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ARCS V

Remedial Activities at Uncontrolled Hazardous Waste Sites in Region V

EPA United States Environmental Protection Agency

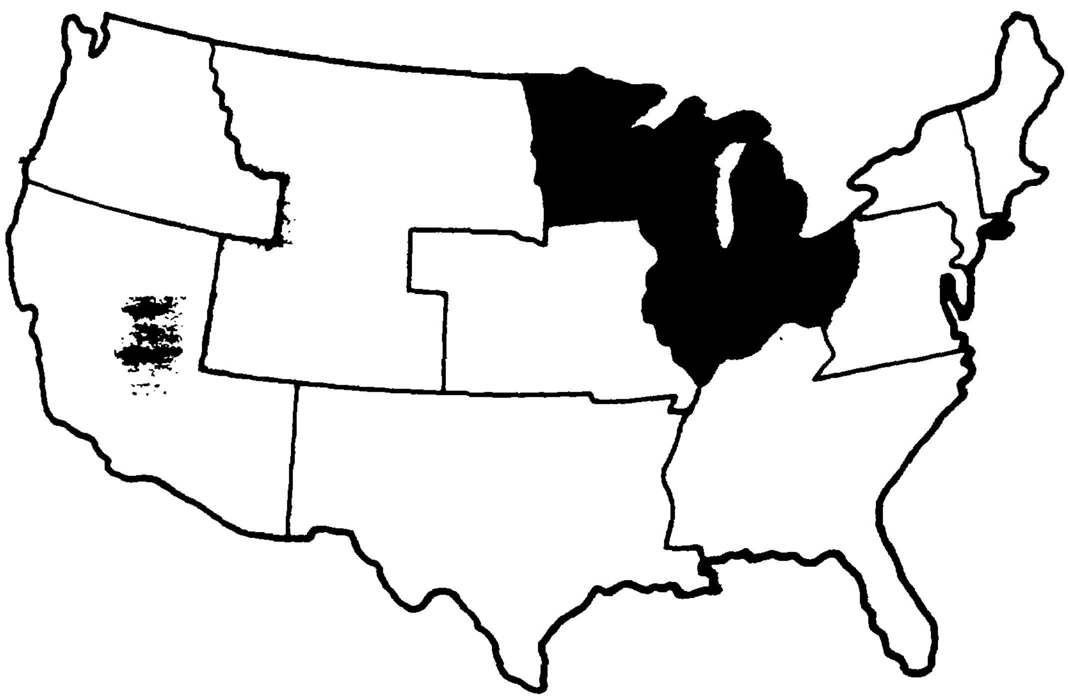
REMEDIAL INVESTIGATION REPORT

Volume 2

ONALASKA MUNICIPAL LANDFILL
Onalaska, Wisconsin

WA 01-5LL5.0 / Contract No. 68-W8-0040

December 22, 1989



CH2M HILL

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GLT913/064.50-3

Appendix A
SITE CHRONOLOGY

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1969

June 1 Town of Onalaska licensed by the Wisconsin Department of Natural Resources (DNR) to operate an 11-acre landfill (License No. 507), previously used as a gravel pit.

1970

July 7 Daily landfill operation reports through the end of July identify Outers Laboratories as depositing paper, wood, oil, and some drums at the site. Operation reports also identify disposal of refuse from private citizens and trash and rubbish collection services.

1971

January 22 The DNR receives complaint concerning open burning of Outers Laboratories industrial wastes.

January 26 The DNR prohibits all open burning at Onalaska landfill; records indicate Outers Laboratories submitted solvent waste for incineration at the Onalaska site.

February 22 The DNR, in a letter to Outers Laboratories, suggests Outers' liquid waste be deposited in a designated area, covered immediately and compacted. Outers also suggested a lockable gate be installed at the site entrance.

August 31 The DNR claims operation of site is not in conformance with the Wisconsin Solid Waste Disposal Standards. All open burning was prohibited except clean wood, which could be burned in an area with restricted access. Metallic cleaner was to be dumped in a separate area and covered immediately.

May 25 Ordinance adopted by Town Board states landfill is to be used freely by town residents, and with written permit by nonresidents, commercial garbage and trash haulers.

1972

August 22 The DNR inspects site for locational conformance and determines if the site meets the locational requirements of the Wisconsin Standards.

1973

March 19 The DNR indicates that the Town of Onalaska had difficulty covering waste because a school and an industry (unnamed) dumped waste daily. The DNR reminded town of waste burning restrictions.

1974

October 15 Relicensing and Inspection Report names City of Onalaska, Town of Medary, and Town of Campbell as also using site.

Solvent reportedly dumped in a separate area at rate of approximately 500 gallons/2 weeks.

A DNR inspector observes leachate, deposition of unauthorized wastes (unspecified), open burning (unspecified), and monitoring wells in use.

1975

July 23 The DNR asks Town of Onalaska to identify the "acid and industrial chemicals" listed on license application as accepted by township from local industry for immediate burial.

July 26 Township reports the material is naphtha, a "standard solvent" used as a cleaning fluid, and says the site receives approximately 2,500 gallons/month. The DNR later determines material was from Outers Laboratories.

August 14 The DNR recommends Outers Laboratories find alternative methods to dispose of naphtha waste.

September 12 Outers Laboratories submits waste review form to the DNR claiming 90 percent of waste was generated by a metal cleaning process that contained naphtha and toluene and remaining 10 percent from paint and spray gun cleaning and machine shop cleaning fluids.

1976

April 16 Outers Laboratories informs the DNR that disposal of liquid waste at Onalaska Landfill has ceased.

June 17 The DNR cites need for a site engineering study because the presence of highly permeable sand and gravel soils on site and evidence of periodic high groundwater occurrences suggest waste material deposited in landfill might generate leachate that will affect groundwater quality.

1977

July 21 Town of Onalaska reports to the DNR that Bill's Pumping Service is dumping rinsing material from a can manufacturing company in La Crosse at a rate of approximately 600 gallons a week.

1978

February 9 The DNR issues an order to the township to submit a report of in-field site conditions. The DNR finds Onalaska Landfill is not in compliance with Wisconsin solid waste codes. Violations are cited because site is operating without surface water drain control; site is located in area of permeable soils; site is operated without proper engineering plans and specifications.

April 17 In-field conditions report by Warzyn is submitted to the DNR. Conclusions recommend phased abandonment of the site because of downgradient groundwater contamination.

May 21 DNR inspection says township no longer receives canning wastes.

June 1 Meeting is held with the DNR and Warzyn to discuss in-field conditions report for Onalaska Landfill; concludes that monitoring well water levels should be determined monthly for 1 year and water quality analyses should be monitored quarterly.

Organic odor detected in soil samples from monitoring levels B-4 and B-3A.

The DNR agrees to phased abandonment proposal.

June 27 The DNR's Standard Hydrogeologic Review identifies St. Francis Hospital, Continental Can of La Crosse, Metallics, and Outers Laboratories as commercial refuse site generators. Continental Can is listed as major source of nonresidential refuse at the site.

Hydrogeologic review also indicates an average of 1 foot between the groundwater and refuse pile. Reported seasonal fluctuations in water levels causes waste to be in contact with groundwater for extended periods of time.

October 19 Warzyn submits Plan of Operation and Phased Abandonment Plan. Suggested the site continue to operate until grades are reached where surface water drainage is acceptably achieved. Abandonment proposed in three phases: November 1, 1978; October 1, 1979; and May 30, 1980, followed by a 2-foot cap and 6 inches of topsoil.

1979

May 1 Warzyn reports two sources of final cover material for landfill that meet DNR standards.

Warzyn water quality report concludes Onalaska Landfill is affecting grôundwater quality as indicated by observed levels of chloride, total hardness, and conductivity.

May 4 The DNR issues plan approval and orders landfill closure by September 30, 1979.

October 1 Landfill license application lists Modern Clean-Up as a major waste hauler for Onalaska township. Mid-State Exterminators reportedly used to control landfill pests. Open burning occurs once every 2 months.

1980

May 30 The DNR modifies order to close landfill. Changes closure date to September 30, 1980.

December 11 A DNR memorandum reports copper wire was salvaged from transformers on the landfill site and identified Trempealeau Electric as a possible source.

1981

October 19 The DNR classifies Onalaska landfill as an open dump because of improper closure.

1982

January 20 The DNR informs Miller of plans to construct a replacement well.

July 15 Miller's attorney investigates Miller well water quality.

July 22 Final cap placed over the landfill. Cap seeding delayed until September 1, 1982.

September 7 The DNR samples monitoring wells and private wells for compliance with drinking water standards and for organic contamination.

November 5 The DNR recommends that well Nos. 4 and 2 and Miller's well be abandoned and replaced with new wells. Suggests increased monitoring and sampling for barium, manganese, and organic compounds.

November 12 Miller receives $25,000 in damages from lawsuit against Outer Laboratories.

1983

January 14 Medary Well Drilling begins drilling a new, deeper well for Cecil Miller.

January 20 The DNR says transformer oil was either dumped on the ground or used to burn insulation off the copper wire.

May 2 An EPA Potential Hazardous Waste Site Inspection Report is submitted.

June 16 A National Priorities List Score Sheet is submitted.

1984

September Onalaska Landfill is placed on the NPL with hazard ranking of 42.97.

September 25 Tech Law, Inc., Fairfax, Virginia, submits draft report to the EPA identifying PRPs.

1986

September 24 Consent order negotiation meeting held with Town of Onalaska. Phased study approach to RI/FS is proposed.

1987

July 31 Town of Onalaska is named PRP by EPA.

October 9 In a Consent Order Negotiation Meeting, the Town of Onalaska proposed $108,000 to do a preliminary investigation at the site. The town would not sign an open ended consent order without a monetary cap and asked to be released from liability for the site if RI/FS costs exceeded $500,000. The town proposed that the EPA fund the remainder of the study if the cost exceeds that amount.

November 4 Deadline for consent order agreement. The EPA could not commit to a mixed funding settlement for an RI/FS. EPA would conduct the RI/FS.

1988

March 28 The U.S. EPA issues a procurement request order for funding an RI/FS.

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Appendix B
CHARACTERISTICS OF CHEMICALS DEPOSITED ONSITE

Appendix B
CHARACTERISTICS OF CHEMICALS DEPOSITED ONSITE

NAPHTHA (VM & P)

Composed of 40 to 80 percent aliphatic hydrocarbons, 25 to 50 percent naphthenic hydrocarbons, 0 to 10 percent benzene, and 0 to 20 percent other aromatic hydrocarbons. Derived from petroleum?

Observable Characteristics:

Watery liquid
Colorless
Gasoline-like odor

Physical and Chemical Properties:

Flash point: 103°F
Boiling point (1 atm): 266-311°F
Specific gravity: 0.84
Latent heat of vaporization: 103-150 Btu/lb
Heat of combustion: 18,200 Btu/lb
Immiscible in water, components slightly soluble in water

NAPHTHA (Stoddard solvent)

Contains paraffins, naphthenes, alkylbenzenes, with a trace of benzene. Derived from petroleum.

Observable Characteristics:

Watery liquid
Colorless
Gasoline-like odor

Physical and Chemical Properties:

Flash point: 103°F
Boiling point (1 atm): 320-390°F
Specific gravity: 0.78
Latent heat of vaporization: 103-150 Btu/lb
Heat of combustion: 18,200 Btu/lb
Immiscible in water, components slightly soluble in water

NAPHTHA (High Flash)

A coal tar derivative consisting of a mixture of aromatic hydrocarbons, principally toluene, xylene, cumene, and possibly benzene (depending on grade).

Observable Characteristics:

Watery liquid
Color - Crude - dark straw-colored
Refined - water-white
Hydrocarbon-like odor (like benzene, toluene, and xylene)
Produces irritating vapor

Physical and Chemical Properties:

Flash point: 107°F
Boiling point (1 atm): 200-500°F
Specific gravity: 0.86-0.88
Latent heat of vaporization: 101 Btu/lb
Heat of combustion: 18,200 Btu/lb
Immiscible in water, components slightly soluble in water

MINERAL SPIRITS

A naphtha composed of a fraction slightly lower in boiling point than Stoddard solvent (names are often used interchangeably). Fraction contains paraffins, naphthenes, olefins and aromatics.

Observable Characteristics:

Watery liquid
Colorless
Gasoline-like odor

Physical and Chemical Properties:

Flash point: 105-140°F, depending on grade
Boiling point (1/atm): 310-395°F
Specific gravity: 0.78
Latent heat of vaporization: not available
Heat of combustion: not available
Immiscible in water, components slightly soluble in water

Solvosol (aka Mineral Spirits)

Ethanol (ethyl alcohol) used as a solvent for resins, oils, hydrocarbons, surface, cleaning preparations, surface coatings, etc.

Observable Characteristics:

Colorless, limpid, volatile liquid
Pungent taste
Ethereal, vinous odor

Physical Chemical Properties:

Flash point: 55°F
Boiling Point: 173°F
Specific gravity: 0.816
Miscible in Water

TOLUENE (Toluol)

Methylbenzene (C_7H_8)

Observable Characteristics:

Mobile liquid
Colorless
Distinct aromatic odor, milder than benzene

Physical and Chemical Properties:

Flash point: 40°F
Boiling point: 110°F
Specific gravity: 0.866
Immiscible in water, components slightly soluble in water

ASPHALTUM

A dark brown to black oily liquid or semiliquid bituminous material resulting from the distillation of petroleum. Consists largely of asphaltic hydrocarbons which is a mixture of paraffinic and aromatic hydrocarbons and heterocyclic compounds containing sulfur, nitrogen, and oxygen. Aka residual oil, liquid asphalt, black oil, petroleum tailings and residuum.

Observable Characteristic:

Oily liquid to semiliquid
Dark brown to black color
Tarry odor

Physical and Chemical Properties:

Flash point: 300-550°F
Boiling point: not pertinent
Specific gravity: 1.11 at 50°C (liquid)
Molecular weight range--290 to 630
Immiscible in water, components slightly soluble in water

PAINT FORMULAS

Proprietary formulas. Solvent components include high-flash petroleum and toluene. Substance is not water soluble.

SYNTHETIC LUBRICANT (PTL-1009)

Amine soap with chemical lubricity and extreme pressure additives.

Observable Characteristics:

Clear fluid
Mild odor

Physical and Chemical Properties:

Flash point: 220°F
Boiling point: 206°F
Specific gravity: 1.08
$pH_{2\%soln}$: 7.2
Saponification value: 24.8
Neutralization No.: 26.45 mg KOH/g
Cloud point: 60°F
Soluble in water

BARIUM

A silver white metallic element. A secondary mineral constituent in carbonate sedimentation rocks of barite. Barium compounds used in many commercial processes. Barium is not very mobile in soils because it forms water insoluble salts and is unable to form soluble complexes with humic and fulvic materials. In an aquatic environment, solubility of barium is controlled by the solubility product of barium carbonate.

The properties of barium compounds vary with specific compounds. A few selected compounds are shown with their physical/chemical properties listed:

	Barium	Barium Carbonate	Barium Chloride	Barium Oxide	Barium Sulfide	Barium Sulfate
Chemical Formula	Ba	$BaCO_3$	$BaCl_2$	BaO	BaS	$BaSo_4$
Molecular Weight	137	197	208	153	169	233
Physical State	Silver White Solid	White Crystal/ Powder	White Solid	Colorless Crystals	In Aqueous Solution	Colorless Solid
Boiling Point	163F°C	N/A	156°C	2,000°C	--	--
Melting Point	730°C	--	960°C	1,923°C	--	1,580°C
Density (g/cm^3)	3.5	4.43	3.9	5.72	4.25	4.5
Vapor Pressure	$1,810 \times 10^{-5}$ mmHg	N/A	N/A	N/A	N/A	N/A
Water Solubility (mg/l)	decomposes	2 (20°C)	31 (0°C)	3.5 (20°C)	decomposes	--

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Appendix C
CAP INVESTIGATION

Appendix C
CAP INVESTIGATION

INTRODUCTION

The cap investigation at the Onalaska Landfill was conducted in two stages according to the scope of Task F1, Subtask FS--Cap Investigation. The first was conducted on April 19 and 20, 1989; the second between May 1 and 3, 1989. The objectives of this investigation were to:

- o Determine the permeability of the existing cap soils to evaluate the magnitude of precipitation infiltration

- o Determine engineering properties of the cap soils to evaluate their susceptibility to damage from freezing/thawing and desiccation and to evaluate the magnitude of damage that has occurred because of freezing and thawing, desiccation, and root damage

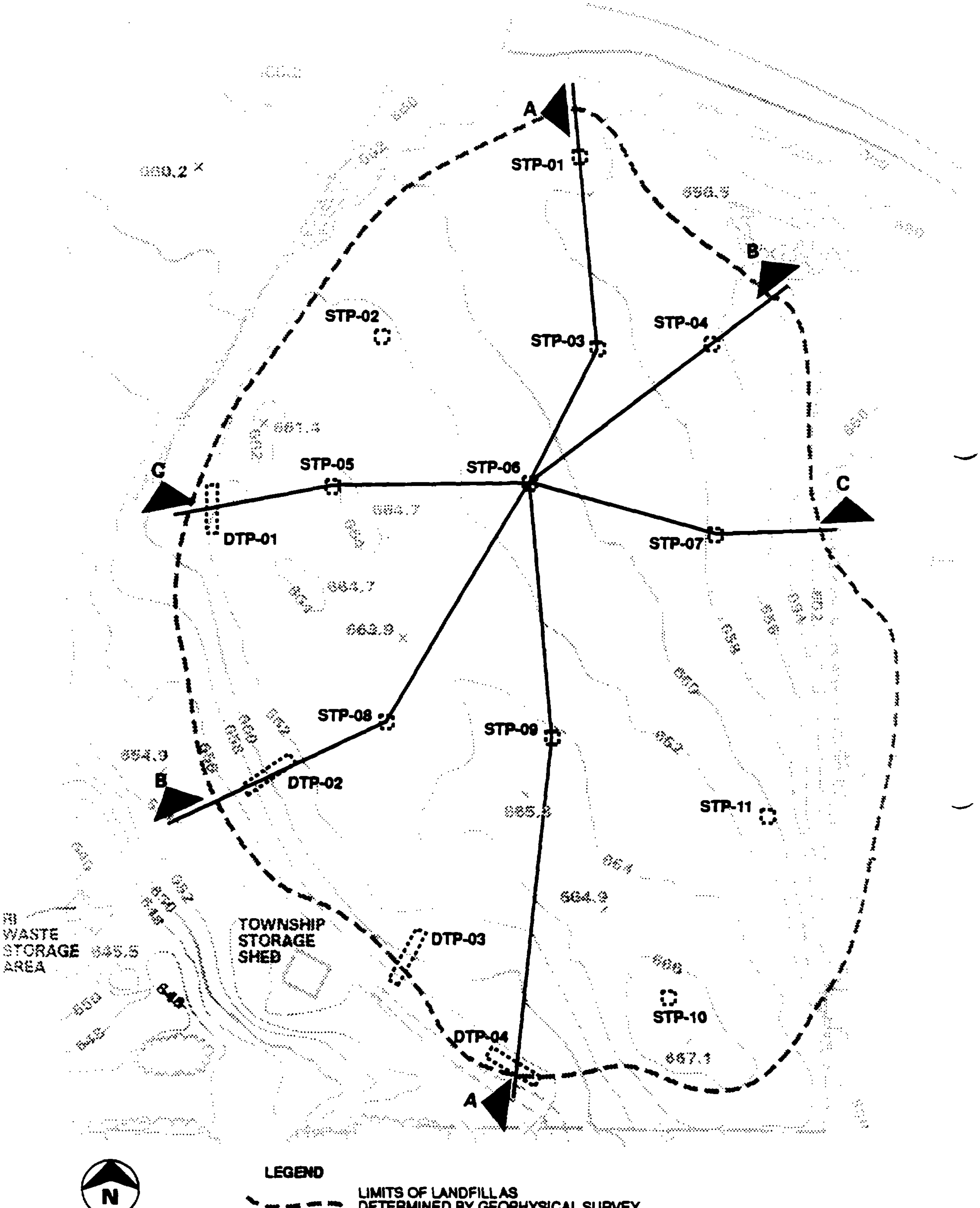
During the first stage of the cap investigation, 11 shallow test pits (STP-01 through STP-11) were excavated through the cap to characterize the thickness of the cap and physical properties of the cap soil. Depths of the shallow test pits ranged from 2.5 to 5 feet. Soil samples, consisting of Shelby tubes and bag samples, were taken at each location for geotechnical analysis. A total of 13 Shelby tube (3-inch thin walled sampler) samples were taken in accordance with ASTM D 1587. At least one Shelby tube was pushed at each test pit location. At locations STP-02 and STP-06, two tubes were pushed. At least one bag sample was taken at each test pit location. Two bag samples were taken at STP-01, STP-03, and STP-04.

Test pit locations are shown in Figure C-1. Test pit logs are included as Attachment C-1. Sample intervals are shown on the test pit logs. In addition to the shallow test pits, four deep test pits were excavated, as shown on Figure C-1, as part of the Task FI, Subtask FI--Solvent Disposal Area Investigation. Deep test pit wall logs were also used to aid in cap characterization; they are included in Appendix H, Source Area and Test Pit Investigation.

The following persons were onsite specifically for the first stage of the cap investigation:

Field Team Member	Affiliation	Responsibility
Chris Lawrence	CH2M HILL	Field Team Leader/ Test Pit Logging
Jeff Salerno	Exploration Technologies, Inc.	Backhoe Operator
Dave Cruise	Exploration Technologies, Inc.	Helper

Geotechnical laboratory testing was performed by Warzyn Engineering, Inc., of Madison, Wisconsin.



GLO65550.RI FIGC-1 10-17-89

LEGEND

LIMITS OF LANDFILL AS DETERMINED BY GEOPHYSICAL SURVEY

STP-10 SHALLOW TEST PIT LOCATION

DTP-04 DEEP TEST PIT LOCATION

NOTE: PITS NOT TO SCALE.

FIGURE C-1
TEST PIT AND CROSS SECTION LOCATIONS
ONALASKA LANDFILL RI/FS

During the second stage of the cap investigation, double-ring infiltrometer tests were conducted to quantify the in situ permeability of the cap. In situ densities and moisture contents of the cap were also measured. Seven double-ring infiltrometer tests were performed. Infiltrometer test locations are shown in Figure C-2. Infiltrometer test locations were chosen based on information derived from shallow test pit excavations, and are roughly adjacent to selected test pits. Density and moisture tests were performed at ground surface on 100 foot centers across the site and at selected locations in pits 1 to 1.5 feet underground. Density and moisture tests were performed to characterize the uniformity of the site soils and the durability of the existing cap.

The following persons were onsite specifically for the second stage of the cap investigation.

Field Team Member	Affiliation	Responsibility
Chris Lawrence	CH2M HILL	Field Team Leader/ Cap Evaluation
Paul Boersma	CH2M HILL	Cap Evaluation

SHALLOW TEST PIT EXCAVATION, SAMPLING, AND TESTING

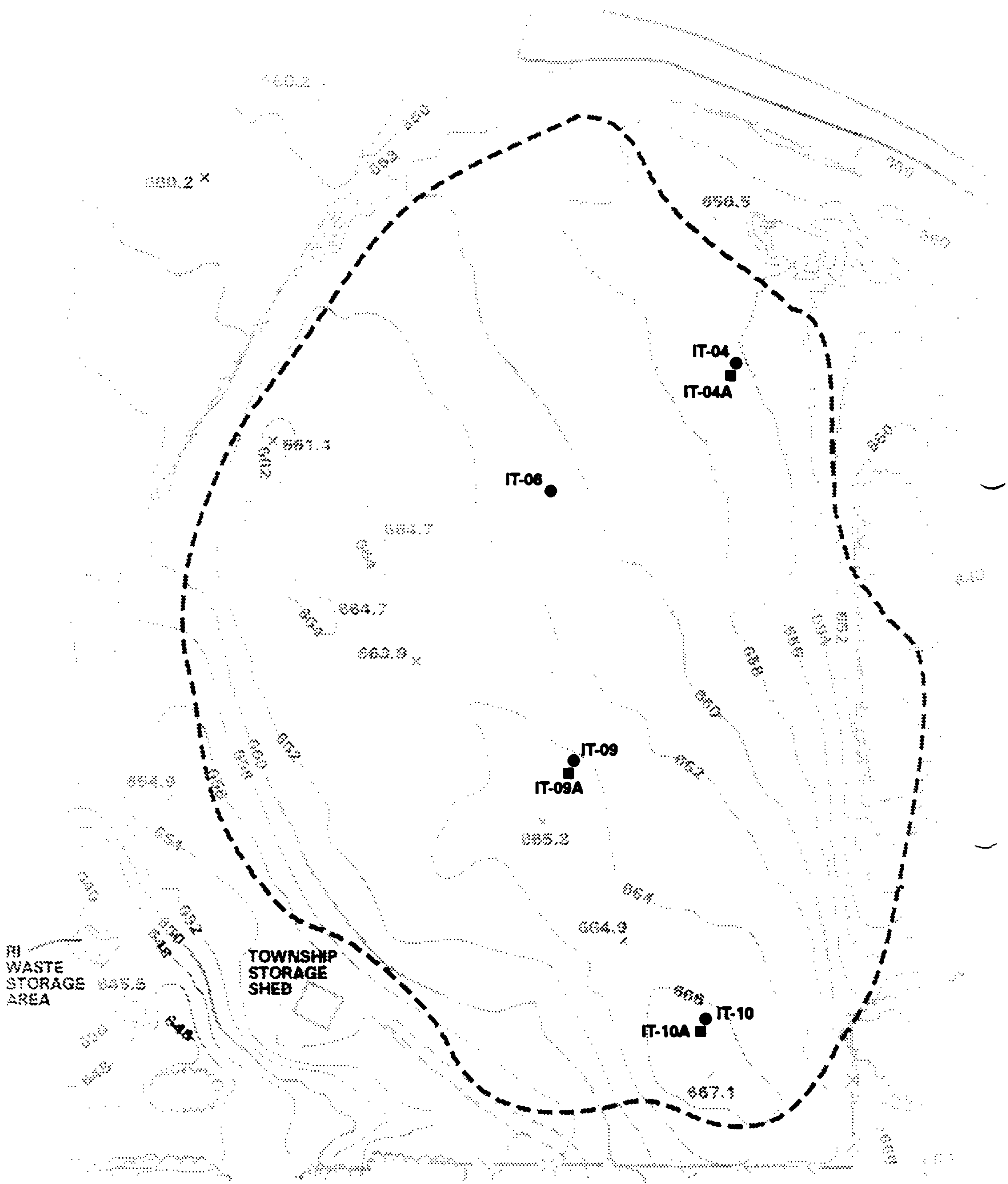
PURPOSE

Shallow test pits were excavated to determine the thickness and material properties of the existing landfill cap. Material from or near the test pits was sampled and tested to:

- o Classify the soil in accordance with the Unified Soil Classification System
- o Determine the in situ permeability and other engineering properties of the soil
- o Characterize the moisture-density relations of the soils to provide a baseline from which to evaluate the extent of damage from freeze and thaw, desiccation, and root damage
- o Determine the permeability of recompacted cap soil

FIELD PROCEDURES

Test pits were excavated using a JD-310A wheel-mounted backhoe/loader. The backhoe, operator, and helper were provided by Exploration Technologies, Inc. (ETI), an environmental services firm based in Madison, Wisconsin.



N

0 100
SCALE IN FEET

LEGEND

LIMITS OF LANDFILL AS DETERMINED BY GEOPHYSICAL SURVEY

IT-10 ● LOCATION OF INFILTROMETER TEST CONDUCTED ON EXISTING GROUND SURFACE

IT-10A ■ LOCATION OF INFILTROMETER TEST CONDUCTED IN PIT

FIGURE C-2
INFILTROMETER TEST LOCATIONS
ONALASKA LANDFILL RI/FS

GLO65550.RI FIGC-2 10-13-89

Test pits were approximately 3 feet long by 2 feet wide. The actual depth of each test pit is shown on the test pit logs. Test pits were excavated in passes approximately 12 inches deep. Test pit soil was classified by a CH2M HILL geotechnical engineer in accordance with ASTM D 2487 during excavation. All cover material was assumed to be uncontaminated and was stockpiled on the ground surface adjacent to the test pit. Excavation continued through the entire thickness of the cap. In all cases, the cap was underlain by sand. Excavation was discontinued when sand was encountered. In two cases (STP-03 and STP-04) refuse was encountered. Soil containing refuse was not stockpiled on the ground surface, but was instead held in the bucket of the backhoe until the hole was backfilled. Test pits were backfilled in the reverse order they were excavated using the backhoe. Backfilled soil was tamped using the backhoe bucket.

Air in the breathing zone was continuously monitored during excavation and backfilling using an HNu photo-ionization device and an MSA explosimeter. No readings above background were observed during excavation of any of the 11 shallow test pits.

Shelby tubes were 30 inches long by 3 inches in diameter. Shelby tubes were pushed from the surface to their full depth and extracted using the backhoe. A special head, provided by ETI, allowed the tube to be pulled using the teeth on the backhoe bucket. Holes left by the Shelby tubes were backfilled using dry concrete. After the Shelby tubes were withdrawn, the ends were packed with damp newspaper and plastic caps were taped into place. Bag samples, consisting of 10 to 20 pounds of soil placed in double-lined plastic bags, were taken from material excavated from the test pits. Soil samples were transported to the Warzyn Soils Lab in Madison by ETI. The Shelby tube samples were transported vertically in a cushioned box.

TEST PIT EXCAVATION SUMMARY

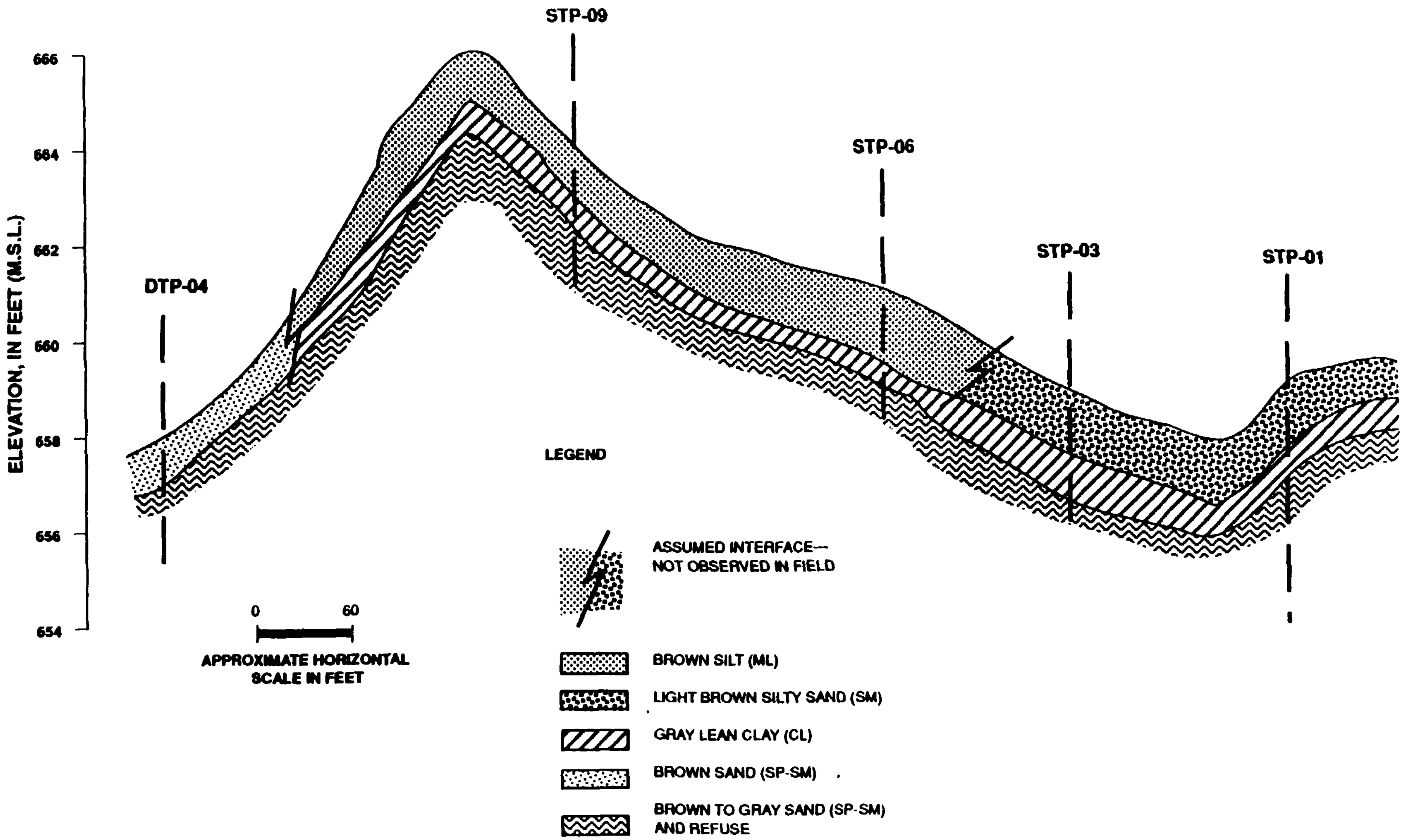
Test pits were excavated in reverse order starting with STP-11 and ending with STP-01. Test pits STP-11 through STP-05 were excavated on April 19, 1989, and test pits STP-04 through STP-01 were excavated on April 20, 1989.

Test pit logs are presented in Attachment C-1. Classifications shown in the logs have been adjusted from the field classifications based on the results of laboratory and infiltrometer testing. Figures C-3 through C-5 show cross sections of the cap based on the test pit logs. Cross section locations are shown on Figure C-1. Table C-1 summarizes material types and thicknesses encountered at each test pit.

LABORATORY TESTING SUMMARY

Soil samples taken from the cap were assumed to be uncontaminated and nonhazardous, so precautions during testing were considered unnecessary. Soil samples from each location were analyzed for grain size, Atterberg limits, density, and permeability. Two moisture-density relation tests were performed on bag samples taken from STP-04. With the exception of one flexible-wall

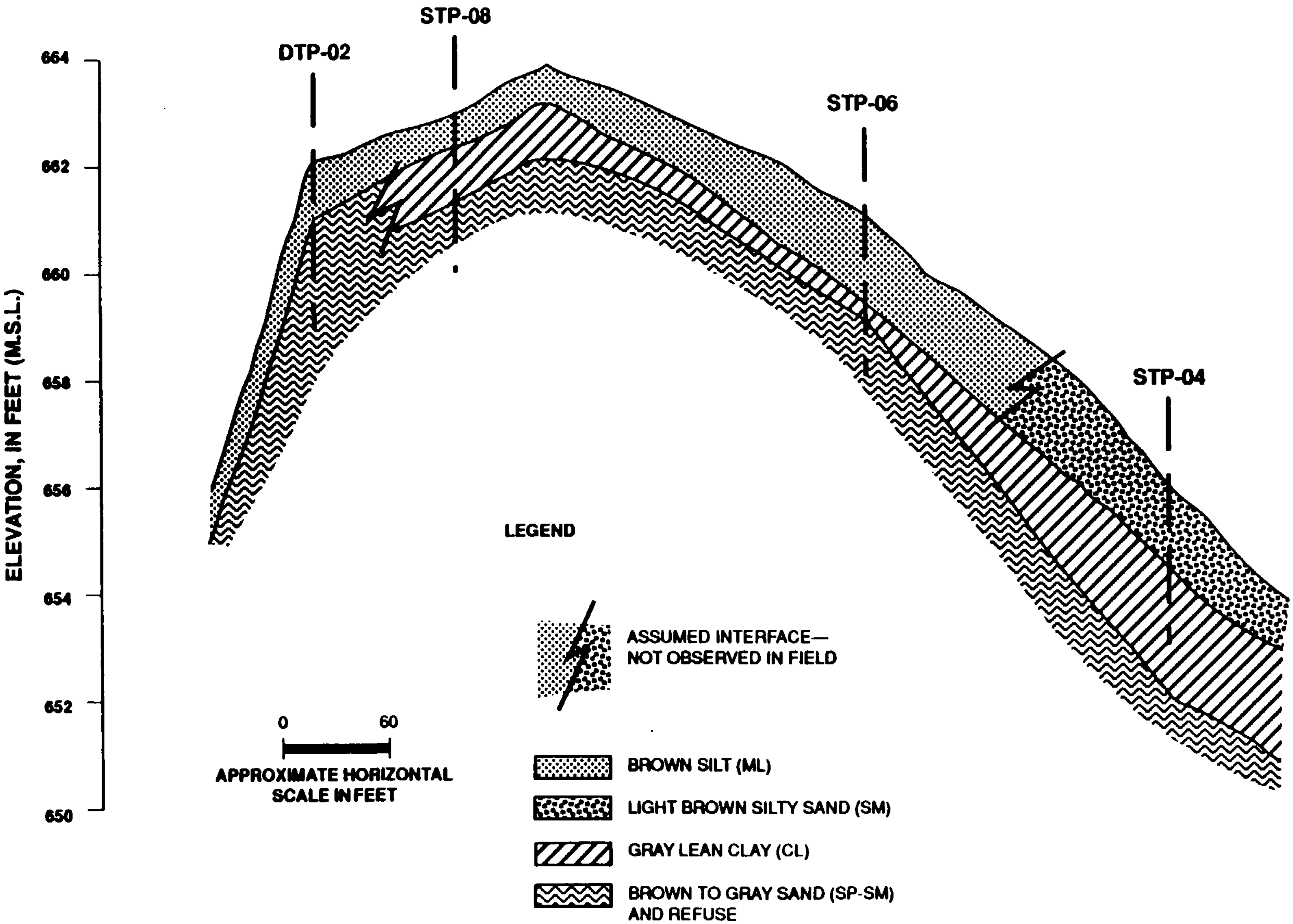
GLO65550.RI Fig C-3/REDUCED 10-27-89



NOTE: This cross-section was constructed based on information obtained from test pits. Cap material and thickness shown between test pits are interpolated, and variations from actual conditions are likely.

FIGURE C-3
SECTION A-A
ONALASKA LANDFILL RI

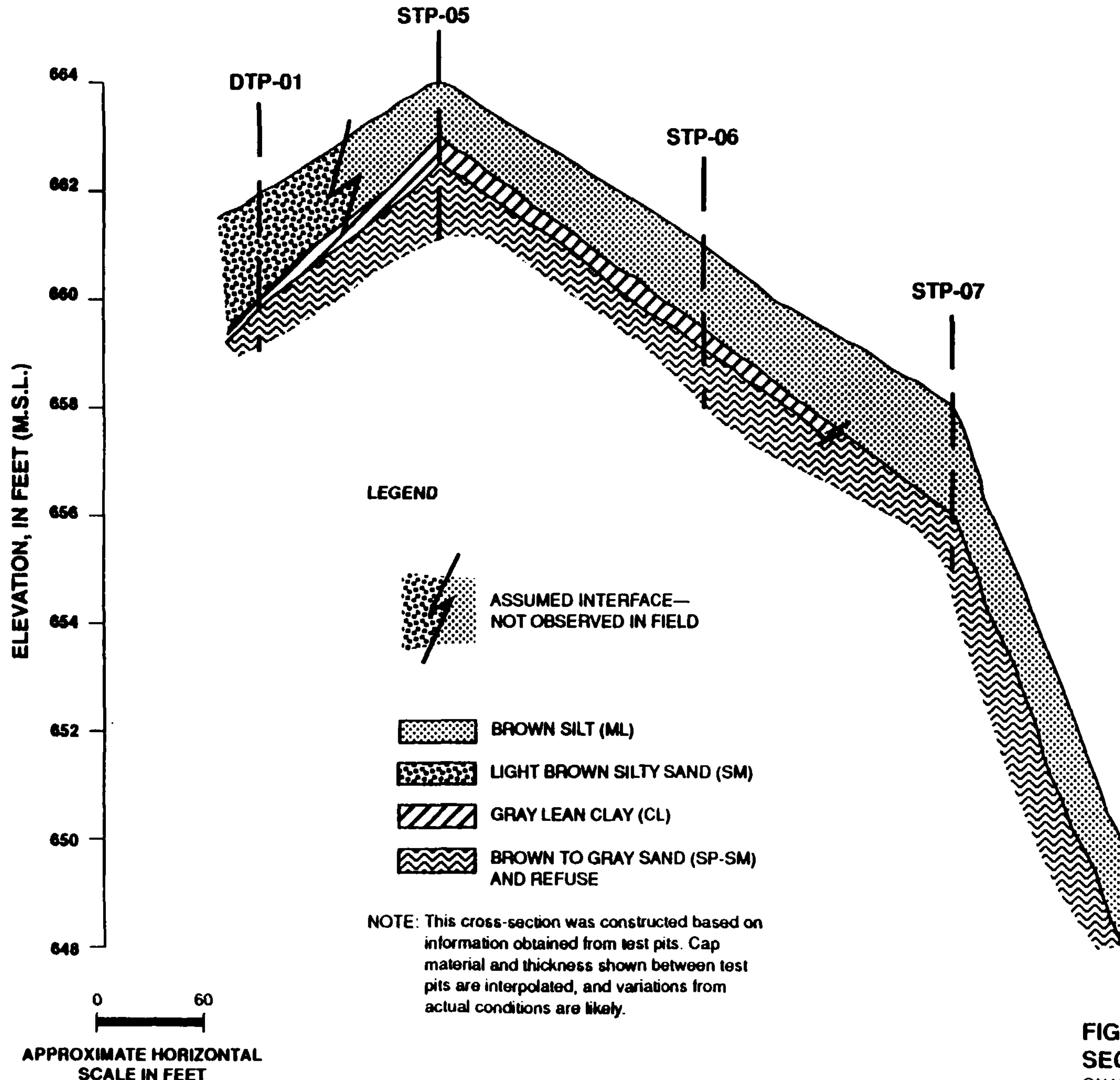
GLO65550.RI Fig C-4/REDUCED 10-27-89



NOTE: This cross-section was constructed based on information obtained from test pits. Cap material and thickness shown between test pits are interpolated, and variations from actual conditions are likely.

FIGURE C-4
SECTION B-B
ONALASKA LANDFILL RI

GLO65550.RI Fig C-5/REDUCED



NOTE: This cross-section was constructed based on information obtained from test pits. Cap material and thickness shown between test pits are interpolated, and variations from actual conditions are likely.

FIGURE C-5
SECTION C-C
ONALASKA LANDFILL RI

Table C-1
TEST PIT LOG SUMMARY

Location	Interval Below Ground Surface (in)	Soil Color	Summary (a) Classification	USCS (a) Classification	Comments
STP-01	0 - 16	Light brown	Silty sand	SM	
	16 - 24	Gray	Lean clay	CL	
	> 24	Brown	Med. to fine sand	SP-SM	
STP-02	0 - 30	Brown to gray	Lean clay	CL	
	> 30	Brown	Med. to fine sand	SP-SM	
STP-03	0 - 8	Light brown	Silty sand	SM	SP-SM contained refuse including medical waste
	8 - 20	Gray	Lean clay	CL	
	> 20	Brown	Med. to fine sand	SP-SM	
STP-04	0 - 18	Light brown	Silty sand	SM	SP-SM contained refuse
	18 - 48	Gray	Lean clay	CL	
	> 48	Brown	Med. to fine sand	SP-SM	
STP-05	0 - 12	Brown	Silt	ML	
	12 - 18	Gray	Lean clay	CL	
	> 18	Brown	Med. to fine sand	SP-SM	
STP-06	0 - 19	Brown	Silt	ML	
	19 - 24	Gray	Lean clay	CL	
	> 24	Brown	Med. to fine sand	SP-SM	
STP-07	0 - 24	Brown	Silt	ML	
	> 24	Gray	Fine sand	SP-SM	
STP-08	0 - 8	Brown	Silt	ML	
	8 - 20	Gray	Lean clay	CL	
	> 20	Brown	Med. to fine sand	SP-SM	
STP-09	0 - 12	Brown	Silt	ML	
	12 - 20	Gray	Lean clay	CL	
	> 20	Gray	Fine sand	SP-SM	
STP-10	0 -	Brown	Silt	ML	
	12 -	Gray	Lean clay	CL	
	>	Gray	Fine sand	SP-SM	
STP-11	0 - 12	Brown	Silt	ML	
	12 - 20	Gray	Lean clay	CL	
	> 20	Gray	Fine sand	SP-SM	
DTP-01	0 - 24	Brown to gray	Silty sand	SM	Refuse observed below 12"
	24 - 26	Gray	Lean clay	CL	
	> 26	Brown	Med. to fine sand	SP-SM	
DTP-02	0 - 12	Brown	Silt	ML	Refuse observed below 24"
	> 12	Brown	Med. to fine sand	SP-SM	
DTP-03	> 0	Brown to gray	Med. to fine sand	SP-SM	Refuse observed below 36"
DTP-04	> 0	Brown	Med. to fine sand	SP-SM	Refuse observed below 12"

(a) The classifications are based on the results of laboratory testing. Samples from every test pit were not laboratory classified, however, soils which were visual observed to be similar to those which were laboratory tested have been given the same classification.

permeability test performed on a recompacted specimen taken from STP-04, permeability tests were performed on undisturbed samples taken from the Shelby tubes.

Soil plasticities of many of the samples were lower than anticipated, resulting in deviations from the testing proposed in the original Work Plan. Rigid-wall permeability tests were performed on samples that were not plastic enough to be extruded and trimmed for flexible-wall permeability testing. Shrinkage limit tests were not expected to provide any useful information and were omitted. With the exception of the permeability tests, laboratory tests were performed in accordance with appropriate ASTM standards. No ASTM standards are available for the types of permeability tests performed. Permeability tests were conducted in accordance with COE EM 1110-2-1906, Appendix VII.

Laboratory analyses were performed on Shelby tube samples taken adjacent to shallow test pits STP-01, STP-02, STP-04, STP-06, STP-07, STP-08, STP-10, and STP-11 and on a bag sample taken from STP-04. Samples to be analyzed were chosen based on visual inspection of sample type and condition. Results of laboratory testing are summarized in Table C-2. Detailed results of laboratory analysis are presented in Attachment C-2.

INFILTRATION TESTING

PURPOSE

Infiltration testing was performed to provide information that would allow order-of-magnitude permeability estimates to be made and to aid in characterization and comparison of different soil types used to construct the existing cap.

FIELD PROCEDURES

Infiltrometer testing was conducted in general accordance with ASTM D 3385, Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometers. The double-ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the rings with water, and then maintaining the water at a constant level. The volume of water added to the inner ring to maintain the water level constant is the measure of the volume of water that infiltrates the soil. The volume infiltrated during timed intervals is converted to an incremental infiltration velocity. The maximum steady state infiltration velocity is equivalent to the infiltration rate.

Testing was performed using infiltrometer rings constructed from well casing, 55-gallon drums, and/or stovepipe. Water used for infiltration testing was taken directly from the Black River and brought to the site in 6-gallon jugs.

For tests conducted underground, a pit large enough to allow placement of the infiltrometer rings was excavated to the interface of the first underlying soil layer. The surface of the underlying soil layer was then leveled, and testing proceeded as described below.

Table C-2
RESULTS OF LABORATORY TESTING

Sample	Sample Interval in Shelby Tube (a) (in)	Description	Laboratory USCS Classification	Natural Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Type of Permeability Test	Liquid Limit	Plastic Index	Maximum (b) Dry Density (pcf)	Optimum (b) Moisture (%)
STP-01	10 - 18	Brown, silty, fine to med. SAND; little clay, trace gravel	SM	11.5	118.0	0.000049	Rigid-wall	NP	NP		
STP-02B	7 - 13	Brown, lean CLAY, trace sand	CL	22.5	102.9	0.00000032	Flexible-wall	30	9		
STP-04	12 - 17	Brown, silty, fine to med. SAND; little clay	SM	15.0	113.0	0.000024	Rigid-wall	NP	NP	120	11
STP-06A	9 - 14	Brown silt, some sand, little clay	ML	15.6	113.4	0.000002	Flexible-wall	19	1		
STP-06B	1 - 6	Gray SILT, some sand, little clay	ML	18.6	108.6	0.0000011	Flexible-wall	21	2		
STP-07	2 - 6	Brown SILT, little sand and clay	ML	22.2	95.0	0.000062	Flexible-wall	22	2		
STP-08	1 - 7	Gray SILT, some sand, little clay	ML	19.6	106.0	0.0000046	Flexible-wall	21	1		
STP-10	1 - 6	Brown, fine to med. SAND, trace silt and clay	SP-SM	7.2	103.5	0.00068	Rigid-wall	NP	NP		
STP-10	15 - 19	Gray-brown SILT, some clay, little sand	ML	22.5	100.2	0.00000055	Flexible-wall	26	4		
STP-11	14 - 19	Brown, silty, fine to med. SAND; little clay	SM	13.4	115.8	0.0000063	Rigid-wall	NP	NP		
STP-04	18 - 48 (Bag Sample)	Brown, lean CLAY, little sand	CL	19.4	103.7	0.00000043(c)	Flexible-wall	30	10	112	14

(a) Zero inches is bottom of tube.

(b) Maximum Dry Density and Optimum Moisture Content were determined in accordance with ASTM D 698. Tests were performed on bag samples taken while excavating test pits.

(c) Permeability test was performed on a trimmed moisture density specimen.

Infiltrometer rings constructed from well casing or 55-gallon drums were set by driving them into place with a sledge hammer. Rings constructed from stovepipe were too fragile to be driven into place and were set into place by excavating a narrow trench with a screwdriver, pouring powdered bentonite into the trench, forcing the ring into place, and backfilling and tamping the trench around the ring.

Equipment constraints and the slow soil infiltration properties required that some deviations from the ASTM procedure be made during testing. Deviations from the ASTM procedure included the following:

- The ASTM procedure requires that the rings be driven or pushed into place, not trenched as previously described.
- The ASTM procedure requires the ratio between the diameters of the inner and outer ring be at least two. The actual ratio was less than two for some tests.
- The ASTM procedure requires that the level of water (head) in the rings be no greater than 6 inches. During the first test no changes in water level were observed at a head of 6 inches over a period of 4 hours. Water levels in subsequent tests were increased to provide heads as high as 15 inches.

Water levels were measured using either a 1-foot ruler fastened to the inside of the ring, or a series of marks etched onto the inside of the ring. Constant heads were maintained by adding water to the rings at various time intervals. Records were kept of the time and volume of added water. Lengths of time the tests were run ranged from 23.5 hours to 46.8 hours. Table C-3 presents a summary of test parameters and calculated infiltration rates.

After an infiltration test was completed, the rings were bailed and removed from the soil. After the rings were removed, a trench approximately 6 inches wide was dug along the centerline of the rings to observe the wetting front in the soil. Dye (green or red food coloring) was added to the inner ring water in Tests IT-4, IT-6, IT-9 and IT-10A to aid in the determination of the depth of wetting front.

Trenches and pits resulting from infiltrometer testing were backfilled by hand. A layer of powdered bentonite, approximately 1 inch thick, was placed in each pit before backfilling.

TESTING SUMMARY

Infiltration tests were numbered to correspond with the shallow test pit they were adjacent to. Infiltration tests IT-4, IT-6, IT-9, and IT-10 were conducted on the ground surface adjacent to shallow test pits STP-04, STP-06, STP-09, and STP-10, respectively. Tests IT-4A, IT-9A, and IT-10A were conducted 1 to 1.5 feet underground and adjacent to shallow test pits STP-04, STP-09, and STP-10,

Table C-3
INFILTRATION TEST SUMMARY

Location	Depth Below Ground Surface	Inner Ring Type	Inner Ring O.D. (in)	Inner Ring I.D. (in)	Outer Ring Type	Outer Ring I.D. (in)	Height of Water in Rings (in)	Infiltration Rate (cm/sec)	Estimated Depth of Wetting Front (in)	Estimated Gradient (in/in)	Estimated Permeability (cm/sec)
IT-4	0"	Well Casing	10.75	10.25	Well Casing	15.38	11	0.0001	3.0	4.7	0.000021
IT-4A	18"	Stove Pipe	10.25	10.00	55-gal Drum	22.50	10	0.000002	0.5	21.0	0.0000001
IT-6	0"	Stove Pipe	10.25	10.00	55-gal Drum	22.50	15	0.0001	3.0	6.0	0.000046
IT-9	0"	Well Casing	12.75	12.00	55-gal Drum	22.50	10	0.00005	3.5	3.8	0.000013
IT-9A	12"	Stove Pipe	10.25	10.00	55-gal Drum	22.50	12	0.00003	0.5	25.0	0.0000012
IT-10	0"	Well Casing	10.75	10.25	Well Casing	15.38	6	0.000022	2.5	3.4	0.0000073
IT-10A	12"	Well Casing	14.00	13.38	55-gal Drum	22.50	10	0.000014	3.0	4.3	0.0000032

respectively. Tests IT-9, IT-10, and IT-10A were started on May 1, 1989, and tests IT-4, IT-4A, IT-6, and IT-9A were started on May 2, 1989.

Incremental infiltration rates were computed using the following formula:

$$R = V/(A \times t)$$

where:

R	=	incremental infiltration rate (cm/s)
V	=	volume of water added to maintain a constant head (cc)
A	=	cross sectional area of inner ring or annular space between rings (cm^2)
t	=	time elapsed since head was last adjusted (s)

Average infiltration rates were computed as a logarithmic average of representative incremental infiltration rates taken after the test had been running for a minimum of 24 hours.

Average infiltration rates were computed using the following formula:

$$R_{AVG} = \text{INV} \log_{10} [(\log_{10} R_1 + \log_{10} R_2 + \ldots + \log_{10} R_{N-1} + \log_{10} R_N)/N]$$

where:

R_{AVG}	=	average infiltration rate
R_N	=	incremental infiltration rate
N	=	number of terms averaged

Permeability values are considered to be order-of-magnitude estimates because gross assumptions concerning hydraulic boundary conditions had to be made. Estimated permeabilities of the soils at each test location were computed using the following formula:

$$k = R_{AVG}/i$$

where:

k	=	permeability (cm/s)
R_{AVG}	=	average infiltration rate (cm/s)
i	=	Hydraulic gradient (cm/cm)

i	=	Hydraulic gradient (cm/cm)
	=	(H+L)/L

where:

H	=	Hydraulic head (cm)
	=	Height of water in infiltration ring
L	=	Length of drainage path (cm)
	=	Depth of wetting front

A brief description of each infiltration test is given below, including the method used to determine the depth of wetting front for each individual test. The depth of saturation referred to in the descriptions is the depth to which excess moisture (excess relative to surrounding and underlying soil) was visually observed.

Test IT-4

Test IT-4 was conducted using rings constructed from well casing. The inner ring had an inner diameter of 10.25 inches and an outer diameter of 10.75 inches. The outer ring had an inner diameter of 15.38 inches. Rings were driven 6 inches into the ground. Soil at the surface was brown silty fine to medium sand. A water level of 11 inches was maintained in the rings during testing. Two ounces of green food coloring were added to the inner ring. The test was run for 28.3 hours. An average infiltration rate of 1.0×10^{-4} cm/s was computed based on the last three incremental infiltration rates measured in the inner ring.

A trench was excavated through the area after the test was completed. Green dye was clearly visible to a depth of 3 inches underground across the area of the inner ring. The depth to which dye was visible appeared to correspond with the depth of saturation and the depth of the root mat. Green dye was also visible along individual deep roots paths to a depth of 6 inches. The depth of wetting front was assumed to be 3 inches based on the presence of the dye and depth of saturation. The permeability of the soil was estimated to be 2.1×10^{-5} cm/s.

Test IT-4A

Test IT-4A was conducted using an inner ring constructed from stove pipe and an outer ring constructed from a steel 55-gallon drum. The inner ring had an inner diameter of 10 inches and an outer diameter of 10.25 inches. The outer ring had an inner diameter of 22.5 inches. The test was conducted in a pit excavated to 18 inches underground at the interface between the brown silty fine to medium sand surface layer and the underlying gray lean clay layer. The rings were placed 6 inches into the gray lean clay layer. A water level of 10 inches was maintained in the rings during testing. The test was run for 29.8 hours. An infiltration rate of 2.2 x 10^{-6} cm/s was the only rate measured in the inner ring.

A trench was excavated through the area after the test was completed. The depth of wetting front was assumed to be 0.5 inches based on the depth of saturation. The permeability of the soil was estimated to be 1.0 x 10^{-7} cm/s.

Test IT-6

Test IT-6 was conducted using an inner ring constructed from stove pipe and an outer ring constructed from a steel 55-gallon drum. The inner ring had an inner diameter of 10 inches and an outer diameter of 10.25 inches. The outer ring had an inner diameter of 22.5 inches. Rings were placed 4 inches underground. Soil at the surface was brown silty fine to medium sand. A water level of 15 inches was maintained in the rings during testing. Two ounces of green food coloring were added to the inner ring. The test was run for 25.4 hours. An average infiltration rate of 1.0 x 10^{-4} cm/s was computed based on the last three incremental infiltration rates measured in the inner ring.

A trench was excavated through the area after the test was completed. Green dye was visible along individual deep root paths to a depth of 9 inches, but the depth of saturation appeared limited to the top 3 inches. The depth of wetting front was assumed to be 3 inches based on the depth of saturation. The permeability of the soil was estimated to be 4.6 x 10^{-5} cm/s.

Test IT-9

Test IT-9 was conducted using an inner ring constructed from well casing and an outer ring constructed from a steel 55-gallon drum. The inner ring had an inner diameter of 12 inches and an outer diameter of 12.75 inches. The outer ring had an inner diameter of 22.5 inches. Rings were placed 6 inches underground. Soil at the surface was brown silt. A water level of 10 inches was maintained in the rings during testing. Two ounces of red food coloring were added to the inner ring. The test was run for 46.8 hours. An average infiltration rate of 5.0 x 10^{-5} cm/s was computed based on the last six incremental infiltration rates measured in the inner ring.

A trench was excavated through the area after the test was completed. No red dye was visible in the excavation. The depth of wetting front was assumed to be 3.5 inches based on the depth of saturation. The permeability of the soil was estimated to be 1.3 x 10^{-5} cm/s.

Test IT-9A

Test IT-9A was conducted using an inner ring constructed from stove pipe and an outer ring constructed from a steel 55-gallon drum. The inner ring had an inner diameter of 10 inches and an outer diameter of 10.25 inches. The outer ring had an inner diameter of 22.5 inches. The test was conducted in a pit excavated to 12 inches underground at the interface between the brown silt surface layer and the underlying gray lean clay layer. The rings were placed 6 inches into the gray lean clay layer. A water level of 12 inches was maintained in the rings during testing. The test was run for 29.9 hours. An average infiltration rate of 3.0 x 10^{-5} cm/s was computed based on the last two incremental infiltration rates measured in the inner ring.

A trench was excavated through the area after the test was completed. The depth of wetting front was assumed to be 0.5 inches based on the depth of saturation. The permeability of the soil was estimated to be 1.2 x 10^{-6} cm/s.

Test IT-10

Test IT-4 was conducted using rings constructed from well casing. The inner ring had an inner diameter of 10.25 inches and an outer diameter of 10.75 inches. The outer ring had an inner diameter of 15.38 inches. Rings were driven 5 inches into the ground. Soil at the surface was brown silt. A water level of 6 inches was maintained in the rings during testing. The test was run for 23.5 hours. An infiltration rate of 2.2 x 10^{-5} cm/s was the only rate measured in the inner ring.

A trench was excavated through the area after the test was completed. The depth of wetting front was assumed to be 2.5 inches based on the depth of saturation. The permeability of the soil was estimated to be 7.3 x 10^{-6} cm/s.

Test IT-10A

Test IT-10A was conducted using an inner ring constructed from well casing and an outer ring constructed from a steel 55-gallon drum. The inner ring had an inner diameter of 13.38 inches and an outer diameter of 14 inches. The outer ring had an inner diameter of 22.5 inches. The test was conducted in a pit excavated to 12 inches underground at the interface between the brown silt surface layer and the underlying gray lean clay layer. The rings were placed 6 inches into the gray lean clay layer. A water level of 10 inches was maintained in the rings during testing. Two ounces of red food dye were added to the inner ring. The test was run for 46.2 hours. An average infiltration rate of 1.4E-5cm/s was computed based on the last four incremental infiltration rates measured in the inner ring.

A trench was excavated through the area after the test was completed. The depth of wetting front was assumed to be 3 inches based on the depth of saturation. The permeability of the soil was estimated to be 3.2 x 10^{-6} cm/s.

NUCLEAR DENSITY AND MOISTURE TESTING/VISUAL INSPECTION

PURPOSE

Nuclear density and moisture tests were performed to aid in characterization of cap soil and determine extent of damage from freeze and thaw and desiccation. Nuclear testing was selected because it was rapid and allowed a large number of tests to be performed across the site.

FIELD PROCEDURES

Density and moisture tests were conducted using a Troxler 3411 Nuclear Density Gage. Tests were conducted in accordance with ASTM D 2922, Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) and ASTM D 3017, Water Content of Soil and Rock in Place by Nuclear Methods. Two tests, one with the source rod 6 inches deep and one with the source rod 12 inches deep, were conducted at each location. At three locations (STP-04, STP-09, and STP-10), density and moisture tests were performed on the underlying gray lean clay layer. These tests were conducted in the pits excavated for infiltrometer rings. The pits provided a minimum of 8 inches clearance on each side of the gauge. Holes drilled for density testing were backfilled with powdered bentonite.

Density and moisture tests were performed on a 100-foot grid across the site. While density testing, the site was visually inspected for depressions, erosional gullies, soft or wet zones, ruts, and animal holes.

DENSITY AND MOISTURE TESTING/VISUAL INSPECTION SUMMARY

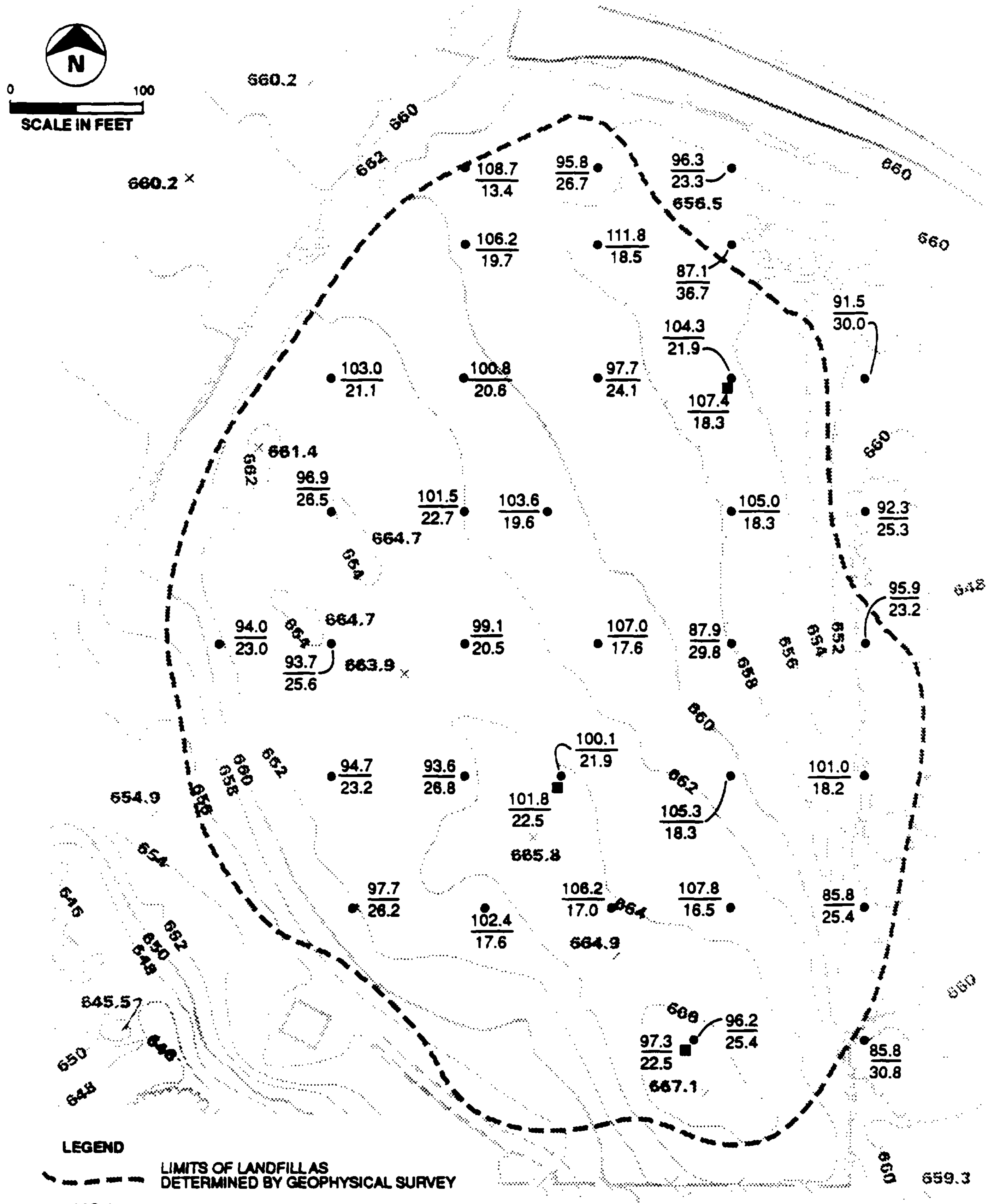
Density test locations and results are shown in Figure C-6. Nuclear moisture test results for tests performed in pits are typically high because of the moisture in the side walls of the pit. For tests taken in pits, dry densities were computed based on the nuclear wet density and the average laboratory moisture content for the soil type being tested. Maximum dry densities were obtained from the moisture-density relation test performed during the laboratory analysis. In situ densities obtained from laboratory analysis of Shelby tube samples are also included in the figure.

Figure C-7 shows areas where significant cap damage or features were observed. Animal holes observed along the east side of the site appeared, from the surface, to extend more than 2 feet underground. Erosional gullies as deep as 1 foot were also observed on the east side of the site. A 6-inch depression approximately 15 feet in diameter was observed near Station 4+00N, 5+00E.

EVALUATION OF PRECIPITATION INFILTRATION

PROCEDURES

Table C-4 summarizes results of laboratory and infiltrometer tests together. Soils with similar properties have been grouped together and average engineering property values (e.g., permeability, density, and moisture content) have been computed for each soil type. Permeabilities estimated from infiltrometer testing were only used to compare soil types and were not included in the determination of average permeability values. Soils used to construct the cap can be classified into three categories: lean clay (CL), silt (ML), and silty sand (SM).



LEGEND

LIMITS OF LANDFILL AS DETERMINED BY GEOPHYSICAL SURVEY

102.4 / 17.6 — DRY DENSITY (PCF) / MOISTURE CONTENT (%)

● LOCATION OF TEST PERFORMED ON GROUND SURFACE

■ LOCATION OF TEST PERFORMED IN PIT

FIGURE C-6
DENSITY TEST RESULTS
ONALASKA RI/FS

GLO6550.RI FIG C-6 10-17-89

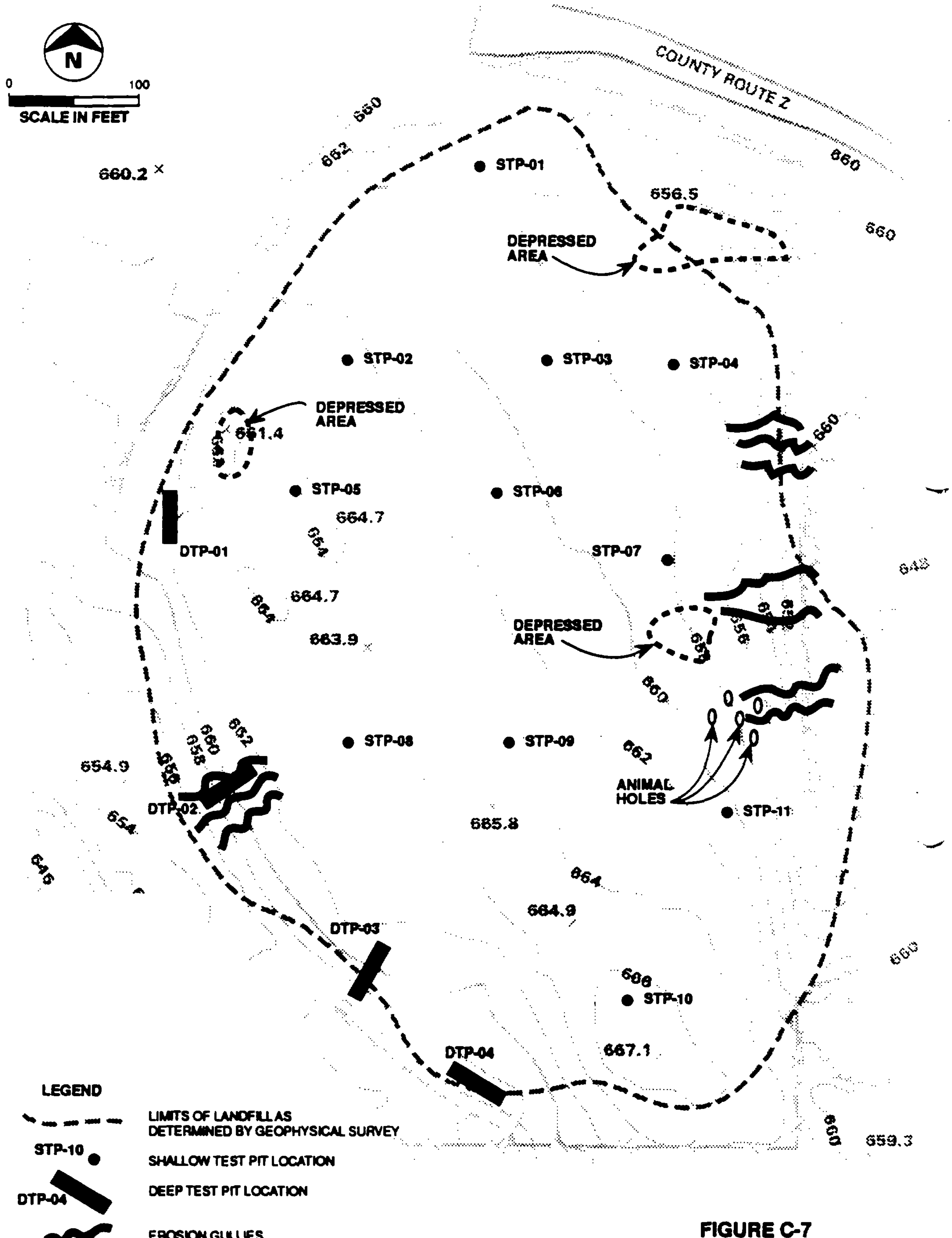


FIGURE C-7
SIGNIFICANT VISIBLE CAP DAMAGE
ONALASKA LANDFILL RI

GLO65550.RI FIG C-7 10-26-89

Table C-4
SUMMARY OF RESULTS OF LABORATORY AND INFILTRATION TESTS

Location	Laboratory Description	Laboratory USCS Classification	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Liquid (a) Limit	Plastic (a) Index	Comments
STP-01	Brown, silty, fine to med. sand; little clay, trace gravel	SM	11.5	118.0	0.000049	NP	NP	
STP-04	Brown, silty, fine to med. sand; little clay	SM	15.0	113.0	0.000024	NP	NP	
IT-4		SM			0.000021			Field classification
IT-6		SM			0.000046			Field classification
STP-11	Brown, silty, fine to med. sand; little clay	SM	13.4	115.8	0.00000063	NP	NP	Permeability value is considered outlying and is not inlcuded in average
AVERAGE			13.3	115.6	0.000034			Based on results of standard proctor (ASTM D698) maximum dry density for this material is 120 pcf and optimum moisture content is 11%
STP-06	Brown silt, some sand, little clay	ML	15.6	113.4	0.000002	19	1	
STP-06	Gray silt, some sand, little clay	ML	18.6	108.6	0.0000011	21	2	
STP-07	Brown silt, little sand and clay	ML	22.2	95.0	0.000062	22	2	Sample is considered outlying and values are not included in averages
STP-08	Gray silt, some sand, little clay	ML	19.6	106.0	0.0000046	21	1	
IT-9		ML			0.000013			
IT-10		ML			0.0000073			
AVERAGE			17.9	109.3	0.0000021	21	2	

Table C-4
SUMMARY OF RESULTS
OF LABORATORY AND INFILTRATION TESTS

Location	Laboratory Description	Laboratory USCS Classification	Moisture Content (%)	Dry Density (pcf)	Permeability (cm/sec)	Liquid (a) Limit	Plastic (a) Index	Comments
STP-02	Brown lean clay, trace sand	CL	22.5	102.9	0.00000032	30	9	Samples all border on classification as a CL-ML. Because the exhibit relatively similar properties they have been grouped together. Sample from STP-04 was recompacted and values from STP-04 are not included in averages.
IT-4A		CL			0.0000001			
IT-9A		CL			0.000001			
STP-10	Gray-brown silt, some clay, little sand	ML	22.5	100.2	0.00000055	26	4	
IT-10A		CL			0.0000032			
STP-04	Brown, lean clay, little sand	CL	19.4	103.7	0.00000043	30	10	
AVERAGE			22.5	101.5	0.00000042	28	7	Based on results of standard proctor (ASTM D698) maximum dry density for this material is 113 pcf and optimum moisture content is 14%
STP-11	Brown, silty, fine to med. sand; trace silt and clay	SP-SM	7.2	103.5	0.00068	NP	NP	

(a) NP = non-plastic

The three soil types are similar except for varying sand content and the lean clay and the silty sand both border on classifications as a silt. Sand content ranges from 57 percent by weight in the silty sand to 6 percent by weight in the lean clay. For the purposes of this cap investigation, soil from STP-10 that was classified as a gray silt (ML) was grouped with soil from STP-2 that was classified as a lean clay (CL) because it was closer to lean clay in terms of visual appearance, grain size, Atterberg limits, and permeability than it was to other silt encountered at the site.

A precipitation infiltration analysis was performed for each thickness and soil-type combination encountered during excavation of test pits. The infiltration analysis was initially performed using both the Wisconsin Department of Natural Resources Water Balance Program and the Hydrologic Evaluation of Landfill Performance (HELP) Model. Both models use simplifying assumptions and have limitations that must be considered when reviewing the results.

The WDNR Water Balance Analysis Program applies procedures that have been developed from water balance computational methods originally published by Thornthwaite and Mather (ref.), adapted by Fenn, Hanley and Degeare (ref.), and detailed by Kmet (ref). These methods do not account for retardation of percolation due to the inclusion of a low permeability barrier layer and increased runoff from saturation of soil over a barrier layer.

The HELP Model was designed for comparison of candidate landfill caps and uses assumptions not appropriate for this analysis. The inappropriate assumptions include:

- The drainage rate out of a segment (vertical percolation soil layer) cannot be limited by the permeability of the segment below it.
- The barrier layer is always saturated and percolation through it is controlled by the head acting on it.
- No evapotranspiration can occur from the barrier layer.

Neither method accounts for either runoff from an adjacent area draining onto the area being analyzed or for infiltration through channels such as cracks or animal burrows.

An extensive parametric study was conducted using both models. No correlation was seen between the models, and the WDNR model did not appear to recognize a low permeability barrier as a deterrent to infiltration. It was concluded that the assumptions made by the HELP Model were more appropriate for this investigation than those made by the WDNR Model; therefore, only the HELP Model was used for the precipitation infiltration evaluation.

Table C-5 summarizes input parameters and the results of the HELP Model analysis. The soil profiles (soil type and thickness) input to the model were developed from the shallow test pit logs and laboratory soil classifications. Soil

Table C-5
RESULTS OF H.E.L.P. MODEL ANALYSIS

Location	Soil Type (USCS)	Layer (a) Type	Layer Thickness (in)	HELP Input Parameters: Porosity (vol/vol)	Field Capacity (vol/vol)	Wilting Point (vol/vol)	Permeability (cm/sec)	Moisture Content (vol/vol)	Percolation Through Cap (in/yr)	Surface Area Assumed Represented by Test Pit (sq ft)
STP-01	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	1.10	20,000
	SM	VP	13	0.381	0.193	0.104	0.000034	0.244		
	CL	BR	8	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-02	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.25	27,000
	CL	VP	15	0.406	0.309	0.210	0.00000042	0.371		
	CL	BR	12	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-03	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	1.90	16,000
	SM	VP	5	0.381	0.193	0.104	0.000034	0.244		
	CL	BR	12	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-04	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.88	19,000
	SM	VP	15	0.381	0.193	0.104	0.000034	0.244		
	CL	BR	30	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-05	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.74	19,000
	ML	VP	9	0.41	0.247	0.135	0.0000021	0.313		
	CL	BR	6	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-06	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.91	20,000
	SM	VP	16	0.381	0.193	0.104	0.000034	0.244		
	CL	BR	5	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		

Table C-5
RESULTS OF H.E.L.P. MODEL ANALYSIS

				HELP Input Parameters						
Location	Soil Type (USCS)	Layer (a) Type	Layer Thickness (in)	Porosity (vol/vol)	Field Capacity (vol/vol)	Wilting Point (vol/vol)	Permeability (cm/sec)	Moisture Content (vol/vol)	Percolation Through Cap (in/yr)	Surface Area Assumed Represented by Test Pit (sq ft)
STP-07	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	2.30	29,000
	ML	VP	9	0.41	0.247	0.135	0.000062	0.313		
	ML	BR	12	0.41	0.247	0.135	0.000062	0.313		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-08	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	1.80	22,000
	SM	VP	11	0.381	0.193	0.104	0.000034	0.244		
	ML	BR	6	0.41	0.247	0.135	0.0000021	0.313		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-09	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.73	25,000
	ML	VP	9	0.41	0.247	0.135	0.0000021	0.313		
	CL	BR	8	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-10	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.73	29,000
	ML	VP	9	0.41	0.247	0.135	0.0000021	0.313		
	CL	BR	8	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
STP-11	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	0.73	34,000
	ML	VP	9	0.41	0.247	0.135	0.0000021	0.313		
	CL	BR	8	0.406	0.309	0.210	0.00000042	0.371		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
DTP-01	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120	4.10	15,000
	SM	BR	12	0.381	0.193	0.104	0.000034	0.244		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		

Table C-5
RESULTS OF H.E.L.P. MODEL ANALYSIS

Location	Soil Type (USCS)	Layer (a) Type	Layer Thickness (in)	HELP Input Parameters Porosity (vol/vol)	Field Capacity (vol/vol)	Wilting Point (vol/vol)	Permeability (cm/sec)	Moisture Content (vol/vol)	Percolation Through Cap (in/yr)	Surface Area Assumed Represented by Test Pit (sq ft)
DTP-02	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	5.80	19,000
	ML	VP	3	0.41	0.247	0.135	0.0000021	0.313		
	ML	BR	6	0.41	0.247	0.135	0.0000021	0.313		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
DTP-03	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	1.40	15,000
	SM	VP	21	0.381	0.193	0.104	0.000034	0.244		
	SM	BR	12	0.381	0.193	0.104	0.000034	0.244		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
DTP-04	SM	VP	3	0.473	0.222	0.104	0.00068	0.244	4.00	6,000
	SM	VP	5	0.381	0.193	0.104	0.000034	0.244		
	SM	BR	4	0.381	0.193	0.104	0.000034	0.244		
	SP-SM	VP	8	0.351	0.071	0.033	0.00068	0.120		
Average Infiltration Rate (weighted by area)									1.60	
Total Area										315,000

(a) VP denotes vertical percolation layer, BR denotes barrier layer.

NOTE: Depth of evaporative zone is 20 inches.

profiles input to the model were adjusted from the test pit logs based on the results of laboratory and infiltrometer testing. While laboratory classification tests were not performed on soil samples taken from every test pit, soils that were observed to be similar to those laboratory tested, based on appearance and infiltration rate, were assigned the laboratory classification. Permeabilities and moisture contents input for each soil type were the average values presented in Table C-4.

The HELP Model was designed for parametric analysis; therefore, it was necessary to make assumptions common to all soil profiles to be able to compare the results. The following assumptions were made for each soil profile analyzed.

- The top layer of each soil was assumed to be 3 inches of silty sand, regardless of what was encountered in the field. This was done to account for the higher permeability expected in this area because of the presence of roots.
- The HELP Model assumes that a barrier layer is always saturated, and that no evapotranspiration can occur from it. Therefore each profile analyzed was assumed to have a barrier layer to allow the model to make consistent assumptions. Labeling a layer as a barrier does not affect the soil layer type or permeability (i.e., if the soil profile observed in the field consisted entirely of silty sand, the barrier would consist of silty sand also).
- The cap was assumed to be underlain by 8 inches of fine sand. Percolation into the waste mass was assumed to be equal to percolation from the bottom of the sand layer.

SUMMARY OF RESULTS

The results of the infiltration study can be summarized as follows:

- The results of the infiltration analysis show annual infiltration rates to range from 0.25 inches per year in areas capped with 2 feet of clay to 5.8 inches per year in areas capped with 1 foot of silt. The average infiltration rate, weighted based on the area of the cap assumed to be represented by each test pit, is 1.6 inches per year or 860 gallons per day across the 7.2-acre cap.
- The HELP Model indicates that infiltration is greatest in areas where the cap is thinnest (DTP-02 and DTP-04). This is because of the thin evaporative zone recognized by the model. The actual evaporative zone may extend through the cap into the waste mass; in these cases, the volume of percolation through the cap may not correspond directly to the volume of leachate produced.
- The HELP Model computes percolation through a barrier layer assuming saturated flow. Percolation is directly related to the

hydraulic head acting above the barrier layer. The actual effectiveness of a clay or silt layer as a barrier is greatly reduced because no lateral drainage layer is included above it, thereby allowing large hydraulic heads to build. The decreased effectiveness is accentuated by the model because of the conservative assumption that the barrier is always saturated.

4) The HELP Model indicated that a thick (> 24 inches) silty sand (SM) layer was nearly as effective a deterrent to infiltration as silt (ML) and clay (CL layers. This is most likely because of assumptions made by the HELP Model, particularly that the barrier layer is always saturated and that no evapotranspiration can occur from it. Because the silty sand is at least one order of magnitude more permeable than the silt or clay, it is likely that infiltration through areas of the cap constructed from sand is greater than through areas of the cap constructed from silt or clay.

5) The infiltration analysis was performed based on microscopic soil properties. Infiltrometer and laboratory testing did not account for macroscopic cap features such as large cracks, erosion gullies, or animal holes. It is likely that, at least in localized areas, precipitation infiltration through these features is much greater than reported here.

FREEZE AND THAW, DESICCATION, AND ROOT DAMAGE EVALUATION

Mechanical stresses, such as those resulting from freeze and thaw, desiccation, and root damage, increase void space within soil, increasing its permeability and decreasing its effectiveness as a cap. When a saturated soil freezes, the soil volume increases 3 to 5 percent, creating mechanical stresses. This phenomenon is termed frost action. Under certain conditions, water near the top of the capillary zone freezes in progressively growing lenses causing substantially higher volume changes. This phenomenon is termed frost heave. The three conditions necessary for frost heave to occur are a frost susceptible soil, freezing conditions, and a water supply. The most frost susceptible soils tend to be silts. Cap soil used at the site has been laboratory classified as silt, clay, sand bordering on classification as a silt. Reported depths of frost in the area range from 3.5 to 6 feet (Sowers et al.). Assuming a minimum depth of frost of 3.5 feet, the entire thickness of the cap would usually be subjected to freezing conditions. Generally, large frost heaves will occur only if a constant supply of groundwater is available. However, the cap cross section observed during test pitting was not uniform, and the potential for perched water in the silt over the clay barrier is likely in some areas. This would provide a source of water that would allow frost heave to occur. However, the magnitude of the frost heave would be limited by the volume of perched groundwater.

As previously described, two soil samples, one silty sand (SM) and one lean clay, were tested for moisture-density relationship (Standard Proctor, ASTM D 698). The silty sand had a maximum dry density of 120 pcf at an optimum moisture content of 11 percent. The lean clay had a maximum dry density of 112 pcf at an optimum moisture content of 14 percent. No moisture density test was performed on the silt (ML) but for the purposes of this report, it was assumed to have a maximum dry density of 116 pcf (the average of the sand and clay maximum densities).

Surface nuclear density tests indicate that the top foot of material has loosened to a point where it is as low as 73 percent of maximum dry density. The cap is assumed to have an original dry density of 90 percent of maximum dry density. This is a common construction compaction requirement and is usually readily attainable in the field. Actual compaction requirements during cap construction are not known. Loosening can be attributed to root damage, frost action, and desiccation damage. In most cases, material tested over 1 foot underground had a dry density of 90 percent or more of the maximum dry density determined in the laboratory analysis.

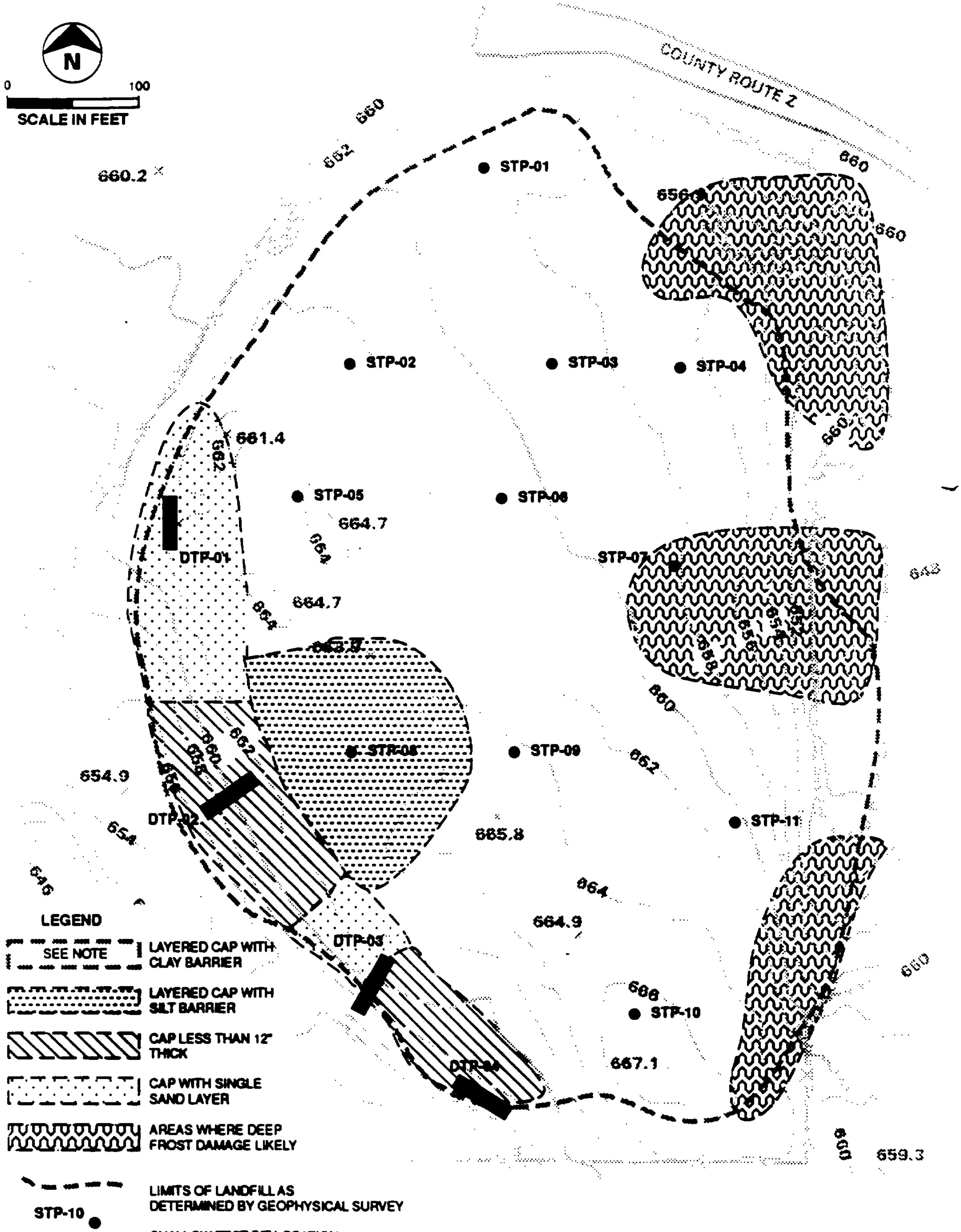
Areas of low density coincided with areas of high moisture content, indicating that frost heave, as described above, may be occurring. One silt specimen taken from a Shelby tube sample obtained approximately 19 inches underground in the area of STP-07 had a dry density of 95 pcf (81 percent of maximum dry density) indicating that deep frost damage could have occurred in some areas. This specimen had a permeability an order of magnitude higher than other silt specimens. Areas where deep frost damage ("deep" meaning frost damage greater than 1 foot underground) is indicated by excessive (excessive relative to the soil type and other moisture tests) surface soil moisture contents. This can be attributed to the depth from which the moisture specimen was obtained. All laboratory samples were taken from at least 15 inches underground surface. Testing was conducted in early May, and it is likely that the ground surface was still saturated from snow melt.

CAP INVESTIGATION SUMMARY AND CONCLUSIONS

Based on the results of field testing, laboratory testing and precipitation infiltration analysis, the cap has been divided into five general classes:

- Single sand layer cap greater than 12 inches thick
- Layered cap greater than 12 inches thick with clay barrier
- Layered cap greater than 12 inches thick with silt barrier
- Layered cap greater than 12 inches thick with evidence of frost damage in the silt barrier
- Single layer sand or silt cap less than 12 inches thick

Figure C-8 shows the cap sectioned into these five classes. Interfaces between cap classes were interpolated based on test pit locations and were not observed in the field.



NOTE: LAYERED CAP WITH CLAY BARRIER ENCOMPASSES APPROXIMATELY ALL OTHER AREAS, WITHIN THE LANDFILL AREA, THAT ARE SHOWN AS BEING CAPPED.

FIGURE C-8
GENERAL CAP CLASSIFICATIONS
ONALASKA LANDFILL RI

GLO65550.RI FIG C-8 10-26-89

Areas of particular concern where infiltration may be greater include those where the cap is less than 12 inches deep, constructed from a single sand layer, or has been affected by frost damage at depth. Areas which are 12 inches or less thick are of particular concern. The precipitation infiltration analysis shows them to provide the least effective barrier to precipitation infiltration and they provide minimal coverage to prevent direct human or animal contact with the waste.

While the Help Model indicates that areas of the cap constructed using silty sand are as effective limiting precipitation infiltration as areas of the cap constructed using clay or silt, this is based on a number of limiting assumptions, as discussed previously. Because the permeability of the silty sand is at least one order of magnitude greater than the silt or clay at the site it is likely that infiltration through these areas is excessive relative to other areas of the cap.

Increased permeability can be explained by loosening and fracturing of the soil from frost action. The cap in the area of STP-07 appears to have been significantly damaged to depth by frost action or frost heave. The permeability of the silt in this area has been tested to be an order of magnitude greater than similar silt located elsewhere at the site and two times greater than silty sand at the site. It is likely that infiltration through areas damaged at depth by frost action or frost heave is substantially greater relative to the rest of the site.

During the visual inspection of the cap erosion gullies, animal holes, and animal holes in erosion gullies were found in some areas. The volume of precipitation infiltration through animal holes in these areas may be more than infiltration through the soil.

The WDNR requires existing landfills to be closed with a minimum 2-foot thick clay cap plus a 1.5- to 2.5- foot thick soil cover layer. Clay used in the cap must contain a minimum of 50 percent material by weight that passes the Number 200 sieve and have a saturated hydraulic conductivity of 1×10^{-7} cm/s or less. The silty sand encountered at the site does not meet the particle size requirement, and none of the material encountered on the site has been shown to have a saturated hydraulic conductivity of 1×10^{-7} cm/s. Therefore, the existing landfill cap is substandard relative to current State requirements.

GLT913/040.50

Attachment C-1
TEST PIT LOGS

TEST PIT LOG LEGEND:

SAMPLE TYPE:
B – BAG SAMPLE
ST – SHELBY TUBE

NOTES:

1. THE TEST PIT LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATE INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING AND/OR TEST PIT LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE LOCATIONS.

2. TEST PITS WERE LOGGED IN THE FIELD BY A CH2M HILL ENGINEERING GEOLOGIST OR GEOTECHNICAL ENGINEER. SAMPLES WERE EXAMINED AND VISUALLY CLASSIFIED IN APPROXIMATE ACCORDANCE WITH ASTM D2488.

3. SOIL DESCRIPTIONS PRESENTED IN THESE LOGS ARE A SUMMARY OF *FIELD LOGS, VISUAL CLASSIFICATIONS AND LABORATORY TESTS.*

4. LABORATORY TEST RESULTS PRESENTED ON THESE LOGS ARE RESULTS OF TESTS PERFORMED ON SHELBY TUBE SAMPLES. SHELBY TUBES WERE PUSHED AS FAR AS 5 FEET AWAY FROM THE TEST PITS AND VERTICAL INTERVALS DO NOT ALWAYS CORRELATE. TEST RESULTS ARE SHOWN ADJACENT TO THE TYPE OF SOIL TESTED, AND ARE NOT NECESSARILY AT THE SHELBY TUBE INTERVAL TESTED.

TEST PIT
LOG LEGEND

CH2M HILL

CHM HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-01 SHEET 1 OF 1

TEST PIT LOG

PROJECT: Onalaska Municipal Landfill RI/FS LOCATION: 3+80E, 7+60N LOGGER: C. Lawrence
ELEVATION: 658 ft ± CONTRACTOR: E.T.I.
EXCAVATION EQUIPMENT: JD 310-A DATE EXCAVATED: 4/20/89
WATER LEVEL AND DATE: Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0 – 1.3'	B-1; ST-1 (0'-2')	SILTY SAND Fine sand, light brown, moist, medium dense (SM)		BEGIN EXCAVATION AT 09:25
1.0'					Wc = 11.5% Dry Density = 118 PCF K = 4.9 x 10^{-5} cm/sec
	1.3' – 2.3' (2.0')	B-2	LEAN CLAY, gray, moist, stiff (CL)		
2.0'					
			POORLY GRADED SAND, medium to fine sand, brown, moist, loose to medium dense (SP)		
3.0'			END TEST PIT @ 3' B.G.S.		FINISH BACKFILLING 10:00
4.0'					
5.0'					

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-02 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 200+40E, 6+00N LOGGER C. Lawrence
ELEVATION 662 ft ± CONTRACTOR E.T.I.
EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/20/89
WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION)
	0		LEAN CLAY, brown to gray, moist, stiff (CL)		BEGIN EXCAVATION at 08:55
1.0'		B-1; ST-1A, ST-1B (0'-2')			Wc = 22.5% LL = 30 PI = 9 Dry Density = 102.9 PCF K = 3.2×10^{-7} cm/sec
2.0'	2.0'				
	2.5'		POORLY GRADED SAND, medium to fine sand, brown, moist, loose to medium dense (SW)		
3.0'			END TEST PIT @ 3' B.G.S.		FINISH BACKFILLING @ 9:20
4.0'					
5.0'					

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-03 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 4+00E, 6+00N LOGGER C. Lawrence

ELEVATION 659 ft ± CONTRACTOR E.T.I.

EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/20/89

WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER		SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0 – 0.7'	B-1	ST-1 (0'-2')	SILTY SAND, fine sand, light brown, moist, medium dense (SM)		BEGIN EXCAVATION @ 08:20
1.0'	0.7' – 1.2'	B-2		LEAN CLAY, gray, moist, stiff (CL)		Gray silty clay layer ranged from 0.5' to 1.5' thick along east pit wall
2.0'	1.2' – 2.0			POORLY GRADED SAND, medium to fine sand, brown, moist, loose to medium dense (SP)		Excavated material contained what appeared to be medical waste (blood-stained plastic bags and labels which read "T&G Bags",
3.0'				END TEST PIT @ 3' B.G.S.		FINISH BACKFILLING @
4.0'						
5.0'						

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-04 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 5+00E, 6+00N LOGGER C. Lawrence

ELEVATION 656 ft ± CONTRACTOR E.T.I.

EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/20/89

WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 5 ft

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0 – 1.5'	B-1; ST-1 (0'-2')	<u>SILTY SAND</u>, fine sand, light brown, moist, medium dense (SM)		BEGIN EXCAVATION @ 07:30 Wc = 15.0% Dry Density = 113.0 PCF $K = 2.4 \times 10^{-5}$ cm/sec
1.0'					
	1.5' – 2.0'		<u>LEAN CLAY</u>, gray, moist, stiff (CL)		
2.0'	2.0' – 4.0'	B-2			
3.0'					
4.0'	4.0'		<u>POORLY GRADED SAND</u>, medium to fine, brown, moist, loose to medium dense (SP)		Refuse observed in excavated material
5.0'			END TEST PIT @ 5.0' B.G.S.		FINISH BACKFILLING @ 08:15

CHM HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-05 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 2+00E, 5+00N LOGGER C. Lawrence

ELEVATION 664 ft ± CONTRACTOR E.T.I.

EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89

WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 2.5 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0	ST-1 (0'-2')	SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 16:20
1.0'	1.0'	B-1	LEAN CLAY, gray, moist, stiff (CL)		
	1.5'	B-2	POORLY GRADED SAND, medium to fine, brown, moist, loose to medium dense (SP)		
2.0'	2.0'				
			END TEST PIT @ 2.5' B.G.S.		FINISH BACKFILLING @ 16:55
3.0'					
4.0'					
5.0'					

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-06 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 3+60E, 5+00N LOGGER C. Lawrence

ELEVATION 661 ft ± CONTRACTOR E.T.I.

EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89

WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0	ST-1A, ST-1B (0'-2')	SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 15:55
1.0'	1.6'				ST-1A / ST-1B Wc = 15.6% / 18.6% Dry Density = 113.4 PCF / 108.6 PCF LL = 19 / 21 PI = 1 / 1 K = 2.0 x 10^{-6} cm/sec / 1.1 x 10^{-6} cm/sec
	2.0'	B-1	LEAN CLAY, gray, moist, stiff (CL)		
2.0'			POORLY GRADED SAND, medium to fine, brown, moist, loose to medium dense (SP)		
3.0'			END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 16:15
4.0'					
5.0'					

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-07 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 5+00E, 4+50N LOGGER C. Lawrence

ELEVATION 658 ft ± CONTRACTOR E.T.I.

EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89

WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE		SOIL DESCRIPTION	SYMBOLIC LOG	COMMENTS
	INTERVAL	TYPE AND NUMBER	SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL		DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0		SILT, mostly brown with some gray zones, moist, stiff (ML)		BEGIN EXCAVATION @ 15:30
1.0'		B-1 ST-1			
	2.0'				Wc = 22.2% Dry Density = 95.0 PCF LL = 21 PI = 2 K = 6.2×10^{-5} cm/sec
2.0'			POORLY GRADED SAND, fine, gray, dry to moist, loose to medium dense (SP)		
3.0'			END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 15:50
4.0'					
5.0'					

CHM HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-08 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 2+50E, 3+00N LOGGER C. Lawrence
ELEVATION ______ CONTRACTOR E.T.I.
EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89
WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION)
	0 – 0.7'	B-1; ST-1 (0'-2')	SANDY SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 15:10 Wc = 19.6% Dry Density = 100.0 PCF LL = 21 PI = 1 K = 4.6 x 10^{-6} cm/sec
1.0'	0.7' – 1.7'	B-1; ST-1 (0'-2')	LEAN CLAY, gray, moist, stiff (CL)		
2.0'	1.7' – 2.0'	ST-1 (0'-2')	POORLY GRADED SAND, medium to fine, brown, moist, loose to medium dense (SP)		
3.0'			END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 15:25
4.0'					
5.0'					

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-09 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 3+80E, 3+00N LOGGER C. Lawrence
ELEVATION 664 ft ± CONTRACTOR E.T.I.
EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89
WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER		SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION
	0		ST-1 (0'-2')	SANDY SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 14:50
1.0'	1.0'	B-1		LEAN CLAY, gray, moist, stiff (CL)		
	1.7'			POORLY GRADED SAND, fine, dry to moist, loose to medium dense (SP)		
2.0'	2.0'					
3.0'				END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 15:05
4.0'						
5.0'						

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-10 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 4+80E, 1+00N LOGGER C. Lawrence
ELEVATION 666 ft ± CONTRACTOR E.T.I.
EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89
WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION)
	0	B-1, ST-1 (0'-2')	SANDY SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 14:20 Wc = 22.5% Dry Density = 100.2 PCF LL = 26 PI = 4 K = 5.5 x 10^{-7} cm/sec
1.0'	1.0'		LEAN CLAY, gray, moist, stiff (CL)		
2.0'	2.0'		POORLY GRADED SAND, fine, gray, dry to moist, loose to medium dense (SP)		Wc = 7.2% Dry Density = 103.5 PCF K = 6.8 x 10^{-4} cm/sec
3.0'			END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 14:45
4.0'					
5.0'					

CH2M HILL

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FS	STP-11 SHEET 1 OF 1

TEST PIT LOG

PROJECT Onalaska Municipal Landfill RI/FS LOCATION 5+50E, 2+50N LOGGER C. Lawrence
ELEVATION 660 ft ± CONTRACTOR E.T.I.
EXCAVATION EQUIPMENT JD 310-A DATE EXCAVATED 4/19/89
WATER LEVEL AND DATE Not encountered APPROX. DIMENSIONS: Length 3 ft Width 2 ft Maximum Depth 3 ft

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SOIL DESCRIPTION (SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DIFFICULTY IN EXCAVATION, RUNNING GRAVEL CONDITION, COLLAPSE OF WALLS, SAND HEAVE, DEBRIS ENCOUNTERED, WATER SEEPAGE, GRADATIONAL CONTACTS, TESTS AND INSTRUMENTATION)
	0 – 1.0'	ST-1 (0'-2')	SANDY SILT, brown, moist, firm to stiff (ML)		BEGIN EXCAVATION @ 13:50 Wc = 13.4% Dry Density = 115.8 PCF K = 6.3 x 10^{-7} cm/sec
1.0'	1.0' – 1.7'	B-1; ST-1 (0'-2')	LEAN CLAY, gray, moist, stiff (CL)		
	1.7'	ST-1 (0'-2')	POORLY GRADED SAND, fine, gray, dry to moist, loose to medium dense (SP)		
2.0'					
3.0'			END TEST PIT @ 3.0' B.G.S.		FINISH BACKFILLING @ 14:15
4.0'					
5.0'					

Attachment C-2
GEOTECHNICAL LABORATORY DATA

WARZYN

June 5, 1989
13410.12

Exploration Technology, Inc.
1402 Emil Street
Madison, WI 53713

Attention: Mr. Tom Ruda

Re: Geotechnical Laboratory Test Results
Onalaska Municipal Landfill Cover
Onalaska, Wisconsin
CH_2M Hill Job # GL065550.FI.FS

Dear Mr. Ruda:

As requested, we have completed laboratory soil testing on the 13, 3-in. diameter Shelby tube samples and 11 bag samples that you delivered to us on April 20, 1989. Testing was performed in general accordance with CH_2M Hill's letter of April 17, 1989. As instructed, each sample which was tested for permeability also had the following laboratory tests performed: natural moisture content, grain size distribution (including a hydrometer analysis for samples with more than about 10% passing the No. 200 sieve), and dry unit weight.

Because many of the samples are silty to sandy in character, changes in the testing program were made from those outlined in the April 17, 1989 letter. These revisions were discussed earlier by telephone with Chris Lawrence of CH_2M Hill, and include the following:

1) Tests were performed on 11 of the 13 Shelby tube samples. Two of the bag samples were tested for standard Proctor compaction, with one of the two bags also tested for permeability at approximately 95% compaction (based on standard Proctor).

2) Due to the lower soil plasticities of many of the samples than anticipated, the shrinkage limit test was not performed. Atterberg limits were not performed on samples which are nonplastic.

3) The lower soil plasticities also influenced specimen preparation and test parameters for the permeability tests. For example, a length-to-diameter ratio of approximately 2:1 instead of 1.5:1 was used, hydraulic gradients were in the range of 8 to 22 instead of 10 to 30, and the time intervals between readings were in some cases about 8 h instead of approximately 24 h.

Warzyn Engineering Inc
One Science Court
University Research Park
PO Box 5385
Madison, Wisconsin 53705
(608) 2[illegible]

4) An average net confining pressure of 2 lb/sq in. was used for the flexible-wall permeability tests. The net confining pressures at the influent and effluent ends of the specimens were slightly lower and higher, respectively, than the average pressure, to create a flow condition during the "rising head/falling head" tests.

5) Because the spread sheets of flexible-wall permeability test data include incremental and cumulative influent and effluent flow volumes for each permeability test reading, plots of water volumes entering and leaving the specimens as a function of time have not been included.

The test results are contained in the attached Grain Size Distribution Test Reports, Moisture-Density Curve, Falling Head Permeability Test Reports and Flexible-Wall Permeability Test Laboratory Data Spread Sheets. Also enclosed are the record sheets used to visually classify the Shelby tube samples and to select portions of the tube samples for laboratory testing.

All soil samples will be stored for 30 days, at which time they will be discarded unless otherwise instructed by you.

Should you have any questions concerning these results or require additional testing, please contact us.

Sincerely,

WARZYN ENGINEERING INC.

Donald W. Arenander
Geotechnical Laboratory Supervisor

DWA/mml/DLN
[L-S-80]

Attachments: As Stated

WARZYN ENGINEERING INC

(c) FLEXIBLE WALL FALLING HEAD PERMEABILITY TEST RESULTS

PROJECT: ONALASKA LANDFILL
CH2M HILL JOB # GL065550.FI.FS
ONALASKA, WISCONSIN

Test No. 1
Job No. 13410.12
Date 05-26-89
Sheet 1 of 3

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3-INCH SHELBY TUBE

SAMPLE (a)	STP 08		STP 10		STP 06A	
RECOVERY	0-2'		0-2'		0-1.7'	
SOIL DESCRIPTION	Gray SILT, Some Sand, Little Clay (ML)		Gray-Brown SILT, Some Clay, Little Sand (ML)		Brown SILT, Some Sand, Little Clay (ML)	
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
SAMPLE DIAMETER (cm)	4.95	4.94	4.96	4.94	4.97	4.95
SAMPLE AREA, A (cm^2)	19.25	19.17	19.29	19.21	19.39	19.28
SAMPLE LENGTH, L (cm)	10.11	10.09	10.11	10.09	10.03	10.00
MOISTURE CONTENT, %	19.6	20.5	22.5	24.1	15.6	16.6
DRY DENSITY (PCF)	106.0	106.6	100.2	100.9	113.4	114.4
MAXIMUM GRADIENT	8	8	8	22	7	7
NET CONFINING PRESSURE (PSI)	2	2	2	2	2	2

COEFFICIENT OF PERMEABILITY, k (cm/sec)

RUN NO.	STP 08	STP 10	STP 06A
1	6.6×10^{-6}	3.1×10^{-6}	2.9×10^{-6}
2	6.7×10^{-6}	1.3×10^{-6}	3.0×10^{-6}
3	6.5×10^{-6}	9.0×10^{-7}	2.9×10^{-6}
4	5.1×10^{-6}	6.7×10^{-7}	2.8×10^{-6}
5	5.7×10^{-6}	7.6×10^{-7}	2.2×10^{-6}
6	4.5×10^{-6}	6.4×10^{-7}	2.0×10^{-6}
7	4.8×10^{-6}	6.1×10^{-7}	2.2×10^{-6}
8	4.5×10^{-6}	5.4×10^{-7}	2.0×10^{-6}
9	4.6×10^{-6}	5.4×10^{-7}	2.1×10^{-6}
10	4.6×10^{-6}	5.7×10^{-7}	2.0×10^{-6}
AVERAGE k, (cm/sec)(b)	4.6×10^{-6}	5.5×10^{-7}	2.0×10^{-6}

FORMULA: (c)

$$K = \frac{2.3\ a\ L}{At} \log 10 \frac{h_0}{h_1}$$

Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

REMARKS: 2

(a) Permeability tests were performed on relatively undisturbed 3-inch diameter Shelby tube samples.

(b) Average coefficient of permeability based on run numbers 8 through 10.

(c) "Rising Head/Falling Head" formula.

