400	.0	Wood chips and cable at 4'
SS042-1	500	-400	7,200	.0	Trash and rubble
SS104-1	-100	-600	5,006	1.0	Oil mixed w/water @ 3', odor
SS112-1	370	-370	4,300	.0	Slight odor
SS108-1	200	-200	3,700	.4	
SS014-1	-500	-200	3,600	.0	Black, appears contam., no odor
SS103-1	-100	-500	3,300	5.0	Slight odor
SS007-1	-50	-500	2,600	.0	
SS032-1	-80	-790	2,400	.0	
SS1025-1	510	-310	2,400	.0	Scrap metal in fill on bank
SS123-1	1160	-1200	2,200	6.0	Dump, creosote odor, sheen @3'
SS126-1	1070	-1180	2,000	.0	Dump
SS141-1	-1100	-350	1,500	.0	
SS029-1	-470	-630	1,400	.4	Creosote odor, pad @ 2'
SS128-1	1460	-1300	1,300	.0	
SS114-1	100	-500	1,200	.0	
SS044-1	390	-590	1,200	.4	
SS022-1	-300	-600	1,200	.0	
SS012-1	-200	-600	1,200	.0	Oil floating @ 1.3', odor
SS021-1	-400	-600	1,100	.0	Creosote odor, rubble in pit
SS066-1	500	-100	1,000	.0	
SS017-2	-500	-500	930	.0	Tarry soil w/ wood & ties @ 2'
SS080-1	1700	-300	920	4.0	Oil coating in fractures
SS1021-1	1220	-770	800	.0	
SS097-1	-300	-300	790	.5	Creosote odor

Table E-2
SOIL SCREENING RESULTS
(arranged by descending EO concentration)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS102-1	-100	-400	730	.0	
SS1023-1	980	-560	720	.0	
SS023-2	-300	-500	620	.0	
SS118-1	600	-450	580	.0	Slight odor
SS056-1	1010	-930	570	.0	
SS023-1	-300	-500	540	.0	
SS101-1	-100	-300	540	2.0	Oil sheen on water at 3'
SS105-1	-100	-700	530	.5	
SS062-1	500	-1000	510	.0	
SS025-1	-300	-680	460	.0	Rubble
SS1019-1	1550	-995	450	.0	
SS117-1	400	-500	440	.0	
SS065-1	400	-100	430	.0	
SS036-1	200	-300	430	.4	
SS122-1	1000	-1130	420	.0	Dump
SS026-1	-200	-700	400	.0	
SS099-1	-200	-100	340	.0	Black, appears contaminated
SS107-1	100	-200	320	.0	
SS110-1	300	-300	310	.0	Oily odor
SS067-1	600	-100	310	.0	
SS068-1	600	-300	300	.0	
SS1022-1	1040	-660	300	.0	
SS119-1	950	-1000	300	.0	Dump site, rubbish
SS136-1	-50	550	270	.0	Offsite, cattail marsh, org. silt
SS009-1	-15	-200	220	.0	
SS003-1	1950	-400	220	.0	Offsite, Fence row, silty clay
SS005-1	-600	130	210	.0	Offsite-RR, natural peaty soil
SS001-1	1540	-65	210	.0	Offsite-RR, between tracks, silt
SS094-1	-400	-200	200	.0	
SS046-1	200	-700	190	.0	
SS016-1	-400	-500	180	.2	
SS013-1	-300	-70	170	.0	
SS106-2	-130	-360	170	.0	Oily water flowing from culvert
SS069-1	820	-100	160	.0	
SS020-1	-600	-620	160	.0	
SS033-1	20	-25	160	.5	Black, creosote odor
SS116-1	300	-500	160	.0	
SS004-1	400	60	140	.0	Offsite-RR, edge of ballast, sand
SS002-1	1700	-55	140	.0	Offsite-RR, below ballast, clay
SS027-1	-500	-400	140	.0	Slight creosote odor
SS120-1	600	-1000	140	.0	
SS059-1	600	-900	140	.0	
SS011-1	-200	-500	140	.0	
SS060-1	400	-900	140	.0	
SS061-1	200	-900	140	.0	
SS010-1	-200	-300	130	1.0	Odor, .1 PPM HNu, Oily water at 3'

Table E-2
SOIL SCREENING RESULTS
(arranged by descending EO concentration)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS124-1	870	-1110	120	.0	
SS055-1	1000	-8000	120	.0	
SS041-1	300	-400	120	.0	
SS090-1	1670	-430	110	.0	
SS095-1	-400	-400	110	.0	
SS106-1	-130	-360	100	.0	Oil stringers in water @ 1'
SS017-1	-500	-500	87	.2	Possibly tarry soils @ 4'
SS111-1	100	-300	71	.0	
SS083-1	1800	-200	69	.0	
SS100-1	-200	-200	66	.0	
SS084-1	1800	-400	65	.0	
SS092-1	-500	-300	63	.0	Slight odor
SS121-1	800	-1060	61	.0	
SS039-1	400	-600	60	.0	
SS058-1	800	-900	59	.0	
SS088-1	1700	-620	56	.0	
SS047-1	100	-800	56	1.0	
SS127-1	1275	-1230	55	.0	Dump
SS031-1	-450	-550	54	6.0	
SS070-1	1160	-570	46	.0	
SS071-1	1300	-300	45	.0	
SS086-1	1900	-500	42	.0	
SS045-1	100	-600	42	.0	
SS146-1	-660	-300	41	.0	Tarry seam @ 3'
SS057-1	900	-1000	38	.0	
SS043-1	600	-600	35	.0	
SS085-1	1900	-300	34	.0	
SS048-1	300	-800	33	.0	
SS093-1	-400	-100	32	.0	
SS1028-1	1370	-795	31	.0	
SS115-1	200	-500	30	.0	
SS034-1	200	-100	30	.4	Black, possibly due to contam.
SS082-1	1700	-200	29	.0	
SS102-1	-100	-400	28	.0	
SS142-1	-700	-500	28	.0	
SS130-1	-300	-800	27	.0	Offsite-RR, ditch by ballast, silt
SS050-1	500	-700	25	.2	Slight creosote odor
SS087-1	1800	-600	24	.0	
SS145-1	-1300	-100	24	.0	
SS078-1	1600	-200	24	.0	
SS076-1	1500	-300	24	.0	
SS079-1	1600	-400	23	.0	
SS135-1	-500	1350	22	.0	Offsite, woods, lowland, org. clay
SS140-1	-1270	-280	22	.0	
SS008-1	-15	-390	21	.5	Oil floating on wtr @ 1.2'
SS1029-1	1640	-980	21	.0	

Table E-2
SOIL SCREENING RESULTS
(arranged by descending EO concentration)

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EO(2) ppm	HEAD-SPACE(3) ppm	FIELD OBSERVATIONS
SS054-1	910	-670	20	.0	
SS132-1	300	550	18	.0	Offsite, cattails, silt loam
SS052-1	700	-800	17	.0	
SS006-1	-40	-680	17	.0	
SS131-1	270	-1000	17	.0	Offsite-RR, Silty sand
SS141-2	-1100	-350	15	.0	
SS1020-1	1370	-880	14	.0	
SS137-1	1060	-850	14	.0	
SS040-1	100	-400	11	.2	
SS133-1	500	650	10	.0	Offsite, grassy, org. silty clay
SS129-1	0	-900	10	.0	Offsite-RR, Organic Silt
SS028-1	-200	-400	9	.2	
SS077-1	1500	-500	8	.0	
SS053-1	900	-800	8	.5	
SS1026-1	740	-395	7	.0	Dredging pile
SS132-2	300	550	6	.0	Offsite, cattails, alluvial clay
SS139-1	1150	-790	0	.0	
SS134-1	550	1450	0	.0	Offsite meadow, silt and sand
SS081-1	1700	-500	0	.0	Sheen on cobbles & some soil
SS075-1	1500	-100	0	.0	
SS138-1	1110	-1030	0	.0	
SS1018-1	1730	-1100	0	.0	
SS072-1	1100	-200	0	.0	
SS051-1	700	-700	0	.0	
SS074-1	1400	-200	0	.0	
SS143-1	-1070	-240	0	.0	
SS073-1	1300	-100	0	.0	
SS1027-1	930	-520	0	.0	
SS144-1	-690	-400	0	.0	Tarry seam at 3'

NOTES: (1) Grid Location:
X = distance east (+) or west (-) of the origin,
Y = distance north (+) or south (-) of the origin.
The origin is the north east corner of the auto storage lot. It is shown on Figure E-1

(2) EO = Extractable Organic Concentration

(3) HEADSPACE = Organic vapor concentration of the air in a plastic bag containing the soil sample. Concentrations are reported in parts per million of benzene equivalents

Table E-3
OFFSITE SOIL SAMPLES

SAMPLE NUMBER	GRID LOCATION(1) X	Y	EXTRACTABLE ORGANICS ppm	FIELD OBSERVATIONS
SS003-1	1950	-400	215	Fence row, silty clay
SS134-1	550	1450	0	Grassy meadow, silt and sand
SS135-1	-500	1350	22	Woods, lowland, organic clay
SS133-1	500	650	10	Grassy, organic silty clay
SS136-1	-50	550	270	Cattail marsh, organic silt
SS132-1	300	550	18	Cattails, silt loam
SS132-2	300	550	6	Cattails, alluvial clay
SS005-1	-600	130	211	RR, natural peaty soil
SS004-1	400	60	143	RR, edge of ballast, sand
SS002-1	1700	-55	139	RR, under ballast, clay
SS001-1	1540	-65	210	RR, between tracks, silt
SS130-1	-300	-800	27	RR, ditch by ballast, silt
SS129-1	0	-900	10	RR, organic silt
SS131-1	270	-1000	17	RR, silty sand

NOTES: (1) Grid Location: Distance in feet from the origin as shown on Figure E-1

(2) EO = Extractable Organic Concentration

(3) HEADSPACE = Organic vapor concentration of the air in a plastic bag containing the soil sample. Concentrations measured with an HNu.

Table E-4 - POLYAROMATIC HYDROCARBON CONCENTRATIONS IN ONSITE SOILS
Concentrations in ppm (wet weight)

SAMPLE	PERCENT MOISTURE	NAP	ACY	ACE	FLR	PHEN	ANT	FLN	PYR	BAA	CHR	BBF	BKF	BAP	IDP	DBA	BGHIP
SS090-1	16	10	2	64	26	53	29	190 D	170 D	72	60	37	26	47	24	1 U	12
SS103-1	12	6	1 U	34	34	92	17	73	50	19	18	9	6	7	7	1 U	10
SS106-1	24	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS108-1	54	1 U	1 U	1 U	1 U	1 U	1 U	10	9	5	4	4	4	4	6	1 U	1 U
SS111-1	40	1 U	1 U	1 U	2	7	13 B	6	4	1 U	2	1 U	1 U	1 U	2	1 U	1 U
SS113-1	47	1000	20 U	700	660	1900	780	830	560	200	230	80	80	73	65	20 U	83
SS114-1	43	1 U	1 U	1 U	1 U	2 B	2 B	2	4	3	3	4	3	3	5	1 U	9
SS126-1	43	1 U	1 U	1	1 U	3 B	2 B	7	5	3	2	3	1	2	5	1 U	6
SS129-1	29	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS138-1	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SB-17-5	18	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SB-17-5R	19	1 U	1 U	1 U	1 U	1 B	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SSFB-1	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SSFB-2	0	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS038-1	13	71	20 U	1000	600	1300	1300	1900	1400	200	320	110	110	88	95	20 U	52
SS044-1	26	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS049-1	40	96	10 U	380	320	100	260	620	400	100	100	30	25	33	20	10 U	23
SS053-1	22	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS056-1	21	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2	1	1 U	1 U	1	3	1 U	1 U
SS061-1	9	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS063-1	0	5 U	5 U	5 U	5 U	65	76	150	140	52	58	29	29	38	41	5 U	43
SS064-1	11	8	5 U	230	5 U	230	79	420	290	110	120	42	42	42	45	5 U	41
SS066-1	26	1 U	1 U	2	1 U	2 B	1 B	3	4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS078-1	14	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS080-2	15	5 U	12	440	41	64	110	350	250	110	85	27	27	30	25	5 U	20
SS081-1	11	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS089-1	30	1700	50 U	1700	1200	2700	930	1100	710	290	210	69	69	71	150	50 U	120
SS090-1	13	1 U	1 U	1	1	3 B	1 U	3	6	4	3	1	2	1 U	1 U	1 U	1 U
SS093-1	13	1 U	1 U	1 U	1 U	1 U	1 U	2	2	1	1	1 U	1 U	1 U	1 U	1 U	1 U
SS094-1	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS1019-1	21	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS1023-1	28	2	1 U	1 U	1 U	2 B	1 U	2	2	4	2	2	1	3	8	1 U	7
SS1023-1R	27	1	1 U	1 U	1 U	1 B	1 U	2	1 U	5	3	3	3	5	15	1 U	13
SS089-1	23	1 U	1 U	1 U	1 U	1 B	1 U	1	2	4	2	1 U	1 U	4	4	1 U	5
SS012-1	10	3	2 U	53	58	130	22 B	10	71	29	30	11	10	12	14	2 U	12
SS015-1	22	100	20 U	250	230	760	95 B	370	260	91	92	50	40	32	40	20 U	90
SS017-2	14	3	1 U	1	1	13	2 B	11	8	4	4	2	2	2	3	1 U	8
SS018-1	12	25	20 U	270	200	270	140 B	660	460	200	200	80	80	76	76	20 U	94
SS019-1	14	79	5 U	180	150	370	79	230	150	57	54	20	20	18	19	5 U	19
SS024-1	5	9	1	4	3	13	5 B	15	13	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SS025-1	13	4	1 U	1 U	1 U	10	1 B	7	5	3	2	2	2	2	3	1 U	6
SS030-1	22	3000	100 U	2900	3200	6000	3500	2000	1300	510	430	170	160	180	100 U	100 U	100 U
SS032-1	23	7	1 U	2	47	59	480	17	12	10	29	10	10	8	13	1 U	13
SS037-1	60	31	24	300	280	940	170 B	610	400	170	180	70	60	57	50	20 U	34

ABBREVIATIONS:
NAP = Naphthalene
ACY = Acenaphthalene
ACE = Acenaphthene
FLR = Fluorene
PHEN = Phenanthrene
ANT = Anthracene
FLN = Fluoranthene
PYR = Pyrene
BAA = Benzo(a)anthracene
CHR = Chrysene
BBF = Benzo(b)fluoranthene
BKF = Benzo(k)fluoranthene
BAP = Benzo(a)pyrene
IDP = Indeno(1,2,3-cd)pyrene
DBA = Dibenzo(a,h)anthracene
BGHIP = Benzo(g,h,i)perylene

QUALIFIERS:
U = Compound analyzed but not detected
B = Compound was detected in the QC blank
D = Secondary dilution result

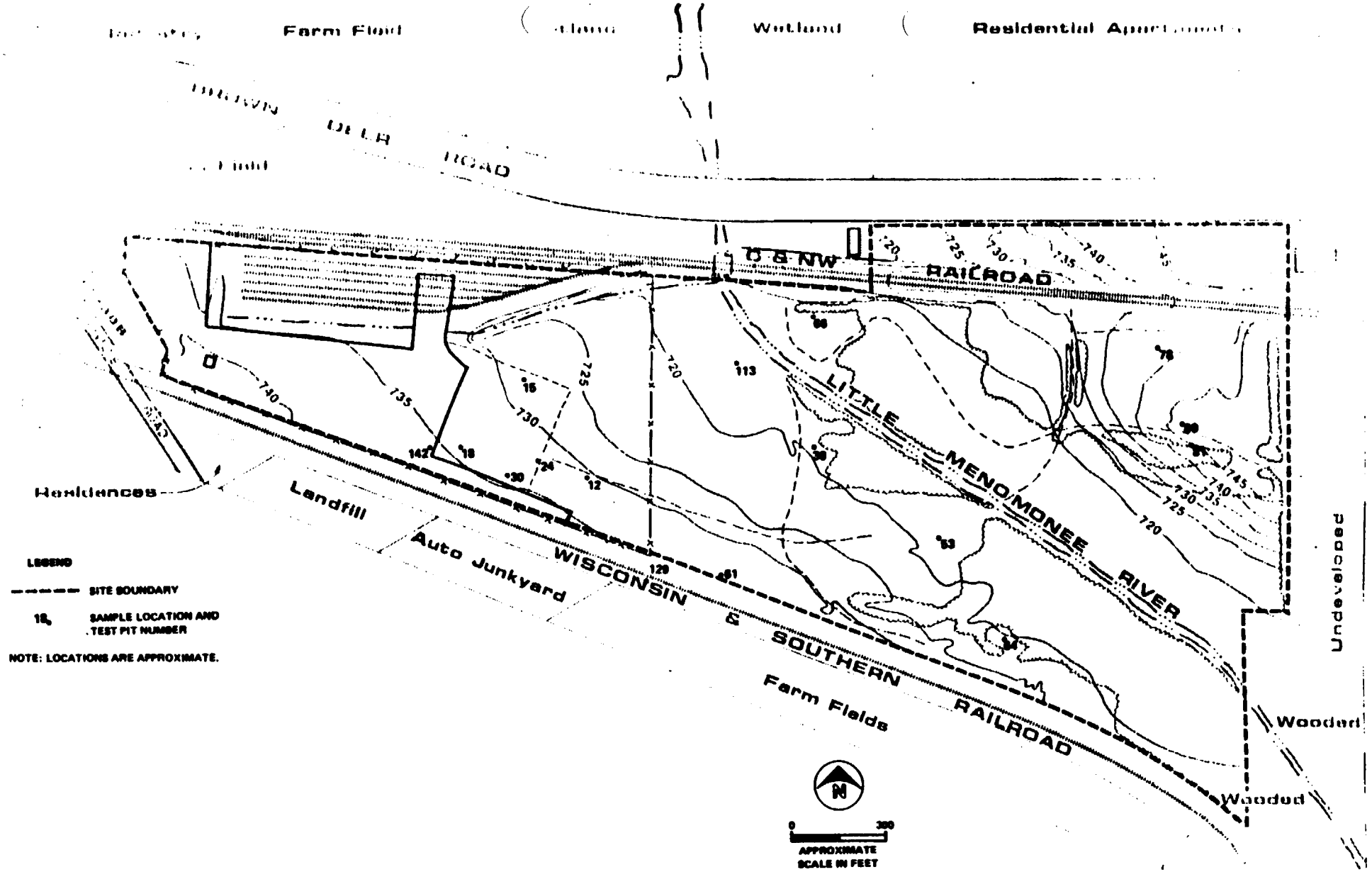


FIGURE E-3
SAMPLING LOCATIONS FOR CLP ANALYSES
MOSS-AMERICAN RI

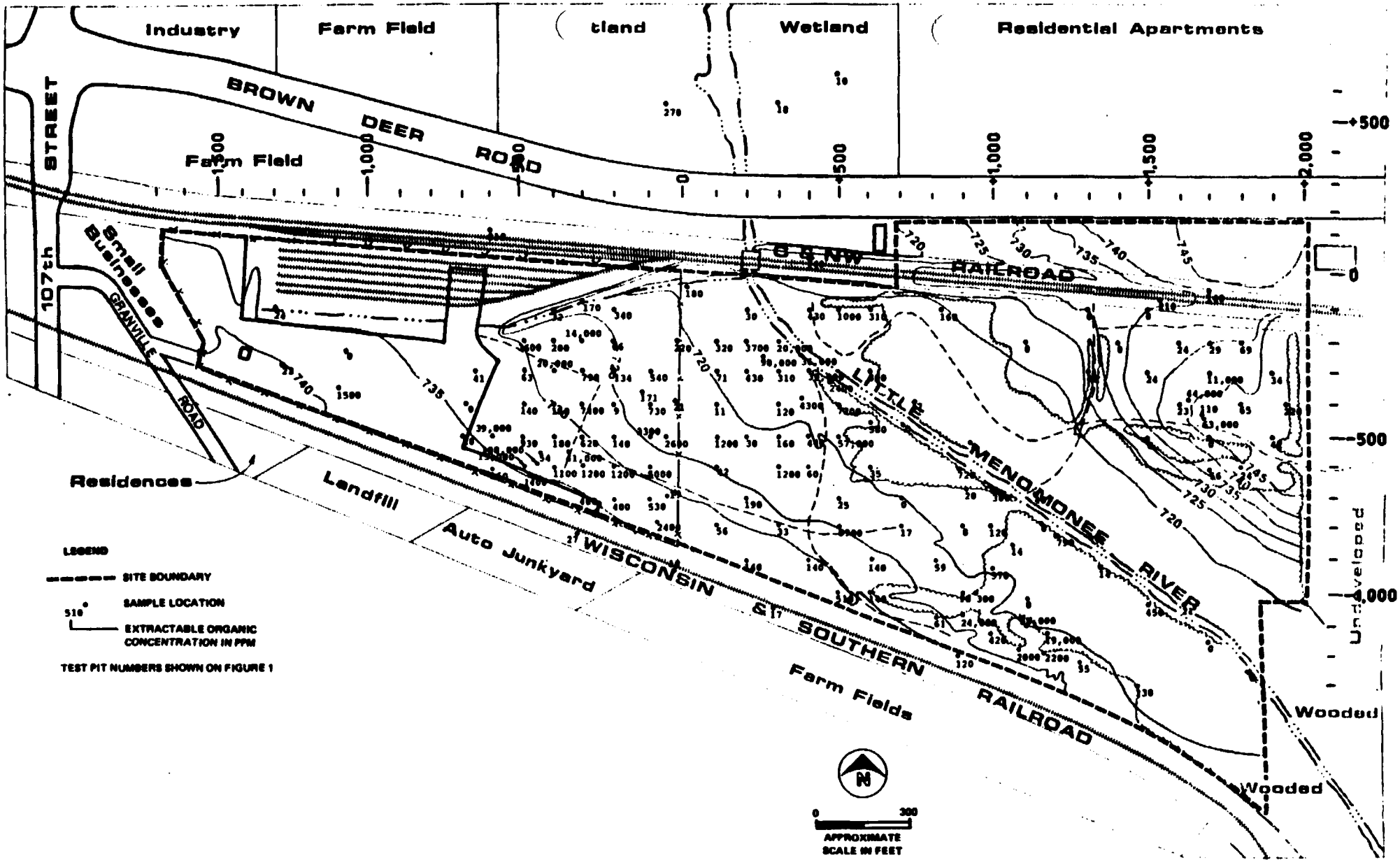


FIGURE E-4
CONCENTRATIONS OF EXTRACTABLE ORGANIC COMPOUNDS
MOSS-AMERICAN RI

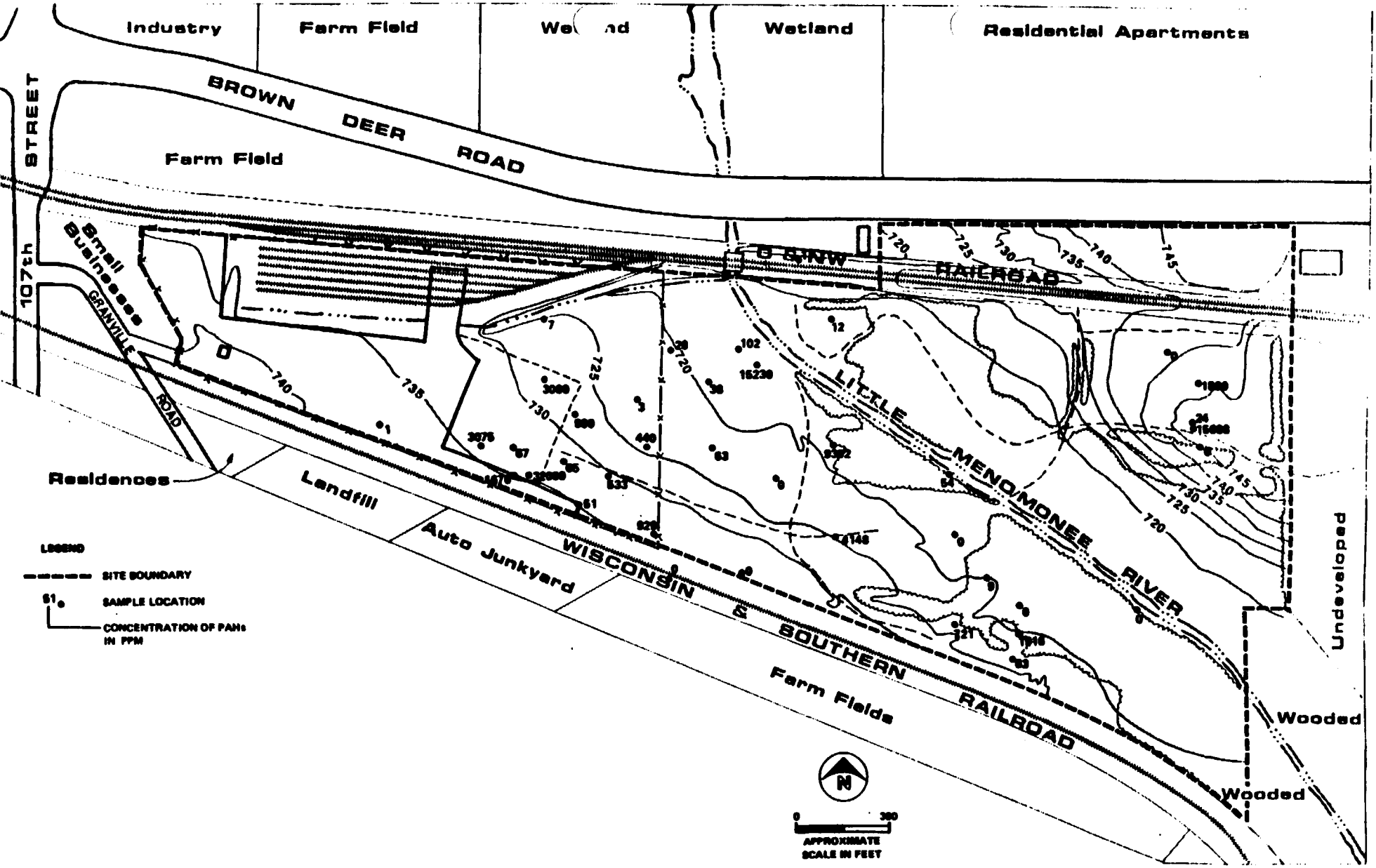


FIGURE E-6
TOTAL PAH CONCENTRATIONS IN SOIL
MOSS-AMERICAN RI

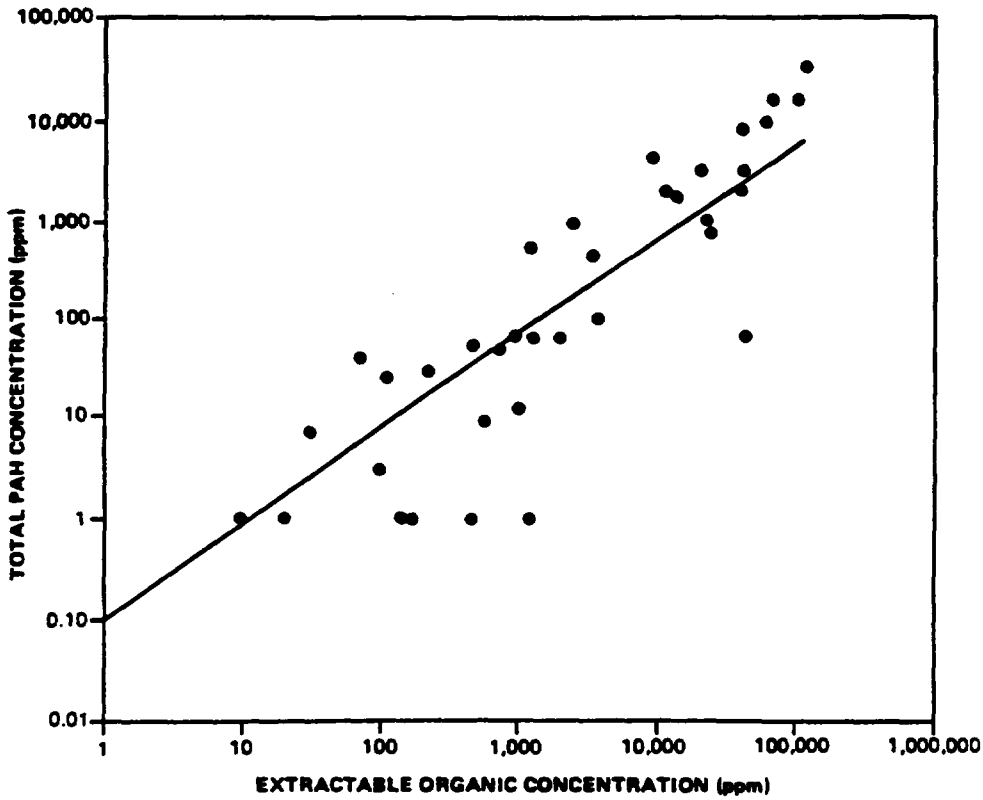


FIGURE E-6
RELATIONSHIP BETWEEN CONCENTRATIONS OF EXTRACTABLE ORGANIC COMPOUNDS AND TOTAL PAHs IN ONSITE SOIL
MOSS-AMERICAN RI

INTERPRETATION

Four primary areas of soil contamination at the Moss-American site are shown in Figure E-7:

Area I--Processing area and vicinity
Area II--Contaminated fill east of the storage area
Area III--Contaminated fill to the southeast
Area IV--Landfill for dredgings

Low levels of contamination were detected south of Area I west of the fence and between areas I and II (see Figure E-7).

The areas shown in Figure E-7 were identified on the basis of:

- EO concentrations greater than 1,000 ppm
- Visible contamination or strong creosote odors
- Proximity to other pits deemed contaminated with similar soil horizons, especially when samples may have been taken from uncontaminated horizons

The extent of each area was determined by the interpretation of available data. Risk-based criteria were not used. The extent of contamination will be modified as necessary following completion of the public health and environmental assessment.

Area I

Extractable organic concentrations in the processing area (the southern third of Area I excluding the panhandle) ranged from negligible to over 10 percent. Inasmuch as spatial variability and high localized levels of contamination characterize the area, it is likely that unidentified "hot spots" are present.

The northern two-thirds of Area I was categorized as the clean, or untreated, lumber storage area in earlier parts of the investigation. However, extractable organic concentrations as high as 2 percent and several visibly contaminated pits indicate contamination in the area.

Existing data describing the history of the site do not explain the contaminated soils found here. Three possible explanations are:

- Contaminants were deposited during site activities not described in the background information.
- Contamination is the result of being in the vicinity of and downhill from the processing area.

- Contaminated soils were reworked following site closure and placed in this area.

The southern panhandle of Area I is the drip track area. Low levels of contamination with limited horizontal and vertical extent may be present there as indicated by one soil boring, or the area may be relatively clean as indicated by three soil borings. The area is shown as potentially contaminated because of the potential for spatial variability.

Areas II and III

Areas II and III were both used as either solid waste disposal areas or fill areas in which the fill included solid waste. Lumber, railroad ties, scrap metal, and other debris are buried in soils containing up to 5.7 percent extractable organic compounds. The area north of Area III contained similar material; however, the extractable organic concentration and visual observations of that solid waste pile did not indicate the presence of contamination. The northern part of Area II coincides with the outfall of the old settling ponds.

Area IV

Dredgings contaminated with creosote from the old settling ponds are buried in the landfill in Area IV. The lateral extent of the landfill is well-defined by stressed surface vegetation. Extractable organic concentrations in the landfill range up to 6 percent.

No dredgings were observed in the area north of Area IV; however, the extractable organic concentration in one test pit was 1.1 percent. Fracture surfaces of the blocky soil were coated with oil. The contamination at that location is believed to be the result of vertical percolation from landfilled dredgings that have since been removed from the site. The area was excavated, presumably for use as fill material, sometime after the dredgings were landfilled.

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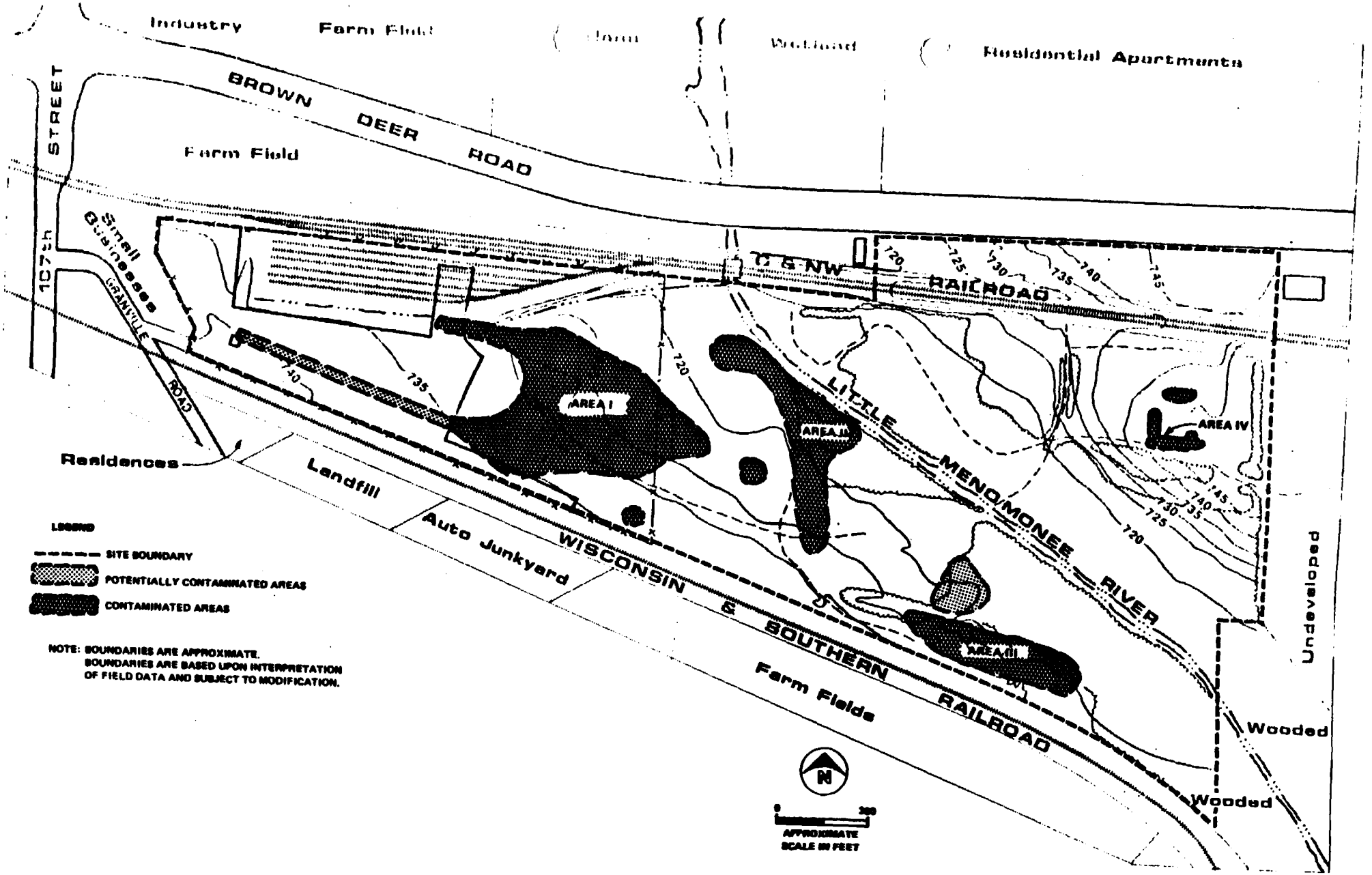


FIGURE E-7
LATERAL EXTENT OF
SOIL CONTAMINATION
MOSS-AMERICAN RI

Appendix F
MONITORING WELL INSTALLATION AND FINDINGS ON SITE GEOLOGY

Appendix F
MONITORING WELL INSTALLATION AND FINDINGS ON SITE GEOLOGY

INTRODUCTION

This appendix summarizes the soil boring and monitoring well installation performed by CH2M HILL at the Moss-American site and the interpretation of the site geology. Well locations, well logs, and construction diagrams are included in this appendix. The field work was part of Task FI, Field Work--Monitoring Well Installation, and Task FS, Field Work--Subsurface Soil.

Monitoring wells were installed between June 2 and July 1, 1988. Exploration Technology, Inc., of Madison, Wisconsin drilled and constructed the wells.

SUMMARY OF FIELD WORK

Monitoring well, soil boring, and cross section locations are shown on Figure F-1. The well locations were chosen:

- To monitor contaminants migrating offsite or to the Little Menomonee River
- To monitor contaminant migration away from known source areas
- To monitor the quality of the groundwater coming onsite
- To define the horizontal extent of groundwater contamination onsite
- To determine horizontal and vertical groundwater gradients

Well nests were installed downgradient from known source areas to monitor vertical contaminant migration. At each well site except MW-14, shallow wells were completed above less permeable silt and till layers. Deeper wells were completed in sandier zones when they were encountered.

Soil borings were completed at four locations where high levels of surface contamination were detected in test pits. Monitoring wells were not installed at those locations because of the potential for cross-contamination during drilling, especially during construction of the deep wells.

Specific objectives for the wells and observations made during installation are as follows:

- MW-1S and MW-1I were installed as "background" wells to monitor groundwater coming onto the site. MW-1I monitors groundwater in the silty clay and sand seams below MW-1S. MW-1S is completed at the interface between the fill and weathered till.

- **MW-2S** is in a filled ditch that had drained from the process area to a ditch along the north boundary of the site. It is screened in weathered till and a silty fine sand seam immediately above a dense unweathered till.

- **MW-3S** and **MW-3I** monitor an area where some soil contamination was detected during the digging of test pits (see the Technical Memorandum for Task G1). MW-3S monitors groundwater in the silty fine sand that lies beneath a silty clay till. MW-3I is screened in the silt and silty clay till below the screened interval for MW-3S. The well nest is at the outfall of a spring that drains the gravel beneath the paved parking lot.

- **MW-4S, MW-4I,** and **MW-4D** are in a well nest immediately downgradient of the former process area--the most contaminated part of the site. MW-4S is screened close to the water table. Free product was seen initially in the water purged from the well; however it was removed during development and not observed during sampling. MW-4I was installed immediately above the reddish brown lacustrine clay encountered at a depth of 39 feet. MW-4D monitors the lacustrine silt and fine sand below the reddish brown clay. A deep well was installed at that location to determine the depth to which groundwater quality has been affected at the most contaminated part of the site.

- **MW-5S** was positioned to monitor contaminants that may be migrating offsite to the north. The base of the screen is set at the top of a dense silty clay till to monitor contaminants migrating laterally along the top of this low permeability till.

- **MW-6S** monitors shallow groundwater in the former storage area. As with MW-5S, the well is positioned above the silty clay till to monitor contaminants migrating along the top of the till.

- **MW-7S** and **MW-7I,** well nests MW-8 and MW-9, and well MW-12S make up a network for monitoring groundwater contaminants as they approach the river. MW-7I is installed in a sandier section of the till. The reddish brown silty clay below the well may be related to the reddish brown clay below MW-4I.

- **MW-8S** and **MW-8I** are in a well nest near the river and at the end of the series of former settling ponds. The nest is between the river and the subsurface clay barrier constructed in 1971. The soil boring for MW-8S did not appear highly contaminated; however, one coarse sand and gravel seam contained small amounts of black, oily liquid. When the well was sampled approximately 2 feet of free product had accumulated in the well. MW-8I is completed in a silt and sand zone and did not appear contaminated when it was installed. The clay

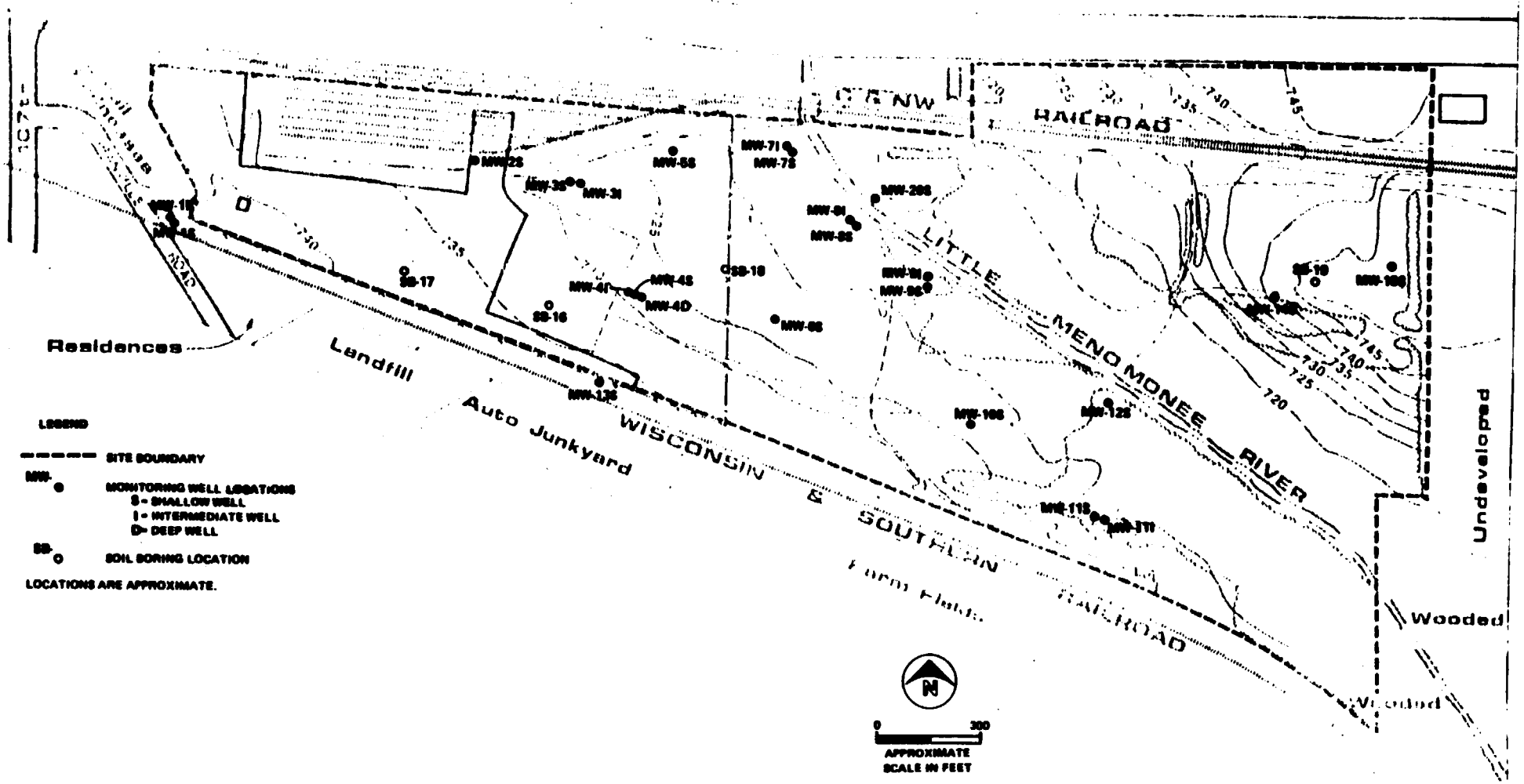


FIGURE F-1
MONITORING WELL AND
SOIL BORING LOCATIONS
MOSS-AMERICAN RI

immediately below the well screen may be related to the clay below wells MW-4I and MW-7I.

- **MW-9S** and **MW-9I** are in an area where the shallow soils appear to be contaminated. The subsurface soils and the water purged from the well during development and sampling did not appear to be contaminated. MW-9I is installed in the Oak Creek Formation at a depth containing silt and sand seams. The well is set at an elevation close to that of MW-7I and MW-8I so that the lateral extent of deep contamination can be determined.

- **MW-10S** is located in an area that may have been intended for use as a storage area. The area has been graded an covered with crushed rock. MW-10S is screened in what appears to be alluvial sediments.

- **MW-11S** and **MW-11I**--The southeast portion of the site was used as a landfill for various types of waste, as described in the Technical Memorandum on surface soils. MW-11S is installed between the landfill and the top of the till. Although the landfill material contains some treated railroad ties and oily liquids, the wells there do not appear to contain any free product. MW-11I was installed because of the contamination found in the surface soils. It is completed in a sandy layer within the Oak Creek Formation.

- **MW-12S** is in a small clearing in the woods near the river. Although site activities apparently did not take place there, the well is generally downgradient from the southeast landfill and the storage areas. It is also near the outfall of a low, swampy area that receives drainage from much of the southeastern part of the site.

- **MW-13S** is a background well use to determine groundwater gradients in the south central part of the site.

- **MW-14S** is downgradient of the landfill in the northeastern part of the site. It is deeper than other shallow wells and is screened in unweathered till and lacustrine deposits of the Oak Creek Formation.

- **MW-15S** is a background well intended to monitor groundwater quality upgradient of the landfill. During drilling and installation the soil appeared saturated from 6 feet below ground to the bottom of the screened interval 20 feet below ground; however, the well did not yield water.

- **SB-16** was completed through the former process building area.

- **SB-17** is in the former drip track area. No evidence of soil contamination was observed at this boring.

- **SB-18**--In 1971 the settling ponds were excavated. The excavated soil was mixed with clean soil and placed in the landfill in the northeast

part of the site. The trench was backfilled with clean soil. Boring SB-18 was made to determine the depth of the excavated trench and to determine if the soil below the trench is contaminated.

- **SB-19** was drilled to determine the depth of the northeast landfill and whether contaminants have migrated below the landfill.

- **MW-20S** was installed to determine whether the Little Menomonee River is actually the groundwater divide for the area. When MW-8S was found to be highly contaminated, there was concern that contaminants may have migrated to the other side of the river, especially through thin sand and gravel seams. MW-20S does not appear contaminated, but the results of the groundwater and soils analyses must be evaluated before final conclusions can be made.

DRILLING METHODS

Exploration Technology used track- and truck-mounted Dietrich D-50 rigs and an ATV-mounted CME 550 drill rig to drill the borings. The drill rigs were steam cleaned at the beginning and end of the job. All down-hole equipment was steam cleaned between borings.

The shallow soil borings and borings not used for monitoring wells were completed using 4-1/4-inch I.D. hollow-stem augers. The borings not used for monitoring wells were filled with cement grout after completion.

For the intermediate and deep borings, hollow-stem augers were used for the first 15 feet of drilling. A temporary 6-inch I.D. steel casing was put in the borehole to prevent migration of contaminant from shallow to deep areas. The casing was driven into a silt or till formation and sealed at the bottom with granular bentonite. Soil that fell to the bottom of the borehole was washed out with clean water before proceeding, and the wash water was drummed. The borehole was advanced below the casing using rotary wash methods and a 4-7/8-inch bit.

Exceptions to the above procedures are described below:

- **MW-1I** is located in an area where contamination was neither expected nor observed. The boring was advanced using 4-1/4-inch I.D. hollow-stem augers for the entire length of the boring.

- **MW-4D**--The 6-inch I.D. steel casing used to drill MW-4D was grouted permanently in place. A 4-inch protective casing was installed around the well.

- **MW-8I** was advanced to 30 feet below ground with 4-1/4-inch I.D. hollow-stem augers. The boring was continued using the rotary wash method with a 3-7/8-inch bit. The augers were left in place and acted as a temporary casing for the borehole.

WELL CONSTRUCTION

Well construction diagrams are included on the well logs in Attachment F-1. All wells were constructed with 2-inch I.D. stainless steel well screens and riser pipe and installed with 0.010-inch slotted, continuous wire-wound screens. The riser pipe joints above the well screen were covered with teflon tape before installation. The well construction materials were steam cleaned before the well was installed.

Shallow wells were installed with 5-foot screens, with the exception of MW-14S which has a 10-foot screen. The intermediate wells were screened in the till, which was not expected to yield much water. They were installed with 10-foot screens to make sampling and aquifer testing possible. The one deep well, MW-4D, was installed with a 5-foot screen.

The annular space between the well and the outside of the borehole was backfilled with No. 30 Flint sand to approximately 2 feet above the well screen, a bentonite seal, and cement-bentonite grout to the ground surface. On a few wells the bentonite seal was extended to the surface, and no grout was necessary. The natural formation collapsed during some of the constructions as well. The details of each construction are noted on the well logs.

A 6-foot-long, 4- or 6-inch O.D. locking protective standpipe was installed over all but three wells. Each is locked with a Number 1 Master padlock. Wells in high traffic areas (MW-01S, MW-01D, and MW-2S) were installed with flush-mounted casings. A concrete pad that slopes away from the protective casing was constructed around each standpipe. Protective posts were installed around the wells in potential traffic areas.

SOIL SAMPLING AND ANALYSIS

Split-spoon samples were collected continuously during drilling to a depth of approximately 20 feet below ground and every 5 feet thereafter. A depth interval was sampled only once at each well nest. For example, if the interval from 0 to 20 feet below ground had already been sampled during the intermediate well installation, it was not sampled during the shallow well installation.

The split-spoon samplers used were 2 feet long and 2.5 inches in diameter (larger than standard samplers) to collect the necessary volume for laboratory analysis. If the sample recovery from the sampler was not large enough for the analysis, two or three successive samples were composited. The samplers were driven with a standard 140-pound hammer. The sample intervals and penetration test results are reported on the well logs.

Samples were collected directly from the split-spoon sampler, or they were transferred to a clean stainless steel pan before being put into jars. The samples were put into jars using a stainless steel spoon. Sample jars to be analyzed for volatile organic compounds were filled first before mixing. If the sample was not very cohesive, it was mixed in a pan. Cohesive samples were

composited by filling a sample jar with several pieces of cohesive soil from different parts of the sampler. The sampling equipment, including the split-spoon samplers, was decontaminated between samples using a detergent wash, methanol rinse, and distilled water rinse.

Each of the split-spoon samples was analyzed for extractable organic compounds content by the onsite close support laboratory (CSL). The analytical methods are described in the Quality Assurance Project Plan. The results of these analyses are reported on the well logs. One, two, or three of the split-spoon samples from each well were sent through the U.S. EPA Contract Laboratory Program (CLP) for analysis of organic priority pollutants, metals, cyanide, carbon, hydrogen, sulfur, oxygen, nitrogen, moisture content, ash content, volatile matter, fixed carbon, total organic carbon, water soluble chlorides, dioxin, heating value, flash point, and pH. These sample locations are also reported on the well logs.

WELL DEVELOPMENT

All wells were developed by purging with a stainless steel bailer. Water was removed from the well until pH, conductivity, and clarity stabilized. Wells that did not recharge quickly were bailed dry several times until clarity did not improve with successive bailings. All development water was retained in labeled 55-gallon drums. Development equipment was decontaminated with a detergent wash, potable water rinse, methanol rinse, and distilled water rinse between wells. Rather then decontaminating the bailer used at MW-8S, which contained substantial oil, that bailer was dedicated to the well.

FINDINGS

GENERAL GEOLOGIC SETTING

The bedrock below the Moss-American site is dolomite and shale of either the Milwaukee Formation or the Thiensville Formation. Pre-glacial erosion cut deep valleys in these rocks. Glacial erosion tended to widen the valleys and leave glacial deposits 0 to 250 feet thick. The unconsolidated deposits below the site are probably about 150 feet thick (SEWRPC 1976).

The glacial deposits encountered at the site are interpreted to be the Oak Creek Formation. The Oak Creek formation has been described as follows:

> Till of the Oak Creek Formation was deposited by ice of the Lake Michigan Lobe as it moved west-southwestward out of the Lake Michigan basin and crossed a large area of southeastern Wisconsin. Lacustrine sediment in the formation was laid down mainly in proglacial environments during brief intervals of ice-front recession.
>
> The Oak Creek Formation includes fine-textured glacial till, lacustrine clay, silt and sand, and some glaciofluvial sand and gravel. The till is strongly calcareous and fine grained, commonly containing between 80

and 90 percent silt and clay in the matrix (less-than-2-mm fraction). Because the relative amounts of silt and clay vary from place to place, the texture of the till ranges from silty clay through clay loam and silty clay loam to silt loam. Commonly, however, the deposit is silty clay or silty clay loam till. The average composition is about 12 percent sand, 43 percent silt, and 45 percent clay. Stones are generally small and not terribly abundant. Illite is the dominant clay mineral in the less-than-0.002-mm fraction, averaging 72 percent of the clays; expandable clay minerals and kaolinite plus chlorite are about equal, 15 and 13 percent, respectively. Dolomite dominates the pebble assemblage, but the drift contains a considerable variety of igneous and metamorphic rock types from the Canadian Shield; basalt is particularly common. Perhaps the most diagnostic item, however, is the presence of dark gray shale fragments, which are presumably derived from the Lake Michigan basin. (Mickelson et al. 1984)

SITE HYDROGEOLOGIC SETTING

Interpretation of site-specific stratigraphy was made by comparing units identified in the field to the known regional geology. Four general units were encountered during the field investigation: fill, recent alluvium, glacial till, and lacustrine deposits of interbedded silt, clay, and fine sand.

Fill materials are described in the Appendix D, Mapping and Surveying, and Appendix E, Surface Soil Screening Investigations. The location and composition of the fill varies considerably across the site, and has changed over time as land use changed. The alluvial sediments are associated with the Little Menomonee River. They consist of silty flood deposits and sand and gravel channel deposits. The alluvial deposits are 4 to 8 feet thick and traverse the center of the site on both sides of the river.

The glacial till and lacustrine deposits make up the Oak Creek Formation. On the site, the till was generally weathered to a depth of 2 to 10 feet. The weathered till and lacustrine deposits are generally brown rather than the gray that is characteristic of Oak Creek till. In addition, the penetration resistance (N) is two to four times higher in the unweathered till than in the weathered zones. ("N" was determined by dropping a 140-pound hammer 2 feet to drive a 3-inch O.D. split-spoon sampler). These two features were used to estimate the boundary between the weathered and unweathered Oak Creek till.

Hydrogeologically, the site consists of a surficial aquifer and a confining unit. It is questionable, however, whether the surficial aquifer would yield enough water to be classified as a true aquifer. It consists of a thin mantle of fill, alluvium, and weathered till. The confining unit is the unweathered Oak Creek Formation.

Slug tests conducted on the Oak Creek Formation in the deep and intermediate wells indicate average conductivities in the screened zones of 1×10^{-5} cm/s to 1×10^{-6} cm/s. The screened zones of the deep and intermediate wells were completed in sandy layers when encountered, or in the zone believed to be most

permeable in the absence of well defined sand zones. Therefore, the bulk conductivity of the entire unit is probably less than the reported values. In addition, the stratigraphy of the screened section of the intermediate wells typically included interbedded lacustrine silts, sands and clays. In those cases, because the silt and clay layers would impede vertical flow, the reported values of hydraulic conductivity are probably due to horizontal flow. Bulk vertical conductivities are probably much lower.

The surficial aquifer comprises everything above the confining unit, including the weathered Oak Creek Formation, alluvial sediments, and fill. The hydraulic conductivities from the tests on shallow wells completed in the alluvium and weathered Oak Creek Formation ranged from 1×10^{-3} cm/s to 1×10^{-4} cm/s. Hydrogeologic properties of the fill are probably comparable; however, more variability should be expected because of the variability in fill material.

The cross sections were constructed to reflect these hydraulic similarities, rather than following a strict geologic interpretation (see Figures F-2 through F-5). Accordingly, three units are shown.

Fill

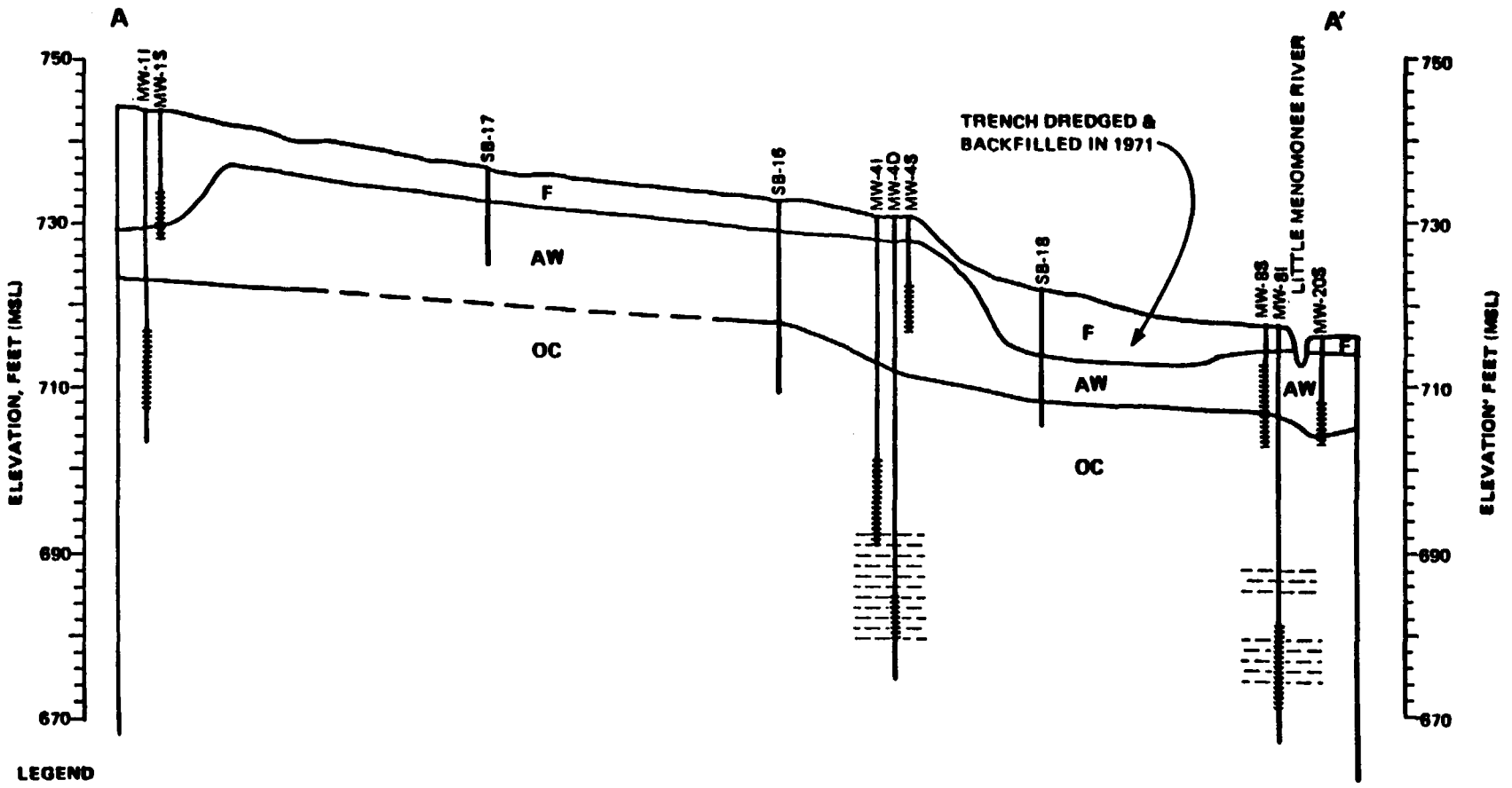
The fill unit consists of a variety of materials that have been added to the surface between 1920 and the present. It is coarse gravel beneath the paved area; cinders and wood chips in the treated storage areas; silty loam in the old settling ponds; dredgings along the river and in the landfill; and trash and miscellaneous debris along the old stream channels (roughly coincident with the edge of the wooded areas).

Recent Alluvium and Weathered Oak Creek Formation

The recent alluvium is associated with the Little Menomonee River. It consists of silt and clay flood deposits and sand and gravel channel deposits. These deposits are hydraulically connected to the weathered Oak Creek Formation. This formation is typically a brown till; however, interbedded proglacial lacustrine deposits are present at several elevations.

Oak Creek Formation

The unweathered part of the Oak Creek Formation is gray. It is dense and typically consisting of silty clay till and interbedded lacustrine deposits. The lacustrine beds consist of laminated or thinly bedded clays, silts, fine sands, and occasionally medium sands.



LEGEND

Fill

F — Gravel, cinders, woodchips, silty loam, river dredgings, trash, railroad ties, other debris.

Recent Alluvium and Weathered Oak Creek Formation

AW — Fine-grained flood deposits, sand and gravel channel deposits, brown silty clay till, with interbedded red, brown and gray lacustrine clays, silts and sands.

Oak Creek Formation

OC — Dense gray silty clay till with interbedded silts, clays and fine sands.

Laminated or thinly bedded clays, silts and fine sands.

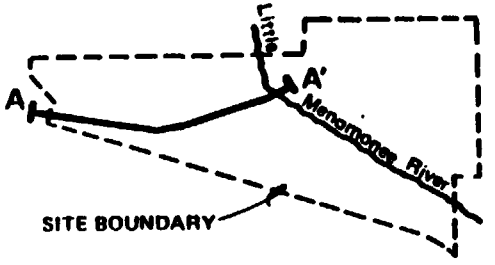
SB — SOIL BORING

MW — MONITORING WELL AND SCREENED INTERVAL

0 300

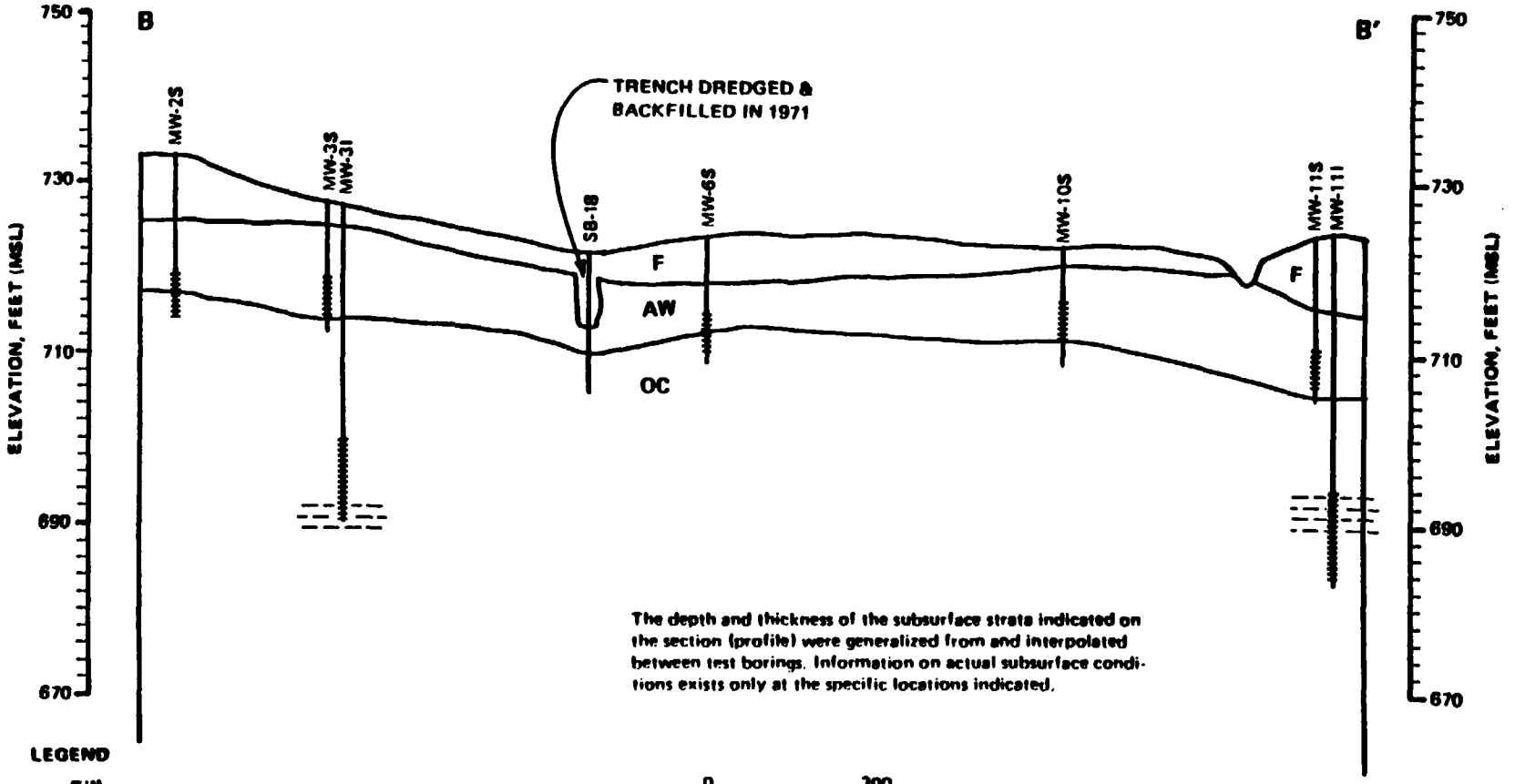
HORIZONTAL SCALE IN FEET

LOCATION



The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations indicated.

FIGURE F-2
CROSS SECTION A - A'
MOSS-AMERICAN RI



The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations indicated.

0 300
HORIZONTAL SCALE IN FEET

LEGEND

Fill

F — Gravel, cinders, woodchips, silty loam, river dredgings, trash, railroad ties, other debris.

Recent Alluvium and Weathered Oak Creek Formation

AW — Fine-grained flood deposits, sand and gravel channel deposits, brown silty clay till, with interbedded red, brown and gray lacustrine clays, silts and sands.

Oak Creek Formation

OC — Dense gray silty clay till with interbedded silts, clays and fine sands.

Laminated or thinly bedded clays, silts and fine sands.

SB — SOIL BORING

MW — MONITORING WELL AND SCREENED INTERVAL

LOCATION

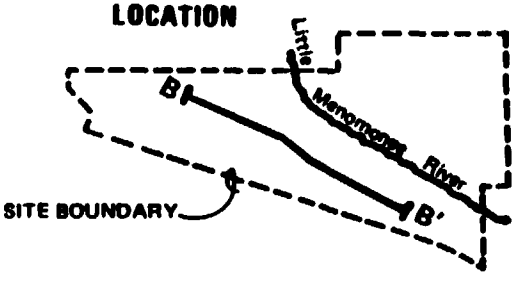
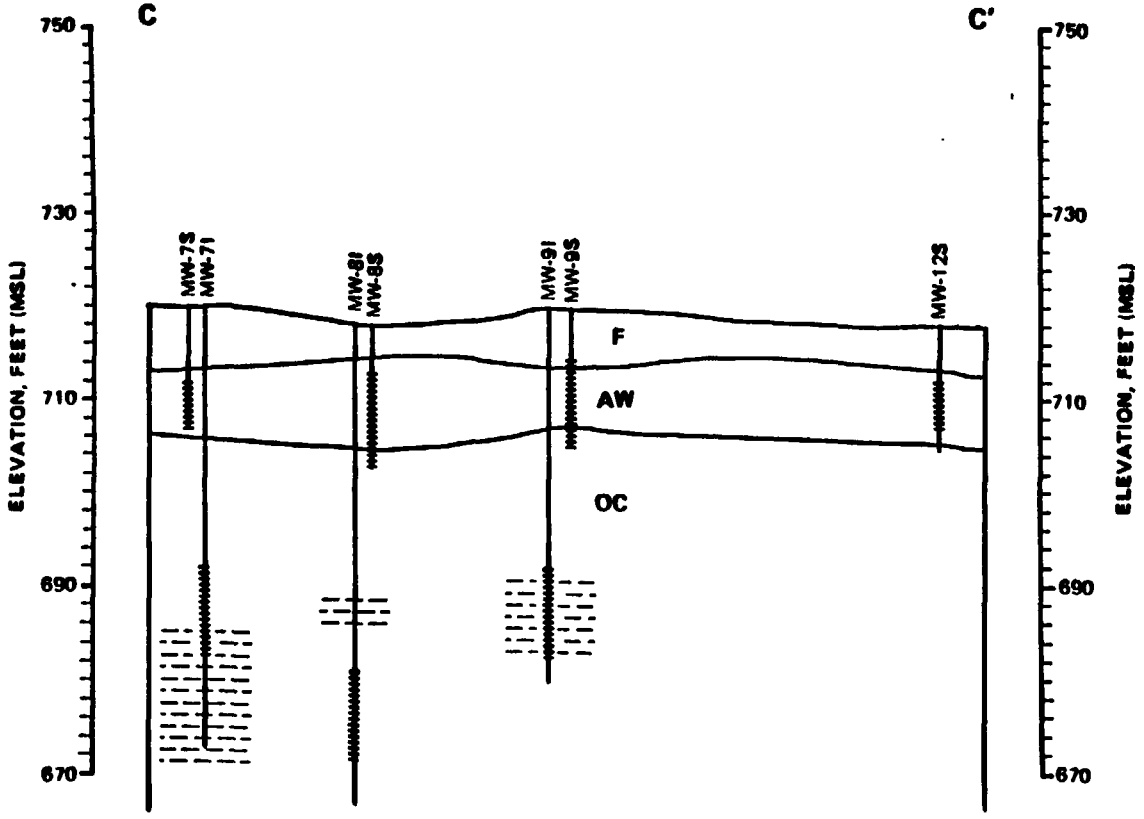
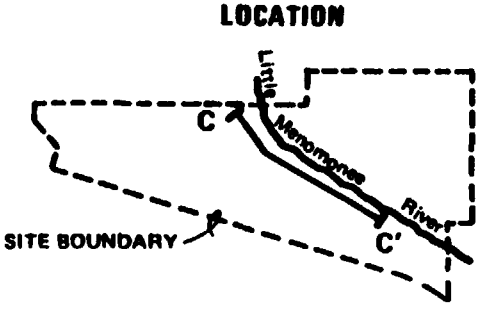


FIGURE F-3
CROSS SECTION B - B'
MOSS-AMERICAN RI





LEGEND

Fill

F — Gravel, cinders, woodchips, silty loam, river dredgings, trash, railroad ties, other debris.

Recent Alluvium and Weathered Oak Creek Formation

AW — Fine-grained flood deposits, sand and gravel channel deposits, brown silty clay till, with interbedded red, brown and gray lacustrine clays, silts and sands.

Oak Creek Formation

OC — Dense gray silty clay till with interbedded silts, clays and fine sands.

0 300

HORIZONTAL SCALE IN FEET

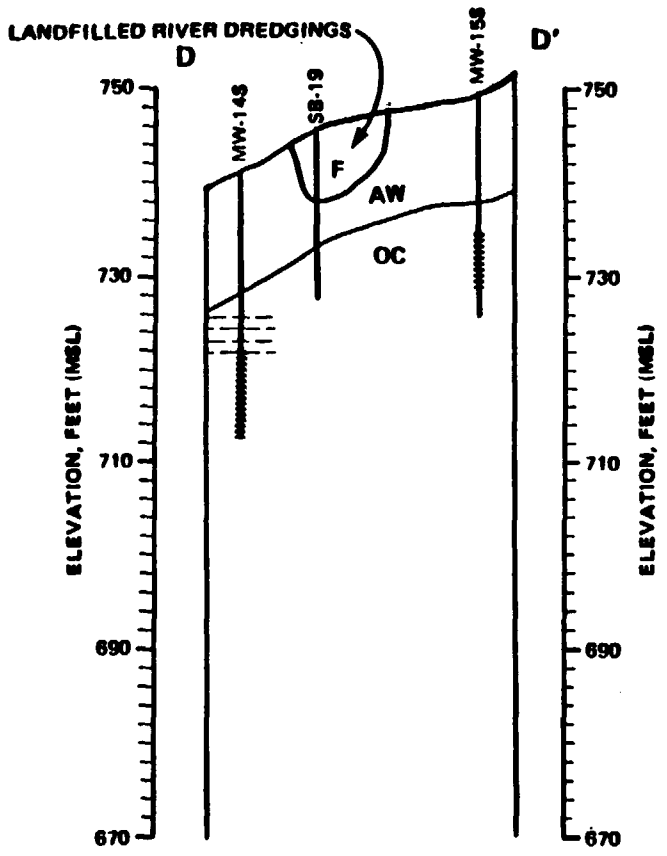
Laminated or thinly bedded clays, silts and fine sands.

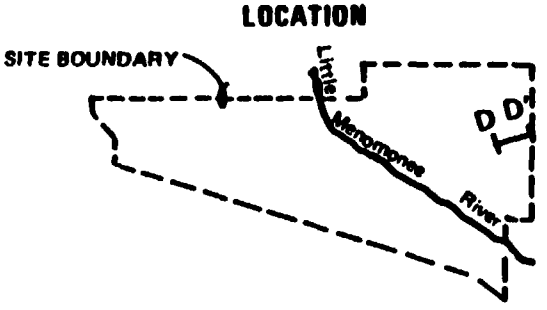
SB — SOIL BORING

MW — MONITORING WELL AND SCREENED INTERVAL

The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations indicated.

FIGURE F-4
CROSS SECTION C - C'
MOSS-AMERICAN RI





LEGEND

Fill

F — Gravel, cinders, woodchips, silty loam, river dredgings, trash, railroad ties, other debris.

Recent Alluvium and Weathered Oak Creek Formation

AW — Fine-grained flood deposits, sand and gravel channel deposits, brown silty clay till, with interbedded red, brown and gray lacustrine clays, silts and sands.

Oak Creek Formation

OC — Dense gray silty clay till with interbedded silts, clays and fine sands.

Laminated or thinly bedded clays, silts and fine sands.

SB — SOIL BORING

MW — MONITORING WELL AND SCREENED INTERVAL

0 300

HORIZONTAL SCALE IN FEET

The depth and thickness of the subsurface strata indicated on the section (profile) were generalized from and interpolated between test borings. Information on actual subsurface conditions exists only at the specific locations indicated.

FIGURE F-5
CROSS SECTION D - D'
MOSS-AMERICAN RI

REFERENCES

Mickelson, D. M., L. Clayton, R. W. Baker, W. N. Mode, and A. F. Schneider. *Pleistocene Stratigraphic Units of Wisconsin*. Geological and Natural History Survey, Misc. Paper 84-1 University of Wisconsin–Extension, Madison, Wisconsin. 1984

SEWRPC (Southeastern Wisconsin Regional Planning Commission). *A Comprehensive Plan for the Menomonee River Wasteshed*, Vol I, Inventory Findings and Forecasts. October 1976. pp. 123-29.

GLT779/024.50

Attachment F-1
WELL LOGS AND SAMPLING INFORMATION

MONITORING WELL BORING LOGS

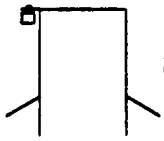
MOSS-AMERICAN SITE

Legend

2" ID #10 SLOT STAINLESS STEEL WELL SCREEN

2" ID STAINLESS STEEL WELL RISER WITH CAP

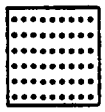
6" ID STEEL OUT CASING



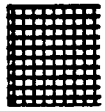
STEEL PROTECTIVE CASING WITH NO. 1 MASTER LOCK

CEMENT/BENTONITE GROUT

BENTONITE SEAL

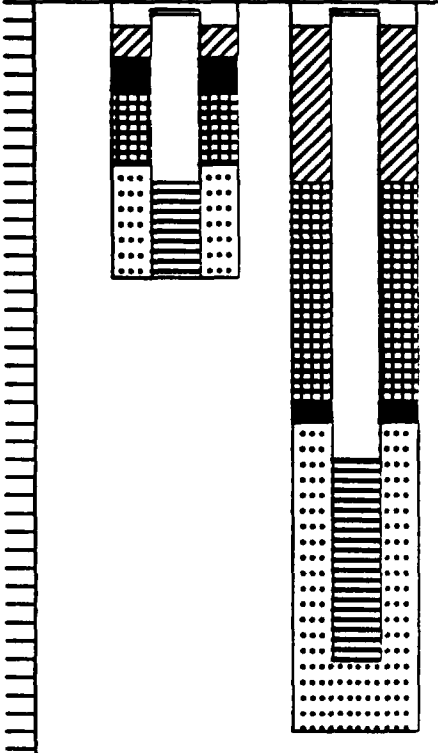


NO. 30 "FLINT" SAND PACK



NATURAL FORMATION COLLAPSE

MOSS-AMERICAN MONITORING WELL MW-01S and MW-01I
MW-01S COMPLETED 6/27/88, MW-01I COMPLETED 6/27/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
Brown and gray loose silty SAND and GRAVEL (SM and GM) (Fill). Asphalt on surface.				
	0.00		50-25-20-18	740
	0.01		100/9	
	0.02		3-3-4-5	
	0.01		30-14-10-7	735
	0.01		24-14-19-32	
	0.00	SB-01-01	24-39-44-58	730
Gray, wet, dense silty SANDS.	0.01		4-8-18-24	
Gray, fine sandy SILT (ML). Laminated.	0.01		8-13-13-12	
	0.01		7-7-9-14	725
Gray silty CLAY with pebbles, wet (CL). Oak Creek till.				
	0.01		16-27-41-52	720
	0.00		19-28-46-48	715
	0.01		26-31-33-39	710
			21-29-18-27	705
				700
				695
				690
				685
				680
				675
				670
				665

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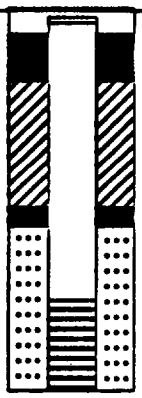
MOSS-AMERICAN MONITORING WELL MW-02S
MW-02S COMPLETED 6/28/88

MW-02S

FLUSH-MOUNTED PROTECTIVE CASING



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Brown silty SAND (SM) grading to clayey SILT (ML). Some gravel. Moist (FILL).	2.05		12-8-10-10
Asphalt on surface.	0.21		7-7-6-4
	0.21		5-5-4-5
	0.01		3-3-4-8
Light brown wet silty CLAY (CL). Trace sand and pebbles (Till).	0.00		2-5-7-10
	0.00		10-10-26-26
			8-17-19-30
Gray silty fine SAND (ML). Trace clay.	0.01	SB-02-01	7-10-12-15
Gray silty CLAY (CL). Trace pebbles. Wet. (Till)	0.00		8-11-27-33

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

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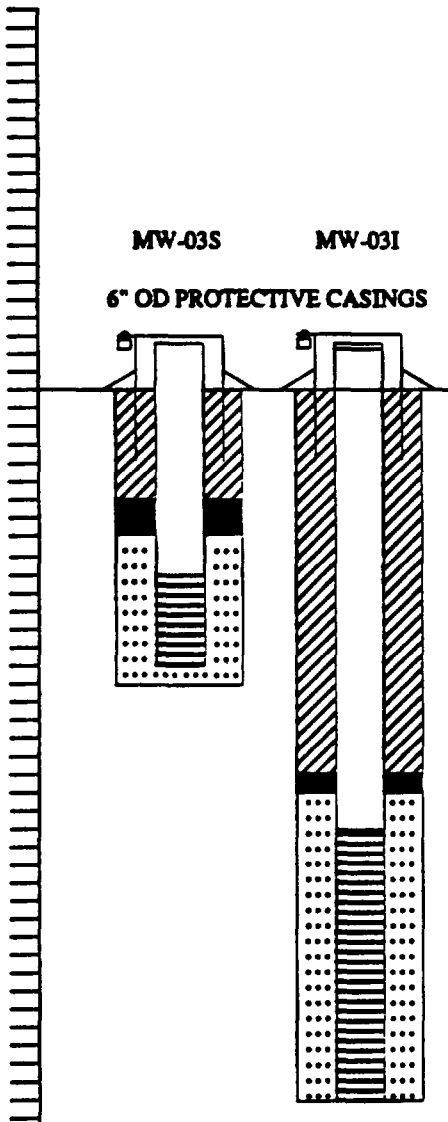
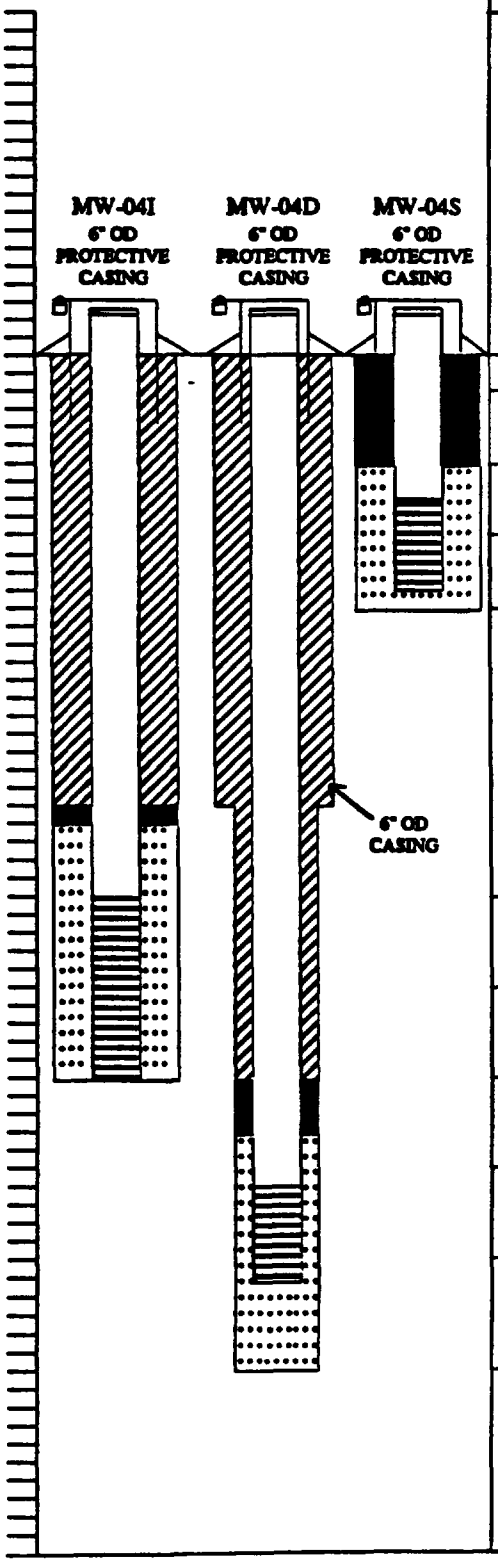
MOSS-AMERICAN MONITORING WELL MW-03S AND MW-03I
MW-03S COMPLETED 6/23/88, MW-03I COMPLETED 6/24/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
Brown, dry SILT and SAND. Some cinders, gravel and clay (Fill)	1.36		12-18-19-23	
	0.03		19-20-22-11	
Brown silty CLAY (CL). Trace pebbles,	0.00		7-9-11-20	725
silty sand in seams (Till).	0.00		7-9-10-10	
Laminated, moist to wet, reddish brown SILTS, gray fine SANDS,	0.00		5-10-11-19	720
golden brown silty SANDS, and gray medium SANDS. Occasionally	0.00	SB-03-01	12-32-54-41	
interbedded with SILTY CLAY TILL.	0.00		11-22-41-46	715
	0.00		5-15-25-20	
Gray wet silty CLAY (CL)(Till). Trace pebbles and sand. NOTE: Additional sample collected from 714-712' had 0.00% extractable				710
organics, penetration test results 10-19-22-27.	Not Analyzed		36-56-56-80	
	0.00		6-22-27-100/5"	
				705
	0.00		25-22-30-46	
				700
	0.00		22-27-21-70	
				695
			28-67-100/5"	
Gray SILT with clay. Poorly laminated to	0.00	SB-03-02	30-47-75-100/5"	690
massive, little very fine sand. Fragments of red clay.				
				685
				680
				675
				670
				665

Rev.9-12-88

MOSS-AMERICAN MONITORING WELL MW-04S, MW-04I, AND MW-04D
MW-04S COMPLETED 6/7/88, MW-04I COMPLETED 6/20/88, MW-04D COMPLETED 6/9/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
Brown gray SAND and GRAVEL (Fill)				730
Black silty SAND (SM). Contains oil or creosote.	1.62		11-12-15-13	
	0.02		20-8-7-9	
Brown silty CLAY (CL). Contains oil or creosote.	0.34		7-6-4-5	725
	0.12		4-10-9-9	
Gray brown sandy SILT (ML). Contains oil or creosote. Some sand seams.	0.08	SB-04-01	6-9-9-11	720
	Not analyzed		4-27-36-48	
Light brown silty CLAY (CL). Oil or creosote present on a few surfaces. Sand and silt in seams (Till). Color changes to gray at 711'.	0.05		17-42-61-88	715
	0.00		3-5-23-76	710
	0.00		8-18-36-54	705
Gray fine SAND with silt. Wet. No evidence of contamination.	0.00	SB-04-02	22-57-87-162	700
No recovery.	0.00		59-50/0.3'	695
Reddish brown CLAY (CH). Fine laminations	0.00		6-16-19-23	690
Gray laminated SILTS, CLAYS, and FINE SANDS, moist.	0.00		7-24-43-60/0.1'	685
Gray CLAY with a little gravel (to 2"). Moist (CL)(Till).	0.00		44-49-100/0.5'	680
	Not Analyzed	SB-04-03	44-100/0.4'	675
				670
				665

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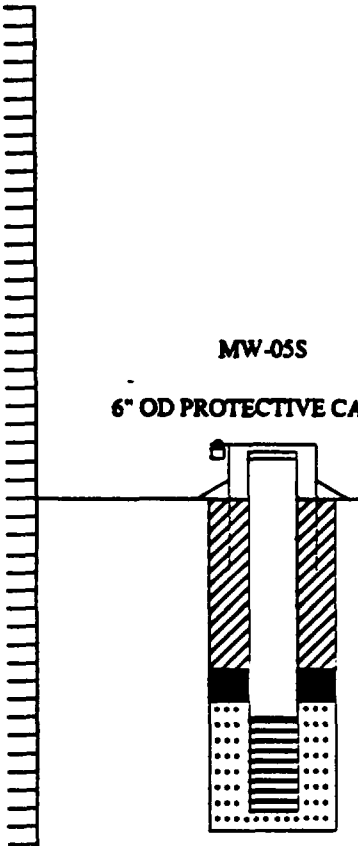
MOSS-AMERICAN MONITORING WELL MW-05S
MW-05S COMPLETED 6/29/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
				725
Brown, blocky sandy SILT (ML)(Fill)	0.01		7-21-27-31	
	0.04		21-27-27-15	720
Black hard sandy SILT (ML)(Fill) with small rocks, cinders, no visible oil.	0.03		20-22-31-10	
Black soft clayey sandy SILT (ML-CL).	0.01		21-5-6-8	
Weathered cobbles of varying lithology. Some	0.00		[illegible]-11-13	715
brown silt.			3-4-5-6	
Light brown soft clayey sandy SILT (ML-CL) Small gravel	0.01	SB-05-01	8-9-12-13	710
Grey, soft wet clayey SANDY SILT (ML) Laminated	0.00		8-10-17-21	
Gray moist silty CLAY (CL)(Till). Trace pebbles.	0.00		26-100/5"	705
				700
				695
				690
				685
				680
				675
				670
				665

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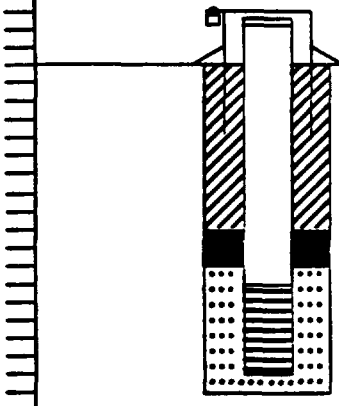
MOSS-AMERICAN MONITORING WELL MW-06S
MW-06S COMPLETED 6/28/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Black-brown cinder SAND (SM)(Fill). Pebbles, dry, some silt	0.96		3-3-4-6
Brown-black to black-grey, dry loose SILTY SAND (SM)(Fill). Some pebbles, some cinders.	0.21		10-9-5-8
Brown, moist, soft sandy SILT (ML)	0.13		7-5-6-5
Brown, moist, loose, poorly sorted silty SAND	0.01		5-6-11-26
(SM). Some gravel.	Not analyzed		6-8-10-12
Brown, wet, sandy SILT (ML) with some gravel (1-2" diameter)	0.0	SB-06-01	10-13-15-25
Light grey, wet, stiff silty CLAY (ML-CL)(Till). Some sand and well-rounded gravel.	0.00		13-17-25-36

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

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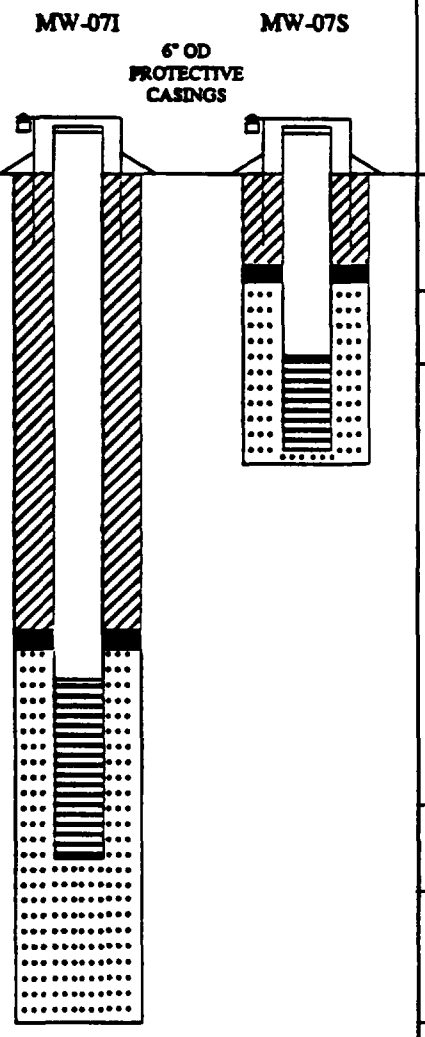
MOSS-AMERICAN MONITORING WELL MW-07S AND MW-07I
MW-07S COMPLETED 6/15/88, MW-07I COMPLETED 6/15/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
				725
				720
Light brown SILT (ML)(Fill). Some roots and wood chips. Localized accumulations of organic material.	0.02		6-10-18-18	
	0.00		15-23-18-19	
	0.10		8-5-7-6	715
Grey, moist, poorly graded very fine SAND and SILT (ML).	0.00		3-3-6-7	
		SB-07-01	10-23-23-22	710
Grey, wet SILTY CLAY with a little sand and trace pebbles (CL). Till.	0.00		9-10-13-23	
	0.00		7-20-22-15	
	0.00		19-38-26-26	705
	0.00		9-12-15-21	
	0.00		10-15-31-80	700
	0.00		6-18-64-73	695
	0.00		3-30-46-40	690
				685
Reddish brown, moist, silty CLAY (CL) (Till). Trace pebbles.	0.00		10-15-42-48	
				680
Gray CLAY (CL) with silt. Clasts of reddish-brown silty clay. Finely laminated.	0.00		33-45-55-78	
				675
SAND seam at 673'.	0.00		20-36-100/5"	
				670
				665

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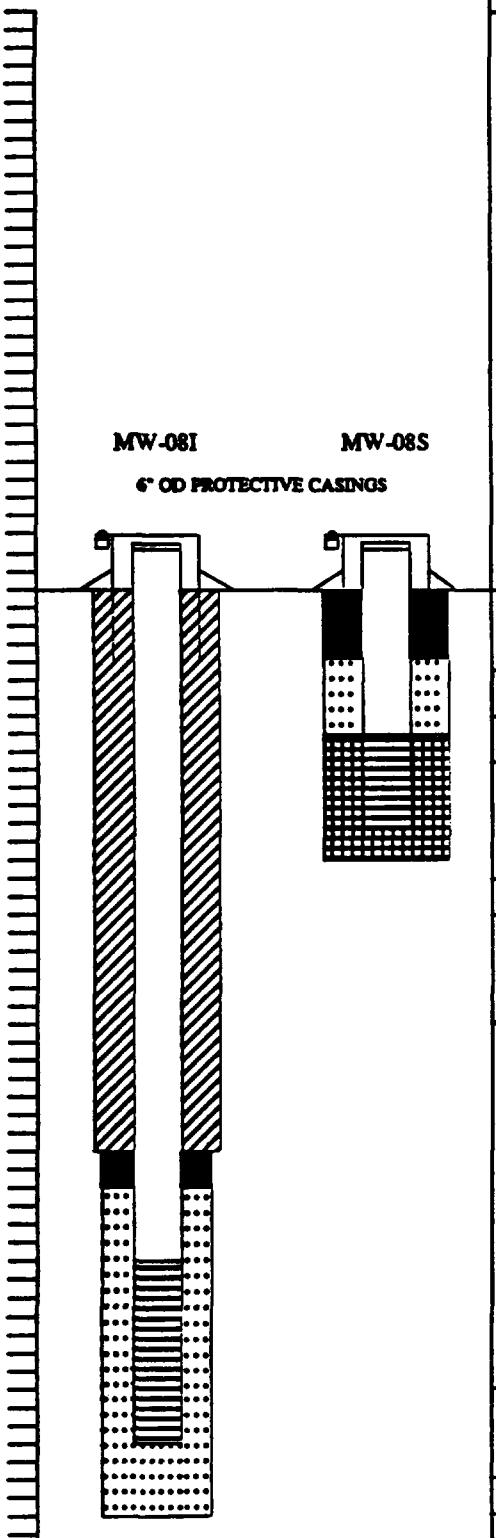
MOSS-AMERICAN MONITORING WELL MW-08S MW-08I
MW-08S COMPLETED 6/13/88 MW-08I COMPLETED 6/13/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
				725
				720
Brown, sandy SILT (ML). Some pebbles.	0.60		5-6-23-23	
	0.00		13-5-5-5	715
Gray clayey fine sandy SILT (ML-CL)(Alluvium). Laminated.	0.01		4-3-5-9	
Gray silty fine SAND (ML)(Alluvium). Medium sand in seams. Oil in seams.	0.00		11-10-15-23	
	0.00	SB-08--02	6-10-15-18	710
Gray, soft silty CLAY (CL). Trace pebbles.	0.00		7-8-7-9	
	0.00		21-21-25-23	705
	0.00		17-25-31-90	
Gray, moist sandy SILT (ML) with pebbles.	0.00		10-20-50-95	
	0.00		100/5"	700
Gray, hard silty CLAY (CL)(Till). No pebbles. Little sand.				695
	Not Analyzed		100/3"	
No recovery.				690
Gray, moist silty CLAY with sand and gravel (CL). Silty SAND seams.	0.00		65-75-100/3"	
				685
No recovery.	0.00		30-23-90-100/4"	
				680
	0.00		17-27-45-50	
				675
Grey, moist, poorly sorted SILT to coarse SAND (ML) with little gravel.	Not Analyzed		48-80-100/3"	
				670
Grey, moist CLAY (CL). Reddish-brown clay clasts	Not Analyzed	SB-08-01	25-48-28-26	
				665

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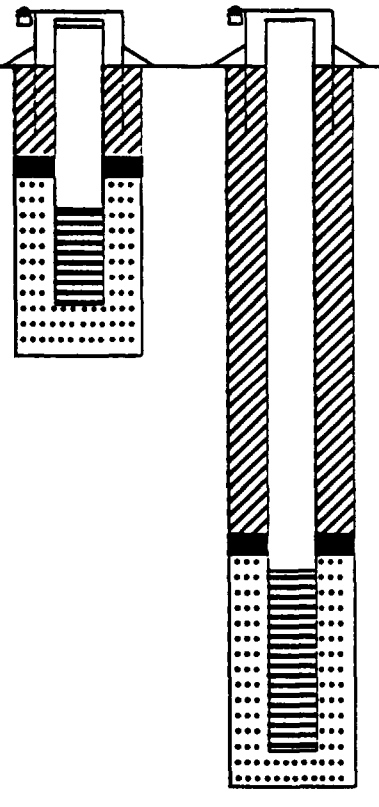
MOSS-AMERICAN MONITORING WELL MW-09S AND MW-09I
MW-09S COMPLETED 6/17/88, MW-09I COMPLETED 6/16/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRAC-TABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
				725
				720
Light brown silty SAND (Fill). Some gravel and wood chips.	0.00		10-20-15-18	
	2.67		12-25-10-5	
	0.21		6-4-5-8	715
	0.00		4-4-10-11	
Gray poorly sorted gravelly SAND (SP) (Alluvium).	0.00	SB-09-01	4-10-19-34	
			10-22-34-62	710
			24-23-21-20	
Gray, fine sandy silty CLAY (CL)(Till). Trace pebbles and gravel.	0.00		10-24-26-48	705
	0.01		10-20-36-45	
	0.01		20-35-80-50/0.2	
	0.00		16-41-56-58	700
	0.01		22-27-40-45	695
Interbedded SILTS, CLAYS, FINE and MEDIUM SANDS. 3" to 4" seams.	Not Analyzed	SB-09-02	44-98-100/0.4'	690
Gray SILT and CLAY Till, trace pebbles, moist.	0.01		75-60-95-25/0'	685
	Not Analyzed		100/0.4'	680
				675
				670
				665

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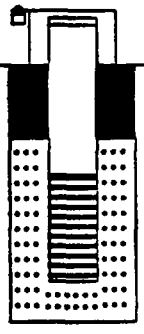
MOSS-AMERICAN MONITORING WELL MW-10S
MW-10S COMPLETED 6/21/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Dark brown weathered sandy SILT (ML). Some gravel fill and pebbles.	0.00		10-11-10-11
Gray and brown unweathered sandy SILT (ML)(Alluvium). Some pebbles.	0.00		75-15-9-11
	0.00		8-5-5-9
Light brown poorly sorted fine to coarse SAND (SM). Some pebbles and cobbles, various lithologies.	0.00		6-19-18-32
	0.00		14-27-43-17
Gray silty CLAY (CL)(Till). Trace pebbles.	0.00	SB-10-01	15-11-12-9
			15-21-35-32

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

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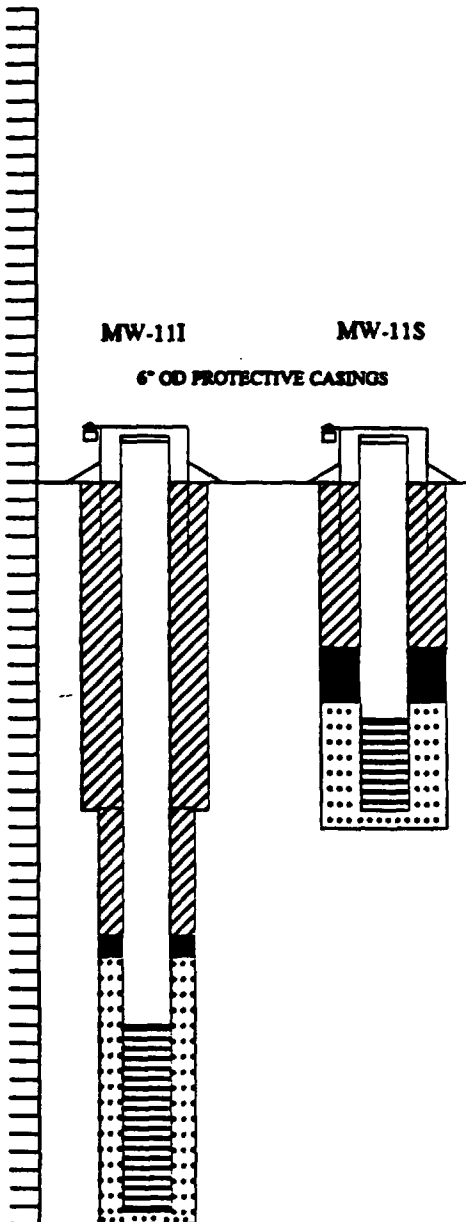
MOSS-AMERICAN MONITORING WELL MW-11S, MW-11I
MW-11S COMPLETED 6/28/88, MW-11I COMPLETED 6/27/88.



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
				735
				730
				725
Light brown, dry, loose silty SAND (SM) (Fill). Some pebbles and roots.	0.00		11-22-31-65	
	0.00		22-30-65-18	720
	5.88		5-6-10-11	
Wood chips (Fill). Wet, black oily fluid.	3.58		17-27-61-5	
Gray brown, wet, loose well-sorted silty SAND (SM).	0.05		3-2-2-10	715
	0.01		2-2-3-6	
Gray, wet, very soft interlayered silty CLAY, SILTS and SANDS (CL-SM). Moss & snail shells in clay.	0.01		1-1-1-2	
	0.00*		3-6-10-27	710
Brown, soft, wet clayey SILT (ML)(Till). Some subangular gravel.	0.00	SB-11-02	16-11-9-7	
	0.00		3-5-7-9	705
	0.00		9-19-20-70	700
Gray, wet, stiff silty CLAY (CL)(Till). Some pebbles.	0.00		15-28-35-48	695
Gray, wet, stiff SILTY CLAY, interbedded wed SILTY CLAY layer.	0.00		9-9-11-13	690
Gray, wet, silty SAND (SM). Some well rounded gravel.	0.00	SB-11-01	35-96-110/5"	685
				680
				675
				670
				665

* Standard penetration tests and extractable organics samples overlap at interval 14'-16' and 15'-17'. Reported interval is 15'-17'. The results were similar for all samples.

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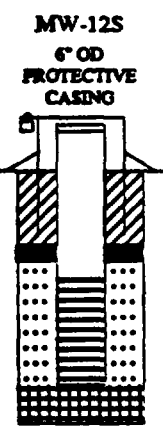
MOSS-AMERICAN MONITORING WELL MW-12S
MW-12S COMPLETED 6/21/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Dark brown, dry, loose, weathered silty fine SAND (SM).	0.00		7-10-13-12
	0.01		10-8-8-9
Gray and brown fine sandy SILT (ML).	0.00		4-10-13-15
Increasing sand with depth.	0.00		1-4-6-8
Gray fine to medium SAND (SP).	0.00	SB-12-01	5-13-23-29
Brown fine to medium SAND (SP).	0.00		5-11-13-45
Brown silty CLAY(CL)(Till). Cohesive silty fine sand in seams (Till).	Not Analyzed		3-5-7-9

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

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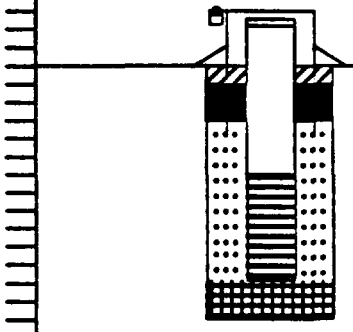
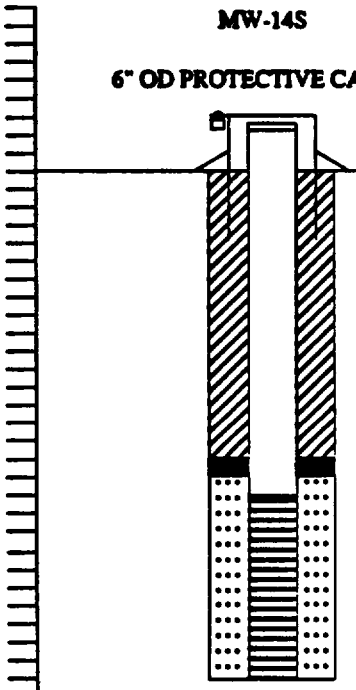
MOSS-AMERICAN MONITORING WELL MW-13S
MW-13S COMPLETED 6/29/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"	
				750
				745
				740
Dark brown weathered sandy SILT (ML). 15% rounded gravel	0.02		9-28-16-14	
	0.01		14-9-13-10	735
Light brown clayey SILT (CL). Some sand and small gravel interbedded with Light brown silty fine SAND (SM). Some small gravel.	Not Analyzed		4-13-9-18	
	0.00		6-9-9-9	730
	0.00		11-20-29-41	
Gray sandy clayey SILT (ML). No gravel, not very hard.	0.00	SB-13-01	5-6-10-17	
	0.00		4-7-11-24	725
Gray, hard, wet clayey SILT (ML)(Till). Some small gravel.				720
				715
				710
				705
				700
				695
				690
				685
				680
				675
				670
				665

Rev.9-12-88

MOSS-AMERICAN MONITORING WELL MW-14S
MW-14S COMPLETED 6/22/88

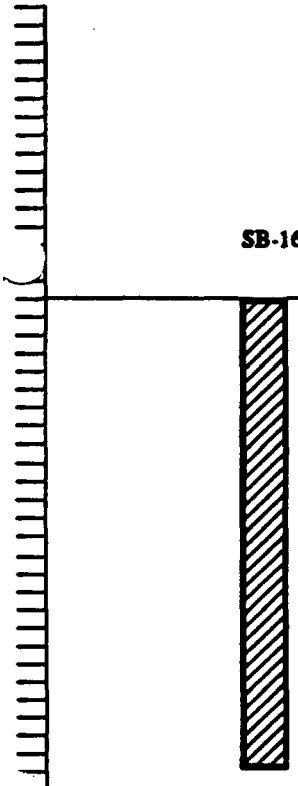


SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Brown SILT (ML). Some sand and gravel, roots.	0.00		10-15-21-22
	0.00		15-27-51-57
Brown silty CLAY (CL). Some sand and gravel (Till).	0.00		15-37-51-57
	0.00		19-25-31-47
	0.00		10-19-36-31
	0.00		22-31-41-45
	0.00		12-17-29-21
Gray CLAY (CL). Some silt and sand in seams.	0.00		5-10-20-19
	0.00	SB-14-01	5-10-17-28
Gray, hard, sandy SILT (SM-ML)(Till). Trace gravel.	0.00		17-30-100/0.4'
	0.00		51-62-100/0.4'
	Not Analyzed		100/0.4'
	0.00		12-100/0.4'

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev.9-12-88

MOSS-AMERICAN SOIL BORING SB-16
SB-16 COMPLETED 6/2/88

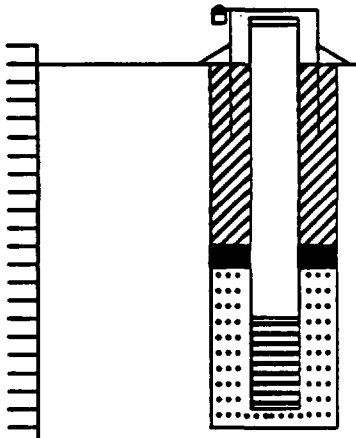


SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Well sorted sandy GRAVEL (Fill). Pieces of former concrete floor.			
			16-10-5-9
Gray, dry to moist stiff silty CLAY (CL-ML).	1.49		5-8-10-13
Visibly contaminated.	0.45	SB-16-01	5-8-48-67
Light brown, dry, hard SILT (ML). Some sand and gravel.	0.00		100/8"
	0.00		100/6"
Brown to gray, moist hard silty CLAY (CL-ML)(Till). Some gravel and sand. Dark red mottling throughout.	0.03		100/6"
	0.00		8-12-34
			12-50/4"
	0.01	SB-16-02	27-48-50/5"

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev.9-12-88

MOSS-AMERICAN MONITORING WELL MW-15S
MW-15S COMPLETED 6/22/88

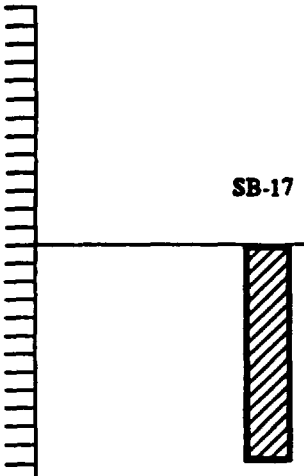


SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Brown dry silty CLAY (CL). Trace pebbles and sand-size shale chips. Formation is moist below 735 ft.	0.00		15-30-30-33
	0.00		45-58-45-50
	0.00		31-19-21-23
	0.00		12-19-24-30
	0.00		2-15-9-12
	0.00		7-10-17-17
	Not analyzed		10-13-15-17
	0.00		15-20-25-30
	0.00	SB-15-01	7-15-23-20
	0.00		14-21-25-25

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev.9-12-88

MOSS-AMERICAN SOIL BORING SB-17
SB-17 COMPLETED 6/3/88

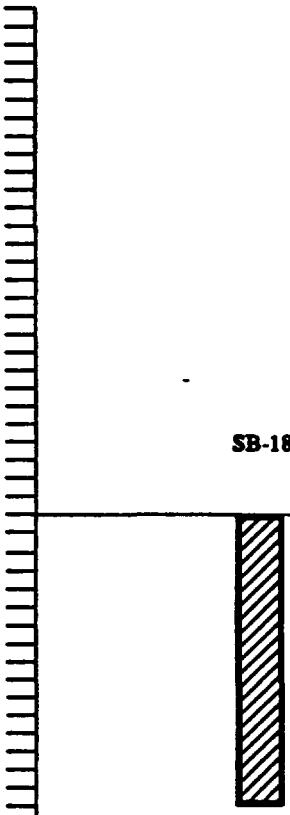


SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Asphalt and gravel (Fill).			
	0.05		15-12-10-8
Black, light brown, and gray silty CLAY and CLAY. Finely laminated. Oxidized and mottled.	0.03		9-9-12
	0.00	SB-17-01	6-5-8-12
	0.00		8-12-15-22
	0.00	SB-17-02	6-22-17-21

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev. 9-12-88

MOSS-AMERICAN SOIL BORING SB-18
SB-18 COMPLETED 6/17/88

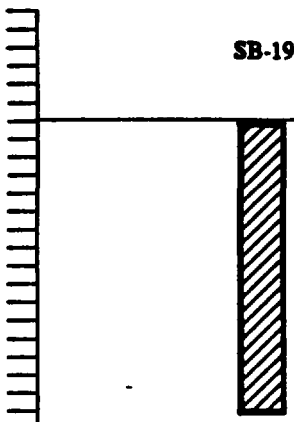


SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Brown sandy silty CLAY (CL)(Fill).	0.00		4-7-4-6
	0.00		3-5-7-11
	0.00		4-5-5-6
	0.27	SB-18-01	4-11-10-9
	0.00		7-7-7-8
Brown sandy silty CLAY (CL)(Till).	0.00		4-10-35-100/5"
	Not Analyzed		40-100/6"
	0.00	SB-18-02	56-40-67-100

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev. 9-12-88

MOSS-AMERICAN SOIL BORING SB-19
SB-19 COMPLETED 6/23/88



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Dark blackish brown SILT (ML) with sand, clay. Some oil (landfill).	0.98		
	1.80		8-5-4-5
	3.73		4-4-7-10
	2.48	SB-19-01	4-3-3-4
Brown, moist, hard silty CLAY (CL). Trace pebbles and gravel. Oxidized surfaces and oil stains present (Till).	0.00		6-32-65-73
	0.00	SB-19-02	21-25-47-65
	0.00		10-20-20-41
	Not Analyzed	SB-19-03	6-19-30-41

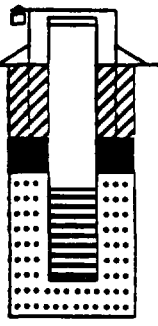
750
745
740
735
730
725
720
715
710
705
700
695
690
685
680
675
670
665

Rev. 9-12-88

MOSS-AMERICAN MONITORING WELL MW-20S
MW-20S COMPLETED 6/29/88

MW-20S

6" OD PROTECTIVE CASING



SOIL DESCRIPTION (USCS GROUP SYMBOL)	EXTRACTABLE ORGANICS (%)	CLP ANALYSIS SAMPLE NUMBER	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6"
Dark brown, dry, soft SILT (ML).	0.00		3-4-4-5
	0.00		4-5-6-8
Gray brown, wet, sandy SILT (ML). Some	0.00		6-7-7-7
clay, trace gravel. Interbedded with fine sand.	0.01		6-7-8-9
Gray silty CLAY(CL)(Till).	0.00		5-7-55-25
Yellowish brown wet sandy SILT (ML).	0.00		3-5-10-18
Gray, moist, silty CLAY (CL). Trace pebbles and gravel (Till).	0.00		12-35-21-27

750 745 740 735 730 725 720 715 710 705 700 695 690 685 680 675 670 665

Rev. 9-12-88

Appendix G
HYDRAULIC CONDUCTIVITY TESTING AND GROUNDWATER ELEVATIONS

Appendix G
HYDRAULIC CONDUCTIVITY TESTING AND GROUNDWATER ELEVATIONS

INTRODUCTION

Tests were conducted at the Moss-American site to determine hydraulic conductivities, and groundwater elevations were measured. This appendix describes the methods and results.

