ASSESSMENT OF THE GEOLOGICAL AND HYDROGEOLOGICAL CHARACTERISTICS OF THE OVERBURDEN BELOW THE S-AREA AND NORTHERN AREA

S-Area Remedial Program

August 1988
Ref. No. 1769

CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

As part of the S-Area Remedial Program specified by the Stipulation and Judgment Approving Settlement Agreement (Settlement Agreement), Occidental Chemical Corporation (OCC) has conducted subsurface investigation surveys of the S-Area Landfill Site and the Northern Site (Study Area) as shown in Figure 1. This involved the drilling, sampling and testing of various wells and boreholes as specified in the Settlement Agreement.

Paragraph C(1) - Site Containment System and Paragraph D(1) - Northern Containment System of the Settlement Agreement specify that the geologic and hydrologic characteristics of the overburden at the Study Area be investigated. The drilling program included boreholes installed for the purpose of defining the areal extent of a Confining Layer or a 10-foot Confining Layer beneath the Study Area. Stratigraphic information from other wells or boreholes installed as part of the subsurface investigation or installed prior to the Settlement Agreement was also used in the definition of the Confining Layer and any Confining Layer Discontinuities identified therein.

Following data collection and assessment, with respect to the Confining Layer, the entire Study Area

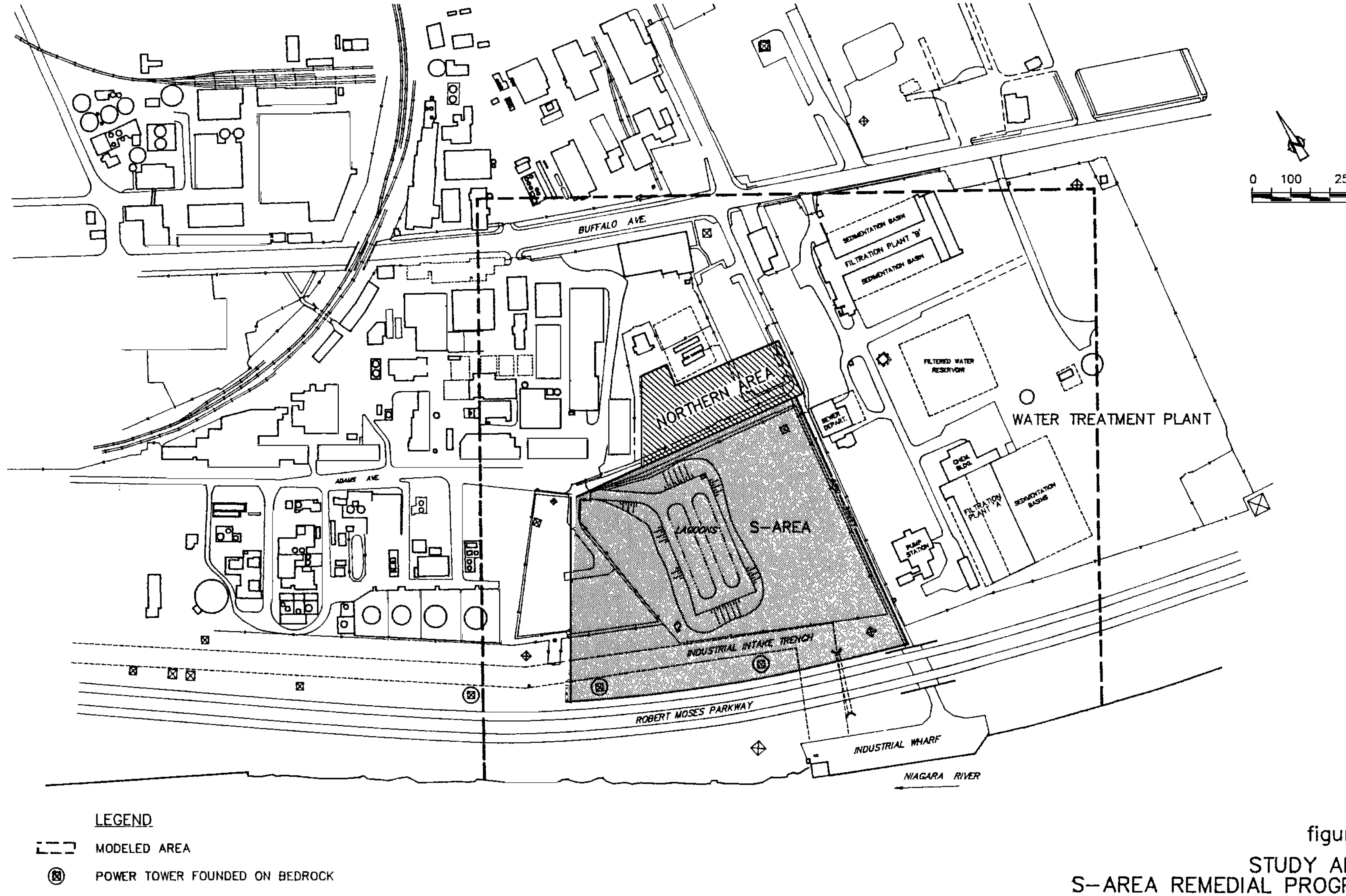

figure 1

STUDY AREA
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was modeled. The modeling procedure required the use of two computer models. The first model, FE3DGW, a three-dimensional finite element model, was used to:

i) determine if an upward hydraulic gradient is expected to be present in the Study Area above 10-foot Confining Layer following Stabilization,

ii) if an upward gradient is not present throughout the S-Area Landfill Site, determine the length required, if any, of a northern portion of the Site Collection System along the northern Site Barrier Wall alignment. (Subparagraphs C(2)(f) and (g)), and

iii) determine if an upward hydraulic gradient is expected to be created within the area of any Confining Layer Discontinuity following Stabilization (Subparagraph C(1)(e)(i)).

The second model, the "S-Area Two-Phase Flow Model", was used to determine if the upward gradient expected to be achieved in the area of a Confining Layer Discontinuity after Stabilization is sufficient to retain NAPL in the overburden. The water levels generated by the FE3DGW model were used as input to the S-Area Two-Phase Flow Model (Subparagraph C(1)(e)(ii)).

Definitions of Confining Layer and Confining Layer Discontinuity are presented in Section 3.0.

If both conditions described in Subparagraph C(1)(e) are satisfied, the Confining Layer Discontinuity satisfies the condition for a Confining Layer Equivalent. If the Confining Layer Equivalent conditions are not satisfied, the Confining Layer Discontinuity beneath the S-Area Landfill Site will require sealing by grouting or a technology which is the performance equivalent.

Sections 2 through 6 inclusive present the results of the subsurface investigation surveys and define the Confining Layer within the confines of the proposed Site Barrier Wall and Northern System Barrier Wall based on the data collected. Section 7 evaluates the impact of the remedial program on the hydraulic conditions in the Study Area.

2.0 BACKGROUND INFORMATION

The information used in the evaluation of the Confining Layer has been compiled from two sources; a series of historical hydrogeologic studies conducted in the vicinity of the S-Area Landfill Site between 1978 and 1982 (discussed in subsequent paragraphs) and the subsurface investigation surveys conducted between 1986 and 1988 pursuant to the Settlement Agreement. Historical information pertinent to the Confining Layer evaluation and the data from the subsurface investigation surveys have been compiled and were presented in the report entitled "Information Summary Report - S-Area Remedial Program - June 1988." The pertinent information includes the stratigraphic logs of the geologic strata encountered at each borehole and well, physical properties of clay and till materials encountered during drilling and injection test results to determine the hydraulic conductivity of the overburden overlying the 10-foot Confining Layer.

Data from the following historical studies were used in the preparation of this report.

a) In 1979, Leggette, Brashears and Graham undertook a site investigation of the entire OCC Niagara Plant, the City of Niagara Falls Drinking Water Treatment Plant to the east and the Robert Moses Parkway to the south. A number of the wells installed during this investigation were completed in the vicinity of the study area. Stratigraphic information from the following wells was used in the compilation of this report:

WS14A	WS43A
WS15A	WS45A
WS16	WS46A
WS17	WS47A
WS18	CW1
WS35A	CW1B
WS36A	SP4A

b) In 1980, Leggette, Brashears and Graham together with Conestoga-Rovers & Associates (CRA) installed nine wells specifically at the S-Area Landfill Site. These wells were designated OW1S-80 through OW9S-80.

c) Later in 1980, CRA augmented the site investigation at the OCC Niagara Plant and along the Robert Moses Parkway with additional well installations. Some of these wells were also within the S-Area Landfill Site and the Northern Area and the stratigraphic information for these wells was used as listed below:

WS53

WS54

WS89

d) In December 1981, CRA initiated an investigation of the Confining Layer and NAPL presence which involved the installation of nine boreholes (BH1-81 through BH8-81 and BH14-81). Subsequently, in March 1982, the remaining ten boreholes (BH9-82 and BH15-82 through BH23-82) were installed. The stratigraphic information from all of these boreholes except BH17-82 and BH18-82, which were installed south of the Robert Moses Parkway, was used in the compilation of this report.

Data from these drilling installations will hereinafter be referred to as "historical" well and borehole stratigraphic information. A complete set of the stratigraphic logs for each of the wells and boreholes installed in the vicinity of the S-Area Landfill Site under the historical programs is presented in the report entitled "Information Summary Report - S-Area Remedial Program - June 1988".

3.0 INVESTIGATION OF THE CONFINING LAYER AND CONFINING LAYER DISCONTINUITY

3.1 DEFINITION OF TERMS

As defined in the Settlement Agreement, a Confining Layer is a "stratum which (i) has a maximum permeability of 1×10^{-7} cm/sec, (ii) has a continuous thickness of at least three feet, and (iii) does not contain non-aqueous liquid or solid phase chemicals". A Confining Layer Discontinuity is subsequently defined as any "portion of the Overburden in which the borings drilled... do not reveal a Confining Layer". To this end, boreholes were drilled through the overburden materials to the top of the bedrock and logged for stratigraphy in order to evaluate the presence and thickness of the various stratigraphic units.

3.2 INFORMATION USED IN THE INVESTIGATION

The Settlement Agreement specifies the installation of boreholes "at approximately 100-foot intervals along the proposed alignment of the Site Barrier Wall and those portions of the Site Collection System which are not immediately adjacent to the proposed alignment of the Site Barrier Wall" and "along the proposed alignment of the Northern System Barrier Wall and the Northern Collection System" (BH100 through BH155 and OW210, OW212, OW245 and

OW269). Subsequent to the installation of these 56 boreholes and four wells, eight additional boreholes were installed between those boreholes which revealed less than five feet of Confining Layer materials (BH194 through BH196 and BH217 through BH221).

In addition, the Settlement Agreement specifies the installation of 21 boreholes within the area of the Site Barrier Wall (BH156 through BH176) from which stratigraphic information was gathered at the time of sampling for grain size distribution, plasticity and permeability, where required. This information was used to define the Confining Layer and 10-foot Confining Layer within the interior of the S-Area Landfill Site.

Prior to commencing the subsurface investigation surveys and using the available historical stratigraphic information, OCC specified the installation of an additional eight boreholes within the Site Barrier Wall at which a Confining Layer Discontinuity was estimated to be present (BH177 through BH184). During the subsurface investigation, 29 more boreholes were installed in order to comply with the Settlement Agreement which specified that any Confining Layer Discontinuity "be defined by drilling additional borings along a grid of no greater than 50-foot centers, proceeding away from each boring drilled ... which revealed a Confining Layer Discontinuity" (BH185 through BH193 and BH197 through BH216). The stratigraphic information from OW213 was also used for this purpose.

It should be noted that these additional boreholes were selected using only the low permeability clay layer at the adjacent boreholes as meeting the requirements of a Confining Layer. Subsequent laboratory permeability testing (see Section 5.1) has proven that a majority of the underlying till layer also meets the Confining Layer requirements. Thus, all of the additional 29 boreholes were not required and it should not be assumed that the Confining Layer Discontinuity reaches the outer extremities of these additional boreholes.

Figure 2 presents the locations of all the boreholes and wells used in the definition of the Confining Layer and Confining Layer Discontinuity. This includes the installations which are part of the subsurface investigation surveys as well as any historical wells and boreholes within the Site Barrier Wall and the Northern Barrier Wall. The historical wells and boreholes used are listed below:

Wells	Boreholes
WS14A	BH 4-81
WS16	BH 5-81
WS17	BH 14-81
WS18	BH 9-82
CW1	BH 15-82
SP4A	BH 16-82
	BH 19-82
	BH 20-82
	BH 21-82
	BH 22-82
	BH 23-82

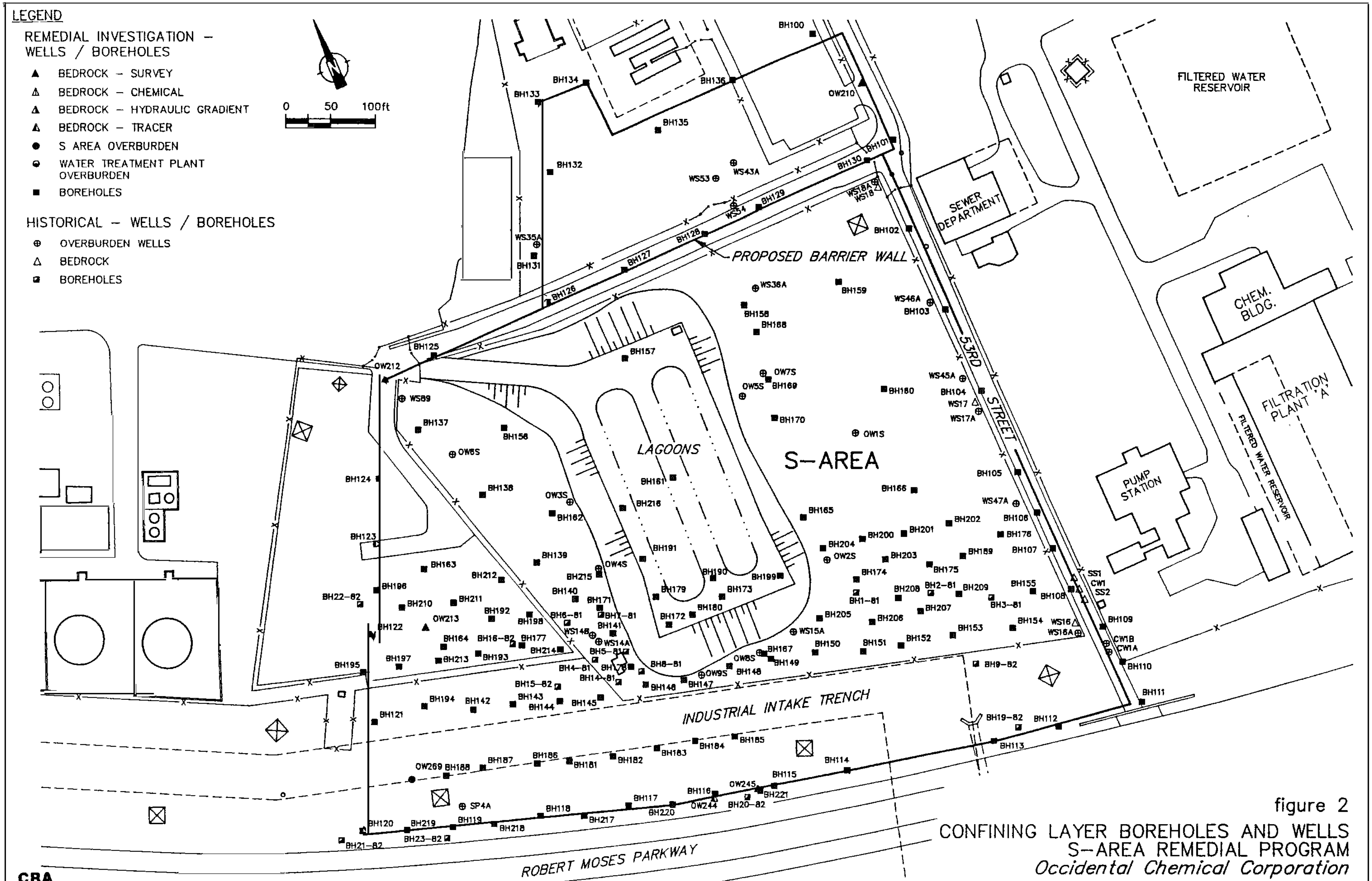

figure 2
CONFINING LAYER BOREHOLES AND WELLS
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4.0 OVERBURDEN STRATIGRAPHY

The overburden material in the vicinity of the Study Area consists of four basic soil units. These soil units are fill materials, overlying alluvial river deposits, overlying glaciolacustrine clay, overlying glacial till. The "Information Summary Report - S-Area Remedial Program - June 1988" discusses each stratigraphic unit in detail and includes all of the stratigraphic logs. The following sections of this report provide a brief description of each soil unit as it pertains to the Study Area.

4.1 TYPICAL OVERBURDEN STRATIGRAPHY

The uppermost soil unit is fill consisting largely of silty, sandy, gravelly soils, cinders, flyash, slag and construction rubble including bricks, wood and concrete. The thickness of fill over most of the S-Area Landfill Site ranges from eight to eighteen feet with exceptions at the lagoons and several other locations. There are apparent depressions in the surface elevation of the native material underlying the fill at drilling locations BH168, BH203, BH204, WS15A and WS14A, and these depressions result in fill thicknesses of 22.0 feet, 27.3 feet, 28.5 feet, 29.0 feet and 32.7 feet, respectively.

The lagoons are raised in elevation above the S-Area Landfill Site, and boreholes installed at the perimeter of the lagoons indicating 26 to 32 feet of total fill materials. The Industrial Intake Pipe Trench cuts through the study area south of the lagoons and north of the Robert Moses Parkway with installed boreholes indicating an average fill thickness of 25 to 26 feet along most of the east-west portion of the Industrial Intake Pipe Trench. The fill thickness along the trench is estimated to increase to over 40 feet as the intakes turn south and proceed under the Parkway toward the Intake Structure. The Robert Moses Parkway is also raised in elevation with the thickness of the fill material ranging from 24 to 32 feet along the southern alignment of the Site Barrier Wall.

The fill layer in the Northern Area is much more uniform than within the S-Area Landfill Site with the thickness of fill materials ranging from six to ten feet.

Figure 3 presents an isopach map of fill contours for the Study Area.

The uppermost native overburden stratum consists of alluvial river deposits (hereinafter "alluvium") underlying the fill material. The alluvium layer consists predominantly of silty sand with varying amounts of gravel, clay and cobbles. The thickness of alluvium over most of the

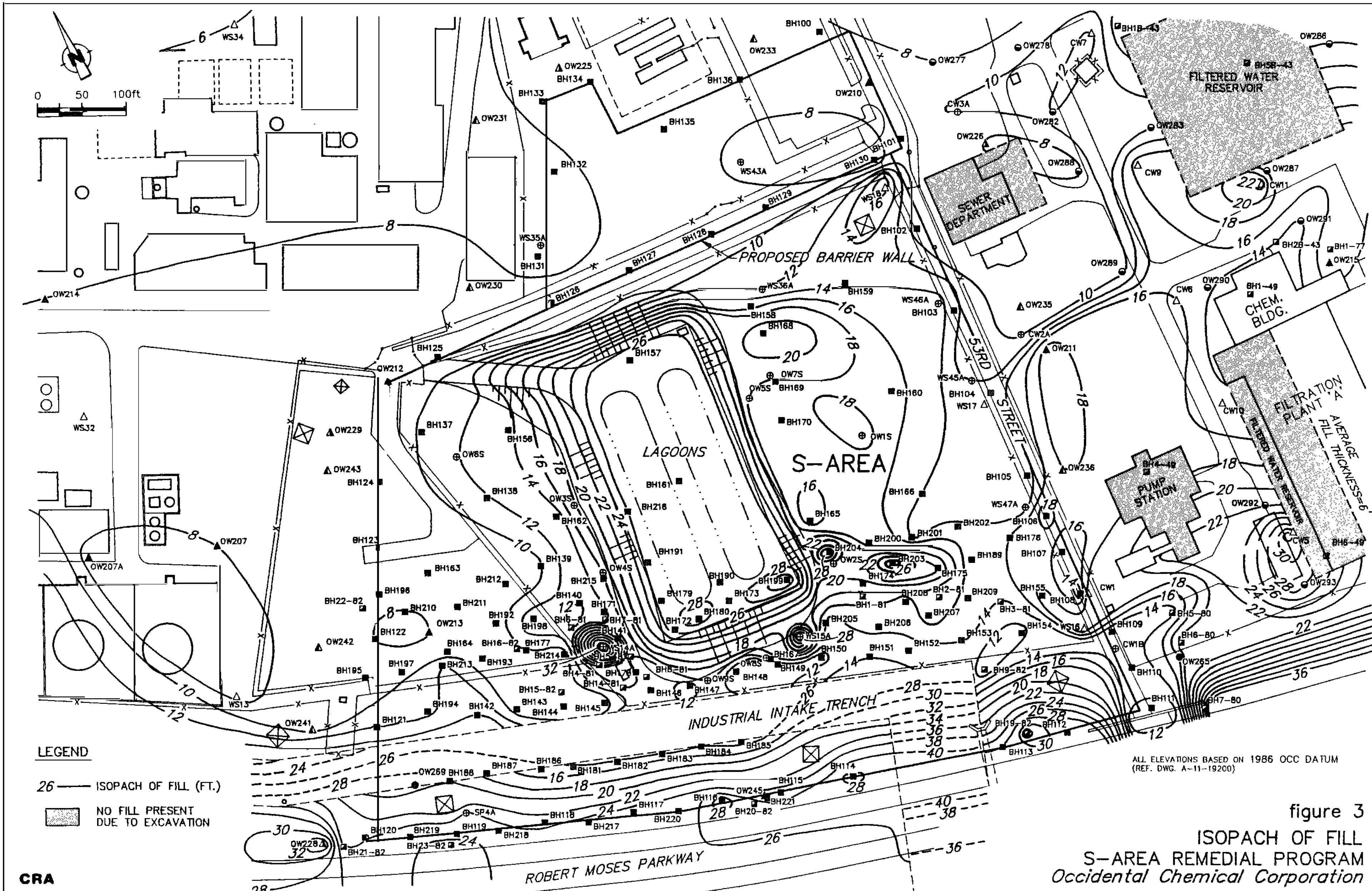

figure 3
ISOPACH OF FILL
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S-Area Landfill Site ranges from 0 feet in the northeast corner (WS18 and WS46A) to 16 feet in the central portions of the Site although several exceptions have been noted. At WS14A and WS15A, where very large depths of fill were noted, there was no alluvium present and at BH204 and BH203 only 2.5 feet and 6.2 feet of alluvium was present, respectively.

During the installation of the Industrial Intake Pipe Trench, excavation took place down through the fill and alluvium layers and into the clay (if present) and till layers. The excavation was apparently backfilled with the stockpiled material from the construction activities. Consequently, in many cases, it is difficult to distinguish between undisturbed alluvium and fill materials which has been excavated and replaced as is the case along the Industrial Intake Pipe Trench. In several of the boreholes which were installed within the trench it is possible that the noted presence of alluvium was backfilled alluvium (i.e. fill).

The alluvium layer in the Northern Area is again much more uniform than within the S-Area Landfill Site with a thickness of alluvial material ranging from one to five feet.

Figure 4 presents the elevation of the top of alluvium contours for the Study Area. As can be seen by the figure, the overall slope is toward the south. Figure 5

figure 4
TOP OF ALLUVIUM
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figure 5
ISOPACH OF ALLUVIUM
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presents an isopach map of the thickness of the alluvium stratum.

Throughout the majority of the Study Area, a clay layer is present underneath the alluvium. The clay is generally a red-brown silty clay of low permeability capable of meeting the specifications for a Confining Layer. The thickness of the clay within the S-Area Landfill Site ranges from 18 feet in the northeast corner to non-existent over most of the southern third of the Site.

The clay layer in the Northern Area increases in thickness as one moves further north. The thickness of the clay material ranges from 15 to 21 feet.

Figure 6 presents the top of clay contours for the Study Area. As can be seen on Figure 6, the clay slopes more steeply to the south than the top of alluvium. Figure 7 presents an isopach map of clay thickness.

Underlying the clay and overlying the bedrock is a till layer. The till material is generally a dense clayey silty sand with varying amounts of fine sand and fine gravel. The thickness of the till over most of the S-Area Landfill Site range from 0.5 feet to 4 feet. Till thicknesses range from six to eight feet along the southern alignment of the Site Barrier Wall.

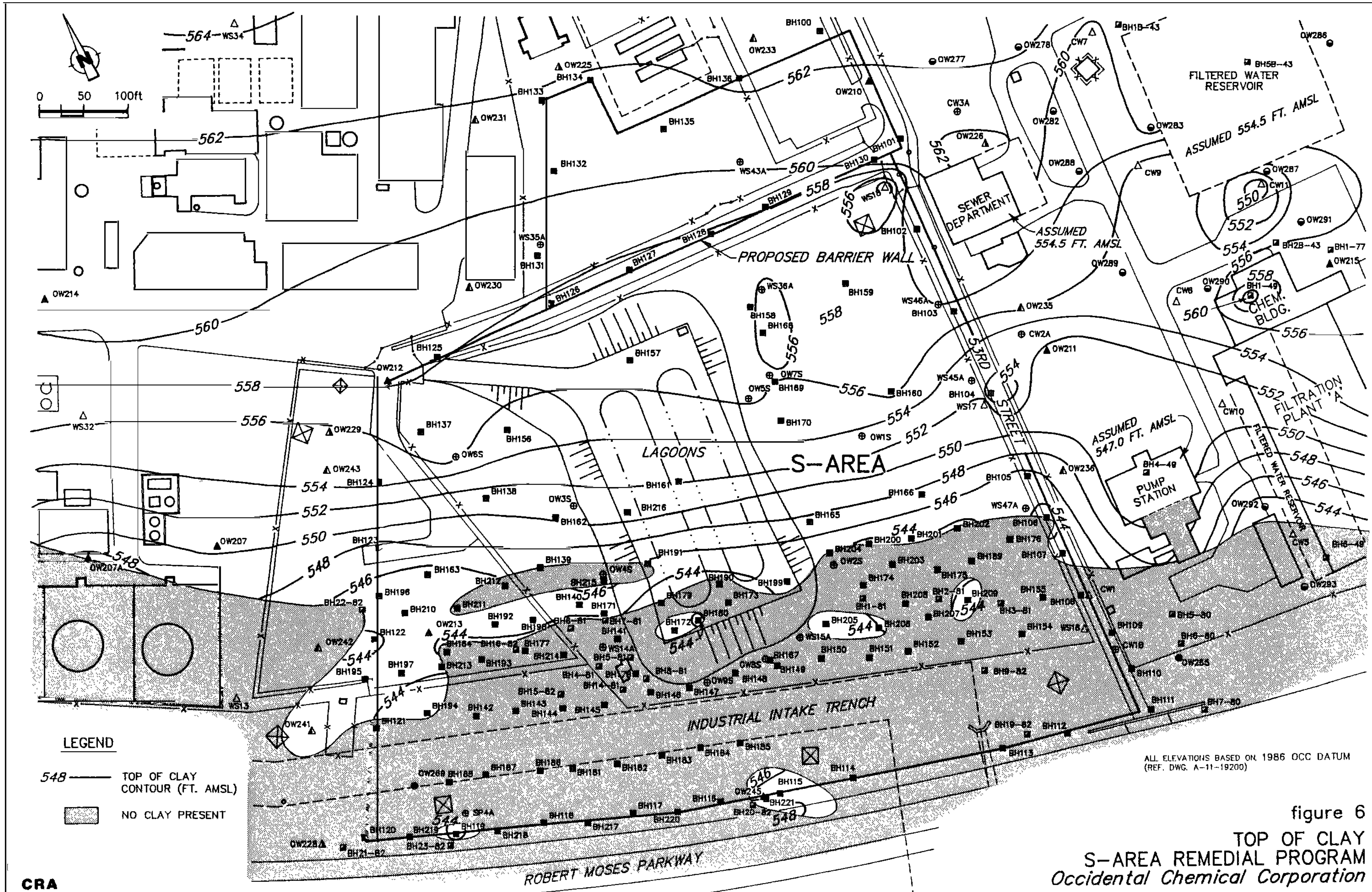

figure 6

TOP OF CLAY
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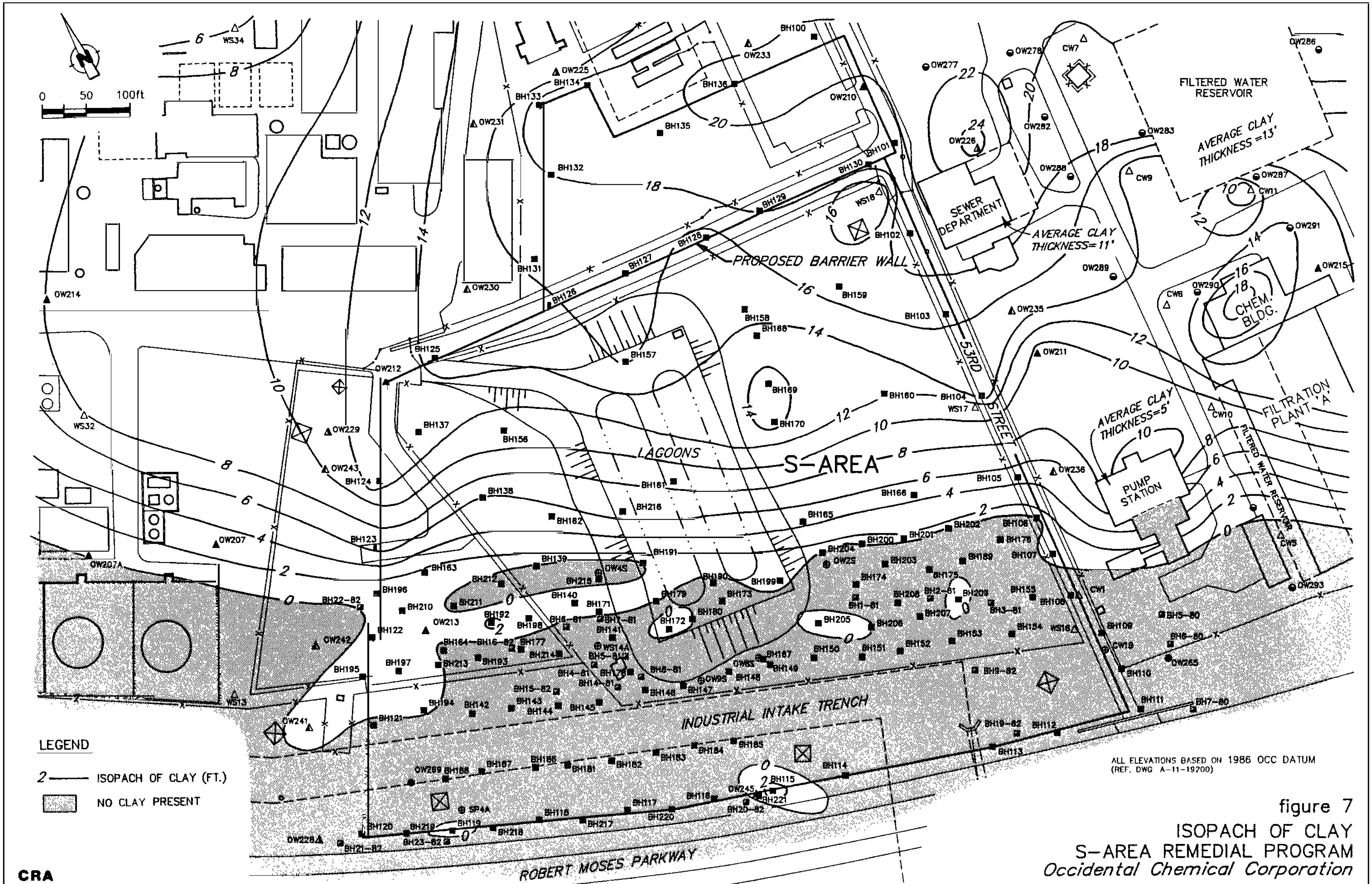

figure 7

ISOPACH OF CLAY

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1769-4/08/88-25-D-0

The till layer in the Northern Area is also thin with the thickness of the till material ranging from one to three feet.

Figure 8 presents the top of till contours for the Study Area. This figure indicates a very gentle overall till slope to the northeast although there are many mounds and depressions. Figure 9 presents an isopach map of till thickness.

The bedrock beneath the S-Area Landfill Site and the Northern Area is generally a gray dolostone which is highly fractured in the upper 15 to 30 feet.

Figure 10 presents the top of bedrock contours for the Study Area indicating a very gentle slope toward the southwest.

Plans showing the top of unit contours and unit isopachs for the area within 1000$\pm$ feet of the S-Area Landfill Site have been previously presented in the "Information Summary Report - Volume II - Drawings".

In order to more clearly present the stratigraphic information obtained, four north-south and five west-east cross-sections have been prepared and are presented in Figures 12 through 20. The location of these cross-sections are shown on Figure 11. The cross-sections also present the underground utilities located in the area and the locations of observed NAPL and iridescent sheen presence.

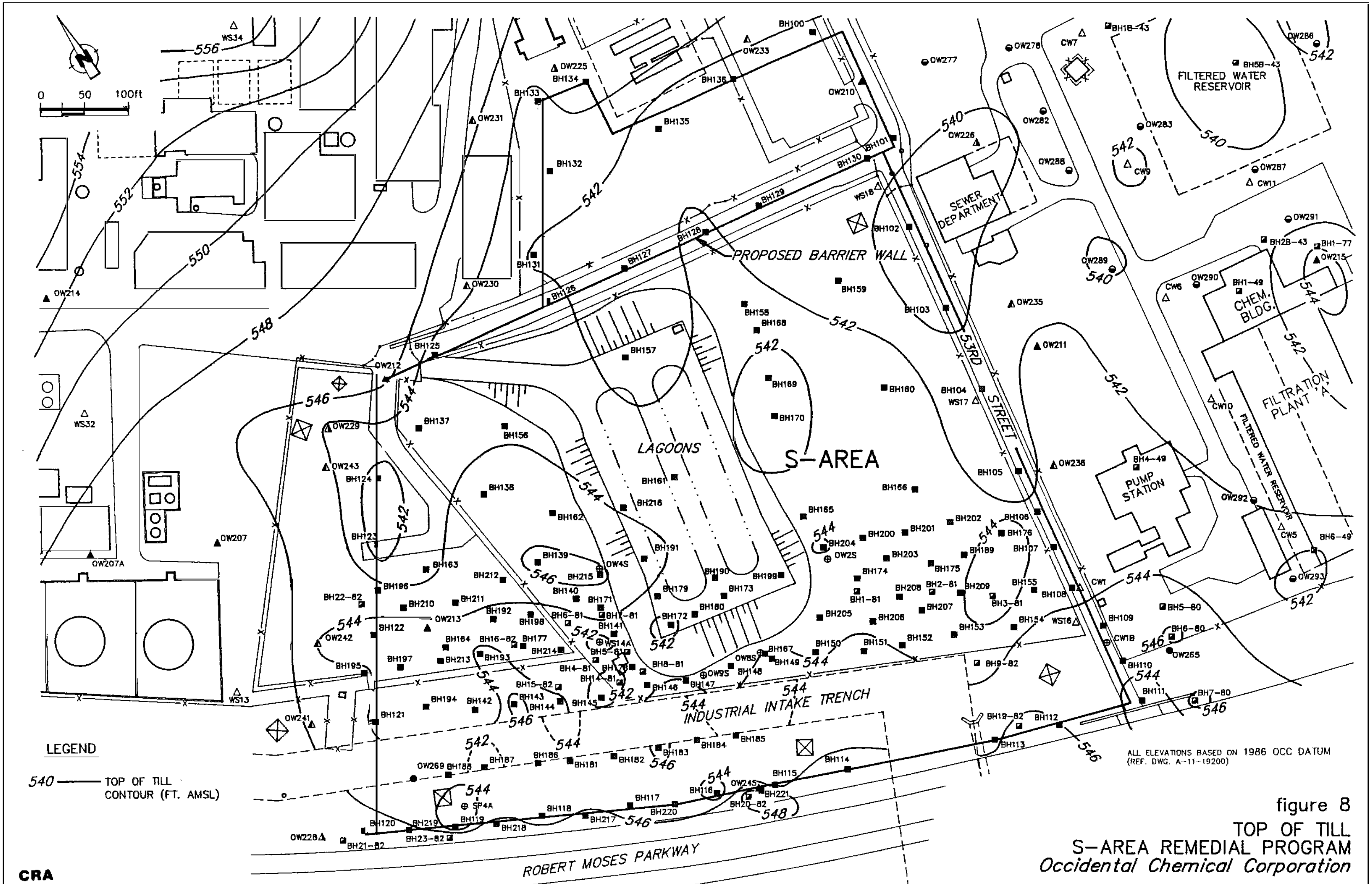

figure 8

TOP OF TILL

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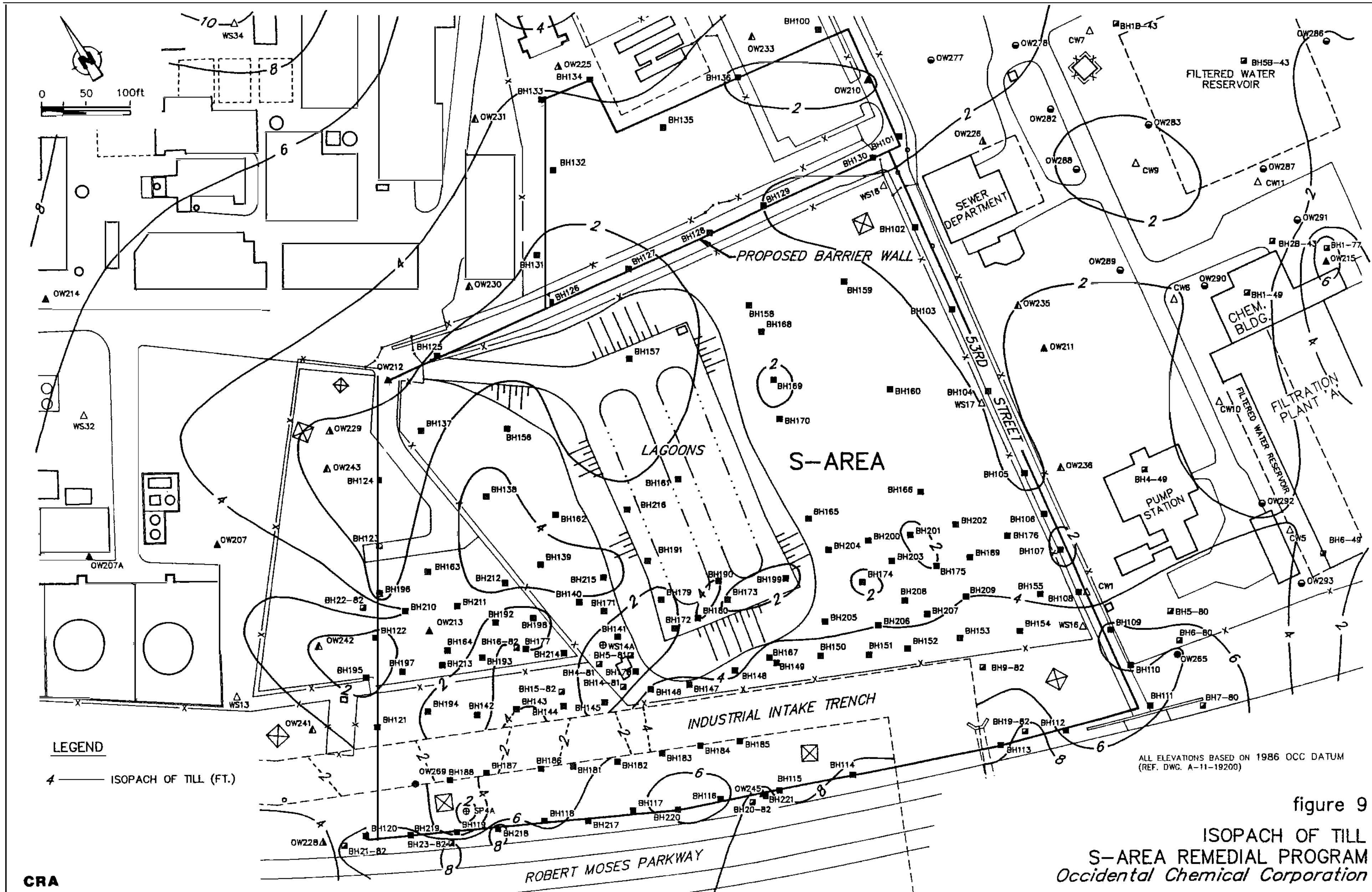

figure 9

ISOPACH OF TILL
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1769–4/08/88–25–D–0

figure 10

TOP OF BEDROCK
S-AREA REMEDIAL PROGRAM
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CRA

1769-4/08/88-25-D-0

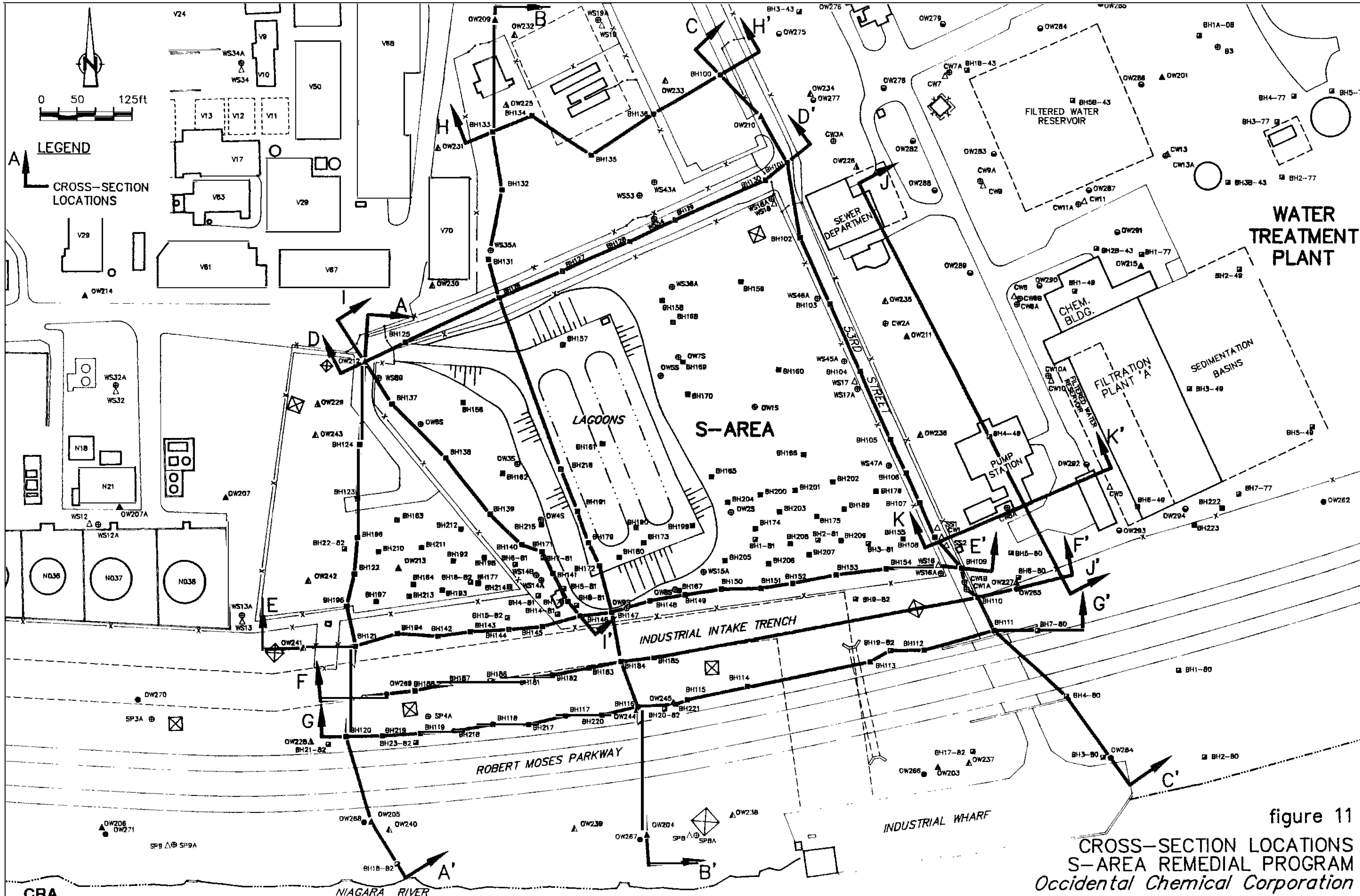

figure 11

CROSS-SECTION LOCATIONS
S-AREA REMEDIAL PROGRAM
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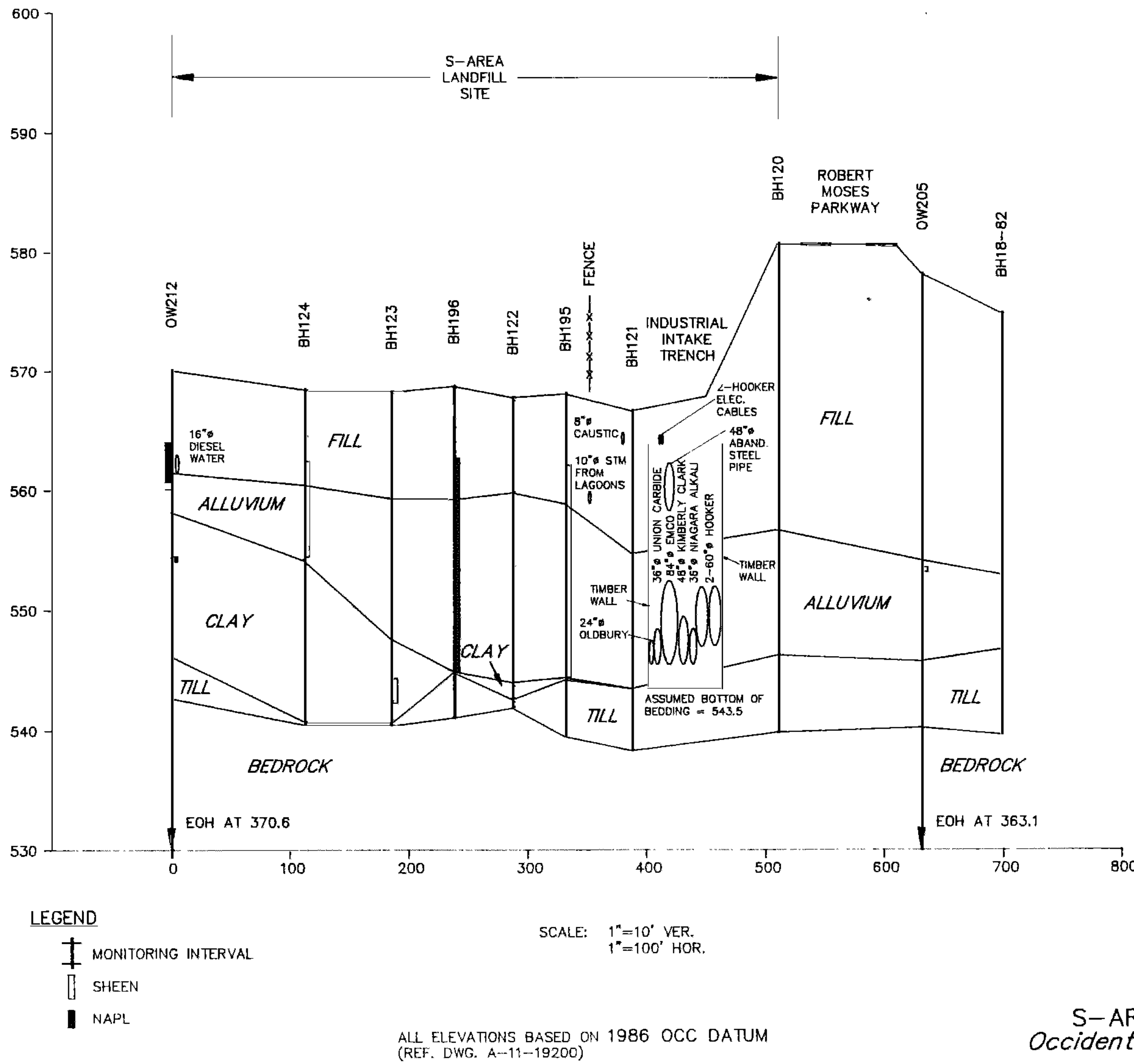

figure 12

CROSS-SECTION A-A'
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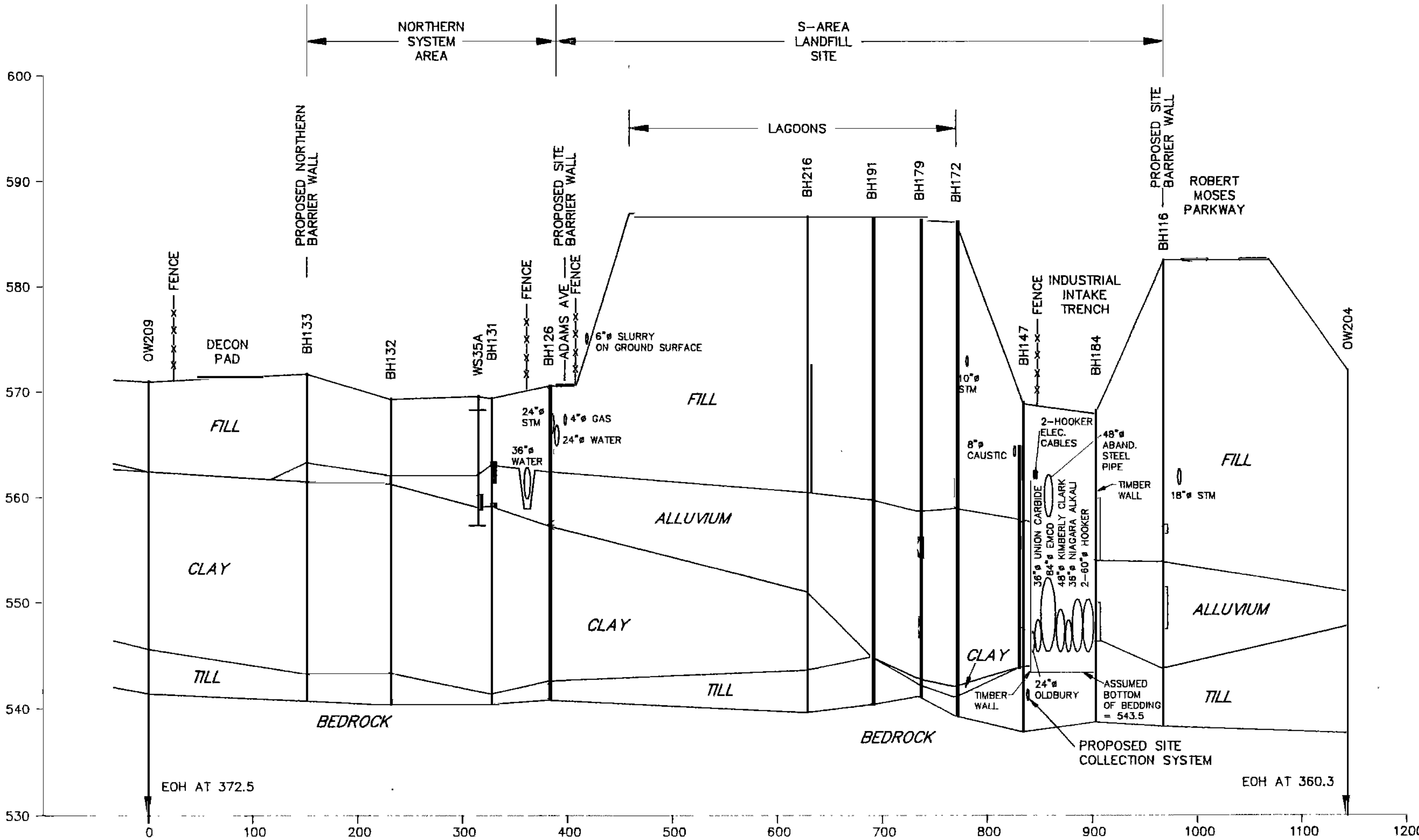
1769-4/08/88-25-D-0 (X-30)



LEGEND

- MONITORING INTERVAL
- SHEEN
- NAPL

SCALE: 1"=10' VER.
1"=100' HOR.

ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

figure 13

CROSS-SECTION B-B'
S-AREA REMEDIAL PROGRAM
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CRA

1769-4/08/88-25-D-0 (X-31)

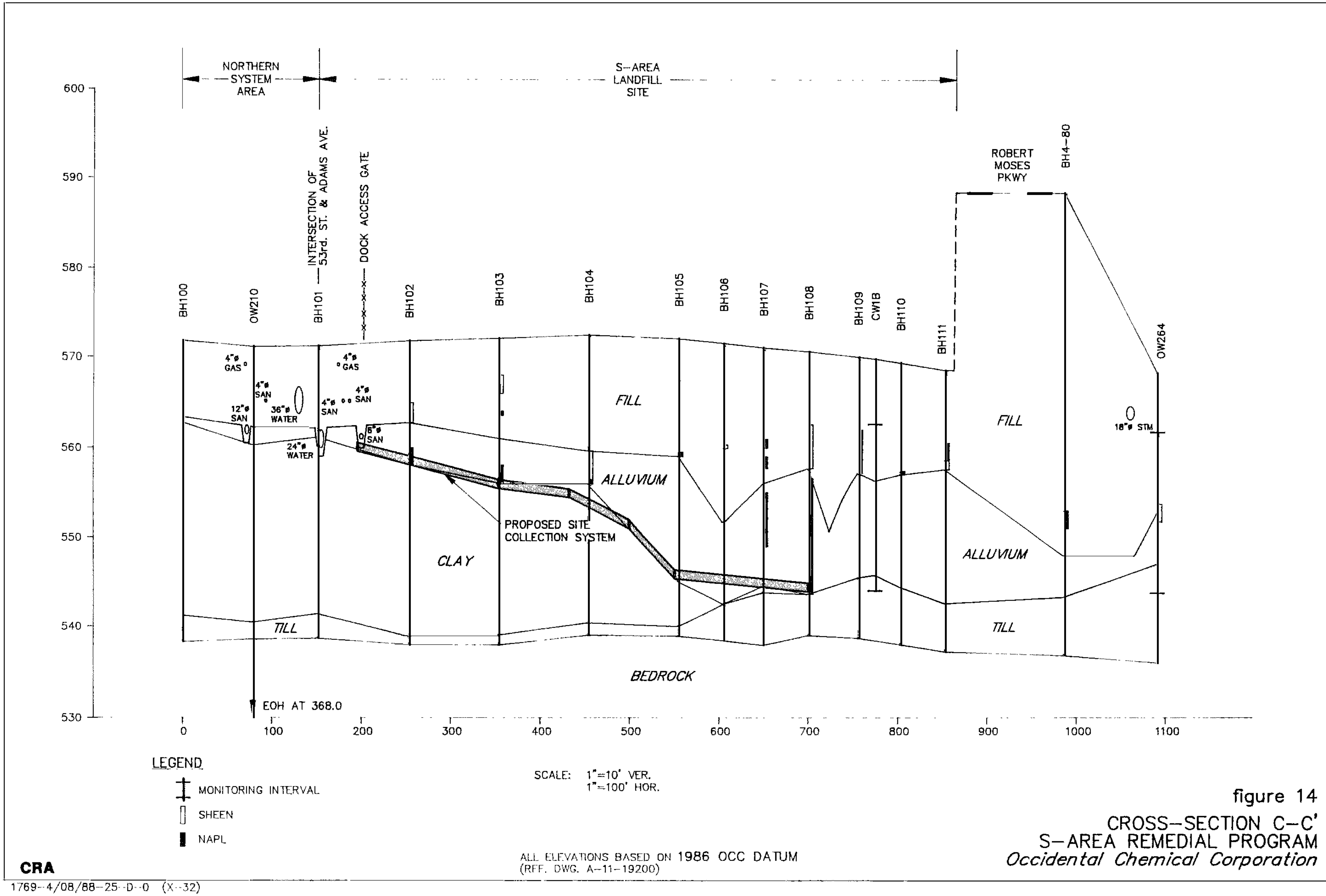

figure 14

CROSS-SECTION C-C'
S-AREA REMEDIAL PROGRAM
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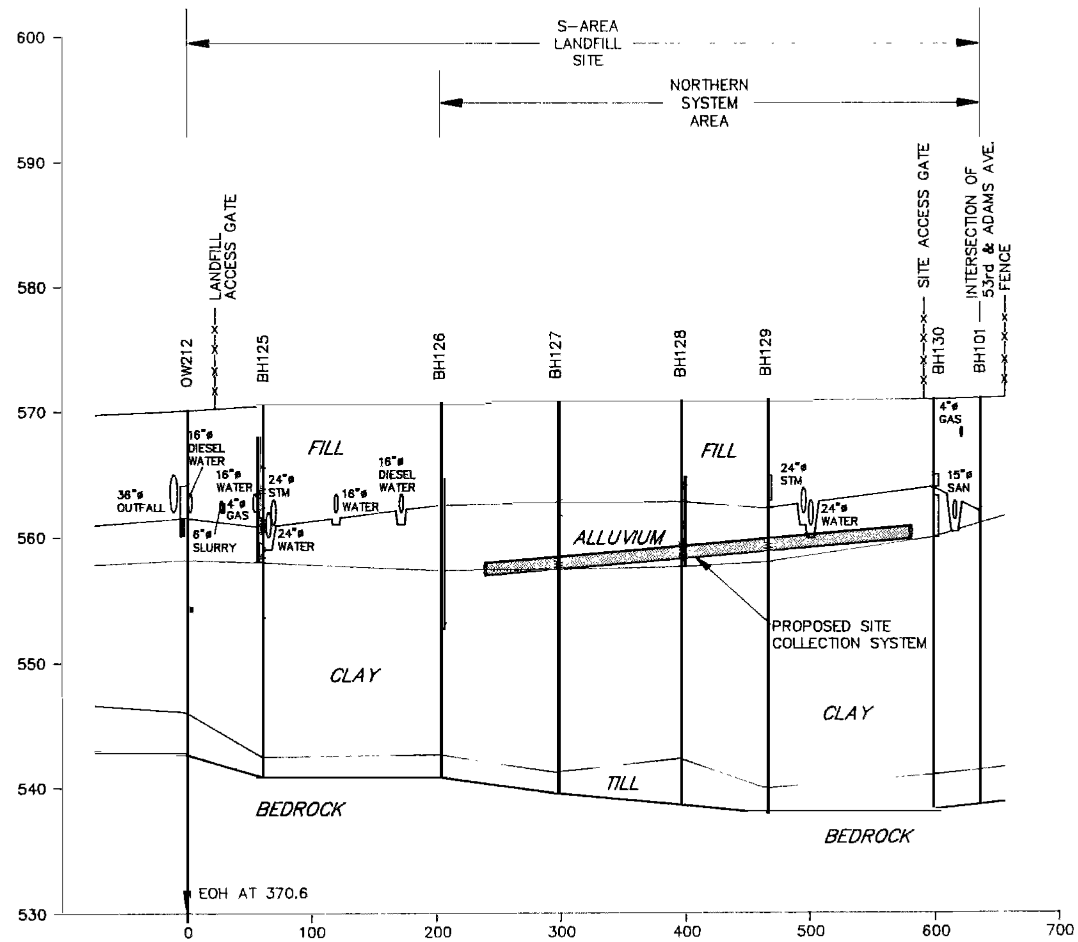

LEGEND

- MONITORING INTERVAL
- SHEEN
- NAPL

SCALE: 1"=10' VER.
1"=100' HOR.

ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

figure 15

CROSS-SECTION D-D'
S-AREA REMEDIAL PROGRAM
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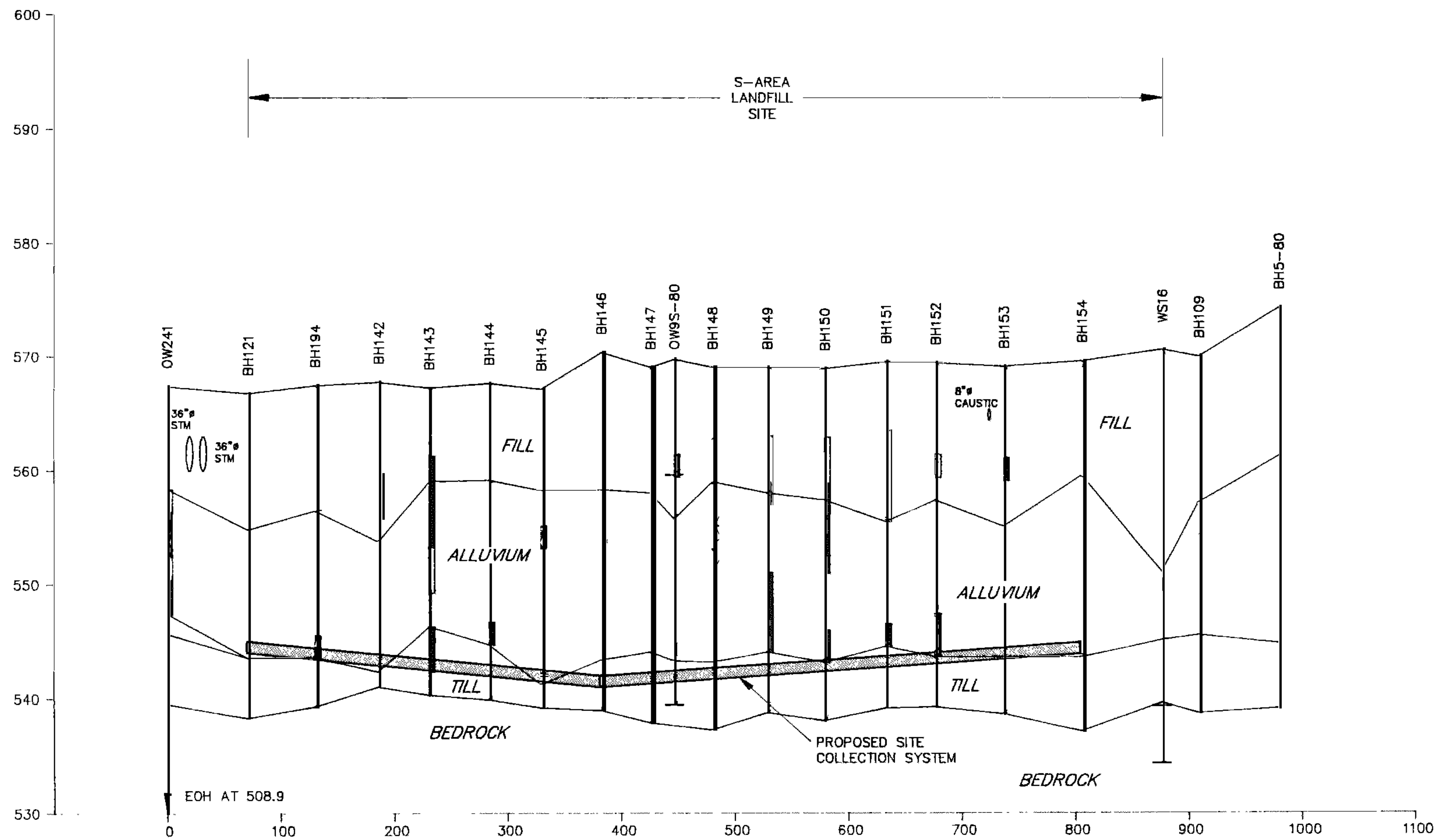
CRA

1769-4/08/88-25-D-0 (X-33)



LEGEND

MONITORING INTERVAL

SHEEN

NAPL

SCALE: 1"=10' VER.
1"=100' HOR.

ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

figure 16

CROSS-SECTION E-E'
S-AREA REMEDIAL PROGRAM
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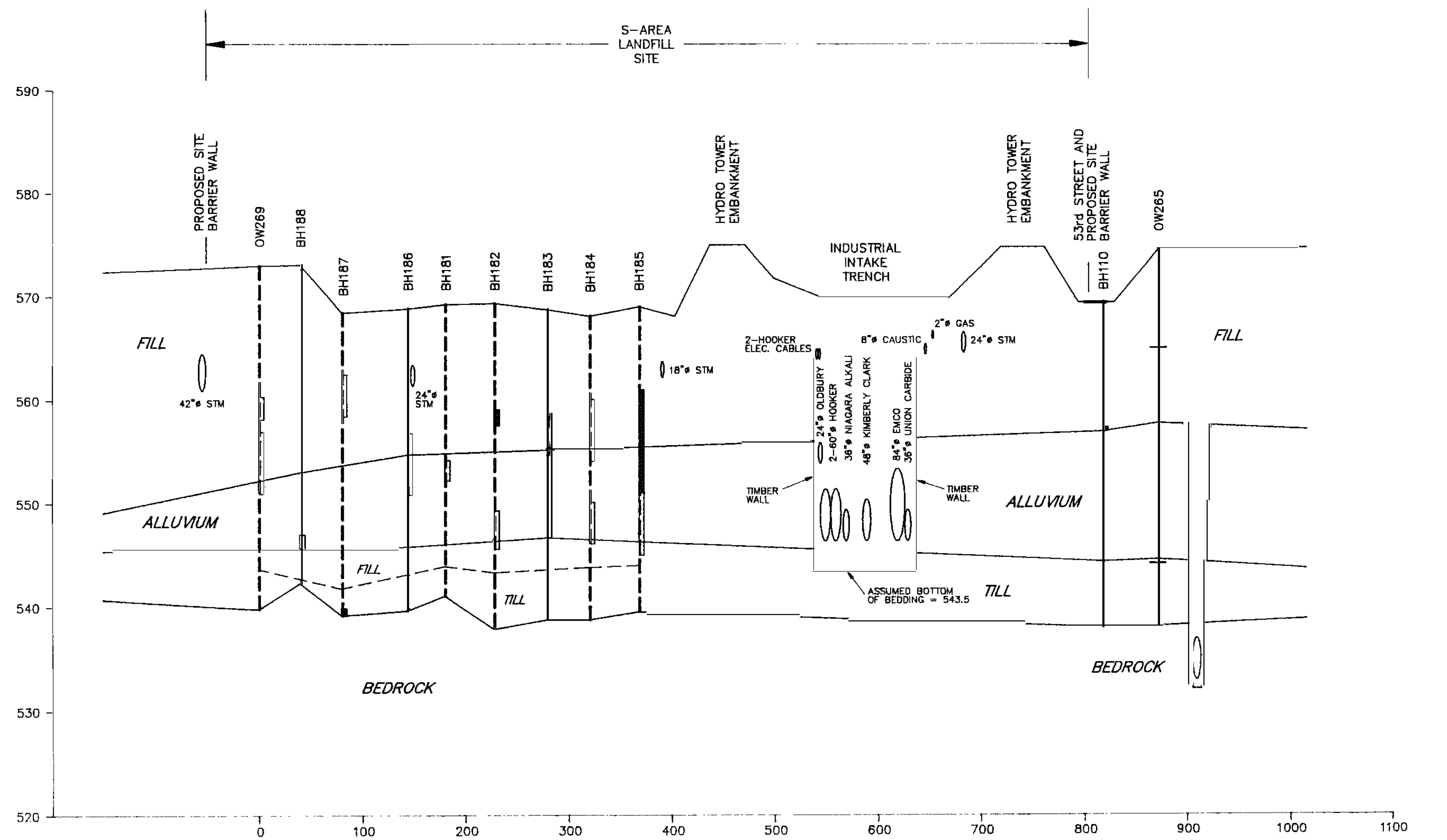
CRA

1769-4/08/88-25-D-0 (X 34)



LEGEND

- MONITORING INTERVAL
- SHEEN
- NAPL

SCALE: 1"=10' VER.
1"=100' HOR.

NOTES: CROSS-SECTION TAKEN ALONG SOUTHERN EDGE OF INDUSTRIAL INTAKE TRENCH .
DASHED LINES INDICATE INFORMATION FOR INSIDE THE TRENCH.
ALL ELEVATIONS BASED ON 1986 OCC DATUM (REF. DWG. A-11-19200)

figure 17

CROSS-SECTION F-F'
S-AREA REMEDIAL PROGRAM
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1769-4/08/88-25-D-0 (X-35)

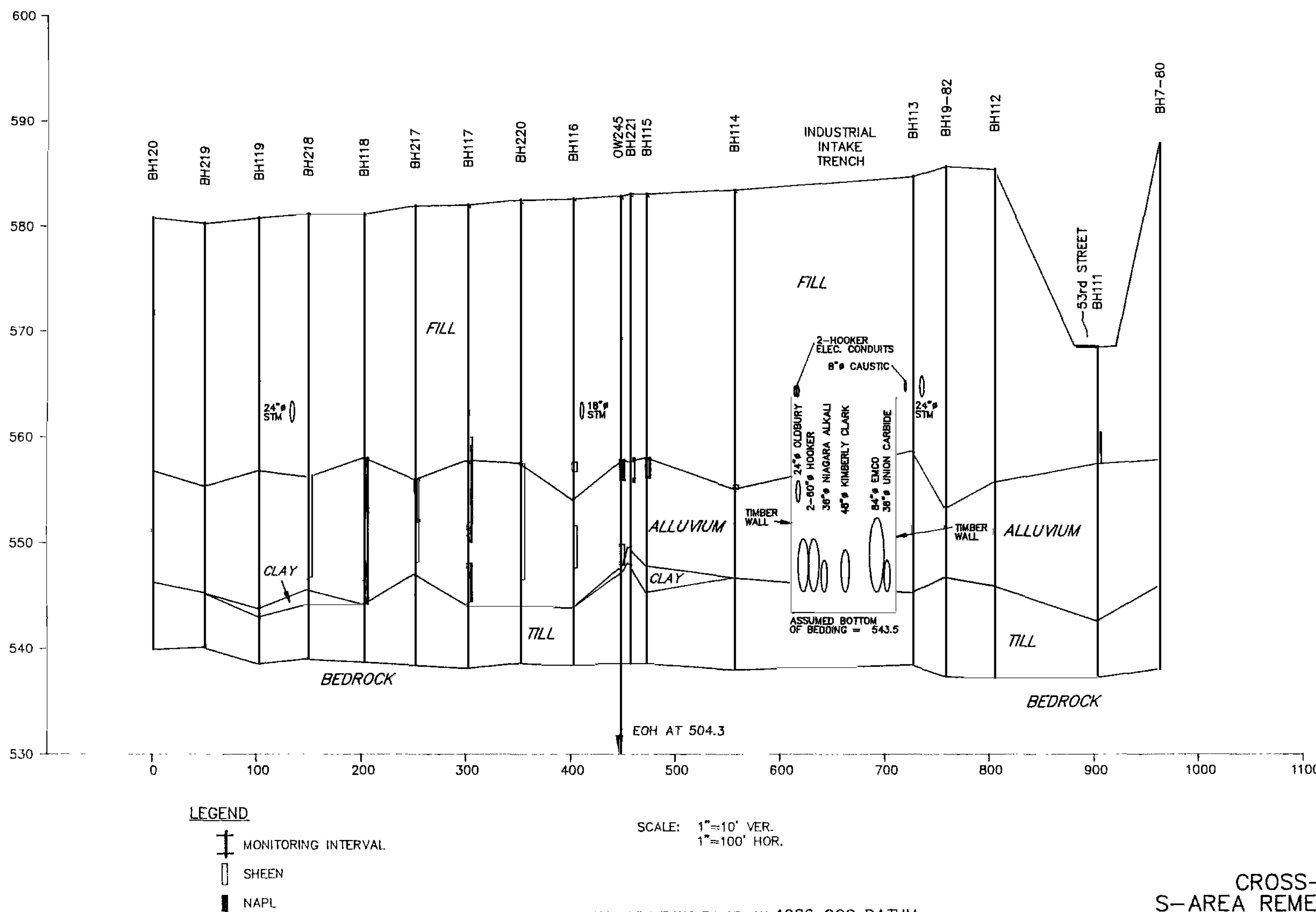


figure 18

CROSS-SECTION G-G'
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-0 (X-36)

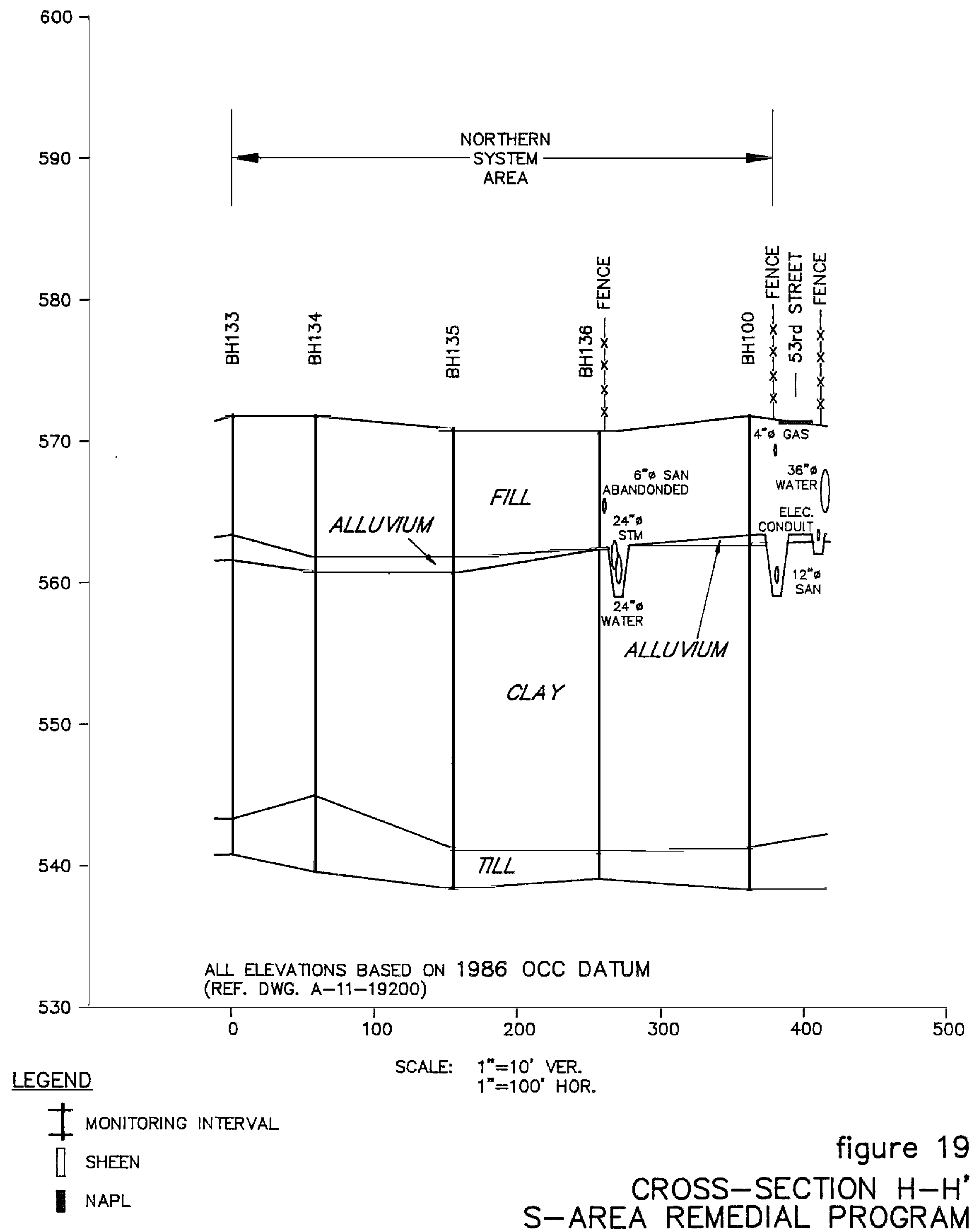
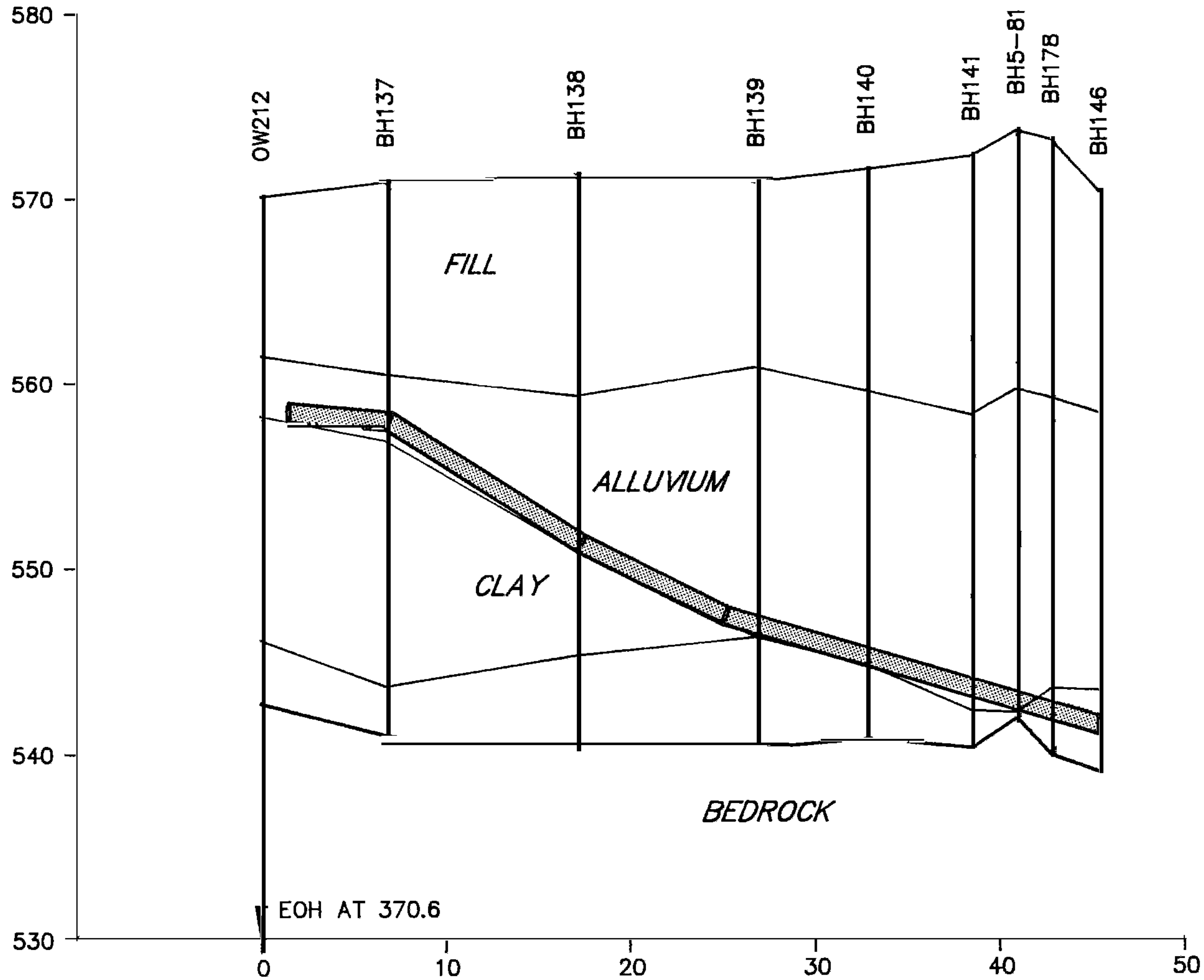


figure 19

CROSS-SECTION H-H'
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-0 (X-37)



LEGEND

MONITORING INTERVAL

SHEEN

NAPL

SCALE: 1"=10' VER.
1"=10' HOR.

ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

figure 20

CROSS-SECTION I-I'
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-0 (X-45)

4.2 TILL PRESENCE BENEATH INDUSTRIAL INTAKE PIPE TRENCH

During the construction of the Industrial Intake Pipe Trench in the late 1950s, six large utility conduits were installed to an elevation of 545.0 feet AMSL (see Figures 12 and 13). This trench was supported by timber walls and I-beams. The excavation was typically to a depth of 543.5 feet AMSL with bedrock generally being between 538 and 540 feet AMSL. The excavation not only removed the alluvium layer but also appears to have removed some of the top portion of the till layer.

In order to determine the thickness of the remaining till present beneath the Industrial Intake Pipe Trench, the stratigraphy of eight boreholes (BH181 through BH188) and one well (OW269) must be examined. These installations are all immediately adjacent to the south timber wall of the Industrial Intake Pipe Trench. It appears that five of the boreholes (BH181, BH182, H184, BH185 and BH187) and well OW269 may be installed within the trench. According to the stratigraphic information table (Table 1), the top of till elevations at five of these six installations are between 543.4 feet and 544.1 feet AMSL indicating the presence of approximately 1.0 to 1.5 feet of bedding material beneath the utility conduits. The top of till elevation at BH187 was observed to be 541.8 feet AMSL indicating some possible over-excavation in this area.

TABLE 1A - STRATIGRAPHIC INFORMATION - S AREA REMEDIAL PROGRAM

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
OW200	572.80	1043.48	1624.60	3.50	569.30	8.00	564.80	25.80	547.00	28.50	544.30	ND
OW201	568.90	680.93	1724.27	--	--	7.00	561.90	28.80	540.10	29.50	539.40	ND
OW202	571.50	-180.68	2028.67	20.00	551.50	--	--	26.50	545.00	37.00	534.50	ND
OW203	568.20	-255.89	1419.75	17.50	550.70	--	--	19.00	549.20	30.10	538.10	ND
OW204	572.30	-346.91	1023.05	21.00	551.30	--	--	24.30	548.00	34.50	537.80	ND
OW205	578.30	-327.96	647.66	24.00	554.30	--	--	32.50	545.80	38.00	540.30	s24.8
OW206	575.10	-335.15	280.08	23.00	552.10	--	--	25.30	549.80	32.50	542.60	ND
OW207	568.70	111.01	450.12	8.00	560.70	18.00	550.70	21.00	547.70	26.00	542.70	ND
OW207A	568.70	98.07	305.64	7.60	561.10	--	--	21.00	547.70	26.50	542.20	n4.5-6.5
OW208	569.60	614.20	341.18	--	--	7.20	562.40	16.00	553.60	24.00	545.60	ND
OW209	571.00	757.27	816.33	--	--	8.50	562.50	25.40	545.60	29.50	541.50	ND
OW210	571.10	627.43	1177.71	8.80	562.30	10.80	560.30	30.60	540.50	32.50	538.60	ND
OW211	570.60	329.12	1377.32	19.00	551.60	19.20	551.40	28.00	542.60	31.00	539.60	ND
OW212	570.10	294.40	639.35	8.60	561.50	11.90	558.20	24.00	546.10	27.40	542.70	s6-8.6 n8.6-10 n15.8
OW213	568.60	15.62	684.92	8.00	560.60	24.10	544.50	25.10	543.50	28.00	540.60	ND
OW214	569.70	383.87	257.73	8.00	561.70	8.00	561.70	16.50	553.20	24.00	545.70	ND
OW215	575.10	425.21	1696.23	17.00	558.10	19.00	556.10	30.70	544.40	37.10	538.00	ND
OW216*	572.30	956.58	1209.20	2.30	570.00	6.90	565.40	24.00	548.30	31.00	541.30	ND
OW217	572.30	1034.86	514.18	2.00	570.30	7.80	564.50	13.50	558.80	26.90	545.40	ND
OW218	574.10	1421.97	925.20	5.00	569.10	9.00	565.10	23.90	550.20	26.50	547.60	ND
OW219	568.50	634.56	43.74	--	--	--	--	5.30	563.20	20.70	547.80	ND
OW220	572.40	1020.03	2018.49	0.50	571.90	7.90	564.50	30.00	542.40	30.10	542.30	ND
OW221*	570.40	-40.07	2431.73	20.00	550.40	--	--	27.80	542.60	31.50	538.90	ND
OW222*	571.60	-312.86	-119.99	20.70	550.90	--	--	20.80	550.80	27.00	544.60	ND
OW223	571.00	860.39	-146.21	2.30	568.70	--	--	4.00	567.00	21.00	550.00	ND
OW224	574.10	1465.37	905.27	5.50	568.60	8.50	565.60	18.00	556.10	25.30	548.80	ND
OW225	571.40	643.24	830.62	--	--	9.00	562.40	27.00	544.40	31.20	540.20	ND
OW226	571.90	559.78	1307.62	--	--	8.00	563.90	32.80	539.10	33.00	538.90	ND
OW227*	574.00	-4.30	1526.20	16.60	557.40	--	--	29.80	544.20	34.80	539.20	ND
OW228	580.00	-218.15	565.59	--	--	--	--	33.00	547.00	40.50	539.50	n40.5
OW229	569.20	237.92	575.39	9.40	559.80	14.00	555.20	25.50	543.70	26.50	542.70	n7.2-13
OW230	569.40	398.60	730.59	8.30	561.10	10.00	559.40	25.00	544.40	28.40	541.00	n6.7-10
OW231	570.10	584.96	737.57	7.70	562.40	9.00	561.10	24.00	546.10	28.80	541.30	ND
OW232*	572.40	738.23	842.29	--	--	8.50	563.90	25.40	547.00	31.00	541.40	ND
OW233	571.00	676.25	1047.00	--	--	8.20	562.80	28.00	543.00	31.00	540.00	ND
OW234*	569.80	659.25	1244.42	--	--	8.00	561.80	29.30	540.50	32.00	537.80	ND
OW235	570.80	377.35	1347.48	9.00	561.80	14.00	556.80	29.50	541.30	31.50	539.30	ND
OW236	577.00	196.55	1395.81	18.00	559.00	29.60	547.40	33.90	543.10	37.50	539.50	s14-16 s22-24
OW237*	568.00	-249.94	1461.42	17.50	550.50	--	--	19.00	549.00	30.00	538.00	ND
OW238	569.40	-319.68	1139.77	20.00	549.40	--	--	24.00	545.40	32.30	537.10	ND
OW239	576.00	-337.40	924.00	24.00	552.00	--	--	29.20	546.80	36.50	539.50	ND
OW240*	576.90	-338.17	671.66	24.00	552.90	--	--	32.50	544.40	38.00	538.90	s24.8
OW241	567.40	-92.36	554.99	9.00	558.40	20.00	547.40	21.80	545.60	27.90	539.50	s9-11 n11-15 s15-17 n17-20
OW242	567.90	-0.95	562.09	8.20	559.70	--	--	23.90	544.00	27.00	540.90	n18-23.9
OW243	568.90	195.61	572.24	10.00	558.90	13.90	555.00	24.00	544.90	28.00	540.90	n6.2-6.4 s9-10
OW244*	583.20	-176.10	1009.37	28.60	554.60	--	--	38.80	544.40	44.10	539.10	s25-25.9 s31-35
OW245	583.00	-165.71	1058.80	25.00	558.00	35.00	548.00	35.60	547.40	44.40	538.60	n25-27 s33-35
OW260	568.40	295.06	2429.24	13.00	555.40	24.40	544.00	26.00	542.40	28.50	539.90	ND
OW261	569.50	-49.36	2431.83	20.00	549.50	--	--	27.80	541.70	31.50	538.00	ND
OW262	574.50	105.34	1946.31	17.50	557.00	--	--	32.40	542.10	34.20	540.30	s15-17
OW263*	571.00	-189.08	2022.55	20.00	551.00							ND
OW264	568.40	-243.92	1655.65	15.50	552.90	--	--	21.20	547.20	32.30	536.10	s14.5-16.5

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TABLE 1A - STRATIGRAPHIC INFORMATION - S AREA REMEDIAL PROGRAM

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
OW265	574.50	-12.76	1526.50	16.60	557.90	--	--	29.80	544.70	36.30	538.20	ND
OW266*	568.20	-265.36	1400.84	17.50	550.70	--	--	19.00	549.20			ND
OW267*	571.90	-352.79	1013.35	21.00	550.90	--	--	24.30	547.60			ND
OW268*	578.50	-328.42	637.26	24.00	554.50	--	--	32.50	546.00			s24.8
OW269	573.00	-153.64	668.13	29.20	543.80	--	--	29.30	543.70	33.20	539.80	s12.6-14.8 s16-22
OW270	571.60	-160.48	329.30	--	--	--	--	26.40	545.20	29.80	541.80	s24-26.4
OW271*	574.60	-343.92	284.82	23.00	551.60	--	--	25.30	549.30			ND
OW272	572.00	-308.77	-113.96	20.70	551.30	--	--	20.80	551.20	28.00	544.00	ND
OW273	570.50	-135.07	-83.15	--	--	--	--	18.80	551.70	26.70	543.80	s12.8-16
OW274	572.10	943.32	1214.59	2.30	569.80	6.90	565.20	24.00	548.10	32.50	539.60	ND
OW275	570.50	740.20	1202.36	7.00	563.50	7.50	563.00	27.50	543.00	32.00	538.50	ND
OW276	571.50	782.28	1294.72	--	--	7.80	563.70	29.00	542.50	32.80	538.70	ND
OW277	570.20	650.73	1248.56	--	--	8.00	562.20	29.30	540.90	32.50	537.70	ND
OW278	570.50	666.96	1344.48	--	--	8.40	562.10	29.80	540.70	33.00	537.50	ND
OW279	570.50	753.09	1425.55	--	--	8.00	562.50	28.50	542.00	31.30	539.20	ND
OW280	569.90	806.38	1538.41	--	--	8.00	561.90	28.00	541.90	29.90	540.00	ND
OW281	570.30	858.05	1625.74	--	--	7.00	563.30	25.80	544.50	28.90	541.40	ND
OW282	571.10	595.36	1384.35	--	--	12.00	559.10	30.50	540.60	32.60	538.50	ND
OW283	571.70	577.50	1494.61	--	--	11.50	560.20	30.00	541.70	32.10	539.60	ND
OW284	569.60	747.38	1558.05	--	--	6.20	563.40	29.00	540.60	29.90	539.70	ND
OW285	569.80	779.13	1640.13	--	--	7.00	562.80	27.80	542.00	28.50	541.30	ND
OW286	570.70	671.65	1695.42	--	--	6.90	563.80	28.20	542.50	31.00	539.70	ND
OW287	574.20	528.69	1624.48	17.80	556.40	20.80	553.40	34.00	540.20	36.10	538.10	ND
OW288	572.20	528.44	1413.92	8.00	564.20	14.00	558.20	31.50	540.70	33.80	538.40	ND
OW289	573.10	416.22	1462.98	9.80	563.30	17.70	555.40	33.60	539.50	34.70	538.40	ND
OW290	574.80	398.67	1557.71	14.50	560.30	19.80	555.00	33.20	541.60	35.70	539.10	ND
OW291	574.40	472.17	1663.21	14.00	560.40	19.80	554.60	33.90	540.50	36.30	538.10	ND
OW292	576.00	156.44	1622.52	22.00	554.00	33.90	542.10	34.00	542.00	37.50	538.50	ND
OW293	575.60	66.87	1667.09	29.80	545.80	--	--	34.20	541.40	37.10	538.50	ND
OW294	574.60	96.18	1757.57	20.00	554.60	--	--	32.00	542.60	36.20	538.40	s15-15.6
BH100	571.80	684.08	1122.39	8.40	563.40	9.00	562.80	30.50	541.30	33.50	538.30	ND
BH101	571.20	565.14	1213.40	9.00	562.20	10.00	561.20	29.70	541.50	32.50	538.70	ND
BH102	571.80	464.47	1231.32	9.00	562.80	13.70	558.10	32.90	538.90	33.80	538.00	s6.8-9 n11.8-13.7
BH103	572.10	373.24	1272.69	11.00	561.10	16.00	556.10	33.00	539.10	34.10	538.00	s4-6 n8-8.5 n14-16
BH104	572.50	281.82	1314.02	12.80	559.70	16.60	555.90	32.00	540.50	33.40	539.10	s12.8-16 n16-16.6
BH105	572.10	190.08	1355.35	13.00	559.10	27.00	545.10	32.00	540.10	33.10	539.00	n12.5-13
BH106	571.60	144.75	1377.14	20.00	551.60	--	--	29.00	542.60	33.10	538.50	s11.3-11.4
BH107	571.10	104.04	1395.43	15.00	556.10	26.50	544.60	27.20	543.90	33.10	538.00	n10-11 n12-13.3 n16-22
BH108	570.70	57.69	1416.07	12.90	557.80	--	--	27.00	543.70	31.60	539.10	s8-12.9 n14-27
BH109	570.10	15.50	1451.81	12.80	557.30	--	--	24.50	545.60	31.30	538.80	n8-12.8
BH110	569.50	-24.45	1473.90	12.40	557.10	--	--	25.00	544.50	31.40	538.10	n12-12.4
BH111	568.70	-69.17	1495.61	11.00	557.70	--	--	26.00	542.70	31.40	537.30	n8-10 s10-11
BH112	585.60	-96.55	1401.34	29.70	555.90	--	--	39.50	546.10	48.40	537.20	ND
BH113	584.90	-112.45	1327.50	26.00	558.90	--	--	39.50	545.40	46.40	538.50	ND
BH114	583.60	-144.82	1160.25	28.40	555.20	--	--	36.80	546.80	45.60	538.00	s28-28.4
BH115	583.20	-162.33	1078.08	25.00	558.20	35.30	547.90	37.80	545.40	44.60	538.60	n25-27
BH116	582.70	-171.45	1010.65	28.60	554.10	--	--	38.80	543.90	44.30	538.40	s25-25.9 s31-35
BH117	582.10	-183.87	912.11	24.20	557.90	--	--	38.00	544.10	44.50	537.60	s22-22.8 n22.8-32 n34-37.6
BH118	581.20	-195.37	813.80	23.10	558.10	--	--	37.00	544.20	42.50	538.70	n23.1-37
BH119	580.80	-207.70	714.67	24.00	556.80	37.00	543.80	37.80	543.00	42.30	538.50	ND
BH120	580.80	-211.58	612.99	24.00	556.80	--	--	34.50	546.30	40.90	539.90	ND
BH121	566.80	-89.83	626.13	12.00	554.80	--	--	23.30	543.50	28.50	538.30	ND

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WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
BH122	567.90	8.18	624.68	8.00	559.90	23.90	544.00	25.30	542.60	26.00	541.90	ND
BH123	568.30	109.59	629.24	8.90	559.40	20.70	547.60	27.70	540.60	27.90	540.40	s24-26
BH124	568.50	182.85	632.32	8.00	560.50	14.30	554.20	27.70	540.80	28.00	540.50	s6-14
BH125	570.50	321.27	694.55	9.70	560.80	12.50	558.00	28.00	542.50	29.60	540.90	n6-12.5
BH126	570.70	381.26	822.28	8.10	562.60	13.30	557.40	28.00	542.70	29.80	540.90	n6-18
BH127	570.80	417.92	908.13	8.00	562.80	13.30	557.50	29.50	541.30	31.20	539.60	n4-13.3
BH128	570.90	458.31	999.50	8.00	562.90	13.20	557.70	28.50	542.40	32.20	538.70	n6-13.2
BH129	571.00	488.25	1061.23	8.60	562.40	12.90	558.10	31.00	540.00	33.00	538.00	s6-8 n8.6-12.9
BH130	571.10	541.67	1183.98	7.00	564.10	11.00	560.10	30.00	541.10	32.80	538.30	s6-7 s8-11
BH131	569.50	433.11	807.18	6.30	563.20	10.20	559.30	28.00	541.50	29.00	540.50	n6-8 n10-10.2
BH132	569.40	527.70	825.35	7.20	562.20	8.00	561.40	26.00	543.40	29.00	540.40	ND
BH133	571.80	606.20	812.10	8.40	563.40	10.20	561.60	28.50	543.30	31.00	540.80	ND
BH134	571.80	628.08	865.67	10.00	561.80	11.00	560.80	26.80	545.00	32.20	539.60	ND
BH135	570.90	575.24	946.56	9.10	561.80	10.20	560.70	29.60	541.30	32.50	538.40	ND
BH136	570.60	630.89	1031.41	8.10	562.50	8.20	562.40	29.70	540.90	31.50	539.10	ND
BH137	570.90	238.10	676.40	10.40	560.50	14.00	556.90	27.30	543.60	29.90	541.00	n4-14 n16-18
BH138	571.30	164.81	749.81	12.00	559.30	20.40	550.90	26.00	545.30	31.10	540.20	n6-22.6
BH139	570.90	88.82	810.34	10.00	560.90	--	--	24.50	546.40	30.60	540.30	n4-24.5
BH140	571.60	47.52	853.12	12.00	559.60	26.80	544.80	27.00	544.60	30.80	540.80	s6-8 n8-10 n16-26.8
BH141	572.30	8.95	895.25	14.00	558.30	--	--	30.00	542.30	32.00	540.30	n6-12 n22-30
BH142	567.80	-76.28	738.38	14.00	553.80	--	--	25.50	542.30	26.80	541.00	n8-12
BH143	567.30	-70.10	782.64	8.20	559.10	--	--	21.00	546.30	27.00	540.30	n6-14 s14-18 n21-25
BH144	567.70	-67.10	835.24	8.50	559.20	--	--	23.00	544.70	27.80	539.90	n21-23
BH145	567.20	-63.06	880.92	8.90	558.30	--	--	26.00	541.20	28.00	539.20	n12-14 n23.1-27.4
BH146	570.40	-48.84	931.93	12.00	558.40	--	--	27.00	543.40	31.40	539.00	s8-10 n10-21 n24-27
BH147	569.10	-43.83	974.99	11.00	558.10	--	--	25.00	544.10	31.20	537.90	n4-25
BH148	569.10	-28.30	1027.21	10.00	559.10	--	--	25.90	543.20	31.80	537.30	s6-10 n10-25.9
BH149	569.10	-20.20	1074.92	11.00	558.10	--	--	25.00	544.10	30.30	538.80	s6-10 n10-12 n18-25
BH150	569.00	-12.69	1124.81	11.50	557.50	--	--	25.80	543.20	30.90	538.10	s6-10 n10-18 n23-25.8
BH151	569.60	-11.52	1178.79	14.00	555.60	--	--	25.00	544.60	30.40	539.20	s6-14 n23-25
BH152	569.50	-4.87	1222.02	12.00	557.50	--	--	25.80	543.70	30.20	539.30	s8-10 n22-25.8
BH153	569.20	6.59	1281.00	14.00	555.20	--	--	25.50	543.70	30.50	538.70	n8-10
BH154	569.70	14.57	1349.31	10.00	559.70	--	--	26.00	543.70	31.30	538.40	s8-12 n14-20 s20-24
BH155	572.80	55.60	1372.58	19.00	553.80	--	--	29.40	543.40	34.20	538.60	s12-14 n19-22
BH156	572.80	240.49	773.54	13.50	559.30	18.50	554.30	29.00	543.80	32.50	540.30	n12-18
BH157	586.20	317.83	908.90	27.30	558.90	29.00	557.20	45.00	541.20	46.50	539.70	n16-18 s19.3-27.3
BH158	576.10	377.73	1044.17	14.50	561.60	18.50	557.60	33.60	542.50	37.50	538.60	n4-6 n16-18.5
BH159	575.10	403.80	1151.45	13.90	561.20	17.50	557.60	34.00	541.10	37.50	537.60	n8-12
BH160	578.10	284.07	1203.01	17.50	560.60	21.90	556.20	34.00	544.10	39.50	538.60	n6-16 n18-20
BH161	585.90	184.24	963.28	26.00	559.90	34.00	551.90	43.00	542.90	46.20	539.70	n14.5-18.5
BH162	573.20	144.26	827.41	13.80	559.40	22.80	550.40	28.00	545.20	32.10	541.10	n6-22.8
BH163	567.50	81.19	683.36	8.10	559.40	22.40	545.10	24.00	543.50	28.00	539.50	n8-12 s18-20
BH164	568.30	-5.93	705.10	9.00	559.30	--	--	25.00	543.30	28.30	540.00	n6-9
BH165	575.30	139.77	1111.59	14.90	560.40	28.00	547.30	33.00	542.30	37.60	537.70	n12-14.9
BH166	573.40	169.84	1237.20	14.00	559.40	25.50	547.90	30.00	543.40	35.10	538.30	n6-25.5
BH167	569.80	-14.28	1067.02	11.00	558.80	--	--	24.00	545.80	30.00	539.80	n6-11
BH168	578.20	348.12	1058.56	22.00	556.20	23.00	555.20	35.50	542.70	40.00	538.20	n14-22
BH169	578.80	294.43	1072.33	18.00	560.80	23.00	555.80	38.00	540.80	40.20	538.60	n8-22
BH170	578.30	251.52	1079.10	17.50	560.80	22.70	555.60	37.50	540.80	40.10	538.20	n6-17.5
BH171	572.00	37.92	880.45	13.20	558.80	27.60	544.40	28.00	544.00	32.00	540.00	n8-27.6
BH172	586.20	18.74	958.53	27.00	559.20	44.00	542.20	45.00	541.20	46.80	539.40	n24-44
BH173	586.30	50.22	1019.14	27.00	559.30	--	--	43.50	542.80	47.10	539.20	n22-24 n27-43.5

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BH174	576.80	69.68	1171.49	18.80	558.00	--	--	34.60	542.20	39.80	537.00	n14-17 s18-18.8 s33.4-34.6
BH175	574.20	86.43	1254.84	22.00	552.20	--	--	32.00	542.20	35.20	539.00	n14-22.7 s24-26 n26-31.9
BH176	573.10	120.18	1335.65	16.00	557.10	--	--	28.00	545.10	34.30	538.80	n8-10 n14-28
BH177	568.60	-4.37	793.52	10.00	558.60	--	--	26.00	542.60	28.30	540.30	n22-26
BH178	573.20	-29.11	915.27	14.00	559.20	--	--	29.70	543.50	33.50	539.70	s12-14 n14-22 n24-29.7
BH179	586.40	50.18	943.78	27.50	558.90	--	--	43.50	542.90	45.10	541.30	n20.6-27.5 n30-32 n36-43.5
BH180	585.90	30.13	985.19	30.00	555.90	41.80	544.10	42.00	543.90	47.50	538.40	n20-41.8
BH181	569.30	-134.47	845.87	--	--	--	--	25.30	544.00	28.20	541.10	s15-17
BH182	569.40	-129.11	894.71	14.00	555.40	--	--	26.00	543.40	31.50	537.90	n10.2-11.8 s20-23.7
BH183	568.80	-119.93	944.33	--	--	--	--	22.00	546.80	30.00	538.80	n10-14 s14-22
BH184	568.20	-111.38	987.64	14.00	554.20	--	--	24.30	543.90	29.40	538.80	s8-14 s18-22
BH185	569.10	-106.35	1032.91	11.50	557.60	--	--	25.00	544.10	29.50	539.60	n8-18 s18-24
BH186	568.90	-136.79	809.84	14.10	554.80	--	--	23.00	545.90	29.20	539.70	s12-18
BH187	568.50	-141.16	748.60	--	--	--	--	26.70	541.80	29.30	539.20	s6-10 n28.6-29.3
BH188	573.10	-149.57	707.03	20.00	553.10	--	--	27.50	545.60	30.80	542.30	s26-27.5
BH189	574.10	95.97	1292.47	15.70	558.40	--	--	31.50	542.60	34.30	539.80	n10-28
BH190	586.40	70.94	1008.97	26.00	560.40	--	--	43.30	543.10	48.10	538.30	n20-26 n40-43.3
BH191	586.50	92.85	928.96	26.50	560.00	--	--	41.50	545.00	46.00	540.50	n20-24 n25.5-41.5
BH192	568.90	25.50	759.62	9.00	559.90	23.90	545.00	26.70	542.20	28.50	540.40	s18-23.9 n23.9-24
BH193	568.80	-13.65	744.45	9.40	559.40	--	--	24.50	544.30	28.00	540.80	n8-24.5
BH194	567.50	-72.52	682.75	11.00	556.50	23.90	543.60	24.00	543.50	28.20	539.30	n6-11 n22-23.9
BH195	568.20	-34.97	614.14	9.20	559.00	23.80	544.40	24.00	544.20	28.70	539.50	s6-23.8
BH196	568.80	57.38	629.30	9.50	559.30	23.90	544.90	24.00	544.80	27.70	541.10	n6-23.9
BH197	568.50	-28.67	654.19	9.00	559.50	24.00	544.50	24.70	543.80	28.70	539.80	n9-14
BH198	568.90	30.33	802.08	14.00	554.90	24.30	544.60	26.00	542.90	28.00	540.90	n6-14 n22-24
BH199	586.80	73.68	1085.52	32.00	554.80	42.50	544.30	43.50	543.30	48.00	538.80	n22-38 n40-42.5
BH200	577.10	115.34	1178.17	17.50	559.60	--	--	34.00	543.10	37.80	539.30	s12-14 n14-34
BH201	576.00	121.32	1225.54	14.00	562.00	32.00	544.00	34.00	542.00	37.00	539.00	n10-15.3 n16-32
BH202	573.90	132.83	1276.76	14.20	559.70	--	--	30.50	543.40	34.80	539.10	n8.2-10 s12-14.2 n16-30.5
BH203	576.70	92.42	1204.44	27.30	549.40	--	--	33.50	543.20	37.60	539.10	n20-33.5
BH204	575.40	105.00	1133.72	28.50	546.90	--	--	31.00	544.40	36.80	538.60	n28-31
BH205	573.20	25.92	1129.73	13.00	560.20	28.50	544.70	29.50	543.70	33.20	540.00	s6-9.3 n12-14 n16-28.5
BH206	573.80	21.68	1189.15	15.00	558.80	29.80	544.00	30.00	543.80	34.80	539.00	n14-16
BH207	573.60	33.73	1244.36	18.00	555.60	30.00	543.60	31.00	542.60	34.70	538.90	n16-18 n24-27
BH208	575.10	48.81	1218.91	14.50	560.60	--	--	31.50	543.60	35.80	539.30	n10-14.5 n24-31.5
BH209	573.70	52.93	1288.03	14.50	559.20	28.30	545.40	30.00	543.70	34.50	539.20	n14.5-16
BH210	568.80	38.09	657.85	8.00	560.80	23.70	545.10	24.00	544.80	28.70	540.10	s8-10 n10-16
BH211	569.00	43.52	716.30	8.30	560.70	--	--	24.00	545.00	29.00	540.00	n4-8
BH212	569.10	68.99	770.50	8.00	561.10	--	--	23.50	545.60	29.50	539.60	n20-23.5
BH213	568.60	-21.74	699.16	12.00	556.60	24.00	544.60	25.00	543.60	28.50	540.10	s4-6 n8-24.5
BH214	568.70	-9.04	836.18	9.20	559.50	--	--	25.30	543.40	28.50	540.20	s8-9.2 n21.5-25.3
BH215	572.70	74.76	879.97	16.00	556.70	--	--	26.00	546.70	31.70	541.00	n6-10 n14-18 n22-24
BH216	586.70	149.92	906.28	26.00	560.70	35.50	551.20	43.00	543.70	47.00	539.70	n14-26
BH217	582.00	-195.76	862.57	26.00	556.00	--	--	34.90	547.10	43.60	538.40	n26-30 s30-33.8
BH218	581.20	-204.47	761.50	25.00	556.20	--	--	33.40	547.80	42.20	539.00	n25-29 s29-34.4
BH219	580.30	-210.98	662.91	25.00	555.30	--	--	33.40	546.90	40.20	540.10	ND
BH220	582.60	-183.05	961.88	25.00	557.60	--	--	38.50	544.10	44.00	538.60	s25-36
BH221	583.20	-168.45	1062.27	25.40	557.80	33.50	549.70	35.00	548.20	44.60	538.60	n25-25.4 s25.4-27 n27-27.4
BH222	575.20	97.61	1807.61	18.00	557.20							ND
BH223	574.80	73.85	1767.95	18.00	556.80							s14.3-16

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WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
OW200	3.50	8.00	25.80	27.80	28.50	3.50	4.50	17.80	2.00	19.80
OW201	7.00	7.00	28.80	29.50	29.50	7.00	0.00	21.80	0.70	22.50
OW202	20.00	26.50	26.50	36.80	37.00	20.00	6.50	0.00	10.30	10.30
OW203	17.50	19.00	19.00	30.10	30.10	17.50	1.50	0.00	11.10	11.10
OW204	21.00	24.30	24.30	34.50	34.50	21.00	3.30	0.00	10.20	10.20
OW205	24.00	32.50	32.50	36.90	38.00	24.00	8.50	0.00	4.40	4.40
OW206	23.00	25.30	25.30	28.80	32.50	23.00	2.30	0.00	3.50	3.50
OW207	8.00	18.00	21.00	26.00	26.00	8.00	10.00	3.00	5.00	8.00
OW207A	7.60	21.00	21.00	26.50	26.50	7.60	13.40	0.00	5.50	5.50
OW208	7.20	7.20	16.00	22.50	24.00	7.20	0.00	8.80	6.50	15.30
OW209	8.50	8.50	25.40	27.50	29.50	8.50	0.00	16.90	2.10	19.00
OW210	8.80	10.80	30.60	32.50	32.50	8.80	2.00	19.80	1.90	21.70
OW211	19.00	19.20	28.00	31.00	31.00	19.00	0.20	8.80	3.00	11.80
OW212	8.60	11.90	24.00	27.40	27.40	8.60	3.30	12.10	3.40	11.60
OW213	8.00	24.10	25.10	28.00	28.00	8.00	16.10	1.00	2.90	2.50
OW214	8.00	8.00	16.50	23.50	24.00	8.00	0.00	8.50	7.00	15.50
OW215	17.00	19.00	30.70	37.10	37.10	17.00	2.00	11.70	6.40	18.10
OW216*	2.30	6.90	24.00	30.30	31.00	2.30	4.60	17.10	6.30	23.40
OW217	2.00	7.80	13.50	26.50	26.90	2.00	5.80	5.70	13.00	18.70
OW218	5.00	9.00	23.90	26.50	26.50	5.00	4.00	14.90	2.60	17.50
OW219	5.30	5.30	5.30	20.50	20.70	5.30	0.00	0.00	15.20	15.20
OW220	0.50	7.90	30.00	30.10	30.10	0.50	7.40	22.10	0.10	22.20
OW221*	20.00	27.80	27.80	31.40	31.50	20.00	7.80	0.00	3.60	3.60
OW222*	20.70	20.80	20.80	25.90	27.00	20.70	0.10	0.00	5.10	5.10
OW223	2.30	4.00	4.00	20.40	21.00	2.30	1.70	0.00	16.40	16.40
OW224	5.50	8.50	18.00	25.30	25.30	5.50	3.00	9.50	7.30	16.80
OW225	9.00	9.00	27.00	31.20	31.20	9.00	0.00	18.00	4.20	22.20
OW226	8.00	8.00	32.80	33.00	33.00	8.00	0.00	24.80	0.20	25.00
OW227*	16.60	29.80	29.80	34.80	34.80	16.60	13.20	0.00	5.00	5.00
OW228	33.00	33.00	33.00	36.50	40.50	33.00	0.00	0.00	3.50	3.50
OW229	9.40	14.00	25.50	26.50	26.50	9.40	4.60	11.50	1.00	12.50
OW230	8.30	10.00	25.00	28.30	28.40	8.30	1.70	15.00	3.30	18.30
OW231	7.70	9.00	24.00	28.80	28.80	7.70	1.30	15.00	4.80	19.80
OW232*	8.50	8.50	25.40	27.50	31.00	8.50	0.00	16.90	2.10	19.00
OW233	8.20	8.20	28.00	30.80	31.00	8.20	0.00	19.80	2.80	22.60
OW234*	8.00	8.00	29.30	32.00	32.00	8.00	0.00	21.30	2.70	24.00
OW235	9.00	14.00	29.50	31.50	31.50	9.00	5.00	15.50	2.00	17.50
OW236	18.00	29.60	33.90	36.50	37.50	18.00	11.60	4.30	2.60	6.90
OW237*	17.50	19.00	19.00	30.00	30.00	17.50	1.50	0.00	11.00	11.00
OW238	20.00	24.00	24.00	32.00	32.30	20.00	4.00	0.00	8.00	8.00
OW239	24.00	29.20	29.20	35.60	36.50	24.00	5.20	0.00	6.40	6.40
OW240*	24.00	32.50	32.50	36.90	38.00	24.00	8.50	0.00	4.40	4.40
OW241	9.00	20.00	21.80	26.70	27.90	9.00	11.00	1.80	4.90	3.00
OW242	8.20	23.90	23.90	25.20	27.00	8.20	15.70	0.00	1.30	1.30
OW243	10.00	13.90	24.00	25.40	28.00	10.00	3.90	10.10	1.40	11.50
OW244*	28.60	38.80	38.80	44.00	44.10	28.60	10.20	0.00	5.20	5.20
OW245	25.00	35.00	35.60	44.00	44.40	25.00	10.00	0.60	8.40	9.00
OW260	13.00	24.40	26.00	28.30	28.50	13.00	11.40	1.60	2.30	3.90
OW261	20.00	27.80	27.80	31.40	31.50	20.00	7.80	0.00	3.60	3.60
OW262	17.50	32.40	32.40	34.00	34.20	17.50	14.90	0.00	1.60	1.60
OW263*	20.00					20.00				
OW264	15.50	21.20	21.20	32.30	32.30	15.50	5.70	0.00	11.10	11.10

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WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
OW265	16.60	29.80	29.80	35.70	36.30	16.60	13.20	0.00	5.90	5.90
OW266*	17.50	19.00	19.00			17.50	1.50	0.00		
OW267*	21.00	24.30	24.30			21.00	3.30	0.00		
OW268*	24.00	32.50	32.50			24.00	8.50	0.00		
OW269	29.20	29.30	29.30	32.80	33.20	29.20	0.10	0.00	3.50	3.50
OW270	26.40	26.40	26.40	29.80	29.80	26.40	0.00	0.00	3.40	3.40
OW271*	23.00	25.30	25.30			23.00	2.30	0.00		
OW272	20.70	20.80	20.80	25.90	28.00	20.70	0.10	0.00	5.10	5.10
OW273	18.80	18.80	18.80	26.70	26.70	18.80	0.00	0.00	7.90	7.90
OW274	2.30	6.90	24.00	30.30	32.50	2.30	4.60	17.10	6.30	23.40
OW275	7.00	7.50	27.50	31.50	32.00	7.00	0.50	20.00	4.00	24.00
OW276	7.80	7.80	29.00	31.80	32.80	7.80	0.00	21.20	2.80	24.00
OW277	8.00	8.00	29.30	32.30	32.50	8.00	0.00	21.30	3.00	24.30
OW278	8.40	8.40	29.80	32.20	33.00	8.40	0.00	21.40	2.40	23.80
OW279	8.00	8.00	28.50	29.00	31.30	8.00	0.00	20.50	0.50	21.00
OW280	8.00	8.00	28.00	29.30	29.90	8.00	0.00	20.00	1.30	21.30
OW281	7.00	7.00	25.80	27.70	28.90	7.00	0.00	18.80	1.90	20.70
OW282	12.00	12.00	30.50	32.40	32.60	12.00	0.00	18.50	1.90	20.40
OW283	11.50	11.50	30.00	32.00	32.10	11.50	0.00	18.50	2.00	20.50
OW284	6.20	6.20	29.00	29.30	29.90	6.20	0.00	22.80	0.30	23.10
OW285	7.00	7.00	27.80	28.50	28.50	7.00	0.00	20.80	0.70	21.50
OW286	6.90	6.90	28.20	31.00	31.00	6.90	0.00	21.30	2.80	24.10
OW287	17.80	20.80	34.00	35.30	36.10	17.80	3.00	13.20	1.30	14.50
OW288	8.00	14.00	31.50	33.80	33.80	8.00	6.00	17.50	2.30	19.80
OW289	9.80	17.70	33.60	34.70	34.70	9.80	7.90	15.90	1.10	17.00
OW290	14.50	19.80	33.20	34.20	35.70	14.50	5.30	13.40	1.00	14.40
OW291	14.00	19.80	33.90	35.20	36.30	14.00	5.80	14.10	1.30	15.40
OW292	22.00	33.90	34.00	34.70	37.50	22.00	11.90	0.10	0.70	0.80
OW293	29.80	34.20	34.20	37.10	37.10	29.80	4.40	0.00	2.90	2.90
OW294	20.00	32.00	32.00	33.60	36.20	20.00	12.00	0.00	1.60	1.60
BH100	8.40	9.00	30.50	33.00	33.50	8.40	0.60	21.50	2.50	24.00
BH101	9.00	10.00	29.70	32.50	32.50	9.00	1.00	19.70	2.80	22.50
BH102	9.00	13.70	32.90	33.80	33.80	9.00	4.70	19.20	0.90	20.10
BH103	11.00	16.00	33.00	33.40	34.10	11.00	5.00	17.00	0.40	17.40
BH104	12.80	16.60	32.00	33.40	33.40	12.80	3.80	15.40	1.40	16.80
BH105	13.00	27.00	32.00	33.00	33.10	13.00	14.00	5.00	1.00	6.00
BH106	20.00	29.00	29.00	32.60	33.10	20.00	9.00	0.00	3.60	3.60
BH107	15.00	26.50	27.20	28.50	33.10	15.00	11.50	0.70	1.30	2.00
BH108	12.90	27.00	27.00	30.00	31.60	12.90	14.10	0.00	3.00	0.00
BH109	12.80	24.50	24.50	30.90	31.30	12.80	11.70	0.00	6.40	6.40
BH110	12.40	25.00	25.00	31.10	31.40	12.40	12.60	0.00	6.10	5.00
BH111	11.00	26.00	26.00	31.40	31.40	11.00	15.00	0.00	5.40	0.00
BH112	29.70	39.50	39.50	45.00	48.40	29.70	9.80	0.00	5.50	5.50
BH113	26.00	39.50	39.50	46.40	46.40	26.00	13.50	0.00	6.90	6.00
BH114	28.40	36.80	36.80	45.60	45.60	28.40	8.40	0.00	8.80	5.00
BH115	25.00	35.30	37.80	44.40	44.60	25.00	10.30	2.50	6.60	9.10
BH116	28.60	38.80	38.80	43.40	44.30	28.60	10.20	0.00	4.60	4.60
BH117	24.20	38.00	38.00	44.50	44.50	24.20	13.80	0.00	6.50	3.90
BH118	23.10	37.00	37.00	42.00	42.50	23.10	13.90	0.00	5.00	1.00
BH119	24.00	37.00	37.80	40.50	42.30	24.00	13.00	0.80	2.70	3.00
BH120	24.00	34.50	34.50	40.80	40.90	24.00	10.50	0.00	6.30	2.00
BH121	12.00	23.30	23.30	26.40	28.50	12.00	11.30	0.00	3.10	3.10