TESTED BY [signature] CHECKED BY [signature] APPROVED BY [signature]

WARZYN ENGINEERING INC

(c) FLEXIBLE WALL FALLING HEAD PERMEABILITY TEST RESULTS

PROJECT: ONALASKA LANDFILL
CH_2M HILL JOB # GL065550.FI.FS
ONALASKA, WISCONSIN

Test No. 1
Job No. 13410.12
Date 05-26-89
Sheet 2 of 3

WARZYN ENGINEERING INC. • ONE SCIENCE COURT • UNIVERSITY RESEARCH PARK • P.O. BOX 5385 • MADISON, WISCONSIN 53705

3-INCH SHELBY TUBE

SAMPLE (a)	STP 02B		STP 06B		STP 07	
RECOVERY	0-2'		0-2'		0-1.8'	
SOIL DESCRIPTION	Brown Lean CLAY, Trace Sand (CL)		Gray SILT, Some Sand, Little Clay (ML)		Brown SILT, Little Sand & Clay (ML)	
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
SAMPLE DIAMETER (cm)	5.01	5.01	4.97	4.96	4.96	4.95
SAMPLE AREA, A (cm^2)	19.75	19.75	19.43	19.30	19.34	19.25
SAMPLE LENGTH, L (cm)	10.03	10.03	10.09	10.06	10.11	10.09
MOISTURE CONTENT, %	22.5	22.2	18.6	20.2	22.2	27.4
DRY DENSITY (PCF)	102.9	102.9	108.6	109.7	95.0	95.7
MAXIMUM GRADIENT	8	22	8	8	8	8
NET CONFINING PRESSURE (PSI)	2	2	2	2	2	2

COEFFICIENT OF PERMEABILITY, k (cm/sec)

RUN NO.	STP 02B	STP 06B	STP 07
1	3.4×10^{-7}	1.9×10^{-6}	8.2×10^{-5}
2	3.1×10^{-7}	1.6×10^{-6}	8.0×10^{-5}
3	3.0×10^{-7}	1.3×10^{-6}	7.6×10^{-5}
4	3.3×10^{-7}	1.1×10^{-6}	7.4×10^{-5}
5	3.4×10^{-7}	1.2×10^{-6}	7.4×10^{-5}
6	3.0×10^{-7}	1.1×10^{-6}	7.2×10^{-5}
7	3.2×10^{-7}	1.2×10^{-6}	6.1×10^{-5}
8	3.2×10^{-7}	1.1×10^{-6}	6.0×10^{-5}
9	3.2×10^{-7}	1.2×10^{-6}	6.2×10^{-5}
10	3.1×10^{-7}	1.1×10^{-6}	6.2×10^{-5}
AVERAGE k, (cm/sec)(b)	3.2×10^{-7}	1.1×10^{-6}	6.2×10^{-5}

FORMULA: (c)

$$K = \frac{2.3\,a\,L}{At} \log 10 \frac{h_0}{h_1}$$

2

Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

REMARKS:

(a) Permeability tests were performed on relatively undisturbed 3-inch diameter Shelby tube samples.

(b) Average coefficient of permeability based on run numbers 8 through 10.

(c) "Rising Head/Falling Head" formula.

TESTED BY [signature] CHECKED BY [signature] APPROVED BY [signature]

WARZYN

ENGINEERING INC

(c) FLEXIBLE WALL FALLING HEAD PERMEABILITY TEST RESULTS

PROJECT: ONALASKA LANDFILL
CH_2M HILL JOB # GL065550.FI.FS
ONALASKA, WISCONSIN

Test No. ____
Job No. 13410.12
Date 05-22-89
Sheet 3 of 3

WARZYN ENGINEERING INC. • ONE SCIENCE COURT • UNIVERSITY RESEARCH PARK • P.O. BOX 5385 • MADISON, WISCONSIN 53705

SAMPLE BAG (a)	STP 04					
RECOVERY	1.5-3.5'					
SOIL DESCRIPTION	Brown Lean CLAY, Little Sand (CL)					
	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
SAMPLE DIAMETER (cm)	4.96	4.95				
SAMPLE AREA, A (cm^2)	19.35	19.24				
SAMPLE LENGTH, L (cm)	9.90	9.87				
MOISTURE CONTENT, %	19.4	20.6				
DRY DENSITY (PCF) (b)	103.7	104.6				
MAXIMUM GRADIENT	8	22				
NET CONFINING PRESSURE (PSI)	2	2				

COEFFICIENT OF PERMEABILITY, k (cm/sec)

RUN NO. 1	4.6×10^{-7}		
2	4.6×10^{-7}		
3	4.6×10^{-7}		
4	4.8×10^{-7}		
5	4.5×10^{-7}		
6	4.2×10^{-7}		
7	4.3×10^{-7}		
8	4.4×10^{-7}		
9	4.2×10^{-7}		
10	4.3×10^{-7}		
AVERAGE k, (cm/sec) (b)	4.3×10^{-7}		

FORMULA: (c)

$$K = \frac{2.3\ a\ L}{At} \log 10 \frac{h_0}{h_1}$$

Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

REMARKS: 2

(a) This permeability test was performed on remolded soil, trimmed from a standard Proctor sample.
Initial percent compaction was 92.6% and the final percent compaction after consolidation was 93.4% at a confining pressure of 2 psi.

(b) Average coefficient of permeability based on run numbers 8 through 10.

(c) "Rising Head/Falling Head" formula.

TESTED BY [signature] CHECKED BY [signature] APPROVED BY [signature]

Job No. 13410
Date: 04/20/89

F .LING HEAD PERMEABILITY TEST

Warzy. .ngineering Inc., 1 Science Ct., University Research Park, PO Box 5385, Madison, WI 53705 (608) 273-0440

PROJECT	ONALASKA LANDFILL
CLIENT	CH2M HILL
SAMPLE (a)	STP 01 @ RECOVERY 0-2.0 FT
SOIL DESCRIPTION	Brown Silty Fine-Medium SAND, Little Clay, Trace Gravel (SM)
SAMPLE DIAMETER (cm)	7.4
SAMPLE AREA, A(cm^2)	42.6

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	16.0	16.0
MOISTURE CONTENT, %	11.5	12.7
DRY DENSITY (lb/cu ft)	118.0	118.0
PERCENT COMPACTION	-	-

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	5.0E-05
2	4.9E-05
3	5.0E-05
4	5.0E-05
5	4.9E-05
6	4.9E-05
7	5.0E-05
8	4.9E-05
9	4.9E-05
10	4.9E-05

AVERAGE COEFFICIENT OF PERMEABILITY = 4.9E-05 cm/sec
(Based on run numbers 8 through 10)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe, t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-in. diameter Shelby tube sample.

CHECKED BY: DWA DATE: 6-2-89 APPROVED BY: DAN DATE: 6-5-89

WARZYN

Job No. 13410
Date: 04/20/89

FALLING HEAD PERMEABILITY TEST

Warzyn Engineering Inc., 1 Science Ct., University Research Park, PO Box 5385, Madison, WI 53705 (608) 273-0440

PROJECT	ONALASKA LANDFILL	
CLIENT	CH2M HILL	
SAMPLE (a)	STP 04 @ RECOVERY 0-2.0 FT	
SOIL DESCRIPTION	Brown Silty Fine-Medium SAND, Little Clay (SM)	
SAMPLE DIAMETER (cm)	7.4	
SAMPLE AREA, A (cm^2)	42.6	
	INITIAL	FINAL
SAMPLE LENGTH, L (cm)	14.0	14.0
MOISTURE CONTENT, %	15.0	15.5
DRY DENSITY (lb/cu ft)	113.0	113.0
PERCENT COMPACTION	-	-

RUN	COEFFICIENT OF PERMEABILITY, k (cm/sec)
1	2.4E-05
2	2.4E-05
3	2.4E-05
4	2.5E-05
5	2.4E-05
6	2.4E-05
7	2.4E-05
8	2.4E-05
9	2.4E-05
10	2.4E-05

AVERAGE COEFFICIENT OF PERMEABILITY = 2.4E-05 cm/sec
(Based on run numbers 8 through 10)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_f}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_f
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-in. diameter Shelby tube sample.

CHECKED BY: DWA DATE: 6-2-89 APPROVED BY: DXN DATE: 6-5-89

WARZYN

Job No. 13410
Date: 04/20/89

F⁄ ⁻.LING HEAD PERMEABILITY TEST

Wars. .gineering Inc., 1 Science Ct., University Research Park, PO Box 5385, Madison, WI 53705 (608) 273-0440

PROJECT	ONALASKA LANDFILL
CLIENT	CH2M HILL
SAMPLE (a)	STP 10 @ RECOVERY 0-2.0 FT
SOIL DESCRIPTION	Brown Fine-Medium SAND, Trace Silt & Clay (SP-SM)
SAMPLE DIAMETER (cm)	7.4
SAMPLE AREA, A(cm^2)	42.6

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	14.4	14.4
MOISTURE CONTENT, %	7.2	19.2
DRY DENSITY (lb/cu ft)	103.5	103.5
PERCENT COMPACTION	-	-

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	1.1E-03
2	9.8E-04
3	8.7E-04
4	7.6E-04
5	7.2E-04
6	7.1E-04
7	6.9E-04
8	7.0E-04
9	6.8E-04
10	6.8E-04
11	6.8E-04

AVERAGE COEFFICIENT OF PERMEABILITY = 6.8E-04 cm/sec
(Based on run numbers 9 through 11)

FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-in. diameter Shelby tube sample.

CHECKED BY: Dwa DATE: 6-2-89 APPROVED BY: DLM DATE: 6-5-89

WARZYN

Job No. 13410
Date: 04/21/89

FALLING HEAD PERMEABILITY TEST

Warz. ;ineering Inc., 1 Science Ct., University Research Park, PO Box 5385, Madison, WI 53705 (608) 273-0440

PROJECT	ONALASKA LANDFILL	
CLIENT	CH2M HILL	
SAMPLE (a)	STP 11 @ RECOVERY 0-2.0 FT	
SOIL DESCRIPTION	Brown Silty Fine-Medium SAND, Little Clay (SM)	
SAMPLE DIAMETER (cm)	7.4	
SAMPLE AREA, A(cm^2)	42.6	

	INITIAL	FINAL
SAMPLE LENGTH, L(cm)	10.7	10.7
MOISTURE CONTENT, %	13.4	13.7
DRY DENSITY (lb/cu ft)	115.8	115.8
PERCENT COMPACTION	-	-

RUN	COEFFICIENT OF PERMEABILITY, k(cm/sec)
1	6.8E-07
2	6.6E-07
3	5.9E-07
4	5.8E-07
5	5.6E-07
6	6.0E-07
7	5.9E-07
8	6.1E-07
9	6.1E-07
10	6.1E-07
11	6.5E-07
12	6.3E-07

AVERAGE COEFFICIENT OF PERMEABILITY = 6.3E-07 cm/sec
(Based on run numbers 10 through 12)

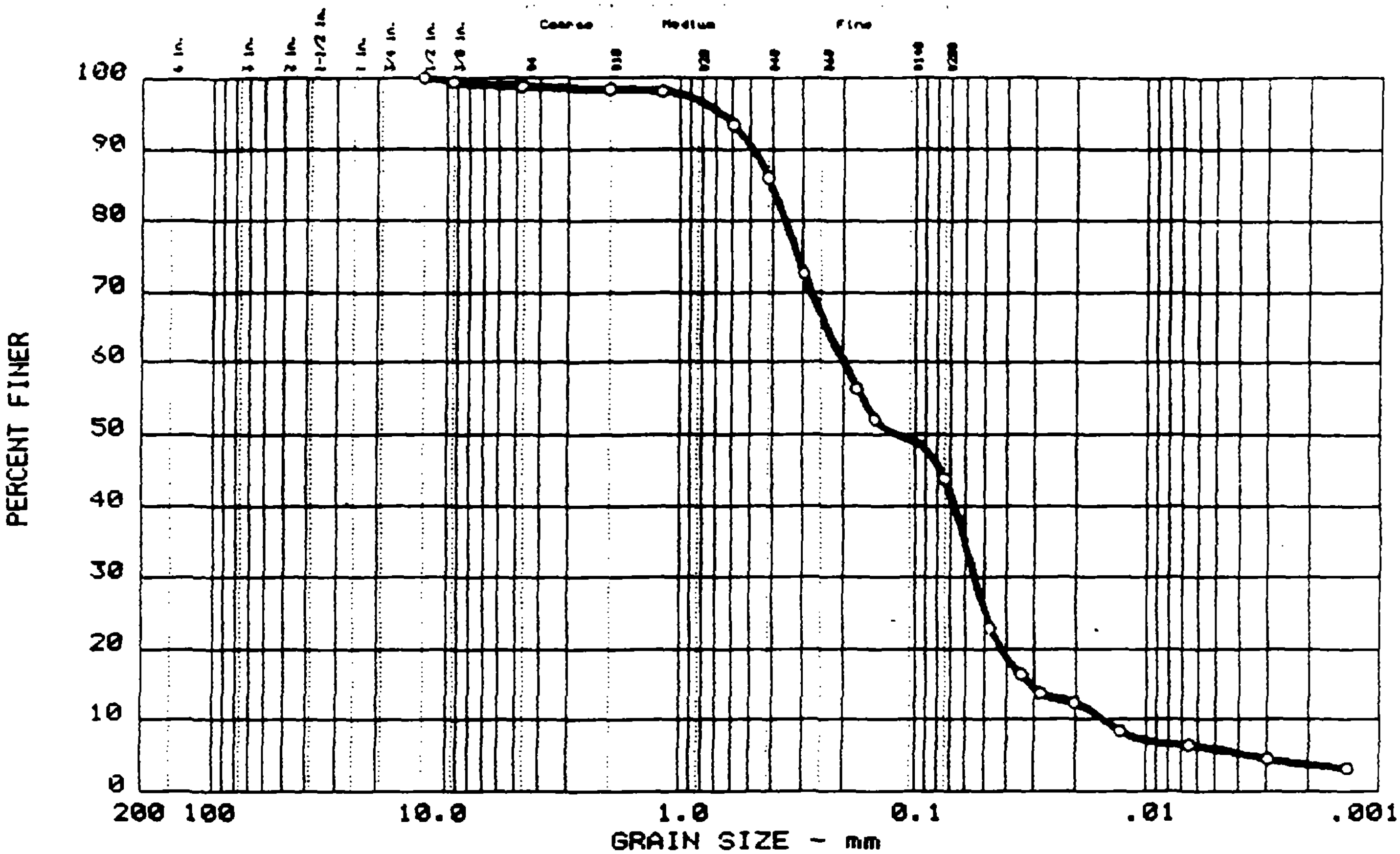
FORMULA: $k = \frac{2.3aL}{At} \log_{10} \frac{h_0}{h_1}$, Where a = cross-sectional area of standpipe,
t = time for water level to fall from initial height, h_0, to final height, h_1
(All other terms are defined above)

FOOTNOTES: (a) This permeability test was performed on a relatively undisturbed 3-in. diameter Shelby tube sample.

CHECKED BY: DWA DATE: 6-2-89 APPROVED BY: DLA DATE: 6-5-89

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	1.2	55.0	37.9	5.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.41	0.20	0.12	0.055	0.0314	0.0152	1.00	13.2

MATERIAL DESCRIPTION	USCS
○ Brown Silty Fine-Medium SAND, Little Clay, Trace Gravel *(Rigid Wall Permeability Test Sample)*	SM

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 01 @ RECOVERY 0-2.0 FT

D[illegible]: 04-20-89

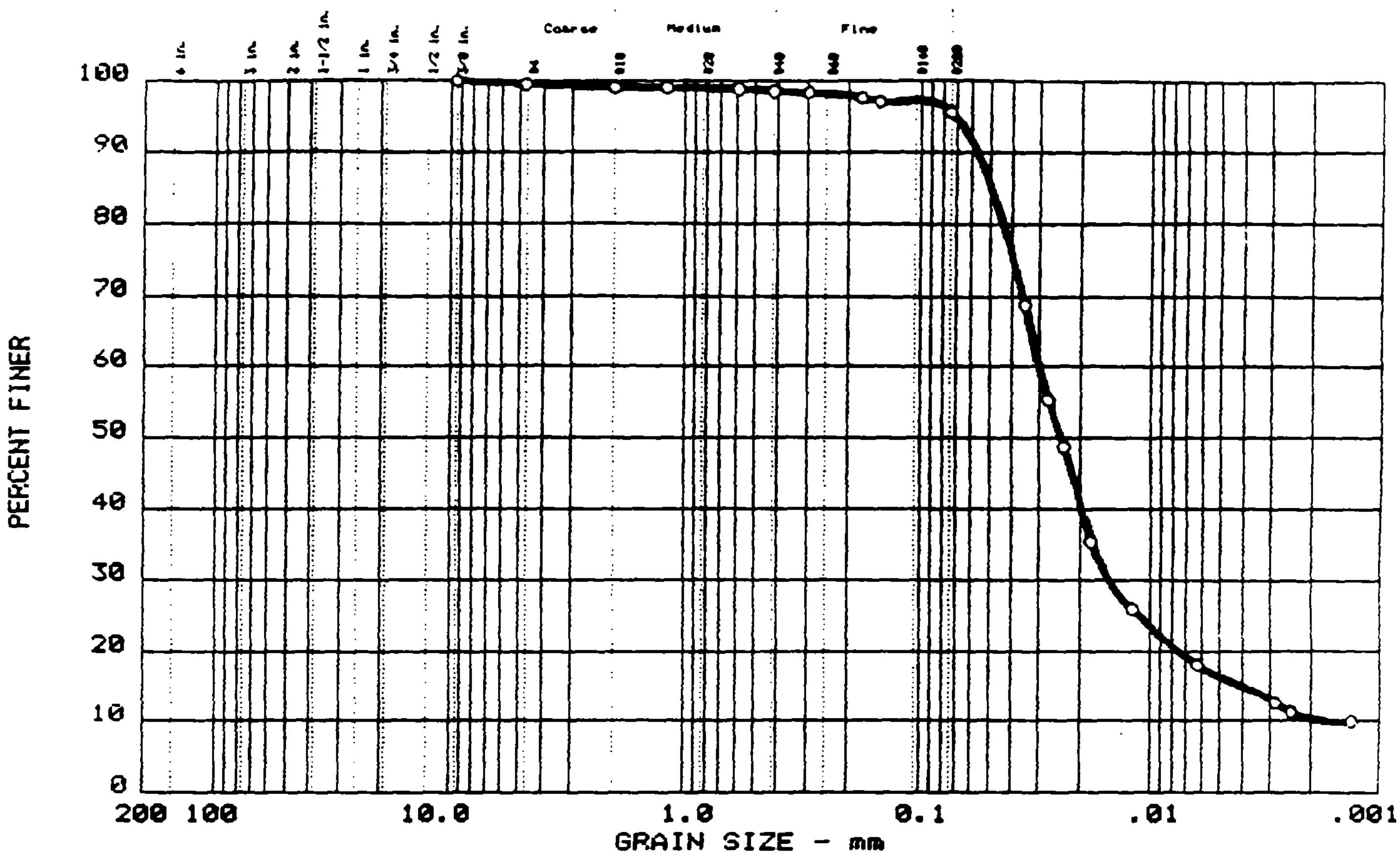
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: [illegible]

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.5	4.0	79.4	16.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	9			0.02	0.015	0.0041	0.0017	4.52	17.6

MATERIAL DESCRIPTION	USCS
○ Brown Lean CLAY, Trace Sand (Flexible Wall Permeability Test Sample)	CL

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 02B @ RECOVERY 0-2.0 FT

Date: 04-20-89

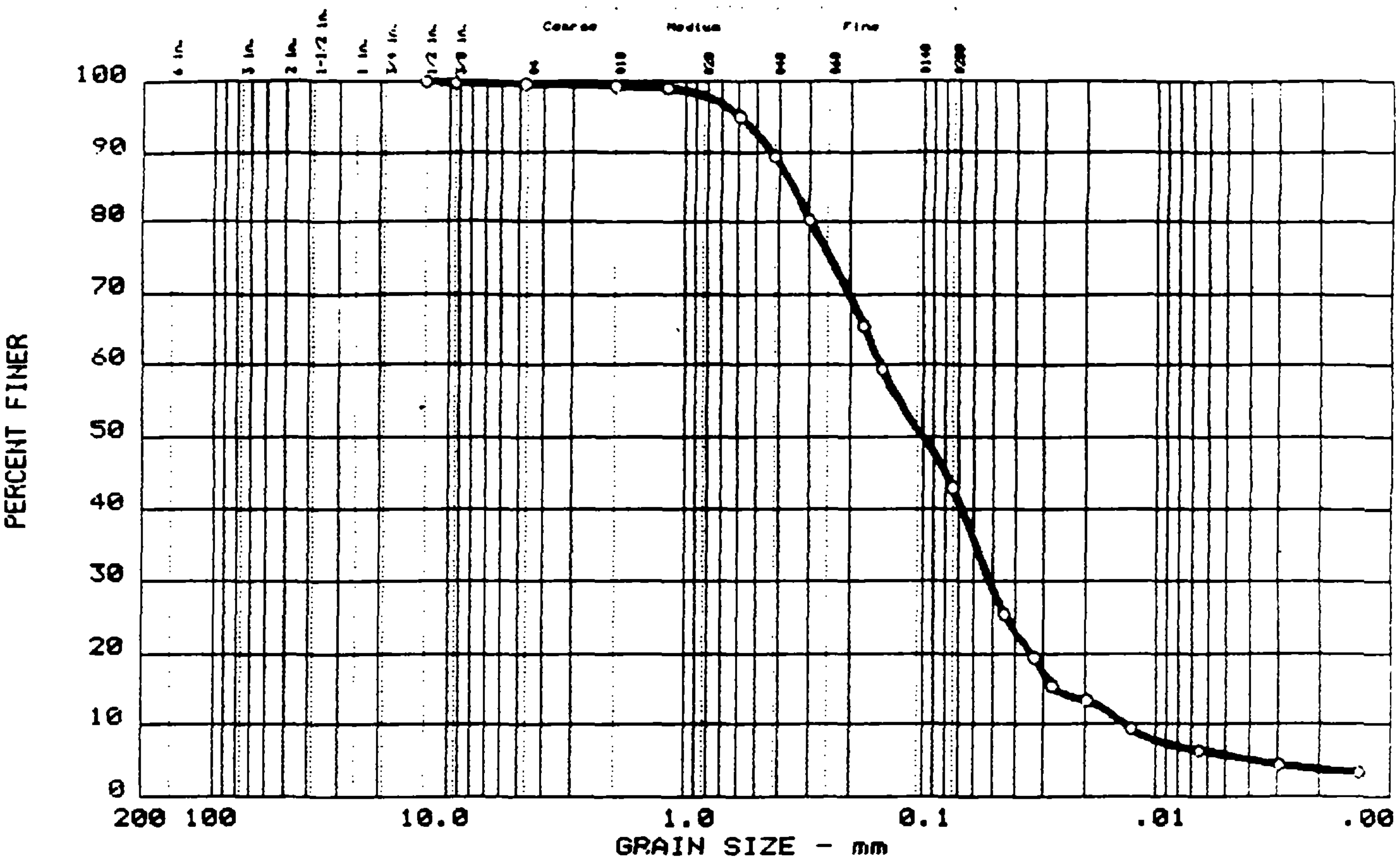
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: [signature]

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.4	56.7	37.2	5.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.35	0.15	0.10	0.052	0.0268	0.0136	1.30	11.1

MATERIAL DESCRIPTION	USCS
○ Brown Silty Fine-Medium SAND, Little Clay (Rigid Wall Permeability Test Sample)	SM

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 04 @ RECOVERY 0-2.0 FT

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

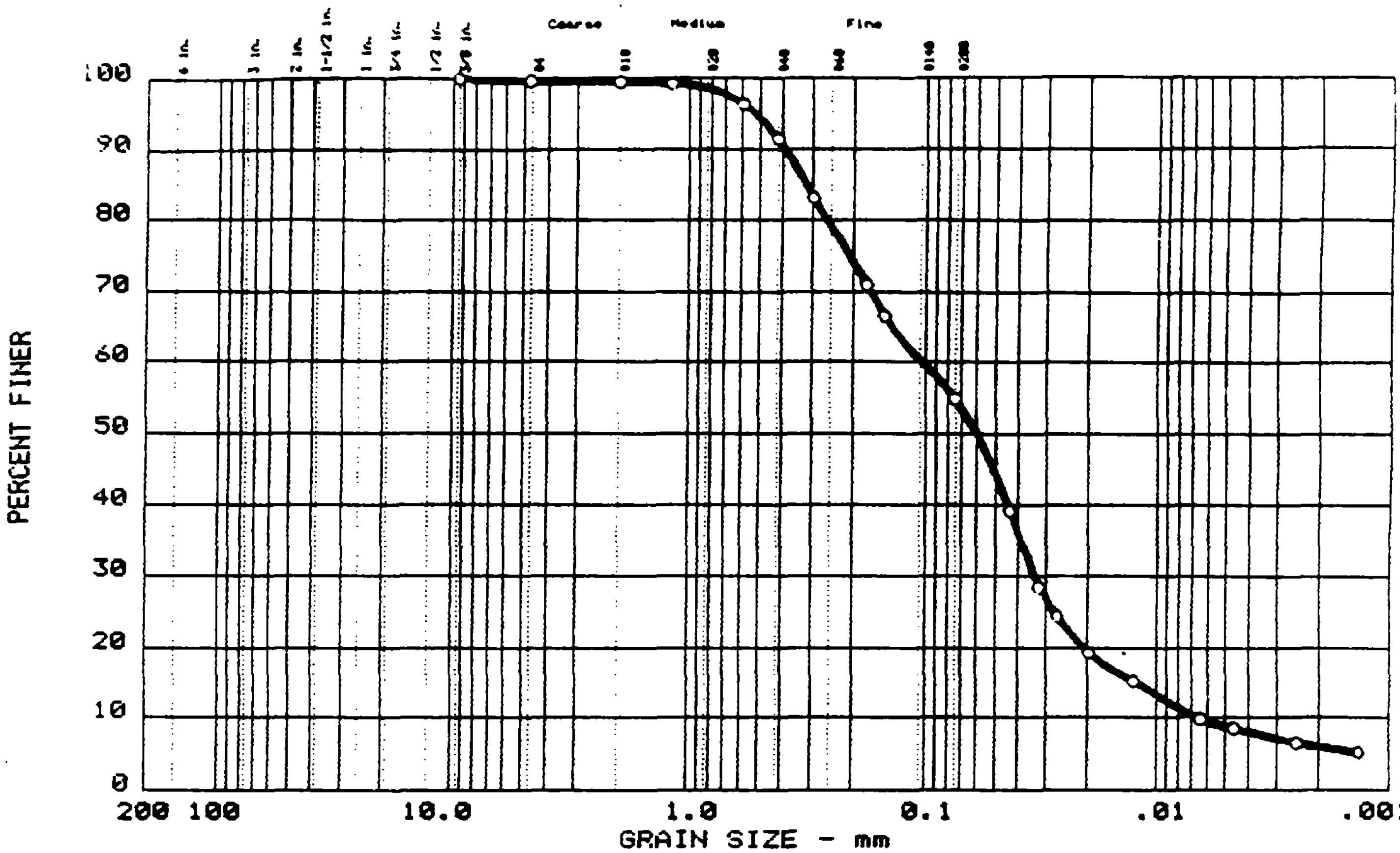
Remarks:

TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: DHN

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.4	44.7	46.1	8.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.32	0.10	0.06	0.034	0.0124	0.0066	1.71	15.4

MATERIAL DESCRIPTION	USCS
○ Brown Sandy SILT, Little Clay (Standard Proctor Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 04 @ 0-.75 FT
(Bag Sample)

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

Sheet No.

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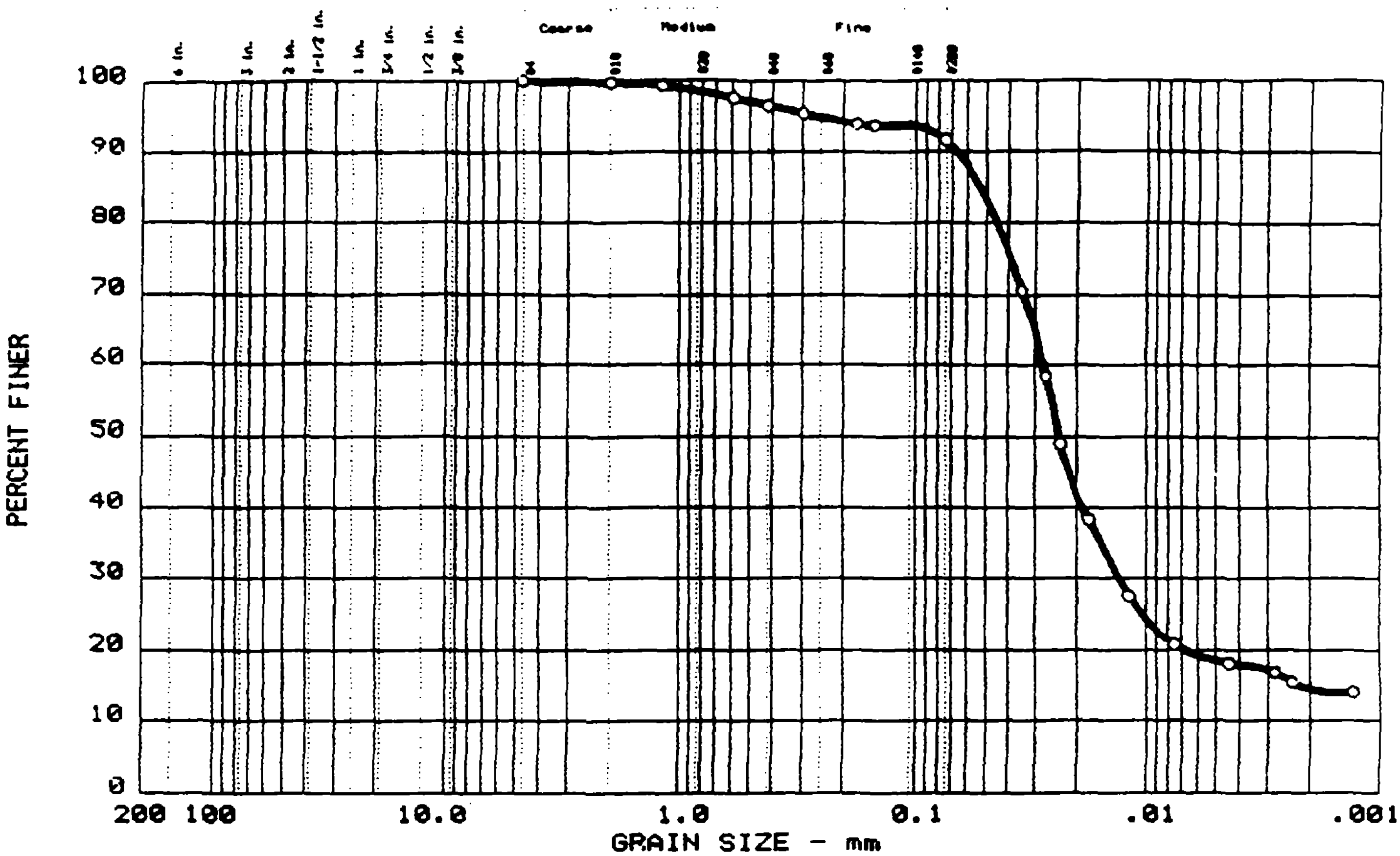
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	0.0	8.5	73.1	18.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	30	10			0.02	0.013	0.0023			

MATERIAL DESCRIPTION	USCS
o Brown Lean CLAY, Little Sand (Standard Proctor and Flexible Wall Permeability Test Sample)	CL

Project No.: 13410.12
Project: ONALASKA LANDFILL
o Sample: STP 04 @ 1.5-3.5 FT
(Bag Sample)

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

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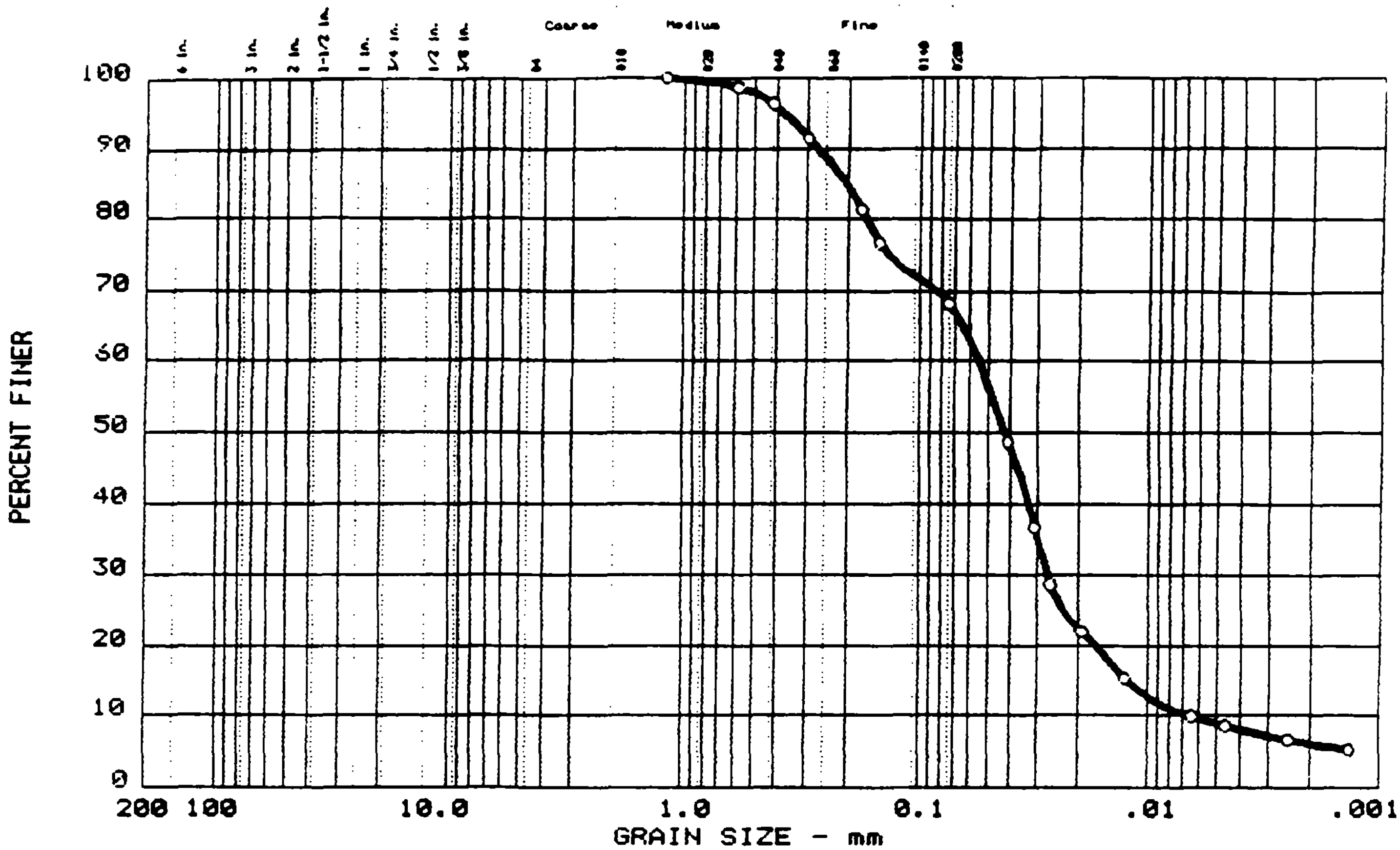
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	31.8	59.3	8.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19	1	0.21		0.04	0.027	0.0123	0.0065	2.07	8.4

MATERIAL DESCRIPTION	USCS
○ Brown SILT, Some Sand, Little Clay (Flexible Wall Permeability Test Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 6A @ RECOVERY 0-1.6 FT

[illegible]: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: CwA
APPROVED BY: DLM

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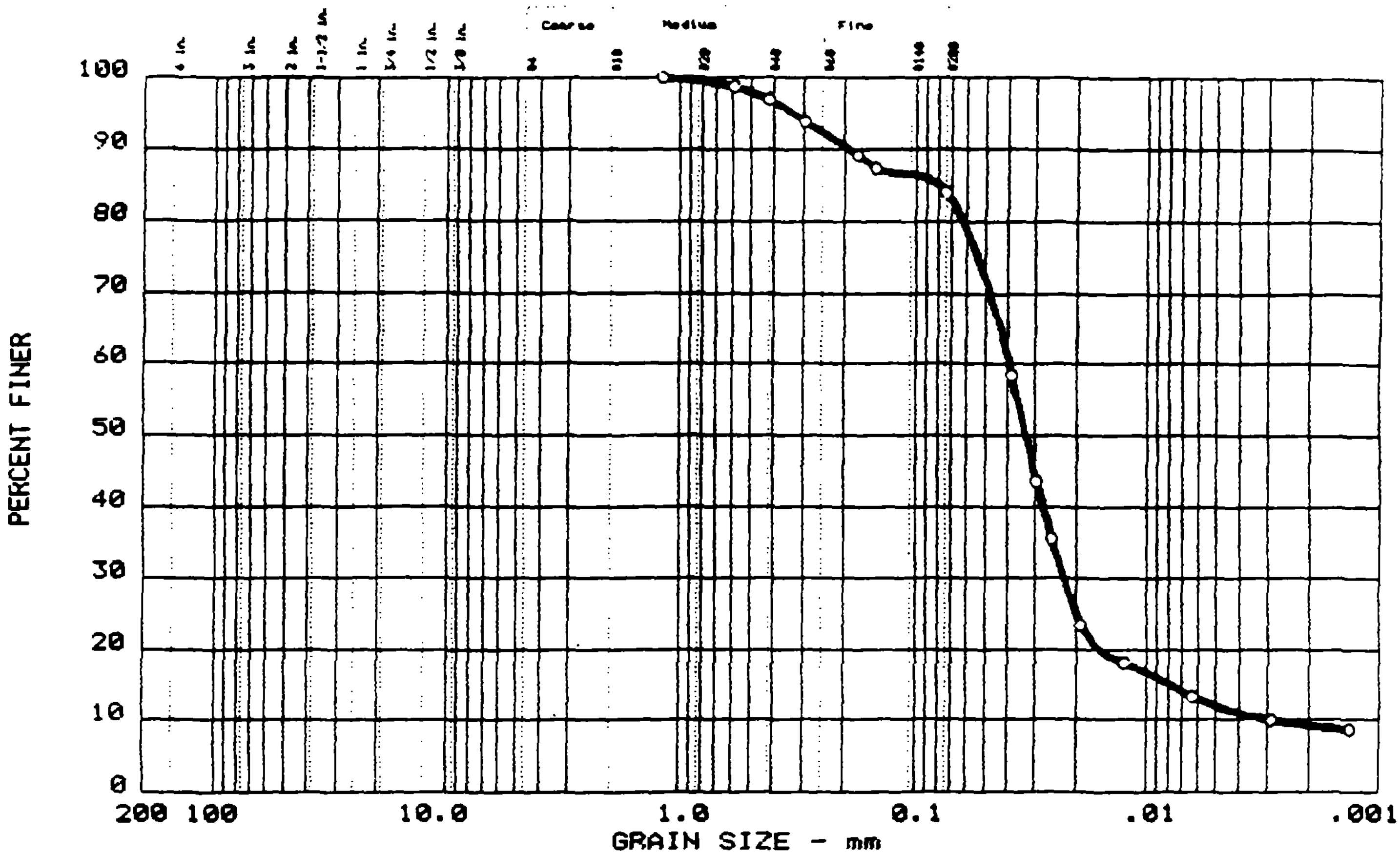
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	16.0	72.1	11.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	21	2	0.08		0.03	0.023	0.0078	0.0029	4.55	13.6

MATERIAL DESCRIPTION	USCS
○ Gray SILT, Some Sand, Little Clay (Flexible Wall Permeability Test Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 06B @ RECOVERY 0-2.0 FT

D •: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
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ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: SKM

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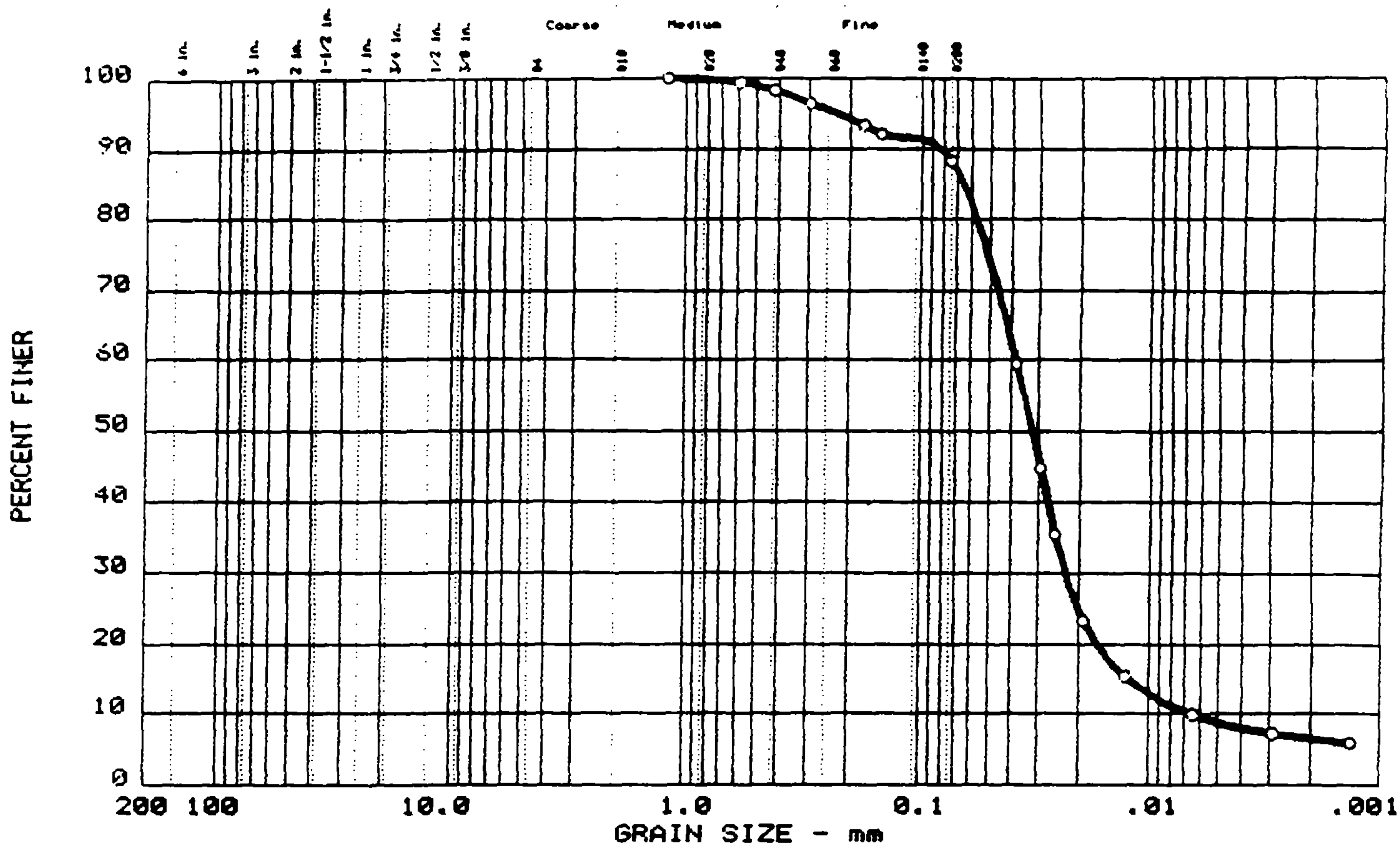
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	11.8	79.4	8.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	2			0.03	0.023	0.0122	0.0066	2.11	5.8

MATERIAL DESCRIPTION	USCS
○ Brown SILT, Little Sand & Clay (Flexible Wall Permeability Test Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 07 @ RECOVERY 0-1.8 FT

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: DWN

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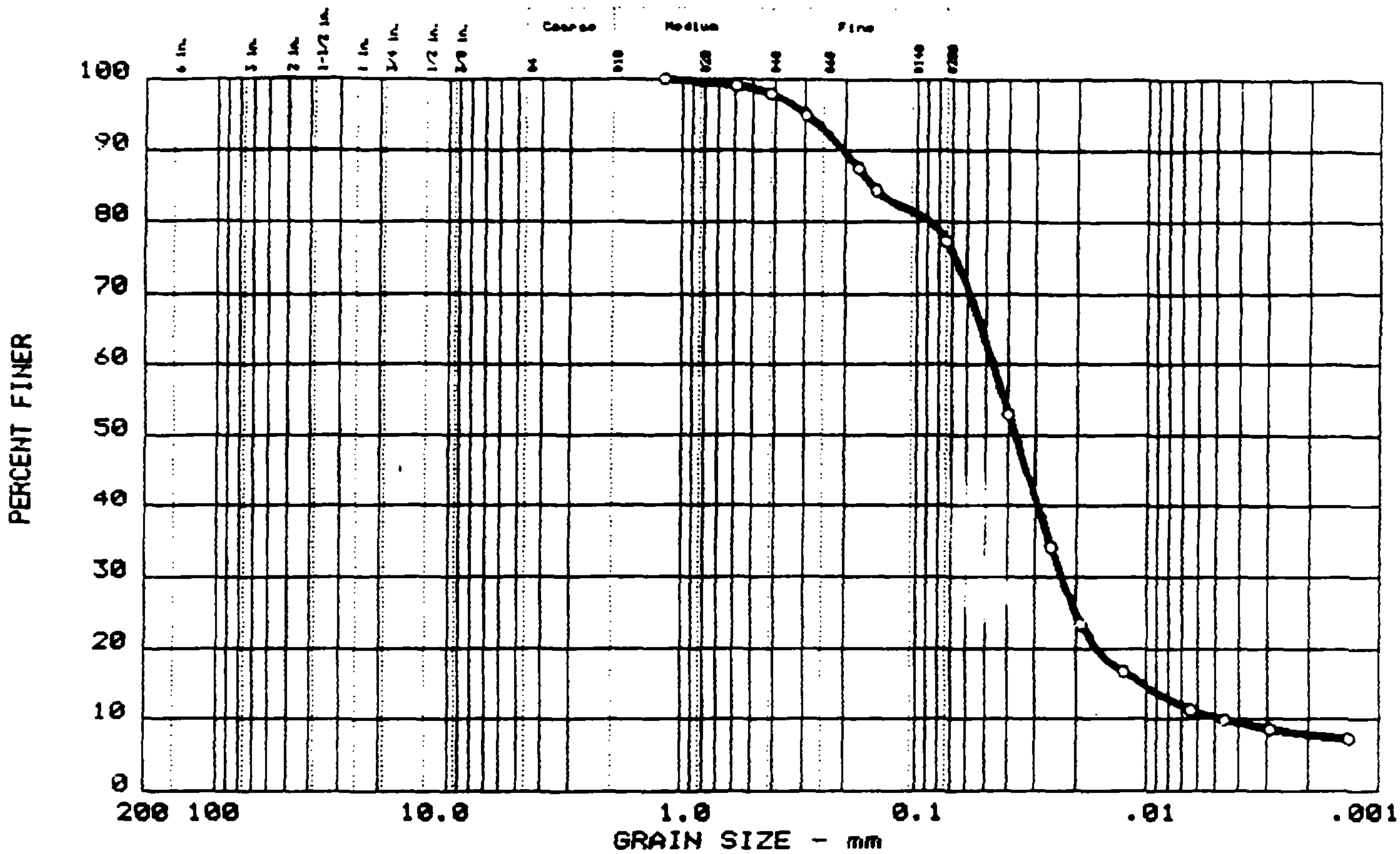
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	0.0	22.8	67.0	10.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	21	1	0.15		0.04	0.023	0.0105	0.0046	2.51	10.0

MATERIAL DESCRIPTION	USCS
o Gray SILT, Some Sand, Little Clay (Flexible Wall Permeability Test Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
o Sample: STP 08 @ RECOVERY 0-2.0 FT

D-*e: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: DWn

Sheet No.

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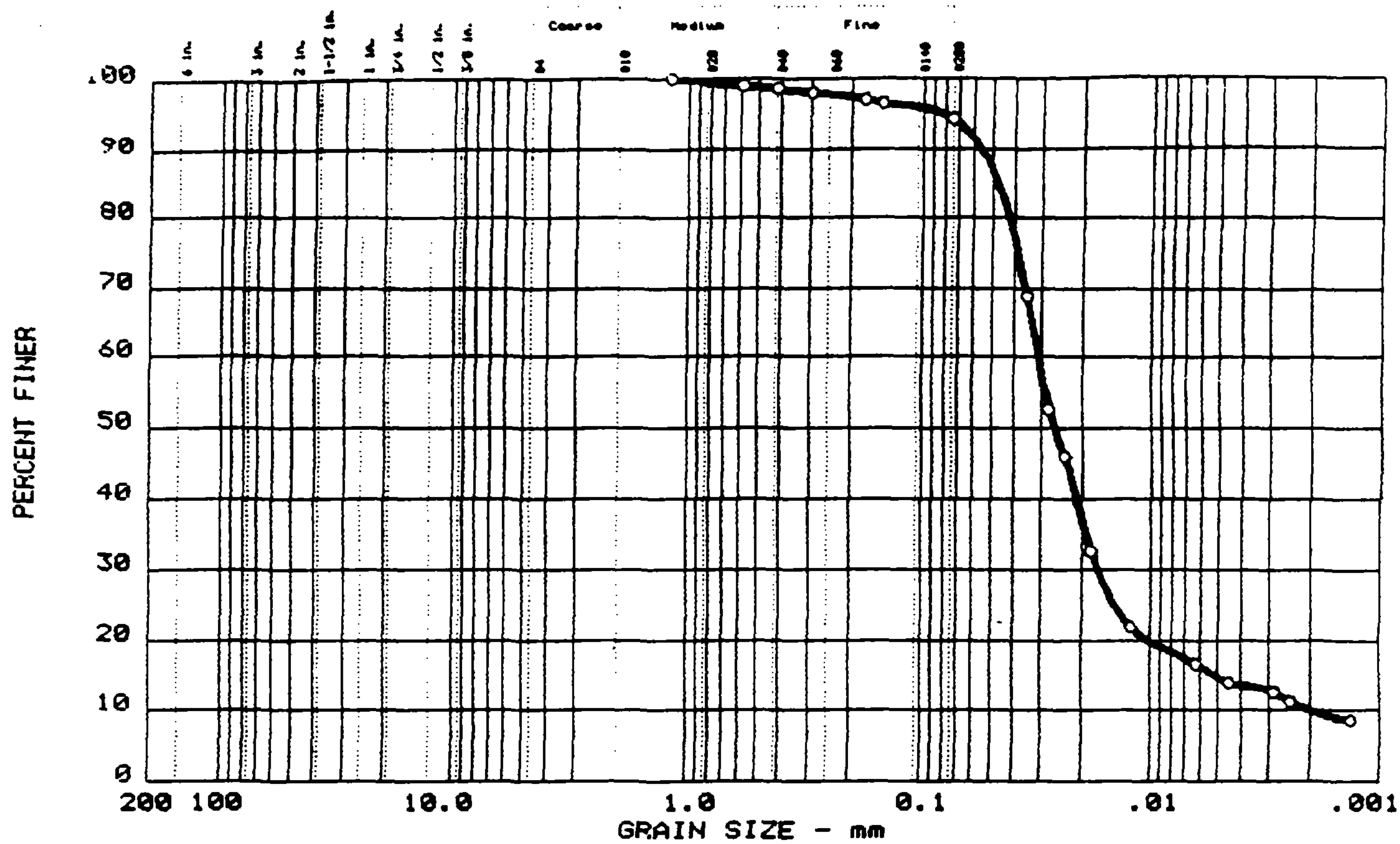
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	0.0	5.7	79.7	14.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	26	4			0.03	0.017	0.0052	0.0020	4.66	15.6

MATERIAL DESCRIPTION	USCS
O Gray-Brown SILT, Some Clay, Little Sand (Flexible Wall Permeability Test Sample)	ML

Project No.: 13410.12
Project: ONALASKA LANDFILL
O Sample: STP 10 @ RECOVERY 0-2.0 FT
(Upper Part of Shelby Tube)

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: WLN

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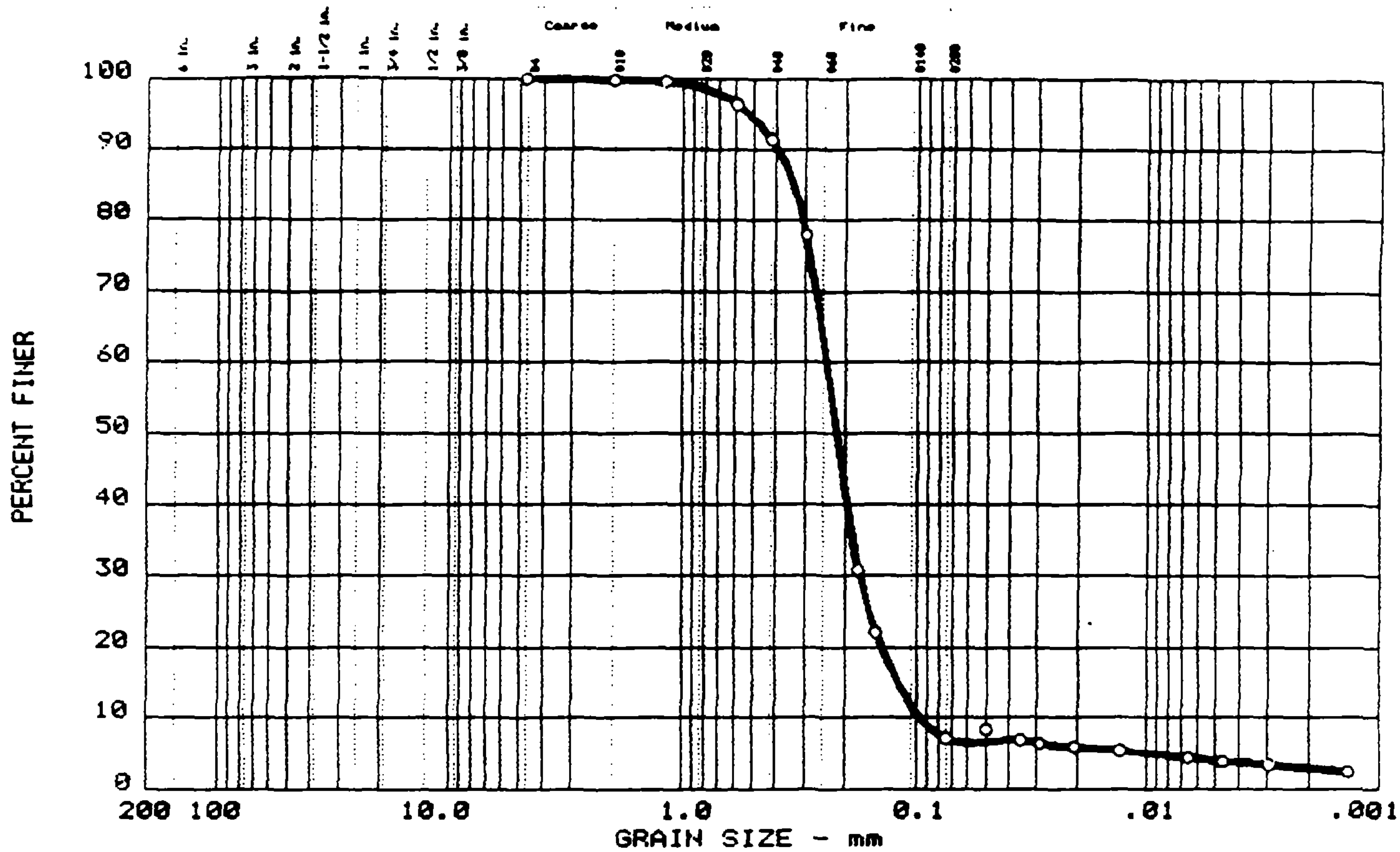
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	92.8	3.2	4.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.34	0.24	0.22	0.175	0.1205	0.0957	1.31	2.5

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Medium SAND, Trace Silt & Clay (Rigid Wall Permeability Test Sample)	SP-SM

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 10 @ RECOVERY 0-2.0 FT
(Lower Part of Shelby Tube)

Date: 04-20-89

Remarks:
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ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: DKN

GRAIN SIZE DISTRIBUTION TEST REPORT
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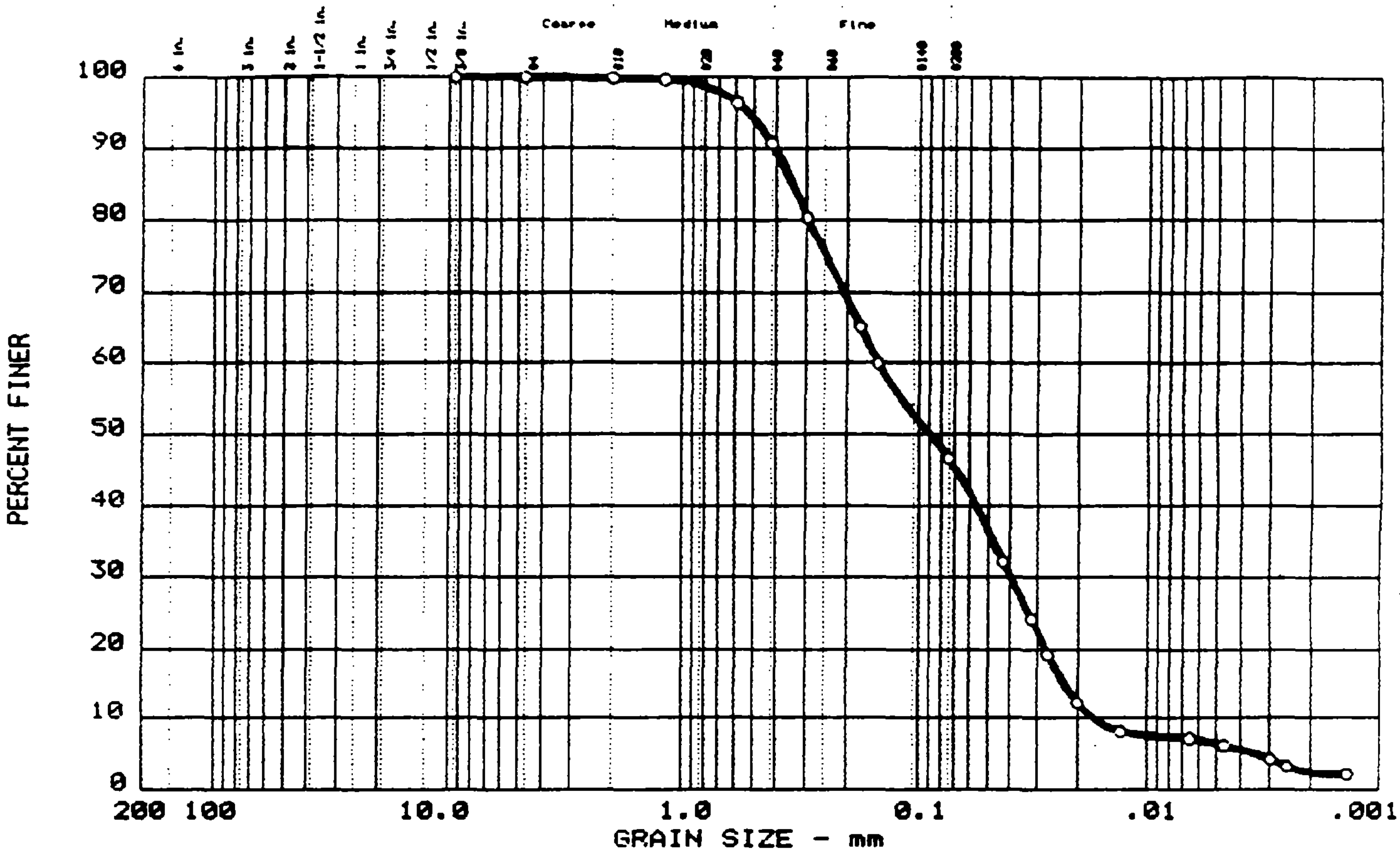
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	53.2	40.3	6.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.34	0.15	0.09	0.040	0.0231	0.0171	0.62	8.7

MATERIAL DESCRIPTION	USCS
○ Brown Silty Fine-Medium SAND, Little Clay (Rigid Wall Permeability Test Sample)	SM

Project No.: 13410.12
Project: ONALASKA LANDFILL
○ Sample: STP 11 @ RECOVERY 0-2.0 FT

Date: 04-20-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

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APPROVED BY: DLN

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WARZYN

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MOISTURE-DENSITY CURVE

PROJECT: ONALASKA LANDFILL

CLIENT: CH_2M HILL

FDT Report No. ____________

Job No. 13410.12

Date 04-20-89

Sheet 1 of 1

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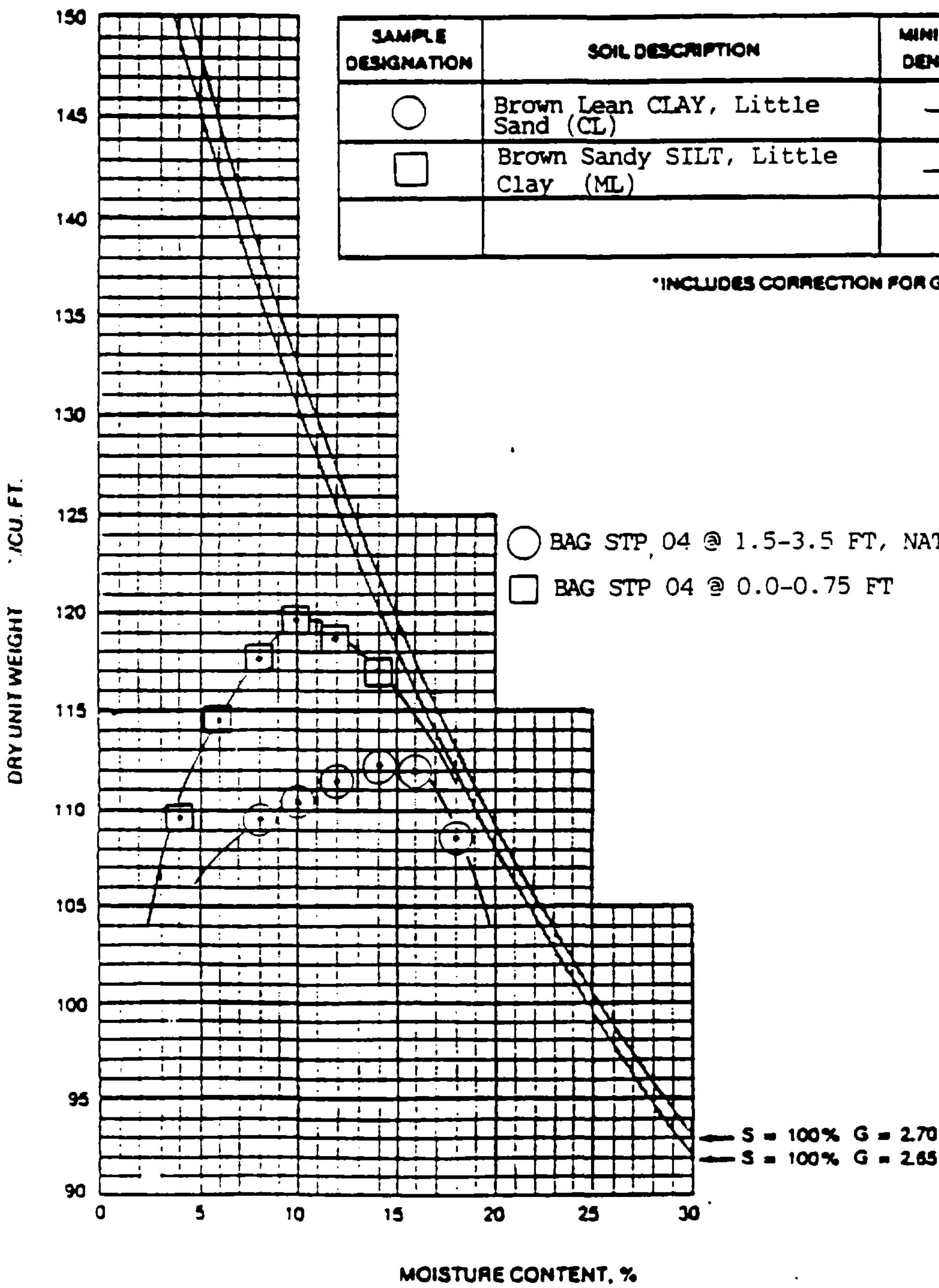
SAMPLE DESIGNATION	SOIL DESCRIPTION	MINIMUM DENSITY	MAXIMUM DENSITY	OPTIMUM MOISTURE
○	Brown Lean CLAY, Little Sand (CL)	—	112 pcf	14 %
□	Brown Sandy SILT, Little Clay (ML)	—	120 pcf	11 %

*INCLUDES CORRECTION FOR GRAVEL RETAINED ON 3/4 IN. SIEVE



TEST METHOD: ☐ MODIFIED PROCTOR

☒ STANDARD PROCTOR

FORM NO 30-03

TESTED BY: DWA/RWP CHECKED BY: [signature] APPROVED BY: [signature]

Appendix D
HYDROGEOLOGY INVESTIGATION

Appendix D
HYDROGEOLOGY INVESTIGATION

INTRODUCTION

This appendix describes the field procedures and presents results of the hydrogeologic investigation (Subtask FQ) of the Onalaska Municipal Landfill site RI/FS. The following activities were performed:

- o Geotechnical Boring
- o Monitoring Well Installation
- o Water Level Monitoring
- o Slug Testing

The start and finish dates for the major activities of the hydrogeologic investigation are listed below.

	Start	Finish
Geotechnical Boring	3/6/89	3/20/89
Monitoring Well Installation	3/10/89	3/30/89
Survey Elevation/Location	3/30/89	3/31/89
Groundwater Elevation	3/31/89	3/31/89
	4/17/89	4/17/89
	6/12/89	6/12/89
Slug Testing	4/27/89	4/27/89

All work was done or observed by CH2M HILL personnel. The overall hydrogeologic investigation was directed by Jeff Lamont. Either Kevin Olson, Jewelle Imada, or Dan Plomb was the field hydrogeologist assigned to log individual boreholes, collect samples, and monitor subcontractor activities. Drilling and monitoring well installations were subcontracted to Exploration Technology, Inc. (ETI), Madison, Wisconsin. Surveying, leveling, and the first round of groundwater elevations were measured by Dan Plomb and Kevin Olson. The second round of groundwater elevations were measured by Phil Smith and Kevin Adler/EPA. Slug testing was performed by Dan Plomb and Kevin Olson.

FIELD PROCEDURES AND RECORDS

GEOTECHNICAL AND MONITORING WELL BORINGS

Eight geotechnical boreholes were drilled and sampled to provide information about the stratigraphy, extent of soil contamination, and preliminary water quality data. Borehole locations are shown in Figure D-1. Soil samples were collected at regular intervals for geologic logging. Soil samples were collected from select boreholes for grain-size analysis or for analysis of routine (RAS) and special (SAS) parameters as specified in the QAPP. Water samples were collected from pre-selected intervals and analyzed at the onsite laboratory for selected VOCs.

Eighteen additional boreholes were drilled for installing groundwater monitoring wells (see Figure D-1). Inasmuch as the drilling and sampling methods are identical and the observations tend to supplement information from the geotechnical borings, the monitoring well boreholes are included in the following discussion. Monitoring well construction details are presented in a later section.

Drilling

Two rigs, a CME 75 and a CME 750, and crews were provided by ETI. All boreholes were drilled by hollow-stem auger or rotary methods.

Four-and-one-quarter inch (ID) hollow-stem augers were used for medium depth (to 80 feet) borings. The lead auger was screened to allow a head of water to enter the hollow stem to minimize sand "blow" into the augers. A wooden plug was also used in the lead auger to prevent sand blow-in in monitoring well boreholes when no soil or water sampling was required during drilling.

The augering methods specified in the Work Plan were not possible below about 80 feet because of limitations of the drilling method. Sand blow-in below 80 feet became significant, which interfered with soil and water sampling. In some cases it was not possible to drive the sand-point (for water samples) past the sand in the auger stem. Below 80 feet, it was difficult to turn the augers because of loose sand caving around the auger flights. In addition, auger methods were not appropriate for drilling through layers of floating free product because of the possibility of contaminating soil and water samples taken from deeper horizons. Accordingly, rotary drilling replaced augering when appropriate.

Rotary drilling was done using a 4½-inch roller bit with a bentonite mud wash. Rotary methods were modified, as described below, to prevent spreading contaminants when drilling through the landfill or through floating naphtha and to avoid using drilling mud in zones to be screened.

Floating naphtha was encountered along the southern and western edges of the landfill. Temporary surface casing was installed in these boreholes to isolate the contaminated zone. The temporary casing was then flushed with clear water to remove contaminants from inside the casing. The flush continued until the flush

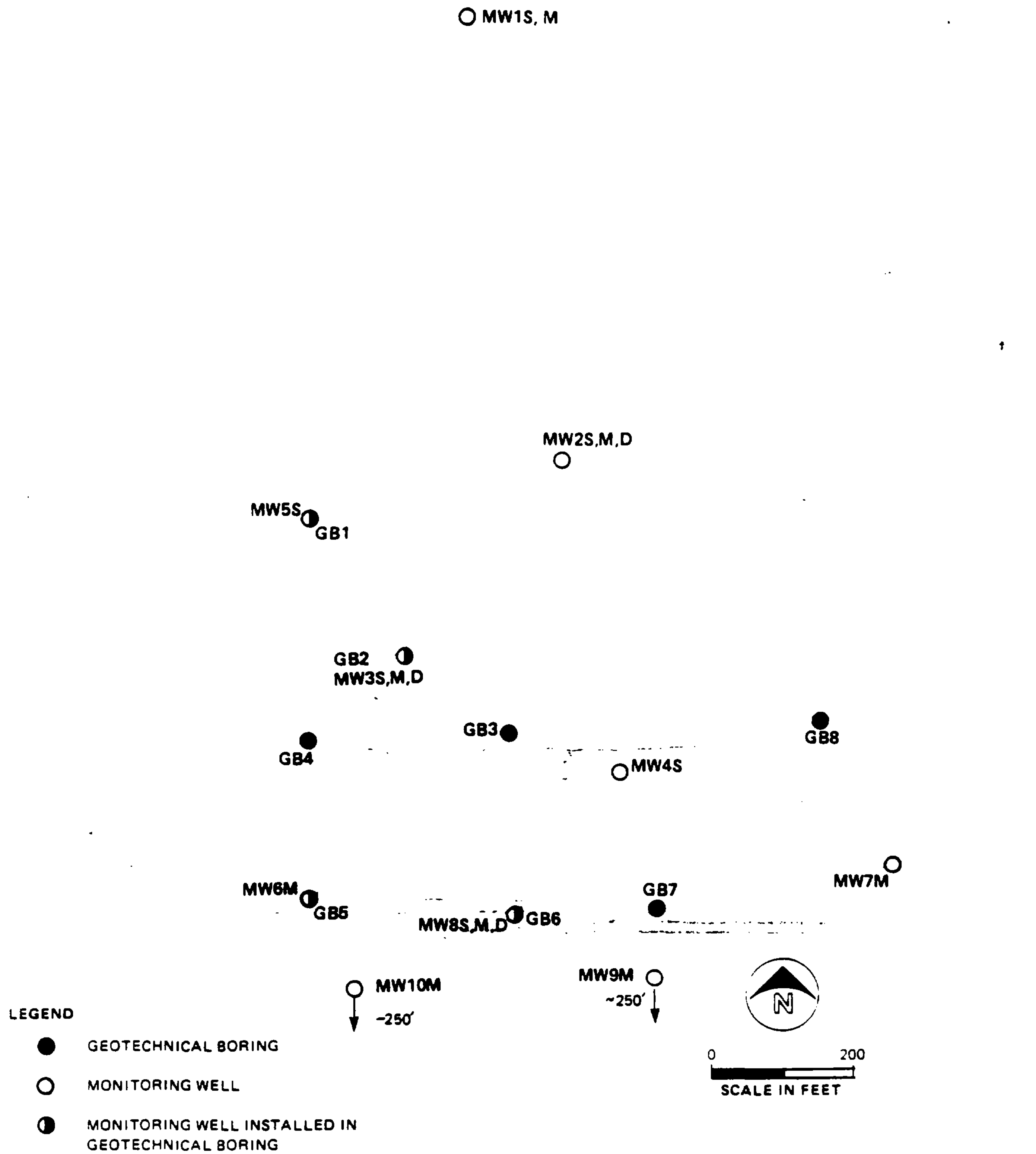


FIGURE D-1
GEOTECHNICAL BORINGS
ONALASKA LANDFILL RI

water was free of visible contamination. The borehole was then advanced with a new batch of drilling mud.

Where monitoring wells were to be built, such as at GB2, the use of drilling mud was discontinued approximately 5-feet above the intended screened zone. Casing was then installed to the bottom of the borehole and the drilling mud was flushed from the casing. The borehole was advanced to the desired depth by drilling and driving casing in 5-foot intervals using clear water. Drilling and driving casing by this method was extremely slow. In addition, a single deep borehole required all of the available 5-inch casing at the site. Because of this, the borehole for MW-8D was drilled to its final depth with mud, eliminating the need for the casing, which was being used in another borehole.

Drilling methods for each borehole are summarized in Table D-1. Additional information regarding drilling methods may be found in the Soil Boring Logs (Attachment 1), which were completed for the geotechnical borings, and in the field notebooks (stored in project files).

Soil Sampling

All soil samples were collected by driving a split-spoon soil sampler into the soil ahead of the open borehole. Normally, a 2-inch spoon was driven with a 140-pound hammer in accordance with ASTM D 1586. However, 3-inch spoons were used when analytical samples were collected to obtain the required volume for RAS and SAS samples.

Locations, depths, and geologic descriptions for all samples taken from geotechnical boreholes are given on the Soil Boring Logs (Attachment 1). For convenience as a quick reference, locations and depths for grain-size samples and analytical samples are also given on Tables D-2 and D-3. Laboratory results for the grain-size analyses are presented in Attachment 2.

Water Samples

Water samples were collected from predetermined depths in the geotechnical boreholes or from screened zones of monitoring wells. Samples were analyzed for selected VOCs in the onsite laboratory to obtain preliminary information on the distribution of VOCs in the groundwater. Analytical results from water samples from the geotechnical boreholes and initial monitoring well boreholes were used to modify, if necessary, the planned depth of the remaining monitoring wells and to evaluate the need for and location of additional monitoring wells.

Samples from geotechnical borings and the initial monitoring well boreholes were collected by driving a 2-inch-diameter, 3-foot screened sandpoint into the undisturbed soil ahead of the augers or casing. Two-inch galvanized riser connected to the sandpoint and extending to the surface formed the temporary well from which samples were taken. At least three volumes from the temporary well were removed before sampling. Samples from monitoring wells installed toward the end of the well-construction period were collected directly

Table D-1 (Page 1 of 2)
SUMMARY OF DRILLING METHODS

	Method	Comments
GB1	Mud rotary to 118 feet Surface casing (5 inches) to 30 feet	Floating product
GB2	Flight auger (pilot hole) to 10 feet Surface casing (6 inches) to 15 feet Mud rotary to 65 feet Water rotary to 80 feet Casing (5 inches) to 80 feet	Floating product Installed MW-3M in borehole
GB3	Auger to 16 feet Surface casing (6 inches) to 20 feet Mud rotary to 68 feet	Floating product
GB4	Auger to 60 feet	
GB5	Auger to 80 feet	Installed MW-6M in borehole
GB6	Auger to 80 feet	Installed MW-8M in borehole
GB7	Auger to 69 feet	
GB8	Auger to 50 feet	
MW-1S	Auger to 26 feet	
MW-1M	Auger to 80 feet	
MW-2S	Auger to 28 feet	
MW-2M	Auger to 78 feet, Wooden plug in screened lead auger	
MW-2D	Auger to 18 feet 6-inch Surface casing to 20 feet Mud rotary to 110 feet Water rotary to 139 feet 5-inch Casing to 134 feet	
MW-3S	Auger to 18 feet	
MW-3M	See GB-2 for details	
MW-3D	Flight auger to 10 feet (pilot hole) 6-inch Surface casing to 15 feet Mud rotary to 100 feet Water rotary to 142 feet 5-inch Casing to 138 feet	
MW-4S	Auger to 28 feet	
MW-5S	Auger to 22 feet	
MW-6M	See GB-5 for details	
MW-7M	Auger to 80 feet	

Table D-1 (Page 2 of 2)
SUMMARY OF DRILLING METHODS

	Method	Comments
MW-8S	Auger to 24 feet	
MW-8M	See GB-6 for details	
MW-8D	Mud rotary to 138 feet	
MW-9M	Auger to 80 feet	
MW-10M	Auger to 80 feet	
MW-11M	Auger to 80 feet	
MW-12S	Auger to 23 feet	Drilled 3 times (well problem)
MW-13S	Auger to 25 feet	
MW-14S	Auger to 18 feet	

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Table D-2
GRAIN-SIZE SAMPLE LOCATIONS

Boring Number	Depth (ft)
GB-1	78
GB-3	22
GB-3	39
GB-3	59
GB-4	13
GB-4	38
GB-4	55
GB-5	78
GB-8	18
GB-8	48
MW-1	20
MW-1	53
MW-1	78
MW-3	18
MW-7	30
MW-7	80

Table D-3
RAS/SAS SAMPLE LOCATIONS

Boring Number	Depth (ft)
GB-1	113-117
GB-2	14
GB-2	55
GB-2	75
GB-6	20
GB-6	80
MW-1	18-22
MW-1	53-55
MW-1	78-80
MW-2	24
MW-2	58
MW-2	75
MW-2	108

from the installed screen. At this point in the investigation, the need for additional wells had been established and rapid turnaround times for analytical results were not critical.

Sample locations and depths are given in Table D-4.

MONITORING WELL INSTALLATION

Well Construction

Boreholes were drilled or augered to the desired depth. Ten feet of screen and enough riser to result in 2 to 3 feet of stick-up were placed in the borehole. Wells penetrating the landfill or floating product were constructed of stainless steel. The other wells are PVC.

Depending on the drilling method, augers or 5-inch casing were then removed to allow approximately 13 feet of sand to cave around the screen to form a natural gravel pack that extended at least 3 feet above the top of the screen.

Approximately 1 foot of bentonite pellets formed a bentonite pellet seal above the gravel pack. One foot of fine-sand was added to prevent the bentonite slurry from penetrating the pellet seal. The borehole was grouted to the surface with a bentonite slurry to form an annular seal. The slurry was added using a tremie pipe that extended to within 2 feet of the fine sand.

The remaining augers or casing were removed after the grout was added. Typically, the grout would settle overnight at or near the water table (10 to 20 feet below the surface). A bentonite/cement grout was used to top off the annular seal. This, in conjunction with a 2-foot-diameter concrete pad, formed a surface seal. The concrete pad also supported the locking 6-inch diameter steel protective casing that was installed over the riser pipe. Bumper posts were installed around wells along the road and in the farm field south of the site.

Attachment 3 contains construction details for each monitoring well. Deviations from the typical construction method are noted on the diagram.

Well Development

Groundwater monitoring wells were developed by removing water from the well. Water was removed with a hand operated (BK pump) or an air-driven (QED well-development pump) positive displacement type pump. The amount of water removed was based on the clarity of the water, the amount of water added during drilling, and the volume of the riser. At least 100 gallons were removed. For deeper wells, five well volumes plus the estimated quantity of lost circulating fluid, were removed. Actual purge volumes are given in Table D-5.

Well Locations/Elevations

Well elevations were established using a tripod level and rod. All riser elevations were measured from the north side of the uncapped riser pipe unless

Table D-4
GROUNDWATER SAMPLE LOCATIONS
CSL FIELD SCREENING

Boring Number	Depth (ft)	Field I.D. No.
GB-1	20	MW-5S-01
GB-1	80	GB-01-01(80)
GB-1	120	GB-01 (120)
GB-3	17	GB-03-01
GB-3	60	GB-03-02
GB-4	8-11	GB-04 (8-11)
GB-4	54-57	GB-04 (54-57)
GB-5	10	GB-5 (10)
GB-5	80	GB-5 (80)
GB-6	18-21	GB-06-(18-21)
GB-6	73	GB-6M-73
GB-6	121-131	MW-8D
GB-7	22	GB-07-01
GB-7	70	GB-07-02
GB-8	18-28	GB08 (18-28)
GB-8	55-58	GB-08 (55-58)
MW-1	23	MW-1S-23 feet
MW-1	80	MW-1M-01
MW-2	28-31	MW-2S-01
MW-2	78-81	MW-2M-01
MW-2	108-111	MW-2D (108-111)
MW-3	18	MW-3S-01
MW-3	69	MW-3M
MW-4	20-30	MW04 (20-30)
MW-7	25-30	MW-7S (25-30)
MW-7	80-82	MW-7M (80-82)
MW-9	25	MW-9M (25)
MW-9	80	MW-9M (80)
MW-10	18-21	MW-10M (18-21)
MW-10	76-78	MW-10M (76-78)
MW-11	20-22	MW11M (20-22)
MW-11	76	MW11M (76)
MW-12	13-23	MW-12S
MW-13	14-24	MW-13S
MW-14	6-16	MW-14S

Table D-5
PURGE VOLUMES FOR WELL DEVELOPMENT

Well Number	Purge Volume
MW-1S	100
MW-1M	100
MW-2S	100
MW-2M	400
MW-2D	400
MW-3S	100
MW-3M	350
MW-3D	400
MW-4S	100
MW-5S	100
MW-6M	100
MW-7M	100
MW-8S	100
MW-8M	100
MW-8D	400
MW-9M	100
MW-10M	100
MW-11M	100
MW-12S	100
MW-13S	100
MW-14S	100

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otherwise noted. Measuring points other than the north side of the riser are marked on the riser pipe. Ground surface elevations are measured from a representative point in the general vicinity of the well.

All elevations were tied to the National Geodetic Vertical Datum (NGVD) through the bench mark establish by Martinez, Inc., as part of the site topographic mapping. Surveyed elevations are given in Table D-6.

The location of each new monitoring well was determined by taping distances from known landmarks or based on the grid established on the site during the geophysical survey. Monitoring well locations were marked on a 1:1200 topographic site map. Monitoring well locations are also shown on Figure D-1. The topographic map is stored in the project file.

GROUNDWATER ELEVATIONS

Depth to water in the monitoring wells was measured with an electric water level indicator. Depths and elevations for March 31, April 17, June 12, and August 2, 1989, are given in Table D-7.

SLUG TESTS

A schematic diagram of the gas-displacement slug test apparatus used in the medium and deep wells is shown in Figure D-2. The apparatus allows for the depression of the water level in the well using compressed nitrogen gas. When the gas pressure in the well equilibrated with the difference in elevation head between the well and aquifer, the test was started by venting the well. Data were collected using a Campbell Scientific, Inc., Model 21X Micrologger linked to Druck pressure transducers.

The gas displacement apparatus cannot be used on wells screens that straddle the water table, as is the case for the shallow wells. Slug tests in shallow wells used the apparatus shown in Figure D-3. A hollow slug was placed in the well to displace water. The test was started by rapidly removing the slug. Data were collected using a single transducer connected to the Micrologger.

Three tests were done on each well that was tested. Raw data for each test were plotted on the graphs in Attachment 6. Data were analyzed according to the method described by Bouwer and Rice (1976) and Bouwer (1989). The average hydraulic conductivity for each well is given in Table D-8.

Table D-6
WELL ELEVATIONS

Well Number	Riser Elevation (ft)	Ground Elevation (ft)
New Wells		
MW-1S	663.22	660.9
MW-1M	663.47	660.9
MW-2S	664.88	662.3
MW-2M	664.93	662.9
MW-2D	665.07	662.75
MW-3S	656.44	653.7
MW-3M	655.43	653.6
MW-3M	655.43	653.6
MW-3D	656.46	653.9
MW-4S	665.01	662.6
MW-5S	659.46	656.4
MW-6M	648.46	646.0
MW-7M	662.51	660.3
MW-8S	661.88	659.4
MW-8M	662.63	659.4
MW-8D	661.65	659.2
MW-9M	656.10	653.6
MW-10M	656.51	653.3
MW-11M	657.17	654.3
MW-12S	662.95	660.2
MW-13S	664.87	661.8
MW-14S	656.19	654.8
Old Wells		
B-1	663.42	660.6
B-2	667.23	665.3
B-3	661.06	659.9
B-4S	656.16	655.1
B-4D	656.62	655.0
B-5	662.00	659.4

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Table D-7
GROUNDWATER ELEVATIONS IN FEET

Well	6/1/88	3/31/89		4/17/89		6/12/89		8/2/89	
Number	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
New Wells									
MW-1S	--	16.87	646.35	19.13	644.10	18.48	644.25	20.88	642.34
MW-1M	--	17.13	646.34	19.35	644.12	19.22	644.25	21.12	642.35
MW-2S	--	17.82	647.06	20.33	644.55	20.16	644.72	22.11	642.77
MW-2M	--	19.07	645.86	20.94	643.99	20.67	644.26	22.59	642.34
MW-2D	--	19.61	645.46	21.05	644.02	20.79	644.28	22.81	642.26
MW-3S	--	11.17	645.27	12.50	643.94	12.35	644.09	14.46	641.98
MW-3M	--	10.12	645.31	11.58	643.85	11.36	644.07	13.35	642.08
MW-3D	--	11.06	645.40	12.52	643.94	12.30	644.16	14.29	642.17
MW-4S	--	20.19	644.82	21.16	643.85	20.90	644.11	22.82	642.19
MW-5S	--	13.82	645.64	15.54	643.92	15.35	644.11	17.52	641.94
MW-6M	--	3.21	645.25	4.83	643.63	4.66	643.80	6.55	641.91
MW-7M	--	18.12	644.39	18.58	643.93	18.28	644.23	20.39	642.12
MW-8S	--	17.15	644.73	18.15	643.73	19.93	643.95	19.91	641.97
MW-8M	--	17.80	644.83	18.90	643.73	18.66	643.97	20.63	642.00
MW-8D	--	16.84	644.81	17.89	643.76	17.65	644.00	19.63	642.02
MW-9M	--	11.73	644.37	12.53	643.57	12.35	643.75	13.71	642.39
MW-10M	--	11.71	644.80	13.07	643.44	12.93	643.58	14.22	642.29
MW-11M	--	13.10	644.07	13.55	643.62	13.21	643.96	15.14	642.03
MW-12S	--	18.43	644.52	19.14	643.81	18.87	644.08	20.90	642.05
MW-13S	--	20.03	644.84	20.86	644.01	20.55	644.32	22.69	642.18
MW-14S	--	11.48	644.71	13.44	642.75	13.24	642.95	15.14	641.05
Old Wells									
B-1	642.61	17.76	645.66	19.28	644.14	19.03	644.39	--	--
B-2A	642.45		--	23.30	643.93	23.12	644.11	--	--
B-3A	642.42	16.09	644.97	17.20	643.86	16.93	644.13	--	--
B-4S	642.45	11.24	644.92	12.82	643.34	12.60	643.56	--	--
B-4D	--	11.20	645.92	12.75	643.87	12.58	644.04	--	--
B-5	642.57	16.92	645.08	18.12	643.88	--	--	--	--
River	642.56								

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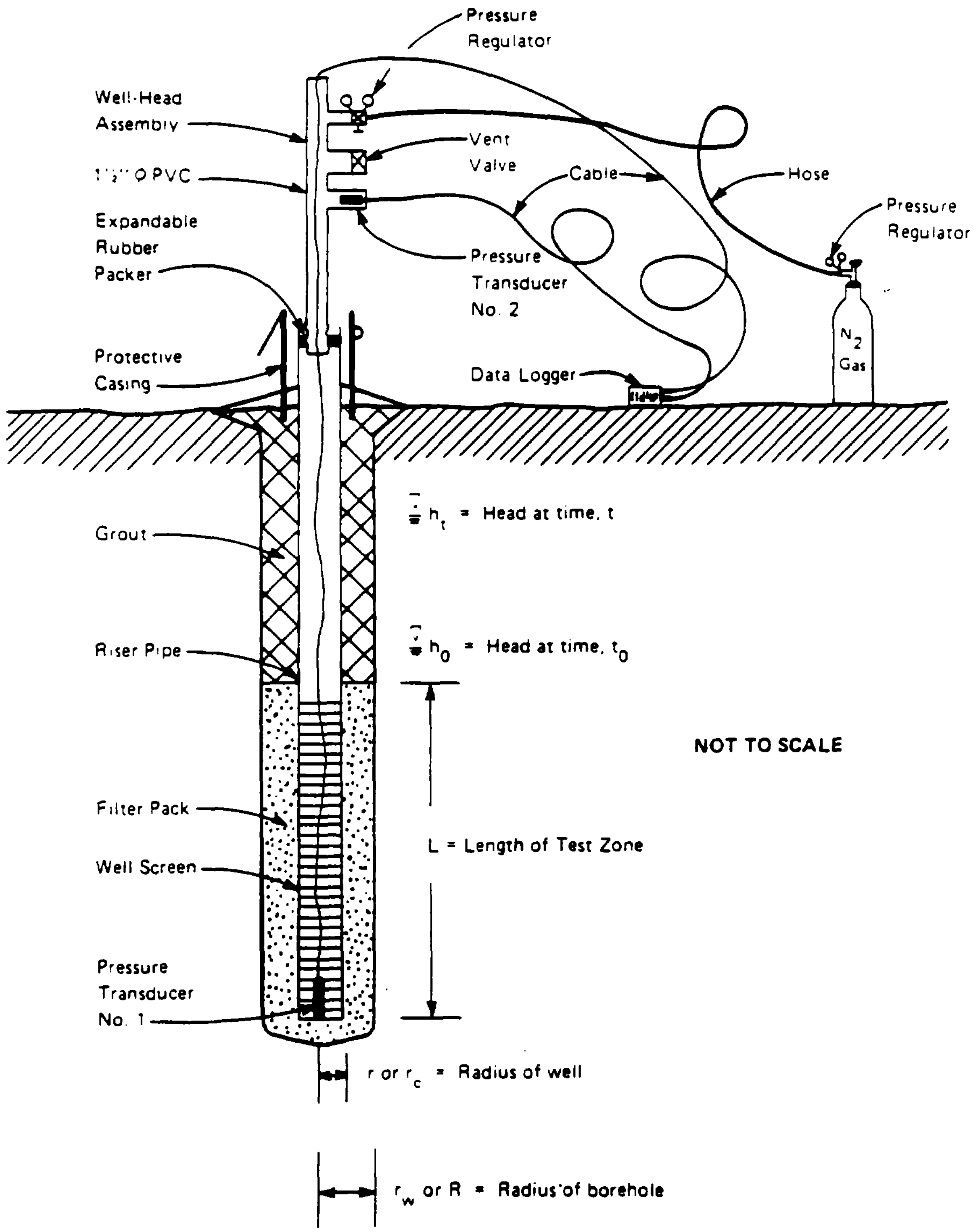

FIGURE D-2
SCHEMATIC DIAGRAM OF NITROGEN SLUG TEST ASSEMBLY
ONALASKA LANDFILL RI

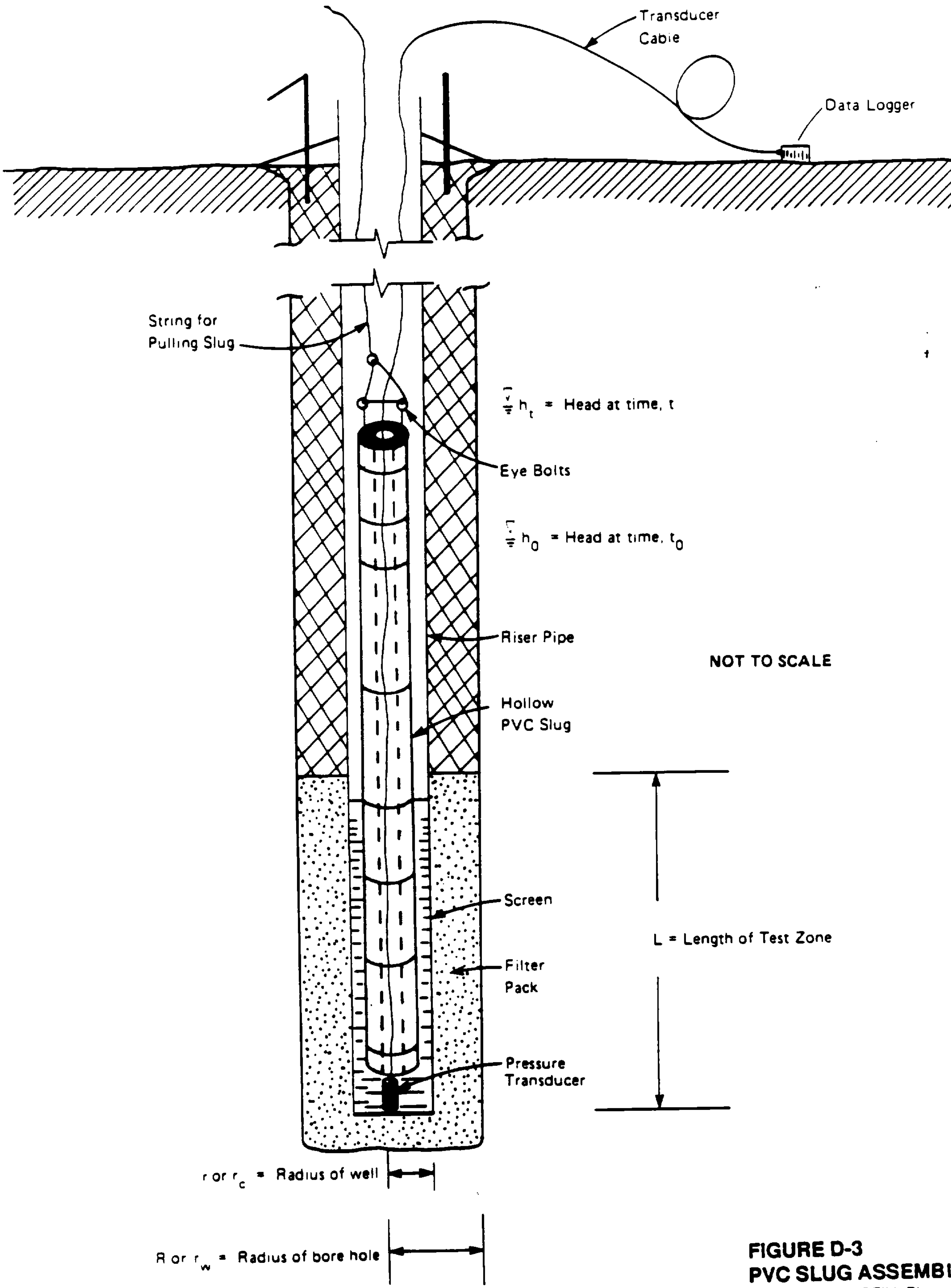

FIGURE D-3
PVC SLUG ASSEMBLY
ONALASKA LANDFILL RI

Table D-8
HYDRAULIC CONDUCTIVITY

Well Number	Average Hydraulic Conductivity (cm/s)	Number of Tests
New Wells		
MW-1S	0.04	3
MW-1M	0.04	3
MW-2M	0.03	3
MW-2D	0.03	3
MW-3M	0.03	3
MW-3D	0.06	3
MW-7M	0.03	3
MW-8M	0.03	3
MW-8D	0.002[a]	3
MW-9M	0.03	3
MW-10M	0.03	3
MW-11M	0.03	3
MW-13S	0.06	3
Old Wells		
B-1	0.01	4
B-2A	0.05	4
B-3A	0.01	4
B-4S	0.009	4
B-4D	0.05	2

[a]Hydraulic Conductivity on MW-8D is probably not representative of the aquifer. It is low most likely because of the drilling method and insufficient well development.

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REFERENCES

Bouwer, Herman and R. C. Rice. Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells. *Water Resources Research*, Vol. 12, No. 3, June, 1976.

Bouwer, Herman. The Bouwer and Rice Slug Test--An Update. *Groundwater*. Vol. 27, No. 3, May-June, 1989.

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Attachment 1
GEOTECHNICAL BORING LOGS

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-01	SHEET 1 OF 4

SOIL BORING LOG

PROJECT ONALASKA LOCATION SE OF MW-5S

ELEVATION ______ DRILLING CONTRACTOR ETI (CME 750)

DRILLING METHOD AND EQUIPMENT MUD ROTARY WITH SPLIT- SPOON SAMPLING

WATER LEVEL AND DATE ______ START 3-13-89 FINISH 3-15-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5	3–5	SS1	1.6	2-1-2-2	Light Brown Silty - Fine Sand	SM	HNu = 0 ppm (t = 11:50)
10	8–10	SS2	-	4-7-6-8	No Recovery		HNu = 0 ppm (t = 11:58)
15	13–15	SS3	1.0	5-7-8-10	Loose Medium to Coarse Sand	SP	HNu = 8-9 ppm SS = 10-12 ppm in Borehole Note: Slight oil sheen on water from SS Hard Drilling - Gravelly
20	18–20	SS4	0.7	4-4-4-5	Loose Coarse Sand and Fine Gravel	SP	HNu = 4 ppm in Borehole = 0 ppm in Breathing Zone = 2-3 ppm in SS Hard Drilling - Gravelly HNu = 0 ppm in Mud
25	23–25	SS5	0.5	10-9-9-6	Loose Coarse Sand and Fine Gravel	SP	HNu = 2-6 ppm in Borehole = 0 ppm in Breathing Zone = 0 ppm in Mud and SS
					Cobbles		
30	28–30	SS6	0.6	7-5-7-7	Loose Coarse Sand and Fine Gravel	SP	HNu = 1-2 ppm in Borehole = 1 ppm in SS = 0 ppm in Breathing Zone

CH2M HILL

PROJECT NUMBER	BORING NUMBER
GLO 65550.F1.FQ	GB-01 SHEET 2 OF 4

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR ETI (CME 750)

DRILLING METHOD AND EQUIPMENT MUD ROTARY WITH SPLIT- SPOON SAMPLING

WATER LEVEL AND DATE START 3-13-89 FINISH 3-15-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							Note: 30' Casing in Hole (t= 4:20)
							Drilling Rough - Gravelly Losing Water
35		*SS7*	*0.6*	*4-14-5-5*	*Gravelly Sand*	*SP*	*HNu = 0 ppm in Borehole (t = 4:40)*
40		*SS8*	*0.2*	*6-6-8-8*	*Fine Gravel with Some Coarse Sand*	*GP*	*(t = 5:00)*
45		*SS9*	*0.2*	*14-14-16-22*	*Fine to Medium Gravel with Some Coarse Sand (Rock Blocking End of Spoon)*	*GP*	*HNu = 0 ppm*
							Drilling Easier Less Gravel
					0.2' Fine - Medium Gravel		*HNu = 0 ppm (t = 8:15)*
50		*SS10*	*1.0*	*12-14-22-16*	*Medium Coarse Sand*	*SP*	
							(t = 8:40) Make Another Batch of Mud
							HNu = 0 ppm in Mud
55		*SS11*	*1.3*	*12-15-14-28*	*Medium - Coarse Sand*	*SP*	*HNu = 0 ppm (t = 9:00)*
					0.5' Gravelly Sand		
60		*SS12*	*0.5*	*15-10-10-13*	*Medium - Coarse Sand with Trace Fine Gravel*		*HNu = 0 ppm*

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-01	SHEET 3 OF 4

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR ETI (CME 750)

DRILLING METHOD AND EQUIPMENT MUD ROTARY WITH SPLIT- SPOON SAMPLING

WATER LEVEL AND DATE START 3-13-89 FINISH 3-15-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65		*SS13*	*1.5*	*3-1-1-1*	*Very Loose Medium Sand with Some Coarse Sand*	*SP*	*(t = 1:05)*
70		*SS14*	*0.9*	*12-11-14-17*	*Medium - Coarse Sand*	*SP*	*HNu = 0 ppm (t = 1:22)*
75		*SS15*	*1.7*	*11-16-13-3*	*Medium - Coarse Sand with Little Fine Gravel*	*SP*	*HNu = 0 ppm (t = 1:50) Mix Batch of Mud*
80		*SS16*	*1.8*	*9-2-2-6*	*Same as Above*	*SP*	
85		*SS17*	*0.9*	*20-30-31-35*	*Brown Medium - Coarse Sand*	*SP*	*OVA = 0 ppm = 1-2 ppm from SS = 4-6 ppm in Mud*
90		*SS18*	*-*	*7-1-5-13*	*Brown Medium - Coarse Sand with Fine Gravel*	*SP*	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-01	SHEET 4 OF 4

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR ETI (CME 750)

DRILLING METHOD AND EQUIPMENT MUD ROTARY WITH SPLIT-SPOON SAMPLING

WATER LEVEL AND DATE START 3-13-89 FINISH 3-15-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
95		SS19		12-10-31-33			(t = 5:05) OVA = 40-50 ppm in Mud = 0 ppm in Breathing Zone = 0 ppm in Borehole
100		SS20		13-17-25-20	Reddish Brown Silty Fine Sand with Trace Medium Sand	SM	
					0.5' Medium Fine Sand		Cobbles
		SS21		11-15-19-24	Reddish Brown Silty Fine Sand with Trace Medium Sand	SM	(t = 5:40)
105							
		SS22	1.8	2-2-11-21	Same as Above	SP	(t = 8:50) Hnu = 0 ppm
110							
		SS23	1.0	31-40-33-28	Reddish Fine Sand	SP	HNu = 0 ppm Take CLP Sample (-0.1)
115							
		3"-SS		17-22			
					END OF BORING		

CH2M HILL

PROJECT NUMBER	BORING NUMBER
GLO 65550.F1.FQ	GB-02 SHEET 1 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION WEST OF SHED, SW OF LANDFILL

ELEVATION ______ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT FLIGHT AUGERS TO MUD ROTARY, WATER ROTARY THROUGH SCREENED ZONE

WATER LEVEL AND DATE ______ START 3-19-89 FINISH 3-20-89 LOGGER K. OLSON

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5		SS1	2.0	4-5-6-3	Medium to Coarse Sand, Brown, Moist. Alt. Sequences of Coarse Sand Grading to Medium Sand. Fineing upward in Approx. 4" Sequences.	SP	HNu = 0 ppm Down Hole Hnu = Ø ppm Sample Headspace 90 LEL = 0
10		SS2	10	3-4-5-5	Same, but with less Apparent Laminar Structure, Trace Fine to Medium Gravel	SP	HNu = 5 ppm in Breathing Zone Diminished to 0 ppm within 1 Min. HNu = 70 ppm on Sample Head-space 90 LEL = 10
							6" Casing installed to 15'
15		SS3	0	5-10-15-23	All Slough	SP	3" Spoon (14' to 16') CLP Sample Added Mud, Flushed to 16' then Sampled. ON-6B02-16
		SS4	0.6	7-7-6-6	Fine to Coarse Sand, Trace Silt and Gravel. Brown in Color.	SP	VOAs (4 - 4oz. jars) and (8 - 8oz. jars)
		SS5	0.7	6-10-8-8	Same as Above	SP	
20							
		SS6	0	7-7-6-5		SP	HNu = 0 ppm Down hole
25							
30							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-02	SHEET 2 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION WEST OF SHED, SW OF LANDFILL

ELEVATION ______ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT FLIGHT AUGERS TO MUD ROTARY, WATER ROTARY THROUGH SCREENED ZONE

WATER LEVEL AND DATE ______ START 3-19-89 FINISH 3-20-89 LOGGER K. OLSON

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35		SS7	0.4	13-18-15-17	Sand with Gravel less than 1"	SP	HNu = 0 ppm on Sample Headspace. Could be mostly slough. Rig has been noisy, so could be occasional Gravel Seams in Last 10'
40							
45		SS8	0.9	12-13-11-14	Fine to Coarse Sand, Trace Gravel	SP	HNu = 0 ppm on Sample Headspace
50							
55		SS9		19-27-49-21	Same as Above, Except Encountered a 4" Gravel Zone, Gravel Less than 2" at 54'	SP	3" Spoon at 55' to Collect CLP Sample (2 - 4oz. jars) for VOAs and (5 - 8oz. jars) ON-6B02-55 Hnu = 0 ppm on Sample Headspace
60					Gravel Zones		Rig Chattering from 57' to 59'

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-02	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION WEST OF SHED, SW OF LANDFILL

ELEVATION ________ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT FLIGHT AUGERS TO MUD ROTARY, WATER ROTARY THROUGH SCREENED ZONE

WATER LEVEL AND DATE ________ START 3-19-89 FINISH 3-20-89 LOGGER K. OLSON

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65	65–67	*SS10*	*0.4*	*21-19-16-13*	*Same as Above, Fine to Coarse Sand, Trace Gravel*	*SP*	*Install 5" Casing to 65', and Flushed with Clear Water*
70							
75	73–75	*SS11*	*0*	*26-30-15-16*		*SP*	*CLP Sample Collected from 73' to Approx. 78', VOAs were Collected from Undisturbed Sample. Some of other Parameters were Collected from Undisturbed Sample and Slough that Settled out in Cased Borehole ON-GB02-75*
80					**END OF BORING**		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-03	SHEET 1 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION 75FT WEST OF SOUTH GATE.

ELEVATION ______ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT CME-75 HSA (4 1/2") AND MUD ROTARY WITH SPLIT-SPOON SAMPLING

WATER LEVEL AND DATE ______ START 3-8-89 FINISH 3-9-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
							HSA
		SS	1.3	29-21-13	Dark Brown Silty - Fine Sand with Trace Fine Gravel	SM	No HNu Deflection
5		SS	1.6	3-4-3-3			LEL = 0%
					Rust Silty - Fine Sand with Trace Fine Gravel	SM	
		SS	0.6	2-5-6-7	Fine to Coarse Sand With Some Silt	SP	LEL = 0%
10		SS	1.3	6-3-1-1			No HNu Deflection
					Dark Brown Fine Sand with Trace Fine Gravel		
		SS	0.5	3-2-2-3	Medium to Coarse Sand and Fine Gravel	SP	HNu Deflection From SS 40-50ppm Borehole 10-15ppm Breathing Zone 0ppm
15		SS	0.7	2-1-1-1	Same as Above (Sample Collected for CSL)	SP	HNu Deflection From Borehole 30-40ppm Breathing Zone 0ppm Last 1/2' Discolored - Grey 1 > 4
		SS	0.3	2-3-12-13	Same as Above	SP	Noted Oil-type Sheen HNu Deflection From SS 12-13ppm Borehole 20ppm Breathing Zone 0ppm Slight Discoloration
20		SS	0.5		Same as Above	SP	HNu Deflection From Borehole 10-15ppm Breathing Zone 3-4ppm
							Mud Rotary
		SS01	0.8	6-11-13-19	Medium to Coarse Sand with Trace Fine Gravel	SP	No Discoloration OVA = 0 Collected Grain Size Sample
25		SS	1.4	30-16-20-16	Same as Above	SP	No OVA Readings
		SS	0.7	5-5-7-5	Same as Above	SP	No OVA Readings
30		SS	0	10-13-12-11	No Recovery		

CH2M HILL

PROJECT NUMBER	BORING NUMBER
GLO 65550.F1.FQ	GB-03 SHEET 2 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION
ELEVATION DRILLING CONTRACTOR
DRILLING METHOD AND EQUIPMENT
WATER LEVEL AND DATE START FINISH LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30							
		SS	0.8	7-8-9-23	Medium - Coarse Sand with Trace Fine Gravel	SP	
					Sand with some Fine Gravel		
35		SS	1.3	27-27-21-22	Medium - Coarse Sand with some Gravel	SP	
					Gravelly Medium Coarse Sand		
		SS	0.8	11-12-13-12	Medium to Coarse Sand, More Gravelly at Bottom	SP	OVA = 0 ppm (t = 11:15)
40		SS02	0.9	11-10-10-13	Medium to Coarse Sand with Trace Fine Gravel	SP	OVA = 0 ppm (t = 11:40) Collected Grain Size Sample
		SS	0.8	15-21-22-24	Same as Above	SP	
45		SS	0.9	12-13-12-12	Same as Above	SP	
		SS	0.8	10-18-20-20	Same as Above	SP	OVA = 0 ppm (t = 13:00)
50		SS	1.1	10-15-15-17	Same as Above	SP	
		SS	0.9	6-10-11-18	Same as Above	SP	OVA = 0 ppm (t = 13:50)
55		SS	0.7	15-15-13-13	Same as Above	SP	
		SS	1.0	18-18-16-25	Gravelly Medium - Coarse Sand Fine to Medium Gravel	SP	
60		SS	0.9	50-48-29-20	Same as Above	SP	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-03	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-9-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
60							
		SS	1.2	20-20-45-35	*Same as Above*	SP	
					Gravelly Fine - Medium Sand		
65		SS	0.9	18-14-11-10	*Medium - Coarse Sand*	SP	OVA = 0 ppm (t = 14:45)
					Fine - Medium Sand		
		SS	1.0	10-10-15-18	*Fine - Medium Sand with Trace Fine Gravel*	SP	OVA = 0 ppm (t = 15:10)
70					**END OF BORING**		

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-04	SHEET 1 OF 2

SOIL BORING LOG

PROJECT ONALASKA LOCATION RAVINE SW OF SHED

ELEVATION ______ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT 4 1/4" AUGERS, LEAD SCREENED, SS SAMPLING WITH 2'-2" SPLIT-SPOONS

WATER LEVEL AND DATE ______ START 3-8-89 FINISH 3-9-89 LOGGER KLO / JJI

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS1	1.0	2-3-3-3	*Brown Medium to Coarse Sand, Moist to Wet, Trace Gravel (fine).*	SP	*HNu = 0 ppm*
		SS2	1.2	6-4-2-2	*Same, but Saturated.*	SP	*HNu = 0 ppm*
5		SS3	1.5	1-3-3-5	*Same, with a Trace of Silt.*	SP	*HNu = 0 ppm*
		SS4	0.2	2-1-2-1	*Same*	SP	*HNu = 0 ppm (Suspect of Validity of these First 4 readings).*
10		SS5	0.8	11-8-4-2	*Same*	SP	*Installed Sandpoint from 8 to 11' to Sample, Collected CSL Sample 15-05 - 3/8/89.*
		SS6	1.5	2-13-15-20	*Brown, Medium to Coarse Sand, Wet, Trace Gravel (up to 1").*	SP	*Collected a Sample for Grain Size Analysis. HNu = 0 ppm SS.*
15		SS7	0	2-2-4-8	*Same*	SP	*A little Fine Gravel Left in Spoon.*
		SS8	1.0	16-15-8-12	*Same, with a Slight Increase in Gravel (subangular).*	SP	*HNu = 0 ppm SS*
20		SS9	0.8	40-13-5-6	*Same*	SP	
		SS10	1.2	21-12-8-9	*Same*	SP	*HNu = 0 ppm SS*
25		SS11	1.8	12-9-11-17	*Same*	SP	
		SS12	2.0	2-6-17-28	*Same*	SP	*HNu = 0 ppm SS*
30							

L65550.F1.FQ GB-04 1 8-17-89

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-04	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-9-89 LOGGER KLO / JJI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS13	1.5	20-15-12-25	Same	SP	
		SS14	2.0	3-5-13-35	Same	SP	
35		No Sample	0	5-2-6-11			
		SS15	2.0	5-12-36-50/5"	Same	SP	Collected a Sample for Grain-size Analysis.
40		No Sample	0	10-6-7-23			
		SS16	2.0	7-7-14-41	Same, with Slightly Less Gravel.	SP	HNu = 0 ppm SS
45		SS17	1.5	15-12-8-13	Same	SP	HNu = 0 ppm SS
		SS18	1.0	21-10-8-30	Same	SP	
50		No Sample	0	16-29-13-13			
		No Sample	0	37-28-29-50		SP	Blow Counts Reflect a Full Spoon, Not the Formation. Replaced Sediment Catcher. Collected Grain-size Sample.
55		SS19	0.9	16-45-44-33	Same, Slightly More Well Graded.	SP	HNu = 0.2 ppm on Cuttings 4ft of Blow In into Augers, Could only Shake out 4".
60		No Sample	0	28-60	END OF BORING		Collected a CSL Sample from Sandpoint within Auger at 53 ft.

