GEOCRES No:
30M3-271-4

Final report

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SITE ASSESSMENT
PHASE 4B:
GEOLOGY, HYDROGEOLOGY AND GEOTECHNICS, BASELINE CONDITIONS

VOLUME 3

APPENDICES E THROUGH J

Prepared for
The Ontario Waste Management Corporation

Submitted By

Gartner Lee Limited

October, 1987

Gartner Lee Limited

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Professional Services in Environmental Management

- Environmental Strategies
- Resources Planning
- Waste Management
- Hydrogeology
- Biology
- Water Quality
- Engineering Geology
- Spill Response

October 30, 1987 GLL 87561

Mr. J.G. Micak
Manager, Environmental Projects
Ontario Waste Management Corporation
2 Bloor Street West, 11th Floor
Toronto, Ontario
M4W 3E2

Attention: Mr. D.F. Chollak,
Environmental Planner

Dear Sirs:

Re: Site Assessment Phase 4B: Geology, Hydrogeology and Geotechnics - Baseline Conditions

We are pleased to provide you with Volume 3 of the above noted three-volume report. This report is one of six Phase 4B companion reports describing baseline conditions, hydrogeologic inputs to landfill design, geotechnical inputs to facilities design, potential impacts of the landfill on ground water, potential impacts of the central operation area on ground water and ground water management strategies.

We thank you for this opportunity to be of service. Should you have any questions please do not hesitate to call.

Yours very truly,

GARTNER LEE LIMITED

for E.G. Anderson, P.Eng.
Consulting Hydrogeologist
Project Director

Glenn Reynolds
G.W. Reynolds, M.Sc.,
Senior Hydrogeologist,
Project Manager

GWR:emh

APPENDIX E

GEOTECHNICAL INFORMATION

APPENDIX E
GEOTECHNICAL INFORMATION

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E1 - LABORATORY TEST RESULTS GOLDER ASSOCIATES (EASTERN CANADA) LTD. REPORT REFERENCE NO. 851-1298

Appendix E1 contains, in full, the factual report prepared by Golder Associates (Eastern Canada) Ltd. on the geotechnical laboratory testing carried out on samples obtained from the geotechnical boreholes.

These tests included;

- WATER CONTENT DETERMINATIONS
  (ASTM D2216-80)
- INDEX PROPERTIES
  (ASTM D2216-80, D4318-84, D422-63)
- LABORATORY VANE SHEAR TESTS
- UNDRAINED TRIAXIAL TESTS
  (ASTM D2850-82)
- UNCONFINED, UNDRAINED TRIAXIAL COMPRESSION TESTS
  (ASTM D2166-85)
- CONSOLIDATED, UNDRAINED TRIAXIAL TESTS
  (Bishop & Henkel Method)
- DIRECT SHEAR TESTS
  (ASTM D3080-72-modified)
- CONSOLIDATION TESTS
  (ASTM D2435-80)
- COMPACTION TESTS
  (ASTM D698-78)

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

FACTUAL REPORT TO
GARTNER LEE ASSOCIATES LIMITED

CONFIDENTIAL

LABORATORY TESTING OF CLAY SOILS
ONTARIO WASTE MANAGEMENT CORPORATION
4B PROGRAM

Gartner Lee Associates Ref. 85-GT-4

DISTRIBUTION:

2 copies, bound 1 copy , unbound	-	Gartner Lee Associates Limited Markham, Ontario
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May, 1986 851-1298

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FIGURES (continued)

May 9, 1986 Our ref: 851-1298

Gartner Lee Associates Limited
Toronto-Buttonville Airport
Markham, Ontario
L3P 3J9

ATTENTION: Mr. R. D. Powell, P. Eng.

RE: LABORATORY TESTING OF CLAY SOILS
ONTARIO WASTE MANAGEMENT CORPORATION
4B PROGRAM
GLAL REF: 85-GT-4

Dear Sirs:

This letter reports the factual results of laboratory tests carried out on samples of clay soils delivered to our laboratory by Gartner Lee Associates Limited. We understand that the samples were obtained from various sites within the OWMC 4B Program.

LABORATORY TESTING

The laboratory tests were carried out in our geotechnical laboratory in Mississauga, Ontario, using the testing program as specified by Gartner Lee Associates Limited. The tests were carried out in accordance with the current ASTM standards, where applicable, as noted in the following sections of the report; any variations from the standards are described. Due to the volume of testing and the time required to complete the scheduled work, the test results were submitted to Gartner Lee Associates in a preliminary form as they became available.

All test results within this report are deemed to be confidential as per the Undertaking of Confidentiality Agreement with the Ontario Waste Management Corporation.

TEST SAMPLES

During the period from December 6, 1985 to March 14, 1986, our laboratory received samples for testing from Gartner Lee Associates. These samples were delivered in sealed plastic containers or 2.78 in. diameter Shelby tubes which were waxed and capped. The Shelby tube samples were stored, horizontally, in our concrete curing room until required for testing. Samples received in plastic containers were used for water content determinations on the date received.

At the time of delivery, Chain of Custody documents were signed and exchanged by both parties.

WATER CONTENT DETERMINATIONS (ASTM D2216-80)

Water content determinations were carried out on clay soil samples that were delivered to our laboratory. These tests were carried out using the whole sample (approximately 70 gm dry weight) on the day of receipt. The results of the water content determinations are summarized on Tables 1 to 6, inclusive.

INDEX PROPERTIES (ASTM D2216-80, D4318-84, D422-63)

The portion of each sample extruded from the Shelby tubes for testing was visually examined to observe the undisturbed fabric of the material to provide a laboratory description of soil type. The trimmings from the test samples were used for the index tests which comprised water content determinations, Atterberg Limits and grain size analyses. These tests were carried out in accordance with ASTM designations D2216-80, D4318-84 and D422-63, respectively. Plots of the grain size distributions are given on Figures 48 to 75, inclusive. Due to computer limitations, the boreholes on the grain size plots were designated by site and hole number only.

LABORATORY VANE SHEAR TESTS

Laboratory vane shear tests were carried out on samples within the Shelby tubes. As discussed prior to carrying out these tests, the samples were cut such that the tests could be conducted on planes oriented at 0°, 38° and 90° to the horizontal (note: the longitudinal axis of the samples is oriented at 90° to the horizontal). These tests were carried out using a 'Geonor' laboratory vane apparatus with a vane length of one half inch. Table 7 summarizes the peak and residual undrained shear strengths obtained from the vane tests, along with the water content at the point of testing. Reference to "base" and "top" under the remarks column indicates tests made at each end of the angled section relative to the base of the Shelby tube.

UNDRAINED TRIAXIAL TESTS (ASTM D2850-82)

Unconsolidated, undrained triaxial compression tests were carried out on specified samples using the effective overburden pressure as the confining pressure. These samples were trimmed at 90° to the horizontal with a nominal 2:1 length/diameter ratio. The results of these tests are shown on Figures 1-1 to 11-2, inclusive.

UNCONFINED, UNDRAINED TRIAXIAL COMPRESSION TESTS (ASTM D2166-85)

Unconfined, undrained triaxial compression tests were carried out on samples at different angles of orientation. Samples with a nominal 2:1 length/diameter ratio were trimmed at angles of 90^o, 45^o and 0^o to the horizontal plane. The results of these tests are shown on Figures 12-1 to 30-2, inclusive.

CONSOLIDATED, UNDRAINED TRIAXIAL TESTS (Bishop & Henkel Method)

Consolidated, undrained triaxial tests with pore water pressure measurements at specified effective cell pressures were carried out. Due to the time required for equalization of the pore pressures, a nominal strain rate of 0.5 percent per hour was selected. However, the time to failure exceeded normal working hours; therefore, the tests were either stopped overnight or slowed down to a strain rate of 0.25 percent per hour. The notations shown on the deviator stress vs axial strain plot for each test summarizes the strain rate history of the tests. The results of the testing are shown on Figures 31-1 to 33-3, inclusive. The computer data sheets for this testing are given in Appendix 1.

DIRECT SHEAR TESTS (ASTM D3080-72-modified)

Consolidated, drained direct shear tests were carried out on samples that were trimmed so that the shear plane was established at 0^o to the horizontal plane. The direct shear test on Sample 6 from BH 85-3-2 was carried out as a peak strength test only, stopping the strain rate overnight. All of the remaining direct shear tests were carried out as peak and residual strength tests, with the sequence given below.

Using a strain rate of 0.5 percent per hour to allow total drainage across the shear plane, the tests were allowed to travel the maximum distance of the shear box. Using the hand crank, the shear plane was returned to the original position. Five additional forward and reverse passes were then made over a total time period of approximately one half hour. The sample was then allowed to stand for two hours, allowing the pore water pressures to dissipate. The final run, noted as the sixth pass, was then made using the previous strain rate of 0.5 percent per hour.

The results of these tests are shown on Figures 34-1 to 39-3, inclusive, with the strain rate history being shown on the shear stress vs horizontal displacement plots. The residual points on the shear stress vs normal stress plot refer to the sixth pass of the test. Computer data sheets for the direct shear tests are given in Appendix 2.

CONSOLIDATION TESTS (ASTM D2435-80)

Consolidation tests were carried out using fixed ring, Bishop bench type presses with samples of 63.5 mm diameter and 19.05 mm height. The standard load increments were applied every 24 hours up to the consolidation press maximum, then rebounded to the original load or swelling pressure, where applicable. The results of these tests are shown on Figures 40-1 to 45-2, inclusive.

COMPACTION TESTS (ASTM D698-78)

Two standard Proctor compaction tests, using composite materials from specific areas, were carried out. The results of these tests are shown on Figures 46 and 47.

We trust that this report is adequate for your purposes. If there are any questions regarding this report, please contact us.

Yours truly
GOLDER ASSOCIATES

F. A. Rydgren

REGISTERED PROFESSIONAL ENGINEER
LEO R. LAHTI
PROVINCE OF ONTARIO

Leo R. Lahti, P. Eng.

FAR/LRL/jm

WATER CONTENT DETERMINATIONS

TABLES 1 to 6

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 9,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
			W-2	36.9%
			W-3	19.3%
			W-6	16.8%
			W-8	22.7%
			W-14	21.2%
			W-15	21.4%
			W-17	25.6%
			W-18	21.6%
			W-23	29.0%
			W-232	24.9%
			W-25	19.2%
			W-26	20.3%
			W-27	20.0%
			W-28	17.6%
			W-30	23.9%
			W-31	25.3%
			W-39	24.6%
			W-40	23.1%
			W-41	28.9%
			W-47	35.5%
			W-48	20.3%
			W-49	21.1%
			W-50	22.4%

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 9,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
			W-51	30.6%
			W-53	12.6%
			W-55	27.6%
			W-57	5.8%
			W-62	29.3%
			W-70	22.3%
			W-72	6.8%
			W-82	31.1%
			W-84	23.0%
			W-92	29.9%
			W-126	29.1%
			W-129	22.0%
			W-135	27.4%
			W-138	36.1%
			W-151	19.6%
			W-153	37.4%
			W-203	29.3%
			W-204	18.0%
			W-205	22.7%
			W-206	17.5%
			W-207	21.1%
			W-208	17.1%
			W-209	18.1%

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 9,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
			W-210	20.7%
			W-211	22.7%
			W-212	20.0%
			W-213	17.9%
			W-214	14.0%
			W-216	31.0%
			W-217	16.1%
			W-230	21.9%
			W-231	23.2%
			W-234	22.3%
			W-239	25.6%
			W-243	22.7%
			W-245	23.6%
			W-259	22.8%
			W-264	31.2%
			W-268	4.5%
			W-272	18.7%
			W-273	17.6%
			W-274	27.0%
			W-280	18.7%
			W-281	23.3%
			W-286	39.5%
			W-289	26.5%

TABLE 1

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 9,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
			W-292	17.8%
			W-295	27.0%
			W-310	30.4%
			W-314	22.0%
			W-324	20.2%
			W-332	21.4%
			W-358	24.8%

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-3-2		1.20	W-9	25.6
85-3-2		2.00	W-37	23.7
85-3-2		2.70	W-294	21.3
85-3-2		3.50	W-279	19.8
85-3-2		4.30	W-98	22.6
85-3-2		8.10	W-251	17.9
85-3-2		9.60	W-328	19.4
85-3-2		14.20	W-252	22.5
85-3-2		15.70	W-285	20.3
85-3-2		17.20	W-302	23.1
85-3-2		20.30	W-43	39.1
85-3-2		21.80	W-308	29.4
85-3-2		23.30	W-44	41.3
85-3-2		27.90	W-242	35.9
85-3-2		29.40	W-121	38.1
85-3-2		26.50	W-236	34.9
85-3-2		27.10	W-258	28.3
85-3-4		15.80	W-278	21.3
85-3-4		16.4	W-311	22.9
85-3-5		1.52	W-296	28.0
85-3-5		2.13	W-287	25.3
85-3-5		2.74	W-336	24.0
85-3-5		3.35	W-315	19.8

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-3-5		3.96	W-260	24.0
85-3-5		4.60	W-290	29.5
85-3-5		5.18	W-344	29.0
85-3-5		5.84	W-269	23.1
85-3-6		27.43	W-241	30.3
85-3-7		16.44	W-257	20.3
85-5-2		1.22	W-131	23.2
85-5-2		1.98	W-127	24.1
85-5-2		2.74	W-60	27.0
85-5-2		3.51	W-71	19.1
85-5-2		4.28	W-233	24.2
85-5-2		5.35	W-130	28.4
85-5-2		6.55	W-67	28.4
85-5-2		8.08	W-226	18.0
85-5-2		9.76	W-200	19.2
85-5-2		11.13	W-58	18.8
85-5-2		12.65	W-201	20.6
85-5-2		14.17	W-33	21.2
85-5-2		15.70	W-120	24.4
85-5-2		17.22	W-225	22.7
85-5-2		18.74	W-74	24.8
85-5-2		20.27	W-73	29.6
85-5-2		21.79	W-65	23.8

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-5-2		23.32	W-45	28.1
85-5-2		24.84	W-56	27.8
85-5-2		26.37	W-32	22.2
85-5-2		27.89	W-229	27.8
85-5-2		29.41	W-228	26.5
85-5-2		30.94	W-215	38.2
85-5-2		32.46	W-154	30.6
85-5-2		33.99	W-52	36.6
85-5-2		35.51	W-64	6.5
85-5-3		26.36	W-282	37.0
85-5-3		26.83	W-338	29.2
85-9-2		1.20	W-297	25.9
85-9-2		2.00	W-249	24.7
85-9-2		2.70	W-10	21.8
85-9-2		3.50	W-13	19.8
85-9-2		4.30	W-342	27.4
85-9-2		5.00	W-244	24.7
85-9-2		6.60	W-38	33.4
85-9-2		8.10	W-316	24.9
85-9-2		9.60	W-343	17.0
85-9-2		11.10	W-22	21.9
85-9-2		12.60	W-304	19.9
85-9-2		14.20	W-12	18.0

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-9-2		15.70	W-317	24.0
85-9-2		17.20	W-281	23.7
85-9-2		18.70	W-237	23.2
85-9-2		20.30	W-16	27.8
85-9-2		21.40	W-77	31.9
85-9-2		23.30	W-276	31.5
85-9-2		24.80	W-275	30.4
85-9-2		25.90	W-54	27.7
85-9-2		27.00	W-292	26.7
85-9-2		29.40	W-240	25.8
85-9-2		31.50	W-277	29.2
85-9-2		32.50	W-266	39.2
85-9-2		33.70	W-11	14.2
85-9-3		26.50	W-352	29.7
85-9-3		27.10	W-29	25.5
85-9-4		15.85	W-80	26.0
85-9-4		16.46	W-24	24.5
85-9-5		1.52	W-270	25.4
85-9-5		2.13	W-364	21.6
85-9-5		2.74	W-299	28.4
85-9-5		3.35	W-347	18.1
85-9-5		3.96	W-351	20.4
85-9-5		4.57	W-301	24.0

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-9-5		5.18	W-349	30.6
85-9-5		5.79	W-283	33.6
85-10-2		1.20	W-359	22.4
85-10-2		2.00	W-263	21.5
85-10-2		2.70	W-305	19.4
85-10-2-		3.50	W-353	22.7
85-10-2		6.50	W-348	22.9
85-10-2		8.10	W-366	27.0
85-10-2		9.60	W-298	26.0
85-10-2		10.60	W-288	19.8
85-10-2		12.60	W-34	26.4
85-10-2		14.20	W-333	19.8
85-10-2		15.70	W-325	20.1
85-10-2		16.70	W-1	22.9
85-10-2		18.70	W-7	20.2
85-10-2		20.30	W-322	18.3
85-10-2		21.30	W-340	18.5
85-10-2		23.30	W-339	35.5
85-10-2		24.80	W-267	36.6
85-10-2		25.80	W-309	28.6
85-10-2		27.90	W-376	35.7
85-10-2		29.40	W-319	39.4
85-10-2		30.40	W-375	39.4

TABLE 2

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED December 20,1985

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-10-2		32.50	W-291	7.3
			W-255	25.9

TABLE 3

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 10,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-3-8	5	25.10	W-354	26.9
85-3-9	1	16.00	W-238	22.1
85-5-4	1	17.22	W-99	20.7
85-5-4	2	17.68	W-91	21.9
85-5-5	1	1.52	W-136	23.1
85-5-5	2	2.13	W-125	25.2
85-5-5	3	2.74	W-177	26.2
85-5-5	4	3.35	W-134	24.0
85-5-5	5	3.96	W-178	26.4
85-5-5	6	4.57	W-156	30.3
85-5-5	7	5.18	W-114	24.9
85-5-5	8	5.79	W-89	25.6
85-8-2	1	.76-1.22	W-36	25.4
85-8-2	2	1.52-1.98	W-112	23.2
85-8-2	3	2.29-2.74	W-96	20.6
85-8-2	5	3.81-4.28	W-148	25.6
85-8-2	6	4.57-5.03	W-165	27.0
85-8-2	8	6.11-6.57	W-144	21.0
85-8-2	9	7.62-8.08	W-111	19.5
85-8-2	10	9.14-9.60	W-158	19.3
85-8-2	11	10.67-11.	W-176	19.5
85-8-2	13	12.19-12.	W-105	23.9
85-8-2	14	13.71-14.	W-101	33.4

TABLE 3

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 10,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-8-2	15	15.24-15.	W-128	29.9
85-8-2	16	16.76-17.	W-146	24.6
85-8-2	18	18.29-18.	W-113	24.9
85-8-2	19	19.81-20.	W-199	23.9
85-8-2	20	21.53-21.	W-174	34.4
85-8-2	21	22.86-23.	W-171	28.6
85-10-3	1	26.50	W-254	29.1
85-10-3	2	27.10	W-219	31.7
85-10-4	1	15.85	W-122	26.0
85-10-4	2	16.46	W-162	26.1
85-10-5	1	1.52	W-90	25.5
85-10-5	2	2.13	W-76	21.5
85-10-5	3	2.74	W-150	24.2
85-10-5	4	3.35	W-61	25.3
85-10-5	5	3.96	W-123	23.0
85-10-5	6	4.57	W-103	21.8
85-10-5	7	5.18	W-86	23.0
85-10-5	8	5.79	W-152	25.4
85-10-8	5	25.15	W-42	35.9
85-10-9	1	16.00	W-133	21.7
85-10-11	1	8.53-9.14	W-68	23.6
85-10-11	2	9.14-9.75	W-157	21.9
			W-132	33.1

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-1-6		27.13	W235	29.8
85-4-2		1.20	W256	21.2
85-4-2		2.00	W248	N/A
85-4-2		2.70	W250	18.2
85-4-2		3.50	W253	18.6
85-4-2		4.30	W313	17.6
85-4-2		5.00	W355	27.8
85-4-2		5.80	W5	18.0
85-4-2		6.60	W330	18.2
85-4-2		7.30	W78	17.3
85-4-2		8.10	W81	19.0
85-4-2		9.60	W300	22.5
85-4-2		11.10	W246	22.6
85-4-2		12.6	W318	27.7
85-4-2		14.2	W4	24.4
85-4-2		15.7	W262	21.6
85-4-2		17.2	W200	23.2
85-4-2		19.7	W201	18.9
85-4-2		21.8	W118	23.7
85-4-2		23.3	W141	N/A
85-4-2		24.8	W205	25.8
85-4-2		27.9	W192	24.1
85-4-2		29.4	W115	30.0

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-4-2		31	W88	31.9
85-4-2		32.5	W143	8.1
85-4-2		33.4	W202	7.2
85-4-3		26.5	W194	20.9
85-4-3		27.1	W175	24.3
85-4-4		15.8	W137	19.9
85-4-4		16.4	W186	17.3
85-4-5		1.50	W223	21.8
85-4-5		2.10	W20	18.2
85-4-5		2.70	W307	22.8
85-4-5		3.40	W202	26.3
85-4-5		4.00	W79	27.6
85-4-5		4.10	W160	25.1
85-4-5		5.2	W372	17.9
85-4-5		5.80	W334	17.4
85-7-2		1.20	W107	20.7
85-7-2		2.00	W106	20.0
85-7-2		2.70	W56	20.8
85-7-2		3.80	W35	23.1
85-7-2		5.00	W116	18.6
85-7-2		6.60	W337	17.5
85-7-2		7.70	W161	20.1
85-7-2		9.60	W385	20.4

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-7-2		11.10	W386	19.5
85-7-2		12.60	W117	19.9
85-7-2		14.20	W85	21.4
85-7-2		15.70	W356	22.0
85-7-2		17.20	W395	27.3
85-7-2		18.30	W384	24.9
85-7-2		20.30	W224	24.6
85-7-2		21.80	W327	23.3
85-7-2		23.30	W405	21.4
85-7-2		24.80	W390	31.5
85-7-2		25.90	W63	26.4
85-7-2		27.90	W392	25.0
85-7-2		29.40	W399	31.3
85-7-2		30.90	W398	37.7
85-7-2		31.50	W403	36.0
85-7-2		33.80	W400	5.3
85-7-3		26.52	W379	28.1
85-7-3		27.13	W261	26.7
85-7-4		15.85	W404	21.4
85-7-4		16.46	W391	24.9
85-7-5		1.52	W360	17.8
85-7-5		2.13	W350	18.4
85-7-5		2.74	W362	23.6

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER   851-1298
PROJECT NAME   Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED   January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-7-5		3.35	W371	28.4
85-7-5		3.96	W382	32.3
85-7-5		4.57	W321	29.2
85-7-5		5.18	W409	21.2
85-7-5		5.79	W139	21.4
85-8-2		24.80	W169	32.0
85-8-2		26.40	W187	34.4
85-8-2		27.90	W197	26.2
85-8-2		29.40	W173	31.0
85-8-2		30.90	W179	27.4
85-8-2		32.50	W191	7.3
85-8-2		33.50	W196	6.6
85-8-3		26.50	W204	34.7
85-8-3		27.10	W190	28.4
85-8-4		15.90	W193	27.0
85-8-4		16.50	W181	26.8
85-8-5		1.50	W183	20.6
85-8-5		2.10	W180	[illegible]
85-8-5		2.70	W170	18.8
85-8-5		3.40	W184	19.5
85-8-5		4.00	W207	20.8
85-8-5		4.60	W185	26.8
85-8-5		5.20	W195	20.4

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-8-5		5.80	W198	21.9
85-8-6		25.90	W166	25.5
85-8-7		16.80	W145	24.2
85-8-8		25.20	W206	24.1
85-8-9		16.10	W189	28.2
85-8-11		9.10	W182	17.8
85-8-11		10.00	W167	17.5
85-11-2		1.20	W59	22.9
85-11-2		2.00	W303	23.9
85-11-2		2.70	W220	18.7
85-11-2		3.50	W367	23.4
85-11-2		4.30	W87	24.4
85-11-2		5.00	W369	30.6
85-11-2		6.60	W75	20.5
85-11-2		8.10	W83	21.1
85-11-2		9.60	W46	20.9
85-11-2		11.10	W368	20.7
85-11-2		12.40	W[illegible]	20.6
85-11-2		14.20	W374	20.4
85-11-2		15.70	W94	18.1
85-11-2		17.20	W221	24.9
85-11-2		18.70	W293	24.4
85-11-2		21.80	W345	23.9

TABLE 4

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED January 23,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-11-2		23.30	W284	21.3
85-11-2		24.80	W396	35.1
85-11-2		27.90	W95	24.5
85-11-2		29.40	W377	32.7
85-11-2		31.00	W271	38.3
85-11-2		32.50	W363	33.2
85-11-2		34.10	W222	13.4
85-11-2		35.40	W218	21.9

TABLE 5

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED February 6,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-1-2		1.22	w681	23.2
85-1-2		1.98	w688	24.1
85-1-2		2.74	w694	18.7
85-1-2		3.51	w691	19.7
85-1-2		4.28	w690	18.1
85-1-2		5.03	w601	17.8
85-1-2		6.10	w692	22.9
85-1-2		8.08	w673	16.3
85-1-2		9.60	w682	16.3
85-1-2		10.67	w695	20.8
85-1-2		14.17	w603	21.5
85-1-2		15.24	w693	23.0
85-1-2		16.31	w626	22.8
85-1-2		17.22	w684	22.2
85-1-2		18.74	w641	24.1
85-1-2		19.81	w604	22.8
85-1-2		21.79	w674	22.6
85-1-2		23.32	w616	25.6
85-1-2		24.84	w640	30.0
85-1-2		25.91	w650	31.2
85-1-2		27.89	w644	28.0
85-1-2		29.41	w608	41.3
85-1-2		30.48	w685	37.4

TABLE 5

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED February 6,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-1-2		32.46	w683	38.5
85-1-2		33.32	w621	7.0
85-1-3		26.52	w394	32.1
85-1-3		27.13	w265	26.6
85-1-4		15.85	w306	23.0
85-1-4		16.46	w370	22.9
85-1-5		1.52	w996	24.0
85-1-5		2.13	w950	26.1
85-1-5		2.74	w979	25.2
85-1-5		3.35	w997	25.5
85-1-5		3.96	w984	26.9
85-1-5		4.57	w995	19.1
85-1-5		5.18	w992	24.2
85-1-5		5.79	w965	29.1
85-1-7		16.46	w209	20.8
85-1-8		25.15	w956	27.0
85-1-9		16.00	w969	23.4
85-11-3		28.03	w335	25.7
85-11-3		28.65	w155	23.5
85-11-4		17.40	w163	25.4
85-11-4		18.00	w247	24.7
85-11-5		1.51	w21	22.4
85-11-5		2.12	w119	19.3

TABLE 5

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC,4B/85-GT-4
DATE TESTED February 6,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-11-5		2.74	w109	18.8
85-11-5		3.35	w381	18.4
85-11-5		3.96	w357	24.1
85-11-5		4.57	w104	27.0
85-11-5		5.18	w97	23.5
85-11-5		5.79	w816	21.6
85-12-2		1.20	w887	21.7
85-12-2		2.00	w947	21.1
85-12-2		2.70	w986	20.6
85-12-2		3.80	w942	21.2
85-12-2		5.00	w968	28.3
85-12-2		6.60	w972	29.9
85-12-2		8.10	w962	18.6
85-12-2		9.60	w951	19.1
85-12-2		10.70	w927	20.8
85-12-2		12.60	w931	18.4
85-12-2		14.20	w939	20.8
85-12-2		15.70	[illegible]	17.4
85-12-2		16.80	w978	26.2
85-12-2		18.70	w896	20.4
85-12-2		20.30	w970	27.3
85-12-2		21.30	w888	23.5
85-12-2		23.30	w981	34.1

TABLE 5

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED February 6,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-12-2		24.80	w946	27.3
85-12-2		25.90	w943	24.9
85-12-2		27.90	w880	28.2
85-12-2		29.40	w994	23.5
85-12-2		30.40	w967	28.6
85-12-2		32.50	w885	35.1
85-12-2		34.00	w952	36.5
85-12-2		35.50	w861	24.7
85-12-3		26.50	w804	29.1
85-12-3		27.10	w858	33.3
85-12-4		17.40	w814	23.6
85-12-4		18.00	w820	23.1
85-12-5		1.50	w835	20.1
85-12-5		2.13	w824	20.0
85-12-5		2.74	w828	19.3
85-12-5		3.35	w859	20.0
85-12-5		3.96	w815	18.1
85-12-5		4.57	w760	[illegible]
85-12-5		5.18	w850	24.0
85-12-5		5.79	w833	23.2
85-12-7		17.60	w851	18.0
85-12-9		25.15	w934	30.8
85-12-11		9.14	w787	18.4

TABLE 5

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED February 6,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-12-11		9.75	w772	18.9

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-13-1		1.36	W-877	22.1
85-13-1		2.88	W-1078	24.4
85-13-1		4.40	W-1041	29.4
85-13-1		5.92	W-1088	19.4
85-13-1		7.44	W-1050	18.4
85-13-1		8.96	W-1069	16.6
85-13-1		10.48	W-1093	16.8
85-13-1		12.00	W-920	19.9
85-13-1		13.52	W-1059	18.0
85-13-1		15.04	W-1070	18.6
85-13-1		16.56	W-1051	22.6
85-13-1		18.08	W-892	18.8
85-13-1		19.60	W-1092	18.1
85-13-1		21.12	W-926	20.9
85-13-1		22.64	W-936	20.5
85-13-1		24.16	W-989	22.1
85-13-1		25.68	W-919	30.6
85-13-1		27.2	W-910	25.0
85-13-1		28.72	W-977	25.9
85-13-1		30.24	W-999	22.8
85-13-1		31.76	W-904	25.7
85-13-1		32.22	W-1075	35.6
85-13-1		34.8	W-906	27.2

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-13-1		36.32	W-964	27.1
85-13-1		37.44	W-941	7.9
85-13-2		1.52	W-1056	19.6
85-13-2		2.13	W-1018	20.8
85-13-2		2.74	W-1083	20.5
85-13-2		3.35	W-929	22.2
85-13-2		3.96	W-1053	25.7
85-13-2		4.57	W-987	30.9
85-13-2		5.18	W-1069	27.6
85-13-2		5.79	W-1063	20.9
85-14-1		1.46	W-1085	20.4
85-14-1		2.78	W-1042	30.7
85-14-1		4.50	W-898	24.9
85-14-1		6.02	W-1057	24.2
85-14-1		7.54	W-1080	26.5
85-14-1		9.06	W-1074	20.3
85-14-1		10.58	W-897	21.2
85-14-1		12.10	W-1058	21.8
85-14-1		13.62	W-884	24.3
85-14-1		15.14	W-998	21.7
85-14-1		16.66	W-1068	23.1
85-14-1		18.18	W-874	27.1
85-14-1		19.70	W-993	25.7

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-14-1		21.22	W-891	35.7
85-14-1		22.74	W-1086	29.0
85-14-1		24.26	W-1077	27.3
85-14-1		25.78	W-930	33.7
85-14-1		27.90	W-863	38.4
85-14-1		28.82	W-937	31.5
85-14-1		30.34	W-867	7.5
85-14-1		33.66	W-1043	6.0
85-14-1		36.73	W-1033	8.0
85-14-2		1.52	W-1065	24.9
85-14-2		2.13	W-901	22.2
85-14-2		2.74	W-1081	34.3
85-14-2		3.35	W-975	29.2
85-14-2		3.96	W-916	26.6
85-14-2		4.57	W-870	27.9
85-14-2		5.18	W-953	23.9
85-14-2		5.79	W-918	23.2
85-15-1		1.52	W-209	21.6
85-15-1		3.04	W-605	22.2
85-15-1		4.56	W-666	21.9
85-15-1		6.08	W-661	21.3
85-15-1		7.60	W-668	23.0
85-15-1		9.12	W-611	21.9

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-15-1		10.64	W-606	21.2
85-15-1		12.16	W-639	28.8
85-15-1		13.66	W-654	38.9
85-15-1		15.20	W-632	28.3
85-15-1		16.72	W-142	23.2
85-15-1		18.24	W-615	25.5
85-15-1		19.76	W-620	24.4
85-15-1		21.28	W-657	23.4
85-15-1		23.80	W-617	35.5
85-15-1		24.32	W-676	28.9
85-15-1		25.84	W-655	32.2
85-15-1		27.36	W-672	28.3
85-15-1		28.88	W-696	29.7
85-15-1		30.40	W-102	40.9
85-15-1		31.92	W-646	34.5
85-15-1		33.44	W-124	37.4
85-15-1		34.96	W-164	15.7
85-15-2		1.51	W-624	23.0
85-15-2		1.97	W-188	26.0
85-15-2		2.58	W-697	31.1
85-15-2		3.19	W-651	18.4
85-15-2		3.80	W-625	28.3
85-15-2		4.41	W-645	27.0

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-15-2		5.02	W-665	27.8
85-15-2		5.63	W-658	27.2
85-16-1		1.32	W-1064	21.5
85-16-1		2.84	W-1076	30.5
85-16-1		4.36	W-957	26.6
85-16-1		5.88	W-875	21.5
85-16-1		7.40	W-895	37.2
85-16-1		8.92	W-1082	35.2
85-16-1		10.44	W-1061	21.3
85-16-1		11.96	W-935	17.6
85-16-1		13.48	W-928	19.1
85-16-1		15.00	W-894	18.7
85-16-1		16.52	W-865	19.6
85-16-1		18.04	W-911	16.6
85-16-1		19.56	W-914	20.7
85-16-1		21.08	W-948	29.9
85-16-1		22.60	W-871	36.8
85-16-1		24.12	W-874	30.8
85-16-1		25.64	W-915	22.1
85-16-2		1.53	W-110	24.7
85-16-2		2.14	W-373	26.9
85-16-2		2.75	W-1079	28.8
85-16-2		3.36	W-980	32.1

TABLE 6

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED March 17,1986

Borehole No.	Sample No.	Depth M	GLA Tare No.	Water Content %
85-16-2		3.97	W-883	21.4
85-16-2		4.58	W-899	26.2
85-16-2		5.19	W-909	28.5
85-16-2		5.80	W-1091	26.7
			W-147	16.2
			W-656	18.8
			W-932	17.5
			W-938	18.4
			W-985	18.0

SUMMARY OF LABORATORY VANE TEST RESULTS

TABLE 7

TABLE 7

JOB NO: 851-1298
GLAL : 85-GT-4

SUMMARY OF LABORATORY VANE TEST RESULTS

VANE ORIENTATION - DEGREES TO HORIZONTAL PLANE

BOREHOLE NO.	SAMPLE NO.	VANE DEGREE	PEAK STRENGTH kPa	REMOULDED STRENGTH kPa	WATER CONTENT %	REMARKS
85- 1-2	7	90	166.5	5.2	29.5	
85- 1-2	11	90	135.1	8.4	21.1	
85- 1-2	21	90	122.5	13.6	22.6	
85- 1-2	21	0	96.4	9.4	23.5	
85- 1-2	21	40	82.7	7.3	20.7	BASE
85- 1-2	21	38	76.4	6.3	22.2	TOP
85- 1-2	30	90	54.5	3.1	40.2	
85- 8-2	4	90	>186.4	-	20.6	
85- 8-2	7	90	>186.4	-	21.3	
85- 8-2	7	0	>186.4	-	29.5	
85- 8-2	7	34	>186.4	-	20.7	BASE
85- 8-2	7	32	>186.4	-	20.1	TOP
85- 8-2	12	90	77.5	10.5	20.5	
85- 8-2	12	0	66.0	7.3	20.1	
85- 8-2	12	35	70.2	9.4	19.4	BASE
85- 8-2	12	35	71.2	9.4	20.0	TOP
85- 8-2	17	90	79.6	8.4	26.6	
85- 8-2	17	0	76.5	7.3	26.4	
85- 8-2	22	90	77.5	8.4	31.8	
85- 8-2	27	90	68.1	7.3	32.9	
85-12-2	4	90	>186.4	-	20.8	
85-12-2	10	90	>186.4	-	17.6	
85-12-2	10	0	173.9	9.4	19.5	
85-12-2	10	38	163.4	8.4	16.8	BASE
85-12-2	10	34	137.2	12.6	18.1	TOP
85-12-2	15	90	121.5	10.5	18.5	
85-12-2	15	0	121.5	8.4	22	
85-12-2	15	38	122.5	7.3	21	BASE
85-12-2	15	37	138.2	12.6	22	TOP
85-12-2	19	90	114.2	10.5	22.6	
85-12-2	19	0	183.2	8.4	17.3	
85-12-2	27	90	82.7	7.3	27.7	

ANGULAR TEST CARRIED OUT ON A 4 INCH SECTION OF SAMPLE WHICH WAS CUT FROM SHELBY TUBE.

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UNDRAINED TRIAXIAL COMPRESSION (Q)

FIGURES 1-1 to 11-2

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 1 OF 2

FIGURE 1-1

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

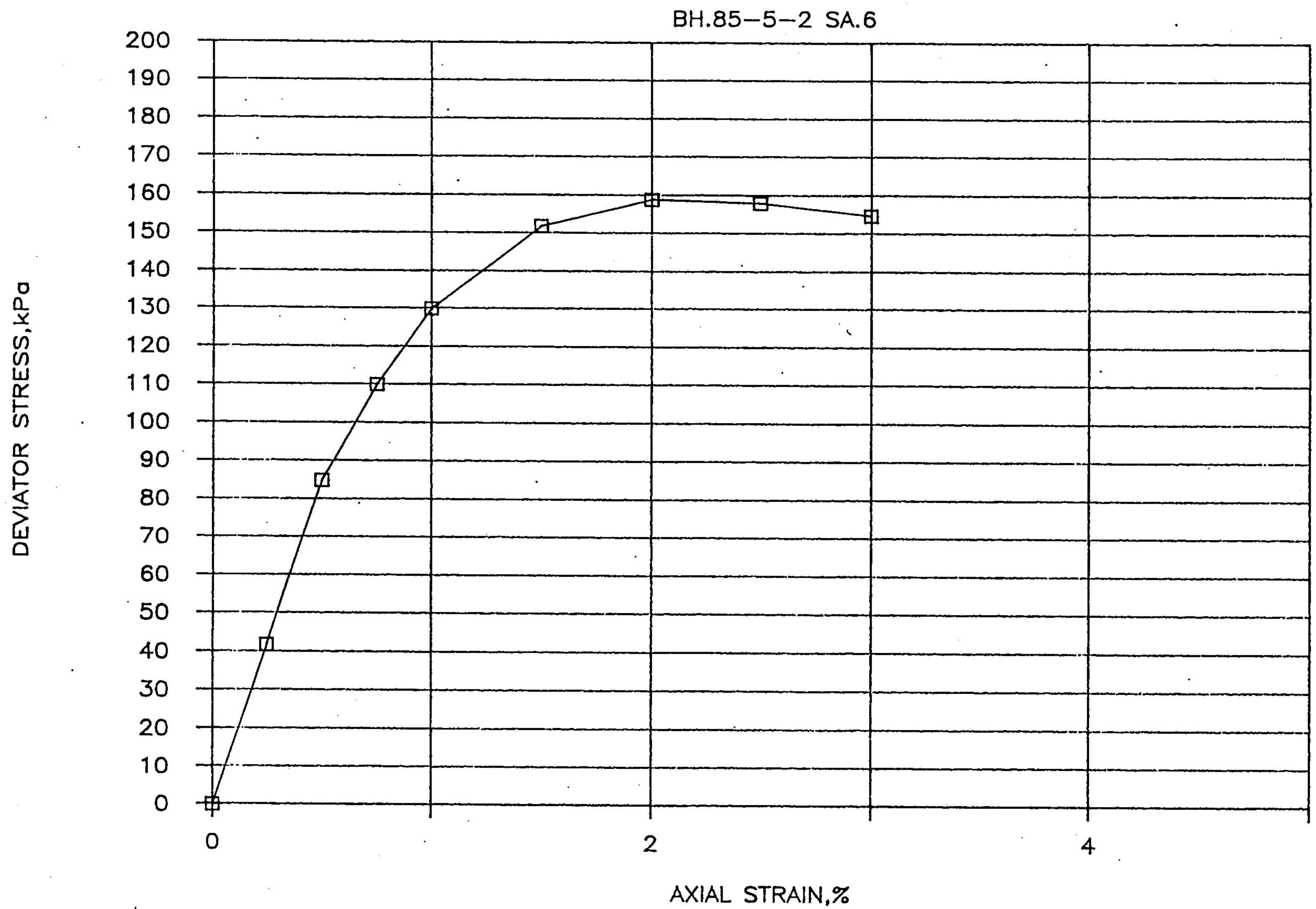
PROJECT NUMBER	851-1298	PROVING RING, kg/mm div.	0.133
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	6	SPECIFIC GRAVITY, assumed	2.78
SAMPLE DEPTH, m	4.27	BH.85-5-2 SA.6	

SAMPLE HEIGHT, cm	10.21	WET WEIGHT, gm	389.1
SAMPLE DIAMETER, cm	5.03	DRY WEIGHT, gm	295.2
SAMPLE AREA, cm2	19.87	WATER CONTENT, %	31.8
SAMPLE VOLUME, cc	202.89	POROSITY, %	47.7
UNIT WEIGHT, kN/m3	18.80	DRY UNIT WT., kN/m3	14.26

TEST RESULTS		LIQUID LIMIT, %	55
COMPRESS. STRESS, kPa	158.9	PLASTIC INDEX, %	24
STRAIN AT FAILURE, %	2.0	LAB. VANE, Peak, kPa	86.9
CELL PRESSURE, kPa	80.6	LAB. VANE, Resid., kPa	12.6

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.5	64.0	0.25	41.90
51.0	130.0	0.50	84.90
76.5	169.0	0.75	110.10
102.1	200.0	1.00	129.96
153.1	235.0	1.50	151.94
204.1	247.0	2.00	158.89
255.1	247.0	2.50	158.08
306.1	243.0	3.00	154.72

PROJECT 851-1298 (DLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 1-2

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 1 OF 2

FIGURE 2-1

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

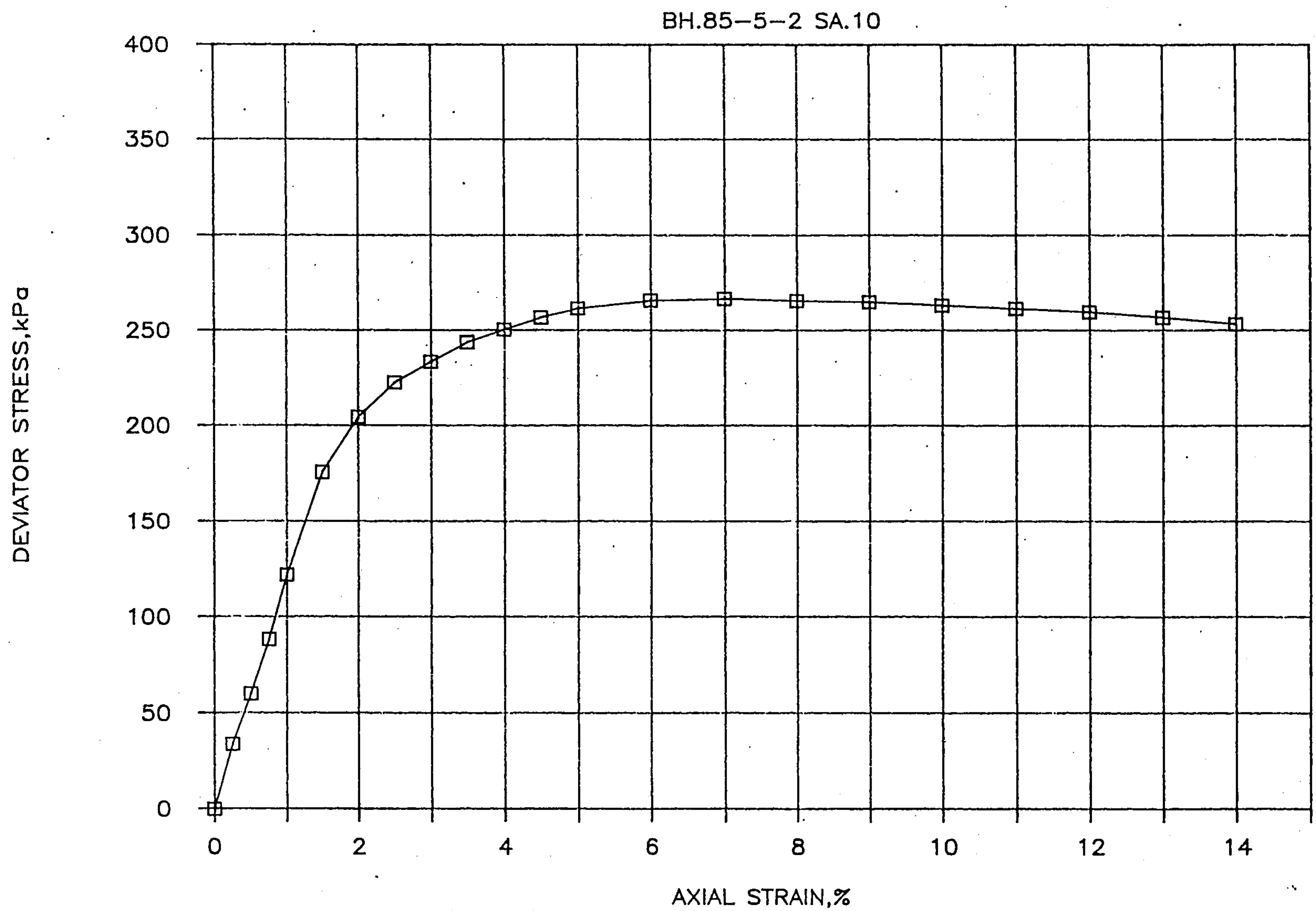
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.133
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	10	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	8.54	BH.85-5-2 SA.10	

SAMPLE HEIGHT,cm	10.14	WET WEIGHT,gm	439.4
SAMPLE DIAMETER,cm	5.03	DRY WEIGHT,gm	372.9
SAMPLE AREA,cm2	19.87	WATER CONTENT,%	17.8
SAMPLE VOLUME,cc	201.49	POROSITY,%	33.4
UNIT WEIGHT,kN/m3	21.38	DRY UNIT WT.,kN/m3	18.14

TEST RESULTS		LIQUID LIMIT,%	
COMPRESS.STRESS,kPa	266.8	PLASTIC INDEX,%	
STRAIN AT FAILURE,%	7.0	LAB. VANE,Peak,kPa	140.3
CELL PRESSURE,kPa	185.3	LAB. VANE,Resid.kPa	28.3

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.3	52.0	0.25	34.05
50.6	92.0	0.50	60.09
75.9	136.0	0.75	88.60
101.4	188.0	1.00	122.17
152.0	272.0	1.50	175.86
202.6	318.0	2.00	204.56
253.2	348.0	2.50	222.72
303.8	367.0	3.00	233.68
354.4	385.0	3.49	243.88
405.0	398.0	3.99	250.81
455.6	410.0	4.49	257.03
506.2	420.0	4.99	261.92
607.6	431.0	5.99	265.95
709.0	437.0	6.99	266.78
810.4	440.0	7.99	265.73
911.8	444.0	8.99	265.23
1013.2	446.0	9.99	263.50
1114.6	448.0	10.99	261.74
1216.0	450.0	11.99	259.95
1317.4	450.0	12.99	257.00
1418.8	449.0	13.99	253.48

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 2-2

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UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

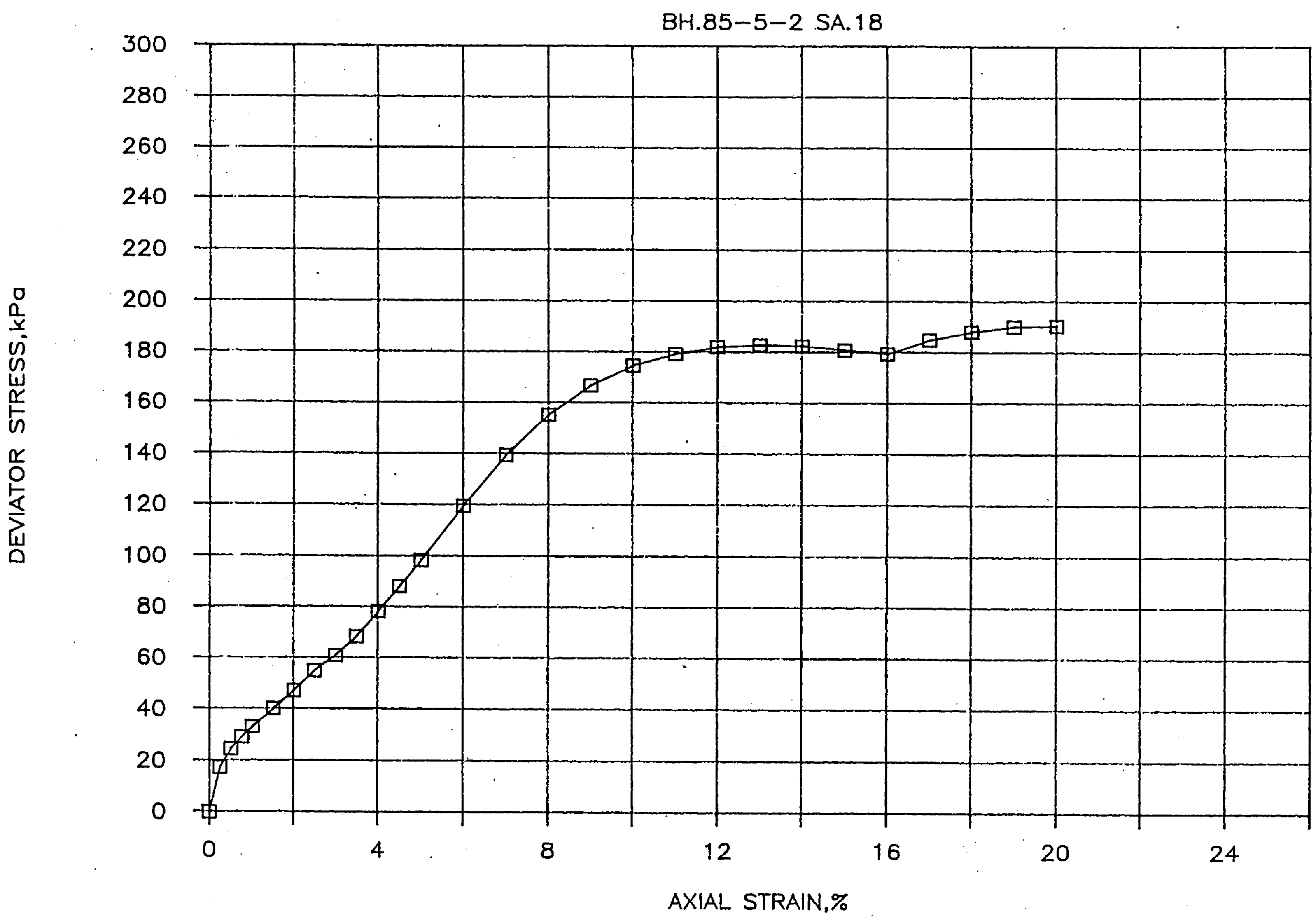
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.133
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	18	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	16.00	BH.85-5-2 SA.18	

SAMPLE HEIGHT,cm	10.11	WET WEIGHT,gm	415.6
SAMPLE DIAMETER,cm	4.98	DRY WEIGHT,gm	339.2
SAMPLE AREA,cm2	19.48	WATER CONTENT,%	22.5
SAMPLE VOLUME,cc	196.92	POROSITY,%	38.0
UNIT WEIGHT,kN/m3	20.69	DRY UNIT WT.,kN/m3	16.89

TEST RESULTS		LIQUID LIMIT,%	37
COMPRESS.STRESS,kPa	182.9	PLASTIC INDEX,%	17
STRAIN AT FAILURE,%	13.0	LAB. VANE,Peak,kPa	83.8
CELL PRESSURE,kPa	248.7	LAB. VANE,Resid.kPa	9.4

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.3	26.0	0.25	17.37
50.6	37.0	0.50	24.65
75.9	44.0	0.75	29.24
101.1	50.0	1.00	33.15
151.7	61.0	1.50	40.23
202.3	72.0	2.00	47.25
252.9	84.0	2.50	54.84
303.5	94.0	3.00	61.06
354.1	106.0	3.50	68.49
404.7	122.0	4.00	78.43
455.3	138.0	4.50	88.25
505.9	155.0	5.00	98.60
607.0	190.0	6.00	119.59
708.1	224.0	7.00	139.49
809.2	252.0	8.00	155.24
910.3	274.0	9.00	166.96
1011.4	290.0	10.00	174.77
1112.5	301.0	11.00	179.38
1213.6	309.0	12.00	182.08
1314.7	314.0	13.00	182.92
1415.8	317.0	14.00	182.55
1516.9	318.0	15.00	180.99
1618.0	319.0	16.00	179.43
1719.1	333.0	17.00	185.07
1820.2	343.0	18.00	188.33
1921.3	351.0	19.00	190.37
2022.4	356.0	20.00	190.70

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 3-2

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

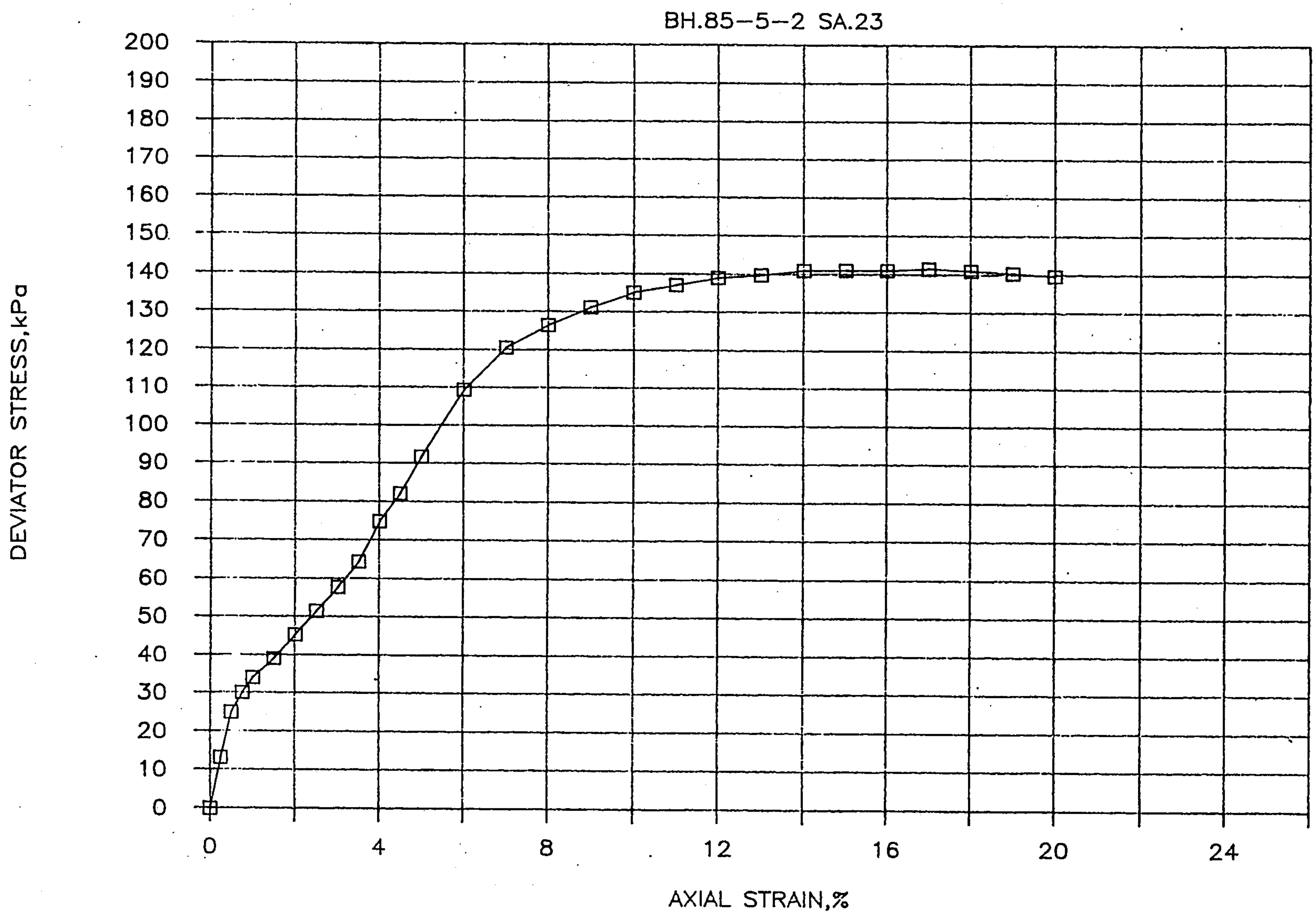
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.133
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	23	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	22.30	BH.85-5-2 SA.23	

SAMPLE HEIGHT,cm	10.12	WET WEIGHT,gm	403.0
SAMPLE DIAMETER,cm	5.01	DRY WEIGHT,gm	318.9
SAMPLE AREA,cm2	19.71	WATER CONTENT,%	26.4
SAMPLE VOLUME,cc	199.50	POROSITY,%	42.5
UNIT WEIGHT,kN/m3	19.80	DRY UNIT WT.,kN/m3	15.67

TEST RESULTS		LIQUID LIMIT,%	37
COMPRESS.STRESS,kPa	141.2	PLASTIC INDEX,%	15
STRAIN AT FAILURE,%	16.0	LAB. VANE,Peak,kPa	60.7
CELL PRESSURE,kPa	443.7	LAB. VANE,Resid.kPa	6.3

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.3	20.0	0.25	13.20
50.6	38.0	0.50	25.02
75.9	46.0	0.75	30.21
101.2	52.0	1.00	34.06
151.8	60.0	1.50	39.10
202.4	70.0	2.00	45.39
253.0	80.0	2.50	51.61
303.6	90.0	3.00	57.76
354.2	101.0	3.50	64.49
404.8	118.0	4.00	74.95
455.4	130.0	4.50	82.14
506.0	146.0	5.00	91.77
607.2	176.0	6.00	109.46
708.4	196.0	7.00	120.60
809.6	208.0	8.00	126.61
910.8	218.0	9.00	131.26
1012.0	227.0	10.00	135.17
1113.2	233.0	11.00	137.20
1214.4	239.0	12.00	139.16
1315.6	243.0	13.00	139.88
1416.8	248.0	14.00	141.11
1518.0	251.0	15.00	141.16
1619.2	254.0	16.00	141.17
1720.4	258.0	17.00	141.68
1821.6	260.0	18.00	141.06
1922.8	262.0	19.00	140.41
2024.0	264.0	20.00	139.74

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 4-2

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.118
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	26	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	25.10	BH.85-5-2 SA.26	

SAMPLE HEIGHT,cm	10.10	WET WEIGHT,gm	391.4
SAMPLE DIAMETER,cm	5.02	DRY WEIGHT,gm	295.0
SAMPLE AREA,cm2	19.79	WATER CONTENT,%	32.7
SAMPLE VOLUME,cc	199.90	POROSITY,%	46.9
UNIT WEIGHT,kN/m3	19.19	DRY UNIT WT.,kN/m3	14.47

TEST RESULTS		LIQUID LIMIT,%	40.5
COMPRESS.STRESS,kPa	133.3	PLASTIC INDEX,%	19.3
STRAIN AT FAILURE,%	5.0	LAB. VANE,Peak,kPa	51.30
CELL PRESSURE,kPa	461.6	LAB. VANE,Resid.kPa	13.6

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.2	38.0	0.25	22.16
50.4	58.0	0.50	33.74
75.6	78.0	0.75	45.26
101.0	98.0	1.00	56.73
151.4	121.0	1.50	69.69
201.8	153.0	2.00	87.67
252.2	179.0	2.50	102.04
302.6	201.0	3.00	114.00
353.0	220.0	3.49	124.13
403.4	232.0	3.99	130.23
453.8	238.0	4.49	132.90
504.2	240.0	4.99	133.32
605.2	242.0	5.99	133.01
706.2	242.0	6.99	131.60
807.2	242.0	7.99	130.18
908.2	242.0	8.99	128.77
1009.2	242.0	9.99	127.35
1110.2	237.0	10.99	123.34
1211.2	235.0	11.99	120.92

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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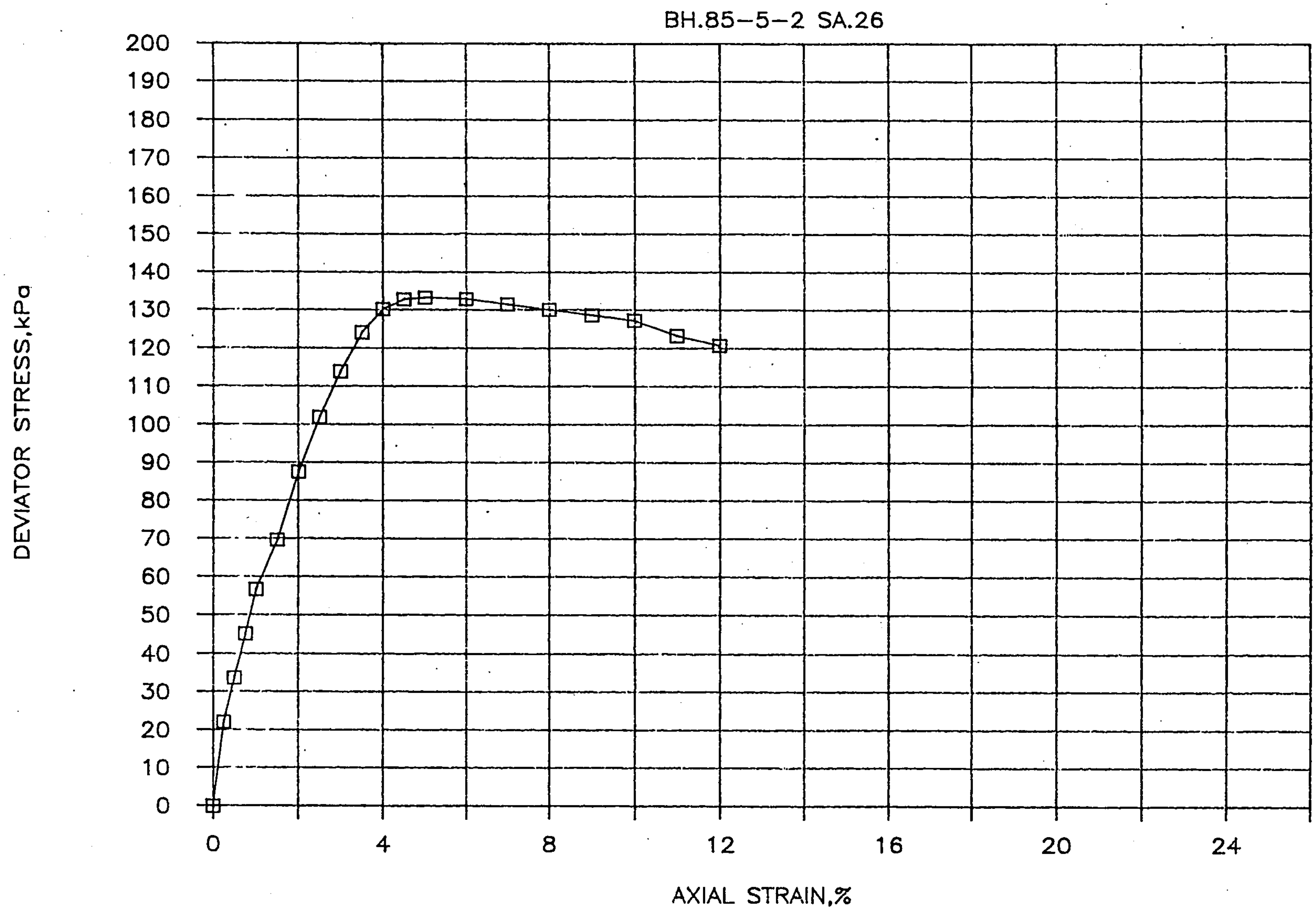

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 5-2

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 1 OF 2

FIGURE 6-1

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.133
BOREHOLE NUMBER	85-5-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	30	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH.m	29.70	BH.85-5-2 SA.30	

SAMPLE HEIGHT,cm	10.16	WET WEIGHT,gm	395.7
SAMPLE DIAMETER,cm	5.03	DRY WEIGHT,gm	301.4
SAMPLE AREA,cm2	19.87	WATER CONTENT,%	31.3
SAMPLE VOLUME,cc	201.89	POROSITY,%	46.3
UNIT WEIGHT,kN/m3	19.21	DRY UNIT WT.,kN/m3	14.63

TEST RESULTS		LIQUID LIMIT,%	38
COMPRESS.STRESS,kPa	145.9	PLASTIC INDEX,%	19
STRAIN AT FAILURE,%	10.0	LAB. VANE,Peak,kPa	64.9
CELL PRESSURE,kPa	488.5	LAB. VANE,Resid.kPa	5.2

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.4	20.0	0.25	13.09
50.8	46.0	0.50	30.04
76.2	55.0	0.75	35.83
101.6	61.0	1.00	39.64
152.4	75.0	1.50	48.49
203.2	88.0	2.00	56.61
254.0	98.0	2.50	62.72
304.8	113.0	3.00	71.95
355.6	125.0	3.50	79.18
406.4	138.0	4.00	86.96
457.2	154.0	4.50	96.53
508.0	168.0	5.00	104.76
609.6	194.0	6.00	119.70
711.2	216.0	7.00	131.86
812.8	232.0	8.00	140.10
914.4	242.0	9.00	144.55
1016.0	247.0	10.00	145.92
1117.6	249.0	11.00	145.46
1219.2	250.0	12.00	144.41
1320.8	248.0	13.00	141.62
1422.4	241.0	14.00	136.04