HYDRAULIC CONDUCTIVITY TESTING

Recovery tests were performed on July 5, 6, and 7, 1988 by Kevin Olson, Stu Grubb, Don Johnson, and Dorothy Hall of CH2M HILL. Each recovery test consisted of measuring water levels in a well following the rapid removal of water from the well. Well locations are shown in Figure G-1. Well recovery data were evaluated using the Bouwer and Rice method.

METHODOLOGY

The tests were conducted as follows:

1. Depth to water (i.e., the static water level) was measured. All depth measurements were done with an electric water level indicator using a tape with 0.1-foot divisions.

2. About 1 gallon of water was quickly removed from the well using a 4-foot-long stainless steel bailer (about three bailer volumes).

3. The depth to water was measured and time was recorded until approximately 90 percent of the initial drawdown in the well recovered.

4. The recovery data for each well were plotted as drawdown versus time. Drawdown is the difference between the static water level (measured before the start of the test) and each measurement taken during the test. Drawdown is plotted on a log scale and a straight line drawn through the plotted data. The drawdown at time = t and at time = 0 is determined from the plot and used in the equation in the next step.

5. The hydraulic conductivity (K) was calculated using the equation

$$K = [r_c^2 * \ln (R_e/r_w)]/2L * 1/t * \ln(y_o/y_t)$$

where,

r_c = Radius of the section of the well in which water rises during the test. When water rose in the sand pack during the test, r_c was corrected to include the pore space in the sand pack.

$\ln (R_e/r_w)$ = Empirical value determined for each well which depends on aquifer and monitoring-well geometry. Each of the screened intervals at the Moss-American site as assumed to be fully penetrating. Therefore:

$$\ln (R_e/r_w) = \left[\frac{1.1}{\ln(H/r_w)}\right] + \left[\frac{C}{L/r_w}\right]^{-1}$$

L = Screen length if the static water level is above the top of the screen; or H, if the static water level is below the top of the screen

H = Static hydraulic head in the well, measured from the bottom of the screen

r_w = Radius of the borehole

C = Emperical constant obtained from Bouwer and Rice

y_o = Initial drawdown in the well (at t = 0) (taken from the graph)

y_t = Drawdown in well at time t (taken from the graph)

RESULTS

Hydraulic conductivities range from 1.7×10^{-3} cm/s to 3.9×10^{-6} cm/s. The values of the parameters used to calculate hydraulic conductivity for each well are given in Table G-1. A plot of drawdown versus time for each test is shown in Attachment G-1.

Values of hydraulic conductivity across the site indicate the values are consistent with published values of hydraulic conductivity for glacial tills (Todd 1980). Hydraulic conductivities of the shallow wells generally range from 1×10^{-3} cm/s to 5×10^{-4} cm/s in wells completed in zones of alluvium and weathered till. Exceptions to this are MW-14S, MW-06S, MW-01S, and MW-10S, with conductivities of 1×10^{-5} to 1×10^{-6} cm/s. Although MW-14S is classified as a shallow well, it is completed in dense till and interbedded silts and fine sands and is therefore more comparable to the intermediate wells. Hydraulic conductivity at MW-06S is also lower than at other shallow wells (2.5×10^{-5}). The conductivities calculated at MW-01S and MW-10S are probably not indicative of the soils near those wells. Caving around the screen at MW-01S and the low water level at MW-10S resulted in poor development of the sand

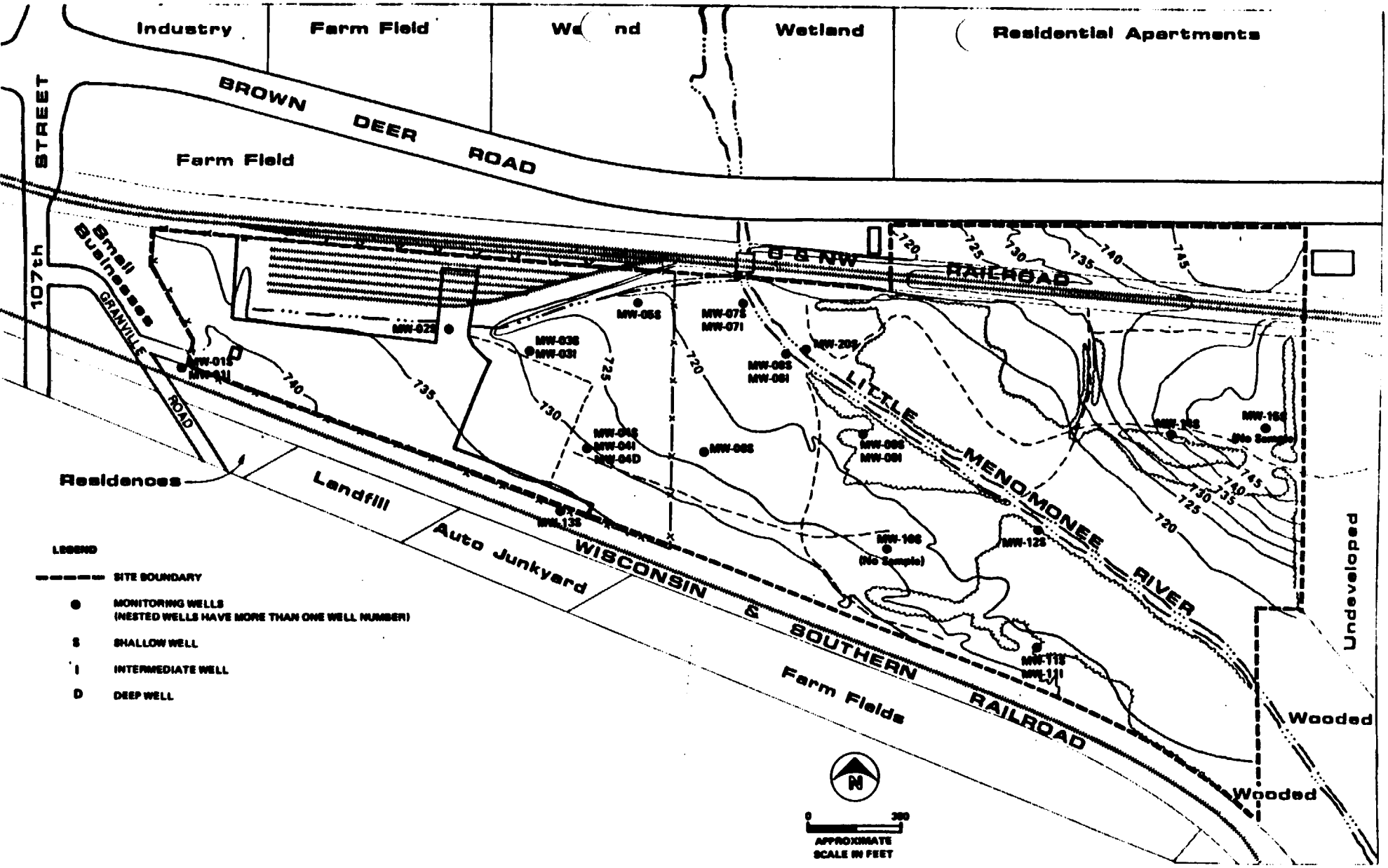


FIGURE G-1
MONITORING WELL LOCATIONS
MOSS-AMERICAN RI

Table G-1

AQUIFER SLUG TEST CALCULATIONS

MOSS AMERICAN SUPERFUND SITE

WELL NUMBER	HYDRAULIC CONDUCTIVITY K (ft/day)	HYDRAULIC CONDUCTIVITY K (cm/s)	CASING RADIUS r (ft)	ln(Re/rw)	SATURATED SCRN LGTH L (ft)	DRAWDOWN @ T=0 Yo (ft)	DRAWDOWN @ T=t Yt (ft)	TIME t (seconds)	HYDRAULIC HEAD H (ft)	BOREHOLE RADIUS r (in)	CONSTANT C (unitless)
MW-01S	0.011	3.9E-06	0.2	2.17	5	6.85	5.01	21000	7.3	4	1.5
MW-01I	0.136	4.8E-05	0.08	3.2	10	8.57	2.51	800	29.0	4	2
MW-02S	1.064	3.8E-04	0.2	2.4	5	4.19	1.58	760	7.9	4	1.5
MW-03S	1.373	4.8E-04	0.2	2.2	5	2.84	1.26	450	32.0	4	1.5
MW-03I	0.332	1.2E-04	0.08	3.64	10	5.19	1.58	360	31.9	2.5	2.7
MW-04S	NOT TESTED DUE TO EXCESSIVE CONTAMINATION IN WELL										
MW-04I	0.161	5.7E-05	0.08	3.64	10	4.05	1.26	730	31.9	2.5	2.7
MW-04D	0.471	1.7E-04	0.08	3.9	5	4.5	2.51	240	35.2	2.5	1.7
MW-05S	0.968	3.4E-04	0.2	2.5	5	3.2	1.58	630	13.8	4	1.5
MW-06S	0.070	2.5E-05	0.2	2.2	5	5.89	4.9	2000	8.1	4	1.5
MW-07S	1.041	3.7E-04	0.08	2.2	5	1.66	0.3	200	8.0	4	1.5
MW-07I	0.071	2.5E-05	0.08	3.64	10	3.62	1.26	1500	32.4	2.5	2.7
MW-08S	NOT TESTED DUE TO EXCESSIVE CONTAMINATION IN WELL										
MW-08I	0.051	1.8E-05	0.08	4.1	10	3.83	2.45	1000	42.6	2	3.1
MW-09S	1.487	5.2E-04	0.2	1.8	4	0.71	0.4	300	4.0	4	1.2
MW-09I	0.013	4.5E-06	0.08	3.64	10	5.52	2	8000	31.0	2.5	2.7
MW-10S	0.012	4.1E-06	0.2	1.3	2	1.75	1.62	7500	2.0	4	0.9
MW-11S	0.388	1.4E-04	0.08	2.4	5	3.8	1.58	300	10.2	4	1.5
MW-11I	0.182	6.4E-05	0.08	3.64	10	4.89	1.58	625	30.8	2.5	2.7
MW-12S	4.746	1.7E-03	0.2	1.3	2	0.48	0.16	260	2.0	4	0.9
MW-13S	3.669	1.3E-03	0.2	2.4	5	2	0.79	210	7.3	4	1.5
MW-14S	0.119	4.2E-05	0.2	2.5	9	0.86	0.76	500	9.0	4	1.8
MW-15S	NOT TESTED, DRY WELL										
MW-20S	0.840	3.0E-04	0.2	2.2	5	1.51	0.5	1000	6.9	4	1.5

pack around the wells. Also, the small number of data points obtained during the tests make the results questionable.

Conductivities in the deep and intermediate wells are distinctly lower than for the shallow wells. The values range from 1.2×10^{-4} cm/s to 4.5×10^{-6} cm/s. The stratigraphy adjacent to the screened section of the wells consists of unweathered glacial till and interbedded lacustrine silts, sands, and clays.

GROUNDWATER ELEVATIONS

Groundwater elevations were collected to define the groundwater flow system and the relationship between groundwater and the Little Menomonee River. Groundwater levels were used to contour groundwater elevations on the site.

METHODOLOGY

Groundwater within each well was measured using an electric water level indicator graduated in 0.01-foot increments. All measurements were taken from the top of the riser pipe in each well and converted to feet above an arbitrary datum. The datum was estimated for the side topographic map.

Surface water elevations were measured at the site concurrently with groundwater level measurements. Surface water elevation data were used to determine the relationship between surface and groundwater at the site. Surface water measurements were recorded to the nearest 0.01 foot from a staff gauge installed in the river between MW-08S and MW-20S.

Groundwater and surface water elevations are summarized in Table G-2 and plotted and contoured in Figure G-2.

RESULTS

Contoured groundwater elevations indicate that a trough exists on the west side of the Little Menomonee River. Limited data exist for the east side, but a similar trough is assumed to exist there. The data indicate that the Little Menomonee River is a gaining stream above monitoring well nest 8 and a losing stream downstream of the well nest. The losing stream may be due to unusually low water levels because of this year's drought. The gaining reach of river upstream of MW-08S is probably due to the swamp north of Brown Deer Road that acts as a constant head boundary and continuous source of groundwater recharge.

Water level measurements should be taken during a period of normal rainfall to determine if these conditions are typical.

Table G-2

WATER LEVEL DATA
MOSS AMERICAN

WELL NO.	RISER ELEVATION	LAND SURFACE ELEVATION	7-5-88 DEPTH TO WATER	7-5-88 ELEVATION	7-5-88 DEPTH TO BOTTOM	7-5-88 ELEVATION	7-19-88 DEPTH TO WATER	7-19-88 ELEVATION
MW-01S	742.19	742.94	8.15	734.04	15.47	726.72	8.02	734.17
MW-01I	742.29	742.84	7.27	735.02	35.52	706.77	7.29	735.00
MW-02S	734.52	735.00	10.35	724.17	20.26	714.26	10.30	724.22
MW-03S	731.55	726.89	9.40	722.15	17.31	714.24	9.51	722.04
MW-03I	730.65	728.78	8.50	722.15	40.54	690.11	8.63	722.02
MW-04S	732.91	731.13	5.04	727.87	NOT TAKEN	NOT TAKEN	5.03	727.88
MW-04I	733.10	730.88	8.80	724.3	40.69	692.41	9.09	724.01
MW-04D	732.49	731.15	16.25	716.24	51.66	680.83	17.15	715.34
MW-05S	724.97	723.15	6.42	718.55	20.42	704.55	6.67	718.30
MW-06S	725.50	722.71	7.15	718.35	15.39	710.11	8.09	717.41
MW-07S	721.84	719.79	7.35	714.49	15.37	706.47	7.46	714.38
MW-07I	721.66	720.06	5.82	715.84	38.81	682.85	6.68	714.98
MW-08S	721.08	718.50	7.57	713.51	NOT TAKEN	NOT TAKEN	8.73	712.35
MW-08I	721.73	718.60	7.79	713.94	50.57	671.16	7.92	713.81
MW-09S	722.03	719.77	11.26	710.77	15.38	706.65	12.09	709.94
MW-09I	721.44	719.50	9.72	711.72	40.86	680.58	10.50	710.94
MW-10S	726.48	724.13	10.44	716.04	12.55	713.93	11.52	714.96
MW-11S	725.57	723.56	10.02	715.55	20.29	705.28	10.74	714.83
MW-11I	725.80	723.49	10.52	715.28	42.57	683.23	12.42	713.38
MW-12S	719.87	717.74	8.21	711.66	12.45	707.42	8.35	711.52
MW-13S	738.55	737.93	5.21	733.34	12.49	726.06	5.73	732.82
MW-14S	742.97	740.97	22.48	720.49	30.58	712.39	22.63	720.34
MW-15S	750.53	749.39	DRY	DRY	10.43	740.1	DRY	
MS-20S	720.13	716.98	9.53	710.6	15.65	704.48	8.30	711.83
Little Menominee River		711.97	1.47	713.44			1.5	713.5

ALL MONITORING WELL MEASUREMENTS TAKEN FROM NORTH SIDE OF TOP OF RISER.
STAFF GAGE REFERENCE: 0 = 711.97'

The stratigraphy adjacent to the screened section of the wells consists of unweathered glacial till and interbedded lacustrine silts, sands, and clays.

GROUNDWATER ELEVATIONS

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Water level measurements should be taken during a period of normal rainfall to determine if these conditions are typical.

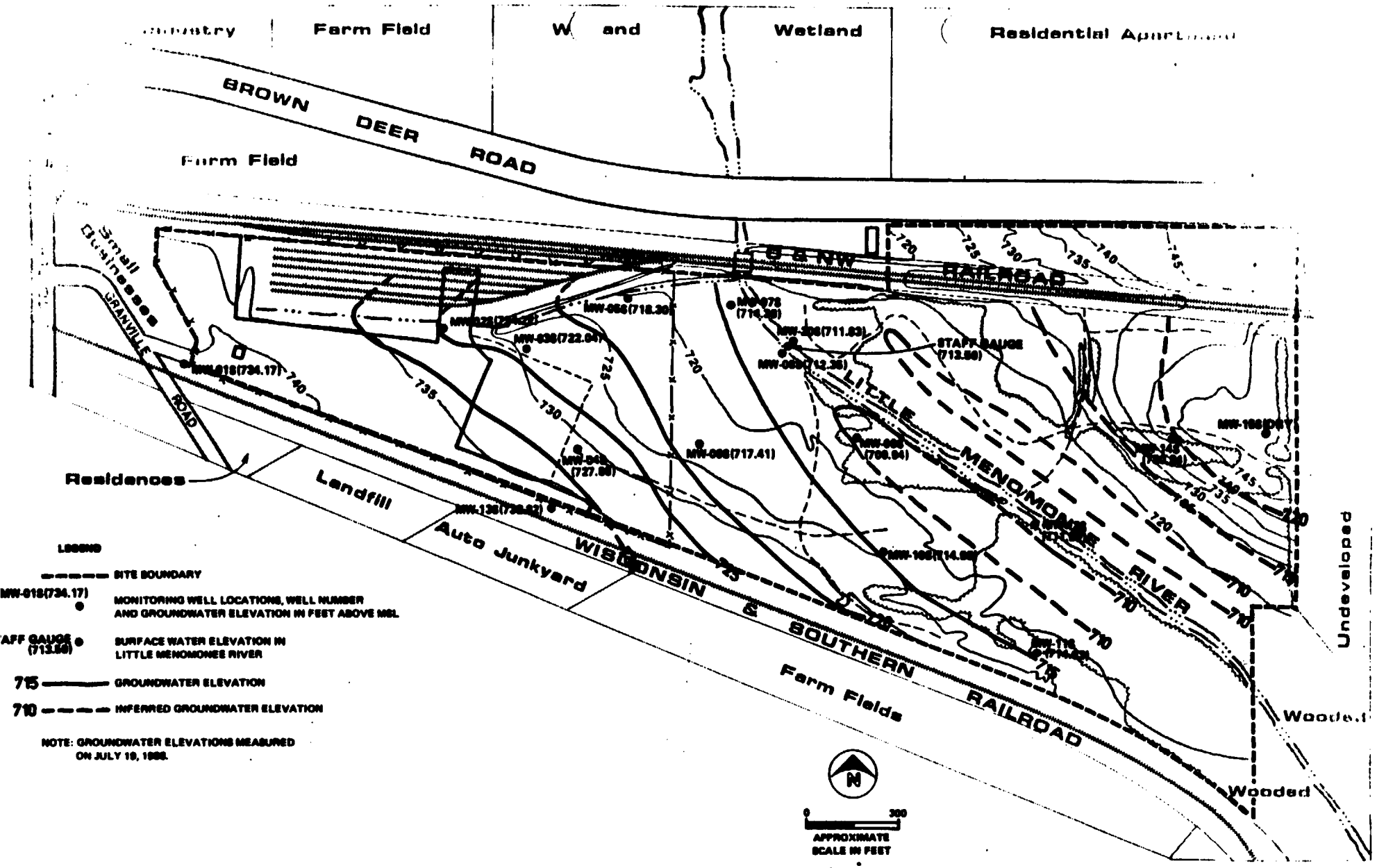


FIGURE G-2
GROUNDWATER ELEVATION CONTOUR MAP
MOSS-AMERICAN RI

REFERENCES

Bouwer, Herman, and R. C. Rice. A slug test for determining conductivity of unconfined aquifers with completely or partially penetrating wells. *Water Resources Research*. 12(1976): 423-8.

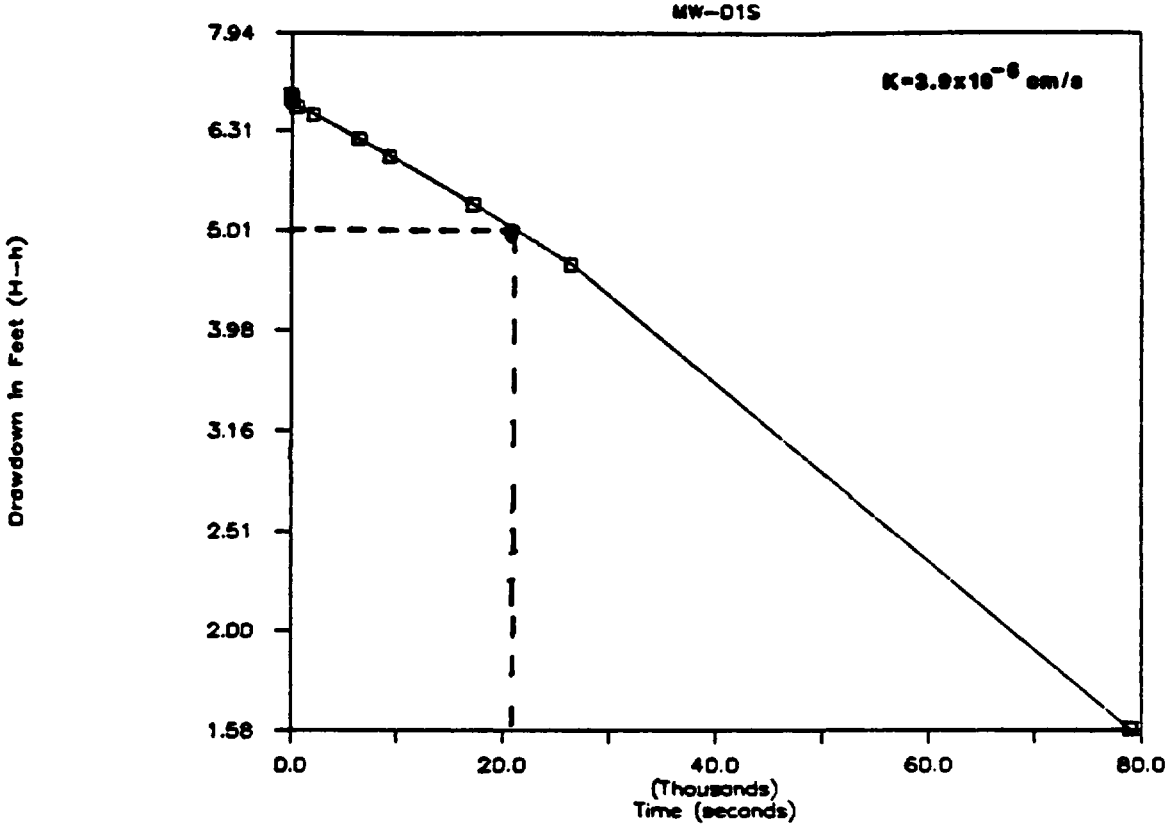
Todd, David K. *Groundwater Hydrology*. New York: John Wiley and Sons. 1980.

GLT779/020.50

Attachment G-1
AQUIFER TEST DATA PLOTS

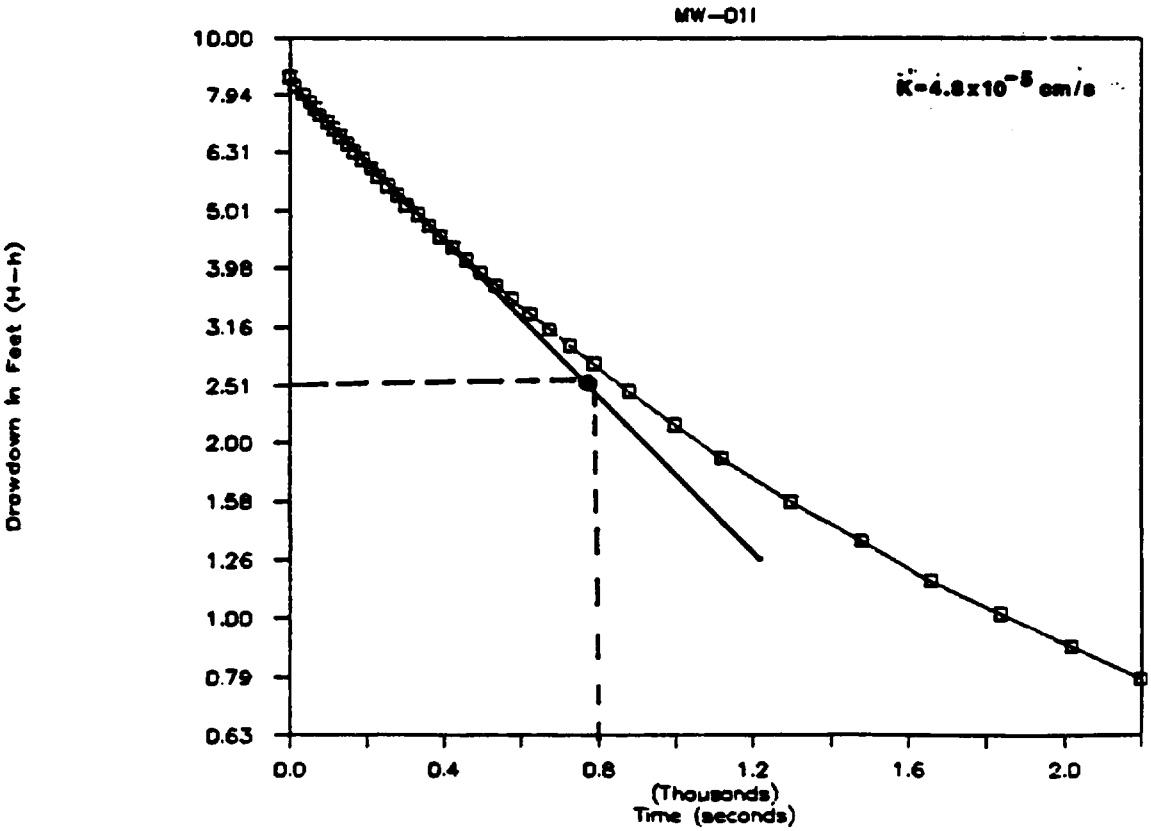
MONITORING WELL RECOVERY TEST

MW-01S



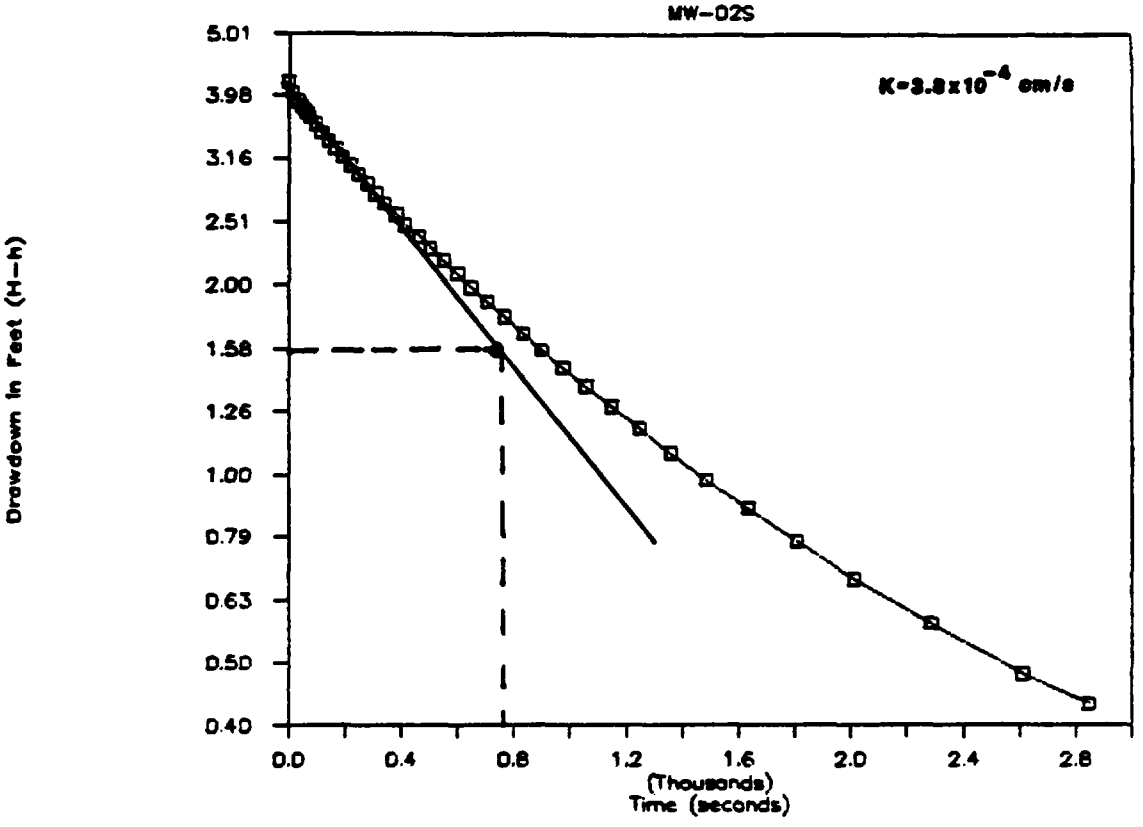
MONITORING WELL RECOVERY TEST

MW-01I



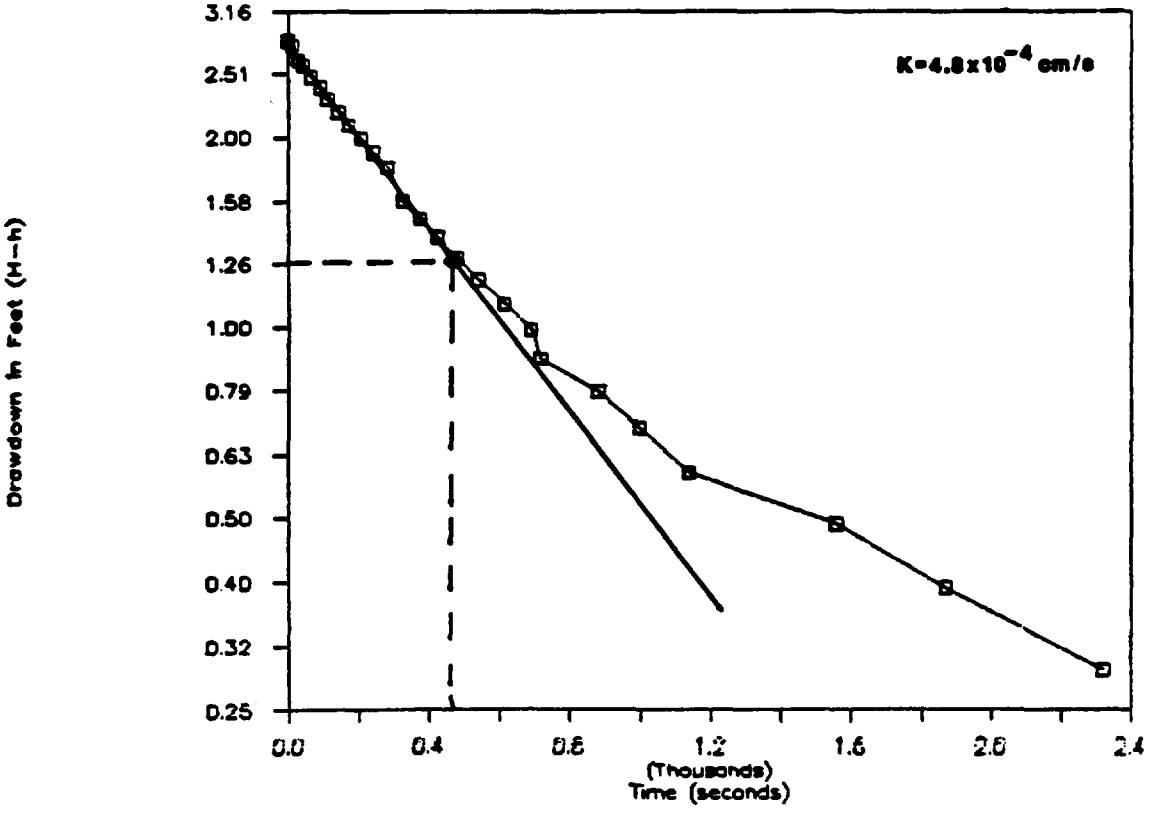
MONITORING WELL RECOVERY TEST

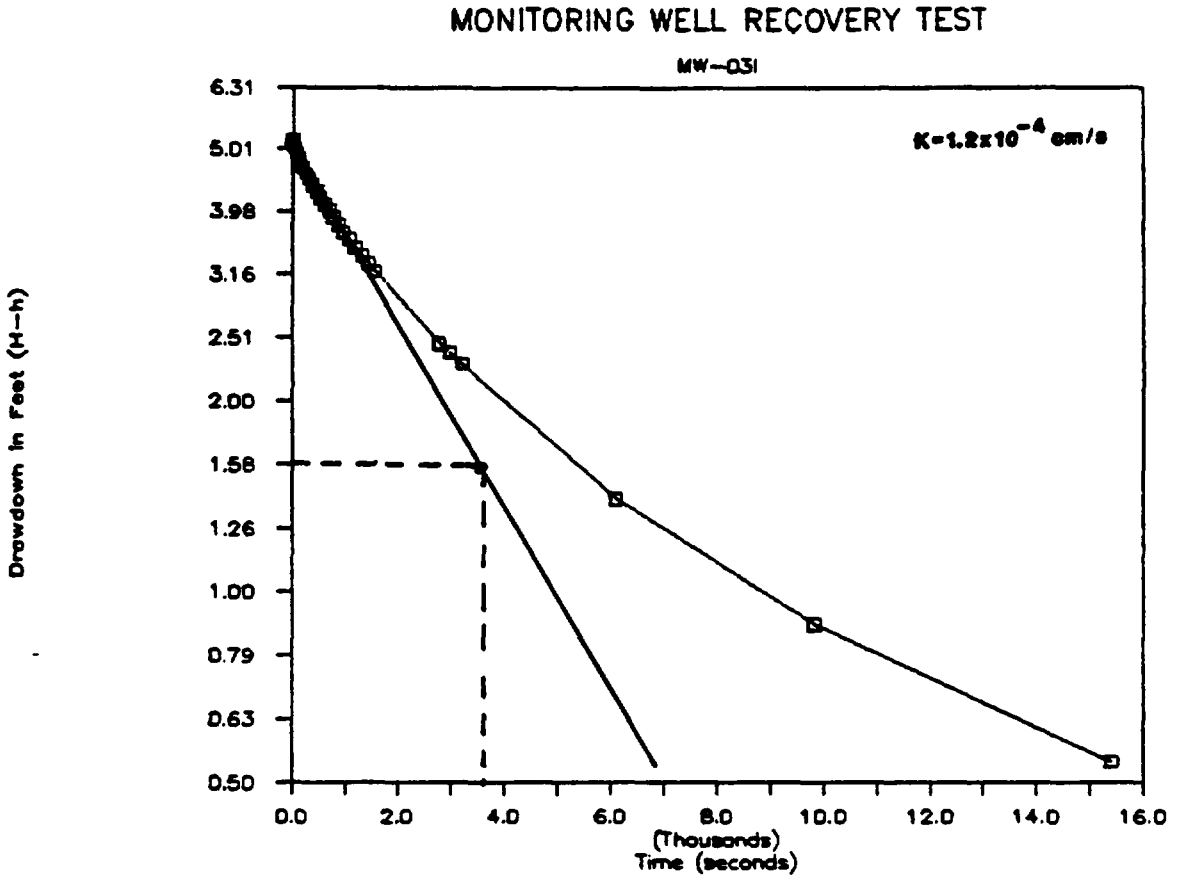
MW-02S

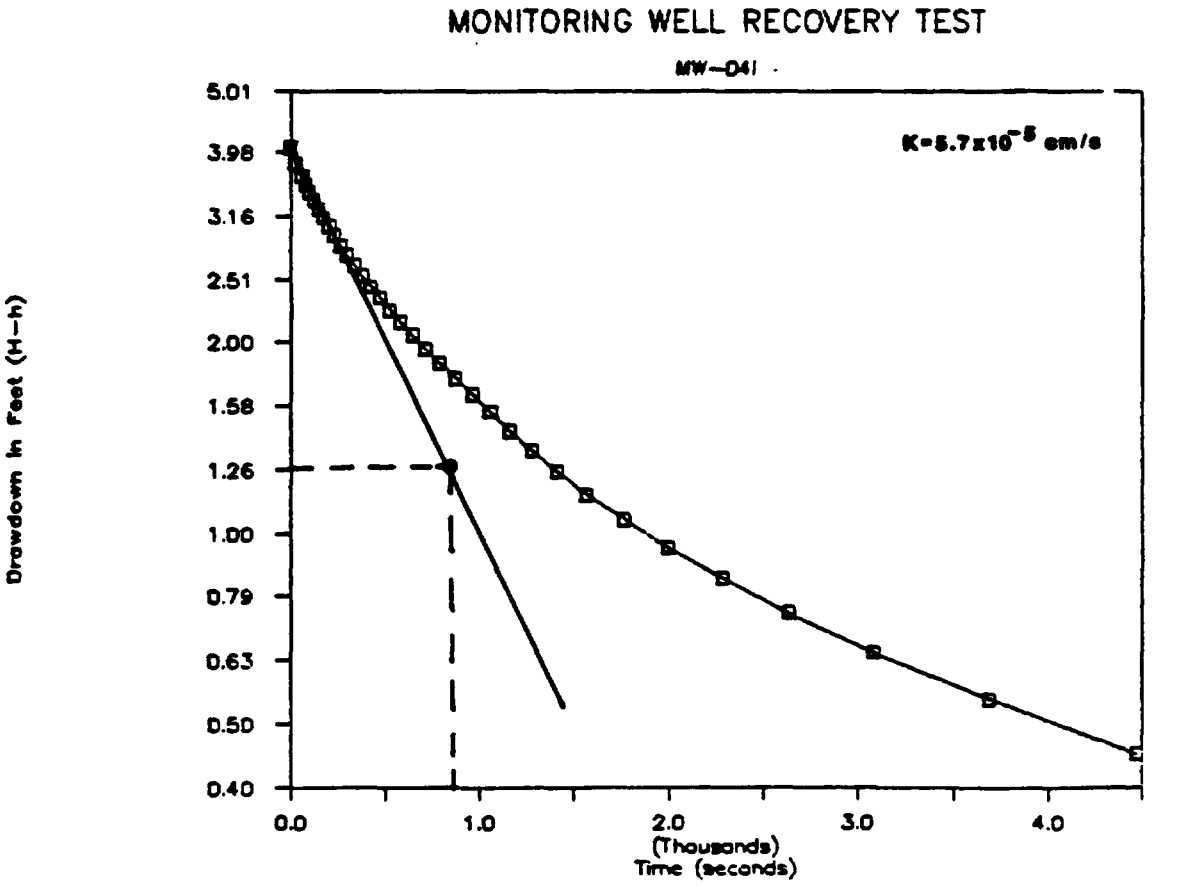


MONITORING WELL RECOVERY TEST

MW-03S

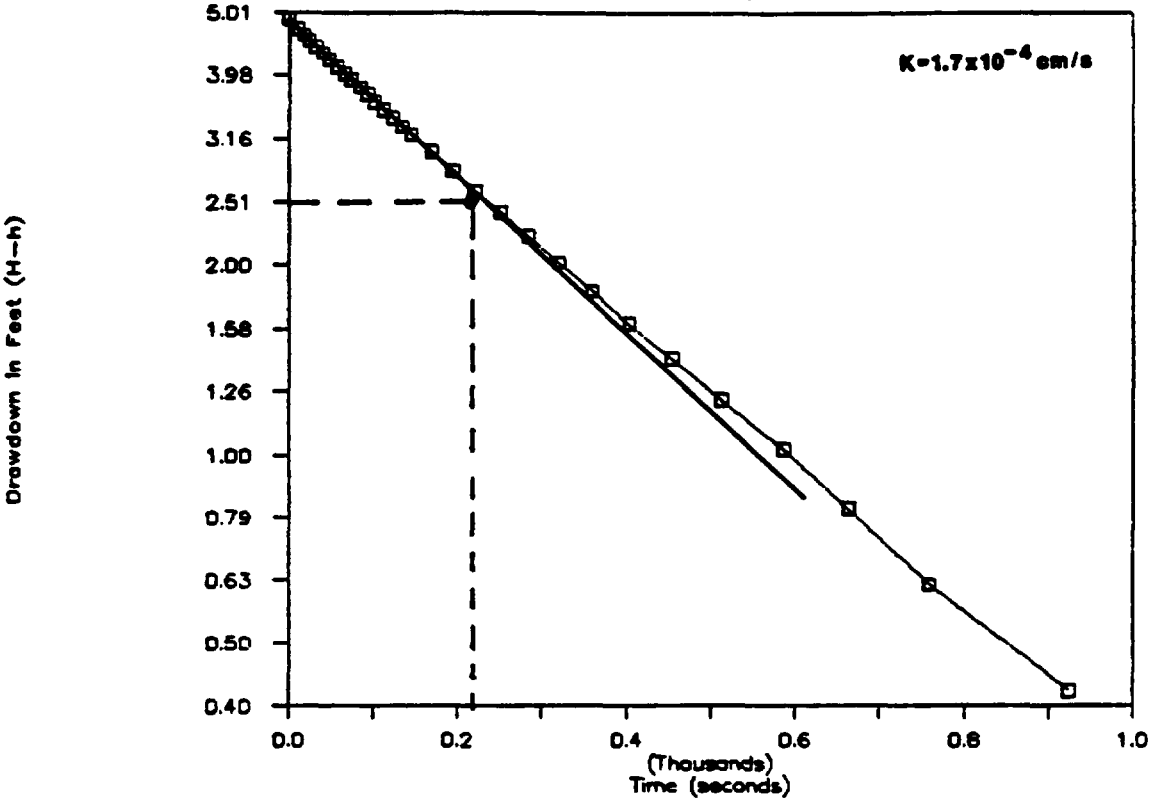



MONITORING WELL RECOVERY TEST
MW-03I
K=1.2x10^-4 cm/s
Drawdown in Feet (H-h)
6.31
5.01
3.98
3.16
2.51
2.00
1.58
1.26
1.00
0.79
0.63
0.50
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
(Thousands)
Time (seconds)


MONITORING WELL RECOVERY TEST
MW-04I
K=5.7x10^-5 cm/s
Drawdown in Feet (H-h)
5.01
3.98
3.16
2.51
2.00
1.58
1.26
1.00
0.79
0.63
0.50
0.40
0.0
1.0
2.0
3.0
4.0
(Thousands)
Time (seconds)

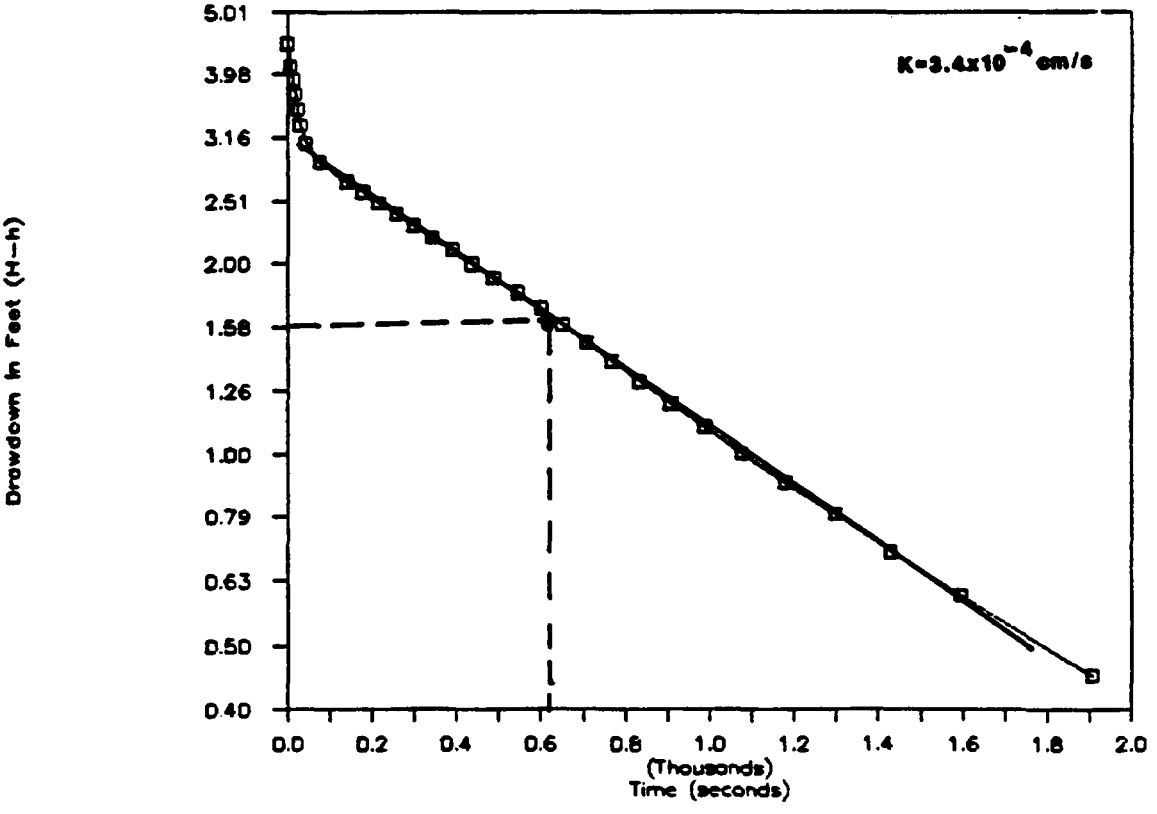
MONITORING WELL RECOVERY TEST

MW-04D



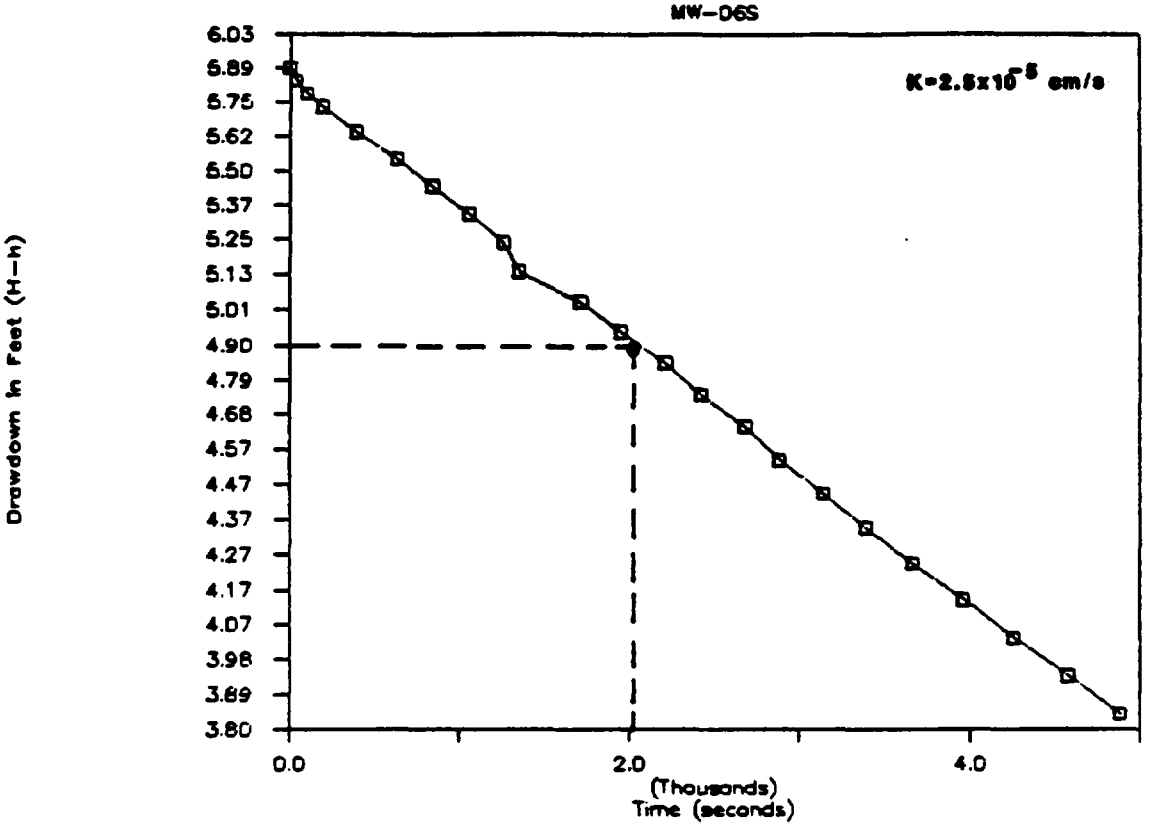
MONITORING WELL RECOVERY TEST

MW-05S



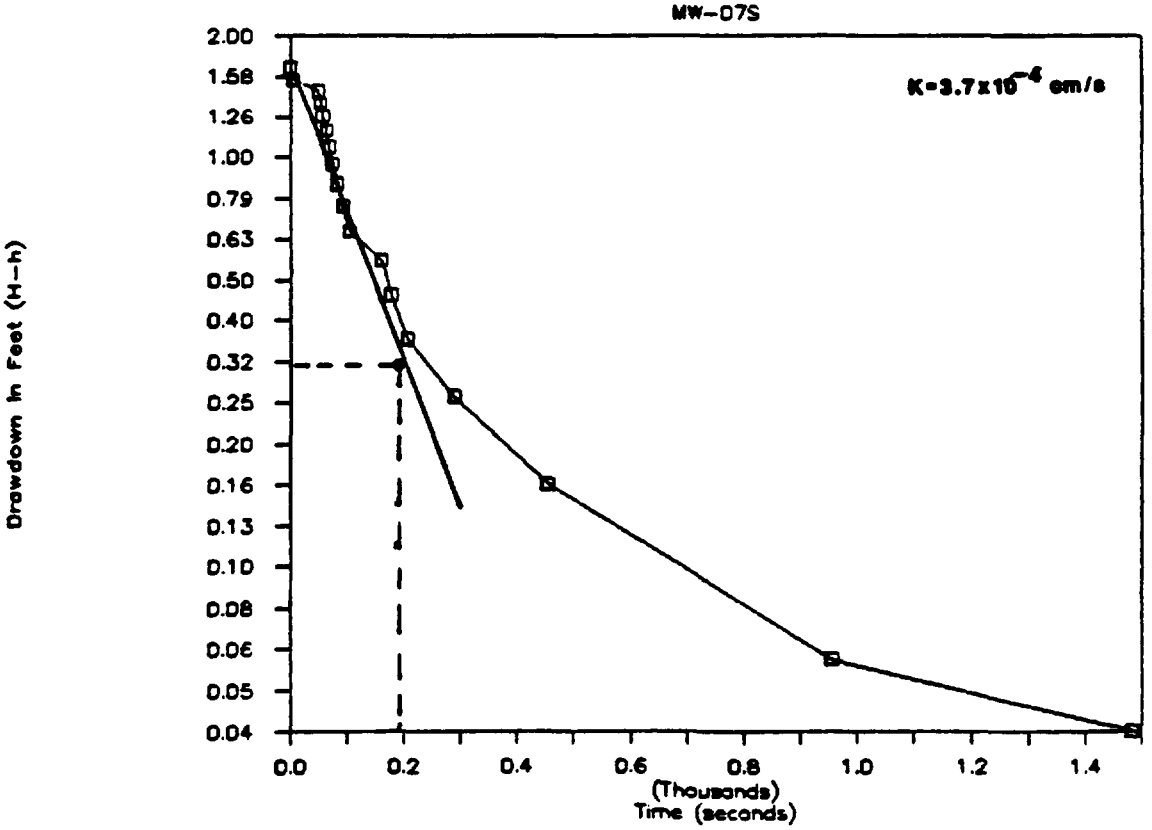
MONITORING WELL RECOVERY TEST

MW-06S



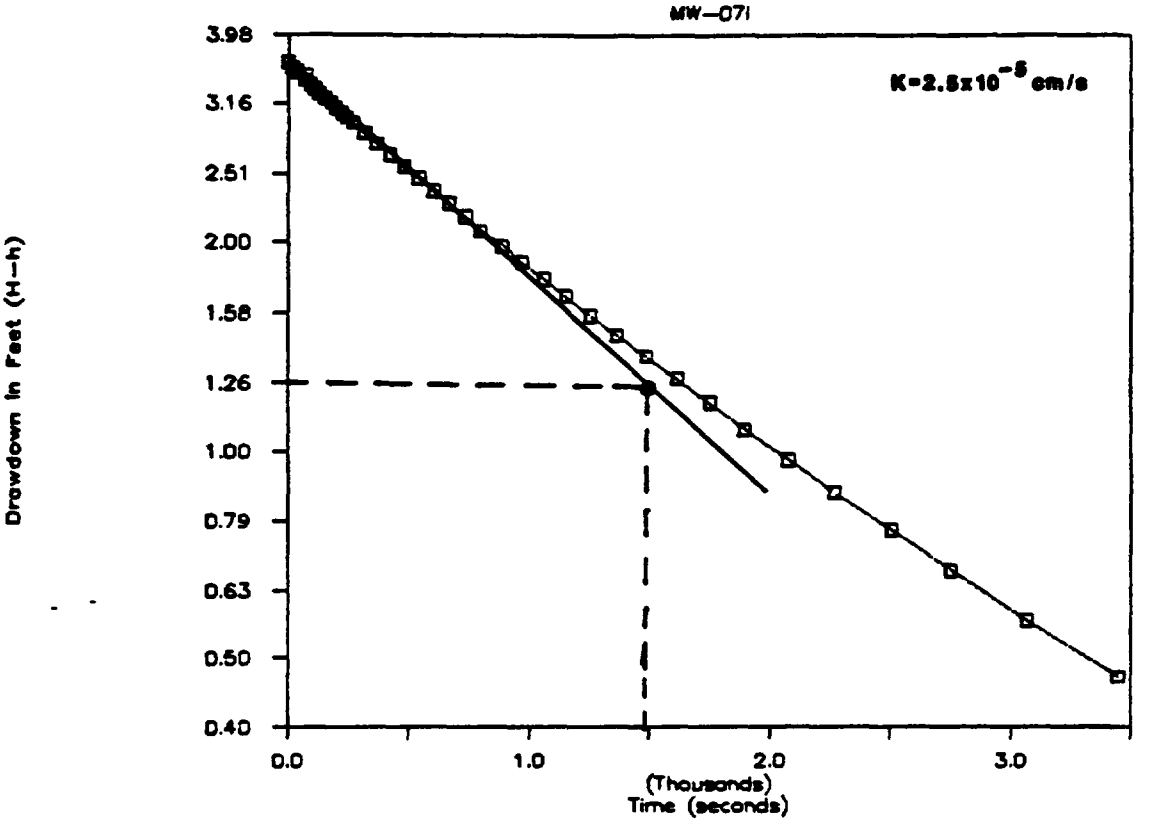
MONITORING WELL RECOVERY TEST

MW-07S



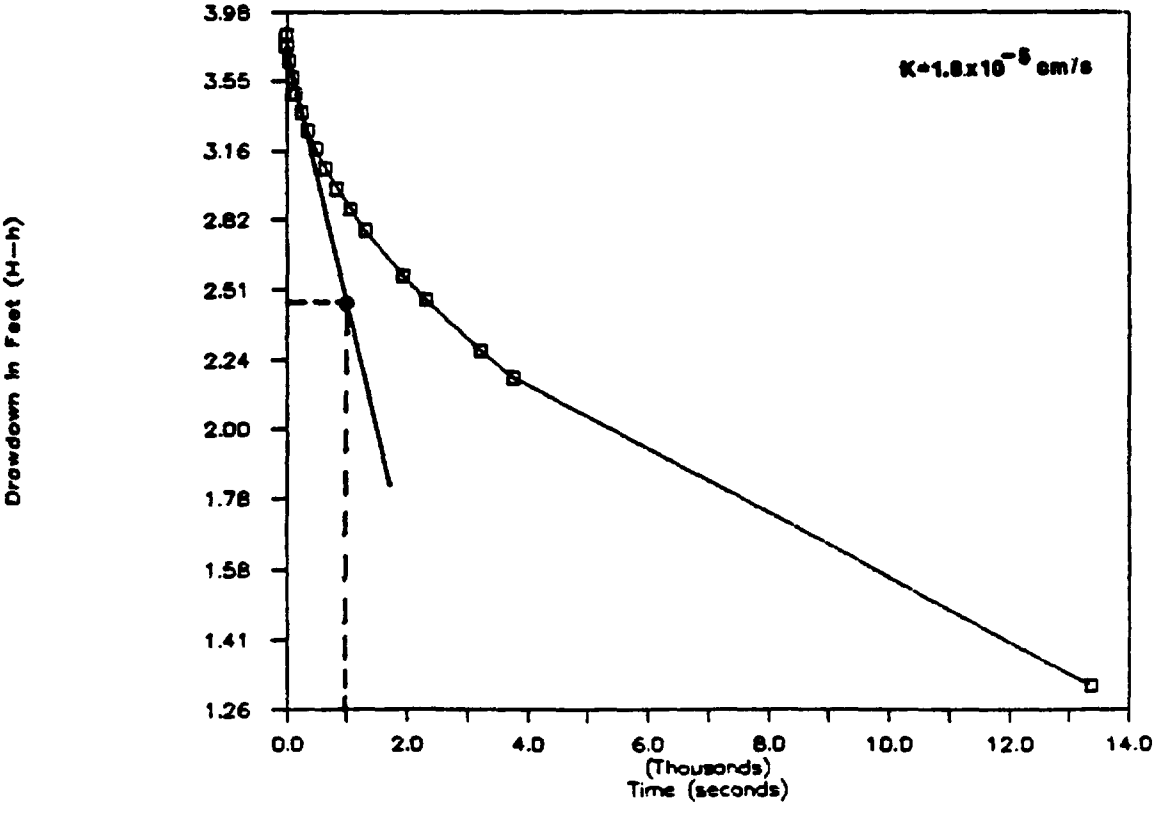
MONITORING WELL RECOVERY TEST

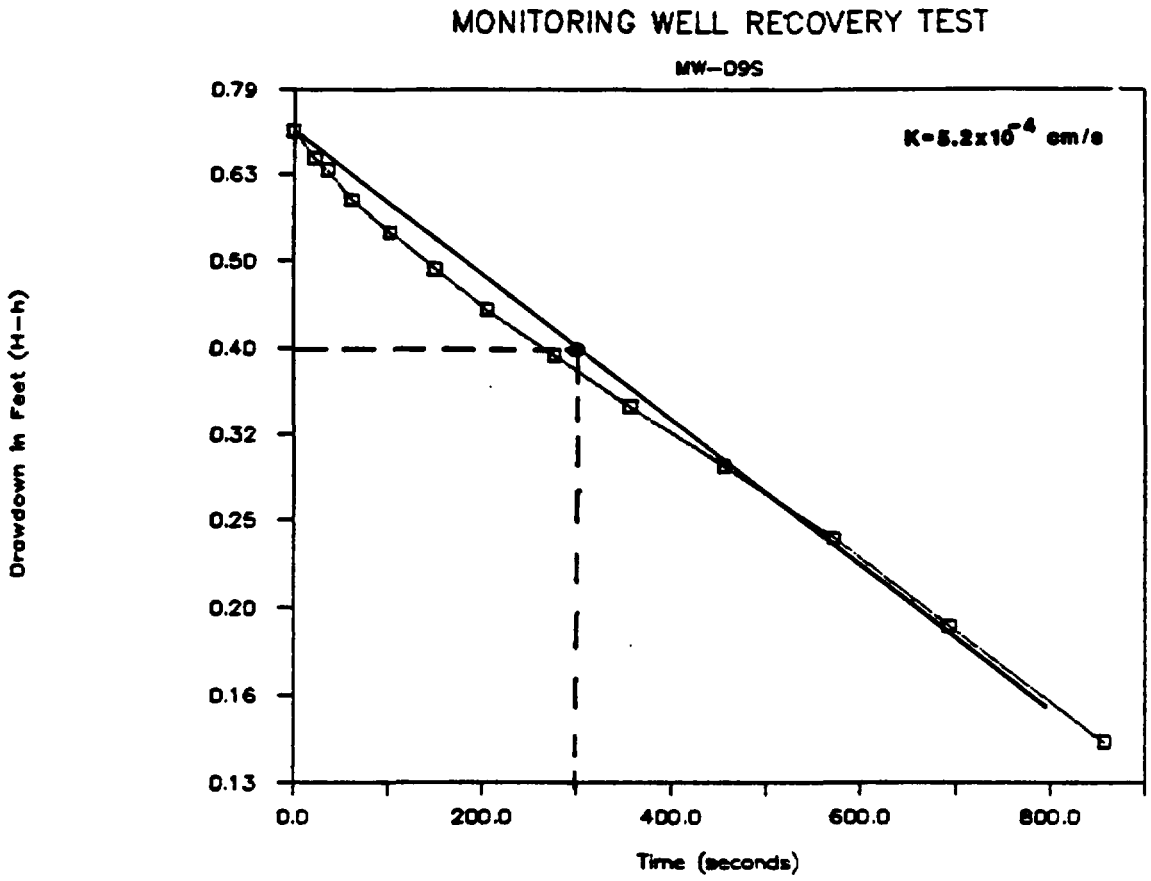
MW-07I

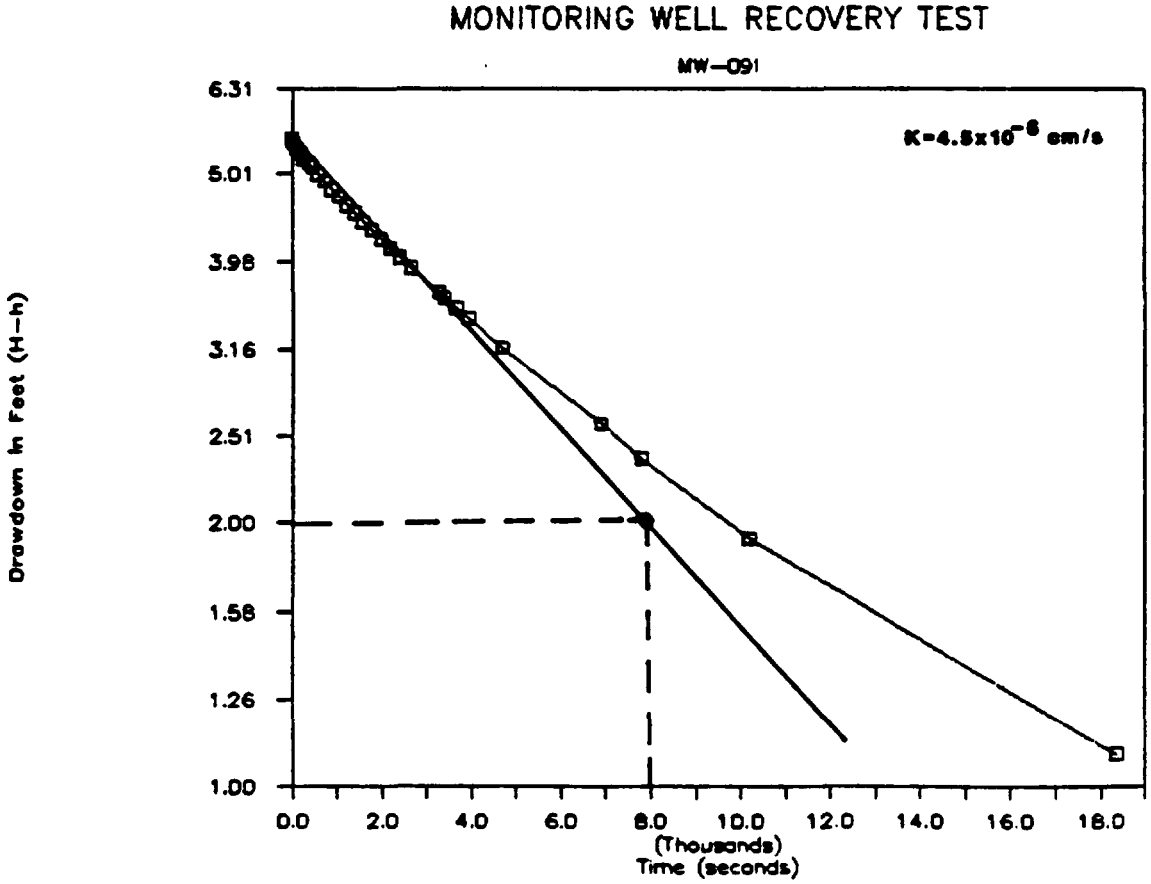


MONITORING WELL RECOVERY TEST

MW-08I

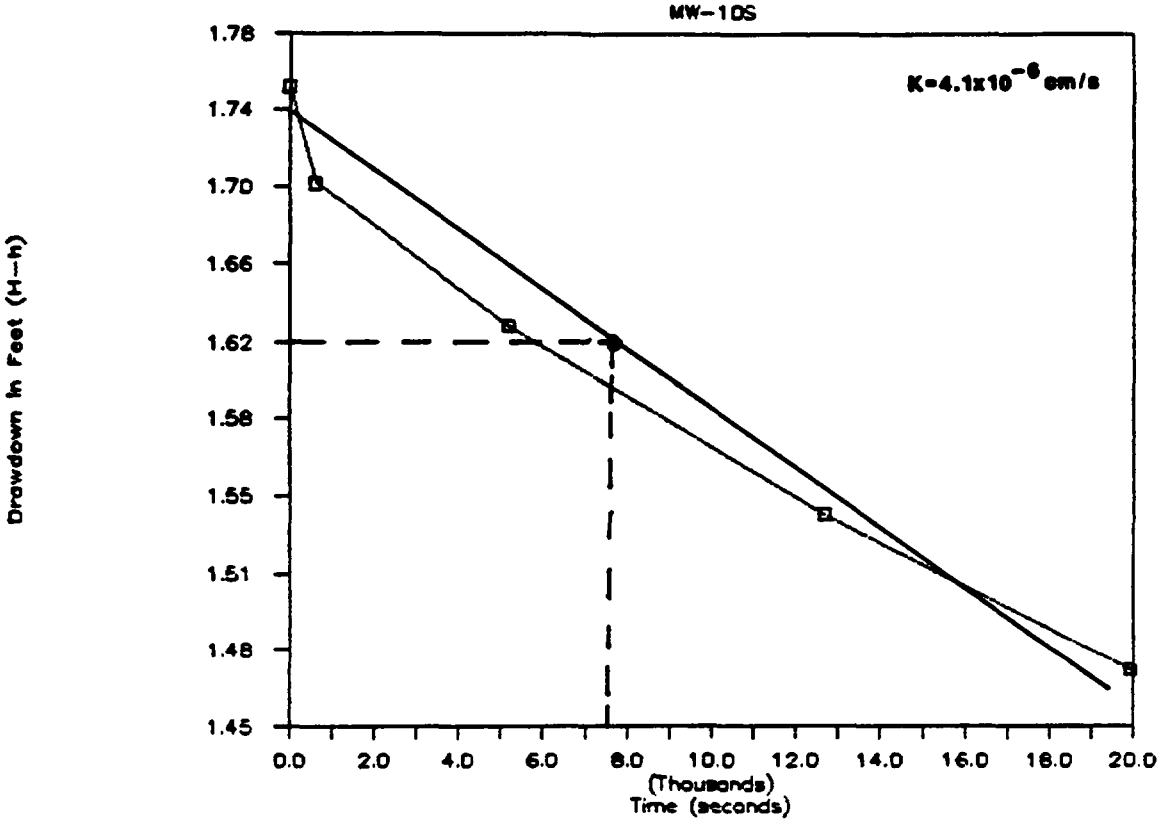



MONITORING WELL RECOVERY TEST
MW-09S
K=5.2x10^-4 cm/s
Drawdown in Feet (H-h)
0.79
0.63
0.50
0.40
0.32
0.25
0.20
0.16
0.13
0.0
200.0
400.0
600.0
800.0
Time (seconds)


MONITORING WELL RECOVERY TEST
MW-09I
K=4.5x10^-6 cm/s
Drawdown in Feet (H-h)
6.31
5.01
3.98
3.16
2.51
2.00
1.58
1.26
1.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
(Thousands)
Time (seconds)

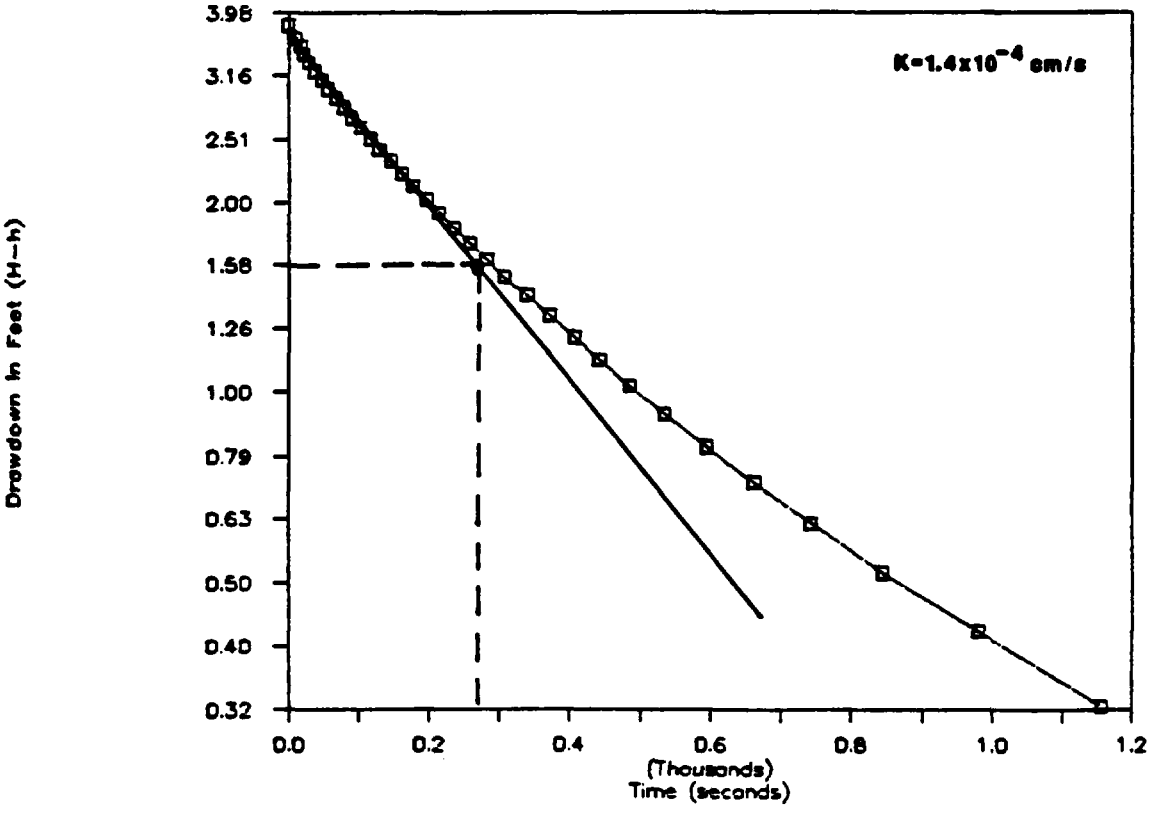
MONITORING WELL RECOVERY TEST

MW-10S



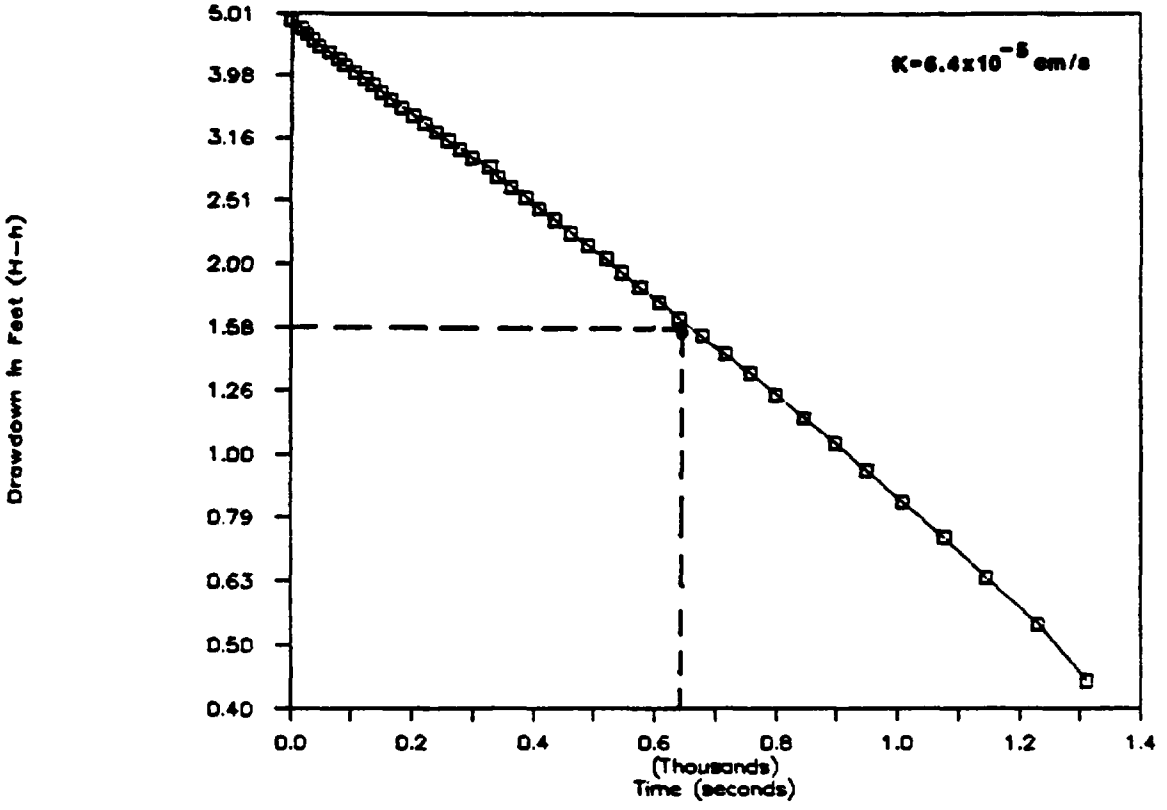
MONITORING WELL RECOVERY TEST

MW-11S



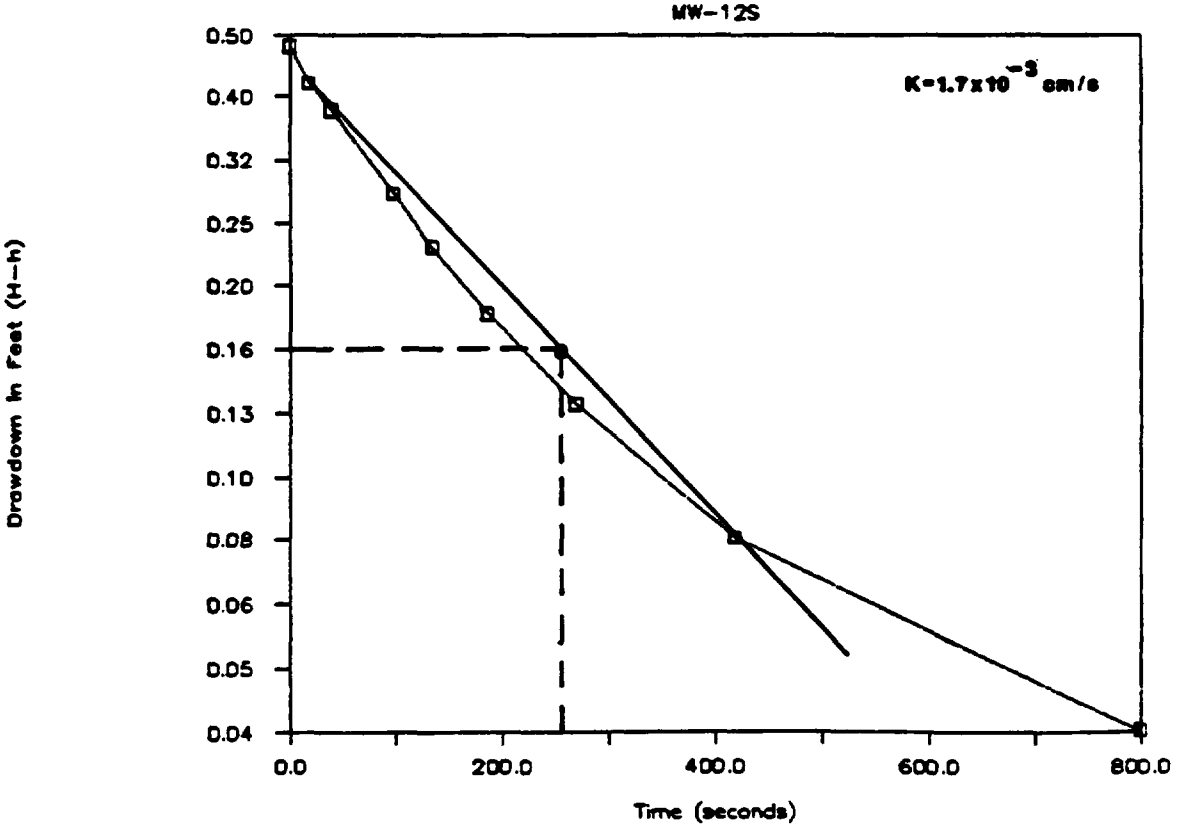
MONITORING WELL RECOVERY TEST

MW-11I



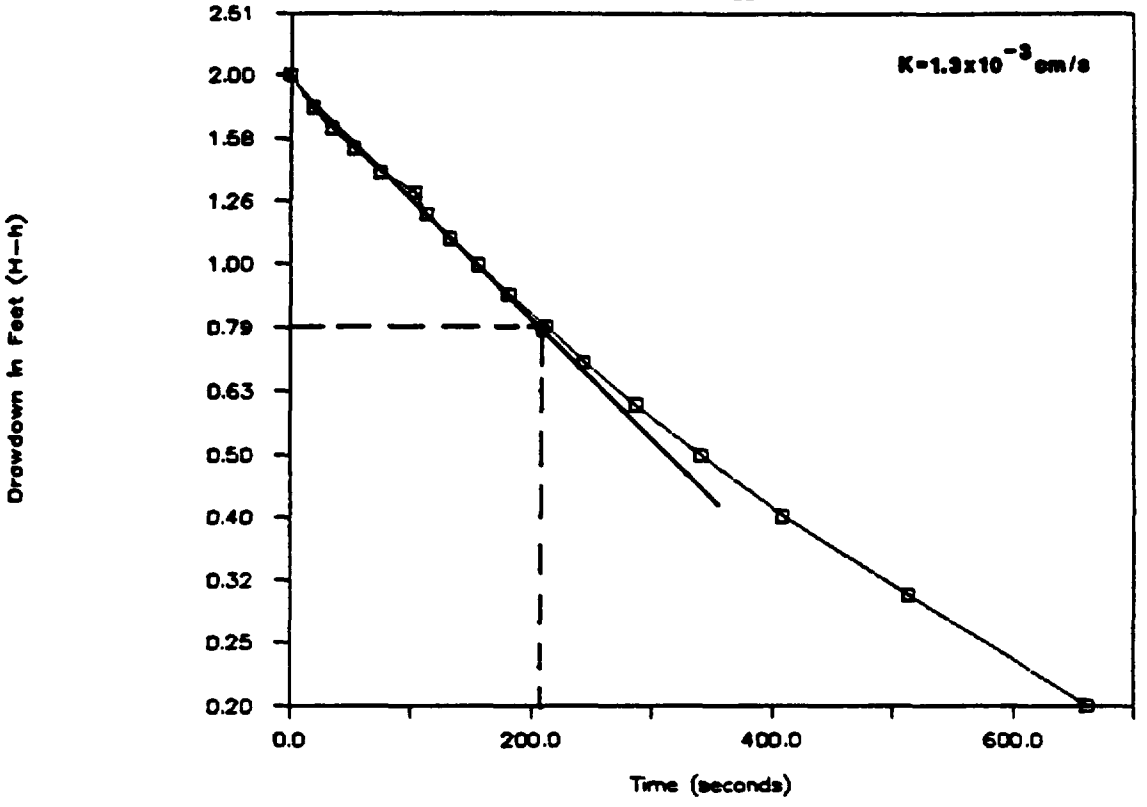
MONITORING WELL RECOVERY TEST

MW-12S



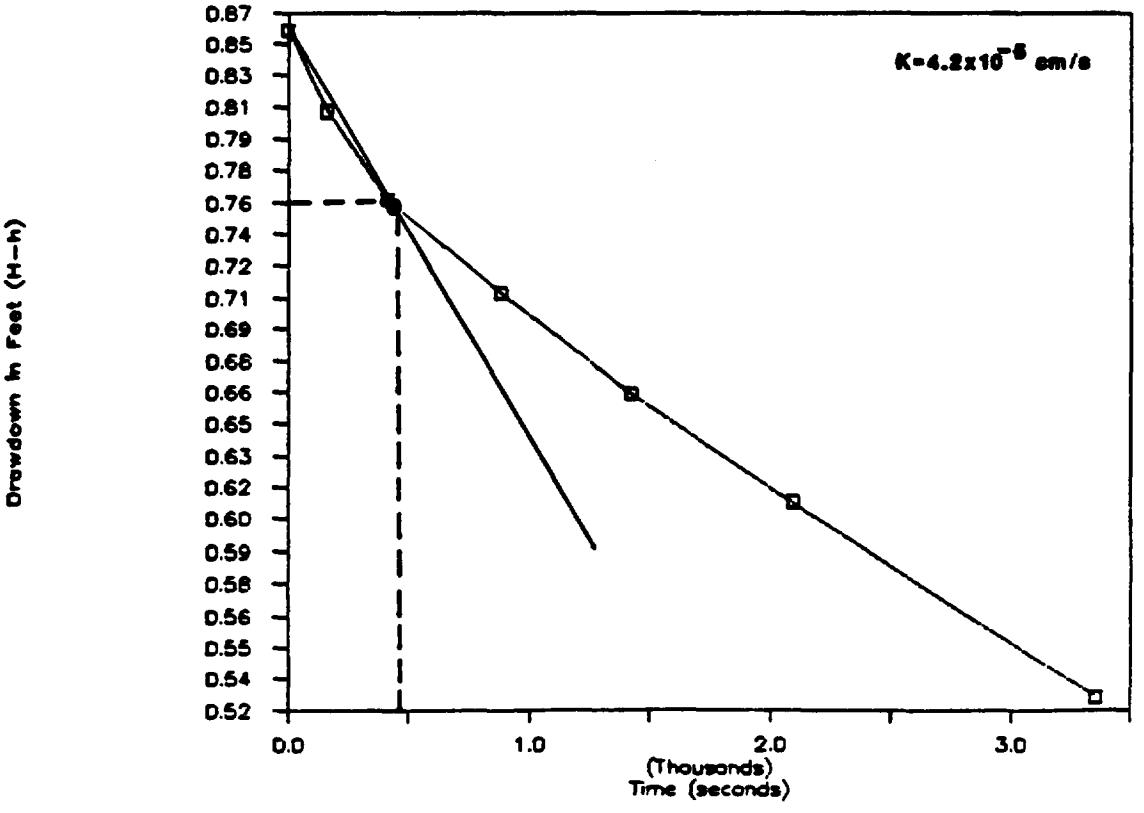
MONITORING WELL RECOVERY TEST

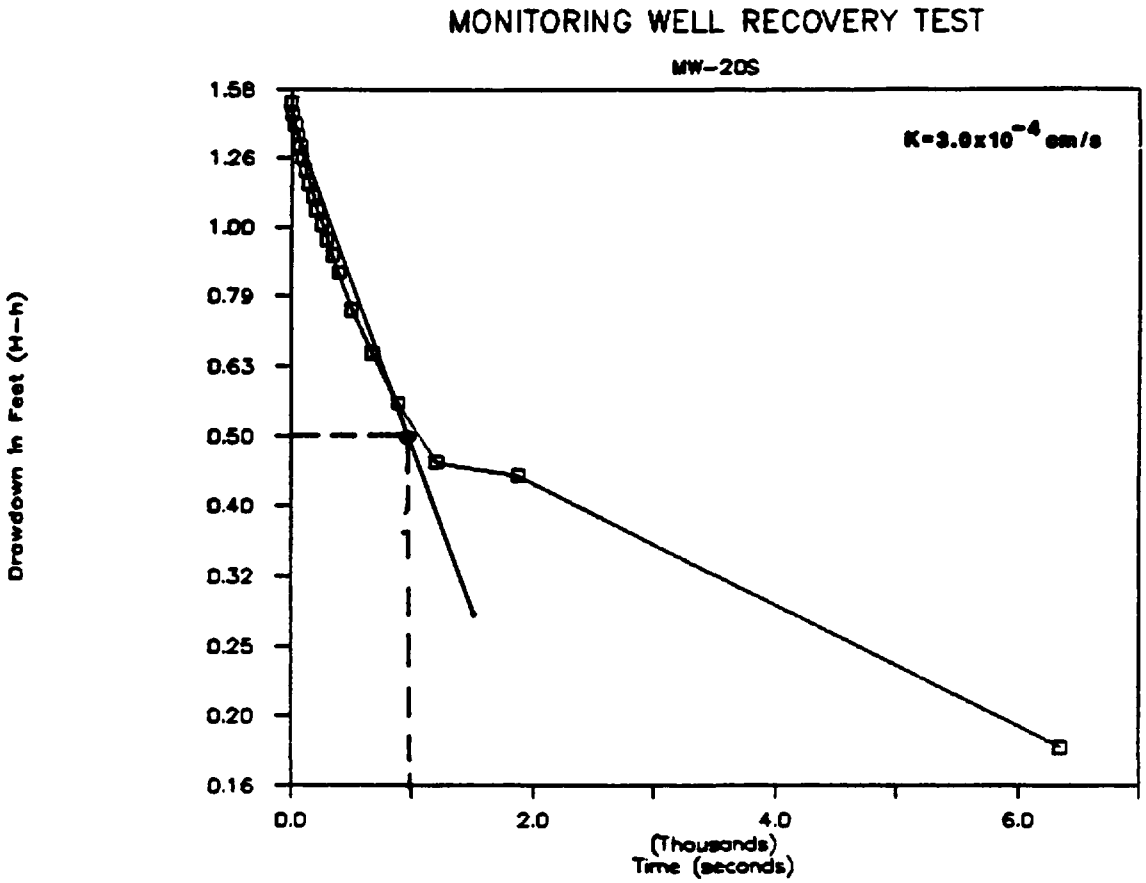
MW-13S



MONITORING WELL RECOVERY TEST

MW-14S




MONITORING WELL RECOVERY TEST
MW-20S
K=3.0x10^-4 cm/s
Drawdown in Feet (H-h)
1.58
1.26
1.00
0.79
0.63
0.50
0.40
0.32
0.25
0.20
0.16
0.0
2.0
4.0
6.0
(Thousands)
Time (seconds)

Appendix H
GROUNDWATER SAMPLING

Appendix H
GROUNDWATER SAMPLING

INTRODUCTION

Groundwater monitoring wells at the Moss-American site were sampled by Kevin Olson, Stu Grubb, Dorothy Hall, and Don Johnson of CH2M HILL on July 11, 12, and 13, 1988. Sample temperature, pH, and conductivity were measured onsite. Samples sent to CLP laboratories were analyzed for BOD, COD, TOC, TDS, TSS, acidity (or alkalinity), total phenols, sulfate, organic compounds, and inorganic chemicals.

SAMPLING PROCEDURE

EQUIPMENT

Four-foot-long, stainless steel, bottom-loading bailers were used to purge and sample each well. Bailers were raised and lowered with 1/8-inch-diameter nylon string. Five-gallon buckets were used to collect and measure purge water. Purge water was stored onsite in 55-gallon drums for disposal by the EPA.

DECONTAMINATION

Bailers were cleaned between each well by scrubbing with a detergent wash and rinsing in tap water, followed by spray rinses with a methanol and distilled water solution and finally with distilled water. Bailer string was discarded after each well and replaced with new string.

PURGING

Each well was purged immediately before sampling. At least five well volumes were removed from wells with sufficient recovery to allow continuous bailing. Other wells were bailed dry three times before sampling. Between each successive bailing the wells were allowed to recover approximately 50 percent. Purge volumes for each well are listed in Table H-1.

SAMPLING

Sample bottles were filled in the field by pouring the sample from the bailer. Following collection, the sample was taken to the field trailer for measurement of pH, conductivity, and temperature, and for preservation and filtering. Information regarding containers, preservation, and filtration of samples is provided in the project Quality Assurance Project Plan. Sampling locations are shown on Figure H-1.

Table E-1
MONITORING WELL PURGE VOLUMES

Well No.	Depth of Water in Well (ft)	Well Volume (gal)	Gallons Purged Before Sampling		
			1st Purge	2nd Purge	3rd Purge
MW-01S	7.3	1.2	1	1	--
MW-01I	28.2	4.6	28	--	--
MW-02S	9.9	1.6	10	--	--
MW-03S	7.9	1.3	5	3	--
MW-03I	32.0	5.2	13	5	10
MW-04S	10	1.6	4	4	--
MW-04I	31.9	5.2	31	--	--
MW-04D	35.4	5.8	35	--	--
MW-05S	14.0	2.3	Bailed dry three times, 5 gal (total) removed		
MW-06S	8.2	1.3	2	1	1
MW-07S	7.9	1.3	8	--	--
MW-07I	33.0	5.4	33	--	--
MW-08S	5	0.8	(a)	--	--
MW-08I	42.8	7.0	42	--	--
MW-09S	4.1	0.7	5	--	--
MW-09I	31.1	5.1	9	5	5
MW-10S	2.1	0.3	0.5	0.1	(b)
MW-11S	10.3	1.7	10	--	--
MW-11I	32.1	5.2	17	14	--
MW-12S	4.2	0.7	4	--	--
MW-13S	7.3	1.2	4.5	3	--
MW-14S	8.1	1.3	8	--	--
MW-15S	Dry	0	--	--	--
MW-20S	6.1	1.0	5	--	--

[a]Sampled without purging
[b]Not sampled due to insufficient recovery

GLT779/018.50

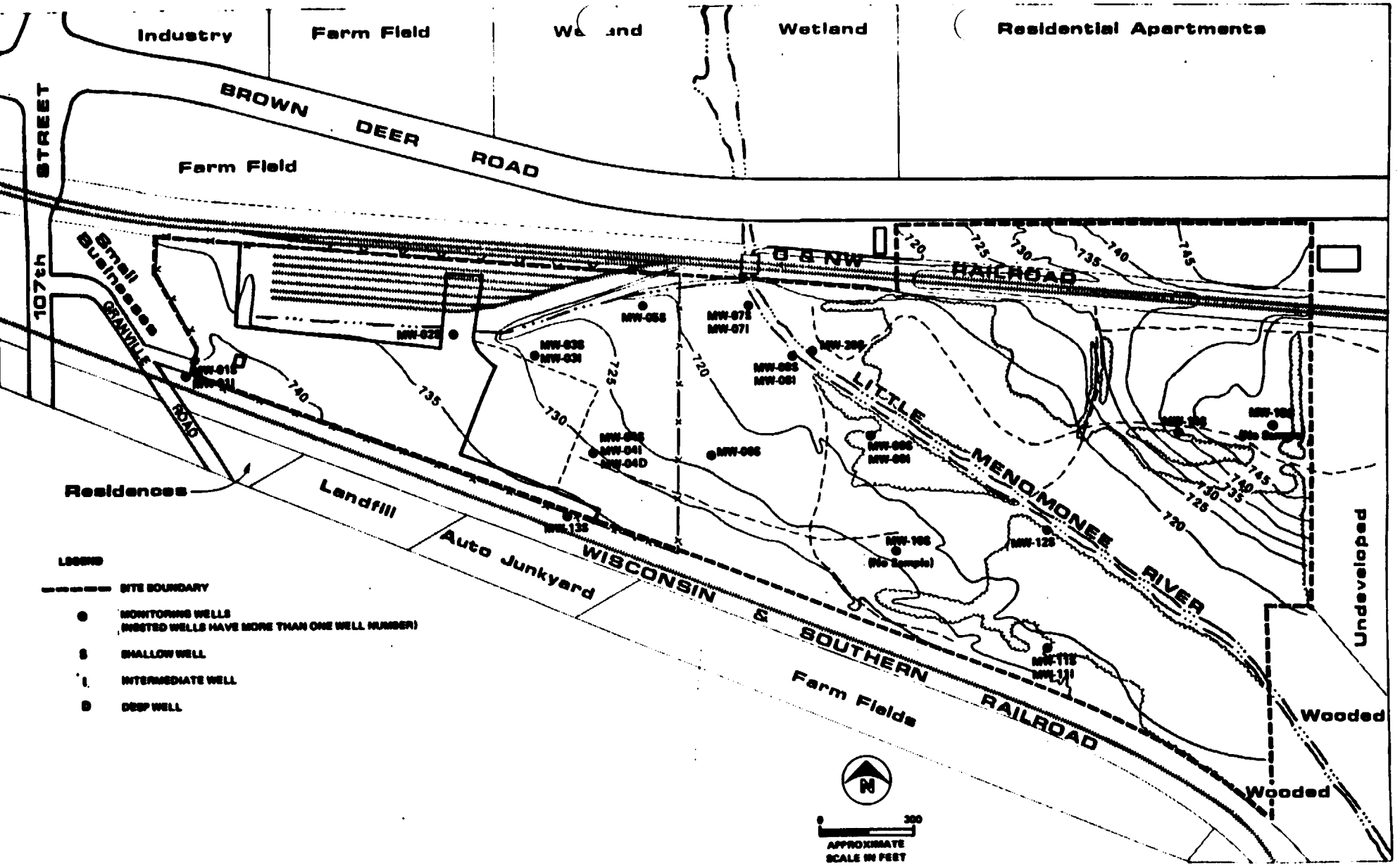


FIGURE H-1
MONITORING WELL LOCATIONS
MOSS-AMERICAN RI

FIELD OBSERVATIONS

The following observations were made during sampling:

- Purge water from MW-04 contained occasional slight oil sheens.
- Creosote odor was detected in MW-07 during purging, although that may have been due to the proximity of a creosoted railroad bridge.
- Occasional oil sheens were noted on purge water from MW-08I.
- Approximately 2 feet of oil had accumulated in MW-08S prior to sampling. The only contamination detected during well construction was in one small sand seam.

The field measurements of pH, conductivity, and temperature are listed in Table H-2. The field parameters were used to indicate abnormal conditions. If any had been found to be abnormal, then resampling after additional purging would have been considered. However, no wells were resampled on the basis of field parameter measurements.

The temperature readings do not accurately reflect the actual groundwater temperature. Ambient air temperature was in the 90s and the warm sensor may have affected the readings. Field measurements of the sample took place with 5 to 10 minutes of sample collection, but some warming may have occurred in that time.

The values obtained for pH fall within a reasonable range. The slightly basic conditions are typical of natural waters in carbonaceous environments. The soils at the Moss-American site are derived from a carbonate-rich glacial till, and part of the site is covered with either dolomite or limestone gravel.

Conductivity in shallow groundwater ranged from 480 to 1,240 µmhos/cm (mean = 875 µmhos/cm). Groundwater from intermediate and deep wells was less conductive, ranging from 250 to 820 µmhos/cm (mean = 450 µmhos/cm). Conductivity measurements are indicative of differences in dissolved ion concentrations in groundwater. The relevance, if any, of the variability in conductivity measurements at the Moss-American site will be evaluated further when complete analytical results are available.

GLT779/017.50

Table H-2
FIELD MEASUREMENTS

Well No.	Date	Time	Temperature[a] (°C)	pH	Conductivity (umhos)
MW-01S	7/13/88	1652	22	7.80	1,050
MW-01I	7/11/88	1130	22	7.53	680
MW-02S	7/11/88	1401	19	7.65	480
MW-03S	7/11/88	1504	22	7.35	960
MW-03I	7/11/88	1511	20	8.50	280
MW-04S	7/13/88	1542	26	7.64	1,020
MW-04I	7/13/88	1113	22	8.14	820
MW-04D	7/12/88	1320	20	8.12	280
MW-05S	7/11/88	1614	16	7.47	800
MW-06S	7/12/88	1457	17	7.61	570
MW-07S	7/12/88	1632	17	6.79	970
MW-07I	7/12/88	1728	19	8.61	350
MW-08S	Not analyzed due to oil contamination				
MW-08I	7/13/88	1028	26	8.41	250
MW-09S	7/12/88	955	24	6.79	860
MW-09I	7/12/88	1653	17	8.21	310
MW-10S	Not sampled--dry				
MW-11S	7/13/88	1611	19	7.11	950
MW-11I	7/12/88	1656	16	7.59	640
MW-12S	7/12/88	1142	23	7.08	770
MW-13S	7/11/88	1218	24	7.11	1,120
MW-14S	7/13/88	1406	20	7.37	600
MW-15S	Not sampled--dry				
MW-20S	7/13/88	1518	21	7.00	1,240

[a]Temperature measurements are not indicative of actual groundwater temperature.

GLT779/18-2

Appendix I
GROUNDWATER FLOW CALCULATIONS

Appendix I
GROUNDWATER FLOW CALCULATIONS

Groundwater flow calculations for the Moss-American site were made using Darcy's law (Freeze and Cherry 1979). The water levels used in these calculations were measured on July 19, 1988, and are reported in Appendix G. Additional calculations using estimated values for normal water levels are also presented. (Data from July 1988 are representative of extremely dry conditions during a drought.)

The governing equation (Darcy's law) used in the calculations is:

$$Q = KIA$$

where:

Q = Groundwater volume passing a given area
K = Hydraulic conductivity of the sediments
I = Hydraulic gradient
A = Cross sectional area through which groundwater flows

Contoured groundwater elevations are shown in Figure I-1. The flow is generally to the east-northeast toward the Little Menomonee River. For these calculations, it is assumed that all of the water passing the 715-foot contour eventually leaves the site. The extreme drought in Wisconsin during the time groundwater elevations were measured has greatly affected the groundwater flow. During more typical periods, the groundwater probably discharges to the river and then flows away from the site.

The portion of the site upgradient of the 715-foot contour has been separated into five flow channels as shown in Figure I-1. Each channel represents the path along which groundwater would flow in that part of the site . The hydraulic characteristics of the nearest monitoring well are considered representative of the entire flow channel. The calculations are summarized in Table I-1. The total horizontal groundwater outflow based on actual conditions in July 1988 is 556,000 gallons per year.

Table I-2 summarizes a similar flow calculation based on anticipated normal conditions. The water table in this case is assumed to be 2 feet below ground. Minimum and maximum estimates for normal flow were obtained by using the minimum and maximum values of hydraulic conductivity measured in the shallow onsite wells. The estimated normal horizontal outflow is between 1.5 and 4.4 million gallons per year.

GLT779/025.50

Table I-1
GROUNDWATER OUTFLOW

	Flow Channels				
	1	2	3	4	5
Width (ft)	190	225	430	430	270
Nearest Monitoring Well	MW-7S	MW-8S	MW-9S	a	MW-11S
Water Level Elevation on 7/19/88	715	715	715	715	715
Top of Till	710	700	707	712	706
Saturated Thickness (ft)	5	5	8	3	9
Area (Width x Saturated Thickness) (ft^2)	950	1,125	3,440	1,290	2,430
Hydraulic Conductivity (K) (ft/day)	1.0	1.4	1.5	1.0	0.4
Gradient (I)	0.015	0.022	0.026	0.022	0.022
Flow Volume (Q)					
(ft^3/day)	15	35	130	28	21
(gal/day)	110	260	1,000	210	160
(gal/yr)	41,000	95,000	360,000	78,000	57,000
Total (gal/day)	1,700				
(gal/yr)	634,000				

[a]MW-10S is the nearest monitoring well. Because the measured value for K in MW-10 (0.012 ft/day) is not representative of the material and the slug test data for that well are questionable, the value used (1.0 ft/day) is the log average value from all shallow wells.

GLT779/026.50

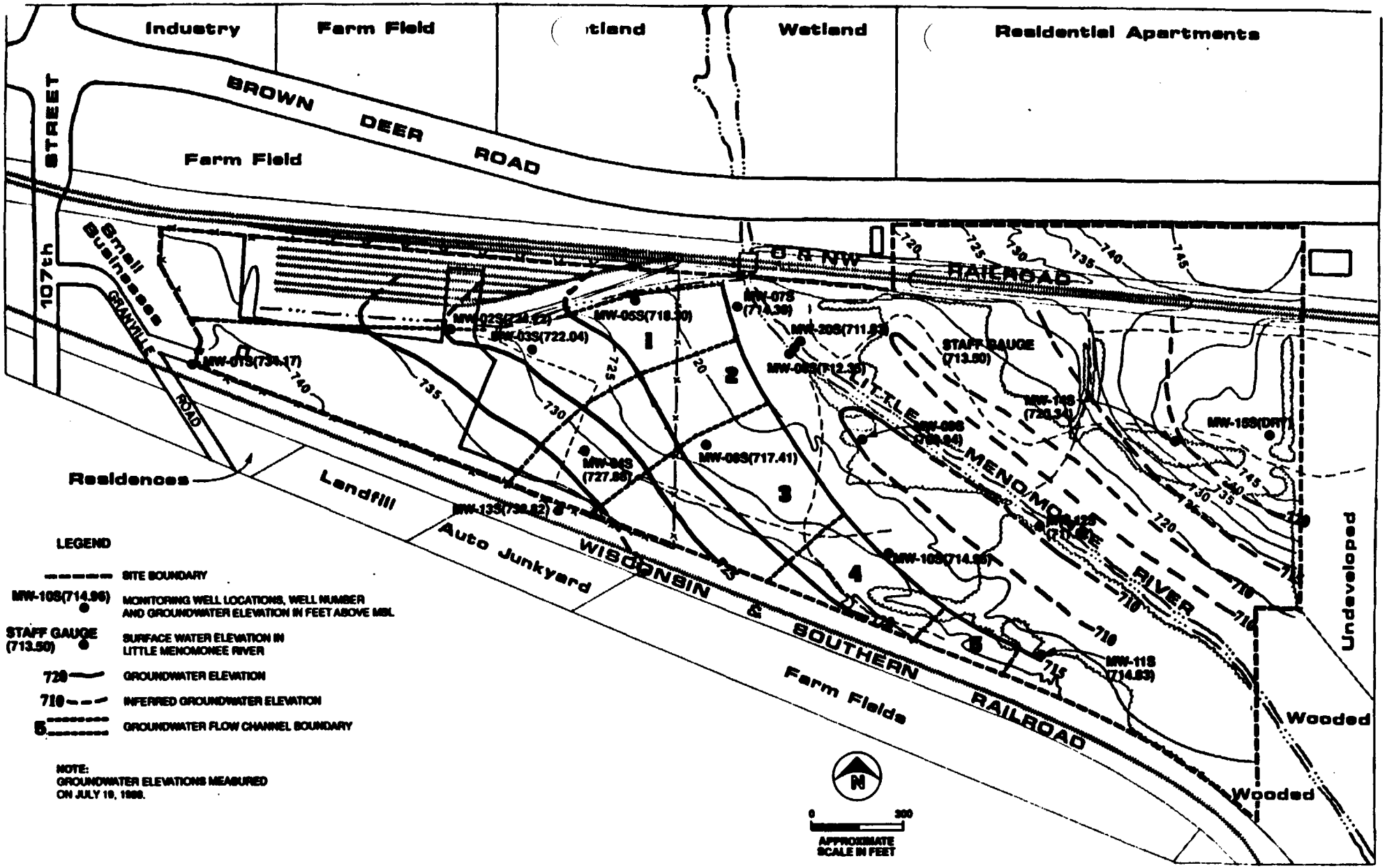
Table I-2
GROUNDWATER OUTFLOW
ESTIMATED "NORMAL" CONDITIONS

	Flow Channels				
	1	2	3	4	5
Width (ft)	190	225	430	430	270
Thickness of Overburden (ft)	14 (MW-07)	11 (MW-08)	12 (MW-06)	11 (MW-10)	19 (MW-11)
Saturated Thickness (ft)	12	9	10	9	15
Area (cross section ft^2)	2,200	2,700	4,300	3,900	4,000
Hydraulic Conductivity[a]	2×10^{-3} cm/s				
Hydraulic Conductivity[b]	4×10^{-4} cm/s				
Gradient	0.02				

Estimated Normal Flow: 1 to 5 million gallons per year (3,000 to 14,000 gpd, or 2 to 10 gpm)

[a]Maximum hydraulic conductivity measured onsite
[b]Log-average hydraulic conductivity for shallow wells

GLT779/077.50



LEGEND

- SITE BOUNDARY
- MW-10S(714.96) — MONITORING WELL LOCATIONS, WELL NUMBER AND GROUNDWATER ELEVATION IN FEET ABOVE MSL
- STAFF GAUGE (713.50) — SURFACE WATER ELEVATION IN LITTLE MENOMONEE RIVER
- 720 — GROUNDWATER ELEVATION
- 710 — INFERRED GROUNDWATER ELEVATION
- 5 — GROUNDWATER FLOW CHANNEL BOUNDARY

NOTE:
GROUNDWATER ELEVATIONS MEASURED ON JULY 19, 1988.

FIGURE I-1
GROUNDWATER ELEVATIONS AND FLOW CHANNELS
MOSS-AMERICAN RI

Appendix J
CONTAMINANT VELOCITY CALCULATIONS

Appendix J
CONTAMINANT VELOCITY CALCULATIONS

This appendix contains the retarded velocity calculations performed for select contaminants at the Moss-American site.

1. The first step was to determine the average linear velocity of groundwater along the four flowpaths illustrated in Figure J-1 using the following equation:

   $V = KI/\theta$

   where:

   V = the linear velocity of groundwater (ft/yr)
   K = the log averaged hydraulic conductivity of the aquifer (ft/day)
   I = the hydraulic gradient along a specific flowpath (ft/ft)
   θ = the effective porosity of the aquifer (dimensionless), assumed to be 0.34 (Todd)

FLOWPATH 1

MW-02S to MW-07S
I = 724.22 - 714.38 ft/945 ft = 0.0104 ft/ft
V = KI/θ
K = 0.4230 ft/day
θ = 0.34 (Todd)
V = (0.4230 ft/day)(0.0104 ft/ft)/0.34 = 0.0129 ft/day = 4.71 ft/yr

FLOWPATH 2

MW-04S to MW-08S
727.88 to 712.35 ft over 720 ft
I = 727.88 - 712.35 ft/720 ft = 0.0220 ft/ft
V = KI/θ
K = 0.4230 ft/day
θ = 0.34
V = (0.4230 ft/day)(0.0220 ft/ft)10.34 = 0.0274 ft/day = 10.00 ft/yr

FLOWPATH 3

MW-11S to the Little Menomonee River
714.83 to 711.52 ft over 360 ft
I = 714.83 - 711.52 ft/360 ft = 0.0092 ft/ft
V = KI/θ
K = 0.4230 ft/day
θ = 0.34
V = (0.4230 ft/day)(0.0092 ft/ft)10.34 = 0.0115 ft/day = 4.20 ft/yr

FLOWPATH 4

MW-14S to MW-12S
720.34 to 711.52 ft over 525 ft
I = 720.34 - 711.52 ft/525 ft = 0.0168 ft/ft
V = KI/θ
K = 0.4230 ft/day
θ = 0.34
V = (0.4230 ft/day)(0.0168 ft/ft)/0.34 = 0.0209 ft/day = 7.63 ft/yr

The average linear velocity for the site is about 7 ft/yr.

2. The second step was to calculate the distribution coefficient for the site using the equation:

$Kd = K_{oc} * \%\ OC/100$

where:

Kd = the distribution coefficient (dimensionless)
K_{oc} = the organic carbon partition coefficient (ml/g)
% OC= the percent of organic carbon in the soils at the site (average = 3%)

Compound	K_{oc} (ml/g)		OC	K_d (ml/g)
Benzo[a]anthracene	1,380,000(1)	*	0.3	41,000
Benzo[a]pyrene	676,083(2)	*	0.3	20,000
Benzo[b]fluoranthene	550,000(1)	*	0.3	16,500
Benzo[k]fluoranthene	550,000(1)	*	0.3	16,500
Chrysene	200,000(1)	*	0.3	6,000
Dibenzo[a,h]anthracene	3,300,000(1)	*	0.3	99,000
Indeno[1,2,3-cd]pyrene	1,600,000(1)	*	0.3	48,000
Naphthalene	1,300(3)	*	0.3	39
Phenanthrene	14,000(1)	*	0.3	420
Benzene	83(1)	*	0.3	3
Ethylbenzene	1,100(1)	*	0.3	33
Toluene	300(1)	*	0.3	9
Xylene	240(1)	*	0.3	7

(1) Superfund Public Health Evaluation Manual, OSWER Directive 9285.4-1, 10/1/86.
(2) Karickhoff, S. W. Sorption of Hydrophobic Pollutants on Natural Sediment. In W. J. Lyman, Chemical Property Estimation Methods. 1982.
(3) Griffen, R. A. Preliminary Report of Soil Contamination Investigation, Seymour RI/FS. 1985.

3. The third step was to calculate the retardation coefficient for the selected contaminants at the site using the following equation:

$Rd = 1 + K_d\ (\rho/\theta)$

Compound	K_d (ml/g)	Rd
Benzo[a]anthracene	41,000	240,000
Benzo[a]pyrene	20,000	120,000
Benzo[b]fluoranthene	16,500	97,000
Benzo[k]fluoranthene	16,500	97,000
Chrysene	6,000	35,000
Dibenzo[a,h]anthracene	99,000	580,000
Indeno[1,2,3-cd]pyrene	48,000	280,000
Naphthalene	39	230
Phenanthrene	420	2,500
Benzene	3	18
Ethylbenzene	33	195
Toluene	9	54
Xylene	7	42

4. The fourth and final step was to calculate the contaminants retarded velocity using the following equation:

$Vc = V/Rd$

where:

V = the average linear velocity of groundwater (ft/yr) estimated to be about 7 ft/yr
Rd = the retardation coefficient (dimensionless)

Compound	V/Rd	Vc
Benzo[a]anthracene	7 ft/yr/240,000	10^{-5} ft/yr
Benzo[a]pyrene	7 ft/yr/120,000	10^{-4} ft/yr
Benzo[b]flouranthene	7 ft/yr/97,000	10^{-4} ft/yr
Benzo[k]flouranthene	7 ft/yr/97,000	10^{-4} ft/yr
Chrysene	7 ft/yr/35,000	10^{-4} ft/yr
Dibenzo[a,h]anthracene	7 ft/yr/580,000	10^{-5} ft/yr
Indeno[1,2,3-cd]pyrene	7 ft/yr/280,000	10^{-5} ft/yr
Naphthalene	7 ft/yr/230	0.03 ft/yr
Phenanthrene	7 ft/yr/2,500	0.003 ft/yr
Benzene	7 ft/yr/18	0.4 ft/yr
Ethylbenzene	7 ft/yr/195	0.04 ft/yr
Toluene	7 ft/yr/54	0.1 ft/yr
Xylene	7 ft/yr/42	0.1 ft/yr

In summary, the retarded travel times range from a few inches per year for the BTX compounds to almost zero for the PAH compounds. These calculations assume migration occurs in the dissolved state with the groundwater.

The calculations do not address the question of free product migration or migration of microemulsions (micelles). Since oil stringers and sheens were observed in the groundwater at the site, it is reasonable to expect that most of the transport is by way of the oil phase (oil seepage). A rigorous calculation of travel times for a saturated oil slug is not possible because of the heterogeneity of the surface soils at the site.

An upper bound for oil seepage is the groundwater velocity. At 7 feet per year, a particle of oil could take 100 years to migrate from the source area to the Little Menomonee River.