PROJECT NUMBER	BORING NUMBER	
GLO 65560.F1.FQ	GB-05	SHEET 1 OF 2

CH2M HILL

SOIL BORING LOG

PROJECT ONALASKA LOCATION WEST EDGE OF [redacted] PROPERTY

ELEVATION ________ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT 4 1/4" AUGERS

WATER LEVEL AND DATE ________ START 3-20-89 FINISH 3-20-89 LOGGER D. PLOMB

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS1	1.1	4-1-2-2	*Dark Brown Fine Coarse Sand, with a little Silt, Loose, and Dry.*	SW	*HNu = 0 ppm on Borehole*
5					*Dark Brown Medium to Coarse Sand, Loose, and Saturated.*	SP	*HNu = 0 ppm SS*
10		SS2	1.0	2-2-2-2	*Same*	SP	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
15		SS3	2.0	5-5-3-3	*Same*	SP	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
20		SS4	2.0	24-28-7	*Same, but with Occasionally Small to Large Gravel.*	SP	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
25		SS5	1.5	14-24-26-23	*Same, but Very Dense*	SP	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
30		SS6	-	23-33-27-16	*Same, but Very Dense*	SP	

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-05	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-20-89 LOGGER D. PLOMB

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
40		SS7	0.4	11-11-7-7	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
50		SS8	No Sample	9-27-29-57	—	—	HNu = 0 ppm on Borehole
60		SS9	0.4	19-36-35-12	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
70		SS10	0.3	45-19-22-13	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
80		SS11	1.5	56-27-27-4	Same, but Very Dense with Increased Gravel Content	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
					END OF BORING		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-06	SHEET 1 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION ENTRANCE TO [redacted]

ELEVATION ____ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT 4 1/4" AUGERS

WATER LEVEL AND DATE ____ START 3-19-89 FINISH 3-19-89 LOGGER D. PLOMB

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
5		SS1	1.6	2-2-3-3	Dark Brown Fine to Coarse Sand, With a little Silt, Dry and Loose.	SW	HNu = 0 ppm on Borehole HNu = 0 ppm SS
10		SS2	0.9	2-3-3-5	Dark Brown Medium to Coarse Sand, Moist and Loose	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
15		SS3	0.4	5-5-5-5	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
20		SS4	1.8	10-8-4-3	Same, But Satuated with Occasionally some Small to Medium Gravel.	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
25		SS5	1.1	16-17-12-5	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS
30		SS6	1.3	10-10-12-8	Same	SP	HNu = 0 ppm on Borehole HNu = 0 ppm SS

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-06	SHEET 2 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH LOGGER D. PLOMB

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
35							
38–40		*SS7*	*1.3*	*35-42-17-13*	*Same, with an Occasional Cobble or Boulder, Very Dense.*	*SP*	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
45							
48–50		*SS8*	*1.8*	*51-68-80-45*	*Same, Cobbles are Still Present, Very Dense.*	*SP*	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
55							
58–60		*SS9*	*0*	*26-83-100/3"*		—	*No Recovery* *HNu = 0 ppm on Borehole*

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-06	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-19-89 LOGGER D. PLOMB

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
65							
70		*SS10*	*0.5*	*40-80-100/3"*	*Same, Very Dense*	*SP*	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
75							
80		*SS11*	*2.0*	—	*Same, Cobbles and Very Dense.*	*SP*	*HNu = 0 ppm on Borehole* *HNu = 0 ppm SS*
					END OF BORING		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-07	SHEET 1 OF 3

SOIL BORING LOG

PROJECT ONALASKA   LOCATION SOUTH OF SITE ENTRANCE

ELEVATION ______   DRILLING CONTRACTOR ETI (CML 75)

DRILLING METHOD AND EQUIPMENT HSA (4 1/2") WITH SPLIT SPOON SAMPLING EVERY 2.5'

WATER LEVEL AND DATE ______   START 3-7-89   FINISH 3-7-89   LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS	1.8	33-21-17-11	*Fine Sand with some Silt* *Fine to Coarse Sand, Poorly Sorted with some Gravel*	*SP*	*Frost to 3'* *HNu = 0*
5		SS	1.6	2-1-2-3	*Loose Fine - Coarse Sand with Trace Gravel Poorly Sorted*	*SP*	*LEL = 0% (t = 9:35)* *RAD = 0.05 (BKG)* *HNu = 0*
		SS	0.4	1-2-3-3	*Same as Above*		
10		SS	0.6	1-3-3-3	*Medium Sand with Trace Fine Sand and some Coarse Sand*	*SP*	
		SS	—	3-5-5-5	*No Recovery (Catcher Broke)*		*HNu = 0* *LEL = 0%*
15		SS	0.8	1-2-2-2	*Medium Sand with Trace Fine Sand and some Coarse Sand*	*SP*	
		SS	0.7	4-3-2-2	*Same as Above*		*LEL = 0%* *HNu = 0 ppm* *W/L = 17'*
20		SS	—		*No Recovery*		*Take H_2O Sample*
		SS	0.4	2-3-13-17	*Medium - Coarse Sand*	*SP*	
25		SS	0.7	4-3-17-18	*Medium - Coarse Sand with Trace Fine Gravel*	*SP*	
		SS	—	2-3-17-37	*No Recovery (Catcher Broke)*	*SP*	*HNu = 0 ppm*
30							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-07	SHEET 2 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
30		SS	—	6-18-13-33	No Recovery		18" Drives
		SS	1.1	3-5-33	Medium Sand	SP	HNu = 0 ppm
35		SS	0.5	13-27-33	Medium Sand and Medium Gravel Fine - Medium Gravel 0.3	SP	
		SS	0.2	8-13-17	Medium - Fine Sand	SP	HNu = 0 ppm
40		SS	—	5-8-13	No Recovery	SP	Hard Drilling - Gravelly
		SS	1.3	6-25-26	Medium Sand with some Coarse Sand and Trace Fine Gravel	SP	
45		SS	0.7	8-10-24	Medium Sand with some Fine Gravel Silty Fine Sand	SP	
		SS	0.4	8-12-28	Medium - Coarse Sand with some Fine Gravel	SP	
50		SS	0.5	5-13-22	Medium - Coarse Sand with Trace Fine Gravel	SP	
		SS	—	5-5-21	No Recovery		
55		SS	0.9	5-10-34	Medium Sand 0.8 Medium - Fine Gravel 0.1	SP	
		SS	0.9	3-17-22	Medium - Coarse Sand with some Fine Gravel	SP	
60							

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-07	SHEET 3 OF 3

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-7-89 LOGGER JAI

DEPTH BELOW SURFACE (FT)	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
60		SS	0.5	13-20-32	*Medium Sand with some Gravel (Last 0.2' Fine - Coarse Sand with Trace Yellowish Brown Silt)*	SP	
		SS	—	11-13-15	*No Recovery*		
65		SS	0.8	4-21-34	*Medium to Coarse Sand with some Fine Gravel and Trace Medium Gravel*	SP	
		SS	1.5	14-21-57	*Same as Above*	SP	
70							

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-08	SHEET 1 OF 2

SOIL BORING LOG

PROJECT ONALASKA LOCATION SE OF LANDFILL

ELEVATION ______ DRILLING CONTRACTOR ETI

DRILLING METHOD AND EQUIPMENT 4 1/4" AUGERS

WATER LEVEL AND DATE ______ START 3-7-89 FINISH 3-8-89 LOGGER KLO

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS1	1.5	32-18-20	Medium to Coarse Sand with Trace Gravel, Moist, Color=7.5 YR 5/6. Loose Below Frostline, Mostly Quartz With Pebbles and Particles of Granite, Magnetite, etc., and Glacial Outwash.	SP	Frost Down to 2 ft.
		SS2	1.5	3-5-6			HNu = 0 ppm on Borehole
5							
		SS3	0.8	2-2-2	Thin 1-2" Fine Sand With Silt, Trace Gravel. Dark Reddish Brown, Color =7.5 YR 3/4, Moist	SM	
		SS4	1.0	15-4-5	Medium to Coarse Sand, as above, but Getting Wetter.	SP	
10							
		SS5	0.6	7-4-5			
		SS6	1.0	12-12-5	Medium Sand, Trace Gravel, Moist.	SP	OUA = 0 ppm on Borehole
15							
		SS7	1.0	3-3-4	Medium to Coarse Sand, Trace Gravel, Color =7.5 YR 4/6.		
							▽ Collected a Grain-size Sample.
		SS8	0.8	2-2-2-2	Same, but Saturated.		
20							OUA = 0 ppm on Borehole
							Blind Drill to 28 ft.
25					Water Sampled for CSL 25 to 28ft. with Well point.		OUA = 0 ppm on Purge Water.
		SS9	1.3	12-16-17	Same, Mostly Medium Sand with some Coarse.		
30							

PROJECT NUMBER	BORING NUMBER	
GLO 65550.F1.FQ	GB-08	SHEET 2 OF 2

SOIL BORING LOG

PROJECT ONALASKA LOCATION

ELEVATION DRILLING CONTRACTOR

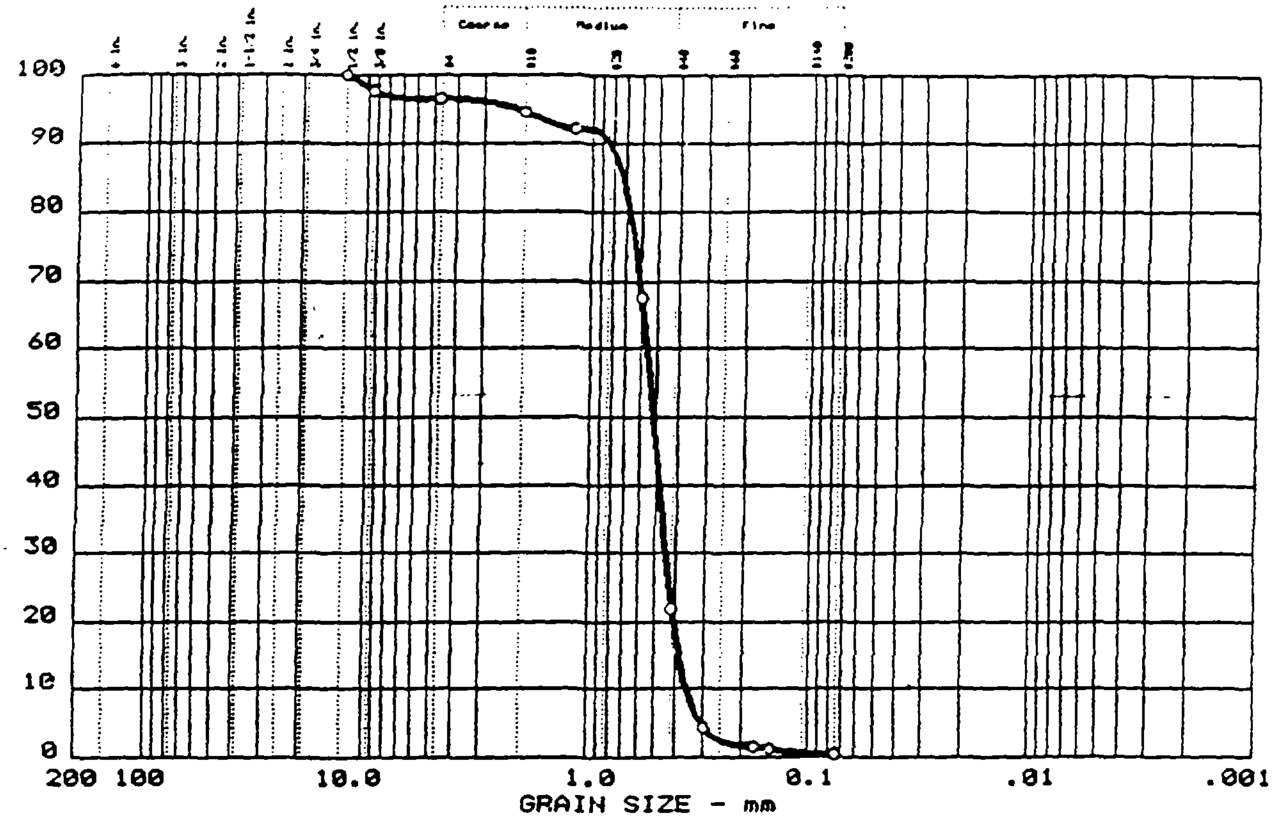
DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH 3-8-89 LOGGER KLO

DEPTH BELOW SURFACE (FT)	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY (FT)	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		SS10	1.0	11-8-8	Same		OVA = 0 ppm on Borehole
		SS11	1.0	10-10-12	Same		
35							
		SS12	1.2	12-15-10	Same		
		SS13	1.7	20-36-42	Same		
40							
		SS14	2.0	7-29-29	Same, but had a 2" Subrounded Gravel Seam (Minus 3/4") in Bottom of Spoon		
		SS15	1.3	12-18-10	Same		OVA = 0 ppm on Borehole
45							
		SS16	0	15-16-6	No Recovery		
		SS17	2.0	12-15-18	Same		Collected a Grain-size Sample.
50							Drove Sandpoint to 58 ft. and Collected a CSL Water Sample.
					END OF BORING		

Attachment 2
GRAIN-SIZE ANALYSES

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	3.5	96.1	0.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	--	--	0.73	0.56	0.52	0.449	0.3890	0.3589	1.01	1.5

MATERIAL DESCRIPTION	USCS
o Brown Fine-Medium SAND, Trace Gravel	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
o Sample: BORING: GB-1 @ 78-80 FT

Date: 03-23-89

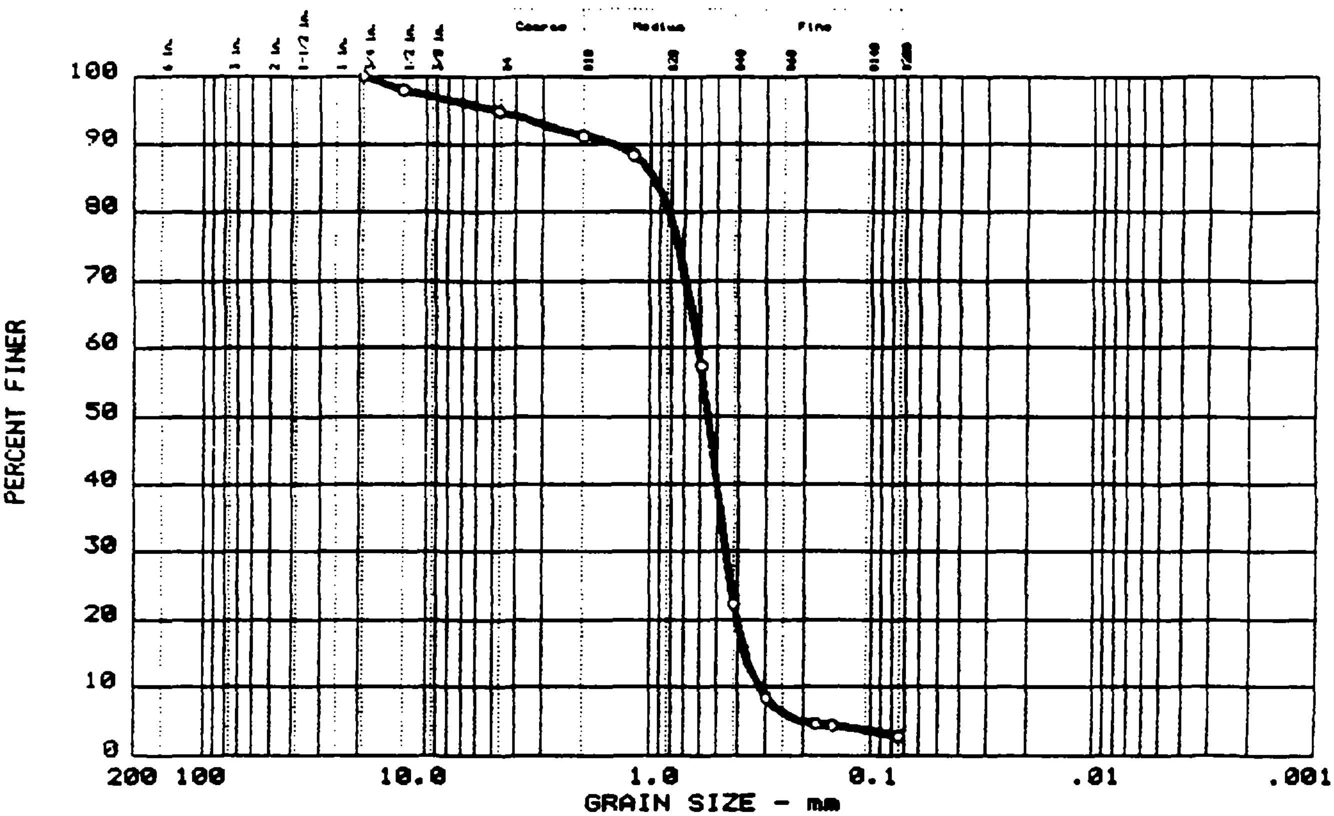
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	5.2	92.0	2.8	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	0.97	0.61	0.55	0.457	0.3741	0.3221	1.07	1.9

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Coarse SAND, Little Gravel, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
○ Sample: BORING: GB3 SAMPLE: 2 @ 39-41 FT

Date: 03-14-89

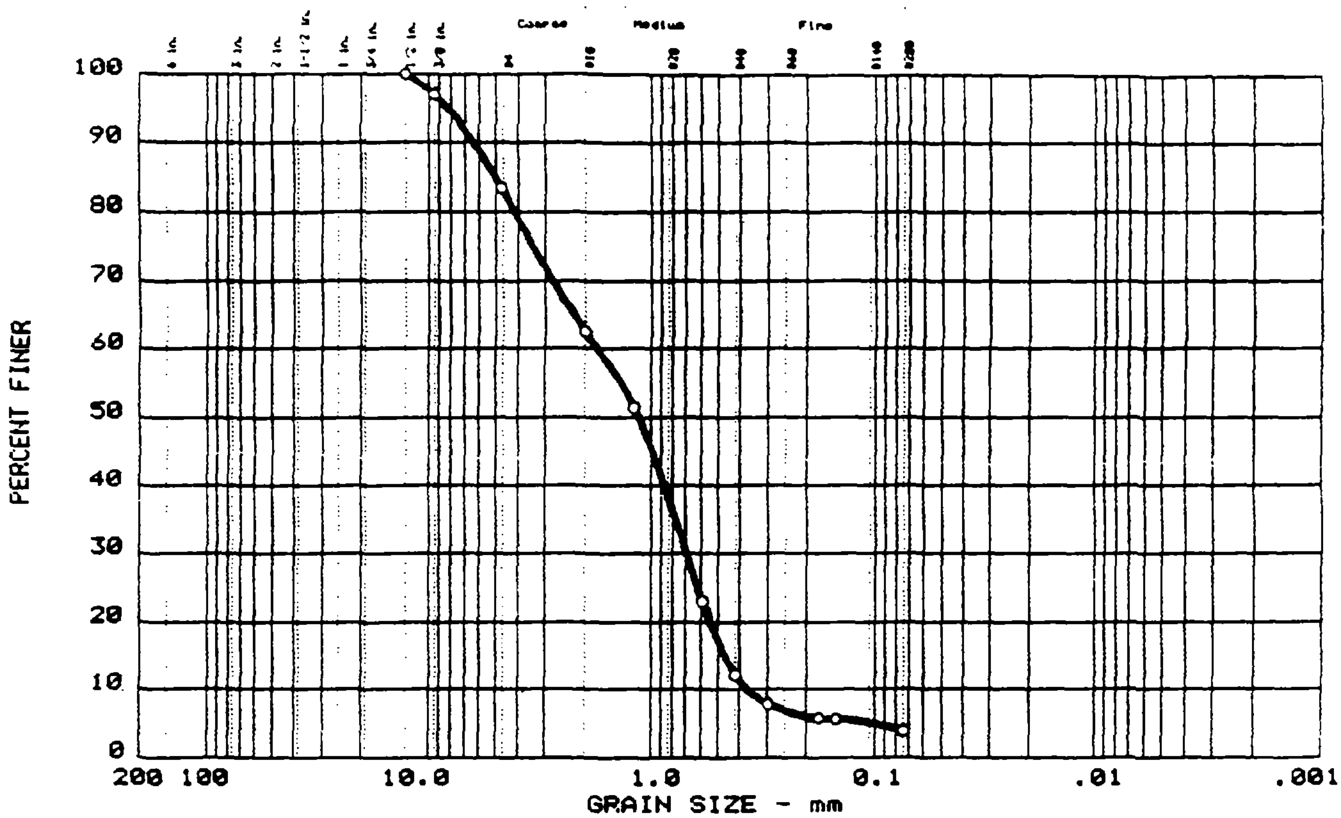
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: LJR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	16.6	79.5	3.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	5.07	1.74	1.14	0.696	0.4694	0.3686	0.76	4.7

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Coarse SAND, Some Gravel, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
○ Sample: BORING: GB3 SAMPLE: 1 @ 22-24 FT

Date: 03-14-89

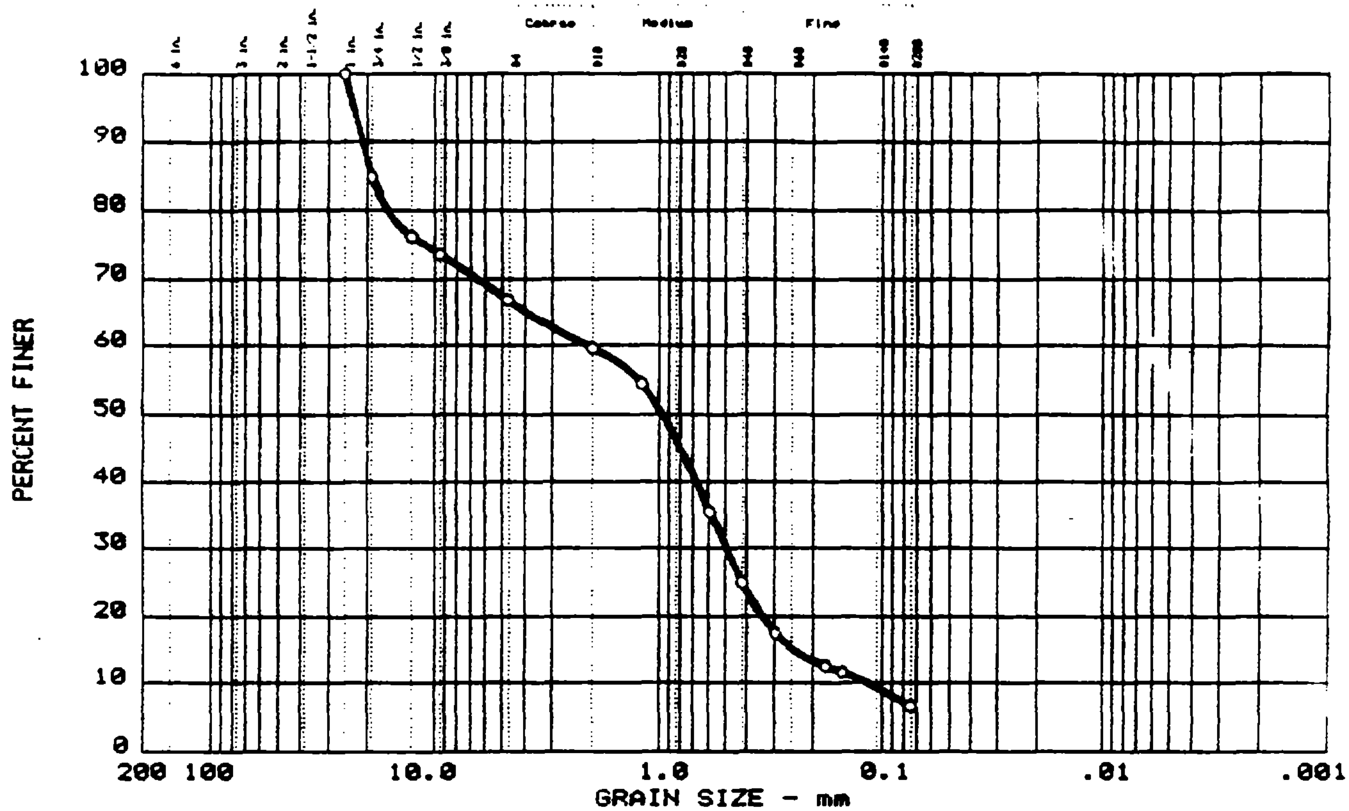
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY:
APPROVED BY:

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	33.2	60.1	6.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	--	--	19.16	2.10	0.96	0.498	0.2466	0.1140	1.03	18.4

MATERIAL DESCRIPTION	USCS
O Brown Fine-Coarse SAND, Some Gravel, Little Silt & Clay	SW-SM

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: GB3 SAMPLE: 3 @ 59-61 FT

Date: 03-14-89

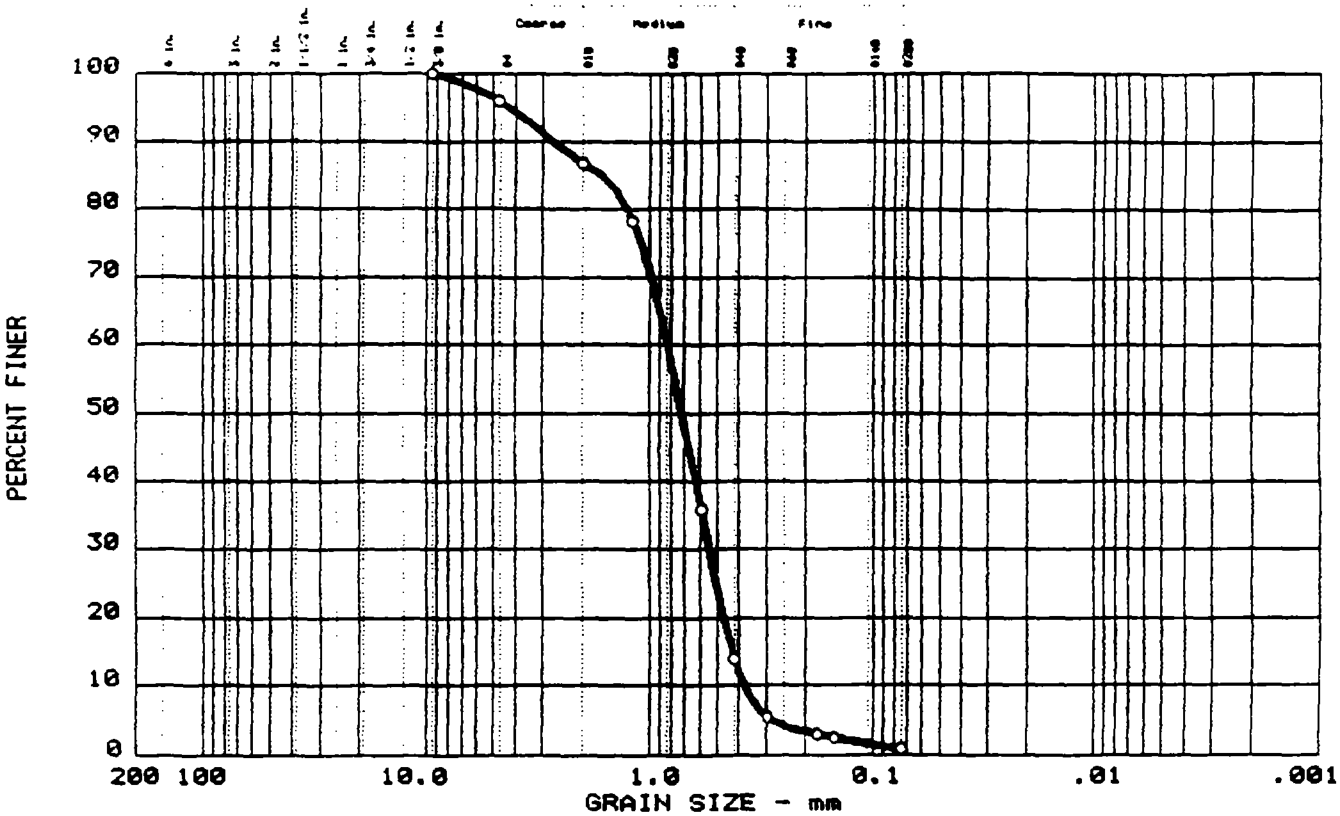
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: LTR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	4.0	95.0	0.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	---	--	1.64	0.83	0.72	0.545	0.4295	0.3784	0.94	2.2

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Coarse SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
○ Sample: BORING: GB4 SAMPLE: 1 @ 13-15 FT

Date: 03-14-89

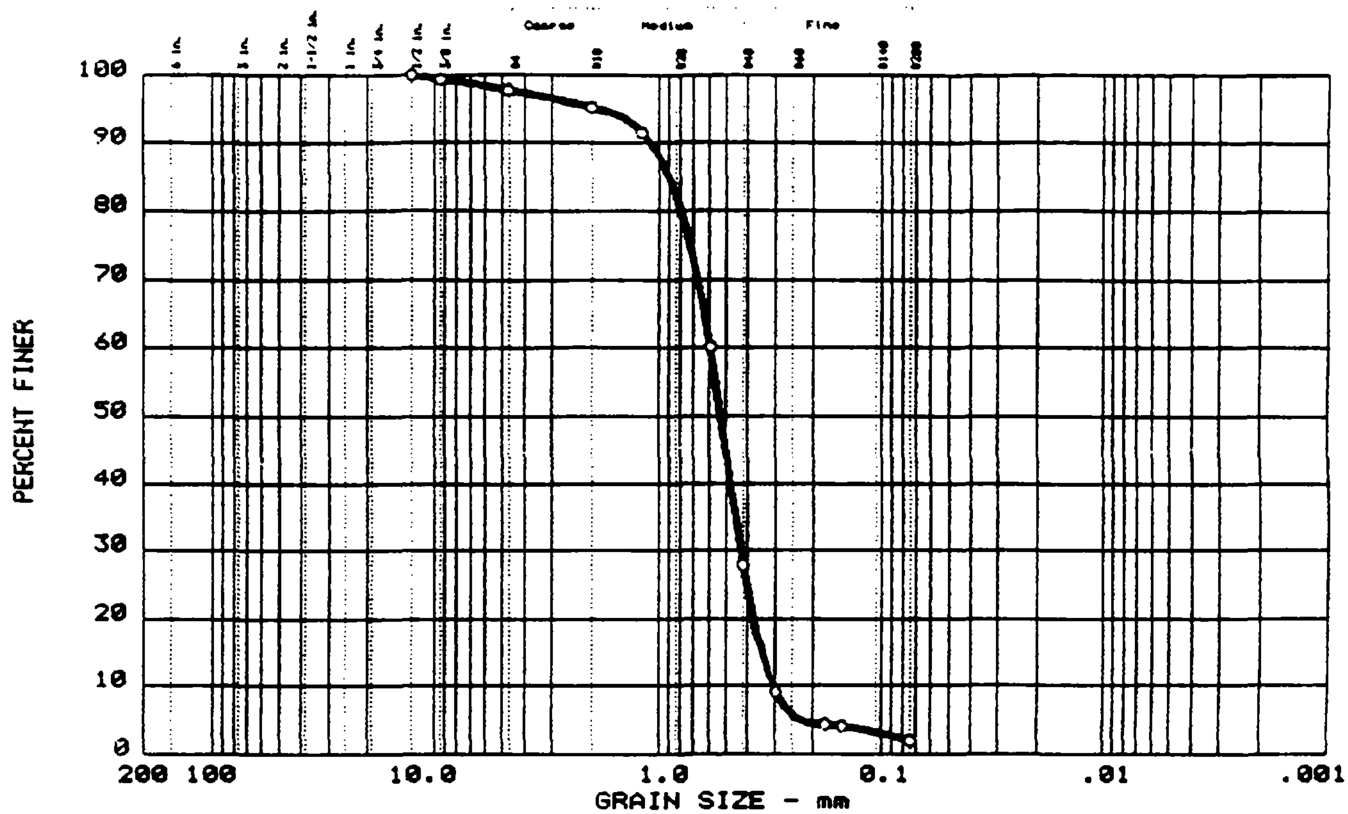
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: WJR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	2.3	95.7	2.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	--	--	0.90	0.59	0.53	0.430	0.3451	0.3041	1.03	1.9

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
o Sample: SAMPLE: GB4 SAMPLE: 2 @ 38-40 FT

Date: 03-14-89

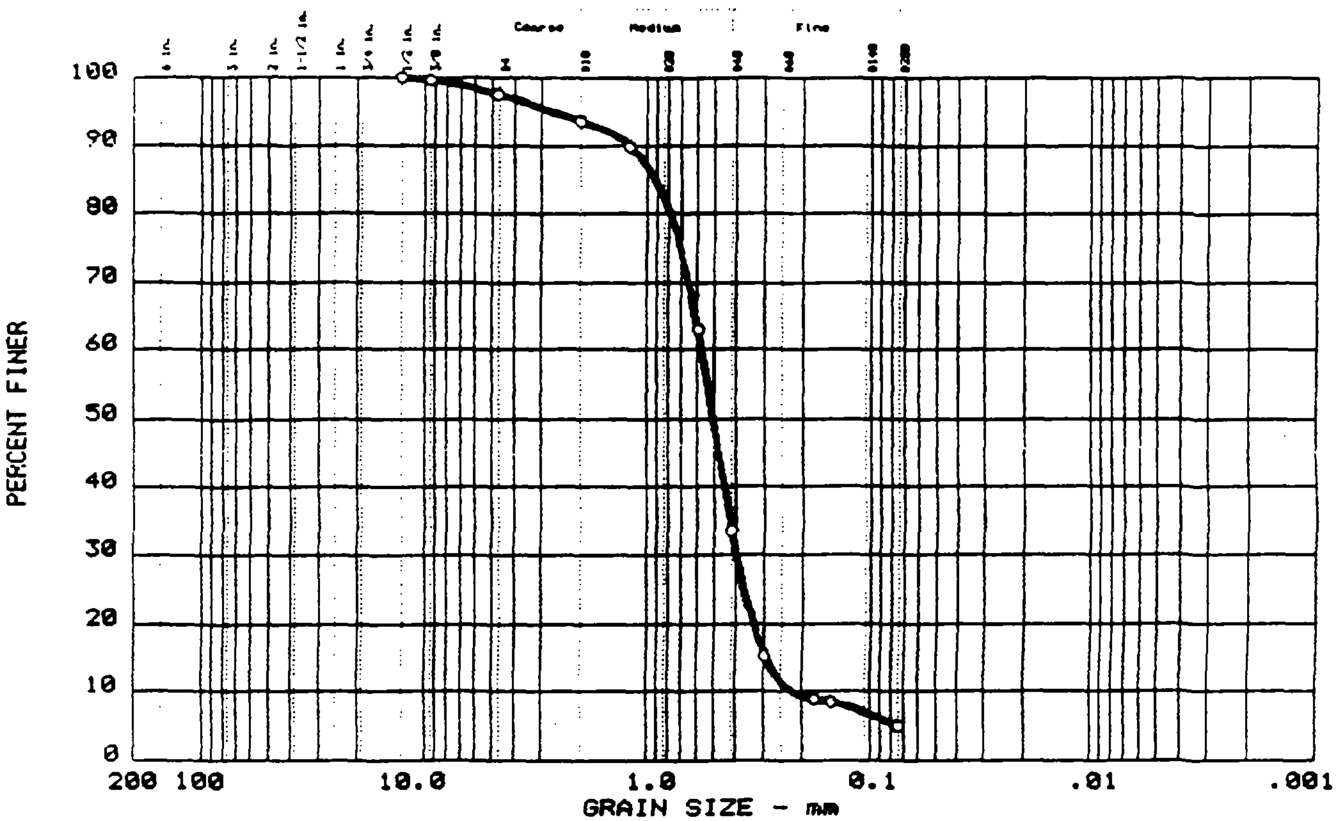
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: WJR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	2.5	92.5	5.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	--	--	0.91	0.57	0.51	0.400	0.2951	0.2239	1.26	2.5

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
o Sample: BORING: GB4 SAMPLE: 3 @ 55-57 FT

Date: 03-14-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

Sheet No.

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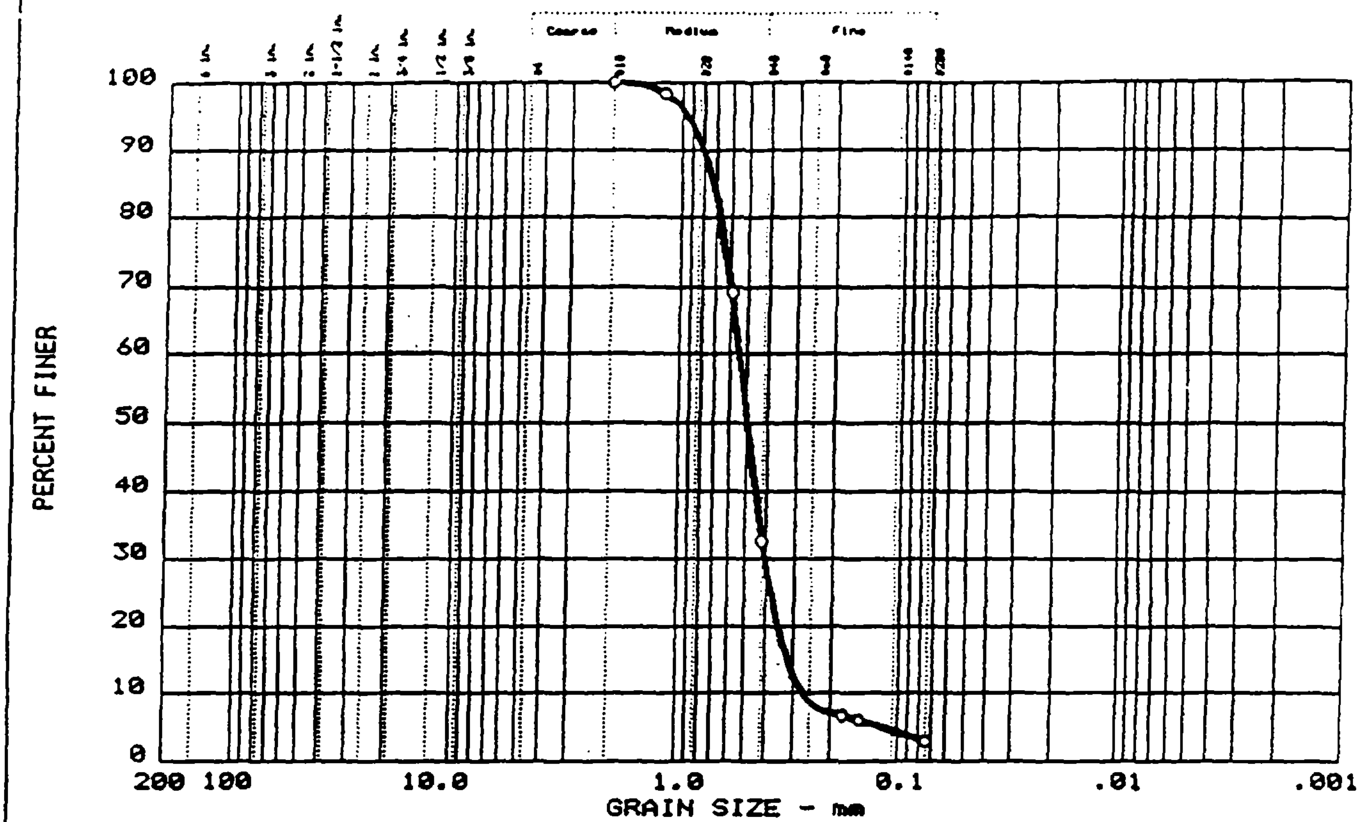
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	0.0	97.1	2.9	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	—	—	0.73	0.54	0.49	0.408	0.3203	0.2726	1.13	2.0

MATERIAL DESCRIPTION	USCS
O Brown Fine-Medium SAND, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: GB-5 @ 78-80 FT

Date: 03-23-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA
ENTERED BY: MML
CHECKED BY: [signature]
APPROVED BY: [signature]

Sheet No.

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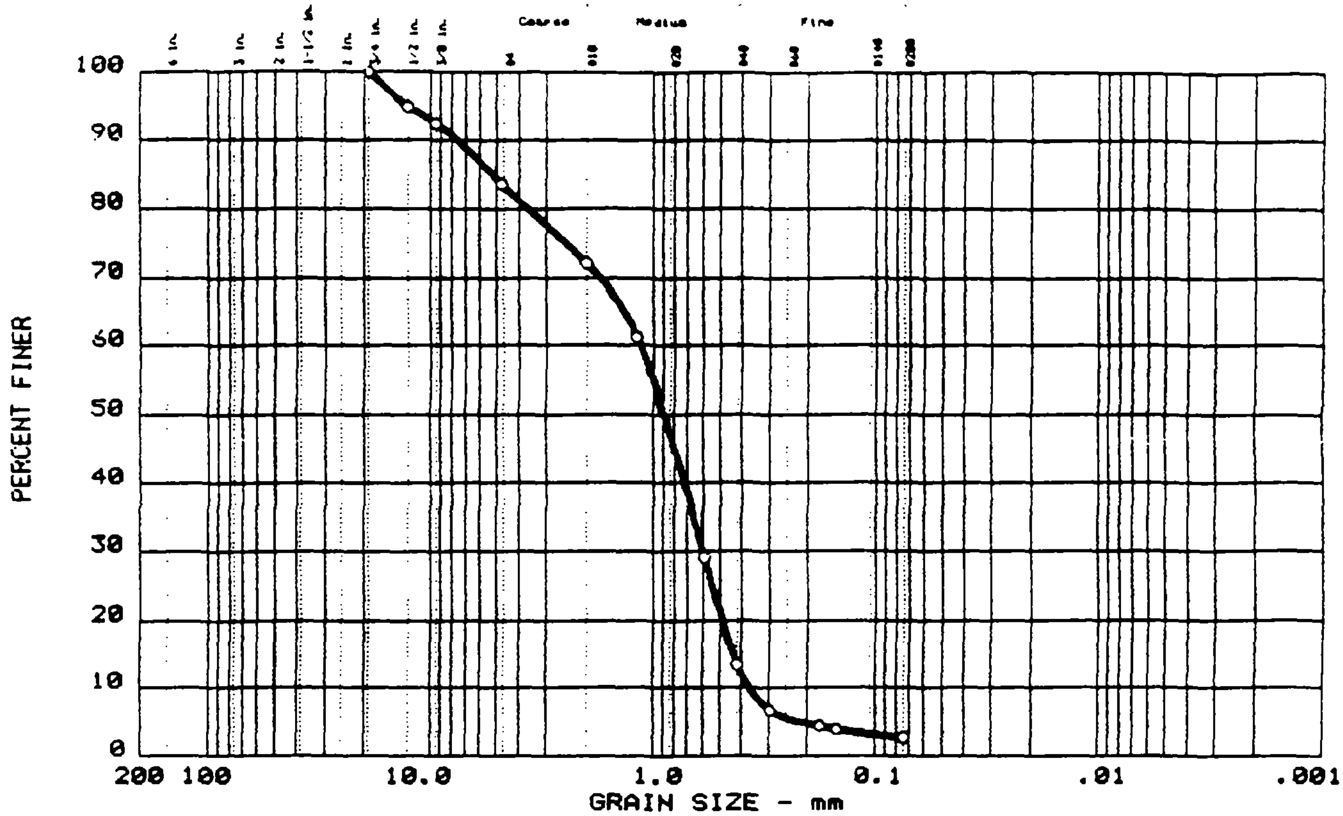
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	16.4	80.9	2.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	5.25	1.14	0.89	0.600	0.4385	0.3690	0.85	3.1

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Coarse SAND, Some Gravel, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
○ Sample: BORING: GB8 SAMPLE: 8 @ 18.5-20.5 FT

Date: 03-14-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: [signature]
APPROVED BY: [signature]

Sheet No.

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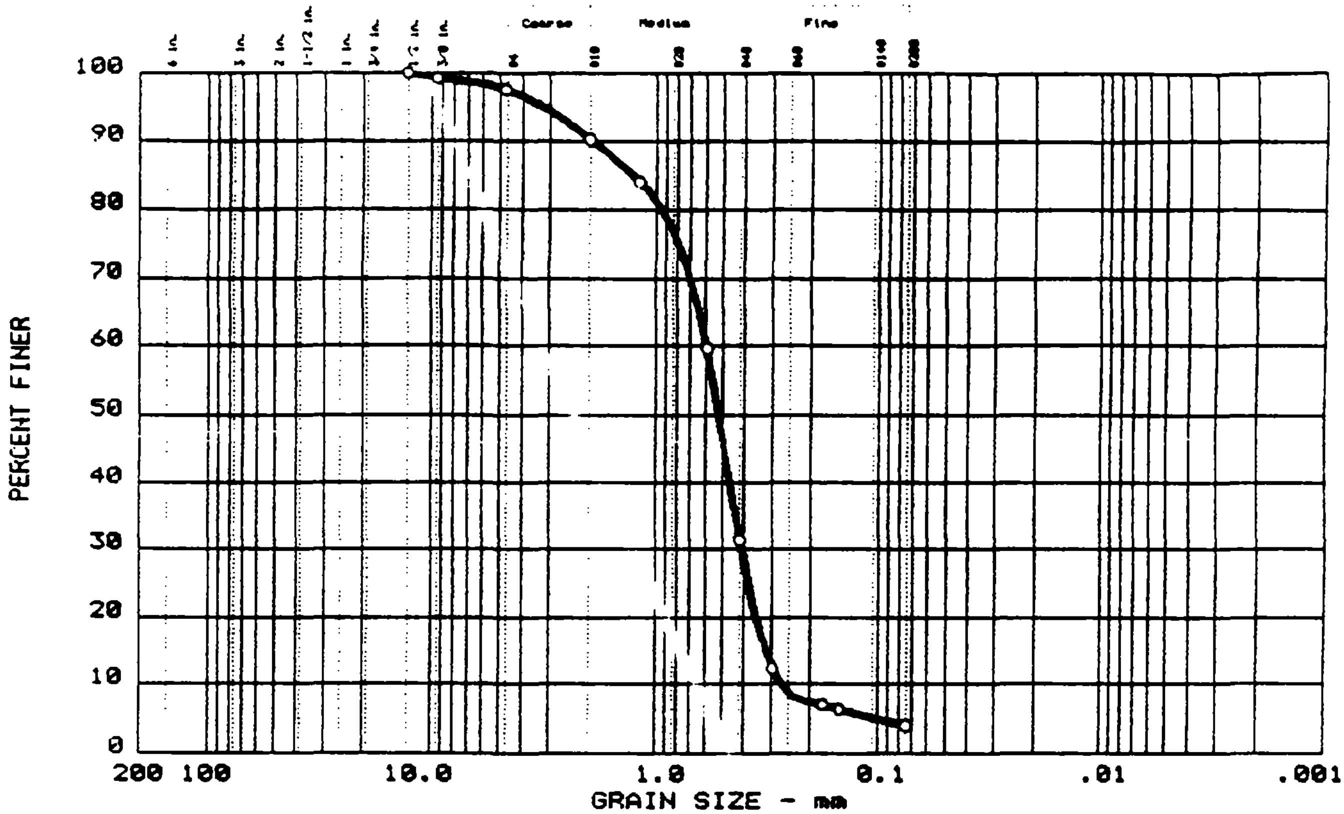
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	2.4	93.6	4.0	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	--	--	1.27	0.57	0.52	0.412	0.3190	0.2712	1.06	2.2

MATERIAL DESCRIPTION	USCS
○ Brown Fine-Coarse SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
○ Sample: BORING: GB8 SAMPLE: 17 @ 48-49.5 FT

Date: 03-14-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: [signature]

Sheet No.

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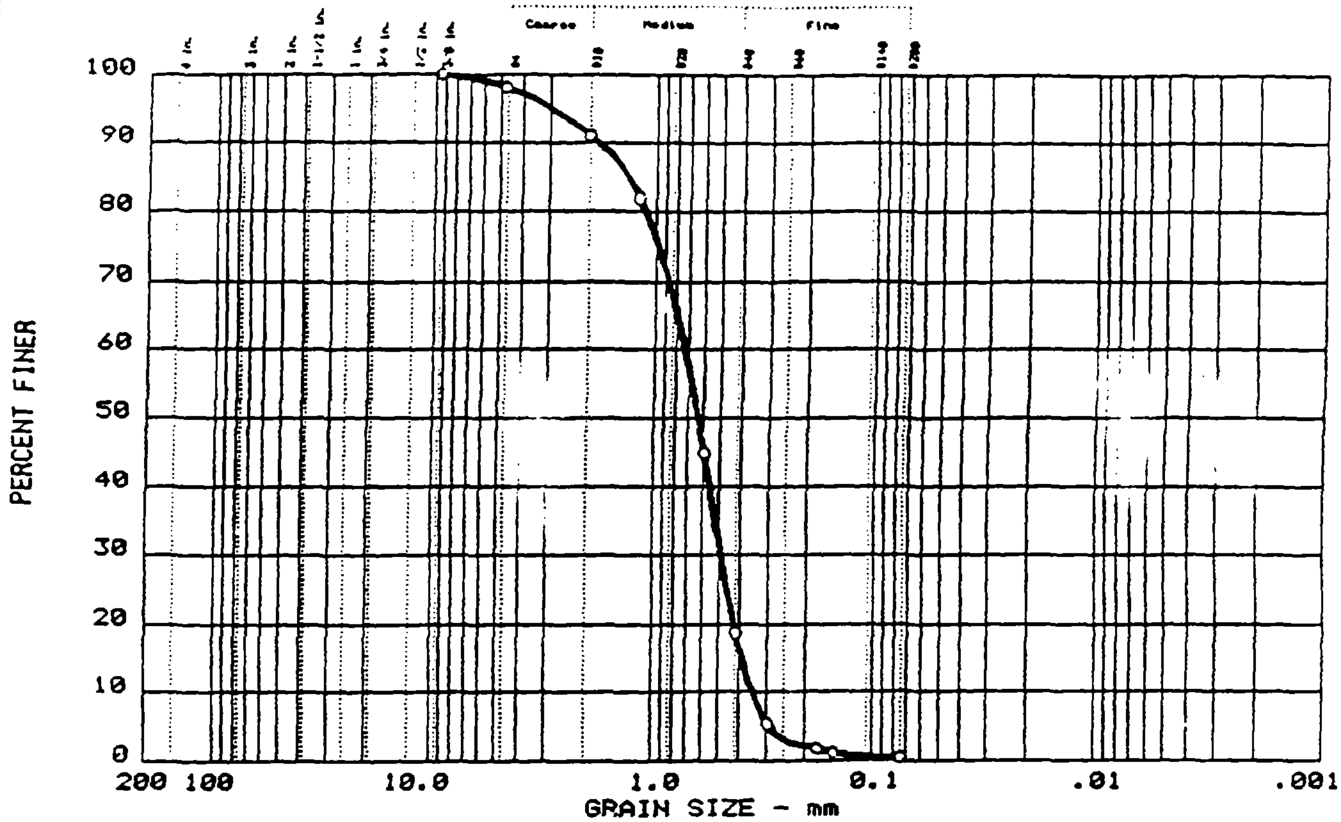
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	1.9	97.7	0.4	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	---	---	1.33	0.73	0.63	0.491	0.3936	0.3508	0.94	2.1

MATERIAL DESCRIPTION	USCS
o Brown Fine-Coarse SAND, Trace Gravel	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
o Sample: BORING: MW-1 @ 20-22 FT

Date: 03-23-89

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: [illegible]

Sheet No.

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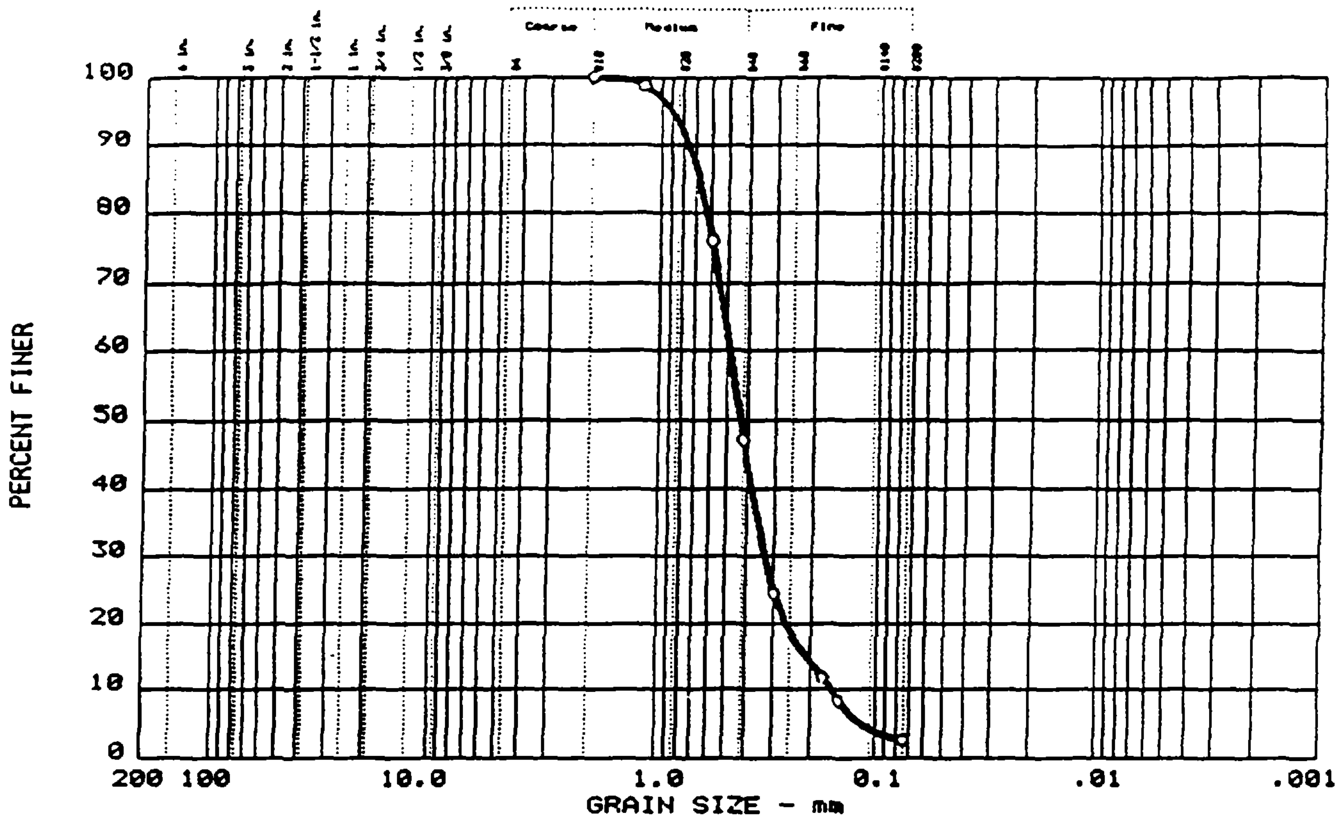
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	0.0	97.3	2.7	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	--	--	0.68	0.49	0.43	0.331	0.2111	0.1618	1.39	3.0

MATERIAL DESCRIPTION	USCS
O Brown Fine-Medium SAND, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: MW-1M @ 53-55 FT

Date: 03-23-89

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: [signature]

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Sheet No.

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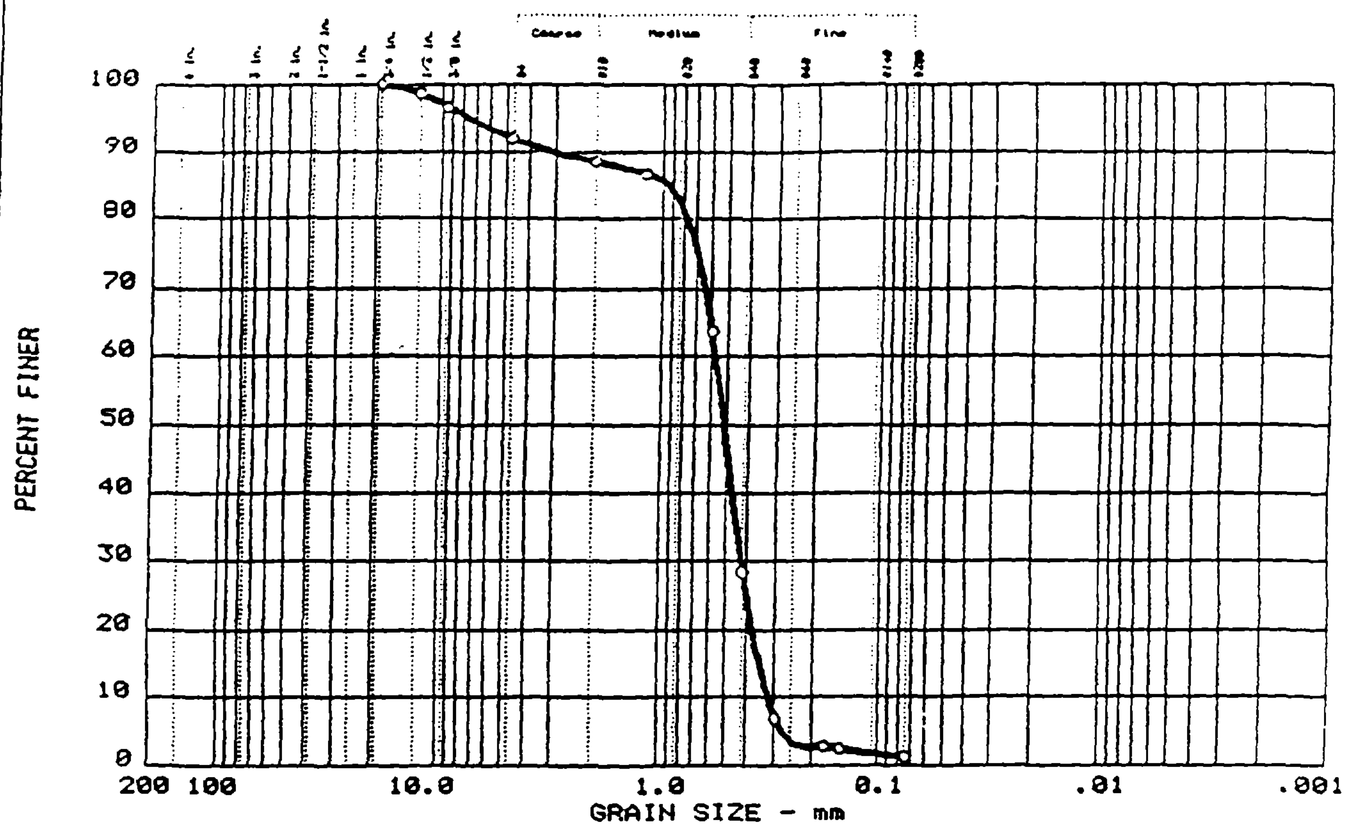
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	8.1	90.6	1.3	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	--	--	0.94	0.57	0.51	0.427	0.3536	0.3221	1.00	1.8

MATERIAL DESCRIPTION	USCS
O Brown Fine-Coarse SAND, Little Gravel, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: MW-1M @ 78-80 FT

Date: 03-23-89

GRAIN SIZE DISTRIBUTION TEST REPORT

WARZYN ENGINEERING INC.

Remarks:

TESTED BY: DWA/RWP

ENTERED BY: MML

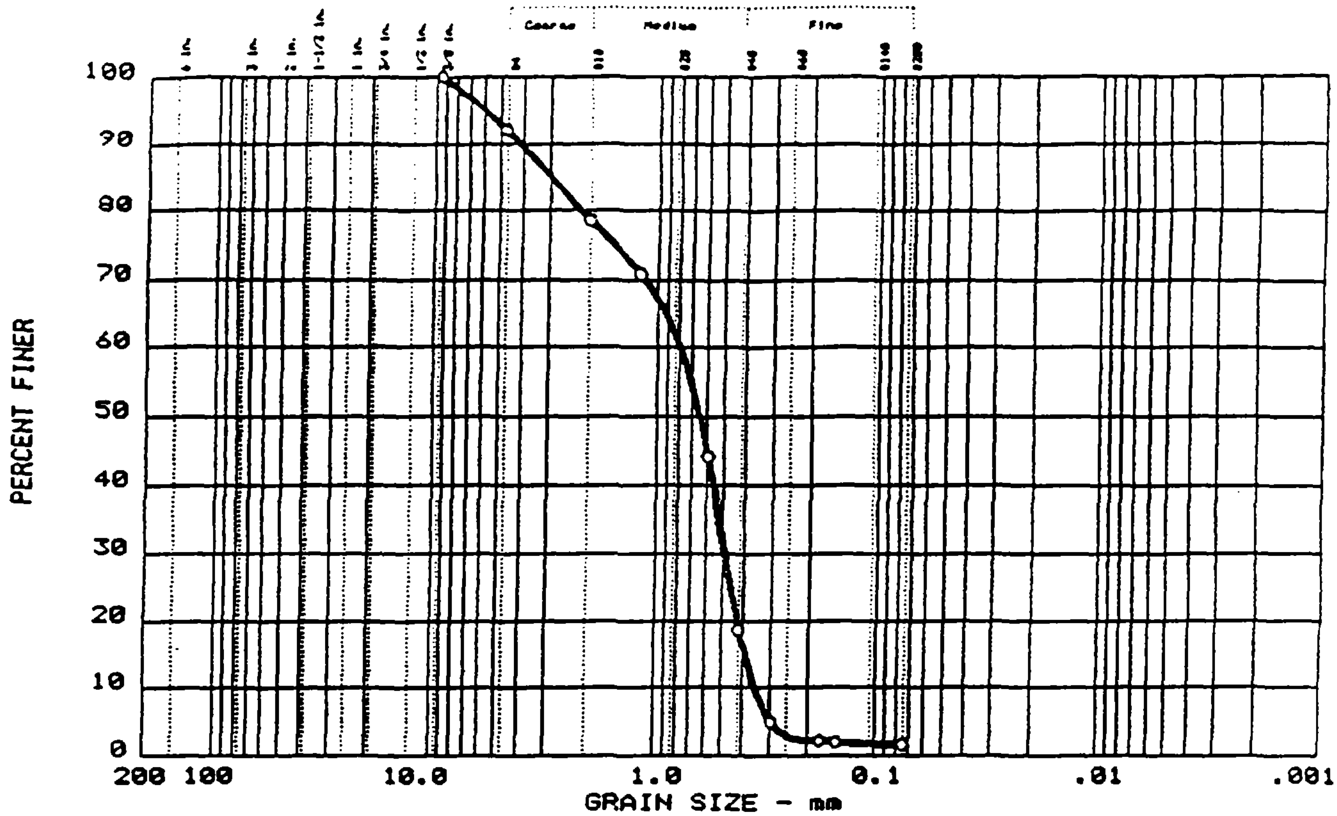
CHECKED BY: DWA

APPROVED BY: WR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	7.9	90.5	1.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	--	--	2.99	0.79	0.64	0.491	0.3945	0.3544	0.86	2.2

MATERIAL DESCRIPTION	USCS
O Brown Fine-Coarse SAND, Little Gravel, Trace Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: MW-7 @ 80-82 FT

Date: 03-23-89

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Sheet No.

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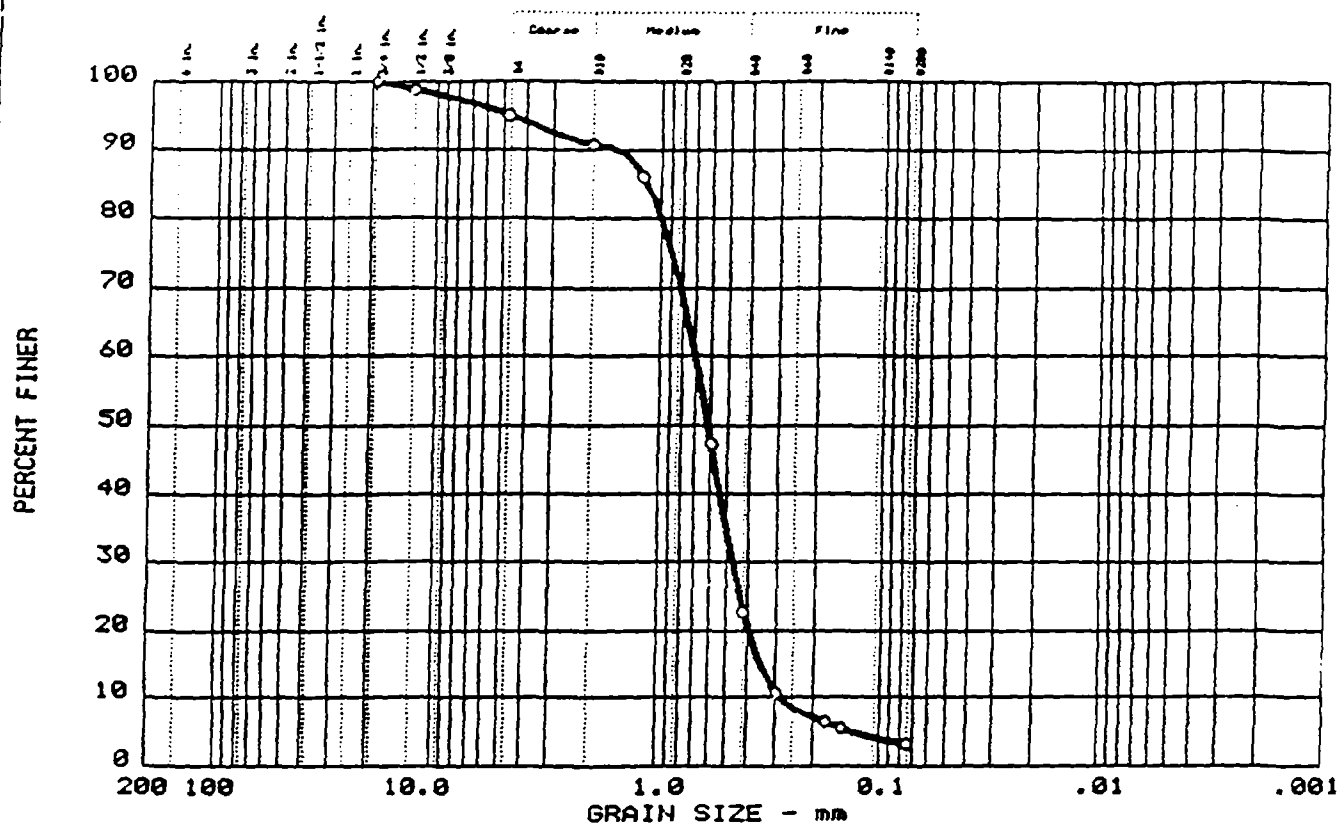
GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	0.0	5.0	91.8	3.2	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	--	--	1.15	0.70	0.61	0.471	0.3532	0.2838	1.11	2.5

MATERIAL DESCRIPTION	USCS
O Brown Fine-Coarse SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
O Sample: BORING: MW-7H @ 30-32 FT

Date: 03-23-89

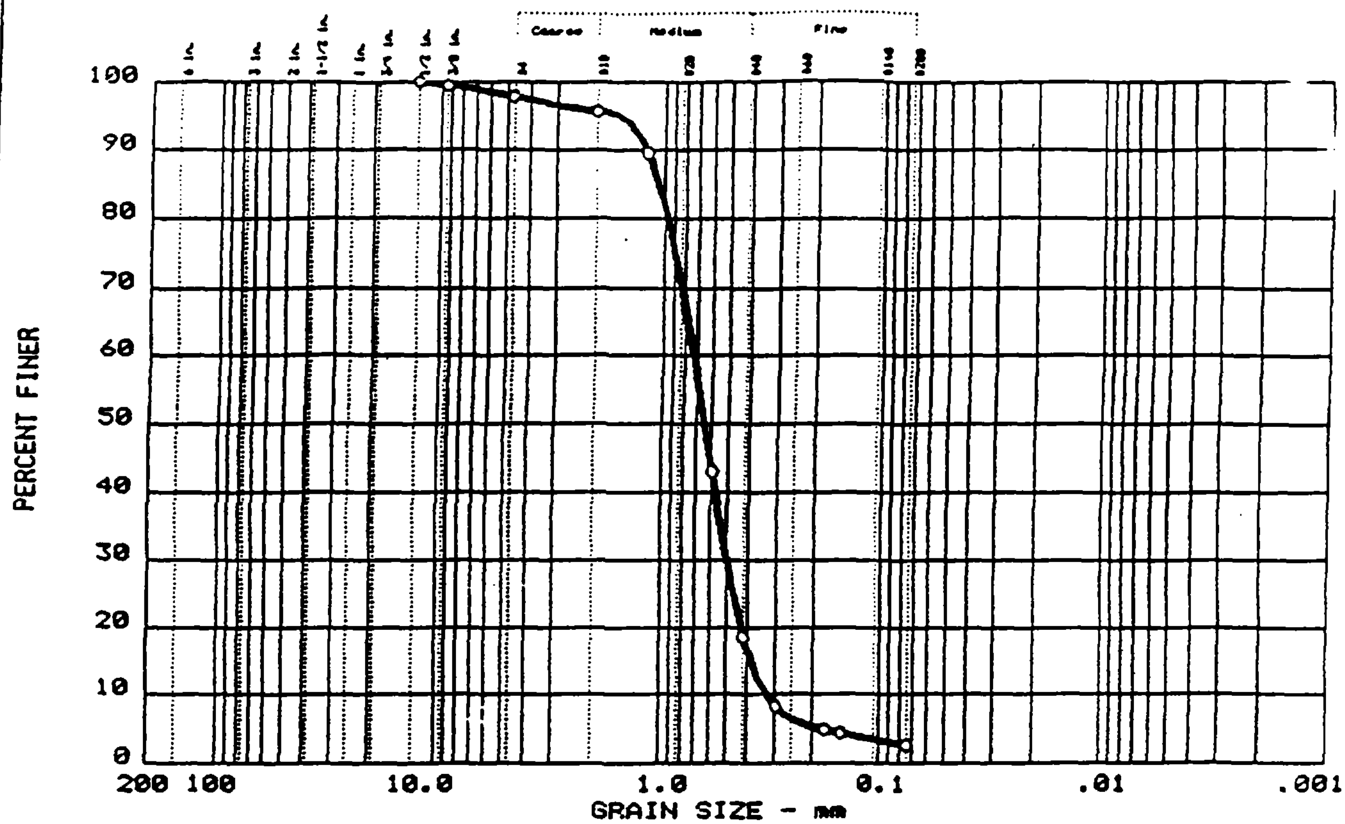
GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

Sheet No.

WARZYN

GRAIN SIZE DISTRIBUTION TEST REPORT



Symbol	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	0.0	2.2	95.2	2.6	

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	—	—	1.07	0.73	0.64	0.501	0.3890	0.3273	1.05	2.2

MATERIAL DESCRIPTION	USCS
o Brown Fine-Medium SAND, Trace Gravel & Silt & Clay	SP

Project No.: 13410.11
Project: ONALASKA LANDFILL
o **Sample:** BORING: MW-35 @ 18-20 FT

Date: 03-23-89

Remarks:
TESTED BY: DWA/RWP
ENTERED BY: MML
CHECKED BY: DWA
APPROVED BY: VJR

GRAIN SIZE DISTRIBUTION TEST REPORT
WARZYN ENGINEERING INC.

Sheet No.

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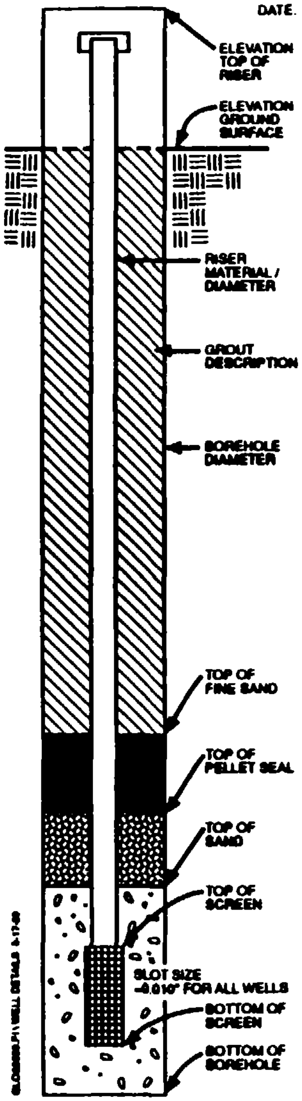
Attachment 3
GROUNDWATER MONITORING WELL
AS-BUILT CONSTRUCTION DATA



	MW-1S	MW-1M	MW-2S	MW-2M	MW-2D	MW-3S	MW-3M	MW-3D	MW-4S	MW-5S	MW-6M
INSTALLED BY	J. Imada	J. Imada	K. Olsen	K. Olsen	K. Olsen	J. Imada	K. Olsen	K. Olsen	K. Olsen	J. Imada	D. Plamb
DATE	3-10-88	3-10-88	3-14-88	3-14-88	3-18-88	3-17-88	3-20-88	3-20-88	3-10-88	3-10-88	3-20-88
ELEVATION TOP OF RISER	663.22	663.47	664.88	664.93	665.07	656.44	656.43	656.46	665.01	650.46	648.46
ELEVATION GROUND SURFACE	661.0	661.0	662.3	662.9	662.8	653.7	653.6	653.9	662.6	650.4	649.0
RISER MATERIAL / DIAMETER	2" PVC	2" PVC	2" SS	2" SS	2" SS	2" SS	2" SS	2" SS	2" SS	2" SS	2" PVC
GROUT DESCRIPTION	Cement / Bentonite	Bentonite / Slurry	Cement / Bentonite	Bentonite Slurry	Cement Over Bentonite / Slurry	Cement / Bentonite	Bentonite Slurry	Bentonite Slurry	Cement / Bentonite	Cement / Bentonite	Bentonite Slurry
BOREHOLE DIAMETER	10"	10"	10"	10"	5"	10"	5"	5"	10"	10"	10"
TOP OF FINE SAND	662.0	N/A	662.8	N/A	N/A	N/A	N/A	N/A	661.6	648.9	N/A
TOP OF PELLET SEAL	661.6	N/A	662.0	N/A	N/A	660.7	N/A	N/A	660.6	646.8	N/A
TOP OF SAND	660.0	661.0	661.0	580.9	542.7	640.7	580.6	530.4	640.1	647.4	587.0
TOP OF SCREEN	648.0	588.3	647.3	583.6	538.9	646.7	585.2	524.8	646.1	644.4	570.0
BOTTOM OF SCREEN	638.0	588.3	637.3	583.6	528.9	636.7	575.2	514.8	636.1	634.4	560.0
BOTTOM OF BOREHOLE	637.5	588.3	634.3	583.6	523.7	636.7	573.1	511.8	636.1	634.4	560.0

	MW-7M	MW-8S	MW-8M	MW-8D	MW-9M	MW-10M	MW-11M	MW-12S	MW-13S	MW-14S
INSTALLED BY	D. Plamb	D. Plamb	D. Plamb	D. Plamb	D. Plamb	D. Plamb	D. Plamb	K. Olsen	K. Olsen	D. Plamb
DATE	3-10-88	3-19-88	3-19-88	3-20-88	3-21-88	3-21-88	3-22-88	3-30-88	3-29-88	3-30-88
ELEVATION TOP OF RISER	662.51	661.88	662.63	661.46	656.10	656.51	657.17	662.96	664.07	656.10
ELEVATION GROUND SURFACE	660.3	660.4	660.4	660.2	653.6	653.3	654.3	660.2	661.6	654.8
RISER MATERIAL / DIAMETER	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" SS
GROUT DESCRIPTION	Bentonite Slurry	Granular Bentonite	Bentonite Slurry	Bentonite Slurry	Bentonite Slurry	Bentonite Slurry	Bentonite Slurry	Granular Bentonite	Granular Bentonite	Granular Bentonite
BOREHOLE DIAMETER	10"	10"	10"	5"	10"	10"	10"	10"	10"	10"
TOP OF FINE SAND	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TOP OF PELLET SEAL	N/A	662.0	N/A	N/A	N/A	N/A	N/A	652.2	652.4	662.8
TOP OF SAND	588.3	660.4	600.4	574.2	583.3	581.8	586.3	651.2	660.8	650.8
TOP OF SCREEN	583.3	648.8	588.3	538.2	586.6	586.5	580.7	647.4	649.2	648.8
BOTTOM OF SCREEN	583.3	638.8	588.3	528.2	576.6	575.5	580.7	637.4	639.2	638.8
BOTTOM OF BOREHOLE	580.3	636.4	581.4	521.2	573.6	573.3	574.3	637.2	636.8	638.8

SS - STAINLESS STEEL

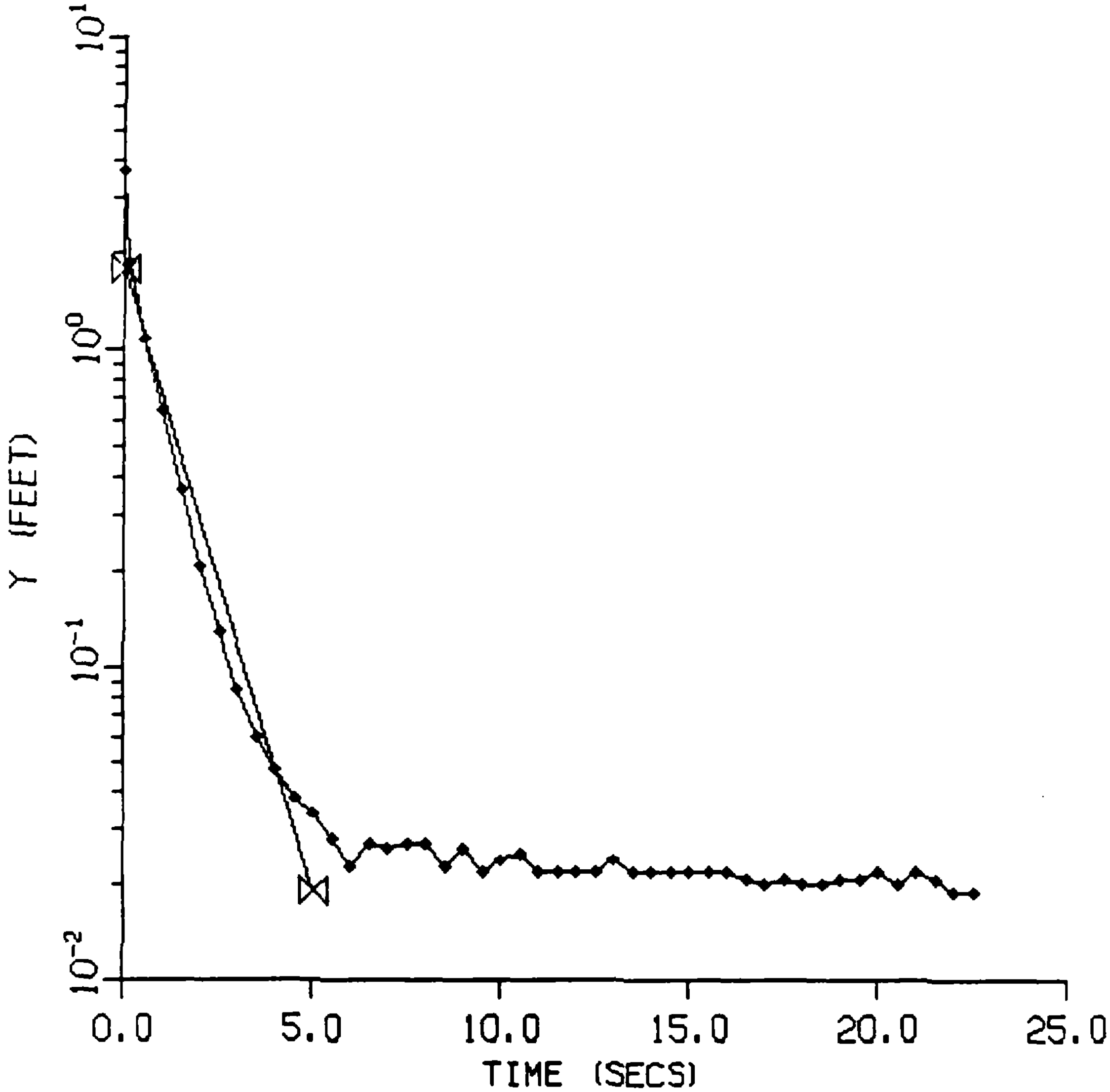
GL08888.P11 WELL DETAILS 3-17-88

WELL CONSTRUCTION DETAILS

ONALASKA RI

Attachment 4
SLUG TEST PLOTS
AND ANALYSES

ØNALASKA LANDFILL
MW-1S
TEST 1



K (CM/S) = 0.045540

WELL SPECS. (FEET)

SCREEN LENGTH = 5.8

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 5.84

COEFFICIENTS

A = 3.57

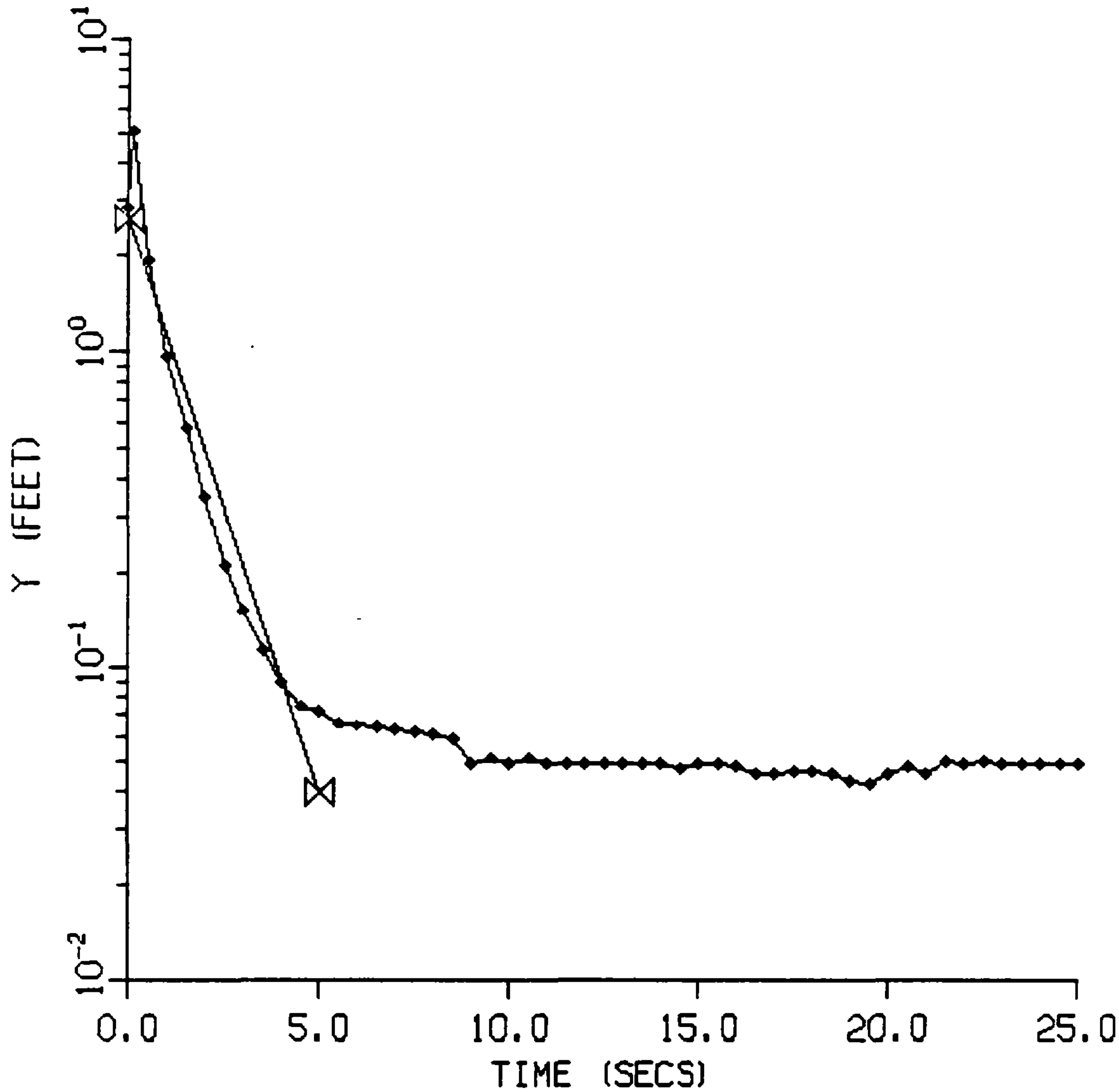
B = 0.60

C = 0.00

Y-INTERCEPT = 1.79

SLOPE = -0.3939

ØNALASKA LANDFILL
MW-1S
TEST 2



K (CM/S) = 0.042155

WELL SPECS. (FEET)

SCREEN LENGTH = 5.8

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 5.84

COEFFICIENTS

A = 3.57

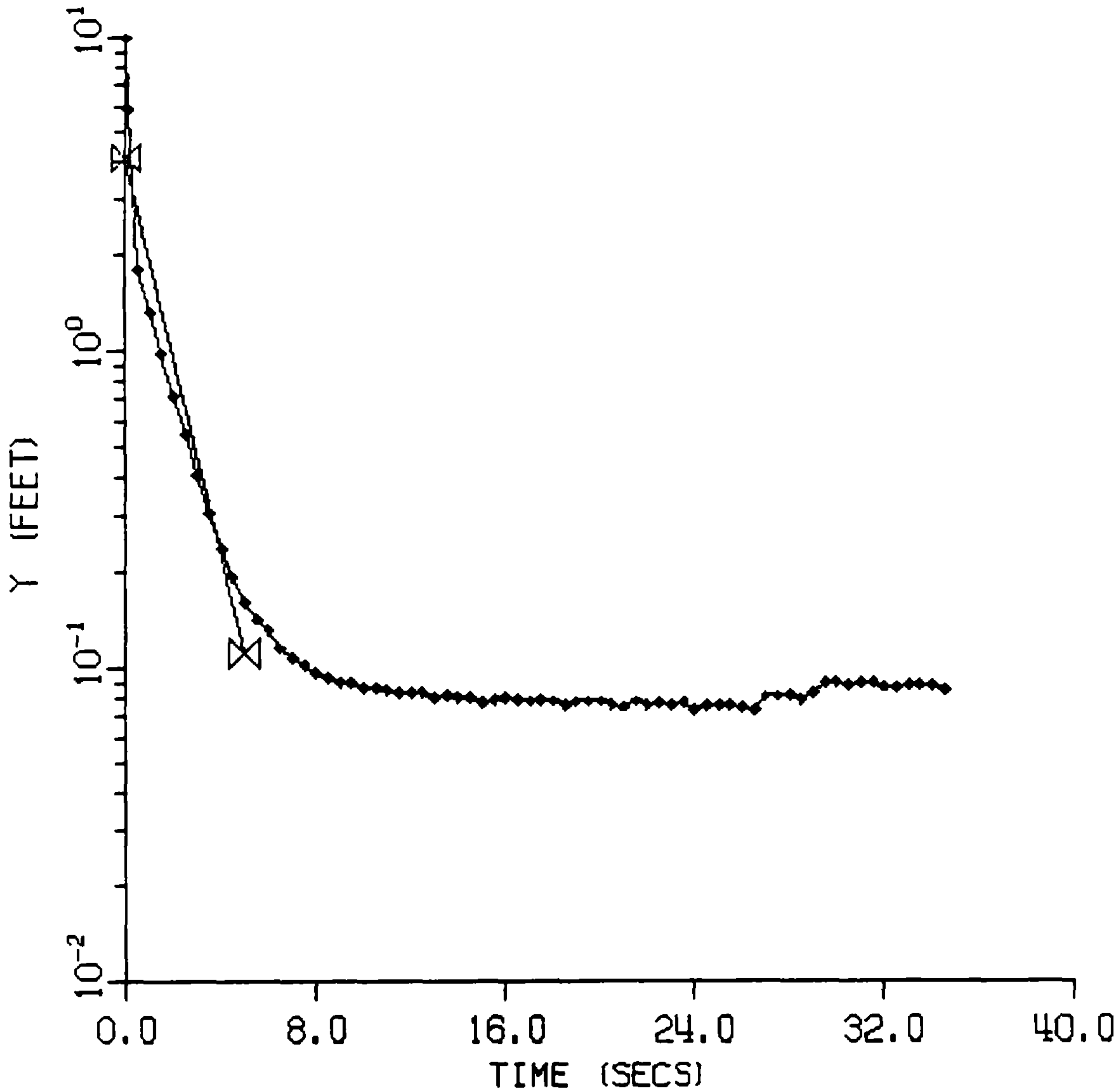
B = 0.60

C = 0.00

Y-INTERCEPT = 2.64

SLOPE = -0.3647

ØNALASKA LANDFILL
MW-1S
TEST 3



K (CM/S) = 0.036110

WELL SPECS. (FEET)