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BH122	8.00	23.90	25.30	26.00	26.00	8.00	15.90	1.40	0.70	2.10
BH123	8.90	20.70	27.70	27.90	27.90	8.90	11.80	7.00	0.20	7.20
BH124	8.00	14.30	27.70	28.00	28.00	8.00	6.30	13.40	0.30	13.70
BH125	9.70	12.50	28.00	28.50	29.60	9.70	2.80	15.50	0.50	16.00
BH126	8.10	13.30	28.00	29.80	29.80	8.10	5.20	14.70	1.80	11.80
BH127	8.00	13.30	29.50	31.20	31.20	8.00	5.30	16.20	1.70	17.90
BH128	8.00	13.20	28.50	32.00	32.20	8.00	5.20	15.30	3.50	18.80
BH129	8.60	12.90	31.00	33.00	33.00	8.60	4.30	18.10	2.00	20.10
BH130	7.00	11.00	30.00	32.30	32.80	7.00	4.00	19.00	2.30	21.30
BH131	6.30	10.20	28.00	29.00	29.00	6.30	3.90	17.80	1.00	18.80
BH132	7.20	8.00	26.00	29.00	29.00	7.20	0.80	18.00	3.00	21.00
BH133	8.40	10.20	28.50	31.00	31.00	8.40	1.80	18.30	2.50	20.80
BH134	10.00	11.00	26.80	32.20	32.20	10.00	1.00	15.80	5.40	21.20
BH135	9.10	10.20	29.60	32.50	32.50	9.10	1.10	19.40	2.90	22.30
BH136	8.10	8.20	29.70	31.50	31.50	8.10	0.10	21.50	1.80	23.30
BH137	10.40	14.00	27.30	29.10	29.90	10.40	3.60	13.30	1.80	11.10
BH138	12.00	20.40	26.00	31.10	31.10	12.00	8.40	5.60	5.10	9.50
BH139	10.00	24.50	24.50	29.20	30.60	10.00	14.50	0.00	4.70	4.70
BH140	12.00	26.80	27.00	30.80	30.80	12.00	14.80	0.20	3.80	4.00
BH141	14.00	30.00	30.00	30.50	32.00	14.00	16.00	0.00	0.50	0.00
BH142	14.00	25.50	25.50	26.00	26.80	14.00	11.50	0.00	0.50	0.00
BH143	8.20	21.00	21.00	25.00	27.00	8.20	12.80	0.00	4.00	0.00
BH144	8.50	23.00	23.00	26.30	27.80	8.50	14.50	0.00	3.30	3.00
BH145	8.90	26.00	26.00	27.40	28.00	8.90	17.10	0.00	1.40	0.00
BH146	12.00	27.00	27.00	31.00	31.40	12.00	15.00	0.00	4.00	3.00
BH147	11.00	25.00	25.00	29.60	31.20	11.00	14.00	0.00	4.60	4.60
BH148	10.00	25.90	25.90	29.80	31.80	10.00	15.90	0.00	3.90	3.90
BH149	11.00	25.00	25.00	29.90	30.30	11.00	14.00	0.00	4.90	4.90
BH150	11.50	25.80	25.80	29.90	30.90	11.50	14.30	0.00	4.10	4.10
BH151	14.00	25.00	25.00	30.20	30.40	14.00	11.00	0.00	5.20	5.20
BH152	12.00	25.80	25.80	30.00	30.20	12.00	13.80	0.00	4.20	4.20
BH153	14.00	25.50	25.50	30.40	30.50	14.00	11.50	0.00	4.90	4.90
BH154	10.00	26.00	26.00	31.30	31.30	10.00	16.00	0.00	5.30	5.00
BH155	19.00	29.40	29.40	33.30	34.20	19.00	10.40	0.00	3.90	1.30
BH156	13.50	18.50	29.00	32.50	32.50	13.50	5.00	10.50	3.50	14.00
BH157	27.30	29.00	45.00	45.30	46.50	27.30	1.70	16.00	0.30	16.30
BH158	14.50	18.50	33.60	36.00	37.50	14.50	4.00	15.10	2.40	17.50
BH159	13.90	17.50	34.00	36.50	37.50	13.90	3.60	16.50	2.50	19.00
BH160	17.50	21.90	34.00	37.60	39.50	17.50	4.40	12.10	3.60	15.70
BH161	26.00	34.00	43.00	45.00	46.20	26.00	8.00	9.00	2.00	11.00
BH162	13.80	22.80	28.00	30.00	32.10	13.80	9.00	5.20	2.00	7.20
BH163	8.10	22.40	24.00	27.00	28.00	8.10	14.30	1.60	3.00	4.60
BH164	9.00	25.00	25.00	28.00	28.30	9.00	16.00	0.00	3.00	0.00
BH165	14.90	28.00	33.00	36.30	37.60	14.90	13.10	5.00	3.30	8.30
BH166	14.00	25.50	30.00	32.80	35.10	14.00	11.50	4.50	2.80	7.30
BH167	11.00	24.00	24.00	29.50	30.00	11.00	13.00	0.00	5.50	5.50
BH168	22.00	23.00	35.50	39.20	40.00	22.00	1.00	12.50	3.70	16.20
BH169	18.00	23.00	38.00	39.70	40.20	18.00	5.00	15.00	1.70	16.70
BH170	17.50	22.70	37.50	39.70	40.10	17.50	5.20	14.80	2.20	17.00
BH171	13.20	27.60	28.00	31.00	32.00	13.20	14.40	0.40	3.00	3.40
BH172	27.00	44.00	45.00	46.80	46.80	27.00	17.00	1.00	1.80	2.80
BH173	27.00	43.50	43.50	45.00	47.10	27.00	16.50	0.00	1.50	0.50

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1A - STRATIGRAPHIC INFORMATION - S AREA REMEDIAL PROGRAM

WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
BH174	18.80	34.60	34.60	36.00	39.80	18.80	15.80	0.00	1.40	1.40
BH175	22.00	32.00	32.00	34.00	35.20	22.00	10.00	0.00	2.00	2.00
BH176	16.00	28.00	28.00	31.90	34.30	16.00	12.00	0.00	3.90	1.90
BH177	10.00	26.00	26.00	28.00	28.30	10.00	16.00	0.00	2.00	2.00
BH178	14.00	29.70	29.70	31.50	33.50	14.00	15.70	0.00	1.80	0.30
BH179	27.50	43.50	43.50	44.60	45.10	27.50	16.00	0.00	1.10	1.10
BH180	30.00	41.80	42.00	46.00	47.50	30.00	11.80	0.20	4.00	4.20
BH181	25.30	25.30	25.30	26.30	28.20	25.30	0.00	0.00	1.00	1.00
BH182	14.00	26.00	26.00	26.50	31.50	14.00	12.00	0.00	0.50	0.50
BH183	22.00	22.00	22.00	29.00	30.00	22.00	0.00	0.00	7.00	7.00
BH184	14.00	24.30	24.30	29.40	29.40	14.00	10.30	0.00	5.10	3.70
BH185	11.50	25.00	25.00	29.50	29.50	11.50	13.50	0.00	4.50	3.00
BH186	14.10	23.00	23.00	28.90	29.20	14.10	8.90	0.00	5.90	3.00
BH187	26.70	26.70	26.70	28.60	29.30	26.70	0.00	0.00	1.90	0.00
BH188	20.00	27.50	27.50	30.80	30.80	20.00	7.50	0.00	3.30	3.30
BH189	15.70	31.50	31.50	34.00	34.30	15.70	15.80	0.00	2.50	2.50
BH190	26.00	43.30	43.30	47.30	48.10	26.00	17.30	0.00	4.00	0.70
BH191	26.50	41.50	41.50	44.50	46.00	26.50	15.00	0.00	3.00	0.50
BH192	9.00	23.90	26.70	26.70	28.50	9.00	14.90	2.80	0.00	2.80
BH193	9.40	24.50	24.50	26.40	28.00	9.40	15.10	0.00	1.90	1.90
BH194	11.00	23.90	24.00	24.70	28.20	11.00	12.90	0.10	0.70	0.80
BH195	9.20	23.80	24.00	24.30	28.70	9.20	14.60	0.20	0.30	0.50
BH196	9.50	23.90	24.00	25.70	27.70	9.50	14.40	0.10	1.70	0.10
BH197	9.00	24.00	24.70	28.00	28.70	9.00	15.00	0.70	3.30	2.00
BH198	14.00	24.30	26.00	26.90	28.00	14.00	10.30	1.70	0.90	2.60
BH199	32.00	42.50	43.50	44.70	48.00	32.00	10.50	1.00	1.20	2.20
BH200	17.50	34.00	34.00	37.10	37.80	17.50	16.50	0.00	3.10	3.10
BH201	14.00	32.00	34.00	35.30	37.00	14.00	18.00	2.00	1.30	3.30
BH202	14.20	30.50	30.50	34.30	34.80	14.20	16.30	0.00	3.80	3.80
BH203	27.30	33.50	33.50	37.30	37.60	27.30	6.20	0.00	3.80	3.80
BH204	28.50	31.00	31.00	34.20	36.80	28.50	2.50	0.00	3.20	3.20
BH205	13.00	28.50	29.50	33.00	33.20	13.00	15.50	1.00	3.50	4.50
BH206	15.00	29.80	30.00	34.00	34.80	15.00	14.80	0.20	4.00	4.20
BH207	18.00	30.00	31.00	34.00	34.70	18.00	12.00	1.00	3.00	2.00
BH208	14.50	31.50	31.50	34.00	35.80	14.50	17.00	0.00	2.50	2.50
BH209	14.50	28.30	30.00	34.00	34.50	14.50	13.80	1.70	4.00	5.70
BH210	8.00	23.70	24.00	28.00	28.70	8.00	15.70	0.30	4.00	2.00
BH211	8.30	24.00	24.00	27.80	29.00	8.30	15.70	0.00	3.80	3.80
BH212	8.00	23.50	23.50	28.00	29.50	8.00	15.50	0.00	4.50	4.50
BH213	12.00	24.00	25.00	27.70	28.50	12.00	12.00	1.00	2.70	2.00
BH214	9.20	25.30	25.30	28.00	28.50	9.20	16.10	0.00	2.70	0.70
BH215	16.00	26.00	26.00	31.30	31.70	16.00	10.00	0.00	5.30	5.30
BH216	26.00	35.50	43.00	46.10	47.00	26.00	9.50	7.50	3.10	8.50
BH217	26.00	34.90	34.90	42.70	43.60	26.00	8.90	0.00	7.80	7.80
BH218	25.00	33.40	33.40	42.00	42.20	25.00	8.40	0.00	8.60	8.60
BH219	25.00	33.40	33.40	39.80	40.20	25.00	8.40	0.00	6.40	4.00
BH220	25.00	38.50	38.50	44.00	44.00	25.00	13.50	0.00	5.50	5.50
BH221	25.40	33.50	35.00	44.50	44.60	25.40	8.10	1.50	9.50	11.00
BH222	18.00					18.00				
BH223	18.00					18.00				

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
B1		258.00	2159.00		--		--		--		--	
B2		368.00	2106.00		--		--		--		--	
B3		723.00	1800.00		--		--		--		--	
B4		884.00	1895.00		--		--		--		--	
B5		1065.00	1811.00		--		--		--		--	
B6		307.00	2306.00		--		--		--		--	
B7		431.00	2250.00		--		--		--		--	
B8		724.00	2117.00		--		--		--		--	
B9		888.00	2045.00		--		--		--		--	
B10		1090.00	1960.00		--		--		--		--	
B11		1033.00	1697.00		--		--		--		--	
B12		276.00	2053.00		--		--		--		--	
H7	546.00	-555.00	-93.00		--		--		--	3.50	542.50	
H8	546.10	-465.00	-300.00		--		--		--	3.00	543.10	
H9	562.90	-63.00	-572.00		--		--		--	22.00	540.90	
H16	550.80	-872.00	1205.00		--		--		--	12.00	538.80	
SP1A	571.80	-116.00	-840.00	20.50	551.30	--	--	24.50	547.30		--	ND
SP2A	573.70	-169.00	-74.00	--	--	--	--	23.00	550.70		--	ND
SP3A	574.20	-187.00	348.00	--	--	--	--	28.00	546.20		--	ND
SP4A	573.70	-184.00	725.00	24.00	549.70	--	--	30.00	543.70	31.00	542.70	ND
SP6&6A	568.30	-345.00	-825.00	--	--	--	--	25.00	543.30	26.00	542.30	ND
SP7&7A	572.80	-339.00	-27.50	--	--	--	--	25.00	547.80	30.50	542.30	ND
SP8&8A	570.40	-347.90	1080.90	--	--	--	--	26.00	544.40	35.00	535.40	n21-26
SP9&9A	574.10	-360.00	369.00	24.00	550.10	--	--	26.00	548.10	29.00	545.10	ND
SS1*	571.00	70.00	1418.90	20.00	551.00	--	--	28.50	542.50	31.50	539.50	n30.5
SS2*	570.90	45.70	1430.80	20.00	550.90	--	--	28.50	542.40	31.50	539.40	n30.5
CW1	570.90	57.10	1424.67	20.00	550.90	--	--	28.50	542.40	31.50	539.40	n30.5
CW1A*	569.90	-12.95	1458.23	13.50	556.40		--		--		--	ND
CW1B	569.90	-3.13	1455.36	13.50	556.40	--	--	24.00	545.90		--	ND
CW2A	570.50	347.00	1348.00	9.00	561.50	17.50	553.00		--		--	ND
CW3A	571.20	595.00	1276.00	--	--	10.50	560.70		--		--	ND
CW4A	571.50	836.00	1118.00	--	--	6.00	565.50		--		--	ND
CW5	576.10	125.00	1654.00	--	--	--	--	32.50	543.60	37.00	539.10	ND
CW6	575.40	383.00	1523.00	16.00	559.40	20.50	554.90	33.50	541.90	36.00	539.40	ND
CW6A*	575.40	373.00	1527.00		--		--		--		--	ND
CW6B*	575.40	381.00	1531.00	16.00	559.40	20.50	554.90		--		--	ND
CW7	570.70	682.00	1428.00	--	--	12.00	558.70	30.00	540.70	30.50	540.20	ND
CW7A*	570.70	688.00	1434.00	--	--	12.00	558.70		--		--	ND
CW8A	577.20	98.00	1514.00	22.50	554.70		--		--		--	ND
CW9	572.30	534.00	1480.00	--	--	16.50	555.80	30.00	542.30	33.00	539.30	ND
CW9A*	572.30	541.00	1476.00		--		--		--		--	ND
CW10	576.90	269.10	1574.00	15.00	561.90	26.50	550.40	36.00	540.90	37.00	539.90	ND
CW10A*	576.90	276.15	1570.00	15.00	561.90		--		--		--	ND
CW11	574.60	513.00	1618.00	22.50	552.10	25.50	549.10	34.50	540.10	36.00	538.60	ND
CW11A*	574.60	510.00	1610.00	22.50	552.10	25.50	549.10		--		--	ND
CW13	573.70	576.18	1731.45	--	--	16.50	557.20	33.00	540.70	36.00	537.70	ND
CW13A*	573.70	575.00	1729.00		--		--		--		--	ND
OW1S-80	576.20	235.00	1170.00	18.50	557.70	22.50	553.70		--		--	n6.5-12.5
OW2S-80	575.30	92.00	1138.00	22.00	553.30	--	--	31.70	543.60		--	n14-31.7
OW3S-80	573.20	157.00	847.00	18.00	555.20	22.80	550.40		--		--	n13-22.8
OW4S-80	572.40	82.00	879.00	16.00	556.40	--	--	26.00	546.40		--	n12-16 n20-24
OW5S-80	578.80	276.00	1042.00	18.00	560.80	22.30	556.50		--		--	n8-22

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
OW6S-80	571.70	211.00	715.00	12.00	559.70	15.70	556.00		--		--	n8.3-10
OW7S-80	579.00	298.00	1070.00	18.00	561.00	22.30	556.70		--		--	n12-14
OW8S-80	570.50	-12.69	1061.36	10.50	560.00	--	--	27.00	543.50		--	ND
OW9S-80	569.80	-38.00	995.00	14.00	555.80	--	--	26.50	543.30		--	n8-10
BH1A-08	564.40	738.19	1774.78	--	--	0.00	564.40	25.00	539.40	27.00	537.40	ND
BH2A-08	550.50	-860.00	2090.00		--		--		--	22.00	528.50	ND
BH3-43	564.20	769.19	1229.78	1.00	563.20	3.00	561.20	25.00	539.20	26.00	538.20	ND
BH1B-43	568.30	691.19	1457.78	--	--	6.60	561.70	27.80	540.50	28.30	540.00	ND
BH2B-43	569.70	449.19	1634.78	--	--	14.10	555.60	29.20	540.50	30.50	539.20	ND
BH3B-43	569.30	539.19	1813.78	--	--	13.20	556.10	30.80	538.50	31.70	537.60	ND
BH4B-43	568.80	788.19	1642.78	--	--	8.20	560.60	--	--	29.10	539.70	ND
BH5B-43	566.70	650.19	1601.78	--	--	7.00	559.70	28.60	538.10	29.70	537.00	ND
BH1-49	569.40	391.19	1605.78	--	--	9.10	560.30	--	--	29.10	540.30	ND
BH2-49	568.40	421.19	1829.78	--	--	11.10	557.30	--	--	30.00	538.40	ND
BH3-49	570.10	259.19	1762.78	10.00	560.10	16.00	554.10	28.00	542.10	32.00	538.10	ND
BH4-49	571.40	194.19	1489.78	--	--	17.00	554.40	27.90	543.50	31.80	539.60	ND
BH5-49	570.20	207.19	1930.78	10.00	560.20	23.90	546.30	30.00	540.20	33.00	537.20	ND
BH6-49	572.00	99.19	1691.78	12.00	560.00	--	--	30.00	542.00	33.00	539.00	ND
BH7-49	571.70	1053.19	1546.78	0.00	571.70	7.10	564.60	26.50	545.20	28.50	543.20	ND
BH1-77	574.90	441.19	1696.78	--	--	17.00	557.90	30.00	544.90	37.00	537.90	ND
BH2-77	569.90	546.19	1887.78	9.00	560.90	17.50	552.40		--		--	ND
BH3-77	568.80	621.19	1880.78	3.50	565.30	9.50	559.30	29.50	539.30	33.00	535.80	ND
BH4-77	568.60	656.19	1903.78	7.00	561.60	7.50	561.10	29.00	539.60	33.50	535.10	ND
BH5-77	569.20	663.19	1955.78	6.50	562.70	8.50	560.70	29.00	540.20	34.00	535.20	ND
BH6-77	573.90	236.19	2016.78	16.00	557.90		--		--		--	ND
BH7-77	575.90	116.19	1829.78	18.00	557.90	--	--	33.00	542.90		--	ND
BH1-80	586.90	-124.81	1747.78	39.00	547.90	--	--	42.00	544.90	43.50	543.40	ND
BH2-80	569.00	-242.81	1782.78	20.00	549.00	--	--	25.00	544.00	33.10	535.90	ND
BH3-80	568.30	-242.81	1644.78	17.00	551.30	--	--	22.00	546.30	30.10	538.20	ND
BH4-80	588.40	-158.81	1594.78	37.00	551.40	--	--	45.00	543.40	51.50	536.90	n35-37
BH5-80	574.40	36.19	1518.78	13.00	561.40	--	--	29.50	544.90	35.20	539.20	ND
BH6-80	574.30	3.19	1528.78	21.00	553.30	--	--	28.00	546.30	35.00	539.30	ND
BH7-80	588.10	-69.81	1554.78	31.00	557.10	--	--	42.00	546.10	50.00	538.10	ND
BH1-81	576.50	55.19	1170.78	17.50	559.00	--	--	33.00	543.50		--	n14-17.5 n22-24 n28-33
BH2-81	573.80	54.19	1255.78	16.00	557.80	--	--	31.30	542.50		--	n10-16 n20-31.3
BH3-81	573.20	49.19	1324.78	14.00	559.20	--	--	27.70	545.50		--	n12-14 n16-18
BH4-81	573.50	-20.81	874.78	14.00	559.50	--	--	31.40	542.10	31.70	541.80	n12-14 n26-31.4
BH5-81	573.70	-11.25	909.36	14.00	559.70	--	--	31.50	542.20	31.80	541.90	n8-9 n12-31.5
BH6-81	571.70	21.19	843.78	12.00	559.70	--	--	29.00	542.70		--	n8-29
BH7-81	573.20	30.19	881.78	13.00	560.20	--	--	27.80	545.40		--	n10-29.8
BH8-81	573.40	-33.81	926.78	13.50	559.90	--	--	29.50	543.90		--	n12-29.5
BH14-81	573.00	-45.81	900.78	14.00	559.00	--	--	31.30	541.70	31.50	541.50	n10-12 n27.5-30
BH9-82	569.90	-25.81	1306.78	11.20	558.70	--	--	26.80	543.10	31.80	538.10	ND
BH15-82	568.40	-50.81	832.78	8.50	559.90	--	--	25.00	543.40	28.20	540.20	n21-23.5
BH16-82	568.90	-2.81	782.78	9.20	559.70	--	--	25.50	543.40	28.60	540.30	n21-25
BH17-82	568.10	-233.81	1466.78	14.00	554.10	--	--	20.00	548.10	23.70	544.40	ND
BH18-82	575.10	-384.69	682.21	22.00	553.10	--	--	28.30	546.80	35.40	539.70	ND
BH19-82	585.90	-96.81	1354.78	32.50	553.40	--	--	39.00	546.90	48.50	537.40	ND
BH20-82	583.40	-181.69	1064.21	27.00	556.40	--	--	34.50	548.90	44.20	539.20	ND
BH21-82	580.20	-221.81	588.78	24.00	556.20	--	--	33.20	547.00	41.20	539.00	ND
BH22-82	568.80	42.19	610.78	9.00	559.80	--	--	23.70	545.10	28.70	540.10	ND
BH23-82	580.40	-219.81	707.78	22.70	557.70	--	--	32.50	547.90	41.90	538.50	ND

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
WS9	570.40	0.00	-638.00	9.50	560.90	--	--	18.50	551.90	28.00	542.40	ND
WS9A*	570.30	4.00	-652.00	9.50	560.80		--		--		--	ND
WS10	570.00	-21.00	-228.00	10.50	559.50	--	--	16.00	554.00	25.50	544.50	ND
WS10A*	569.70	-13.00	-225.00	10.50	559.20		--		--		--	ND
WS11	567.70	-12.00	9.00	9.00	558.70	--	--	15.00	552.70	24.00	543.70	ND
WS11A*	567.70	-6.00	2.00	9.00	558.70		--		--		--	ND
WS12	568.90	75.00	264.00	12.00	556.90	--	--	21.00	547.90	26.50	542.40	ND
WS12A*	569.30	75.00	276.00	12.00	557.30		--		--		--	ND
WS13	567.60	-56.00	471.10	7.50	560.10	--	--	21.00	546.60	27.00	540.60	ND
WS13A*	568.10	-47.00	-471.00	7.50	560.60		--		--		--	ND
WS14A	573.60	0.00	879.00	--	--	--	--	--	--	32.70	540.90	n28.5-30.5
WS14B*	573.30	7.00	872.00		--		--		--		--	ND
WS15A	573.20	11.00	1100.00	--	--	29.00	544.20		--		--	n26.5-29
WS16	570.70	19.00	1420.00	19.50	551.20	--	--	25.50	545.20	31.00	539.70	ND
WS16A*	570.90	8.72	1423.39	19.50	551.40	--	--	25.50	545.40		--	ND
WS17	572.00	268.00	1306.00	13.50	558.50	20.50	551.50	31.00	541.00	33.00	539.00	n7.5-12
WS17A*	572.20	259.00	1310.00	13.50	558.70	20.50	551.70		--		--	n7.5-12
WS18	571.60	509.60	1195.60	--	--	17.50	554.10	31.50	540.10	33.00	538.60	n31.5-33
WS18A*	571.60	517.00	1192.00	--	--	17.50	554.10		--		--	ND
WS19	571.90	750.00	961.00	--	--	8.50	563.40	24.00	547.90	30.50	541.40	ND
WS19A*	571.90	758.00	956.00	--	--	8.50	563.40		--		--	ND
WS20	572.50	1047.00	776.00	3.00	569.50	8.00	564.50	19.50	553.00	25.50	547.00	ND
WS20A*	572.50	1047.00	767.00	3.00	569.50	8.00	564.50		--		--	ND
WS21	573.20	1313.00	873.00	1.50	571.70	8.50	564.70	18.00	555.20	27.50	545.70	ND
WS21A*	573.20	1301.00	871.00	1.50	571.70	8.50	564.70		--		--	ND
WS22	573.50	1580.00	870.00	3.00	570.50	7.50	566.00	20.00	553.50	21.50	552.00	ND
WS22A*	573.50	1575.00	880.00	3.00	570.50	7.50	566.00		--		--	ND
WS23	572.80	2203.00	992.00	--	--	7.00	565.80	19.50	553.30	24.00	548.80	ND
WS23A*	572.80	2195.00	996.00	--	--	7.00	565.80		--		--	ND
WS24	573.90	1846.00	-40.00	5.00	568.90	9.00	564.90	15.50	558.40	22.50	551.40	ND
WS24A*	573.90	1850.00	-35.00	5.00	568.90	9.00	564.90		--		--	ND
WS28	570.40	835.00	-741.00	3.00	567.40	6.00	564.40	9.00	561.40	22.50	547.90	ND
WS28A*	570.40	837.00	-752.00	3.00	567.40	6.00	564.40		--		--	ND
WS29	571.10	850.00	-222.00	3.00	568.10	--	--	5.50	565.60	21.00	550.10	ND
WS29A*	571.10	838.00	-222.00	3.00	568.10	--	--	5.50	565.60		--	ND
WS30	572.20	956.70	332.40	1.50	570.70	7.30	564.90	9.00	563.20	25.00	547.20	ND
WS30A*	572.20	952.00	340.00	1.50	570.70	7.30	564.90		--		--	ND
WS31	572.10	1270.00	105.00	3.00	569.10	6.00	566.10	11.00	561.10	23.50	548.60	ND
WS31A*	572.10	1278.00	108.00	3.00	569.10	6.00	566.10		--		--	ND
WS32	568.80	254.00	300.00	9.50	559.30	12.00	556.80	20.00	548.80	24.50	544.30	ND
WS32A*	568.80	263.00	300.00	9.50	559.30	12.00	556.80		--		--	ND
WS33A	570.60	495.00	-697.00	7.50	563.10	9.00	561.60		--		--	ND
WS34	570.20	690.00	470.00	--	--	6.00	564.20	12.00	558.20	24.90	545.30	ND
WS34A*	570.20	700.00	470.00	6.00	564.20	7.50	562.70		--		--	ND
WS35A	569.70	446.00	810.00	7.50	562.20	10.50	559.20		--		--	n7.5-10.5
WS36A	575.50	397.00	1057.00	12.00	563.50	20.00	555.50		--		--	n7.5-20
WS37A	572.20	1624.00	1260.00	0.00	572.20	8.00	564.20		--		--	ND
WS38A	572.50	2040.00	463.00	--	--	4.50	568.00		--		--	n1.5-4.5
WS39A	572.80	1660.00	288.00	--	--	5.50	567.30		--		--	n0.5-5.5
WS40	572.40	1155.00	-412.00	3.00	569.40	7.50	564.90	9.00	563.40	22.00	550.40	ND
WS40A*	572.40	1150.00	-402.00	3.00	569.40	7.50	564.90		--		--	ND
WS40B*	572.40	1152.00	-391.00	3.00	569.40	7.50	564.90	9.00	563.40		--	ND

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TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH #	GROUND ELEVATION	GRID CO-ORDINATES NORTH	EAST	DEPTH TO ALLUVIUM (FEET)	ELEV.OF ALLUVIUM	DEPTH TO CLAY (FEET)	ELEV.OF CLAY	DEPTH TO TILL (FEET)	ELEV.OF TILL	DEPTH TO BEDROCK (FEET)	ELEV.OF BEDROCK	NAPL/SHEEN DEPTH OBSERVED (FEET)
WS42A	573.10	1114.00	1078.00	4.50	568.60	9.50	563.60		--		--	ND
WS43A	568.50	539.00	1032.00	--	--	7.50	561.00		--		--	n3-6
WS44A	573.50	1181.00	1428.00	3.00	570.50	9.50	564.00		--		--	ND
WS45A	571.90	296.00	1292.00	12.00	559.90	19.20	552.70		--		--	n12-15 n18-19.2
WS46A	573.00	381.00	1255.00	--	--	15.00	558.00		--		--	ND
WS47A	572.30	155.00	1353.00	12.00	560.30	27.00	545.30		--		--	ND
WS53	569.40	521.00	1012.00		--		--		--		--	ND
WS54	570.70	490.00	1032.00		--		--		--		--	n5-8
WS55	572.20	848.00	951.00		--	7.00	565.20		--		--	ND
WS56	572.20	853.00	963.00		--	8.00	564.20		--		--	ND
WS57	572.20	866.00	984.00		--	8.00	564.20		--		--	ND
WS58	570.30	710.00	-664.00	--	--	4.00	566.30		--		--	ND
WS59	570.30	670.00	-660.00	--	--	6.00	564.30		--		--	ND
WS83	569.00	583.00	124.00		--	7.00	562.00		--		--	ND
WS84	569.20	582.00	151.00		--	7.00	562.20		--		--	ND
WS89	569.80	273.00	658.00		--		--		--		--	ND
WS93	573.10	1100.00	464.00		--	7.50	565.60		--		--	ND
WS94	572.80	1086.00	452.00		--	7.50	565.30		--		--	ND
WS95	572.60	1071.00	440.00		--	8.00	564.60		--		--	ND
WS96	573.60	1182.00	726.00		--	7.00	566.60		--		--	ND
WS97	573.60	1200.00	761.00		--	7.00	566.60		--		--	ND
WS98	573.60	1211.00	782.00		--	7.00	566.60		--		--	ND
WS105	573.00	1896.00	-36.00		--	7.00	566.00		--		--	ND
WS107	573.90	1850.00	-7.00		--	6.00	567.90		--		--	ND
WS109	572.60	1854.00	272.00		--	8.00	564.60		--		--	n5-8
WS113	571.80	1078.00	-348.00		--	7.50	564.30		--		--	ND
BH1		800.00	2488.00	--	--	17.10		33.90		40.90		ND
BH2		910.00	2282.00	6.20		11.40		28.60		36.80		ND
BH3		1010.00	2525.00	10.10		11.50		28.60		34.00		ND
BH4		1115.00	2482.00	4.90		8.20		27.20		33.00		ND
BH6		1095.00	2200.00	1.70		6.10			--		--	ND
BH9		982.00	2890.00		--	17.50		33.60		36.60		ND
OW1-82	572.30	910.00	2167.00	6.00	566.30	10.00	562.30	28.00	544.30	36.10	536.20	ND
OW2-82	570.50	460.00	2340.00	12.20	558.30	24.20	546.30	31.20	539.30	34.00	536.50	ND
OW3-82	576.10	732.00	2445.00	16.80	559.30	25.80	550.30	31.80	544.30	39.20	536.90	ND
OW4-82	574.10	1015.00	2525.00	--	--	11.80	562.30	26.80	547.30	33.30	540.80	ND
OW5-82	574.50	595.00	2715.00	18.20	556.30	--	--	28.20	546.30	35.70	538.80	ND

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TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
B1										
B2										
B3										
B4										
B5										
B6										
B7										
B8										
B9										
B10										
B11										
B12										
H7					3.50					
H8					3.00					
H9					22.00					
H16					12.00					
SP1A	20.50	24.50	24.50			20.50	4.00	0.00		
SP2A	23.00	23.00	23.00			23.00	0.00	0.00		
SP3A	28.00	28.00	28.00			28.00	0.00	0.00		
SP4A	24.00	30.00	30.00	31.00	31.00	24.00	6.00	0.00	1.00	1.00
SP6&6A	25.00	25.00	25.00	26.00	26.00	25.00	0.00	0.00	1.00	1.00
SP7&7A	25.00	25.00	25.00	30.50	30.50	25.00	0.00	0.00	5.50	5.50
SP8&8A	26.00	26.00	26.00	35.00	35.00	26.00	0.00	0.00	9.00	9.00
SP9&9A	24.00	26.00	26.00	28.00	29.00	24.00	2.00	0.00	2.00	2.00
SS1*	20.00	28.50	28.50	31.50	31.50	20.00	8.50	0.00	3.00	3.00
SS2*	20.00	28.50	28.50	31.50	31.50	20.00	8.50	0.00	3.00	3.00
CW1	20.00	28.50	28.50	31.50	31.50	20.00	8.50	0.00	3.00	3.00
CW1A*	13.50					13.50				
CW1B	13.50	24.00	24.00			13.50	10.50	0.00		
CW2A	9.00	17.50				9.00	8.50			
CW3A	10.50	10.50				10.50	0.00			
CW4A	6.00	6.00				6.00	0.00			
CW5	32.50	32.50	32.50	37.00	37.00	32.50	0.00	0.00	4.50	4.50
CW6	16.00	20.50	33.50	36.00	36.00	16.00	4.50	13.00	2.50	15.50
CW6A*										
CW6B*	16.00	20.50				16.00	4.50			
CW7	12.00	12.00	30.00	30.50	30.50	12.00	0.00	18.00	0.50	18.50
CW7A*	12.00	12.00				12.00	0.00			
CW8A	22.50					22.50				
CW9	16.50	16.50	30.00	33.00	33.00	16.50	0.00	13.50	3.00	16.50
CW9A*										
CW10	15.00	26.50	36.00	37.00	37.00	15.00	11.50	9.50	1.00	10.50
CW10A*	15.00					15.00				
CW11	22.50	25.50	34.50	36.00	36.00	22.50	3.00	9.00	1.50	10.50
CW11A*	22.50	25.50				22.50	3.00			
CW13	16.50	16.50	33.00	35.80	36.00	16.50	0.00	16.50	2.80	19.30
CW13A*										
OW1S-80	18.50	22.50				18.50	4.00			
OW2S-80	22.00	31.70	31.70			22.00	9.70	0.00		
OW3S-80	18.00	22.80				18.00	4.80			
OW4S-80	16.00	26.00	26.00			16.00	10.00	0.00		
OW5S-80	18.00	22.30				18.00	4.30			

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TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
OW6S-80	12.00	15.70				12.00	3.70			
OW7S-80	18.00	22.30				18.00	4.30			
OW8S-80	10.50	27.00	27.00			10.50	16.50	0.00		
OW9S-80	14.00	26.50	26.50			14.00	12.50	0.00		
BH1A-08	0.00	0.00	25.00	27.00	27.00	0.00	0.00	25.00	2.00	27.00
BH2A-08					22.00					
BH3-43	1.00	3.00	25.00	26.00	26.00	1.00	2.00	22.00	1.00	23.00
BH1B-43	6.60	6.60	27.80	28.30	28.30	6.60	0.00	21.20	0.50	21.70
BH2B-43	14.10	14.10	29.20	30.50	30.50	14.10	0.00	15.10	1.30	16.40
BH3B-43	13.20	13.20	30.80	31.70	31.70	13.20	0.00	17.60	0.90	18.50
BH4B-43	8.20	8.20	29.10	29.10	29.10	8.20	0.00	20.90	0.00	20.90
BH5B-43	7.00	7.00	28.60	29.70	29.70	7.00	0.00	21.60	1.10	22.70
BH1-49	9.10	9.10	29.10	29.10	29.10	9.10	0.00	20.00	0.00	20.00
BH2-49	11.10	11.10	30.00	30.00	30.00	11.10	0.00	18.90	0.00	18.90
BH3-49	10.00	16.00	28.00	32.00	32.00	10.00	6.00	12.00	4.00	16.00
BH4-49	17.00	17.00	27.90	31.80	31.80	17.00	0.00	10.90	3.90	14.80
BH5-49	10.00	23.90	30.00	33.00	33.00	10.00	13.90	6.10	3.00	9.10
BH6-49	12.00	30.00	30.00	33.00	33.00	12.00	18.00	0.00	3.00	3.00
BH7-49	0.00	7.10	26.50	28.50	28.50	0.00	7.10	19.40	2.00	21.40
BH1-77	17.00	17.00	30.00	37.00	37.00	17.00	0.00	13.00	7.00	20.00
BH2-77	9.00	17.50				9.00	8.50			
BH3-77	3.50	9.50	29.50	33.00	33.00	3.50	6.00	20.00	3.50	23.50
BH4-77	7.00	7.50	29.00	33.50	33.50	7.00	0.50	21.50	4.50	26.00
BH5-77	6.50	8.50	29.00	34.00	34.00	6.50	2.00	20.50	5.00	25.50
BH6-77	16.00					16.00				
BH7-77	18.00	33.00	33.00			18.00	15.00	0.00		
BH1-80	39.00	42.00	42.00	43.50	43.50	39.00	3.00	0.00	1.50	1.50
BH2-80	20.00	25.00	25.00	33.10	33.10	20.00	5.00	0.00	8.10	8.10
BH3-80	17.00	22.00	22.00	30.00	30.10	17.00	5.00	0.00	8.00	8.00
BH4-80	37.00	45.00	45.00	51.50	51.50	37.00	8.00	0.00	6.50	6.50
BH5-80	13.00	29.50	29.50	35.00	35.20	13.00	16.50	0.00	5.50	5.50
BH6-80	21.00	28.00	28.00	35.00	35.00	21.00	7.00	0.00	7.00	7.00
BH7-80	31.00	42.00	42.00	50.00	50.00	31.00	11.00	0.00	8.00	8.00
BH1-81	17.50	33.00	33.00			17.50	15.50	0.00		
BH2-81	16.00	31.30	31.30			16.00	15.30	0.00		
BH3-81	14.00	27.70	27.70			14.00	13.70	0.00		
BH4-81	14.00	31.40	31.40	31.70	31.70	14.00	17.40	0.00	0.30	0.30
BH5-81	14.00	31.50	31.50	31.80	31.80	14.00	17.50	0.00	0.30	0.30
BH6-81	12.00	29.00	29.00			12.00	17.00	0.00		
BH7-81	13.00	27.80	27.80			13.00	14.80	0.00		
BH8-81	13.50	29.50	29.50			13.50	16.00	0.00		
BH14-81	14.00	31.30	31.30	31.50	31.50	14.00	17.30	0.00	0.20	0.20
BH9-82	11.20	26.80	26.80	30.80	31.80	11.20	15.60	0.00	4.00	4.00
BH15-82	8.50	25.00	25.00	28.20	28.20	8.50	16.50	0.00	3.20	3.20
BH16-82	9.20	25.50	25.50	28.60	28.60	9.20	16.30	0.00	3.10	3.10
BH17-82	14.00	20.00	20.00	23.70	23.70	14.00	6.00	0.00	3.70	3.70
BH18-82	22.00	28.30	28.30	34.80	35.40	22.00	6.30	0.00	6.50	6.50
BH19-82	32.50	39.00	39.00	48.50	48.50	32.50	6.50	0.00	9.50	9.50
BH20-82	27.00	34.50	34.50	44.20	44.20	27.00	7.50	0.00	9.70	9.70
BH21-82	24.00	33.20	33.20	41.20	41.20	24.00	9.20	0.00	8.00	8.00
BH22-82	9.00	23.70	23.70	28.70	28.70	9.00	14.70	0.00	5.00	5.00
BH23-82	22.70	32.50	32.50	41.90	41.90	22.70	9.80	0.00	9.40	9.40

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
WS9	9.50	18.50	18.50	24.50	28.00	9.50	9.00	0.00	6.00	6.00
WS9A*	9.50					9.50				
WS10	10.50	16.00	16.00	25.50	25.50	10.50	5.50	0.00	9.50	9.50
WS10A*	10.50					10.50				
WS11	9.00	15.00	15.00	24.00	24.00	9.00	6.00	0.00	9.00	9.00
WS11A*	9.00					9.00				
WS12	12.00	21.00	21.00	26.50	26.50	12.00	9.00	0.00	5.50	5.50
WS12A*	12.00					12.00				
WS13	7.50	21.00	21.00	27.00	27.00	7.50	13.50	0.00	6.00	6.00
WS13A*	7.50					7.50				
WS14A	32.70	32.70	32.70	32.70	32.70	32.70	0.00	0.00	0.00	0.00
WS14B*										
WS15A	29.00	29.00				29.00	0.00			
WS16	19.50	25.50	25.50	31.00	31.00	19.50	6.00	0.00	5.50	5.50
WS16A*	19.50	25.50	25.50			19.50	6.00	0.00		
WS17	13.50	20.50	31.00	33.00	33.00	13.50	7.00	10.50	2.00	12.50
WS17A*	13.50	20.50				13.50	7.00			
WS18	17.50	17.50	31.50	33.00	33.00	17.50	0.00	14.00	1.50	14.00
WS18A*	17.50	17.50				17.50	0.00			
WS19	8.50	8.50	24.00	28.50	30.50	8.50	0.00	15.50	4.50	20.00
WS19A*	8.50	8.50				8.50	0.00			
WS20	3.00	8.00	19.50	24.00	25.50	3.00	5.00	11.50	4.50	16.00
WS20A*	3.00	8.00				3.00	5.00			
WS21	1.50	8.50	18.00	27.50	27.50	1.50	7.00	9.50	9.50	19.00
WS21A*	1.50	8.50				1.50	7.00			
WS22	3.00	7.50	20.00	21.50	21.50	3.00	4.50	12.50	1.50	14.00
WS22A*	3.00	7.50				3.00	4.50			
WS23	7.00	7.00	19.50	24.00	24.00	7.00	0.00	12.50	4.50	17.00
WS23A*	7.00	7.00				7.00	0.00			
WS24	5.00	9.00	15.50	18.50	22.50	5.00	4.00	6.50	3.00	9.50
WS24A*	5.00	9.00				5.00	4.00			
WS28	3.00	6.00	9.00	22.50	22.50	3.00	3.00	3.00	13.50	16.50
WS28A*	3.00	6.00				3.00	3.00			
WS29	3.00	5.50	5.50	21.00	21.00	3.00	2.50	0.00	15.50	15.50
WS29A*	3.00	5.50	5.50			3.00	2.50	0.00		
WS30	1.50	7.30	9.00	24.00	25.00	1.50	5.80	1.70	15.00	16.70
WS30A*	1.50	7.30				1.50	5.80			
WS31	3.00	6.00	11.00	23.50	23.50	3.00	3.00	5.00	12.50	17.50
WS31A*	3.00	6.00				3.00	3.00			
WS32	9.50	12.00	20.00	24.50	24.50	9.50	2.50	8.00	4.50	12.50
WS32A*	9.50	12.00				9.50	2.50			
WS33A	7.50	9.00				7.50	1.50			
WS34	6.00	6.00	12.00	22.00	24.90	6.00	0.00	6.00	10.00	16.00
WS34A*	6.00	7.50				6.00	1.50			
WS35A	7.50	10.50				7.50	3.00			
WS36A	12.00	20.00				12.00	8.00			
WS37A	0.00	8.00				0.00	8.00			
WS38A	4.50	4.50				4.50	0.00			
WS39A	5.50	5.50				5.50	0.00			
WS40	3.00	7.50	9.00	22.00	22.00	3.00	4.50	1.50	13.00	14.50
WS40A*	3.00	7.50				3.00	4.50			
WS40B*	3.00	7.50	9.00			3.00	4.50	1.50		

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

TABLE 1B - STRATIGRAPHIC INFORMATION - S AREA HISTORIC INFORMATION

WELL/BH	DEPTH TO ALLUVIUM (FEET)	DEPTH TO CLAY (FEET)	DEPTH TO TILL (FEET)	DEPTH TO BASE TILL (FEET)	DEPTH TO BEDROCK (FEET)	THICKNESS OF FILL (FEET)	THICKNESS OF ALLUVIUM (FEET)	THICKNESS OF CLAY (FEET)	THICKNESS OF TILL (FEET)	THICKNESS OF CONF. LAYER (FEET)
WS42A	4.50	9.50				4.50	5.00			
WS43A	7.50	7.50				7.50	0.00			
WS44A	3.00	9.50				3.00	6.50			
WS45A	12.00	19.20				12.00	7.20			
WS46A	15.00	15.00				15.00	0.00			
WS47A	12.00	27.00				12.00	15.00			
WS53										
WS54										
WS55		7.00								
WS56		8.00								
WS57		8.00								
WS58	4.00	4.00				4.00	0.00			
WS59	6.00	6.00				6.00	0.00			
WS83		7.00								
WS84		7.00								
WS89										
WS93		7.50								
WS94		7.50								
WS95		8.00								
WS96		7.00								
WS97		7.00								
WS98		7.00								
WS105		7.00								
WS107		6.00								
WS109		8.00								
WS113		7.50								
BH1	17.10	17.10	33.90	40.90	40.90	17.10	0.00	16.80	7.00	23.80
BH2	6.20	11.40	28.60	36.80	36.80	6.20	5.20	17.20	8.20	25.40
BH3	10.10	11.50	28.60	34.00	34.00	10.10	1.40	17.10	5.40	22.50
BH4	4.90	8.20	27.20	33.00	33.00	4.90	3.30	19.00	5.80	24.80
BH6	1.70	6.10				1.70	4.40			
BH9		17.50	33.60	36.60	36.60			16.10	3.00	19.10
OW1-82	6.00	10.00	28.00	35.10	36.10	6.00	4.00	18.00	7.10	25.10
OW2-82	12.20	24.20	31.20	34.00	34.00	12.20	12.00	* 7.00	2.80	9.80
OW3-82	16.80	25.80	31.80	35.90	39.20	16.80	9.00	6.00	4.10	10.10
OW4-82	11.80	11.80	26.80	33.30	33.30	11.80	0.00	15.00	6.50	21.50
OW5-82	18.20	28.20	28.20	34.20	35.70	18.20	10.00	0.00	6.00	6.00

NOTE: * = PARTIAL OR TOTAL STRATIGRAPHY DENOTED AT ADJACENT WELL/BOREHOLE

Examining the stratigraphy at the remaining three boreholes (BH183, BH186 and BH188), the top of till elevations are 546.8 feet, 545.9 feet and 545.6 feet AMSL, respectively. These elevations are all above the installed elevation of the utility conduits at 545.0 feet AMSL indicating that these three boreholes are all installed on the outside of the Industrial Intake Pipe Trench. The difference in the top of till elevations inside and outside the trench indicates an average excavation of 2.5 feet of till material in this area of the trench.

The excavation of till material within the Industrial Intake Pipe Trench has reduced the amount of till present between the fill layer and the bedrock. The top of bedrock elevation at the six installations within the trench ranges from 537.9 feet to 541.1 feet AMSL. During the drilling operations, spoon refusal sometimes occurred prior to auger refusal. The soil material augered through following spoon refusal was therefore not sampled and its specifics are unknown. For the purpose of determining the thickness of the till and subsequently the Confining Layer, the bottom of sampled till was used as the base of the till elevation and not the top of bedrock elevation which was identified by auger refusal. This difference between bottom of sampled till and top of bedrock is usually less than one foot but at BH181 and BH182 this difference was 1.9 feet and 5.0 feet, respectively. The remaining thickness of till at the six installations inside the trench ranges from 0.5 feet to 5.1 feet. Three of these measured till thicknesses were less than the three feet required to meet the definition of a Confining Layer (BH182 - 0.5 feet, BH181 - 0.6 feet and BH187 - 1.9 feet).

4.3 NAPL PRESENCE IN OVERBURDEN

At the boreholes and wells used to define the Confining Layer within the Study Area, Non-Aqueous Phase Liquid (NAPL) was noted in the overburden in more than 80 percent of the installations. In addition, an iridescent sheen was noted to be present at an additional ten percent of the installations although NAPL was not observed. The stratigraphic information table (Table 1) presents the noted observations of NAPL and iridescent sheens along with the stratigraphic information for each well or borehole.

A review of this data indicates that over 95 percent of the NAPL observations were noted in the fill and alluvium layers. It was most common for NAPL to be present in the lower alluvium immediately overlying the clay or till. However, the observations of NAPL presence stopped at the top of the clay layer or at the top of the till layer (when the clay layer was not present) in the majority of the installations.

4.3.1 NAPL Presence in Clay/Till

There were only five observations of NAPL in the clay layer and four observations of NAPL in the till layer. These observations are summarized in Table 2 along with the pertinent stratigraphic information. Figure 21 illustrates the locations where NAPL was noted in the clay or till layers.

At four of the five observations of NAPL in the clay layer, the NAPL was observed in the top 2.4 to 4.7 feet of the layer with 3.4 to 10.0 feet of "NAPL-free" clay and 1.8 to 5.1 feet of till underlying the NAPL impregnated clay. These four boreholes (OW212, BH126, BH137 and BH138) are in the northwest corner of the S-Area Landfill Site where the clay is relatively thick. Only BH192 has less than three feet of clay and the NAPL was noted in only the top 0.1 feet of the clay at this installation.

As previously mentioned, NAPL was observed in the till layer on four occasions. Three of these boreholes (BH143, BH145 and BH187) are located in the southwest corner of the S-Area Landfill Site where there was no overlying clay layer. The final NAPL observation was at WS18 in the northeast corner of the S-Area Landfill Site where 14 feet of clay overlies the till layer.

TABLE 2

NAPL PRESENCE IN CLAY/TILL LAYER

Well/ Borehole	Clay Interval (feet)	Till Interval (feet)	NAPL Interval (feet)	Remaining Continuous Clay/Till Thickness (feet)
OW212	11.9-24.0	24.0-27.4	15.8	11.6
BH126	13.3-28.0	28.0-29.8	6.0-18.0	11.8
BH137	14.0-27.3	27.3-29.1	16.0-18.0	11.1
BH138	20.4-26.0	26.0-31.1	6.0-22.6	9.5
BH143	-	21.0-25.0	21.0-25.0	0.0
BH145	-	26.0-27.4	23.1-27.4	0.0
BH187	-	26.7-28.6	28.6-29.3	1.9
BH192	23.9-26.7	-	23.9-24.0	2.7
WS18	17.5-31.5	31.5-33.0	31.5-33.0	14.0

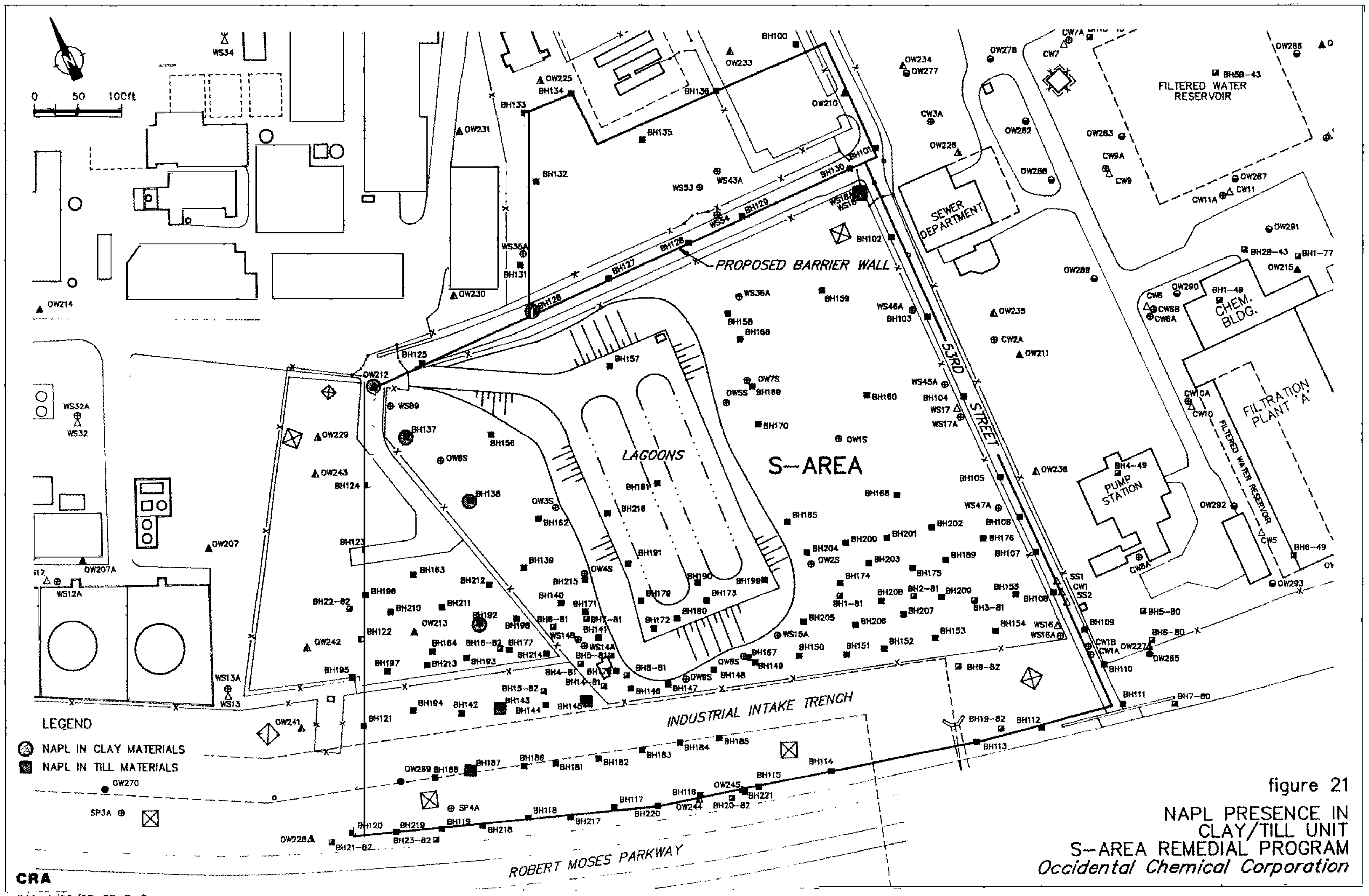

figure 21
NAPL PRESENCE IN CLAY/TILL UNIT
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

At two of the boreholes, BH143 and BH145, the NAPL was evident throughout the entire thickness of the sampled till material (4.0 and 1.4 feet thick, respectively). Consequently, no "NAPL-free" till was observed at these two locations. At BH187, NAPL was not noted in the 1.9 feet of sampled till but was noted in the bottom 0.7 feet of sample containing shattered rock fragments. It is therefore assumed that this NAPL had not penetrated vertically through the till at this location but was present at BH187 due to horizontal NAPL migration from an adjacent location via the rock fragments and bedrock fractures beneath the till. This is similar to the observation of NAPL at OW228 located approximately 200 feet southwest of BH187. During the split spoon sampling of the overburden materials at OW228, there had been no evidence of NAPL presence. However, during the reaming of the grout within the overburden casing (prior to bedrock penetration) NAPL was observed to be present in the drilling return water. Consequently, it is assumed that the NAPL migrated from the fractured bedrock and not from the overburden.

At WS18 a "trace black oily substance" was observed in the 1.5 feet of till overlying the bedrock but not in the overlying 14 feet of clay. This NAPL must have migrated upward from the bedrock as well. It should be noted that although well WS18 previously contained NAPL, recent sampling events have not observed any NAPL presence. It appears that the sampling activities have removed the mobile NAPL presence at this location.

4.3.2 Power Tower Foundations

There are several electric power transmission towers located on the S-Area Landfill Site and the adjacent areas. The excavation for and the construction of the foundations for these power towers may provide possible routes for NAPL migration through the clay/till layer to the bedrock. In order to address this possibility, CRA prepared a report in 1981 entitled "Foundation Details for Power Transmission Towers - S-Area". Table 1 in the report indicates that all but three of the power towers are supported in the overburden. The towers supported in the overburden are not of concern as demonstrated by a comparison of the stratigraphic information from adjacent wells and/or boreholes with the tower foundations which show that none of the tower foundation excavations penetrated the entire alluvium and thus the clay/till layer was undisturbed.

Three of the towers (south of the S-Area Landfill Site) are supported on bedrock through the use of piles driven through the overburden to the bedrock. The locations of these three towers are presented in Figure 1. The excavations associated with the construction of the power towers, penetrated 13 feet of overburden (fill) and piles were then driven to bedrock since the overburden in the vicinity of these towers is primarily fill from the construction of the Robert Moses Parkway. The driving of these piles penetrated the native till materials and as such provides a potential vertical pathway for APL and NAPL migration through the till layer to the bedrock. Whether the piles could contribute to vertical NAPL migration is dependent upon the tower locations. All three of these towers supported on the bedrock are located south of the Industrial Intake Pipe Trench which appears to have restricted lateral migration of NAPL to the south. From the stratigraphic information table (Table 1), it is noted that NAPL was observed in the alluvium overlying the till at only a few boreholes south of the trench. Consequently, only the eastern of the three power towers is located within the NAPL plume in the overburden. The central tower is located near an area of NAPL presence and the western tower is some distance from the area of NAPL presence in the overburden and therefore is not of concern for vertical NAPL migration.

Further discussion on the presence of NAPL in the overburden south of the Industrial Intake Pipe Trench and the probable effect of the Industrial Intake Pipe Trench on NAPL migration has been presented in the report "Assessment of APL/NAPL Migration from the S-Area in the Overburden Toward the Niagara River".

5.0 PHYSICAL TESTING OF SOIL SAMPLES

As previously mentioned in Section 3.0, one of the criteria of a Confining Layer is that the stratum has a maximum permeability of 1 x 10^{-7} cm/sec. It also states in the Settlement Agreement that "Soils sampled by split-spoon sampling... which have comparable grain size distributions and plasticity as soils sampled" for permeability testing "shall be presumed to have the same permeability". In order to assess the soil conditions, various split-spoon samples and Shelby Tube samples were submitted for grain size distribution, plasticity and permeability testing.

5.1 TEST METHODS

During the subsurface investigation surveys, a total of 311 disturbed (jar) soil samples were submitted to Empire Soils Investigations, Inc. (ESI) for grain size distribution analysis and plasticity testing. 298 of these samples were tested for the specified physical parameters. In addition, 82 undisturbed (Shelby Tube) and minimally disturbed (three-inch Split Spoon Liner) soil samples were submitted to ESI or Glynn Geotechnical Engineering (GGE) for permeability testing as well as grain size distribution and plasticity testing. Only 73 of these samples were tested for permeability. In addition, several Shelby Tube samples were submitted to the EPA/State for analysis. These results have not yet been received and therefore, are not included in this report. All testing was conducted as specified in "Appendix B - Plans, Specification and Protocols for the Subsurface Investigation - S-Area/Water Treatment Plant - S-Area Remedial Program" submitted to the Governmental Agencies on June 1, 1986. All samples were transported from the Site by ESI or CRA via properly authorized chain-of-custody record.

The grain size distribution testing was completed following the ASTM D-422-63 standard method for "Particle-Size Analysis of Soils". The plasticity testing was completed following the ASTM D-4318-83 standard test method for "Liquid Limit, Plastic Limit and Plasticity Index of Soils". This method has replaced the ASTM D-423 and ASTM D-424 standard methods previously specified in the Appendix B document. The permeability testing was completed following the ASTM D-2434-68 standard test method for "Permeability of Granular Soils (Constant Head)".

5.2 TESTING RESULTS

The results of physical properties testing available at the time of submission of the Information Summary Report were compiled and submitted as Appendix 5 of the Information Summary Report. Results received subsequent to the June 1 submission of Appendix 5 are enclosed with this document for insertion into Appendix 5.

Tables 3 through 6 present a summary listing of all of the physical testing results. Table 3 includes all of the clay samples while Tables 4, 5 and 6 include samples identified to consist of fine, medium and coarse-grained till. The following list indicates the soil descriptions which were grouped under each category.

Fine Till	Medium Till	Coarse Till
Silty Clay	Clayey Sand	Silty Gravel
Clayey Silt	Clayey Gravel	Gravelly Sand
Sandy Clay	Sandy Silt	Sandy Gravel
	Silty Sand	
	Gravelly Silt	

Table 7 summarizes the physical testing results for all four soil groupings by indicating the minimum, maximum and average results.

It should be noted that the permeability results listed on these tables were for a differential head of 10 psi for ESI data and 8 psi for GGE data. These values were used as opposed to the 5 psi differential head data because the permeability values were generally more conservative (i.e. higher). The difference between the two permeability values given for each tested sample were small. Only the sample from BH203 (33.5 - 35.5 feet) with permeability values of 1.1×10^{7} and 8.3×10^{-8} cm/sec for the 5 and 10 psi differential head,

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH100	20.0 - 22.0	Jar	76.3	22.6	1.0	0.1	39	20	19	
BH101	10.0 - 12.0	Jar	77.1	17.3	5.5	0.0	NA	NA	NA	
	12.0 - 14.0	Jar	72.1	21.6	4.3	2.0	NA	NA	NA	
	14.0 - 16.0	Jar	71.1	23.1	5.3	0.4	NA	NA	NA	
	16.0 - 18.0	Jar	67.2	29.2	3.6	0.0	37	15	22	
	18.0 - 20.0	Jar	81.9	15.5	2.3	0.3	45	21	24	
	20.0 - 22.0	Jar	74.4	22.5	2.2	0.9	40	19	21	
	22.0 - 24.0	Jar	70.1	26.9	2.5	0.5	36	17	19	
	24.0 - 26.0	Jar	83.8	14.7	1.3	0.2	45	23	22	
	26.0 - 28.0	Jar	82.4	12.2	4.4	1.0	51	28	23	
	28.0 - 30.0	Jar	63.0	23.6	11.8	1.7	35	17	18	
BH102	13.0 - 15.0	Jar	69.3	23.8	7.0	0.0	NA	NA	NA	
	15.0 - 17.0	Jar	72.4	25.9	1.8	0.0	39	20	19	
	17.0 - 19.0	Jar	65.1	32.9	2.0	0.0	33	13	20	
	19.0 - 21.0	Jar	75.1	22.4	2.4	0.0	40	20	20	
	21.0 - 23.0	Jar	72.7	25.6	1.7	0.0	41	20	21	
	23.0 - 25.0	Jar	70.0	27.3	2.3	0.4	37	19	18	
	25.0 - 27.0	Jar	80.2	17.8	2.0	0.0	45	25	20	
	27.0 - 29.0	Jar	80.7	16.4	2.9	0.0	45	22	23	
	29.0 - 31.0	Jar	81.2	15.2	3.0	0.6	45	20	25	
	31.0 - 33.0	Jar	63.0	25.1	9.6	2.2	37	17	20	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH103	16.0 - 18.0	Jar	60.3	31.3	8.5	0.0	28	8	20	
	18.0 - 20.0	Jar	69.2	20.3	10.4	0.0	NA	NA	NA	
	20.0 - 22.0	Jar	70.1	27.0	2.9	0.0	41	18	23	
	22.0 - 24.0	Jar	73.6	24.2	1.5	0.6	38	17	21	
	24.0 - 26.0	Jar	74.1	24.0	1.9	0.0	41	19	22	
	26.0 - 28.0	Jar	76.6	22.1	1.4	0.0	45	25	20	
	28.0 - 30.0	Jar	75.3	22.7	2.0	0.0	39	18	21	
	30.0 - 32.0	Jar	69.3	26.1	2.6	2.0	39	19	20	
	32.0 - 33.4	Jar	60.7	25.9	11.8	1.7	38	20	18	
BH104	17.0 - 19.0	Jar	72.1	24.7	2.7	0.5	37	17	20	
	19.0 - 21.0	Jar	75.9	21.2	2.7	0.3	43	17	20	
	21.0 - 23.0	Jar	83.8	14.1	2.0	0.0	44	25	19	
	23.0 - 25.0	Jar	87.4	10.6	1.7	0.2	49	22	27	
	25.0 - 27.0	Jar	87.3	10.7	2.0	0.0	52	26	26	
	27.0 - 29.0	Jar	85.6	12.6	1.8	0.0	42	22	20	
	29.0 - 31.0	Jar	71.2	22.3	5.1	1.4	40	20	20	
BH105	27.0 - 28.0	Jar	81.5	15.3	3.1	0.1	47	23	24	
BH115	35.0 - 37.0	Jar	57.1	30.2	9.7	3.0	29	10	19	
	42.0 - 44.0	Tube	76.1	21.9	2.0	0.0	45	21	24	2.4×10^{-8}
BH117	40.0 - 41.3	Jar	75.1	17.7	5.1	2.2	45	24	21	
BH117A	40.0 - 41.9	Liner	73.0	24.0	3.0	0.0	42	24	18	2.9×10^{-8}

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH123	21.0 - 22.0	Jar	86.7	11.6	1.7	0.0	48	24	24	
	22.0 - 24.0	Jar	86.9	9.7	2.7	0.7	51	23	28	
BH124	14.6 - 16.0	Jar	66.4	31.1	2.5	0.0	33	19	14	
	16.0 - 18.0	Jar	55.0	41.4	3.4	0.3	32	11	21	
	18.0 - 20.0	Jar	68.1	28.6	3.0	0.2	40	18	22	
	20.0 - 22.0	Jar	75.5	23.4	1.1	0.0	37	18	19	
	22.0 - 24.0	Jar	76.3	22.2	1.2	0.3	43	20	23	
	24.0 - 26.0	Jar	83.0	14.7	2.3	0.0	53	26	27	
BH125	14.0 - 16.0	Jar	67.3	29.6	2.5	0.6	21	7	14	
	16.0 - 18.0	Jar	77.2	21.9	0.8	0.1	45	19	26	
	18.0 - 20.0	Jar	65.8	28.5	4.0	1.7	28	13	15	
	20.0 - 22.0	Jar	64.4	30.8	3.4	1.4	27	13	14	
	22.0 - 24.0	Jar	71.4	27.3	1.3	0.0	39	19	20	
	24.0 - 26.0	Jar	79.2	19.7	1.0	0.1	45	19	26	
	26.0 - 28.0	Jar	81.2	15.8	1.4	1.5	48	23	25	
BH126	14.0 - 16.0	Jar	70.8	26.1	3.0	0.2	NA	NA	NA	
	16.0 - 18.0	Jar	61.4	37.1	1.5	0.1	36	14	22	
	18.0 - 20.0	Jar	69.0	26.9	4.2	0.0	43	21	22	
	20.0 - 22.0	Jar	67.1	30.5	2.0	0.4	36	17	19	
	22.0 - 24.0	Jar	68.0	30.1	1.9	0.0	NA	NA	NA	
	24.0 - 26.0	Jar	80.9	15.9	1.9	1.3	48	23	25	
	26.0 - 28.0	Jar	82.8	15.6	1.6	0.0	45	19	26	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH127	14.0 - 16.0	Jar	61.2	24.9	12.8	1.1	34	15	19	
	16.0 - 18.0	Jar	51.4	27.7	18.9	2.0	30	16	14	
	18.0 - 20.0	Jar	70.2	26.3	3.1	0.3	44	24	20	
	20.0 - 22.0	Jar	74.0	24.5	1.6	0.0	42	21	21	
	22.0 - 24.0	Jar	69.1	29.9	1.0	0.0	NA	NA	NA	
	24.0 - 26.0	Jar	82.8	15.8	1.2	0.2	46	19	27	
	26.0 - 28.0	Jar	81.2	16.6	1.2	1.0	47	26	21	
	28.0 - 30.0	Jar	67.4	24.9	7.3	0.5	41	18	23	
BH128	13.2 - 14.0	Jar	77.0	20.0	3.0	0.0	42	20	22	
	14.0 - 16.0	Jar	72.9	23.7	3.5	0.0	40	18	22	
	16.0 - 18.0	Jar	68.3	29.5	2.2	0.0	38	19	19	
	18.0 - 20.0	Jar	68.8	29.8	1.3	0.1	36	17	19	
	20.0 - 22.0	Jar	71.1	26.6	2.3	0.0	41	21	20	
	22.0 - 24.0	Jar	71.9	26.9	1.3	0.0	39	23	16	
	24.0 - 26.0	Jar	86.8	12.1	0.8	0.3	47	30	17	
	26.0 - 28.0	Jar	85.7	12.9	1.4	0.0	46	26	20	
	28.0 - 30.0	Jar	63.7	23.1	11.9	1.3	36	15	21	
BH129	12.9 - 14.0	Jar	77.0	22.1	0.8	0.0	43	18	25	
	14.0 - 16.0	Jar	70.5	28.5	1.0	0.0	39	13	26	
	16.0 - 18.0	Jar	68.9	30.1	1.0	0.0	38	13	25	
	18.0 - 20.0	Jar	76.3	22.8	0.9	0.0	18	6	12	
	20.0 - 22.0	Jar	71.0	26.4	2.6	0.0	45	21	24	
	22.0 - 24.0	Jar	71.7	27.7	0.6	0.0	25	9	16	
	24.0 - 26.0	Jar	85.4	13.3	1.3	0.0	28	12	16	
	26.0 - 28.0	Jar	82.9	16.1	1.1	0.0	31	9	22	
	28.0 - 30.0	Jar	77.5	19.5	2.7	0.3	43	19	24	
	30.0 - 31.0	Jar	74.6	17.5	7.4	0.5	45	21	24	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH130	14.0 - 16.0	Jar	75.4	23.5	1.1	0.0	42	20	22	
	16.0 - 18.0	Jar	72.8	26.8	0.4	0.0	39	19	20	
	18.0 - 20.0	Jar	66.7	32.3	1.0	0.0	37	17	20	
	20.0 - 22.0	Jar	74.9	22.4	2.6	0.1	44	23	21	
	22.0 - 24.0	Jar	69.7	29.1	1.2	0.1	37	17	20	
	24.0 - 26.0	Jar	84.0	15.2	0.8	0.0	52	27	25	
	26.0 - 28.0	Jar	85.5	13.9	0.6	0.0	47	25	22	
	28.0 - 30.0	Jar	80.0	18.3	1.7	0.0	49	26	23	
BH131	18.0 - 20.0	Jar	74.5	23.7	1.8	0.0	42	20	22	
BH132	16.0 - 18.0	Jar	74.2	24.9	0.8	0.1	41	19	22	
BH133	22.5 - 24.5	Jar	79.0	18.0	1.9	1.1	41	20	21	
BH134	20.0 - 22.0	Jar	72.0	26.6	1.3	0.1	38	16	22	
BH135	24.0 - 26.0	Jar	82.6	15.9	1.4	0.1	45	23	22	
BH136	26.0 - 28.0	Jar	86.2	11.8	1.6	0.4	47	20	27	
BH137	14.0 - 16.0	Jar	58.5	39.8	1.7	0.0	33	15	18	
	16.0 - 18.0	Jar	59.4	37.0	3.6	0.0	34	15	19	
	18.0 - 20.0	Jar	72.8	25.0	1.4	0.8	42	21	21	
	20.0 - 22.0	Jar	73.0	25.0	1.9	0.0	41	21	20	
	22.0 - 24.0	Jar	77.1	20.3	2.6	0.0	43	21	22	
	24.0 - 26.0	Jar	81.1	15.2	3.7	0.0	48	22	26	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH138	20.0 - 22.0	Jar	61.5	34.1	4.4	0.0	34	13	21	
	22.0 - 24.0	Jar	71.7	24.7	2.8	0.7	38	17	21	
	24.0 - 26.0	Jar	67.9	25.0	5.7	1.3	45	24	21	
BH139	28.0 - 29.2	Jar	77.0	22.1	0.8	0.0	18	6	12	
BH149	26.5 - 28.0	Jar	79.4	15.2	4.7	0.7	42	20	22	
BH154	27.5 - 28.0	Jar	72.6	14.8	10.3	2.3	NA	NA	NA	
BH156	22.0 - 24.0	Tube	64.8	35.2	0.0	0.0	50	29	21	4.0×10^{-8}
	24.0 - 26.0	Tube	83.0	17.0	0.0	0.0	43	23	20	3.5×10^{-8}
	26.0 - 28.0	Tube	57.6	42.4	0.0	0.0	41	25	16	2.4×10^{-8}
BH157	30.0 - 32.0	Jar	66.4	32.7	0.8	0.1	30	16	14	
	32.0 - 34.0	Tube	54.4	42.1	3.5	0.0	30	13	17	4.2×10^{-8}
	34.0 - 36.0	Tube	80.5	17.7	1.5	0.3	49	26	23	2.2×10^{-8}
	38.0 - 40.0	Tube	77.5	20.3	1.9	0.3	46	22	24	1.9×10^{-8}
	40.0 - 42.0	Tube	81.6	17.0	1.4	0.0	50	29	21	1.6×10^{-8}
	42.0 - 44.0	Tube	75.1	22.1	2.8	0.0	42	22	20	2.4×10^{-8}
BH158	18.5 - 20.0	Jar	Sample Not Tested							
	20.0 - 22.0	Tube	75.8	21.3	3.0	0.0	45	22	23	2.3×10^{-8}
	22.0 - 24.0	Tube	64.9	34.8	0.3	0.0	37	17	20	4.4×10^{-8}
	24.0 - 26.0	Tube	82.7	14.9	2.4	0.0	54	32	22	3.5×10^{-8}
	26.0 - 28.0	Tube	79.8	20.0	0.2	0.0	55	34	21	3.4×10^{-8}
	32.0 - 34.0	Jar	67.8	30.7	1.5	0.0	38	17	21	
	34.0 - 36.0	Tube	82.4	16.0	1.6	0.0	53	34	19	no perm due to voids
BH159	17.5 - 18.0	Jar	77.0	23.0	0.0	0.0	NA	NA	NA	
	22.0 - 24.0	Jar	72.8	25.3	1.9	0.0	41	19	22	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH159A	18.0 - 20.0	Tube	71.0	27.0	2.0	0.0	39	23	16	4.6×10^{-8}
	20.0 - 22.0	Tube	72.4	26.7	0.9	0.0	48	25	23	4.0×10^{-8}
	24.0 - 26.0	Tube	72.1	26.9	1.0	0.0	38	16	22	6.1×10^{-8}
	26.0 - 28.0	Tube	78.3	20.9	0.8	0.0	46	26	20	3.1×10^{-8}
	28.0 - 30.0	Jar	78.8	18.3	2.0	0.8	47	24	23	
	32.0 - 34.0	Tube	68.6	22.1	8.4	0.9	39	20	19	3.2×10^{-8}
BH160	24.0 - 26.0	Tube	84.9	14.1	1.0	0.0	51	31	20	2.6×10^{-8}
	32.0 - 34.0	Tube	63.5	29.4	5.7	1.4	33	23	10	2.7×10^{-8}
BH161	34.0 - 36.0	Jar	Sample Not Analyzed							
	34.0 - 36.0	Tube	Not tested as sample contained wood, decaying organics, etc.							
	38.0 - 40.0	Tube	85.3	13.8	0.9	0.0	55	35	20	1.7×10^{-8}
BH162	24.0 - 26.0	Jar	Sample Not Analyzed							
	24.0 - 26.0	Tube	87.4	9.6	3.0	0.0	53	29	24	2.2×10^{-8}
BH163	22.4 - 24.0	Jar	90.0	7.4	2.2	0.4	49	22	27	
BH165	30.0 - 32.0	Tube	69.9	24.8	5.3	0.0	46	21	25	3.4×10^{-8}
BH166	26.0 - 28.0	Tube	88.6	10.8	0.6	0.0	53	26	27	2.7×10^{-8}
BH168	24.0 - 26.0	Jar	67.9	30.6	1.3	0.1	36	19	17	
	26.0 - 28.0	Jar	75.5	20.8	2.5	1.2	40	20	20	
	28.0 - 30.0	Jar	66.6	27.5	5.9	0.0	37	16	21	
	30.0 - 32.0	Jar	77.3	21.5	1.2	0.0	42	18	24	
	32.0 - 34.0	Jar	81.7	17.2	1.2	0.0	46	22	24	
	34.0 - 38.0	Jar	70.1	19.3	7.9	2.7	43	18	25	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH169	23.0 - 24.0	Jar	66.2	30.7	2.8	0.3	37	19	18	
	24.0 - 26.0	Jar	76.6	21.2	2.2	0.0	41	18	23	
	26.0 - 28.0	Jar	63.2	28.2	8.5	0.0	32	14	18	
	28.0 - 30.0	Jar	70.0	27.2	2.8	0.1	37	16	21	
	30.0 - 32.0	Jar	78.5	20.3	1.2	0.0	47	24	23	
	32.0 - 34.0	Jar	83.9	14.2	1.9	0.0	46	24	22	
	34.0 - 36.0	Jar	81.3	15.3	3.2	0.2	45	22	23	
	36.0 - 38.0	Tube	82.4	13.2	3.5	0.9	49	23	26	4.1×10^{-8}
BH170	22.7 - 24.0	Jar	Not tested due to high degree of contamination.							
	24.0 - 26.0	Jar	Not tested due to high degree of contamination.							
	26.0 - 28.0	Jar	Not tested due to high degree of contamination.							
	28.0 - 30.0	Jar	Not tested due to high degree of contamination.							
	30.0 - 34.0	Jar	Not tested due to high degree of contamination.							
	34.0 - 36.0	Jar	Not tested due to high degree of contamination.							
BH180	41.8 - 42.0	Jar	67.7	20.0	11.5	0.9	NA	NA	NA	
	44.0 - 46.0	Jar	64.5	27.6	6.6	1.3	36	18	18	
BH182	26.0 - 26.5	Jar	74.9	19.3	5.7	0.1	43	25	18	
BH184	24.0 - 26.0	Jar	76.6	17.5	4.7	1.2	39	20	19	
BH186	24.0 - 26.0	Jar	64.9	24.2	10.9	0.0	33	16	17	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH192	24.0 - 26.0	Jar	53.6	29.6	15.2	1.7	28	13	15	
	26.0 - 26.7	Tube	54.7	39.2	6.1	0.0	35	17	18	1.6×10^{-8}
BH194	23.9 - 24.0	Jar	Insufficient sample to perform testing.							
BH206	32.0-34.0.0	Liner	79.7	17.1	3.2	0.0	45	26	19	3.5×10^{-8}
BH216	34.0 - 36.0	Jar	72.2	25.0	2.7	0.1	NA	NA	NA	
	36.0 - 38.0	Jar	75.2	20.9	3.9	0.1	NA	NA	NA	
	40.0 - 42.0	Tube	85.4	14.0	0.6	0.0	47	23	24	2.4×10^{-8}
OW210	25.0 - 27.0	Jar	84.3	14.9	0.9	0.0	45	25	20	
OW212	12.0 - 14.0	Jar	74.4	25.1	0.4	0.0	30	12	18	
	14.0 - 16.0	Jar	60.7	37.8	1.5	0.0	31	13	18	
	16.0 - 18.0	Jar	62.5	36.1	1.4	0.0	32	14	18	
	18.0 - 20.0	Jar	65.6	32.0	2.3	0.2	33	14	19	
	20.0 - 22.0	Jar	77.6	18.9	3.4	0.1	44	26	18	
	22.0 - 24.0	Jar	88.6	9.6	1.9	0.0	47	25	22	
	24.0 - 26.0	Jar	68.0	23.7	7.9	0.4	40	20	20	

NA - insufficient sample size
NP - non plastic

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH101	30.0 - 32.0	Jar	50.0	24.4	17.0	8.6	31	14	17	
	32.0 - 32.5	Jar	33.7	34.5	25.9	5.9	23	10	13	
BH102	33.0 - 33.8	Jar	26.9	34.3	26.7	12.1	20	7	13	
BH104	31.0 - 33.0	Jar	53.7	27.3	16.1	2.9	32	16	16	
BH105	28.0 - 30.0	Jar	62.3	16.2	15.4	6.1	35	14	21	
	30.0 - 32.0	Jar	43.9	23.1	24.0	9.0	27	11	16	
BH107	26.5 - 28.0	Jar	50.5	26.6	17.6	5.3	30	16	14	
BH109	28.0 - 29.3	Jar	27.8	31.8	25.6	14.7	19	5	14	
BH110	26.0 - 28.0	Jar	32.6	31.1	24.8	11.4	22	7	15	
BH113	42.0 - 44.0	Jar	56.7	22.9	17.9	2.5	37	20	17	
	44.0 - 46.0	Jar	29.2	33.2	27.7	9.9	18	3	15	
BH115	37.0 - 39.0	Jar	33.0	31.4	24.5	11.0	23	10	13	
BH117	38.0 - 40.0	Jar	53.8	23.9	16.4	6.0	32	15	17	
BH117A	38.0 - 40.0	Liner	49.0	23.0	19.5	8.5	34	25	9	1.5×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH119	37.0 - 38.0	Jar	48.8	28.8	20.0	2.5	26	9	17	
	38.0 - 40.0	Jar	41.8	29.0	22.0	7.2	28	10	18	
BH120	34.5 - 36.0	Jar	46.0	23.8	19.5	10.6	34	17	17	
	36.0 - 36.5	Jar	37.3	28.1	23.8	10.7	26	8	18	
BH121	23.3 - 24.0	Jar	36.4	34.8	26.9	1.9	NA	NA	NA	
BH124	26.0 - 27.6	Jar	41.2	28.1	24.7	6.1	28	19	9	
BH125	28.0 - 28.5	Jar	37.4	38.6	19.4	4.5	24	12	12	
BH126	28.0 - 29.8	Jar	44.5	30.1	18.7	6.6	NA	NA	NA	
BH130	30.0 - 32.0	Jar	38.9	34.2	21.8	5.1	24	10	14	
BH137	26.0 - 28.0	Jar	58.1	24.2	10.2	7.5	37	18	19	
BH138	26.0 - 28.0	Jar	52.7	15.7	20.4	11.2	NA	NA	NA	
BH140	26.8 - 28.0	Jar	49.4	26.2	22.7	1.7	27	13	14	
BH144	24.5 - 26.0	Jar	48.3	27.1	18.8	5.9	NA	NA	NA	

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH146	27.0 - 28.0	Jar	48.2	27.6	19.7	4.5	29	13	16	
	28.0 - 30.0	Jar	64.2	16.9	11.4	7.4	42	24	18	
BH147	26.0 - 28.0	Jar	37.1	31.6	24.8	6.5	20	10	10	
BH148	26.0 - 28.0	Jar	37.3	35.7	19.0	7.9	22	9	13	
	28.0 - 29.8	Jar	33.0	41.9	21.3	3.8	20	9	11	
BH149	25.0 - 26.0	Jar	28.2	35.1	28.0	8.7	NA	NA	NA	
BH151	28.0 - 29.7	Jar	39.1	35.1	22.4	3.4	26	12	14	
BH153	30.0 - 30.4	Jar	34.6	21.6	31.7	12.2	25	9	16	
BH154	28.0 - 29.0	Jar	48.8	24.4	19.4	7.4	31	17	14	
	30.0 - 31.0	Jar	36.9	31.2	23.8	8.1	24	10	14	
BH156	30.0 - 32.0	Tube	43.5	20.0	31.4	5.1	24	12	12	
BH157	44.0 - 45.3	Tube	49.7	30.2	10.8	9.3	22	8	14	7.1×10^{-8}
BH163	24.0 - 26.0	Jar	60.8	23.2	14.0	2.0	35	17	18	
	26.3 - 27.0	Tube	27.6	37.7	26.5	8.2	19	6	13	7.9×10^{-8}
BH165	32.0 - 34.0	Tube	53.9	25.6	16.8	3.7	31	14	17	3.6×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH166	29.0 - 31.0	Tube	54.7	26.5	16.0	2.8	30	15	15	2.1×10^{-8}
BH167	24.0 - 26.0	Jar	28.3	36.9	18.0	16.8	22	9	13	
BH168	38.0 - 39.2	Jar	33.0	41.2	22.4	3.3	21	6	15	
BH177	26.0 - 28.0	Jar	43.7	22.9	19.6	13.7	25	11	14	
BH179	43.5 - 44.0	Jar	61.0	22.9	13.3	2.9	42	20	22	
BH183	26.0 - 28.0	Jar	65.2	22.7	8.9	3.2	33	12	21	
BH184	26.0 - 28.0	Jar	40.2	30.8	20.2	8.8	25	11	14	
BH185	26.5 - 28.0	Jar	61.1	23.5	14.6	0.8	24	10	14	
BH186	23.0 - 24.0	Jar	39.1	34.7	18.5	7.8	24	9	15	
BH188	28.0 - 30.0	Jar	47.1	25.8	18.7	8.4	27	11	16	
BH190	43.3 - 44.0	Jar	39.3	35.5	17.7	7.5	28	14	14	
BH193	24.5 - 26.0	Jar	29.2	31.5	26.0	13.3	18	5	13	
BH198	24.3 - 26.0	Liner	32.5	47.0	19.5	1.0	37	27	10	No perm. - disturbed
	26.8 - 26.9	Liner	47.5	14.5	24.5	13.5	35	24	11	2.1×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH200	34.0 - 35.3	Liner	32.4	35.6	24.1	7.9	21	12	9	3.4×10^{-8}
BH200A	36.0 - 37.1	Jar	69.7	18.8	8.9	2.6	37	18	19	
BH201	32.0 - 34.0	Liner	47.5	35.7	13.0	3.8	36	18	18	3.1×10^{-8}
BH204	30.0 - 31.5	Jar	69.3	19.8	7.8	3.1	34	15	19	
	31.5 - 33.5	Liner	29.8	32.0	28.4	9.8	22	11	11	3.0×10^{-8}
BH207	30.0 - 32.0	Liner	41.1	36.4	18.4	4.1	23	9	14	6.4×10^{-8}
BH208	32.0 - 34.0	Liner	38.5	16.0	36.0	19.5	17	13	4	1.4×10^{-8}
BH209	30.0 - 32.0	Liner	27.5	35.0	23.0	14.5	24	21	3	3.1×10^{-8}
BH211	24.0 - 26.0	Liner	26.0	50.5	18.0	5.5	22	14	8	No perm. - disturbed
	26.0 - 27.8	Liner	19.5	53.5	19.0	8.0	NP	NP	NP	No perm. - disturbed
BH212	23.5 - 24.0	Jar	Not tested due to high degree of contamination							
BH213	24.0 - 25.0	Jar	38.5	29.1	28.3	4.0	18	8	10	
BH217	38.0 - 40.0	Liner	68.5	13.0	14.0	4.5	39	20	19	1.3×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH220	38.5 - 39.0	Jar	28.8	26.2	25.9	19.1	NP	NP	NP	
	39.0 - 41.0	Jar	24.6	31.7	23.6	20.1	16	5	11	
	41.0 - 43.0	Liner	72.5	7.0	19.0	1.5	42	25	17	1.4×10^{-8}
	43.0 - 44.0	Jar	Sample Not Analyzed							
BH221	37.0 - 39.0	Liner	35.0	49.5	12.5	3.0	40	22	18	1.8×10^{-8}
OW212	26.0 - 27.4	Jar	38.1	26.0	25.3	10.5	23	10	13	

NA - insufficient sample size

NP - non plastic

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH183	28.0 - 29.0	Jar	25.4	37.8	25.7	11.0	17	5	12	
BH185	28.0 - 29.5	Jar	12.7	27.7	34.4	25.2	15	6	9	*
BH186	26.0 - 28.0	Jar	15.2	28.4	44.0	12.4	NP	NP	NP	*
BH189	32.0 - 34.0	Liner	18.5	33.5	31.5	16.5	16	12	4	No perm. - disturbed
BH190	44.0 - 45.3	Jar	12.3	21.9	52.8	13.0	NP	NP	NP	*
	47.0 - 47.3	Jar	18.4	38.3	26.4	16.9	16	4	12	
BH191	41.5 - 42.0	Jar	22.0	29.3	32.2	16.6	NA	NA	NA	
	42.0 - 44.0	Liner	11.8	32.0	46.0	10.2	20	2	18	1.4×10^{-7}
BH193	26.0 - 26.4	Jar	14.6	35.9	40.6	9.0	NA	NA	NA	
BH196	24.0 - 25.7	Jar	14.0	28.5	36.3	21.3	NA	NA	NA	*
BH197	24.0 - 26.0	Liner	20.5	34.0	37.0	8.5	NP	NP	NP	4.0×10^{-8}
	26.0 - 28.0	Liner	13.5	33.0	29.0	24.5	27	23	4	1.2×10^{-7}
BH199	42.0 - 44.0	Jar	25.8	36.9	29.4	7.9	15	10	5	
BH201	34.0 - 34.5	Liner	18.4	31.6	30.9	19.1	17	7	10	8.0×10^{-8}
	35.0 - 35.3	Jar	17.6	35.6	30.2	16.6	18	5	13	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH161	40.0 - 42.0	Tube	27.4	37.3	31.6	3.7	17	4	13	8.5×10^{-8}
	42.0 - 44.0	Tube	23.1	34.6	23.1	19.2	16	4	12	3.8×10^{-8}
	44.0 - 45.0	Tube	18.5	35.3	26.9	19.3	16	5	11	3.7×10^{-8}
	44.0 - 45.0	Jar	17.8	33.4	24.9	23.8	18	4	14	
BH162	28.0 - 30.0	Tube	21.2	35.7	23.5	19.6	24	8	16	3.5×10^{-8}
BH167	26.0 - 26.3	Jar	20.0	34.4	17.8	27.8	NA	NA	NA	
	28.0 - 29.5	Jar	20.8	34.9	26.7	17.7	17	8	9	
BH169	38.0 - 39.6	Tube	17.9	39.8	27.7	14.6	18	3	15	3.5×10^{-8}
	39.6 - 39.7	Jar	21.6	35.7	32.2	10.5	17	7	10	
BH170	38.0 - 39.0	Jar	24.6	33.0	28.6	13.9	19	9	10	
BH171	27.6 - 28.0	Jar	25.2	32.5	31.0	6.3	18	6	12	
	28.0 - 29.7	Jar	25.7	35.8	31.1	7.4	19	6	13	
BH172	45.0 - 46.8	Jar	23.0	25.0	28.0	23.9	22	6	16	
BH173	43.5 - 44.0	Jar	26.0	31.6	26.5	16.0	22	9	13	
BH176	30.0 - 31.9	Jar	17.2	31.5	31.0	20.4	17	6	11	
BH180	42.0 - 44.0	Jar	20.7	24.3	38.6	16.4	20	9	11	
BH181	24.0 - 26.0	Jar	25.6	22.0	30.0	22.4	25	14	11	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH150	25.8 - 26.0	Jar	Insufficient sample to perform testing							
	26.0 - 28.0	Jar	19.6	28.5	26.5	25.4	NA	NA	NA	
	28.0 - 29.9	Jar	19.5	30.8	28.7	21.0	20	11	9	
BH151	25.0 - 26.0	Jar	25.6	34.5	29.2	10.7	NA	NA	NA	
	26.0 - 26.3	Jar	20.3	25.7	34.1	20.0	18	6	12	
	26.0 - 26.3	Jar	18.7	36.3	31.4	13.6	16	4	12	
	28.0 - 29.7	Jar	22.6	28.9	35.5	13.0	16	3	13	
BH152	25.8 - 26.0	Jar	26.0	32.2	34.8	7.1	NA	NA	NA	
BH153	26.0 - 28.0	Jar	20.0	31.4	31.1	17.6	15	5	10	
	28.0 - 29.8	Jar	24.4	28.0	34.8	12.8	NP	NP	NP	
BH154	26.0 - 27.5	Jar	16.3	30.0	31.3	22.5	17	5	12	
	31.0 - 31.3	Jar	13.4	28.4	38.7	19.6	NA	NA	NA	*
BH155	29.4 - 30.0	Jar	17.8	32.8	31.6	17.8	NA	NA	NA	
	30.0 - 32.0	Jar	17.0	27.4	32.6	22.9	NA	NA	NA	*
	32.0 - 33.3	Jar	18.2	32.7	35.7	13.4	16	5	11	
BH159A	34.0 - 36.0	Tube	16.1	36.3	31.4	16.2	17	5	12	4.0×10^{-8}
BH160	34.0 - 36.0	Tube	26.2	27.9	19.6	26.3	25	11	14	2.6×10^{-8}
	36.0 - 37.6	Jar	26.2	29.3	29.5	15.0	19	6	13	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH118	38.0 - 40.0	Jar	13.6	27.2	40.5	18.8	13	3	10	*
	40.0 - 42.0	Jar	11.3	26.9	41.7	20.1	NP	NP	NP	*
BH119	40.0 - 40.5	Jar	15.7	28.7	41.0	14.6	20	7	13	*
BH120	36.5 - 38.0	Jar	12.9	29.3	37.6	20.2	15	2	13	*
BH122	24.0 - 26.0	Jar	23.4	32.5	33.8	10.4	NA	NA	NA	
BH123	24.0 - 26.0	Jar	24.4	39.6	30.3	5.7	20	5	15	
	26.0 - 27.9	Jar	21.2	36.7	34.6	7.5	15	5	10	
BH137	28.0 - 29.1	Jar	26.7	31.2	28.8	13.3	23	10	13	
BH138	28.0 - 30.0	Jar	17.3	33.0	32.5	17.2	16	3	13	
	30.0 - 31.1	Jar	18.6	33.6	29.3	18.4	17	5	12	
BH139	26.0 - 28.0	Jar	20.2	34.1	28.9	16.8	19	7	12	
BH140	28.0 - 30.0	Jar	23.5	31.5	29.3	15.7	23	10	13	
	30.0 - 30.8	Jar	25.8	24.6	41.5	8.1	21	8	13	
BH141	30.0 - 30.5	Jar	18.5	26.6	33.1	21.9	22	9	13	*
BH147	25.0 - 26.0	Jar	27.8	34.4	31.0	6.8	19	9	10	
	28.0 - 29.6	Jar	24.2	25.0	39.0	11.8	16	3	13	
BH149	28.0 - 29.9	Jar	21.4	29.1	30.7	18.7	19	7	12	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH104	33.0 - 33.4	Jar	18.8	33.2	31.4	16.6	17	3	14	
BH106	29.0 - 30.0	Jar	18.9	33.7	34.6	12.9	19	5	14	
	30.0 - 32.0	Jar	17.3	31.0	32.3	19.4	NA	NA	NA	
	32.0 - 32.6	Jar	16.7	32.6	31.1	19.6	NP	NP	NP	
BH109	26.0 - 28.0	Jar	20.9	29.7	26.1	23.3	17	6	11	
BH110	28.0 - 30.0	Jar	21.8	29.7	25.5	23.0	20	8	12	
	30.0 - 31.1	Jar	15.6	30.6	35.6	18.1	16	5	11	*
BH111	28.0 - 30.0	Jar	14.9	29.2	33.7	22.2	16	9	7	*
BH112	39.5 - 40.0	Jar	21.9	32.1	28.9	17.2	22	9	13	
	40.0 - 42.0	Jar	17.8	29.1	30.0	23.0	NA	NA	NA	
	44.0 - 45.0	Jar	22.6	31.4	33.5	12.5	NP	NP	NP	
BH113	39.5 - 40.0	Jar	16.4	28.6	33.2	21.8	18	7	11	*
	40.0 - 42.0	Jar	24.4	33.2	30.0	12.4	20	8	12	
	46.0 - 46.4	Jar	15.1	28.7	36.2	20.0	NA	NA	NA	*
BH114	36.0 - 38.0	Jar	15.7	29.2	31.5	23.6	NP	NP	NP	*
	38.0 - 40.0	Jar	18.2	29.2	29.1	23.6	16	4	12	
	43.0 - 44.6	Tube	14.3	27.9	32.7	25.1	14	5	9	*

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH202	32.0 - 33.2	Liner	18.5	34.5	32.0	15.0	NP	NP	NP	1.5×10^{-7}
	33.5 - 34.3	Liner	15.9	27.8	37.6	18.7	15	7	8	6.1×10^{-8}
BH203	35.5 - 37.3	Liner	18.5	28.0	37.0	16.5	29	24	5	4.4×10^{-8}
BH205	30.0 - 30.7	Liner	16.3	30.3	27.5	25.9	17	5	12	9.3×10^{-8}
BH212	24.0 - 26.0	Liner	20.5	47.5	27.5	4.5	21	14	7	2.9×10^{-8}
BH213	24.5 - 26.0	Jar	16.4	45.8	20.3	17.5	16	3	13	
	26.0 - 27.0	Jar	15.7	28.0	42.4	13.9	12	5	7	*
	27.0 - 27.7	Liner	2.5	42.5	48.0	7.0	NP	NP	NP	4.0×10^{-7}
BH214	25.3 - 26.0	Jar	35.2	18.2	20.6	26.0	27	13	14	
BH215	28.0 - 30.0	Jar	23.5	37.2	30.1	9.2	17	6	11	
	30.0 - 31.3	Liner	24.0	28.5	25.0	22.5	18	14	4	1.6×10^{-8}
BH216	42.0 - 44.0	Tube	18.3	32.4	30.8	18.5	17	6	11	3.1×10^{-8}
	44.0 - 45.0	Liner	16.5	30.5	27.0	26.5	NP	NP	NP	2.2×10^{-7}
BH219	39.0 - 39.8	Liner	15.5	25.0	37.0	22.5	NP	NP	NP	5.3×10^{-7}
BH221	35.0 - 37.0	Jar	20.3	33.5	36.4	9.7	12	4	8	
	40.0 - 42.0	Liner	22.0	33.5	32.0	12.5	43	24	19	2.0×10^{-8}

NA - insufficient sample size
NP - non plastic

* Estimated permeability >1 x 10^{-7} cm/sec (see text)

TABLE 6

COARSE TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH108	28.0 - 30.0	Jar	15.2	25.5	29.8	29.5	16	5	11	*
BH111	26.0 - 28.0	Jar	11.5	20.0	36.1	32.4	18	10	8	*
BH112	42.0 - 44.0	Jar	12.4	21.5	32.3	33.9	NA	NA	NA	
BH120	38.0 - 40.0	Jar	10.1	25.3	31.1	33.5	17	4	13	
BH121	24.0 - 26.0	Jar	16.5	28.2	26.4	28.8	14	3	11	
BH139	24.0 - 26.0	Jar	15.3	26.0	27.9	30.9	15	4	11	
BH146	30.0 - 31.0	Jar	17.0	14.2	38.2	30.7	22	11	11	*
BH149	26.0 - 26.5	Jar	20.6	29.3	22.8	27.2	16	5	11	
BH153	25.5 - 26.0	Jar	15.5	26.0	26.8	31.6	20	8	12	
BH159A	36.0 - 36.5	Jar	15.8	27.3	26.2	30.6	NA	NA	NA	
BH171	29.7 - 30.0	Jar	8.7	19.5	28.1	43.8	15	2	13	
	30.0 - 31.0	Jar	12.3	24.2	26.4	37.1	16	5	11	
BH173	44.0 - 45.0	Jar	10.5	26.3	32.3	30.9	13	3	10	*
BH176	28.0 - 30.0	Jar	14.3	25.0	33.0	27.7	17	6	11	*

continued....

TABLE 6

COARSE TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH178	29.7 - 30.0	Jar	15.1	13.1	29.8	42.0	NA	NA	NA	
	30.0 - 31.5	Jar	8.4	13.0	41.6	37.0	NA	NA	NA	*
BH179	44.0 - 44.6	Jar	12.2	20.1	33.6	34.1	21	5	16	
BH194	24.0 - 24.7	Jar	8.1	16.3	31.0	44.6	NA	NA	NA	
BH200A	34.0 - 36.0	Liner	15.1	27.3	19.8	37.8	18	10	8	2.3×10^{-8}
BH203	33.5 - 35.5	Liner	12.7	20.8	17.5	49.0	18	5	13	8.3×10^{-8}
BH204	33.5 - 34.2	Liner	12.6	20.5	25.7	41.2	17	7	10	7.7×10^{-8}
BH207	32.0 - 34.0	Liner	20.5	14.5	34.5	30.0	16	12	4	1.1×10^{-7}
BH209	32.0 - 34.0	Liner	16.0	17.0	25.5	41.5	15	12	3	3.3×10^{-8}
BH210	24.0 - 26.0	Liner	11.0	17.0	49.5	22.5	22	16	6	2.6×10^{-7}
	26.0 - 28.0	Liner	20.0	18.0	5.0	57.0	NP	NP	NP	9.9×10^{-8}
BH214	26.0 - 28.0	Jar	10.1	18.0	39.7	32.2	12	3	9	*
BH218	37.0 - 39.0	Liner	19.5	17.5	31.5	31.5	NP	NP	NP	No perm. - disturbed

NA - insufficient sample size
NP - non plastic

* Estimated permeability >1 x 10^{-7} cm/sec (see text)

TABLE 7

SUMMARY OF PHYSICAL TESTING RESULTS

		Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
CLAY	minimum	51.4	9.6	0.0	0.0	18	6	10	1.6×10^{-8}
	maximum	90.0	42.4	18.9	3.0	55	35	28	6.1×10^{-8}
	average[1] (n = 180)	73.7	22.8	3.1	0.4	41	20	21	2.9×10^{-8} (n = 29)
FINE TILL	minimum	19.5	7.0	7.8	0.8	17	3	3	1.3×10^{-8}
	maximum	72.5	53.5	36.0	19.5	42	27	22	7.9×10^{-8}
	average[1] (n = 73)	43.2	29.0	20.4	7.4	28	13	15	2.7×10^{-8} (n = 15)
MEDIUM TILL	minimum	2.5	18.2	17.8	3.7	12	2	5	1.6×10^{-8}
	maximum	35.2	47.7	52.8	27.8	43	24	16	5.3×10^{-7}
	average[1] (n = 100)	19.6	31.7	32.0	16.7	18	7	11	6.3×10^{-8} (n = 22)
COARSE TILL	minimum	8.1	13.0	5.0	22.5	12	2	3	2.3×10^{-8}
	maximum	20.6	29.3	49.5	57.0	22	16	16	2.6×10^{-7}
	average[1] (n = 27)	14.0	21.2	29.7	35.1	17	7	10	7.6×10^{-8} (n = 7)

Note: Arithmetic average except for permeability which is geometric mean.

respectively, had permeability values above the 1 x 10^{-7} cm/sec criteria at 5 psi but below 10 psi.

The Settlement Agreement allows that soils with comparable grain size distribution and plasticity, as soils for which permeability testing has been conducted, shall be presumed to have the same permeability. In order to concisely present the grain size distribution results, all of the samples were grouped as either clay, fine till, medium till or coarse till.

Permeability tests of 44 samples of clay and fine till showed that all had permeabilities less than the 1 x 10^{-7} cm/sec criteria. Permeability testing of 22 medium till samples and seven coarse till samples showed that six medium till and two coarse till samples had permeabilities greater than 1 x 10^{-7} cm/sec. These results necessitated a detailed look at the grain size distribution and plasticity testing results in order to correlate these properties with the high permeabilities and then apply this correlation to the samples for which no permeability testing was conducted.

5.2.1 Summary of High Permeability Results

Referring to Tables 5 and 6, there are four samples with permeabilities greater than 1×10^{-7} cm/sec. These samples are listed below.

Borehole	Sample Depth	Permeability
BH 219	39.0 - 39.8 ft	5.3×10^{-7} cm/sec
BH 213	27.0 - 27.7 ft	4.0×10^{-7} cm/sec
BH 210	24.0 - 26.0 ft	2.6×10^{-7} cm/sec
BH 216	44.0 - 44.5 ft	2.2×10^{-7} cm/sec

There are four other samples which have permeability values only slightly above the 1×10^{-7} cm/sec criteria. These samples are listed below will be discussed further in the following paragraphs.

Borehole	Sample Depth	Permeability
BH 202	32.0 - 33.2 ft	1.5×10^{-7} cm/sec
BH 191	42.0 - 44.0 ft	1.4×10^{-7} cm/sec
BH 197	26.0 - 28.0 ft	1.2×10^{-7} cm/sec
BH 207	32.0 - 34.0 ft	1.2×10^{-7} cm/sec

In order to determine whether the actual permeabilities of the second group of four samples were higher or lower, a comparison was made with other samples having similar physical characteristics. It was found that the BH202 (32.0 - 33.2 feet) sample had physical characteristics similar to three other samples, but the resultant permeability values of the other three samples were all well below the 1 x 10^{-7} cm/sec criteria. The following three samples have clay, silt, sand and gravel percentages averaging within three percent of the corresponding percentages for the two previously-mentioned samples.

Borehole	Sample Depth	Permeability
BH159A	34.0 - 36.0 ft	4.0 x 10^{-8} cm/sec
BH197	24.0 - 26.0 ft	4.0 x 10^{-8} cm/sec
BH216	42.0 - 44.0 ft	3.1 x 10^{-8} cm/sec

Due to the similar physical characteristics of all the above-mentioned samples and the low permeability values of these samples, it is postulated that the sample from BH202 (32.0 - 33.2 feet) should be classified as a sample having a permeability less than 1 x 10^{-7} cm/sec.

The other three samples, with borderline permeability values have physical characteristics more closely resembling the four samples which definitely have permeabilities greater than the 1 x 10^{-7} cm/sec criteria.

The next subsection of this report characterizes the physical properties of the samples which had permeability values greater than the 1 x 10^{-7} cm/sec criteria, and it will be confirmed that the three remaining borderline samples will have permeabilities greater than 1 x 10^{-7} cm/sec.

5.2.2 Characterization of High Permeability Results

Initially, all the samples with permeability values greater than 1 x 10^{-7} cm/sec were classified with respect to clay content. The 22 samples with clay content less than 21 percent are listed in Table 8 in order of increasing clay content from the top to the bottom. Three of the samples with permeabilities much greater than 1 x 10^{-7} cm/sec as well as two of the borderline permeabilities are included in the first eight samples with the lowest clay content. The three remaining samples in the top 8 samples have permeabilities less than the 1 x 10^{-7} cm/sec criteria. The last identified sample having a permeability greater than 1 x 10^{-7} cm/sec (BH207 32-34') is listed on Table 8 as having a clay content of 20.5 percent. However, 13 samples having lower clay contents have permeabilities of less than 1 x 10^{-7} cm/sec. Therefore, classifying all samples by only clay content does not provide a satisfactory method for identifying samples having

TABLE 8

LOWEST CLAY CONTENT PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Permeability (cm/sec)
BH213	27.0 - 27.0	2.5	42.5	48.0	7.0	4.0×10^{-7} *
BH210	24.0 - 26.0	11.0	17.0	49.5	22.5	2.6×10^{-7} *
BH191	42.0 - 44.0	11.8	32.0	46.0	10.2	1.4×10^{-7} *
BH204	33.5 - 34.2	12.6	20.5	25.7	41.2	7.7×10^{-8}
BH203	33.5 - 35.5	12.7	20.8	20.8	49.0	8.3×10^{-8}
BH197	26.0 - 28.0	13.5	33.5	28.5	24.5	1.2×10^{-7} *
BH200A	34.0 - 36.0	15.1	27.3	19.8	37.8	2.3×10^{-8}
BH219	39.0 - 39.8	15.5	25.0	37.0	22.5	5.3×10^{-7} *
BH202	33.5 - 34.3	15.9	27.8	37.6	18.7	6.1×10^{-8}
BH209	32.0 - 34.0	16.0	17.0	25.5	41.5	3.3×10^{-8}
BH159A	34.0 - 36.0	16.1	36.3	31.4	16.2	4.0×10^{-8}
BH205	30.0 - 30.7	16.3	30.3	27.5	25.9	9.3×10^{-8}
BH216	44.0 - 45.0	16.5	30.0	27.0	26.5	2.2×10^{-7} *
BH169	38.0 - 39.6	17.9	39.8	27.7	14.6	3.5×10^{-8}
BH216	42.0 - 44.0	18.3	32.4	30.8	18.5	3.1×10^{-8}
BH201	34.0 - 34.5	18.4	31.6	30.9	19.1	8.0×10^{-8}
BH203	35.5 - 37.3	18.5	28.0	37.0	16.5	4.4×10^{-8}
BH202	32.0 - 33.2	18.5	34.5	32.0	15.0	1.5×10^{-7}
BH161	44.0 - 45.0	18.5	35.3	26.9	19.3	3.7×10^{-8}
BH207	32.0 - 34.0	20.5	14.5	34.5	30.0	1.2×10^{-7} *
BH197	24.0 - 26.0	20.5	34.0	37.0	8.5	4.0×10^{-8}
BH212	24.0 - 26.0	20.5	47.5	27.5	4.5	2.9×10^{-8}

* Permeability >1×10^{-7} cm/sec

permeabilities greater than 1 x 10^{-7} cm/sec but does emphasize the importance of clay content on the permeability.

Another attempt to classify the high permeability samples involved grouping according to the combined sand and gravel content. Table 9 lists 15 samples with coarse content (sand plus gravel) greater than 50 percent in decreasing order of coarse content. This list includes all seven high permeability samples along with the eight samples which pass the 1 x 10^{-7} cm/sec criteria. Upon further examination, it is noted that for all the high permeability samples, the sand content is larger than the gravel content. The opposite is true for seven of the eight passing samples. The only exception is the BH202 (33.5 - 34.3) sample. It will be assumed that since its physical characteristics are similar to the high permeability samples that this sample may be classified as having a high permeability.

This examination of the soils' physical properties led to the development of the following criteria to be used in determining the permeability status of the remaining samples for which only grain size distribution and plasticity testing was conducted:

i) clay content <21 percent, and
ii) coarse content ≥ 53.5 percent with sand content exceeding gravel content.

TABLE 9

HIGHEST COARSE CONTENT PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Percent Coarse	Permeability (cm/sec)
BH210	24.0 - 26.0	11.0	17.0	49.5	22.5	72.0	2.6×10^{-7} *
BH209	32.0 - 34.0	16.0	17.0	25.5	41.5	67.0	3.3×10^{-8}
BH204	33.5 - 34.2	12.6	20.5	25.7	41.2	66.9	7.7×10^{-8}
BH203	33.5 - 35.5	12.7	20.8	17.5	49.0	66.5	8.3×10^{-8}
BH207	32.0 - 34.0	20.5	14.5	34.5	30.0	64.5	1.2×10^{-7} *
BH210	26.0 - 28.0	20.0	18.0	5.0	57.0	62.0	9.9×10^{-8}
BH219	39.0 - 39.8	15.5	25.0	37.0	22.5	59.5	5.3×10^{-7} *
BH200A	34.0 - 36.0	15.1	27.3	19.8	37.8	57.6	2.3×10^{-8}
BH202	33.5 - 34.3	15.9	27.8	37.6	18.7	56.3	6.1×10^{-8}
BH191	42.0 - 44.0	11.8	32.0	46.0	10.2	56.2	1.4×10^{-7} *
BH213	27.0 - 27.7	2.5	42.5	48.0	7.0	55.0	4.0×10^{-7} *
BH197	26.0 - 28.0	13.5	33.0	29.0	24.5	53.5	1.2×10^{-7} *
BH216	44.0 - 45.0	16.5	30.0	27.0	26.5	53.5	2.2×10^{-7} *
BH205	30.0 - 30.7	16.3	30.3	27.5	25.9	53.4	9.3×10^{-8}
BH203	35.5 - 37.3	18.5	28.5	37.0	16.0	53.0	4.4×10^{-8}

* Permeability >1 x 10^{-7} cm/sec

These criteria included all samples with permeabilities greater than 1 x 10^{-7} cm/sec, except the previously discussed sample from BH202 (32.0 - 33.2 feet) and includes one sample from BH202 (33.5 - 34.3 feet) that had achieved a maximum permeability of 1 x 10^{-7} cm/sec during testing.

5.2.3 Expected Permeability of Untested Samples

Using the two criteria for estimating permeability, all of the physical testing results were examined. Tables 5 and 6 include an asterisk in the permeability column indicating those samples for which permeability testing was not conducted but due to their grain size distribution would be expected to exceed the 1 x 10^{-7} cm/sec criteria.

6.0 DEFINITION OF CONFINING LAYER & CONFINING LAYER EQUIVALENT

6.1 BACKGROUND

In order to determine the areal extent of any Confining Layer Discontinuity, the thickness of the Confining Layer must be evaluated using the three criteria of a Confining Layer as stated in Section 3.0 of this report.

The first criteria specifies that the stratum "has a maximum permeability of 1×10^{-7} cm/sec". This required laboratory testing for permeability as well as grain size distribution and plasticity as described in Section 5.1 of this report. The testing results indicate that not only did the material in the clay layer meet this criteria but that most of the sampled material from the till layer (84 percent of all samples) also had a permeability of less than 1×10^{-7} cm/sec.

In order to determine the till thickness which would meet the 1×10^{-7} cm/sec criteria, each borehole stratigraphic log had to be examined. There are intervals at various boreholes which did not have samples submitted for physical testing and these had to be interpreted from their descriptions whether or not they would be expected to meet the 1×10^{-7} cm/sec criteria.

Special attention was given to the quantity of sand and gravel indicated and whether clay was indicated as being present in trace amounts or not present at all. Physical testing results from adjacent samples were also considered in the evaluation. Table 10 lists all the boreholes and the respective information indicating the till thicknesses which do not meet the 1×10^{-7} cm/sec criteria. The remaining clay/till thickness can be utilized to meet the second criteria that the stratum "has a continuous thickness of at least three feet".

From this remaining clay/till thickness, any material containing "non-aqueous liquid or solid phase chemicals" must not be included in order to meet the third and last criteria of a Confining Layer. The sampled clay and till materials containing NAPL were discussed previously in Section 4.2 and have been deleted from the clay/till thickness where appropriate.

Figure 22 presents the top of Confining Layer contours by combining the top of clay contours with the top of till contours, where clay was not present, and excluding all clay or till material above any observed NAPL except:

- at BH187 where the NAPL appears to be in the top fractured rock and not the till layer; and
- at WS18 where the NAPL appears in the till layer but not the overlying clay layer.

TABLE 10

NON-CONFINING LAYER TILL MATERIALS

Well/ Borehole	Clay Interval (feet)	Till Interval (feet)	Failure Interval (feet)	Remaining Continuous Clay/Till Thickness (feet)
BH108	-	27.0-30.0	27.0-30.0	0.0
BH110	-	25.0-31.1	30.0-31.1	5.0
BH111	-	26.0-31.4	26.0-31.4	0.0
BH113	-	39.5-46.4	39.5-40.0 &	
			46.0-46.4	6.0
BH114	-	36.8-45.6	36.8-38.0 &	
			43.0-44.6	5.0
BH117	-	38.0-44.5	41.9-42.0 &	
			42.5-44.5	3.9
BH118	-	37.0-42.0	38.0-42.0	1.0
BH119	37.0-37.8	37.8-40.5	40.0-40.5	3.0
BH120	-	34.5-40.8	36.5-38.0 &	
			40.0-40.8	2.0
BH141	-	30.0-30.5	30.0-30.5	0.0
BH142	-	25.5-26.0	25.5-26.0	0.0
BH143	-	21.0-25.0	21.0-25.0	0.0
BH144	-	23.0-26.3	26.0-26.3	3.0
BH146	-	27.0-31.0	30.0-31.0	3.0
BH154	-	26.0-31.3	31.0-31.3	5.0
BH155	-	29.4-33.3	30.0-32.0	1.3
BH164	-	25.0-28.0	25.0-28.0	0.0
BH173	-	43.5-45.0	44.0-45.0	0.5
BH176	-	28.0-31.9	28.0-30.0	1.9
BH178	-	29.7-31.5	30.0-31.5	0.3
BH184	-	24.3-29.4	28.0-29.4	3.7
BH185	-	25.0-29.5	28.0-29.5	3.0
BH186	-	23.0-28.9	26.0-28.9	3.0
BH187	-	26.7-28.6	26.7-28.6	0.0
BH190	-	43.3-47.3	44.0-47.0	0.7
BH191	-	41.5-44.5	42.0-44.0	0.5
BH196	23.9-24.0	24.0-25.7	24.0-25.7	0.1
BH197	24.0-24.7	24.7-28.0	26.0-28.0	2.0
BH207	30.0-31.0	31.0-34.0	32.0-34.0	2.0
BH210	23.7-24.0	24.0-28.0	24.0-26.0	2.0
BH213	24.0-25.0	25.0-27.7	26.0-27.7	2.0
BH214	-	25.3-28.0	26.0-28.0	0.7
BH216	35.5-43.0	43.0-46.1	44.0-46.1	8.5
BH219	-	35.0-39.8	37.4-39.8	2.4
OW241	20.0-21.8	21.8-26.7	23.0-26.7	3.0

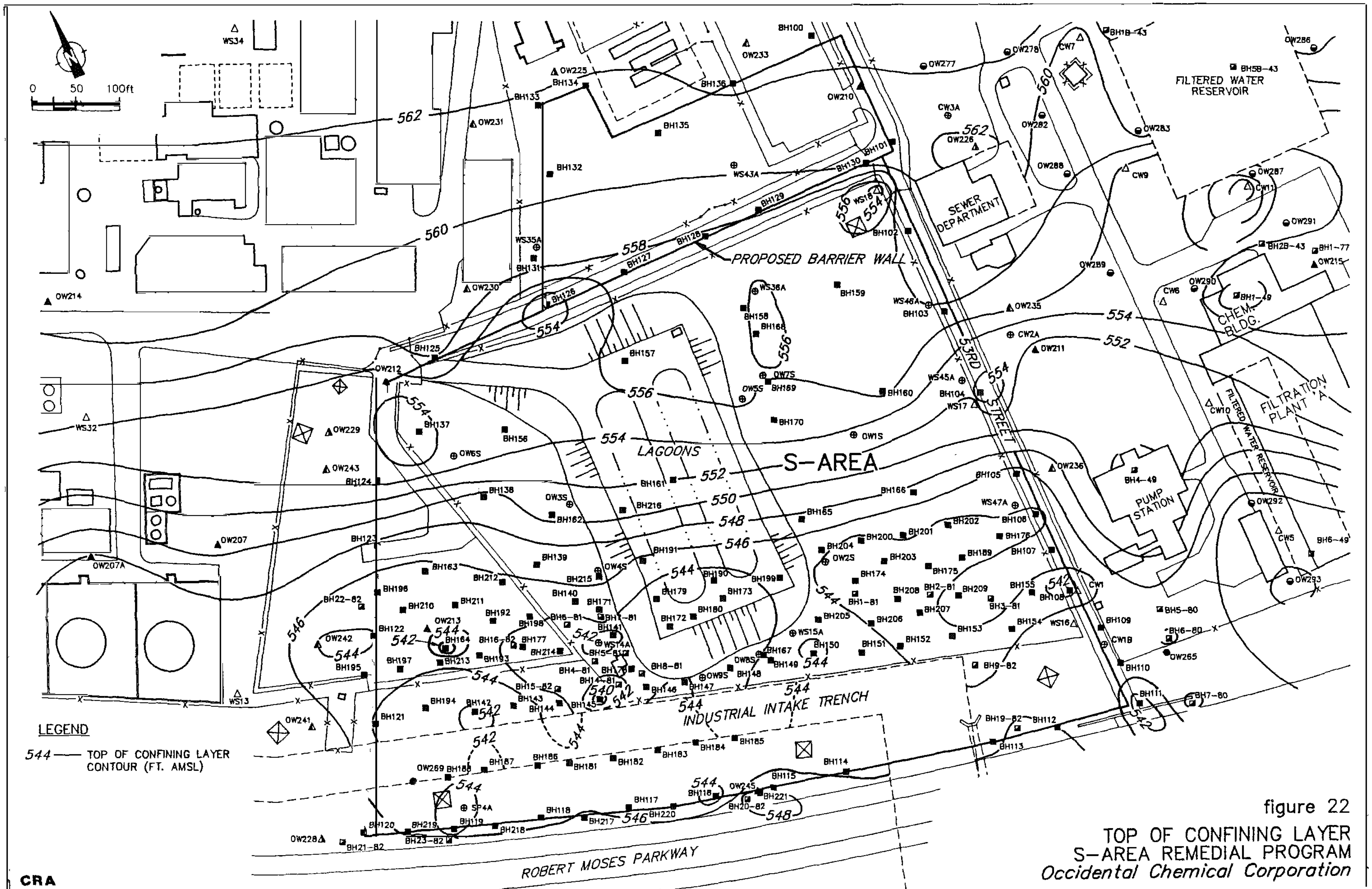

figure 22

TOP OF CONFINING LAYER
S-AREA REMEDIAL PROGRAM
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1769-4/08/88-25-D-0

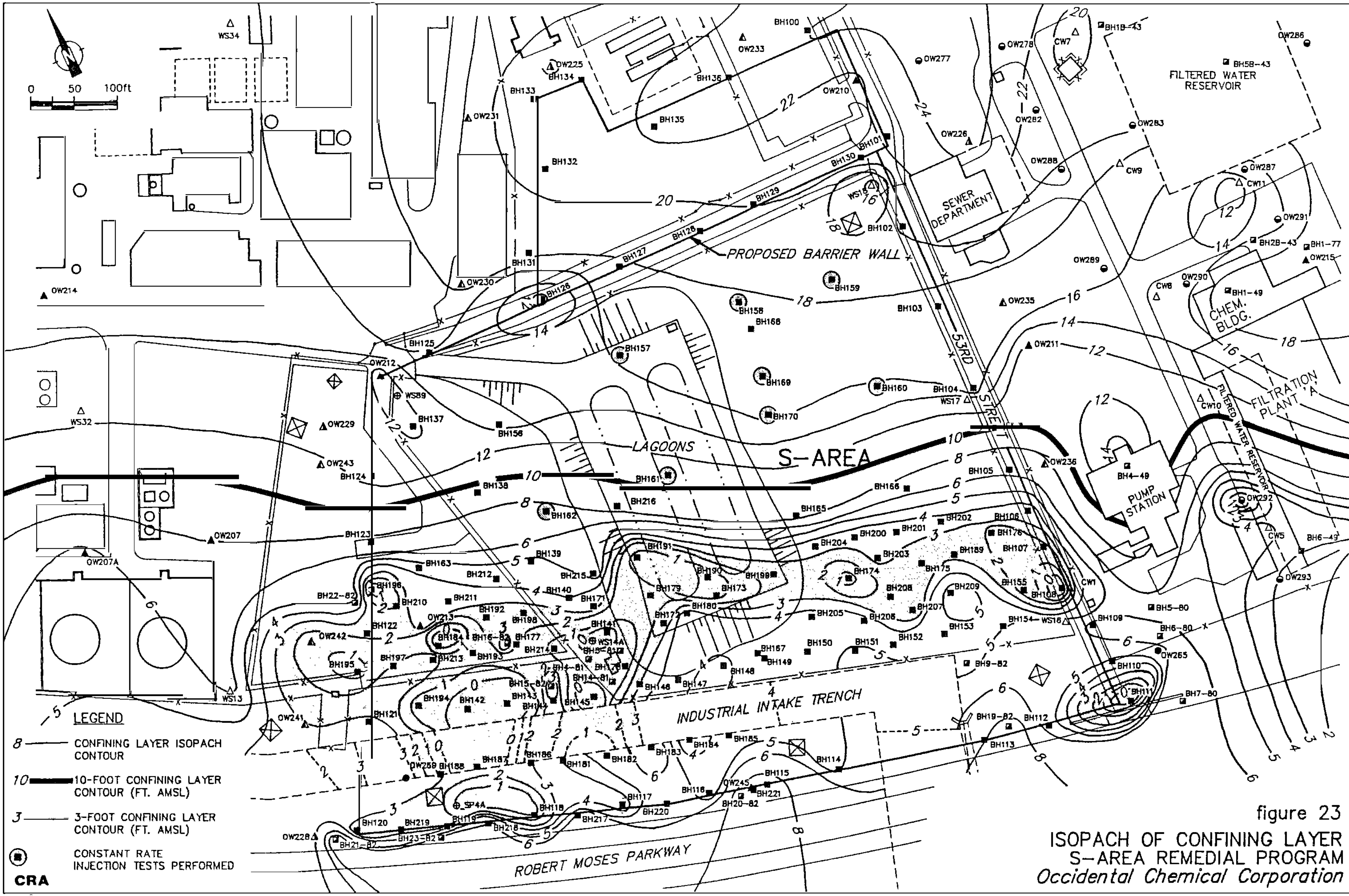

figure 23
ISOPACH OF CONFINING LAYER
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

Based upon the previous discussions, Figure 23 presents an isopach map of the Confining Layer thickness.