GLT779/074.50

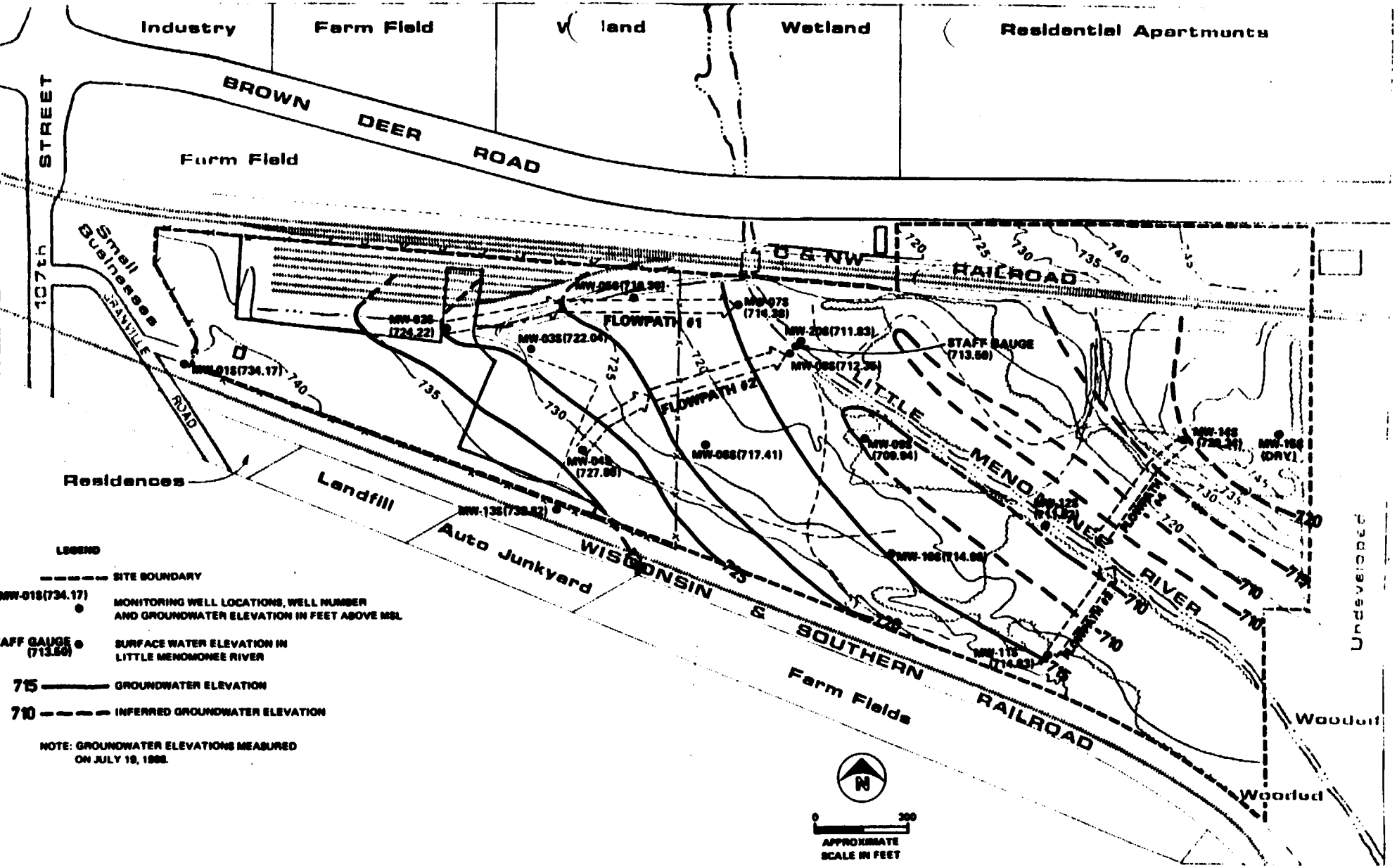


FIGURE J-1
GROUNDWATER FLOWPATHS
MOSS-AMERICAN RI

Appendix K
BASELINE RISK ASSESSMENT

Appendix K
BASELINE RISK ASSESSMENT

INTRODUCTION

A baseline risk assessment is an evaluation of the potential threats to public health and the environment from the site in the absence of any remedial action (U.S. EPA 1988d). It identifies and characterizes the toxicity of contaminants of concern, the potential exposure pathways, the potential human and environmental receptors, and the extent of expected impact or threat under the conditions defined for the site.

This appendix presents the baseline risk assessment for the Moss-American site. A risk assessment was performed to characterize the potential risk posed by the site in order to support a decision whether to proceed with a feasibility study of potential remedial actions. It addresses the potential risks associated with the Moss-American site assuming no corrective actions will take place and no restrictions will be placed on future use of the site (i.e., the "no-action alternative"). Thus, it addresses potential risks from the site under current and feasible future land uses. Evaluation of a no-action alternative is required under Section 300.68(f)(1)(v) of the National Contingency Plan (NCP) (U.S. EPA 1985c).

BASIS

This risk assessment was performed consistent with the following guidances:

- U.S. EPA risk assessment guidelines (U.S. EPA 1986a, 1986b, 1986c, and 1986d)
- The Risk Assessment Guidance for Superfund--Human Health Evaluation Manual Part A (U.S. EPA 1989f)
- The Risk Assessment Guidance for Superfund--Environmental Evaluation Manual (U.S. EPA 1989e)

This risk assessment is based on the following major assumptions:

- No remedial actions will be taken.
- No land use restrictions will be in effect.
- There is the potential for future development of the site.

- For the purpose of calculations, contaminant concentrations will not change over time.

- All carcinogenic PAHs are as potent as benzo[a]pyrene.

This risk assessment is based on the data collected during the RI and presented in Chapter 3. Data that may represent contamination of samples in the laboratory or in the field or that failed to meet quality control guidelines (e.g., insufficient surrogate spike recovery) were not used. Estimated results (data with a "J" qualifier) that met data validation requirements were used.

ORGANIZATION

This appendix is organized into the following sections:

- **Contaminant Identification** identifies the contaminants evaluated in the assessment.

- **Toxicity Assessment** summarizes the toxicity of the selected contaminants.

- **Exposure Assessment** describes how receptors could come into contact with contaminants from the site.

- **Public Health Risk Characterization** integrates the toxicity and exposure assessments to estimate the potential risks to public health from exposure to site contaminants.

- **Environmental Evaluation** considers the potential environmental effects associated with the site.

- **Limitations and Assumptions** summarizes the basic assumptions used in the risk assessment and limitations of data and methodology.

The methodology used to assess public health risk is outlined in Appendix L. The risk calculation data tables are presented in Appendix M.

CONTAMINANT IDENTIFICATION

Seventy chemicals on the U.S. EPA's Target Compound List (TCL) and Target Analyte List (TAL) were detected at the site. These chemicals are presented by media of occurrence on Table K-1. There were 47 organic compounds and 23

Table K-1
COMPOUNDS DETECTED AT THE MOSS AMERICAN SITE

CHEMICAL	SURFACE SOIL	SUBSURFACE SOIL	SEDIMENTS	GROUNDWATER WELLS	SURFACE WATER
POLYCYCLIC AROMATIC HYDROCARBONS					
Benzo(a)anthracene	X	X	X	X	
Benzo(a)pyrene	X	X	X	X	
Benzo(b)fluoranthene	X	X	X	X	
Benzo(k)fluoranthene	X	X	X	X	
Chrysene	X	X	X	X	
Dibenzo(a,h)anthracene	X	X	X		
Indeno(1,2,3-cd)pyrene	X	X	X		
Acenaphthene	X	X	X	X	X
Acenaphthylene	X	X	X	X	
Anthracene	X	X	X	X	
Benzo(g,h,i)perylene	X	X	X		
Fluoranthene	X	X	X	X	
Fluorene	X	X	X	X	X
2-Methylnaphthalene	X	X	X	X	X
Naphthalene	X	X	X	X	X
Phenanthrene	X	X	X	X	X
Pyrene	X	X	X	X	
PHTHALATES					
bis(2-Ethylhexyl)phthalate	X	X		X	
Butylbenzylphthalate			X		
Diethylphthalate		X			
Dimethylphthalate	X	X			
Di-n-butylphthalate		X	X		X
Di-n-octylphthalate		X	X		
BENZENE/TOLUENE/XYLENE (BTX)					
Benzene	X			X	
Ethylbenzene	X	X	X	X	
Toluene	X	X	X		
Xylenes	X	X		X	
OTHER VOLATILES					
Styrene	X	X		X	
Carbon disulfide		X			
KETONES					
Acetone	X	X	X		
2-Butanone		X	X		
4-Methyl-2-pentanone	X				
Isophorone		X		X	
HALOGENATED ALKENES & ALKANES					
Chloroform		X	X		
1,1,-Dichloroethane	X				

Table K-1
COMPOUNDS DETECTED AT THE MOSS AMERICAN SITE

CHEMICAL	SURFACE SOIL	SUBSURFACE SOIL	SEDIMENTS	GROUNDWATER WELLS	SURFACE WATER
Methylene chloride	X	X	X		X
Tetrachloroethene	X				
1,1,1-Trichloroethane	X	X			
OTHER SEMI-VOLATILE COMPOUNDS					
Benzoic Acid	X	X	X		
Chlorobenzene		X			
Dibenzofuran	X	X	X	X	X
4-Chloroaniline					
PHENOLIC COMPOUNDS					
2,4-Dimethylphenol	X			X	
2,4-Dinitrophenol	X				
N-Nitrosodiphenylamine	X		X		
Pentachlorophenol		X			
Phenol		X		X	
INORGANIC CHEMICALS					
Aluminum	X	X	X	X	X
Antimony	X	X	X		
Arsenic	X	X	X	X	
Barium	X	X	X	X	X
Beryllium	X	X	X		
Cadmium	X	X	X		
Calcium	X	X	X	X	X
Chromium	X	X	X	X	
Cobalt	X	X	X		
Copper	X	X	X		
Cyanide	X	X			
Iron	X	X	X	X	X
Lead	X	X	X	X	
Magnesium	X	X	X	X	X
Manganese	X	X	X	X	X
Mercury	X	X	X		
Nickel	X	X	X	X	
Potassium	X	X	X	X	X
Selenium	X		X		
Sodium	X	X	X	X	X
Thallium	X				
Vanadium	X	X	X	X	
Zinc	X	X	X	X	X
DIOXINS and FURANS					
Heptachlorodioxin	X		X		
Heptachlorofuran			X		
Hexachlorodioxin		X	X		

Table K-1
COMPOUNDS DETECTED AT THE MOSS AMERICAN SITE

CHEMICAL	SURFACE SOIL	SUBSURFACE SOIL	SEDIMENTS	GROUNDWATER WELLS	SURFACE WATER
Hexachlorofuran			X		
Octachlorodioxin	X		X		
Tetrachloro-dioxin(total)	X				
Tetrachloro-2,3,7,8-dioxin	X				
Pentachlorodioxin			X		
Pentachlorofuran			X		

inorganic chemicals. As discussed in Chapter 3, many of the organic chemicals detected are constituents of creosote.

From this group of chemicals a subset of chemicals were identified as contaminants of potential concern to be used in this risk assessment. Contaminants of potential concern were selected in a two-step process. The first step entailed identifying all chemicals that have either a toxicity factor (i.e., cancer potency factor or reference dose) issued by U.S. EPA or a state or federal environmental media standard or criterion and were detected in an environmental medium or location with which people or wildlife could have contact. Thirty chemicals detected at the site met this selection criterion (see Table K-2).

Since not all chemicals detected at the site have toxicity values or environmental standards, a second review step was performed to determine whether any other chemicals should be included as contaminants of potential concern for the risk. Factors considered in this review included toxicity information, frequency of detection at the site, concentration detected, and environmental fate considerations.

Seven polycyclic aromatic hydrocarbons (PAHs) were added as contaminants of potential concern based on carcinogenicity concerns. They do not have individual cancer potency factors, so they were evaluated using the cancer potency factor of benzo[a]pyrene (see Table K-2). Chemicals that do not have critical toxicity values but were included as contaminants of potential concern include noncarcinogenic PAHs (e.g., anthracene, phenanthrene, and fluorene) and dibenzofuran. These chemicals are major constituents of creosote. The risks from exposure to these chemicals were not quantitatively estimated, however, the significance of exposure to these chemicals is discussed under "Toxicity Assessment".

Nine chlorinated dioxins and furans were selected as chemicals of potential concern. Based on toxicity concerns of these chemicals, only 2,3,7,8-tetrachloridbenzo-p-dioxin (TCDD) has a cancer potency. The other compounds were addressed using the dioxin equivalency approach outlined in Chapter 3.

The remaining chemicals detected at this site were not included in this risk assessment. Their exclusion, however, should not significantly alter the outcome of the risk assessment. For example, the chemicals not included either have relatively low toxicity, were detected in only one or two of the samples analyzed, or were present at relatively low concentrations. Inorganic compounds were not included if the detected concentrations did not exceed background soil concentrations.

Table K-2
Potential Contaminants of Concern and Criteria for Selection
Moss-American Site

CHEMICAL	Selected based on critical toxicity values	Selected based on toxicity concerns	Selected based on other factors
Acenaphthene			d
Acenaphthylene			d
Acetone	a		
Anthracene			d
Antimony	a		
Arsenic	b		
Barium	a		
Benzene	b		
Benzo[a]anthracene		c	
Benzo[b]fluoranthene		c	
Benzo[k]fluoranthene		c	
Benzo[g,h,i]perylene		c	
Benzo[a]pyrene	a		
Benzoic Acid	a		
Beryllium	a		
bis(2-Ethylhexyl)phthalate	a/b		
2-Butanone	a		
Cadmium	a/b		
Chlorinated dioxins and furans			f
Chloroform	a/b		
Chromium	a/b		
Chrysene			d
Copper	a		
Creosote	b		e
Dibenz[a,h]anthracene		c	
Dibenzofuran			d
1,1-Dichloroethane	a/b		
2,4-Dinitrophenol	a		
Ethylbenzene	a		
Fluoranthene			d
Fluorene			d
Indeno[1,2,3-cd]pyrene		c	
Lead	a		
Manganese	a		
Mercury	a		
Methylene chloride	a/b		
Naphthalene	a		
Nickel	a		
Phenanthrene			d
Phenol	a		
Pyrene			d
Styrene	a		
2,3,7,8-TCDD	b		
Toluene	a		
1,1,1-Trichloroethane	a		
Vanadium	a		
Xylenes	a		
Zinc	a		

a. Selected based on having a reference dose value.
b. Selected based on having a cancer potency value.
c. PAHs selected based on potential carcinogenicity.
d. Selected based on frequency of occurance and relative abundance.
e. Creosote selected because it is the major source material.
f. Dioxins and furans selected based on toxicity.

TOXICITY ASSESSMENT

HUMAN HEALTH EFFECTS

This section summarizes the toxicological effects associated with exposure of people to the contaminants of concern and the dose-response relationships for those chemicals.

Contaminant Classification

For the purpose of this risk assessment, human health effects were divided into two broad categories--carcinogenic or noncarcinogenic. Consequently, human health risks were evaluated in terms of carcinogenic and noncarcinogenic risks. This division was based on the mechanism of action currently associated with each category. Although the chemicals was divided into two categories, some are associated with effects in both categories. The division was based on the mechanism of action currently associated with each category.

Carcinogens are chemicals that cause or induce cancer. Carcinogenic effects demonstrate a nonthreshold mechanism. In this approach, there is no level of exposure (i.e., threshold) to a carcinogen that will not result in the possibility of developing cancer. Chemicals causing noncarcinogenic effects (i.e., systemic toxins) exhibit a level of exposure from above zero to some finite value that can be tolerated by the organism without causing an observed health effect.

U.S. EPA has developed a carcinogen classification scheme (U.S. EPA 1986d) using a weight-of-evidence approach to classify the likelihood of a chemical to be a human carcinogen. Information considered in developing the classification includes human studies of the association between cancer incidence and exposure as well as long-term animal studies under controlled laboratory conditions. Other supporting evidence considered includes short-term tests for genotoxicity, metabolic and pharmacokinetic properties, toxicological effects other than cancer, structure-activity relationships, and physical/chemical properties of the chemical.

Nineteen of the individual contaminants detected at the site and creosote as mixture are classified as known (class A), probable (class B1 and B2), or possible (class C) human carcinogens by the U.S. EPA Carcinogen Assessment Group. Those chemicals and definitions of the EPA classifications are presented on Table K-3.

Noncarcinogenic health effects include a variety of toxic effects on body systems such as renal toxicity (toxicity to the kidney), teratogenicity (damage to the developing fetus), and central nervous system disorders. It is believed that organisms may have adaptive mechanisms that must be overcome before a toxic

Table K-3
POTENTIAL CARCINOGENS
MOSS-AMERICAN SITE

	U.S. EPA Carcinogen Assessment Group Classification (a)	
CHEMICAL	INGESTION	INHALATION
Arsenic	A	A
Benzene	A	A
Benzo[a]anthracene	B2	B2
Benzo[b]fluoranthene	B2	B2
Benzo[k]fluoranthene	B2	B2
Benzo[a,h]anthracene	B2	B2
Benzo[a]pyrene	B2	B2
Beryllium	D	B2
bis(2-Ethylhexyl)phthalate	B2	D
Cadmium	D	B1
Chloroform	B2	D
Chromium (hexavalent)	D	A
Chrysene	B2	B2
Creosote	B1	B1
1,1-Dichloroethane	C	D
Indeno[1,2,3-cd]pyrene	C	C
Methylene Chloride	B2	B2
Nickel	D	A
N-Nitrosodiphenylamine	B2	D
Tetrachloroethene	B2	B2

(a) U.S. EPA Carcinogen Assessment Group Classification

A: Human carcinogen - Sufficient evidnece from epidemiological studies.

B1: Probable human carcinogen - Limited evidence of carcinogenicity to humans.

B2: Probable human carcinogen - Sufficient evidence in animals and inadequate or no human evidence.

C: Possible human carcinogen - Limited evidence in animals and the absence of human data.

D: Not Classified - Inadequate or no evidence to classify.

endpoint (effect) is manifested. The toxicity of a chemical is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations. The noncarcinogenic effects of the chemicals at the site are summarized below.

Toxicity Profiles

Summary toxicity profiles for selected contaminants are presented in Table K-4. The chemicals listed in Table K-4 are representative of the contaminants of potential concern for the site. The omission from Table K-4 of a chemical listed on Table K-2 does not imply that the chemical is without toxic effects. The profiles describe specific toxic effects associated with exposure to those chemicals. Detailed profiles can be found in the toxicological literature.

Creosote

Creosote is the major material used at the Moss-American site. It is a complex mixture of more than 200 compounds. Because of this, its properties and effects are summarized separately in this section.

Creosote is a heavy, flammable, oily liquid with a characteristic caustic burning taste and sharp, smoky odor. PAHs comprise 75 percent of creosote, with phenanthrene and anthracene being the major constituents (17.4 to 23 percent) (Lorenz and Gjovik 1972). Other components include phenolic compounds, aromatic amines, and specifically dibenzofuran, naphthalene, and methylnaphthalene.

Acute Effects. Acute exposure to creosote liquid or vapor may cause local effects such as skin irritation and ulceration. Human fatalities have been reported 14 to 16 hours after ingestion of 1 to 2 grams by children or 7 grams by adults (Clayton and Clayton 1981). Systemic poisoning effects may include salivation, vomiting, respiratory difficulties, headache, cyanosis, convulsions, and cardiovascular failure. Dermal contact may produce burning, itching, skin eruptions, and contact dermatitis (Sittig 1985).

Chronic Effects. Prolonged exposure to creosote may cause degeneration of organ tissues. Results of organ damage indicate kidney inefficiency and hemolytic anemia (Gosselin, et al. 1984). Creosote may also indirectly alter the toxicity of other chemicals by induction of metabolizing enzymes of the liver and lungs (IARC 1985).

Carcinogenicity. Creosote is listed as a class B1 carcinogen according to the U.S. EPA 1986 classification scheme. It has been reported to cause skin carcinomas in humans through chronic dermal exposure to the compounds in industry (NCI 1985). It has been found to be carcinogenic to mice and

Table K-4 (Page 1 of 5)
PROFILES OF SELECTED CHEMICALS
MOSS-AMERICAN SITE

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Arsenic	Acute oral exposure can cause muscular cramps, facial swelling, cardiovascular reactions, severe gastrointestinal damage, and vascular collapse leading to death; sensory loss, hematopoietic symptoms delayed after exposure to high concentrations and usually reversible. Inhalation exposures can cause severe irritation of nasal lining, larynx, and bronchi.	Chronic oral or inhalation exposure can produce changes in skin, including hyperpigmentation and hyperkeratosis; peripheral neuropathy; liver injury; cardiovascular disorders; oral exposures associated with peripheral vascular disease, blackfoot disease.	Known human carcinogen; oral exposures associated with skin cancer, inhalation exposures with lung cancer.	May be essential. Toxicity varies for different compounds; inorganic trivalent arsenic compounds usually more toxic than pentavalent compounds; high doses of some inorganic arsenic compounds to pregnant laboratory animals produced malformations in offspring.
Benzene	Acute exposures (inhalation) to high levels of benzene may lead to depression of the central nervous system, unconsciousness, and death or may cause fatal cardiac arrhythmias.	Major toxic effect is hematopoietic toxicity (affects formation of blood); chronic exposure of workers to low levels has been associated with blood disorders, such as leukemia and aplastic anemia (depression of all three cell types of the blood in absence of functioning marrow).	Sufficient evidence that human and animal carcinogen; strong correlation between exposure to benzene by inhalation and leukemia.	Chromosomal aberrations in bone marrow and blood have been reported in experimental animals and some workers.
Benzo[a]pyrene	Acute toxicity appears low when administered by oral or dermal routes to lab animals.	Prolonged exposure may produce chronic dermatitis and reproductive changes. Repeated oral doses to mice have caused hypoplastic anemia.	Benzo[a]pyrene is a constituent of coal tar which is classified as a Level 1 known carcinogen by IARC and a Level B2 probable carcinogen by EPA. Ingestion may produce stomach tumors and inhalation lung cancer. Prolonged skin exposure has been linked to an increase in skin cancer among workers.	Benzo[a]pyrene is the most carcinogenic of the PAHs. It is also a mutagen. (See PAHs for general toxicity information.)
Cadmium	For acute exposures by ingestion, symptoms of cadmium toxicity include nausea, vomiting, diarrhea, muscular cramps, salivation, spasms, drop in blood pressure, vertigo, loss of consciousness, and collapse. Acute renal failure, liver damage, and death may occur. Exposure by inhalation can cause irritation, coughing, labored respiration, vomiting, acute chemical pneumonitis, and pulmonary edema.	Respiratory and renal toxicity are major effects in workers. Chronic oral exposures can produce kidney damage. Cadmium accumulates in kidney, and nephropathy results after critical concentration in kidney is reached. Inhalation can cause chronic obstructive pulmonary disease, including bronchitis, progressive fibrosis, and emphysema. Chronic exposure affects calcium metabolism and can cause loss of calcium from bone, bone pain, osteomalacia, and osteoporosis. Chronic exposure may be associated with hypertension. Cadmium can product testicular atrophy, sterility, and teratogenic effects in experimental animals.	Increased risk of prostate cancer and perhaps respiratory tract cancer in workers exposed by inhalation. No evidence of carcinogenicity from chronic oral exposure.	A nonessential element.
Chloroform	Anesthetic depresses CNS. Fatalities in humans may be rapid, resulting from cardiac arrest (apparently sensitization to epinephrine) or delayed with kidney and liver damage; respiratory depression, coma, liver and kidney damage are among the symptoms of exposure to chloroform. In laboratory animals, acute toxicity depends on species, strain, sex, and age; liver damage may be cause of death in rats and mice after acute exposure.	Kidney damage (renal tubular necrosis) can occur in mice; and kidney and liver damage in rats, rabbits, dogs, and guinea pigs exposed by inhalation.	Carcinogenic in mice (hepatomas, hepatocellular caricinomas), male rats (malignant kidney tumors), and female rats (thyroid tumors).	Fetotoxic in rats and rabbits.

Table K-4 (Page 2 of 5)
PROFILES OF SELECTED CHEMICALS
MOSS-AMERICAN SITE

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Chromium	Major acute effect from oral exposure is renal tubular necrosis. Inhalation of chromate salts results in irritation and inflammation of nasal mucosa, ulceration, and perforation of nasal septum.	Chronic exposure to hexavalent chromium has resulted in kidney damage in animals and humans. Inhalation exposures to chromates in industrial settings have resulted in nasal membrane inflammation, chronic rhinitis, laryngitis, and pharyngitis. Exposures to skin can result in allergic skin reactions in sensitive individual. Overall, hexavalent forms are usually more toxic than trivalent forms.	Excess lung cancer has been associated with chromate-producing industry workers. Chromate salts are carcinogenic in rats exposed by inhalation.	Essential element. Toxicity is related to valence state.
Creosote	The liquid and vapors of creosote are strong irritants. Exposure may produce local erthema, burning, itching, pigmentation, and possible ulceration of the skin. Eye injuries could result from direct contact to the eye. Systemic poisoning may result in salivation, vomiting, headache, loss of reflexes, and respiratory difficulties. Direct contact with skin may cause severe chemical burns.	Repeated exposure has been associated with an increased risk of developing bronchitis, and cancer of the lungs, skin, bladder and kidneys (see cancer potential).	Creosote is classified as a B1 probable carcinogen by the U.S. EPA. Workers occupationally exposed to creosote by chronic skin exposure have developed cancer papillomas on the forearm and scrotum. Repeated skin exposure to rats has produced skin cancer.	Creosote has shown to be mutagenic to rats and mice after the chemical is first metabolized by the organism. Creosote contains many known carcinogens such as benzo[a]pyrene and other PAHs, as well as other chemicals that may act as cocarcinogens, initiators, or promotors of carcinogenesis.
1,2-Dichloroethane	Central nervous system depression, lung irritation, and injury to liver, kidney, and adrenals have been reported. Deaths in humans exposed by ingestion or inhalation may result from circulatory and respiratory failure.	Chronic exposure can cause liver degeneration and kidney damage in laboratory animals. Eye damage (necrosis of corneal epithelium) has been observed in dogs injected with 1,2-dichloroethane. Repeated exposures have been associated with anorexia, nausea, liver and kidney dysfunction, and neurological disorders in workers.	Carcinogenic in mice and rats exposed orally.	Mutagenic in some tests in bacteria, barley, and fruit flies.
Ethylbenzene	Ethylbenzene is irritating to eyes, mucous membranes, and skin. It can cause headaches and narcosis.			

Table K-4 (Page 3 of 5)
PROFILES OF SELECTED CHEMICALS
MOSS-AMERICAN SITE

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Lead	Acute inorganic lead intoxication in humans is characterized by encephalopathy, abdominal pain, hemolysis, liver damage, renal tubular necrosis, seizures, coma, and respiratory arrest.	Chronic low levels of exposure to lead can affect the hematopoietic system, the nervous system, and the cardiovascular system. Lead inhibits several key enzymes involved in heme biosynthesis. One characteristic effect of chronic lead intoxication is anemia, by reduced hemoglobin production and shortened erythrocyte survival. In humans, lead exposure has resulted in nervous system injury including reduced hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. The developing child appears especially sensitive to lead-induced nervous system injury. Lead can also affect the immune system and produce gingival lead lines. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans. Exposure to lead is associated with sterility, abortion, neonatal mortality, and morbidity. Organolead compounds are neurotoxic.	Lead salts have some evidence of carcinogenicity in animals.	Children are especially sensitive to low level effects.
Manganese	Acute inhalation exposures to very high concentrations can cause manganese pneumonitis.	Chronic manganese poisoning results from inhalation of high concentrations of manganese dust. Chronic manganese poisoning is characterized by psychiatric symptoms, such as irritability, difficulty in walking, speech disturbances, and compulsive behavior and by encephalopathy and progressive deterioration of the central nervous system. Chronic effects of manganese poisoning are similar to Parkinson's disease. Liver changes are also frequently seen. Individuals with an iron deficiency may be more susceptible to chronic poisoning.		Manganese is an essential nutrient. Manganese concentrations in water a 50 µg/l may exhibit undesirable taste and discoloration.
Mercury	Inhalation of mercury vapor can cause bronchitis and nervous system effects. Oral exposure can result in abdominal cramps, gastrointestinal effects, ulceration, shock, circulatory collapse, and renal failure.	Occupational exposure to inorganic mercury can produce effects on nervous system, including tremors, erethism, muscular weakness, personality changes, gingivitis, and colored eye reflex. In children, pink eye disease has been reported after ingestion of mercurous compounds. Exposure to organic mercury can cause sensory and visual disturbances, tingling, paresthesiae, numbness, tunnel vision leading to blindness, weakness in extremities and progressive ataxia, tremor, cerebral atrophy, and degeneration of nerves; visual, peripheral neuropathy, and death.		Mercury crosses placenta. Toxicity depends on chemical form. Metallic, organic, and inorganic compounds can be biotransformed.
Methylene chloride	Acts on the central nervous system, causing narcosis; affects the liver. Fatalities have been associated with acute or prolonged exposure.	In animals chronic exposure can affect the liver and kidney. Damage to liver and central nervous system following long-term occupational exposure has been reported.	Carcinogen in laboratory animals.	Mutagenic in some bacterial tests.

Table K-4 (Page 4 of 5)
PROFILES OF SELECTED CHEMICALS
MOSS-AMERICAN SITE

Chemical	Acute Toxicity Summary*	Chronic Toxicity Summary*	Cancer Potential	Other
Naphthalene	Inhalation of vapor may cause eye irritation, headache, and confusion. Ingestion may cause abdominal pain, nausea and vomitting. Skin and/or eye contact may lead to systemic effects such as bladder irritation, kidney effects and hemoletic effects such as anemia, decreased hemoglobin. In animal studies, naphthalene was observed to produce bronchiolar necrosis in rats.	Occurence of cataracts upon naphthalene vapor and dust exposure has been observed in humans. Subchronic animal studies have shown that oral doses of naphthalene produced cataracts and degeneration of the retina. Dermatis has also been reported in workers that have repeated skin exposure. Two studies have reported hemolytic anemia in infants born to mothers exposed to naphthalene during pregnancy.	Studies have not shown that naphthalene is carcinogenic. Naphthalene is commonly found in coal tar and epidemiological studies have shown coal tar to be carcinogenic. The role of naphthalene alone could not be determined.	Acute exposure to large doses may cause hemolytic effects (destruction of red blood cells). This effect is most pronounced in individuals with a hereditary deficiency of glucose-6-phosphate dehydrogenase.
Phenol	Corrosive to tissue; severe eye damage and blindness may result from direct eye contact; skin contact may produce whitening of skin, burn, or systemic poisoning. Paleness, weakness, sweating, headaches, cyanosis, kidney damage, and death may occur.	Chronic phenol poisoning is rare; it induces vomiting, difficulty swallowing, diarrhea, lack of appetite, headaches, fainting, dizziness, and neural disturbances. Liver and kidney damage may occur.	Phenol may promote the effects of certain carcinogens.	
Polycyclic aromatic hydrocarbons	Acute toxicity by oral and dermal doses appears low when administered to lab animals.	Exposure to high concentrations of noncarcinogenic PAHs may result in widespread tissue damage to proliferating tissues such as intestinal epithelium, bone marrow lymphoid organs, and testes. Chronic dermatitis and hyperkeratosis may also result from repeated skin exposure. Carcinogenic PAHs can produce immunosuppressive effects in humans.	PAHs are constituents of coal tar which is classified as a level B2 probable carcinogen by CAG and level known carcinogen by IARC. Stomach tumors can result from ingestion and lung cancer from inhalation exposure. An increased incidence of skin cancer has been noted from direct prolonged skin contact.	PAHs include: benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, indeno[1,2,3-cd]pyrene.
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	2,3,7,8-TCDD is the most toxic known synthetic chemical, based on LD50 studies. The oral LD50 in guinea pigs is 0.6 to 2 µg/kg and in mice is 284 µg/kg. A single dose of 0.1 to 300 µg/kg can produce toxic effects in rats, guinea pigs, chickens, and mice. Toxic effects include liver damage (histopathologic change, jaundice, increased liver weights), thymic atrophy, gastric hemorrhage, testicular degeneration, weight loss, pericardial edema (chickens), and kidney and hematological effects. Humans exposed to TCDD by industrial accidents reported nausea, vomiting, headaches, fatigue, muscular aches and joint pains, peripheral neuropathy, loss of libido, and irritation of eyes, respiratory tract, and skin; skin reactions resembled a chemical burn, followed by chloracne (an often persistent, disfiguring skin disease with blackheads, cysts, and pustules, usually on face and shoulders); some symptoms persisted for years after exposure.	Toxic effects from chronic exposure are similar to those from acute exposure. In laboratory animals, exposure to TCDD can produce extreme weight loss, thymic atrophy, liver damage, impaired kidney function, hematological effects, hormonal alterations, immune suppression, altered lipid metabolism, nervousness and irritability; liver is a particularly sensitive target organ, with degeneration, necrosis, and inflammatory changes demonstrated; some studies of mice attributed mortality to amyloidosis, extensive disposition of proteinaceous material in kidney. TCDD is fetotoxic and teratogenic in laboratory animals and adversely affects reproduction. Humans exposed to TCDD generally have been exposed to multiple chemicals; skin diseases, including chloracne and porphyria cutanea tarda (photosensitive skin disease), liver impairment, and peripheral nerve damage have been reported. Veterans exposed to Agent Orange containing TCDD reported numbness of extremities, skin rash and irritation, liver dysfunction, weakness, decreased sex drive, and psychological effects.	In animals, oral exposure to TCDD produced malignant tumors in multiple organs, including liver, thyroid, adrenals, lung, kidney, testes, nasal structures, ear duct, and skin; leukemia was demonstrated in some studies. Mouse skin studies have indicated that TCDD is a complete carcinogen, while other studies suggest that TCDD is a promoter, particulary in liver. Soft tissue sarcomas have been found in workers occupationally exposed to TCDD and other chemicals, usually trichlorophenol or phenoxy acids.	Bacterial tests and a study of chromosomal breaks in rats are among those indicating that TCDD is mutagenic; many other tests have been negative. TCDD can accumulate in fat and milk. It alters enzyme activity and may affect metabolism of other chemicals. TCDD is a contaminant that can be produced in the manufacture of chlorophenols.

Table K-4 (Page 5 of 5)
PROFILES OF SELECTED CHEMICALS
MOSS-AMERICAN SITE

Chemical	Acute Toxicity Summary[a]	Chronic Toxicity Summary[a]	Cancer Potential	Other
Toluene	Humans exposed by inhalation experimentally or occupationally or by intentional abuse may exhibit excitation, then CNS depression and necrosis; neurotoxic effects include nausea, fatigue, and incoordination at low levels and confusion, ataxia, and weakness at higher levels; in rats, irritation of mucous membranes and incoordination have been observed, as well as pulmonary irritation with subchronic exposure.	CNS effects have been reported in workers, such as disturbances in memory and thinking, psychomotor skills, visual accuracy, sensorimotor speed, and performance tests; indications of cerebral and cerebellar dysfunction include tremors, ataxia, and equilibrium disorders, bizarre behavior and emotional lability may occur. In cases of abuse, changes in liver and kidney function have been observed. In rats, a decrease in hematocrit has been reported.	Embryotoxicity and possible teratogenicity in mice have been reported in an abstract; in rats, skeletal retardation of offspring has been described.	
Xylene	Acute exposures to inhaled xylene can depress the central nervous system and irritate mucous membranes.	Changes in behavioral tests, manual coordination, balance, and electroencephalographic patterns have been reported in humans exposed to xylenes; development of tolerance against some of these effects has been described. Effects on liver of rats have been reported.		
Zinc	Acute adverse effects of zinc include metal fume fever by the inhalation of fumes. Fever, nausea, vomiting, stomach cramps, diarrhea may result from acute ingestions.	Prolonged ingestion of zinc can result in irritability, muscular stiffness and pain, loss of appetite, and nausea. High levels of zinc in diet may retard growth and produce defective mineralization of bone.		Essential nutrient. Taste threshold 15 ppm; 40 ppm soluble zinc salts impart a metallic taste.

Sources:

Casarett and Doull's Toxicology, 3rd editions, ed. C. D. Klaassen, M. O. Amdur, and J. Doull, Macmillan Publishing Co., New York 1986.
IARC Monographs, Vol. 3, 20, 29, International Agency for Research on Cancer, Lyon, France, 1973, 1979, 1980.
Drinking Water and Health, Vo. 1, National Academy of Sciences, 1977.
Handbook of Toxic and Hazardous Chemicals, M. Sittig, Noyes Publications, Park Ridge, New Jersey, 1981.
EPA Health Advisories for Inorganics, organics, and pesticides, March, 1987.
Experimental and Clinical Neurotoxicology, ed. P. S. Spencer and H. H. Schaumburg, Williams and Wilkins, Baltimore, 1980.
Pesticides Studies in Man, W. J. Hayes, Williams and Wilkins, Baltimore, 1982.
29 CFR 1910:50412-50499, December 10, 1985, OSHA, Occupational Exposure to Formaldehyde.
40 CFR 141:25720-25734, July 8, 1987, EPA, Drinking Water.
ACGIH, American Conference of Governmental Industrial Hygienists, Inc., Documentation of the Threshold Limit Values, 1980, 1984.
Health Effects Assessment Document for Naphthalene, U.S. EPA, 1984.

[a]Health effect or target organ may be based on animal studies and does not imply that the results of exposure to humans will be the same.

mutagenic to mice and rats after it was first metabolized by the organism (Bos, et al. 1987). The lack of oral and inhalation exposure data make it difficult to determine toxicity in humans from these routes. Total creosote concentrations were not determined, but the following are some of the major constituents detected at the site that contribute to the toxicity of creosote.

PAHs are major constituents of creosote. Some PAHs are carcinogenic, such as benzo[a]anthracene and benzo[a]pyrene and have been related to the carcinogenic characteristics of creosote (U.S. EPA 1987). Studies have documented that PAHs induce tumors of the skin, lung, and other epithelial tissues and have been summarized by the EPA (1980a).

Noncarcinogenic Components. Noncarcinogenic PAHs such as phenanthrene, anthracene, and fluorene are also found in creosote. Fluoranthene, like most other noncarcinogenic PAHs, has a relatively low LD_{50} of 2 g/kg (oral) and 3.2 g/kg (dermal). However, application of fluoranthene to mouse skin previously exposed to a carcinogenic PAH (e.g., benzo[a]pyrene) has greatly enhanced the carcinogenic effects (U.S. EPA 1980b). No reference dose values have been determined for noncarcinogenic PAHs. Exposure to high concentrations of PAHs may produce noncarcinogenic effects including widespread tissue damage to proliferating tissues such as skin, intestinal epithelium, and lymphoid organs.

Phenol is also a constituent of creosote. Although present in low concentrations, phenol and phenolic-derivations of tar acids have been related to the acute toxicity of creosote (Gosselin, et al. 1984). Phenol itself is known to cause severe skin burns upon dermal contact and is rapidly absorbed through the skin. Systemic effects may result from this absorption or other routes of acute exposure and include paleness, weakness, stomach disturbances, shock and possibly death. Phenol has been shown to increase the carcinogenic effects of PAHs and other carcinogens when applied simultaneously to the skin of a mouse (Casarett and Doull 1986). The chemical skin burns and systemic effects that were reported in children cleaning up the Little Menomonee River may have been caused by the phenolic compounds in creosote.

Dose-Response Relationships

Toxicity is dependent upon the dose or concentration of the substance (i.e., the dose-response relationship). Critical toxicity values are a quantitative expression of the dose-response relationship for a chemical. Critical toxicity values take the form of reference doses and cancer potency factors, both of which are specific to exposure routes.

Two primary sources of toxicity values were used. The primary source is the U.S. EPA's Integrated Risk Information System (IRIS) database

(U.S. EPA, 1989b). IRIS is the U.S. EPA's repository of agencywide verified toxicity values. If a toxicity value was not available through IRIS, then the Quarterly Update of the Health Effects Assessment Summary Table (HEAST) issued by the EPA's Office of Research and Development (U.S. EPA 1989g) was consulted. Cancer potency factors for arsenic and benzo[a]pyrene were taken from other U.S. EPA sources (U.S. EPA 1988b and U.S. EPA 1980a).

Reference Dose. The toxicity value describing the dose-response relationship for noncarcinogenic effects is the reference dose (RfD). The U.S. EPA RfD Work Group (U.S. EPA 1989b) defines RfDs as follows:

> In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is generally expressed in units of milligram per kilogram of body weight per day (mg/kg/day).

The RfDs used in this assessment are presented in Table K-5. This assessment uses the term RfD to describe all of the toxicity values for noncarcinogenic effects. Some of the RfDs listed in the HEAST update have also not yet undergone the agencywide verification process that values in IRIS have.

RfDs for some inorganic compounds are for specific forms (e.g., hexavalent and trivalent chromium). The TAL analyses do not, however, report concentrations of specific forms, but rather give results in terms of "total" inorganic chemical. In such situations, it was assumed that unless otherwise known, the most toxic form is present and its RfD used.

Cancer Potency Factor. The dose-response relationship for carcinogens is expressed as a carcinogenic potency factor or slope factor. Carcinogenic potency factors are presented in units of the inverse of milligrams of chemical per kilogram of body weight per day. The potency factors used in this assessment are summarized on Table K-5.

The data used for estimating the dose-response relationship are taken from lifetime animal studies or human occupational or epidemiological studies where excess cancer risk has been associated with exposure to the chemical. In animal studies, it is assumed that if a carcinogenic response occurs at the dose levels used in the study, then a response will occur at all lower doses. For practical reasons, low levels of risk cannot be measured directly, either by animal experiments or epidemiologic studies (U.S. EPA 1984a). Use of cancer potency factors inherently assumes that cancer risk is probalistic and any degree of exposure leads to some degree of risk.

Table K-5
TOXICITY VALUES
MOSS-AMERICAN SITE

	Ingestion Route:				Inhalation Route:				Ingestion Route:			Inhalation Route:		
Chemical	U.S.EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source	Date	U.S.EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source	Date	Reference Dose (RfD) mg/kg/day	Source	Date	Reference Dose (RfD) mg/kg/day	Source	Date
Acetone	-	-	-	-	-	-	-	-	0.1	IRIS	7-1-89	-	-	-
Antimony	-	-	-	-	-	-	-	-	0.0004	IRIS	3-1-88	-	-	-
Arsenic	A	1.75	e	-	A	50	IRIS	6-1-88	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	0.05	IRIS	8-1-89	0.0001	HEAST	7-1-89
Benzene	A	0.029	IRIS	2-1-88	A	0.029	IRIS	2-1-88	-	-	-	-	-	-
Benzo(a)anthracene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Benzo(b)fluoranthene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Benzo(k)fluoranthene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Benzoic acid	-	-	-	-	-	-	-	-	4	IRIS	8-1-89	-	-	-
Benzo(a)pyrene	B2	11.5	a	d	B2	6.1	d	d	-	-	-	-	-	-
Benzo(g,h,i)perlyene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Beryllium	-	-	-	-	B2	8.4	IRIS	9-7-88	0.005	IRIS	9-7-88	-	-	-
bis(2-Ethylhexyl)phthalate	B2	0.014	IRIS	9-7-88	-	-	-	-	0.02	IRIS	8-1-89	-	-	-
2-Butanone	-	-	-	-	-	-	-	-	0.05	IRIS	3-1-88	0.09	HEAST	7-1-89
Butyl benzyl phthalate	-	-	-	-	-	-	-	-	0.2	HEAST	7-1-89	-	-	-
Cadmium	-	-	-	-	B1	6.1	IRIS	3-1-88	0.0005	IRIS	10-1-89	-	-	-
Carbon disulfide	-	-	-	-	-	-	-	-	0.1	IRIS	2-1-89	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	0.03	HEAST	7-1-89	0.005	HEAST	7-1-89
Chloroform	B2	0.0061	IRIS	-30-88	B2	0.081	IRIS	-30-88	0.01	IRIS	8-30-88	-	-	-
Chromium III	-	-	-	-	-	-	-	-	1	IRIS	8-1-88	-	-	-
Chromium VI	-	-	-	-	A	41	IRIS	3-1-88	0.005	IRIS	3-1-88	-	-	-
Chyrsene	C	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Coal Tars	-	-	-	-	ND	2.2	HEAST	7-1-89	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	0.037	f	-	-	-	-
Creosote	B1	-	IRIS	3-1-88	B1	-	IRIS	3-1-88	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	0.02	b	b	-	-	-
Dibenz[a,h]anthracene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-
Dibutyl phthalate	-	-	-	-	-	-	-	-	0.1	IRIS	9-7-88	-	-	-
1,1-Dichloroethene	C	0.091	HEAST	7-1-89	-	-	-	-	0.1	HEAST	7-1-88	0.1	HEAST	7-1-89
Diethyl phthalate	-	-	-	-	-	-	-	-	0.8	IRIS	9-7-88	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-	-	0.002	IRIS	3-1-88	-	-	-
Ethylbenzene	-	-	-	-	-	-	-	-	0.1	IRIS	9-7-88	-	-	-
Indeno(1,2,3-cd)pyrene	B2	11.5	d	d	B2	6.1	d	d	-	-	-	-	-	-

Table K-5
TOXICITY VALUES
MOSS-AMERICAN SITE

	Ingestion Route:				Inhalation Route:				Ingestion Route:			Inhalation Route:		
Chemical	U.S.EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source	Date	U.S.EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source	Date	Reference Dose (RfD) mg/kg/day	Source	Date	Reference Dose (RfD) mg/kg/day	Source	Date
Lead	-	-	-	-	-	-	-	-	g	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	0.2	HEAST	7-1-89	0.0003	HEAST	7-1-89
Mercury (inorganic)	-	-	-	-	-	-	-	-	0.0003	HEAST	7-1-89	-	-	-
4-Methyl-2-pentanone	-	-	-	-	-	-	-	-	0.05	IRIS	7-1-89	0.02	HEAST	7-1-89
Naphthalene	-	-	-	-	-	-	-	-	0.4	HEAST	7-1-89	-	-	-
Nickel	-	-	-	-	-	-	-	-	0.02	IRIS	3-1-88	-	-	-
N-Nitrosodiphenylamine	B2	0.0049	IRIS	3-1-88	-	-	-	-	-	-	-	-	-	-
PAHs	B2/C	11.5	d	d	B2/C	6.11	d	d	-	-	-	-	-	-
Pentachlorophenol	-	-	-	-	-	-	-	-	0.03	IRIS	6-30-88	-	-	-
Phenol	-	-	-	-	-	-	-	-	0.04	IRIS	6-1-89	-	-	-
Selenium	-	-	-	-	-	-	-	-	0.003	HEAST	7-1-89	0.001	HEAST	7-1-89
Styrene	-	-	-	-	-	-	-	-	0.2	IRIS	6-30-88	-	-	-
2,3,7,8-TCDD (Dioxin)	B2	156000	HEAST	7-1-89	B2	156000	HEAST	7-1-89	-	-	-	-	-	-
Tetrachloroethene	B2	0.051	HEAST	7-1-89	B2	0.0033	HEAST	7-1-89	0.01	IRIS	3-1-88	-	-	-
Toluene	-	-	-	-	-	-	-	-	0.3	IRIS	6-7-89	1	HEAST	7-1-89
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	0.09	IRIS	6-1-89	0.3	HEAST	7-1-89
Vanadium	-	-	-	-	-	-	-	-	0.007	HEAST	7-1-89	-	-	-
Xylenes	-	-	-	-	-	-	-	-	2	IRIS	7-1-89	0.4	HEAST	7-1-89
Zinc	-	-	-	-	-	-	-	-	0.2	HEAST	7-1-89	-	-	-

a. Sources of Toxicity Values:
IRIS - Integrated Risk Information System. U.S. EPA 1989a.
SPHEM - Superfund Public Health Evaluation Manual. U.S.EPA 1986a.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989g.
HEAST(v) - Health Effects Assessment Summary Tables. Verified values awaiting entry into IRIS.

b. Cyanide value based on free cyanide.

c. Nickel value based on nickel-soluble salts.

d. Carcinoginic PAHs based on benzo[a]pyrene. Benzo[a]pyrene potency listed in The Ambient Water Quality Criteria Document for PAHs. U.S. EPA 1980a.

e. Based on Risk Assessment Council unit risk of 5E-5(l/ug) U.S. EPA 1988b.

f. Based on MCCG of 1.3 (mg/l).

g. RfD for lead under review. This assessment uses the AIC value of 0.0014 given in the Superfund Public Health Evaluation Manual.

The approach used by the U.S. EPA to estimate the carcinogenic potency factor from animal studies or human data assumes a dose-response relationship with no threshold. There is uncertainty and conservatism built into the EPA's risk extrapolation approach. EPA has stated that cancer risks estimated by this method produce estimates that provide a rough but plausible upper limit of risk; that is, it is not likely that the true risk would be much more than the estimated risk, but it could be considerably lower (U.S. EPA 1985d).

Benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3,c,d]pyrene are carcinogenic PAHs that do not have cancer potency factors. Guidance from the U.S. EPA has been to apply the cancer potency factor of benzo[a]pyrene for those chemicals (U.S. EPA 1980a, 1984b). This assessment follows that guidance.

ENVIRONMENTAL EFFECTS

PAHs are the primary chemicals detected at the Moss-American site that may pose an environmental concern. There are, however, no promulgated criteria or standards for PAHs for the protection of sensitive species of aquatic organisms or wildlife. A major review of the environmental effects of PAHs on wildlife and plants was conducted by Eisler (1987). The information presented in the following sections is derived primarily from that review.

Toxicity to Aquatic Organisms

Early indications of carcinogenicity and toxicity to animals and the common occurrence of PAH in petroleum, creosote, and combustion products has resulted in numerous studies of effects of mixtures and pure compounds of PAH on aquatic organisms. Much of the recent literature on toxicity of PAH has been reviewed by Eisler (1987). Toxic effects of the PAH compounds vary widely among compounds and among groups of aquatic organisms, but some generalizations can be derived from the studies reviewed by Eisler.

The impacts of PAH include examples of lethality from acute (short-term) and chronic (long-term) exposures to concentrations ranging form 30 to 150,000 µg/l of various compounds. Some compounds are extremely variable in toxicity to different animals. For example, the acute toxicity of naphthalene ranges from 920 to 150,000 µg/l while the single value reported for chronic toxicity was 50 µg/l (Eisler 1987, Table 5). However, reported acute toxicity values for other PAH compounds range from 250 to 5,800 µg/l.

Acute toxicities are generally well above concentrations found in water of environmental settings (Neff 1979) or even above the solubility of some compounds. However, concentrations of PAH in interstitial water (pore water)

in sediment containing high concentrations of PAH may approach or exceed toxic concentrations. For example, Socha and Carpenter (1987) found concentrations of 110 µg/l phenanthrene and 52 µg/l fluoranthene in pore water of heavily contaminated marine sediment (free creosote present). Those concentrations are up to 10 times higher than acutely toxic concentrations reported by Eisler (1987, Table 5), and above concentrations of fluoranthene that are toxic at chronic exposures (U.S. EPA 1986).

Lower concentrations of PAH can adversely affect behavior of aquatic animals. Reduced predatory ability of bluegill sunfish has been reported at 62 µg/l of fluorene (Boyle, et al. 1984; 1985; Finger, et al. 1985). Feeding by marine copepods was reduced at concentrations of naphthalene of 1,000 µg/l, while 50 µg/l was toxic over 10 days to 30 percent of the copepods (Berdugo, et al. 1977). Socha and Carpenter (1987) found concentrations of several PAHs up to 0.5 to 1.0 µg/l in pore water of creosote-contaminated marine sediment.

Particulate material in sediment that is ingested by aquatic animals can be an important means of exposure. Landrum and Scavia (1983) found that sediment-associated anthracene contributed about 77 percent of the body burden of a freshwater amphipod, *Hyallela azteca*. Lesser contributions from sediment sources (9 to 53 percent) were found for other amphipods (Landrum, et al. 1984).

PAHs that are carcinogenic to mammals are generally also carcinogenic to fish (Eisler 1987 and references therein). The mechanism of carcinogenesis appears to be similar in fish to that in mammals, in that some intermediate products of biodegradation in the liver are the actual carcinogens. Many aquatic invertebrates lack the enzyme systems for degrading PAH and appear to be at lower risk of cancer, but tend to bioconcentrate PAH to a greater extent. High incidences of tumors, particularly of the liver and skin, have been observed in several populations of marine and freshwater fish that live in close proximity to PAH contaminated sediment. One population of marine fish with a high incidence of PAH-induced tumors was also found to experience reduced ovarian development (Johnson, et al. 1988), an effect that could reduce reproduction.

In many cases, aquatic organisms from PAH-contaminated environments have a higher incidence of tumors and hyperplastic diseases than those from nonpolluted environments. Carcinogenic PAHs have not been unequivocally identified as the causative agent for an increased incidence of cancer in any natural population of aquatic organisms, according to Neff (1982). However, a growing body of evidence, mostly circumstantial, links PAHs to cancer in fish populations, especially bottom dwelling fish from areas with sediments heavily contaminated with PAHs (Baumann and Lech, in press).

Terrestrial Plants

Biological effects of PAHs on terrestrial vegetation have been reviewed by U.S. EPA (1980a), Lee and Grant (1981), Wang and Meresz (1982), Edwards (1983), and Sims and Overcash (1983). In general, these authors agreed on several points:

- Plants and vegetables can absorb PAHs from soils through their roots, and translocate them to other plant parts such as developing shoots. Lower molecular weight PAHs were absorbed by plants more readily than higher molecular weight PAHs.

- Aboveground parts of a vegetable, especially the outer shell or skin, contained more PAHs than underground parts. This was attributed to airborne deposition and subsequent adherence to the plant.

- PAH-induced phytotoxic effects were rare although the database for this subject is small.

- Most higher plants can catabolize benzo[a]pyrene and possibly other PAHs, but metabolic pathways are not clearly defined.

- The biomagnification potential of vegetation in terrestrial and aquatic food chains has not been determined.

Wildlife

Limited data were available on biological effects on reptiles and amphibians. Although some studies indicated the potential for carcinogenic effects from exposure to PAHs, amphibians are more resistant to PAH carcinogenics than mammals (Eisler 1987).

Eisler only found two articles on PAHs and avian wildlife, and both concerned mallards. One study showed no signs of mortality or visible signs of toxicity during exposure, although increased liver weight and blood flow to the liver were observed in mallards fed diets containing 4,000 mg/kg PAHs/kg (mostly naphthalenes, naphthenes, and phenanthrene) for 7 months. A second study measured embryo toxicity of various PAHs applied externally to the surface of mallard eggs.

Numerous PAH compounds are distinct in their ability to produce tumors in skin and in most epithelial tissues of almost all animal species tested. Malignancies were often induced by acute exposures to microgram qualities.

Acute and chronic exposure to various carcinogenic PAHs have resulted in destruction of hematopoietic and lymphoid tissues, ovotoxicity, antispermatogenic effects, adrenal necrosis, change in the intestinal and respiratory epithelina, and other effects. For the most part, however, tissue damage occurs at dose levels that would also be expected to induce carcinomas. There is a scarcity of data available on the toxicological properties of PAHs which are not demonstrably carcinogenic to mammals.

Unsubstituted aromatic PAHs with less than four condensed rings have not shown tumorigenic activity. Many but not all 4-, 5-, and 6-ring PAH compounds are carcinogenic. Only a few unsubstituted hydrocarbons with seven rings or greater are tumorigenic or carcinogenic.

EXPOSURE ASSESSMENT

This section identifies the means by which people or terrestrial and aquatic wildlife can come into contact with chemicals from the site. It addresses exposures under current site conditions and exposures that may result from potential use of the site and surrounding area in the future. This section also identifies the potential magnitude, frequency, and duration of exposures, and the routes by which the receptors may be exposed.

EXPOSURE PATHWAY ANALYSIS

An exposure pathway is the means by which a contaminant moves from a source to a receptor. A complete exposure pathway has five elements (Figure K-1):

- A contaminant source
- A mechanism for contaminant release
- An environmental transport medium
- An exposure point (receptor location)
- A feasible route of exposure

Exposure may occur when contaminants migrate from the site to an exposure point (i.e., a location where receptors can come into contact with contaminants) or when a receptor comes into direct contact with waste or contaminated media at the site. An exposure pathway is complete (i.e., there is exposure) if there is a way for the receptor to take in contaminants through ingestion, inhalation, or dermal absorption of contaminated media or waste.

Sources

The existing sources of contamination at the site are identified in Chapter 2. They include the surface soil and subsurface soil in the process area, the treated

tie storage area, the northeast landfill, and the southwest landfill. The sediments in the Little Menomonee River are also considered a source.

Factors Influencing Release and Transport

The behavior of the chemicals at the Moss-American site are influenced by physical and chemical conditions at the site and in the surrounding area. Their form, transport, and fate depend upon such factors as pH, temperature, soil moisture, oxidation-reduction potential, physiochemical properties of the surface and subsurface strata, water chemistry, and the macro and micro-organisms present. Table K-6 lists some of the important physical and chemical properties of the major chemical groups.

Release and Transport Mechanisms

Potential mechanisms for contaminant release and migration at the Moss-American site are:

- Release of contaminants to the atmosphere by volatilization or erosion and transport by the wind
- Leaching of contaminants into the groundwater and subsequent discharge to the Little Menomonee River
- Surface runoff of contaminants from the site into the Little Menomonee River
- Nonaqueous phase liquid transport
- Release of contaminants from the sediments of the Little Menomonee River and the movement of sediments

Releases to the Air. Contaminants in surface soils could be released from the site by erosion (wind or mechanical) or volatilization. Contaminants that tend to be bound to soil (i.e., have high K_{OC} values or low solubility) would be released to the air by erosion. This would include PAHs and inorganic chemicals. These contaminants are found in both portions of the site.

The site east of the river contains the area where creosote wastes were landfilled. There is no vegetative cover over this area, and it is possible for dust to be released both by the wind and mechanical resuspension. A path used by children riding dirt bikes run through by this area.

Most of the site west of the river contains some sort of cover that would limit dust release. The site has portions that are vegetated, covered with wet areas,

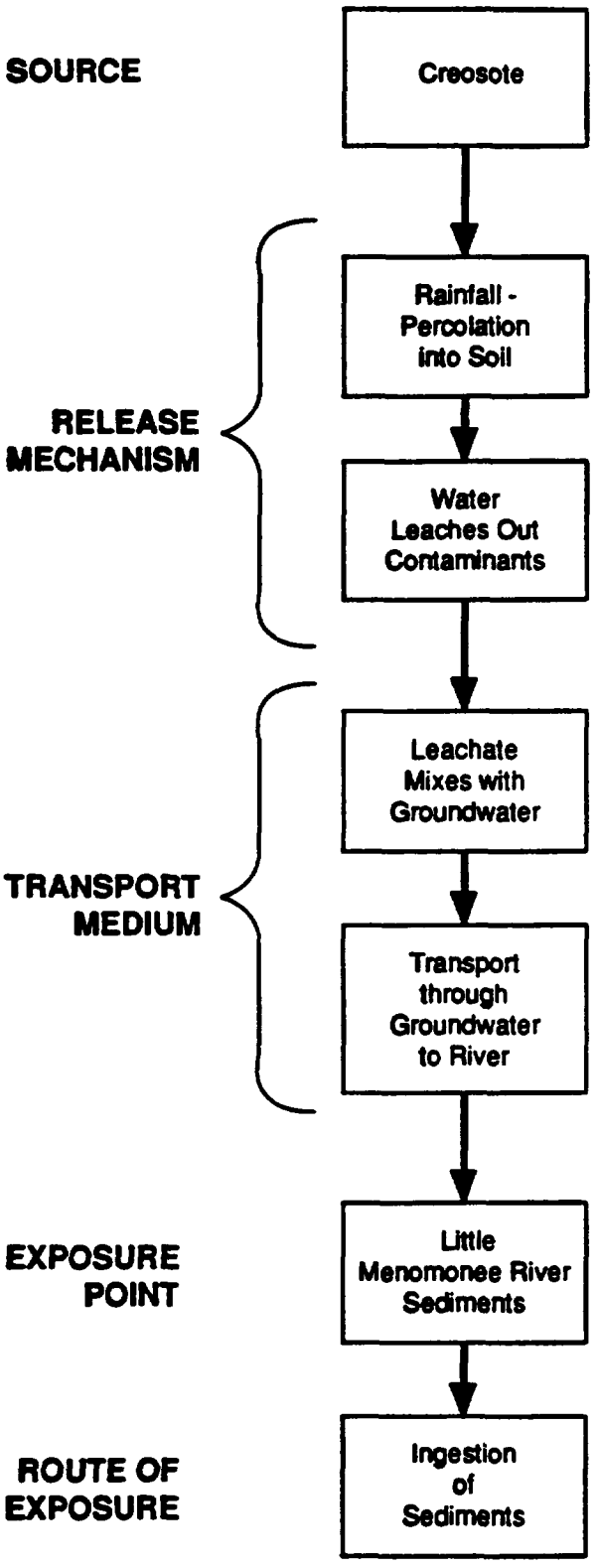


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FIGURE K-1
ELEMENTS OF A COMPLETE EXPOSURE PATHWAYS
MOSS-AMERICAN RI

Table K-6
PHYSICAL AND CHEMICAL PROPERTIES OF SELECTED CHEMICALS OF CONCERN

Chemical	Molecular[a] Weight (g/mole)	Vapor[a] Pressure (mm/Hg)	Solubility[a] in Water (mg/l @ 25°C)	Log[b,e] K_{ow}	K_{oc}[c,d] (ml/g)	Henry's Law[a] Constant (atm-m^3/mole)	Specific Gravity (at 20°C)
Polycyclic Aromatic Hydrocarbons (PAHs)							
Benzo[a]anthracene*	228	2.2×10^{-8}	5.7×10^{-3}	5.60	1,380,000	1.16×10^{-6}	1.27
Benzo[a]pyrene*	252	5.6×10^{-9}	3.8×10^{-3}	6.04	676,083[h]	1.55×10^{-6}	1.35
Benzo[b]fluoranthene*	252	5.0×10^{-7}	1.4×10^{-2}	6.06	550,000	1.19×10^{-5}	--
Benzo[k]fluoranthene*	252	5.1×10^{-7}	4.3×10^{-3}	6.06	550,000	3.94×10^{-5}	--
Chrysene*	228	6.3×10^{-9}	1.8×10^{-3}	5.61	200,000	1.05×10^{-6}	1.27
Dibenzo[a,h]anthracene*	278	1.0×10^{-10}	5.0×10^{-4}	6.80	3,300,000	7.33×10^{-8}	1.28
Indeno[1,2,3-cd]pyrene*	276	1.0×10^{-10}	5.3×10^{-4}	6.50	1,600,000	6.86×10^{-8}	--
Naphthalene	128	4.9×10^{-2}	34.0	3.37	1,300	2.40×10^{-4}	1.15
Phenanthrene	178	6.8×10^{-4}	1.0	4.46	14,000	1.59×10^{-4}	--
Benzene/Toluene/Xylene (BTX)							
Benzene	78	95.2	1.75×10^{-3}	2.12	83	5.59×10^{-3}	0.88
Ethylbenzene	106	7.0	1.52×10^{-2}	3.15	1,100	6.43×10^{-3}	0.87
Toluene	92	28.7	5.35×10^{-2}	2.69	300	6.37×10^{-3}	0.87
Xylene	106	10.0	1.98×10^{-2}	3.26	240	7.04×10^{-3}	0.86
Inorganics							
Cadmium	112	Negligible	Varies[i]	--	--	--	11.30
Lead	207	Negligible	Varies[i]	--	--	--	6.90 - 7.20
Zinc	65	Negligible	Varies[i]	--	--	--	3.25 - 3.50
Arsenic	75	Negligible	Varies[i]	--	--	--	5.70
Mercury	201	Negligible	Varies[i]	--	--	--	13.55

[a]U.S. EPA Treatability Manual, 1980. W.H.O., 1978.
[b]Log K_{ow} = Log of Octonal-water partition coefficient.
[c]K_{oc} = Organic carbon partition coefficient.
[d]Lyman, 1982.
[e]Verschueren, 1983.
[h]Calculated using regression formula: Log K_{oc} = 1.0; Log K_{ow} - 0.21.
[i]Solubility of inorganics is highly dependent on valance state and ionic strength of solution.

*Carcinogenic PAHs.

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covered with gravel, paved, or crusted with tar, because of these factors, so the wind-driven release of dust and gravel is not unlikely. There is some potential for release of dusts, especially when soil condition are dry, if dirt bikes are ridden across exposed areas.

Volatile organic compounds (such as benzene, ethylbenzene, toluene, and xylene) were detected in the subsurface soil. Chemical and physical properties of the volatile compounds include relatively high vapor pressures, Henry's law constants, and solubility in water and relatively low octanol-water and organic carbon partition coefficients. These chemicals could be released through volatilization and diffusion up through the soil or volatilization if site soils were excavated. The amount of volatile compounds released from undisturbed soil is expected to be low because the average concentration of these chemicals in the subsurface soil is low. For example the average concentration in the east landfill and western site are respectively, benzene--not detected and 4 µg/kg; ethylbenzene--29 µg/kg and 6 µg/kg; toluene--120 µg/kg and 41 µg/kg; and xylene 53 µg/kg and 5 µg/kg.

The semivolatile compounds such as PAHs are present in the subsurface soil at much higher concentrations than volatile compounds such as benzene. These chemicals, however, have relatively low vapor pressure, Henry's law constants, solubilities in water and relatively high octanol-water and organic carbon partition coefficient. Therefore, their potential to be released to the ambient area is limited.

To evaluate the potential for volatization from the western portion of the site, volatilization was modeled using a simple model based on Farmer and Shen (U.S. EPA 1988a). The methodology is described in Appendix L. It produces estimates of volatile emissions that are conservative for most conditions.

It was assumed that the source area was 100,000 m^2. The average contaminant concentration to a depth of 10 feet was used to describe the source term. Ambient air concentrations for both onsite and at a distance of 300 meters were estimated. (See Table L-1, Appendix L).

The highest onsite air concentration of a volatile compound was benzene at 3×10^{-6} mg/m^3. The onsite air concentration of total carcinogenic PAHs was estimated at 4×10^{-10} mg/m^3. The air concentrations 300 meters from the site are estimated to be 100 times less than the onsite concentrations. These levels suggest that volatilization to a minor contaminant release mechanism for this site.

Releases to Groundwater. Contaminants could also be transported from onsite soils through leaching to the groundwater. Inorganic chemicals and organic compounds could enter the groundwater as water infiltrates are the percolates

through contaminated soils. Once contaminants have entered the groundwater, one primary potential migration pathway exists. Groundwater could recharge the Little Menomonee River in the area adjacent to the site. Contaminants that migrate along this pathway could volatilize, precipitate, or sorb onto sediment. Another potential migration pathway could be the recharge of underlying aquifers by contaminated groundwater.

PAHs have a high molecular weight, an extremely low vapor pressure, low Henry's law constant, low solubility in water, and very high octanol-water and organic carbon partition coefficients. In general, these properties make PAH compounds relatively immobile and quite persistent in the environment. PAHs would therefore be expected to leach slowly from soils at the site because of their high affinity for sorption in most soils. Although the rate is expected to be extremely slow relative to other compounds detected at the site, PAHs could migrate once introduced into the groundwater at the site.

Benzene, toluene, xylene and other VOCs exhibit relatively high mobility and low persistence in the environment because their chemical and physical properties allow them to leach easily from contaminated soils and waste. Under existing site conditions, these compounds could leach from soils into the groundwater.

Releases to the Little Menomonee River. Contaminants can be released to the river by the discharge of shallow groundwater and surface runoff to the river. Contaminants may also discharge by nonaqueous phase liquid transport along the former ditch.

As discussed previously, contaminants can leach to the groundwater. The primary pathway for current releases from the site is groundwater. This pathway appears to be responsible for much of the current contaminant movement to the Little Menomonee River for both the soluble and free product phase. The shallow groundwater beneath the site is believed to move toward the river.

Contaminant velocities were estimated for the recent alluvium and weathered till at the site. The estimates were intended to quantify the relative mobility of the compounds of concern in groundwater. Retarded velocities were calculated using the log average hydraulic conductivities and the average hydraulic gradient of the site. Specific calculations are provided in Appendix I.

Table K-7 summarizes the retardation coefficients calculated for each compound and the retarded velocities of compounds along four distinct flow paths at the site (see Appendix J for the development of these values). Retarded velocities for PAH range from 7.0×10^{-4} to 1.25 ft/yr and for BTX compounds from 5.25×10^{-1} to 1.67 ft/yr in the recent alluvium and weathered Oak Creek till.

Table K-7
RETARDED VELOCITIES[a]

Compound	Rd[b]	V[c] = 4.71 ft/yr	V = 10.00 ft/yr	V = 4.20 ft/yr	V = 7.63 ft/yr
PAHs					
Benzo[a]anthracene	2440	0.0019 ft/yr	0.0041 ft/yr	0.0017 ft/yr	0.0031 ft/yr
Benzo[a]pyrene	1200	0.0039	0.0083	0.0035	0.0064
Benzo[b]fluoranthene	976	0.0048	0.0103	0.0043	0.0078
Benzo[k]fluoranthene	976	0.0048	0.0103	0.0043	0.0078
Chrysene	359	0.0131	0.0279	0.0117	0.0213
Dibenzo[a,h]anthracene	5827	0.0008	0.0017	0.0007	0.0013
Indeno[1,2,3-cd]pyrene	2828	0.0017	0.0035	0.0015	0.0027
Naphthalene	8	0.5888	1.2500	0.5250	0.9538
Phenathrene	31	0.1519	0.3226	0.1355	0.2461
BTXs					
Benzene	6	0.7850	1.6667	0.7000	1.2717
Ethylbenzene	8	0.5888	1.2500	0.5250	0.9538
Toluene	6	0.7850	1.6667	0.7000	1.2717
Xylene	6	0.7850	1.6667	0.7000	1.2717

[a]See Appendix J for the development of these values
[b]RD = Contaminant retardation coefficient
[c]V = Average linear velocity

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The velocity calculations indicate that the migration of contaminants in groundwater is very slow (7.0×10^{-4} ft/yr to 1.67 ft/yr). These estimates tend to support the observation of limited contamination found in groundwater at the site, with the exception of the free product found in monitoring wells MW-04S and MW-08S. The small amounts of contamination found in the solution of 5 of the 24 monitoring wells at the site were PAH compounds. These PAH compounds go into solution sparingly and migrate at very slow rates, which may be why they have not been detected in the Little Menomonee River.

Contamination was not observed in groundwater sampled from the intermediate and deep monitoring wells, indicating that migration of contaminants to the underlying bedrock aquifer has not occurred. The lack of contamination in groundwater at the site can also be partially explained by the physical properties associated with the PAH compounds (i.e., low solubility, low Henry's law constants, and high organic carbon partition coefficients).

Free product (primarily PAHs) was detected in monitoring well MW-8S, which is installed near the Little Menomonee River and the ditch formerly used to discharge wastewater into the river. During field work, free product was observed being emitted to the river from the area where the outfall of the settling ponds previously existed. It appears that the filled ditch and surrounding soils may act as a potential conduit for migration of free product from the site to the Little Menomonee River.

Contaminants at the site migrate in solution and as free product. The flux of contaminants entering the Little Menomonee River from groundwater in either phase cannot be quantified based on existing data.

Runoff is the other potential source of continued releases of contaminants to the river. Runoff from the site could carry contaminants to the river, either in dissolved form or sorbed on soil. The potential for this transport mechanism is low because of the relatively flat grade across the site and the vegetative cover that helps inhibit erosion.

BTXs could also be dissolved and transported to surface water by surface runoff. Under existing site conditions, the BTX compounds could leach from the soils into the groundwater or be transported to surface waters by runoff. Once in the surface water and exposed to aerobic and sunlit conditions, the compounds may be volatilized or oxidized and dispersed. BTXs bound to river sediments will be slowly released to surface waters.

Release and Transport from Sediments. Once contaminants have been transported to the Little Menomonee River sediments, several potential contaminant migration pathways exist. Contaminants in these sediments could dissolve, re-enter solution, and volatilize or migrate intact with scoured or

suspended sediment when streamflow is high. In this manner, contaminants could eventually be transported downstream to the Menomonee River. Based on the interpretation of site investigation results, this seems to have occurred.

Sediment contamination in the Little Menomonee River is best characterized by its erratic distribution. Based on field observations, the relatively insoluble PAHs sorbed to river sediments seem to be carried along the stream bottom and eventually to collect in sedimentation areas with low stream velocities. The interpretation of the analyses of onsite and downstream samples leads to the conclusion that some relatively insoluble PAHs partition into bottom sediments, while more soluble and volatile compounds such as naphthalene occur in the bottom sediments at a relatively lower concentration range.

Potential Exposure Pathways

Based on the analysis of potential contaminant migration and a review of the site setting, potential exposure pathways for the Moss-American site under current land use and potential future land use were identified and evaluated for their potential feasibility. The potential exposure pathways evaluated are illustrated in Figure K-2. The analyses of the pathways are summarized in Table K-8. The following exposure pathways were evaluated as the most feasible exposure pathways for the site:

- Exposure of recreational users (especially children) by direct contact of contaminated sediments in the Little Menomonee River
- Exposure of aquatic organisms and wildlife through direct contact of contaminated sediments in the Little Menomonee River
- Exposure of wildlife through consumption of aquatic organisms from the Little Menomonee River
- Exposure of site visitors under current conditions from the release of contaminants in the surface to the air by erosion
- Exposure of site visitors under current conditions by direct contact with contaminated surface soil
- Exposure of construction workers or future site users by direct contact with subsurface material exposed by site development

The following sections discuss the exposure pathways in greater detail.

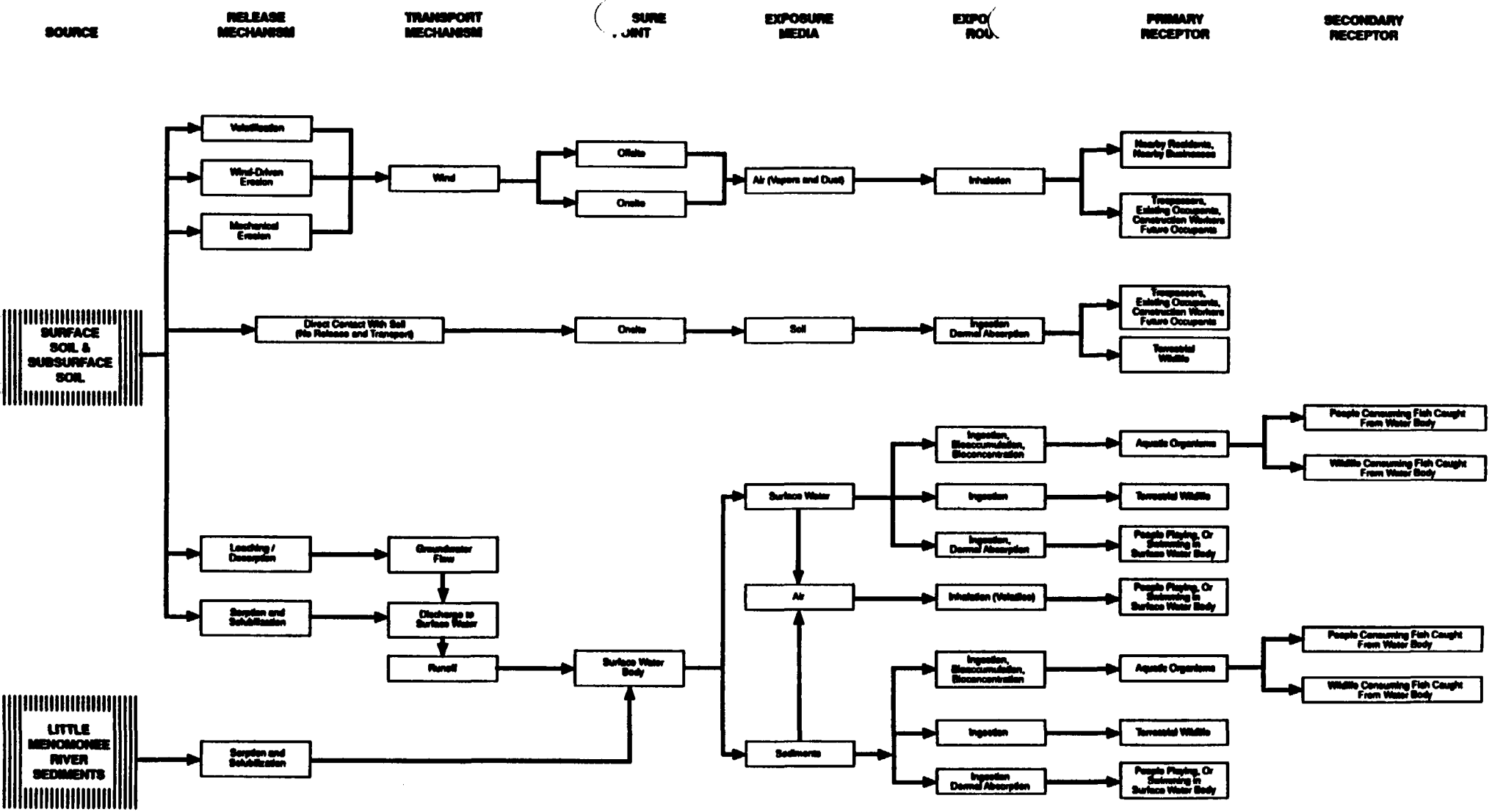

FIGURE K-2
POTENTIAL EXPOSURE ROUTES
MOSS-AMERICAN RI

Table K-8
POTENTIAL EXPOSURE PATHWAYS
MOSS-AMERICAN SITE

Source	Release Mechanism	Transport Medium	Exposure Point	Exposure Route	Potential Receptors	Exposure Pathway Retained for Evaluation?
SITE - CURRENT USE						
Contaminated surface soil and subsurface soil	Volatilization	Air	Onsite/Offsite	Inhalation	Site visitors, people at the fenceline, offsite residents, people at offsite businesses.	No. Estimates of potential volatilization indicate that releases from this mechanism are relatively low.
Contaminated surface soil	Wind-driven or mechanical erosion	Air	Onsite	Inhalation	Site visitors	Yes. Contaminants present in surface soil. The site is partially covered by vegetation and cement. Low potential for wind-driven emissions, however, use of dirt bikes by children may result in dust resuspension and exposure to these individuals.
Contaminated surface soil	Wind-driven or mechanical erosion	Air	Offsite	Inhalation	People at fenceline, offsite residents, people at offsite businesses.	No. Because of site cover wind-driven erosion has a low potential. Dirt bikes can periodically result in localized release of dust, however, contaminant concentration would be substantially diluted at offsite receptor locations. No receptors at fenceline except car facility. Nearest residences and businesses more than 1/4 mile away.
Contaminated surface soil	Exposure through direct contact with in place contaminants		Onsite	Ingestion	Terrestrial wildlife	Yes. Mammals and birds can come into direct contact with contaminated surface soil. Burrowing animals can contact subsurface soil.
Contaminated surface soil	No release or transport-exposure through direct contact		Onsite	Ingestion Dermal absorption	Site visitors	Yes. Site access is not completely restricted. There are indications of recreational use of the site.
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater	Onsite	Ingestion Dermal absorption	Onsite well users	No. No well current wells onsite or downgradient of site.
ONSITE - FUTURE USE						
Contaminated surface soil and subsurface soil	Wind-driven or mechanical erosion	Air	Onsite	Inhalation	Future site occupants	No. Subsurface and surface soils contaminated, however, development would result in most of the site being covered by lawn, pavement, or structures.
Contaminated surface soil and subsurface soil	No release or transport-exposure through direct contact with soils exposed by excavation.		Onsite	Ingestion Dermal absorption	Future site occupants	Yes. Site has potential for residential development although development as a park has greater potential given the current site use and ownership.
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater	Onsite	Ingestion Dermal absorption	Future site occupants	No. Shallow aquifer has insufficient yield for water supply. Existing water mains nearby can supply water to the site.
LITTLE MENOMONEE RIVER						
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater release to river.	Little Menomonee River (water)	Ingestion Dermal absorption	Recreational users of the Little Menomonee River	No. Discharge of contaminants has occured. Water has relatively low contaminants.
			Little Menomonee River (sedimen	Ingestion Dermal absorption	Recreational users of the Little Menomonee River	Yes. Discharge of contaminants has occured. Sediments are contaminated. Land area surrounding river is county park land.
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater release to river.	Little Menomonee River (water and sediment)	Ingestion Bioconcentration	Aquatic organisms	Yes. Aquatic organism inhabit waters, but in limited quantities and species type.

Table K-6
POTENTIAL EXPOSURE PATHWAYS
MOSS-AMERICAN SITE

Source	Release Mechanism	Transport Medium	Exposure Point	Exposure Route	Potential Receptors	Exposure Pathway Retained for Evaluation?
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater release to river.	Little Menomonee River (fish)	Ingestion	People who consume fish.	Yes. Some potential for fishing along the river although most fishing occurs upstream from the site. No data on PAH concentration in fish or frequency of fishing activities.
Contaminated surface soil and subsurface soil	Leaching and desorption	Groundwater release to river.	Little Menomonee River (fish)	Ingestion	Wildlife that consumes fish	Yes. Abundant wildlife utilize the river corridor.
Contaminated sediments in the Little Menomonee River	Volatilization	Air	Little Menomonee River	Inhalation	Recreational users	No. Although access to the river is not restricted, volatiles present in water and sediment are at relatively low concentrations.
Contaminated sediments in the Little Menomonee River	No release or transport – exposure through direct contact		Little Menomonee River	Dermal absorption Ingestion	Recreational users	Yes. River sediments are contaminated and seasonally exposed. Access to river is not restricted. River corridor is heavily used.
Contaminated sediments in the Little Menomonee River	No release or transport – exposure through direct contact		Little Menomonee River	Dermal absorption Ingestion	Wildlife	Yes. River sediments are contaminated and seasonally exposed. Abundant wildlife in area.
Contaminated sediments in the Little Menomonee River	Solubilization or suspension	water	Little Menomonee River	Ingestion Bioconcentration	Aquatic organisms	Yes. Aquatic life is present but intimited quantities and species type.
Contaminated sediments in the Little Menomonee River	Solubilization or suspension	water	Little Menomonee River	Ingestion	People who consume fish	Yes. Some potential for fishing along the river although most fishing occurs upstream from the site. No data on PAH concentration in fish or frequency of fishing activities.
Contaminated sediments in the Little Menomonee River	Solubilization or suspension	water	Little Menomonee River	Ingestion	Wildlife that consume fish.	Yes. Wildlife is abundant in the river corridor.

EXPOSURE PATHWAYS--LITTLE MENOMONEE RIVER

The 5-mile segment of the Little Menomonee River that extends from the site to the river's confluence with the Menomonee River is considered a primary environmental corridor. The land bordering the river is owned by the Milwaukee County Park District, and although most of the land is not formally a park, it is heavily used as a park area (Sullivan 1989). Figure K-3 illustrates the general land use of the area surrounding the Little Menomonee River and the Moss-American site. Surrounding the river are numerous residential subdivisions and a school.

A bike trail runs along the river corridor from Good Hope Road to the confluence of the river with the Menomonee River. The river corridor is heavily used by joggers, hikers, picnickers, and bird and wildlife watchers.

The river is not generally used for swimming because of its shallow depths and channelization, but it is possible for children to swim in the river (SEWRPC 1976). During the RI investigation a rope swing over the river was observed, indicating the use of the river for recreation and possibly swimming. Undeveloped portions of the river corridor could be developed into formal park facilities that could be used by more people than currently use it. The bike trails are to be extended to Appleton Avenue and Silver Spring Drive within the year (Sullivan 1989). The Southeastern Wisconsin Regional Planning Commission (SEWRPC) concluded that the potential for development of these areas as children's swimming sites is great because of the good access to the river.

Potential Human Exposures--Sediment

People engaging in activities such as hiking and swimming in or near the river could have contact with contaminated sediments. This contact could result in exposure through ingestion of sediment, dermal absorption of contaminants in the sediment, or inhalation of contaminants in the sediment.

The river level declines in some seasons, resulting in areas of dry, exposed sediments or sediments with shallow depth of water covering them. Children and adults who use the bike trails and park facility, as well as students walking home from school, may come in contact with the sediments. In 1971 high school students participating in a cleanup project developed chemical burns on their arms and legs after direct contact with the sediment (DNR 1985).

Potential Human Exposures--Surface Water

Inadvertent ingestion or direct contact with surface water by people swimming or working in the river, playing along its banks, or fishing along it could result in exposure to contaminants in the water. However, since very few contaminants were detected in the surface water of the river and those detected were at relatively low concentrations, these pathways do not appear to be major exposure pathways for this site.

Potential Human Exposures--Fish Consumption

People are known to fish upstream of the site. The wetlands area north of Brown Deer Road is suitable for sustaining fishable populations of sport fish (DNR 1985). Fish indigenous to the Little Menomonee River and Menomonee River are transient, especially seasonally. As such, fish in both adult and subadult life stages may be exposed to contaminated habitats and migrate to less contaminated areas, such as the area above Brown Deer Road, where they could be caught and consumed. Fishing is not restricted in the Little Menomonee River adjacent to and downstream from the site, and there are no data available to quantify the number of individuals who may fish there or the frequency of this activity.

There are no data available on potential contaminant concentrations in fish in the Little Menomonee River. Sampling and analysis of fish tissue was not part of the RI so the potential bioconcentration of PAHs from sediments and surface water cannot be estimated. Although PAHs have a high octanol water partition coefficient, often a predictor of bioconcentration potential in fish, fish metabolize PAHs limiting the amount of PAHs that could accumulate in fish tissues. Consequently, tissue concentrations would be substantially less than levels predicted from octanol water partition coefficients. While consumption of fish from the river is possible, exposures from this pathway are not quantifiable.

Potential Aquatic/Terrestrial Wildlife Exposures

Aquatic organisms in the river could come into contact with contaminants in solution or sorbed to solids. They may also be exposed to contaminants when water containing the chemicals passes over their gill surfaces, when they ingest water, or when they ingest other organisms that have incorporated contaminants. The first mechanism is termed "bioconcentration." The mechanisms associated with dietary intake are referred to as "bioaccumulation."

Terrestrial organisms that feed on aquatic organisms that have incorporated contaminants may also be exposed, as would people who consume fish from the river. Fish populations are limited in the river downstream of the site because of the lack of suitable habitat, but migrating or spawning organisms could be

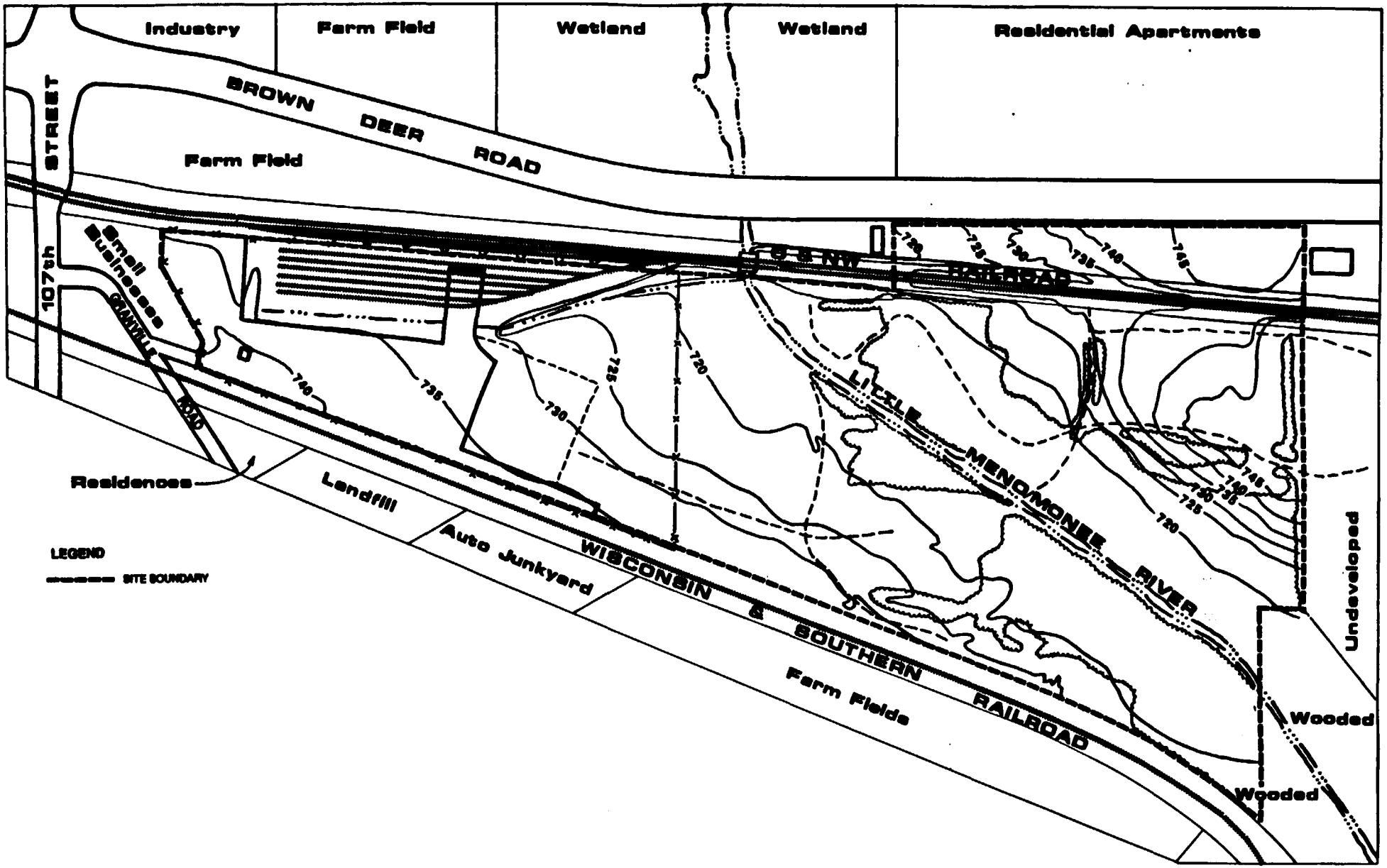

FIGURE K-3
LAND USE MAP
MOSS-AMERICAN RI

exposed. Small numbers of benthic organisms and macroinvertebrates are also present.

Many wildlife such as deer, raccoon, opossum, rabbit, mink, waterfowl, and songbirds use the river as a food and water resource. Terrestrial wildlife can come into contact with contaminated soil, ingest plants that have taken up contaminants, or become coated with creosote. Birds or mammals could become exposed through the food chain by ingesting other organisms that also have contact with the river.

EXPOSURE PATHWAYS ONSITE

Exposures onsite could occur as a result of direct contact with contaminants or the inhalation of contaminates released to the ambient air. This assessment considers the potential exposures under current site conditions as well as exposures associated with future development of the site.

Current Site Conditions

The Moss-American site is easily accessible and located in an urban area (Figure K-4). The portion of the site east of the Little Menomonee River is bounded by Brown Deer Road on the north and on the east by an area being developed commercially. It has trails that are frequently used by teenagers as dirt bike trails. The site west of the river consists of an open unfenced area and a fenced automobile storage and loading facility. The area nearest the river is heavily vegetated, undeveloped land that is not fenced and has unrestricted access. It is owned by the Milwaukee County Park District. The park-like appearance of the area may encourage recreational use of the site.

Site visitors would most likely be children. Exposure could result from direct contact with the soil resulting in inadvertent ingestion or dermal absorption of contaminants. Additionally, teenagers who ride dirt bikes on the site could be exposed through inhalation of dust. It is possible that both the east area and west unfenced areas may be used as a park by children and even adults.

An automobile storage and loading facility is located on the far western section of the site. The original process area was located there and is now covered with a gravel parking lot. The storage area is separated from the rest of the site by a chainlink fence. Because the area is covered, neither site visitors nor workers at the facility are expected to be exposed. The workers at the automobile facility could come in contact with the unfenced areas of the site, but there is currently no work-related reason for them to be there.

Site Development

Development of the site for residential, recreational, or commercial purposes could present situations in which people would have direct contact with contaminants. The degree of exposure potential posed by any of these situations depends on the specific use of the site.

The site is owned by Milwaukee County Park District, and it may be developed into a formal park facility. If the site is used for recreation, exposure could occur from contact with contaminants in the site surface. Exposure in a recreation setting would be similar to exposure in trespass setting except for two major differences. First, park development may require landscaping, which could limit direct exposure or minor excavations to construct baseball diamonds and restroom facilities, which could increase the potential for direct contact exposure. Second, either type of park development may attract more people to the site than would be attracted if the land remained undeveloped.

Both commercial and residential development of the site would require the excavation of subsurface material for building foundations and utility lines. Excavation could expose buried waste and contaminated soil. If left in place on the surface, future site occupants could come into contact with it.

Commercial or light industrial development, such as a warehouse, shopping plaza, or office park, would have relatively low potential for direct contact. Access to contaminants would be limited because much of the site would be covered by the building and parking lot. Potentially exposed individuals would most likely be maintenance personnel or utility workers.

Residential site use would have a greater potential for direct exposure than other uses. Gardens and lawns may provide ready access to contaminants present in the surface soil. People could be exposed through a variety of outdoor activities including gardening and play activities. Studies at other Superfund sites have indicated that contaminant levels in indoor dust are similar to those found in contaminated outdoor soil (ICF 1986; Binder, et al. 1985). Therefore, direct contact exposures could occur year round. Small children (toddlers) are most likely to be exposed in the indoor setting.

POTENTIALLY EXPOSED POPULATIONS

Land use in the area surrounding the Moss-American site and the Little Menomonee River is approximately 48 percent agricultural, 13 percent woodlands, 10 percent industrial, and the remainder recreational parkland and residences (U.S. EPA 1977). However, residential development has incurred in this area over the past 10 years. The population was estimated to be between 3,500 to 10,000 persons per square mile in 1970 (SEWRPC 1976), and further

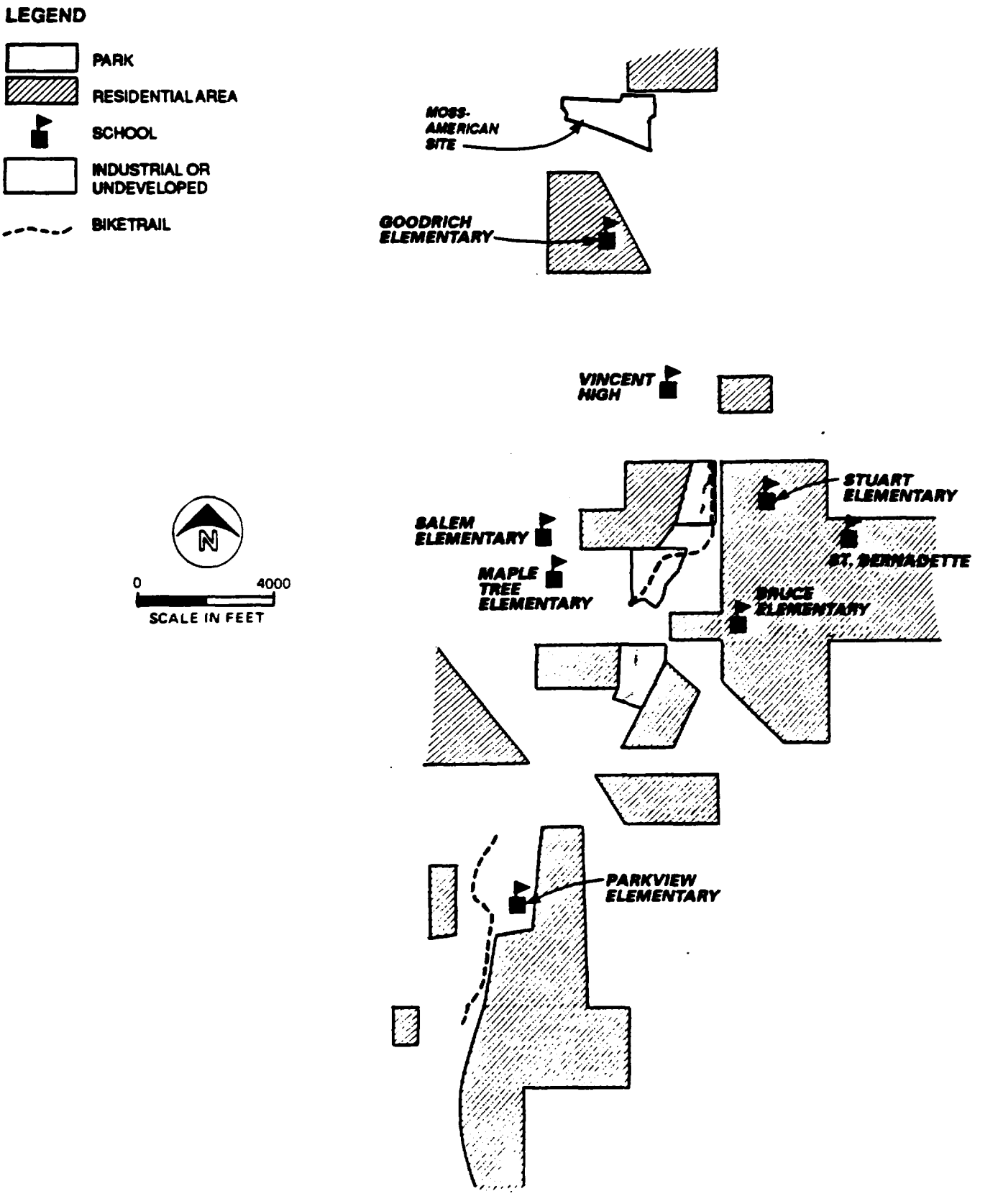

FIGURE K-4
LAND USE MAP
MENOMONEE RIVER
MOSS-AMERICAN RI

residential development of this area has increased this number in the past 10 years.

The primary population at risk of exposure to site-related contamination under current site conditions are visitors to the site. This would most likely be children who live nearby and use the site for recreational purposes such as hiking and dirt bike riding. Workers at the automobile storage facility may also come into minimal contact with contaminated surface soil. If the site is further developed, construction workers and future occupants such as recreational users or residents of the site may also be exposed through direct contact with subsurface soils. The site and areas south of Brown Deer Road are classified by the Milwaukee County Park District as underdeveloped parkland since they are large enough to be developed into a usable park facility (Sullivan 1989).

The Wisconsin DNR (1985) has concluded that land use in the Little Menomonee Watershed is 60 percent rural and 40 percent urban, with most of the urban use in Milwaukee County. The river south of Brown Deer Road is classified by the DNR as an intermediate fish and aquatic life stream capable of supporting tolerant to very tolerant forage fish and macroinvertebrates. Boating is limited because of inadequate river flow in some areas, but children may use rafts and other flotation devices (SEWRPC 1976).

Since the Milwaukee County Park District owns the land surrounding the river, there is a potential for people to come to the park from other communities. A paved bike path extends north for 3 miles adjacent to the Little Menomonee River beginning at the confluence with the Menomonee River. This path was used by Milwaukee County for a biking event in 1976 (Emerick 1989). Many dirt trails also lie adjacent to the river. Soccer playing fields are located in the landscaped parks between Silver Spring Drive and Hampton Avenue. These park areas have high intensity use on an informal basis according to the Milwaukee County Park District (Sullivan 1989). A 1970 survey (SEWRPC 1976) listed the four most important recreational activities associated with the entire Menomonee watershed to be swimming, picnicking, fishing, and target shooting. Forty-three percent of recreational activities were water-based. People participating in these activities or other outdoor activities such as picnicking, jogging, hiking, and bird watching may also come in contact with the river.

The most heavily urbanized areas are on the Little Menomonee River area near Fond du Lac Avenue and Silver Spring Drive (Figure K-3). Residential areas border the parks along the river. The population in those areas has the greatest potential for exposure to sediments in the Little Menomonee River as access to the river is unrestricted. The children who attend the many schools located along the river also have a potential of coming in contact with the river while walking to and from school.

The site is not directly adjacent to residential areas. The land use north of the site along and north of Brown Deer Road is primarily commercial. People using the commercial establishments along Brown Deer Road have little reason to enter the site. The railroad tracks directly north and southwest of the site may serve to restrict access to the site from those directions. Commercial development of the land east of the site may also limit access from that direction.

In contrast, the Little Menomonee River, the surrounding wooded areas, and county park lands to the south may attract people toward the area of the site. Along the lower reaches of the Little Menomonee River there are residential areas adjacent to the site as well as developed park land that can provide potential receptors. The group most likely to come onto the site or play along the river banks are children and teenagers. The summer months would be time of the year when the most site visits would be made. Adults could also come onto the site. Although there was some indication of one individual attempting to spend extended periods of time on the site, the most typical adult visit is presumed to be on weekends.

Weather conditions can limit trespass exposures by discouraging outdoor activities as well as reducing exposures while onsite. For example, snow covered or frozen soil would reduce or eliminate direct contact exposures as well as prevent airborne releases. The number of days with frozen soil conditions or with precipitation can give some indication of the number of potential exposure days. On average in Milwaukee, there are 139 days per year with temperatures below 32°F. (i.e., frozen soil) and 77 days per year with precipitation greater than 0.01 inch (National Weather Service--Mitchell Field).

PUBLIC HEALTH RISK CHARACTERIZATION

This section presents an evaluation of the potential risks to public health associated with the Moss-American site. Exposure situations are evaluated by estimating the carcinogenic and noncarcinogenic risk associated with them. The estimation of risks assumed that exposure remains constant over the exposure periods assessed (i.e., contaminant concentrations and intake levels are constant). Where appropriate, exposure media concentrations are also compared to standards and criteria for protection of human health.

RISK ESTIMATION METHODOLOGY

This section summarizes the approach used in developing the human health risk estimates presented in this section. Appendix L presents a description of the methodology used.

Noncarcinogenic Effects

Noncarcinogenic risk is assessed by comparison of the estimated daily intake of a contaminant to its RfD. This comparison serves as a measure of the potential for noncarcinogenic health effects. To assess the potential for noncarcinogenic effects posed by multiple chemicals, a "hazard index" approach has been adopted (U.S. EPA 1986c). The method assumes dose additivity. The estimated daily intake of each chemical by an individual route of exposure is divided by its RfD and the resulting quotients are summed to provide a hazard index. When the index exceeds one, there is potential for a noncarcinogenic health risk.

If the estimated daily intake for any single chemical is greater than its reference dose, the hazard index will exceed unity. The hazard index can exceed unity even if no single chemical's daily intake exceeds its reference dose. In this situation, to determine if there is potential for a health risk the chemicals in the mixture are segregated by similar critical effect or target organ. Separate hazard indexes are derived for each effect, and if any of the separate indexes exceed unity there is potential for a noncarcinogenic health risk.

Carcinogenic Effects

The potential for carcinogenic effects is evaluated by estimating excess lifetime cancer risk. Excess lifetime cancer risk is the incremental increase in the probability of developing cancer during one's lifetime over the background probability of developing cancer (i.e., if no exposure to site contaminants occurs). For example, a 1×10^{-6} excess lifetime cancer risk means that for every 1 million people exposed to the carcinogen throughout their lifetime (typically assumed to be 70 years), the average incidence of cancer is increased by one case of cancer. Because of the methods followed by U.S. EPA in estimating cancer potency factors, the excess life cancer risks estimated in the assessment should be regarded as upper bounds on the potential cancer risks rather than accurate representations of true cancer risk.

While synergistic or antagonistic interactions might occur between carcinogens and other chemicals at the site, especially PAHs, there is insufficient information in the toxicological literature to predict the effects of such interactions. Therefore, consistent with EPA guidelines on chemical mixtures (U.S. EPA 1986c), carcinogenic risks were treated as additive in the assessment.

RISK ESTIMATION

The exposure assessment section identified the potential exposure pathways associated with the Moss-American site. Based on that analysis three exposure settings were defined to describe potential exposures for current site conditions

and future potential site use. These exposure settings were used to evaluate the health threats from the Moss-American site. They are:

- Current conditions--onsite trespass setting
- Current conditions--river recreational setting
- Future use--residential development setting

The factors used in estimating exposure include the frequency and duration of exposure, the magnitude of exposure, the point of exposure, the route of exposure, and the concentrations at the point of exposure. The methodology for calculating exposures is presented in Appendix L.

In this assessment, exposure point concentrations were estimated by direct measurement at a point of potential contact, except for airborne dust which was modeled. The highest detected contaminant concentrations and mean contaminant concentrations were estimated. To estimate a mean concentration, at least 10 percent of the samples had to be positive for the contaminant of concern. One-half the contract required detection limit was used in the calculation of mean concentrations when a chemical was reported as "not detected."

Acute exposures to contaminants are not quantitatively addressed because no methodologies are currently available. Acute effects, (e.g., skin burns) are addressed qualitatively. This acute effect has been related to the phenolic compounds in creosote. However, as discussed in Chapter 3, phenols were not frequently detected in the sediment which may be due to limitations in the analytical methods used.

Current Conditions--Onsite Trespass Setting

The exposure pathway analysis indicated that exposures under existing conditions would be a result of individuals coming onto the site. This activity will be termed "trespass," although use of this term is not meant to imply trespass in the legal sense. The trespass exposure setting is used to evaluate whether health threats exist under existing site conditions.

Exposure Assumptions. Trespass is an intermittent type of exposure. There is no standard exposure settings to describe trespass exposures. People would not be expected to come onto the site daily. The frequency of exposure will depend on such factors as site access, proximity of the site to residential areas or other areas of human activity, seasonal considerations, weather conditions, and attractiveness of the site.

To assess the potential exposures to people under the trespass setting, assumptions describing potential exposures were made. An average of 40 site

visits per year was assumed for the individual most exposed. This corresponds approximately to two visits per week in the summer and one visit per week in the spring (April and May) and fall (September and October). An average of 2 hours is assumed to be spent onsite per visit. It is assumed exposure occurs for 10 years. Exposure assumptions are summarized in Table K-9.

The exposure routes associated with trespass that were evaluated include:

- Direct contact with surface soil resulting in incidental ingestion of contaminated soil
- Direct contact with surface soil resulting in dermal absorption of contaminants in soil
- Inhalation of contaminants bound to airborne dust

For direct contact with surface soil, a typical soil ingestion rate 0.1 g/day was assumed. This ingestion rate is based on recent guidance from U.S. EPA (U.S. EPA 1989c). It was assumed that 100 percent of the contaminants bound to the soil are bioavailable. For soil, this is probably a conservative assumption. Contaminants bound to soil tend to be less bioavailable than contaminants in an aqueous solution, but estimates of bioavailability of contaminants bound to soil are not readily obtainable.

Dermal absorption exposure was not estimated because of the considerable uncertainties associated with such an estimate. An illustrative, conservative estimate of dermal absorption exposure was made for comparison to ingestion exposures. While subject to substantial uncertainty, conservative estimates of potential dermal absorption exposure were substantially less than estimates of potential exposure through to ingestion (see Appendix L). Consequently, potential exposure through the dermal absorption route was not quantitatively estimated in this assessment.

It was assumed that the greatest release of dust to the air would occur when children ride dirt bikes across the site. Individuals with the greatest exposure to dust would be the people riding the dirt bikes. Although it is likely that children would not ride dirt bikes as often as people trespass onto the site, the same assumptions regarding frequency of exposure used for direct contact by trespassers were used to estimate inhalation risks. This should result in a conservative estimate of inhalation risks. Dust was assumed to be 100 percent respirable. Inhalation rates of 20 l/min and 13 l/min were assumed to be representative for adults and children engaged in light activities, respectively (ICRP 1974).

Table K-9
EXPOSURE ASSUMPTIONS
MOSS-AMERICAN SITE

Target Receptor	Route	Intake Rate	Body Weight	Frequency
Trespass Setting				
Child	Ingestion	0.1 g/day	35-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	0.1 g/day	70-kg	40 days/yr 10 yrs
Child	Inhalation	13 l/min	35-kg	-
Adult	Inhalation	20 l/min	70-kg	-
Individual used for lifetime cancer risk estimate	Inhalation	20 l/min	70-kg	2 hr/day 40 days/yr 10 yrs
Residential Setting				
Toddler	Ingestion	0.2 g/day	15-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	Age 1-5: 0.2 g/day Age 6-70: 0.1 g/day	70-kg	365 days/y 70 yrs
Recreational Setting				
Child	Ingestion	0.1 g/day	35-kg	-
Adult	Ingestion	0.1 g/day	70-kg	-
Individual used for lifetime cancer risk estimate	Ingestion	0.1 g/day	70-kg	40 days/yr 10 yrs

Noncarcinogenic risks are evaluated by comparing daily chemical intakes to RfDs. Because trespass exposures are intermittent, averaging exposure over a lifetime or an extended period may underestimate noncarcinogenic risks. In this assessment, the daily chemical intake during an exposed day was estimated and used as the basis for evaluation. The daily chemical intake is in milligrams of contaminant per kilogram of body weight per day (mg/kg/day). Noncarcinogenic risks from trespass exposures were evaluated for a 10-year child (35-kg body weight) and an adult (70-kg body weight).

To evaluate exposure to carcinogens, exposures over a lifetime yielded an average chemical intake in milligrams of contaminant per kilogram of body weight per day (mg/kg/day). Carcinogenic risk from trespass exposure was evaluated for an individual weighing 70 kg with a 70-year lifetime.

Concentrations. Onsite exposures in the trespass setting would result from direct contact with surface soil and inhalation of dusts. No samples were taken that represent strictly surface soil (i.e., the top several inches). The samples that were used to represent trespass exposure were those taken from shallow test pits.

These samples were used for the following reasons. The site history does not indicate any subsurface disposal of creosote. Consequently, contamination found below the site surface are a result of spills and drippings from treated rail ties. There is evidence of visible surface contamination. While the site contains fill material, the fill is from or before the time of site operation, therefore the site surface is same as the site surface during operations. Based on this information, samples taken from the test pits are used as representative of the surface soil. Test pit samples from areas currently paved or covered by gravel were not used. The samples and concentrations used to estimate onsite trespass exposure are presented on Table K-10.

To evaluate onsite trespass exposures, the site was divided into regions east and west of the river. The area east of the river is the landfill disposal area. Evaluation of the eastern area was based on the results of limited sampling in the portion of the site where dredgings from the drainage ditch were landfilled. Consequently, risks estimated from those data are conservative and represent only a small subset of the eastern portion of the site. The area west of the river extends from the river west up the automobile storage area fenceline.

Dust may be released to the air by the wind or by mechanical erosion (i.e., dirt bikes). Potential dust levels were modeled using the mass balance approach (see Appendix L). In this approach, ambient dust levels were assumed to be 100 $\mu g/m^3$. Furthermore, contaminant concentrations in the dust were assumed to be the same as in the surface soil.

Table K-10
Concentrations Of Contamiants To Estimate Exposure
Soil Ingestion Exposure - Trespass Setting
Moss-American Site

	East Site Concentrations (ug/l)		West Site Concentrations (ug/l)	
CHEMICAL	Highest Detected Concentration	Geometric Mean Concentration	Highest Detected Concentration	Geometric Mean Concentration
Acetone	b	b	210	36
Arsenic	5600	4490	110000	7780
Barium	85300	82762	197000	98628
Benzene	b	b	11	4
Benzo(a)anthracene	170000	2893	380000	8418
Benzo(b)fluoranthene	78000	2232	270000	9050
Benzo(k)fluoranthene	78000	2232	240000	8714
Benzo(a)pyrene	71000	2163	200000	5673
Beryllium	1100	978	1400	1010
Cadmium	6700	6125	75900	1010
Chromium	26500	25008	29700	13484
Chrysene	190000	3003	490000	11448
Copper	31900	27028	50000	18517
Dibenzo(g,h,i)perylene	12000	1190	51000	3790
2,4-Dinitrophenol	b	b	620000	a
Ethylbenzene	1600	24	240	12
Indeno(1,2,3-cd)pyrene	13000	1228	49000	3387
Lead	14800	10606	411000	60430
Manganese	729000	651926	407000	225443
Mercury	1300	603	1400	379
Naphthalene	1500000	5979	66000	11103
Nickel	30900	29256	21700	15904
Styrene	2600	29	b	b
Toluene	1300	206	580	171
1,1,1-Trichloroethane	19000	56	b	b
Vanadium	34500	33537	22400	17686
Xylenes	1400	50	120	8
Zinc	128000	124451	9760000	735438

(a) This chemical detected in less than 10% of samples taken.
No estimate of a mean concentration made.
(b) Not detected.

Trespass Risks. The estimation of trespass risks for both east and west site locations is presented in Appendix M, Tables M-1 to M-12. A summary of this assessment based on average and highest detected concentrations is presented in Table K-11.

No estimated intakes by ingestion exceeded RfDs for the eastern section of the site for highest or average concentrations. Total excess lifetime cancer risks by ingestion were 3×10^{-4} for highest detected concentrations and 5×10^{-6} for geometric mean concentrations. Carcinogenic PAHs were detected in surface soil samples and contributed the most to the carcinogenic risks. The highest detected concentrations of PAHs were in the east landfill area.