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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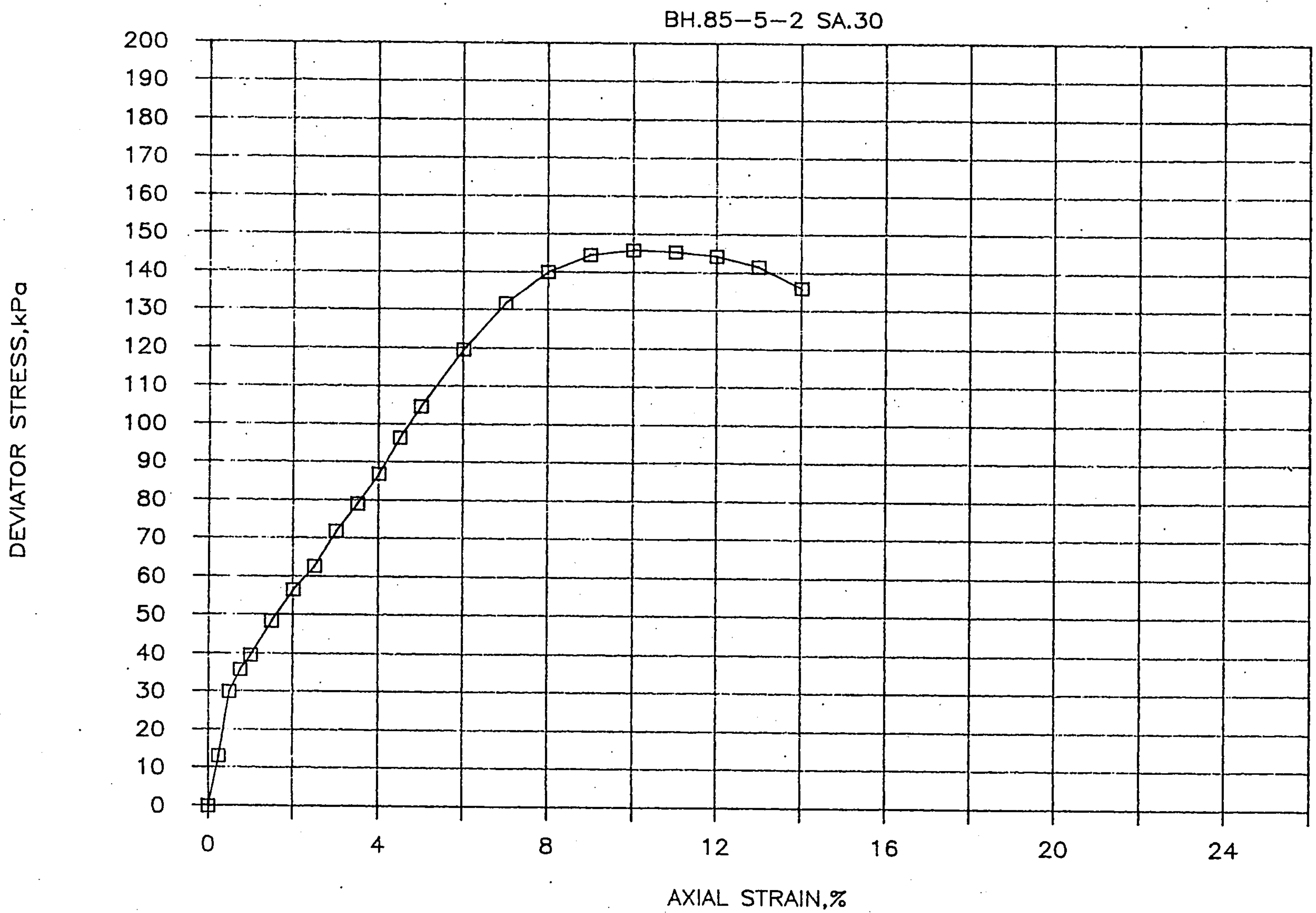

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UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 6-2

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

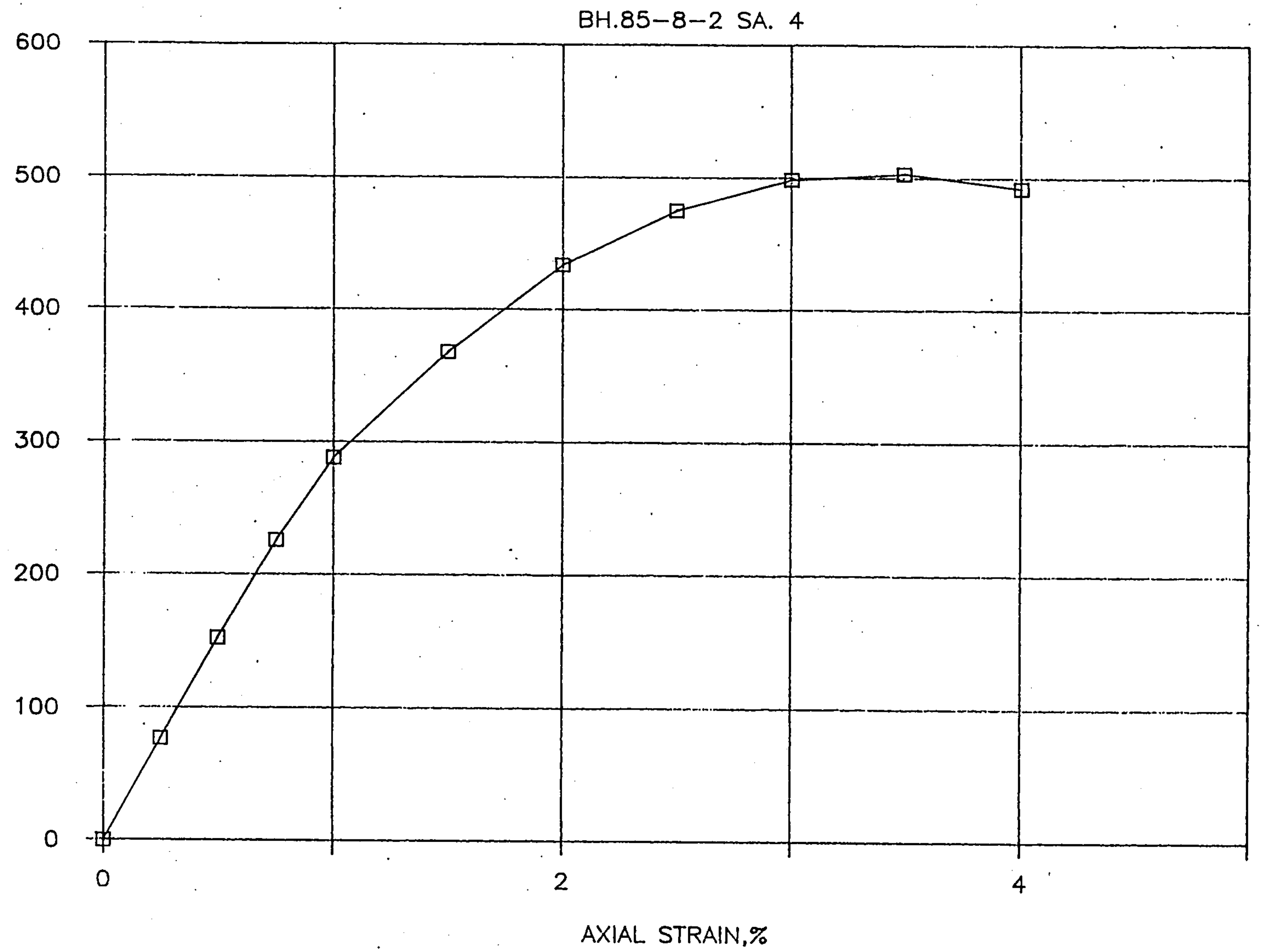
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.133
BOREHOLE NUMBER	85-8-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	4	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	3.1	BH.85-8-2 SA. 4	

SAMPLE HEIGHT,cm	10.19	WET WEIGHT,gm	436.2
SAMPLE DIAMETER,cm	5.12	DRY WEIGHT,gm	361.8
SAMPLE AREA,cm2	20.59	WATER CONTENT,%	20.6
SAMPLE VOLUME,cc	209.80	POROSITY,%	38.0
UNIT WEIGHT,kN/m3	20.38	DRY UNIT WT.,kN/m3	16.91

TEST RESULTS		LIQUID LIMIT,%	34
COMPRESS.STRESS,kPa	503.8	PLASTIC INDEX,%	15
STRAIN AT FAILURE,%	3.5	LAB. VANE,Peak,kPa	>186.4
CELL PRESSURE,kPa	43.4	LAB. VANE,Resid.,kPa	

Strain Dial mm	Load Dail mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.5	122.0	0.25	77.10
51.0	242.0	0.50	152.54
76.5	360.0	0.75	226.35
101.9	460.0	1.00	288.50
152.9	590.0	1.50	368.17
203.9	700.0	2.00	434.59
254.9	770.0	2.50	475.60
305.9	812.0	3.00	498.97
356.4	824.0	3.50	503.76
407.9	810.0	4.00	492.61

PROJECT 851-1298 (GLAL PROJECT #85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 7-2

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

PROJECT NUMBER	851-1298	PROVING RING, kg/mm div.	0.133
BOREHOLE NUMBER	85-8-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	7	SPECIFIC GRAVITY, assumed	2.78
SAMPLE DEPTH, m	5.8	BH.85-8-2 SA.7	

SAMPLE HEIGHT, cm	10.12	WET WEIGHT, gm	406.7
SAMPLE DIAMETER, cm	4.99	DRY WEIGHT, gm	335.3
SAMPLE AREA, cm2	19.56	WATER CONTENT, %	21.3
SAMPLE VOLUME, cc	197.91	POROSITY, %	39.1
UNIT WEIGHT, kN/m3	20.14	DRY UNIT WT., kN/m3	16.61

TEST RESULTS		LIQUID LIMIT, %	38
COMPRESS.STRESS, kPa	291.1	PLASTIC INDEX, %	21
STRAIN AT FAILURE, %	4.5	LAB. VANE, Peak, kPa	>186.4
CELL PRESSURE, kPa	86.1	LAB. VANE, Resid., kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.3	55.0	0.25	36.59
50.6	112.0	0.50	74.33
75.9	152.0	0.75	100.62
101.2	200.0	1.00	132.06
151.8	290.0	1.50	190.52
202.4	355.0	2.00	232.03
253.0	402.0	2.50	261.41
303.6	428.0	3.00	276.89
354.2	446.0	3.50	287.05
404.8	454.0	4.00	290.68
455.4	457.0	4.50	291.08
506.0	458.0	5.00	290.19
607.2	448.0	6.00	280.87
708.4	432.0	7.00	267.96

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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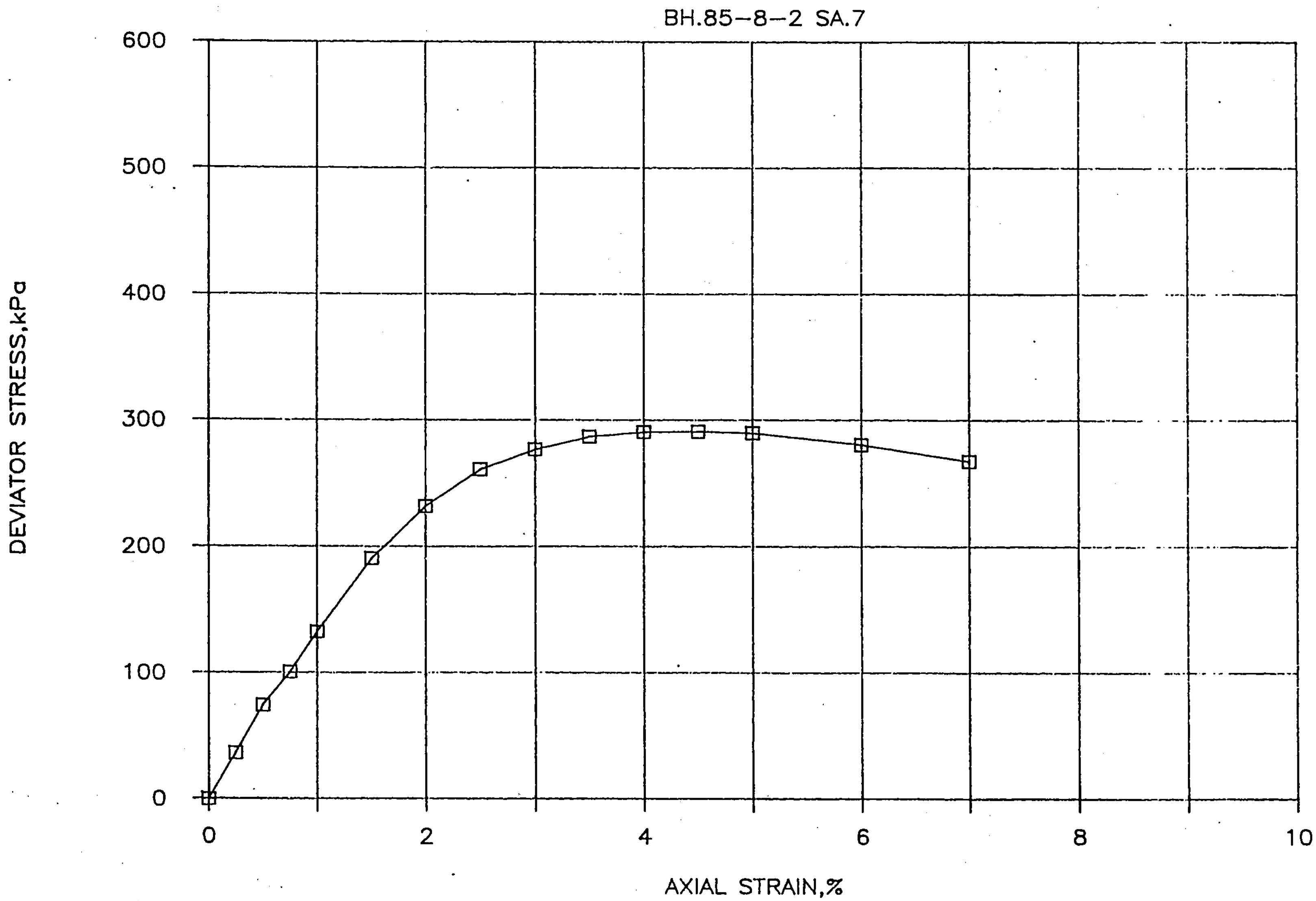


UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 8-2

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 1 OF 2

FIGURE 9-1

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

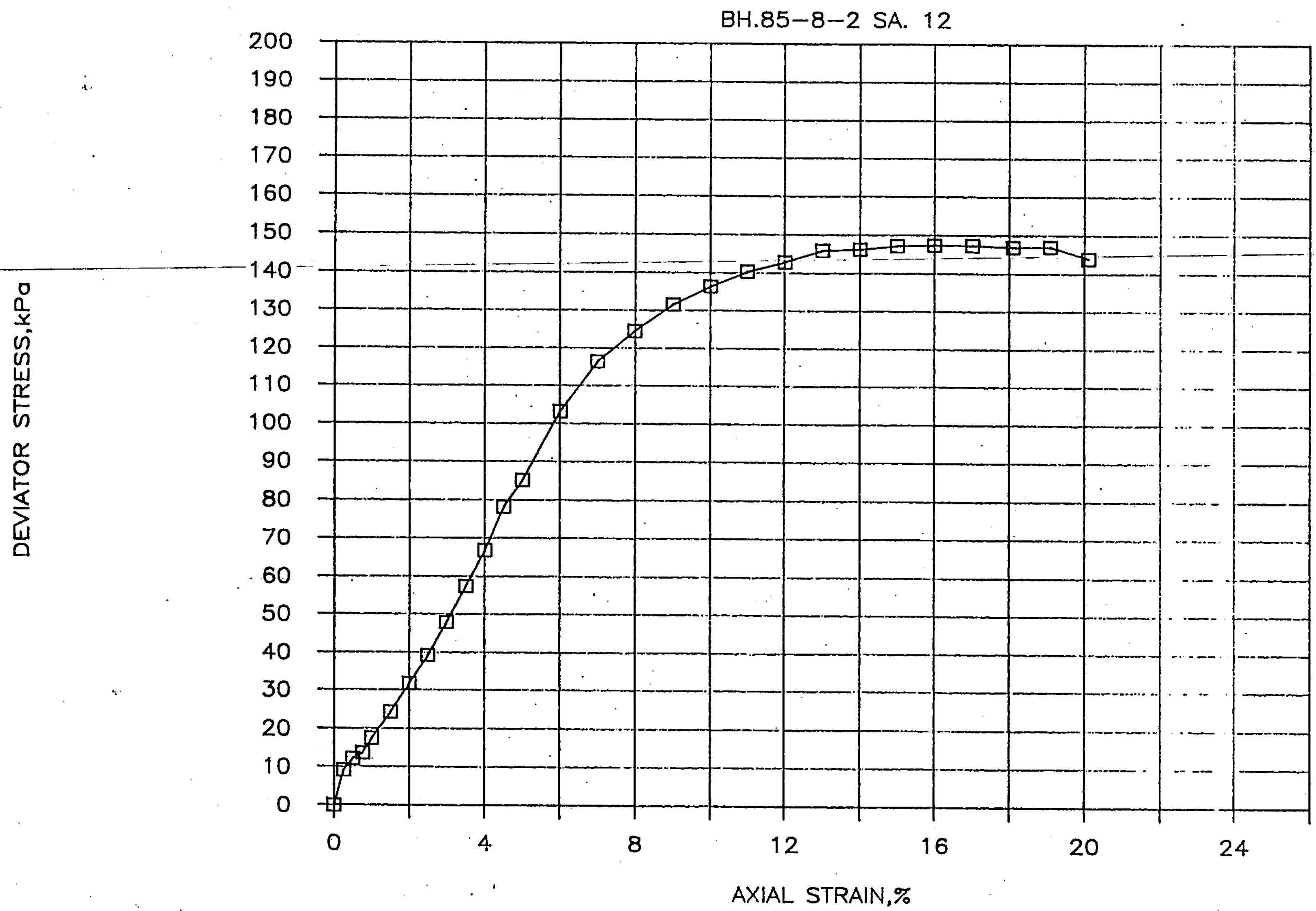
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.311
BOREHOLE NUMBER	85-8-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	12	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	12.19	BH.85-8-2 SA. 12	

SAMPLE HEIGHT,cm	10.18	WET WEIGHT,gm	428.1
SAMPLE DIAMETER,cm	5.01	DRY WEIGHT,gm	355.3
SAMPLE AREA,cm2	19.71	WATER CONTENT,%	20.5
SAMPLE VOLUME,cc	200.68	POROSITY,%	36.3
UNIT WEIGHT,kN/m3	20.91	DRY UNIT WT.,kN/m3	17.36

TEST RESULTS		LIQUID LIMIT,%	29
COMPRESS.STRESS,kPa	147.5	PLASTIC INDEX,%	17
STRAIN AT FAILURE,%	16.0	LAB. VANE,Peak,kPa	77.5
CELL PRESSURE,kPa	216.3	LAB. VANE,Resid.,kPa	10.5

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.4	6.0	0.25	9.26
50.9	8.0	0.50	12.31
76.3	9.0	0.75	13.82
101.8	11.5	1.00	17.61
152.7	16.0	1.50	24.38
203.6	21.0	2.00	31.84
254.5	26.0	2.50	39.22
305.4	32.0	3.00	48.02
356.3	38.5	3.50	57.48
407.2	45.0	4.00	66.84
458.1	53.0	4.50	78.31
509.0	58.0	5.00	85.25
610.8	71.0	6.00	103.26
712.6	81.0	7.00	116.55
813.4	87.5	7.99	124.56
915.2	93.5	8.99	131.65
1018.0	98.0	10.00	136.46
1119.8	102.0	11.00	140.45
1221.6	105.0	12.00	142.96
1323.4	108.5	13.00	146.04
1425.2	110.0	14.00	146.36
1527.0	112.0	15.00	147.29
1628.8	113.5	16.00	147.50
1730.6	114.8	17.00	147.42
1842.4	116.0	18.10	146.99
1944.2	117.5	19.10	147.07
2046.0	116.5	20.10	144.02

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 9-2

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UNDRAINED TRIAXIAL COMPRESSION (Q) SHEET 1 OF 2	FIGURE 10-1

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.311
BOREHOLE NUMBER	85-8-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	17	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	18.1	BH.85-8-2 SA. 17	
SAMPLE HEIGHT,cm	10.14	WET WEIGHT,gm	405.2
SAMPLE DIAMETER,cm	5.02	DRY WEIGHT,gm	320.0
SAMPLE AREA,cm2	19.79	WATER CONTENT,%	26.6
SAMPLE VOLUME,cc	200.69	POROSITY,%	42.6
UNIT WEIGHT,kN/m3	19.79	DRY UNIT WT.,kN/m3	15.63
TEST RESULTS		LIQUID LIMIT,%	39
COMPRESS.STRESS,kPa	156.7	PLASTIC INDEX,%	19
STRAIN AT FAILURE,%	17.0	LAB. VANE,Peak,kPa	79.6
CELL PRESSURE,kPa	323.8	LAB. VANE,Resid.,kPa	8.4

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator STRESS kPa
0.0	0.0	0	0.00
25.1	9.2	0.25	14.14
50.2	13.0	0.49	19.93
75.3	15.5	0.74	23.71
101.4	17.5	1.00	26.70
151.6	21.5	1.50	32.64
202.8	25.5	2.00	38.51
252.0	29.0	2.48	43.58
302.2	33.5	2.98	50.08
352.4	38.0	3.48	56.52
402.6	42.5	3.97	62.89
452.8	48.5	4.47	71.40
503.0	52.5	4.96	76.89
604.4	63.0	5.96	91.30
705.8	74.5	6.96	106.81
806.2	85.5	7.95	121.28
907.4	96.0	8.95	134.70
1014.0	103.0	10.00	142.85
1115.4	107.5	11.00	147.43
1216.8	113.0	12.00	153.24
1318.2	116.0	13.00	155.52
1419.6	118.0	14.00	156.38
1521.0	119.5	15.00	156.53
1622.4	121.0	16.00	156.63
1723.8	122.5	17.00	156.68
1825.5	124.0	18.00	156.68
1926.6	125.5	19.00	156.65
2028.0	126.5	20.00	155.95

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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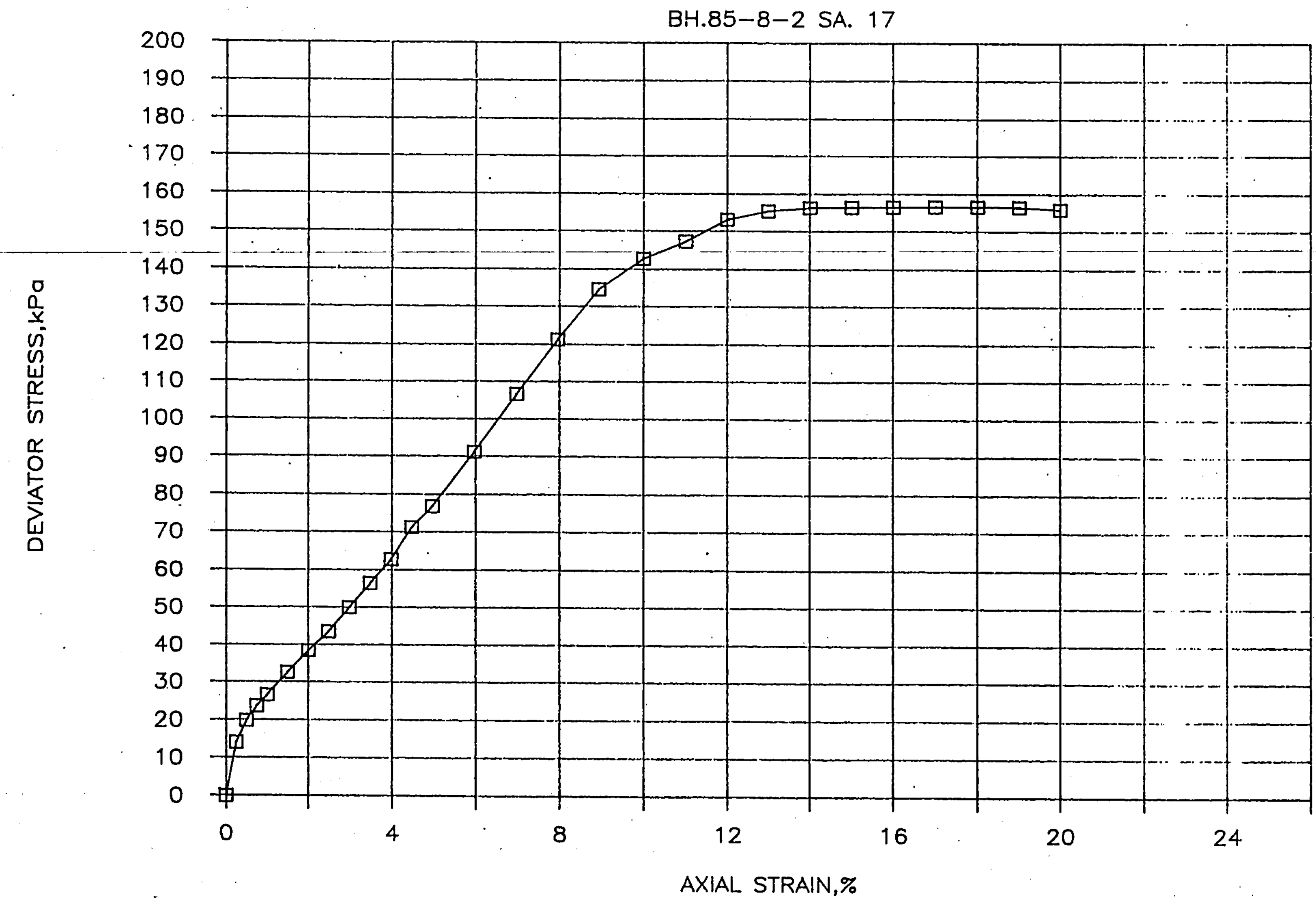

UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 10-2

UNDRAINED TRIAXIAL COMPRESSION TEST (Q)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.311
BOREHOLE NUMBER	85-8-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	22	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	24.12	BH.85-8-2 SA.22	

SAMPLE HEIGHT,cm	10.19	WET WEIGHT,gm	388.6
SAMPLE DIAMETER,cm	5.00	DRY WEIGHT,gm	294.9
SAMPLE AREA,cm2	19.63	WATER CONTENT,%	31.8
SAMPLE VOLUME,cc	200.08	POROSITY,%	47.0
UNIT WEIGHT,kN/m3	19.04	DRY UNIT WT.,kN/m3	14.45

TEST RESULTS		LIQUID LIMIT,%	42
COMPRESS.STRESS,kPa	137.2	PLASTIC INDEX,%	20
STRAIN AT FAILURE,%	13.0	LAB. VANE,Peak,kPa	77.5
CELL PRESSURE,kPa	425.1	LAB. VANE,Resid.,kPa	8.4

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator STRESS kPa
0.0	0.0	0	0.00
25.5	20.0	0.25	30.99
50.9	24.0	0.50	37.09
101.9	28.5	1.00	43.83
152.8	32.0	1.50	48.96
203.7	35.0	2.00	53.28
254.6	38.5	2.50	58.31
305.6	42.0	3.00	63.28
356.5	46.5	3.50	69.70
407.5	50.5	4.00	75.31
458.4	54.5	4.50	80.85
509.5	59.5	5.00	87.80
611.4	68.0	6.00	99.29
713.3	76.0	7.00	109.79
815.2	84.0	8.00	120.04
917.1	89.0	9.00	125.80
1019.0	93.0	10.00	130.01
1120.9	97.5	11.00	134.79
1222.8	98.5	12.00	134.64
1324.7	101.5	13.00	137.17
1426.6	102.0	14.00	136.26
1528.5	102.5	15.00	135.33
1630.4	102.5	16.00	133.74

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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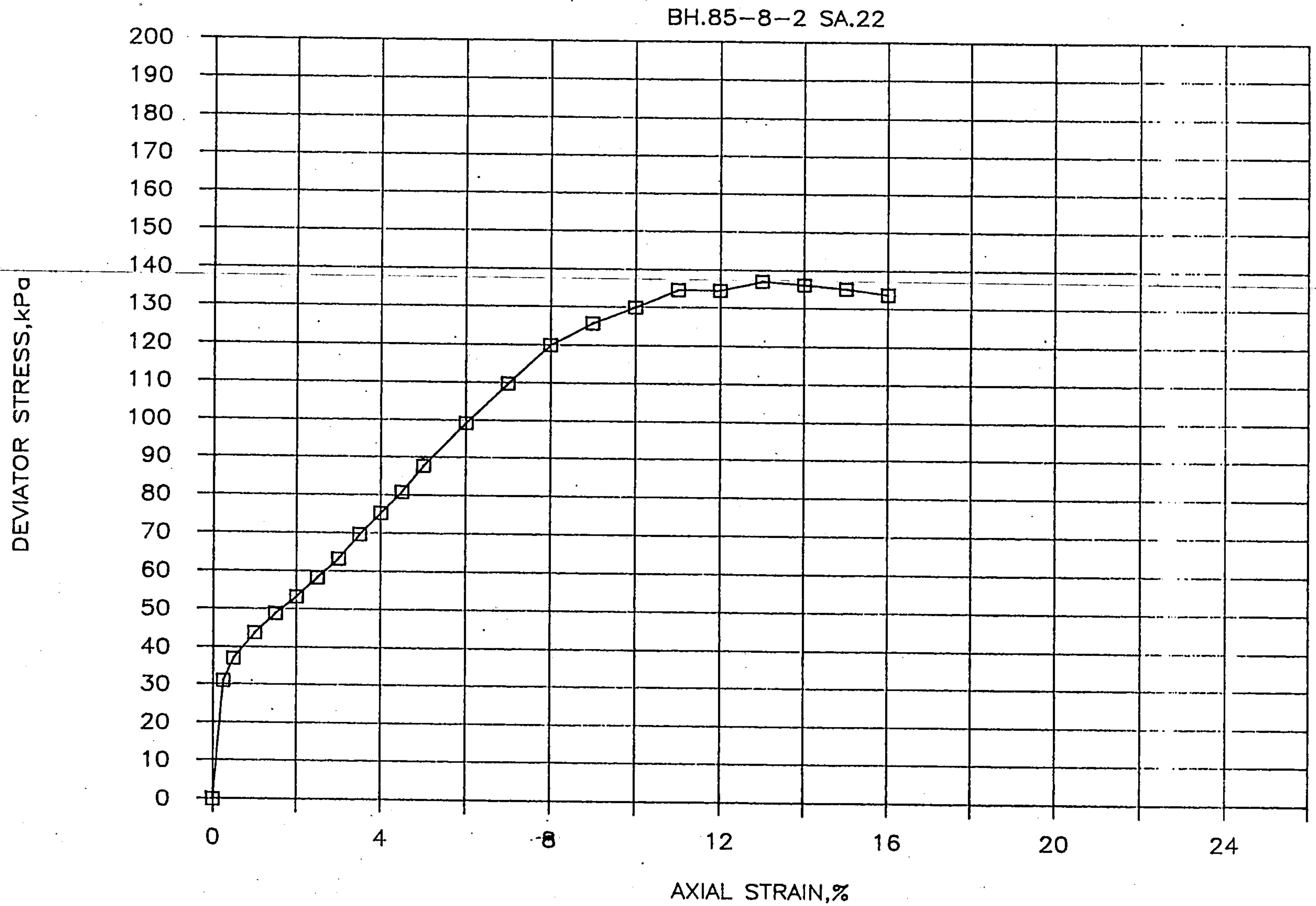


UNDRAINED TRIAXIAL COMPRESSION (Q)

SHEET 2 OF 2

FIGURE 11-2

UNDRAINED TRIAXIAL COMPRESSION (U)

FIGURES 12-1 to 30-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 12-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

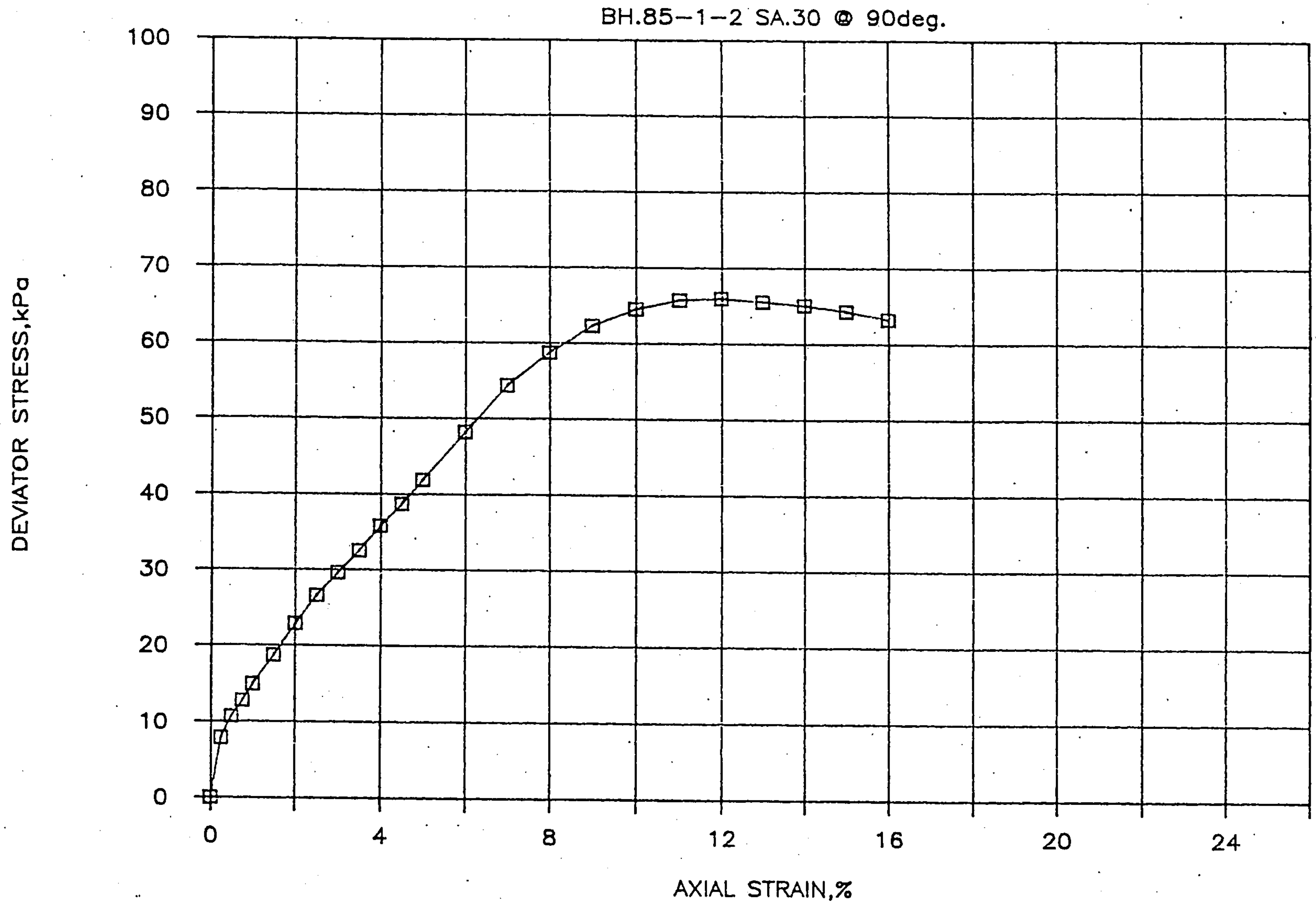
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-1-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	30	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	29.65	BH.85-1-2 SA.30 @ 90 deg.	

SAMPLE HEIGHT,cm	7.25	WET WEIGHT,gm	162.7
SAMPLE DIAMETER,cm	3.87	DRY WEIGHT,gm	123.0
SAMPLE AREA,cm2	11.76	WATER CONTENT,%	33.1
SAMPLE VOLUME,cc	85.28	POROSITY,%	
UNIT WEIGHT,kN/m3	18.70	DRY UNIT WT.,kN/m3	14.05

TEST RESULTS		LIQUID LIMIT,%	42
COMPRESS.STRESS,kPa	65.9	PLASTIC INDEX,%	24
STRAIN AT FAILURE,%	12.0	LAB. VANE,Peak,kPa	37.7
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	3.1

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
18.1	22.0	0.25	7.87
36.2	30.0	0.50	10.70
54.3	36.0	0.75	12.81
72.5	42.0	1.00	14.91
108.7	53.0	1.50	18.72
144.9	65.0	2.00	22.84
181.1	76.0	2.50	26.57
217.3	85.0	3.00	29.56
253.5	94.0	3.50	32.52
289.7	104.0	4.00	35.79
325.9	113.0	4.49	38.69
362.1	123.0	4.99	41.89
434.6	143.0	5.99	48.19
507.1	163.0	6.99	54.35
579.6	178.0	7.99	58.71
652.0	191.0	8.99	62.32
724.5	200.0	9.99	64.53
797.0	206.0	10.99	65.73
869.5	209.0	11.99	65.94
942.0	210.0	12.99	65.50
1014.5	211.0	13.99	65.06
1086.9	211.0	14.99	64.30
1159.5	210.0	15.99	63.24

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 12-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 13-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

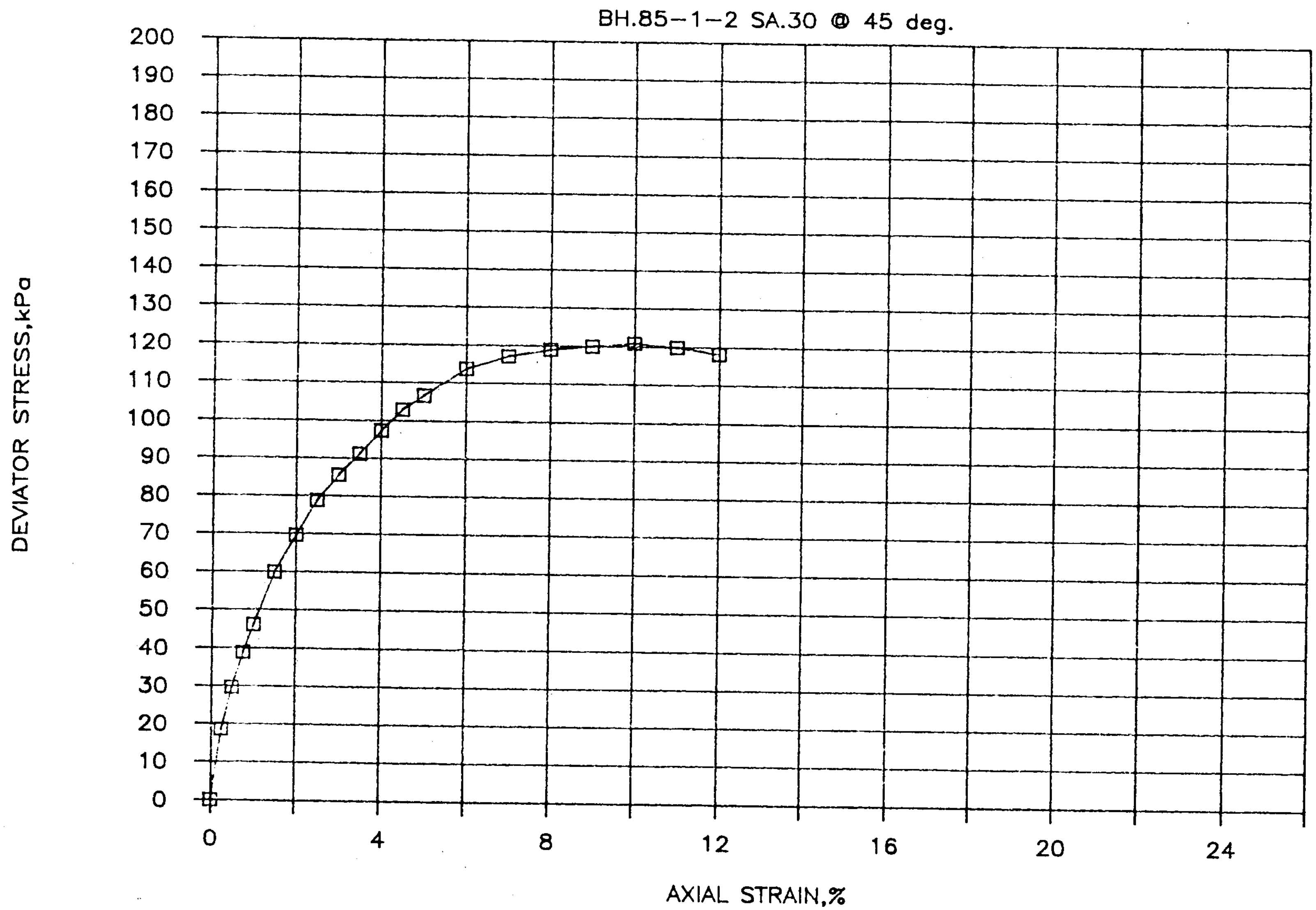
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-1-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	30	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	29.79	BH.85-1-2 SA.30 @ 45 deg.	

SAMPLE HEIGHT,cm	5.56	WET WEIGHT,gm	87.0
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	61.1
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	41.8
SAMPLE VOLUME,cc	47.84	POROSITY,%	
UNIT WEIGHT,kN/m3	17.82	DRY UNIT WT.,kN/m3	12.57

TEST RESULTS		LIQUID LIMIT,%	42
COMPRESS.STRESS,kPa	120.9	PLASTIC INDEX,%	24
STRAIN AT FAILURE,%	10.0	LAB. VANE,Peak,kPa	37.7
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	3.1

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.9	38.0	0.25	18.58
27.8	61.0	0.50	29.74
41.7	80.0	0.75	38.91
55.6	95.0	1.00	46.09
83.4	124.0	1.50	59.86
111.2	145.0	2.00	69.64
139.0	165.0	2.50	78.84
166.8	180.0	3.00	85.57
194.6	193.0	3.50	91.27
222.4	207.0	4.00	97.39
250.2	220.0	4.50	102.96
278.0	229.0	5.00	106.61
333.6	247.0	6.00	113.78
389.2	257.0	7.00	117.13
444.8	264.0	8.00	119.03
500.4	269.0	9.00	119.96
556.0	274.0	10.00	120.85
611.6	275.0	11.00	119.94
667.2	274.0	12.00	118.17

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)
SHEET 2 OF 2

FIGURE 13-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-1-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	30	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	29.65	BH.85-1-2 SA.30 @ 0 deg.	

SAMPLE HEIGHT,cm	5.26	WET WEIGHT,gm	83.7
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	59.8
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	39.6
SAMPLE VOLUME,cc	45.26	POROSITY,%	
UNIT WEIGHT,kN/m3	18.13	DRY UNIT WT.,kN/m3	12.99

TEST RESULTS		LIQUID LIMIT,%	42
COMPRESS.STRESS,kPa	156.3	PLASTIC INDEX,%	24
STRAIN AT FAILURE,%	7.0	LAB. VANE,Peak,kPa	37.7
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	3.1

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.1	23.0	0.25	11.24
26.2	37.0	0.50	18.04
39.3	50.0	0.75	24.32
52.6	68.0	1.00	32.99
78.8	110.0	1.50	53.10
105.0	159.0	2.00	76.37
131.2	199.0	2.49	95.09
157.4	235.0	2.99	111.72
183.6	264.0	3.49	124.86
209.8	285.0	3.99	134.10
236.0	304.0	4.49	142.30
262.2	319.0	4.98	148.54
314.8	338.0	5.98	155.73
367.4	343.0	6.98	156.35
420.0	331.0	7.98	149.26

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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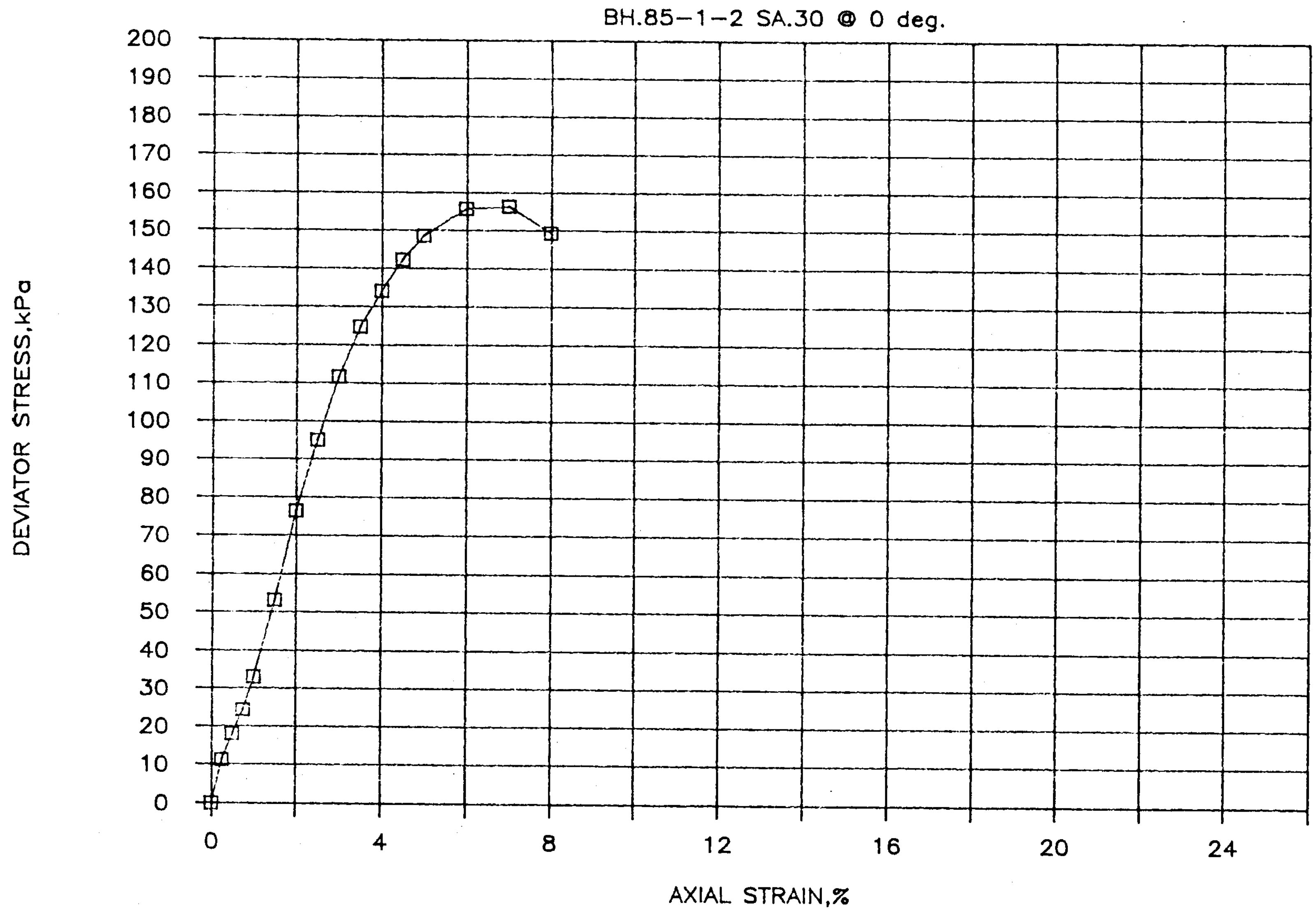


UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 14-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

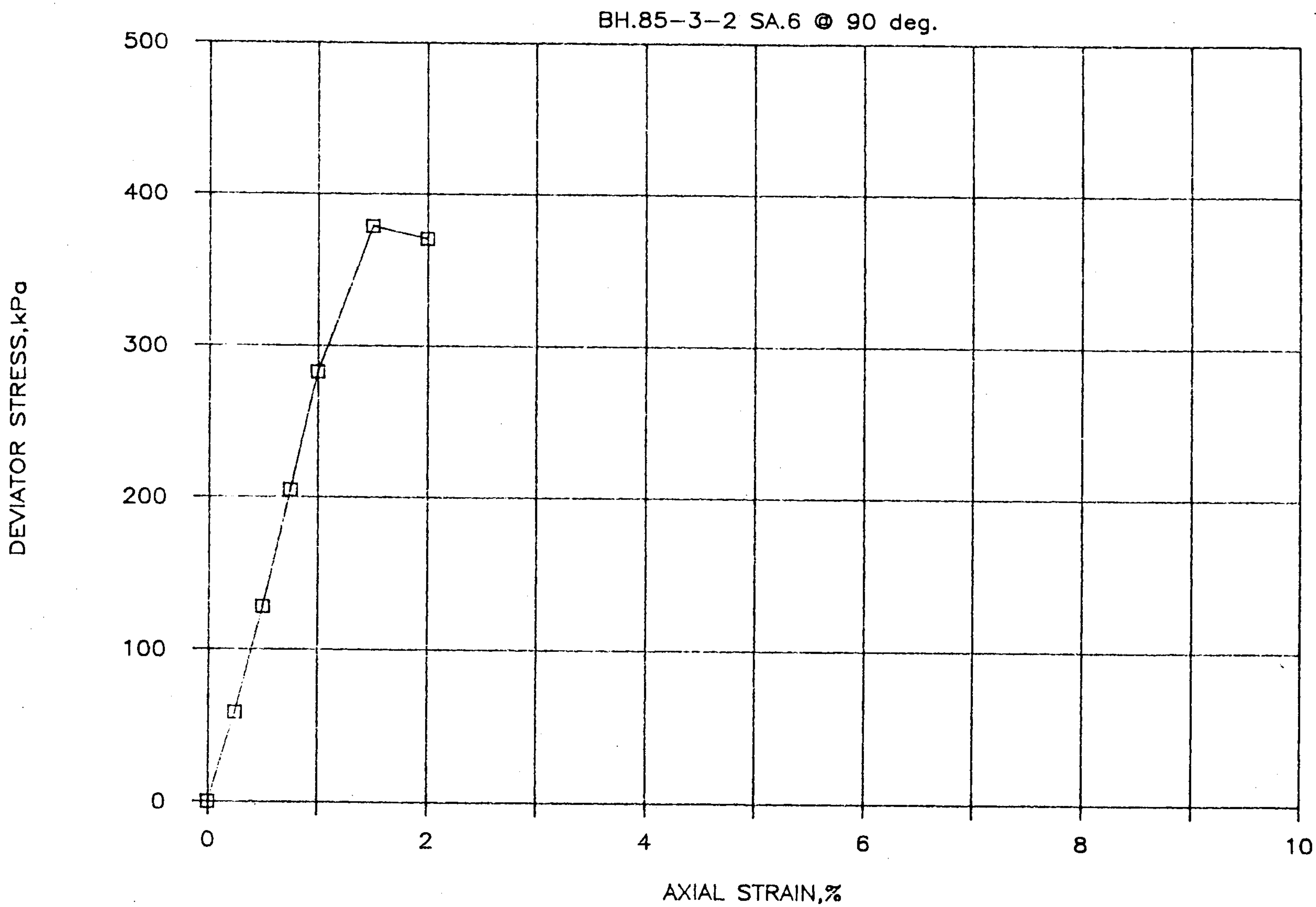
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	6	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	4.75	BH.85-3-2 SA.6 @ 90 deg.	

SAMPLE HEIGHT,cm	8.40	WET WEIGHT,gm	195.9
SAMPLE DIAMETER,cm	3.90	DRY WEIGHT,gm	151.9
SAMPLE AREA,cm2	11.95	WATER CONTENT,%	28.8
SAMPLE VOLUME,cc	100.35	POROSITY,%	
UNIT WEIGHT,kN/m3	19.14	DRY UNIT WT.,kN/m3	14.86

TEST RESULTS		LIQUID LIMIT,%	55
COMPRESS.STRESS,kPa	378.0	PLASTIC INDEX,%	29
STRAIN AT FAILURE,%	1.5	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
21.0	165.0	0.25	58.10
42.0	365.0	0.50	128.20
63.0	584.0	0.75	204.61
84.0	808.0	1.00	282.38
126.0	1088.0	1.50	378.31
168.0	1070.0	2.00	370.16

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 15-2

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UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	6	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	4.73	BH.85-3-2 SA.6 @ 45 deg.	

SAMPLE HEIGHT,cm	5.81	WET WEIGHT,gm	98.0
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	76.3
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	28.3
SAMPLE VOLUME,cc	49.99	POROSITY,%	
UNIT WEIGHT,kN/m3	19.22	DRY UNIT WT.,kN/m3	14.98

TEST RESULTS		LIQUID LIMIT,%	55
COMPRESS.STRESS,kPa	303.6	PLASTIC INDEX,%	29
STRAIN AT FAILURE,%	6.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
14.5	43.0	0.25	21.02
29.0	95.0	0.50	46.32
43.5	148.0	0.75	71.99
58.1	200.0	1.00	97.03
87.1	310.0	1.50	149.64
116.1	398.0	2.00	191.15
145.1	470.0	2.50	224.58
174.1	527.0	3.00	250.53
203.1	568.0	3.50	268.63
232.1	600.0	3.99	282.30
261.1	623.0	4.49	291.59
290.1	643.0	4.99	299.38
348.2	659.0	5.99	303.60
406.3	660.0	6.99	300.83
464.4	600.0	7.99	270.54

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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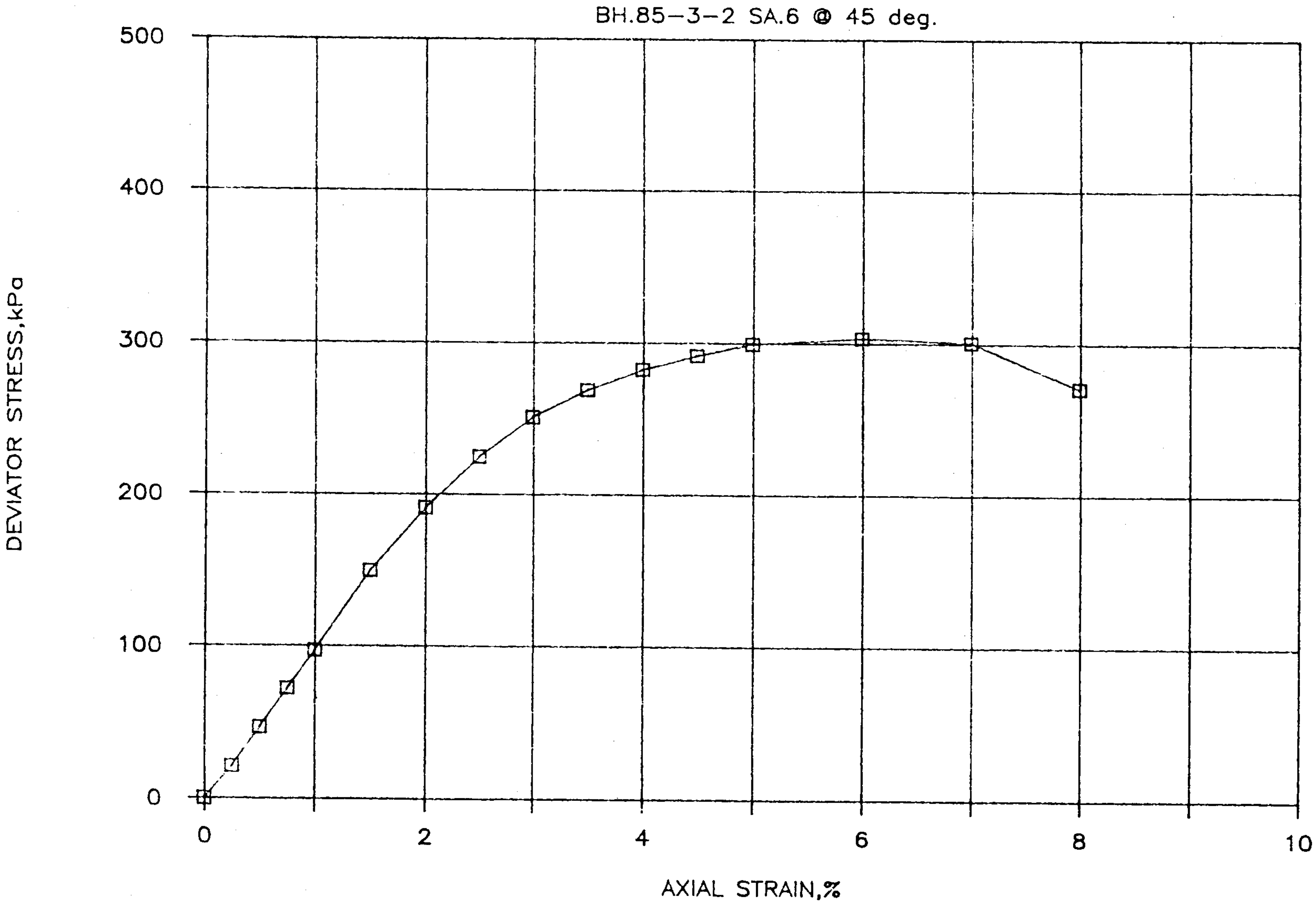


UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 16-2

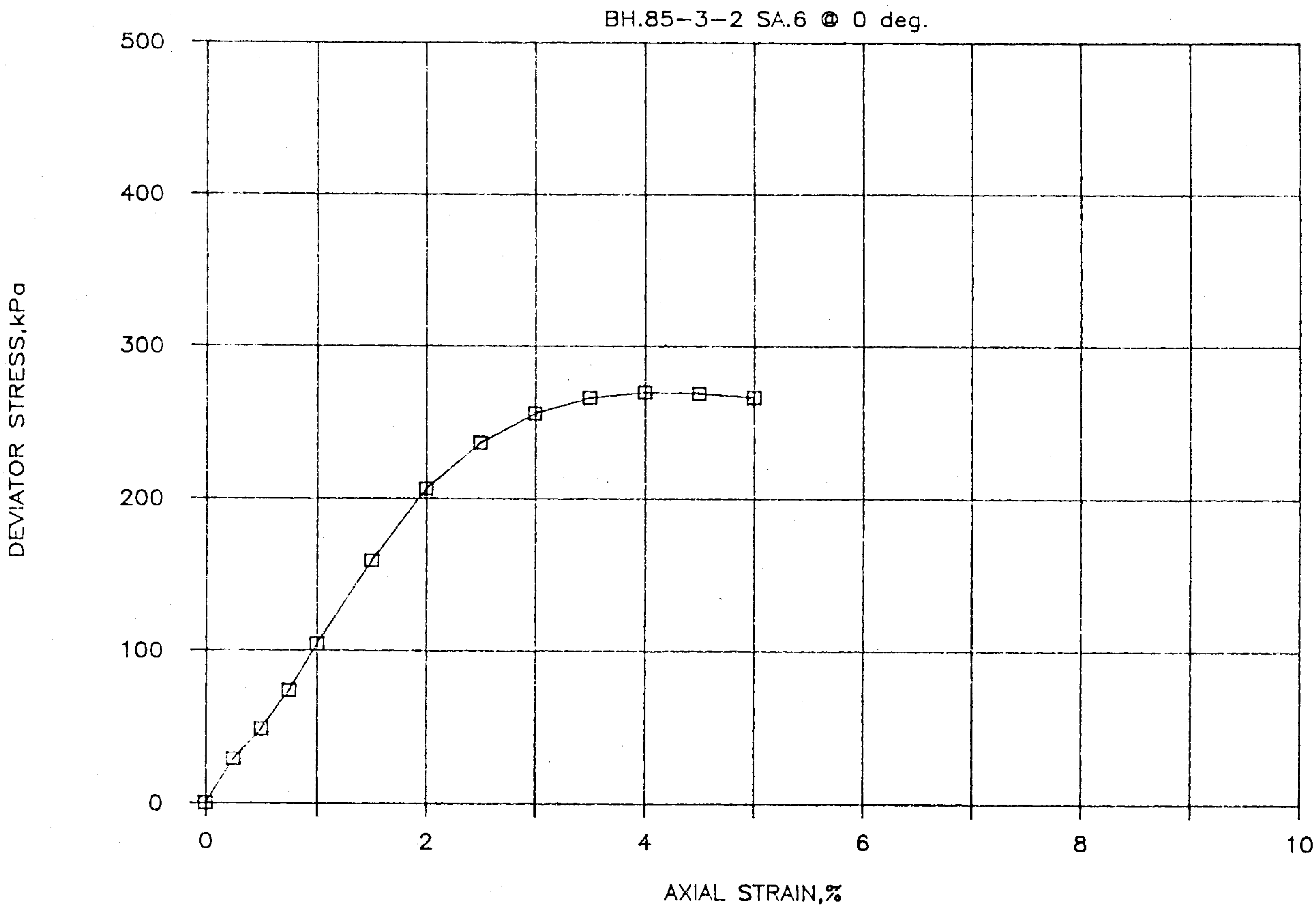
UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	6	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	4.70	BH.85-3-2 SA.6 @ 0 deg.	

SAMPLE HEIGHT,cm	5.48	WET WEIGHT,gm	91.1
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	70.7
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	28.5
SAMPLE VOLUME,cc	47.15	POROSITY,%	
UNIT WEIGHT,kN/m3	18.94	DRY UNIT WT.,kN/m3	14.74

TEST RESULTS		LIQUID LIMIT,%	55
COMPRESS.STRESS,kPa	268.9	PLASTIC INDEX,%	29
STRAIN AT FAILURE,%	4.5	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.7	60.0	0.25	29.33
27.4	100.0	0.50	48.76
41.1	152.0	0.75	73.93
54.8	215.0	1.00	104.31
82.2	330.0	1.50	159.30
109.6	430.0	2.00	206.51
137.0	495.0	2.50	236.52
164.4	538.0	3.00	255.75
191.8	563.0	3.50	266.25
219.2	573.0	4.00	269.58
246.6	574.5	4.50	268.87
274.0	572.0	5.00	266.30



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 17-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

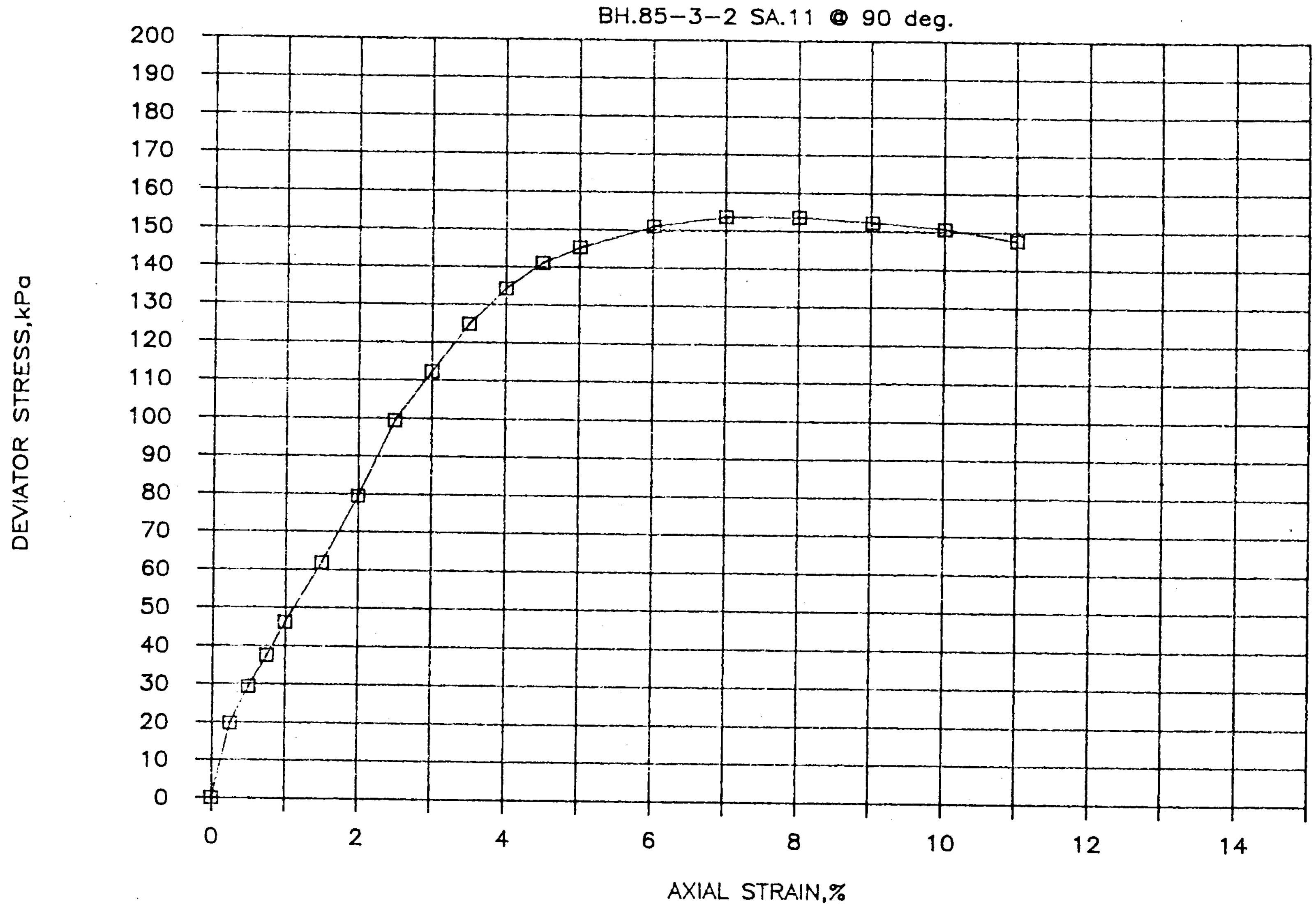
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	11	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	12.35	BH.85-3-2 SA.11 @ 90 deg.	