Two plans are also enclosed with this report showing the top of Confining Layer and isopach of Confining Layer contours based on all available data. These plans should replace the previously submitted Plans 4 and 10 contained in the "Information Summary Report - Volume II - Drawings".

There are several drilling installations which indicate definite and possible routes of NAPL migration to the bedrock. As previously mentioned in Section 4.3.1, two boreholes (BH143 and BH145) contained evidence of NAPL throughout the entire thickness of sampled till with no overlying clay. This presence indicates a definite route for potential vertical NAPL migration to the bedrock.

Another definite area for potential vertical NAPL migration is in the area of WS14(A/B). No clay or till materials were found at this drilling location. Adjacent boreholes (BH4-81, BH5-81, BH14-81 and BH141) indicate only 0.2 to 0.5 feet of till material present with no overlying clay layer. During the drilling of WS14 in 1979, NAPL was noted from 28.5 to 30.5 feet below ground surface with a strong odor detected below this to the bedrock surface at 32.7 feet. BH4-81 and BH5-81 indicated NAPL presence in the alluvium to the alluvium/till contact and NAPL was present at BH14-81 within 1.5 feet of the alluvium/till contact. BH141, installed during the recent subsurface investigation, also had NAPL present over much of the alluvium to the alluvium/till contact. This hole in the Confining Layer at WS14 is a definite route for potential NAPL migration with evidence of available NAPL in the vicinity.

Possible routes for potential vertical NAPL migration are through the disturbed materials adjacent to the power tower foundation piles driven to bedrock. These routes previously discussed in Section 4.3.2 are to be evaluated by future tracer studies.

A final possible area of potential vertical NAPL migration is the Industrial Intake Pipe Trench. The limited data available indicates the presence of 0.5 to 5 feet of till remaining above the bedrock below the trench. There may be areas along the trench where the top of the bedrock elevation increases or areas where the till was overexcavated thus reducing the till thickness.

6.2 EXTENT OF 10-FOOT CONFINING LAYER

To illustrate the extent of the 10-foot Confining Layer at the Study Area, the 10-foot isopach is highlighted on Figure 23. The area north of the 10-foot isopach contour is the defined area illustrating a 10-foot Confining Layer presence. As can be seen on Figure 23, the northern half of the S-Area Landfill Site as well as the entire Northern Area meets the criteria of a 10-foot Confining Layer.

6.3 EXTENT OF CONFINING LAYER DISCONTINUITY

To illustrate the extent of the Confining Layer Discontinuity at the S-Area Landfill Site, the area within the three-foot isopach contours are shaded on Figure 23.

This is the area which, if determined not to be a Confining Layer Equivalent, as defined in Section 6.3, "shall be sealed by plugging the Bedrock beneath such Confining Layer Discontinuity with appropriate grouting material, or its performance equivalent".

With regards to the Northern Area, there is no Confining Layer Discontinuity present. Figure 23 indicates that approximately 16 to 24 feet of Confining Layer material is present across the entire Northern Area. It should be noted that the majority of this Confining Layer is composed of clay material and that NAPL was not present in the clay except at BH126 directly adjacent to the S-Area Landfill Site. Even at BH126, the Confining Layer was still 11.8 feet thick.

6.4 DETERMINATION OF CONFINING LAYER EQUIVALENT

6.4.1 Definition of Terms

An overburden area without a Confining Layer as defined in the Settlement Agreement is a Confining Layer Discontinuity but it is possible for a Confining Layer Discontinuity to be a Confining Layer Equivalent. The Settlement Agreement defines a Confining Layer Equivalent as "a Confining Layer Discontinuity which, following implementation and stabilization of the Site Containment System, is expected to be effective as a Confining Layer in preventing the downward migration of aqueous and non-aqueous phase liquids containing chemicals from the Landfill Site". In order to determine if the identified Confining Layer Discontinuity can be deemed a Confining Layer Equivalent, the "S-Area Two-Phase Flow Model" (Arthur D. Little, Inc., May 1983) was applied to the S-Area Landfill Site utilizing water table elevations and the results of injection test permeabilities undertaken during the subsurface investigation surveys. The following sections present the water table information and injection test results. The discussions regarding the modeling follow in Section 7.0.

6.4.2 Water Level Measurements

Figures 24 and 25 illustrate the water table elevations for the Study Area as recorded on February 8 and April 18, 1988.

The water levels reflect the overburden groundwater table on these dates. The groundwater contours indicate a flow towards the south and the Niagara River but there is also an obvious mound beneath the S-Area lagoons. The groundwater mound results in radial flow in all directions within the area proposed to be enclosed by the Site Barrier Wall.

6.4.3 Injection Test Results

The Settlement Agreement specifies that "at eight appropriate locations throughout the area within the Site Barrier Wall which has a 10-foot Confining Layer, Hooker (OCC) shall conduct constant-rate injection tests in the Overburden above such 10-foot Confining Layer and, utilizing the results of the tests, shall calculate the permeability of such Overburden". During the drilling of the eight boreholes highlighted on Figure 23, the specified injection tests were conducted. It is to be noted that, as shown on Figure 23, the Confining Layer at BH162 was not in excess of 10 feet

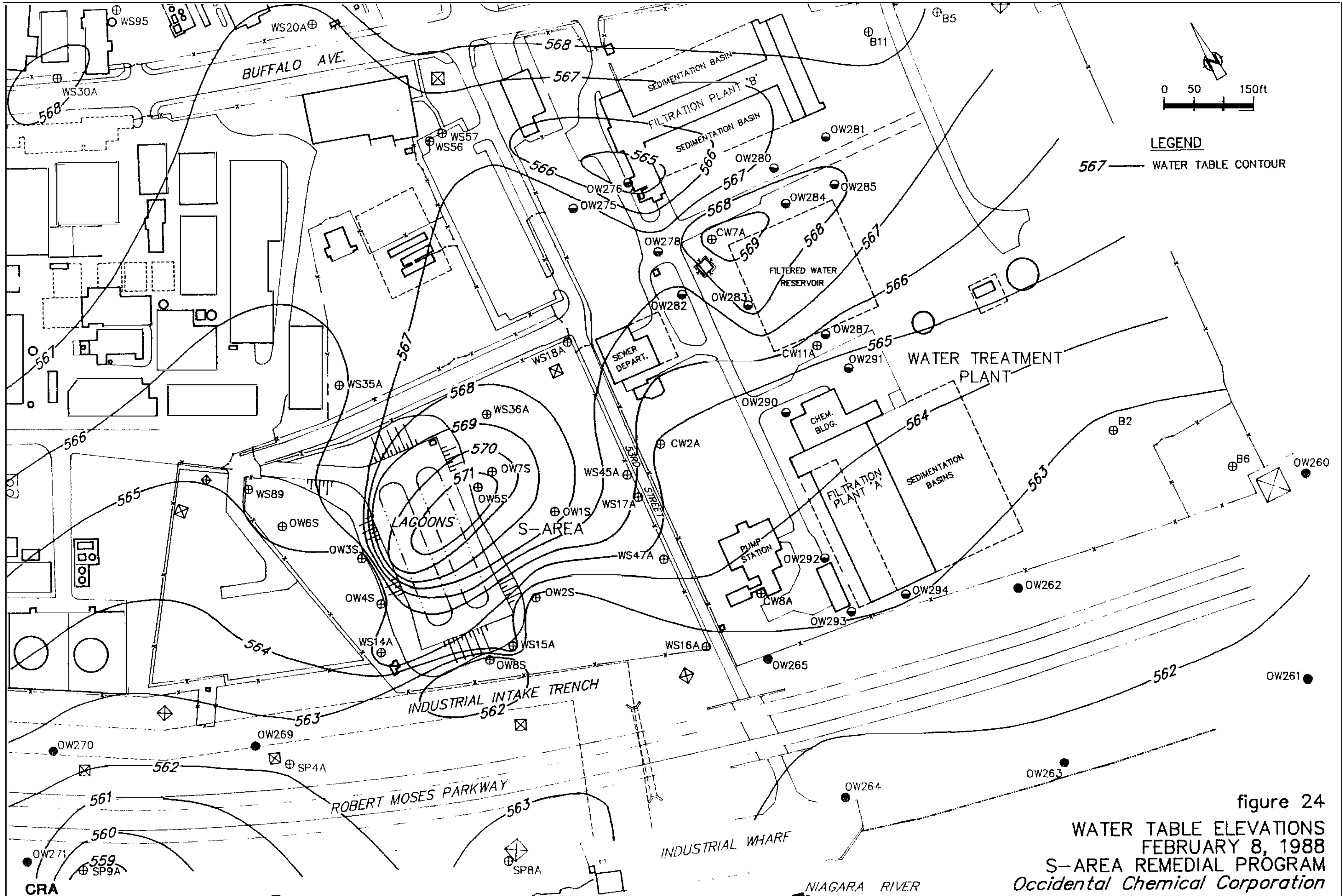

figure 24

WATER TABLE ELEVATIONS
FEBRUARY 8, 1988
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0 (P-26)

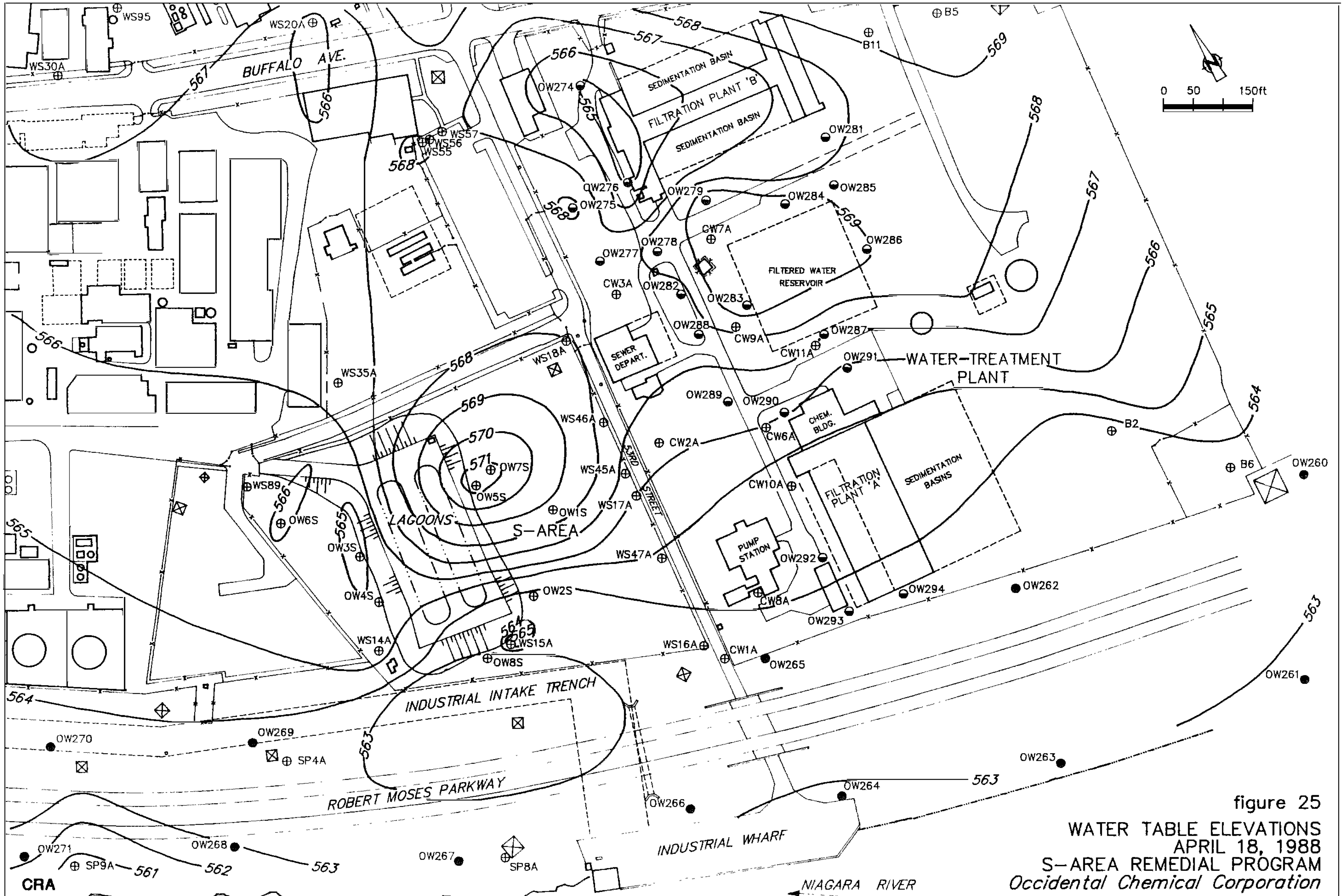

figure 25

WATER TABLE ELEVATIONS
APRIL 18, 1988
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0 (P-27)

thick (7.2 feet). The reason for this is that the boreholes utilized for injection testing were selected based on data from surrounding existing boreholes. Thus, it was interpolated, based upon data available at that time, that the Confining Layer was 10 feet thick at the selected location. The exact thickness of the Confining Layer, following the approved procedure, could only be confirmed upon completion of the borehole. The tests were conducted following penetration of the fill and alluvium layers and prior to penetration of the clay and till layers. A full description of the test methods used is contained in the Information Summary Report. Table 11 lists the permeabilities calculated for the overburden materials tested. These hydraulic conductivity values are used in the modeling described in Section 7.0.

The hydraulic conductivity values obtained from the injection tests are all consistent with expectations. The values range from 3.1×10^{-5} to 6.1×10^{-4} cm/sec with a geometric mean value of 1.0×10^{-4} cm/sec. This value is three orders of magnitude higher than the maximum allowable permeability for the Confining Layer. This indicates that groundwater within the Site Barrier Wall will tend to flow laterally through the overburden to the Site Collection System as opposed to vertically through the clay/till towards the bedrock.

TABLE 11

INJECTION TEST PERMEABILITY RESULTS
S-AREA LANDFILL

Borehole Number	Ground Elevation	Top of Sandpack Depth (ft)	Top of Sandpack Elevation	Bottom of Screen Depth (ft)	Bottom of Screen Elevation	Bottom of Sandpack Depth (ft)	Bottom of Sandpack Elevation	Hydraulic Conductivity (cm/sec)
BH157-88	586.2	9.0	577.2	28.5	557.7	29.0	557.2	3.1×10^{-5}
BH158-87	576.1	7.8	568.3	18.0	558.1	18.5	557.6	1.4×10^{-4}
BH159-87	575.1	3.2	571.9	17.0	558.1	17.5	557.6	6.1×10^{-4}
BH160-87	578.1	7.0	571.1	21.0	557.1	21.9	556.2	1.3×10^{-4}
BH161-88	585.9	7.2	578.7	33.4	552.5	34.0	551.9	6.2×10^{-5}
BH162-88	573.2	3.4	569.8	23.0	550.2	22.8	550.4	9.9×10^{-5}
BH169-87	578.8	6.0	572.8	22.8	556.0	23.0	555.8	1.1×10^{-4}
BH170-87	578.3	5.9	572.4	22.4	555.9	22.7	555.6	4.8×10^{-5}

7.0 CONTAINMENT SYSTEMS MODELING

7.1 INTRODUCTION

Two numerical models are used to assist in the evaluation of the proposed containment systems for the S-Area Landfill Site. The use of models is considered to be advantageous for at least two reasons:

1) they assist in understanding the response of the hydrogeologic regime to the system parameters, and
2) they assist in the assessment of remedial alternatives to control chemical migration.

The first model used is a groundwater flow model, FE3DGW, which is a three-dimensional finite element model, used to:

i) determine if an upward hydraulic gradient is expected to be present throughout the area of the 10-foot Confining Layer following Stabilization,

ii) determine the length required, if any, for the northern portion of the Site Collection System along the northern Site Barrier Wall alignment if an upward gradient is not present throughout the area of the 10-foot Confining Layer (Subparagraphs C(2)(f) and (g)), and

iii) determine if an upward hydraulic gradient is expected to be created within the area of any Confining Layer Discontinuity following Stabilization (Subparagraph C(1)(e)(i)).

The second model, the "S-Area Two-Phase Flow Model", was used to determine if the upward gradients expected to be achieved in the areas of a Confining Layer Discontinuity after Stabilization are sufficient to retain NAPL in the overburden. The water levels generated by the FE3DGW model were used as input to the Two-Phase Flow Model (Subparagraph C(1)(e)(ii)).

The following sections present more detail on the conceptualization of the Site, on the use of the models, and model results.

7.2 GROUNDWATER FLOW MODEL

The FE3DGW (Finite Element 3-Dimensional Ground Water) model was developed for analyzing flow through large, multilayered groundwater systems. The model has the capability of assessing noncontinuous and continuous layering, time-dependent and constant sources/sinks, and transient as well as steady-state flow. The model can be used to confirm site characterization, evaluate groundwater flow rates, and estimate travel path and travel time in regional and local groundwater systems.

The model was developed by the Office of Nuclear Waste Isolation at the Battelle Memorial Institute, Columbus, Ohio. The FE3DGW code was written for the VAX computer system in 1984. This was an update of the FE3DGW-PDP 11/70 version (Gupta, Cole and Bond, 1979).

Since the FE3DGW model was intended for use on large, multilayered natural groundwater systems, the computational and support programs were organized as separate and independent. The main computational program is divided into five subprograms for staged execution. PROG1 reads input files and identifies errors in node and element description. It provides an opportunity to verify the input before computation. Programs PROG2 and BAND set up the files for repeated computation in transient or sensitivity and uncertainty analysis. PROG2 calculates element areas and in doing so, ensures the nodes assigned to each element are compatible. Programs PROG3I and PROG3 were used for repeated simulation with redefined boundary condition values. Finally, the use of WTABLE (a separate program within the FE3DGW model) was required to solve steady-state, water table problems. This is accomplished through the iterative execution of WTABLE, PROG2 and PROG3.

7.3 S-AREA TWO-PHASE FLOW MODEL

The S-Area Two-Phase Flow Model is a one-dimensional model developed by Arthur D. Little Inc. (ADL) to analyze the simultaneous flow of aqueous phase liquids and non-aqueous phase liquids (NAPL). Thus, the model analyzes the simultaneous flows of two immiscible fluids in the porous medium domain. The model uses the IMPES (implicit pressure-explicit saturation) method to solve the combined multi-phase flow equation and calculate the NAPL and water saturations. The interfacial surface tension between the wetting phase and non-wetting phase fluid is nonzero with a capillary pressure difference existing across the fluid-fluid interface. The capillary pressure representation in the model is a non-hysteretic function of the degree of saturation of the wetting fluid. No phase changes are assumed to occur within the system.

The model was developed to aid in the analyses of the conditions at S-Area Landfill Site and assess possible downward migration of NAPL from overlying unconsolidated deposits into the underlying bedrock. To verify the computational accuracy of the numerical model, ADL

(1983) included a mass balance routine to provide an independent calculation of changes in fluid saturation and fluid phase inflow and outflow. In addition, the model has been shown to develop comparable results to those of Osborne (1984).

7.4 MODEL INPUTS

7.4.1 FE3DGW

Site hydrogeology has been previously presented in the "Information Summary Report" and in the various assessment reports submitted to date. In general, the area of investigation consists of three major hydrogeologic units, the fill/alluvium layers overlying a clay/till aquitard overlying the Lockport dolomite.

The geographic area simulated by the FE3DGW model, as shown on Figure 1, is approximately 1,550 feet wide and 1,450 feet long. The areal discretization consists of 539 elements and 574 nodes. The grid layout is shown on Figure 26. The overall model consists of 2,124 nodes and 1,535 elements.

The vertical discretization consists of three units; fill, alluvium and the clay/till aquitard with the top of the bedrock assigned as a prescribed-head boundary. It is

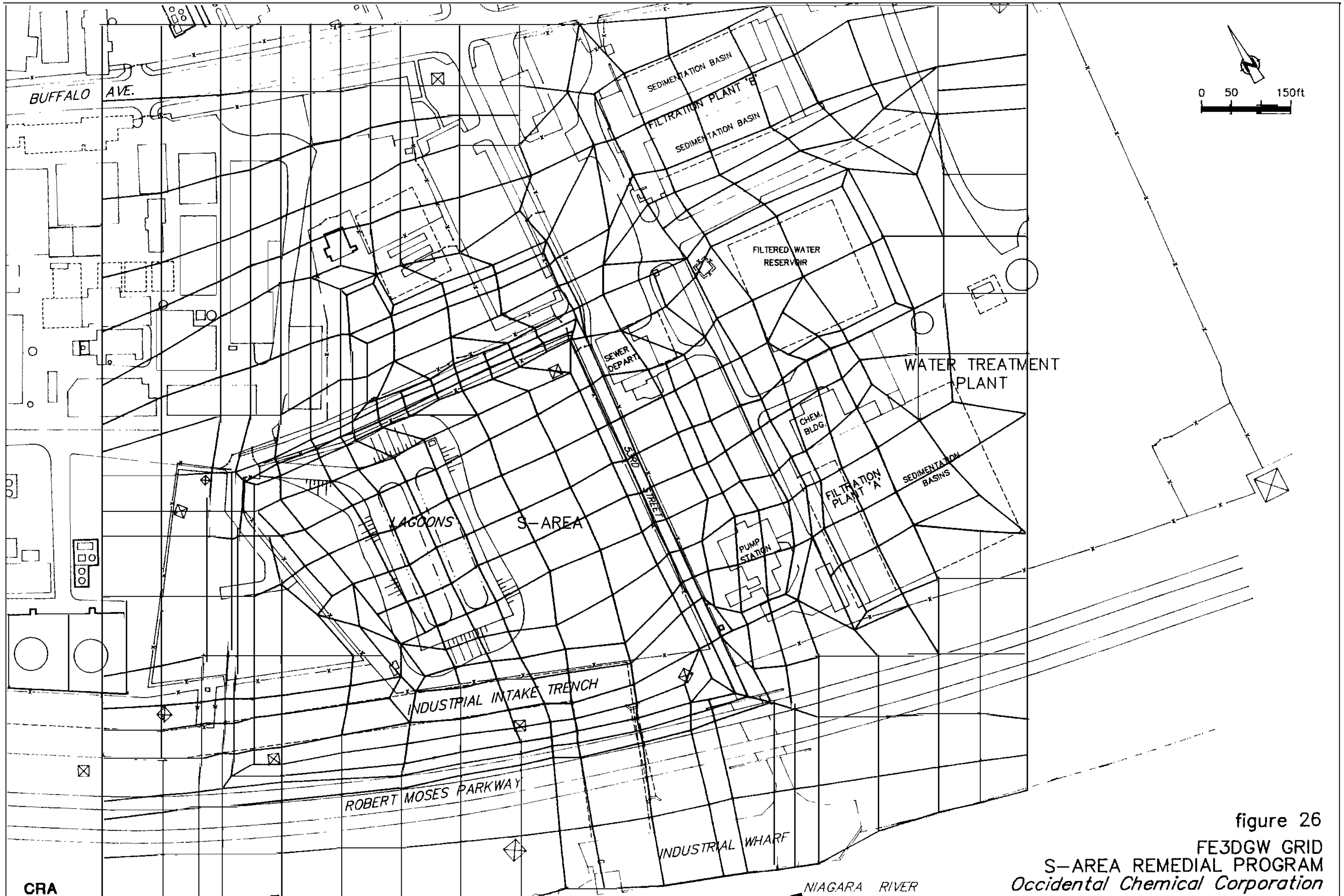

figure 26

FE3DGW GRID
S-AREA REMEDIAL PROGRAM
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noted that at some locations not all of the above units are present. Hydraulic conductivity results presented in Section 6.0 indicate that the clay and till generally have similar hydraulic conductivities and thus can be modeled as one hydrogeologic unit. The zones with various hydraulic conductivity values are shown on Figures 27 and 28 for the fill and alluvium, respectively. Due to the nature of the fill and alluvium materials, $K_H:K_V$ ratios of 1:1 and 10:1 were assumed for the fill and alluvium.

As indicated on Figures 27 and 28, there are areas with hydraulic conductivities in the same order of magnitude. It is noted that the majority of the measured hydraulic conductivities indicated on these figures were calculated from short-term tests and thus reflect conditions in close proximity of the tested wells. A horizontal hydraulic conductivity of 1×10^{-7} cm/sec was assumed for the entire areal extent and thickness of the clay/till aquitard with a $K_H:K_V$ ratio of 10:1.

As previously stated, the top of the bedrock (Lockport dolomite) was assigned as a prescribed-head boundary due to the water-bearing characteristics of the upper bedrock and the overlying aquitard which restricts vertical migration between the fill/alluvium and the bedrock. Nodes at the top of bedrock were assigned the measured potentiometric head. The east, west and north boundaries

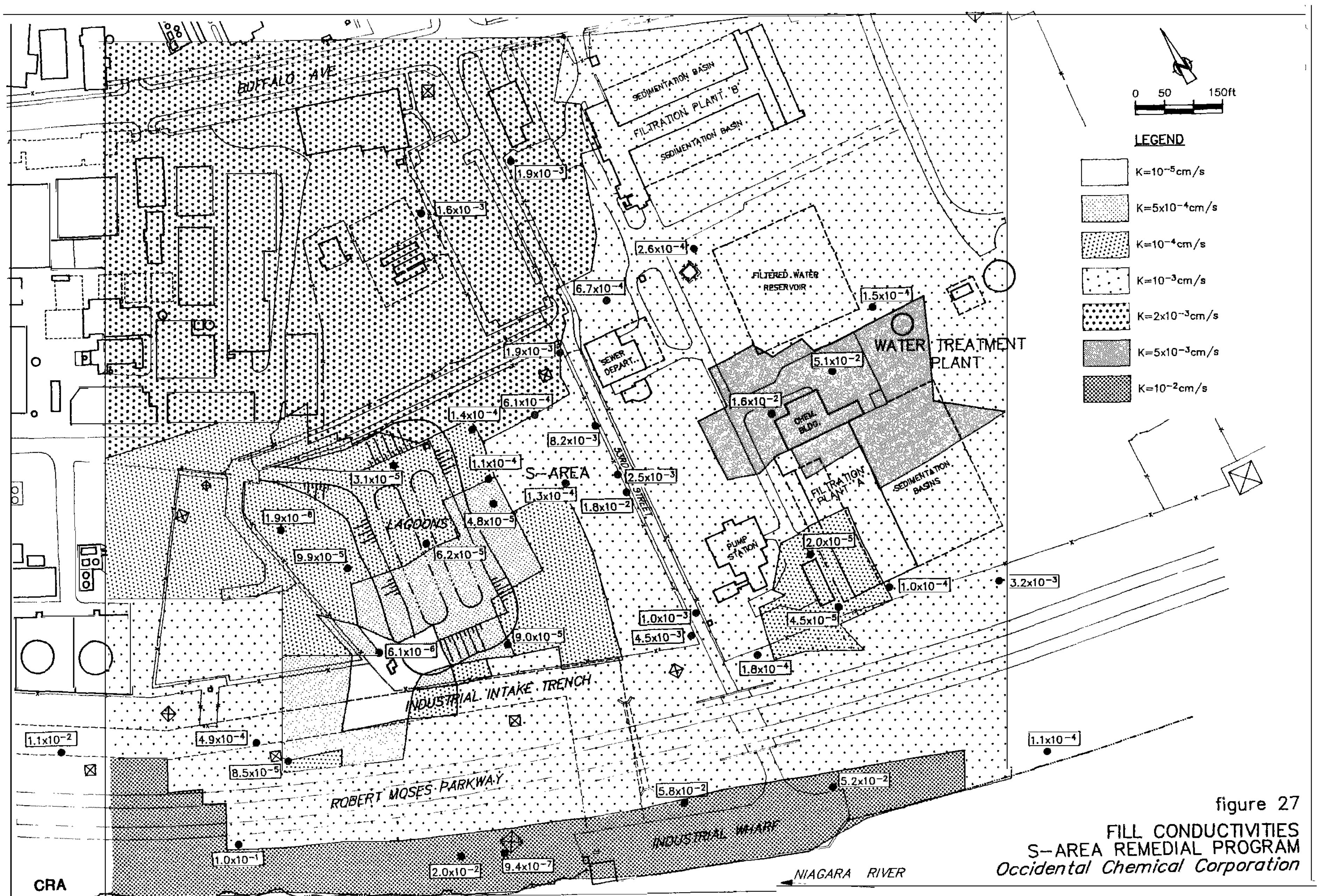

figure 27

FILL CONDUCTIVITIES
S-AREA REMEDIAL PROGRAM
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1769-4/08/88-25-D-0 (P-24)

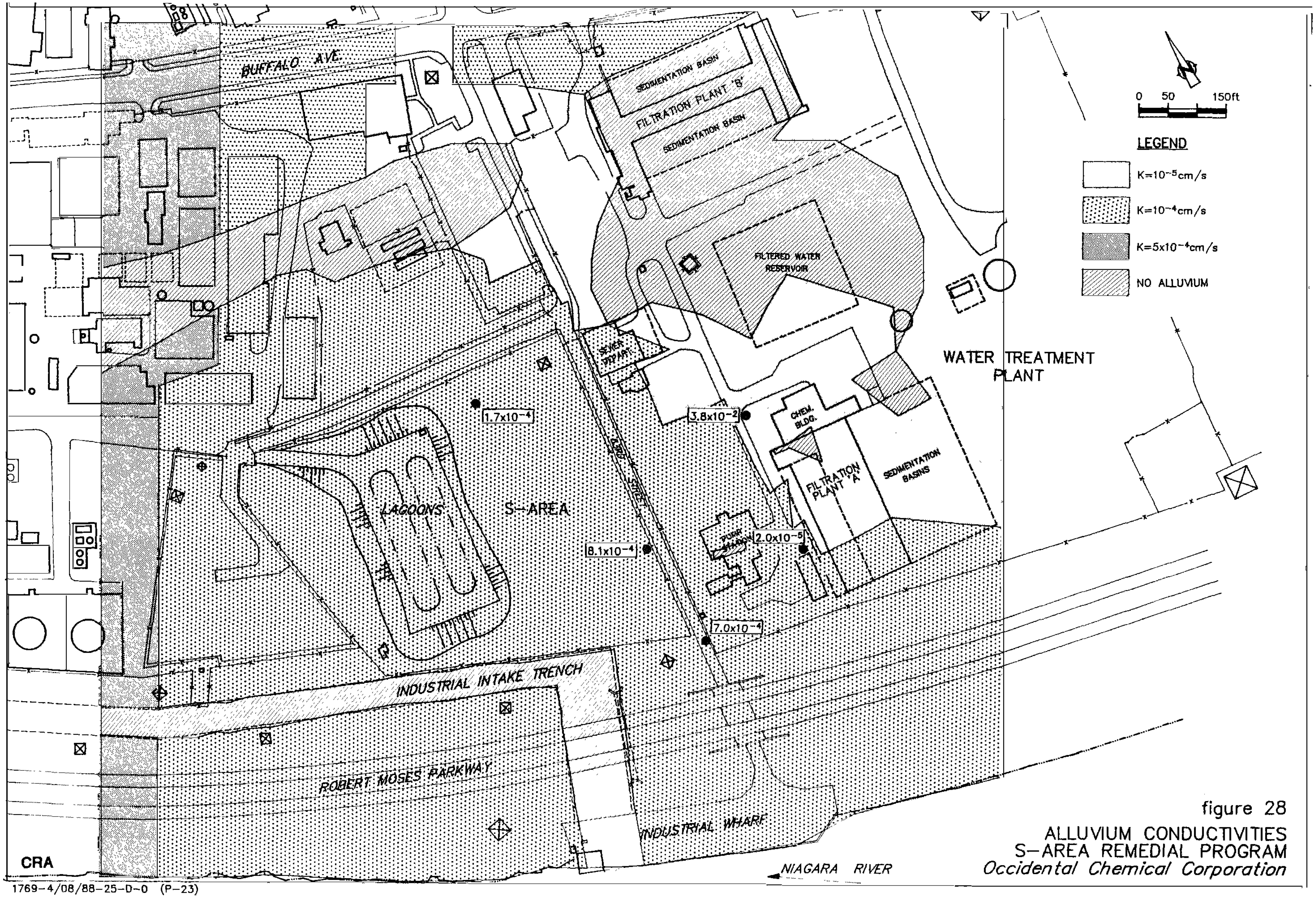


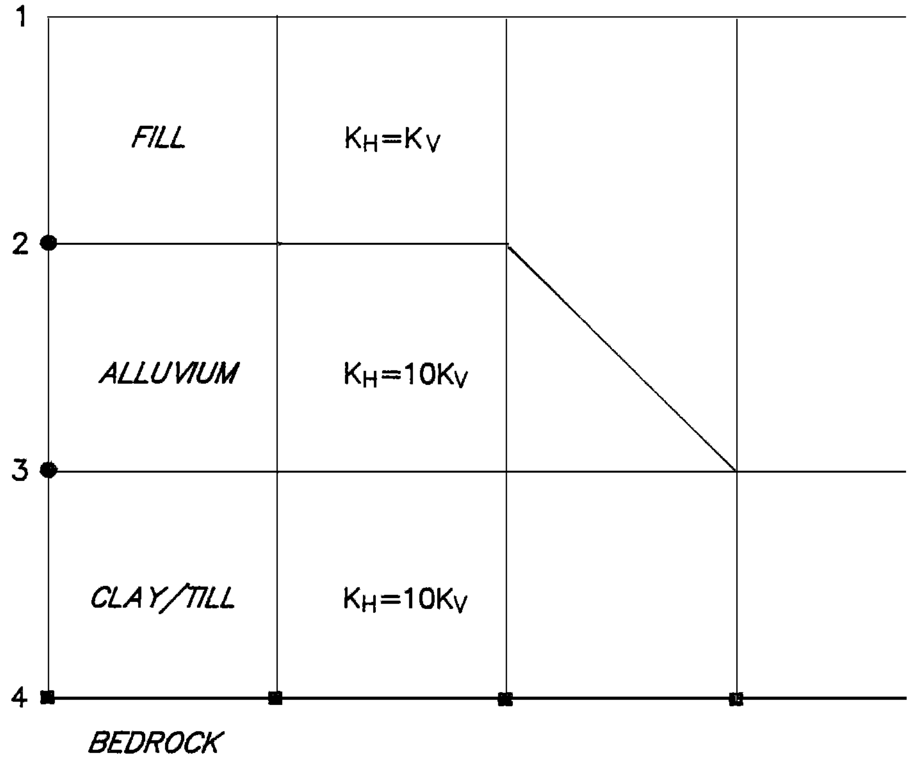
figure 28
ALLUVIUM CONDUCTIVITIES
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

were modeled as prescribed head boundaries with all nodes above the clay/till contact, except the uppermost node, assigned the measured overburden water-table. Along the south boundary, the fill/alluvium nodes were assigned the river elevation head. A vertical schematic of the conceptualization is shown on Figure 29.

Initial estimates of infiltration recharge due to precipitation was obtained using the Hydrologic Evaluation of Landfill Performance (HELP) model (Schroeder et al, 1984). The HELP model results indicate a recharge value on the order of 3 inches/year. Inspection of the measured overburden water levels indicated two areas of additional recharge, the area underlying the lagoons and the area in the northwest corner of the filtered water reservoir. In addition, one discharge area east of Filtration Plant "B" was noted.

7.4.2 S-Area Two-Phase Flow Model

One purpose of the modeling is to define which portions of the Confining Layer Discontinuity can be classified as a Confining Layer Equivalent. Therefore, the S-Area Two-Phase Flow Model was applied to a sizeable number of locations representing various lithologies and NAPL levels, in combination with the upward hydraulic gradient information generated using the FE3DGW model.



LEGEND

● PRESCRIBED HEAD NODE
(OVERBURDEN WATER TABLE)

■ PRESCRIBED HEAD NODE
(BEDROCK POTENTIOMETRIC HEAD)

figure 29

CONCEPTUALIZATION SCHEMATIC
S-AREA REMEDIAL PROGRAM
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The functions relating capillary pressure and relative permeabilities of both water and NAPL to the degree of saturation were taken as reported in ADL (1983). The boundary conditions for the model included prescribed aqueous phase pressures and degrees of saturation at the upper and lower ends of the column.

The following criteria were utilized in the modeling of columns within the Confining Layer Discontinuity:

i) if NAPL concentrations in the clay increased, the column was assumed to have 'failed' meaning the immediate region surrounding the column cannot be classified as a Confining Layer Equivalent;

ii) if the NAPL concentration remained zero in the clay for the simulation (4,000$\pm$ days) or if the model reached steady-state, then the column was assumed to have 'passed' meaning the immediate region surrounding the column can be classified as a Confining Layer Equivalent;

iii) if all four factors for a column (upward gradient, clay thickness, NAPL percentage and NAPL thickness) were more conservative than those of a column that passed, then the column was assumed to have 'passed'; and

iv) columns with no NAPL present or NAPL present only above the water table were not modeled and were classified as a Confining Layer Equivalent.

7.5 MODEL CALIBRATION

The groundwater flow for the modeled system was assessed using the FE3DGW model for steady-state conditions.

The groundwater levels measured on February 8, 1988 were used for calibration purposes. Inspection of available historical water levels in the overburden in the vicinity of the Site indicate that the range of fluctuation in the overburden water levels is on the order of approximately two feet with the February water levels generally midrange. Thus it was assumed that the February 1988 data was representative of average (steady-state) conditions.

Calibration of the FE3DGW model was performed by adjusting recharge estimates, source and sink terms, and hydraulic conductivities.

The calibrated hydraulic conductivities for the fill and alluvium are shown on Figures 27 and 28 respectively. The calibrated recharge, including the source and sink areas, are shown on Figure 30.

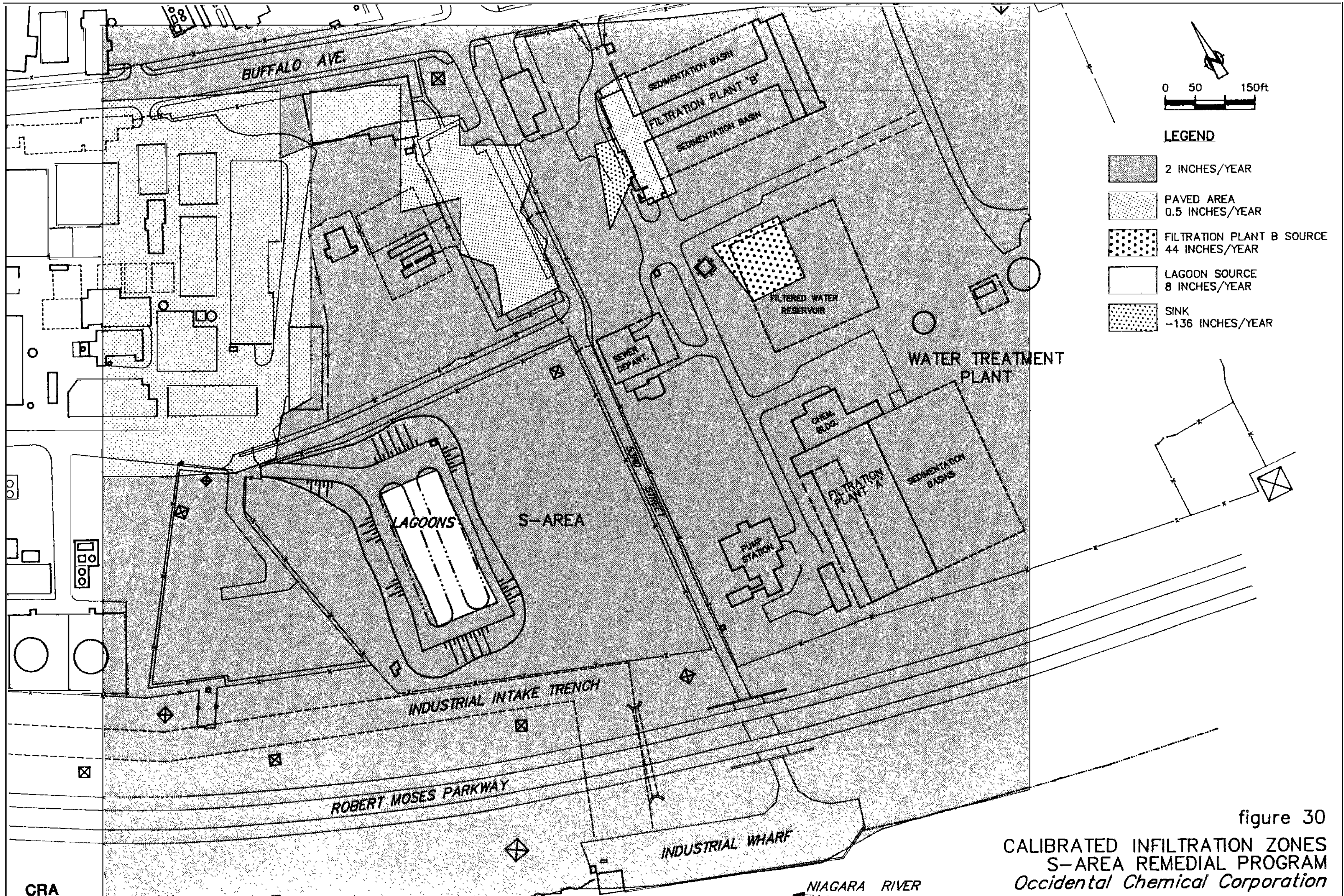

figure 30

CALIBRATED INFILTRATION ZONES
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To assist in reproducing the measured phreatic surface, the modeled area was divided into areas of developed (buildings, asphalt, concrete) and vegetated land.

The infiltration values shown on Figure 30 are less than the initial recharge estimate from the HELP model. This is an expected result due to:

i) the conservative assumptions and procedures in the HELP model generally estimate high values of infiltration

ii) previous studies, in which both the HELP model and a numerical model were used, indicate that the HELP model generally produces higher estimates of infiltration than the calibrated numerical model.

The final rates that were deemed representative of the natural conditions are summarized below:

General Site Infiltration	=	2	inches/year
Developed Area Infiltration	=	0.5	inches/year
Lagoon Infiltration (over 26,188 sq. ft.)	=	8	inches/year
Filtration Plant B Infiltration (over 11,851 sq. ft.)	=	44	inches/year
Sink flux rate (over 5,329 sq. ft.)	=	136	inches/year

The calibrated hydraulic conductivities generally follow the pattern of measured hydraulic conductivities. As stated previously, most of the measured hydraulic conductivities were obtained from short-term tests and thus reflect conditions local to the tested well. It is then not unexpected that the calibrated values, which are more representative of larger scale conditions, would vary from the measured values.

Due to the manner in which fill was placed in the landfill, it is not possible to identify vertical layering in the fill material. Thus K_H was assumed equal to K_V. The K_H:K_V ratio of 10:1 assumed for the alluvium and clay/till strata is consistent with previous analyses of similar materials. As previously stated, the clay/till unit was modeled as one hydrogeologic unit. Layering was observed in the clay but not in the till, however, the use of $K_H = 1 \times 10^{-7}$ cm/sec and the above ratio resulted in a K_V of 1×10^{-8} cm/sec.

Figure 31 illustrates the calibrated phreatic water table contours overlain with the interpolated water table contours using the February 8, 1988 data set. It should be noted that the water table contours for the February 8 data set, in the vicinity of the lagoons, have incorporated data from boreholes installed during the time frame surrounding February 8, 1988. A comparison between

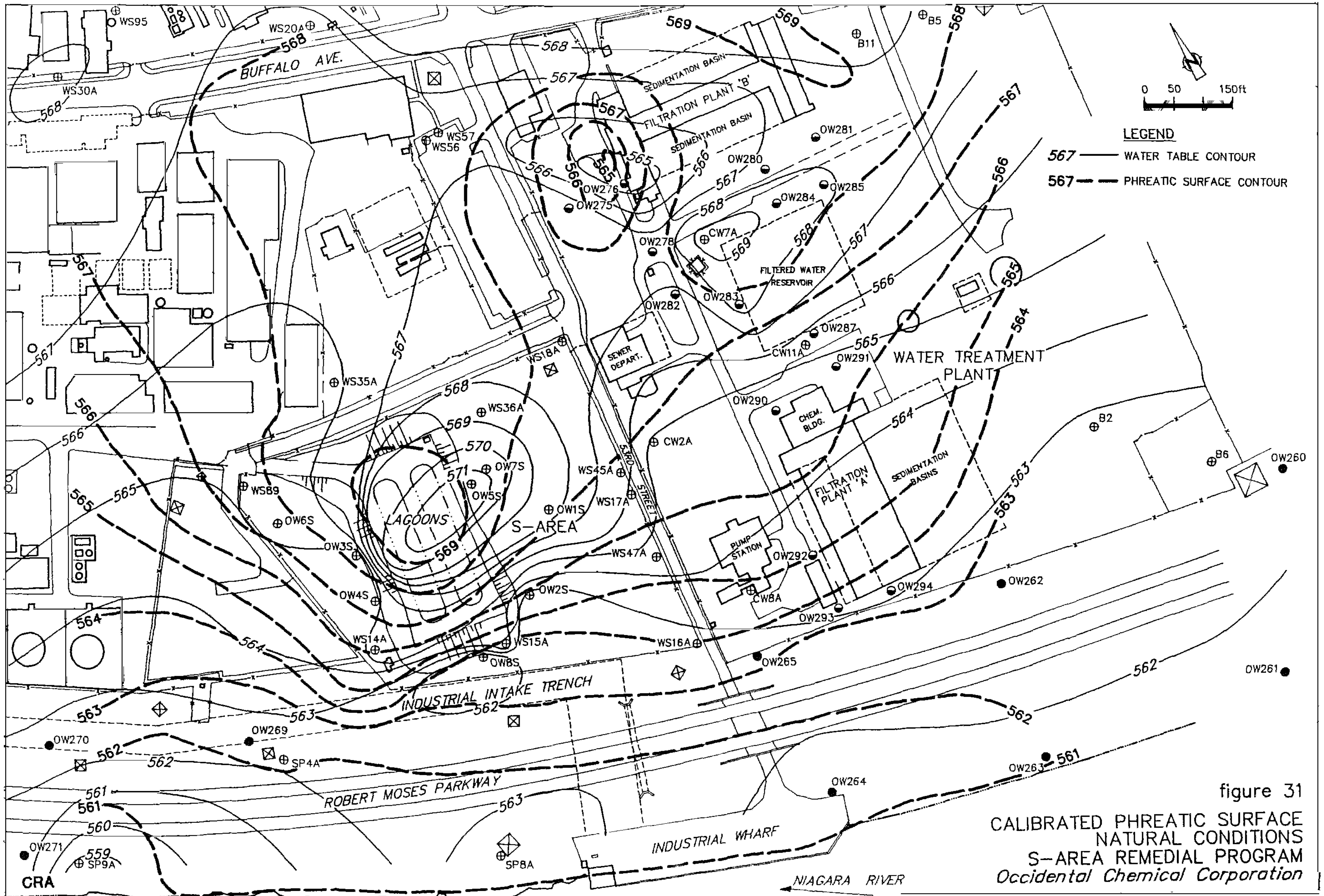

figure 31

CALIBRATED PHREATIC SURFACE
NATURAL CONDITIONS
S-AREA REMEDIAL PROGRAM
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measured head and modeled head is shown on Table 12. The absolute minimum and maximum differences are 0.0 feet and 3.7 feet with a root mean squared difference (RMSD) of 1.55 feet.

Inspection of the differences indicates the following pattern:

i) the modeled mound in the vicinity of the lagoons is approximately 2 feet lower than measured,

ii) immediately surrounding this area, the modeled water table elevations are higher in the range of 1 to 3.7 feet,

iii) the modeled water table elevations in the area of the sink east of Filtration Plant B are approximately one foot higher than measured, and

iv) the modeled water table elevations south of the Filtered Water Reservoir to the River are higher than measured with the difference of approximately 2 feet at the south side of the Reservoir gradually decreasing to 0 at the River's edge.

The modeled water table in the vicinity of the lagoons indicates that:

TABLE 12

OBSERVED VS. MODELED WATER TABLE ELEVATIONS

Observed Elevations as per February 8, 1988

Well Point	Observed Elevation	Modeled Elevations: Kv (Clay) = E-8 Diff.	Kv (Clay) = E-8 Elev.	Kv (Clay) = E-7 Diff.	Kv (Clay) = E-7 Elev.	Diff. Delta K
OW262	562.54	-0.16	562.70	-0.26	562.80	-0.10
OW264	561.46	0.36	561.10	-0.04	561.50	-0.40
OW265	562.66	-0.84	563.50	-0.44	563.10	0.40
OW269	562.77	0.57	562.20	0.67	562.10	0.10
OW275	567.50	0.70	566.80	2.00	565.50	1.30
OW276	564.21	-0.99	565.20	0.41	563.80	1.40
OW278	567.23	-0.17	567.40	0.73	566.50	0.90
OW280	567.14	-1.46	568.60	-0.96	568.10	0.50
OW281	566.98	-1.72	568.70	-1.22	568.20	0.50
OW282	566.77	-1.03	567.80	-0.43	567.20	0.60
OW283	568.54	0.44	568.10	1.24	567.30	0.80
OW284	568.93	0.03	568.90	0.73	568.20	0.70
OW285	568.30	0.00	568.30	0.30	568.00	0.30
OW287	565.62	-2.08	567.70	-0.68	566.30	1.40
OW290	564.71	-1.69	566.40	-0.09	564.80	1.60
OW291	564.49	-1.71	566.20	-1.31	565.80	0.40
OW292	563.29	-1.91	565.20	-1.41	564.70	0.50
OW293	562.99	-0.71	563.70	-0.31	563.30	0.40
OW294	563.04	-0.66	563.70	-0.36	563.40	0.30
B5	567.80	-0.40	568.20	-0.30	568.10	0.10
B11	568.81	0.01	568.80	0.11	568.70	0.10
SP4A	562.18	0.08	562.10	0.28	561.90	0.20
SP8&8A	563.50	2.50	561.00	2.00	561.50	-0.50
CW11A	565.23	-1.37	566.60	-0.87	566.10	0.50
OW1S-80	568.61	1.21	567.40	2.11	566.50	0.90
OW2S-80	562.63	-3.37	566.00	-2.67	565.30	0.70
OW3S-80	564.41	-3.69	568.10	-2.59	567.00	1.10
OW4S-80	564.75	-2.75	567.50	-1.55	566.30	1.20
OW5S-80	571.75	2.85	568.90	3.85	567.90	1.00
OW6S-80	565.91	-1.59	567.50	-0.69	566.60	0.90
OW7S-80	570.77	2.37	568.40	3.27	567.50	0.90
OW8S-80	561.51	-1.99	563.50	-1.99	563.50	0.00
WS14A	563.67	-2.43	566.10	-1.33	565.00	1.10
WS15A	564.55	0.55	564.00	0.75	563.80	0.20
WS16A	562.91	-1.19	564.10	-0.69	563.60	0.50
WS17A	565.55	-1.15	566.70	-0.35	565.90	0.80
WS18A	567.66	-0.24	567.90	0.56	567.10	0.80
WS20A	566.02	-1.08	567.10	-1.78	567.80	-0.70
WS35A	565.95	-2.35	568.30	-1.45	567.40	0.90
WS36A	568.39	0.19	568.20	0.89	567.50	0.70
WS45A	566.41	-0.49	566.90	0.31	566.10	0.80
WS47A	564.69	-0.91	565.60	-0.21	564.90	0.70
WS56	566.67	-1.63	568.30	-0.93	567.60	0.70
WS57	566.61	-1.69	568.30	-0.99	567.60	0.70
WS95	567.90	0.00	567.90	0.40	567.50	0.40
Root Mean Square Difference		1.55 ft.		1.35 ft.		
Minimum Difference		0.00 ft.		0.04 ft.		
Maximum Difference		3.69 ft.		3.85 ft.		

i) the recharge rate through the lagoons may be too low,

ii) there may be a band of low permeability material along the south and west sides of the lagoon, or

iii) a combination of the above.

Measured hydraulic conductivity values (Figure 27) along the south and west sides of the lagoon range from 1.9 x 10^{-6} to 9.9 x 10^{-5} cm/sec with no distinct trend to indicate a band of low permeability material for the fill. No measured values in this area are available for the alluvium (Figure 28). As shown on Figure 27, the calibrated hydraulic conductivities in this area for the fill are in the range from 1 x 10^{-5} to 1 x 10^{-4} cm/sec.

Further simulation to decrease the difference between the measured and modeled phreatic surfaces in the area of the lagoons was not deemed necessary as:

i) regardless of whether the lagoons are relined are relocated, this source of increased recharge will be eliminated, and

ii) the proposed Site Collection System, without the northern leg, will be installed on both sides of the band of low conductivity. Therefore, the band will act as a divide (barrier wall effect) with flow on each side of the band flowing to a portion of the Site Collection System. Further discussion is provided in Section 7.7.1.

The results are deemed to be adequately close to the existing conditions. Although the contours do not exactly correspond in all areas, the represented flow vectors are consistent with the existing ones.

7.6 SENSITIVITY ANALYSIS

Two additional computer runs were made to test the sensitivity of the model to parameter perturbations. The changes made for each run are:

i) Run 1 - Increase K_H from 1×10^{-7} cm/sec to 1×10^{-6} cm/sec for the clay/till unit. This corresponds to an increase from 1×10^{-8} cm/sec to 1×10^{-7} cm/sec for K_V. It is noted that none of the tested clay/till samples had a hydraulic conductivity higher than 1×10^{-6} cm/sec and only a few had hydraulic conductivities exceeding 1×10^{-7} cm/sec (see Tables 3 to 6).

ii) Run 2 - Decrease the recharge to the area of the lagoons from 8 inches/year to 6 inches/year.

The modeled phreatic surface for the additional Runs 1 and 2 are shown on Figures 32 and 33, respectively.

The results for Run 1 indicate a minimum and maximum absolute difference between modeled and measured phreatic head of 0.04 and 3.85 feet, respectively, with a RMSD of 1.35 feet. The pattern of overburden groundwater flow is generally the same as for the calibrated case. The peak elevation in the area of the lagoons decreased from 570.0 to 569.0 feet.

The results for Run 2 are essentially the same as for the calibrated case, except that the maximum modeled peak has decreased from 570.0 to 569.4 feet.

7.7 SIMULATION OF HYDRAULIC CONDITIONS FOLLOWING REMEDIATION

This section presents the modeled results simulating the effect of the barrier walls and collection systems as defined in the Settlement Agreement on the groundwater flow regime in the overburden at the Study Area.

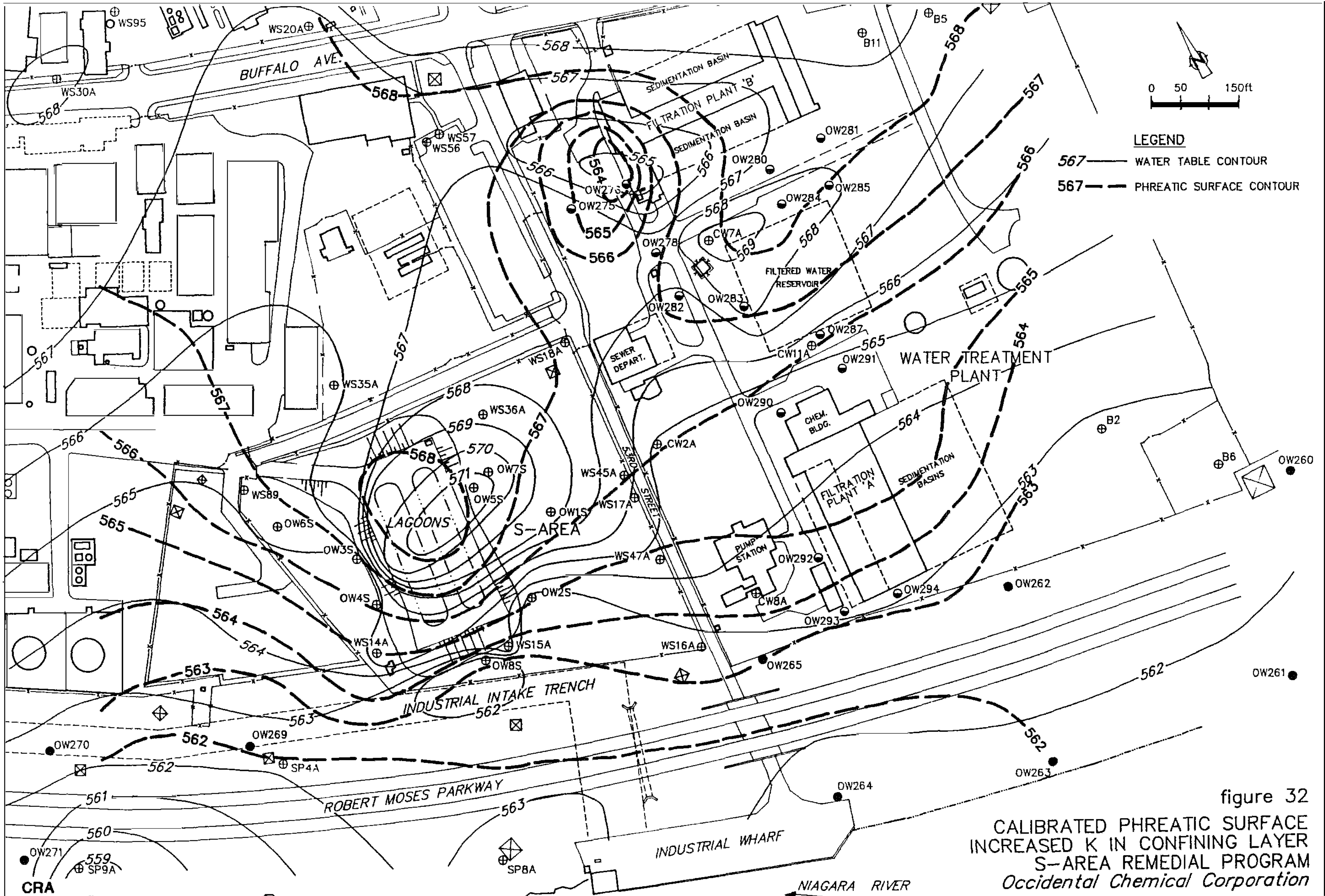


figure 32

CALIBRATED PHREATIC SURFACE
INCREASED K IN CONFINING LAYER
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-0-0 (P-26)

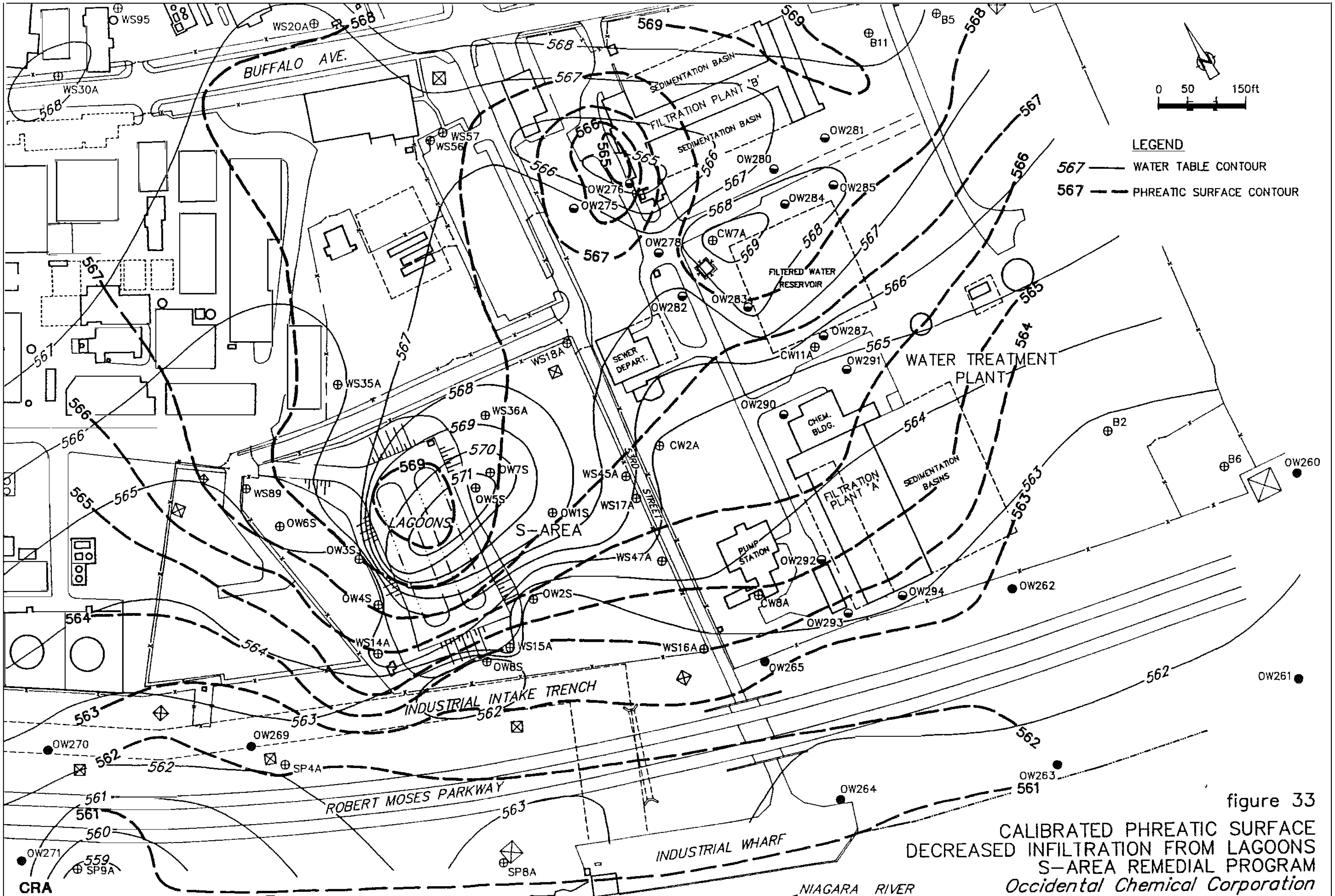


figure 33

CALIBRATED PHREATIC SURFACE
DECREASED INFILTRATION FROM LAGOONS
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0 (P-26)

7.7.1 Groundwater Flow Assessment

The groundwater conditions were evaluated after construction and operation as appropriate of the following remedial activities as defined in the Settlement Agreement:

1) the S-Area Landfill Site Barrier Wall and the Northern System Barrier Wall,
2) the S-Area Landfill Site Collection System, as shown on Figure C-3 of the Settlement Agreement,
3) the Northern Area Collection System,
4) the Pump Station Collection System,
5) asphalting of the area north of the Pump Station, and
6) capping the areas within the Site Barrier Wall and the Northern System Barrier Wall.

These activities are shown on Figure 34.

To model the effect of the barrier walls, a harmonic mean of the hydraulic conductivities was used for those elements which contained the barrier walls. The physical basis of this was to produce the same total head loss through an element with the harmonic mean as the summation of the actual head losses of the individual materials in the element. The principles utilized to obtain the harmonic mean are presented in Appendix A.

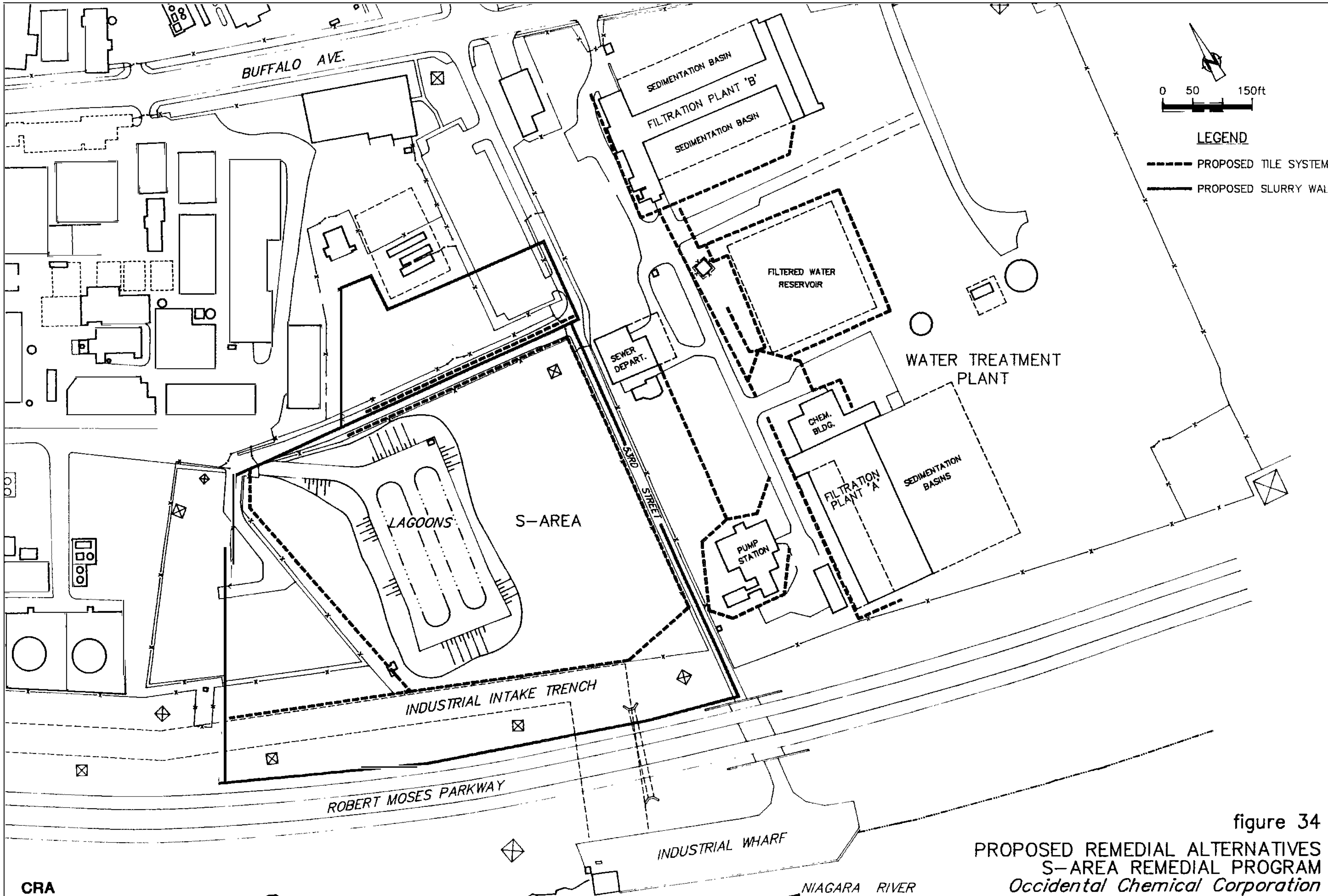


figure 34
PROPOSED REMEDIAL ALTERNATIVES
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-04/08/88-25 -D-0 (P-28)

The tile collection systems were modeled by prescribing tile nodes as prescribed head nodes using the elevation of the tile invert. The tile collection systems are shown, in cross-section, on Figures 13, 14, 15, 16, 35 and 36.

The HELP model was used to estimate the quantity of recharge percolating through the proposed cap over the Study Area. The estimated value was 1.5 inches/year. This is higher than the recharge assigned to developed areas (0.5 inches/year) during initial modeling but was used in the remedial evaluation design to provide conservative estimates within the region encircled by the proposed barrier walls. The zones of recharge for remedial activity evaluation are shown on Figure 37.

Due to the effect of remedial actions, the water table, in certain locations, was drawn down below the base of the surface element. The available FE3DGW model produces errors when this situation occurs, or when the water table is above the top of the surface element. Due to this model restriction, surface elements were removed, as required. Thus, the remedial alternative model consisted of 1,896 nodes and 1,317 elements.

The modeled remedial activity phreatic surface for $K_H = 1 \times 10^{-7}$ cm/sec and $K_H = 1 \times 10^{-6}$ cm/sec is shown on Figures 38 and 39,

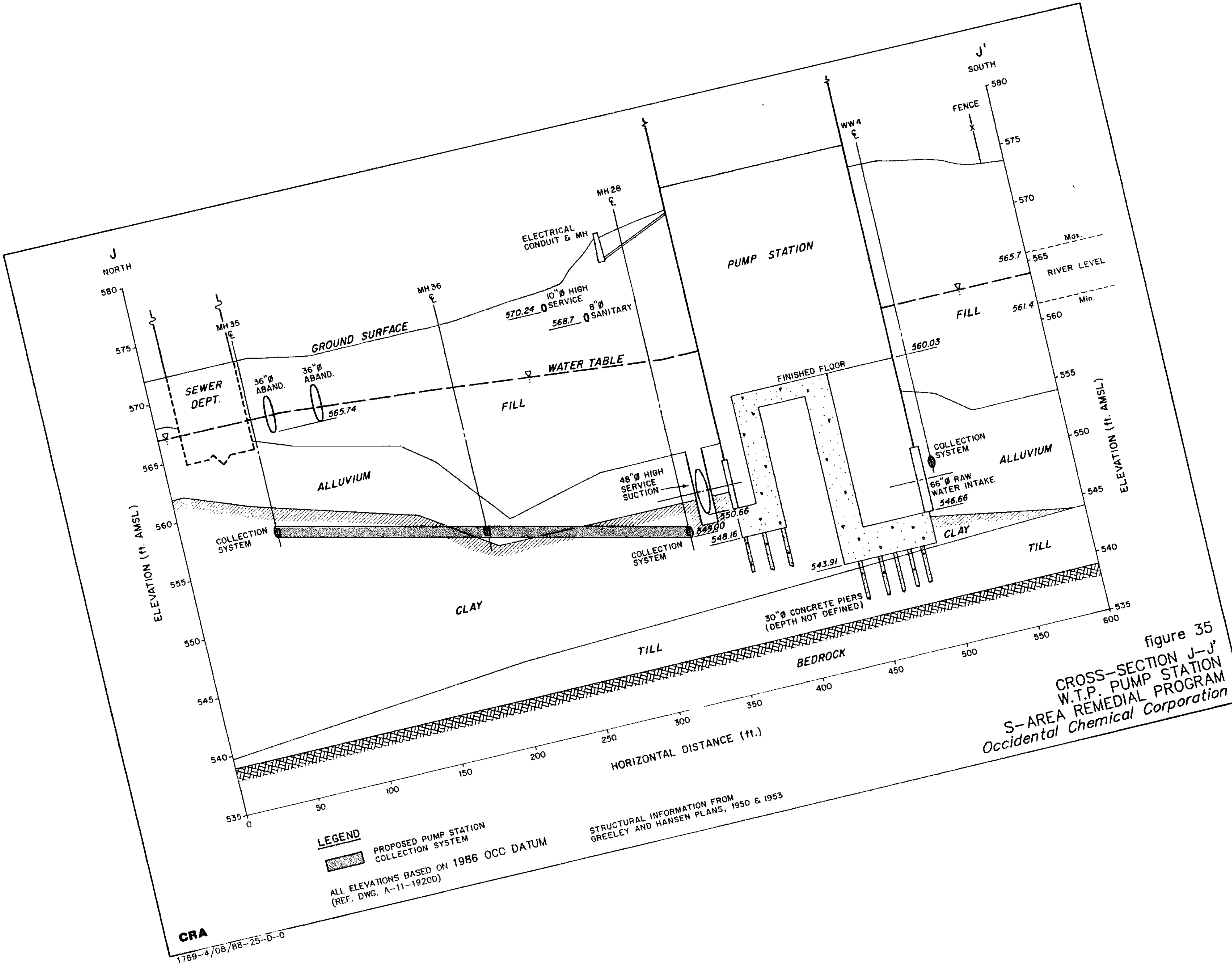
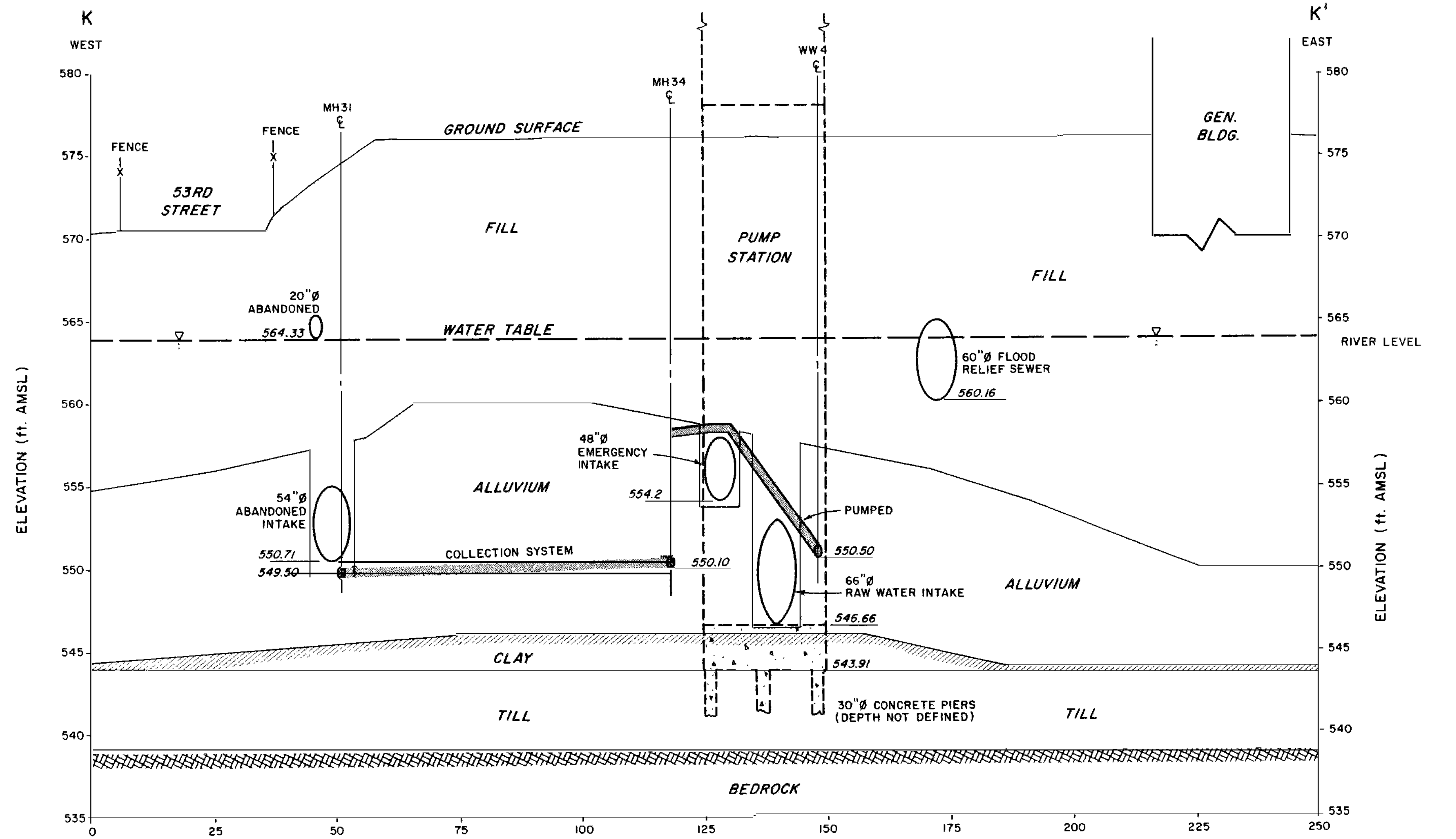


figure 35

CROSS-SECTION J–J'
W.T.P. PUMP STATION
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation



LEGEND

PROPOSED PUMP STATION COLLECTION SYSTEM

ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

STRUCTURAL INFORMATION FROM
GREELEY AND HANSEN PLANS, 1950 & 1953

CRA

figure 36

CROSS-SECTION K-K'
W.T.P. PUMP STATION
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

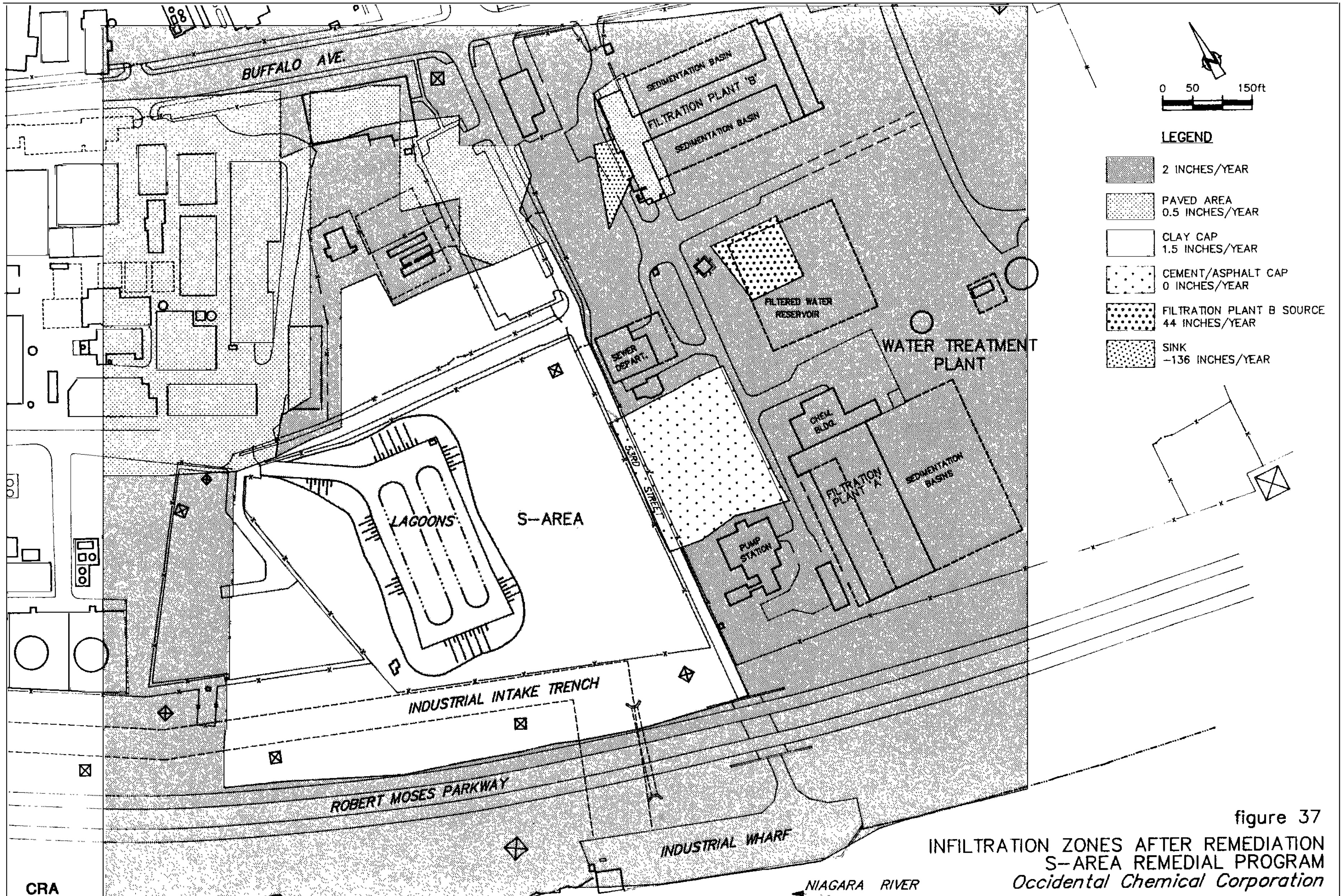


figure 37

INFILTRATION ZONES AFTER REMEDIATION
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0 (P-21)

respectively. The isopachs of head differential between the modeled phreatic surface and measured bedrock potentiometric head are presented in Figures 40 and 41 for $K_H = 1 \times 10^{-6}$ cm/sec and $K_H = 1 \times 10^{-7}$ cm/sec, respectively. These results indicate that throughout the area of the 10-foot Confining Layer, within the Site Barrier Wall, an upward gradient exists except for small areas in the northwest and northeast corners. These areas can be addressed by installing a 200-foot length of tile drain running east from the northwestern end of the Site Collection System and a 100-foot length of tile drain running west from the northeastern end of the Site Collection System.

For the modeled remedial activities, the water table is essentially within the alluvium. For the small areas where the water table is still within the fill, the saturated fill thickness is on the order of 0.5 feet and the fill and alluvium hydraulic conductivities are similar. Thus, local fluctuations in the fill hydraulic conductivity values will only influence the remedial flow patterns very slightly.

Generally, the model run using $K_H = 1 \times 10^{-6}$ cm/sec for the clay/till has less upward gradient than the $K_H = 1 \times 10^{-7}$ cm/sec run. The vertical head pattern along the alignment of the Site Collection System is the same for both runs. In areas of the

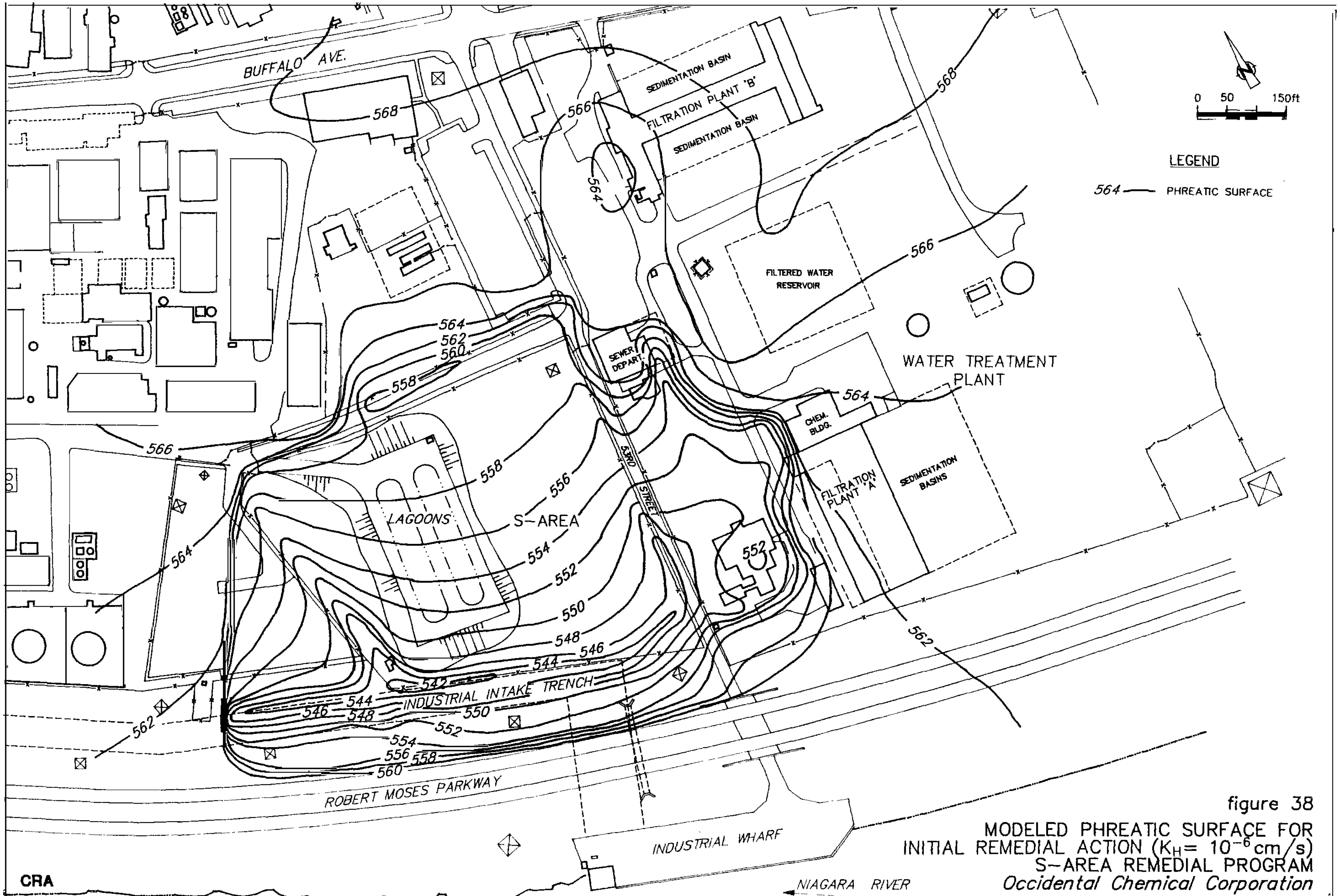


figure 38

MODELED PHREATIC SURFACE FOR INITIAL REMEDIAL ACTION ($K_H = 10^{-6}$ cm/s)
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

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1769-4/08/88-25-D-0

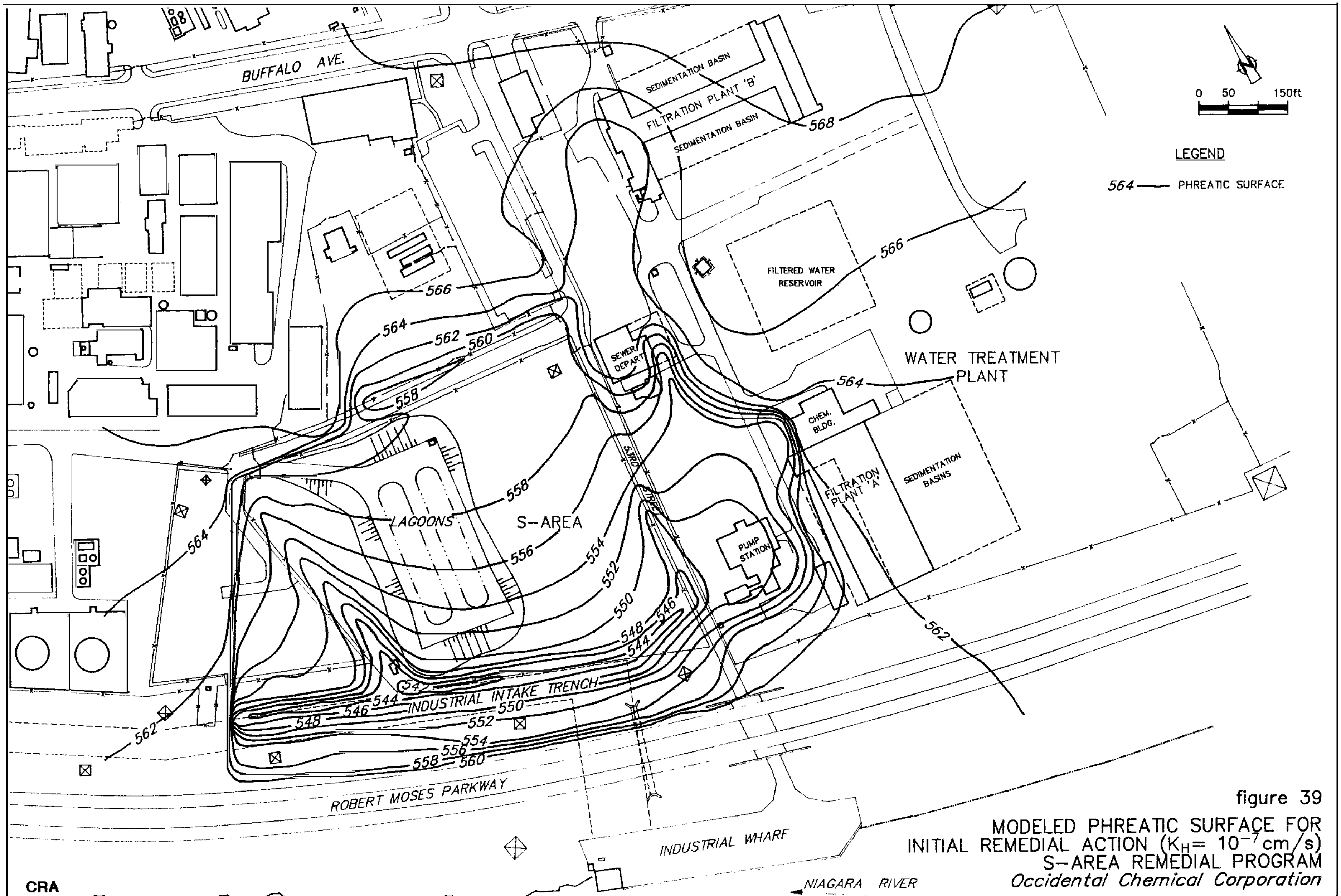


figure 39

MODELED PHREATIC SURFACE FOR INITIAL REMEDIAL ACTION ($K_H = 10^{-7}$ cm/s)
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

figure 40

ISOPACH OF OVERBURDEN PHREATIC SURFACE/BEDROCK POTENTIOMETRIC SURFACE DIFFERENTIAL ($K_H = 10^{-6}$ cm/s)

S-AREA REMEDIAL PROGRAM

Occidental Chemical Corporation

1769--4/08/88--25--D--0

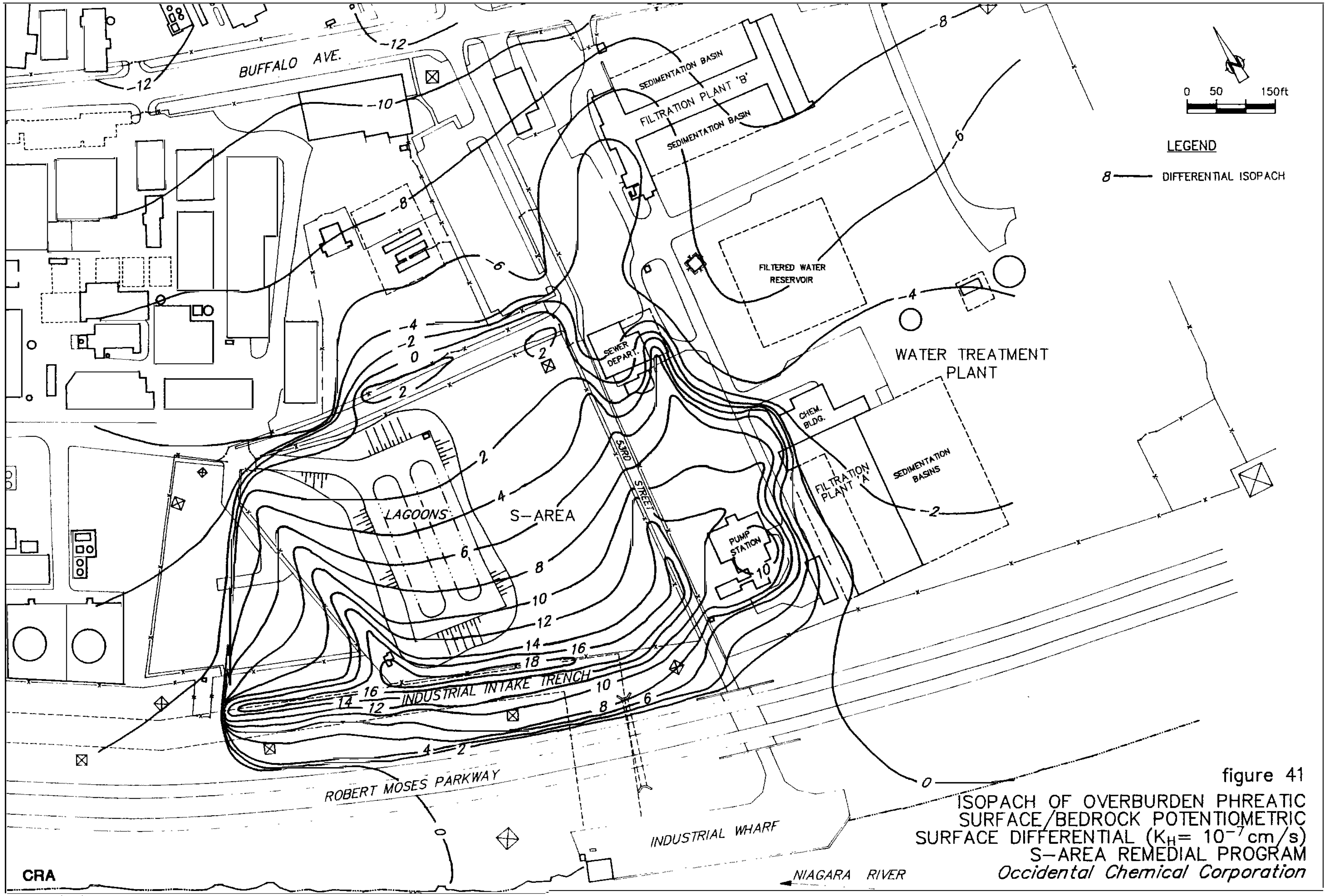


figure 41
ISOPACH OF OVERBURDEN PHREATIC SURFACE/BEDROCK POTENTIOMETRIC SURFACE DIFFERENTIAL ($K_H = 10^{-7}$ cm/s)
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

Confining Layer Discontinuity adjacent to the Site Collection System, the upward head for K_H = 1 x 10^{-6} cm/sec is approximately 2 feet less than for K_H = 1 x 10^{-7} cm/sec. This difference gradually diminishes to zero toward the north in conjunction with thickening of the clay/till. The decrease in upward head is due to the increased clay/till hydraulic conductivity and subsequent additional upward flux from the bedrock to the alluvium through the areas where the clay/till is thin.

In the Northern Containment Area, the top of clay elevation ranges from 558 to 562 feet AMSL. In the same area, the bedrock potentiometric elevation ranges from 560 to 559 feet AMSL. Therefore, it is difficult, if not impossible, to create an upward gradient throughout a large portion of the Northern Area. Complete dewatering of the fill/alluvium would still result in a downward head difference ranging from 0 to 2 feet as shown on Figures 40 and 41.

7.7.2 NAPL Migration Assessment

For the modeling, NAPL density was taken as 100.5 lb/ft^3 and viscosity as 0.000118 $lbf.s/ft^2$ (5.6 centipoise). In addition, for the two-phase flow modeling, the vertical hydraulic conductivities were taken as:

K_V (Alluvium/fill) = 1×10^{-5} cm/sec

K_V (clay) = 1×10^{-7} cm/sec

K_V (Bedrock) = 1×10^{-3} cm/sec

Porosity was assumed as 0.30. Residual concentrations were assumed as follows: for water, 0.20 and for NAPL, 0.10.

A total of 54 columns were evaluated using the criteria indicated in Section 7.4.2 regarding the determination of which portions of the Confining Layer Discontinuity can be classified as a Confining Layer Equivalent. Summary results of the analyses are indicated in Figure 42. Failure of the Confining Layer Discontinuity to act as a Confining Layer Equivalent was determined at the following boreholes:

BH 118

BH 187

BH 196

BH 199

These regions of the Confining Layer Discontinuity indicate failure to act as a Confining Layer Equivalent in preventing the downward migration of NAPL. These regions have been delineated on Figure 43. To obtain a Confining Layer Equivalent in these areas, grouting or a technology which is a performance equivalent would be required.

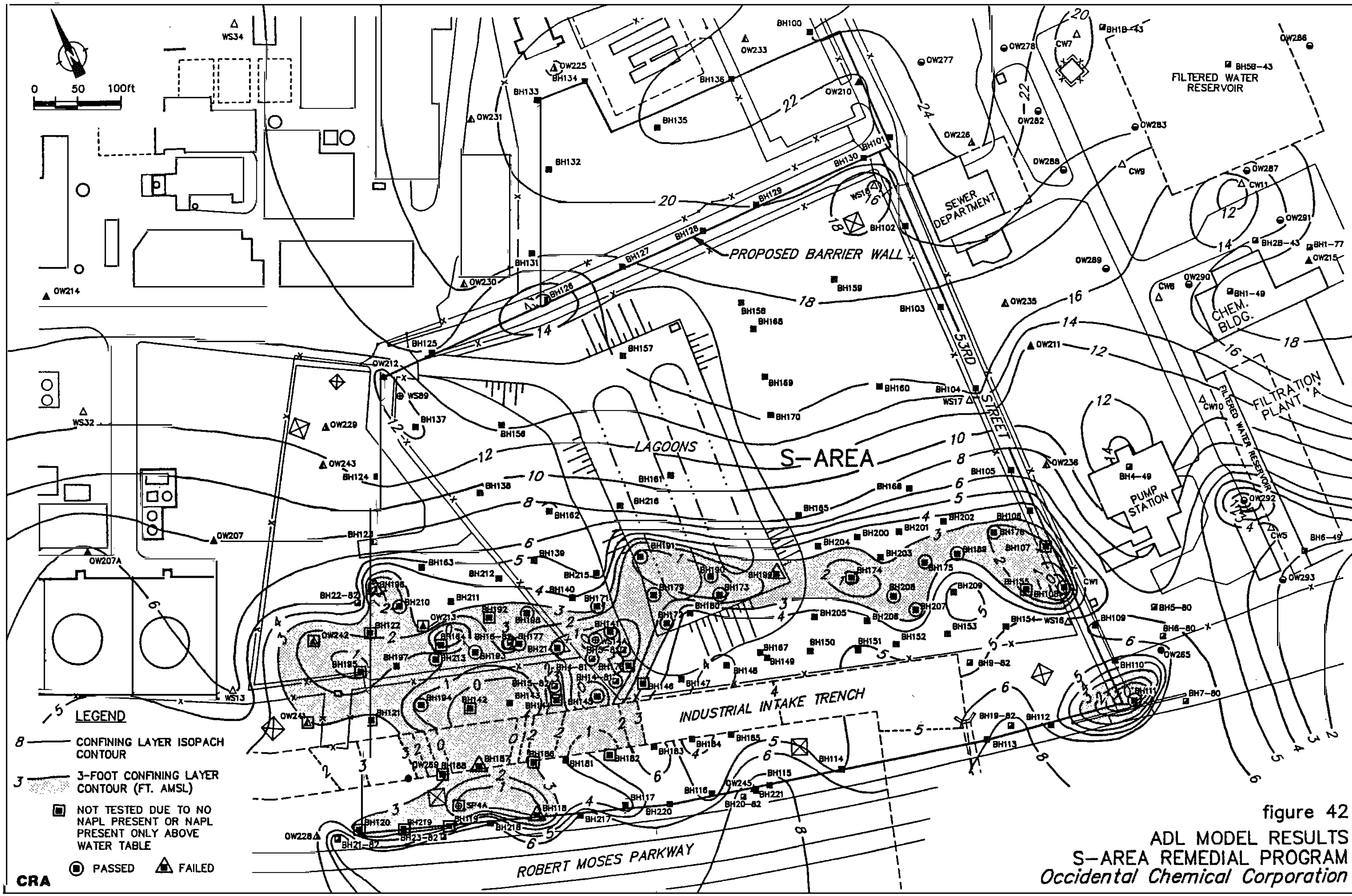


figure 42

ADL MODEL RESULTS
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

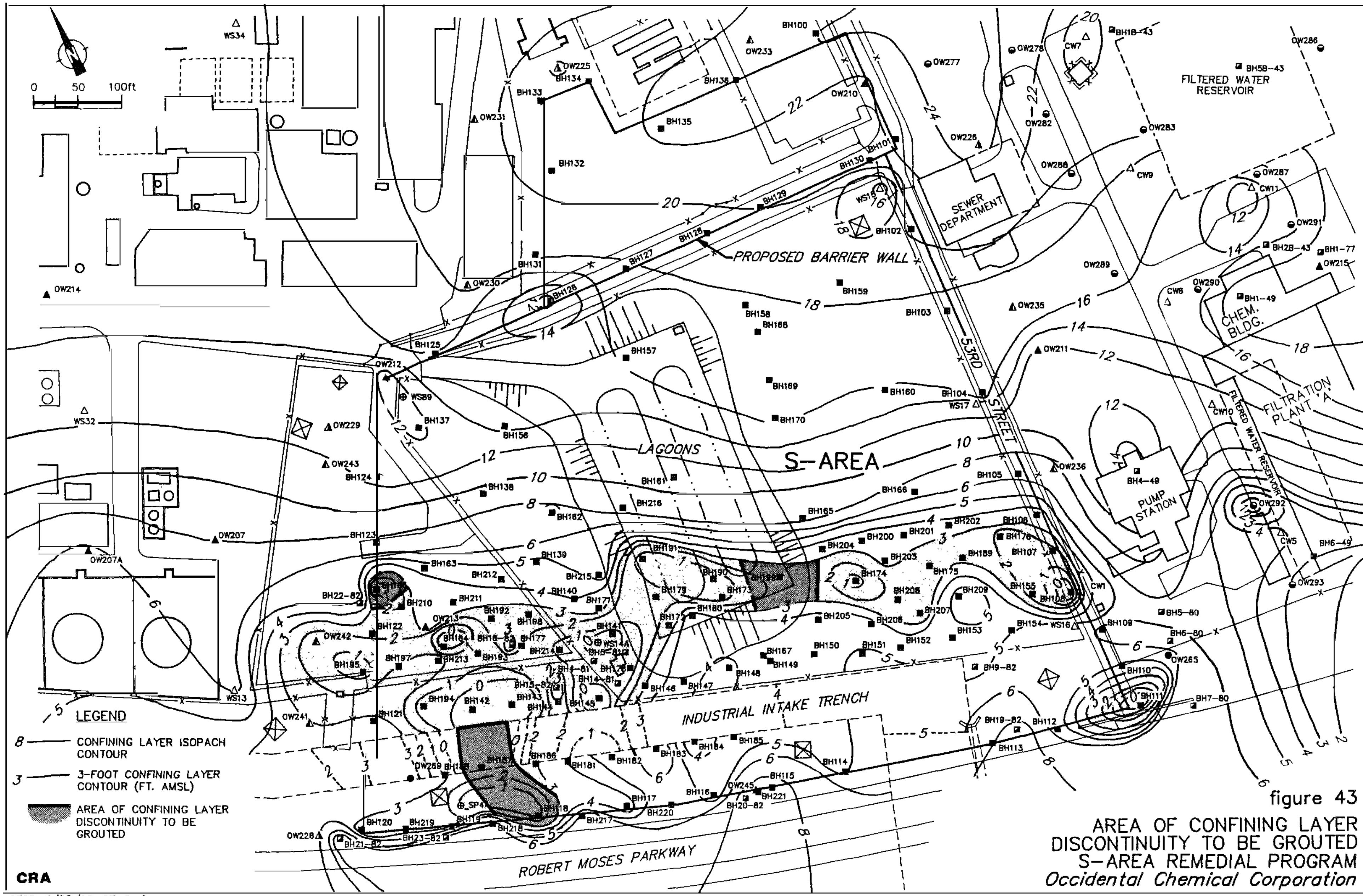


figure 43

AREA OF CONFINING LAYER DISCONTINUITY TO BE GROUTED
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

1769-4/08/88-25-D-0

8.0 ADDITIONAL DATA REQUIREMENTS

The boreholes located on an approximate 50-foot grid across the entire area of the Confining Layer Discontinuity were sufficient to define the discontinuity. Therefore, no further field data are required to adequately define the areal and vertical extent of the Confining Layer Discontinuity.

No further hydraulic and hydrogeologic data are required to complete the modeling regarding the 10-foot Confining Layer. A sufficient number of injection tests were completed over the area of the 10-foot Confining Layer to fully define the hydraulic conditions.

No further NAPL testing is required to complete the modeling regarding NAPL migration. The known physical characteristics regarding NAPL have been incorporated into the ADL model results.

9.0 CONCLUSIONS

Based upon the information collected to date and the assessments described in this report, the following conclusions have been formulated:

1) The Northern Site contains a Confining Layer under all of the site.

2) The S-Area Landfill Site contains a Confining Layer Discontinuity under a portion of the site which has been defined.

3) Based upon the modeling results during operation of the Northern Collection System, a consistent upward gradient in the Northern Site will not exist due to the elevation of the perched overburden water table on top of the clay stratum and the typical elevations of the bedrock groundwater table. This will not affect the design of the Northern Containment System as described in the Settlement Agreement.

4) Based upon modeling results during operation of the proposed Site Collection System, an upward gradient will be present over a majority of the area of the 10-foot Confining Layer within the Site Barrier Wall. Two small

areas exist in the northeast and northwest corners of this area where an upward gradient will not be present. An upward gradient would be created in these areas by the installation of two short sections of collection tile as follows:

i) a 200-foot length of drain tile running east from the northwestern end of the Site Collection System, and

ii) a 100-foot length of drain tile running west from the northeastern end of the Site Collection System.

5) Based upon modeling results during operation of the proposed Site Collection System, three portions of the Confining Layer Discontinuity identified under the S-Area Landfill Site will not act as a Confining Layer Equivalent. To prevent the downward migration of NAPL in these areas, would require the use of grouting or another technology which is the performance equivalent.

6) All permeability testing of clay samples indicated the permeability of the clay beneath the S-Area Landfill Site was less than the 1×10^{-7} cm/sec hydraulic conductivity criteria, as required for definition as a Confining Layer.

7) The above conclusions regarding the performance of the Site Containment System assumes existing hydraulic conditions in the bedrock. Thus, any significant changes in these conditions could invalidate the conclusions.

10.0 REFERENCES

Arthur D. Little Inc., "S-Area Two-Phase Flow Model", report to Wald, Harkrader and Ross, Washington, D.C., May 1983.

Gupta, S.K., Cole, C.R., Bond, F.W., and Monti, A.M., "Finite-Element Three-Dimensional Ground-Water (FE3DGW) Flow Model: Formulation, Computer Source Listings, and User's Manual", ONWI, Baltelle Memorial Institute, Columbus, Ohio, October 1984.

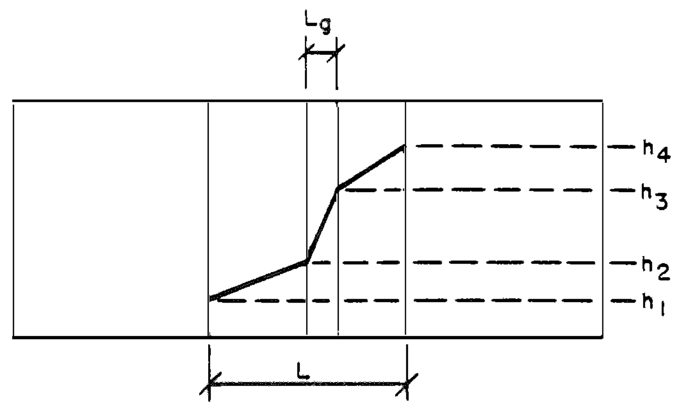
Osborne, M., "Numerical Modeling of Immiscible Two-Phase Flow in Porous Media", M.A.Sc. Thesis, Dept. of Civil Engineering, University of Waterloo, Waterloo, Ontario, 1984.

Schroeder, P.R., Morgan, J.M., Walsk, T.M. and Gibson, A.C., "The Hydrologic Evaluation of Landfill Performance (HELP) Model: Volume 1 User's Guide for Version 1", (U.S.) Army Engineer Waterways Experiment Station, Vicksburg, MS, June 1984.

APPENDIX A

CALCULATION OF HARMONIC MEAN HYDRAULIC CONDUCTIVITY FOR ELEMENTS WITH GROUT CURTAIN WALL

Schematic A shows three elements, with the middle element containing a grout curtain wall with lower hydraulic conductivity than the porous media.



The head loss profile is indicated in Schematic A illustrating that for one dimensional flow and a constant q, a larger head loss occurs through the grout curtain wall.

For constant q the following can be stated:

$$q = K_{ave}\left(\frac{h_4-h_1}{L}\right) = K_g\left(\frac{h_3-h_2}{L_g}\right) = K_L\left(\frac{h_4-h_3}{L_R}\right) = K_L\left(\frac{h_2-h_1}{L_L}\right) \qquad \text{(A-1)}$$

where: q = Darcy flux (L/T)

L = Length of element (L)

L_g = Thickness of grout curtain (L)

L_R = Thickness of element to the right of the grout curtain (L)

L_L = Thickness of element to the left of the grout curtain (L)

K_g = Hydraulic conductivity of grout curtain (L/T)

K_L = Hydraulic conductivity of porous media (L/T)

Rearranging terms in Equation (A-1) give:

$$q \frac{L}{K_{ave}} = h_4 - h_1 \tag{A-2}$$

$$q \frac{L_g}{K_g} = h_3 - h_2 \tag{A-3}$$

$$q \frac{L_R}{K_L} = h_4 - h_3 \tag{A-4}$$

$$q \frac{L_L}{K_L} = h_2 - h_1 \tag{A-5}$$

Therefore

$$q \frac{L_g}{K_g} + q \frac{L_R}{K_L} = q \frac{L_L}{K_L} = q \frac{L}{K_{ave}} \tag{A-6}$$

Deleting q, Equation (A-6) is rewritten as:

$$\frac{L}{K_{ave}} = \frac{L_g}{\;} + \frac{L_R}{\;} + \frac{L_L}{\;} \tag{A-7}$$

Since $L_R + L_L = L - Lg$

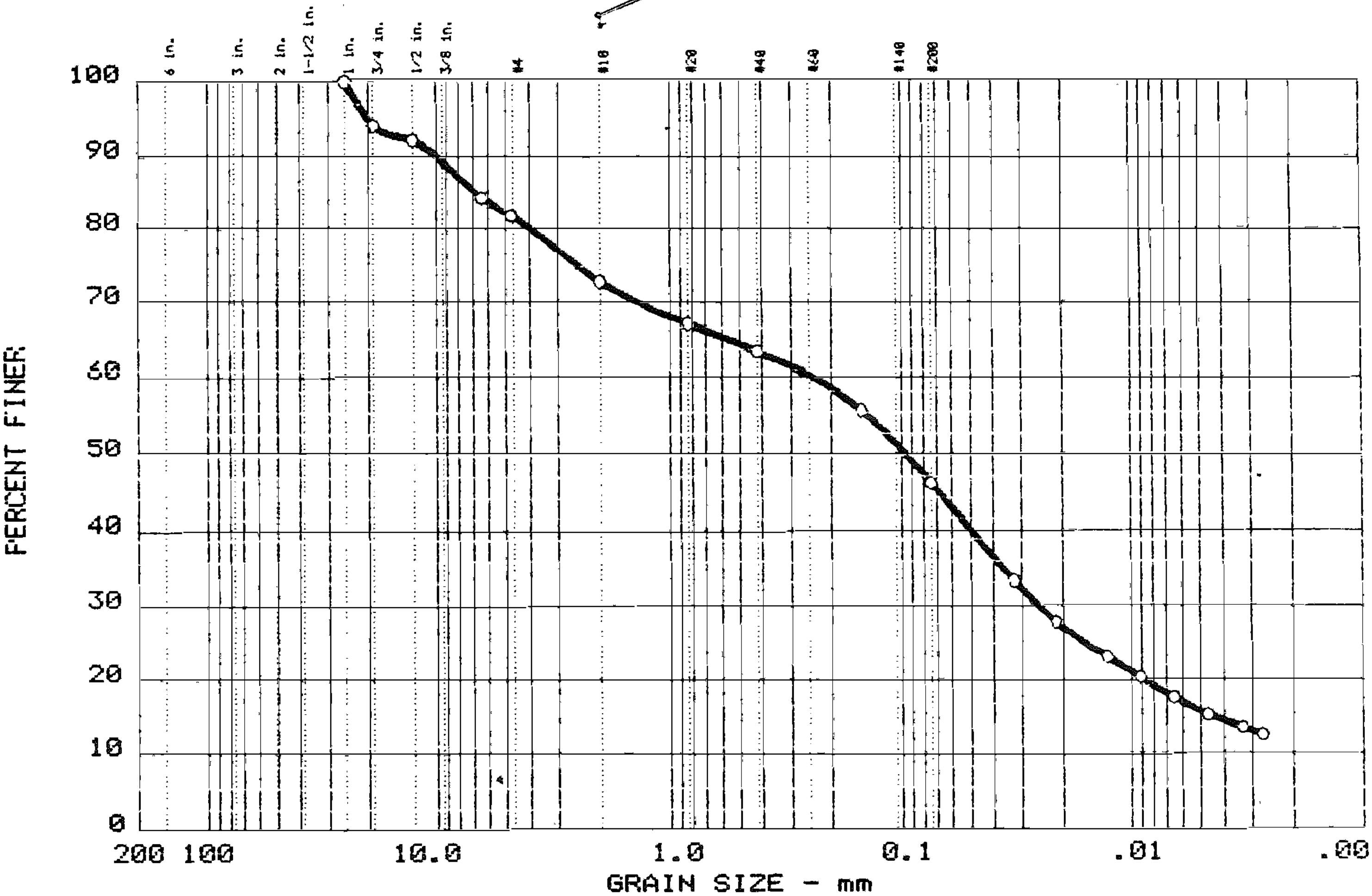
$$\frac{L}{K_{ave}} = \frac{L_g}{K_g} = \frac{L-L_g}{K_L} \tag{A-8}$$

Equation (A-8) was employed to calculate the harmonic mean hydraulic conductivity for those elements which contained a grout curtain wall.