A comparison of estimated ingestion intakes to RfDs for the western site area showed no RfDs to be exceeded for either adult or child exposure. However, the hazard index exceeded one for highest concentrations for both adult and child ingestion. Cadmium, 2,4-dinitrophenol, and lead are the primary contributors to the hazard index value. However, because these chemicals do not have similar toxic effects they can not be assumed to be additive. Therefore, the segregation of these chemicals suggest no potential for noncarcinogenic effects. Further, the chemical 2,4-dinitrophenol was detected in only one sample (SS113), located near the discharge ditch.

Excess lifetime cancer risk estimates associated with the western site area range from 5×10^{-4} (for highest detected concentrations) to 2×10^{-5} (for geometric mean concentrations). The risks are attributed primarily to PAHs. The highest concentrations were detected near the former drainage ditch and treated storage area.

No estimated chemical intakes through inhalation exposures exceeded the RfDs on the east or west side of the site. The excess lifetime cancer risks from inhalation exposures ranged from 2×10^{-6} to 4×10^{-8} (highest detected and mean concentration respectively) for the western site area and 3×10^{-6} to 1×10^{-7} (highest detected and mean concentration, respectively) for the eastern site area.

A conservative approach was taken in making assumptions that describe potential human exposures resulting from the Moss-American site. The trespass setting assumed that under current site conditions children or adults could use the site informally for recreation. The number of times they might come to the site is unknown. An intermittent exposure at a frequency of 40 times per year was assumed to be a conservative outer bound to describe recreational use.

The application of toxicity values is another example of the use of conservative assumptions to address uncertainty. Because there are no toxicity values based on intermittent exposure, the toxicity values used in the assessment are based on long-term or chronic exposure. These values were used to assess both the

Table K–11
Summary of Onsite Trespass Risks
Moss–American Site

		Noncarcinogenic Risks			Carcinogenic Risks – Ingestion		Carcinogenic Risks – Inhalation	
Exposure Setting	Concentration	Target Population	Ingestion Hazard Index	Inhalation Hazard Index	Chemicals Exceeding RfD	Total Ingestion Excess Lifetime Cancer Risk	Major Chemicals	Total Inhalation Excess Lifetime Cancer Risk	Major Chemicals
East	Highest Detected	Child	0.15	0.14	None	-	-	-	-
	Geometric Mean	Child	0.11	0.014	None	-	-	-	-
	Highest Detected	Adult	0.073	0.012	None	3E–04	PAHs(a)	2E–06	PAHs(a)
	Geometric Mean	Adult	0.055	0.011	None	5E–06	PAHs(a)	4E–06	PAHs(a)
West	Highest Detected	Child	2.4	0.023	None	-	-	-	-
	Geometric Mean	Child	0.24	0.008	None	-	-	-	-
	Highest Detected	Adult	1.2 b	0.018	None	5E–04	PAHs(a)	3E–06	PAHs(a)
	Geometric Mean	Adult	0.12	0.006	None	2E–05	PAHs(a)	1E–07	PAHs(a)

Exposure Assumptions:
Noncarcinogenic Risks – 36 kg body weight (child), 70 kg body weight (adult), 0.1 g/day soil intake.
child inhalation rate 13 l/min, adult inhalation rate 20 l/min.
Carcinogenic Risks – 70 kg body weight, 0.1 g/day soil intake, 2–day/wk, 20–wks/yr, 10 years.

a. PAHs include benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene chrysene, dibenz[a,h]anthracene, indeno[1,2,3–cd]pyrene.
b. No individual chemical intake exceeds RfD. When hazard indexes are re–estimated by health effect, no subindexes exceed 1.

intermittent trespass and continuous residential exposure. Applying these values to intermittent exposures was conservative from the standpoint of health protection.

Dermal contact is the most probable route of exposure, but that route was not evaluated quantitatively. A conservative sample estimate of dermal absorption from direct contact was made (Appendix L) to compare with estimates from ingestion. The comparison indicated that the intake of chemicals from dermal exposure would be an order of magnitude less than that resulting from ingestion exposures. Although the potential for acute exposure effects from dermal exposure is probable, the route is not addressed. No methodologies are currently available to address acute exposures. Further, there are no data that relate concentrations of creosote constituents to the potential for skin burns.

One final source of uncertainty is associated with PAH toxicity. The majority of the chemicals detected onsite were PAHs. Except for benzo[a]pyrene, there are insufficient data for developing cancer potency factors for PAHs. Following U.S. EPA guidance, the cancer potency factors for all carcinogenic PAHs were assumed to be the same as benzo[a]pyrene. Studies have indicated that benzo[a]pyrene is the most potent of the PAHs, so the application of this potency factor to other PAHs may result in an overestimate of risks. This apparent conservatism may be balanced by the identified potential for synergistic interaction between PAHs. The carcinogenicity of some PAHs may be enhanced in the presence of others.

Noncarcinogenic PAHs make up the majority of the contaminants present at the site, but most do not have RfDs. They have low toxicity, but their contribution to overall site risks cannot be quantified and is a major uncertainty in the risk assessment.

Future Use--Residential Development Setting

The future use exposure setting is used to evaluate public health threats that may be associated with any change in the site use or conditions. Although the site currently has a mixed use--open land and automobile storage--it is feasible that the land use may change to include residential or commercial development. Since part of the site is owned by the county it could be used as park land.

Because land use cannot be predicted accurately, the EPA has suggested that a "reasonable maximum exposure scenario" be used to assess future exposures (U.S. EPA 1988b). A residential use would be the most restrictive use (i.e., the use with the most potential exposures), so it was adopted as the future use evaluated in this assessment.

Exposure Assumptions. Assumptions were made to describe a potential residential exposure setting (see Table K-9). It was assumed that residential exposure occurs daily over an entire lifetime. This assumption is conservative in that it assumes indoor contact with contaminated dust is similar to outdoor contact with contaminated soil.

The routes of exposure associated with residential development of the site that are evaluated include:

- Direct contact with outdoor surface soil and indoor dust resulting in incidental ingestion of contaminants
- Direct contact with outdoor surface soil and indoor dust resulting in dermal absorption of contaminants in soil and dust

For direct contact with surface soil and indoor dust, a typical soil ingestion rate of 0.2 g/day was assumed for children aged 1 to 6 and 0.1 g/day for older children and adults. These ingestion rates are based on recent EPA guidance (U.S. EPA 1989a). As in the trespass setting, it is assumed that 100 percent of the contaminants bound to the soil and dust are absorbed upon ingestion.

Dermal absorption exposures are not explicitly estimated but are assumed to be less than those for ingestion (see Appendix L). Inhalation of soil and dust is assumed to be minor, unlike the current setting where dirt bikes and other activities can cause dust release. A residential use would not have the same potential for mechanical erosion and would lead to more of the site being covered than currently (i.e., by lawns, driveways, and structures).

Noncarcinogenic risks from residential exposures were evaluated for a small child/toddler (15-kg body weight) and an adult (70-kg body weight). Carcinogenic risk from residential exposures were evaluated for an individual weighing 70 kg with a 70-year lifetime.

Concentrations. Onsite exposures in the residential setting would result from direct contact with contaminants in the surface soil. Residential development of the site could require the excavation of subsurface material for building foundations and utility lines. Excavation could expose contaminated subsurface material. If left in place on the surface, residents could come into contact with the material. The contaminant levels present in the surface would depend on the location of the excavation, the amount of material excavated, and the deposition of excavated material.

This assessment based future residential soil contamination concentrations on all onsite test pit samples and soil borings to a depth of 15 feet (the approximate limit of potential building foundation excavation). The samples and

concentrations used to estimate residential exposure are presented on Table K-12.

To evaluate residential exposures at the site, the site was divided into two regions, as mentioned above. The area east of the river is the land disposal area; the other extends west from the river and includes the current automobile storage area fenceline.

Risk Estimates. The risk estimates for site development are presented in Appendix M, Tables M-13 to M-18. Noncarcinogenic and carcinogenic risks are summarized in Table K-13.

No estimated intakes exceeded RfDs for noncarcinogens for the eastern site area. Estimated risks for the highest detected and geometric mean concentrations were 2×10^{-2} and 2×10^{-4}, respectively. PAH concentrations detected in the east landfill area contributed to the estimated lifetime cancer risk.

No estimated intakes for mean concentrations exceeded the RfDs for development of the western section. However, the RfDs for cadmium, lead and 2,4-dinitrophenol were exceeded for highest detected concentrations. 2,4-dinitrophenol was detected in only one sample and was not included for the average concentrations.

Carcinogenic PAHs detected in the surface and subsurface samples contributed most to the carcinogenic risks. The excess lifetime cancer risks ranged from 4×10^{-2} (highest detected concentrations) to 3×10^{-4} (geometric mean concentrations). Contaminants detected in the former drainage ditch, process area, treated storage area, and west landfill contributed the most to risk.

The future uses of the site are uncertain. The future site use evaluated in this assessment was residential development. Although it is not the most likely use, it is feasible. The evaluation of this setting produced a conservative upper bound on risks associated with future site uses.

Current Conditions--River Recreational Setting

The exposure pathway analysis indicated that exposures under existing conditions would be a result of individuals engaged in activities along the Little Menomonee River. There is direct and indirect evidence to demonstrate these activities, which are referred to here as "recreational." The recreational exposure setting was used to evaluate whether health threats exist at the river on the basis of existing conditions.

Table K-12
Concentrations Of Contamiants To Estimate Exposure
Soil Ingestion Exposure – Residential Development Setting
Moss-American Site

CHEMICAL	East Site Concentrations (ug/kg) Highest Detected Concentration	East Site Concentrations (ug/kg) Geometric Mean Concentration	West Site Concentrations (ug/kg) Highest Detected Concentration	West Site Concentrations (ug/kg) Geometric Mean Concentration
Acetone	120	a	370	60
Arsenic	6800	4695	71400	4482
Barium	183000	58263	197000	62253
Benzene	b	b	100	4
Benzo[a]anthracene	190000	2675	380000	1802
Benzo[b]fluoranthene	87000	3274	270000	1466
Benzo[k]fluoranthene	78000	1707	250000	1009
Benzo[a]pyrene	71000	1736	230000	1315
Benzoic Acid	230	a	810	212
Beryllium	1200	409	1300	491
Bis(2-ethylhexyl)phthalat	460	a	1600	265
Cadmium	6900	5315	75900	4952
Chromium	26500	20789	81200	15696
Chrysene	460	2524	510000	1864
Copper	36600	25659	137000	24814
Dibenz[a,h]anthracene	b	b	24000	452
Dibenzo(g,h,i)perylene	12000	1050	77000	977
1,1-Dichloroethane	210	a	b	b
2,4-Dinitrophenol	b	b	620000	a
Dioxin (equivalent)	0.28	-	0.001	-
Ethylbenzene	4100	29	450	6
Indeno(1,2,3-cd)pyrene	13000	1065	78000	927
Lead	31000	14926	519000	21609
Manganese	841000	517778	828000	328182
Mercury	1300	239	3900	247
Methylene chloride	b	b	10000	6
Naphthalene	2600000	6549	1800000	2135
Nickel	30900	24181	21900	15254
Styrene	9300	36	380	4
Toluene	2000	120	580	41
1,1,1-Trichloroethane	19000	a	11	11
Vanadium	38200	25948	34900	13719
Xylenes	1700	53	1100	5
Zinc	219000	130310	9760000	285190

(a) This chemical detected in less than 10% of samples taken.
No estimate of a mean concentration made.

(b) Not detected.

Table K–13
Summary of Residential Development Risks
Moss–American Site

			Noncarcinogenic Risks		Carcinogenic Risks – Ingestion	
Exposure Setting	Concentration	Target Population	Ingestion Hazard Index	Chemicals Exceeding RfD	Total Ingestion Excess Lifetime Cancer Risk	Major Chemicals
East	Highest Detected	Child	0.92	None	–	–
	Geometric Mean	Child	0.49	None	–	–
	Highest Detected	Adult	0.089	None	2E–02	PAHs(a)
	Geometric Mean	Adult	0.051	None	2E–04	PAHs(a)
West	Highest Detected	Child	12	Cadmium, lead 2,4–dinitrophenol	–	–
	Geometric Mean	Child	0.5	None	–	–
	Highest Detected	Adult	1.3 b	None	4E–02	PAHs(a)
	Geometric Mean	Adult	0.054	None	3E–04	PAHs(a)

Exposure Assumptions:
Noncarcinogenic Risks – Child: 35 kg body weight 0.2 g/day soil intake.
– Adult: 70–kg body weight, 0.1 g/day soil intake.
Carcinogenic Risks – Lifetime average: 70 kg body weight, 0.1 g/day soil intake.
Exposure daily for 70 years.

a. PAHs include benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, indeno[1,2,3–cd]pyrene.

b. No individual chemical intake exceeds RfD. When hazard indexes are re–estimated by health effect, no subindexes exceed 1.

Exposure Assumptions. The same exposure assumptions used to describe trespass exposures onsite (except for inhalation of dust) are used to define recreational exposures along the river. While it is possible that exposures may be more frequent along the river than for the site given the proximity to residences and the park setting, the two settings were treated the same for the purpose of this assessment. The exposure assumptions are summarized in Table K-9.

The routes of exposure associated with recreational exposures along the river that were evaluated include:

- Direct contact with river sediments resulting in incidental ingestion of contaminated sediment
- Direct contact with river sediment resulting in dermal absorption of contaminants in sediments

The river is part of county park lands. It is assumed that in the future the corridor along the Little Menomonee River will remain undeveloped parkland. Consequently, the recreational exposure defined here also applies to the potential recreational exposures in the future.

Concentrations. Offsite exposures in the recreational setting would result from direct contact with the river sediment. Although the sediments are some times underwater, it was assumed that there would be ready access to the sediments, especially in periods of low stream levels. For exposures to contaminated sediments in the Little Menomonee River, the river was divided into mile long segments (river miles) (Figure K-5).

The highest detected contaminant concentrations per river mile were used to represent the high exposure point concentrations for individual river miles. Average exposure point concentrations were estimated by calculating the geometric mean for detected concentrations of contaminants within a river mile. Since contaminants in the sediments are not distributed uniformly throughout the river, the mean sediment concentrations of contaminants within a river mile may be more representative of a typical exposure than the highest detected sediment concentration within the river mile. The use of the highest detected concentrations may overestimate actual exposures, but it may be used to approximate an upper end of potential exposures. Concentrations used to estimate exposures are presented in Table K-14.

Risk Estimates. The estimation of the recreational river risks are presented in Tables M-19 to M-33. A summary of the results of this assessment are presented in Table K-15.

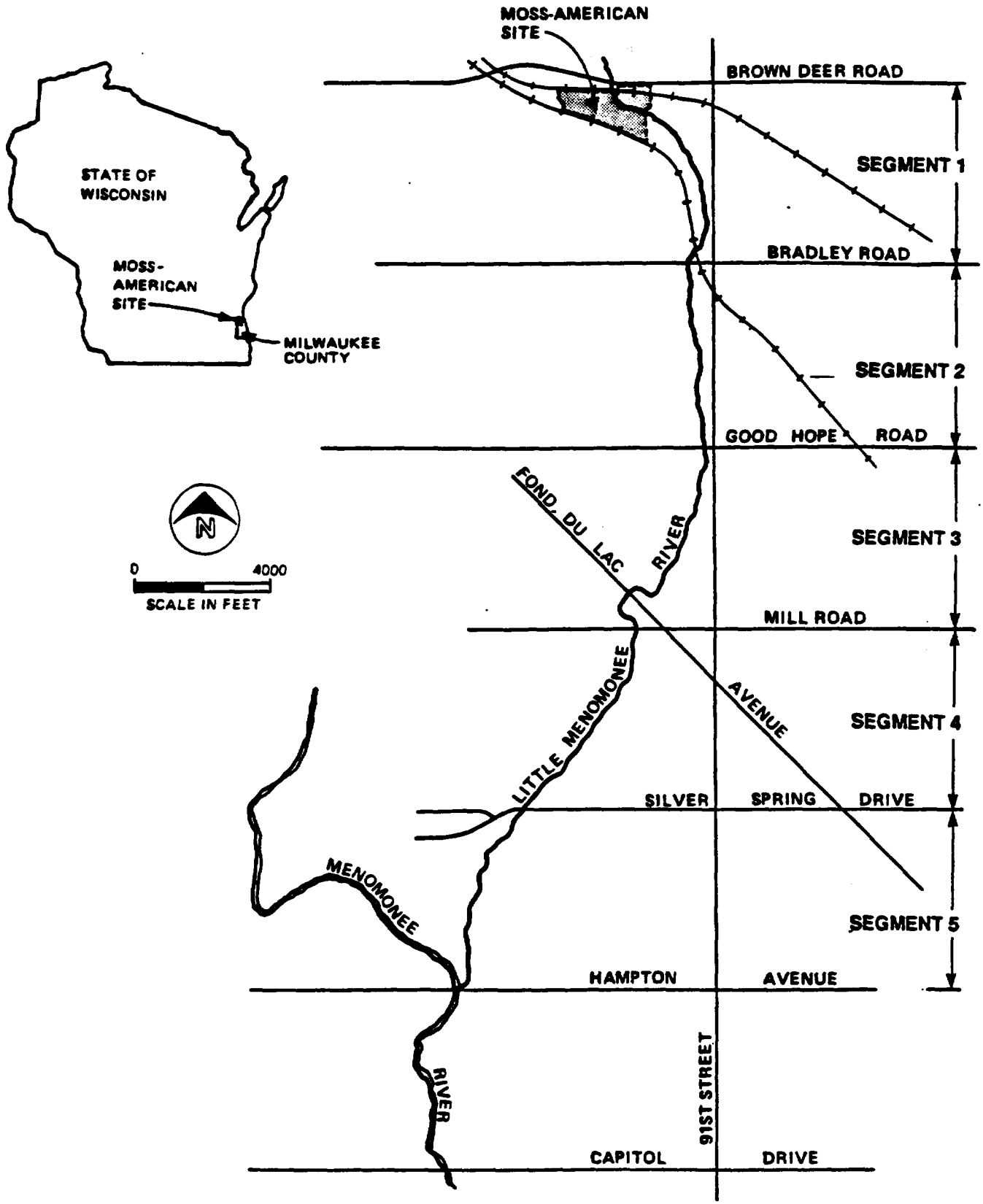

FIGURE K-5
RIVER SEGMENTS
LITTLE MENOMONEE RIVER
MOSS-AMERICAN RI

Table K-14
Concentrations Of Contamiants To Estimate Exposure
Sediment Ingestion Exposure - Recreational Exposure Setting
Moss-American Site

	Stream Reach 1 Concentrations (ug/kg)		Stream Reach 2 Concentrations (ug/kg)		Stream Reach 3 Concentrations (ug/kg)		Stream Reach 4 Concentrations (ug/kg)		Stream Reach 5 Concentrations (ug/kg)	
CHEMICAL	Highest Detected Concentration	Geometric Mean Concentration	Highest Detected Concentration	Geometric Mean Concentration	Highest Detected Concentration	Geometric Mean Concentration	Highest Detected Concentration	Geometric Mean Concentration	Highest Detected Concentration	Geometric Mean Concentration
Acetone	32000	3300	260	260	2100	2100	-	-	-	-
Antimony	1100	1100	1700	1100	-	-	-	-	-	-
Arsenic	8000	4200	5100	4000	7000	6200	10000	8000	4000	4000
Barium	92000	80000	93000	80000	96000	81000	82000	48000	780000	60000
Benzo[a]anthracene	140000	26000	97000	18000	190000	22000	88000	4000	4000	2000
Benzo[b]fluoranthene	84000	22000	4000	9000	58000	9400	44000	3400	20000	1600
Benzo[k]fluoranthene	41000	9100	83000	5800	68000	6000	17000	1600	30000	1300
Benzo[g,h,i]perylene	14000	6300	14000	3400	24000	1700	2900	1600	3400	1600
Benzo[a]pyrene	84000	22000	6700	8000	84000	6700	37000	3100	20000	1600
Benzoic Acid	-	-	-	-	-	-	600	600	2300	2000
Beryllium	1100	910	1300	800	7100	710	-	-	-	-
2-Butanone	87	87	87	87	-	-	-	-	-	-
Butylbenzylphthalate	-	-	-	-	-	-	-	-	720	720
Cadmium	14000	7100	7000	5000	7100	6000	6200	4000	8000	5100
4-Chloroaniline	-	-	-	-	-	-	-	-	-	-
Chloroform	600	200	420	120	-	-	-	-	-	-
Chromium	22000	19000	18000	18000	24000	21000	24000	16000	33000	28000
Chrysene	180000	19000	81000	9300	110000	16000	38000	4200	3400	2700
Copper	32000	26000	29000	22000	29000	24000	27000	20000	48000	30000
Dibenz[a,h]anthracene	1600	1300	-	-	-	-	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	-	-	-
2,4-Dinitrophenol	-	-	-	-	-	-	-	-	-	-
Dioxin (equivalents)	-	-	-	-	0.00014	0.00014	0.74	-	0.004	0.004
Ethylbenzene	730	110	3	3	240	160	4	4	-	-
Indeno(1,2,3-cd)pyrene	23000	4300	26000	4000	9100	2300	4400	1100	3400	1600
Lead	110000	32000	53000	34000	110000	63000	19000	88000	210000	170000
Manganese	680000	460000	730000	500000	950000	800000	680000	880	460000	400000
Mercury	430	120	300	160	420	300	310	300	420	300
Methylene chloride	33000	8400	12000	4200	1400	800	-	-	-	-
Naphthalene	380000	140000	11000	4700	310000	8400	-	-	-	-
Nickel	-	-	-	-	24000	21000	19000	18000	24000	21000
Selenium	-	-	-	-	-	-	1300	1300	-	-
Styrene	-	-	-	-	-	-	-	-	-	-
Toluene	950	99	230	160	-	-	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-
Vanadium	31000	26000	29000	22000	30000	26000	23000	21000	23000	21000
Xylenes	-	-	-	-	-	-	-	-	-	-
Zinc	2200000	670000	91000	47000	350000	310000	360000	260000	490000	380000

Table K-15
Summary of Recreational Use Risks
Little Menomonee River

			Noncarcinogenic risks - Ingestion		Carcinogenic risks - Ingestion	
Stream Mile	Concentration	Target Population	Ingestion Hazard Index	Chemicals Exceeding RfD	Excess Lifetime Cancer Risk	Major Chemicals
1	Highest Detected	Child	0.46	None	-	-
	Geometric Mean	Child	0.16	None	-	-
	Highest Detected	Adult	0.20	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.08	None	3E-05	PAHs (a)
2	Highest Detected	Child	0.21	None	-	-
	Geometric Mean	Child	0.14	None	-	-
	Highest Detected	Adult	0.10	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.07	None	2E-05	PAHs (a)
3	Highest Detected	Child	0.32	None	-	-
	Geometric Mean	Child	0.26	None	-	-
	Highest Detected	Adult	0.16	None	1E-04	PAHs (a)
	Geometric Mean	Adult	0.13	None	2E-05	PAHs (a)
4	Highest Detected	Child	0.12	None	-	-
	Geometric Mean	Child	0.23	None	-	-
	Highest Detected	Adult	0.06	None	5E-05	PAHs (a)
	Geometric Mean	Adult	0.12	None	5E-06	PAHs (a)
5	Highest Detected	Child	0.56	None	-	-
	Geometric Mean	Child	0.47	None	-	-
	Highest Detected	Adult	0.30	None	3E-05	PAHs (a)
	Geometric Mean	Adult	0.23	None	3E-06	PAHs (a)

Exposure Assumptions:
Noncarcinogenic Risks – Child: 35 kg body weight, 0.1 g/day soil intake
– Adult: 70 kg body weight, 0.1 g/day soil intake
Carcinogenic Risks – 70 kg body weight, 0.1 g/day soil intake
Exposure duration: 2 days/week for 20 weeks/year, 10 years

a. PAHs include benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo[g,h,i]perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene

A comparison of estimated intakes to RfDs has shown that no RfDs were exceeded for any river mile. This evaluation suggests that there does not appear to be a potential chronic noncarcinogenic risk from ingestion exposure to noncarcinogens.

Carcinogenic PAHs were detected in all stream miles of the Little Menomonee River. The excess lifetime cancer risks levels for all stream miles ranged from 1×10^{-4} (highest detected concentration) to 3×10^{-6} (mean concentration). The carcinogenic PAHs were the major contributors to the risk estimates. The highest estimated risks were associated with river miles 1, 2, and 3, for which the risk estimates were the same. The excess cancer risk levels ranged from 1×10^{-4} (for highest detected concentrations) to 2×10^{-5} (for geometric mean concentrations). All river miles had estimated risks greater than 1×10^{-6}.

A conservative approach was taken in making assumptions that describe potential human exposures resulting from contact with contaminated sediments. The trespass setting assumed that under current conditions children or adults could use the river informally for recreation. The number of times they might be in contact with the river is unknown, but an intermittent exposure at a frequency of 40 times per year was assumed to be a conservative outer bound for recreational use.

The application of toxicity values is another example of the use of conservative assumptions to address uncertainty. Because there are no toxicity values based on intermittent exposure, the toxicity values used in the assessment were based on long-term or chronic exposure. These values were used to assess the intermittent trespass or recreational exposure. Applying these values to intermittent exposures was conservative from the standpoint of health protection.

Dermal contact was not quantitatively evaluated but it is the most probable route of exposure to sediments. A conservative sample estimate of dermal absorption from direct contact was made to compare with estimates from ingestion (Appendix L). The comparison indicated that the intake of chemicals from dermal exposure would be an order of magnitude less than that resulting from ingestion exposure.

The effects from acute dermal exposure to contaminants in the sediments is a potential concern. In 1971 teenagers who came into contact with river sediments received skin burns, as did laboratory workers conducting tests in the late 1970s. Burns associated with creosote are typically the result of phenolic compounds; however, phenols were rarely detected in the sediment or soil samples taken in the RI. As discussed in Chapter 3, analytical methods routinely used may not be adequate to quantify phenolic concentrations. Even if they were quantifiable, there are no data that relate concentrations of creosote constituents to the potential for skin burns from contact with creosote

constituents. Additionally, no current methods are available for quantitatively evaluating acute exposure risks. In the absence of these data and recognizing the site's history and the presence of creosote, the continued potential for burns is assumed.

One final source of uncertainty is associated with PAH toxicity. The majority of the chemicals detected onsite were PAHs. Except for benzo[a]pyrene, sufficient data do not exist for developing cancer potency factors for PAHs. Following U.S. EPA guidance, the cancer potency factors for all carcinogenic PAHs were assumed to be the same as benzo[a]pyrene. Studies have indicated that benzo[a]pyrene is the most potent of the PAHs, so the application of this potency factor to other PAHs may overestimate risks. This apparent conservatism may be balanced by the identified potential for synergistic interaction between PAHs. The carcinogenicity of some PAHs be enhanced in the presence of other PAHs.

Most noncarcinogenic PAHs do not have RfDs, but they nevertheless make up the majority of the contaminants present in the sediments. They have low toxicity, but their contribution to overall site risk cannot be quantified and is a major uncertainty in the risk assessment. Studies have indicated that some noncarcinogenic PAHs may enhance the carcinogenicity of carcinogenic PAHs.

ENVIRONMENTAL EVALUATION

The sediments of the Little Menomonee River are contaminated with creosote from the Moss-American site to the confluence with the Menomonee River. In some areas the sediment contains visible amounts of creosote and oils. In many areas disturbance of the sediment results in the release of oily substances that cause sheens and slicks on the water surface. Aquatic plants and animals in the Little Menomonee River are exposed to creosote that continues to be released to the river by groundwater flow and to creosote contained in the sediment from past releases.

Most of the creosote in the river is in the sediment and often with higher concentrations at depth. Aquatic plants and animals that rest on or burrow in the sediment are likely to be exposed more often and to higher concentrations than organisms living in the water or on the water surface. Disturbance of the sediment by high flows or by people or animals wading in the river causes occasional releases of creosote to the water and water surface.

Birds or terrestrial animals that travel through, rest or feed on the river may also be exposed to contaminants from creosote. Birds and animals with a high affinity for water are probably exposed more than animals that have only incidental contact with the river.

Most of the Little Menomonee River has been altered by channelization for drainage and flood control. Aerial photographs of the flood plain downstream of the Moss-American site show the presence of former channel meanders that were eliminated by channel straightening. Dredge spoil piles are also evident along much of the lower river. Channelization was performed upstream of Brown Deer Road and the Moss-American site, but some sections of the river flow through or are adjacent to wetlands and are somewhat less altered. The watershed above Brown Deer Road contains more agricultural and less residential and urban land use than the watershed below Brown Deer Road. The Little Menomonee River receives contaminants from agricultural land, stormwater discharge, seven industrial and one municipal permitted discharges, a closed landfill, and the Moss-American site.

The Wisconsin DNR has considered past changes in habitat (channelization and removal of cover) the past and present effects of sources of contamination in establishing classifications for the Little Menomonee River. Above Brown Deer Road, the river is classified as a full fish and aquatic life stream capable of supporting intolerant-to-tolerant forage fish and macroinvertebrates. Below Brown Deer Road to the confluence with the Menomonee River the river had been classified an intermediate fish and aquatic life stream capable of supporting tolerant to very tolerant forage fish and macroinvertebrates. It has been recently revised upward to full fish and aquatic life based on additional data obtained by the DNR (Mace 1989).

Aquatic animals in the Little Menomonee River have been sampled several times to determine the effects of land use and pollution on aquatic resources. Several studies were reviewed by Bannerman, et al. (1976) and the DNR (1984). Studies by the DNR between 1973 and 1977 found 11 species of fish from four classes. There was a general decrease in species diversity and numbers downstream of the Milwaukee County line. The most common species were green sunfish, creek chub, brown bullhead, blacknose dace, white sucker, and fathead minnows. Abrams and Chesters (1977) examined data on benthic macroinvertebrates from the Menomonee River basin to determine if trends indicating adverse effects of urban runoff could be detected. Their review included the Little Menomonee River and employed a biotic index developed by Hilsenhoff (1977) to describe water quality and the effects of contamination. Abrams and Chesters noted that earlier sampling programs indicated that in 1953 only pollution-tolerant sludge worms lived in oil- and tar-contaminated sediment near the Moss-American site. A qualitative study in 1971 by the DNR showed varying degrees of pollution from the Moss-American site to the Menomonee River. Four sites on the Little Menomonee River sampled in 1977, including one upstream of the site, all had biotic indices that indicated poor water quality in May 1977, but the index for one location downstream of the site (91st Street and Good Hope Road) had an index that represented good water quality in November 1976. Abrams and Chesters concluded that for the

Menomonee River basin as a whole, the adverse effects or urban and industrial point sources of pollution masked any effects of urban nonpoint sources of pollution.

A more recent study by the DNR (1984) found that the same fish species reported in 1977 still dominated the Little Menomonee River, but also reported northern pike above river mile 7 upstream of the site. It was concluded that pike migrated up the river past the Moss-American site. The DNR also noted that the blacknose dace, thought to be somewhat intolerant of pollution, was found downstream of the site. Small individuals of some species of sport fish were also found downstream of the site and are believed to use some parts of the lower river for migration, and possibly spawning. Aquatic life in general was found to be about 50 percent as abundant downstream than it is upstream of the site.

The sediment in the Little Menomonee River are contaminated with PAHs. As discussed, aquatic organisms from PAH-contaminated environments have a higher incidence of tumors and hyper plastic diseases than those from nonpolluted environments. There is a growing body of evidence, mostly circumstantial, linking PAHs to cancer in fish population, especially bottom dwelling fish from areas with sediments heavily contaminated with PAHs. The concentrations of PAHs found in the sediments of the Little Menomonee River are similar to those in water bodies where increased fish tumors have been found.

Most biological investigations of the Little Menomonee River have concluded that the lower river is ecologically impaired, with some effects attributed to creosote contamination from the Moss-American site. Those same studies have generally noted that the various effects of habitat loss, chemical pollution, soil erosion, and nonpoint source pollution cannot be readily distinguished.

UNCERTAINTIES AND LIMITATIONS IN THIS ASSESSMENT

Uncertainties in this risk assessment are due to uncertainties in the risk assessment process in general (i.e., the toxicological database), specific uncertainties in characterizing the site, and uncertainties associated with describing exposures. Uncertainties and limitations in this assessment are described below.

UNCERTAINTY FACTORS

The uncertainties in this risk assessment are summarized in Table K-16. This risk assessment is subject to uncertainty from:

Table K-16

UNCERTAINTY FACTORS
MOSS-AMERICAN SITE

Uncertainty Factor	Effect of Uncertainty	Comment
Use of cancer potency factors	May overestimate risks	Potencies are upper 95th percent confidence limits. Considered unlikely to underestimate true risk.
Risks/doses assumed to be additive	May over or under estimate risks	Does not account for synergism or antagonism.
Critical toxicity values derived primarily from animal studies.	May over or under estimate risks	Extrapolation from animal to humans may induce error due to differences in absorption, pharmacokinetics, target organs, enzymes, and population variability.
Critical toxicity values derived primarily from high doses, most exposures are at low doses.	May over or under estimate risks	Assumes linear at low doses. Tend to have conservative exposure assumptions.
Critical toxicity values	May over or under estimate risks	Not all values represent the same degree of certainty. All are subject to change as new evidence becomes availble.
Bioavailibity from soil assumed to be 100%	May overestimate risk	Contaminants may preferently bind to soil and not entirely release to GI tract. Actual intake may be less than the intake amount estimated.
Affect of absorption	May over or under estimate risks	The assumption that absorption is equivalent across species is implicit in the derivation of the critical toxicity values. Absorption may actually vary with chemical.
Estimates of inhalation exposure	May overestimate risk	Methods used to estimate dust concentrations were conservative.
Inorganic analysis	May overestimate risk	Inorganic analysis reports results for total metals and not specific forms. Assumed the metal was present in its most toxic form.
Not all chemicals at the site have critical toxicity values.	May underestimate risk	Can not quanititatively estimate risks, must address these chemicals quantitatively.
No criteria for acute exposures to creosote or phenolics.	May underestimate risk	Can not quantitatively evaluate acute effects from contact with sediments and soils.
Analysis for phenolic compounds.	May underestimate risk	Analytical methods may undersetimate the presence of phenolic compounds in sediment.

Table K-16

UNCERTAINTY FACTORS
MOSS-AMERICAN SITE

Uncertainty Factor	Effect of Uncertainty	Comment
Relative source contribution is not accounted for.	May underestimate risk	Exposures not associated with the site are not included within the risk assessment. This approach may miss incremental risks from the site.
Contaminant loss during sampling	May underestimate risk	May underestimate contaminant concentrations, especially VOCs.
The dermal absorption route of exposure was not quantified	May underestimate risk	Exposures from dermal contact were not included in assessment, however, exposures estimated to be less than exposures from ingestion.
Analysis limited to TAL and TCL chemicals.	May underestimate risk	The TAL and TCL chemicals may represent only a subset of the toxic chemicals which are present at the site.
Exposure assumptions	May under or overestimate risk	Assumpitons regarding media intake, population characteristics, and exposure patterns may not characterize exposures.
Contaminant concentrations assumed constant.	May under or overestimate risk	Did not account for environmental fate, transport, or transfer which may alter contaminant concentration.
Method detection limits	May underestimate risk	For some chemicals (PAHs) the method detection limit is above a concentration which might be of concern.

- Sampling and analysis
- Fate and transport estimation
- Exposure estimation
- Toxicological data

Uncertainty associated with sampling and analysis includes the inherent variability (standard error) in the analysis, representativeness of the samples, sampling errors, and heterogeneity of the sample matrix. While the QA/QC used in the RI serves to reduce such errors, it cannot eliminate all errors associated with sampling and analysis.

The toxicological database is also a source of uncertainty. The EPA outlined some of the sources of uncertainty in its *Guidelines for Carcinogen Risk Assessment* (U.S. EPA 1986d). They include extrapolation from high to low doses and from animals to humans; species differences in uptake, metabolism, and organ distribution; species differences in target site susceptibility; and human population variability with respect to diet, environment, activity patterns, and cultural factors.

ASSUMPTIONS IN THIS ASSESSMENT

Major assumptions used in this risk assessment are:

- Contaminant concentrations remain constant over the exposure period.
- Exposure remains constant over time.
- The selected ingestion rates and population characteristics (weight, life span) are representative for a potentially exposed population.
- Risks are additive.
- All intake of contaminants is from the exposure medium being evaluated (no relative source contribution).

SUMMARY

This baseline risk assessment evaluated the potential threats to public health and the environment from the Moss-American site under the no-action alternative. The following exposure settings were developed to evaluate potential risks from current and future site conditions:

- Exposure of visitors (or trespassers), using the site for recreational purposes by direct contact with contaminated surface soils and inhalation of dusts

- Exposure of future site users by direct contact with subsurface wastes disturbed during site development

- Exposure of recreational users of the Little Menomonee River through direct contact with contaminated sediments

- Exposure of aquatic organisms and wildlife to contaminated sediments in the Little Menomonee River

A trespass setting was developed to address the informal recreational uses of the site. This setting assumed that people used the site intermittently (approximately 40 times per year). This evaluation indicated that the estimated intake of the chemicals evaluated for chronic noncarcinogen effects did not exceed the RfDs for those chemicals. The individual excess lifetime cancer risks estimated for the site east of the river ranged from 3×10^{-4} (highest detected contaminant concentration) to 5×10^{-6} (geometric mean contaminant concentrations) and for the site west of the river ranged from 5×10^{-4} (highest concentration) to 2×10^{-5} (geometric mean). Contaminants detected in the east landfill, west landfill, treated storage area, and former drainage ditch contribute the most to the risk. PAHs were the main chemical group contributing to risk.

Inhalation exposure was evaluated to determine the potential risk to people generating dust onsite while participating in certain activities, such as dirt bike riding. The evaluation indicated that there does not appear to be a potential for adverse noncarcinogenic health effects. The individual excess lifetime cancer risk estimates for the site east of the river ranged from 3×10^{-6} (highest detected contaminant concentration) to 8×10^{-8} (mean contaminant concentrations); for the site west of the river estimates ranged from 5×10^{-6} (highest detected contaminant concentration) to 2×10^{-7} (geometric mean contaminant concentrations).

To evaluate potential future risks associated with the site, a residential setting was employed. The setting represents a reasonable maximum exposure setting if the site is developed. Based on this evaluation, there appears to be a potential noncarcinogenic risk resulting from exposure of adults and children to concentrations of lead and cadmium. The individual excess lifetime cancer risk estimates for the site east of the river were concentrations of 2×10^{-2} (highest detected) and 2×10^{-4} (geometric mean). The individual excess lifetime cancer risk estimates for the site west of the river were concentrations of 4×10^{-2} (highest detected) and 3×10^{-4} for (geometric mean). The locations of greatest concern are the east and west landfills, treated storage area, and former

drainage ditch. The PAHs were the major chemical group that contributed to the risk.

The potential health risks to people engaged in recreation along the Little Menomonee River were evaluated. The evaluation indicated that the estimated intakes of noncarcinogens did not exceed their RfDs. Individual excess lifetime cancer risk estimates from ingestion of sediment were greater than 1×10^{-6} for all river segments. The highest estimates were associated with river miles 1, 2, and 3 and ranged from concentrations of 1×10^{-5} (highest detected) to and 2×10^{-5} (geometric mean).

The cancer risks that were estimated are conservative in the selection of exposure assumptions and the application of the cancer potency factor of benzo[a]pyrene to the other carcinogenic PAHs. They were not conservative in that they do not account for synergism and co-carcinogenic effects that are known to occur with PAHs.

There is a potential for acute dermal effects from contact with creosote contamination in the river sediments. The toxicity of creosote was reviewed, and it was concluded that creosote and some of its constituents are dermally toxic and may cause skin burns and systemic toxic effects. This risk cannot be quantified with current available methodologies. No current literature is available that relates concentrations of creosote to the acute dermal effects. However, the continued potential for acute dermal effects from sediment contact may be assumed to still exist because: 1) there is documentation of people receiving skin burns after they came in contact with sediments in the Little Menomonee River; 2) creosote is known to be associated with skin burns; and 3) constituents of creosote have been detected in the sediment.

Biological investigations of the Little Menomonee River performed before the RI concluded that the river downstream of the site is ecologically impaired. This could be a result of creosote contamination from the Moss-American site. PAHs have been associated with increased tumor production in fish living in PAH-contaminated environments. The various effects other human activities including habitat loss, soil erosion, channelization, and nonpoint pollution on the river may also severely restrict the quality of the ecological community in the river.

GLT938/032.50

Appendix L
RISK ASSESSMENT METHODOLOGY

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NONCARCINOGENIC RISKS

Noncarcinogenic health risks are evaluated by comparison of the estimated daily intake of a chemical to the reference dose (RfD) for the chemical.

CHEMICAL INTAKE ESTIMATION

Estimating of chemical intake requires estimating the concentration of the chemical at the point of exposure and estimating intake of the exposure medium. Since RfDs are provided in milligrams of chemical per kilogram of body weight per day (mg/kg/day), chemical intakes must be expressed in similar units to account for the body weight of the potentially exposed individual. The daily intake of a chemical from a single exposure medium is estimated as:

$$DI_x = C_x * MI_m * Abs * [1/BW] \qquad \text{(L-1)}$$

where:

DI_x = Daily intake of chemical x (mg/kg/day)
C_x = Concentration of chemical x in the medium (units are media specific)
MI_m = Daily intake of the exposure medium (mass or volume per day)
Abs = Absorption factor (percent of the chemical absorbed by the body)
BW = Body weight (kg)

The RfDs are typically estimated based on the amount of chemical delivered to the test species (delivered dose), not on the amount actually absorbed (absorbed dose). In such instances, an absorption factor of one is used, which assumes that the absorption of the chemical is constant across species (i.e., that absorption is the same in humans as it is in the test species).

A medium-specific daily chemical intake is made by substituting an estimate of daily medium intake for MI_m in equation L-1. The medium intake is selected appropriate to the route of exposure and exposure setting. The body weight of the potentially exposed individual is also specific to the exposure situation.

COMPARISON OF DAILY CHEMICAL INTAKE TO REFERENCE DOSE

Noncarcinogenic risk from the exposure to a single chemical is evaluated by comparing the estimated daily intake of the chemical to the reference dose of the chemical. This comparison may be expressed as the ratio of the daily intake to the reference dose and can be interpreted as follows:

[DI/RfD] ≥ 1 Potential for health effects (L-2)

[DI/RfD] ≤ 1 Health effects not anticipated (L-3)

HAZARD INDEX APPROACH

Exposure situations may involve the potential exposure to more than one chemical. To assess the potential for noncarcinogenic effects posed by multiple chemicals, a "hazard index" approach can be used. This approach, which is based on EPA's *Guidelines for Health Risk Assessment of Chemical Mixtures* (U.S. EPA 1986a), assumes dose additivity and sums the ratios of the daily intakes of individual chemicals to their reference doses. This sum is called the hazard index.

$$\text{Hazard Index} = DI_1/RfD_1 + DI_2/RfD_2 + \ldots DI_i/RfDi \quad \text{(L-4)}$$

where:

DI_i = daily intake of the i^{th} chemical (mg/kg/day)
RfD_i = reference dose of the i^{th} chemical (mg/kg/day)

When the hazard index exceeds unity, it is a numerical indicator of the transition between acceptable and unacceptable exposure levels. Any single chemical with an estimated daily intake greater than the corresponding reference dose will cause the hazard index to exceed unity, and there may be a concern for potential health effects resulting from the exposure.

For multiple chemical exposures, the hazard index can exceed unity even if no single chemical exceeds the reference dose for that chemical. The assumption of additivity is most properly applied to chemicals that induce the same effect by the same mechanism or in the same target organ. If the hazard index is near or exceeds unity, the chemicals in the mixture are segregated by critical effect or target organ and separate indices are derived for each effect or target organ. If any of the separate indices exceed unity, then there may be a concern for potential health effects. Chemicals that are essential nutrients are excluded from the index when in the range of essentiality.

CARCINOGENIC RISK

To estimate risks from exposure to carcinogens, the following is needed:

- Lifetime average daily intake of the chemical
- Carcinogenic potency factor

LIFETIME AVERAGE DAILY CHEMICAL INTAKE ESTIMATION

To estimate lifetime average daily chemical intake, it is necessary to estimate the chemical concentration at the exposure point throughout the exposure period and the exposure medium intake throughout the exposure period.

Generalized Method for Estimating Exposure Medium Intake

The lifetime average daily exposure media intake can be estimated from the following general equation:

$$LMI_m = (1/N) \sum_{i=1}^{M} MI_i * Abs * [1/BW_i] * f \qquad (L\text{-}5)$$

where:

LMI_m = Lifetime average daily media intake (mass or volume/kg/day)
N = Number of years in a lifetime (assume 70)
M = Number of age classes (one age class per year)
MI_i = Average daily media intake in age class i
Abs = Absorption factor (percent of the chemical absorbed by the body--assume 100 percent)
BW_i = Body weight in age class i (kg)
f = Fraction of the year exposed

U.S. EPA typically assumes a constant body weight (typically 70 kg) in estimating lifetime cancer risk. This assumption would alter equation L-5 to yield:

$$LMI_m = (1/N) * (1/BW) \sum_{i=1}^{M} MI_i * Abs * f \qquad (L\text{-}6)$$

If media intake is also assumed to be constant, the estimate of intake further simplifies to:

$$LMI_m = (1/BW) * MI * Abs \qquad (L\text{-}7)$$

Generalized Method for Estimating Chemical Intake

The lifetime average daily chemical intake can be estimated from the following alteration in equation L-5:

$$LCI_x = (1/N) \sum_{i=1}^{M} Cx_i * MI_i * Abs * [1/BW_i] * f \qquad (L\text{-}8)$$

where:

LCI_x = Lifetime average daily intake of chemical x (mg/kg/day)
N = Number of years in a lifetime (assume 70)
M = Number of age classes (one age class per year)
Cx_i = Concentration of chemical x during age class i
MI_i = Average daily media intake in age class i
Abs = Absorption factor (percent of the chemical absorbed by the body)

BW_i = Body weight in age class i (kg)
f = Fraction of the year exposed

This equation accounts for changing chemical concentrations over time. When concentrations are assumed to remain constant over time, equation L-8 changes to:

$$LCI_x = (1/N) * C_x \sum_{i=1}^{M} MI_i * Abs * [1/BW_i] * f \quad \text{(L-9)}$$

where:

C_x = Concentration of chemical x over entire exposure period

If body weight and intake are assumed to be constant, as in equation L-7, then chemical intake can be estimated as:

$$LCI_m = C_x * (1/BW) * MI * Abs \quad \text{(L-10)}$$

ESTIMATING CANCER RISKS CAUSED BY EXPOSURE TO A SINGLE CARCINOGEN

Excess lifetime cancer risk from exposure to a single carcinogen can be estimated by the following:

$$R = 1 - e^{-(P_X * LCI_X)} \quad \text{(L-11)}$$

where:

R = Excess lifetime cancer risk
e = 2.71828
P_x = Cancer potency factor $(mg/kg/day)^{-1}$ for chemical x
LCI_x = Lifetime average daily chemical intake (mg/kg/day) of chemical x

Where the risks are low ($R \leq 10^{-3}$), equation L-11 can be approximated by:

$$R = P * LCI_x \quad \text{(L-12)}$$

ESTIMATING CANCER RISKS CAUSED BY EXPOSURE TO MULTIPLE CARCINOGENS

Exposure situations may involve the potential exposure to more than one carcinogen. To assess the potential for carcinogenic effects posed by exposure to multiple carcinogens, it is assumed in the absence of information on estimating synergistic or antagonistic effects that risks are additive. This approach is based on EPA's *Guidelines for Health Risk Assessment of Chemical Mixtures* (U.S. EPA 1986a) and EPA's *Guidelines for Cancer Risk Assessment* (U.S. EPA 1986b).

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, equation H-12 may be generalized to:

$$R_m = \sum_{i=1}^{N} 1 - e^{-(P_i * LCI_i)} \qquad \text{(L-13)}$$

where:

R_m = Sum of the excess lifetime cancer risks of the individual carcinogens for exposure route m
e = 2.71828
P_i = Cancer potency factor $(mg/kg/day)^{-1}$ for the i^{th} chemical
LCI_i = Lifetime average daily chemical intake (mg/kg/day) of the i^{th} chemical

DERMAL ABSORPTION FROM SOIL

Factors such as the health of the skin, the location of the area of skin exposed, hydration of the skin, time of exposure, molecular size of the chemical, lipid solubility of the skin, thickness of the skin, temperature, and the type of solvent the solute is dissolved in influence the absorption of chemicals into the skin layer. Dermal absorption is a complex activity controlled by many factors, and it is not possible to predict exposures from this route.

Skin is not very permeable, so it is a relatively good lipoid barrier separating humans from their environment. However, the skin can absorb some chemicals in sufficient quantities to produce systemic effects (Casserett and Doull 1986). Absorption of a chemical requires passage through the outer skin layer, the stratum corneum. Passage through this barrier is the rate limiting step in dermal absorption. It appears all toxicants move across the stratum corneum by passive diffusion following Fick's Law.

Dermal absorption of volatile compounds in pure form or dilute solution has been observed and documented by several studies (Dutkiewitz and Tyros 1967; Dutkiewitz and Tyros 1968; Scheuplein and Blank 1971; Scheuplein and Ross 1974).

Dermal absorption from soil will be a function of the concentration of contaminants in the soil, the amount of soil in contact with the skin, the amount of skin in contact with soil, the duration and frequency of the contact, and the type of contaminant. The amount of soil that accumulates on a person's skin will be controlled by several factors including soil type, soil conditions, activity the person is engaged in, soil conditions, body surface area exposed, hygiene habits, and time of contact. Schaum (1984) used a range of soil accumulation of 0.5 to 1.5 mg/cm^2. OHEA also suggests this range, with an average value of 1.0 mg/cm^2. EPA's *Superfund Exposure Assessment Manual* suggests a range of 1.45 to 2.77 mg/cm^2 (U.S. EPA 1988).

The area of skin exposed depends on climate and the activity in which the individual is engaged. For example, the hands and face are the areas most

likely to be exposed. If gloves are worn, then exposure could be significantly reduced. The surface area of the head is estimated as 1,180 cm^2 for males and 1,100 cm^2 for females based on one reference (Anderson et al. 1984) and 1,350 cm^2 for males and 1,200 cm^2 based on a second reference (ICRP 1974). The surface areas of the hands and arms, respectively, are estimated as 840 cm^2 and 2,280 cm^2 for men and 746 cm^2 and 2,100 cm^2 for women (Anderson et al. 1984). Schaum estimated that 910 cm^2 of skin would be exposed by an individual wearing long sleeves, gloves, pants, and shoes and 2,940 cm^2 by an individual wearing short sleeves, open necked shirts, pants, shoes, but no hat or gloves.

In addition to factors influencing the amount of soil contact with the skin, numerous factors control the absorption process. A significant factor in soil exposures is the transfer of the chemical from the soil to the skin. This multistep process requires the chemical to first desorb from the soil and then diffuse across the outer skin layer. Desorption will be governed by the chemical's relative affinity for the soil as compared to the skin or water (i.e., sweat or water associated with the soil). It will also be governed by the amount of moisture present on the skin or with the soil, skin conditions (e.g., health, thickness, hydration), and the time in contact.

These factors are not generally estimated or well correlated and understood. In lieu of these relationships, it has been suggested that a certain percentage of contaminants present in the soil adhering to the skin be assumed to be absorbed by the skin. Varying amounts have been suggested: from 0.07 to 3 percent for dioxin (Schaum, 1984), 5 percent for PCBs (U.S. EPA 1986c), up to 100 percent for compounds where no absorption information is available.

Based on the above and U.S. EPA guidance (U.S. EPA 1988; U.S. EPA 1986c), a conservative estimate of dermal absorption exposure can be estimated if one assumes the following:

- Body weight: 70 kg
- Soil deposition: 1 mg/cm^2
- Surface area of hands: 840 cm^2
- Absorption: 5 percent
- Frequency: Once daily

Exposure = 1 mg/cm^2 x 840 cm^2 x 5 percent x 1/70 kg
= 0.60 mg of soil/kg body weight/day

If this is compared to the intake through ingestion (assume 100 mg/day; 70 kg body weight) of 1.4 mg of soil/kg bw/day, it is seen that dermal absorption from soil during contact may not be as great as ingestion exposures, and, as discussed, there is uncertainty with such an estimate. Consequently, dermal absorption from direct contact with contaminated soil is not estimated in this assessment.

MASS LOADING APPROACH FOR AIRBORNE DUST

In addition to emissions of volatile organic compounds from soil, soil may become suspended in the ambient air. Surface soil may be suspended by wind or mechanical forces. Subsurface soil may be suspended in air during excavation activities. The approach in this analysis assumes that a given amount of soil mass is present in the ambient air. The dust loading is not modeled but rather is assumed to be the same as levels typically found in urban environments. This mass loading approach has been previously used to model the airborne concentrations in excavation exposures (U.S. NRC 1986; U.S. DOE 1986; Healy, 1980).

It is assumed that dust containing site-related chemicals is present in the ambient air at the level typically found in urban air, or 100 $\mu g/m^3$ (U.S. DOE, 1986). This approach also assumes that all airborne particles are of respirable size.

The mass loading approach requires two parameters: dust loading in the atmosphere and chemical concentration in the source soil. To calculate the effective airborne concentrations of a given chemical, the following equation can be applied:

$$C_a = ML * C_s * UC \qquad \text{(L-14)}$$

where:

C_a = Chemical concentration in air (mg/m^3)
ML = Mass loading ($\mu g/m^3$)
C_s = Soil concentration (mg/kg)
UC = Unit conversion 10^{-9} (kg/ug)

VOLATILE EMISSION CALCULATIONS

The model used to estimate volatile emissions is based on a model for estimating volatile releases from covered landfills (without internal gas generation) containing toxic materials developed by Farmer and later modified (U.S. EPA, 1988). Diffusion to the atmosphere is assumed to occur from a planar surface within the landfill using Fick's Law of steady-state diffusion. Processes such as biodegradation, transport in water, adsorption, and landfill gas production are ignored by the calculation. The modified equation used to described the volatilization is:

$$E_i = D_i * C_s i * A * P_s * M_i/d_{sc} \qquad \text{(L-15)}$$

where:

E_i = emission rate of compound i (g/s)
D_i = diffusion coefficient of compound i (cm^2/s)
$C_s i$ = saturated vapor concentration of compound i (g/cm^3)
A = exposed area (cm^2)

P_s = the ratio of air-filled soil porosity to total soil porosity (dimensionless)
M_i = weight fraction of compound i in the waste (g/g)
d_{sc} = effective depth of soil cover (cm)

The soil moisture may be accounted for by replacing the total soil porosity with a porosity ratio term. This ratio is defined as:

$$P_s = P_a^{10/3}/P_t^2 \qquad \text{(L-16)}$$

where:

P_t = total soil porosity (dimensionless)
P_a = the air-filled soil porosity (dimensionless)

The total soil porosity and the air-filled porosity are computed once the soil types are defined. In the rare case where the soil is completely dry, the air-filled porosity becomes the total soil porosity, and P_s becomes $P_t^{4/3}$. This occurs in the original formulation of eq. L-16. The total soil porosity is calculated as:

$$P_t = 1.0 - (B/p) \qquad \text{(L-17)}$$

where:

B = bulk density of the soil (g/cm^3)
p = particle density (g/cm^3); 2.65 for mineral material

The air-filled porosity, P_a, can be calculated using the total soil porosity minus the field capacity for water of the soil. The equation for computing air-filled porosity is:

$$P_a = P_t - \theta \qquad \text{(L-18)}$$

where:

θ = percent field capacity for water of soil (dimensionless)

If the diffusion coefficient for the chemical is unknown, it can be calculated using Fuller's method given by Perry and Chilton:

$$D_i = \frac{(0.01 * T^{1.75} \ (1/MW_i + 1/MW_{air})^{0.5})}{PR_{air} * ((EV_i)^{.333}) + (EV_{air})^{.333})^2} \qquad \text{(L-19)}$$

where:

D_i = diffusion coefficient of compound i (cm^2/s)
T = annual average air temperature (°K)
MW_i = molecular weight of compound i (g/mol)
MW_{air} = molecular weight of air (328.8) (g/mol)
PR_{air} = atmospheric pressure of site (atm)
EV_i = molecular diffusion volume of air (20.1) (cm^3/mole)

The molecular weight and volume of a compound are needed to compute the vapor concentration (C_{si}) using the following:

$$C_{si} = \frac{VP_i * MW_i}{R * T} \quad \text{(L-20)}$$

C_{si} = saturated vapor concentration of compound i (g/cm^3)

where:

VP_i = saturated vapor pressure of the compound i (mm H_g)
MW_i = molecular weight of compound i (g/mole)
R = molar gas constant (6.23 x 104 cm^3 mm Hg/°K mole)
T = annual average air temperature (°K)

Since the saturated vapor concentration of the compound in the soil is used, this assumes that contaminant concentrations are constant throughout the soil layer. This assumption provides an upper limit for the volatilization rate.

Although there is no generally accepted methodology for estimating onsite concentration from an area source, onsite air concentration was estimated based on the "box mode" approach (U.S. EPA, 1986c):

$$C = Q/(LS * V * H) \quad \text{(L-21)}$$

where:

H = mixing height (2 meters)
V = average wind speed with mixing zone
= 0.5 times wind speed at mixing height
LS = width dimension of contaminated area perpendicular to the wind direction

The contaminant source term was based on the average subsurface contaminant concentration in the west side of the site to a depth of 10 feet. A source area of 100,000 m^2 was assumed. The depth of soil above the source material was assumed to be 0.1 m.

The mixing width for the box model was assumed to be 10 m, and the mixing height was assumed to be 2 m. A wind speed of 6 m/s was assumed. The estimates of volatilization and onsite concentration are presented in Table L-1.

The ambient air concentration at a distance of 300 meters was also estimated by a centerline of a plume directly downwind from the source using Turner's method (U.S. EPA, 1988). It is based on:

$$C(X) = \frac{Q}{\pi \sigma_y \sigma_z \mu} \quad \text{(L-22)}$$

where:

C(X)	=	concentration of substance at distance x from site (mass/volume
Q	=	release rate of substance from site (mass/time)
δ_y	=	dispersion coefficient in the lateral (crosswind) direction (distance)
μ	=	mean wind speed (distance/time)
π	=	the value pi = 3.14

A stability class of D was assumed. The results are presented in Table L-1.

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Table L-1
MOSS-AMERICAN SITE
ESTIMATION OF POTENTIAL VOLATILIZATION
WEST SITE

SITES VOLATILE EMISSION CALCULATIONS		(I)	(I)	(I)	(I)	(I/C)	(C)	(C)	(C)	(C)	(C)
COMPOUND	CAS #	Concentration in soil (mg/kg)	Molecular Weight (g/mol)	Atomic Diffusion Volume	Vapor Pressure (mm Hg)	Diffusion Coefficien (cm2/sec.)	Saturated Vapor Conc. (g/cm3)	Emission Rate (g/sec. per cm2)	Emission Rate (g/sec. from Area	Airborne Conc. On-site (mg/m3)	Airborne Conc. at Distance (mg/m3)
Benzene	71-43-2	0.004	78.0	90.68	9.52E+01	0.08187	4.21E-04	1.89E-12	1.89E-06	3.15E-05	3.80E-07
Benzo[a]pyrene	50-32-8	1.3	252.3	252.76	5.60E-09	0.04698	8.01E-14	6.71E-20	6.71E-14	1.12E-12	1.35E-14
Benzo[b]fluoranthene	205-99-2	2.8	252.3	252.76	5.00E-07	0.04698	7.15E-12	1.29E-17	1.29E-11	2.15E-10	2.59E-12
Benzo[g,h,i]perylene	191-24-2	2.1	276.0	252.76	1.03E-10	0.04677	1.61E-15	2.17E-21	2.17E-15	3.62E-14	4.36E-16
Benzo[k]fluoranthene	207-08-9	2.2	252.3	252.76	5.10E-07	0.04698	7.29E-12	1.03E-17	1.03E-11	1.72E-10	2.08E-12
Benzo[a]anthracene	56-55-3	3.9	228.3	239.96	2.20E-08	0.04839	2.85E-13	7.37E-19	7.37E-13	1.23E-11	1.48E-13
Chrysene	218-01-9	4	228.3	239.96	6.30E-09	0.04839	8.15E-14	2.16E-19	2.16E-13	3.61E-12	4.35E-14
Dibenzo[a,h]anthrancene	53-70-3	0.45	278.4	289.72	1.00E-10	0.04385	1.58E-15	4.27E-22	4.27E-16	7.12E-15	8.58E-17
Ethylbenzene	100-41-4	0.006	116.0	151.80	7.00E+00	0.06268	4.60E-05	2.37E-13	2.37E-07	3.96E-06	4.77E-08
Indeno[1,2,3-cd]pyrene	193-39-5	2.1	276.0	265.56	1.00E-10	0.04570	1.56E-15	2.06E-21	2.06E-15	3.43E-14	4.14E-16
Naphthalene	91-20-3	4.3	128.2	140.44	8.70E-02	0.06425	6.32E-07	2.39E-12	2.39E-06	3.99E-05	4.81E-07
Toluene	108-88-3	0.041	92.0	111.14	2.81E+01	0.07359	1.46E-04	6.07E-12	6.07E-06	1.01E-04	1.22E-06
Xylene	1330-20-7	0.005	106.0	131.60	1.00E+01	0.06735	6.01E-05	2.78E-13	2.78E-07	4.63E-06	5.58E-08

Parameters Used to Calculated Volitilization:		
Ambient Temperature (C)	10	(I) Typical subsurface temperatue is 10 degrees C.
Absolute Pressure (atmospheres)	1.00	(I) Use 1.0
Soil Bulk Density (g/cm3)	1.50	(I) Typical range is 1.0 to 2.0
Particle Density (g/cm3)	2.65	(I) 2.65 is representative of average density material
Moisture Filled Porosity	0.10	(I) Range 0 to 1.0 but must be less than Total Porosity
Total Porosity	0.43	(C) As a check this should be between 0.33 and 0.55
Air Filled Porosity	0.33	(C) Calculated by spreadsheet
Ratio of Air Filled to Total Porosity	0.14	(C) Calculated by spreadsheet
Surface Area of contaminated zone (m2)	1000000	(I) Site specific
Depth of Soil Cover (cm)	100	(I) Site specific

Parameters Used to Calculated Airborne Concentration:		
Average Wind Speed (m/s)	6.00	(I) Site specific (3 m/s can be used as a conservative estimate)
Minimum Area Width (m)	10.00	(I) Site specific
Mixing Height (m)	2.00	(I) Use 2 m for on-site calculations
Stability Class	D	Not used in spreadsheet, but used to estimate dispersion coefficients
Receptor Distance Downwind (km)	0.30	Not used in spreadsheet, but used to estimate dispersion coefficients
Lateral Dispersion Coefficient (m)	22.00	(I) See pp 3-14 and 3-15 of Superfund Exposure Assessment Manual (Versar, 1987)
Vertical Dispersion Coefficient (m)	12.00	(I) See pp 3-14 and 3-15 of Superfund Exposure Assessment Manual (Versar, 1987)
Fraction of Time Wind Blows Toward Receptor	1.00	(I) Site specific (.3 can be used as a conservative upper bound)

(I) Indicates value must be input by user.
(C) Indicates value is calculated by spreadsheet.
(I/C) Indicates value may be input by user or calculated by the spreadsheet.

Appendix M
RISK CALCULATION DATA TABLES

Table M-1
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - TRESPASSERS EAST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Barium	0.05	I	85000	0.0002	0.005	NO	83000	0.0002	0.005	NO
Beryllium	0.005	I	1100	0.0000	0.001	NO	900	0.0000	0.001	NO
Cadmium	0.0005	I	6700	0.0000	0.038	NO	6100	0.0000	0.035	NO
Chromium (b)	0.005	I	27000	0.0001	0.015	NO	25000	0.0001	0.014	NO
Copper	0.037	H	32000	0.0001	0.002	NO	27000	0.0001	0.002	NO
Ethylbenzene	0.1	I	1600	0.0000	0.000	NO	24	0.0000	0.000	NO
Lead	0.0014	S	15000	0.0000	0.031	NO	11000	0.0000	0.022	NO
Manganese	0.2	I	730000	0.0021	0.010	NO	650000	0.0019	0.009	NO
Mercury (c)	0.0003	H	1300	0.0000	0.012	NO	600	0.0000	0.006	NO
Naphthalene	0.4	H	1500000	0.0043	0.011	NO	7400	0.0000	0.000	NO
Nickel (d)	0.02	I	31000	0.0001	0.004	NO	29000	0.0001	0.004	NO
Styrene	0.2	I	2600	0.0000	0.000	NO	29	0.0000	0.000	NO
Toluene	0.3	I	1300	0.0000	0.000	NO	200	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	I	19000	0.0001	0.001	NO	56	0.0000	0.000	NO
Vanadium	0.007	H	35000	0.0001	0.014	NO	34000	0.0001	0.014	NO
Xylenes	2	I	1400	0.0000	0.000	NO	50	0.0000	0.000	NO
Zinc	0.2	I	130000	0.0004	0.002	NO	120000	0.0003	0.002	NO
Hazard Index (Sum of DI/RfD)					0.147				0.114	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table M-2
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - TRESPASSERS EAST

Chemical	(a)	Reference Dose (RfD) mg/kg/day	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Barium	I	0.05	85000	0.0001	0.002	NO	83000	0.0001	0.002	NO
Beryllium	I	0.005	1100	0.0000	0.000	NO	980	0.0000	0.000	NO
Cadmium	I	0.0005	6700	0.0000	0.019	NO	6100	0.0000	0.017	NO
Chromium (b)	I	0.005	27000	0.0000	0.008	NO	25000	0.0000	0.007	NO
Copper	H	0.037	32000	0.0000	0.001	NO	27000	0.0000	0.001	NO
Ethylbenzene	I	0.1	1600	0.0000	0.000	NO	24	0.0000	0.000	NO
Lead	S	0.0014	15000	0.0000	0.015	NO	10000	0.0000	0.010	NO
Manganese	H	0.2	730000	0.0010	0.005	NO	650000	0.0009	0.005	NO
Mercury (c)	H	0.0003	1300	0.0000	0.006	NO	600	0.0000	0.003	NO
Naphthalene	H	0.4	1500000	0.0021	0.005	NO	7400	0.0000	0.000	NO
Nickel (d)	I	0.02	31000	0.0000	0.002	NO	29000	0.0000	0.002	NO
Styrene	I	0.2	2600	0.0000	0.000	NO	29	0.0000	0.000	NO
Toluene	I	0.3	1300	0.0000	0.000	NO	200	0.0000	0.000	NO
1,1,1-Trichloroethane	I	0.09	19000	0.0000	0.000	NO	56	0.0000	0.000	NO
Vanadium	H	0.007	35000	0.0001	0.007	NO	34000	0.0000	0.007	NO
Xylenes	I	2	1400	0.0000	0.000	NO	50	0.0000	0.000	NO
Zinc	I	0.2	130000	0.0002	0.001	NO	120000	0.0002	0.001	NO
Hazard Index (Sum of DI/RfD)					0.074				0.056	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual. ~~U.S. EPA 1986.~~
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. ~~U.S. EPA 1989.~~
B: Cyanide value based on free cyanide.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table M-3
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - TRESPASSERS EAST

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	5600	2E-07	4500	2E-07
Benzo(a)anthracene	B2	11.5	C	410000	1E-04	3800	1E-06
Benzo(b)fluoranthene	B2	11.5	C	98000	3E-05	2700	7E-07
Benzo(k)fluoranthene	B2	11.5	C	98000	3E-05	2700	7E-07
Benzo(a)pyrene	B2	11.5	B	100000	3E-05	2600	7E-07
Benzo(g,h,i)perylene	B2	11.5	C	31000	8E-06	2100	5E-07
Chrysene	C	11.5	C	300000	8E-05	3700	1E-06
Indeno(1,2,3-cd)pyrene	B2	11.5	C	210000	5E-05	2200	6E-07
SUM OF RISKS =					3E-04		5E-06

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.00002

(a) Source: A: U.S. EPA 1988.
B: U.S. EPA 1988.
C: Based on benzo(a)pyrene.

Table H-4
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - TRESPASSERS WEST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	210	0.0000	0.000	NO	36	0.0000	0.000	NO
Barium	0.05	I	200000	0.0006	0.011	NO	99000	0.0003	0.006	NO
Beryllium	0.005	I	1400	0.0000	0.001	NO	1000	0.0000	0.001	NO
Cadmium	0.0005	I	76000	0.0002	0.434	NO	13000	0.0000	0.074	NO
Chromium (b)	0.005	I	30000	0.0001	0.017	NO	19000	0.0001	0.011	NO
Copper	0.037	H	50000	0.0001	0.004	NO	25000	0.0001	0.002	NO
Cyanide (d)	0.02	I	2300	0.0000	0.000	NO	1700	0.0000	0.000	NO
2,4-Dinitrophenol	0.002	I	620000	0.0018	0.886	NO	(f)	0.0000	0.000	NO
Ethylbenzene	0.1	I	240	0.0000	0.000	NO	12	0.0000	0.000	NO
Lead	0.0014	S	410000	0.0012	0.837	NO	60000	0.0002	0.122	NO
Manganese	0.2	H	410000	0.0012	0.006	NO	230000	0.0007	0.003	NO
Mercury (c)	0.0003	H	1400	0.0000	0.013	NO	380	0.0000	0.004	NO
Naphthalene	0.4	H	66000	0.0002	0.000	NO	13000	0.0000	0.000	NO
Nickel (e)	0.02	I	22000	0.0001	0.003	NO	16000	0.0000	0.002	NO
Toluene	0.3	I	580	0.0000	0.000	NO	170	0.0000	0.000	NO
Vanadium	0.007	H	22000	0.0001	0.009	NO	18000	0.0001	0.007	NO
Xylenes	2	I	120	0.0000	0.000	NO	8	0.0000	0.000	NO
Zinc	0.2	I	9800000	0.0280	0.140	NO	740000	0.0021	0.011	NO
Hazard Index (Sum of DI/RfD)					2.362				0.243	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Cyanide value based on free cyanide.
(e) Nickel value based on nickel-soluble salts.
(f) Insufficient number of positive detections to estimate a mean concentration.

Table M-5
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - TRESPASSERS WEST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	210	0.0000	0.000	NO	36	0.0000	0.000	NO
Barium	0.05	I	200000	0.0003	0.006	NO	99000	0.0001	0.003	NO
Beryllium	0.005	I	1400	0.0000	0.000	NO	1000	0.0000	0.000	NO
Cadmium	0.0005	I	76000	0.0001	0.217	NO	13000	0.0000	0.037	NO
Chromium (b)	0.005	I	30000	0.0000	0.009	NO	19000	0.0000	0.005	NO
Copper	0.037	H	50000	0.0001	0.002	NO	25000	0.0000	0.001	NO
Cyanide (d)	0.02	I	2300	0.0000	0.000	NO	1700	0.0000	0.000	NO
2,4-Dinitrophenol	0.002	I	620000	0.0009	0.443	NO	(f)	0.0000	0.000	NO
Ethylbenzene	0.1	I	240	0.0000	0.000	NO	12	0.0000	0.000	NO
Lead	0.0014	S	410000	0.0006	0.418	NO	60000	0.0001	0.061	NO
Manganese	0.2	H	410000	0.0006	0.003	NO	230000	0.0003	0.002	NO
Mercury (c)	0.0003	H	1400	0.0000	0.007	NO	380	0.0000	0.002	NO
Naphthalene	0.4	H	66000	0.0001	0.000	NO	13000	0.0000	0.000	NO
Nickel (e)	0.02	I	22000	0.0000	0.002	NO	16000	0.0000	0.001	NO
Toluene	0.3	I	580	0.0000	0.000	NO	170	0.0000	0.000	NO
Vanadium	0.007	H	22000	0.0000	0.004	NO	18000	0.0000	0.004	NO
Xylenes	2	I	120	0.0000	0.000	NO	8	0.0000	0.000	NO
Zinc	0.2	I	9800000	0.0140	0.070	NO	740000	0.0011	0.005	NO
Hazard Index (Sum of DI/RfD)					1.181				0.122	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Cyanide value based on free cyanide.
(e) Nickel value based on nickel-soluble salts.
(f) Insufficient number of positive detections to estimate a mean concentration.

Table N-6
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE -TRESPASSERS WEST

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	110000	4E-06	7800	3E-07
Benzene	A	0.029	I	11	7E-12	4	3E-12
Benzo(a)anthracene	B2	11.5	B	380000	1E-04	13000	3E-06
Benzo(b)fluoranthene	B2	11.5	B	270000	7E-05	11000	3E-06
Benzo(k)fluoranthene	B2	11.5	B	240000	6E-05	10000	3E-06
Benzo(a)pyrene	B2	11.5	C	200000	5E-05	8200	2E-06
Benzo(g,h,i)perylene	B2	11.5	B	51000	1E-05	6800	2E-06
Chyrsene	C	11.5	B	490000	1E-04	16000	4E-06
Indeno(1,2,3-cd)pyrene	B2	11.5	B	120000	3E-05	6800	2E-06
SUM OF RISKS =					5E-04		2E-05

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.00002

(a) Source: I: IRIS - Integrated Risk Information System.
A: U.S. EPA 1988.
B: Based on benzo(a)pyrene.
C: U.S. EPA 1980.

Table N-7
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD INHALATION EXPOSURE - TRESPASSERS EAST

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	Geometric Mean Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?	Highest Detected Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?
arium	0.0001	HEAST	0.0000083	0.000	0.003699	NO	0.0000085	0.000	0.003789	NO
eryllium	0.005	IRIS b	0.000000098	0.000	0.000001	NO	0.00000011	0.000	0.000001	NO
admium	0.0005	IRIS b	0.00000061	0.000	0.000054	NO	0.00000067	0.000	0.000060	NO
hromium VI	0.005	IRIS b	0.0000025	0.000	0.000022	NO	0.0000027	0.000	0.000024	NO
opper	0.01	HEAST b	0.00000027	0.000	0.000001	NO	0.0000032	0.000	0.000014	NO
thylbenzene	0.1	IRIS b	0.0000000024	0.000	0.000000	NO	0.00000016	0.000	0.000000	NO
ead	0.0014	SPHEM b	0.0000011	0.000	0.000035	NO	0.0000015	0.000	0.000048	NO
anganese	0.0003	HEAST	0.000066	0.000	0.009806	NO	0.000073	0.000	0.010846	NO
ercury (inorganic)	0.0003	HEAST b	0.000000079	0.000	0.000012	NO	0.00000013	0.000	0.000019	NO
aphthalene	0.4	HEAST b	0.00000059	0.000	0.000000	NO	0.00014	0.000	0.000016	NO
ickel	0.02	HEAST b/d	0.0000029	0.000	0.000006	NO	0.0000031	0.000	0.000007	NO
tyrene	0.2	IRIS b	0.0000000028	0.000	0.000000	NO	0.00000026	0.000	0.000000	NO
oluene	1	HEAST	0.00000002	0.000	0.000000	NO	0.00000013	0.000	0.000000	NO
,1,1-Trichloroethane	0.3	HEAST	0.000000005	0.000	0.000000	NO	0.0000019	0.000	0.000000	NO
anadium	0.007	HEAST b	0.0000034	0.000	0.000022	NO	0.0000035	0.000	0.000022	NO
ylenes	0.4	HEAST	0.000000005	0.000	0.000000	NO	0.00000014	0.000	0.000000	NO
inc	0.01	HEAST	0.000012	0.000	0.000053	NO	0.000013	0.000	0.000058	NO
azard Index (Sum of DI/RfD)					0.014				0.015	

XPOSURE ASSUMPTIONS

xposure setting	Trespass
xposed individual	Child
ody weight (kg)	35
nhalation rate (l/min)	13
ime exposed (hrs/day)	2
olume of air inhaled/day (l/d	1560

a) Sources of Toxicity Values:
IRIS - Integrated Risk Information System.
SPHEM - Superfund Public Health Evaluation Manual. U.S.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
b) No inhalation RfD available, based on ingestion RfD.
c) Nickel value based on nickel-soluble salts.
d) Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.

Table M-8
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT INHALATION EXPOSURE - TRESPASSERS EAST

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	Geometric Mean Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?	Highest Detected Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?
Barium	0.0001	HEAST	0.0000083	0.000	0.002846	NO	0.0000085	0.000	0.002914	NO
Beryllium	0.005	IRIS b	0.000000098	0.000	0.000001	NO	0.00000011	0.000	0.000001	NO
Cadmium	0.0005	IRIS b	0.00000061	0.000	0.000042	NO	0.00000067	0.000	0.000046	NO
Chromium VI	0.005	IRIS b	0.0000025	0.000	0.000017	NO	0.0000027	0.000	0.000019	NO
Copper	0.01	HEAST	0.00000027	0.000	0.000001	NO	0.0000032	0.000	0.000011	NO
Ethylbenzene	0.1	IRIS b	0.0000000024	0.000	0.000000	NO	0.00000016	0.000	0.000000	NO
Lead	0.0014	SPHEM b	0.0000011	0.000	0.000027	NO	0.0000015	0.000	0.000037	NO
Manganese	0.0003	HEAST	0.000066	0.000	0.007543	NO	0.000073	0.000	0.008343	NO
Mercury (inorganic)	0.0003	HEAST b	0.000000079	0.000	0.000009	NO	0.00000013	0.000	0.000015	NO
Naphthalene	0.4	HEAST b	0.00000059	0.000	0.000000	NO	0.00014	0.000	0.000012	NO
Nickel	0.02	HEAST b/d	0.0000029	0.000	0.000005	NO	0.0000031	0.000	0.000005	NO
Styrene	0.2	IRIS b	0.0000000028	0.000	0.000000	NO	0.00000026	0.000	0.000000	NO
Toluene	1	HEAST	0.00000002	0.000	0.000000	NO	0.00000013	0.000	0.000000	NO
1,1,1-Trichloroethane	0.3	HEAST	0.000000005	0.000	0.000000	NO	0.0000019	0.000	0.000000	NO
Vanadium	0.007	HEAST b	0.0000034	0.000	0.000017	NO	0.0000035	0.000	0.000017	NO
Xylenes	0.4	HEAST	0.000000005	0.000	0.000000	NO	0.00000014	0.000	0.000000	NO
Zinc	0.01	HEAST b	0.000012	0.000	0.000041	NO	0.000013	0.000	0.000045	NO
Hazard Index (Sum of DI/RfD)					0.011				0.011	

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Exposed individual	Adult
Body weight (kg)	70
Inhalation rate (l/min)	20
Time exposed (hrs/day)	2
Volume of air inhaled/day (l	2400

(a) Sources of Toxicity Values:
IRIS - Integrated Risk Information System.
SPHEM - Superfund Public Health Evaluation Manual.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) No inhalation RfD available, based on ingestion RfD.
(c) Nickel value based on nickel-soluble salts.
(d) Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.

Table M-9
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
INHALATION EXPOSURE - TRESPASSERS EAST

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration mg/m3	Excess Lifetime Cancer Risk	Geometric (b) Mean Concentration mg/m3	Excess Lifetime Cancer Risk
Arsenic	A	50	I	5.6E-07	6E-08	4.5E-07	5E-08
Benzo[a]anthracene	B2	6.1	B	4.1E-05	5E-07	3.8E-07	5E-09
Benzo[b]fluoranthene	B2	6.1	B	9.8E-06	1E-07	2.7E-07	4E-09
Benzo[k]fluoranthene	B2	6.1	B	9.8E-06	1E-07	2.7E-07	4E-09
Benzo[g,h,i]perylene	B2	6.1	B	1.2E-06	2E-08	2.1E-07	3E-09
Benzo[a]pyrene	B2	6.1	C	1.0E-05	1E-07	2.6E-07	3E-09
Chyrsene	B2	6.1	B	3.0E-05	4E-07	3.7E-07	5E-09
Indeno[1,2,3-cd]pyrene	B2	6.1	B	2.1E-05	3E-07	2.2E-07	3E-09
SUM OF RISKS =					2E-06		7E-08

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Inhalation rate (l/min)	20
Body weight (kilograms)	70
Time exposed (hrs)	8
Number of days per week	2
Number of weeks per year	20
Number of years exposed	10
Lifetime average air intake (liters/kg body weight/day)	2.15

a. Source: I: IRIS - Integrated Risk Information System.
B: Based on benzo[a]pyrene.
C: U.S. EPA 1980
b. Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.

Table N-10
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD INHALATION EXPOSURE - TRESPASSERS WEST

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	Highest (d) Detected Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?	Geometric (d) Mean Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?
Acetone	0.1	HEAST (b)	0.000000021	0.000	0.000000	NO	0.0000000035	0.000	0.000000	NO
Barium	0.0001	HEAST	0.00002	0.000	0.008914	NO	0.0000099	0.000	0.004413	NO
Beryllium	0.005	IRIS (b)	0.00000014	0.000	0.000001	NO	0.0000001	0.000	0.000001	NO
Cadmium	0.0005	IRIS (b)	0.0000076	0.000	0.000677	NO	0.0000001	0.000	0.000009	NO
Chromium VI	0.005	IRIS (b)	0.000003	0.000	0.000027	NO	0.0000013	0.000	0.000012	NO
Copper	0.01	HEAST	0.000005	0.000	0.000022	NO	0.0000019	0.000	0.000008	NO
Cyanide	0.02	HEAST (b)	0.00000023	0.000	0.000001	NO	0.00000017	0.000	0.000000	NO
2,4-Ditrophenol	0.002	IRIS (b)	0.000062	0.000	0.001382	NO	e	0.000	0.000000	NO
Ethylbenzene	0.1	IRIS (b)	0.000000024	0.000	0.000000	NO	0.0000000012	0.000	0.000000	NO
Lead	0.0014	SPHEM (b)	0.000041	0.000	0.001305	NO	0.000006	0.000	0.000191	NO
Manganese	0.0003	HEAST	0.000041	0.000	0.006091	NO	0.000023	0.000	0.003417	NO
Mercury (inorganic)	0.0003	HEAST (b)	0.00000014	0.000	0.000021	NO	0.000000038	0.000	0.000006	NO
Naphthalene	0.4	HEAST (b)	0.0000066	0.000	0.000001	NO	0.0000013	0.000	0.000000	NO
Nickel	0.02	HEAST (b/d)	0.0000022	0.000	0.000005	NO	0.0000016	0.000	0.000004	NO
Toluene	1	HEAST	0.000000058	0.000	0.000000	NO	0.000000017	0.000	0.000000	NO
Vanadium	0.007	HEAST (b)	0.0000022	0.000	0.000014	NO	0.0000018	0.000	0.000011	NO
Xylenes	0.4	HEAST	0.000000012	0.000	0.000000	NO	0.0000000008	0.000	0.000000	NO
Zinc	0.01	HEAST (b)	0.00098	0.000	0.004368	NO	0.000073	0.000	0.000325	NO
Hazard Index (Sum of DI/RfD)					0.023				0.008	

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Exposed individual	Child
Body weight (kg)	35
Inhalation rate (l/min)	13
Time exposed (hrs/day)	2
Volume of air inhaled/day (l	1560

(a) Sources of Toxicity Values:
IRIS - Integrated Risk Information System.
SPHEM - Superfund Public Health Evaluation Manual.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) No inhalation RfD available, based on ingestion RfD.
(c) Cyanide value based on free cyanide.
(d) Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.
(e) Insufficient number of positive detections to estimate a mean concentration.

Table M-11
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT INHALATION EXPOSURE - TRESPASSERS WEST

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	Highest (d) Detected Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?	Geometric (d) Mean Concentration mg/m3	Daily Intake (DI) mg/kg/day	DI/RfD	Reference Dose Exceeded?
Acetone	0.1	HEAST (b)	0.000000021	0.000	0.000000	NO	0.0000000035	0.000	0.000000	NO
Barium	0.0001	HEAST	0.00002	0.000	0.006857	NO	0.0000099	0.000	0.003394	NO
Beryllium	0.005	IRIS (b)	0.00000014	0.000	0.000001	NO	0.0000001	0.000	0.000001	NO
Cadmium	0.0005	HEAST (b)	0.0000076	0.000	0.000521	NO	0.0000001	0.000	0.000007	NO
Chromium VI	0.005	IRIS (b)	0.000003	0.000	0.000021	NO	0.0000013	0.000	0.000009	NO
Copper	0.01	SPHEM	0.000005	0.000	0.000017	NO	0.0000019	0.000	0.000007	NO
Cyanide	0.02	HEAST (b)	0.00000023		0.000000	NO	0.00000017	0.000	0.000000	NO
2,4-Ditrophenol	0.002	IRIS (b)	0.000062	0.000	0.001063	NO	e			
Ethylbenzene	0.1	IRIS (b)	0.000000024	0.000	0.000000	NO	0.0000000012	0.000	0.000000	NO
Lead	0.0014	SPHEM (b)	0.000041	0.000	0.001004	NO	0.000006	0.000	0.000147	NO
Manganese	0.0003	HEAST	0.000041	0.000	0.004686	NO	0.000023	0.000	0.002629	NO
Mercury (inorganic)	0.000051	HEAST (b)	0.00000014	0.000	0.000094	NO	0.000000038	0.000	0.000026	NO
Naphthalene	0.4	HEAST (b)	0.0000066	0.000	0.000001	NO	0.0000013	0.000	0.000000	NO
Nickel	0.02	HEAST (b/d)	0.0000022	0.000	0.000004	NO	0.0000016	0.000	0.000003	NO
Toluene	1	HEAST	0.000000058	0.000	0.000000	NO	0.000000017	0.000	0.000000	NO
Vanadium	0.007	HEAST (b)	0.0000022	0.000	0.000011	NO	0.0000018	0.000	0.000009	NO
Xylenes	0.4	HEAST	0.000000012	0.000	0.000000	NO	0.0000000008	0.000	0.000000	NO
Zinc	0.01	HEAST (b)	0.00098	0.000	0.003360	NO	0.000073	0.000	0.000250	NO
Hazard Index (Sum of DI/RfD)					0.018				0.006	

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Exposed individual	Adult
Body weight (kg)	70
Inhalation rate (l/min)	20
Time exposed (hrs/day)	2
Volume of air inhaled/day (l/day)	2400

(a) Sources of Toxicity Values:
IRIS - Integrated Risk Information System.
SPHEM - Superfund Public Health Evaluation Manual.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) No inhalation RfD available, based on ingestion RfD.
(c) Cyanide value based on free cyanide.
(d) Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.
(e) Insufficient number of positive detections to estimate a mean concentration.

Table M-12
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
INHALATION EXPOSURE -TRESPASSERS WEST

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest (b) Detected Concentration mg/m3	Excess Lifetime Cancer Risk	Geometric (b) Mean Concentration mg/m3	Excess Lifetime Cancer Risk
Arsenic	A	50	I	1.1E-05	1E-06	7.8E-07	8E-08
Benzene	A	0.029	I	1.1E-09	7E-14	4.0E-10	2E-14
Benzo(a)anthracene	B2	6.1	B	3.8E-05	5E-07	1.3E-06	2E-08
Benzo(b)fluoranthene	B2	6.1	B	2.7E-05	4E-07	1.1E-06	1E-08
Benzo(k)fluoranthene	B2	6.1	B	2.4E-05	3E-07	1.0E-06	1E-08
Benzo(g,h,i)perylene	B2	6.1	B	5.1E-06	7E-08	6.8E-07	9E-09
Benzo(a)pyrene	B2	6.1	C	2.0E-05	3E-07	8.2E-07	1E-08
Chyrsene	B2	6.1	B	4.9E-05	6E-07	1.6E-06	2E-08
Indeno(1,2,3-cd)pyrene	B2	6.1	B	1.2E-05	2E-07	6.8E-07	9E-09
SUM OF RISKS =					3E-06		2E-07

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Inhalation rate (l/min)	20
Body weight (kilograms)	70
Time exposed (hrs)	8
Number of days per week	2
Number of weeks per year	20
Number of years exposed	10
Lifetime average air intake (liters/kg body wt./day)	2.15

a. Source: I: IRIS - Integrated Risk Information System.
B: Based on benzo(a)pyrene.
C: U.S. EPA 1980
b. Air concentrations based on surface soil data. Assumed dust loading of 100 mg/m3.

Table N-13
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - DEVELOPMENT EAST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
:etone	0.1	I	120	0.0000	0.000	NO	120	0.0000	0.000	NO
ırium	0.05	I	180000	0.0024	0.048	NO	58000	0.0008	0.015	NO
:nzoic Acid	4	I	230	0.0000	0.000	NO	230	0.0000	0.000	NO
:ryllium	0.005	I	1200	0.0000	0.003	NO	410	0.0000	0.001	NO
is(2-Ethylhexyl)phthalate	0.02	I	460	0.0000	0.000	NO	460	0.0000	0.000	NO
dmium	0.0005	I	6900	0.0001	0.184	NO	5300	0.0001	0.141	NO
romium (b)	0.005	I	27000	0.0004	0.072	NO	21000	0.0003	0.056	NO
pper	0.037	H	37000	0.0005	0.013	NO	26000	0.0003	0.009	NO
,1-Dichloroethane	0.12	S	210	0.0000	0.000	NO	210	0.0000	0.000	NO
thylbenzene	0.1	I	4100	0.0001	0.001	NO	29	0.0000	0.000	NO
ad	0.0014	S	31000	0.0004	0.295	NO	15000	0.0002	0.143	NO
nganese	0.2	H	840000	0.0112	0.056	NO	520000	0.0069	0.035	NO
rcury (c)	0.0003	H	1300	0.0000	0.058	NO	240	0.0000	0.011	NO
phthalene	0.4	H	2600000	0.0347	0.087	NO	5800	0.0001	0.000	NO
ickel (d)	0.02	H	31000	0.0004	0.021	NO	24000	0.0003	0.016	NO
tyrene	0.2	I	9300	0.0001	0.001	NO	36	0.0000	0.000	NO
oluene	0.3	I	2000	0.0000	0.000	NO	120	0.0000	0.000	NO
,1,1-Trichloroethane	0.09	I	19000	0.0003	0.003	NO	19000	0.0003	0.003	NO
nadium	0.007	H	38000	0.0005	0.072	NO	26000	0.0003	0.050	NO
ylenes	2	I	1700	0.0000	0.000	NO	53	0.0000	0.000	NO
inc	0.2	H	220000	0.0029	0.015	NO	220000	0.0029	0.015	NO
zard Index (Sum of DI/RfD)					0.928				0.495	

(POSURE ASSUMPTIONS

posure Setting	Residential
posed Individual	Child
il Intake (grams/day)	0.2
dy Weight (kilograms)	15

a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
b) Assumed to be in the (+6) hexavalent state.
c) Assumed to be alkyl mercury.
d) Nickel value based on nickel-soluble salts.

Table M-14
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - DEVELOPMENT EAST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	120	0.0000	0.000	NO	120	0.0000	0.000	NO
Barium	0.05	I	180000	0.0003	0.005	NO	58000	0.0001	0.002	NO
Benzoic Acid	4	I	230	0.0000	0.000	NO	230	0.0000	0.000	YES
Beryllium	0.005	I	1200	0.0000	0.000	NO	410	0.0000	0.000	NO
bis(2-Ethylhexyl)phthalate	0.02	I	460	0.0000	0.000	NO	460	0.0000	0.000	NO
Cadmium	0.0005	I	6900	0.0000	0.020	NO	5300	0.0000	0.015	NO
Chromium (b)	0.005	I	27000	0.0000	0.008	NO	21000	0.0000	0.006	NO
Copper	0.037	H	37000	0.0001	0.001	NO	26000	0.0000	0.001	NO
1,1-Dichloroethane	0.12	H	210	0.0000	0.000	NO	210	0.0000	0.000	NO
Ethylbenzene	0.1	I	4100	0.0000	0.000	NO	29	0.0000	0.000	NO
Lead	0.0014	S	31000	0.0000	0.032	NO	15000	0.0000	0.015	NO
Manganese	0.2	H	840000	0.0012	0.006	NO	520000	0.0007	0.004	NO
Mercury (c)	0.0003	H	1300	0.0000	0.006	NO	240	0.0000	0.001	NO
Naphthalene	0.4	H	2600000	0.0037	0.009	NO	5800	0.0000	0.000	NO
Nickel (d)	0.02	C	31000	0.0000	0.002	NO	24000	0.0000	0.002	NO
Styrene	0.2	H	9300	0.0000	0.000	NO	36	0.0000	0.000	NO
Toluene	0.3	I	2000	0.0000	0.000	NO	120	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	I	19000	0.0000	0.000	NO	19000	0.0000	0.000	NO
Vanadium	0.007	H	38000	0.0001	0.008	NO	26000	0.0000	0.005	NO
Xylenes	2	I	1700	0.0000	0.000	NO	53	0.0000	0.000	NO
Zinc	0.2	H	220000	0.0003	0.002	NO	220000	0.0003	0.002	NO
Hazard Index (Sum of DI/RfD)					0.099				0.053	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table M-15
MOSS-AMERICAN
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - EAST DEVELOPMENT

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	6800	2E-05	4700	1E-05
Benzo(a)anthracene	B2	11.5	B	410000	7E-03	2800	5E-05
Benzo(b)fluoranthene	B2	11.5	B	99000	2E-03	2100	3E-05
Benzo(k)fluoranthene	B2	11.5	B	99000	2E-03	1900	3E-05
Benzo(g,h,i)perylene	B2	11.5	B	12000	2E-04	1500	2E-05
Benzo(a)pyrene	B2	11.5	C	100000	2E-03	1900	3E-05
bis(2-Ethylhexyl)phthalate	B2	0.014	I	460	9E-09	460	9E-09
Chrysene	C	11.5	B	300000	5E-03	2700	4E-05
1,1-Dichloroethene	C	0.091	H	210	3E-08	210	3E-08
Indeno(1,2,3-cd)pyrene	B2	11.5	B	210000	3E-03	1500	2E-05
2,3,7,8-TCDD (Dioxin)	B2	156000	H	0.28	6E-05	b	0E+00
SUM OF RISKS =					2E-02		2E-04

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Soil Intake (grams/kg body weight/day)	0.0014

(a) Source: I: IRIS - Integrated Risk Information System.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo[a]pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table N-16
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - DEVELOPMENT WEST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	370	0.0000	0.000	NO	60	0.0000	0.000	NO
Barium	0.05	I	200000	0.0027	0.053	NO	62000	0.0008	0.017	NO
Benzoic Acid	4	I	810	0.0000	0.000	NO	210	0.0000	0.000	NO
Beryllium	0.005	I	1300	0.0000	0.003	NO	490	0.0000	0.001	NO
bis(2-Ethylhexyl)phthalate	0.02	I	1600	0.0000	0.001	NO	266	0.0000	0.000	NO
Cadmium	0.0005	I	76000	0.0010	2.027	YES	5000	0.0001	0.133	NO
Chromium (b)	0.005	I	81000	0.0011	0.216	NO	16000	0.0002	0.043	NO
Copper	0.037	H	140000	0.0019	0.050	NO	25000	0.0003	0.009	NO
Cyanide (d)	0.02	H	3000	0.0000	0.002	NO	1400	0.0000	0.001	NO
2,4-Dinitrophenol	0.002	I	620000	0.0083	4.133	YES	(f)	0.0000	0.000	NO
Ethylbenzene	0.1	I	450	0.0000	0.000	NO	6	0.0000	0.000	NO
Lead	0.0014	S	520000	0.0069	4.952	YES	22000	0.0003	0.210	NO
Manganese	0.2	H	830000	0.0111	0.055	NO	330000	0.0044	0.022	NO
Mercury (c)	0.0003	H	3900	0.0001	0.173	NO	250	0.0000	0.011	NO
Methylene chloride	0.06	I	10000	0.0001	0.002	NO	6	0.0000	0.000	NO
Naphthalene	0.4	H	1800000	0.0240	0.060	NO	4300	0.0001	0.000	NO
Nickel (e)	0.02	H	220	0.0000	0.000	NO	15000	0.0002	0.010	NO
Styrene	0.2	I	380	0.0000	0.000	NO	4	0.0000	0.000	NO
Tetrachloroethene	0.01	I	9	0.0000	0.000	NO	3	0.0000	0.000	NO
Toluene	0.3	I	580	0.0000	0.000	NO	41	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	I	11	0.0000	0.000	NO	11	0.0000	0.000	NO
Vanadium	0.007	H	35000	0.0005	0.067	NO	14000	0.0002	0.027	NO
Xylenes	2	I	1100	0.0000	0.000	NO	5	0.0000	0.000	NO
Zinc	0.21	S	9800000	0.1307	0.622	NO	290000	0.0039	0.018	NO
Hazard Index (Sum of DI/RfD)					12.419				0.502	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Child
Soil Intake (grams/day)	0.2
Body Weight (kilograms)	15

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Cyanide value based on free cyanide.
(e) Nickel value based on nickel-soluble salts.
(f) Insufficient number of positive detections to estimate a mean concentration.

Table M-17
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - DEVELOPMENT WEST

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	370	0.0000	0.000	NO	60	0.0000	0.000	NO
Barium	0.05	I	200000	0.0003	0.006	NO	62000	0.0001	0.002	NO
Benzoic Acid	4	I	810	0.0000	0.000	NO	210	0.0000	0.000	NO
Beryllium	0.005	I	1300	0.0000	0.000	NO	500	0.0000	0.000	NO
bis(2-Ethylhexyl)phthalate	0.02	I	1600	0.0000	0.000	NO	266	0.0000	0.000	NO
Cadmium	0.0005	I	76000	0.0001	0.217	NO	5000	0.0000	0.014	NO
Chromium (b)	0.005	I	81000	0.0001	0.023	NO	16000	0.0000	0.005	NO
Copper	0.037	H	140000	0.0002	0.005	NO	25000	0.0000	0.001	NO
Cyanide (d)	0.02	H	3000	0.0000	0.000	NO	1400	0.0000	0.000	NO
2,4-Dinitrophenol	0.002	I	620000	0.0009	0.443	NO	(f)	0.0000	0.000	NO
Ethylbenzene	0.1	I	450	0.0000	0.000	NO	6	0.0000	0.000	NO
Lead	0.0014	S	520000	0.0007	0.531	NO	22000	0.0000	0.022	NO
Manganese	0.2	H	830000	0.0012	0.006	NO	330000	0.0005	0.002	NO
Mercury (c)	0.0003	H	3900	0.0000	0.019	NO	250	0.0000	0.001	NO
Methylene chloride	0.06	I	10000	0.0000	0.000	NO	6	0.0000	0.000	NO
Naphthalene	0.4	H	1800000	0.0026	0.006	NO	4300	0.0000	0.000	NO
Nickel (e)	0.02	H	220	0.0000	0.000	NO	15000	0.0000	0.001	NO
Styrene	0.2	I	380	0.0000	0.000	NO	4	0.0000	0.000	NO
Tetrachloroethene	0.01	I	9	0.0000	0.000	NO	3	0.0000	0.000	NO
Toluene	0.3	I	580	0.0000	0.000	NO	41	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	I	11	0.0000	0.000	NO	11	0.0000	0.000	NO
Vanadium	0.007	H	35000	0.0001	0.007	NO	14000	0.0000	0.003	NO
Xylenes	2	I	1100	0.0000	0.000	NO	5	0.0000	0.000	NO
Zinc	0.2	H	9800000	0.0140	0.070	NO	290000	0.0004	0.002	NO
Hazard Index (Sum of DI/RfD)					1.334				0.054	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Cyanide value based on free cyanide.
(e) Nickel value based on nickel-soluble salts.
(f) Insufficient number of positive detections to estimate a mean concentration.

Table M-18
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - DEVELOPMENT WEST

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	71000	2E-04	4500	1E-05
Benzene	A	0.029	I	100	4E-09	4	2E-10
Benzo(a)anthracene	B2	11.5	B	650000	1E-02	3900	6E-05
Benzo(b)fluoranthene	B2	11.5	B	270000	4E-03	2800	5E-05
Benzo(k)fluoranthene	B2	11.5	B	250000	4E-03	2200	4E-05
Benzo(g,h,i)peryiene	B2	11.5	B	77000	1E-03	2100	3E-05
Benzo(a)pyrene	B2	11.5	C	230000	4E-03	2600	4E-05
bis(2-Ethylhexyl)phthalate	B2	0.014	I	16000	3E-07	270	5E-09
Chyrsene	C	11.5	B	550000	9E-03	4000	7E-05
Dibenz(a,h)anthracene	B2	11.5	B	24000	4E-04	450	7E-06
Indeno(1,2,3-cd)pyrene	B2	11.5	B	120000	2E-03	2100	3E-05
Methylene chloride	B2	0.0075	I	10000	1E-07	6	7E-11
Nitrosodiphenylamine	B2	0.0049	I	270	2E-09	290	2E-09
2,3,7,8-TCDD (Dioxin)	B2	156000	N	0.00	2E-07	0.00079	2E-07
Tetrachloroethene	B2	0.051	N	9	7E-10	3	2E-10
SUM OF RISKS =					4E-02		3E-04

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Soil Intake (grams/kg body weight/day)	0.0014

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo(a)pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table H-19
MOSS AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - STREAM REACH 1

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	32000	0.0001	0.001	NO	3300	0.0000	0.000	NO
Antimony	0.0004	I	1100	0.0000	0.008	NO	1100	0.0000	0.008	NO
Barium	0.05	I	92000	0.0003	0.005	NO	80000	0.0002	0.005	NO
Beryllium	0.005	I	1100	0.0000	0.001	NO	910	0.0000	0.001	NO
2-Butanone	0.05	I	87	0.0000	0.000	NO	87	0.0000	0.000	NO
Cadmium	0.0005	I	14000	0.0000	0.080	NO	7100	0.0000	0.041	NO
4-Chloroaniline	0.004	N	60000	0.0002	0.043	NO	d			
Chloroform	0.01	I	990	0.0000	0.000	NO	200	0.0000	0.000	NO
Chromium (b)	0.005	I	22000	0.0001	0.013	NO	18000	0.0001	0.010	NO
Copper	0.037	N	32000	0.0001	0.002	NO	25000	0.0001	0.002	NO
Ethylbenzene	0.1	I	730	0.0000	0.000	NO	110.43	0.0000	0.000	NO
Lead	0.0014	S	120000	0.0003	0.245	NO	32000	0.0001	0.065	NO
Manganese	0.2	N	660000	0.0019	0.009	NO	460000	0.0013	0.007	NO
Mercury (c)	0.0003	N	430	0.0000	0.004	NO	120	0.0000	0.001	NO
Methylene chloride	0.06	I	33000	0.0001	0.002	NO	6400	0.0000	0.000	NO
Naphthalene	0.4	N	350000	0.0010	0.003	NO	140000	0.0004	0.001	NO
Toluene	0.3	I	950	0.0000	0.000	NO	99.44	0.0000	0.000	NO
Vanadium	0.007	N	31000	0.0001	0.013	NO	26000	0.0001	0.011	NO
Zinc	0.2	N	2200000	0.0063	0.031	NO	570000	0.0016	0.008	NO
Hazard Index (Sum of DI/RfD)					0.460				0.159	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.

Table M-20
MOSS AMERICAN
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - STREAM REACH 1

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	32000	0.0000	0.000	NO	3300	0.0000	0.000	NO
Antimony	0.0004	I	1100	0.0000	0.004	NO	1100	0.0000	0.004	NO
Barium	0.05	I	92000	0.0001	0.003	NO	80000	0.0001	0.002	NO
Beryllium	0.005	I	1100	0.0000	0.000	NO	910	0.0000	0.000	NO
2-Butanone	0.05	I	87	0.0000	0.000	NO	87	0.0000	0.000	NO
Cadmium	0.0005	I	14000	0.0000	0.040	NO	7100	0.0000	0.020	NO
Chloroform	0.01	I	990	0.0000	0.000	NO	200	0.0000	0.000	NO
Chromium (b)	0.005	I	22000	0.0000	0.006	NO	18000	0.0000	0.005	NO
Copper	0.037	H	32000	0.0000	0.001	NO	25000	0.0000	0.001	NO
Ethylbenzene	0.1	I	730	0.0000	0.000	NO	110	0.0000	0.000	NO
Lead	0.0014	S	110000	0.0002	0.112	NO	32000	0.0000	0.033	NO
Manganese	0.2	H	660000	0.0009	0.005	NO	460000	0.0007	0.003	NO
Mercury (c)	0.0003	H	430	0.0000	0.002	NO	120	0.0000	0.001	NO
Methylene chloride	0.06	I	33000	0.0000	0.001	NO	6400	0.0000	0.000	NO
Naphthalene	0.4	H	350000	0.0005	0.001	NO	140000	0.0002	0.001	NO
Toluene	0.3	I	950	0.0000	0.000	NO	99	0.0000	0.000	NO
Vanadium	0.007	H	31000	0.0000	0.006	NO	26000	0.0000	0.005	NO
Zinc	0.2	H	2200000	0.0031	0.016	NO	570000	0.0008	0.004	NO
Hazard Index (Sum of DI/RfD)					0.198				0.079	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.

Table M-21
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - STREAM REACH 1

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	8000	3E-07	4200	2E-07
Benzo(a)anthracene	B2	11.5	B	140000	4E-05	26000	7E-06
Benzo(b)fluoranthene	B2	11.5	B	64000	2E-05	13000	3E-06
Benzo(k)fluoranthene	B2	11.5	B	41000	1E-05	9100	2E-06
Benzo(a)pyrene	B2	11.5	C	54000	1E-05	12000	3E-06
Chloroform	B2	0.0061	I	990	1E-10	200	3E-11
Chyrsene	C	11.5	B	150000	4E-05	19000	5E-06
Dibenz(a,h)anthracene	B2	11.5	B	1600	4E-07	1300	3E-07
Indeno(1,2,3-cd)pyrene	B2	11.5	B	23000	6E-06	4300	1E-06
Methylene chloride	B2	0.0075	I	33000	6E-09	6400	1E-09
SUM OF RISKS =					1E-04		2E-05

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.00002

(a) Source: I: IRIS - Integrated Risk Information System.
M: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo(a)pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table N-22
NOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE -STREAM REACH 2

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	290	0.0000	0.000	NO	290	0.0000	0.000	NO
Antimony	0.0004	I	1700	0.0000	0.012	NO	1100	0.0000	0.008	NO
Barium	0.05	I	93000	0.0003	0.005	NO	59000	0.0002	0.003	NO
Beryllium	0.005	I	1300	0.0000	0.001	NO	880	0.0000	0.001	NO
2-Butanone	0.05	I	67	0.0000	0.000	NO	67	0.0000	0.000	NO
Cadmium	0.0005	I	7600	0.0000	0.043	NO	5600	0.0000	0.032	NO
Chloroform	0.01	I	420	0.0000	0.000	NO	120	0.0000	0.000	NO
Chromium (b)	0.005	I	15000	0.0000	0.009	NO	15000	0.0000	0.009	NO
Copper	0.037	H	29000	0.0001	0.002	NO	22000	0.0001	0.002	NO
Ethylbenzene	0.1	I	3	0.0000	0.000	NO	3	0.0000	0.000	NO
Lead	0.0014	S	53000	0.0002	0.108	NO	34000	0.0001	0.069	NO
Manganese	0.2	H	730000	0.0021	0.010	NO	500000	0.0014	0.007	NO
Mercury (c)	0.0003	H	360	0.0000	0.003	NO	160	0.0000	0.002	NO
Methylene chloride	0.06	I	12000	0.0000	0.001	NO	4200	0.0000	0.000	NO
Naphthalene	0.4	H	11000	0.0000	0.000	NO	4700	0.0000	0.000	NO
Toluene	0.3	I	230	0.0000	0.000	NO	100	0.0000	0.000	NO
Vanadium	0.007	H	29000	0.0001	0.012	NO	22000	0.0001	0.009	NO
Zinc	0.2	H	91000	0.0003	0.001	NO	47000	0.0001	0.001	NO
Hazard Index (Sum of DI/RfD)					0.208				0.142	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.

Table M-23
MOSS-AMERICAN STREAM REACH 2
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	290	0.0000	0.000	NO	290	0.0000	0.000	NO
Antimony	0.0004	I	1700	0.0000	0.006	NO	1100	0.0000	0.004	NO
Barium	0.05	I	93000	0.0001	0.003	NO	59000	0.0001	0.002	NO
Beryllium	0.005	I	1300	0.0000	0.000	NO	880	0.0000	0.000	NO
2-Butanone	0.05	I	67	0.0000	0.000	NO	67	0.0000	0.000	NO
Cadmium	0.0005	I	7600	0.0000	0.022	NO	5600	0.0000	0.016	NO
Chloroform	0.01	I	420	0.0000	0.000	NO	120	0.0000	0.000	NO
Chromium (b)	0.005	I	15000	0.0000	0.004	NO	15000	0.0000	0.004	NO
Copper	0.037	N	29000	0.0000	0.001	NO	22000	0.0000	0.001	NO
Ethylbenzene	0.1	I	3	0.0000	0.000	NO	3	0.0000	0.000	NO
Lead	0.0014	S	53000	0.0001	0.054	NO	34000	0.0000	0.035	NO
Manganese	0.2	N	730000	0.0010	0.005	NO	500000	0.0007	0.004	NO
Mercury (c)	0.0003	N	360	0.0000	0.002	NO	160	0.0000	0.001	NO
Methylene chloride	0.06	I	12000	0.0000	0.000	NO	4200	0.0000	0.000	NO
Naphthalene	0.4	N	11000	0.0000	0.000	NO	4700	0.0000	0.000	NO
Toluene	0.3	I	230	0.0000	0.000	NO	100	0.0000	0.000	NO
Vanadium	0.007	N	29000	0.0000	0.006	NO	22000	0.0000	0.004	NO
Zinc	0.2	N	90000	0.0001	0.001	NO	47000	0.0001	0.000	NO
Hazard Index (Sum of DI/RfD)					0.104				0.071	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.