SAMPLE HEIGHT,cm	8.62	WET WEIGHT,gm	205.5
SAMPLE DIAMETER,cm	3.79	DRY WEIGHT,gm	167.9
SAMPLE AREA,cm2	11.28	WATER CONTENT,%	22.3
SAMPLE VOLUME,cc	97.25	POROSITY,%	
UNIT WEIGHT,kN/m3	20.72	DRY UNIT WT.,kN/m3	16.94

TEST RESULTS		LIQUID LIMIT,%	34
COMPRESS.STRESS,kPa	153.7	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	8.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
21.6	53.0	0.25	19.76
43.2	79.0	0.50	29.38
64.8	101.0	0.75	37.47
86.2	125.0	1.00	46.26
129.4	168.0	1.50	61.85
172.6	217.0	2.00	79.49
215.8	273.0	2.50	99.49
259.0	310.0	3.00	112.39
302.2	346.0	3.51	124.80
345.4	374.0	4.01	134.20
388.6	395.0	4.51	140.99
431.8	409.0	5.01	145.22
518.0	430.0	6.01	151.07
604.2	442.0	7.01	153.64
690.4	447.0	8.01	153.70
777.6	448.0	9.02	152.35
862.8	448.0	10.01	150.70
949.0	444.0	11.01	147.69

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 18-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 19-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	11	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	12.33	BH.85-3-2 SA.11 @ 45 deg.	
SAMPLE HEIGHT,cm	5.36	WET WEIGHT,gm	95.2
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	79.0
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	21.8
SAMPLE VOLUME,cc	46.12	POROSITY,%	
UNIT WEIGHT,kN/m3	20.23	DRY UNIT WT.,kN/m3	16.61
TEST RESULTS		LIQUID LIMIT,%	34
COMPRESS.STRESS,kPa	182.7	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	20.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.4	28.0	0.25	13.69
26.8	44.0	0.50	21.46
40.2	61.0	0.75	29.67
53.6	77.0	1.00	37.36
80.4	111.0	1.50	53.58
107.2	144.0	2.00	69.16
134.0	172.0	2.50	82.18
160.8	195.0	3.00	92.70
187.6	215.0	3.50	101.68
214.4	234.0	4.00	110.09
241.2	252.0	4.50	117.94
268.0	266.0	5.00	123.84
321.6	293.0	6.00	134.97
375.2	315.0	7.00	143.57
428.8	336.0	8.00	151.49
482.4	354.0	9.00	157.87
536.0	370.0	10.00	163.19
589.6	386.0	11.00	168.36
643.2	400.0	12.00	172.50
696.8	413.0	13.00	176.09
750.4	423.0	14.00	178.28
804.0	432.0	15.00	179.95
857.6	440.0	16.00	181.13
911.2	448.0	17.00	182.23
964.8	454.0	18.00	182.44
1018.4	460.0	19.00	182.60
1072.0	466.0	20.00	182.70

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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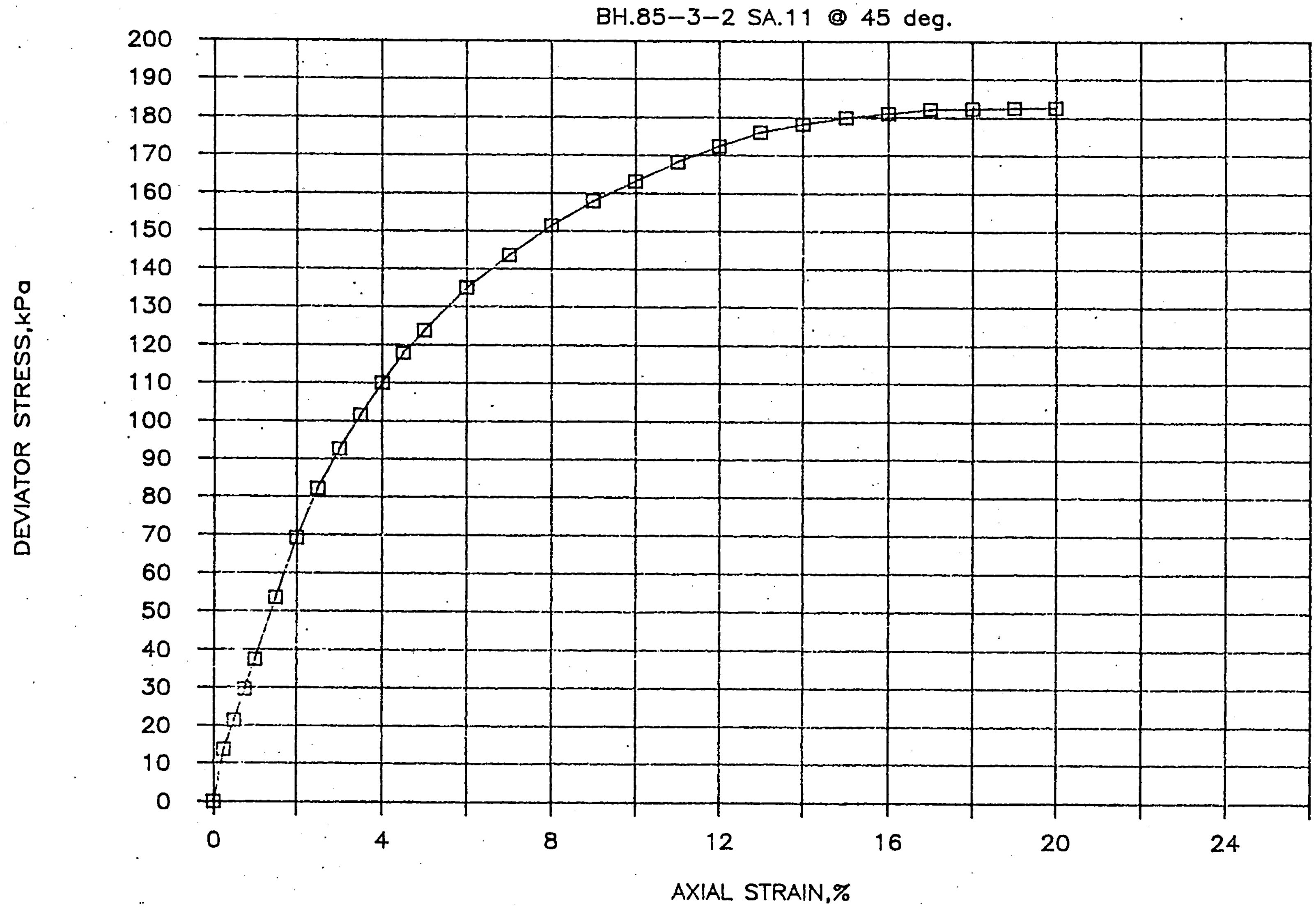

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UNDRAINED TRIAXIAL COMPRESSION (U)
SHEET 2 OF 2

FIGURE 19-2

UNDRAINED TRIAXIAL COMPRESSION (U) SHEET 1 OF 2	FIGURE 20-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

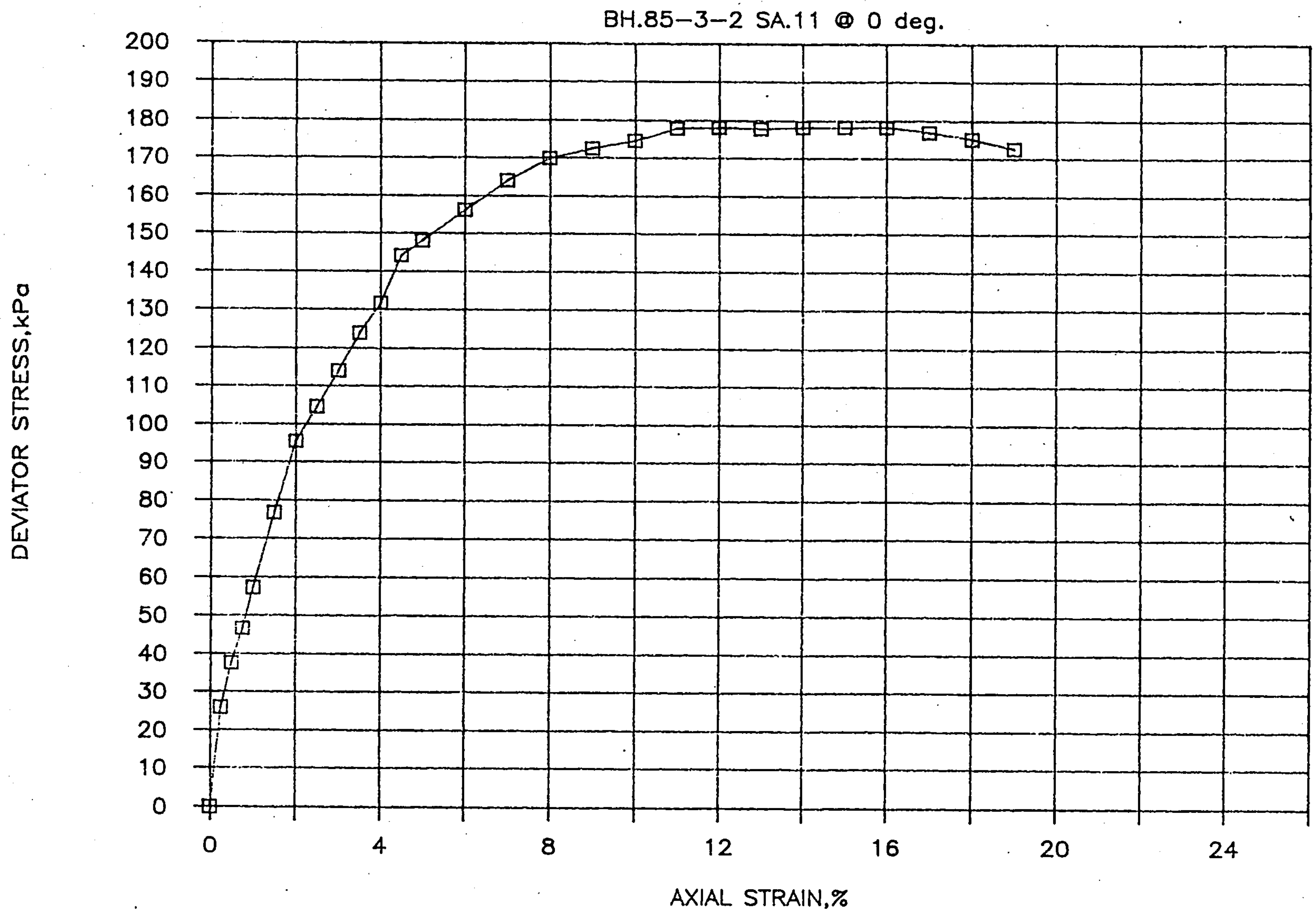
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	11	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	12.29	BH.85-3-2 SA.11 @ 0 deg.	

SAMPLE HEIGHT,cm	5.44	WET WEIGHT,gm	97.2
SAMPLE DIAMETER,cm	3.31	DRY WEIGHT,gm	79.3
SAMPLE AREA,cm2	8.60	WATER CONTENT,%	22.3
SAMPLE VOLUME,cc	46.81	POROSITY,%	
UNIT WEIGHT,kN/m3	20.36	DRY UNIT WT.,kN/m3	16.65

TEST RESULTS		LIQUID LIMIT,%	34
COMPRESS.STRESS,kPa	178.3	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	15.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.6	53.0	0.25	25.91
27.2	77.0	0.50	37.55
40.8	96.0	0.75	46.69
54.4	118.0	1.00	57.25
81.6	159.0	1.50	76.75
108.8	199.0	2.00	95.57
136.0	219.0	2.50	104.64
163.2	240.0	3.00	114.09
190.4	262.0	3.50	123.90
217.6	280.0	4.00	131.73
244.8	308.0	4.50	144.15
272.0	318.0	5.00	148.05
326.4	339.0	6.00	156.17
380.8	360.0	7.00	164.07
435.2	377.0	8.00	169.98
489.6	387.0	9.00	172.59
544.0	396.0	10.00	174.66
598.4	408.0	11.00	177.95
652.8	413.0	12.00	178.11
707.2	417.0	13.00	177.79
761.6	423.0	14.00	178.28
816.0	428.0	15.00	178.29
870.4	433.0	16.00	178.25
924.8	435.0	17.00	176.94
979.2	436.0	18.00	175.21
1033.6	435.0	19.00	172.68

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 20-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 21-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

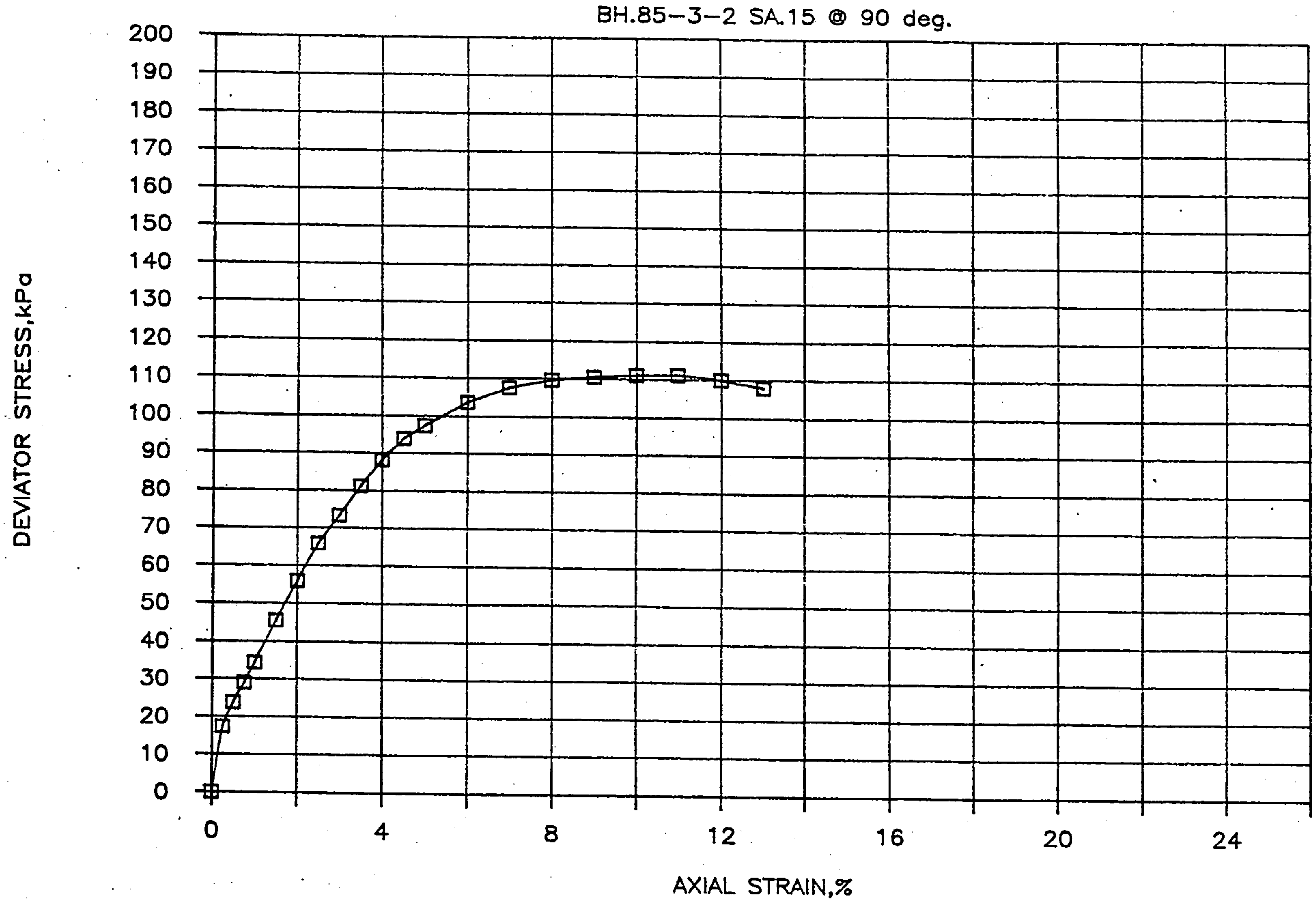
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	15	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	18.76	BH.85-3-2 SA.15 @ 90 deg.	

SAMPLE HEIGHT,cm	8.61	WET WEIGHT,gm	211.5
SAMPLE DIAMETER,cm	3.73	DRY WEIGHT,gm	172.9
SAMPLE AREA,cm2	10.93	WATER CONTENT,%	22.2
SAMPLE VOLUME,cc	94.08	POROSITY,%	
UNIT WEIGHT,kN/m3	22.04	DRY UNIT WT.,kN/m3	18.03

TEST RESULTS		LIQUID LIMIT,%	31
COMPRESS.STRESS,kPa	111.1	PLASTIC INDEX,%	14
STRAIN AT FAILURE,%	10.0	LAB. VANE,Peak,kPa	64.9
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	4.0

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
21.5	45.0	0.25	17.32
43.0	62.0	0.50	23.81
64.5	76.0	0.75	29.11
86.1	90.0	1.00	34.39
129.1	120.0	1.50	45.62
172.1	148.0	2.00	55.97
215.1	175.0	2.50	65.85
258.1	196.0	3.00	73.37
301.1	218.0	3.50	81.19
344.1	238.0	4.00	88.18
387.1	255.0	4.50	93.98
430.1	266.0	5.00	97.53
516.2	286.0	5.99	103.76
602.3	300.0	7.00	107.68
688.4	309.0	8.00	109.71
774.5	315.0	8.99	110.63
860.6	320.0	10.00	111.15
946.7	324.0	11.00	111.29
1032.8	324.0	11.99	110.04
1118.9	322.0	13.00	108.12

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 21-2

UNDRAINED TRIAXIAL COMPRESSION (U) SHEET 1 OF 2	FIGURE 22-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	15	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	18.68	BH.85-3-2 SA.15 @ 45 deg.	

SAMPLE HEIGHT,cm	5.47	WET WEIGHT,gm	94.3
SAMPLE DIAMETER,cm	3.20	DRY WEIGHT,gm	77.3
SAMPLE AREA,cm2	8.04	WATER CONTENT,%	21.7
SAMPLE VOLUME,cc	43.99	POROSITY,%	
UNIT WEIGHT,kN/m3	21.02	DRY UNIT WT.,kN/m3	17.27

TEST RESULTS		LIQUID LIMIT,%	31
COMPRESS.STRESS,kPa	145.6	PLASTIC INDEX,%	14
STRAIN AT FAILURE,%	8.0	LAB. VANE,Peak,kPa	64.9
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	4.0

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.7	83.0	0.25	43.41
27.4	118.0	0.50	61.56
41.1	150.0	0.75	78.06
54.7	180.0	1.00	93.44
82.1	220.0	1.50	113.62
109.5	241.0	2.00	123.84
136.9	254.0	2.50	129.85
164.3	264.0	3.00	134.27
191.7	271.0	3.50	137.12
219.1	277.0	4.01	139.42
246.5	281.0	4.51	140.70
273.9	285.0	5.01	141.95
328.6	292.0	6.01	143.91
383.3	298.0	7.01	145.30
438.0	302.0	8.01	145.67
492.7	304.0	9.01	145.04
547.4	305.5	10.01	144.16
602.1	306.0	11.01	142.79
656.8	306.5	12.01	141.41
711.5	307.2	13.01	140.13
766.2	309.0	14.01	139.33
820.9	310.0	15.01	138.15
875.6	311.3	16.01	137.10
930.3	314.3	17.01	136.77
985.0	317.0	18.01	136.28
1039.7	320.0	19.01	135.90
1094.4	322.0	20.01	135.06

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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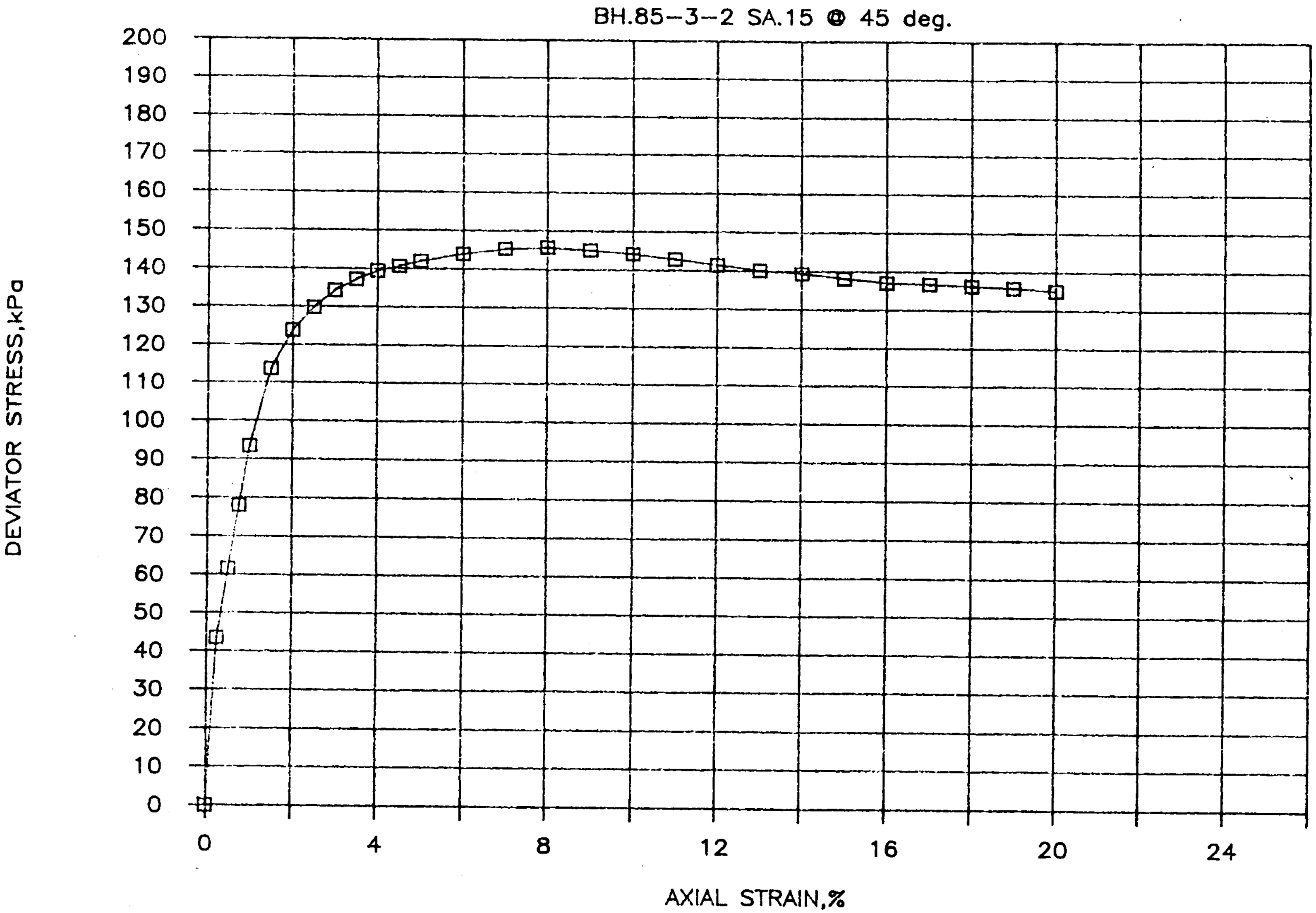

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 22-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 23-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	15	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	18.70	BH.85-3-2 SA.15 @ 0 deg.	

SAMPLE HEIGHT,cm	6.30	WET WEIGHT,gm	149.3
SAMPLE DIAMETER,cm	3.74	DRY WEIGHT,gm	121.9
SAMPLE AREA,cm2	10.99	WATER CONTENT,%	22.3
SAMPLE VOLUME,cc	69.21	POROSITY,%	
UNIT WEIGHT,kN/m3	21.15	DRY UNIT WT.,kN/m3	17.30

TEST RESULTS		LIQUID LIMIT,%	31
COMPRESS.STRESS,kPa	119.7	PLASTIC INDEX,%	14
STRAIN AT FAILURE,%	19.0	LAB. VANE,Peak,kPa	64.9
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	4.0

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
15.7	37.0	0.25	14.17
31.4	46.0	0.50	17.57
47.1	53.0	0.75	20.19
63.0	62.0	1.00	23.56
94.4	79.0	1.50	29.87
125.8	95.0	2.00	35.74
157.2	113.0	2.50	42.29
188.6	129.0	2.99	48.03
220.0	146.0	3.49	54.09
251.4	161.0	3.99	59.33
282.8	176.0	4.49	64.53
314.2	189.0	4.99	68.93
377.2	215.0	5.99	77.59
440.2	240.0	6.99	85.69
503.2	263.0	7.99	92.89
566.2	282.0	8.99	98.52
629.2	300.0	9.99	103.66
692.2	315.0	10.99	107.63
755.2	328.0	11.99	110.81
818.2	340.0	12.99	113.56
881.2	351.0	13.99	115.89
944.2	361.0	14.99	117.80
1007.2	370.0	15.99	119.32
1070.2	375.0	16.99	119.49
1133.2	380.0	17.99	119.63
1196.2	385.0	18.99	119.72
1259.2	387.0	19.99	118.86

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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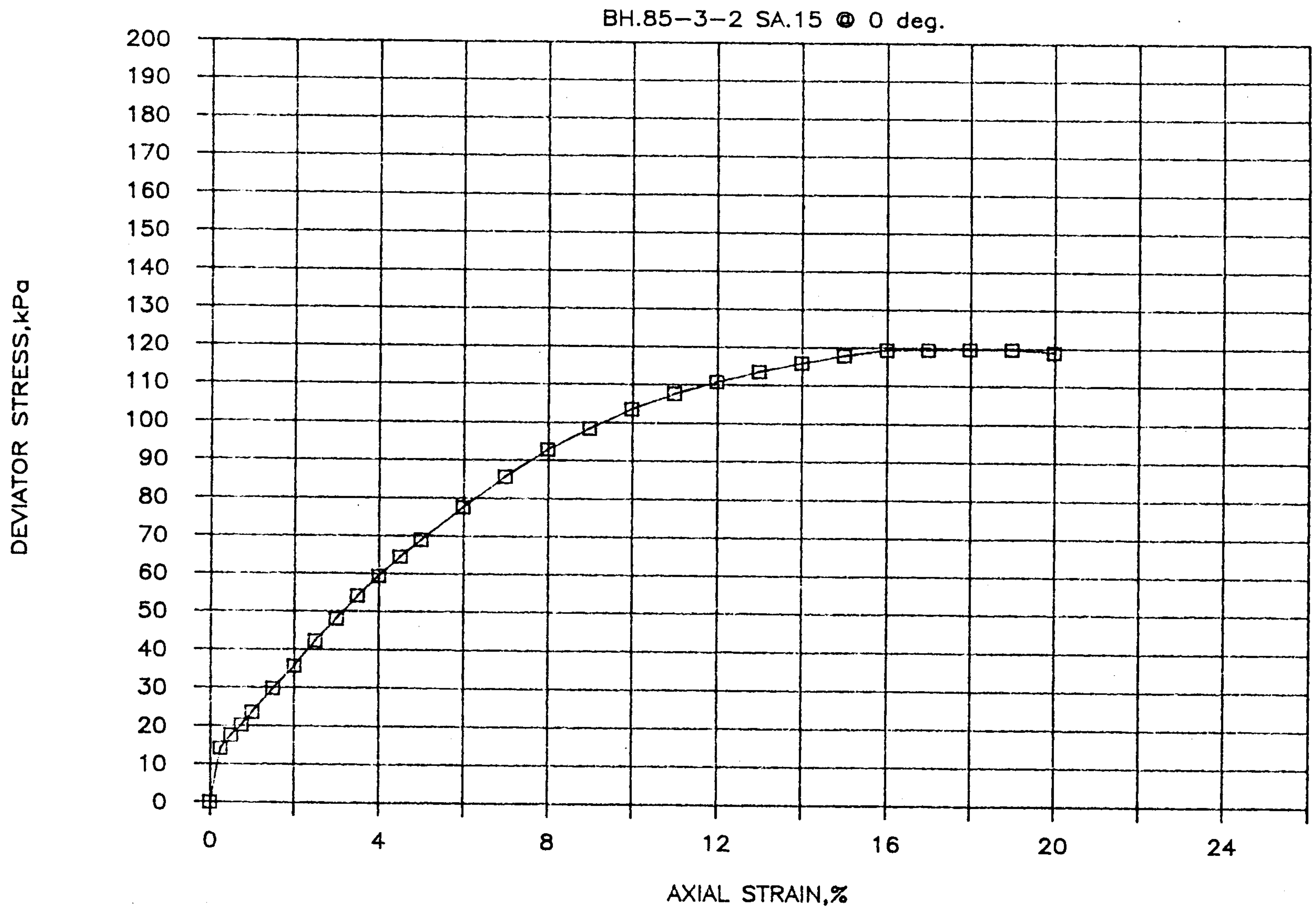


UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 23-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

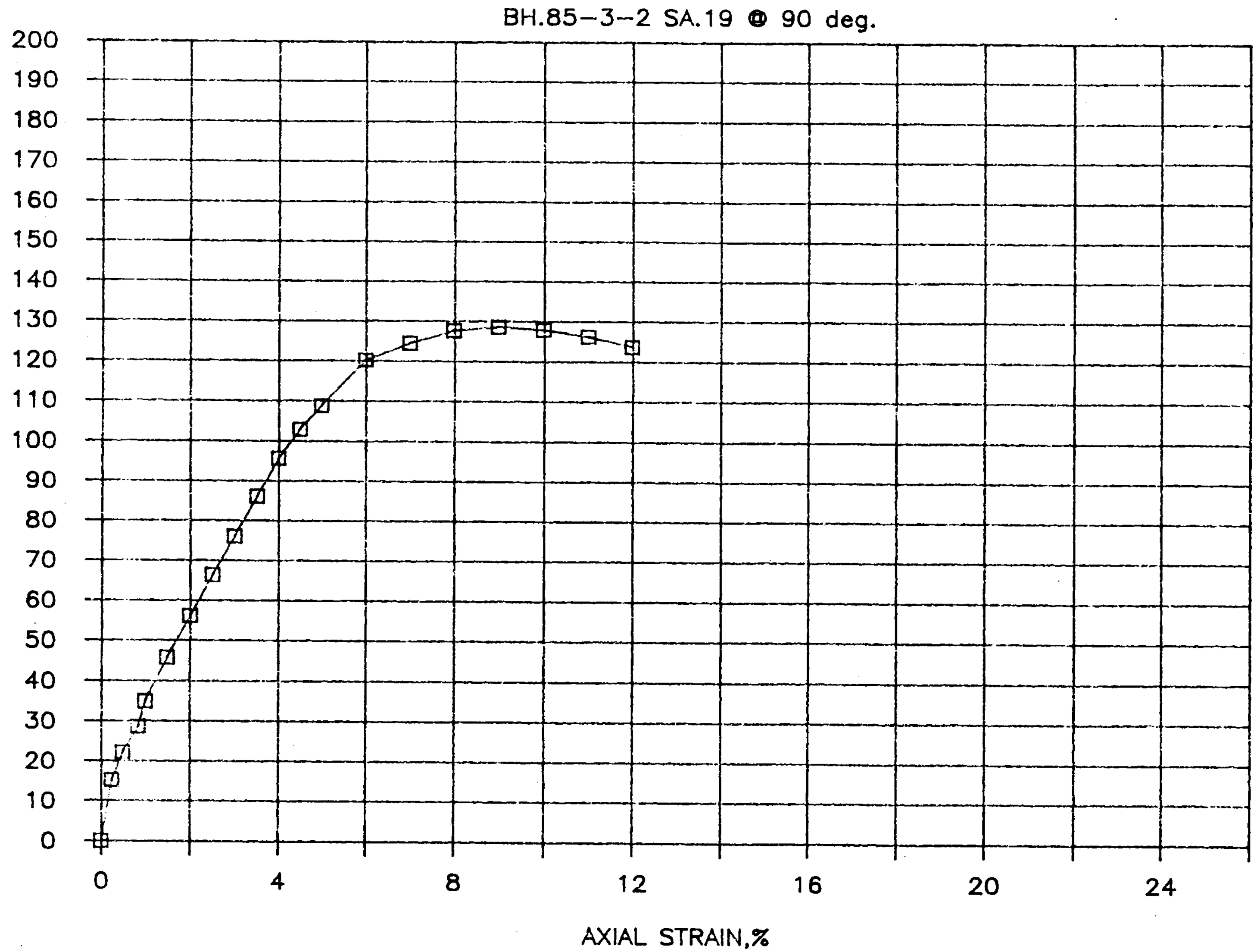
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	19	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	24.85	BH.85-3-2 SA.19 @ 90 deg.	

SAMPLE HEIGHT,cm	9.14	WET WEIGHT,gm	187.2
SAMPLE DIAMETER,cm	3.80	DRY WEIGHT,gm	147.0
SAMPLE AREA,cm2	11.34	WATER CONTENT,%	27.4
SAMPLE VOLUME,cc	92.32	POROSITY,%	
UNIT WEIGHT,kN/m3	19.88	DRY UNIT WT.,kN/m3	15.60

TEST RESULTS		LIQUID LIMIT,%	37
COMPRESS.STRESS,kPa	128.6	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	9.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
20.3	41.0	0.25	15.21
40.6	60.0	0.50	22.20
68.9	78.0	0.85	28.76
81.4	95.0	1.00	34.97
122.0	125.0	1.50	45.78
162.6	154.0	2.00	56.12
203.2	183.0	2.50	66.35
243.8	211.0	3.00	76.11
284.4	240.0	3.49	86.12
325.0	268.0	3.99	95.67
365.6	290.0	4.49	102.99
406.2	308.0	4.99	108.81
487.6	344.0	5.99	120.25
569.0	360.0	6.99	124.50
650.4	373.0	7.99	127.61
731.8	380.0	8.99	128.59
813.2	382.0	9.99	127.85
894.6	381.5	10.99	126.26
976.0	378.0	11.99	123.70

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 24-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	19	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	24.75	BH.85-3-2 SA.19 @ 45 deg.	

SAMPLE HEIGHT,cm	5.01	WET WEIGHT,gm	81.7
SAMPLE DIAMETER,cm	3.78	DRY WEIGHT,gm	61.7
SAMPLE AREA,cm2	11.22	WATER CONTENT,%	31.8
SAMPLE VOLUME,cc	56.22	POROSITY,%	
UNIT WEIGHT,kN/m3	14.25	DRY UNIT WT.,kN/m3	10.81

TEST RESULTS		LIQUID LIMIT,%	37
COMPRESS.STRESS,kPa	80.3	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	7.1	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
12.7	44.0	0.25	16.49
25.4	59.0	0.51	22.06
38.1	74.0	0.76	27.60
50.9	86.0	1.02	31.99
76.3	111.0	1.52	41.08
101.7	134.0	2.03	49.33
127.1	154.0	2.54	56.40
152.5	172.0	3.04	62.67
177.9	184.0	3.55	66.69
203.3	193.0	4.06	69.58
228.7	203.0	4.56	72.80
254.1	211.0	5.07	75.27
305.0	223.0	6.09	78.70
355.9	230.0	7.10	80.29
406.8	232.0	8.12	80.10
457.7	228.0	9.14	77.85
508.6	222.0	10.15	74.95

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

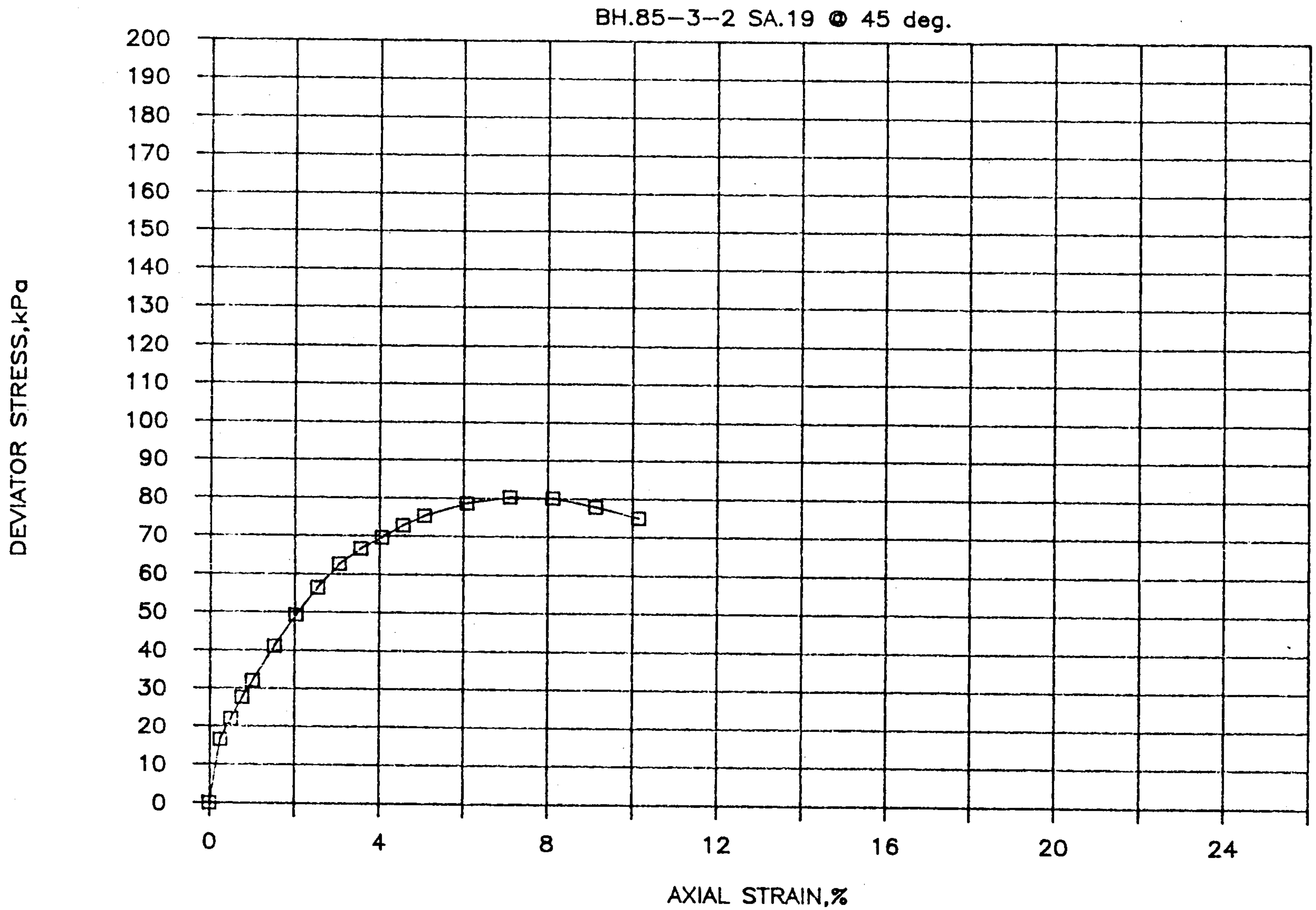

FIGURE 25-2

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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 26-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	85-3-2	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	19	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	24.65	BH.85-3-2 SA.19 @ 0 deg.	

SAMPLE HEIGHT,cm	5.46	WET WEIGHT,gm	92.4
SAMPLE DIAMETER,cm	3.36	DRY WEIGHT,gm	72.7
SAMPLE AREA,cm2	8.87	WATER CONTENT,%	26.8
SAMPLE VOLUME,cc	48.41	POROSITY,%	
UNIT WEIGHT,kN/m3	18.72	DRY UNIT WT.,kN/m3	14.76

TEST RESULTS		LIQUID LIMIT,%	37
COMPRESS.STRESS,kPa	123.6	PLASTIC INDEX,%	16
STRAIN AT FAILURE,%	14.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
13.6	38.0	0.25	18.03
27.2	55.0	0.50	26.03
40.8	70.0	0.75	33.04
54.6	86.0	1.00	40.49
81.6	110.0	1.49	51.53
108.8	133.0	1.99	61.99
136.0	152.0	2.49	70.49
163.2	167.0	2.99	77.05
190.4	180.0	3.49	82.62
217.6	191.0	3.98	87.22
244.8	200.0	4.48	90.85
272.0	210.0	4.98	94.90
326.4	227.0	5.98	101.51
380.8	241.0	6.97	106.62
435.2	254.0	7.97	111.17
489.6	268.0	8.97	116.03
546.0	278.0	10.00	118.99
598.4	286.0	10.96	121.11
652.8	292.0	11.96	122.27
707.2	298.0	12.95	123.37
761.6	302.0	13.95	123.59
816.0	305.0	14.94	123.38
870.4	307.0	15.94	122.73
924.8	307.0	16.94	121.28
979.2	308.5	17.93	120.41
1033.6	308.5	18.93	118.95
1088.0	308.5	19.93	117.48

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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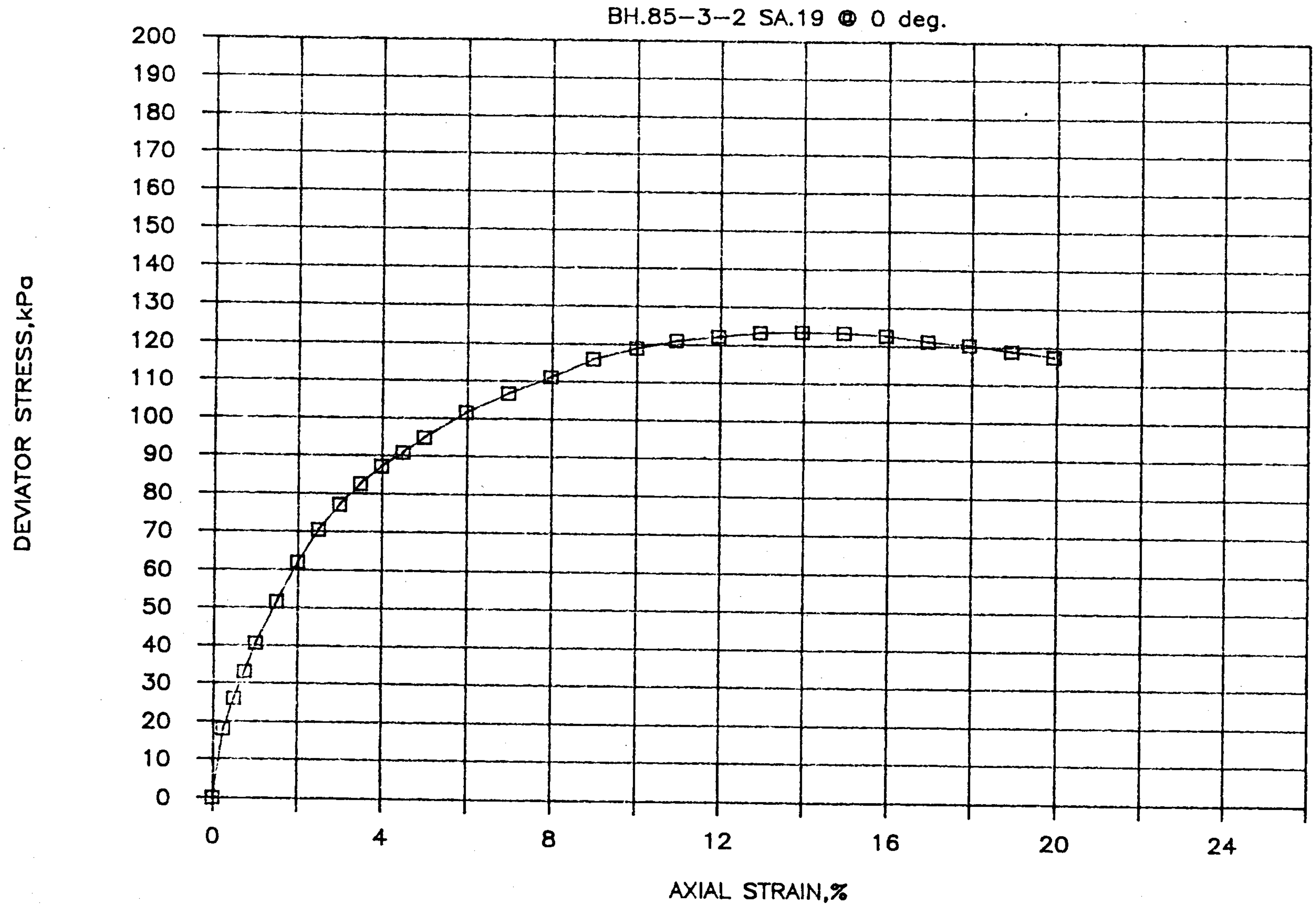


UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 26-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

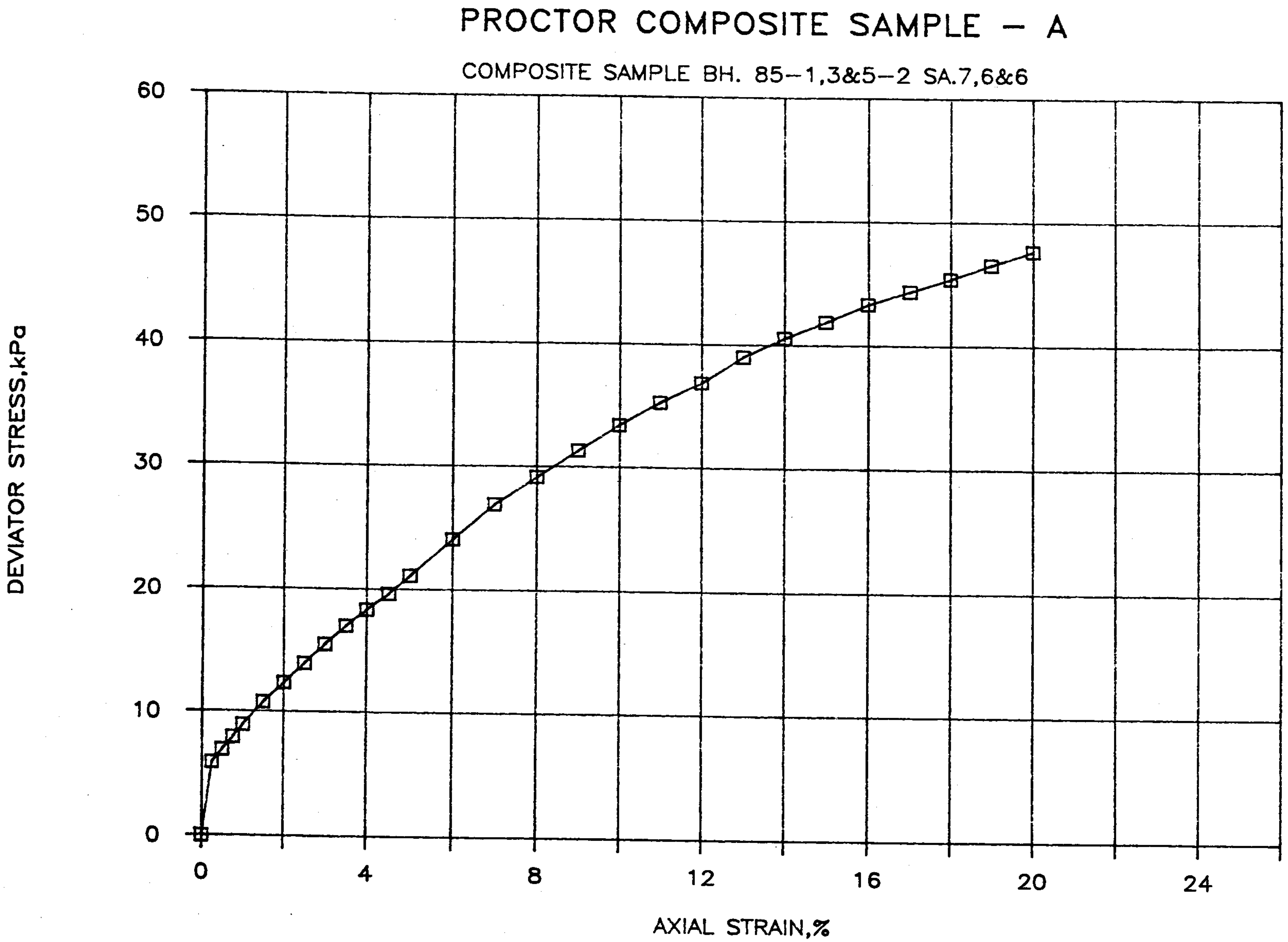
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	1 3 5	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	7 6 6	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	UPPER TILL	PROCTOR COMPOSITE SAMPLE - A	

SAMPLE HEIGHT,cm	10.01	WET WEIGHT,gm	396.6
SAMPLE DIAMETER,cm	5.06	DRY WEIGHT,gm	324.9
SAMPLE AREA,cm2	20.11	WATER CONTENT,%	22.1
SAMPLE VOLUME,cc	201.29	POROSITY,%	
UNIT WEIGHT,kN/m3	19.31	DRY UNIT WT.,kN/m3	15.82

TEST RESULTS		LIQUID LIMIT,%	
COMPRESS.STRESS,kPa	47.7	PLASTIC INDEX,%	
STRAIN AT FAILURE,%	20.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.0	28.0	0.25	5.86
50.0	33.0	0.50	6.89
75.0	38.0	0.75	7.91
100.1	43.0	1.00	8.93
150.0	52.0	1.50	10.74
200.0	60.0	2.00	12.33
250.0	68.0	2.50	13.90
300.0	76.0	3.00	15.46
350.0	84.0	3.50	17.00
400.0	91.0	4.00	18.32
450.0	98.0	4.49	19.63
500.0	106.0	4.99	21.12
600.0	122.0	5.99	24.05
700.0	138.0	6.99	26.92
800.0	151.0	7.99	29.13
900.0	164.0	8.99	31.30
1000.0	177.0	9.99	33.41
1100.0	189.0	10.99	35.28
1200.0	200.0	11.99	36.91
1300.0	214.0	12.99	39.05
1400.0	225.0	13.99	40.58
1500.0	235.0	14.98	41.90
1600.0	246.0	15.98	43.34
1700.0	255.0	16.98	44.39
1800.0	264.0	17.98	45.41
1900.0	274.0	18.98	46.55
2000.0	284.0	19.98	47.66

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 27-2

UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 1 OF 2

FIGURE 28-1

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

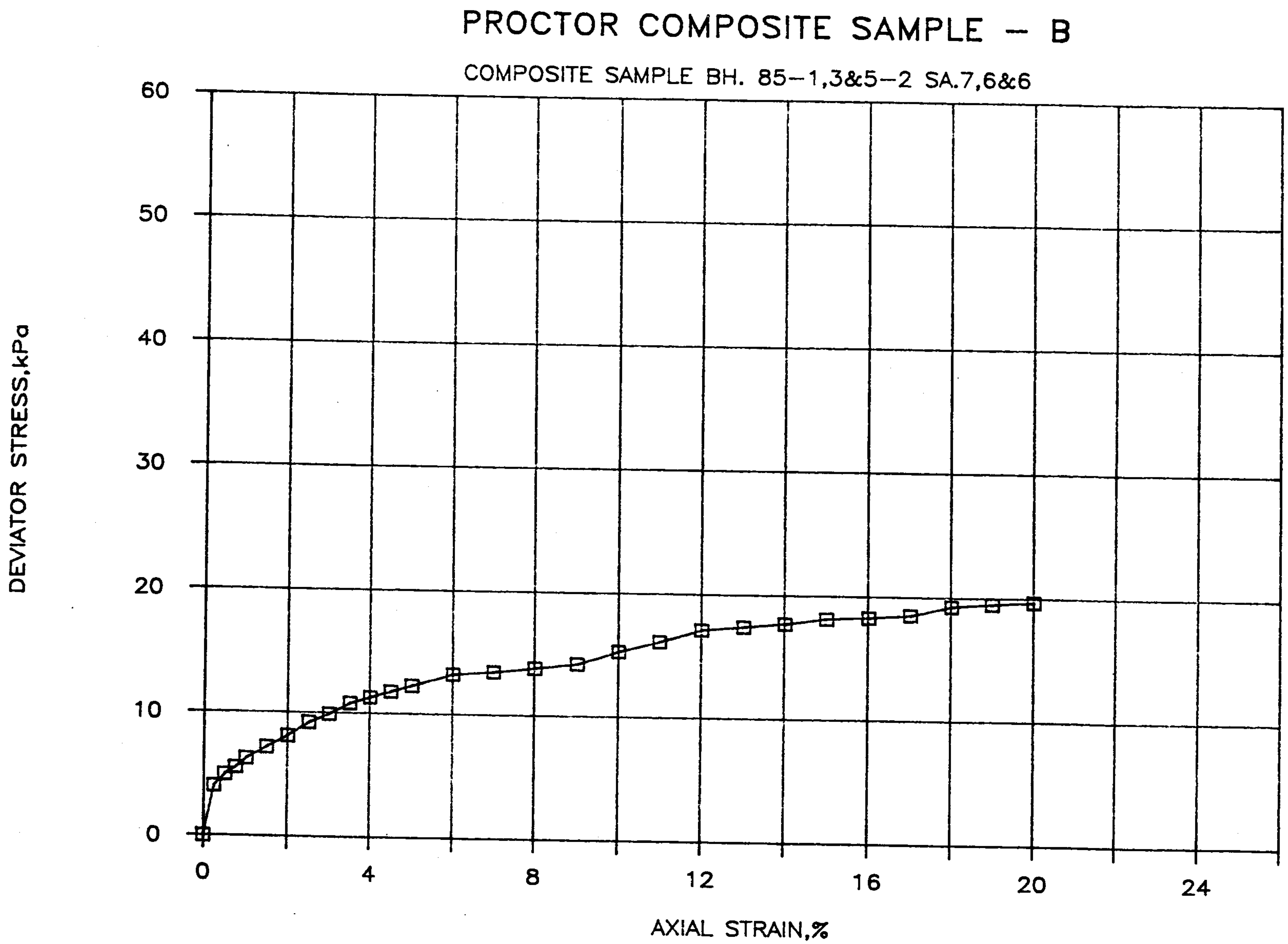
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	1 3 5	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	7 6 6	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	UPPER TILL	PROCTOR COMPOSITE SAMPLE - B	

SAMPLE HEIGHT,cm	8.50	WET WEIGHT,gm	367.4
SAMPLE DIAMETER,cm	5.28	DRY WEIGHT,gm	293.6
SAMPLE AREA,cm2	21.90	WATER CONTENT,%	24.9
SAMPLE VOLUME,cc	186.11	POROSITY,%	
UNIT WEIGHT,kN/m3	19.35	DRY UNIT WT.,kN/m3	15.49

TEST RESULTS		LIQUID LIMIT,%	
COMPRESS.STRESS,kPa	19.7	PLASTIC INDEX,%	
STRAIN AT FAILURE,%	20.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
21.3	21.0	0.25	4.03
42.6	26.0	0.50	4.98
63.9	29.0	0.75	5.54
85.0	33.0	1.00	6.29
127.6	38.0	1.50	7.21
170.2	43.0	2.00	8.12
212.8	49.0	2.50	9.20
255.4	53.0	3.00	9.90
298.0	58.0	3.51	10.78
340.6	61.0	4.01	11.28
383.2	64.0	4.51	11.77
425.8	67.0	5.01	12.26
510.8	73.0	6.01	13.21
595.8	75.0	7.01	13.43
680.8	78.0	8.01	13.82
765.8	81.0	9.01	14.19
850.8	88.0	10.01	15.25
935.8	94.0	11.01	16.11
1020.8	101.0	12.01	17.12
1105.8	104.0	13.01	17.42
1190.8	107.0	14.01	17.72
1275.8	111.0	15.01	18.17
1360.8	113.0	16.01	18.28
1445.8	116.0	17.01	18.54
1530.8	122.0	18.01	19.26
1615.8	125.0	19.01	19.50
1700.8	128.0	20.01	19.72

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 28-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	3	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	10 11	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	LOWER TILL	PROCTOR COMPOSITE SAMPLE - A	

SAMPLE HEIGHT,cm	10.07	WET WEIGHT,gm	412.7
SAMPLE DIAMETER,cm	4.97	DRY WEIGHT,gm	347.6
SAMPLE AREA,cm2	19.40	WATER CONTENT,%	18.7
SAMPLE VOLUME,cc	195.36	POROSITY,%	
UNIT WEIGHT,kN/m3	20.71	DRY UNIT WT.,kN/m3	17.45

TEST RESULTS		LIQUID LIMIT,%	
COMPRESS.STRESS,kPa	73.7	PLASTIC INDEX,%	
STRAIN AT FAILURE,%	20.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
25.2	36.0	0.25	7.81
50.4	45.0	0.50	9.73
75.6	54.0	0.75	11.65
100.7	61.0	1.00	13.13
151.1	73.0	1.50	15.63
201.5	85.0	2.00	18.11
251.9	96.0	2.50	20.35
302.3	108.0	3.00	22.77
352.7	119.0	3.50	24.96
403.1	130.0	4.00	27.13
453.5	141.0	4.50	29.27
503.9	152.0	5.00	31.39
604.6	173.0	6.00	35.35
705.3	196.0	7.00	39.62
806.0	215.0	8.00	42.99
906.7	235.0	9.00	46.48
1007.4	255.0	10.00	49.88
1108.1	274.0	11.00	53.01
1208.8	295.0	12.00	56.43
1309.5	314.0	13.00	59.38
1410.2	331.0	14.00	61.87
1510.9	347.0	15.00	64.11
1611.6	363.0	16.00	66.28
1712.3	378.0	17.00	68.19
1813.0	396.0	18.00	70.58
1913.7	409.0	19.00	72.01
2014.4	424.0	20.00	73.73

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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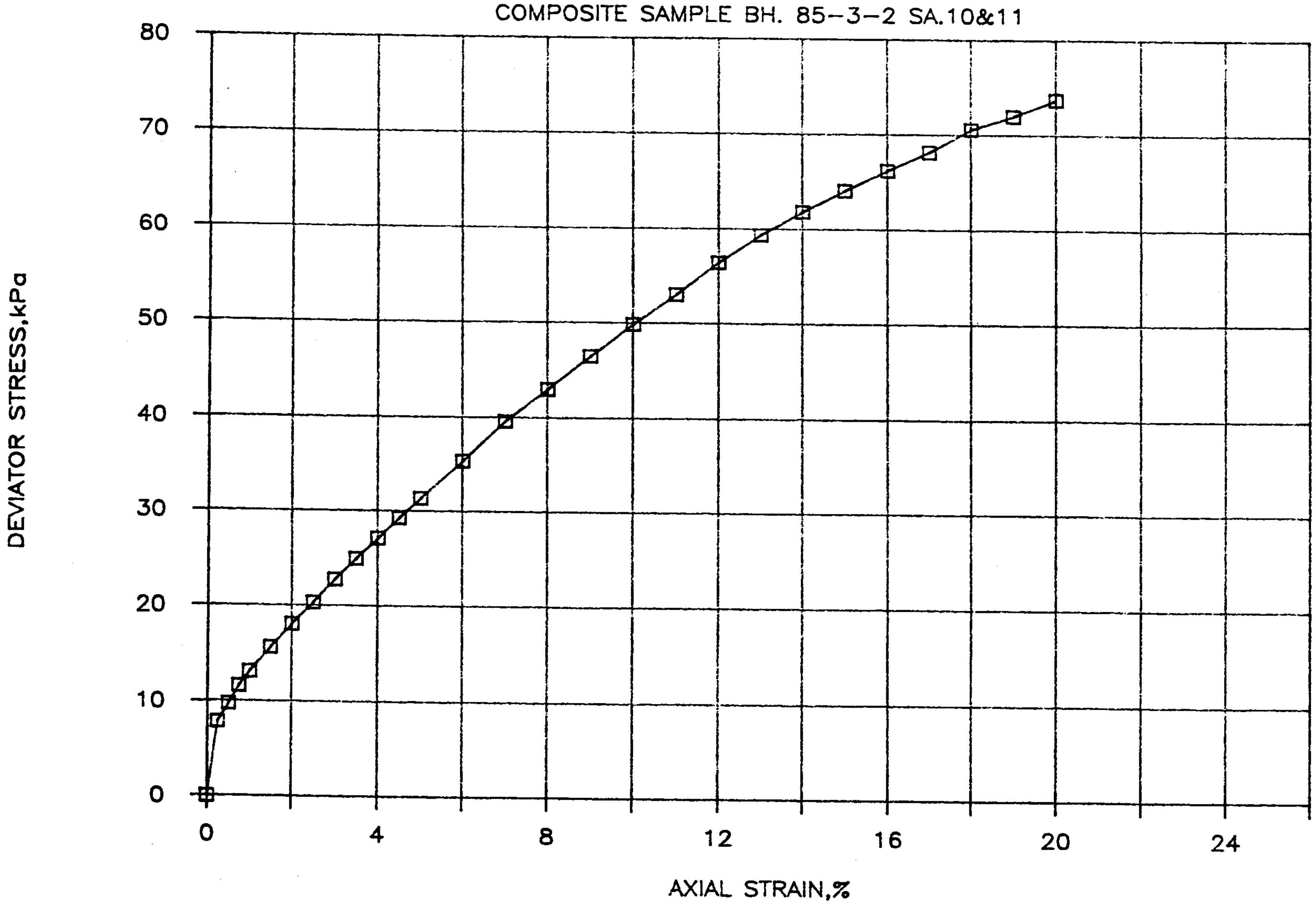
PROCTOR COMPOSITE SAMPLE - A



UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 29-2

UNDRAINED TRIAXIAL COMPRESSION TEST (U)

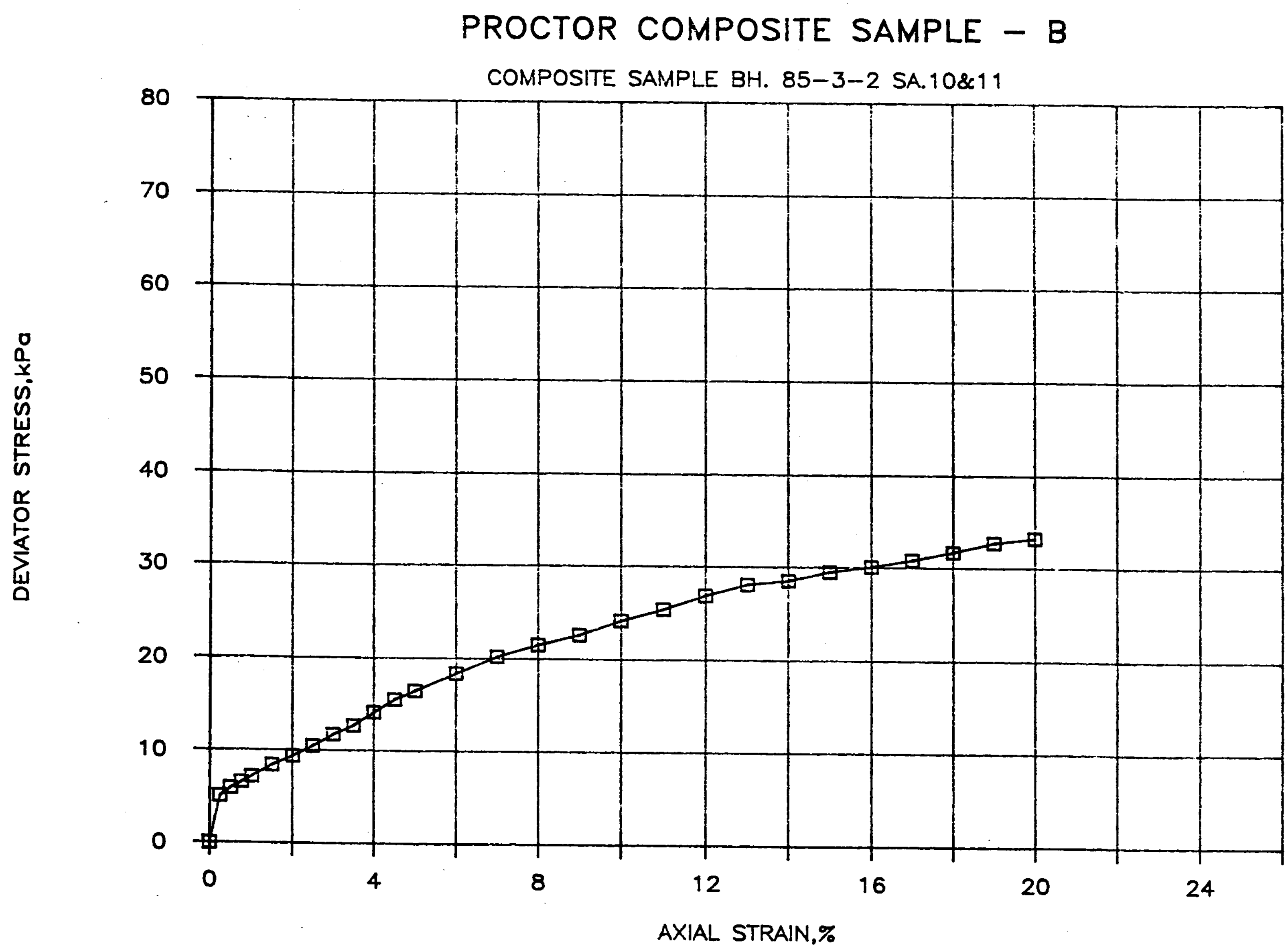
PROJECT NUMBER	851-1298	PROVING RING,kg/mm div.	0.043
BOREHOLE NUMBER	3	STRAIN RATE mm/min	0.2032
SAMPLE NUMBER	10 11	SPECIFIC GRAVITY,assumed	2.78
SAMPLE DEPTH,m	LOWER TILL	PROCTOR COMPOSITE SAMPLE - B	

SAMPLE HEIGHT,cm	9.95	WET WEIGHT,gm	411.4
SAMPLE DIAMETER,cm	4.94	DRY WEIGHT,gm	340.3
SAMPLE AREA,cm2	19.17	WATER CONTENT,%	20.8
SAMPLE VOLUME,cc	190.71	POROSITY,%	
UNIT WEIGHT,kN/m3	21.15	DRY UNIT WT.,kN/m3	17.51

TEST RESULTS		LIQUID LIMIT,%	
COMPRESS.STRESS,kPa	33.3	PLASTIC INDEX,%	
STRAIN AT FAILURE,%	20.0	LAB. VANE,Peak,kPa	
CELL PRESSURE,kPa	0.0	LAB. VANE,Resid.kPa	

Strain Dial mm	Load Dial mm	Axial Strain %	Deviator Stress kPa
0.0	0.0	0	0.00
24.8	23.0	0.25	5.05
49.7	27.0	0.50	5.91
74.5	30.0	0.75	6.55
99.5	33.0	1.00	7.19
149.2	39.0	1.50	8.45
198.9	43.5	2.00	9.38
248.6	49.0	2.50	10.51
298.3	55.0	3.00	11.74
348.0	60.0	3.50	12.74
397.7	67.0	4.00	14.15
447.4	74.0	4.50	15.55
497.1	79.0	5.00	16.51
596.6	89.0	6.00	18.41
696.1	99.0	7.00	20.26
795.6	106.5	8.00	21.56
895.1	113.0	9.00	22.62
994.6	122.0	10.00	24.16
1094.1	130.0	11.00	25.46
1193.6	139.0	12.00	26.91
1293.1	147.0	13.00	28.14
1392.6	151.0	14.00	28.57
1492.1	158.0	15.00	29.55
1591.6	163.0	16.00	30.13
1691.1	169.0	17.00	30.86
1790.6	176.0	18.00	31.75
1890.1	184.0	19.00	32.79
1989.6	189.0	20.00	33.27

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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UNDRAINED TRIAXIAL COMPRESSION (U)

SHEET 2 OF 2

FIGURE 30-2

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

FIGURES 31-1 to 33-3

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

	A	B	C
BOREHOLE NUMBER	85-5-2	85-5-2	85-5-2
SAMPLE NUMBER	13	13	13
SAMPLE DEPTH , m	9.94	10.07	10.19
SPECIMEN DIAMETER , cm	5.03	5.10	5.04
SPECIMEN HEIGHT , cm	10.12	10.15	10.16
WATER CONTENT BEFORE CONSOLIDATION %	20	20	21
CELL PRESSURE, kPa	330.7	600.1	930.8
BACK PRESSURE, kPa	130.9	199.8	130.9
PORE PRESSURE PARAMETER, B	0.97	0.98	0.97
CONSOLIDATION PRESSURE,Sc, kPa	199.8	400.3	799.9
VOLUME CHANGE CONSOLIDATION,Vc,cc	-6.0	-7.0	-10.3
WATER CONTENT AFTER CONSOLIDATION %	18	18	18
AVERAGE RATE OF STRAIN,%/hr	0.50	0.50	0.50
AVERAGE LOAD INCREMENT, kPa			
AVERAGE LOAD DURATION ,hr			
TIME TO FAILURE ,days	2	2	2
WATER CONTENT AFTER TEST %	18	18	18
MAX.DEVIATOR STRESS,(S1-S3),kPa	349.7	456.5	670.7
AXIAL STRAIN AT FAILURE,(S1-S3)max.%	11.9	6.5	9.2
MAX EFFECTIVE PRINCIPAL STRESS RATIO ,(S'1/S'3)max.%	3.4	3.2	3.2
AXIAL STRAIN AT (S'1/S'3)max.	3.5	6.5	8.0
PORE PRESSURE PARAMETER,Af	0.136	0.430	0.727
NATURAL WATER CONTENT ,w,%	19	19	20
LIQUID LIMIT, wl	30		
PLASTIC LIMIT, wp	19		
DRY UNIT WEIGHT, kn/m	18.06	17.79	17.35
FILTER DRAINS USED ,y/n	Y	y	y

SAMPLE DESCRIPTION 'A,brown fissured claye silt to silty clay some fine gravel
B,brown fissured clayey silt to silty clay some fine gravel
C,brown silty clay to clayey silt with some fine gravel