APPENDIX B

ADDITIONAL PHYSICAL TESTING RESULTS

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	2	0.0	18.1	35.6	30.6	15.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	16	5	6.76	0.23	0.09	0.026	0.0045			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME SILT LITTLE GRAVEL LITTLE CLAY	SC-SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 110-87, S-16, 30.0'-31.1'

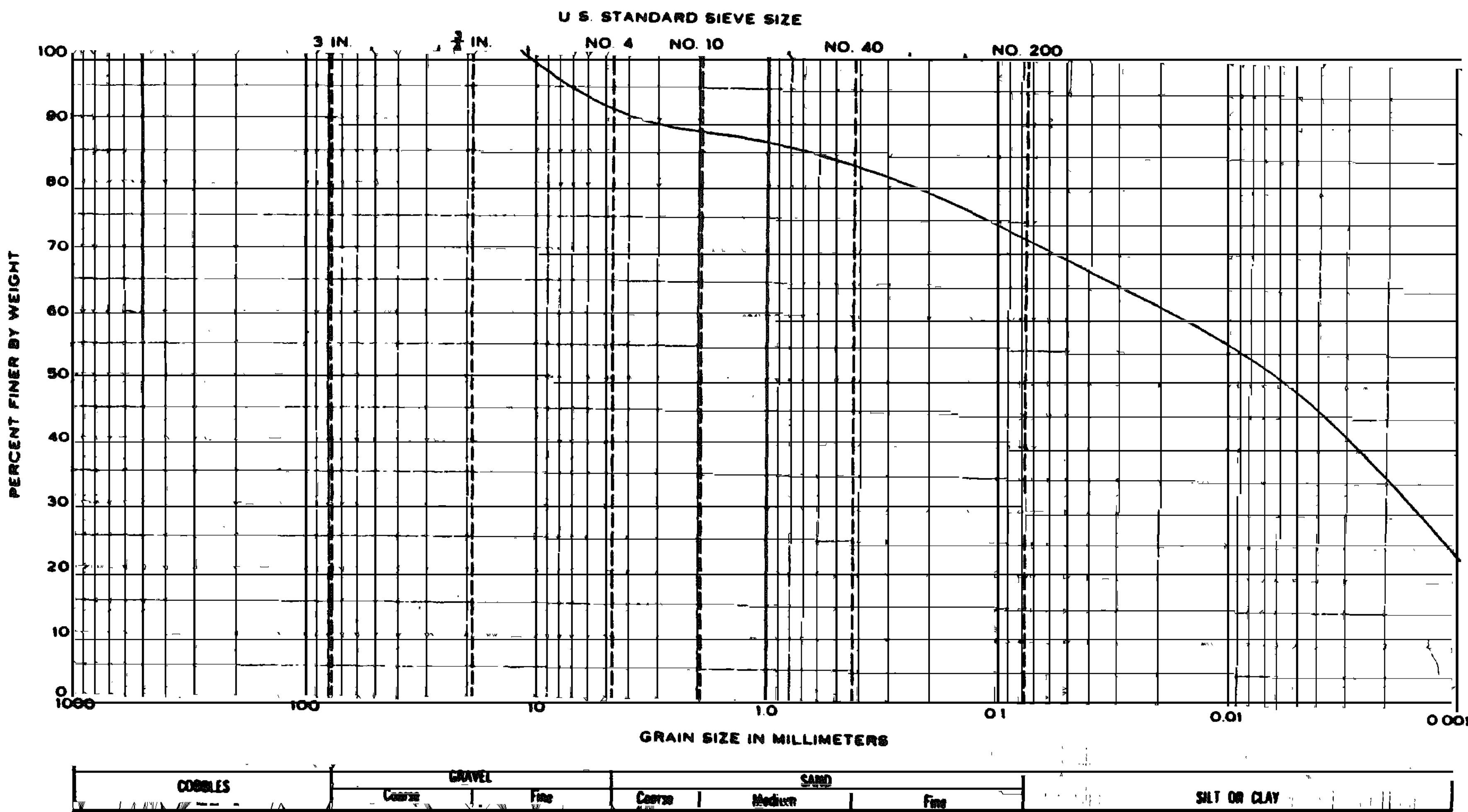
Date: 6-10-88

Remarks:
JAR SAMPLE

GS-275
A-235

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1



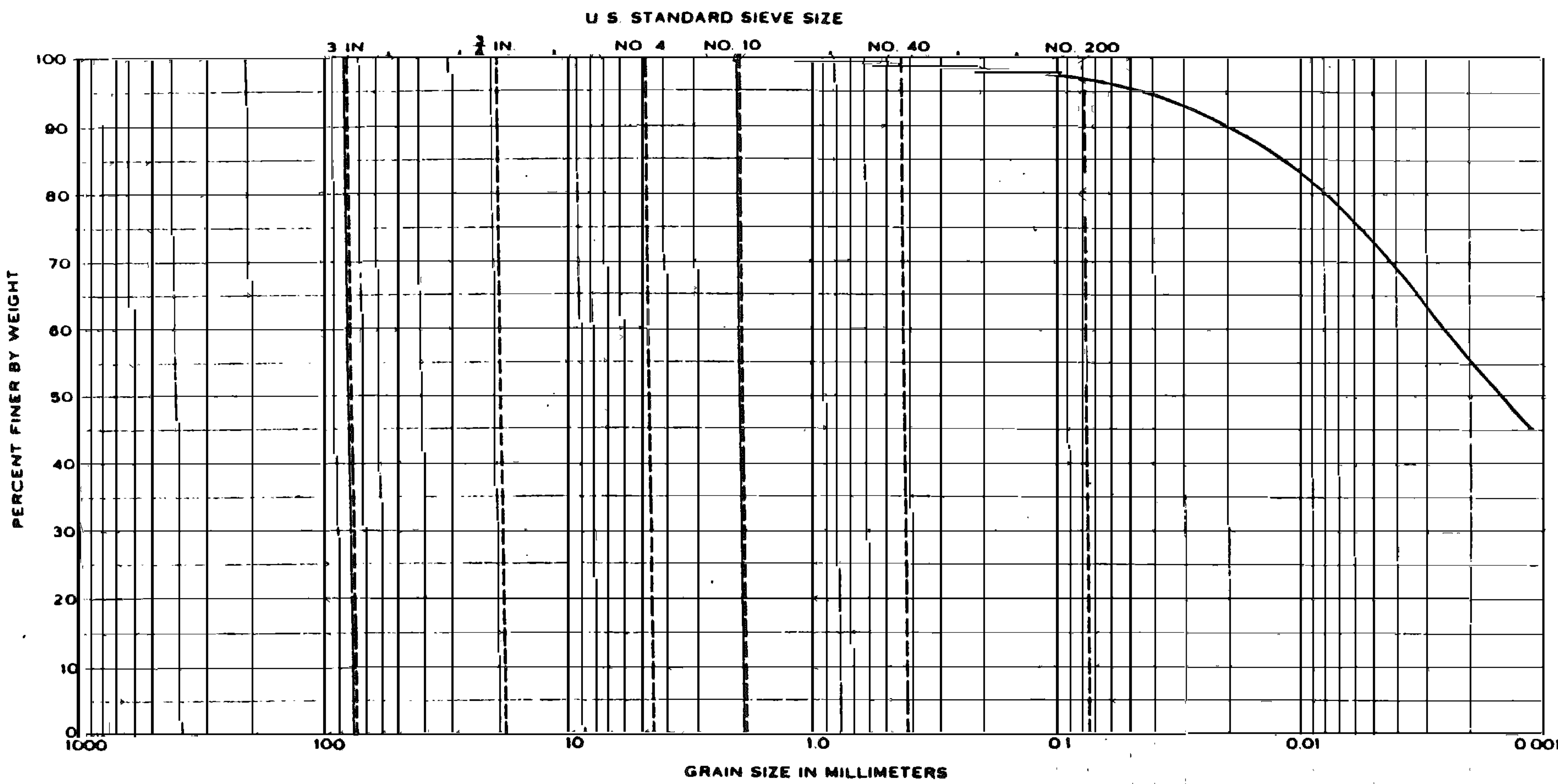
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-117A S-3	38'-40'	Brown C-F Sandy SILT	23.7	34	25	9

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-117A S-4	40'-41.9'	Brown Silty CLAY (CL)	32.0	42	24	18

Project Glynn Geotechnical Engrs.

Occidental Chemical Corp.

S-Area Landfill

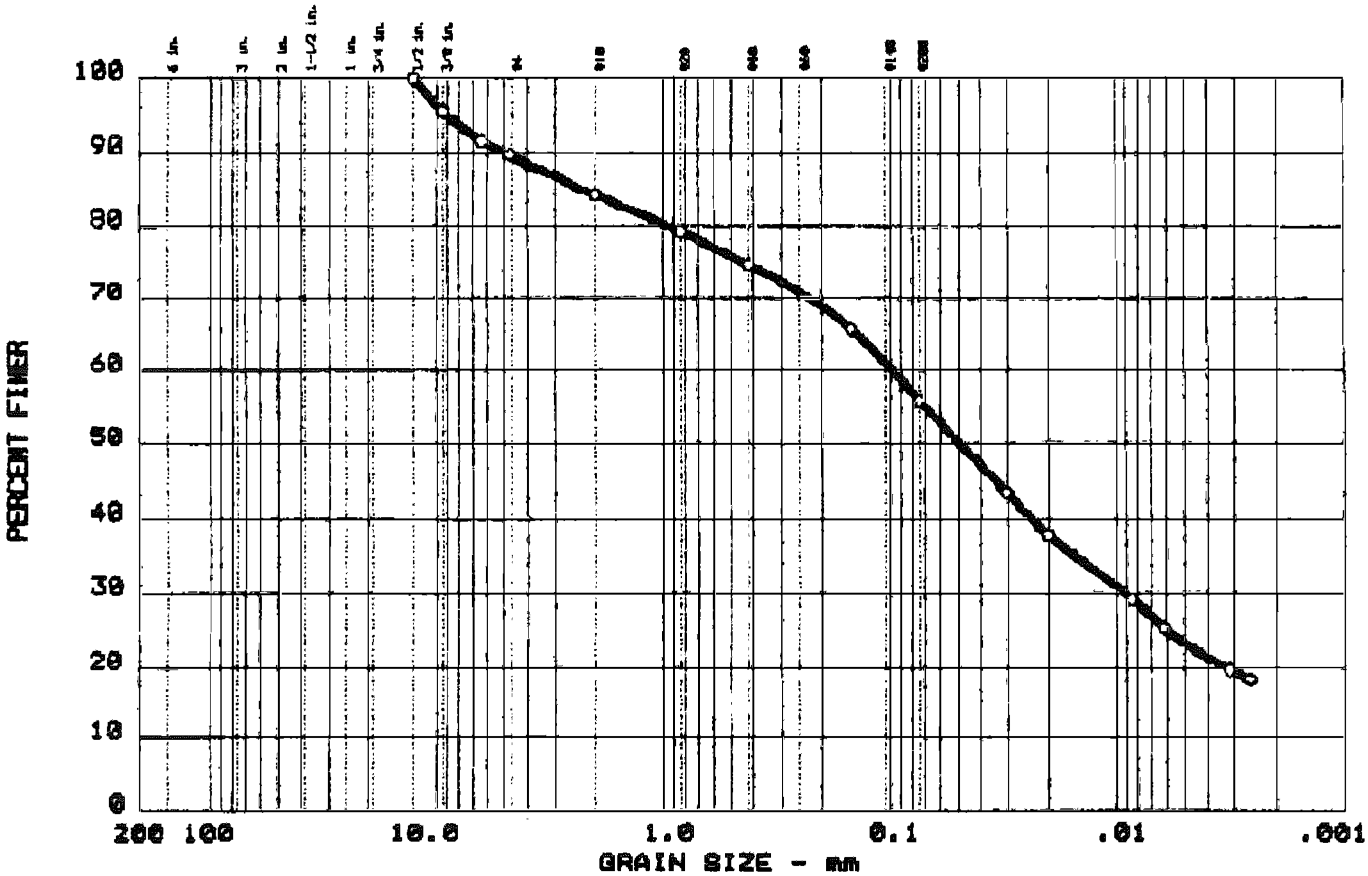
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	7	0.0	10.4	33.6	32.5	23.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	NA	NA	2.21	0.10	0.05	0.009				

MATERIAL DESCRIPTION	USCS	AASHTO
O SAND SOME SILT SOME CLAY LITTLE GRAVEL	ML	

Project No.: DD-86-90
Project: "S" AREA REMEDEATION
O Location: BH - 122-87, S-13, 24.0'-26.0'

Date: 7-29-88

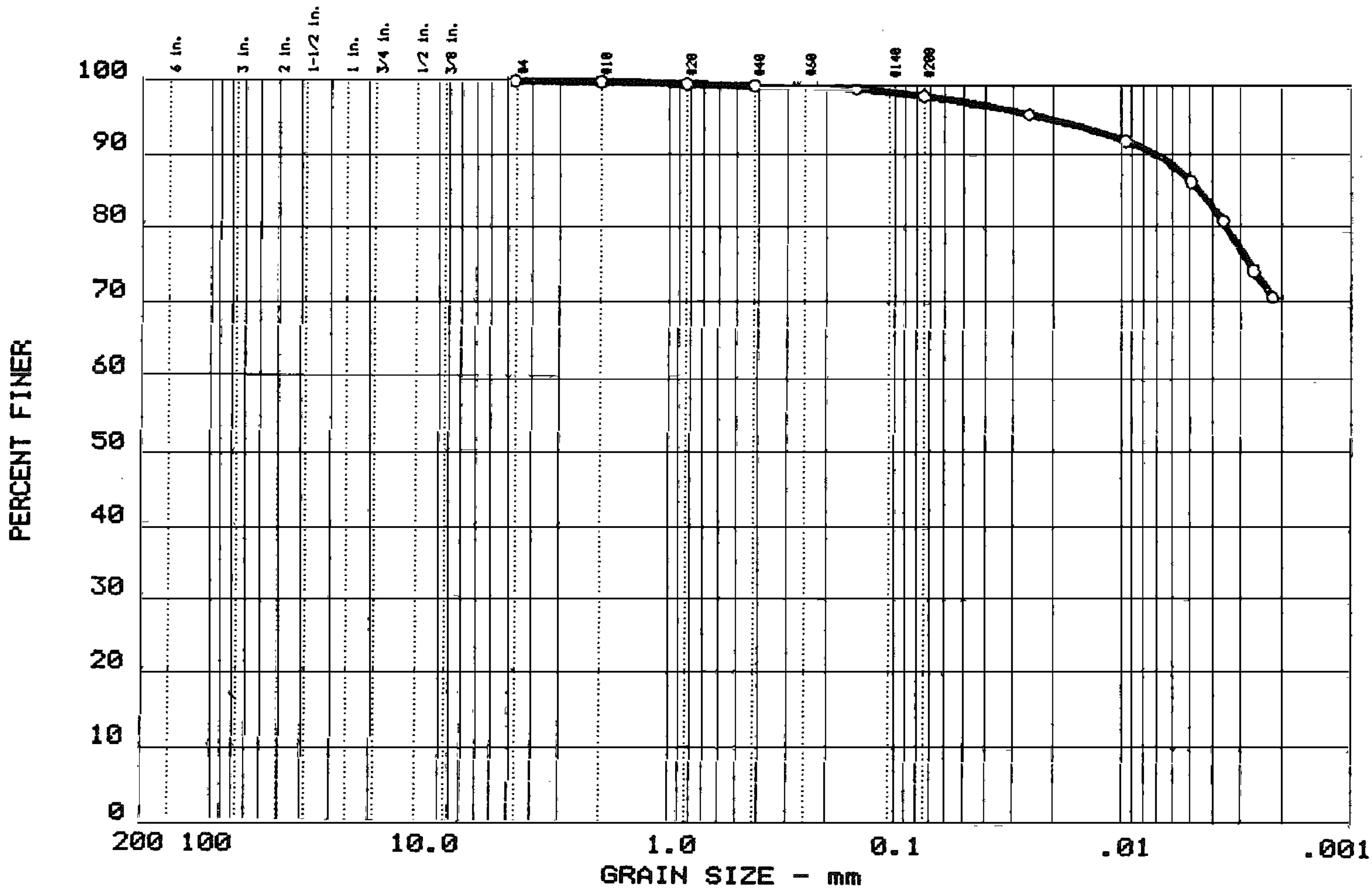
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE

REPORT NOS.: GS-333

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	6	0.0	0.0	1.7	11.6	86.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	48	24								

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 123-87, S-11B, 21.0'-22.0'

Date: 6-21-88

Remarks:

JAR SAMPLE

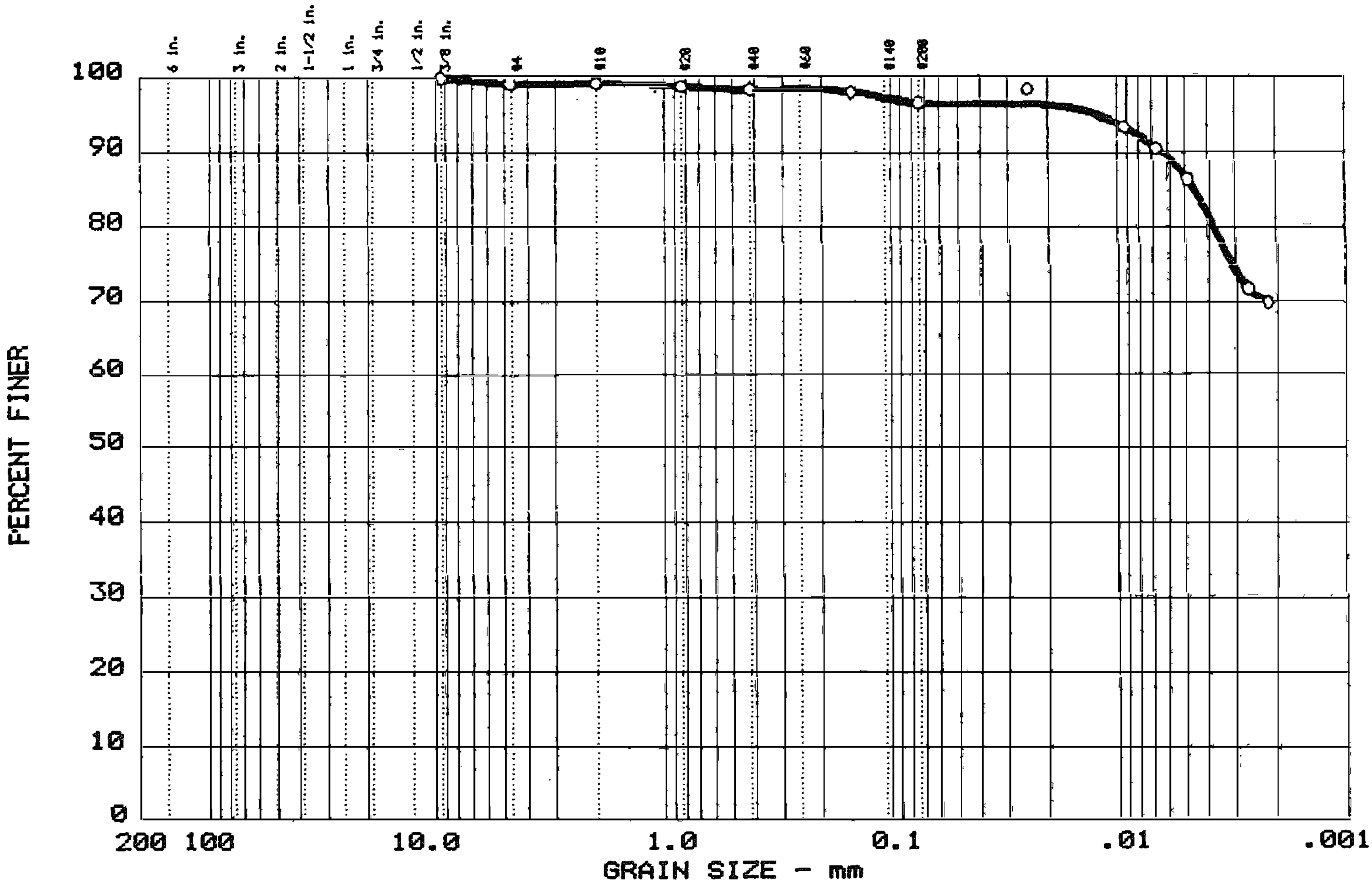
GS-307
A-262

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	7	0.0	0.7	2.7	9.7	86.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	51	23								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY TRACE SILT TRACE SAND	CH	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 123-87, S-12, 22.0'-24.0'

Date:

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

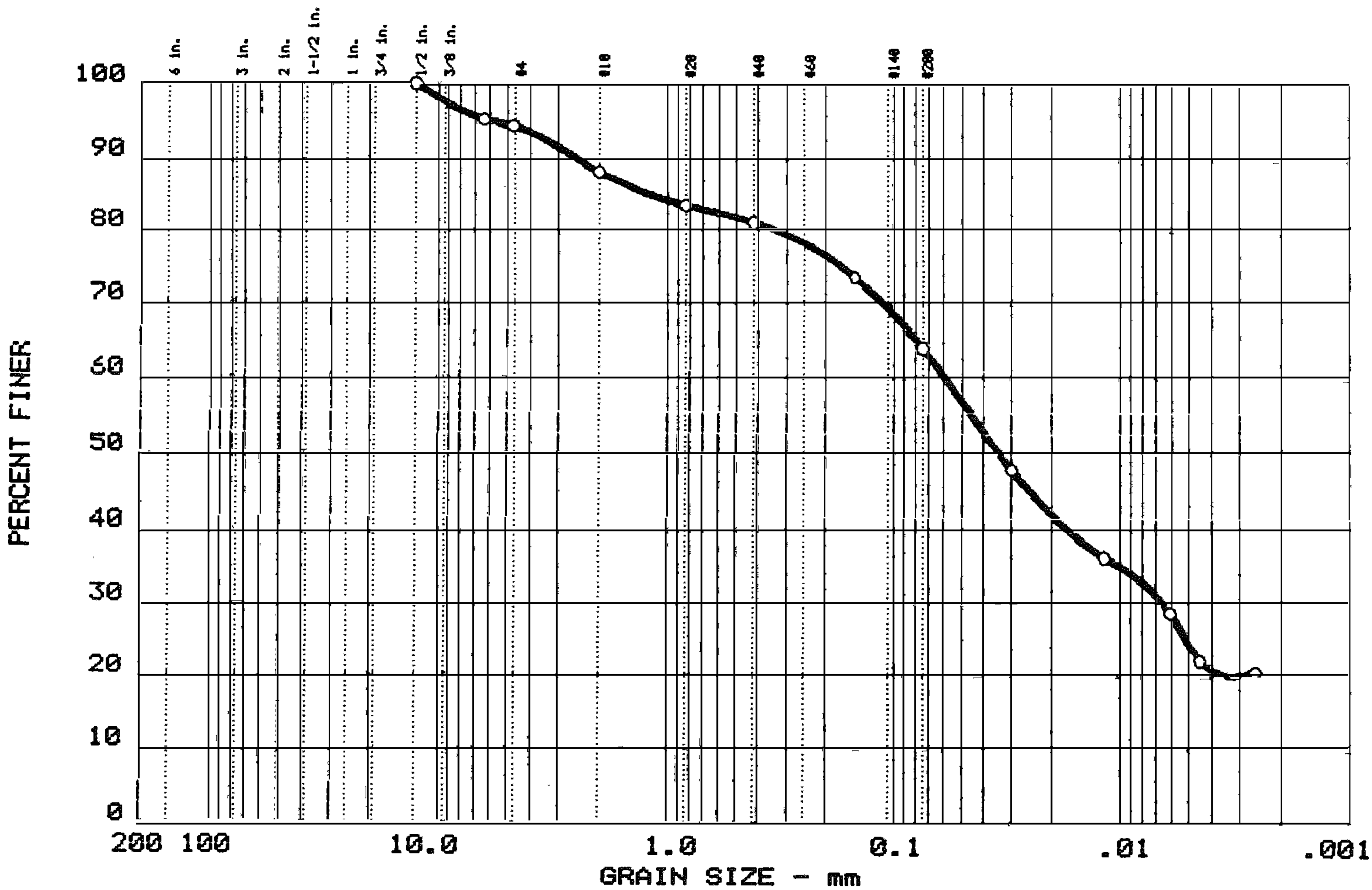
Remarks:

JAR SAMPLE

GS-308
A-263

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	5.7	30.3	39.6	24.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	20	5	1.22		0.03	0.006				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 123-87, S-13, 24.0'-26.0'

Date:

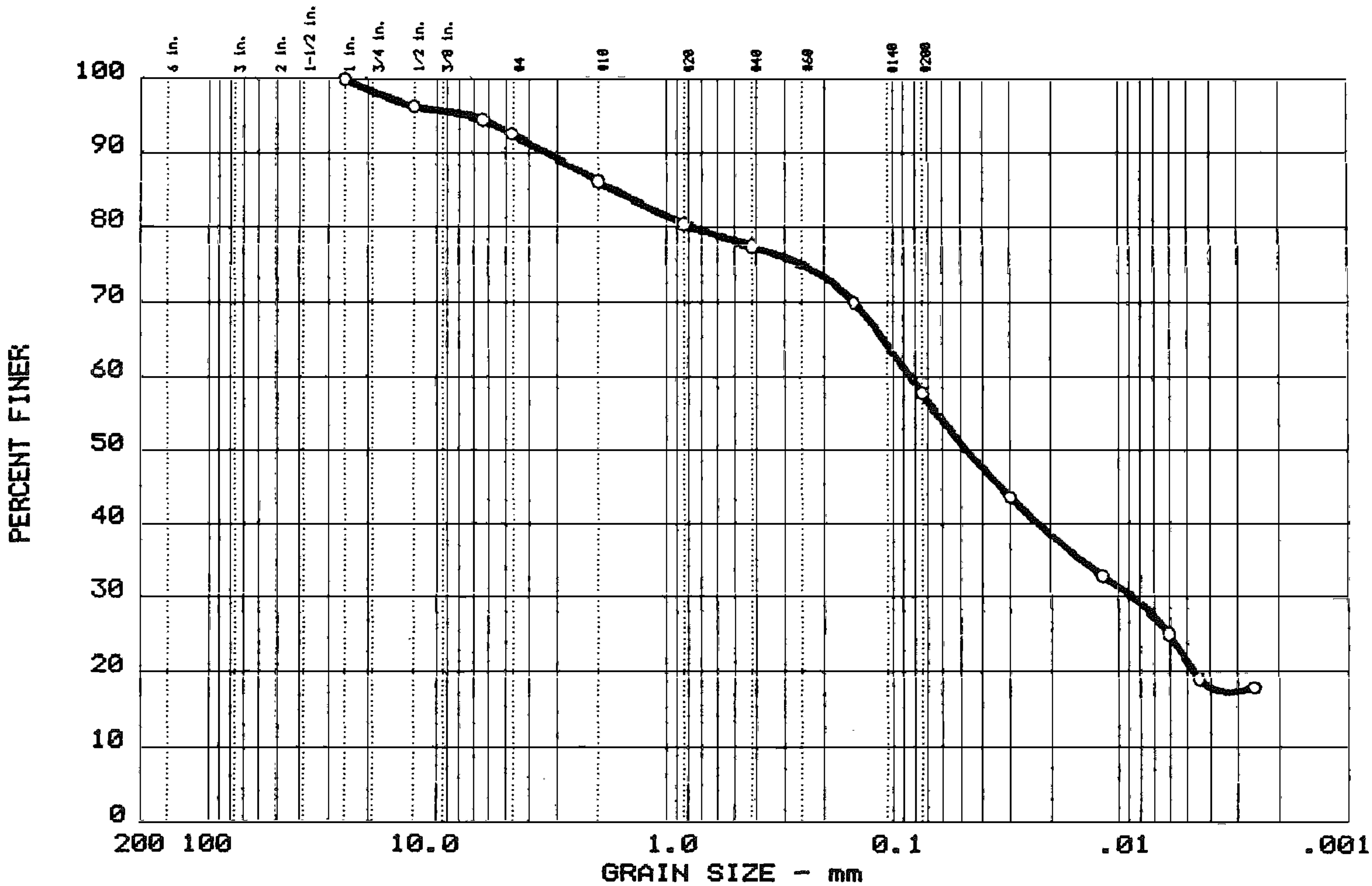
Remarks:
JAR SAMPLE

GS-309
A-264

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	9	0.0	7.5	34.6	36.7	21.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	15	5	1.72	0.08	0.05	0.009				

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 123-87, S-14, 26.0'-28.0'

Date: '

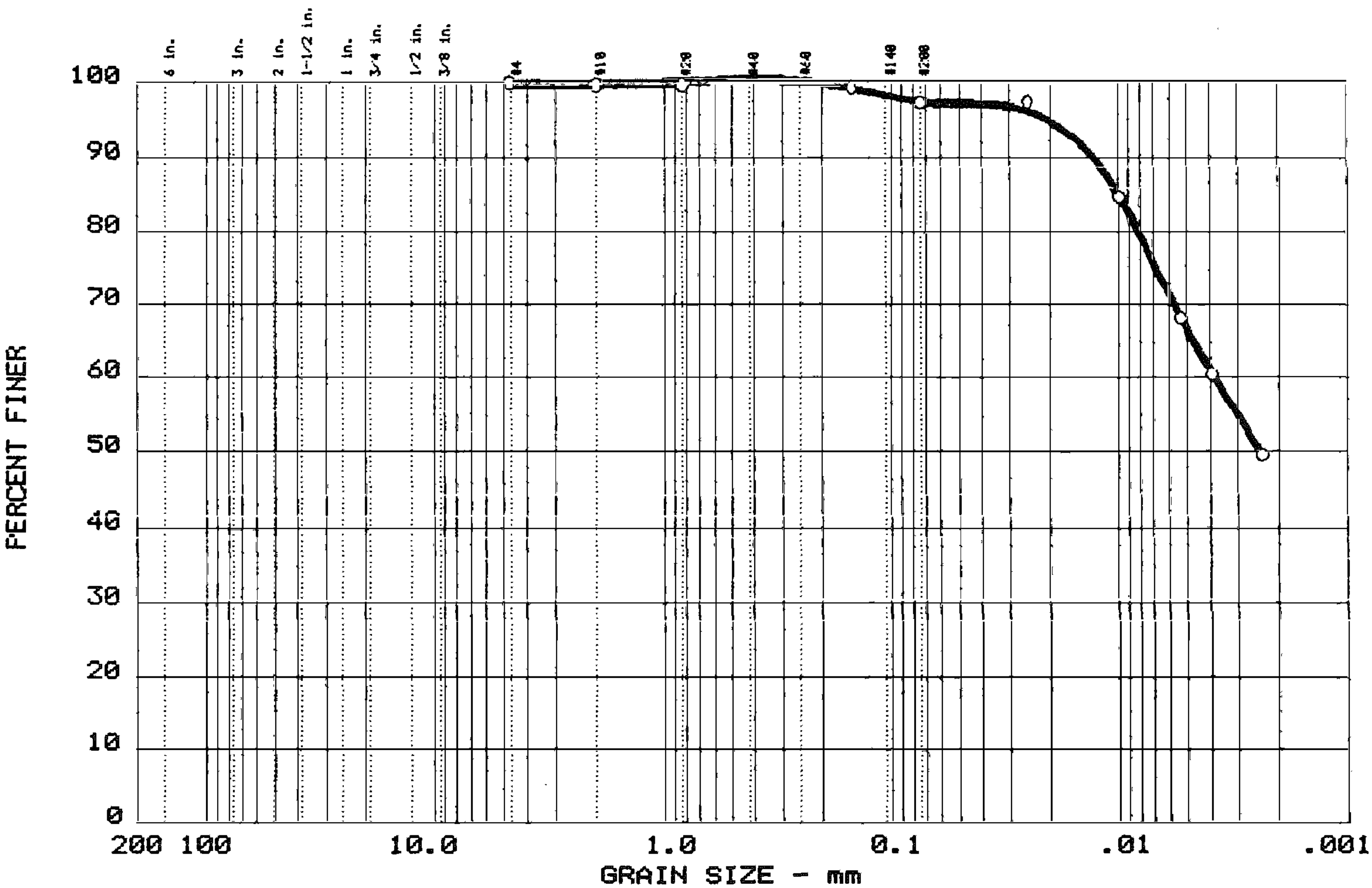
Remarks:
JAR SAMPLE

GS-310
A-265

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	10	0.0	0.0	2.5	31.1	66.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	33	19			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 124-87, S-8B, 14.0'-16.0'

Date: '

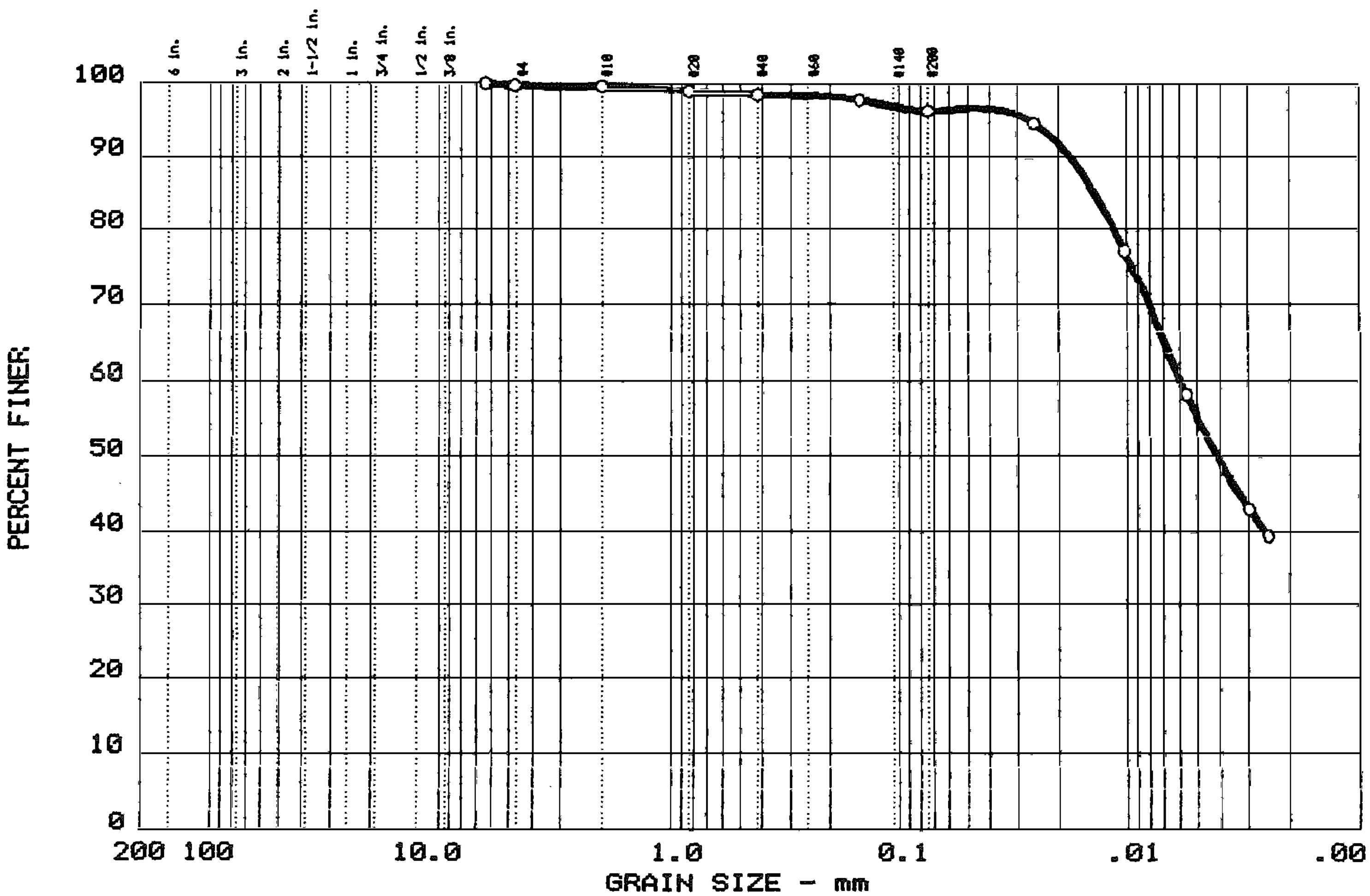
Remarks:
JAR SAMPLE

GS-311
A-266

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	11	0.0	0.3	3.4	41.4	55.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	32	11			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 124-87, S-9, 16.0'-18.0'

Date:

Remarks:

JAR SAMPLE

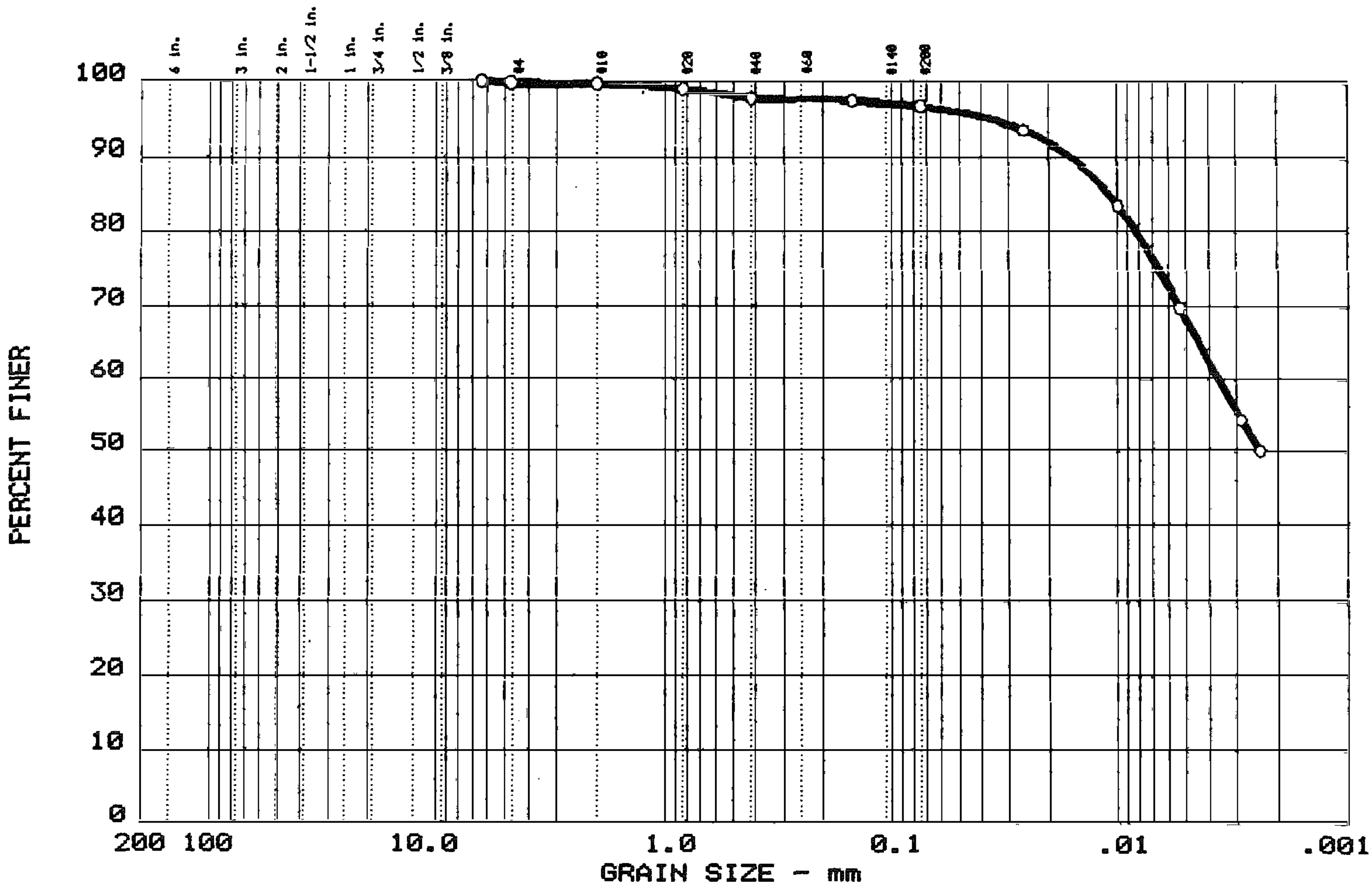
GS-312
A-267

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	12	0.0	0.2	3.0	28.6	68.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	40	18								

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 124-87, S-10, 18.0'-20.0'

Date: '

Remarks:

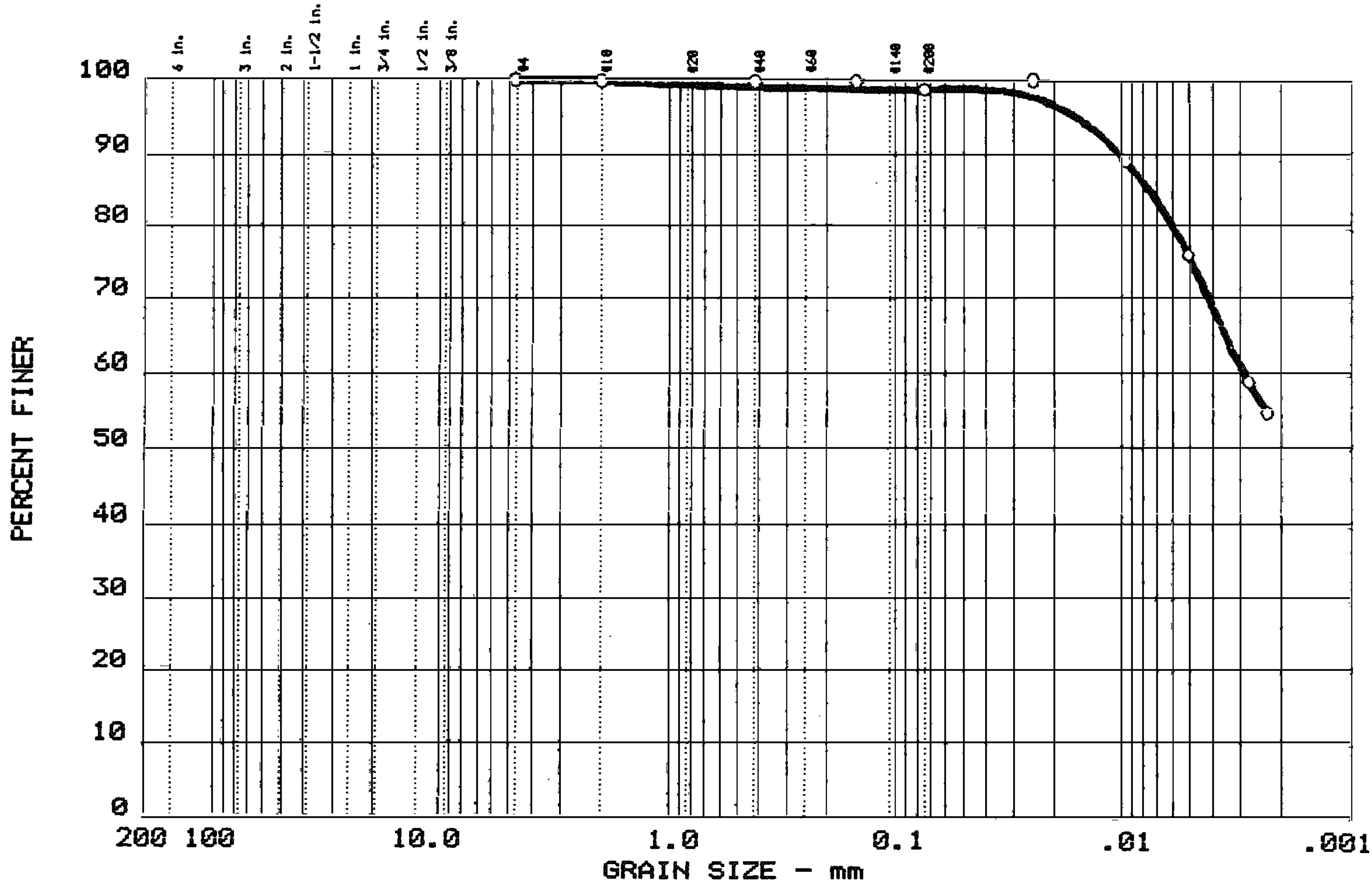
JAR SAMPLE

GS-313
A-268

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	13	0.0	0.0	1.1	23.4	75.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	37	18								

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 124-87, S-11, 20.0'-22.0'

Date: '

Remarks:

JAR SAMPLE

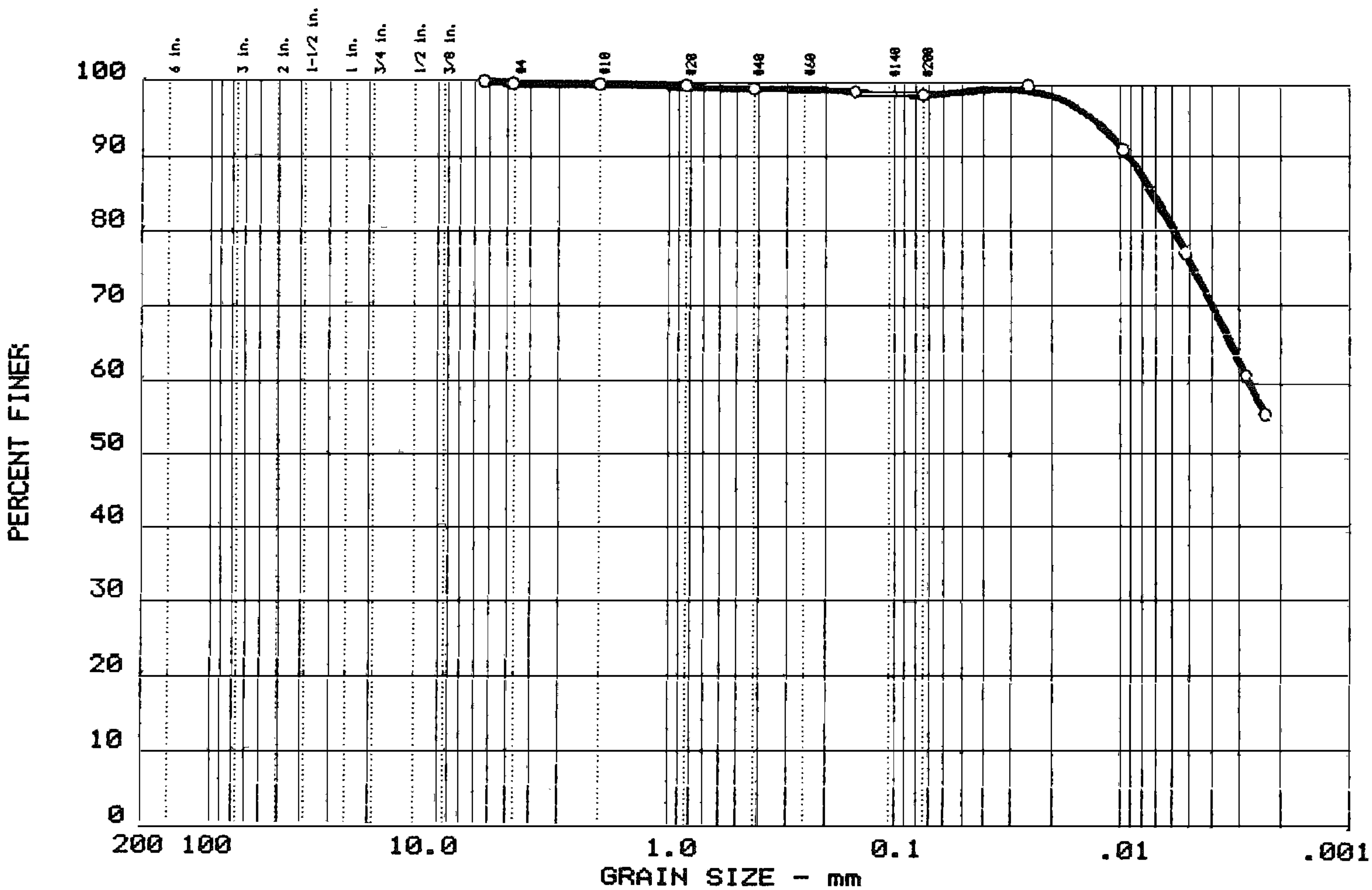
GS-314
A-269

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	14	0.0	0.3	1.2	22.2	76.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	43	20								

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 124-87, S-12, 22.0'-24.0'

Date: '

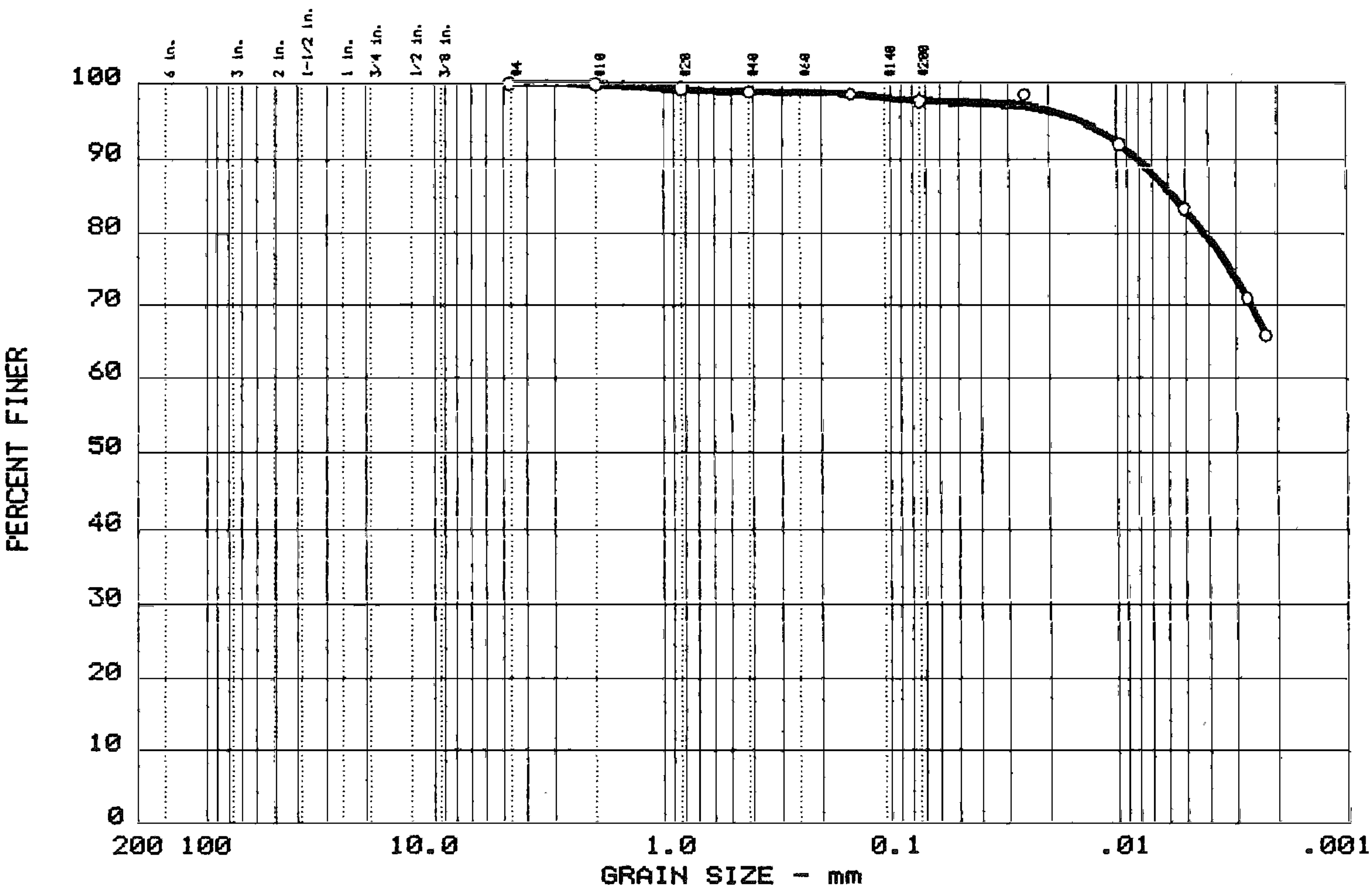
Remarks:
JAR SAMPLE

GS-315
A-270

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	15	0.0	0.0	2.3	14.7	83.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	53	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CH	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 124-87, S-13, 24.0-26.0'

Date: '

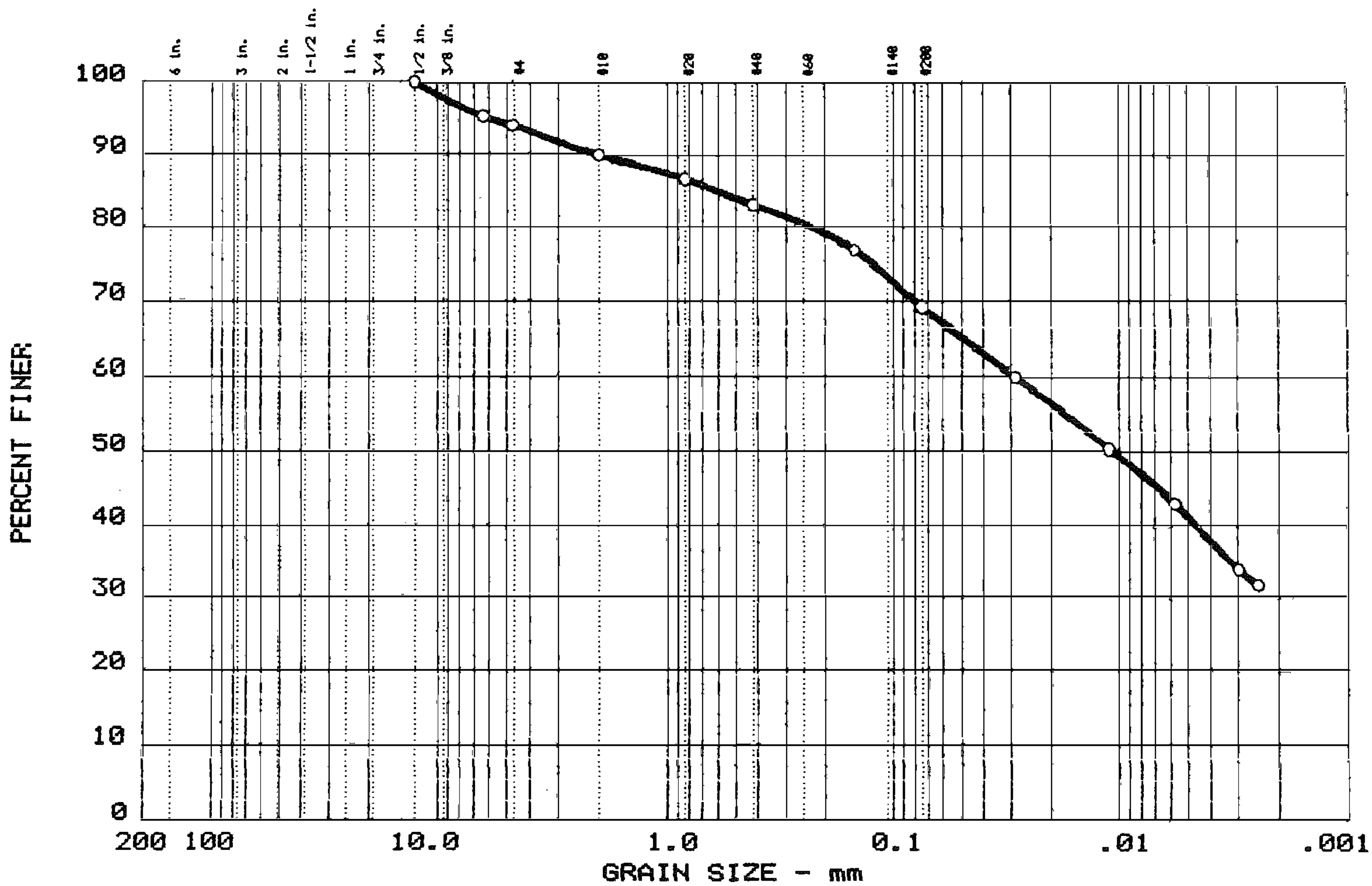
Remarks:
JAR SAMPLE

GS-316
A-271

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	16	0.0	6.1	24.7	28.1	41.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	28	19	0.61		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT SOME SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 124-87, S-14   26.0'-27.6'

Date:

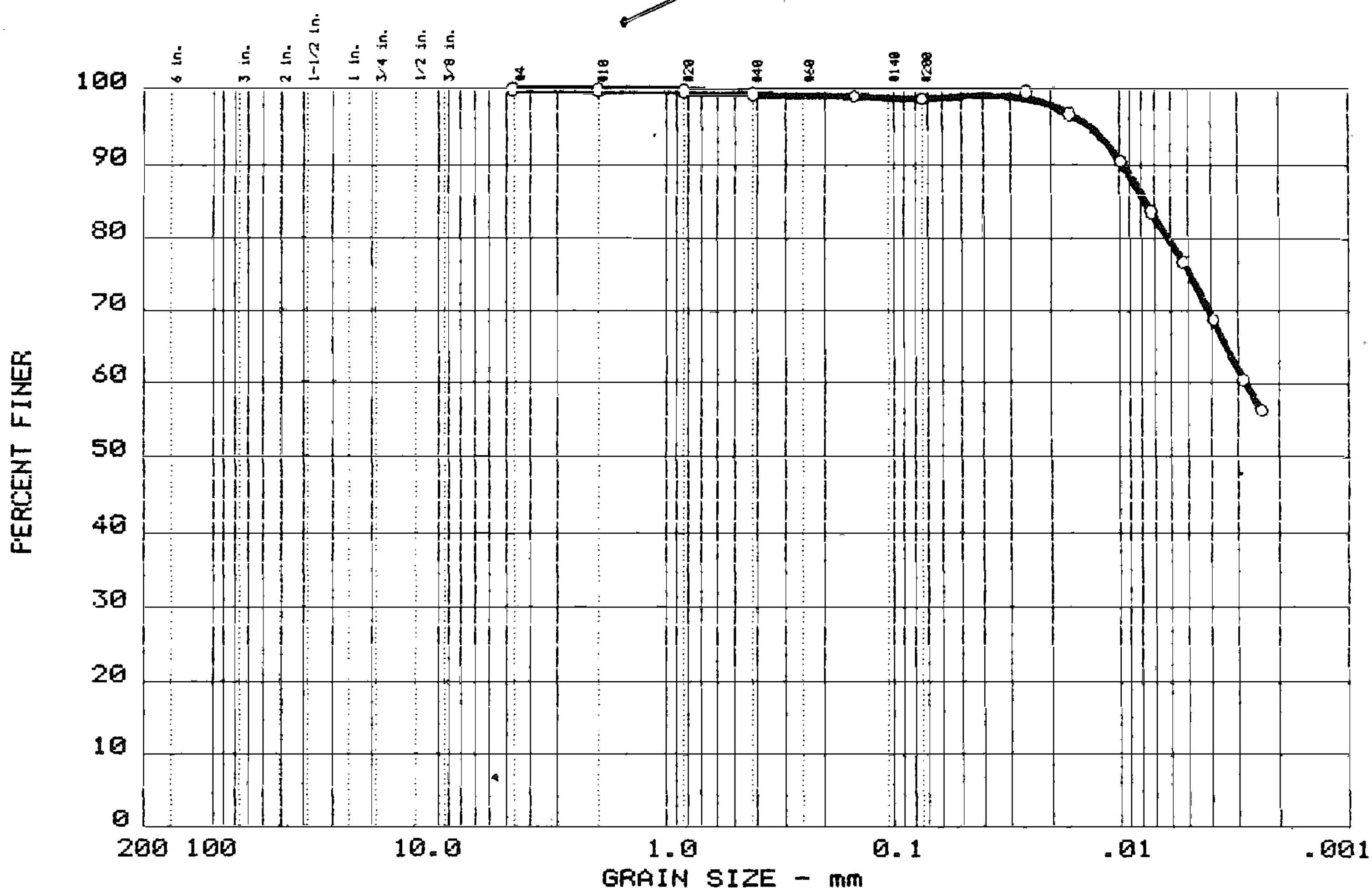
Remarks:
JAR SAMPLE

GS-317
A-272

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	0.0	1.1	23.5	75.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	42	20								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-66-90
Project: "S" AREA REMEDIATION
○ Location: BH - 130-87, S-7, 14.0'-16.0'

Date: 6-10-88

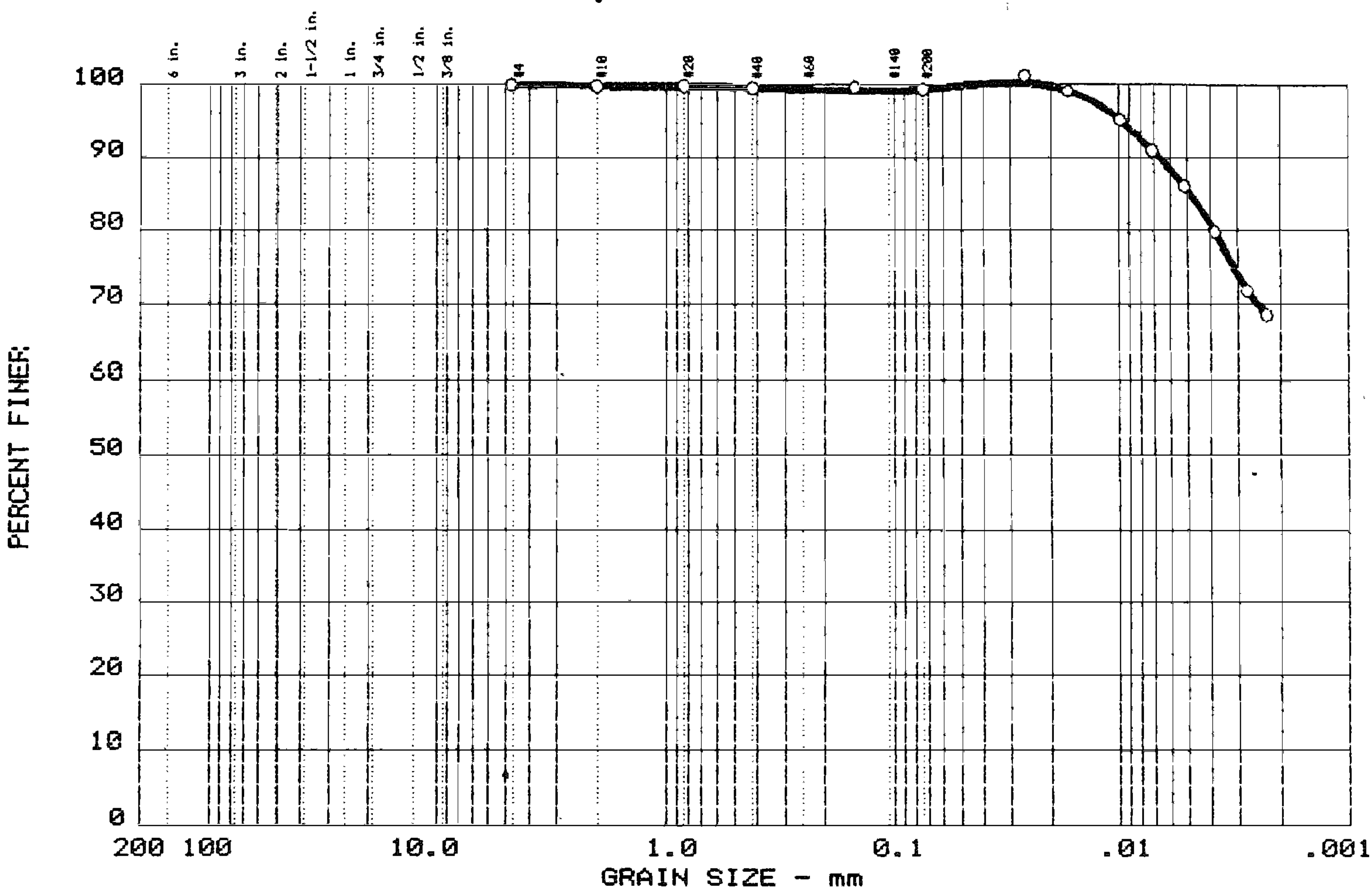
Remarks:
JAR SAMPLE

GS-268
A-228

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	0.0	0.6	13.9	85.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	47	25								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-8$_6$-90
Project: "S" AREA REMEDIATION
○ Location: BH - 130-87, S-13, 26.0'-28.0'

Date: 6-10-88

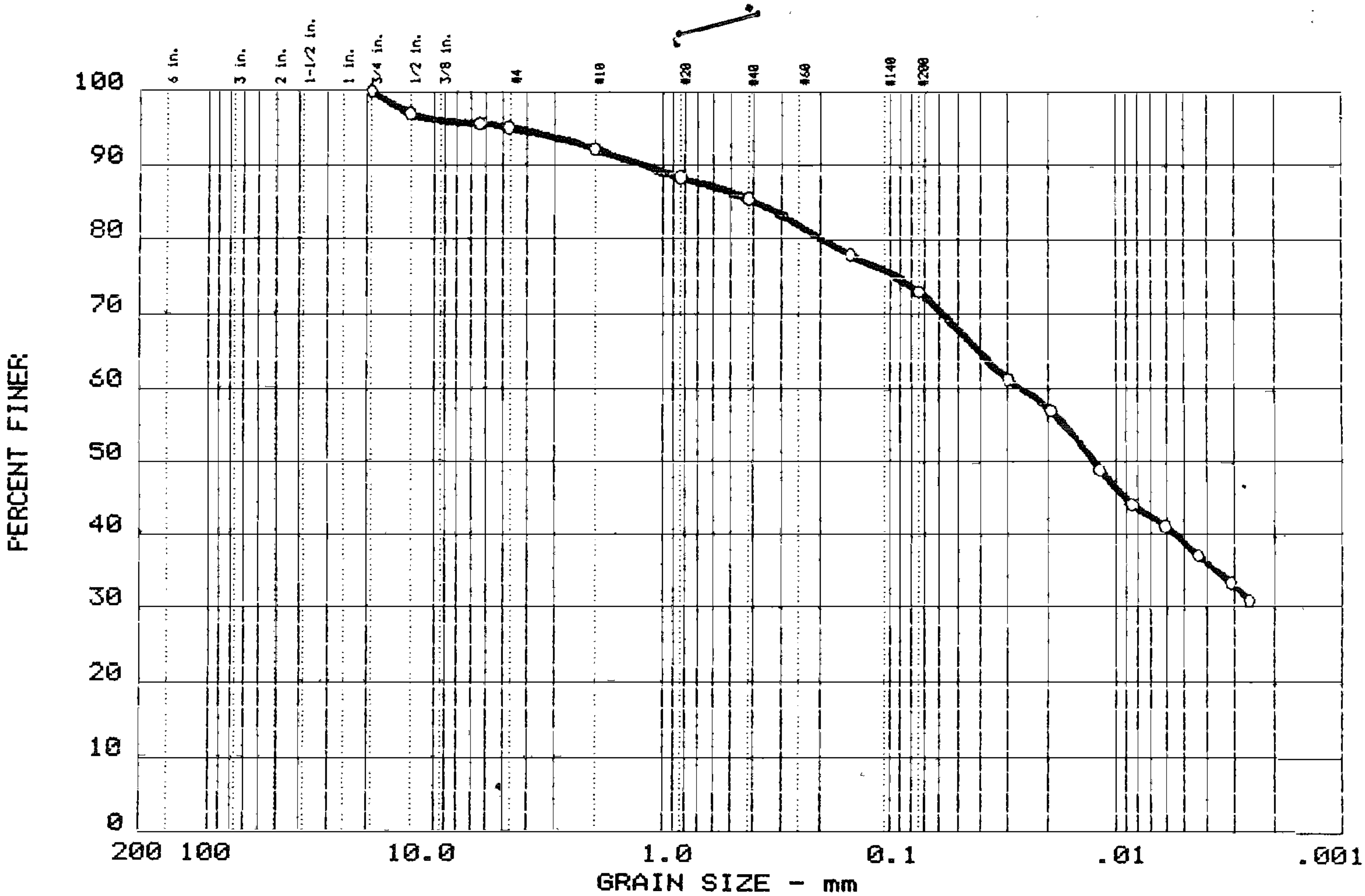
Remarks:
JAR SAMPLE

GS-269
A-229

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	5.1	21.8	34.2	38.9

	LL	PI	D85	D60	D50	D30	D15	D10	Cc	Cu
○	24	10	0.38		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT SOME SAND TRACE GRAVEL	CL	

Project No.: BD-886-90
Project: "S" AREA REMEDIATION
○ Location: BH - 130-87, S-15, 30.0'-32.0'

Date: 6-10-88

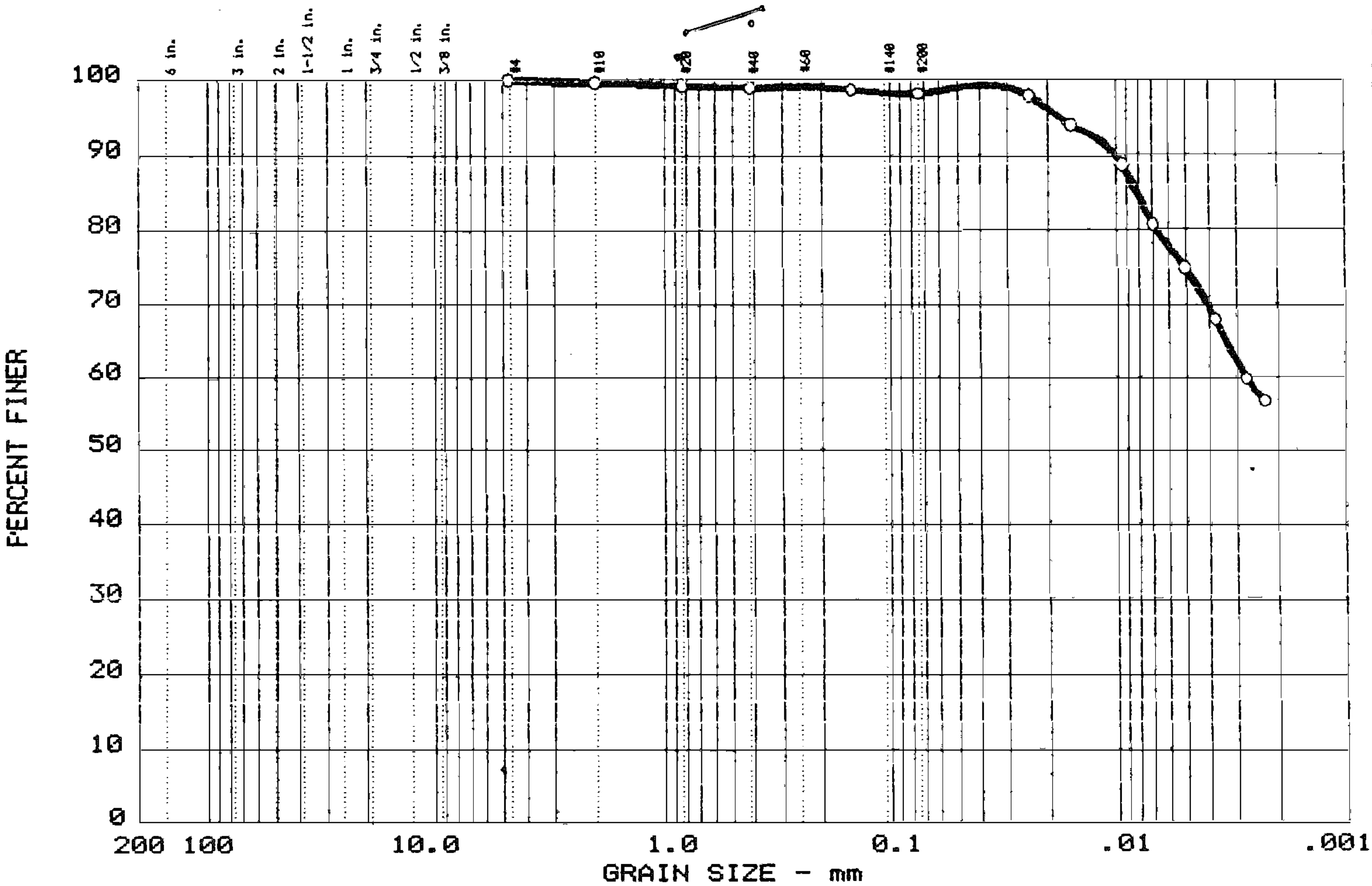
Remarks:
JAR SAMPLE

GS-270
A-230 F

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	0.0	1.8	23.7	74.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	42	20								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 131-87, S-10, 18.0'-20.0'

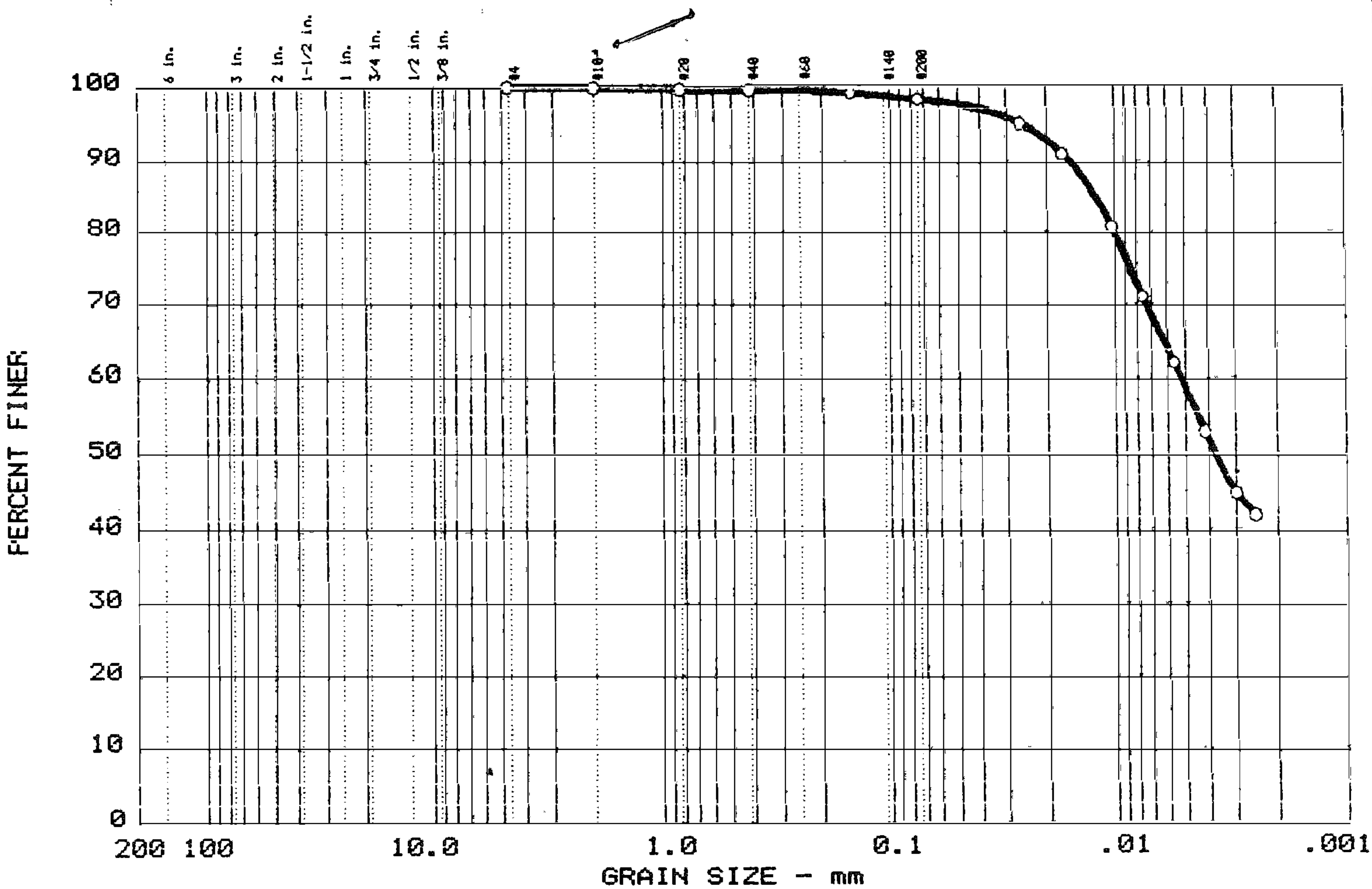
Date: 6-10-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
GS-271
A-231

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	10	0.0	0.0	1.7	39.8	58.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	33	15			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
O Location: BH - 137-87, S-8, 14.0'-16.0'

Date: 6-13-88

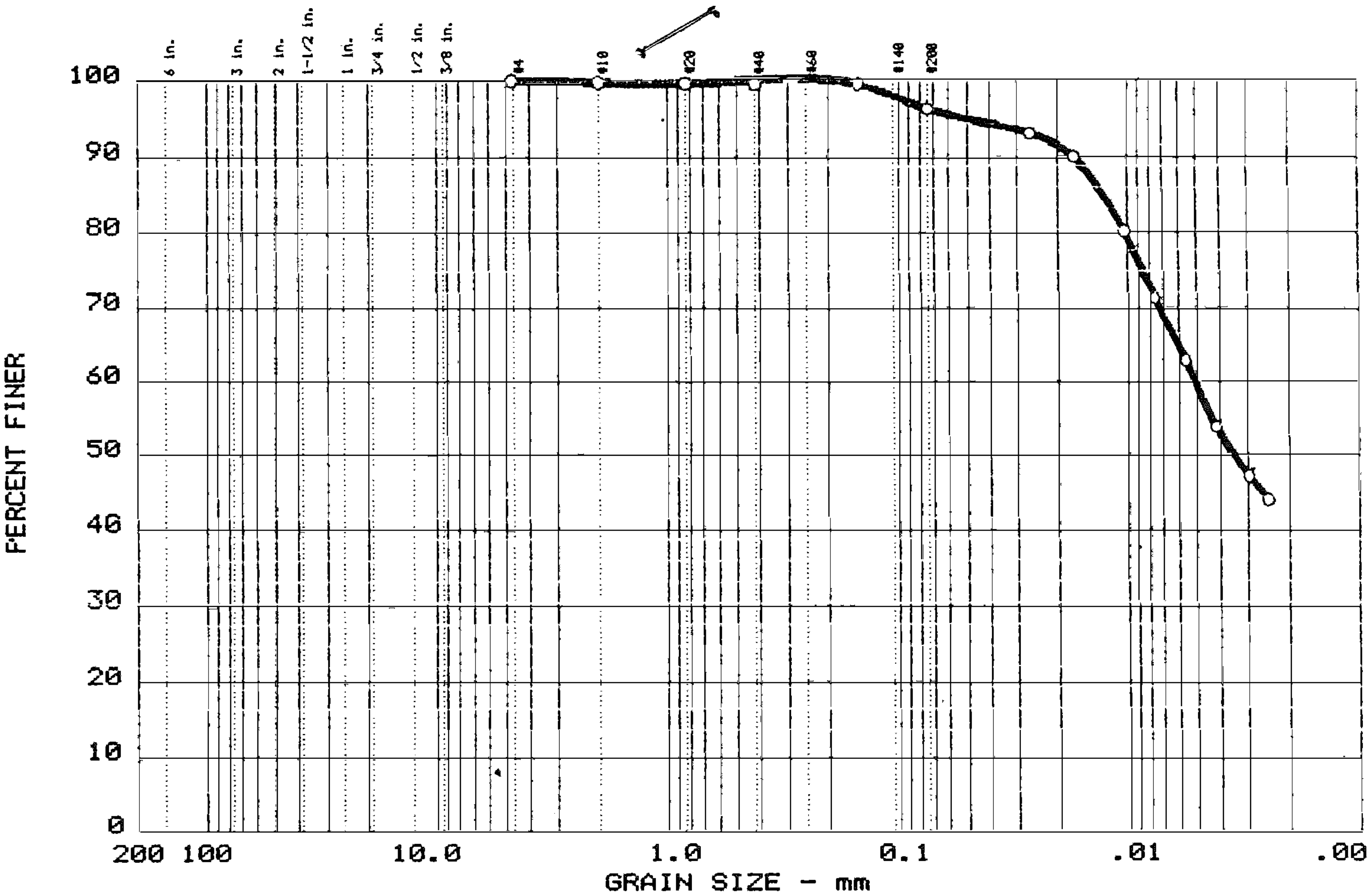
Remarks:
JAR SAMPLE

GS-276
A-236

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	0.0	3.6	37.0	59.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	34	15			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 137-87, S-9, 16.0'-18.0'

Date: 6-13-88

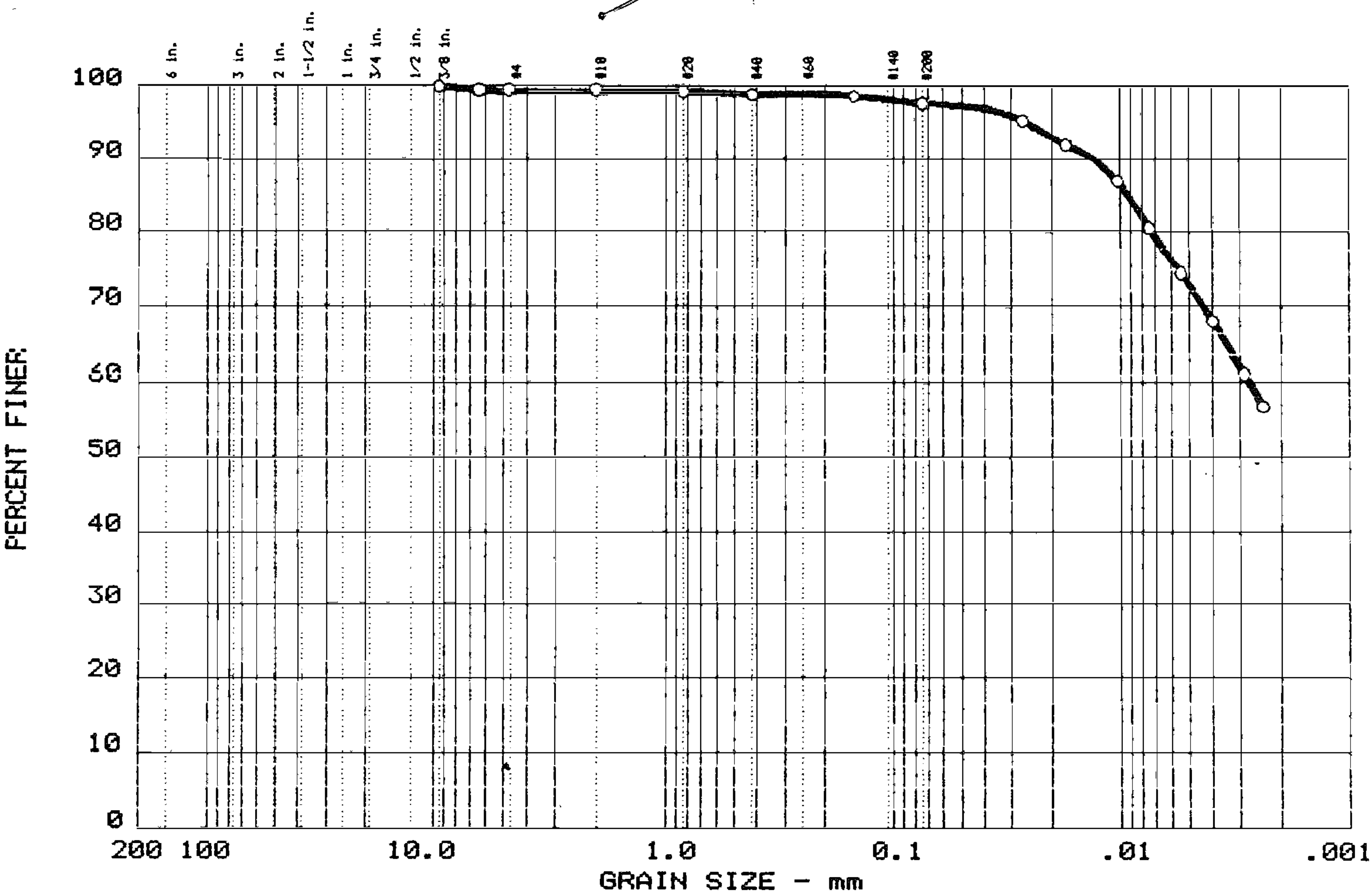
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE

GS-277
A-237

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	0.8	1.4	25.0	72.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	42	21								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 137-87, S-10, 18.0'-20.0'

Date: 6-13-88

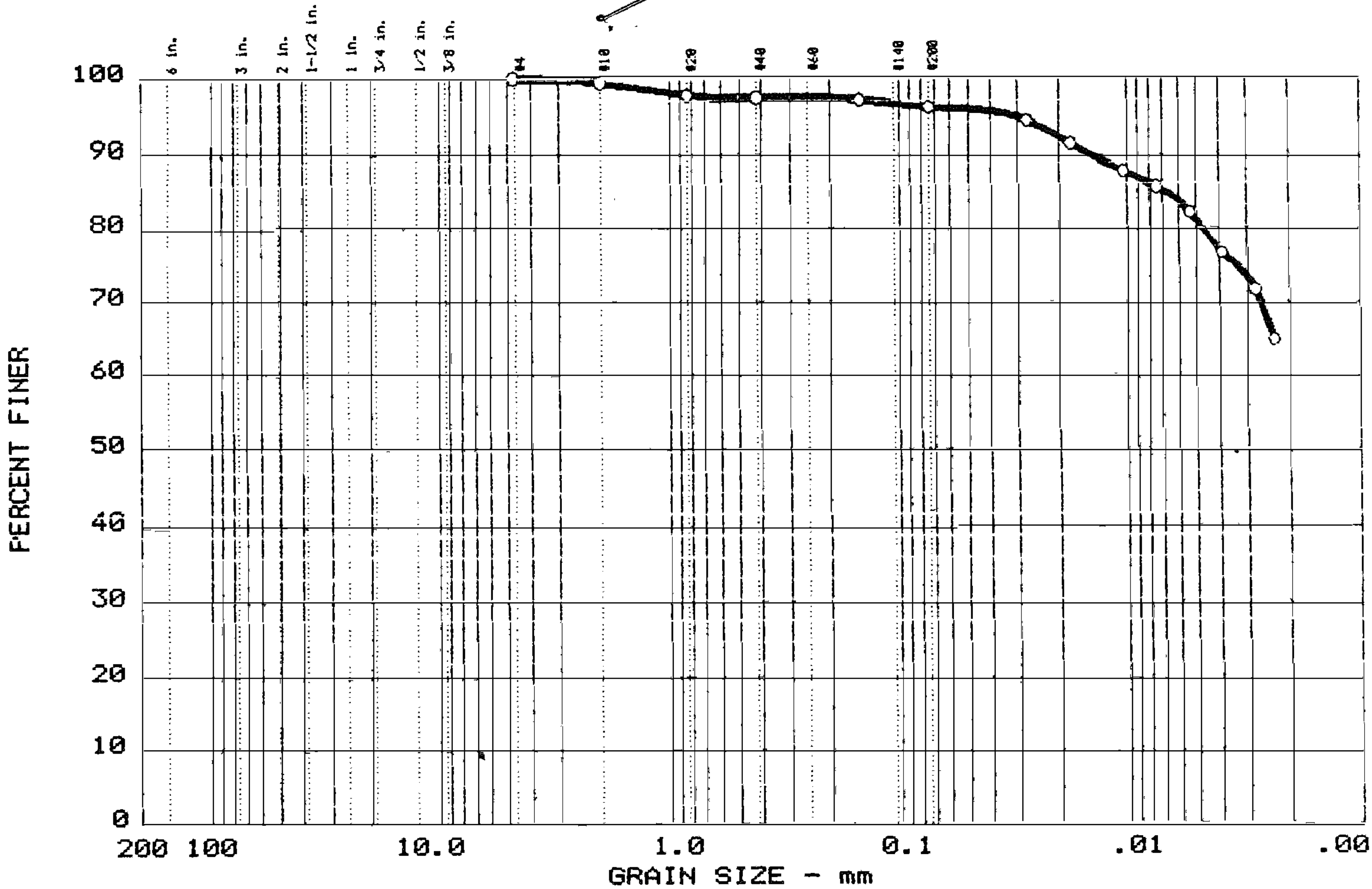
Remarks:
JAR SAMPLE

GS-278
A-238

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	0.0	3.7	15.2	81.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	48	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 137-87, S-13, 24.0'-26.0'

Date: 6-10-88

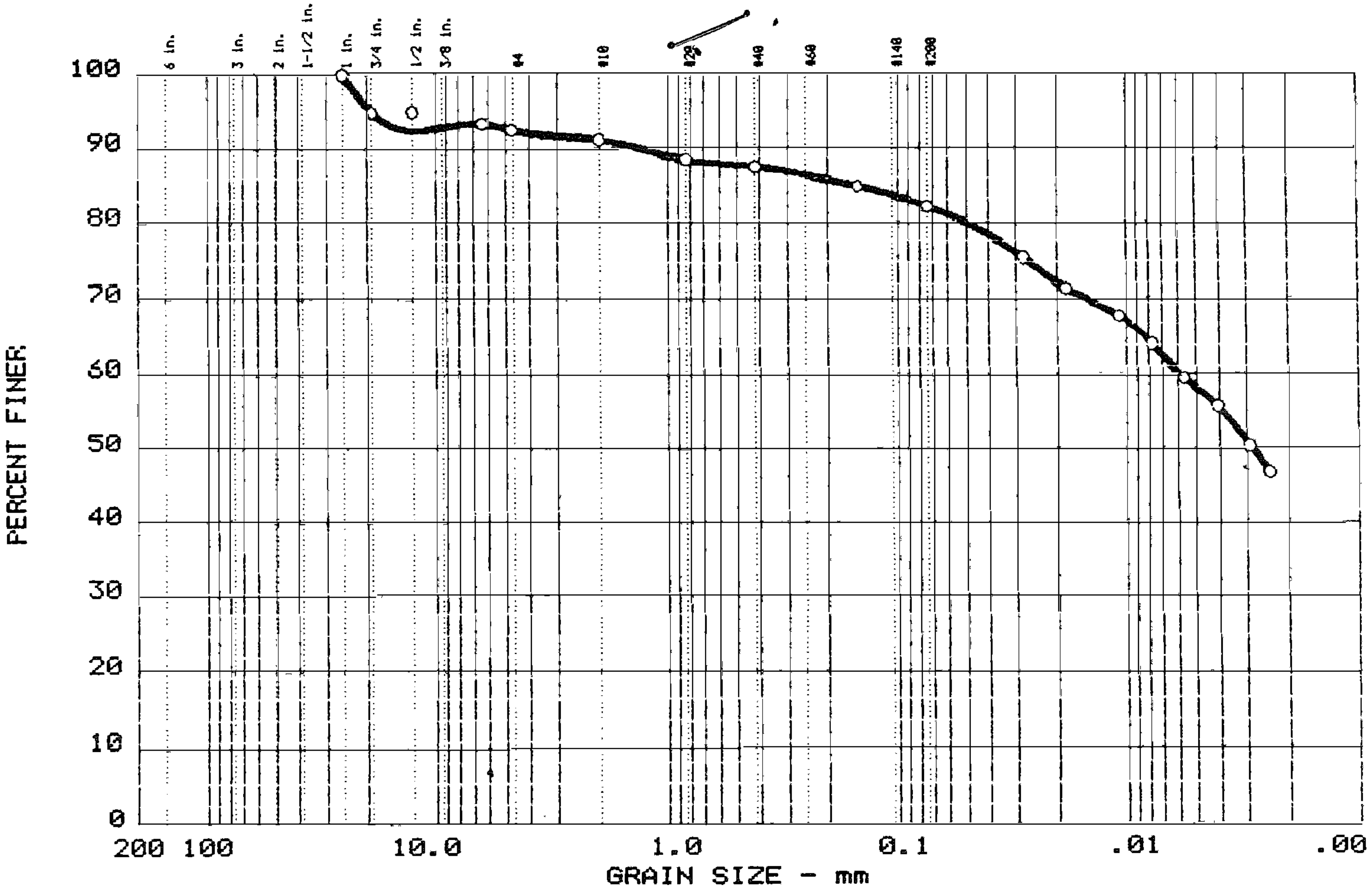
Remarks:
JAR SAMPLE

GS-279
A-239

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	7.5	10.2	24.2	58.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	18	0.16		0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT LITTLE SAND TRACE GRAVEL	CL	

Project No.: BD-66-90
Project: "S" AREA REMEDIATION
○ Location: BH - 137-87, S-14, 26.0'-28.0'

Date: 6-10-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

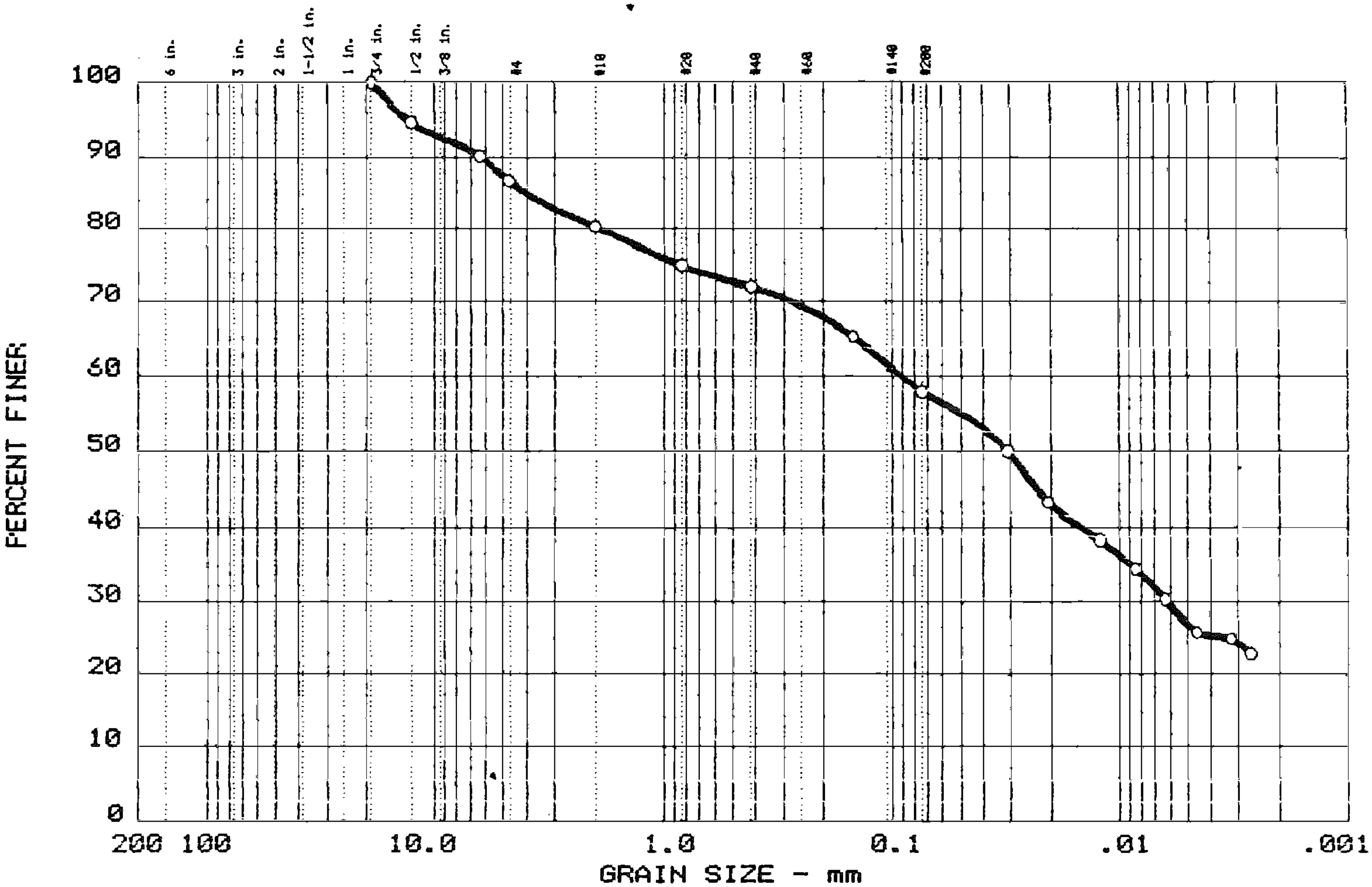
Remarks:
JAR SAMPLE

GS-280
A-240

F

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	7	0.0	13.3	28.8	31.2	26.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	23	10	4.03	0.09	0.03	0.006				

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT SOME SAND LITTLE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 137-87, S-15, 28.0'-29.1'

Date: 6-10-88

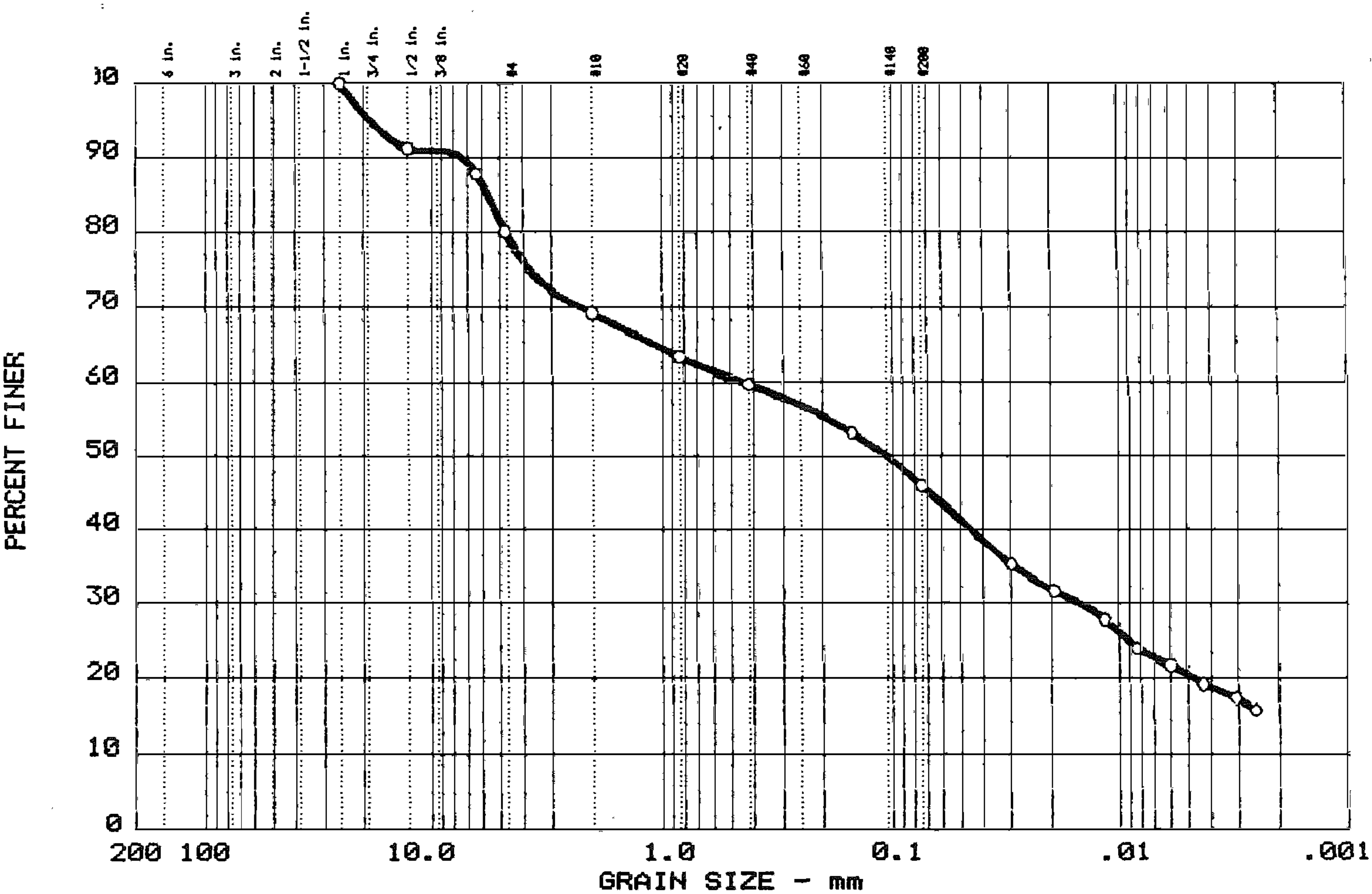
Remarks:
JAR SAMPLE

GS-281
A-241

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
11	0.0	20.0	34.1	25.7	20.3

LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
18	6	5.67	0.44	0.10	0.015				

MATERIAL DESCRIPTION	USCS	AASHTO
o SILTY SAND SOME CLAY SOME GRAVEL	SC-SM	

Project No.: BD-86-90
Project: S-AREA REMEDIATION
o Location: BH - 151-87, S-14A, ~~25.0'-26.0'~~
26.0 - 26.3

Date: 3-11-88

Remarks:
JAR SAMPLE

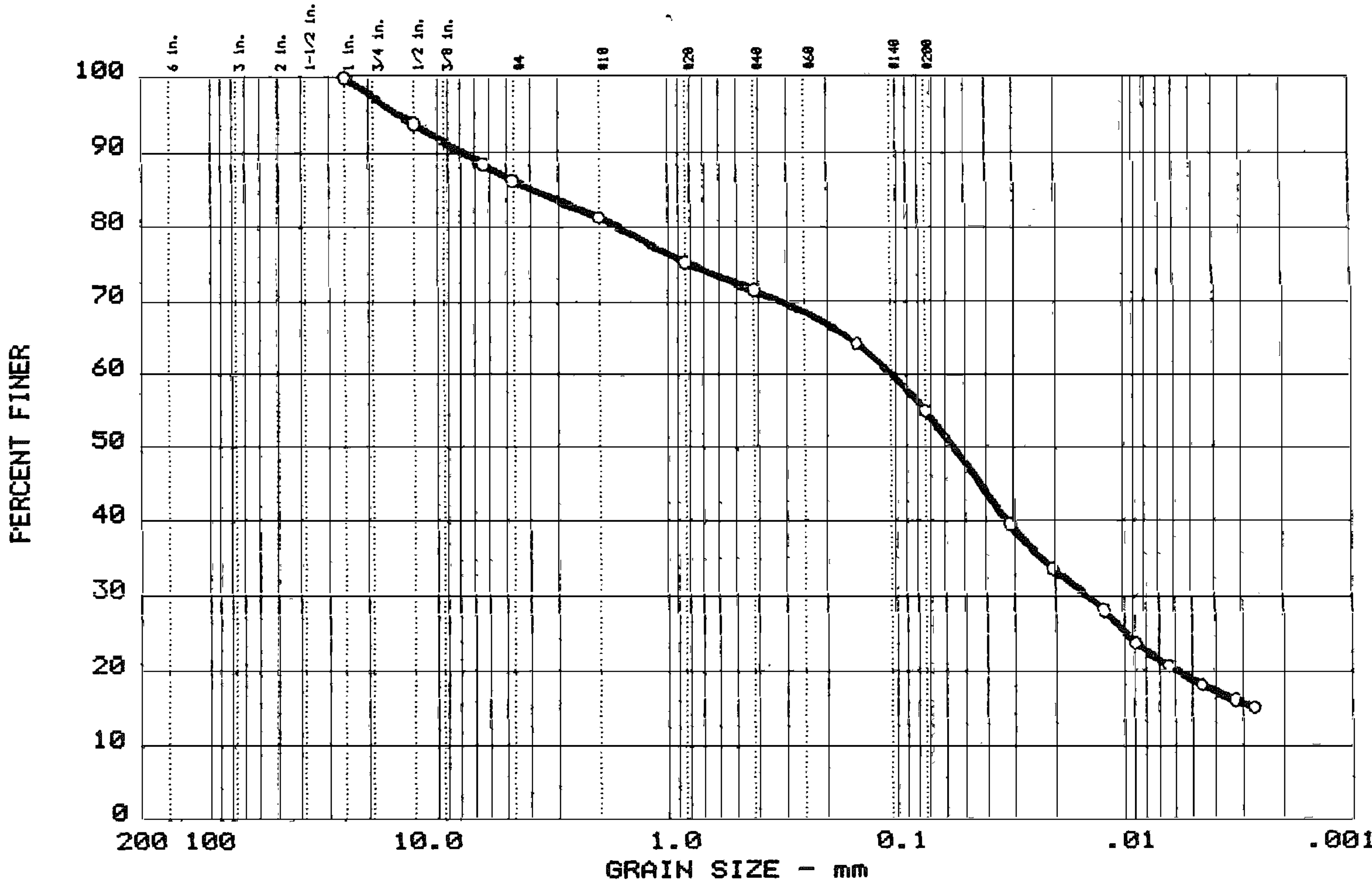
GS-303
A-258

M

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 11

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	17	0.0	13.6	31.4	36.3	18.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	16	4	3.76	0.10	0.06	0.015				

MATERIAL DESCRIPTION	USCS	AASHTO
O SANDY SILT LITTLE CLAY LITTLE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 151-87, S-14B, ~~25.0'-26.0'~~
26.0 - 26.3

Date: 5-6-88

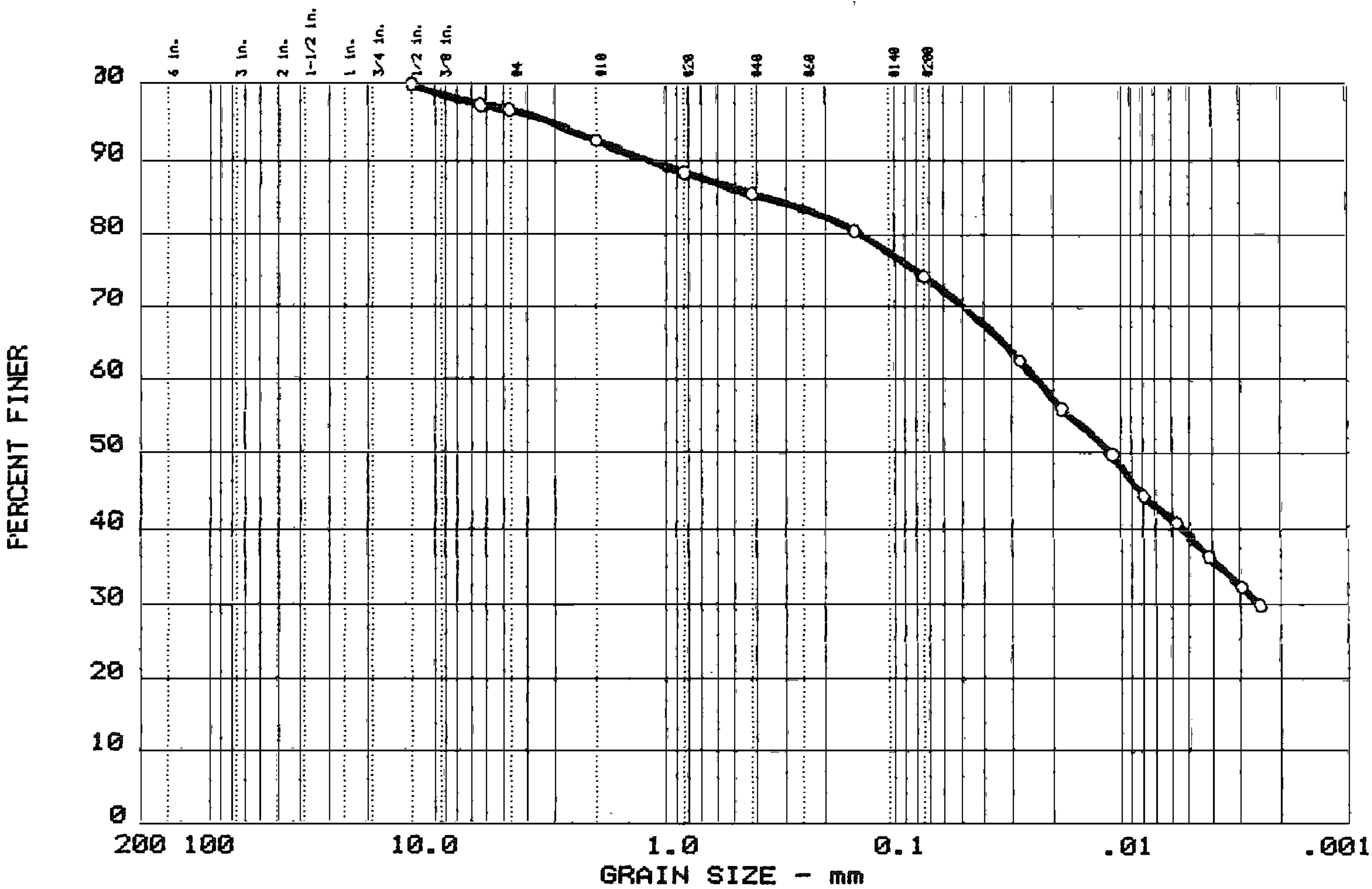
Remarks:
JAR SAMPLE

GS-304
A-259

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
12	0.0	3.4	22.4	35.1	39.1

LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
26	12	0.37		0.01	0.002				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILTY CLAY SOME SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: S-AREA REMEDIATION
○ Location: BH - 151-87, S15A, 28.0'-29.7'

Date: 3-11-88

Remarks:

JAR SAMPLE

F

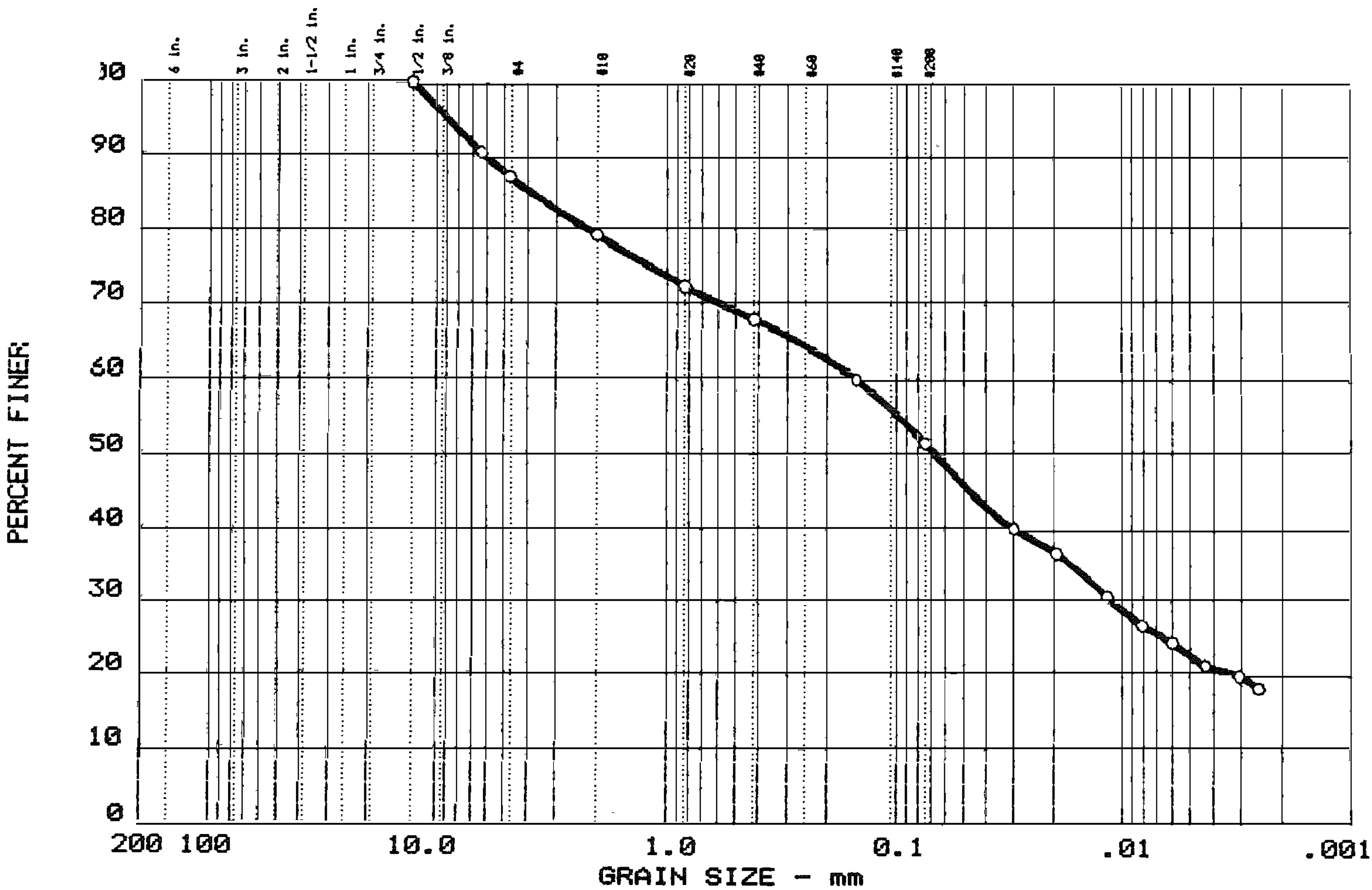
GS-305
A-260

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
13	0.0	13.0	35.5	28.9	22.6

LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
16	3	3.89	0.15	0.07	0.011				

MATERIAL DESCRIPTION	USCS	AASHTO
o SILTY SAND SOME CLAY LITTLE GRAVEL	ML	

Project No.: BD-86-90
Project: S-AREA REMEDIATION
o Location: BH - 151-87, S-15B, 28.0'-29.7'

Date: 3-11-88

Remarks:

JAR SAMPLE

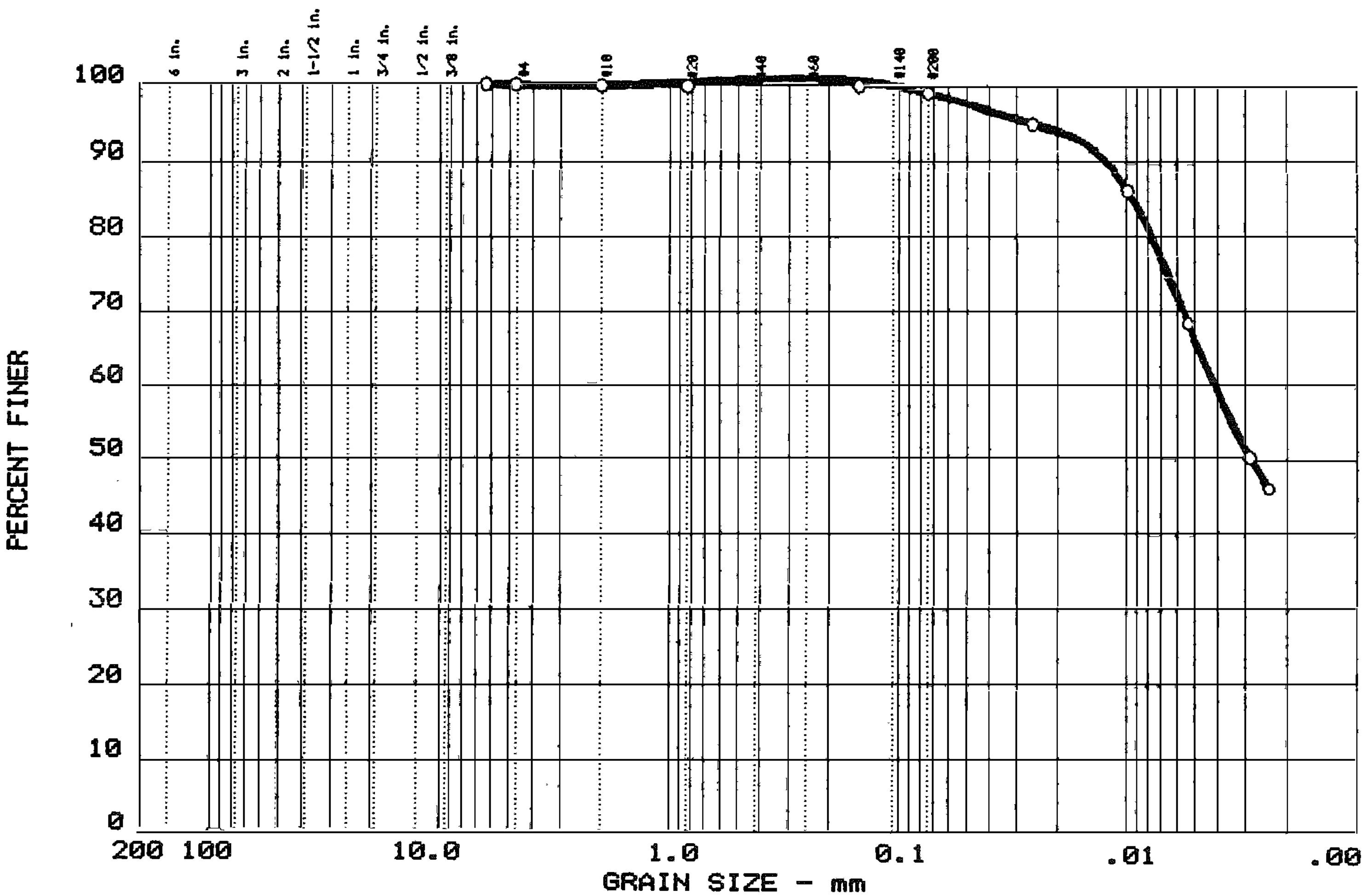
GS-306 M
A-261

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 13

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	17	0.0	0.1	0.8	32.7	66.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	16			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 157, S-16, 30.0'-32.0'

Date: '

Remarks:

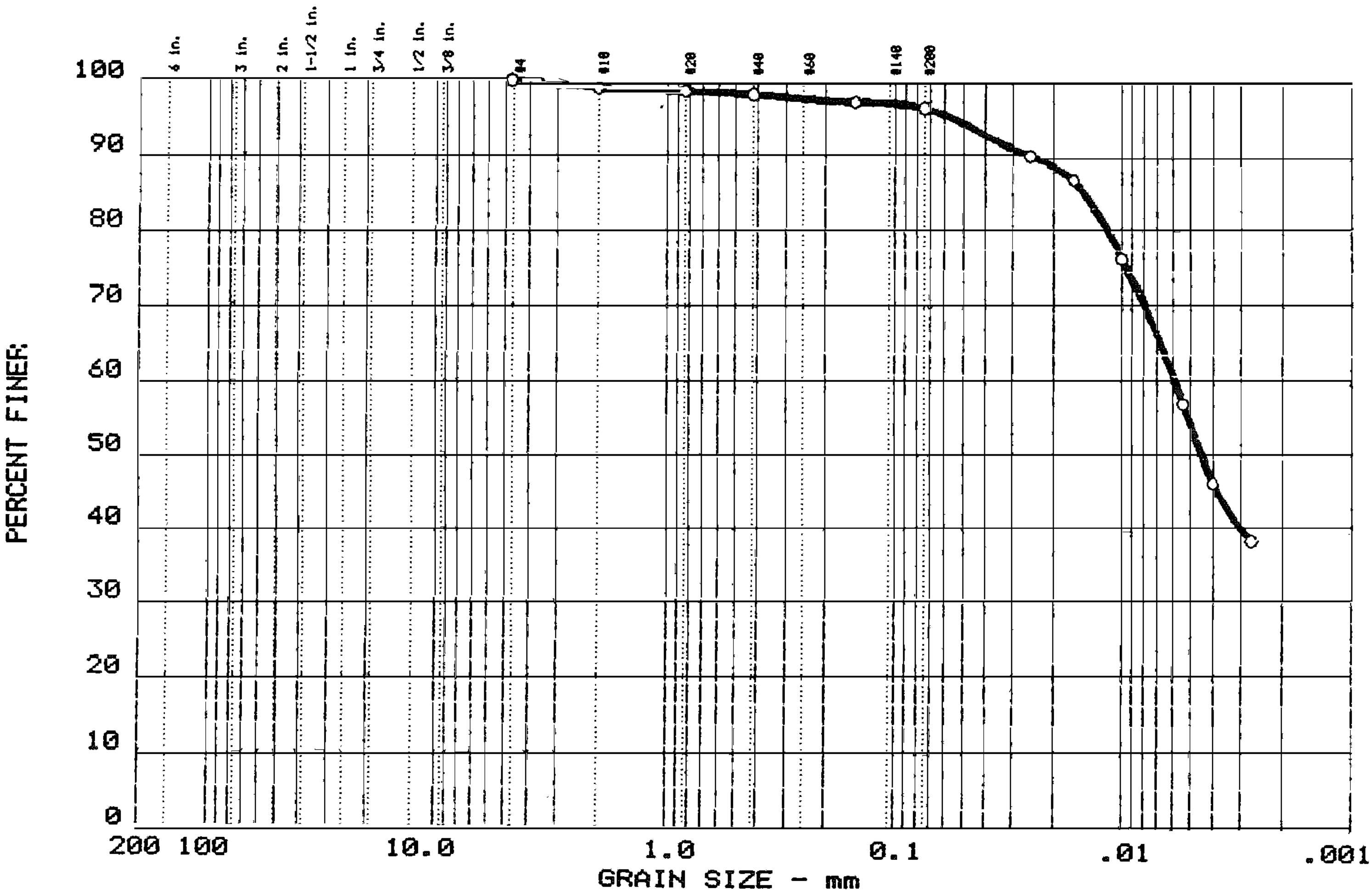
JAR SAMPLE

GS-291
A-248

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	17	0.0	0.0	3.5	42.1	54.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	30	13			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 157-88, S-17, 32.0'-34.0'