Table M-24
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - STREAM REACH 2

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	5100	2E-07	4800	2E-07
Benzo(a)anthracene	B2	11.5	B	97000	3E-05	18000	5E-06
Benzo(b)fluoranthene	B2	11.5	B	49000	1E-05	9900	3E-06
Benzo(k)fluoranthene	B2	11.5	B	53000	1E-05	5500	1E-06
Benzo(g,h,i)perylene	B2	11.5	B	14000	4E-06	3400	9E-07
Benzo(a)pyrene	B2	11.5	C	67000	2E-05	8600	2E-06
Chloroform	B2	0.0061	I	420	6E-11	120	2E-11
Chyrsene	C	11.5	B	81000	2E-05	9300	2E-06
Dibenz(a,h)anthracene	B2	11.5	B	2400	6E-07	2200	6E-07
Indeno(1,2,3-cd)pyrene	B2	11.5	B	26000	7E-06	4700	1E-06
Methylene chloride	B2	0.0075	I	12000	2E-09	4200	7E-10
Nitrosodiphenylamine	B2	0.0049	I	3100	3E-10	3100	3E-10
SUM OF RISKS =					1E-04		2E-05

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.0000

(a) Source: I: IRIS - Integrated Risk Information System.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo(a)pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table H-25
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - STREAM REACH 3

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	2100	0.0000	0.000	NO	2100	0.0000	0.000	NO
Barium	0.05	I	85000	0.0002	0.005	NO	81000	0.0002	0.005	NO
Beryllium	0.005	I	710	0.0000	0.000	NO	710	0.0000	0.000	NO
Cadmium	0.0005	I	7100	0.0000	0.041	NO	6800	0.0000	0.039	NO
Chromium (b)	0.005	I	24000	0.0001	0.014	NO	21000	0.0001	0.012	NO
Copper	0.037	N	28000	0.0001	0.002	NO	24000	0.0001	0.002	NO
Ethylbenzene	0.1	I	240	0.0000	0.000	NO	190	0.0000	0.000	NO
Lead	0.0014	S	110000	0.0003	0.224	NO	83000	0.0002	0.169	NO
Manganese	0.22	N	950000	0.0027	0.012	NO	800000	0.0023	0.010	NO
Mercury (c)	0.0003	N	420	0.0000	0.004	NO	360	0.0000	0.003	NO
Methylene chloride	0.06	I	1400	0.0000	0.000	NO	890	0.0000	0.000	NO
Naphthalene	0.4	N	310000	0.0009	0.002	NO	6400	0.0000	0.000	NO
Nickel (d)	0.02	N	24000	0.0001	0.003	NO	21000	0.0001	0.003	NO
Vanadium	0.007	N	30000	0.0001	0.012	NO	28000	0.0001	0.011	NO
Zinc	0.2	N	350000	0.0010	0.005	NO	310000	0.0009	0.004	NO
Hazard Index (Sum of DI/RfD)					0.326				0.260	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table M-26
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE -STREAM REACH 3

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Acetone	0.1	I	2100	0.0000	0.000	NO	2100	0.0000	0.000	NO
Barium	0.05	I	85000	0.0001	0.002	NO	81000	0.0001	0.002	NO
Beryllium	0.005	I	710	0.0000	0.000	NO	710	0.0000	0.000	NO
Cadmium	0.0005	I	7100	0.0000	0.020	NO	6800	0.0000	0.019	NO
Chromium (b)	0.005	I	24000	0.0000	0.007	NO	21000	0.0000	0.006	NO
Copper	0.037	H	28000	0.0000	0.001	NO	24000	0.0000	0.001	NO
Ethylbenzene	0.1	I	240	0.0000	0.000	NO	190	0.0000	0.000	NO
Lead	0.0014	S	110000	0.0002	0.112	NO	83000	0.0001	0.085	NO
Manganese	0.2	H	950000	0.0014	0.007	NO	800000	0.0011	0.006	NO
Mercury (c)	0.0003	H	420	0.0000	0.002	NO	360	0.0000	0.002	NO
Methylene chloride	0.06	I	1400	0.0000	0.000	NO	890	0.0000	0.000	NO
Naphthalene	0.4	H	310000	0.0004	0.001	NO	6400	0.0000	0.000	NO
Nickel (d)	0.02	H	24000	0.0000	0.002	NO	21000	0.0000	0.002	NO
Vanadium	0.007	H	30000	0.0000	0.006	NO	28000	0.0000	0.006	NO
Zinc	0.2	H	350000	0.0005	0.003	NO	310000	0.0004	0.002	NO
Hazard Index (Sum of DI/RfD)					0.163				0.131	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts

Table M-27
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE -STREAM REACH 3

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	7000	3E-07	6200	2E-07
Benzo[a]anthracene	B2	11.5	B	190000	5E-05	22000	6E-06
Benzo[b]fluoranthene	B2	11.5	B	58000	1E-05	9400	2E-06
Benzo[k]fluoranthene	B2	11.5	B	58000	1E-05	6600	2E-06
Benzo[g,h,i]perylene	B2	11.5	B	4000	1E-06	1700	4E-07
Benzo[a]pyrene	B2	11.5	C	54000	1E-05	8700	2E-06
Chyrsene	C	11.5	B	110000	3E-05	18000	5E-06
Dibenz[a,h]anthracene	B2	11.5	B	1400	4E-07	1400	4E-07
Indeno[1,2,3-cd]pyrene	B2	11.5	B	9100	2E-06	2300	6E-07
Methylene chloride	B2	0.0075	I	1400	2E-10	890	1E-10
2,3,7,8-TCDD (Dioxin)	B2	156000	N	0.00014	5E-10	0.00014	5E-10
SUM OF RISKS =					1E-04		2E-05

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.0000

(a) Source: I: IRIS - Integrated Risk Information System.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo[a]pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table H-28
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - STREAM REACH 4

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Barium	0.05	I	82000	0.0002	0.005	NO	46000	0.0001	0.003	NO
Benzoic Acid	4	I	660	0.0000	0.000	NO	500	0.0000	0.000	NO
Cadmium	0.0005	I	6200	0.0000	0.035	NO	4800	0.0000	0.027	NO
Chromium (b)	0.005	I	24000	0.0001	0.014	NO	16000	0.0000	0.009	NO
Copper	0.037	H	27000	0.0001	0.002	NO	20000	0.0001	0.002	NO
Ethylbenzene	0.1	I	4	0.0000	0.000	NO	4	0.0000	0.000	NO
Lead	0.0014	S	19000	0.0001	0.039	NO	85000	0.0002	0.173	NO
Manganese	0.2	H	650000	0.0019	0.009	NO	590	0.0000	0.000	NO
Mercury (c)	0.0003	H	310	0.0000	0.003	NO	300	0.0000	0.003	NO
Nickel (d)	0.02	H	19000	0.0001	0.003	NO	18000	0.0001	0.003	NO
Selenium	0.003	H	1300	0.0000	0.001	NO	1300	0.0000	0.001	NO
Vanadium	0.007	H	23000	0.0001	0.009	NO	21000	0.0001	0.009	NO
Zinc	0.21	H	360000	0.0010	0.005	NO	280000	0.0008	0.004	NO
Hazard Index (Sum of DI/RfD)					0.125				0.233	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table M-29
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - STREAM REACH 4

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Barium	0.05	I	82200	0.0001	0.002	NO	46000	0.0001	0.001	NO
Benzoic Acid	4	I	660	0.0000	0.000	NO	490	0.0000	0.000	NO
Cadmium	0.0005	I	6200	0.0000	0.018	NO	4800	0.0000	0.014	NO
Chromium (b)	0.005	I	24000	0.0000	0.007	NO	16000	0.0000	0.005	NO
Copper	0.037	H	27000	0.0000	0.001	NO	20000	0.0000	0.001	NO
Ethylbenzene	0.1	I	4	0.0000	0.000	NO	4	0.0000	0.000	NO
Lead	0.0014	S	19000	0.0000	0.019	NO	85000	0.0001	0.087	NO
Manganese	0.2	H	650000	0.0009	0.005	NO	590	0.0000	0.000	NO
Mercury (c)	0.0003	H	310	0.0000	0.001	NO	300	0.0000	0.001	NO
Nickel (d)	0.02	H	19000	0.0000	0.001	NO	18000	0.0000	0.001	NO
Selenium	0.003	S	1300	0.0000	0.001	NO	1300	0.0000	0.001	NO
Vanadium	0.007	H	23000	0.0000	0.005	NO	21000	0.0000	0.004	NO
Zinc	0.2	H	360000	0.0005	0.003	NO	280000	0.0004	0.002	NO
Hazard Index (Sum of DI/RfD)					0.063				0.117	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be the (+6) hexavalent state.
(c) Assumed to be alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table H-30
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - STREAM REACH 4

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	10000	4E-07	5800	2E-07
Benzo(a)anthracene	B2	11.5	B	56000	1E-05	4900	1E-06
Benzo(b)fluoranthene	B2	11.5	B	44000	1E-05	3400	9E-07
Benzo(k)fluoranthene	B2	11.5	B	17000	4E-06	1800	5E-07
Benzo(g,h,i)perylene	B2	11.5	B	3400	9E-07	1000	3E-07
Benzo(a)pyrene	B2	11.5	C	37000	1E-05	3100	8E-07
Chyrsene	C	11.5	B	38000	1E-05	4200	1E-06
Dibenz(a,h)anthracene	B2	11.5	B	180	5E-08	280	7E-08
Indeno(1,2,3-cd)pyrene	B2	11.5	B	4400	1E-06	1100	3E-07
2,3,7,8-TCDD (Dioxin)	B2	156000	H	0.74	3E-06	b	0E+00
SUM OF RISKS =					5E-05		5E-06

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.0000

(a) Source: H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo(a)pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

Table M-31
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
CHILD SOIL INGESTION EXPOSURE - STREAM REACH 5

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Antimony	0.0004	I	4500	0.0000	0.032	NO	4500	0.0000	0.032	NO
Barium	0.05	I	750000	0.0021	0.043	NO	68000	0.0002	0.004	NO
Benzoic Acid	4	I	2300	0.0000	0.000	NO	2000	0.0000	0.000	NO
Butyl benzyl phthalate	0.2	H	720	0.0000	0.000	NO	720	0.0000	0.000	NO
Cadmium	0.0005	I	5900	0.0000	0.034	NO	5100	0.0000	0.029	NO
Chromium (b)	0.005	I	33000	0.0001	0.019	NO	28000	0.0001	0.016	NO
Copper	0.037	H	46000	0.0001	0.004	NO	39000	0.0001	0.003	NO
Lead	0.0014	S	210000	0.0006	0.429	NO	170000	0.0005	0.347	NO
Manganese	0.2	H	450000	0.0013	0.006	NO	400000	0.0011	0.006	NO
Mercury (c)	0.0003	H	420	0.0000	0.004	NO	300	0.0000	0.003	NO
Nickel (d)	0.02	H	24000	0.0001	0.003	NO	21000	0.0001	0.003	NO
Vanadium	0.007	H	23000	0.0001	0.009	NO	21000	0.0001	0.009	NO
Zinc	0.2	H	490000	0.0014	0.007	NO	380000	0.0011	0.005	NO
Hazard Index (Sum of DI/RfD)					0.590				0.457	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Child
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	35

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table H-32
MOSS-AMERICAN SITE
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
ADULT SOIL INGESTION EXPOSURE - STREAM REACH 5

Chemical	Reference Dose (RfD) mg/kg/day	(a)	Highest Detected Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose	Geometric Mean Concentration ug/kg	Estimated Daily Intake (DI) mg/kg/day	DI/RfD	Exceed Reference Dose
Antimony	0.0004	I	4500	0.0000	0.016	NO	4500	0.0000	0.016	NO
Barium	0.05	I	750000	0.0011	0.021	NO	68000	0.0001	0.002	NO
Benzoic Acid	4	I	2300	0.0000	0.000	NO	2000	0.0000	0.000	NO
Butyl benzyl phthalate	0.2	N	720	0.0000	0.000	NO	720	0.0000	0.000	NO
Cadmium	0.0005	I	5900	0.0000	0.017	NO	5100	0.0000	0.015	NO
Chromium (b)	0.005	I	33000	0.0000	0.009	NO	28000	0.0000	0.008	NO
Copper	0.037	N	46000	0.0001	0.002	NO	39000	0.0001	0.002	NO
Lead	0.0014	S	210000	0.0003	0.214	NO	170000	0.0002	0.173	NO
Manganese	0.2	N	450000	0.0006	0.003	NO	400000	0.0006	0.003	NO
Mercury (c)	0.0003	N	420	0.0000	0.002	NO	300	0.0000	0.001	NO
Nickel (d)	0.02	N	24000	0.0000	0.002	NO	21000	0.0000	0.002	NO
Vanadium	0.007	N	23000	0.0000	0.005	NO	21000	0.0000	0.004	NO
Zinc	0.21	N	490000	0.0007	0.003	NO	380000	0.0005	0.003	NO
Hazard Index (Sum of DI/RfD)					0.295				0.228	

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Exposed Individual	Adult
Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70

(a) Source: I: IRIS - Integrated Risk Information System.
S: SPHEM - Superfund Public Health Evaluation Manual.
N: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
(b) Assumed to be in the (+6) hexavalent state.
(c) Assumed to alkyl mercury.
(d) Nickel value based on nickel-soluble salts.

Table H-33
MOSS-AMERICAN SITE
EXCESS LIFETIME CANCER RISK
SOIL INGESTION EXPOSURE - STREAM REACH 5

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	(a)	Highest Detected Concentration ug/kg	Excess Lifetime Cancer Risk	Geometric Mean Concentration ug/kg	Excess Lifetime Cancer Risk
Arsenic	A	1.75	A	4500	2E-07	4500	2E-07
Benzo(a)anthracene	B2	11.5	B	4000	1E-06	2000	5E-07
Benzo(b)fluoranthene	B2	11.5	B	26000	7E-06	1900	5E-07
Benzo(k)fluoranthene	B2	11.5	B	36000	9E-06	1300	3E-07
Benzo(g,h,i)perylene	B2	11.5	B	3400	9E-07	1000	3E-07
Benzo(a)pyrene	B2	11.5	C	28000	7E-06	1800	5E-07
Chyrsene	C	11.5	B	3400	9E-07	2700	7E-07
Dibenz(a,h)anthracene	B2	11.5	B	200	5E-08	b	--
Indeno(1,2,3-cd)pyrene	B2	11.5	B	3400	9E-07	1000	3E-07
2,3,7,8-TCDD (Dioxin)	B2	156000	H	0.004	1E-08	b	--
SUM OF RISKS =					3E-05		3E-06

EXPOSURE ASSUMPTIONS

Exposure Setting	Trespass
Daily Soil Intake (grams/day)	0.1
Body Weight (kilograms)	70
Number of days/week exposed	2
Number of weeks/year exposed	20
Number of years exposed	10
Lifetime Average Soil Intake (grams/kg body weight/day)	0.00002

(a) Source: H: HEAST - Health Effects Assessment Summary Tables - Quarterly Summary.
B: Based on benzo(a)pyrene.
A: U.S. EPA 1988
C: U.S. EPA 1980

(b) Insufficient positive detects to calculate a mean.

Appendix N
QUALITY ASSURANCE/QUALITY CONTROL EVALUATION OF LABORATORY DATA

Appendix N
QUALITY ASSURANCE/QUALITY CONTROL EVALUATION OF LABORATORY DATA

INTRODUCTION

The U.S. EPA requires that all chemical data gathered during an RI be evaluated for precision and accuracy. Errors in the data can originate either during sampling or during the laboratory analysis of the samples. The magnitude and source of errors can be assessed through the collection and analysis of field replicate, duplicate, split, spiked, and blank samples. This appendix presents the RI analytical data and a quality assurance/quality control evaluation of those data at the Moss-American site.

PROCEDURE

The QA/QC procedures stated in the Quality Assurance Project Plan (QAPP) for this project include both field sampling and laboratory analysis. Data review is performed by U.S. EPA's Region V CRL according to the *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses and the Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses* (U.S. EPA Office of Emergency and Remedial Response 1988). These reviews, plus additional observations by CH2M HILL, are incorporated into the final data validation written for each set of data before its use.

BLANKS

Generally, at least one field blank and one laboratory blank are prepared for every set of samples submitted for analyses. Trip blanks were not prepared. Refer to Appendixes B, C, E, F and H for details on blanks that were used for each sampling effort. The field blank (HPLC-grade water for groundwater, surface water, and leachate samples; clean sand for soil and sediment samples) provides a means of identifying contaminants introduced during sampling. The laboratory blank (reagent blank) has a similar function with respect to the identification of contaminants introduced during laboratory preparation and analysis of the samples.

DUPLICATES/REPLICATES

Duplicate samples characterize the precision of the data. Usually at least one field replicate and one laboratory duplicate are prepared for each set of samples submitted. By comparing field replicates and laboratory duplicates, a determination can be made as to whether scatter in the data is due to field sampling or laboratory techniques. Scatter attributable to chemical testing is measured by comparing the concentrations of spiked constituents in split portions of the same sample. The presence of greater scatter in the values reported for the field replicates than what is found among the laboratory duplicate data is attributable in general to sampling error.

Both field replicates and laboratory duplicate samples are analyzed to determine data precision, a measure of the reproducibility of an analysis. The results are reported as relative percent difference (RPD) and calculated by:

$$RPD = \frac{D1 - D2}{(D1 + D2)/2} \times 100\%$$

where:

D1 = concentration of original sample
D2 = concentration of duplicate or replicate sample

Acceptable RPDs are specified by the U.S. EPA and are listed in the QA/QC portion of the data.

SPIKE RECOVERIES

Spike sample analyses are done to determine the effect of the sample matrix on extraction, digestion, and measurement procedures. Spike recoveries are also used to determine the accuracy of the analyses, which is a measure of the agreement between an experimental determination and the true value of the parameter being measured.

In general, a known amount of compound is added to a sample, the sample is analyzed, and the amount of spike compound recovered by analysis is compared to the amount added. The type of spikes varies from organic to inorganic analyses and from low to high concentration analyses.

A "surrogate spike" in organic analysis is a compound not expected to be present in environmental samples, but with properties similar to those of the target compounds. It is added to all samples before extraction and other sample preparation. Percent recovery (%R) is calculated by:

$$\%R = SSR/SA \times 100\%$$

where:

SSR = quantity measured in spiked sample
SA = quantity of spike added

A "matrix spike" consists of target compounds added to a sample just before analysis. It is analogous to the "method spike" done for high concentration inorganic analysis. Both analyses are performed to evaluate matrix effects on the analytical methodology and data accuracy.

Percent recovery for a matrix spike is calculated by:

$$\%R = \frac{SSR-SR}{SA} \times 100\%$$

where:

SR = quantity measured in unspiked sample
SSR = quantity measured in spiked sample
SA = quantity of spike added

The "method spike" for high concentration inorganics and the "spike sample analysis" for low and medium inorganic concentrations are the same. The spike is added before any reagents are added to the sample. Percent recovery is calculated as for a matrix or method spike.

A recovery above the control limits may indicate a high bias in the data, while a recovery below the control limits may indicate a low bias and detection limits higher than those specified by the contract.

QUANTITATION/DETECTION LIMITS

A quantitation/detection limit is the minimum amount of a chemical that can be confidently detected and quantified. An individual laboratory's quantitation/ detection limits may be lower than the Contract Required Detection Limits (CRDL) or Contract Required Quantitation Limits (CRQL) established for the CLP. In that case, data lower than the CRDL or CRQL are reported and they are considered estimated because the accuracy of quantification below these levels is uncertain. Contamination or other analytical problems (such as low sample recoveries) may cause the actual detection limit to be higher than that reported by the laboratory. When that occurs, it is noted in the laboratory validation documentation.

SERIAL DILUTION

For inductively coupled plasma analysis, a serial dilution analysis is done for each set of samples of similar matrix type and concentration. For an analyte concentration at least a factor of 10 above CRDL, the measured concentrations of the undiluted sample and of the sample after a five-fold dilution should agree within 10 percent. If the difference is greater than 10 percent, the results for that compound are considered estimated due to matrix interference.

INSTRUMENT QC

In addition to the above procedures, other instrument-specific tests are done such as initial continuing calibration, decafluorotriphenylphosphine, and bromofluorobenzene tuning for the gas chromatograph/mass spectrometer (GC/MS), and determining linearity of standard calibration curves by calculating the coefficient of correlation. Initial and continuing calibration of instruments with standard solutions are used to ensure that the instrument is capable of

producing acceptable quantitative data. Calibration verification results must fall within control limits or the results are flagged estimated, or unusable.

DATA REVIEW AND VALIDATION

CRL DATA REVIEW

The U.S. EPA Sample Management Office (SMO) receives data packages through the CLP and distributes them to the Laboratory Sciences Services Section (LSSS) of the U.S. EPA Region V CRL. In Region 5, LSSS reviews all data packages resulting from regional sampling efforts. The following items are reviewed by the LSSS, as stated in Laboratory Data Validation Functional Guidelines:

- Sample holding times at the CLP laboratory
- GC/MS tuning and performance (organic compounds only)
- Instrument calibration (initial and continuing)
- Blanks
- Interference check sample analysis (inorganic chemicals only)
- Surrogate recoveries (organic compounds only)
- Matrix and analytical spike analysis
- Duplicate sample analysis
- Compound identification (organic compounds only)
- Overall assessment of data

DATA VALIDATION

After the LSSS-reviewed data packages are received by CH2M HILL, the reviewer's comments are summarized in the final data validation before interpretation of the data by project staff. Any data noted in the review that should be qualified are flagged with the appropriate symbol. Results for field blanks and field replicates are reviewed (these may or may not be considered by the LSSS), and the data further qualified if necessary. Finally, the data set as a whole is examined for consistency, anomalous results, and whether the data are reasonable for the samples involved. The following data qualifiers were used on this project:

- Data are flagged as estimated (J) if a QA/QC parameter has not been satisfied or the sample concentration was above the analytical detection limit but less than the CRQL or the CRDL. However, the data are still used quantitatively. Whenever possible, the estimated data are compared to similar data that are not estimated.

- If a chemical is detected in a blank, that chemical is flagged in all the samples for the set as blank contaminated (B) if the concentrations in the sample are less than five times the blank concentration. Acetone, methylene chloride, 2-butanone, toluene, and the phthalate esters are common laboratory contaminants.

When these chemicals are detected in a blank, they are flagged in the samples when they are less than 10 times the blank concentration. Blank contaminated data are not used quantitatively or qualitatively.

- Data are flagged as unusable (R) when the analytical procedures and results exceed the QA/QC limits specified in the EPA guidelines. Unusable data are not used either quantitatively or qualitatively.

Sample data are identified by case numbers and traffic report by numbers for routine analytical services (RAS), and by SAS numbers for special analytical services (e.g., fast turnaround times or high hazard samples). For RAS samples, a case number is assigned to a group of samples collected at one time, and individual samples are assigned unique traffic report numbers to identify them from time of sampling through reporting of the analytical data. For SAS samples, the first four numbers define a group of samples and the final letters/numbers identify individual samples (e.g., SAS3136E01, SAS3136E02). CH2M HILL assigns each sample another unique identification related to sampling location, time of sampling, and depth of sample (e.g., SW87-01-T, for surface water sample collected in 1987 at location 1 and at the top portion of the pond).

Tables N-1 and N-2 list parameters analyzed for in each sample and the detection limits before data interpretation by project staff.

ORGANIC COMPOUNDS IN SOIL AND SEDIMENT

Four soil boring samples were analyzed by Environmental Control Technology Corporation (ENCOTECH) for low and medium concentration organic compounds, Case No. 9736, OTR Nos. ES622, ES623, EW801, and EW802. The data are qualified as follows:

- The 7-day extraction holding time was not met for the VOC fraction of all four samples. The VOC data should be considered estimated; they have been flagged "J."

- Methylene chloride (10 µg/kg) and acetone (17 µg/kg) were measured in the method blank. All positive results for these compounds less than 10 times the blank concentration have been flagged "B" and should be considered unusable because of possible blank contamination. Methylene chloride (3 µg/kg) was also measured in the field blanks.

- Matrix spike recoveries were below the control limits for the base/neutral extractable fraction (36 and 35 percent). Matrix spike duplicate results were out of control limits for the base/neutral fraction (56 percent) and acid extractable fraction (-53 and

Table N-1
TARGET ANALYTE LIST AND
CONTRACT-REQUIRED DETECTION LIMITS

Inorganic Target Analyte	Detection Limit Low Concentration Analysis[a] Water (ug/l)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5,000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5,000
Manganese	15
Mercury	0.2
Nickel	50
Potassium	5,000
Selenium	5
Silver	10
Sodium	5,000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

[a]The detection limits for samples may be considerably higher depending on the sample matrix.

[12/87]

Table B-2 (Page 1 of 3)
TARGET COMPOUND LIST AND
CONTRACT REQUIRED QUANTITATION LIMITS

			Quantitation Limits Low Concentration Analysis[a]	
	Volatile	CAS Number	Water (ug/l)	Soil/Sediment[b] (ug/kg)
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl Chloride	75-01-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene Chloride	75-09-2	5	5
6.	Acetone	67-64-1	10	10
7.	Carbon Disulfide	75-15-0	5	5
8.	1,1-Dichloroethene	75-34-4	5	5
9.	1,1-Dichloroethane	75-35-3	5	5
10.	1,2-Dichloroethene (total)	540-59-0	5	5
11.	Chloroform	67-66-3	5	5
12.	1,2-Dichloroethane	107-06-2	5	5
13.	2-Butanone	78-93-2	10	10
14.	1,1,1-Trichloroethane	71-55-6	5	5
15.	Carbon Tetrachloride	56-23-5	5	5
16.	Vinyl Acetate	108-05-4	10	10
17.	Bromodichloromethane	75-27-4	5	5
18.	1,1,2,2-Tetrachloroethane	79-34-5	5	5
19.	1,2-Dichloropropane	78-87-5	5	5
20.	Cis-1,3-Dichloropropene	10061-02-5	5	5
21.	Trichloroethene	79-01-6	5	5
22.	Dibromochloromethane	124-48-1	5	5
23.	1,1,2-Trichloroethane	79-00-5	5	5
24.	Benzene	71-43-2	5	5
25.	Trans-1,3-Dichloropropene	10061-01-6	5	5
26.	Bromoform	75-25-2	5	5
27.	2-Hexanone	591-78-6	10	10
28.	4-Methyl-2-pentanone	108-10-1	10	10
29.	Tetrachloroethene	127-18-4	5	5
30.	Toluene	108-88-3	5	5
31.	Chlorobenzene	108-90-7	5	5
32.	Ethyl Benzene	100-41-4	5	5
33.	Styrene	100-42-5	5	5
34.	Xylenes (total)	133-02-7	5	5
	Semivolatile			
35.	Phenol	108-95-2	10	330
36.	bis(2-Chloroethyl)ether	111-44-4	10	330
37.	2-Chlorophenol	95-57-8	10	330
38.	1,3-Dichlorobenzene	541-73-1	10	330
39.	1,4-Dichlorobenzene	106-46-7	10	330
40.	Benzyl Alcohol	100-51-6	10	330
41.	1,2-Dichlorobenzene	95-50-1	10	330
42.	2-Methylphenol	95-48-7	10	330
43.	bis(2-Chloroisopropyl)ether	39638-32-9	10	330

Note: Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated by dry weight as required by the contract, will be higher.

[b] Medium soil/sediment CRQLs for volatile TCL compounds are 100 times the individual low soil/sediment CRQL; for semivolatile TCL compounds they are 60 times the individual low soil/sediment CRQL.

Table B-2 (Page 2 of 3)

Semivolatile (Continued)	CAS Number	Quantitation Limits Low Concentration Analysis [a] Water (ug/l)	Soil/Sediment [b] (ug/kg)
44. 4-Methylphenol	106-44-5	10	330
45. N-Nitroso-Dipropylamine	621-64-7	10	330
46. Hexachloroethane	67-72-1	10	330
47. Nitrobenzene	98-95-3	10	330
48. Isophorone	78-59-1	10	330
49. 2-Nitrophenol	88-75-5	10	330
50. 2,4-Dimethylphenol	105-67-9	10	330
51. Benzoic Acid	65-85-0	50	1,600
52. bis(2-Chloroethoxy)methane	111-91-1	10	330
53. 2,4-Dichlorophenol	120-83-2	10	330
54. 1,2,4-Trichlorobenzene	120-82-1	10	330
55. Naphthalene	91-20-3	10	330
56. 4-Chloroaniline	106-47-8	10	330
57. Hexachlorobutadiene	87-68-3	10	330
58. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
59. 2-Methylnaphthalene	91-57-6	10	330
60. Hexachlorocyclopentadiene	77-47-4	10	330
61. 2,4,6-Trichlorophenol	88-06-2	10	330
62. 2,4,5-Trichlorophenol	95-95-4	50	1,600
63. 2-Chloronaphthalene	91-58-7	10	330
64. 2-Nitroaniline	88-74-4	50	1,600
65. Dimethyl Phthalate	131-11-3	10	330
66. Acenaphthylene	208-96-8	10	330
67. 2,6-Dinitrotoluene	606-20-2	10	330
68. 3-Nitroaniline	99-09-2	50	1,600
69. Acenaphthene	83-32-9	10	330
70. 2,4-Dinitrophenol	51-28-5	50	1,600
71. 4-Nitrophenol	100-02-7	50	1,600
72. Dibenzofuran	132-64-9	10	330
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl Phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1,600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1,600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl Phenyl ether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1,600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butylphthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butyl Benzyl Phthalate	85-68-7	10	330

Note: Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated by dry weight as required by the contract, will be higher.

[b] Medium soil/sediment CRQLs for volatile TCL compounds are 100 times the individual low soil/sediment CRQL; for semivolatile TCL compounds they are 60 times the individual low soil/sediment CRQL.

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Semivolatile (Continued)	CAS Number	Quantitation Limits Low Concentration Analysis[a] Water (ug/l)	Soil/Sediment[b] (ug/kg)
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benzo(a)anthracene	56-55-3	10	330
91. Chrysene	218-01-9	10	330
92. bis(2-ethylhexyl)phthalate	117-81-7	10	330
93. Di-n-octyl Phthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330
Pesticides/PCBs			
100. alpha-BHC	319-84-6	0.05	8.0
101. beta-BHC	319-85-7	0.05	8.0
102. delta-BHC	319-86-8	0.05	8.0
103. gamma-BHC (Lindane)	58-89-9	0.05	8.0
104. Heptachlor	76-44-8	0.05	8.0
105. Aldrin	309-00-2	0.05	8.0
106. Heptachlor Epoxide	1024-57-3	0.05	8.0
107. Endosufan I	959-98-8	0.05	8.0
108. Dieldrin	60-57-1	0.10	16.0
109. 4,4'-DDE	72-55-9	0.10	16.0
110. Endrin	72-20-8	0.10	16.0
111. Endosulfan II	33213-65-9	0.10	16.0
112. 4,4'-DDD	72-54-8	0.10	16.0
113. Endosulfan Sulfate	1031-07-8	0.10	16.0
114. 4,4'-DDT	50-29-3	0.10	16.0
115. Endrin Ketone	53494-70-5	0.10	16.0
116. Methoxychlor	72-43-5	0.5	80.0
117. Alpha-chlordane	5103-71-9	0.5	80.0
118. gamma-chlordane	5103-74-2	0.5	80.0
119. Toxaphene	8001-35-2	1.0	160.0
120. PCB Arochlor-1016	12674-11-2	0.5	80.0
121. PCB Arochlor-1221	11104-28-2	0.5	80.0
122. PCB Arochlor-1232	11141-16-5	0.5	80.0
123. PCB Arochlor-1242	53469-21-9	0.5	80.0
124. PCB Arochlor-1248	12672-29-6	0.5	80.0
125. PCB Arochlor-1254	11097-69-1	1.0	160.0
126. PCB Arochlor-1260	11096-82-5	1.0	160.0

Note: Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

[a] Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated by dry weight as required by the contract, will be higher.

[b] Medium soil/sediment CRQLs for volatile TCL compounds are 100 times the individual low soil/sediment CRQL; for semivolatile TCL compounds they are 60 times the individual low soil/sediment CRQL.

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52 percent). Although there may be matrix interferences, the data were not qualified based on the MS/MSD results.

Fifteen sediment and one soil sample, including two field replicates and one field blank, were analyzed for low and medium concentration organic compounds by York Laboratories (YORK), case No. 9773, OTR Nos. EW805, EW814, and EW816 to EW828, and EW830. The data are qualified as follows:

- For the medium concentration sample (EW805), methylene chloride (1,100 µg/kg), acetone (2,300 µg/kg), 2-butanone (810 µg/kg), toluene (260 µg/kg), styrene (88 µg/kg), xylene (380 µg/kg), butylbenzylphthalate (160 µg/kg), and bis(2-ethylhexyl)phthalate (410 µg/kg) were measured in the laboratory method blanks. Styrene results less than 5 times the blank concentration, or results for any of the other compounds less than 10 times the blank concentration should be considered unusable because of contamination, and have been flagged "B."

- For the low concentration samples, the following table lists the laboratory method blank results:

	Associated Samples					
	EW816 EW817 EW827	EW818 EW819 EW821 EW823 EW824 EW828	EW822	EW814 EW820 EW825 EW826 EW830	EW814 EW816 EW817 EW827	EW805
(µg/kg):						
chloroform	250	--	--	1		
2-butanone	1,400	1,600	970	5		
toluene	150	--	170	1		
xylene	130	320	290	---		
acetone	--	2,400	4,200	12		
methylene chloride	--	--	390	8		
butylbenzylphthalate					180	160
bis(2-ethylhexyl)phthalate					700	410

Any sample result less than 5 or 10 times the associated blank concentration should be considered unusable because of contamination; it has been flagged "B."

- In the sediment field blanks, xylene (2 µg/kg), chloroform (2 µg/kg), di-n-butylphthalate (26 and 42 µg/kg), butylbenzylphthalate (62 µg/kg), diethylphthalate (25 µg/kg), fluoranthene (16 µg/kg), phenanthrene (29 µg/kg), and pyrene (15 µg/kg) were measured in the blanks. Any sample result less than 10 times the blank concentration for the phthalates or 5 times the blank concentration for the other compounds should be considered unusable; it has been flagged "B."

- Matrix spike recoveries were out of control limits for phenol (105 percent), 2-chlorophenol (114 percent), 1,4 dichlorobenzene

(109 percent), N-nitro-di-n-propylamine (130 percent), 1,2,4-trichlorobenzene (127 and 120 percent), and 2-4-dinitrotoluene (100 percent). Matrix spike duplicates were out of control limits for 4-nitrophenol (200 RPD). Data have not been flagged based on MS/MSD results.

- Holding times were exceeded for the semivolatile fraction of sample EW805. All detected data should be considered estimated and have been flagged "J."

- Because of calibration outliers (difference between initial and continuing calibration) outside of the control limits for methylene chloride (76 percent), acetone (65 percent) and 2-butanone (43 percent) for samples EW814, EW820, EW825, EW826, and EW830, the results for these compounds should be considered estimated and have been flagged "J."

- The relative standard deviation (RSD) for the initial calibration response factor was above the control limit for methylene chloride (81 percent) and acetone (85 percent) for samples EW805, EW814, EW816, EW817, EW819, EW821 to EW825, and EW828. The average relative response factor for 2-butanone (0.032) was also below the acceptable range for these samples. Nondetected 2-butanone results should be considered unusable due to possible false negatives, and have been flagged "R." All other results for these compounds should be considered estimated and have been flagged "J." The RSD was also out of the control limits for benzo[b]fluoranthene (83 percent), indeno[1,2,3-cd]pyrene (53 percent), and benzo[g,h,i]perylene (32 percent) for samples EW818 to EW826 and EW828. These results should be considered estimated and have been flagged "J."

Fifteen soil and sediment samples were analyzed by YORK for low and medium concentration organic compounds, case No. 9773, OTR Nos. EW806 to EW813, EW815, and EW829 to EW834. The data are qualified as follows:

- For the medium concentration sample EW833, acetone (2,400 µg/kg), 2-butanone (1,600 µg/kg), and xylenes (320 µg/kg), were measured in the volatile fraction laboratory method blank. Bis(2-ethylhexyl)phthalate (270 µg/kg) was measured in the semivolatile fraction method blank for samples EW830, EW833, and EW834. Any sample result less than 5 times the blank concentration for xylenes, or 10 times the blank for the other compounds, should be considered unusable; it has been flagged "B."

- For the low concentration samples, the following table lists the laboratory method blank results:

	Associated Samples				
(µg/kg):	EW808 EW809	EW806 EW807	EW810	EW830 EW834	EW811 to EW813 EW815 EW829 EW831 EW832
methylene chloride	7	4	10	8	--
acetone	17	18	35	12	20
2-butanone	7	8	6	5	26
toluene	1	--	--	1	2
chloroform	--	--	--	1	--

	EW833RE EW834RE	EW806 to EW810 EW807RE	EW811 to EW813 EW815 EW829 EW831 EW832
fluoranthene	11	--	--
pyrene	10	--	--
bis(2-ethylhexyl)phthalate	10	26	38
benzoic acid	--	44	--

Any sample result less than 5 or 10 times the associated blank concentration should be considered unusable; it has been flagged "B."

- For the sediment samples, xylene (2 µg/kg), chloroform (2 µg/kg), di-n-butylphthalate, (26 and 42 µg/kg), butylbenzylphthalate (62 µg/kg), diethyl-phthalate (25 µg/kg), fluoranthene (16 µg/kg), phenanthrene (29 µg/kg), and pyrene (15 µg/kg) were measured in the field blanks. For the soil boring samples, methylene chloride (3 µg/kg) was measured in the field blanks. Any sample result less than 10 times the associated blank concentration for the phthalates or methylene chloride, or less than 5 times the associated blank concentration for the other compounds should be considered unusable because of possible blank contamination; it has been flagged "B."

- Because of calibration outliers, the following data should be considered estimated: methylene chloride in samples EW810, EW830, EW833, and EW834 (difference between initial and continuing calibration of 42 to 76 percent); acetone in samples EW806 to EW810, EW830 and EW834 (difference of 63 to 68 percent) and in sample EW833 (relative standard deviation (RSD) of response factor for initial calibration of 35 percent); 2-butanone in samples EW806 to EW810, EW830, EW833, and EW834 (response factor of 0.02 to 0.04); benzoic acid in samples EW807, EW809, EW810, EW812, EW813, EW815, EW829, and EW831 to EW834 (27 to 59 percent D); and benzo[k]fluoranthene (33 percent RSD), indeno[1,2,3-cd]pyrene (53 percent RSD) and benzo[g,h,i]perylene (32 percent RSD) in samples EW806 to

EW808, EW810, EW812, EW813, EW815, and EW829 to EW832. Nondetected 2-butanone results for the associated samples should be considered unusable because of possible false-negatives; they have been flagged "R." All other results should be considered estimated and have been flagged "J."

- Because of surrogate spike recoveries for the BNA fraction of 0 percent for samples EW833, EW834, and EW346 to 548 percent for EW807, these samples were reanalyzed. The recoveries improved on reanalysis, and the results from the reanalysis were used instead of the original results. Surrogate recoveries were still out of the control limits for EW807RE (220 to 280 percent), EW833RE (119 to 155 percent) and EW834RE (122 to 144 percent). All semivolatile results should be considered estimated, and have been flagged "J."

Twenty soil borings and surface soil samples were analyzed by Radian Corporation (RADIAN) for low concentration organic compounds, Case No. 9917, OTR Nos. EW803, EW844 to EW852, and EW866 to EW875. The data are qualified as follows:

- Acetone (5 to 6 µg/kg), 2-butanone (4 µg/kg), di-n-butylphthalate (70 to 180 µg/kg), bis(2-ethylhexyl)phthalate (95 to 290 µg/kg), fluoranthene (110 µg/kg), and pyrene (91 µg/kg), were measured in the laboratory method blanks. Any sample result less than 5 times the blank concentration for fluoranthene or pyrene, or 10 times the associated blank concentration for the other compounds should be considered unusable; it has been flagged "B."

- Methylene chloride (3 µg/kg) was measured in the soil boring field blanks, and 2-butanone (6 to 9 µg/kg), phenol (100 µg/kg), di-n-butylphthalate (1,100 µg/kg), and bis(2-ethylhexyl)phthalate (1,400 µg/kg), were measured in the surface soil field blanks. Any sample result less than 5 times the associated field blank concentration for phenol, or less than 10 times for the other compounds, should be considered unusable; it has been flagged "B."

- Holding times were exceeded for volatile and semivolatile fractions of all samples. Any detected data should be considered estimated, possibly biased low; they have been flagged "J."

- The following calibration outliers were noted: 2-butanone (0.02 RF and 93 to 100 percent D) and acetone (49 to 100 percent D) for all samples, and dimethylphthalate (47 percent D) and diethylphthalate (100 percent D) for samples EW803 and EW866. Any nondetected 2-butanone results should be considered unusable due to possible false negatives and have been flagged "R." All other data should be considered estimated.

Eleven surface soil samples were analyzed by RADIAN for low and medium concentration organic compounds, case No. 9917, OTR Nos. EW853 to EW863. The data are qualified as follows:

- For the low concentration samples, acetone (5 to 6 µg/kg) were measured in the laboratory method blanks. Acetone (1,900 µg/kg) and 2-butanone (4,500 µg/kg) were also measured in the medium-concentration method blank associated with sample EW857.

- The following table lists the compounds measured in the laboratory method blanks, and their associated samples:

	Associated Samples			
	EW853-857, EW857DL, EW858DL	EW861	EW860, EW860DL, EW862, EW863	EW855RE
phenol	23,000	--	--	--
bis(2-ethylhexyl)phthalate	9,100	110	95	2,300
fluoranthene	--	110	--	--
pyrene	--	91	--	--
di-n-buthylphthalate	--	--	70	--

- The field blanks contained 2-butanone (6 to 9 µg/kg), phenol (100 µg/kg), bis(2-ethylhexyl)phthalate (1,400 µg/kg) and di-n-butylphthalate (1,100 µg/kg). Any sample result less than 5 times the field blank concentration for phenol, or 10 times the blank concentration for the other compounds should be considered unusable, and has been flagged "B."

- Holding times were exceeded for the volatile and semivolatile fractions in all samples. All usable detected data should be considered estimated, possibly biased low, and have been flagged "J."

- The following calibration outliers were noted: 2-butanone (RF of 0.027 to 0.038 and 41 to 100 percent D) for all samples, xylene (63 percent D), and 1,1,1-trichloroethane (26 percent D) for sample EW857, acetone (97 to 150 percent D) for all samples, benzoic acid (26 percent D) and indeno [1,2,3-cd]pyrene (78 percent D) for samples EW860, EW860DL, and EW863, and benzoic acid (53 percent RSD) for samples EW853 to EW859, EW861, EW857DL, EW858DL, and EW855RE. Any nondetected 2-butanone results should be considered unusable due to possible false negatives, and have been flagged "R." All other data should be considered estimated (J).

- Several samples were diluted to be within the calibration range of high concentration compounds. For these samples, the detection limits for nondetected compounds from the undiluted samples were reported, while the diluted sample results were reported for the detected compounds.

Nine subsurface soil samples were analyzed by Keystone Environmental Resources (KEYTX) for low and medium concentration organic compounds, case No. 9897, OTR Nos. EW835 to EW843. The data are qualified as follows:

- Methylene chloride (3 µg/kg) was measured in the field blanks. Any sample result less than 10 times the blank concentration should be considered unusable, and has been flagged "B." No target compounds were detected in the laboratory method blanks.

- Because of a low response factor (RF) for 2-butanone (0.01 to 0.04) nondetected results for all samples should be considered unusable due to possible false negatives, and have been flagged "R." All detected results should be considered estimated, and have been flagged "J."

- Acetone results for samples EW835 to EW838, EW840 to EW843, EW837DL and EW838DL should be considered estimated because of calibration outliers (29 to 45 percent D) for continuing calibration, and 33 percent RSD for initial calibration, and have been flagged "J."

- Matrix spike recoveries were out of the control limits for toluene (145 percent) in the low concentration MS/MSD sample (EW835), and benzene (163 percent), toluene (144 percent), n-nitroso-di-n-propylamine (40 percent), 1,2,4-trichlorobenzene (33 and 0 percent), 2,4-dinitrotoluene (0 percent), pyrene (16 percent), and acenaphthene (554 percent) for the medium-concentration MS/MSD sample (EW839). All positive results associated with the compounds mentioned above would be considered estimated, and have been flagged "J."

- The relative percent difference (RPD) between matrix spike duplicates was out of the control limits for benzene (32 percent), 1,2,4-trichlorobenzene (200 percent), acenaphthene (125 percent), 2,4-dinitrotoluene (200 percent), and pyrene (221 percent) for the medium concentration MSD sample (EW839). All positive results associated with the above-mentioned compounds in sample EW839 should be considered estimated and have been flagged "J."

Sixty-six sediment samples were analyzed for PAHs and phenolic acids by CH2M HILL's Montgomery laboratory, laboratory Nos. 11269001 through 11269066. The data are qualified as follows:

- The PAH fraction had low surrogate spike recoveries for samples SD038 (16, 31 percent), SD222 (10, 23 percent), and SD227 (16, 28 percent). All PAH data for these samples should be considered estimated, possibly biased low, and have been flagged "J."

Forty-four surface soil samples, including two field blanks, were analyzed for PAHs and phenolic acids by CH2M HILL's laboratory in Montgomery, Alabama, laboratory Nos. 11354001 to 11354044. The data are qualified as follows:

- Phenanthrene (1,000 µg/kg) and anthracene (3,000 µg/kg) were measured in the method blank. Any sample result less than 5 times the blank concentration for these compounds should be considered unusable because of possible blank contamination, and has been flagged "B."

DIOXINS IN SOIL AND SEDIMENT

Seventy-two soil and sediment samples were analyzed by Enseco/California Analytical Labs (CAL) for total tetra-through octacloro dioxins and furans, and 2,3,7,8-tetra-chlorodioxin and furan, SAS No. 3770E, Sample Nos. E01, E02, E07 to E12, E21, E24, E27, E30, E33, E36, E39, E42, E45, E48, E51, E54, E57, E60, E63, E66, E69, E72, E75, E78, E81, E84, E87, E90, E93, E96, E99, E102, E105, E108, E111, E126 to E137, E152, E153, E157, E160, E163, E166, E169, E172, E175, E178, E181, E184, E187, E190, E193, E194, E196, E202, E205, E208, and E211. The data are qualified as follows:

- Surrogate spike recoveries were out of control limits for samples E11 (5 to 229 percent, and 21 to 179 percent on reanalysis) E48 (3.6 to 142 percent), E63 (2.7 to 278 percent), E66 (2.4 to 337 percent), E160 (5 to 340 percent), E166 (3 percent), E190 (1 to 484 percent), E202 (6 percent), E75 (26 to 133 percent), E108 (1 to 224 percent), E30, and E87. The poor surrogate recoveries were attributed to low internal standard recoveries by the EPA reviewer. Reanalysis was requested for these samples, and later received for samples E30, E48, E63, E66, E75, E87, E108, E160, E166, E190, and E202. Data from the reanalysis should be used for samples E11, E30, and E87. Recoveries were not improved with reanalysis for samples E48, E63, and E66 and the data were considered unusable. Recoveries for samples E75, E108, E160, E166, E190, and E202 were not improved upon reanalysis, and the data from the first analyses should be used for these samples.

- Duplicates of E157, E164, E193, and E199 were run by the laboratory.

- All other QA/QC results were acceptable.

INORGANIC ANALYTES IN SOIL AND SEDIMENT

Nine soil boring samples, including one field replicate, were analyzed by Northern Labs and Engineering, Inc. (NLE) for low concentration metals and cyanide, case No. 9897, ITR Nos. MEW412 to MEW420. The data are qualified as follows:

- The method blank contained aluminum (4.4 mg/kg), iron (1.8 mg/kg), silver (0.8 mg/kg), and zinc (0.5 mg/kg). Any sample result less than 5 times the blank concentration should be considered unusable due to contamination and has been flagged "B."

- Low spike sample recoveries were reported for antimony (33.7 percent), arsenic (51.5 percent), selenium (53.0 percent), silver (72.7 percent), and thallium (52.1 percent). (No selenium or thallium was detected in any sample, and all positive silver results were already flagged "B.") All antimony and arsenic data should be considered estimated, possibly biased low, and have been flagged "J."

- The relative percent difference for method duplicates was out of the control limits for arsenic (49.4 percent). All arsenic data should be considered estimated, and have been flagged "J."

- The percent difference after serial dilution was above the limit of 10 percent for iron, manganese and zinc. All data for these metals have been flagged "J" and should be considered estimated.

- Field duplicate precision was poor. Samples MEW416 and MEW417 were replicates from SB19-02. Relative percent difference ranged from -139 percent (calcium) to 181 percent (barium) and was above ±35 percent for most of the metals detected. No qualifications were applied to the data, as the poor precision may be due to nonhomogeneity of the field samples.

Fourteen soil and sediment samples, including one field blank and one field replicate, were analyzed by Roy F. Weston, Inc. (WESTON) for low concentration metals and cyanide, case No. 9773, ITR Nos. MEW395 to MEW403, MEW405, MEW407, and MEW409 to MEW411. The data are qualified as follows:

- Aluminum (23 to 26 mg/kg) beryllium (0.14 mg/kg), and sodium (232 mg/kg) were measured in the laboratory blanks. All sample

results for these analytes less than 5 times the highest blank concentrations should be considered unusable due to contamination, and have been flagged "B."

- Spike sample recoveries were out of the control limits for antimony (12.6 percent), selenium (68 percent), silver (18.4 percent), cyanide (12.3 percent) and zinc (128 percent). Nondetected antimony, silver and cyanide results should be considered unusable due to possible false negatives, and have been flagged "R." All other results should be considered estimated (antimony, selenium, silver, and cyanide possibly biased low, and zinc possibly biased high) and have been flagged "J."

- The difference after serial dilution exceeded 10 percent for aluminum and manganese. All aluminum and manganese results should be considered estimated due to matrix interference and have been flagged "J."

Twenty soil and sediment samples, including one field blank and one field replicate, were analyzed by WESTON for low concentration metals and cyanide, case No. 9773, ITR Nos. MEW388 to MEW394, MEW404, MEW406, MEW408, and MEW791 to MEW800. The data are qualified as follows:

- Aluminum (23 to 26 mg/kg), antimony (0.8 mg/kg), beryllium (0.14 mg/kg), and sodium (232 mg/kg) were measured in the laboratory preparation blanks. All sample results less than 5 times the blank concentration should be considered unusable due to contamination, and are flagged "B."

- Spike sample recoveries were poor for the data set as a whole. Antimony (5.6 to 27.6 percent), arsenic (60.2 percent), beryllium (71.8 percent), chromium (73 percent), cobalt (70.9 percent), copper (72.3 percent), lead (-50 to 72.8 percent), mercury (-34.1 to 146 percent), nickel (69.2 percent), selenium (0 to 71.9 percent), silver (25.2 percent), thallium (33.5 to 52 percent), vanadium (73.7 percent) and cyanide (63 percent) recoveries were all out of the control limits. Due to possible false negatives, all nondetected results for antimony, lead, mercury, selenium, and silver should be considered unusable, and have been flagged "R." All other results should be considered estimated and possibly biased low and have been flagged "J."

- The relative percent difference between method duplicates was out of the control limits for antimony (73.5 to 200 percent), cadmium (40.9 percent), mercury (200 percent) and lead (41.8 to 58.4 percent). Results for these analytes should be considered estimated due to poor precision, and have been flagged "J."

- Postdigestion spike recoveries were also out of control limits for antimony, chromium, lead, selenium, thallium and vanadium.

Results for these analytes are already flagged due to other QC parameters, and should be considered estimated.

- The difference after serial dilution exceeded 10 percent for manganese and zinc. These results should be considered estimated and have been flagged "J."

Thirty-one soil samples, including four field blanks and four field replicates, were analyzed by Roy F. Weston, Inc., California (WESCA), for low concentration inorganics, case No. 9917. The samples were divided into two sample delivery groups (SDG), with ITR Nos. MEW422 to MEW440 in SDG MEW430, and ITR Nos. MEW421, MEW441, and MEW443 to MEW452 in SDG MEW441. The results of the data review are summarized below. For SDG MEW430:

- Antimony (0.4 mg/kg), cadmium (0.62 mg/kg), potassium (102 mg/kg), and thallium (0.18 mg/kg) were measured in the laboratory preparation blank. Any sample results less than 5 times the associated blank concentrations should be considered unusable due to possible contamination, and have been flagged "B."

- Spike sample results were out of the control limits for antimony (11 percent), silver (68 percent), mercury (-90 percent), and cyanide (126 percent). Nondetected antimony results should be considered unusable due to possible false negatives, and have been flagged "R." Results for silver and mercury, possibly biased low, and cyanide, possibly biased high, should be considered estimated and have been flagged "J."

- The relative percent difference between method duplicates was above the control limit for calcium (42 percent), copper (38 percent), magnesium (54 percent), and mercury (148 percent). Results for these analytes should be considered estimated due to poor precision and have been flagged "J."

- The percent difference after serial dilution was above the control limit of 10 percent for zinc. All zinc results should be considered estimated due to matrix interference, and have been flagged "J."

- Lead showed poor precision on results reanalysis. All lead data should be considered estimated and have been flagged "J." MEW436 and MEW437. Results for samples MEW436 and MEW437 were calculated incorrectly (according to the EPA reviewer) and should be considered unusable (flagged "R").

The results for SDG MEW441 are qualified as follows:

- Antimony (0.4 mg/kg), potassium (102 mg/kg), and cadmium (0.62 mg/kg), were measured in the laboratory preparation blanks. Any sample results less than 5 times the blank concentration

should be considered unusable due to possible contamination, and have been flagged "B."

- Spike sample results were out of the control limits for antimony (4.3 percent), copper (30 percent), lead (129 percent), manganese (74.6 percent) nickel (73 percent), selenium (51 percent), silver (61 percent), thallium (64 percent), and zinc (-80 percent). Any nondetected antimony or zinc results should be considered unusable due to possible false negatives, and have been flagged "R." Lead may be biased high; the other analytes may be biased low. All results for these analytes should be considered estimated and have been flagged "J."

- The relative percent difference between method duplicates was out of the control limits for copper (108 percent), mercury (194 percent), and zinc (97 percent). Results for these analytes should be considered estimated due to poor precision, and have been flagged "J."

- The difference after serial dilution was above the control limit for manganese (14 percent) and zinc (65 percent). Results for these analytes should be considered estimated due to matrix interference and have been flagged "J."

PHYSICAL PARAMETERS IN SOIL AND SEDIMENT

Eleven soil samples were analyzed for grain size and seven of these samples were also analyzed for Atterberg limits (Case SAS 3770E, Sample Nos. E213-E223) by IT Analytical Services (ITPA). No qualification of the data was necessary.

TREATMENT PARAMETERS IN SOIL AND SEDIMENT

Six soil samples were analyzed for ultimate analysis (percent carbon, percent oxygen, percent hydrogen, percent sulfur, percent nitrogen, percent moisture, and percent ash); TOC; soluble chloride; heating value; and flashpoint (Case SAS 3770E, Sample Nos. E13-18) by Versar, Inc. (VERSAR). One soil sample was analyzed for TOC and percent moisture only (case SAS 3770E, Sample No. E19) by VERSAR. No qualification of the data was necessary, although it should be noted that the Btu sample aliquot did not combust completely and the analytical results should be used with caution.

Thirty-three soil and sediment samples including two replicate sets and two field blanks were analyzed for ultimate analysis (percent carbon, percent oxygen, percent hydrogen, percent sulfur, percent nitrogen, percent moisture, and percent ash); TOC; soluble chloride; heating value; and flashpoint (Case SAS 3770E, Sample Nos. E22, E25, E28, E31, E34, E37, E40, E43, E46, E46R, E49, E52, E55, E55R, E58, E61, E64, E67, E70, E73, E76, E79, E82, E85, E88, E91,

E94, E97, E100, E103, E106, E109, and E112) by VERSAR. One soil sample was analyzed for TOC and percent moisture only (Case SAS 3770E, Sample No. E113) by VERSAR. The data are qualified as follows:

- The Btu sample aliquot did not combust completely and the analytical results should be used with caution, although the data were not qualified.
- Spike sample recovery was out of control limits for percent hydrogen (127 percent). The data are biased high. All detected results for percent hydrogen are considered estimated and flagged "J."

Twenty-eight soil and sediment samples including four replicate sets and four field blanks were analyzed for ultimate analysis (percent carbon, percent oxygen, percent hydrogen, percent sulfur, percent nitrogen, percent moisture, and percent ash); TOC; soluble chloride; heating value; and flashpoint (Case SAS 3770E, Sample Nos. E114-125, E154, E155, E161, E164, E167, E173, E176, E179, E182, E185, E188, E191, E197, E203, E209, and E212) by VERSAR. Five soil samples (Case 3770E, Sample Nos. E158, E170, E194, E200, and E206) were analyzed for TOC and percent moisture only. No qualification of the data was necessary although it should be noted that the Btu sample aliquot did not combust completely and the analytical results should be used with caution, although the data were not qualified.

Thirty-three soil and sediment samples were analyzed for proximate analysis (percent moisture, percent ash, percent volatile matter, and percent fixed carbon) by Nanco Laboratories, Inc. (NANCO) (Case SAS3770E, Sample Nos. E20, E23, E26, E29, E32, E35, E38, E41, E44, E47, E50, E53, E56, E59, E62, E65, E68, E71, E74, E77, E80, E83, E83FB, E86, E86FB, E89, E92, E95, E98, E101, E104, E107, and E110). The sample location identification for samples E77, E80, E83, E83FB, E86, and E86FB is uncertain. The data for these samples are unusable and have not been reported in the tables. No qualification of the data is necessary.

Twenty-eight soil samples including four replicate sets and four field blanks were analyzed for proximate analysis (percent moisture, percent ash, percent volatile matter, and percent fixed carbon) by NANCO (Case SAS 3770E, Sample Nos. E138-151, E159, E162, E165, E171, E174, E177, E180, E183, E186, E189, E195, E201, E207, and E210). No qualification of the data is necessary, but it should be noted that percent moisture and percent volatile organic matter are accurate to only one significant digit because the weight measurement was only done to the nearest 0.1 gram (although the data were not adjusted).

Six soil samples were analyzed for proximate analysis (percent moisture, percent ash, percent volatile matter, and percent fixed carbon) but NANCO (Case SAS 3770E, Sample Nos. E01 to E06). No qualification of the data is necessary, but it should be noted that the percent moisture may be biased high due to the organics that may have volatilized during drying.

- The relative percent difference (RPD) for field replicates exceeded control limits for percent hydrogen (dry) (128 RPD) for samples E46 and E46R, percent hydrogen (dry) (73 RPD), TOC (88 RPD) for samples E124 and E125, chloride (38 RPD) for samples E118 and E119, percent oxygen (dry) (112 RPD), percent hydrogen (dry) (135 RPD), percent hydrogen (as rec'd) (69 RPD), and chloride (52 RPD) for samples E173 and E176, percent carbon (dry and as rec'd) (49 RPD) for samples E179 and E182, percent moisture (120 RPD) for samples E148 and E149, percent moisture (200 RPD) and percent volatile matter (67 RPD) for E177 and E180 and percent moisture (67 RPD) and percent volatile matter (43 RPD) for samples E142 and E143. These samples for the listed parameters are considered estimated and flagged "J."

SURFACE WATER

Twenty surface water samples, including one field duplicate and one field blank, were analyzed for either total or dissolved inorganics by KEYTX, case No. 9529, ITR Nos. MEW765 to MEW768, MEW785 to MEW790, and MEW480 to MEW489. The data are qualified as follows:

- Iron was measured in the field blank (51.7 µg/l dissolved and 43.1 µg/l total). All iron data less than 5 times the associated blank concentration should be considered unusable and have been flagged "B."

- Copper, iron, and thallium were measured in the preparation blank at 20.0, 27.4, and 111.3 µg/l, respectively. Iron data are already qualified due to the field blanks, and no thallium was detected in any samples. All copper data less than 100 µg/l should be considered unusable and have been flagged "B."

- Spike sample recoveries were above the control limits for arsenic (130.8 percent) and iron (135.7 percent). Arsenic was not detected in any sample. All total iron data should be considered estimated (possibly biased high) and have been flagged "J."

Ten surface water samples, including one field blank and one field replicate, were analyzed by Environmental Science and Engineering, Inc. (ESECO) for low concentration organic compounds, case No. 9529, OTR Nos. ES612 to ES621. The data are qualified as follows:

- Bromoform (2 µg/l), methylene chloride (1 µg/l), chloroform (4 µg/l), and bis(2-ethylhexyl)phthalate (13 µg/l) were measured in the method blanks. Any bromoform or chloroform sample results less than 5 times the blank concentration, or of methylene chloride or bis(2-ethylhexyl)phthalate results less than 10 times the blank concentration should be considered unusable due to contamination and have been flagged "B."

- The percent difference between initial and continuing calibration was out of the control limit for 2-methylnaphthalene (38.4 percent). This compound was only detected in sample ES618, which should be considered estimated, and has been flagged "J."

Ten surface water samples, including one field replicate and one field blank were analyzed for alkalinity, COD, BOD, TOC, sulfate, TSS, TDS, pH, and phenol by JTC Environmental Consultants (JTC), SAS Nos. 3370-E01 to 3370-E10. The data are qualified as follows:

- BOD (2 mg/l) and COD (1.6 mg/l) were measured in the field blank, and COD (4.9 mg/l) was measured in the method blank. All BOD data less than 10 mg/l and all COD data less than 2.5 mg/l should be considered unusable and have been flagged "B."

- Spike recovery for TOC (62.5 percent) was below the control limits. All TOC data should be considered estimated, possibly biased low, and have been flagged "J." The COD recovery was above control limits (127.9 percent). All COD data should be considered estimated, possibly biased high, and have been flagged "J."

GROUNDWATER

Twenty groundwater samples, including two field replicates, were analyzed by ENSECO/Rocky Mountain Analytical (RMAL) for either low concentration total and dissolved metals and cyanide, case No. 10009, ITR Nos. MET951, MET952, MET959 to MET962, MET971, MET972, MEW453, MEW454, MEW465 to MEW468, MEW473 to MEW478. The data are qualified as follows:

- Two field blanks were analyzed both as filtered and unfiltered samples. The following results apply to all groundwater inorganic data (a total of three data sets). Aluminum (66.9 µg/l), barium (2.5 µg/l), calcium (697 and 1,060 µg/l), lead (3.8 and 6.8 µg/l), magnesium (162 µg/l), nickel (10.3 µg/l), sodium (2,490 µg/l), and zinc (9 and 18.3 µg/l) were measured in the filtered field blanks. Aluminum (42.4 and 51.2 µg/l), barium (3.9 to 10.3 µg/l), calcium (481 and 680 µg/kg), lead (2.4 and 3 µg/l), magnesium (104 µg/l), nickel (15 µg/l), and zinc (10.5 and 4.8 µg/l) were measured in the unfiltered field blanks. Any sample results less than 5 times the associated blank concentrations should be considered unusable due to possible contamination, and have been flagged "B."

- Copper (6.8 and 20 µg/l), antimony (38.6 µg/l), and beryllium (1.0 µg/l) were measured in the calibration or preparation blanks. Sample concentrations less than 5 times the blank concentration for these metals should be considered unusable due to contamination and are flagged "B."

- Spike sample recoveries for aluminum (74 percent) and selenium (0 percent) were below the control limits. All aluminum data are considered estimated, probably biased low, and flagged "J." All selenium data should be considered unusable and flagged "R." (No selenium was detected in any sample, and false negatives are possible.)

- Total concentrations were greater than dissolved for sodium in samples MET951 and MET952, MET961 and MET962, MET971 and MET972, MEW467 and MEW468, and MEW475 and MEW476; for arsenic in samples MET959 and MET960; for barium and potassium in samples MEW453 and MEW454; for copper in MEW467 and MEW468; and for lead in samples MEW477 and MEW478. Although total should be greater or equal to dissolved concentrations, the differences are generally small and within the variability of the analytical methods.

- The relative percent difference for method duplicates for cadmium (22.6 percent) was above the control limit. All cadmium was above the control limit. All cadmium data should be considered estimated, and have been flagged "J."

- Because of percent differences after serial dilution greater than 10 percent, all barium, chromium, manganese, nickel, vandium, and zinc data should be considered estimated because of matrix interference, and have been flagged "J."

- Lead in sample MET960 should be considered estimated because of a coefficient of correlation for the method of standard addition less than 0.995, and has been flagged "J."

Twenty groundwater samples, including one field blank, were analyzed by RMAL for either low concentration total or dissolved metals and total cyanide, Case No. 10009, ITR Nos. MEW455 to MEW464, MEW469 to MEW472, MET953, MET954, MET963, MET964, MET967 and MET968. The data are qualified as follows:

- The field blanks discussed above apply to these samples as well.

- Antimony (29 to 47 µg/l), beryllium (1.0 µg/l), copper (20 µg/l), calcium (66 to 121 µg/l), iron (74.2 µg/l), lead (2.5 µg/l), magnesium (91 µg/l), thallium (2.5 and 2.6 µg/l) and zinc (3 to 10.3 µg/l) were measured in the calibration and/or preparation blanks. Sample results less than five times the highest associated blank concentration should be considered unusable due to contamination, and have been flagged "B."

- The spike sample recovery for aluminum (157 percent) is above the control limits; aluminum results may be biased high. Arsenic

(73.8 percent) and selenium (0 percent) recoveries are below the control limits; arsenic results may be biased low, and false negatives are possible for selenium. All aluminum and arsenic data should be considered estimated and have been flagged "J." All selenium data should be considered unusable and have been flagged "R."

- The relative percent difference between method duplicates was above the control limit for lead (200 percent). All lead data should be considered estimated, and have been flagged "J."

- The correlation coefficient for the method of standard additions (MSA) is below the limit of 0.995 for lead in samples MET954 and MET964. These data should be considered estimated.

- Total concentrations are greater than dissolved concentrations for arsenic in samples MET953, MET954, MEW455 and MEW456; for sodium in samples MEW455, MEW456, MEW461, MEW462, MEW471, and MEW472; and for all detected inorganics in the field blank (MET967 and MET968). The differences are within the variability of the analytical methods, and no flags have been added.

Ten groundwater samples, including one field blank, were analyzed by RMAL for either low and medium concentration dissolved or total metals and cyanide, case No. 10009. The samples are divided into two QC sample delivery groups (SDG) with ITR Nos. MET957, MET958, MET965, MET966, MET969, MET970, MET973, and MET974 in SDG MET957; and MET975 and MET976 in SDG MET975. The data are qualified as follows:

- The field blanks discussed above also apply to these samples.

- Calcium (80.6 µg/l) and iron (25.4 µg/l) were measured in the laboratory blanks associated with SDG MET957; and magnesium (75.8 and 91.0 µg/l) and calcium (87 µg/l) were found in laboratory blanks associated with SDG MET975. Any sample concentration less than 5 times the associated field or laboratory blank concentration should be considered unusable and has been flagged "B."

- Spike sample recoveries for antimony (59 percent), arsenic (73.5 percent), lead (62 percent), and selenium (0 percent) were below the control limits for SDG MET957. For these samples nondetected selenium results should be considered unusable and have been flagged "R." Antimony, arsenic, and lead data should be considered estimated (possibly biased low) and have been flagged "J." Recoveries for lead (71 percent) selenium (74 percent), thallium (73.2 percent), and silver (72.8 percent) are below the control limits for SDG MET975. All lead, selenium,

thallium, and silver for these samples should also be considered estimated, (possibly biased low) and have been flagged "J."

- The relative percent difference between laboratory method duplicates was outside of the control limits for cadmium (200 percent) in SDG MET957 and zinc (41.9 percent) in SDG MET975. These results should be considered estimated because of poor precision, and have been flagged "J."

- Dissolved concentrations were higher than total for every analyte detected in samples MET975 and MET976 (MW04S) and MET969 and MET970 (a field blank). This may be expected for the field blank due to added exposure to contamination during filtration; however, results for MET975 and MET976 should be considered unusable (unless a switch in sample identification can be shown) and have been flagged "R."

- The difference after serial dilution exceeds 10 percent for barium (13.8 percent), copper (15.8 percent), iron (12 percent), and manganese (12.1 percent) in SDG MET975. Results for these samples should be considered estimated and have been flagged "J."

One groundwater sample from a monitoring well was analyzed by JTC for metals (Case SAS3249I, Sample No. I01) by high concentration procedures. The sample was composed of a water and a nonwater miscible phase but only the nonwater miscible phase (free product phase) was analyzed. The data are qualified as follows:

- The holding time for mercury analysis was exceeded and the mercury data is considered estimated although it was not detected in the sample.

- Spike sample recoveries were out of control limits for aluminum (61 percent), copper (70 percent), barium (84 percent), mercury (68 percent), nickel (18 percent), sodium (-76.5 percent), magnesium (83 percent), silver (0 percent), and thallium (60 percent). The data are biased low and the quantification limits may be higher than reported. The result for silver is considered unusable and flagged "R." All detected results for the other metals are considered estimated and flagged "J."

- The relative percent difference between method duplicates was out of control limits for sodium (18 and 33) and the sodium data were considered estimated (J).

- The laboratory control sample for silicon was outside control limits. No silicon was detected and no qualification was necessary.

Twenty-five groundwater samples, including two field blanks and two field replicates, were analyzed for low concentration organic compounds by PEI

Associates, Inc. (PEI), case No. 10009, OTR Nos. EW864, EW876 to EW890, EW892 to EW900. The data are qualified as follows:

- Chloroform (7 and 15 µg/l), toluene (8 µg/l) ethylbenzene (4 µg/l), and xylene (5 µg/l) were measured in the field blanks. All chloroform, ethylbenzene, and xylene results less than 5 times and toluene results less than 10 times the blank concentrations should be considered unusable because of contamination and have been flagged "B."

- Volatile fraction holding times were exceeded for all samples. All volatile data should be considered estimated, possibly biased low, and have been flagged "J."

- Semivolatile organic compound holding times were exceeded for samples EW877 to EW880, EW884, EW895, and EW897. All semivolatile data for these samples should be considered estimated, and have been flagged "J."

- Methylene chloride was detected in the laboratory blanks (6 to 9 µg/l). All methylene chloride results less than 10 times the corresponding blank concentration should be considered unusable and have been flagged "B."

- Because of a difference between initial and continuing calibration greater than the control limit of 25 percent, the following data should be considered estimated, and have been flagged "J": benzene in samples EW864, EW877 to EW880, EW884, EW885, EW895, EW889, EW900, EW892, EW896, and EW898; and styrene and xylene in all samples. (These have already been flagged "J" because of holding times.)

- Samples EW864, EW886, and EW887 contained compounds at concentrations beyond the linear calibration range and were diluted and reanalyzed. The diluted sample results should be used.

One monitoring well groundwater sample was analyzed by Clayton Environmental Consultants (CLAYTN) for volatile and extractable organic compounds and toxaphene/aroclors (Case SAS 30001, Sample No. 101) by high concentration procedures. The extractable and toxaphene/aroclor fraction was separated into a water and a nonwater miscible phase (free product phase) for analysis. The data are qualified as follows:

- Because of calibration outliers, the results for 2-butanone and endosulfan I are considered estimated (J) for all detected results and unusable (R) for nondetected results for these compounds. Also because of calibration outliers, the positive results for acetone are considered estimated (J).

- Common laboratory contaminants, acetone (7 mg/kg) and bis(2-ethylhexyl)phthalate (86 mg/kg) were found in the method blank. Bromoform (0.8 mg/kg), carbon disulfide (0.4 mg/kg), naphthalene (11 mg/kg), 2-methylnaphthalene (6 mg/kg), acenaphthene (3 mg/kg), dibenzofuran (2 mg/kg), fluorene (3 mg/kg), phenanthrene (8 mg/kg), fluoranthene (3 mg/kg), and pyrene (3 mg/kg) were found in the method blank. Samples associated with these blanks that contain these contaminants at concentrations less than 10 times the common laboratory contaminant or 5 times the other compound concentrations are considered unusable and flagged "B."

- Calibration curve criteria were not met for the toxaphene/aroclor analysis and the data are considered estimated although no compounds were detected.

Twenty-five groundwater samples, including two field blanks and two field replicates, were analyzed by JTC Environmental Consultants (JTC) for BOD, COD, SO_4, TDS, TSS, alkalinity, acidity, TOC, and phenols, SAS No. 3770E, sample Nos. E224 to E246, E248 and E250. The data are qualified as follows:

- The calibration verification was out of control limits for alkalinity (89 percent). Samples E230 to E238 should be considered estimated, and have been flagged "J."

- The holding time for BOD was exceeded for samples E224 to E231, E239, and E234. The holding time limit for COD was exceeded for samples E224 to E241. These data should be considered estimated, and have been flagged "J."

- Raw laboratory results were not submitted for EPA review for BOD in samples E244 and E248. These data should be considered estimated and have been flagged "J."

REFERENCES

CH2M HILL. *Quality Assurance Project Plan*, Moss-American Site. October 15, 1987.

U.S. Environmental Protection Agency. *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses*. February 1988.

U.S. Environmental Protection Agency. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*. July 1988.

GLT864/043.50

Appendix O
ANALYTICAL DATA SUMMARY TABLES

Table 0-1
OCCURRENCE AND CONCENTRATION RANGE OF
ORGANIC COMPOUNDS DETECTED IN
SURFACE SOILS

Compound	Number of Samples in which Compound was Detected (Total = 18 Samples)	Concentration Range (ug/kg) minimum	maximum
Carcinogenic PAHs:			
Benzo(a)anthracene	14	79	420,000
Benzo(a)pyrene	14	82	230,000
Benzo(b)fluoranthene	14	130	270,000
Benzo(k)fluoranthene	11	170	250,000
Chrysene	14	110	510,000
Dibenz(a,h)anthracene	4	890	24,000
Indeno(1,2,3-cd)pyrene	10	160	78,000
Benzo(g,h,i)perylene	11	220	77,000
Noncarcinogenic PAHs:			
Acenaphthene	11	290	2,000,000
Acenaphthylene	10	220	30,000
Anthracene	12	140	2,200,000
Fluoranthene	12	800	2,200,000
Fluorene	11	190	1,700,000
2-methylnaphthalene	11	410	1,000,000
Naphthalene	13	110	1,800,000
Phenanthrene	13	350	2,700,000
Pyrene	12	600	2,000,000
Benzene, Ethylbenzene, Toluene, Xylenes (BTX):			
Benzene	3	4	100
Toluene	18	2	1,300
Xylene (total)	4	5	14,000
Ethylbenzene	5	1	1,600
Chlorinated VOCs:			
1,1,1-Trichloroethane	1	19,000	19,000
Tetrachloroethene	1	9	9
methylene chloride	1	2	2
1,1-Dichloroethane	1	210	210
Other VOCs:			
Styrene	2	380	2,600
Ketones:			
Acetone	5	63	370
4-methyl-2-pentanone	2	3	8
Other Semi-volatile Compounds:			
Dibenzofuran	13	69	1,300,000
Benzoic acid	3	220	280
Phenolic Compounds:			
2,4-Dimethylphenol	1	280	280
N-Nitrosodiphenylamine	1	270	270
2,4-Dinitrophenol	1	620,000	620,000
Phthalates:			
Dimethylphthalate	1	230	230
Dioxins and Furans:			
Heptachloro dioxin	3	0.46	1
Octachloro dioxin	3	1.4	4.3
Tetrachloro dioxin (Total)	1	0.13	0.13
Tetrachloro dioxin (2,3,7,8)	1	0.11	0.11

Table 0-2
ORGANIC CONTAMINANTS IN SURFACE SOILS
MOSS AMERICAN SITE

	Summary of Concentrations (ug/kg)			
Sample ID	BTX	Chlorinated VOC	Carcinogenic PAH	Noncarcinogenic PAH
MA-SS012-02	21	(6)	59,000	160,000
MA-SS012-02FR	40	2	130,000	520,000
MA-SS015-02	89	(6)	37,000	97,000
MA-SS015-02FR	33	(6)	37,000	100,000
MA-SS018-02	31	(6)	880,000	250,000
MA-SS024-02	27	(6)	5,300	13,000
MA-SS030-02	2,000	9	1,800,000	16,000,000
MA-SS038-02	830	(24)	150,000	2,000,000
MA-SS053-02	100	(6)	570	(790)
MA-SS061-02	27	(5)	1,500	600
MA-SS064-02	230	(11)	1,700,000	6,500,000
MA-SS066-02	24	(7)	(860)	(860)
MA-SS078-02	67	(6)	(760)	(760)
MA-SS081-02	100	(6)	(750)	(750)
MA-SS089-02	17,000	19,000	610,000	9,800,000
MA-SS113-02	550	(16)	1,300,000	8,800,000
MA-SS129-02	2	(7)	2,500	3,900
MA-SS142-01	120	(6)	(800)	460

NOTES:
- BTX = benzene, ethylbenzene, toluene, and xylenes
- Chlorinated VOC = chlorinated volatile organic compounds
- Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene
- Noncarcinogenic PAH = all other target PAHs
- FR = field replicate
- (___) = no compounds in group detected, detection limit for individual compounds reported.

Table D-3
ORGANIC CONTAMINANTS IN SURFACE SOILS
PAH DATA
MOSS AMERICAN SITE

Sample ID	Summary of Concentrations (ug/kg) Carcinogenic PAH	Noncarcinogenic PAH
SS004-01	(1000)	1,000
SS009-01	24,000	4,000
SS012-01	140,000	390,000
SS015-01	560,000	2,500,000
SS017-02	28,000	42,000
SS018-01	920,000	2,100,000
SS019-01	240,000	1,400,000
SS024-01	(1000)	61,000
SS025-01	21,000	30,000
SS030-01	1,900,000	30,000,000
SS032-01	120,000	810,000
SS037-01	1,600,000	6,500,000
SS038-01	1,100,000	8,200,000
SS044-01	(1000)	(1000)
SS049-01	550,000	3,600,000
SS053-01	(1000)	(1000)
SS056-01	8,000	(1000)
SS061-01	(1000)	(1000)
SS063-01	290,000	430,000
SS064-01	500,000	1,400,000
SS066-01	(1000)	12,000
SS078-01	(1000)	(1000)
SS080-02	380,000	1,500,000
SS081-01	(1000)	(1000)
SS089-01	1,400,000	14,000,000
SS090-01	12,000	12,000
SS093-01	3,000	4,000
SS098-01	330,000	650,000
SS103-01	86,000	350,000
SS106-01	(1000)	3,000
SS108-01	60,000	42,000
SS111-01	6,000	32,000
SS113-01	1,500,000	14,000,000
SS114-01	52,000	11,000
SS126-01	40,000	23,000
SS129-01	(1000)	(1000)
SS138-01	(2000)	(2000)
*SS1003-01	(1000)	(1000)
*SS1019-01	(1000)	(1000)
*SS1023-01	38,000	9,000
*SS1023-01FR	65,000	4,000

NOTES:
Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(ah)anthracene, and benzo(g,h,i)perylene
Noncarcinogenic PAH = all other target PAHs
FR = field replicate
(___) = no compounds in group detected, detection limit for individual compounds reported.
* = From the banks or floodplains of the Little Menomonee River.

Table D-4
OCCURRENCE AND CONCENTRATION RANGE OF
INORGANIC ANALYTES DETECTED IN
SURFACE SOILS

Analyte	Number of Samples In Which Compound was Detected (Total = 18 Samples)	Concentration Range (mg/kg) Minimum	Maximum
TRACE ELEMENTS:			
Antimony	1	3.2	3.2
Arsenic	17	1.8	110
Barium	18	19.9	197
Beryllium	18	0.45	1.4
Cadmium	16	4	75.9
Chromium	18	9.5	81.2
Cobalt	18	5.1	14.4
Copper	18	8	137
Lead	16	4.7	519
Mercury	18	0.15	3.9
Nickel	18	11.2	30.9
Selenium	2	1.8	2.1
Silver	1	1.8	1.8
Thallium	1	0.25	0.25
Vanadium	18	12.2	38.2
Zinc	18	112	9.760
OTHER ANALYTES:			
Aluminum	18	2.260	16.400
Calcium	18	11.400	162.000
Cyanide	4	1.6	3
Iron	18	8.040	32.200
Magnesium	18	3.680	64.400
Potassium	16	521	2.570
Sodium	18	612	1.500

Table 0-5
OCCURRENCE AND CONCENTRATION RANGE OF
ORGANIC COMPOUNDS DETECTED IN
SUBSURFACE SOILS

Compound	Number of Samples in which Compound was Detected (Total = 34 Samples)	Concentration Range (ug/kg) minimum	maximum
Carcinogenic PAHs:			
Benzo(a)anthracene	6	69	190,000
Benzo(a)pyrene	6	40	84,000
Benzo(b)fluoranthene	10	10	87,000
Benzo(k)fluoranthene	9	14	20,000
Chrysene	9	38	120,000
Dibenzo(a,h)anthracene	2	51	1,800
Indeno(1,2,3-cd)pyrene	4	29	9,900
Benzo(g,h,i)perylene	5	44	10,000
Noncarcinogenic PAHs:			
Acenaphthene	12	9	2,700,000
Acenaphthylene	3	24	47,000
Anthracene	11	11	1,800,000
Fluoranthene	14	16	2,300,000
Fluorene	11	17	2,100,000
2-methylnaphthalene	9	8	1,300,000
Naphthalene	11	19	2,600,000
Phenanthrene	13	60	4,600,000
Pyrene	13	16	1,600,000
Benzene, Ethylbenzene, Toluene, Xylenes (BTX)			
Toluene	26	2	2,000
Ethylbenzene	6	3	4,100
Xylene (total)	8	2	17,000
Chlorinated VOCs			
1,1,1-Trichloroethane	3	6	11
Chloroform	1	2	2
Methylene chloride	2	33	10,000
Other VOCs:			
Styrene	4	1	9,300
Carbon disulfide	1	4	4
Ketones:			
Isophorone	1	27	27
Acetone	7	20	120
2-Butanone	1	10	10
Other Semi-volatile Compounds:			
Dibenzofuran	11	11	1,600,000
Benzoic Acid	3	76	810
Phenols:			
4-Nitrophenol	1	240	240
Phenol	2	46	78
Pentachlorophenol	2	110	700
Phthalates:			
Di-n-butylphthalate	10	25	2,800
Di-n-octylphthalate	2	12	25
Bis(2-Ethylhexyl)phthalate	9	42	5,800
Dimethylphthalate	2	700	1,300
Diethylphthalate	3	31	6,000
Dioxins and Furans:			
1,2,3,7,8,9-Hexachloro dioxin 1	1	7	7

Table 0-6
ORGANIC CONTAMINANTS IN SUBSURFACE SOILS
MOSS AMERICAN SITE

Sample ID	Summary of Concentrations (ug/kg) BTX	Chlorinated VOC	Carcinogenic PAH	Noncarcinogenic PAH
MA-SB001-01	170	(6)	(750)	(750)
MA-SB002-01	110	(6)	(780)	(780)
MA-SB003-01	19	44	(370)	(370)
MA-SB003-02	16	6	(360)	(360)
MA-SB004-01	(710)	(710)	200,000	2,100,000
MA-SB004-02	12	(6)	(370)	210
MA-SB004-03	8	(6)	60	690
MA-SB005-01	380	(6)	120	240
MA-SB005-01FR	50	(6)	(790)	(790)
MA-SB006-01	71	(6)	(750)	(750)
MA-SB007-01	2	(6)	(420)	(420)
MA-SB008-01	35	(6)	280	32
MA-SB008-02	79	(29)	120	26,000
MA-SB009-01	(6)	2	1,700	390
MA-SB009-02	(6)	(6)	10	(540)
MA-SB010-01	51	(6)	(570)	(570)
MA-SB011-01	290	(5)	(720)	(720)
MA-SB011-02	55	(6)	590	5,000
MA-SB011-02FR	120	(5)	1,100	12,000
MA-SB012-01	13	(6)	(400)	(400)
MA-SB013-01	220	(6)	(740)	160
MA-SB014-01	660	(6)	(410)	(410)
MA-SB015-01	860	(6)	(380)	(380)
MA-SB016-01	21	(6)	(23,000)	120,000
MA-SB016-02	26	(6)	(380)	5,900
MA-SB017-01	7	(6)	(370)	(370)
MA-SB017-02	9	(6)	(380)	(380)
MA-SB017-05	NA	NA	(1000)	(1000)
MA-SB017-05FR	NA	NA	(1000)	(1000)
MA-SB018-01	140	10,000	1,700	6,600
MA-SB018-02	16	(6)	66	160
MA-SB019-01	23,000	(880)	450,000	19,000,000
MA-SB019-02	7	(6)	(370)	1,300
MA-SB019-03	(6)	(6)	(380)	(380)

NOTES:

BTX = benzene, ethylbenzene, toluene, and xylenes

Chlorinated VOC = chlorinated volatile organic compounds

Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(ah)anthracene, and benzo(g,h,i)perylene

Noncarcinogenic PAH = all other target PAHs

FR = field replicate

NA = not analyzed

(___) = no compounds in group detected, detection limit for individual compounds reported.

Table 0-7
OCCURRENCE AND CONCENTRATION RANGE OF
INORGANIC ANALYTES DETECTED IN
SUBSURFACE SOILS

Analyte	Number of Samples in Which Compound was Detected (Total = 32 Samples)	Concentration Range (mg/kg) Minimum	Maximum
TRACE ELEMENTS:			
Antimony	2	0.66	5.1
Arsenic	29	1.3	7.8
Barium	32	5.2	105
Beryllium	12	0.45	1
Cadmium	29	1.6	6.9
Chromium	32	4.6	24
Cobalt	32	2.8	14
Copper	32	5.6	87.5
Lead	31	2.3	31
Manganese	32	95.7	841
Mercury	18	0.1	4.5
Nickel	29	7.1	28
Thallium	8	0.21	0.38
Vanadium	29	5.8	37
Zinc	32	36	1,740
OTHER ANALYTES:			
Aluminum	32	1,820	16,900
Calcium	32	9,100	194,000
Cyanide	3	1.7	2
Iron	32	6,320	26,600
Magnesium	32	5,350	66,400
Potassium	28	447	2,290
Sodium	19	204	1,230

Table 0-8
OCCURRENCE AND CONCENTRATION RANGE OF
ORGANIC COMPOUNDS DETECTED IN
GROUNDWATER

Compound	Number of Samples In Which Compound was Detected (Total = 25 Samples)	Concentration Range (ug/l) Minimum	Maximum w/o Free Product
Carcinogenic PAHs:			
Benzo(a)anthracene	1	81	81
Benzo(a)pyrene	1	23	23
Benzo(b)fluoranthene	1	23	23
Benzo(k)fluoranthene	1	25	25
Chrysene	1	69	69
Noncarcinogenic PAHs:			
Acenaphthene	3	11	1,400
Acenaphthylene	1	22	22
Anthracene	2	8	110
Fluoranthene	3	13	460
Fluorene	2	20	630
2-Methylnaphthalene	1	520	520
Naphthalene	3	3,100	5,500
Phenanthrene	2	28	2,000
Pyrene	3	11	300
Benzene, Ethylbenzene, Toluene, Xylenes (BTX):			
Benzene	2	5	7
Ethylbenzene	1	27	27
Xylene (total)	3	30	45
Other VOCs:			
Styrene	1	9	9
Other semi-volatile compounds:			
Dibenzofuran	2	9	560
Isophorone	1	41	41
Phenols:			
Phenol	1	8	8
2,4-Dimethylphenol	1	14	14
Phthalates:			
Bis(2-Ethylhexyl)phthalate	3	9	13

Table 0-9
ORGANIC CONTAMINANTS IN GROUNDWATER
MOSS AMERICAN SITE

	Summary of Concentrations (ug/l)			
Sample ID	BTX	Chlorinated VOC	Carcinogenic PAH	Noncarcinogenic PAH
MA-MW02S-01	(5)	(5)	(10)	35
MA-MW04S-01	72	(5)	220	11,000
MA-MW07S-01	37	(5)	(10)	3,100
MA-MW07S-01FR	35	(5)	(10)	3,100
MA-MW08S-01	(2,500)	(2,500)	(20,000)	(20,000)
MA-MW08S-FP	NA	NA	20,000,000	200,000,000
MA-MW11S-01	(5)	(5)	(10)	120

NOTES:
- BTX = benzene, ethylbenzene, toluene, and xylenes
- Chlorinated VOC = chlorinated volatile organic compounds
- Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(ah)anthracene, and benzo(g,h,i)perylene
- Noncarcinogenic PAH = all other target PAHs
- FR = field replicate
- FP = free product sample
- NA = not analyzed
- (___) = no compounds in group detected, detection limit for individual compounds reported.

The remainder of the groundwater samples were below the detection limits of 5 ug/l for BTX and Chlorinated VOC, and 10 ug/l for Carcinogenic PAH and Noncarcinogenic PAH compounds. These include groundwater samples MA-MW01S-01, MA-MW01I-01, MA-MW03S-01, MA-MW03I-01, MA-MW04I-01, MA-MW04D-01, MA-MW04D-01FR, MW-05S-01, MW-06S-01, MA-MW07I-01, MA-MW08I-01, MA-MW09S-01, MA-MW09I01, MA-MW11I-01, MA-MW12S-01, MA-MW13S-01, MA-MW14S-01, and MA-MW20S-01

Table 0-10
OCCURRENCE AND CONCENTRATION RANGE OF
DISSOLVED INORGANIC ANALYTES DETECTED IN
GROUNDWATER

Analyte	Numbers of Samples in Which Compound was Detected (Total = 22 Samples)	Concentration Range (ug/l) Minimum	Maximum
TRACE ELEMENTS			
Arsenic	13	1.3	7.8
Barium	22	40	294
Chromium	2	6.7	7.8
Manganese	22	32	1.440
Vanadium	5	4.7	6.9
OTHER ANALYTES:			
Calcium	22	21.600	250.000
Iron	19	156	4.810
Magnesium	22	10.100	90.200
Potassium	22	1.580	6.260
Sodium	19	14.400	97.100

Table 0-11
OCCURRENCE AND CONCENTRATION RANGE OF
ORGANIC COMPOUNDS DETECTED IN
SURFACE WATER

Compound	Number of Samples in Which Compound was Detected (Total = 9 Samples)	Concentration Range (ug/l)	
		Minimum	Maximum
Noncarcinogenic PAHs:			
Acenaphthene	1	11	11
Fluorene	1	5	5
2-Methylnaphthalene	1	2	2
Naphthalene	1	11	11
Phenanthrene	1	2	2
Chlorinated VOCs:			
Methylene chloride	1	1	1
Other Semi-volatile Compounds:			
Dibenzofuran	1	6	6
Phthalates:			
Di-n-butylphthalate	2	2	4

Table 0-12
ORGANIC CONTAMINANTS IN SURFACE WATER
MOSS AMERICAN SITE

	Summary of Concentrations (ug/l)			
SAMPLE ID	BTX	Chlorinated VOC	Carcinogenic PAH	Noncarcinogenic PAH
MA-SW001-01	(5)	1	(10)	(10)
MA-SW007-01	(5)	(5)	(10)	31

NOTES:
BTX = benzene, ethylbenzene, toluene, and xylenes
Chlorinated VOC = chlorinated volatile organic compounds
Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(ah)anthracene, and benzo(g,h,i)perylene
Noncarcinogenic PAH = all other target PAHs
FR = field replicate
(___) = no compounds in group detected, detection limit for individual compounds reported.

The remainder of the surface water samples were below the detection limits of 5 ug/l for BTX and Chlorinated VOC, and 10 ug/l for Carcinogenic PAH and Noncarcinogenic PAH compounds, including MA-SW002-01, MA-SW003-01, MA-SW004-01, MA-SW005-01, MA-SW006-01, and MA-SW008-01.

Table 0-13
OCCURRENCE AND CONCENTRATION RANGE OF
DISSOLVED INORGANIC ANALYTES DETECTED IN
SURFACE WATER

Analyte	Number of Samples in Which Compound was Detected (Total = 9 Samples)	Concentration Range (mg/kg) Minimum	Maximum
TRACE ELEMENTS:			
Barium	9	41.1	95.9
Manganese	9	53.5	124
Zinc	5	10.7	46.9
OTHER ANALYTES:			
Aluminum	2	55.4	73.6
Calcium	9	95.900	135.000
Iron	2	465	632
Magnesium	9	42.900	45.400
Potassium	9	1.520	4.580
Sodium	9	7.010	62.900

Table 0-14
OCCURRENCE AND CONCENTRATION RANGE OF
ORGANIC COMPOUNDS DETECTED IN
SEDIMENTS

Compound	Number of Samples in which Compound was Detected (Total = 18 Samples)	Concentration Range (ug/kg) minimum	maximum
Carcinogenic PAHs:			
Benzo(a)anthracene	18	260	140,000
Benzo(a)pyrene	17	320	84,000
Benzo(b)fluoranthene	18	340	64,000
Benzo(k)fluoranthene	17	66	35,000
Chrysene	18	390	180,000
Dibenzo(a,h)anthracene	8	180	2,400
Indeno(1,2,3-cd)pyrene	14	180	15,000
Benzo(g,h,i)perylene	13	150	13,000
Noncarcinogenic PAHs:			
Acenaphthene	17	160	800,000
Acenaphthylene	4	97	1,400
Anthracene	17	71	710,000
Fluoranthene	16	750	830,000
Fluorene	17	200	630,000
2-methylnaphthalene			
Naphthalene	9	1,300	350,000
Phenanthrene	18	280	1,500,000
Pyrene	18	700	800,000
Benzene, Ethylbenzene, Toluene, Xylenes (BTX):			
Ethylbenzene	8	3	730
Toluene	4	44	950
Chlorinated VOCs:			
Chloroform	6	340	990
Methylene chloride	9	630	33,000
Ketones:			
2-Butanone	2	67	87
Acetone	4	290	32,000
Other Semi-volatile Compounds:			
Dibenzofuran	16	130	520,000
Benzoic Acid	4	370	2,300
4-Chloroaniline	1	60,000	60,000
Phenols:			
N-Nitrosodiphenylamine	1	3,100	3,100
Phthalates:			
Butylbenzylphthalate	1	720	720
Di-n-butylphthalate	1	210,000	210,000
Di-n-octylphthalate	3	25	90
Dioxins and Furans:			
Octachloro furan	1	8.8	8.8
Pentachloro furan	1	0.55	0.55
Heptachloro dioxin	3	0.14	11
Hexachloro furan	2	0.23	8.4
Octachloro dioxin	8	0.48	5.5
Pentachloro dioxin	1	0.45	0.45
Heptachloro furan	2	0.75	22
Hexachloro dioxin	1	8.7	8.7

Table 0-15
ORGANIC CONTAMINANTS IN SEDIMENTS
MOSS AMERICAN SITE

	Summary of Concentrations (ug/kg)			
Sample ID	BTX	Chlorinated VOC	Carcinogenic PAH	Noncarcinogenic PAH
MA-SD301-01	3	(8)	8,900	8,300
MA-SD302-01	(8)	(8)	15,000	17,000
MA-SD303-01	(7)	(7)	12,000	22,000
MA-SD304-01	(36)	(36)	68,000	150,000
MA-SD305-01	4	(6)	1,700	1,800
MA-SD306-01	240	790	140,000	1,100,000
MA-SD306-01FR	130	630	210,000	2,900,000
MA-SD307-01	230	1,400	320,000	4,800,000
MA-SD308-01	(1100)	12,000	200,000	1,600,000
MA-SD309-01	230	1,900	150,000	1,200,000
MA-SD309-01FR	(1000)	4,600	150,000	650,000
MA-SD310-01	47	(7)	74,000	100,000
MA-SD311-01	(930)	3,400	130,000	1,400,000
MA-SD312-01	730	990	450,000	5,500,000
MA-SD313-01	640	33,000	270,000	3,200,000
MA-SD314-01	950	3,600	160,000	1,800,000
MA-SD315-01	(46)	(46)	20,000	290,000
MA-SD316-01	(9)	(9)	83,000	610,000

NOTES:
BTX = benzene, ethylbenzene, toluene, and xylenes
Chlorinated VOC = chlorinated volatile organic compounds
Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene dibenzo(ah)anthracene, and benzo(g,h,i)perylene
Noncarcinogenic PAH = all other target PAHs
FR = field replicate
(___) = no compounds in group detected, detection limit for individual compounds reported.

Table 0-16 (Page 1 of 2)
ORGANIC CONTAMINANTS IN SEDIMENTS
PAH ANALYSIS
MOSS AMERICAN SITE

	Summary of Concentrations (ug/kg)	
Sample ID	Carcinogenic PAH	Noncarcinogenic PAH
SD001-01	96.000	10.000
SD005-01	21.000	17.000
SD007-01	4.000	4.000
SD009-01	8.000	8.000
SD014-01	5.000	6.000
SD018-01	5.000	6.000
SD019-01	6.000	10.000
SD025-01	9.000	8.000
SD031-01	140.000	960.000
SD035-01	(1000)	(1000)
SD038-01	22.000	65.000
SD051-01	16.000	28.000
SD054-01	34.000	39.000
SD058-01	140.000	610.000
SD062-01	500.000	3.800.000
SD063-01	100.000	460.000
SD067-01	26.000	160.000
SD070-01	20.000	6.000
SD070-01FR	18.000	3.000
SD073-01	46.000	73.000
SD076-01	140.000	570.000
SD078-01	(1000)	(1000)
SD091-01	210.000	430.000
SD093-01	51.000	(8000)
SD097-01	(1000)	(1000)
SD100-01	(2000)	(2000)
SD110-01	(1000)	(1000)
SD116-01	(1000)	(1000)
SD131-01	100.000	25.000
SD134-01	12.000	16.000
SD137-01	(1000)	(1000)
SD140-01	8.000	6000
SD144-01	53.000	130.000
SD147-01	(1000)	(1000)
SD154-01	(1000)	(1000)
SD155-01	(8000)	(8000)
SD158-01	18.000	61.000
SD164-01	310.000	1.900.000
SD165-01	270.000	1.600.000
SD175-01	10.000	24.000
SD179-01	7.000	11.000
SD187-01	31.000	34.000
SD192-01	1.000	10.000
SD197-01	240.000	39.000

Table 0-16 (Page 1 of 2)
ORGANIC CONTAMINANTS IN SEDIMENTS
PAH ANALYSIS
MOSS AMERICAN SITE

Sample ID	Summary of Concentrations (ug/kg) Carcinogenic PAH	Noncarcinogenic PAH
SD204-01	320.000	2,800.000
SD207-01	22.000	13.000
SD207-01FR	260.000	2,500.000
SD214-01	77.000	46.000
SD217-01	4.000	4.000
SD221-01	(1000)	(1000)
SD221-01FR	(1000)	(1000)
SD222-01	87.000	100.000
SD227-01	11.000	34.000
SD231-01	280.000	1,700.000
SD233-01	340.000	2,400.000
SD234-01	240.000	1,700.000
SD236-01	230.000	2,000.000
SD244-01	220.000	740.000
SD255-01	29.000	110.000
SD257-01	(2000)	(2000)
SD258-01	(1000)	(1000)
SD260-01	20.000	20.000

NOTES:

BTX = benzene, ethylbenzene, toluene, and xylenes
Carcinogenic PAH = benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(ah)anthracene, and benzo(g,h,i)perylene
Noncarcinogenic PAH = all other target PAHs
FR = field replicate
(___) = no compounds in group detected, detection limit for individual compounds reported.