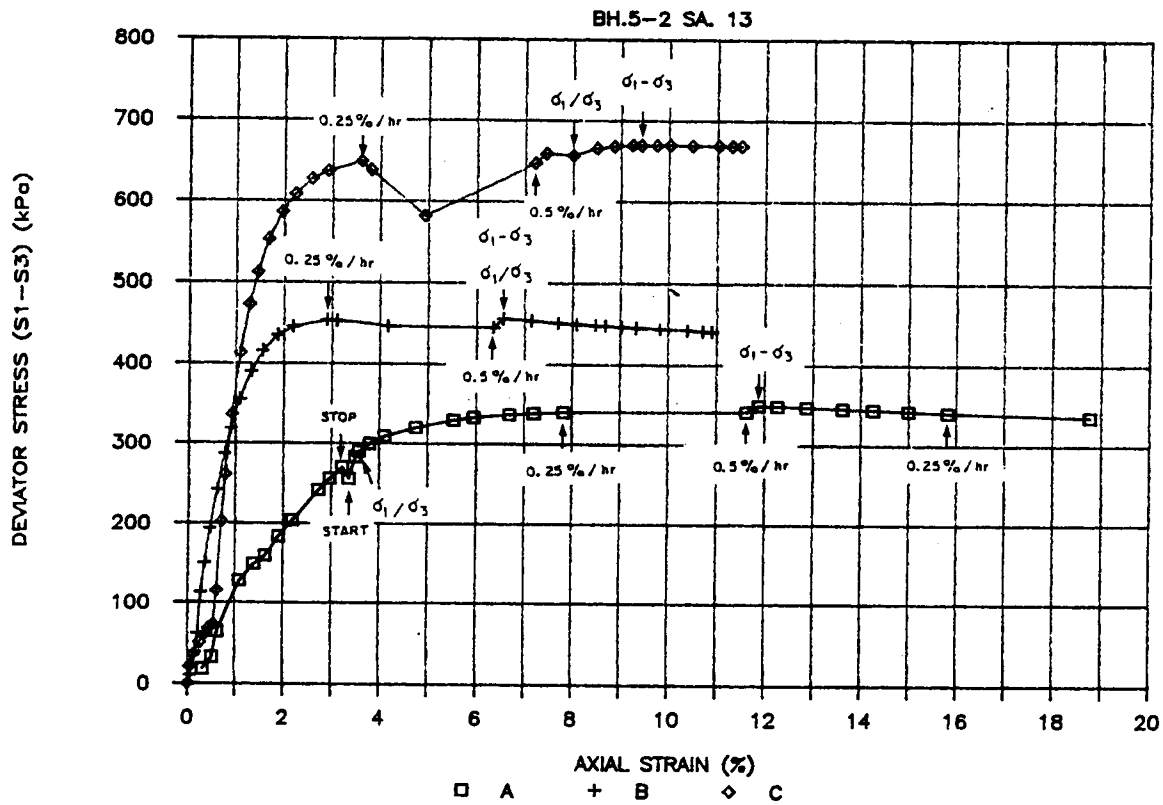
	A	B	C
RATE OF STRAIN,%/hr.CHANGED	n/a	n/a	n/a
AXIAL STRAIN,%,WHERE CHANGED	n/a	n/a	n/a
FAILURE PLANE NUMBER	n/a	n/a	n/a
ANGLE OF FAILURE, DEGREES	bulging	bulging	bulging
LAB. VANE PEAK STRENGTH (kPa)			
LAB.VANE RESIDUAL STRENGTH (kPa)			

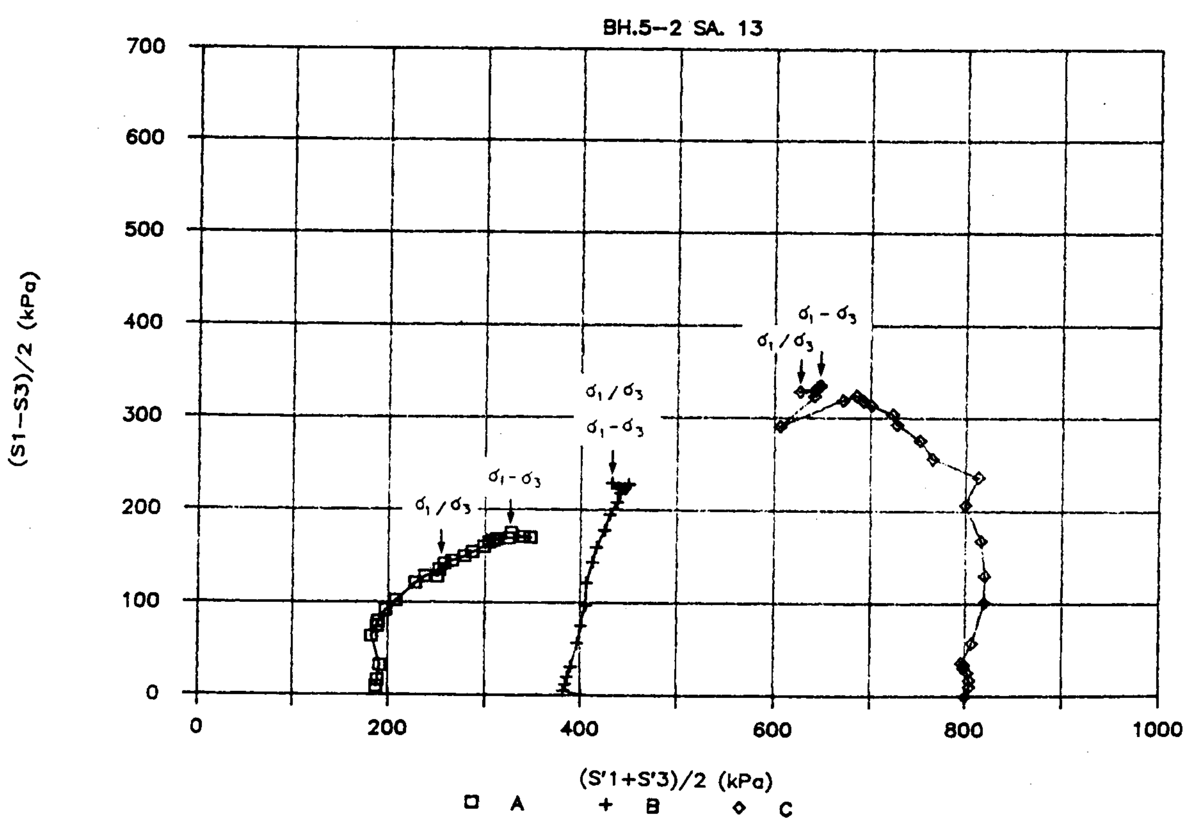
DATE March,1986
PROJECT NUMBER 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

SHEET 2 OF 3

FIGURE 31-2





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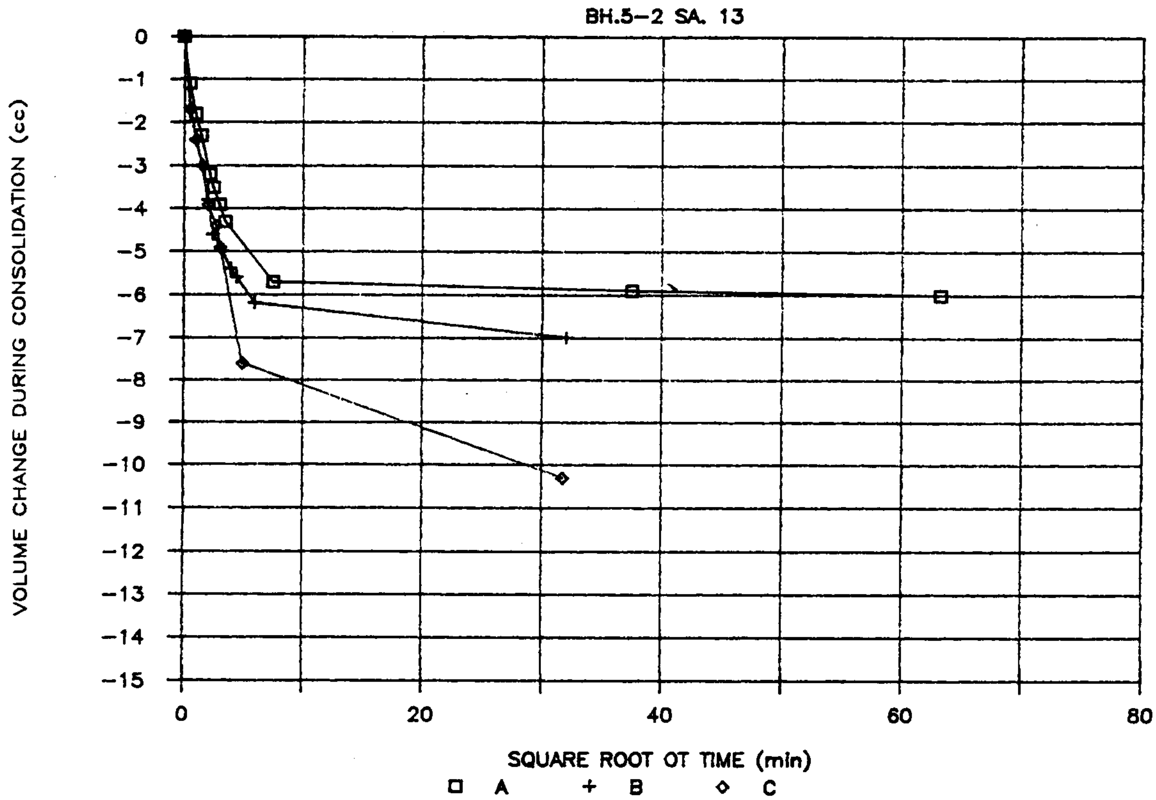
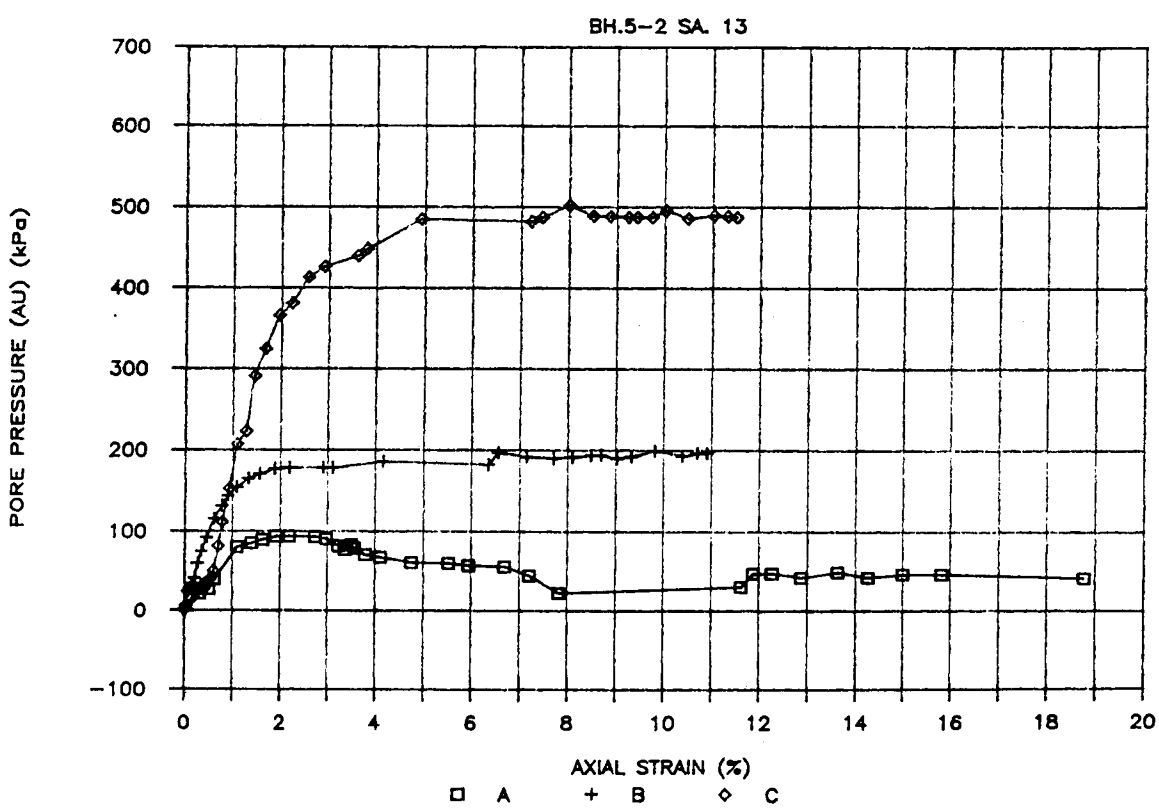
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

SHEET 3 OF 3

FIGURE 31-3





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CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

	A	B	C
BOREHOLE NUMBER	85-B-2	85-B-2	85-B-2
SAMPLE NUMBER	4	4	4
SAMPLE DEPTH , m	2.82	2.95	2.79
SPECIMEN DIAMETER , cm	5.01	5.05	5.00
SPECIMEN HEIGHT , cm	10.14	10.09	10.12
WATER CONTENT BEFORE CONSOLIDATION %	19	21	22
CELL PRESSURE , kPa	287.3	580.8	1026.6
BACK PRESSURE, kPa	62.0	130.9	130.9
PORE PRESSURE PARAMETER ,B	0.97	0.98	0.98
CONSOLIDATION PRESSURE,Sc, kPa	225.3	449.9	895.7
VOLUME CHANGE CONSOLIDATION,Vc,cc	-7.2	-4.4	-11.3
WATER CONTENT AFTER CONSOLIDATION %	17	20	19
AVERAGE RATE OF STRAIN,%/hr	0.50	0.50	0.50
AVERAGE LOAD INCREMENT, kPa			
AVERAGE LOAD DURATION ,hr			
TIME TO FAILURE ,days	2	2	1
WATER CONTENT AFTER TEST %	19	20	20
MAX.DEVIATOR STRESS,(S1-S3),kPa	643.6	946.8	971.1
AXIAL STRAIN AT FAILURE,(S1-S3)max.%	10.2	13.3	3.7
MAX EFFECTIVE PRINCIPAL STRESS RATIO ,(S'1/S'3)max.%	3.8	3.8	2.5
AXIAL STRAIN AT (S'1/S'3)max.	6.2	7.7	3.7
PORE PRESSURE PARAMETER,Af	-0.023	0.086	0.459
NATURAL WATER CONTENT ,w,%	19	20	21
LIQUID LIMIT, wl	35		
PLASTIC LIMIT, wp	17		
DRY UNIT WEIGHT, kN/m3	17.68	17.12	16.95
FILTER DRAINS USED ,y/n	Y	y	y

SAMPLE DESCRIPTION 'A,stiff brown silty clay to clayey silt, some gypsum pockets
B,same as sample A
C,same as sample A

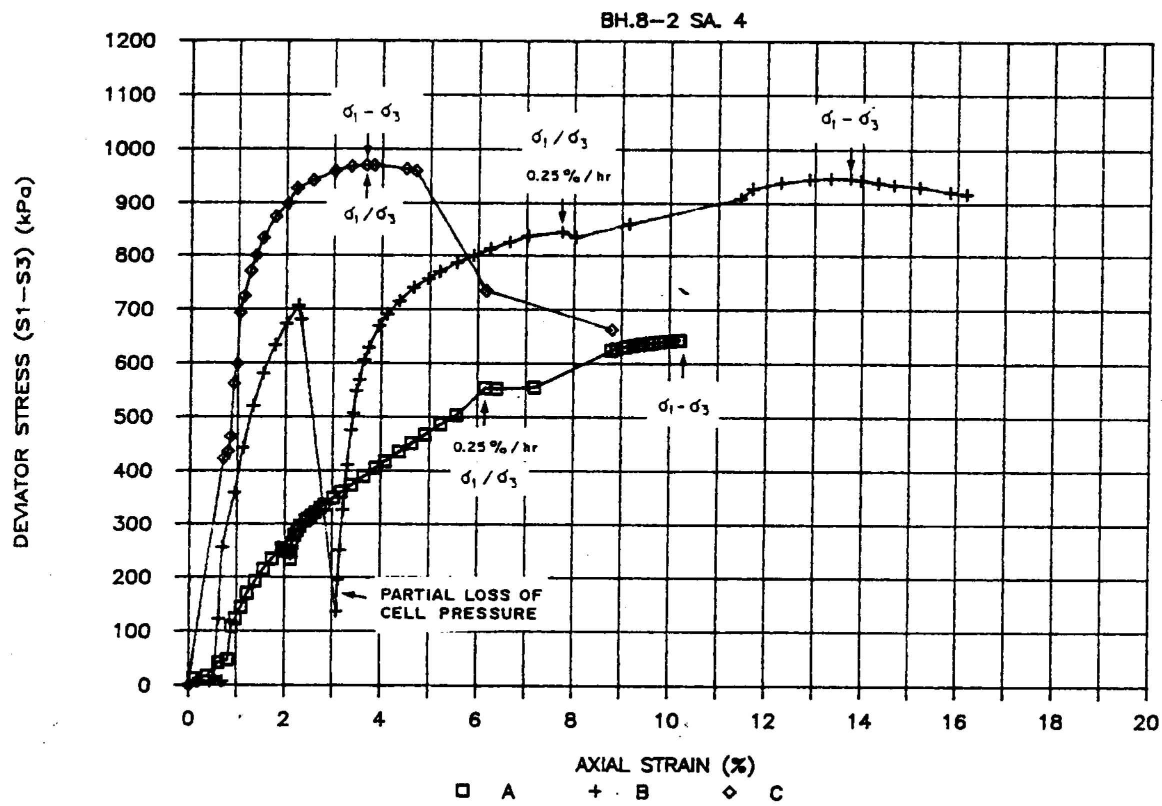
	A	B	C
RATE OF STRAIN,%/hr.CHANGED	n/a	n/a	n/a
AXIAL STRAIN,%,WHERE CHANGED	n/a	n/a	n/a
FAILURE PLANE NUMBER	n/a	n/a	n/a
ANGLE OF FAILURE, DEGREES	bulging	64	65
LAB. VANE PEAK STRENGTH (kPa)			
LAB.VANE RESIDUAL STRENGTH (kPa)			

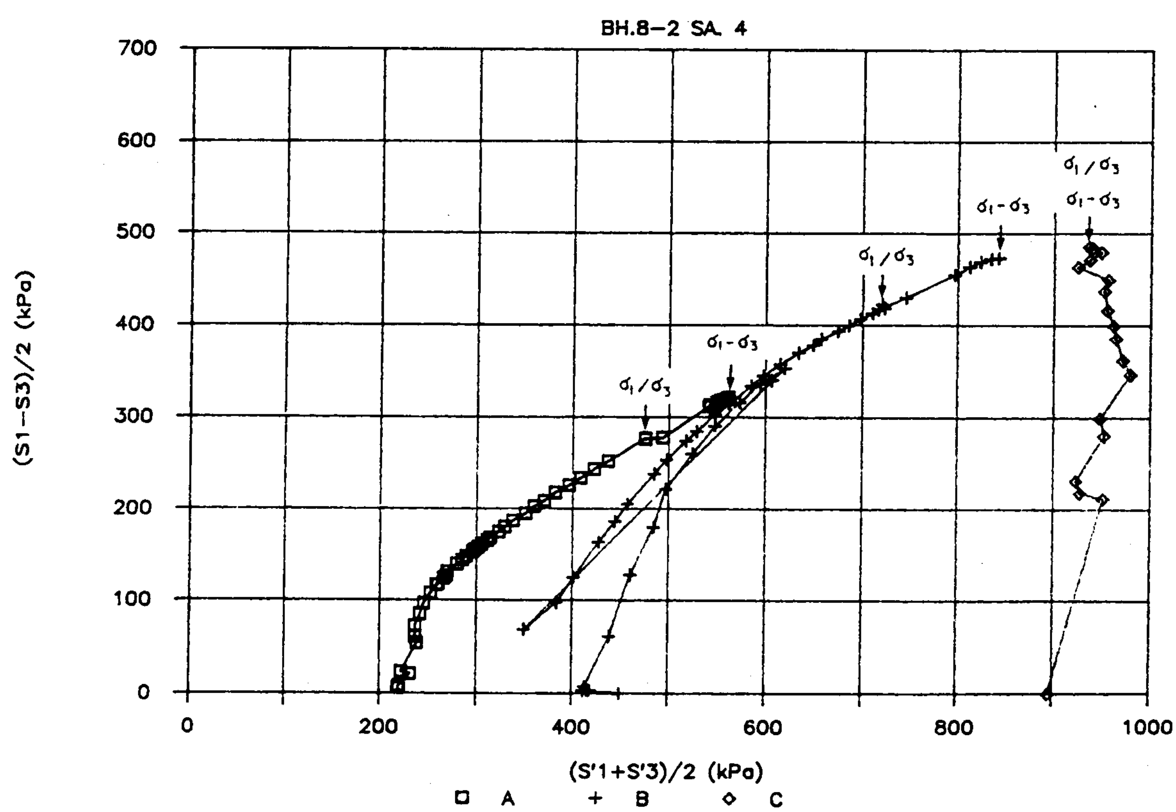
DATE March,1986
PROJECT NUMBER 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

SHEET 2 OF 3

FIGURE 32-2





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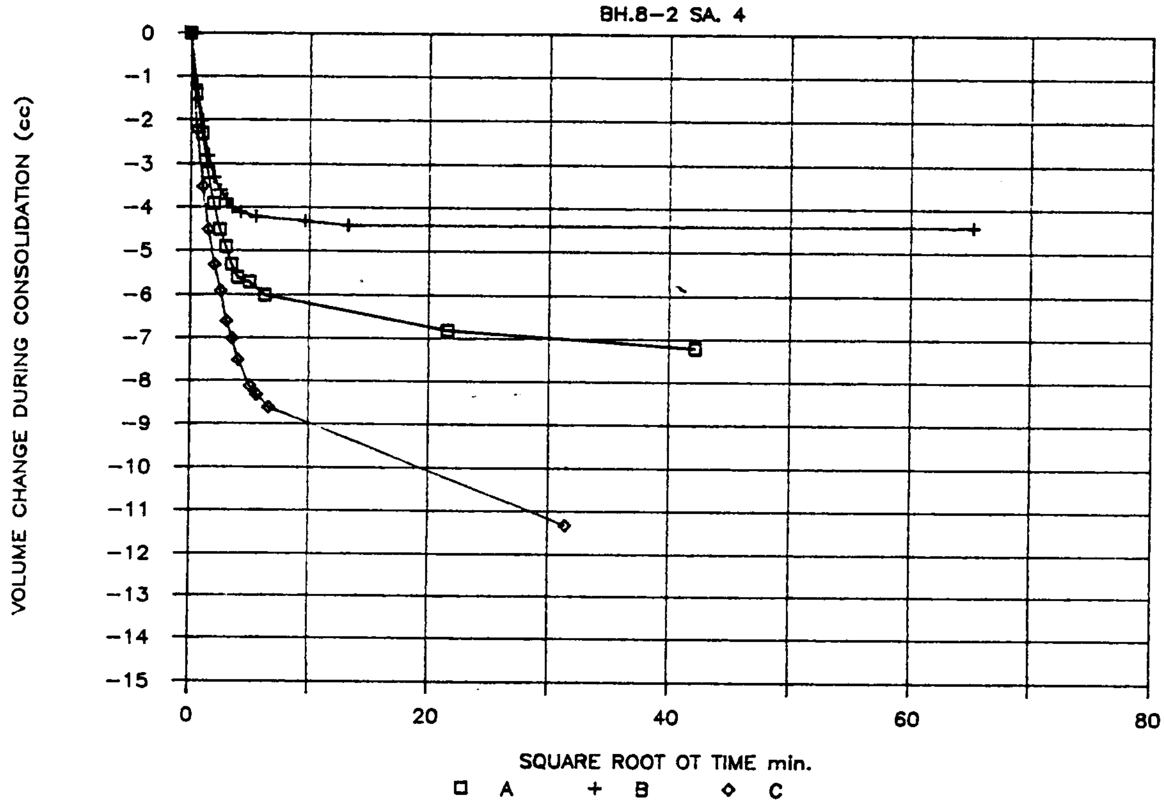
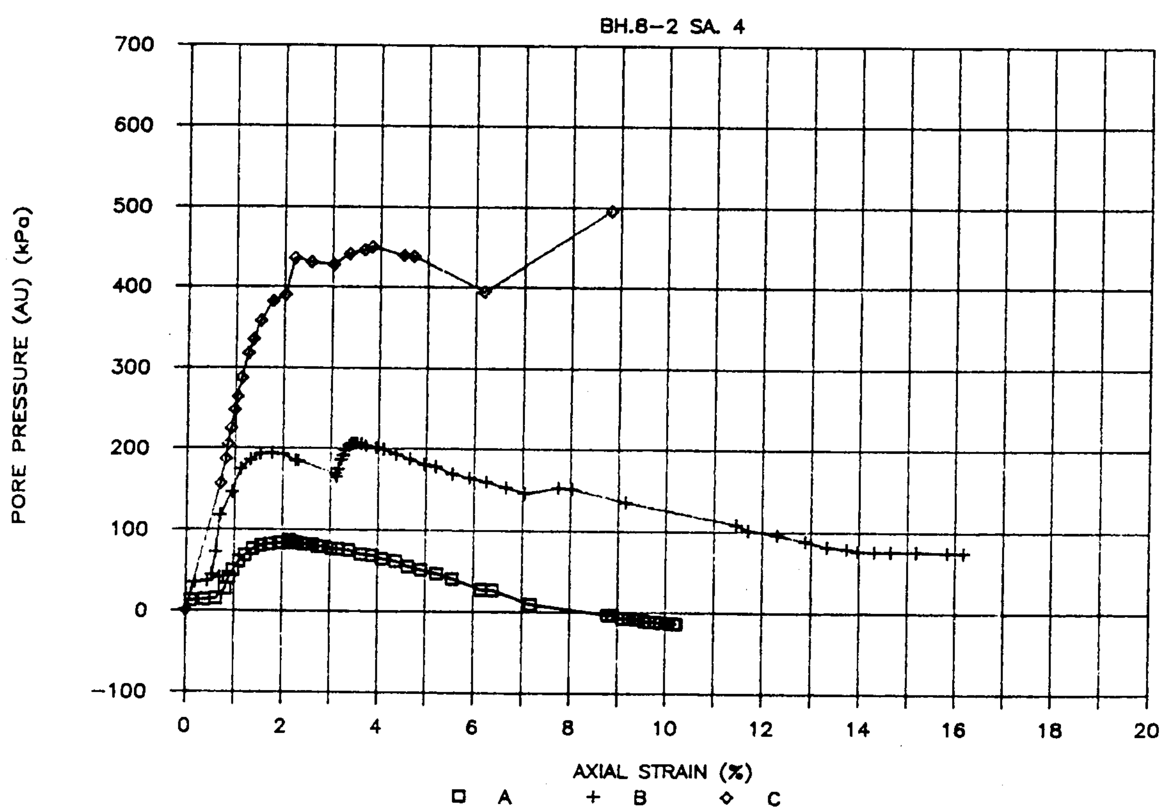
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

SHEET 3 OF 3

FIGURE 32-3





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CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 1 OF 3	FIGURE 33-1

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

	A	B	C
BOREHOLE NUMBER	85-8-2	85-8-2	85-8-2
SAMPLE NUMBER	22	22	22
SAMPLE DEPTH , m	23.77	23.90	24.02
SPECIMEN DIAMETER , cm	4.99	5.00	5.04
SPECIMEN HEIGHT , cm	10.17	10.19	10.12
WATER CONTENT BEFORE CONSOLIDATION %	35	27	30
CELL PRESSURE , kPa	381.0	599.4	711.7
BACK PRESSURE, kPa	130.9	199.8	62.0
PORE PRESSURE PARAMETER ,B	0.97	0.96	0.98
CONSOLIDATION PRESSURE,Sc, kPa	250.1	399.6	649.7
VOLUME CHANGE CONSOLIDATION,Vc,cc	-14.7	-14.9	-21.0
WATER CONTENT AFTER CONSOLIDATION %	30	22	23
AVERAGE RATE OF STRAIN,%/hr	0.50	0.50	0.50
AVERAGE LOAD INCREMENT, kPa			
AVERAGE LOAD DURATION ,hr			
TIME TO FAILURE ,days	2	2	2
WATER CONTENT AFTER TEST %	30	22	24
MAX.DEVIATOR STRESS,(S1-S3),kPa	190.3	309.6	400.9
AXIAL STRAIN AT FAILURE,(S1-S3)max.%	8.2	9.0	6.9
MAX EFFECTIVE PRINCIPAL STRESS RATIO ,(S'1/S'3)max.%	3.1	3.3	2.8
AXIAL STRAIN AT (S'1/S'3)max.	6.9	9.0	6.9
PORE PRESSURE PARAMETER,Af	0.829	0.863	1.057
NATURAL WATER CONTENT ,w,%	33	22	28
LIQUID LIMIT, wl		32	
PLASTIC LIMIT, wp		15	
DRY UNIT WEIGHT, kN/m3	14.54	15.92	15.38
FILTER DRAINS USED ,y/n	Y	y	y

SAMPLE DESCRIPTION 'A,irregular layered red grey silty clay to clayey silt
B,same as sample A
C,same as sample A

	A	B	C
RATE OF STRAIN,%/hr.CHANGED	n/a	n/a	n/a
AXIAL STRAIN,%,WHERE CHANGED	n/a	n/a	n/a
FAILURE PLANE NUMBER	n/a	n/a	n/a
ANGLE OF FAILURE, DEGREES	bulging	bulging	bulging
LAB. VANE PEAK STRENGTH (kPa)			
LAB.VANE RESIDUAL STRENGTH (kPa)			

DATE March,1986
PROJECT NUMBER 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

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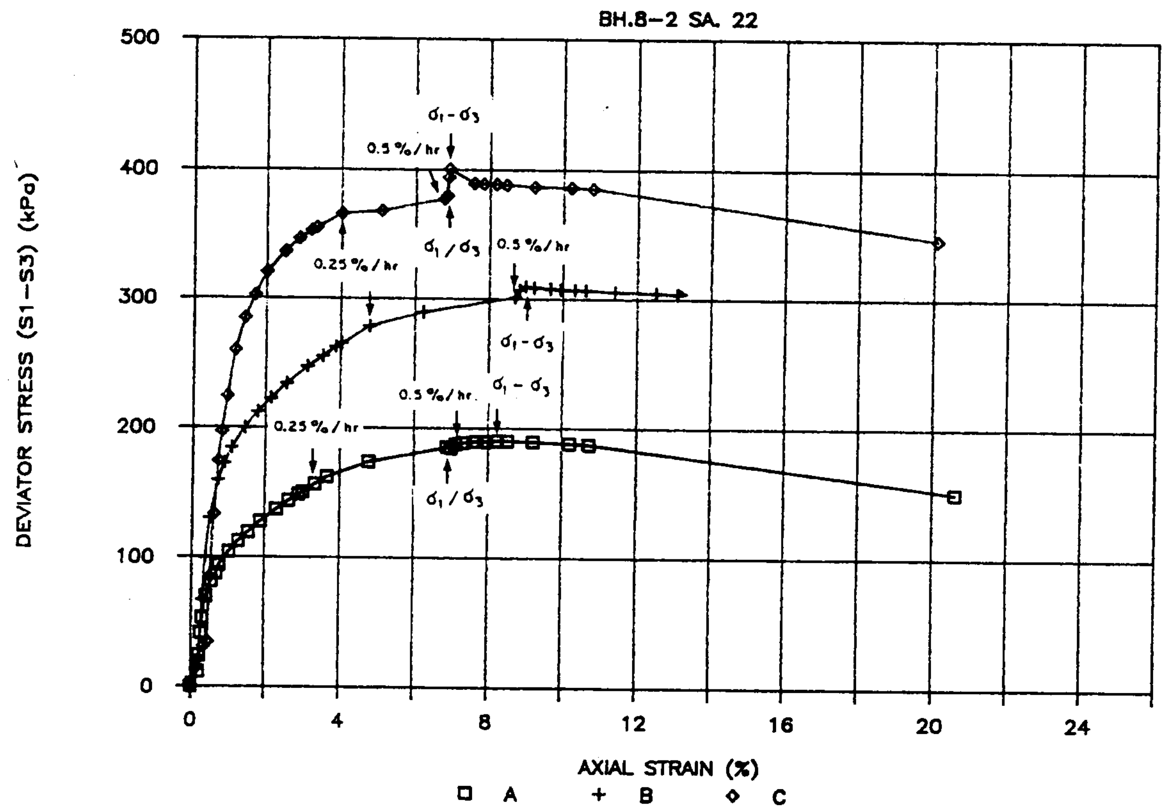
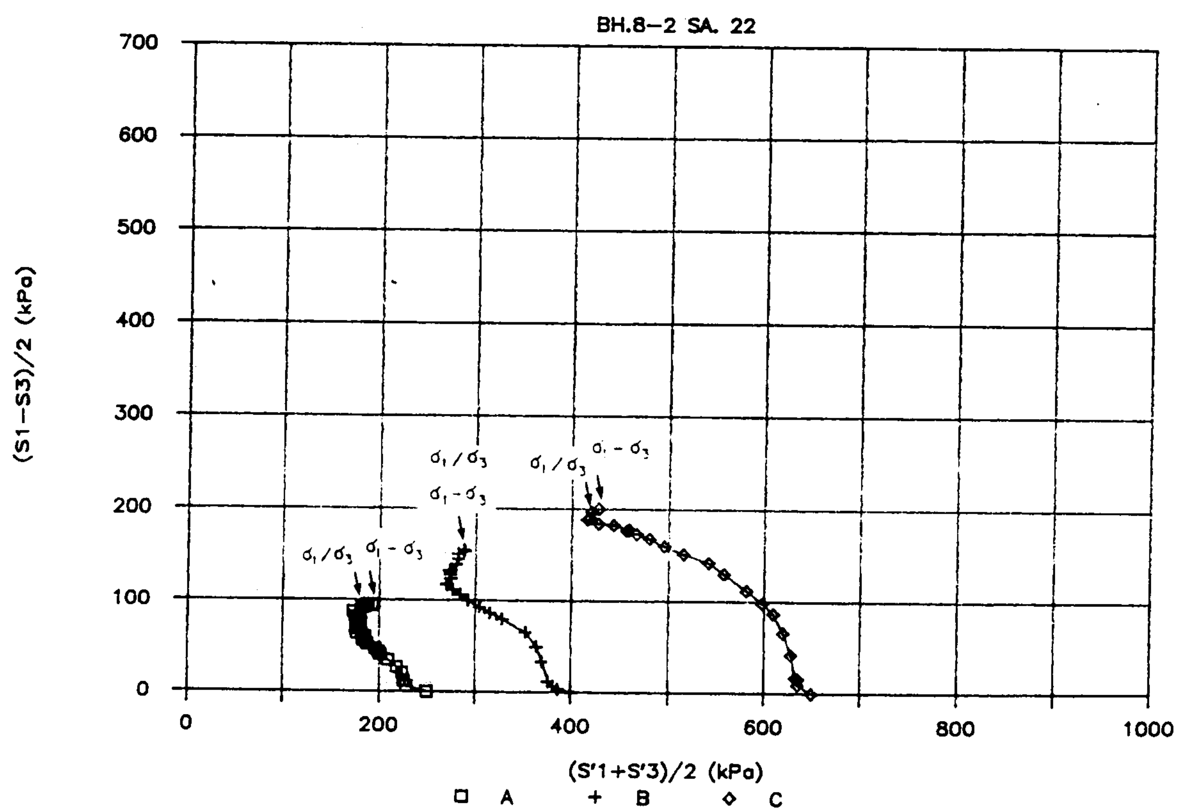
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

SHEET 2 OF 3

FIGURE 33-2





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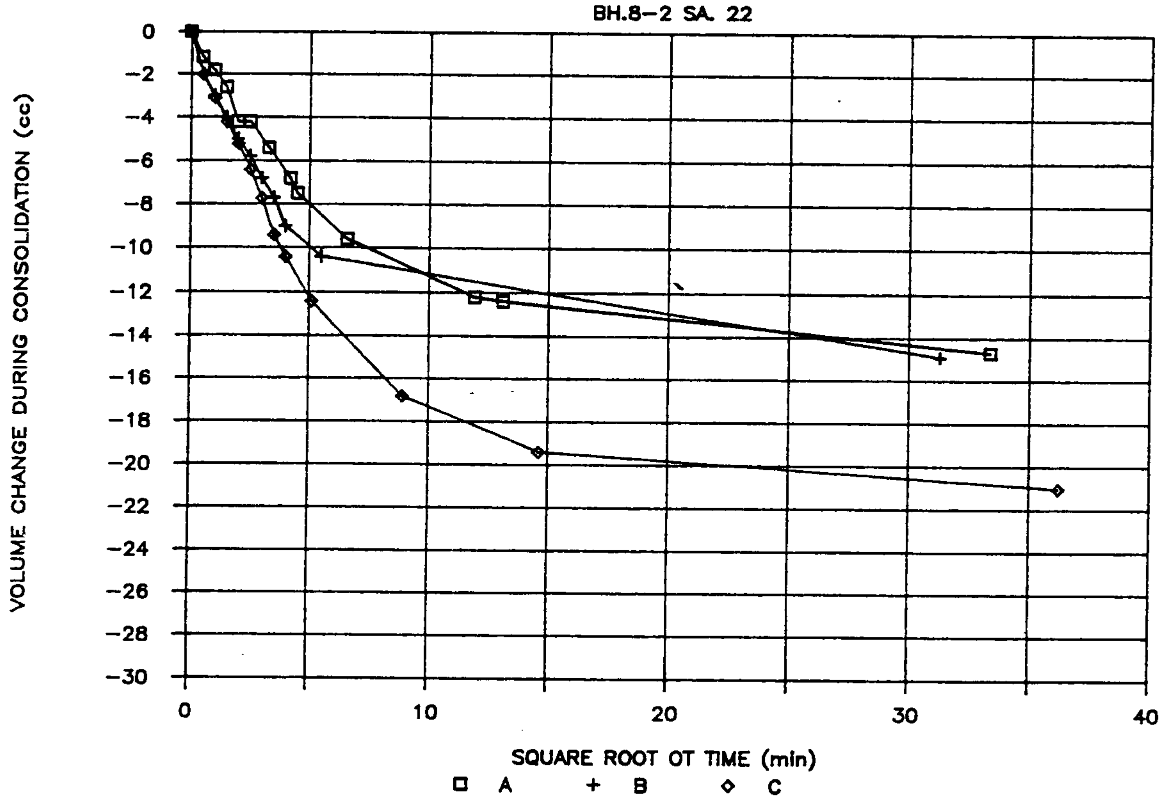
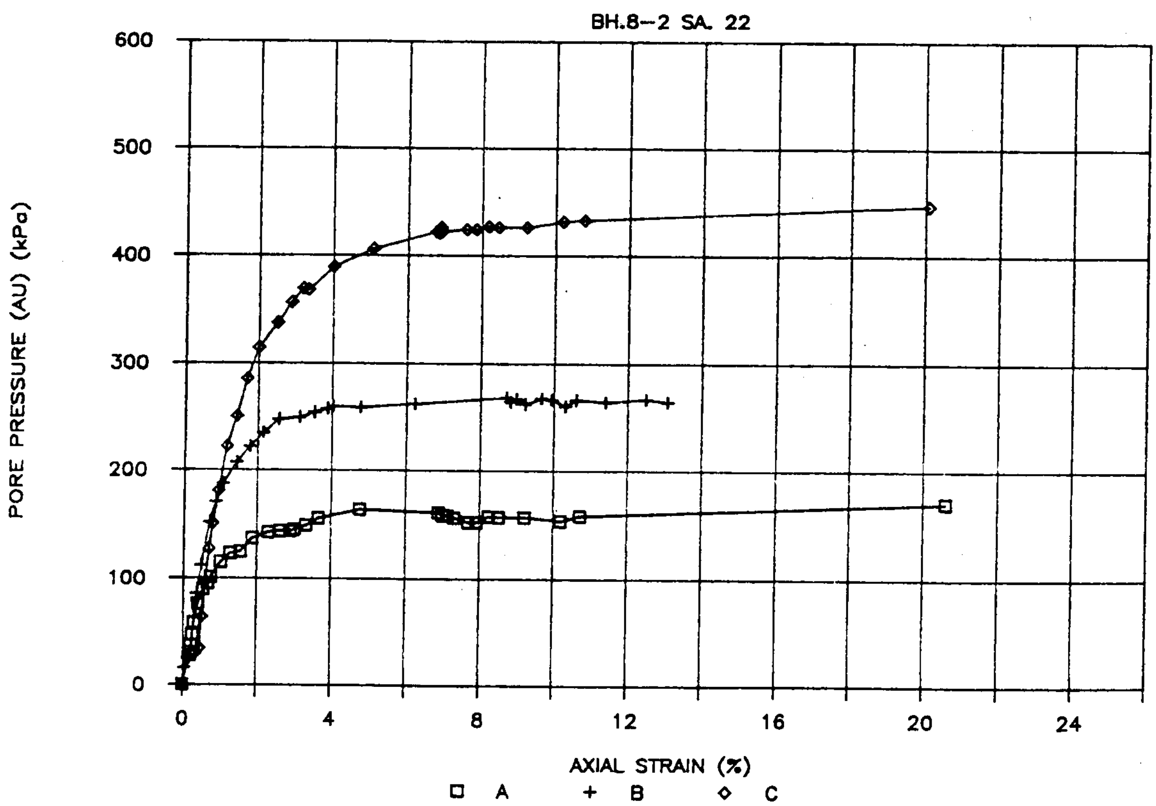
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 3 OF 3

FIGURE 33-3





Date _______________
Project _______________

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Data by __________
Checked by __________

CONSOLIDATED DRAINED DIRECT SHEAR TEST

FIGURES 34-1 to 39-3

CONSOLIDATED DRAINED DIRECT SHEAR TEST

CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-3-2	85-3-2	85-3-2
SAMPLE NUMBER	6	6	6
SAMPLE DEPTH, m	4.85	4.92	5.05
SAMPLE HEIGHT, mm	25.20	25.20	25.20
SAMPLE WIDTH, mm	59.50	59.65	59.65
WATER CONTENT, BEFORE CONSOLIDATION ,%	32	30	30
NORMAL (CONSOLIDATION) STRESS, kPa	300	599	1000
WATER CONTENT, SHEAR PLANE, %	32	33	31
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	128.1	194.4	350.6
RESIDUAL SHEAR STRESS, kPa, first pass			
second pass			
third pass			
HORIZONTAL DISPLACEMENT AT PEAK, mm	2.12	2.46	2.94
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass			
second pass			
third pass			
NATURAL WATER CONTENT, %	32	33	29
LIQUID LIMIT, wl	61		
PLASTIC LIMIT, wp	31		
UNIT WEIGHT, kN/m3	19.15	19.08	19.20

SAMPLE DESCRIPTION A, red silty clay with some fine gravel
B, same as sample A
C, same as sample A

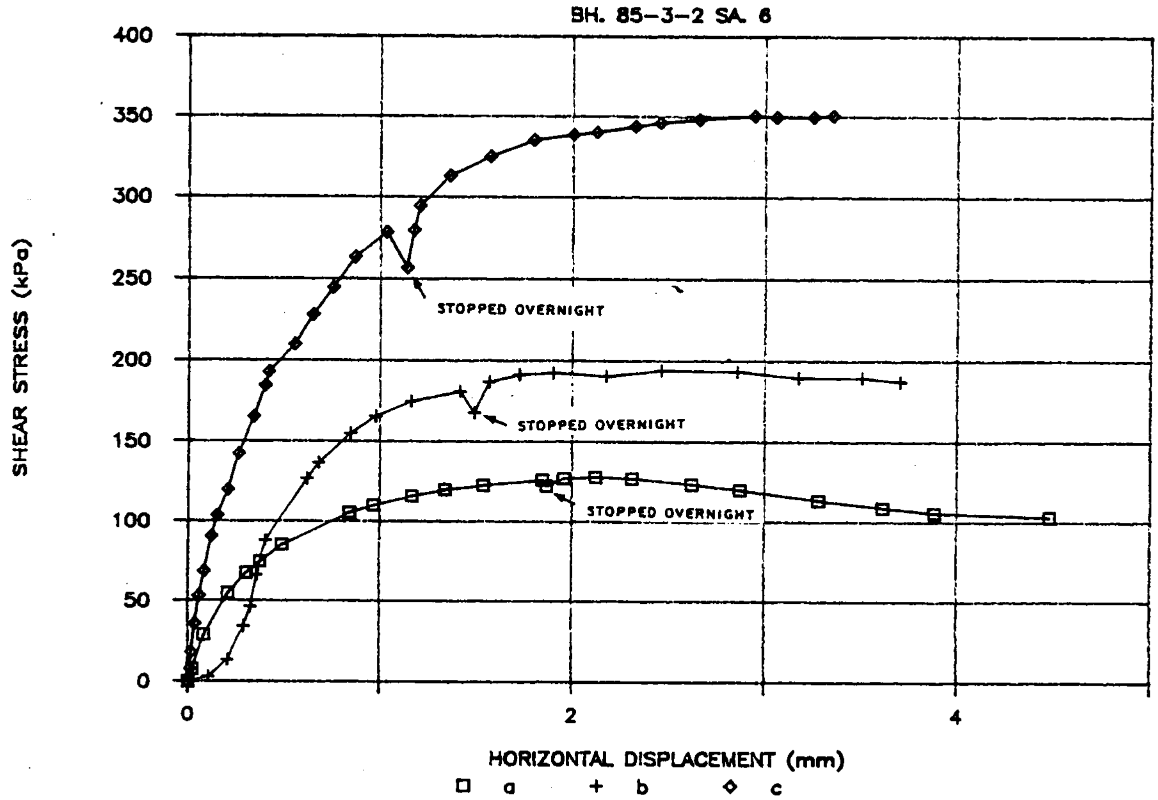
FAILURE PLANE MATERIAL as above description

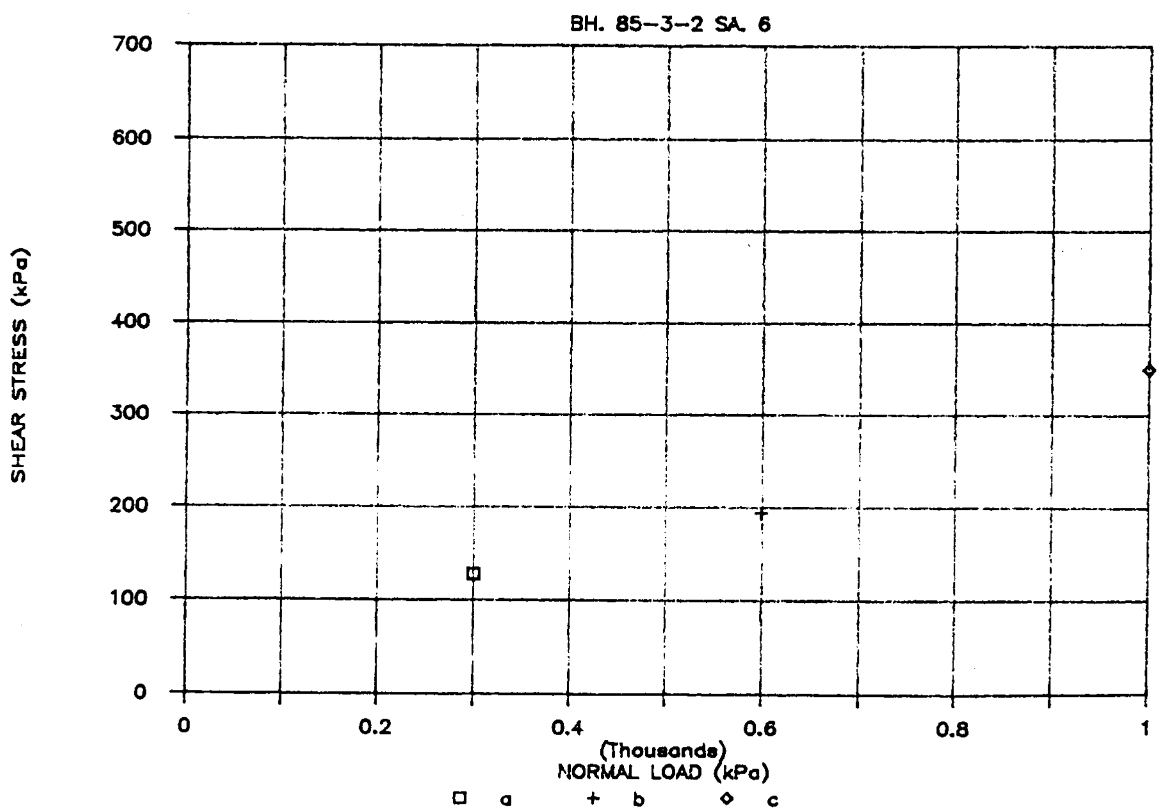
DATE March 1986
PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 2 OF 3

FIGURE 34-2





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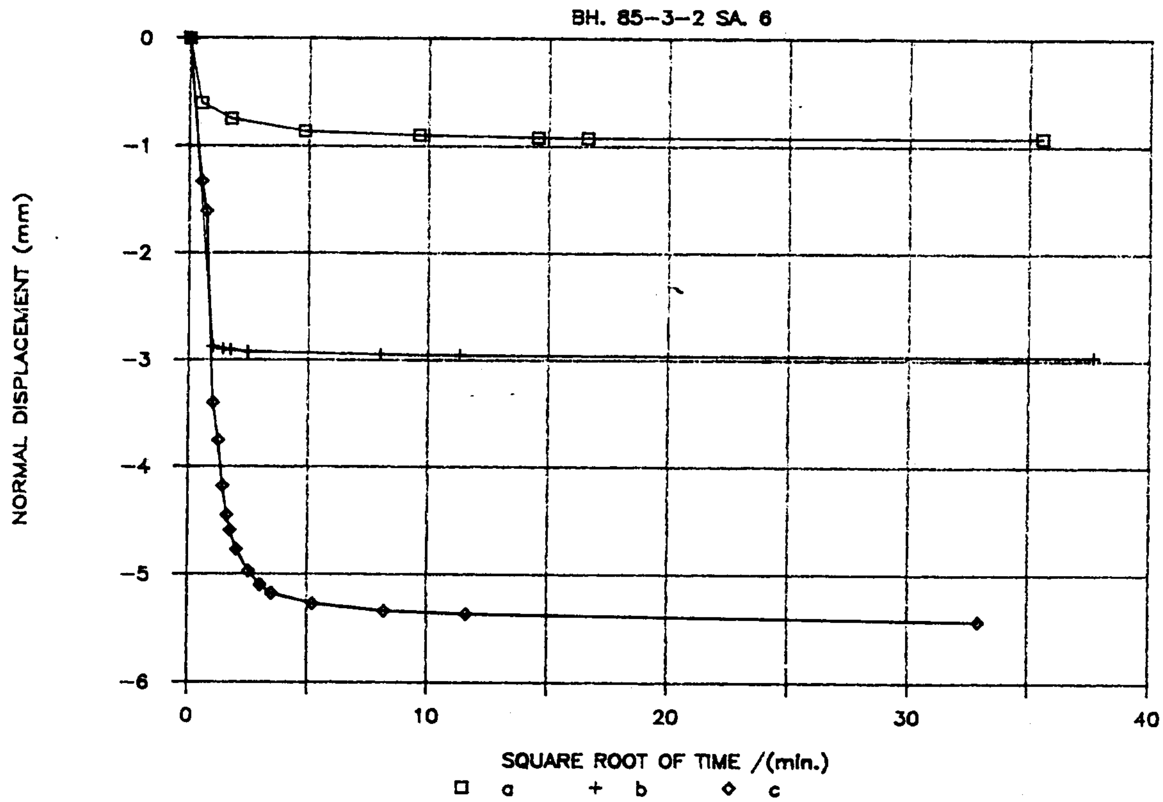
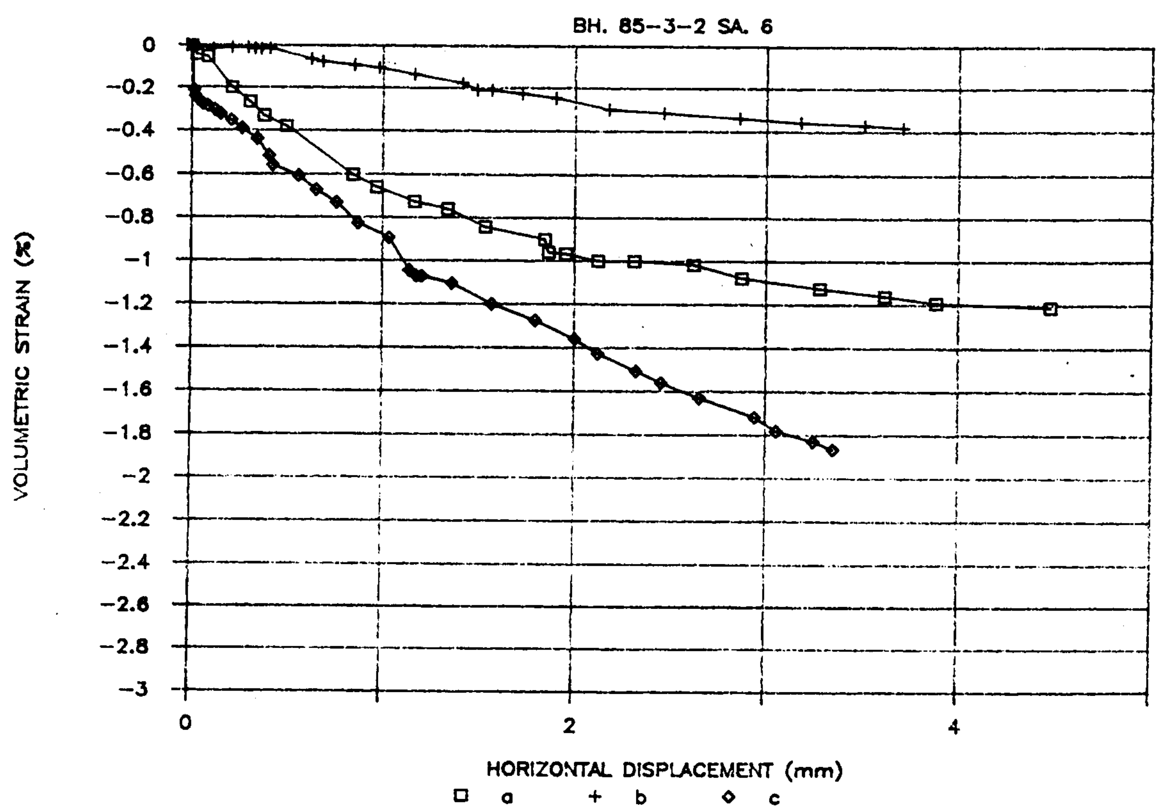
CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 3 OF 3

FIGURE 34-3





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CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 1 OF 3

FIGURE 35-1

CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-3-2	85-3-2	85-3-2
SAMPLE NUMBER	11	11	11
SAMPLE DEPTH, m	12.55	12.60	12.70
SAMPLE HEIGHT, mm	25.00	25.20	25.00
SAMPLE WIDTH, mm	59.50	59.50	59.50
WATER CONTENT,BEFORE CONSOLIDATION, %	21	19	21
NORMAL (CONSOLIDATION) STRESS, kPa	227	498	750
WATER CONTENT, SHEAR PLANE, %	21	18	18
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	48.9	242.6	315.6
RESIDUAL SHEAR STRESS, kPA, first pass	40.0	136.2	207.3
fifth pass	29.3	148.6	160.4
sixth pass	45.2	207.8	295.2
HORIZONTAL DISPLACEMENT AT PEAK, mm	4.21	7.28	4.23
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass	9.56	25.74	14.24
fifth pass	58.61	96.08	54.29
sixth pass	70.17	112.06	65.96
NATURAL WATER CONTENT, %	21	19	21
LIQUID LIMIT, wl			35
PLASTIC LIMIT, wp			18
UNIT WEIGHT, kN/m3	20.83	20.85	19.20

SAMPLE DESCRIPTION A,red silty clay with some fine gravel
B,same as sample A
C,same as sample A

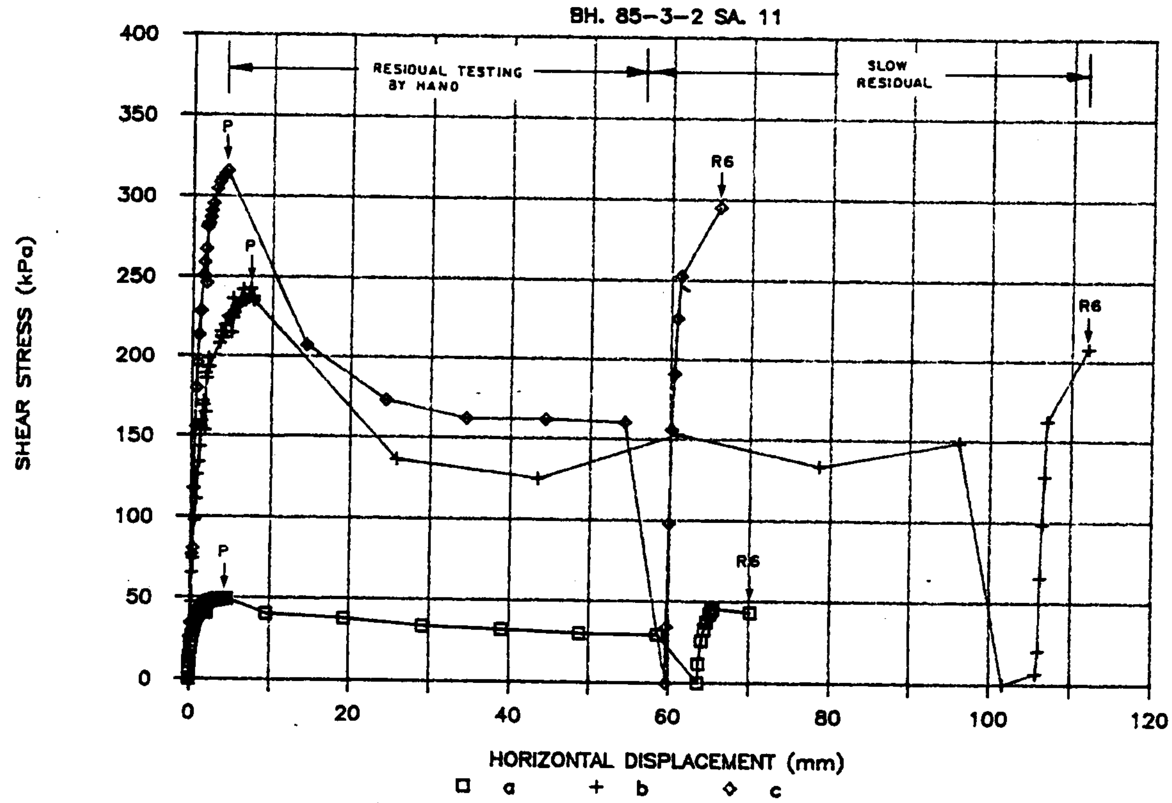
FAILURE PLANE MATERIAL (a) as above, gravel on failure plane

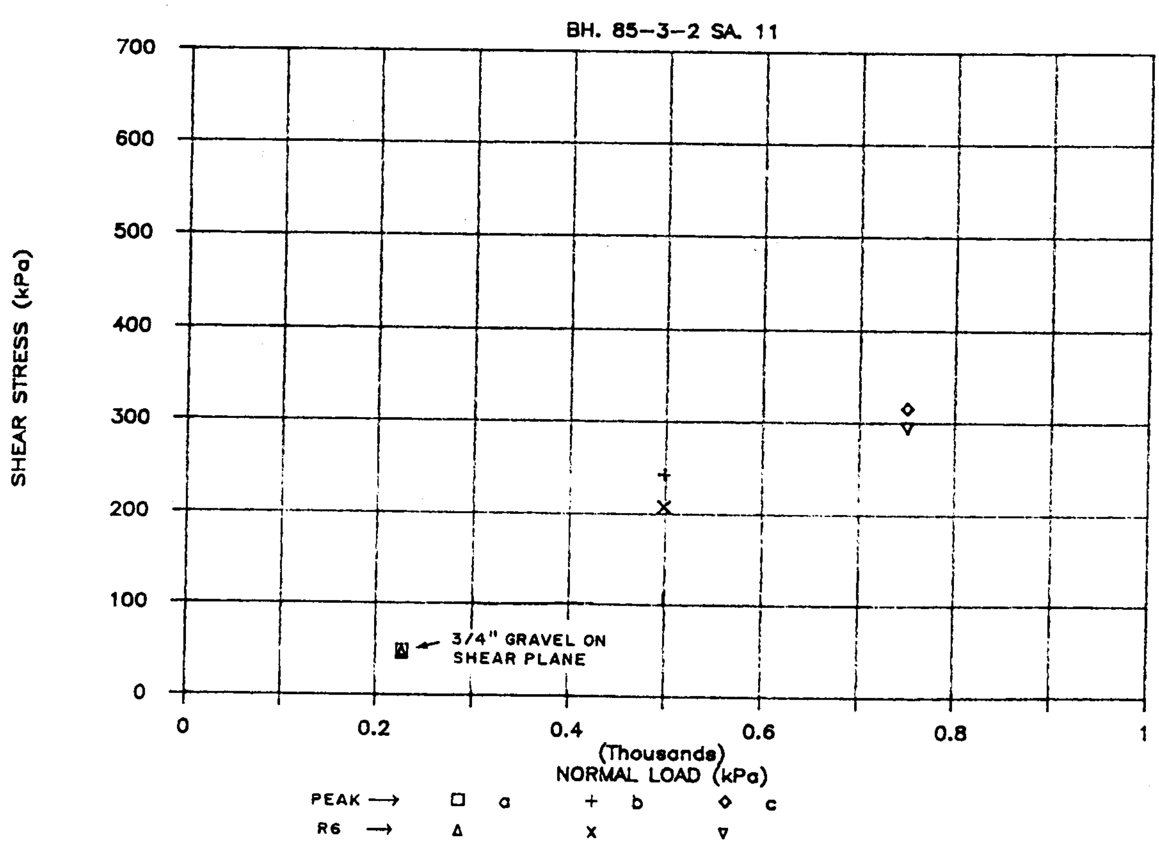
DATE March 1986
PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 2 OF 3

FIGURE 35-2





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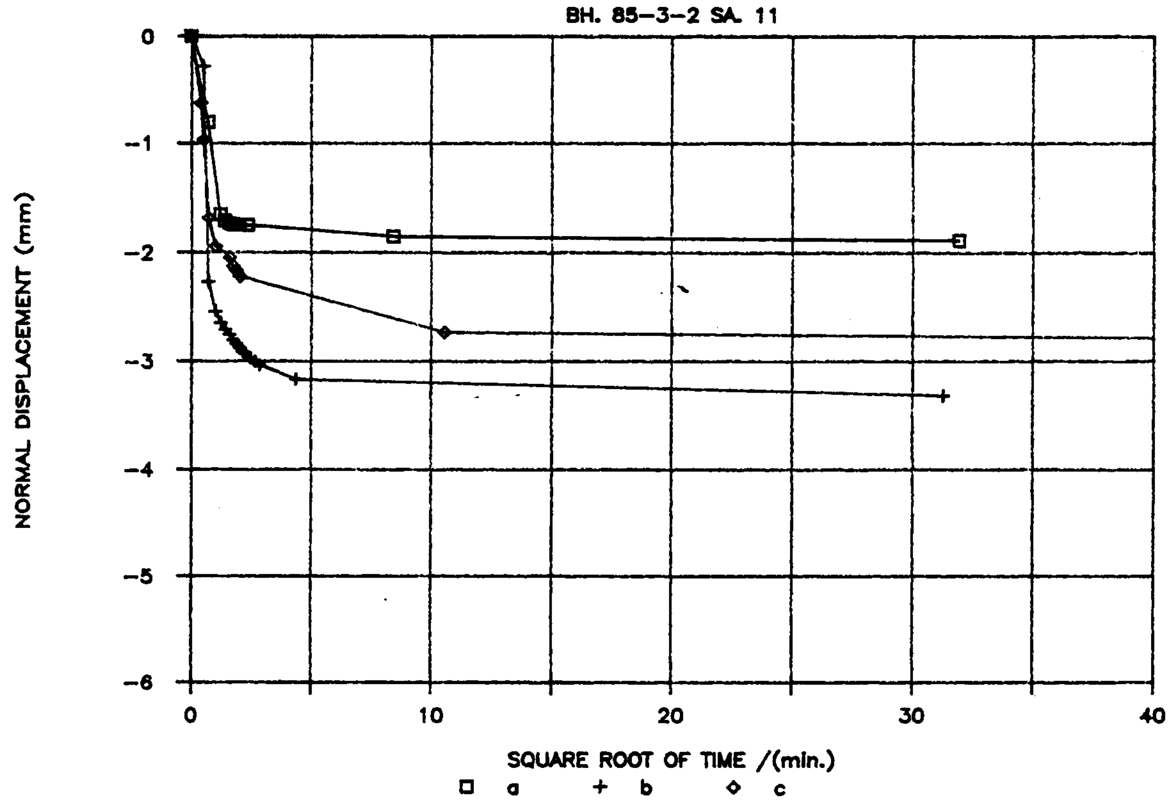
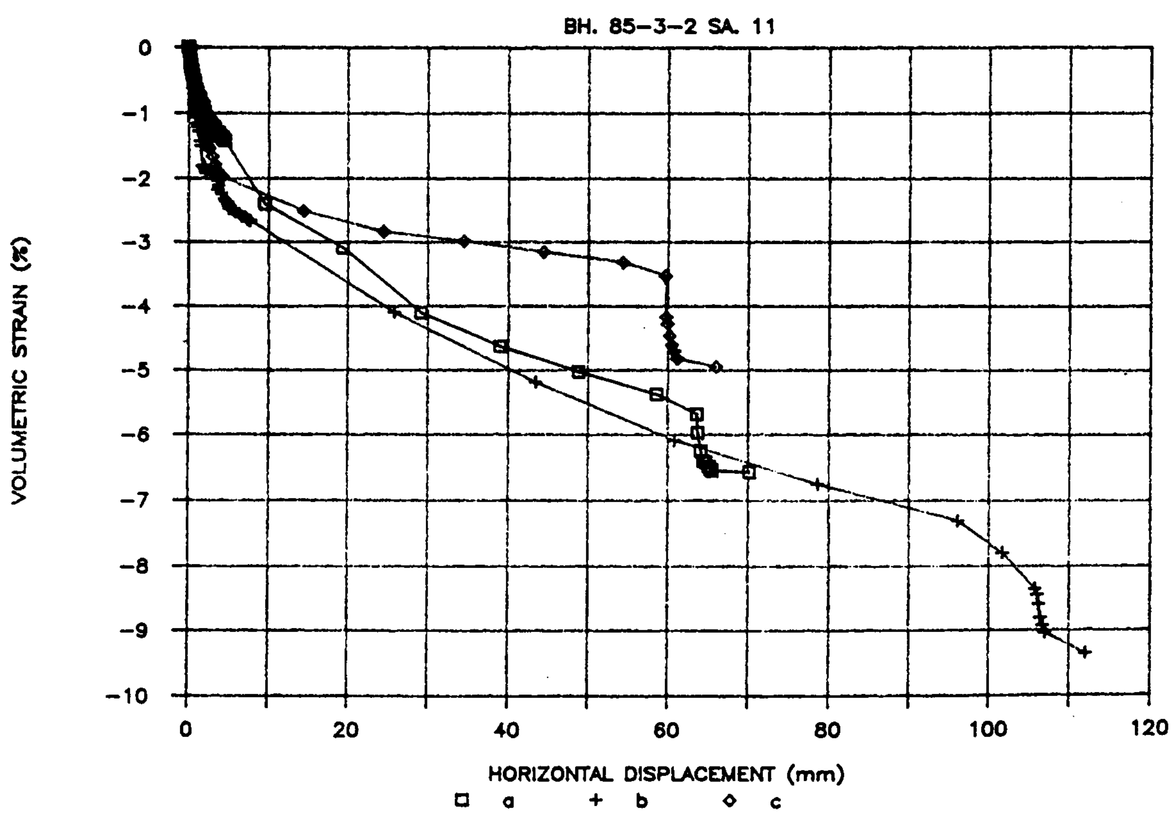
CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 3 OF 3

FIGURE 35-3





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CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 1 OF 3