Date: 6-22-88

Remarks:

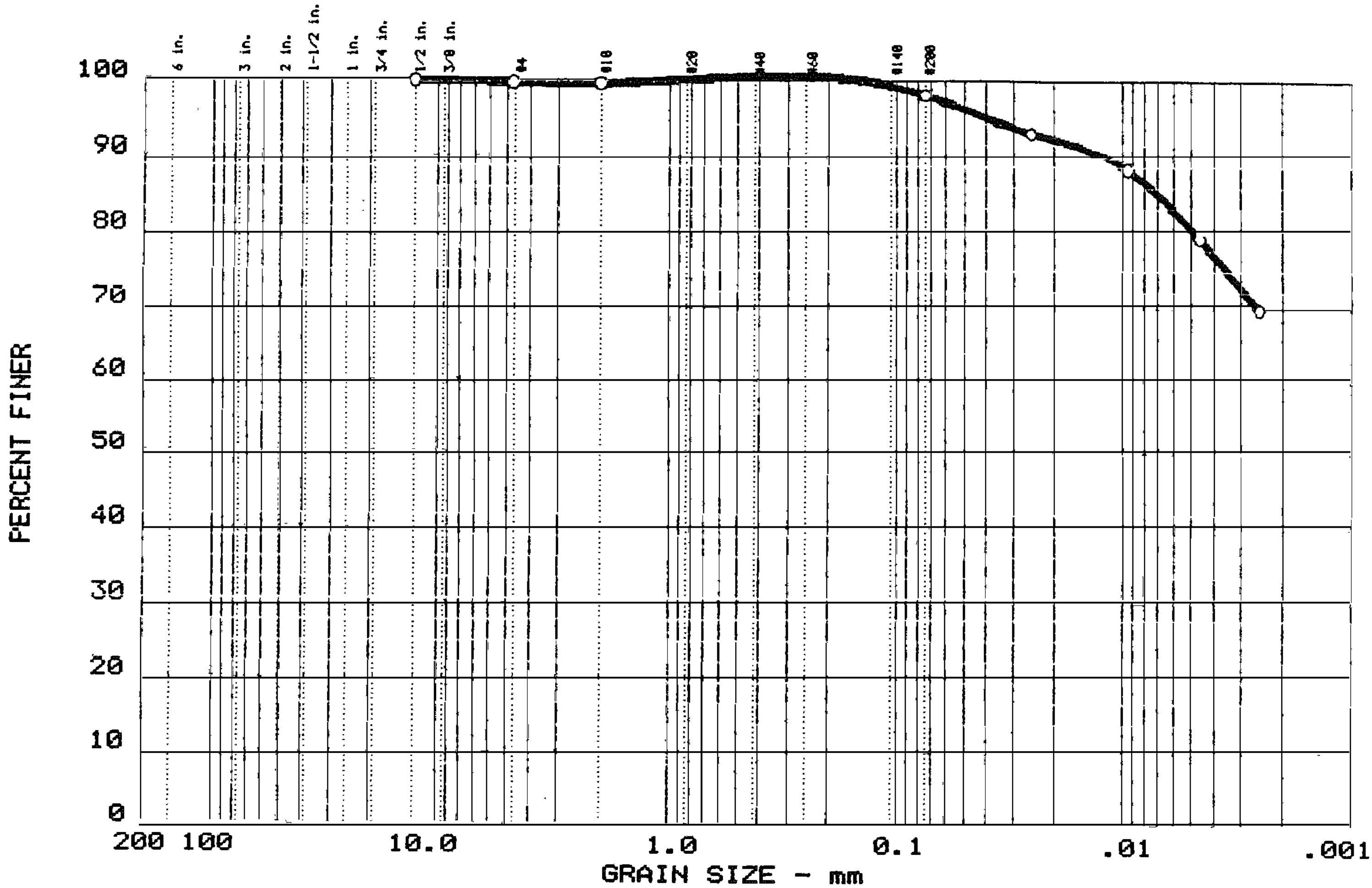
SHELBY TUBE

GS-321
A-274
P-46

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 17

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	15	0.0	0.3	1.5	17.7	80.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	49	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 157-88, S-18, 34.0'-36.0'

Date: 6-22-88

Remarks:

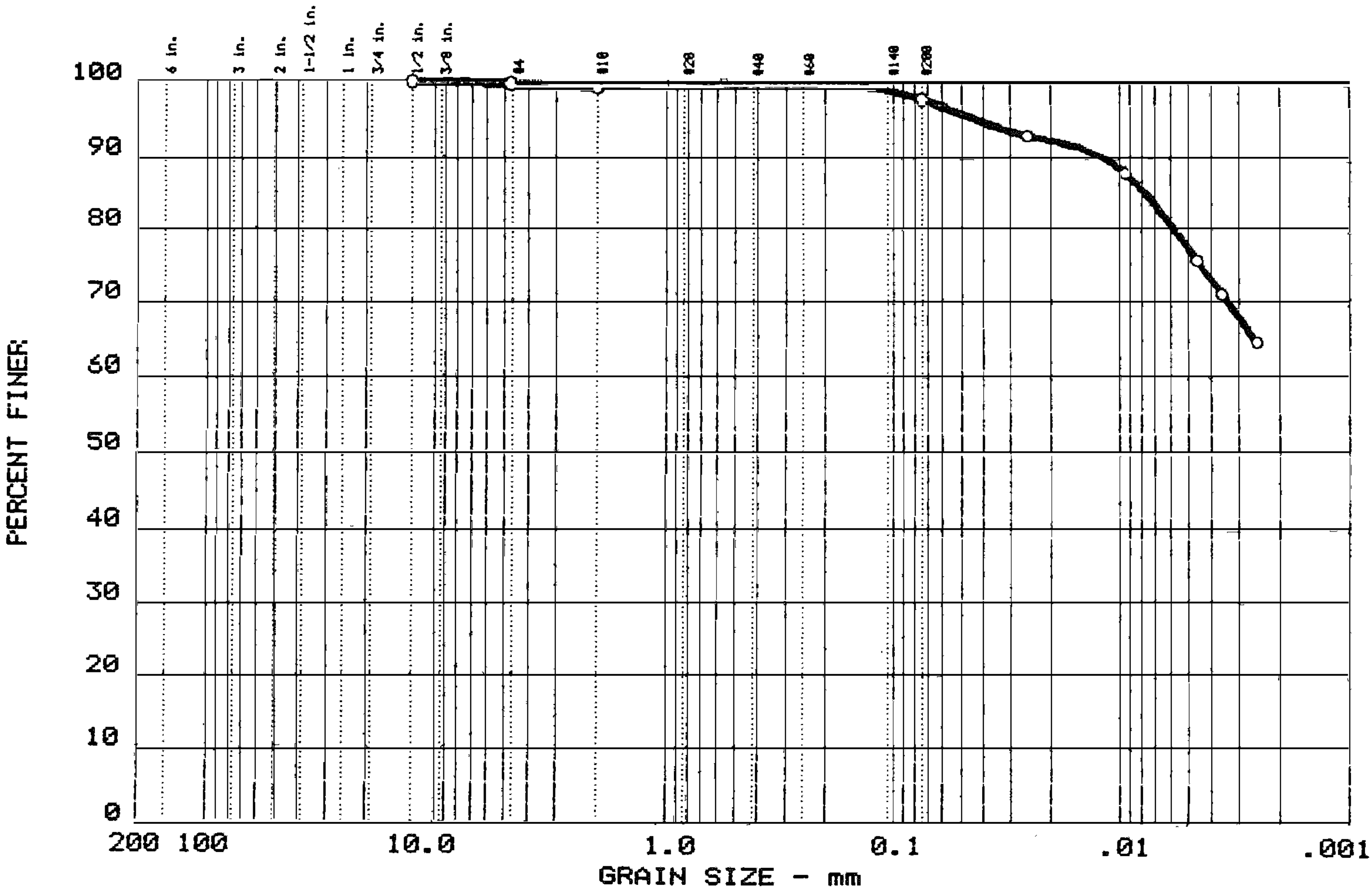
SHELBY TUBE

GS-322
A-275
P-47

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 15

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	16	0.0	0.3	1.9	20.3	77.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	46	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 157-88, S-20, 38.0'-40.0'

Date: 6-22-88

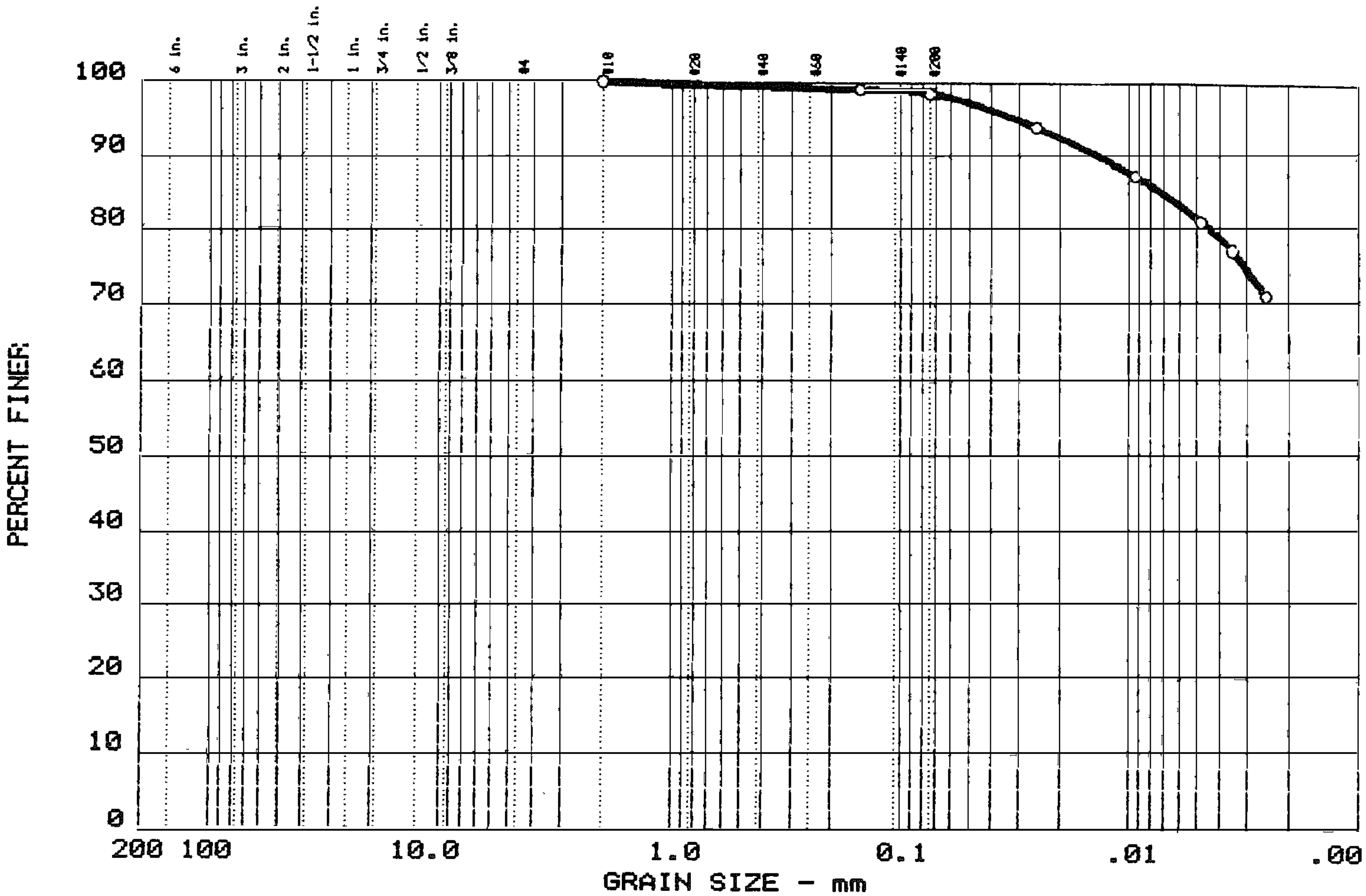
Remarks:
SHELBY TUBE

GS-323
A-276
P-48

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 16

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	14	0.0	0.0	1.4	17.0	81.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	50	29								

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 157-88, S-21, 40.0'-42.0'

Date: 6-22-88

Remarks:

SHELBY TUBE

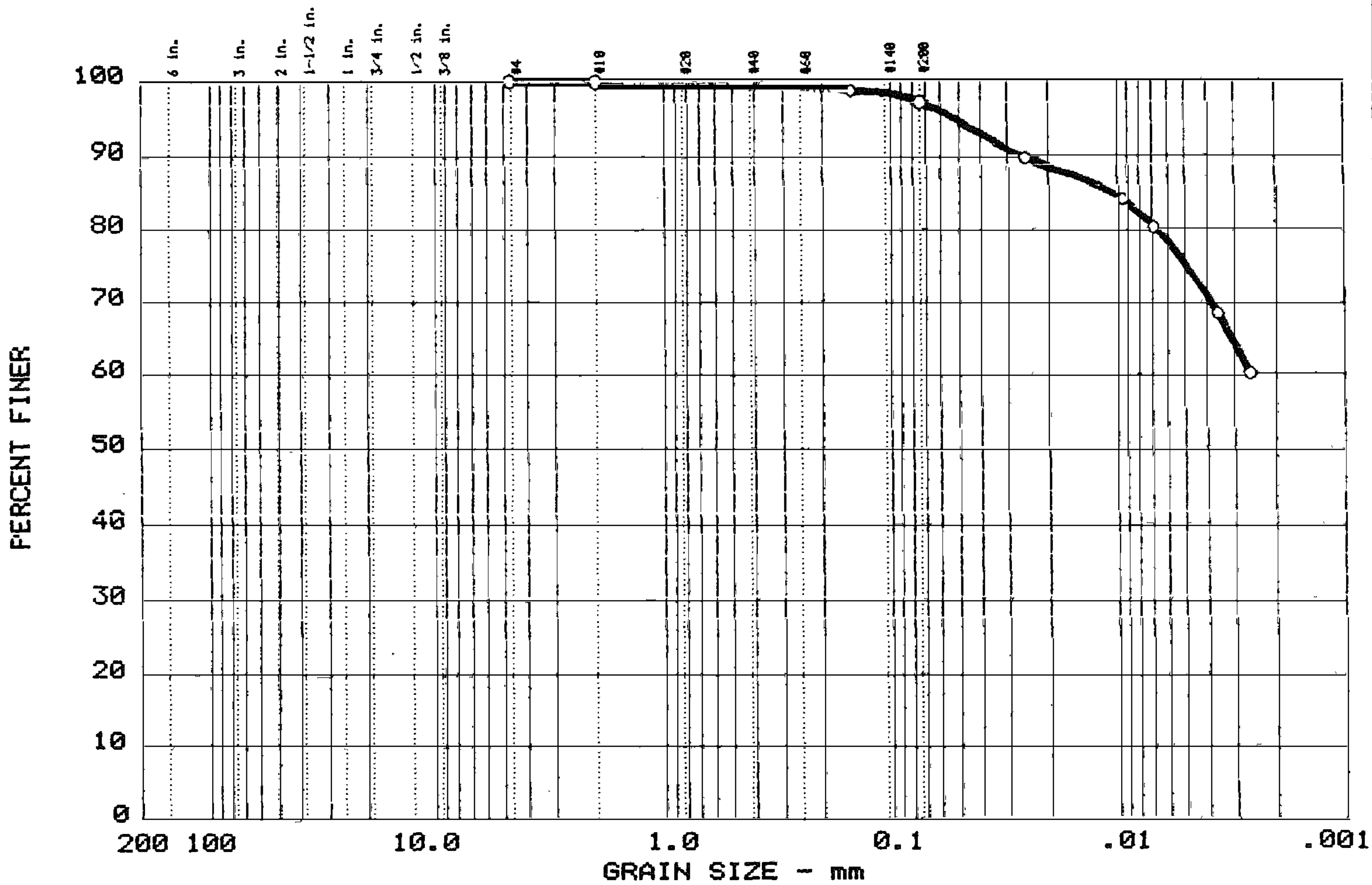
GS-324
A-277
P-49

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 14

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	13	0.0	0.0	2.8	22.1	75.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	42	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 157-88, S-22, 42.0'-44.0'

Date: 6-22-88

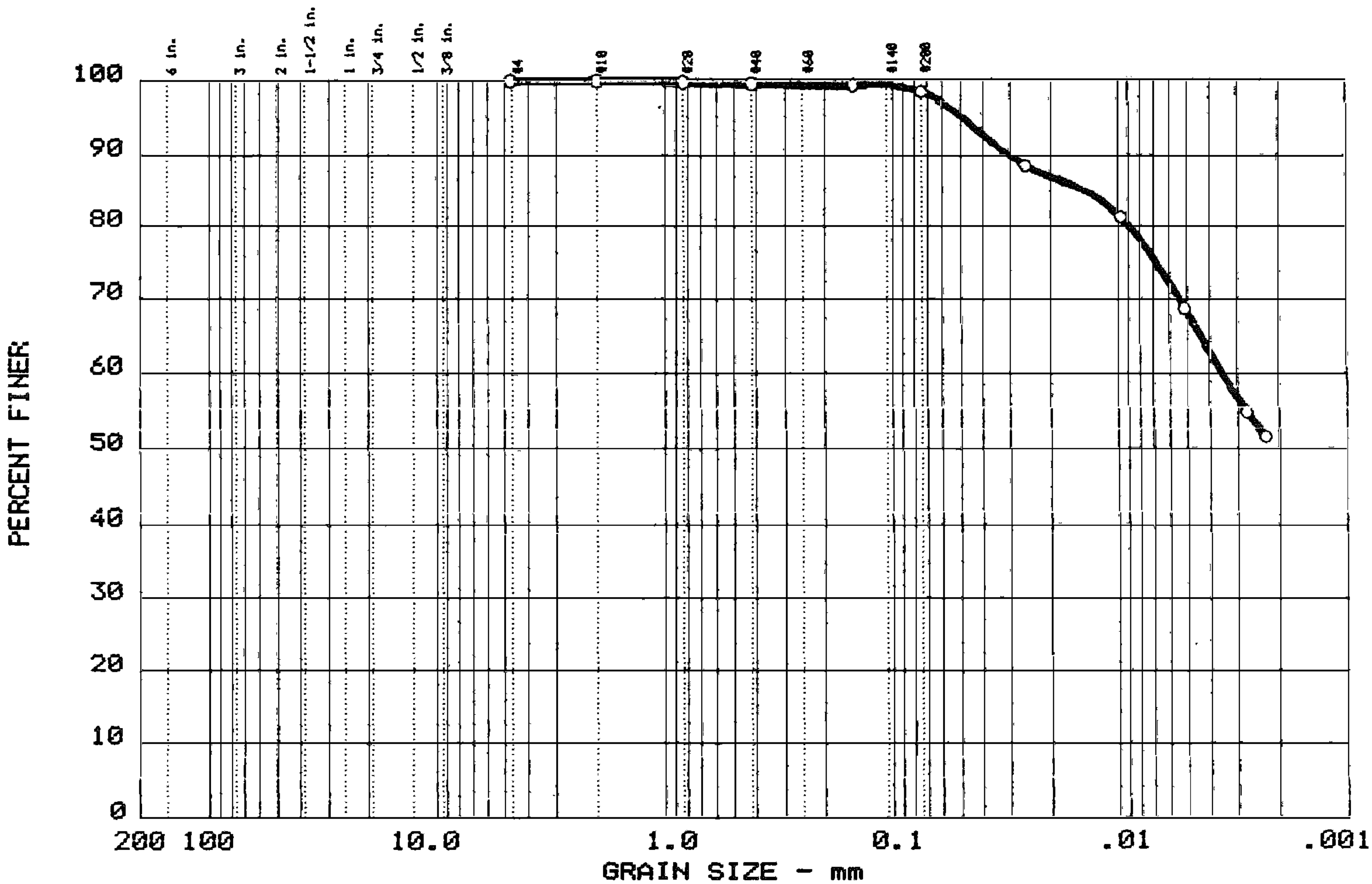
Remarks:
SHELBY TUBE

GS-325
A-278
P-50

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 13

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	18	0.0	0.0	1.5	30.7	67.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	38	17								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 158-, S-17, 32.0' - 34.0'

Date:

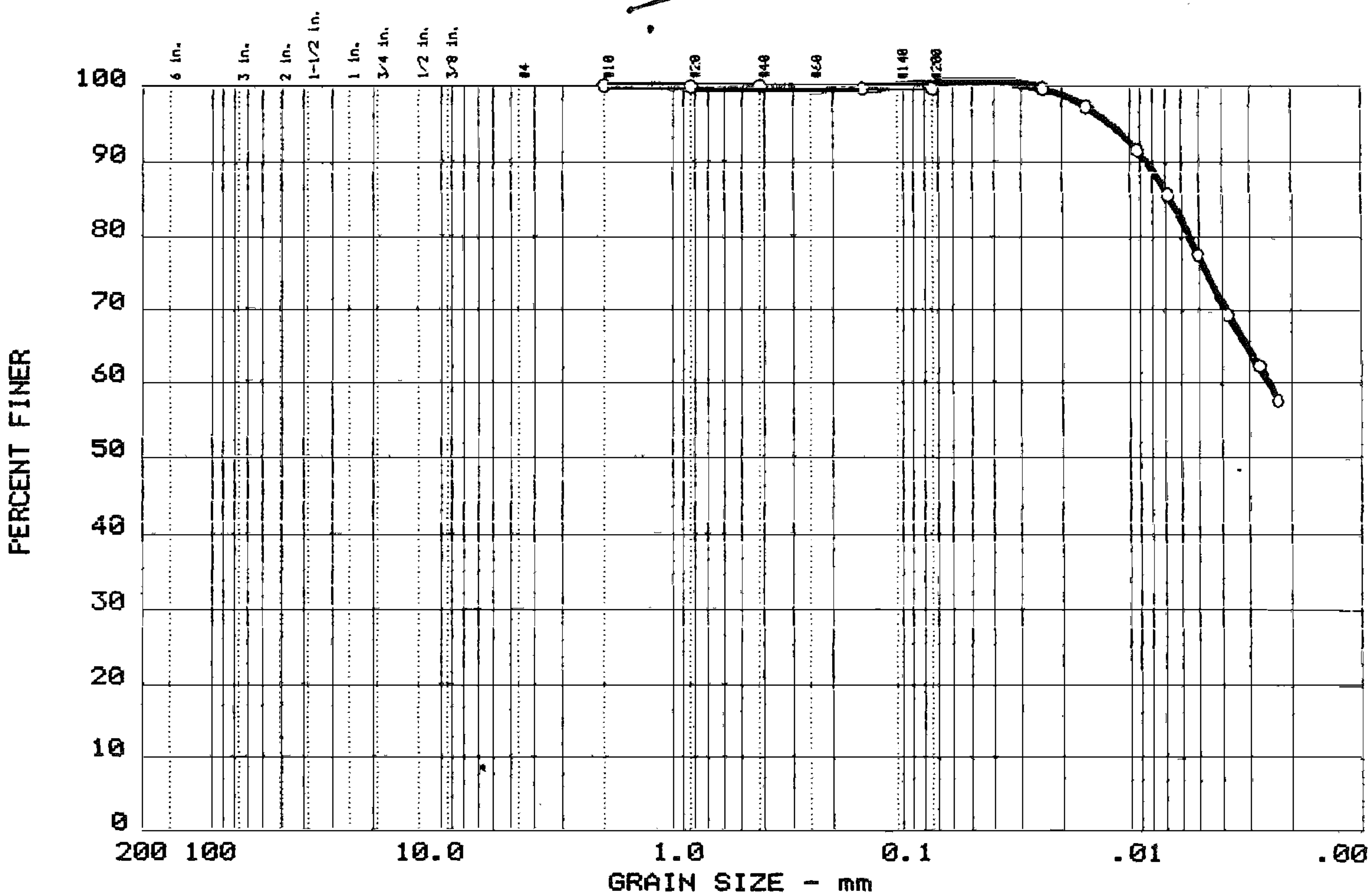
Remarks:
JAR SAMPLE

GS-318
A-273

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 13

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	12	0.0	0.0	-0.4	23.1	77.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	ML	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 159-87, S-9B, 17.5'-18.0'

Date: 6-13-88

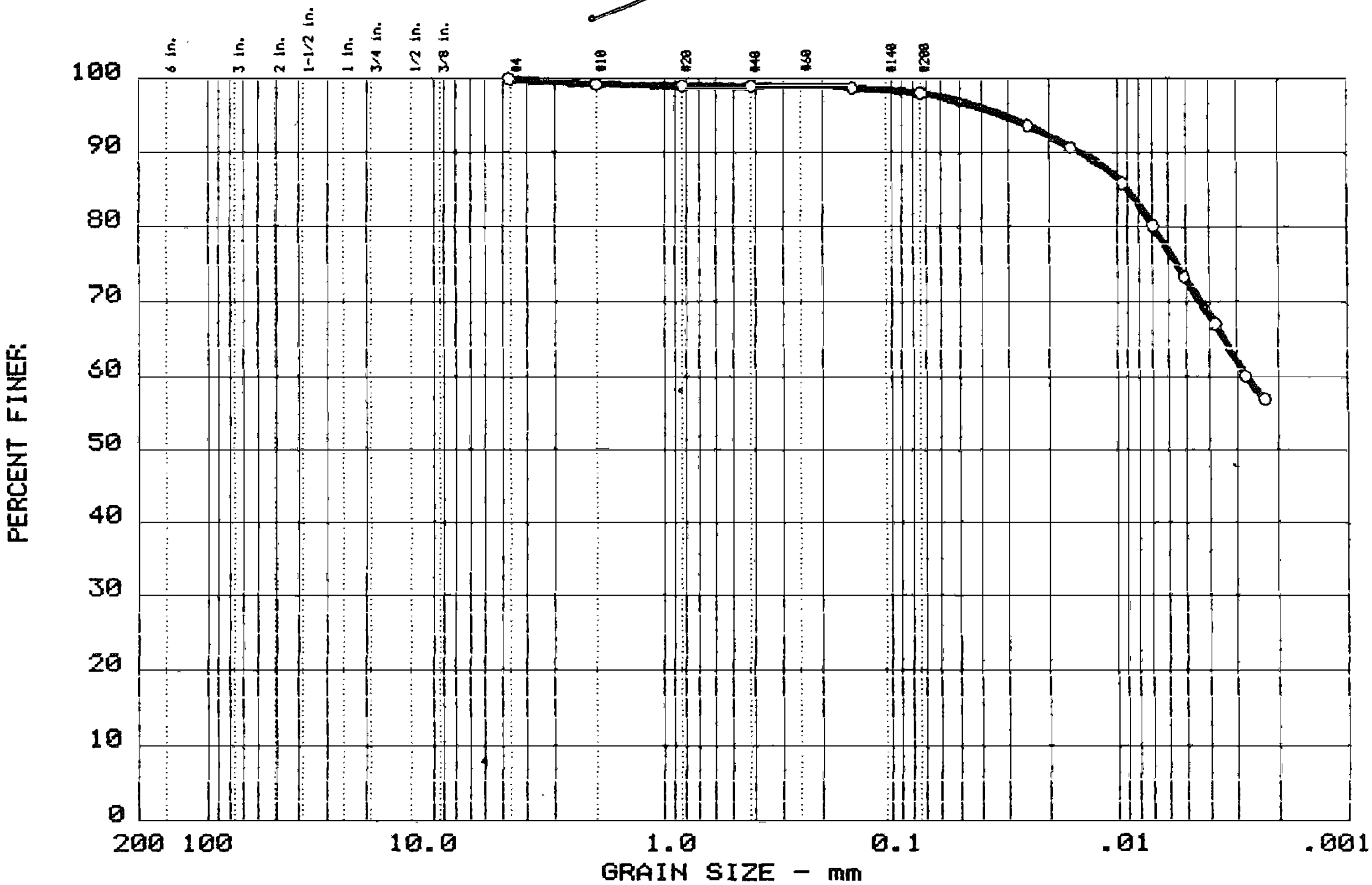
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
(INSUFFICIENT SAMPLE
FOR ATTERBERG LIMITS)

GS-284

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	0.0	1.9	25.3	72.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	41	19								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-8 6-90
Project: "S" AREA REMEDEATION
○ Location: BH - 159-87, S-12, 22.0'-24.0'

Date: 6-13-88

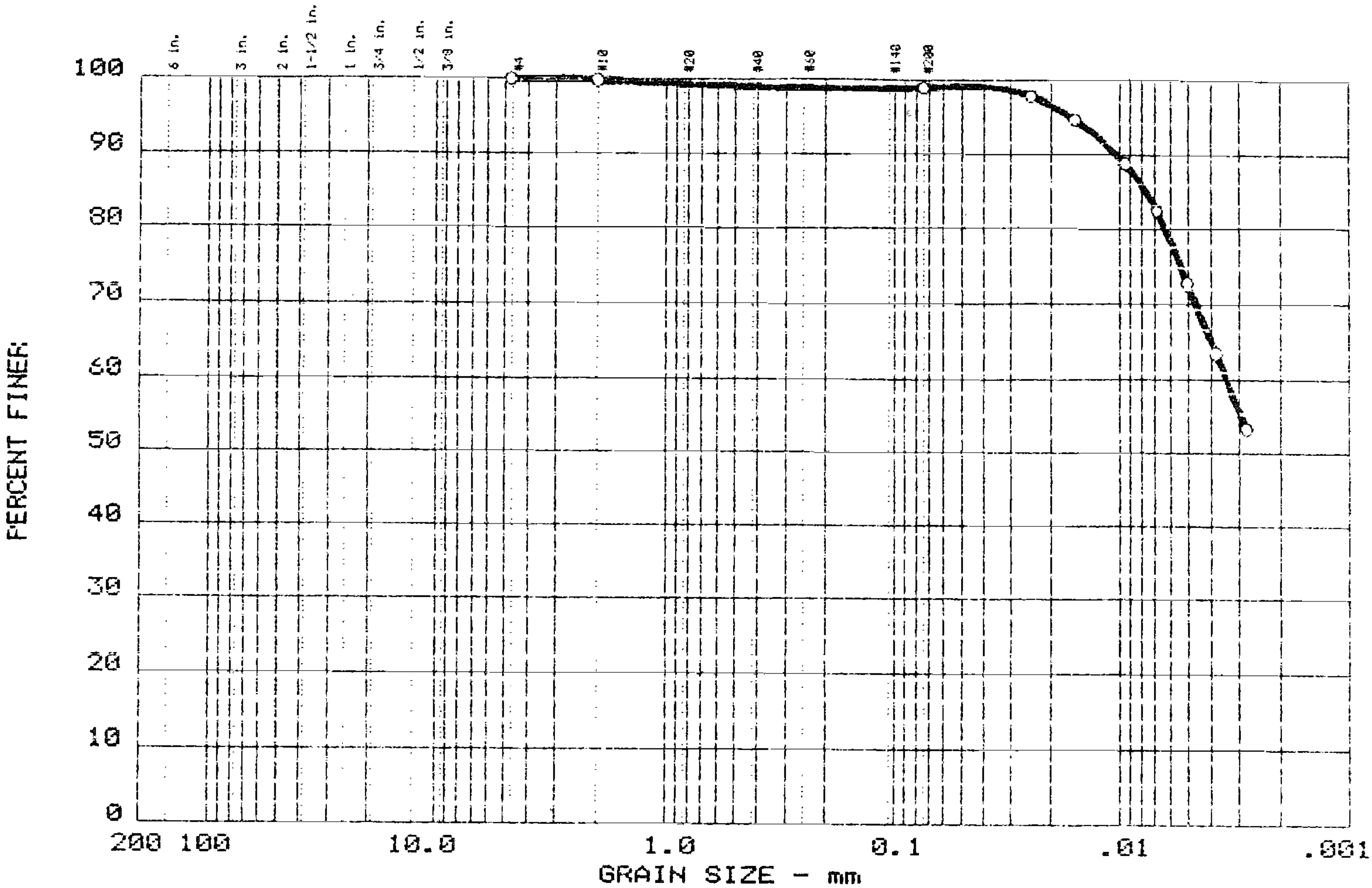
Remarks:
JAR SAMPLE

GS-285
A-243

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	0.0	1.0	26.9	72.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	38	16								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH -159A, S-4, 24.0'-26.0'

Date: 6-8-88

Remarks:
UNDISTURBED SAMPLE

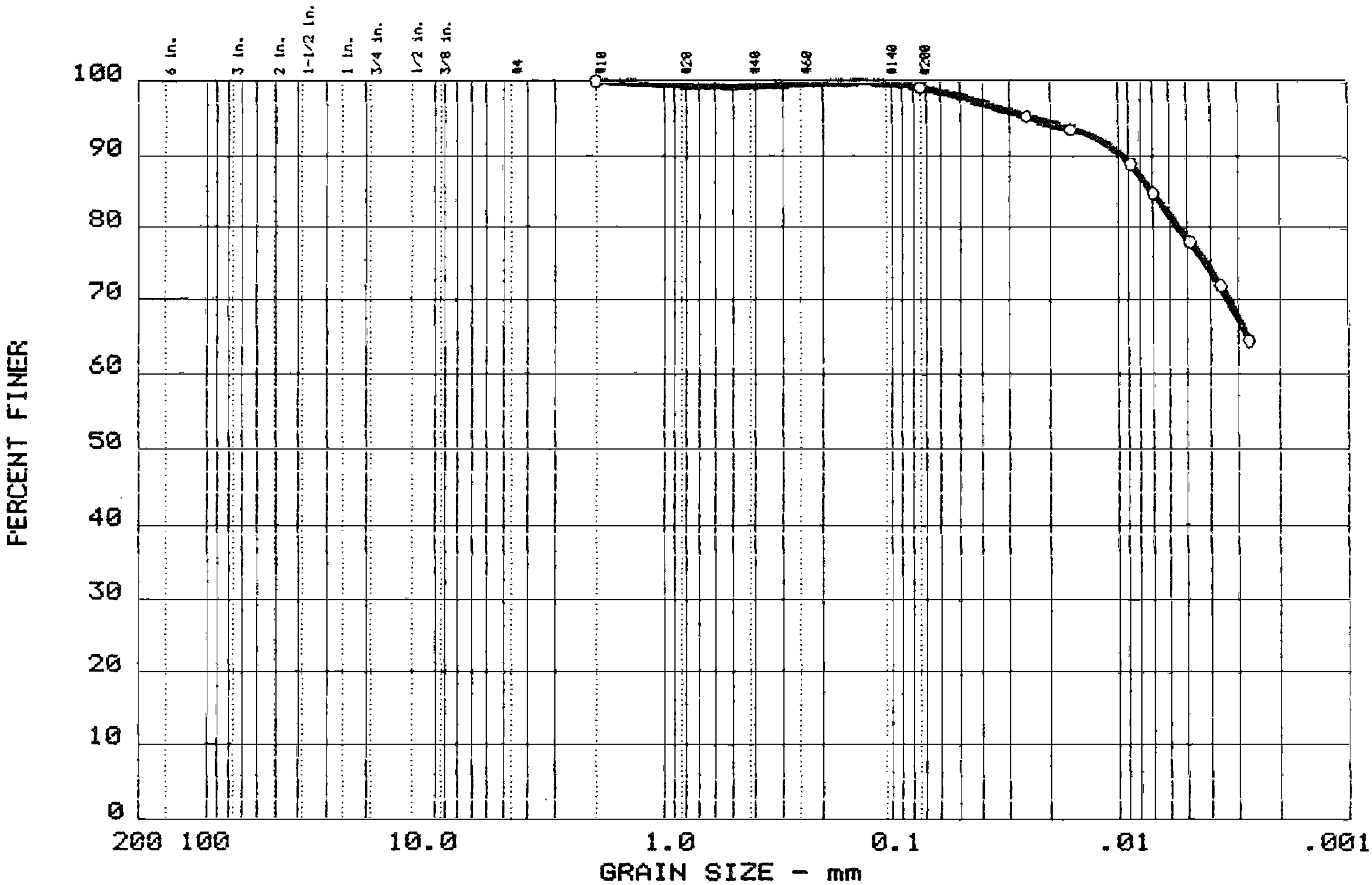
GS-262
A-222
P-40

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	18	0.0	0.0	0.8	20.9	78.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	46	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 159A , S-5, 26.0'-28.0'

Date: 6-8-88

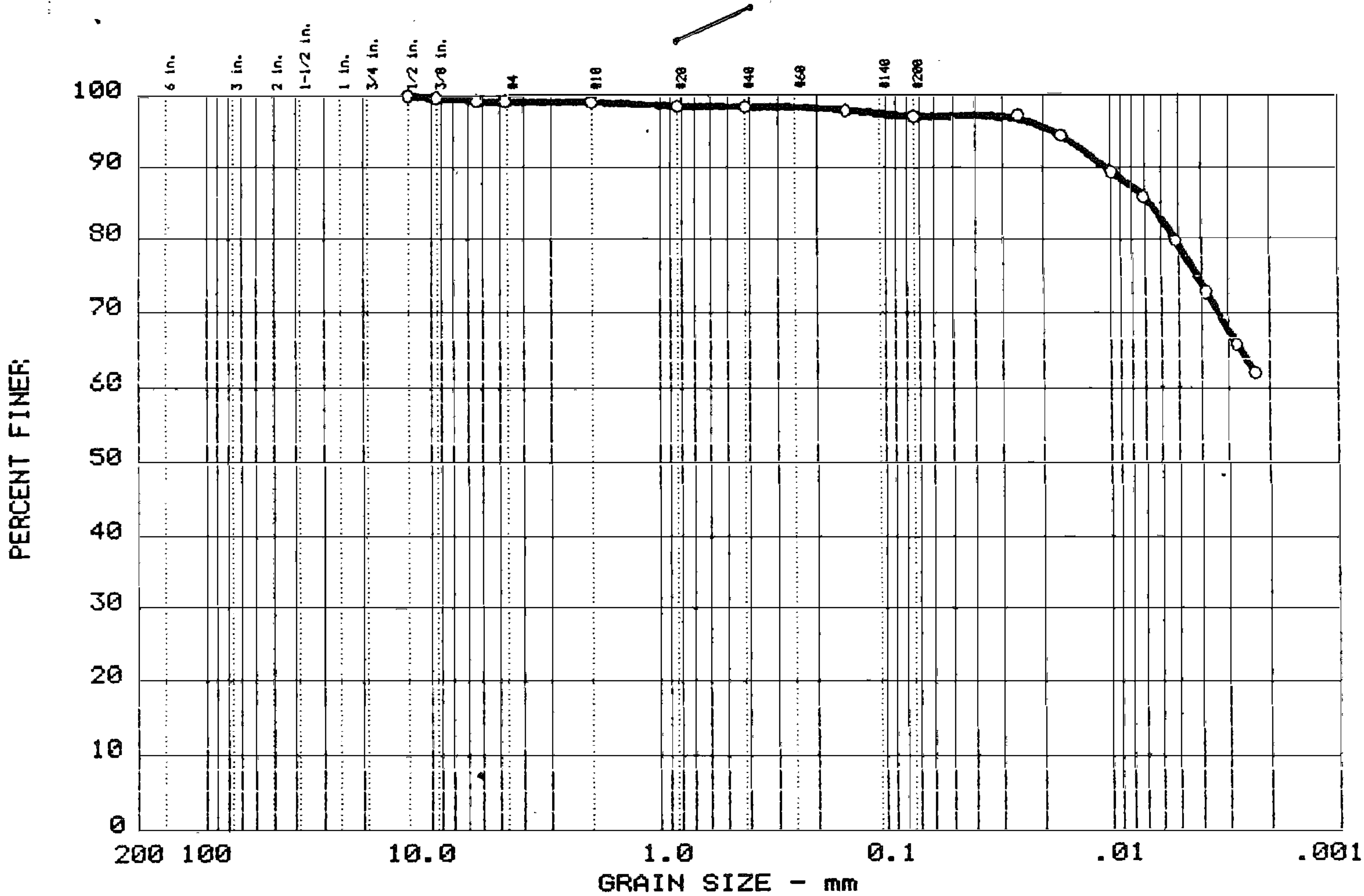
Remarks:
UNDISTURBED SAMPLE

GS-263
A-223
P-41

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	13	0.0	0.8	2.0	18.3	78.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	47	24								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 159A-87, S-6, 28.0'-30.0'

Date: 6-13-88

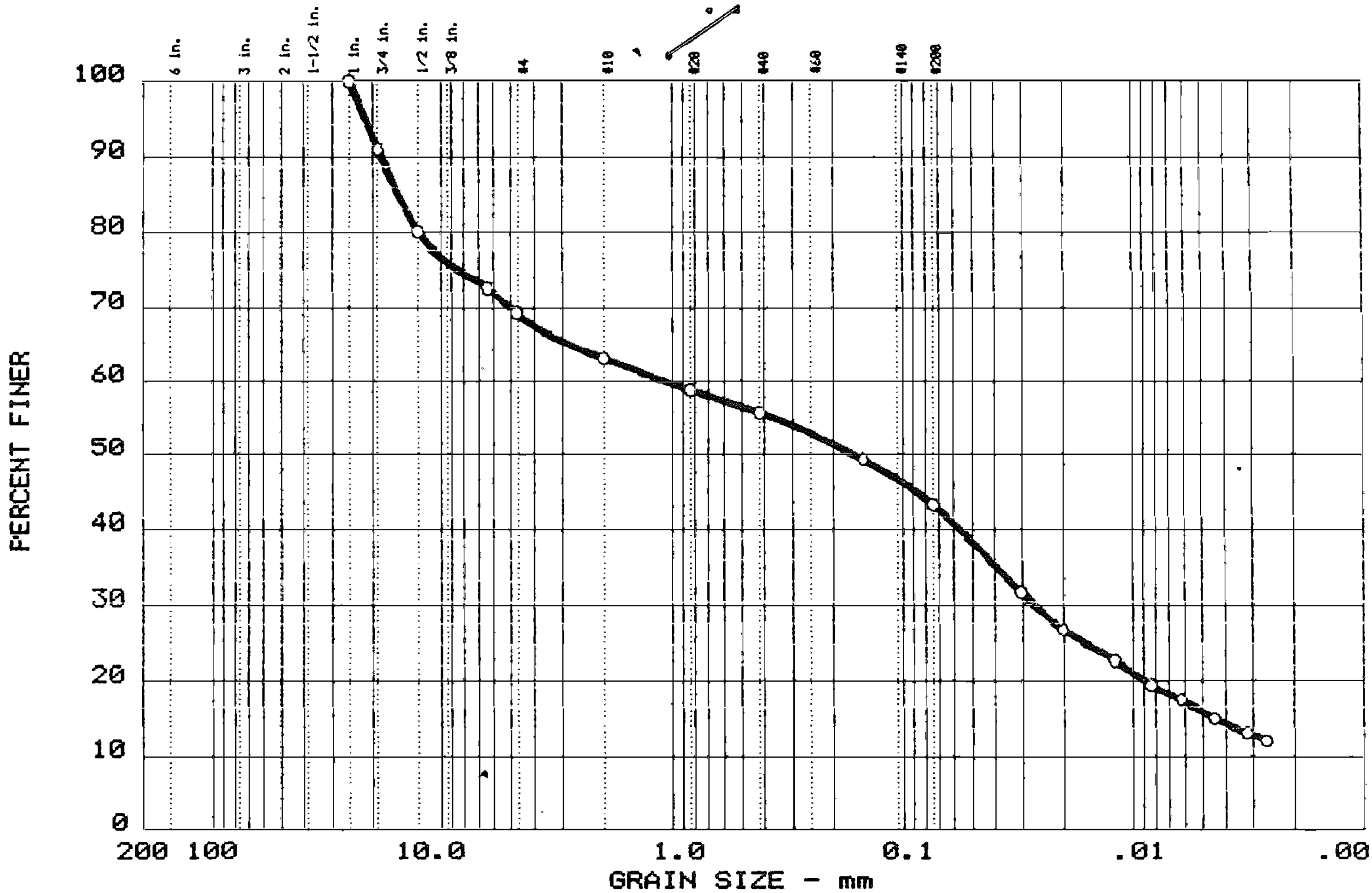
Remarks:
JAR SAMPLE

GS-282
A-242

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	14	0.0	30.6	26.2	27.3	15.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA	15.49	1.06	0.16	0.027	0.0044			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SILT SOME SAND LITTLE CLAY	GM	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 159A-87, S-10/11, 36.0'-36.5'

Date: 6-13-88

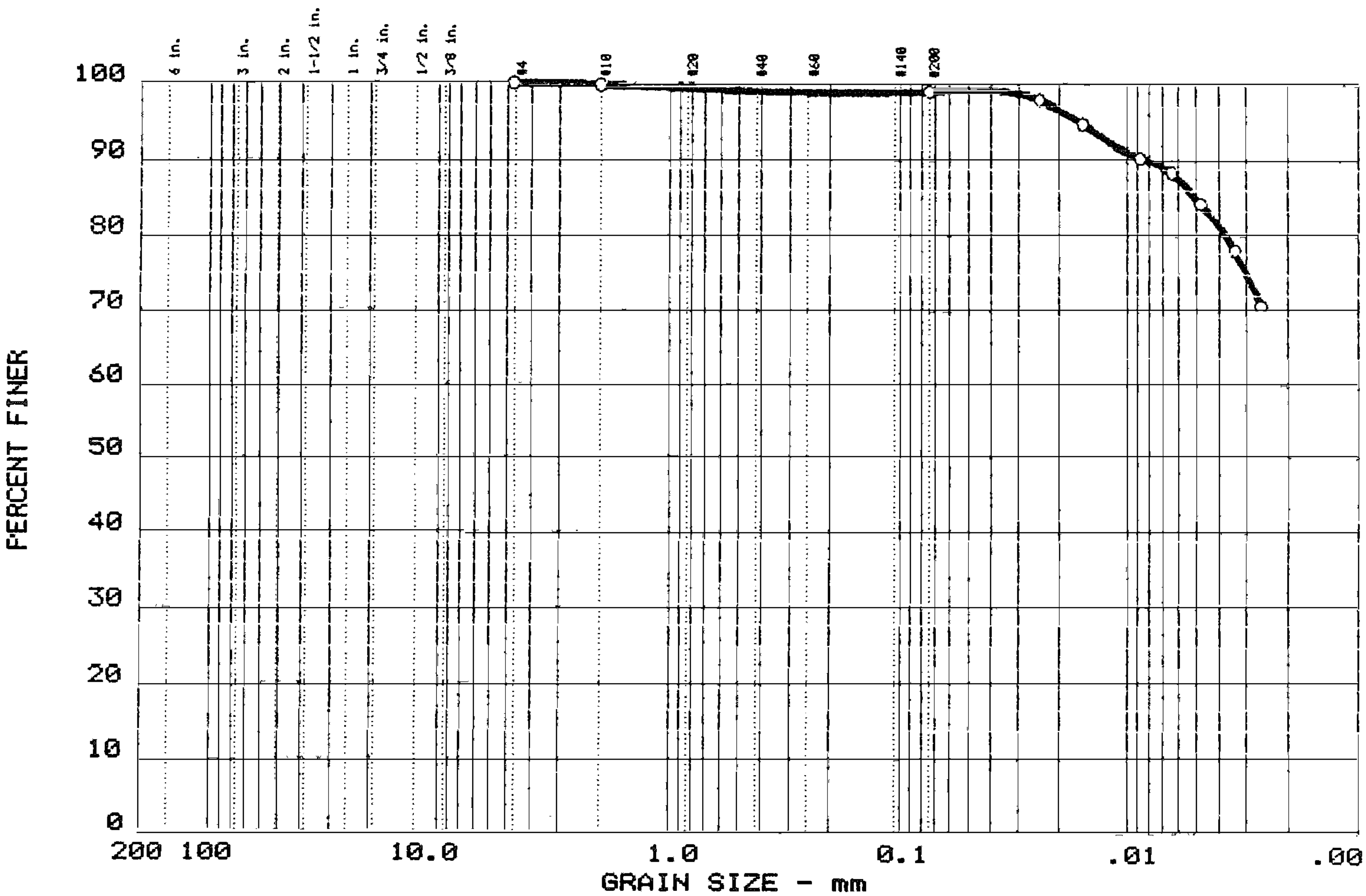
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
(INSUFFICIENT SAMPLE
SIZE FOR ATTERBERG)

GS-283

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	17	0.0	0.0	1.0	14.1	84.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	51	31								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CH	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 160 , S-13, 24.0'-26.0'

Date: 6-8-88

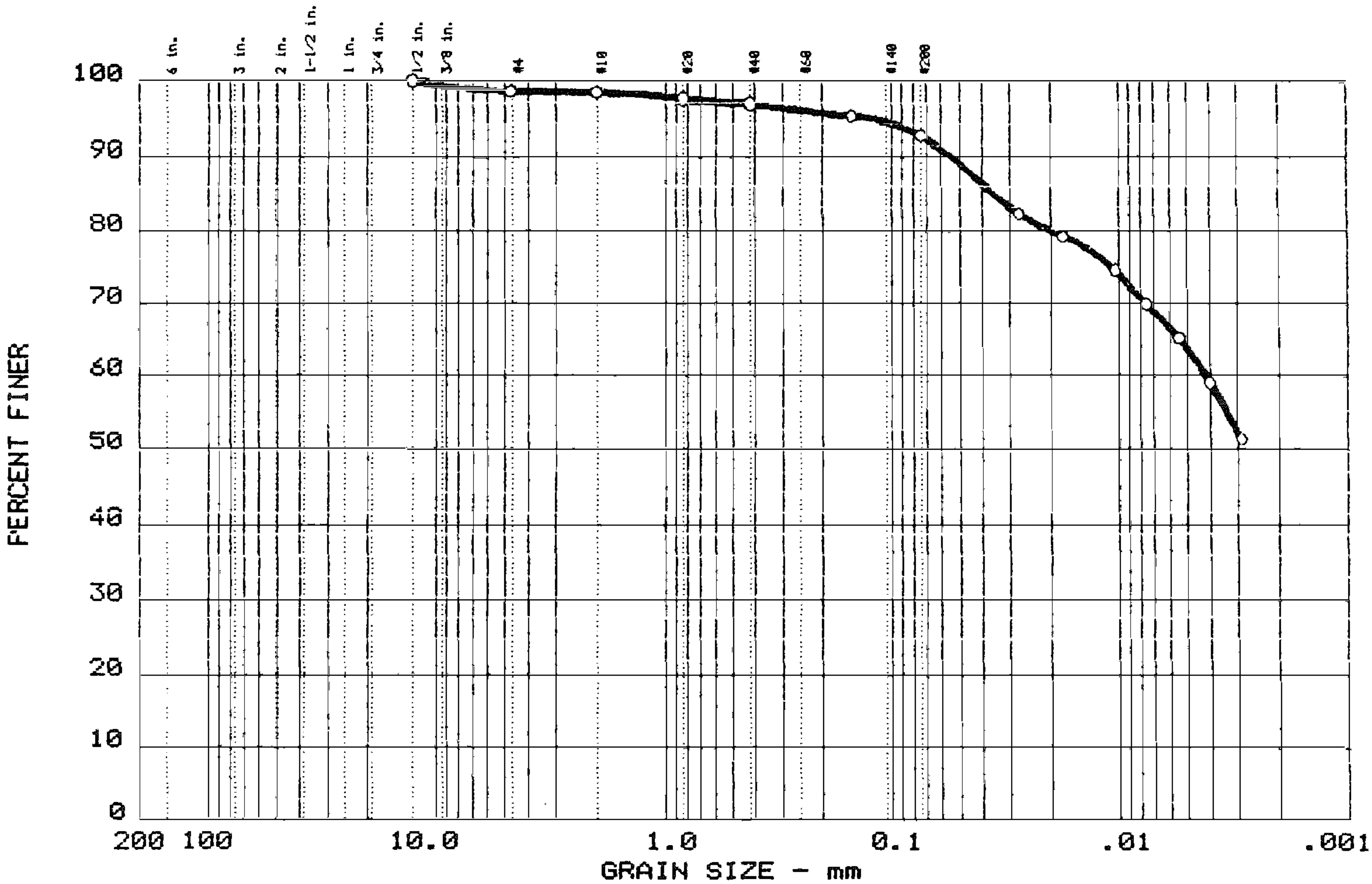
Remarks:
UNDISTURBED SAMPLE

GS-264
A-224
P-42

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	15	0.0	1.4	5.7	29.4	63.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	33	23								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND TRACE GRAVEL	CL	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 160-88, S-17, 32.0'-34.0'

Date: 6-8-88

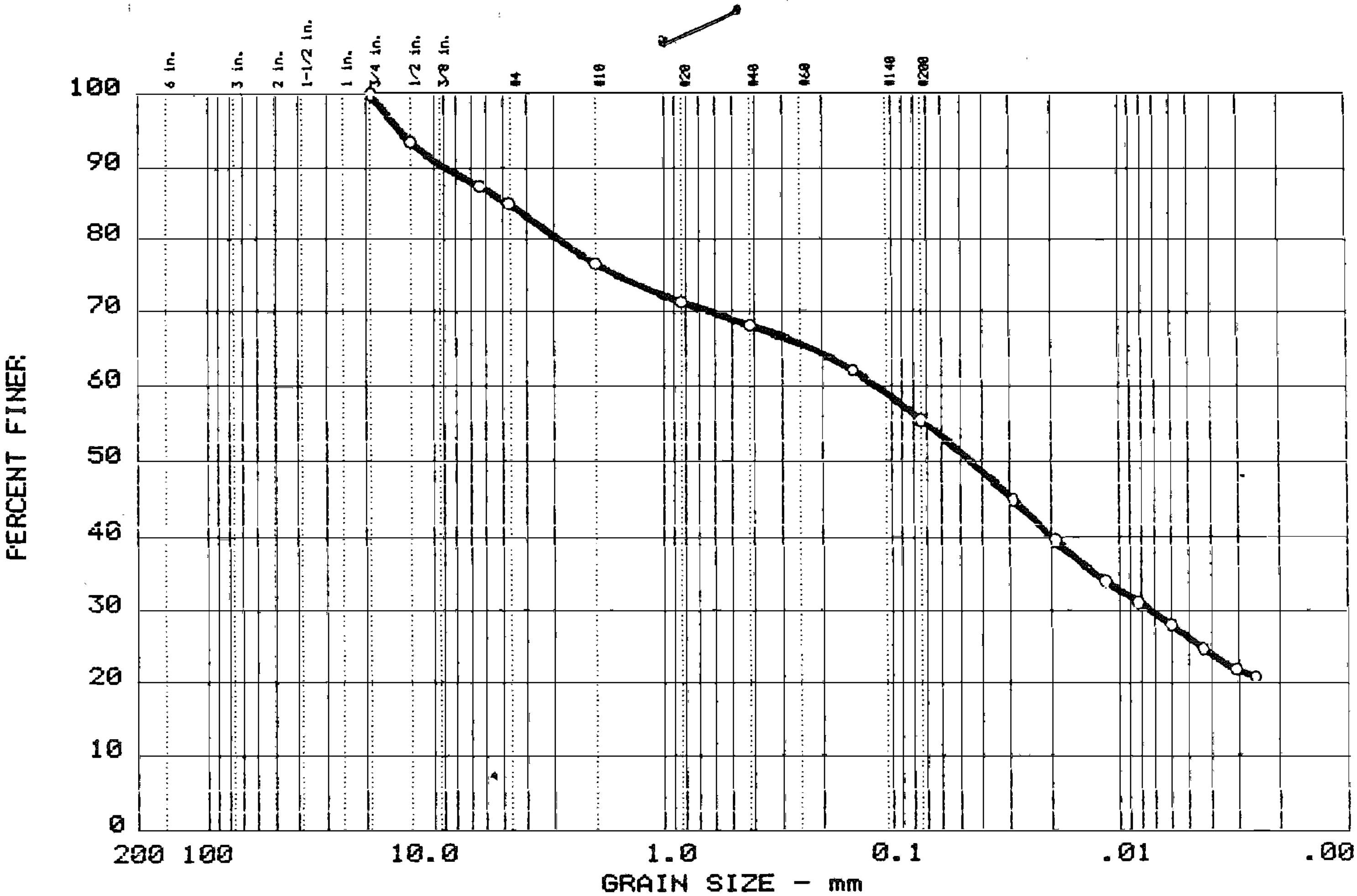
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
UNDISTURBED SAMPLE

GS-265
A-225
P-43

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	15	0.0	15.0	29.5	29.3	26.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19	6	4.73	0.12	0.04	0.007				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILTY SAND SOME CLAY LITTLE GRAVEL	CL-ML	

Project No.: BD-8 6-90
Project: "S" AREA REMEDEATION
○ Location: BH - 160-87, S-19/20, 36.0'-37.6'

Date: 6-13-88

Remarks:
JAR SAMPLE

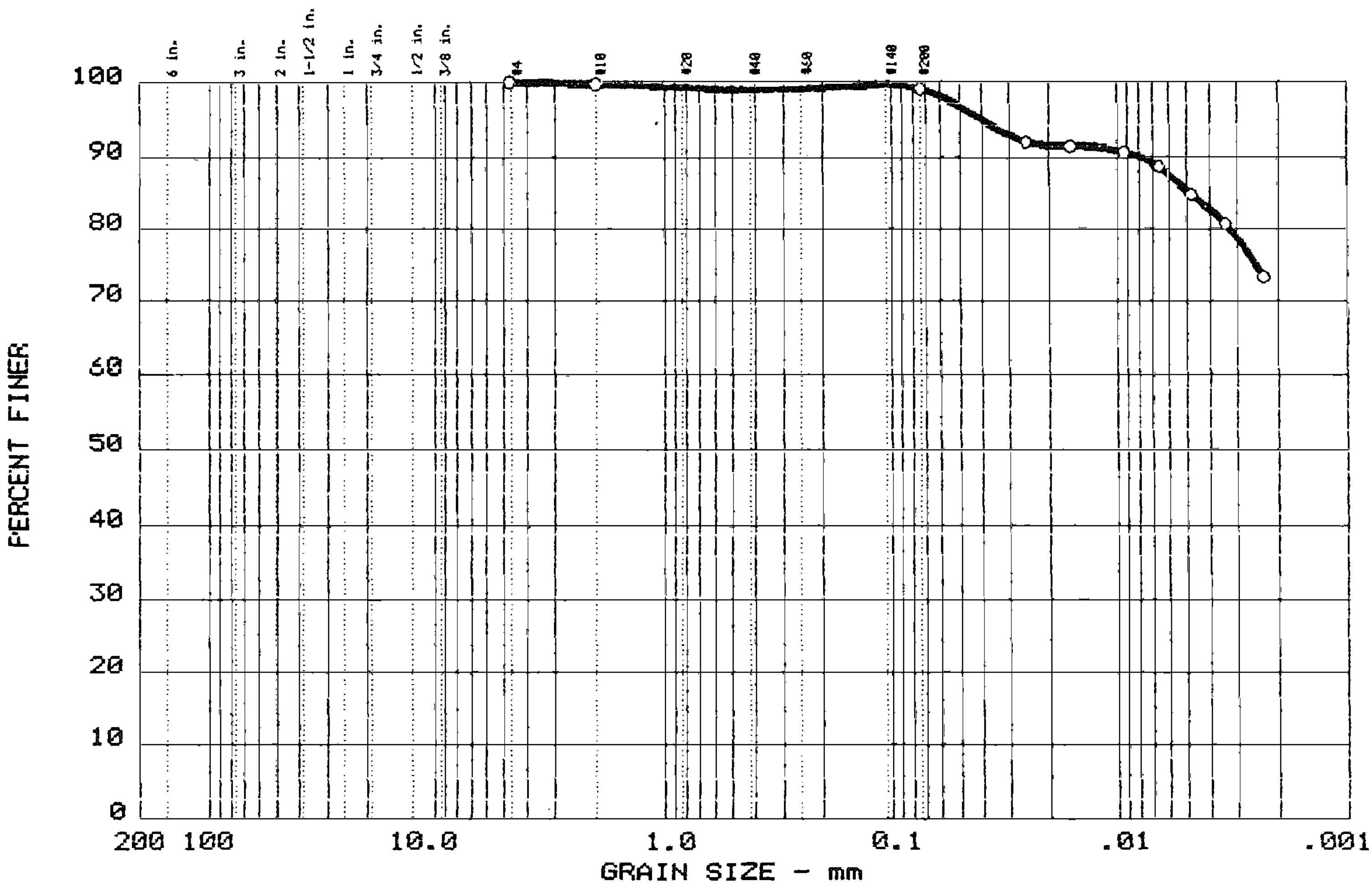
M

GS-286
A-244

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	13	0.0	0.0	0.9	13.8	85.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	55	35								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CH	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 161-88, S-21, 38.0'-40.0'

Date: 6-8-88

Remarks:

UNDISTURBED SAMPLE

GS-266

A-226

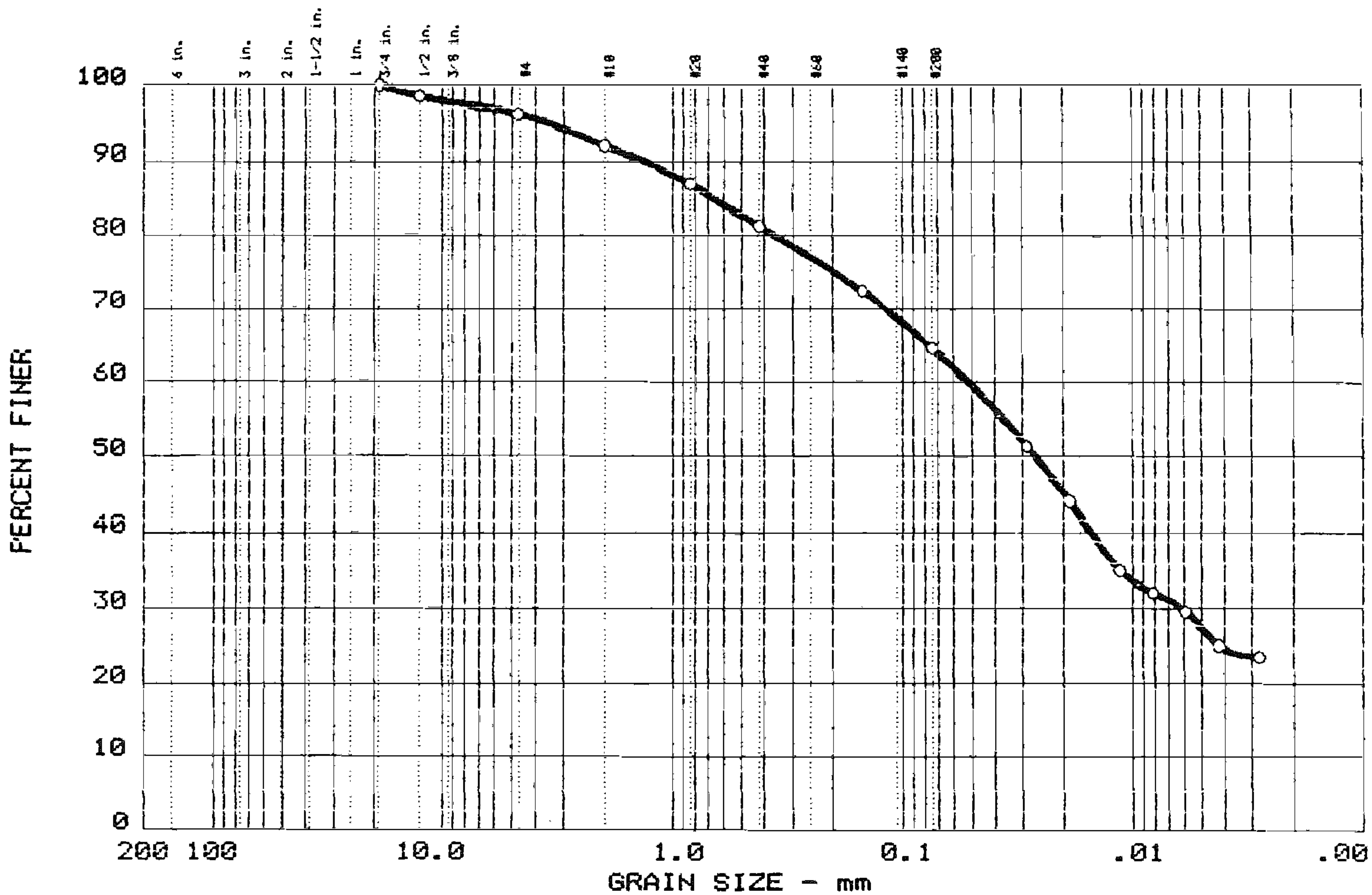
P-44

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	10	0.0	3.7	31.6	37.3	27.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	17	4	0.65		0.03	0.006				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH 161-88, S-22, 40.0'-42.0'

Date: 6-8-88

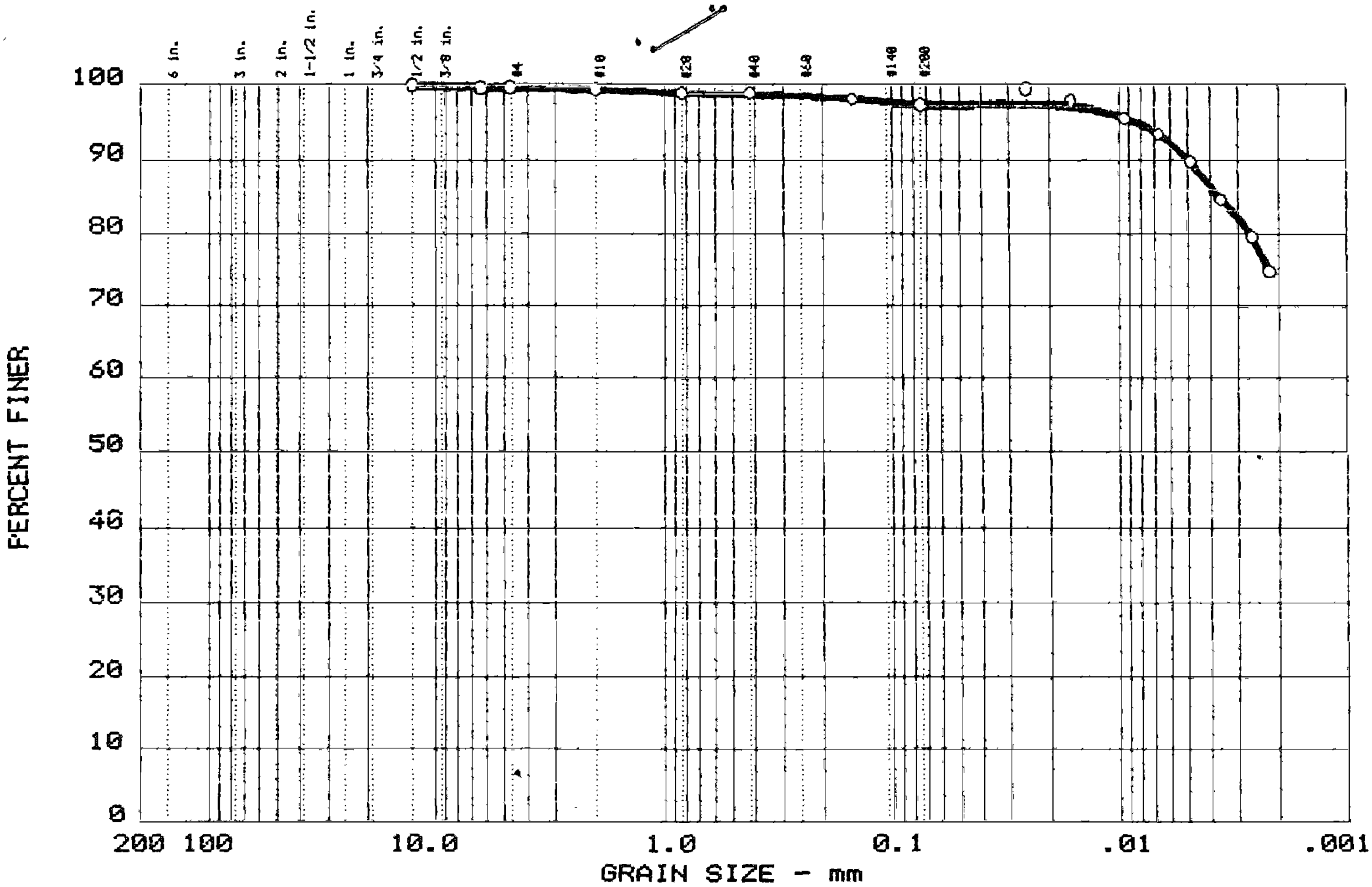
Remarks:
UNDISTURBED SAMPLE

GS-267
A-227
P-45

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 01

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	17	0.0	0.4	2.2	7.4	90.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	49	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY TRACE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 163-87, S-13, 22.4'-24.0'

Date: 6-13-88

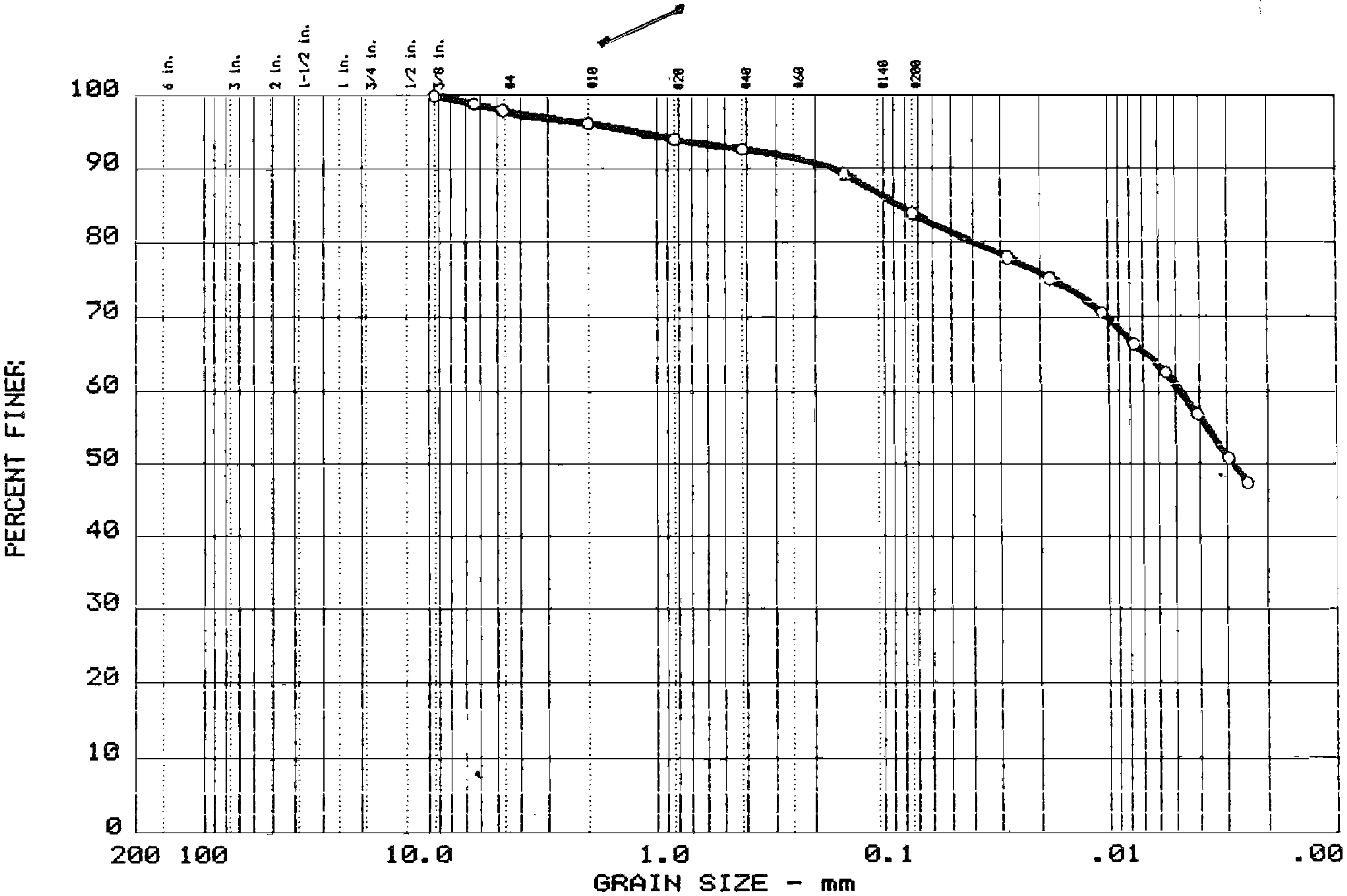
Remarks:
JAR SAMPLE

GS-2/2
A-232

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	16	0.0	2.0	14.0	23.2	60.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	35	17	0.08		0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT LITTLE SAND TRACE GRAVEL	CL	

Project No.: BD-8 6-90
Project: "S" AREA REMEDEATION
○ Location: BH - 163-87, S-14, 24.0'-26.0'

Date: 6-13-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:

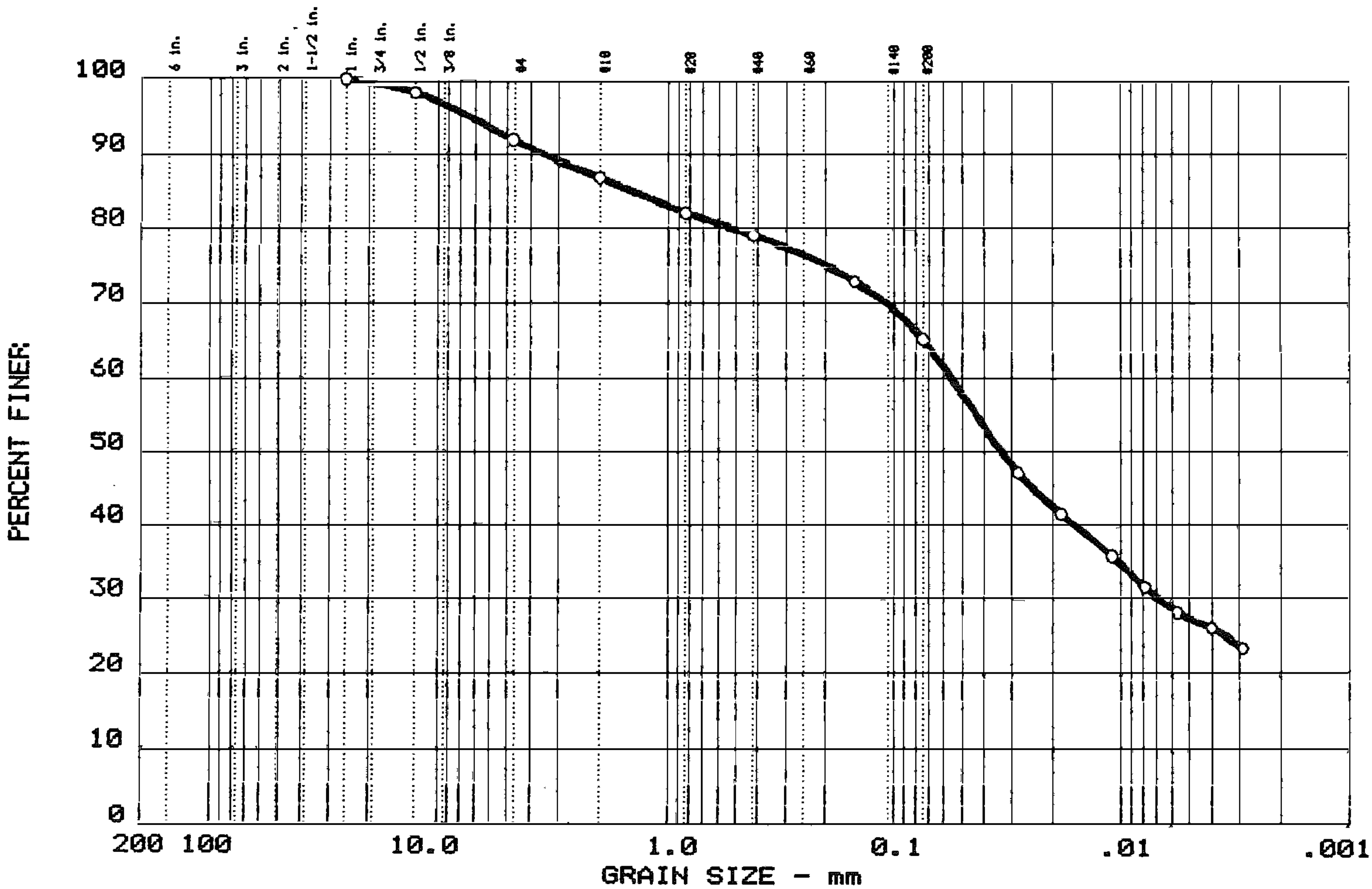
JAR SAMPLE

GS-273 F

A-233

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	12	0.0	8.2	26.5	37.7	27.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	19	6	1.46		0.03	0.007				

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME CLAY SOME SAND TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 163-87, S- ,26.3'-27.0'

Date: 6-22-88

Remarks:

SHELBY TUBE

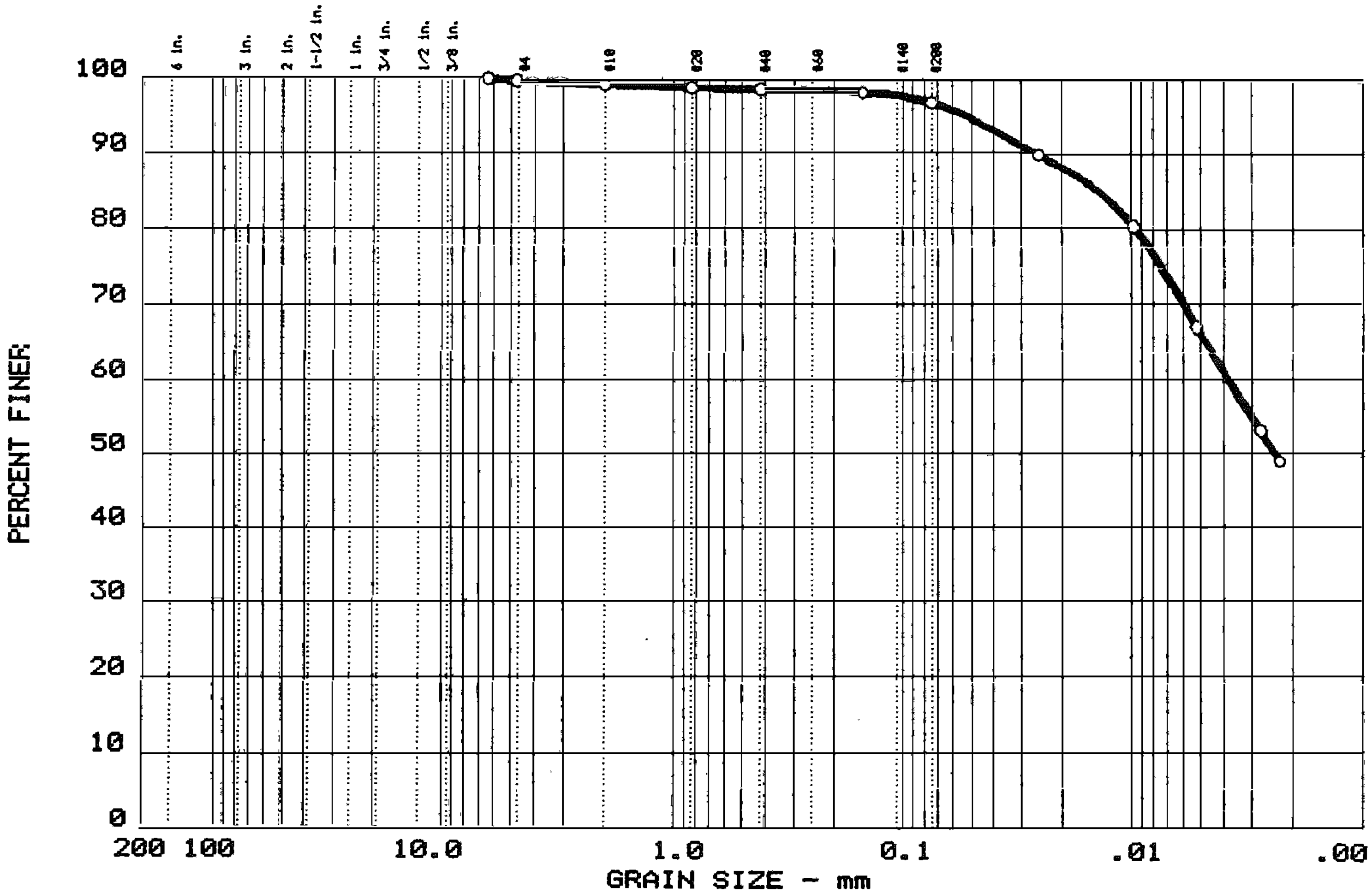
GS-333
A-286
P-52

F

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	19	0.0	0.3	2.8	30.7	66.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	37	19			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90

Project: "S" AREA REMEDIATION

O Location: BH - 169-87, S-11B, 23.0'-24.0'

Date: '

Remarks:

JAR SAMPLE

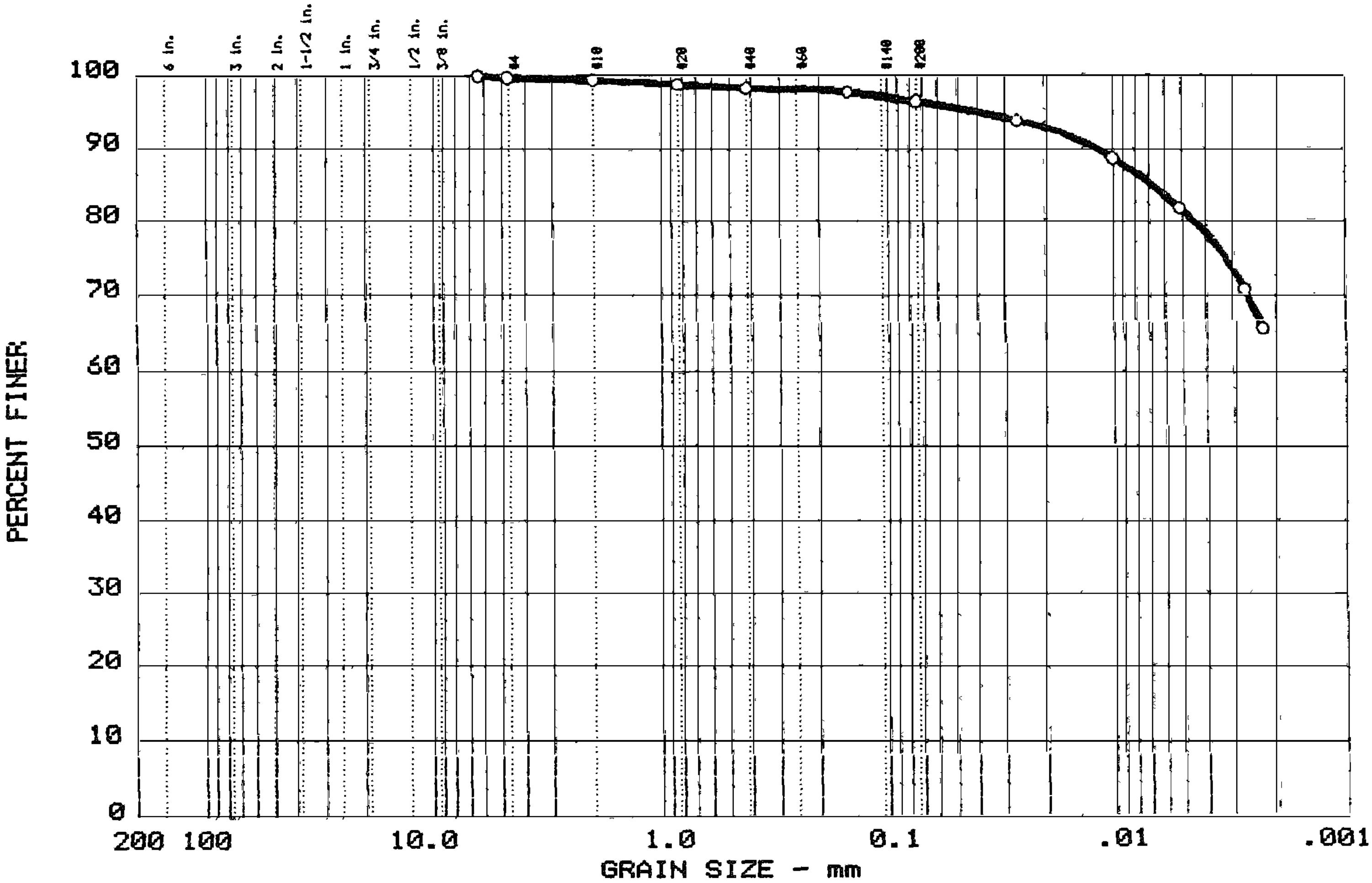
GS-292
A-249

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 14

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	0.2	3.2	15.3	81.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	45	22								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 169-87, S-17,34.0'-36.0'

Date: 6-21-88

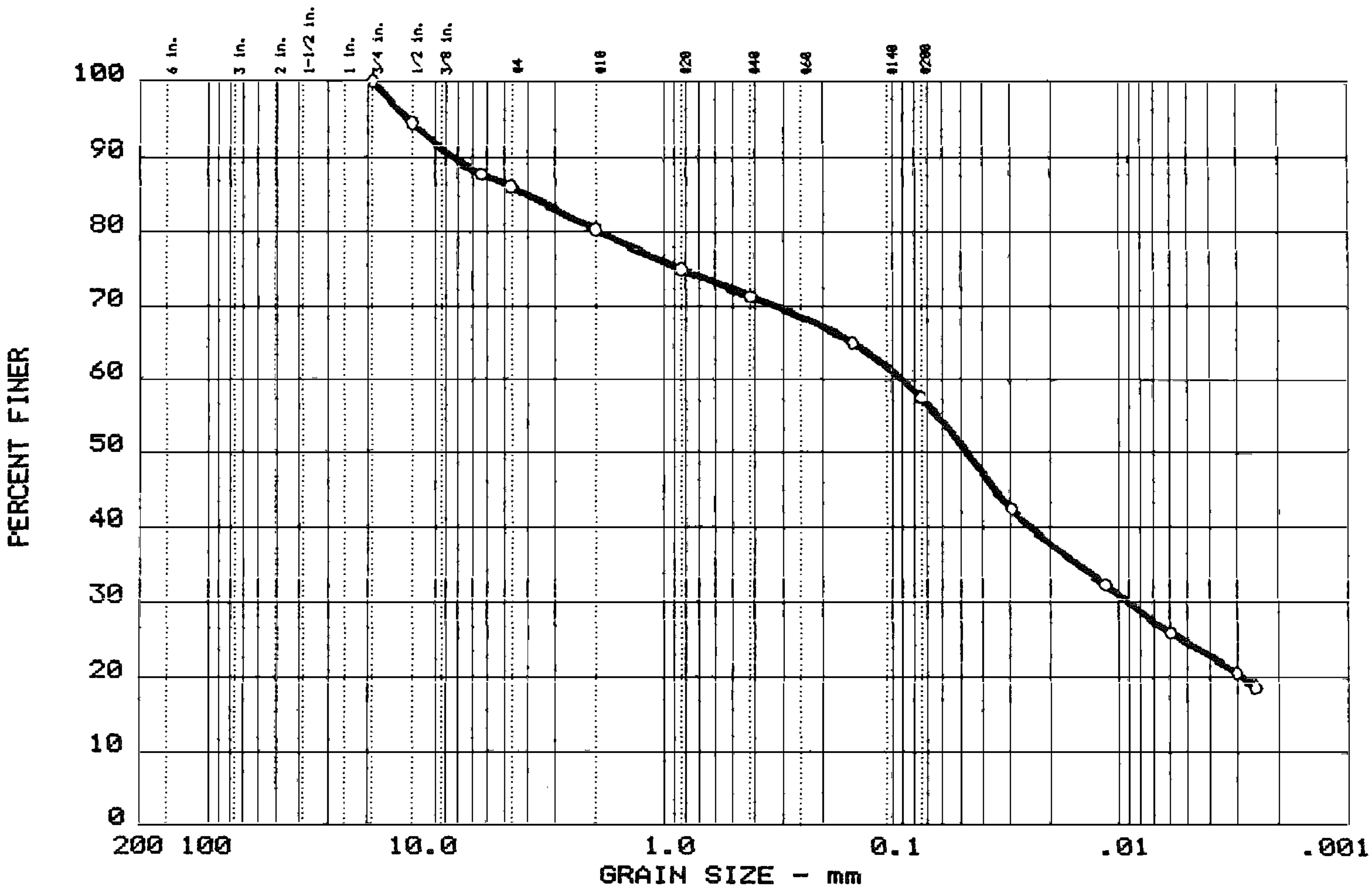
Remarks:
JAR SAMPLE

GS-293
A-250

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 14

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	2	0.0	13.9	28.6	33.0	24.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	19	9	3.94	0.09	0.05	0.009				

MATERIAL DESCRIPTION	USCS	AASHTO
o SILT SOME SAND SOME CLAY LITTLE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH 170, S-20, 38.0'-39.0'

Date: 6-21-88

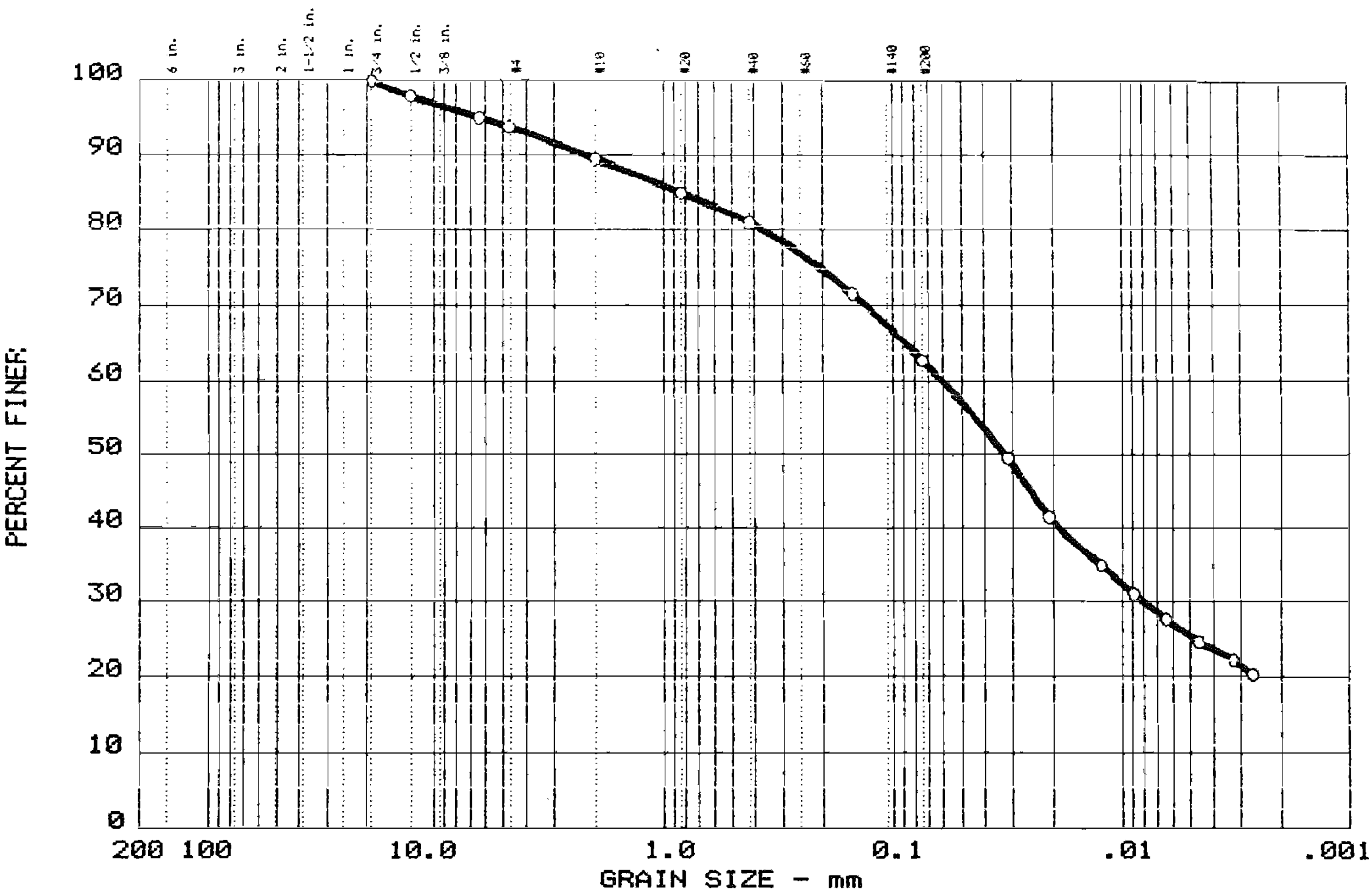
Remarks:
JAR SAMPLE

GS-294
A-251

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 15

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	6.3	31.0	37.5	25.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	6	0.85		0.03	0.008				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 171-87, S-13B, 27.6'-28.0'

Date: 6-13-88

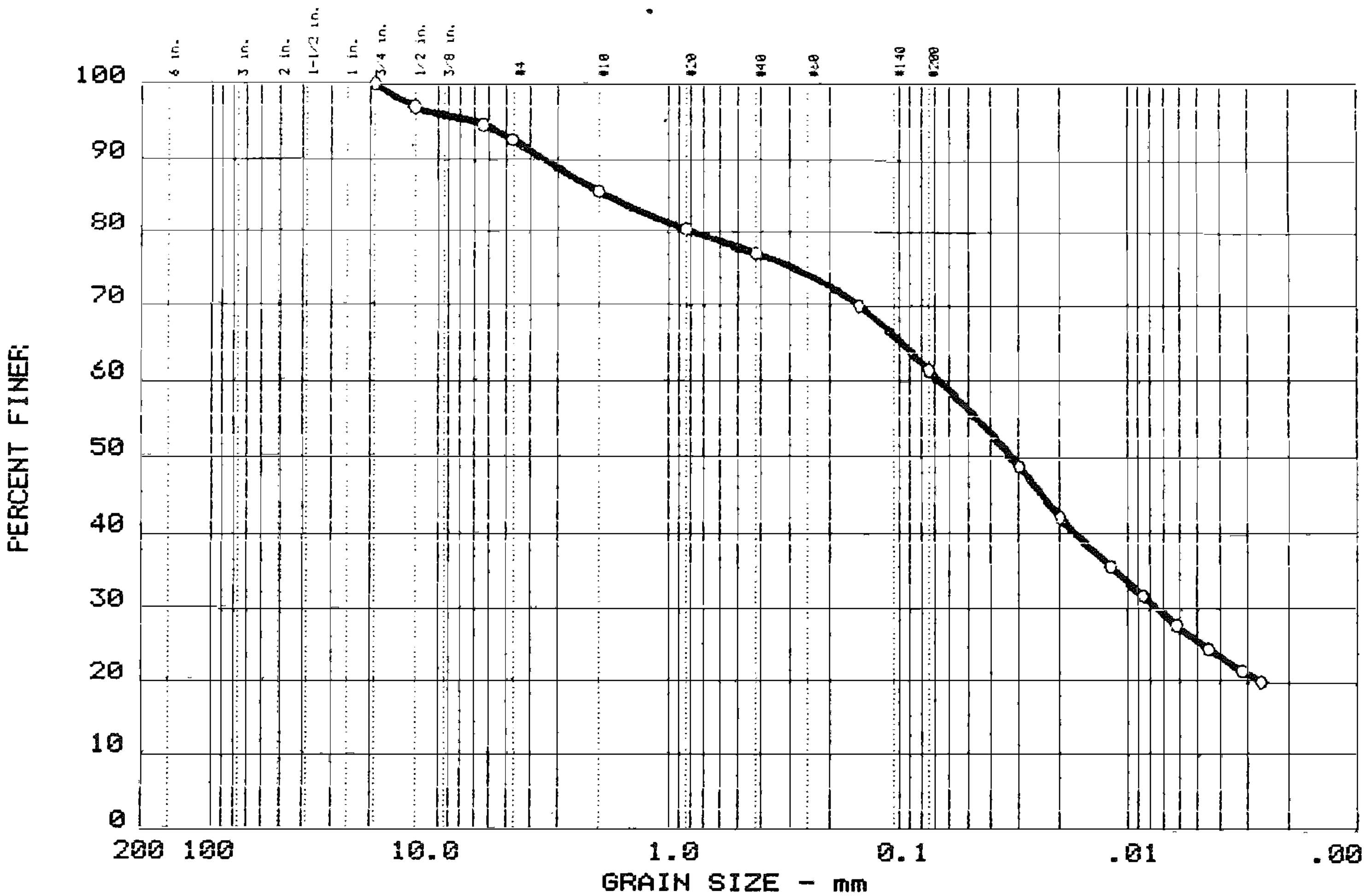
Remarks:
JAR SAMPLE

GS-295
A-252

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 14

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	20	0.0	7.4	31.1	35.8	25.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	19	6	1.84		0.03	0.007				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 171-87, S-14A, 28.0'-29.7'

Date: 6-13-88

Remarks:

JAR SAMPLE

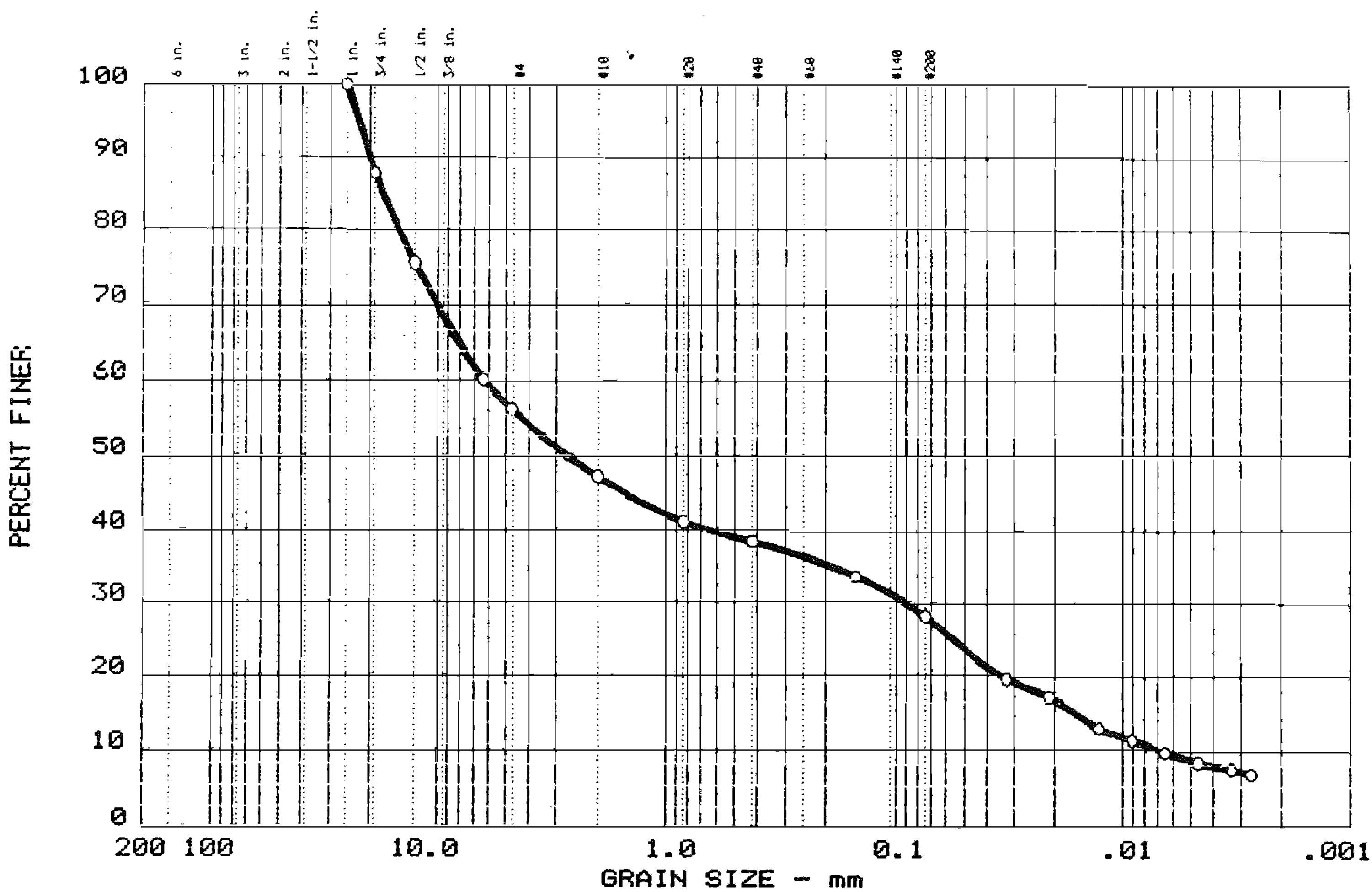
GS-296
A-253

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 13

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	18	0.0	43.8	28.1	19.5	8.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	15	2	17.58	6.24	2.66	0.089	0.0160	0.0068	0.19	922.6

MATERIAL DESCRIPTION	USCS	AASHTO
O GRAVEL SOME SAND LITTLE SILT TRACE CLAY	GM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 171-87, S-14B, 29.7'-30.0'

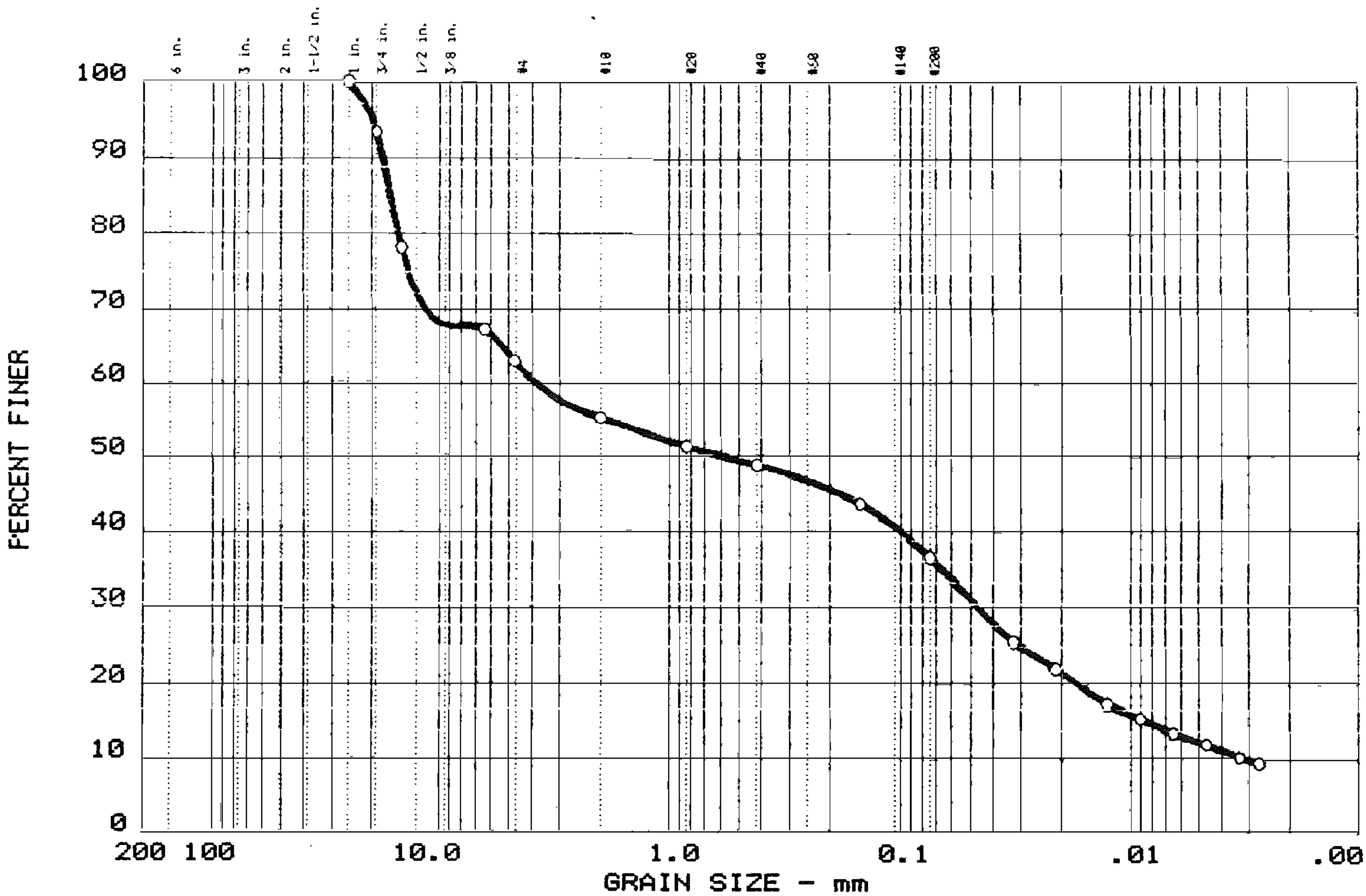
Date: 6-13-88

Remarks:
JAR SAMPLE
GS-297
A-254

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 11

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	19	0.0	37.1	26.4	24.2	12.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	16	5	16.46	3.86	0.59	0.046	0.0084	0.0029	0.19	1318.3

MATERIAL DESCRIPTION	USCS	AASHTO
o GRAVEL SOME SAND SOME SILT LITTLE CLAY	GC-GM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 171-87, S-15, 30.0'-31.0'

Date: 6-13-88

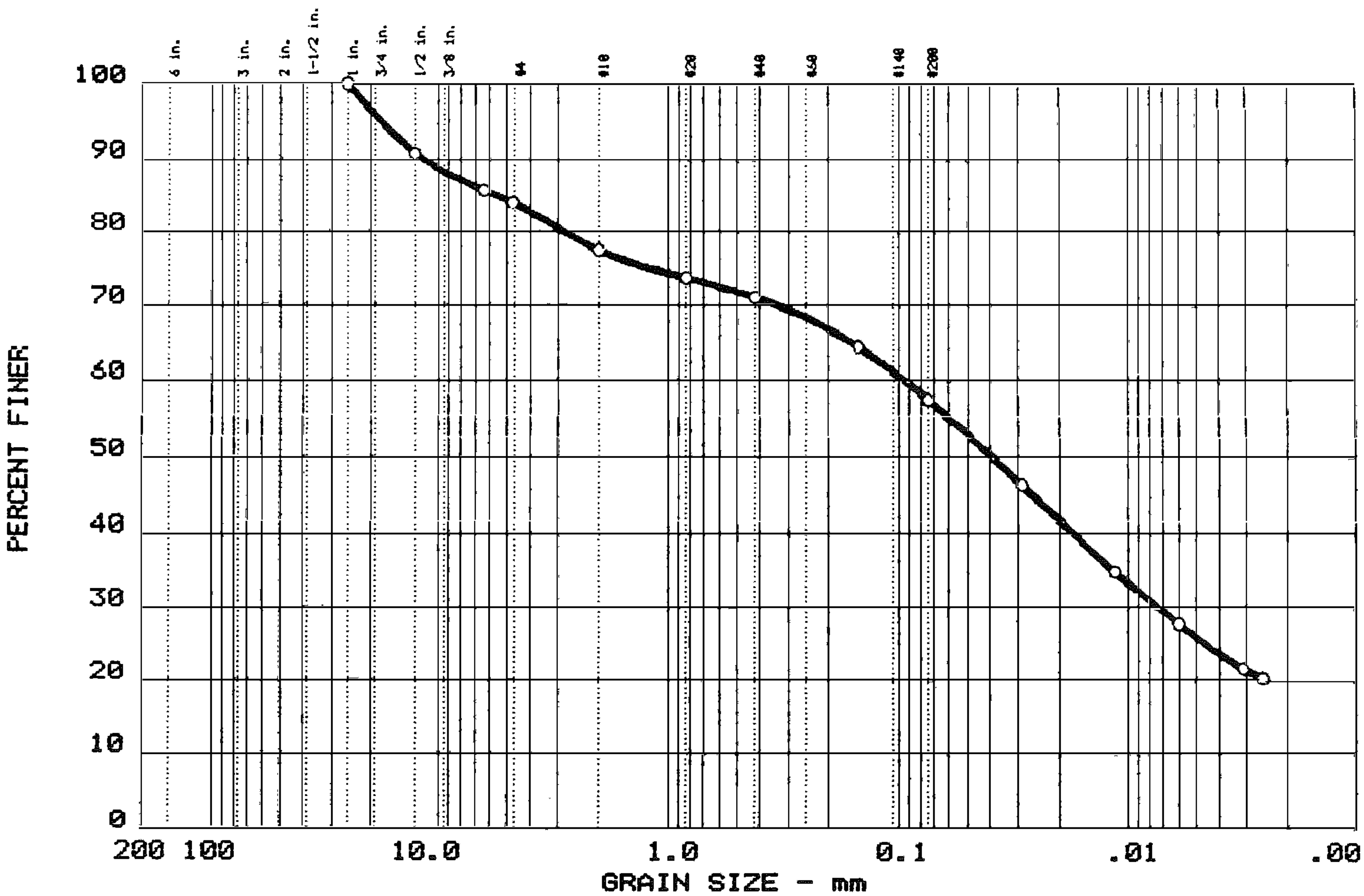
Remarks:
JAR SAMPLE

GS-298
A-255

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 12

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	3	0.0	16.0	26.5	31.6	26.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	22	9	5.56	0.09	0.04	0.007				

MATERIAL DESCRIPTION	USCS	AASHTO
o SILT SOME SAND SOME CLAY LITTLE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 173-87, S-22B, 43.5'-44.0'

Date: 6-21-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

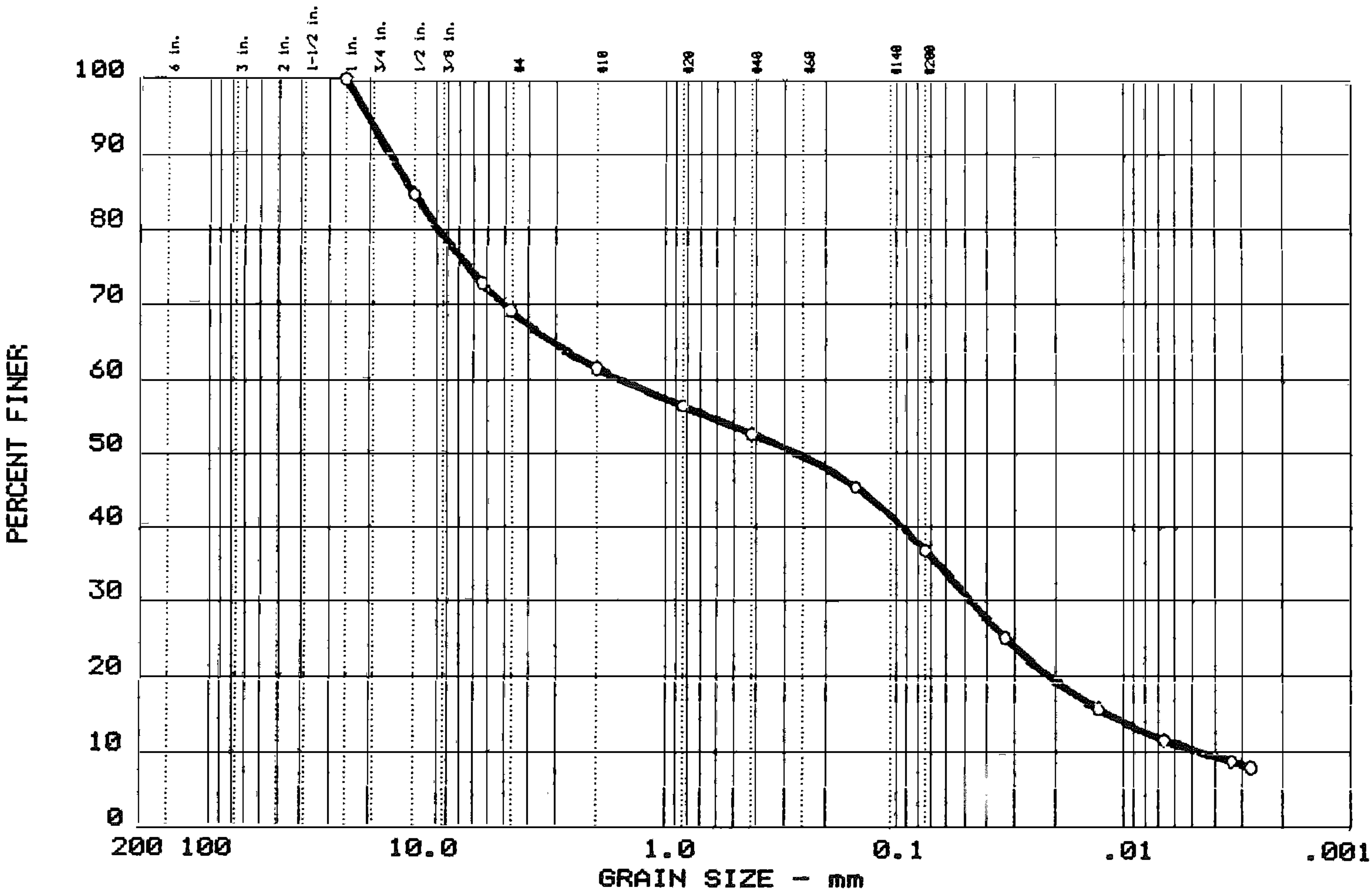
Remarks:
JAR SAMPLE

GS-299
A-256

M

Fig. No. 16

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	4	0.0	30.9	32.3	26.3	10.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	13	3	13.02	1.55	0.26	0.046	0.0113	0.0044	0.31	350.8

MATERIAL DESCRIPTION	USCS	AASHTO
o SAND SOME GRAVEL SOME SILT LITTLE CLAY	SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 173-87, S-23, 44.0'-45.0

Date: 6-21-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:

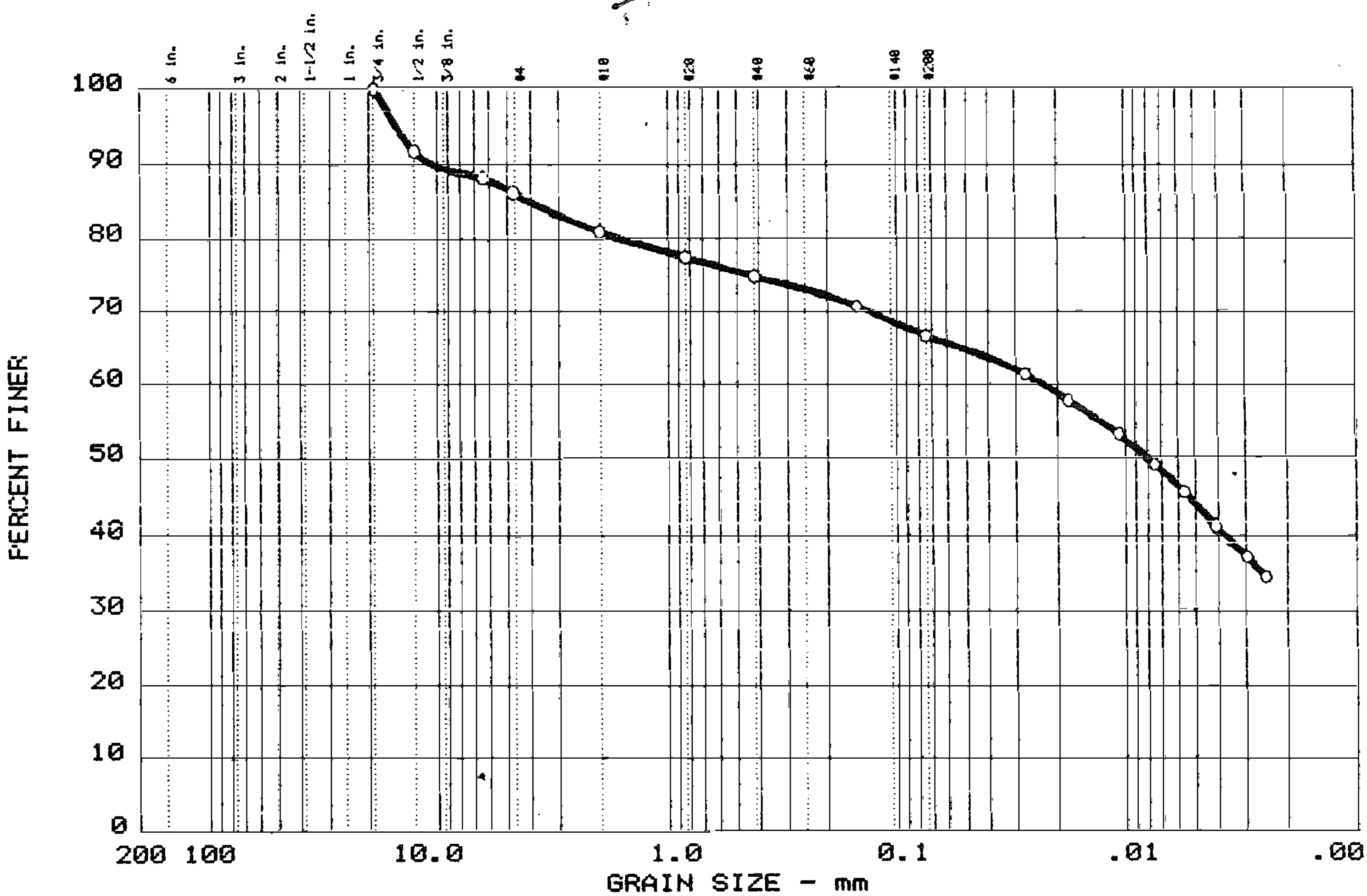
JAR SAMPLE

C

GS-300
A-257

Fig. No. 17

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	2	0.0	13.7	19.6	22.9	43.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	25	11	3.98		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT LITTLE SAND LITTLE GRAVEL	CL	