Table 0-17
OCCURRENCE AND CONCENTRATION RANGE OF
INORGANIC ANALYTES DETECTED IN
SEDIMENTS

Analyte	Number of Samples in Which Compound was Detected (Total = 18 Samples)	Concentration Range (mg/kg) Minimum	Maximum
TRACE ELEMENTS:			
Antimony	4	0.77	4.5
Arsenic	18	3.5	10.1
Barium	18	19.3	93.1
Beryllium	9	0.71	1.3
Cadmium	18	4.1	14.1
Chromium	18	10.6	32.6
Cobalt	18	5.1	11.5
Copper	18	13.5	45.5
Lead	18	18.4	213
Manganese	18	296	945
Mercury	10	0.21	0.43
Nickel	8	16.4	24.4
Selenium	1	1.3	1.3
Vanadium	18	16.5	30.9
Zinc	18	230	2,200
OTHERS ANALYTES:			
Aluminum	18	3,330	14,500
Calcium	18	49,400	119,000
Iron	18	12,900	28,100
Magnesium	18	20,400	61,800
Potassium	8	466	1,840
Sodium	5	1,190	1,250

Appendix P
ANALYTICAL DATA

SAMPLES COLLECTED

May, June, and July 1988

DATA QUALIFIERS: (same for all tables)

- B: Detected in blank
- D: Diluted sample results reported
- J: Estimated value
- R: Unusable value
- U: Not detected at specified quantification limit
- —: Not analyzed for
- *: The reported value is the average of four replicates

FR: Field Replicate
FB: Field Blank

SOIL DATA

MOSS-AMERICAN
SURFACE SOIL
SEMIVOLATILES

Sample No.:	MA-SSFB05	MA-SSFB-06	MA-SS012-02	MA-SS012-02FR	MA-SS015-02
TR No.:	EW862	EW863	EW851	EW860	EW852
	Field Blank	Field Blank		Replicate	
Parameter	Conc. (ug/kg)				
Phenol	100 J	660 U	760 U	330 B	1500 U
bis(2-Chloroethyl)ether	660 U	660 U	760 U	1600 U	1500 U
2-Chlorophenol	660 U	660 U	760 U	1600 U	1500 U
1,3-Dichlorobenzene	660 U	660 U	760 U	1600 U	1500 U
1,4-Dichlorobenzene	660 U	660 U	760 U	1600 U	1500 U
Benzyl alcohol	660 U	660 U	760 U	1600 U	1500 U
1,2-Dichlorobenzene	660 U	660 U	760 U	1600 U	1500 U
2-Methylphenol	660 U	660 U	760 U	1600 U	1500 U
bis(2-Chloroisopropyl)ether	660 U	660 U	760 U	1600 U	1500 U
4-Methylphenol	660 U	660 U	760 U	1600 U	1500 U
N-Nitroso-di-n-propylamine	660 U	660 U	760 U	1600 U	1500 U
Hexachloroethane	660 U	660 U	760 U	1600 U	1500 U
Nitrobenzene	660 U	660 U	760 U	1600 U	1500 U
Isophorone	660 U	660 U	760 U	1600 U	1500 U
2-Nitrophenol	660 U	660 U	760 U	1600 U	1500 U
2,4-Dimethylphenol	660 U	660 U	760 U	280 J	1500 U
Benzoic Acid	3200 U	3200 U	3700 U	7800 U	7400 U
bis(2-Chloroethoxy)methane	660 U	660 U	760 U	1600 U	1500 U
2,4-Dichlorophenol	660 U	660 U	760 U	1600 U	1500 U
1,2,4-Trichlorobenzene	660 U	660 U	760 U	1600 U	1500 U
Naphthalene	660 U	660 U	19000 J	57000 DJ	3500 J
4-Chloroaniline	660 U	660 U	760 U	1600 U	1500 U
Hexachlorobutadiene	660 U	660 U	760 U	1600 U	1500 U
4-Chloro-3-methylphenol	660 U	660 U	760 U	1600 U	1500 U
2-Methylnaphthalene	660 U	660 U	8200 J	22000 J	1500 J
Hexachlorocyclopentadiene	660 U	660 U	760 U	1600 U	1500 U
2,4,6-Trichlorophenol	660 U	660 U	760 U	1600 U	1500 U
2,4,5-Trichlorophenol	3200 U	3200 U	3700 U	7800 U	7400 U
2-Chloronaphthalene	660 U	660 U	760 U	1600 U	1500 U
2-Nitroaniline	3200 U	3200 U	3700 U	7800 U	7400 U
Dimethylphthalate	660 U	660 U	760 U	1600 U	1500 U
Acenaphthylene	660 U	660 U	1300 J	3100 J	740 J
2,6-Dinitrotoluene	660 U	660 U	760 U	1600 U	1500 U
3-Nitroaniline	3200 U	3200 U	3700 U	7800 U	7400 U
Acenaphthene	660 U	660 U	7500 J	21000 J	6200 J
2,4-Dinitrophenol	3200 U	3200 U	3700 U	7800 U	7400 U
4-Nitrophenol	3200 U	3200 U	3700 U	7800 U	7400 U
Dibenzofuran	660 U	660 U	16000 J	43000 DJ	7300 J
2,4-Dinitrotoluene	660 U	660 U	760 U	1600 U	1500 U
Diethylphthalate	660 U	660 U	760 U	1600 U	1500 U
4-Chlorophenyl-phenylether	660 U	660 U	760 U	1600 U	1500 U
Fluorene	660 U	660 U	3200 J	8200 J	8000 J
4-Nitroaniline	3200 U	3200 U	3700 U	7800 U	7400 U
4,6-Dinitro-2-methylphenol	3200 U	3200 U	3700 U	7800 U	7400 U
N-Nitrosodiphenylamine	660 U	660 U	760 U	1600 U	1500 U
4-Bromophenyl-phenylether	660 U	660 U	760 U	1600 U	1500 U
Hexachlorobenzene	660 U	660 U	760 U	1600 U	1500 U
Pentachlorophenol	3200 U	3200 U	3700 U	7800 U	7400 U
Phenanthrene	660 U	660 U	52000 DJ	160000 DJ	21000 J
Anthracene	660 U	660 U	12000 J	25000 J	9600 J
Di-n-butylphthalate	640 B	1100 B	760 U	480 B	190 B
Fluoranthene	660 U	660 U	32000 J	140000 DJ	25000 J
Pyrene	660 U	660 U	28000 J	87000 DJ	21000 J
Butylbenzylphthalate	660 U	660 U	760 U	1600 U	1500 U
3,3'-Dichlorobenzidine	1300 U	1300 U	1500 U	3200 U	3000 U
Benzo(a)anthracene	660 U	660 U	9000 J	24000 D	7400 J
Chrysene	660 U	660 U	12000 J	31000 D	9500 J
bis(2-Ethylehexyl)phthalate	1400 B	290 B	550 B	1200 B	630 B
Di-n-octylphthalate	660 U	660 U	760 U	1600 U	1500 U
Benzo(b)fluoranthene	660 U	660 U	16000 J	27000 JD	6500 J
Benzo(k)fluoranthene	660 U	660 U	760 U	20000 J	5200 J
Benzo(a)pyrene	660 U	660 U	9500 J	17000 J	4100 J
Indeno(1,2,3-cd)pyrene	660 U	660 U	5700 J	16000 U	1500 U
Dibenz(a,h)anthracene	660 U	660 U	760 U	2000 J	890 J
Benzo(g,h,i)perylene	660 U	660 U	6900 J	8200 J	3100 J

NORS-AMERICAN
SURFACE SOIL
SEMIVOLATILES

Sample No.:	NA-SS015-02FR	NA-SS018-02	NA-SS024-02	NA-SS030-02	NA-SS038-02
TR No.:	EW861	EW854	EW855	EW859	EW856
	Replicate				
Parameter					
Phenol	2300 U	46000 U	100 B	180000 U	49000 U
bis(2-Chloroethyl)ether	2300 U	46000 U	740 U	180000 U	49000 U
2-Chlorophenol	2300 U	46000 U	740 U	180000 U	49000 U
1,3-Dichlorobenzene	2300 U	46000 U	740 U	180000 U	49000 U
1,4-Dichlorobenzene	2300 U	46000 U	740 U	180000 U	49000 U
Benzyl alcohol	2300 U	46000 U	740 U	180000 U	49000 U
1,2-Dichlorobenzene	2300 U	46000 U	740 U	180000 U	49000 U
2-Methylphenol	2300 U	46000 U	740 U	180000 U	49000 U
bis(2-Chloroisopropyl)ether	2300 U	46000 U	740 U	180000 U	49000 U
4-Methylphenol	2300 U	46000 U	740 U	180000 U	49000 U
N-Nitroso-di-n-propylamine	2300 U	46000 U	740 U	180000 U	49000 U
Hexachloroethane	2300 U	46000 U	740 U	180000 U	49000 U
Nitrobenzene	2300 U	46000 U	740 U	180000 U	49000 U
Isophorone	2300 U	46000 U	740 U	180000 U	49000 U
2-Nitrophenol	2300 U	46000 U	740 U	180000 U	49000 U
2,4-Dimethylphenol	2300 U	46000 U	740 U	180000 U	49000 U
Benzoic Acid	11000 U	220000 U	220 J	870000 U	240000 U
bis(2-Chloroethoxy)methane	2300 U	46000 U	740 U	180000 U	49000 U
2,4-Dichlorophenol	2300 U	46000 U	740 U	180000 U	49000 U
1,2,4-Trichlorobenzene	2300 U	46000 U	740 U	180000 U	49000 U
Naphthalene	3900 J	38000 J	890 J	1800000 J	530000 J
4-Chloroaniline	2300 U	46000 U	740 U	180000 U	49000 U
Hexachlorobutadiene	2300 U	46000 U	740 U	180000 U	49000 U
4-Chloro-3-methylphenol	2300 U	46000 U	740 U	180000 U	49000 U
2-Methylnaphthalene	1800 J	11000 J	410 J	1000000 J	110000 J
Hexachlorocyclopentadiene	2300 U	46000 U	740 U	180000 U	49000 U
2,4,6-Trichlorophenol	2300 U	46000 U	740 U	180000 U	49000 U
2,4,5-Trichlorophenol	11000 U	220000 U	3600 U	870000 U	240000 U
2-Chloronaphthalene	2300 U	46000 U	740 U	180000 U	49000 U
2-Nitroaniline	11000 U	220000 U	3600 U	870000 U	240000 U
Dimethylphthalate	2300 U	46000 U	230 J	180000 U	49000 U
Acenaphthylene	460 J	7000 J	220 J	17000 J	49000 U
2,6-Dinitrotoluene	2300 U	46000 U	740 U	180000 U	49000 U
3-Nitroaniline	11000 U	220000 U	3600 U	870000 U	240000 U
Acenaphthene	7500 J	14000 J	290 J	2000000 J	160000 J
2,4-Dinitrophenol	11000 U	220000 U	3600 U	870000 U	240000 U
4-Nitrophenol	11000 U	220000 U	3600 U	870000 U	240000 U
Dibenzofuran	8100 J	16000 J	650 J	1300000 J	120000 J
2,4-Dinitrotoluene	2300 U	46000 U	740 U	180000 U	49000 U
Diethylphthalate	2300 U	46000 U	740 U	180000 U	49000 U
4-Chlorophenyl-phenylether	2300 U	46000 U	740 U	180000 U	49000 U
Fluorene	9700 J	7000 J	190 J	1700000 J	150000 J
4-Nitroaniline	11000 U	220000 U	3600 U	870000 U	240000 U
4,6-Dinitro-2-methylphenol	11000 U	220000 U	3600 U	870000 U	240000 U
N-Nitrosodiphenylamine	270 J	46000 U	740 U	180000 U	49000 U
4-Bromophenyl-phenylether	2300 U	46000 U	740 U	180000 U	49000 U
Hexachlorobenzene	2300 U	46000 U	740 U	180000 U	49000 U
Pentachlorophenol	11000 U	220000 U	3600 U	870000 U	240000 U
Phenanthrene	21000 J	40000 J	2500 J	2700000 J	480000 J
Anthracene	13000 J	R	1000 J	2200000 J	86000 J
Di-n-butylphthalate	2300 U	46000 U	1000 B	180000 U	49000 U
Fluoranthene	21000 J	80000 J	3300 J	2200000 J	250000 J
Pyrene	25000 J	52000 J	3800 J	2000000 J	200000 J
Butylbenzylphthalate	2300 U	46000 U	740 U	180000 U	49000 U
3,3'-Dichlorobenzidine	4600 U	91000 U	1500 U	360000 U	97000 U
Benzo(a)anthracene	6500 J	50000 J	690 J	420000 J	40000 J
Chrysene	9400 J	93000 J	1100 J	510000 J	48000 J
bis(2-Ethylehexyl)phthalate	540 B	8200 B	1900 B	25000 B	6500 B
Di-n-octylphthalate	2300 U	46000 U	740 U	180000 U	49000 U
Benzo(b)fluoranthene	11000 J	230000 J	1100 J	260000 J	23000 J
Benzo(k)fluoranthene	2300 U	170000 J	920 J	250000 J	18000 J
Benzo(a)pyrene	4400 J	180000 J	670 J	230000 J	16000 J
Indeno(1,2,3-cd)pyrene	2000 J	78000 J	810 J	53000 J	49000 U
Dibenz(a,h)anthracene	1300 J	46000 U	740 U	24000 J	49000 U
Benzo(g,h,i)perylene	1900 J	77000 J	740 U	51000 J	49000 U

MOSS-AMERICAN
SURFACE SOIL
SEMIVOLATILES

Sample No.:	MA-SS053-02	MA-SS061-02	MA-SS064-02	MA-SS066-02	MA-SS078-02
TR No.:	EW845	EW849	EW853	EW850	EW848
Parameter					
Phenol	790 U	710 U	230000 U	860 U	760 U
bis(2-Chloroethyl)ether	790 U	710 U	230000 U	860 U	760 U
2-Chlorophenol	790 U	710 U	230000 U	860 U	760 U
1,3-Dichlorobenzene	790 U	710 U	230000 U	860 U	760 U
1,4-Dichlorobenzene	790 U	710 U	230000 U	860 U	760 U
Benzyl alcohol	790 U	710 U	230000 U	860 U	760 U
1,2-Dichlorobenzene	790 U	710 U	230000 U	860 U	760 U
2-Methylphenol	790 U	710 U	230000 U	860 U	760 U
bis(2-Chloroisopropyl)ether	790 U	710 U	230000 U	860 U	760 U
4-Methylphenol	790 U	710 U	230000 U	860 U	760 U
N-Nitroso-di-n-propylamine	790 U	710 U	230000 U	860 U	760 U
Hexachloroethane	790 U	710 U	230000 U	860 U	760 U
Nitrobenzene	790 U	710 U	230000 U	860 U	760 U
Isophorone	790 U	710 U	230000 U	860 U	760 U
2-Nitrophenol	790 U	710 U	230000 U	860 U	760 U
2,4-Dimethylphenol	790 U	710 U	230000 U	860 U	760 U
Benzoic Acid	3800 U	3500 U	1100000 U	230 J	3700 U
bis(2-Chloroethoxy)methane	790 U	710 U	230000 U	860 U	760 U
2,4-Dichlorophenol	790 U	710 U	230000 U	860 U	760 U
1,2,4-Trichlorobenzene	790 U	710 U	230000 U	860 U	760 U
Naphthalene	790 U	110 J	230000 U	860 U	760 U
4-Chloroaniline	790 U	710 U	230000 U	860 U	760 U
Hexachlorobutadiene	790 U	710 U	230000 U	860 U	760 U
4-Chloro-3-methylphenol	790 U	710 U	230000 U	860 U	760 U
2-Methylnaphthalene	790 U	710 U	230000 U	860 U	760 U
Hexachlorocyclopentadiene	790 U	710 U	230000 U	860 U	760 U
2,4,6-Trichlorophenol	790 U	710 U	230000 U	860 U	760 U
2,4,5-Trichlorophenol	3800 U	3500 U	1100000 U	4200 U	3700 U
2-Chloronaphthalene	790 U	710 U	230000 U	860 U	760 U
2-Nitroaniline	3800 U	3500 U	1100000 U	4200 U	3700 U
Dimethylphthalate	790 U	710 U	230000 U	860 U	760 U
Acenaphthylene	790 U	710 U	30000 J	860 U	760 U
2,6-Dinitrotoluene	790 U	710 U	230000 U	860 U	760 U
3-Nitroaniline	3800 U	3500 U	1100000 U	4200 U	3700 U
Acenaphthene	790 U	710 U	1200000 J	860 U	760 U
2,4-Dinitrophenol	3800 U	3500 U	1100000 U	4200 U	3700 U
4-Nitrophenol	3800 U	3500 U	1100000 U	4200 U	3700 U
Dibenzofuran	790 U	69 J	210000 J	860 U	760 U
2,4-Dinitrotoluene	790 U	710 U	230000 U	860 U	760 U
Diethylphthalate	790 U	710 U	230000 U	860 U	760 U
4-Chlorophenyl-phenylether	790 U	710 U	230000 U	860 U	760 U
Fluorene	790 U	710 U	480000 J	860 U	760 U
4-Nitroaniline	3800 U	3500 U	1100000 U	4200 U	3700 U
4,6-Dinitro-2-methylphenol	3800 U	3500 U	1100000 U	4200 U	3700 U
N-Nitrosodiphenylamine	790 U	710 U	230000 U	860 U	760 U
4-Bromophenyl-phenylether	790 U	710 U	230000 U	860 U	760 U
Hexachlorobenzene	790 U	710 U	230000 U	860 U	760 U
Pentachlorophenol	3800 U	3500 U	1100000 U	4200 U	3700 U
Phenanthrene	790 U	350 J	320000 J	860 U	760 U
Anthracene	790 U	140 J	440000 J	860 U	760 U
Di-n-butylphthalate	790 U	710 U	230000 U	510 B	230 B
Fluoranthene	86 B	370 B	2200000 J	860 U	760 U
Pyrene	110 B	300 B	1800000 J	860 U	760 U
Butylbenzylphthalate	790 U	710 U	230000 U	860 U	760 U
3,3'-Dichlorobenzidine	1600 U	1400 U	450000 U	1700 U	1500 U
Benzo(a)anthracene	79 J	110 J	380000 J	860 U	760 U
Chrysene	110 J	200 J	490000 J	860 U	760 U
bis(2-Ethylehexyl)phthalate	190 B	260 B	26000 B	320 B	390 B
Di-n-octylphthalate	790 U	710 U	230000 U	860 U	760 U
Benzo(b)fluoranthene	130 J	470 J	270000 J	860 U	760 U
Benzo(k)fluoranthene	170 J	710 U	240000 J	860 U	760 U
Benzo(a)pyrene	82 J	140 J	200000 J	860 U	760 U
Indeno(1,2,3-cd)pyrene	790 U	200 J	49000 J	860 U	760 U
Dibenz(a,h)anthracene	790 U	710 U	230000 U	860 U	760 U
Benzo(g,h,i)perylene	790 U	330 J	51000 J	860 U	760 U

ROSS-AMERICAN
SURFACE SOIL
SEMIVOLATILES

Sample No.:	MA-SS081-02	MA-SS089-02	MA-SS113-02	MA-SS129-02	MA-SS142-01
TR No.:	EW847	EW857	EW858	EW846	EW844
Parameter					
Phenol	750 U	46000 U	130000 U	110 B	800 U
bis(2-Chloroethyl)ether	750 U	46000 U	130000 U	910 U	800 U
2-Chlorophenol	750 U	46000 U	130000 U	910 U	800 U
1,3-Dichlorobenzene	750 U	46000 U	130000 U	910 U	800 U
1,4-Dichlorobenzene	750 U	46000 U	130000 U	910 U	800 U
Benzyl alcohol	750 U	46000 U	130000 U	910 U	800 U
1,2-Dichlorobenzene	750 U	46000 U	130000 U	910 U	800 U
2-Methylphenol	750 U	46000 U	130000 U	910 U	800 U
bis(2-Chloroisopropyl)ether	750 U	46000 U	130000 U	910 U	800 U
4-Methylphenol	750 U	46000 U	130000 U	910 U	800 U
N-Nitroso-di-n-propylamine	750 U	46000 U	130000 U	910 U	800 U
Hexachloroethane	750 U	46000 U	130000 U	910 U	800 U
Nitrobenzene	750 U	46000 U	130000 U	910 U	800 U
Isophorone	750 U	46000 U	130000 U	910 U	800 U
2-Nitrophenol	750 U	46000 U	130000 U	910 U	800 U
2,4-Dimethylphenol	750 U	46000 U	130000 U	910 U	800 U
Benzoic Acid	3600 U	220000 U	620000 U	280 J	3900 U
bis(2-Chloroethoxy)methane	750 U	46000 U	130000 U	910 U	800 U
2,4-Dichlorophenol	750 U	46000 U	130000 U	910 U	800 U
1,2,4-Trichlorobenzene	750 U	46000 U	130000 U	910 U	800 U
Naphthalene	750 U	1500000 DJ	460000 J	660 J	460 J
4-Chloroaniline	750 U	46000 U	130000 U	910 U	800 U
Hexachlorobutadiene	750 U	46000 U	130000 U	910 U	800 U
4-Chloro-3-methylphenol	750 U	46000 U	130000 U	910 U	800 U
2-Methylnaphthalene	750 U	990000 DJ	200000 J	510 J	800 U
Hexachlorocyclopentadiene	750 U	46000 U	130000 U	910 U	800 U
2,4,6-Trichlorophenol	750 U	46000 U	130000 U	910 U	800 U
2,4,5-Trichlorophenol	3600 U	220000 U	620000 U	4400 U	3900 U
2-Chloronaphthalene	750 U	46000 U	130000 U	910 U	800 U
2-Nitroaniline	3600 U	220000 U	620000 U	4400 U	3900 U
Dimethylphthalate	750 U	46000 U	130000 U	910 U	800 U
Acenaphthylene	750 U	9200 J	18000 J	910 U	800 U
2,6-Dinitrotoluene	750 U	46000 U	130000 U	910 U	800 U
3-Nitroaniline	3600 U	220000 U	620000 U	4400 U	3900 U
Acenaphthene	750 U	1700000 DJ	930000 J	910 U	800 U
2,4-Dinitrophenol	3600 U	220000 U	620000 J	4400 U	3900 U
4-Nitrophenol	3600 U	220000 U	620000 U	4400 U	3900 U
Dibenzofuran	750 U	1200000 DJ	630000 J	290 J	800 U
2,4-Dinitrotoluene	750 U	46000 U	130000 U	910 U	800 U
Diethylphthalate	750 U	46000 U	130000 U	910 U	800 U
4-Chlorophenyl-phenylether	750 U	46000 U	130000 U	910 U	800 U
Fluorene	750 U	1100000 DJ	950000 J	910 U	800 U
4-Nitroaniline	3600 U	220000 U	620000 U	4400 U	3900 U
4,6-Dinitro-2-methylphenol	3600 U	220000 U	620000 U	4400 U	3900 U
N-Nitrosodiphenylamine	750 U	46000 U	130000 U	910 U	800 U
4-Bromophenyl-phenylether	750 U	46000 U	130000 U	910 U	800 U
Hexachlorobenzene	750 U	46000 U	130000 U	910 U	800 U
Pentachlorophenol	3600 U	220000 U	620000 U	4400 U	3900 U
Phenanthrene	750 U	2000000 DJ	2400000 DJ	1100 J	800 U
Anthracene	750 U	390000 J	710000 J	230 J	800 U
Di-n-butylphthalate	480 B	46000 U	130000 U	980 B	170 B
Fluoranthene	750 U	1100000 DJ	1700000 J	800 J	800 U
Pyrene	750 U	1000000 DJ	1200000 J	600 J	800 U
Butylbenzylphthalate	750 U	46000 U	130000 U	910 U	800 U
3,3'-Dichlorobenzidine	1500 U	93000 U	260000 U	1800 U	1600 U
Benzo(a)anthracene	750 U	170000 J	320000 J	260 J	800 U
Chrysene	750 U	190000 J	380000 J	530 J	800 U
bis(2-Ethylehexyl)phthalate	350 B	44000 B	44000 B	750 B	170 B
Di-n-octylphthalate	750 U	46000 U	130000 U	910 U	800 U
Benzo(b)fluoranthene	750 U	78000 J	160000 J	710 J	800 U
Benzo(k)fluoranthene	750 U	78000 J	190000 J	380 J	800 U
Benzo(a)pyrene	750 U	71000 J	160000 J	260 J	800 U
Indeno(1,2,3-cd)pyrene	750 U	13000 J	34000 J	160 J	800 U
Dibenz(a,h)anthracene	750 U	46000 U	130000 U	910 U	800 U
Benzo(g,h,i)perylene	750 U	12000 J	31000 J	220 J	800 U

MOSS-AMERICAN
SURFACE SOIL
VOLATILES

Sample No.:	MA-SSFB05-01	MA-SSFB06-01	MA-SS012-02	MA-SS012-02FR	MA-SS015-02	MA-SS015-02FR	MA-SS018-02	MA-SS024-02	MA-SS030-02
TR No.:	EW862	EW863	EW851	EW860	EW852	EW861	EW854	EW855	EW859
	Field Blank	Field Blank		Replicate		Replicate			
Parameter	Conc. (ug/kg)								
Chloromethane	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Bromomethane	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Vinyl chloride	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Chloroethane	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Methylene chloride	5 U	5 U	3 U	2 J	6 U	6 U	6 U	6 U	29 U
Acetone	8 B	9 B	11 B	5 B	63 J	17 B	72 J	11 B	260 J
Carbon disulfide	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,1-Dichloroethene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,1-Dichloroethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,2-Dichloroethene (total)	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Chloroform	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,2-Dichloroethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
2-Butanone	6 J	9 J	R	R	12 B	R	7 B	8 B	63 B
1,1,1-Trichloroethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Carbon tetrachloride	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Vinyl acetate	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Bromodichloromethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,2-Dichloropropane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
cis-1,3-Dichloropropene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Trichloroethene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Dibromochloromethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
1,1,2-Trichloroethane	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Benzene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	100 J
trans-1,3-Dichloropropene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Bromoform	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
4-Methyl-2-pentanone	10 U	10 U	12 U	12 U	12 U	12 U	12 U	3 J	8 J
2-Hexanone	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Tetrachloroethene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	9 J
1,1,2,2-Tetrachloroethane	10 U	10 U	12 U	12 U	12 U	12 U	12 U	11 U	57 U
Toluene	5 U	5 U	21 J	40 J	89 J	33 J	25 J	27 J	380 J
Chlorobenzene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	29 U
Ethylbenzene	5 U	5 U	6 U	6 U	6 U	6 U	1 J	6 U	450 J
Styrene	5 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U	380 J
Xylene (total)	5 U	5 U	6 U	6 U	6 U	6 U	5 J	6 U	1100 J

MOSS-AMERICAN
SURFACE SOIL
VOLATILES

Sample No.:	MA-SS038-02	MA-SS053-02	MA-SS061-02	MA-SS064-02	MA-SS066-02	MA-SS078-02	MA-SS081-02	MA-SS089-02	MA-SS113-02
TR No.:	EW856	EW845	EW849	EW853	EW850	EW848	EW847	EW857	EW858
Parameter									
Chloromethane	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Bromomethane	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Vinyl chloride	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Chloroethane	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Methylene chloride	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Acetone	210 J	12 U	13 B	19 B	6 B	9 B	5 B	3000 B	33 B
Carbon disulfide	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,1-Dichloroethene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,1-Dichloroethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	210 J	16 U
1,2-Dichloroethene (total)	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Chloroform	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,2-Dichloroethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
2-Butanone	37 B	R	R	12 B	R	R	4 B	6300 B	R
1,1,1-Trichloroethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	19000 J	16 U
Carbon tetrachloride	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Vinyl acetate	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Bromodichloromethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,2-Dichloropropane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
cis-1,3-Dichloropropene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Trichloroethene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Dibromochloromethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,1,2-Trichloroethane	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Benzene	11 J	6 U	5 U	11 U	7 U	6 U	6 U	600 U	4 J
trans-1,3-Dichloropropene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Bromoform	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
4-Methyl-2-pentanone	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
2-Hexanone	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Tetrachloroethene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
1,1,2,2-Tetrachloroethane	49 U	12 U	11 U	23 U	13 U	12 U	11 U	1200 U	33 U
Toluene	580 J	100 J	27 J	230 J	24 J	67 J	100 J	1300 J	400 J
Chlorobenzene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	600 U	16 U
Ethylbenzene	240 J	6 U	5 U	11 U	7 U	6 U	6 U	1600 J	27 J
Styrene	24 U	6 U	5 U	11 U	7 U	6 U	6 U	2600 J	16 U
Xylene (total)	R	6 U	5 U	11 U	7 U	6 U	6 U	14000 J	120 J

MOSS-AMERICAN
SURFACE SOIL
VOLATILES

Sample No.:	MA-SS129-02	MA-SS142-01
TR No.:	EWB46	EWB44
Parameter		
Chloromethane	14 U	12 U
Bromomethane	14 U	12 U
Vinyl chloride	14 U	12 U
Chloroethane	14 U	12 U
Methylene chloride	7 U	6 U
Acetone	5 B	370 J
Carbon disulfide	7 U	6 U
1,1-Dichloroethene	7 U	6 U
1,1-Dichloroethane	7 U	6 U
1,2-Dichloroethene (total)	7 U	6 U
Chloroform	7 U	6 U
1,2-Dichloroethane	7 U	6 U
2-Butanone	R	71 B
1,1,1-Trichloroethane	7 U	6 U
Carbon tetrachloride	7 U	6 U
Vinyl acetate	14 U	12 U
Bromodichloromethane	7 U	6 U
1,2-Dichloropropane	7 U	6 U
cis-1,3-Dichloropropene	7 U	6 U
Trichloroethene	7 U	6 U
Dibromochloromethane	7 U	6 U
1,1,2-Trichloroethane	7 U	6 U
Benzene	7 U	6 U
trans-1,3-Dichloropropene	7 U	6 U
Bromoform	7 U	6 U
4-Methyl-2-pentanone	14 U	12 U
2-Hexanone	14 U	12 U
Tetrachloroethene	7 U	6 U
1,1,2,2-Tetrachloroethane	14 U	12 U
Toluene	2 J	120 DJ
Chlorobenzene	7 U	6 U
Ethylbenzene	7 U	6 U
Styrene	7 U	6 U
Xylene (total)	7 U	6 U

MOSS-AMERICAN
SURFACE SOIL
DIOXIN

SAMPLING DATES: 6/29/88 to 6/30/88

Sample No.:	MA-SS012-02	MA-SS012-02FR	MA-SS015-02	MA-SS015-02FR	MA-SS018-02	MA-SS024-02	MA-SS030-02	MA-SS038-02
OTR No.:	E172	E175	E178	E181	E184	E187	E190	E163
Comments:		Replicate		Replicate				
Parameter (ng/g)								
Tetrachloro furan (Total)	0.0090 U	0.0053 U	0.011 U	0.0078 U	0.028 U	0.017 U	0.13 U	0.033 U
Tetrachloro furan (2,3,7,8)	0.0090 U	0.0053 U	0.011 U	0.0078 U	0.028 U	0.017 U	0.13 U	0.033 U
Pentachloro furan	0.063 U	0.043 U	0.12 U	0.077 U	0.88 U	0.059 U	0.45 U	0.20 U
Hexachloro furan	0.059 U	0.041 U	0.044 U	0.025 U	0.028 U	0.019 U	0.050 U	0.066 U
Heptachloro furan	0.13 U	0.064 U	0.065 U	0.089 U	0.036 U	0.027 U	0.13 U	0.050 U
Octachloro furan	0.27 U	0.28 U	0.29 U	0.59 U	0.26 U	0.082 U	0.46 U	0.47 U
Tetrachloro dioxin (Total)	0.020 U	0.016 U	0.024 U	0.013 U	0.019 U	0.013 U	0.14 U	0.013 U
Tetrachloro dioxin (2,3,7,8)	0.020 U	0.016 U	0.024 U	0.013 U	0.019 U	0.013 U	0.14 U	0.013 U
Pentachloro dioxin	0.040 U	0.022 U	0.054 U	0.045 U	0.059 U	0.025 U	0.25 U	0.058 U
Hexachloro dioxin	0.062 U	0.030 U	0.063 U	0.073 U	0.077 U	0.033 U	0.16 U	0.058 U
Heptachloro dioxin	0.83	0.46	0.074 U	0.11 U	0.086 U	0.042 U	1.0 J	0.070 U
Octachloro dioxin	2.0	1.4	0.36 U	0.64 U	0.47 U	0.20 U	4.3 J	0.40 U

MOSS-AMERICAN
SURFACE SOIL
DIOXIN

Sample No.:	MA-SS053-02	MA-SS061-02	MA-SS064-02	MA-SS066-02	MA-SS078-02	MA-SS081-02	MA-SS089-02	MA-SS113-02
OTR No.:	E157	E169	E166	E196	E199	E193	E202	E160
Comments:								
Parameter (ng/g)								
Tetrachloro furan (Total)	0.0096 U	0.035 U	0.44 U	0.013 U	0.010 U	0.025 U	0.030 U	0.14 U
Tetrachloro furan (2,3,7,8)	0.0096 U	0.035 U	0.44 U	0.013 U	0.010 U	0.025 U	0.030 U	0.14 U
Pentachloro furan	0.10 U	0.24 U	2.9 U	0.12 U	0.12 U	0.17 U	1.9 U	0.34 U
Hexachloro furan	0.028 U	0.082 U	0.32 U	0.038 U	0.024 U	0.059 U	0.085 U	0.084 U
Heptachloro furan	0.040 U	0.20 U	0.42 U	0.075 U	0.062 U	0.17 U	0.11 U	0.082 U
Octachloro furan	0.14 U	1.5 U	2.0 U	0.36 U	0.27 U	0.43 U	0.60 U	0.28 U
Tetrachloro dioxin (Total)	0.0081 U	0.020 U	0.31 U	0.014 U	0.013 U	0.021 U	0.056 U	0.047 U
Tetrachloro dioxin (2,3,7,8)	0.0081 U	0.020 U	0.31 U	0.014 U	0.013 U	0.021 U	0.056 U	0.047 U
Pentachloro dioxin	0.060 U	0.20 U	2.5 U	0.082 U	0.048 U	0.074 U	0.45 U	0.23 U
Hexachloro dioxin	0.040 U	0.11 U	0.47 U	0.097 U	0.060 U	0.11 U	0.35 U	0.10 U
Heptachloro dioxin	0.041 U	0.28 U	0.40 UP	0.090 U	0.11 U	0.13 U	0.15 U	0.12 U
Octachloro dioxin	0.21 U	1.2 U	2.5 UP	0.90 U	0.42 U	0.93 U	0.47 U	0.40 U

MOSS-AMERICAN
SURFACE SOIL
DIOXIN

Sample No.:	MA-SS129-02	MA-SS142-01	MA-SSFB05-01	MA-SSFB06-01
OTR No.:	E205	E135	E208	E211
Comments:			Field Blank	Field Blank
Parameter (ng/g)				
Tetrachloro furan (Total)	0.0072 U	0.012 U	0.0055 U	0.0083 U
Tetrachloro furan (2,3,7,8)	0.0072 U	0.012 U	0.0055 U	0.0083 U
Pentachloro furan	0.10 U	0.080 U	0.048 U	0.082 U
Hexachloro furan	0.037 U	0.021 U	0.014 U	0.030 U
Heptachloro furan	0.13 U	0.033 U	0.019 U	0.030 U
Octachloro furan	0.28 U	0.13 U	0.058 U	0.086 U
Tetrachloro dioxin (Total)	0.13	0.011 U	0.0088 U	0.014 U
Tetrachloro dioxin (2,3,7,8)	0.11	0.011 U	0.0088 U	0.014 U
Pentachloro dioxin	0.063 U	0.062 U	0.035 U	0.069 U
Hexachloro dioxin	0.083 U	0.042 U	0.035 U	0.079 U
Heptachloro dioxin	0.11 U	0.037 U	0.019 U	0.027 U
Octachloro dioxin	0.56 U	0.16 U	0.056 U	0.11 U

MOSS-AMERICAN
SURFACE SOIL
INORGANICS

Sample ID:	MA-SSFB05	MA-SSFB06	MA-SS012-02	MA-SS012-02FR	MA-SS015-02	MA-SS015-02FR	MA-SS018-02	MA-SS024-02	MA-SS030-02	MA-SS038-02
TR No.:	MEW439	MEW440	MEW428	MEW437	MEW429	MEW438	MEW431	MEW432	MEW436	MEW433
	Field Blank	Field Blank		Replicate		Replicate				
Parameter	Conc. (mg/kg)									
Aluminum	36.3	42.8	4780	4830	5810	4340	5080	2610	6540	5360
Antimony	R	R	0.43 B	1.0 B	2.5 B	3.2 J	0.25 B	R	0.45 B	1.5 B
Arsenic	0.16 J	0.88 U	22.7	46.8	15.8	23.8 J	7.1	71.4	23.1	7.4 J
Barium	8.6 J	7.5 U	64.4	52.2	81.8	67.4	75.5	41.7	65.8	124
Beryllium	0.26 J	0.21 U	1.1	0.87 J	1.2	1.0 J	1.3	0.72 J	0.93 J	1.2
Cadmium	0.49 U	0.49 U	5.4	4.4	8.3	6.0	10.2	3.0 B	8.2	5.5
Calcium	58.1 J	29.4 J	62400 J	79500 J	36700 J	27300 J	138000 J	123000 J	66000 J	13100 J
Chromium	1.3 U	1.3 U	36.9	36.2	35.7	21.1	9.5	12.5	81.2	29.7
Cobalt	2.7 U	2.7 U	9.0 J	7.9 J	11.8	7.1 J	8.1 J	6.4 J	7.1 J	8.4 J
Copper	2 J	1.9 U	105 J	23.5 J	135 J	125 J	137 J	19.6 J	27.5 J	27.8 J
Iron	62.2	70.6	17100	11200	32200	22500	29900	8040	16100	15200
Lead	0.41 J	0.24 J	85.1 J	R	519 J	355 J	59.1 J	44.4 J	R	114 J
Magnesium	27.9 U	27.9 U	33700 J	39700 J	16000 J	12100 J	56000 J	60200 J	30700 J	3680 J
Manganese	1.2 J	0.79 U	295	253	444	256	186	257	515	230
Mercury	0.81 J	0.63 J	0.37 J	0.61 J	3.9 J	2.6 J	0.39 J	0.29 J	1.1 J	0.29 J
Nickel	3.0 U	3.0 U	21.9	17.8	25.0	17.4	20.4	13.8	15.6	21.7
Potassium	92.2 B	108 B	713 J	730 J	595 J	521 J	726 J	503 B	926 J	857 J
Selenium	0.88 U	0.89 U	1.1 U	1.1 U	1.0 U	0.96 U	1.8 J	0.95 U	0.96 U	1.1 U
Silver	1.5 U	1.5 U	1.9 U	2.0 U	1.9 U	1.8 U	1.9 U	1.7 U	1.9 U	1.9 U
Sodium	199 J	176 J	1050 J	999 J	1430	1030 J	1210	649 J	887 J	926 J
Thallium	0.18 U	0.18 U	0.50 B	0.21 U	0.52 B	0.26 B	0.60 B	0.40 B	0.60 B	0.62 B
Vanadium	2.9 U	2.9 U	20.5	18.7	26.1	17.9	27.9	14.7	19.4	14.6
Zinc	22.2 J	31.0 J	899 J	626 J	1200 J	1020 J	1890 J	269 J	2590 J	891 J
Cyanide	1.5 U	1.5 U	3.0 J	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.6 J	2.3 J

MOSS-AMERICAN
SURFACE SOIL
INORGANICS

Sample ID:	MA-SS053-02	MA-SS061-02	MA-SS064-02	MA-SS066-02	MA-SS078-02	MA-SS081-02	MA-SS089-02	MA-SS113-02	MA-SS129-02	MA-SS142-01
TR No.:	MEW422	MEW426	MEW430	MEW427	MEW425	MEW424	MEW434	MEW435	MEW423	MEW421
Parameter										
Aluminum	10300	2260	5480	12300	16400	15100	14100	7550	9920	13000
Antimony	0.43 B	0.39 B	2.2 B	R	0.53 J	0.41 B	0.44 B	R	1.5 B	1.2 B
Arsenic	1.0 U	3.0 J	4.5	3.2 J	2.6 J	3.6	5.6	110	30.9	1.8 J
Barium	71.6	19.9 J	54.1	183	86.5	85.3	80.3	197	113	126
Beryllium	0.85 J	0.45 J	0.73 J	1.2	1.2	1.1	0.87 J	1.4 J	1.3	0.98 J
Cadmium	4.0	2.8 B	19.8	6.4	6.7	6.7	5.6	75.9	6.2	6.0
Calcium	16000 J	162000 J	62400 J	11400 J	103000 J	72400 J	62100 J	39600 J	21200 J	61100
Chromium	16.8	9.8	12.4	19.9	27.9	26.5	23.6	19.0	17.8	20.1
Cobalt	5.9 J	7.9 J	5.1 J	9.8	14.4	12.6	13.6	9.5 J	10.2	10.0
Copper	12.0 J	8.0 J	22.6 J	36.6 J	22.5 J	31.9 J	22.9 J	50.0 J	42.6 J	87.2 J
Iron	10400	8460	11100	12800	20200	19800	21200	14900	22400	18400
Lead	10.7 J	4.7 J	26.6 J	21.9 J	11.4 J	7.6 J	14.8 J	411 J	76.7 J	20.5 J
Magnesium	9630 J	64400 J	29700 J	4400 J	30800 J	38900 J	35900 J	5450 J	11100 J	22100
Manganese	92.6	676	298	201	508	583	729	487	332	828 J
Mercury	1.4 J	0.51 J	0.15 J	0.72 J	0.28 J	0.28 J	1.3 J	0.34 J	0.50 J	0.20 J
Nickel	11.2	14.2	12.3	23.0	29.5	27.7	30.9	21.4	21.6	20.3 J
Potassium	733 J	429 B	877 J	812 J	2570	2140	1820	1060 J	768 J	1270
Selenium	1.1 U	4.9 U	0.99 U	2.1	1.00 U	0.97 U	1.1 U	1.1 U	1.2 U	1.0 U
Silver	1.9 U	1.8 U	1.9 U	1.8 U	1.9 U	1.8	2.0 U	2.0 U	2.1 U	1.9 U
Sodium	1130	655 J	680 J	612 J	959 J	1500	873 J	954 J	853 J	897 J
Thallium	0.57 B	0.20 U	0.70 B	0.30 B	0.29 B	0.42 B	0.40 B	0.54 B	0.42 B	0.25 J
Vanadium	15.5	12.2	19.3	38.2	33.0	32.6	34.5	22.4	27.2	33.4
Zinc	145 J	200 J	9760 J	191 J	112 J	121 J	128 J	232 J	269 J	202 J
Cyanide	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	2.4 J

MOSS AMERICAN RI
SURFACE SOIL
TREATMENT PARAMETERS
SAS No.: 3770E

SAMPLE DATES: 6/29/88 to 6/30/88

Sample ID:	MA-SS012-02	MA-SS012-02FR	MA-SS015-02	MA-SS015-02FR	MA-SS018-02	MA-SS024-02	MA-SS030-02	MA-SS038-02	MA-SS053-02	MA-SS061-02
TR No.:	E171/E173	E174/E176	E177/E179	E180/E182	E183/185	E186/E188	E189/E191	E162/E164	/E158	/E170
Comments:		Replicate		Replicate						
NANCO LAB:										
% Moisture	20	20	10	0 U	20	10	10	40	--	--
% Ash	57	53	69	61	47	61	67	51	--	--
% Volatile Matter	26	29	21	39	33	29	23	9	--	--
% Fixed Carbon	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
VERSAR LAB:										
% Carbon (dry)	18.1	16.2	9.59	5.83	25	13.1	23.41	20.2	--	--
% Carbon (as rec'd)	14.4	13.2	8.34	5.05	20.5	11.9	20.6	12.6	--	--
% Oxygen (dry)	3.4	12	12.8	16.6	3.7	23.3	0.7	7.6	--	--
% Oxygen (as rec'd)	20.9	26.2	24.1	26.3	21	30.4	11.3	38.2	--	--
% Hydrogen (dry)	1.3	-0.55	1.1 U	-0.43	1.2 U	1.1 U	-0.09	0.48	--	--
% Hydrogen (as rec'd)	3.33	1.62	1 U	1.13	1 U	1 U	1.26	4.52	--	--
% Nitrogen (dry)	1.3 U	1.2 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U	1.6 U	--	--
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
% Ash (dry)	77.2	72.4	77.6	78	71.3	63.6	76	71.7	--	--
% Ash (as rec'd)	61.4	59	67.5	67.5	58.5	57.7	66.9	44.7	--	--
% Sulphur (dry)	1.3 U	1.2 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U	1.6 U	--	--
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--	--
% Moisture	20.5	18.5	13	13.4	18	9.3	12	37.7	--	--
TOC (mg/kg)	102000	80900	54000	43200	86300	44100	43300	87400	12500	39300
Chloride (mg/kg)	76.2	44.7	16.9	20.3	23.7	38.5	53.3	25.8	--	--
Flashpoint (degrees F)	136	138	138	142	139	142	139	142	--	--
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	--	--
% Total Solids									82.7	91.3

MOSS AMERICAN RI
SURFACE SOIL
TREATMENT PARAMETERS
SAS No.: 3770E

Sample ID:	MA-SS064-02	MA-SS066-02	MA-SS078-02	MA-SS081-02	MA-SS089-02	MA-SS113-02	MA-SS129-02	MA-SS142-01	MA-SSFB05-01	MA-SSFB06-01
TR No.:	E165/E167	E195/E197	/E200	/E194	E201/E203	E159/E161	/E206	E147/E123	E207/E209	E210/E212
Comments:									Field Blank	Field Blank
NANCO LAB:										
% Moisture	20	30	--	--	10	40	--	20	10	0 U
% Ash	52	70	--	--	68	37	--	71	99.9	100
% Volatile Matter	29	1 U	--	--	26	24	--	14	1 U	1 U
% Fixed Carbon	1 U	1 U	--	--	1 U	1 U	--	1 U	1 U	1 U
			--	--			--			
VERSAR LAB:			--	--			--			
% Carbon (dry)	23	7.87	--	--	12.3	28.9	--	6.03	1 U	
% Carbon (as rec'd)	19.8	6.04	--	--	9.95	13.8	--	5.22	1 U	1 U
% Oxygen (dry)	6.5	7.2	--	--	4.9	5.5	--	9.5	0	0
% Oxygen (as rec'd)	18	26.2	--	--	20.9	49.1	--	20.1	0	0
% Hydrogen (dry)	0.46	0.43	--	--	-0.37	-1.49	--	0.88	1 U	1 U
% Hydrogen (as rec'd)	1.96	2.94	--	--	1.84	5.14	--	1.57	1 U	1 U
% Nitrogen (dry)	1.2 U	1.3 U	--	--	1.2 U	2.1 U	--	1.2 U	1 U	1 U
% Nitrogen (as rec'd)	1 U	1 U	--	--	1 U	1 U	--	1 U	1 U	1 U
% Ash (dry)	70	84.5	--	--	83.2	67.1	--	84.4	100	100
% Ash (as rec'd)	60.2	64.8	--	--	67.3	32	--	73.1	100	100
% Sulphur (dry)	1.2 U	1.3 U	--	--	1.2 U	2.1 U	--	1.2 U	1 U	1 U
% Sulphur (as rec'd)	1 U	1 U	--	--	1 U	1 U	--	1 U	1 U	1 U
% Moisture	14	23.3	--	--	19.1	52.3	--	13.4	0	0
TOC (mg/kg)	85600	59500	4100	12200	56000	127000	67600	18500	126 *	420 *
Chloride (mg/kg)	37.1	13.8	--	--	13.9	33.8	--	13.3	25.5	20
Flashpoint (degrees F)	139	146	--	--	143	136	--	140	>230	>230
BTU (per lb.)	2214	500 U	--	--	500 U	500 U	--	500 U	500 U	500 U
% Total Solids			85.8	87			69.5			

NOSS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	NA-SB001-01	NA-SB002-01	NA-SB003-01	NA-SB003-02	NA-SBFB03
TR No.:	EW803	EW869	EW842	EW843	EW874 Field Blank
Parameter	Conc. (ug/kg)				
Phenol	750 U	780 U	370 U	360 U	660 U
bis(2-Chloroethyl)ether	750 U	780 U	370 U	360 U	660 U
2-Chlorophenol	750 U	780 U	370 U	360 U	660 U
1,3-Dichlorobenzene	750 U	780 U	370 U	360 U	660 U
1,4-Dichlorobenzene	750 U	780 U	370 U	360 U	660 U
Benzyl alcohol	750 U	780 U	370 U	360 U	660 U
1,2-Dichlorobenzene	750 U	780 U	370 U	360 U	660 U
2-Methylphenol	750 U	780 U	370 U	360 U	660 U
bis(2-Chloroisopropyl)ether	750 U	780 U	370 U	360 U	660 U
4-Methylphenol	750 U	780 U	370 U	360 U	660 U
N-Nitroso-di-n-propylamine	750 U	780 U	370 U	360 U	660 U
Hexachloroethane	750 U	780 U	370 U	360 U	660 U
Nitrobenzene	750 U	780 U	370 U	360 U	660 U
Isophorone	750 U	780 U	370 U	360 U	660 U
2-Nitrophenol	750 U	780 U	370 U	360 U	660 U
2,4-Dimethylphenol	750 U	780 U	370 U	360 U	660 U
Benzoic Acid	3700 U	3800 U	1900 U	1800 U	3200 U
bis(2-Chloroethoxy)methane	750 U	780 U	370 U	360 U	660 U
2,4-Dichlorophenol	750 U	780 U	370 U	360 U	660 U
1,2,4-Trichlorobenzene	750 U	780 U	370 U	360 U	660 U
Naphthalene	750 U	780 U	370 U	360 U	660 U
4-Chloroaniline	750 U	780 U	370 U	360 U	660 U
Hexachlorobutadiene	750 U	780 U	370 U	360 U	660 U
4-Chloro-3-methylphenol	750 U	780 U	370 U	360 U	660 U
2-Methylnaphthalene	750 U	780 U	370 U	360 U	660 U
Hexachlorocyclopentadiene	750 U	780 U	370 U	360 U	660 U
2,4,6-Trichlorophenol	750 U	780 U	370 U	360 U	660 U
2,4,5-Trichlorophenol	3700 U	3800 U	1900 U	1800 U	3200 U
2-Chloronaphthalene	750 U	780 U	370 U	360 U	660 U
2-Nitroaniline	3700 U	3800 U	1900 U	1800 U	3200 U
Dimethylphthalate	1300 J	780 U	370 U	360 U	660 U
Acenaphthylene	750 U	780 U	370 U	360 U	660 U
2,6-Dinitrotoluene	750 U	780 U	370 U	360 U	660 U
3-Nitroaniline	3700 U	3800 U	1900 U	1800 U	3200 U
Acenaphthene	750 U	780 U	370 U	360 U	660 U
2,4-Dinitrophenol	3700 U	3800 U	1900 U	1800 U	3200 U
4-Nitrophenol	3700 U	3800 U	1900 U	1800 U	3200 U
Dibenzofuran	750 U	780 U	370 U	360 U	660 U
2,4-Dinitrotoluene	750 U	780 U	370 U	360 U	660 U
Diethylphthalate	6000 J	780 U	370 U	360 U	660 U
4-Chlorophenyl-phenylether	750 U	780 U	370 U	360 U	660 U
Fluorene	750 U	780 U	370 U	360 U	660 U
4-Nitroaniline	3700 U	3800 U	1900 U	1800 U	3200 U
4,6-Dinitro-2-methylphenol	3700 U	3800 U	1900 U	1800 U	3200 U
N-Nitrosodiphenylamine	750 U	780 U	370 U	360 U	660 U
4-Bromophenyl-phenylether	750 U	780 U	370 U	360 U	660 U
Hexachlorobenzene	750 U	780 U	370 U	360 U	660 U
Pentachlorophenol	3700 U	3800 U	1900 U	1800 U	3200 U
Phenanthrene	750 U	780 U	370 U	360 U	660 U
Anthracene	750 U	780 U	370 U	360 U	660 U
Di-n-butylphthalate	540 B	780 U	370 U	360 U	660 U
Fluoranthene	750 U	780 U	370 U	360 U	660 U
Pyrene	750 U	780 U	370 U	360 U	660 U
Butylbenzylphthalate	750 U	780 U	370 U	360 U	660 U
3,3'-Dichlorobenzidine	1500 U	1600 U	750 U	730 U	1300 U
Benzo(a)anthracene	750 U	780 U	370 U	360 U	660 U
Chrysene	750 U	780 U	370 U	360 U	660 U
bis(2-Ethylehexyl)phthalate	1300 B	220 B	370 U	540	290 B
Di-n-octylphthalate	750 U	780 U	370 U	360 U	660 U
Benzo(b)fluoranthene	750 U	780 U	370 U	360 U	660 U
Benzo(k)fluoranthene	750 U	780 U	370 U	360 U	660 U
Benzo(a)pyrene	750 U	780 U	370 U	360 U	660 U
Indeno(1,2,3-cd)pyrene	750 U	780 U	370 U	360 U	660 U
Dibenz(a,h)anthracene	750 U	780 U	370 U	360 U	660 U
Benzo(g,h,i)perylene	750 U	780 U	370 U	360 U	660 U

NOSS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	MA-SB004-01	MA-SB004-02	MA-SB004-03	MA-SBFB04	MA-SB005-01
TR No.:	EW805	EW806	EW807	EW875 Field Blank	EW872
Parameter					
Phenol	22000 U	370 U	46 J	660 U	830 U
bis(2-Chloroethyl)ether	22000 U	370 U	390 U	660 U	830 U
2-Chlorophenol	22000 U	370 U	390 U	660 U	830 U
1,3-Dichlorobenzene	22000 U	370 U	390 U	660 U	830 U
1,4-Dichlorobenzene	22000 U	370 U	390 U	660 U	830 U
Benzyl alcohol	22000 U	370 U	390 U	660 U	830 U
1,2-Dichlorobenzene	22000 U	370 U	390 U	660 U	830 U
2-Methylphenol	22000 U	370 U	390 U	660 U	830 U
bis(2-Chloroisopropyl)ether	22000 U	370 U	390 U	660 U	830 U
4-Methylphenol	22000 U	370 U	390 U	660 U	830 U
N-Nitroso-di-n-propylamine	22000 U	370 U	390 U	660 U	830 U
Hexachloroethane	22000 U	370 U	390 U	660 U	830 U
Nitrobenzene	22000 U	370 U	390 U	660 U	830 U
Isophorone	22000 U	370 U	1900 U	660 U	830 U
2-Nitrophenol	22000 U	370 U	390 U	660 U	830 U
2,4-Dimethylphenol	22000 U	370 U	390 U	660 U	830 U
Benzoic Acid	104000 U	1800 U	35 B	3200 U	4000 U
bis(2-Chloroethoxy)methane	22000 U	370 U	390 U	660 U	830 U
2,4-Dichlorophenol	22000 U	370 U	390 U	660 U	830 U
1,2,4-Trichlorobenzene	22000 U	370 U	390 U	660 U	830 U
Naphthalene	630000 J	52 J	19 J	660 U	830 U
4-Chloroaniline	22000 U	370 U	390 U	660 U	830 U
Hexachlorobutadiene	22000 U	370 U	390 U	660 U	830 U
4-Chloro-3-methylphenol	22000 U	370 U	390 U	660 U	830 U
2-Methylnaphthalene	220000 J	370 U	390 U	660 U	830 U
Hexachlorocyclopentadiene	22000 U	370 U	390 U	660 U	830 U
2,4,6-Trichlorophenol	22000 U	370 U	390 U	660 U	830 U
2,4,5-Trichlorophenol	22000 U	1800 U	1900 U	3200 U	4000 U
2-Chloronaphthalene	22000 U	370 U	390 U	660 U	830 U
2-Nitroaniline	22000 U	1800 U	1900 U	3200 U	4000 U
Dimethylphthalate	22000 U	370 U	390 U	660 U	830 U
Acenaphthylene	47000 J	370 U	390 U	660 U	830 U
2,6-Dinitrotoluene	22000 U	370 U	390 U	660 U	830 U
3-Nitroaniline	104000 U	1800 U	1900 U	3200 U	4000 U
Acenaphthene	240000 J	370 U	240 J	660 U	830 U
2,4-Dinitrophenol	104000 U	1800 U	1900 U	3200 U	4000 U
4-Nitrophenol	104000 U	1800 U	240 J	3200 U	4000 U
Dibenzofuran	180000 J	370 U	390 U	660 U	830 U
2,4-Dinitrotoluene	22000 U	370 U	390 U	660 U	830 U
Diethylphthalate	22000 U	370 U	390 U	660 U	830 U
4-Chlorophenyl-phenylether	22000 U	370 U	390 U	660 U	830 U
Fluorene	230000 J	370 U	56 J	660 U	830 U
4-Nitroaniline	104000 U	1800 U	1900 U	3200 U	4000 U
4,6-Dinitro-2-methylphenol	104000 U	1800 U	1900 U	3200 U	4000 U
N-Nitrosodiphenylamine	22000 U	370 U	390 U	660 U	830 U
4-Bromophenyl-phenylether	22000 U	370 U	390 U	660 U	830 U
Hexachlorobenzene	22000 U	370 U	390 U	660 U	830 U
Pentachlorophenol	104000 U	1800 U	110 J	3200 U	4000 U
Phenanthrene	22000 U	73 J	180 J	660 U	830 U
Anthracene	84000 J	370 U	11 J	660 U	830 U
Di-n-butylphthalate	22000 U	370 U	390 U	660 U	200 J
Fluoranthene	320000 J	43 J	60 J	660 U	110 J
Pyrene	290000 J	43 J	120 J	660 U	130 J
Butylbenzylphthalate	22000 U	370 U	390 U	660 U	830 U
3,3'-Dichlorobenzidine	43000 U	740 U	790 U	1300 U	1700 U
Benzo(a)anthracene	70000 J	370 U	390 U	660 U	830 U
Chrysene	60000 J	370 U	60 J	660 U	830 U
bis(2-Ethylehexyl)phthalate	22000 U	370 U	1300 B	320 B	290 B
Di-n-octylphthalate	22000 U	370 U	390 U	660 U	830 U
Benzo(b)fluoranthene	18000 J	370 U	390 U	660 U	830 U
Benzo(k)fluoranthene	20000 J	370 U	390 U	660 U	120 J
Benzo(a)pyrene	22000 J	370 U	390 U	660 U	830 U
Indeno(1,2,3-cd)pyrene	5600 J	370 U	390 U	660 U	830 U
Dibenz(a,h)anthracene	1800 J	370 U	390 U	660 U	830 U
Benzo(g,h,i)perylene	4100 J	370 U	390 U	660 U	830 U

NOSS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	MA-SB005-01FR	MA-SB006-01	MA-SB007-01	MA-SB008-01	MA-SB008-02
TR No.:	EW873	EW870	EW810	EW808	EW809
	Replicate				
Parameter					
Phenol	790 U	750 U	420 U	450 U	1200 U
bis(2-Chloroethyl)ether	790 U	750 U	420 U	450 U	1200 U
2-Chlorophenol	790 U	750 U	420 U	450 U	1200 U
1,3-Dichlorobenzene	790 U	750 U	420 U	450 U	1200 U
1,4-Dichlorobenzene	790 U	750 U	420 U	450 U	1200 U
Benzyl alcohol	790 U	750 U	420 U	450 U	1200 U
1,2-Dichlorobenzene	790 U	750 U	420 U	450 U	1200 U
2-Methylphenol	790 U	750 U	420 U	450 U	1200 U
bis(2-Chloroisopropyl)ether	790 U	750 U	420 U	450 U	1200 U
4-Methylphenol	790 U	750 U	420 U	450 U	1200 U
N-Nitroso-di-n-propylamine	790 U	750 U	420 U	450 U	1200 U
Hexachloroethane	790 U	750 U	420 U	450 U	1200 U
Nitrobenzene	790 U	750 U	420 U	450 U	1200 U
Isophorone	790 U	750 U	420 U	450 U	1200 U
2-Nitrophenol	790 U	750 U	420 U	450 U	1200 U
2,4-Dimethylphenol	790 U	750 U	420 U	450 U	1200 U
Benzoic Acid	3800 U	3700 U	2000 U	2200 U	810 J
bis(2-Chloroethoxy)methane	790 U	750 U	420 U	450 U	1200 U
2,4-Dichlorophenol	790 U	750 U	420 U	450 U	1200 U
1,2,4-Trichlorobenzene	790 U	750 U	420 U	450 U	1200 U
Naphthalene	790 U	750 U	420 U	450 U	16000
4-Chloroaniline	790 U	750 U	420 U	450 U	1200 U
Hexachlorobutadiene	790 U	750 U	420 U	450 U	1200 U
4-Chloro-3-methylphenol	790 U	750 U	420 U	450 U	1200 U
2-Methylnaphthalene	790 U	750 U	420 U	450 U	4700
Hexachlorocyclopentadiene	790 U	750 U	420 U	450 U	1200 U
2,4,6-Trichlorophenol	790 U	750 U	420 U	450 U	1200 U
2,4,5-Trichlorophenol	3800 U	3700 U	2000 U	2200 U	5900 U
2-Chloronaphthalene	790 U	750 U	420 U	450 U	1200 U
2-Nitroaniline	3800 U	3700 U	2000 U	2200 U	5900 U
Dimethylphthalate	790 U	750 U	420 U	450 U	1200 U
Acenaphthylene	790 U	750 U	420 U	450 U	1200 U
2,6-Dinitrotoluene	790 U	750 U	420 U	450 U	1200 U
3-Nitroaniline	3800 U	3700 U	2000 U	2200 U	5900 U
Acenaphthene	790 U	750 U	420 U	450 U	3100
2,4-Dinitrophenol	3800 U	3700 U	2000 U	2200 U	5900 U
4-Nitrophenol	3800 U	3700 U	2000 U	2200 U	5900 U
Dibenzofuran	790 U	750 U	420 U	450 U	1300
2,4-Dinitrotoluene	790 U	750 U	420 U	450 U	1200 U
Diethylphthalate	790 U	750 U	420 U	450 U	1200 U
4-Chlorophenyl-phenylether	790 U	750 U	420 U	450 U	1200 U
Fluorene	790 U	750 U	420 U	450 U	1100
4-Nitroaniline	3800 U	3700 U	2000 U	2200 U	5900 U
4,6-Dinitro-2-methylphenol	3800 U	3700 U	2000 U	2200 U	5900 U
N-Nitrosodiphenylamine	790 U	750 U	420 U	450 U	1200 U
4-Bromophenyl-phenylether	790 U	750 U	420 U	450 U	1200 U
Hexachlorobenzene	790 U	750 U	420 U	450 U	1200 U
Pentachlorophenol	3800 U	3700 U	2000 U	2200 U	5900 U
Phenanthrene	790 U	750 U	420 U	450 U	500 J
Anthracene	790 U	750 U	420 U	450 U	1200 U
Di-n-butylphthalate	160 J	2800 J	37 J	39 J	1200 U
Fluoranthene	790 U	750 U	420 U	16 J	240 J
Pyrene	790 U	750 U	420 U	16 J	230 J
Butylbenzylphthalate	790 U	750 U	420 U	450 U	1200 U
3,3'-Dichlorobenzidine	1600 U	1500 U	830 U	900 U	2400 U
Benzo(a)anthracene	790 U	750 U	420 U	450 U	1200 U
Chrysene	790 U	750 U	420 U	46 J	1200 U
bis(2-Ethylehexyl)phthalate	270 B	270 B	380 J	450 U	1600
Di-n-octylphthalate	790 U	750 U	420 U	450 U	1200 U
Benzo(b)fluoranthene	790 U	750 U	420 U	74 J	51 J
Benzo(k)fluoranthene	790 U	750 U	420 U	87 J	33 J
Benzo(a)pyrene	790 U	750 U	420 U	450 U	40 J
Indeno(1,2,3-cd)pyrene	790 U	750 U	420 U	29 J	1200 U
Dibenz(a,h)anthracene	790 U	750 U	420 U	450 U	1200 U
Benzo(g,h,i)perylene	790 U	750 U	420 U	44 J	1200 U

NOSS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	NA-SB009-01	NA-SB009-02	NA-SB010-01	NA-SB011-01	NA-SB011-02
TR No.:	EM831	EM832	EM836	EM866	EM867
Parameter					
Phenol	350 U	540 U	570 U	720 U	740 U
bis(2-Chloroethyl)ether	350 U	540 U	570 U	720 U	740 U
2-Chlorophenol	350 U	540 U	570 U	720 U	740 U
1,3-Dichlorobenzene	350 U	540 U	570 U	720 U	740 U
1,4-Dichlorobenzene	350 U	540 U	570 U	720 U	740 U
Benzyl alcohol	350 U	540 U	570 U	720 U	740 U
1,2-Dichlorobenzene	350 U	540 U	570 U	720 U	740 U
2-Methylphenol	350 U	540 U	570 U	720 U	740 U
bis(2-Chloroisopropyl)ether	350 U	540 U	570 U	720 U	740 U
4-Methylphenol	350 U	540 U	570 U	720 U	740 U
N-Nitroso-di-n-propylamine	350 U	540 U	570 U	720 U	740 U
Hexachloroethane	350 U	540 U	570 U	720 U	740 U
Nitrobenzene	350 U	540 U	570 U	720 U	740 U
Isophorone	350 U	540 U	570 U	720 U	740 U
2-Nitrophenol	350 U	540 U	570 U	720 U	740 U
2,4-Dimethylphenol	350 U	540 U	570 U	720 U	740 U
Benzoic Acid	1700 U	2600 U	2800 U	3500 U	3600 U
bis(2-Chloroethoxy)methane	350 U	540 U	570 U	720 U	740 U
2,4-Dichlorophenol	350 U	540 U	570 U	720 U	740 U
1,2,4-Trichlorobenzene	350 U	540 U	570 U	720 U	740 U
Naphthalene	350 U	540 U	570 U	720 U	260 J
4-Chloroaniline	350 U	540 U	570 U	720 U	740 U
Hexachlorobutadiene	350 U	540 U	570 U	720 U	740 U
4-Chloro-3-methylphenol	350 U	540 U	570 U	720 U	740 U
2-Methylnaphthalene	350 U	540 U	570 U	720 U	180 J
Hexachlorocyclopentadiene	350 U	540 U	570 U	720 U	740 U
2,4,6-Trichlorophenol	350 U	540 U	570 U	720 U	740 U
2,4,5-Trichlorophenol	1700 U	2600 U	2800 U	3500 U	3600 U
2-Chloronaphthalene	350 U	540 U	570 U	720 U	740 U
2-Nitroaniline	1700 U	2600 U	2800 U	3500 U	3600 U
Dimethylphthalate	350 U	540 U	570 U	700 J	740 U
Acenaphthylene	56 J	540 U	570 U	720 U	740 U
2,6-Dinitrotoluene	350 U	540 U	570 U	720 U	740 U
3-Nitroaniline	1700 U	2600 U	2800 U	3500 U	3600 U
Acenaphthene	9 J	540 U	570 U	720 U	690 J
2,4-Dinitrophenol	1700 U	2600 U	2800 U	3500 U	3600 U
4-Nitrophenol	1700 U	2600 U	2800 U	3500 U	3600 U
Dibenzofuran	11 J	540 U	570 U	720 U	380 J
2,4-Dinitrotoluene	350 U	540 U	570 U	720 U	740 U
Diethylphthalate	350 U	540 U	570 U	1800 J	740 U
4-Chlorophenyl-phenylether	350 U	540 U	570 U	720 U	740 U
Fluorene	350 U	540 U	570 U	720 U	420 J
4-Nitroaniline	1700 U	2600 U	2800 U	3500 U	3600 U
4,6-Dinitro-2-methylphenol	1700 U	2600 U	2800 U	3500 U	3600 U
N-Nitrosodiphenylamine	350 U	540 U	570 U	720 U	740 U
4-Bromophenyl-phenylether	350 U	540 U	570 U	720 U	740 U
Hexachlorobenzene	350 U	540 U	570 U	720 U	740 U
Pentachlorophenol	1700 U	2600 U	2800 U	3500 U	3600 U
Phenanthrene	60 J	540 U	570 U	720 U	1400 J
Anthracene	60 J	540 U	570 U	720 U	310 J
Di-n-butylphthalate	25 J	33 J	570 U	280 B	740 U
Fluoranthene	100 J	540 U	570 U	720 U	990 J
Pyrene	100 J	540 U	570 U	720 U	700 J
Butylbenzylphthalate	350 U	540 U	570 U	720 U	740 U
3,3'-Dichlorobenzidine	710 U	1100 U	1100 U	1400 U	1500 U
Benzo(a)anthracene	69 J	540 U	570 U	720 U	150 J
Chrysene	89 J	540 U	570 U	720 U	190 J
bis(2-Ethylehexyl)phthalate	110 B	540 U	570 U	730 B	270 B
Di-n-octylphthalate	350 U	25 J	570 U	720 U	740 U
Benzo(b)fluoranthene	500	10 J	570 U	720 U	120 J
Benzo(k)fluoranthene	98 J	540 U	570 U	720 U	130 J
Benzo(a)pyrene	350 J	540 U	570 U	720 U	740 U
Indeno(1,2,3-cd)pyrene	300 J	540 U	570 U	720 U	740 U
Dibenz(a,h)anthracene	51 J	540 U	570 U	720 U	740 U
Benzo(g,h,i)perylene	280 J	540 U	570 U	720 U	740 U

MOSS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	MA-SB011-02FR	MA-SB012-01	MA-SB013-01	MA-SB014-01	MA-SB015-01
TR No.:	EW868	EW835	EW871	EW838	EW837
	Replicate				
Parameter					
Phenol	78 J	400 U	740 U	410 U	380 U
bis(2-Chloroethyl)ether	680 U	400 U	740 U	410 U	380 U
2-Chlorophenol	680 U	400 U	740 U	410 U	380 U
1,3-Dichlorobenzene	680 U	400 U	740 U	410 U	380 U
1,4-Dichlorobenzene	680 U	400 U	740 U	410 U	380 U
Benzyl alcohol	680 U	400 U	740 U	410 U	380 U
1,2-Dichlorobenzene	680 U	400 U	740 U	410 U	380 U
2-Methylphenol	680 U	400 U	740 U	410 U	380 U
bis(2-Chloroisopropyl)ether	680 U	400 U	740 U	410 U	380 U
4-Methylphenol	680 U	400 U	740 U	410 U	380 U
N-Nitroso-di-n-propylamine	680 U	400 U	740 U	410 U	380 U
Hexachloroethane	680 U	400 U	740 U	410 U	380 U
Nitrobenzene	680 U	400 U	740 U	410 U	380 U
Isophorone	680 U	400 U	740 U	410 U	380 U
2-Nitrophenol	680 U	400 U	740 U	410 U	380 U
2,4-Dimethylphenol	680 U	400 U	740 U	410 U	380 U
Benzoic Acid	3300 U	2000 U	3600 U	2100 U	1900 U
bis(2-Chloroethoxy)methane	680 U	400 U	740 U	410 U	380 U
2,4-Dichlorophenol	680 U	400 U	740 U	410 U	380 U
1,2,4-Trichlorobenzene	680 U	400 U	740 U	410 U	380 U
Naphthalene	830 J	400 U	740 U	410 U	380 U
4-Chloroaniline	680 U	400 U	740 U	410 U	380 U
Hexachlorobutadiene	680 U	400 U	740 U	410 U	380 U
4-Chloro-3-methylphenol	680 U	400 U	740 U	410 U	380 U
2-Methylnaphthalene	580 J	400 U	740 U	410 U	380 U
Hexachlorocyclopentadiene	680 U	400 U	740 U	410 U	380 U
2,4,6-Trichlorophenol	680 U	400 U	740 U	410 U	380 U
2,4,5-Trichlorophenol	3300 U	2000 U	3600 U	2100 U	1900 U
2-Chloronaphthalene	680 U	400 U	740 U	410 U	380 U
2-Nitroaniline	3300 U	2000 U	3600 U	2100 U	1900 U
Dimethylphthalate	680 U	400 U	740 U	410 U	380 U
Acenaphthylene	680 U	400 U	740 U	410 U	380 U
2,6-Dinitrotoluene	680 U	400 U	740 U	410 U	380 U
3-Nitroaniline	3300 U	2000 U	3600 U	2100 U	1900 U
Acenaphthene	1700 J	400 U	740 U	410 U	380 U
2,4-Dinitrophenol	3300 U	2000 U	3600 U	2100 U	1900 U
4-Nitrophenol	3300 U	2000 U	3600 U	2100 U	1900 U
Dibenzofuran	940 J	400 U	740 U	410 U	380 U
2,4-Dinitrotoluene	680 U	400 U	740 U	410 U	380 U
Diethylphthalate	680 U	400 U	740 U	410 U	380 U
4-Chlorophenyl-phenylether	680 U	400 U	740 U	410 U	380 U
Fluorene	1000 J	400 U	740 U	410 U	380 U
4-Nitroaniline	3300 U	2000 U	3600 U	2100 U	1900 U
4,6-Dinitro-2-methylphenol	3300 U	2000 U	3600 U	2100 U	1900 U
N-Nitrosodiphenylamine	680 U	400 U	740 U	410 U	380 U
4-Bromophenyl-phenylether	680 U	400 U	740 U	410 U	380 U
Hexachlorobenzene	680 U	400 U	740 U	410 U	380 U
Pentachlorophenol	3300 U	2000 U	3600 U	2100 U	1900 U
Phenanthrene	3500 J	400 U	81 J	410 U	380 U
Anthracene	800 J	400 U	740 U	410 U	380 U
Di-n-butylphthalate	680 U	400 U	2800 J	410 U	380 U
Fluoranthene	2000 J	400 U	76 J	410 U	380 U
Pyrene	1500 J	400 U	740 U	410 U	380 U
Butylbenzylphthalate	680 U	400 U	740 U	410 U	380 U
3,3'-Dichlorobenzidine	1400 U	800 U	1500 U	830 U	760 U
Benzo(a)anthracene	270 J	400 U	740 U	410 U	380 U
Chrysene	360 J	400 U	740 U	410 U	380 U
bis(2-Ethylehexyl)phthalate	180 B	190 J	1000 B	410 U	5800
Di-n-octylphthalate	680 U	400 U	740 U	410 U	380 U
Benzo(b)fluoranthene	130 J	400 U	740 U	410 U	380 U
Benzo(k)fluoranthene	150 J	400 U	740 U	410 U	380 U
Benzo(a)pyrene	140 J	400 U	740 U	410 U	380 U
Indeno(1,2,3-cd)pyrene	680 U	400 U	740 U	410 U	380 U
Dibenz(a,h)anthracene	680 U	400 U	740 U	410 U	380 U
Benzo(g,h,i)perylene	680 U	400 U	740 U	410 U	380 U

NOBS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	MA-SB016-01	MA-SB016-02	MA-SB017-01	MA-SB017-02	MA-SB018-01
TR No.:	ES622	ES623	EW801	EW802	EW833
Parameter					
Phenol	23000 U	380 U	370 U	380 U	430 U
bis(2-Chloroethyl)ether	23000 U	380 U	370 U	380 U	430 U
2-Chlorophenol	23000 U	380 U	370 U	380 U	430 U
1,3-Dichlorobenzene	23000 U	380 U	370 U	380 U	430 U
1,4-Dichlorobenzene	23000 U	380 U	370 U	380 U	430 U
Benzyl alcohol	23000 U	380 U	370 U	380 U	430 U
1,2-Dichlorobenzene	23000 U	380 U	370 U	380 U	430 U
2-Methylphenol	23000 U	380 U	370 U	380 U	430 U
bis(2-Chloroisopropyl)ether	23000 U	380 U	370 U	380 U	430 U
4-Methylphenol	23000 U	380 U	370 U	380 U	430 U
N-Nitroso-di-n-propylamine	23000 U	380 U	370 U	380 U	430 U
Hexachloroethane	23000 U	380 U	370 U	380 U	430 U
Nitrobenzene	23000 U	380 U	370 U	380 U	430 U
Isophorone	23000 U	380 U	370 U	380 U	430 U
2-Nitrophenol	23000 U	380 U	370 U	380 U	430 U
2,4-Dimethylphenol	23000 U	380 U	370 U	380 U	430 U
Benzoic Acid	110000 U	1900 U	1800 U	1900 U	150 J
bis(2-Chloroethoxy)methane	23000 U	380 U	370 U	380 U	430 U
2,4-Dichlorophenol	23000 U	380 U	370 U	380 U	430 U
1,2,4-Trichlorobenzene	23000 U	380 U	370 U	380 U	430 U
Naphthalene	19000 J	890	370 U	380 U	20 J
4-Chloroaniline	23000 U	380 U	370 U	380 U	430 U
Hexachlorobutadiene	23000 U	380 U	370 U	380 U	430 U
4-Chloro-3-methylphenol	23000 U	380 U	370 U	380 U	430 U
2-Methylnaphthalene	5900 J	240 J	370 U	380 U	8 J
Hexachlorocyclopentadiene	23000 U	380 U	370 U	380 U	430 U
2,4,6-Trichlorophenol	23000 U	380 U	370 U	380 U	430 U
2,4,5-Trichlorophenol	110000 U	1900 U	1800 U	1900 U	2100 U
2-Chloronaphthalene	23000 U	380 U	370 U	380 U	430 U
2-Nitroaniline	110000 U	1900 U	1800 U	1900 U	2100 U
Dimethylphthalate	23000 U	380 U	370 U	380 U	430 U
Acenaphthylene	23000 U	380 U	370 U	380 U	24 J
2,6-Dinitrotoluene	23000 U	380 U	1800 U	380 U	430 U
3-Nitroaniline	110000 U	1900 U	370 U	1900 U	2100 U
Acenaphthene	15000 J	580	1800 U	380 U	1300 J
2,4-Dinitrophenol	110000 U	1900 U	1800 U	1900 U	2100 U
4-Nitrophenol	110000 U	1900 U	370 U	1900 U	2100 U
Dibenzofuran	10000 J	420	370 U	380 U	490
2,4-Dinitrotoluene	23000 U	380 U	370 U	380 U	430 U
Diethylphthalate	23000 U	380 U	370 U	380 U	430 U
4-Chlorophenyl-phenylether	23000 U	380 U	370 U	380 U	430 U
Fluorene	12000 J	570	370 U	380 U	2200
4-Nitroaniline	110000 U	1900 U	1800 U	1900 U	2100 U
4,6-Dinitro-2-methylphenol	110000 U	1900 U	1800 U	1900 U	2100 U
N-Nitrosodiphenylamine	23000 U	380 U	370 U	380 U	430 U
4-Bromophenyl-phenylether	23000 U	380 U	370 U	380 U	430 U
Hexachlorobenzene	23000 U	380 U	370 U	380 U	430 U
Pentachlorophenol	110000 U	700 J	1800 U	1900 U	2100 U
Phenanthrene	32000	1600	370 U	380 U	2400
Anthracene	15000 J	910	370 U	380 U	600
Di-n-butylphthalate	23000 U	380 U	370 U	380 U	44 J
Fluoranthene	13000 J	720	370 U	380 U	4200 B
Pyrene	8700 J	420	370 U	380 U	3300 B
Butylbenzylphthalate	23000 U	380 U	370 U	380 U	430 U
3,3'-Dichlorobenzidine	47000 U	770 U	750 U	770 U	870 U
Benzo(a)anthracene	23000 U	380 U	370 U	380 U	650
Chrysene	23000 U	380 U	370 U	380 U	600
bis(2-Ethylehexyl)phthalate	23000 U	810	42 J	380 U	51 B
Di-n-octylphthalate	23000 U	380 U	370 U	380 U	12 J
Benzo(b)fluoranthene	23000 U	380 U	370 U	380 U	210 J
Benzo(k)fluoranthene	23000 U	380 U	370 U	380 U	46 J
Benzo(a)pyrene	23000 U	380 U	370 U	380 U	190 J
Indeno(1,2,3-cd)pyrene	23000 U	380 U	370 U	380 U	430 U
Dibenz(a,h)anthracene	23000 U	380 U	370 U	380 U	430 U
Benzo(g,h,i)perylene	23000 U	380 U	370 U	380 U	50 J

NOBS-AMERICAN
SUBSURFACE SOILS
SEMIVOLATILES

Sample No.:	MA-SB018-02	MA-SB019-01	MA-SB019-02	MA-SB019-03
TR No.:	EM834	EM839	EM840	EM841
Parameter				
Phenol	400 U	28000 U	370 U	380 U
bis(2-Chloroethyl)ether	400 U	28000 U	370 U	380 U
2-Chlorophenol	400 U	28000 U	370 U	380 U
1,3-Dichlorobenzene	400 U	28000 U	370 U	380 U
1,4-Dichlorobenzene	400 U	28000 U	370 U	380 U
Benzyl alcohol	400 U	28000 U	370 U	380 U
1,2-Dichlorobenzene	400 U	28000 U	370 U	380 U
2-Methylphenol	400 U	28000 U	370 U	380 U
bis(2-Chloroisopropyl)ether	400 U	28000 U	370 U	380 U
4-Methylphenol	400 U	28000 U	370 U	380 U
N-Nitroso-di-n-propylamine	400 U	28000 U	370 U	380 U
Hexachloroethane	400 U	28000 U	370 U	380 U
Nitrobenzene	400 U	28000 U	370 U	380 U
Isophorone	400 U	28000 U	370 U	380 U
2-Nitrophenol	400 U	28000 U	370 U	380 U
2,4-Dimethylphenol	400 U	28000 U	370 U	380 U
Benzoic Acid	76 J	140000 U	1900 U	1900 U
bis(2-Chloroethoxy)methane	400 U	28000 U	370 U	380 U
2,4-Dichlorophenol	400 U	28000 U	370 U	380 U
1,2,4-Trichlorobenzene	400 U	28000 U	370 U	380 U
Naphthalene	400 U	2600000 DJ	330 J	380 U
4-Chloroaniline	400 U	28000 U	370 U	380 U
Hexachlorobutadiene	400 U	28000 U	370 U	380 U
4-Chloro-3-methylphenol	400 U	28000 U	370 U	380 U
2-Methylnaphthalene	400 U	1300000 DJ	97 J	380 U
Hexachlorocyclopentadiene	400 U	28000 U	370 U	380 U
2,4,6-Trichlorophenol	400 U	28000 U	370 U	380 U
2,4,5-Trichlorophenol	2000 U	140000 U	1900 U	1900 U
2-Chloronaphthalene	400 U	28000 U	370 U	380 U
2-Nitroaniline	2000 U	140000 U	1900 U	1900 U
Dimethylphthalate	400 U	28000 U	370 U	380 U
Acenaphthylene	400 U	28000 U	370 U	380 U
2,6-Dinitrotoluene	400 U	28000 U	370 U	380 U
3-Nitroaniline	2000 U	140000 U	1900 U	1900 U
Acenaphthene	20 J	2700000 DJ	190 J	380 U
2,4-Dinitrophenol	2000 U	140000 U	1900 U	1900 U
4-Nitrophenol	2000 U	140000 U	1900 U	1900 U
Dibenzofuran	11 J	1600000 DJ	110 J	380 U
2,4-Dinitrotoluene	400 U	28000 U	370 U	380 U
Diethylphthalate	31 J	28000 U	370 U	380 U
4-Chlorophenyl-phenylether	400 U	28000 U	370 U	380 U
Fluorene	17 J	2100000 DJ	110 J	380 U
4-Nitroaniline	2000 U	140000 U	1900 U	1900 U
4,6-Dinitro-2-methylphenol	2000 U	140000 U	1900 U	1900 U
N-Nitrosodiphenylamine	400 U	28000 U	370 U	380 U
4-Bromophenyl-phenylether	400 U	28000 U	370 U	380 U
Hexachlorobenzene	400 U	28000 U	370 U	380 U
Pentachlorophenol	2000 U	140000 U	1900 U	1900 U
Phenanthrene	88 J	4600000 DJ	220 J	380 U
Anthracene	34 J	1800000 DJ	72 J	380 U
Di-n-butylphthalate	48 J	28000 U	370 U	380 U
Fluoranthene	140 B	2300000 DJ	180 J	380 U
Pyrene	92 B	1600000 DJ	110 J	380 U
Butylbenzylphthalate	400 U	28000 U	370 U	380 U
3,3'-Dichlorobenzidine	800 U	56000 U	750 U	760 U
Benzo(a)anthracene	400 U	190000 J	370 U	380 U
Chrysene	38 J	120000 J	370 U	380 U
bis(2-Ethylehexyl)phthalate	61 B	28000 U	460	110 J
Di-n-octylphthalate	400 U	28000 U	370 U	380 U
Benzo(b)fluoranthene	14 J	87000 J	370 U	380 U
Benzo(k)fluoranthene	14 J	28000 U	370 U	380 U
Benzo(a)pyrene	400 U	34000 J	370 U	380 U
Indeno(1,2,3-cd)pyrene	400 U	9900 J	370 U	380 U
Dibenz(a,h)anthracene	400 U	28000 U	370 U	380 U
Benzo(g,h,i)perylene	400 U	10000 J	370 U	380 U

MOSS-AMERICAN
SUBSURFACE SOILS
VOLATILES

Sample ID:	MA-SB001-01	MA-SB002-01	MA-SB003-01	MA-SB003-02	MA-SBFB03-01	MA-SB004-01	MA-SBFB04-01	MA-SB004-02	MA-SB004-03
TR No.:	EW803	EW869	EW842	EW843	EW874 Field Blank	EW805	EW875 Field Blank	EW806	EW807
Parameter	Conc. (ug/kg)								
Chloromethane	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Bromomethane	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Vinyl chloride	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Chloroethane	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Methylene chloride	6 U	3 B	33	11 B	5 U	1300 B	3 J	6 B	15 B
Acetone	9 B	13 B	47 J	11 U	10 B	1400 U	7 B	29 B	79 B
Carbon disulfide	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,1-Dichloroethene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,1-Dichloroethane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,2-Dichloroethene (total)	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Chloroform	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,2-Dichloroethane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
2-Butanone	R	R	R	R	R	1400 U	R	5 B	13 B
1,1,1-Trichloroethane	6 U	6 U	11	6	5 U	710 U	5 U	6 U	6 U
Carbon tetrachloride	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Vinyl acetate	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Bromodichloromethane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,2-Dichloropropane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Trichloroethene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Dibromochloromethane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,1,2-Trichloroethane	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Benzene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
trans-1,3-Dichloropropene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
2-Chloroethylvinylether	--	--	--	--	--	--	--	--	--
Bromoform	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
4-Methyl-2-pentanone	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
2-Hexanone	11 U	12 U	11 U	11 U	10 U	1400 U	10 U	11 U	11 U
Tetrachloroethene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
1,1,2,2-Tetrachloroethane	11 U	12 U	6 U	5 U	10 U	710 U	10 U	6 U	6 U
Toluene	170 J	110 J	19	16	5 U	430 B	5 U	10	8
Chlorobenzene	6 U	6 U	6 U	5 U	5 U	710 U	5 U	6 U	6 U
Ethylbenzene	6 U	6 U	6 U	5 U	5 U	580 U	5 U	6 U	6 U
Styrene	6 U	6 U	6 U	5 U	5 U	160 B	5 U	6 U	6 U
Xylene (total)	6 U	6 U	6 U	5 U	5 U	1800 B	5 U	2 J	6 U

MOSS-AMERICAN
SUBSURFACE SOILS
VOLATILES

Sample ID:	MA-SB005-01	MA-SB005-01FR	MA-SB006-01	MA-SB007-01	MA-SB008-01	MA-SB008-02	MA-SB009-01	MA-SB009-02	MA-SB010-01
TR No.:	EW872	EW873 Replicate	EW870	EW810	EW808	EW809	EW831	EW832	EW836
Parameter									
Chloromethane	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Bromomethane	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Vinyl chloride	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Chloroethane	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Methylene chloride	6 U	6 B	6 U	11 B	5 B	75 B	6 U	6 U	11 B
Acetone	9 B	12 U	8 B	87 B	81 B	420 B	7 B	10 B	120 J
Carbon disulfide	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,1-Dichloroethene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,1-Dichloroethane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,2-Dichloroethene (total)	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Chloroform	6 U	6 U	6 U	6 U	6 U	29 U	2 J	6 U	6 U
1,2-Dichloroethane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
2-Butanone	R	R	11 U	10 B	10 B	39 B	7 B	9 B	R
1,1,1-Trichloroethane	6 U	6 U	R	6 U	6 U	29 U	6 U	6 U	6 U
Carbon tetrachloride	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Vinyl acetate	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Bromodichloromethane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,2-Dichloropropane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Trichloroethene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Dibromochloromethane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,1,2-Trichloroethane	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Benzene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
trans-1,3-Dichloropropene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
2-Chloroethylvinylether	--	--	--	--	--	--	--	--	--
Bromoform	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
4-Methyl-2-pentanone	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
2-Hexanone	13 U	12 U	11 U	12 U	13 U	59 U	11 U	11 U	11 U
Tetrachloroethene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	13 U	12 U	11 U	6 U	6 U	29 U	6 U	6 U	6 U
Toluene	380 DJ	50 J	71 J	2 J	23	34 B	5 B	8 B	51
Chlorobenzene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Ethylbenzene	6 U	6 U	6 U	6 U	3 J	21 J	6 U	6 U	6 U
Styrene	6 U	6 U	6 U	6 U	6 U	29 U	6 U	6 U	6 U
Xylene (total)	6 U	6 U	6 U	6 U	9	58	6 U	6 U	6 U

MOSS-AMERICAN
SUBSURFACE SOILS
VOLATILES

Sample ID:	MA-SB011-01	MA-SB011-02	MA-SB011-02FR	MA-SB012-01	MA-SB013-01	MA-SB014-01	MA-SB015-01	MA-SB016-01	MA-SB016-02
TR No.:	EW866	EW867	EW868	EW835	EW871	EW838	EW837	ES622	ES623
			Replicate						
Parameter									
Chloromethane	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Bromomethane	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Vinyl chloride	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Chloroethane	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Methylene chloride	5 U	6 U	1 B	16 B	2 B	7 B	9 B	45 B	15 B
Acetone	11 U	13 B	14 B	20 J	5 B	34 J	81 J	29 B	49 B
Carbon disulfide	5 U	6 U	5 U	6 U	6 U	4 J	6 U	6 U	6 U
1,1-Dichloroethene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1-Dichloroethene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethene (total)	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Chloroform	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloroethane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
2-Butanone	R	4 B	R	R	R	R	R	12 U	12 U
1,1,1-Trichloroethane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Carbon tetrachloride	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Vinyl acetate	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Bromodichloromethane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2-Dichloropropane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
cis-1,3-Dichloropropene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Trichloroethene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Dibromochloromethane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2-Trichloroethane	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
Benzene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
trans-1,3-Dichloropropene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
2-Chloroethylvinylether	--	--	--	--	--	--	--	12 U	12 U
Bromoform	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
4-Methyl-2-pentanone	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
2-Hexanone	11 U	11 U	10 U	12 U	11 U	13 U	11 U	12 U	12 U
Tetrachloroethene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	6 U	6 U
1,1,2,2-Tetrachloroethane	11 U	11 U	10 U	6 U	11 U	6 U	6 U	6 U	6 U
Toluene	290 DJ	55 J	120 J	13 J	220 J	660 D	860 D	7 J	7 J
Chlorobenzene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	2 J	2 J
Ethylbenzene	5 U	6 U	5 U	6 U	6 U	6 U	6 U	4 J	5 J
Styrene	5 U	6 U	1 J	6 U	6 U	6 U	6 U	4 J	2 J
Xylene (total)	5 U	6 U	3 J	6 U	6 U	6 U	6 U	10 J	14 J

MOSS-AMERICAN
SUBSURFACE SOILS
VOLATILES

Sample ID:	MA-SB017-01	MA-SB017-02	MA-SB018-01	MA-SB018-02	MA-SB019-01	MA-SB019-02	MA-SB019-03
TR No.:	EW801	EW802	EW833	EW834	EW839	EW840	EW841
Parameter							
Chloromethane	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Bromomethane	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Vinyl chloride	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Chloroethane	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Methylene chloride	15 B	10 B	10000 J	47 B	880 U	11 B	10 B
Acetone	89 B	85 B	6900 B	56 B	1800 U	120 J	100 J
Carbon disulfide	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,1-Dichloroethene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,1-Dichloroethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,2-Dichloroethene (total)	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Chloroform	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,2-Dichloroethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
2-Butanone	10 J	12 U	470 B	R	R	R	R
1,1,1-Trichloroethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Carbon tetrachloride	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Vinyl acetate	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Bromodichloromethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,2-Dichloropropane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
cis-1,3-Dichloropropene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Trichloroethene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Dibromochloromethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,1,2-Trichloroethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Benzene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
trans-1,3-Dichloropropene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
2-Chloroethylvinylether	11 U	12 U	--	--	--	--	--
Bromoform	6 U	6 U	740 U	6 U	880 U	6 U	6 U
4-Methyl-2-pentanone	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
2-Hexanone	11 U	12 U	1500 U	11 U	1800 U	11 U	11 U
Tetrachloroethene	6 U	6 U	740 U	6 U	880 U	6 U	6 U
1,1,2,2-Tetrachloroethane	6 U	6 U	740 U	6 U	880 U	6 U	6 U
Toluene	4 J	9 J	740 U	16	2000 J	7	6 U
Chlorobenzene	6 U	1 J	740 U	6 U	880 U	6 U	6 U
Ethylbenzene	6 U	6 U	140 J	6 U	4100 J	6 U	6 U
Styrene	6 U	6 U	740 U	6 U	9300 J	6 U	6 U
Xylene (total)	3 J	6 U	310 B	6 U	17000 J	6 U	6 U

MOSS-AMERICAN
SUBSURFACE SOILS
DIOXIN

Sample No.:	MA-SB001-01	MA-SB002-01	MA-SB003-01	MA-SB003-02	MA-SBFB03-01	MA-SB004-01	MA-SBFB04-01	MA-SB004-02	MA-SB005-01
TR No.:	E129	E132	E126	E127	E152 Field Blank	E11	E153 Field Blank	E12	E136
Parameter	Conc. (ng/g)								
Tetrachloro furan (Total)	0.033 U	0.032 U	0.0088 U	0.0057 U	0.010 U	0.020 U	0.0069 U	0.019 U	0.010 U
Tetrachloro furan (2,3,7,8)	0.033 U	0.032 U	0.0088 U	0.0057 U	0.010 U	0.020 U	0.0069 U	0.019 U	0.010 U
Pentachloro furan	0.096 U	0.16 U	0.065 U	0.043 U	0.080 U	0.033 U	0.069 U	0.069 U	0.061 U
Hexachloro furan	0.052 U	0.037 U	0.027 U	0.020 U	0.023 U	0.018 U	0.023 U	0.048 U	0.021 U
Heptachloro furan	0.095 U	0.078 U	0.037 U	0.023 U	0.030 U	0.015 U	0.035 U	0.042 U	0.040 U
Octachloro furan	0.31 U	0.36 U	0.14 U	0.13 U	0.12 U	0.11 U	0.21 U	0.23 U	0.15 U
Tetrachloro dioxin (Total)	0.022 U	0.018 U	0.013 U	0.0086 U	0.0067 U	0.013 U	0.0074 U	0.021 U	0.011 U
Tetrachloro dioxin (2,3,7,8)	0.022 U	0.018 U	0.013 U	0.0086 U	0.0067 U	0.013 U	0.0074 U	0.021 U	0.011 U
Pentachloro dioxin	0.063 U	0.14 U	0.055 U	0.044 U	0.037 U	0.026 U	0.043 U	0.062 U	0.053 U
Hexachloro dioxin	0.078 U	0.066 U	0.036 U	0.025 U	0.037 U	0.013 U	0.043 U	0.068 U	0.038 U
Heptachloro dioxin	0.12 U	0.097 U	0.14 U	0.035 U	0.044 U	0.028 U	0.041 U	0.067 U	0.054 U
Octachloro dioxin	0.44 U	0.47 U	0.55 U	0.11 U	0.160 U	0.11 U	0.19 U	0.19 U	0.21 U

MOSS-AMERICAN
SUBSURFACE SOILS
DIOXIN

Sample No.:	MA-SB005-01FR	MA-SB006-01	MA-SB007-01	MA-SB008-01	MA-SB008-02	MA-SB009-01	MA-SB009-02	MA-SB010-01	MA-SB011-01
TR No.:	E137	E133	E27	E21	E24	E84	E87	E99	E128
	Replicate								
Parameter									
Tetrachloro furan (Total)	0.010 U	0.021 U	0.012 U	0.018 U	0.0094 U	0.011 U	0.0071 U	0.0047 U	0.010 U
Tetrachloro furan (2,3,7,8)	0.010 U	0.021 U	0.012 U	0.018 U	0.0094 U	0.011 U	0.0071 U	0.0047 U	0.010 U
Pentachloro furan	0.089 U	0.17 U	0.055 U	0.063 U	0.078 U	0.084 U	0.12 U	0.052 U	0.050 U
Hexachloro furan	0.021 U	0.054 U	0.030 U	0.040 U	0.030 U	0.026 U	0.045 U	0.016 U	0.017 U
Heptachloro furan	0.045 U	0.088 U	0.057 U	0.072 U	0.050 U	0.022 U	0.12 U	0.033 U	0.016 U
Octachloro furan	0.14 U	0.25 U	0.26 U	0.26 U	0.25 U	0.090 U	0.30 U	0.14 U	0.068 U
Tetrachloro dioxin (Total)	0.015 U	0.019 U	0.016 U	0.033 U	0.016 U	0.0094 U	0.011 U	0.0064 U	0.018 U
Tetrachloro dioxin (2,3,7,8)	0.015 U	0.019 U	0.016 U	0.033 U	0.016 U	0.0094 U	0.011 U	0.0064 U	0.018 U
Pentachloro dioxin	0.042 U	0.13 U	0.055 U	0.080 U	0.070 U	0.052 U	0.053 U	0.029 U	0.053 U
Hexachloro dioxin	0.030 U	0.073 U	0.065 U	0.052 U	0.065 U	0.044 U	0.16 U	0.039 U	0.023 U
Heptachloro dioxin	0.031 U	0.11 U	0.061 U	0.087 U	0.11 U	0.029 U	0.087 U	0.022 U	0.019 U
Octachloro dioxin	0.14 U	0.34 U	0.17 U	0.34 U	0.20 U	0.12 U	0.26 U	0.15 U	0.080 U

MOSS-AMERICAN
SUBSURFACE SOILS
DIOXIN

Sample No.:	MA-SB011-02	MA-SB011-02FR	MA-SB012-01	MA-SB013-01	MA-SB014-01	MA-SB015-01	MA-SB016-01	MA-SB016-02	MA-SB017-01
TR No.:	E130	E131 Replicate	E96	E134	E105	E102	E07	E08	E09
Parameter									
Tetrachloro furan (Total)	0.018 U	0.0093 U	0.0087 U	0.028 U	0.0060 U	0.0083 U	0.013 U	0.024 U	0.013 U
Tetrachloro furan (2,3,7,8)	0.018 U	0.0093 U	0.0087 U	0.028 U	0.0060 U	0.0083 U	0.013 U	0.024 U	0.013 U
Pentachloro furan	0.11 U	0.098 U	0.095 U	0.12 U	0.060 U	0.086 U	0.058 U	0.091 U	0.057 U
Hexachloro furan	0.038 U	0.032 U	0.038 U	0.042 U	0.022 U	0.039 U	0.040 U	0.040 U	0.041 U
Heptachloro furan	0.087 U	0.068 U	0.11 U	0.063 U	0.036 U	0.058 U	0.043 U	0.058 U	0.063 U
Octachloro furan	0.27 U	0.24 U	0.36 U	0.25 U	0.14 U	0.16 U	0.092 U	0.20 U	0.20 U
Tetrachloro dioxin (Total)	0.016 U	0.012 U	0.017 U	0.018 U	0.015 U	0.039 U	0.021 U	0.021 U	0.027 U
Tetrachloro dioxin (2,3,7,8)	0.016 U	0.012 U	0.017 U	0.018 U	0.015 U	0.039 U	0.021 U	0.021 U	0.027 U
Pentachloro dioxin	0.10 U	0.081 U	0.068 U	0.092 U	0.034 U	0.058 U	0.063 U	0.11 U	0.066 U
Hexachloro dioxin	0.046 U	0.042 U	0.080 U	0.068 U	0.052 U	0.087 U	0.056 U	0.086 U	0.076 U
Heptachloro dioxin	0.068 U	0.063 U	0.069 U	0.11 U	0.043 U	0.047 U	0.078 U	0.062 U	0.081 U
Octachloro dioxin	0.26 U	0.42 U	0.52 U	0.29 U	0.25 U	0.26 U	0.12 U	0.16 U	0.27 U

MOSS-AMERICAN
SUBSURFACE SOILS
DIOXIN

Sample No.:	MA-SB017-02	MA-SB018-01	MA-SB018-02	MA-SB019-01	MA-SB019-02
TR No.:	E10	E90	E93	E108	E111
Parameter					
Tetrachloro furan (Total)	0.023 U	0.011 U	0.011 U	0.26 U	0.0027 U
Tetrachloro furan (2,3,7,8)	0.023 U	0.011 U	0.011 U	0.26 U	0.0027 U
Pentachloro furan	0.12 U	0.070 U	0.055 U	0.60 U	0.047 U
Hexachloro furan	0.046 U	0.022 U	0.025 U	0.18 U	0.016 U
Heptachloro furan	0.059 U	0.084 U	0.033 U	0.093 U	0.022 U
Octachloro furan	0.38 U	0.16 U	0.16 U	0.25 U	0.075 U
Tetrachloro dioxin (Total)	0.026 U	0.010 U	0.015 U	0.15 U	0.014 U
Tetrachloro dioxin (2,3,7,8)	0.026 U	0.010 U	0.015 U	0.15 U	0.014 U
Pentachloro dioxin	0.12 U	0.048 U	0.034 U	0.40 U	0.030 U
Hexachloro dioxin	0.092 U	0.039 U	0.052 U	7.0 J	0.041 U
Heptachloro dioxin	0.058 U	0.041 U	0.034 U	0.12 U	0.020 U
Octachloro dioxin	0.20 U	0.25 U	0.015 U	0.38 U	0.12 U

ROSS-AMERICAN
SUBSURFACE SOILS
INORGANICS

Sample ID:	MA-SB001-01	MA-SB002-01	MA-SBFB03	MA-SB003-01	MA-SB003-02	MA-SBFB04	MA-SB004-01	MA-SB004-02	MA-SB004-03	MA-SB005-01
TR No.:	MEW441	MEW446	MEW451 Field Blank	MEW419	MEW420	MEW452 Field Blank	MEW795	MEW796	MEW797	MEW449
Parameter	Conc. (mg/kg)									
Aluminum	4180	5870	44.9	3370	4390	43.3	2510	5070	5840	7920
Antimony	0.48 B	R	0.36 B	3.7 U	3.5 U	0.72 B	1.3 B	1.4 B	1.3 B	0.43 B
Arsenic	1.3 J	1.8 J	0.9 U	3.4 J	2.1 J	0.96 J	2.4 J	1.3 J	2.4 J	1.5 J
Barium	51.3	81.1	8.1 U	39	52	7.9 U	46.8	45.4	51.3	69.9
Beryllium	0.58 J	0.68 J	0.36 J	0.2 U	0.2 U	0.22 U	0.16 UJ	0.26 B	0.18 B	0.84 J
Cadmium	3.4	3.5	0.54 U	2.4	2.8	0.52 U	2.6	2.8	3.2	3.3
Calcium	144000	149000	65.6 J	182000	128000	40.2 J	188000	164000	147000	125000
Chromium	11.3	14.7	1.4 U	5.5	6.5	1.4 U	7.8 J	11.6 J	13.6 J	18.5
Cobalt	8.3 J	11.4	3.0 U	3.1 J	4.2 J	2.8 U	3.7 J	5.3 J	6.9 J	8.6 J
Copper	42.3 J	14.4 J	2.1 U	11	12	2.0 U	9.5 J	11.2 J	13.3 J	19.3 J
Iron	7030	10900	51.7	8620 J	10300 J	56.3	8450	10400	11500	12300
Lead	5.4 J	5.3 J	0.45 J	6.8	9.4	0.33 J	8.1 J	2.3 J	8.3 J	9.0 J
Magnesium	64300	58100	30.2 U	63400	64300	30 U	54300	55500	60000	53100
Manganese	268 J	522 J	46.6 J	557 J	529 J	1.2 J	499 J	394 J	477 J	99.5 J
Mercury	4.5 J	0.27 J	0.33 J	0.11 U	0.1 U	0.13 J	0.10 J	R	1.1 J	0.23 J
Nickel	17.3 J	19.3 J	3.2 U	7.1	11	3.2 U	10.1 J	15.6 J	17.5 J	16.8 J
Potassium	776 J	1240	163 B	611 J	1040	246 B	612 J	1130	1340	1390
Selenium	1.0 U	1.0 U	1.1 U	1.0 U	9.4 U	0.88 U	R	R	R	1.1 U
Silver	1.8 U	1.9 U	2 U	0.5 U	0.6 B	1.86 U	R	R	R	2.1 U
Sodium	961 J	845 J	264 J	212 J	305 J	218 J	668 B	817 B	839 B	850 J
Thallium	0.2 U	0.29 J	0.25 J	20 U	19 U	0.18 U	1.4 UJ	0.26 UJ	0.26 UJ	0.38 J
Vanadium	15.9	18.0	3.1 U	0.9 U	0.8 U	3.0 U	14.6 J	18.2 J	18.3 J	24.4
Zinc	311 J	92.9 J	50.9 J	41 J	77 J	25.5 J	226 J	188 J	146 J	113 J
Cyanide	1.5 U	2.0 J	1.5 U	7.9 U	8.2 U	1.5 U	2.6 UJ	2.6 UJ	2.6 UJ	1.7 J

MOSS-AMERICAN
SUBSURFACE SOIL
INORGANICS

Sample ID:	MA-SB005-01FR	MA-SB006-01	MA-SB007-01	MA-SB008-01	MA-SB008-02	MA-SB009-01	MA-SB009-02	MA-SB010-01	MA-SB011-01	MA-SB011-02
TR No.:	MEW450 Replicate	MEW447	MEW800	MEW798	MEW799	MEW408	MEW409	MEW413	MEW443	MEW444
Parameter										
Aluminum	9450	7910	4890	10900	6650	2660	2810 J	6030	2500	3390
Antimony	0.57 B	R	R	1.2 B	1.0 B	1.1 B	0.66 J	3.0 U	R	0.51 B
Arsenic	1.0 U	2.5	1.6 J	2.7 J	1.6 J	1.7 J	2 J	2.6 J	1.9 J	1.4 J
Barium	83.8	68.1	37.4 J	73.7	63.2	23.0 J	33.9 J	54	41.0 J	42.5
Beryllium	0.93 J	0.83 J	0.65 B	0.73 J	0.39 B	0.16 UJ	0.15 U	0.1 U	0.51 J	0.62 J
Cadmium	3.8	4.0	3.9	5.1	4.0	2.9	5.9	3.1	3.1	2.8 B
Calcium	77400	137000	68500	93900 J	126000	166000	174000	139000	150000	116000
Chromium	18.6	17.9	12.8 J	21.5 J	14.1 J	10.6 J	10.2	9.3	9.6	10.5
Cobalt	8.7 J	7.3 J	5.6 J	9.1 J	6.6 J	8.0 J	7 J	5.4 J	6.8 J	8.9 J
Copper	22.8 J	87.5 J	15.6 J	27.6 J	18.6 J	7.2 J	12.6	17	8.8 J	12.1 J
Iron	12600	14900	14200	17600	13900	9210	9390	11400 J	7300	8610
Lead	7.5 J	6.9 J	11.3 J	7.5 J	6.8 J	9.1 J	13.8 J	8.8	6.5 J	6.5 J
Magnesium	34500	54900	36500	48300	55200	66400	62000	57700	56000	51600
Manganese	95.7 J	562 J	228 J	425 J	395 J	525 J	466 J	404 J	376 J	346 J
Mercury	0.23 J	0.21 J	R	0.33 J	0.16 J	0.20 J	1.2	0.10 U	0.21 J	0.51 J
Nickel	17.0 J	18.8 J	13.9 J	22.2 J	15.8 J	12.7 J	13.1 B	14	12.9 J	16.8 J
Potassium	1230	1400	748 J	2010	1080	447 J	636 B	1180	663 J	709 J
Selenium	1.1 U	0.97 U	R	R	R	R	0.84 UJ	1.0 U	0.96 U	0.96 U
Silver	2.0 U	1.9 U	R	R	R	R	R	0.4 U	1.8 U	1.8 U
Sodium	929 J	1170	658 B	959 B	852 B	695 B	726 B	246 J	750 J	630 J
Thallium	0.38 J	0.32 J	0.28 UJ	0.29 UJ	1.4 UJ	0.25 UJ	0.24 UJ	20 U	0.21 J	0.26 J
Vanadium	25.3	21.3	19.9 J	26.9 J	21.5 J	13.8 J	17.4	5.8 J	10.9	13.6
Zinc	189 J	189 J	117 J	118 J	127 J	235 J	633 J	59 J	107 J	91.8 J
Cyanide	1.5 U	1.5 U	2.9 UJ	2.8 UJ	3.0 UJ	2.8 UJ	R	11 U	1.5 U	1.5 U

NOSS-AMERICAN
SUBSURFACE SOIL
INORGANICS

Sample ID:	MA-SB011-02FR	MA-SB012-01	MA-SB013-01	MA-SB014-01	MA-SB015-01	MA-SB016-01	MA-SB016-02	MA-SB017-01	MA-SB017-02	MA-SB018-01
TR No.:	MEW645 Replicate	MEW612	MEW648	MEW615	MEW614	MEW791	MEW792	MEW793	MEW794	MEW610
Parameter										
Aluminum	3060	2700	1820	10600	9230	3520	6960	12000	5990	14400 J
Antimony	0.46 B	3.7 U	0.62 B	3.1 U	3.4 U	2.9 B	R	1.5 B	R	R
Arsenic	1.9 J	7.8 J	2.5 J	2.4 U	2.4 J	3.1 J	2.8 J	3.5 J	3.8 J	0.5 U
Barium	39.4 J	38	26.3 J	63	61	33.8 J	61.1	81.7	59.7	105
Beryllium	0.74 J	0.2 U	0.45 J	0.2 U	0.2 U	0.32 B	0.61 B	0.79 J	0.45 B	1
Cadmium	2.9 B	1.8	1.9 B	4.3	4.0	2.4	4.5	6	3.4	6.3
Calcium	136000	162000	141000	112000	139000	186000	148000	62800	159000	9100
Chromium	9.5	4.6	7.9	17	14	9.8 J	13.2 J	23.3 J	15.1 J	23.9
Cobalt	9.2 J	2.9 J	4.5 J	8.8	7.2 J	10.1 J	8.2 J	11.4 J	6.5 J	4.7 J
Copper	9.5 J	8.8	8.6 J	26	16	13.2 J	19.1 J	22.5 J	16.3 J	18.8
Iron	7620	6320 J	7600	15600 J	14000 J	10800	13100	21700	12700	16800
Lead	6.3 J	7.1	9.4 J	9.8	9.6	5.3 J	8.8 J	8.5 J	6.6 J	24 J
Magnesium	48000	62500	45700	53500	54000	64700	55800	39700	55100	5350
Manganese	334 J	425 J	483 J	396 J	486 J	724 J	335 J	590 J	511 J	162 J
Mercury	0.30 J	0.10 U	0.17 J	0.12 U	0.1 U	R	0.22 J	0.60 J	0.31 J	0.12 U
Nickel	15.6 J	7.4	8.6 J	21	17	13.7 J	15.4 J	24.0 J	15.3 J	13.9 B
Potassium	720 J	520 J	509 B	2140	2290	782 J	1650	2160	1290	881 B
Selenium	0.94 U	1.0 U	0.96 U	1.2 U	7.8 U	R	R	R	R	1.1 UJ
Silver	1.9 U	0.9 B	1.7 U	0.4 U	0.5 B	R	R	R	R	R
Sodium	645 J	227 J	612 J	317 J	277 J	773 B	888 B	1230	891 B	727 B
Thallium	0.27 J	19 U	0.34 J	24 U	16 U	0.26 UJ	1.4 UJ	0.28 UJ	0.26 UJ	0.3 U
Vanadium	12.3	0.9 U	8.9 J	16	10	18.6 J	22.7 J	34.9 J	19.4 J	19
Zinc	125 J	36 J	102 J	43 J	52 J	231 J	104 J	148 J	167 J	1740 J
Cyanide	1.5 U	8.3 U	1.7 J	11 U	11 U	2.6 UJ	2.9 UJ	3.1 UJ	2.9 UJ	R

MOSS-AMERICAN
SUBSURFACE SOIL
INORGANICS

Sample ID:	MA-SB018-02	MA-SB019-01	MA-SB019-02	MA-SB019-03
TR No.:	MEW411	MEW416	MEW417	MEW418
Parameter				
Aluminum	2130 J	16900	7600	7130
Antimony	R	5.1 J	3.2 U	3.2 U
Arsenic	2.3 J	6.8 J	5.2 J	2.4 J
Barium	44.2	103	5.2	53
Beryllium	0.16 U	0.2 U	0.2 U	0.2 U
Cadmium	1.6	6.9	3.4	4.4
Calcium	194000	18500	103000	114000
Chromium	8.3	24	13	12
Cobalt	2.8 J	14	4.7 J	6.7 J
Copper	5.6	26	16	16
Iron	7280	26600 J	12600 J	16100 J
Lead	5.5 B	31	9.7	25
Magnesium	64100	13600	58100	55400
Manganese	595 J	841 J	518 J	475 J
Mercury	0.12 U	0.12 U	0.10 U	0.10 U
Nickel	9 B	28	15	16
Potassium	420 B	1900	1520	1620
Selenium	0.92 UJ	1.3 U	1.1 U	1.1 U
Silver	R	0.6 U	0.5 U	0.4 U
Sodium	485 B	204 J	218 J	242 J
Thallium	0.26 UJ	2.6 U	22 U	22 U
Vanadium	10.6	37	7.4 J	6.9 J
Zinc	131 J	219 J	58 J	66 J
Cyanide	R	12 U	11 U	6.7 U

MOSS-AMERICAN
SOIL BORINGS
TREATMENT PARAMETERS
SAS No.: 3770E

Sample ID:	MA-SB01-01	MA-SBFB01-01	MA-SB02-01	MA-SB03-01	MA-SB03-02	MA-SBFB03-01	MA-SB04-01	MA-SB04-02	MA-SB04-03	MA-SBFB04-01
TR No.:	E141/E117	/E79	E144/E120	E138/E114	E139/E115	E150/E154	E05/E17	E06/E18	E19	E151/E155
NANCO LAB:										
% Moisture	20		10	20	20	0 U	30	20		0 U
% Ash	79		67	73	80	100	65	75		100
% Volatile Matter	18		29	22	17	1 U	8	18		1 U
% Fixed Carbon	1 U		1 U	1 U	1 U	1 U	1 U	1 U		1 U
VERSAR LAB:										
% Carbon (dry)	7.36	3.26	6.55	8	7.61	1 U	8.39	8.18		1 U
% Carbon (as rec'd)	6.49	3.26	5.66	7.02	6.79	1 U	7.14	7.57		1 U
% Oxygen (dry)	6.64	3.94	11.3	7.5	9.69	0	21.3	19.0		0
% Oxygen (as rec'd)	17.7	4.03	21.8	18.9	19.4	0	31.4	25.1		0
% Hydrogen (dry)	1.1 U	1 U	0.29	1.1 U	1.1 U	1 U	-0.18	1.07 U		1 U
% Hydrogen (as rec'd)	1 U	1 U	1.77	1 U	1 U	1 U	1.51 U	1 U		1 U
% Nitrogen (dry)	1.1 U	1 U	1.2 U	1.1 U	1.1 U	1 U	1.18 U	1.08 U		1 U
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		1 U
% Ash (dry)	86	92.8	81.9	84.5	82.7	100	70.5	72.8		100
% Ash (as rec'd)	75.9	92.7	70.8	74.1	73.8	100	60.8	67.3		100
% Sulphur (dry)	1.1 U	1 U	1.2 U	1.1 U	1.1 U	1 U	1.18 U	1.08 U		1 U
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U		1 U
% Moisture	11.8	8.1	13.6	12.3	10.8	0	14.9	7.50	11.0	0
TOC (mg/kg)	21000	851	30800	12200	26600	142 *	26600	37700	28900	133 *
Chloride (mg/kg)	20.4	117	11.5	28.7	29.3	10.3	5 U	8.6		36.1
Flashpoint (degrees F)	138	>230	138	142	136	144	134	133		148
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U		500 U

MOSS-AMERICAN
SOIL BORINGS
TREATMENT PARAMETERS
SAS No.: 3770E

Moss American
Soil Borings
Treatment Parameters
SAS No.: 3770E

Sample ID:	MA-SB05-01FR	MA-SB06-01	MA-SB07-01	MA-SB08-01	MA-SB08-02	MA-SB09-01	MA-SB09-02	MA-SB10-01	MA-SB11-01	MA-SB11-02
TR No.:	E149/E125	E145/E121	E26/E28	E20/E22	E23/E25	/E85	/E88	E98/E100	E140/E116	E142/E118
MARCO LAB:										
% Moisture	10	10	10	20	10			16	8	20
% Ash	64	69	71	74	78			68	82	79
% Volatile Matter	28	29	23	16	27			19	42	18
% Fixed Carbon	1 U	1 U	1 U	1 U	1 U			1 U	1 U	1 U
VERSAR LAB:										
% Carbon (dry)	6	6.84	4.68	4.97	6.72	8.31	5.28	4.41	7.8	6.6
% Carbon (as rec'd)	4.87	5.86	3.92	3.95	5.65	7.35	4.8	3.78	7.07	5.9
% Oxygen (dry)	9.8	9.6	9.8	17	17.3	15.5	20.1	14.5	21.9	8
% Oxygen (as rec'd)	24.7	20.9	24.5	31.8	28.7	24	27.4	26.7	28.2	17.8
% Hydrogen (dry)	-0.19	0.1	1.2 U	-0.23	-0.42	0.74 J	1.1 U	0.7 J	0.31	1.1 U
% Hydrogen (as rec'd)	1.96	1.69	1 U	2.12	1.43	1.95 J	1 U	2.2 J	1.33	1 U
% Nitrogen (dry)	1.2 U	1.2 U	1.2 U	1.3 U	1.2 U	1.1 U	1.1 U	1.17 U	1.1 U	1.1 U
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Ash (dry)	84.4	83.5	85.5	78.3	76.4	75.4	74.6	81.1	70	85.4
% Ash (as rec'd)	68.4	71.6	71.6	62.2	64.3	66.7	67.8	69.5	63.4	76.3
% Sulphur (dry)	1.2 U	1.2 U	1.2 U	1.3 U	1.2 U	1.1 U	1.1 U	1.17 U	1.1 U	1.1 U
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Moisture	18.9	14.3	16.3	20.6	15.9	11.6	9.1	14.3	9.4	10.6
TOC (mg/kg)	8130	24300	23400	29100	32600	21700	45900	11700	22200	18000
Chloride (mg/kg)	15.5	5.7 U	20.5	17.7	15.7	95.1	26.2	5.7 U	15.1	12.8
Flashpoint (degrees F)	138	135	121	145	153	138	139	136	139	160
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U

MOSS-AMERICAN
SOIL BORINGS
TREATMENT PARAMETERS
SAS No.: 3770E

Moss American
Soil Borings
Treatment Parameters
SAS No.: 3770E

Sample ID:	MA-SB11-02FR	MA-SB12-01	MA-SB13-01	MA-SB14-01	MA-SB15-01	MA-SB16-01	MA-SB16-02	MA-SB17-01	MA-SB17-02	MA-SB18-02
TR No.:	E143/E119	E95/E97	E146/E122	E104/E106	E101/E103	E01/E13	E02/E14	E03/E15	E04/E16	E92/E94
NANCO LAB:										
% Moisture	10	14	20	17	14	22	20	33	30	20
% Ash	75	77	70	67	69	60	61	65	63	81
% Volatile Matter	28	22	17	19	23	18	19	2	8	20
% Fixed Carbon	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
VERSAR LAB:										
% Carbon (dry)	6.84	7.22	7.97	6.03	6.69	9.65	6.97	4.09	6.50	7.7
% Carbon (as rec'd)	6.14	6.28	7.01	4.95	5.74	8.06	5.97	3.14	5.53	6.88
% Oxygen (dry)	7.4	6.72	4.2	14.2	13	20.9	15.9	10.6	17.7	17.8
% Oxygen (as rec'd)	15.7	17.4	14.3	27.6	23.8	32.1	28.0	28.8	28.3	25.3
% Hydrogen (dry)	-0.09	-0.44 J	-0.32	-0.43 J	-0.09 J	-0.25	1.15 U	0.17	0.27	-0.19 J
% Hydrogen (as rec'd)	1.06	1.07 J	1.06	1.65 J	1.51 J	1.64	1 U	2.73	1.90	1.02 J
% Nitrogen (dry)	1.1 U	1.1 U	1.1 U	1.2 U	1.2 U	1.2 U	1.17 U	1.3 U	1.18 U	1.1 U
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Ash (dry)	85.9	86.5	88.2	80.2	80.4	74.9	77.1	85.1	75.5	74.7
% Ash (as rec'd)	77.1	75.3	77.6	65.8	69	58.2	66.0	65.4	64.3	66.8
% Sulphur (dry)	1.1 U	1.1 U	1.1 U	1.2 U	1.2 U	1.2 U	1.17 U	1.3 U	1.18 U	1.1 U
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Moisture	10.2	13	12	17.9	14.2	16.5	14.4	23.2	14.9	10.6
TOC (mg/kg)	13900	19200	20800	27600	5210	47900	36400	11800	32700	38900
Chloride (mg/kg)	8.7	18.5	15.2	13.8	16.3	54.8	74.8	45.2	65	77.4
Flashpoint (degrees F)	138	139	134	131	138	130	143	141	141	138
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500	500 U	500 U

MOSS-AMERICAN
SOIL BORINGS
TREATMENT PARAMETERS
SAS No.: 3770E

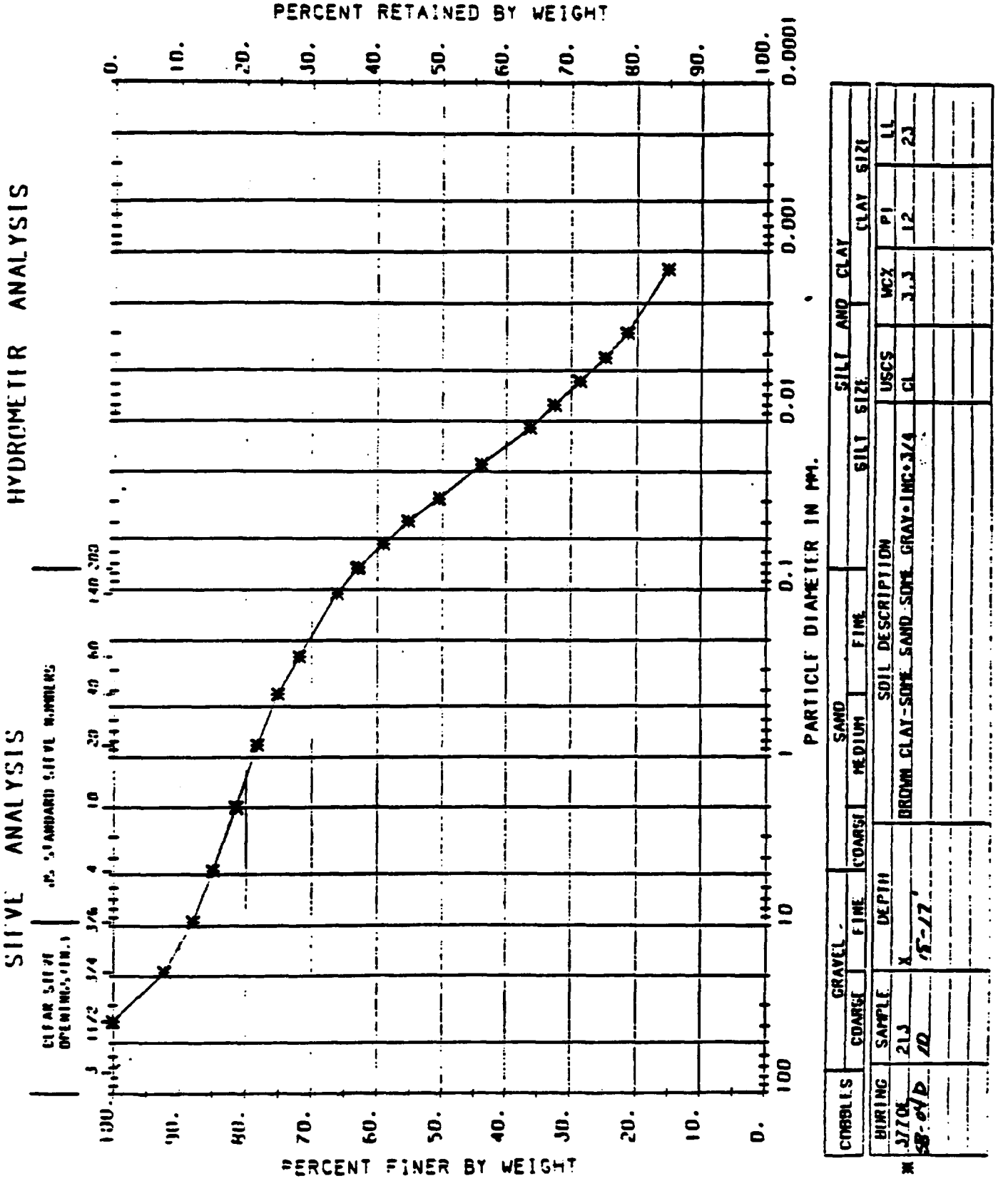
Sample ID:	MA-SB19-01	MA-SB19-02	MA-SB19-03
TR No.:	E107/E109	E110/E112	/E113
NANCO LAB:			
% Moisture	20	12	
% Ash	69	76	
% Volatile Matter	12	23	
% Fixed Carbon	1 U	1 U	
VERSAR LAB:			
% Carbon (dry)	16	4.55	
% Carbon (as rec'd)	13.4	4.04	
% Oxygen (dry)	2.2	14.8	
% Oxygen (as rec'd)	16.5	24.3	
% Hydrogen (dry)	0.41 J	-0.06 J	
% Hydrogen (as rec'd)	2.19 J	1.2 J	
% Nitrogen (dry)	1.2 U	1.1 U	
% Nitrogen (as rec'd)	1 U	1 U	
% Ash (dry)	81.3	80.7	
% Ash (as rec'd)	67.9	71.7	
% Sulphur (dry)	1.2 U	1.1 U	
% Sulphur (as rec'd)	1 U	1 U	
% Moisture	16.5	11.2	19.1
TOC (mg/kg)	47900	20500	25600
Chloride (mg/kg)	75.8	17	
Flashpoint (degrees F)	140	137	
BTU (per lb.)	500 U	500 U	