FIGURE 36-1

CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-3-2	85-3-2	85-3-2
SAMPLE NUMBER	19	19	19
SAMPLE DEPTH, m	24.70	24.80	24.92
SAMPLE HEIGHT, mm	25.20	25.20	25.00
SAMPLE WIDTH, mm	59.50	59.50	59.50
WATER CONTENT, BEFORE CONSOLIDATION, %	26	24	26
NORMAL (CONSOLIDATION) STRESS, kPa	148	300	599
WATER CONTENT, SHEAR PLANE, %	29	25	30
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	57.4	116.2	220.0
RESIDUAL SHEAR STRESS, kPa, first pass	40.9	58.0	90.8
fifth pass	27.3	51.2	112.7
sixth pass	60.7	118.6	203.5
HORIZONTAL DISPLACEMENT AT PEAK, mm	2.12	2.46	2.94
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass	14.18	18.37	21.29
fifth pass	52.30	67.74	79.10
sixth pass	63.59	79.51	91.32
NATURAL WATER CONTENT, %	26	24	29
LIQUID LIMIT, wl	38		
PLASTIC LIMIT, wp	19		
UNIT WEIGHT, kN/m3	19.96	20.06	20.15

SAMPLE DESCRIPTION A,red fissured silty clay with some fine gravel
B,same as sample A
C,same as sample A

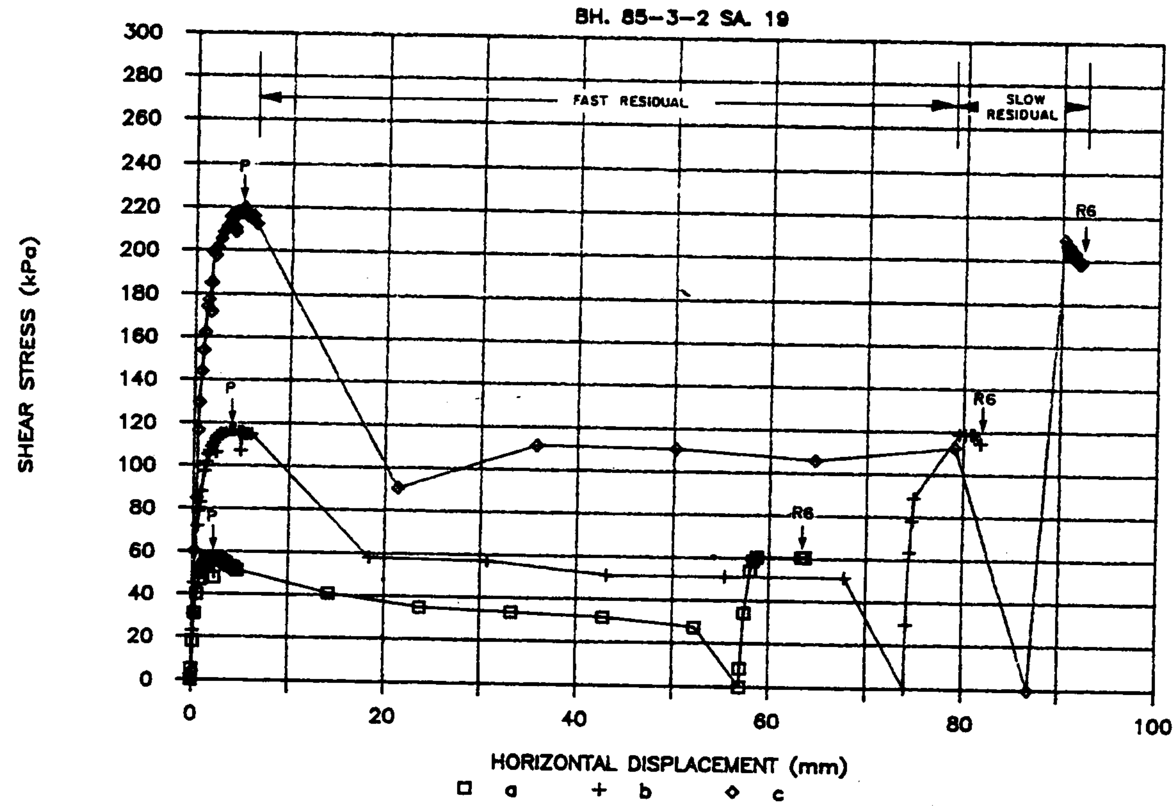
FAILURE PLANE MATERIAL as above description

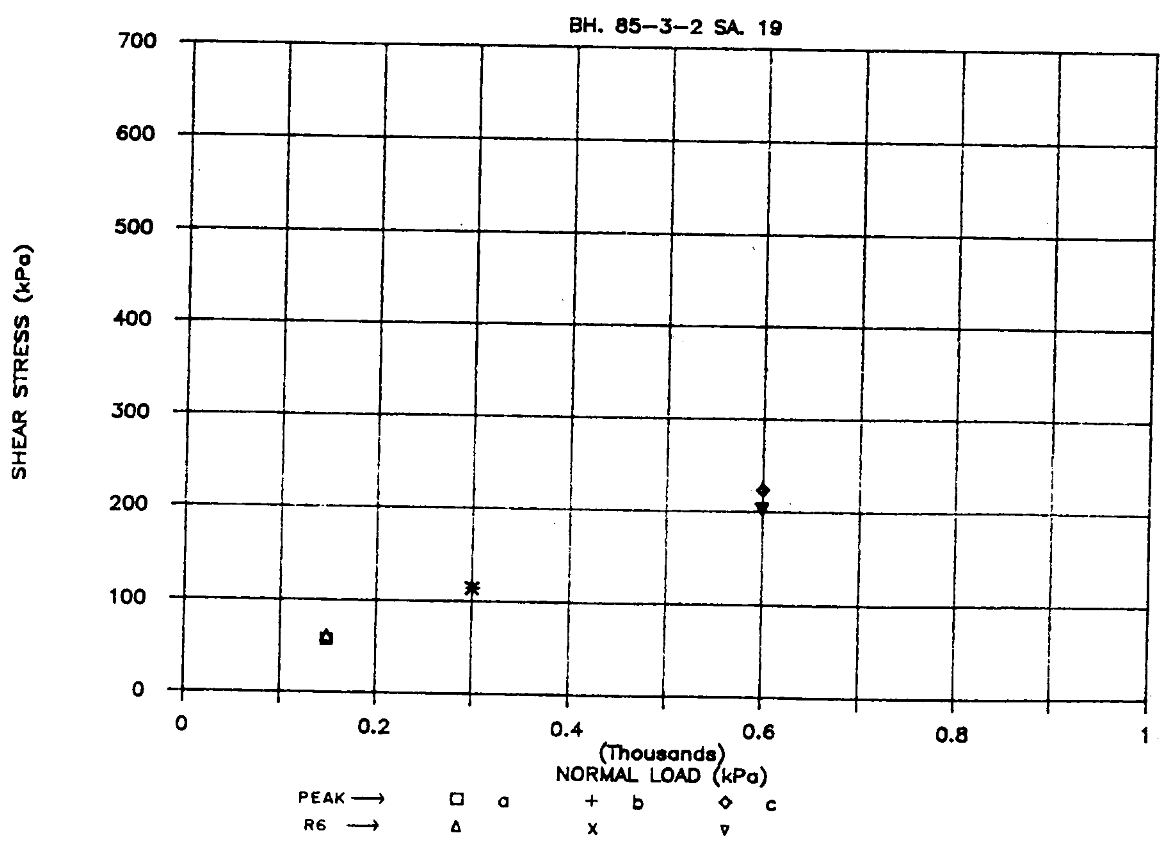
DATE March 1986
PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 2 OF 3

FIGURE 36-2





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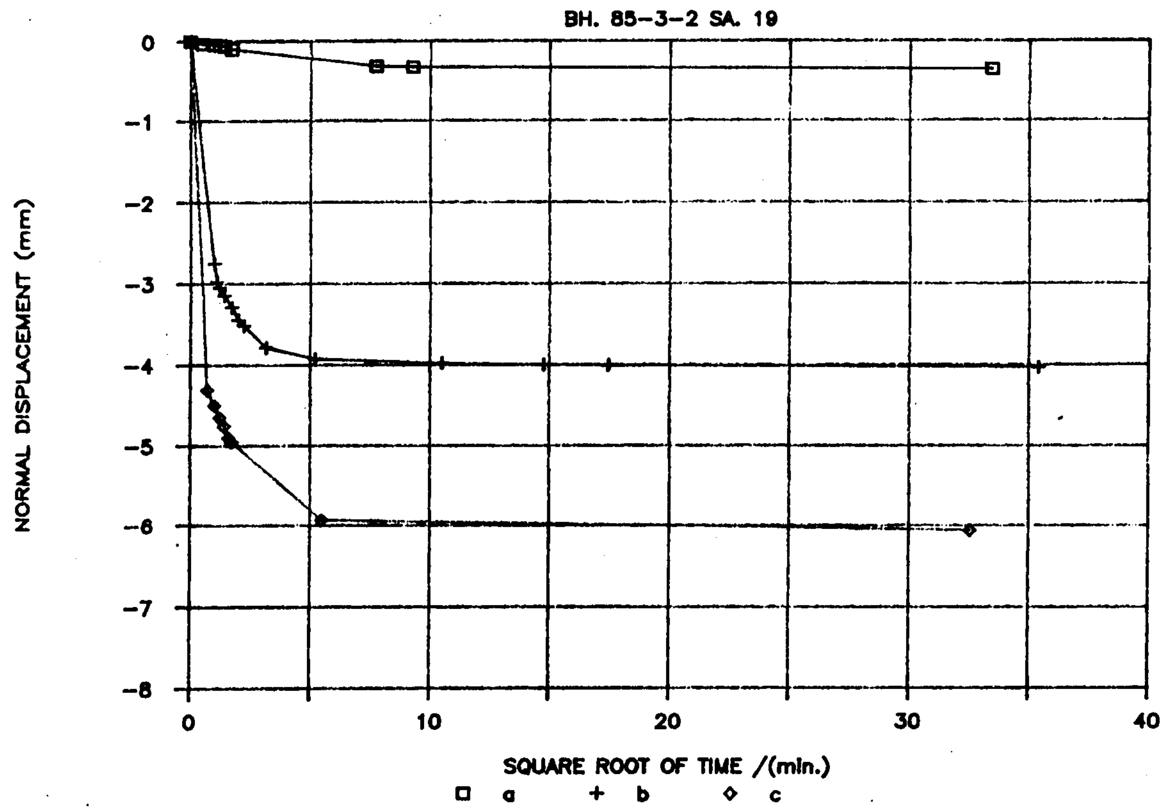
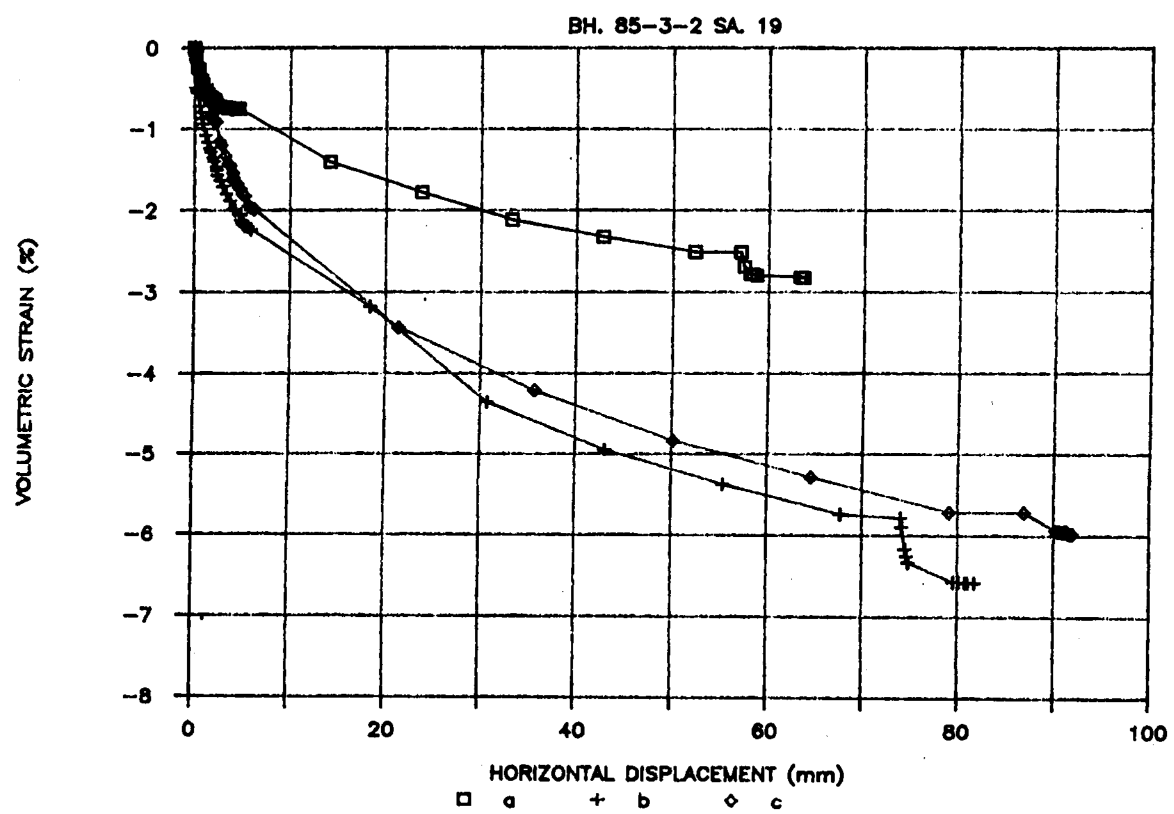
CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 3 OF 3

FIGURE 36-3





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CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 1 OF 3

FIGURE 37-1

CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-10-2	85-10-2	85-10-2
SAMPLE NUMBER	7	7	7
SAMPLE DEPTH, m	6.00	5.89	5.80
SAMPLE HEIGHT, mm	25.20	25.20	25.00
SAMPLE WIDTH, mm	59.50	59.50	59.50
WATER CONTENT,BEFORE CONSOLIDATION, %	19	19	19
NORMAL (CONSOLIDATION) STRESS, kPa	300	599	999
WATER CONTENT, SHEAR PLANE, %	26	22	23
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	139.1	234.8	397.4
RESIDUAL SHEAR STRESS, kPa,first pass	115.2	165.1	300.9
fifth pass	72.5	183.7	296.7
sixth pass	135.6	229.9	373.1
HORIZONTAL DISPLACEMENT AT PEAK, mm	3.58	6.42	4.60
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass	23.04	23.74	20.40
fifth pass	85.30	89.09	78.74
sixth pass	100.49	104.96	93.61
NATURAL WATER CONTENT, %	19	19	19
LIQUID LIMIT, wl			36
PLASTIC LIMIT, wp			19
UNIT WEIGHT, kN/m3	20.61	20.61	20.36

SAMPLE DESCRIPTION A,red fissured silty clay with trace fine gravel
B,same as sample A
C,same as sample A

FAILURE PLANE MATERIAL as above description

DATE April, 1986
PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

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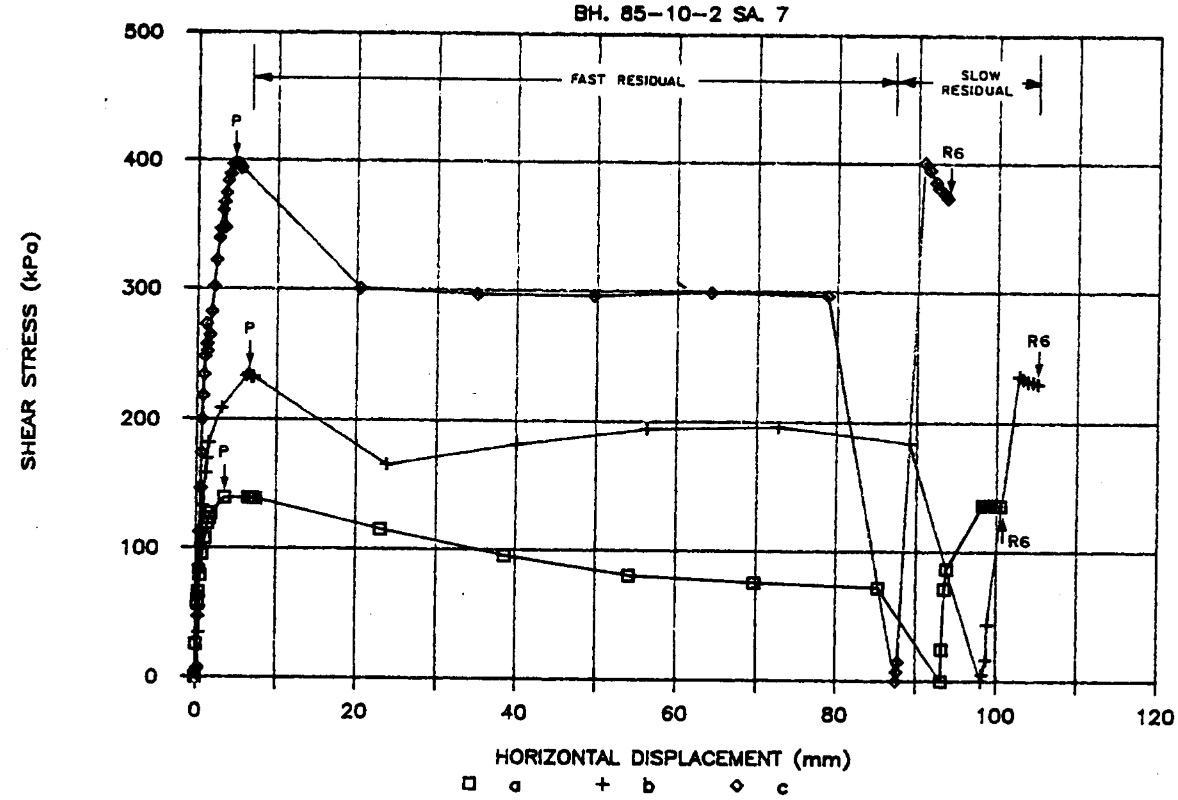
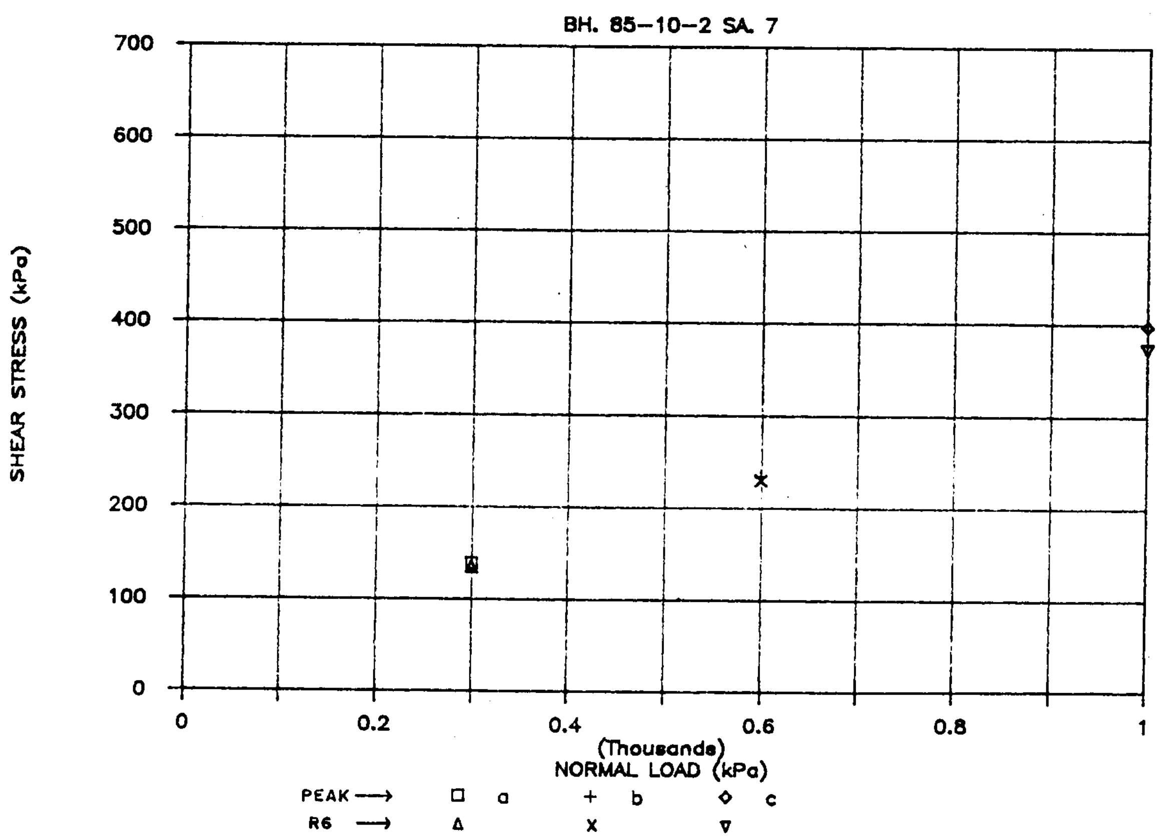
CONSOLIDATED DRAINED DIRECT SHEAR TEST SHEET 2 OF 3	FIGURE 37-2





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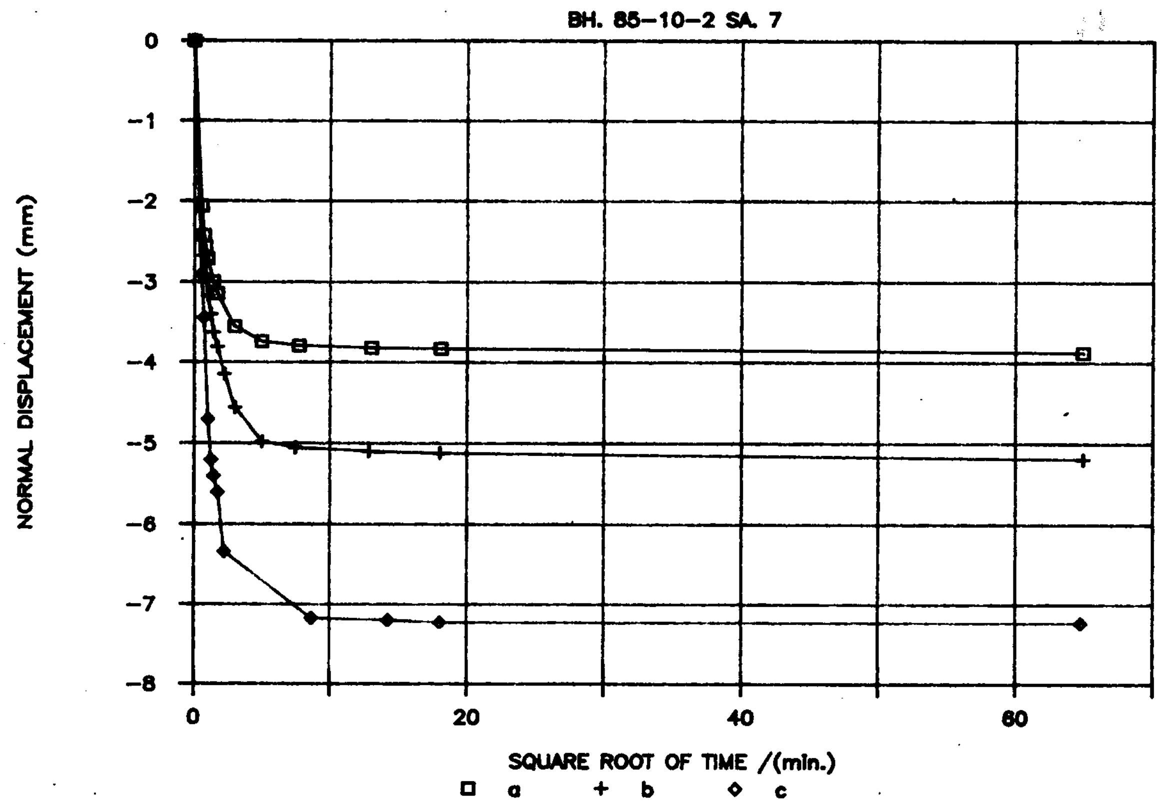
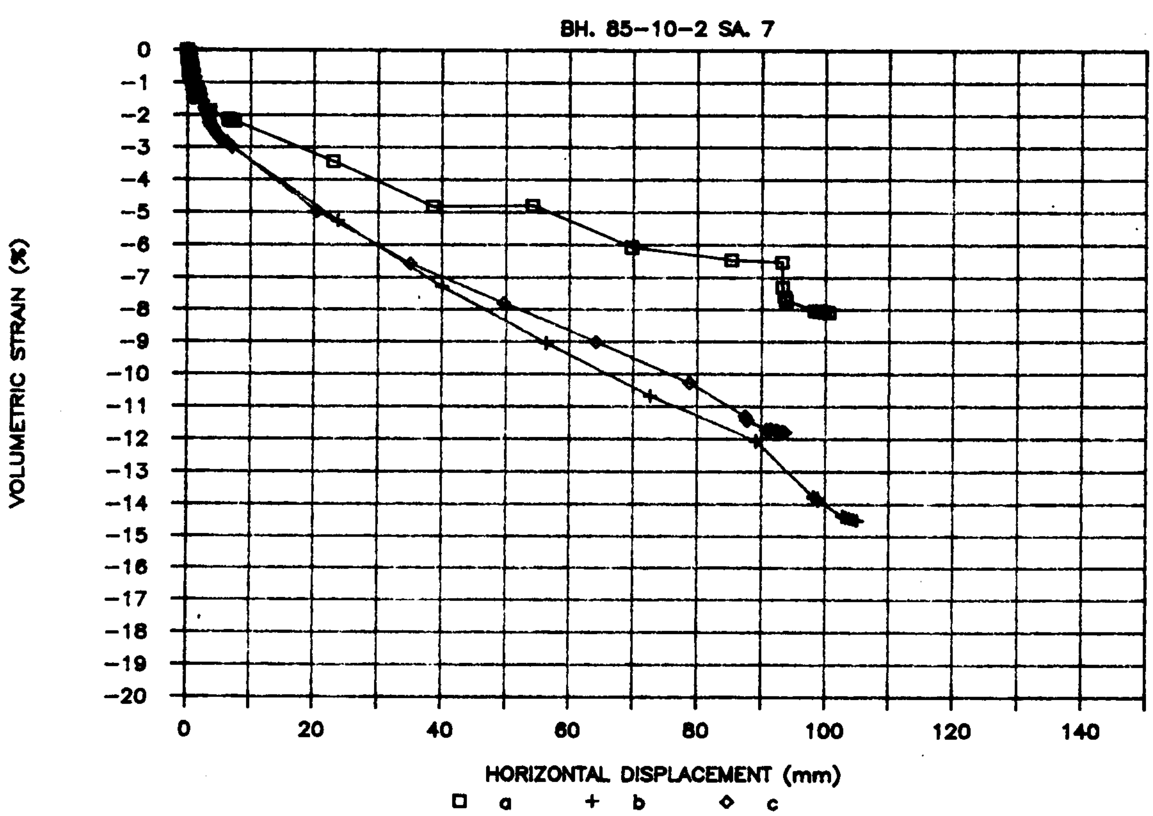
CONSOLIDATED DRAINED DIRECT SHEAR TEST SHEET 3 OF 3	FIGURE 37-3





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CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-10-2	85-10-2	85-10-2
SAMPLE NUMBER	20	20	20
SAMPLE DEPTH, m	20.84	20.77	20.65
SAMPLE HEIGHT, mm	25.20	25.20	25.00
SAMPLE WIDTH, mm	59.50	59.50	59.50
WATER CONTENT, BEFORE CONSOLIDATION, %	18	18	17
NORMAL (CONSOLIDATION) STRESS, kPa	199	400	650
WATER CONTENT, SHEAR PLANE, %	16	17	21
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	112.9	222.7	400.5
RESIDUAL SHEAR STRESS, kPa, first pass	74.2	149.3	325.6
fifth pass	78.5	179.2	344.6
sixth pass	120.3	226.1	336.8
HORIZONTAL DISPLACEMENT AT PEAK, mm	7.12	6.40	7.09
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass	22.00	22.45	23.30
fifth pass	81.11	83.18	87.42
sixth pass	95.15	97.84	103.39
NATURAL WATER CONTENT, %	18	18	17
LIQUID LIMIT, wl		25	
PLASTIC LIMIT, wp		10	
UNIT WEIGHT, kN/m3	21.21	20.82	21.21

SAMPLE DESCRIPTION A, red fissured silty clay with trace fine gravel
B, same as sample A
C, same as sample A

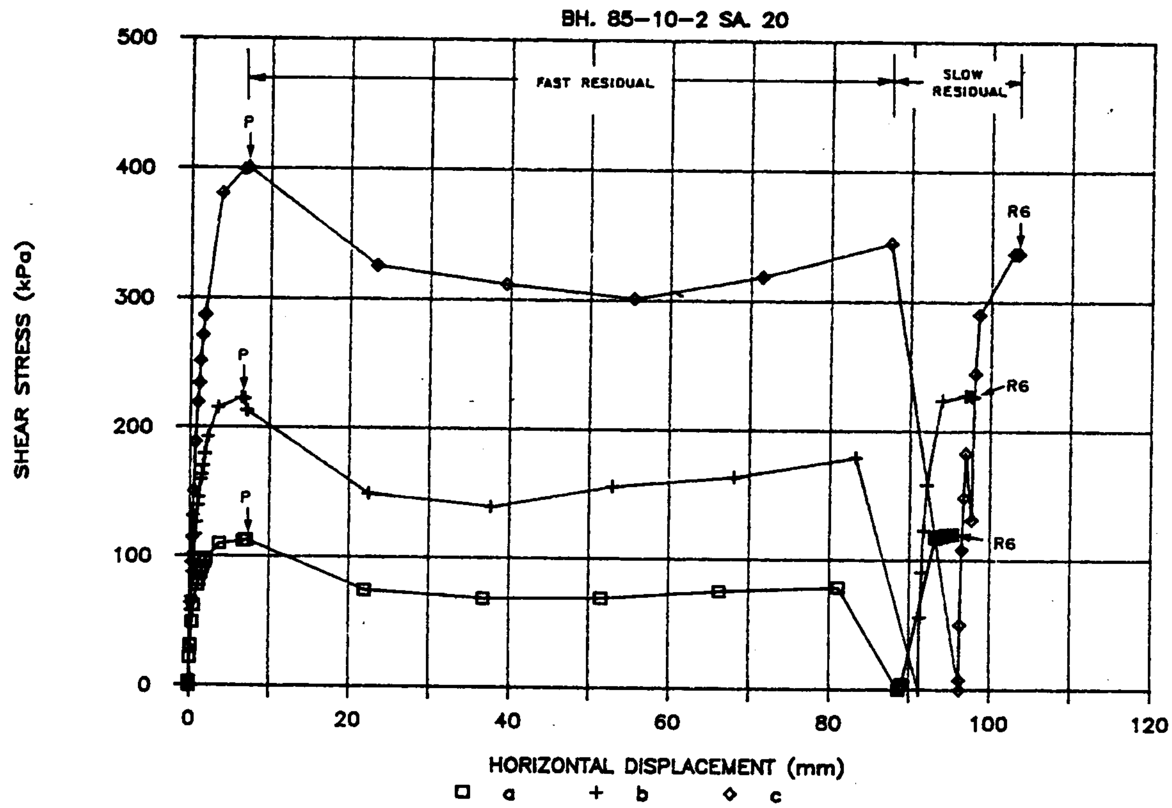
FAILURE PLANE MATERIAL as above description

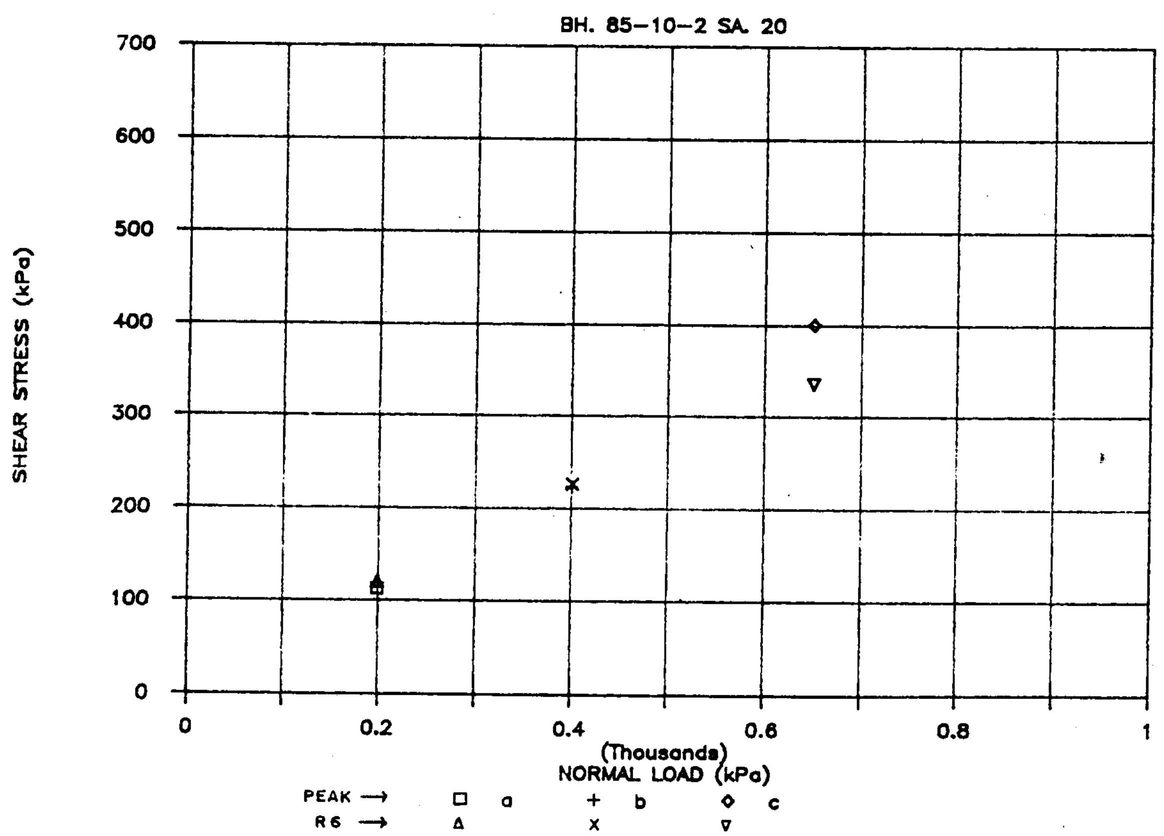
DATE April, 1986
PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 2 OF 3

FIGURE 38-2





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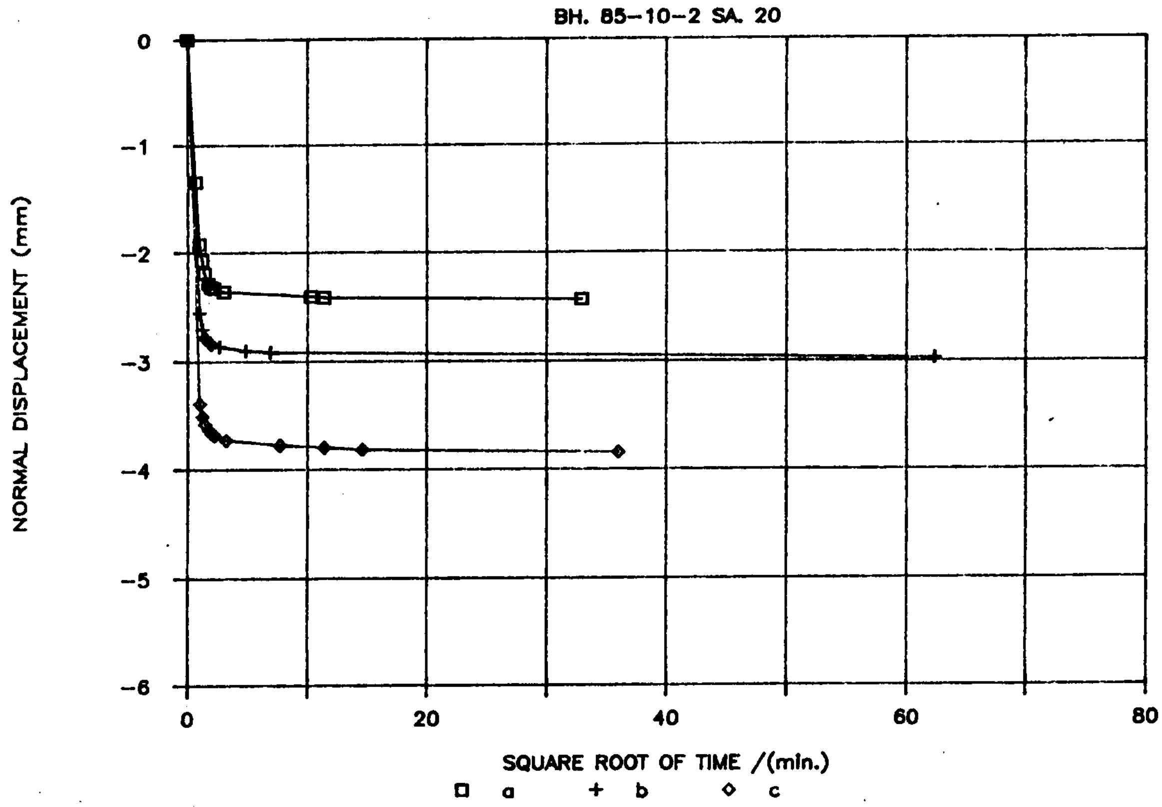
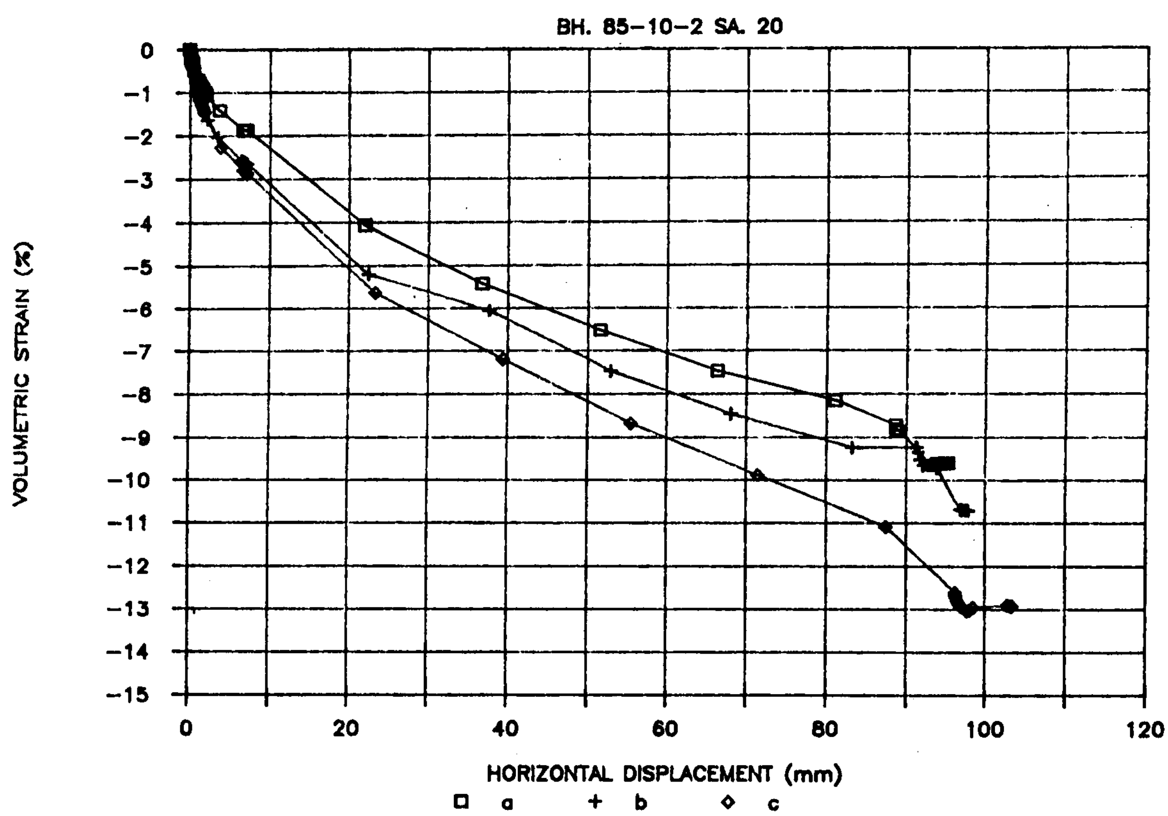
CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 3 OF 3

FIGURE 38-3





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CONSOLIDATED DRAINED DIRECT SHEAR TEST SHEET 1 OF 3	FIGURE 39-1

CONSOLIDATED DRAINED DIRECT SHEAR TESTS

TEST NUMBER	A	B	C
BOREHOLE NUMBER	85-10-2	85-10-2	85-10-2
SAMPLE NUMBER	28	28	28
SAMPLE DEPTH, m	29.70	29.75	29.80
SAMPLE HEIGHT, mm	25.20	25.20	25.00
SAMPLE WIDTH, mm	59.50	59.50	59.50
WATER CONTENT,BEFORE CONSOLIDATION, %	35	34	36
NORMAL (CONSOLIDATION) STRESS, kPa	303	500	700
WATER CONTENT, SHEAR PLANE, %	38	21	24
AVERAGE RATE OF STRAIN, %/hr.	0.5	0.5	0.5
TIME TO FAILURE, days	1.5	1.5	1.5
PEAK SHEAR STRESS, kPa	96.7	176.5	214.0
RESIDUAL SHEAR STRESS, kPa, first pass	32.3	110.9	117.6
fifth pass	75.0	67.4	107.3
sixth pass	98.5	160.6	155.2
HORIZONTAL DISPLACEMENT AT PEAK, mm	5.85	6.61	3.12
HORIZONTAL DISPLACEMENT, RESIDUAL, mm			
first pass	23.28	23.14	23.70
fifth pass	86.08	85.64	98.47
sixth pass	100.67	101.13	103.90
NATURAL WATER CONTENT, %	35	34	36
LIQUID LIMIT, wl	49		
PLASTIC LIMIT, wp	25		
UNIT WEIGHT, kN/m3	18.59	20.96	19.26

SAMPLE DESCRIPTION A,red fissured silty clay with trace fine gravel
B,same as sample A
C,same as sample A

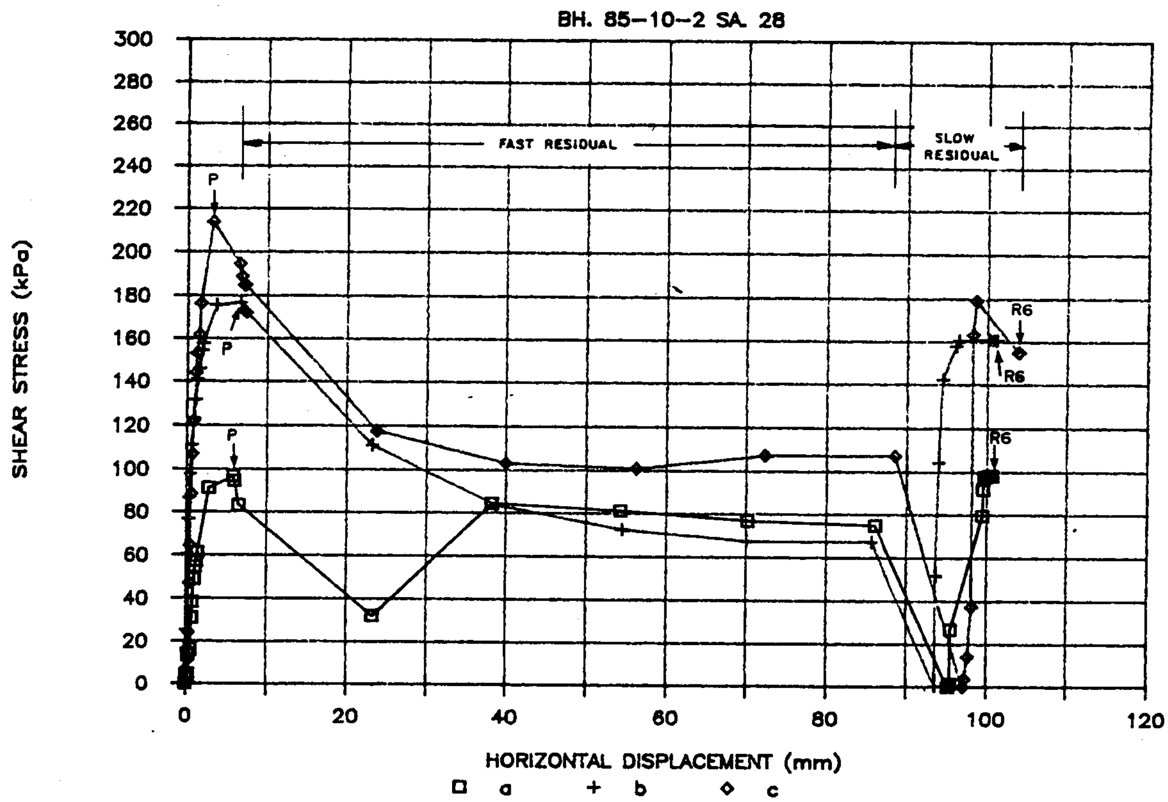
FAILURE PLANE MATERIAL as above description

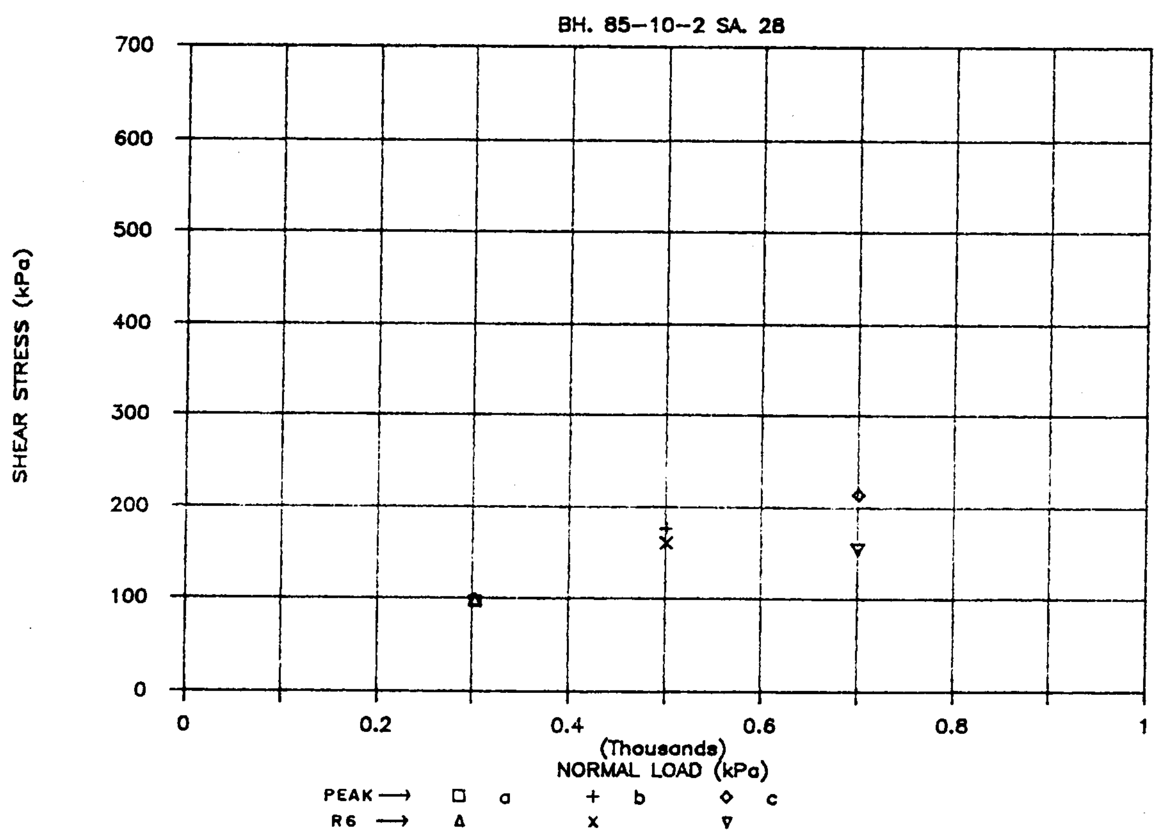
DATE April, 1986
PROJECT 851-1298 (GLAL Project # 85-GT-4)
DATA BY F.A.R.

CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 2 OF 3

FIGURE 39-2





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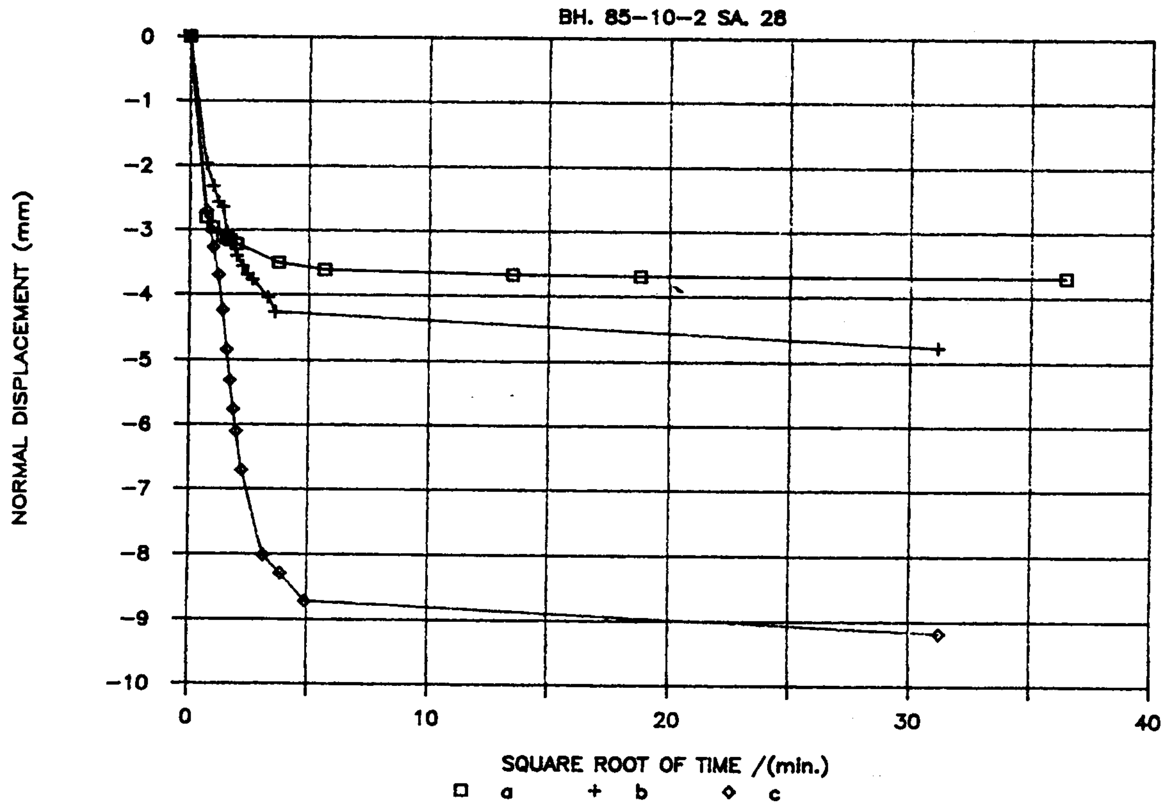
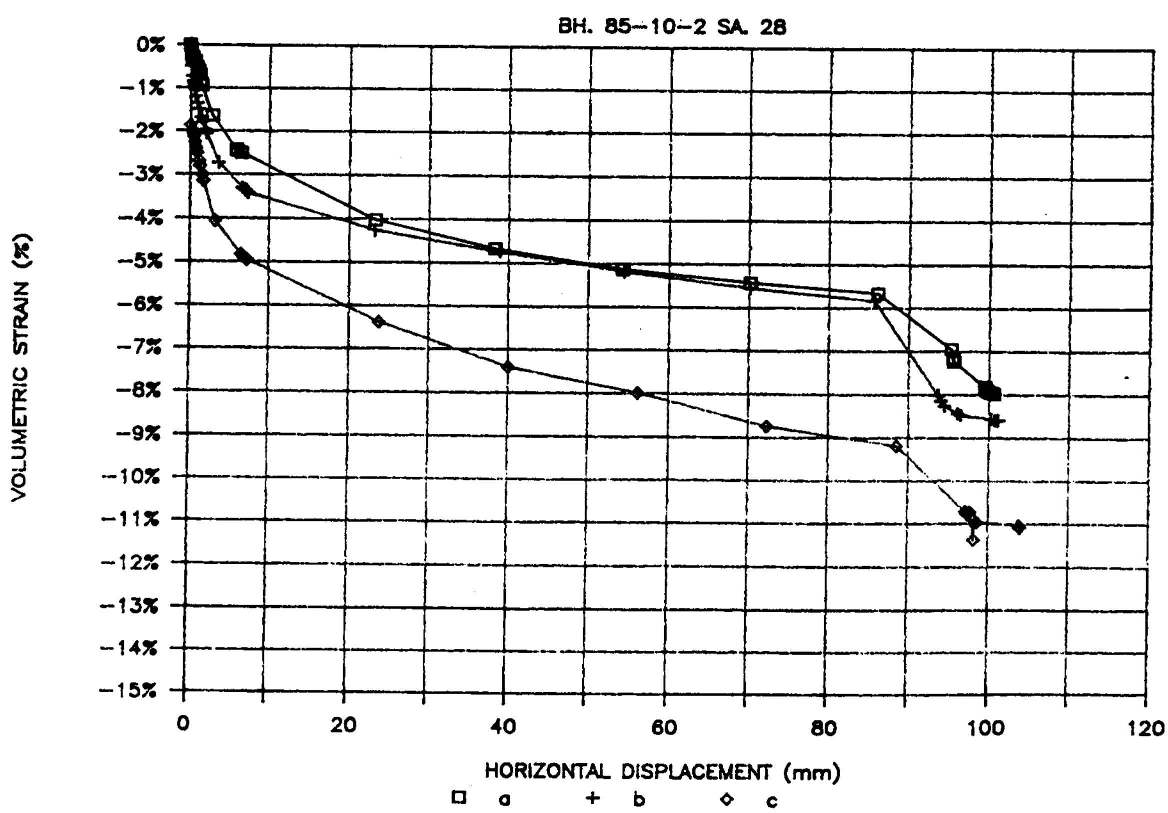
CONSOLIDATED DRAINED DIRECT SHEAR TEST

SHEET 3 OF 3

FIGURE 39-3





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CONSOLIDATION

FIGURES 40-1 to 45-2

CONSOLIDATION

SHEET 1 OF 2

FIGURE 40-1

PROJECT 851-1298 SPECIFIC GRAVITY 2.78 DATE ST. 86-01-27
SAMPLE BH.85-5-2 SA.6 DRY WEIGHT,gm 90.44 DATE FN. 86-02-05
AREA(mm2) 3166.9 SOLIDS HT.mm (2HS) 10.273

Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm2 / s t90
0.00	19.050	0.854	19.050	swelling	
9.65	18.970	0.847	19.010	swelling	
19.31	18.884	0.838	18.927	228	3.33E-03
38.62	18.792	0.829	18.838	180	4.18E-03
77.23	18.701	0.820	18.746	150	4.97E-03
154.46	18.551	0.806	18.626	156	4.72E-03
308.92	18.351	0.786	18.451	258	2.80E-03
617.84	18.064	0.758	18.207	180	3.91E-03
1235.68	17.516	0.705	17.790	240	2.80E-03
2471.36	16.658	0.622	17.087		
607.84	16.986	0.653	16.822		
38.62	18.022	0.754	17.504		

WATER CONTENT % ,initial 30 LIQUID LIMIT % 50
WATER CONTENT %, final 30 PLASTIC LIMIT % 28
UNIT WEIGHT,kN/m3 19.05

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

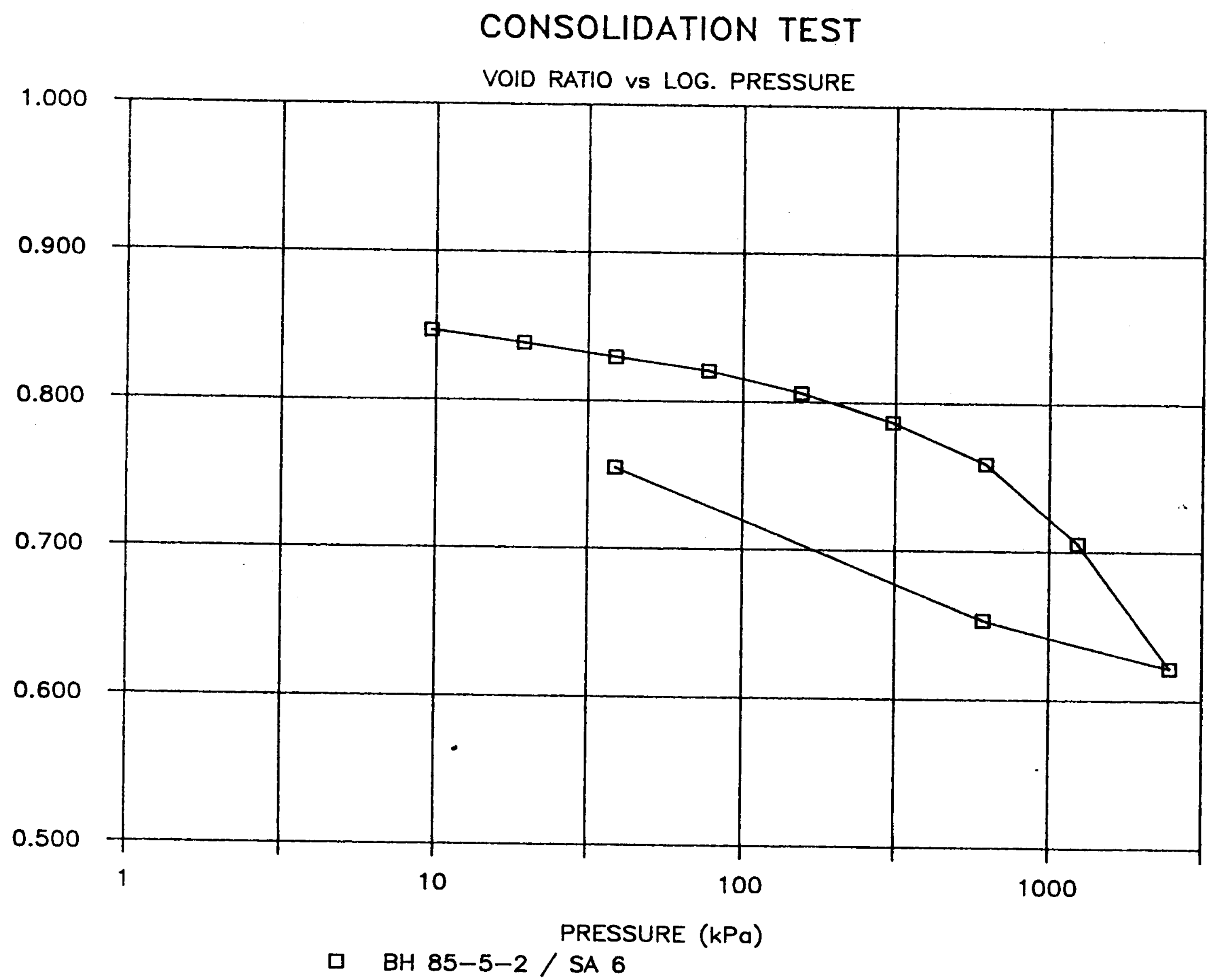

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FIGURE 40-2

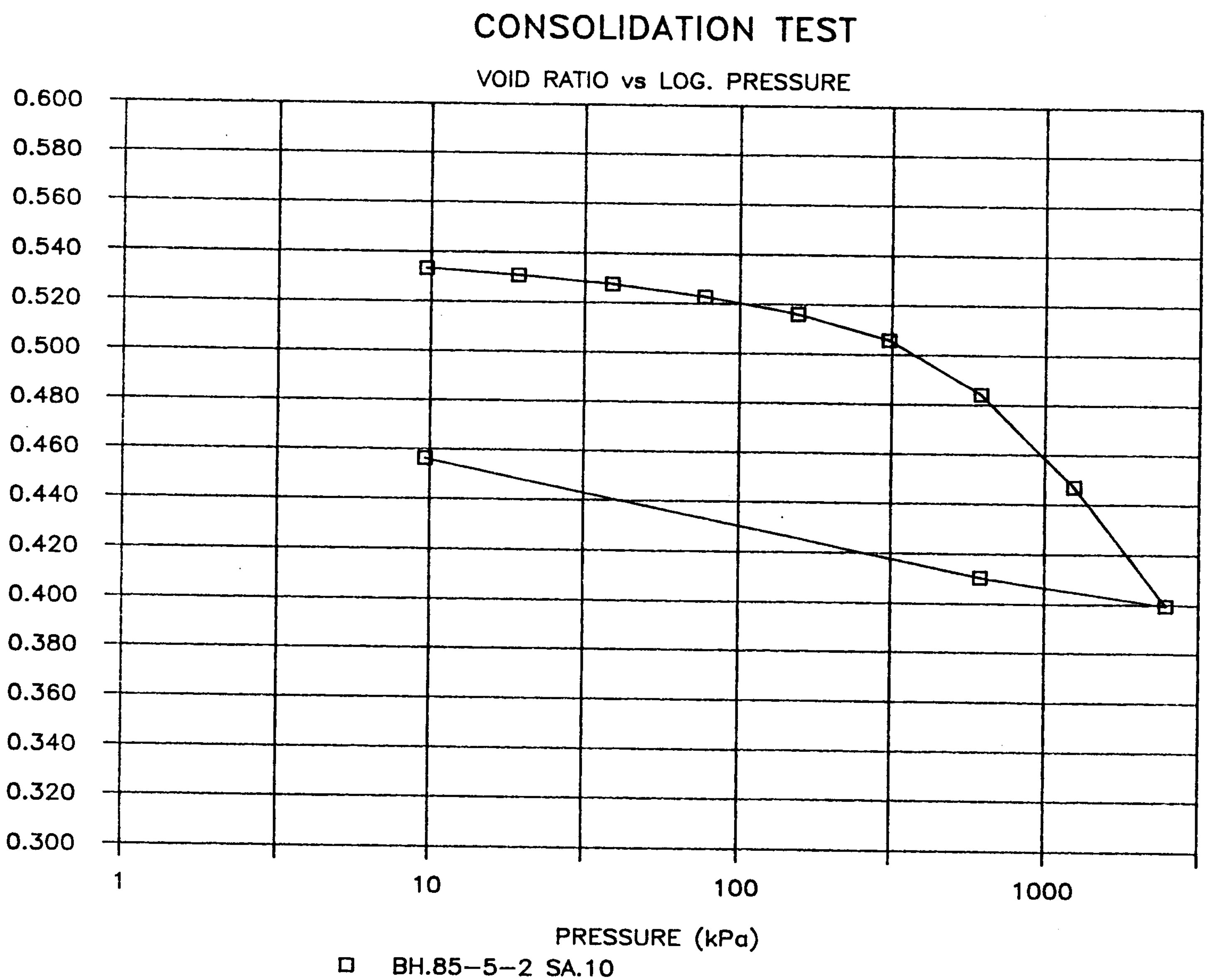
PROJECT 851-1298 | SPECIFIC GRAVITY 2.78 | DATE ST. 86-01-09
SAMPLE BH.85-5-2 SA.10 | DRY WEIGHT,gm 109.06 | DATE FN. 86-02-16
AREA(mm2) 3166.9 | SOLIDS HT.mm (2HS) 12.388

Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm sq / s t90
0.00	19.050	0.538	19.050	150	5.13E-03
9.65	18.993	0.533	19.021	216	3.55E-03
19.31	18.960	0.531	18.976	156	4.89E-03
38.62	18.921	0.527	18.940	108	7.04E-03
77.23	18.861	0.523	18.891	96	7.88E-03
154.46	18.780	0.516	18.820	90	8.34E-03
308.92	18.654	0.506	18.717	72	1.03E-02
617.84	18.384	0.484	18.519	138	5.27E-03
1235.70	17.925	0.447	18.154	108	6.47E-03
2471.36	17.337	0.400	17.631		
617.84	17.473	0.411	17.405		
9.65	18.037	0.456	17.755		

WATER CONTENT %, initial 19
WATER CONTENT %, final 17
UNIT WEIGHT,kN/m3 21.05

LIQUID LIMIT % 27
PLASTIC LIMIT % 18

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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CONSOLIDATION
SHEET 2 OF 2

FIGURE 41-2

CONSOLIDATION

SHEET 1 OF 2

FIGURE 42-1

PROJECT 851-1298 SPECIFIC GRAVITY 2.78 DATE ST. 86-01-21
SAMPLE BH.85-5-2 SA.18 DRY WEIGHT,gm 99.81 DATE FN. 86-02-27
AREA(mm2) 3166.9 SOLIDS HT.mm (2HS) 11.337

Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm2 / s t90
0.00	19.050	0.680	19.050	swelling	
9.65	19.022	0.678	19.036	192	4.00E-03
19.31	18.991	0.675	19.006	240	3.19E-03
38.62	18.914	0.668	18.952	216	3.53E-03
57.92	18.866	0.664	18.890	306	2.47E-03
77.23	18.823	0.660	18.844	216	3.49E-03
154.46	18.634	0.644	18.728	210	3.54E-03
308.92	18.379	0.621	18.507	204	3.56E-03
617.84	17.980	0.586	18.180	168	4.17E-03
1235.68	17.381	0.533	17.680	180	3.68E-03
2471.36	16.605	0.465	16.993		
617.84	16.739	0.476	16.672		
19.31	17.698	0.561	17.218		