Project No.: BD-8$_6$-90
Project: "S" AREA REMEDEATION
○ Location: BH - 177-87, S-13, 26.0'-28.0'

Date: 6-13-88

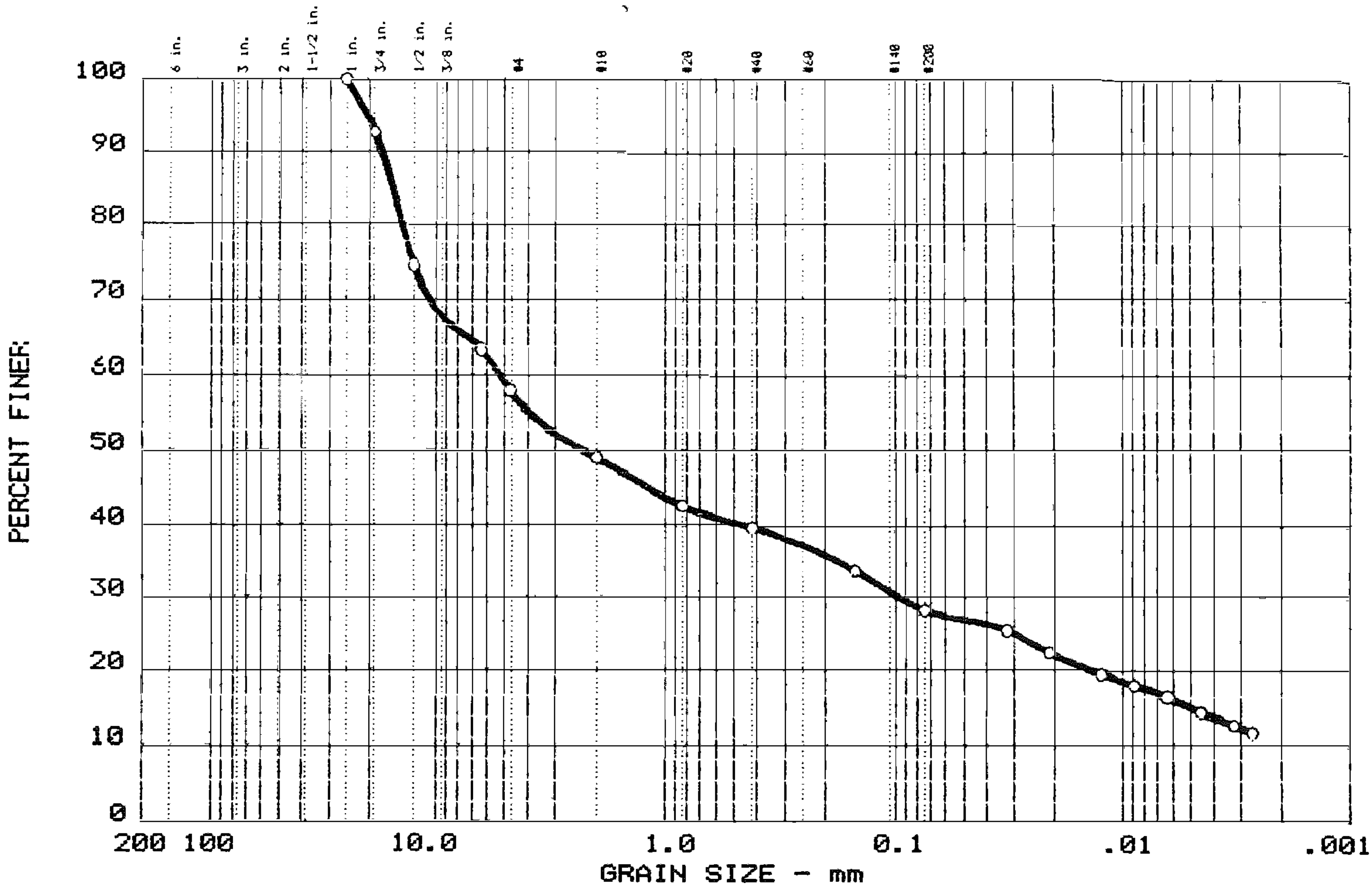
Remarks:
JAR SAMPLE

GS-274
A-234

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 15

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	42.0	29.8	13.1	15.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA	16.00	5.24	2.26	0.096	0.0049			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND LITTLE CLAY LITTLE SILT	GM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 178-87, S-15B, 29.7'-30.0'

Date: 6-13-88

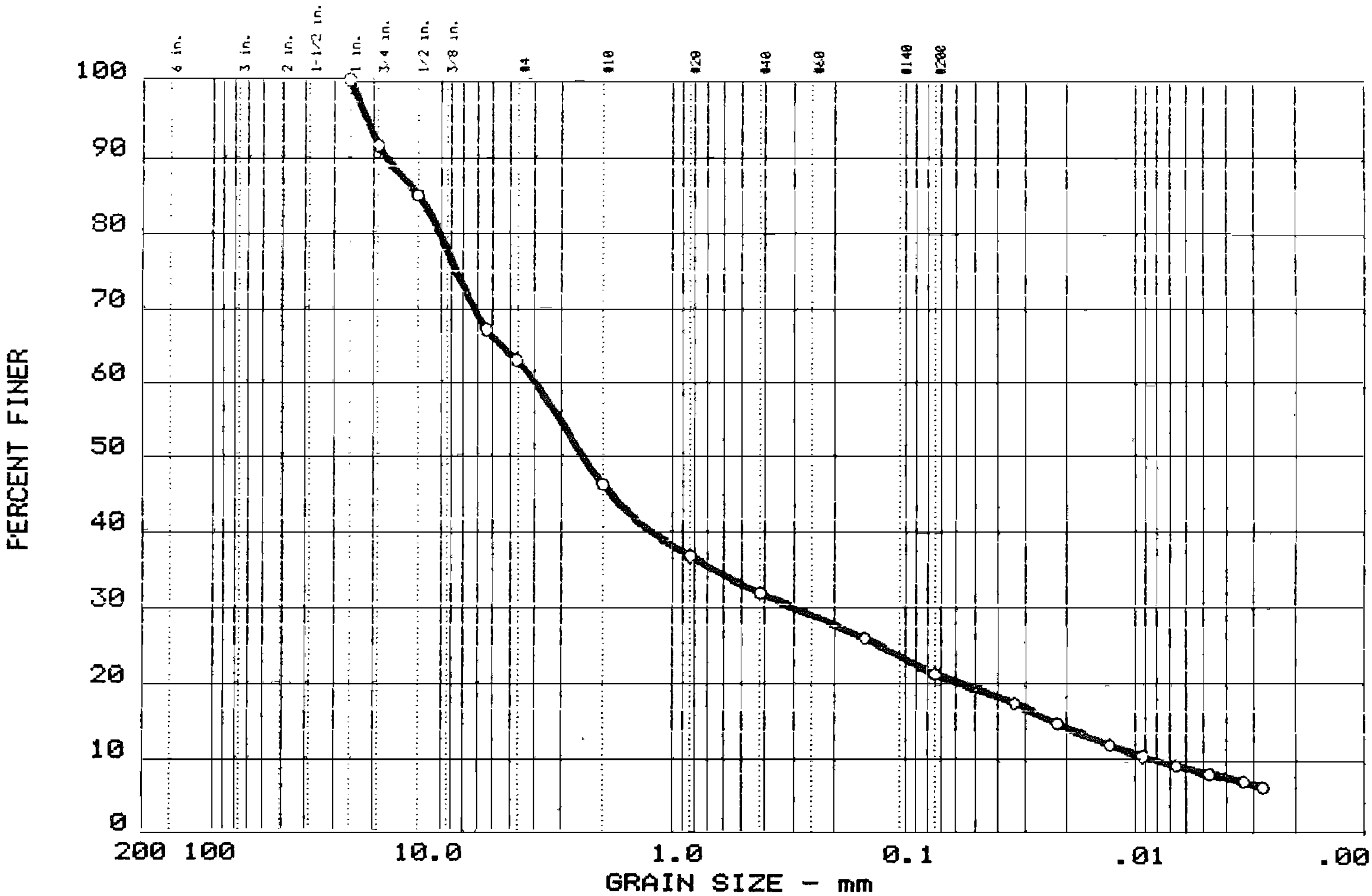
Remarks:
JAR SAMPLE
(INSUFFICIENT MATERIAL
FOR ATTERBERG)

GS-301

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 16

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	37.0	41.6	13.0	8.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA	12.69	3.97	2.45	0.294	0.0221	0.0078	2.79	507.0

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND AND GRAVEL LITTLE SILT TRACE CLAY	SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 178-87, S-16, 30.0'-31.5'

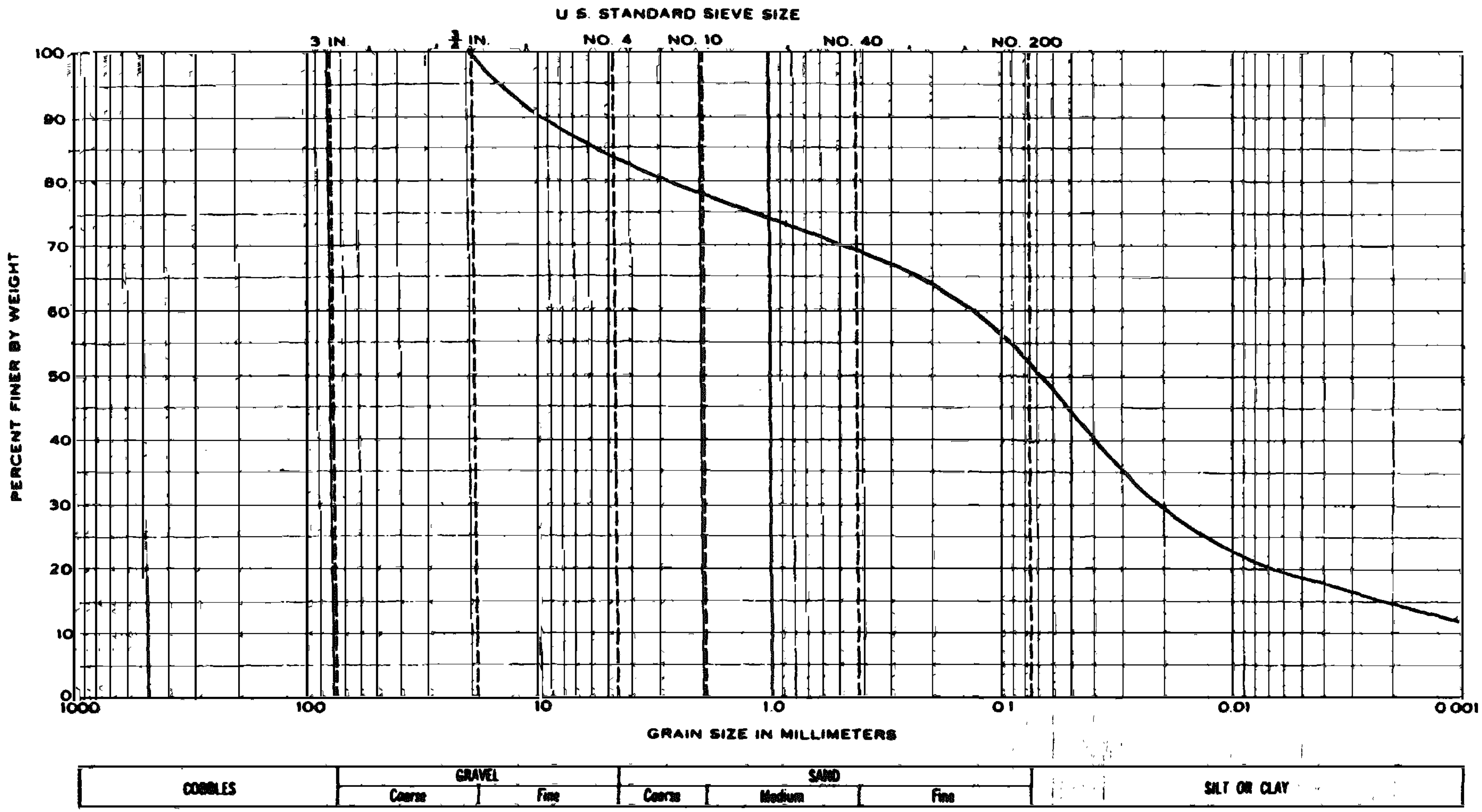
Date: 6-13-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
JAR SAMPLE
(INSUFFICIENT MATERIAL
FOR ATTERBERG)

GS-302

Fig. No. 17



Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-189 S-16	32'-34'	Brown Sandy Low Plastic SILT	7.1	16	12	4

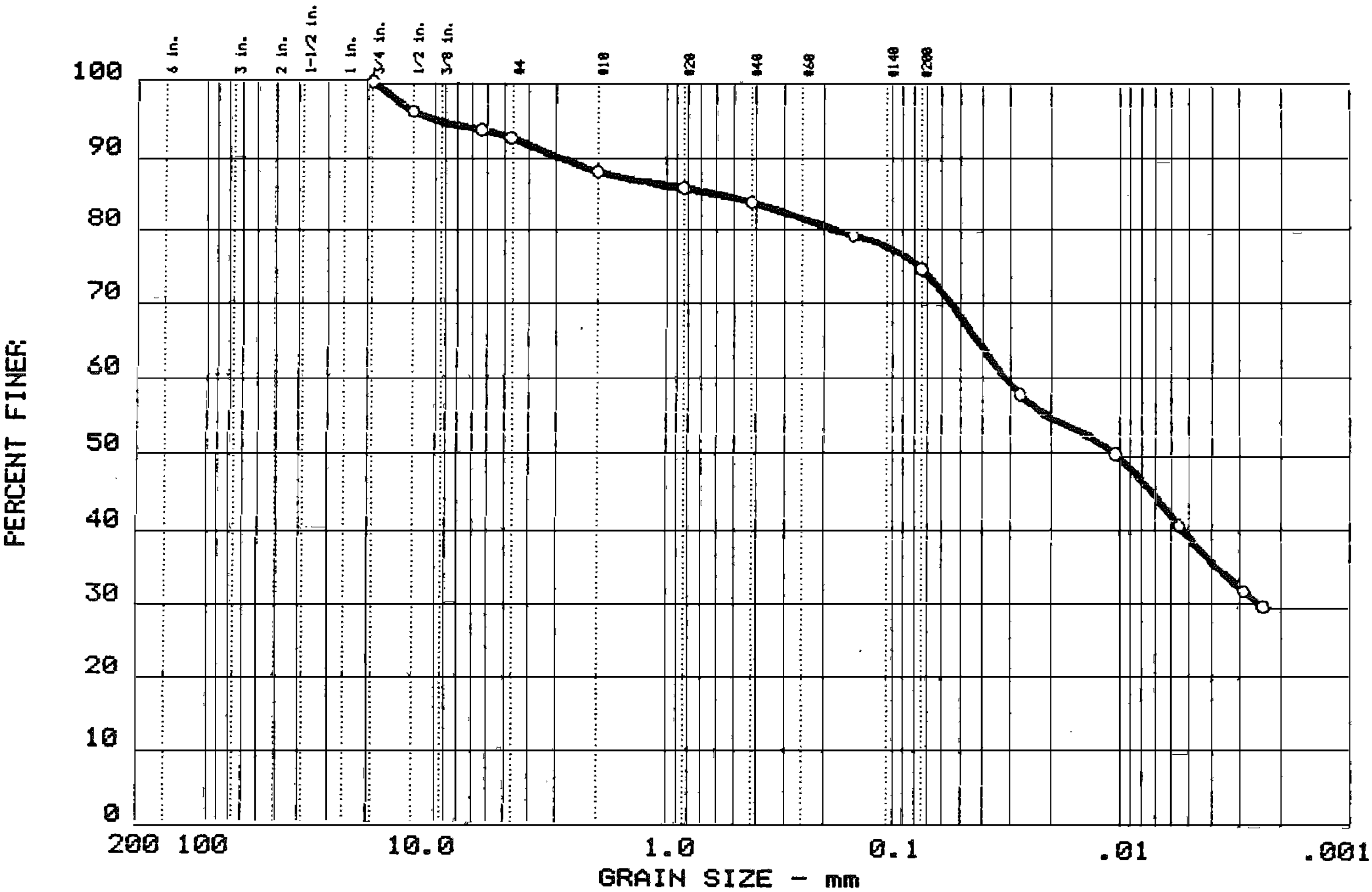
GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	7.5	17.7	35.5	39.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	28	14	0.58		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY AND SILT LITTLE SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 190- , S-21, 42.0'-44.0'

Date: 6-22-88

Remarks:
JAR SAMPLE

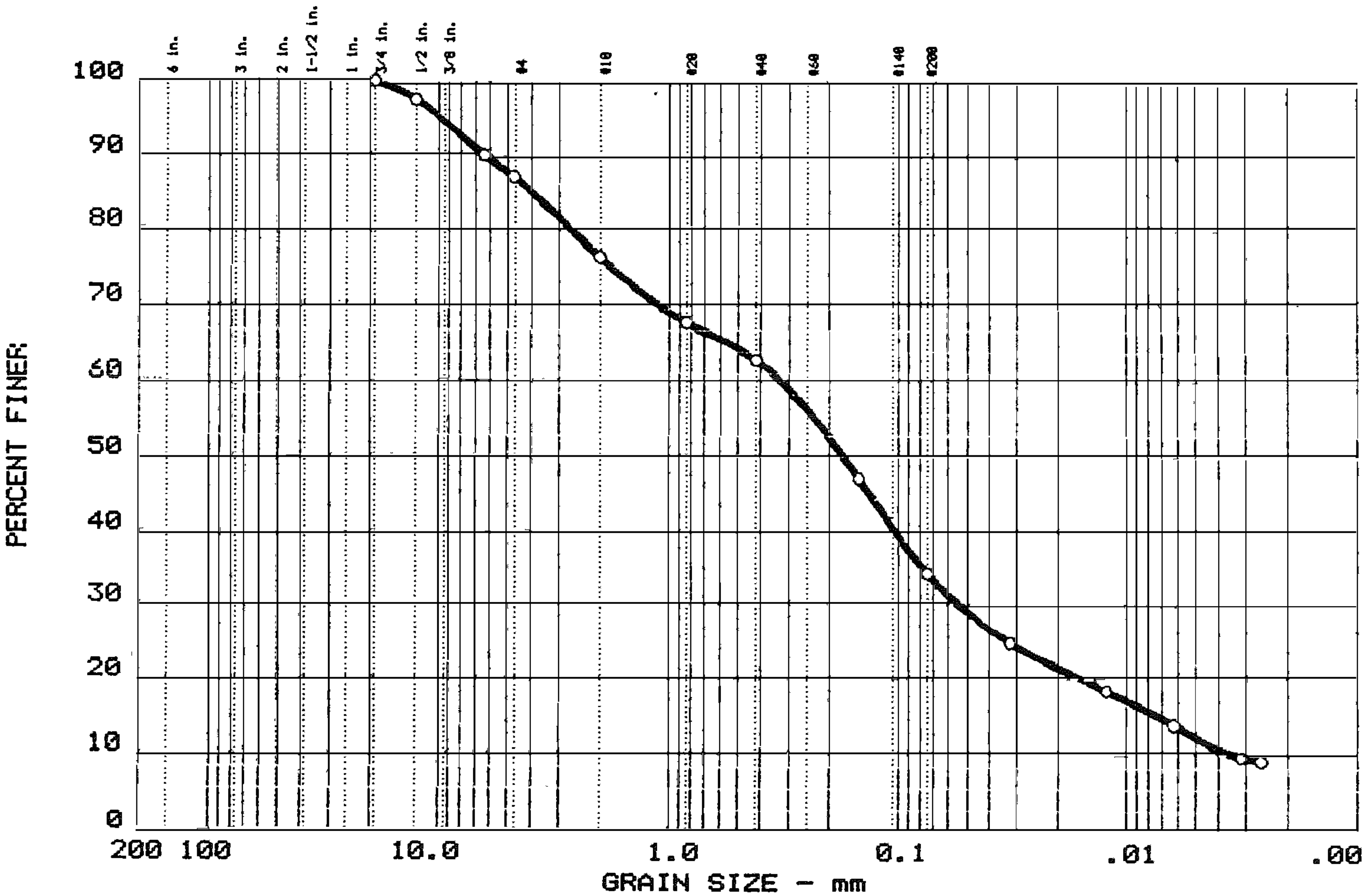
GS-338
A-289

F

GRAIN SIZE DISTRIBUTION TEST REPORT
MPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	1	0.0	13.0	52.8	21.9	12.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	NP	NP	3.98	0.32	0.17	0.054	0.0072	0.0035	2.63	93.3

MATERIAL DESCRIPTION	USCS	AASHTO
O SAND SOME SILT LITTLE GRAVEL LITTLE CLAY	SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH-190- , S-22, 44.0'-45.3'

Date: 6-22-88

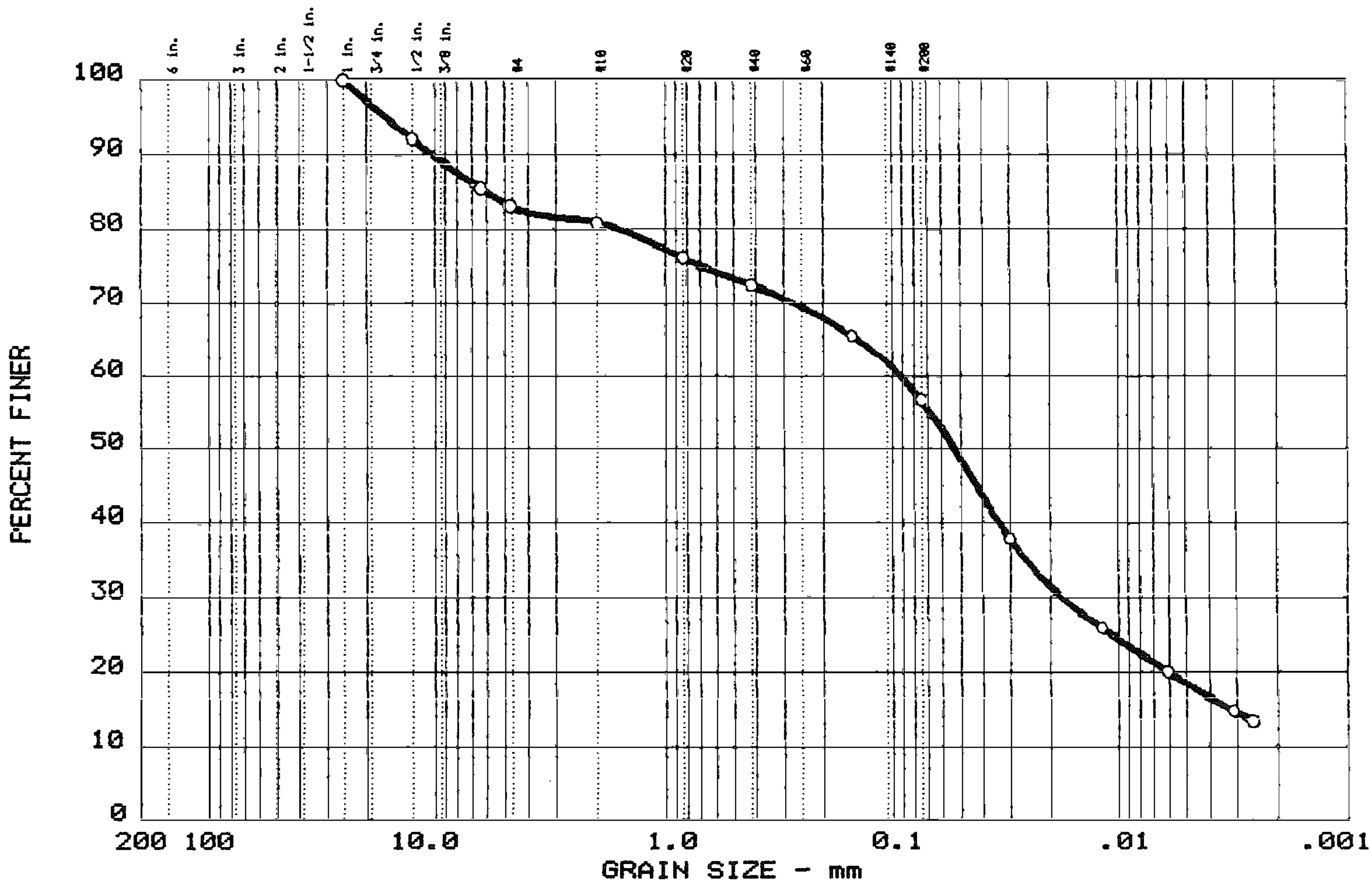
Remarks:
JAR SAMPLE

GS-339
A-290

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	2	0.0	16.9	26.4	38.3	18.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	16	4	6.03	0.09	0.05	0.018	0.0032			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND LITTLE CLAY LITTLE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 190- , S-23, 47.0'-47.3'

Date: 6-22-88

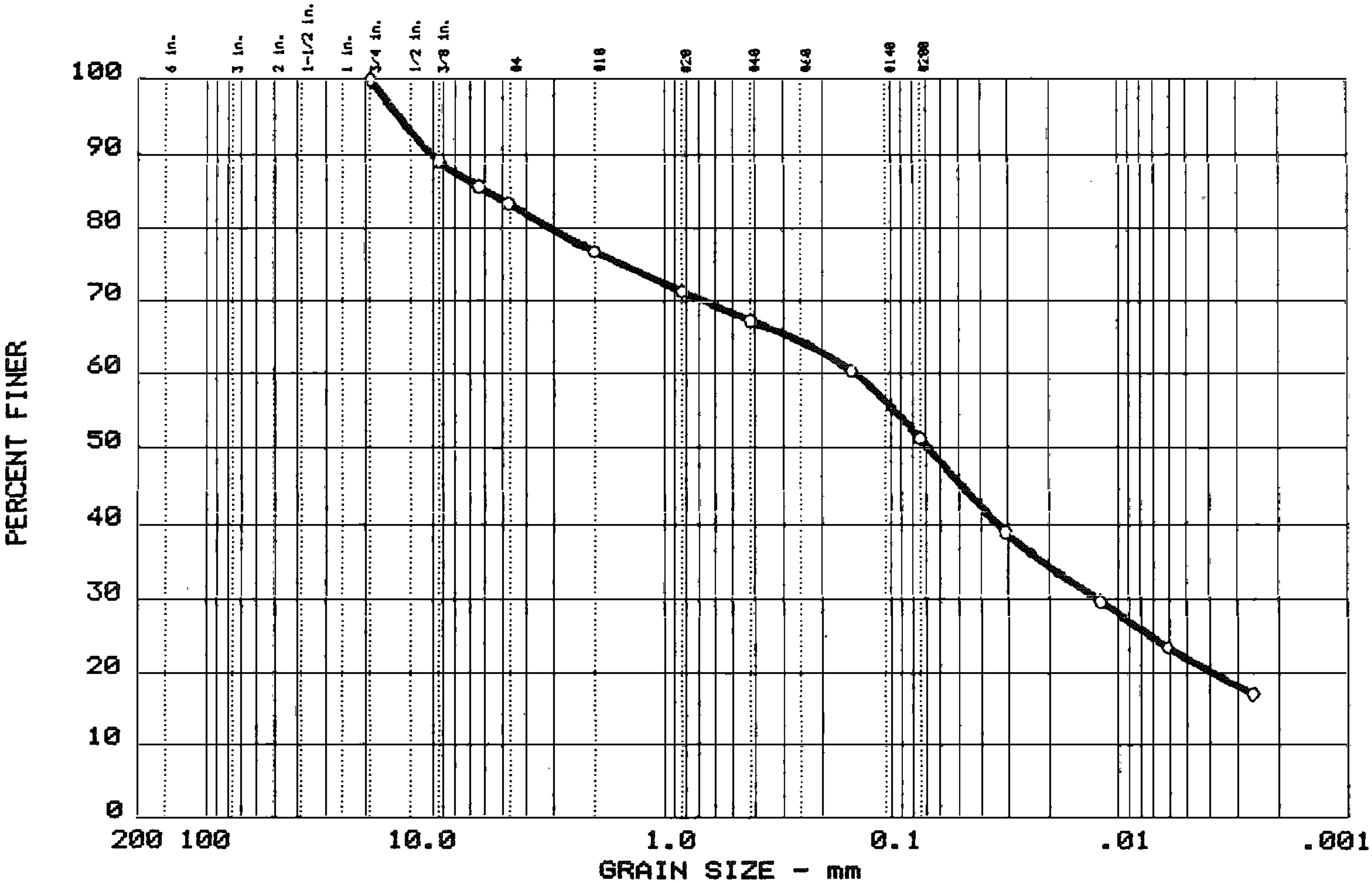
Remarks:
JAR SAMPLE

GS-340
A-291

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	5	0.0	16.6	32.2	29.3	22.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	NA	NA	5.75	0.14	0.07	0.012				

MATERIAL DESCRIPTION	USCS	AASHTO
o SAND SOME SILT SOME CLAY LITTLE GRAVEL	ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 191-, S-20, 40.0' - 42.0'

Date: 6-21-88

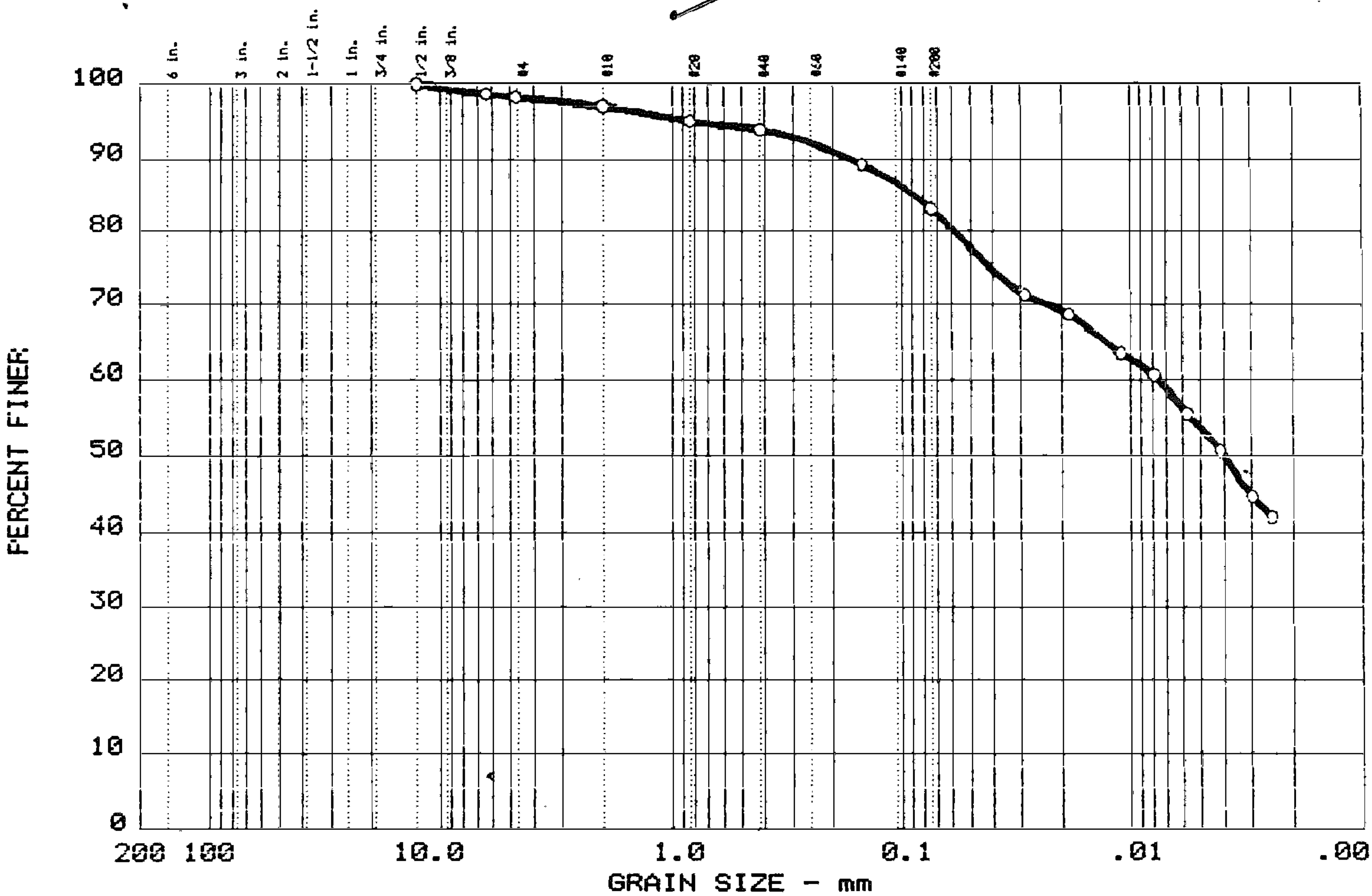
Remarks:
JAR SAMPLE
INNSUFFICIENT MATERIAL
FOR ATTERBERG

GS-319

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 18

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	1.7	15.2	29.6	53.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	28	13	0.09		0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT LITTLE SAND TRACE GRAVEL	CL	

Project No.: BD-8$_6$-90
Project: "S" AREA REMEDEATION
○ Location: BH - 192-87, S-12/13, 24.0'-26.0'

Date: 6-13-88

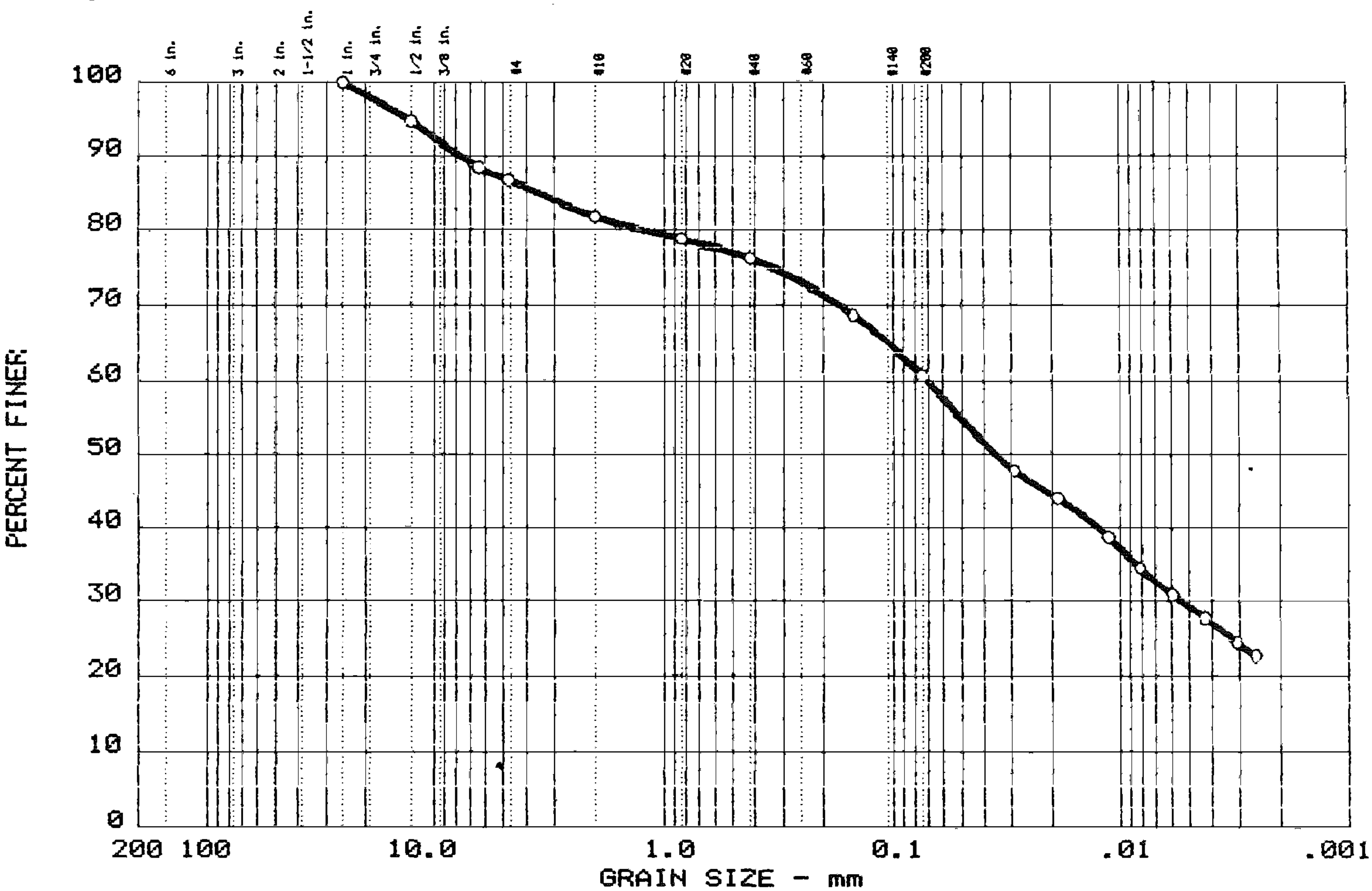
Remarks:
JAR SAMPLE

GS-287
A-245

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 18

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	13.3	26.0	31.5	29.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	5	3.55		0.04	0.005				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME CLAY SOME SAND LITTLE GRAVEL	CL - ML	

Project No.: BD-86 -90
Project: "S" AREA REMEDEATION
○ Location: BH - 193-87, S-12B, 24.5'-26.0'

Date: 6-13-88

Remarks:
JAR SAMPLE

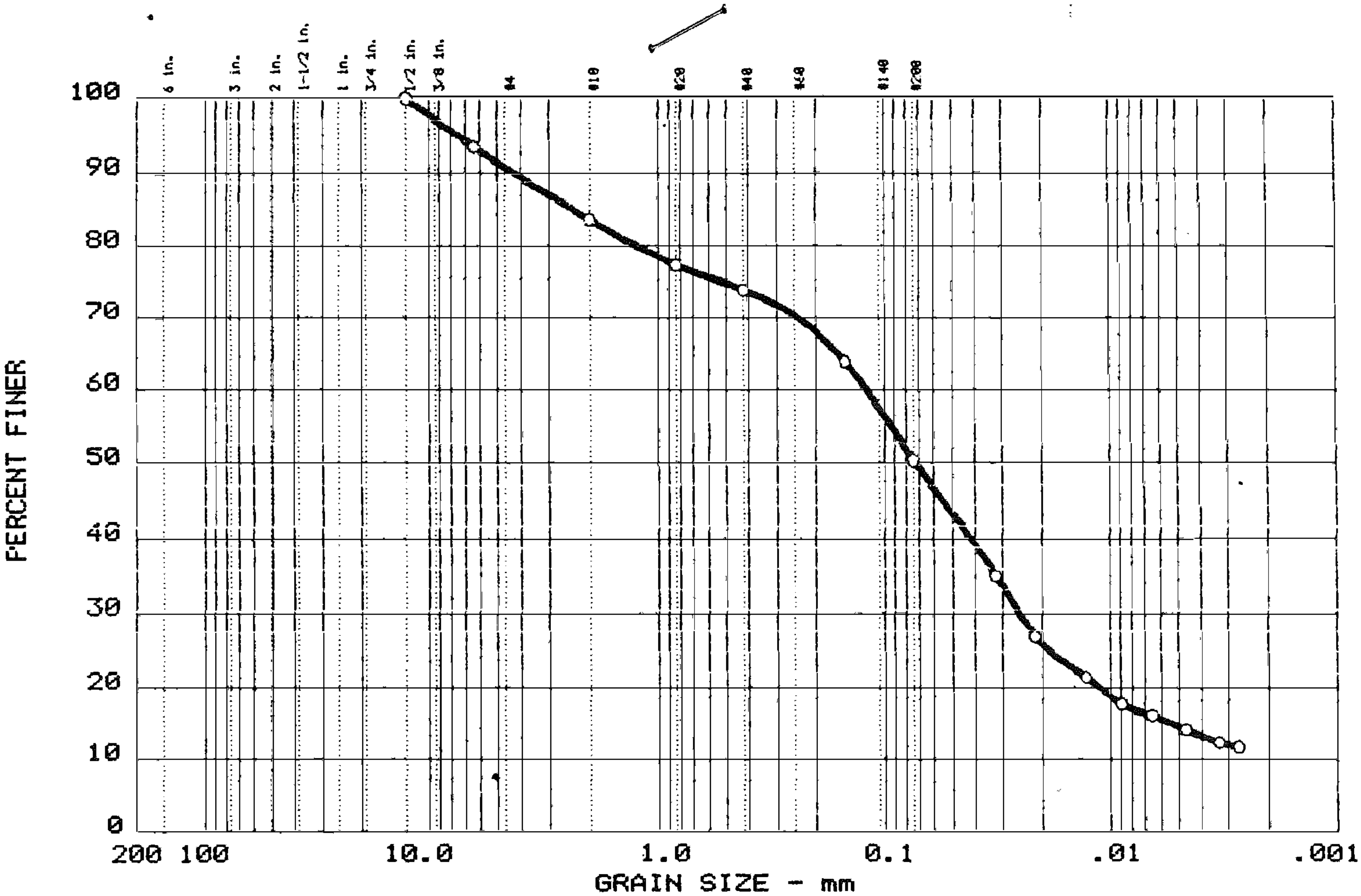
F

GS-288
A-246

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 19

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	7	0.0	9.0	40.6	35.9	14.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA	2.34	0.12	0.07	0.025	0.0054			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND AND SILT LITTLE CLAY TRACE GRAVEL	ML	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
○ Location: BH - 193-87, S-13, 26.0'-26.4'

Date: 6-13-88

Remarks:
JAR SAMPLE
(INSUFFICIENT SAMPLE
FOR ATTERBERG)

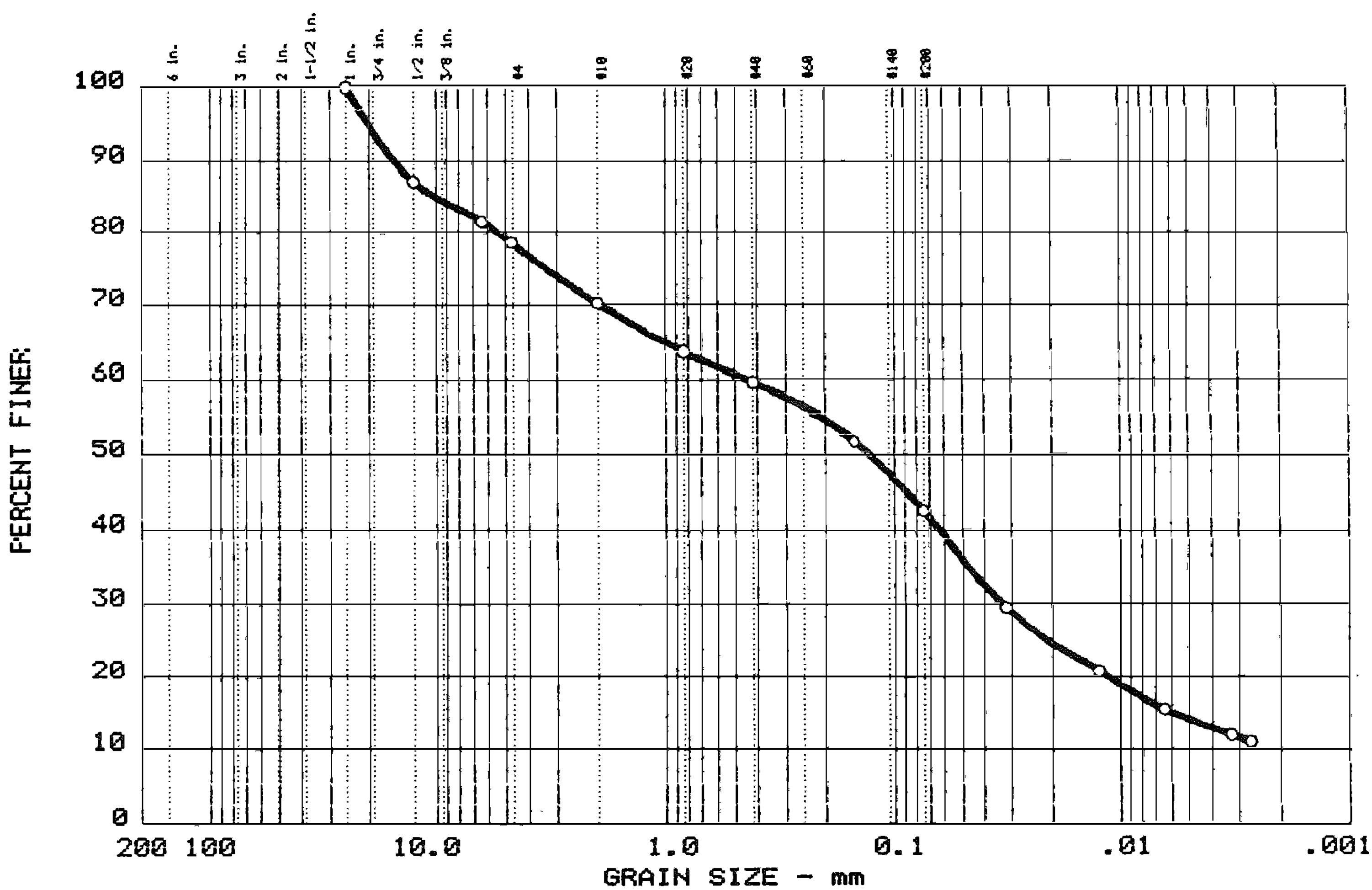
M

GS-289

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 20

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	11	0.0	21.3	36.3	28.5	14.0

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	NA	NA	10.00	0.44	0.13	0.033	0.0060			

MATERIAL DESCRIPTION	USCS	AASHTO
o SAND SOME SILT SOME GRAVEL LITTLE CLAY	SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 196- , S-13, 24.0'-25.7'

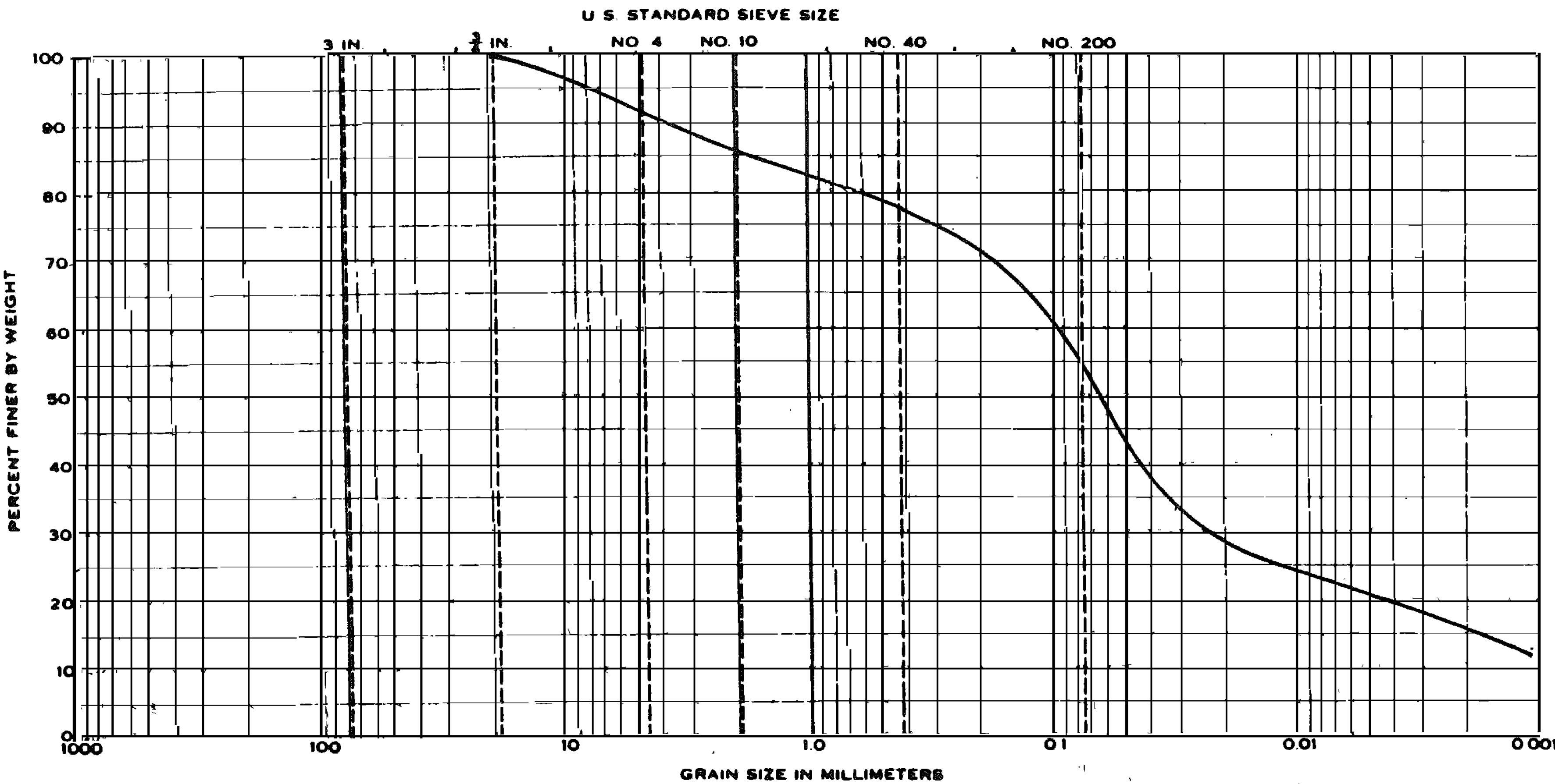
Date: 6-22-88

Remarks:
JAR SAMPLE
INSUFFICIENT MATERIAL
FOR ATTERBERG

GS-320

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

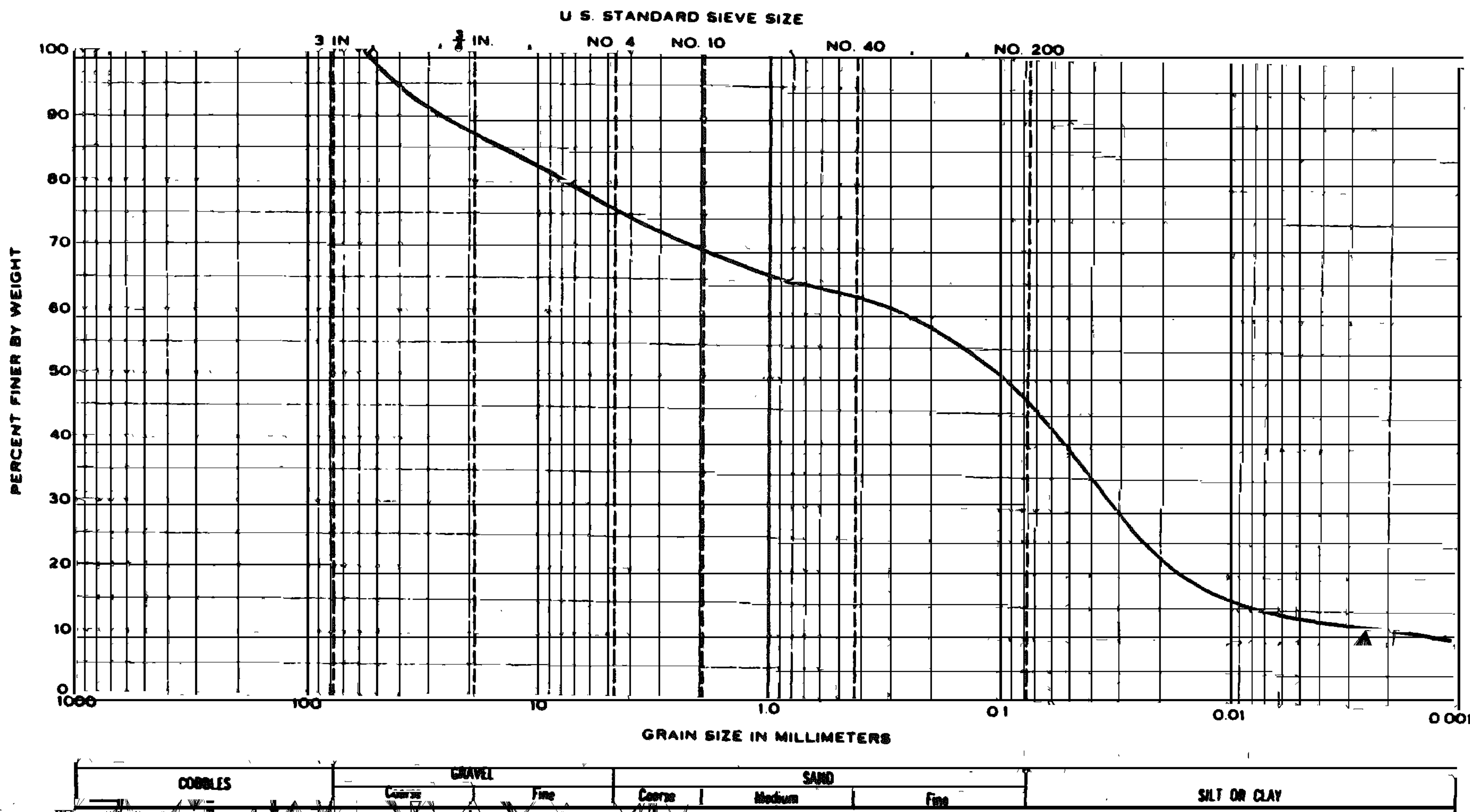
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-197 S-13	24'-26'	Brown Sandy SILT	8.1	NP	NP	NP

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



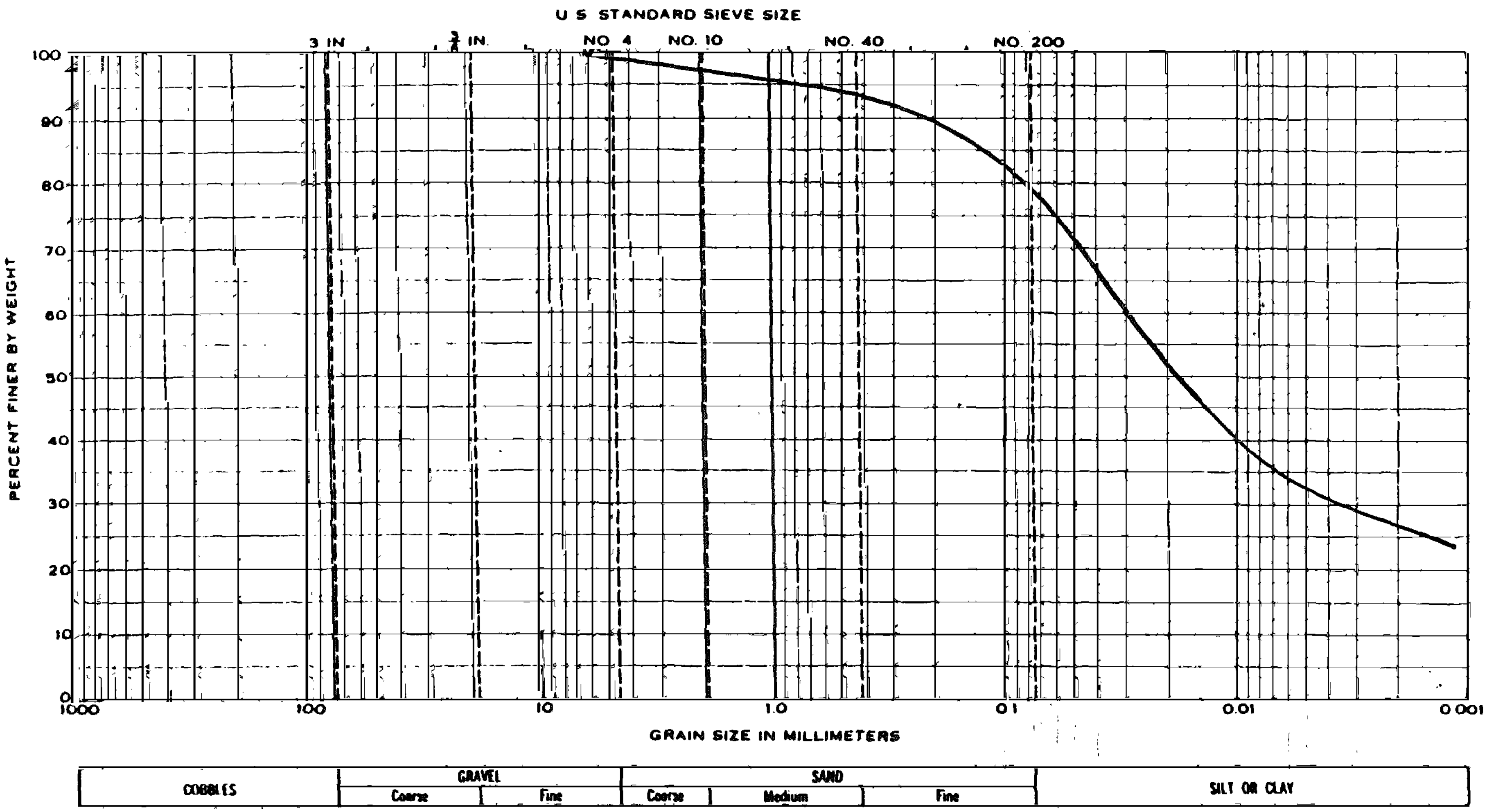
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-197 S-14	26'-28'	Brown Silty C-F SAND and GRAVEL	6.1	27	23	4

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



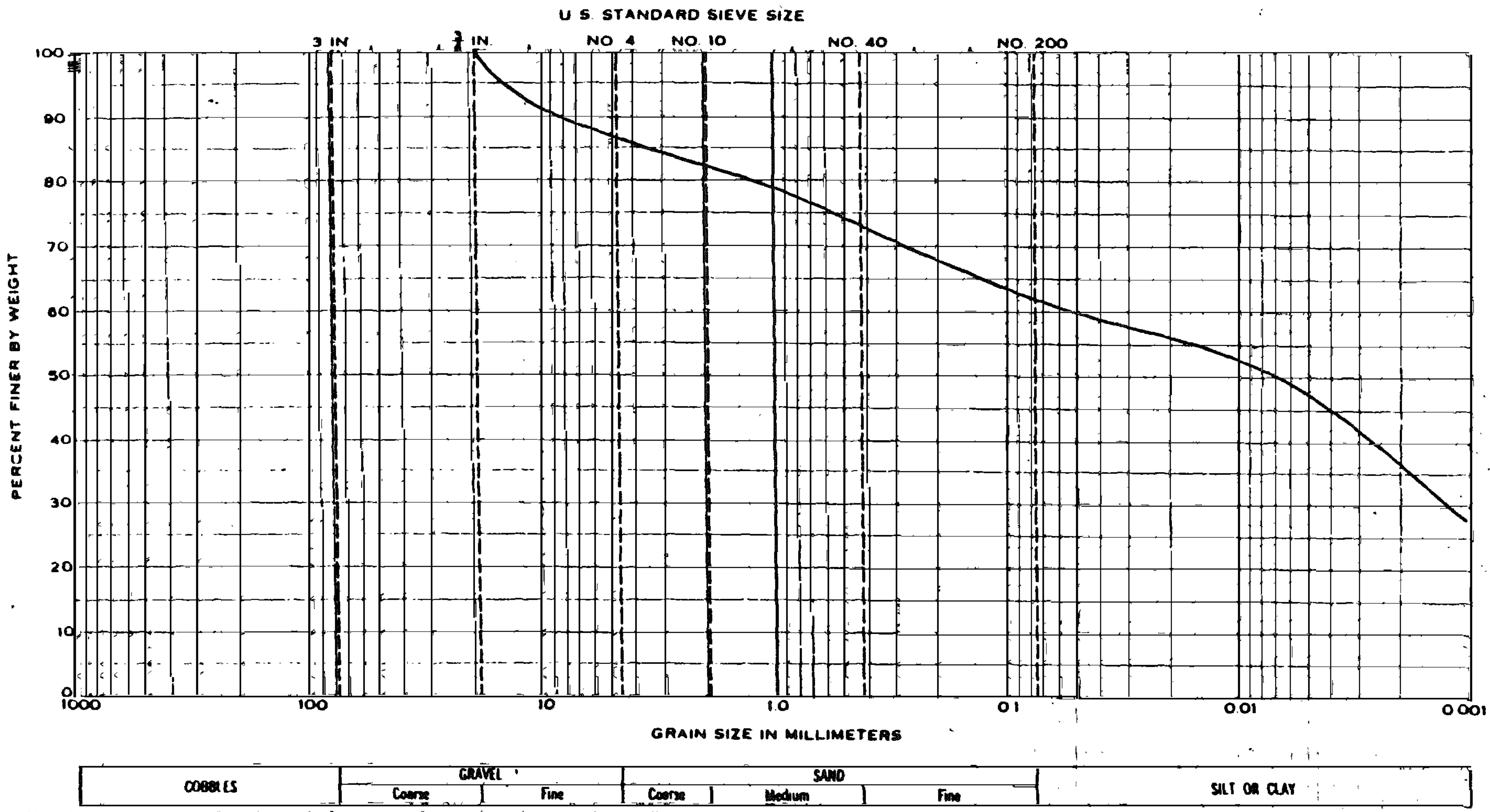
Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-198 S-12	24'-26'	Brown Sandy Clayey SILT	22.1	37	27	10

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-198 S-13	23.6'-26.9'	Brown Sandy Silty CLAY	22.1	35	24	11

Project Glynn Geotechnical Engrs.

Occidental Chemical Corp.

S-Area Landfill

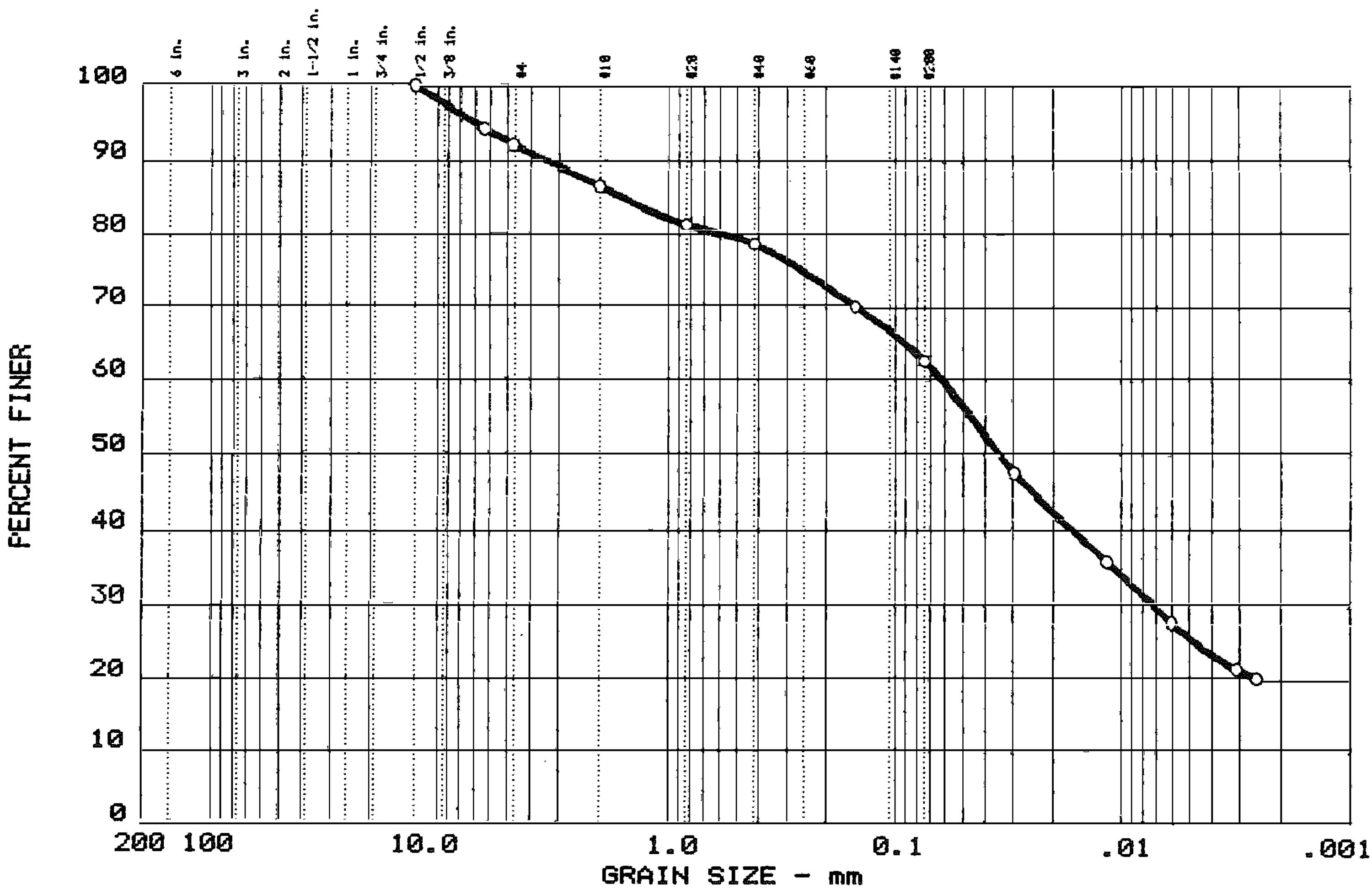
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	6	0.0	7.9	29.4	36.9	25.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	15	10	1.58		0.03	0.007				

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME SAND SOME CLAY TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 199- , S-22C,

Date: 6-22-88

Remarks:

JAR SAMPLE

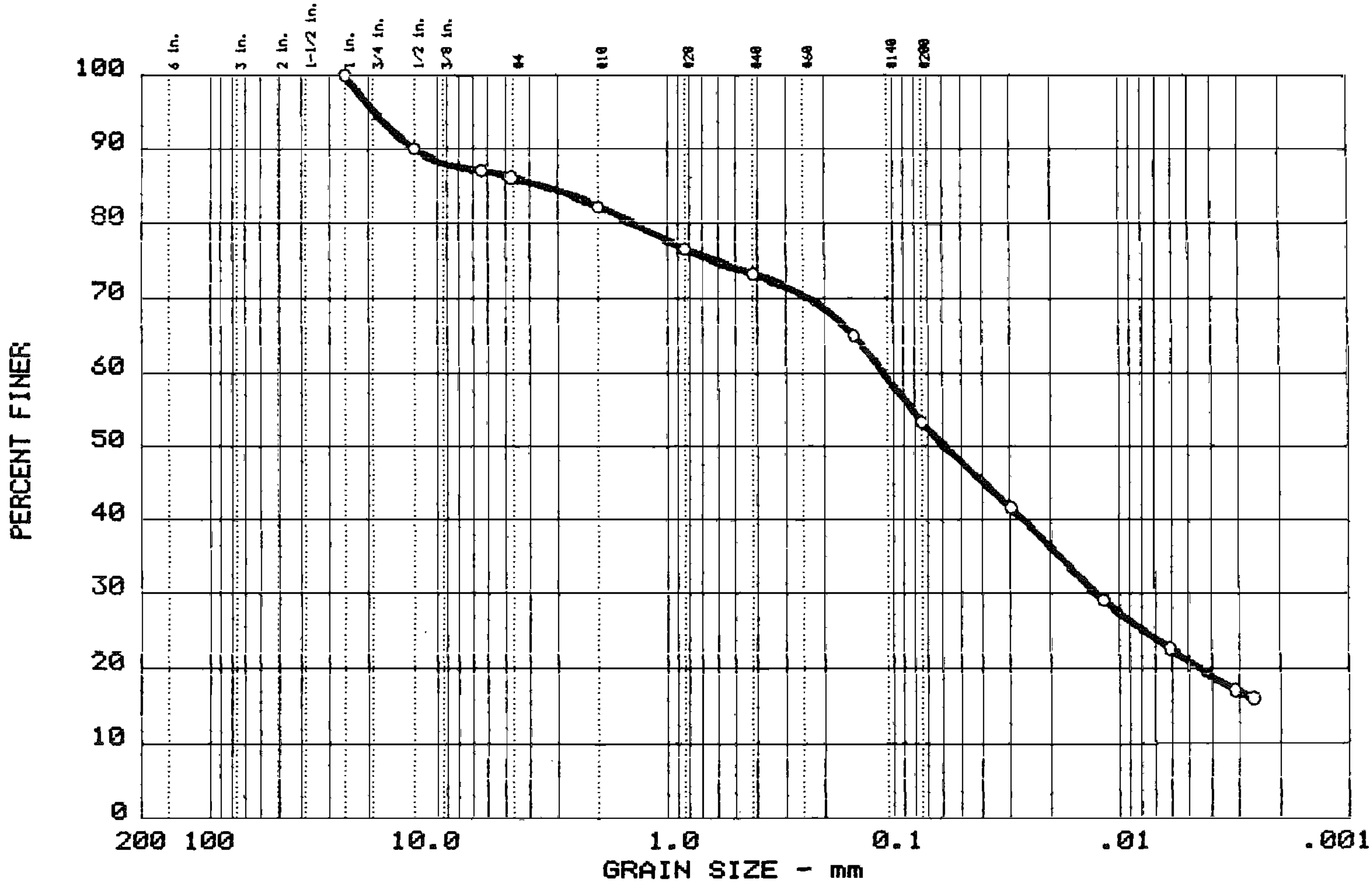
GS-343
A-294

M

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 5

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	5	0.0	13.9	32.7	32.5	20.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	13	5	3.35	0.11	0.06	0.013				

MATERIAL DESCRIPTION	USCS	AASHTO
o SAND SOME SILT SOME CLAY LITTLE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 199- , S-23, 44.0'-44.7'

Date: 6-22-88

Remarks:

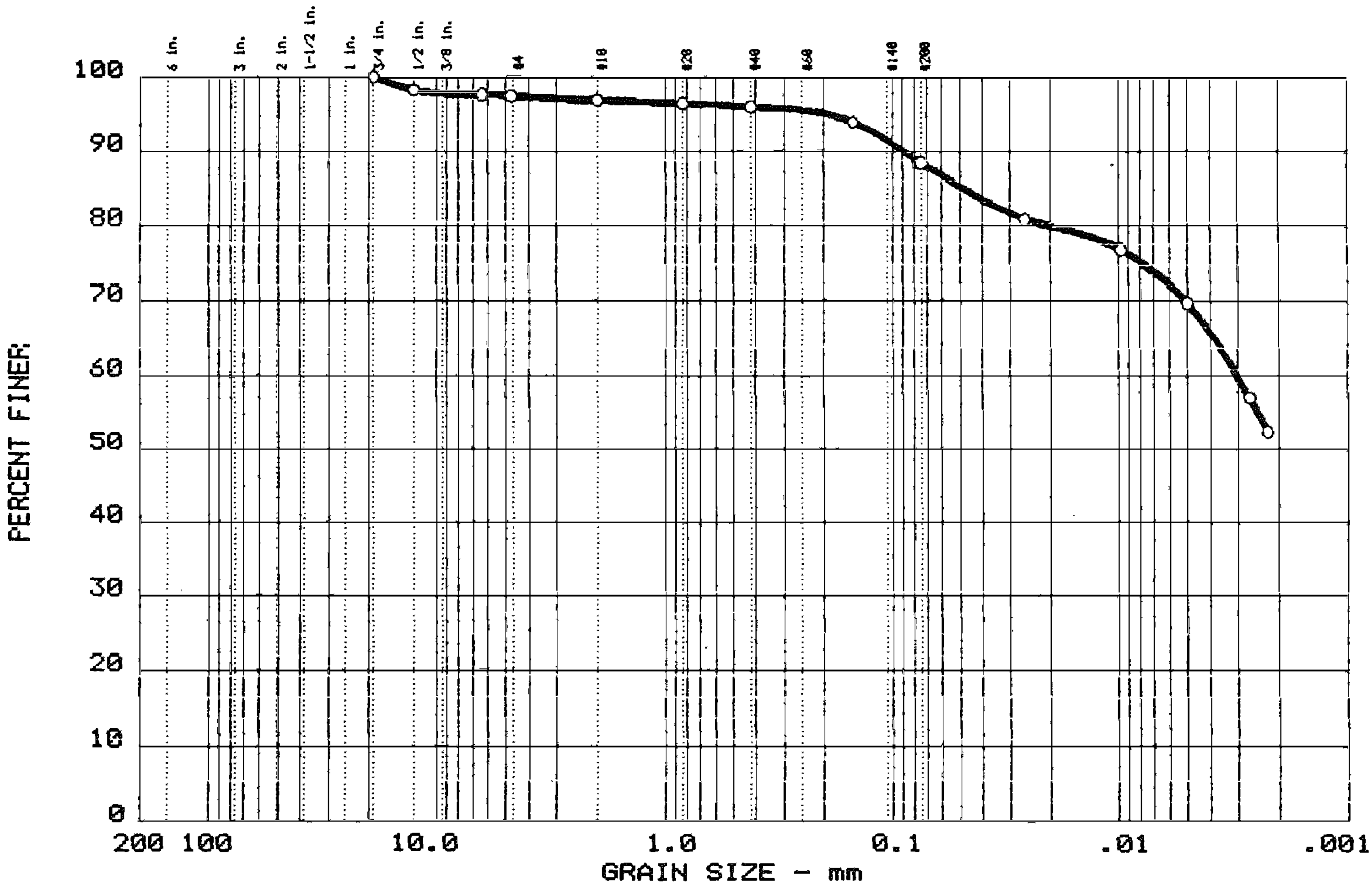
JAR SAMPLE

GS-344
A-295

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	2.6	8.9	18.8	69.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	37	18								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 200- , S-5, 36.0'-37.1'

Date: 6-22-88

Remarks:

JAR SAMPLE

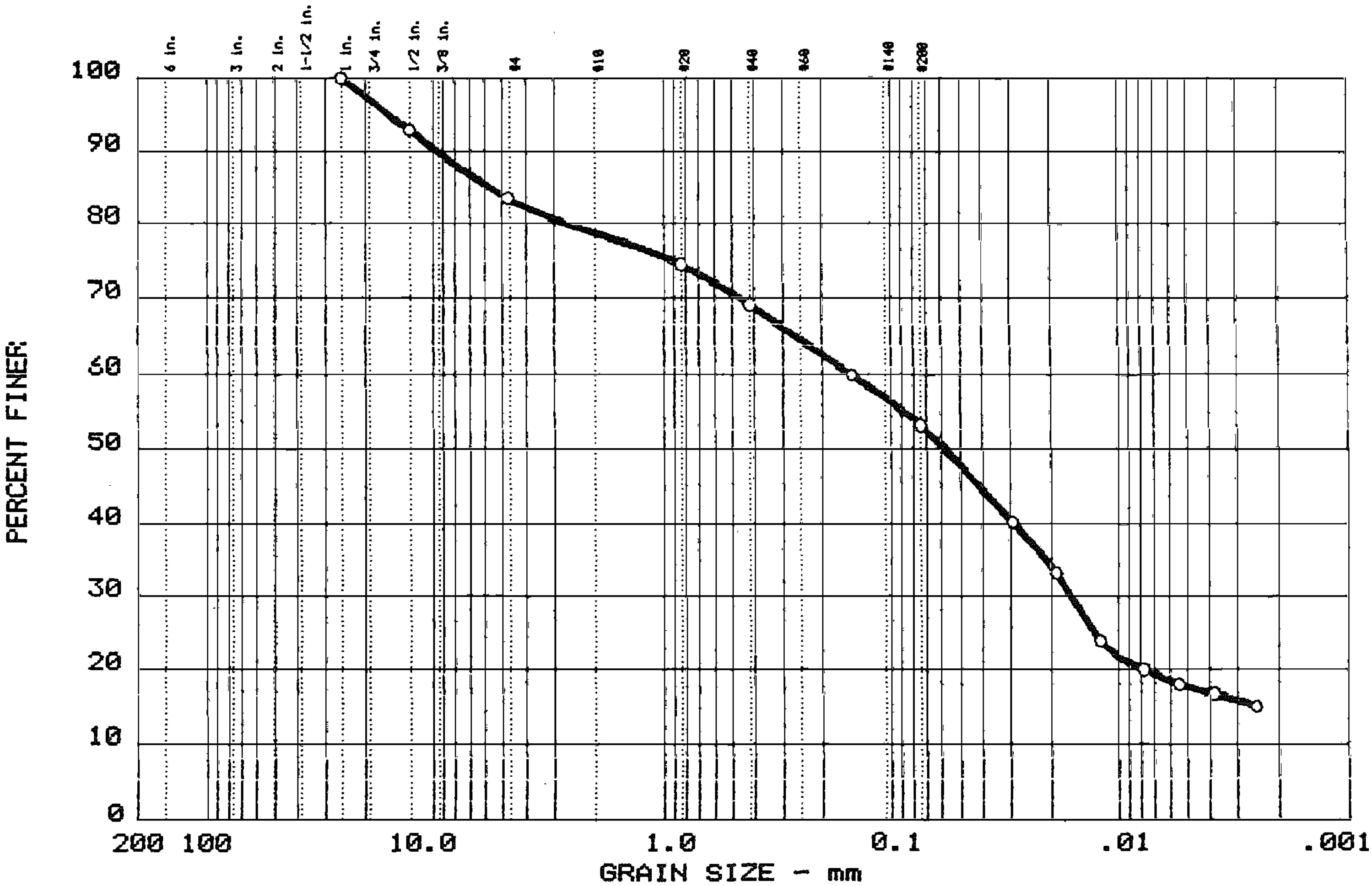
GS-341
A-292

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	3	0.0	16.6	30.2	35.6	17.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	5	5.75	0.15	0.06	0.016				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND LITTLE CLAY LITTLE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 201-88, S-18, 35.0'-35.3'

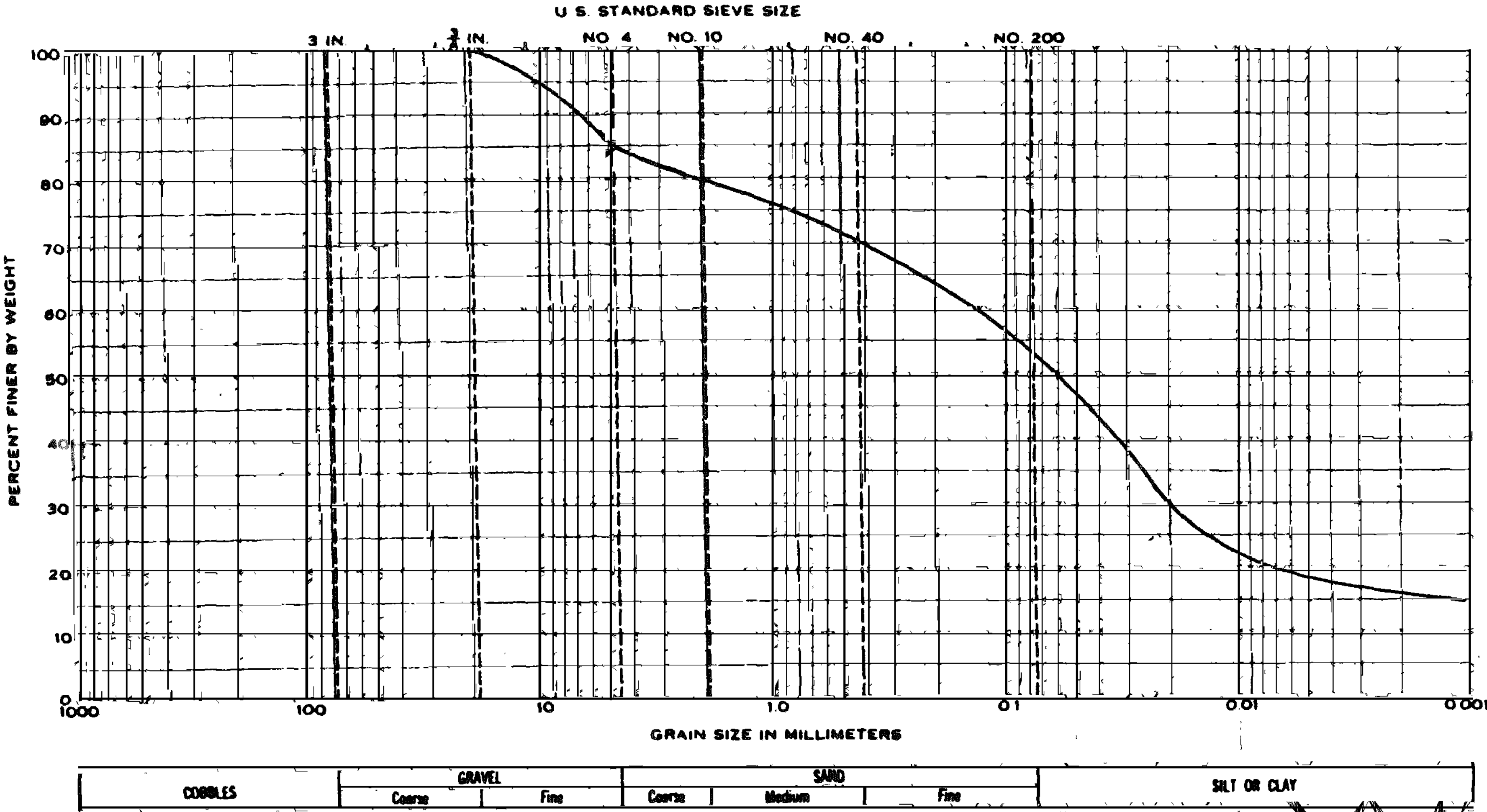
Date: 6-22-88

Remarks:
JAR SAMPLE

GS-342
A-293

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2



Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI	
BH-202 S-16	32'-33.2'	Brown C-F Sandy SILT	8.1	NP	NP	NP	

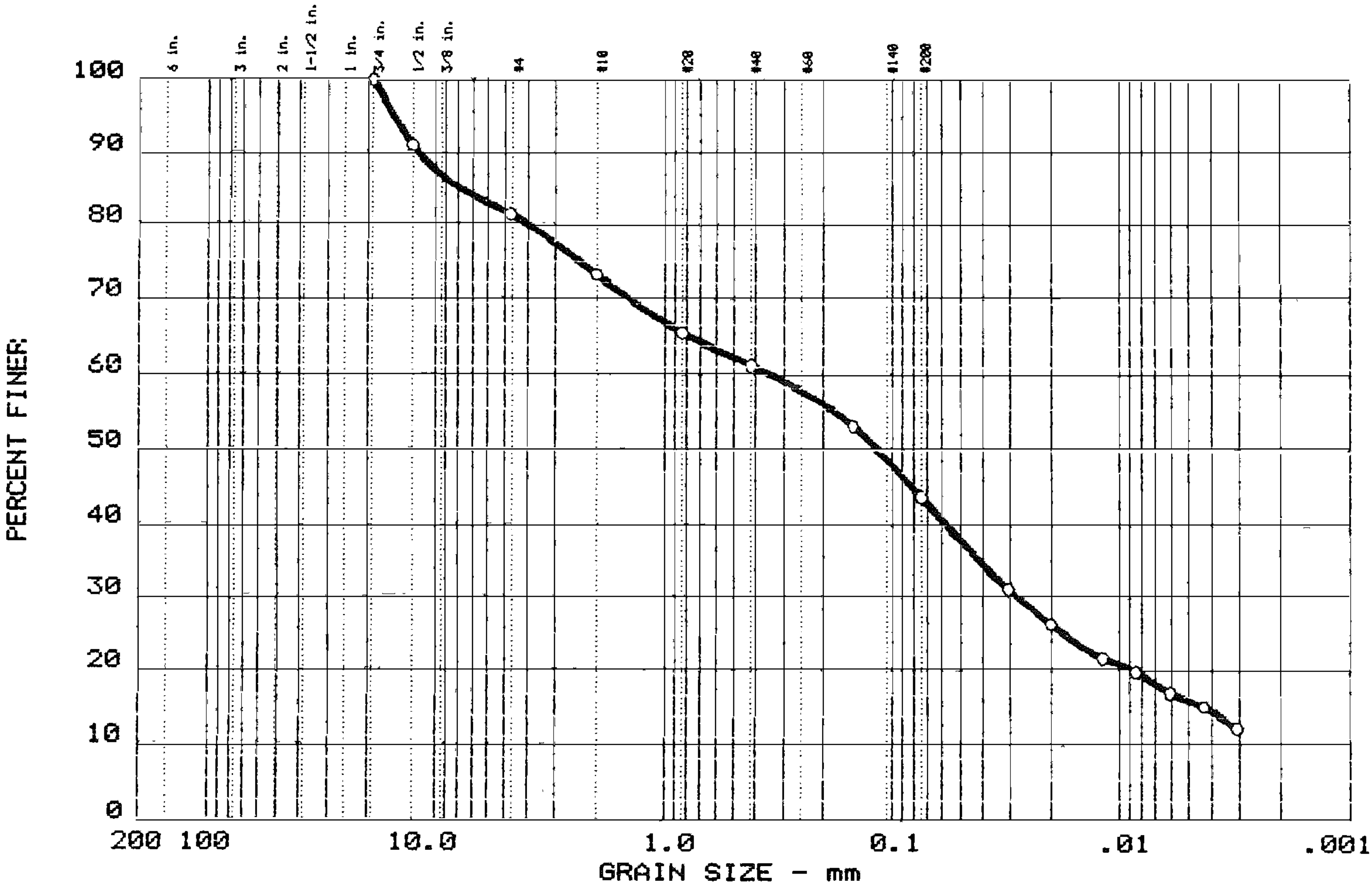
Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	16	0.0	18.7	37.6	27.8	15.9

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	15	7	7.94	0.34	0.11	0.028	0.0042			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME SILT LITTLE GRAVEL LITTLE CLAY	SC-SM	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 202-88, S-17, 33.5'-34.3'

Date: 6-8-88

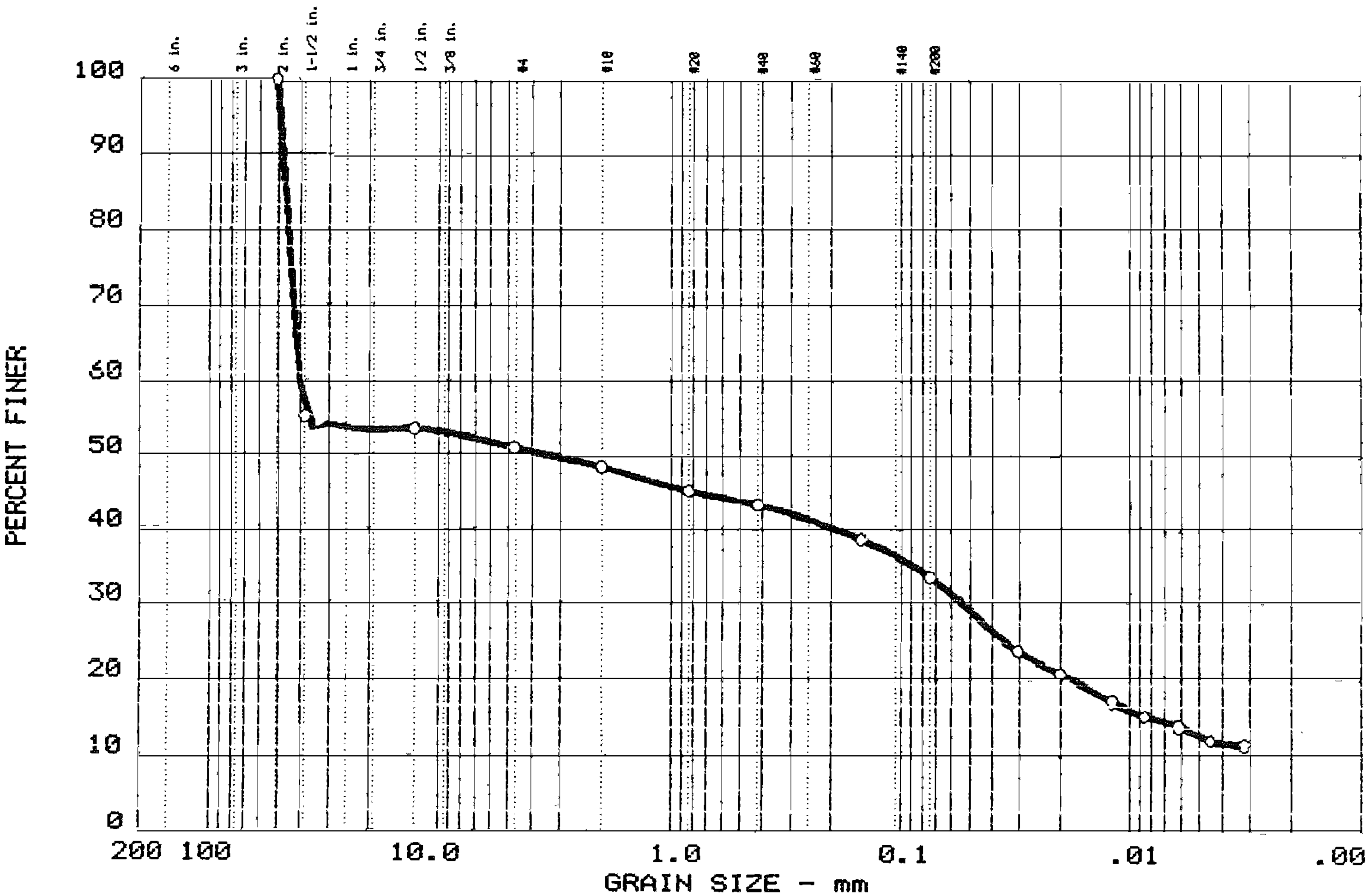
Remarks:
UNDISTURBED SAMPLE
(DENNISON TUBE)

GS-258
A-218
P-36

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	14	0.0	49.0	17.5	20.8	12.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	5	47.15	40.32	3.35	0.054	0.0076			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SILT LITTLE SAND LITTLE CLAY	GC-GM	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 203-88, S-17, 33.5'-35.5'

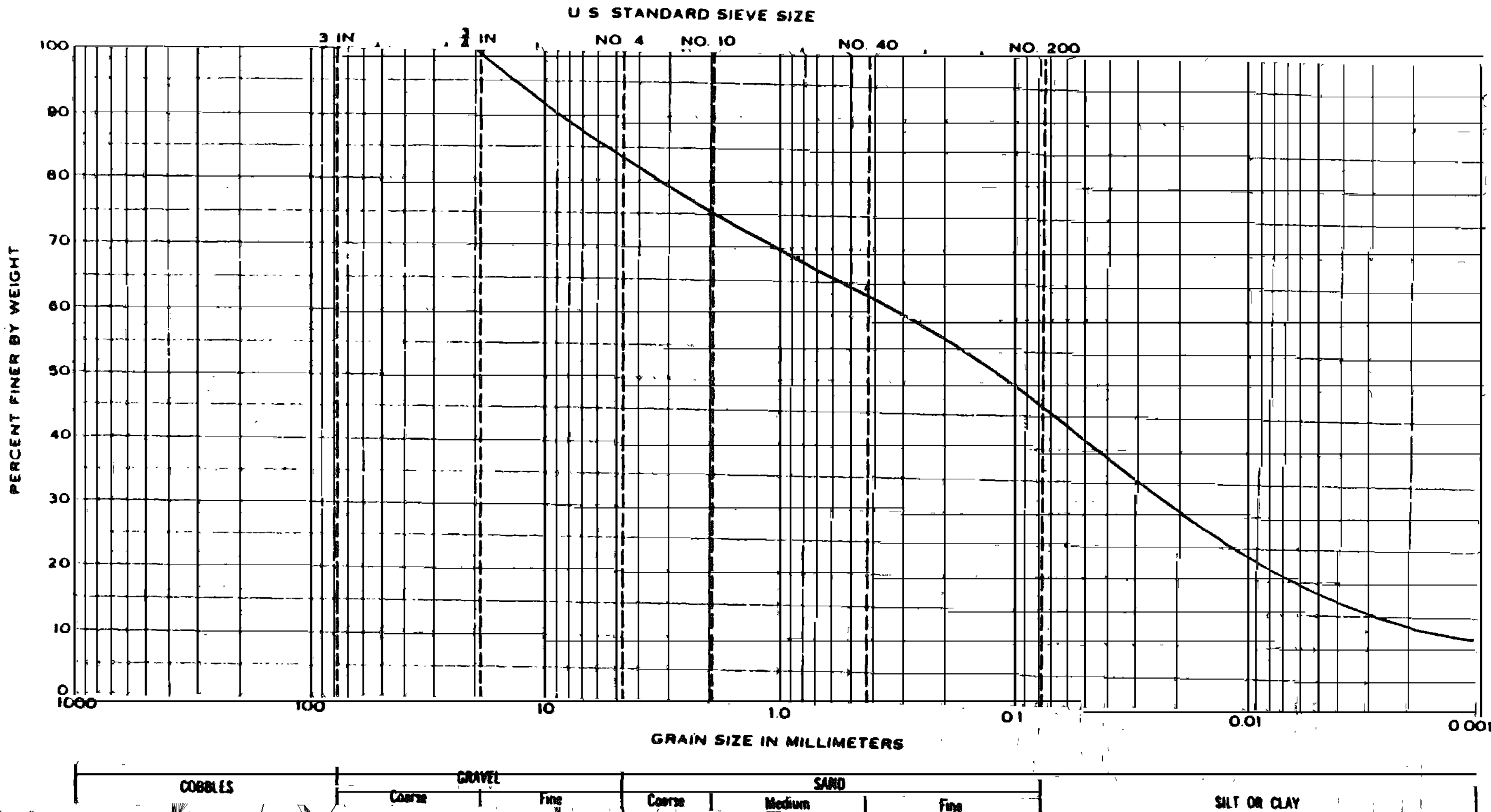
Date: 6-8-88

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
UNDISTURBED SAMPLE
(DENNISON TUBE)

GS-259 C
A-219
P-37

Fig. No. 5



Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-203 S-18	35.5'-37.4'	Brown Silty Clayey SAND	19.5	29	24	5

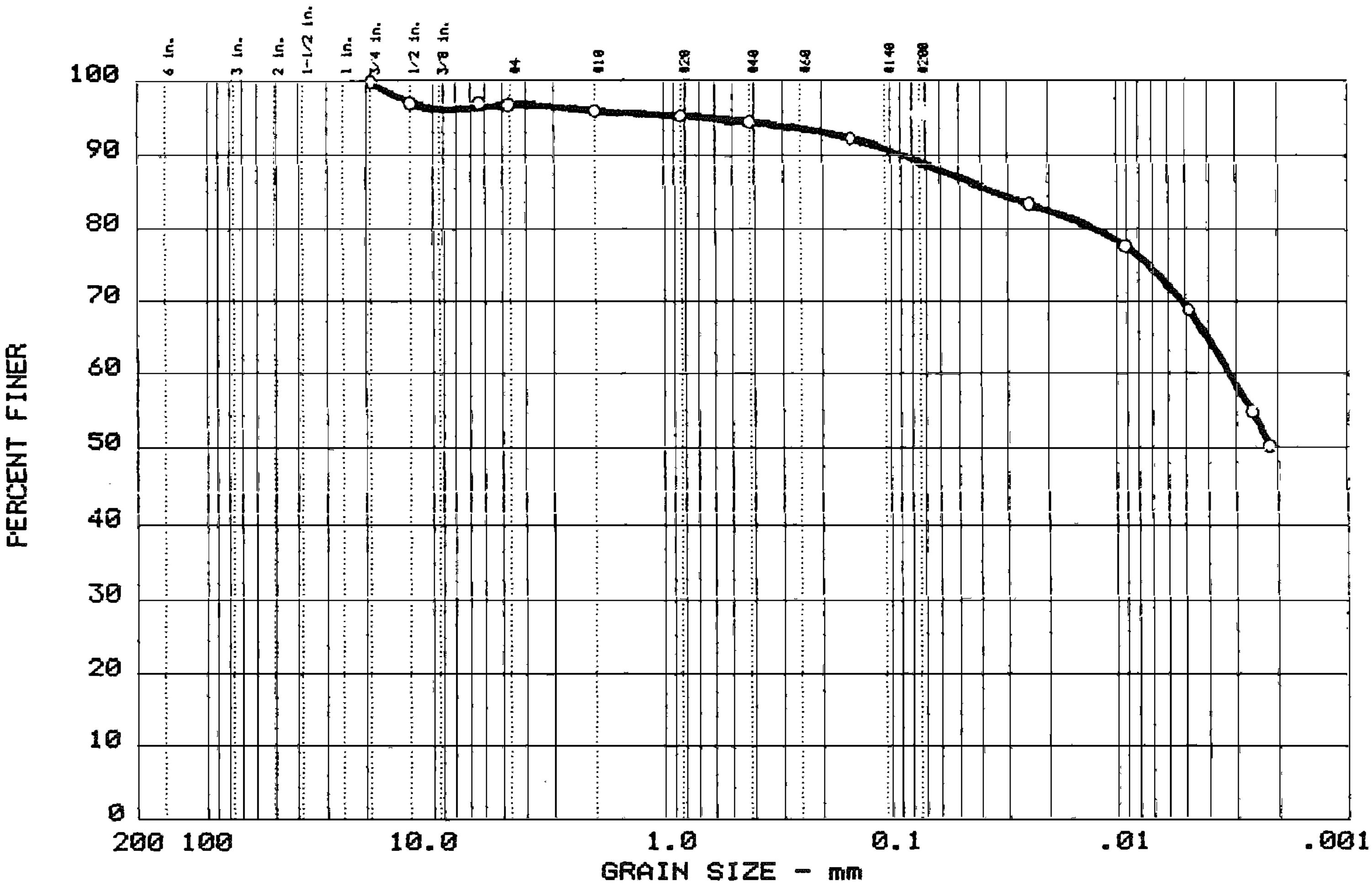
GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	20	0.0	3.1	7.8	19.8	69.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	34	15								

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY LITTLE SILT TRACE SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 204- , S-2, 30.0'-31.5'

Date: 6-21-88

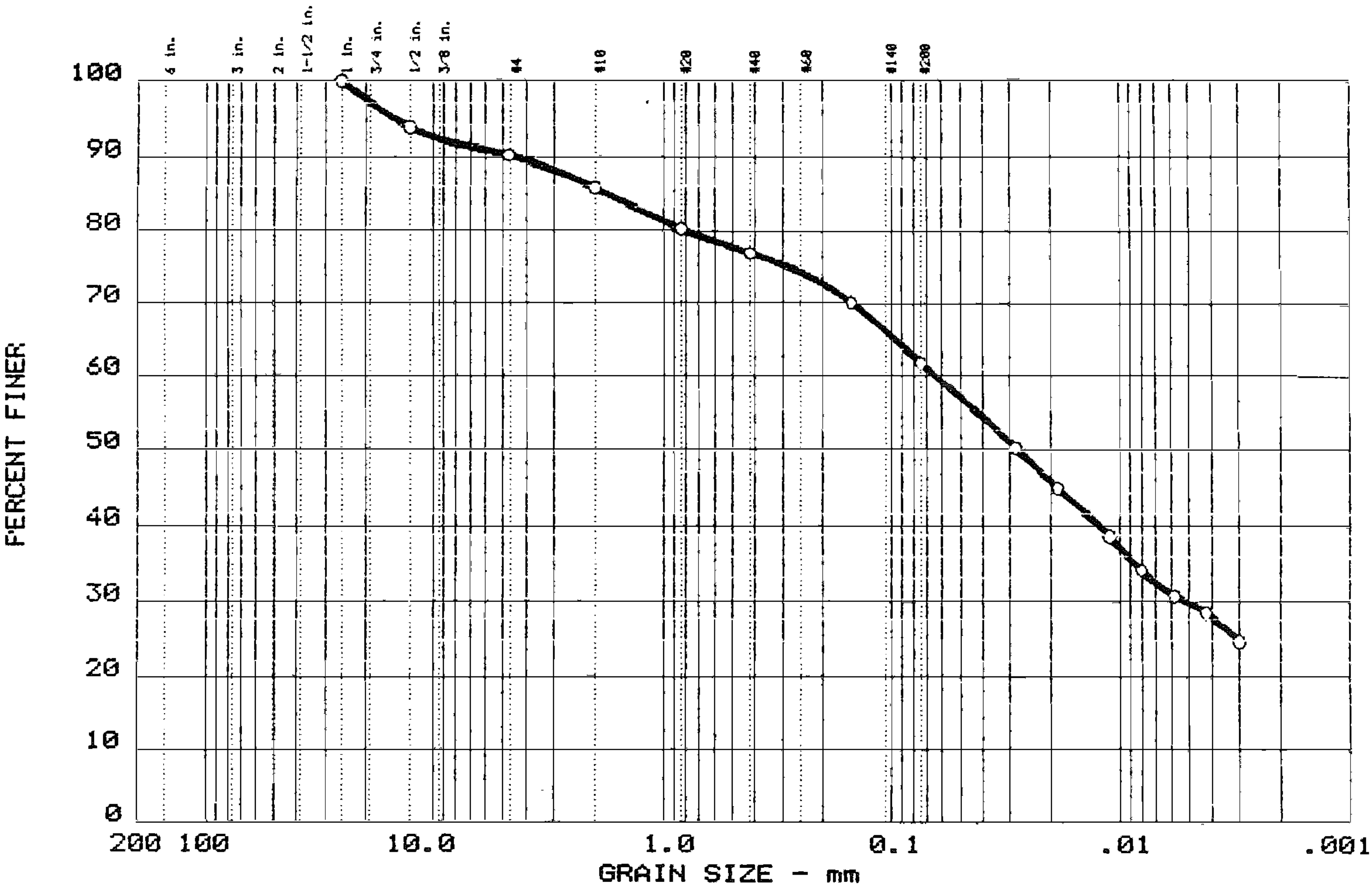
Remarks:
JAR SAMPLE

GS-290
A-247

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 14

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	20	0.0	9.8	28.4	32.0	29.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	11	1.78		0.03	0.005				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME CLAY SOME SAND TRACE GRAVEL	CL	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 204 , S-3, 31.5'-33.5'

Date: 6-8-88

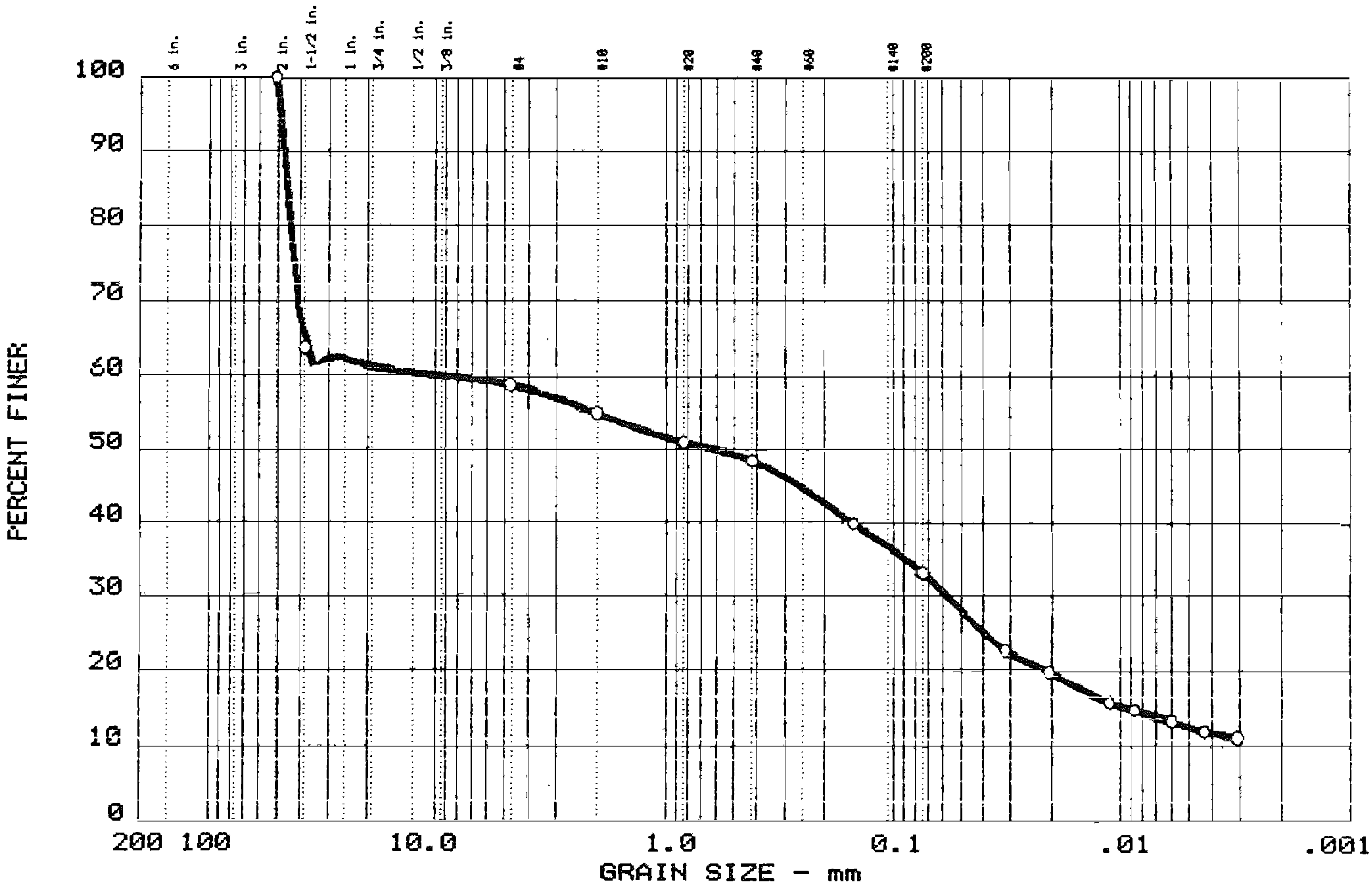
GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:
UNDISTURBED SAMPLE
(DENNISON TUBE)

GS-256
A-216
P-34

Fig. No. 11

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	19	0.0	41.2	25.7	20.5	12.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	17	7	46.18	8.03	0.59	0.057	0.0088			

MATERIAL DESCRIPTION	USCS	AASHTO
○ GRAVEL SOME SAND SOME SILT LITTLE CLAY	GC-GM	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 204-88, S-4, 33.5'-34.2'

Date: 6-8-88

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Remarks:

UNDISTURBED SAMPLE

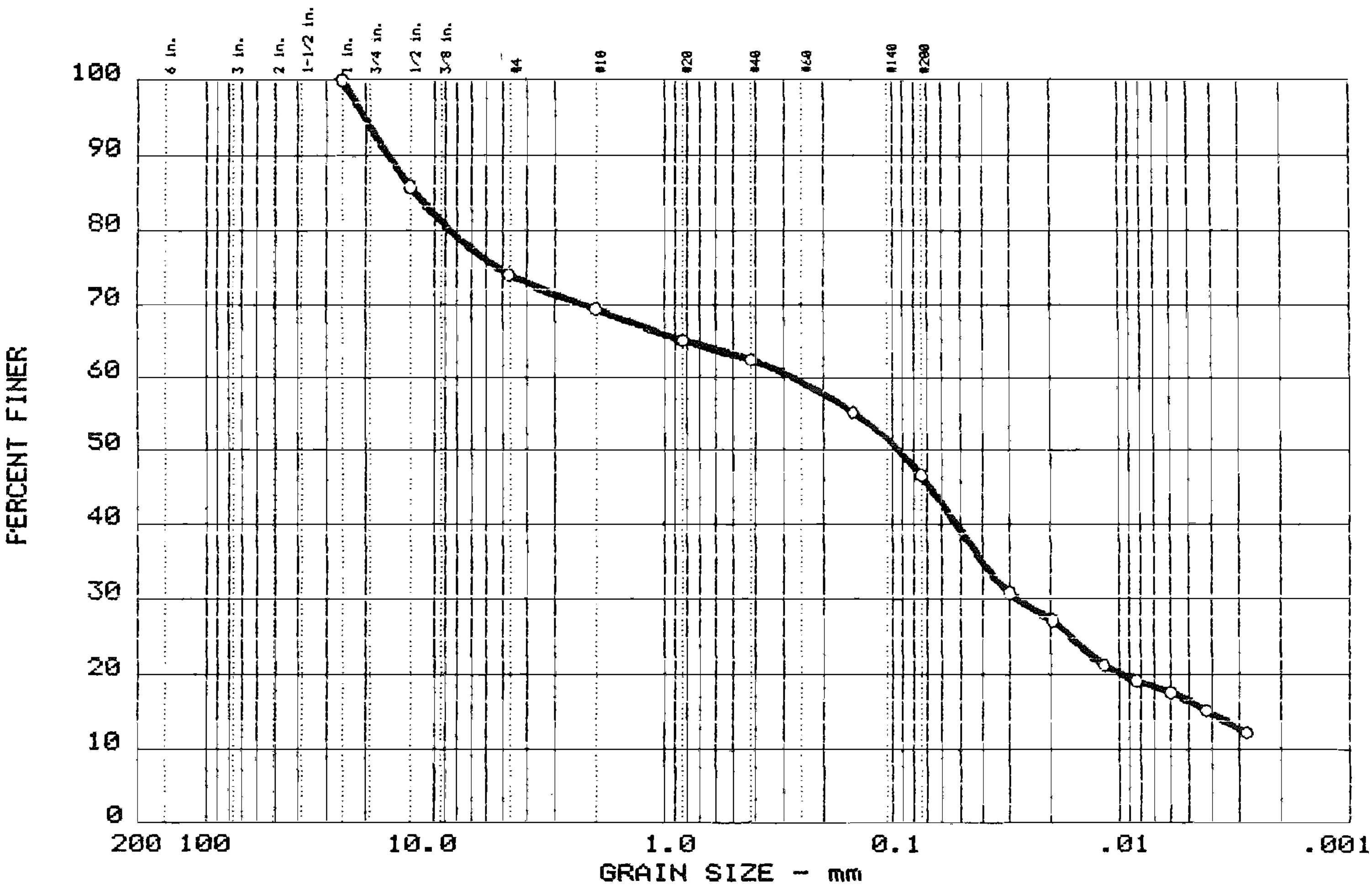
(DENNISON TUBE)

GS-257

A-217
P-35

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	12	0.0	25.9	27.5	30.3	16.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	17	5	12.02	0.26	0.09	0.028	0.0041			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SILT SOME SAND SOME GRAVEL LITTLE CLAY	SC-SM	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 205-88, S-16, 30.0'-30.7'

Date: 6-8-88

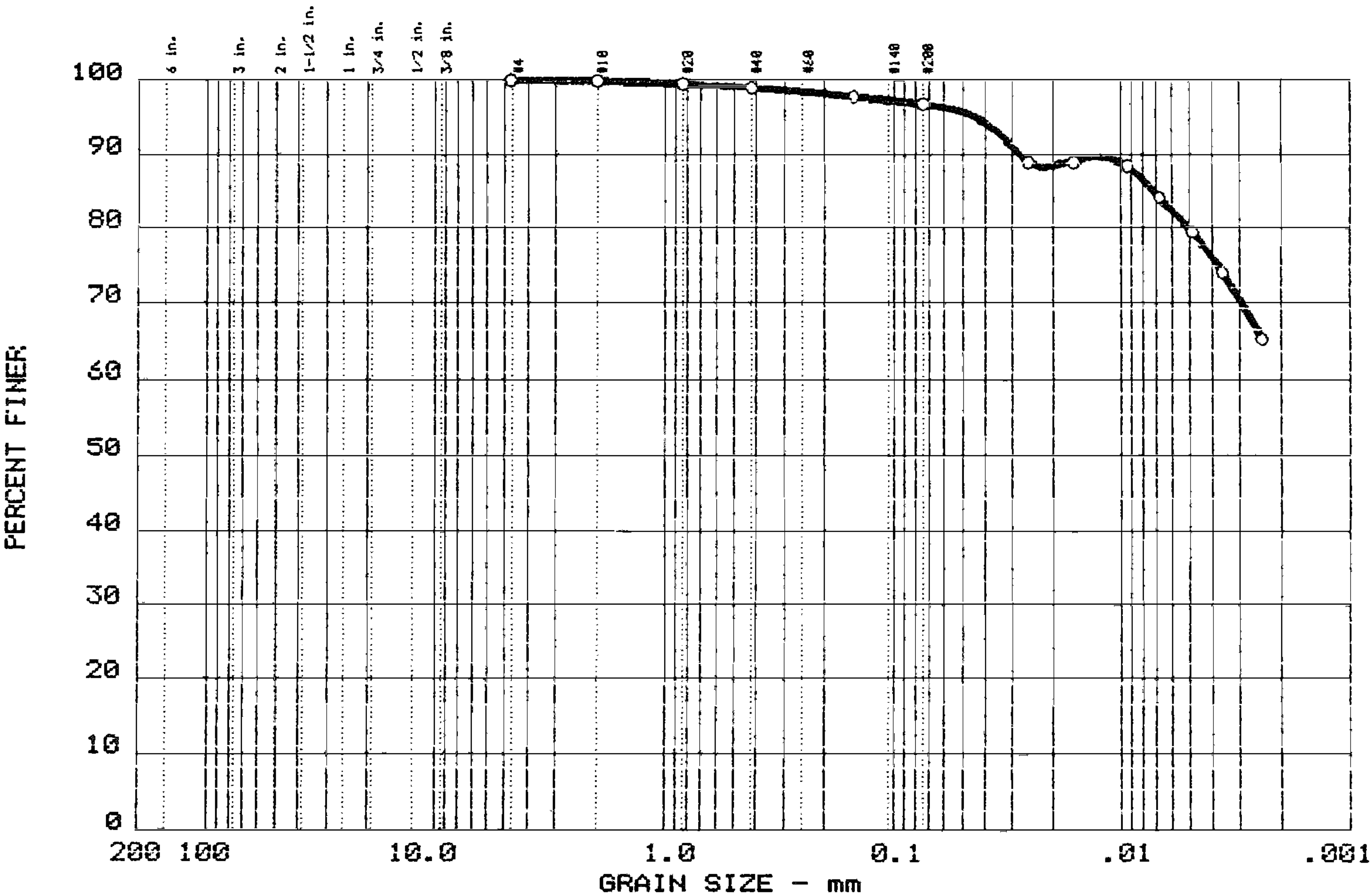
Remarks:
UNDISTURBED SAMPLE
(DENNISON TUBE)

GS-260
A-220
P-38

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	0.0	3.2	17.1	79.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	45	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND	CL	

Project No.: BD-87-90
Project: "S" AREA REMEDIATION
○ Location: BH - 206-88, S-17, 32.0'-34.0'

Date: 6-8-88

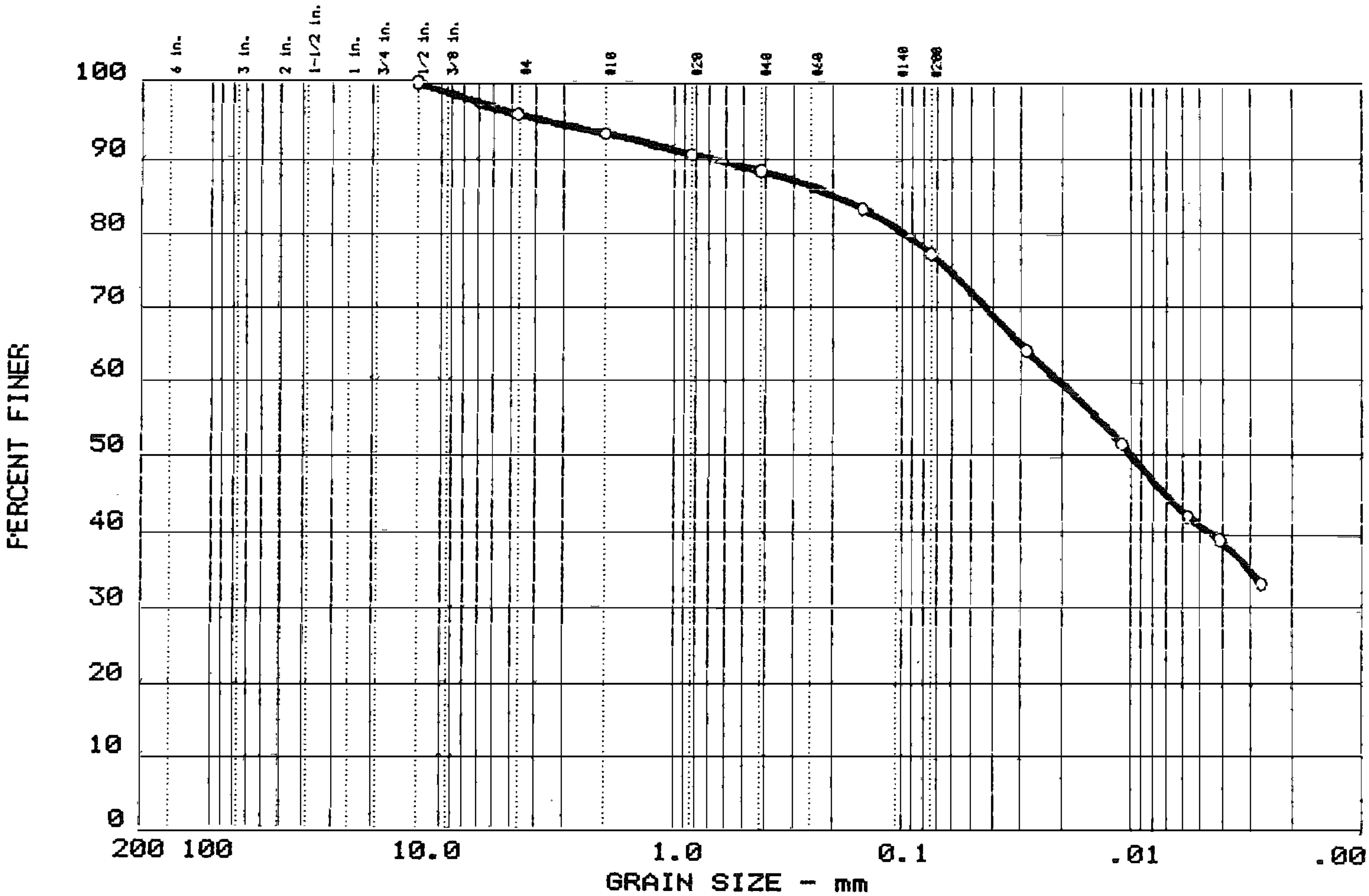
Remarks:
UNDISTURBED SAMPLE
(DENNISON TUBE)

GS-261
A-221
P-39

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	18	0.0	4.1	18.4	36.4	41.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	23	9	0.19		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY AND SILT LITTLE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 207-88, S-16, 30.0'-32.0'