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0004



* * * * GRAIN SIZE ANALYSIS * * * *

==========REDUCED RESULTS==========

PROJECT NAME:	USEPA	SB-04D-10 15-17'	
PROJECT NO.:	SAS 3770E	BORING NO.	3770E
SAMPLE NO.:	213	DEPTH:	X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	92.2
0.375IN.	9.500	87.9
NO. 4	4.750	84.9
NO. 10	2.000	81.4
NO. 20	0.850	78.2
NO. 40	0.425	75.1
NO. 60	0.250	71.8
NO. 140	0.106	66.1
NO. 200	0.075	63.0

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCE
0.0738	65.5	62.8
0.0539	61.6	59.0
0.0393	57.6	55.2
0.0288	52.6	50.4
0.0181	45.7	43.8
0.0110	37.7	36.2
0.0080	33.8	32.4
0.0058	29.8	28.6
0.0042	25.8	24.7
0.0030	22.3	21.4
0.0013	15.9	15.2

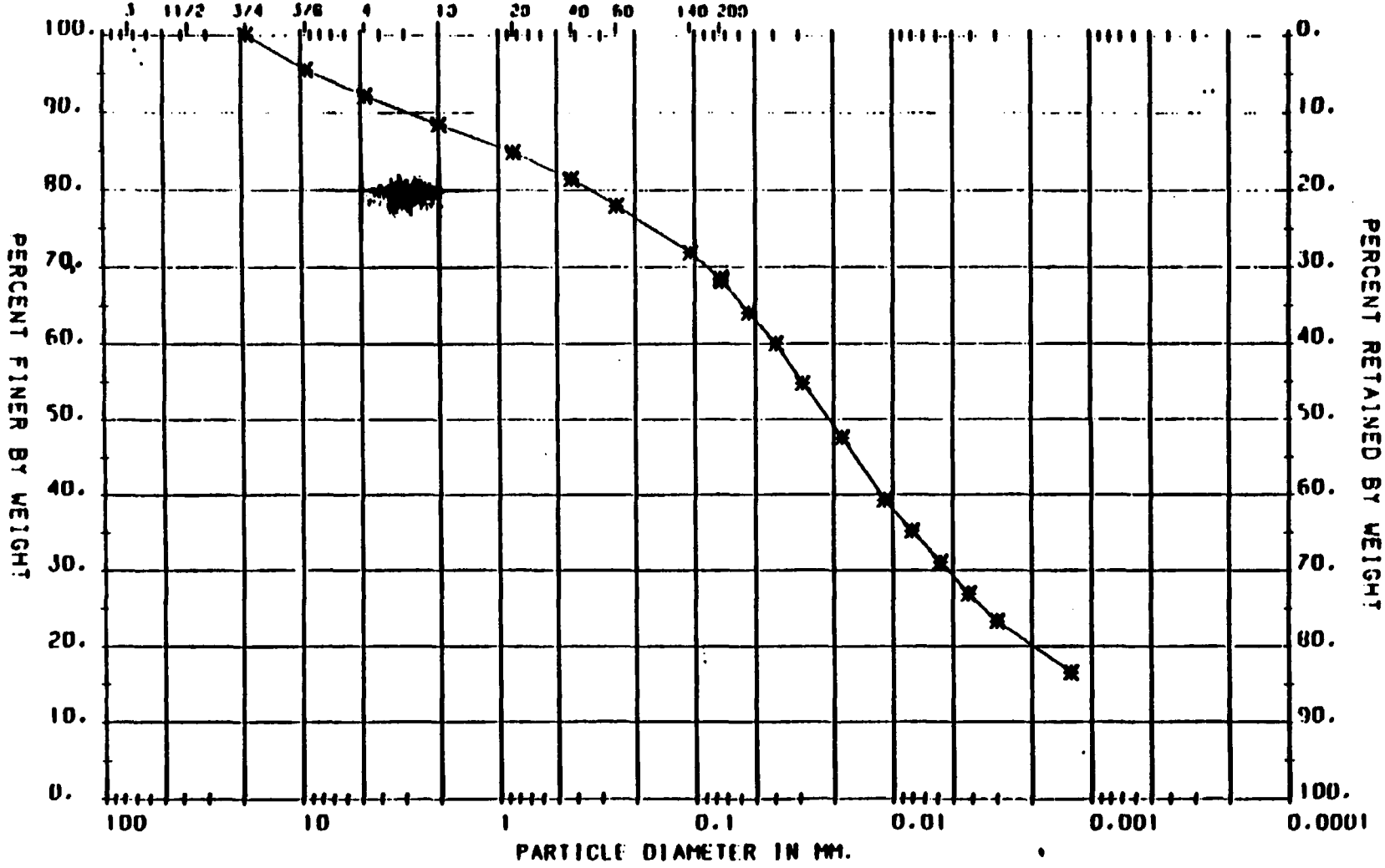
CORRECTION FACTOR= 0.96

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 365.96
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 65.09
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO. SAS 3770E

0006

SIEVE ANALYSIS | HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	PI	LL
*	3770E	213	X	BROWN CLAY-SOME SAND SOME GRAV•(XC•3/4	CL	3.3	12	23
	SB-04D	10	15-17					

* * * * GRAIN SIZE ANALYSIS * * * *

0007

========REDUCED RESULTS========

SB-040-10
15-17'

PROJECT NAME:	USEPA		
PROJECT NO.:	SAS 3770E	BORING NO.:	3770E
SAMPLE NO.:	213	DEPTH:	X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	95.4
NO. 4	4.750	92.1
NO. 10	2.000	88.4
NO. 20	0.850	84.8
NO. 40	0.425	81.4
NO. 60	0.250	77.9
NO. 140	0.106	71.8
NO. 200	0.075	68.4

===HYDROMETER ANALYSIS===

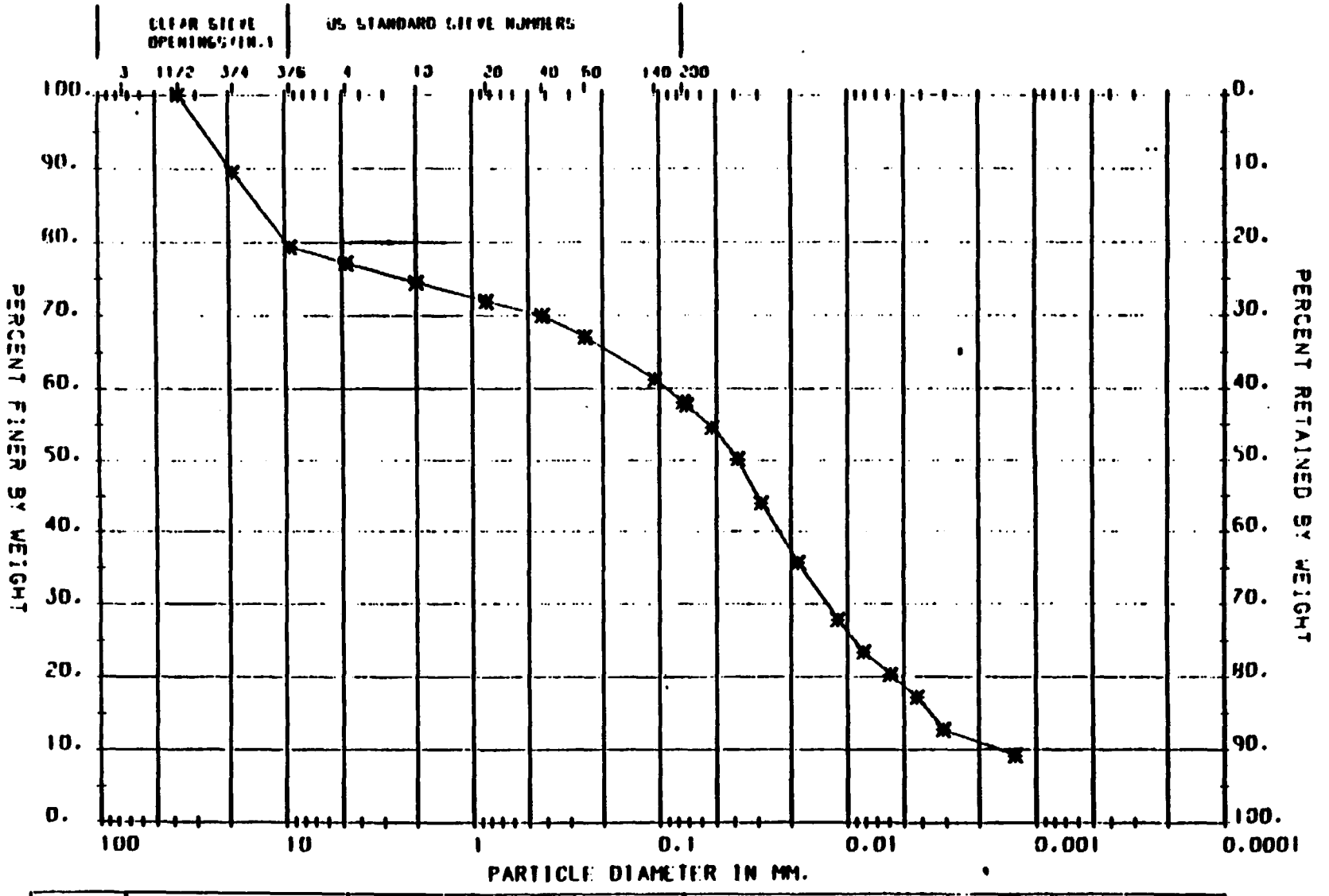
DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0738	71.2	68.1
0.0539	66.9	64.0
0.0393	62.6	59.9
0.0288	57.2	54.7
0.0181	49.6	47.5
0.0110	41.0	39.2
0.0080	36.7	35.1
0.0058	32.4	31.0
0.0042	28.0	26.8
0.0030	24.3	23.2
0.0013	17.3	16.5

CORRECTION FACTOR= 0.96

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 337.34
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 65.09
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E

SIEVE ANALYSIS | HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	PI	LL
*	3770L	214	X	BRN CLAY-SOME GRAVEL-SOME SAND•INC•3/4	CL	5.3	11	22
	SB-04D	10	15-17					

0009

* * * * GRAIN SIZE ANALYSIS * * * *

========REDUCED RESULTS========

SB-040-10
15-17'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E RUKING NO.: 3770E

SAMPLE NO.: 214 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	89.4
0.375IN.	9.500	79.3
NO. 4	4.750	77.1
NO. 10	2.000	74.4
NO. 20	0.850	71.8
NO. 40	0.425	69.9
NO. 60	0.250	67.0
NO. 140	0.106	61.2
NO. 200	0.075	58.0

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0721	58.6	57.6
0.0526	55.5	54.5
0.0387	51.0	50.1
0.0288	44.7	43.9
0.0184	36.2	35.6
0.0113	28.2	27.7
0.0082	23.7	23.3
0.0059	20.6	20.2
0.0043	17.4	17.1
0.0031	13.0	12.7
0.0013	9.4	9.2

CORRECTION FACTOR= 0.98

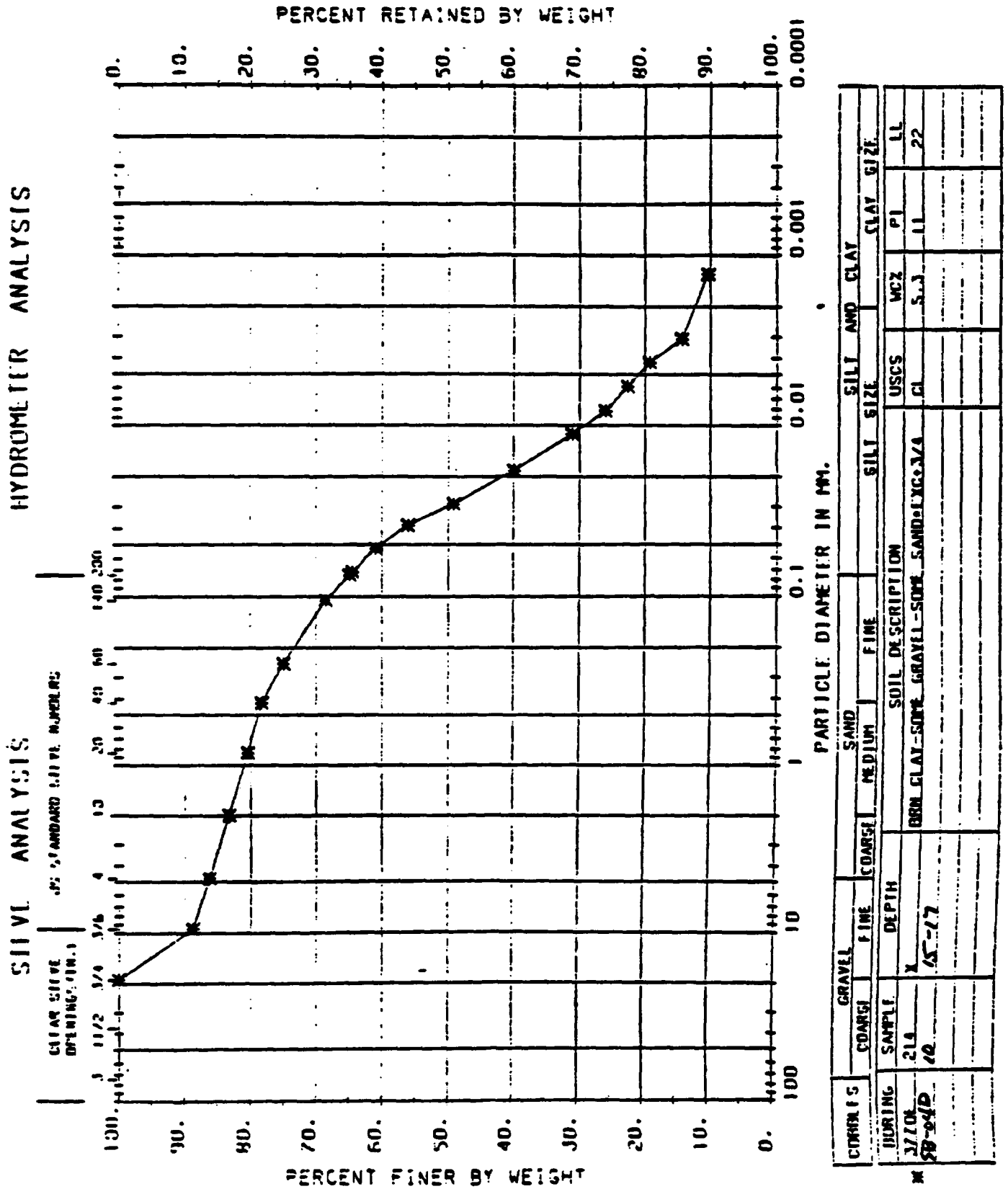
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 258.41
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.03
VISCOSITY OF WATER (MILLIPOISES)= 9.91

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0010



* * * * GRAIN SIZE ANALYSIS * * * *

0011

==========REDUCED RESULTS==========

SB-04B-1D
15-17'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 214 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	88.7
NO. 4	4.750	86.2
NO. 10	2.000	83.2
NO. 20	0.850	80.3
NO. 40	0.425	78.2
NO. 60	0.250	74.9
NO. 140	0.106	68.4
NO. 200	0.075	64.8

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCENT
0.0721	65.5	64.4
0.0526	62.0	60.9
0.0387	57.0	56.0
0.0288	50.0	49.1
0.0184	40.5	39.8
0.0113	31.5	31.0
0.0082	26.5	26.0
0.0059	23.0	22.6
0.0043	19.5	19.2
0.0031	14.5	14.3
0.0013	10.5	10.3

CORRECTION FACTOR= 0.98

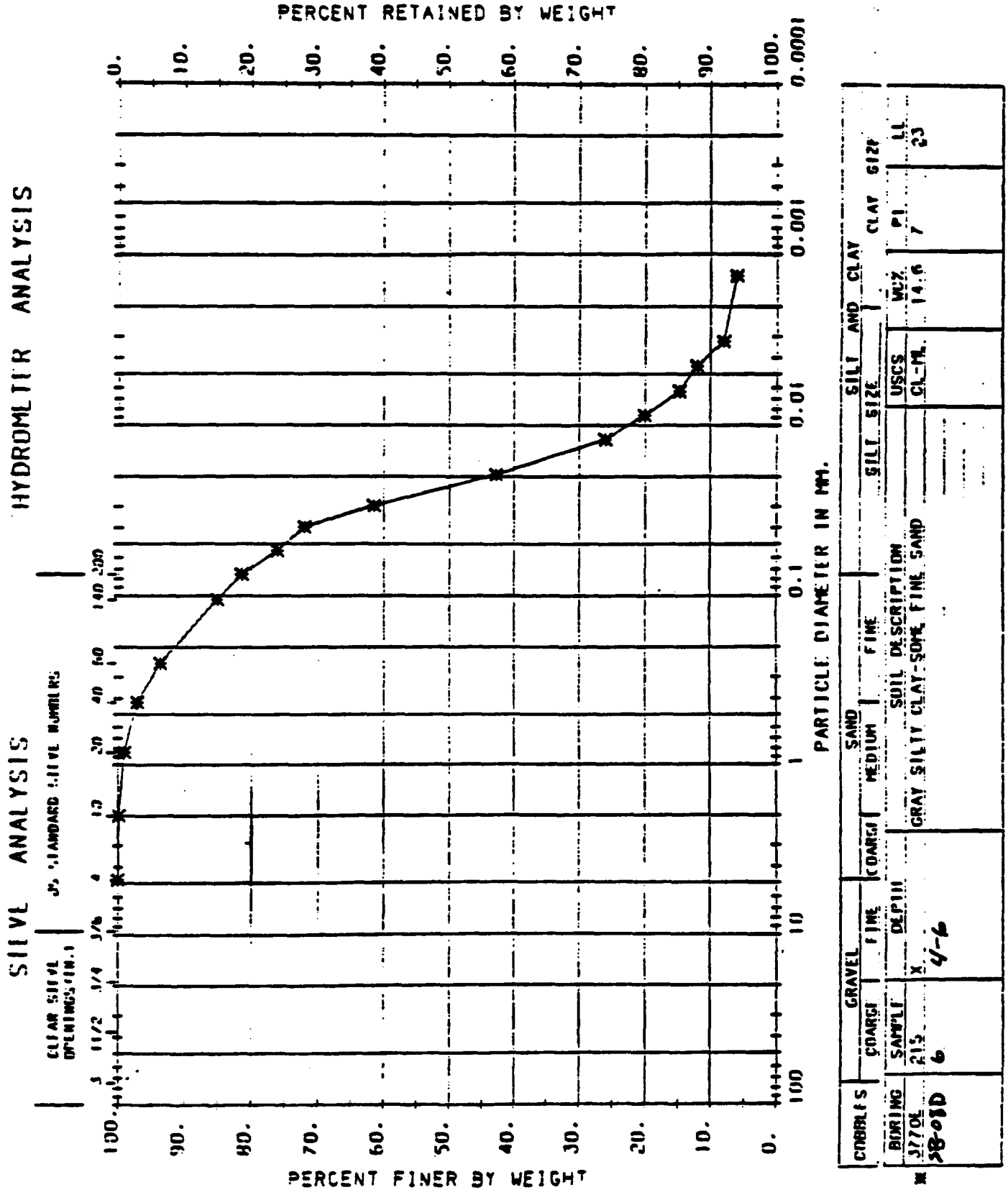
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 231.06
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.03
VISCOSITY OF WATER (MILLIPOISES)= 9.91

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0012



* * * * GRAIN SIZE ANALYSIS * * * *

0013

==========REDUCED RESULTS==========

SB-08D-06
4-6

PROJECT NAME:	USEPA		
PROJECT NO.:	SAS 3770E	BORING NO.:	3770E
SAMPLE NO.:	215	DEPTH:	X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	100.0
NO. 4	4.750	100.0
NO. 10	2.000	99.8
NO. 20	0.850	99.0
NO. 40	0.425	97.1
NO. 60	0.250	93.7
NO. 140	0.106	85.1
NO. 200	0.075	81.4

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCENT
0.0750	77.5	81.4
0.0548	72.4	76.1
0.0396	68.6	72.0
0.0297	58.4	61.4
0.0195	40.7	42.7
0.0121	24.8	26.0
0.0088	19.1	20.0
0.0063	14.0	14.7
0.0045	11.4	12.0
0.0032	7.6	8.0
0.0013	5.7	6.0

CORRECTION FACTOR= 1.05

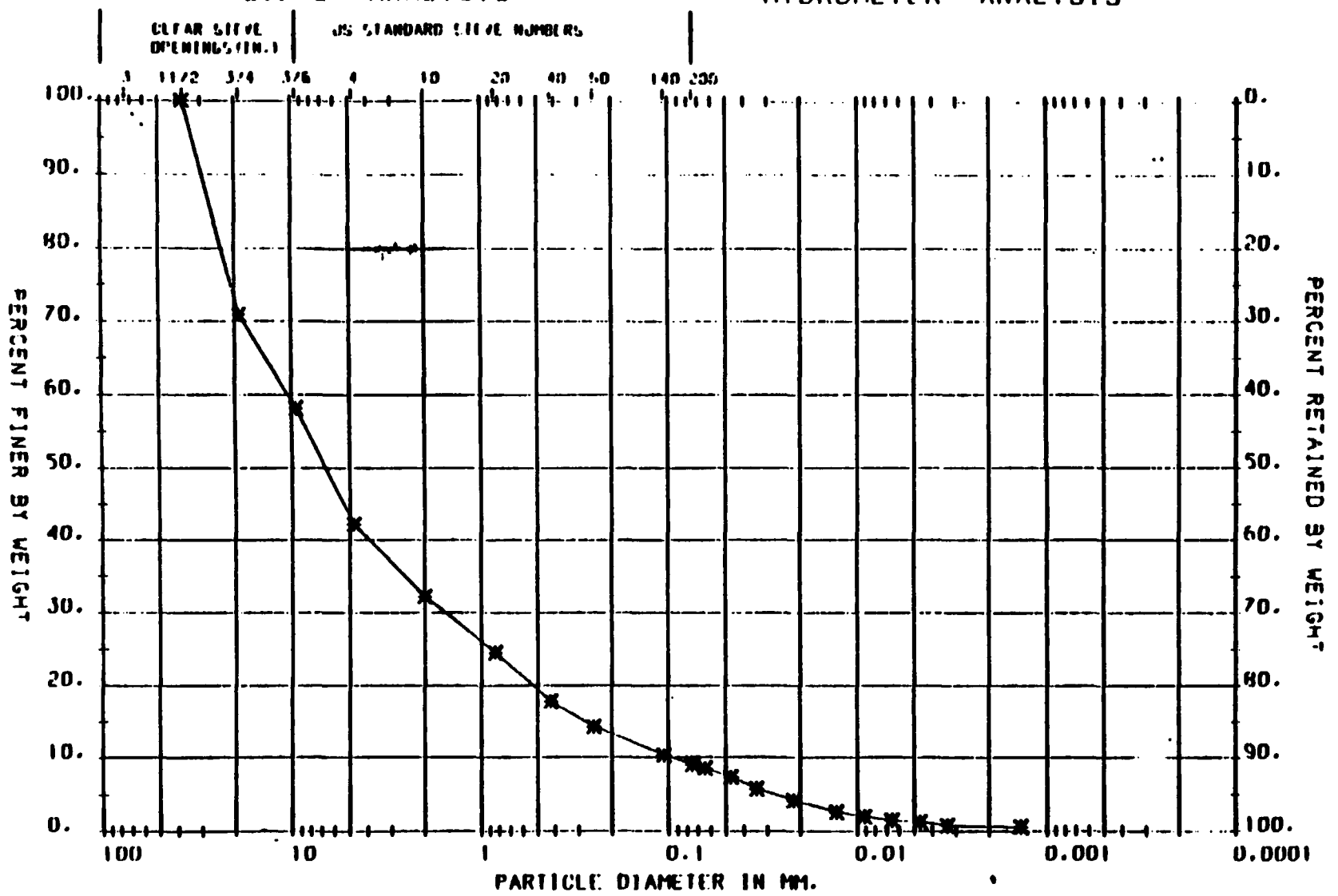
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 255.24
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 62.38
VISCOSITY OF WATER (MILLIPOISES)= 9.91

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO. SAS 3770E

SILVL ANALYSIS — HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
X	3770E	216	X	BROWN SANDY GRAVEL-TRACE CLAY +INC+3/4	GW-GC	8.2	108	2.4
	SB-07I	1	9-10					

0014

* * * * GRAIN SIZE ANALYSIS * * * *

0015

==========REDUCED RESULTS==========

SB-07I-1
9-10

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770F BORING NO.: 3770E

SAMPLE NO.: 21B DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	70.8
0.375IN.	9.500	58.1
NO. 4	4.750	42.1
NO. 10	2.000	32.1
NO. 20	0.850	24.4
NO. 40	0.425	17.7
NO. 60	0.250	14.2
NO. 140	0.106	10.3
NO. 200	0.075	9.0

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0885	8.7	9.6
0.0643	7.8	8.5
0.0468	6.7	7.3
0.0342	5.2	5.7
0.0215	3.7	4.1
0.0129	2.3	2.5
0.0092	1.7	1.9
0.0066	1.3	1.4
0.0047	1.1	1.2
0.0033	0.7	0.7
0.0014	0.4	0.5

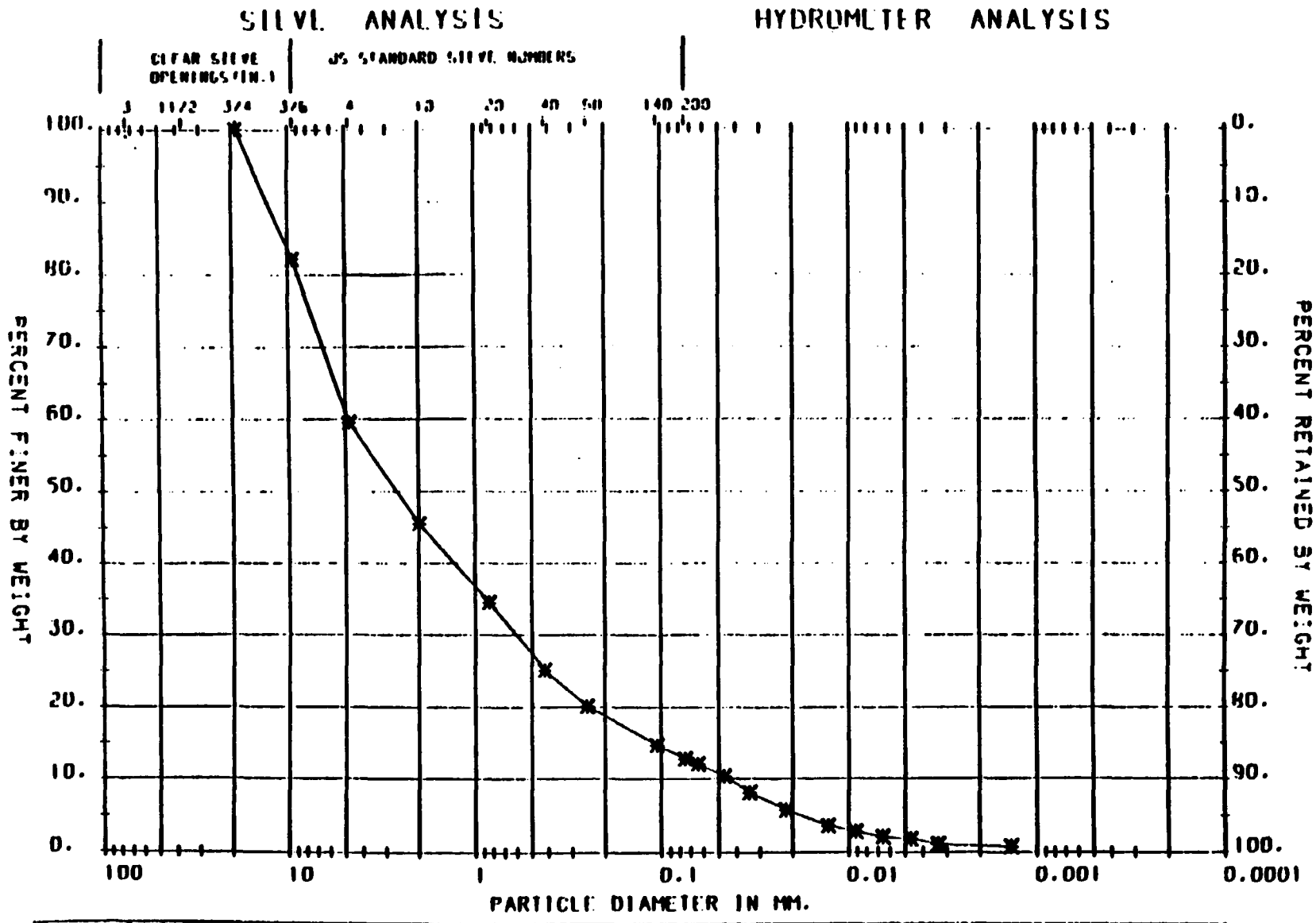
CORRECTION FACTOR= 1.09

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 664.35
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 118.03
VISCOSITY OF WATER (MILLIPOISES)= 9.91

CU= 108.0 CZ= 2.4

D60= 10.5145 D30= 1.5804 D10= 0.0974

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
*	3770E SB-07I	216 / 1	X 9-10	BROWN SANDY GRAVEL-TRACE CLAY *EXC+3/4	GW-GC	8.2	108	1.7

-0016

* * * * GRAIN SIZE ANALYSIS * * * *

==========REDUCED RESULTS==========

SB-072-1
9-10

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 216 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	82.1
NO. 4	4.750	59.4
NO. 10	2.000	45.4
NO. 20	0.850	34.4
NO. 40	0.425	25.0
NO. 60	0.250	20.0
NO. 140	0.106	14.6
NO. 200	0.075	12.7

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCE
0.0885	12.4	13.5
0.0643	11.0	12.0
0.0468	9.4	10.3
0.0342	7.4	8.1
0.0215	5.3	5.7
0.0129	3.2	3.5
0.0092	2.5	2.7
0.0066	1.9	2.0
0.0047	1.5	1.7
0.0033	0.9	1.0
0.0014	0.6	0.7

CORRECTION FACTOR= 1.09

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 470.63
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 118.03
VISCOSITY OF WATER (MILLIPOISES)= 9.91

CU= 107.8 CZ= 1.7

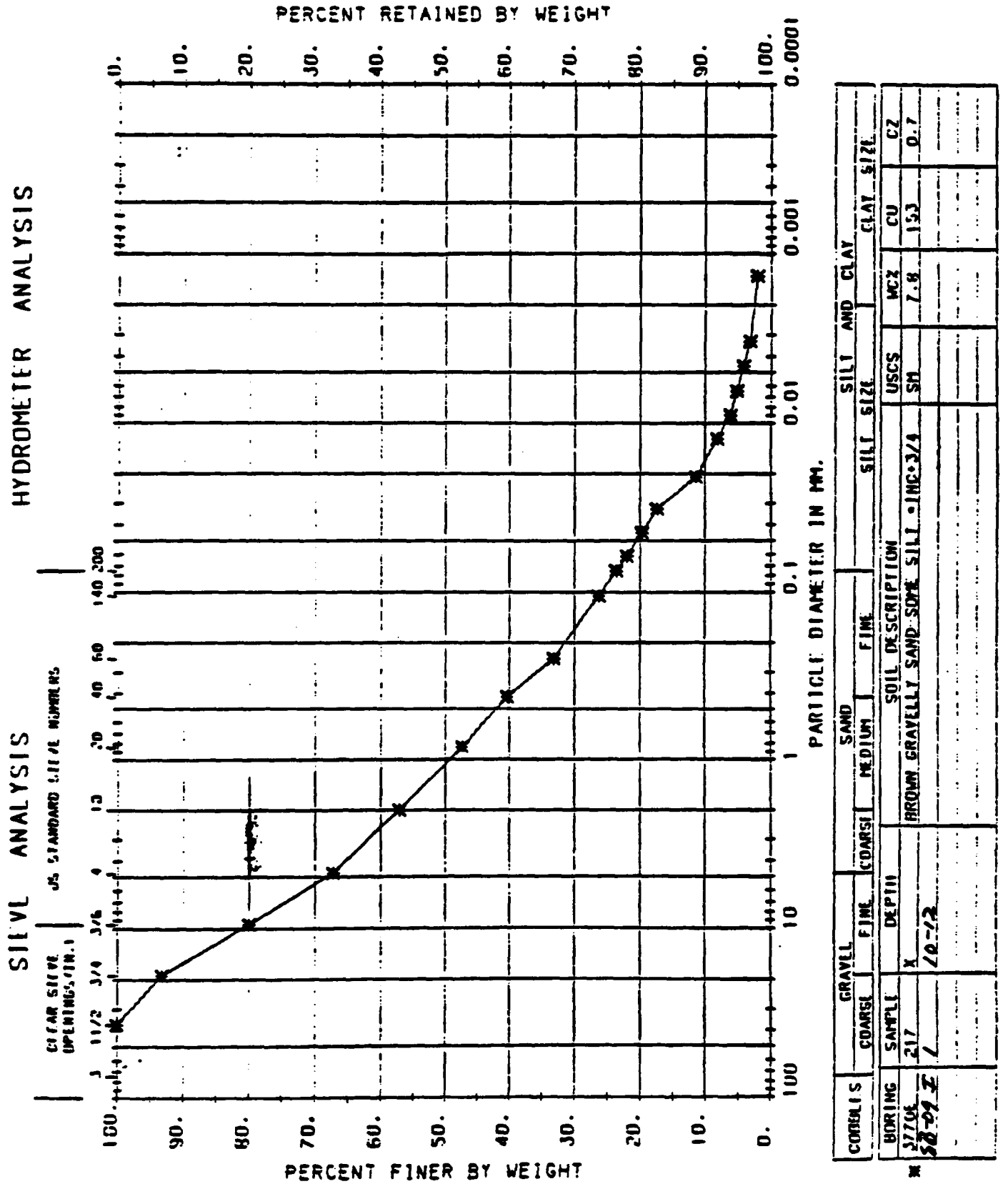
D60= 4.8353 D30= 0.6143 D10= 0.0449

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0018



* * * * GRAIN SIZE ANALYSIS * * * * 0019

========REDUCED RESULTS========

PROJECT NAME: USEPA SB-09Z-01 10-12'

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 217 DEPTH: x

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	93.2
0.375IN.	9.500	79.9
NO. 4	4.750	67.2
NO. 10	2.000	57.1
NO. 20	0.850	47.2
NO. 40	0.425	40.2
NO. 60	0.250	33.1
NO. 140	0.106	26.2
NO. 200	0.075	23.5

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0840	23.8	24.4
0.0614	21.4	21.9
0.0447	19.1	19.6
0.0324	16.9	17.3
0.0209	11.2	11.4
0.0125	7.9	8.1
0.0090	6.0	6.1
0.0064	5.0	5.1
0.0046	4.0	4.1
0.0033	3.0	3.1
0.0014	2.0	2.0

CORRECTION FACTOR= 1.02

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 172.06
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 92.35
VISCOSITY OF WATER (MILLIPOISES)= 9.91

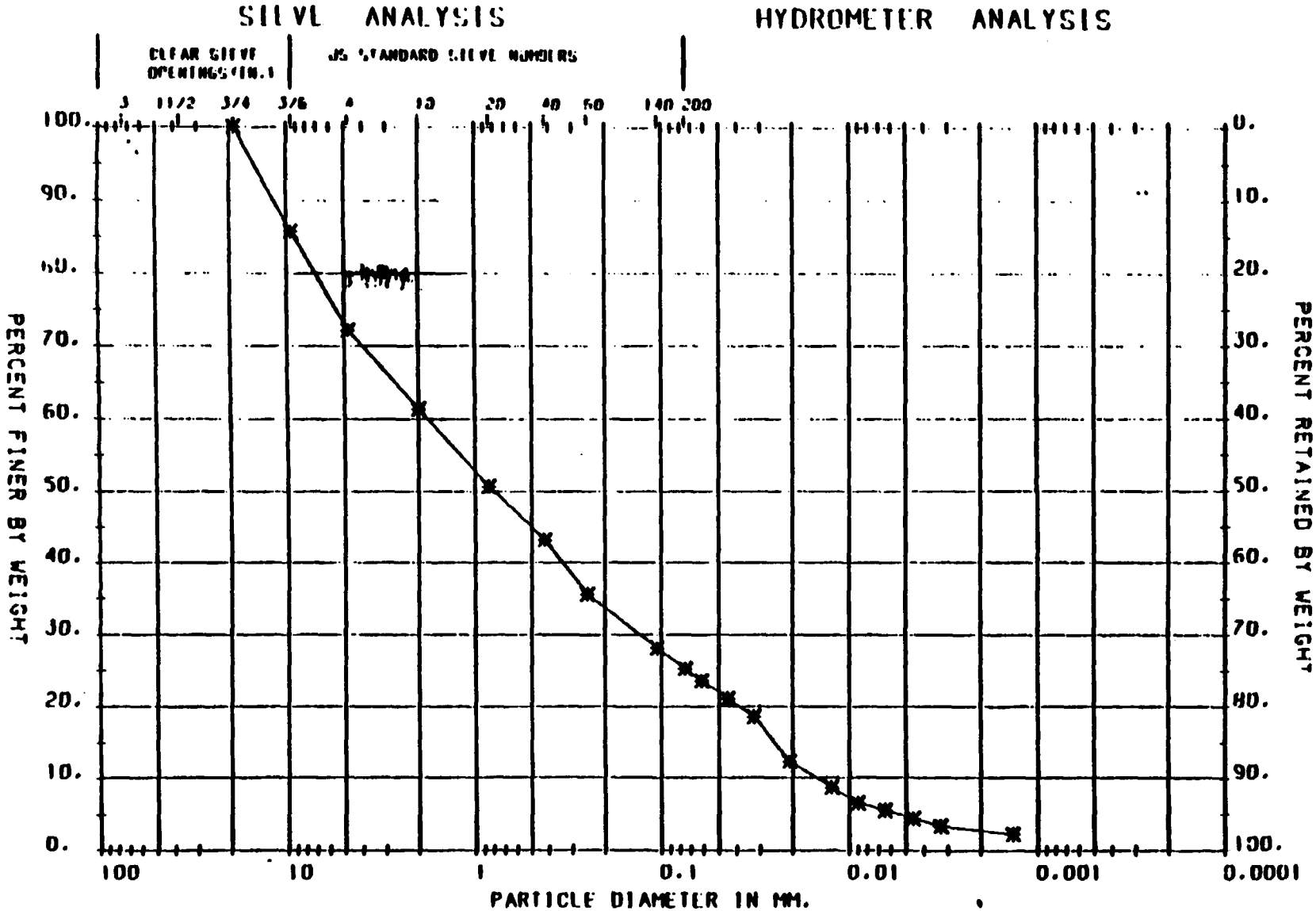
CU= 153.3 CZ= 0.7

D60= 2.5617 D30= 0.1708 D10= 0.0167

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
X	3770E	217	X	BROWN GRAVELLY SAND-SOME SILT •EXC•3/4	SM	7.8	120	0.6
	SB-01C	1	10-12					

0020

* * * * GRAIN SIZE ANALYSIS * * * *

0021

========REDUCED RESULTS========

SB-09I-1
10-12'

PROJECT NAME:	USEPA		
PROJECT NO.:	SAS 3770E	BORING NO.:	3770E
SAMPLE NO.:	217	DEPTH:	X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	85.7
NO. 4	4.750	72.1
NO. 10	2.000	61.3
NO. 20	0.850	50.6
NO. 40	0.425	43.1
NO. 60	0.250	35.5
NO. 140	0.106	28.1
NO. 200	0.075	25.2

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0840	25.6	26.2
0.0614	22.9	23.5
0.0447	20.5	21.0
0.0324	18.1	18.5
0.0209	12.0	12.3
0.0125	8.5	8.7
0.0090	6.4	6.5
0.0064	5.3	5.5
0.0046	4.3	4.4
0.0033	3.2	3.3
0.0014	2.1	2.2

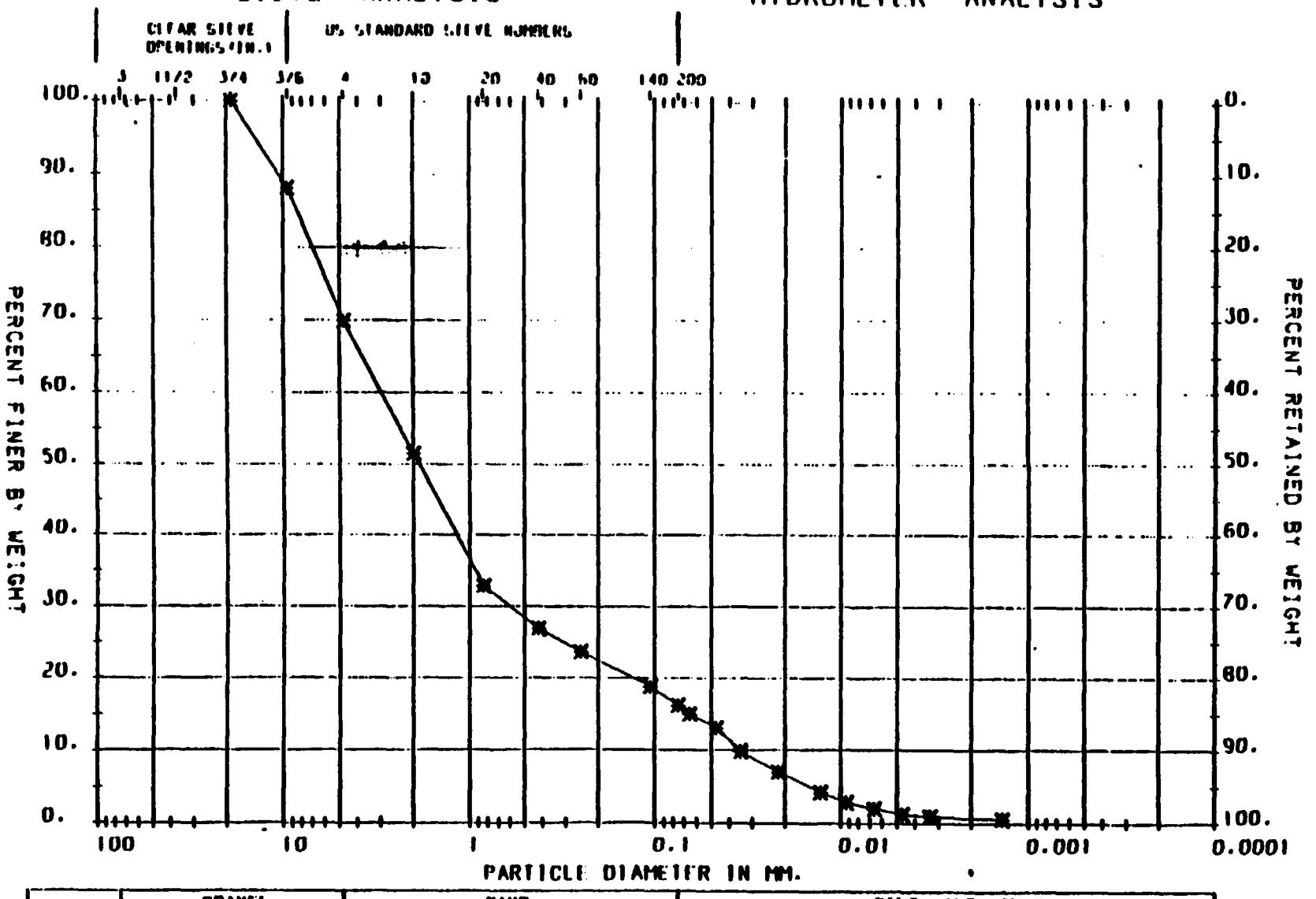
CORRECTION FACTOR= 1.02

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 160.42
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 92.35
VISCOSITY OF WATER (MILLIPOISES)= 9.91

CU= 120.1 CZ= 0.6

D60= 1.8067 D30= 0.1327 D10= 0.0150

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
*	SB10L	21B	X	BROWN SANDY GRAVEL-TRACE CLAY *EXC:3/4	GP-GC	8.5	84.5	3.6
	SB-10S	1	10-11					

0022

* * * * GRAIN SIZE ANALYSIS * * * *

0023

========REDUCED RESULTS========

PROJECT NAME: USEPA SB-105 -01 10-11

PROJECT NO.: SAS 3770E BORING NO. 3770E

SAMPLE NO.: 218 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	88.1
NO. 4	4.750	69.8
NO. 10	2.000	51.4
NO. 20	0.850	32.7
NO. 40	0.425	26.8
NO. 60	0.250	23.5
NO. 140	0.106	18.7
NO. 200	0.075	16.1

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCENT
0.0896	16.7	17.7
0.0656	14.1	14.9
0.0474	12.3	13.0
0.0348	9.2	9.8
0.0218	6.6	7.0
0.0129	4.0	4.2
0.0093	2.6	2.8
0.0066	1.8	1.9
0.0047	1.1	1.2
0.0033	0.9	0.9
0.0014	0.4	0.5

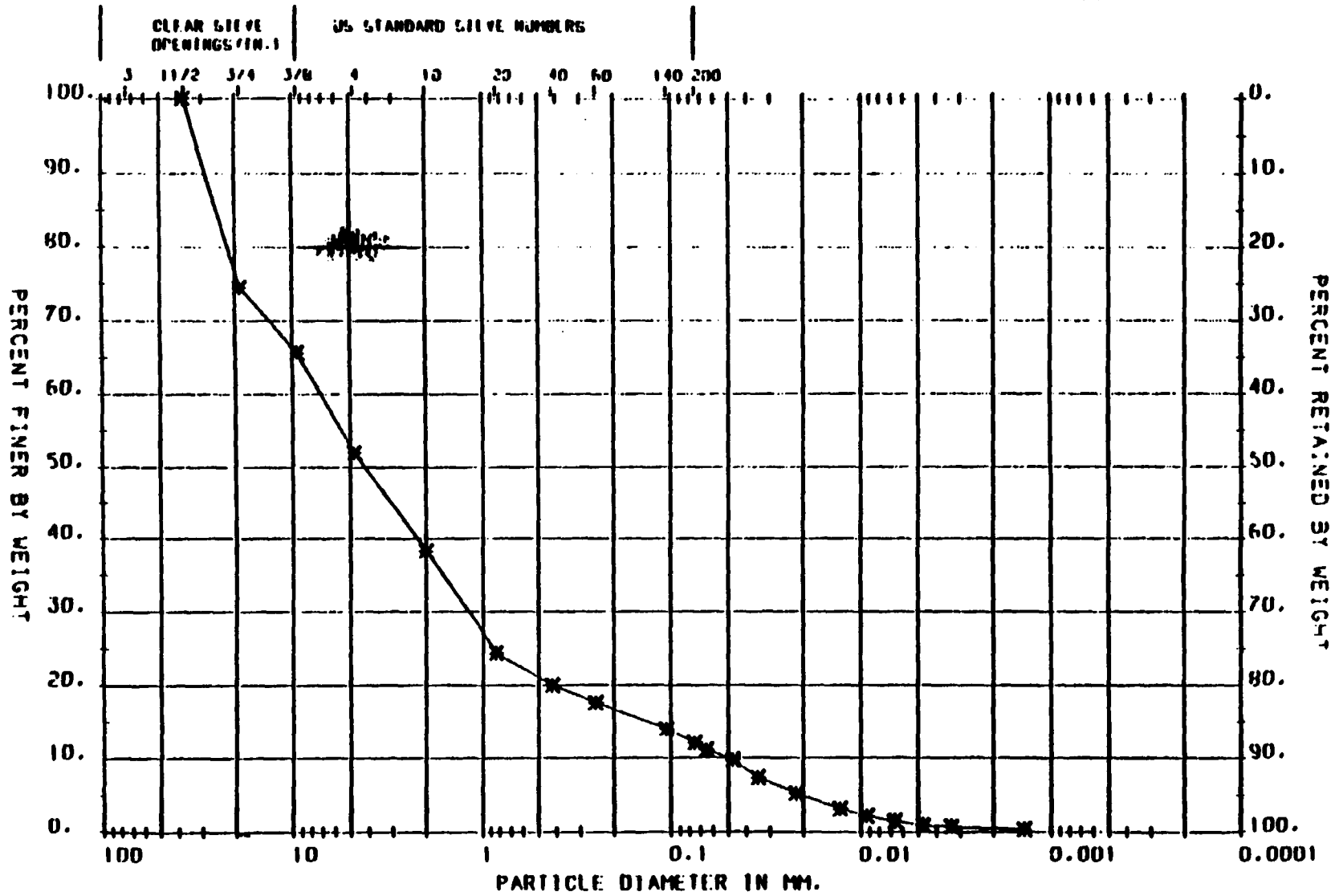
CORRECTION FACTOR= 1.06

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 198.81
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 93.94
VISCOSITY OF WATER (MILLIPOISES)= 9.91

CU= 84.5 CZ= 3.6

D60= 3.0006 D30= 0.6191 D10= 0.0355

SIEVE ANALYSIS — HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
*	3770E	21B	X	BROWN SANDY GRAVEL-TRACE CLAY *INC+3/4	GP-GC	8.5	141	4.0
	SB-10S	1	10-11					

PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E

0024

* * * * GRAIN SIZE ANALYSIS * * * *

========REDUCED RESULTS========

SB-105-01
10-11

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 218 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	74.4
0.375IN.	9.500	65.6
NO. 4	4.750	51.9
NO. 10	2.000	38.2
NO. 20	0.850	24.3
NO. 40	0.425	19.9
NO. 60	0.250	17.5
NO. 140	0.106	13.9
NO. 200	0.075	12.0

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0896	12.4	13.2
0.0656	10.4	11.1
0.0474	9.1	9.7
0.0348	6.9	7.3
0.0218	4.9	5.2
0.0129	2.9	3.1
0.0093	2.0	2.1
0.0066	1.3	1.4
0.0047	0.8	0.9
0.0033	0.7	0.7
0.0014	0.3	0.3

CORRECTION FACTOR= 1.06

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 267.29
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 93.94
VISCOSITY OF WATER (MILLIPOISES)= 9.91

CU= 140.8 CZ= 4.0

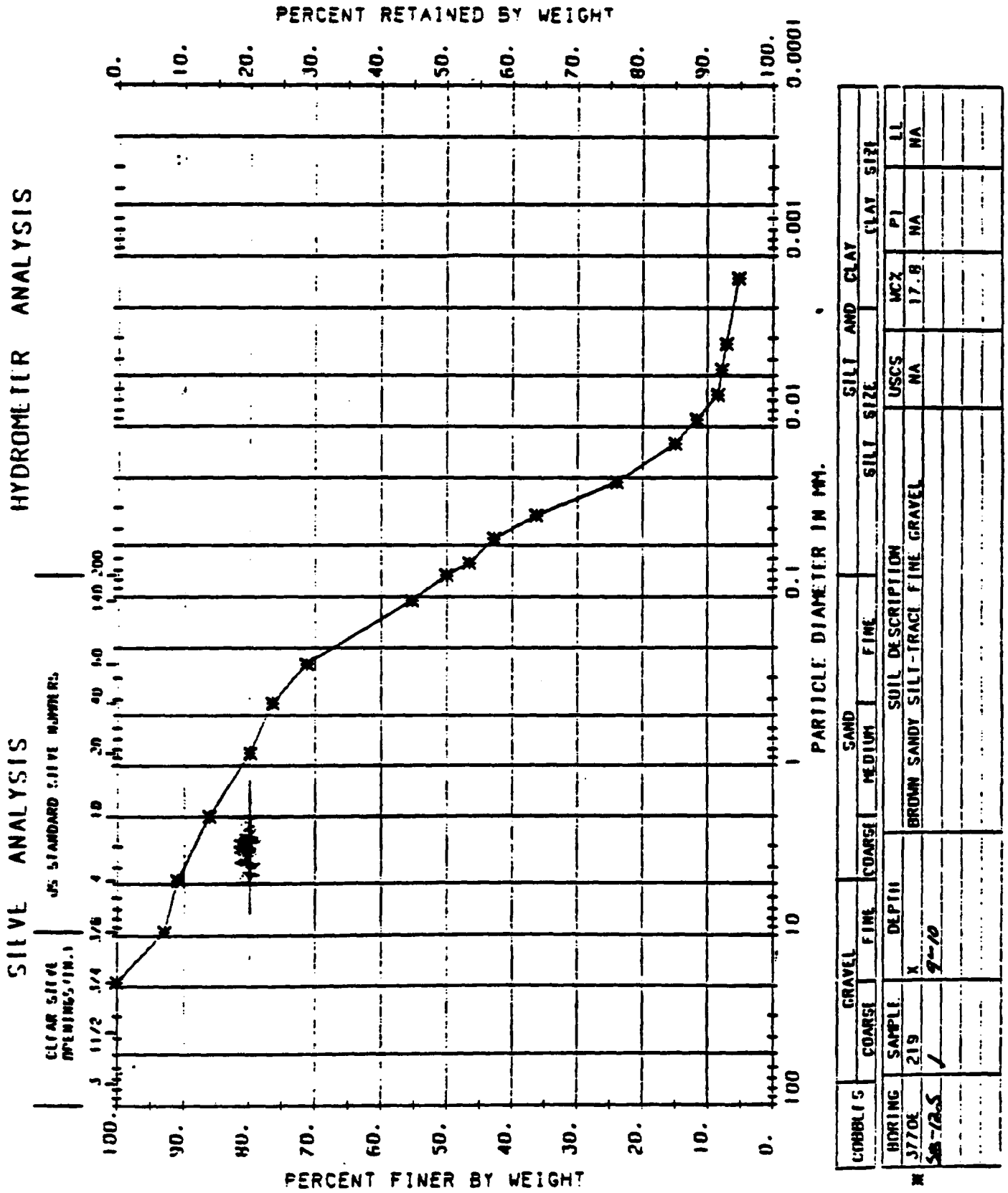
D60= 7.1653 D30= 1.2048 D10= 0.0509

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0026



* * * * GRAIN SIZE ANALYSIS * * * *

========REDUCED RESULTS========

PROJECT NAME: USEPA

SB-12S-1
9-10'

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 219 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.68

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	92.8
NO. 4	4.750	90.9
NO. 10	2.000	86.1
NO. 20	0.850	79.8
NO. 40	0.425	76.4
NO. 60	0.250	71.2
NO. 140	0.106	55.2
NO. 200	0.075	49.9

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0872	41.6	53.0
0.0635	36.5	46.5
0.0457	33.3	42.7
0.0332	28.4	36.2
0.0212	18.8	23.9
0.0127	11.7	14.9
0.0091	9.1	11.6
0.0065	6.6	8.4
0.0046	6.1	7.8
0.0033	5.6	7.1
0.0013	4.1	5.2

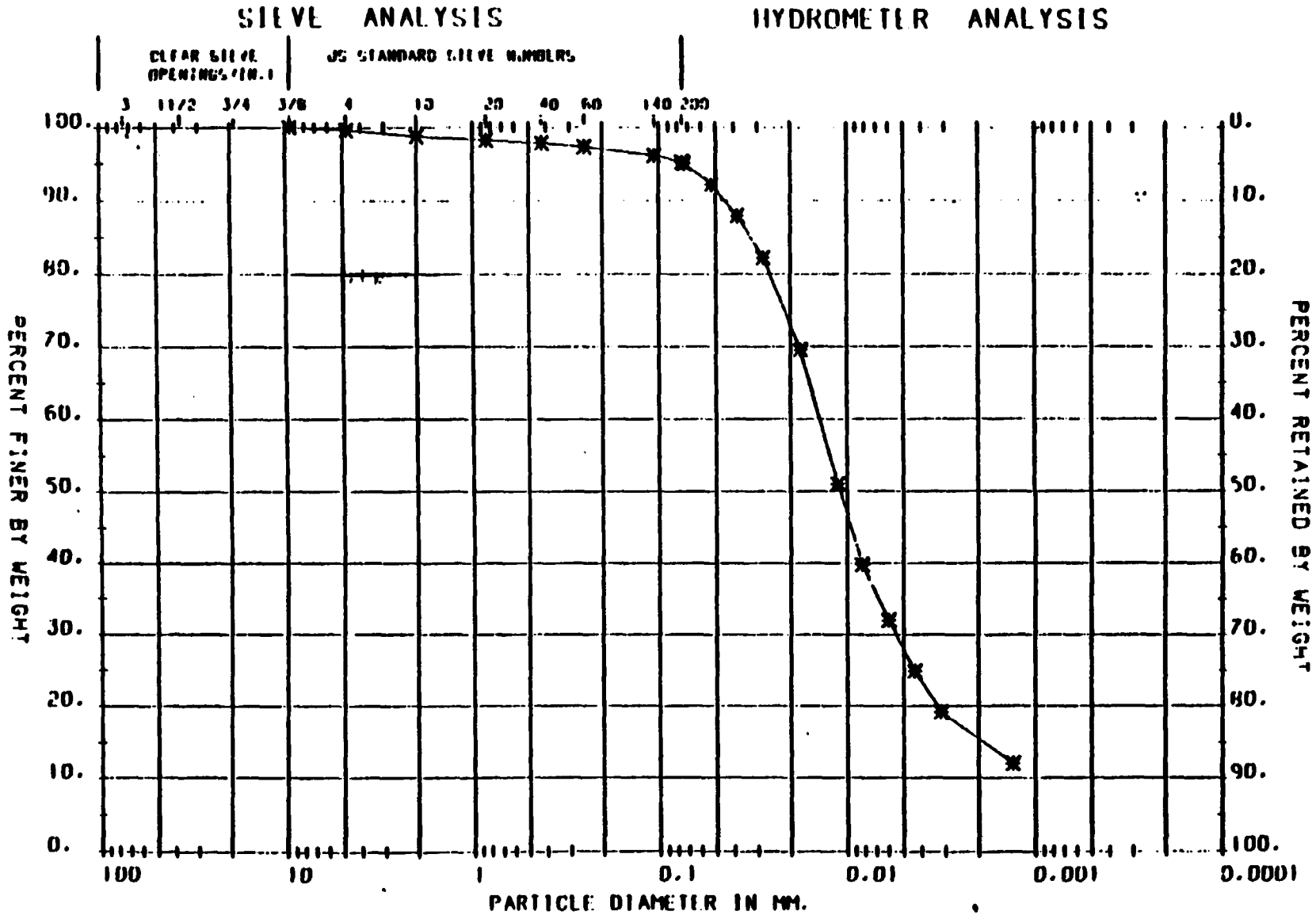
CORRECTION FACTOR= 1.27

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 242.32
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 67.72
VISCOSITY OF WATER (MILLIPOISES)= 9.91

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	PI	LL
*	3770E	220	X	BROWN SILTY CLAY	CL-ML	16.8	5	19
	SB-025	1	16-18					

0028

* * * * GRAIN SIZE ANALYSIS * * * *

========REDUCED RESULTS========

SB-025-1
16-18'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO. 3770E

SAMPLE NO.: 220 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	100.0
NO. 4	4.750	99.6
NO. 10	2.000	98.7
NO. 20	0.850	98.2
NO. 40	0.425	97.8
NO. 60	0.250	97.3
NO. 140	0.106	96.1
NO. 200	0.075	95.2

===HYDROMETER ANALYSIS===

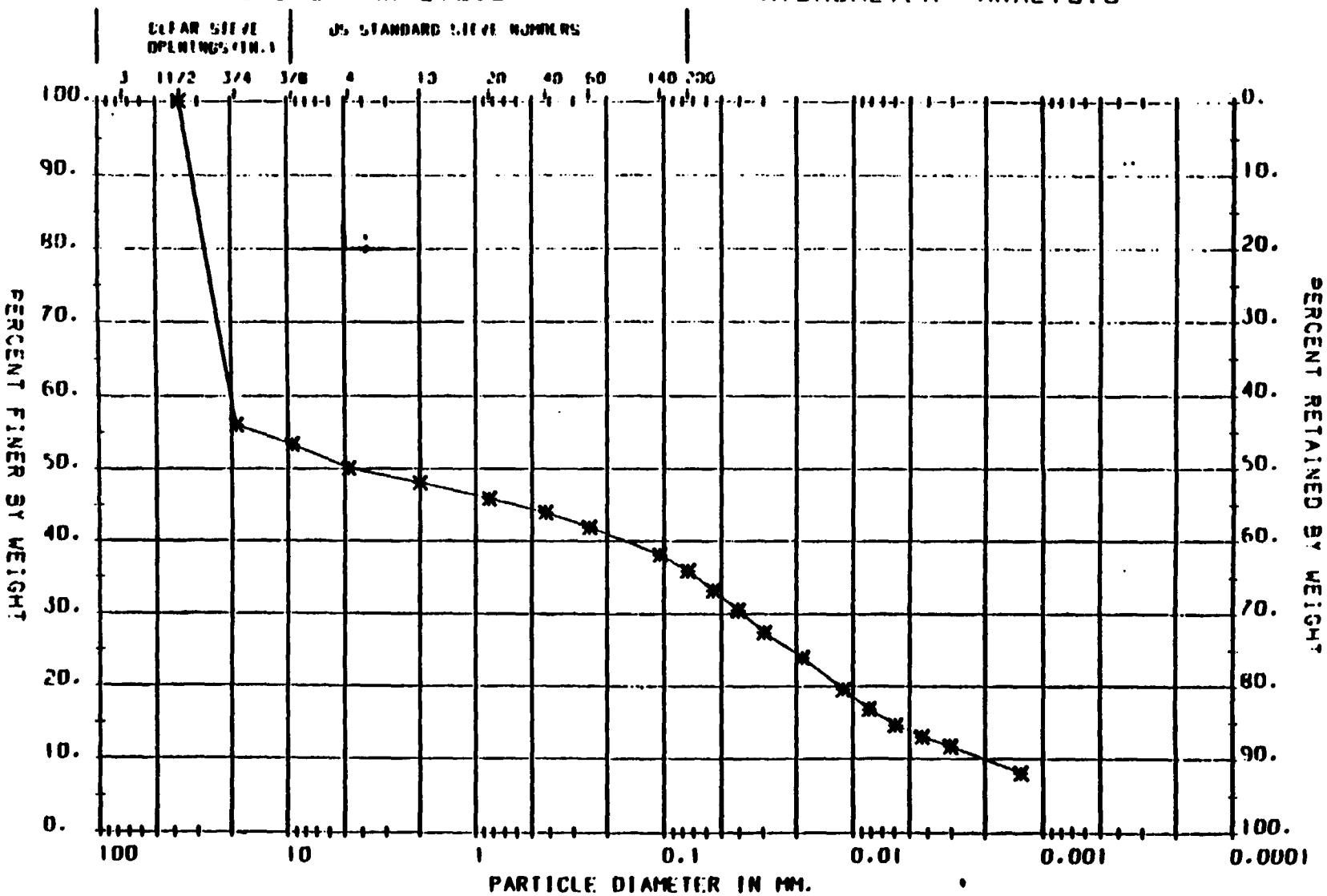
DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0732	97.2	95.0
0.0526	94.3	92.1
0.0381	89.9	87.9
0.0278	84.1	82.2
0.0177	71.1	69.5
0.0112	52.2	51.0
0.0083	40.6	39.7
0.0060	32.6	31.9
0.0044	25.4	24.8
0.0032	19.6	19.1
0.0013	12.3	12.0

CORRECTION FACTOR= 0.98

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 344.83
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 54.05
VISCOSITY OF WATER (MILLIPOISES)= 9.77

SIEVE ANALYSIS

HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	PI	LL
*	3770E	221	X	BROWN CLAYEY GRAVEL-SOME SAND +INC+3/4	GC	13.9	6	19
	SB-065	1	10-12					

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0030

* * * * GRAIN SIZE ANALYSIS * * * *

==========REDUCED RESULTS==========

SB-065-01
10-12'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 221 DEPTH: x

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	56.0
0.375IN.	9.500	53.3
NO. 4	4.750	50.0
NO. 10	2.000	48.0
NO. 20	0.850	45.8
NO. 40	0.425	43.9
NO. 60	0.250	41.8
NO. 140	0.106	38.0
NO. 200	0.075	35.8

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0749	38.1	35.8
0.0552	35.2	33.1
0.0405	32.3	30.4
0.0298	29.1	27.4
0.0186	25.4	23.9
0.0113	20.8	19.5
0.0083	17.9	16.8
0.0060	15.6	14.6
0.0043	13.8	13.0
0.0030	12.4	11.7
0.0013	8.7	8.1

CORRECTION FACTOR= 0.94

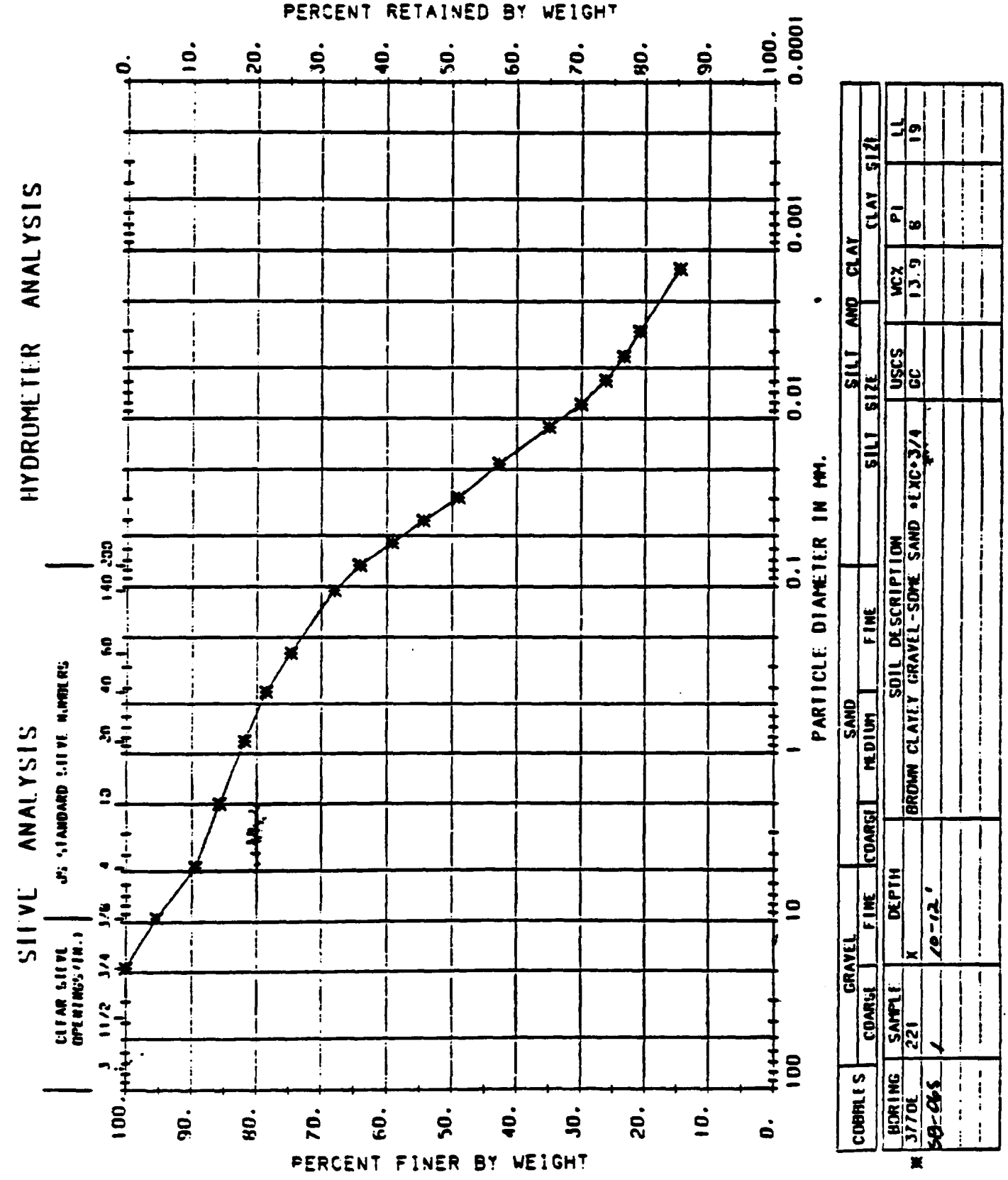
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 534.14
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.81
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0032



* * * * GRAIN SIZE ANALYSIS * * * * 0033

========REDUCED RESULTS========

SB-065 -01
10-12'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 221 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.65

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	95.3
NO. 4	4.750	89.4
NO. 10	2.000	85.7
NO. 20	0.850	81.8
NO. 40	0.425	78.5
NO. 60	0.250	74.7
NO. 140	0.106	67.9
NO. 200	0.075	64.0

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0749	68.0	64.0
0.0552	62.8	59.1
0.0405	57.7	54.3
0.0298	52.0	48.9
0.0186	45.3	42.6
0.0113	37.1	34.9
0.0083	31.9	30.0
0.0060	27.8	26.2
0.0043	24.7	23.3
0.0030	22.1	20.8
0.0013	15.5	14.5

CORRECTION FACTOR= 0.94

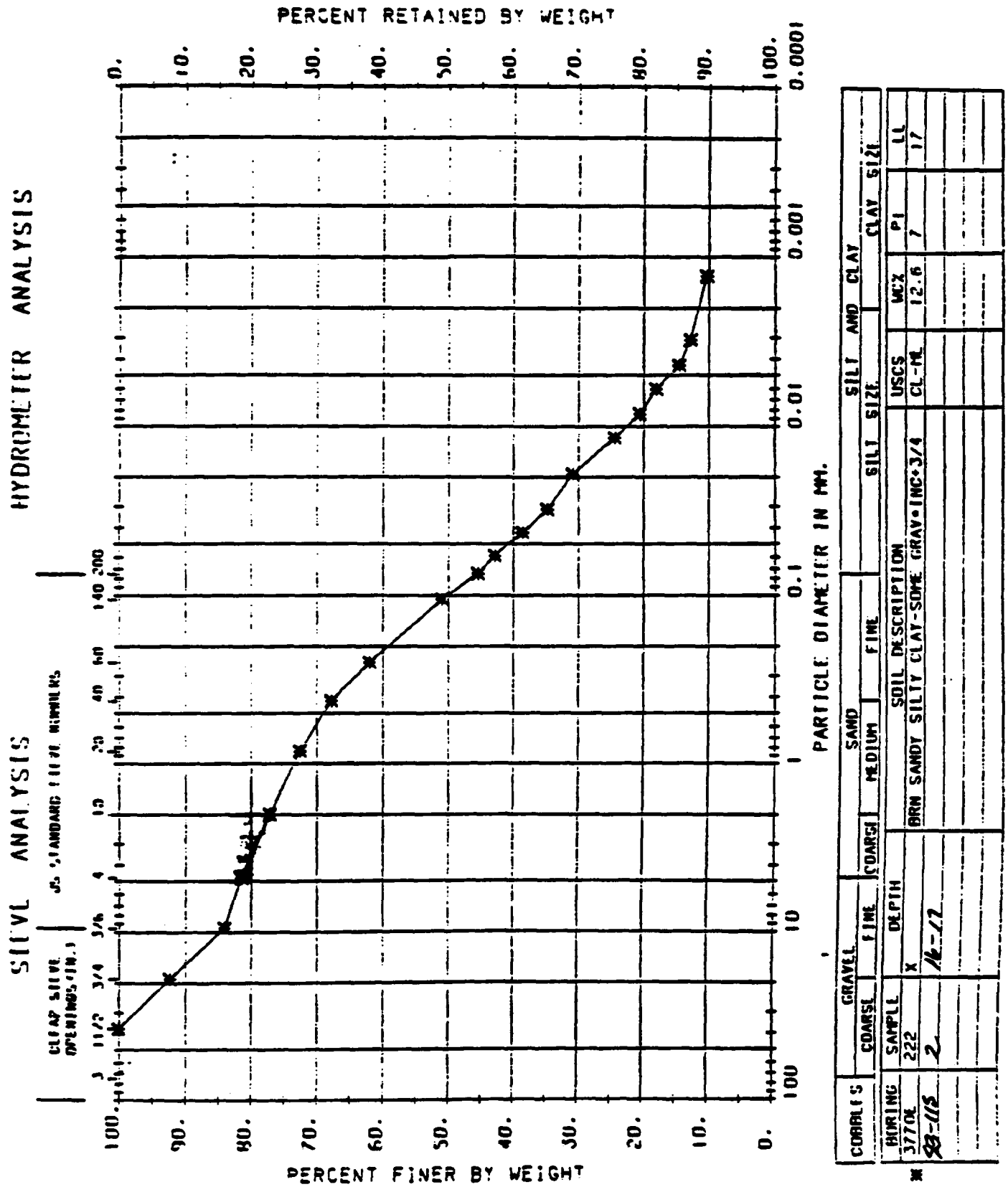
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 298.92
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.81
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E

0034



* * * * GRAIN SIZE ANALYSIS * * * *

========REDUCED RESULTS========

PROJECT NAME:	USEPA	SB-115-2 16-17	
PROJECT NO.:	SAS 3770E	BORING NO.:	3770E
SAMPLE NO.:	222	DEPTH:	X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	92.3
0.375IN.	9.500	84.0
NO. 4	4.750	81.4
NO. 10	2.000	77.1
NO. 20	0.850	72.5
NO. 40	0.425	67.7
NO. 60	0.250	61.9
NO. 140	0.106	50.9
NO. 200	0.075	45.4

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0810	48.8	46.2
0.0589	45.2	42.8
0.0430	40.7	38.5
0.0313	36.6	34.7
0.0193	32.6	30.8
0.0117	25.8	24.4
0.0085	21.7	20.5
0.0061	19.0	18.0
0.0044	15.4	14.5
0.0031	13.6	12.8
0.0013	10.9	10.3

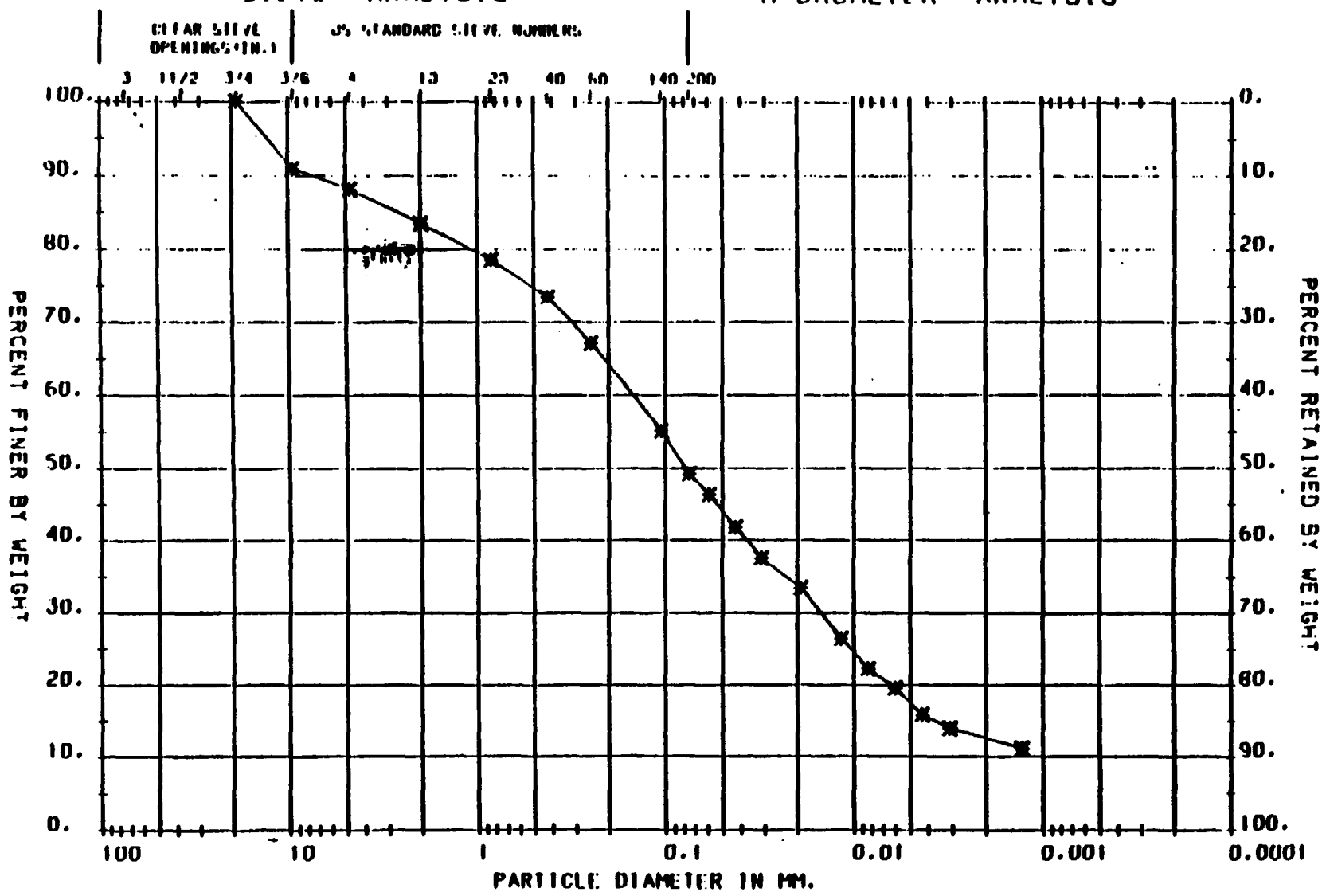
CORRECTION FACTOR= 0.95

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 271.32
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 67.71
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E

0036

SIEVE ANALYSIS | HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	PI	LL
X	3770E	222	X	BRN SANDY SILTY CLAY-SOME GRAV+EXC+3/4	CL-ML	12.6	7	17
	SB-115	2	12-17					

* * * * GRAIN SIZE ANALYSIS * * * *

0037

==========REDUCED RESULTS==========

SB-115-2
16-M'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 222 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.70

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	90.9
NO. 4	4.750	88.1
NO. 10	2.000	83.5
NO. 20	0.850	78.5
NO. 40	0.425	73.4
NO. 60	0.250	67.1
NO. 140	0.106	55.1
NO. 200	0.075	49.1

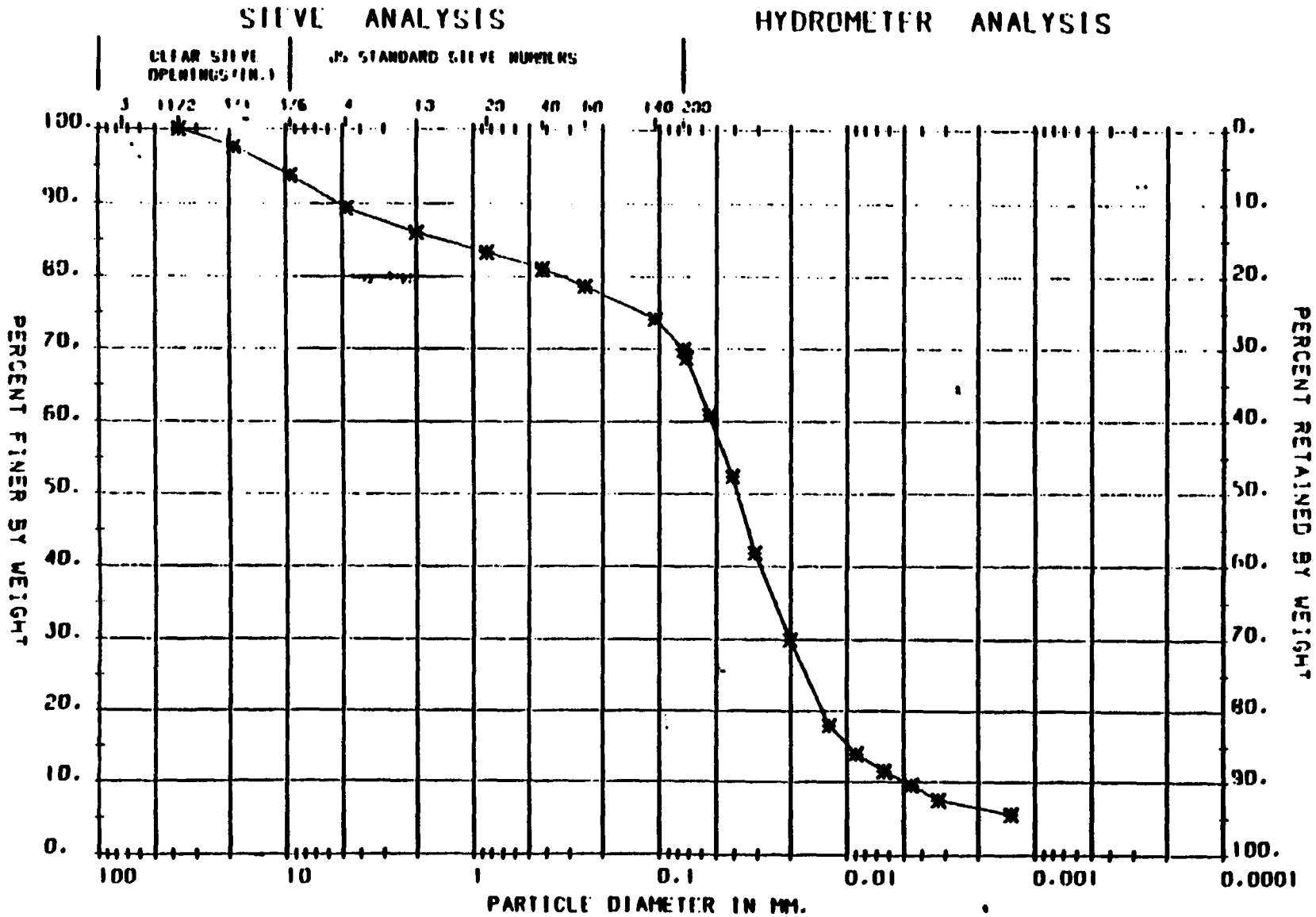
===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0810	52.9	50.0
0.0589	49.0	46.3
0.0430	44.1	41.7
0.0313	39.7	37.5
0.0193	35.3	33.4
0.0117	27.9	26.4
0.0085	23.5	22.2
0.0061	20.6	19.5
0.0044	16.6	15.8
0.0031	14.7	13.9
0.0013	11.8	11.1

CORRECTION FACTOR= 0.95

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 250.51
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 67.71
VISCOSITY OF WATER (MILLIPOISES)= 9.77

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WCX	CU	CZ
*	3770E	223	X	GRAV SILT-SOME SAND-TRACE GRAV•INC•3/4	NA	15.3	10.6	1.5
	SB-135	1	A-12					

0038

* * * * GRAIN SIZE ANALYSIS * * * *

-0039

========REDUCED RESULTS========

SB-135-01
11-12

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 223 DEPTH: X

ASSUMED SPECIFIC GRAVITY = 2.68

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	97.6
0.375IN.	9.500	93.7
NO. 4	4.750	89.3
NO. 10	2.000	85.9
NO. 20	0.850	83.2
NO. 40	0.425	81.0
NO. 60	0.250	78.6
NO. 140	0.106	74.1
NO. 200	0.075	69.8

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0723	71.1	68.7
0.0547	62.8	60.8
0.0412	54.1	52.3
0.0312	43.3	41.8
0.0202	30.9	29.9
0.0124	18.5	17.9
0.0090	14.4	13.9
0.0064	11.8	11.5
0.0046	9.8	9.5
0.0033	7.7	7.5
0.0013	5.7	5.5

CORRECTION FACTOR= 0.97

WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 675.31
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.53
VISCOSITY OF WATER (MILLIPOISES)= 9.77

CU= 10.6 CZ= 1.5

D60= 0.0533 D30= 0.0203 D10= 0.0050

MOSS AMERICAN
SEDIMENT
TREATMENT PARAMETERS
SAS No.: 3770E

Sample No.:	MA-SD309-01FR	MA-SD310-01	MA-SD311-01	MA-SD312-01	MA-SD313-01	MA-SD314-01	MA-SD315-01	MA-SD316-01	MA-SDFB02-01
TR No.:	/E55R Replicate	E56/E58	E59/E61	E62/E64	E65/E67	E68/E70	E71/E73	E74/E76	/E82 Field Blank
NANCO LAB:									
% Moisture	--	50	40	60	40	60	50	40	--
% Ash	--	55	60	29	51	45	44	42	--
% Volatile Matter	--	1 U	6	11	15	1 U	7	18	--
% Fixed Carbon	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--
VERSAR LAB:									
% Carbon (dry)	6.05	4.65	6.21	8.58	6.49	7.28	6.96	5.94	1.82
% Carbon (as rec'd)	3.84	3.21	3.92	3.8	3.88	3.7	3.91	3.28	1.82
% Oxygen (dry)	10.1	10.3	10.2	3.47	12.5	7.34	9.35	10.4	4.98
% Oxygen (as rec'd)	38.8	34.6	39.2	51	43.2	47.4	44.2	45.5	5.07
% Hydrogen (dry)	2.26 J	2.12 J	3.31 J	6.65 J	5.09 J	4.67 J	4.89 J	3.65 J	1 U
% Hydrogen (as rec'd)	5.52 J	4.92 J	6.22 J	9.18 J	7.54 J	7.88 J	7.65 J	7.03 J	1 U
% Nitrogen (dry)	1.6 U	1.4 U	1.6 U	2.3 U	1.7 U	2 U	1.8 U	1.8 U	1 U
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Ash (dry)	81.6	82.9	80.3	81.3	75.9	80.7	78.8	80	93.2
% Ash (as rec'd)	51.8	57.3	50.7	36	45.4	41	44.3	44.2	93.1
% Sulphur (dry)	1.6 U	1.4 U	1.6 U	2.3 U	1.7 U	2 U	1.8 U	1.8 U	1 U
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1	1 U	1 U
% Moisture	36.5	30.9	36.9	55.7	40.2	49.2	43.8	44.8	0.1
TOC (mg/kg)	23900	24700	28200	55100	28100	57100	55700	39500	1200
Chloride (mg/kg)	90.2	98.5	21.9	148	124	205	140	203	49.9
Flashpoint (degrees F)	134	129	141	133	131	127	134	125	>230
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U

MOSS-AMERICAN
SEDIMENT
VOLATILES

Sample No.:	MA-SD308-01	MA-SD309-01	MA-SD309-01FR	MA-SD310-01	MA-SD311-01	MA-SD312-01	MA-SD313-01	MA-SD314-01
TR No.:	EW818	EW819	EW828 Replicate	EW820	EW821	EW822	EW823	EW824
Parameter (ug/kg)								
Chloromethane	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Bromomethane	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Vinyl chloride	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Chloroethane	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Methylene chloride	12000	1500 J	4200 J	55 B	3100 J	2100 B	33000 J	2600 J
Acetone	4800 B	1900 U	3500 B	290	2500 B	5200 B	32000 J	12000 B
Carbon disulfide	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,1-Dichloroethene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,1-Dichloroethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,2-Dichloroethene (total)	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Chloroform	420 J	380 J	420 J	7 U	340 J	990 J	2000 U	960 J
1,2-Dichloroethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
2-Butanone	1500 B	2200 B	2000 B	67	1500 B	3200 B	4200 B	4100 B
1,1,1-Trichloroethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Carbon tetrachloride	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Vinyl acetate	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Bromodichloromethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,2-Dichloropropane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
cis-1,3-Dichloropropene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Trichloroethene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Dibromochloromethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,1,2-Trichloroethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Benzene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
trans-1,3-Dichloropropene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Bromoform	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
4-Methyl-2-pentanone	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
2-Hexanone	2200 U	1900 U	2000 U	15 U	1900 U	5500 U	4000 U	4700 U
Tetrachloroethene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
1,1,2,2-Tetrachloroethane	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Toluene	1100 U	230 J	1000 U	44	930 U	640 B	230 J	950 J
Chlorobenzene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Ethylbenzene	1100 U	960 U	1000 U	3 J	930 U	730 J	410 J	2300 U
Styrene	1100 U	960 U	1000 U	7 U	930 U	2800 U	2000 U	2300 U
Xylene (total)	1100 U	230 B	1000 U	10 B	110 B	1600 B	750 B	980 B

MOSS-AMERICAN
SEDIMENT
VOLATILES

SAMPLE DATES: 6/16/88 to 6/17/88

Sample No.:	MA-SD301-01	MA-SD302-01	MA-SD303-01	MA-SD304-01	MA-SD305-01	MA-SD306-01	MA-SD306-01FR	MA-SD307-01
TR No.:	EW811	EW812	EW813	EW814	EW815	EW816	EW827 Replicate	EW817
Parameter (ug/kg)								
Chloromethane	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Bromomethane	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Vinyl chloride	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Chloroethane	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Methylene chloride	8 U	8 U	7 U	300 B	6 B	790 J	630 J	1400 J
Acetone	190 B	24 B	110 B	470 B	77 B	2100 U	2000 U	2100 J
Carbon disulfide	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,1-Dichloroethene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,1-Dichloroethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,2-Dichloroethene (total)	8 U	8 U	7 U	36 U	6 U	1000 U	9990 U	1000 U
Chloroform	8 U	8 U	7 U	36 U	6 B	340 B	390 B	1000 U
1,2-Dichloroethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
2-Butanone	44 B	10 B	27 B	120 B	23 U	1800 B	1300 B	2400 B
1,1,1-Trichloroethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Carbon tetrachloride	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Vinyl acetate	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Bromodichloromethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,2-Dichloropropene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
cis-1,3-Dichloropropene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Trichloroethene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Dibromochloromethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,1,2-Trichloroethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Benzene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
trans-1,3-Dichloropropene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Bromoform	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
4-Methyl-2-pentanone	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
2-Hexanone	16 U	16 U	14 U	72 U	13 U	2100 U	2000 U	2100 U
Tetrachloroethene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
1,1,2,2-Tetrachloroethane	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Toluene	4 B	5 B	3 B	36 U	6 U	240 B	210 B	320 B
Chlorobenzene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Ethylbenzene	3 J	8 U	7 U	36 U	4 U	240 J	130 J	230 J
Styrene	8 U	8 U	7 U	36 U	6 U	1000 U	990 U	1000 U
Xylene (total)	8 U	8 U	7 U	36 U	6 U	260 B	130 B	520 B

MOSS-AMERICAN
SEDIMENTS
INORGANICS

Sample No.:	MA-SD307-01	MA-SD308-01	MA-SD309-01	MA-SD309-01FR	MA-SD310-01	MA-SD311-01	MA-SD312-01	MA-SD313-01	MA-SD314-01
TR No.:	MEW394	MEW395	MEW396	MEW405	MEW397	MEW398	MEW399	MEW400	MEW401
				Replicate					
Parameter									
Aluminum	10700	5980 J	14500 J	7440 J	6630 J	9330 J	11200 J	9080 J	14200 J
Antimony	0.97 B	1.7 J	R	R	0.77 J	R	R	R	1.1 J
Arsenic	7 J	4.2	5.1	4.8	5	6.4	5.5	4.4	3.5
Barium	85.4	30.6 J	93.1	71.1	58.8	70.5	90.9	62.1	87.6
Beryllium	0.21 B	0.6 B	1.3	0.71 J	0.74 J	0.51 B	1	0.73 J	0.83 J
Cadmium	6.3	4.4	7.6	4.9	5.9	6	5.9	5.2	7.6
Calcium	66000	101000	63200	70700	66300	61000	49400	119000	59600
Chromium	18.3 J	14.5	22.4	12.5	14.2	15.6	17.8	16.7	21
Cobalt	8.3 J	5.1 J	7.9 J	8.1 J	5.6 J	6.5 J	8.2 J	7.6 J	9.3 J
Copper	22.5 J	13.5	29.2	24	23.6	20.2	23.1	17.4	29.3
Iron	20200	14200	24200	16900	12900	18600	22800	16900	21500
Lead	58.2 J	52.6 J	30.5 J	35.7 J	24.6 J	19.7 J	20.2 J	18.4 J	33.7 J
Magnesium	26300	43200	27800	32500	26000	24200	20400	55900	25900
Manganese	682 J	725 J	478 J	551 J	338 J	555 J	485 J	662 J	399 J
Mercury	0.42 J	0.36	0.21 U	0.17 U	0.21	0.15 U	0.15 U	0.15 U	0.25
Nickel	18 J	14.5 B	31 B	15.8 B	15.7 B	21.5 B	22.9 B	23.4 B	29 B
Potassium	1380	750 B	1960 B	699 B	665 B	846 B	1070 B	1450 B	1670 B
Selenium	R	1.3 UJ	1.8 UJ	1.3 UJ	1.2 UJ	1.2 UJ	1.4 UJ	1.2 UJ	1.4 UJ
Silver	R	R	R	R	R	R	R	R	R
Sodium	1060 B	763 B	931 B	795 B	502 B	801 B	873 B	903 B	866 B
Thallium	0.35 UJ	0.37 UJ	0.52 U	0.36 U	0.33 UJ	0.33 U	0.4 U	0.33 UJ	0.39 U
Vanadium	29.9 J	19.6	28.5	23.9	16.5	22.1	27.9	21.4	30.9
Zinc	354 J	290 J	554 J	337 J	913 J	368 J	442 J	263 J	569 J
Cyanide	3.9 UJ	R	R	R	R	R	R	R	R

MOSS-AMERICAN
SEDIMENTS
INORGANICS

Sample No.:	MA-SDFB01-01	MA-SDFB02-01	MA-SD301-01	MA-SD302-01	MA-SD303-01	MA-SD304-01	MA-SD305-01	MA-SD306-01	MA-SD306-01FR
TR No.:	MEW406 Field Blank	MEW407 Field Blank	MEW388	MEW389	MEW390	MEW391	MEW392	MEW393	MEW404 Replicate
Parameter	Conc. (mg/kg)								
Aluminum	972	876	7820	9380	9710	8820	3330	11000	11500
Antimony	R	R	4.5 J	R	0.74 B	R	R	0.82 B	1.1 B
Arsenic	0.87 J	0.37 U	4.4 J	4.5 J	4.9 J	4 J	10.1 J	5.8 J	6 J
Barium	8.1 U	8.4 U	62.8	74.6	82.2	62.1	19.3 J	82.8	75.6
Beryllium	0.14 UJ	0.14 B	0.24 UJ	0.56 B	0.45 B	0.35 B	0.17 B	0.71 J	0.68 B
Cadmium	0.97	0.5 U	4.4	5.9	6.2	4.3	4.1 J	6.9	7.1
Calcium	42500	43400	100000	80200	79900	76600	116000	91200	92000
Chromium	6.8 J	4.7	32.6 J	24.8 J	23.6 J	16.2 J	10.6 J	23.5 J	21.6 J
Cobalt	3.6 J	2.3 U	8.1 J	7.1 J	7.4 J	6 J	7.9 J	9.8 J	8.9 J
Copper	2.3 J	1.8 U	33.2 J	45.5 J	27.1 J	20.6 J	14.6 J	27.5 J	23.3 J
Iron	3570	12100	16300	16900	18700	17800	28100	20400	22800
Lead	2.7 J	0.82 B	143 J	213 J	187 J	130 J	25.4 J	108 J	91.5 J
Magnesium	21500	17700	37800	36500	33900	36100	61800	37900	40300
Manganese	121 J	89.1 J	448 J	366 J	564 J	645 J	551 J	788 J	945 J
Mercury	R	0.09 U	0.21 J	0.42 J	0.3 J	0.31 J	R	0.31 J	R
Nickel	3.1 UJ	3.4 B	24.4 J	18 J	17.5 J	19 J	16.4 J	23.6 J	21.4 J
Potassium	73.9 U	76 U	1050	1410	1390	1320	466 J	1830	1840
Selenium	R	0.79 U	R	R	R	1.3 J	R	R	R
Silver	R	R	R	R	R	R	R	R	R
Sodium	422 B	192 B	1190	1200	1120 B	1230	1250	1220	1190 B
Thallium	0.22 UJ	0.22 U	0.39 UJ	0.36 UJ	0.36 UJ	0.37 UJ	0.29 UJ	0.39 UJ	0.4 UJ
Vanadium	7 J	5.4 U	19.3 J	22.9 J	22.4 J	22.8 J	17 J	28.2 J	27.2 J
Zinc	74.3 J	77.4 J	298 J	493 J	279 J	359 J	230 J	288 J	304 J
Cyanide	2.4 UJ	R	4.2 UJ	4 UJ	3.5 UJ	3.8 UJ	3.1 UJ	4 UJ	3.9 UJ

MOSS AMERICAN
SEDIMENT
TREATMENT PARAMETERS
SAS No.: 3770E

Sample No.:	MA-SD301-01	MA-SD302-01	MA-SD303-01	MA-SD304-01	MA-SD305-01	MA-SD306-01	MA-SD306-01FR	MA-SD307-01	MA-SD308-01	MA-SD309-01
TR No.:	E29/E31	E32/E34	E35/E37	E38/E40	E41/E43	E44/E46	/E46R Replicate	E47/E49	E50/E52	E53/E55
NANCO LAB:										
% Moisture	55	50	30	36	10	50	--	50	45	40
% Ash	59	49	56	54	66	51	--	52	49	45
% Volatile Matter	0 U	2	15	14	36	4	--	1 U	7	15
% Fixed Carbon	1 U	1 U	1 U	1 U	1 U	1 U	--	1 U	1 U	1 U
VERSAR LAB:										
% Carbon (dry)	5.38	7.32	4.81	5.55	3.65	6.76	7.07	5.51	6.52	5.35
% Carbon (as rec'd)	2.84	4.58	3.12	3.5	2.79	3.86	4.01	3.52	4.1	3.32
% Oxygen (dry)	14.7	14.2	10.2	9.08	14	12.5	10.9	8.56	10.2	9.21
% Oxygen (as rec'd)	49.7	42.1	37.8	38.5	31.7	45.2	44.7	37.5	39.4	39.4
% Hydrogen (dry)	1.32 J	0.57 J	3.3 J	3.08 J	0.23 J	0.52 J	2.39 J	1.53 J	1.89 J	2.85 J
% Hydrogen (as rec'd)	5.98 J	4.54 J	6.07 J	6.07 J	2.82 J	5.1 J	6.2 J	5.02 J	5.34 J	6.01 J
% Nitrogen (dry)	1.9 U	1.6 U	1.5 U	1.6 U	1.3 U	1.8 U	1.8 U	1.6 U	1.6 U	1.6 U
% Nitrogen (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Ash (dry)	78.6	77.9	81.7	82.3	82.1	80.2	79.6	84.4	81.4	82.6
% Ash (as rec'd)	41.5	48.8	53	51.9	62.7	45.8	45.1	53.9	51.2	51.3
% Sulphur (dry)	1.9 U	1.6 U	1.5 U	1.6 U	1.3 U	1.8 U	1.8 U	1.6 U	1.6 U	1.6 U
% Sulphur (as rec'd)	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
% Moisture	47.2	37.4	35.1	36.9	23.6	42.9	43.3	36.1	37.1	37.9
TOC (mg/kg)	26700	36100	19300	26600	10100	32900	31700	28900	24800	29600
Chloride (mg/kg)	142	192	95.5	67.8	34	61.3	58.4	45.4	61.8	75.4
Flashpoint (degrees F)	131	130	138	135	135	142	131	128	124	133
BTU (per lb.)	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U

MOSS-AMERICAN
SEDIMENTS
INORGANICS

Sample No.:	MA-SD315-01		MA-SD316-01	
TR No.:	MEW402		MEW403	
Parameter				
Aluminum	13500	J	12900	J
Antimony		R		R
Arsenic	4.8		8	
Barium	92.4		82.7	
Beryllium	0.92	J	1.1	
Cadmium	14.1		6.3	
Calcium	49600		67900	
Chromium	18.7		21.7	
Cobalt	11.5		11.4	
Copper	30.6		32.4	
Iron	21100		22600	
Lead	35.5	J	117	J
Magnesium	23300		28100	
Manganese	296	J	476	J
Mercury	0.43		0.16	U
Nickel	24.2	B	19.8	B
Potassium	1310	B	1330	B
Selenium	1.5	B	1.5	UJ
Silver		R		R
Sodium	795	B	845	B
Thallium	0.41	U	0.42	UJ
Vanadium	30.7		26.7	
Zinc	2200	J	621	J
Cyanide		R		R

GROUNDWATER DATA

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY M.W. — DATE 7-22-88
PROJECT NO 3337706 — CALC. BY RDH — DATE 7-25-88
B H NO SMDE — SAMPLE 213 — CHECKED BY BK — DATE 7-26-88
SAMPLE DEPTH —
SOIL DESCRIPTION light brown clay

SB-04D-10
15-17'

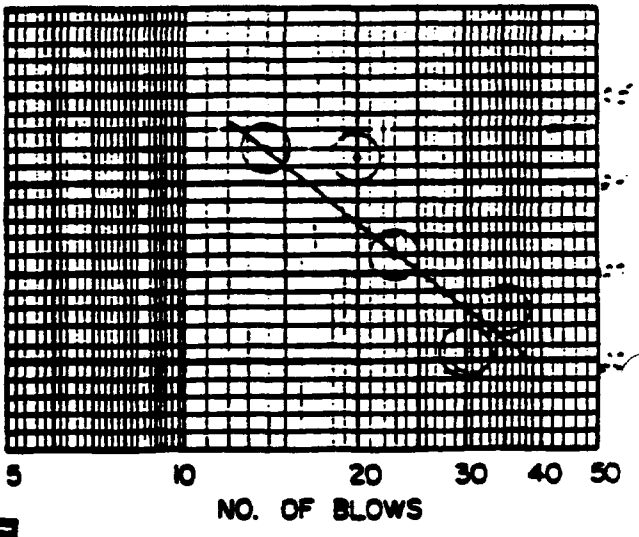
LIQUID LIMIT Material is sieved -40

Determination No.	1	2	3	4	5
Container No.	m_1	m_2	m_3	m_4	m_5
Wt of Container + Wet Soil, gm	13.36	13.43	11.28	11.53	12.72
Wt. of Container + Dry Soil, gm	11.15	11.24	9.41	9.54	10.49
Wt. of Water, W_w, gm					
Wt of Container, gm	1.35	1.34	1.35	1.34	1.34
Wt. of Dry Soil, W_s, gm					
Water Content, w, %	22.6	22.1	23.2	24.3	24.4
No of Blows	35	30	23	20	14

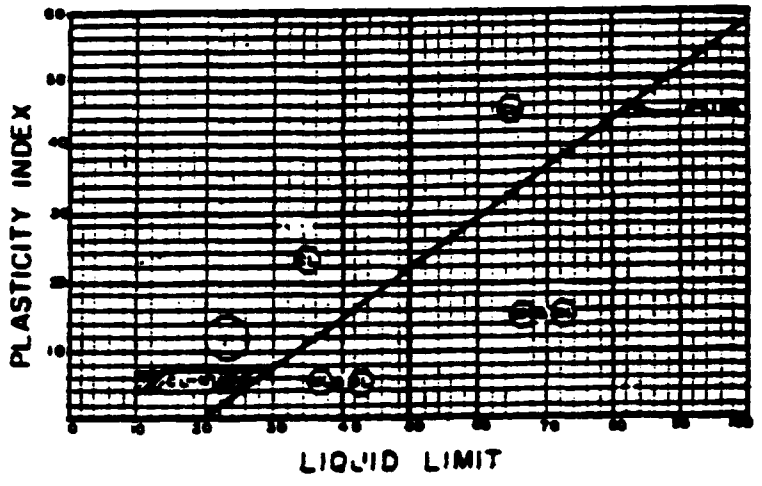
PLASTIC LIMIT

Determination No.	1	2	3
Container No.	m_6	m_7	m_8
Wt of Container + Wet Soil, gm	7.06	6.73	6.87
Wt. of Container + Dry Soil, gm	6.50	6.22	6.33
Wt. of Water, W_w, gm			
Wt of Container, gm	1.34	1.35	1.34
Wt of Dry Soil, W_s, gm			
Water Content, w, %	10.9	10.5	10.8
		10.7	

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	23
PLASTIC LIMIT	11
PLASTICITY INDEX	12
NATURAL WATER CONTENT	3.3
USCS SYMBOL	CL

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY M.W. — DATE 7-22-88
PROJECT NO 3770 E — CALC BY ADH — DATE 7-25-88
B H NO SB10E — SAMPLE 214 — CHECKED BY RG — DATE 7-26-88
SAMPLE DEPTH
SOIL DESCRIPTION Light brown low clay

SB-04D-10
15-17'

LIQUID LIMIT Plate 16.1 is SIEVA-4C

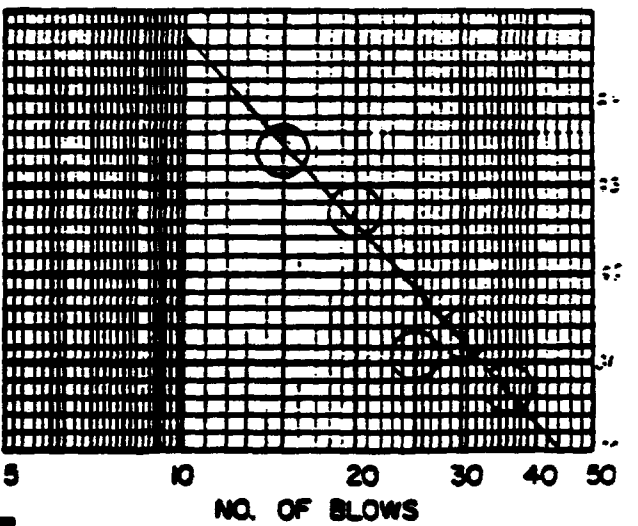
Determination No.	1	2	3	4	5
Container No.	m_9	m_{10}	m_{11}	m_{12}	m_{13}
Wt of Container + Wet Soil, gm	13.08	12.76	14.70	15.90	12.49
Wt. of Container + Dry Soil, gm	11.63	10.76	12.37	13.21	10.38
Wt. of Water, W_w, gm					
Wt of Container, gm	1.35	1.35	1.34	1.36	1.35
Wt of Dry Soil, W_s, gm					
Water Content, w, %	20.3	21.3	21.1	22.3	23.4
No of Blows	36	30	25	20	15

PLASTIC LIMIT

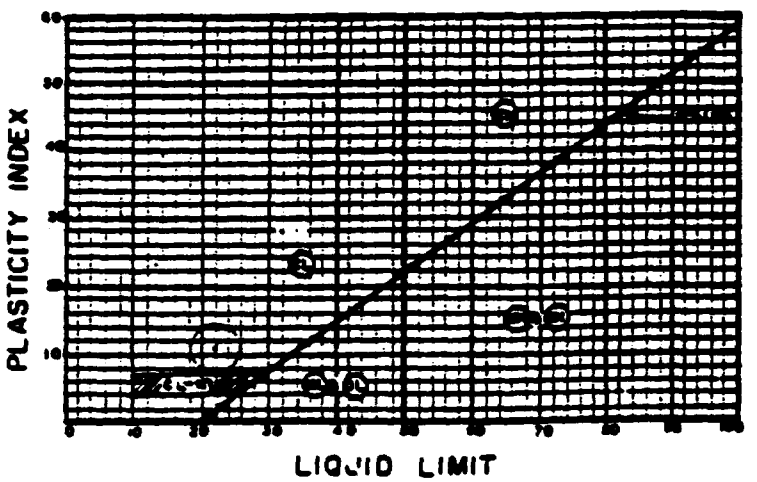
Determination No.	1	2	3
Container No.	m_{14}	m_{15}	m_{16}
Wt of Container + Wet Soil, gm	6.93	6.95	7.59
Wt of Container + Dry Soil, gm	6.39	6.46	6.96
Wt. of Water, W_w, gm			
Wt of Container, gm	1.35	1.35	1.35
Wt of Dry Soil, W_s, gm			
Water Content, w, %	10.7	10.9	11.2

10.9

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	22
PLASTIC LIMIT	11
PLASTICITY INDEX	11
NATURAL WATER CONTENT	5.3
USCS SYMBOL	CL

0121

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY ADH — DATE 1-25-88
PROJECT NO 30330 E — CALC. BY ADH — DATE 2-26-88
B H NO SITE — SAMPLE 22C — CHECKED BY EG — DATE 2/28/88
SAMPLE DEPTH
SOIL DESCRIPTION brown silty clay

SB-02S-1
16-18'

LIQUID LIMIT Material Is Sieved -40

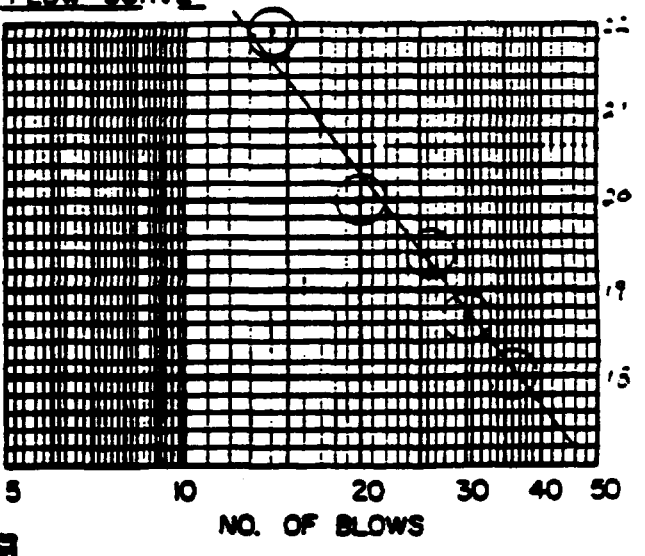
Determination No.	1	2	3	4	5
Container No.	R1	R2	R3	R4	R5
Wt. of Container + Wet Soil, gm	21.71	19.81	21.07	18.70	21.54
Wt. of Container + Dry Soil, gm	18.73	17.05	18.02	15.96	18.33
Wt. of Water, W_w, gm					
Wt of Container, gm	2.23	2.26	2.21	2.24	2.21
Wt. of Dry Soil, W_s, gm					
Water Content, w, %	18.1	18.7	19.8	20.0	21.9
No of Blows	36	30	26	20	14

PLASTIC LIMIT

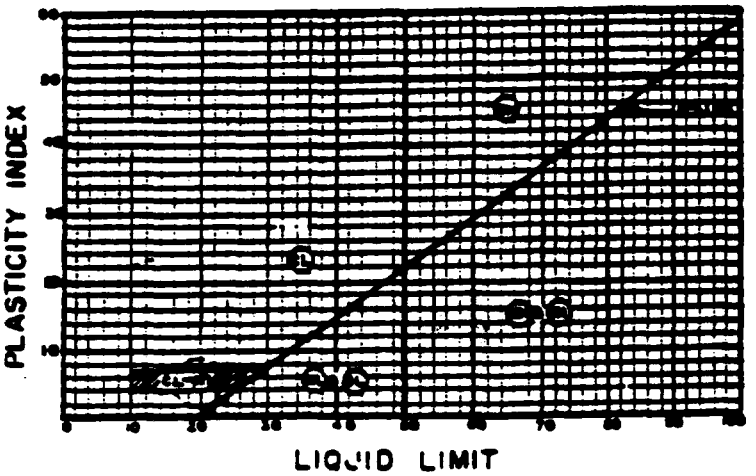
Determination No.	1	2	3
Container No.	R6	R7	R8
Wt of Container + Wet Soil, gm	9.29	9.06	10.11
Wt. of Container + Dry Soil, gm	6.66	8.23	9.11
Wt. of Water, W_w, gm			
Wt of Container, gm	2.20	2.23	2.24
Wt of Dry Soil, W_s, gm			
Water Content, w, %	14.1	13.8	14.6
		14.2	

WATER CONTENT

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	19
PLASTIC LIMIT	14
PLASTICITY INDEX	5
NATURAL WATER CONTENT	16.8
USCS SYMBOL	CL-ML

U120

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY KDH — DATE 7-25-88
PROJECT NO 153306 — CALC. BY KDH — DATE 7-26-88
B.H NO 3MW5 — SAMPLE 2S — CHECKED BY RJG — DATE 7-29-88
SAMPLE DEPTH —
SOIL DESCRIPTION Gray silty clay - some fine sand

SB-08D-6
4-6'

LIQUID LIMIT Material is sieved -40

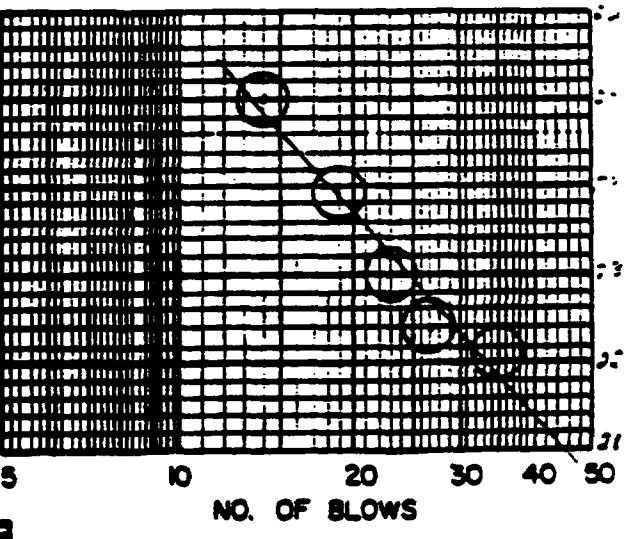
Determination No.	1	2	3	4	5
Container No.	D1	D2	D3	D4	D5
Wt. of Container + Wet Soil, gm	22.83	21.33	15.11	21.88	23.00
Wt. of Container + Dry Soil, gm	19.11	17.83	12.70	18.09	18.65
Wt. of Water, W_w, gm					
Wt of Container, gm	2.26	2.20	2.23	2.23	2.24
Wt. of Dry Soil, W_s, gm					
Water Content, w, %	22.1	22.4	23.0	23.9	25.0
No of Blows	35	27	23	19	14

PLASTIC LIMIT

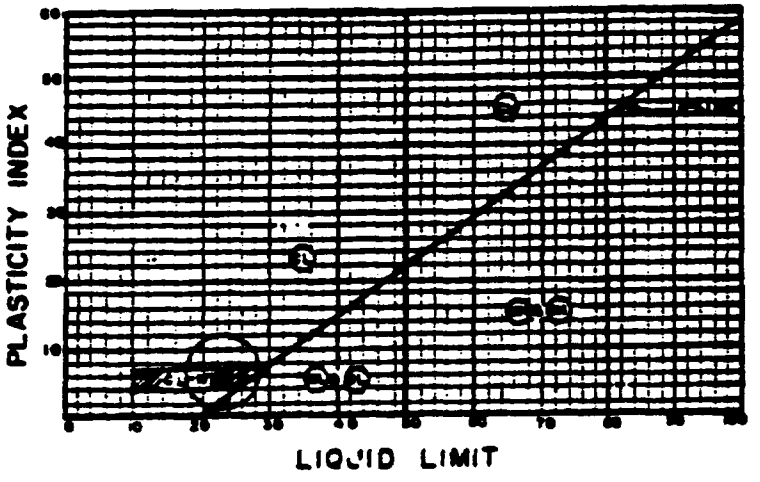
Determination No.	1	2	3
Container No.	D6	D7	D8
Wt of Container + Wet Soil, gm	7.77	8.85	9.27
Wt. of Container + Dry Soil, gm	7.02	7.91	8.27
Wt. of Water, W_w, gm			
Wt of Container, gm	2.25	2.23	2.22
Wt. of Dry Soil, W_s, gm			
Water Content, w, %	15.7	16.5	16.5

16.2

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	≈ 23
PLASTIC LIMIT	16
PLASTICITY INDEX	≈ 7
NATURAL WATER CONTENT	14.6
USCS SYMBOL	CL-ML

Group 4

U122

ATTERBERG LIMITS TESTS

PROJECT U.S EPA — TESTED BY RDH — DATE 7-25-88
PROJECT NO. SAP 3730E — CALC. BY RDH — DATE 7-26-88
B.H NO. 3MOC — SAMPLE 221 — CHECKED BY BG — DATE 7-28-88
SAMPLE DEPTH —
SOIL DESCRIPTION Brown [redacted] loamy clay

SB-06S-D1
10-12'

LIQUID LIMIT -40 SIEVE Material is sieved -40

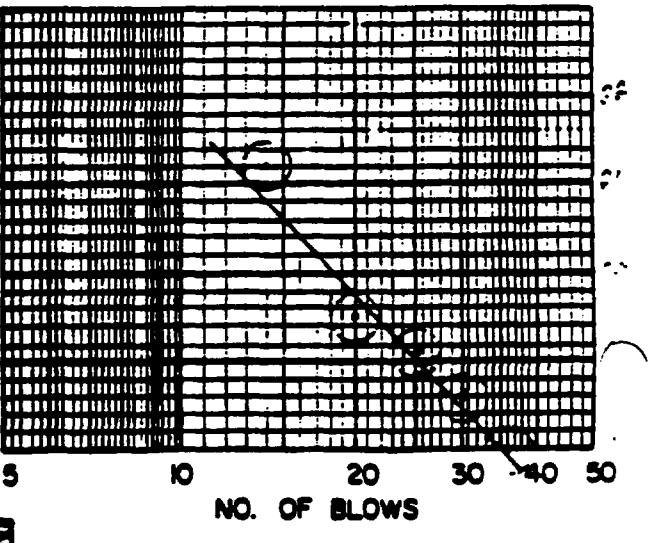
Determination No	1	2	3	4	5
Container No.	R9	R10	R11	R12	R13
Wt. of Container + Wet Soil, gm	20.86	17.31	17.95	15.16	21.23
Wt. of Container + Dry Soil, gm	18.01	15.29	15.43	13.05	17.80
Wt. of Water, W_w, gm					
Wt of Container, gm	2.22	2.25	2.26	2.25	2.21
Wt. of Dry Soil, W_s, gm					
Water Content, w, %	18.6	18.6	19.1	19.5	21.2
No. of Blows	36	30	25	20	14

PLASTIC LIMIT

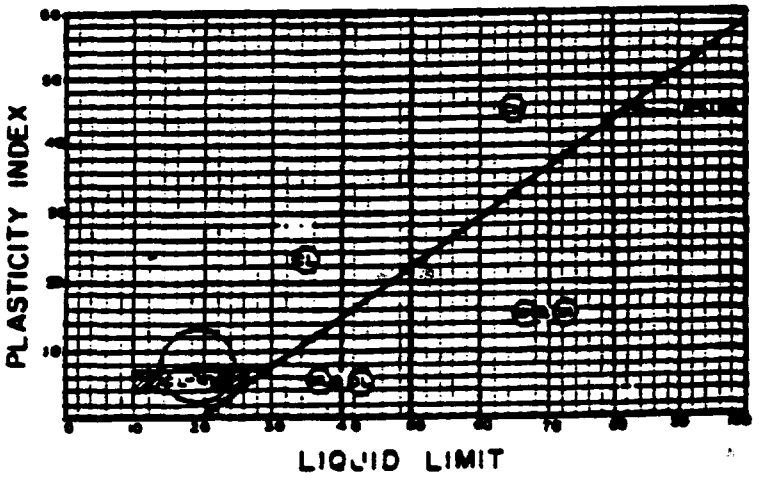
Determination No.	1	2	3
Container No.	R14	R15	R16
Wt. of Container + Wet Soil, gm	8.05	8.25	7.42
Wt. of Container + Dry Soil, gm	7.47	8.12	6.94
Wt. of Water, W_w, gm			
Wt of Container, gm	2.21	2.29	2.22
Wt of Dry Soil, W_s, gm			
Water Content, w, %	11.0	10.7	10.2

10.6

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	19
PLASTIC LIMIT	11
PLASTICITY INDEX	8
NATURAL WATER CONTENT	13.9
USCS SYMBOL	CL-[redacted]

Group A

-0123

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY RDH — DATE 7-25-88
PROJECT NO 3772E — CALC. BY RDH — DATE 7-26-88
B.H NO SB11E — SAMPLE 222 — CHECKED BY [illegible] — DATE 7-28-88
SAMPLE DEPTH
SOIL DESCRIPTION Brown silty clay

SB-11S-02
16-17'

LIQUID LIMIT -40 sieve Material is sieved -40

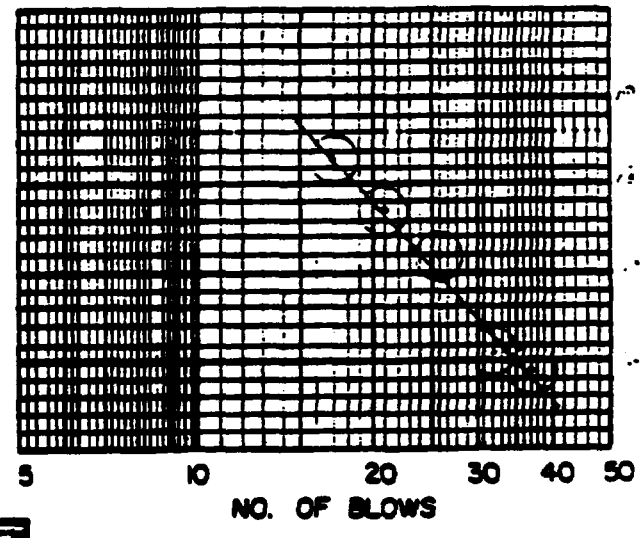
Determination No.	1	2	3	4	5
Container No.	B1	B2	B3	B4	B5
Wt. of Container + Wet Soil, gm	13.46	18.64	13.34	10.94	21.53
Wt. of Container + Dry Soil, gm	15.37	16.37	12.08	9.66	18.54
Wt. of Water, W_w, gm					
Wt of Container, gm	2.25	2.23	2.24	2.26	2.21
Wt. of Dry Soil, W_s, gm					
Water Content, w, %	15.9	16.1	17.2	17.4	18.3
No of Blows	37	32	26	21	17

PLASTIC LIMIT

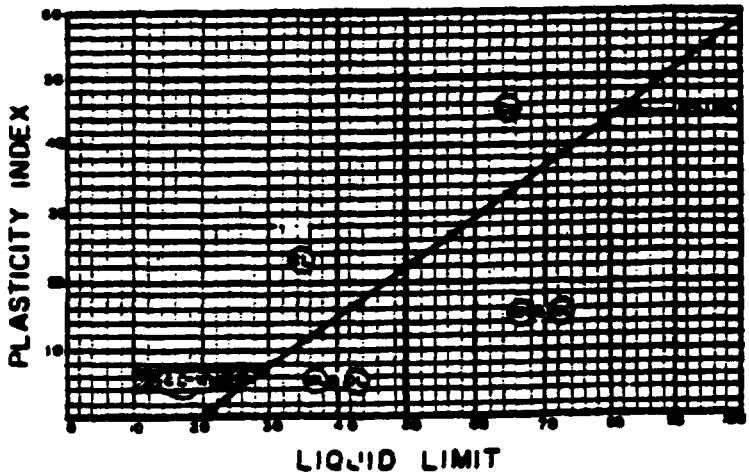
Determination No.	1	2	3
Container No.	B6	B7	B8
Wt of Container + Wet Soil, gm	6.72	7.32	10.56
Wt. of Container + Dry Soil, gm	8.11	6.87	9.77
Wt. of Water, W_w, gm			
Wt of Container, gm	2.23	2.26	2.25
Wt of Dry Soil, W_s, gm			
Water Content, w, %	10.4	9.8	10.5

10.2

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	17
PLASTIC LIMIT	10
PLASTICITY INDEX	7
NATURAL WATER CONTENT	13.6
USCS SYMBOL	CL-ML

ATTERBERG LIMITS TESTS

PROJECT USEPA — TESTED BY ZOH — DATE 3-25-88
PROJECT NO 13330E — CALC. BY — — DATE —
B.H NO 317E — SAMPLE 223 — CHECKED BY ETG — DATE 7-28-88
SAMPLE DEPTH —
SOIL DESCRIPTION ~~[illegible]~~

SB-135-01
11-12'

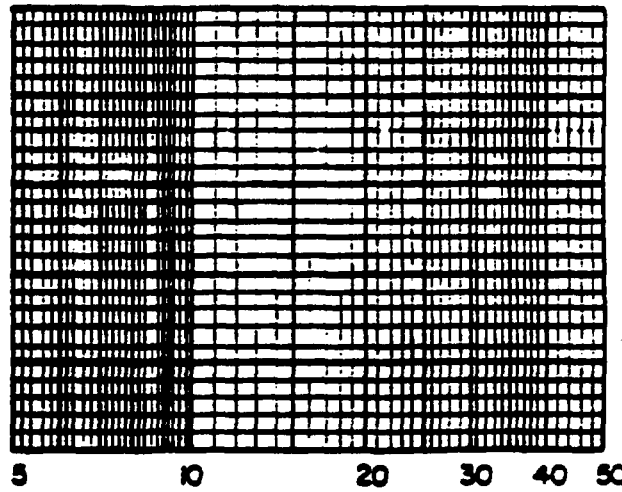
LIQUID LIMIT - 40 sieve Material is sieved -40

Determination No.	1	2	3	4	5
Container No.	50	51	52	53	54
Wt. of Container + Wet Soil, gm		N	O	N	
Wt. of Container + Dry Soil, gm		PLAST	IC		
Wt. of Water, W_w, gm					
Wt of Container, gm	2.24	2.22	2.24	2.24	2.22
Wt. of Dry Soil, W_s, gm					
Water Content, w, %					
No of Blows					

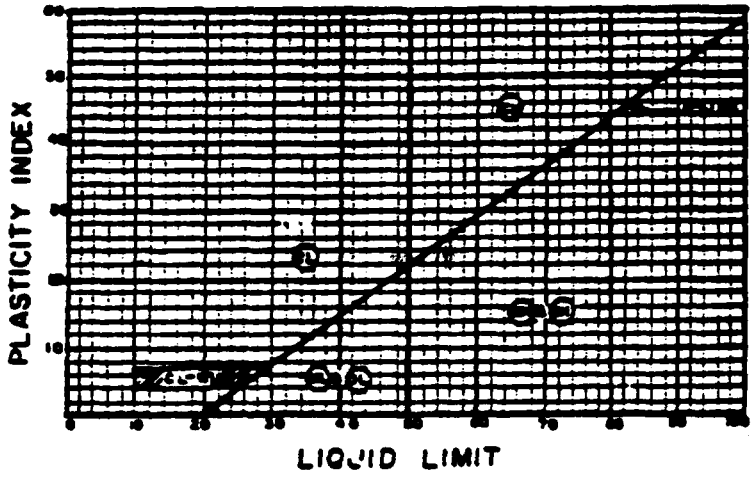
PLASTIC LIMIT

Determination No.	1	2	3
Container No.	55	56	57
Wt. of Container + Wet Soil, gm	N	O	N
Wt. of Container + Dry Soil, gm	PL	AS	TIC
Wt. of Water, W_w, gm			
Wt of Container, gm	2.22	2.23	2.26
Wt of Dry Soil, W_s, gm			
Water Content, w, %			

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS

LIQUID LIMIT	
PLASTIC LIMIT	
PLASTICITY INDEX	
NATURAL WATER CONTENT	15.3
USCS SYMBOL	

IT CORPORATION

Group M

0125

WATER CONTENT TESTS
COMPUTER PROGRAM WATER$

PROJECT USEPA — TESTED BY RDH — DATE 7-13-88
PROJECT NO. 3770E — CALCULATED BY RDH — DATE 7-13-88
CHECKED BY [signature] — DATE 7-18-88

NO. OF BORINGS	DEPTH UNITS (b)
PROJECT NO.	BORING NO.