WATER CONTENT %, initial 24
WATER CONTENT %, final 22
UNIT WEIGHT,kN/m3 20.19

LIQUID LIMIT % 37
PLASTIC LIMIT % 20

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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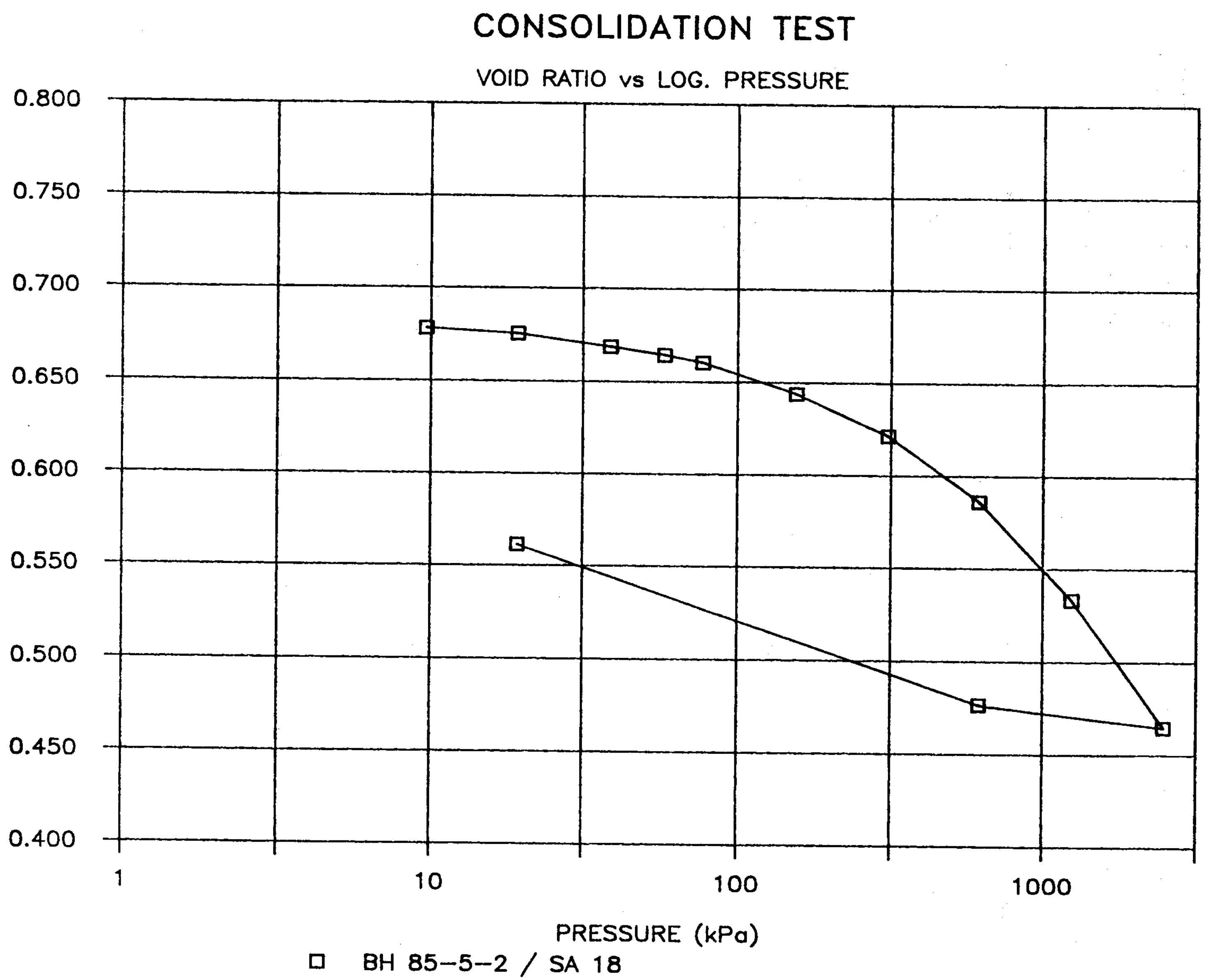


CONSOLIDATION
SHEET 2 OF 2

FIGURE 42-2

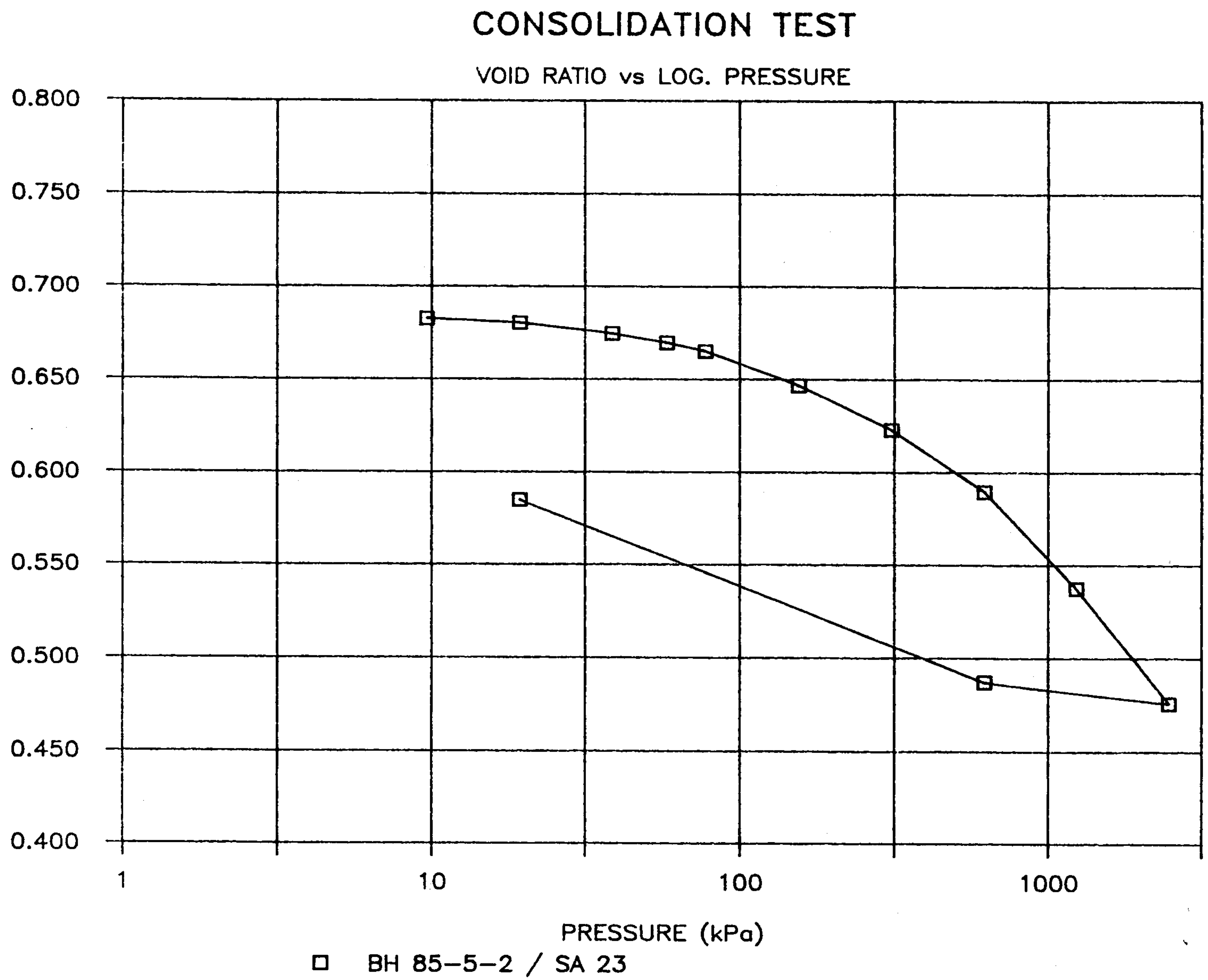
PROJECT 851-1298 SPECIFIC GRAVITY 2.78 DATE ST. 86-01-09
SAMPLE BH.85-5-2 SA.23 DRY WEIGHT,gm 99.68 DATE FN. 86-02-15
AREA(mm2) 3166.9 SOLIDS HT.mm (2HS) 11.322

Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm2 /s t90
0.00	19.050	0.682	19.050	swelling	
9.65	19.046	0.682	19.048	swelling	
19.31	19.022	0.680	19.034	132	5.82E-03
38.62	18.957	0.674	18.989	246	3.11E-03
57.92	18.901	0.669	18.929	228	3.33E-03
77.23	18.850	0.665	18.875	150	5.04E-03
154.46	18.644	0.647	18.747	204	3.65E-03
308.92	18.373	0.623	18.508	222	3.27E-03
617.84	17.998	0.590	18.185	210	3.34E-03
1235.68	17.404	0.537	17.701	156	4.26E-03
2471.36	16.707	0.476	17.055		
617.84	16.837	0.487	16.772		
19.31	17.943	0.585	17.390		

WATER CONTENT %, initial 25
WATER CONTENT %, final 22
UNIT WEIGHT,kN/m3 20.17

LIQUID LIMIT % 37
PLASTIC LIMIT % 21

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)



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CONSOLIDATION
SHEET 2 OF 2

FIGURE 43-2

CONSOLIDATION

SHEET 1 OF 2

FIGURE 44-1

PROJECT 851-1298 SPECIFIC GRAVITY 2.78 DATE ST. 86-01-09
SAMPLE BH.85-5-2 SA.26 DRY WEIGHT,gm 85.15 DATE FN. 86-02-15
AREA(mm2) 3166.9 SOLIDS HT.mm (2HS) 9.672

Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm2 / s t90
0.00	19.050	0.970	19.050		
9.65	19.030	0.968	19.040	114	6.74E-03
19.31	18.968	0.961	18.999	300	2.55E-03
38.62	18.802	0.944	18.885	138	5.48E-03
57.92	18.692	0.933	18.747	1080	6.90E-04
77.23	18.614	0.925	18.653	246	3.00E-03
154.46	18.327	0.895	18.470	318	2.27E-03
308.92	18.016	0.863	18.171	360	1.94E-03
617.84	17.513	0.811	17.764	330	2.03E-03
1235.68	16.871	0.744	17.192	246	2.55E-03
2471.36	15.801	0.634	16.336		
617.85	16.202	0.675	16.001		
19.31	17.732	0.833	16.967		

WATER CONTENT %, initial 35
WATER CONTENT %, final 33
UNIT WEIGHT,kN/m3 18.67

LIQUID LIMIT % 55
PLASTIC LIMIT % 32

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

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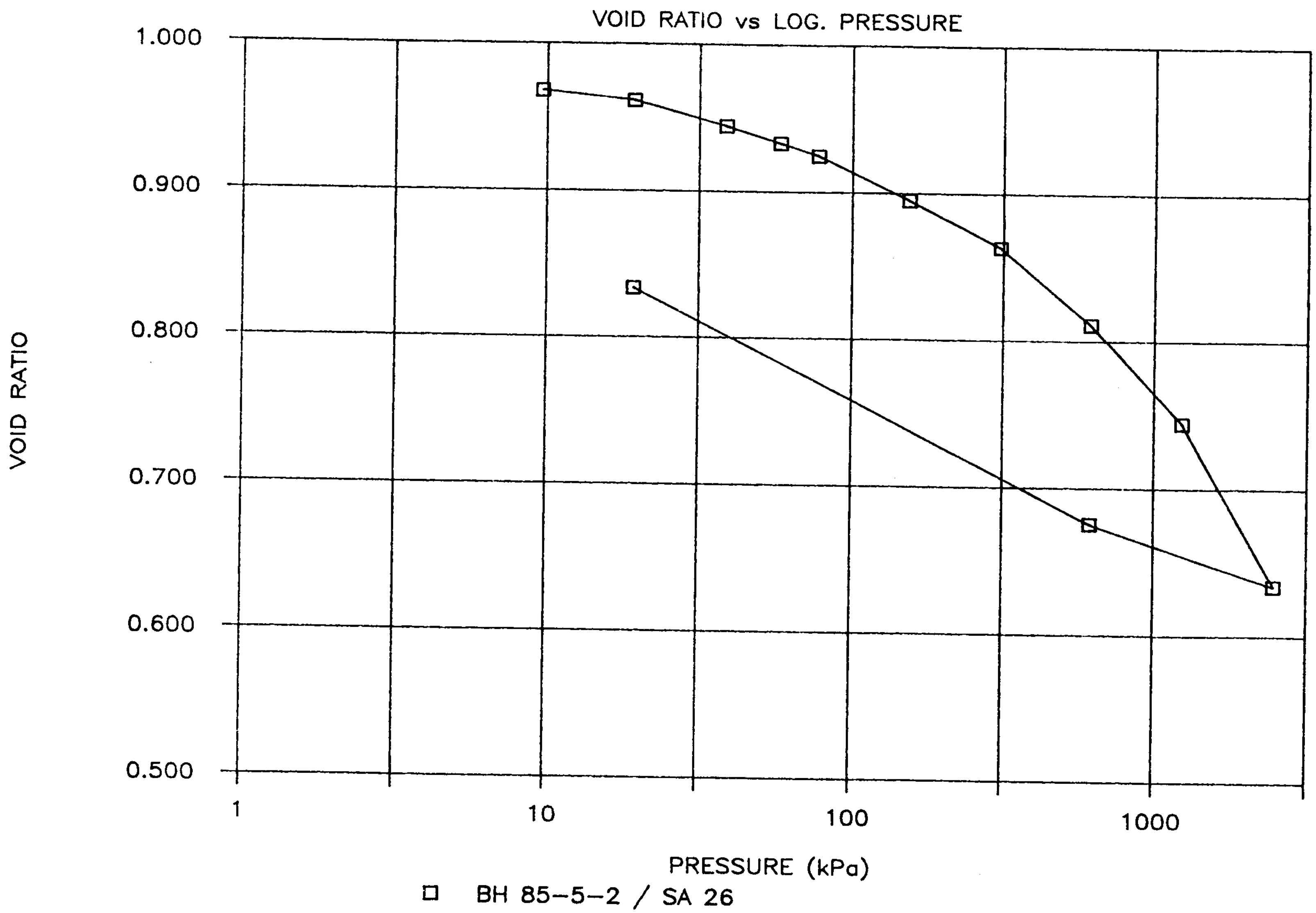
CONSOLIDATION TEST



Golder Associates

CONSOLIDATION
SHEET 2 OF 2

FIGURE 44-2

CONSOLIDATION

SHEET 1 OF 2

FIGURE 45-1

PROJECT 851-1298 SPECIFIC GRAVITY 2.78 DATE ST. 86-01-27
SAMPLE BH.85-5-2 SA.30 DRY WEIGHT,gm 78.08 DATE FN. 86-02-05
AREA(mm2) 3126.3 SOLIDS HT.mm (2HS) 8.984

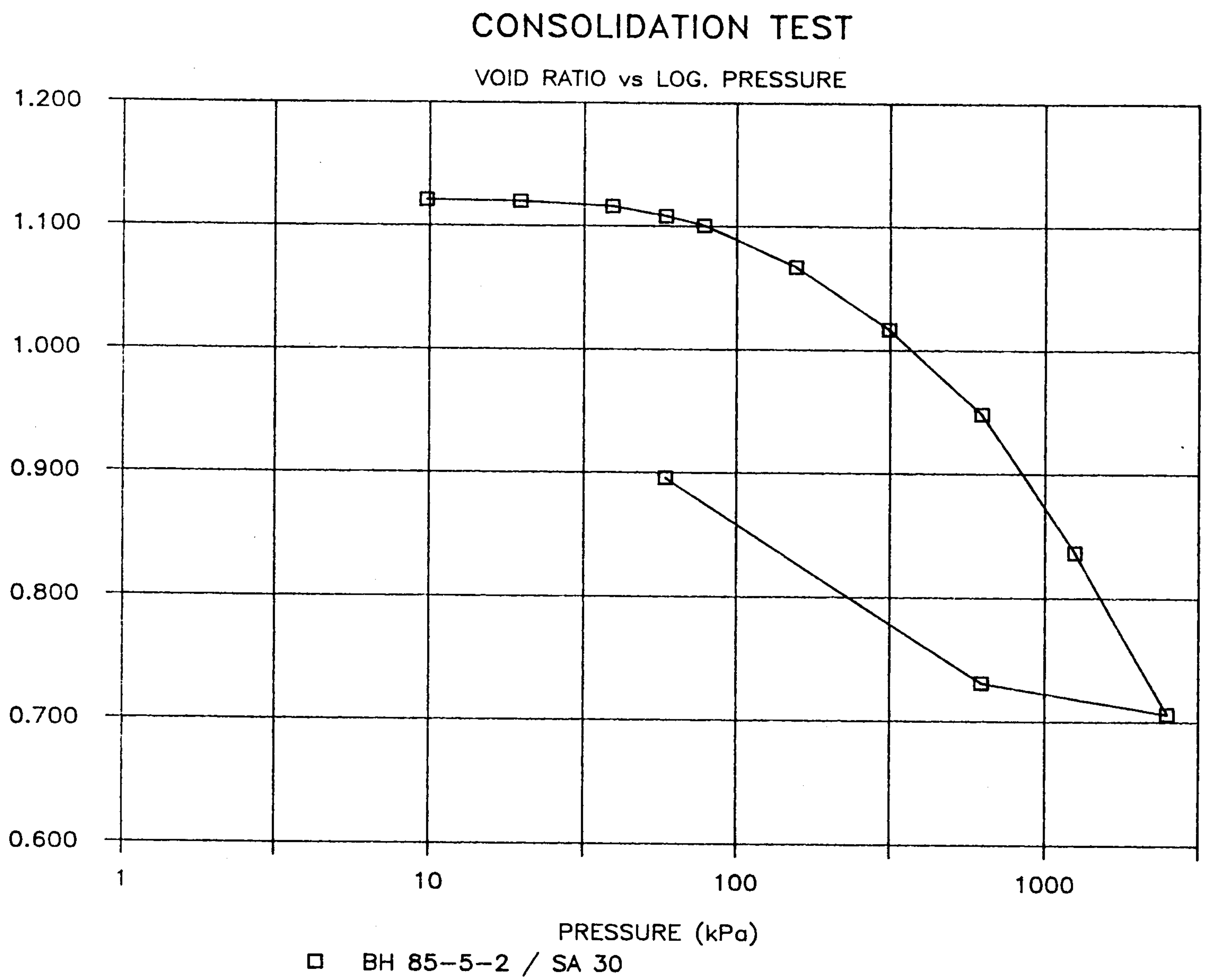
Applied Load kPa	Corr. Height mm	Void Ratio	Average Height mm	t90 sec	Cv cm2 / s t90
0.00	19.050	1.120	19.050	swelling	
9.78	19.051	1.121	19.050	swelling	
19.55	19.041	1.119	19.046	swelling	
39.11	19.008	1.116	19.024	180	4.26E-03
58.66	18.939	1.108	18.973	360	2.12E-03
78.22	18.871	1.101	18.905	630	1.20E-03
156.44	18.572	1.067	18.721	900	8.26E-04
312.88	18.120	1.017	18.346	840	8.50E-04
625.76	17.500	0.948	17.810	174	3.87E-03
1251.52	16.500	0.837	17.000	1500	4.09E-04
2503.04	15.331	0.706	15.915		
625.76	15.549	0.731	15.440		
58.66	17.031	0.896	16.290		

WATER CONTENT %, initial 42
WATER CONTENT %, final 37
UNIT WEIGHT,kN/m3 18.24

LIQUID LIMIT % 41
PLASTIC LIMIT % 23

PROJECT 851-1298 (GLAL PROJECT # 85-GT-4)

Golder Associates



CONSOLIDATION
SHEET 2 OF 2

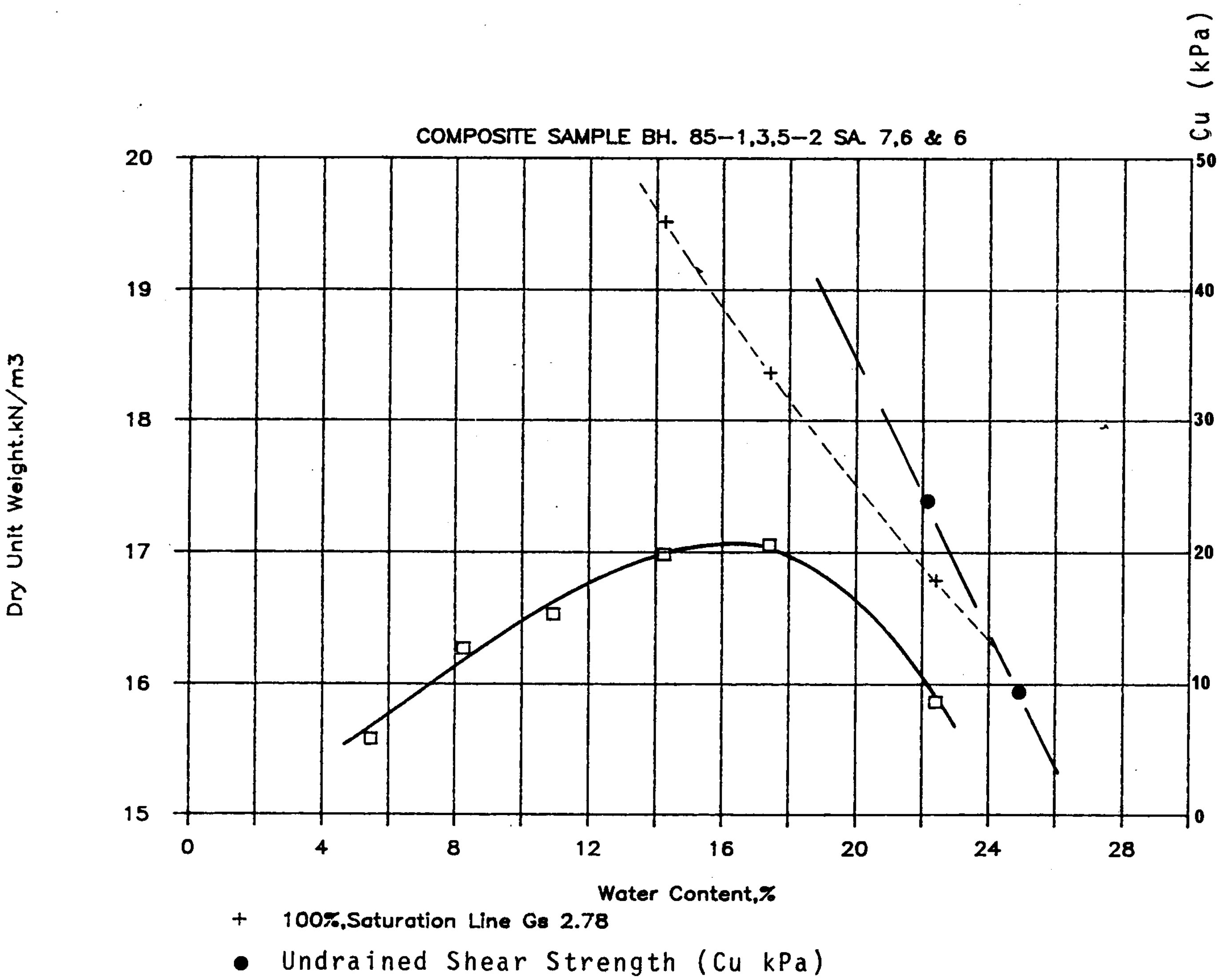
FIGURE 45-2

LABORATORY COMPACTION TEST RESULTS

FIGURES 46 and 47

LABORATORY COMPACTION TEST RESULTS

FIGURE 46



Dry Unit Weight,kN/m3	17.12	Passing Sieve	no.4
Optimum Water Content,%	16.4	Tested By	WW
Natural Water Content,%		Date of Test	85/04/28
Project Number	851-1298	Sample Number	1/7-3/6-5/6 composite
Material Type	UPPER	Data By	FAR

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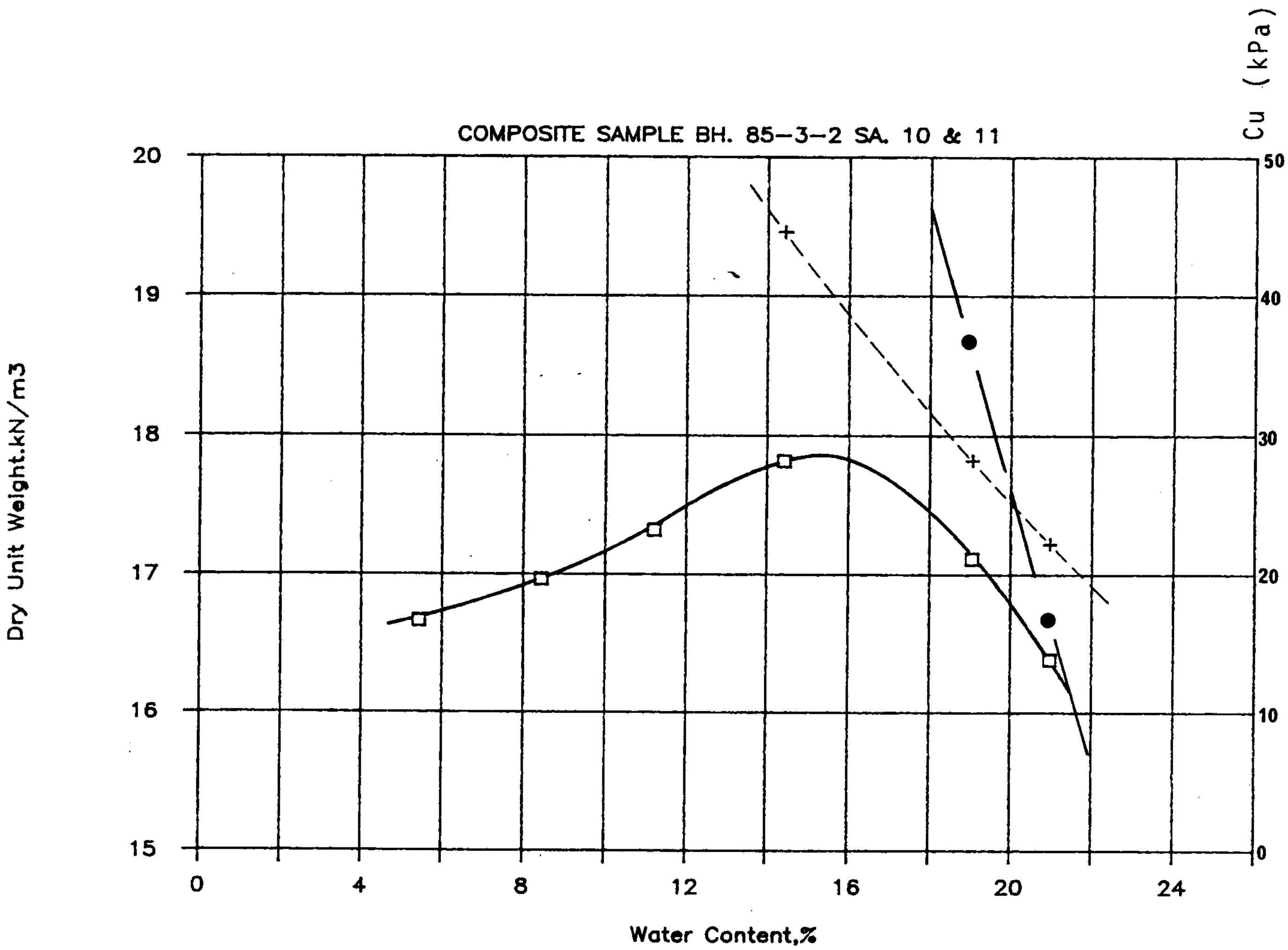
LABORATORY COMPACTION TEST RESULTS

SHEET 1 OF 1

FIGURE 47



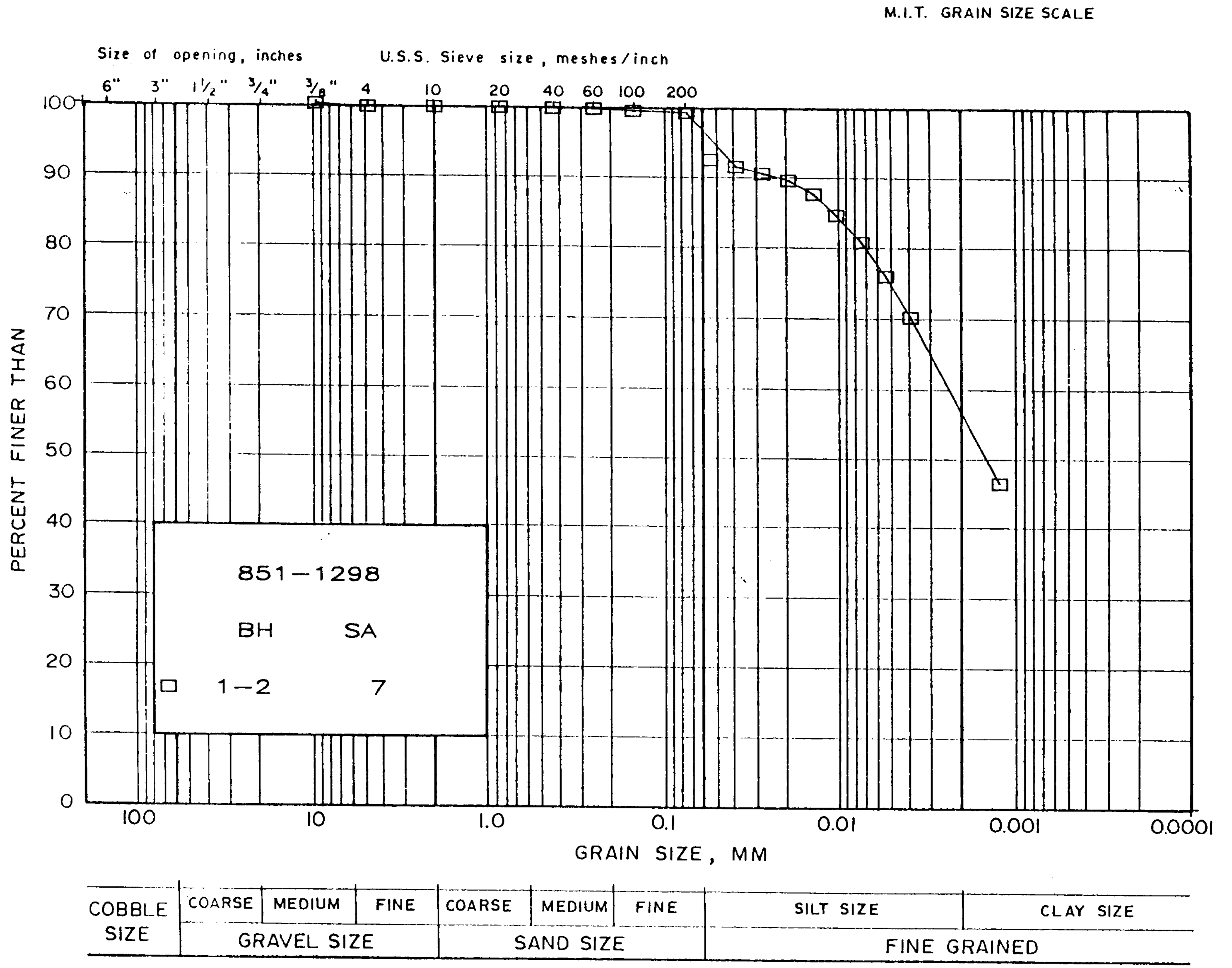
\+ 100%.Saturation Line Gs 2.78

● Undrained Shear Strength (Cu kPa)

Dry Unit Weight,kN/m3	17.85	Passing Sieve	no.4
Optimum Water Content,%	15.6	Tested By	WW
Natural Water Content,%		Date of Test	85/04/28
Project Number	851-1298	Sample Number	85-3-2 10 & 11
Material Type	Till	Data By	FAR

GRAIN SIZE DISTRIBUTION

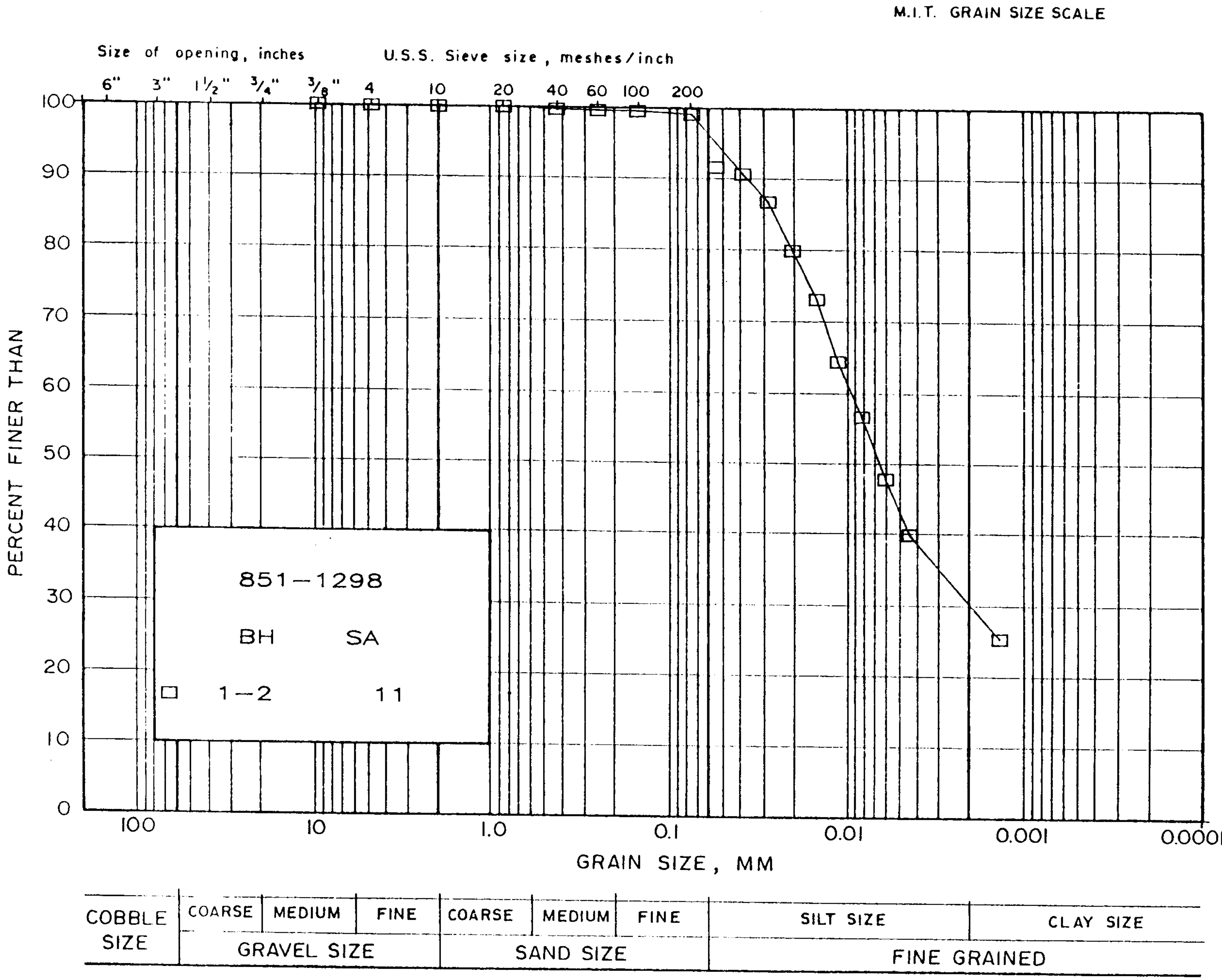
FIGURES 48 to 73



Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 48



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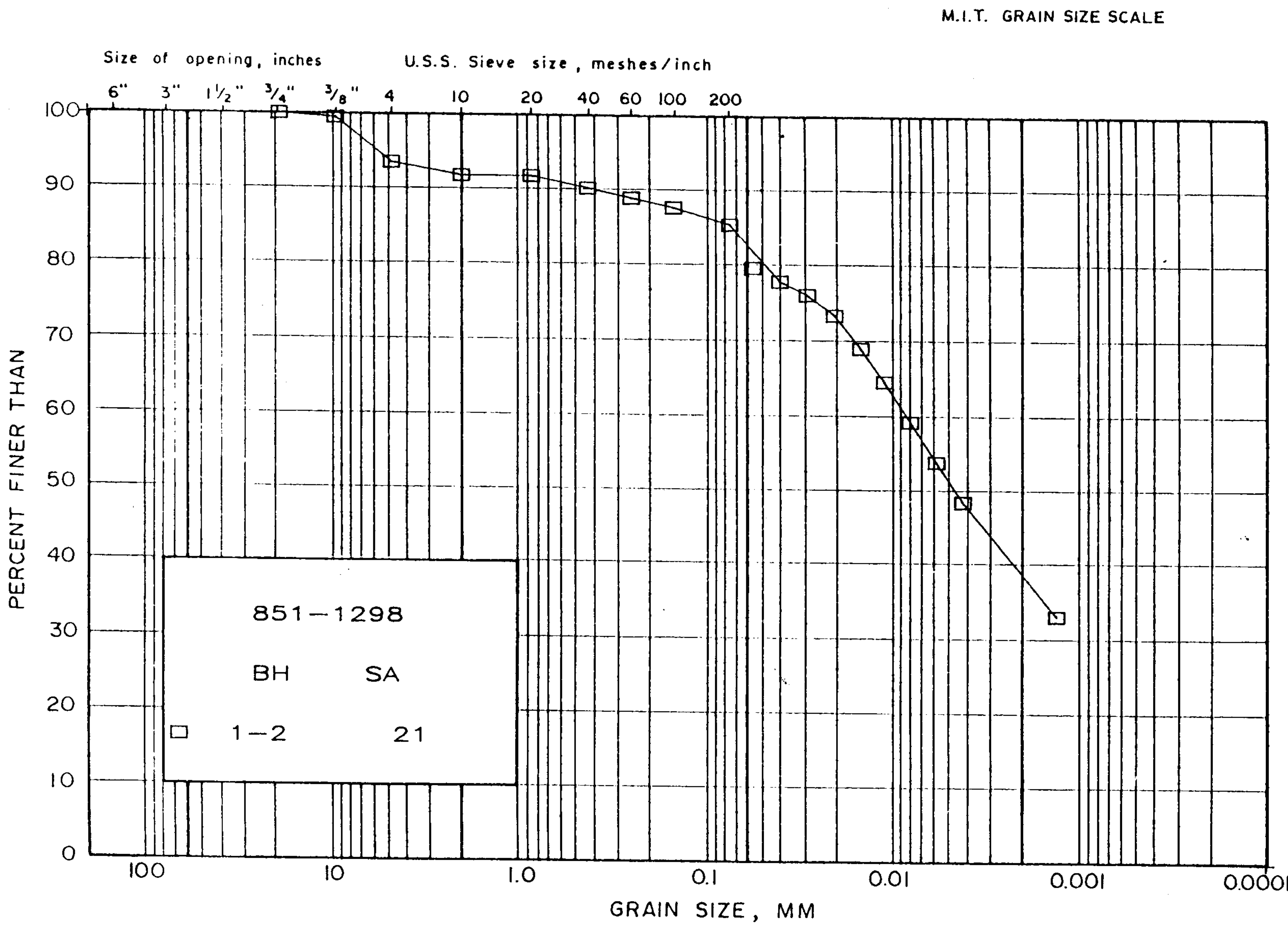
GRAIN SIZE DISTRIBUTION

FIGURE 49

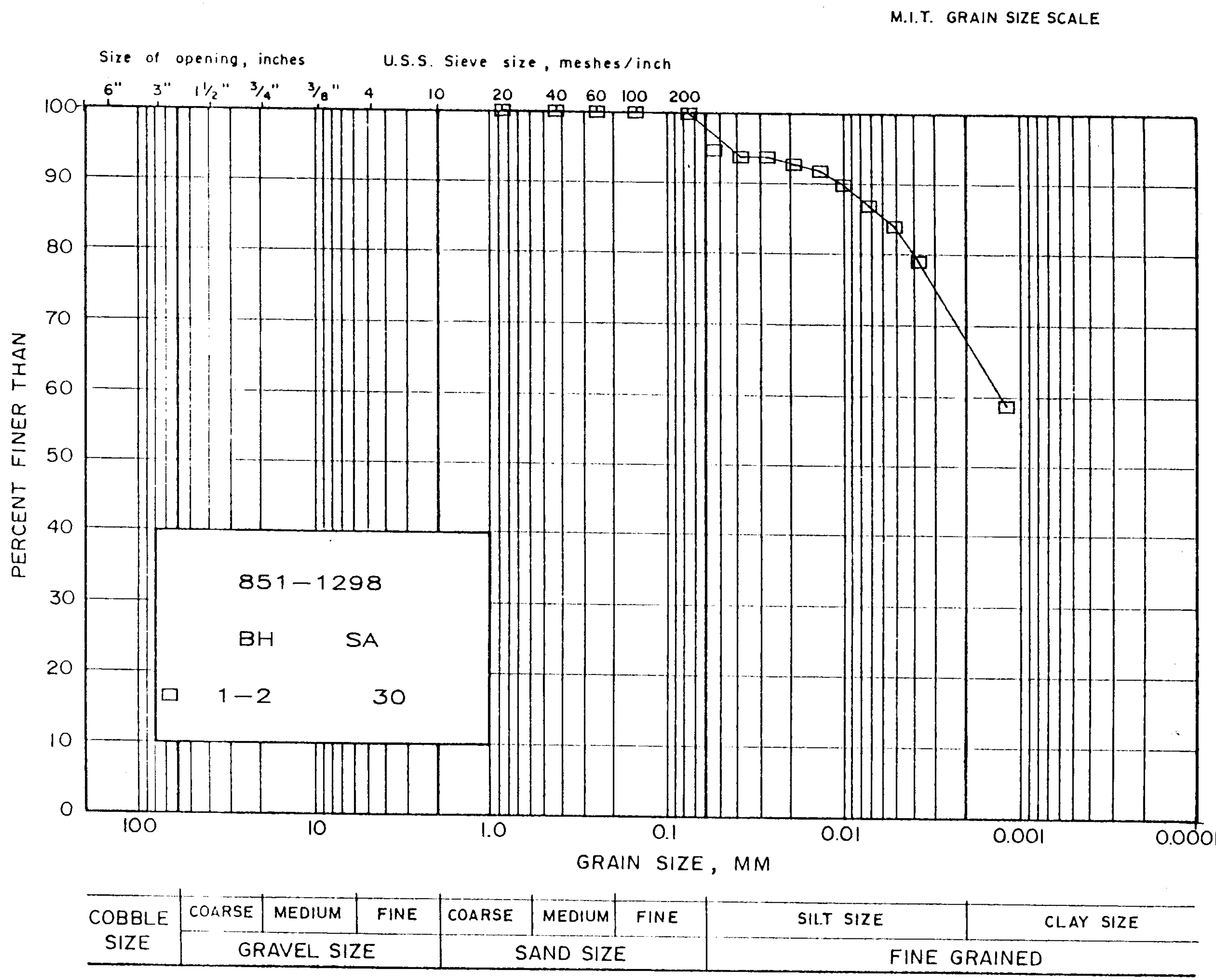
Golder Associates



COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

GRAIN SIZE DISTRIBUTION

FIGURE 50

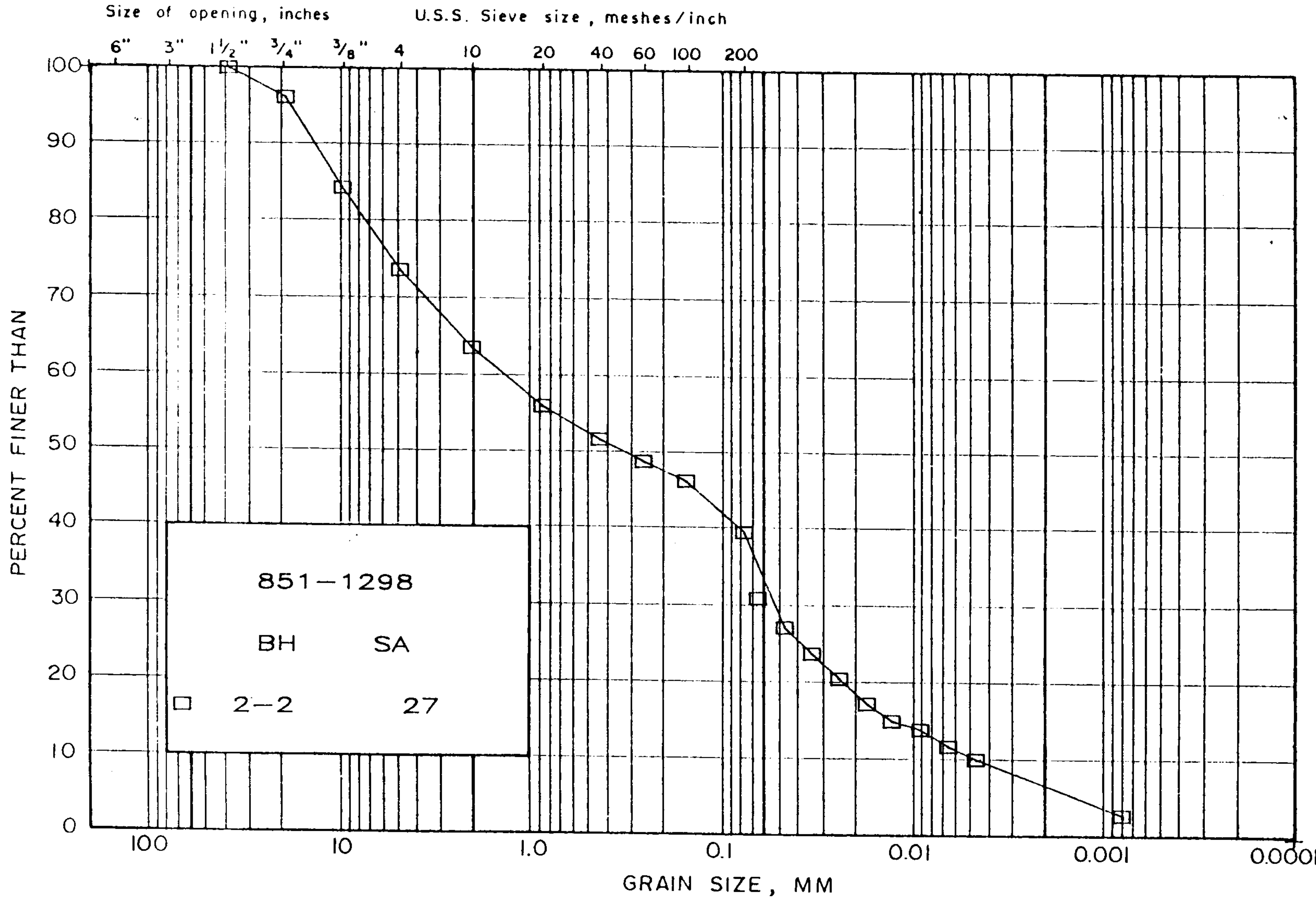


Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 51

PROJECT No. ....



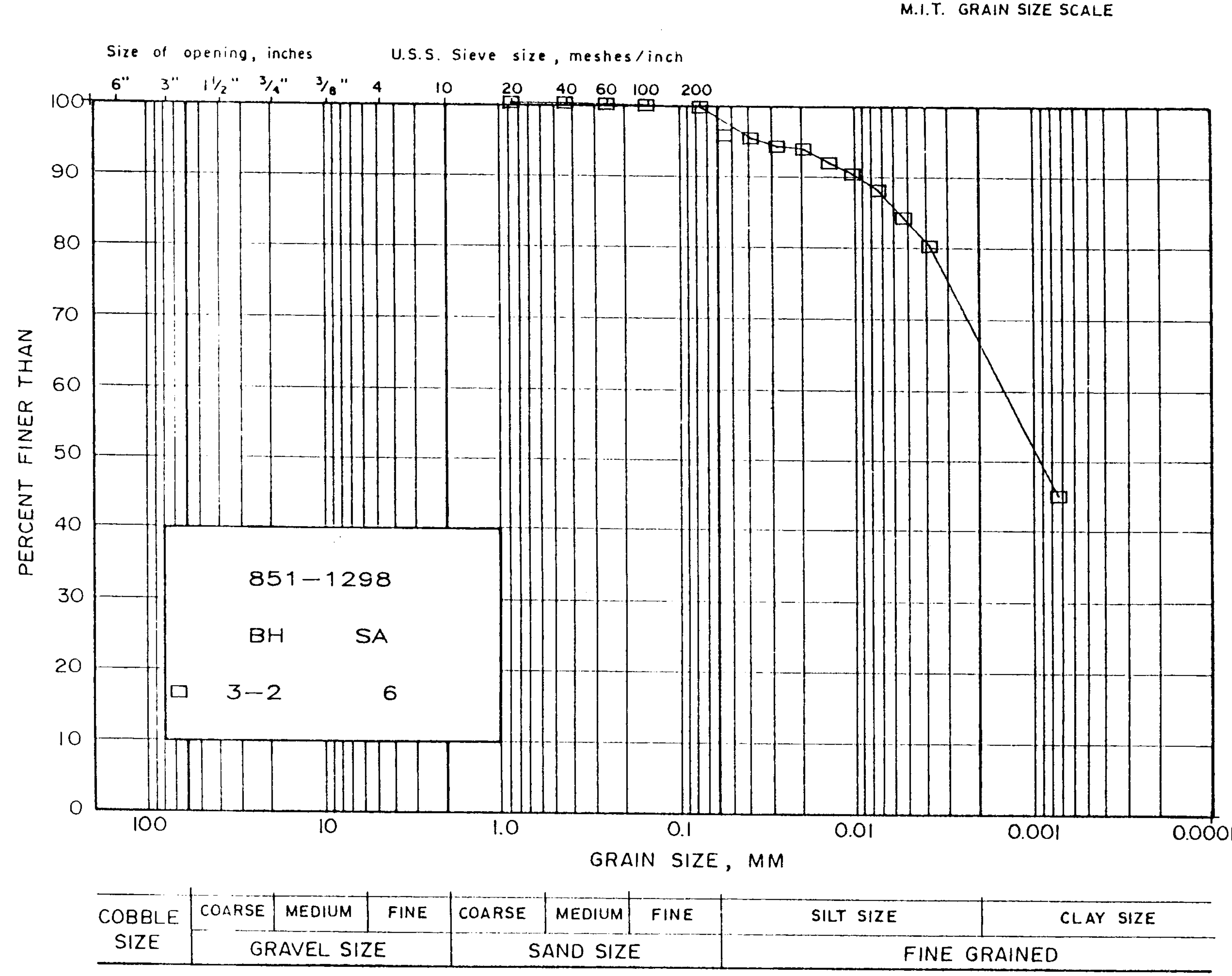
COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