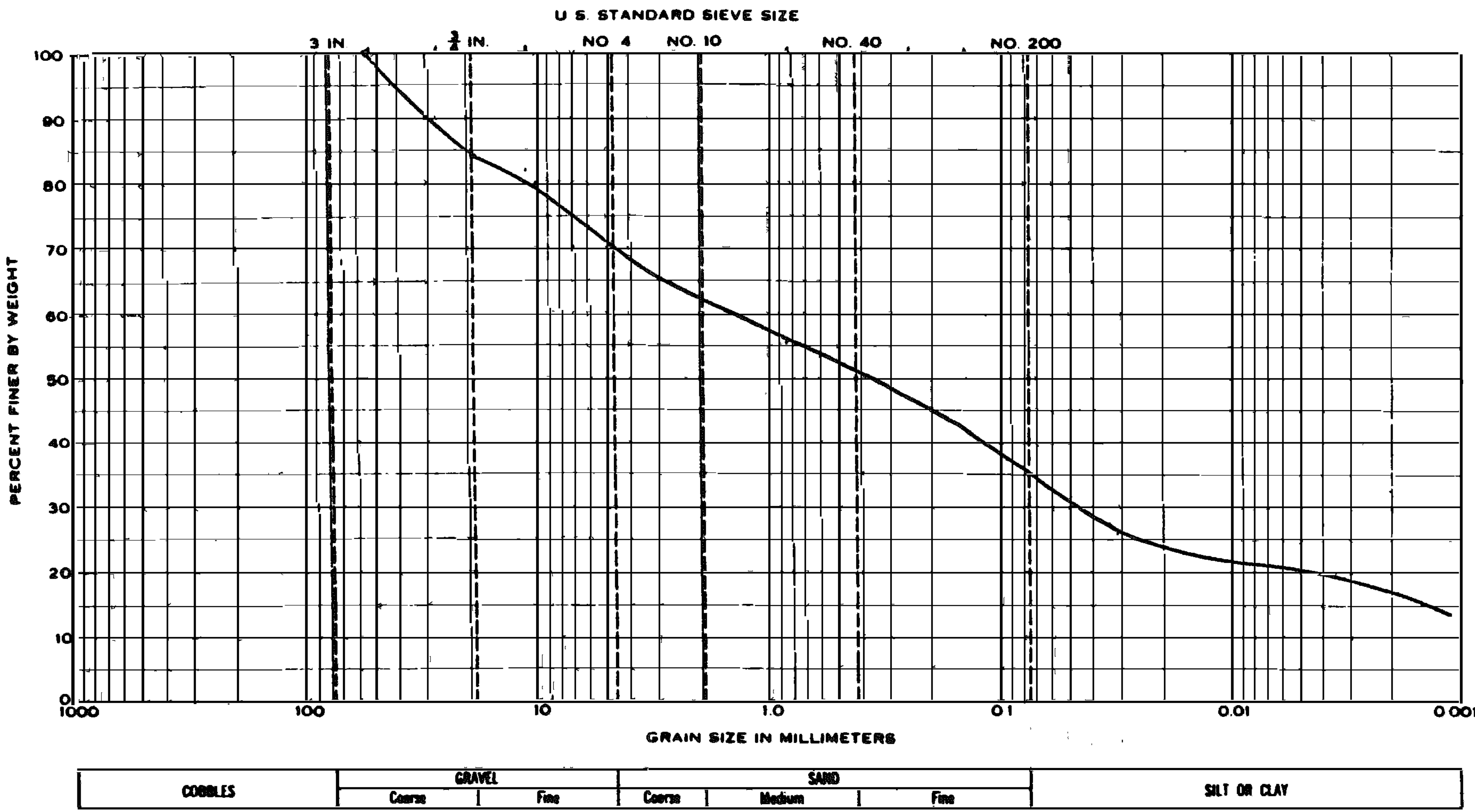
Date: 6-22-88

Remarks:
DENNISON SAMPLE

GS-326
A-279
P-51

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 18



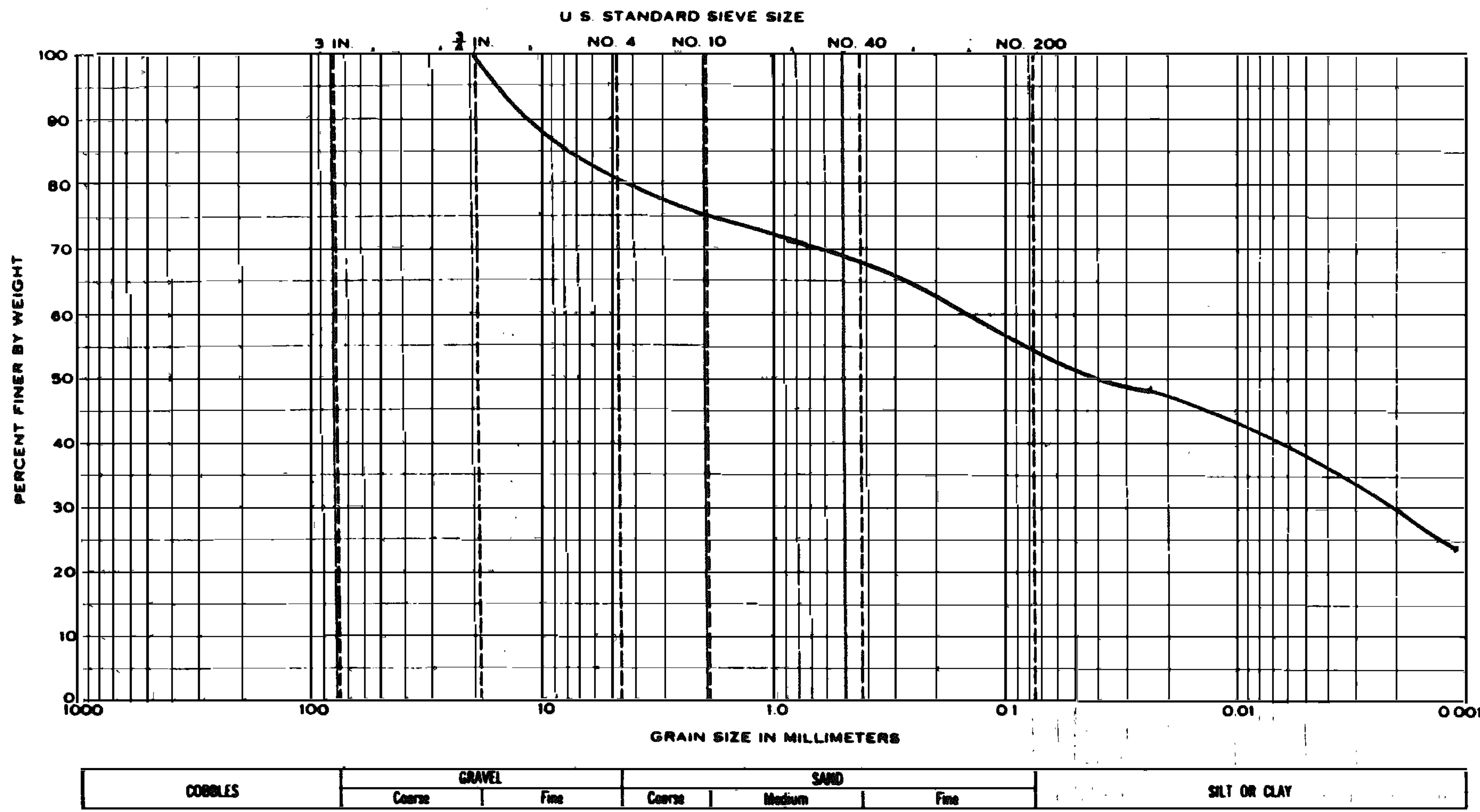
Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI	
BH-207	32'-34'	Brown Silty C-F	8.7	16	12	4	
S-17		SAND & GRAVEL					

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing

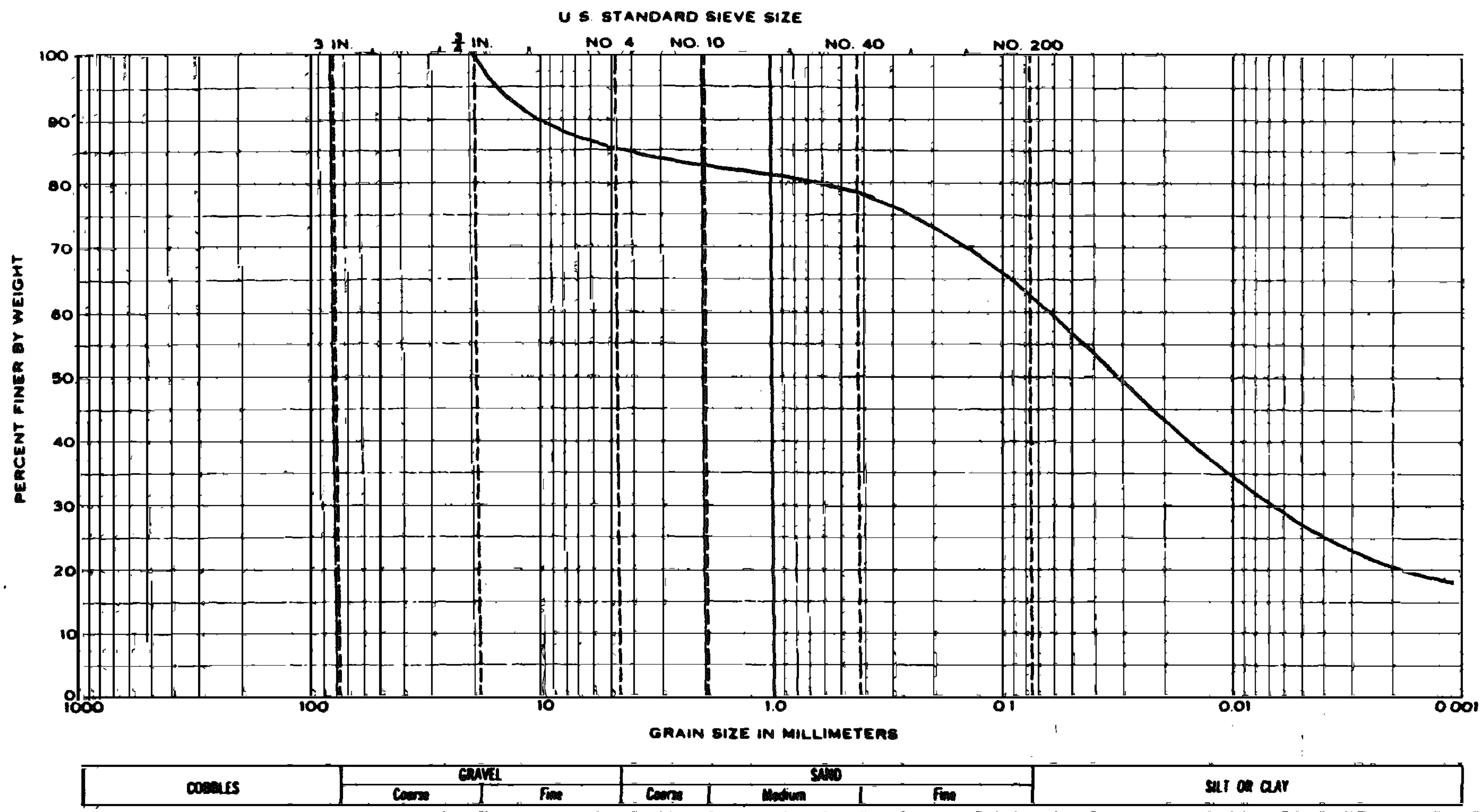


Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-208 S-16	32'-34'	Brown C-F Sandy SILT	19.2	17	13	4

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York
Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



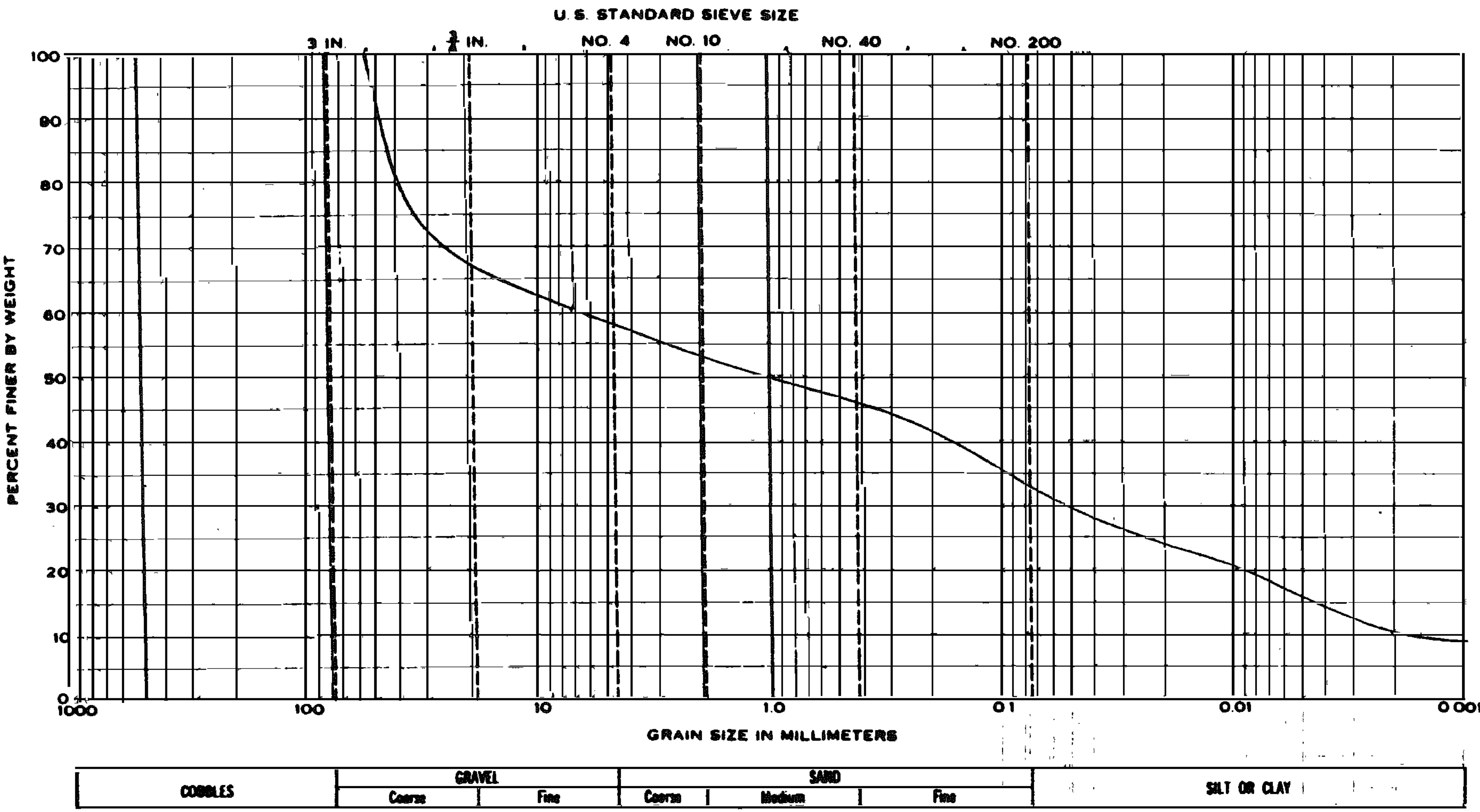
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-209 S-15	30'-32'	Brown C-F Sandy SILT with Fine Gravel	26.6	24	21	3

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



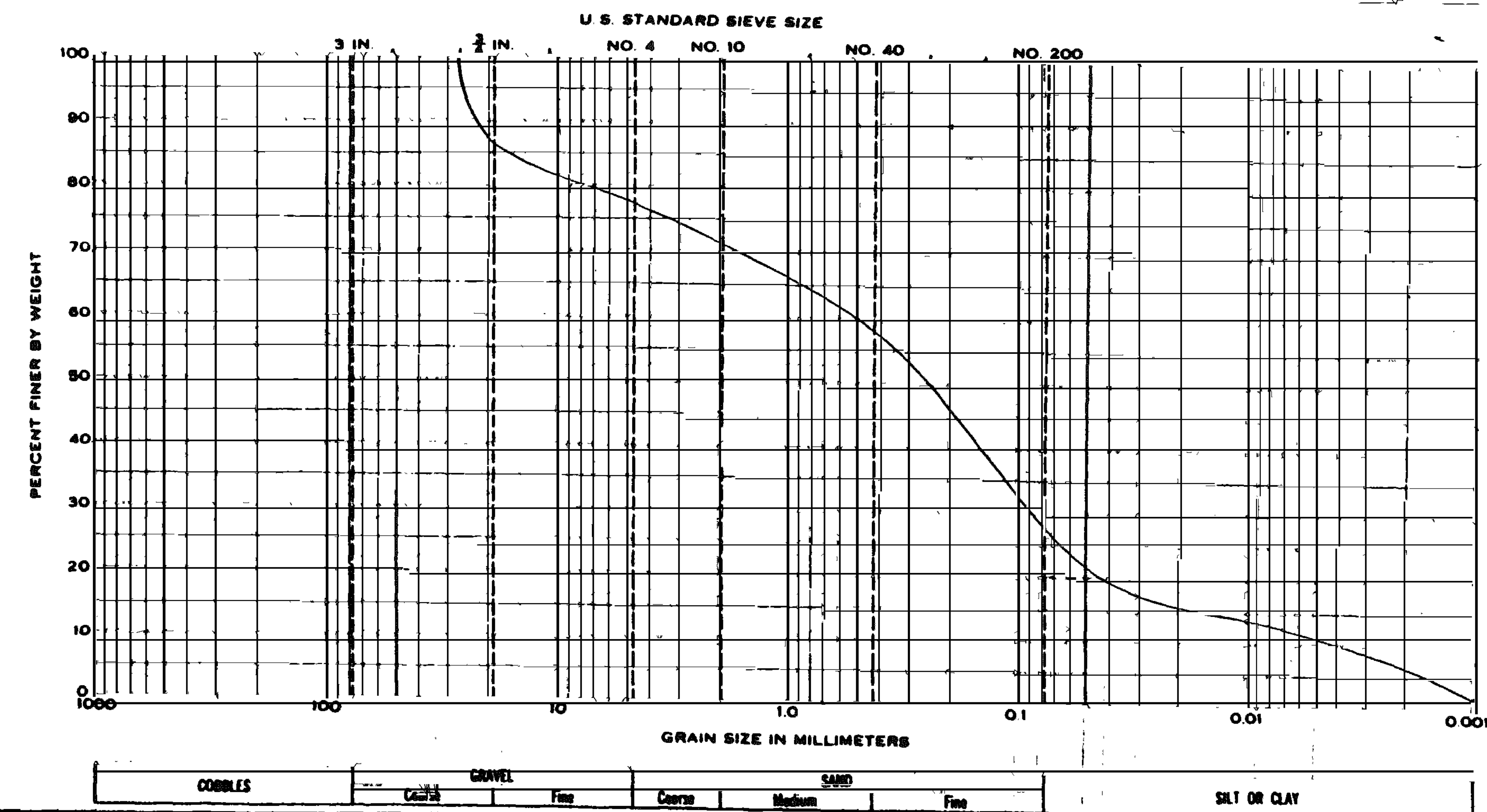
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-209 S-16	32'-34'	Brown C-F Silty SAND and C-F GRAVEL	8.7	15	12	3

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



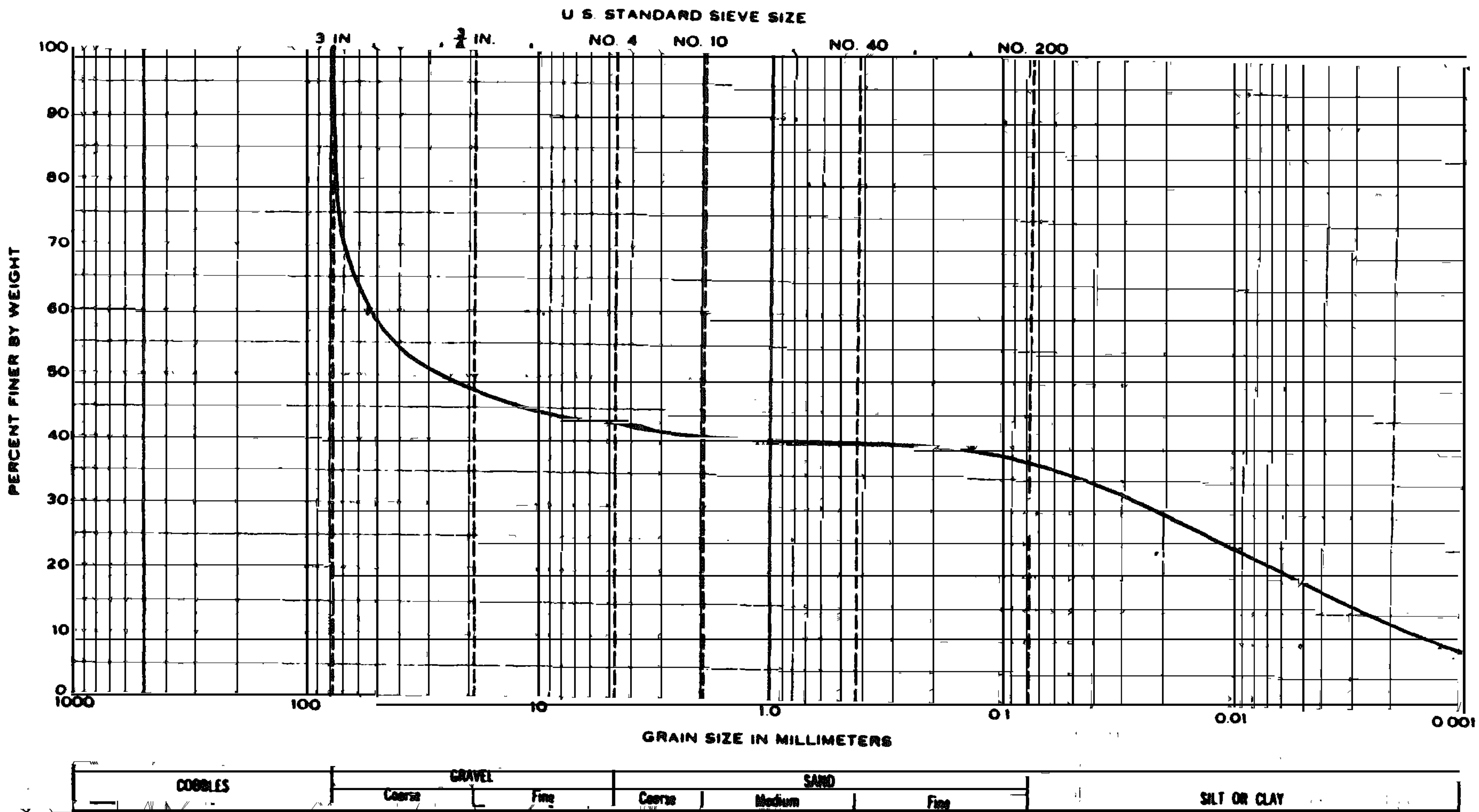
Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-210 S-13	24'-26'	Brown C-F Silty SAND with Fine Gravel	6.6	22	16	6

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



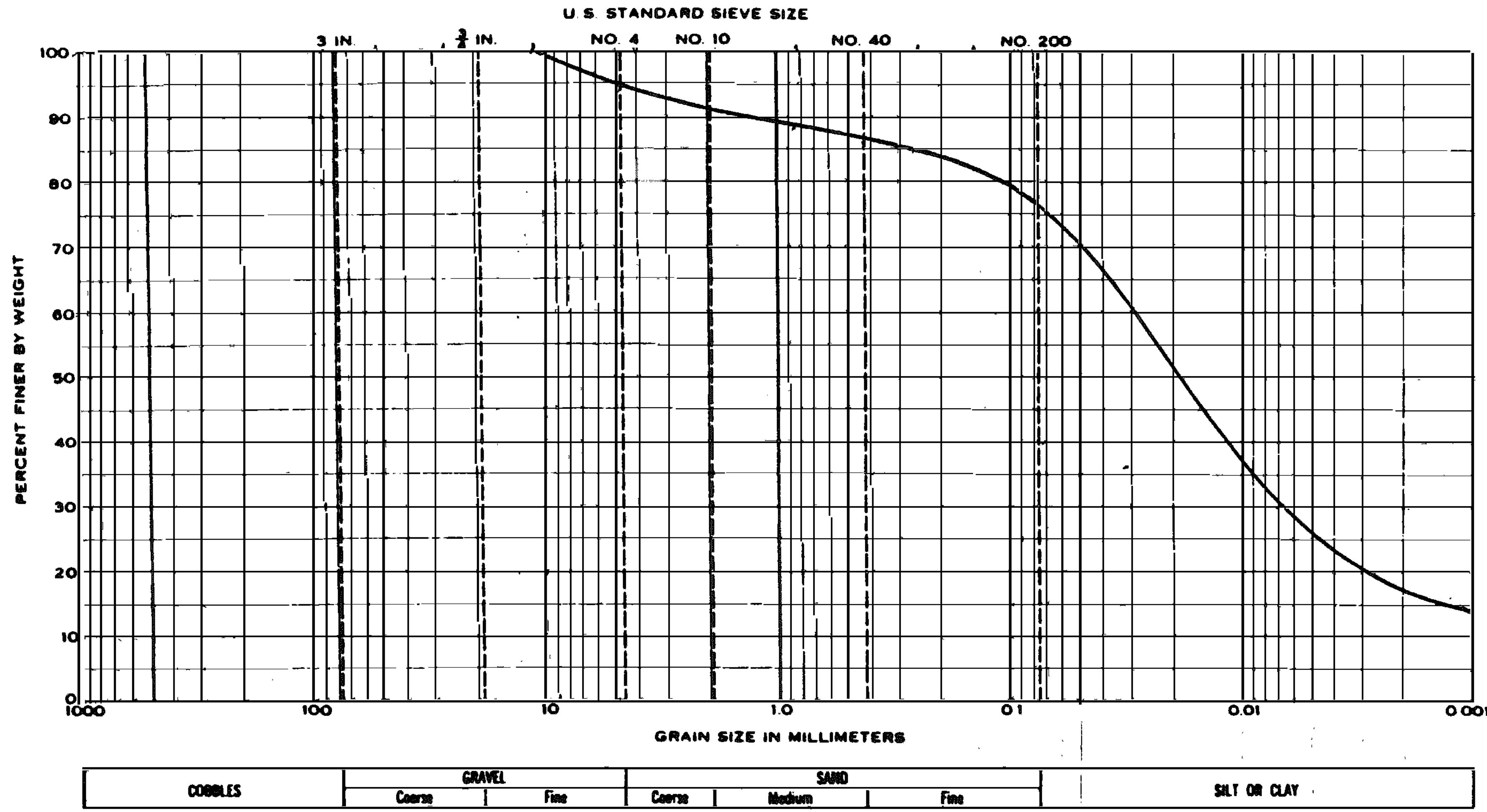
Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-210 S-14	26'-28'	Brown Silty GRAVEL with Some Sand	3.6	NP	NP	NP

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



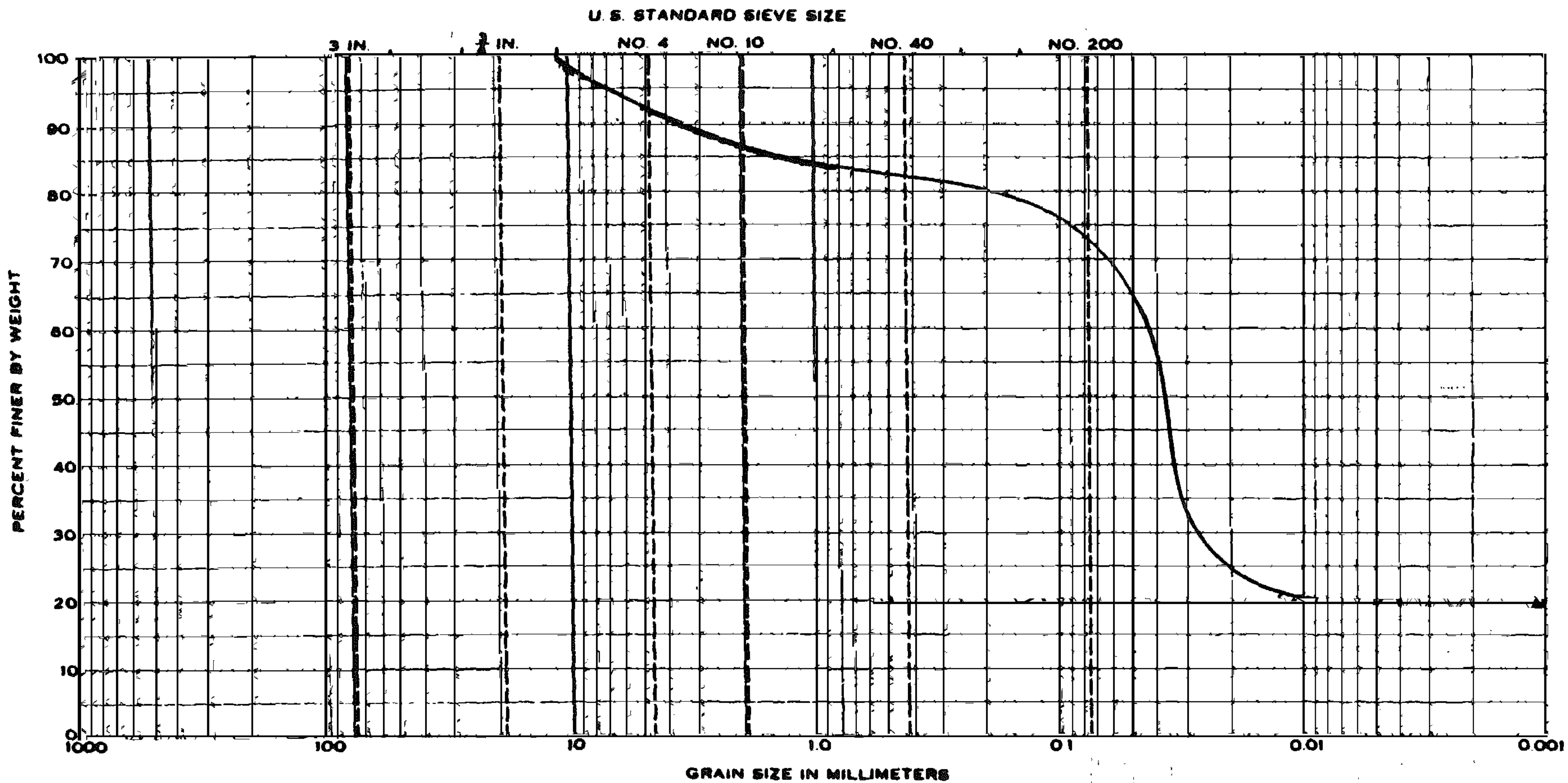
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI	
BH-211 S-13	24'-26'	Brown Sandy SILT	21.1	22	14	8	

Project: Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date: June 13, 1988 Job No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



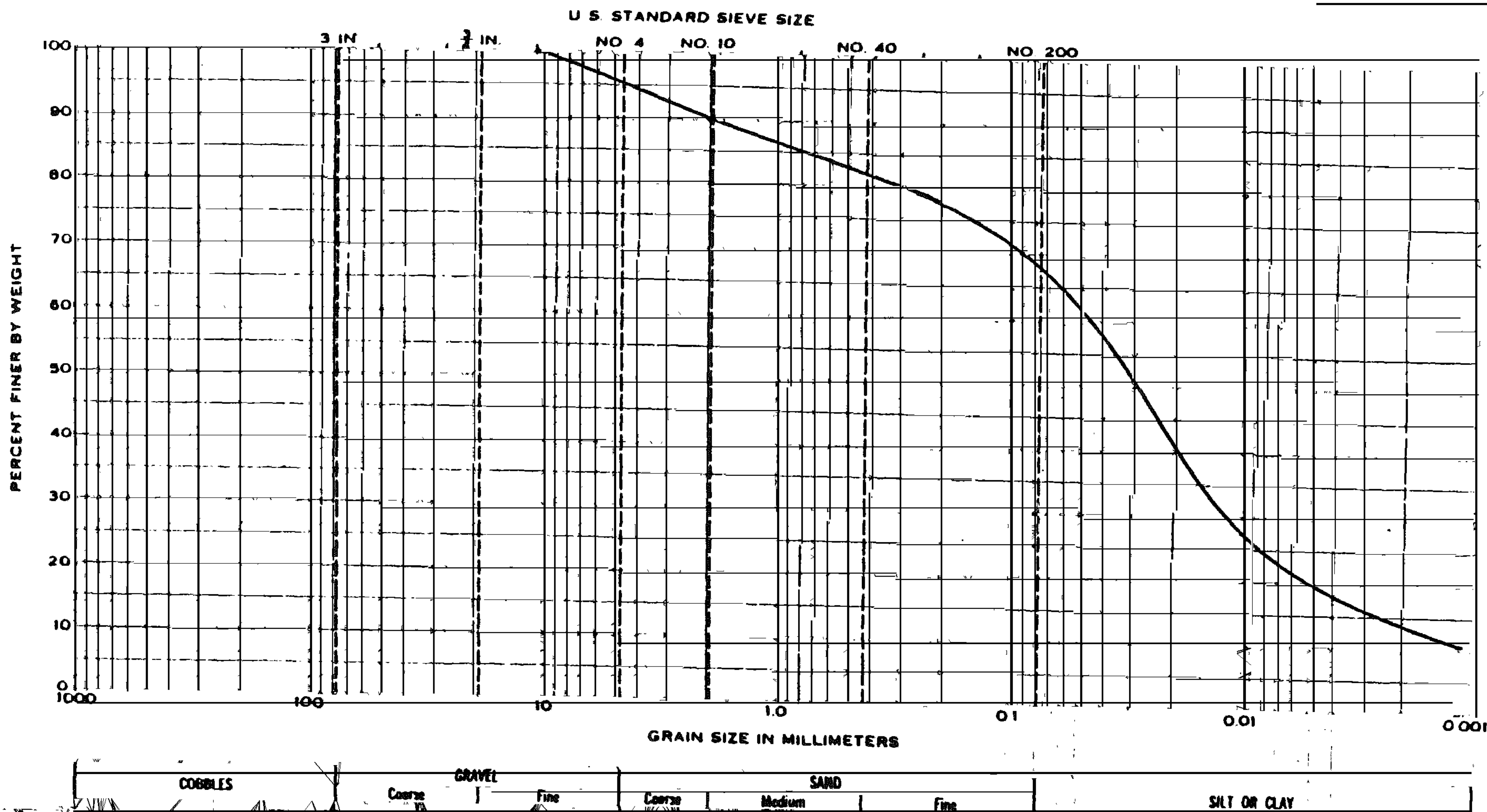
COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI	
BH-211	26'-27.8'	Brown Fine Sandy	23.7	NP	NP	NP	
S-14		SILT					

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York
Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-212 S-13	24'-26'	Br. sandy silty clay/clayey SILT (cl-ml)	14.2	21	14	7

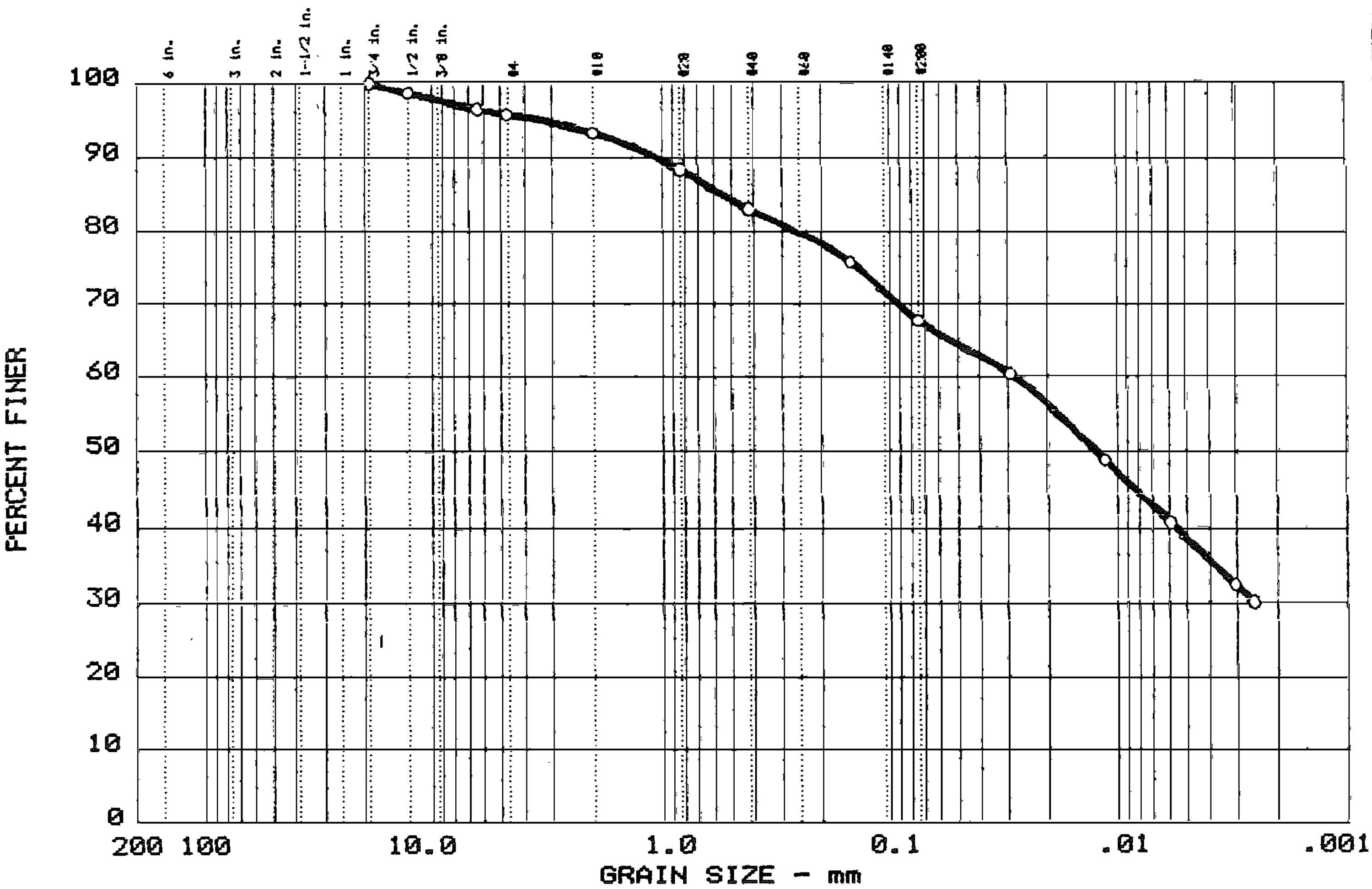
Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	11	0.0	4.0	28.3	29.1	38.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	18	8	0.54		0.01					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT SOME SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 213- , S-13A, 24.0'-24.5'

Date: 6-22-88

Remarks:
JAR SAMPLE

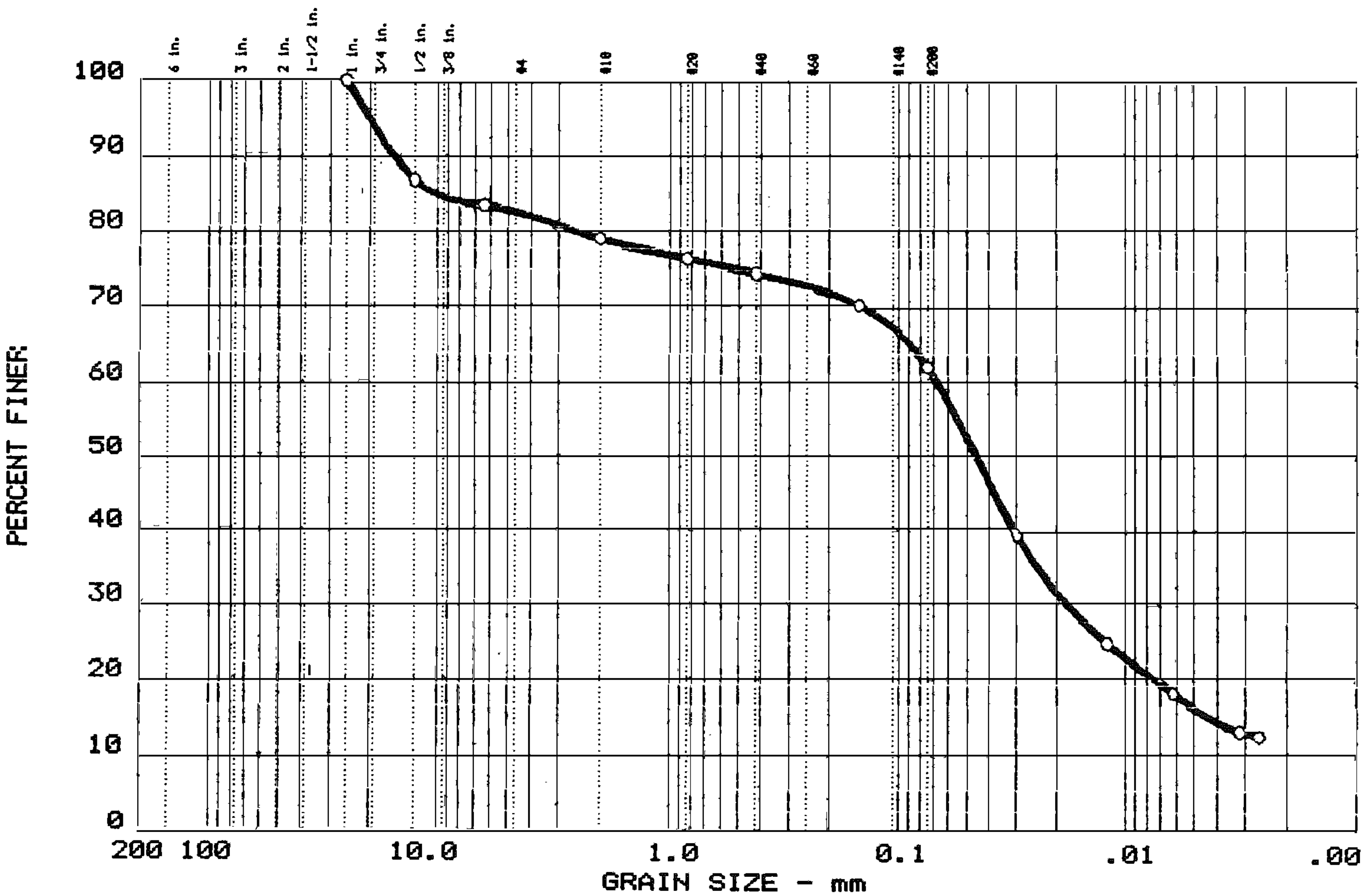
GS-345
A-296

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	2	0.0	17.5	20.3	45.8	16.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	16	3	10.59		0.05	0.018	0.0042			

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME SAND LITTLE GRAVEL LITTLE CLAY	ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 213- , S-13B, 24.5'-26.0'

Date: 6-22-88

Remarks:

JAR SAMPLE

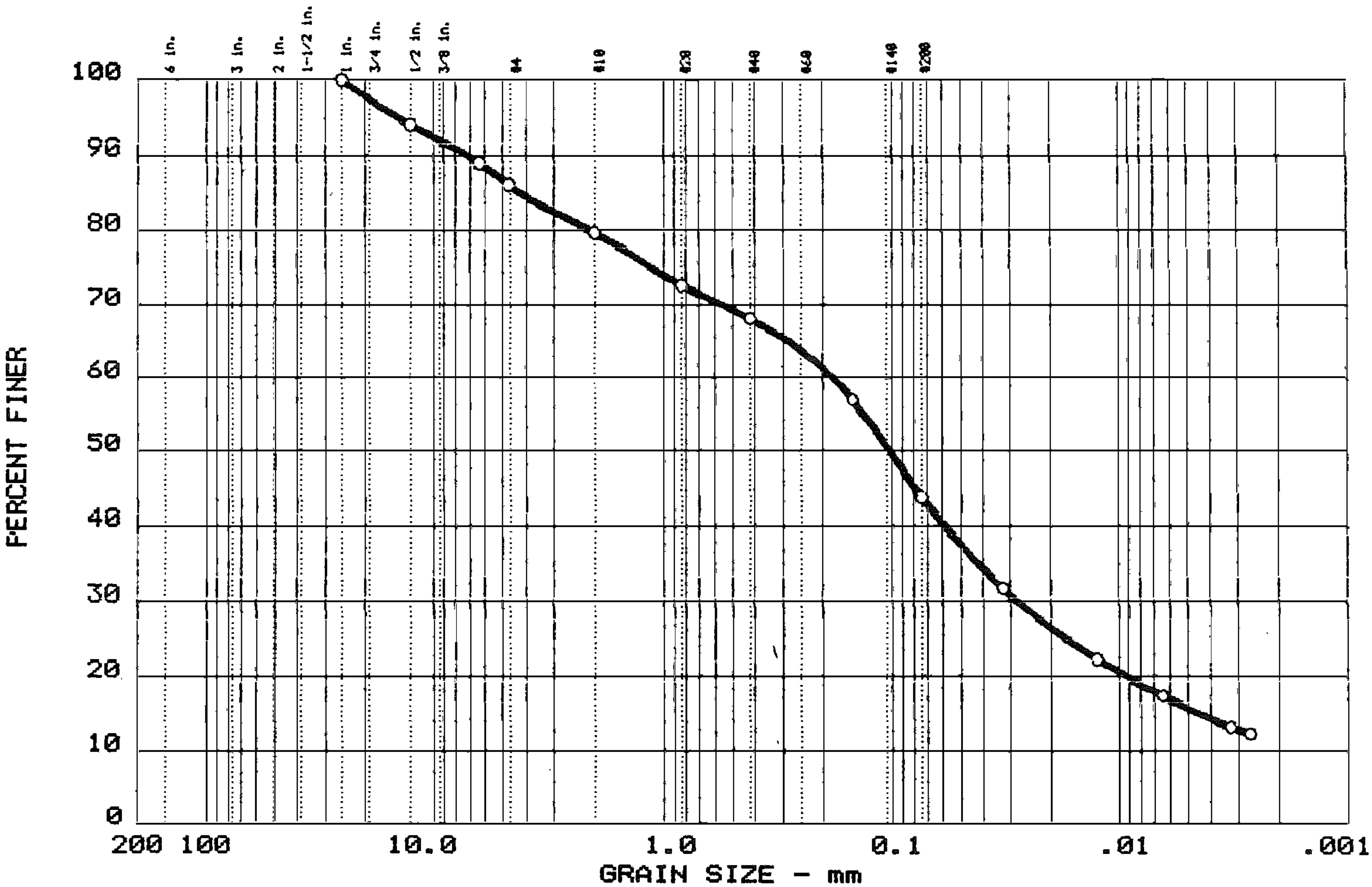
GS-337
A-288

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 2

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	8	0.0	13.9	42.4	28.0	15.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	12	5	4.17	0.18	0.10	0.028	0.0044			

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME SILT LITTLE CLAY LITTLE GRAVEL	SC-SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 213 , S-14, 26.0'-27.0'

Date: 6-22-88

Remarks:

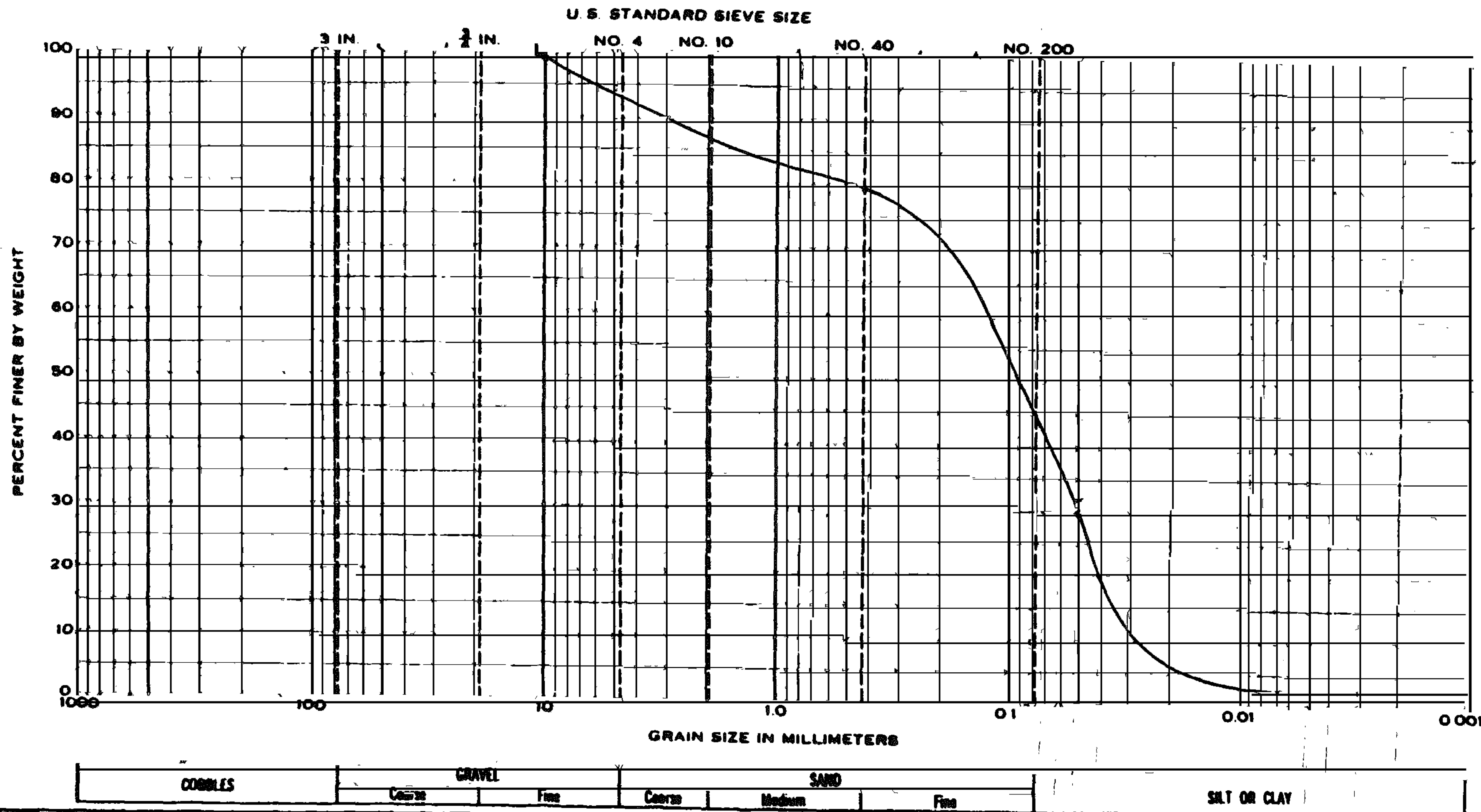
JAR SAMPLE

GS-346
A-297

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7



Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-213 S-15	27'-27.7'	Brown Silty C-F SAND	9.0	NP	NP	NP

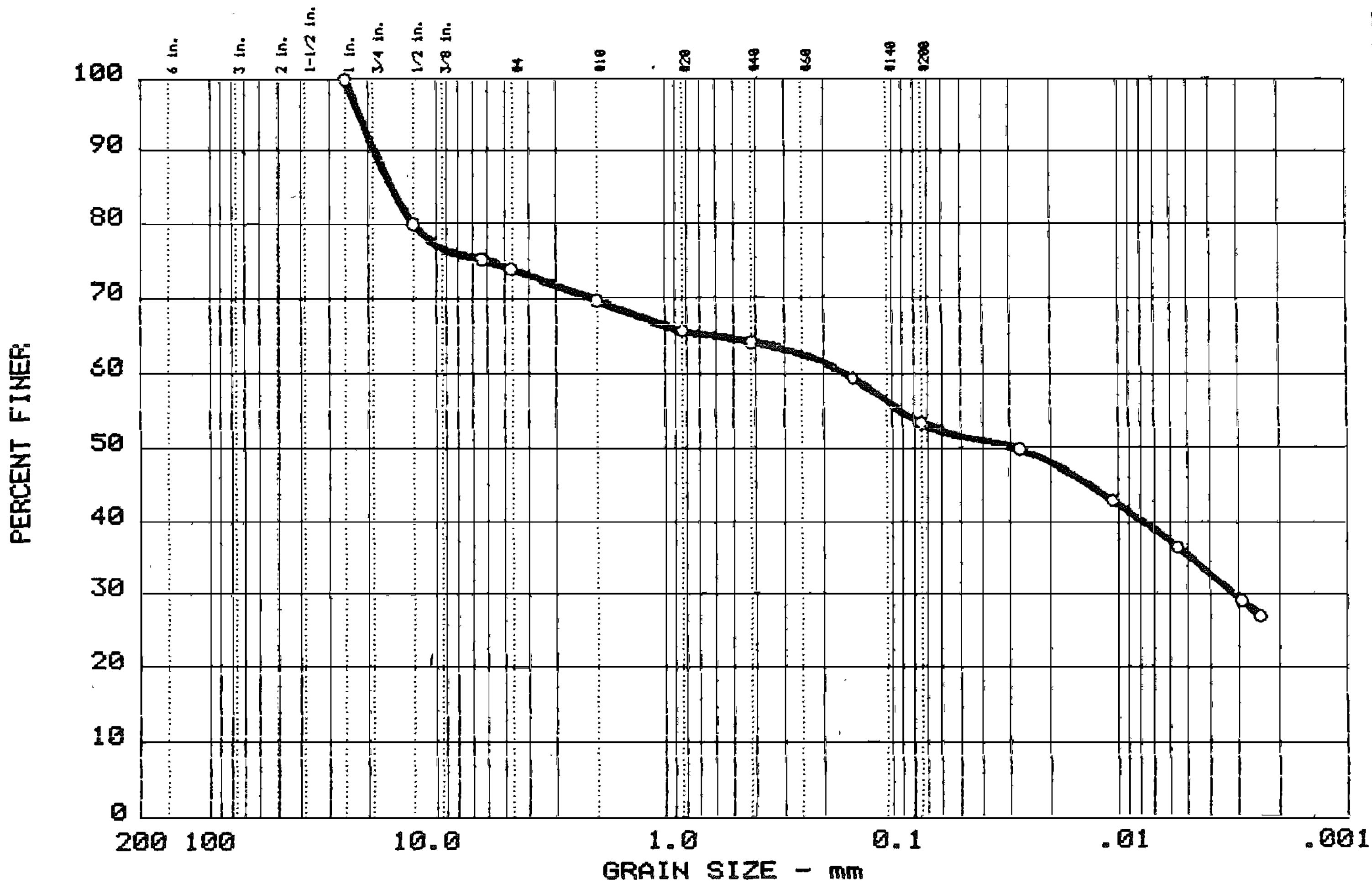
Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	7	0.0	26.0	20.6	18.2	35.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	27	13	15.85	0.16	0.03	0.003				

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY SOME GRAVEL SOME SAND LITTLE SILT	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: BH - 214- ,S-13, 25.3'-26.0'

Date: 6-22-88

Remarks:
JAR SAMPLE

GS-347

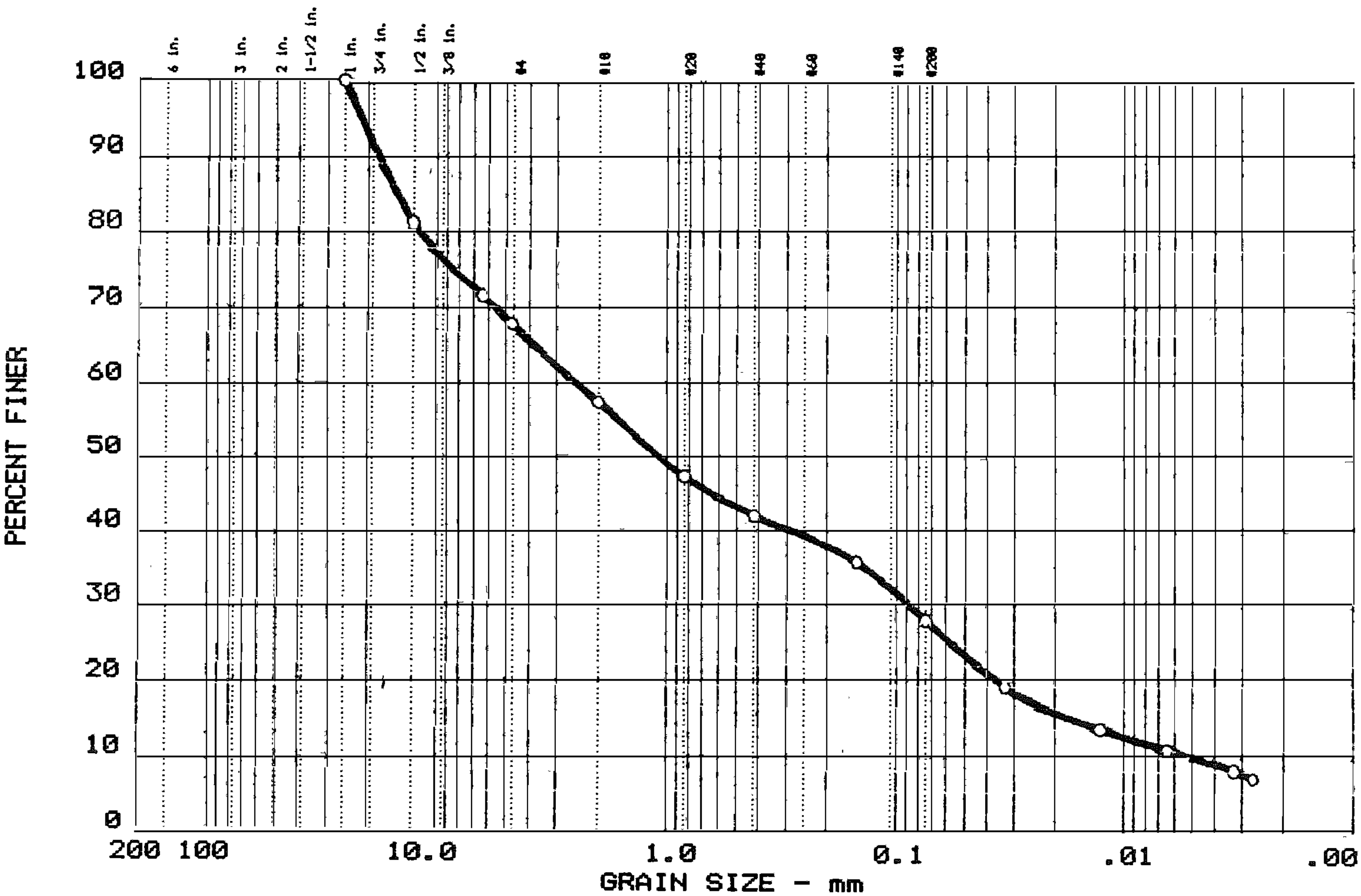
A-298

M

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	10	0.0	32.2	39.7	18.0	10.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	12	3	15.14	2.48	1.08	0.086	0.0166	0.0048	0.62	512.9

MATERIAL DESCRIPTION	USCS	AASHTO
O SAND SOME GRAVEL LITTLE SILT LITTLE CLAY	SM	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 214- ,S-14, 26.0'-28.0'

Date: 6-22-88

Remarks:

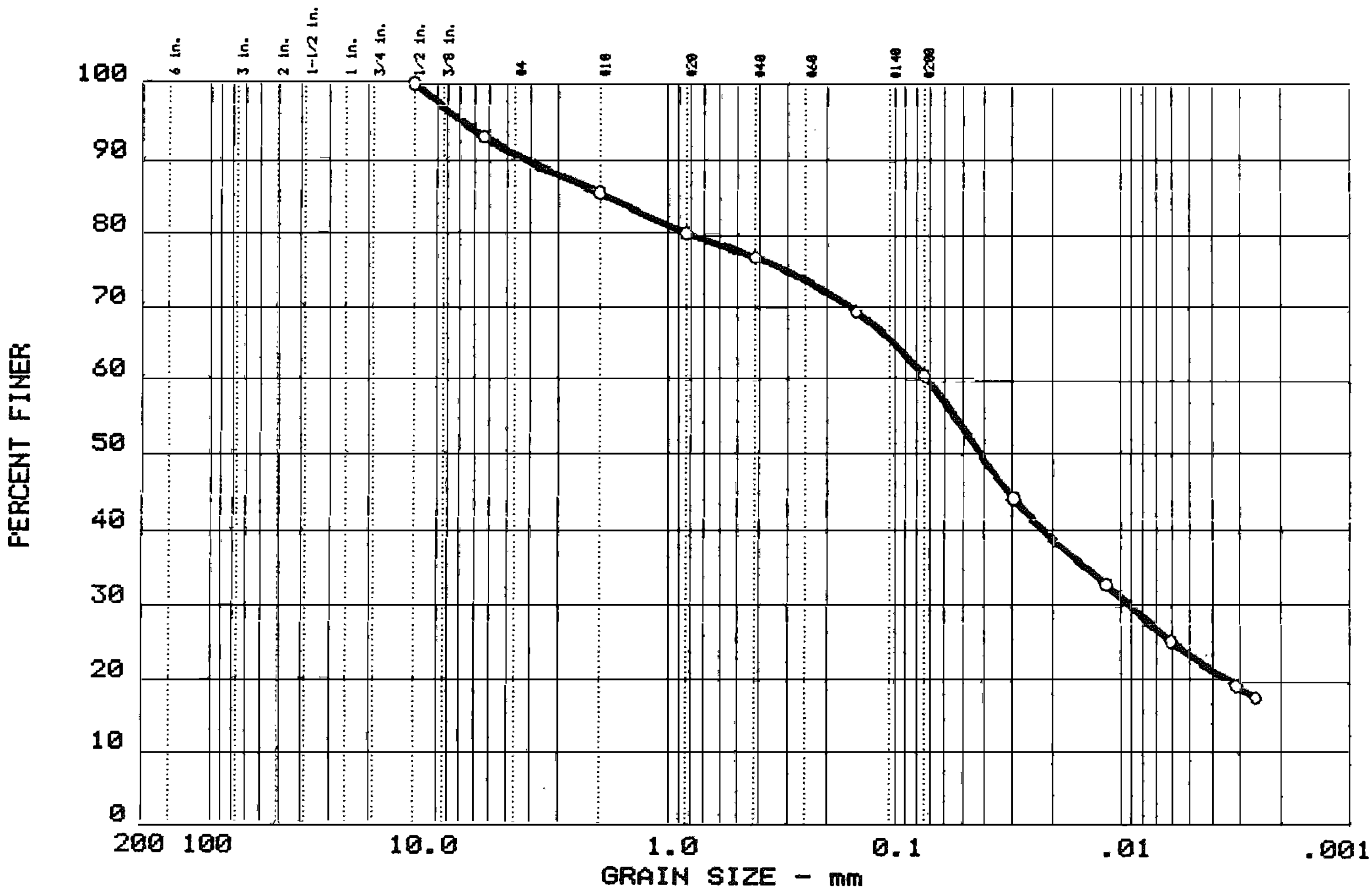
JAR SAMPLE

GS-348
A-299

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	3	0.0	9.2	30.1	37.2	23.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	17	6	1.84		0.04	0.009				

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME SAND SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: BH - 215- , S-3, 28.0'-30.0'

Date: 6-22-88

Remarks:

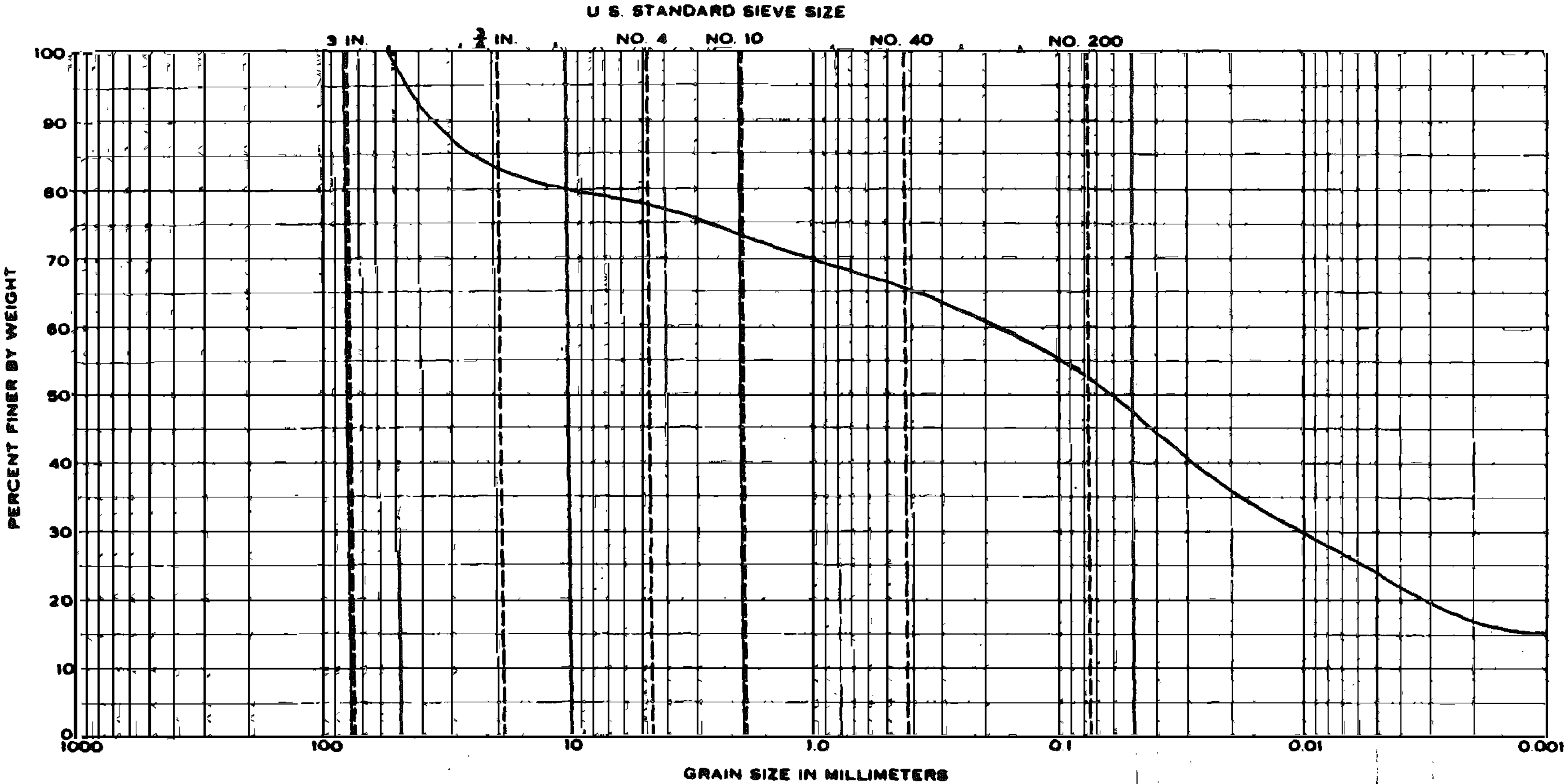
JAR SAMPLE

GS-334
A-287

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-215 S-4	30'-31.3'	Brown Silty C-F SAND with Fine Gravel	12.2	18	14	4

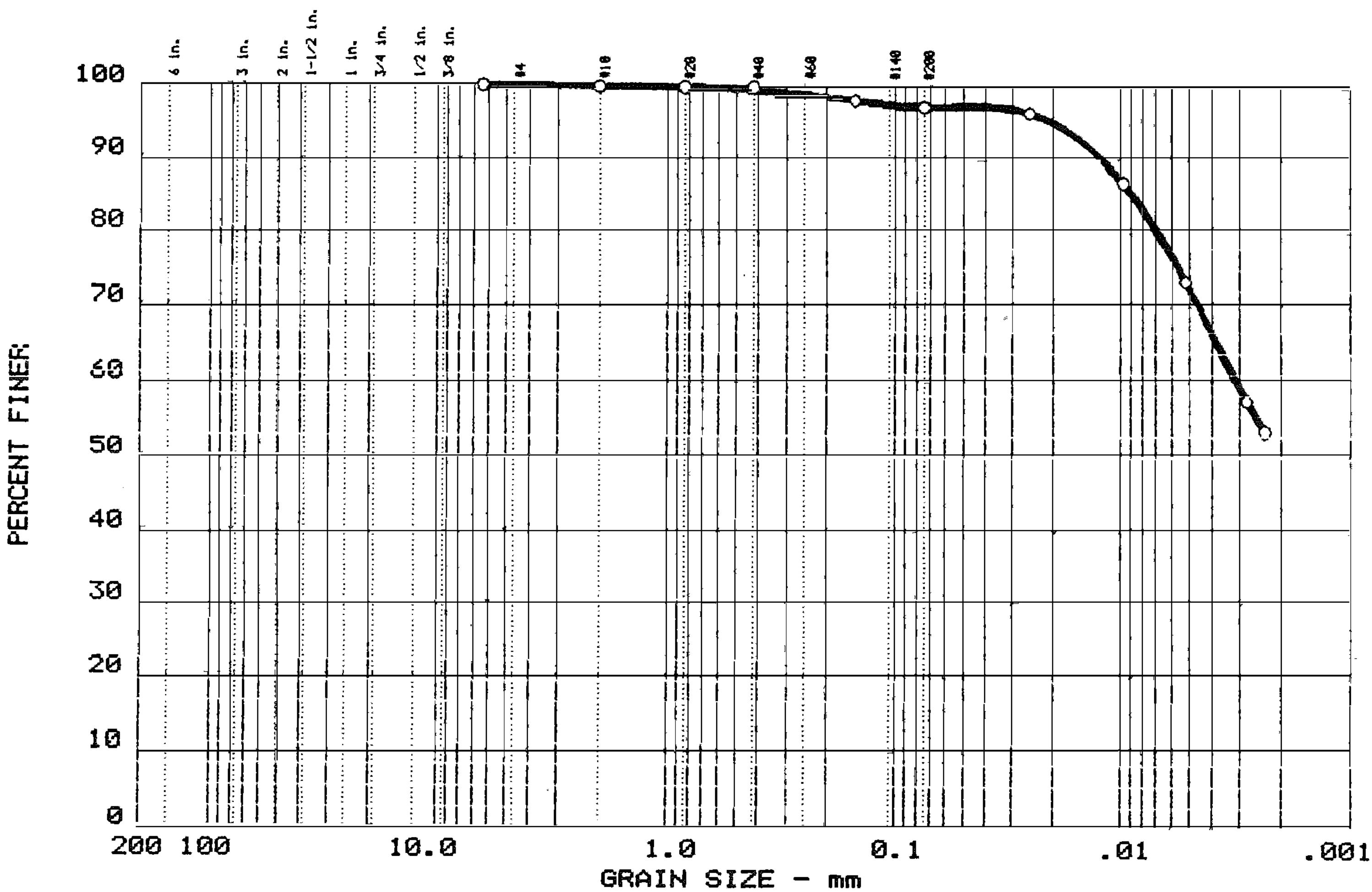
GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York
Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing

M

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	0.1	2.7	25.0	72.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 216- , S-17, 34.0' - 36.0'

Date: 6-22-88

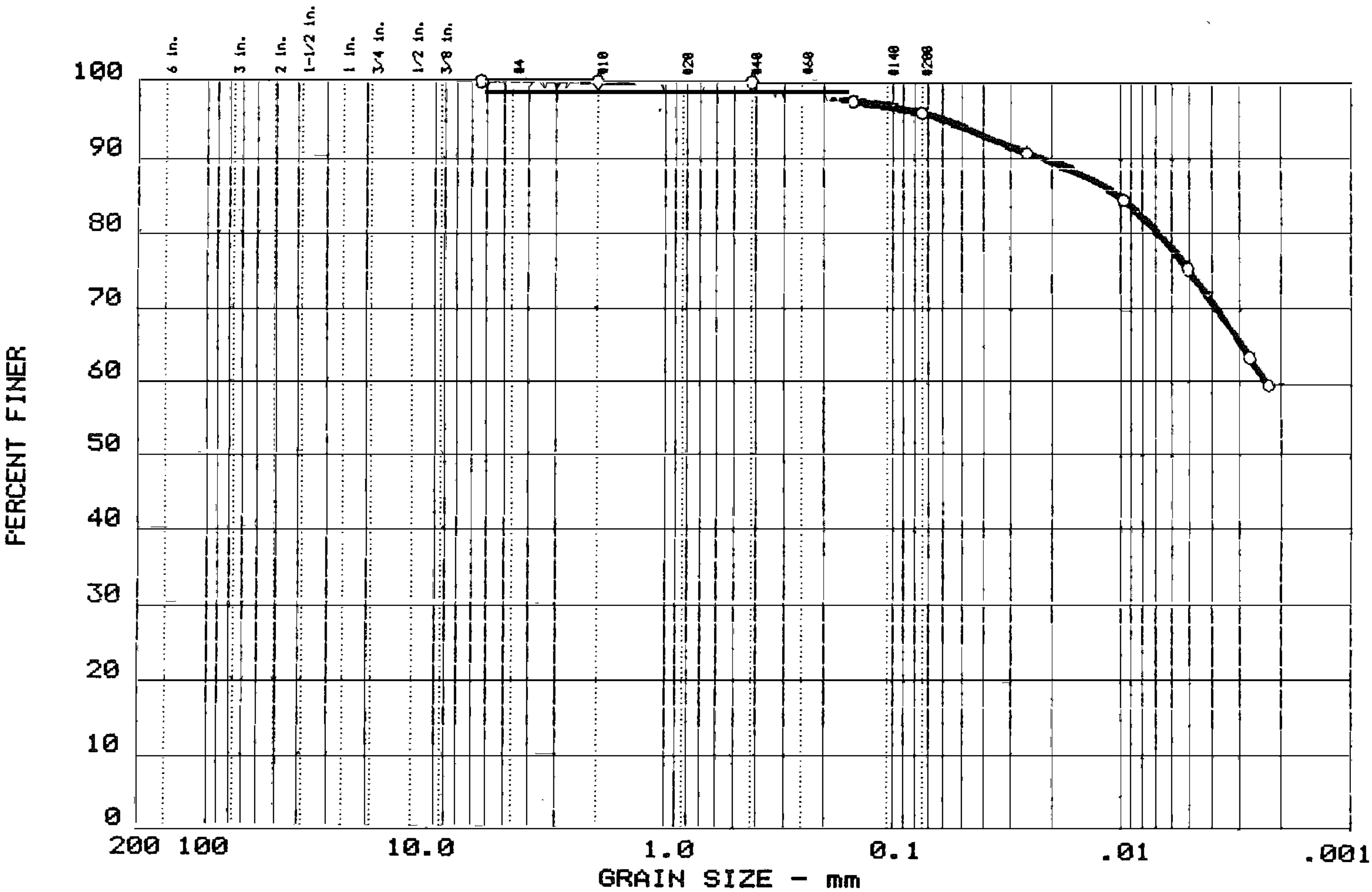
Remarks:
JAR SAMPLE
INSUFFICIENT MATERIAL
FOR ATTERBERG

GS-335

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 4

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	5	0.0	0.1	3.9	20.9	75.2

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NA	NA								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 216- , S-18, 36.0' - 38.0'

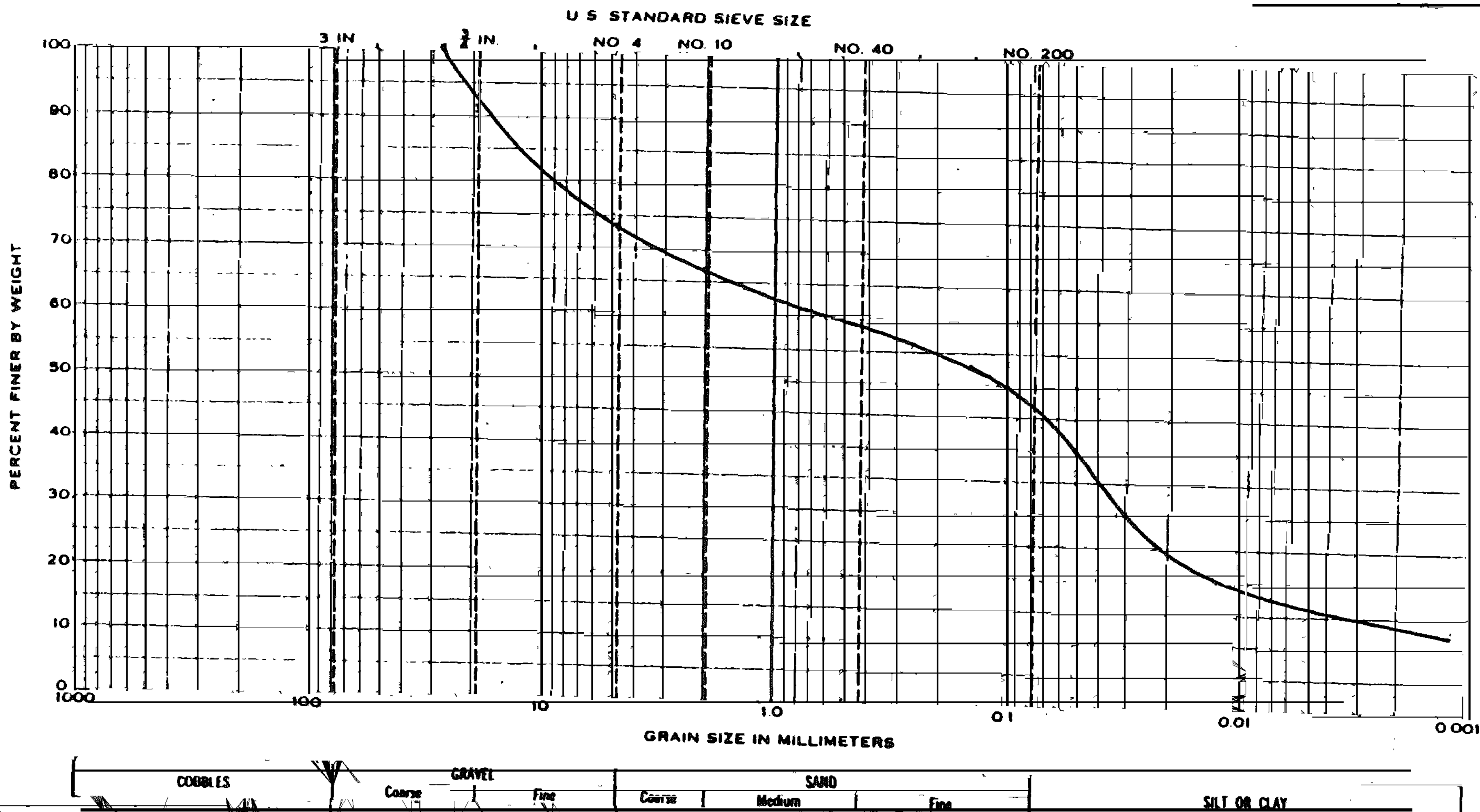
Date: 6-22-88

Remarks:
JAR SAMPLE
INSUFFICIENT MATERIAL
FOR ATTERBERG

GS-336

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 5



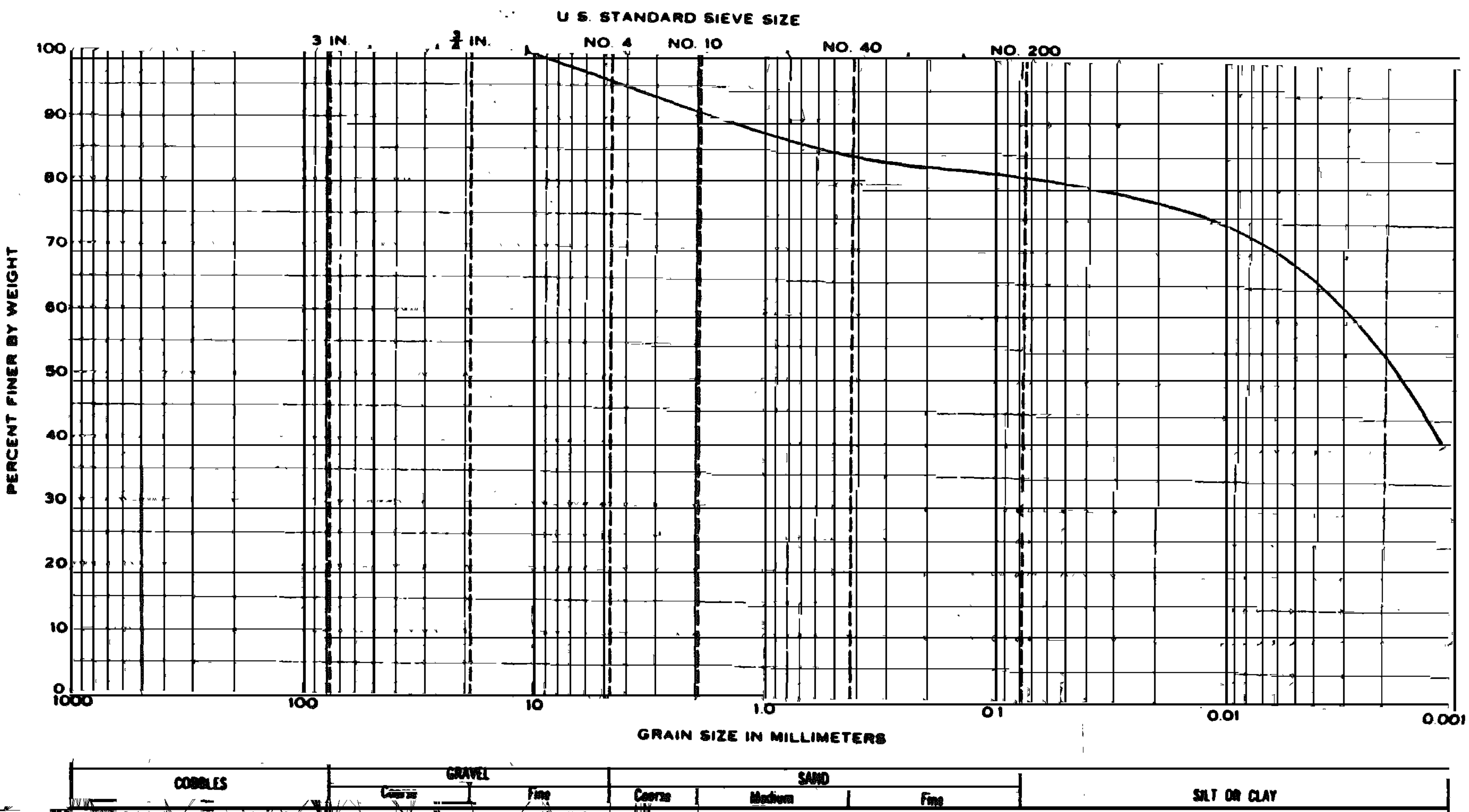
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-216 S-22	44'-45'	Brown Silty C-F SAND with F. Gravel	8.7	16	NP	NP

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 Job No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC
Materials Testing



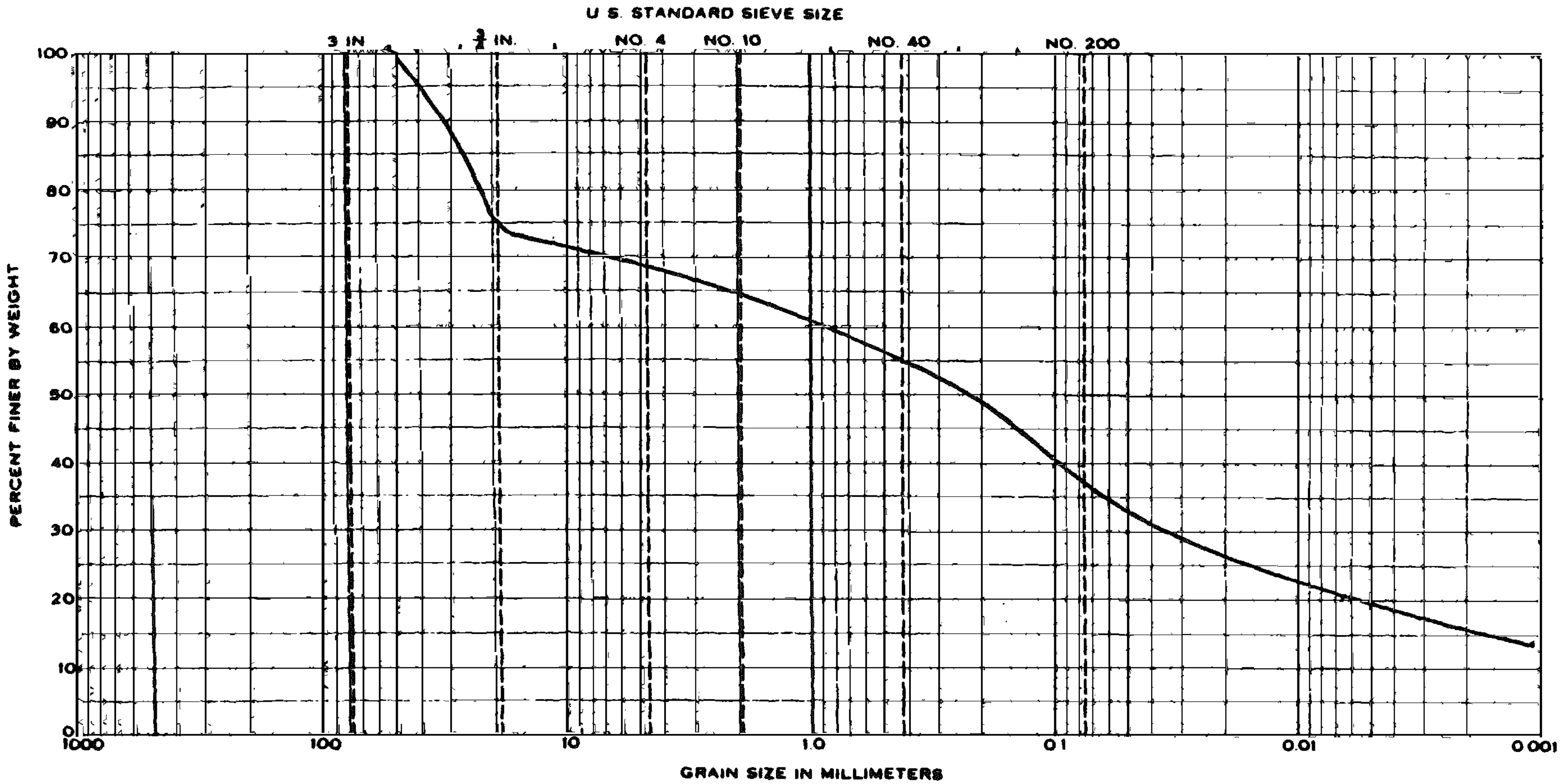
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-217 S-7	38'-40'	Brown Fine Sandy Silty CLAY	5.7	39	20	19

GRADATION CURVES

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

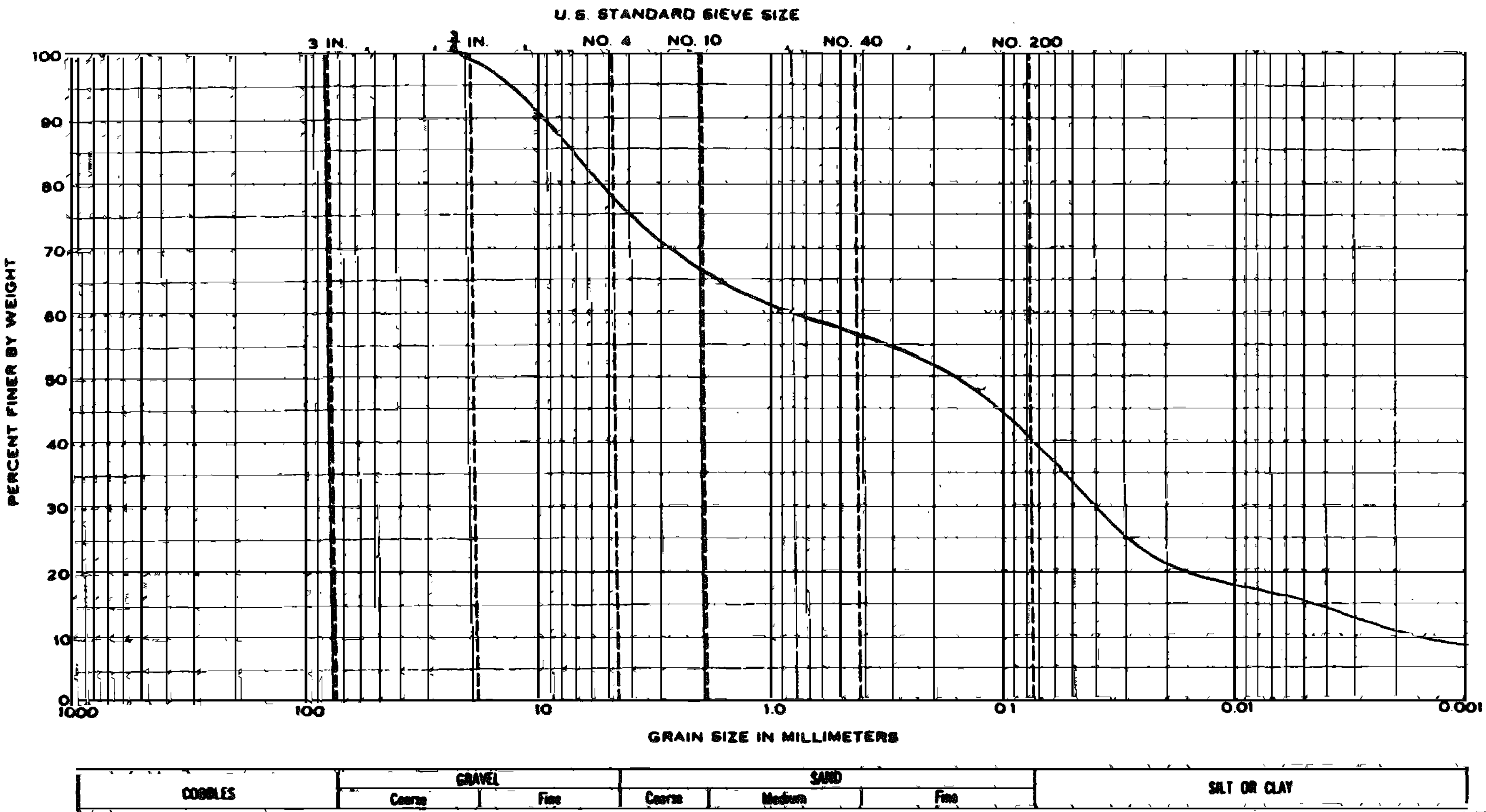
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-218 S-7	37'-39'	Brown Silty C-F SAND & GRAVEL	5.7	NP	NP	NP

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

GRADATION CURVES

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing



Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-219 S-8	39'-39.8'	Brown Silty C-F SAND & F. Gravel	6.4	NP	NP	NP

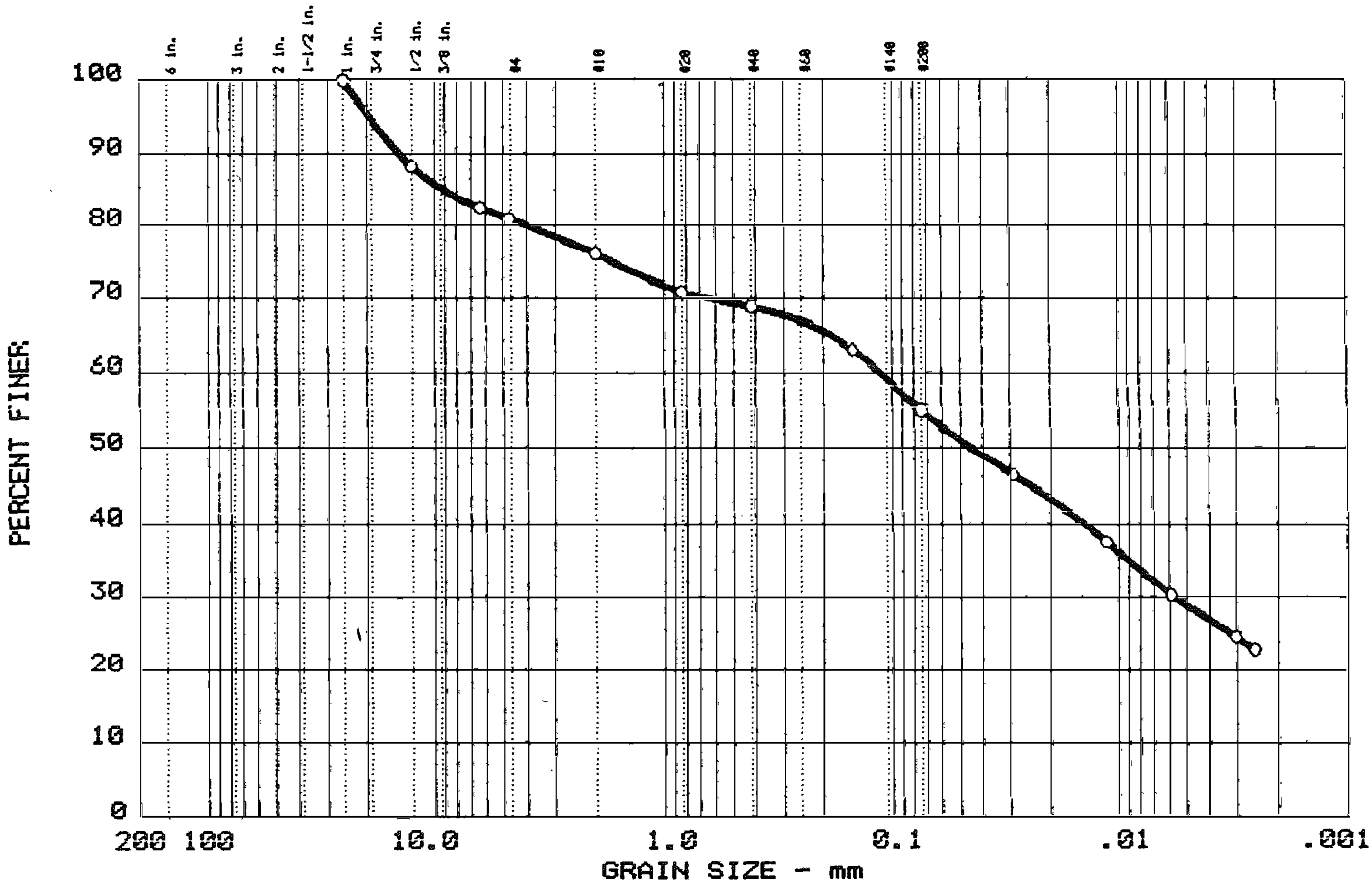
Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	4	0.0	19.1	25.9	26.2	28.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NP	NP	9.33	0.11	0.04	0.006				

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY SOME SILT SOME SAND LITTLE GRAVEL	ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 220- , S-7b , 38.5'-39.0'

Date: 6-22-88

Remarks:

JAR SAMPLE

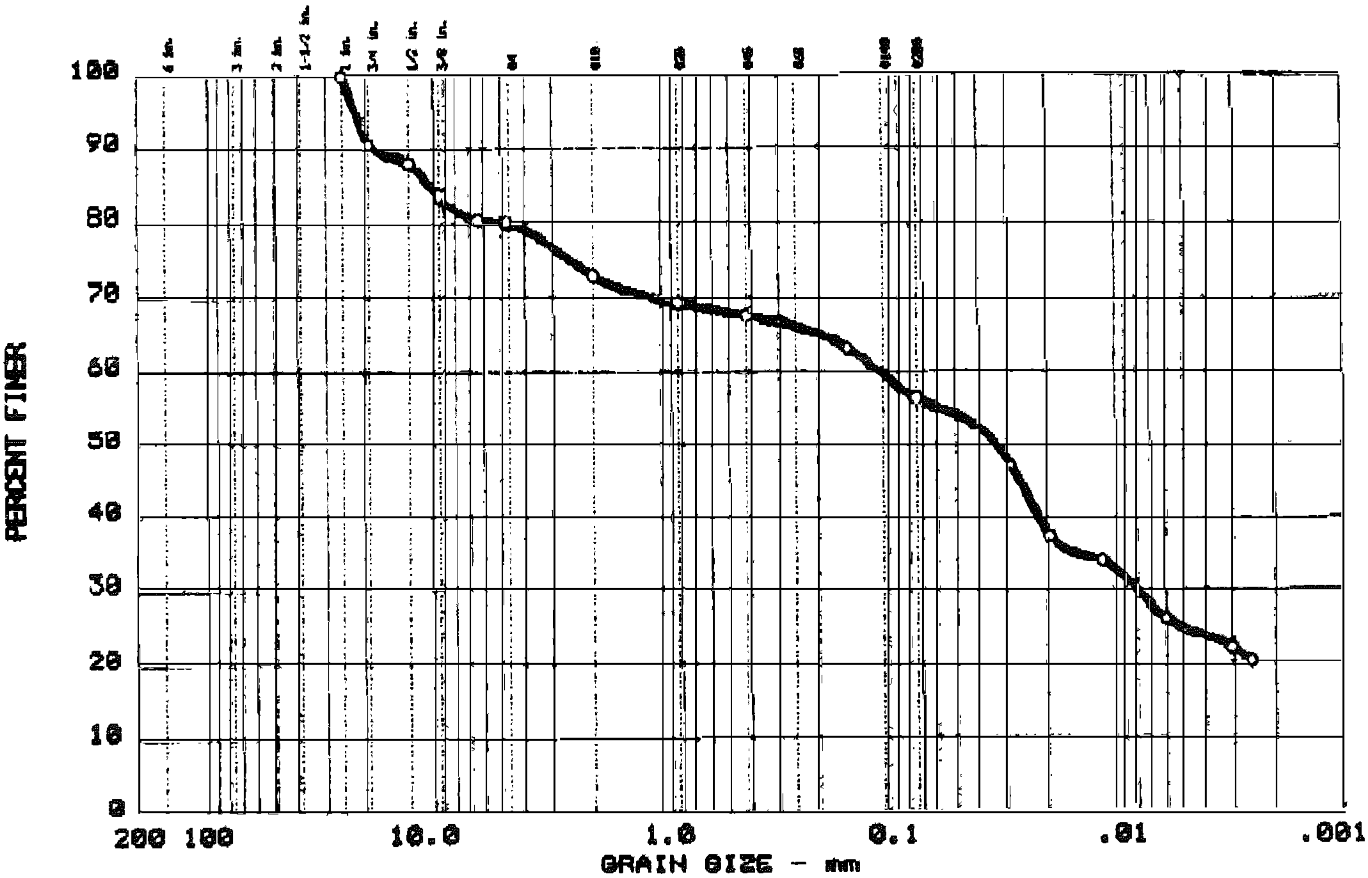
GS-349
A-300

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 3

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	6	0.0	20.1	23.6	31.7	24.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	16	5	10.23	0.11	0.03	0.008				

MATERIAL DESCRIPTION	USCS	AASHTO
O SILT SOME CLAY SOME SAND SOME GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDEATION
O Location: BH - 220- ,S-8, 39.0'-41.0'

Date: 7-29-88

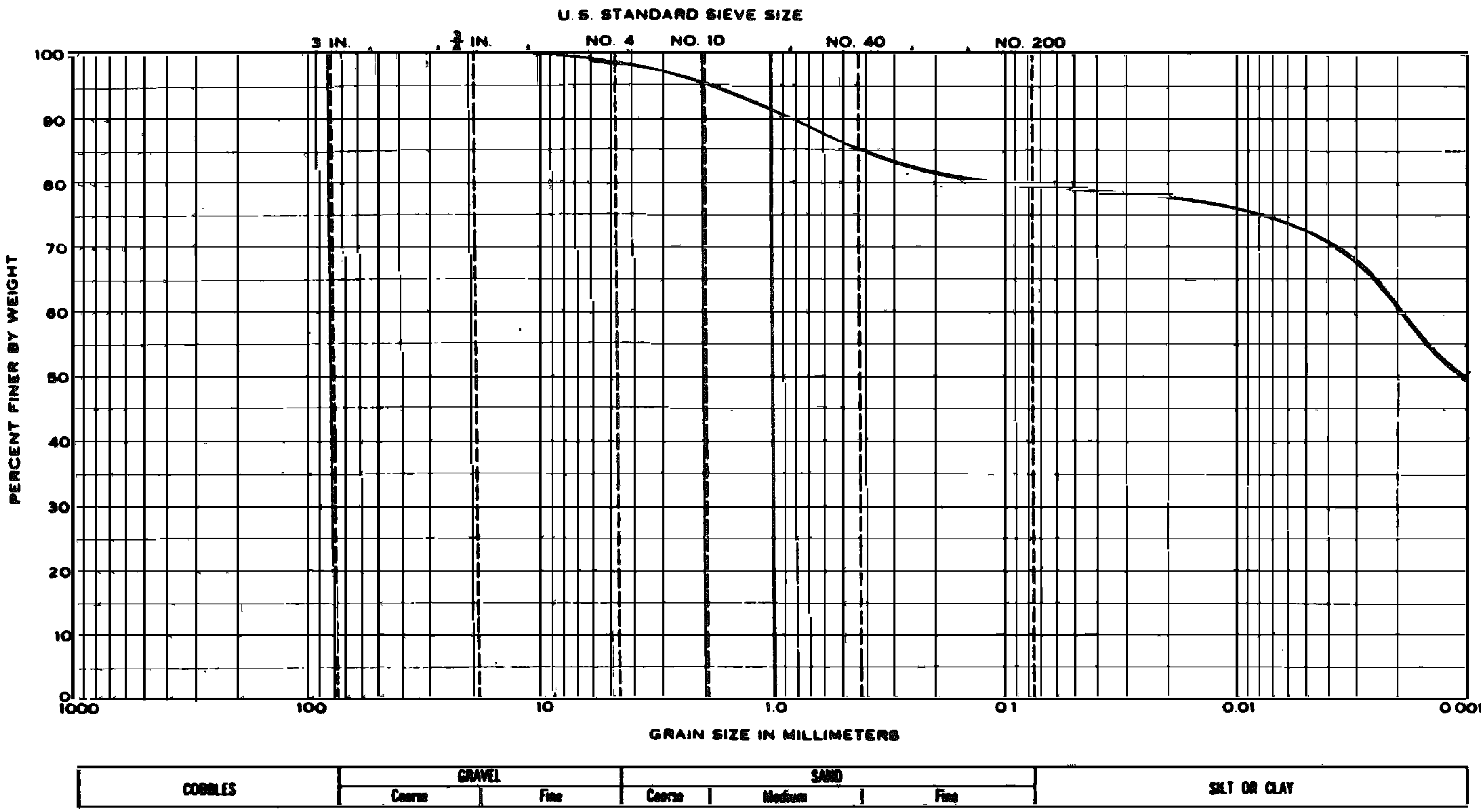
Remarks:
JAR SAMPLE

REPORT NOS.: GS-334
A-302

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1



Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-220	41'-43'	Brown Fine Sandy	31.1	42	25	17
S-9		Silty CLAY				

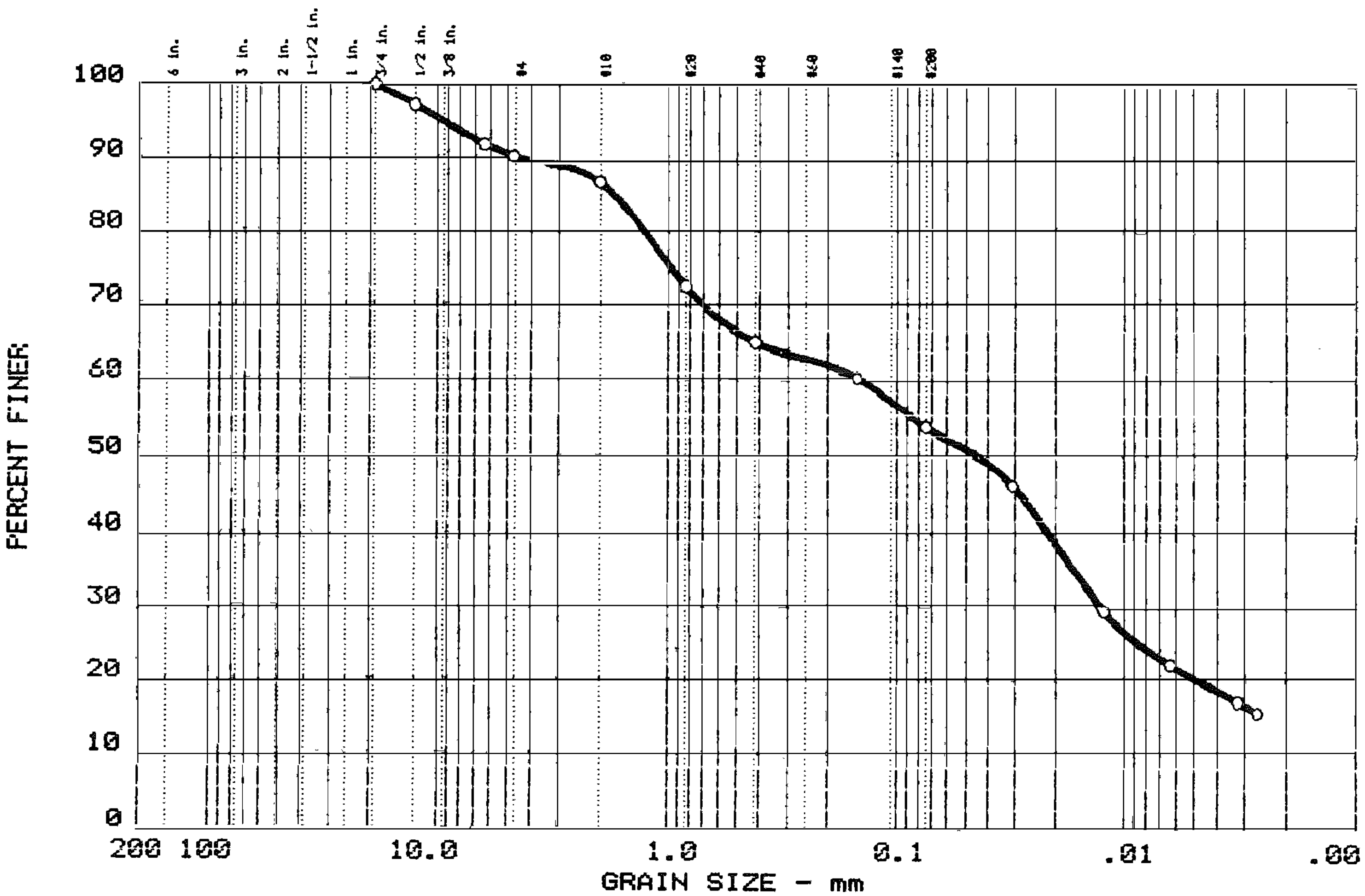
Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0.0	9.7	36.4	33.5	20.3

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	12	4	1.74	0.14	0.04	0.013				

MATERIAL DESCRIPTION	USCS	AASHTO
○ SAND SOME SILT SOME CLAY TRACE GRAVEL	CL-ML	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: BH - 221- ,S-6, 35.0'-37.0'

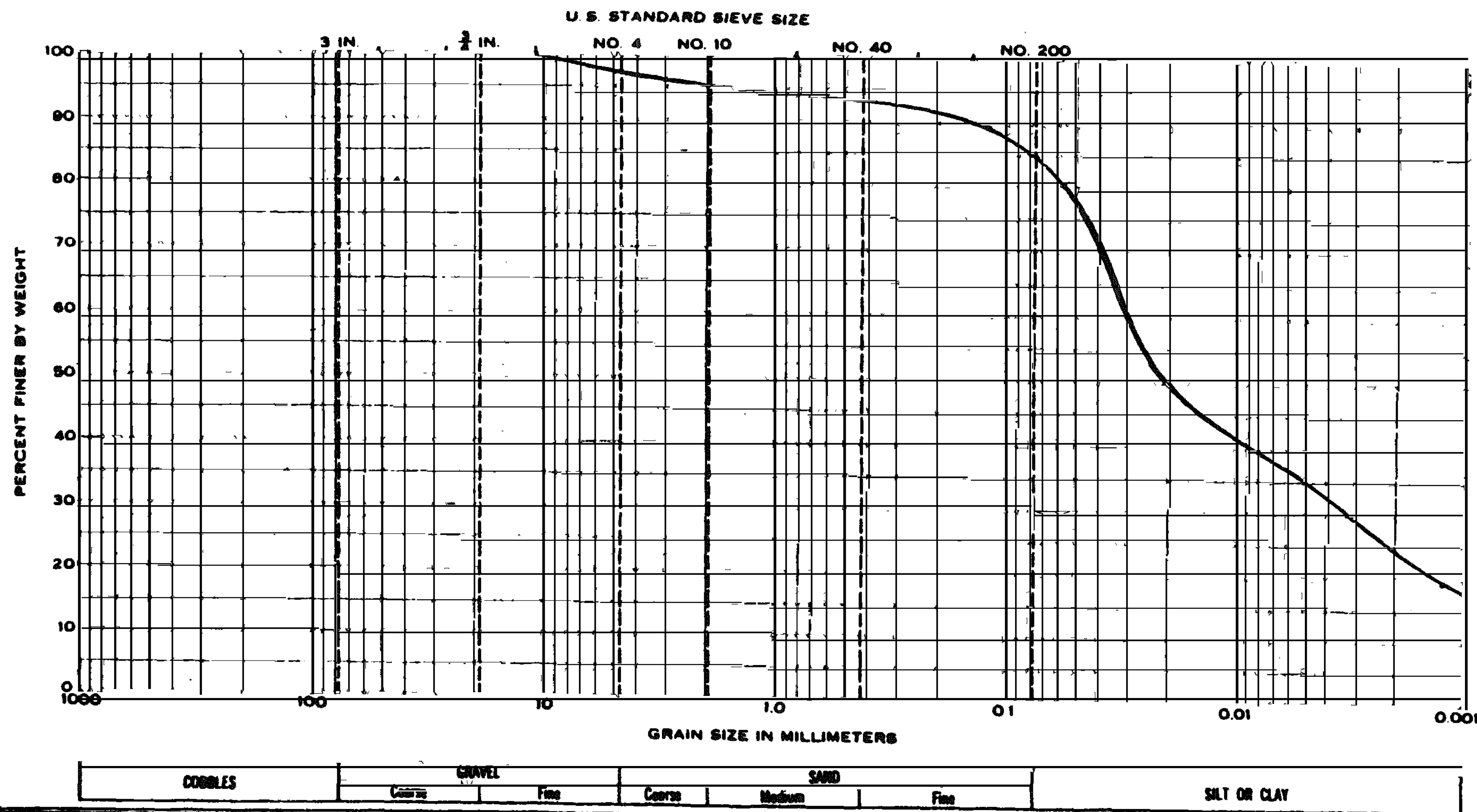
Date: 6-22-88

Remarks:
JAR SAMPLE

GS-350
A-301

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8



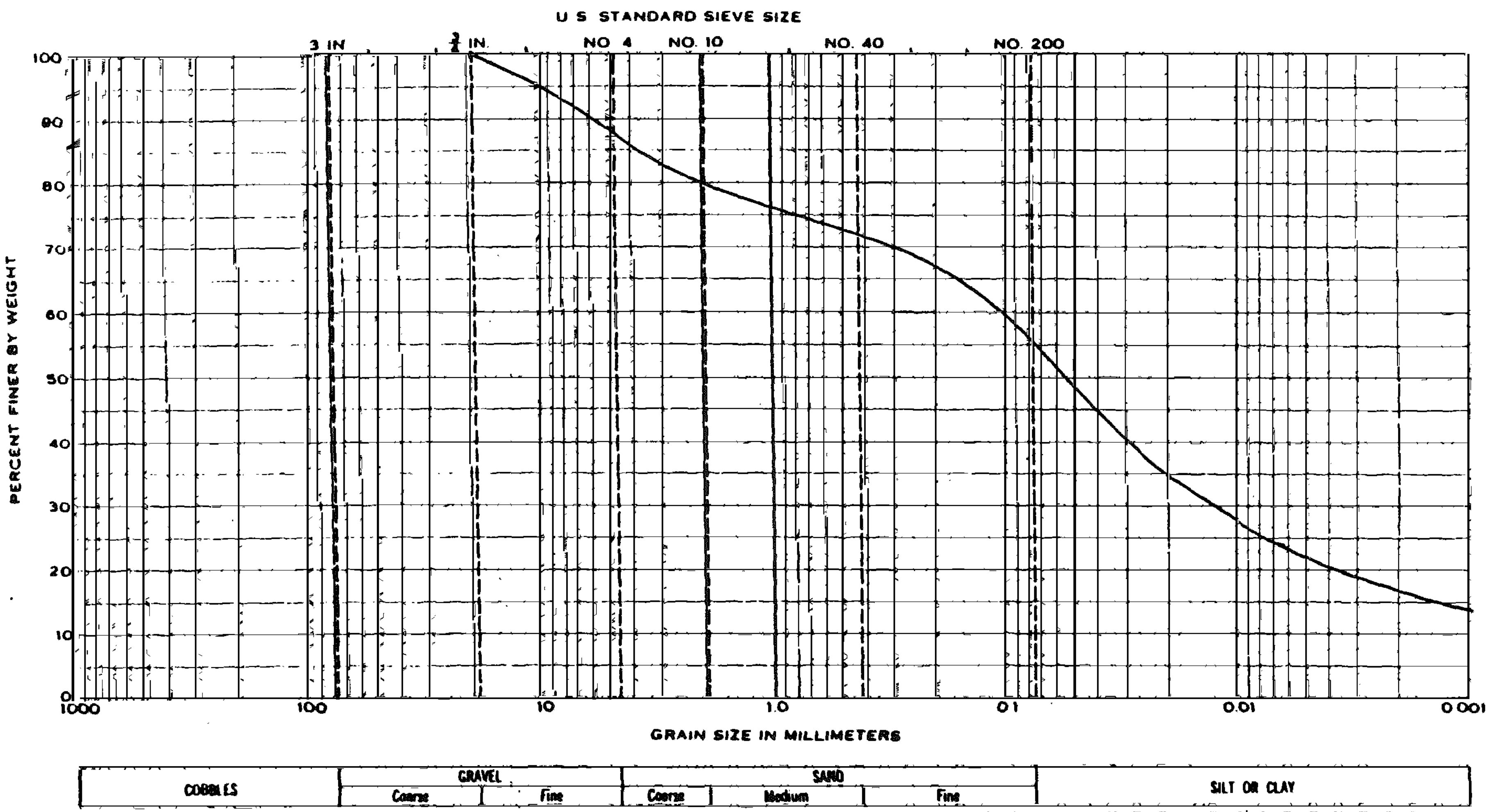
Sample No.	Elev or Depth	Classification	Nat WC	LL	PL	PI
BH-221 S-7	37'-39'	Brown Fine Sandy Silty CLAY	18.8	40	22	18

Project Glynn Geotechnical Engrs.
Occidental Chemical Corp.
S-Area Landfill
Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

GRADATION CURVES

J & L TESTING COMPANY, INC.
Materials Testing



Sample No.	Elev or Depth	Classification	NatWC	LL	PL	PI
BH-221 S-8	40'-42'	Br. sandy CLAY (CL)	28.9	43	24	19

GRADATION CURVES

Project Glynn Geotechnical Engrs.

Occidental Chemical Corp.