(b) 0 - FEET
1 - METERS

COMPUTER INPUT

+ +	SAMPLE NUMBER	213	214	215	216	217	218	219	220
+ +	DEPTH, m or ft.	GRAB	GRAB	5'-6	01-0	09-1	10-1	1	GRAB
+ +	TARE NUMBER	K10	C-C1	17	2	289	C 4	336	93.5
+ +	WT. TARE + WS, gm	90.48	76.47	166.96	189.61	188.29	83.01	166.85	100.52
+ +	WT. TARE + DS, gm	88.78	74.60	153.03	177.36	182.31	79.58	152.56	92.68
	WT. WATER, gm	—	—	—	—	—	—	—	—
	WT. TARE, gm	42.89	39.31	103.90	108.60	105.98	59.19	105.35	46.72
	WT. DS, gm	—	—	—	—	—	—	—	—
	W, %	3.3	5.3	14.6	8.2	7.8	8.5	13.8	16.8
	COMMENTS								

+ +	SAMPLE NUMBER	221	222	223					999
+ +	DEPTH, m. or ft.	—	11-2	—					0
+ +	TARE NUMBER	21	1001	257					0
+ +	WT. TARE+ WS, gm	175.76	169.49	239.40					
+ +	WT. TARE+ DS, gm	167.27	150.88	217.47					
	WT. WATER, gm	—	—	—					
	WT. TARE, gm	106.02	43.27	106.63					
	WT. DS, gm	—	—	—					
	W, %	13.9	12.6	15.3					
	COMMENTS								

* USE STANDARD WC% FOR ASTM
SAMPLE WAS NOT ENOUGH FOR WC%

\+ FOR COMPUTER USE ONLY

ASTM D2216-80 water Content Requires 100 gm minim wet samples for WC% Analysis

* * * * GRAIN SIZE ANALYSIS * * * *

0041

========REDUCED RESULTS========

SB-133-01
11-12'

PROJECT NAME: USEPA

PROJECT NO.: SAS 3770E BORING NO.: 3770E

SAMPLE NO.: 223 DEPTH: x

ASSUMED SPECIFIC GRAVITY = 2.68

===SIEVE ANALYSIS===

SIEVE NO.	DIAMETER IN MM	PERCENT FINER
3.0 IN.	75.000	100.0
1.5 IN.	37.500	100.0
0.75 IN.	19.000	100.0
0.375IN.	9.500	96.0
NO. 4	4.750	91.4
NO. 10	2.000	88.0
NO. 20	0.850	85.3
NO. 40	0.425	83.0
NO. 60	0.250	80.5
NO. 140	0.106	75.9
NO. 200	0.075	71.5

===HYDROMETER ANALYSIS===

DIAMETER IN MM	PERCENT FINER	CORRECTED PERCEN
0.0723	72.8	70.4
0.0547	64.4	62.3
0.0412	55.4	53.6
0.0312	44.3	42.9
0.0202	31.7	30.6
0.0124	19.0	18.4
0.0090	14.8	14.3
0.0064	12.1	11.7
0.0046	10.0	9.7
0.0033	7.9	7.7
0.0013	5.8	5.6

CORRECTION FACTOR= 0.97

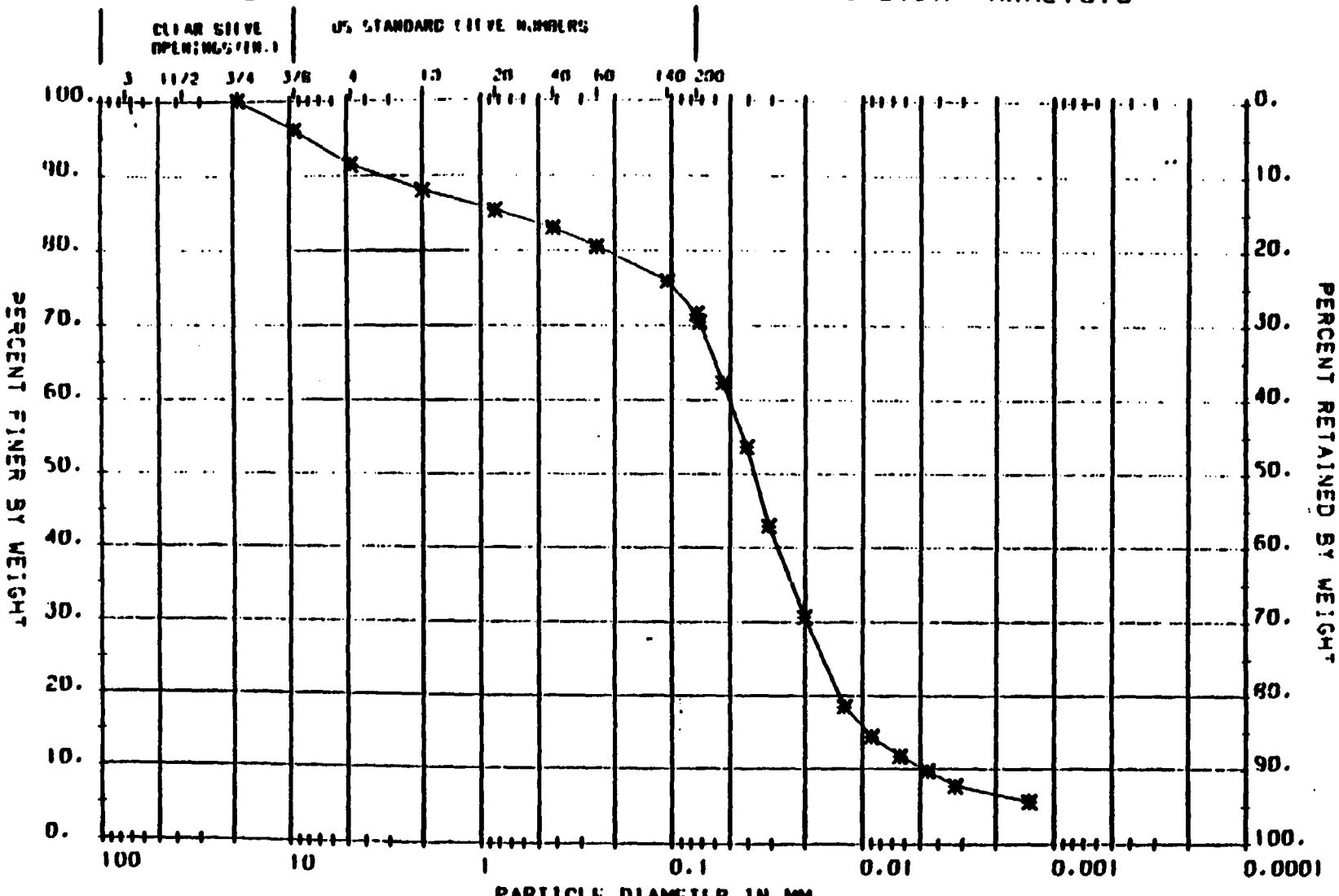
WT. OF SOIL FOR SIEVE ANALYSIS (GM)= 659.09
WT. OF SOIL FOR HYDROMETER ANALYSIS (GM)= 66.53
VISCOSITY OF WATER (MILLIPOISES)= 9.77

CU= 10.5 CZ= 1.6

D60= 0.0508 D30= 0.0197 D10= 0.0048

GRAIN SIZE ANALYSIS
PROJECT NAME: USEPA
PROJECT NO.: SAS 3770E

SILT ANALYSIS | HYDROMETER ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

	BORING	SAMPLE	DEPTH	SOIL DESCRIPTION	USCS	WC%	CU	CZ
*	3770E	223	X	GRAY SILT-SOME SAND-TRACE GRAV+(XC+3/4	NA	15.3	10.5	1.6
	SB-13	1	11-12					

0040

MOSS-AMERICAN
SEDIMENT
DIOXIN

Sample No.:	MA-SD315-01	MA-SD316-01
TR No.:	E72	E75
Parameter		
Tetrachloro furan (Total)	0.045 U	0.014 U
Tetrachloro furan (2,3,7,8)	0.045 U	0.014 U
Pentachloro furan	0.079 U	0.033 U
Hexachloro furan	0.036 U	0.028 U
Heptachloro furan	0.067 U	0.056 U
Octachloro furan	0.40 U	0.27 U
Tetrachloro dioxin (Total)	0.022 U	0.018 U
Tetrachloro dioxin (2,3,7,8)	0.022 U	0.018 U
Pentachloro dioxin	0.090 U	0.031 U
Hexachloro dioxin	0.034 U	0.030 U
Heptachloro dioxin	0.14 U	0.12 U

MOSS-AMERICAN
SEDIMENT
DIOXIN

Sample No.:	MA-SD307-01	MA-SD308-01	MA-SD309-01	MA-SD309-01FR	MA-SD310-01	MA-SD311-01	MA-SD312-01	MA-SD313-01	MA-SD314-01
TR No.:	E48	E51	E54	E81	E57	E60	E63	E66	E69
				Replicate					
Parameter									
Tetrachloro furan (Total)	R	0.045 U	0.094 U	0.040 U	0.015 U	0.081 U	R	R	0.096 U
Tetrachloro furan (2,3,7,8)	R	0.045 U	0.094 U	0.040 U	0.015 U	0.081 U	R	R	0.096 U
Pentachloro furan	R	0.052 U	0.12 U	0.059 U	0.046 U	0.091 U	R	R	0.095 U
Hexachloro furan	R	0.033 U	0.040 U	0.048 U	0.032 U	0.036 U	R	R	0.066 U
Heptachloro furan	R	0.053 U	0.12 U	0.16 U	0.058 U	0.050 U	R	R	0.078 U
Octachloro furan	R	0.20 U	0.20 U	0.50 U	0.26 U	0.34 U	R	R	0.49 U
Tetrachloro dioxin (Total)	R	0.024 U	0.033 U	0.016 U	0.022 U	0.027 U	R	R	0.035 U
Tetrachloro dioxin (2,3,7,8)	R	0.024 U	0.033 U	0.016 U	0.022 U	0.027 U	R	R	0.035 U
Pentachloro dioxin	R	0.056 U	0.14 U	0.069 U	0.045 U	0.073 U	R	R	0.13 U
Hexachloro dioxin	R	0.039 U	0.064 U	0.039 U	0.030 U	0.030 U	R	R	0.062 U
Heptachloro dioxin	R	0.10 U	0.28 U	0.30 U	0.082 U	0.085 U	R	R	0.15 U

MOSS-AMERICAN
SEDIMENT
VOLATILES

Sample No.:	MA-SD315-01	MA-SD316-01	MA-SDFB01-01	MA-SDFB02-01
TR No.:	EW825	EW826	EW829 Field Blank	EW830 Field Blank
Parameter (ug/kg)				
Chloromethane	91 U	18 U	10 U	10 U
Bromomethane	91 U	18 U	10 U	10 U
Vinyl chloride	91 U	18 U	10 U	10 U
Chloroethane	91 U	18 U	10 U	10 U
Methylene chloride	330 B	72 B	5 U	22 B
Acetone	450 B	330	4 B	14 B
Carbon disulfide	46 U	9 U	5 U	5 U
1,1-Dichloroethene	46 U	9 U	5 U	5 U
1,1-Dichloroethane	46 U	9 U	5 U	5 U
1,2-Dichloroethene (total)	46 U	9 U	5 U	5 U
Chloroform	46 U	9 U	2 J	5 U
1,2-Dichloroethane	46 U	9 U	5 U	5 U
2-Butanone	150 B	87	4 B	10 U
1,1,1-Trichloroethane	46 U	9 U	5 U	5 U
Carbon tetrachloride	46 U	9 U	5 U	5 U
Vinyl acetate	91 U	18 U	10 U	10 U
Bromodichloromethane	46 U	9 U	5 U	5 U
1,2-Dichloropropane	46 U	9 U	5 U	5 U
cis-1,3-Dichloropropene	46 U	9 U	5 U	5 U
Trichloroethene	46 U	9 U	5 U	5 U
Dibromochloromethane	46 U	9 U	5 U	5 U
1,1,2-Trichloroethane	46 U	9 U	5 U	5 U
Benzene	46 U	9 U	5 U	5 U
trans-1,3-Dichloropropene	46 U	9 U	5 U	5 U
Bromoform	46 U	9 U	5 U	5 U
4-Methyl-2-pentanone	91 U	18 U	10 U	10 U
2-Hexanone	91 U	18 U	10 U	10 U
Tetrachloroethene	46 U	9 U	5 U	5 U
1,1,2,2-Tetrachloroethane	46 U	9 U	5 U	5 U
Toluene	46 U	9 U	5 B	8 B
Chlorobenzene	46 U	9 U	5 U	5 U
Ethylbenzene	46 U	9 U	5 U	5 U
Styrene	46 U	9 U	5 U	5 U
Xylene (total)	46 U	9 U	5 U	2 J

MOSS-AMERICAN
SEDIMENT
DIOXIN

Sample No.:	MA-SDFB01-01	MA-SDFB02-01	MA-SD301-01	MA-SD302-01	MA-SD303-01	MA-SD304-01	MA-SD305-01	MA-SD306-01	MA-SD306-01FR
TR No.:	E01 Field Blank	E02 Field Blank	E30	E33	E36	E39	E42	E45	E78 Replicate
Parameter	Conc. (ng/g)								
Tetrachloro furan (Total)	0.0075 U	0.0054 U	0.065 U	0.020 U	0.013 U	0.020 U	0.0067 U	0.071 U	0.068 U
Tetrachloro furan (2,3,7,8)	0.0075 U	0.0054 U	0.065 U	0.020 U	0.013 U	0.020 U	0.0067 U	0.071 U	0.068 U
Pentachloro furan	0.018 U	0.016 U	1.0 U	0.086 U	0.55	0.064 U	0.022 U	0.099 U	0.085 U
Hexachloro furan	0.013 U	0.0096 U	0.31 U	0.23	8.4	0.048 U	0.016 U	0.064 U	0.086 U
Heptachloro furan	0.024 U	0.027 U	0.48 U	0.75	22	0.11 U	0.099 U	0.13 U	0.18 U
Octachloro furan	0.10 U	0.053 U	2.2 U	1.7 U	8.8	0.46 U	0.14 U	0.29 U	0.56 U
Tetrachloro dioxin (Total)	0.0082 U	0.011 U	0.086 U	0.019 U	0.017 U	0.020 U	0.010 U	0.026 U	0.030 U
Tetrachloro dioxin (2,3,7,8)	0.0082 U	0.011 U	0.086 U	0.019 U	0.017 U	0.020 U	0.010 U	0.026 U	0.030 U
Pentachloro dioxin	0.017 U	0.014 U	0.28 U	0.068 U	0.45	0.061 U	0.037 U	0.072 U	0.087 U
Hexachloro dioxin	0.016 U	0.0097 U	0.38 U	0.10 U	8.7	0.043 U	0.016 U	0.064 U	0.089 U
Heptachloro dioxin	0.026 U	0.016 U	0.46 U	1.2	11	0.14 U	0.042 U	0.14	0.31 U

MOSS-AMERICAN
SEDIMENT
SEMI-VOLATILES

Sample No.:	MA-SD308-01	MA-SD309-01	MA-SD309-01FR	MA-SD310-01	MA-SD311-01
TR No.:	EW818	EW819	EW828 Replicate	EW820	EW821
Parameter					
Phenol	58000 U	57000 U	28000 U	60000 U	27000 U
bis(2-Chloroethyl)ether	58000 U	57000 U	28000 U	60000 U	27000 U
2-Chlorophenol	58000 U	57000 U	28000 U	60000 U	27000 U
1,3-Dichlorobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
1,4-Dichlorobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
Benzyl alcohol	58000 U	57000 U	28000 U	60000 U	27000 U
1,2-Dichlorobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
2-Methylphenol	58000 U	57000 U	28000 U	60000 U	27000 U
bis(2-Chloroisopropyl)ether	58000 U	57000 U	28000 U	60000 U	27000 U
4-Methylphenol	58000 U	57000 U	28000 U	60000 U	27000 U
N-Nitroso-di-n-propylamine	58000 U	57000 U	28000 U	60000 U	27000 U
Hexachloroethane	58000 U	57000 U	28000 U	60000 U	27000 U
Nitrobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
Isophorone	58000 U	57000 U	28000 U	60000 U	27000 U
2-Nitrophenol	58000 U	57000 U	28000 U	60000 U	27000 U
2,4-Dimethylphenol	58000 U	57000 U	28000 U	60000 U	27000 U
Benzoic Acid	280000 U	270000 U	130000 U	280000 U	130000 U
bis(2-Chloroethoxy)methane	58000 U	57000 U	28000 U	60000 U	27000 U
2,4-Dichlorophenol	58000 U	57000 U	28000 U	60000 U	27000 U
1,2,4-Trichlorobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
Naphthalene	11000 J	57000 U	1300 J	60000 U	59000
4-Chloroaniline	58000 U	57000 U	28000 U	60000 U	27000 U
Hexachlorobutadiene	58000 U	57000 U	28000 U	60000 U	27000 U
4-Chloro-3-methylphenol	58000 U	57000 U	28000 U	60000 U	27000 U
2-Methylnaphthalene	22000 J	57000 U	800 J	60000 U	91000
Hexachlorocyclopentadiene	58000 U	57000 U	28000 U	60000 U	27000 U
2,4,6-Trichlorophenol	58000 U	57000 U	28000 U	60000 U	27000 U
2,4,5-Trichlorophenol	280000 U	270000 U	130000 U	280000 U	130000 U
2-Chloronaphthalene	58000 U	57000 U	28000 U	60000 U	27000 U
2-Nitroaniline	280000 U	270000 U	130000 U	280000 U	130000 U
Dimethylphthalate	58000 U	57000 U	28000 U	60000 U	27000 U
Acenaphthylene	58000 U	57000 U	1200 J	60000 U	1400 J
2,6-Dinitrotoluene	58000 U	57000 U	28000 U	60000 U	27000 U
3-Nitroaniline	280000 U	270000 U	130000 U	280000 U	130000 U
Acenaphthene	220000	140000	100000	35000 J	180000
2,4-Dinitrophenol	280000 U	270000 U	130000 U	280000 U	130000 U
4-Nitrophenol	280000 U	270000 U	130000 U	280000 U	130000 U
Dibenzofuran	150000	83000	60000	1600 J	130000
2,4-Dinitrotoluene	58000 U	57000 U	28000 U	60000 U	27000 U
Diethylphthalate	58000 U	57000 U	28000 U	60000 U	27000 U
4-Chlorophenyl-phenylether	58000 U	57000 U	28000 U	60000 U	27000 U
Fluorene	200000	130000	95000	4100 J	170000
4-Nitroaniline	280000 U	270000 U	130000 U	280000 U	130000 U
4,6-Dinitro-2-methylphenol	280000 U	270000 U	130000 U	280000 U	130000 U
N-Nitrosodiphenylamine	58000 U	3100 J	28000 U	60000 U	27000 U
4-Bromophenyl-phenylether	58000 U	57000 U	28000 U	60000 U	27000 U
Hexachlorobenzene	58000 U	57000 U	28000 U	60000 U	27000 U
Pentachlorophenol	280000 U	270000 U	130000 U	280000 U	130000 U
Phenanthrene	460000	320000	220000	15000 J	320000
Anthracene	66000	43000 J	35000	23000 J	190000
Di-n-butylphthalate	58000 U	57000 U	210000	60000 U	27000 U
Fluoranthene	300000	270000	28000 U	60000 U	200000
Pyrene	290000	300000	200000	25000 J	190000
Butylbenzylphthalate	58000 U	57000 U	28000 U	60000 U	27000 U
3,3'-Dichlorobenzidine	120000 U	110000 U	56000 U	120000 U	54000 U
Benzo(a)anthracene	58000	54000 J	42000	58000 J	34000
Chrysene	54000 J	52000 J	44000	7000 J	39000
bis(2-Ethylehexyl)phthalate	58000 U	57000 U	28000 U	60000 U	27000 U
Di-n-octylphthalate	58000 U	57000 U	28000 U	60000 U	27000 U
Benzo(b)fluoranthene	26000 J	22000 J	22000 J	4600 J	16000 J
Benzo(k)fluoranthene	23000 J	4200 J	4400 J	800 J	15000 J
Benzo(a)pyrene	25000 J	18000 J	20000 J	3900 J	16000 J
Indeno(1,2,3-cd)pyrene	8800 J	4500 J	7400 J	60000 U	5800 J
Dibenz(a,h)anthracene	2400 J	57000 U	2000 J	60000 U	1600 J
Benzo(g,h,i)perylene	7000 J	57000 U	6100 J	60000 U	4900 J

MOSS-AMERICAN
SEDIMENT
SEMI-VOLATILES

Sample No.:	MA-SD312-01	MA-SD313-01	MA-SD314-01	MA-SD315-01	MA-SD316-01
TR No.:	EW822	EW823	EW824	EW825	EW826
Parameter					
Phenol	200000 U	140000 U	170000 U	33000 U	33000 U
bis(2-Chloroethyl)ether	200000 U	140000 U	170000 U	33000 U	33000 U
2-Chlorophenol	200000 U	140000 U	170000 U	33000 U	33000 U
1,3-Dichlorobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
1,4-Dichlorobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
Benzyl alcohol	200000 U	140000 U	170000 U	33000 U	33000 U
1,2-Dichlorobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
2-Methylphenol	200000 U	140000 U	170000 U	33000 U	33000 U
bis(2-Chloroisopropyl)ether	200000 U	140000 U	170000 U	33000 U	33000 U
4-Methylphenol	200000 U	140000 U	170000 U	33000 U	33000 U
N-Nitroso-di-n-propylamine	200000 U	140000 U	170000 U	33000 U	33000 U
Hexachloroethane	200000 U	140000 U	170000 U	33000 U	33000 U
Nitrobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
Isophorone	200000 U	140000 U	170000 U	33000 U	33000 U
2-Nitrophenol	200000 U	140000 U	170000 U	33000 U	33000 U
2,4-Dimethylphenol	200000 U	140000 U	170000 U	33000 U	33000 U
Benzoic Acid	950000 U	680000 U	810000 U	160000 U	160000 U
bis(2-Chloroethoxy)methane	200000 U	140000 U	170000 U	33000 U	33000 U
2,4-Dichlorophenol	200000 U	140000 U	170000 U	33000 U	33000 U
1,2,4-Trichlorobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
Naphthalene	350000	210000	78000 J	33000 U	33000 U
4-Chloroaniline	200000 U	140000 U	60000 J	33000 U	33000 U
Hexachlorobutadiene	200000 U	140000 U	170000 U	33000 U	33000 U
4-Chloro-3-methylphenol	200000 U	140000 U	170000 U	33000 U	33000 U
2-Methylnaphthalene	340000	200000	170000 U	33000 U	33000 U
Hexachlorocyclopentadiene	200000 U	140000 U	170000 U	33000 U	33000 U
2,4,6-Trichlorophenol	200000 U	140000 U	170000 U	33000 U	33000 U
2,4,5-Trichlorophenol	950000 U	680000 U	810000 U	160000 U	160000 U
2-Chloronaphthalene	200000 U	140000 U	170000 U	33000 U	33000 U
2-Nitroaniline	950000 U	680000 U	810000 U	160000 U	160000 U
Dimethylphthalate	200000 U	140000 U	170000 U	33000 U	33000 U
Acenaphthylene	200000 U	140000 U	170000 U	33000 U	33000 U
2,6-Dinitrotoluene	200000 U	140000 U	170000 U	33000 U	33000 U
3-Nitroaniline	950000 U	680000 U	810000 U	160000 U	160000 U
Acenaphthene	800000	460000	280000	8000 J	78000
2,4-Dinitrophenol	950000 U	680000 U	810000 U	160000 U	160000 U
4-Nitrophenol	950000 U	680000 U	810000 U	160000 U	160000 U
Dibenzofuran	520000	300000	180000	4800 J	49000
2,4-Dinitrotoluene	200000 U	140000 U	170000 U	33000 U	33000 U
Diethylphthalate	200000 U	140000 U	170000 U	33000 U	33000 U
4-Chlorophenyl-phenylether	200000 U	140000 U	170000 U	33000 U	33000 U
Fluorene	630000	350000	220000	7400 J	71000
4-Nitroaniline	950000 U	680000 U	810000 U	160000 U	160000 U
4,6-Dinitro-2-methylphenol	950000 U	680000 U	810000 U	160000 U	160000 U
N-Nitrosodiphenylamine	200000 U	140000 U	170000 U	33000 U	33000 U
4-Bromophenyl-phenylether	200000 U	140000 U	170000 U	33000 U	33000 U
Hexachlorobenzene	200000 U	140000 U	170000 U	33000 U	33000 U
Pentachlorophenol	950000 U	680000 U	810000 U	160000 U	160000 U
Phenanthrene	1500000	850000	520000	24000	160000
Anthracene	270000	140000	85000 J	5500 J	28000 J
Di-n-butylphthalate	200000 U	140000 U	170000 U	33000 U	33000 U
Fluoranthene	830000	470000	300000	23000	140000
Pyrene	800000	470000	300000	220000	130000
Butylbenzylphthalate	200000 U	140000 U	170000 U	33000 U	33000 U
3,3'-Dichlorobenzidine	400000 U	280000 U	340000 U	66000 U	66000 U
Benzo(a)anthracene	140000 J	79000 J	51000 J	5100 J	25000 J
Chrysene	150000 J	87000 J	53000 J	6500 J	26000 J
bis(2-Ethylehexyl)phthalate	200000 U	140000 U	170000 U	33000 U	33000 U
Di-n-octylphthalate	200000 U	140000 U	170000 U	33000 U	33000 U
Benzo(b)fluoranthene	64000 J	33000 J	20000 J	4200 J	11000 J
Benzo(k)fluoranthene	12000 J	26000 J	5000 J	890 J	2600 J
Benzo(a)pyrene	54000 J	30000 J	21000 J	3400 U	11000 J
Indeno(1,2,3-cd)pyrene	15000 J	8200 J	6400 J	1700 J	3400 J
Dibenz(a,h)anthracene	200000 U	140000 U	170000 U	33000 U	1100 J
Benzo(g,h,i)perylene	13000 J	7100 J	5600 J	1700 J	3000 J

MOSS-AMERICAN
SEDIMENT
SEMI-VOLATILES

Sample No.:	MA-SDFB01-01	MA-SDFB02-01	MA-SD301-01	MA-SD302-01	MA-SD303-01
TR No.:	EW829	EW830	EW811	EW812	EW813
	Field Blank	Field Blank			
Parameter			Conc. (ug/kg)		
Phenol	330 U	330 U	3000 U	2600 U	2700 U
bis(2-Chloroethyl)ether	330 U	330 U	3000 U	2600 U	2700 U
2-Chlorophenol	330 U	330 U	3000 U	2600 U	2700 U
1,3-Dichlorobenzene	330 U	330 U	3000 U	2600 U	2700 U
1,4-Dichlorobenzene	330 U	330 U	3000 U	2600 U	2700 U
Benzyl alcohol	330 U	330 U	3000 U	2600 U	2700 U
1,2-Dichlorobenzene	330 U	330 U	3000 U	2600 U	2700 U
2-Methylphenol	330 U	330 U	3000 U	2600 U	2700 U
bis(2-Chloroisopropyl)ether	330 U	330 U	3000 U	2600 U	2700 U
4-Methylphenol	330 U	330 U	3000 U	2600 U	2700 U
N-Nitroso-di-n-propylamine	330 U	330 U	3000 U	2600 U	2700 U
Hexachloroethane	330 U	330 U	3000 U	2600 U	2700 U
Nitrobenzene	330 U	330 U	3000 U	2600 U	2700 U
Isophorone	330 U	330 U	3000 U	2600 U	2700 U
2-Nitrophenol	330 U	330 U	3000 U	2600 U	2700 U
2,4-Dimethylphenol	330 U	330 U	3000 U	2600 U	2700 U
Benzoic Acid	1600 U	1600 U	1800 J	2300 J	660 J
bis(2-Chloroethoxy)methane	330 U	330 U	3000 U	2600 U	2700 U
2,4-Dichlorophenol	330 U	330 U	3000 U	2600 U	2700 U
1,2,4-Trichlorobenzene	330 U	330 U	3000 U	2600 U	2700 U
Naphthalene	330 U	330 U	3000 U	2600 U	2700 U
4-Chloroaniline	330 U	330 U	3000 U	2600 U	2700 U
Hexachlorobutadiene	330 U	330 U	3000 U	2600 U	2700 U
4-Chloro-3-methylphenol	330 U	330 U	3000 U	2600 U	2700 U
2-Methylnaphthalene	330 U	330 U	3000 U	2600 U	120 J
Hexachlorocyclopentadiene	330 U	330 U	3000 U	2600 U	2700 U
2,4,6-Trichlorophenol	330 U	330 U	3000 U	2600 U	2700 U
2,4,5-Trichlorophenol	1600 U	1600 U	15000 U	13000 U	13000 U
2-Chloronaphthalene	330 U	330 U	3000 U	2600 U	2700 U
2-Nitroaniline	1600 U	1600 U	15000 U	13000 U	13000 U
Dimethylphthalate	330 U	330 U	3000 U	2600 U	2700 U
Acenaphthylene	330 U	330 U	3000 U	140 J	97 J
2,6-Dinitrotoluene	330 U	330 U	3000 U	2600 U	2700 U
3-Nitroaniline	1600 U	1600 U	15000 U	13000 U	13000 U
Acenaphthene	330 U	330 U	160 J	220 J	810 J
2,4-Dinitrophenol	1600 U	1600 U	15000 U	13000 U	13000 U
4-Nitrophenol	1600 U	1600 U	15000 U	13000 U	13000 U
Dibenzofuran	330 U	330 U	3000 U	130 J	380 J
2,4-Dinitrotoluene	330 U	330 U	3000 U	2600 U	2700 U
Diethylphthalate	25 J	330 U	3000 U	2600 U	2700 U
4-Chlorophenyl-phenylether	330 U	330 U	3000 U	2600 U	2700 U
Fluorene	330 U	330 U	200 J	260 J	690 J
4-Nitroaniline	1600 U	1600 U	15000 U	13000 U	13000 U
4,6-Dinitro-2-methylphenol	1600 U	1600 U	15000 U	13000 U	13000 U
N-Nitrosodiphenylamine	330 U	330 U	3000 U	2600 U	2700 U
4-Bromophenyl-phenylether	330 U	330 U	3000 U	2600 U	2700 U
Hexachlorobenzene	330 U	330 U	3000 U	2600 U	2700 U
Pentachlorophenol	1600 U	1600 U	15000 U	13000 U	13000 U
Phenanthrene	29 J	12 J	360 J	3000	2900
Anthracene	330 U	330 U	3000 U	690 J	700 J
Di-n-butylphthalate	26 J	42 J	3000 U	150 B	53 B
Fluoranthene	16 J	330 U	4000	6700	8400
Pyrene	15 J	330 U	3800	6400	8500
Butylbenzylphthalate	330 U	62 J	3000 U	720 J	2700 U
3,3'-Dichlorobenzidine	660 U	660 U	6000 U	5200 U	5300 U
Benzo(a)anthracene	330 U	330 U	1300 J	2300 J	2400 J
Chrysene	330 U	330 U	1900 J	3100	3200
bis(2-Ethylehexyl)phthalate	330 U	310 B	2200 B	2800 B	1700 B
Di-n-octylphthalate	330 U	330 U	74 J	90 J	2700 U
Benzo(b)fluoranthene	330 U	330 U	2000 J	3300	1700 J
Benzo(k)fluoranthene	330 U	330 U	250 J	560 J	380 J
Benzo(a)pyrene	330 U	330 U	1500 J	2800	2100 J
Indeno(1,2,3-cd)pyrene	330 U	330 U	1000 J	1400 J	1000 J
Dibenz(a,h)anthracene	330 U	330 U	200 J	200 J	180 J
Benzo(g,h,i)perylene	330 U	330 U	780 J	1100 J	770 J

NOSS-AMERICAN
SEDIMENT
SEMI-VOLATILES

Sample No.:	MA-SD304-01	MA-SD305-01	MA-SD306-01	MA-SD306-01FR	MA-SD307-01
TR No.:	EW814	EW815	EW816	EW827 Replicate	EW817
Parameter					
Phenol	28000 U	880 U	30000 U	150000 U	160000 U
bis(2-Chloroethyl)ether	28000 U	880 U	30000 U	150000 U	160000 U
2-Chlorophenol	28000 U	880 U	30000 U	150000 U	160000 U
1,3-Dichlorobenzene	28000 U	880 U	30000 U	150000 U	160000 U
1,4-Dichlorobenzene	28000 U	880 U	30000 U	150000 U	160000 U
Benzyl alcohol	28000 U	880 U	30000 U	150000 U	160000 U
1,2-Dichlorobenzene	28000 U	880 U	30000 U	150000 U	160000 U
2-Methylphenol	28000 U	880 U	30000 U	150000 U	160000 U
bis(2-Chloroisopropyl)ether	28000 U	880 U	30000 U	150000 U	160000 U
4-Methylphenol	28000 U	880 U	30000 U	150000 U	160000 U
N-Nitroso-di-n-propylamine	28000 U	880 U	30000 U	150000 U	160000 U
Hexachloroethane	28000 U	880 U	30000 U	150000 U	160000 U
Nitrobenzene	28000 U	880 U	30000 U	150000 U	160000 U
Isophorone	28000 U	880 U	30000 U	150000 U	160000 U
2-Nitrophenol	28000 U	880 U	30000 U	150000 U	160000 U
2,4-Dimethylphenol	28000 U	880 U	30000 U	150000 U	160000 U
Benzoic Acid	104000 U	370 J	140000 U	710000 U	750000 U
bis(2-Chloroethoxy)methane	28000 U	880 U	30000 U	150000 U	160000 U
2,4-Dichlorophenol	28000 U	880 U	30000 U	150000 U	160000 U
1,2,4-Trichlorobenzene	28000 U	880 U	30000 U	150000 U	160000 U
Naphthalene	28000 U	880 U	21000 J	29000	310000
4-Chloroaniline	28000 U	880 U	30000 U	150000 U	160000 U
Hexachlorobutadiene	28000 U	880 U	30000 U	150000 U	160000 U
4-Chloro-3-methylphenol	28000 U	880 U	30000 U	150000 U	160000 U
2-Methylnaphthalene	4500 J	880 U	51000	72000	300000
Hexachlorocyclopentadiene	28000 U	880 U	30000 U	150000 U	160000 U
2,4,6-Trichlorophenol	28000 U	880 U	30000 U	150000 U	160000 U
2,4,5-Trichlorophenol	104000 U	4300 U	140000 U	710000 U	750000 U
2-Chloronaphthalene	28000 U	880 U	30000 U	150000 U	160000 U
2-Nitroaniline	104000 U	4300 U	140000 U	710000 U	750000 U
Dimethylphthalate	28000 U	880 U	30000 U	150000 U	160000 U
Acenaphthylene	28000 U	880 U	30000 U	150000 U	160000 U
2,6-Dinitrotoluene	28000 U	880 U	30000 U	150000 U	160000 U
3-Nitroaniline	104000 U	4300 U	140000 U	710000 U	750000 U
Acenaphthene	20000 J	880 U	170000	310000	670000
2,4-Dinitrophenol	104000 U	4300 U	140000 U	710000 U	750000 U
4-Nitrophenol	104000 U	4300 U	140000 U	710000 U	750000 U
Dibenzofuran	14000 J	880 U	105000	180000	450000
2,4-Dinitrotoluene	28000 U	880 U	30000 U	150000 U	160000 U
Diethylphthalate	28000 U	880 U	30000 U	150000 U	160000 U
4-Chlorophenyl-phenylether	28000 U	880 U	30000 U	150000 U	160000 U
Fluorene	16000 J	880 U	130000	240000	560000
4-Nitroaniline	104000 U	4300 U	140000 U	710000 U	750000 U
4,6-Dinitro-2-methylphenol	104000 U	4300 U	140000 U	710000 U	750000 U
N-Nitrosodiphenylamine	28000 U	880 U	30000 U	150000 U	160000 U
4-Bromophenyl-phenylether	28000 U	880 U	30000 U	150000 U	160000 U
Hexachlorobenzene	28000 U	880 U	30000 U	150000 U	160000 U
Pentachlorophenol	104000 U	4300 U	140000 U	710000 U	750000 U
Phenanthrene	44000	280 J	320000	670000	1400000
Anthracene	4400 J	71 J	39000	710000 J	150000
Di-n-butylphthalate	28000 U	880 U	30000 U	150000 U	160000 U
Fluoranthene	28000 J	750 J	210000	400000	690000
Pyrene	29000	700 J	200000	430000	750000
Butylbenzylphthalate	28000 U	880 U	30000 U	150000 U	160000 U
3,3'-Dichlorobenzidine	57000 U	1800 U	60000 U	300000 U	310000 U
Benzo(a)anthracene	56000	260 J	38000	71000 J	110000 J
Chrysene	6200 J	390 J	42000	76000 J	110000 J
bis(2-Ethylehexyl)phthalate	470 B	270 B	30000 U	150000 U	160000 U
Di-n-octylphthalate	28000 U	25 J	30000 U	150000 U	160000 U
Benzo(b)fluoranthene	3500 J	340 J	18000 J	29000 J	36000 J
Benzo(k)fluoranthene	28000 U	66 J	13000 J	5000 J	35000 J
Benzo(a)pyrene	2700 J	320 J	15000 J	24000 J	32000 J
Indeno(1,2,3-cd)pyrene	28000 U	180 J	4600 J	150000 U	160000 U
Dibenz(a,h)anthracene	28000 U	880 U	1400 J	150000 U	160000 U
Benzo(g,h,i)perylene	28000 U	150 J	4000 J	150000 U	160000 U

SEDIMENT DATA

MOSS-AMERICAN
SURFACE WATER
CONVENTIONAL PARAMETERS

Sample No.:	MA-SW001-01	MA-SW002-01	MA-SW003-01	MA-SW004-01	MA-SW005-01	MA-SW006-01	MA-SW007-01	MA-SW008-01	MA-SW009-01	MA-SWFB10-01
TR No.:	E01	E02	E03	E04	E05	E10	E09	E08	E06	E07 Field Blank
Parameter	Conc. (mg/l)									
pH (pH units)	8.39	8.27	8.25	8.32	8.27	8.12	8.25	8.46	8.22	6.12
Alkalinity	302	317	307	310	310	310	332	305	310	-7.5
Phenol (ug/l)	2.0 U	2.0 U	2.0 U	2.0 U	4.3	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
BOD	4.1 B	3.8 B	2.9 B	3.5 B	3.2 B	2.9 B	3.1 B	2.7 B	3.3 B	2.0 B
TOC	16.4 J	32.7 J	16.3 J	18.5 J	18.8 J	16.6 J	12.3 J	12.8 J	17.2 J	1.0 U
COD	35 J	38 J	38 J	0.6 U	35 J	36 J	20 J	21 J	38 J	1.6 B
Sulfate	80	74	65	73	79	71	109	77	80	5.0 U
TSS	20	20	24	24	18	16	20	60	16	0.0 U
TDS	432	443	544	412	400	530	730	448	432	0.0 U

MOSS-AMERICAN
SURFACE WATER
INORGANICS

Sample ID:	MA-SW001-01	MA-SW001-01	MA-SW002-01	MA-SW002-01	MA-SW003-01	MA-SW003-01	MA-SW004-01	MA-SW004-01	MA-SW005-01	MA-SW005-01
TR No.:	MEW480	MEW765	MEW481	MEW766	MEW482	MEW767	MEW483	MEW768	MEW484	MEW785
	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Parameter	Conc. (ug/l)									
Aluminum	54.4 U	141 J	54.4 U	192 J	54.1 U	218	54.1 U	247 U	54.1 U	208
Antimony	35.5 U	54.1 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U
Arsenic	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 J	5 U	5 U
Barium	54.8 J	59.7 J	56.6 J	61.5 J	59.4 J	62.9 J	57.6 J	59.6 U	60.6 J	63.9 J
Beryllium	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Cadmium	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1	3.1 U	3.1 U
Calcium	102000	107000	104000	108000	102000	107000	105000	103000 U	108000	108000
Chromium	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U
Cobalt	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 B	13.4 U	13.4 U
Copper	14.1 B	20.8 B	9.2 B	14.1 B	15.8 B	19.9 B	5.8 B	5 J	4.7 U	5 B
Iron	123 B	636 J	118 B	715 J	253 B	891 J	244 B	952 U	194 B	843 J
Lead	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2	2 U	2 U
Magnesium	43100	45300	44000	45700	42900	45100	44200	43100	45400	45600
Manganese	90.4	106	95.1	111	124	129	110	116 U	94.4	104
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	31.5 U	34.5 J	34.5 U	34.5 U
Potassium	3160 J	3260 J	3010 J	3120 J	2860 J	3430 J	3270 J	3690 U	2960 J	3240 J
Selenium	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Silver	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5	5.5 U	5.5 U
Sodium	48100	50600	49000	51200	27200	28300	24000	23400 U	23100	23100
Thallium	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Vanadium	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 J	7.4 U	7.4 U
Zinc	10.7 J	16.6 J	10.5 U	15.7 J	20.9	18.9 J	10.5 U	14.2 U	10.5 U	13.4 J
Cyanide		10 U		10 U		10 U		10		10 U

MOSS-AMERICAN
SURFACE WATER
INORGANICS

Sample ID:	MA-SW005-01FR	MA-SW005-01FR	MA-SW006-01	MA-SW006-01	MA-SW007-01	MA-SW007-01	MA-SW008-01	MA-SW008-01	MA-SWFB10-01	MA-SWFB10-01
TR No.:	MEW485	MEW786	MEW487	MEW788	MEW486	MEW787	MEW489	MEW790	MEW488	MEW789
	Replicate Filtered	Replicate Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Field Blank Filtered	Field Blank Unfiltered
Parameter										
Aluminum	54.1 U	224	73.6 J	192 J	55.4 J	170 J	54.1 U	222	54.1 U	54.1 U
Antimony	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U	35.5 U
Arsenic	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Barium	60.3 J	64 J	60.8 J	66.1 J	95.9 J	96.6 J	41.1 J	44.6 J	13.1 U	13.1 U
Beryllium	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Cadmium	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U
Calcium	108000	109000	106000	115000	135000	134000	95900	101000	129 U	129 U
Chromium	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U	8.7 U
Cobalt	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U	13.4 U
Copper	5.8 B	8.3 B	8.3 B	4.7 U	15.7 B	10.7 B	12.5 B	4.7 U	4.7 U	4.7 U
Iron	219 B	881 J	632	819 J	465	774 J	205 B	959 J	51.7 J	41.3 J
Lead	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Magnesium	45300	45500	44700	48300	43500	43500	42900	44600	160 U	160 U
Manganese	93.7	104	99.7	104	53.5	52.8	112	185	3.4 U	3.4 U
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U	34.5 U
Potassium	3100 J	3380 J	3100 J	3140 J	4580 J	4210 J	1520 J	1490 U	1490 U	1490 U
Selenium	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Silver	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U
Sodium	23200	22900	20100	21400	62900	63100	7010	7280	102 U	102 U
Thallium	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Vanadium	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U	7.4 U
Zinc	10.5 U	13.9 J	20	12.6 J	46.9	40.3	12.5 J	95.9	10.5 U	10.5 U
Cyanide		10 U		10 U		10 U		10 U		10 U

MOSS-AMERICAN
SURFACE WATER
VOLATILES

Sample ID:	MA-SW001-01	MA-SW002-01	MA-SW003-01	MA-SW004-01	MA-SW005-01	MA-SW005-01FR	MA-SW006-01	MA-SW007-01
TR No.:	ES612	ES613	ES614	ES615	ES616	ES617 Replicate	ES619	ES621
Parameter	Conc. (ug/l)							
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	2 B	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

MOSS-AMERICAN
SURFACE WATER
VOLATILES

Sample ID:	MA-SW008-01	MA-SWFB010-01
TR No.:	ES618	ES620
		Field Blank
Parameter		
Chloromethane	10 U	10 U
Bromomethane	10 U	10 U
Vinyl chloride	10 U	10 U
Chloroethane	10 U	10 U
Methylene chloride	5 U	5 U
Acetone	10 U	10 U
Carbon disulfide	5 U	5 U
1,1-Dichloroethene	5 U	5 U
1,1-Dichloroethane	5 U	5 U
1,2-Dichloroethene (total)	5 U	5 U
Chloroform	5 U	18 B
1,2-Dichloroethane	5 U	5 U
2-Butanone	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U
Carbon tetrachloride	5 U	5 U
Vinyl acetate	10 U	10 U
Bromodichloromethane	5 U	5 U
1,2-Dichloropropane	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U
Trichloroethene	5 U	5 U
Dibromochloromethane	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U
Benzene	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U
Bromoform	5 U	5 U
4-Methyl-2-pentanone	10 U	10 U
2-Hexanone	10 U	10 U
Tetrachloroethene	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U
Toluene	5 U	5 U
Chlorobenzene	5 U	5 U
Ethylbenzene	5 U	5 U
Styrene	5 U	5 U
Xylene (total)	5 U	5 U

MOSS-AMERICAN
SURFACE WATER
SEMI-VOLATILES

Sample No.:	MA-SW001-01	MA-SW002-01	MA-SW003-01	MA-SW004-01	MA-SW005-01
TR No.:	ES612	ES613	ES614	ES615	ES616
Parameter	Conc. (ug/l)				
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	4 J	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U
Pyrene	50 U	50 U	50 U	50 U	50 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylehexyl)phthalate	34 B	150 B	10 U	6 B	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

MOSS-AMERICAN
SURFACE WATER
SEMI-VOLATILES

Sample No.:	MA-SW005-01FR	MA-SW006-01	MA-SW007-01	MA-SW008-01	MA-SWFB10-01
TR No.:	ES617 Replicate	ES619	ES621	ES618	ES620 Field Blank
Parameter					
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	11	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	2 J	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	11	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	6 J	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	5 J	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	2 J	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	2 J	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U
Pyrene	50 U	50 U	50 U	50 U	50 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylehexyl)phthalate	96 B	10 U	2 B	1 B	2 B
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

SURFACE WATER DATA

MOSS-AMERICAN
GROUNDWATER
CONVENTIONAL PARAMET

Sample No.:	MA-MWFB05-01	MA-MW05S-01	MA-MWFB06-01	MA-MWFB06-01	MA-MW06S-01	MA-MW07I-01	MA-MW07S-01	MA-MW07S-01FR	MA-MW08I-01
TR No.:	E229	E230	E250RE	E250	E231	E241	E238	E239	E242
	Field Blank		Field Blank	Field Blank				Replicate	
Parameter									
Alkalinity	-50	365 J	-40	-36	321 J	178	550 J	516	110
Phenol (ug/l)	2.6 B	5 B		2 U	2 U	2 U	44	44	2 U
BOD	2 U	2 U		2 U	11 J	2 U	16 J	9 J	3 J
TOC	1 U	90 J		1 J	19 J	86 J	23 J	22 J	22 J
COD	5 U	25.3 J		5 U	8.77 J	104.8 J	78 J	74.8 J	22.2
Sulfate	3 U	64		3.6 J	78	55	3 U	3.2 B	41 J
TSS	0 U	12020		0 U	204	89270	1402	922	1370
TDS	0 U	599		0 U	490	262	714	698	188

MOSS-AMERICAN
GROUNDWATER
CONVENTIONAL PARAMET

Sample No.:	MA-MW08S-01	MA-MW09I-01	MA-MW09S-01	MA-MW11I-01	MA-MW11S-01	MA-MW12S-01	MA-MW14S-01	MA-MW20S-01
TR No.:	E248	E237	E232	E240	E246	E234	E243	E245
Parameter								
Alkalinity	620	182 J	440 J	590	660	430 J	354	320
Phenol (ug/l)	510	2 U	5 B	2 U	2 U	2 U	2 U	2 U
BOD		2 U	2 U	2 U	2 U	4 J	2 U	2.6 J
TOC	R	20 J	334 J	29 J	8 J	31 J	67 J	11 J
COD	196	25.3 J	57.8 J	64.5 J	67.1	55.2 J	63.5	137
Sulfate		39	80	113	47 J	64	72 J	36 J
TSS	170	774	19740	12605	6355	1036	2014	5360
TDS	819	264	663	543	753	621	492	1369

MOSS-AMERICAN
GROUNDWATER
INORGANICS

Sample ID:	MA-MW04D-01FR	MA-MW04D-01FR	MA-MWFB05-01	MA-MWFB05-01	MA-MWFB06-01	MA-MWFB06-01
TR No.:	MEW467	MEW468	MET967	MET968	MET969	MET970
Comments:	Filtered Replicate	Unfiltered Replicate	Filtered Field Blank	Unfiltered Field Blank	Filtered Field Blank	Unfiltered Field Blank
Parameter (ug/l)						
Aluminum	333 B	1940 J	35 UJ	51.2 J	66.9 J	42.4 J
Antimony	29 U	29 U	29 U	29 U	29 UJ	29 UJ
Arsenic	2.3 J	3 J	2 UJ	2 UJ	1 UJ	1 UJ
Barium	71.7 J	74.2 J	2.5 J	10.3 J	3 U	3.9 J
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U
Cadmium	5 U	5 U	5 U	5 U	5 UJ	5 UJ
Calcium	24500	85400	1060 J	680 J	697 J	481 J
Chromium	6 UJ	25.4 J	6 U	6 U	5 U	5 U
Cobalt	6 U	7 J	6 U	6 U	5 U	5 U
Copper	16 B	15.5 B	6.9 B	6 U	5 U	5 U
Iron	362	3350	56 U	74.2 B	55.8 B	30.4 B
Lead	2 UJ	2.4 B	3.8 J	3 J	6.8 J	2.4 J
Magnesium	18400	44400	70 U	70 U	162 J	104 J
Manganese	33.3 J	264 J	7 U	7 U	5 U	5 U
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	8 UJ	8.8 B	10.3 J	15 J	9 U	9 U
Potassium	1890 J	2210 J	126 U	126 U	151 U	151 U
Selenium	R	R	R	R	R	R
Silver	4 U	4 U	4 U	4 U	4 U	4 U
Sodium	28400	26500	2000 U	2000 U	2490 J	1520 U
Thallium	2 UJ	2 UJ	2.4 B	2.3 B	2 U	2 U
Vanadium	5 UJ	6 J	5 U	5 U	4 U	4 U
Zinc	12.7 B	20.8 B	9 J	4.8 J	18.3 J	10.5 J
Cyanide		10 U		10 U		10 U

MOSS-AMERICAN
GROUNDWATER
CONVENTIONAL PARAMETERS

Sample No.:	MA-MW01D-01	MA-MW01S-01	MA-MW02S-01	MA-MW03I-01	MA-MW03S-01	MA-MW04D-01	MA-MW04D-01FR	MA-MW04I-01	MA-MW04S-01
TR No.:	E224	E249	E226	E228	E-227	E235	E236 Replicate	E233	E244
Parameter	Conc. (mg/l)								
Alkalinity	154		183	85	330	146 J	145 J	52 J	520
Phenol (ug/l)	2 U	2 U	2 U	2 U	3 B	2 U	2 U	2 U	146
BOD	2 U		2 U	2 U	2 J	2 U	2 U	2 U	53 J
TOC	186 J		210 J	55 J	213 J	17 J	16 J	52 J	15 J
COD	39.7 J		83.6 J	35.1 J	43.9 J	54.2 J	11.4 J	24.3 J	656
Sulfate	105 J		88	100 J	86	32	30	10 B	78 J
TSS	29420		11940	3945	6800	1796	1070	1252	9800
TDS	435		441	278	7480	217	2150	756	807

MOSS-AMERICAN
GROUNDWATER
VOLATILES

Sample ID:	MA-MW11I-01	MA-MW11S-01	MA-MW12S-01	MA-MW13S-01	MA-MW14S-01	MA-MW20S-01	MA-MWFB05-01	MA-MWFB06-01
IR No.:	EW893	EW892	EW894	EW895	EW896	EW900	EW897	EW898
Comments:							Field Blank	Field Blank
Parameter (ug/l)								
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	4 B	5 U	4 B	5 B	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	7 J	15 J
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	8 J
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	4 J
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 J

MOSS-AMERICAN
GROUNDWATER
INORGANICS

SAMPLE DATES: 7/11/88 to 7/13/88

Sample ID:	MA-MW01D-01	MA-MW01D-01	MA-MW01S-01	MA-MW01S-01	MA-MW02S-01	MA-MW02S-01	MA-MW03S-01	MA-MW03S-01	MA-MW03I-01
TR No.:	MEW455	MEW456	MEW453	MEW454	MEW457	MEW458	MEW459	MEW460	MEW461
Comments:	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Parameter (ug/l)									
Aluminum	55.8 B	211000 J	134 B	276 J	2620 J	84200 J	974 J	30900 J	2160 J
Antimony	29 U	145 U	29 U	29 U	29 U	145 U	29 U	145 U	29 U
Arsenic	4.8 J	2 UJ	2 U	2.8 J	2 UJ	29.2 J	2 UJ	10.6 J	3 J
Barium	120 J	1560	52.1 J	51.1 B	137 J	821 J	220	528 J	45.1 J
Beryllium	1 U	7.2 J	1 U	1 U	1 U	5 U	1 U	5 U	1 U
Cadmium	5 U	25 U	5 U	5 U	5 U	25 U	5 U	25 U	5 U
Calcium	54500	2840000	94900	100000	102000	1270000	138000	1260000	25000
Chromium	6 U	383	6 UJ	6 UJ	6 U	198	6 U	78.2	7.8 J
Cobalt	6 U	175 J	6 U	6 U	6 U	86 J	6 U	44.6 J	6 U
Copper	6 U	482	16.8 B	20 B	6 U	209	6 U	78.8 B	14.7 B
Iron	69.6 B	317000	156	395	4810	134000	1660	61400	2640
Lead	2.3 B	10 UJ	2 UJ	2 UJ	2 UJ	66.5 J	2 UJ	30.7 J	2 UJ
Magnesium	32500	1280000	76500	81500	41700	540000	62400	519000	10100
Manganese	139	10500	102 J	110 J	298	4810	309	4750	74.9
Mercury	0.2 U	0.3	0.2 U	1.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	16.8 B	397	8 UJ	10.4 B	11.2 B	164 J	8 U	44 B	8 B
Potassium	2460 J	38400	5960	5820	2590 J	17100 J	3020 J	8640 J	1850 J
Selenium	R	R	R	R	R	R	R	R	R
Silver	4 U	20 U	4 U	4 U	4 U	20 U	4 U	20 U	4 U
Sodium	45100	44200	97100	98000	40700	41600	18000	48100	56500
Thallium	2.3 B	20 UJ	20 UJ	20 UJ	2.8 B	2.9 B	2.5 B	2 UJ	2 UJ
Vanadium	6.3 J	484	5 UJ	5 UJ	5 U	207 J	5 U	89.1 J	6.9 J
Zinc	6.2 B	1050	6.4 B	21.1 B	62.8 B	670	29.7 B	398	24 B
Cyanide		10 U		NA		10 U		10 U	

MOSS-AMERICAN
GROUNDWATER
INORGANICS

Sample ID:	MA-MW03I-01	MA-MW04D-01	MA-MW04D-01	MA-MW04I-01	MA-MW04I-01	MA-MW04S-01	MA-MW04S-01	MA-MW05S-01	MA-MW05S-01
TR No.:	MEW462	MEW465	MEW466	MEW463	MEW464	MET975	MET976	MEW469	MEW470
Comments:	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Parameter (ug/l)									
Aluminum	16200 J	308 B	7090 J	222 B	10900 J	R	R	572 J	50600 J
Antimony	29 U	29 U	29 U	29 U	29 U	R	R	29 U	145 U
Arsenic	10.6 J	2.3 J	5.4 J	2.4 J	11.7 J	R	R	7.8 J	11.3 J
Barium	156 J	54.3 J	130 J	124 J	226	R	R	150 J	801 J
Beryllium	1 U	1 U	1 U	1 U	1 U	R	R	1 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U	R	R	5 U	25 U
Calcium	297000	25500	234000	51100	271000	R	R	80100	2260000
Chromium	59.1	6 UJ	49 J	6 U	72.2	R	R	6 U	119
Cobalt	16.5 J	6 U	6.3 J	6 U	10.1 J	R	R	6 U	54 J
Copper	45.8 B	14.4 B	30 B	6 U	28.3 B	R	R	8 B	156
Iron	23800	315	11300	305 B	17300	R	R	710	106000
Lead	10.6 B	2 UJ	10.5 B	2 UJ	11.2 B	R	R	7.7 B	56 J
Magnesium	133000	18300	109000	26700	121000	R	R	38400	786000
Manganese	916	41.7 J	814 J	31.7	809	R	R	101	7410
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	R	R	0.2 U	0.2 U
Nickel	41.7 B	8 UJ	28 B	25.6 B	66.6 B	R	R	8 U	104 J
Potassium	5210	2400 J	4290 J	5100	5780	R	R	6260	15300 J
Selenium	R	R	R	R	R	R	R	R	R
Silver	4 U	4 U	4 U	4 U	4 U	R	R	4 U	20 U
Sodium	55000	27300	28000	71000	71600	R	R	75800	81700
Thallium	2 UJ	2 UJ	3.6 J	2 UJ	2 UJ	R	R	2 UJ	2 UJ
Vanadium	39.5 J	5 UJ	17.4 J	5 U	27.8 J	R	R	5 U	136 J
Zinc	88.7	3.1 B	81.6 J	3 B	72	R	R	7.3 B	641
Cyanide	10 U		10 U		10 U		R		10 U

MOSS-AMERICAN
GROUNDWATER
INORGANICS

Sample ID:	MA-MW06S-01	MA-MW06S-01	MA-MW07S-01	MA-MW07S-01	MA-MW07S-01FR	MA-MW07S-01FR	MA-MW07I-01	MA-MW07I-01	MA-MW08I-01
TR No.:	MEW471	MEW472	MEW473	MEW474	MEW475	MEW476	MEW477	MEW478	MET951
Comments:	Filtered	Unfiltered	Filtered	Unfiltered	Filtered Replicate	Unfiltered	Filtered	Unfiltered	Filtered
Parameter (ug/l)									
Aluminum	122 B	5250 J	341 J	28800 J	361 J	46100 J	742 J	174000 J	1270 J
Antimony	29 U	29 U	29 U	29 U	29 U	29 U	29 U	392 J	29 U
Arsenic	2 UJ	2.4 J	2 U	9 J	2 U	21.4	6.6 J	2 UJ	2.6 J
Barium	98.4 J	140 J	290 J	495 J	294 J	607 J	75.3 J	2170 J	40.3 J
Beryllium	1 U	1 U	1 U	1.2 B	1 U	1.1 B	1 U	12.7 J	1 U
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U	5 U	50 U	5 U
Calcium	91300	147000	128000	444000	126000	644000	36200	8240000	21600
Chromium	6 U	62.1	6 UJ	72.5 J	6 UJ	100 J	6 UJ	387 J	6 UJ
Cobalt	6 U	6 U	6 U	27.9 J	6 U	45.8 J	6 U	197 J	6 U
Copper	6.4 B	16.5 B	11.1 B	108	9.8 B	161	10.5 B	560	37.3 B
Iron	240 B	8690	3210	50900	2530	76300	920	394000	1240
Lead	2 UJ	12.5 B	2 U	28.2	2 U	55.9	5.9 B	2 UJ	2 UJ
Magnesium	37000	61700	41400	187000	41200	281000	27500	3650000	11000
Manganese	148	357	860 J	2210 J	843 J	3070 J	41.3 J	30100 J	68.2 J
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.3	0.2 U
Nickel	8 U	44.9 B	11.1 B	81 J	12.7 B	130 J	8 UJ	433 J	8 UJ
Potassium	1770 J	3270 J	3860 J	9430	3990 J	13000	2100 J	27400 J	1580 J
Selenium	R	R	R	R	R	R	R	R	R
Silver	4 U	4 U	4 U	4 U	4 U	4 U	4 U	40 U	4 U
Sodium	14400	12500	74100	74500	75200	75000	26100	35600 J	29000
Thallium	2 UJ	2 UJ	2 UJ	20 U	2 UJ	20 U	2 UJ	20 U	2 UJ
Vanadium	5 U	12.7 J	5 UJ	68.3 J	5 UJ	106 J	5.1 J	434 J	5 UJ
Zinc	11.8 B	109	13.5 B	366 J	15.3 B	531 J	8.7 B	1830 J	18.6 B
Cyanide		10 U		10 U		10 U		10 U	

MOSS-AMERICAN
GROUNDWATER
INORGANICS

Sample ID:	MA-MW08I-01	MA-MW08S-FP	MA-MW09S-01	MA-MW09S-01	MA-MW09I-01	MA-MW09I-01	MA-MW11I-01	MA-MW11I-01	MA-MW11S-01
TR No.:	MET952	101	MET953	MET954	MET971	MET972	MET959	MET960	MET957
Comments:	Unfiltered	Unfiltered Free Product	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
Parameter (ug/l)									
Aluminum	18100 J	476000 J	71.5 B	56500 J	3190 J	12600 J	234 B	122000 J	92.9 B
Antimony	29 U	20000 U	29 U	145 U	29 U	29 U	29 U	145 U	29 UJ
Arsenic	10.6	20000 U	3.9 J	2 UJ	2 U	7.4 J	3.7 J	2 UJ	4.8 J
Barium	171 J	119000 U	227	834 J	93.4 J	153 J	113 J	1210 J	201
Beryllium	1 U	40000 U	1 U	5 U	1 U	1 U	1 U	6.2 J	1 U
Cadmium	5 U	9900 U	5 U	25 U	5 U	5 U	5 U	25 U	5 UJ
Calcium	249000	794000 U	151000	2190000	45300	197000	80600	2790000	120000
Chromium	60.6 J	28000 U	6 U	132	6.7 J	89.8 J	6 UJ	246 J	5 U
Cobalt	13.3 J	198000 U	6 U	98.8 J	6 U	11.4 J	6 U	102 J	5 U
Copper	75.8 B	40000 U	6 U	250	27.9 B	45.1 B	33.2 B	282	6.5 B
Iron	26400	198000 U	533	181000	3250	17400	264	210000	533
Lead	13.4 B	127000 U	2 UJ	46 J	2 U	7.4 B	2 UJ	37 J	2 UJ
Magnesium	111000	794000 U	45300	836000	27700	102000	48200	1340000	86400
Manganese	986 J	40000 U	1440	8710	157 J	737 J	108 J	9930 J	417
Mercury	0.2 U	300 U	0.2 U	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	44.1 B	40000 U	17.7 B	168 J	8 UJ	51.3 B	8 UJ	245 J	9 U
Potassium	5480	40000 U	2520 J	11500 J	4270 J	5990	2510 J	23500 J	2930 J
Selenium	R	20000 U	R	R	R	R	R	R	R
Silver	4 U	794000 U	4 U	20 U	4 U	4 U	4 U	20 U	4 U
Sodium	27700	R	9190 B	10000 U	25500	20400	20000	25900	26800
Thallium	3.2 J	11600000 J	2.4 B	3.6 B	2 UJ	3 J	2 UJ	20 UJ	2 UJ
Vanadium	39.1 J	397000 U	5 U	162 J	5.1 J	25.5 J	5 UJ	298 J	4.7 J
Zinc	120 J	397000 U	42.7 B	3360	15.4 B	86.9 J	6.3 B	814 J	23.4 B
Cyanide	10 U	198000 U		10 U		10 U		10 U	

MOSS-AMERICAN
GROUNDWATER
INORGANICS

Sample ID:	MA-MW11S-01	MA-MW12S-01	MA-MW12S-01	MA-MW13S-01	MA-MW13S-01	MA-MW14S-01	MA-MW14S-01	MA-MW20S-01	MA-MW20S-01
TR No.:	MET958	MET961	MET962	MET963	MET964	MET965	MET966	MET973	MET974
Comments:	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered
Parameter (ug/l)									
Aluminum	25600	764 J	14300 J	474 J	5140 J	321 B	40600	173 B	41300
Antimony	29 UJ	29 U	29 U	29 U	29 U	29 UJ	29 UJ	29 UJ	33.8 J
Arsenic	3.9 J	2 U	9.2 J	2 UJ	6.8 J	4.1 J	9.6 J	1.3 J	15.9 J
Barium	404	144 J	275 J	179 J	232	128 J	634	181 J	755
Beryllium	1 U	1 U	1 U	1 U	1 U	1 U	1.1 J	1 U	1.1 J
Cadmium	5 UJ	5 U	5.9 J	5 U	5 U	5 UJ	5.5 J	5 UJ	5 UJ
Calcium	441000	131000	257000	222000	285000	81500	924000	250000	842000
Chromium	48.4	6 UJ	50.8 J	6 U	70.5	5 U	191	5 U	104
Cobalt	25.9 J	6 U	14.5 J	6 U	6 U	5 U	36.8 J	5 U	40.2 J
Copper	109	41.3 B	86.8 B	11 B	35 B	5.6 B	111	9.3 B	143
Iron	58000	955	20800	1610	11400	431	76500	234	63700
Lead	44.5 J	2 UJ	15.9	2 UJ	17.8 J	2.7 B	39.5 J	2.4 B	56.1 J
Magnesium	239000	49400	110000	90200	120000	47100	376000	75500	356000
Manganese	1880	417 J	1030 J	374	708	242	3360	1050	3810
Mercury	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	81.8	16.8 B	64.1 B	25.3 B	50.6 B	9 U	130	9 U	116
Potassium	8610	2290 J	5190	2510 J	3950 J	5350	14000	3390 J	11600
Selenium	R	R	R	R	R	R	R	R	R
Silver	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Sodium	27800	8830 B	6940	19200	16300	11000 B	9520	42200	41400
Thallium	2 UJ	2 UJ	3.4 J	2.5 B	2.5 B	2 UJ	2 UJ	2 UJ	2 UJ
Vanadium	69.5	5 UJ	37.9 J	5 U	12.7 J	4 U	109	4 U	110
Zinc	535	18.9 B	139 J	75.1 B	182	18.4 B	450	25.7 B	407
Cyanide	10 U		10 U		10 U		10 U		10 U

MOSS-AMERICAN
GROUNDWATER
VOLATILES

SAMPLING DATES: 7/11/88 to 7/13/88

Sample ID:	MA-MW01D-01	MA-MW01S-01	MA-MW02S-01	MA-MW03S-01	MA-MW03I-01	MA-MW04D-01	MA-MW04D-01FR	MA-MW04I-01	MA-MW04S-01
TR No.:	EW877	EW876	EW878	EW879	EW880	EW882	EW883	EW881	EW864
Comments:							Replicate		
Parameter (ug/l)									
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Methylene chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Vinyl acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	41 B
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	27 J
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	9 J
Xylene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	45 J

MOSS-AMERICAN
GROUNDWATER
VOLATILES

Sample ID:	MA-MW05S-01	MA-MW06S-01	MA-MW07S-01	MA-MW07S-01FR	MA-MW07I-01	MA-MW08I-01	MA-MW08S-01	MA-MW09I-01	MA-MW09S-01
TR No.:	EW884	EW885	EW886	EW887	EW888	EW889	I01	EW899	EW890
Comments:				Replicate					
Parameter (ug/l)									
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Vinyl chloride	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Methylene chloride	4 B	6 B	6 U	6 U	5 U	5 U	2500 U	6 B	5 B
Acetone	10 U	10 U	10 U	10 U	10 U	10 U	5500 B	10 U	10 U
Carbon disulfide	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Chloroform	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	R	10 U	10 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Carbon tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Vinyl acetate	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Bromodichloromethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Dibromochloromethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Benzene	5 U	5 U	7 J	5 J	5 U	5 U	2500 U	5 U	5 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Bromoform	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
4-Methyl-2-pentanone	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	5000 U	10 U	10 U
Tetrachloroethene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Toluene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Ethylbenzene	5 U	5 U	18 B	18 B	5 U	5 U	2500 U	5 U	5 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	2500 U	5 U	5 U
Xylene (total)	5 U	5 U	30 J	30 J	5 U	5 U	2500 U	5 U	5 U

MOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW01D-01	MA-MW01S-01	MA-MW02S-01	MA-MW03I-01	MA-MW03S-01
TR No.:	EW877	EW876	EW878	EW880	EW879
Parameter	Conc. (ug/l)				
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	41 J	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	11 J	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U	50 U	50 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	13 J	10 U	10 U
Pyrene	10 U	10 U	11 J	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylehexyl)phthalate	10 U	11	9 J	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

MOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW04D-01	MA-MW04D-01FR	MA-MW04I-01	MA-MW04S-01	MA-MWFB05-01
TR No.:	EW882	EW883 Replicate	EW881	EW864	EW897 Field Blank
Parameter					
Phenol	10 U	10 U	10 U	8 J	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	20 U	10 U
2-Chlorophenol	10 U	10 U	10 U	20 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	20 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	20 U	10 U
Benzyl alcohol	10 U	10 U	10 U	20 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	20 U	10 U
2-Methylphenol	10 U	10 U	10 U	20 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	20 U	10 U
4-Methylphenol	10 U	10 U	10 U	20 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	20 U	10 U
Hexachloroethane	10 U	10 U	10 U	20 U	10 U
Nitrobenzene	10 U	10 U	10 U	20 U	10 U
Isophorone	10 U	10 U	10 U	20 U	10 U
2-Nitrophenol	10 U	10 U	10 U	20 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	14 J	10 U
Benzoic Acid	50 U	50 U	50 U	100 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	20 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	20 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	20 U	10 U
Naphthalene	10 U	10 U	10 U	5500 D	10 U
4-Chloroaniline	10 U	10 U	10 U	20 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	20 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	20 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	520	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	20 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	20 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	100 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	20 U	10 U
2-Nitroaniline	50 U	50 U	50 U	100 U	50 U
Dimethylphthalate	10 U	10 U	10 U	20 U	10 U
Acenaphthylene	10 U	10 U	10 U	22	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	20 U	10 U
3-Nitroaniline	50 U	50 U	50 U	100 U	50 U
Acenaphthene	10 U	10 U	10 U	1400 D	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	100 U	50 U
4-Nitrophenol	50 U	50 U	50 U	100 U	50 U
Dibenzofuran	10 U	10 U	10 U	560	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	20 U	10 U
Diethylphthalate	10 U	10 U	10 U	20 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	20 U	10 U
Fluorene	10 U	10 U	10 U	630	10 U
4-Nitroaniline	50 U	50 U	50 U	100 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U	100 U	50 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	100 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	20 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	20 U	10 U
Pentachlorophenol	50 U	50 U	50 U	100 U	50 U
Phenanthrene	10 U	10 U	10 U	2000 D	10 U
Anthracene	10 U	10 U	10 U	110	10 U
Di-n-butylphthalate	10 U	10 U	10 U	20 U	10 U
Fluoranthene	10 U	10 U	10 U	460 D	10 U
Pyrene	10 U	10 U	10 U	300 D	10 U
Butylbenzylphthalate	10 U	10 U	10 U	20 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	40 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	81	10 U
Chrysene	10 U	10 U	10 U	69	10 U
bis(2-Ethylehexyl)phthalate	10 U	8 J	10 U	13 J	10 U
Di-n-octylphthalate	10 U	10 U	10 U	20 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	23	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	25	10 U
Benzo(a)pyrene	10 U	10 U	10 U	23	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	20 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	20 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	20 U	10 U

NOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW05S-01	MA-MWFB06-01	MA-MW06S-01	MA-MW07I-01	MA-MW07S-01
TR No.:	EW884	EW898	EW885	EW888	EW886
		Field Blank			
Parameter					
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	3100 D
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U	50 U	50 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylehexyl)phthalate	10 U	10 U	10 U	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

MOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW07S-01FR	MA-MW08I-01	MA-MW08S-FP	MA-MW08S-01	MA-MW09I-01
TR No.:	EW887	EW889	I01	I01	EW899
	Replicate		Free Product		
Parameter					
Phenol	10 U	10 U	2500000 U	20000 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	2500000 U	20000 U	10 U
2-Chlorophenol	10 U	10 U	2500000 U	20000 U	10 U
1,3-Dichlorobenzene	10 U	10 U	2500000 U	20000 U	10 U
1,4-Dichlorobenzene	10 U	10 U	2500000 U	20000 U	10 U
Benzyl alcohol	10 U	10 U	2500000 U	20000 U	10 U
1,2-Dichlorobenzene	10 U	10 U	2500000 U	20000 U	10 U
2-Methylphenol	10 U	10 U	2500000 U	20000 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	2500000 U	20000 U	10 U
4-Methylphenol	10 U	10 U	2500000 U	20000 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	2500000 U	20000 U	10 U
Hexachloroethane	10 U	10 U	2500000 U	20000 U	10 U
Nitrobenzene	10 U	10 U	2500000 U	20000 U	10 U
Isophorone	10 U	10 U	2500000 U	20000 U	10 U
2-Nitrophenol	10 U	10 U	2500000 U	20000 U	10 U
2,4-Dimethylphenol	10 U	10 U	2500000 U	20000 U	10 U
Benzoic Acid	50 U	50 U	12000000 U	100000 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	2500000 U	20000 U	10 U
2,4-Dichlorophenol	10 U	10 U	2500000 U	20000 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	2500000 U	20000 U	10 U
Naphthalene	3100 D	10 U	25000000	20000 U	10 U
4-Chloroaniline	10 U	10 U	2500000 U	20000 U	10 U
Hexachlorobutadiene	10 U	10 U	2500000 U	20000 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	2500000 U	20000 U	10 U
2-Methylnaphthalene	10 U	10 U	25000000	20000 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	2500000 U	20000 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	2500000 U	20000 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	12000000 U	100000 U	50 U
2-Chloronaphthalene	10 U	10 U	2500000 U	20000 U	10 U
2-Nitroaniline	50 U	50 U	12000000 U	100000 U	50 U
Dimethylphthalate	10 U	10 U	2500000 U	20000 U	10 U
Acenaphthylene	10 U	10 U	2500000 U	20000 U	10 U
2,6-Dinitrotoluene	10 U	10 U	2500000 U	20000 U	10 U
3-Nitroaniline	50 U	50 U	12000000 U	100000 U	50 U
Acenaphthene	10 U	10 U	28000000	20000 U	10 U
2,4-Dinitrophenol	50 U	50 U	12000000 U	100000 U	50 U
4-Nitrophenol	50 U	50 U	12000000 U	100000 U	50 U
Dibenzofuran	10 U	10 U	20000000	20000 U	10 U
2,4-Dinitrotoluene	10 U	10 U	2500000 U	20000 U	10 U
Diethylphthalate	10 U	10 U	2500000 U	20000 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	2500000 U	20000 U	10 U
Fluorene	10 U	10 U	26000000	20000 U	10 U
4-Nitroaniline	50 U	50 U	12000000 U	100000 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	12000000 U	100000 U	50 U
N-Nitrosodiphenylamine	50 U	50 U	2500000 U	20000 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	2500000 U	20000 U	10 U
Hexachlorobenzene	10 U	10 U	2500000 U	20000 U	10 U
Pentachlorophenol	50 U	50 U	12000000 U	100000 U	50 U
Phenanthrene	10 U	10 U	27000000	20000 U	10 U
Anthracene	10 U	10 U	7200000	20000 U	10 U
Di-n-butylphthalate	10 U	10 U	2500000 U	20000 U	10 U
Fluoranthene	10 U	10 U	35000000	20000 U	10 U
Pyrene	10 U	10 U	29000000	20000 U	10 U
Butylbenzylphthalate	10 U	10 U	2500000 U	20000 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	6800000	20000 U	20 U
Benzo(a)anthracene	10 U	10 U	6600000	20000 U	10 U
Chrysene	10 U	10 U	5000000 U	40000 U	10 U
bis(2-Ethylehexyl)phthalate	10 U	10 U	2500000 U	20000 U	10 U
Di-n-octylphthalate	10 U	10 U	2500000 U	20000 U	10 U
Benzo(b)fluoranthene	10 U	10 U	1800000 J	20000 U	10 U
Benzo(k)fluoranthene	10 U	10 U	2900000	20000 U	10 U
Benzo(a)pyrene	10 U	10 U	2000000 J	20000 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	2500000 U	20000 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	2500000 U	20000 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	2500000 U	20000 U	10 U

MOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW09S-01	MA-MW11I-01	MA-MW11S-01	MA-MW12S-01	MA-MW13S-01
TR No.:	EWB90	EWB93	EWB92	EWB94	EWB95
Parameter					
Phenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
Benzyl alcohol	10 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	10 U	10 U	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	50 U	50 U	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Dimethylphthalate	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	38	10 U	10 U
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	9 J	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	20	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U	50 U	50 U	50 U
N-Nitrosodiphenylamine	50 U	50 U	50 U	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	28	10 U	10 U
Anthracene	10 U	10 U	8 J	10 U	10 U
Di-n-butylphthalate	10 U	10 U	10 U	10 U	10 U
Fluoranthene	10 U	10 U	18	10 U	10 U
Pyrene	10 U	10 U	11	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U
Benzo(a)anthracene	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U
bis(2-Ethylehexyl)phthalate	10 U	10 U	10 U	10 U	10 U
Di-n-octylphthalate	10 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U	10 U	10 U	10 U

MOSS-AMERICAN
GROUNDWATER
SEMI-VOLATILES

Sample No.:	MA-MW14S-01	MA-MW20S-01
TR No.:	EW896	EW900
Parameter		
Phenol	10 U	10 U
bis(2-Chloroethyl)ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
Benzyl alcohol	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
2-Methylphenol	10 U	10 U
bis(2-Chloroisopropyl)ether	10 U	10 U
4-Methylphenol	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitrophenol	10 U	10 U
2,4-Dimethylphenol	10 U	10 U
Benzoic Acid	50 U	50 U
bis(2-Chloroethoxy)methane	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 U	10 U
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
4-Chloro-3-methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U
2-Chloronaphthalene	10 U	10 U
2-Nitroaniline	50 U	50 U
Dimethylphthalate	10 U	10 U
Acenaphthylene	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	50 U	50 U
Acenaphthene	10 U	10 U
2,4-Dinitrophenol	50 U	50 U
4-Nitrophenol	50 U	50 U
Dibenzofuran	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethylphthalate	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U
Fluorene	10 U	10 U
4-Nitroaniline	50 U	50 U
4,6-Dinitro-2-methylphenol	50 U	50 U
N-Nitrosodiphenylamine	50 U	50 U
4-Bromophenyl-phenylether	10 U	10 U
Hexachlorobenzene	10 U	10 U
Pentachlorophenol	50 U	50 U
Phenanthrene	10 U	10 U
Anthracene	10 U	10 U
Di-n-butylphthalate	10 U	10 U
Fluoranthene	10 U	10 U
Pyrene	10 U	10 U
Butylbenzylphthalate	10 U	10 U
3,3'-Dichlorobenzidine	20 U	20 U
Benzo(a)anthracene	10 U	10 U
Chrysene	10 U	10 U
bis(2-Ethylehexyl)phthalate	10 U	10 U
Di-n-octylphthalate	10 U	10 U
Benzo(b)fluoranthene	10 U	10 U
Benzo(k)fluoranthene	10 U	10 U
Benzo(a)pyrene	10 U	10 U
Indeno(1,2,3-cd)pyrene	10 U	10 U
Dibenz(a,h)anthracene	10 U	10 U
Benzo(g,h,i)perylene	10 U	10 U

Appendix Q
BIBLIOGRAPHY

Appendix Q
BIBLIOGRAPHY

Chapter 1

Crandall, Clifford J. June 5, 1984. Preliminary Sampling for Creosote of the Moss-American Site (correspondence to Penny Podell, Milwaukee County).

Envirex, Inc. (Rexnord Report) n.d. Demonstration of Removal and Treatment of Contaminated River Bottom Muds, Phase II, Draft Report. Prepared for Office of Research and Monitoring, Environmental Protection Agency.

Helvig, J. R. September 3, 1975. Stream Segment Survey of the Little Menomonee River. Internal Report of the Environmental Protection Agency.

Hussa, Robert O., Harvey B. Hopps, Joseph W. McCarthy, and Terrence L. Rinehart. 1973. The Creosote Problem in the Little Menomonee River. Scientific Committee, Citizens for Menomonee River Restoration, Inc.

National Enforcement Investigations Center (NEIC). June 1977. Impact of Creosote Deposits in the Little Menomonee River, Wisconsin. U. S. Environmental Protection Agency, EPA-330/2-77-016.

National Enforcement Investigations Center (NEIC). November 1977. The Potential for Pollution of the Little Menomonee River from the Kerr-McGee/Moss-American Plant Site, Milwaukee, Wisconsin. U.S. Environmental Protection Agency, EPA-330/2-77-022.

Sanders, Robert G., Stanley R. Rich and Thomas G. Pantazelos (Bio-Test Laboratories, Inc.). January 1973. Methods of Physically Remove Hazardous Material from Bottoms of Watercourses, for the Office of Research and Monitoring, U. S. Environmental Protection Agency, Contract 68-03-0181.

United Stated Army Corps of Engineers. 1971. Sampling of Little Menomonee River. Prepared by S. E. Miller.

Chapter 2

CH2M HILL, Inc. 1982. *Inline Storage Facilities Plan*, Vol. 1. Program Management Office. Milwaukee Water Pollution Abatement Program. Prepared for Milwaukee Metropolitan Sewerage District.

Federal Emergency Management Agency (FEMA). Flood Insurance Study, City of Milwaukee, WIsconsin, Community Number 550278. Revised November 19, 1987.

Foley, F. C., W. C. Walton, and W. J. Drescher. 1953. Groundwater Conditions in the Milwaukee-Waukesha Area, Wisconsin. U. S. Geological Survey.

Southeastern Wisconsin Regional Planning Commission (SEWRPC). October 1976. A Comprehensive Plan for the Menomonee River Watershed, Volume 1: Inventory Findings and Forecasts. Planning Report No. 26, Waukesha, Wisconsin.

Southeastern Wisconsin Regional Planning Commission (SEWRPC). October 1976. A Comprehensive Plan for the Menomonee River Watershed, Volume 2: Alternative Plans and Recommended Plan. Planning Report No. 26, Waukesha, Wisconsin.

United States Department of Agriculture, Soil Conservation Service. 1971. Soil Survey of Milwaukee and Waukesha Counties, Wisconsin.

Chapter 3

Callahan, Michael A., et al. December 1979. Water-Related Fate of 129 Priority Pollutants. Office of Water and Waste Management, U. S. EPA, EPA-440/4-79-029a.

Dragun, James. *The Soil Chemistry of Hazardous Materials*, Hazardous Materials Control Research Institute. Silver Spring, Maryland.

Jenkins, Cate. Alternate Concentration Limits for Dioxin Groundwater Contamination at Wood Preserving Sites. EPA memorandum dated May 8, 1986, to Bob Stewart. [Copied and distributed by Eileen Claussen, Characterization and Assessment Division (WH 562B), Office of Solid Waste and Emergency Response, in a memo titled "Technical Review Memorandum Concerning Analytical Strategies to Characterize Exposure Scenarios at Wood Preserving Sites" dated July 21, 1986.]

Chapter 4

Southeastern Wisconsin Regional Planning Commission (SEWRPC). October 1976. A Comprehensive Plan for the Menomonee River Watershed, Volume 1: Inventory Findings and Forecasts. Planning Report No. 26, Waukesha, Wisconsin.

Southeastern Wisconsin Regional Planning Commission (SEWRPC). October 1976. A Comprehensive Plan for the Menomonee River Watershed, Volume 2: Alternative Plans and Recommended Plan. Planning Report No. 26, Waukesha, Wisconsin.

United States Environmental Protection Agency. October 1, 1986. Superfund Public Health Evaluation Manual. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.4-1.

Wisconsin Department of Natural Resources. January 1985. *Stream Classification for the Little Menomonee River, Menomonee Watershed* by W. Wawrzyn.

U. S. Environmental Protection Agency (1988d). *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final.* OSWER Directive 9355.3-01. October 1988.

Appendix G

Bower, Herman, R. C. Rice. June 1976. A Slug Test for Determining Conductivity of Unconfined Aquifers with Completely of Partially Penetrating Wells. *Water Resource Research.* 12:423-5.

Todd, David K. 1980. *Groundwater Hydrology.* New York: John Wiley and Sons.

Appendix I

Freeze, R. Allan, and John A. Cherry. 1979. *Groundwater.* Englewood Cliffs, New Jersey: Prentice-Hall.

Appendix J

Griffen, R. A. June 1985. Preliminary Report of Soil Contamination Investigation, Seymour RI/FS.

Karickhoff, S. W., Sorption of Hydrophobic Pollutants on Natural Sediments. 1979.

Appendix K

Abrams, R., and G. Chesters. 1976. The Benthic Macroinvertebrates of the Menomonee River.

Bannerman, R., M. F. Bonn, and J. G. Konrad. 1984. The IJC Menomonee River Watershed Study: Surface Water Quality, 1975-1979. Volume 12 U. S. EPA Region 5. EPA-905/4-79-029-C.

Bauman, P. C., and J. J. Lech. In press. PAH's, Metabolites, and Neoplasia in Feral Fish Populations. *PAH Metabolism in the Aquatic Environment.* U. Varanasi, ed. Boca Raton, Fla: CRC Press.

Binder, S., W. Kay, D. Forney, and D. Paschal. 1985. Arsenic Exposure in Children Living Near the Former Copper Smelter at Anaconda, Montana.

Proceedings of the 6th National Conference on the Management of Uncontrolled Hazardous Waste Sites. Washington, DC. 1985.

Bos, R. P., et al. 1987. Fluoranthene, a Volatile Mutagenic Compound Present in Creosote and Coal Tar. *Mutagen Research* (3):119-25.

Boyle, T. P., et al. 1984. Distribution and rate of Disappearance of Fluorene in Pond Ecosystems. *Chemosphere* 13: 997-1,008.

Casarett and Doull. 1986 *Toxicology*. Ed. C. D. Klaasen, M. O. Amdur, and J. Doull. 3rd edition. New York: Macmillan Publishing Company.

Clayton, G. D., and F. E. Clayton. 1981. *Patty's Industrial Hygiene and Toxicology Vol. 2A-2C Toxicology*. New York: John Wiley and Sons.

Edwards, N. T. 1983. Polycyclic Aromatic Hydrocarbons (PAH's) in the Terrestrial Environment--A Review. *J. Environ. Qual.* 12:427-41.

Eisler, R. 1987. Polycyclic Aromatic Hydrocarbon Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review. *U. S. Fish Wildl. Serv. Biol. Report.* 85 (1.11) 81 pp.

Finger, S. E., et al. 1985. Comparison of Laboratory and Field Assessment of Fluorene--Part I: Effects of Fluorene on the Survival, Growth, Reproduction and Behavior of Aquatic Organisms in Laboratory Tests. pp. 120-33. *Validation and predictability of laboratory methods for assessing the fate and effects of contaminations in aquatic ecosystems*. T. P. Boyle, ed. ASTM STP 865. American Society for Testing and Materials, Philadelphia.

Gosselin, R. E., R. D. Smith, and H. C. Hodge. 1984. *Clinical toxicology of Commercial Products*. 5th edition, Baltimore: Williams & Wilkins.

Hilsenhoff, W. L. 1982. Using a Biotic Index to Evaluate Water Quality in Streams. Wisconsin Department of Natural Resources Technical Bulletin No. 132.

ICF-Clement. April 23, 1986. Endangerment Assessment: Mill Creek, Montana Anaconda Smelter Side. Revised Final Report. Prepared by Clement Associates for U. S. EPA Region 8.

International Agency for Research in Cancer (IARC). 1985. *Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*. Vol. 35.

Landrum, P., F., et al. 1984. Role of Sediment in the bioaccumulation of Benzo(a)pyrene by the Amphipod, *Pontoporeia hoyi*. Pp. 799-812. *Polynuclear Aromatic Hydrocarbons: Mechanisms, Methods, and Metabolism*. M. Cooke and A. J. Dennis, ed. Columbus, Ohio: Battelle Press.

Landrum, P. F., and D. Scavia. 1983. Influence of Sediment on Anthracene Uptake, Depuration, and Biotransformation by the Amphipod *Hyalella azteca*. *Canada J. Fish Aquatic Sci.* 40:298-305.

Lee, S. E., and L. Grand ed. 1981. *Health and Ecological Assessment of Polynuclear Aromatic Hydrocarbons*. Park Forest South, Illinois: Pathotex. 364 pp.

Lorenz, L. F., and L. R. Gjovick. 1982. Analyzing Creosote by Gas Chromatography: Relationship to Creosote Specifications. *Proceedings American Wood Preservation Association*. 68:32-42.

National Cancer Institute (NCI). 1985. *Creosote: Monograph of Human Exposure to Chemicals in the Workplace*. No. 1-CP-26002-03.

Neff, J. M. 1982. Polycyclic Aromatic hydrocarbons in the Aquatic Environment and Cancer Risk to Aquatic Organisms and Man. Pages 385-409. *Symposium: Carcinogenic Polynuclear Aromatic Hydrocarbons in the Marine Environment*. N. L. Richards and B. L. Jackson, ed. U. S. EPA Report 60/9-82-013.

Sims, R. C, and R. Overcash. 1983. Fate of Polynuclear Aromatic Compounds (PNAs or PACs) in Soil-Plant Systems. Residue Rev. 88: 1-68.

Sittig, M. 1985. *Handbook of Toxic and Hazardous Chemicals and Carcinogens*. 2nd edition. Park Ridge: Noyes.

Southeastern Wisconsin Regional Planning Commission (SEWRPC). October 1976. *A Comprehensive Plan for the Menomonee River Watershed*.

Sullivan, B. November 15, 1988. Personal Communication between A. M. Stumpf, CH2M HILL and B. Sullivan, Wisconsin County Park District.

U. S. Department of Energy. 1986. *Draft Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes*. DOE/EIS-0113. Washington, DC.

U. S. Environmental Protection Agency (1980a). *Ambient Water Quality Criteria for Polycyclic Aromatic Hydrocarbons*. 1980.

U. S. Environmental Protection Agency (1980b). *Ambient Water Quality Criteria for Fluoranthene*. EPA 440/5-80-049. 1980.

U. S. Environmental Protection Agency (1984a). *Health Assessment Document for Inorganic Arsenic: Final Report*. EPA-600/8-83-021F, Office of Health and Environmental Assessment. March 1984.

U. S. Environmental Protection Agency (1984b). *Health Effects Assessment for Polycyclic Aromatic Hydrocarbons (PAH's)*. EPA/540/1-86/013, Office of Research and Development. September 1984.

U. S. Environmental Protection Agency (1985a). *Mutagenicity and Carcinogenicity Assessment of 1,2-Butadiene: Final Report.* EPA/600/8-85/004F, Office of Health and Environmental Assessment, September 1985.

U. S. Environmental Protection Agency (1985b). EPA Proposal to Set Recommended Drinking Water Limits for Inorganic, Synthetic Organic Chemicals, Microorganisms. *Federal Register* 50: 46936. November 13, 1985.

U. S. Environmental Protection Agency (1985c). Revised National Oil and Hazardous Substances Pollution Contingency Plan Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980. *Federal Register* 50: 47950. November 20, 1985.

U. S. Environmental Protection Agency (1986a). Guidelines for Estimating Exposure. *Federal Register* 51:34042-45. September 24, 1986.

U. S. Environmental Protection Agency (1986b). Guidelines for Mutagenicity Risk Assessment. *Federal Register* 51: 34006-25. September 24, 1986.

U. S. Environmental Protection Agency (1986c). Guidelines for the Health Risk Assessment of Chemical Mixtures. *Federal Register* 51: 34014-41. September 24, 1986.

U. S. Environmental Protection Agency (1986d). Guidelines for Carcinogen Risk Assessment. *Federal Register* 51: 33992-34013. September 24, 1986.

U. S. Environmental Protection Agency (1986e). *Superfund Public Health Evaluation Manual.* EPA 540/1-86-060. October 1986.

U. S. Environmental Protection Agency (1987). *Health Effects Assessment for Creosote.* EPA/600/8-88/025, Office of Research and Development. July 1987.

U. S. Environmental Protection Agency (1988a). *Superfund Exposure Assessment Manual.* OSWER Directive 9285.5-1, Office of Emergency and Remedial Response. April 1988.

U. S. Environmental Protection Agency (1988b). Memorandum from Lee Thomas to Assistant Administrators. Subject: Recommended Agency Policy on the Carcinogenicity Risk Associated with the Ingestion of Inorganic Arsenic. June 21, 1988.

U. S. Environmental Protection Agency (1988c). Proposed Revisions to the National Oil and Hazardous Substances Pollution Contingency Plan Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980. *Federal Register* 53: 15394. December 21, 1988.

U. S. Environmental Protection Agency (1989a). Integrated Risk Information System. Chemical Files. U. S. EPA Integrated Risk Information System Data Base, Office of Research and Development, Cincinnati, Ohio. 1989.

U. S. Environmental Protection Agency (1989b). Integrated Risk Information System. Background Information. U. S. EPA Integrated Risk Information System Data Base, Office of Research and Development, Cincinnati, Ohio. 1989.

U.S. Environmental Protection Agency (1989c). *Interim Final Guidance for Soil Ingestion Rates*. OSWER Directive 9850.4. January 27, 1989.

U. S. Environmental Protection Agency (1989d). *Exposure Factors Handbook - Final Report*. EPA/600/8-89/043, Office of Health and Environmental Assessment. March 1989.

U.S. Environmental Protection Agency (1989e). Risk Assessment Guidance for Superfund--Environmental Evaluation Manual. Interim Final. EPA/540/1-89-001A OSWER Directive 9285.701. March 1989.

U. S. Environmental Protection Agency (1989f). Risk Assessment Guidance for Superfund--Human Health Evaluation Manual. Part A. Interim Final. OSWER Directive 9285.701A. October 1989.

U. S. Environmental Protection Agency (1989g). Health Effects Assessment Summary Tables - Third Quarter FY 1989. OERR 9200.6-303-(89-3), Office of Research and Development. 1989.

Verschueren, K. 1983. *Handbook of Environmental Data on Organic Chemicals*. Second edition, Van Nostgrand Reinhold Company.

Wisconsin Department of Natural Resources. 1984. Water Quality Standards Review for the Milwaukee Metropolitan Area. Bureau of Water Resource Management, Madison. May 16 correspondence to U. S. EPA.

Wisconsin Department of Natural Resources. January 1985. *Stream Classification for the Little Menomonee River, Menomonee Water Shed* by W. Wawrzyn.

Appendix L

Anderson, E., et al. *Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments*. EPA-600/8-85-010. August 1985.

Cawsarett and Doull. *Toxicology*. 3rd edition. ed. C. D. Klaasen, M. O. Amdur, and J. Duoll. New York: Macmillan Publishing Company. 1986.

Dutkiewicz, T., and H. Tyras. 1967. A Study of Skin Absorption of Ethylbenzene in Man. *British Journal of Industrial Medicine* 24: 330-2.

Dutkiewicz, T., and H. Tyras. 1968. Skin Absorption of Toluene, Styrene, and Xylene by Man. *British Journal of Industrial Medicine* 25:243.

Healy, J. W. 1980. Review of Resuspension Models. *Transuranic Elements in the Environment*. DOE-TIC-2280. Springfield, VA: Technical Information Center.

International Commission on Radiological Protection. 1974. *Report of the Task Group on Reference Man*. International Commission on Radiological Protection Publication No. 23, W. S. Snyder, ed. Oxford: Pergamon Press.

Schaum, J. November 1984. *Risk Analysis of TCDD Contaminated Soil*. U. S. EPA Office of Health and Environmental Assessment. EPA 600/8-84-031.

Scheuplein, R. J., and I. H. Blank. 1971. Permeability of the Skin. *Physiological Review* 51(4): 702-47.

Scheuplein, R. J., and L. W. Ross. 1974. Mechanism of Percutaneous Absorption V. Percutaneous Absorption of Solvent Deposited Solids. *The Journal of Investigative Dermatology* 62: 353-60.

U.S. Department of Energy. 1986. *Draft Environmental Impact Statement: Disposal of Hanford Defense High-Level, Transuranic and Tank Wastes*. DOE/EIS-0113. Washington, DC.

U. S. Environmental Protection Agency (1986a). Guidelines for the Health Risk Assessment of Chemical Mixtures. *Federal Register* 51: 34014-41. September 24, 1986.

U. S. Environmental Protection Agency (1986b). Guidelines for Carcinogen Risk Assessment. *Federal Register* 51: 33992-34013. September 24, 1986.

U. S. Environmental Protection Agency (1986c). *Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup*. U. S. EPA Exposure Assessment Group, EPA/600/6-86/002. May 1986.

U. S. Environmental Protection Agency (1988). *Superfund Exposure Assessment Manual*. OSWER Directive 9285.5-1, Office of Emergency and Remedial Response. April 1988.

U. S. Nuclear Regulatory Commission (NRC). 1986. *Update of Part 61 Impacts Analysis Methodology*. NUREG; CR-4370, Vol. 1 and 2, Washington, DC.

GLT864/101.50