SCREEN LENGTH = 5.8

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 5.84

COEFFICIENTS

A = 3.57

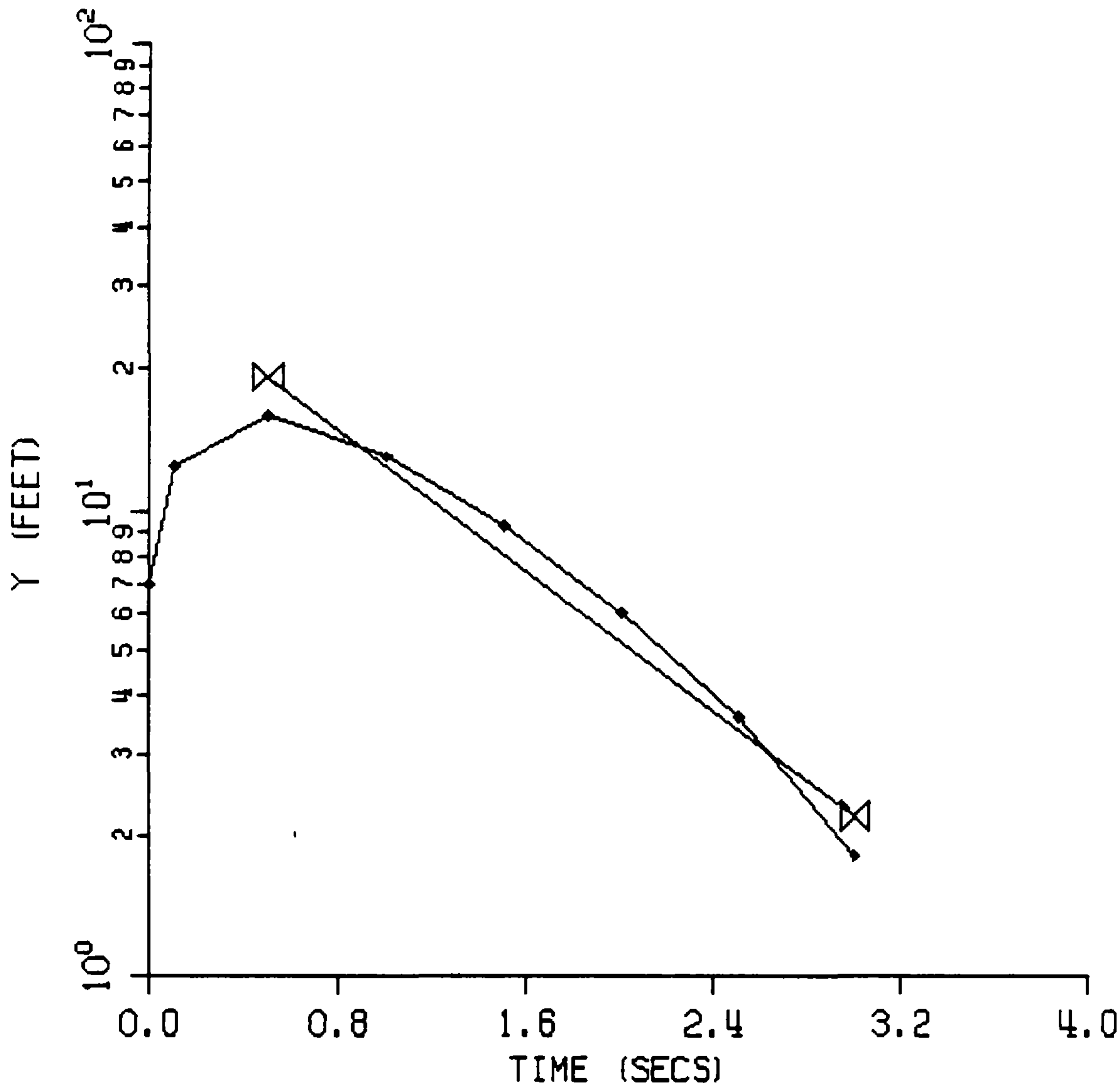
B = 0.60

C = 0.00

Y-INTERCEPT = 4.06

SLOPE = -0.3124

ØNALASKA LANDFILL
MW-1M
TEST 1



K (CM/S) = 0.036630

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

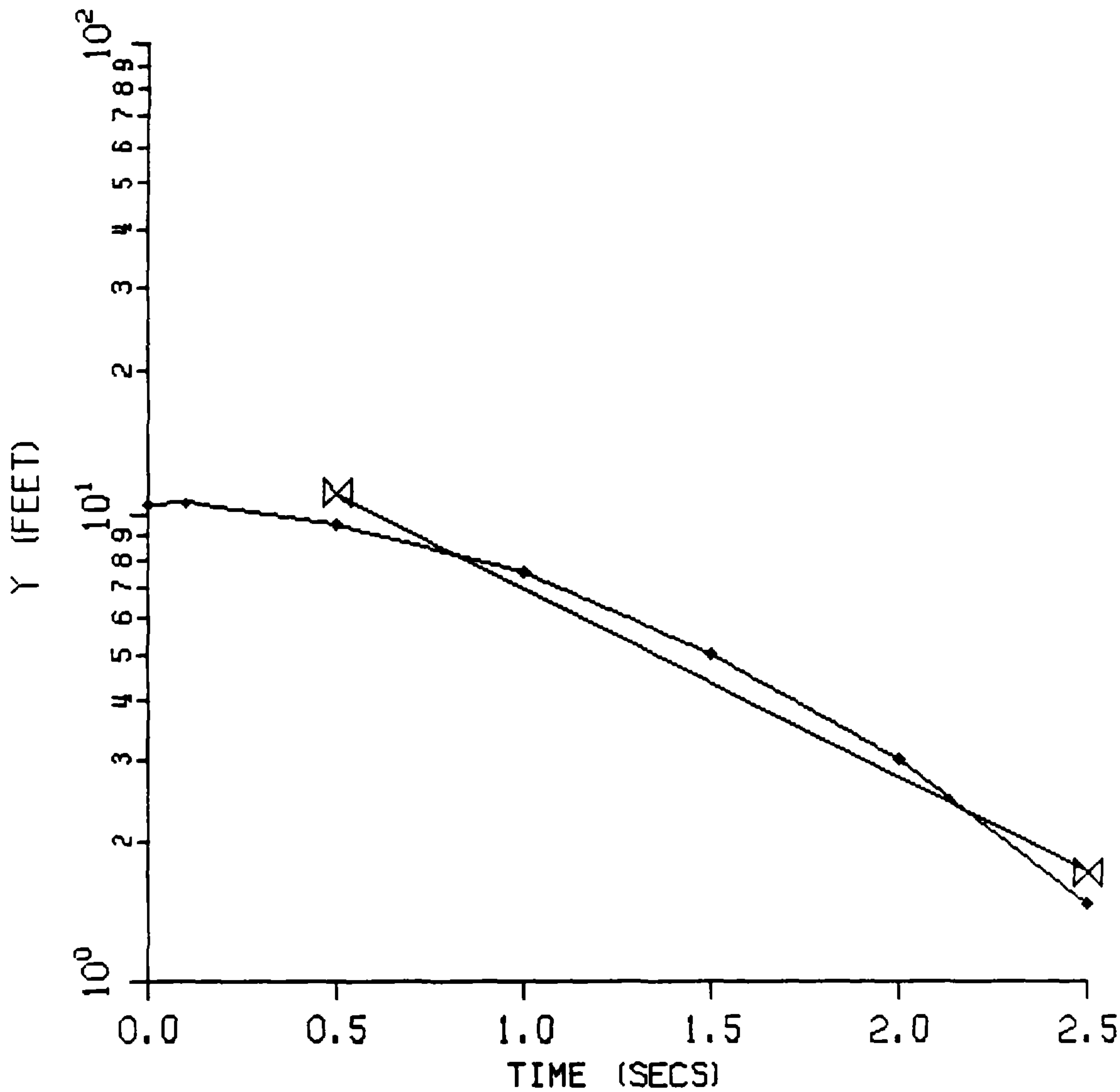
B = 0.82

C = 0.00

Y-INTERCEPT = 29.41

SLOPE = -0.3756

ØNALASKA LANDFILL
MW-1M
TEST 2



K (CM/S) = 0.039394

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

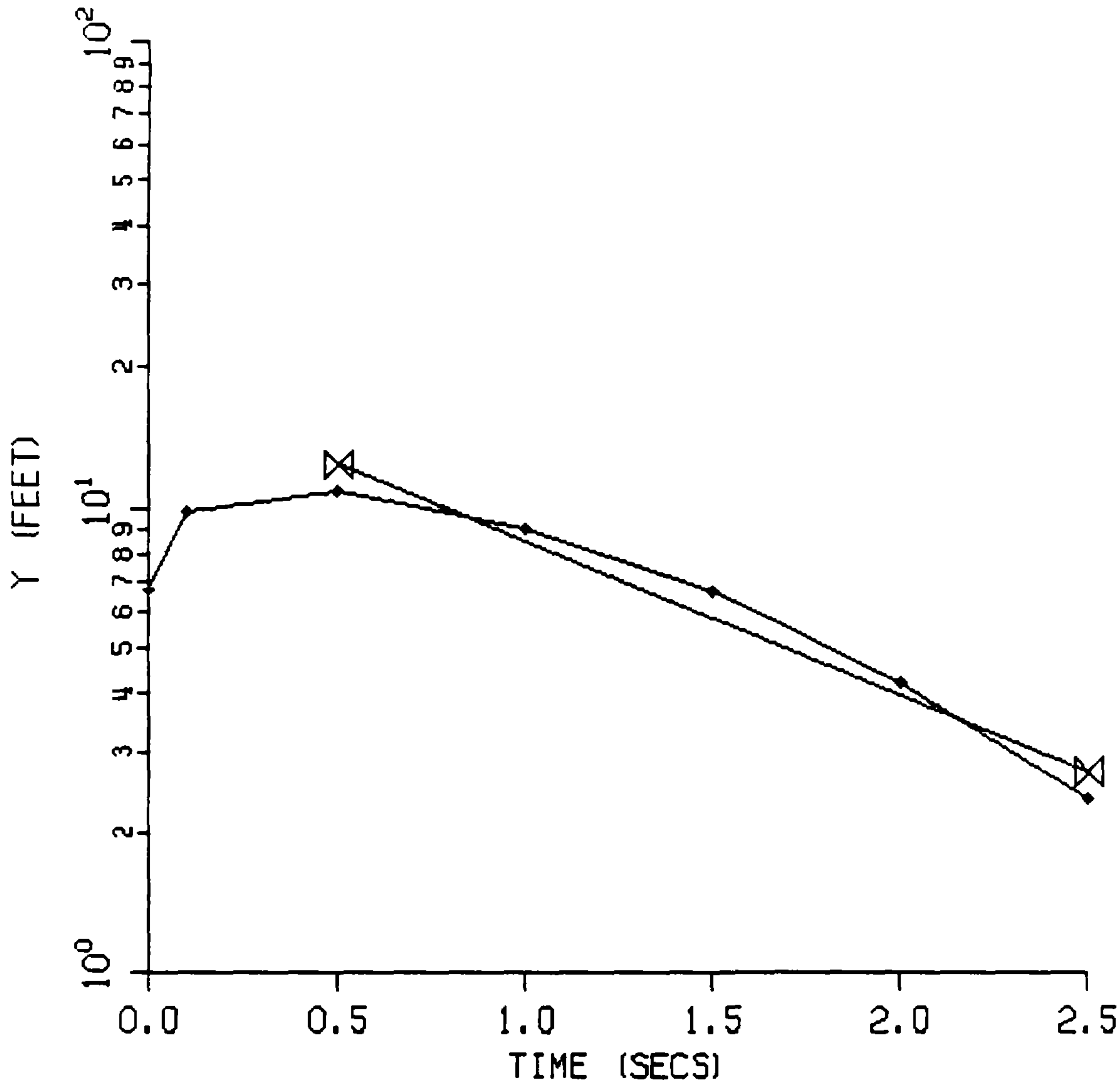
B = 0.82

C = 0.00

Y-INTERCEPT = 17.52

SLOPE = -0.4040

ØNALASKA LANDFILL
MW-1M
TEST 3



K (CM/S) = 0.032188

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

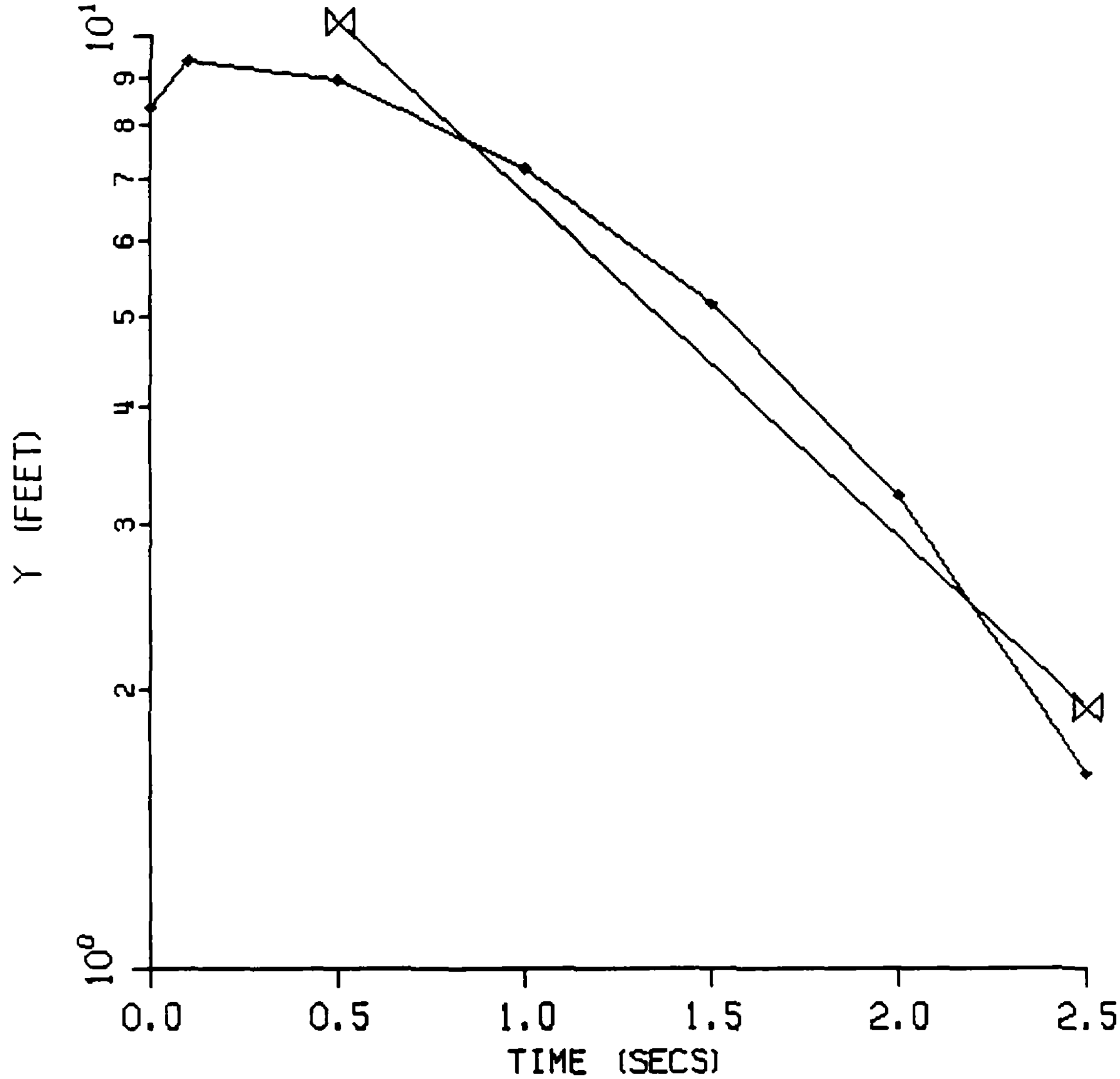
B = 0.82

C = 0.00

Y-INTERCEPT = 18.06

SLOPE = -0.3301

ØNALASKA LANDFILL
MW-2M
TEST 1



K (CM/S) = 0.035767

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

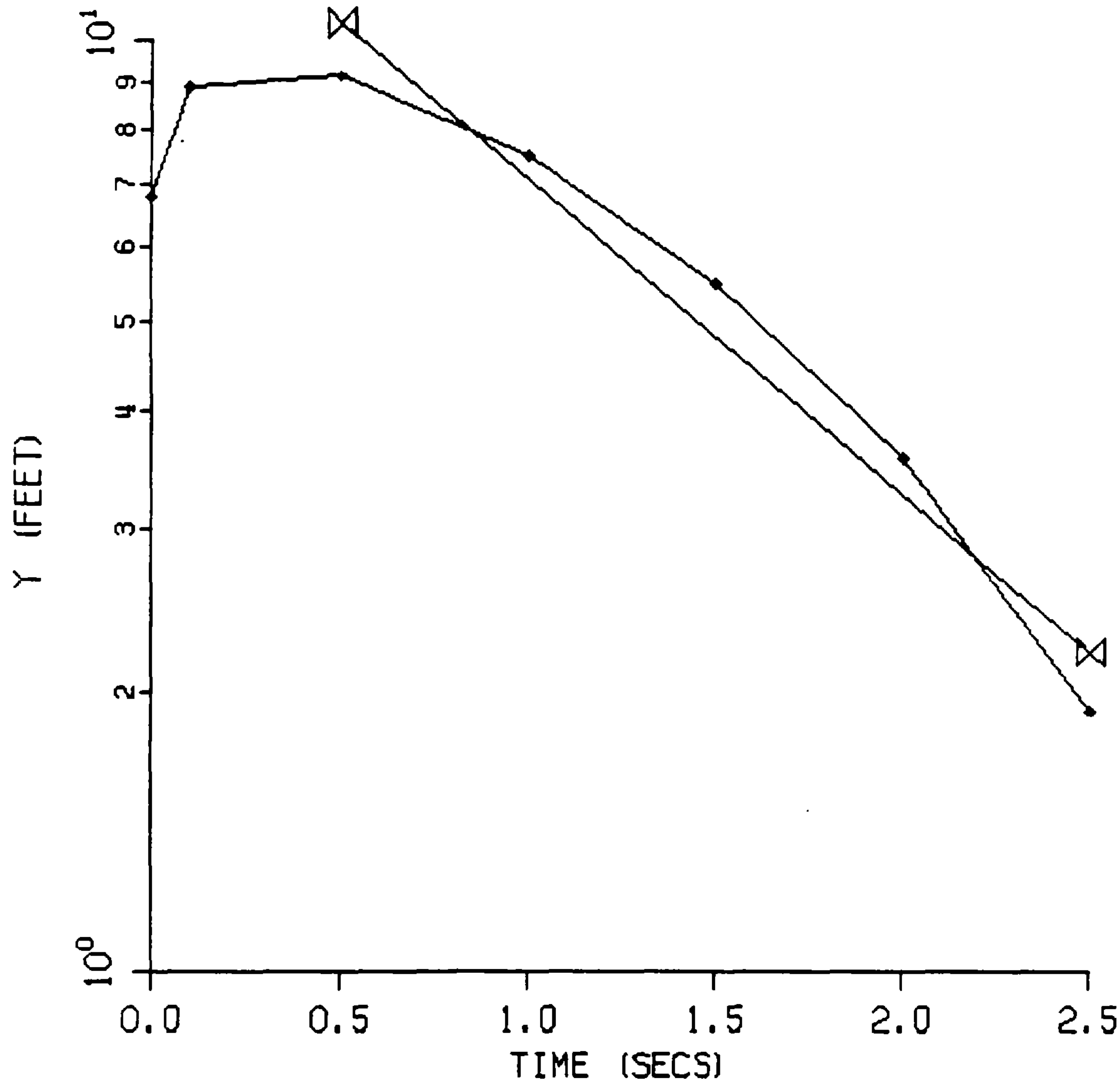
B = 0.82

C = 0.00

Y-INTERCEPT = 15.76

SLOPE = -0.3668

ØNALASKA LANDFILL
MW-2M
TEST 2



K (CM/S) = 0.032852

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

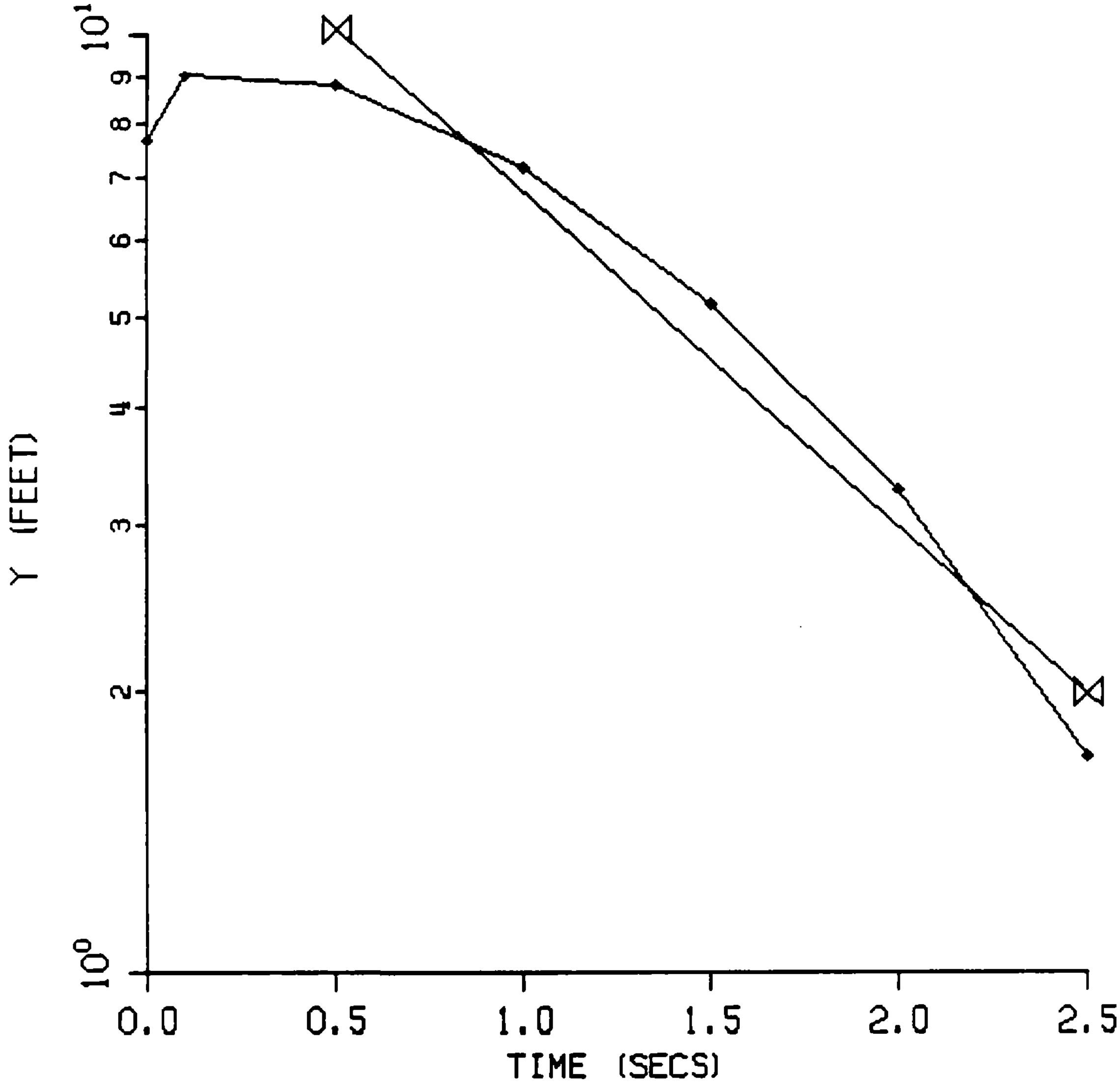
B = 0.82

C = 0.00

Y-INTERCEPT = 15.38

SLOPE = -0.3369

ØNALASKA LANDFILL
MW-2M
TEST 3



K (CM/S) = 0.034497

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 55.60

COEFFICIENTS

A = 4.76

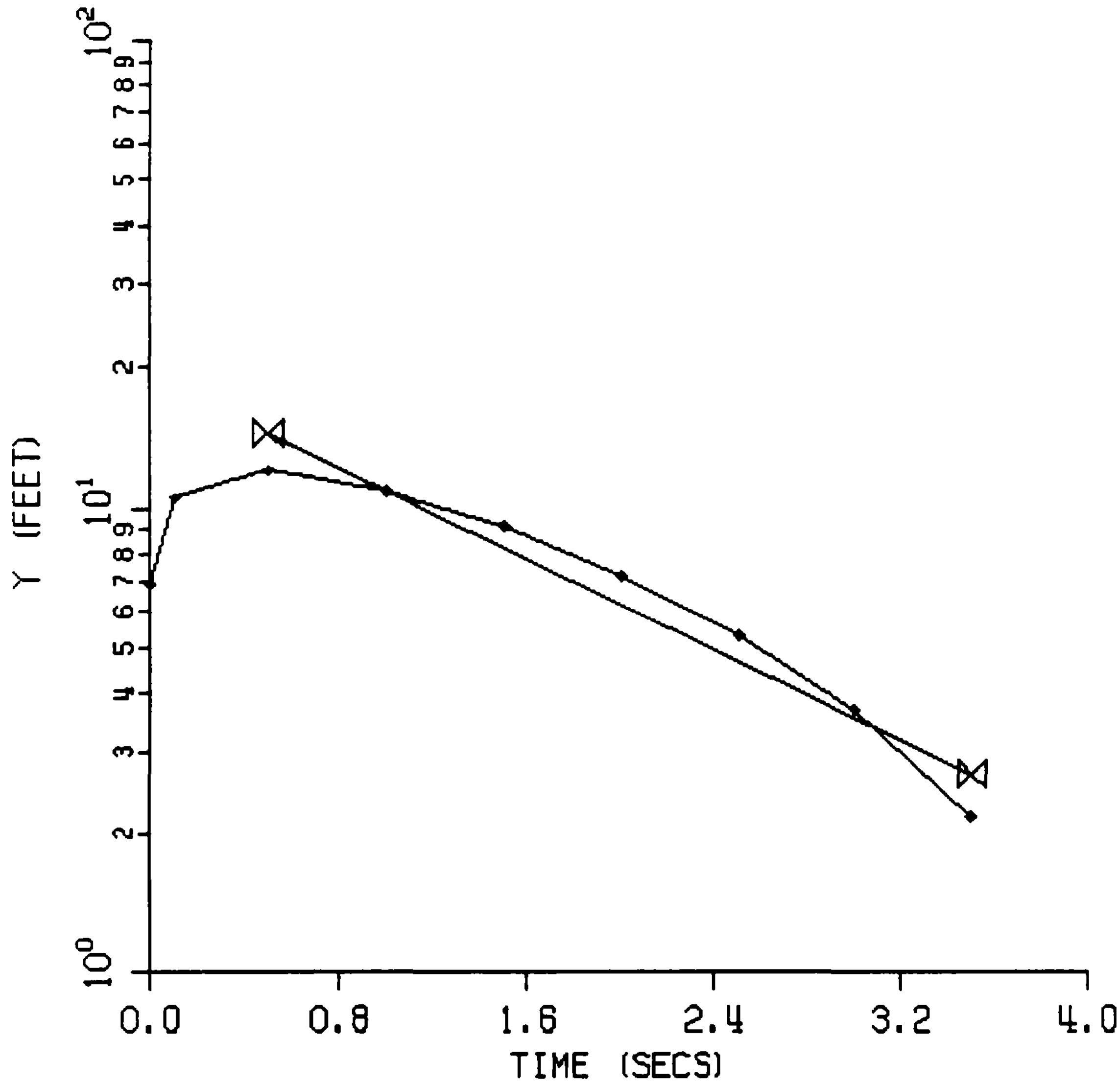
B = 0.82

C = 0.00

Y-INTERCEPT = 15.26

SLOPE = -0.3537

ØNALASKA LANDFILL
MW-2D
TEST 1



K (CM/S) = 0.030967

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 116.80

COEFFICIENTS

A = 0.00

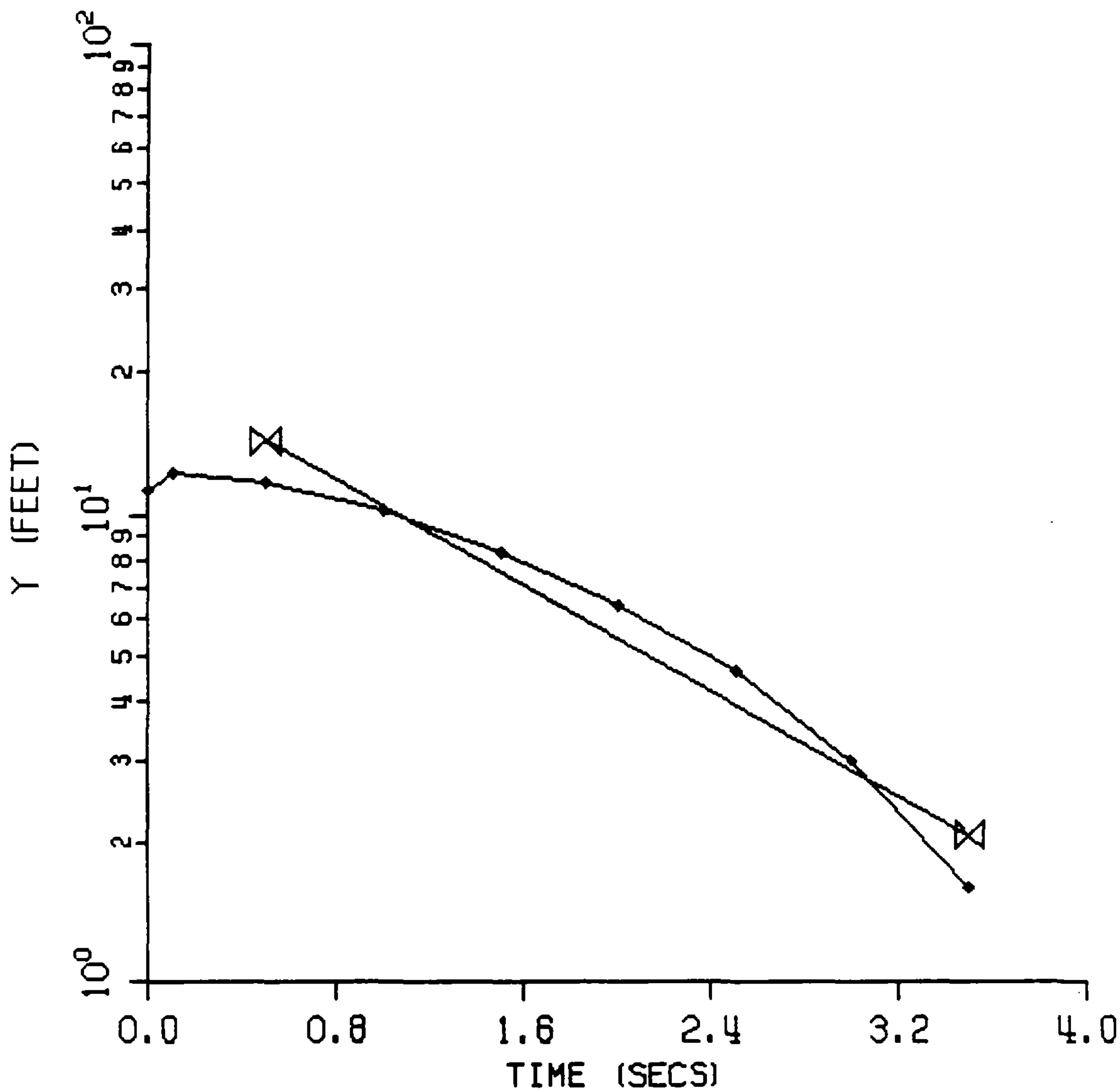
B = 0.00

C = 4.74

Y-INTERCEPT = 19.06

SLOPE = -0.2432

ØNALASKA LANDFILL
MW-2D
TEST 2



K (CM/S) = 0.035611

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 116.80

COEFFICIENTS

A = 0.00

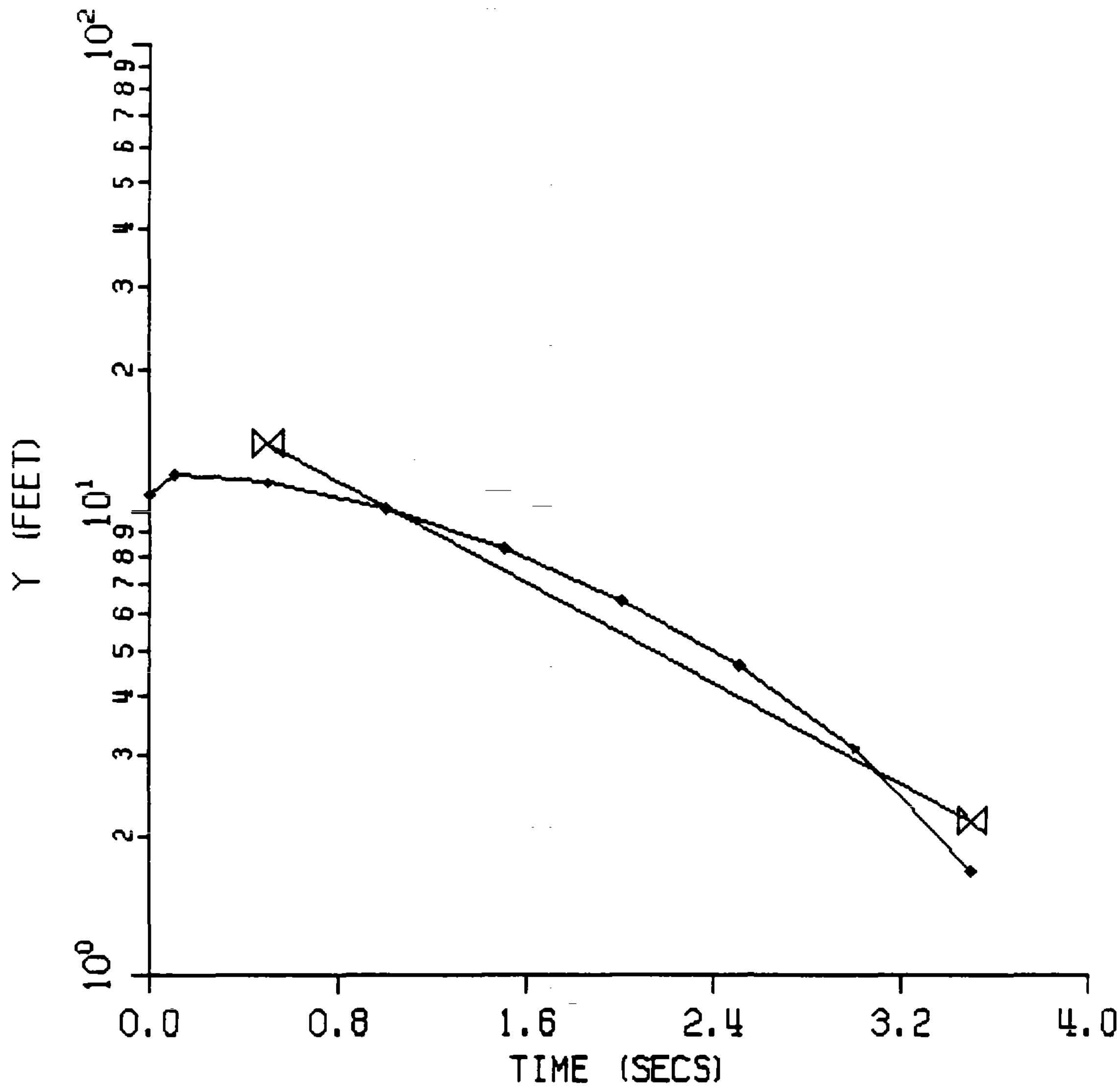
B = 0.00

C = 4.74

Y-INTERCEPT = 19.72

SLOPE = -0.2796

ØNALASKA LANDFILL
MW-2D
TEST 3



K (CM/S) = 0.034363

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 116.80

COEFFICIENTS

A = 0.00

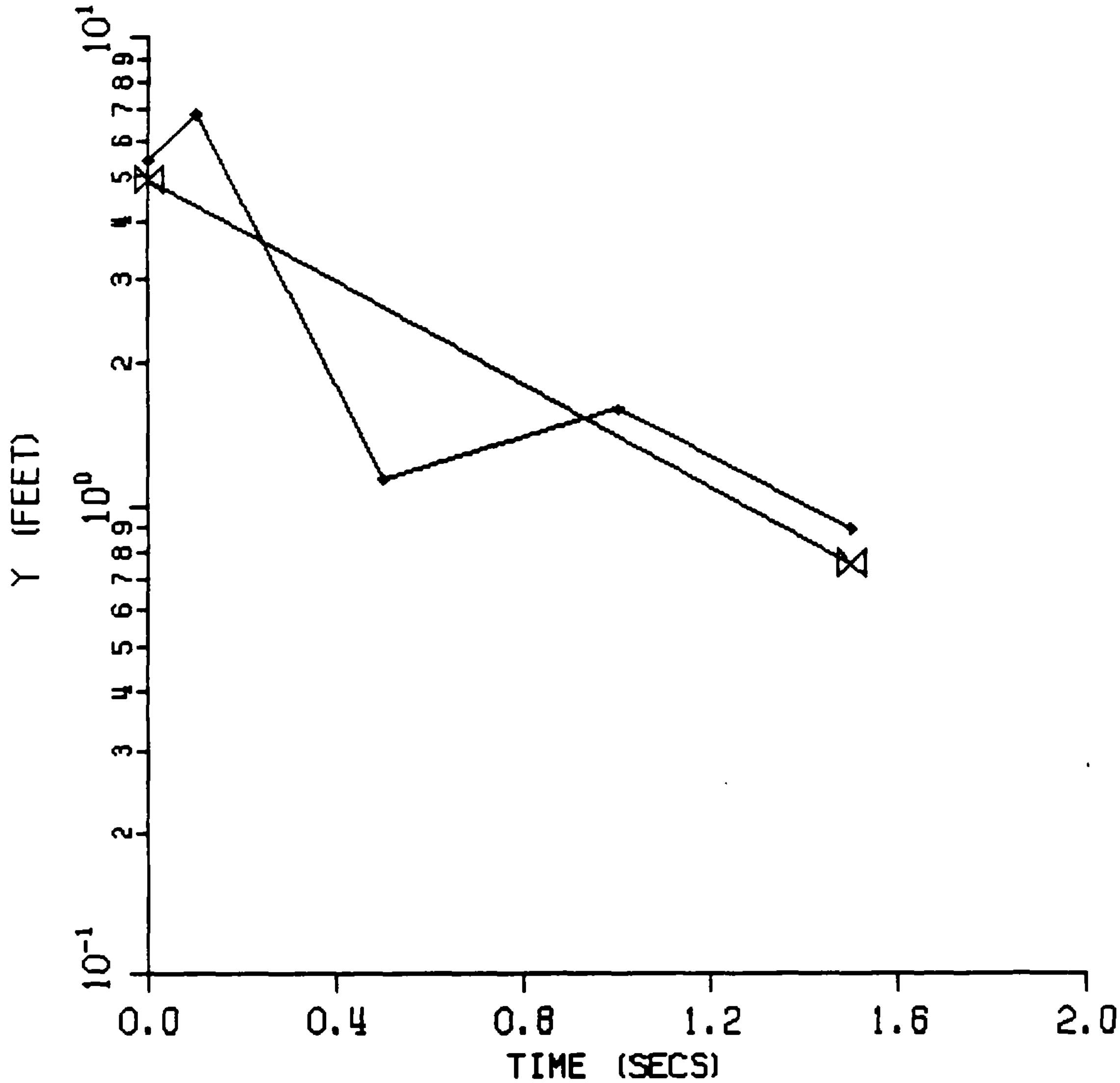
B = 0.00

C = 4.74

Y-INTERCEPT = 18.95

SLOPE = -0.2698

ØNALASKA LANDFILL
MW-3M
TEST 1



K (CM/S) = 0.054232

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 68.20

COEFFICIENTS

A = 4.76

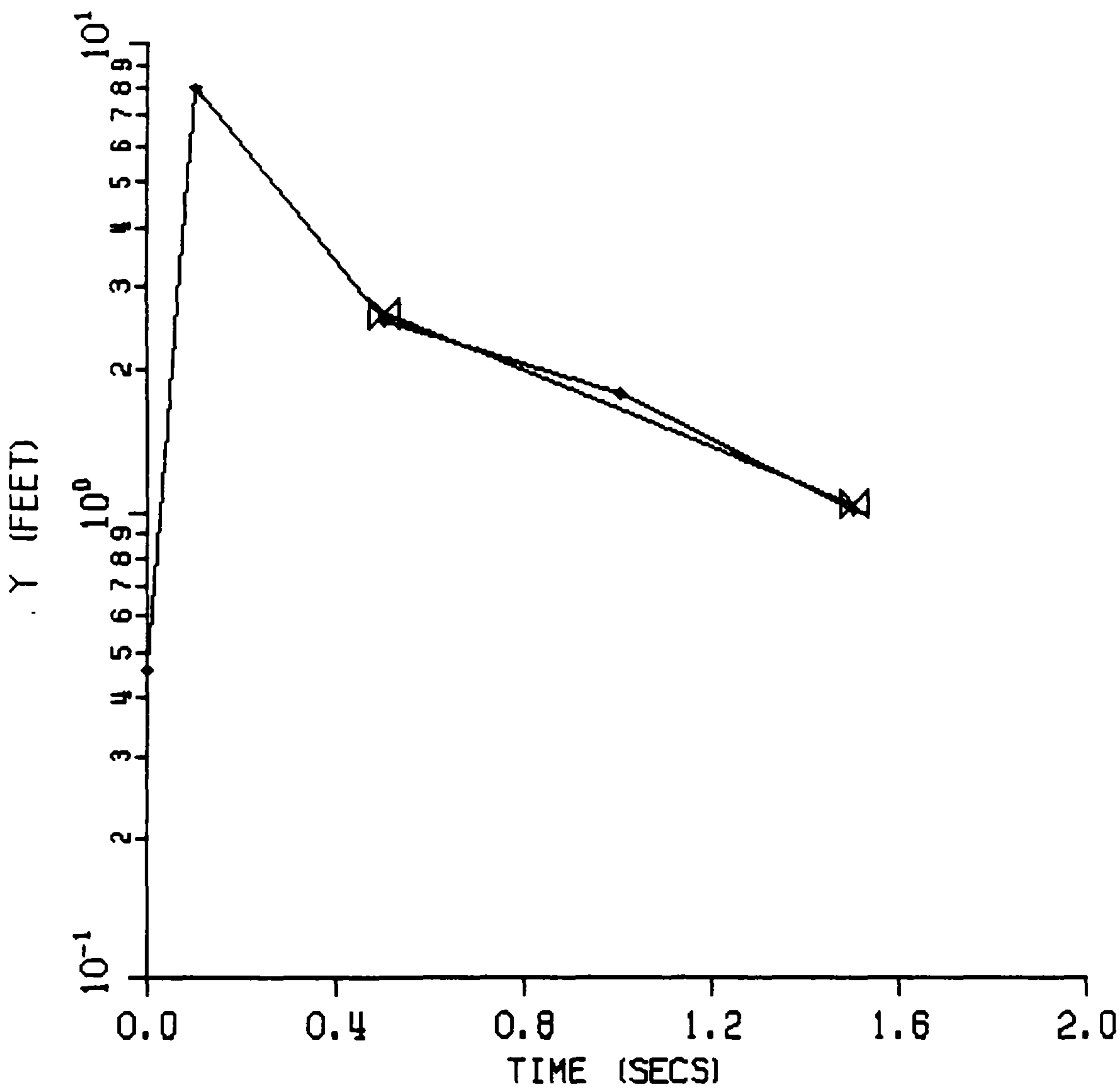
B = 0.82

C = 0.00

Y-INTERCEPT = 4.93

SLOPE = -0.5447

ØNALASKA LANDFILL
MW-3M
TEST 2



K (CM/S) = 0.040155

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 68.20

COEFFICIENTS

A = 4.76

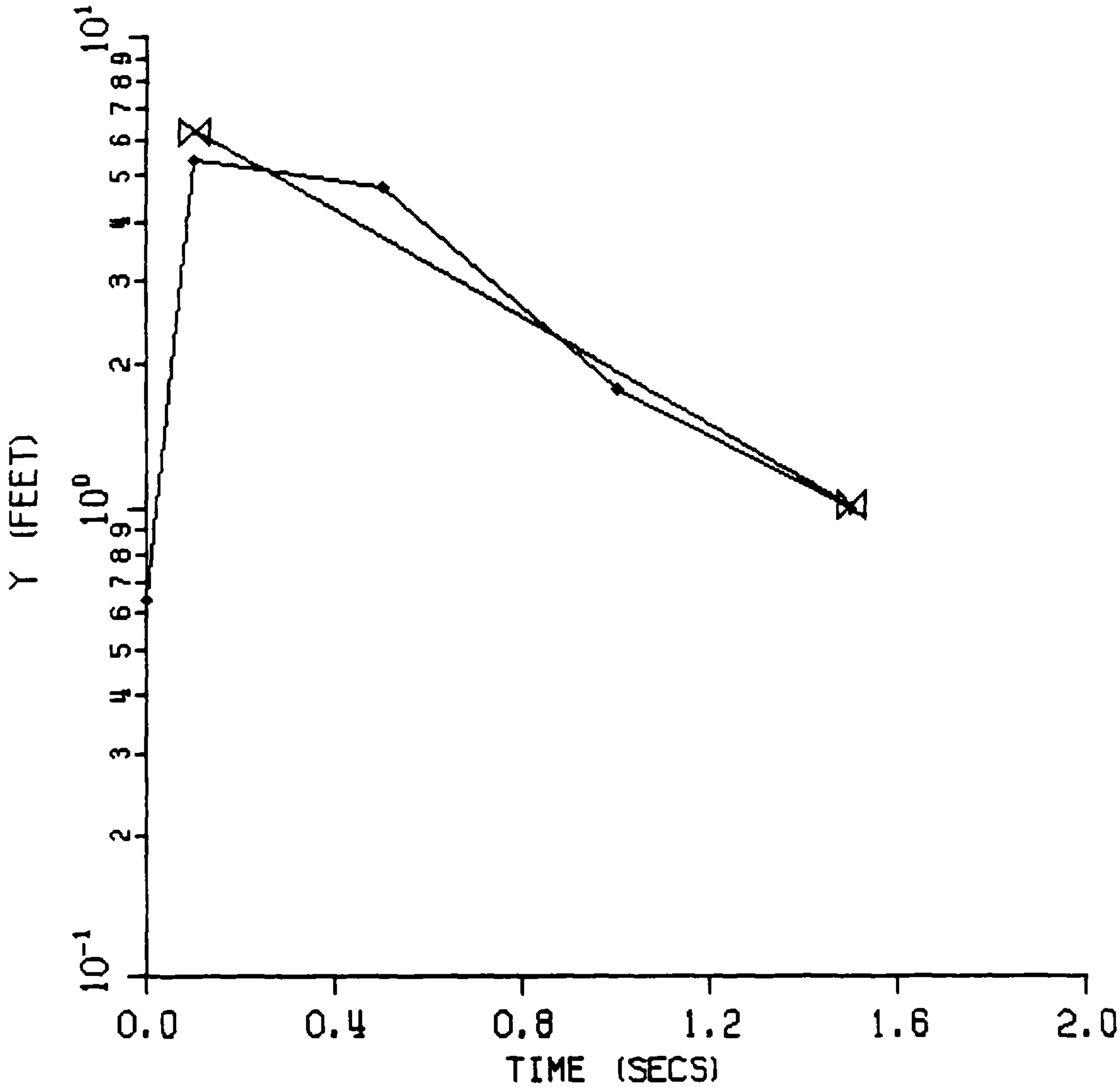
B = 0.82

C = 0.00

Y-INTERCEPT = 4.18

SLOPE = -0.4033

ØNALASKA LANDFILL
MW-3M
TEST 3



K (CM/S) = 0.056394

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 68.20

COEFFICIENTS

A = 4.76

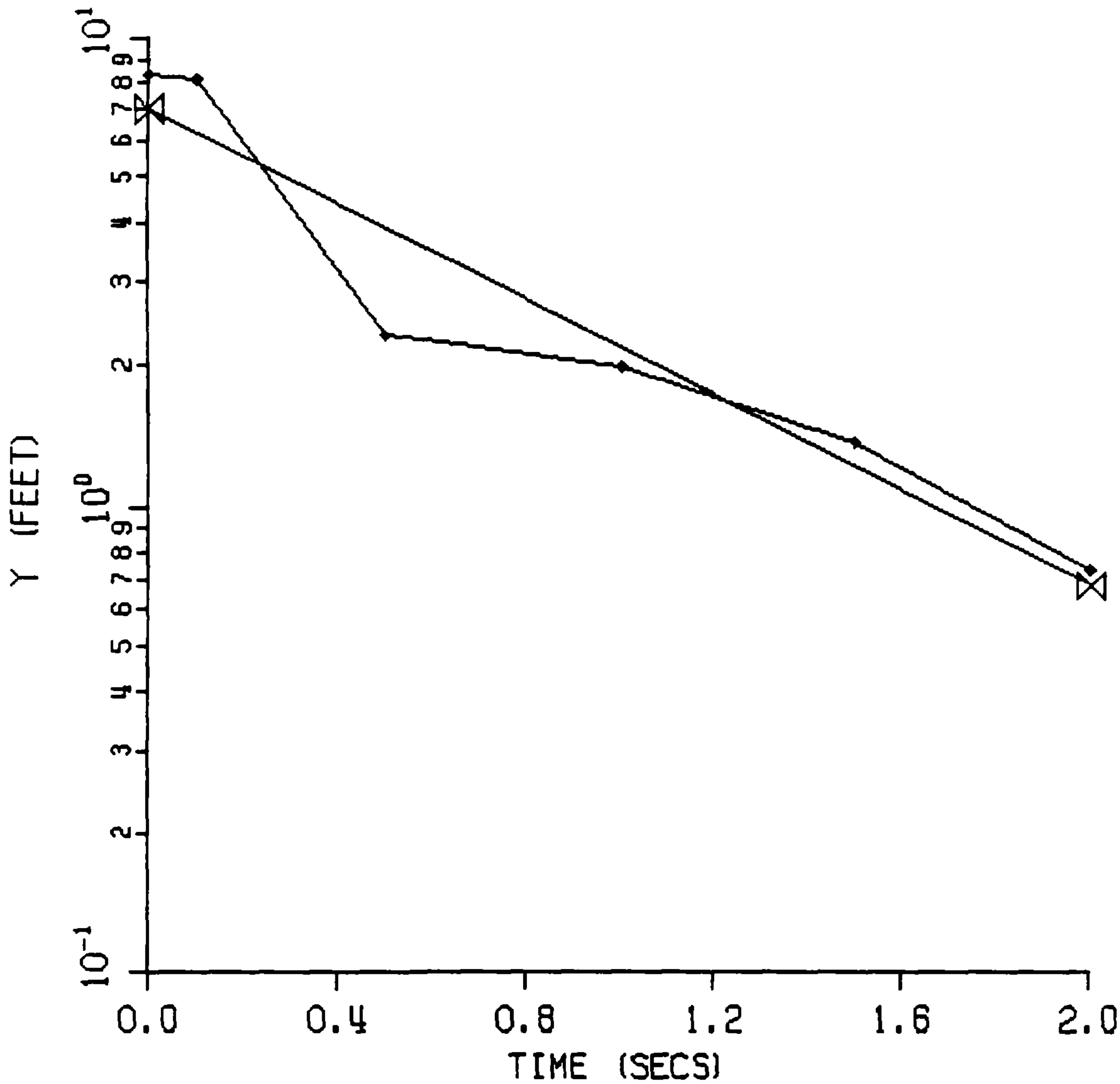
B = 0.82

C = 0.00

Y-INTERCEPT = 7.13

SLOPE = -0.5664

ØNALASKA LANDFILL
MW-3D
TEST 1



K (CM/S) = 0.065404

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 128.60

COEFFICIENTS

A = 0.00

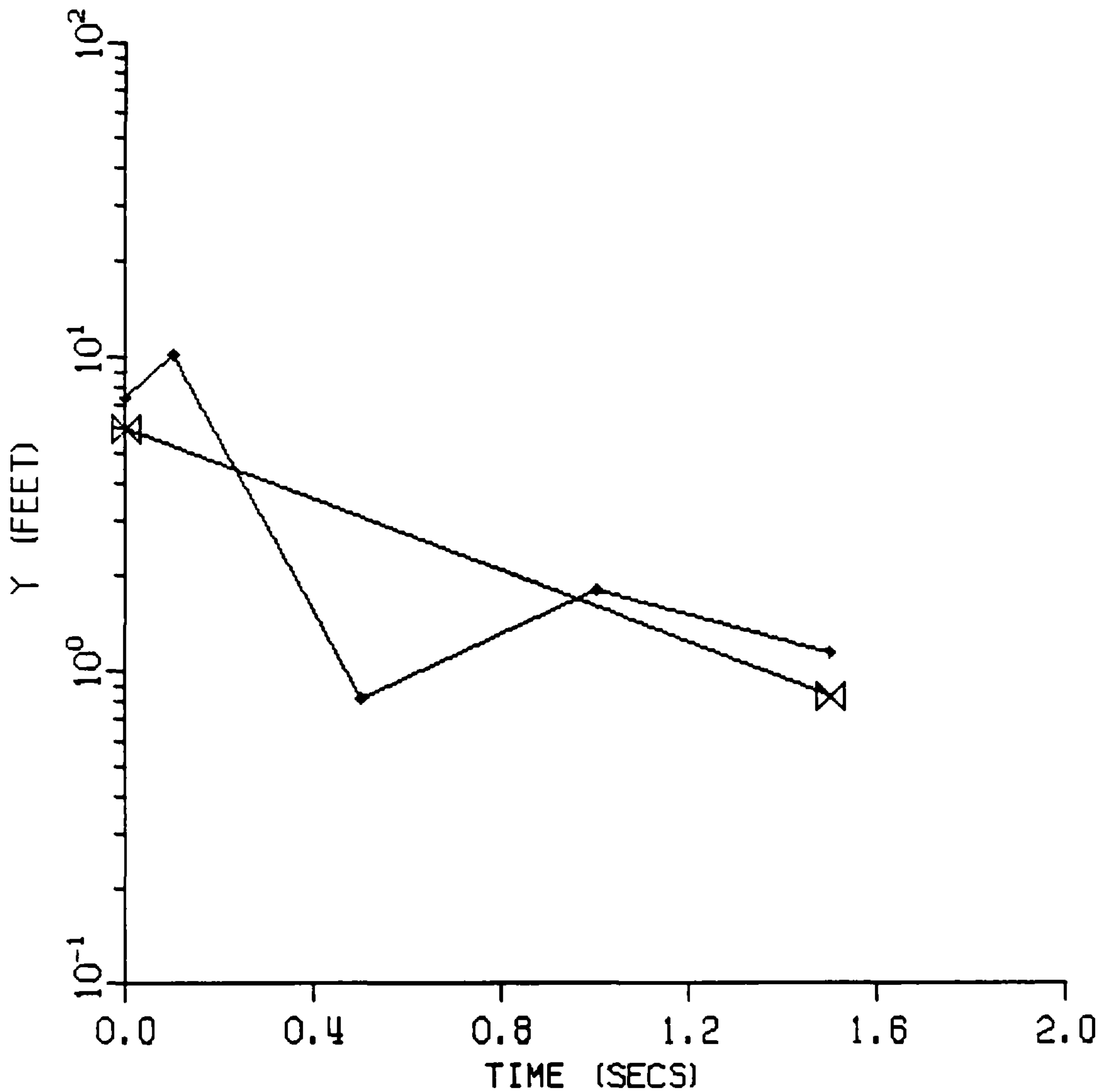
B = 0.00

C = 4.74

Y-INTERCEPT = 7.01

SLOPE = -0.5082

ØNALASKA LANDFILL
MW-3D
TEST 2



K (CM/S) = 0.073429

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 128.60

COEFFICIENTS

A = 0.00

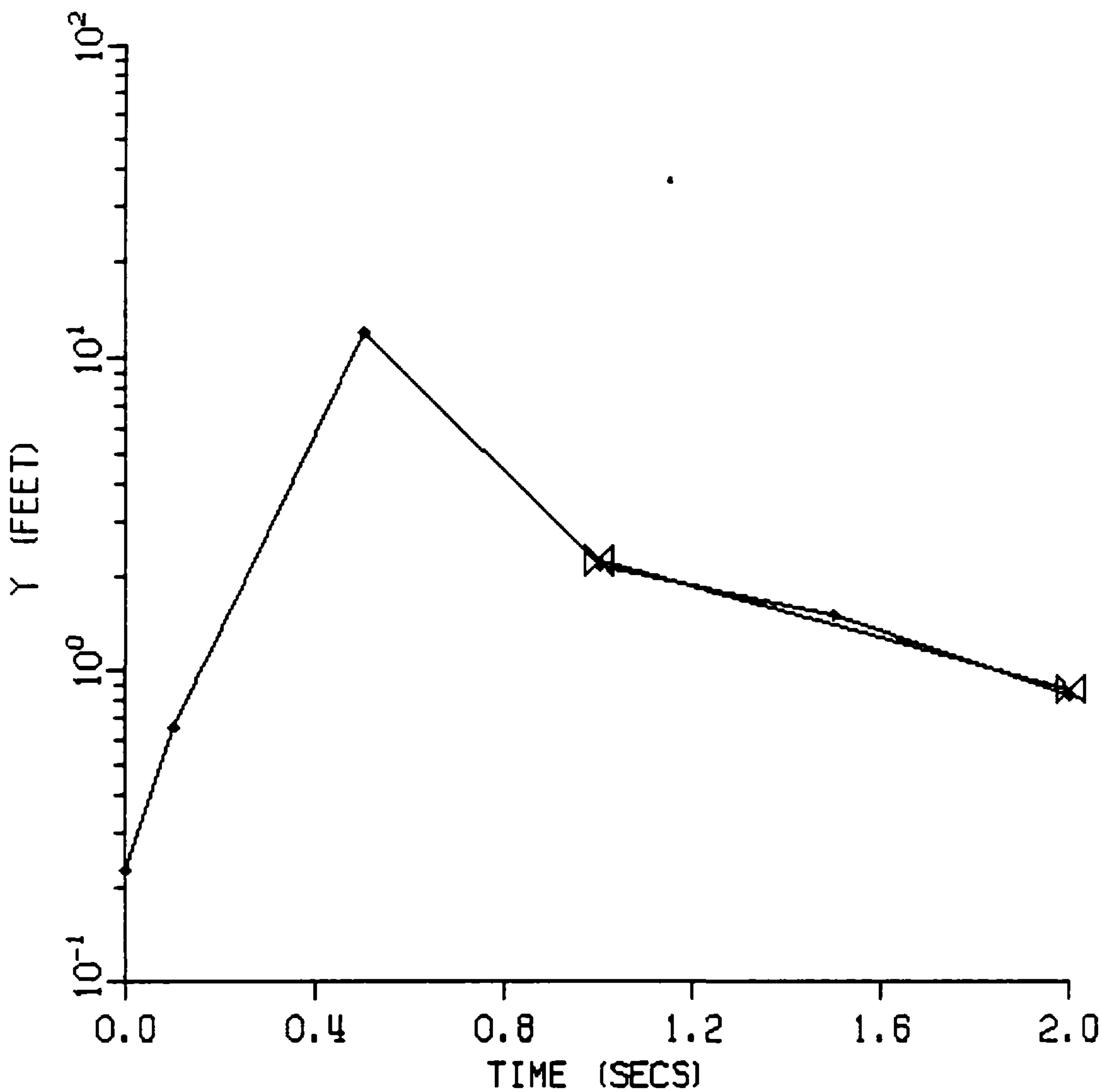
B = 0.00

C = 4.74

Y-INTERCEPT = 5.94

SLOPE = -0.5706

ØNALASKA LANDFILL
MW-3D
TEST 3



K (CM/S) = 0.053289

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 128.60

COEFFICIENTS

A = 0.00

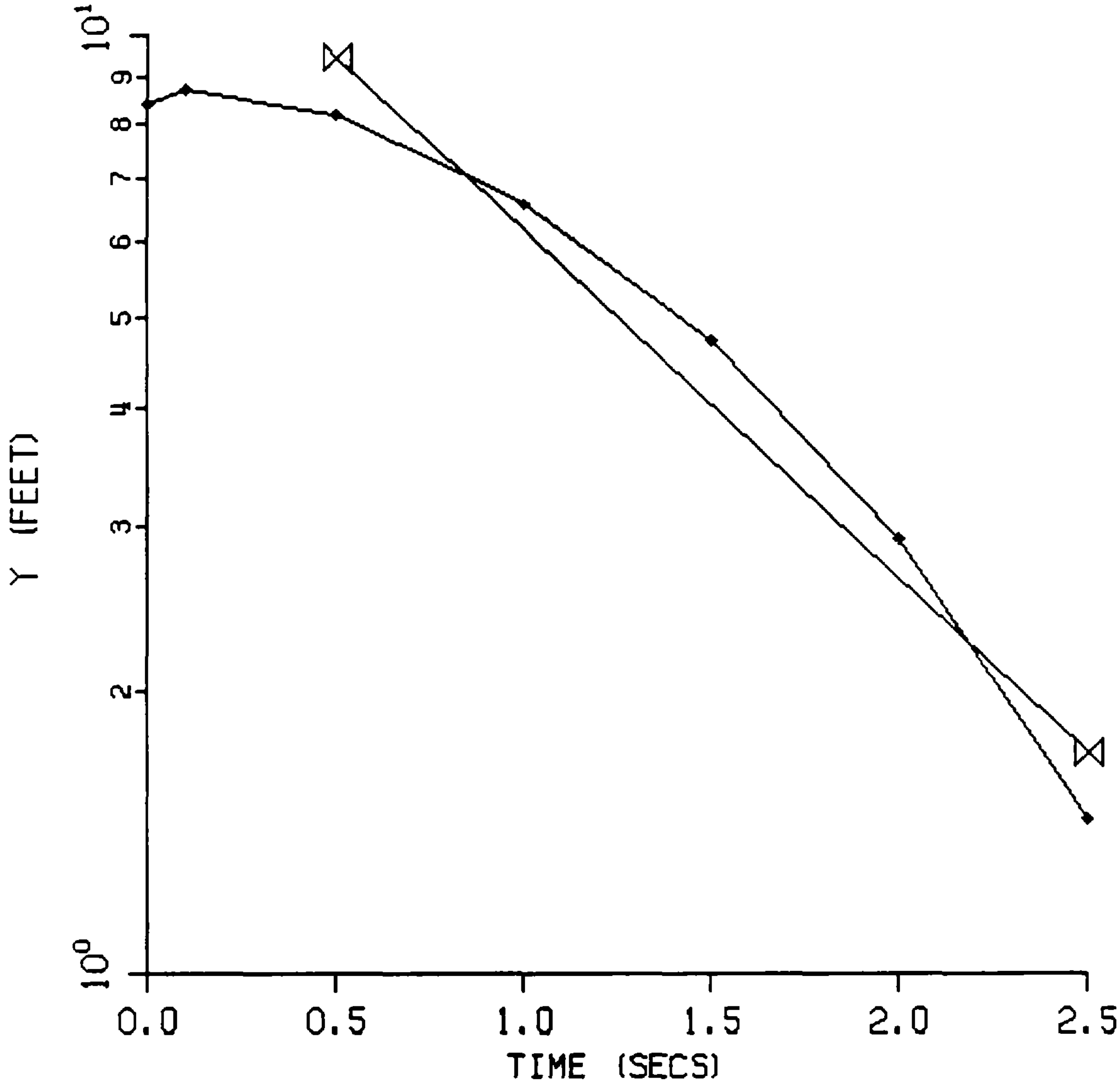
B = 0.00

C = 4.74

Y-INTERCEPT = 5.84

SLOPE = -0.4141

ØNALASKA LANDFILL
MW-7M
TEST 1



K (CM/S) = 0.036418

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 60.00

COEFFICIENTS

A = 4.76

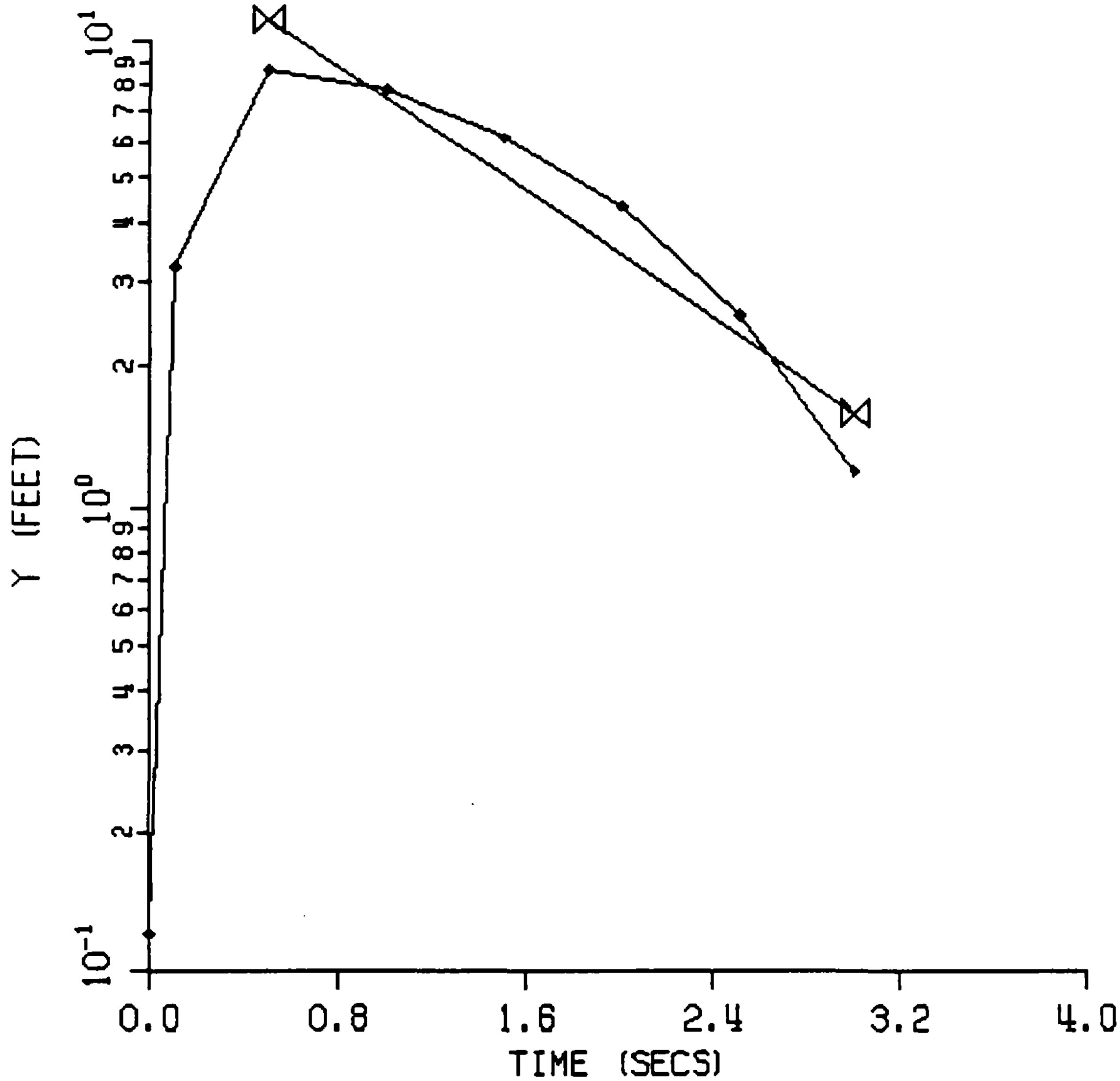
B = 0.82

C = 0.00

Y-INTERCEPT = 14.54

SLOPE = -0.3705

ØNALASKA LANDFILL
MW-7M
TEST 2



K (CM/S) = 0.033165

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 60.00

COEFFICIENTS

A = 4.76

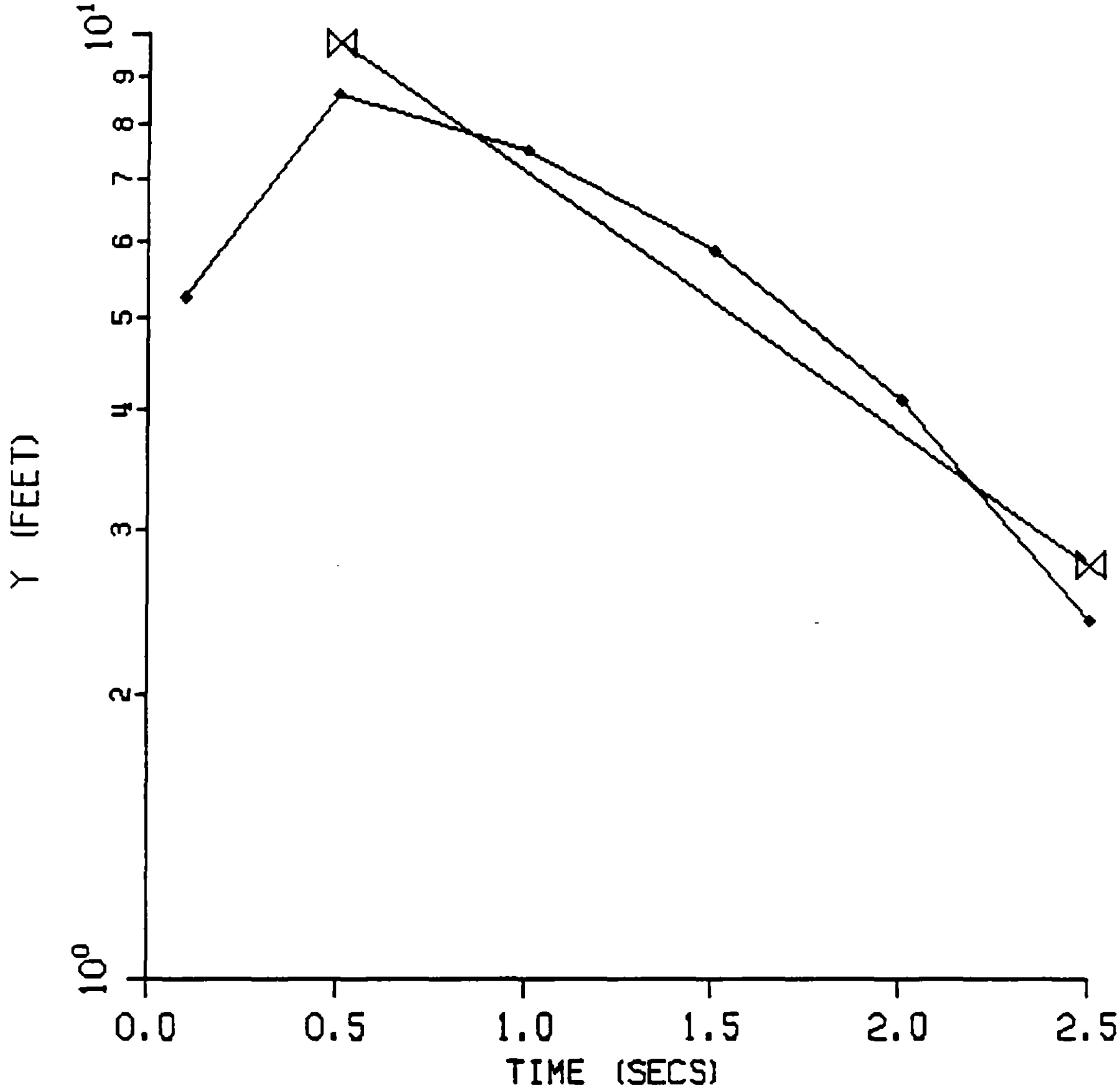
B = 0.82

C = 0.00

Y-INTERCEPT = 16.36

SLOPE = -0.3374

ØNALASKA LANDFILL
MW-7M
TEST 3



K (CM/S) = 0.027044

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 60.00

COEFFICIENTS

A = 4.76

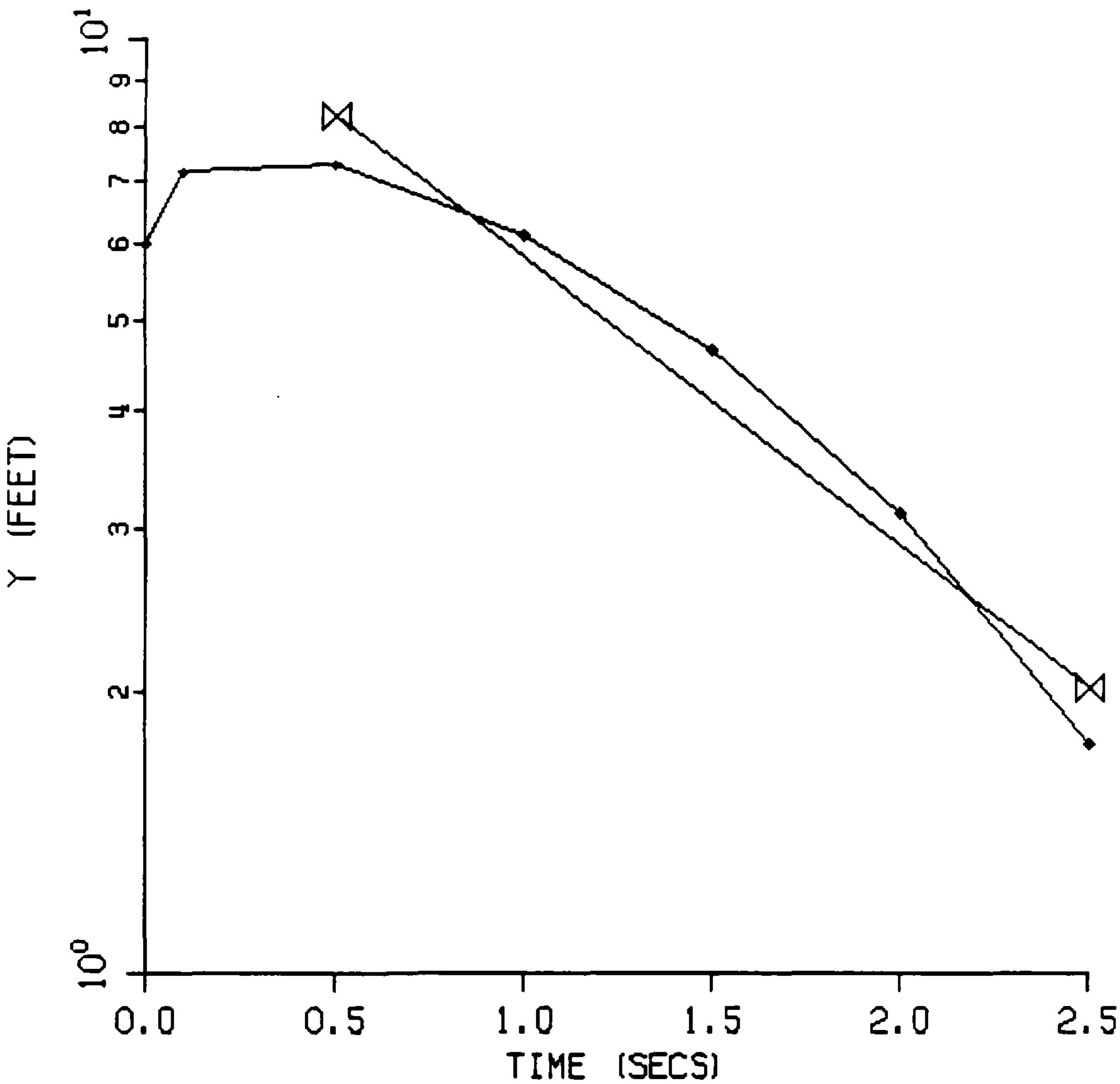
B = 0.82

C = 0.00

Y-INTERCEPT = 13.46

SLOPE = -0.2751

ØNALASKA LANDFILL
MW-8M
TEST 1



K (CM/S) = 0.029835

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 56.80

COEFFICIENTS

A = 4.76

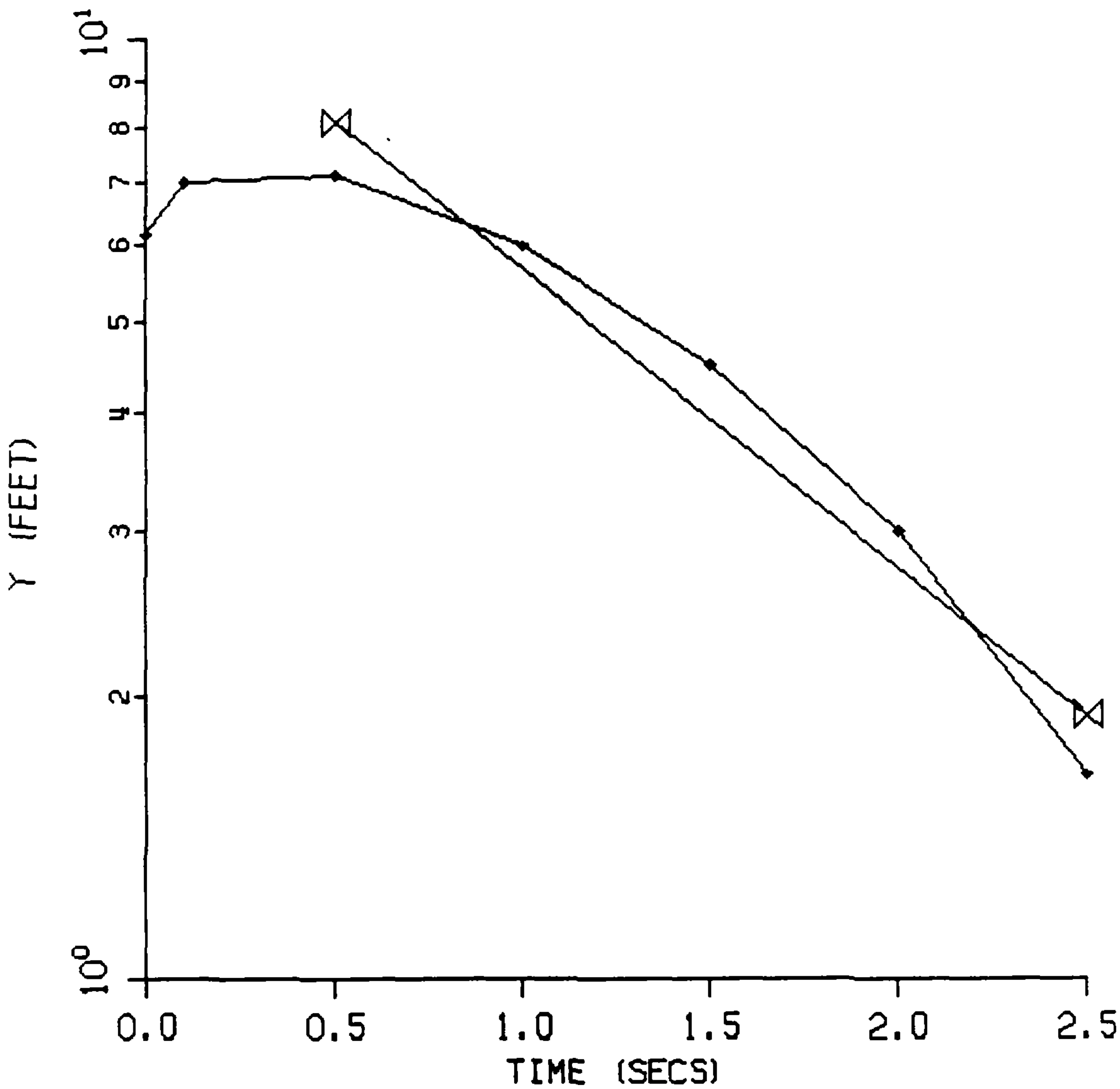
B = 0.82

C = 0.00

Y-INTERCEPT = 11.72

SLOPE = -0.3053

ØNALASKA LANDFILL
MW-8M
TEST 2



K (CM/S) = 0.030766

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 56.80

COEFFICIENTS

A = 4.76

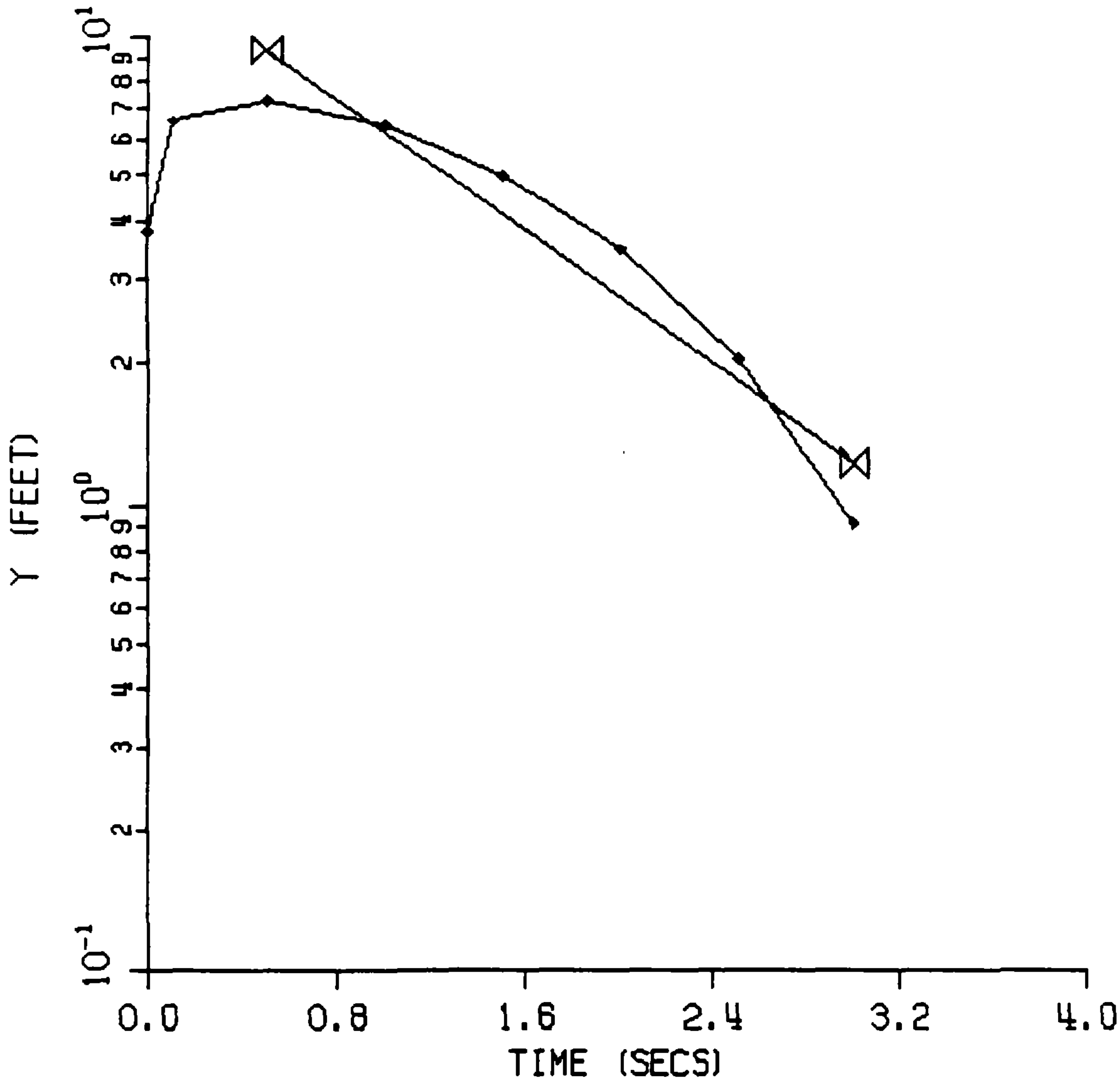
B = 0.82

C = 0.00

Y-INTERCEPT = 11.70

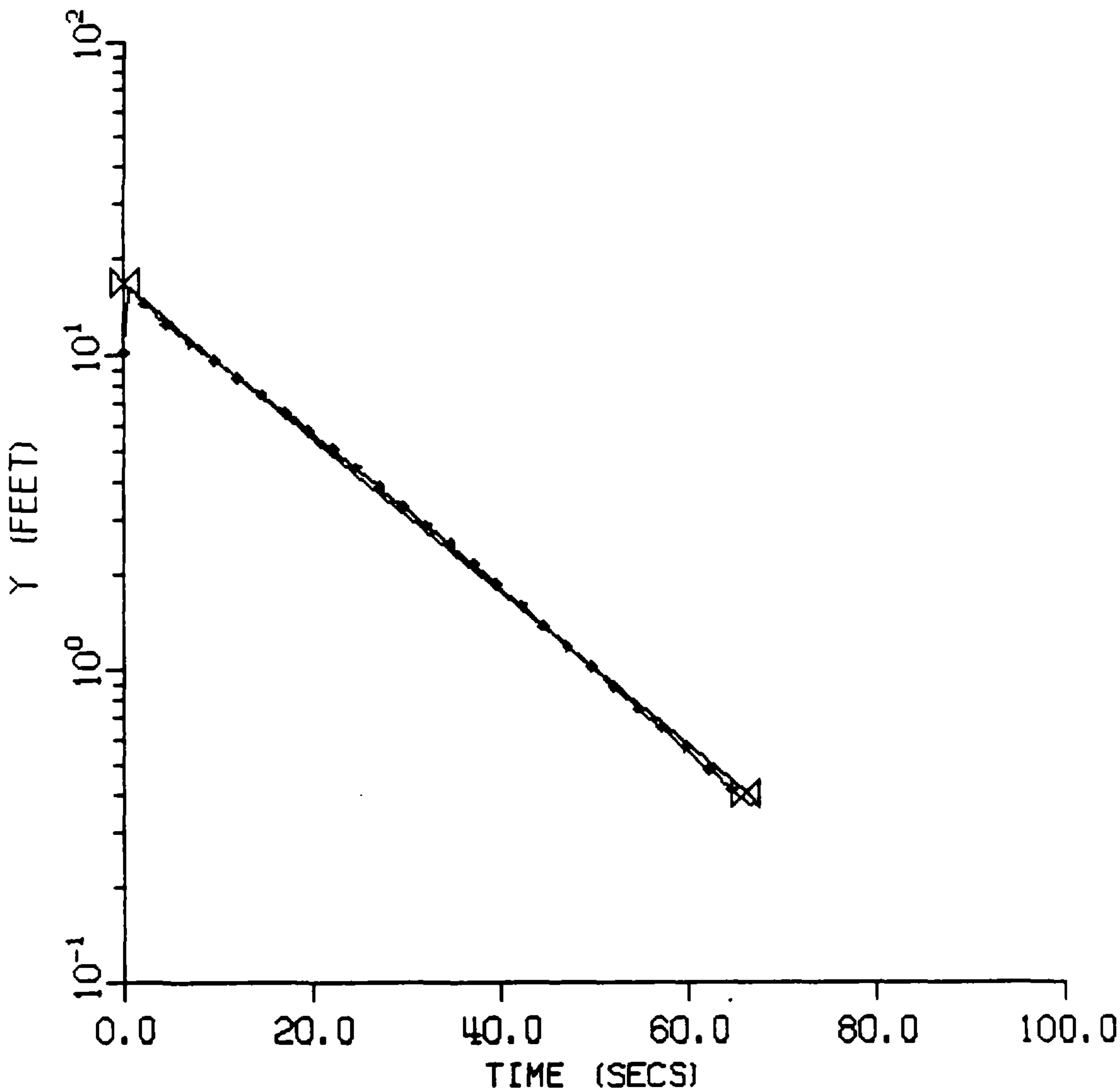
SLOPE = -0.3148

ØNALASKA LANDFILL
MW-8M
TEST 3



K (CM/S) = 0.034502	COEFFICIENTS
WELL SPECS. (FEET)	A = 4.76
SCREEN LENGTH = 10.0	B = 0.82
WELL SCREEN/BORE RADIUS = 0.08	C = 0.00
WELL CASING RADIUS = 0.08	Y-INTERCEPT = 14.02
AQUIFER THICKNESS = 130.0	SLOPE = -0.3530
H (FEET) = 56.80	

ØNALASKA LANDFILL
MW-8D
TEST 1



K (CM/S) = 0.003129

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 117.10

COEFFICIENTS

A = 0.00

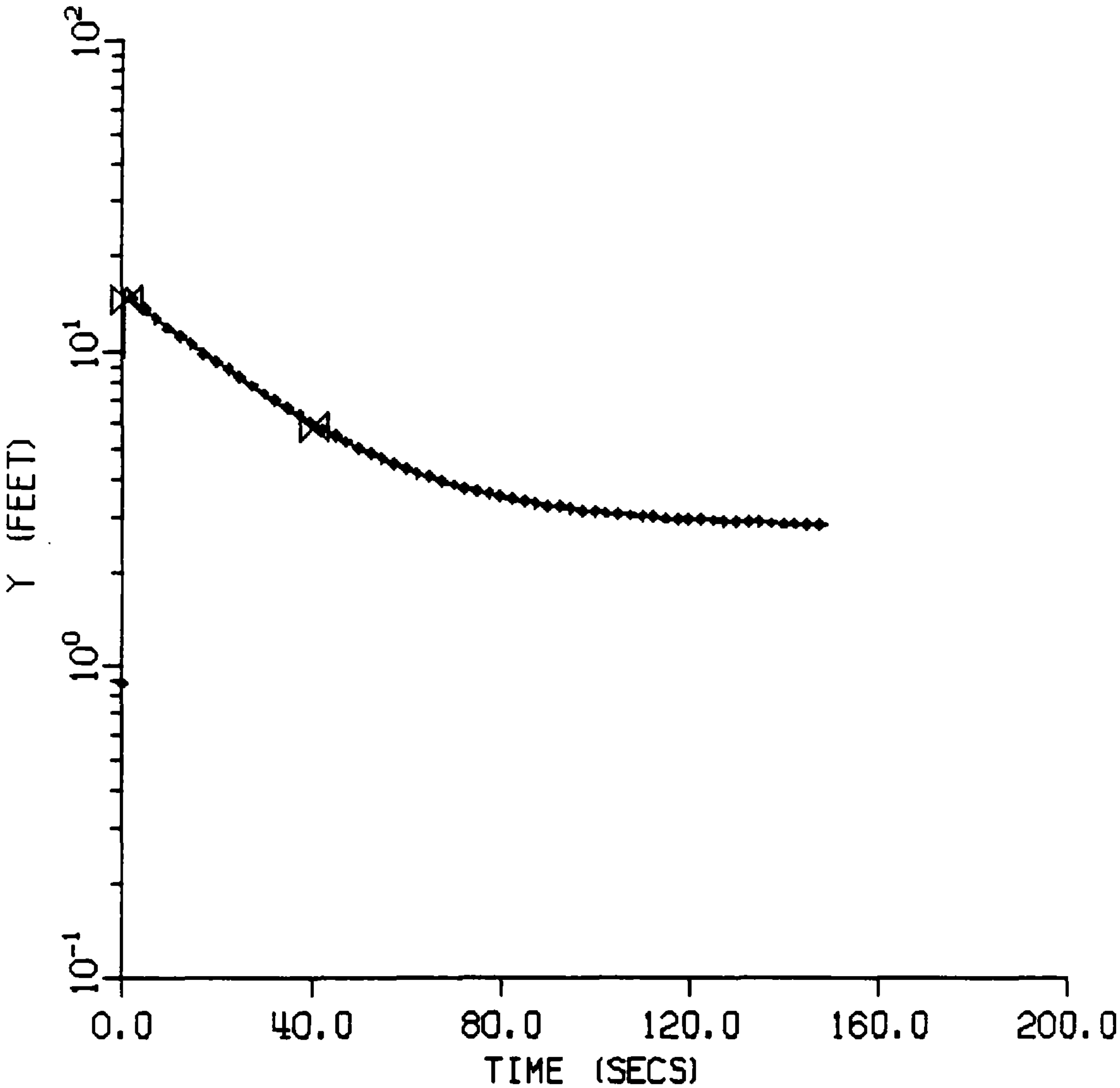
B = 0.00

C = 4.74

Y-INTERCEPT = 16.79

SLOPE = -0.0246

ØNALASKA LANDFILL
MW-8D
TEST 2



K (CM/S) = 0.001324

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 117.10

COEFFICIENTS

A = 0.00

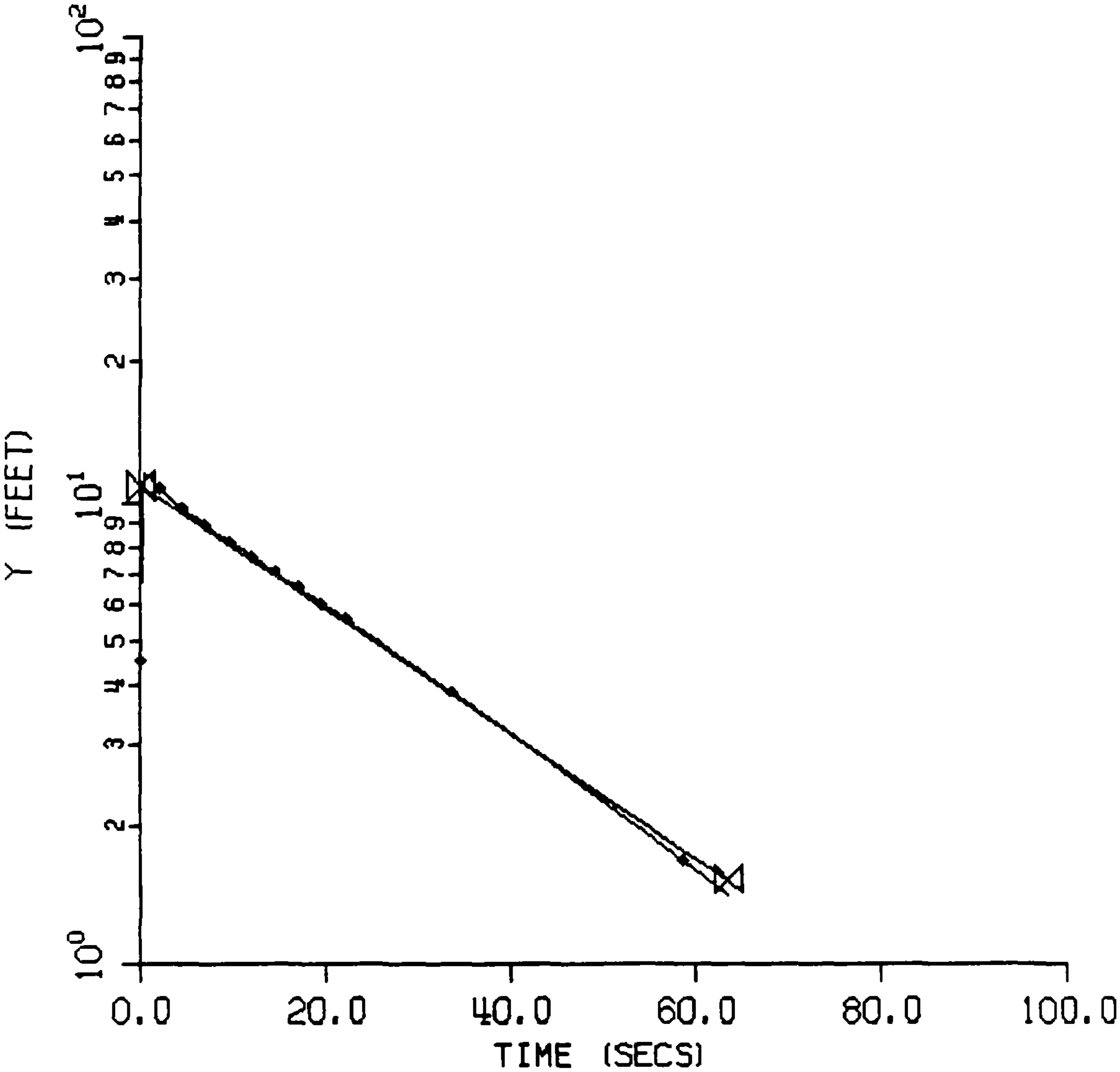
B = 0.00

C = 4.74

Y-INTERCEPT = 15.04

SLOPE = -0.0104

ØNALASKA LANDFILL
MW-8D
TEST 3



K (CM/S) = 0.001709

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 117.10

COEFFICIENTS

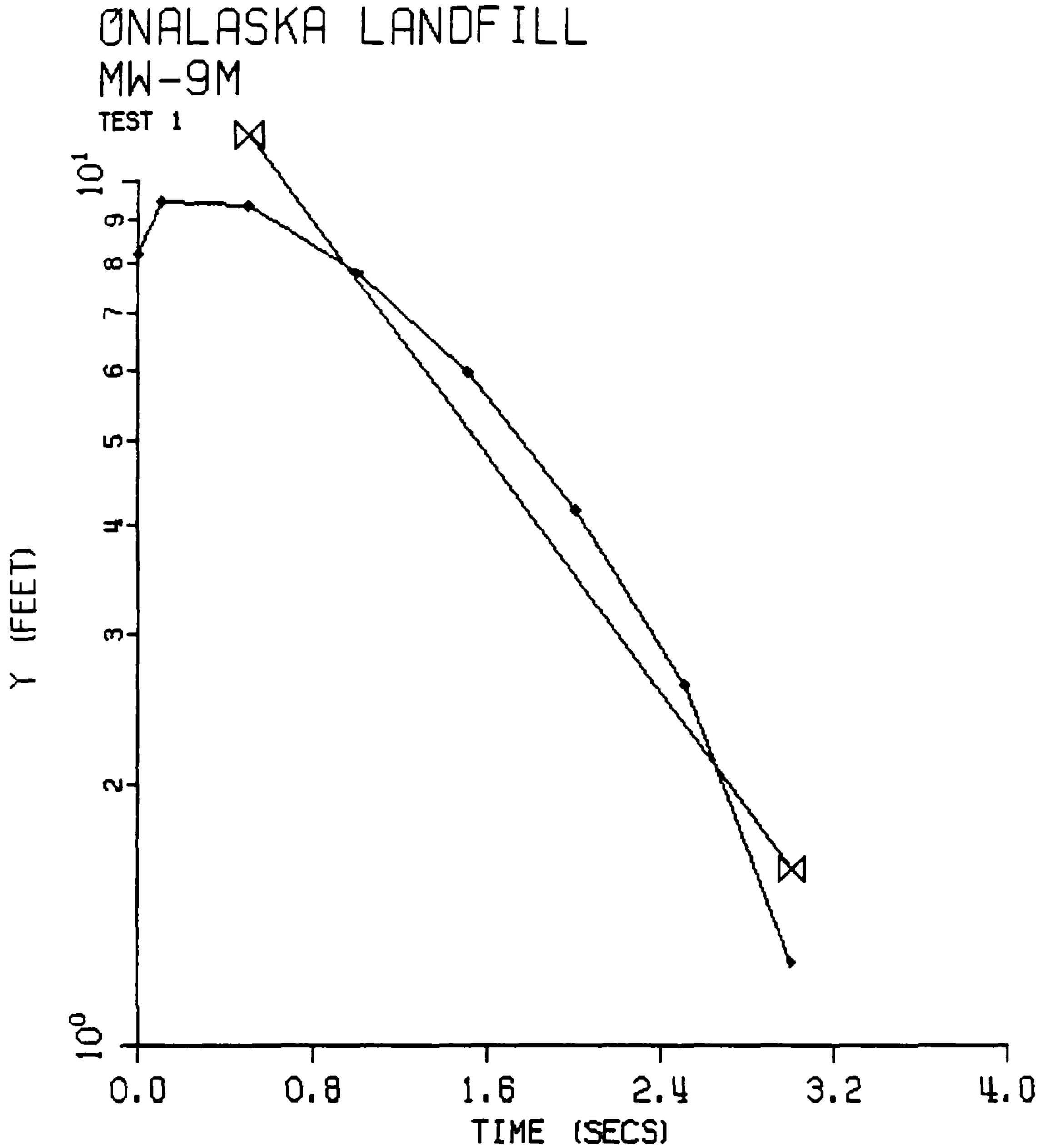
A = 0.00

B = 0.00

C = 4.74

Y-INTERCEPT = 10.82

SLOPE = -0.0134



K (CM/S) = 0.033744

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 66.60

COEFFICIENTS

A = 4.76

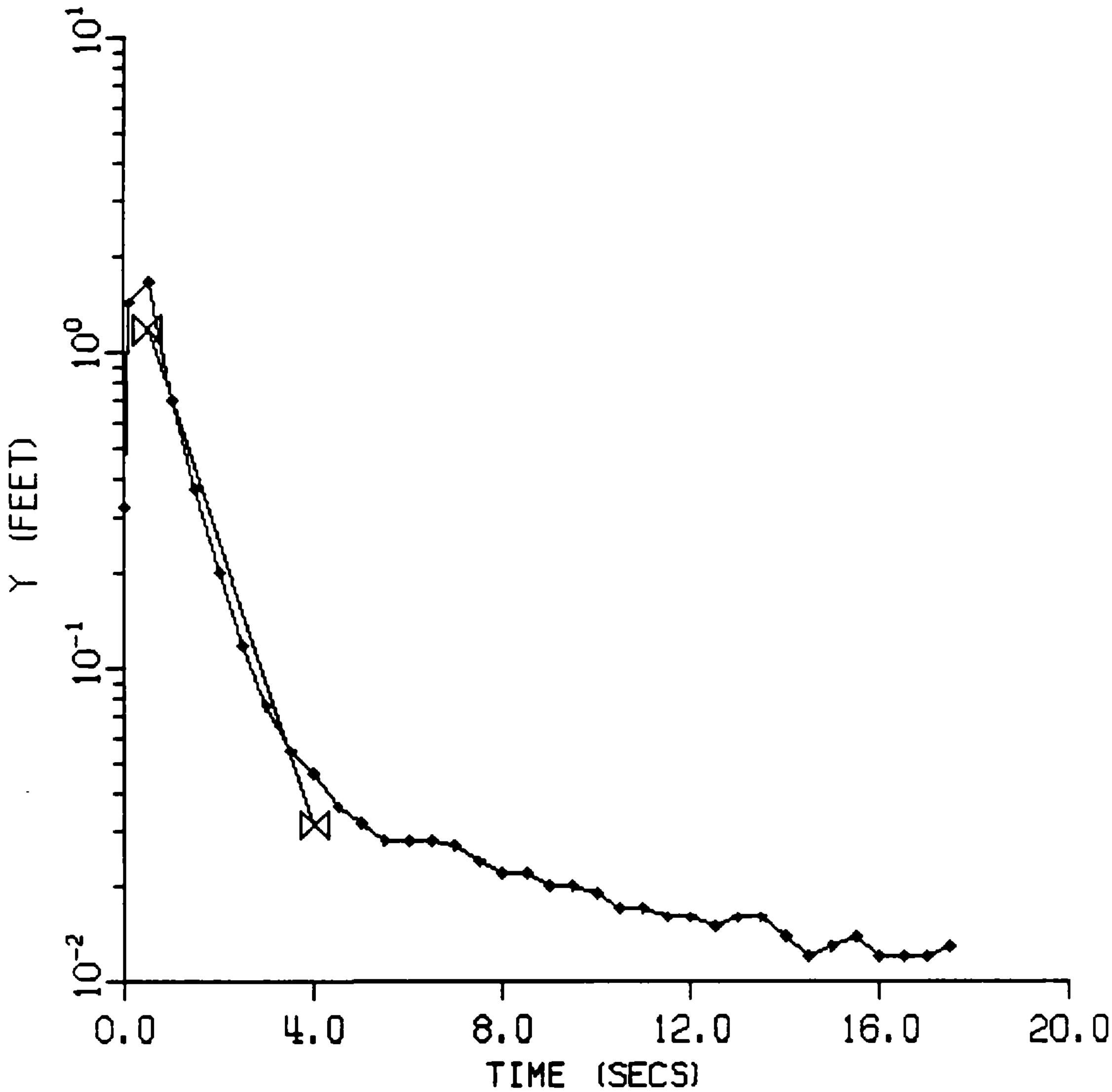
B = 0.82

C = 0.00

Y-INTERCEPT = 16.72

SLOPE = -0.3397

ØNALASKA LANDFILL
MW-13S
TEST 1



K (CM/S) = 0.062068

WELL SPECS. (FEET)

SCREEN LENGTH = 4.5

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 4.50

COEFFICIENTS

A = 3.12

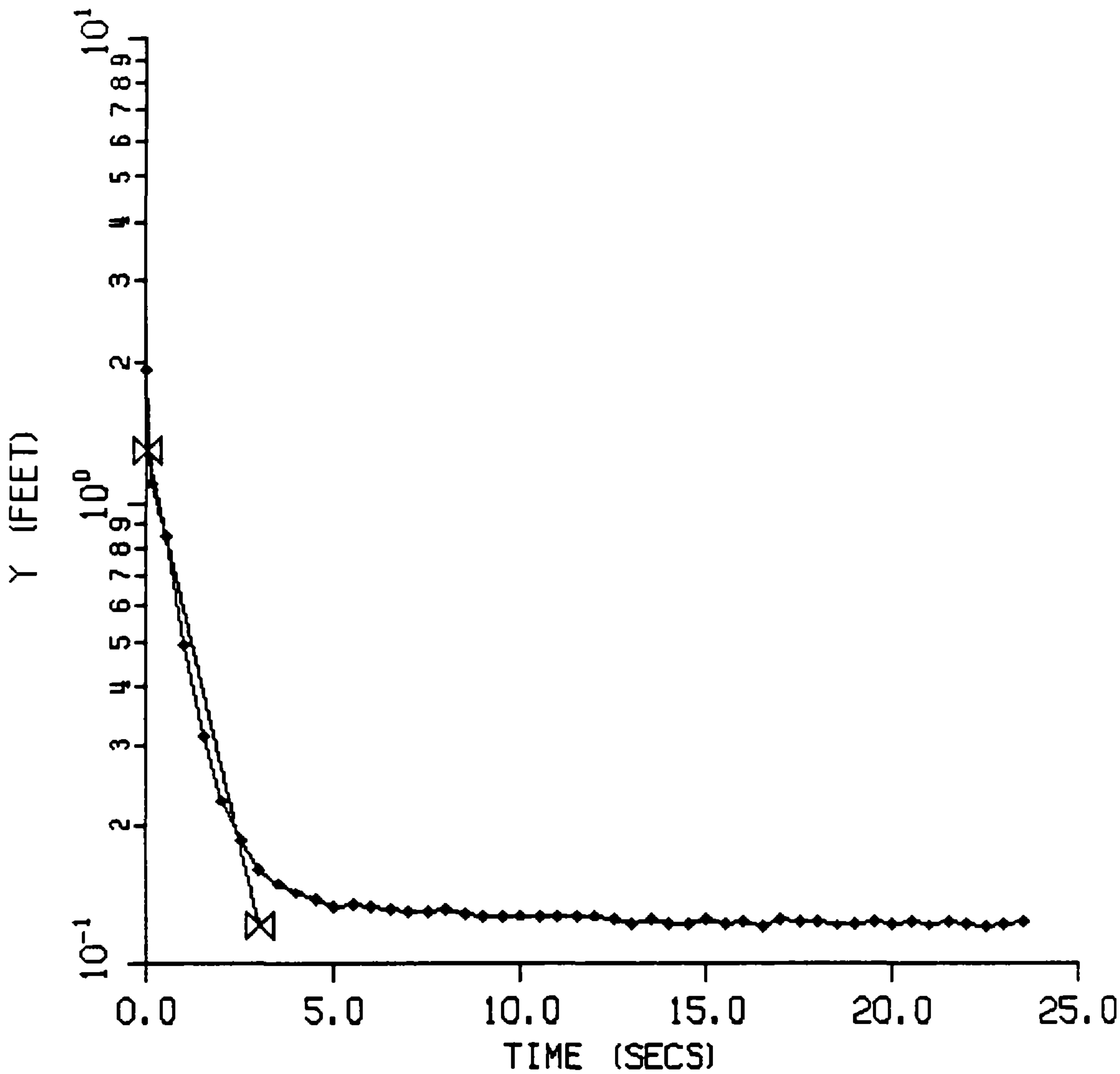
B = 0.52

C = 0.00

Y-INTERCEPT = 1.97

SLOPE = -0.4482

ØNALASKA LANDFILL
MW-13S
TEST 2



K (CM/S) = 0.047507

WELL SPECS. (FEET)

SCREEN LENGTH = 4.5

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 4.50

COEFFICIENTS

A = 3.12

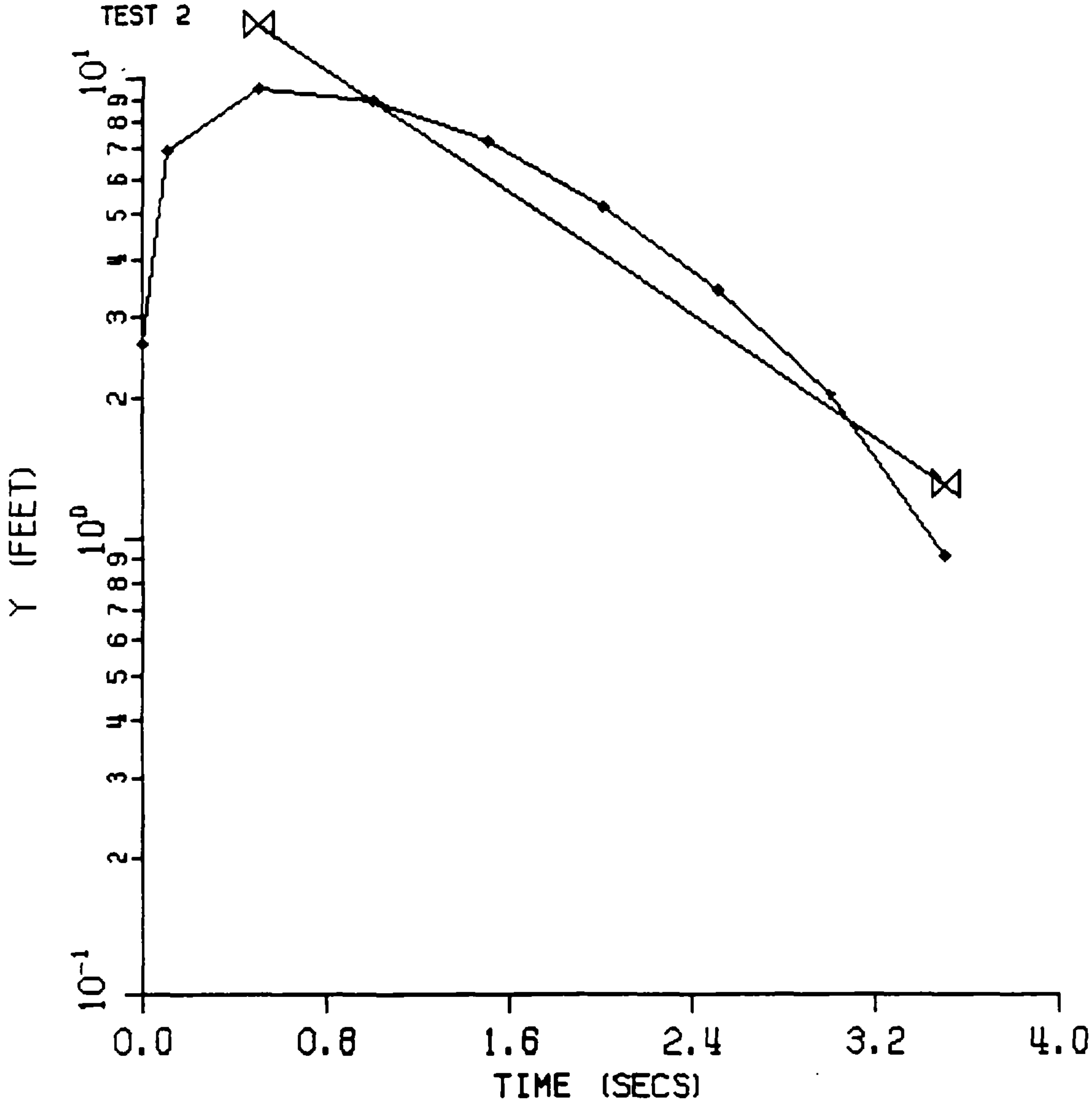
B = 0.52

C = 0.00

Y-INTERCEPT = 1.30

SLOPE = -0.3430

ØNALASKA LANDFILL
MW-11M
TEST 2



K (CM/S) = 0.032988

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 62.80

COEFFICIENTS

A = 4.76

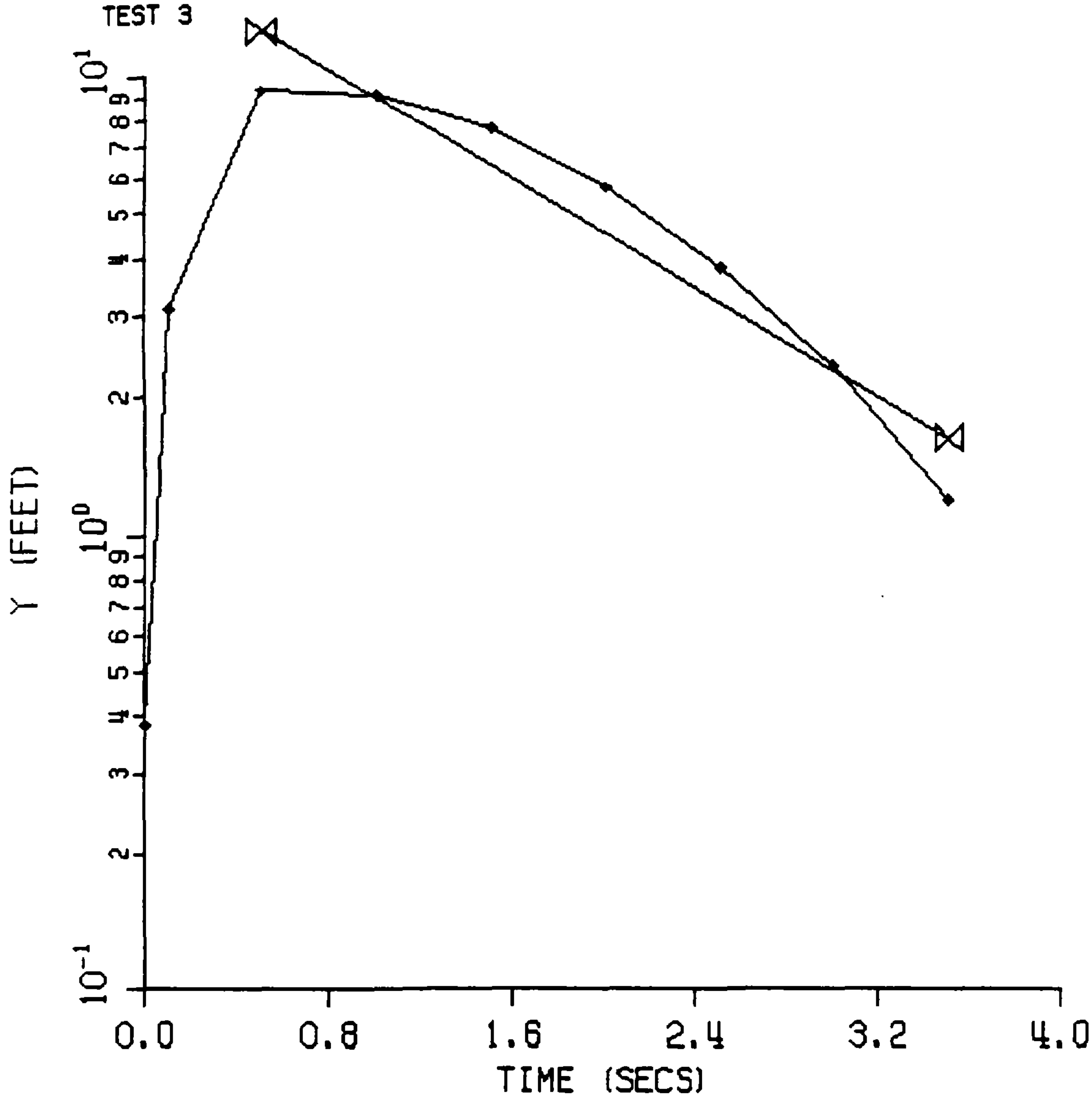
B = 0.82

C = 0.00

Y-INTERCEPT = 19.28

SLOPE = -0.3341

ØNALASKA LANDFILL
MW-11M
TEST 3



K (CM/S) = 0.029394

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 62.80

COEFFICIENTS

A = 4.76

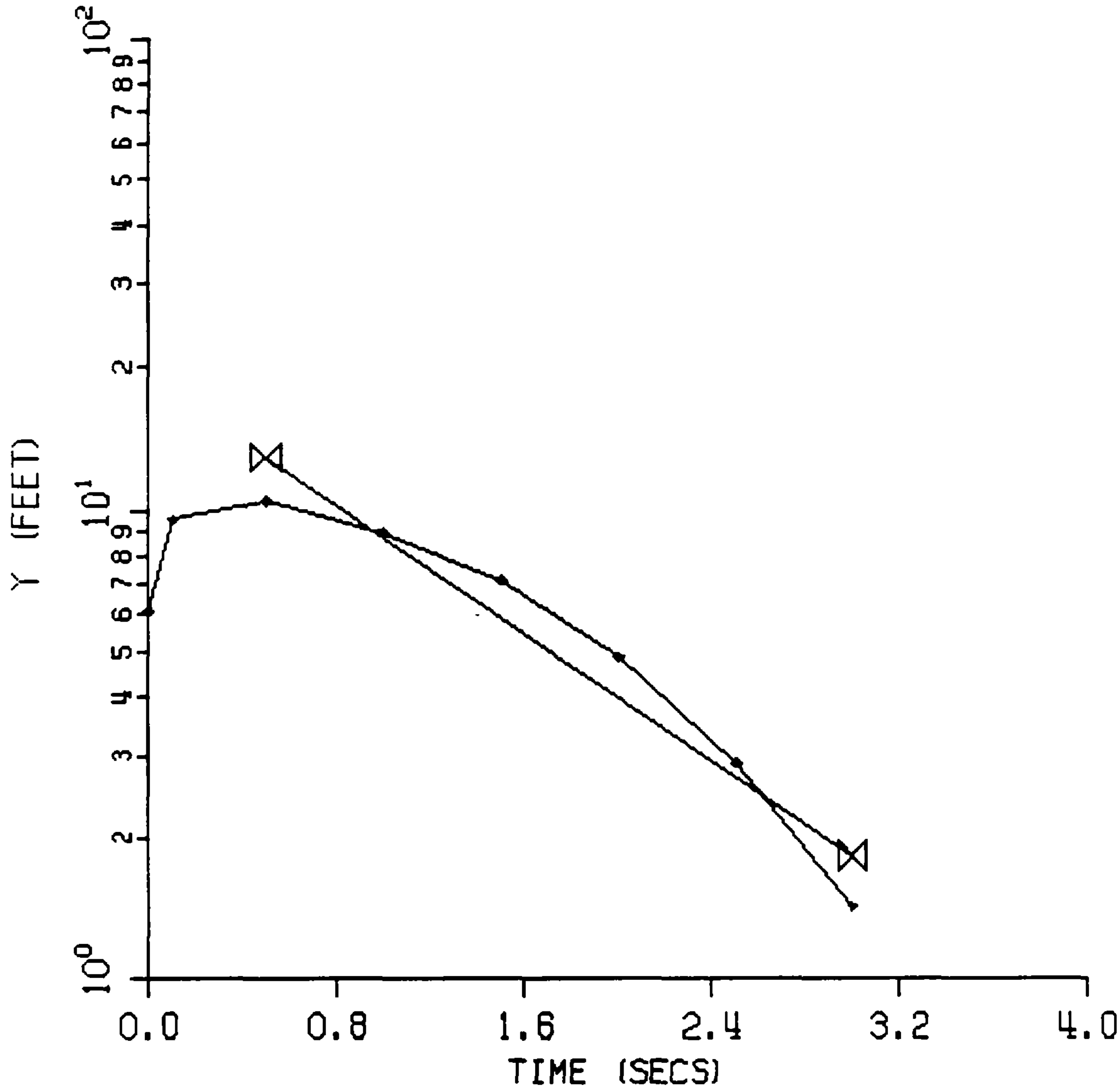
B = 0.82

C = 0.00

Y-INTERCEPT = 17.94

SLOPE = -0.2977

ØNALASKA LANDFILL
MW-10M
TEST 3



K (CM/S) = 0.033840

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 67.70

COEFFICIENTS

A = 4.76

B = 0.82

C = 0.00

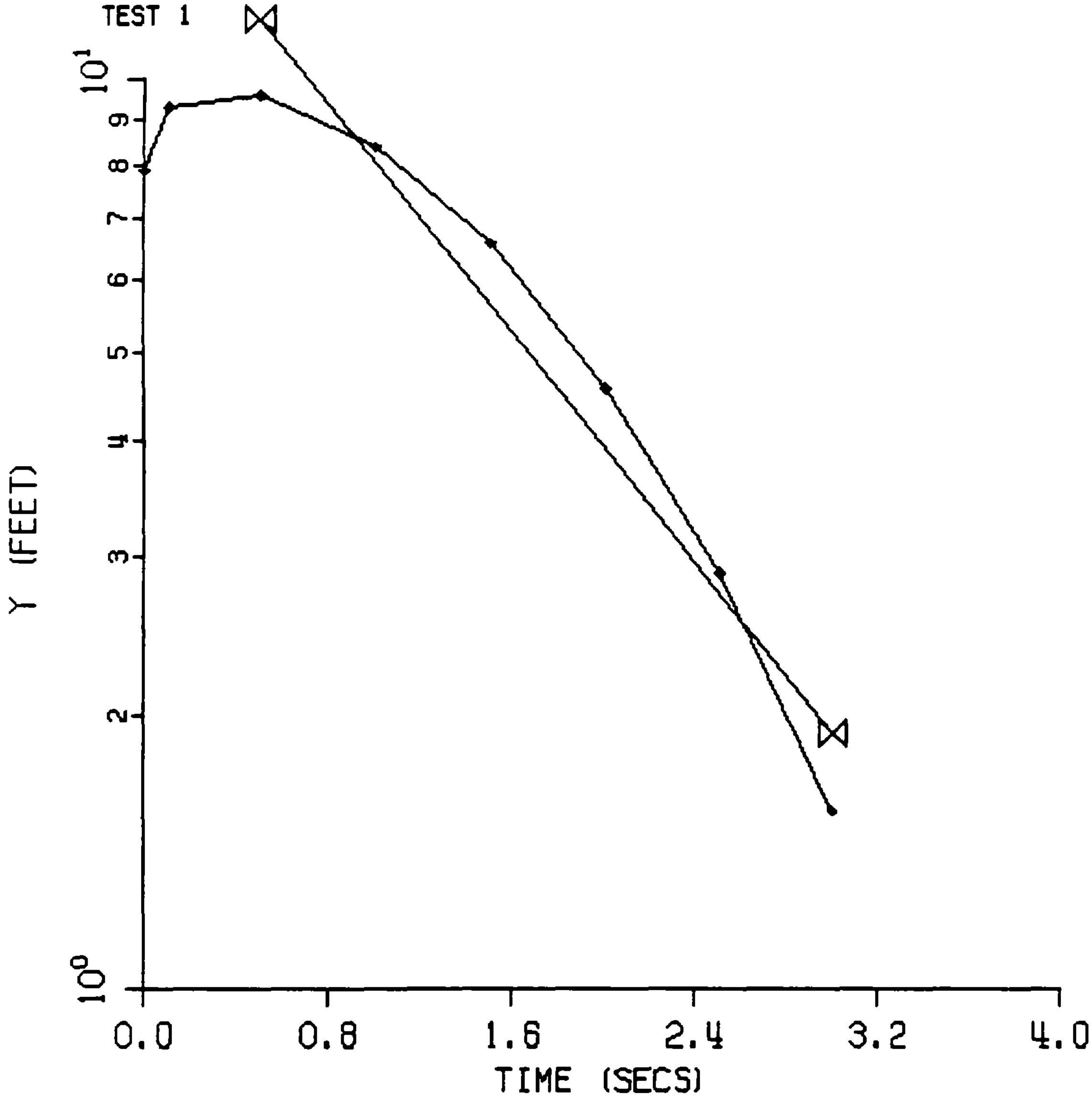
Y-INTERCEPT = 19.10

SLOPE = -0.3401

ØNALASKA LANDFILL

MW-11M

TEST 1



K (CM/S) = 0.030938

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 62.80

COEFFICIENTS

A = 4.76

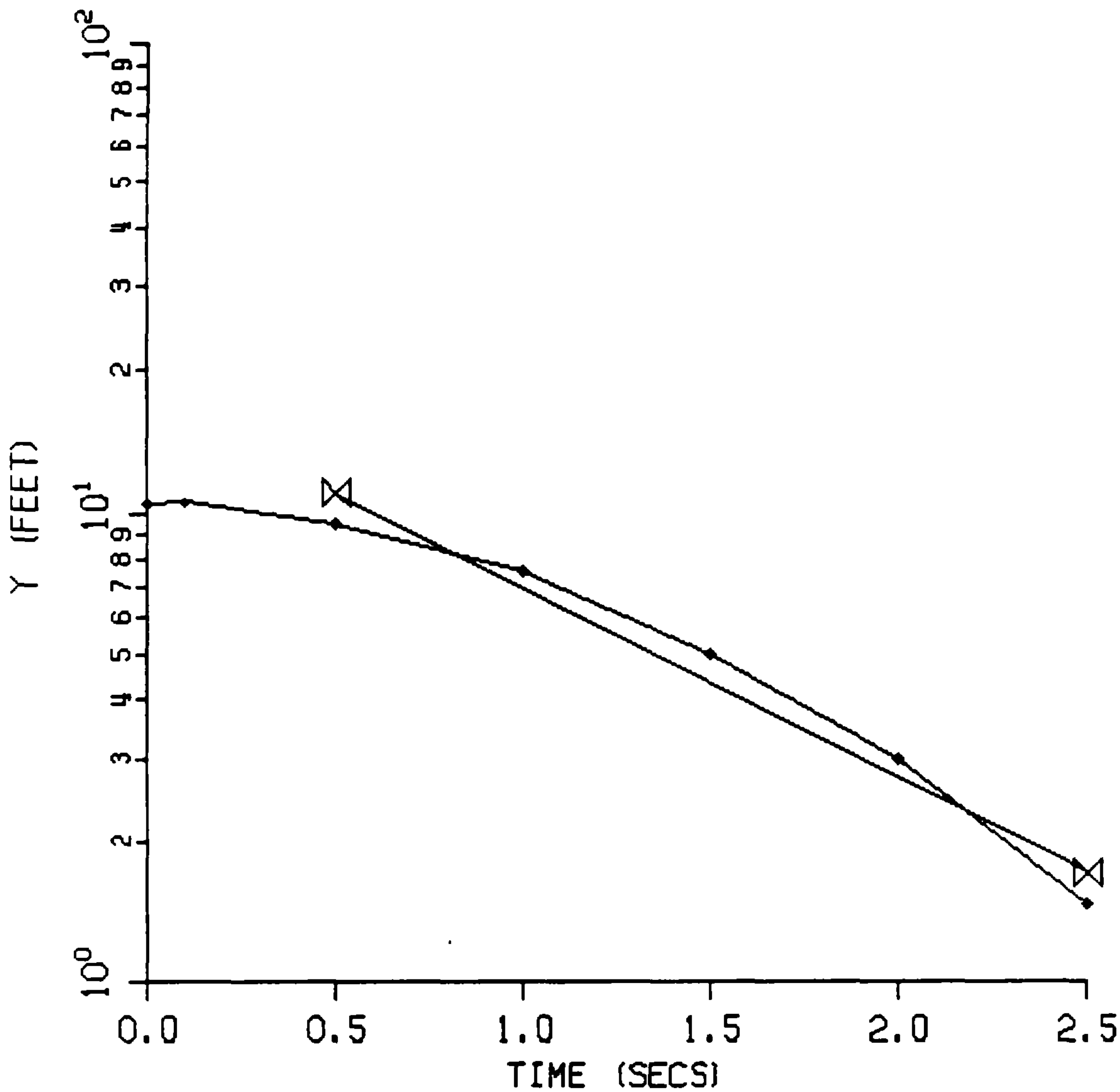
B = 0.82

C = 0.00

Y-INTERCEPT = 16.64

SLOPE = -0.3133

ØNALASKA LANDFILL
MW-10M
TEST 1



K (CM/S) = 0.040194

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 67.70

COEFFICIENTS

A = 4.76

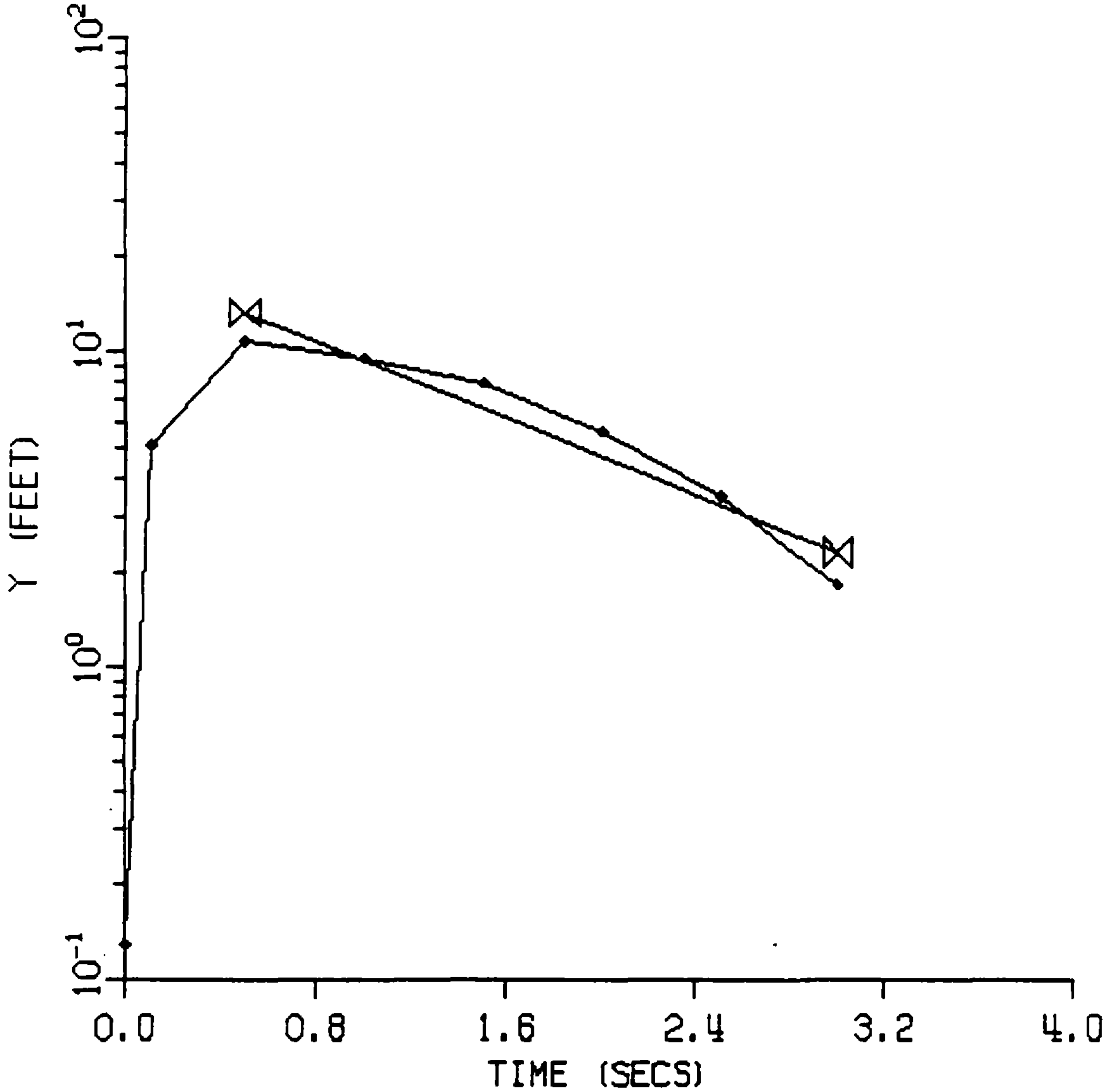
B = 0.82

C = 0.00

Y-INTERCEPT = 17.52

SLOPE = -0.4040

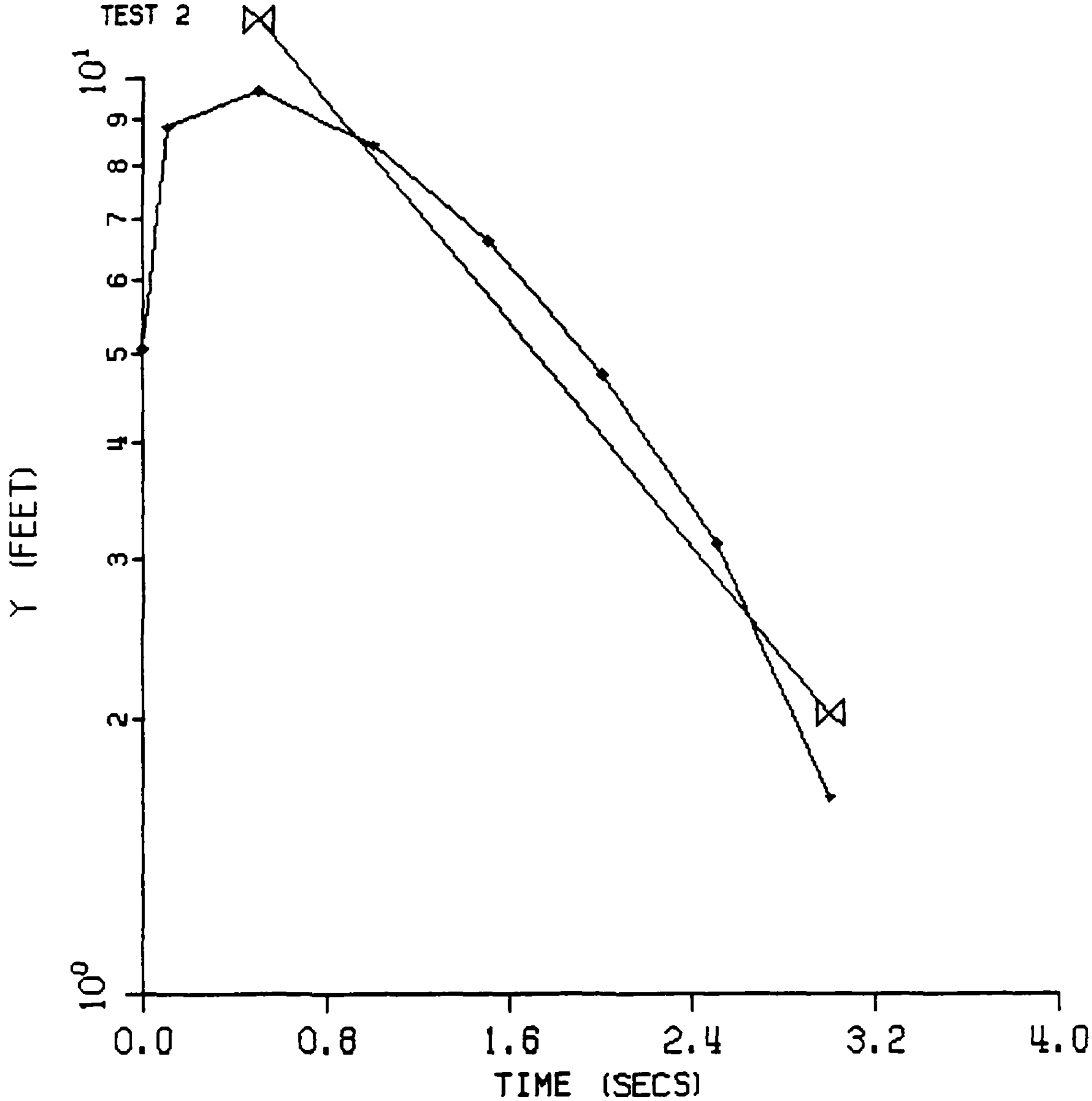
ØNALASKA LANDFILL
MW-10M
TEST 2



K (CM/S) = 0.029954
WELL SPECS. (FEET)
SCREEN LENGTH = 10.0
WELL SCREEN/BORE RADIUS = 0.08
WELL CASING RADIUS = 0.08
AQUIFER THICKNESS = 130.0
H (FEET) = 67.70