Golder Associates

GRAIN SIZE DISTRIBUTION

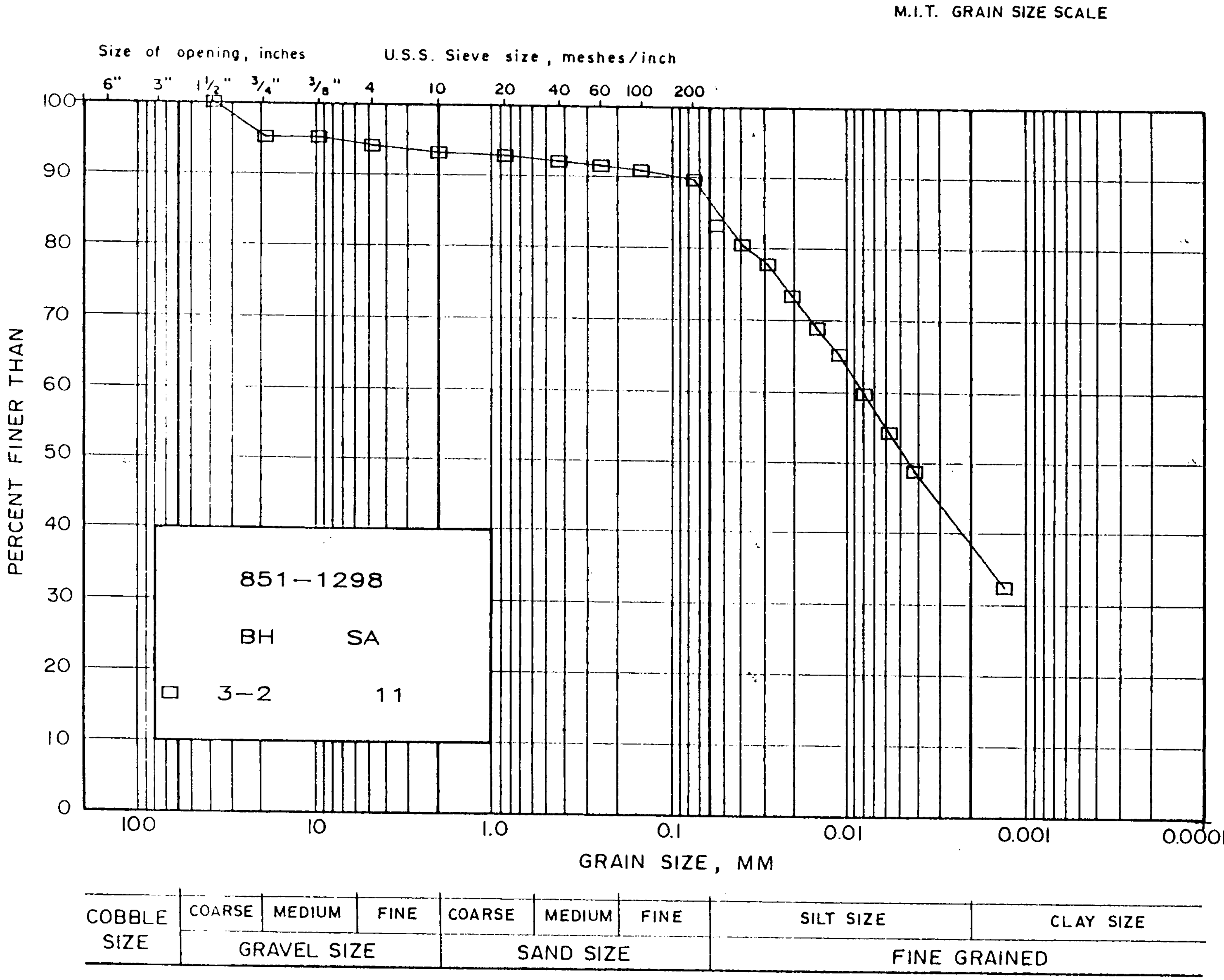
FIGURE 52

Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 53

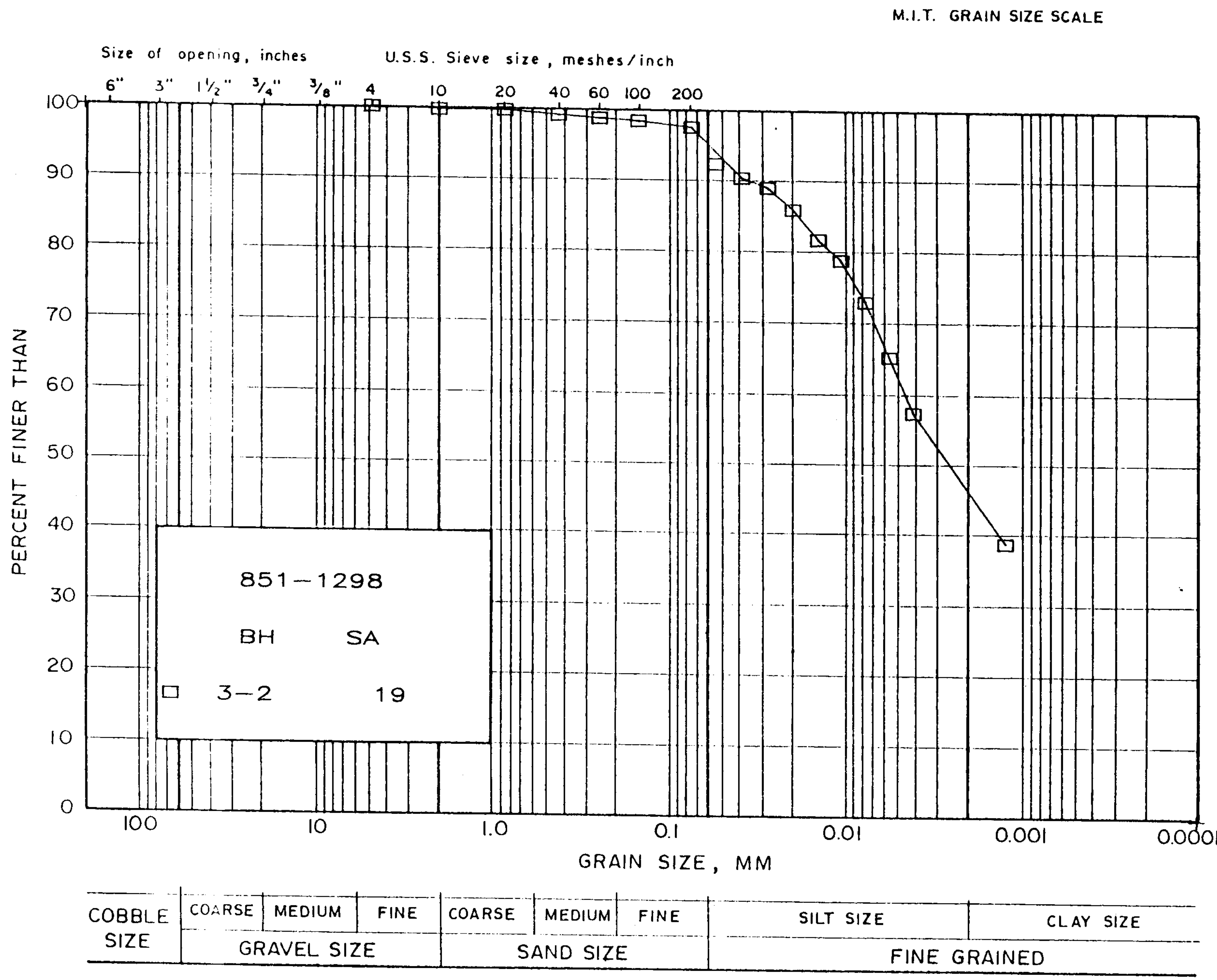


Golder Associates

GRAIN SIZE DISTRIBUTION

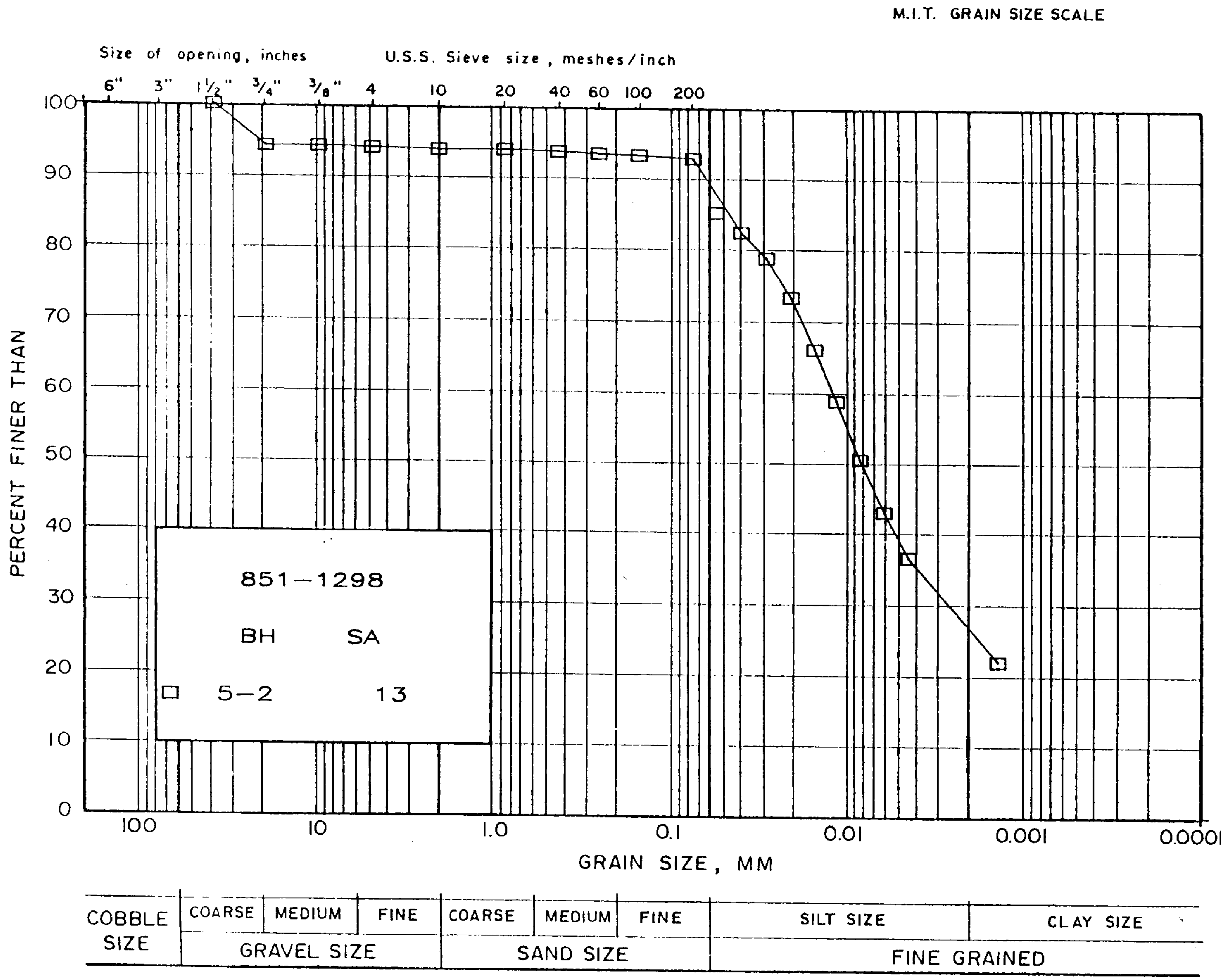
FIGURE 54

Golder Associates



GRAIN SIZE DISTRIBUTION

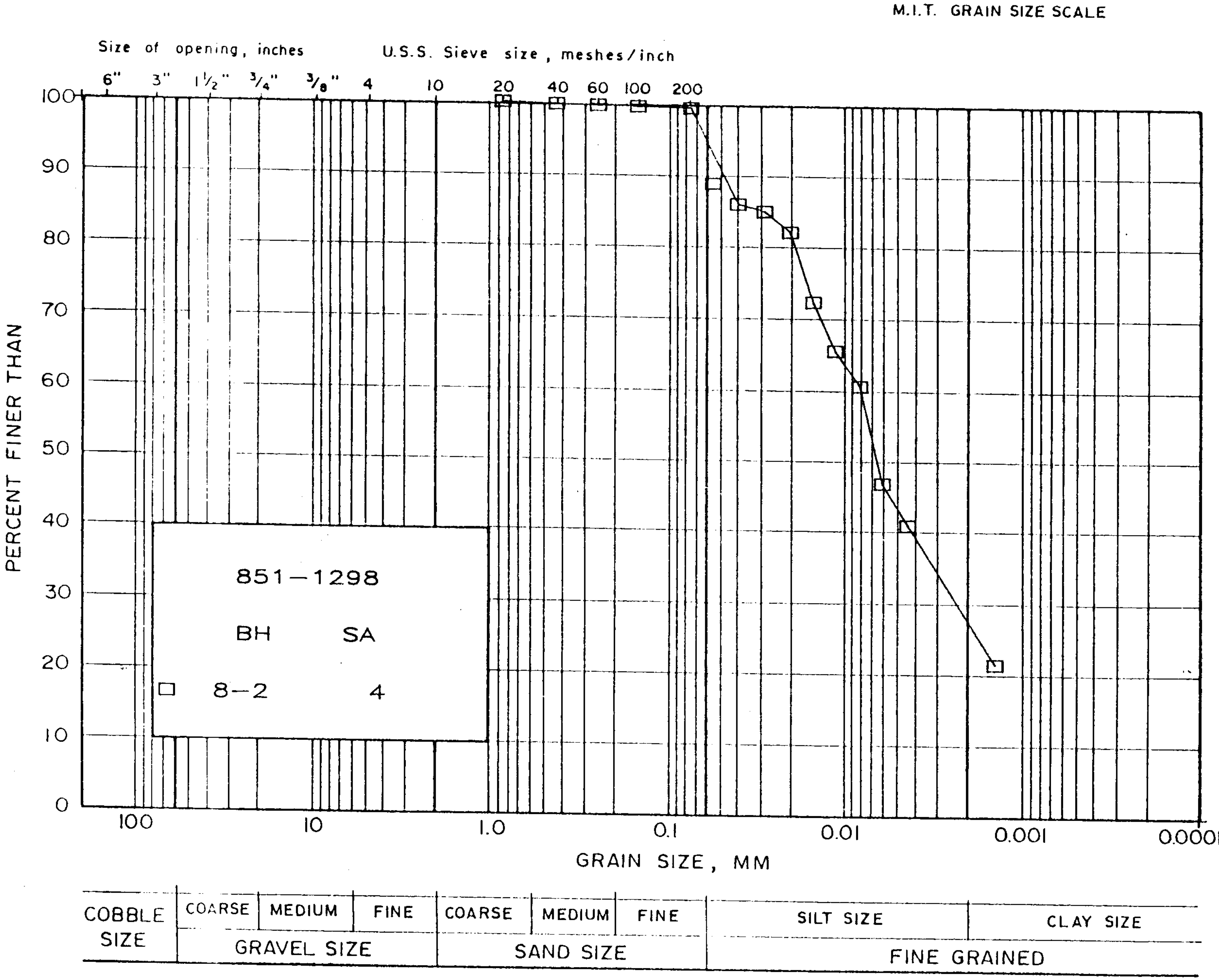
FIGURE 55



Golder Associates

GRAIN SIZE DISTRIBUTION

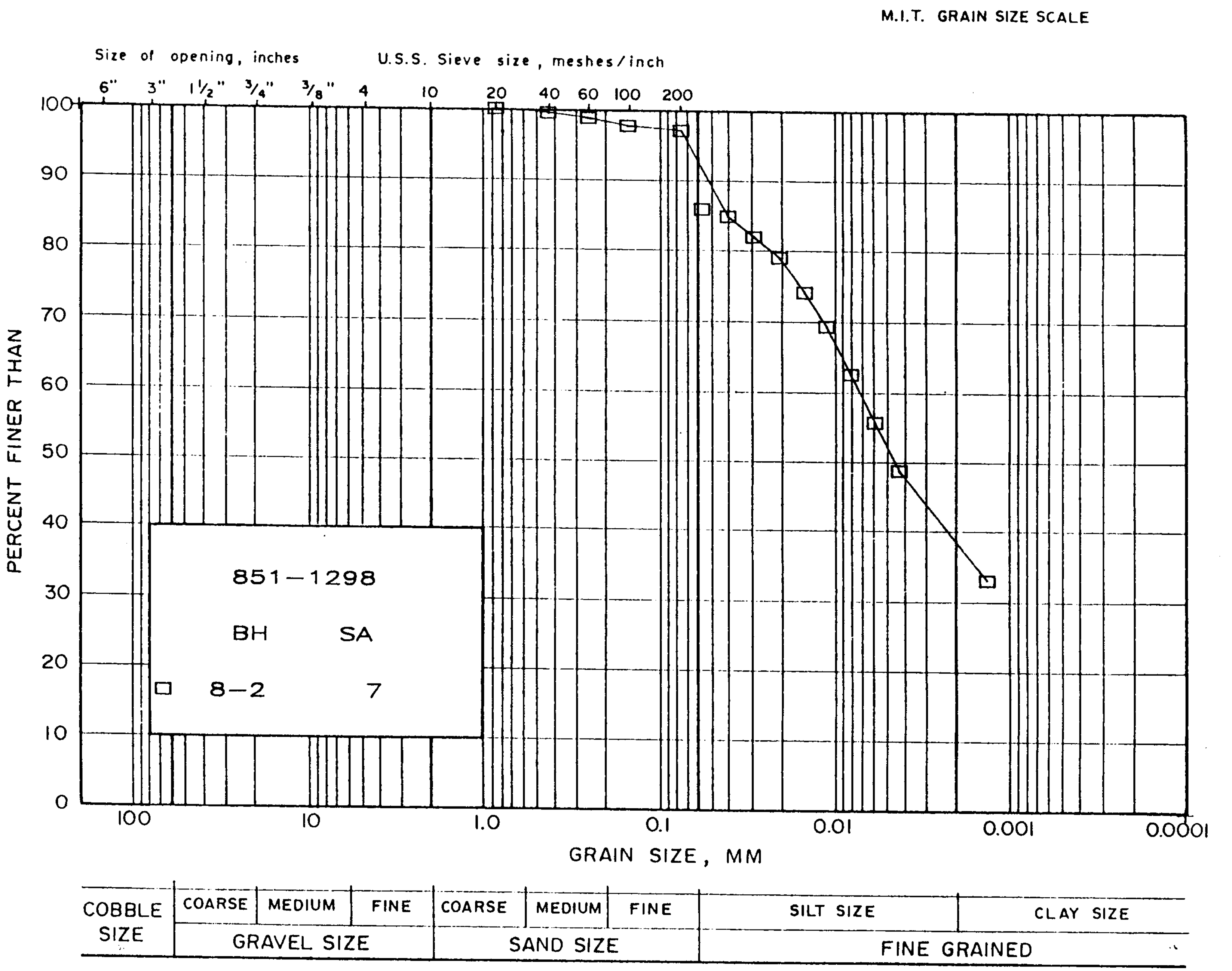
FIGURE 56



Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 57

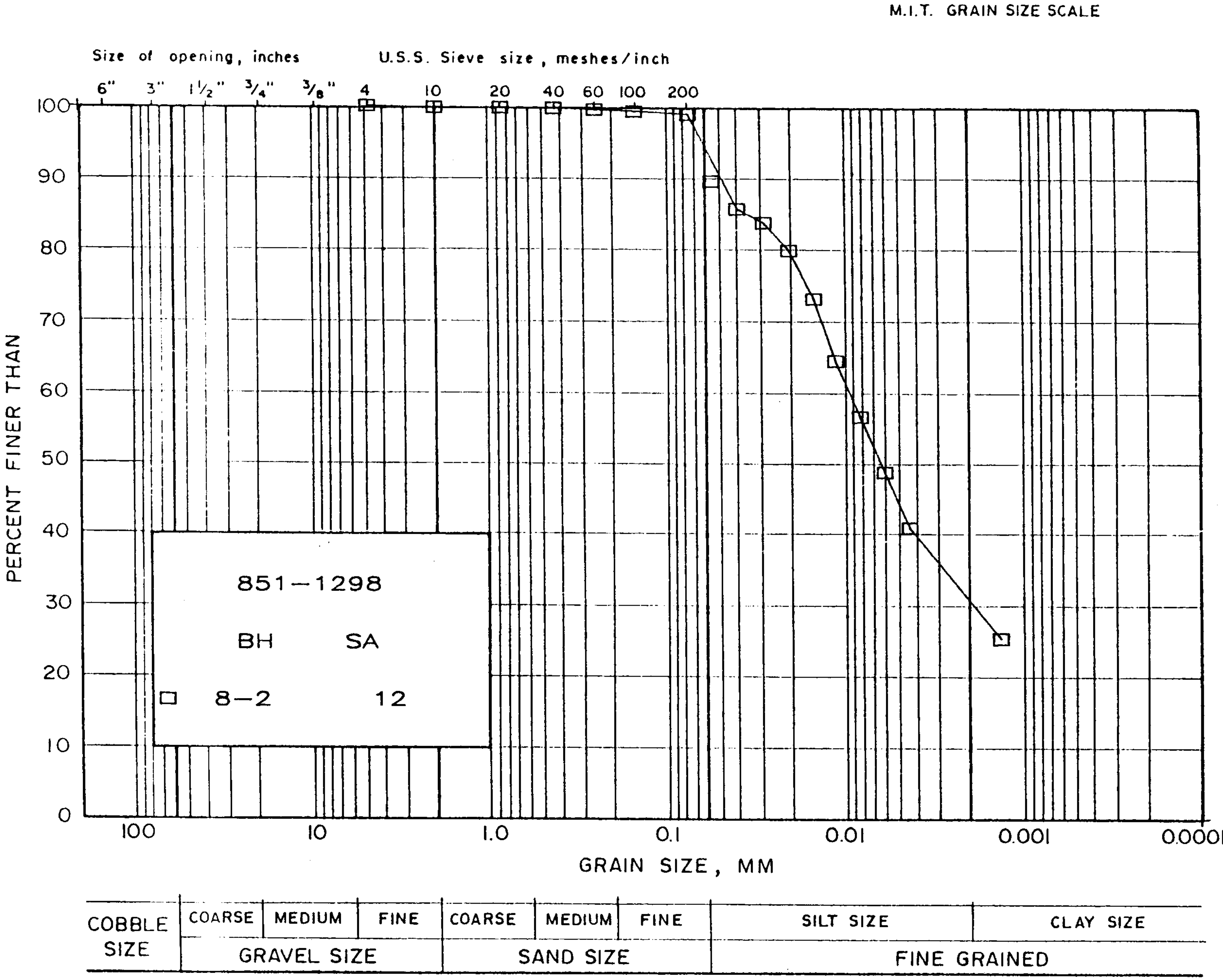


Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 58

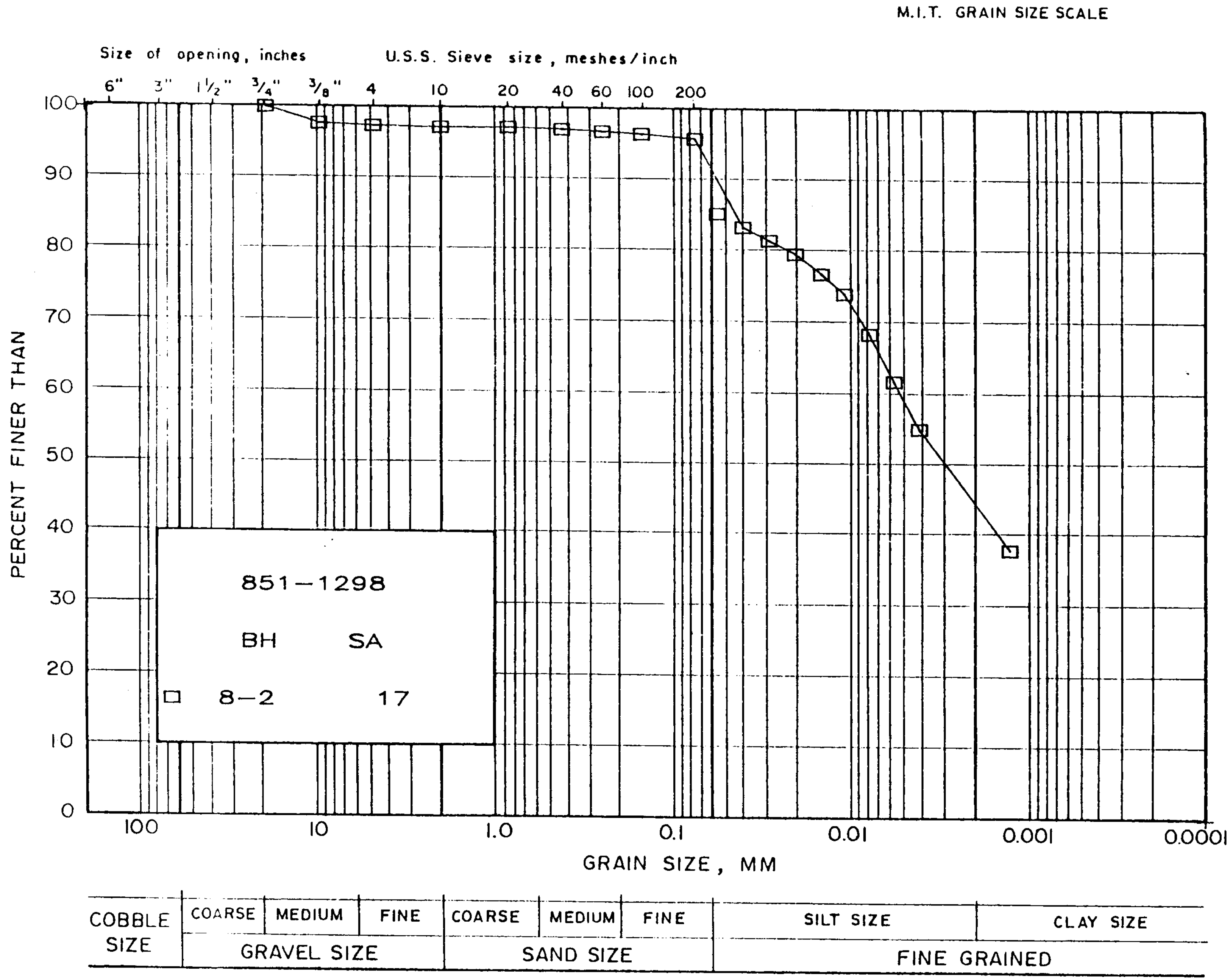
Golder Associates



GRAIN SIZE DISTRIBUTION

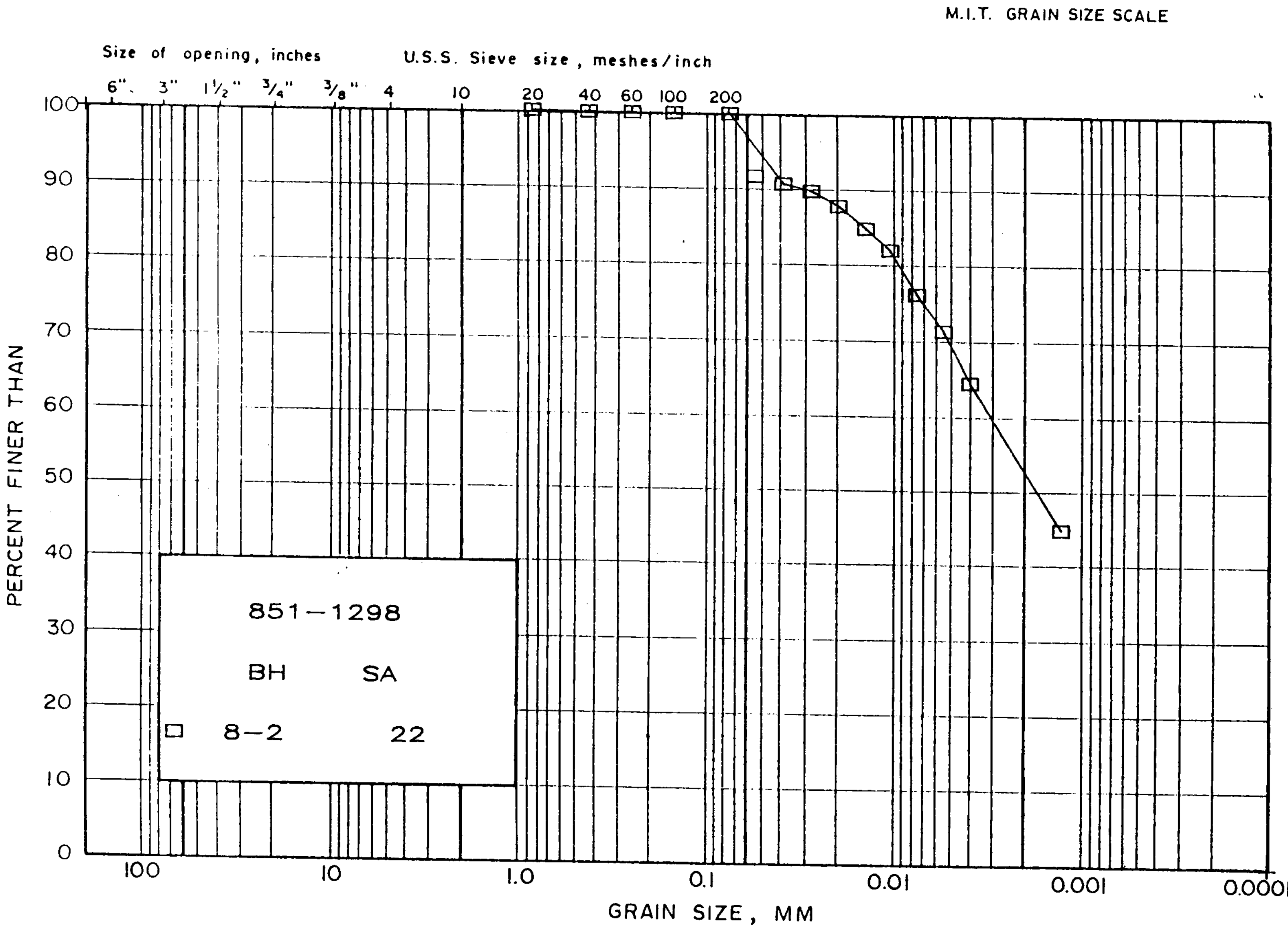
FIGURE 59

Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 60

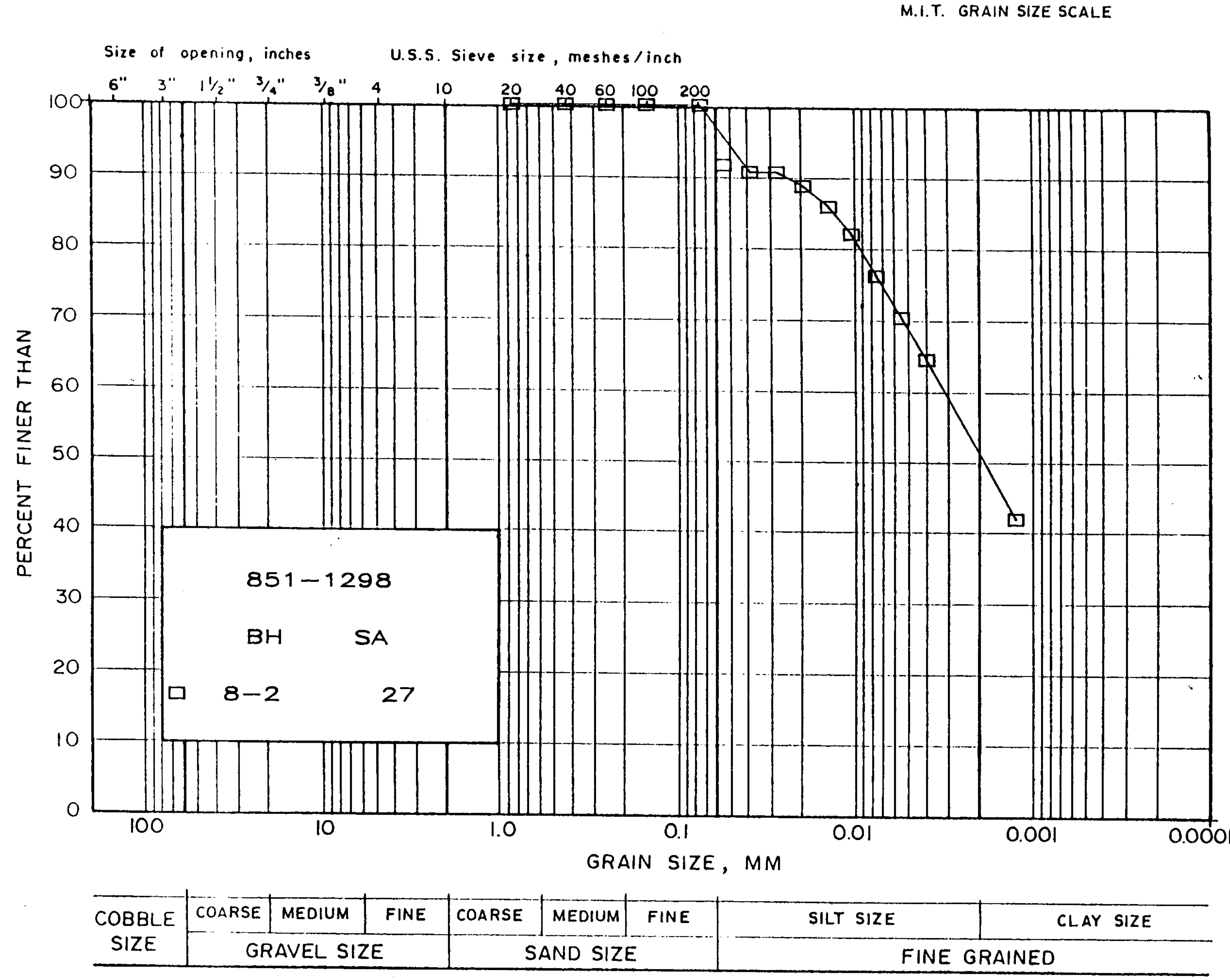


COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

Golder Associates

GRAIN SIZE DISTRIBUTION

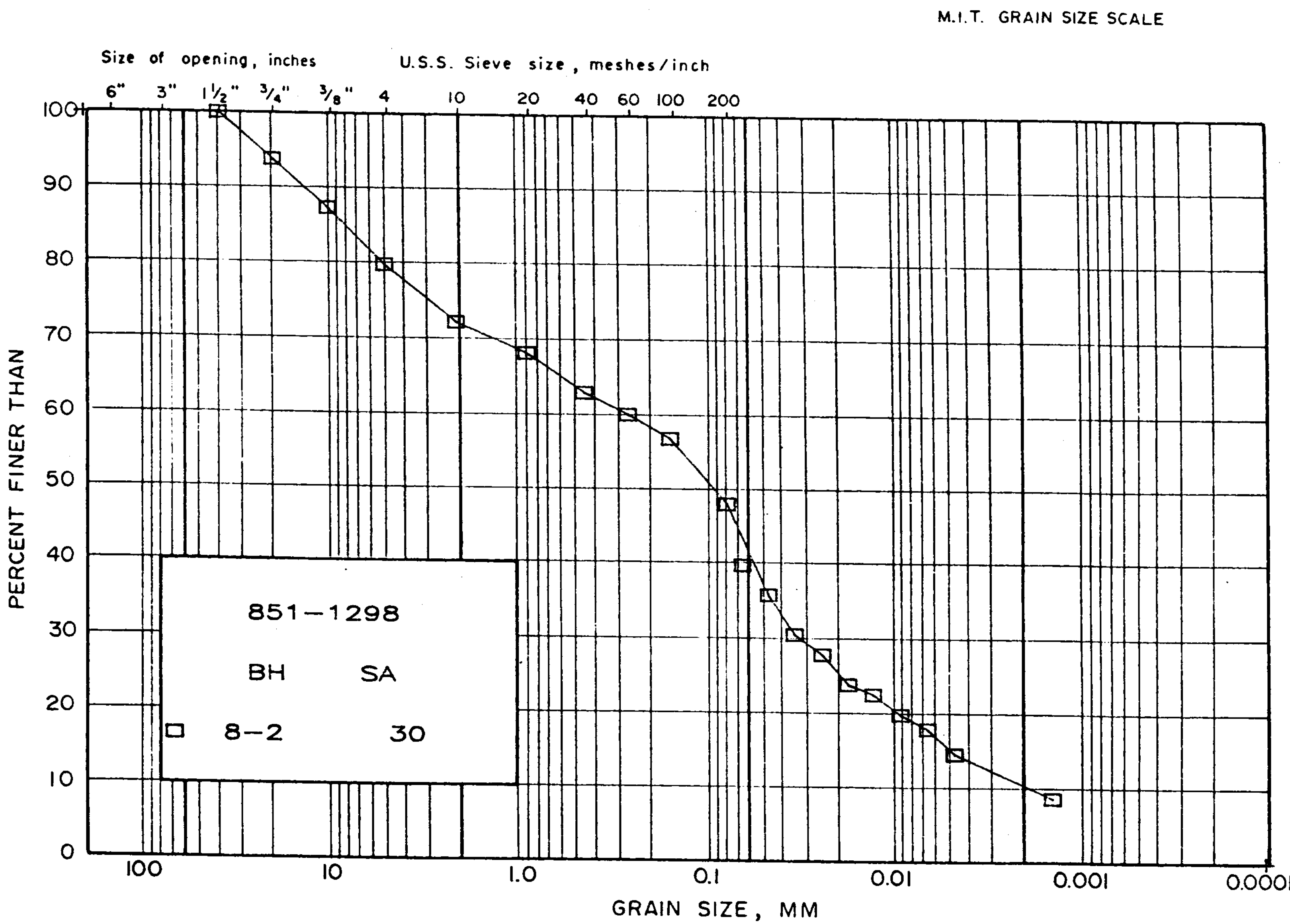
FIGURE 61



Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 62



COBBLE SIZE	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE
	GRAVEL SIZE			SAND SIZE			FINE GRAINED	

Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 63

Golder Associates

GRAIN SIZE DISTRIBUTION

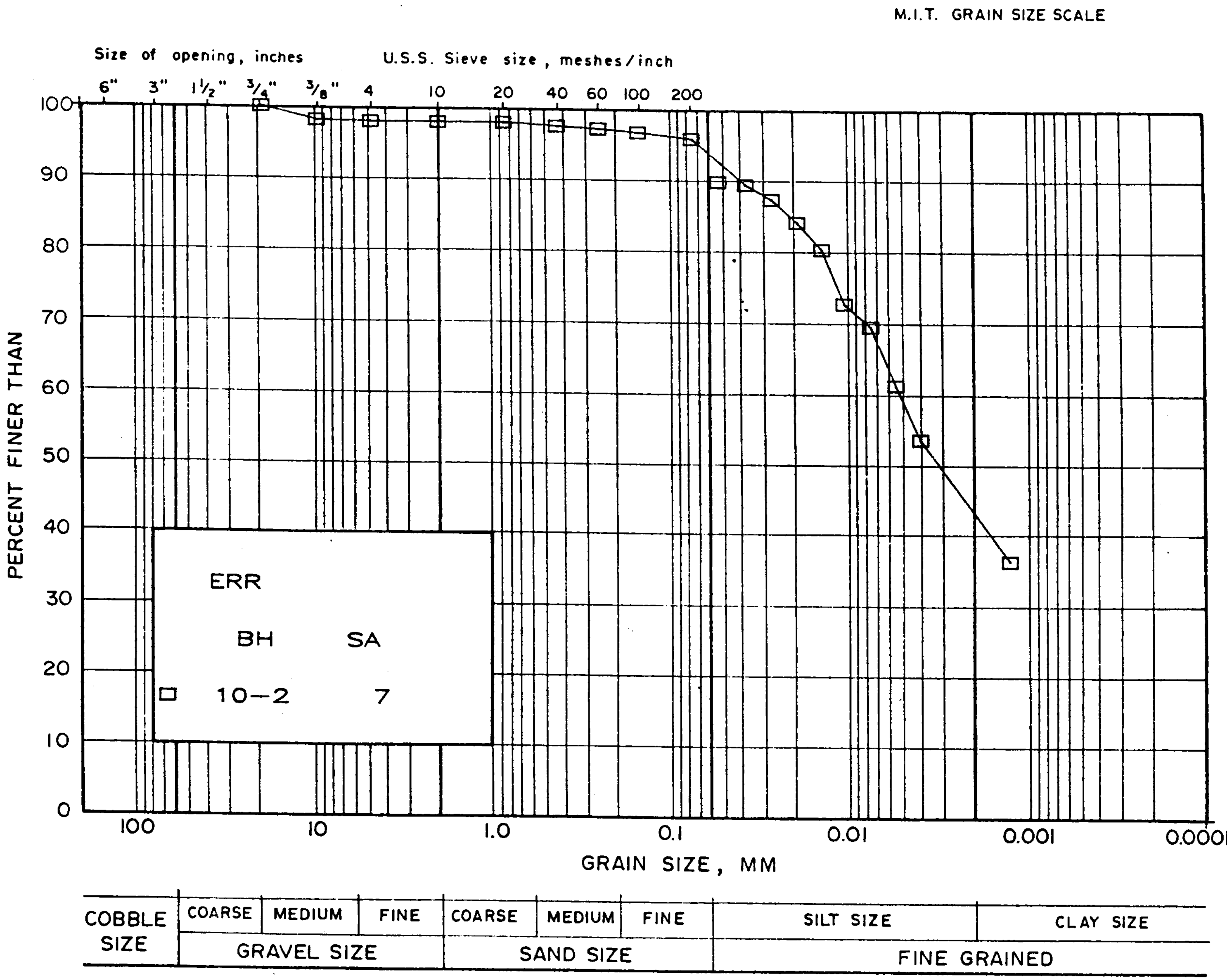
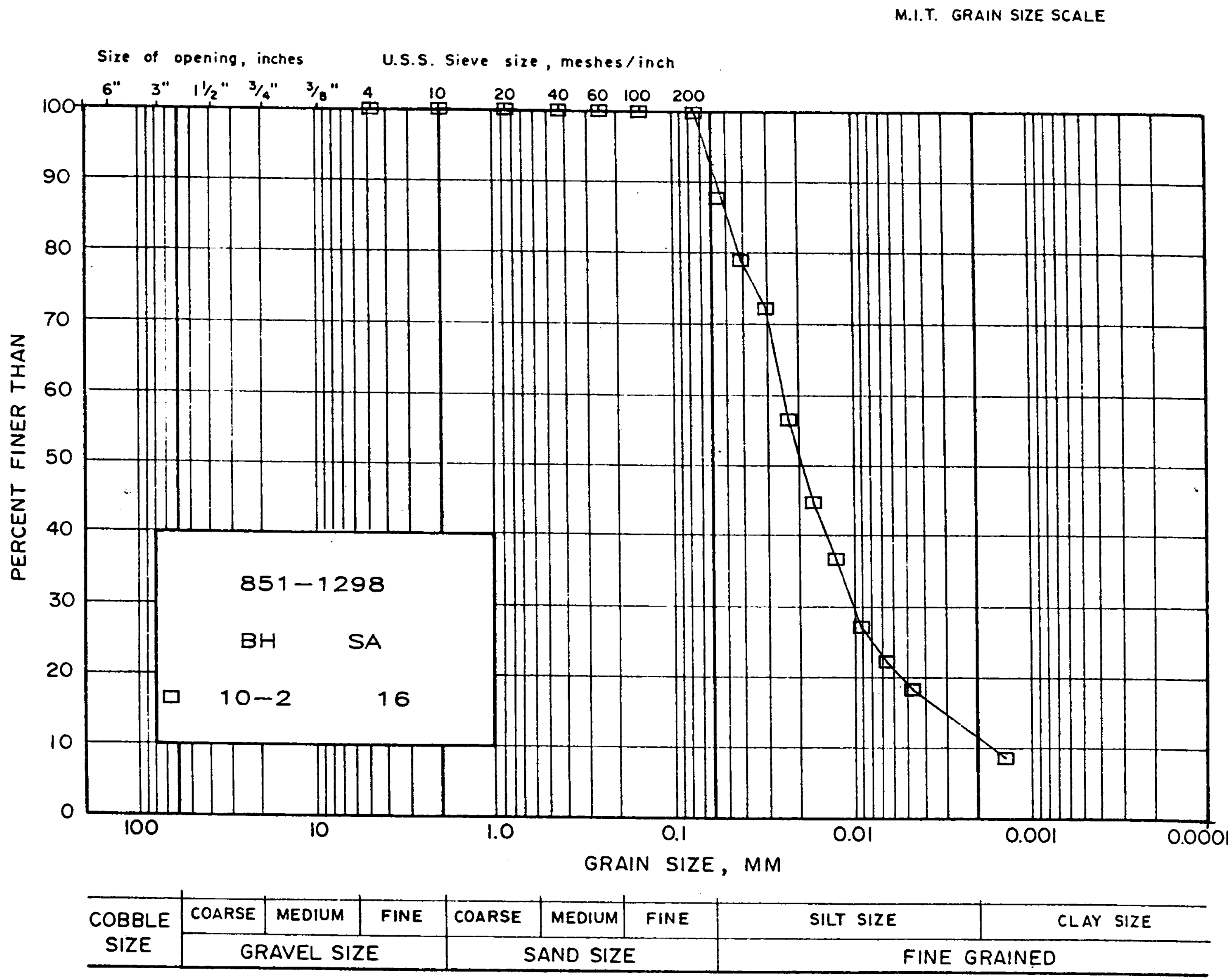


FIGURE 64

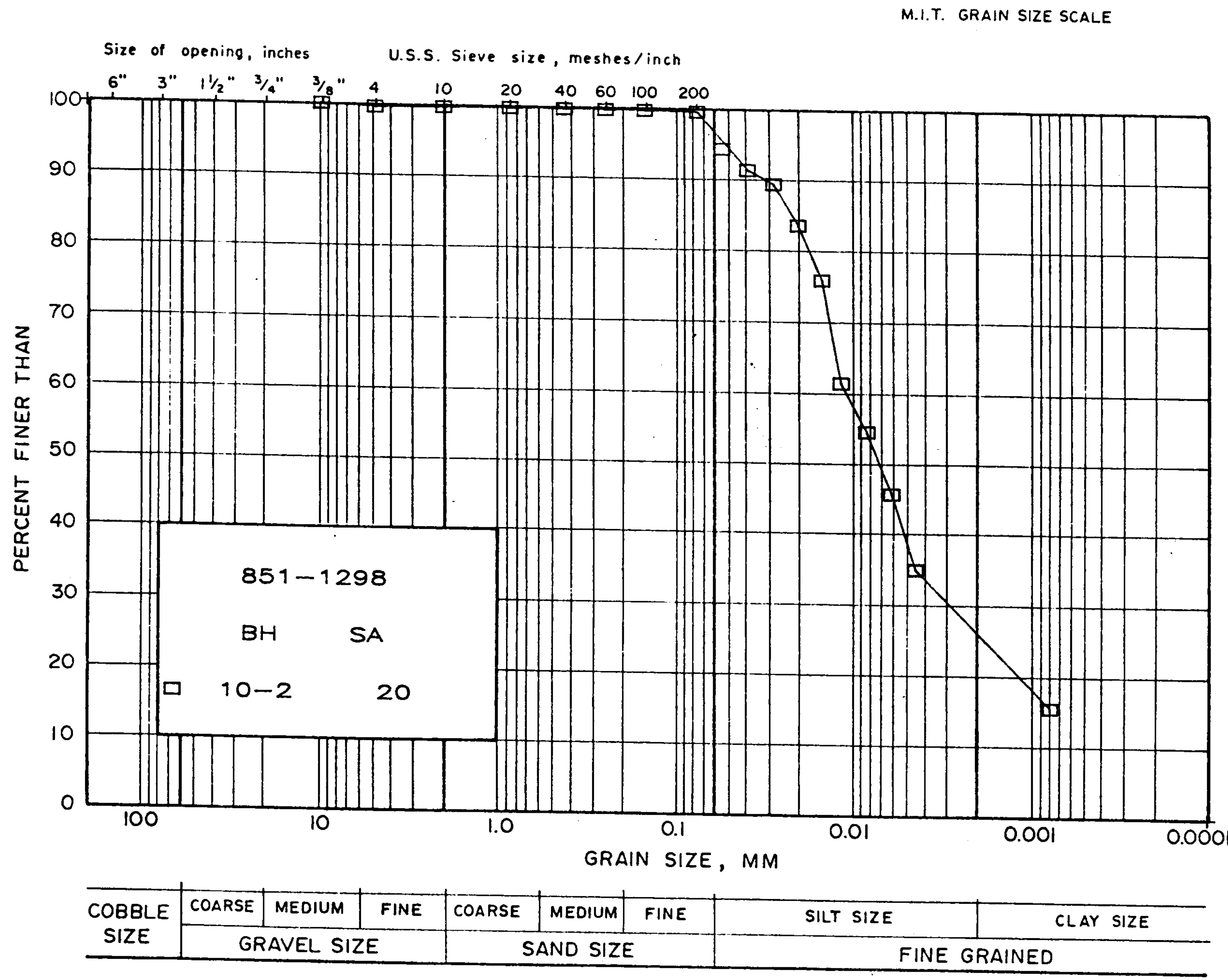
Golder Associates



GRAIN SIZE DISTRIBUTION

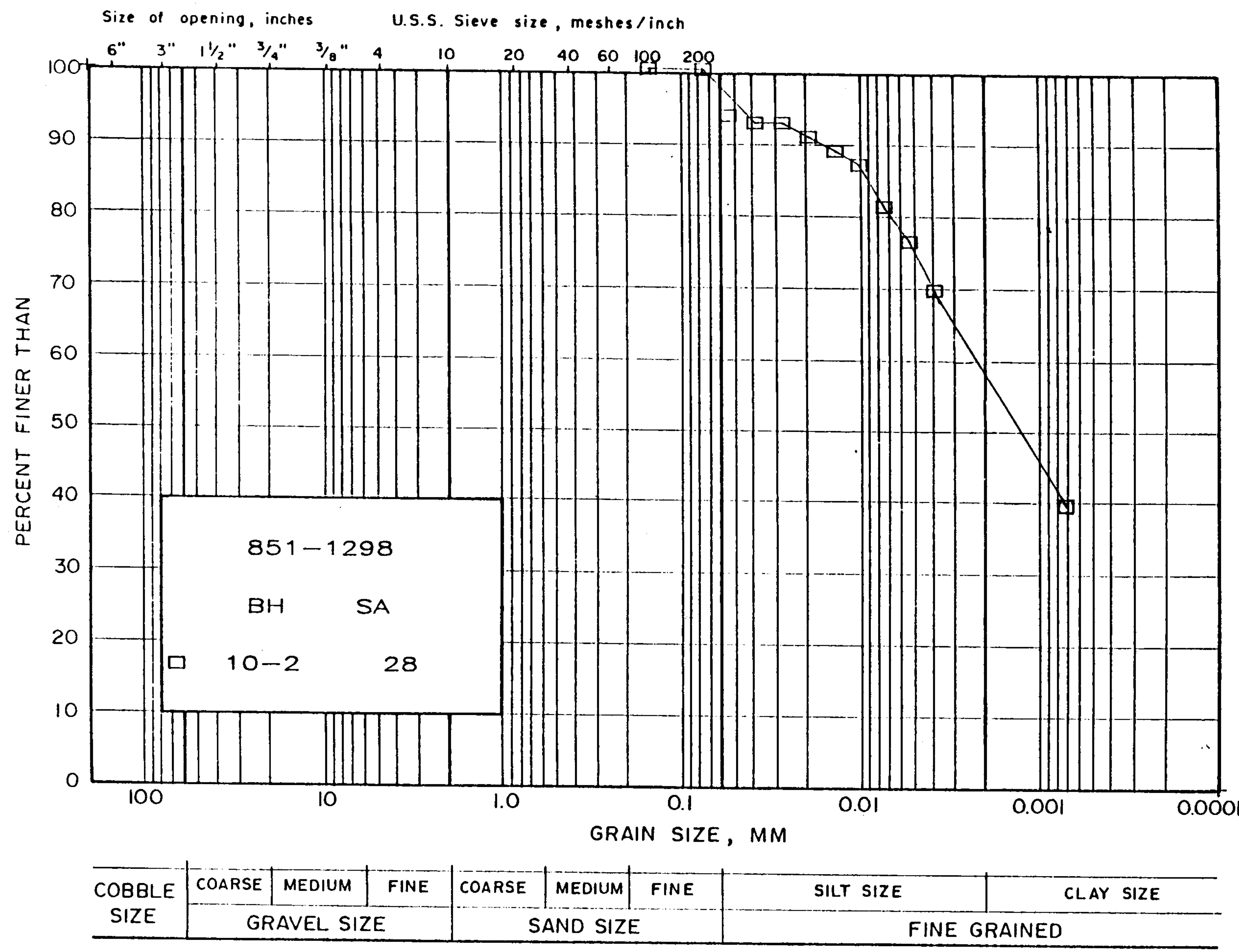
FIGURE 65

Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 66

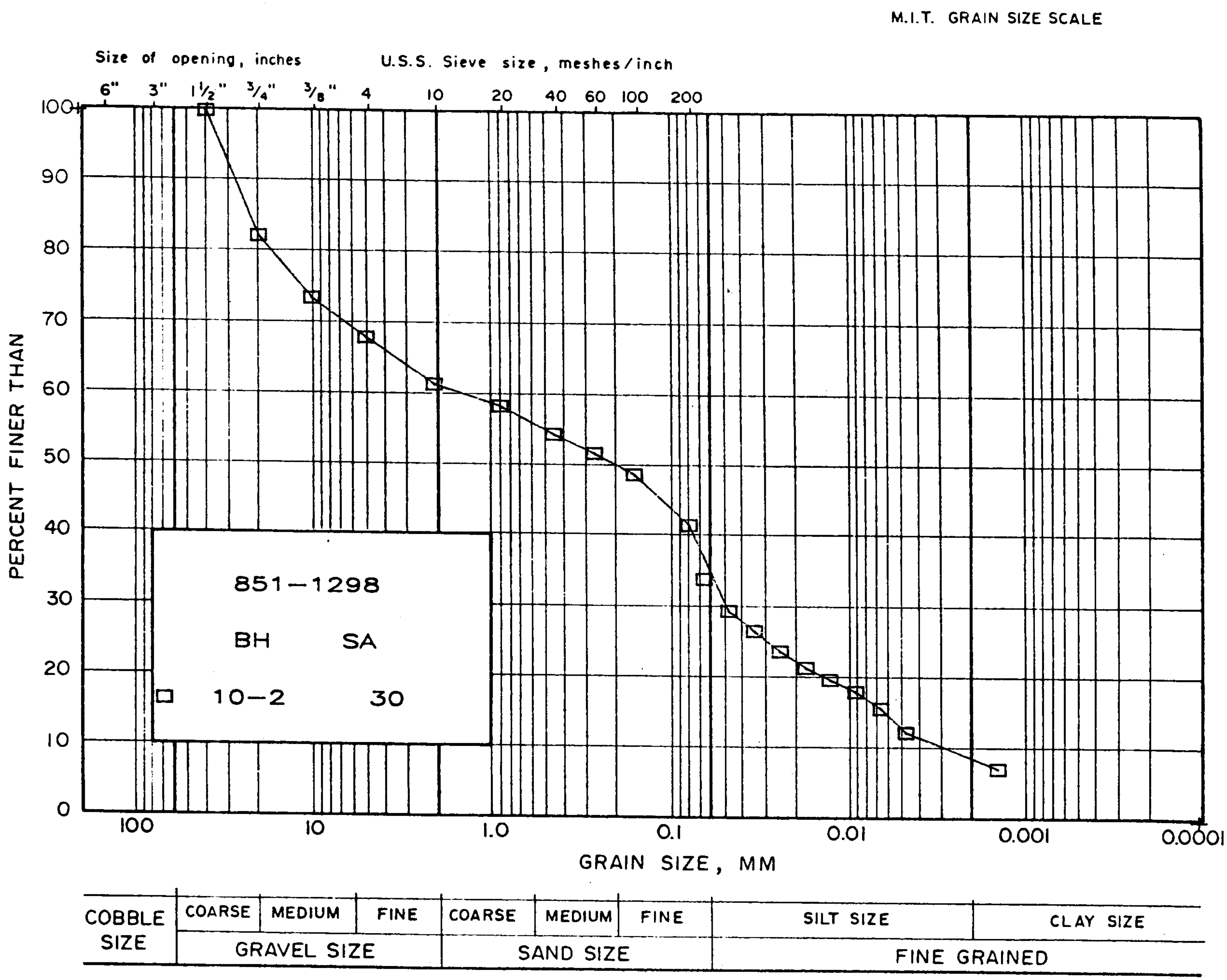


Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 67

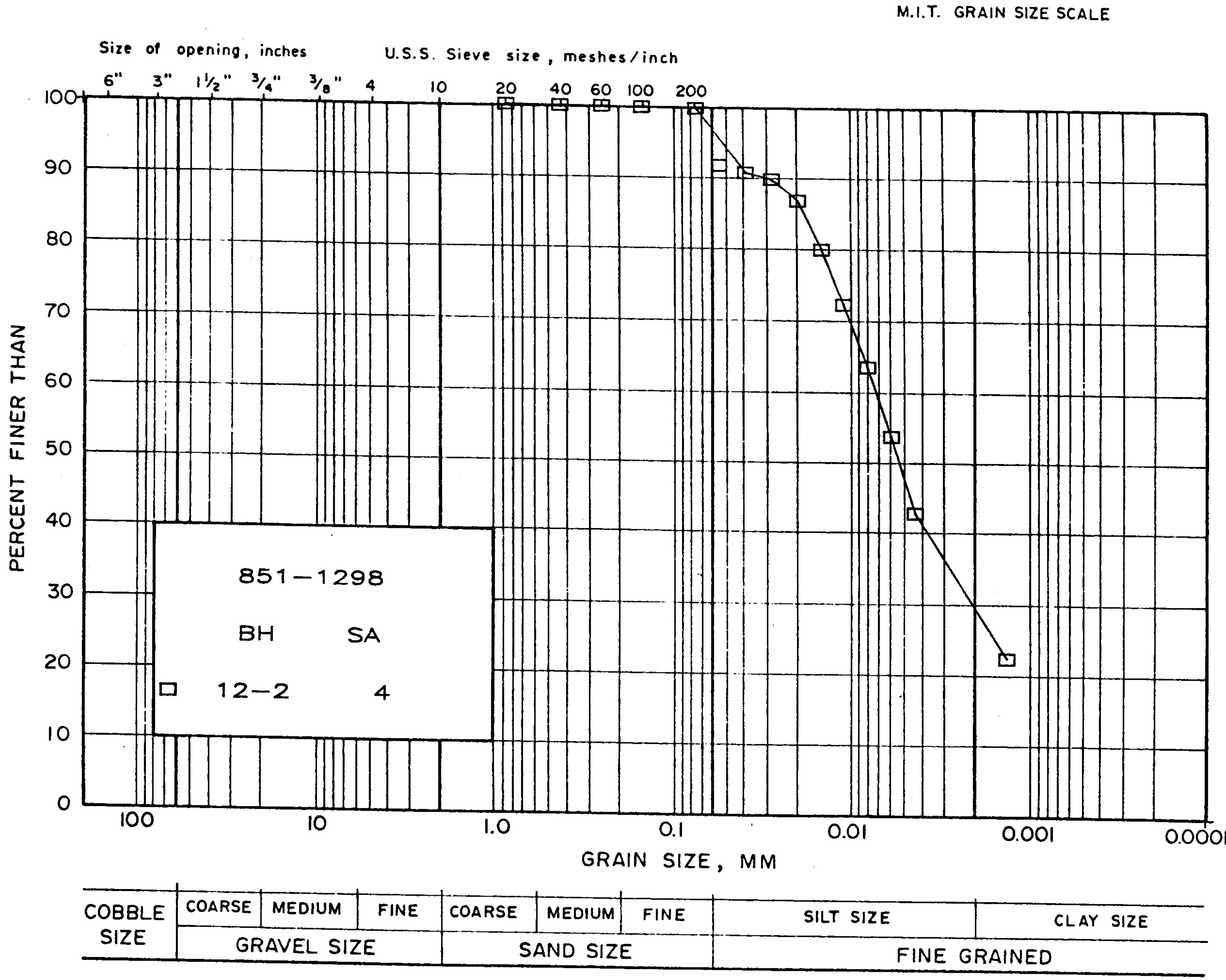
Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 68

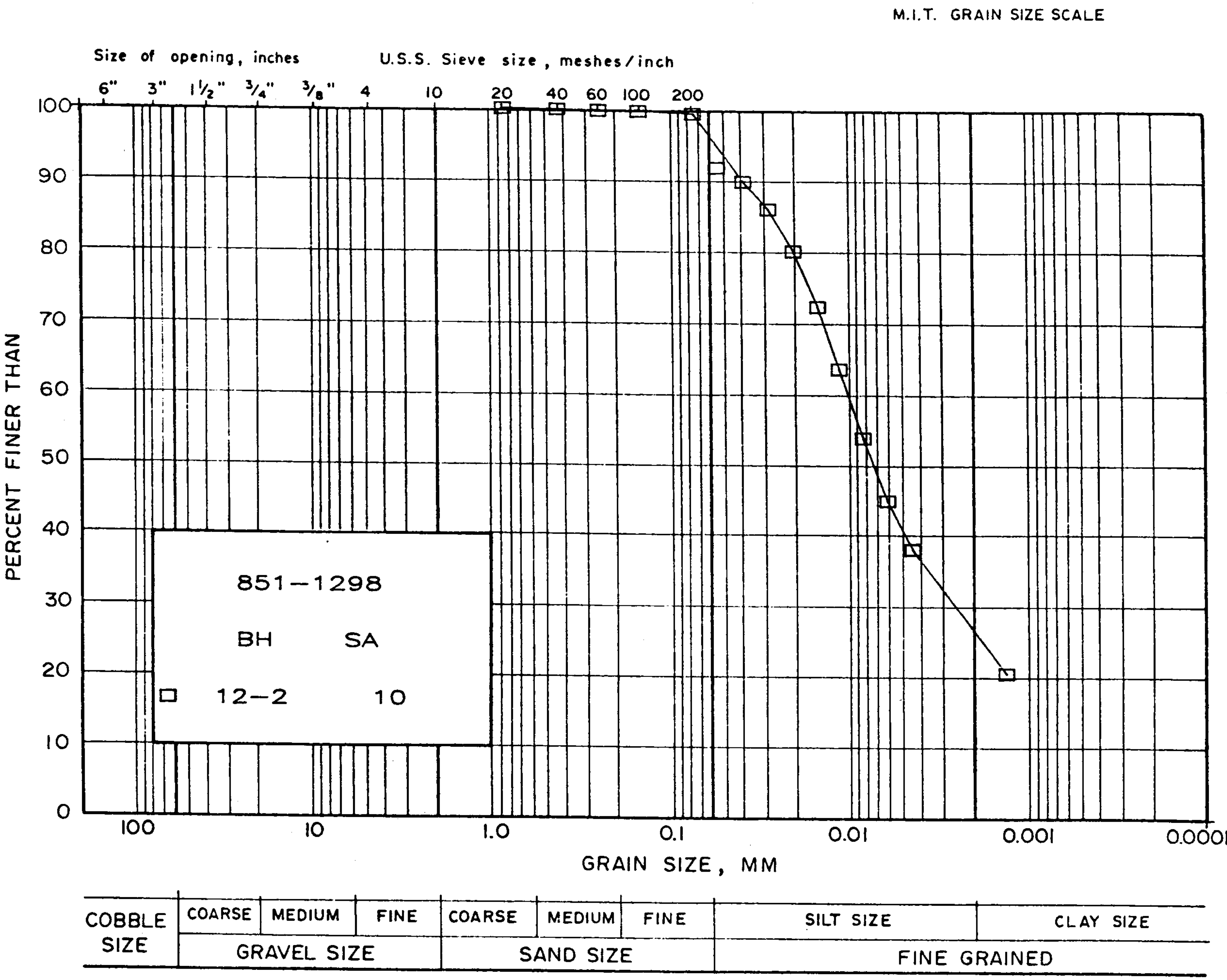
Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 69

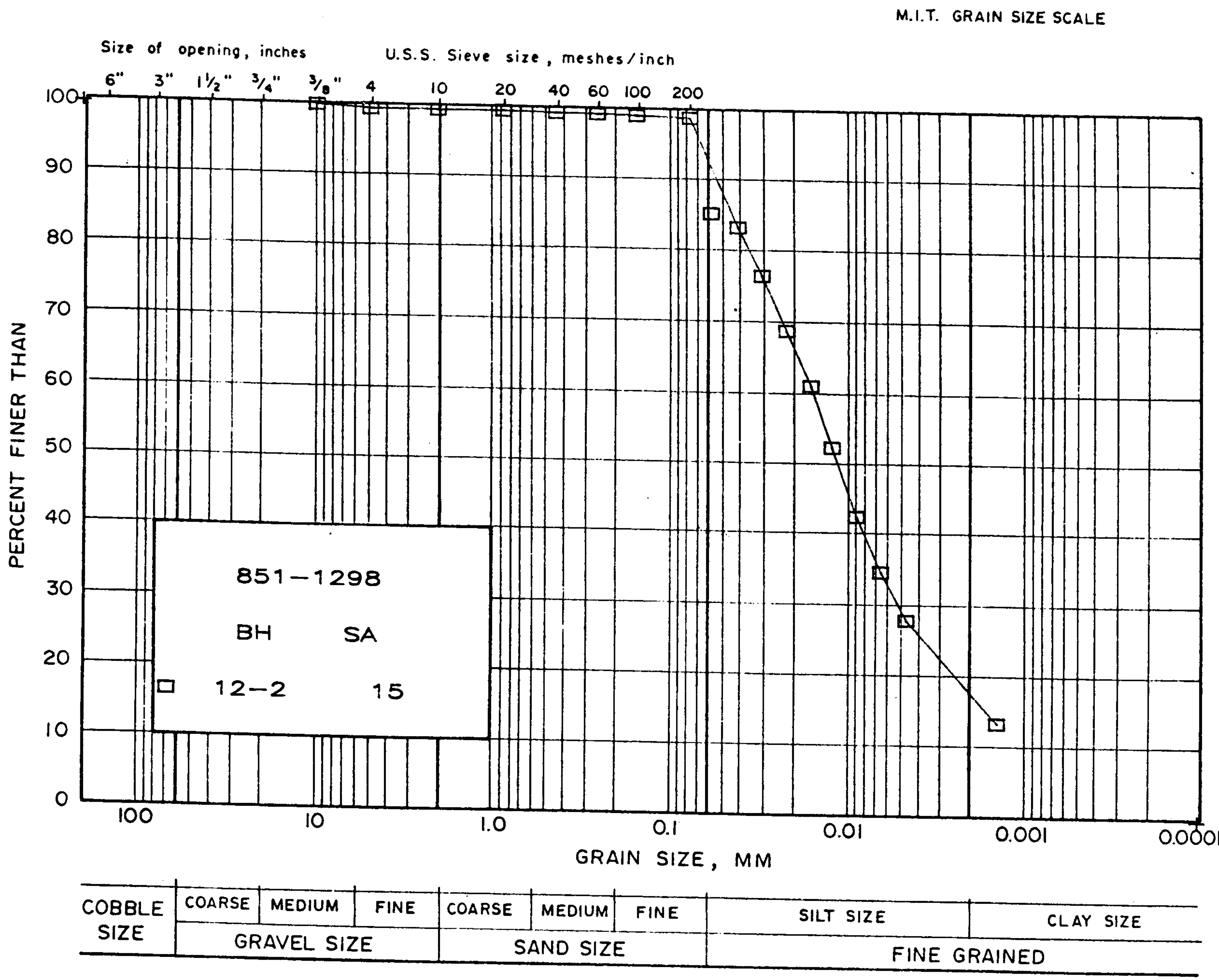
Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 70

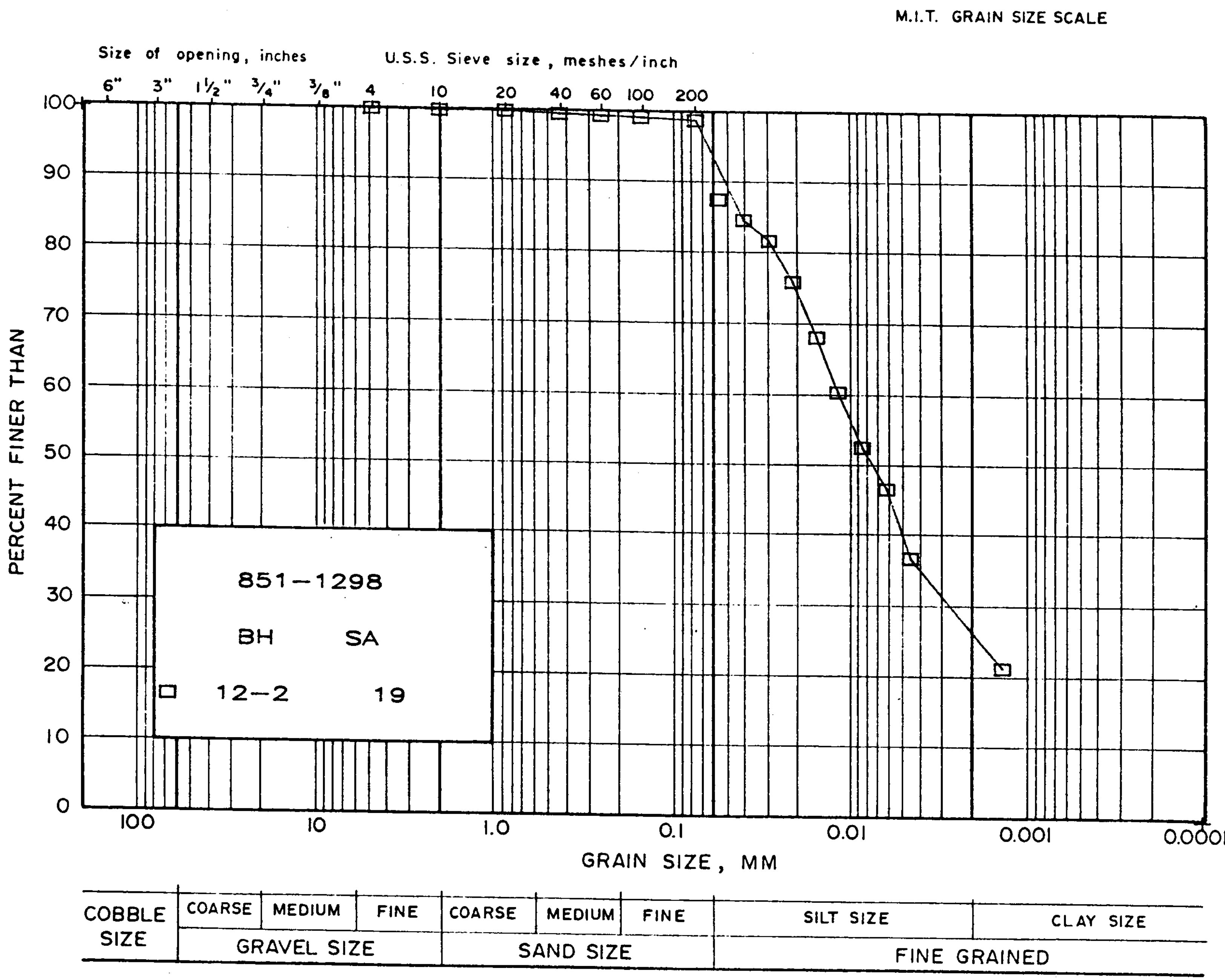
GRAIN SIZE DISTRIBUTION



Golder Associates

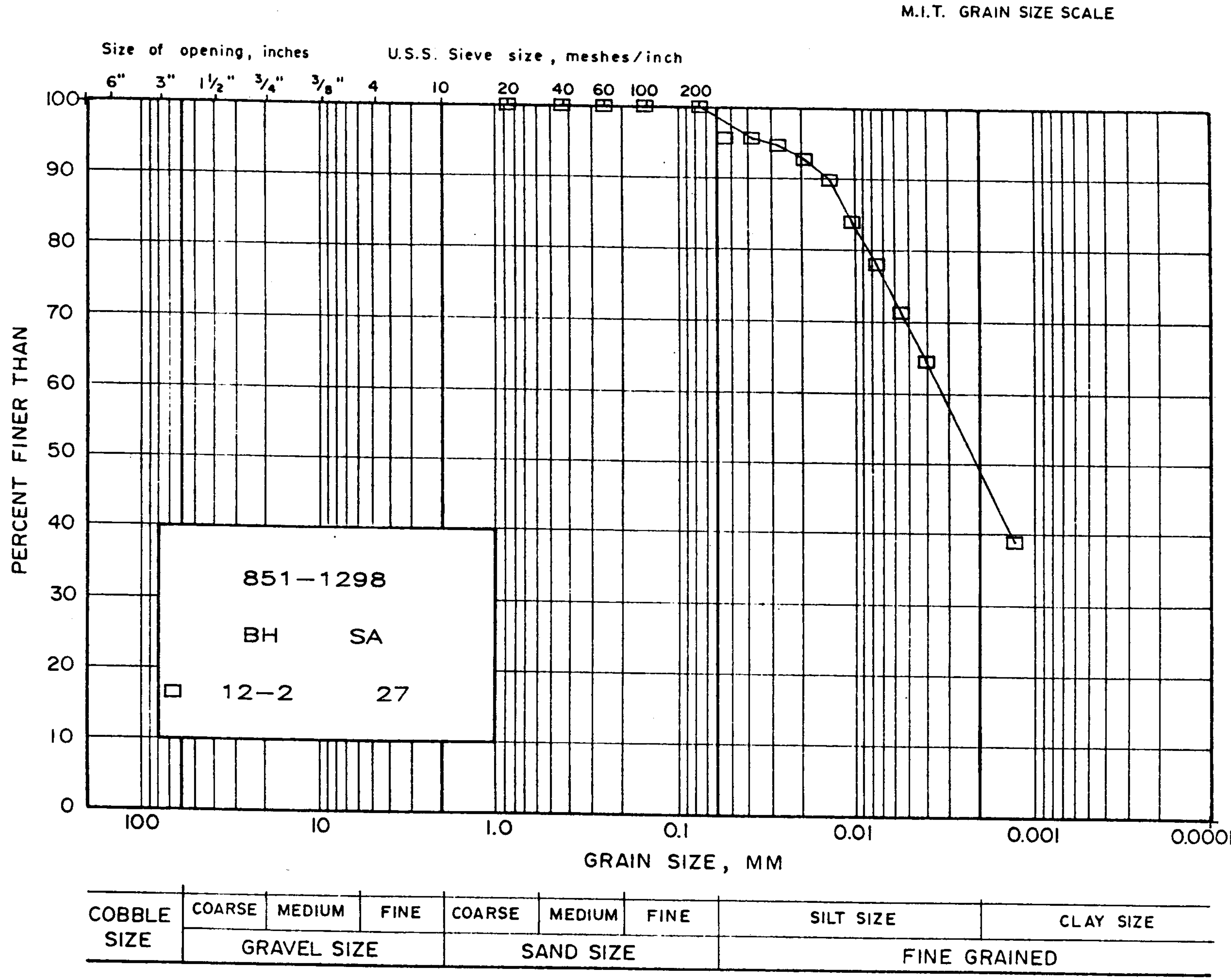
FIGURE 71

Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 72

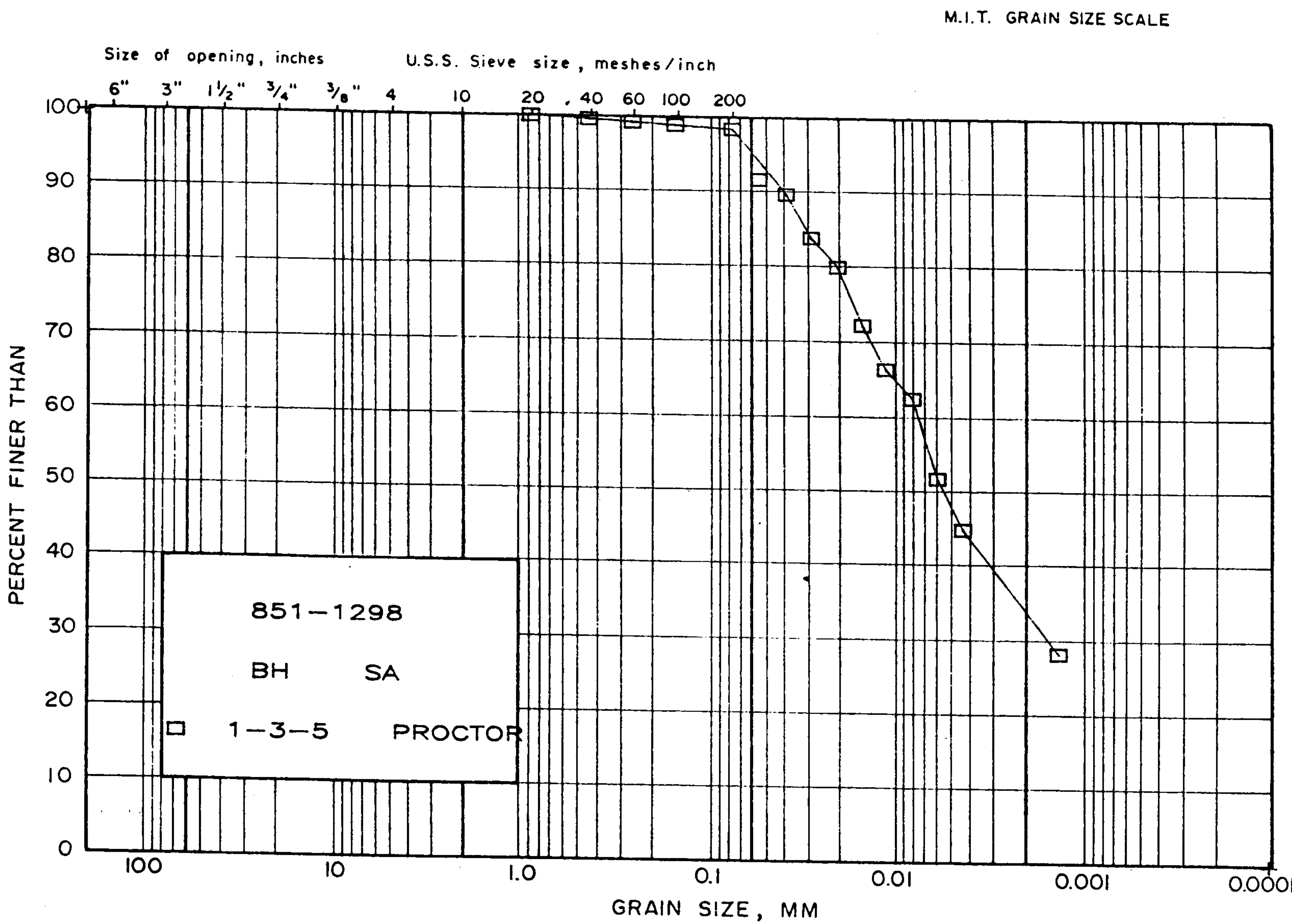


Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 73

Golder Associates

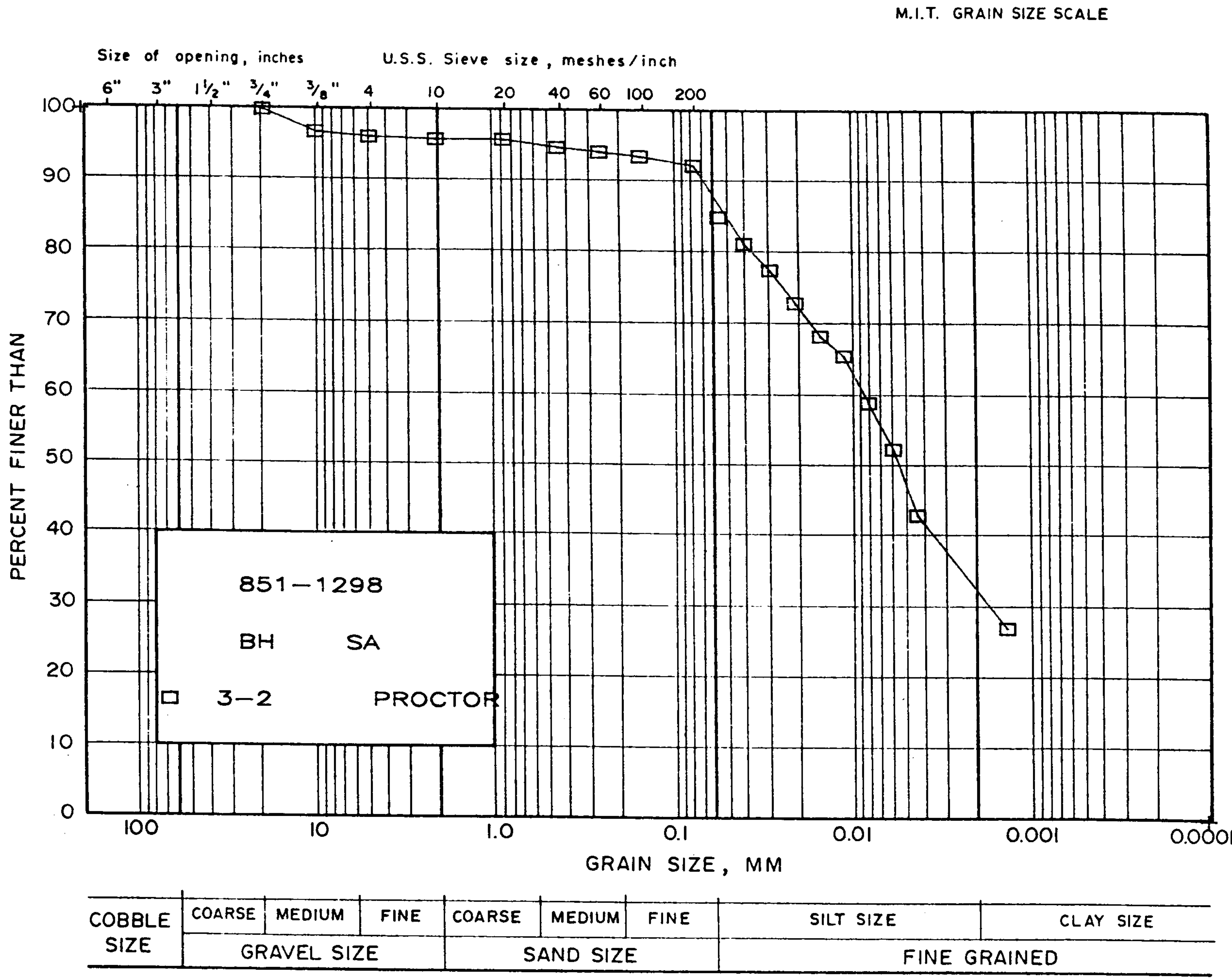


COBBLE SIZE	GRAVEL SIZE			SAND SIZE			FINE GRAINED	
	COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE	SILT SIZE	CLAY SIZE

GRAIN SIZE DISTRIBUTION

FIGURE 74

Golder Associates



GRAIN SIZE DISTRIBUTION

FIGURE 75

APPENDIX 1

COMPUTER DATA SHEETS

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH 5-2 SA 13

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	330.7	130.9	0.0	0.0	0.00	0.0	0.00	1.00	0.0	199.8
0.5	-1.1		152.3	21.4	32.0	0.32	31.0	18.36	1.10	9.2	187.6
1.0	-1.8		157.8	26.9	51.5	0.51	55.0	32.51	1.19	16.3	189.2
1.5	-2.3		170.9	40.0	62.5	0.62	108.5	64.06	1.40	32.0	191.9
2.2	-3.2		211.5	80.6	110.0	1.10	217.0	127.50	2.07	63.7	182.9
2.5	-3.5		216.3	85.4	139.6	1.39	254.2	148.92	2.30	74.5	188.8
3.0	-3.9		220.5	89.6	162.9	1.63	272.8	159.44	2.45	79.7	189.9
3.5	-4.3		224.6	93.7	190.8	1.90	314.8	183.46	2.73	91.7	197.8
7.5	-5.7		224.6	93.7	219.2	2.19	351.2	204.08	2.92	102.0	208.1
37.5	-5.9		223.9	93.0	274.0	2.73	419.5	242.41	3.27	121.2	220.0
63.3	-6.0		221.2	90.3	297.5	2.97	445.5	256.81	3.34	128.4	237.9
			212.9	82.0	323.5	3.23	471.5	271.07	3.30	135.5	253.3
			208.1	77.2	337.5	3.37	446.5	256.33	3.09	128.2	250.8
			214.3	83.4	350.5	3.50	494.9	283.74	3.44	141.9	258.3
			210.1	79.2	358.0	3.57	507.0	290.45	3.41	145.2	265.8
			201.9	71.0	380.0	3.79	525.1	300.13	3.33	150.1	278.9
			198.4	67.5	411.0	4.10	543.0	309.36	3.34	154.7	286.9
			192.2	61.3	476.0	4.75	566.0	320.29	3.31	160.1	298.6
			191.5	60.6	554.0	5.53	588.0	330.02	3.37	165.0	304.2
			188.8	57.9	596.0	5.95	597.0	333.58	3.35	166.8	308.7
			187.4	56.5	670.0	6.69	608.0	337.06	3.35	168.5	311.8
			175.7	44.8	722.0	7.21	615.0	339.04	3.19	169.5	324.5
			153.6	22.7	783.5	7.82	621.5	340.36	2.92	170.2	347.2
			161.9	31.0	1165.0	11.63	651.0	341.79	3.02	170.9	339.7
			178.4	47.5	1190.0	11.88	668.0	349.72	3.30	174.9	327.1
			179.1	48.2	1229.0	12.27	669.8	349.12	3.30	174.6	326.1
			173.6	42.7	1290.0	12.87	671.6	347.63	3.21	173.8	330.9
			180.5	49.6	1365.0	13.62	674.3	346.03	3.30	173.0	323.2
			173.6	42.7	1429.0	14.26	676.8	344.74	3.19	172.4	329.4
			177.8	46.9	1503.0	15.00	679.0	342.88	3.24	171.4	324.4
			177.8	46.9	1585.0	15.82	682.1	341.13	3.23	170.6	323.5
			172.9	42.0	1881.0	18.77	696.0	335.87	3.13	167.9	325.7