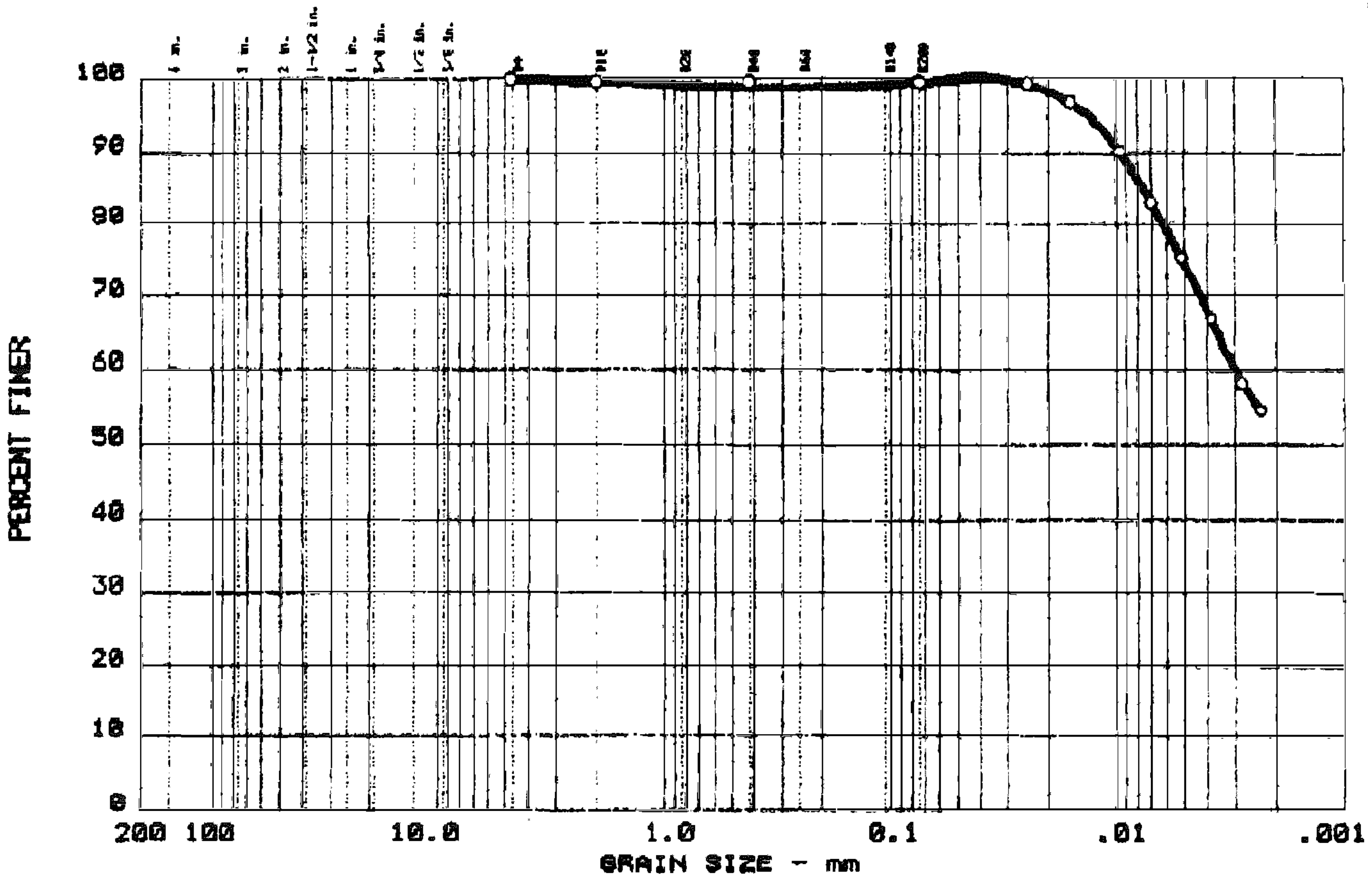
S-Area Landfill

Niagara Falls, New York

Date June 13, 1988 JOB No. 88C285-01

J & L TESTING COMPANY, INC.
Materials Testing

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	9	0.0	0.0	0.4	25.1	74.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	30	12								

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY SOME SILT TRACE SAND	CL	

Project No.: BT-86-90
Project: "S" AREA REMEDIATION
o Location: OW - 212,S-7,12.0'-14.0'

Date: 7-25-88

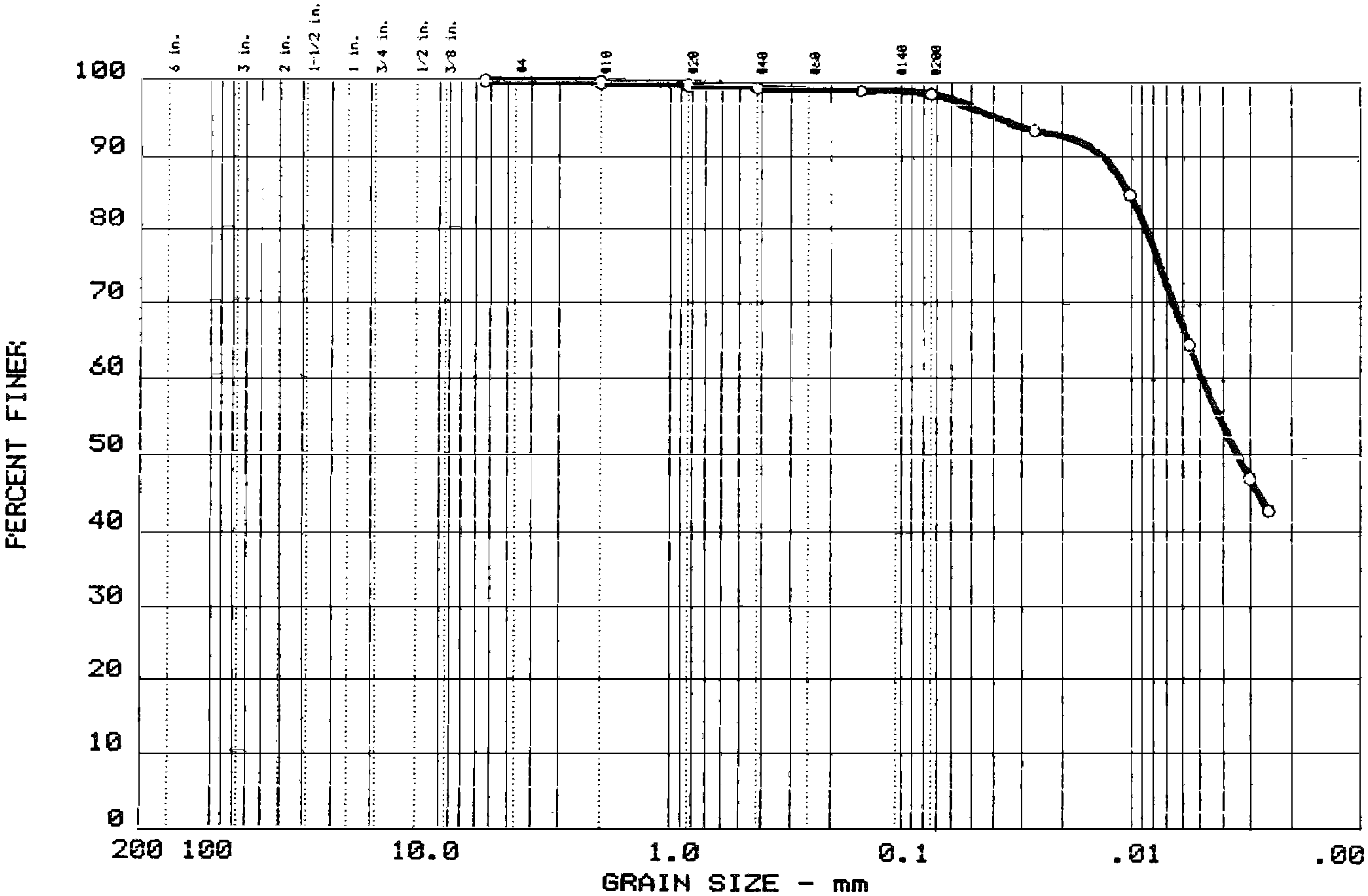
Remarks:
JAR SAMPLE

REPORT NOS.: GS-335
A-303

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	6	0.0	0.0	1.5	37.8	60.7

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	31	13			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: OW - 212-87, S-8, 14.0'-16.0'

Date: 6-22-88

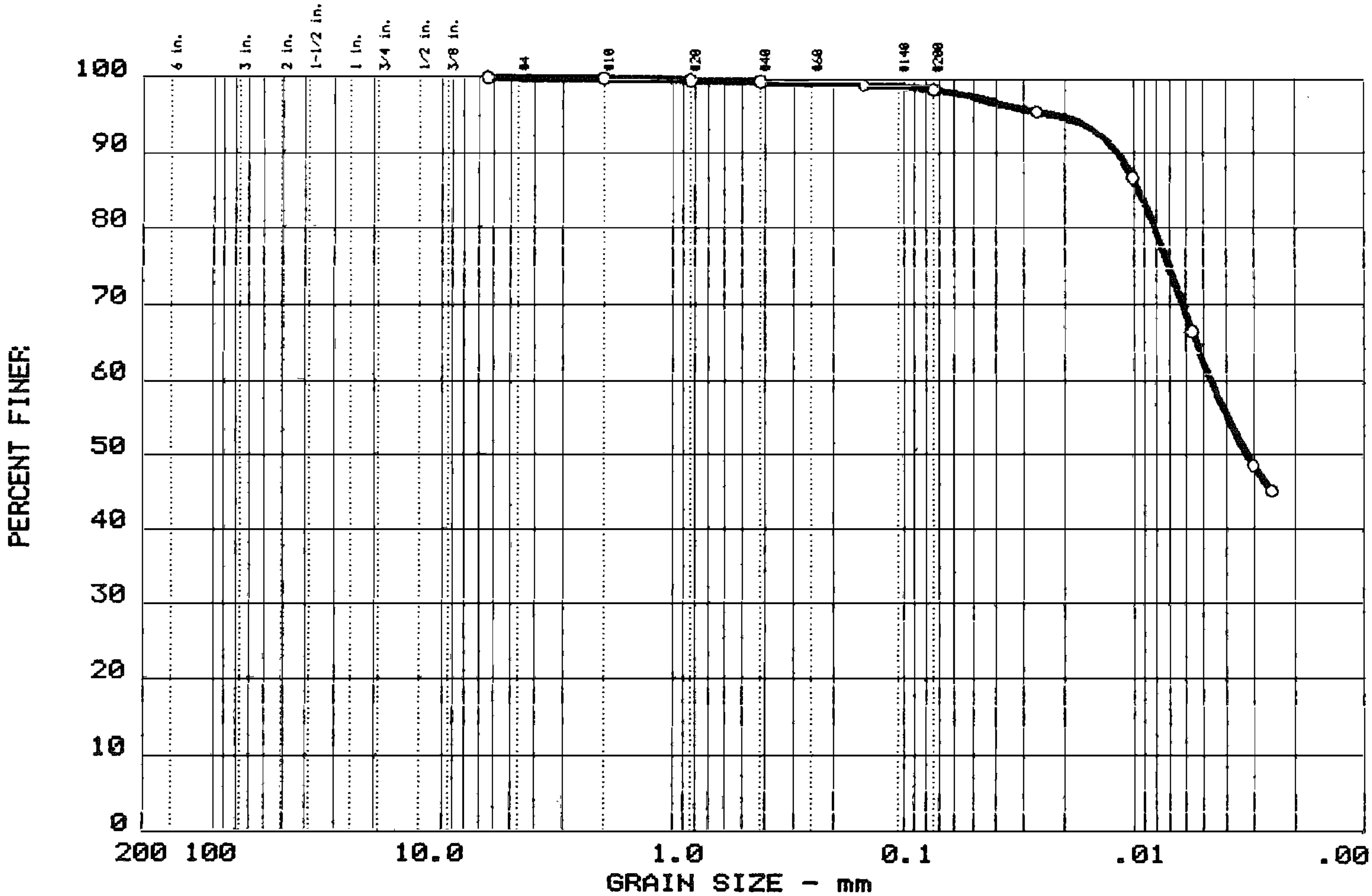
Remarks:
JAR SAMPLE

GS-327
A-280

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 6

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	7	0.0	0.0	1.4	36.1	62.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	32	14			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY AND SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: OW - 212-87, S-9, 16.0'-18.0'

Date: 6-22-88

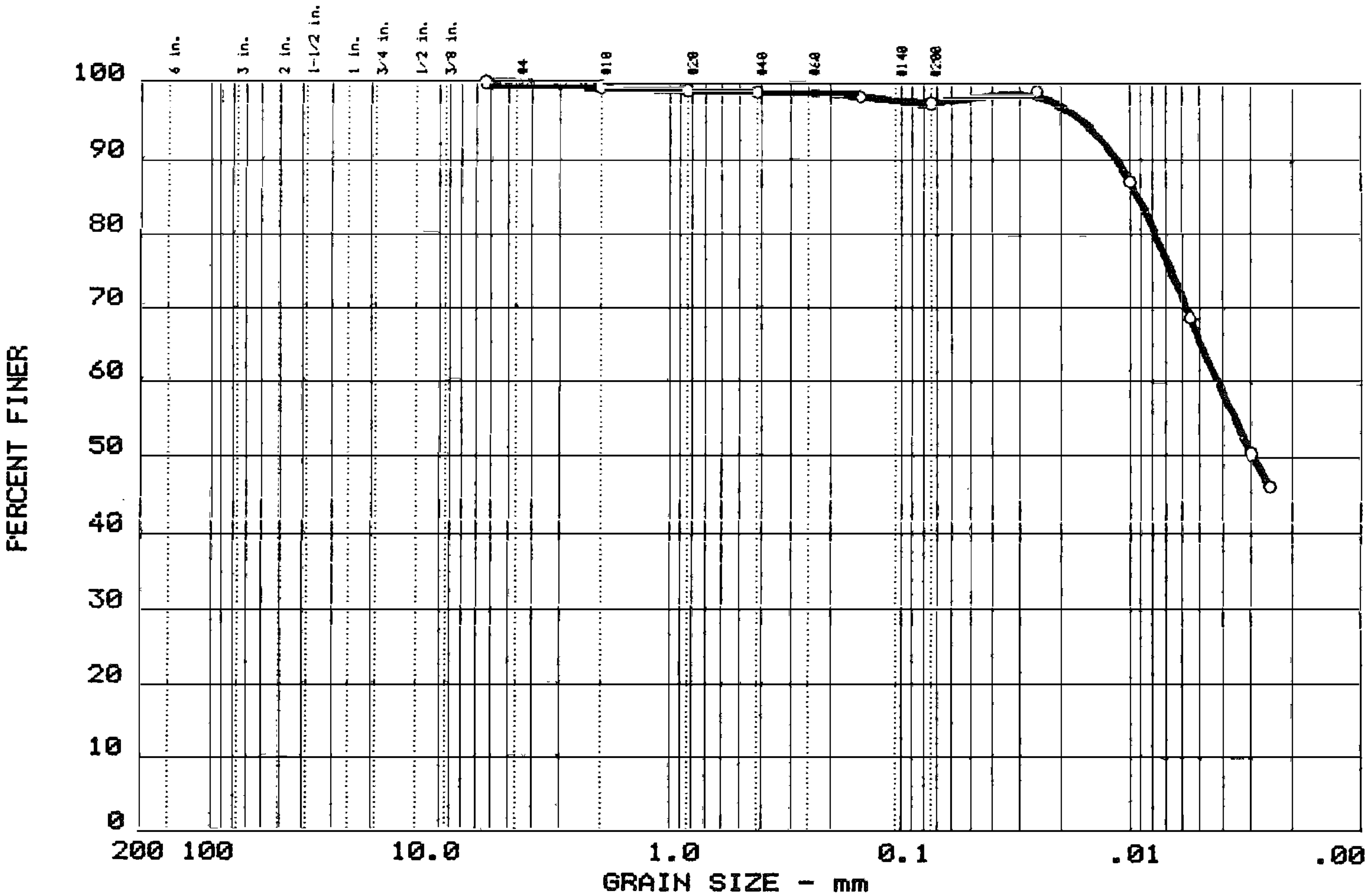
Remarks:
JAR SAMPLE

GS-328
A-281

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 7

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
o	8	0.0	0.2	2.3	32.0	65.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o	33	14			0.00					

MATERIAL DESCRIPTION	USCS	AASHTO
o CLAY SOME SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
o Location: OW - 212-87, S-10, 18.0'-20.0'

Date: 6-22-88

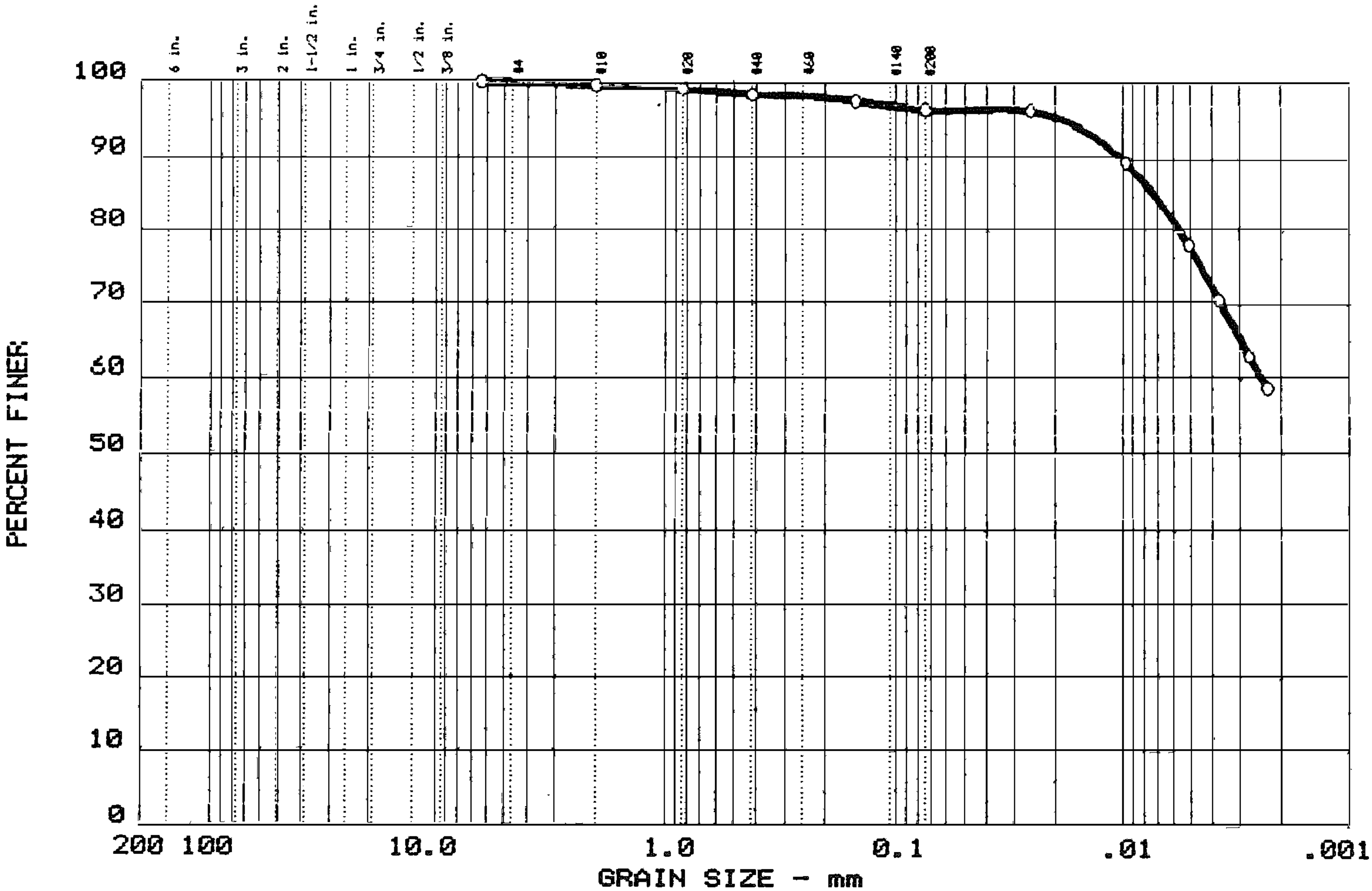
Remarks:
JAR SAMPLE

GS-329
A-282

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 8

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	1	0.0	0.1	3.4	18.9	77.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	44	26								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY LITTLE SILT TRACE SAND TRACE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: OW - 212 , S-11, 20.0'-22.0'

Date: 6-22-88

Remarks:

JAR SAMPLE

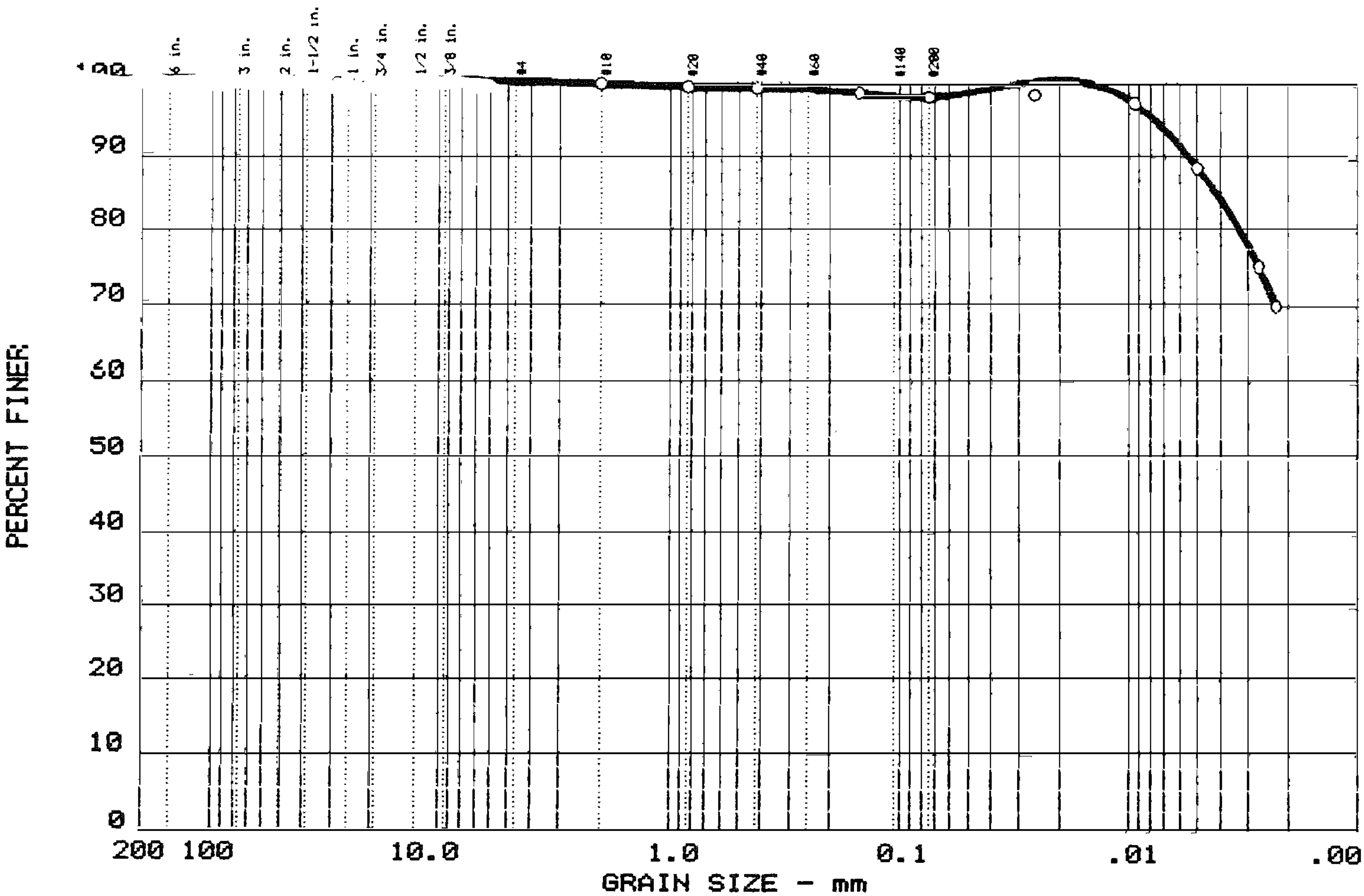
GS-330
A-283

GRAIN SIZE DISTRIBUTION TEST REPORT

EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 1

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
○	9	0	0.	1.9	9.6	88.6

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	47	25								

MATERIAL DESCRIPTION	USCS	AASHTO
○ CLAY TRACE SILT TRACE SAND	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
○ Location: OW - 212-87, S-12, 22.0'-24.0'

Date: 6-22-88

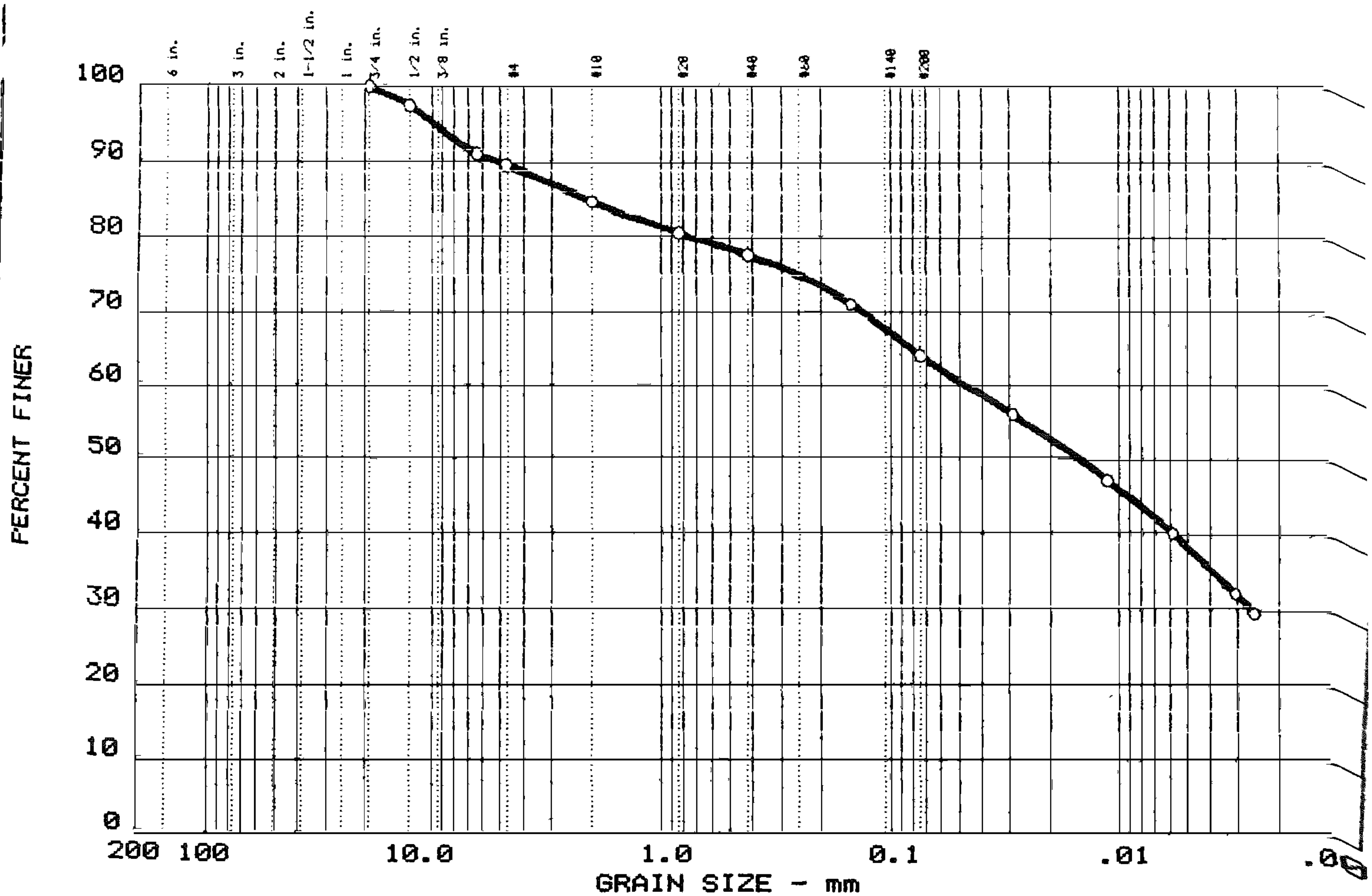
Remarks:
JAR SAMPLE

GS-331
A-284

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 9

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	%+3"	% GRAVEL	% SAND	% SILT	% CLAY
O	10	0.0	10.5	25.3	26.0	38.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
O	23	10	2.09		0.01	0.003				

MATERIAL DESCRIPTION	USCS	AASHTO
O CLAY SOME SILT SOME SAND LITTLE GRAVEL	CL	

Project No.: BD-86-90
Project: "S" AREA REMEDIATION
O Location: OW - 212-87, S-14, 26.0'-27.4'

Date: 6-22-88

Remarks:
JAR SAMPLE

GS-332
A-285

GRAIN SIZE DISTRIBUTION TEST REPORT
EMPIRE SOILS INVESTIGATIONS, INC.

Fig. No. 10

APPENDIX C

ADDITIONAL PERMEABILITY RESULTS

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-117A
DESCRIPTION:S-3
38-40
TUBE

DATE:JUNE 15 1988
JOB No.:88C285-01

CELL NO.:13 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	3.220	in	FINAL HEIGHT:	3.974	in
INITIAL DIAMETER:	2.0300	in	FINAL DIAMETER:	2.0000	in
INITIAL WET WEIGHT:	405.2	gm	FINAL WET WEIGHT:	428.9	gm
WET DENSITY =	148.0	pcf	WET DENSITY :	130.8	pcf
MOISTURE CONTENT:	23.7	%	MOISTURE CONTENT:	20.4	%
DRY DENSITY:	119.6	pcf	DRY DENSITY:	108.6	pcf
INITIAL SATURATION:	156.7	%	FINAL SATURATION:	99.9	%
INITIAL VOID RATIO:	.408310		FINAL VOID RATIO:	.551345	

TEST PARAMETERS..

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA................................

FLOW (Q):	.32	.50	.00	.00	cc
LENGTH (L):	3.97	3.97	.00	.00	in
AREA (A):	3.14	3.14	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	490.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.511E-008	cm/sec
TEST NO. 2, k=	1.506E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-117A
DESCRIPTION: S-4
40-41.9
TUBE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 1 FLUID: DEAIRED WATER B-Parameter: 0.99

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	4.076	in	FINAL HEIGHT:	3.948	in
INITIAL DIAMETER:	2.0400	in	FINAL DIAMETER:	2.0200	in
INITIAL WET WEIGHT:	413.7	gm	FINAL WET WEIGHT:	404.0	gm
WET DENSITY =	118.2	pcf	WET DENSITY :	121.5	pcf
MOISTURE CONTENT:	32.0	%	MOISTURE CONTENT:	29.1	%
DRY DENSITY:	89.5	pcf	DRY DENSITY:	94.1	pcf
INITIAL SATURATION:	98.0	%	FINAL SATURATION:	99.5	%
INITIAL VOID RATIO:	.881624		FINAL VOID RATIO:	.789677	

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	50.00	.00	.00	psi
HEAD WATER:	50.00	45.00	.00	.00	psi
TAIL WATER:	42.00	40.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	1.10	1.00	.00	.00	cc
LENGTH (L):	3.95	3.95	.00	.00	in
AREA (A):	3.20	3.20	.00	.00	sqin
HEAD (h):	8.00	5.00	.00	.00	psi
TIME (t):	600.00	800.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	2.634E-008	cm/sec
TEST NO. 2, k=	2.874E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-157-88
SAMPLE S-17
DEPTH (FT) 32´ - 34´

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	30
PLASTIC LIMIT	17
PLASTICITY INDEX	13

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.83	2.80
HEIGHT (IN)	4.02	3.90
WATER CONTENT(%)	25.80	21.10
VOID RATIO	.66	.58
SATURATION (%)	107.00	100.60
DRY DENSITY (PCF)	103.20	108.80

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	4.17 X 10 -8	4.17 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-157-88
SAMPLE	S-18
DEPTH (FT)	34′ - 36′

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	49
PLASTIC LIMIT	23
PLASTICITY INDEX	26

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.87	2.81
HEIGHT (IN)	4.02	3.61
WATER CONTENT(%)	46.50	34.10
VOID RATIO	1.24	.93
SATURATION (%)	103.20	101.20
DRY DENSITY (PCF)	76.70	89.00

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	2.09 X 10 -8	2.19 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-157-88
SAMPLE S-20
DEPTH (FT) 38′ - 40′

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	46
PLASTIC LIMIT	24
PLASTICITY INDEX	22

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.78	2.75
HEIGHT (IN)	5.16	4.95
WATER CONTENT(%)	40.10	32.40
VOID RATIO	.99	.87
SATURATION (%)	111.20	103.00
DRY DENSITY (PCF)	86.20	92.00

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	9.53 X 10 -9	1.91 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-157-88
SAMPLE S-21
DEPTH (FT) 40´ - 42´

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	50
PLASTIC LIMIT	21
PLASTICITY INDEX	29

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.82	2.76
HEIGHT (IN)	5.51	5.04
WATER CONTENT(%)	47.80	36.80
VOID RATIO	1.26	.97
SATURATION (%)	104.30	104.50
DRY DENSITY (PCF)	75.90	82.30

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	1.38 X 10 -8	1.63 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-157-88
SAMPLE	S-22
DEPTH (FT)	42´ - 44´

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	42
PLASTIC LIMIT	20
PLASTICITY INDEX	22

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.81	2.79
HEIGHT (IN)	4.75	4.40
WATER CONTENT(%)	37.30	29.60
VOID RATIO	1.01	.83
SATURATION (%)	101.70	98.00
DRY DENSITY (PCF)	85.50	94.00

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	2.32 X 10 -8	2.43 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-159A-88
SAMPLE	S-4
DEPTH (FT)	24' - 26'

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	38
PLASTIC LIMIT	22
PLASTICITY INDEX	16

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.83	2.80
HEIGHT (IN)	4.59	4.40
WATER CONTENT(%)	39.70	34.60
VOID RATIO	1.09	.97
SATURATION (%)	100.30	98.60
DRY DENSITY (PCF)	82.10	89.30

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	6.39 X 10 -8	6.06 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-159A
SAMPLE	S-5
DEPTH (FT)	26' - 28'

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	46
PLASTIC LIMIT	20
PLASTICITY INDEX	26

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.80	2.74
HEIGHT (IN)	4.44	4.27
WATER CONTENT(%)	45.70	38.60
VOID RATIO	1.23	1.04
SATURATION (%)	102.00	101.60
DRY DENSITY (PCF)	76.90	83.90

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	2.50 X 10 -8	3.07 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-160
SAMPLE	S-13
DEPTH (FT)	24' - 26'

UNIFIED CLASSIFICATION	CH
LIQUID LIMIT	51
PLASTIC LIMIT	20
PLASTICITY INDEX	31

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.79	2.74
HEIGHT (IN)	3.69	3.50
WATER CONTENT(%)	49.10	40.80
VOID RATIO	1.30	1.11
SATURATION (%)	103.30	101.40
DRY DENSITY (PCF)	74.50	81.50

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	2.10 X 10 -8	2.58 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-160-88
SAMPLE	S-17
DEPTH (FT)	32' - 34'

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	33
PLASTIC LIMIT	10
PLASTICITY INDEX	23

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.81	2.79
HEIGHT (IN)	3.68	3.52
WATER CONTENT(%)	34.20	28.50
VOID RATIO	.89	.78
SATURATION (%)	106.10	100.50
DRY DENSITY (PCF)	91.00	96.40

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	2.39 X 10 -8	2.68 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-161-88
SAMPLE S-19
DEPTH (FT) 34.0′ - 36.0′

UNIFIED CLASSIFICATION
LIQUID LIMIT
PLASTIC LIMIT
PLASTICITY INDEX

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)		
HEIGHT (IN)		
WATER CONTENT(%)		
VOID RATIO		
SATURATION (%)		
DRY DENSITY (PCF)		

EFFECTIVE CONSOLIDATION PRESSURE (PSI)

PERMEABILITY DATA

CELL PRESSURE (PSI)
BACK PRESSURE
AT BOTTOM OF SPECIMEN (PSI)
AT TOP OF SPECIMEN (PSI)
HYDRAULIC GRADIENT
PERMEABILITY (CM/SEC)

Remarks: Sample contained wood, decaying organics and deleterious material.
No sample available for test.

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-161-88
SAMPLE	S-21
DEPTH (FT)	38' - 40'

UNIFIED CLASSIFICATION	CH
LIQUID LIMIT	55
PLASTIC LIMIT	20
PLASTICITY INDEX	35

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.83	2.82
HEIGHT (IN)	4.43	4.08
WATER CONTENT(%)	44.30	36.20
VOID RATIO	1.18	.99
SATURATION (%)	103.60	100.70
DRY DENSITY (PCF)	78.90	86.20

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	1.18 X 10 -8	1.74 X 10 -8

REMARKS: Shelby Tube

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-161-88
SAMPLE	S-22
DEPTH (FT)	40' - 42'

UNIFIED CLASSIFICATION	CL-ML
LIQUID LIMIT	17
PLASTIC LIMIT	13
PLASTICITY INDEX	4

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.85	2.86
HEIGHT (IN)	4.73	4.70
WATER CONTENT(%)	17.20	14.20
VOID RATIO	.43	.42
SATURATION (%)	112.90	96.70
DRY DENSITY (PCF)	120.10	121.20

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	8.29 X 10 -8	8.54 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-163-87
SAMPLE
DEPTH (FT) 26.3´ - 27.0´

UNIFIED CLASSIFICATION	CL-ML
LIQUID LIMIT	19
PLASTIC LIMIT	13
PLASTICITY INDEX	6

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.78	2.79
HEIGHT (IN)	4.73	4.59
WATER CONTENT(%)	17.20	13.80
VOID RATIO	.42	.39
SATURATION (%)	112.60	98.00
DRY DENSITY (PCF)	120.90	123.60

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	9.32 X 10 -8	7.93 X 10 -8

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-197
DESCRIPTION: S-13
24-26
TUBE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 15 FLUID: DEAIRED WATER B-Parameter: 0.99

PHYSICAL PROPERTY DATA.................................

INITIAL HEIGHT:	3.747 in	FINAL HEIGHT:	3.716 in
INITIAL DIAMETER:	2.0800 in	FINAL DIAMETER:	2.0500 in
INITIAL WET WEIGHT:	489.7 gm	FINAL WET WEIGHT:	478.2 gm
WET DENSITY =	146.4 pcf	WET DENSITY :	148.4 pcf
MOISTURE CONTENT:	8.1 %	MOISTURE CONTENT:	7.2 %
DRY DENSITY:	135.4 pcf	DRY DENSITY:	138.4 pcf
INITIAL SATURATION:	99.1 %	FINAL SATURATION:	100.4 %
INITIAL VOID RATIO:	.215534	FINAL VOID RATIO:	.189131

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA...............................

FLOW (Q):	1.35	2.00	.00	.00	cc
LENGTH (L):	3.72	3.72	.00	.00	in
AREA (A):	3.30	3.30	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	700.00	650.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	4.052E-008	cm/sec
TEST NO. 2, k=	4.041E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-197
DESCRIPTION:S-14
26-28
TUBE/MANY STONES AND DRY

DATE:JUNE 15 1988
JOB No.:88C285-01

CELL NO.:14 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA...............................

INITIAL HEIGHT:	3.442 in	FINAL HEIGHT:	3.500 in
INITIAL DIAMETER:	2.1500 in	FINAL DIAMETER:	2.1200 in
INITIAL WET WEIGHT:	495.1 gm	FINAL WET WEIGHT:	495.1 gm
WET DENSITY =	150.8 pcf	WET DENSITY :	152.5 pcf
MOISTURE CONTENT:	6.1 %	MOISTURE CONTENT:	6.3 %
DRY DENSITY:	142.1 pcf	DRY DENSITY:	143.5 pcf
INITIAL SATURATION:	90.8 %	FINAL SATURATION:	100.0 %
INITIAL VOID RATIO:	.180558	FINAL VOID RATIO:	.169384

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA..............................

FLOW (Q):	5.70	8.00	.00	.00	cc
LENGTH (L):	3.50	3.50	.00	.00	in
AREA (A):	3.53	3.53	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	800.00	750.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.318E-007	cm/sec
TEST NO. 2, k=	1.334E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-198
DESCRIPTION:S-13
26.8/27.9
tube sample

DATE:JUNE 7 1988
JOB No.:88C285-01

CELL NO.:12 FLUID:DEAIRED WATER B-Parameter:1.

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	2.465	in	FINAL HEIGHT:	2.473	in
INITIAL DIAMETER:	1.9800	in	FINAL DIAMETER:	1.9800	in
INITIAL WET WEIGHT:	266.5	gm	FINAL WET WEIGHT:	268.9	gm
WET DENSITY =	133.6	pcf	WET DENSITY :	134.4	pcf
MOISTURE CONTENT:	16.9	%	MOISTURE CONTENT:	18.0	%
DRY DENSITY:	114.3	pcf	DRY DENSITY:	113.9	pcf
INITIAL SATURATION:	94.9	%	FINAL SATURATION:	99.9	%
INITIAL VOID RATIO:	.484635		FINAL VOID RATIO:	.490050	

TEST PARAMETERS......................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA..............................

FLOW (Q):	1.10	1.78	.00	.00	cc
LENGTH (L):	2.47	2.47	.00	.00	in
AREA (A):	3.08	3.08	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	800.00	800.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	2.061E-008	cm/sec
TEST NO. 2, k=	2.084E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-202
DESCRIPTION:S-16
32-33.2
TUBE SAMPLE

DATE:JUNE 15 1988
JOB No.:88C285-01

CELL NO.:3 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA.................................

INITIAL HEIGHT:	4.084	in	FINAL HEIGHT:	4.030	in
INITIAL DIAMETER:	2.2800	in	FINAL DIAMETER:	2.2800	in
INITIAL WET WEIGHT:	650.9	gm	FINAL WET WEIGHT:	647.5	gm
WET DENSITY =	148.6	pcf	WET DENSITY :	149.8	pcf
MOISTURE CONTENT:	8.1	%	MOISTURE CONTENT:	7.6	%
DRY DENSITY:	137.4	pcf	DRY DENSITY:	139.2	pcf
INITIAL SATURATION:	98.8	%	FINAL SATURATION:	99.7	%
INITIAL VOID RATIO:	.220344		FINAL VOID RATIO:	.204933	

TEST PARAMETERS......................................

CELL PRESSURE:	50.00	55.00	.00	.00	psi
HEAD WATER:	45.00	50.00	.00	.00	psi
TAIL WATER:	40.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA..............................

FLOW (Q):	1.10	6.60	.00	.00	cc
LENGTH (L):	4.03	4.03	.00	.00	in
AREA (A):	4.08	4.08	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	140.00	500.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.447E-007	cm/sec
TEST NO. 2, k=	1.520E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-202
SAMPLE	S-17
DEPTH (FT)	33.5′ - 34.3′

UNIFIED CLASSIFICATION	SC - SM
LIQUID LIMIT	15
PLASTIC LIMIT	8
PLASTICITY INDEX	7

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.28	2.26
HEIGHT (IN)	4.15	4.06
WATER CONTENT(%)	7.40	6.80
VOID RATIO	.22	.17
SATURATION (%)	92.30	108.50
DRY DENSITY (PCF)	140.50	146.40

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	5.05 X 10 -8	6.12 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-203-88
SAMPLE	S-17
DEPTH (FT)	33.5′ - 35.5′

UNIFIED CLASSIFICATION	GC - GM
LIQUID LIMIT	18
PLASTIC LIMIT	13
PLASTICITY INDEX	5

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.34	2.36
HEIGHT (IN)	4.10	3.88
WATER CONTENT(%)	8.90	7.00
VOID RATIO	.20	.15
SATURATION (%)	124.50	127.00
DRY DENSITY (PCF)	143.90	149.00

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	1.07 X 10 -7	8.33 X 10 -8

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-203
DESCRIPTION:S-18
35.5-37.4
TUBE SAMPLE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:2 FLUID:DEAIRED WATER B-Parameter:0.98

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	3.686	in	FINAL HEIGHT:	3.605	in
INITIAL DIAMETER:	2.0200	in	FINAL DIAMETER:	1.9900	in
INITIAL WET WEIGHT:	408.0	gm	FINAL WET WEIGHT:	399.5	gm
WET DENSITY =	131.5	pcf	WET DENSITY :	135.6	pcf
MOISTURE CONTENT:	19.5	%	MOISTURE CONTENT:	17.0	%
DRY DENSITY:	110.0	pcf	DRY DENSITY:	115.9	pcf
INITIAL SATURATION:	98.0	%	FINAL SATURATION:	99.9	%
INITIAL VOID RATIO:	.540571		FINAL VOID RATIO:	.462165	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA...........................

FLOW (Q):	1.00	1.95	.00	.00	cc
LENGTH (L):	3.61	3.61	.00	.00	in
AREA (A):	3.11	3.11	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	600.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	4.326E-008	cm/sec
TEST NO. 2, k=	4.394E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-204
SAMPLE	S-3
DEPTH (FT)	31.5′ - 33.5′

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	22
PLASTIC LIMIT	11
PLASTICITY INDEX	11

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.40	2.45
HEIGHT (IN)	4.58	4.15
WATER CONTENT(%)	15.60	12.50
VOID RATIO	.41	.34
SATURATION (%)	103.40	102.60
DRY DENSITY (PCF)	121.30	128.50

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	3.11 X 10 -8	2.97 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-204
SAMPLE	S-4
DEPTH (FT)	33.5′ - 34.2′

UNIFIED CLASSIFICATION	GC - GM
LIQUID LIMIT	17
PLASTIC LIMIT	10
PLASTICITY INDEX	7

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.36	2.36
HEIGHT (IN)	4.22	4.14
WATER CONTENT(%)	9.40	8.30
VOID RATIO	.25	.22
SATURATION (%)	104.10	104.20
DRY DENSITY (PCF)	137.30	140.80

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	1.01 X 10 - 7	7.65 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-205-88
SAMPLE	S-16
DEPTH (FT)	30' - 30.7'

UNIFIED CLASSIFICATION	SC - SM
LIQUID LIMIT	17
PLASTIC LIMIT	12
PLASTICITY INDEX	5

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.36	2.40
HEIGHT (IN)	4.15	3.77
WATER CONTENT(%)	11.70	9.20
VOID RATIO	.32	.25
SATURATION (%)	101.50	103.10
DRY DENSITY (PCF)	130.40	137.80

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	8.75 X 10 -8	9.28 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE	BH-206-88
SAMPLE	S-17
DEPTH (FT)	32' - 34'

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	45
PLASTIC LIMIT	19
PLASTICITY INDEX	26

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.33	2.35
HEIGHT (IN)	3.46	3.27
WATER CONTENT(%)	33.50	29.60
VOID RATIO	.87	.79
SATURATION (%)	106.10	102.10
DRY DENSITY (PCF)	91.80	95.50

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	3.19 X 10 -8	3.51 X 10 -8

S-AREA LANDFILL
PERMEABILITY SUMMARY SHEET

BOREHOLE BH-207-88
SAMPLE S-16
DEPTH (FT) 30.0´ - 32.0´

UNIFIED CLASSIFICATION	CL
LIQUID LIMIT	23
PLASTIC LIMIT	14
PLASTICITY INDEX	9

SPECIMEN DATA

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
DIAMETER (IN)	2.35	2.40
HEIGHT (IN)	3.41	3.13
WATER CONTENT(%)	23.90	19.00
VOID RATIO	.60	.51
SATURATION (%)	110.70	101.90
DRY DENSITY (PCF)	107.60	113.40

EFFECTIVE CONSOLIDATION PRESSURE (PSI) 10 (average)

PERMEABILITY DATA

CELL PRESSURE (PSI)	95	95
BACK PRESSURE		
AT BOTTOM OF SPECIMEN (PSI)	85	90
AT TOP OF SPECIMEN (PSI)	80	80
HYDRAULIC GRADIENT	5	10
PERMEABILITY (CM/SEC)	6.54 X 10 -8	6.37 X 10 -8

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-207
DESCRIPTION: S-17
32
TUBE

DATE: JUNE 16 1988
JOB No.: 88C285-01

CELL NO.: 16 FLUID: DEAIRED WATER B-Parameter: 0.99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	3.070	in	FINAL HEIGHT:	3.040	in
INITIAL DIAMETER:	2.0150	in	FINAL DIAMETER:	2.0100	in
INITIAL WET WEIGHT:	379.0	gm	FINAL WET WEIGHT:	377.1	gm
WET DENSITY =	147.3	pcf	WET DENSITY :	148.8	pcf
MOISTURE CONTENT:	8.7	%	MOISTURE CONTENT:	8.2	%
DRY DENSITY:	135.6	pcf	DRY DENSITY:	137.5	pcf
INITIAL SATURATION:	98.2	%	FINAL SATURATION:	100.0	%
INITIAL VOID RATIO:	.238276		FINAL VOID RATIO:	.220604	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	6.00	7.90	.00	.00	cc
LENGTH (L):	3.04	3.04	.00	.00	in
AREA (A):	3.17	3.17	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	800.00	750.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.341E-007	cm/sec
TEST NO. 2, k=	1.177E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-208
DESCRIPTION: S-16
32-34
TUBE SAMPLE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 10 FLUID: DEAIRED WATER B-Parameter: 1.0

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	2.738 in	FINAL HEIGHT:	2.669 in
INITIAL DIAMETER:	2.0000 in	FINAL DIAMETER:	1.9800 in
INITIAL WET WEIGHT:	294.5 gm	FINAL WET WEIGHT:	289.5 gm
WET DENSITY =	130.3 pcf	WET DENSITY :	134.1 pcf
MOISTURE CONTENT:	19.2 %	MOISTURE CONTENT:	17.3 %
DRY DENSITY:	109.3 pcf	DRY DENSITY:	114.3 pcf
INITIAL SATURATION:	97.0 %	FINAL SATURATION:	100.0 %
INITIAL VOID RATIO:	.530839	FINAL VOID RATIO:	.464109

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.50	.20	.00	.00	cc
LENGTH (L):	2.67	2.67	.00	.00	in
AREA (A):	3.08	3.08	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	140.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.618E-008	cm/sec
TEST NO. 2, k=	1.444E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-209
DESCRIPTION:S-15
30-32
TUBE SAMPLE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:14 FLUID:DEAIRED WATER B-Parameter:.99

PHYSICAL PROPERTY DATA...............................

INITIAL HEIGHT:	2.709	in	FINAL HEIGHT:	2.680	in
INITIAL DIAMETER:	2.0000	in	FINAL DIAMETER:	1.8900	in
INITIAL WET WEIGHT:	279.1	gm	FINAL WET WEIGHT:	263.8	gm
WET DENSITY =	124.8	pcf	WET DENSITY :	133.5	pcf
MOISTURE CONTENT:	26.6	%	MOISTURE CONTENT:	19.7	%
DRY DENSITY:	98.6	pcf	DRY DENSITY:	111.6	pcf
INITIAL SATURATION:	97.9	%	FINAL SATURATION:	99.4	%
INITIAL VOID RATIO:	.752476		FINAL VOID RATIO:	.548770	

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.90	1.40	.00	.00	cc
LENGTH (L):	2.68	2.68	.00	.00	in
AREA (A):	2.81	2.81	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	500.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	3.209E-008	cm/sec
TEST NO. 2, k=	3.120E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-209
DESCRIPTION: S-16
32
TUBE SAMPLE

DATE: JUNE 16 1988
JOB No.: 88C285-01

CELL NO.: 15 FLUID: DEAIRED WATER B-Parameter: 0.99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	2.660 in	FINAL HEIGHT:	2.631 in
INITIAL DIAMETER:	2.0000 in	FINAL DIAMETER:	1.9900 in
INITIAL WET WEIGHT:	324.1 gm	FINAL WET WEIGHT:	321.3 gm
WET DENSITY =	147.6 pcf	WET DENSITY :	149.4 pcf
MOISTURE CONTENT:	8.7 %	MOISTURE CONTENT:	7.8 %
DRY DENSITY:	135.8 pcf	DRY DENSITY:	138.6 pcf
INITIAL SATURATION:	99.8 %	FINAL SATURATION:	100.2 %
INITIAL VOID RATIO:	.234197	FINAL VOID RATIO:	.209003

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	1.20	2.00	.00	.00	cc
LENGTH (L):	2.63	2.63	.00	.00	in
AREA (A):	3.11	3.11	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	600.00	600.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	3.157E-008	cm/sec
TEST NO. 2, k=	3.289E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-210
DESCRIPTION:S-13
24-26
TUBE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:19 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA.................................

INITIAL HEIGHT:	3.287	in	FINAL HEIGHT:	3.285	in
INITIAL DIAMETER:	2.0300	in	FINAL DIAMETER:	2.1100	in
INITIAL WET WEIGHT:	392.4	gm	FINAL WET WEIGHT:	420.0	gm
WET DENSITY =	140.4	pcf	WET DENSITY :	139.2	pcf
MOISTURE CONTENT:	6.6	%	MOISTURE CONTENT:	14.1	%
DRY DENSITY:	131.7	pcf	DRY DENSITY:	122.0	pcf
INITIAL SATURATION:	63.8	%	FINAL SATURATION:	99.8	%
INITIAL VOID RATIO:	.279293		FINAL VOID RATIO:	.381296	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA............................

FLOW (Q):	7.10	7.20	.00	.00	cc
LENGTH (L):	3.29	3.29	.00	.00	in
AREA (A):	3.50	3.50	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	300.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	2.490E-007	cm/sec
TEST NO. 2, k=	2.630E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY
TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-210
DESCRIPTION: S-14
26-28
TUBE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 18 FLUID: DEAIRED WATER B-Parameter: .99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	3.680	in	FINAL HEIGHT:	3.679	in
INITIAL DIAMETER:	1.9400	in	FINAL DIAMETER:	1.9400	in
INITIAL WET WEIGHT:	415.8	gm	FINAL WET WEIGHT:	429.5	gm
WET DENSITY =	145.5	pcf	WET DENSITY :	150.3	pcf
MOISTURE CONTENT:	3.6	%	MOISTURE CONTENT:	7.1	%
DRY DENSITY:	140.4	pcf	DRY DENSITY:	140.4	pcf
INITIAL SATURATION:	51.1	%	FINAL SATURATION:	100.4	%
INITIAL VOID RATIO:	.188602		FINAL VOID RATIO:	.189240	

TEST PARAMETERS...................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA............................

FLOW (Q):	2.00	3.40	.00	.00	cc
LENGTH (L):	3.68	3.68	.00	.00	in
AREA (A):	2.96	2.96	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	500.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	9.291E-008	cm/sec
TEST NO. 2, k=	9.872E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-212
DESCRIPTION: S-13
24-26
TUBE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 19   FLUID: DEAIRED WATER   B-Parameter: 0.99

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	3.158	in	FINAL HEIGHT:	3.010	in
INITIAL DIAMETER:	1.9300	in	FINAL DIAMETER:	1.9100	in
INITIAL WET WEIGHT:	335.2	gm	FINAL WET WEIGHT:	326.1	gm
WET DENSITY =	138.1	pcf	WET DENSITY :	143.9	pcf
MOISTURE CONTENT:	14.2	%	MOISTURE CONTENT:	11.1	%
DRY DENSITY:	120.9	pcf	DRY DENSITY:	129.5	pcf
INITIAL SATURATION:	98.0	%	FINAL SATURATION:	100.4	%
INITIAL VOID RATIO:	.390185		FINAL VOID RATIO:	.297718	

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA..............................

FLOW (Q):	.70	1.40	.00	.00	cc
LENGTH (L):	3.01	3.01	.00	.00	in
AREA (A):	2.87	2.87	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	600.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1. k=	2.745E-008	cm/sec
TEST NO. 2. k=	2.859E-008	cm/sec
TEST NO. 3. k=	.000E+000	cm/sec
TEST NO. 4. k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-213
DESCRIPTION: S-15
27-27.7
TUBE

DATE: JUNE 15 1988
JOB No.: 88C285-01

CELL NO.: 17   FLUID: DEAIRED WATER   B-Parameter: 1.0

PHYSICAL PROPERTY DATA.............................

INITIAL HEIGHT:	2.460	in	FINAL HEIGHT:	2.450	in
INITIAL DIAMETER:	1.9500	in	FINAL DIAMETER:	1.9500	in
INITIAL WET WEIGHT:	282.6	gm	FINAL WET WEIGHT:	282.6	gm
WET DENSITY =	146.4	pcf	WET DENSITY :	147.0	pcf
MOISTURE CONTENT:	9.0	%	MOISTURE CONTENT:	9.0	%
DRY DENSITY:	134.3	pcf	DRY DENSITY:	134.9	pcf
INITIAL SATURATION:	98.3	%	FINAL SATURATION:	100.4	%
INITIAL VOID RATIO:	.245494		FINAL VOID RATIO:	.240431	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA............................

FLOW (Q):	13.50	4.20	.00	.00	cc
LENGTH (L):	2.45	2.45	.00	.00	in
AREA (A):	2.99	2.99	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	100.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	4.134E-007	cm/sec
TEST NO. 2, k=	4.019E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-215
DESCRIPTION:S-4
30-31.7
TUBE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:27 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA...............................

INITIAL HEIGHT:	3.093	in	FINAL HEIGHT:	3.022	in
INITIAL DIAMETER:	2.0000	in	FINAL DIAMETER:	1.9900	in
INITIAL WET WEIGHT:	360.6	gm	FINAL WET WEIGHT:	355.8	gm
WET DENSITY =	141.2	pcf	WET DENSITY :	144.1	pcf
MOISTURE CONTENT:	12.2	%	MOISTURE CONTENT:	10.7	%
DRY DENSITY:	125.9	pcf	DRY DENSITY:	130.2	pcf
INITIAL SATURATION:	98.8	%	FINAL SATURATION:	99.8	%
INITIAL VOID RATIO:	.331619		FINAL VOID RATIO:	.287998	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.45	.14	.00	.00	cc
LENGTH (L):	3.02	3.02	.00	.00	in
AREA (A):	3.11	3.11	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	100.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.632E-008	cm/sec
TEST NO. 2, k=	1.587E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-216
DESCRIPTION:S-22
44-45
TUBE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:18 FLUID:DEAIRED WATER B-Parameter:0.98

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	3.840 in	FINAL HEIGHT:	3.850 in
INITIAL DIAMETER:	2.1000 in	FINAL DIAMETER:	2.0800 in
INITIAL WET WEIGHT:	507.7 gm	FINAL WET WEIGHT:	504.5 gm
WET DENSITY =	145.3 pcf	WET DENSITY :	146.8 pcf
MOISTURE CONTENT:	8.7 %	MOISTURE CONTENT:	8.1 %
DRY DENSITY:	133.7 pcf	DRY DENSITY:	135.8 pcf
INITIAL SATURATION:	99.0 %	FINAL SATURATION:	100.5 %
INITIAL VOID RATIO:	.232020	FINAL VOID RATIO:	.212767

TEST PARAMETERS.......................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA..............................

FLOW (Q):	5.70	.85	.00	.00	cc
LENGTH (L):	3.85	3.85	.00	.00	in
AREA (A):	3.40	3.40	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	50.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	2.411E-007	cm/sec
TEST NO. 2, k=	2.247E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-217
DESCRIPTION:S-7
38-40
TUBE

DATE:JUNE 15 1988
JOB No.:88C285-01

CELL NO.:16 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	3.166	in	FINAL HEIGHT:	3.273	in
INITIAL DIAMETER:	2.0500	in	FINAL DIAMETER:	1.9700	in
INITIAL WET WEIGHT:	328.4	gm	FINAL WET WEIGHT:	323.7	gm
WET DENSITY =	119.6	pcf	WET DENSITY :	123.5	pcf
MOISTURE CONTENT:	29.1	%	MOISTURE CONTENT:	27.2	%
DRY DENSITY:	92.7	pcf	DRY DENSITY:	97.1	pcf
INITIAL SATURATION:	96.0	%	FINAL SATURATION:	99.9	%
INITIAL VOID RATIO:	.818410		FINAL VOID RATIO:	.735293	

TEST PARAMETERS....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.33	.20	.00	.00	cc
LENGTH (L):	3.27	3.27	.00	.00	in
AREA (A):	3.05	3.05	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	200.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.323E-008	cm/sec
TEST NO. 2, k=	1.253E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-219
DESCRIPTION:S-8
39-39.8
TUBE

DATE:JUNE 16
JOB No.:88C285-01

CELL NO.:25 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA...............................

INITIAL HEIGHT:	2.715	in	FINAL HEIGHT:	2.740	in
INITIAL DIAMETER:	2.0400	in	FINAL DIAMETER:	2.0300	in
INITIAL WET WEIGHT:	342.7	gm	FINAL WET WEIGHT:	345.0	gm
WET DENSITY =	147.0	pcf	WET DENSITY :	148.1	pcf
MOISTURE CONTENT:	6.4	%	MOISTURE CONTENT:	7.1	%
DRY DENSITY:	138.1	pcf	DRY DENSITY:	138.3	pcf
INITIAL SATURATION:	89.9	%	FINAL SATURATION:	100.3	%
INITIAL VOID RATIO:	.187051		FINAL VOID RATIO:	.186109	

TEST PARAMETERS......................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	13.00	8.00	.00	.00	cc
LENGTH (L):	2.74	2.74	.00	.00	in
AREA (A):	3.24	3.24	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	400.00	150.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	5.135E-007	cm/sec
TEST NO. 2, k=	5.267E-007	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY
TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-220
DESCRIPTION:S-9
41-43
TUBE

DATE:JUNE 15 1988
JOB No.:88C285-01

CELL NO.:22 FLUID:DEAIRED WATER B-Parameter:0.99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	2.810	in	FINAL HEIGHT:	2.860	in
INITIAL DIAMETER:	2.1000	in	FINAL DIAMETER:	2.0700	in
INITIAL WET WEIGHT:	313.8	gm	FINAL WET WEIGHT:	303.2	gm
WET DENSITY =	122.7	pcf	WET DENSITY :	119.9	pcf
MOISTURE CONTENT:	31.1	%	MOISTURE CONTENT:	31.0	%
DRY DENSITY:	93.6	pcf	DRY DENSITY:	91.5	pcf
INITIAL SATURATION:	105.5	%	FINAL SATURATION:	100.0	%
INITIAL VOID RATIO:	.793218		FINAL VOID RATIO:	.833949	

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.44	.75	.00	.00	cc
LENGTH (L):	2.86	2.86	.00	.00	in
AREA (A):	3.37	3.37	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	550.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.396E-008	cm/sec
TEST NO. 2, k=	1.352E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY TEST RESULTS

CLIENT:GLYNN GEOTECHNICAL
PROJECT LOCATION:OXY PROJECT
SAMPLE NO.:BH-221
DESCRIPTION:S-7
27-29
TUBE

DATE:JUNE 16 1988
JOB No.:88C285-01

CELL NO.:19 FLUID:DEAIRED WATER B-Parameter:1.

PHYSICAL PROPERTY DATA................................

INITIAL HEIGHT:	3.393	in	FINAL HEIGHT:	3.447	in
INITIAL DIAMETER:	2.0500	in	FINAL DIAMETER:	2.0000	in
INITIAL WET WEIGHT:	388.2	gm	FINAL WET WEIGHT:	382.7	gm
WET DENSITY =	131.9	pcf	WET DENSITY :	134.5	pcf
MOISTURE CONTENT:	18.8	%	MOISTURE CONTENT:	17.1	%
DRY DENSITY:	111.1	pcf	DRY DENSITY:	114.9	pcf
INITIAL SATURATION:	99.3	%	FINAL SATURATION:	100.1	%
INITIAL VOID RATIO:	.508462		FINAL VOID RATIO:	.458417	

TEST PARAMETERS.....................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA...........................

FLOW (Q):	.44	.70	.00	.00	cc
LENGTH (L):	3.45	3.45	.00	.00	in
AREA (A):	3.14	3.14	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	500.00	500.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	1.802E-008	cm/sec
TEST NO. 2, k=	1.792E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

SUMMARY OF TRIAXIAL PERMEABILITY
TEST RESULTS

CLIENT: GLYNN GEOTECHNICAL
PROJECT LOCATION: OXY PROJECT
SAMPLE NO.: BH-221
DESCRIPTION: S-8
40-42
TUBE

DATE: JUNE 16 1988
JOB No.: 88C285-01

CELL NO.: 17 FLUID: DEAIRED WATER B-Parameter: 0.99

PHYSICAL PROPERTY DATA..............................

INITIAL HEIGHT:	3.148 in	FINAL HEIGHT:	3.244 in
INITIAL DIAMETER:	2.0400 in	FINAL DIAMETER:	2.0000 in
INITIAL WET WEIGHT:	317.9 gm	FINAL WET WEIGHT:	321.6 gm
WET DENSITY =	117.6 pcf	WET DENSITY :	120.1 pcf
MOISTURE CONTENT:	28.9 %	MOISTURE CONTENT:	30.4 %
DRY DENSITY:	91.2 pcf	DRY DENSITY:	92.1 pcf
INITIAL SATURATION:	93.0 %	FINAL SATURATION:	99.9 %
INITIAL VOID RATIO:	.832384	FINAL VOID RATIO:	.814936

TEST PARAMETERS......................................

CELL PRESSURE:	55.00	55.00	.00	.00	psi
HEAD WATER:	50.00	50.00	.00	.00	psi
TAIL WATER:	45.00	42.00	.00	.00	psi

PERMEABILITY INPUT DATA.............................

FLOW (Q):	.72	1.40	.00	.00	cc
LENGTH (L):	3.24	3.24	.00	.00	in
AREA (A):	3.14	3.14	.00	.00	sqin
HEAD (h):	5.00	8.00	.00	.00	psi
TIME (t):	650.00	850.00	.00	.00	min

COMPUTED PERMEABILITY @ 20 degrees Centigrade.......

TEST NO. 1, k=	2.135E-008	cm/sec
TEST NO. 2, k=	1.984E-008	cm/sec
TEST NO. 3, k=	.000E+000	cm/sec
TEST NO. 4, k=	.000E+000	cm/sec

APPENDIX D

CONFINING LAYER PLANS

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH100	20.0 - 22.0	Jar	76.3	22.6	1.0	0.1	39	20	19	
BH101	10.0 - 12.0	Jar	77.1	17.3	5.5	0.0	NA	NA	NA	
	12.0 - 14.0	Jar	72.1	21.6	4.3	2.0	NA	NA	NA	
	14.0 - 16.0	Jar	71.1	23.1	5.3	0.4	NA	NA	NA	
	16.0 - 18.0	Jar	67.2	29.2	3.6	0.0	37	15	22	
	18.0 - 20.0	Jar	81.9	15.5	2.3	0.3	45	21	24	
	20.0 - 22.0	Jar	74.4	22.5	2.2	0.9	40	19	21	
	22.0 - 24.0	Jar	70.1	26.9	2.5	0.5	36	17	19	
	24.0 - 26.0	Jar	83.8	14.7	1.3	0.2	45	23	22	
	26.0 - 28.0	Jar	82.4	12.2	4.4	1.0	51	28	23	
	28.0 - 30.0	Jar	63.0	23.6	11.8	1.7	35	17	18	
BH102	13.0 - 15.0	Jar	69.3	23.8	7.0	0.0	NA	NA	NA	
	15.0 - 17.0	Jar	72.4	25.9	1.8	0.0	39	20	19	
	17.0 - 19.0	Jar	65.1	32.9	2.0	0.0	33	13	20	
	19.0 - 21.0	Jar	75.1	22.4	2.4	0.0	40	20	20	
	21.0 - 23.0	Jar	72.7	25.6	1.7	0.0	41	20	21	
	23.0 - 25.0	Jar	70.0	27.3	2.3	0.4	37	19	18	
	25.0 - 27.0	Jar	80.2	17.8	2.0	0.0	45	25	20	
	27.0 - 29.0	Jar	80.7	16.4	2.9	0.0	45	22	23	
	29.0 - 31.0	Jar	81.2	15.2	3.0	0.6	45	20	25	
	31.0 - 33.0	Jar	63.0	25.1	9.6	2.2	37	17	20	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH103	16.0 - 18.0	Jar	60.3	31.3	8.5	0.0	28	8	20	
	18.0 - 20.0	Jar	69.2	20.3	10.4	0.0	NA	NA	NA	
	20.0 - 22.0	Jar	70.1	27.0	2.9	0.0	41	18	23	
	22.0 - 24.0	Jar	73.6	24.2	1.5	0.6	38	17	21	
	24.0 - 26.0	Jar	74.1	24.0	1.9	0.0	41	19	22	
	26.0 - 28.0	Jar	76.6	22.1	1.4	0.0	45	25	20	
	28.0 - 30.0	Jar	75.3	22.7	2.0	0.0	39	18	21	
	30.0 - 32.0	Jar	69.3	26.1	2.6	2.0	39	19	20	
	32.0 - 33.4	Jar	60.7	25.9	11.8	1.7	38	20	18	
BH104	17.0 - 19.0	Jar	72.1	24.7	2.7	0.5	37	17	20	
	19.0 - 21.0	Jar	75.9	21.2	2.7	0.3	43	17	20	
	21.0 - 23.0	Jar	83.8	14.1	2.0	0.0	44	25	19	
	23.0 - 25.0	Jar	87.4	10.6	1.7	0.2	49	22	27	
	25.0 - 27.0	Jar	87.3	10.7	2.0	0.0	52	26	26	
	27.0 - 29.0	Jar	85.6	12.6	1.8	0.0	42	22	20	
	29.0 - 31.0	Jar	71.2	22.3	5.1	1.4	40	20	20	
BH105	27.0 - 28.0	Jar	81.5	15.3	3.1	0.1	47	23	24	
BH115	35.0 - 37.0	Jar	57.1	30.2	9.7	3.0	29	10	19	
	42.0 - 44.0	Tube	76.1	21.9	2.0	0.0	45	21	24	2.4×10^{-8}
BH117	40.0 - 41.3	Jar	75.1	17.7	5.1	2.2	45	24	21	
BH117A	40.0 - 41.9	Liner	73.0	24.0	3.0	0.0	42	24	18	2.9×10^{-8}

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH123	21.0 - 22.0	Jar	86.7	11.6	1.7	0.0	48	24	24	
	22.0 - 24.0	Jar	86.9	9.7	2.7	0.7	51	23	28	
BH124	14.6 - 16.0	Jar	66.4	31.1	2.5	0.0	33	19	14	
	16.0 - 18.0	Jar	55.0	41.4	3.4	0.3	32	11	21	
	18.0 - 20.0	Jar	68.1	28.6	3.0	0.2	40	18	22	
	20.0 - 22.0	Jar	75.5	23.4	1.1	0.0	37	18	19	
	22.0 - 24.0	Jar	76.3	22.2	1.2	0.3	43	20	23	
	24.0 - 26.0	Jar	83.0	14.7	2.3	0.0	53	26	27	
BH125	14.0 - 16.0	Jar	67.3	29.6	2.5	0.6	21	7	14	
	16.0 - 18.0	Jar	77.2	21.9	0.8	0.1	45	19	26	
	18.0 - 20.0	Jar	65.8	28.5	4.0	1.7	28	13	15	
	20.0 - 22.0	Jar	64.4	30.8	3.4	1.4	27	13	14	
	22.0 - 24.0	Jar	71.4	27.3	1.3	0.0	39	19	20	
	24.0 - 26.0	Jar	79.2	19.7	1.0	0.1	45	19	26	
	26.0 - 28.0	Jar	81.2	15.8	1.4	1.5	48	23	25	
BH126	14.0 - 16.0	Jar	70.8	26.1	3.0	0.2	NA	NA	NA	
	16.0 - 18.0	Jar	61.4	37.1	1.5	0.1	36	14	22	
	18.0 - 20.0	Jar	69.0	26.9	4.2	0.0	43	21	22	
	20.0 - 22.0	Jar	67.1	30.5	2.0	0.4	36	17	19	
	22.0 - 24.0	Jar	68.0	30.1	1.9	0.0	NA	NA	NA	
	24.0 - 26.0	Jar	80.9	15.9	1.9	1.3	48	23	25	
	26.0 - 28.0	Jar	82.8	15.6	1.6	0.0	45	19	26	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH127	14.0 - 16.0	Jar	61.2	24.9	12.8	1.1	34	15	19	
	16.0 - 18.0	Jar	51.4	27.7	18.9	2.0	30	16	14	
	18.0 - 20.0	Jar	70.2	26.3	3.1	0.3	44	24	20	
	20.0 - 22.0	Jar	74.0	24.5	1.6	0.0	42	21	21	
	22.0 - 24.0	Jar	69.1	29.9	1.0	0.0	NA	NA	NA	
	24.0 - 26.0	Jar	82.8	15.8	1.2	0.2	46	19	27	
	26.0 - 28.0	Jar	81.2	16.6	1.2	1.0	47	26	21	
	28.0 - 30.0	Jar	67.4	24.9	7.3	0.5	41	18	23	
BH128	13.2 - 14.0	Jar	77.0	20.0	3.0	0.0	42	20	22	
	14.0 - 16.0	Jar	72.9	23.7	3.5	0.0	40	18	22	
	16.0 - 18.0	Jar	68.3	29.5	2.2	0.0	38	19	19	
	18.0 - 20.0	Jar	68.8	29.8	1.3	0.1	36	17	19	
	20.0 - 22.0	Jar	71.1	26.6	2.3	0.0	41	21	20	
	22.0 - 24.0	Jar	71.9	26.9	1.3	0.0	39	23	16	
	24.0 - 26.0	Jar	86.8	12.1	0.8	0.3	47	30	17	
	26.0 - 28.0	Jar	85.7	12.9	1.4	0.0	46	26	20	
	28.0 - 30.0	Jar	63.7	23.1	11.9	1.3	36	15	21	
BH129	12.9 - 14.0	Jar	77.0	22.1	0.8	0.0	43	18	25	
	14.0 - 16.0	Jar	70.5	28.5	1.0	0.0	39	13	26	
	16.0 - 18.0	Jar	68.9	30.1	1.0	0.0	38	13	25	
	18.0 - 20.0	Jar	76.3	22.8	0.9	0.0	18	6	12	
	20.0 - 22.0	Jar	71.0	26.4	2.6	0.0	45	21	24	
	22.0 - 24.0	Jar	71.7	27.7	0.6	0.0	25	9	16	
	24.0 - 26.0	Jar	85.4	13.3	1.3	0.0	28	12	16	
	26.0 - 28.0	Jar	82.9	16.1	1.1	0.0	31	9	22	
	28.0 - 30.0	Jar	77.5	19.5	2.7	0.3	43	19	24	
	30.0 - 31.0	Jar	74.6	17.5	7.4	0.5	45	21	24	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH130	14.0 - 16.0	Jar	75.4	23.5	1.1	0.0	42	20	22	
	16.0 - 18.0	Jar	72.8	26.8	0.4	0.0	39	19	20	
	18.0 - 20.0	Jar	66.7	32.3	1.0	0.0	37	17	20	
	20.0 - 22.0	Jar	74.9	22.4	2.6	0.1	44	23	21	
	22.0 - 24.0	Jar	69.7	29.1	1.2	0.1	37	17	20	
	24.0 - 26.0	Jar	84.0	15.2	0.8	0.0	52	27	25	
	26.0 - 28.0	Jar	85.5	13.9	0.6	0.0	47	25	22	
	28.0 - 30.0	Jar	80.0	18.3	1.7	0.0	49	26	23	
BH131	18.0 - 20.0	Jar	74.5	23.7	1.8	0.0	42	20	22	
BH132	16.0 - 18.0	Jar	74.2	24.9	0.8	0.1	41	19	22	
BH133	22.5 - 24.5	Jar	79.0	18.0	1.9	1.1	41	20	21	
BH134	20.0 - 22.0	Jar	72.0	26.6	1.3	0.1	38	16	22	
BH135	24.0 - 26.0	Jar	82.6	15.9	1.4	0.1	45	23	22	
BH136	26.0 - 28.0	Jar	86.2	11.8	1.6	0.4	47	20	27	
BH137	14.0 - 16.0	Jar	58.5	39.8	1.7	0.0	33	15	18	
	16.0 - 18.0	Jar	59.4	37.0	3.6	0.0	34	15	19	
	18.0 - 20.0	Jar	72.8	25.0	1.4	0.8	42	21	21	
	20.0 - 22.0	Jar	73.0	25.0	1.9	0.0	41	21	20	
	22.0 - 24.0	Jar	77.1	20.3	2.6	0.0	43	21	22	
	24.0 - 26.0	Jar	81.1	15.2	3.7	0.0	48	22	26	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH138	20.0 - 22.0	Jar	61.5	34.1	4.4	0.0	34	13	21	
	22.0 - 24.0	Jar	71.7	24.7	2.8	0.7	38	17	21	
	24.0 - 26.0	Jar	67.9	25.0	5.7	1.3	45	24	21	
BH139	28.0 - 29.2	Jar	77.0	22.1	0.8	0.0	18	6	12	
BH149	26.5 - 28.0	Jar	79.4	15.2	4.7	0.7	42	20	22	
BH154	27.5 - 28.0	Jar	72.6	14.8	10.3	2.3	NA	NA	NA	
BH156	22.0 - 24.0	Tube	64.8	35.2	0.0	0.0	50	29	21	4.0×10^{-8}
	24.0 - 26.0	Tube	83.0	17.0	0.0	0.0	43	23	20	3.5×10^{-8}
	26.0 - 28.0	Tube	57.6	42.4	0.0	0.0	41	25	16	2.4×10^{-8}
BH157	30.0 - 32.0	Jar	66.4	32.7	0.8	0.1	30	16	14	
	32.0 - 34.0	Tube	54.4	42.1	3.5	0.0	30	13	17	4.2×10^{-8}
	34.0 - 36.0	Tube	80.5	17.7	1.5	0.3	49	26	23	2.2×10^{-8}
	38.0 - 40.0	Tube	77.5	20.3	1.9	0.3	46	22	24	1.9×10^{-8}
	40.0 - 42.0	Tube	81.6	17.0	1.4	0.0	50	29	21	1.6×10^{-8}
	42.0 - 44.0	Tube	75.1	22.1	2.8	0.0	42	22	20	2.4×10^{-8}
BH158	18.5 - 20.0	Jar	Sample Not Tested							
	20.0 - 22.0	Tube	75.8	21.3	3.0	0.0	45	22	23	2.3×10^{-8}
	22.0 - 24.0	Tube	64.9	34.8	0.3	0.0	37	17	20	4.4×10^{-8}
	24.0 - 26.0	Tube	82.7	14.9	2.4	0.0	54	32	22	3.5×10^{-8}
	26.0 - 28.0	Tube	79.8	20.0	0.2	0.0	55	34	21	3.4×10^{-8}
	32.0 - 34.0	Jar	67.8	30.7	1.5	0.0	38	17	21	
	34.0 - 36.0	Tube	82.4	16.0	1.6	0.0	53	34	19	no perm due to voids
BH159	17.5 - 18.0	Jar	77.0	23.0	0.0	0.0	NA	NA	NA	
	22.0 - 24.0	Jar	72.8	25.3	1.9	0.0	41	19	22	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH159A	18.0 - 20.0	Tube	71.0	27.0	2.0	0.0	39	23	16	4.6×10^{-8}
	20.0 - 22.0	Tube	72.4	26.7	0.9	0.0	48	25	23	4.0×10^{-8}
	24.0 - 26.0	Tube	72.1	26.9	1.0	0.0	38	16	22	6.1×10^{-8}
	26.0 - 28.0	Tube	78.3	20.9	0.8	0.0	46	26	20	3.1×10^{-8}
	28.0 - 30.0	Jar	78.8	18.3	2.0	0.8	47	24	23	
	32.0 - 34.0	Tube	68.6	22.1	8.4	0.9	39	20	19	3.2×10^{-8}
BH160	24.0 - 26.0	Tube	84.9	14.1	1.0	0.0	51	31	20	2.6×10^{-8}
	32.0 - 34.0	Tube	63.5	29.4	5.7	1.4	33	23	10	2.7×10^{-8}
BH161	34.0 - 36.0	Jar	Sample Not Analyzed							
	34.0 - 36.0	Tube	Not tested as sample contained wood, decaying organics, etc.							
	38.0 - 40.0	Tube	85.3	13.8	0.9	0.0	55	35	20	1.7×10^{-8}
BH162	24.0 - 26.0	Jar	Sample Not Analyzed							
	24.0 - 26.0	Tube	87.4	9.6	3.0	0.0	53	29	24	2.2×10^{-8}
BH163	22.4 - 24.0	Jar	90.0	7.4	2.2	0.4	49	22	27	
BH165	30.0 - 32.0	Tube	69.9	24.8	5.3	0.0	46	21	25	3.4×10^{-8}
BH166	26.0 - 28.0	Tube	88.6	10.8	0.6	0.0	53	26	27	2.7×10^{-8}
BH168	24.0 - 26.0	Jar	67.9	30.6	1.3	0.1	36	19	17	
	26.0 - 28.0	Jar	75.5	20.8	2.5	1.2	40	20	20	
	28.0 - 30.0	Jar	66.6	27.5	5.9	0.0	37	16	21	
	30.0 - 32.0	Jar	77.3	21.5	1.2	0.0	42	18	24	
	32.0 - 34.0	Jar	81.7	17.2	1.2	0.0	46	22	24	
	34.0 - 38.0	Jar	70.1	19.3	7.9	2.7	43	18	25	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH169	23.0 - 24.0	Jar	66.2	30.7	2.8	0.3	37	19	18	
	24.0 - 26.0	Jar	76.6	21.2	2.2	0.0	41	18	23	
	26.0 - 28.0	Jar	63.2	28.2	8.5	0.0	32	14	18	
	28.0 - 30.0	Jar	70.0	27.2	2.8	0.1	37	16	21	
	30.0 - 32.0	Jar	78.5	20.3	1.2	0.0	47	24	23	
	32.0 - 34.0	Jar	83.9	14.2	1.9	0.0	46	24	22	
	34.0 - 36.0	Jar	81.3	15.3	3.2	0.2	45	22	23	
	36.0 - 38.0	Tube	82.4	13.2	3.5	0.9	49	23	26	4.1×10^{-8}
BH170	22.7 - 24.0	Jar	Not tested due to high degree of contamination.							
	24.0 - 26.0	Jar	Not tested due to high degree of contamination.							
	26.0 - 28.0	Jar	Not tested due to high degree of contamination.							
	28.0 - 30.0	Jar	Not tested due to high degree of contamination.							
	30.0 - 34.0	Jar	Not tested due to high degree of contamination.							
	34.0 - 36.0	Jar	Not tested due to high degree of contamination.							
BH180	41.8 - 42.0	Jar	67.7	20.0	11.5	0.9	NA	NA	NA	
	44.0 - 46.0	Jar	64.5	27.6	6.6	1.3	36	18	18	
BH182	26.0 - 26.5	Jar	74.9	19.3	5.7	0.1	43	25	18	
BH184	24.0 - 26.0	Jar	76.6	17.5	4.7	1.2	39	20	19	
BH186	24.0 - 26.0	Jar	64.9	24.2	10.9	0.0	33	16	17	

continued....

TABLE 3

CLAY PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH192	24.0 - 26.0	Jar	53.6	29.6	15.2	1.7	28	13	15	
	26.0 - 26.7	Tube	54.7	39.2	6.1	0.0	35	17	18	1.6×10^{-8}
BH194	23.9 - 24.0	Jar	Insufficient sample to perform testing.							
BH206	32.0-34.0.0	Liner	79.7	17.1	3.2	0.0	45	26	19	3.5×10^{-8}
BH216	34.0 - 36.0	Jar	72.2	25.0	2.7	0.1	NA	NA	NA	
	36.0 - 38.0	Jar	75.2	20.9	3.9	0.1	NA	NA	NA	
	40.0 - 42.0	Tube	85.4	14.0	0.6	0.0	47	23	24	2.4×10^{-8}
OW210	25.0 - 27.0	Jar	84.3	14.9	0.9	0.0	45	25	20	
OW212	12.0 - 14.0	Jar	74.4	25.1	0.4	0.0	30	12	18	
	14.0 - 16.0	Jar	60.7	37.8	1.5	0.0	31	13	18	
	16.0 - 18.0	Jar	62.5	36.1	1.4	0.0	32	14	18	
	18.0 - 20.0	Jar	65.6	32.0	2.3	0.2	33	14	19	
	20.0 - 22.0	Jar	77.6	18.9	3.4	0.1	44	26	18	
	22.0 - 24.0	Jar	88.6	9.6	1.9	0.0	47	25	22	
	24.0 - 26.0	Jar	68.0	23.7	7.9	0.4	40	20	20	

NA - insufficient sample size
NP - non plastic

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH101	30.0 - 32.0	Jar	50.0	24.4	17.0	8.6	31	14	17	
	32.0 - 32.5	Jar	33.7	34.5	25.9	5.9	23	10	13	
BH102	33.0 - 33.8	Jar	26.9	34.3	26.7	12.1	20	7	13	
BH104	31.0 - 33.0	Jar	53.7	27.3	16.1	2.9	32	16	16	
BH105	28.0 - 30.0	Jar	62.3	16.2	15.4	6.1	35	14	21	
	30.0 - 32.0	Jar	43.9	23.1	24.0	9.0	27	11	16	
BH107	26.5 - 28.0	Jar	50.5	26.6	17.6	5.3	30	16	14	
BH109	28.0 - 29.3	Jar	27.8	31.8	25.6	14.7	19	5	14	
BH110	26.0 - 28.0	Jar	32.6	31.1	24.8	11.4	22	7	15	
BH113	42.0 - 44.0	Jar	56.7	22.9	17.9	2.5	37	20	17	
	44.0 - 46.0	Jar	29.2	33.2	27.7	9.9	18	3	15	
BH115	37.0 - 39.0	Jar	33.0	31.4	24.5	11.0	23	10	13	
BH117	38.0 - 40.0	Jar	53.8	23.9	16.4	6.0	32	15	17	
BH117A	38.0 - 40.0	Liner	49.0	23.0	19.5	8.5	34	25	9	1.5×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH119	37.0 - 38.0	Jar	48.8	28.8	20.0	2.5	26	9	17	
	38.0 - 40.0	Jar	41.8	29.0	22.0	7.2	28	10	18	
BH120	34.5 - 36.0	Jar	46.0	23.8	19.5	10.6	34	17	17	
	36.0 - 36.5	Jar	37.3	28.1	23.8	10.7	26	8	18	
BH121	23.3 - 24.0	Jar	36.4	34.8	26.9	1.9	NA	NA	NA	
BH124	26.0 - 27.6	Jar	41.2	28.1	24.7	6.1	28	19	9	
BH125	28.0 - 28.5	Jar	37.4	38.6	19.4	4.5	24	12	12	
BH126	28.0 - 29.8	Jar	44.5	30.1	18.7	6.6	NA	NA	NA	
BH130	30.0 - 32.0	Jar	38.9	34.2	21.8	5.1	24	10	14	
BH137	26.0 - 28.0	Jar	58.1	24.2	10.2	7.5	37	18	19	
BH138	26.0 - 28.0	Jar	52.7	15.7	20.4	11.2	NA	NA	NA	
BH140	26.8 - 28.0	Jar	49.4	26.2	22.7	1.7	27	13	14	
BH144	24.5 - 26.0	Jar	48.3	27.1	18.8	5.9	NA	NA	NA	

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH146	27.0 - 28.0	Jar	48.2	27.6	19.7	4.5	29	13	16	
	28.0 - 30.0	Jar	64.2	16.9	11.4	7.4	42	24	18	
BH147	26.0 - 28.0	Jar	37.1	31.6	24.8	6.5	20	10	10	
BH148	26.0 - 28.0	Jar	37.3	35.7	19.0	7.9	22	9	13	
	28.0 - 29.8	Jar	33.0	41.9	21.3	3.8	20	9	11	
BH149	25.0 - 26.0	Jar	28.2	35.1	28.0	8.7	NA	NA	NA	
BH151	28.0 - 29.7	Jar	39.1	35.1	22.4	3.4	26	12	14	
BH153	30.0 - 30.4	Jar	34.6	21.6	31.7	12.2	25	9	16	
BH154	28.0 - 29.0	Jar	48.8	24.4	19.4	7.4	31	17	14	
	30.0 - 31.0	Jar	36.9	31.2	23.8	8.1	24	10	14	
BH156	30.0 - 32.0	Tube	43.5	20.0	31.4	5.1	24	12	12	
BH157	44.0 - 45.3	Tube	49.7	30.2	10.8	9.3	22	8	14	7.1×10^{-8}
BH163	24.0 - 26.0	Jar	60.8	23.2	14.0	2.0	35	17	18	
	26.3 - 27.0	Tube	27.6	37.7	26.5	8.2	19	6	13	7.9×10^{-8}
BH165	32.0 - 34.0	Tube	53.9	25.6	16.8	3.7	31	14	17	3.6×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH166	29.0 - 31.0	Tube	54.7	26.5	16.0	2.8	30	15	15	2.1×10^{-8}
BH167	24.0 - 26.0	Jar	28.3	36.9	18.0	16.8	22	9	13	
BH168	38.0 - 39.2	Jar	33.0	41.2	22.4	3.3	21	6	15	
BH177	26.0 - 28.0	Jar	43.7	22.9	19.6	13.7	25	11	14	
BH179	43.5 - 44.0	Jar	61.0	22.9	13.3	2.9	42	20	22	
BH183	26.0 - 28.0	Jar	65.2	22.7	8.9	3.2	33	12	21	
BH184	26.0 - 28.0	Jar	40.2	30.8	20.2	8.8	25	11	14	
BH185	26.5 - 28.0	Jar	61.1	23.5	14.6	0.8	24	10	14	
BH186	23.0 - 24.0	Jar	39.1	34.7	18.5	7.8	24	9	15	
BH188	28.0 - 30.0	Jar	47.1	25.8	18.7	8.4	27	11	16	
BH190	43.3 - 44.0	Jar	39.3	35.5	17.7	7.5	28	14	14	
BH193	24.5 - 26.0	Jar	29.2	31.5	26.0	13.3	18	5	13	
BH198	24.3 - 26.0	Liner	32.5	47.0	19.5	1.0	37	27	10	No perm. - disturbed
	26.8 - 26.9	Liner	47.5	14.5	24.5	13.5	35	24	11	2.1×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH200	34.0 - 35.3	Liner	32.4	35.6	24.1	7.9	21	12	9	3.4×10^{-8}
BH200A	36.0 - 37.1	Jar	69.7	18.8	8.9	2.6	37	18	19	
BH201	32.0 - 34.0	Liner	47.5	35.7	13.0	3.8	36	18	18	3.1×10^{-8}
BH204	30.0 - 31.5	Jar	69.3	19.8	7.8	3.1	34	15	19	
	31.5 - 33.5	Liner	29.8	32.0	28.4	9.8	22	11	11	3.0×10^{-8}
BH207	30.0 - 32.0	Liner	41.1	36.4	18.4	4.1	23	9	14	6.4×10^{-8}
BH208	32.0 - 34.0	Liner	38.5	16.0	36.0	19.5	17	13	4	1.4×10^{-8}
BH209	30.0 - 32.0	Liner	27.5	35.0	23.0	14.5	24	21	3	3.1×10^{-8}
BH211	24.0 - 26.0	Liner	26.0	50.5	18.0	5.5	22	14	8	No perm. - disturbed
	26.0 - 27.8	Liner	19.5	53.5	19.0	8.0	NP	NP	NP	No perm. - disturbed
BH212	23.5 - 24.0	Jar	Not tested due to high degree of contamination							
BH213	24.0 - 25.0	Jar	38.5	29.1	28.3	4.0	18	8	10	
BH217	38.0 - 40.0	Liner	68.5	13.0	14.0	4.5	39	20	19	1.3×10^{-8}

continued....

TABLE 4

FINE TILL PHYSICAL TESTING RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH220	38.5 - 39.0	Jar	28.8	26.2	25.9	19.1	NP	NP	NP	
	39.0 - 41.0	Jar	24.6	31.7	23.6	20.1	16	5	11	
	41.0 - 43.0	Liner	72.5	7.0	19.0	1.5	42	25	17	1.4×10^{-8}
	43.0 - 44.0	Jar	Sample Not Analyzed							
BH221	37.0 - 39.0	Liner	35.0	49.5	12.5	3.0	40	22	18	1.8×10^{-8}
OW212	26.0 - 27.4	Jar	38.1	26.0	25.3	10.5	23	10	13	

NA - insufficient sample size

NP - non plastic

TABLE 7

SUMMARY OF PHYSICAL TESTING RESULTS

		Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
CLAY	minimum	51.4	9.6	0.0	0.0	18	6	10	1.6×10^{-8}
	maximum	90.0	42.4	18.9	3.0	55	35	28	6.1×10^{-8}
	average[1] (n = 180)	73.7	22.8	3.1	0.4	41	20	21	2.9×10^{-8} (n = 29)
FINE TILL	minimum	19.5	7.0	7.8	0.8	17	3	3	1.3×10^{-8}
	maximum	72.5	53.5	36.0	19.5	42	27	22	7.9×10^{-8}
	average[1] (n = 73)	43.2	29.0	20.4	7.4	28	13	15	2.7×10^{-8} (n = 15)
MEDIUM TILL	minimum	2.5	18.2	17.8	3.7	12	2	5	1.6×10^{-8}
	maximum	35.2	47.7	52.8	27.8	43	24	16	5.3×10^{-7}
	average[1] (n = 100)	19.6	31.7	32.0	16.7	18	7	11	6.3×10^{-8} (n = 22)
COARSE TILL	minimum	8.1	13.0	5.0	22.5	12	2	3	2.3×10^{-8}
	maximum	20.6	29.3	49.5	57.0	22	16	16	2.6×10^{-7}
	average[1] (n = 27)	14.0	21.2	29.7	35.1	17	7	10	7.6×10^{-8} (n = 7)

Note: Arithmetic average except for permeability which is geometric mean.

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH183	28.0 - 29.0	Jar	25.4	37.8	25.7	11.0	17	5	12	
BH185	28.0 - 29.5	Jar	12.7	27.7	34.4	25.2	15	6	9	*
BH186	26.0 - 28.0	Jar	15.2	28.4	44.0	12.4	NP	NP	NP	*
BH189	32.0 - 34.0	Liner	18.5	33.5	31.5	16.5	16	12	4	No perm. - disturbed
BH190	44.0 - 45.3	Jar	12.3	21.9	52.8	13.0	NP	NP	NP	*
	47.0 - 47.3	Jar	18.4	38.3	26.4	16.9	16	4	12	
BH191	41.5 - 42.0	Jar	22.0	29.3	32.2	16.6	NA	NA	NA	
	42.0 - 44.0	Liner	11.8	32.0	46.0	10.2	20	2	18	1.4×10^{-7}
BH193	26.0 - 26.4	Jar	14.6	35.9	40.6	9.0	NA	NA	NA	
BH196	24.0 - 25.7	Jar	14.0	28.5	36.3	21.3	NA	NA	NA	*
BH197	24.0 - 26.0	Liner	20.5	34.0	37.0	8.5	NP	NP	NP	4.0×10^{-8}
	26.0 - 28.0	Liner	13.5	33.0	29.0	24.5	27	23	4	1.2×10^{-7}
BH199	42.0 - 44.0	Jar	25.8	36.9	29.4	7.9	15	10	5	
BH201	34.0 - 34.5	Liner	18.4	31.6	30.9	19.1	17	7	10	8.0×10^{-8}
	35.0 - 35.3	Jar	17.6	35.6	30.2	16.6	18	5	13	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH161	40.0 - 42.0	Tube	27.4	37.3	31.6	3.7	17	4	13	8.5×10^{-8}
	42.0 - 44.0	Tube	23.1	34.6	23.1	19.2	16	4	12	3.8×10^{-8}
	44.0 - 45.0	Tube	18.5	35.3	26.9	19.3	16	5	11	3.7×10^{-8}
	44.0 - 45.0	Jar	17.8	33.4	24.9	23.8	18	4	14	
BH162	28.0 - 30.0	Tube	21.2	35.7	23.5	19.6	24	8	16	3.5×10^{-8}
BH167	26.0 - 26.3	Jar	20.0	34.4	17.8	27.8	NA	NA	NA	
	28.0 - 29.5	Jar	20.8	34.9	26.7	17.7	17	8	9	
BH169	38.0 - 39.6	Tube	17.9	39.8	27.7	14.6	18	3	15	3.5×10^{-8}
	39.6 - 39.7	Jar	21.6	35.7	32.2	10.5	17	7	10	
BH170	38.0 - 39.0	Jar	24.6	33.0	28.6	13.9	19	9	10	
BH171	27.6 - 28.0	Jar	25.2	32.5	31.0	6.3	18	6	12	
	28.0 - 29.7	Jar	25.7	35.8	31.1	7.4	19	6	13	
BH172	45.0 - 46.8	Jar	23.0	25.0	28.0	23.9	22	6	16	
BH173	43.5 - 44.0	Jar	26.0	31.6	26.5	16.0	22	9	13	
BH176	30.0 - 31.9	Jar	17.2	31.5	31.0	20.4	17	6	11	
BH180	42.0 - 44.0	Jar	20.7	24.3	38.6	16.4	20	9	11	
BH181	24.0 - 26.0	Jar	25.6	22.0	30.0	22.4	25	14	11	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH150	25.8 - 26.0	Jar	Insufficient sample to perform testing							
	26.0 - 28.0	Jar	19.6	28.5	26.5	25.4	NA	NA	NA	
	28.0 - 29.9	Jar	19.5	30.8	28.7	21.0	20	11	9	
BH151	25.0 - 26.0	Jar	25.6	34.5	29.2	10.7	NA	NA	NA	
	26.0 - 26.3	Jar	20.3	25.7	34.1	20.0	18	6	12	
	26.0 - 26.3	Jar	18.7	36.3	31.4	13.6	16	4	12	
	28.0 - 29.7	Jar	22.6	28.9	35.5	13.0	16	3	13	
BH152	25.8 - 26.0	Jar	26.0	32.2	34.8	7.1	NA	NA	NA	
BH153	26.0 - 28.0	Jar	20.0	31.4	31.1	17.6	15	5	10	
	28.0 - 29.8	Jar	24.4	28.0	34.8	12.8	NP	NP	NP	
BH154	26.0 - 27.5	Jar	16.3	30.0	31.3	22.5	17	5	12	
	31.0 - 31.3	Jar	13.4	28.4	38.7	19.6	NA	NA	NA	*
BH155	29.4 - 30.0	Jar	17.8	32.8	31.6	17.8	NA	NA	NA	
	30.0 - 32.0	Jar	17.0	27.4	32.6	22.9	NA	NA	NA	*
	32.0 - 33.3	Jar	18.2	32.7	35.7	13.4	16	5	11	
BH159A	34.0 - 36.0	Tube	16.1	36.3	31.4	16.2	17	5	12	4.0×10^{-8}
BH160	34.0 - 36.0	Tube	26.2	27.9	19.6	26.3	25	11	14	2.6×10^{-8}
	36.0 - 37.6	Jar	26.2	29.3	29.5	15.0	19	6	13	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH118	38.0 - 40.0	Jar	13.6	27.2	40.5	18.8	13	3	10	*
	40.0 - 42.0	Jar	11.3	26.9	41.7	20.1	NP	NP	NP	*
BH119	40.0 - 40.5	Jar	15.7	28.7	41.0	14.6	20	7	13	*
BH120	36.5 - 38.0	Jar	12.9	29.3	37.6	20.2	15	2	13	*
BH122	24.0 - 26.0	Jar	23.4	32.5	33.8	10.4	NA	NA	NA	
BH123	24.0 - 26.0	Jar	24.4	39.6	30.3	5.7	20	5	15	
	26.0 - 27.9	Jar	21.2	36.7	34.6	7.5	15	5	10	
BH137	28.0 - 29.1	Jar	26.7	31.2	28.8	13.3	23	10	13	
BH138	28.0 - 30.0	Jar	17.3	33.0	32.5	17.2	16	3	13	
	30.0 - 31.1	Jar	18.6	33.6	29.3	18.4	17	5	12	
BH139	26.0 - 28.0	Jar	20.2	34.1	28.9	16.8	19	7	12	
BH140	28.0 - 30.0	Jar	23.5	31.5	29.3	15.7	23	10	13	
	30.0 - 30.8	Jar	25.8	24.6	41.5	8.1	21	8	13	
BH141	30.0 - 30.5	Jar	18.5	26.6	33.1	21.9	22	9	13	*
BH147	25.0 - 26.0	Jar	27.8	34.4	31.0	6.8	19	9	10	
	28.0 - 29.6	Jar	24.2	25.0	39.0	11.8	16	3	13	
BH149	28.0 - 29.9	Jar	21.4	29.1	30.7	18.7	19	7	12	

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH104	33.0 - 33.4	Jar	18.8	33.2	31.4	16.6	17	3	14	
BH106	29.0 - 30.0	Jar	18.9	33.7	34.6	12.9	19	5	14	
	30.0 - 32.0	Jar	17.3	31.0	32.3	19.4	NA	NA	NA	
	32.0 - 32.6	Jar	16.7	32.6	31.1	19.6	NP	NP	NP	
BH109	26.0 - 28.0	Jar	20.9	29.7	26.1	23.3	17	6	11	
BH110	28.0 - 30.0	Jar	21.8	29.7	25.5	23.0	20	8	12	
	30.0 - 31.1	Jar	15.6	30.6	35.6	18.1	16	5	11	*
BH111	28.0 - 30.0	Jar	14.9	29.2	33.7	22.2	16	9	7	*
BH112	39.5 - 40.0	Jar	21.9	32.1	28.9	17.2	22	9	13	
	40.0 - 42.0	Jar	17.8	29.1	30.0	23.0	NA	NA	NA	
	44.0 - 45.0	Jar	22.6	31.4	33.5	12.5	NP	NP	NP	
BH113	39.5 - 40.0	Jar	16.4	28.6	33.2	21.8	18	7	11	*
	40.0 - 42.0	Jar	24.4	33.2	30.0	12.4	20	8	12	
	46.0 - 46.4	Jar	15.1	28.7	36.2	20.0	NA	NA	NA	*
BH114	36.0 - 38.0	Jar	15.7	29.2	31.5	23.6	NP	NP	NP	*
	38.0 - 40.0	Jar	18.2	29.2	29.1	23.6	16	4	12	
	43.0 - 44.6	Tube	14.3	27.9	32.7	25.1	14	5	9	*

continued....

TABLE 5

MEDIUM TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH202	32.0 - 33.2	Liner	18.5	34.5	32.0	15.0	NP	NP	NP	1.5×10^{-7}
	33.5 - 34.3	Liner	15.9	27.8	37.6	18.7	15	7	8	6.1×10^{-8}
BH203	35.5 - 37.3	Liner	18.5	28.0	37.0	16.5	29	24	5	4.4×10^{-8}
BH205	30.0 - 30.7	Liner	16.3	30.3	27.5	25.9	17	5	12	9.3×10^{-8}
BH212	24.0 - 26.0	Liner	20.5	47.5	27.5	4.5	21	14	7	2.9×10^{-8}
BH213	24.5 - 26.0	Jar	16.4	45.8	20.3	17.5	16	3	13	
	26.0 - 27.0	Jar	15.7	28.0	42.4	13.9	12	5	7	*
	27.0 - 27.7	Liner	2.5	42.5	48.0	7.0	NP	NP	NP	4.0×10^{-7}
BH214	25.3 - 26.0	Jar	35.2	18.2	20.6	26.0	27	13	14	
BH215	28.0 - 30.0	Jar	23.5	37.2	30.1	9.2	17	6	11	
	30.0 - 31.3	Liner	24.0	28.5	25.0	22.5	18	14	4	1.6×10^{-8}
BH216	42.0 - 44.0	Tube	18.3	32.4	30.8	18.5	17	6	11	3.1×10^{-8}
	44.0 - 45.0	Liner	16.5	30.5	27.0	26.5	NP	NP	NP	2.2×10^{-7}
BH219	39.0 - 39.8	Liner	15.5	25.0	37.0	22.5	NP	NP	NP	5.3×10^{-7}
BH221	35.0 - 37.0	Jar	20.3	33.5	36.4	9.7	12	4	8	
	40.0 - 42.0	Liner	22.0	33.5	32.0	12.5	43	24	19	2.0×10^{-8}

NA - insufficient sample size
NP - non plastic

* Estimated permeability >1 x 10^{-7} cm/sec (see text)

TABLE 6

COARSE TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH108	28.0 - 30.0	Jar	15.2	25.5	29.8	29.5	16	5	11	*
BH111	26.0 - 28.0	Jar	11.5	20.0	36.1	32.4	18	10	8	*
BH112	42.0 - 44.0	Jar	12.4	21.5	32.3	33.9	NA	NA	NA	
BH120	38.0 - 40.0	Jar	10.1	25.3	31.1	33.5	17	4	13	
BH121	24.0 - 26.0	Jar	16.5	28.2	26.4	28.8	14	3	11	
BH139	24.0 - 26.0	Jar	15.3	26.0	27.9	30.9	15	4	11	
BH146	30.0 - 31.0	Jar	17.0	14.2	38.2	30.7	22	11	11	*
BH149	26.0 - 26.5	Jar	20.6	29.3	22.8	27.2	16	5	11	
BH153	25.5 - 26.0	Jar	15.5	26.0	26.8	31.6	20	8	12	
BH159A	36.0 - 36.5	Jar	15.8	27.3	26.2	30.6	NA	NA	NA	
BH171	29.7 - 30.0	Jar	8.7	19.5	28.1	43.8	15	2	13	
	30.0 - 31.0	Jar	12.3	24.2	26.4	37.1	16	5	11	
BH173	44.0 - 45.0	Jar	10.5	26.3	32.3	30.9	13	3	10	*
BH176	28.0 - 30.0	Jar	14.3	25.0	33.0	27.7	17	6	11	*

continued....

TABLE 6

COARSE TILL PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Sample Type	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Liquid Limit	Plasticity Index	Plastic Limit	Permeability (cm/sec)
BH178	29.7 - 30.0	Jar	15.1	13.1	29.8	42.0	NA	NA	NA	
	30.0 - 31.5	Jar	8.4	13.0	41.6	37.0	NA	NA	NA	*
BH179	44.0 - 44.6	Jar	12.2	20.1	33.6	34.1	21	5	16	
BH194	24.0 - 24.7	Jar	8.1	16.3	31.0	44.6	NA	NA	NA	
BH200A	34.0 - 36.0	Liner	15.1	27.3	19.8	37.8	18	10	8	2.3×10^{-8}
BH203	33.5 - 35.5	Liner	12.7	20.8	17.5	49.0	18	5	13	8.3×10^{-8}
BH204	33.5 - 34.2	Liner	12.6	20.5	25.7	41.2	17	7	10	7.7×10^{-8}
BH207	32.0 - 34.0	Liner	20.5	14.5	34.5	30.0	16	12	4	1.1×10^{-7}
BH209	32.0 - 34.0	Liner	16.0	17.0	25.5	41.5	15	12	3	3.3×10^{-8}
BH210	24.0 - 26.0	Liner	11.0	17.0	49.5	22.5	22	16	6	2.6×10^{-7}
	26.0 - 28.0	Liner	20.0	18.0	5.0	57.0	NP	NP	NP	9.9×10^{-8}
BH214	26.0 - 28.0	Jar	10.1	18.0	39.7	32.2	12	3	9	*
BH218	37.0 - 39.0	Liner	19.5	17.5	31.5	31.5	NP	NP	NP	No perm. - disturbed

NA - insufficient sample size
NP - non plastic

* Estimated permeability $>1 \times 10^{-7}$ cm/sec (see text)

TABLE 8

LOWEST CLAY CONTENT PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Permeability (cm/sec)
BH213	27.0 - 27.0	2.5	42.5	48.0	7.0	4.0×10^{-7} *
BH210	24.0 - 26.0	11.0	17.0	49.5	22.5	2.6×10^{-7} *
BH191	42.0 - 44.0	11.8	32.0	46.0	10.2	1.4×10^{-7} *
BH204	33.5 - 34.2	12.6	20.5	25.7	41.2	7.7×10^{-8}
BH203	33.5 - 35.5	12.7	20.8	20.8	49.0	8.3×10^{-8}
BH197	26.0 - 28.0	13.5	33.5	28.5	24.5	1.2×10^{-7} *
BH200A	34.0 - 36.0	15.1	27.3	19.8	37.8	2.3×10^{-8}
BH219	39.0 - 39.8	15.5	25.0	37.0	22.5	5.3×10^{-7} *
BH202	33.5 - 34.3	15.9	27.8	37.6	18.7	6.1×10^{-8}
BH209	32.0 - 34.0	16.0	17.0	25.5	41.5	3.3×10^{-8}
BH159A	34.0 - 36.0	16.1	36.3	31.4	16.2	4.0×10^{-8}
BH205	30.0 - 30.7	16.3	30.3	27.5	25.9	9.3×10^{-8}
BH216	44.0 - 45.0	16.5	30.0	27.0	26.5	2.2×10^{-7} *
BH169	38.0 - 39.6	17.9	39.8	27.7	14.6	3.5×10^{-8}
BH216	42.0 - 44.0	18.3	32.4	30.8	18.5	3.1×10^{-8}
BH201	34.0 - 34.5	18.4	31.6	30.9	19.1	8.0×10^{-8}
BH203	35.5 - 37.3	18.5	28.0	37.0	16.5	4.4×10^{-8}
BH202	32.0 - 33.2	18.5	34.5	32.0	15.0	1.5×10^{-7}
BH161	44.0 - 45.0	18.5	35.3	26.9	19.3	3.7×10^{-8}
BH207	32.0 - 34.0	20.5	14.5	34.5	30.0	1.2×10^{-7} *
BH197	24.0 - 26.0	20.5	34.0	37.0	8.5	4.0×10^{-8}
BH212	24.0 - 26.0	20.5	47.5	27.5	4.5	2.9×10^{-8}

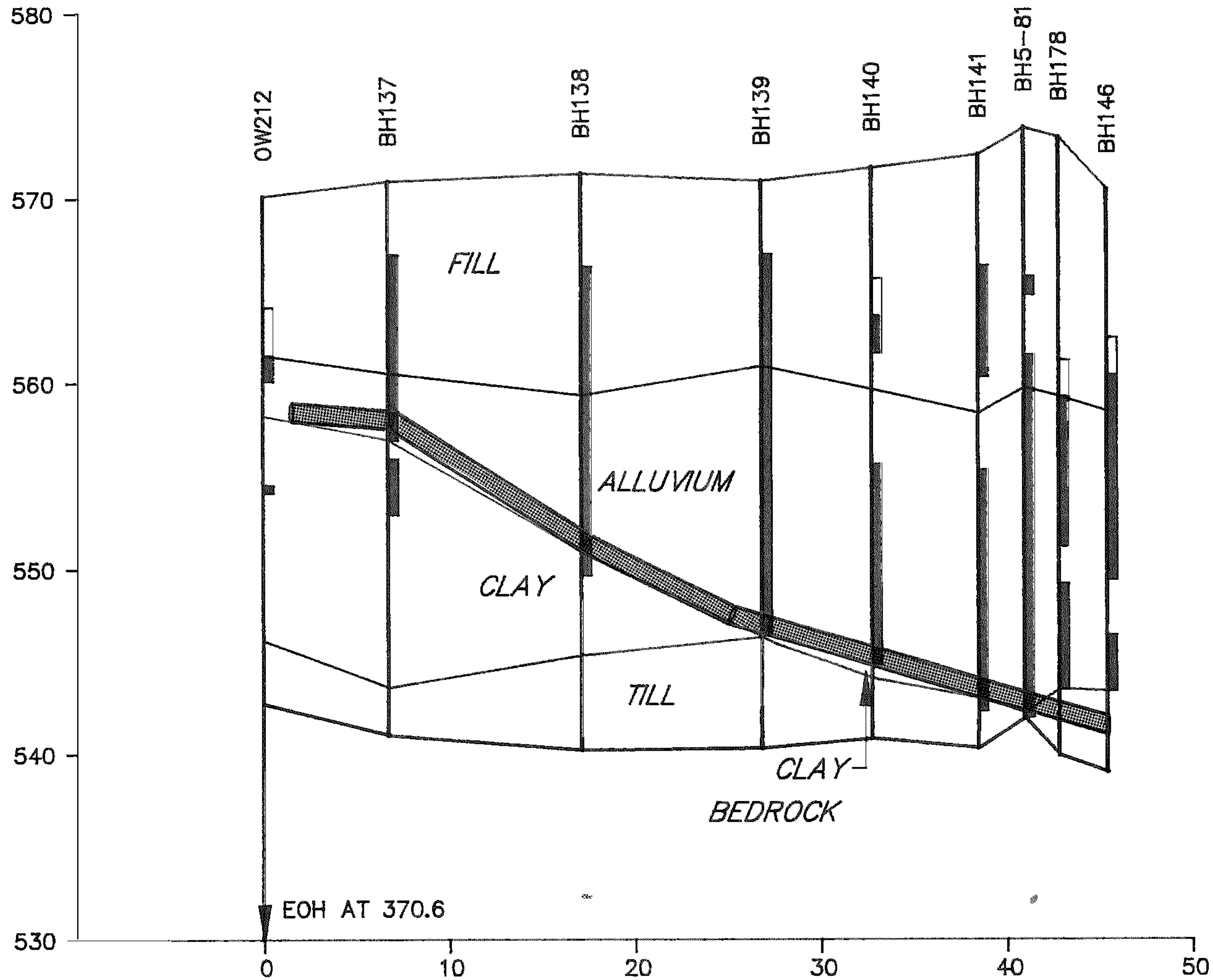
* Permeability $>1 \times 10^{-7}$ cm/sec

TABLE 9

HIGHEST COARSE CONTENT PHYSICAL TEST RESULTS

Well/ Borehole Number	Sample Depth (ft)	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Percent Coarse	Permeability (cm/sec)
BH210	24.0 - 26.0	11.0	17.0	49.5	22.5	72.0	2.6×10^{-7} *
BH209	32.0 - 34.0	16.0	17.0	25.5	41.5	67.0	3.3×10^{-8}
BH204	33.5 - 34.2	12.6	20.5	25.7	41.2	66.9	7.7×10^{-8}
BH203	33.5 - 35.5	12.7	20.8	17.5	49.0	66.5	8.3×10^{-8}
BH207	32.0 - 34.0	20.5	14.5	34.5	30.0	64.5	1.2×10^{-7} *
BH210	26.0 - 28.0	20.0	18.0	5.0	57.0	62.0	9.9×10^{-8}
BH219	39.0 - 39.8	15.5	25.0	37.0	22.5	59.5	5.3×10^{-7} *
BH200A	34.0 - 36.0	15.1	27.3	19.8	37.8	57.6	2.3×10^{-8}
BH202	33.5 - 34.3	15.9	27.8	37.6	18.7	56.3	6.1×10^{-8}
BH191	42.0 - 44.0	11.8	32.0	46.0	10.2	56.2	1.4×10^{-7} *
BH213	27.0 - 27.7	2.5	42.5	48.0	7.0	55.0	4.0×10^{-7} *
BH197	26.0 - 28.0	13.5	33.0	29.0	24.5	53.5	1.2×10^{-7} *
BH216	44.0 - 45.0	16.5	30.0	27.0	26.5	53.5	2.2×10^{-7} *
BH205	30.0 - 30.7	16.3	30.3	27.5	25.9	53.4	9.3×10^{-8}
BH203	35.5 - 37.3	18.5	28.5	37.0	16.0	53.0	4.4×10^{-8}

* Permeability >1 x 10^{-7} cm/sec



LEGEND

MONITORING INTERVAL

SHEEN

NAPL

SCALE: 1"=10' VER.
1"=10' HOR.

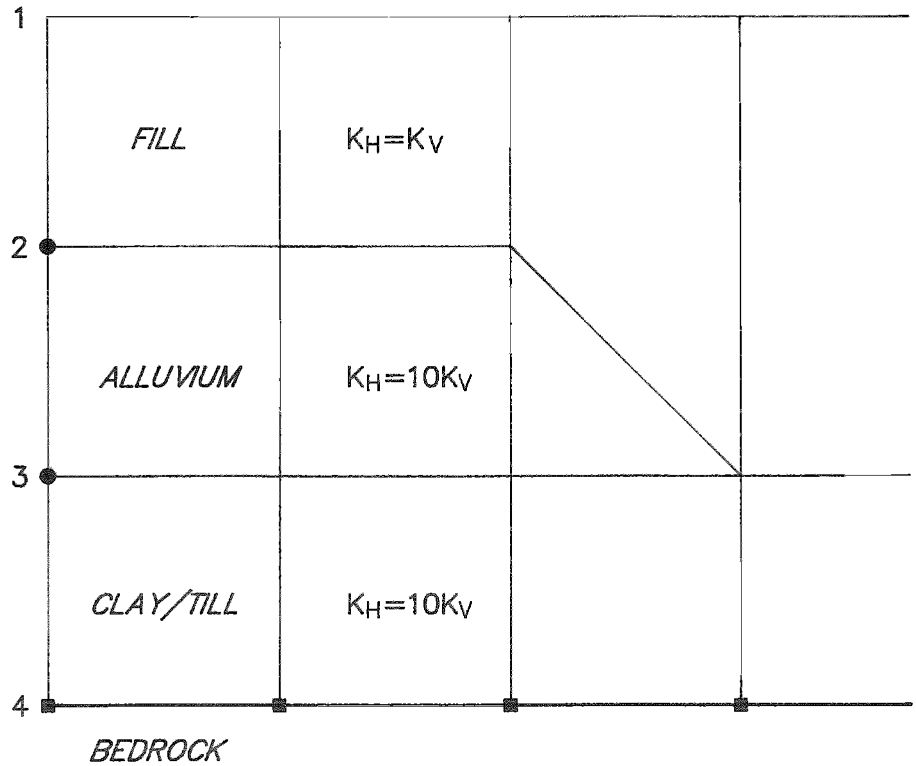
ALL ELEVATIONS BASED ON 1986 OCC DATUM
(REF. DWG. A-11-19200)

figure 20

CROSS-SECTION I-I'
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-1 (X-45)



LEGEND

● PRESCRIBED HEAD NODE (OVERBURDEN WATER TABLE)

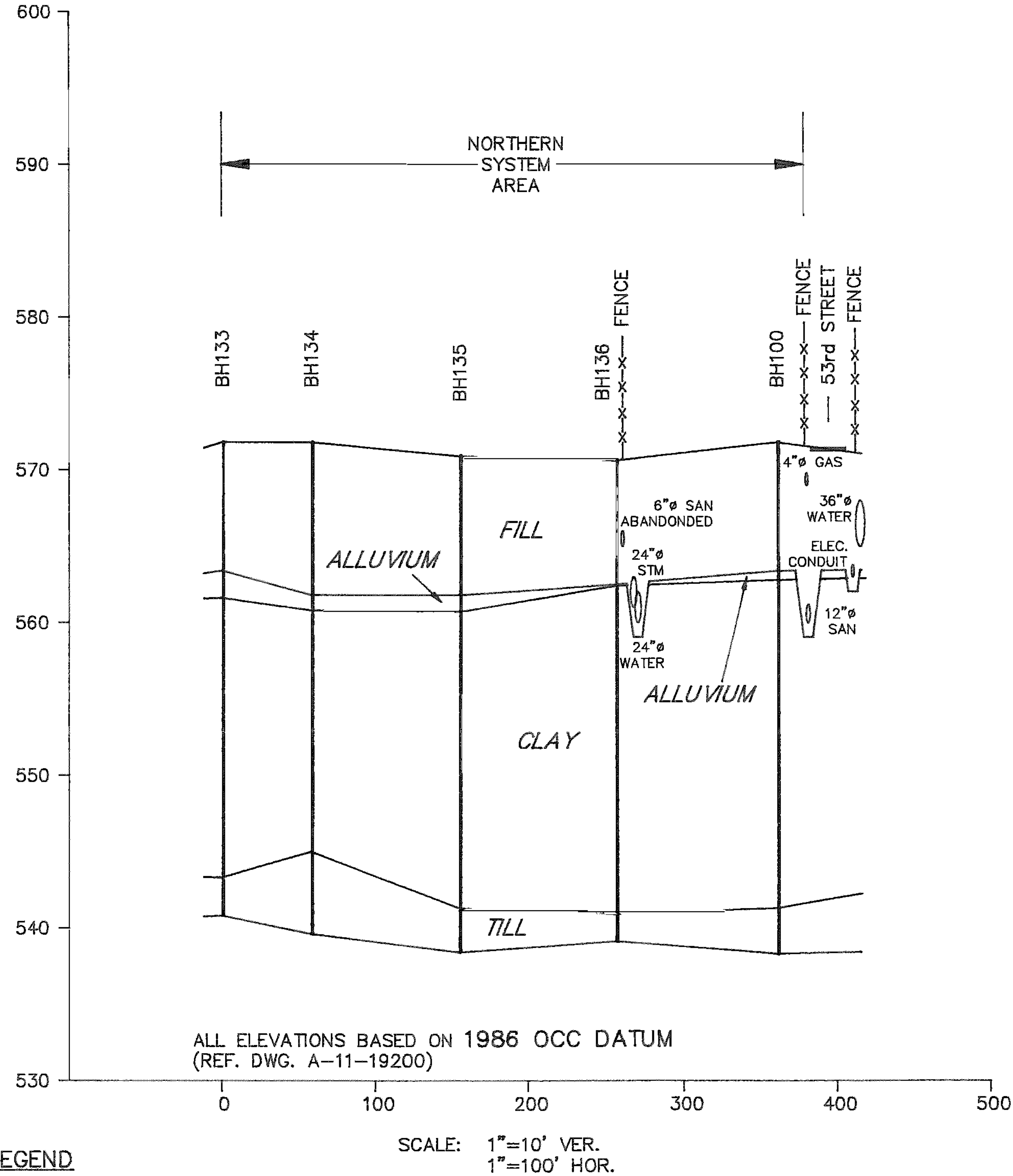
■ PRESCRIBED HEAD NODE (BEDROCK POTENTIOMETRIC HEAD)

figure 29

CONCEPTUALIZATION SCHEMATIC
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-0 (D-2)



LEGEND

MONITORING INTERVAL

SHEEN

NAPL

figure 19

CROSS-SECTION H-H'
S-AREA REMEDIAL PROGRAM
Occidental Chemical Corporation

CRA

1769-4/08/88-25-D-0 (X-37)