COEFFICIENTS
A = 4.76
B = 0.82
C = 0.00
Y-INTERCEPT = 18.69
SLOPE = -0.3010

ØNALASKA LANDFILL
MW-9M
TEST 2



K (CM/S) = 0.030127

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 66.60

COEFFICIENTS

A = 4.76

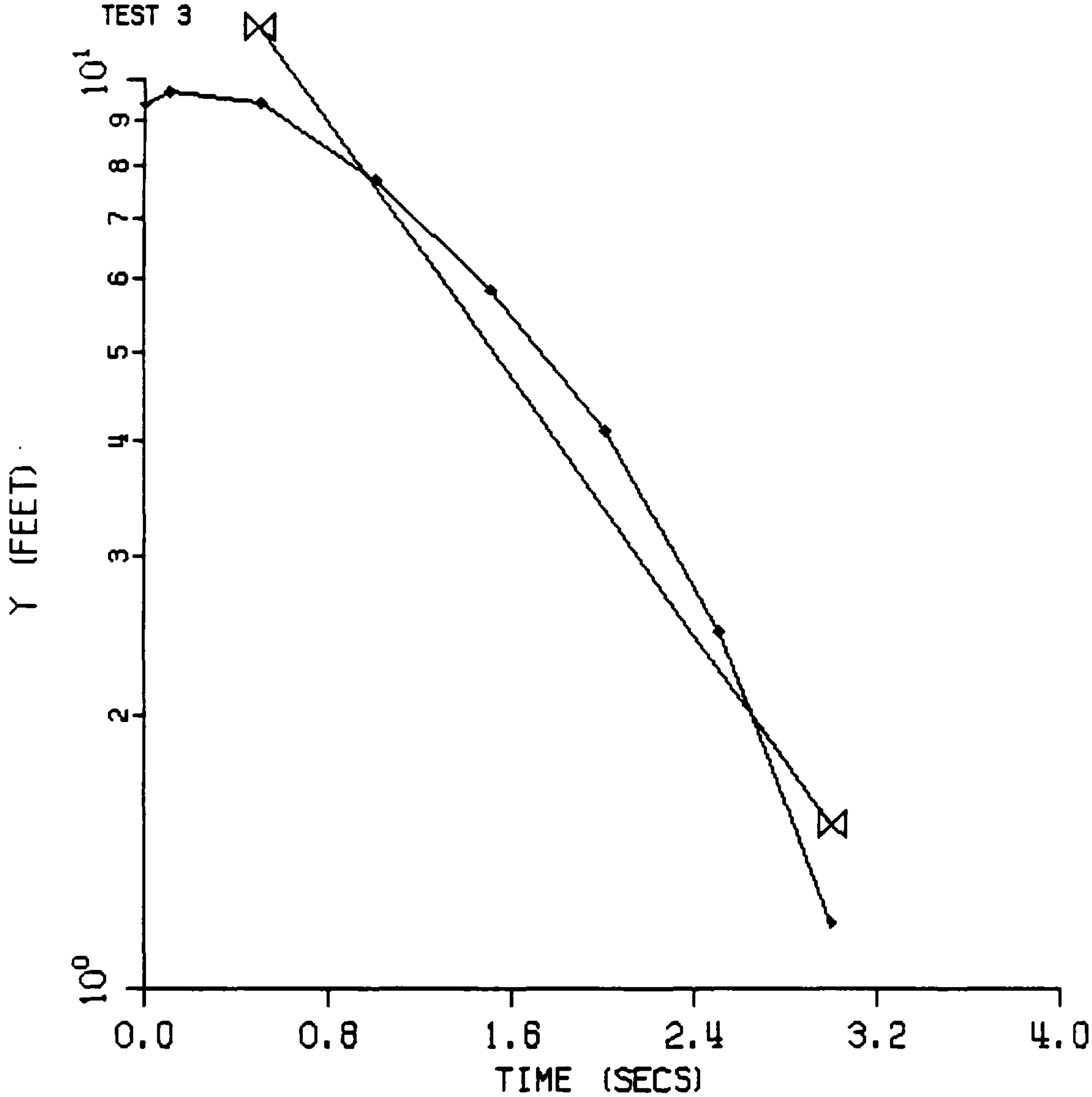
B = 0.82

C = 0.00

Y-INTERCEPT = 16.49

SLOPE = -0.3033

ØNALASKA LANDFILL
MW-9M
TEST 3



K (CM/S) = 0.034849

WELL SPECS. (FEET)

SCREEN LENGTH = 10.0

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 66.60

COEFFICIENTS

A = 4.76

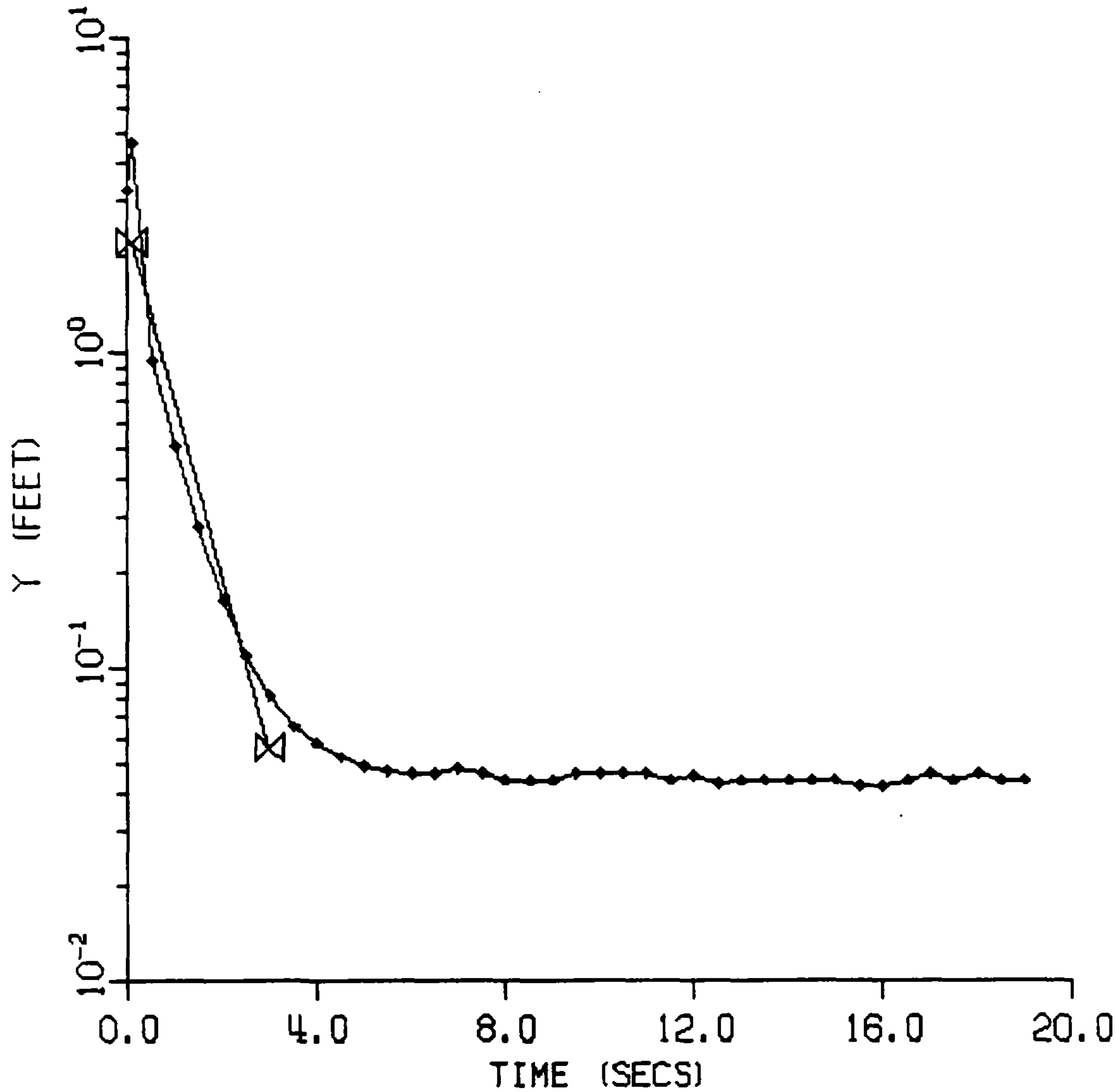
B = 0.82

C = 0.00

Y-INTERCEPT = 17.06

SLOPE = -0.3508

ØNALASKA LANDFILL
MW-13S
TEST 3



K (CM/S) = 0.076396

WELL SPECS. (FEET)

SCREEN LENGTH = 4.5

WELL SCREEN/BORE RADIUS = 0.08

WELL CASING RADIUS = 0.08

AQUIFER THICKNESS = 130.0

H (FEET) = 4.50

COEFFICIENTS

A = 3.12

B = 0.52

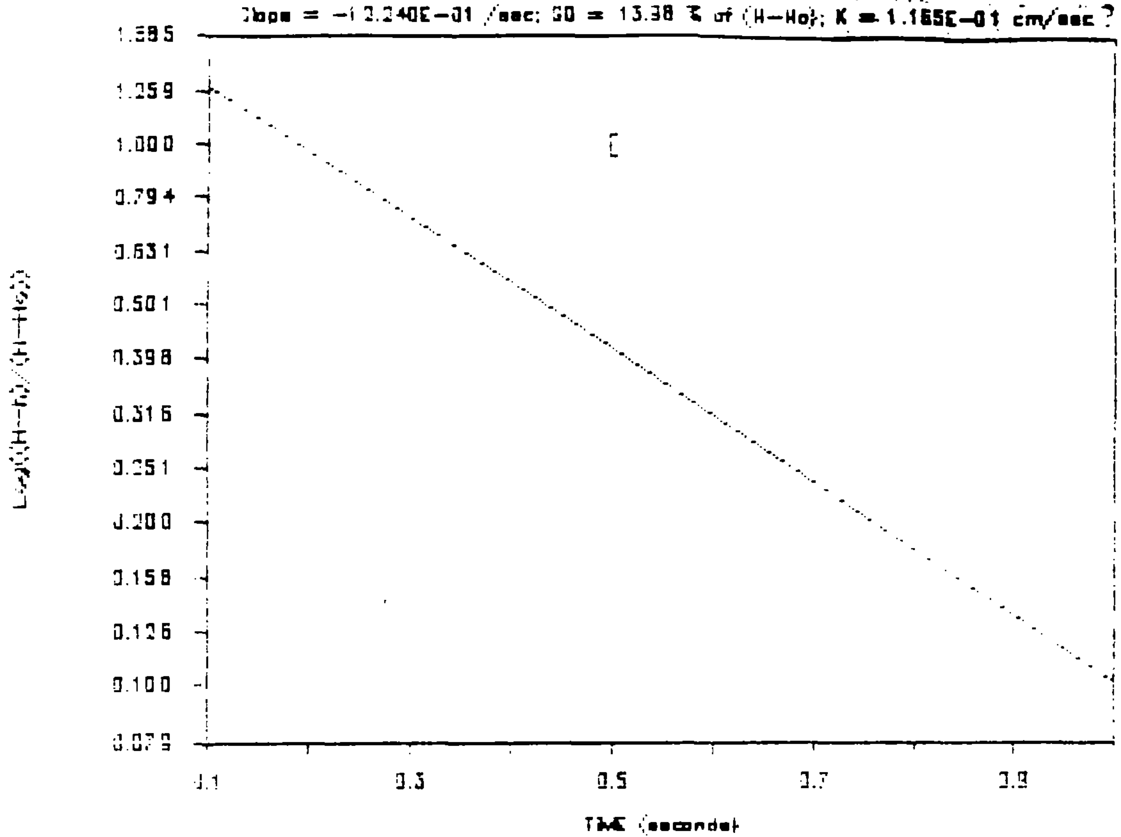
C = 0.00

Y-INTERCEPT = 2.52

SLOPE = -0.5516

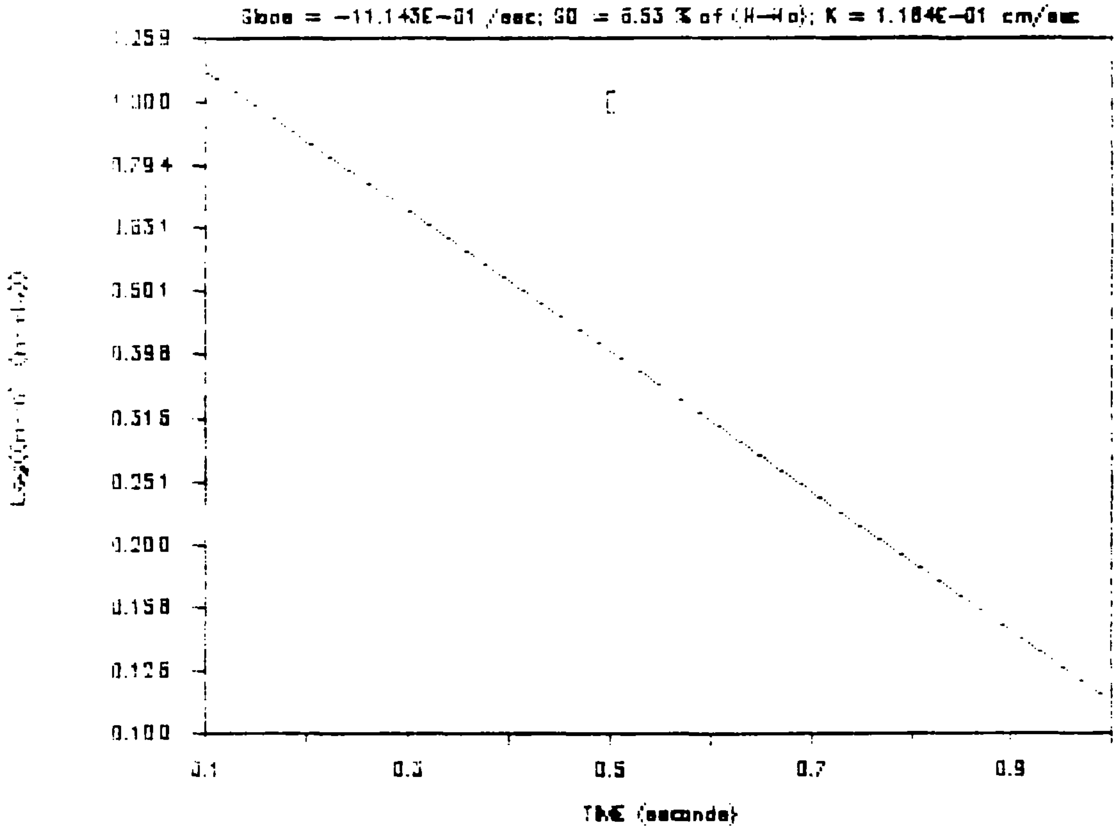
Aquifer Slug Test #1 (Rising Head) at MW-B1A; 5 data points

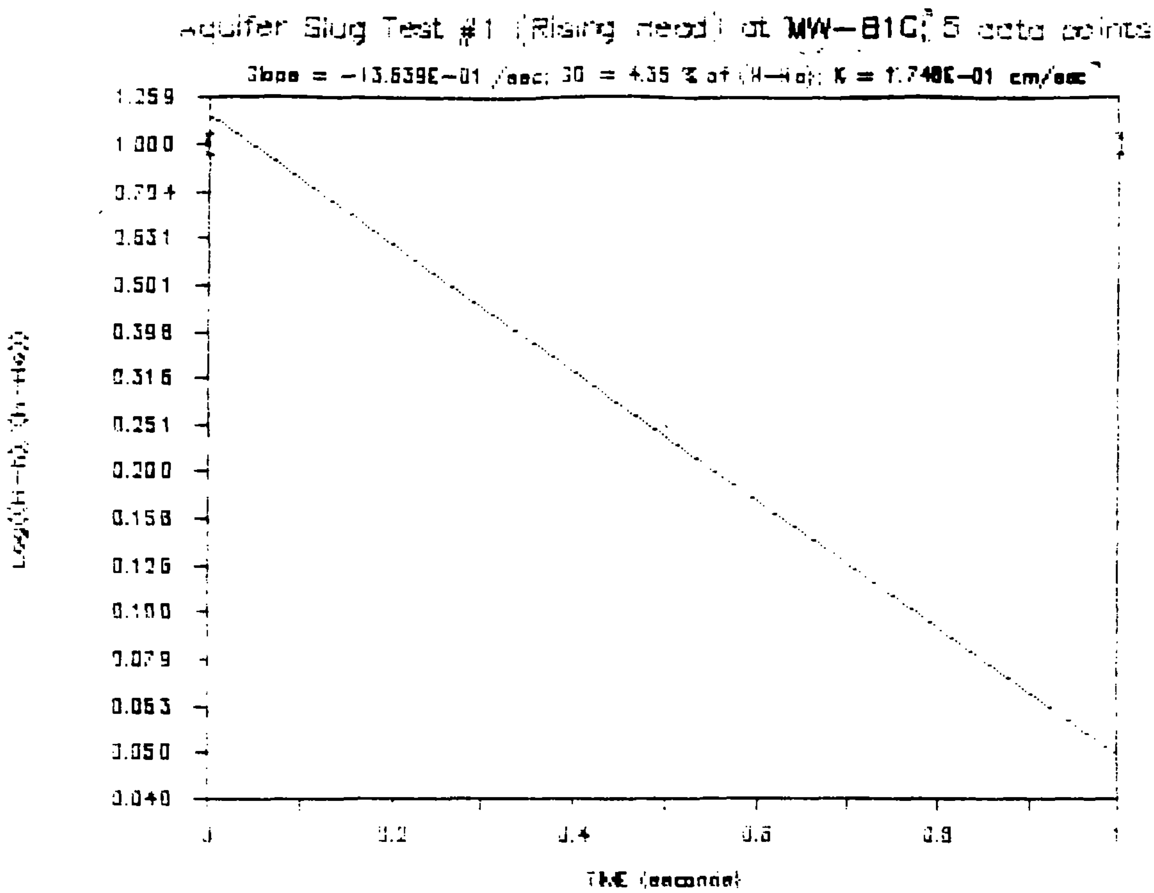
Slope = -12.240E-01 /sec; SD = 13.38 % of (H-Ho); K = 1.165E-01 cm/sec

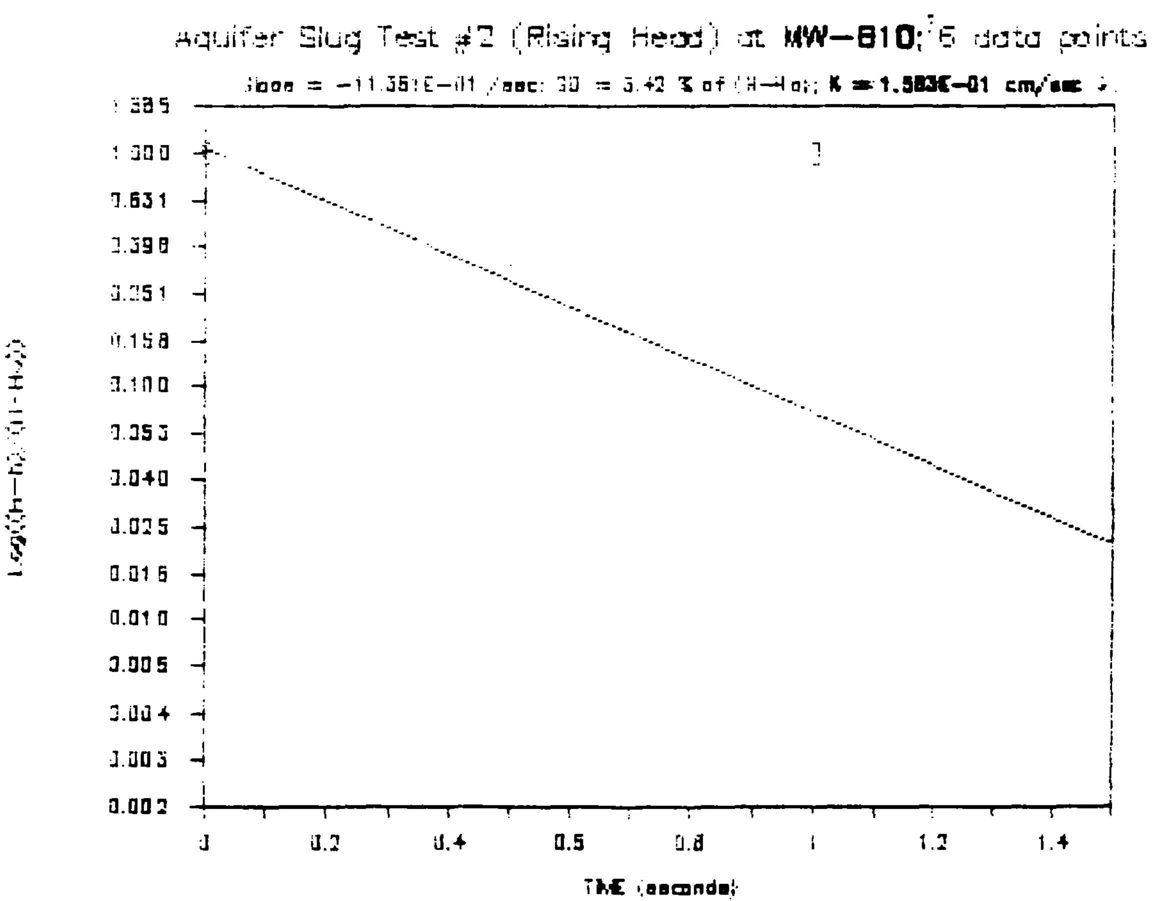


Aquifer Slug Test #2 (Rising Head) at MW-B1A; 5 data points

Slope = -11.143E-01 /sec; SD = 6.53 % of (H-Ho); K = 1.184E-01 cm/sec

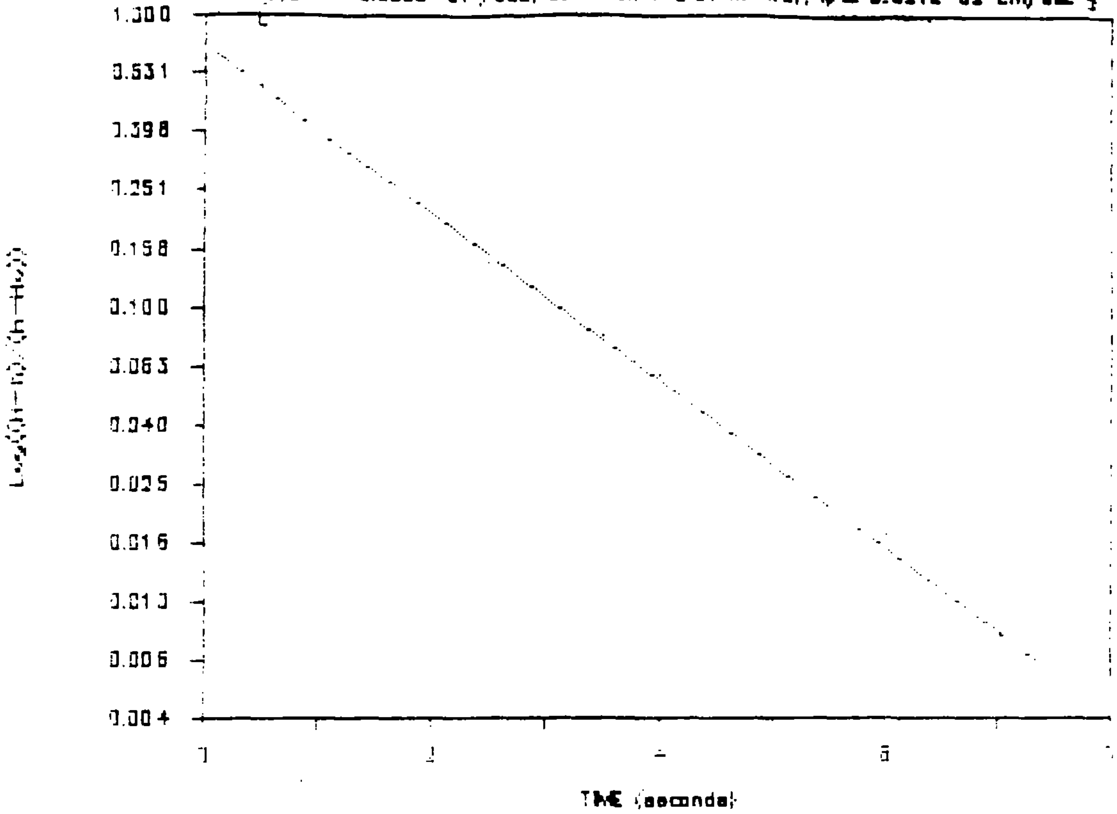



Aquifer Slug Test #1 (Rising Head) at MW-81C; 5 data points
Slope = -13.639E-01 /sec; SD = 4.35 % of (H-Ho); K = 1.748E-01 cm/sec
1.259
1.000
0.794
0.631
0.501
0.398
0.316
0.251
0.200
0.158
0.126
0.100
0.079
0.063
0.050
0.040
0
0.2
0.4
0.6
0.8
1
TIME (seconds)


Aquifer Slug Test #2 (Rising Head) at MW-810; 6 data points
Slope = -11.361E-01 /sec; SD = 5.42 % of (H-Ho); K = 1.583E-01 cm/sec
1.585
1.000
0.631
0.398
0.251
0.158
0.100
0.063
0.040
0.025
0.016
0.010
0.006
0.004
0.003
0.002
0
0.2
0.4
0.6
0.8
1
1.2
1.4
TIME (seconds)

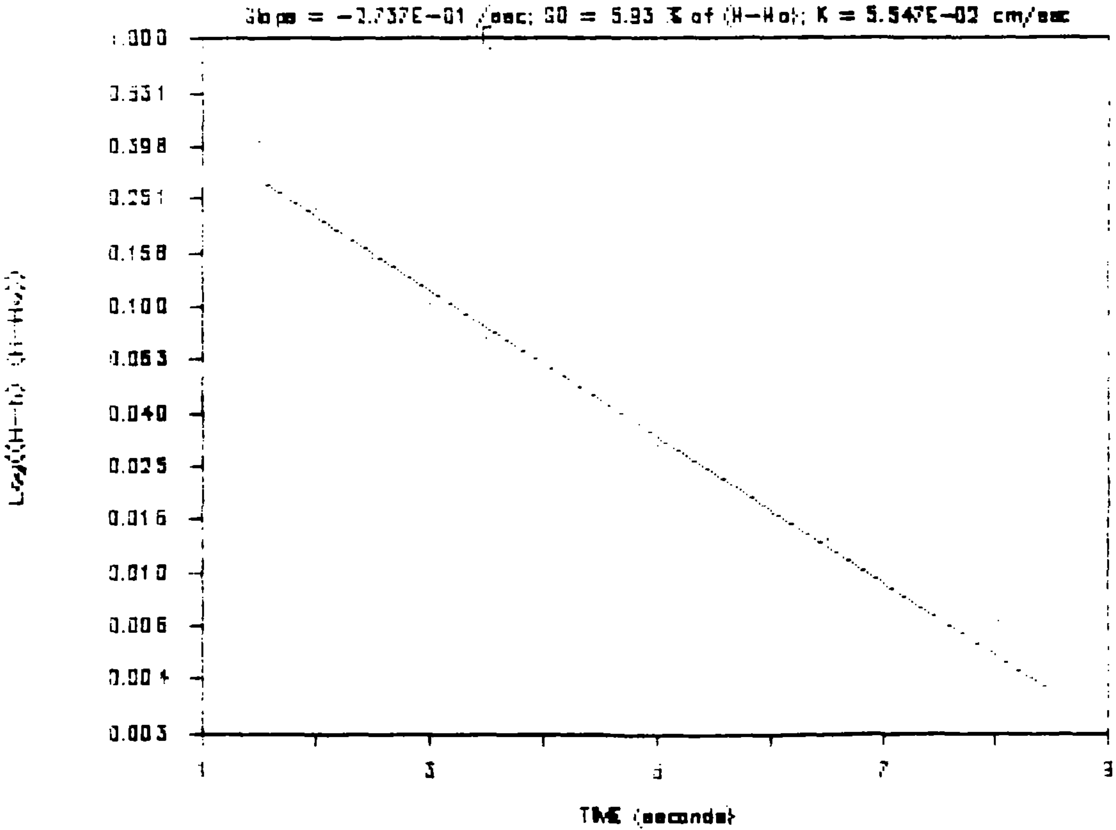
Aquifer Slug Test #1 (Rising Head) at MW-82A; 20 data points

Slope = -2.865E-01 /sec; S0 = 5.74 % of (H-Ho); K = 5.531E-02 cm/sec



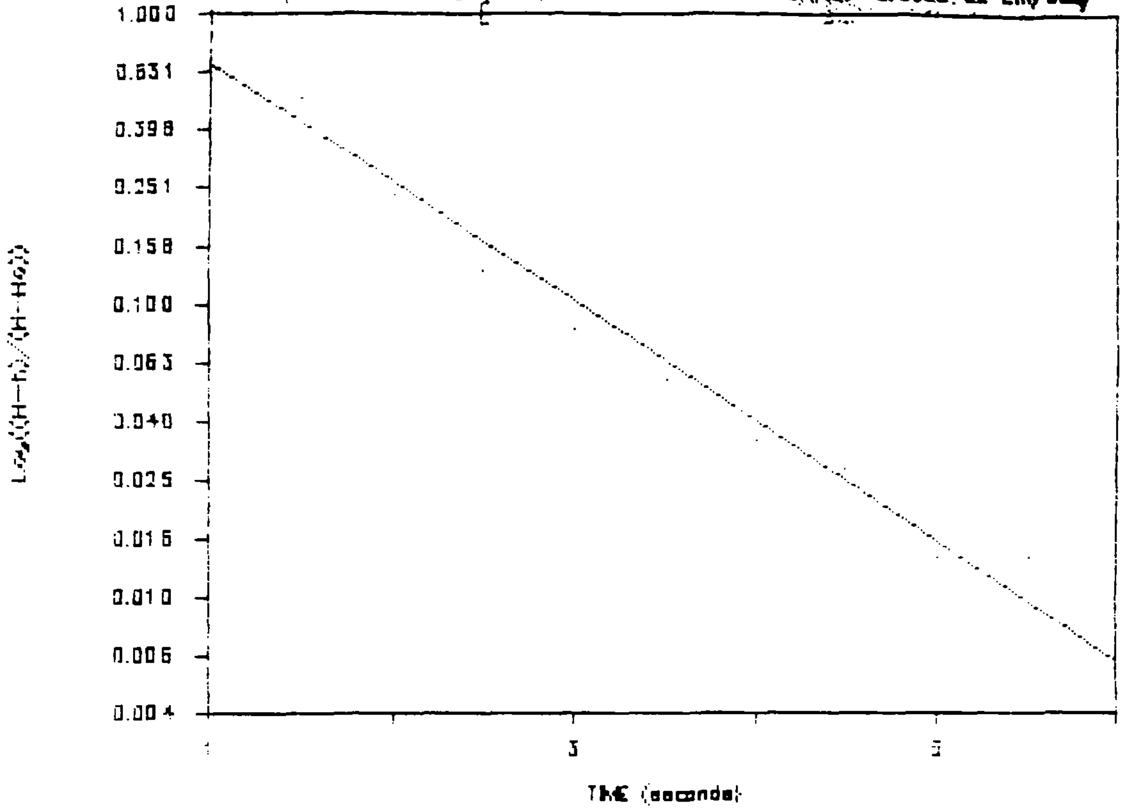
Aquifer Slug Test #2 (Rising Head) at MW-82B; 40 data points

Slope = -2.737E-01 /sec; S0 = 5.93 % of (H-Ho); K = 5.547E-02 cm/sec



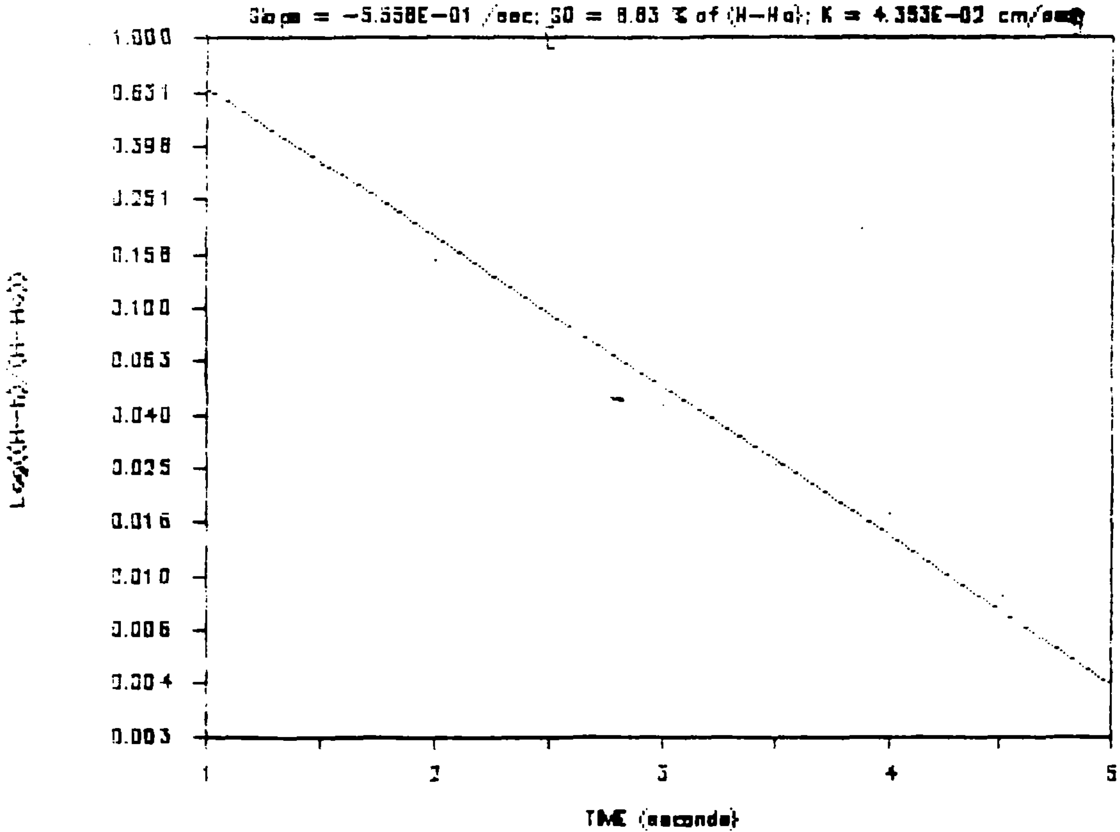
Aquifer Slug Test #1 (Rising Head) at [redacted] 39 data points

Slope = −4.114E−01 /sec; SD = 3.47 % of (H−Ho); [redacted] cm/sec



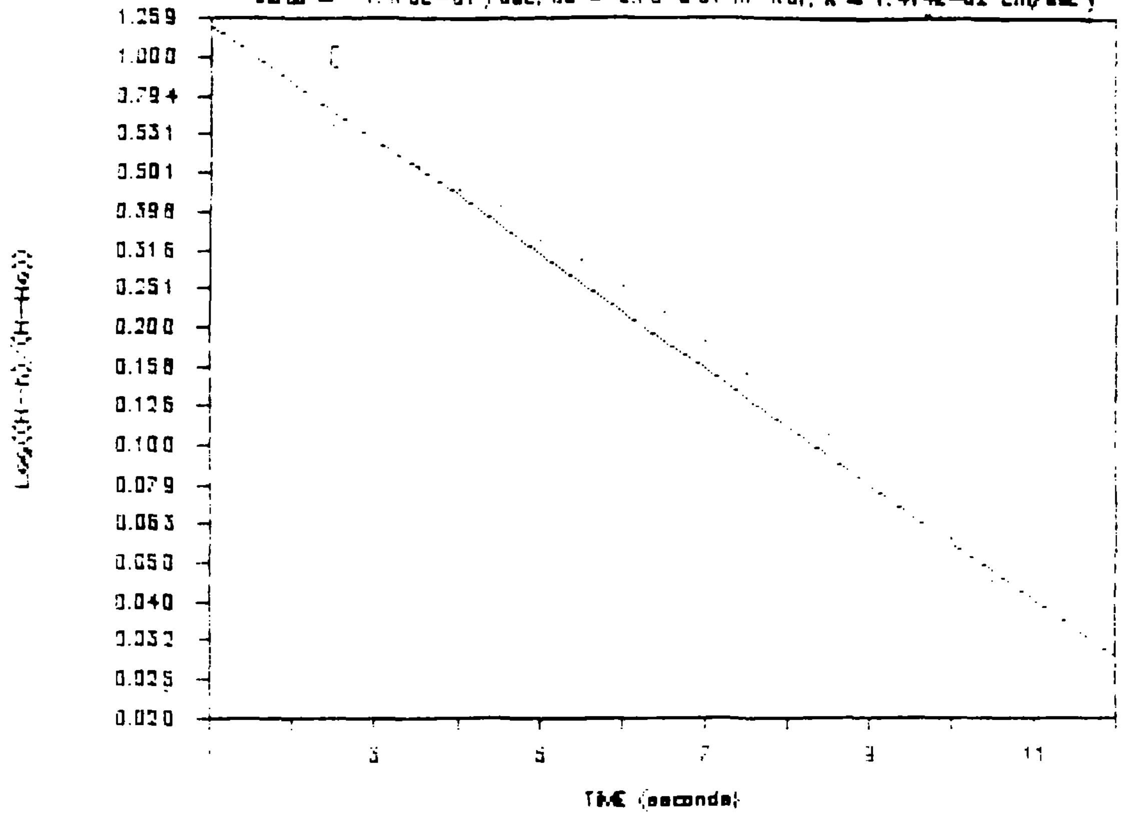
Aquifer Slug Test #2 (Rising Head) at MW−B20; 15 data points

Slope = −5.558E−01 /sec; SD = 8.83 % of (H−Ho); K = 4.353E−02 cm/sec



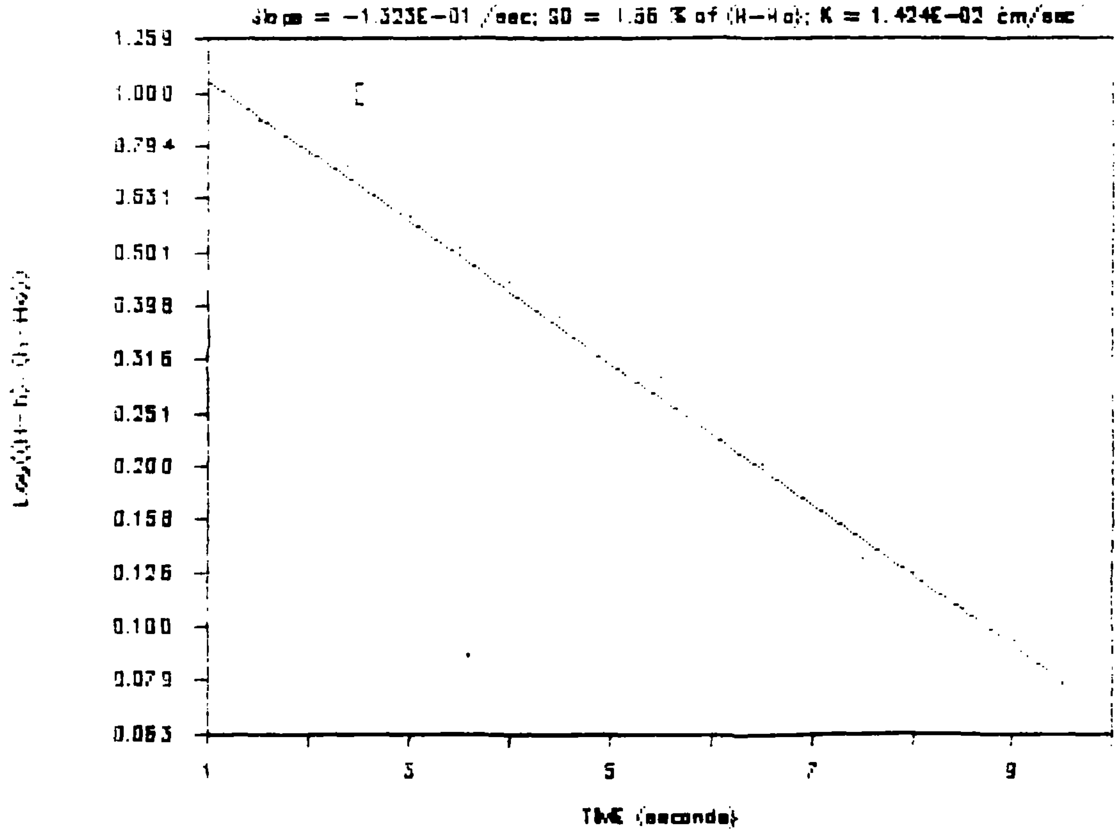
Aquifer Slug Test #1 (Rising Head) at MW–83[illegible] 30 data points

Slope = –1.475E–01 /sec; SD = 5.78 % of (H–Ho); K = 1.414E–02 cm/sec



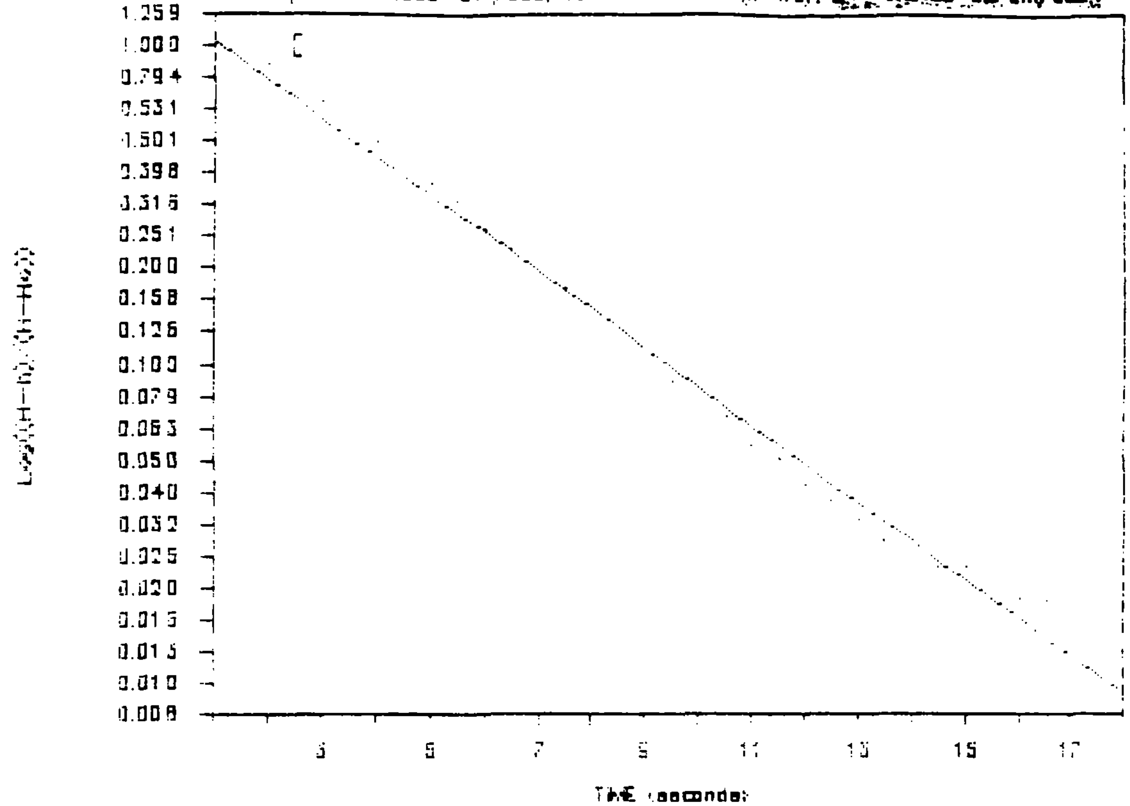
Aquifer Slug Test #1 (Rising Head) at MW–83C; 76 data points

Slope = –1.323E–01 /sec; SD = 1.56 % of (H–Ho); K = 1.424E–02 cm/sec



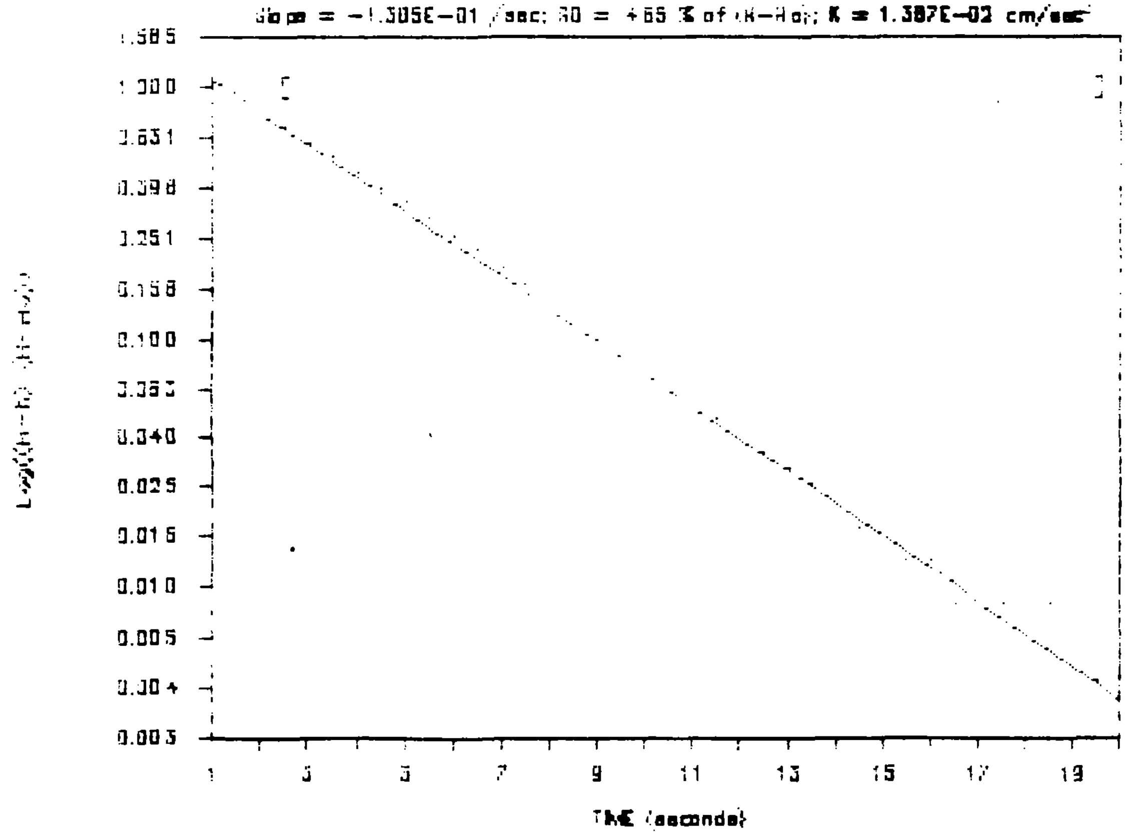
Aquifer Slug Test #2 (Rising Head) at MW-830; 58 data points

Slope = -1.209E-01 /sec; S0 = 6.16 % of (H-Ho); K = 1.142E-02 cm/sec



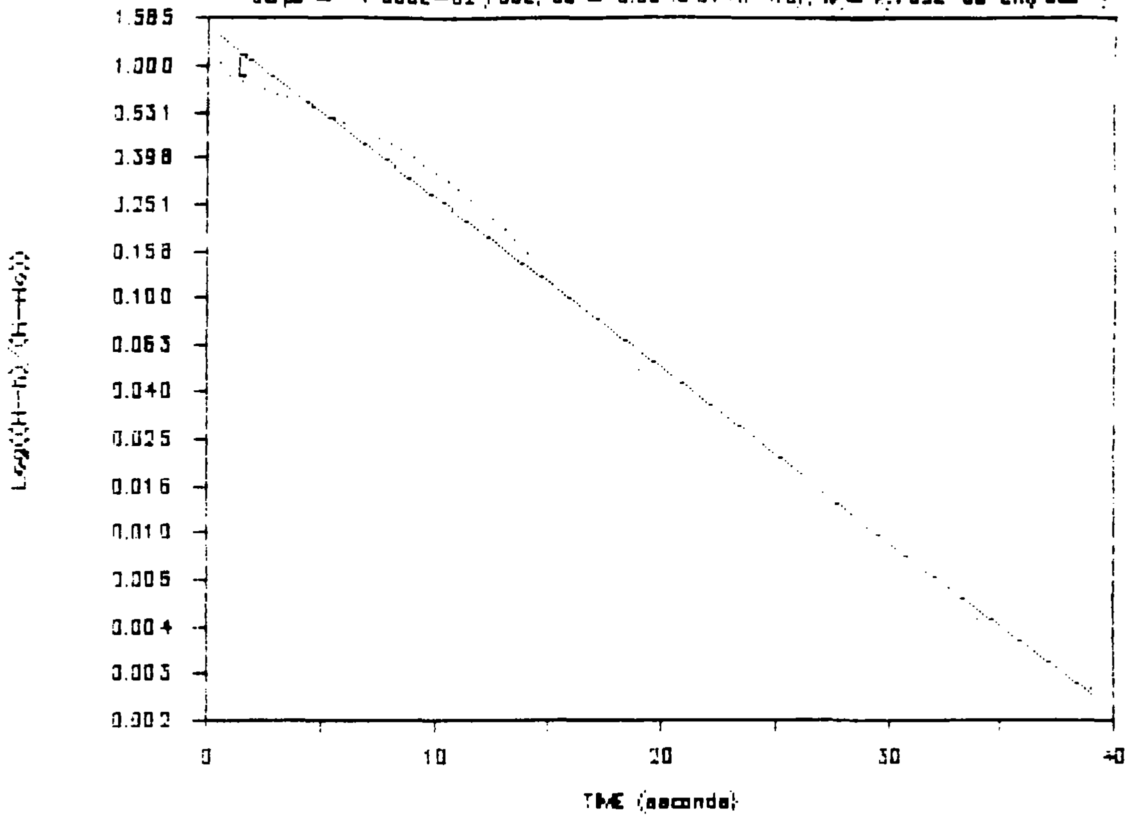
Aquifer Slug Test #2 (Rising Head) at MW-830; 71 data points

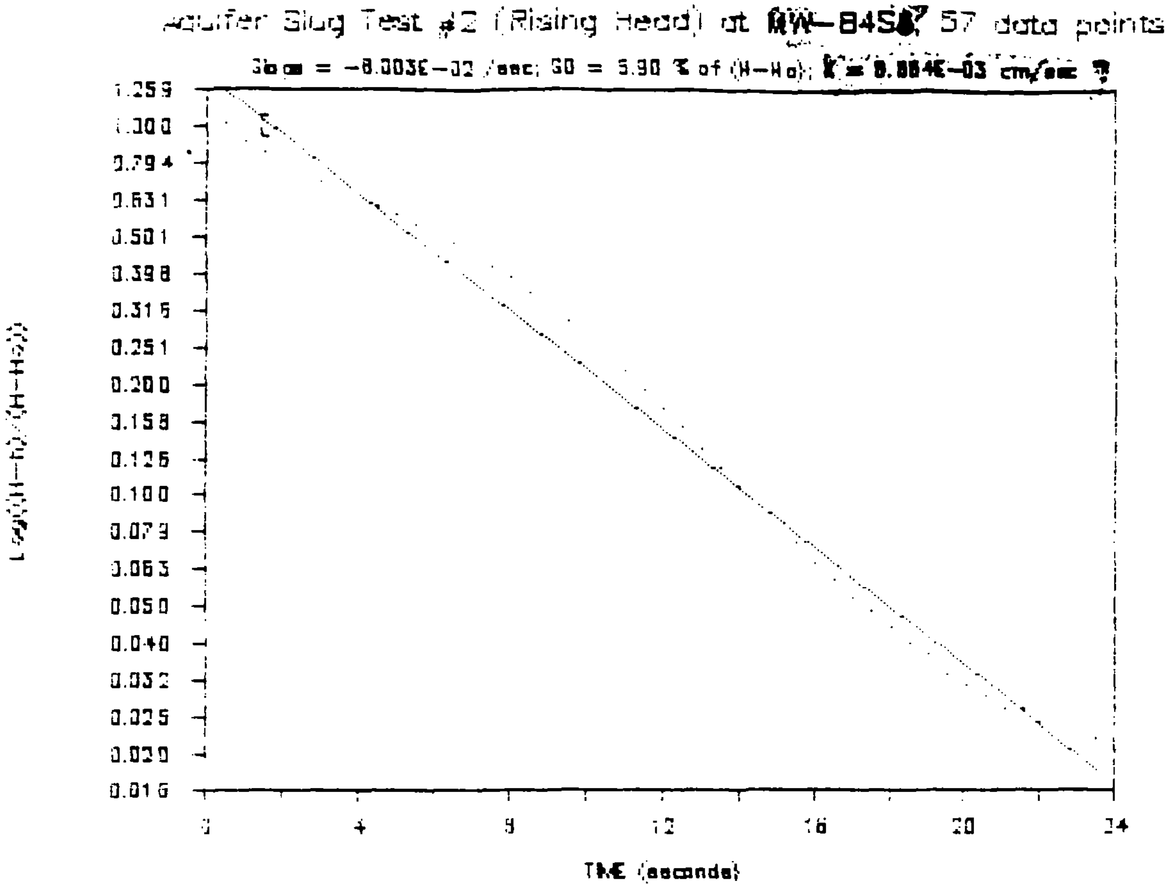
Slope = -1.305E-01 /sec; S0 = 465 % of (H-Ho); K = 1.387E-02 cm/sec



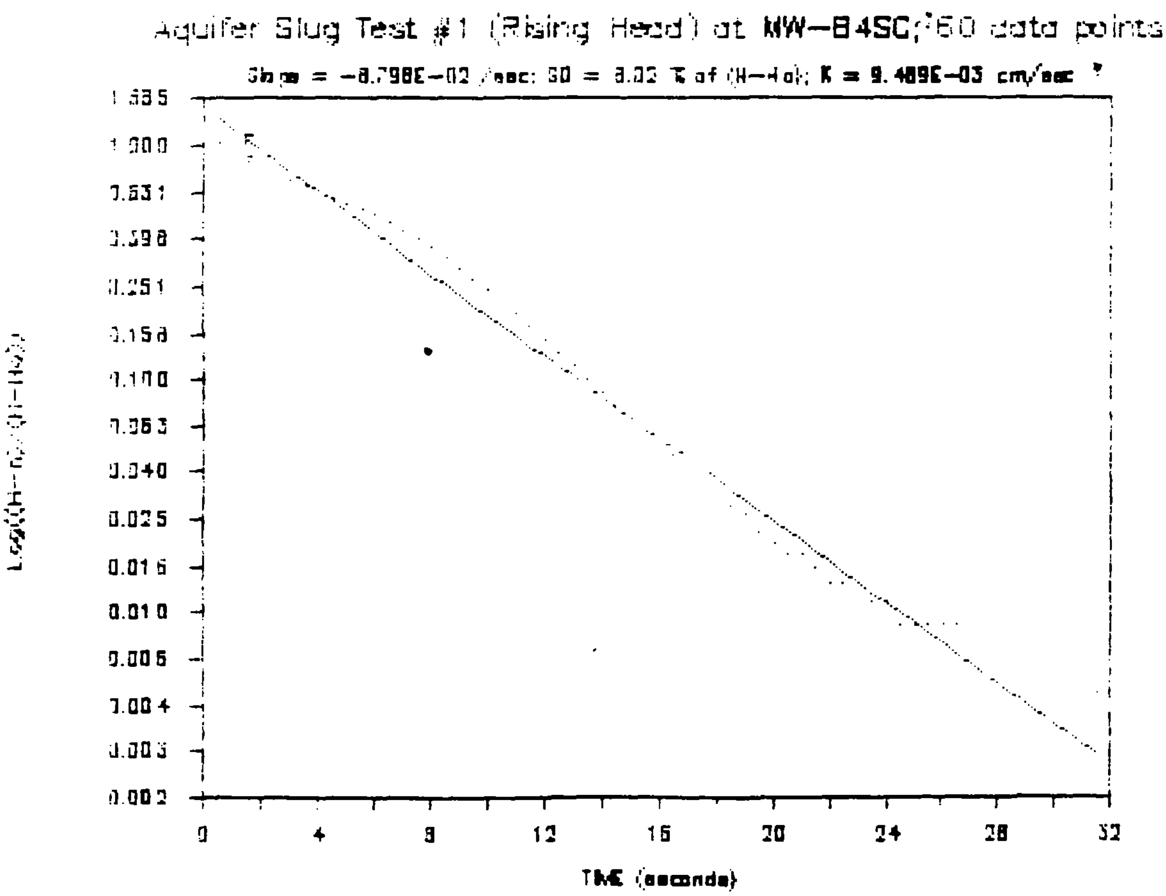
Aquifer Slug Test #1 (Rising Head) at MW-84SA; 36 data points

Slope = -7.306E-02 /sec; SD = 8.62 % of (H-Ho); K = 7.789E-03 cm/sec

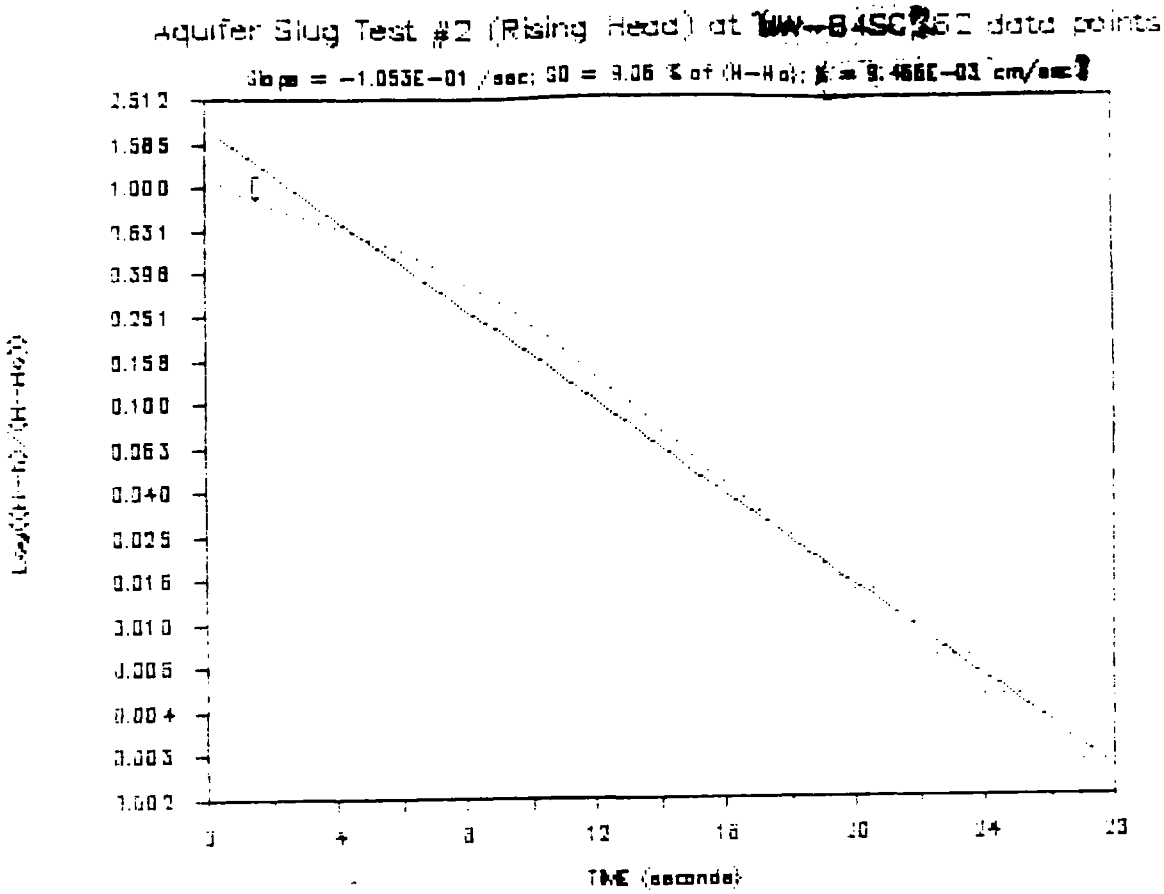




Aquifer Slug Test #2 (Rising Head) at MW-84S; 57 data points
Slope = -8.003E-02 /sec; SD = 5.90 % of (H-Ho); K = 8.884E-03 cm/sec
1.259
1.000
0.794
0.631
0.501
0.398
0.316
0.251
0.200
0.158
0.126
0.100
0.079
0.063
0.050
0.040
0.032
0.025
0.020
0.016
0
4
8
12
16
20
24
TIME (seconds)
Log((H-h)/(H-Ho))

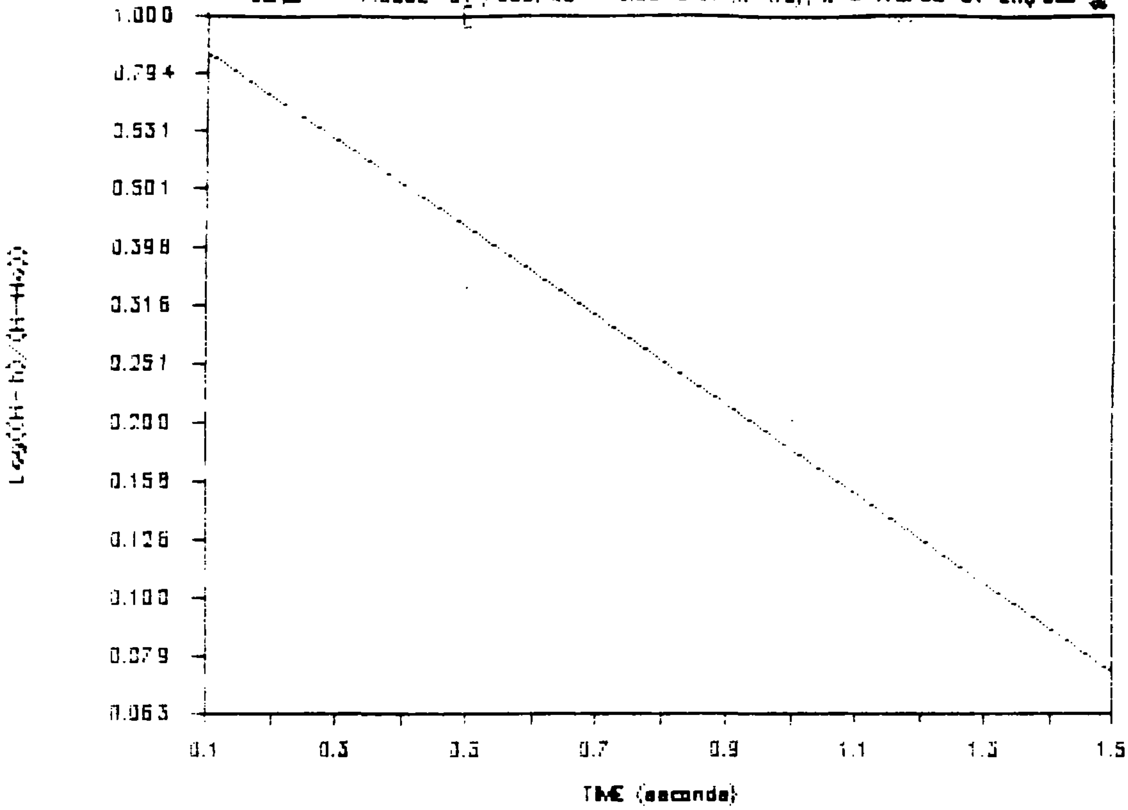


Aquifer Slug Test #1 (Rising Head) at MW-84SC; 60 data points
Slope = -8.798E-02 /sec; SD = 8.02 % of (H-Ho); K = 9.489E-03 cm/sec
1.585
1.000
0.631
0.398
0.251
0.158
0.100
0.063
0.040
0.025
0.016
0.010
0.006
0.004
0.003
0.002
0
4
8
12
16
20
24
28
32
TIME (seconds)
Log((H-h)/(H-Ho))


Aquifer Slug Test #2 (Rising Head) at MW-84SC 252 data points
Slope = -1.053E-01 /sec; SD = 9.06 % of (H-Ho); K = 9.466E-03 cm/sec
2.512
1.585
1.000
0.631
0.398
0.251
0.158
0.100
0.063
0.040
0.025
0.016
0.010
0.006
0.004
0.003
0.002
0
4
8
12
16
20
24
28
TIME (seconds)

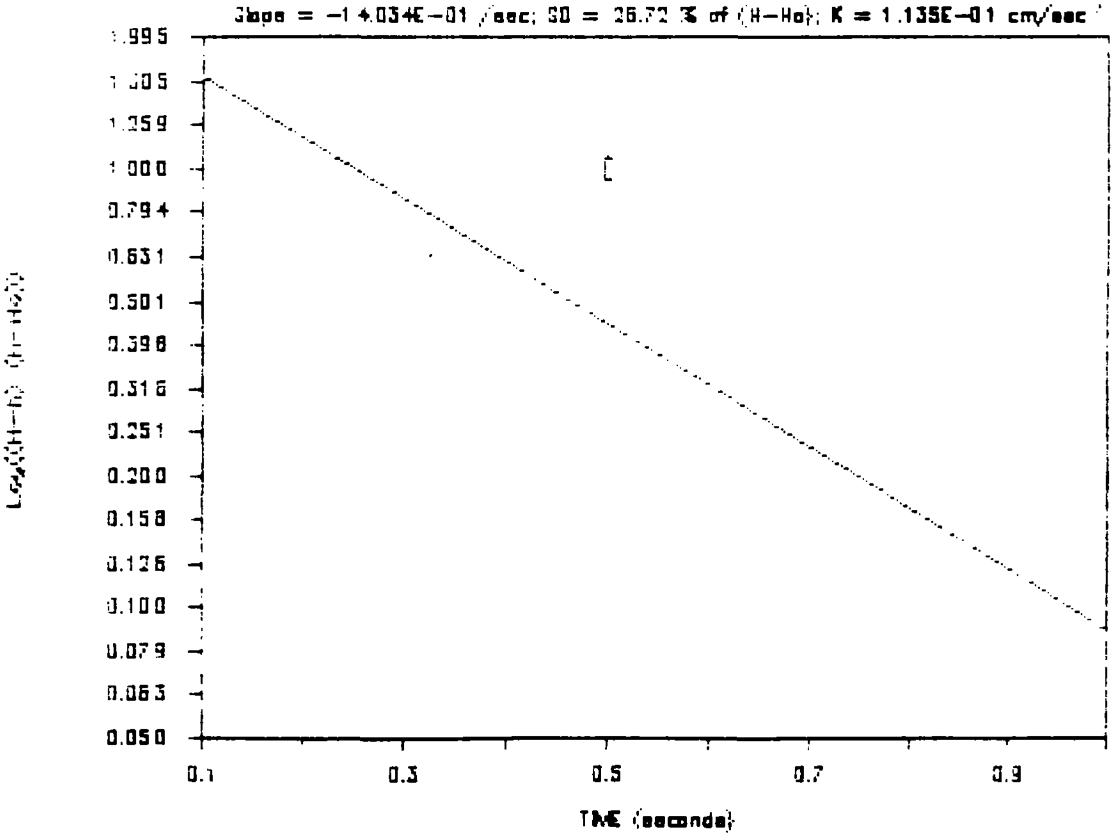
Aquifer Slug Test #1 (Rising Head) at MW-84DA; 5 data points

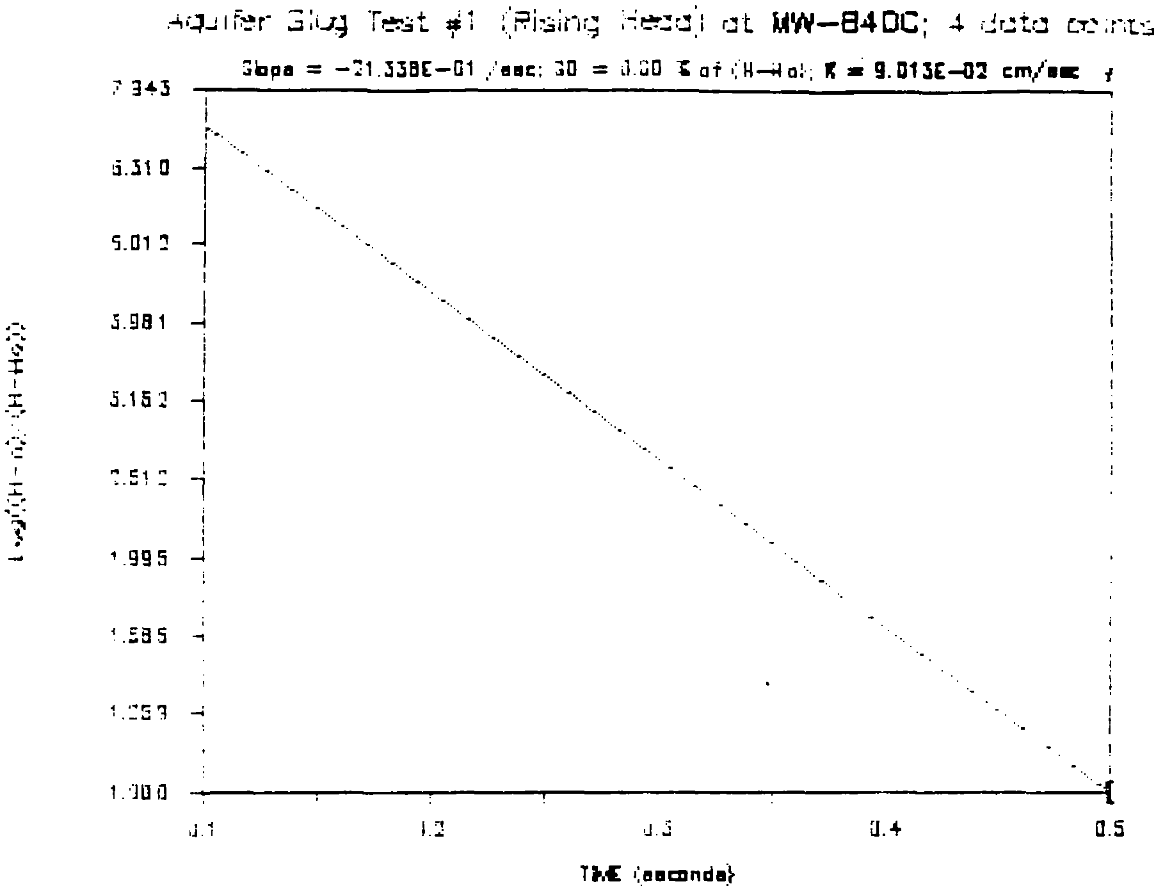
Slope = -7.500E-01 /sec; SD = 5.62 % of (H-Ho); K = 1.075E-01 cm/sec

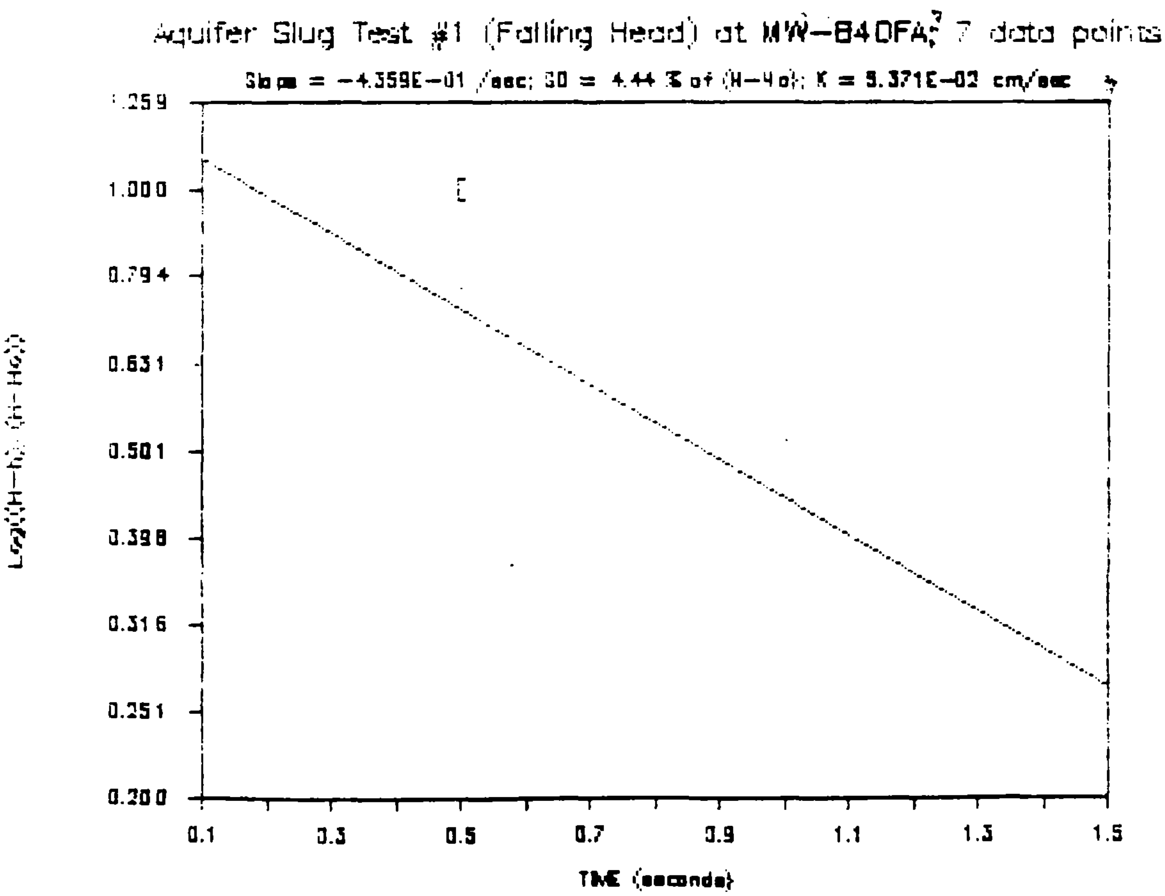


Aquifer Slug Test #2 (Rising Head) at MW-84DB; 5 data points

Slope = -1.4034E-01 /sec; SD = 26.72 % of (H-Ho); K = 1.135E-01 cm/sec




Aquifer Slug Test #1 (Rising Head) at MW-840C; 4 data points
TIME (seconds)


Aquifer Slug Test #1 (Falling Head) at MW-840FA; 7 data points
TIME (seconds)

Appendix E
GEOPHYSICAL SURVEYS

Appendix E
GEOPHYSICAL SURVEYS

INTRODUCTION

Geophysical surveys were performed at the Onalaska landfill from October 6 to 8, 1988 by Don Johnson and Jewelle Imada of CH2M HILL. The objectives of the investigations were:

- o To determine the location, extent, and magnitude of the main drum disposal area and the location of the buried truck.
- o To map the groundwater conductivity plume extending south of the landfill.
- o To locate the "designated" solvent disposal area.

Magnetometer and electromagnetic conductivity methods were used to meet the objectives. The magnetometer survey included measurement of the earth's total magnetic field and the vertical magnetic gradient. The electromagnetic survey was performed by measuring the ground conductivity with the Geonics EM34 at 10- and 20-meter coil separations.

The magnetometer survey defined several areas of buried metal. The magnetometer interpretations were performed using the total field data. The vertical gradient data were not used because the shallow, scattered metal throughout the landfill caused excessive noise levels. The total field data are not affected as much by the scattered metal.

The electromagnetic survey was unable to detect a conductivity plume on the south side of the landfill or to identify liquid disposal pits. The electromagnetic data have been used to delineate the limit of the landfill and to estimate its thickness.

MAGNETOMETER SURVEY

PROCEDURES

Magnetometer readings were made over a 20- by 20-foot grid across the site. The readings were made using an EDA OMNI IV magnetometer that simultaneously measured total field and vertical gradient values. A base station was located off the landfill in an area with no nearby metal, and readings were made there several times a day to determine the amount of diurnal drift in the total field. The amount of drift was small (less than 50 gammas) compared to the observed anomaly sizes (several thousand gammas) and no drift correction was performed. The vertical gradient is not affected by diurnal drift.

Data were contoured with a 500-gamma contour interval (Figure E-1). The source locations for the anomalies were interpreted from profile plots (not included) and are shown on Figure E-2. Data are tabulated in Attachment 1.

RESULTS

The site was operated as a landfill accepting domestic, commercial, and industrial wastes. Accordingly, a considerable amount of metal is scattered throughout the refuse. The scattered metal is the primary source of noise in the magnetometer data. Several areas throughout the landfill exhibit magnetic anomalies with magnitudes much stronger than the noise, and extend across several lines. These anomalies are caused by areas of fill that contain more metal than the remainder of the fill.

The approximate locations of the buried metal causing the most prominent anomalies are shown in Figure E-2. It is not possible using the magnetic data alone to determine whether the buried metal is drums or not. Additional site investigations will be necessary to establish the nature of the source. The areas of buried metal have been listed according to anomaly size (both amplitude and extent). The strongest anomalies have amplitudes on the order of 5,000 gammas. Anomalies less than about 500 gammas could not be used because they could not be distinguished from noise. Areas A, B, and C have the greatest anomalies. The remaining areas have smaller anomalies and represent smaller quantities of metal or less dense concentrations of metal. Since these areas are evident across at least two lines, they are presented here. Anomalies appearing on only one line are note discussed.

Area A

Area A the largest source area identified at the site, covering an area about 400 feet by 100 feet. It is located along the southern perimeter of the landfill. The character of the anomalies change across the area, so for descriptive purposes, Area has been divided into three subareas.

Subarea A1. The anomalies on the western end of Area A (lines 220 to 260, and possibly line 280) constitute Subarea A1. They indicate a narrower source than the remainder of Area A, probably less than 40 feet wide. Because of its dimensions, it has the best chances of being the buried tank truck. The truck, however, could be within Subareas A2 or A3 and not be identifiable.

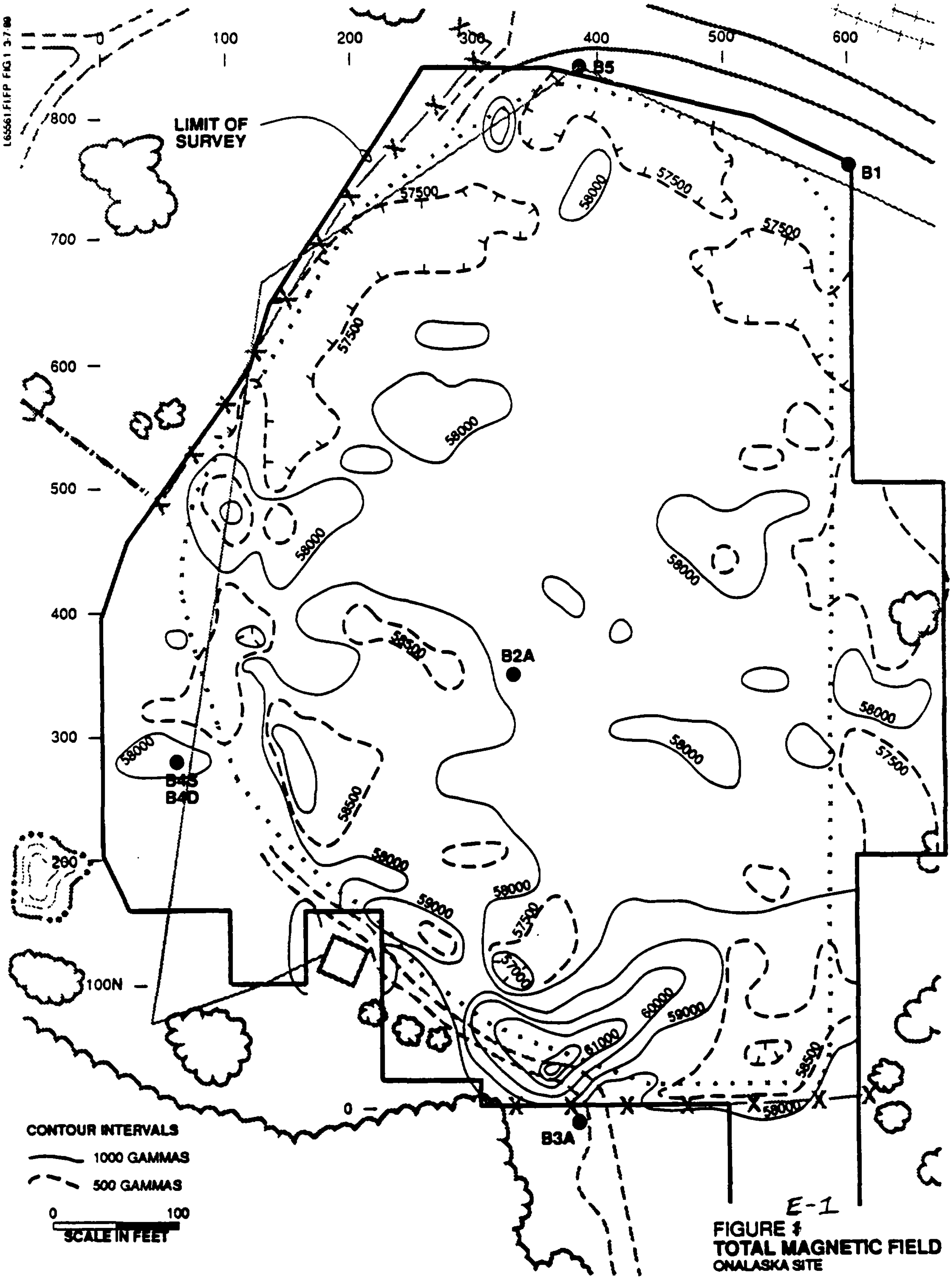


FIGURE 1
TOTAL MAGNETIC FIELD
ONALASKA SITE

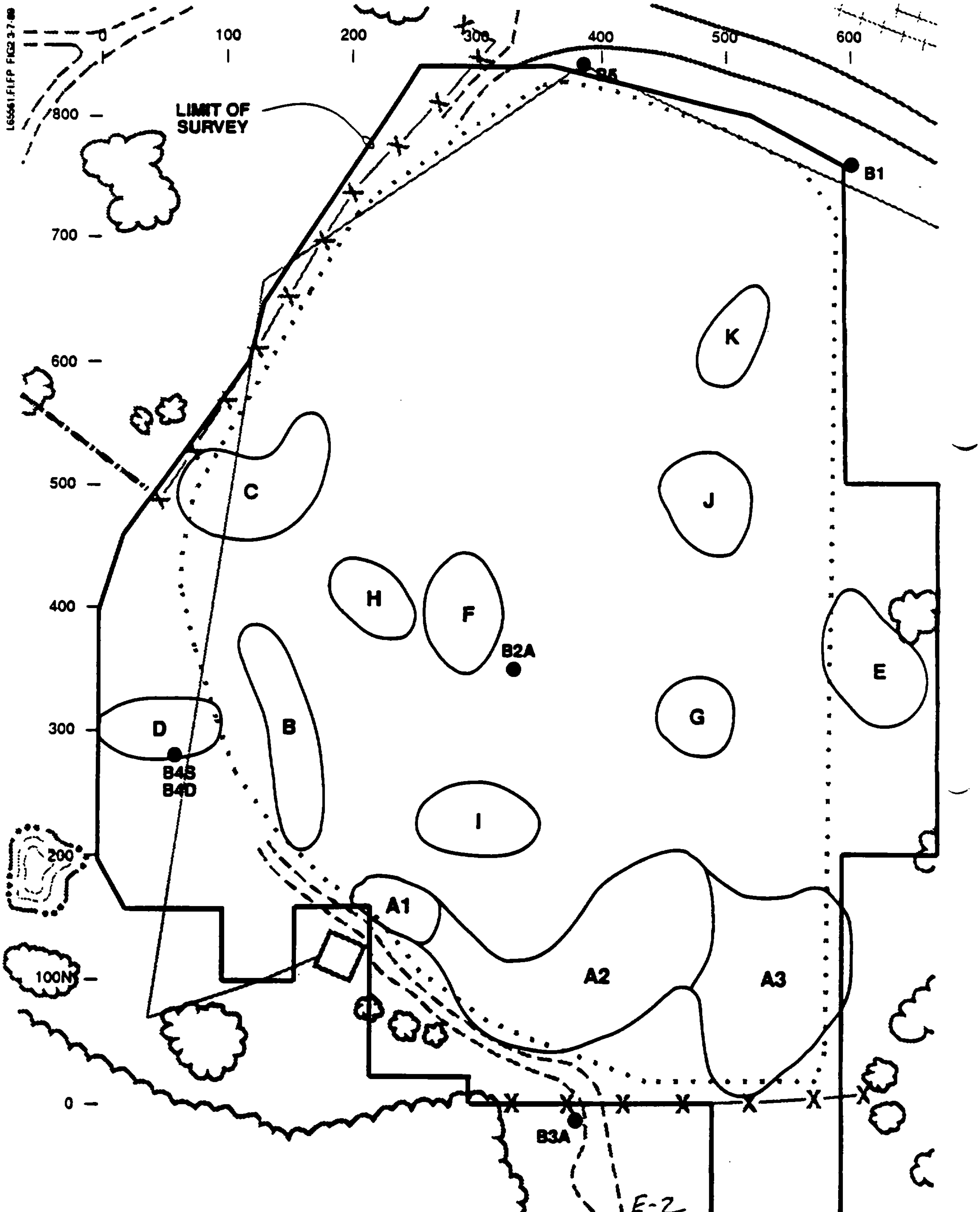


FIGURE E-2
INTERPRETED AREAS OF BURIED METAL
ONALASKA SITE

Subarea A2. Subarea A2 extends from line 280 to line 480 and averages about 100 feet in width. The strongest magnetic anomalies encountered in the survey are included in this zone.

Subarea A3. Subarea A3 extends from line 500 to line 580. It is seen, but weakly, on line 600. The source of these anomalies is about 200 feet wide. The anomalies are about half the amplitudes of the anomalies making up Subarea A2.

Area B

Area B is located along the southwestern edge of the fill. It is about 200 feet long and 40 feet wide, and it is strongest on line 160.

Area C

Area C is located along the western edge of the landfill, but its shape does not conform to the edge of the landfill like Area B does. This source corresponds to an area of "barrels and oil seep" shown on Figure 2-4 of the work plan. A powerline crosses Area C and may be distorting the shape. The powerline does not affect all the anomalies in this area, and cannot be the source.

Area D

The source of this anomaly is probably well nest B4.

Area E

Area E extends east of what appears to be the east edge of the landfill. Minor amounts of domestic trash and rusted drums were observed in the vicinity.

Area F

A small trench identified in the July 10, 1973, aerial photo is located within Area F.

Areas G-K

Areas G through K are within the landfill. They have no distinguishing features, are small in amplitude, and are limited in extent relative to areas A through C.

ELECTROMAGNETIC SURVEY

PROCEDURES

Ground conductivity measurements were made using the Geonics EM34. Readings were made on a 40- by 40-foot grid across the site. An additional east-west line was run south of the landfill to determine if a plume could be detected. Measurements were made with the system operated in the horizontal dipole position and at both 10- and 20-meter separations between receiver and transmitter coils. Data are tabulated in Attachment 2.

Landfill thickness was estimated by comparing measured 10-meter and 20-meter electromagnetic conductivities against a set of interpretation curves (Figure E-3). The curves indicate the theoretical instrument responses over a two-layer earth. The upper layer thickness and conductivity are variable. The bottom layer is infinitely thick and at a constant conductivity of 5 mmhos/meter. The curves were generated using a program supplied by Geonics for use with its instruments.

The edge of the landfill is identified in the data where the conductivity is greater than the average background (about 5 mmhos/m). Exceptions to this are in the vicinity of the powerline which crosses the site. The edge of the landfill can also be defined by comparing the 10-meter data with the 20-meter data. The values are the same off the landfill where the ground conductivity does not change with depth. On the landfill, the fill material is more conductive than the native material beneath and the 10- and 20-meter data differ since they are seeing to different depths.

RESULTS

The 10-meter conductivity data are presented in Figure E-4. No conductivity plume was detected south of the landfill. The data collected along grid line 80 south indicates an increase in conductivity from background (about 5 mmhos/m) to 9 mmho/m. The highest conductivity along this line occurs at the powerline and the conductivity changes may be related to this feature. The 20-meter data reflect the average ground conductivity to about twice the depth as the 10-meter data. The 10-meter and 20-meter data differed by very little, indicating the instrument was seeing no differences in conductivity with depth and therefore no groundwater conductivity plume.

No features that are recognizable as liquid waste disposal areas are evident in the data. Four areas shown in Figure E-4 where localized conductivity anomalies correspond with magnetic anomalies. There is apparently sufficient metal in these locations to cause both conductivity and magnetic anomalies.

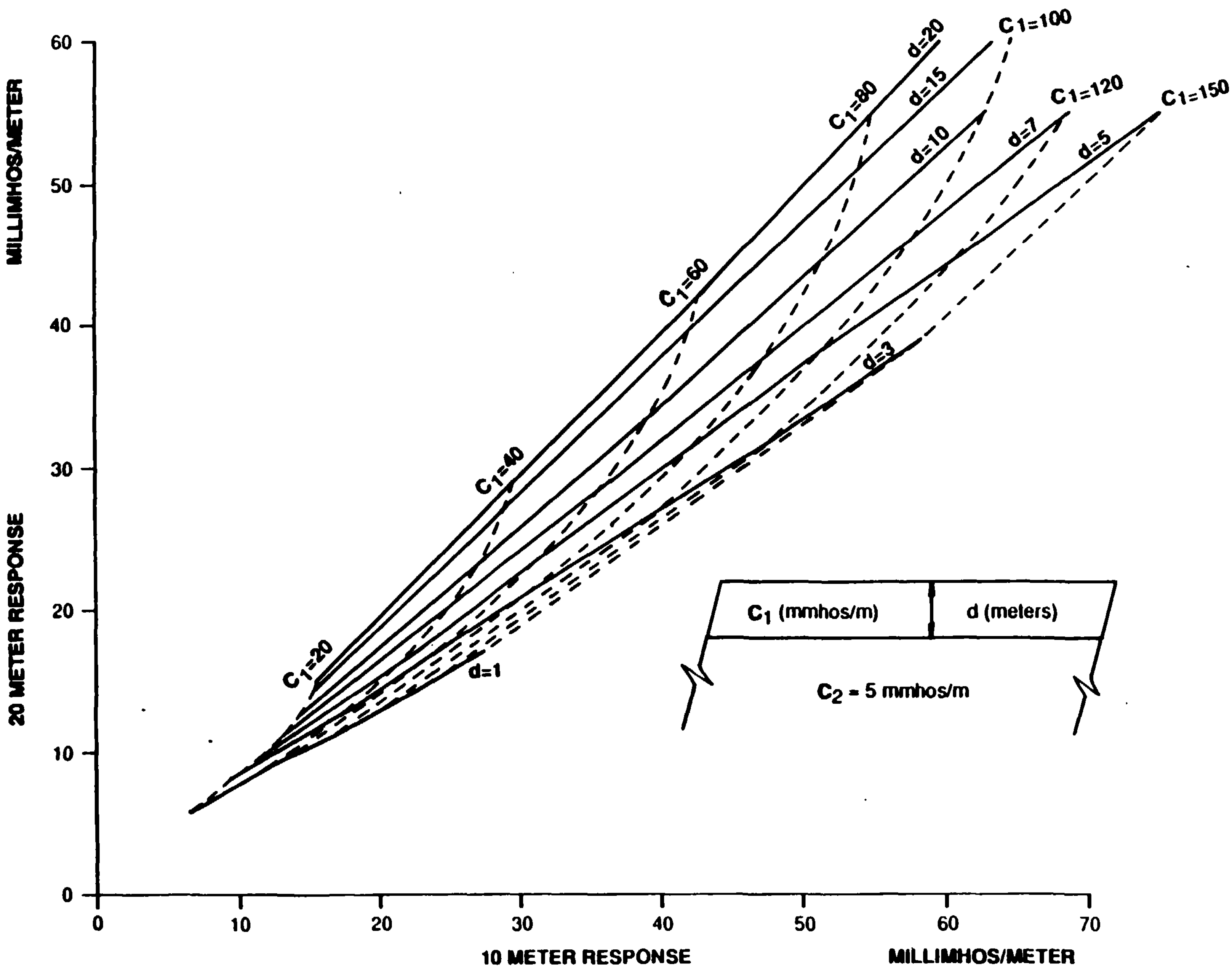


FIGURE 3
INTERPRETATION CURVES
FOR EM 34 DATA
ONALASKA SITE

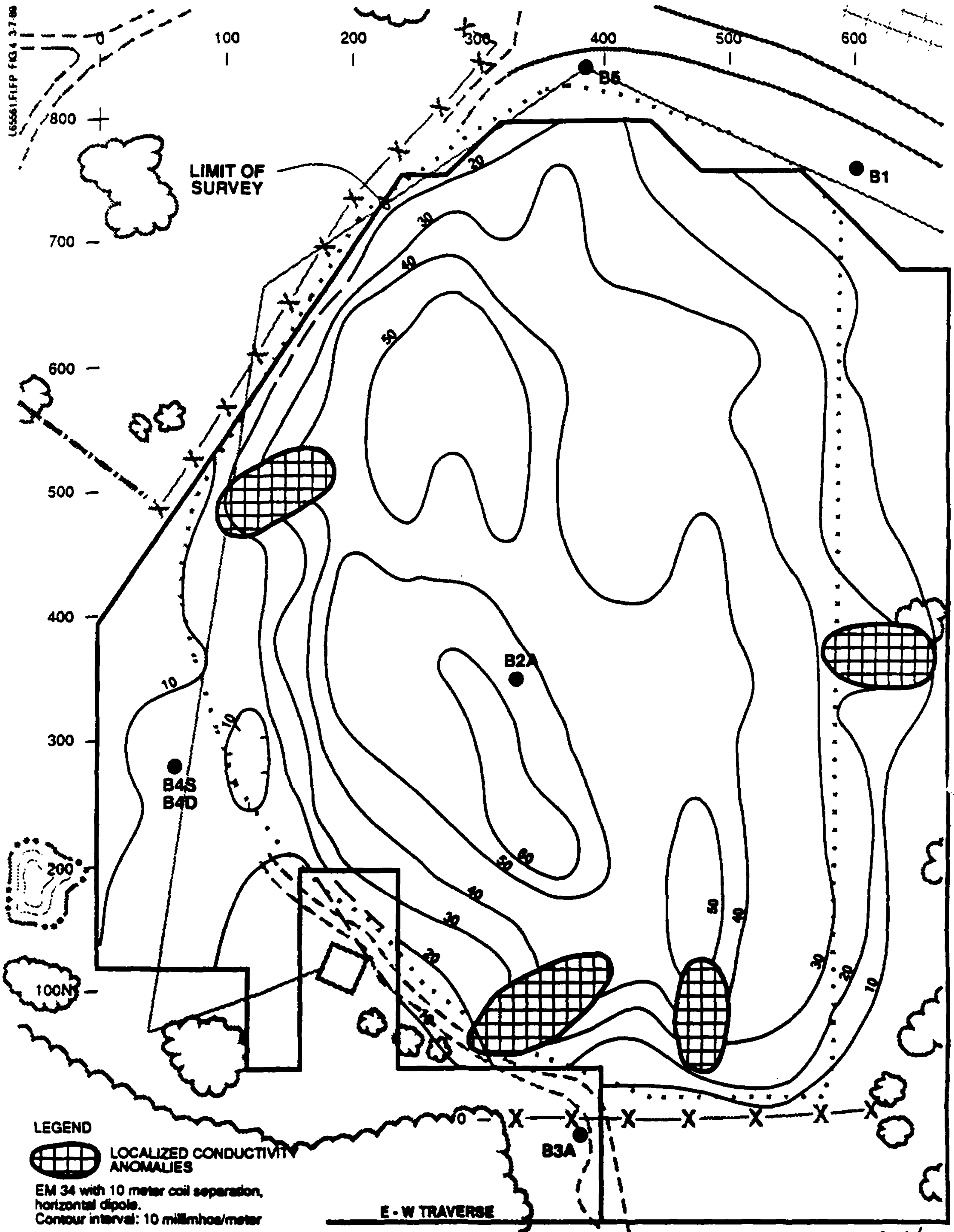


FIGURE E-4
EM CONDUCTIVITY
ONALASKA SITE

Two lie within magnetic area A2; the others correspond to magnetic areas C and E.

The limit of the landfill and the estimated depths determined from the graph in Figure E-3 are shown in Figure E-5.

GLT913/025.50

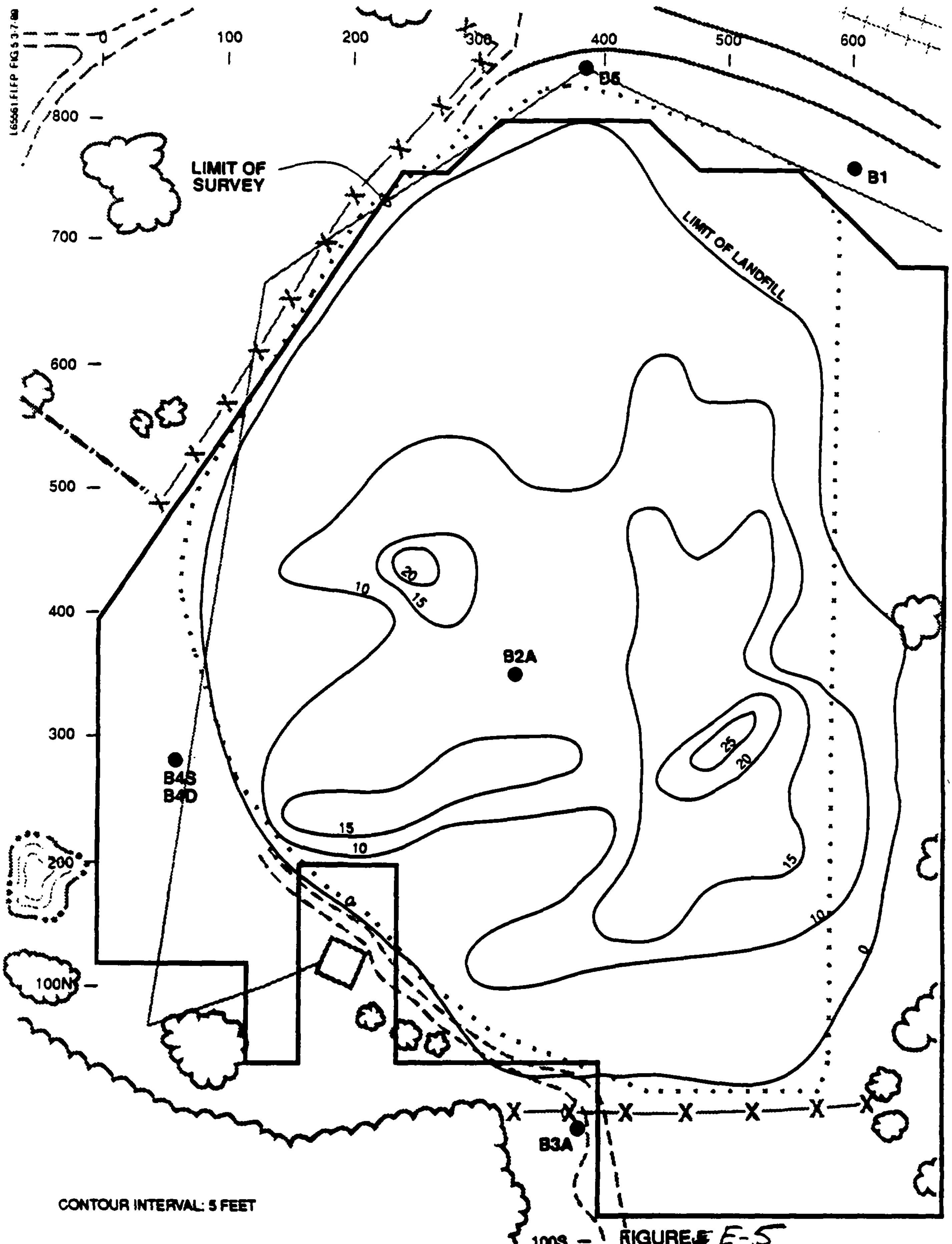


FIGURE 5 E-5
ESTIMATED LANDFILL THICKNESS
ONALASKA SITE

Attachment 1
MAGNETOMETER DATA

[illegible] - MAGNETIC SURVEY RESULTS [illegible]
(TOTAL FIELD READINGS IN GAMMAS)

	0	20	40	60	80	100	120	140	160	180	200	220	240
900 N													
880 N													
860 N													
840 N													
820 N													
800 N													57639
780 N												57506	57596
760 N												57559	57542
740 N											57636	57515	57901
720 N											57740	57313	57293
700 N										57434	57211	57140	57338
680 N									57817	57357	57370	57154	57443
660 N								57735	57401	57223	57576	57765	57666
640 N								57405	57207	57031	57443	57539	57739
620 N								57257	56994	57194	57612	57549	57877
600 N							57471	57165	57231	57607	57958	57742	57886
580 N						57383	57667	57741	57102	57515	57850	57998	58217
560 N						57480	57938	57242	56399	57440	57846	58092	58419
540 N					57554	57494	57821	57273	57147	57479	57714	57387	58019
520 N					57415	58141	57660	57297	57679	57383	58135	58049	57893
500 N				57635	58570	58843	57636	57378	57910	58009	57993	57769	57753
480 N			57598	57539	58293	59300	58154	58747	58425	58062	58142	57926	57768
460 N		57662	57652	57672	58411	58841	58411	58551	58174	57784	57832	57918	57802
440 N		57675	57639	57642	57757	58008	57659	58185	57392	57147	57299	57504	57653
420 N		57610	57491	57566	57581	57457	57514	58152	57711	57955	58063	57499	57985
400 N	57643	57565	57655	57653	57417	57365	57149	57790	58087	58045	58661	58424	58383
380 N	57630	57500	57670	58398	57525	57279	56805	57644	57812	58068	58516	58505	59672
360 N	57620	57578	57595	57717	57395	57472	58281	57936	57701	57893	57845	58072	58137
340 N	57600	57586	57844	57687	57326	57350	57958	58194	57782	57851	58256	58356	58260
320 N	57613	57655	57355	57374	57491	57318	57605	58795	58184	58101	58436	58473	58368
300 N	57635	57802	58291	57935	57602	57246	57648	59204	58734	58604	58445	58343	58400
280 N	57682	58091	58435	58246	58238	57865	57518	58141	59351	58558	58577	58548	58445
260 N	57691	57672	57754	57951	57783	57489	57462	57948	59370	58656	58557	58437	58023
240 N	57695	57674	57665	57811	57474	57788	57446	57712	59479	58623	58557	58311	57900
220 N	57701	57671	57673	57925	57730	57773	57563	57524	58637	58847	58271	58077	59068
200 N	57669	57812	57708	57651	57666	57729	57552	57411	57706	58307	57967	58012	58215
180 N		57712	57701	57760	57613	57652	57884	57348	57191	57964	58149	57927	57645
160 N		57718	57710	57664	57643	57583	57459	57520	56786	57112	58842	59612	59204
140 N						57554	57298	57081	56366	57722		59846	59460
120 N						57557	57339	57295	55932			55623	57378
100 N						57594	57635	57292	56390			56566	57098
80 N									57228			57046	57776
60 N									57549			57415	57383
40 N									57632			57576	57427
20 N												57481	57395
0												57469	58200
20 S													

UNALASKA -- 49
TOTAL FIELD [illegible]

	260	280	300	320	340	360	380	400	420	440	460	480	500
900 N													
880 N													
860 N													
840 N	57742	57715	57768	57746	57626	57685							
820 N	57698	57694	57692	57604	57524	57395	57238	57151		57417			
800 N	57631	57604	57538	57913	57411	57231	57588	57495	57242	57300	57374	57460	57625
780 N	57524	57564	57773	57743	57249	57340	57676	57722	57380	57352	57381	57473	57580
760 N	57951	57864	57580	57609	57662	57643	57772	58174	57428	57460	57355	57408	57469
740 N	57576	57616	57381	57668	57915	57982	58031	58060	57686	57564	57429	57399	57548
720 N	57130	57313	57448	57259	57394	57619	58076	57913	57803	57546	57528	57567	57474
700 N	57401	57265	57370	57553	57495	57873	57369	57687	57588	57456	57579	57531	57571
680 N	57375	57447	57489	57564	57518	57572	57602	57733	57749	57576	57669	57595	57383
660 N	57755	57591	57632	57494	57672	57727	57694	57769	57859	57635	57541	57385	57258
640 N	57392	57351	57882	57661	57751	57890	57330	57719	57900	57841	57694	57531	57246
620 N	58112	58165	58015	57364	57736	57544	57625	57609	57825	57847	57918	57823	57650
600 N	57732	57754	57967	57806	57921	57722	57607	57609	57509	57545	57796	57799	58004
580 N	58371	57971	58149	57829	57938	57927	57922	57867	57532	57300	57643	57857	57794
560 N	58459	58344	58184	58008	57956	57894	57719	57658	57658	57252	57594	57917	57876
540 N	58210	58013	57762	57766	57888	57913	57775	57547	57725	57656	57594	57657	57640
520 N	58027	57745	57905	57913	57744	57935	57936	57683	57672	57852	57683	57589	57642
500 N	57937	57954	57900	57727	57500	57797	57927	57868	57735	57826	57801	57659	57596
480 N	57836	57699	57585	57549	57374	57756	57745	57731	57650	57753	58212	58126	57903
460 N	57434	57516	57583	57660	57558	57570	57654	57660	57681	57732	58111	58256	58153
440 N	58097	57573	57468	57434	57523	57683	57599	57533	57782	57624	57873	58138	57961
420 N	57937	57615	57519	57364	57611	58009	57844	57546	57724	57695	57753	57382	58031
400 N	58043	57980	57666	57311	57622	57936	58010	57903	57707	57640	57859	57856	57658
380 N	58325	58271	58074	57629	57507	57584	57615	57802	58112	57982	57916	57663	57547
360 N	58516	58705	58383	57758	57561	57472	57703	57891	57734	57827	57801	57590	57557
340 N	58292	58589	58306	57857	57485	57555	57596	57730	57818	57762	57639	57477	57536
320 N	58266	58202	58310	58162	57902	57672	57545	57810	57847	57954	57939	57857	57783
300 N	58261	58139	58203	58169	57901	57711	57733	57809	58046	58215	58060	58146	57966
280 N	58218	57954	57920	57987	57929	57935	57767	57671	57867	57995	57988	58247	58187
260 N	58129	57993	57728	57799	57951	57989	57698	57624	57836	57858	57735	57938	58064
240 N	58070	58240	58121	57846	57597	57628	57498	57616	57493	57621	57501	57776	57765
220 N	58170	58462	58302	58251	57944	57633	57462	57294	57598	57442	57290	57618	57661
200 N	58301	58718	58807	58670	58441	57653	57607	57710	57643	57590	57525	57399	57504
180 N	58488	58306	58289	58382	58310	57869	57735	57868	57879	57867	57863	57769	57441
160 N	58127	58049	58122	57718	57634	57272	57676	57710	58028	57984	58172	57980	57556
140 N	59588	59140	58118	57746	57917	57447	57366	57838	58469	58434	58287	58089	58289
120 N	58359	59559	58679	56306	57019	57003	57810	58299	58941	59199	59436	59732	58968
100 N	57427	58959	58997	56271	56442	57185	58707	58667	59359	60078	60174	59822	58883
80 N	57384	58849	60208	59441	58426	59530	59932	59391	60015	60365	59467	59049	58777
60 N	57417	57923	60348	61783	61459	60539	60304	61585	61338	59372	58554	58811	58950
40 N	57314	57707	59313	60066	61041	61758	62645	60479	59628	58475	58722	58890	58802
20 N	57319	57549	58133	59767	60478	63483	59576	57386	58022	57898	58068	58495	58896
0				57976	58764	59319	59055	57852	57756	58214	58729	58529	59478
20 S													57588

[illegible] -- [illegible]

[illegible] 2

	260	280	300	320	340	360	380	400	420	440	460	480	500
40 S													[illegible]
60 S													[illegible]699
80 S													[illegible]712
100 S													[illegible]713

UNALASKA -- ?A
TOTAL FIELD ?

	520	540	560	580	600
900 N					
880 N					
860 N					
840 N					
820 N					
800 N	57660				
780 N	57622	57656	57730		
760 N	57530	57655	57679	57663	57724
740 N	57570	57554	57659	57691	57666
720 N	57544	57583	57633	57635	57602
700 N	57499	57502	57575	57574	57624
680 N	57309	57391	57498	57559	57546
660 N	57157	57209	57385	57513	57485
640 N	57193	57447	57454	57465	57377
620 N	57626	57505	57645	57489	57366
600 N	57978	57750	57780	57435	57214
580 N	57827	57778	57838	57721	57313
560 N	57797	57363	58146	57926	57496
540 N	57693	57978	58142	58087	57580
520 N	57463	57494	57782	57901	57416
500 N	57708	57876	57968	57797	57359
480 N	58000	58239	58078	57790	57423
460 N	58070	57389	57777	57601	57306
440 N	58010	57825	57474	57302	57147
420 N	58011	57897	57652	57368	57090
400 N	57878	57825	57764	57338	57610
380 N	57609	57552	57723	57589	57949
360 N	57739	57766	57770	57597	58097
340 N	58171	58120	57969	57739	58241
320 N	57893	57939	57822	57510	58145
300 N	57725	57943	58075	57755	57330
280 N	57649	57518	58060	58005	57442
260 N	57877	57890	57738	57706	57372
240 N	57928	57747	57647	57714	57639
220 N	57810	57773	57965	58129	57810
200 N	57734	57866	57930	57998	57719
180 N	57389	57587	57710	57923	57794
160 N	57382	57715	57743	58019	58006
140 N	58144	58031	58024	58115	58046
120 N	58651	58249	58563	58521	58064
100 N	58882	58272	58529	58744	58432
80 N	58443	58342	58219	58567	58572
60 N	58892	58652	58660	58664	58385
40 N	58474	58489	58530	58238	57896
20 N	58687	58996	58821	57906	57647
0	59695	59422	58821	57834	58311
20 S	57568	57594	57633	57631	57635

UNALASKA -- MA

TOTAL FIELD NT

	520	540	560	580	600
40 3	57675	57571	57683	57675	57572
60 3	57693	57691	57598	57697	57687
80 3	57701	57697	57704	57699	57707
100 3	57712	57701	57702	57706	57702

Attachment 2
ELECTROMAGNETIC CONDUCTIVITY DATA

UNALASKA LANDFILL

[illegible] METER COIL SEPERATION -- HORIZONTAL DIPOLES
Readings in mMHOs/meter

	-120	-80	-40	0	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600	640	680	720
800 N	---	---	---	---	---	---	---	---	---	---	---	11	---	24	10	---	---	---	---	---	---	---
760 N	---	---	---	---	---	---	---	---	---	10	18	24	32	23	15	11	3	3	---	---	---	---
720 N	---	---	---	---	---	---	---	---	5	21	33	29	40	26	20	17	12	10	8	---	---	---
680 N	---	---	---	---	---	---	---	---	16	35	42	31	35	28	26	24	16	16	9	4	3	---
640 N	---	---	---	---	---	---	---	10	41	44	54	42	35	34	32	30	24	20	11	4	4	---
600 N	---	---	---	---	---	---	---	23	46	57	56	54	41	33	30	33	35	25	3	5	4	---
560 N	---	---	---	---	---	---	18	36	48	56	52	56	44	32	38	31	27	27	12	5	4	---
520 N	---	---	---	---	---	3	25	43	48	52	48	54	40	39	34	30	31	26	13	7	5	---
480 N	---	---	---	---	---	11	24	34	45	51	46	51	42	35	31	42	33	24	11	3	5	---
440 N	---	---	---	---	7	11	14	29	51	45	49	50	44	35	35	43	34	26	12	11	7	---
400 N	---	---	---	7	7	11	14	33	57	58	55	50	46	42	45	45	36	33	22	14	3	---
360 N	---	---	---	5	9	7	15	36	59	57	52	56	45	41	54	44	41	38	21	24	7	---
320 N	---	---	---	6	12	18	8	27	58	51	59	62	52	42	55	49	36	38	18	19	6	---
280 N	---	---	---	7	11	19	9	29	46	50	51	61	56	42	44	46	39	34	25	8	5	---
240 N	---	---	---	8	10	14	11	19	37	43	51	64	54	49	45	52	40	34	24	6	4	---
200 N	---	---	---	9	12	11	11	7	30	36	42	49	67	52	41	52	39	35	23	5	4	---
160 N	---	---	---	10	14	12	9	9	---	25	31	40	46	45	42	50	40	37	27	5	4	---
120 N	---	---	---	9	23	12	7	8	---	13	24	27	44	46	45	51	37	40	24	4	3	---
80 N	---	---	---	---	---	---	10	9	---	9	15	34	58	32	28	45	22	30	11	4	4	3
40 N	---	---	---	---	---	---	11	9	---	9	9	20	26	13	13	20	21	23	4	4	3	---
0	---	---	---	---	---	---	---	9	---	---	---	---	---	4	1	-2	---	2	1	2	3	3
40 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	4	4	5	5	3	3	---
80 S	8	3	3	9	9	3	8	8	7	5	5	5	5	5	4	3	4	4	4	3	3	3
120 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	3	4	4	4	3	3	---
160 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	3	4	---	4	3	3	3
200 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	3	4	4	4	3	3	---
240 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4	4	4	5	4	3	3	3

UNALASKA LANDFILL

20 METER COIL SEPERATION -- HORIZONTAL DIPOLES
(Readings in mMHOs/meter)

	-120	-80	-40	0	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600	640	680	720
800 N	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
760 N	---	---	---	---	---	---	---	---	---	10	12	11	19	16	12	8	6	---	---	---	---	---
720 N	---	---	---	---	---	---	---	---	---	12	22	17	25	16	17	11	10	9	10	---	---	---
680 N	---	---	---	---	---	---	---	---	13	22	29	19	25	17	18	15	13	11	12	---	---	---
640 N	---	---	---	---	---	---	---	---	23	25	35	25	20	19	20	18	17	14	12	---	5	---
600 N	---	---	---	---	---	---	---	12	24	38	40	30	26	22	21	19	19	15	10	5	4	---
560 N	---	---	---	---	---	---	32	23	29	36	33	35	27	22	22	20	22	16	7	5	5	---
520 N	---	---	---	---	---	---	32	26	30	38	35	34	28	23	23	22	24	17	10	6	5	---
480 N	---	---	---	---	---	7	23	23	32	36	33	35	29	25	24	27	25	16	11	7	5	---
440 N	---	---	---	---	21	15	17	22	35	37	37	36	28	25	28	32	26	19	14	10	6	---
400 N	---	---	---	---	7	27	13	22	34	36	41	34	31	28	34	32	28	21	13	11	6	---
360 N	---	---	---	5	10	13	10	25	40	40	42	38	33	28	43	32	29	24	11	13	5	---
320 N	---	---	---	5	12	30	6	21	39	35	39	44	36	30	39	35	30	28	13	10	7	---
280 N	---	---	---	6	12	29	8	21	32	33	38	46	42	28	34	39	29	25	17	8	5	---
240 N	---	---	---	7	13	26	11	15	28	32	35	43	43	29	34	37	31	24	18	6	5	---
200 N	---	---	---	9	16	19	15	13	20	22	25	41	36	33	32	38	30	26	17	5	4	---
160 N	---	---	---	3	19	16	10	9	---	13	25	25	32	36	34	36	26	25	17	4	4	---
120 N	---	---	---	9	10	13	9	2	---	11	18	25	32	25	27	34	24	23	13	5	4	---
80 N	---	---	---	---	---	---	7	6	---	11	9	16	22	13	15	29	17	16	11	4	4	---
40 N	---	---	---	---	---	---	---	9	---	11	6	16	20	11	11	16	15	10	-1	4	3	---
0	---	---	---	---	---	---	---	10	---	---	---	---	---	5	---	---	---	5	2	4	3	---
40 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
80 S	7	8	8	9	9	9	9	9	8	5	6	6	6	5	5	5	4	4	4	3	3	3
120 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
160 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5	4	4	---	4	3	3	3
200 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
240 S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5	4	4	3	3	3	3	3

Appendix F
SHALLOW GROUNDWATER SAMPLING

Appendix F
SHALLOW GROUNDWATER SAMPLING

INTRODUCTION

The shallow groundwater sampling investigation consisted of sampling groundwater through a narrow probe and analyzing the samples in the onsite close support laboratory. The analysis and results are discussed in Appendix G. This investigation was substituted for the soil gas survey of Subtask FT, Solvent Disposal Area Investigation, when evaluation of the initial soil gas results indicated a high degree of variability in analytical results. Also soil moisture, which reduces soil gas VOC concentrations, was high as a result of the spring thaw.

The objectives of the shallow groundwater sampling investigation were:

- To locate the major disposal area for solvent waste within the landfill
- To determine the extent of the floating naphtha downgradient of the landfill
- To provide additional groundwater analytical data to aid in selecting locations for monitoring wells

The third objective was not originally an objective of the soil gas survey, but was added during the field investigation to reduce drilling costs and potentially avoid the need for an additional phase of monitoring well installations.

Sampling was conducted in two episodes, from March 19 to 21 and from March 28 to 30, 1989. The sample team leader on all days of sampling was Phil Smith. Additional samplers were:

- Jeff LaMont on March 19 to 21, 28, and 30
- Dan Plomb on March 28 and 29
- Kevin Olson on March 29

FIELD PROCEDURES

Sampling was accomplished by driving a 0.625-inch O.D. stainless steel probe to about 2 feet below the water table and withdrawing a 40-ml sample with a peristaltic pump. The probe consisted of a 10-inch slotted intake tip and 2.5-foot sections of stainless steel.

A slide hammer was used to drive and remove the probe. Once the probe was at the desired depth, a 2-foot length of silicon tubing was attached to a nipple at the end of the probe. At least three probe volumes were withdrawn with the peristaltic pump prior to filling three 40-ml VOA vials. One of the vials was filled halfway for subsequent headspace analysis. The other two were filled and capped with no air bubbles. The vials were marked with the sample location and stored in a cooler. Several times per day samples were delivered to the close support laboratory for analysis of toluene, xylene, TCE, PCE, and 1,1,1-TCA.

A headspace analysis was performed in the field to provide information for sample dilution and to aid in the selection of the subsequent probe sampling locations. A half-filled VOA vial was heated for 5 minutes on the auto heater outlet. The vial lid was opened slightly to allow insertion of an HNu probe to measure organic vapors.

Field blanks were collected by drawing distilled water through the probe tip and 5 feet of pipe with the peristaltic pump. Field duplicates were taken by filling six VOA vials instead of three.

Decontamination of the probe and silicone tubing was performed at each sample location. The probe tip and each 2.5-foot section were removed and decontaminated individually. The sections were scrubbed in a solution of water and trisodium triphosplate and rinsed in distilled water; a 10 percent solution of methanol and distilled water; and again in distilled water. Silicon tubing was decontaminated by drawing at least three tubing volumes through the tubing.

RESULTS

Shallow groundwater sampling locations were selected based on HNu headspace results and laboratory testing results. Table F-1 presents the probe sampling locations, HNu headspace results, and observations during sampling.

GLT913/074.50

Table F-1
SHALLOW GROUNDWATER SAMPLING RESULTS

Sample Number	Grid Coordinates	Depth of Proble Tip	Date	Time	HNu Headspace (ppm)	Observations
PB-01	160E 160N	13' 6"	3/19/89	1050	500	
PB-02	80E 90N	5'	3/19/89	1137	400	Sheen on water sample
PB-03	20W 80N	4' 3"	3/19/89	1145	50	
PB-04	80E 30N	4' 3"	3/19/89	1330	5	
PB-05	160E 30N	5' 4"	3/19/89	1340	500	Slight sheen on water sample
PB-06	Probe blank	--	3/19/89	1409	7	HNu reading may be due to moisture evaporation from probe
PB-07	Bottle blank	--	3/19/89	1420	0.5	
PB-08	40W 30N	5' 10"	3/19/89	1437	55	
PB-09	80W 90N	3' 4"	3/19/89	1504	1.5	Light milky brown color
PB-10	160E 80S	4' 10"	3/19/89	1534	170	Slight yellow-green color; slight foaming when shaken
PB-11	240E 70S	15" 10"	3/19/89	1605	200	Slight yellow-green color; slight foaming when shaken
PB-12	320E 80S	17' 0"	3/20/89	804	18	
PB-13	372E 40S	19' 6"	3/20/89	845	125	Slightly cloudy; naphtha smell during purging
PB-14	400E 160S	16' 6"	3/20/89	918	35	Yellow-green color
PB-15	570E 70S	21' 6"	3/20/89	1022	140	Slightly cloudy; foaming
PB-16	680E 80S	21' 0"	3/20/89	1115	1.5	
PB-17	600E 160S	18' 6"	3/20/89	1150	1.5	
PB-18	480E 160S	21' 0"	3/20/89	1337	260	Yellow-green color; slightly cloudy
PB-19	0E 200N	3' 4"	3/20/89	1404	480	Yellow-green color; slightly cloudy
PB-20	40W 330N	12'6"	3/20/89	1430	60	Yellow-green color; slightly cloudy
PB-21	10E 430N	15' 6"	3/20/89	1505	260	Yellow-green color; slightly cloudy
PB-22	70E 540N	21' 0"	3/20/89	1608	6	
PB-23	150W 410N	14' 4"	3/20/89	1700	3	
PB-24	680E 430N	8' 4"	3/21/89	841	1	
PB-25	680E 280N	8' 0"	3/21/89	921	1	
PB-26	655E 160N	15' 10"	3/21/89	1000	5	
PB-27	Probe blank	--	3/21/89	1025	1.5	
PB-28						
PB-29						

Table F-1 (Continued)

Sample Number	Grid Coordinates	Depth of Proble Tip	Date	Time	HNu Headspace (ppm)	Observations
PB-30	110E 440N	19' 0"	3/29/89	1012	400	Slight foaming
PB-31	180E 450N	21' 0"	3/29/89	1353	60	Slight foaming
PB-32	120E 530N	20' 0"	3/29/89	1435	90	
PB-33	200E 350N	21'	3/29/89			No sample obtained
PB-34	120E 350N	14' 0"	3/30/89	1107	450	
PB-35	190E 160N	13' 0"	3/30/89	1205	420	Slight foaming
PB-36	300W 400N	8' 0"	3/30/89	1423	9	
PB-37	290W 490N	4' 0"	3/30/89	1450	6	
PB-38	340W 310N	5' 0"	3/30/89	1700	4	
PB-39	210W 420N	10' 4"	3/30/89	1508	3	
PB-40	210W 420N	10' 4"	3/30/89	1508	3	Field duplicate of PB-39
PB-41	210W 340N	8' 0"	3/30/89	1530	3	
PB-42	Probe blank	--	3/30/89	1543	0	
PB-43	300W 200N	5' 6"	3/30/89	1637	2	
PB-44	200W 80N	8' 0"	3/30/89	1612	4	

GLT866/46

Appendix G
CLOSE SUPPORT LABORATORY ANALYSIS

Appendix G
CLOSE SUPPORT LABORATORY ANALYSIS

INTRODUCTION

From March 21, 1989 to April 30, 1989, a CH2M HILL Close Support Laboratory (CSL) was deployed at the Onalaska Municipal Landfill ARCS V site in Onalaska, Wisconsin. The CSL, equipped with a Hewlett-Packard 5890A gas chromatograph in conjunction with both a flame ionization detector and electron capture detectors, was used to analyze soil and water samples for the following target compounds, which were selected based on available historical data from previous investigations at the site:

Compound	Abbreviation
1,1,1-Trichloroethane	1,1,1-TCA
Trichloroethene	TCE
Perchloroethylene	PCE
Toluene	TOL
Xylenes	XYL

The purpose of the CSL was to provide an onsite Level II sample screening analysis with quick turnaround, and thereby allow for informed and timely field decisions on where to place monitoring wells and what samples to submit to the CLP. This technical memorandum addresses both the usability of the resultant CSL data and compliance with the project data quality objectives.

Before using the CSL analytical data, the user must be familiar with the general workings of gas chromatography (GC) methods, the QA/QC protocol incorporated in the named methods, the major influences on the GC system, and the onsite CSL operations. This memorandum provides the reader with a general understanding of gas chromatography and how GC was integrated into the Onalaska project as part of the CSL. In addition, this memorandum will address the quality control/quality assurance measures needed to assess data quality and describe how these measures were incorporated into the CSL. Finally, the memorandum focuses on the actual CSL data and discusses its usability.

ANALYTICAL APPROACH

The basic components of a laboratory gas chromatograph include the oven, column, integrator, and carrier gas. The standard GC analytical method is described below.

Prior to GC analysis, soil samples are extracted with a suitable solvent. The solvent allows for mass transfer of organics from the sample into the solvent. Once the sample has been extracted with solvent (done by physically agitating the solvent/sample mixture), the resultant extract may be used for GC analysis.

A small portion of the extract (0.5 µl to 5 µl) is then injected into the injection port of the GC, where it is vaporized.

Next the carrier gas, which continuously purges the system, sweeps the sample components into the GC column. As the compounds are swept through the column, the individual compounds will begin to separate. Chromatographic separation is a function of both chemical and physical properties of the column and the sample constituents. Consequently, the individual compounds elute at different characteristic retention times. (Retention time is the time between extract injection and compound detection.) Detection occurs at the column's end by use of various detectors. The relative response by the detector is a measure of a compounds concentration. Identification and quantification of compounds are based on expected retention time and response as compared to calibration standards.

A site-specific method was developed that met project objectives for the Onalaska site. CSL staff employed standard gas chromatography methods to analyze soil samples (EPA Method 3550--Sonification Extraction and Method 8000--Gas Chromatography Analysis as found in SW846, *Test Methods for Evaluating Solid Waste*, 3rd edition, 1986). Pentane was used in conjunction with physical agitation to extract the Onalaska target compounds from the sample matrix. The extract was subsequently analyzed on a capillary gas chromatograph using an electron capture detector (ECD) for the chlorinated compounds and a flame ionization detector (FID) for the aromatic compounds. Gas chromatography with an ECD or FID is a common instrumental analysis used by laboratories for the qualification and quantification of complex mixtures.

CSL OPERATIONS

The CSL was housed in the EPA laboratory trailer. During mobilization of the CSL, the HP5890A GC with the HP3392 Integrator and the HP7673 Autosampler were interfaced and powered up. The required GC gases were then installed, and appropriate flows were established. Nitrogen (ultrapure) was chosen as the carrier gas, and air (zero grade) and hydrogen (ultrapure) were needed for the FID. The system was checked for leaks.

As mentioned earlier, both the ECD and FID detectors were used at the Onalaska CSL. The ECD is very sensitive to chlorinated compounds such as TCA, TCE, and PCE, while the FID is more appropriate for nonchlorinated aromatics such as TOL and XYL.

To record detector response, an integrator was used to electronically calculate the concentration of a compound. The presence of compounds eluting from the GC column results in a peak shaped response drawn on the integrator chart paper. The integrator integrates the area under the peak, and this area correlates to a concentration. However, many "area counts," as they are called, do not necessarily correlate to a high compound concentration because every compound responds differently to a detector. A 1 µg/ml standard of a given compound may register a large peak and many area counts by GC/FID, while a

1 μg/ml standard of another compound registers a small peak with a few area counts by GC/FID.

Calibration is required to establish gas chromatographic performance, detector response factors, and retention times for each target compound. A response factor is defined as the standard concentration of a compound divided by the area counts as produced by the integrator. For example, a 1 μg/ml toluene standard that produces 20,000 area counts produces a response factor of 0.00005 μg/ml per area counts.

A five-point standard calibration curve was used for the Onalaska CSL. Using 2,000 μg/ml custom standards prepared and assayed by Supelco, Inc., serial dilutions to concentrations of 2.0 μg/ml, 1.0 μg/ml, 0.2 μg/ml, 0.1 μg/ml, and 0.02 μg/ml were made for the ECD compounds and 5.0 μg/ml, 2.0 μg/ml, 1.0 μg/ml, 0.5 μg/ml, and 0.1 μg/ml for the FID compounds. All standards were prepared using Burdick & Jackson GC-Capillary Grade Pentane. Before any standards were analyzed, the pentane was analyzed by GC/FID-ECD to establish the level of purity.

A five-level calibration was performed to assess detector linearity because a detector does not respond uniformly over a wide concentration range. As a result, a good working range must be found where the detector response is linear and the subsequent response factors are relatively constant. Samples of unknown concentration are then analyzed within this working range. If a sample concentration exceeds the working range, it must be diluted and reanalyzed.

QUALITY ASSURANCE/QUALITY CONTROL AND CSL DATA VALIDATION

The Onalaska CSL analytical program involves a number of special analyses to characterize the quality of a data set. The following questionnaire presents the concerns of an environmental chemist regarding the validity of any analytical method. They are followed by QA/QC procedures that must be part of the analytical approach to address the issue of concern.

1. Is the instrument-system working?

   Relevant QA/QC Procedure: Initial calibration, continuing calibration, and retention time markers

2. Is the method working?

   Relevant QA/QC Procedure: Matrix spike/matrix spike duplicates

3. Are analytical results reproducible?

   Relevant QA/QC Procedure: Laboratory duplicates

4. Is there a problem with laboratory cross-contamination?

   Relevant QA/QC Procedure: Laboratory blanks---solvent, syringe, method

5. Is there a problem with cross-contamination due to sampling?

   Relevant QA/QC Procedure: Field blanks

6. Is the sampling being performed in a reproducible fashion?

   Relevant QA/QC Procedure: Field duplicates

CALIBRATION

Instrument calibration must precede any sample analysis. More specifically, instrument calibration conforming to QA/QC criteria must be demonstrated. For the Onalaska CSL, initial calibration consisted of the analysis of a series of standards. Specifically, the concentrations mentioned earlier were analyzed by GC/FID-ECD in succession. A calibration curve for each compound could then be constructed by plotting standard concentration on the abscissa and the corresponding area counts on the ordinate. The plot should show a direct relationship between the standard concentration and area counts. Between the low and high standards, the calibration curve should be linear, and hence this region defines the working linear range for the analysis. The linearity of the working range is determined by using least squares to compute the correlation coefficient from the calibration data. The correlation coefficient for a linear segment is 1.00. Standards were analyzed until the calibration curve correlation coefficients were 0.98 and better.

CONTINUING CALIBRATION

After initial calibration was completed, analysis of samples began. GC systems change with time due to factors such as column condition and changing flow rates, so it was necessary to continuously monitor the GC by continuing to calibrate. The midrange standard was analyzed periodically to determine GC performance. The Onalaska CSL SOP set a continuing calibration frequency of one in twenty, but CSL staff checked calibration more frequently to ensure the reliability of GC results.

RETENTION TIME MARKER

A retention time (RT) marker is a compound that can be used to measure retention time drift and injection reproducibility. In most cases, a solvent impurity peak is likely to be chosen as an RT marker because it exists at a specific concentration that will not change and it elutes at a characteristic retention time. Therefore, both the retention time and the area counts of the RT marker should be consistent from run to run. By monitoring the RT marker, the GC system is monitored indirectly.

SPIKED SAMPLES

Spike sample analyses are done to determine the effect of the sample matrix on the solvent extraction method and on measurement procedures. To prepare a matrix spike (MS), a known amount of compound is added to a sample, the sample is analyzed, and the amount of the spiked compound recovered is compared to the amount added.

Matrix spike analysis was performed as part of the CSL analysis. A matrix spike is a target compound added to a sample and prepared as a sample. Matrix spike samples are analyzed to evaluate matrix effects on the analytical method. Poor recoveries may be due to poor sample preparation and an inefficient extraction process, a GC system that has changed, matrix interferences, or other factors.

Percent recovery for a target compound spike is calculated by:

$$R = [(SSR-SR)/SA] \times 100$$

where:

SSR	=	spike sample result
SR	=	sample result
SA	=	spike added

Because of their physical/chemical characteristics, certain compounds can be readily extracted. After years of performing rigorous statistical analyses on historical data, the EPA has developed acceptable recovery ranges for TCL compounds. These ranges represent empirical benchmarks; however, they are useful in gauging the extraction efficiency of a solvent for a given compound.

Using matrix spike/matrix spike duplicate data, it is possible to construct quality control charts that illustrate the accuracy of the spike analysis. Such a control chart is constructed by plotting percent recoveries on the ordinate and dates analyzed on the abscissa. Reading the chart from left to right, the data points should cluster near the 100 recovery line.

If there is just one analyst for a project's duration, recoveries will trend closer to the 100 percent recovery line. This is because over time the analyst has honed his or her technique. Conversely, a trend may not be discernable if more than one analyst staffed the laboratory for the project's duration.

DUPLICATES

Duplicates refer to two representative aliquots from a discrete sample. Both field and laboratory duplicate samples were analyzed to determine data precision, a measure of reproducibility of the analysis. The results were then reported as relative percent difference (RPD) and were calculated by:

$$RPD = [[(D1-D2)/[(D1+D2)/2]] \times 100$$

where:

D1	=	concentration of the first duplicate
D2	=	concentration of the second duplicate

Matrix Spike Duplicates

To prepare a matrix spike duplicate (MSD), a given sample is separated into two fractions and each fraction is spiked with the same amount of known compound. There are now two samples: the matrix spike and the matrix spike duplicate.

Taken together, the percent recoveries for the MS/MSD are used to calculate the relative percent difference between the two numbers. RPD is a measure of precision. In other words, two samples derived from the same location and spiked with equal amounts of target compound should produce recoveries that are identical. In practice it is very difficult to spike two different samples with exactly equal amounts of a target compound, so it is unlikely that the two samples will be exactly the same. Consequently, the EPA has set quality control limits for RPD.

Using MS/MSD data, a quality control chart can be constructed that will graphically show the precision for the spike analysis. The control chart is constructed by plotting RPDs on the ordinate versus dates analyzed on the abscissa. Reading from left to right, the data points should cluster near the 0.0 RPD baseline.

Laboratory Duplicates

As the name suggests, laboratory duplicates are duplicates prepared in the laboratory to monitor laboratory reproducibility. To prepare a laboratory duplicate, a sample is split into two fractions and prepared and analyzed as two discrete samples. The results for the two samples should fall within certain QA/QC criteria for RPDs. Poor replication may indicate laboratory carelessness. Regardless, laboratory duplicates must be interpreted carefully since some matrixes are inherently difficult to replicate perfectly. In such cases, the QA/QC criteria may be adjusted accordingly.

Field Duplicates

Two samples collected in the field at the same location, depth, and orientation comprise a sample and a field duplicate. As might be expected, there is a great deal of variability associated with field duplicates, especially soil, because of the heterogeneous composition of the matrix.

BLANKS

A blank is a clean sample equivalent that is processed and analyzed as a sample to determine the existence and magnitude of potential contamination introduced during sampling, shipping, or analysis. The general heading of "blanks" can be separated into field blanks and laboratory blanks.

Field Blanks

Field blanks check field decontamination procedures. They are collected in the field during a sampling effort. Laboratory grade deionized water or high performance liquid chromatography (HPLC) water is used for aqueous field blanks. To prepare the field blank, the water is transferred to the sampling device (i.e., bailer) before being transferred to the sample container. The process mimics the actual groundwater sampling procedure.

Laboratory Blanks

Laboratory blanks check laboratory procedures. They can be divided into method blanks, solvent blanks, and syringe blanks.

Method Blanks. Method blanks are prepared in the laboratory as part of the analytical protocol. These blanks, prepared from HPLC grade water or washed sand, are processed along with the samples through each sample preparation and analysis step. Method blanks check possible contamination that might have been introduced during sample preparation.

Solvent Blanks. Since the analytical method used at Onalaska required a solvent extraction sample preparation, it was imperative to periodically check the solvent for contamination. This was accomplished by analyzing the solvent by GC/FID. A contaminated solvent could lead to false positives.

Syringe Blanks. All sample extracts are introduced into the GC by microliter syringes. Even though the syringe is cleaned after each injection, it is important to check the syringe for possible cross-contamination. This is accomplished by injecting syringe headspace into the GC. Syringe blanks also allow monitoring of the background signal and possible carryover caused by a previous contaminated sample.

ONALASKA CSL DATA VALIDATION/DATA ASSESSMENT

The purpose of data validation is to determine the precision and accuracy of a data set, to characterize the weaknesses of questionable data, and to determine data usability.

The Onalaska data were evaluated by assessing the QA/QC criteria described earlier. These QA/QC criteria are evaluated quantitatively when their values are specified in the analytical methods or as part of the project data quality objectives (DQOs). If values are not specified, a qualitative assessment is made using established data validation procedures and a knowledge of good laboratory procedures.

All samples were analyzed using a flame ionization detector (FID) and electron capture (ECD) detectors. The results for TOL and XYL were obtained using the FID. Due to its increased sensitivity, the ECD was used to quantify DCE, TCA, TCE, and PCE.

Overall, the data generated from the Onalaska site was determined to be good and 100 percent usable for the DQO specified in the SOW (e.g., screening analysis). All CSL data is summarized in Table 1. Appendixes A and B in project files contain the CSL computation sheets that were used to calculate concentrations; these sheets provide a record of all samples analyzed, including QA/QC samples. A discussion of the data validation parameters follows.

HOLDING TIMES

All samples and extracts were refrigerated from the time they were sampled until they were analyzed. All samples were extracted within 2 days (48 hrs) of sampling. All extracts were analyzed within 2 days (48 hrs) of extraction. These holding times are well within Contract Laboratory Program (CLP) requirements.

INSTRUMENT CALIBRATION

Response factors for each detector (flame ionization detector and electron capture detector) were calculated initially using a five-level calibration (2.0 µg/ml, 1.0 µg/ml, 0.2 µg/ml, 0.1 µg/ml, and 0.02 µg/ml for the chlorinated compounds and levels of 5.0 µg/ml, 2.0 µg/ml, 1.0 µg/ml, 0.5 µg/ml, and 0.1 µg/ml for the aromatics). Whenever a change was made in the system, a new initial calibration was performed.

Initial Calibration

To assess the instrument performance before the analysis of any samples, the correlation coefficient of the least squares line was calculated for each compound and the total response was considered.

Continuing Calibration

A continuing calibration standard was analyzed before each set of samples and used to calculate the concentration of the target compounds in each batch. To assess instrument stability before sample analysis, the percent difference between the response factor (RF) for the initial standard and the continuing calibration response factor was calculated. The criteria for continuing calibration RFs allowed for a ± 15 percent variance from the initial calibration RF. All continuing calibration criteria were met.

DETECTION LIMITS

The working ranges established for the target compounds were based on anticipated concentrations of Onalaska-derived samples. The working range for DCE, TCA, TCE, and PCE was 0.02 µg/ml to 2.0 µg/ml, while the working range for TOL and XYL was 0.1 µg/ml to 5.0 µg/ml. This is not to say the instrument could not detect compounds at concentrations lower than the low end standard of the working range; detection limits are a function of instrument capabilities and analytical methodologies.

The instrument detection limit (IDL) represents the lowest concentration an instrument can detect. This concentration must be discernable from background noise. The IDL represents a theoretical detection limit because one is assuming 100 percent extraction efficiency and no chemical/physical or electronic interferences. The IDL is determined by analyzing the low standard of the working range. This standard is analyzed repeatedly, and statistics are performed on the pool of standards data.

The method detection limit (MDL) represents the lowest concentration the instrument can detect for a certain methodology. Because of extraction inefficiencies and interferences, the MDL will always be greater than the IDL. To determine the MDL, matrixes are spiked with compounds at sequentially lower concentrations until the concentrations can no longer be detected. In general, the MDL is twice the IDL.

The Onalaska CSL results indicate that compounds are sometimes detected above the MDL but below the working range for the detector. In such case, compounds are qualitatively identified but quantitatively suspect because the concentrations do not fall within the working calibration range. Accordingly, these values are flagged with a "J," meaning estimated.

BLANK ANALYSIS

A blank sample containing only the extraction solvent was analyzed with each batch of samples. The amount of target compound in the blank was considered in determining whether any compound found in the sample could have come from the solvents. No blank contaminant was found at a level greater than 10 percent of the compound at the reported detection limit; therefore, no qualification of the data was necessary due to blank contamination. See Table 1 for blank sample results.

MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Tables 3, 4, 5, 6, and 7 in the project files following the text summarize the recovery of compounds detected in the matrix spike and matrix spike duplicate samples. Regarding the MS/MSD samples, the recovery of target compounds was within the specified control limits set in the analytical method. In some cases the recoveries were outside of the control limits because the sample chosen to be spiked was highly contaminated. High levels of organic compound background in highly contaminated samples caused inaccuracy in the integration, and therefore quantitation, of the target compounds. Regardless, the recoveries for the "clean" samples demonstrated the validity of the method. As for the duplicate analyses, RPDs between like samples were within QA/QC acceptable ranges.

No qualification of the data was necessary since these results do not indicate a problem with the sample matrix in the recovery of target compounds. Figures 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15 in the project files graphically depict the results of the MS/MSD samples.

For an interpretation of the control charts, please refer to relevant sections of this memorandum.

CSL "GC FINGERPRINT" STUDY

According to past records, it is known that naphtha was disposed of at the Onalaska site. However, it is unclear as to the specific identity of the naphtha pollutants. In addition, soil was found to be visibly contaminated near MW14S, outside the area of suspected naphtha contamination. The area near MW14S had a diesel fuel odor. As an aside experiment, the CSL staff analyzed a number of samples of diesel fuels and attempted to match the resultant chromatograms with pure product sample chromatograms. Unfortunately, no pure product was captured for analysis and no obvious correlation was observed between the diesel fuel chromatograms and the sample chromatograms. This is not surprising given the differences between the Onalaska CSL target compounds and typical naphtha (oil variety) constituents. Figures 16 and 17 in the project files show example chromatograms.

GLT913/067.50

TABLE 1

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ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	Toluene	Xylenes	Matrix
GB-07-01	128	1	3/17/89	*0.080 N*	*0.020 J*	Water
GB-07-02	129	3	3/17/89	*0.120*	*0.010 J*	Water
GB-08 (55'-58')	130	5	3/17/89	*0.040 N*	BMDL	Water
GB-03-01	131	7	3/17/89	*0.690*	*1.12*	Water
GB08 (18'-28')	134	9	3/17/89	*0.040 N*	BMDL	Water
GB03-02	135	11	3/17/89	*0.110 N*	BMDL	Water
GB04 (8'-11')	136	13	3/17/89	*0.390 N*	BMDL	Water
GB04 (54'-57')	137	15	3/17/89	*0.100*	*0.040 J*	Water
MW04 (20'-30')	139	19	3/17/89	*0.110*	*0.060 J*	Water
MW-2S-01	140	21	3/17/89	*0.130 N*	BMDL	Water
GB-01-01 (80')	141	23	3/17/89	*0.150 N*	BMDL	Water
GB-01-(120')	147	27	3/18/89	*0.140 N*	BMDL	Water
MW-5S-01	155	17	3/18/89	*4.51*	*0.420*	Water
MW-2M-01	156	25	3/18/89	BMDL	BMDL	Water
MW-1S-23'	158	29	3/18/89	*0.170 N*	BMDL	Water
MW-2D(108'-111')	159	31	3/18/89	BMDL	BMDL	Water
MW-1M-01	160	33	3/18/89	*0.030 N*	BMDL	Water
MW-3S-01	161	35	3/18/89	*6.58*	*0.530*	Water
MW-7S(25'-30')	162	37	3/18/89	*0.160 N*	BMDL	Water

N = Qualitatively suspect.
J = Estimated value. Reported value is below quantitation limit.
BMDL = Below method detection limit.

4/19/89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	Toluene	Xylenes	Matrix
MW-7M (80'-82')	163	39	3/18/89	0.130 N	0.030 J	Water
MW4PS01	206	41	3/20/89	37.900 J	1.390	Water
GB-06-(18'-21')	209	43	3/20/89	0.470 J	0.010 J	Water
PB-02	213	45	3/20/89	0.440	0.020 J	Water
PB-03	214	47	3/20/89	0.420	0.010 J	Water
PB-04	215	49	3/20/89	0.610 J	0.010 J	Water
PB-05	216	51	3/20/89	8.690 J	0.950	Water
PB-06	218	53	3/20/89	0.140	0.010 J	Water
PB-08	219	55	3/20/89	0.040 J	0.020 J	Water
PB-09	220	57	3/20/89	0.050 J	BMDL	Water
PB-10	221	59	3/20/89	0.130	0.220	Water
PB-11	222	61	3/20/89	0.360	0.230	Water
GB-6M-73'	224	63	3/20/89	0.190 J	BMDL	Water
PB-12	225	65	3/20/89	0.010 J	0.010 J	Water
PB-13	227	67	3/20/89	0.430 J	0.220	Water
PB-14	228	69	3/20/89	0.410 J	BMDL	Water
PB-16	230	73	3/20/89	0.200 J	BMDL	Water
PB-17	231	75	3/20/89	0.150 J	BMDL	Water
PB-18	233	77	3/20/89	5.570 J	0.140	Water
PB-20	236	81	3/21/89	0.140	0.110	Water
PB-21	238	83	3/21/89	3.400	0.670	Water

4/19/89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	Toluene	Xylenes	Matrix
GB-5 (10')	239	85	3/21/89	BMDL	BMDL	Water
GB-5 (80')	240	87	3/21/89	BMDL	BMDL	Water
PB-22	241	89	3/21/89	*0.140*	*0.010* J	Water
PB-23	242	91	3/21/89	*0.220* J	BMDL	Water
MW-10M (18'-21')	249,261	93	3/21/89	BMDL	BMDL	Water
PB-24	250,262	95	3/21/89	BMDL	BMDL	Water
PB-25	251,263	97	3/21/89	BMDL	BMDL	Water
PB-26	252,264	99	3/21/89	BMDL	BMDL	Water
PB-27	254,265	101	3/21/89	BMDL	BMDL	Water
PB-19	255	79	3/21/89	*10.900*	*0.310*	Water
MW-10M (76'-78')	257	103	3/21/89	BMDL	BMDL	Water
MW-9M (25')	258	105	3/21/89	BMDL	BMDL	Water
PB-15	259	71	3/21/89	*1.080*	*0.120*	Water
MW-9M (80')	266	107	3/21/89	BMDL	BMDL	Water
MW-3M	340	109	3/28/89	*0.010* J	*0.020* J	Water
MW-11M (20'-22')	343	113	3/28/89	BMDL	BMDL	Water
MW-11M (76')	344	115	3/28/89	BMDL	BMDL	Water
PB-28	346	117	3/28/89	BMDL	BMDL	Water
PB-29	347	119	3/28/89	BMDL	BMDL	Water
PB-30	363	121	3/29/89	*43.000* J	*0.650*	Water
PB-31	369	123	3/29/89	*5.970* J	*0.470*	Water

TABLE 1

4/19/89

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	Toluene	Xylenes	Matrix
PB-32	373	125	3/29/89	*5.030* J	*0.770*	Water
MW-12S	380	127	3/30/89	BMDL	BMDL	Water
MW-14S	386	129	3/30/89	BMDL	BMDL	Water
MW-13S	389	135	3/30/89	BMDL	BMDL	Water
MW-8D	390	137	3/30/89	BMDL	BMDL	Water
PB-34	391	131	3/30/89	*20.400* J	*0.830*	Water
PB-35	393	133	3/30/89	*13.300* J	*0.766*	Water
PB-37	395	139	3/30/89	BMDL	BMDL	Water
PB-39	396	141	3/30/89	BMDL	BMDL	Water
PB-40	397	143	3/30/89	BMDL	BMDL	Water
PB-38	399	145	3/30/89	BMDL	BMDL	Water
PB-41	401	147	3/30/89	BMDL	BMDL	Water
PB-42	402	149	3/30/89	BMDL	BMDL	Water
PB-43	403	151	3/30/89	BMDL	BMDL	Water
PB-44	404	153	3/30/89	BMDL	BMDL	Water
PB-45	405	155	3/30/89	BMDL	BMDL	Water
PB-46	406	157	3/30/89	*0.140* J	BMDL	Water
TP-01 (CSL)	454	159	4/18/89	*0.050*	*0.060* J	Soil
TP-02 (CSL)	456	161	4/18/89	BMDL	BMDL	Soil
TP-03 (CSL)	463	163	4/18/89	*1.830*	*0.390* J	Soil
TP-04 (CSL)	458	165	4/18/89	*13.800* J	*2.430* J	Soil

((

TABLE 1

4/19/89

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	Toluene	Xylenes	Matrix
TP-05 (CSL)	464	167	4/18/89	BMDL	BMDL	Soil
TP-06 (CSL)	466	169	4/18/89	BMDL	BMDL	Soil
TP-07 (CSL)	467	171	4/18/89	*9.270* J	BMDL	Soil
TP-08 (CSL)	469	173	4/18/89	*1.1*[illegible]	*0.670*	Soil
TP-09 (CSL)	472	177	4/18/89	BMDL	BMDL	Soil
TP-10 (CSL)	474	179	4/18/89	BMDL	BMDL	Soil
TP-FB-04 (CSL)	479	181	4/19/89	BMDL	BMDL	Soil
TP-11 (CSL)	480	183	4/19/89	*0.975*	*5.990* J	Soil
TP-11-FR (CSL)	483	185	4/19/89	*1.720*	*9.670* J	Soil
TP-12 (CSL)	486	187	4/19/89	BMDL	BMDL	Soil
TP-13 (CSL)	488	189	4/19/89	*0.085* J	BMDL	Soil
TP-14 (CSL)	490	191	4/19/89	BMDL	BMDL	Soil

4-20-89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)

Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	1,1,1-TCA	TCE	PCE	Matrix
GB03-02	92	12	3/15/89	BMDL	BMDL	BMDL	Water
GB04 (8'-11')	93	14	3/15/89	BMDL	BMDL	BMDL	Water
GB04 (54'-57')	94	16	3/15/89	BMDL	BMDL	BMDL	Water
MW-5S-01	95	18	3/15/89	BMDL	BMDL	BMDL	Water
MW04 (20'-30')	96	20	3/15/89	BMDL	BMDL	BMDL	Water
MW-2S-01	97	22	3/15/89	BMDL	BMDL	BMDL	Water
GB-01-01 (80')	98	24	3/15/89	BMDL	BMDL	BMDL	Water
MW-2M-01	99	26	3/15/89	BMDL	BMDL	BMDL	Water
GB-07-01	101	2	3/15/89	*0.010*	BMDL	BMDL	Water
GB-07-02	102	4	3/15/89	BMDL	BMDL	BMDL	Water
GB08 (55'-58')	103	6	3/15/89	BMDL	BMDL	BMDL	Water
GB-01 (120')	171	28	3/19/89	BMDL	BMDL	BMDL	Water
MW-1S-23'	176	30	3/19/89	BMDL	BMDL	BMDL	Water
MW2D(108'-111')	177	32	3/19/89	BMDL	BMDL	BMDL	Water
MW-1M-01	178	34	3/19/89	BMDL	BMDL	BMDL	Water
MW-3S-01	179	36	3/19/89	*0.130*	*0.010*	BMDL	Water
MW-7S-(20'-30')	181	38	3/19/89	BMDL	BMDL	BMDL	Water
MW-7M-(80'-82')	182	40	3/19/89	BMDL	BMDL	BMDL	Water
MW4PS-01	186	42	3/19/89	*0.730*	*0.010*	BMDL	Water
GB-06(18'-21')	187	44	3/19/89	BMDL	BMDL	BMDL	Water

4-20-89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)

Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	1,1,1-TCA	TCE	PCE	Matrix
PB-02	192	46	3/19/89	BMDL	BMDL	BMDL	Water
PB-03	193	48	3/19/89	*0.008*	BMDL	BMDL	Water
PB-04	195	50	3/19/89	BMDL	BMDL	BMDL	Water
PB-05	196	52	3/19/89	*0.050*	BMDL	*0.010*	Water
PB-06	197	54	3/19/89	BMDL	BMDL	BMDL	Water
PB-09	272	58	3/21/89	BMDL	BMDL	BMDL	Water
PB-10	273	60	3/21/89	BMDL	BMDL	BMDL	Water
PB-11	274	62	3/21/89	BMDL	BMDL	BMDL	Water
GB-6M (73')	275	64	3/21/89	BMDL	BMDL	BMDL	Water
PB-12	277	66	3/21/89	BMDL	BMDL	BMDL	Water
PB-13	278	68	3/21/89	BMDL	BMDL	BMDL	Water
PB-14	279	70	3/21/89	BMDL	BMDL	BMDL	Water
PB-16	280	74	3/21/89	*0.010*	BMDL	BMDL	Water
PB-17	282	76	3/21/89	*0.040*	BMDL	BMDL	Water
PB-18	283	78	3/21/89	BMDL	BMDL	BMDL	Water
PB-18 DUP	284	78 DUP	3/21/89	BMDL	BMDL	BMDL	Water
PB-20	285	82	3/22/89	BMDL	BMDL	BMDL	Water
PB-21	287	84	3/22/89	*0.090*	BMDL	BMDL	Water
GB-5 (10')	288	86	3/22/89	BMDL	BMDL	BMDL	Water
GB-5 (80')	289	88	3/22/89	BMDL	BMDL	BMDL	Water
PB-22	290	90	3/22/89	BMDL	BMDL	BMDL	Water

4-20-89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)

Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	1,1,1-TCA	TCE	PCE	Matrix
PB-23	292	92	3/22/89	BMDL	BMDL	BMDL	Water
MW-10M (18-21')	293	94	3/22/89	BMDL	BMDL	BMDL	Water
PB-24	294	96	3/22/89	BMDL	BMDL	BMDL	Water
PB-25	295	98	3/22/89	BMDL	BMDL	BMDL	Water
PB-26	297	100	3/22/89	BMDL	BMDL	BMDL	Water
PB-27	298	102	3/22/89	BMDL	BMDL	BMDL	Water
MW-10M (76'-78')	299	104	3/22/89	BMDL	BMDL	BMDL	Water
MW-9M (25')	300	106	3/22/89	BMDL	BMDL	BMDL	Water
MW-9M (80')	301	108	3/22/89	BMDL	BMDL	BMDL	Water
PB-08	302	56	3/22/89	BMDL	BMDL	BMDL	Water
PB-15	308	72	3/22/89	*0.450*	BMDL	BMDL	Water
PB-19	309	80	3/22/89	BMDL	BMDL	BMDL	Water
HOSE DISC WATER	310	112	3/22/89	BMDL	BMDL	BMDL	Water
MW-3M	311	110	3/22/89	BMDL	BMDL	BMDL	Water
MW-11M (20'-22')	312	114	3/22/89	BMDL	BMDL	BMDL	Water
MW-11M (76')	313	116	3/22/89	BMDL	BMDL	BMDL	Water
PB-28	417	118	3/31/89	BMDL	BMDL	BMDL	Water
PB-29	418	120	3/31/89	BMDL	BMDL	BMDL	Water
PB-30	419	122	3/31/89	*0.010 J*	BMDL	BMDL	Water
PB-31	424	124	3/31/89	*0.470*	BMDL	BMDL	Water
PB-32	425	126	3/31/89	*0.020*	BMDL	BMDL	Water

4-20-89

TABLE 1

ONALASKA CLOSE SUPPORT LABORATORY DATA

Units for Water = ug/ml (ppm)

Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	1,1,1-TCA	TCE	PCE	Matrix
MW-12S	426	128	3/31/89	BMDL	BMDL	BMDL	Water
MW-14S	427	130	3/31/89	BMDL	BMDL	BMDL	Water
PB-34	431	132	3/31/89	*0.210*	*0.010*	BMDL	Water
PB-35	432	134	3/31/89	*0.040*	BMDL	BMDL	Water
PB-38	433	136	3/31/89	BMDL	BMDL	BMDL	Water
MW-8D	434	138	3/31/89	BMDL	BMDL	BMDL	Water
PB-37	435	140	3/31/89	BMDL	BMDL	BMDL	Water
PB-39	436	142	3/31/89	BMDL	BMDL	BMDL	Water
PB-40	437	144	3/31/89	BMDL	BMDL	BMDL	Water
PB-41	438	148	3/31/89	BMDL	BMDL	BMDL	Water
PB-42	439	150	3/31/89	BMDL	BMDL	BMDL	Water
PB-43	440	152	3/31/89	BMDL	BMDL	BMDL	Water
PB-44	441	154	3/31/89	BMDL	BMDL	BMDL	Water
TP-01	506	160	4/20/89	BMDL	BMDL	BMDL	Soil
TP-02	507	162	4/20/89	BMDL	BMDL	BMDL	Soil
TP-03	508	164	4/20/89	BMDL	BMDL	BMDL	Soil
TP-04	509	166	4/20/89	BMDL	BMDL	*0.010*	Soil
TP-05	511	168	4/20/89	BMDL	BMDL	BMDL	Soil
TP-06	512	170	4/20/89	BMDL	BMDL	BMDL	Soil
TP-07	513	172	4/20/89	BMDL	BMDL	BMDL	Soil
TP-08	514	174	4/20/89	BMDL	BMDL	BMDL	Soil

TABLE 1

4-20-89

ONALASKA CLOSE SUPPORT LABORATORY DATA
Units for Water = ug/ml (ppm)
Units for Soil = mg/kg

Field I.D.	GC RUN#	CSL I.D.	Date Analyzed	1,1,1-TCA	TCE	PCE	Matrix
MW-14S (8.5')	515	176	4/20/89	BMDL	BMDL	BMDL	Soil
TP-09	516	178	4/20/89	BMDL	BMDL	BMDL	Soil
TP-10	517	180	4/20/89	BMDL	BMDL	BMDL	Soil
TP-FR-04	518	182	4/20/89	BMDL	BMDL	BMDL	Soil
TP-11	519	184	4/20/89	BMDL	BMDL	BMDL	Soil
TP-11-FR	520	186	4/20/89	BMDL	BMDL	BMDL	Soil
TP-12	521	188	4/20/89	BMDL	BMDL	BMDL	Soil
TP-13	522	190	4/20/89	BMDL	BMDL	BMDL	Soil

Appendix H
SOURCE AREA AND TEST PIT INVESTIGATION

Appendix H
SOURCE AREA TEST PIT INVESTIGATION

INTRODUCTION

The source area test pit investigation was conducted between April 17 and 19, 1989 to fulfill the requirements of Task FI, Subtask FT, Solvent Disposal Area Investigation. The objectives of the investigation were:

- o To locate the major disposal area for the solvent waste within the landfill and to evaluate the degree of contamination in the unsaturated soils in this area
- o To obtain data important in the evaluation of soil incineration and offsite disposal
- o To locate and determine the condition of a cache of 300 drums and a 500-gallon tank truck buried at the landfill site

Four test pits were excavated to a maximum depth of 14 feet. Test pit locations were selected based on the results of the geophysical investigation and observations made during the hydrogeological investigation. Test pit locations are shown in Figure H-1.

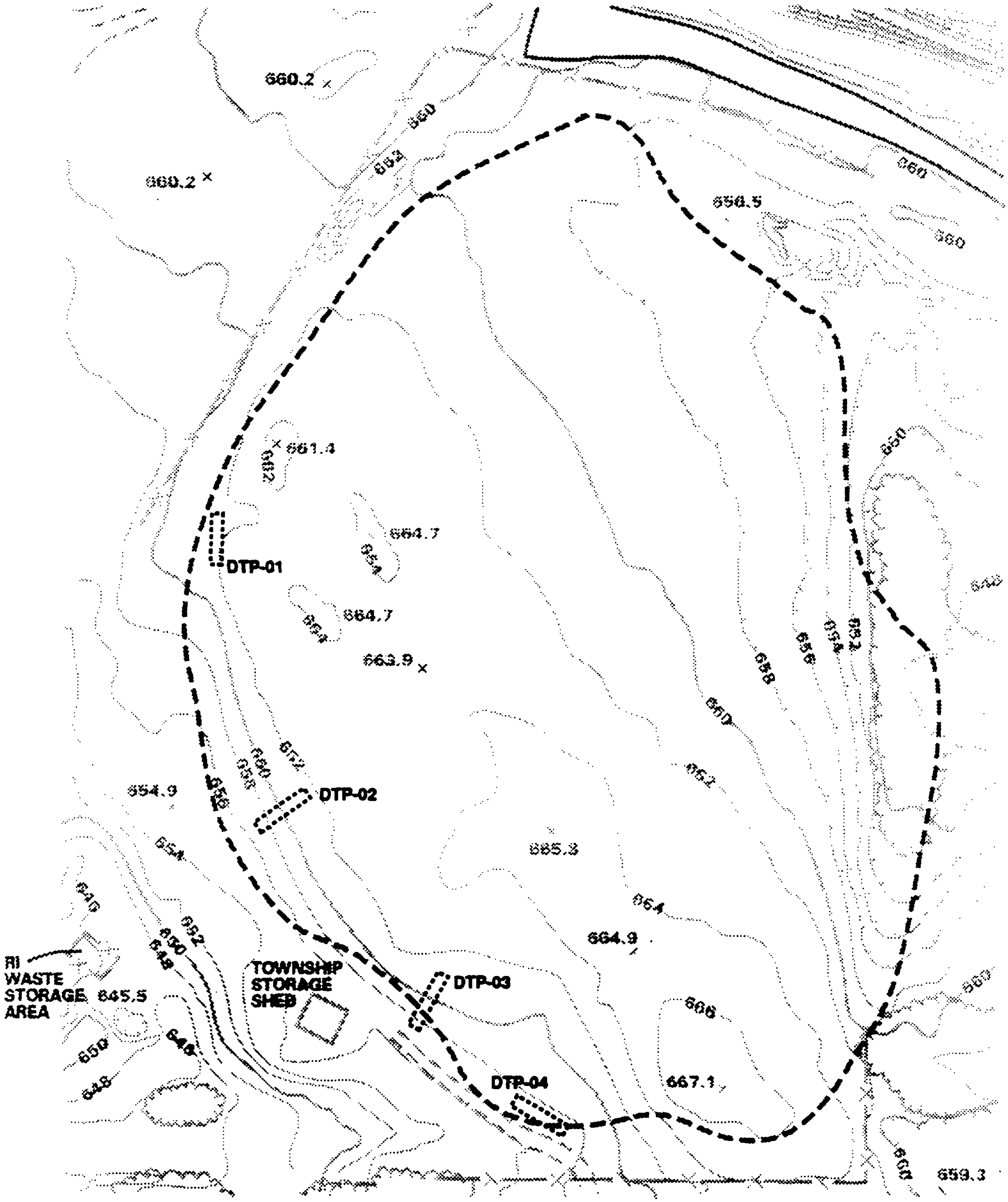
Fourteen soil samples were taken from the test pits for analysis by the close support laboratory. Soil samples were extracted and analyzed for indicator VOCs. Sample locations are shown on the test pit logs. Based on the results of testing and visual observation, eight soil samples were submitted for CLP analysis of TCL organic and inorganic chemicals as well as total organic carbon (TOC), total organic halides (TOX), sulfur, moisture content, Btu content and EP toxicity.

The following persons were on site specifically for the source area test pit investigation:

Team Member	Affiliation	Responsibility
Jeff Lamont	CH2M HILL	Field Team Leader
Kevin Olson	CH2M HILL	Site Safety Officer
Chris Lawrence	CH2M HILL	Test Pit Logging/Sampling
Jeff Salerno	ETI	Backhoe Operator
Dave Cruise	ETI	Helper

FIELD PROCEDURES

Test pits were excavated using a John Deere JD-310A wheel-mounted backhoe loader. The backhoe, operator, and helper were all provided by Exploration



LEGEND

LIMITS OF LANDFILL AS DETERMINED BY GEOPHYSICAL SURVEY

DTP-04 DEEP TEST PIT LOCATION (Pit not to scale)

N

0 100 SCALE IN FEET

FIGURE H-1
DEEP TEST PIT LOCATIONS
ONALASKA LANDFILL RI/FS

GLO6550.RI FIGH-1 10-24-89

Technologies, Inc. (ETI), an environmental services firm based in Madison, Wisconsin.

For all test pits, the top 2 feet of soil was assumed to be uncontaminated cover material and was stockpiled separately from the material encountered during further excavation. All excavated material encountered more than 2 feet below ground surface was stockpiled on a layer of 6-mil polyethylene, which was placed on the ground surface adjacent to the test pit before the start of excavation.

Test pits were excavated in passes approximately 12 inches deep. Uniform passes were difficult because of the nature of the waste material. The maximum depth of excavation was limited to approximately 14 feet by the reach of the backhoe. The backhoe could excavate approximately 10 linear feet of trench from one location. After the limits of excavation were reached from one location, the backhoe would move forward and excavation would continue. Test pit trenches ranged from 2 to 8 feet wide by 28 to 40 feet long. The actual dimensions of each pit are shown on the test pit logs. Each test pit was logged using the Unified Soil Classification System. Test pits were backfilled in reverse of the order by which they were excavated using the front-end loader bucket.

Air in the breathing zone was continuously monitored during excavation and backfilling, using an HNu photoionization device (PID). If sustained PID readings above background were observed, field team members would upgrade to level B personal protective equipment.

Fourteen soil samples were taken for analysis by the close support laboratory. Sample locations were chosen on the basis of visual observations (material changes, discolorations, or adjacent to an anomaly). Samples were also taken from the last layer of soil excavated for all test pits.

TEST PIT EXCAVATION SUMMARY

Test pit DTP-01 was excavated on April 17, test pits DTP-02 and DTP-03 were excavated on April 18, and test pit DTP-04 was excavated on April 19. A brief description of each test pit is given below. The test pits varied laterally in the types and thicknesses of material encountered, and a more accurate description of each pit is presented in the test pit wall logs (Figures H-2 through H-5).

DTP-01

DTP-01 was excavated from Station 1+00E, 4+80N to Station 1+00E, 4+40N. The ground surface elevation was approximately 662 feet. The pit was approximately 40 feet long by 2 feet wide and was excavated to a maximum depth of 13 feet.

The first 12 inches of excavated material consisted of brown well-graded sand with silt. This was underlain by a layer of gray silty clayey sand, ranging in thickness from 6 inches at the south end of the pit to 12 inches at the north

PROJECT NUMBER	TEST PIT NUMBER	
GLO65550.FI.FT	DTP-01	SHEET 1 OF 1

TEST PIT WALL LOG

PROJECT ONALASKA — LOCATION 1+00E, 4+80N TO 1+00E, 4+40N — MAP OF E WALL OF PIT

ELEVATION 662' — CONTRACTOR ETI — DATE EXCAVATED 4/17/89

WATER LEVEL AND DATE 13' B.G.S. 4/17/89 — EXCAVATION METHOD BACKHOE - JD - 310A — LOGGER J. LAMONT / C. LAWRENCE

APPROXIMATE DIMENSIONS: LENGTH 40' — WIDTH 2' — DEPTH 12 - 13' — REMARKS

COMMENTS

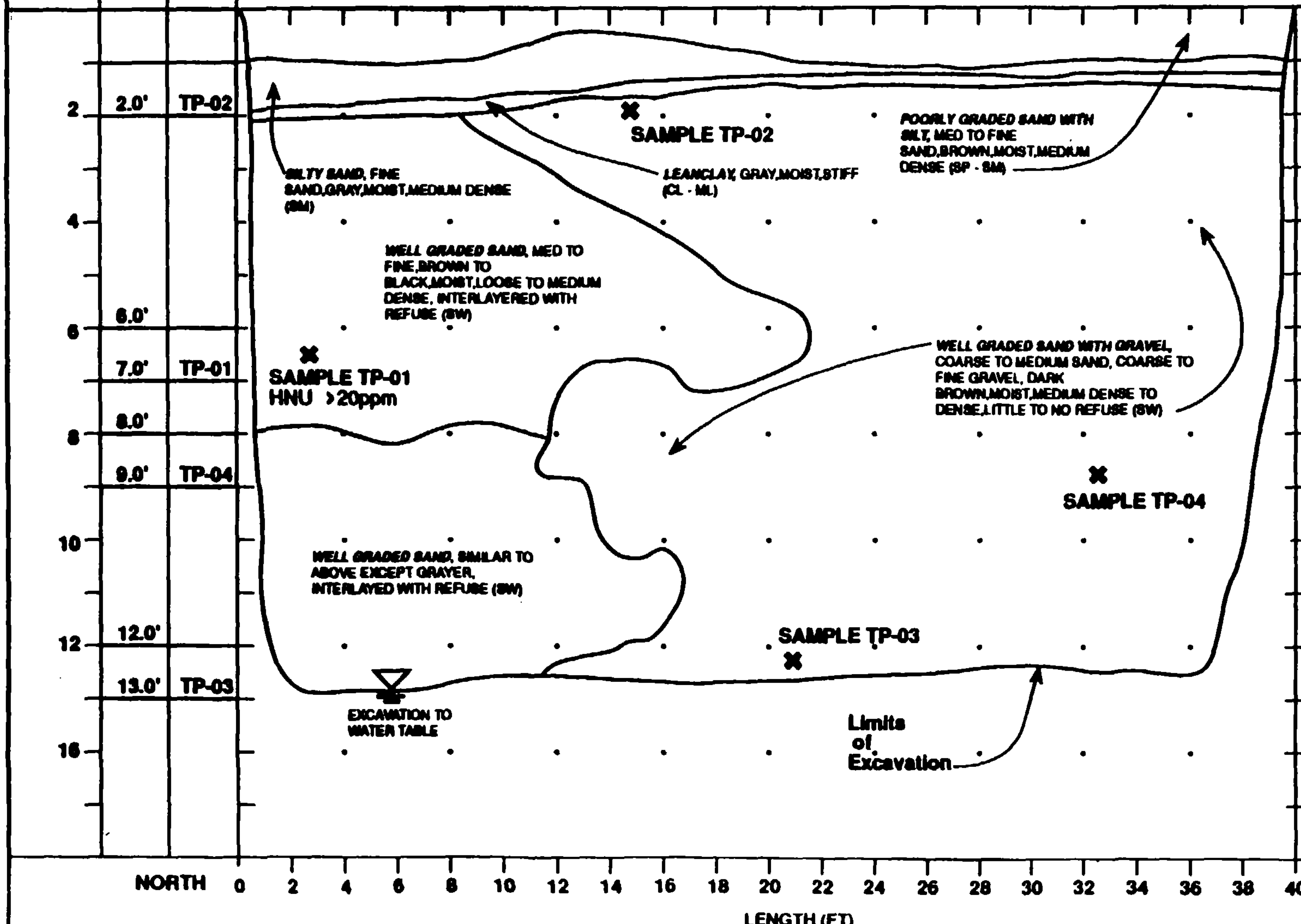


FIGURE H-2
DTP-01
ONALASKA LANDFILL RI

GLO65550.FI\TP-01 10-24-89

PROJECT NUMBER	TEST PIT NUMBER	
GLO65550.FI.FT	DTP-02	SHEET 1 OF 1

TEST PIT WALL LOG

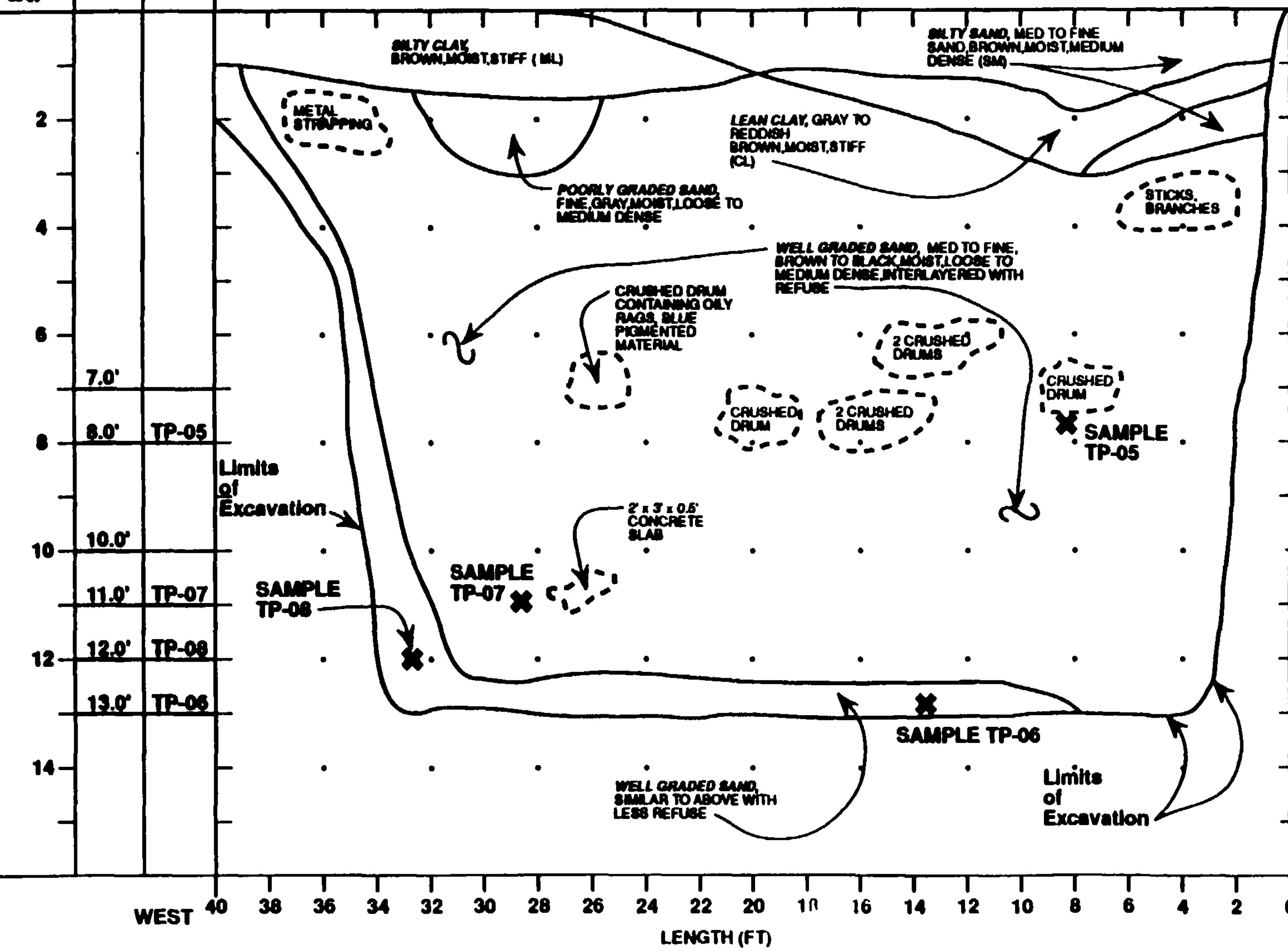
PROJECT ONALASKA LOCATION 1+40E, 2+50N TO 1+70E, 2+80N MAP OF N WALL OF PIT

ELEVATION 656' - 660' CONTRACTOR ETI DATE EXCAVATED 4/18/89

WATER LEVEL AND DATE NONE ENCOUNTERED EXCAVATION METHOD BACKHOE JD - 310 - A LOGGER C. LAWRENCE

APPROXIMATE DIMENSIONS: LENGTH 40' WIDTH 2 - 4' DEPTH 13' REMARKS

DEPTH BELOW SURFACE (FT)	SAMPLE Interval	SAMPLE Type and Number
	7.0'	
	8.0'	TP-05
	10.0'	
	11.0'	TP-07
	12.0'	TP-08
	13.0'	TP-06



COMMENTS

Began excavation at 0820 hrs

Stop excavation and begin backfilling at 1110 break for lunch 1230 - 1330 stop backfilling at 1500.

FIGURE H-3
DTP-02
ONALASKA LANDFILL RI

GLO65550.FI\ TP-02 8-26-89

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FT	DTP-03 SHEET 1 OF 1

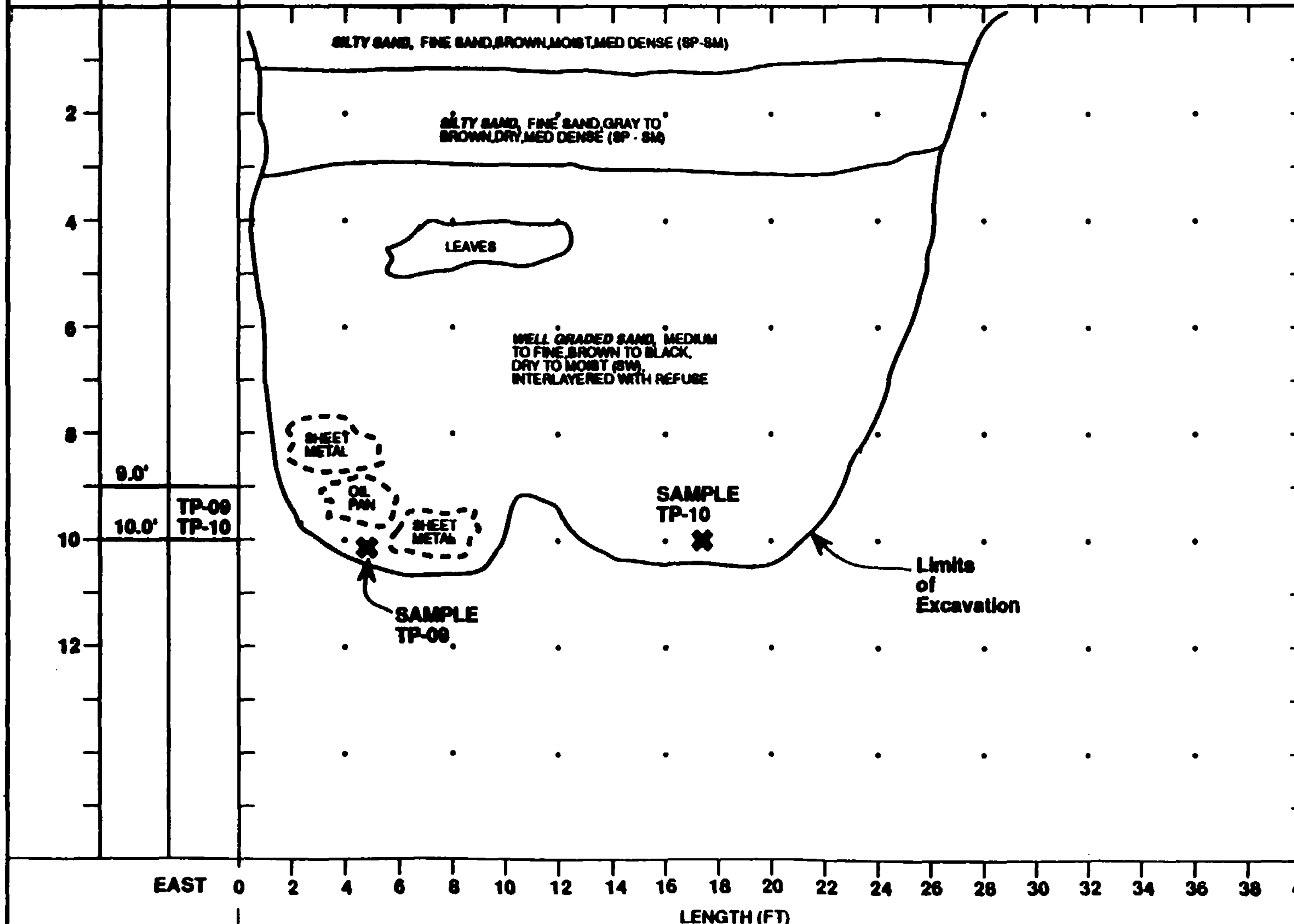
TEST PIT WALL LOG

PROJECT ONALASKA LOCATION 2+50E, 1+20N TO 2+60E, 1+50N MAP OF S WALL OF PIT

ELEVATION 658' - 662' CONTRACTOR ETI DATE EXCAVATED 4/18/89

WATER LEVEL AND DATE NOT ENCOUNTERED EXCAVATION METHOD BACKHOE JD - 310 - A LOGGER CHRIS LAWRENCE

APPROXIMATE DIMENSIONS: LENGTH 28' WIDTH 2' - 3' DEPTH 10.5' REMARKS



COMMENTS

Began excavation at 1530.

Little evidence of leave decomposition

Stop excavation and begin backfilling at 1700 stop backfilling at 1800.

FIGURE H-4
DTP-03
ONALASKA LANDFILL RI

GLO65550.FI\ TP 03 8 26 89

PROJECT NUMBER	TEST PIT NUMBER
GLO65550.FI.FT	DTP-04 SHEET 1 OF 1

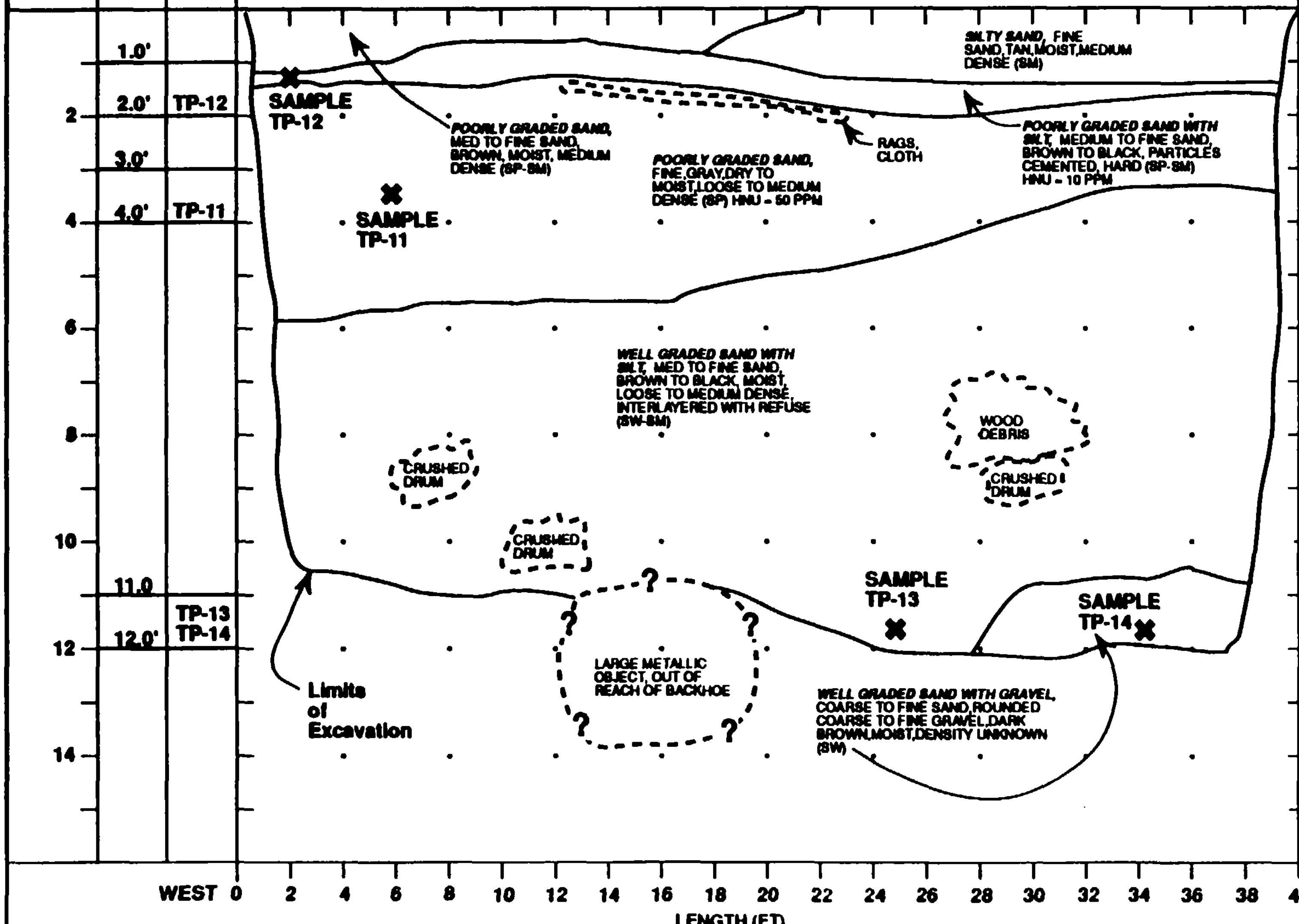
TEST PIT WALL LOG

PROJECT ONALASKA LOCATION 3+60E, 0+40N TO 3+80E 0+30N MAP OF N WALL OF PIT

ELEVATION 657' CONTRACTOR ETI DATE EXCAVATED 4/19/89

WATER LEVEL AND DATE NOT ENCOUNTERED EXCAVATION METHOD BACKHOE JD - 310 - A LOGGER C. LAWRENCE

APPROXIMATE DIMENSIONS: LENGTH 38' WIDTH 2' - 8' DEPTH 10' - 12' REMARKS



COMMENTS

Began excavation at 0755 HNU reading 10 ppm at top of trench on west side after ~ 0.5' of excavation.
Sample TP-11 taken at 0805 upgrade to Level B at 0815 (2 ppm on HNU in BZ).

TP-12 taken at 0845.

TP-13 taken at 1022.

Large amounts of sheet metal, cans, and other metallic debris observed throughout excavation.

TP-14 taken at 1120.

Fine gray sand layer continuously sloughing during pit excavation.

Stop excavation and begin backfilling at 1130.
Finish backfilling at 1215.

FIGURE H-5
DTP-04
ONALASKA LANDFILL RI

GLO65550.FI \ TP-04 8-25-89

end. The silty clayey sand layer was underlain by approximately 2 inches of gray silty clay.

From approximately 2 to 13 feet below ground, a well-graded sand was encountered. Sand in the north half of the pit ranged in color from brown to black to gray and was interlayered with refuse. Sand in the south half of the pit was dark brown with gravel and contained little to no refuse. The water table was encountered at approximately 13 feet. No drums were encountered. Sustained PID readings above background were observed in the breathing zone after approximately 6 feet of excavation at the north end of the pit, and field team personal protection was upgraded to level B.

Four soil samples were taken for analysis. Sample TP-01 was taken approximately 6.5 feet below ground, 2 feet from the north end of the pit. PID readings from the soil sample of over 20 ppm were observed. Sample TP-02 was taken 2 feet below ground, 15 feet from the north end of the pit; sample TP-03 was taken 12.5 feet below ground, 22 feet from the north end of the pit; and Sample TP-04 was taken 9 feet below ground, 32 feet from the north end of the pit.

DTP-02

DTP-02 was excavated from Station 1+40E, 2+50N to Station 1+70E, 2+80N. The ground surface elevation ranged from 656 feet on the west side to 660 feet on the east side. The pit was approximately 40 feet long and 2 to 4 feet wide and was excavated to a maximum depth of 13 feet.

The first 12 inches of excavated material consisted of brown silty clay on the west side of the pit, and a brown silty sand on the east side of the pit. The brown silty sand was underlain by a 6- to 12-inch layer of gray to reddish brown silty clay.

A well-graded sand was encountered approximately 2 feet to 13 feet below ground. Sand ranged in color from brown to black, and was interlayered with refuse. Sand encountered lower than 12 feet below ground appeared to contain less refuse. The water table was not encountered. Six crushed drums were excavated 6 to 8 feet below ground, 10 to 30 feet from the east wall of the pit. One drum contained oily rags and a blue pigmented material. The other drums contained no residue. No sustained PID readings above background were observed in the breathing zone.

Four soil samples were taken for analysis. Sample TP-05 was taken approximately 7.5 feet below ground, 8 feet from the east end of the pit. Sample TP-06 was taken 13 feet below ground, 14 feet from the east end of the pit; sample TP-07 was taken 11 feet below ground, 28 feet from the east end of the pit, and sample TP-08 was taken 12 feet below ground, 32 feet from the east end of the pit.

DTP-03

DTP-03 was excavated from Station 2+50E, 1+20N to Station 2+60E, 1+50N. The ground surface elevation ranged from 658 feet on the west side to 662 feet on the east. The pit was 28 feet long and 2 to 3 feet wide and was excavated to a maximum depth of 10.5 feet.

The first 36 inches of excavated material consisted of brown to gray silty clayey sand. A well-graded sand was encountered 3 to 10.5 feet below ground. Sand ranged in color from brown to black and was interlayered with refuse. The water table was not encountered. No drums were encountered, but metal debris (sheet metal, car oil pan, etc.) was excavated 8 to 10 feet below ground on the east side of the pit. No sustained PID readings above background were observed in the breathing zone.

Two soil samples were taken for analysis. Sample TP-09 was taken approximately 10 feet below ground, 4 feet from the east end of the pit and sample TP-10 was taken 10 feet below ground, 17 feet from the east end of the pit.

DTP-04

DTP-04 was excavated from Station 3+50E, 0+40N to Station 3+80E, 0+20N. The ground surface elevation was approximately 657 feet. The pit was approximately 38 feet long and 2 to 8 feet wide and was excavated to a maximum depth of 12 feet.

The first 12 inches of excavated material consisted of brown well-graded sand to silty sand. This was underlain by a 6-inch thick layer of dark brown to black cemented sand and a 2- to 4-foot layer of fine gray sand. A brown to black well-graded sand interlayered with refuse was encountered in the rest of the excavation.

Three crushed drums were excavated, and large amounts of sheet metal, cans, and other metallic debris were observed throughout the excavation. No residue was observed on the drums. The backhoe bucket struck a large metal object approximately 16 feet from the west end of the pit. The object could not be unearthed because the reach of the backhoe was not long enough. Efforts to unearth the object caused the fine gray sand to slough, increasing the width of the pit up to 8 feet in some locations. The water table was not encountered. Sustained PID readings above background were observed in the breathing zone after the first foot of excavation, and field team personal protection was upgraded to level B.

Four soil samples were taken for analysis. Sample TP-11 was taken approximately 4 feet below ground, 6 feet from the east end of the pit, in the fine gray sand. PID readings of 50 ppm were observed coming off of the sample. Sample TP-12 was taken 1.5 feet below ground, 1 foot from the east end of the pit, from the layer of cemented sand. TP-13 was taken 11 feet below ground, 24 feet from the west end of the pit. TP-14 was taken 11 feet below ground, 34 feet from the west end of the pit.

GLT913/072.50

Appendix I
ENVIRONMENTAL SAMPLING

Appendix I
ENVIRONMENTAL SAMPLING

INTRODUCTION

This appendix summarizes the sampling procedures and field analytical results for residential well, monitoring well, surface water, and sediment sampling. Sampling of soils from borings is discussed in Appendix D and from test pits in Appendix H. Shallow groundwater sampling is discussed in Appendix F.

RESIDENTIAL WELL SAMPLING

PURPOSE AND SCOPE

Residential well sampling was performed to determine whether contaminants from the landfill site had migrated to surrounding residential wells. Seven residential wells were sampled on March 15, 1989 (Figure I-1). Three additional residential wells located on the property of [redacted] could not be sampled because the [redacted] were gone for the winter but were sampled on April 20 as part of the monitoring well sampling. The Sportsmen's Club well could not be sampled because it was silted.

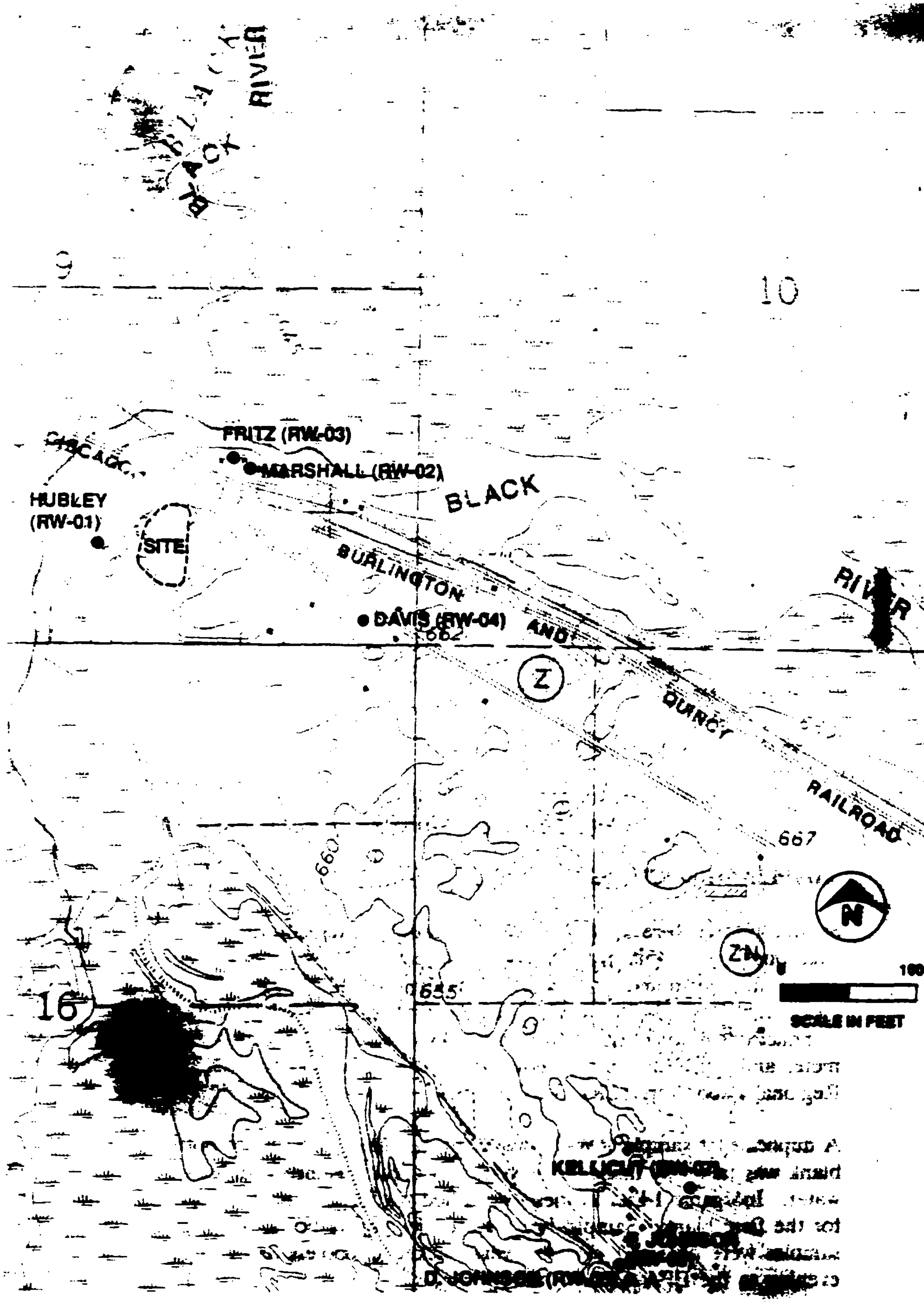
The sampling team consisted of:

- Phil Smith, CH2M HILL/Sample Team Leader
- Cathy Kantowski, CH2M HILL/Sample Team Member

SAMPLING PROCEDURES

Sample bottles were filled directly from faucets after allowing the water to run wide open for 10 minutes. Residents were asked if water softeners were present and sample locations were chosen upstream of water softeners, if present. Field measurement of pH was made immediately preceding sample collection. Conductivity measurements were not taken because of the unavailability of a meter and difficulties in rescheduling sample analysis at the U.S. EPA Central Regional Laboratory (CRL) in Chicago.

A duplicate of sample RW-04 was taken by filling two sets of bottles. A field blank was taken by filling VOA vials and organic sample bottles with HPLC water. Inorganic 1-liter bottles were filled with locally obtained distilled water for the field blank. Samples were stored in coolers before packaging. Once all samples were obtained, samples were packed in coolers and shipped the same evening to the EPA CRL.



LEGEND

● RESIDENTIAL WELL SAMPLING LOCATION

RESIDENTIAL WELL SAMPLING LOCATIONS

[illegible]

The wells sampled and field results are summarized in Table I-1. Samples were analyzed at the CRL for the target organic and inorganic compounds.

MONITORING WELL SAMPLING

PURPOSE AND SCOPE

Monitoring well sampling was performed to determine the nature and extent of groundwater contamination. Twenty-one monitoring wells, five existing landfill wells, and the three residential wells on the [redacted] property were sampled from April 17 to 20. A second round of monitoring well sampling was performed from June 12 to 14.

Sampling personnel for the April sampling were:

- o Phil Smith, CH2M HILL/Sample Team Leader, Crew 1
- o Paul Boersma, CH2M HILL/Sample Team Member, Crew 1
- o Brian Laude, CH2M HILL/Sample Team Leader, Crew 2
- o Cathy Kantowski, CH2M HILL/Sample Team Member, Crew 2
- o Kevin Adler, U.S. EPA/Sample Team Member, Crew 2

Sampling personnel for the June sampling were:

- o Phil Smith, CH2M HILL/Sample Team Leader, Crew 1
- o Dorothy Hall, CH2M HILL/Sample Team Member, Crew 1
- o Paul Boersma, CH2M HILL/Sample Team Leader, Crew 2
- o Chris Lawrence, CH2M HILL/Sample Team Member, Crew 2
- o Cathy Kantowski, CH2M HILL/Sample Team Member, Paperwork
- o Brian Laude, CH2M HILL/Sample Team Member, Crew 2

SAMPLING PROCEDURES

Round 1

Water levels were taken in all wells the morning of April 17. After opening the well cap, HNu readings were taken according to the Site Safety Plan. Water levels were taken with an electric water level indicator. The indicator probe was slowly lowered until the buzzer and the light responded. The corresponding location of the indicator line flush with the top of well casing was marked and the probe was raised and lowered two more times. The depth to water was recorded and was later used to calculate purge quantity. The water level indicator probe was decontaminated between wells first with a 10 percent methanol and distilled water solution followed by a distilled water rinse.

Table I-1
RESIDENTIAL WELL SAMPLING

Sample Number	Residence	Tap Location	Sample Time	pH
RW-01	[redacted]	Outside tap next to front door	1120	7.9
RW-02	[redacted]	Outside tap on east side of house	1140	7.5
RW-03	[redacted]	Outside tap on east side of house	1152	7.7
RW-04	[redacted]	Outside tap on south side of house	1731	7.7
RW-05	[redacted]	Outside tap on each side of house	1407	7.7
RW-06	[redacted]	Inside faucet in laundry room	1423	7.8
RW-07	[redacted]	Outside tap next to front door	1523	8.1

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The thickness of the floating naphtha layer was measured in wells on or near the landfill with a clear bailer. Table I-2 identifies the wells where the clear bailer was used. The bailer was slowly lowered about 1 foot into the water table. It was withdrawn and the thickness of the floating layer recorded. The floating layer was found to be either 1/8 inch thick or absent in all wells sampled.

Dedicated teflon tubing was placed in all wells. In wells where the hydraulic lift was less than 18 feet, a peristaltic pump was used for purging the well and collecting all samples except the VOC sample. An 18-inch section of silicone tubing was secured to the teflon tubing and dedicated to the well for use in the peristaltic pump head. Wells with a hydraulic lift over 18 feet were purged and sampled with a Waterra pump from Solinist. The pump consists of a small diameter PVC check valve screwed to the bottom of the teflon tubing. Water is pumped by quickly lowering and raising the tubing. The pump achieved a pumping rate of 1 to 2 gpm.

The wells were purged of five well volumes from near the top of the water level. To remove stagnant water in the well, the tubing was temporarily raised during purging until air was drawn in and then slowly lowered.

Following purging, a glass jar was partially filled and pH, conductivity, and temperature were measured immediately as specified in the QAPP. Next, organic and SAS sample bottles were filled. The last bottle to be filled using the pumps was the 1-liter plastic bottle for the metals sample. Once filled, this sample was immediately filtered at the well through a 0.45-micron filter. The filtering pump was decontaminated with a dilute nitric acid solution and rinsed with distilled water.

VOA samples were obtained using dedicated 3-foot PVC bailers. The bailer was lowered, raised, and emptied twice before a sample was obtained. Each VOA vial was filled with a separately bailed sample. Following sampling, the bailer, nylon rope, and tubing were replaced in the well and secured to the well cap.

Duplicate samples were obtained by twice filling the number of bottles in the same manner described above. Field blanks were obtained for both sampling techniques. In each case, a 5-foot section of tubing was used with either a 1½ foot section of silicone tubing or the PVC foot valve. HPLC water was drawn through the tube for the organic sample. Distilled water was used for the SAS and metals sample. The metals blank sample was also filtered. The VOA blank sample was obtained by pouring HPLC water into a 3-foot PVC bailer and then into the VOA vials.

Samples were stored in coolers before packaging. The samples were packaged and shipped each afternoon. Table I-2 presents field measurements for Round 1 sampling.

Table I-2
GROUNDWATER SAMPLING--ROUND 1

Well Number	Depth to Water Table (ft)	Water Table Elevation (feet MSL)	Water Purge Volume (gallons)	Sample Date and Time		pH	Conductivity (umhos/cm² @ 25°C)	Temperature (°C)	Pure Phase Thickness (inches)[b]
MW1S	19.13	644.10	5.2	4/19/89	1350	7.2	385	14	
MW1M	19.35	644.12	46.0	4/19/89	1310	7.5	250	15	
MW2S	20.33	644.55	6.2	4/18/89	0840	6.8	1,500	10	0"
MW2M	20.94	643.99	50.0	4/18/89	1050	6.7	675	12	
MW2D	21.05	644.02	96.0	4/18/89	1200	7.5	270	12	
MW3S[a]	12.50	643.94	13.0	4/17/89	1511	6.6	560	11	1/8"
MW3M[a]	11.58	643.85	57.0	4/17/89	1702	7.1	510	14	
MW3D[a]	12.52	643.94	109.0	4/18/89	0949	7.4	505	12	
MW4S	21.16	643.85	4.0	4/18/89	1425	6.7	660	13	0" sheen present
MW5S	15.54	643.92	8.6	4/18/89	1405	6.6	695	11	0"
MW6M	4.83	643.63	62.0	4/18/89	1604	7.5	380	13	
MW7M	18.58	643.93	50.0	4/18/89	1600	7.6	370	13	
MW8S[a]	18.15	643.73	5.7	4/19/89	0910	7.0	500	12	
MW8M	18.90	643.73	47.0	4/19/89	1044	7.5	405	12	
MW8D	17.89	643.76	97.0	4/19/89	1421	7.5	350	13	
MW9M[a]	12.53	643.57	55.0	4/20/89	1100	7.6	335	11	
MW10M[a]	13.07	643.44	56.0	4/20/89	0930	7.2	625	11	
MW11M	13.55	643.62	46.0	4/20/89	0940	7.4	390	11	
MW12S	19.14	643.81	5.5	4/19/89	0740	7.3	320	8	0"
MW13S	20.86	644.01	4.1	4/19/89	0830	7.1	305	8	
MW14S	13.44	642.75	10.0	4/20/89	0815	6.5	390	11	0" sheen present
MW20S[d]	--	--	40.0	4/20/89	1200	7.2	945	12	[redacted]" well
MW20D[d]	--	--	(15 mins.)	4/20/89	1040	7.2	530	11	[redacted]
MW21S[d]	--	--	10.0	4/20/89	1100	7.1	714	10	[redacted] Garden well
B1	19.28	644.14	13.0	4/19/89	1120	7.1	345	11	
B2	23.30	643.98	25.0	4/19/89	1030	6.8	840	12	0"
B3	17.20	643.89	9.8	4/19/89	0925	6.9	625	11	0"
B4S	12.82	643.34	7.3	4/18/89	1051	7.6	970	11	1/8"
B4D	12.75	643.87	32.0	4/18/89	0918	7.4	515	11	
B5[c]	18.12	643.88							

[a]Peristaltic pump used for sampling all components except VOCs.
[b]Blank indicates pure phase not measured.
[c]No sample obtained, well did not recharge.
[d]Residential wells on [redacted] property.

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Round 2

Water levels were taken the morning of June 12 by Paul Boersma and Chris Lawrence. The measurement procedure was the same as that for Round 1. The thickness of the naphtha layer was not measured during Round 2. An oil sheen on the purge water was noted for three wells (see Table I-2).

Purging and sampling procedures were as described for Round 1 with the following exception. In wells where the peristaltic pump was used for purging, the dedicated 18-inch silicone tubing was removed before sampling and a PVC foot valve was placed on the teflon tubing. Sampling of the well for all components other than VOCs was then performed by quickly lowering and raising the tubing. As a result all wells were sampled using the same procedure. Table I-3 presents the field measurements for Round 2 sampling.

SURFACE WATER AND SEDIMENT SAMPLING

PURPOSE AND SCOPE

Surface water and sediment sampling were performed to determine whether contaminants from the site had migrated to surface waters near the site. Twelve locations were sampled on June 12, 1989.

Sampling personnel were:

- Phil Smith, CH2M HILL/Sample Team Leader
- Kevin Adler, U.S. EPA/Sample Team Member

SAMPLING PROCEDURES

Surface water sampling was begun at the most downstream locations and proceeded upstream to the background sample locations. Sample bottles for surface water were filled by submerging the bottles as they filled at mid-depth in the water column. The surface water sample was collected before any sediment was disturbed.

Samples in swampy areas or areas of ponded water were taken within a few feet of the dry bank nearest the site. Samples in the main channel (SW-03, SW-05, SW-11 and SW-12) were taken within 1 foot of the eastern bank. An extra sample jar was filled with water for field measurements of pH, conductivity, and temperature. Field measurements were made within 5 minutes of sample collection. Duplicate surface water samples were taken at SW-11 and SW-12. A

Table I-3
GROUNDWATER SAMPLING--ROUND 2

Well Number	Depth to Water Table (ft)	Water Table Elevation (feet MSL)	Water Purge Volume (gallons)	Sample Date and Time		pH	Conductivity (umhos/cm² @ 25°C)	Temperature (°C[a])
MW1S	18.98	644.25	5.2	6/14/89	1030	7.3	265	11
MW1M	19.22	644.25	46.0	6/14/89	1120	7.5	160	13
MW2S	20.16	644.72	9.0	6/12/89	1445	6.2	1,965	17
MW2M	20.67	644.26	50.0	6/12/89	1610	6.0	570	12
MW2D	20.79	644.28	96.0	6/12/89	1645	6.1	250	15
MW3S	12.35	644.09	13.0	6/13/89	0930	6.6	615	14
MW3M	11.36	644.07	57.0	6/13/89	0950	7.1	605	17
MW3D	12.30	644.16	110.0	6/13/89	1010	7.5	430	17
MW4S	20.90	644.11	4.0	6/13/89	0825	5.9	650	14
MW5S	15.35	644.11	9.0	6/14/89	1631	5.8	790	13
MW6M	4.66	643.80	62.0	6/14/89	0845	6.5	485	13
MW7M	18.28	644.23	50.0	6/13/89	0941	6.6	320	14
MW8S	17.93	643.95	6.0	6/13/89	1530	7.0	540	13
MW8M	18.66	643.97	48.0	6/13/89	1500	7.6	360	15
MW8D	17.65	644.00	97.0	6/14/89	1025	6.4	350	13
MW9M	12.35	643.75	56.0	6/14/89	1405	7.1	350	12
MW10M	12.93	643.58	57.0	6/14/89	1145	6.4	650	14
MW11M	13.21	643.96	53.0	6/14/89	1610	6.3	320	12
MW12S	18.87	644.08	5.6	6/13/89	1128	7.1	345	14
MW13S	20.55	644.32	4.3	6/13/89	1055	6.5	240	17
MW14S	13.24	642.95	10.0	6/14/89	0925	6.8	405	12
B1	19.03	644.39	14.0	6/13/89	1355	6.5	350	18
B2	23.12	664.16	25.0	6/13/89	1500	6.3	710	16
B3	16.93	664.16	10.0	6/14/89	0825	7.0	585	10
B4S	12.60	643.56	7.0	6/13/89	1110	6.7	925	16
B4D	12.58	644.04	33.0	6/13/89	1120	7.3	550	15
B5[a]								

[a]No sample taken. Well does not recharge.

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blank sample was prepared by pouring HPLC water directly into the sample jars for all samples except the metals sample. Distilled water was used for the metals blank. All surface water samples were unfiltered. Samples were preserved as described in the QAPP.

Sediment samples were obtained at the same locations as the surface water samples immediately following surface water sampling. A stainless steel spoon was used to collect sediment from the depth interval of 0 to 6 inches. Sediment was spooned into the jars until full. The jars were capped and stored in a cooler before packaging. Duplicate sediment samples were taken at locations SD-11 and SD-12. A field blank was prepared by spooning laboratory grade diatomaceous earth into sample jars. The stainless steel spoon was decontaminated with solutions of trisodium phosphate, 10 percent methanol, and distilled water between each sample.

Field measurements for the surface water and sediment samples are summarized in Table I-4.

NONAQUEOUS PHASE SAMPLING

PURPOSE AND SCOPE

Soil samples were collected from the unsaturated zone immediately above the water table (approximately 15 feet) to assess the extent and nature of nonaqueous phase contamination along the southwestern edge of the landfill. RI data indicated that nonaqueous phase contamination floating on the water table may have been smeared through the soils that come in contact with seasonal water table fluctuations. Five samples (SSB-01 through SSB-05) were collected on September 20, 1989.

Sampling personnel were:

- o Jeffrey Lamont/CH2M HILL/Sample Team Leader
- o Paul Boersma/CH2M HILL/Sample Team Member

SAMPLING PROCEDURES

Soil borings were advanced from 6 to 10 feet below ground using a "Little Beaver" power auger. The auger is powered by a cart mounted gasoline engine developed for shallow boring work.

The auger was first used to advance the borehole to its target depth for sampling. It worked well in the upper 3 to 4 feet of soil, but was quick to bind upon encountering obstructions such as sticks and rocks. When the auger could

Table I-4
SURFACE WATER AND SEDIMENT SAMPLING

Location[a]	Coordinates		Description	Sample Time	pH	Conductivity (umhos/cm² @ 25°C)	Temperature (°C)
SW-01	900E	1900S	Swampy area. Water depth approx. 6".	0950	6.9	300	15.5
SW-02	500E	1600S	Swampy area. Water depth approx. 12".	1010	6.5	125	19.0
SW-03	500W	1700S	Main channel. Sandy sediment.	1105	7.1	117	20.0
SW-04	80E	850S	Ponded water approx. 6" in occasional channel. Flow >0.1 cfs.	1030	7.0	125	19.0
SW-05	480W	310S	Main channel, sandy sediment.	1330	7.0	125	19.0
SW-06	220W	220S	Swampy area. Water depth approx. 12".	1400	6.3	190	19.0
SW-07	380W	240N	Ponded water approx. 12" in backwater of main channel. No flow.	1430	6.5	122	20.0
SW-08	370W	330N	Ponded water approx. 6" in occasional channel.	1450	6.5	166	20.0
SW-09	360W	440N	Ponded water approx. 12" in occasional channel.	1500	6.9	170	19.0
SW-10	280W	650N	Ponded water approx. 12" in occasional channel.	1520	7.0	233	19.0
SW-11	50W	1070N	Main channel, sandy sediment.	1640	6.9	122	20.0
SW-12	130W	1000N	Main channel, sandy sediment.	1710	7.0	122	20.0

[a]Sediment locations are identical to surface water locations

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no longer be advanced, a 2-inch hand auger was used. Soil samples were collected when the desired depth was reached. The hand auger was then decontaminated with a series of TSP, methanol, and distilled water rinses. After sampling was completed boreholes were filled with their cuttings. Boreholes were monitored with an HNu during and after being completed to their target depth.

Sample analysis included Total Petroleum Hydrocarbons (TPH) for SSB-01 through SSB-05, Benzene, Toluene, Ethylbenzene, and Sylenes (BTEX) compounds for SSB-02, SSB-04, and SSB-05, and the complete Target Compound List (TCL) for SSB-03 and a partial TCL for samples SSB-01 and SSB-04. Results are presented in Appendix J.

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Appendix J
ANALYTICAL RESULTS AND DATA VALIDATION

Appendix J
ANALYTICAL RESULTS AND DATA VALIDATION

INTRODUCTION

This appendix presents the data validation for the Onalaska RI/FS CLP laboratory data and the analytical results (presented in Attachment A). [Note to Reviewer: Round 2 groundwater, surface water and sediment results are not included in this draft]. Data validation is the technical review of a data package as stipulated in the RI/FS Quality Assurance Project Plan.

Before the laboratory data are sent to CH2M HILL, the U.S. EPA Sample Management Office receives the data packages from the participating laboratories and distributes them to the Environmental Sciences Assistance Team (ESAT) of the Central Regional Laboratory (CRL). The ESAT reviews the data resulting from regional sampling efforts using a document that describes procedures for Contract Compliance Screening (CCS) of Contract Laboratory Program (CLP) IFB contract reports and their QC deliverables (1,2). The CCS procedures provide assessment of data in terms of both completeness and technical compliance with contract requirements. A CCS assessment worksheet, review narrative, and summarized analytical data are routed to CH2M HILL.

CH2M HILL further reviews the data using the Functional Guideline documents (3,4). The document offers guidance in laboratory data evaluation and validation. For methods not listed in the functional guidelines a procedure parallel to the guidance document was used. Data noted in the review that should be qualified are flagged with the appropriate symbol. Results for field duplicates and field blanks are also reviewed and the data further qualified. Finally, the data set as a whole is examined for consistency, anomalous results, and whether the data are reasonable for the samples involved.

The site investigation samples were analyzed for semivolatiles, volatiles, pesticides/polychlorinated biphenyls (pesticide/PCB), metals, and various wet chemistry parameters. The following discussion highlights non-compliant data and their effect on specific samples or the whole data set.

The data review results are discussed in the following order: round one sampling, round two sampling, nonaqueous phase sampling.

Qualitative Symbols (Flags)

J = used when an analyte is present below the required detection limit or the values are estimated because QA/QC measures were not met.

B = used when an analyte is also present in the associated laboratory blank or field sample blank as well as the sample.

R = used when the reported value is unusable because QA/QC measures were not met.

ROUND ONE SAMPLES

SEMIVOLATILE ANALYSIS

Two matters are discussed in general which were regularly noted in the data review for semivolatile analysis. They are holding times and sample reanalysis for contract compliance.

A sample prepared for analysis which exceeded the required holding times may not be representative of its original condition. The analyte concentration may have been reduced or the analyte has become non-detectable. For samples exceeding holding time criteria the data user should not use non-detectable values (i.e., values reported less than the contract required quantification limits, or CRQL) as an indication of the absence of an analyte. Additionally, analyte concentration values reported greater than CRQL may be biased low.

Often times samples are re-extracted and reanalyzed to meet CLP SOW (5) contract compliance and reported as unique samples. These analyses aid the data reviewer during evaluation of the data set; however they are not required for the end data user and are excluded from the final result tables unless they provide additional information. In this case, the reanalyses either supplement or supersede the original analysis.

Case 11542: Eight low level concentration soil samples (OTR numbers EBP00 to EBP09) were sent to CEIMIC laboratory.

Internal standard Perylene-d12 for soil sample EBP02 was above acceptance range. Analytes quantified with this internal standard are flagged J, estimated.

No target compound list (TCL) compounds were detected in field blank sample EBP06.

Field duplicate samples EBP03 and EBP04 did not contain analytes above the CRQL.

Case 11639: Seven low-level concentration soil samples (OTR numbers EBP10 to EBP16) were sent to Western Research Institute (WRI).

Field blank sample EPB10 contains the common contaminant bis(2-ethylhexyl)phthalate. All samples containing this contaminant less than 10 times the field blank value are flagged B, blank contamination.

Field duplicate samples EPB11 and EBP12 do not contain analytes above the CRQL. Sample EBP11 has 2 TCL compounds less than CRQL and 10 TICS. Sample EBP12 has 2 TCL compounds less than CRQL and 17 tentatively identified compounds (TICS). No qualification of the data set was applied based on field duplicate results. The analytes present below CRQL and the TICS suggest agreement among the field duplicate.

Case 11790: 20 low-level concentration water samples (OTR numbers EBP17 to EBP36) were sent to S-Cubed laboratory.

Holding time exceeded acceptable range for samples EBP17, EBP21RE, EBP22RE, EBP26RE, EBP28RE, EBP31RE, EBP34RE, and EBP35RE. For sample EBP17 all analyte concentrations reported above CRQL are flagged J, estimated; nondetects are unusable. Samples denoted with the -RE suffix are qualified in a following discussion.

GC/MS initial calibration and continuing calibration outliers were reported; however, samples did not contain the analytes affected by the outliers.

Acid fraction surrogate recoveries were below acceptable range for samples EBP21, EBP22, EBP26, EBP31, EBP33, EBP34, and EBP35. Re-extraction and analysis of these samples provided similar surrogate results; therefore, the surrogate recovery difficulties are attributed to matrix interference. Acid fraction analytes in these samples are flagged J, estimated; the nondetects are unusable. Only the original analyses are presented in the final sample result tables.

Acid fraction surrogate recoveries were below acceptable range for sample EBP33. EBP33 was used for the MS/MSD which also had surrogate recoveries below the acceptance range. Sample EBP33 is qualified as discussed in the preceding paragraph.

Base/neutral (BN) fraction surrogate recoveries were below acceptable range for sample EBP28. Re-extraction and analysis provided acceptable BN fraction surrogates but the acid fraction surrogates were below the acceptance range. BN fraction results from EBP28RE and acid fraction results from EBP28 are reported. All analytes greater than CRQL are flagged J, estimated and the nondetects are unusable.

Matrix spike recoveries were below acceptance range for the acid fraction compounds 4-chloro-3-methylphenol and 2-chlorophenol. In addition two other acid fraction spiking compounds were at the lower end of the acceptable range. These results are consistent with the low surrogate recoveries representative of the sample. Low recoveries of acid fraction compounds are suspected for samples reporting low surrogate recoveries and have been previously qualified. Precision criteria for 1,4-dichlorobenzene were outside of acceptable range. No qualification of the data set has been applied based on matrix spike recovery data.

No TCL compounds were reported above CRQL in field duplicate samples EBP18 and EBP19 or field duplicate samples EBP24 and EBP25.

Case 11790: 15 low-level concentration water samples (OTR numbers EBP37 to EBP41, EBP49, EBP53 to EBP58, and EBP60 to EBP62) were sent to S-Cubed laboratory.

Holding time was exceeded for sample EBP55 and all analytes reported above CRQL are flagged J, estimated. Four samples which were re-extracted due to poor surrogate performance did not meet holding time requirements and are qualified below.

Laboratory blank SBLK03 contains the common contaminant di-n-butyl phthalate. Samples associated with this blank and containing this analyte less than 10 times the blank concentration are flagged B, blank contamination.

No TCL compounds were detected in the field duplicate samples EBP56 and EBP57.

Acid fraction surrogate recoveries for samples EBP39, EBP53, EBP60, and EBP62 were below the acceptable range. These samples were re-extracted and analyzed. The reanalysis results paralleled the original results; therefore, the low recoveries are attributed to matrix influence. Only the original results are presented in the final sample concentration tables. Because of the low surrogate recoveries, results for the acid fraction compounds are not useable.

Case 11790: 10 low-level concentration soil samples (OTR numbers EPB42 to EBP48 and EBP50 to EBP52) were sent to S-Cubed.

Holding times were exceeded for the re-extraction of samples EBP43, EBP51, and EBP52. No qualification of these samples was necessary, because the original sample analyses are reported in the final sample concentration tables.

GC/MS initial calibration and continuing calibration outliers were reported; however, samples did not contain the analytes affected by the outliers.

Laboratory blanks contain TIC compounds including benzaldehyde. No TCL compounds were detected in the field blank sample EBP48. Samples containing benzaldehyde at less than 5 times the associated laboratory blank value are flagged B, blank contamination.

Sample EBP51 was re-extracted and analyzed because two acid fraction surrogates were above the acceptance range. The reanalysis produced similar results; therefore, all acid fraction compounds are flagged J, estimated.

Matrix spike analyses were performed at twice the contract specified concentration level. No qualification of the data set is applied because matrix spike recoveries were within acceptance range and the deviation is inconsequential.

Field duplicate samples EBP50 and EBP51 report similar TCL compounds but at significantly different concentrations. The analyses of these samples encountered dissimilar analytical difficulties, either surrogate or internal standard deficiencies. Differences in concentration can be explained by the deficiencies; however, the dissimilar difficulties suggests the deficiencies were an outcome of poor laboratory technique. Compounds associated with the acid fraction in field duplicate samples are flagged J, estimated. Other samples affected by the field duplicates have been previously qualified.

Internal standard performance of 1,4-dichlorobenzene-d4 was below acceptance range for samples EBP43, EBP50, and EBP52. Subsequent re-extraction and reanalysis of these sample produced similar internal standard performance results and surrogate recoveries below acceptance range. The original analysis is reported because of the unacceptable surrogate recoveries in the reanalysis. Analytes reported above CRQL and associated with 1,4-dichlorobenzene-d4 are flagged J, estimated.

VOLATILE ORGANIC ANALYSIS

Samples which contain high concentrations of TCL compounds are frequently reanalyzed using a diluted aliquot. Reanalysis of the diluted sample brings analyte concentrations within instrument calibration range but the associated laboratory blank may also contain analytes as a contaminant at the same concentration level. The analyte is present in the sample as demonstrated by the first analysis; however, the analyte would be qualified as blank contamination in the diluted analysis. In these instances, the concentration value that exceeds the calibration range is reported and qualified J, estimated.

The laboratory diluted and reanalyzed samples to determine analyte concentration within the instrument calibration range or meet contract compliance and submitted individual results for each analysis. For purposes of data end use, only one sample profile is needed. So, the multiple analyses are combined using the following guideline to use all available information and maintain consistency. First, values from the undiluted sample when the analyte was within the calibration range of the instrument are reported. Secondly, values from the greatest diluted analysis, within calibration range and not affected by qualifiers, are reported. Thirdly, any reasonable value is reported.

Case 11542: Eight low-level concentration soil samples (OTR numbers EBP00 to EBP09) were sent to CEIMIC laboratory.

Matrix spike precision data for 1,1-dichloroethane were outside of control limits. The sample set is not qualified based on the precision deficiency.

The field blank samples contained methylene chloride and acetone. Additionally, the laboratory blank analysis for VBLK01 contained acetone and 2-butanone and VBLK02 contained acetone. Samples containing methylene chloride at less than 10 times the field blank concentration and acetone or 2-butanone at less than 10 times the associated laboratory blank are flagged B, blank contamination.

Case 11639: Seven low-level concentration soil samples (OTR numbers EBP10 to EBP16) were sent to Western Research Institute.

Field blank sample EBP10 contains acetone and benzene. No TCL compounds were detected in the laboratory blanks. Samples containing these contaminants at less than 10 times the acetone value and less than 5 times the benzene value are flagged B, blank contamination.

Field duplicate samples EPB11 and EPB12 both have three TLC compounds above CRQL that meet precision criteria. Additionally, EBP11 has xylene and four low-concentration TICs, where EBP12 has three low-concentration TICS. No qualification of the data set is made based on field duplicate results.

Case 11790: 20 low-level concentration water samples (OTR numbers EBP17 to EBP36 were sent to S-Cubed laboratory.

GC/MS initial calibration and continuing calibration outliers were reported; however, samples did not contain the analytes affected by the outliers.

Toluene was found in laboratory blank VBLK01 and VBLK02 and field blank sample EBP27. Xylene was found in the field blank sample EBP27. Samples containing toluene less than 10 times their associated laboratory blank value or xylene less than 5 times the field blank value are flagged B, blank contamination.

Field duplicate samples EBP18 and EBP19 are not comparable. Sample EBP18 contains TCL compounds at concentrations greater than CRQL while sample EBP19 does not report them or reports them at concentrations much less than EBP18. Three facts suggest laboratory results for the undiluted analysis of EBP18 result from cross contamination and are not real. First, Sample EBP18 was analyzed immediately after EBP17, which contains high concentrations of volatiles, without taking steps to decontaminate the GC system. This is the source of cross contamination. Secondly, later analysis of a diluted aliquot of EBP18, when the GC system was operating free of contamination, did not contain the analyte concentrations reported in the undiluted analysis. Thirdly, field duplicate EBP19 was not consistent with the results for undiluted analysis of EBP18. For these reasons all analytes associated with the undiluted analysis of EBP18 and found in sample EBP17 (analyzed preceding EBP18) are unusable. Data from EBP19 should be used to evaluate groundwater from this well. Field duplicate samples EBP24 and EBP25 do not contain analytes above CRQL. No qualification of the data set is applied based on field duplicate data.

Case 11790: 15 low-level concentration water samples (OTR numbers EBP37 to EBP41, EBP49, EBP53 to EBP58, and EBP60 to EBP62) were sent to S-Cubed laboratory.

Surrogate recovery for 1,2-dichloroethane-d4 was 1 percent above acceptance range. No qualification was applied due to the marginal deficiency.

Toluene was present in the laboratory blanks VBLK03 and VBLK04. Field blank sample EEBP49 contains the contaminant chloroform. Samples containing the above contaminants at less than 10 times the toluene values from the associated laboratory blank and less than 5 times the chloroform value from the field blank are flagged B, blank contamination.

Case 11790: 10 low-level concentration soil samples (OTR numbers EPB42 to EBP48 and EBP50 to EBP52) were sent to S-Cubed.

Calibration outliers were reported for acetone and xylene. Samples reporting these analytes are flagged J, estimated.

Laboratory blank VBLK01 contains methylene chloride, 2-butanone, toluene, and 10 TICs. Laboratory blank VBLK02 contains 2-butanone. Laboratory blank VBLK03, a medium level blank, contains methylene chloride and 2-butanone. The field blank sample EBP48 contains methylene chloride, carbon disulfide, 2-butanone, and xylene. Samples containing methylene chloride or 2-butanone less than 10 times the value found in the field blank are flagged B, blank contamination. Samples containing carbon disulfide or xylene less than 5 times the value found in the field blank are flagged B, blank contamination. Samples associated with VBLK01 and contain toluene at less than 10 times the value reported in the blank are flagged B, blank contamination.

The matrix spike recoveries for toluene (0 percent) were below acceptance range. The unspiked sample contains 89 µg/Kg toluene and was spiked with 50 µg/Kg toluene. Only 49 mg/Kg was recovered. The GC system was inefficient but demonstrated an ability to recover toluene. For this reason samples containing toluene are flagged J, estimated, rather than unusable.

Field duplicate samples EBP50 and EBP51 contain the same TCL compounds but at different concentrations, a result of using different methodologies for analysis. The low-level analysis of sample EBP50 found concentrations of TCL compounds which exceeded the calibration of GC system. The sample was reanalyzed as a medium level volatile. Sample EBP51 also contained TCL compounds at levels exceeding the GC system calibration but was reanalyzed at a diluted level within the calibration range. No qualification was applied to the data set based on field duplicate sample results.

Internal standard performance was below acceptance range for sample EBP50; however, this sample was reanalyzed as a medium level and internal performance was acceptable.

PESTICIDE/PCB

Case 11542: Eight low-level concentration soil samples (OTR numbers EBP00 to EBP09) were sent to CEIMIC laboratory.

Matrix spike recoveries for heptachlor were above acceptable range. Samples reporting this compound are flagged J, estimated value.

Surrogate recovery were above acceptable range for EBP00, EPB01, EBP02, EBP04, EBP07, and EBP09. Acceptable surrogate recovery was reported in the laboratory blank. The lab blank data suggests a matrix effect was responsible for the high sample surrogate recoveries. Analytes reported greater than the CRQL in these samples are flagged J, estimated.

Case 11639: Seven low-level concentration soil samples (OTR numbers EBP10 to EBP16) were sent to Western Research Institute (WRI).

All QA/QC measures are within acceptable range and the data can be used without qualification.

Case 11790: 20 low-level concentration water samples (OTR numbers EBP17 to EBP36) were sent to S-Cubed Laboratory.

Initial calibration linearity for p,p'-DDT and Aldrin were outside acceptable range. Analyte concentrations in the data set greater than CRQL are flagged J, estimated.

Surrogate recovery for sample EBP22 was above acceptance range. No TCL compounds are reported; therefore, no qualifying flag was applied.

The MS/MSD analyses were spiked at a level 10 times greater than SOW requirements. MS recoveries were universally lower than MSD recoveries which is consistent with the surrogate recovery differences resulting in a seemingly low precision. No qualification of the data set is applied based on matrix spike data.

Case 11790: 15 low concentration water samples (OTR numbers EBP37 to EBP41, EBP49, EBP53 to EBP58, and EBP60 to EBP62) were sent to S-Cubed Laboratory.

The matrix spikes were within the acceptable range but the relative percent difference for lindane, heptachlor, and endrin were outside the acceptance range. No qualification of the data was supported by this deficiency.

Surrogate recovery for EBP61 and EBP62 was above acceptance range. No TCL compounds were detected in these samples; therefore no qualification of the data is applied.

The laboratory blank PBLK5 contains gamma BHC. No TCL compounds were reported in the field blank. All samples containing gamma BHC at less than 5 times the laboratory blank value are flagged B, blank contamination.

The chromatographic system used to quantify pesticides experienced difficulty with endrin breakdown and continuing calibration check outliers. No qualification of the data set was applied because no TCL compounds were detected in the samples.

Case 11790: 10 low-level concentration soil samples (OTR numbers EPB42 to EBP48 and EBP50 to EBP52) were sent to S-Cubed Laboratory.

The GC system experienced surrogate compound (dibutylchlorendate, or DBC) retention shifts. The acceptable limit is equal to or less than 0.3 percent and this was exceeded by no more than 0.2 percent (0.5 percent total). Using DBC for evaluation of retention shift represents a "worst case" scenario and does not infer unacceptable GC performance.

Gamma BHC was found in the laboratory blanks PBLK01, PBLK02, and field blank EBP48. Samples containing this contaminant less than 5 times the value found in the associated field blank are flagged B, blank contamination.

Surrogate recoveries (199 to 999 percent) were above acceptable range for all samples and laboratory blanks, except EBP50. The laboratory case narrative cites sample interference as the cause. All reported analytes, except those in EBP50, are flagged J, estimated.

TOTAL METALS

Case 11542: 10 low-level concentration soil samples (ITR numbers MEBC00 to MEBC09) were sent to Wilson Laboratory.

Matrix spike recoveries for lead and silver were above acceptable range. Samples containing these elements are flagged J, estimated value.

Case 11639: Seven low-level concentration soil samples (ITR numbers MEBC10 to MEBC 16) were sent to Nanco Laboratory.

Matrix spike recoveries for antimony, copper, silver, and zinc were below the acceptance range. Acceptable post-digestion matrix spike for copper (101 percent) suggests the low pre-digestion spike recovery was matrix related. Low recoveries indicate possible elevation of detection limits. All samples containing these elements are flagged J, estimated value.

The matrix spike and duplicate audits for mercury were performed on the field blank. Using the field blank does not present a true reflection of matrix influence and the bias is unknown. Therefore all mercury data reported greater than CRDL are flagged J, estimated due to unknown precision and bias.

Duplicate analysis for copper was outside of control limits. Copper results were previously qualified.

CCS reports interference of aluminum, iron, and magnesium. Samples reporting these elements are flagged J, estimated values.

Field blank sample MEBC10 was found to contain the elements aluminum, arsenic, copper, iron, lead, magnesium, mercury, and zinc. No qualification is made for the field blank because the quality of the soil for use as a blank control is unknown.

Field duplicate sample results (MEBC11 and MEBC12) compare acceptably for elements detected greater than CRDL, except copper. Copper was previously qualified.

Case 11790: 20 low-level concentration water samples (ITR numbers MEBC17 to MEBC36) were sent to Rocky Mountain Analytical Laboratory.

Matrix spike recovery for iron was above acceptance range and selenium (0 percent) was below acceptance range. Samples reporting iron are flagged J, estimated value. Samples reporting selenium greater than IDL are flagged J, estimated value, and less than CRDL are unusable.

CCS reports the Laboratory Control Sample for arsenic and selenium was below acceptance range. All samples reporting arsenic are flagged J, estimated value. Selenium was previously qualified.

The interference due to lead and arsenic was noted by the CCS. All lead results are flagged J, estimated value. Arsenic was previously qualified.

Field blank sample MEBC27 was found to contain the elements barium, calcium, iron, magnesium, manganese, potassium, and zinc. No qualification is made for the field blank because the quality of the water for use as a blank control is unknown.

Case 11790: 15 low-level concentration water samples (ITR numbers MEBC37 to MEBC41, MEBC49, MEBC53 through MEBC58, and MEBC60 through MEBC62) and 10 low-concentration soil samples (MEBC42 through MEBC48 and MEBC50 through MEBC52) were sent to Rocky Mountain Analytical Laboratory. The water and soil analyses are separated to simplify discussion.

Water Analysis

The serial dilution for zinc indicates interference. Samples containing zinc are flagged J, estimated. The preparation blank contained zinc. Samples reporting zinc at less than 5 times the amount found in the preparation blank are flagged B, blank contamination.

Field blank samples MEBC49 and MEBC55 contained lead and zinc. No qualification was made for the field blank because the quality of the water for use as a field blank is unknown.

The laboratory flagged arsenic, selenium, and thallium due to interference. Samples reporting these elements greater than CRDL are flagged J, estimated value.

Soil Analysis

Matrix spike recovery for antimony was below acceptable range and for manganese was above acceptable range. Samples do not contain antimony above the IDL; however, detection limits may be elevated due to the low recovery. Samples reporting manganese above CRDL are flagged J, estimated value.

Element interference was noted for arsenic, potassium, and thallium. Samples containing these elements are flagged J, estimated value.

The preparation blank contained zinc. Samples reporting zinc at less than 5 times the amount found in the preparation blank are flagged B, blank contamination.

Field blank sample MEBC48 contained aluminum, barium, calcium, iron, potassium, and zinc. No qualification was made for field blank contamination because the quality of the soil for use as a field blank is unknown.

Field duplicate samples MEBC50 and MEBC51 meet precision criteria for seven TCL components. Silver data does not meet precision criteria and are flagged J, due to poor precision.

Case SAS4558E: 10 low-level concentration water samples (SAS numbers 4558E35 to 4558E44) were sent to JTC Environmental Consultants.

Calibration verification outliers were below acceptance range for barium, cadmium, and lead. Laboratory Control Samples were below acceptable range for mercury and arsenic. Matrix Spike recoveries were below acceptance range for cadmium, mercury, and selenium. Matrix Spike recoveries were above acceptable range for lead. Since all analytes were detected below CRDL and flagged J, estimated, no qualification is applied.

GENERAL CHEMISTRY PARAMETERS

Review of the Special Analytical Services (SAS) chemistry parameters does not follow the form by form review used in evaluation of the organic and inorganic parameters. Instead a review procedure consisting of evaluating holding times, initial calibration or calibration verification, continuing calibration, matrix spike analyses, and blank versus sample results was implemented.

Case SAS4558E: 32 low-level concentration water samples (SAS numbers 4558E01 to 4558E16 and 4558E17 to 4558E36) were sent to Rocky Mountain Analytical Laboratory for analysis of Alkalinity, Ammonia and Nitrate + Nitrite, BOD, Chloride, COD, Oil & Grease, Sulfide, Sulfate, TOC, Total Phosphorous, TDS, and TSS.

The samples were delivered as two separate groups. For ease of discussion the two delivery groups are combined and the discussion separated by analysis type.

ALKALINITY

Holding times were exceeded in some samples; however no qualification is applied based on the deficiency. All other QA/QC measures were met and the data can be used without qualification.

AMMONIA AND NITRATE + NITRITE

The field blank contains Nitrate + Nitrite. Samples 4558E19, E21 to E24, and E32 are flagged B, blank contamination.

BOD

The depletion of the unseeded dilution water blanks exceeded the limits for BOD. All BOD concentrations are flagged J, estimated.

Field duplicates samples 4558E07 and 4558E08 were outside acceptable precision range.

CHLORIDE

The primary SAS method was not used; instead an acceptable alternative method was performed. All data are acceptable for use.

COD

The matrix spike recovery is above acceptable range. COD data for samples 4558E18 to E21, E23, E24, E27, E28, and E32 are flagged J, estimated.

OIL AND GREASE

Holding time was exceeded for all samples. Matrix spike recovery (130 percent) was above acceptable range. The field blank contains oil and grease. All data should be flagged J, estimated. The detection limit may be elevated due to the missed holding times.

SULFATE

The primary SAS method was not used; instead an alternative method was performed. No information supports the exclusion of the data; therefore, the data are acceptable for use.

SULFIDE

Holding times were exceeded for all samples. No concentrations were reported above detection limits. All data should be considered unusable for determination of the presence or absence of sulfide.

TOC

All QA/QC measures were met and the data are acceptable for use.

TOTAL PHOSPHORUS

The lab did not use the primary SAS method; however, the method used is acceptable. All data are acceptable for use.

TSS/TDS

The field blank contained TDS and all data are flagged B, blank contamination.

Case SAS4558E: 10 low-level concentration soil samples (SAS numbers 4558E46 to 4558E55) were sent to Hazen Research, Inc., for analysis of Sulfur Content and Total Chlorine.

All QA/QC measures were met and the data are acceptable for use.

Case SAS4501E: 17 low-level concentration soil samples (SAS numbers 4501E01 to 4501E17) were sent to Keystone Environmental Laboratory for the analysis of Total Organ Carbon (TOC).

Field blank sample 4501E07 contains TOC. Sample 4501E13 and 4501E14 are flagged B, blank contamination.

Case SAS4501E: 10 low-level concentration soil samples (SAS numbers 4501E51 to 4501E60) were sent to Keystone Environmental Laboratory for the analysis of Total Organ Carbon (TOC).

Field duplicate samples 4501E57 (TOC = 447 mg/Kg) and 4501E58 (TOC = 4400 mg/Kg) show poor reproducibility. All samples are flagged J, estimated, due to the poor precision.

ROUND TWO SAMPLES

SEMIVOLATILES ANALYSIS

Case Number 12130: 20 low-concentration-level water samples (TR Numbers EBP63 TO EBP77 and EBP93 TO EBP97) were sent to S-Cubed.

Surrogate recoveries were below the acceptance range for sample EBP95. Subsequent re-extraction and analysis produced similar results suggesting interference from the matrix. The acid fraction analyte concentrations are estimated and flagged J and the non-detected acid fraction analytes are unusable.

Surrogate recoveries were below the acceptance range for the base/neutral fraction in sample EBP96. Subsequent re-extraction and analysis produced acceptable base/neutral recoveries but unacceptable acid fraction surrogate and internal standard recoveries. The deficiencies were a result of interferences from the large number of substituted benzenes present in the sample. Data from the original analysis is reported and base/neutral analytes concentrations are flagged J, estimated.

No TCL compounds were detected in the field blank sample EBP77 or field duplicate samples EBP73/74 and EBP75/76. No qualification of the data was made based on field blank or duplicate sample data.

Case Number 12130: 15 low-concentration-level soil samples (TR Numbers EBP78 to EBP92) were sent to S-Cubed.

Field Blank sample EBP92 is free of contamination.

No TLC compounds were present in field blank sample EBP92 or field duplicate samples EBP88/EBP89 and EBP90/EBP91 greater than CRQL. No qualifications of the data set are applied based on field blank or duplicate sample data.

All other QA/QC measures are acceptable and the data can be used without additional qualification.

Case Number 12130: 13 low-concentration-level water samples (TR Numbers EBP98 and EEF00 to EEF11) were sent to S-Cubed.

Extraction holding time was exceeded for sample EEF01. Analyte concentrations reported greater than CRQL are estimated and flagged J, CRQL values may be elevated for non-detected analytes.

Continuing calibration outliers affect benzoic acid in sample EEFF01. The concentration value is flagged J, estimated.

Surrogate recoveries were below the acceptance range for the acid fraction compounds in samples EEF03, EEF08, EEF10, and EEF11.

Re-extraction and analyses performed on these samples encountered similar surrogate difficulties and suggest a matrix effect condition. Acid fraction analytes reported at CRQL are unusable and analyte concentrations greater than CRQL are J, estimated.

Matrix spike analysis were above acceptance range by 7 percent for two compounds. The sample used for analysis contained eight native TCL compounds representing a difficult sample to analyze. No qualification of the data set was made on the basis of matrix recoveries.

Laboratory blank samples SBLK11 and SBLK12 contain phenol. No field blank sample was sent to the laboratory. Values for phenol are flagged B is samples reporting less than five times the amount in the associated laboratory blank.

Field duplicate samples EEF00/01 are qualitatively and quantitatively similar, except for Benzyl alcohol which differs by a factor of 10. No explanation can be given for the apparent difference. The Benzyl alcohol concentrations are estimated and flagged J in samples reporting this analyte.

Case Number 12130: 13 low-concentration-level water samples (OTR Numbers EEF12 to EEF24) were sent to S-Cubed.

Extraction holding times were exceeded for samples EEF17, EEF18, and EEF19. Analyte concentrations reported greater than CRQL are estimated and flagged J and the CRQL may be elevated for non-detected analytes.

Surrogate recoveries were below acceptance range for the acid fraction compounds in samples EEF12, EEF14, EEF20, and EEF24. Re-extraction and analyses performed on these samples encountered similar surrogate difficulties and suggest a matrix effect condition. Acid fraction extractable compound data reported at CRQL is unusable and analyte concentrations greater than CRQL are estimated and flagged J.

Matrix spike recoveries were acceptable; however, the laboratory substituted the chain of custody specified sample with EEF13. The case narrative states that analytical difficulties were experienced using EEF12. No qualification of the data set is applied based on matrix spike recovery data.

No TLC compounds greater than CRQL were detected in the field blank samples EEF22 and EEF23 or field duplicate samples EER18/EEF19. No qualifications of the data set are applied based on field blank or duplicate data.

VOLATILE ANALYSIS

Sample reanalysis was sometimes required to meet instrument calibration or contract compliance and reported as individual results. For purposes of data evaluation only one sample profile is needed. The multiple analyses are combined into one profile by using the following guideline which uses all available information and maintains consistency. First, values from the undiluted sample when the analyte was within the instrument calibration range are reported. Secondly, values from the greatest dilution within instrument calibration range and not affected by qualifiers, are reported. In the special case when analytes from reanalysis of a diluted sample are qualified with blank contamination and the analyte is present in the sample as demonstrated by the undiluted analysis the concentration value that exceeds the calibration range is reported and qualified J, estimated. Thirdly, any reasonable value is reported with qualification.

Case Number 12130: 20 low-concentration-level water samples (TR Numbers EBP63 TO EBP77 and EBP93 TO EBP97) were sent to S-Cubed.

Sample EBP97 contains toluene which may be an artifact of instrument contamination from the preceding analysis of EBP96. This is possible because sample EBP96 contains a high concentration of toluene which may cause instrument contamination. No attempt to decontaminate the instrument was performed. No qualification of sample EBP97 was applied based on the available data.

All other QA/QC measures were met and the data are acceptable.

Case Number 12130: 15 low-concentration-level soil samples (TR Numbers EBP78 to EBP92) were sent to S-Cubed.

A continuing calibration outlier affects 2-butanone in sample EBP89. The concentration value is estimated and flagged J.

Laboratory blank samples VBLK01, VBLK02, and VBLK03 contain methylene chloride. Field blank sample EBP92 contains methylene chloride and toluene. Values for methylene chloride are flagged B in samples reporting less than 10 times the amount found in the associated laboratory blank. Values for toluene are flagged B in samples reporting less than 10 times the amount found in the field blank sample.

No TCL compounds were detected at concentration levels greater than CRQL in field duplicate samples EBP90/91. The analyte 2-butanone was reported in sample EBP89, but not its duplicate EBP90. Values for 2-butanone are estimated and flagged J.

Case Number 12130: 13 low-concentration-level water samples (TR Numbers EBP98 and EEF00 to EEF11) were sent to S-Cubed.

Matrix spike recovery for toluene was above the acceptance range. No qualification of the data set is applied because the high toluene recoveries may have been influenced by contamination.

Surrogate recovery for toluene-d8 were below the acceptance range for field duplicate samples EEF00 and EEF01. These samples contain many non-TCL compounds which have obstructed the quantification of the surrogate. No qualification is applied to these samples because reanalysis of a diluted aliquot was performed with acceptable surrogate performance.

Field duplicate samples EEF00 and EEF01 each contain 7 TCL compounds which exhibit acceptable precision. Ethyl benzene is present in EEF00, but not EEF01. No qualification of the data set is applied based on field duplicate data.

Laboratory blank samples VBLK15 and VBLK16 contain toluene. No field blank samples were sent to the laboratory. Values for toluene are flagged B in samples reported less than 10 times the amount found in the associated laboratory blank.

Samples EEF09, EEF10, and EEF11 contain toluene which may be the result of instrument cross contamination. Indication that contamination occurred is supported by three points. Analysis of sample EEF08 preceded the forementioned samples and contains a high concentration of toluene which may cause instrument contamination. In following sequential analysis of EEF09, EEF10, and EEF11 the toluene concentration diminishes. No attempt to decontaminate the instrument was performed.

Sample EEF02 contains toluene and xylene which may be the result of instrument contamination from the analysis of EEF01. The claim is supported for reasons similar to those indicated in the previous paragraph.

Case Number 12130: 13 low-concentration-level water samples (TR Numbers EEF12 to EEF24) were sent to S-Cubed.

All QA/QC measures are acceptable and the data are useable.

PESTICIDE/PCB ANALYSIS

Pesticide/PCB analyses were affected by non-TCL compounds eluting in the retention window of gamma-BHC. The problem is not sufficiently documented in all data packages; however, each case has suggestive information which renders gamma-BHC data unusable.

Case Number 12130: 20 low-concentration-level water samples (TR Numbers EBP63 TO EBP77 and EBP93 TO EBP97) were sent to S-Cubed.

Continuing calibration response factors for delta BHC, DDD, DDE, endrin, endrin ketone, and endosulfan were outside the acceptable limits. Analyte concentrations greater than CRQL, in all samples, are estimated based on the unstable response factors and flagged J.

Matrix spike recoveries were above the acceptable range for gamma-BHC. The high recoveries may be the result of quantification errors caused by the presence of non-TLC compounds in the gamma-BHC retention window. Dieldrin precision data were marginally outside the acceptable limits; however, no samples contain dieldrin. No qualification of the data set is applied based on matrix spike recoveries.

No TCL compounds were reported for the field blank sample EBP77. Laboratory blank PBLK10 contains gamma-BHC. Values for gamma-BHC are flagged B in samples reporting less than 5 times the amount found in the laboratory blank.

No TLC compounds were reported in field duplicate samples EBP73/74. The analyte gamma-BHC was reported in field sample EBP75 but not the duplicate sample EBP76. Analytical interferences with gamma-BHC have been previously mention. No qualification of the data set is made based on field duplicate data.

Case Number 12130: 15 low-concentration-level soil samples (TR Numbers EBP78 to EBP92) were sent to S-Cubed.

The laboratory could not control instrument performance as demonstrated by retention time shifts, unstable calibration factors, and matrix spike and surrogate recoveries above acceptance range. Analyte concentration values in all samples reported above CRQL are estimated and flagged J. Data reported as non-detected are unusable.

Case Number 12130: 13 low-concentration-level water samples (TR Numbers EBP98 and EEF00 to EEF11) were sent to S-Cubed.

Extraction holding time was exceeded for sample EEF10. Analyte concentrations reported greater than CRQL are estimated and flagged J and the CRQL may be elevated for non-detected analytes.

Matrix spike recoveries, ranging 284 to 580 percent, were above the acceptable range for all spiking compounds. The high recoveries are attributed to sample specific matrix interference. No qualification of the data set is made based on matrix spike recoveries.

A field blank sample was not sent to the laboratory. No TLC compounds were reported in field duplicate samples EEF18/19. No qualification of the data set is applied based on field blank or duplicate data.

Case Number 12130: 13 low-concentration-level water samples (TR Numbers EEF12 to EEF24) were sent to S-Cubed.

Surrogate recovery was below acceptance range for sample EEF24. The data for this sample are unusable.

Extraction holding times were exceeded for samples EEF19 and EEF23. Analyte concentrations reported greater than CRQL are estimated and flagged J and CRQL may be elevated for non-detected analytes.

INORGANIC ANAYSES

Case 12130: 10 low concentration level water samples (Numbers MEBC63 through MEBC72) and 10 low concentration level soil samples (Numbers MEBC78 through MEBC87) were sent to Keystone Laboratories.

LCS analytical spike recoveries did not meet acceptance criteria for most elements. Failure to produce acceptable LCS data provides sufficient basis to reject all the analytical data to be used in a decision making process. Because some cursory information may be obtained, the data is provided for review.

Case 12130: This case contained two sample delivery groups (SDG). SDG MEWCW28 contained 1 low concentration level water sample (Number MECW28). SDG MEBC73 contains 15 low concentration level water samples (Numbers MEBC73 through MEBC77, MEBC93 through MEBC98, and MECW04 through MECW07) and 5 low concentration level soil samples (Numbers MEBC88 through MEBC92). The samples were originally sent to Keystone Laboratories then rerouted to Skinner and Sherman Laboratories after Keystone was unable to fulfill its assignment.

Water Samples (SDG MEBC73)

Water sample MEBC73 was spiked and prepared at Keystone Laboratories then rerouted to Skinner and Sherman Laboratories for analyses. Because the preparation was formed at another lab the data can be used to qualify sample MEBC73, but not the data set. Sample MEBC74, which is the field duplicate of Sample MeBC73, was prepared at Skinner and Sherman Labs and duplicated acceptably. MEBC76 was spiked, prepared, and analyzed at Skinner and Sherman and was used to evaluate spike recovery performance.

Reported values for sample MEBC73, even though they duplicate well with MEBC74, are flagged "R" because of unacceptable matrix spike recoveries.

Holding times for mercury analyses were exceeded. All reported values greater than IDL are flagged "J" and values reported less than CRDL are flagged "R".

The preparation blank contained iron, sodium, and zinc. Reported values less than 5 times the amount found in the blank are flagged "B".

Matrix interference of arsenic, selenium, and thallium were reported and the reported values flagged "J".

Samples MEBC75/76, MEBC73/74, MEBC97/98, and MECW04/05 are field duplicates. The RPDs are acceptable for all duplicate sets. Field duplicates are not used to qualify the data set.

Sediment Sample (SDG MEBC73)

Laboratory spike recoveries for lead, manganese, and thallium were below the acceptance range and flagged "J" for values reported greater than IDL and flagged "R" for values reported less than CRDL.

Duplicate RPDs results did not meet acceptance criteria for aluminum and iron. Values reported greater than IDL are flagged "J".

Sodium was found in the preparation blank and flagged "B" on sample values less than 5 times the amount found in the blank.

Samples MEBC88 and MEBC89 were field duplicates. The duplicate RPD's exceeded 35 percent for aluminum, iron, manganese, and zinc. No qualifications of the data set were made based on the field duplicates.

Water Sample (SDG MECW28)

Laboratory spike recoveries for arsenic, lead, and selenium were below acceptance range and flagged "J" for values reported greater than IDL and flagged "R" for values reported less than CRDL.

All other QA/QC measures were met and the data acceptable.

Case 12130: 20 low concentration level water samples (Numbers MECW09 through MECW27). The samples were originally sent to Keystone Laboratories then rerouted to Skinner and Sherman Laboratories after Keystone was unable to fulfill its assignment.

Water sample MECW23 was spiked and prepared at Keystone Laboratories then rerouted to Skinner and Sherman Laboratories for analyses. Because of the preparation was performed at another lab the data can be used to qualify sample MECW23, but not the data set. MECW13 was spiked, prepared, and analyzed at Skinner and Sherman and was used to evaluate spike recovery performance.

Laboratory spike recoveries were below acceptance range for arsenic and selenium in samples MECW13 and MECW23 and thallium in sample MECW23. Reported values greater than IDL are flagged "J" and reported values less than CRDL are flagged "R", except thallium in samples MECW23 which is not flagged.

Iron and zinc were found in the preparation blank. Reported values less than 5 times the amount in the blank are flagged "B".

Samples MECW26 and MECW27 are field blanks, which were found to contain elements greater than IDL. No qualification of the data set was made based on field blanks because the analytical quality of the water used is unknown.

OIL AND GREASE

Case Number SAS4668E: 31 low-concentration-level water samples (TR Numbers 4668E01 to 4668E31) were sent to National Environmental Testing, Inc.

Holding time criteria (10 days) were exceeded for all samples by 13 to 14 days. Exceeding the holding time may result in the decrease or loss of oil and grease components. Samples reporting concentration values greater than the detection limit are estimated and flagged J. Samples which report the detection limit cannot be used to evaluate the absence of oil and grease; however, gross concentrations are not expected.

NONAQUEOUS SAMPLES

Analyses of five samples (SAMPLE ID SSB01 through SSB05) were performed at the CH2M HILL Montgomery laboratory. The samples were analyzed in accordance with procedures described in the following EPA documents.

- o Test Methods for Evaluating Solid Waste (1986)
- o Method 602, EPA-600/4_82_057 (1982)
- o Method 418.2 EPA-600/4_78_012 (1978)

The only deliverable was a sample result form analogous to the CLP FORM I. Data review consists of reviewing holding times, surrogate recoveries, detection limits, and laboratory blank contamination. For sample analysis using Method 602 the initial and continuing calibration data was also provided. Additional review of these data consists of checking the relative percent difference of the initial calibration response factors and response factor difference of the continuing calibration.

VOLATILE ANALYSIS (Method 8240)

Laboratory blank sample QC BLANK SM, a medium level analysis, contains chloromethane, methylene chloride, toluene, and xylenes. Laboratory blank sample QC BLANK S contains methylene chloride and acetone. Sample results reporting the common laboratory contaminants methylene chloride or toluene at less than 10 times the amount found in the associated blank are flagged B. Sample results reporting chloromethane or xylene at less than 5 times the amount found in the associated blank are flagged B.

All other QA/QC measures were met and the data are acceptable for use.

SEMIVOLATILE ANALYSIS (Method 8270)

All QA/QC measures were met and the data are acceptable for use.

PESTICIDE/PCB ANALYSIS (Method 8080)

All QA/QC measures were met and the data acceptable for use.

PURGABLE AROMATICS-BENZENE, TOLUENE, and XYLENE; BTX (Method 602)

All QA/QC measures were met and the data acceptable for use.

TOTAL PETROLEUM HYDROCARBONS-TPH (Method 418.2)

All QA/QC
measures were met and the data acceptable for use.

RESIDENTIAL WELL DATA VALIDATION

Organic Analysis

- o Carbon disulfide (0.2 to 0.8 µg/l) was identified in the method and field blank. Di-n-butylphthalate (9 µg/l) pp-DDT (0.04 µg/l) were found in the field blank. Samples which contain these contaminants at concentrations less than ten times the blank pi-n-butylphthalate concentration or less than five times the blank carbon disulfide or pp-DDT concentrations are considered unusable and flagged "B."

- o Mass spectral confirmation failed for several compounds including carbon disulfide (87ZCO1SO8), 2-4 Dinitrophenol (87ZCO1RO7), 4-Nitroso-DI-n-propylamine (87ZCO1SO1-SO6, RO7, DO9), Bis(2-chloroisopropyl)ether (87ZCO1SO4, SO6, RO7), Benzoic acid (89ZCO1SO5, SO8) and 4-Nitrophenol (89ZCO1SO5, SO6).

Results for these compounds are considered unusable and flagged "R."

Residential Wells

- o Total of nine samples: 7 RW samples, one replicate, and one field blank

Inorganic Analysis

- o Spike sample recovery for cadmium was beyond control limits for 87ZCO1SO1 and cadmium was considered estimated (J) and may be biased high.

- o Barium (68.5 µg/l), calcium (0.7 mg/l) and sodium (1.1 mg/l) were identified in the field blank. Samples which contain these contaminants at concentrations less than five times the blank concentrations are considered unusable and flagged "B."

- o Field duplicate sample differences for chromium and nickel were outside control limits and positive results for these compounds are considered estimated.

REFERENCES

1. U.S. EPA. *Contract Compliance Screening Procedures for RAS Organics Data Packages*. 9/87 revision.

2. U.S. EPA. *Contract Compliance Screening Procedures for RAS Inorganics Data Under SOW N. 787*. 1988 revision.

3. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluation Organics Analyses*. February 1, 1988

4. U.S. EPA. *Laboratory Data Validation Functional Guidelines for Evaluation Inorganics Analyses*. July 1, 1988

5. U.S. EPA. *Contract Laboratory Program Statement of Work for Organic Analyses*. 7/87 revision.

GLT913/068.50

Attachment 1
DATA TABLES

INORGANIC CHEMICAL ANALYSIS OF RESIDENTIAL WELL SAMPLES (Page 1 of 4)

	DETECTION LIMITS	Sample Location:	RW01-01	RW02-01	RW03-01	RW04-01	FRRW04-01	RW05-01	RW06-01	RW07-01	RWFB-01
		Resident Name:	Hubley	Marshall	Fritz	Davis	Davis	D. Johnson	F. Johnson	Kellicut	Field Blank
		Date Sampled:	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15
		CRL Number:	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S08	89ZC01D09	89ZC01S04	89ZC01S05	89ZC01S06	89ZC01R07
		Laboratory:	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL
INORGANIC CHEMICALS (ug/l)											
ALUMINUM	80.0		--	--	--	--	--	--	--	--	--
ANTIMONY	2.0		--	--	--	--	--	--	--	--	--
ARSENIC	2.0		--	18.0	--	--	--	--	--	--	--
BARIUM	6.0		99.9	--	344.0	20.3 B	20.7 B	44.2 B	32.4 B	35.9 B	13.7
BERYLLIUM	1.0		--	--	--	--	--	--	--	--	--
BORON	80.0		--	--	--	--	--	--	--	--	--
CADMIUM	0.2		0.2 J	--	--	--	--	--	--	--	--
CALCIUM	500.0		31500.0	--	60200.0	66600.0	68100.0	56200.0	62500.0	46600.0	700.0
CHROMIUM	8.0		11.1 J	--	--	--	10.7	--	--	--	--
COBALT	6.0		--	--	--	--	--	--	--	--	--
COPPER	6.0		12.0	--	13.5	8.0	11.3	--	7.0	9.4	--
CYANIDE	5.0		--	--	--	--	--	--	--	--	--
IRON	80.0		587.0	--	1080.0	828.0	795.0	1190.0	535.0	--	--
LEAD	2.0		--	--	--	--	--	--	--	--	--
LITHIUM	10.0		--	--	--	--	--	--	--	--	--
MAGNESIUM	100.0		11600.0	--	14300.0	18000.0	18300 0	14100.0	16000.0	16800.0	--
MANGANESE	5.0		359.0	--	704.0	161.0	163.0	134.0	198.0	--	--
MERCURY	0.2		0.2	--	--	--	--	0.2	--	--	--
MOLYBDENUM	15.0		--	--	--	--	--	--	--	--	--
NICKEL	15.0		--	--	--	--	15.1 J	--	--	--	--
POTASSIUM	5000.0		--	--	--	--	--	--	--	--	--
SELENIUM	2.0		--	--	--	--	--	--	--	--	--
SILVER	6.0		--	--	--	--	--	--	--	--	--
SODIUM	1000.0		8100.0	68000.0	3400.0 B	3600.0 B	3900.0 B	3700.0 B	3800 0 B	4600.0 B	1100.0
THALLIUM	2.0		--	--	--	--	--	--	--	--	--
TITANIUM	25.0		--	--	--	--	--	--	--	--	--
VANADIUM	5.0		--	--	--	--	--	--	--	--	--
ZINC	40.0		56.8	--	347.0	--	--	120.0	212.0	87.2	--

NOTES:

B = Blank contamination

J = Estimated value

-- = Not detected at detection limit

ORGANIC COMPOUND ANALYSIS OF RESIDENTIAL WELL SAMPLES (Page 2 of 4)

	DETECTION LIMITS	Sample Location:	RW01-01	RW02-01	RW03-01	RW04-01	FRRW04-01	RW05-01	RW06-01	RW07-01	RWFB-01
		Resident Name:	Hubley	Marshall	Fritz	Davis	Davis	D. Johnson	F. Johnson	Kellicut	Field Blank
		Date Sampled:	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15
		CRL Number:	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S08	89ZC01D09	89ZC01S04	89ZC01S05	89ZC01S06	89ZC01R07
		Laboratory:	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL
ORGANIC COMPOUNDS (ug/l)											
VOLATILE											
CHLOROMETHANE	3.0		--	--	--	--	--	--	--	--	--
BROMOMETHANE	3.0		--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	3.0		--	--	--	--	--	--	--	--	--
CHLOROETHANE	3.0		--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	1.0		--	--	--	0.8 B	--	--	--	--	--
ACETONE	50.0		--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	0.3		100.0	26.0	180.0	R	170.0	170.0	110.0	130.0	0.2 B
1,1-DICHLOROETHENE	1.0		--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	1.0		--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	1.0		--	--	--	--	--	--	--	--	--
CHLOROFORM	1.0		--	--	--	1.0	1.0	--	--	--	--
1,2-DICHLOROETHANE	1.0		--	--	--	--	--	--	--	--	--
2-BUTANONE	20.0		--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	1.0		--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	1.0		--	--	--	--	--	--	--	--	--
VINYL ACETATE	10.0		--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	1.0		--	--	--	--	--	--	--	--	--
ACROLEIN	75.0		--	--	--	--	--	--	--	--	--
ACRYLONITRILE	50.0		--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	1.0		--	--	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	1.0		--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	1.0		--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	1.0		--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	1.0		--	--	--	--	--	--	--	--	--
BENZENE	1.0		--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	1.0		--	--	--	--	--	--	--	--	--
2-CHLOROETHYLVINYLETHER	1.0		--	--	--	--	--	--	--	--	--
BROMOFORM	1.0		--	--	--	--	--	--	--	--	--
2-HEXANONE	4.0		--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	4.0		--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	1.0		--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	1.0		--	--	--	--	--	--	--	--	--
TOLUENE	1.0		--	--	--	--	--	--	--	--	--
CHLOROBENZENE	1.0		--	--	--	--	--	--	--	--	--
ETHYLBENZENE	1.0		--	--	--	--	--	--	--	--	--
STYRENE	2.0		--	--	--	--	--	--	--	--	--
M-XYLENE	2.0		--	--	--	--	--	--	--	--	--
O/P-XYLENE	2.0										

NOTES:

B = Blank contamination

-- = Not detected at detection limit

R = Unusable data

Dilution Factor: 1.0

ORGANIC COMPOUND ANALYSIS OF RESIDENTIAL WELL SAMPLING (PAGE 3 OF 4)

	DETECTION LIMITS									
Sample Location:		RW01-01	RW02-01	RW03-01	RW04-01	FBRW04-01	RW05-01	RW06-01	RW07-01	RWFB-01
Resident Name:		Hubley	Marshall	Fritz	Davis	Davis	D. Johnson	F. Johnson	Kellicut	Field Blank
Date Sampled:		89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15
CRL Number:		89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S08	89ZC01D09	89ZC01S04	89ZC01S05	89ZC01S06	89ZC01R07
Laboratory:		EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL
ORGANIC COMPOUNDS (ug/l)										
SEMIVOLATILE										
PHENOL	2	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	2	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	2	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	2	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	2	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	2	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	3	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	1	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	3	--	--	--	--	--	R	--	R	R
4-METHYLPHENOL	1	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	2	R	R	R	--	R	R	R	R	R
HEXACHLOROETHANE	2	--	--	--	--	--	--	--	--	--
NITROBENZENE	3	--	--	--	--	--	--	--	--	--
ISOPHORONE	3	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	2	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	2	--	--	--	--	--	--	--	--	--
BENZOIC ACID	30	--	--	--	R	--	--	R	--	--
BIS(2-CHLOROETHOXY)METHANE	3	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	2	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	2	--	--	--	--	--	--	--	--	--
NAPHTHALENE	2	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	2	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	3	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	2	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	2	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	2	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	2	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	2	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	2	--	--	--	--	--	--	--	--	--
2-NITROANILINE	3	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	2	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	2	--	--	--	--	--	--	--	--	--
3-NITROANILINE	1	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	2	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	15	--	--	--	--	--	--	--	--	R
4-NITROPHENOL	2	--	--	--	--	--	--	R	R	--
DIBENZOFURAN	1	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	1	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	1	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	1	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	1	--	--	--	--	--	--	--	--	--
FLUORENE	1	--	--	--	--	--	--	--	--	--
4-NITROANILINE	3	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	15	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	2	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	2	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	2	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	2	--	--	--	--	--	--	--	--	--
PHENANTHRENE	1	--	--	--	--	--	--	--	--	--
ANTHRACENE	3	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	2	13 B	9 B	6 B	6 B	10 B	6 B	6 B	11 B	9
FLUORANTHENE	2	--	--	--	--	--	--	--	--	--
PYRENE	2	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	4	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	2	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	1	2	2	--	--	--	--	--	--	--
CHRYSENE	2	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	2	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	2	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	2	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	2	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	4	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	3	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	4	--	--	--	--	--	--	--	--	--

NOTES:
- -- = Not detected at detection limit
- B = Blank contamination
- R = Unuseable data

Dilution factor: 1.0

ORGANIC COMPOUND (PESTICIDES and PCBs) ANALYSIS OF RESIDENTIAL WELL SAMPLES (Page 4 of 4)

	DETECTION LIMITS	Sample Location:	RW01-01	RW02-01	RW03-01	RW04-01	FRRW04-01	RW05-01	RW06-01	RW07-01	RWFB-01
		Resident Name:	Hubley	Marshall	Fritz	Davis	Davis	D. Johnson	F. Johnson	Kellicut	Field Blank
		Date Sampled:	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15	89-03-15
		CRL Number:	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S08	89ZC01D09	89ZC01S04	89ZC01S05	89ZC01S06	89ZC01R07
		Laboratory:	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL	EPA CRL
ORGANIC COMPOUNDS (ug/l)											
PESTICIDES and PCBs											
ALPHA-BHC	0.02		--	--	--	--	--	--	--	--	--
BETA-BHC	0.02		--	--	--	--	--	--	--	--	--
DELTA-BHC	0.02		--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	0.002		--	--	--	--	--	--	--	--	--
HEPTACHLOR	0.03		--	--	--	--	--	--	--	--	--
ALDRIN	0.02		--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	0.01		--	--	--	--	--	--	--	--	--
ENDOSULFAN I	.01 to .02		--	--	--	--	0.02 J	0.02 J	0.02 J	--	--
DIELDRIN	0.01		--	--	--	--	--	--	--	--	--
4,4-DDE	0.005		--	--	--	--	--	--	--	--	--
ENDRIN	0.01		--	--	--	--	--	--	--	--	--
ENDOSULFAN II	0.01		--	--	--	--	--	--	--	--	--
4,4-DDD	0.02		--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	0.13		--	--	--	--	--	--	--	--	--
4,4-DDT	0.02		0.03 J, B	0.04 J, B	0.04 J, B	0.02 J, B	0.07 B	--	--	0.02 J, B	0.04 J, B
METHOXYCHLOR	0.02		--	--	--	--	--	--	--	--	--
ENDRIN KETONE	0.03		--	--	--	--	--	--	--	--	--
CHLORDANE	0.02		--	--	--	--	--	--	--	--	--
TOXAPHENE	0.25		--	--	--	--	--	--	--	--	--
AROCLOR-1242	0.2		--	--	--	--	--	--	--	--	--
AROCLOR-1248	0.2		--	--	--	--	--	--	--	--	--
AROCLOR-1254	0.2		--	--	--	--	--	--	--	--	--
AROCLOR-1260	0.2		--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	0.05		--	--	--	--	--	--	--	--	--

NOTES:
J = Estimated value
-- = Not detected at detection limit
B = Blank contamination

VOLATILE ORGANIC COMPOUNDS - GROUNDWATER

Sample Location	MW1S-01	MW1S-02	MW1M-01	MW1M-02	MW1B01-01	MW1B01-02	MWB1-01	MWB1-02	MW02S-01	MW02S-02	FRMW02S-01	MW1B02-01	MW1B02-02	MW02M-01
Sample Number	EBP32	EEF15	EBP37	EEF16	EBP27	EEF22	EBP36	EEF08	EBP18	EBP93	EBP19	EBP49	EEF23	EBP29
Date Sampled	04-19-89	06-14-89	04-19-89	06-14-89	04-17-89	06-14-89	04-19-89	06-13-89	04-17-89	06-12-89	04-17-89	04-19-89	06-14-89	04-17-89
CRL Number	89ZC02S18	89ZC40S46	89ZC02S13	89ZC40S47	89ZC02R01	89ZC40R04	89ZC02S15	89ZC40S37	89ZC02S05	89ZC40S26	89ZC02D05	89ZC02R02	89ZC40R03	89ZC02S06
Laboratory	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED
ORGANIC COMPOUNDS (ug/l)														
VOLATILE														
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	14	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	3 J	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--	--	5 J	2 J	5 J	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	82 B	2 B	--	2 B	--	--	--	--	--	3 J	84 B	--	1 B	--
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--	5 J	4 J	10	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	220 B	--	--	--	66 B	42	88 B	--	--	--

NOTES:

- B = Blank contamination.
- J = Estimated value.
- -- = < contract required detection limit.
- * = Potential contaminant, see narrative.

File: W-MWVOC.WK1

VOLATILE ORGANIC COMPOUNDS -
GROUNDWATER

Sample Location:	MW02M-02	MW02D-01	MW02D-02	MWB2-01	MWB2-02	MW03S-01	MW03S-02	FRMW03S-02	MWF803-01	MW03M-01	MW03M-02	MW03D-01	MW03D-02
Sample Number:	EBP94	EBP22	EBP95	EBP38	EEF09	EBP17	EEF00	EEF01	EBP55	EBP30	EEF02	EBP21	EEF03
Date Sampled:	06-12-89	04-17-89	06-12-89	04-19-89	06-13-89	04-17-89	06-13-89	06-13-89	04-20-89	04-17-89	06-13-89	04-18-89	06-13-89
CRL Number:	89ZC40S27	89ZC02S07	89ZC40S28	89ZC02S22	89ZC40S38	89ZC02S01	89ZC40S23	89ZC40D23	89ZC02R04	89ZC02S02	89ZC40S32	89ZC02S10	89ZC40S33
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2
ORGANIC COMPOUNDS (ug/l)													
VOLATILE													
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	7 J	--	--	--	--	--	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	15	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	190	250 J	190	--	--	--	5 J	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	180	250 J	180	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	17	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	240	450 J	360 J	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	11	14	13	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	13	11	12	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	--	--	--	19	21	8300 J	20000 J	18000	--	140 B	230 *	160 B	9 B
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	2 J	--	--	--	210	230 J	--	--	--	--	230	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	2300 J	1800	1700	--	--	62 *	450 B	--

NOTES:
- B = Blank contamination.
- J = Estimated value.
- -- = < contract required detection limit.
- * = Potential contaminant, see narrative.

File: W-MWVOC.WK1

VOLATILE ORGANIC COMPOUNDS - GROUNDWATER

Sample Location:	MW83-01	MW83-02	MW45-01	MW45-02	MW84S-01	MW84S-02	MW84D-01	MW84D-02	MW05S-01	MW05S-02	MW06M-01	MW06M-02	MW7M-01	MW7M-02
Sample Number:	EBP39	EEF12	EBP26	EBP96	EBP20	EEF04	EBP23	EEF05	EBP28	EEF24	EBP31	EEF14	EBP24	EBP97
Date Sampled:	04-19-89	06-14-89	04-17-89	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-18-89	06-14-89	04-17-89	06-14-89	04-18-89	06-13-89
CRL Number:	89ZC02S21	89ZC40S48	89ZC02S03	89ZC40S29	89ZC02S08	89ZC40S34	89ZC02S09	89ZC40S31	89ZC02S11	89ZC40S43	89ZC02S04	89ZC40S50	89ZC02S12	89ZC40S30
Laboratory:	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2
ORGANIC COMPOUNDS (ug/l)														
VOLATILE														
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	53	45	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	20	51	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	2 J	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	760	1200	3 J	39	570	800	36	43	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	260	320 J	--	--	27	21	5	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	5 J	--	3 J	3 J	--	--	7	8	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	10	12	--	--	7	6	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	10	3 B	530 J	270	5300 J	14000 J	--	--	8300 J	11000 J	--	3 B	--	2 J
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	42	35	160	160	31	27	160	150	--	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	350 B	300	1300 J	1800	64 B	37	1400 J	1700	--	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value.
- -- = < contract required detection limit.
- * = Potential contaminant, see narrative.

File: W-MWVOC.WK1

VOLATILE ORGANIC COMPOUNDS - GROUNDWATER

Sample Location:	FRMW7M-01	FRMW7M-02	MW08S-01	MW08S-02	MW08M-01	MW08M-02	MW08D-01
Sample Number:	EBP25	EBP98	EBP34	EEF10	EBP35	EEF11	EBP33
Date Sampled:	04-18-89	06-13-89	04-19-89	06-13-89	04-19-89	06-13-89	04-19-89
CRL Number:	89ZC02D12	89ZC40D30	89ZC02S16	89ZC40S39	89ZC02S17	89ZC40S40	89ZC02S14
Laboratory:	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED
ORGANIC COMPOUNDS (ug/l)							
VOLATILE							
CHLOROMETHANE	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--
TOLUENE	--	--	--	17	--	14	--
CHLOROBENZENE	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	--	--

Sample Location:	MW08D-02	MW09M-01	MW09M-02	FRMW09M-02	MW10M-01	MW10M-02	MW11M-01
Sample Number:	EEF17	EBP54	EEF18	EEF19	EBP53	EEF20	EBP56
Date Sampled:	06-14-89	04-20-89	06-14-89	06-14-89	04-20-89	06-14-89	04-20-89
CRL Number:	89ZC40S45	89ZC02S33	89ZC40S42	89ZC40D42	89ZC02S32	89ZC40S41	89ZC02S35
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED
ORGANIC COMPOUNDS (ug/l)							
VOLATILE							
CHLOROMETHANE	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--
TOLUENE	--	--	--	2 B	--	--	--
CHLOROBENZENE	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	--	--

NOTES:

- B = Blank contamination.
- J = Estimated value.
- -- = < contract required detection limit.
- * = Potential contaminant, see narrative.

File: W-MWVOC.WK1

VOLATILE ORGANIC COMPOUNDS - GROUNDWATER

Sample Location.	FRMW11A-01	MW11A-02	MW12S-01	MW12S-02	MW13S-01	MW13S-02	MW14S-01	MW14S-02	MW20S-01	MW20D-01	MW21S-01
Sample Number.	EBP57	EEF21	EBP41	EEF06	EBP40	EEF07	EBP58	EEF13	EBP60	EBP61	EBP62
Date Sampled.	04-20-89	06-14-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	04-20-89	04-20-89	04-20-89
CRL Number.	89ZC02D35	89ZC40S44	89ZC02S19	89ZC40S35	89ZC02S20	89ZC40S36	89ZC02S31	89ZC40S49	89ZC02S34	89ZC02S36	89ZC02S37
Laboratory	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)											
VOLATILE											
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	15
METHYLENE CHLORIDE	--	--	--	--	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	490
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	--	--	--	--	--	--	--	--	--	--	--
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	--	--	--	--	--	--

NOTES:

- B = Blank contamination
- J = Estimated value.
- -- = < contract required detection limit
- * = Potential contaminant, *see narrative*

File: W-MWVOC.WK1

SEMI-VOLATILES - GROUNDWATER

Sample Location:	MWB1-01	MWB1-02	MWFB01-01	MWFB01-02	MW1A-01	MW1A-02	MW1S-01	MW1S-02	MWB2-01	MWB2-02	MWFB02-01	MWFB02-02	MW02D-01	MW02D-02
Sample Number:	EBP36	EEF08	EBP37	EEF22	EBP32	EEF16	EBP32	EEF15	EBP36	EEF09	EBP49	EEF23	EBP22	EBP95
Date Sampled:	04-19-89	06-13-89	04-17-89	06-14-89	04-19-89	06-14-89	04-19-89	06-14-89	04-19-89	06-13-89	04-19-89	06-14-89	04-17-89	06-12-89
CRL Number:	89ZC02S15	89ZC40S37	89ZC02R01	89ZC40R04	89ZC02S18	89ZC40S47	89ZC02S18	89ZC40S46	89ZC02S22	89ZC40S38	89ZC02R02	89ZC40R03	89ZC02S07	89ZC40S28
Laboratory:	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2
ORGANIC COMPOUNDS (ug/l)														
SEMIVOLATILE														
PHENOL	--	--	--	--	--	--	130	--	--	3 B	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	150	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	62	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	--	--	--	--	--	--	71	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	70	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	120	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	84	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	160	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	78	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	100	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	74	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	5 J
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- -- = < contract required detection limit

File W:MWBNA.WK1

((

SEMI-VOLATILES - GROUNDWATER

Sample Location:	MW02S-01	MW02S-02	FRMW02S-01	MW02M-01	MW02M-02	MWB3-01	MWB3-02	MWFB03-01	MW03D-01	MW03D-02	MW03M-01	MW03M-02	MW03S-01	MW03S-02
Sample Number:	EBP18	EBP93	EBP19	EBP29	EBP94	EBP39	EEF12	EBP55	EBP21	EEF03	EBP30	EEF02	EBP17	EEF00
Date Sampled:	04-17-89	06-12-89	04-17-89	04-17-89	06-12-89	04-19-89	06-14-89	04-20-89	04-18-89	06-13-89	04-17-89	06-13-89	04-17-89	06-13-89
CRL Number:	89ZC02S05	89ZC40S26	89ZC02D05	89ZC02S06	89ZC40S27	89ZC02S21	89ZC40S48	89ZC02R04	89ZC02S10	89ZC40S33	89ZC02S02	89ZC40S32	89ZC02S01	89ZC40S23
Laboratory:	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S CUBED	S-CUBED Round 2
ORGANIC COMPOUNDS (ug/l)														
SEMIVOLATILE														
PHENOL	--	--	--	--	--	--	--	6 J	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	2 J	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--	--	16
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	56 J	88
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	64 J	78
N-NITROSO-DI-n-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	8 J
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--	--	23 J
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	56 J	40
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	2 J	--	--	--	--	--	--	--	--	--	14 J	9 J
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	5 J	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	7 J	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES
- B = Blank contamination
- J = Estimated value
- -- = < contract required detection limit

SEMI-VOLATILES - GROUNDWATER

Sample Location:	FRMW03S-02	MW84D-01	MW84D-02	MW84S-01	MW84S-02	MW4S-01	MW4S-02	MW05S-01	MW05S-02	MW06M-01	MW06M-02	MW7M-01	MW7M-02	FRMW7M-01
Sample Number:	EEF01	EBP23	EEF05	EBP20	EEF04	EBP26	EBP96	EBP28	EEF24	EBP31	EEF14	EBP24	EBP97	EBP25
Date Sampled:	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-17-89	06-13-89	04-18-89	06-14-89	04-17-89	06-14-89	04-18-89	06-13-89	04-18-89
CRL Number:	89ZC40D23	89ZC02S09	89ZC40S31	89ZC02S08	89ZC40S34	89ZC02S03	89ZC40S29	89ZC02S11	89ZC40S43	89ZC02S04	89ZC40S50	89ZC02S12	89ZC40S30	89ZC02D12
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED
ORGANIC COMPOUNDS (ug/l)														
SEMIVOLATILE														
PHENOL	--	--	--	--	--	--	--	6 J	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	160	--	--	8 J	--	--	--	21	13	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	91	--	--	--	17	--	--	58	30	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	93	--	--	--	41	--	55	110	40	--	--	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	8 J	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	22 J	--	--	20 J	10 J	--	8 J	71	11 J	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	43	--	--	39	45	23	20	47	51	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	11	4 J	--	14	23	9 J	7 J	10	15	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	19	--	3 J	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES
- B = Blank contamination
- J = Estimated value
- -- = < contract required detection limit

File [illegible]

SEMI-VOLATILES - GROUNDWATER

Sample Location	FRMW7m-02	MW08D-01	MW08D-02	MW08M-01	MW08M-02	MW08S-01	MW08S-02	MW09M-01	MW09M-02	FRMW09M-02	MW10M-01	MW10M-02	MW11M-01	FRMW11M-01
Sample Number	EBP98	EBP33	EEF17	EBP35	EEF11	EBP34	EEF10	EBP54	EEF18	EEF19	EBP53	EEF20	EBP56	EBP57
Date Sampled:	06-13-89	04-19-89	06-14-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	06-14-89	04-20-89	06-14-89	04-20-89	04-20-89
CRL Number:	89ZC40D30	89ZC02S14	89ZC40S45	89ZC02S17	89ZC40S40	89ZC02S16	89ZC40S39	89ZC02S33	89ZC40S42	89ZC40D42	89ZC02S32	89ZC40S41	89ZC02S35	89ZC02D35
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)														
SEMIVOLATILE														
PHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- -- = < contract required detection limit

SEMI-VOLATILES - GROUNDWATER

Sample Location:	MW11M-02	MW12S-01	MW12S-02	MW13S-01	MW13S-02	MW14S-01	MW14S-02	MW20S-01	MW20D-01	MW21S-01
Sample Number:	EEF21	EBP41	EEF06	EBP40	EEF07	EBP58	EEF13	EBP60	EBP61	EBP62
Date Sampled:	06-14-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	04-20-89	04-20-89	04-20-89
CRL Number:	89ZC40S44	89ZC02S19	89ZC40S35	89ZC02S20	89ZC40S36	89ZC02S31	89ZC40S49	89ZC02S34	89ZC02S36	89ZC02S37
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)										
SEMIVOLATILE										
PHENOL	--	--	2 B	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--

NOTES
- B = Blank contamination
- J = Estimated value
- -- = < contract required detection limit

PESTICIDE/PCBS - GROUNDWATER

Sample Location:	MWB1-01	MWB1-02	MWFB01-01	MWFB01-02	MW1A-01	MW1A-02	MW1S-01	MW1S-02	MWB2-01	MWB2-02	MWFB02-01	MWFB02-02	MW02D-01	MW02D-02
Sample Number:	EBP36	EEF08	EBP27	EEF22	EBP37	EEF16	EBP32	EEF15	EBP38	EEF09	EBP49	EEF23	EBP22	EBP95
Date Sampled:	04-19-89	06-13-89	04-17-89	06-14-89	04-19-89	06-14-89	04-19-89	06-14-89	04-19-89	06-13-89	04-19-89	06-14-89	04-17-89	06-12-89
CRL Number:	89ZC02S15	89ZC40S37	89ZC02R01	89ZC40R04	89ZC02S13	89ZC40S47	89ZC02S18	89ZC40S46	89ZC02S22	89ZC40S38	89ZC02R02	89ZC40R03	89ZC02S07	89ZC40S28
Laboratory	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
		Round 2		Round 2		Round 2		Round 2		Round 2		Round 2		Round 2
ORGANIC COMPOUNDS (ug/l)														
PESTICIDES and PCBs														
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	0.12 J	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

-- = Not detected at detection limit.
R = Unusable
B = Blank contamination.
J = *Estimated value*

File: W-MWPCB.WK1

PESTICIDE/PCBs - GROUNDWATER

Sample Location:	MW02M-01	MW02M-02	MW02S-01	FRMW02S-01	MW02S-02	MW03-01	MW03-02	MWFB03-01	MW03D-01	MW03D-02	MW03M-01	MW03M-02	MW03S-01	MW03S-02
Sample Number:	EBP29	EBP94	EBP18	EBP19	EBP93	EBP39	EEF12	EBP55	EBP21	EEF03	EBP30	EEF02	EBP17	EEF00
Date Sampled:	04-17-89	06-12-89	04-17-89	04-17-89	06-12-89	04-19-89	06-14-89	04-20-89	04-18-89	06-13-89	04-17-89	06-13-89	04-17-89	06-13-89
CRL Number:	89ZC02S06	89ZC40S27	89ZC02S05	89ZC02D05	89ZC40S26	89ZC02S21	89ZC40S48	89ZC02R04	89ZC02S10	89ZC40S33	89ZC02S02	89ZC40S32	89ZC02S01	89ZC40S23
Laboratory:	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2
ORGANIC COMPOUNDS (ug/l)														
PESTICIDES and PCBs														
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	--	--	--	--	0.02 R	--	--	0.04 R	--	--	--	0.04 R
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

-- = Not detected at detection limit.
R = Unusable.
B = Blank contamination
J = Estimated value.

File: W-MWPCB.WK1

PESTICIDE/PCBS - GROUNDWATER

Sample Location:	MW03S-02	MW84D-01	MW84D-02	MW84S-01	MW84S-02	MW4S-01	MW4S-02	MW05S-01	MW05S-02	MW06M-01	MW06M-02	MW7M-01	MW7M-02	FKMW7M-01
Sample Number:	EEF01	EBP23	EEF05	EBP20	EEF04	EBP26	EBP96	EBP28	EEF24	EBP31	EEF14	EBP24	EBP97	EBP25
Date Sampled:	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-17-89	06-13-89	04-18-89	06-14-89	04-17-89	06-14-89	04-18-89	06-13-89	04-18-89
CRL Number:	89ZC40D23	89ZC02509	89ZC40531	89ZC02508	89ZC40534	89ZC02503	89ZC40529	89ZC02511	89ZC40543	89ZC02504	89ZC40550	89ZC02512	89ZC40530	89ZC02D12
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED
ORGANIC COMPOUNDS (ug/l)														
PESTICIDES and PCBs														
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	--	--	--	--	0.14 B	--	--	--	--	--	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	0.06 J	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	0.38 J	1.20 J	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	0.22 J	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
- -- = Not detected at detection limit.
- R = Unusable
- B = Blank contamination
- J = Estimated value

File: W-MWPCB.WK1

PESTICIDE/PCBs - GROUNDWATER

Sample Location:	FRMW7M-02	MW08D-01	MW08D-02	MW08M-01	MW08M-02	MW08S-01	MW08S-02	MW09M-01	MW09M-02	FRMW09M-02	MW10M-01	MW10M-02	MW11M-01	FRMW11M-01
Sample Number:	EBP98	EBP33	EEF17	EBP35	EEF11	EBP34	EEF10	EBP54	EEF18	EEF19	EBP53	EEF20	EBP56	EBP57
Date Sampled:	06-13-89	04-19-89	06-14-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	06-14-89	04-20-89	06-14-89	04-20-89	04-20-89
CRL Number:	89ZC40D30	89ZC02S14	89ZC40S45	89ZC02S17	89ZC40S40	89ZC02S16	89ZC40S39	89ZC02S33	89ZC40S42	89ZC40D42	89ZC02S32	89ZC40S41	89ZC02S35	89ZC02D35
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
	Round 2		Round 2		Round 2		Round 2		Round 2	Round 2		Round 2		
ORGANIC COMPOUNDS (ug/l)														
PESTICIDES and PCBs														
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	0.02 R	--	--	--	--	--	0.04 R	--	--	--	--	--	--	0.09 R
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
-- = Not detected at detection limit.
R = Unusable.
B = Blank contamination
J = Estimated value

File. W-MWPCB.WK1

PESTICIDE/PCBS - GROUNDWATER

Sample Location:	MW11M-02	MW12S-01	MW12S-02	MW13S-01	MW13S-02	MW14S-01	MW14S-02	MW20D-01	MW20S-01	MW21S-01
Sample Number:	EEF21	EBP41	EEF06	EBP40	EEF07	EBP58	EEF13	EBP61	EBP60	EBP62
Date Sampled:	06-14-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	04-20-89	04-20-89	04-20-89
CRL Number:	89ZC40S44	89ZC02S19	89ZC40S35	89ZC02S20	89ZC40S36	89ZC02S31	89ZC40S49	89ZC02S36	89ZC02S34	89ZC02S37
Laboratory:	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED Round 2	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)										
PESTICIDES and PCBs										
ALPHA-BHC	--	--	--	--	--	--	0.01 J	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	0.03 R	--	0.02 R	--	--	--	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	0.03 J	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	0.05 J	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--

NOTES:

-- = Not detected at detection limit
R = Unusable
B = Blank contamination
J = Estimated value

File: W-MWPCB.WK1

INORGANICS - GROUNDWATER

Sample Location:	MWB01-01	MWB01-02	MWFB01-01	MWFB01-02	MW01S-01	MW01S-02	MW01M-01	MW01M-02	MWB02-01	MWB02-02	MWFB02-01	MWFB02-02	MW02S-01
ITE Sample Number.	MEBC36	MECW12	MEBC27	MECW26	MEBC32	MECW19	MEBC37	MECW20	MEBC38	MECW13	MEBC49	MECW27	MEBC18
Date Sampled:	04-19-89	06-13-89	04-18-89	06-14-89	04-19-89	06-14-89	04-19-89	06-14-89	04-19-89	06-13-89	04-19-89	06-14-89	04-18-89
CRL Number:	89ZC02S54	89ZC40S86	89ZC02R05	89ZC40R07	89ZC02S57	89ZC40S95	89ZC02S58	89ZC40S96	89ZC02S53	89ZC40S87	89ZC02R06	89ZC40R08	89ZC02S44
Laboratory.	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL
INORGANIC CHEMICALS (ug/l)													
ALUMINUM	119 J	--	--	54.4 J	--	--	--	--	103 J	--	--	--	1090
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	6 1 J	2.1 J	--	-- R	1 J	-- R	9.8 J	10 1 J	29.2	-- R	--	-- R	9 5 J
BARIUM	275	274	8 J	10 3 J	59 J	37.7 J	289	257	2010	1600	--	17 2 J	352
BERYLLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CADMIUM	--	--	--	--	5 2	--	--	--	5 2	--	--	5 5	--
CALCIUM	35000	36500	345 J	510 J	42500	38800	30800	27500	71300	61600	108 J	791 J	46300
CHROMIUM	--	--	--	--	--	--	--	--	--	--	--	--	24 8
COBALT	--	--	--	--	--	--	--	--	--	--	--	--	8 1 J
COPPER	--	--	--	--	5 4 J	--	--	--	--	--	5.2 J	--	8 3 J
IRON	14800	16100	72 3 J	45 8 B	163	69 2 B	4460	5260	79800	73600	--	45 8 J	55800
LEAD	--	--	--	--	--	--	--	--	1 8 J	--	2.1 J	--	7 6
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	6570	6890	65 5 J	44.5 J	13700	13700	3380 J	3030 J	19500	16200	47.6 J	--	20600
MANGANESE	6230	7070	8 4 J	--	426	34 4	994	942	204	1690	--	6 1 J	1340
MERCURY	--	--	--	--	--	--	--	--	--	--	--	--	--
NICKEL	6 4 J	7 5 J	--	--	--	--	--	--	--	--	--	--	27 8 J
POTASSIUM	1780 J	2040 J	144 J	--	2320 J	2680 J	1360 J	1210 J	8380	7590	--	--	44600
SELENIUM	-- R	-- R	-- R	-- R	-- R	-- R	--	-- R	--	-- R	--	-- R	-- R
SILVER	--	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	4920 J	3340 J	--	1840 J	4830 J	4290 J	3030 J	3230 J	10900	9510	--	1260 J	41500
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
VANADIUM	3.8 J	--	--	--	--	--	--	--	3.5 J	--	--	--	8 1 J
ZINC	9.4 J	--	14.7 J	8 9 B	28.5	--	7 6	--	7.4 J	--	6 5 J	9 6 B	49 8

NOTES:

- B = Blank contamination.
- J = Estimated value.
- R = Unuseable data
- -- = < contract required detection limit.

File: W-MWINO.WK1

INORGANICS - GROUNDWATER

Sample Location	MW02S-02	FRMW02S-01	MW02M-01	MW02M-02	MW02D-01	MW02D-02	MWB03-01
ITR Sample Number:	MEBC93	MEBC19	MEBC29	MEBC94	MEBC22	MEBC95	MEBC39
Date Sampled:	06-12-89	04-18-89	04-18-89	06-12-89	04-18-89	06-12-89	04-19-89
CRL Number:	89ZC02S71	89ZC02D44	89ZC02S45	89ZC02S88	89ZC02S46	89ZC02S72	89ZC02S52
Laboratory:	KEYSTONE Round 2	RMAL	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL
INORGANIC CHEMICALS (ug/l)							
ALUMINUM	51 J	690	44.1 J	--	25.2 J	--	29.4 J
ANTIMONY	--	--	--	--	--	--	--
ARSENIC	3.1 J	9.1 J	19.4	18.8 J	2.4 J	3.3 J	6.1 J
BARIUM	376	348	1390	989	152 J	147 J	979
BERYLLIUM	--	--	--	--	--	--	--
CADMIUM	12.6	6	--	--	--	--	--
CALCIUM	89200	45500	89300	64600	33200	30800	53900
CHROMIUM	--	19.5	--	--	--	--	--
COBALT	19.6 J	7 J	--	--	--	--	--
COPPER	4.1 J	6.7 J	--	--	8.1 J	--	--
IRON	91300	54100	24700	16700	473	379	4080
LEAD	3 B	8.6	8.1	1 J	--	1.8 J	--
CYANIDE	--	--	--	--	--	--	--
MAGNESIUM	30800	20400	25100	19300	12700	12000	22900
MANGANESE	3500	1300	972	680	1190	1120	3630
MERCURY	-- R	--	--	-- R	--	-- R	--
NICKEL	18.7 J	23.3 J	7.4 J	--	5.4 J	--	--
POTASSIUM	60400	43800	1480 J	1270 J	988 J	846 J	16100
SELENIUM	--	-- R	-- R	--	-- R	--	--
SILVER	--	--	--	--	--	--	--
SODIUM	60100	41400	5360	3910 J	2780 J	1850 J	7550
THALLIUM	--	--	--	--	--	--	--
VANADIUM	--	6.4 J	--	--	--	--	--
ZINC	68.6	140	58.4	12.4 B	9.9 J	23 B	6.6 J

Sample Location	MWB03-02	MWFB03-01	MW03S-01	MW03S-02	FRMW03S-02	MW03M-01
ITR Sample Number:	MECW16	MEBC55	MEBC17	MECW04	MECW05	MEBC30
Date Sampled:	06-14-89	04-20-89	04-17-89	06-13-89	06-13-89	04-17-89
CRL Number:	89ZC40S90	89ZC02R08	89ZC02S38	89ZC40S80	89ZC40D80	89ZC02S39
Laboratory:	KEYSTONE Round 2	RMAL	RMAL	KEYSTONE Round 2	KEYSTONE Round 2	RMAL
INORGANIC CHEMICALS (ug/l)						
ALUMINUM	--	--	47.8 J	235	362	43.5 J
ANTIMONY	--	--	--	--	--	--
ARSENIC	4.8 J	--	19.4	24.1 J	22.1 J	68.4
BARIUM	869	--	593	439	480	2760
BERYLLIUM	--	--	--	--	--	--
CADMIUM	--	--	--	--	--	--
CALCIUM	49100	--	53200	49300	52500	50800
CHROMIUM	--	--	--	--	--	--
COBALT	7.2 J	--	16.6 J	15 J	12.4 J	5.8 J
COPPER	--	--	--	5.2 J	--	--
IRON	5060	--	43000	39900	42900	27300
LEAD	--	--	--	2.1 J	1.9 J	--
CYANIDE	--	--	--	--	--	--
MAGNESIUM	22500	--	14600	13700	14700	19500
MANGANESE	3180	--	3720	3870	4280	1260
MERCURY	--	--	--	-- R	-- R	--
NICKEL	--	--	19.8 J	15.1 J	10.8 J	6.3 J
POTASSIUM	16000	--	17000	15500	16500	19700
SELENIUM	-- R	--	-- R	--	--	-- R
SILVER	--	--	--	--	--	--
SODIUM	8100	--	14200	12900	13500	5910
THALLIUM	--	--	--	--	--	--
VANADIUM	--	--	3.4 J	--	--	--
ZINC	--	3.4	10.9 J	15.3 B	10.2 B	14.4 J

NOTES
- B = Blank contamination
- J = Estimated value
- R = Unuseable data
- -- = < contract required detection limit

File: W-MWINO.WK1

INORGANICS - GROUNDWATER

Sample Location:	MW03M-02	MW03D-01	MW03D-02	MW04S-01	MW04S-02	MWB04S-01	MWB04S-02	MWB04D-01	MWB04D-02	MW05S-01	MW05S-02	MW06M-01	MW06M-02
ITR Sample Number:	MECW06	MEBC21	MECW07	MEBC26	MEBC96	MEBC20	MECW08	MEBC23	MECW09	MEBC28	MECW25	MEBC31	MECW18
Date Sampled:	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-18-89	06-13-89	04-18-89	06-14-89	04-18-89	06-14-89
CRL Number:	89ZC40581	89ZC02542	89ZC40582	89ZC02547	89ZC02577	89ZC02540	89ZC40583	89ZC02541	89ZC40579	89ZC02543	89ZC40599	89ZC02548	89ZC40593
Laboratory:	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2
INORGANIC CHEMICALS (ug/l)													
ALUMINUM	--	21.3 J	--	49.5 J	--	36.1 J	41 J	43 J	--	70 J	--	--	--
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	65.7 J	6.9 J	6 J	10.2	13.4 J	12.8	13 J	14.7	14.3 J	8 J	4.1 J	1.1 J	-- R
BARIUM	2680	1140	838	401	623	582	434	682	584	347	129 J	1370	1390
BERYLLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CADMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CALCIUM	49900	77900	59000	143000	57600	66400	108000	71000	63600	81400	49600	68800	66300
CHROMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
COBALT	--	--	--	--	13.4 J	14.3 J	6 J	--	--	19.8 J	--	4.9 J	--
COPPER	--	--	--	--	--	6.5 J	--	--	--	--	--	--	--
IRON	30100	3560	2870	29500	25900	25100	37900	19400	18200	57800	2020	--	140 B
LEAD	--	--	1 J	--	1.3 J	--	1.1 J	--	2 J	--	--	--	--
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	20300	25600	19900	28500	15800	17400	26100	29200	26600	40100	12100	15800	16000
MANGANESE	1160	4110	2910	3320	2470	3050	3390	521	471	6890	811	4500	4250
MERCURY	-- R	--	-- R	--	-- R	--	--	--	--	--	--	--	--
NICKEL	--	6.5 J	--	--	9.6 J	17 J	--	--	--	8.8 J	--	8.1 J	10.5 J
POTASSIUM	19800	2090 J	1840 J	19100	13900	10300	20900	1570 J	1690 J	1810 J	921 J	1080 J	1110 J
SELENIUM	--	-- R	--	-- R	--	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R
SILVER	--	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	5040	5870	4560 J	3750 J	5020	5350	3340 J	5420	4260 J	2000 J	2550 J	6630	5950
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
VANADIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
ZINC	16.5 B	9.4 J	9.2 B	15.1 J	18 J	23.9	--	7.5 J	--	31.6	8.8 B	6.7 J	--

NOTES:

- B = Blank contamination.
- J = Estimated value
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- -- = < contract required detection limit.

File W-MWINO.WK1

INORGANICS - GROUNDWATER

Sample Location:	MW07M-01	MW07M-02	FRMW07M-01	FRMW07M-02	MW08S-01	MW08S-02	MW08M-01	MW08M-02	MW08D-01	MW08D-02	MW09M-01	MW09M-02	FRMW09M-02
ITR Sample Number:	MEBC24	MEBC97	MEBC25	MEBC98	MEBC34	MECW14	MEBC35	MECW15	MEBC33	MECW21	MEBC54	MECW22	MECW23
Date Sampled:	04-18-89	06-13-89	04-18-89	06-13-89	04-19-89	06-13-89	04-19-89	06-13-89	04-19-89	06-14-89	04-20-89	06-14-89	06-14-89
CRL Number:	89ZC02S49	89ZC02S78	89ZC02D49	89ZC02D78	89ZC02S55	89ZC40S91	89ZC02S56	89ZC40S89	89ZC02S59	89ZC40S94	89ZC02S69	89ZC40S98	89ZC40D98
Laboratory:	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	KEYSTONE Round 2
INORGANIC CHEMICALS (ug/l)													
ALUMINUM	--	--	33 J	--	--	81 3 J	--	--	--	--	27 8 J	--	--
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	3.3 J	4.1 J	3 3 J	3 6 J	--	2 2 J	--	12 3 J	3 2 J	3 4 J	5 3 J	4 8 J	121 J
BARIUM	235	216	226	218	145 J	140 J	600	454	88 2 J	87 8 J	122 J	107 J	115 J
BERYLLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CADMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CALCIUM	49500	45000	47500	45300	72900	63300	65000	48200	42700	41300	53900	48900	49800
CHROMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
COBALT	--	--	--	--	8.7 J	9 6 J	--	--	--	--	--	--	--
COPPER	--	--	--	--	6.2 J	--	--	--	--	--	--	--	--
IRON	1140	1440	1160	1400	--	294	--	164 B	32.9 J	142 B	882	1030	958
LEAD	--	1.3 J	3 1 J	--	2.7 J	--	--	--	--	--	--	--	151
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	11900	11100	11500	11200	25900	22600	17200	13000	13700	13600	13200	12300	12600
MANGANESE	718	582	682	577	5690	5270	3060	2130	2530	2480	991	729	759
MERCURY	--	-- R	--	-- R	--	--	--	--	--	--	--	--	-- R
NICKEL	--	--	6 1 J	--	19.9 J	18 7 J	8 7 J	9 J	5 1 J	--	--	--	--
POTASSIUM	1010 J	902 J	1030	969 J	2970 J	3580 J	1370 J	1220 J	1310 J	1240 J	1010 J	938 J	988 J
SELENIUM	-- R	--	-- R	--	-- R	-- R	-- R	-- R	-- R	-- R	--	-- R	3 1 J
SILVER	--	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	3140 J	2650 J	3440 J	2460 J	10300	13900	10500	8320	8280	5220	3360 J	2910 J	2940 J
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--	3 1 J
VANADIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
ZINC	14.4 J	15 2 B	19 3 J	36.3 B	20 2	--	13 8 J	--	9 J	--	6 1 J	7 5 B	8 2 B

NOTES:

B = Blank contamination
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R = Unuseable data
-- = < contract required detection limit.

File W-MWINO.WK1

INORGANICS - GROUNDWATER

Sample Location:	MW10M-01	MW10M-02	MW11M-01	MW11M-02	FRMW11M-01	MW12S-01	MW12S-02	MW13S-01	MW13S-02	MW14S-01	MW14S-02	MW20S-01	MW20D-01
ITR Sample Number:	MEBC53	MECW24	MEBC56	MECW28	MEBC57	MEBC41	MECW10	MEBC40	MECW11	MEBC58	MECW17	MEBC60	MEBC61
Date Sampled:	04-20-89	06-14-89	04-20-89	06-14-89	04-20-89	04-19-89	06-13-89	04-19-89	06-13-89	04-20-89	06-14-89	04-20-89	04-20-89
CRL Number:	89ZC02568	89ZC40S97	89ZC02S70	89ZC41S01	89ZC02D70	89ZC02S50	89ZC40S84	89ZC02S51	89ZC40S85	89ZC02S74	89ZC40S92	89ZC02S71	89ZC02S72
Laboratory:	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	KEYSTONE Round 2	RMAL	RMAL
INORGANIC CHEMICALS (ug/l)													
ALUMINUM	24 J	--	38.5 J	68.8 J	35.8 J	30 6 J	35 J	55.3 J	62.2 J	28.1 J	--	--	26 6 J
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	--	-- R	3.6 J	12 J	4.6 J	--	-- R	--	3 J	--	-- R	3.5 J	--
BARIUM	141 J	132 J	143 J	357	145 J	14.9 J	17.2 J	11.3 J	15.8 J	134 J	152 J	1280	24 8 J
BERYLLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CADMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
CALCIUM	76600	61800	54300	77100	54500	37500	35500	24500	25400	41900	47600	111000	71500
CHROMIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
COBALT	--	--	--	17 J	--	--	--	--	--	--	--	--	--
COPPER	--	--	--	4 6 J	--	--	--	--	--	--	--	--	--
IRON	--	64.4 B	1690	62900	1660	--	132 B	95.0 J	204 B	3670	7410	456	2210
LEAD	--	--	--	-- R	--	--	--	--	1.8 J	--	--	2 0 J	--
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	27600	22600	12600	37800	12800	15300	14800	10200	11000	10700	12900	40100	18000
MANGANESE	2780	2190	1040	5960	1050	7.5 J	--	19.1	23.6	952	1260	7710	100
MERCURY	--	--	--	-- R	--	--	--	--	--	--	--	--	--
NICKEL	9.2 J	7.5 J	--	--	--	--	--	--	--	--	--	5 6 J	--
POTASSIUM	1910	1930 J	1000 J	1690 J	945 J	397 J	419 J	350 J	737 J	5720	7150	3040 J	2450 J
SELENIUM	--	-- R	--	--	--	--	-- R	--	-- R	--	-- R	--	--
SILVER	--	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	41800	42200	3040 J	1570 J	3310 J	3290 J	7410	1830 J	2360 J	12700	15100	32600	8160
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--	--
VANADIUM	--	--	--	5.3 J	--	--	--	--	--	--	--	--	--
ZINC	10.1 J	6.6 B	14 2 J	24.3 B	2.7 J	9.6 J	8.2 B	5.8 J	8.8 B	5.8 J	6 B	491	12 6 J

NOTES:

B = Blank contamination.

J = Estimated value.

R = Unuseable data.

-- = < contract required detection limit.

File: W-MWINO.WK1

INORGANICS - GROUNDWATER

Sample Location:	MW21S-01
ITR Sample Number:	MEBC62
Date Sampled:	04-20-89
CRL Number:	89ZC02573
Laboratory:	RMAL

INORGANIC CHEMICALS (ug/l)

ALUMINUM	--
ANTIMONY	--
ARSENIC	--
BARIUM	201
BERYLLIUM	--
CADMIUM	--
CALCIUM	80300
CHROMIUM	--
COBALT	4.3 J
COPPER	--
IRON	160
LEAD	--
CYANIDE	--
MAGNESIUM	39400
MANGANESE	3220
MERCURY	--
NICKEL	13.4 J
POTASSIUM	1990 J
SELENIUM	--
SILVER	--
SODIUM	6400
THALLIUM	--
VANADIUM	--
ZINC	1010

NOTES:
- B = Blank contamination
- J = Estimated value.
- R = Unuseable data.
- -- = < contract required detection limit.

File: W-MWINO.WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	ON-MWB1-01	ON-MWB1-02	ON-MWFB01-01	ON-MWFB01-02	ON-MW1M-01	ON-MW1M-02	ON-MW1S-01	ON-MW1S-02	ON-MWB2-01	ON-MWB2-02	ON-MWFB02-01	ON-MWFB02-02
SAMPLE NUMBER:	4558E-20	4668E-15	4558E-13	4668E-25	4558E-24	4668E-24	4558E-23	4668E-23	4558E-19	4668E-16	4558E-25	4668E-27
DATE SAMPLED:	04/19/89	06/13/89	04/18/89	06/14/89	04/19/89	06/14/89	04/19/89	06/14/89	04/19/89	06/13/89	04/19/89	06/14/89
CRL NUMBER:	89ZC02S17	89ZC41S14	89ZC02R01	89ZC41R09	89ZC02S21	89ZC41S23	89ZC02S20	89ZC41S22	89ZC02S16	89ZC41S15	89ZC02R03	89ZC41R10
LABORATORY:	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2
SAS ANALYSES (mg/l)												
TOTAL PHOSPHORUS	0.24		--		0 13		0 13		0.03 B		0 083	
SULFIDE (FILTRATES)	--		--		--		--		--		--	
SULFIDE (FILTERS)	--		--		--		--		--		--	
COD	15 2 J		--		9.6 J		6 J		25.6 J		--	
TOC	6.7		--		4.4		3 2		6.8		--	
TSS	2 5		--		3 0		68 0		145		--	
TDS	190 B		--		132 B		191 B		337 B		--	
NO2 + NO3	--		--		0 69 B		0 35		311 B		382	
NH3	0 33		--		0 30		0 19		7.1		--	
CHLORIDE	5 6		--		5 8		5.4		15.8		--	
SULFATE	30 3		--		6 0		12 2		--		--	
TOTAL ALKALINITY	--		--		82 1		140		293		--	
BOD	--		--		--		--		--		--	
OIL AND GREASE	--	0 5 J		< 0 4	--	< 0 4	--	< 0 4	--	< 8.4	--	< 0 4

NOTES:
- B = Blank contamination
- J = Estimated value.
- -- = < detection limit

File: SAS_MW.WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	ON-MW02D-01	ON-MW02D-02	ON-MW02M-01	ON-MW02M-02	ON-MW02S-01	ON-MW02S-02	ON-FRMW02S-01	ON-MW03-01	ON-MW03-02	ON-MWFB03-01	ON-MW03D-01	ON-MW03D-02
SAMPLE NUMBER:	4558E-10	4668E-03	4558E-09	4668E-02	4558E-07	4668E-01	4558E-08	4558E-18	4668E-18	4558E-29	4558E-05	4668E-11
DATE SAMPLED:	04/17/89	06/12/89	04/18/89	06/12/89	04/17/89	06/12/89	04/17/89	04/19/89	06/14/89	04/20/89	04/18/89	06/13/89
CRL NUMBER:	89ZC02S09	89ZC41S04	89ZC02S08	89ZC41S03	89ZC02S07	89ZC41S02	89ZC02D07	89ZC02S15	89ZC41S16	89ZC02R04	89ZC02S05	89ZC41S10
LABORATORY:	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	RMAL	Allied Round 2	RMAL	RMAL	Allied Round 2
SAS ANALYSES (mg/l)												
TOTAL PHOSPHORUS	0.017		0.011		0.11		0.11	0.21		0.019 B	0.22	
SULFIDE (FILTRATES)	--		--		--		--	--		--	--	
SULFIDE (FILTERS)	--		--		--		--	--		--	--	
COD	5.8		24.1		104		136	11.2 J		--	16.2	
TOC	--		3.8		31.8		30	4.8		--	5.3	
TSS	--		50		269		219	10.5		--	--	
TDS	145		341		445		425	293 B		223	322 B	
NO2 + NO3	--		--		--		--	--		--	--	
NH3	--		0.55		83.2		75.7	14.3		--	0.34	
CHLORIDE			7.7		54.3		55.2	11.0		--	13.5	
SULFATE			--		--		--			--	--	
TOTAL ALKALINITY			316		521		525	273		--	285	
BOD	--		--		100 J		18.4 J	--		--	--	
OIL AND GREASE		< 0.4		0.6 J		3 J		--	0.5 J	3.2 J		0.7 J

NOTES:
- B = Blank contamination
- J = Estimated value.
- -- = < detection limit

File: SAS_MW WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	ON-MW03M-01	ON-MW03M-02	ON-MW03S-01	ON-MW03S-02	ON-FRMW03S-02	ON-MW4S-01	ON-MW4S-02	ON-MW04D-01	ON-MW04D-02	ON-MW04S-01	ON-MW04S-02	ON-MW05S-01
SAMPLE NUMBER:	4558E-02	4668E-10	4558E-01	4668E-08	4668E-09	4558E-11	4668E-04	4558E-04	4668E-07	4558E-03	4668E-12	4558E-06
DATE SAMPLED:	04/17/89	06/13/89	04/17/89	06/13/89	06/13/89	04/17/89	06/13/89	04/18/89	06/13/89	04/18/89	06/13/89	04/18/89
CRL NUMBER:	89ZC02S02	89ZC41S09	89ZC02S01	89ZC41S08	89ZC41D08	89ZC02S10	89ZC41S05	89ZC02S04	89ZC41S07	89ZC02S03	89ZC41S11	89ZC02S06
LABORATORY:	RMAL	Allied Round 2	RMAL	Allied Round 2	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL
SAS ANALYSES (mg/l)												
TOTAL PHOSPHORUS	0.053		0.018 B			0.19		0.2		0.12		0 083
SULFIDE (FILTRATES)	--		--			--		--		--		--
SULFIDE (FILTERS)	--		--			--		--		--		--
COD	23.7		55.3			56		13 7		57		104
TOC	4.6		12 4			21.8		3.1		16.4		21 6
TSS	61.5		82			275		28.5		58		269
TDS	263		312			331		291		827		445
NO2 + NO3	--		--			--		--		--		--
NH3	8 8		12 9			9 2		2 1		2.1		1 1
CHLORIDE	11 6		11 6			6		4 6		5.4		--
SULFATE	--		--			--		--		49.8		--
TOTAL ALKALINITY	244		244			300		291		406		371
BOD	--		21 J			44 J		--		42 J		84 5 J
OIL AND GREASE		0.45 J		17 J	8 J		17 J		< 0.4		13 J	

NOTES:
- B = Blank contamination.
- J = Estimated value.
- -- = < detection limit

File: SAS_MW.WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	ON-MW05S-02	ON-MW06M-01	ON-MW06M-02	ON-MW7M-01	ON-MW7M-02	ON-FRMW7M-01	ON-FRMW7M-02	ON-MW08D-01	ON-MW08D-02	ON-MW08M-01	ON-MW08M-02	ON-MW08S-01
SAMPLE NUMBER:	4668E-30	4558E-12	4668E-21	4558E-14	4668E-05	4558E-15	4668E-06	4558E-26	4668E-22	4558E-22	4668E-19	4558E-21
DATE SAMPLED:	06/14/89	04/17/89	06/14/89	04/18/89	06/13/89	04/18/89	06/13/89	04/19/89	06/14/89	04/19/89	06/13/89	04/19/89
CRL NUMBER:	89ZC41S26	89ZC02S11	89ZC41S20	89ZC02S12	89ZC41S06		89ZC41D06	89ZC02S22	89ZC41S21	89ZC02S19	89ZC41S18	89ZC02S18
LABORATORY:	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL
SAS ANALYSES (mg/l)												
TOTAL PHOSPHORUS		--		0.013 B		--		--		0 04 B		0 058 B
SULFIDE (FILTRATES)		--		--		--		--		--		--
SULFIDE (FILTERS)		--		--		--		--		--		--
COD		9 6		6 2		--		--		--		14 8 J
TOC		2 6		--		--		--		2 4		5 3
TSS		--		--		--		59 5		--		59 5
TDS		264		185		181		209 B		270 B		348 B
NO2 + NO3		--		--		--		--		267 B		247 B
NH3		0 17		--		0.1		--		0.13		1 3
CHLORIDE		--		--		--		--		--		15 1
SULFATE		--		--		--		6 0		--		--
TOTAL ALKALINITY		236		170		167		159		222		262
BOD		2 J		--		--		--		--		--
OIL AND GREASE	12 J		0 7 J		< 0 4		< 0 4	--	< 0 4	--	< 0 4	--

NOTES:
- B = Blank contamination.
- J = Estimated value.
- -- = < detection limit

File: SAS_MW WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	GN-MW08S-02	GN-MW09M-01	GN-MW09M-02	GN-FRMW09M-02	GN-MW10M-01	GN-MW10M-02	GN-MW11M-01	GN-MW11M-02	GN-FRMW11M-01	GN-MW12S-01	GN-MW12S-02	GN-MW13S-01
SAMPLE NUMBER:	4668E-17	4558E-28	4668E-28	4668E-29	4558E-27	4668E-26	4558E-30	4668E-31	4558E-31	4558E-16	4668E-13	4558E-17
DATE SAMPLED:	06/13/89	04/20/89	06/14/89	06/14/89	04/20/89	06/14/89	04/20/89	06/14/89	04/20/89	04/18/89	06/13/89	04/18/89
CRL NUMBER:	89ZC41S17	89ZC02S24	89ZC41S25	89ZC41D25	89ZC02S23	89ZC41S24	89ZC02S25	89ZC41S27	89ZC02D25	89ZC02S13	89ZC41S12	89ZC02S14
LABORATORY:	Allied Round 2	RMAL	Allied Round 2	Allied Round 2	RMAL	Allied Round 2	RMAL	Allied Round 2	RMAL	RMAL	Allied Round 2	RMAL
SAS ANALYSES (mg/l)												
TOTAL PHOSPHORUS		0.084 B			0.036 B		0.02 B		--	0.045 B		0.03 B
SULFIDE (FILTRATES)		--			--		--		--	--		--
SULFIDE (FILTERS)		--			--		--		--	--		--
COD		8 J			10.4 J		--		--	5.8		--
TOC		--			4.6		--		--	--		--
TSS		--			--		--		--	94		45.5
TDS		--			397 B		213 B		206 B	173 B		119 B
NO2 + NO3		--			--		--		--	0.29		0.40
NH3		--			--		--		--	--		--
CHLORIDE		--			19.5		--		--	--		--
SULFATE		--			--		--		--	--		5.0
TOTAL ALKALINITY		174			347		181		173	135		92.5
BOD		--			--		--		--	--		--
OIL AND GREASE	< 0.4	3.1 B	< 0.4	< 0.4	5.1 B	< 0.4	--	< 0.4	--		< 0.4	

NOTES:

B = Blank contamination
J = Estimated value.
-- = < detection limit

File: SAS_MW.WK1

SPECIAL ANALYTICAL SERVICES -
GROUNDWATER

SAMPLE LOCATION:	ON-MW13S-02	ON-MW14S-01	ON-MW14S-02
SAMPLE NUMBER:	4668E-14	4550E-32	4668E-20
DATE SAMPLED:	06/13/89	04/20/89	06/14/89
CRL NUMBER:	89ZC41S13	89ZC02S26	89ZC41S19
LABORATORY:	Allied	RMAL	Allied
	Round 2		Round 2
SAS ANALYSES (mg/l)			
TOTAL PHOSPHORUS		0.19	
SULFIDE (FILTRATES)		--	
SULFIDE (FILTERS)		--	
COD		16.8 J	
TOC		4.5	
TSS		28.0	
TDS		226 B	
NO2 + NO3		0.83 B	
NH3		0.26	
CHLORIDE		--	
SULFATE		11.5	
TOTAL ALKALINITY		166	
BOD		--	
OIL AND GREASE	< 0.4	1.6 B	2 J

NOTES:

B = Blank contamination

J = Estimated value.

-- = < detection limit

File: SAS_MW.WK1

VOLATILE ORGANIC COMPOUNDS -
SOILS

Sample Location:	FBSB01	GB01-113-117	ON-FBGB02	ON-GB02M-14	ON-FRGB02M-14	ON-GB02M-55	ON-GB02M-75	ON-GB06M-20	ON-GB06M-80	1P03-01	1P04-01	1PTB04-01
Sample Number:	EBP06	EBP05	EBP10	EBP11	EBP12	EBP13	EBP14	EBP15	EBP16	EBP42	EBP43	EBP48
Date Sampled:	03-15-89	03-15-89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	04-17-89	04-17-89	04-19-89
CRL Number:	89ZC01R01	89ZC01S08	892C01R01	892C01S01	892C01D01	8892C01S02	892C01S03	892C01S04	892C01S05	89ZC02S25	89ZC02S26	89ZC02R03
Laboratory:	CEIMIC	CEIMIC	WRI	WRI	WRI	WRI	WRI	WRI	WRI	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
VOLATILE												
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	7 B	15 B	--	33	35	--	10	13	23	6 B	--	6 B
ACETONE	14 B	29 B	5 J	68	19 B	11 B	31 B	26 B	35 B	88 J	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	8 B	--	5 B
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	30 B	15 B	10 B
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	4 J	--	--	--	7	7	7	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	--	5 J	--	5 J	6	5 J	5 J	4 J	--	290	20	--
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--	--	--	7	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	5 J	--	--	1 J	--	--	1000 J	110 B	560 B

NOTES
- B = Blank contamination
- J = Estimated value
- -- = < detection limit

Date 08/16/89

File S IPVOC WRI

VOLATILE ORGANIC COMPOUNDS -
SOILS

Sample Location	TP07-01	TP08-01	TP09-01	TP10-01	TP11-01	FRTP11-01	TP13-01	MW02D-24	MW02D-58	MW02D-75	MW02D-108	FRMW02D-108	MW01S-18-22
Sample Number.	EBP44	EBP45	EBP46	EBP47	EBP50	EBP51	EBP52	EBP00	EBP01	EBP02	EBP03	EBP04	EBP07
Date Sampled.	04-18-89	04-18-89	04-18-89	04-18-89	04-19-89	04-19-89	04-19-89	03-15-89	03-15-89	03-15-89	03-15-89	03-15-89	03-16-89
CRL Number.	89ZC02S27	89ZC02S28	89ZC02S29	89ZC02S30	89ZC02S23	89ZC02D23	89ZC02S24	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S04	89ZC01D04	89ZC01S06
Laboratory	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC
ORGANIC COMPOUNDS (ug/kg)													
VOLATILE													
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	4 B	4 B	7 B	10 B	9 B	2 B	--	97	10 B	27 B	6 B	18 B	67 B
ACETONE	54 J	47 J	--	39 J	--	40 J	86 J	160	21 B	23 B	16 B	22 B	95 B
CARBON DISULFIDE	5 B	10 B	--	6 B	19 B	5 B	5 B	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	4 J	3 J	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	21 B	47 B	3 B	6 B	--	25 B	24 B	12 B	5 J	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	4 J	3 J	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	87	67	70	83	1700	330	77	--	--	--	--	--	--
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	34	--	--	1600	660	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	540 B	600 B	360 B	90 B	24000	5600 J	--	3 J	--	--	--	--	--

NOTES.
B = Blank contamination
J = Estimated value
-- = < detection limit

Date 08/16/89

File S TPVOC WK1

VOLATILE ORGANIC COMPOUNDS -
SOILS

Sample Location:	MW01A-78-80	MW01A-53-55
Sample Number:	E8P08	E8P09
Date Sampled:	03-16-89	03-16-89
CRL Number:	89ZC01508	89ZC01507
Laboratory:	CEIMIC	CEIMIC
ORGANIC COMPOUNDS (ug/kg)		
VOLATILE		
CHLOROMETHANE	--	--
BROMOMETHANE	--	--
VINYL CHLORIDE	--	--
CHLOROETHANE	--	--
METHYLENE CHLORIDE	12 B	14 B
ACETONE	23 B	20 B
CARBON DISULFIDE	--	--
1,1-DICHLOROETHENE	--	--
1,1-DICHLOROETHANE	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--
CHLOROFORM	--	--
1,2-DICHLOROETHANE	--	--
2-BUTANONE	2 J	--
1,1,1-TRICHLOROETHANE	--	--
CARBON TETRACHLORIDE	--	--
VINYL ACETATE	--	--
BROMODICHLOROMETHANE	--	--
1,2-DICHLOROPROPANE	--	--
CIS-1,3-DICHLOROPROPENE	--	--
TRICHLOROETHENE	--	--
DIBROMOCHLOROMETHANE	--	--
1,1,2-TRICHLOROETHANE	--	--
BENZENE	--	--
TRANS-1,3-DICHLOROPROPENE	--	--
BROMOFORM	--	--
4-METHYL-2-PENTANONE	--	--
2-HEXANONE	--	--
TETRACHLOROETHENE	--	--
1,1,2,2-TETRACHLOROETHANE	--	--
TOLUENE	--	4 J
CHLOROBENZENE	--	--
ETHYLBENZENE	--	--
STYRENE	--	--
TOTAL XYLENES	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- -- = < detection limit

Date 08/16/89

File S IPVOC WK1

SEMI-VOLATILES - SOILS

Sample Location:	FBSB01	ON-GB02M-14	ON-FRGB02M-14	ON-GB02M-55	ON-GB02M-75	ON-GB06M-20	ON-GB06M-80	ON-FBGB02	GB01-113-117	TP03-01	TP04-01	TPFB04-01
Sample Number:	EBP06	EBP11	EBP12	EBP13	EBP14	EBP15	EBP16	EBP10	EBP05	EBP42	EBP43	EBP48
Date Sampled:	03-15-89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	03-15-89	04-17-89	04-17-89	04-19-89
CRL Number:	89ZC01R01	892C01S01	892C01D01	8892C01S02	892C01S03	892C01S04	892C01S05	892C01R01	89ZC01S05	89ZC02S25	89ZC02S26	89ZC02R03
Laboratory:	CEIMIC	WRI	WRI	WRI	WRI	WRI	WRI	WRI	CEIMIC	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
SEMIVOLATILE												
PHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	810	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--	490 J	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	30 J	22 J	--	29 J	--	25 J	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	70 J	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	84 B	86 B	57 B	40 B	81 B	54 B	20 J	170 J	96 J	130 J	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- R = Unuseable data
- -- = < detection limit

SEMI-VOLATILES - SOILS

Sample Location:	TP07-01	TP08-01	TP09-01	TP10-01	TP11-01	FRTP11-01	TP13-01	MW02D-24	MW02D-58	MW02D-75	MW02D-108	FRMW02D-108	MW01S-18-22
Sample Number:	EBP44	EBP45	EBP46	EBP47	EBP50	EBP51	EBP52	EBP00	EBP01	EBP02	EBP03	EBP04	EBP07
Date Sampled:	04-18-89	04-18-89	04-18-89	04-18-89	04-19-89	04-19-89	04-19-89	03-15-89	03-15-89	03-15-89	03-15-89	03-15-89	03-16-89
CRL Number:	89ZC02S27	89ZC02S28	89ZC02S29	89ZC02S30	89ZC02S23	89ZC02D23	89ZC02S24	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S04	89ZC01D04	89ZC01S06
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC
ORGANIC COMPOUNDS (ug/kg)													
SEMIVOLATILE													
PHENOL	--	--	--	--	--	--	--	80 J	--	--	160 J	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	100 J	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	44 J	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	340 J	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	68 J	--	--
NAPHTHALENE	--	--	--	--	1400	3500	540 J	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	95 J	--	--
2-METHYLNAPHTHALENE	--	130 J	--	--	700 J	2300	190 J	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	70 J	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	120 J	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	69 J	--	--
PHENANTHRENE	--	--	--	--	160 J	440 J	220 J	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	170 J	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	180 J	--	--	--	64 J	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	150 J	160 J	--	--	230 J	850	2300	5300	--	1200	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

B = Blank contamination
J = Estimated value
R = Unuseable data
-- = < detection limit

File: S-TPBNA.WK1

SEMI-VOLATILES - SOILS

Sample Location.	MW01A-78-80	MW01A-53-55
Sample Number.	EBP08	EBP09
Date Sampled.	03-16-89	03-16-89
CRL Number:	89ZC01S08	89ZC01S07
Laboratory.	CEIMIC	CEIMIC
ORGANIC COMPOUNDS (ug/kg)		
SEMIVOLATILE		
PHENOL	--	--
BIS(2-CHLOROETHYL)ETHER	--	--
2-CHLOROPHENOL	--	--
1,3-DICHLOROBENZENE	--	--
1,4-DICHLOROBENZENE	--	--
BENZYL ALCOHOL	--	--
1,2-DICHLOROBENZENE	--	--
2-METHYLPHENOL	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--
4-METHYLPHENOL	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--
HEXACHLOROETHANE	--	--
NITROBENZENE	--	--
ISOPHORONE	--	--
2-NITROPHENOL	--	--
2,4-DIMETHYLPHENOL	--	--
BENZOIC ACID	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--
2,4-DICHLOROPHENOL	--	--
1,2,4-TRICHLOROBENZENE	--	--
NAPHTHALENE	--	--
4-CHLOROANILINE	--	--
HEXACHLOROBUTADIENE	--	--
4-CHLORO-3-METHYLPHENOL	--	--
2-METHYLNAPHTHALENE	--	--
HEXACHLOROCYCLOPENTADIENE	--	--
2,4,6-TRICHLOROPHENOL	--	--
2,4,5-TRICHLOROPHENOL	--	--
2-CHLORONAPHTHALENE	--	--
2-NITROANILINE	--	--
DIMETHYL PHTHALATE	--	--
ACENAPHTHYLENE	--	--
2,6-DINITROTOLUENE	--	--
3-NITROANILINE	--	--
ACENAPHTHENE	--	--
2,4-DINITROPHENOL	--	--
4-NITROPHENOL	--	--
DIBENZOFURAN	--	--
2,4-DINITROTOLUENE	--	--
DIETHYL PHTHALATE	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--
FLUORENE	--	43 J
4-NITROANILINE	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--
N-NITROSODIPHENYLAMINE	--	--
4-BROMOPHENYL PHENYL ETHER	--	--
HEXACHLOROBENZENE	--	--
PENTACHLOROPHENOL	--	--
PHENANTHRENE	--	--
ANTHRACENE	--	--
DI-N-BUTYL PHTHALATE	--	--
FLUORANTHENE	--	--
PYRENE	--	--
BUTYL BENZYL PHTHALATE	--	--
3,3-DICHLOROBENZIDINE	--	--
BENZO(A)ANTHRACENE	--	--
CHRYSENE	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--
DI-N-OCTYL PHTHALATE	--	--
BENZO(B)FLUORANTHENES	--	--
BENZO(K)FLUORANTHENES	--	--
BENZO(A)PYRENE	--	--
INDENO(1,2,3-CD)PYRENE	--	--
DIBENZ(A,H)ANTHRACENE	--	--
BENZO(GHI)PERYLENE	--	--

NOTES:

- B = Blank contamination
- J = Estimated value
- R = Unuseable data
- -- = < detection limit

File: S-IPBNA WK1

PESTICIDE/PCBS - SOILS

Sample Location:	FBSB01	GB01-113-117	ON-GB02M-14	ON-FRGB02M-14	ON-GB02M-55	ON-GB02M-75	ON-GB06M-20	ON-GB06M-80	ON-FBGB02
Sample Number:	EBP06	EBP05	EBP11	EBP12	EBP13	EBP14	EBP15	EBP16	EBP10
Date Sampled:	03-15-89	03-15-89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89	3/20/89
CRL Number:	89ZC01R01	89ZC01S05	892C01S01	892C01D01	8892C01S02	892C01S03	892C01S04	892C01S05	892C01R01
Laboratory:	CEIMIC	CEIMIC	WRI	WRI	WRI	WRI	WRI	WRI	WRI
ORGANIC COMPOUNDS (ug/kg)									
PESTICIDES and PCBs									
ALPHA-BHC	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	--	--	--	--	--	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--

NOTES:
- B = Blank contamination.
- J = Estimated value.
- -- = < detection limit.

File: S-P&PCB.WK1

PESTICIDE/PCBS - SOILS

Sample Location:	TP03-01	TP04-01	TPFB04-01	TP07-01	TP08-01	TP09-01	TP10-01	TP11-01	FRTP11-01	TP13-01
Sample Number:	EBP42	EBP43	EBP48	EBP44	EBP45	EBP46	EBP47	EBP50	EBP51	EBP52
Date Sampled:	04-17-89	04-17-89	04-19-89	04-18-89	04-18-89	04-18-89	04-18-89	04-19-89	04-19-89	04-19-89
CRL Number:	89ZC02S25	89ZC02S26	89ZC02R03	89ZC02S27	89ZC02S28	89ZC02S29	89ZC02S30	89ZC02S23	89ZC02D23	89ZC02S24
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)										
PESTICIDES and PCBs										
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	86 B	59 B	130 B	--	120 B	190 B	--	--	--	190 B
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	28	--	330	--	--	--	25
ENDRIN	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	32	--	360	--	--	--	140
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	130	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--

NOTES:
B = Blank contamination.
J = Estimated value.
-- = < detection limit.

File: S-P&PCB.WK1

PESTICIDE/PCBS - SOILS

Sample Location:	MW02D-24	MW02D-58	MW02D-75	MW02D-108	FRMW02D-108	MW01S-18-22	MW01M-78-80	MW01M-53-55
Sample Number:	EBP00RE	EBP01	EBP02	EBP03	EBP04	EBP07	EBP08	EBP09
Date Sampled:	03-15-89	03-15-89	03-15-89	03-15-89	03-15-89	03-16-89	03-16-89	03-16-89
CRL Number:	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S04	89ZC01D04	89ZC01S06	89ZC01S08	89ZC01S07
Laboratory:	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC	CEIMIC
ORGANIC COMPOUNDS (ug/kg)								
PESTICIDES and PCBs								
ALPHA-BHC	--	--	--	--	--	--	--	
BETA-BHC	--	--	--	--	--	--	--	
DELTA-BHC	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	--	--	--	--	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--

NOTES:

- B = Blank contamination.
- J = Estimated value.
- -- = < detection limit.

File: S-P&PCB.WK1

INORGANICS - SOILS

Sample Location	TP03-01	TP04-01	TPFB04-01	TP07-01	TP08-01	TP09-01	TP10-01	TP11-01	FRTP11-01	TP13-01	MW02D-24	MW02D-58
ITR Number	MEBC42	MEBC43	MEBC48	MEBC44	MEBC45	MEBC46	MEBC47	MEBC50	MEBC51	MEBC52	MEBC00	MEBC01
Date Sampled	04-17-89	04-17-89	04-18-89	04-18-89	04-18-89	04-18-89	04-18-89	04-19-89	04-19-89	04-19-89	03-15-89	03-15-89
CRL Number:	89ZC02S60	89ZC02S61	89ZC02R07	89ZC02S62	89ZC02S63	89ZC02S64	89ZC02S65	89ZC02S66	89ZC02D66	89ZC02S67	89ZC01S09	89ZC01S10
Laboratory	RMAL	RMAL	RMAL	RMAL	RMAL	RMAL	RMAL	RMAL	RMAL	RMAL	Wilson	Wilson
INORGANIC CHEMICALS (mg/kg)												
ALUMINUM	2980	4550	57	5130	3990	3220	3480	2610	3120	10800	1730	1890
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	0.96 J	0.71 J	--	0 95 J	1 6 J	0 7 J	1 1 J	0 74 J	0.75 J	17 6 J	--	--
BARIUM	27.3 J	39.5 J	0 43 J	47	36 J	29 7 J	62 3	50 8	45 6	184	--	20 8 J
BERYLLIUM	--	--	--	0.35 J	--	--	0 23 J	--	--	0 29 J	--	--
CADMIUM	--	--	--	--	--	--	--	--	1 5 J	3.5	--	--
CALCIUM	2660	1330	43 9 J	3100	1860	2390	7400	955 J	886 J	19200	1210	6910
CHROMIUM	7 3	9.4	--	9.4	7 8	7.6	8	5 8	7.8	27 6	4 1	7 4
COBALT	5 J	5 6 J	--	5.4 J	4 J	4 8 J	4 9 J	4 1 J	4.2 J	6.8 J	2 8 J	4 6 J
COPPER	10 9	14 45	--	14 7	10.1	11.7	10	4.9 J	7.4	217	8 7	7 8
IRON	6860	8180	68.8	8290	6950	6680	6910	4860	4220	26500	5240	7060
LEAD	3 4 J	2 J	--	37.9 J	9.1 J	6.7 J	170 J	41.9 J	39.8 J	274 J	2.4 J	1 1 J
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	2260	1850	43 9 J	2400	1590	2150	4790	931 J	903 J	5980	1410	3610
MANGANESE	348 J	409 J	--	337 J	242 J	255 J	292 J	139 J	129 J	562 J	53 7	176
MERCURY	--	--	--	--	--	--	--	--	--	--	--	--
NICKEL	10 8	12	--	19.9	9 8	10 2	10 1	7 5 J	7.7 J	20.6	--	7 9 J
POTASSIUM	262 J	317 J	33 J	362 J	361 J	349	340 J	234 J	206 J	582 J	--	--
SELENIUM	--	--	--	--	--	--	--	--	--	--	--	--
SILVER	--	--	--	--	--	--	--	1 9 J	34.6	1 9 J	--	--
SODIUM	--	--	--	--	--	--	--	--	--	--	--	--
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--
VANADIUM	13 4	14 7	--	14 8	12.3	13	12 7	9 9 J	9 7 J	17 7	9 5 J	12 6
ZINC	21.2	21	3 8 B	65 4	32 4	112	39 5	53	54 8	918	9 6	11 4

NOTES:

B = Blank contamination

J = Estimated value.

-- = < contract required detection limit

File: S-INO WK1

INORGANICS - SOILS

Sample Location:	MW02D-75	MW02D-108	FRMW02D-108	GB01-113-117	FBSB01	MW01S-18-22	MW01M-78-80	MW01M-53-55	FBGB-02	GB02M-14	FRGB02M-14	GB02M-55
ITR Number:	MEBC02	MEBC03	MEBC04	MEBC05	MEBC06	MEBC07	MEBC08	MEBC09	MEBC10	MEBC11	MEBC12	MEBC13
Date Sampled.	03-15-89	03-15-89	03-15-89	03-15-89	03-15-89	03-16-89	03-16-89	03-16-89	03-20-889	03-20-89	03-20-89	03-20-89
CRL Number:	89ZC01S11	89ZC01S12	89ZC01D12	89ZC01S13	89ZC01R02	89ZC01S14	89ZC01S16	89ZC01S15	89ZC01R02	89ZC01S06	89ZC01D06	89ZC01S07
Laboratory:	Wilson	Wilson	Wilson	Wilson	Wilson	Wilson	Wilson	Wilson	NANCO	NANCO	NANCO	NANCO
INORGANIC CHEMICALS (mg/kg)												
ALUMINUM	1310	1470	1470	1610	--	2260	1170	1780	30 7 J	2400 J	2490 J	2850 J
ANTIMONY	--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC	--	--	--	--	--	--	--	--	0.16 J	1.4 J	1 J	1 J
BARIUM	16.2 J	--	14.1 J	15.7	--	18.2 J	--	20.3 J	--	15.4 J	20 J	19 6 J
BERYLLIUM	--	--	--	--	--	--	--	--	--	0.48 J	0 47 J	0.46 J
CADMIUM	--	--	1.1 J	--	--	--	1 3	--	--	--	--	--
CALCIUM	3310	4090	3480	3070	--	1850	4700	1640	--	3340	3890	4120
CHROMIUM	--	4.5	4	4.7	--	7.4	3 3	3.2	--	9.9	8 9	9 1
COBALT	--	--	--	--	--	2.8 J	22	2.6 J	--	3.6 J	4 2 J	3 9 J
COPPER	5 6 J	6.6	5 9	--	--	7 4	3 9 J	--	42.5 J	45 9 J	--	--
IRON	3760	4680	4580	5560	45	6000	3700	5170	65.3 B	5870 J	7230 J	6360 J
LEAD	1 J	1 5 J	2.5 J	2 5 J	--	4.7 J	1 3 J	10 8 J	0.32 J	2.4	1 6	1 4
CYANIDE	--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM	1570	2120	1920	2300	--	2240	2160	1430	61.1 J	2230 J	2080 J	2350 J
MANGANESE	79 8	107	113	173	--	226	140	104	--	185	215	111
MERCURY	--	--	--	--	--	--	--	--	0.055 J	0.072 J	0 058 J	0 063 J
NICKEL	4 7 J	6 J	4.7 J	--	--	9.3 J	4 8 J	11.6	--	--	4 4 J	3 4 J
POTASSIUM	--	--	--	--	--	--	--	--	--	317 J	--	--
SELENIUM	--	1.2 J	--	--	--	--	--	--	--	--	--	--
SILVER	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	--	--	--	--	--	--	--	--	--	223 J	229 J	200 J
THALLIUM	--	--	--	--	--	--	--	--	--	--	--	--
VANADIUM	5 J	11.1 J	8.6 J	8.3 J	--	9 2	8 J	12.4	--	11 5 J	18 6	9 6 J
ZINC	5 9	8.5	9.7	10 4	--	15.1	7 5	18	26.9 J	53.6 J	36.1 J	36 9 J

NOTES:

B = Blank contamination.
J = Estimated value.
-- = < contract required detection limit.

File: S-IND.WK1

INORGANICS - SOILS

Sample Location:	GB02M-75	GB06M-20	GM06M-80
ITR Number:	MEBC14	MEBC15	MEBC16
Date Sampled	03-20-89	03-20-89	03-20-89
CRL Number:	89ZC01S08	89ZC01S09	89ZC01S10
Laboratory:	NANCO	NANCO	NANCO
INORGANIC CHEMICALS (mg/kg)			
ALUMINUM	3680 J	4260 J	2200 J
ANTIMONY	--	--	--
ARSENIC	2 J	0.72 J	1 J
BARIUM	37.9 J	21.5 J	26.3 J
BERYLLIUM	0.45 J	0.72 J	0.48 J
CADMIUM	0.9 J	--	--
CALCIUM	23100	1940	6210
CHROMIUM	10.1	13.2	9.1
COBALT	4.7 J	4.8 J	4.3 J
COPPER	8.1 J	--	--
IRON	9300 J	9500 J	6470 J
LEAD	1.7	1.2	1.4
CYANIDE	--	--	--
MAGNESIUM	12000 J	2630 J	2410 J
MANGANESE	435	161	195
MERCURY	0.15 J	--	--
NICKEL	5.6 J	8.4 J	3.8 J
POTASSIUM	--	--	--
SELENIUM	--	--	--
SILVER	--	--	--
SODIUM	--	--	--
THALLIUM	--	--	--
VANADIUM	15.2	10.5 J	13.6
ZINC	30.5 J	28.5 J	56.3 J

NOTES:

B = Blank contamination

J = Estimated value

-- = < contract required detection limit

File: S-INO.WK1

SPECIAL ANALYTICAL SERVICES -
SOILS

SAMPLE LOCATION:	ON-TP03-01	ON-TP04-01	ON-TPFB04-01	ON-TP07-01	ON-TP08-01	ON-TP09-01	ON-TP10-01	ON-TP11-01
SAMPLE NUMBER:	4501E-51	4501E-52	4501E-60	4501E-53	4501E-54	4501E-55	4501E-56	4501E-57
DATE SAMPLED:	04/17/89	04/17/89	04/19/89	04/18/89	04/18/89	04/18/89	04/18/89	04/19/89
CRL NUMBER:	89ZC02S14	89ZC02S15	89ZC02R03	89ZC02S16	89ZC02S17	89ZC02S18	89ZC02S19	89ZC02S20
LABORATORY:	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE
SAS ANALYSES (mg/kg)								
TOC	3000 J	300 J	11 J	3200 J	746 J	1400 J	8600 J	447 J

NOTES:
- B = Blank contamination.
- J = Estimated value.

File: SAS_TOC.WK1

SPECIAL ANALYTICAL SERVICES -
SOILS

SAMPLE LOCATION:	ON-FRTP11-01	ON-TP13-01	ON-MW02D-24	ON-MW02D-58	ON-MW02D-75	ON-MW02D-108	ON-FRMW02D-108	ON-GB01-113-
SAMPLE NUMBER:	4501E-58	4501E-59	4501E-01	4501E-02	4501E-03	4501E-04	4501E-05	4501E-06
DATE SAMPLED:	04/19/89	04/19/89	03/15/89	03/15/89	03/15/89	03/15/89	03/15/89	03/15/89
CRL NUMBER:	89ZC02D20	89ZC02S21	89ZC01S01	89ZC01S02	89ZC01S03	89ZC01S04	89ZC01D04	89ZC01S05
LABORATORY:	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE
SAS ANALYSES (mg/kg)								
TOC	4400 J	14700 J	112	156	189	147	167	394

NOTES:

B = Blank contamination.
J = Estimated value.

File: SAS_TOC.WK1

SPECIAL ANALYTICAL SERVICES -
SOILS

SAMPLE LOCATION:	117 ON-FBSB01	ON-MW01S-18-22	ON-MW01M-53-55	ON-MW01M-78-80	ON-GB02M-14	ON-FRGB02M-14	ON-GB02M-55
SAMPLE NUMBER:	4501E-07	4501E-08	4501E-09	4501E-10	4501E-11	4501E-12	4501E-13
DATE SAMPLED:	03/15/89	03/16/89	03/16/89	03/16/89	03/20/89	03/20/89	03/20/89
CRL NUMBER:	89ZC01R01	89ZC01S06	89ZC01S07	89ZC01S08	89ZC01S09	89ZC01D09	89ZC01S10
LABORATORY:	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE
SAS ANALYSES (mg/kg)							
TOC	13.1	9990	638	284	131	391	40 B

NOTES:

B = Blank contamination.
J = Estimated value.

File: SAS_TOC.WK1

SPECIAL ANALYTICAL SERVICES -
SOILS

SAMPLE LOCATION:	ON-GB02M-75	ON-FBGB02	ON-GB06M-20	ON-GB06M-80
SAMPLE NUMBER:	4501E-14	4501E-17	4501E-15	4501E-16
DATE SAMPLED:	03/20/89	03/20/89	03/20/89	03/20/89
CRL NUMBER:	89ZC01S11	89ZC01R02	89ZC01S12	89ZC01S13
LABORATORY:	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE
SAS ANALYSES (mg/kg)				
TOC	19 B	13	79	156

NOTES:
B = Blank contamination.
J = Estimated value.

File: SAS_TOC.WK1

SPECIAL ANALYTICAL SERVICES -
SOILS

SAMPLE LOCATION:	ON-TPB-01	ON-TP03-01	ON-TP04-01	ON-FBTP04-01	ON-TP07-01	ON-TP08-01	ON-TP09-01	ON-TP10-01	ON-TP11-01	ON-FRTP11-01
SAS SAMPLE NUMBER:	4558E55	4558E46	4558E47	4558E54	4558E48	4558E49	4558E50	4558E51	4558E52	4558E53
DATE SAMPLED:	04/19/89	04/17/89	04/17/89	04/19/89	04/18/89	04/18/89	04/18/89	04/18/89	04/19/89	04/19/89
CRL NUMBER:	89ZC40S09	89ZC40S01	89ZC40S02	89ZC40R08	89ZC40S03	89ZC40S04	89ZC40S05	89ZC40S06	89ZC40S07	89ZC40D07
LABORATORY:	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN	HAZEN
SAS ANALYSES (%)										
CHLORINE	0.03	<0.01	0.10	<0.01	0.13	0.07	0.02	<0.01	0.02	<0.01
SULFUR	0.14	0.03	0.03	0.02	0.03	0.02	0.06	0.03	0.04	0.03

File: SU-CL_TP.WK1

EP TOXICITY - SOILS

Sample Location:	TP03-01	TP04-01	TPFB04-01	TP07-01	TP08-01	TP09-01	TP10-01	TP11-01	FRTP11-01	TP13-01
SAS Sample Number:	4558E35	4558E36	4558E44	4558E37	4558E38	4558E39	4558E40	4558E41	4558E42	4558E43
Date Sampled:	04-17-89	04-17-89	04-18-89	04-18-89	04-18-89	04-18-89	04-18-89	04-19-89	04-19-89	04-19-89
CRL Number:	89ZC02S27	89ZC02S28	89ZC02R06	89ZC02S29	89ZC02S30	89ZC02S31	89ZC02S32	89ZC02S33	89ZC02D33	89ZC02S34
Laboratory:	JTC	JTC	JTC	JTC	JTC	JTC	JTC	JTC	JTC	JTC
INORGANIC CHEMICALS (mg/kg)										
ARSENIC	6.5 J	3.7 J	2.8 J	6.6 J	6.4 J	6.5 J	4.6 J	6.7 J	6.0 J	18.0 J
BARIUM	271.0	293.0	--	486.0	107.0	375.0	326.0	628.0	791.0	161.0
CADMIUM	15.1 J	25.6 J	4.8 J	7.7 J	7.4 J	11.8 J	12.5 J	24.1 J	--	--
CHROMIUM	17.3 J	31.9 J	--	--	11.8 J	8.9 J	14.9 J	37.4 J	--	--
LEAD	--	89.5 J	89.3 J	--	--	--	--	--	--	--
MERCURY	--	--	--	--	--	--	--	--	--	--
SELENIUM	7.0 J	6.9 J	4.1 J	3.8 J	4.2 J	4.2 J	5.7 J	4.9 J	6.1 J	6.0 J
SILVER	--	12.2 J	--	--	--	--	9.3 J	8.2	--	--

NOTES:

J = Estimated value.

-- = < contract required detection limit.

File: EPTOX.WK1

VOLATILE ORGANIC COMPOUNDS -
SEDIMENT

Sample Location:	ON-SD01-01	ON-SD02-01	ON-SD03-01	ON-SD04-01	ON-SD05-01	ON-SD06-01	ON-SD07-01	ON-SD08-01	ON-SD09-01	ON-SD10-01	ON-SD11-01	ON-FRSD11-01
Sample Number:	EBP78	EBP79	EBP80	EBP81	EBP82	EBP83	EBP84	EBP85	EBP86	EBP87	EBP88	EBP89
Date Sampled:	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S01	89ZC40S02	89ZC40S03	89ZC40S04	89ZC40S05	89ZC40S06	89ZC40S07	89ZC40S08	89ZC40S09	89ZC40S10	89ZC40S21	89ZC40D21
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
VOLATILE												
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	10 B	8 B	7 B	20 B	8 B	17 B	22 B	25 B	14 B	6 B	14 B	5 B
ACETONE	--	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	16 J	--	--	--	--	--	--	--	--	--	62 J	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	9 B	3 B	--	21 B	3 B	--	2 B	7 B	--	--	--	6 B
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- -- = Not detected at detection limit

File W-SDVOC.WK1

VOLATILE ORGANIC COMPOUNDS -
SEDIMENT

Sample Location:	ON-SD12-01	ON-FRSD12-01	ON-SDFB13-01
Sample Number:	EBP90	EBP91	EBP92
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S22	89ZC40D22	89ZC40R01
Laboratory:	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)			
VOLATILE			
CHLOROMETHANE	--	--	--
BROMOMETHANE	--	--	--
VINYL CHLORIDE	--	--	--
CHLOROETHANE	--	--	--
METHYLENE CHLORIDE	9 B	15 B	45 B
ACETONE	--	--	--
CARBON DISULFIDE	--	--	--
1,1-DICHLOROETHENE	--	--	--
1,1-DICHLOROETHANE	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--
CHLOROFORM	--	--	--
1,2-DICHLOROETHANE	--	--	--
2-BUTANONE	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--
CARBON TETRACHLORIDE	--	--	--
VINYL ACETATE	--	--	--
BROMODICHLOROMETHANE	--	--	--
1,2-DICHLOROPROPANE	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--
TRICHLOROETHENE	--	--	--
DIBROMOCHLOROMETHANE	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--
BENZENE	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--
BROMOFORM	--	--	--
4-METHYL-2-PENTANONE	--	--	--
2-HEXANONE	--	--	--
TETRACHLOROETHENE	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--
TOLUENE	9 B	10 B	28
CHLOROBENZENE	--	--	--
ETHYLBENZENE	--	--	--
STYRENE	--	--	--
TOTAL XYLENES	--	--	--

NOTES:
- B = Blank contamination
- J = Estimated value
- -- = Not detected at detection limit

File: B:SDVOC.WK1

SEMI-VOLATILES - SEDIMENT

Sample Location:	ON-SD01-01	ON-SD02-01	ON-SD03-01	ON-SD04-01	ON-SD05-01	ON-SD06-01	ON-SD07-01	ON-SD08-01	ON-SD09-01	ON-SD10-01	ON-SD11-01	ON-FRSD11-01
Sample Number	EBP78	EBP79	EBP80	EBP81	EBP82	EBP83	EBP84	EBP85	EBP86	EBP87	EBP88	EBP89
Date Sampled	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S01	89ZC40S02	89ZC40S03	89ZC40S04	89ZC40S05	89ZC40S06	89ZC40S07	89ZC40S08	89ZC40S09	89ZC40S10	89ZC40S21	89ZC40D21
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
SEMIVOLATILE												
PHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--

NOTES: E = Estimated value
-- = Not detected at detection limit

File: W-SDBNA.WK1

SEMI-VOLATILES - SEDIMENT

Sample Location:	ON-SD12-01	ON-FRSD12-01	ON-SDFB13-01
Sample Number:	EBP90	EBP91	EBP92
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S22	89ZC40D22	89ZC40R01
Laboratory:	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)			
SEMIVOLATILE			
PHENOL	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--
2-CHLOROPHENOL	--	--	--
1,3-DICHLOROBENZENE	--	--	--
1,4-DICHLOROBENZENE	--	--	--
BENZYL ALCOHOL	--	--	--
1,2-DICHLOROBENZENE	--	--	--
2-METHYLPHENOL	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--
4-METHYLPHENOL	--	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--	--
HEXACHLOROETHANE	--	--	--
NITROBENZENE	--	--	--
ISOPHORONE	--	--	--
2-NITROPHENOL	--	--	--
2,4-DIMETHYLPHENOL	--	--	--
BENZOIC ACID	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--
2,4-DICHLOROPHENOL	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--
NAPHTHALENE	--	--	--
4-CHLOROANILINE	--	--	--
HEXACHLOROBUTADIENE	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--
2-METHYLNAPHTHALENE	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--
2-CHLORONAPHTHALENE	--	--	--
2-NITROANILINE	--	--	--
DIMETHYL PHTHALATE	--	--	--
ACENAPHTHYLENE	--	--	--
2,6-DINITROTOLUENE	--	--	--
3-NITROANILINE	--	--	--
ACENAPHTHENE	--	--	--
2,4-DINITROPHENOL	--	--	--
4-NITROPHENOL	--	--	--
DIBENZOFURAN	--	--	--
2,4-DINITROTOLUENE	--	--	--
DIETHYL PHTHALATE	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--
FLUORENE	--	--	--
4-NITROANILINE	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--
HEXACHLOROBENZENE	--	--	--
PENTACHLOROPHENOL	--	--	--
PHENANTHRENE	--	--	--
ANTHRACENE	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--
FLUORANTHENE	--	--	--
PYRENE	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--
BENZO(A)ANTHRACENE	--	--	--
CHRYSENE	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--
BENZO(B)FLUORANTHENES	--	--	--
BENZO(K)FLUORANTHENES	--	--	--
BENZO(A)PYRENE	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--
BENZO(GHI)PERYLENE	--	--	--

NOTES: E = Estimated value
-- = Not detected at detection limit

File W-SDBNA WK1

PESTICIDE/PCB - SEDIMENT

Sample Location:	ON-SD01-01	ON-SD02-01	ON-SD03-01	ON-SD04-01	ON-SD05-01	ON-SD06-01	ON-SD07-01	ON-SD08-01	ON-SD09-01	ON-SD10-01	ON-SD11-01	ON-FRSD11-01
Sample Number.	EBP78	EBP79	EBP80	EBP81	EBP82	EBP83	EBP84	EBP85	EBP86	EBP87	EBP88	EBP89
Date Sampled.	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number.	89ZC40S01	89ZC40S02	89ZC40S03	89ZC40S04	89ZC40S05	89ZC40S06	89ZC40S07	89ZC40S08	89ZC40S09	89ZC40S10	89ZC40S21	89ZC40D21
Laboratory.	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
PESTICIDES and PCBs												
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	--	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	--	9.3 J	--	--	4.9 J	--	--	--	3.8 J	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	4.9 J	--	--	--	--	--	--	4.8 J	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--

NOTES.

-- = Not detected at detection limit.

J = Estimated value.

File. W-SDPCB.WK1

PESTICIDE/PCB - SEDIMENT

Sample Location:	ON-SD12-01	ON-FRSD12-01	ON-SDFB13-01
Sample Number:	EBP90	EBP91	EBP92
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number.	89ZC40S22	89ZC40D22	89ZC40R01
Laboratory:	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)			
PESTICIDES and PCBs			
ALPHA-BHC	--	--	--
BETA-BHC	--	--	--
DELTA-BHC	--	--	--
GAMMA-BHC (LINDANE)	--	4.1 J	--
HEPTACHLOR	--	--	--
ALDRIN	--	--	--
HEPTACHLOR EPOXIDE	--	--	--
ENDOSULFAN I	--	--	--
DIELDRIN	--	--	--
4,4-DDE	--	--	--
ENDRIN	--	--	--
ENDOSULFAN II	--	--	--
4,4-DDD	--	--	--
ENDRIN ALDEHYDE	--	--	--
ENDOSULFAN SULFATE	--	--	--
4,4-DDT	--	--	--
METHOXYCHLOR	--	--	--
ENDRIN KETONE	--	--	--
CHLORDANE	--	--	--
TOXAPHENE	--	--	--
AROCLOR-1016	--	--	--
AROCLOR-1221	--	--	--
AROCLOR-1232	--	--	--
AROCLOR-1242	--	--	--
AROCLOR-1248	--	--	--
AROCLOR-1254	--	--	--
AROCLOR-1260	--	--	--

NOTES:

-- = Not detected at detection limit.

J = Estimated value.

File: W-SDPCB.WK1

INORGANICS - SEDIMENTS

Sample Location:	SD01-01	SD02-01	SD03-01	SD04-01	SD05-01	SD06-01	SD07-01	SD08-01	SD09-01	SD10-01	SD11-01	FRSD11-01	SD12-01
ITR Sample Number:	MEBC78	MEBC79	MEBC80	MEBC81	MEBC82	MEBC83	MEBC84	MEBC85	MEBC86	MEBC87	MEBC88	MEBC89	MEBC90
Date Sampled:	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S51	89ZC40S52	89ZC40S53	89ZC40S54	89ZC40S63	89ZC40S64	89ZC40S65	89ZC40S66	89ZC40S67	89ZC40S68	89ZC40S75	89ZC40D75	89ZC40S76
Laboratory:	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	SKINER	SKINER	SKINER
INORGANIC CHEMICALS (mg/kg)													
ALUMINUM	4560 R	7080 R	2870 R	3420 R	11100 R	7070 R	998 R	11000 R	696 R	9050 R	2060 J	783 J	3260 J
ANTIMONY	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--	--
ARSENIC	3 R	2.4 R	1 7 R	2.2 R	7.8 R	2 4 R	1.6 R	3 4 R	-- R	2 6 R	1 4 J	--	1 J
BARIUM	86.7 R	73.2 R	39 5 R	60 R	108 R	76 2 R	13 7 R	135 R	7 4 R	109 R	29 9 J	10 2 J	36 4 J
BERYLLIUM	0.23 R	0 44 R	0.24 R	-- R	0 77 R	0.43 R	-- R	0 75 R	-- R	0 62 R	--	--	--
CADMIUM	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--	--
CALCIUM	3300 R	1300 R	1010 R	1140 R	1690 R	2550 R	408 R	2680 R	279 R	2560 R	1170 J	371 J	1600
CHROMIUM	9.5 R	13.5 R	6 6 R	7.1 R	20 5 R	14 6 R	2.6 R	24 2 R	2 3 R	19.4 R	3.8	0 94 J	6 1
COBALT	-- R	5.6 R	4.5 R	5 R	9 5 R	5 4 R	-- R	8 1 R	-- R	6.1 R	3 1 J	1 4 J	4 J
COPPER	9.1 R	10.8 R	4 7 R	5 R	14.5 R	10 3 R	-- R	17 2 R	2.3 R	10 9 R	6.9	--	5 5 J
IRON	8090 R	10200 R	6420 R	8490 R	18900 R	10200 R	2510 R	14400 R	1650 R	13600 R	4370 J	1810 J	7240 J
LEAD	13.3 R	15 7 R	5 2 R	6 5 R	37 7 R	7.8 R	0.78 R	24 R	0 46 R	17 2 R	2 8 J	1 J	4 J
MAGNESIUM	1180 R	1730 R	848 R	942 R	2280 R	1970 R	340 R	2590 R	222 R	2370 R	802 J	278 J	1390
MANGANESE	64 3 R	210 R	186 R	516 R	340 R	125 R	111 R	189 R	43.6 R	293 R	191 J	82.2 J	302 J
MERCURY	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--	--
NICKEL	-- R	13 7 R	-- R	9 2 R	21 5 R	11 6 R	-- R	16.7 R	-- R	14 8 R	3 5 J	--	5 7 J
POTASSIUM	-- R	527 R	-- R	-- R	922 R	780 R	-- R	1200 R	-- R	964 R	229 J	85.9 J	338 J
SELENIUM	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	0 6 J	0 54 J	--
SILVER	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--	--
SODIUM	-- R	38 3 R	-- R	-- R	85 3 R	56 1 R	-- R	79 1 R	-- R	53 5 R	34 1 B	25 1 B	39 7 B
THALLIUM	-- R	-- R	-- R	0 74 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R
VANADIUM	22 R	23 R	11 R	10 4 R	37.2 R	23.8 R	4 4 R	36 5 R	4 R	27 2 R	5 3 J	2 5 J	11 9 J
ZINC	42.2 R	43 2 R	26 R	37 R	65 R	53 4 R	11 1 R	106 R	10 2 R	51 5 R	20 2	8.6	21 5

NOTES:

B = Blank contamination
J = Estimated value
R = Unuseable data
-- = < contract required detection limit

File: W-SDINO.WK1

INORGANICS - SEDIMENTS

Sample Location:	FRSD12-01	SDFB13-01
ITR Sample Number:	MEBC91	MEBC92
Date Sampled:	06-12-89	06-12-89
CRL Number:	89ZC40D76	89ZC40R06
Laboratory:	SKINER	SKINER

INORGANIC CHEMICALS (mg/kg)

ALUMINUM	5360 J	276 J
ANTIMONY	--	--
ARSENIC	1.6 J	0.88 J
BARIUM	67	4.6 J
BERYLLIUM	--	--
CADMIUM	--	--
CALCIUM	2500	1400
CHROMIUM	10.2	10.2
COBALT	5.6 J	--
COPPER	7.5	--
IRON	11300 J	143 J
LEAD	6 J	-- J
MAGNESIUM	1820	79.5 J
MANGANESE	459 J	1.9 J
MERCURY	--	--
NICKEL	8 J	--
POTASSIUM	562 J	66.8 J
SELENIUM	--	--
SILVER	--	--
SODIUM	82.4 B	1220
THALLIUM	-- R	-- R
VANADIUM	16.2	19.3
ZINC	36.6	1.3

NOTES:

B = Blank contamination.
J = Estimated value.
R = Unuseable data.
-- = < contract required detection limit.

File: W-SDIND.WK1

VOLATILE ORGANIC COMPOUNDS -
SURFACE WATER

Sample Location:	ON-SW01-01	ON-SW02-01	ON-SW03-01	ON-SW04-01	ON-SW05-01	ON-SW06-01	ON-SW07-01	ON-SW08-01	ON-SW09-01	ON-SW10-01	ON-SW11-01	ON-FRSW11-01
Sample Number:	EBP63	EBP64	EBP65	EBP66	EBP67	EBP68	EBP69	EBP70	EBP71	EBP72	EBP73	EBP74
Date Sampled:	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S11	89ZC40S12	89ZC40S13	89ZC40S14	89ZC40S15	89ZC40S16	89ZC40S17	89ZC40S18	89ZC40S19	89ZC40S20	89ZC40S24	89ZC40D24
Laboratory:	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
VOLATILE												
CHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
METHYLENE CHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
ACETONE	--	--	--	--	--	--	--	--	--	--	--	--
CARBON DISULFIDE	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
2-BUTANONE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
CARBON TETRACHLORIDE	--	--	--	--	--	--	--	--	--	--	--	--
VINYL ACETATE	--	--	--	--	--	--	--	--	--	--	--	--
BROMODICHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROPROPANE	--	--	--	--	--	--	--	--	--	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBROMOCHLOROMETHANE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
BENZENE	--	--	--	--	--	--	--	--	--	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--	--	--	--	--	--	--	--	--	--
BROMOFORM	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYL-2-PENTANONE	--	--	--	--	--	--	--	--	--	--	--	--
2-HEXANONE	--	--	--	--	--	--	--	--	--	--	--	--
TETRACHLOROETHENE	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
TOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ETHYLBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
STYRENE	--	--	--	--	--	--	--	--	--	--	--	--
TOTAL XYLENES	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

B = Blank contamination
E = Estimated value
-- = Not detected at detection limit

File: W:SWVOC.WK1

VOLATILE ORGANIC COMPOUNDS -
SURFACE WATER

Sample Location:	ON-SW12-01	ON-FRSW12-01	ON-SWFB13-01
Sample Number:	EBP75	EBP76	EBP77
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S25	89ZC40D25	89ZC40R02
Laboratory:	S-CUBED	S-CUBED	S-CUBED

ORGANIC COMPOUNDS (ug/kg)

VOLATILE			
CHLOROMETHANE	--	--	--
BROMOMETHANE	--	--	--
VINYL CHLORIDE	--	--	--
CHLOROETHANE	--	--	--
METHYLENE CHLORIDE	--	--	--
ACETONE	--	--	--
CARBON DISULFIDE	--	--	--
1,1-DICHLOROETHENE	--	--	--
1,1-DICHLOROETHANE	--	--	--
1,2-DICHLOROETHENE (TOTAL)	--	--	--
CHLOROFORM	--	--	--
1,2-DICHLOROETHANE	--	--	--
2-BUTANONE	--	--	--
1,1,1-TRICHLOROETHANE	--	--	--
CARBON TETRACHLORIDE	--	--	--
VINYL ACETATE	--	--	--
BROMODICHLOROMETHANE	--	--	--
1,2-DICHLOROPROPANE	--	--	--
CIS-1,3-DICHLOROPROPENE	--	--	--
TRICHLOROETHENE	--	--	--
DIBROMOCHLOROMETHANE	--	--	--
1,1,2-TRICHLOROETHANE	--	--	--
BENZENE	--	--	--
TRANS-1,3-DICHLOROPROPENE	--	--	--
BROMOFORM	--	--	--
4-METHYL-2-PENTANONE	--	--	--
2-HEXANONE	--	--	--
TETRACHLOROETHENE	--	--	--
1,1,2,2-TETRACHLOROETHANE	--	--	--
TOLUENE	--	--	--
CHLOROBENZENE	--	--	--
ETHYLBENZENE	--	--	--
STYRENE	--	--	--
TOTAL XYLENES	--	--	--

NOTES:
- B = Blank contamination
- E = Estimated value
- -- = Not detected at detection limit

File: W-SWVOC.WK1

((

SEMI-VOLATILES - SURFACE WATER

Sample Location	ON-SW01-01	ON-SW02-01	ON-SW03-01	ON-SW04-01	ON-SW05-01	ON-SW06-01	ON-SW07-01	ON-SW08-01	ON-SW09-01	ON-SW10-01	ON-SW11-01	ON-FRSW11-01
Sample Number	EBP63	EBP64	EBP65	EBP66	EBP67	EBP68	EBP69	EBP70	EBP71	EBP72	EBP73	EBP74
Date Sampled	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number	89ZC40S11	89ZC40S12	89ZC40S13	89ZC40S14	89ZC40S15	89ZC40S16	89ZC40S17	89ZC40S18	89ZC40S19	89ZC40S20	89ZC40S24	89ZC40D24
Laboratory	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)												
SEMIVOLATILE												
PHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,3-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
1,4-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZYL ALCOHOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--	--	--	--	--	--	--	--	--	--
4-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSO-DI-n-PROPLYAMINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROETHANE	--	--	--	--	--	--	--	--	--	--	--	--
NITROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
ISOPHORONE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DIMETHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
BENZOIC ACID	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBUTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-METHYLNAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
2-CHLORONAPHTHALENE	--	--	--	--	--	--	--	--	--	--	--	--
2-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
DIMETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHYLENE	--	--	--	--	--	--	--	--	--	--	--	--
2,6-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
3-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
ACENAPHTHENE	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZOFURAN	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DINITROTOLUENE	--	--	--	--	--	--	--	--	--	--	--	--
DIETHYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
FLUORENE	--	--	--	--	--	--	--	--	--	--	--	--
4-NITROANILINE	--	--	--	--	--	--	--	--	--	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--	--	--	--	--	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--	--	--	--	--	--	--	--	--	--
HEXACHLOROBENZENE	--	--	--	--	--	--	--	--	--	--	--	--
PENTACHLOROPHENOL	--	--	--	--	--	--	--	--	--	--	--	--
PHENANTHRENE	--	--	--	--	--	--	--	--	--	--	--	--
ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
FLUORANTHENE	--	--	--	--	--	--	--	--	--	--	--	--
PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
CHRYSENE	--	--	--	--	--	--	--	--	--	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(B)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(K)FLUORANTHENES	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(A)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--	--	--	--	--	--	--	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--	--	--	--	--	--	--	--	--	--
BENZO(GHI)PERYLENE	--	--	--	--	--	--	--	--	--	--	--	--

NOTES E = Estimated value
-- = Not detected at detection limit

File W-SWBNA WK1

SEMI-VOLATILES - SURFACE WATER

Sample Location:	ON-SW12-01	ON-FRSW12-01	ON-SWFB13-01
Sample Number:	EBP75	EBP76	EBP77
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S25	89ZC40D25	89ZC40R02
Laboratory:	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/l)			
SEMIVOLATILE			
PHENOL	--	--	--
BIS(2-CHLOROETHYL)ETHER	--	--	--
2-CHLOROPHENOL	--	--	--
1,3-DICHLOROBENZENE	--	--	--
1,4-DICHLOROBENZENE	--	--	--
BENZYL ALCOHOL	--	--	--
1,2-DICHLOROBENZENE	--	--	--
2-METHYLPHENOL	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	--	--	--
4-METHYLPHENOL	--	--	--
N-NITROSO-DI-N-PROPLYAMINE	--	--	--
HEXACHLOROETHANE	--	--	--
NITROBENZENE	--	--	--
ISOPHORONE	--	--	--
2-NITROPHENOL	--	--	--
2,4-DIMETHYLPHENOL	--	--	--
BENZOIC ACID	--	--	--
BIS(2-CHLOROETHOXY)METHANE	--	--	--
2,4-DICHLOROPHENOL	--	--	--
1,2,4-TRICHLOROBENZENE	--	--	--
NAPHTHALENE	--	--	--
4-CHLOROANILINE	--	--	--
HEXACHLOROBUTADIENE	--	--	--
4-CHLORO-3-METHYLPHENOL	--	--	--
2-METHYLNAPHTHALENE	--	--	--
HEXACHLOROCYCLOPENTADIENE	--	--	--
2,4,6-TRICHLOROPHENOL	--	--	--
2,4,5-TRICHLOROPHENOL	--	--	--
2-CHLORONAPHTHALENE	--	--	--
2-NITROANILINE	--	--	--
DIMETHYL PHTHALATE	--	--	--
ACENAPHTHYLENE	--	--	--
2,6-DINITROTOLUENE	--	--	--
3-NITROANILINE	--	--	--
ACENAPHTHENE	--	--	--
2,4-DINITROPHENOL	--	--	--
4-NITROPHENOL	--	--	--
DIBENZOFURAN	--	--	--
2,4-DINITROTOLUENE	--	--	--
DIETHYL PHTHALATE	--	--	--
4-CHLOROPHENYL PHENYL ETHER	--	--	--
FLUORENE	--	--	--
4-NITROANILINE	--	--	--
4,6-DINITRO-2-METHYLPHENOL	--	--	--
N-NITROSODIPHENYLAMINE	--	--	--
4-BROMOPHENYL PHENYL ETHER	--	--	--
HEXACHLOROBENZENE	--	--	--
PENTACHLOROPHENOL	--	--	--
PHENANTHRENE	--	--	--
ANTHRACENE	--	--	--
DI-N-BUTYL PHTHALATE	--	--	--
FLUORANTHENE	--	--	--
PYRENE	--	--	--
BUTYL BENZYL PHTHALATE	--	--	--
3,3-DICHLOROBENZIDINE	--	--	--
BENZO(A)ANTHRACENE	--	--	--
CHRYSENE	--	--	--
BIS(2-ETHYLHEXYL)PHTHALATE	--	--	--
DI-N-OCTYL PHTHALATE	--	--	--
BENZO(B)FLUORANTHENES	--	--	--
BENZO(K)FLUORANTHENES	--	--	--
BENZO(A)PYRENE	--	--	--
INDENO(1,2,3-CD)PYRENE	--	--	--
DIBENZ(A,H)ANTHRACENE	--	--	--
BENZO(GHI)PERYLENE	--	--	--

NOTES E = Estimated value
-- = Not detected at detection limit

File # SWBNA WK1

PESTICIDE/PCBS - SURFACE WATER

Sample Location:	ON-SW01-01	ON-SW02-01	ON-SW03-01	ON-SW04-01	ON-SW05-01	ON-SW06-01	ON-SW07-01	ON-SW08-01	ON-SW09-01	ON-SW10-01	ON-SW11-01	ON-TRSW11-01
Sample Number:	EBP63	EBP64	EBP65	EBP66	EBP67	EBP68	EBP69	EBP70	EBP71	EBP72	EBP73	EBP74
Date Sampled:	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number	89ZC40S11	89ZC40S12	89ZC40S13	89ZC40S14	89ZC40S15	89ZC40S16	89ZC40S17	89ZC40S18	89ZC40S19	89ZC40S20	89ZC40S24	89ZC40D24
Laboratory	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)												
PESTICIDES and PCBs												
ALPHA-BHC	--	--	--	--	--	--	--	--	--	--	--	--
BETA-BHC	--	--	--	--	--	--	--	--	--	--	--	--
DELTA-BHC	--	--	--	--	--	0.01 J	--	--	--	--	--	--
GAMMA-BHC (LINDANE)	--	0.04 B	--	0.06 B	--	--	0.03 B	--	--	0.07 B	--	--
HEPTACHLOR	--	--	--	--	--	--	--	--	--	--	--	--
ALDRIN	--	--	--	--	--	--	--	--	--	--	--	--
HEPTACHLOR EPOXIDE	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN I	--	--	--	--	--	--	--	--	--	--	--	--
DIELDRIN	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDE	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN II	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDD	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN ALDEHYDE	--	--	--	--	--	--	--	--	--	--	--	--
ENDOSULFAN SULFATE	--	--	--	--	--	--	--	--	--	--	--	--
4,4-DDT	--	--	--	--	--	--	--	--	--	--	--	--
METHOXYCHLOR	--	--	--	--	--	--	--	--	--	--	--	--
ENDRIN KETONE	--	--	--	--	--	--	--	--	--	--	--	--
CHLORDANE	--	--	--	--	--	--	--	--	--	--	--	--
TOXAPHENE	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1016	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1221	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1232	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1242	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1248	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1254	--	--	--	--	--	--	--	--	--	--	--	--
AROCLOR-1260	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:

-- = Not detected at detection limit

B = Blank contamination

J = Estimated value

File: W-SWPCB.WK1

PESTICIDE/PCBS - SURFACE WATER

Sample Location:	ON-SW12-01	ON-FRSW12-01	ON-SWFB13-01
Sample Number:	EBP75	EBP76	EBP77
Date Sampled:	06-12-89	06-12-89	06-12-89
CRL Number:	89ZC40S25	89ZC40D25	89ZC40R02
Laboratory:	S-CUBED	S-CUBED	S-CUBED
ORGANIC COMPOUNDS (ug/kg)			
PESTICIDES and PCBs			
ALPHA-BHC	--	--	--
BETA-BHC	--	--	--
DELTA-BHC	--	--	--
GAMMA-BHC (LINDANE)	0.09 B	--	--
HEPTACHLOR	--	--	--
ALDRIN	--	--	--
HEPTACHLOR EPOXIDE	--	--	--
ENDOSULFAN I	--	--	--
DIELDRIN	--	--	--
4,4-DDE	--	--	--
ENDRIN	--	--	--
ENDOSULFAN II	--	--	--
4,4-DDD	--	--	--
ENDRIN ALDEHYDE	--	--	--
ENDOSULFAN SULFATE	--	--	--
4,4-DDT	--	--	--
METHOXYCHLOR	--	--	--
ENDRIN KETONE	--	--	--
CHLORDANE	--	--	--
TOXAPHENE	--	--	--
AROCLOR-1016	--	--	--
AROCLOR-1221	--	--	--
AROCLOR-1232	--	--	--
AROCLOR-1242	--	--	--
AROCLOR-1248	--	--	--
AROCLOR-1254	--	--	--
AROCLOR-1260	--	--	--

NOTES:

-- = Not detected at detection limit.

B = Blank contamination.

J = Estimated value.

File: W-SWPCB.WK1

INORGANICS - SURFACE WATER

Sample Location	SW01-01	SW02-01	SW03-01	SW04-01	SW05-01	SW06-01	SW07-01	SW08-01	SW09-01	SW10-01	SW11-01	FRSW11-01	SW12-01
ITR Sample Number	MEBC63	MEBC64	MEBC65	MEBC66	MEBC67	MEBC68	MEBC69	MEBC70	MEBC71	MEBC72	MEBC73	MEBC74	MEBC75
Date Sampled	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89	06-12-89
CRL Number	89ZC40S55	89ZC40S56	89ZC40S57	89ZC40S58	89ZC40S59	89ZC40S60	89ZC40S61	89ZC40S62	89ZC40S69	89ZC40S70	89ZC40S73	89ZC40D73	89ZC40S74
Laboratory	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	KEYSTONE	SKINNER	SKINNER	SKINNER
INORGANIC CHEMICALS (ug/l)													
ALUMINUM	74000 R	2450 R	460 R	8300 R	382 R	96 3 R	606 R	777 R	237 R	76 8 R	397 R	602	729
ANTIMONY	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
ARSENIC	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	6 1 R	-- R	--	--
BARIUM	2470 R	96 4 R	31 3 R	133 R	31 R	63 7 R	52 R	69 6 R	53 5 R	74 8 R	33 1 R	31 1 J	31 1 J
BERYLLIUM	6.3 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
CADMIUM	7.1 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
CALCIUM	123000 R	13800 R	12200 R	18000 R	12800 R	20800 R	17000 R	17200 R	20500 R	27600 R	13400 R	12800	12900
CHROMIUM	98.4 R	-- R	-- R	13 4 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
COBALT	51 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
COPPER	119 R	13 4 R	9 1 R	-- R	20 8 R	16 5 R	16 1 R	6 9 R	8 8 R	-- R	-- R	--	--
IRON	230000 R	12200 R	2030 R	14500 R	1930 R	10200 R	8420 R	10700 R	3430 R	8260 R	2060 R	2330	2380
LEAD	298 R	3 6 R	-- R	5 8 R	-- R	2 7 R	2.4 R	1 4 R	1 5 R	-- R	1 8 R	1.8 J	1 8 J
MAGNESIUM	32500 R	4840 R	4750 R	7760 R	4990 R	7150 R	6350 R	6180 R	7140 R	9820 R	5260 R	5040	5100
MANGANESE	2350 R	2020 R	185 R	1880 R	198 R	1930 R	816 R	1540 R	2090 R	3430 R	176 R	176	169
MERCURY	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	0 35 J
NICKEL	101 R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
POTASSIUM	6820 R	3420 R	1870 R	4160 R	1920 R	3980 R	2620 R	2440 R	5610 R	3770 R	2200 R	2110 J	2120 J
SELENIUM	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	2 7 R	--	--
SILVER	-- R	6 1 R	8 6 R	-- R	-- R	-- R	5 8 R	-- R	-- R	-- R	-- R	--	--
SODIUM	3280 R	2430 R	2420 R	2710 R	2510 R	2820 R	2770 R	3090 R	2540 R	2420 R	2690 R	2540 J	2600 J
THALLIUM	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	-- R	--	--
VANADIUM	416 R	14 8 R	-- R	25 6 R	-- R	6 3 R	6 9 R	6 9 R	-- R	-- R	-- R	--	--
ZINC	923 R	32 2 R	12 1 R	56 3 R	17 8 R	28 5 R	18.6 R	22 3 R	15 1 R	8 9 R	16 R	10 3 B	9 3 B

NOTES:

B = Blank contamination
J = Estimated value
R = Unuseable data
-- = < contract required detection limit

INORGANICS - SURFACE WATER

Sample Location:	FRSW12-01	SWFB13-01
ITR Sample Number:	MEBC76	MEBC77
Date Sampled.	06-12-89	06-12-89
CRL Number:	89ZC40D74	89ZC40R05
Laboratory:	SKINNER	SKINNER
INORGANIC CHEMICALS (ug/l)		
ALUMINUM	690	--
ANTIMONY	--	--
ARSENIC	--	--
BARIUM	30.7 J	--
BERYLLIUM	--	--
CADMIUM	--	--
CALCIUM	13000	--
CHROMIUM	--	--
COBALT	--	--
COPPER	--	4 8 J
IRON	2360	22 9 B
LEAD	2.2 J	2.7 J
MAGNESIUM	5110	--
MANGANESE	169	--
MERCURY	-- R	-- R
NICKEL	--	--
POTASSIUM	2150 J	--
SELENIUM	--	--
SILVER	--	--
SODIUM	2640 J	64 5 B
THALLIUM	--	--
VANADIUM	--	--
ZINC	13.1 B	11.5 B

NOTES:
- B = Blank contamination
- J = Estimated value
- R = Unuseable data.
- -- = < contract required detection limit

File: U-SWINO.WK1

Appendix K
RISK ASSESSMENT METHODOLOGY

Appendix K
RISK ASSESSMENT METHODOLOGY

EXPOSURE ESTIMATION

Exposure is defined as the contact of an organism with a chemical or physical agent. In this assessment, exposure is normalized for time and body weight. Exposure normalized for time and body weight is termed "intake." Chemical intake is expressed as mg chemical/kg body weight/day.

GENERIC ESTIMATION OF INTAKE

Equation K-1 presents a generic equation for calculating chemical intake:

$$I = (C \times CR \times EF \times ED) \div (BW \times AT) \qquad (K\text{-}1)$$

where:

I	=	Chemical intake (mg/kg body weight/day)
C	=	Chemical concentration (e.g., mg/l)
CR	=	Contact rate (e.g., liters/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Carcinogens

A lifetime average intake (or chronic daily intake) of the chemical is estimated for carcinogens. This acts to prorate the total cumulative intake over a lifetime. An averaging time of 75 years is used for carcinogens.

Intake can change over a lifetime as body weight, contact rate, exposure frequency, and chemical concentrations change. Equation K-1 can be modified to address this issue:

$$I = (1/AT) \sum_{i=1}^{M} (C_i \times CR_i \times EF_i \times ED_i) + BW_i \qquad \text{(K-2)}$$

where:

I	=	Chronic daily intake of the chemical (mg/kg body weight/day)
AT	=	Averaging time (days)
C_i	=	Chemical concentration in i^{th} time period (e.g., mg/l)
CR_i	=	Contact rate in i^{th} time period (e.g., liters/day)
EF_i	=	Exposure frequency in i^{th} time period (days/year)
M	=	Number of time periods
ED	=	Exposure duration in i^{th} time period (years)
BW_i	=	Body weight in i^{th} time period (kg)

U.S. EPA typically assumes a constant body weight (typically 70 kg) in estimating lifetime cancer risk. This assumption would alter equation K-2 to yield the following:

$$I = 1/(AT+BW) \sum_{i=1}^{M} (C_i \times CR_i \times EF_i \times ED_i) \qquad \text{(K-3)}$$

Noncarcinogens

The chemical intake of noncarcinogens is estimated over the appropriate exposure period or averaging time. The averaging time selected depends on the toxic endpoint being assessed.

This assessment evaluated exposure to noncarcinogenic systemic toxicants. For systemic toxicants, intakes are calculated by averaging intakes over the period of exposure. The averaging time typically used is no longer than a year. In this assessment, it was conservatively assumed that the averaging time was a day. Therefore, equation K-1 can be simplified to:

$$I = (C \times CR) + (BW) \qquad \text{(K-4)}$$

where:

I	=	Chemical intake (mg/kg body weight/day)
C	=	Chemical concentration (e.g., mg/l)
CR	=	Contact rate (e.g., liters/day)
BW	=	Body weight (kg)

MEDIUM-SPECIFIC INTAKES

The following sections present the methodology for estimating intake from specific environmental media.

Intake--Drinking Water

An equation for calculating chemical intake through ingestion of drinking water is presented below:

$$I = (CW \times IR \times EF \times ED \times CF) + (BW \times AT) \qquad \text{(K-5)}$$

where:

I	=	Chemical intake (mg/kg body weight/day)
CW	=	Chemical concentration in water (µg/l)
IR	=	Ingestion rate (liters/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-3} mg/µg)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Intake--Soil Ingestion

An equation for calculating chemical intake through ingestion of soil or sediment is presented below:

$$I = (CS \times IR \times EF \times DF \times ED \times CF) + (BW \times AT) \qquad \text{(K-6)}$$

where:

I	=	Chemical intake (mg/kg body weight/day)
CS	=	Chemical concentration in soil (µg/kg)
IR	=	Ingestion rate (grams/day)
EF	=	Exposure frequency (days/year)
DF	=	Desorption factor (assume 100%)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-3} mg/µg x 10^{-3} kg/g)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Intake--Dermal Contact, Water

An equation for calculating chemical intake through dermal absorption of chemicals in water is presented below:

$$I = (CW \times SA \times PC \times ET \times EF \times ED \times CF) \div (BW \times AT) \quad \text{(K-7)}$$

where:

I	=	Chemical intake (mg/kg body weight/day)
CW	=	Chemical concentration in water (μg/l)
SA	=	Surface area (cm^2)
PC	=	Permeability of water (cm/hr)
ET	=	Exposure time per day (hour/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (volumetric for water and unit conversion-- 10^{-3} l/cm^3 x 10^{-3} mg/μg)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

CARCINOGENIC RISK ESTIMATION

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The cancer potency factor or slope factor (SF) converts estimated daily chemical intakes averaged over a lifetime of exposure directly to incremental risk.

To estimate risks from exposure to carcinogens, the following is needed:

- o Chronic daily intake of the chemical
- o Carcinogenic potency factor

ESTIMATING CANCER RISKS CAUSED BY EXPOSURE TO A SINGLE CARCINOGEN

The one-hit equation can be used to describe excess lifetime cancer risk from exposure to a carcinogen. This model can be described by the following:

$$Risk = 1 - exp^{-(SF \times CDI)} \qquad (K-8)$$

where:

Risk = Excess lifetime cancer risk as a unitless probability
exp = the exponential (2.71828)
SF = Slope factor or cancer potency factor $(mg/kg/day)^{-1}$
CDI = Chronic daily intake averaged over a lifetime (mg/kg/day)

Where the risks are low ($Risk < 10^{-3}$), it can generally be assumed that the dose-response relationship will be in the linear low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant and risk is directly related to intake. This can be described by:

$$Risk = SF \times CDI \qquad (K-9)$$

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 synergistic or antagonistic effects that carcinogenic risks are additive. This approach is based on the EPA's Guidelines for Health Risk Assessment of Chemical Mixtures (U.S. EPA 1986d) and the EPA's Guidelines for Cancer Risk Assessment (U.S. EPA 1986a).

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation is used:

$$Risk_T = \sum_{i=1}^{N} Risk_i \qquad (K-10)$$

where:

$Risk_T$ = Total cancer risk from route of exposure
$Risk_i$ = Cancer risk for the i^{th} chemical

NONCARCINOGENIC RISK ESTIMATION

COMPARISON OF INTAKE TO REFERENCE DOSE

The potential for noncarcinogenic health effects from exposure to a contaminant is evaluated by comparing an exposure level over a specified time period with a reference dose (RfD) for a similar time period. This ratio of exposure to toxicity is called a hazard quotient and is described below:

$$HQ = E \div RfD \qquad \text{(K-11)}$$

where:

HQ	=	Noncancer hazard quotient
E	=	Exposure level (or intake in mg/kg/day)
RfD	=	Reference dose (mg/kg/day)

This comparison can be interpreted as follows:

$HQ \geq 1$	Potential for health effects	(K-12)
$HQ < 1$	Health effects not anticipated	(K-13)

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 1986d), 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 (HI).

$$HI = E_1/RfD_1 + E_2/RfD_2 + \ldots E_i/RfD_i \qquad \text{(K-14)}$$

where:

HI	=	Hazard index
E_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 and there may be concern for potential health effects. Any single chemical with an estimated daily intake greater than the corresponding reference dose will cause the hazard index to exceed unity.

For multiple chemical exposures, the hazard index can exceed unity even if no single chemical exposure 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 separated indices are derived for each effect or target organ. If any of these 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.

GLT913/038.50

Appendix L
RISK ASSESSMENT DATA TABLES

Table L-1
SOURCE/PLUME AREA MONITORING WELL
RI SAMPLE DATA
ONALASKA SITE

NONCARCINOGENS Chemical	Detection (a) Limit Values	MW02S-01 Concentration (ug/l)	MW02M-01 Concentration (ug/l)	MW02D-01 Concentration (ug/l)	MW03S-01 Concentration (ug/l)	MW03M-01 Concentration (ug/l)	MW04S-01 Concentration (ug/l)	MW05S-01 Concentration (ug/l)
Barium	200	352	1390	152	593	2760	401	347
Benzoic acid	50	25	25	25	23	25	25	71
Chromium	10	24.8	5	5	5	5	5	5
Copper	25	8.3	12.5	8.1	12.5	12.5	12.5	12.5
1,1-Dichloroethane	5	2.5	2.5	2.5	190	2.5	2.5	570
1,1-Dichloroethene	5	2.5	2.5	2.5	15	2.5	2.5	2.5
Ethylbenzene	5	5	2.5	2	210	2.5	42	160
Lead	5	7.6	8.1	2.5	2.5	2.5	2.5	2.5
Manganese	15	1340	972	1190	3720	1260	3320	6890
2-Methylphenol	10	5	5	5	56	5	5	58
4-Methylphenol	10	5	5	5	64	5	5	110
Naphthalene	10	5	5	5	56	5	23	47
Nickel	40	27.8	7.4	5.4	19.8	6.3	20	8.8
Phenol	10	5	5	5	6	5	5	5
Toluene	5	2.5	2.5	2.5	8300	2.5	530	8300
1,1,1-Trichloroethane	5	2.5	2.5	2.5	240	2.5	2.5	2.5
Vanadium	50	8.1	25	25	3.4	25	25	25
Xylenes	5	2.5	2.5	2.5	2300	2.5	2.5	1400
Zinc	20	49.8	58.4	9.9	10.9	14.4	15.1	31.6

CARCINOGENS Chemical	Detection Limit Values	MW02S-01 Concentration (ug/l)	MW02M-01 Concentration (ug/l)	MW02D-01 Concentration (ug/l)	MW03S-01 Concentration (ug/l)	MW03M-01 Concentration (ug/l)	MW04S-01 Concentration (ug/l)	MW05S-01 Concentration (ug/l)
Arsenic	10	9.5	19.4	2.4	19.4	68.4	10.2	8
Benzene	5	5	2.5	2.5	13	2.5	2.5	7
DDD	0.10	0.05	0.05	0.05	0.05	0.05	0.38	0.05
1,4 Dichlorobenzene	10	2	5	5	5	5	5	5
1,1-Dichloroethane	5	2.5	2.5	2.5	190	2.5	2.5	570
1,1-Dichloroethene	5	2.5	2.5	2.5	15	2.5	2.5	2.5
Trichloroethene	5	2.5	2.5	2.5	11	2.5	2.5	2.5

Table L-1
SOURCE/PLUME AREA MONITORING WELL
RI SAMPLE DATA
ONALASKA SITE

NONCARCINOGENS Chemical	MW06M-01 Concentration (ug/l)	MW08S-01 Concentration (ug/l)	MW08M-01 Concentration (ug/l)	MW08D-01 Concentration (ug/l)	MW21S-01 Concentration (ug/l)	Average Concentration	(a)	Highest Detected
Barium	1370	145	600	88.2	201	699.93		2760.00
Benzoic acid	25	25	25	25	25	28.67		71.00
Chromium	5	5	5	5	5	6.65	*	24.80
Copper	12.5	6.2	12.5	12.5	12.5	11.26		12.50
1,1-Dichloroethane	36	2.5	2.5	2.5	490	108.83		570.00
1,1-Dichloroethene	2.5	2.5	2.5	2	2.5	3.50		15.00
Ethylbenzene	2.5	2.5	2.5	2.5	2.5	36.38		210.00
Lead	2.5	2.7	2.5	2.5	2.5	3.41		8.10
Manganese	4500	5690	3060	2530	3220	3141.00		6890.00
2-Methylphenol	5	5	5	5	5	13.67		58.00
4-Methylphenol	5	5	5	5	5	18.67		110.00
Naphthalene	5	5	5	5	5	14.25		56.00
Nickel	8.1	19.9	8.7	5.1	13.4	12.56		27.80
Phenol	5	5	5	5	5	5.08	*	6.00
Toluene	2.5	2.5	2.5	2.5	2.5	1429.38		8300.00
1,1,1-Trichloroethane	2.5	2.5	2.5	2.5	2.5	22.29		240.00
Vanadium	25	25	25	25	25	21.79		25.00
Xylenes	2.5	2.5	2.5	2.5	2.5	310.42		2300.00
Zinc	6.7	20.2	13.8	9	1010	104.15		1010.00

CARCINOGENS Chemical	MW06M-01 Concentration (ug/l)	MW08S-01 Concentration (ug/l)	MW08M-01 Concentration (ug/l)	MW08D-01 Concentration (ug/l)	MW21S-01 Concentration (ug/l)	Average		Highest Detected
Arsenic	1.1	5	5	3.2	5	13.05		68.40
Benzene	2.5	2.5	2.5	2.5	2.5	3.96		13.00
DDD	0.05	0.05	0.05	0.05	0.05	0.08	*	0.38
1,4 Dichlorobenzene	5	5	5	5	5	4.75		5.00
1,1-Dichloroethane	36	2.5	2.5	2.5	490	108.83		570.00
1,1-Dichloroethene	2.5	2.5	2.5	2.5	2.5	3.54	*	15.00
Trichloroethene	2.5	2.5	2.5	2.5	2.5	3.21		11.00

(a) One-half CLP detection limit value used where compound was not detected for determination of Average (Arithmetic Mean) Concentration Values.

NOTE: "*" indicates compound detected in less than 10% of monitoring wells, hence compound not required for estimation of risk.

17-Oct-89

Table L-2
TEST PIT RI SOIL SAMPLE DATA
ONALASKA SITE

Chemical	Average Concentration ug/kg	Highest Detected Concentration ug/kg
Acetone	39.87	88
Arsenic	4380	17600
Barium	93010	184000
bis(2-Ethylhexyl)phthalate	462	2300
Cadmium	2620	3500
Chromium	10360	27600
Copper	37660	217000
DDD	71.5	360
DDE	52.87	330
DDT	23.25	130
Ethylbenzene	206.68	1600
Isophorone	64	340
Lead	68000	274000
Manganese	323000	562000
Naphthalene	609.37	3500
Nickel	14170	20600
Pyrene	43	170
Toluene	299.25	1700
Trichloroethene	2.68	4
Vanadium	15450	17700
Xylenes	3140.3	24000
Zinc	157788	918000

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW02D-01 Concentration ug/l	MW02D-01 Lifetime Average Chemical Intake mg/kg/day	MW02D-01 Excess Lifetime Cancer Risk	MW02M-01 Concentration ug/l	MW02M-01 Lifetime Average Chemical Intake mg/kg/day	MW02M-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	2.4	6.857E-05	1E-04	19.4	5.543E-04	1E-03
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						1E-04			1E-03
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables--Quarterly Summary, U.S. EPA 19 89.
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW02S-01 Concentration ug/l	MW02S-01 Lifetime Average Chemical Intake mg/kg/day	MW02S-01 Excess Lifetime Cancer Risk	MW03S-01 Concentration ug/l	MW03S-01 Lifetime Average Chemical Intake mg/kg/day	MW03S-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	9.5	2.714E-04	5E-04	19.4	5.543E-04	1E-03
Benzene	A	0.029	IRIS	5	1.429E-04	4E-06	13	3.714E-04	1E-05
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST	2	5.714E-05	1E-06		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00	190	5.429E-03	5E-04
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00	15	4.286E-04	3E-04
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00	11	3.143E-04	3E-06
SUM OF RISKS						5E-04			2E-03
SUM of RISKS W/O As						6E-06			8E-04

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables--Quarterly Summary, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW03M-01 Concentration ug/l	MW03M-01 Lifetime Average Chemical Intake mg/kg/day	MW03M-01 Excess Lifetime Cancer Risk	MW04S-01 Concentration ug/l	MW04S-01 Lifetime Average Chemical Intake mg/kg/day	MW04S-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	68.4	1.954E-03	3E-03	10.2	2.914E-04	5E-04
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00	0.38	1.086E-05	3E-06
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						3E-03			5E-04
SUM of RISKS W/O As						0E+00			3E-06

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables--Quarterly Summary, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

				MW05S-01			MW06M-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	8	2.286E-04	4E-04	1.1	3.143E-05	5E-05
Benzene	A	0.029	IRIS	7	2.000E-04	6E-06		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST	570	1.629E-02	1E-03	36	1.029E-03	9E-05
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						2E-03			1E-04
SUM of RISKS W/O As						1E-03			9E-05

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables--*Quarterly Summary*, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW07M-01 Concentration ug/l	MW07M-01 Lifetime Average Chemical Intake mg/kg/day	MW07M-01 Excess Lifetime Cancer Risk	MW08D-01 Concentration ug/l	MW08D-01 Lifetime Average Chemical Intake mg/kg/day	MW08D-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	3.3	9.429E-05	2E-04	3.2	9.143E-05	2E-04
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						2E-04			2E-04
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables—Quarterly Summary, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

				MW09M-01			MW11M-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	5.3	1.514E-04	3E-04	4.1	1.171E-04	2E-04
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						3E-04			2E-04
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables--Quarterly Summary, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-3
EXCESS LIFETIME CANCER RISK
GROUNDWATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW20S-01 Concentration ug/l	MW20S-01 Lifetime Average Chemical Intake mg/kg/day	MW20S-01 Excess Lifetime Cancer Risk	MW21S-01 Concentration ug/l	MW21S-01 Lifetime Average Chemical Intake mg/kg/day	MW21S-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	3.5	0.000E+00	0E+00		0.000E+00	0E+00
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00	490	0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						0E+00			0E+00
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables—Quarterly Summary, U.S. EPA 19
U.S. EPA - U.S. EPA 1988a.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW02S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW02M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	352	0.0101	0.201	NO	1390	0.0397	0.794	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	24.8	0.0007	0.142	NO	--	0.0000	0.000	NO
Copper	0.037	HEAST	8.3	0.0002	0.006	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	5	0.0001	0.001	NO	--	0.0000	0.000	NO
Lead	0.0014	HEAST	7.6	0.0002	0.155	NO	8.1	0.0002	0.165	NO
Manganese	0.22	HEAST	1340	0.0383	0.174	NO	972	0.0278	0.126	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	27.8	0.0008	0.040	NO	7.4	0.0002	0.011	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	8.1	0.0002	0.033	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	49.8	0.0014	0.007	NO	58.4	0.0017	0.008	NO
Hazard Index (Sum of DI/RfD)					0.760				1.105	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW02D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW03S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	152	0.0043	0.087	NO	593	0.0169	0.339	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	23	0.0007	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	8.1	0.0002	0.006	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	190	0.0054	0.603	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	15	0.0004	0.048	NO
Ethylbenzene	0.1	IRIS	2	0.0001	0.001	NO	210	0.0060	0.060	NO
Lead	0.0014	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	1190	0.0340	0.155	NO	3720	0.1063	0.483	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	56	0.0016	0.003	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	64	0.0018	0.004	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	56	0.0016	0.004	NO
Nickel	0.02	(b)	5.4	0.0002	0.008	NO	19.8	0.0006	0.028	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	6	0.0002	0.004	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	8300	0.2371	0.790	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	240	0.0069	0.076	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	3.4	0.0001	0.014	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	2300	0.0657	0.033	NO
Zinc	0.2	HEAST	9.9	0.0003	0.001	NO	10.9	0.0003	0.002	NO
Hazard Index (Sum of DI/RfD)					0.257				2.491	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – Health Effects Assessment Summary Tables – Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW03M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW04S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	2760	0.0789	1.577	YES	401	0.0115	0.229	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	42	0.0012	0.012	NO
Lead	0.0014	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Manganese	0.22	HEAST	1260	0.0360	0.164	NO	3320	0.0949	0.431	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	23	0.0007	0.002	NO
Nickel	0.02	(b)	6.3	0.0002	0.009	NO	--	0.0000	0.000	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	530	0.0151	0.050	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	14.4	0.0004	0.002	NO	15.1	0.0004	0.002	NO
Hazard Index (Sum of DI/RfD)					1.752				0.727	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW05S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW06M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	347	0.0099	0.198	NO	1370	0.0391	0.783	NO
Benzoic acid	4	IRIS	71	0.0020	0.001	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	570	0.0163	1.810	YES	36	0.0010	0.114	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	160	0.0046	0.046	NO	—	0.0000	0.000	NO
Lead	0.0014	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	6890	0.1969	0.895	NO	4500	0.1286	0.584	NO
2-Methylphenol	0.5	IRIS	58	0.0017	0.003	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	110	0.0031	0.006	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	47	0.0013	0.003	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	8.8	0.0003	0.013	NO	8.1	0.0002	0.012	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	8300	0.2371	0.790	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	1400	0.0400	0.020	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	31.6	0.0009	0.005	NO	6.7	0.0002	0.001	NO
Hazard Index (Sum of DI/RfD)					3.789				1.494	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

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Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW07M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW08S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	235	0.0067	0.134	NO	145	0.0041	0.083	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	HEAST	--	0.0000	0.000	NO	6.2	0.0002	0.005	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	HEAST	--	0.0000	0.000	NO	2.7	0.0001	0.055	NO
Manganese	0.22	HEAST	718	0.0205	0.093	NO	5690	0.1626	0.739	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	--	0.0000	0.000	NO	19.9	0.0006	0.028	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	14.4	0.0004	0.002	NO	20.2	0.0006	0.003	NO
Hazard Index (Sum of DI/RfD)					0.230				0.913	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – Health Effects Assessment Summary Tables – Quarterly Summary U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW08M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW08D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	600	0.0171	0.343	NO	88.2	0.0025	0.050	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	—	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	3060	0.0874	0.397	NO	2530	0.0723	0.329	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	8.7	0.0002	0.012	NO	5.1	0.0001	0.007	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	13.8	0.0004	0.002	NO	9	0.0003	0.001	NO
Hazard Index (Sum of DI/RfD)					0.755				0.388	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW09M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW10M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	122	0.0035	0.070	NO	141	0.0040	0.081	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	991	0.0283	0.129	NO	2780	0.0794	0.361	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	—	0.0000	0.000	NO	9.2	0.0003	0.013	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	6.1	0.0002	0.001	NO	10.1	0.0003	0.001	NO
Hazard Index (Sum of DI/RfD)					0.199				0.456	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – *Health Effects Assessment Summary* Tables – Quarterly Summary. U.S EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW11M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW12S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	143	0.0041	0.082	NO	14.9	0.0004	0.009	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	1040	0.0297	0.135	NO	7.5	0.0002	0.001	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	14.2	0.0004	0.002	NO	9.6	0.0003	0.001	NO
Hazard Index (Sum of DI/RfD)					0.219				0.011	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – Health Effects Assessment Summary Tables – Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW13S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW14S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	11.3	0.0003	0.006	NO	134	0.0038	0.077	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Manganese	0.22	HEAST	19.1	0.0005	0.002	NO	952	0.0272	0.124	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	5.8	0.0002	0.001	NO	5.8	0.0002	0.001	NO
Hazard Index (Sum of DI/RfD)					0.010				0.201	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary U S EPA 1989
(b) Nickel value base on nickel-soluble salts

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW20S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW20D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	1280	0.0366	0.731	NO	24.8	0.0007	0.014	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	HEAST	2	0.0001	0.041	NO	—	0.0000	0.000	NO
Manganese	0.22	HEAST	7710	0.2203	1.001	YES	100	0.0029	0.013	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	5.6	0.0002	0.008	NO	—	0.0000	0.000	NO
Phenol	0.04	IRIS								
Toluene	0.3	IRIS	—	0.0000	0.000	NO		0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	491	0.0140	0.007	NO	—	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					1.789				0.027	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – Health Effects Assessment Summary Tables – Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-4
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW21S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	201	0.0057	0.115	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO
Copper	0.037	HEAST	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	490	0.0140	1.556	YES
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO
Lead	0.0014	HEAST	--	0.0000	0.000	NO
Manganese	0.22	HEAST	3220	0.0920	0.418	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO
Nickel	0.02	(b)	13.4	0.0004	0.019	NO
Phenol	0.04	IRIS				
Toluene	0.3	IRIS		0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO
Zinc	0.2	HEAST	--	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					2.108	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.
(b) Nickel value base on nickel-soluble salts.

Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

				MW02D-01			MW02M-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	2.4	5.786E-08	1E-07	19.4	4.677E-07	8E-07
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						1E-07			8E-07
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

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Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

				MW02S-01			MW03S-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	9.5	2.290E-07	4E-07	19.4	4.677E-07	8E-07
Benzene	A	0.029	IRIS	5	1.205E-07	3E-09	13	3.134E-07	9E-09
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST	2	4.821E-08	1E-09		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00	190	4.580E-06	4E-07
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00	15	3.616E-07	2E-07
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00	11	2.652E-07	3E-09
SUM OF RISKS						4E-07			1E-06
SUM of RISKS W/O As						5E-09			6E-07

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) *Sources of Cancer Potency Factors:*
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW03M-01 Concentration ug/l	MW03M-01 Lifetime Average Chemical Intake mg/kg/day	MW03M-01 Excess Lifetime Cancer Risk	MW04S-01 Concentration ug/l	MW04S-01 Lifetime Average Chemical Intake mg/kg/day	MW04S-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	68.4	1.649E-06	3E-06	10.2	2.459E-07	4E-07
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00	0.38	9.161E-09	2E-09
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						3E-06			4E-07
SUM of RISKS W/O As						0E+00			2E-09

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

				MW05S-01			MW06M-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	8	1.929E-07	3E-07	1.1	2.652E-08	5E-08
Benzene	A	0.029	IRIS	7	1.687E-07	5E-09		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST	570	1.374E-05	1E-06	36	8.679E-07	8E-08
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						2E-06			1E-07
SUM of RISKS W/O As						1E-06			8E-08

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW07M-01 Concentration ug/l	MW07M-01 Lifetime Average Chemical Intake mg/kg/day	MW07M-01 Excess Lifetime Cancer Risk	MW08D-01 Concentration ug/l	MW08D-01 Lifetime Average Chemical Intake mg/kg/day	MW08D-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	3.3	7.955E-08	1E-07	3.2	7.714E-08	1E-07
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						1E-07			1E-07
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-5
EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	MW09M-01 Concentration ug/l	MW09M-01 Lifetime Average Chemical Intake mg/kg/day	MW09M-01 Excess Lifetime Cancer Risk	MW11M-01 Concentration ug/l	MW11M-01 Lifetime Average Chemical Intake mg/kg/day	MW11M-01 Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	5.3	1.278E-07	2E-07	4.1	9.884E-08	2E-07
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						2E-07			2E-07
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-5

EXCESS LIFETIME CANCER RISK
GROUNDWATER DERMAL ABSORPTION EXPOSURE
ONALASKA SITE

				MW20S-01			MW21S-01		
Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk	Concentration ug/l	Lifetime Average Chemical Intake mg/kg/day	Excess Lifetime Cancer Risk
Arsenic	A	1.75	U.S. EPA	3.5	0.000E+00	0E+00		0.000E+00	0E+00
Benzene	A	0.029	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
DDD	B2	0.24	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
1,4 Dichlorobenzene	B2	0.024	HEAST		0.000E+00	0E+00		0.000E+00	0E+00
1,1-Dichloroethane	C	0.091	HEAST		0.000E+00	0E+00	490	0.000E+00	0E+00
1,1-Dichloroethene	C	0.6	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
Trichloroethene	B2	0.011	IRIS		0.000E+00	0E+00		0.000E+00	0E+00
SUM OF RISKS						0E+00			0E+00
SUM of RISKS W/O As						0E+00			0E+00

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Water Absorption Rate (mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hr)	0.25
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime Average Water Intake (liters/kg body wt./day)	0.00002

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System, U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables, U.S. EPA 1989.
U.S. EPA - U.S. EPA 1988a.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW02S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW02M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	352	0.0008	0.017	NO	1390	0.0034	0.067	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	24.8	0.0001	0.012	NO	--	0.0000	0.000	NO
Copper	0.037	SPHEM	8.3	0.0000	0.001	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	5	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	SPHEM	7.6	0.0000	0.013	NO	8.1	0.0000	0.014	NO
Manganese	0.22	SPHEM	1340	0.0032	0.015	NO	972	0.0023	0.011	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	27.8	0.0001	0.003	NO	7.4	0.0000	0.001	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	8.1	0.0000	0.003	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	49.8	0.0001	0.001	NO	58.4	0.0001	0.001	NO
Hazard Index (Sum of DI/RfD)					0.064				0.093	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U S EPA 1988
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U S EPA 1989

(b) Nickel value base on nickel-soluble salts

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW02D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW03S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	152	0.0004	0.007	NO	593	0.0014	0.029	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	23	0.0001	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	SPHEM	8.1	0.0000	0.001	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	190	0.0005	0.051	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	15	0.0000	0.004	NO
Ethylbenzene	0.1	IRIS	2	0.0000	0.000	NO	210	0.0005	0.005	NO
Lead	0.0014	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	SPHEM	1190	0.0029	0.013	NO	3720	0.0090	0.041	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	56	0.0001	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	64	0.0002	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	56	0.0001	0.000	NO
Nickel	0.02	(b)	5.4	0.0000	0.001	NO	19.8	0.0000	0.002	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	6	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	8300	0.0200	0.067	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	240	0.0006	0.006	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	3.4	0.0000	0.001	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	2300	0.0055	0.003	NO
Zinc	0.2	HEAST	9.9	0.0000	0.000	NO	10.9	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.022				0.210	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW03M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW04S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	2760	0.0067	0.133	NO	401	0.0010	0.019	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	42	0.0001	0.001	NO
Lead	0.0014	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Manganese	0.22	SPHEM	1260	0.0030	0.014	NO	3320	0.0080	0.036	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	23	0.0001	0.000	NO
Nickel	0.02	(b)	6.3	0.0000	0.001	NO	--	0.0000	0.000	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	530	0.0013	0.004	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	14.4	0.0000	0.000	NO	15.1	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.148				0.061	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW05S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW06M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	347	0.0008	0.017	NO	1370	0.0033	0.066	NO
Benzoic acid	4	IRIS	71	0.0002	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	570	0.0014	0.153	NO	36	0.0001	0.010	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	160	0.0004	0.004	NO	—	0.0000	0.000	NO
Lead	0.0014	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	SPHEM	6890	0.0166	0.075	NO	4500	0.0108	0.049	NO
2-Methylphenol	0.5	IRIS	58	0.0001	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	110	0.0003	0.001	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	47	0.0001	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	8.8	0.0000	0.001	NO	8.1	0.0000	0.001	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	8300	0.0200	0.067	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	1400	0.0034	0.002	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	31.6	0.0001	0.000	NO	6.7	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.320				0.126	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW07M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW08S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	235	0.0006	0.011	NO	145	0.0003	0.007	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	SPHEM	--	0.0000	0.000	NO	6.2	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	SPHEM	--	0.0000	0.000	NO	2.7	0.0000	0.005	NO
Manganese	0.22	SPHEM	718	0.0017	0.008	NO	5690	0.0137	0.062	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	--	0.0000	0.000	NO	19.9	0.0000	0.002	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	14.4	0.0000	0.000	NO	20.2	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.019				0.077	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) *Sources of RfDs:*
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW08M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW08D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	600	0.0014	0.029	NO	88.2	0.0002	0.004	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	SPHEM	3060	0.0074	0.034	NO	2530	0.0061	0.028	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	8.7	0.0000	0.001	NO	5.1	0.0000	0.001	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	13.8	0.0000	0.000	NO	9	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.064				0.033	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
**COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE**

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW09M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW10M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	122	0.0003	0.006	NO	141	0.0003	0.007	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Manganese	0.22	SPHEM	991	0.0024	0.011	NO	2780	0.0067	0.030	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	--	0.0000	0.000	NO	9.2	0.0000	0.001	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	6.1	0.0000	0.000	NO	10.1	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.017				0.038	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW11M-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW12S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	143	0.0003	0.007	NO	14.9	0.0000	0.001	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Copper	0.037	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Lead	0.0014	SPHEM	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Manganese	0.22	SPHEM	1040	0.0025	0.011	NO	7.5	0.0000	0.000	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Nickel	0.02	(b)	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Phenol	0.04	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Toluene	0.3	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO	--	0.0000	0.000	NO
Zinc	0.2	HEAST	14.2	0.0000	0.000	NO	9.6	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.018				0.001	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD) DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW13S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW14S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	11.3	0.0000	0.001	NO	134	0.0003	0.006	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Manganese	0.22	SPHEM	19.1	0.0000	0.000	NO	952	0.0023	0.010	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Phenol	0.04	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	5.8	0.0000	0.000	NO	5.8	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.001				0.017	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts.

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW20S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?	MW20D-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	1280	0.0031	0.062	NO	24.8	0.0001	0.001	NO
Benzoic acid	4	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Cadmium	0.0005	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Chromium VI	0.005	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Copper	0.037	SPHEM	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
1,1-Dichloroethene	0.009	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Lead	0.0014	SPHEM	2	0.0000	0.003	NO	—	0.0000	0.000	NO
Manganese	0.22	SPHEM	7710	0.0186	0.084	NO	100	0.0002	0.001	NO
2-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Naphthalene	0.4	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Nickel	0.02	(b)	5.6	0.0000	0.001	NO	—	0.0000	0.000	NO
Phenol	0.04	IRIS		0.0000	0.000	NO		0.0000	0.000	NO
Toluene	0.3	IRIS	—	0.0000	0.000	NO		0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Vanadium	0.007	HEAST	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Xylenes	2	IRIS	—	0.0000	0.000	NO	—	0.0000	0.000	NO
Zinc	0.2	HEAST	491	0.0012	0.006	NO	—	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.156				0.002	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS – Integrated Risk Information System. U.S. EPA 1988.
HEAST – Health Effects Assessment Summary Tables – *Quarterly Summary*. U.S. EPA 1989.

(b) Nickel value base on nickel-soluble salts

Table L-6
COMPARISON OF ESTIMATED DAILY INTAKE
TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION EXPOSURE

Chemical	Reference Dose (RfD) mg/kg/day	Source (a)	MW21S-01 Concentration ug/l	Daily Intake (DI) mg/kg/day	DI/RfD	Intake Exceeds Reference Dose?
Barium	0.05	IRIS	201	0.0005	0.010	NO
Benzoic acid	4	IRIS	--	0.0000	0.000	NO
gamma BHC (lindane)	0.0003	IRIS	--	0.0000	0.000	NO
bis(2-ethylhexyl)phthalate	0.02	IRIS	--	0.0000	0.000	NO
Cadmium	0.0005	HEAST	--	0.0000	0.000	NO
Chromium VI	0.005	IRIS	--	0.0000	0.000	NO
Copper	0.037	SPHEM	--	0.0000	0.000	NO
1,1-Dichloroethane	0.009	IRIS	490	0.0012	0.131	NO
1,1-Dichloroethene	0.009	IRIS	--	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	--	0.0000	0.000	NO
Lead	0.0014	SPHEM	--	0.0000	0.000	NO
Manganese	0.22	SPHEM	3220	0.0078	0.035	NO
2-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	--	0.0000	0.000	NO
Naphthalene	0.4	HEAST	--	0.0000	0.000	NO
Nickel	0.02	(b)	13.4	0.0000	0.002	NO
Phenol	0.04	IRIS		0.0000	0.000	NO
Toluene	0.3	IRIS		0.0000	0.000	NO
1,1,1-Trichloroethane	0.09	IRIS	--	0.0000	0.000	NO
Vanadium	0.007	HEAST	--	0.0000	0.000	NO
Xylenes	2	IRIS	--	0.0000	0.000	NO
Zinc	0.2	HEAST	--	0.0000	0.000	NO
Hazard Index (Sum of DI/RfD)					0.178	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate(mg/cm2/hr)	0.5
Body Weight (kilograms)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water	0.25
Water intake (l/kg-day)	0.0024

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U S EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary U S EPA 1989

(b) Nickel value base on nickel-soluble salts

Table L-7
EXCESS LIFETIME CANCER RISK
WATER INGESTION - MEAN MONITORING WELL CONCENTRATIONS
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Carcinogenic Potency Factor (kg-day/mg)	Source (a)	Average (b) Concentration (ug/l)	Lifetime Average Chemical Intake (mg/kg/day)	Excess Lifetime Cancer Risk
Arsenic	A	1.75	HEAST	13.05	3.729E-04	7E-04
Benzene	A	0.029	IRIS	3.96	1.131E-04	3E-06
1,1-Dichloroethane	C	0.091	HEAST	108.83	3.109E-03	3E-04
SUM OF RISKS						9E-04
SUM of RISKS W/O As (d)						3E-04

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Daily Water Intake (liters/day)	2
Body Weight (kilograms)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	70
Lifetime Average Water Intake (liters/kg body wt./day)	0.029

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989

(b) Average = Arithmetic Mean Value for groundwater monitoring well data for compounds detected in greater than 10% of 12 source/downgradient monitoring wells.

(c) Highest detected concentration in 12 source/downgradient monitoring wells.

(d) Arsenic detected above background concentration at one well only (MW03M), hence this value is most representative of excess lifetime cancer risk.

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Table L-8
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
WATER INGESTION EXPOSURE
ONALASKA SITE

Chemical	Reference Dose (RfD) (mg/kg/day)	Source (a)	Average (b) Concentration (ug/l)	Daily Intake (DI) (mg/kg/day)	DI/RfD	Intake Exceeds eference Dose?
Barium	0.05	IRIS	699.93	0.0200	0.400	NO
Benzoic acid	4	IRIS	28.67	0.0008	0.000	NO
Copper	0.037	d	11.26	0.0003	0.009	NO
1,1-Dichloroethane	0.009	IRIS	108.83	0.0031	0.345	NO
Ethylbenzene	0.1	IRIS	36.38	0.0010	0.010	NO
Lead	0.0014	HEAST	3.41	0.0001	0.070	NO
Manganese	0.22	HEAST	3141	0.0897	0.408	NO
2-Methylphenol	0.5	IRIS	13.67	0.0004	0.001	NO
4-Methylphenol	0.5	IRIS	18.67	0.0005	0.001	NO
Naphthalene	0.4	HEAST	14.25	0.0004	0.001	NO
Nickel	0.02	c	12.56	0.0004	0.018	NO
Toluene	0.3	IRIS	1429.38	0.0408	0.136	NO
Vanadium	0.007	HEAST	21.79	0.0006	0.089	NO
Xylenes	2	IRIS	310.42	0.0089	0.004	NO
Zinc	0.2	HEAST	104.15	0.0030	0.015	NO
Hazard Index (Sum of DI/RfD)					1.507	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water Intake (liters/day)	2
Body Weight (kilograms)	70

(a) *Sources of Cancer Potency Factors:*
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables - Quarterly Summary. U.S. EPA 1989

(b) Average = Arithmetic Mean Value for groundwater monitoring well data for compounds detected in greater than 10% of 12 source/downgradient monitoring wells.

(c) Nickel value based on nicklessoluble salts

(d) Copper RfD based on proposed MCLG. See HEAST.

Table L-9
EXCESS LIFETIME CANCER RISK
DERMAL ABSORPTION OF CONTAMINANTS IN GROUNDWATER
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Cancer Potency Factor (kg-day/mg)	Source (a)	Average Concentration ug/l	Lifetime Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
Arsenic	A	2	(c)	13.05	3.146E-07	6E-07
Benzene	A	0.029	IRIS	3.96	9.546E-08	3E-09
1,1-Dichloroethane	B2	0.091	HEAST	108.83	2.624E-06	2E-07
SUM OF RISKS						9E-07

EXPOSURE ASSUMPTIONS

Exposure Setting

Exposed Individual

Water absorption rate (mg/cm2/hr)	0.5
Body weight (kg)	70
Surface area (cm2)	18000
Percent submerged	0.75
Time in water (hrs/day)	0.25
Number of days per week	7
Number of weeks per year	52
Number of years exposed	75
Years in lifetime	75
Lifetime average media intake (l/kg body wt./day)	0.0000241

(a) Cancer potency values based on ingestion. Sources of cancer potency factors:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables. U.S. EPA 1989

(b) Average = Arithmetic mean for groundwater MW da MW data for compounds detected in > 10% of MWs f 13 source/downgradient MWs

(c) Based on Risk Assessment Council unit risk of 5x10-5(ug/l)-1. U.S. EPA 1988.

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Table L-10
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
DERMAL ABSORPTION OF CONTAMINANTS IN GROUNDWATER
ONALASKA SITE

Chemical	Reference Dose (RfD) mg/kg-day	Source (a	Average Concentration ug/l	Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD?
Barium	0.05	IRIS	699.93	0.0017	0.034	NO
Benzoic acid	4	IRIS	28.67	0.0001	0.000	NO
Copper	0.037	d	11.26	0.0000	0.001	NO
1,1-Dichloroethane	0.009	IRIS	108.83	0.0003	0.029	NO
Ethylbenzene	0.1	IRIS	36.38	0.0001	0.001	NO
Lead	0.0014	HEAST	3.41	0.0000	0.006	NO
Manganese	0.2	HEAST	3141	0.0076	0.038	NO
2-Methylphenol	0.5	IRIS	13.67	0.0000	0.000	NO
4-Methylphenol	0.5	IRIS	18.67	0.0000	0.000	NO
Naphthalene	0.4	HEAST	14.25	0.0000	0.000	NO
Nickel	0.02	c	12.56	0.0000	0.002	NO
Toluene	0.3	IRIS	1429.38	0.0034	0.011	NO
Vanadium	0.007	HEAST	21.79	0.0001	0.008	NO
Xylenes	2	IRIS	310.42	0.0007	0.000	NO
Zinc	0.2	HEAST	104.15	0.0003	0.001	NO
Hazard Index (Sum of DI/RfD) =					0.131	

EXPOSURE ASSUMPTIONS

Exposure Setting	Residential
Exposed Individual	Adult
Water absorption rate (mg/cm2/hr)	0.5
Body weight (kg)	70
Surface area (cm2)	18000
Percent submerged	75
Time in water (hrs/day)	0.25
Water Intake (l/kg-day)	0.002411

(a) Based on ingestion RfDs. Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables. U.S. EPA 1989
(b) Average = Arithmetic mean for groundwater MW data for compounds detected in >10% of 12 source/downgradient MW.
(c) Nickel value base on nickel-soluble salts.
(d) Copper RfD based on proposed MCLG. See HEAST.

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Table L-11
EXCESS LIFETIME CANCER RISK
TRESPASS SOIL INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Cancer Potency Factor (kg-day/mg)	Source (a)	Average Concentration ug/kg	Lifetime Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
Arsenic	A	2	c	4380	6.385E-08	1E-07
bis(2-Ethylhexyl)phthalate	B2	0.014	IRIS	462	6.735E-09	9E-11
DDD	B2	0.24	IRIS	71.5	1.042E-09	3E-10
DDE	B2	0.34	IRIS	52.87	7.707E-10	3E-10
DDT	B2	0.34	IRIS	23.25	3.389E-10	1E-10
Trichloroethene	B2	0.011	IRIS	2.68	3.907E-11	4E-13
SUM OF RISKS						1E-07
SUM OF RISKS W/O As						7E-10

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Soil ingestion rate (g/day)	0.1
Body weight (kg)	70
Number of days/week exposed	2
Number of weeks/year exposed	26
Number of years exposed	5
Years in lifetime	70
Lifetime average soil intake (g/kg body weight per day)	0.000015

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System. U.S. EPA 1988.

(b) Based on Risk Assessment Council unit risk of 5x10-5(ug/l)-1. U.S. EPA 1988.

Table L-12
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
TRESPASS SOIL INGESTION EXPOSURE
ONALASKA SITE

Chemical	Reference Dose (RfD) mg/kg-day	Source (a)	Average Concentration ug/kg	Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD?
Acetone	0.1	IRIS	39.87	0.0000	0.000	NO
Barium	0.05	IRIS	93010	0.0003	0.005	NO
bis(2-Ethylhexyl)phthalate	0.02	IRIS	462	0.0000	0.000	NO
Cadmium	0.0005	HEAST	2620	0.0000	0.015	NO
Chromium VI	0.005	IRIS	10360	0.0000	0.006	NO
Copper	0.037	d	37660	0.0001	0.003	NO
DDT	0.0005	IRIS	23.25	0.0000	0.000	NO
Ethylbenzene	0.1	IRIS	206.68	0.0000	0.000	NO
Isophorone	0.15	IRIS	64	0.0000	0.000	NO
Lead	0.0014	HEAST	68000	0.0002	0.139	NO
Manganese	0.2	HEAST	323000	0.0009	0.005	NO
Naphthalene	0.4	HEAST	609.37	0.0000	0.000	NO
Nickel	0.02	c	14170	0.0000	0.002	NO
Pyrene	0.003	HEAST	43	0.0000	0.000	NO
Toluene	0.3	IRIS	299.25	0.0000	0.000	NO
Vanadium	0.007	HEAST	15450	0.0000	0.006	NO
Xylenes	2	IRIS	3140.3	0.0000	0.000	NO
Zinc	0.2	HEAST	158000	0.0005	0.002	NO
Hazard Index (Sum of DI/RfD)					0.1834	

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Exposed individual	Child(10 yrs)
Soil intake (grams/day)	0.1
Body weight (kilograms)	35

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables. U.S. EPA 1989

(b) Cyanide value based on free cyanide.

(c) Nickel value base on nickel-soluble salts.

(d) Copper RfD based on proposed MCLG. See HEAST.

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Table L-13
EXCESS LIFETIME CANCER RISK
RESIDENTIAL SOIL INGESTION EXPOSURE
ONALASKA SITE

Chemical	U.S. EPA Carcinogen Classification	Cancer Potency Factor (kg-day/mg)	Source (a)	Average (b) Concentration ug/kg	Lifetime Average Chemical Intake (mg/kg-day)	Excess Lifetime Cancer Risk
Arsenic	A	2	c	4380	6.257E-06	1E-05
bis(2-Ethylhexyl)phthalate	B2	0.014	IRIS	462	6.600E-07	9E-09
DDD	B2	0.24	IRIS	71.5	1.021E-07	2E-08
DDE	B2	0.34	IRIS	52.87	7.553E-08	3E-08
DDT	B2	0.34	IRIS	23.25	3.321E-08	1E-08
Trichloroethene	B2	0.011	IRIS	2.68	3.829E-09	4E-11
SUM OF RISKS						1E-05
SUM OF RISKS W/O As						7E-08

EXPOSURE ASSUMPTIONS

Exposure setting	Residential
Soil ingestion rate (g/day)	0.1
Body weight (kg)	70
Number of days/week exposed	7
Number of weeks/year exposed	52
Number of years exposed	75
Years in lifetime	75
Lifetime average soil intake (g/kg body weight per day)	0.0014

(a) Sources of Cancer Potency Factors:
IRIS - Integrated Risk Information System. U.S. EPA 1988.

(b) Carcinogenic PAHs based on benzo[a]pyrene. Benzo[a]pyrene potency from Ambient Water Quality Criteria Document. U.S. EPA 1980.

(c) Based on Risk Assessment Council unit risk of 5x10-5(ug/l)-1. U.S. EPA 1988.

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Table L-14
COMPARISON OF ESTIMATED DAILY INTAKE TO REFERENCE DOSE (RfD)
RESIDENTIAL SOIL INGESTION EXPOSURE
ONALASKA SITE

Chemical	Reference Dose (RfD) mg/kg-day	Source (a)	Average Concentration ug/kg	Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD?
Acetone	0.1	IRIS	39.87	0.0000	0.000	NO
Barium	0.05	IRIS	93010	0.0012	0.025	NO
bis(2-Ethylhexyl)phthalate	0.02	IRIS	462	0.0000	0.000	NO
Cadmium	0.0005	HEAST	2620	0.0000	0.070	NO
Chromium VI	0.005	IRIS	10360	0.0001	0.028	NO
Copper	0.037	d	37660	0.0005	0.014	NO
DDT	0.0005	IRIS	23.25	0.0000	0.001	NO
Ethylbenzene	0.1	IRIS	206.68	0.0000	0.000	NO
Isophorone	0.15	IRIS	64	0.0000	0.000	NO
Lead	0.0014	HEAST	68000	0.0009	0.648	NO
Manganese	0.2	HEAST	323000	0.0043	0.022	NO
Naphthalene	0.4	HEAST	609.37	0.0000	0.000	NO
Nickel	0.02	c	14170	0.0002	0.009	NO
Pyrene	0.003	HEAST	43	0.0000	0.000	NO
Toluene	0.3	IRIS	299.25	0.0000	0.000	NO
Vanadium	0.007	HEAST	15450	0.0002	0.029	NO
Xylenes	2	IRIS	3140.3	0.0000	0.000	NO
Zinc	0.2	HEAST	158000	0.0021	0.011	NO
Hazard Index (Sum of DI/RfD)					0.8556	

EXPOSURE ASSUMPTIONS

Exposure setting	Trespass
Exposed individual	Child(toddler)
Soil intake (grams/day)	0.2
Body weight (kilograms)	15

(a) Sources of RfDs:
IRIS - Integrated Risk Information System. U.S. EPA 1988.
HEAST - Health Effects Assessment Summary Tables. U.S. EPA 1989

(b) Cyanide value based on free cyanide.

(c) Nickel value base on nickel-soluble salts.

(d) Copper RfD based on proposed MCLG. See HEAST.