LENGTH,INITIAL.cm	10.120
DIAMETER,cm	5.030
AREA,INITIAL,cm2	19.874
VOLUME,INITIAL,cc	201.123
CONS. VOLUME CHANGE,	6.0
VOLUMETERIC STRN,cc	0.030
LENGTH,CONS.cm	10.019
AREA,CONS.,cm2	19.479
CONS.VOLUME,cc	195.123
PROVING RING kg/div	0.118
EFF.CELL PRESS.kPa	199.8

stopped overnight at 3.23%
restarted at 3.37%

slowed to .25%/hr. at 7.82%
increased to .5%/hr. at 11.63%
slowed to .25%/hr. at 15.82%

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH 5-2 SA 13

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	600.1	199.8	0.0	0.0	0.00	0.0	0.00	1.00	0.0	400.3
0.5	-1.7		223.2	23.4	5.5	0.05	17.0	9.84	1.03	4.9	381.8
1.0	-2.4		227.4	27.6	10.0	0.10	40.0	23.15	1.06	11.6	384.3
1.5	-3.0		233.6	33.8	16.2	0.16	67.0	38.76	1.11	19.4	385.9
2.0	-3.8		241.1	41.3	21.9	0.22	105.9	61.23	1.17	30.6	389.6
2.4	-4.6		259.8	59.9	28.2	0.28	194.8	112.56	1.33	56.3	396.6
3.2	-5.0		274.9	75.1	35.5	0.35	260.0	150.12	1.46	75.1	400.3
3.9	-5.4		291.4	91.6	46.5	0.46	336.0	193.79	1.63	96.9	405.6
4.4	-5.6		314.9	115.1	61.7	0.61	421.2	242.56	1.85	121.3	406.5
5.9	-6.2		330.7	130.9	76.9	0.77	499.0	286.93	2.06	143.5	412.9
32.0	-7.0		343.1	143.3	90.0	0.90	554.8	318.60	2.24	159.3	416.3
			352.8	153.0	108.0	1.08	620.3	355.57	2.44	177.8	425.1
			364.5	164.7	132.1	1.32	682.2	390.10	2.66	195.0	430.7
			370.0	170.2	155.0	1.54	728.3	415.50	2.81	207.7	437.9
			376.2	176.4	187.0	1.86	765.0	435.02	2.94	217.5	441.4
slowed to .25%/hr. at 2.89%			377.6	177.8	219.0	2.18	786.1	445.57	3.00	222.8	445.3
			377.6	177.8	290.0	2.89	806.5	453.82	3.04	226.9	449.4
increased to .5%/hr at 6.34%			377.6	177.8	311.0	3.10	807.0	453.13	3.04	226.6	449.1
			385.2	185.3	417.2	4.16	803.9	446.46	3.08	223.2	438.2
			381.7	181.9	636.0	6.34	820.0	445.04	3.04	222.5	440.9
LENGTH,INITIAL.cm		10.15	396.2	196.4	657.0	6.55	843.0	456.50	3.24	228.2	432.2
DIAMETER,cm		5.10	391.3	191.5	716.2	7.14	843.3	453.78	3.17	226.9	435.6
AREA,INITIAL,cm2		20.43	389.3	189.5	772.0	7.69	843.2	451.01	3.14	225.5	436.3
VOLUME,INITIAL,cc		207.4	391.3	191.5	811.5	8.09	844.0	449.51	3.15	224.8	433.5
CONS. VOLUME CHANGE,		7.0	393.4	193.6	851.0	8.48	845.0	448.12	3.17	224.1	430.7
VOLUMETERIC STRN,cc		0.03	393.4	193.6	871.0	8.68	845.7	447.51	3.16	223.8	430.4
LENGTH,CONS.cm		10.04	389.3	189.5	904.5	9.01	846.5	446.30	3.12	223.1	434.0
AREA,CONS.,cm2		19.97	392.0	192.2	934.8	9.31	847.9	445.55	3.14	222.8	430.8
CONS.VOLUME,cc		200.4	398.9	199.1	984.2	9.81	850.0	444.23	3.21	222.1	423.3
PROVING RING kg/div		0.118	392.7	192.9	1043.0	10.39	853.0	442.90	3.14	221.4	428.8
EFF.CELL PRESS.kPa		400.3	396.2	196.4	1073.9	10.70	853.0	441.38	3.16	220.7	424.6
			396.2	196.4	1093.5	10.90	854.0	440.93	3.16	220.5	424.4

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298

Sample Number: BH 5-2 SA 13

Sample A: A

Sample B: B

Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	930.8	130.9	0.0	0.0	0.00	0.0	0.00	1.00	0.0	799.9
0.5	-1.7		137.1	6.2	3.0	0.03	31.0	20.97	1.03	10.5	804.2
1.0	-2.4		144.0	13.1	12.0	0.12	52.0	35.14	1.04	17.6	804.4
1.5	-3.0		153.6	22.7	25.1	0.25	75.0	50.62	1.07	25.3	802.5
2.0	-3.9		163.3	32.4	37.5	0.37	91.0	61.34	1.08	30.7	798.2
2.7	-4.4		166.0	35.1	43.5	0.44	101.0	68.04	1.09	34.0	798.8
3.0	-4.9		171.6	40.7	53.0	0.53	108.0	72.69	1.10	36.3	795.6
4.9	-7.6		181.9	51.0	60.0	0.60	172.0	115.68	1.15	57.8	806.8
31.7	-10.3		212.9	82.0	70.0	0.70	302.0	202.91	1.28	101.5	819.4
			241.8	110.9	78.0	0.78	390.0	261.82	1.38	130.9	819.9
slowed to .25%/hr. at 3.59%			283.2	152.3	90.8	0.91	502.0	336.58	1.52	168.3	815.9
increased to .5%/hr at 7.21%			338.3	207.4	108.0	1.08	618.0	413.63	1.70	206.8	799.3
			354.1	223.2	127.0	1.27	708.0	472.96	1.82	236.5	813.1
LENGTH,INITIAL.cm		10.16	422.4	291.4	143.5	1.44	768.0	512.18	2.01	256.1	764.5
DIAMETER,cm		5.04	455.4	324.5	165.8	1.66	830.0	552.27	2.16	276.1	751.5
AREA,INITIAL,cm2		19.95	496.8	365.9	194.0	1.94	884.0	586.52	2.35	293.3	727.3
VOLUME,INITIAL,cc		202.72	511.9	381.0	222.2	2.22	920.0	608.64	2.45	304.3	723.2
CONS. VOLUME CHANGE,		10.30	544.3	413.4	256.2	2.56	952.0	627.62	2.62	313.8	700.3
VOLUMETERIC STRN,cc		0.05	557.4	426.5	289.3	2.90	970.0	637.31	2.71	318.7	692.1
LENGTH,CONS.cm		9.99	570.5	439.6	359.0	3.59	995.5	649.37	2.80	324.7	685.0
AREA,CONS.,cm2		19.28	579.4	448.5	379.0	3.79	981.0	638.58	2.82	319.3	670.6
CONS.VOLUME,cc		192.42	616.0	485.1	491.0	4.92	904.0	581.60	2.85	290.8	605.6
PROVING RING kg/div		0.133	613.2	482.3	720.0	7.21	1031.5	647.62	3.04	323.8	641.4
EFF.CELL PRESS.kPa		799.9	618.7	487.8	742.0	7.43	1054.0	660.18	3.11	330.1	642.2
			633.2	502.3	798.0	7.99	1056.0	657.43	3.21	328.7	626.3
			620.1	489.2	848.0	8.49	1077.0	666.85	3.15	333.4	644.1
			619.4	488.5	884.0	8.85	1085.0	669.16	3.15	334.6	646.0
			618.7	487.8	922.0	9.23	1092.0	670.66	3.15	335.3	647.4
			618.7	487.8	940.0	9.41	1094.0	670.56	3.15	335.3	647.4
			618.7	487.8	972.0	9.73	1098.0	670.63	3.15	335.3	647.4
			627.0	496.1	1000.0	10.01	1102.0	670.98	3.21	335.5	639.3
			616.6	485.7	1046.0	10.47	1106.0	669.97	3.13	335.0	649.1
			620.8	489.9	1100.0	11.01	1113.0	670.14	3.16	335.1	645.1
			620.1	489.2	1129.0	11.30	1116.0	669.75	3.16	334.9	645.6
			618.7	487.8	1147.7	11.49	1118.0	669.54	3.15	334.8	646.9

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298

Sample Number: BH.85-8-2 SA.4

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	287.3	62.0	0.0	0.0	0.000	0.0	0.00	1.00	0.0	225.3
0.5	-1.4		73.7	11.7	11.0	0.110	51.2	11.47	1.05	5.7	219.3
1.0	-2.3		75.1	13.1	40.0	0.399	73.8	16.48	1.08	8.2	220.4
1.5	-3.2		76.5	14.5	63.0	0.629	187.7	41.83	1.20	20.9	231.7
2.0	-3.9		88.2	26.2	81.9	0.817	212.8	47.33	1.24	23.7	222.8
2.5	-4.5		102.7	40.7	90.0	0.898	487.1	108.25	1.59	54.1	238.8
3.0	-4.9		111.6	49.6	98.0	0.978	551.5	122.46	1.70	61.2	236.9
3.5	-5.3		122.6	60.6	109.8	1.096	650.5	144.27	1.88	72.1	236.8
4.0	-5.6		130.2	68.2	122.5	1.223	768.0	170.11	2.08	85.1	242.1
5.0	-5.7		137.8	75.8	138.9	1.386	874.0	193.27	2.29	96.6	246.1
6.3	-6.0		141.9	79.9	156.2	1.559	976.0	215.45	2.48	107.7	253.1
21.6	-6.8		144.0	82.0	174.1	1.738	1065.2	234.71	2.64	117.4	260.7
42.2	-7.2		145.4	83.4	194.3	1.939	1155.5	254.09	2.79	127.0	269.0
LENGTH,INITIAL.cm		10.140	145.4	83.4	200.1	1.997	1133.9	249.19	2.76	124.6	266.5
DIAMETER.cm		5.010	145.4	83.4	213.1	2.127	1067.0	234.18	2.65	117.1	259.0
AREA,INITIAL,cm2		19.716	145.4	83.4	214.2	2.138	1132.2	248.46	2.75	124.2	266.1
VOLUME,INITIAL,cc		199.922	148.8	86.8	215.8	2.154	1196.0	262.42	2.89	131.2	269.7
CONS. VOLUME CHANGE,		7.2	146.8	84.8	221.1	2.207	1272.0	278.94	2.98	139.5	280.0
VOLUMETERIC STRN,cc		0.036	145.4	83.4	226.3	2.259	1313.0	287.78	3.03	143.9	285.8
LENGTH,CONS.cm		10.018	145.4	83.4	232.3	2.319	1349.5	295.60	3.08	147.8	289.7
AREA,CONS.,cm2		19.243	144.0	82.0	243.0	2.426	1398.0	305.89	3.13	152.9	296.2
CONS.VOLUME,cc		192.722	144.0	82.0	249.0	2.485	1420.0	310.51	3.17	155.3	298.6
PROVING RING kg/div		0.044	143.3	81.3	256.0	2.555	1445.0	315.75	3.19	157.9	301.9
EFF.CELL PRESS.kPa		225.3	143.3	81.3	265.0	2.645	1475.0	322.01	3.24	161.0	305.0
			140.6	78.6	275.0	2.745	1512.0	329.75	3.25	164.9	311.6
stopped overnight at 1.94%			141.2	79.2	283.4	2.829	1543.0	336.22	3.30	168.1	314.2
restarted at 2.00%			138.5	76.5	303.3	3.027	1606.0	349.23	3.35	174.6	323.4
			137.8	75.8	319.0	3.184	1658.0	359.96	3.41	180.0	329.5
			136.4	74.4	340.0	3.394	1724.0	373.48	3.48	186.7	337.6
			131.6	69.6	365.7	3.650	1805.0	389.99	3.50	195.0	350.7
			130.2	68.2	389.8	3.891	1883.0	405.82	3.58	202.9	360.0
			126.1	64.1	409.3	4.086	1943.0	417.91	3.59	209.0	370.2
			123.3	61.3	438.8	4.380	2033.0	435.92	3.66	218.0	381.9
			117.1	55.1	464.3	4.635	2112.0	451.65	3.65	225.8	396.0
			113.0	51.0	492.0	4.911	2195.0	468.04	3.69	234.0	408.3
			108.2	46.2	525.0	5.240	2291.0	486.82	3.72	243.4	422.5
			102.0	40.0	557.0	5.560	2379.8	503.99	3.72	252.0	437.3
slowed to .25%/hr. at 6.16%			88.9	26.9	617.5	6.164	2635.0	554.46	3.79	277.2	475.6
			88.2	26.2	641.0	6.398	2635.0	553.08	3.78	276.5	475.6
			71.0	9.0	719.5	7.182	2670.0	555.73	3.57	277.9	494.2
			57.9	-4.1	880.0	8.784	3054.0	624.69	3.72	312.3	541.8
			58.6	-3.4	891.0	8.894	3073.0	627.82	3.74	313.9	542.6
			53.7	-8.3	911.0	9.093	3098.0	631.54	3.70	315.8	549.3
			54.4	-7.6	927.3	9.256	3116.5	634.17	3.72	317.1	549.9
			53.0	-8.9	940.0	9.383	3128.3	635.68	3.71	317.8	552.1
			53.0	-8.9	946.0	9.443	3136.0	636.83	3.72	318.4	552.7
			50.3	-11.7	959.1	9.573	3146.2	637.97	3.69	319.0	556.0
			49.6	-12.4	968.0	9.662	3153.0	638.73	3.69	319.4	557.1
			49.6	-12.4	980.0	9.782	3163.0	639.90	3.69	319.9	557.6

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298

Sample Number: BH.85-8-2 SA.4

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
			48.2	-13.8	992.0	9.902	3175.0	641.40	3.68	320.7	559.8
			48.2	-13.8	1008.2	10.064	3184.2	642.18	3.69	321.1	560.2
maximum capacity of prooving			47.5	-14.5	1020.8	10.189	3194.0	643.26	3.68	321.6	561.4
ring reached at 10.23%			47.5	-14.5	1025.0	10.231	3197.0	643.56	3.68	321.8	561.5

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH.85-8-2 SA.4

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	580.8	130.9	0.0	0.0	0.000	0.0	0.00	1.00	0.0	449.9
0.5	-1.2		165.4	34.4	19.0	0.190	4.0	6.17	1.01	3.1	418.5
1.0	-2.0		167.4	36.5	44.9	0.448	4.0	6.15	1.01	3.1	416.5
1.5	-2.8		172.2	41.3	70.0	0.699	4.3	6.60	1.02	3.3	411.9
2.0	-3.3		175.0	44.1	53.0	0.529	10.0	15.37	1.04	7.7	413.5
2.5	-3.6		203.3	72.3	62.0	0.619	80.0	122.83	1.33	61.4	439.0
3.0	-3.8		248.0	117.1	70.1	0.700	167.0	256.20	1.77	128.1	460.9
3.5	-4.0		276.3	145.4	95.0	0.948	235.0	359.62	2.18	179.8	484.3
4.2	-4.1		305.2	174.3	112.0	1.118	290.0	443.03	2.61	221.5	497.1
5.5	-4.2		316.2	185.3	132.0	1.318	341.0	519.89	2.97	259.9	524.5
9.6	-4.3		323.8	192.9	153.0	1.527	382.0	581.16	3.26	290.6	547.6
13.2	-4.4		324.5	193.6	177.0	1.767	417.2	633.17	3.47	316.6	572.9
65.2	-4.4		323.1	192.2	200.2	1.999	445.0	673.76	3.61	336.9	594.5
			314.9	184.0	226.8	2.264	468.3	707.12	3.66	353.6	619.5
stopped overnight at 2.26%			314.9	184.0	232.0	2.316	451.2	680.94	3.56	340.5	606.4
restarted at 2.32%			299.7	168.8	310.0	3.095	91.5	136.99	1.49	68.5	349.6
			295.6	164.7	313.0	3.125	131.0	196.06	1.69	98.0	383.3
			305.2	174.3	316.5	3.160	167.7	250.90	1.91	125.4	401.0
			316.9	186.0	322.4	3.219	218.7	327.01	2.24	163.5	427.4
			322.5	191.5	327.0	3.265	249.0	372.14	2.44	186.1	444.4
LENGTH,INITIAL.cm		10.89	328.7	197.7	330.8	3.302	275.0	410.83	2.63	205.4	457.6
DIAMETER,cm		5.05	334.2	203.3	338.8	3.382	319.0	476.17	2.93	238.1	484.7
AREA,INITIAL,cm2		20.03	336.9	206.0	343.2	3.426	340.0	507.29	3.08	253.6	497.5
VOLUME,INITIAL,cc		202.1	336.9	206.0	348.0	3.474	368.1	548.94	3.25	274.5	518.4
CONS. VOLUME CHANGE,		4.4	336.9	206.0	355.4	3.548	382.0	569.23	3.33	284.6	528.5
VOLUMETERIC STRN,cc		0.02	336.2	205.3	365.0	3.644	407.0	605.88	3.48	302.9	547.5
LENGTH,CONS.cm		10.82	333.5	202.6	373.8	3.732	423.2	629.43	3.54	314.7	562.0
AREA,CONS.,cm2		19.74	330.7	199.8	395.0	3.943	451.0	669.30	3.68	334.6	584.7
CONS.VOLUME,cc		197.7	329.3	198.4	412.0	4.113	466.8	691.52	3.75	345.9	597.2
PROVING RING kg/div		0.311	323.8	192.9	437.0	4.363	484.7	716.17	3.79	358.1	615.1
EFF.CELL PRESS.kPa		449.9	317.6	186.7	467.0	4.662	503.0	740.88	3.81	370.4	633.6
			310.7	179.8	497.0	4.962	515.9	757.50	3.80	378.7	648.8
			308.7	177.8	521.1	5.202	526.0	770.37	3.83	385.2	657.3
			299.7	168.8	555.3	5.544	539.5	787.30	3.80	393.6	674.7
			294.9	164.0	590.3	5.893	550.6	800.52	3.80	400.3	686.2
			290.1	159.2	625.3	6.242	561.7	813.63	3.80	406.8	697.6
			283.2	152.3	665.9	6.648	572.8	826.12	3.78	413.1	710.7
			276.3	145.4	704.0	7.028	583.3	837.84	3.75	418.9	723.4
slowed to .25%/hr. at 7.74%			283.2	152.3	775.0	7.737	593.0	845.20	3.84	422.6	720.3
			281.8	150.9	804.0	8.026	588.0	835.52	3.79	417.8	716.8
			265.3	134.4	917.0	9.155	613.5	861.06	3.73	430.5	746.1
increased to .5%/hr. at 11.45%			239.1	108.2	1147.0	11.451	665.0	909.75	3.66	454.9	796.6
			232.2	101.3	1172.0	11.700	680.0	927.65	3.66	463.8	812.4
			226.7	95.8	1232.0	12.299	692.8	938.70	3.65	469.3	823.5
			219.1	88.2	1290.5	12.883	702.0	944.83	3.61	472.4	834.1
			212.2	81.3	1335.0	13.328	707.1	946.84	3.57	473.4	842.0
			210.1	79.2	1376.0	13.737	710.0	946.24	3.55	473.1	843.8
			207.4	76.5	1398.0	13.957	710.0	943.83	3.53	471.9	845.3
			206.7	75.8	1434.0	14.316	709.0	938.56	3.51	469.3	843.4

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH.85-8-2 SA.4

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
			206.7	75.8	1467.5	14.650	708.9	934.77	3.50	467.4	841.5
			206.7	75.8	1521.5	15.189	710.8	931.35	3.49	465.7	839.8
			205.3	74.4	1586.0	15.833	709.0	921.94	3.46	461.0	836.5
			205.3	74.4	1620.0	16.173	709.3	918.61	3.45	459.3	834.8

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH.85-8-2 SA.4

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	711.7	130.9	0.0	0.0	0.000	0.0	0.00	0.65	0.0	895.7
0.5	-2.2		287.3	156.4	69.0	0.695	618.0	423.69	1.15	211.8	951.1
1.0	-3.5		317.6	186.7	78.8	0.794	638.0	436.96	1.17	218.5	927.5
1.5	-4.5		335.5	204.6	83.8	0.844	678.0	464.12	1.22	232.1	923.1
2.0	-5.3		355.5	224.6	89.0	0.896	822.0	562.40	1.37	281.2	952.3
2.5	-5.9		378.9	248.0	96.0	0.967	877.0	599.60	1.44	299.8	947.5
3.0	-6.6		394.8	263.9	102.0	1.027	1016.0	694.21	1.60	347.1	978.9
3.5	-7.0		418.2	287.3	110.0	1.108	1062.0	725.05	1.67	362.5	970.9
4.0	-7.5		448.5	317.6	124.0	1.249	1132.0	771.74	1.79	385.9	963.9
5.0	-8.1		465.8	334.8	134.0	1.350	1175.0	800.24	1.87	400.1	961.0
5.6	-8.3		488.5	357.6	149.0	1.501	1226.0	833.70	1.96	416.8	955.0
6.6	-8.6		512.6	381.7	174.0	1.753	1290.0	874.97	2.09	437.5	951.5
31.4	-11.3		520.9	390.0	199.0	2.004	1329.5	899.46	2.16	449.7	955.5
LENGTH,INITIAL.cm		10.12	566.4	435.4	219.0	2.206	1374.0	927.65	2.33	463.8	924.1
DIAMETER,cm		5.00	561.5	430.6	253.0	2.548	1402.0	943.24	2.35	471.6	936.7
AREA,INITIAL,cm2		19.64	558.1	427.2	299.0	3.012	1434.0	960.18	2.38	480.1	948.6
VOLUME,INITIAL,cc		198.73	571.9	441.0	332.3	3.347	1452.0	968.87	2.44	484.4	939.2
CONS. VOLUME CHANGE,		11.30	576.7	445.8	363.6	3.662	1460.0	971.03	2.46	485.5	935.4
VOLUMETERIC STRN,cc		0.06	580.8	449.9	379.1	3.818	1462.1	970.85	2.47	485.4	931.2
LENGTH,CONS.cm		9.93	569.8	438.9	445.0	4.482	1462.0	964.09	2.42	482.0	930.8
AREA,CONS.,cm2		18.89	569.1	438.2	465.5	4.689	1460.5	961.02	2.41	480.5	930.0
CONS.VOLUME,cc		187.43	525.0	394.1	612.0	6.164	1136.0	735.92	1.84	368.0	869.6
PROVING RING kg/div		0.133	627.0	496.1	872.0	8.783	1055.0	664.37	1.87	332.2	731.8

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH. 85-8-2 SA. 22

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	381.0	130.9	0.0	0.0	0.00	0.0	0.00	1.00	0.0	250.1
0.5	-1.2		157.8	26.9	20.0	0.20	52.0	11.77	1.05	5.9	229.1
1.0	-1.8		167.4	36.5	22.1	0.22	106.3	24.05	1.11	12.0	225.6
1.5	-2.6		177.8	46.8	26.1	0.26	184.0	41.62	1.20	20.8	224.1
2.0	-4.2		188.8	57.9	30.5	0.31	234.5	53.02	1.28	26.5	218.7
2.5	-4.2		206.7	75.8	41.0	0.41	308.0	69.56	1.40	34.8	209.1
3.3	-5.4		220.5	89.6	54.0	0.54	360.0	81.20	1.51	40.6	201.1
4.2	-6.8		226.0	95.1	67.5	0.68	387.2	87.21	1.56	43.6	198.6
4.5	-7.5		232.2	101.3	75.0	0.76	417.0	93.85	1.63	46.9	195.7
6.6	-9.6		246.0	115.1	101.0	1.02	464.0	104.15	1.77	52.1	187.1
11.9	-12.2		254.2	123.3	126.5	1.27	502.0	112.39	1.89	56.2	183.0
13.1	-12.4		255.6	124.7	154.0	1.55	535.0	119.44	1.95	59.7	185.1
33.4	-14.7		268.0	137.1	185.0	1.86	573.0	127.52	2.13	63.8	176.7
LENGTH,INITIAL.cm		10.170	273.5	142.6	228.0	2.30	618.4	137.02	2.27	68.5	176.0
DIAMETER,cm		4.990	274.9	144.0	261.0	2.63	651.0	143.75	2.35	71.9	178.0
AREA,INITIAL,cm2		19.559	274.9	144.0	287.7	2.90	675.0	148.63	2.40	74.3	180.4
VOLUME,INITIAL,cc		198.915	276.3	145.4	298.2	3.01	684.2	150.50	2.44	75.2	180.0
CONS. VOLUME CHANGE,		14.7	279.7	148.8	330.0	3.33	713.9	156.51	2.55	78.3	179.5
VOLUMETERIC STRN,cc		0.074	286.6	155.7	362.0	3.65	743.0	162.35	2.72	81.2	175.6
LENGTH,CONS.cm		9.919	294.9	164.0	472.5	4.76	805.0	173.86	3.02	86.9	173.0
AREA,CONS.,cm2		18.595	292.1	161.2	683.0	6.89	878.0	185.40	3.09	92.7	181.6
CONS.VOLUME,cc		184.215	289.4	158.5	694.0	7.00	876.0	184.76	3.02	92.4	184.0
PROVING RING kg/div		0.043	289.4	158.5	706.0	7.12	892.1	187.91	3.05	94.0	185.6
EFF.CELL PRESS.kPa		250.1	287.3	156.4	725.0	7.31	899.0	188.97	3.02	94.5	188.2
			283.2	152.3	762.0	7.68	905.9	189.66	2.94	94.8	192.7
slowed to .25%/hr at 3.65%			283.2	152.3	786.0	7.92	909.0	189.81	2.94	94.9	192.7
			288.7	157.8	818.5	8.25	914.7	190.32	3.06	95.2	187.5
increase to .5%/hr at 6.89%			288.0	157.1	845.2	8.52	917.2	190.28	3.05	95.1	188.1
			288.0	157.1	915.0	9.22	921.6	189.72	3.04	94.9	187.9
			284.6	153.6	1011.8	10.20	925.0	188.37	2.95	94.2	190.6
			289.4	158.5	1064.0	10.73	926.0	187.47	3.05	93.7	185.4
			301.8	170.9	2045.2	20.62	836.5	150.59	2.90	75.3	154.5

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1298
Sample Number: BH. 85-8-2 SA. 22

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	599.4	199.8		0.0	0.00	0.0	0.00	1.00	0.0	399.6
0.5	-2.0		199.8	0.0	0.0	0.00	0.0	0.00	1.00	0.0	399.6
1.0	-3.0		215.7	15.9	3.9	0.04	4.0	6.53	1.02	3.3	397.0
1.5	-4.0		224.6	24.8	12.9	0.13	7.9	12.89	1.03	6.4	381.2
2.0	-5.0		234.9	35.1	22.3	0.22	14.2	23.15	1.06	11.6	376.0
2.5	-5.8		263.2	63.4	30.9	0.31	41.0	66.80	1.20	33.4	369.6
3.0	-6.8		285.2	85.4	37.2	0.37	61.0	99.32	1.32	49.7	363.8
3.5	-7.7		312.1	112.3	49.0	0.49	80.0	130.10	1.45	65.0	352.3
4.0	-9.0		351.4	151.6	70.0	0.70	98.2	159.35	1.64	79.7	327.7
5.5	-10.4		370.7	170.9	85.9	0.86	106.5	172.54	1.75	86.3	315.0
31.3	-14.9		387.2	187.4	105.8	1.06	114.0	184.32	1.87	92.2	304.4
			407.2	207.4	141.5	1.42	124.0	199.76	2.04	99.9	292.1
			421.7	221.9	176.2	1.77	132.2	212.22	2.19	106.1	283.8
			434.8	234.9	210.8	2.12	139.2	222.66	2.35	111.3	276.0
			447.2	247.3	253.9	2.55	147.1	234.28	2.54	117.1	269.4
			449.2	249.4	308.4	3.10	156.3	247.51	2.65	123.7	273.9
slowed to .25%/hr at 4.76%			454.0	254.2	349.0	3.51	162.2	255.77	2.76	127.9	273.2
			457.5	257.7	383.4	3.86	167.2	262.71	2.85	131.3	273.3
increase to .5%/hr at 8.69%			459.6	259.8	398.7	4.01	169.1	265.27	2.90	132.6	272.5
			458.9	259.1	473.0	4.76	179.0	278.61	2.98	139.3	279.8
LENGTH,INITIAL.cm		10.19	462.3	262.5	618.0	6.22	189.0	289.67	3.11	144.8	281.9
DIAMETER,cm		5.00	468.5	268.7	864.0	8.69	202.0	301.42	3.30	150.7	281.6
AREA,INITIAL,cm2		19.64	464.4	264.6	875.8	8.81	206.0	306.99	3.27	153.5	288.5
VOLUME,INITIAL,cc		200.1	467.1	267.3	892.3	8.98	208.1	309.55	3.34	154.8	287.0
CONS. VOLUME CHANGE,		14.9	462.3	262.5	916.0	9.22	208.1	308.74	3.25	154.4	291.5
VOLUMETERIC STRN,cc		0.07	467.8	268.0	959.0	9.65	208.5	307.86	3.34	153.9	285.5
LENGTH,CONS.cm		9.94	466.4	266.6	986.4	9.93	208.9	307.51	3.31	153.7	286.7
AREA,CONS.,cm2		18.66	460.2	260.4	1024.0	10.30	209.5	307.10	3.21	153.5	292.7
CONS.VOLUME,cc		185.2	466.4	266.6	1053.0	10.60	210.0	306.83	3.31	153.4	286.4
PROVING RING kg/div		0.311	464.4	264.6	1132.0	11.39	211.0	305.55	3.26	152.8	287.8
EFF.CELL PRESS.kPa		399.6	467.1	267.3	1240.9	12.49	213.1	304.77	3.30	152.4	284.7
			464.4	264.6	1290.0	13.06	214.0	304.05	3.25	152.0	287.0

CYCLE C

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

Project Number: 851-1290
Sample Number: BH. 85-8-2 SA. 22

Sample A: A
Sample B: B
Sample C: C

Square Root of Time min	TOTAL Volume Change cc	Cell Pressure kPa	Total P.W.P kPa	Changed P.W.P kPa	STRAIN DIAL READING .01 mm	AXIAL STRAIN %	STRESS DIAL READING .002 mm	Deviator Stress kPa	Effective Principal Stress Ratio	Shear Stress kPa	Effective Normal Stress kPa
0.0	0.0	711.7	62.0	0.0	0.0	0.00	0.0	0.00	1.00	0.0	649.7
0.5	-2.0		86.1	24.1	14.0	0.14	31.0	19.29	1.03	9.6	635.2
1.0	-3.1		91.6	29.6	33.2	0.34	50.6	31.43	1.05	15.7	635.8
1.5	-4.2		96.5	34.4	43.0	0.44	56.2	34.87	1.06	17.4	632.7
2.0	-5.2		126.1	64.1	49.5	0.51	137.0	84.94	1.14	42.5	628.1
2.5	-6.4		158.5	96.5	58.0	0.59	215.0	133.19	1.24	66.6	619.8
3.0	-7.7		189.5	127.5	68.0	0.70	282.0	174.51	1.33	87.3	609.5
3.5	-9.4		212.9	150.9	77.1	0.79	319.0	197.23	1.40	98.6	597.4
4.0	-10.4		243.2	181.2	90.3	0.92	364.0	224.74	1.48	112.4	580.9
5.1	-12.4		284.6	222.5	112.0	1.15	423.0	260.58	1.61	130.3	557.4
8.9	-16.8		312.8	250.8	137.5	1.41	464.0	285.09	1.71	142.5	541.4
14.6	-19.4		347.9	285.9	163.0	1.67	494.0	302.72	1.83	151.4	515.1
36.2	-21.0		376.9	314.9	194.0	1.99	525.3	320.86	1.96	160.4	495.3
LENGTH,INITIAL.cm		10.12	400.3	338.3	243.0	2.49	554.2	336.78	2.08	168.4	479.8
DIAMETER,cm		5.04	418.9	356.9	279.0	2.86	573.0	346.89	2.18	173.4	466.2
AREA,INITIAL,cm2		19.95	432.0	370.0	309.0	3.16	585.0	353.03	2.26	176.5	456.2
VOLUME,INITIAL,cc		201.92	430.6	368.6	323.7	3.31	589.9	355.44	2.26	177.7	458.8
CONS. VOLUME CHANGE,		21.00	452.0	390.0	390.0	3.99	612.0	366.16	2.41	183.1	442.8
VOLUMETERIC STRN,cc		0.10	469.2	407.2	495.0	5.07	623.0	368.57	2.52	184.3	426.8
LENGTH,CONS.cm		9.77	485.1	423.0	660.0	6.76	650.0	377.70	2.67	188.9	415.5
AREA,CONS.,cm2		18.57	483.7	421.7	667.0	6.83	654.9	380.26	2.67	190.1	418.2
CONS.VOLUME,cc		180.92	489.2	427.2	671.0	6.87	680.0	394.66	2.77	197.3	419.8
PROVING RING kg/div		0.118	485.1	423.0	673.7	6.90	691.0	400.92	2.77	200.5	427.1
EFF.CELL PRESS.kPa		649.7	487.1	425.1	739.0	7.56	676.5	389.69	2.73	194.8	419.4
			487.1	425.1	764.0	7.82	678.0	389.48	2.73	194.7	419.3
slowed to .25%/hr at 3.99%			489.9	427.9	797.8	8.17	680.0	389.16	2.75	194.6	416.4
			489.2	427.2	824.0	8.43	681.0	388.59	2.75	194.3	416.8
increase to .5%/hr at 6.76%			489.2	427.2	899.0	9.20	684.5	387.31	2.74	193.7	416.2
			494.7	432.7	995.9	10.19	691.1	386.78	2.78	193.4	410.4
			496.1	434.1	1052.0	10.77	694.0	385.92	2.79	193.0	408.6
			509.9	447.9	1962.0	20.08	696.2	346.73	2.72	173.4	375.2

APPENDIX 2

COMPUTER DATA SHEETS

DIRECT SHEAR TESTS

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	6	length,mm	59.50			A	0.308	24.28	300.0
SAMPLE DEPTH,m	4.8-5.1	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	22.24	599.0
TEST DATE	85-03-06	height,mm	25.20	VOLUME,cc	89.27	C	0.149	21.10	999.7

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	2500.0	0	0.0	0.0	0.000	1200.0	0.00	0.0
0.25	0.5	2200.0	-0.600	4.0	9.0	0.022	1194.9	-0.042	7.7
3.00	1.7	2129.0	-0.742	14.9	34.0	0.081	1193.5	-0.053	29.0
23.00	4.8	2071.0	-0.858	33.5	64.1	0.207	1176.0	-0.198	54.7
92.00	9.6	2053.0	-0.894	46.0	79.0	0.302	1167.9	-0.264	67.4
211.00	14.5	2043.0	-0.914	55.0	87.5	0.375	1160.0	-0.329	74.6
275.00	16.6	2042.0	-0.916	69.1	100.0	0.491	1154.1	-0.378	85.3
1262.00	35.5	2041.0	-0.918	109.0	124.0	0.842	1127.9	-0.601	105.8
				122.5	129.1	0.967	1120.2	-0.657	110.1
				143.8	136.2	1.166	1112.0	-0.725	116.2
				162.0	140.9	1.338	1108.0	-0.758	120.2
				182.2	144.2	1.534	1098.0	-0.840	123.0
stopped overnight at 1.84 mm				214.0	148.0	1.844	1091.0	-0.898	126.3
restarted at 1.86 mm				215.0	143.5	1.863	1083.8	-0.957	122.4
				225.2	149.2	1.954	1082.9	-0.965	127.3
				242.2	150.2	2.122	1078.9	-0.998	128.1
				260.9	149.2	2.311	1078.8	-0.998	127.3
				291.1	145.0	2.621	1076.9	-1.014	123.7
				315.3	141.0	2.871	1069.5	-1.075	120.3
				354.2	133.2	3.276	1063.5	-1.124	113.6
				386.8	128.0	3.612	1059.0	-1.161	109.2
				413.0	124.1	3.882	1055.3	-1.192	105.9
				472.0	121.1	4.478	1053.0	-1.211	103.3

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	6	length,mm	59.50			A	0.308	24.28	300.0
SAMPLE DEPTH,m	4.8-5.1	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	22.24	599.0
TEST DATE	85-03-86	height,mm	25.20	VOLUME,cc	89.27	C	0.149	21.10	999.7

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	2900.0	0.000	0.0	0.0	0.000	1400.0	0.000	0.0
1.00	1.0	1464.0	-2.872	12.1	7.8	0.105	1398.2	-0.016	3.2
2.00	1.4	1452.0	-2.896	27.1	33.0	0.205	1399.0	-0.009	13.6
3.00	1.7	1449.0	-2.902	45.5	83.5	0.288	1399.0	-0.009	34.5
6.00	2.4	1441.0	-2.918	54.9	113.0	0.323	1398.5	-0.013	46.6
64.00	8.0	1429.0	-2.942	67.8	160.5	0.357	1398.2	-0.016	66.2
128.00	11.3	1425.0	-2.950	82.9	213.0	0.403	1398.5	-0.013	87.9
1420.00	37.7	1420.0	-2.960	123.5	308.0	0.619	1393.0	-0.063	127.1
				134.2	331.7	0.679	1391.7	-0.075	136.9
				159.9	376.0	0.847	1390.0	-0.090	155.2
				177.9	401.2	0.977	1388.5	-0.103	165.6
				200.9	423.9	1.161	1385.0	-0.135	174.9
				229.0	439.0	1.412	1380.5	-0.175	181.2
				230.3	407.2	1.489	1376.9	-0.208	168.0
				246.9	453.0	1.563	1376.9	-0.208	187.0
				264.8	464.0	1.720	1375.2	-0.223	191.5
				283.1	467.1	1.897	1372.9	-0.244	192.8
				309.9	462.1	2.175	1367.0	-0.297	190.7
				340.2	471.0	2.460	1365.3	-0.312	194.4
				379.3	469.3	2.854	1362.7	-0.335	193.7
				409.2	460.0	3.172	1360.5	-0.355	189.8
				442.0	459.7	3.501	1359.0	-0.369	189.7
				461.0	454.3	3.701	1358.0	-0.378	187.5

stopped overnight at 1.41 mm
restarted at 1.49 mm

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	6	length,mm	59.50			A	0.308	24.28	300.0
SAMPLE DEPTH,m	4.8-5.1	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	22.24	599.0
TEST DATE	85-03-86	height,mm	25.20	VOLUME,cc	89.27	C	0.149	21.10	999.7

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	3123.0	0.000	0.0	0.0	0.000	1500.0	0.000	0.0
0.25	0.5	2460.0	-1.326	4.5	18.8	0.007	1477.5	-0.213	7.8
0.50	0.7	2320.0	-1.606	10.1	43.9	0.013	1474.8	-0.239	18.1
1.00	1.0	1420.0	-3.406	20.6	87.0	0.032	1473.0	-0.256	35.9
1.50	1.2	1245.0	-3.756	31.2	128.9	0.054	1470.8	-0.277	53.2
2.00	1.4	1035.0	-4.176	41.0	165.5	0.079	1469.9	-0.285	68.3
2.50	1.6	900.0	-4.446	55.5	219.0	0.117	1468.0	-0.303	90.4
3.00	1.7	830.0	-4.586	65.0	251.1	0.148	1466.0	-0.322	103.6
4.00	2.0	742.0	-4.762	78.5	291.0	0.203	1463.0	-0.351	120.1
6.25	2.5	640.0	-4.966	94.9	345.1	0.259	1459.0	-0.389	142.4
9.00	3.0	575.0	-5.096	113.9	400.8	0.337	1453.8	-0.438	165.4
12.00	3.5	535.0	-5.176	129.3	447.0	0.399	1445.5	-0.517	184.5
27.00	5.2	487.5	-5.271	135.2	467.7	0.417	1441.0	-0.559	193.0
67.00	8.2	456.0	-5.334	157.0	509.0	0.552	1435.9	-0.608	210.1
135.00	11.6	441.0	-5.362	175.3	553.0	0.647	1429.2	-0.671	228.2
1084.00	32.9	410.0	-5.426	194.0	593.0	0.754	1423.0	-0.730	244.7
				214.3	638.2	0.867	1413.0	-0.825	263.4
stopped overnight at 1.03 mm				230.0	675.0	1.030	1406.0	-0.891	278.6
restarted at 1.136 mm				238.0	622.0	1.136	1390.0	-1.043	256.7
				238.0	622.0	1.136	1390.0	-1.043	256.7
				253.0	678.5	1.173	1387.0	-1.071	280.0
				263.0	714.0	1.202	1387.0	-1.071	294.7
				287.8	759.0	1.360	1383.6	-1.103	313.2
				314.3	788.0	1.567	1373.4	-1.200	325.2
				342.0	813.0	1.794	1365.5	-1.275	335.5
				364.0	821.2	1.998	1356.5	-1.360	338.9
				377.0	824.8	2.120	1349.5	-1.427	340.4
				399.0	834.0	2.322	1341.0	-1.507	344.2
				413.0	839.3	2.451	1335.5	-1.559	346.4
				434.2	844.4	2.653	1328.0	-1.630	348.5
				464.0	849.5	2.941	1318.9	-1.717	350.6
				475.0	848.0	3.054	1312.0	-1.782	350.0
				494.0	848.2	3.244	1307.0	-1.829	350.1
				504.7	850.5	3.346	1303.0	-1.867	351.0

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2							
SAMPLE NUMBER	11	length,mm	59.50		A	0.149	23.31	227.3
SAMPLE DEPTH,m	12.4-12.6	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	21.88	498.1
TEST DATE	86-03-10	height,mm	25.20	VOLUME,cc 89.27	C	0.308	22.38	750.0

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
0.00	0.0	2400.0	0	0.0	0.0	0.000	2061.0	0.000	0.0
0.50	0.7	2000.0	-0.800	1.0	16.1	-0.022	2061.0	0.000	6.6
1.50	1.2	1574.0	-1.652	5.9	24.9	0.009	2061.0	0.000	10.3
2.00	1.4	1546.0	-1.708	12.5	32.4	0.060	2058.9	-0.018	13.4
2.50	1.6	1532.0	-1.736	26.3	46.3	0.170	2045.5	-0.133	19.1
3.00	1.7	1527.0	-1.746	36.6	55.0	0.256	2036.8	-0.208	22.7
4.00	2.0	1527.0	-1.746	48.1	63.0	0.355	2029.0	-0.275	26.0
5.50	2.3	1526.0	-1.748	61.0	70.9	0.468	2019.0	-0.360	29.3
71.00	8.4	1473.0	-1.854	74.0	77.5	0.585	2011.0	-0.429	32.0
1021.00	32.0	1456.2	-1.888	88.0	83.0	0.714	2001.5	-0.510	34.3
				105.0	88.3	0.873	1995.9	-0.559	36.4
stopped overnight at 2.095 mm				121.1	93.7	1.024	1984.8	-0.654	38.7
restart at 2.124 mm				134.8	96.3	1.155	1979.0	-0.704	39.7
				153.0	99.9	1.330	1970.9	-0.773	41.2
				175.0	102.7	1.545	1968.1	-0.797	42.4
				189.9	105.8	1.687	1958.9	-0.876	43.7
				211.2	107.6	1.897	1954.0	-0.918	44.4
				231.5	109.8	2.095	1945.4	-0.992	45.3
				232.0	98.0	2.124	1937.0	-1.064	40.4
				245.0	113.0	2.224	1935.0	-1.081	46.6
				253.5	113.2	2.309	1934.0	-1.090	46.7
				277.2	114.9	2.542	1929.4	-1.129	47.4
				306.5	115.9	2.833	1925.0	-1.167	47.8
				333.0	116.6	3.097	1920.0	-1.210	48.1
				350.5	117.0	3.271	1917.4	-1.232	48.3
				363.1	117.9	3.395	1910.2	-1.294	48.7
				382.5	118.0	3.589	1910.0	-1.296	48.7
				397.6	118.1	3.740	1909.0	-1.304	48.7
				418.5	118.3	3.948	1904.0	-1.347	48.8
peak shear stress at 48.9 kPa				445.1	118.5	4.214	1901.1	-1.372	48.9
				457.2	118.5	4.335	1900.0	-1.381	48.9
				472.4	118.6	4.487	1895.5	-1.420	48.9
end of peak run				485.7	118.9	4.619	1895.1	-1.423	49.1
residual shear stress , by hand			(r1)	975.7	97.0	9.563	1780.0	-2.411	40.0
			(r2)	1955.7	91.0	19.375	1700.0	-3.097	37.6
			(r3)	2935.7	81.0	29.195	1582.0	-4.110	33.4
			(r4)	3915.7	77.0	39.003	1521.0	-4.633	31.8
			(r5)	4895.7	72.0	48.813	1475.0	-5.028	29.7
			(r6)	5875.7	71.0	58.615	1434.0	-5.380	29.3
residual shear stress ,			(r7)	6365.7	0	63.657	1398.0	-5.689	0.0
machine speed at 0.5 %/hr				6383.7	27.9	63.781	1364.3	-5.978	11.5
				6426.7	62.1	64.143	1331.0	-6.263	25.6
				6463.2	78.9	64.474	1314.2	-6.408	32.6

DIRECT SHEAR TESTS

							Proving	Consol	Normal
PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Ring	Height	Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	11	length,mm	59.50			A	0.149	23.31	227.3
SAMPLE DEPTH,m	12.4-12.6	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	21.88	490.1
TEST DATE	86-03-10	height,mm	25.20	VOLUME,cc	89.27	C	0.308	22.38	750.0

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
				6492.7	89.8	64.747	1312.0	-6.426	37.1
				6536.7	102.0	65.163	1304.0	-6.495	42.1
				6561.7	107.5	65.402	1299.0	-6.538	44.4
				6574.7	109.5	65.528	1297.5	-6.551	45.2
				7037.7	104.0	70.169	1295.0	-6.572	42.9

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	11	length,mm	59.50			A	0.149	23.31	227.3
SAMPLE DEPTH,m	12.4-12.6	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	21.88	498.1
TEST DATE	86-03-10	height,mm	25.20	VOLUME,cc	89.27	C	0.308	22.38	750.0

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
0.00	0.0	3272.0	0.000	0.0	0.0	0.000	2100.0	0.000	0.0
0.25	0.5	3130.0	-0.284	3.0	4.1	0.022	2093.0	-0.064	1.7
0.50	0.7	2140.0	-2.264	18.9	61.5	0.066	2084.0	-0.146	25.4
1.00	1.0	2002.0	-2.540	22.0	64.0	0.092	2082.0	-0.165	26.4
1.50	1.2	1950.0	-2.644	41.0	114.0	0.182	2062.9	-0.339	47.0
2.00	1.4	1919.0	-2.706	56.4	157.7	0.249	2058.0	-0.384	65.1
2.50	1.6	1896.0	-2.752	67.5	178.9	0.317	2048.0	-0.475	73.8
3.00	1.7	1871.0	-2.802	95.0	236.5	0.477	2031.0	-0.631	97.6
3.50	1.9	1852.0	-2.840	119.5	268.5	0.658	2008.0	-0.841	110.8
4.00	2.0	1834.0	-2.876	138.0	305.0	0.770	1997.8	-0.934	125.9
4.50	2.1	1815.0	-2.914	158.3	324.0	0.935	1984.0	-1.060	133.7
5.00	2.2	1806.0	-2.932	177.2	347.0	1.078	1973.0	-1.161	143.2
6.00	2.4	1785.0	-2.974	193.8	376.0	1.196	1967.5	-1.211	155.2
7.00	2.6	1768.0	-3.008	204.0	384.8	1.278	1960.2	-1.278	158.8
8.00	2.8	1753.0	-3.038	235.0	415.0	1.528	1943.3	-1.432	171.3
19.00	4.4	1686.0	-3.172	237.0	409.0	1.552	1935.5	-1.504	168.8
978.00	31.3	1612.0	-3.320	248.0	371.0	1.738	1901.0	-1.819	153.1
				256.0	398.0	1.764	1902.0	-1.810	164.3
stopped weekend at 1.552 mm				272.5	457.5	1.810	1902.0	-1.810	188.8
restart at 1.738 mm				274.8	449.5	1.849	1902.0	-1.810	185.5
				294.5	466.2	2.013	1898.0	-1.846	192.4
				303.5	481.0	2.073	1895.0	-1.874	198.5
				314.0	467.5	2.205	1890.0	-1.920	192.9
				443.0	503.5	3.423	1881.0	-2.002	207.8
				463.0	514.0	3.610	1876.0	-2.048	212.1
				477.5	511.8	3.751	1868.0	-2.121	211.2
				467.0	521.4	3.627	1861.0	-2.185	215.2
				517.5	531.9	4.111	1855.0	-2.239	219.5
				557.0	544.5	4.481	1845.0	-2.331	224.7
				575.0	545.6	4.659	1841.0	-2.367	225.2
stopped overnight at 4.905 mm				594.5	547.5	4.850	1840.0	-2.377	226.0
restart at 5.063 mm				594.5	519.9	4.905	1835.0	-2.422	214.6
				615.0	543.4	5.063	1830.0	-2.468	224.3
				620.5	572.1	5.061	1829.0	-2.477	236.1
				636.0	550.8	5.258	1828.0	-2.486	227.3
				657.0	560.2	5.450	1827.3	-2.493	231.2
				677.5	563.5	5.648	1825.9	-2.505	232.6
				697.5	564.8	5.845	1822.8	-2.534	233.1
				747.1	586.0	6.299	1819.0	-2.569	241.8
				790.0	569.4	6.661	1815.0	-2.605	235.0
				818.0	574.0	7.032	1813.5	-2.619	236.9
peak shear stress at 242.6 kPa				846.0	587.8	7.294	1809.9	-2.652	242.6
				879.0	575.0	7.640	1808.0	-2.669	237.3

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	11	length,mm	59.50			A	0.149	23.31	227.3
SAMPLE DEPTH,m	12.4-12.6	width,mm	59.50	AREA,mm^2	3540.25	B	0.149	21.88	498.1
TEST DATE	86-03-10	height,mm	25.20	VOLUME,cc	89.27	C	0.308	22.38	750.0

	Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
end of peak run					880.0	569.0	7.662	1808.0	-2.669	234.8
residual shear stress , by hand				(r1)	2640.0	330.0	25.740	1651.0	-4.104	136.2
				(r2)	4400.0	303.0	43.394	1532.0	-5.192	125.1
				(r3)	6160.0	370.0	60.860	1433.0	-6.097	152.7
				(r4)	7920.0	323.0	78.554	1360.0	-6.764	133.3
				(r5)	9680.0	360.0	96.080	1300.0	-7.313	148.6
residual shear stress ,				(r6)	10170.0	0	101.700	1246.0	-7.806	0.0
machine speed at 0.5 %/hr					10578.0	16.0	105.748	1185.0	-8.364	6.6
					10615.0	49.5	106.051	1175.0	-8.455	20.4
					10654.5	158.0	106.229	1159.9	-8.601	65.2
					10692.0	238.5	106.443	1135.0	-8.821	98.4
					10732.5	310.0	106.705	1122.4	-8.936	127.9
					10778.5	393.0	106.999	1110.0	-9.049	162.2
					11306.5	503.5	112.058	1075.0	-9.369	207.8

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1290	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2							
SAMPLE NUMBER	11	length,mm	59.50		A	0.149	23.31	227.3
SAMPLE DEPTH,m	12.4-12.6	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	21.88	498.1
TEST DATE	86-03-10	height,mm	25.20	VOLUME,cc 89.27	C	0.300	22.38	750.0

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
0.00	0.0	3491.0	0.000	0.0	0.0	0.000	1906.0	0.000	0.0
0.16	0.4	3180.0	-0.622	6.5	14.8	0.035	1909.0	0.027	12.6
0.25	0.5	3010.0	-0.962	16.2	39.9	0.082	1895.0	-0.098	34.0
0.50	0.7	2650.0	-1.682	24.4	40.5	0.163	1887.0	-0.170	34.5
1.00	1.0	2520.0	-1.942	36.5	89.7	0.186	1873.0	-0.295	76.5
2.50	1.6	2470.0	-2.042	47.5	94.2	0.287	1865.0	-0.366	80.4
3.00	1.7	2430.0	-2.122	59.2	138.0	0.316	1854.0	-0.465	117.7
3.50	1.9	2411.0	-2.160	85.0	182.5	0.405	1837.0	-0.617	155.7
4.00	2.0	2387.0	-2.208	104.5	210.8	0.623	1827.0	-0.706	179.8
111.00	10.5	2127.5	-2.727	119.5	229.5	0.736	1818.0	-0.786	195.8
4054.00	63.7	2079.0	-2.824	137.0	250.2	0.870	1806.0	-0.894	213.4
				157.2	268.0	1.036	1797.0	-0.974	228.6
				193.5	294.0	1.347	1785.0	-1.081	250.8
				210.0	303.5	1.493	1778.0	-1.144	258.9
stopped weekend at 1.708 mm				228.5	312.9	1.659	1770.0	-1.215	266.9
restart at 1.797 mm				228.5	288.5	1.708	1762.0	-1.287	246.1
				245.5	328.8	1.797	1760.0	-1.305	280.5
				252.0	330.1	1.860	1756.0	-1.340	281.6
				265.0	332.0	1.986	1753.0	-1.367	283.2
				285.0	336.1	2.178	1745.0	-1.439	286.7
				303.0	341.0	2.348	1739.0	-1.492	290.9
				322.7	346.3	2.534	1734.0	-1.537	295.4
				368.1	357.0	2.967	1720.0	-1.662	304.6
				400.8	362.0	3.284	1705.5	-1.792	308.8
				431.8	365.0	3.588	1695.1	-1.885	311.4
peak shear stress at 315.6 kPa				464.1	368.0	3.905	1689.0	-1.939	313.9
end of peak run				497.0	370.0	4.230	1685.0	-1.975	315.6
residual shear stress , by hand			(r1)	1491.0	243.0	14.424	1625.0	-2.511	207.3
			(r2)	2485.0	203.0	24.444	1589.0	-2.833	173.2
			(r3)	3479.0	190.0	34.410	1572.0	-2.985	162.1
			(r4)	4473.0	190.0	44.350	1553.0	-3.155	162.1
			(r5)	5467.0	188.0	54.294	1535.0	-3.315	160.4
residual shear stress ,			(r6)	5964.0	0	59.640	1511.0	-3.530	0.0
machine speed at 0.5 %/hr				5980.0	40.0	59.720	1440.0	-4.164	34.1
				6012.0	115.0	59.890	1428.0	-4.272	98.1
				6053.0	183.0	60.164	1407.0	-4.459	156.1
				6086.5	224.0	60.417	1391.0	-4.602	191.1
				6127.9	265.0	60.749	1380.0	-4.701	226.1
				6172.0	296.0	61.120	1367.0	-4.817	252.5
				6665.0	346.0	65.958	1353.0	-4.942	295.2

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving	Consol	Normal
BOREHOLE NUMBER	85-3-2					Ring	Height	Stress
SAMPLE NUMBER	19	length,mm	59.50		A	0.308	24.64	148.4
SAMPLE DEPTH,m	24.4-25.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.308	20.96	299.6
TEST DATE	86-03-26	height,mm,	25.20	VOLUME,cc 89.27	C	0.149	19.14	598.9

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	1350.0	0	0.0	0.0	0.000	2150.0	0.000	0.0
0.25	0.5	1335.0	-0.030	6.0	5.8	0.048	2147.0	-0.024	4.9
1.00	1.0	1330.0	-0.040	19.5	21.0	0.153	2138.0	-0.097	17.9
1.50	1.2	1325.0	-0.050	40.0	36.1	0.328	2119.8	-0.245	30.8
2.00	1.4	1321.0	-0.058	62.0	47.0	0.526	2117.8	-0.261	40.1
3.00	1.7	1301.0	-0.098	89.2	55.0	0.782	2102.0	-0.390	46.9
60.00	7.7	1190.0	-0.320	106.0	58.8	0.942	2095.0	-0.446	50.2
86.00	9.3	1187.0	-0.326	134.0	62.3	1.215	2086.0	-0.519	53.1
1120.00	33.5	1170.0	-0.360	154.8	64.5	1.419	2080.0	-0.568	55.0
				176.5	65.1	1.635	2076.2	-0.599	55.5
				198.0	66.0	1.848	2074.0	-0.617	56.3
				214.5	66.7	2.012	2071.5	-0.637	56.9
stopped weekend at 2.228 mm				236.0	66.1	2.228	2070.0	-0.649	56.4
restarted at 2.248 mm				236.0	56.0	2.248	2065.0	-0.690	47.8
peak shear stress at 57.4 kPa				245.0	67.3	2.315	2063.0	-0.706	57.4
				259.9	67.3	2.464	2061.0	-0.722	57.4
				275.0	66.9	2.616	2061.0	-0.722	57.1
				287.2	66.2	2.740	2060.4	-0.727	56.5
				311.5	65.5	2.984	2060.0	-0.730	55.9
				344.0	64.5	3.311	2060.0	-0.730	55.0
				367.1	63.6	3.544	2058.5	-0.743	54.3
				405.0	62.4	3.925	2058.0	-0.747	53.2
				431.5	61.9	4.191	2057.9	-0.748	52.8
				449.5	61.1	4.373	2057.5	-0.751	52.1
end of peak run				476.0	60.1	4.640	2057.4	-0.752	51.3
residual shear stress, by hand			(r1)	1428.0	48.0	14.184	1976.0	-1.412	40.9
			(r2)	2380.0	41.0	23.718	1930.0	-1.786	35.0
			(r3)	3332.0	39.0	33.242	1889.0	-2.118	33.3
			(r4)	4284.0	37.0	42.766	1864.0	-2.321	31.6
			(r5)	5236.0	32.0	52.296	1841.0	-2.508	27.3
residual shear stress,			(r6)	5712.0	0.0	57.120	1841.0	-2.508	0.0
machine speed at 0.5 %/hr.				5716.5	10.0	57.145	1840.5	-2.512	8.5
				5757.0	40.2	57.490	1818.0	-2.695	34.3
				5822.0	63.3	58.093	1807.0	-2.784	54.0
				5852.0	69.0	58.382	1807.0	-2.784	58.9
				5893.0	71.0	58.788	1805.0	-2.800	60.6
				6352.0	71.0	63.378	1802.0	-2.825	60.6
				6373.0	71.2	63.588	1801.5	-2.829	60.7
				6388.0	71.2	63.738	1801.5	-2.829	60.7

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS	Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2						
SAMPLE NUMBER	19	length,mm	59.50	A	0.308	24.64	148.4
SAMPLE DEPTH,m	24.4-25.0	width,mm	59.50	AREA,mm^2 3540.25 B	0.308	20.96	299.6
TEST DATE	86-03-26	height,mm,	25.20	VOLUME,cc 89.27 C	0.149	19.14	598.9

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	2338.0	0.000	0.0	0.0	0.000	2274.0	0.000	0.0
1.00	1.0	960.0	-2.756	13.0	26.8	0.076	2258.0	-0.153	22.9
1.25	1.1	850.0	-2.976	13.8	26.8	0.084	2222.0	-0.496	22.9
1.50	1.2	810.0	-3.056	28.5	53.0	0.179	2218.0	-0.534	45.2
2.00	1.4	764.0	-3.148	43.5	69.5	0.296	2216.0	-0.553	59.3
3.00	1.7	690.0	-3.296	64.5	84.2	0.477	2198.0	-0.725	71.8
4.00	2.0	613.0	-3.450	78.0	92.2	0.596	2190.0	-0.801	78.7
5.00	2.2	576.0	-3.524	90.0	97.2	0.706	2182.0	-0.878	82.9
10.00	3.2	442.0	-3.792	104.5	103.0	0.839	2175.0	-0.945	87.9
27.00	5.2	375.0	-3.926	137.0	113.9	1.142	2160.0	-1.088	97.2
110.00	10.5	346.0	-3.984	157.2	119.0	1.334	2151.0	-1.174	101.5
218.00	14.8	338.0	-4.000	178.0	123.0	1.534	2143.0	-1.250	104.9
305.00	17.5	333.9	-4.008	196.5	125.1	1.715	2138.0	-1.298	106.7
1253.00	35.4	319.0	-4.038	215.0	127.4	1.895	2131.0	-1.364	108.7
				232.1	129.4	2.062	2127.0	-1.403	110.4
stopped weekend at 2.297 mm				256.0	131.4	2.297	2119.0	-1.479	112.1
restarted at 2.317 mm				256.5	124.0	2.317	2115.0	-1.517	105.8
				265.0	133.1	2.384	2108.0	-1.584	113.5
				298.5	134.5	2.716	2102.0	-1.641	114.7
				326.5	134.5	2.996	2094.0	-1.718	114.7
				361.5	135.4	3.344	2085.0	-1.803	115.5
				398.5	136.0	3.713	2076.0	-1.889	116.0
peak shear stress at 116.2 kPa				435.0	136.2	4.078	2066.0	-1.985	116.2
				450.5	136.2	4.233	2064.0	-2.004	116.2
				491.5	135.4	4.644	2058.0	-2.061	115.5
stopped overnight at 4.800 mm				507.0	135.0	4.800	2058.0	-2.061	115.2
restarted at 4.822 mm				507.2	125.2	4.822	2051.0	-2.128	106.8
				529.5	135.4	5.024	2047.0	-2.166	115.5
				556.5	134.5	5.296	2044.0	-2.195	114.7
				586.5	134.5	5.596	2043.0	-2.204	114.7
end of peak run				616.7	134.5	5.898	2040.0	-2.233	114.7
residual shear stress, by hand			(r1)	1850.4	68	18.368	1940.0	-3.187	58.0
			(r2)	3084.4	67	30.710	1817.0	-4.361	57.2
			(r3)	4318.4	60	43.064	1755.0	-4.952	51.2
			(r4)	5552.4	60	55.404	1710.0	-5.382	51.2
			(r5)	6786.4	60	67.744	1672.0	-5.744	51.2
residual shear stress,			(r6)	7403.4	0	74.034	1667.0	-5.792	0.0
machine speed at 0.5 %/hr.				7424.9	34.8	74.179	1655.0	-5.906	29.7
				7461.9	74.5	74.470	1627.0	-6.174	63.6
				7485.9	91.8	74.675	1618.0	-6.260	78.3
				7505.9	104	74.851	1610.0	-6.336	88.7
				7978.4	139	79.506	1585.0	-6.574	118.6
				8037.9	139	80.101	1585.0	-6.574	118.6

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS	Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2						
SAMPLE NUMBER	19	length,mm	59.50	A	0.308	24.64	148.4
SAMPLE DEPTH,m	24.4-25.0	width,mm	59.50	AREA,mm^2 3540.25 B	0.308	20.96	299.6
TEST DATE	86-03-26	height,mm,	25.20	VOLUME,cc 89.27 C	0.149	19.14	598.9

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
				8106.4	139	80.786	1584.0	-6.584	118.6
				8132.9	139	81.051	1584.0	-6.584	118.6
				8202.4	134	81.756	1584.0	-6.584	114.3

DIRECT SHEAR TESTS

		BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
PROJECT NUMBER	851-1298								
BOREHOLE NUMBER	85-3-2								
SAMPLE NUMBER	19	length,mm	59.50			A	0.308	24.64	148.4
SAMPLE DEPTH,m	24.4-25.0	width,mm	59.50	AREA,mm^2	3540.25	B	0.308	20.96	299.6
TEST DATE	86-03-26	height,mm,	25.20	VOLUME,cc	89.27	C	0.149	19.14	598.9

	Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
	0.00	0.0	3300.0	0.000	0.0	0.0	0.000	2455.0	0.000	0.0
	0.50	0.7	1150.0	-4.300	9.0	10.0	0.070	2453.0	-0.021	4.1
	1.00	1.0	1052.0	-4.496	25.0	74.2	0.102	2442.0	-0.136	30.6
	1.50	1.2	978.0	-4.644	45.5	146.5	0.162	2438.0	-0.178	60.5
	2.00	1.4	922.0	-4.756	77.0	206.0	0.358	2431.0	-0.251	85.0
	2.50	1.6	850.0	-4.900	99.0	282.5	0.425	2425.0	-0.313	116.6
	3.00	1.7	825.0	-4.950	114.8	314.0	0.520	2420.0	-0.366	129.6
	30.00	5.5	335.0	-5.930	141.0	349.0	0.712	2414.0	-0.428	144.0
	1059.00	32.5	268.5	-6.063	161.0	372.0	0.864	2407.3	-0.498	153.9
					182.0	393.0	1.034	2402.0	-0.554	162.2
					205.0	422.2	1.206	2398.0	-0.596	174.2
					221.0	430.0	1.350	2394.0	-0.637	177.5
stopped weekend at 1.545 mm					244.2	448.5	1.545	2390.0	-0.679	185.1
restarted at 1.616 mm					245.0	416.9	1.616	2376.0	-0.825	172.1
					256.8	449.1	1.670	2373.0	-0.857	185.3
					271.5	482.8	1.749	2373.0	-0.857	199.3
					284.0	485.4	1.869	2372.0	-0.867	200.3
					297.8	479.1	2.020	2369.0	-0.899	197.7
					321.0	488.2	2.234	2368.0	-0.909	201.5
					357.0	498.1	2.574	2345.0	-1.149	205.6
					380.3	505.6	2.792	2340.0	-1.202	208.7
					420.9	512.0	3.185	2327.5	-1.332	211.3
					454.1	523.0	3.495	2317.8	-1.434	215.8
					475.0	525.8	3.698	2316.0	-1.452	217.0
stopped overnight at 3.965 mm					501.0	522.5	3.965	2307.3	-1.543	215.6
restarted at 3.989 mm					501.0	510.3	3.989	2301.3	-1.606	210.6
					504.8	505.9	4.036	2298.0	-1.640	208.8
					524.0	528.0	4.184	2297.5	-1.646	217.9
					545.2	529.0	4.394	2295.1	-1.671	218.3
					564.5	528.0	4.589	2290.2	-1.722	217.9
					584.5	528.0	4.789	2287.9	-1.746	217.9
peak shear stress at 220.0 kPa					603.0	533.0	4.964	2283.0	-1.797	220.0
					625.0	524.0	5.202	2280.0	-1.829	216.3
					665.0	523.0	5.604	2269.0	-1.944	215.8
					697.0	523.7	5.923	2266.5	-1.970	216.1
end of peak run					724.5	515.0	6.215	2265.0	-1.985	212.5
residual shear stress, by hand (r1)					2173.0	220.0	21.290	2126.0	-3.438	90.8
(r2)					3621.0	270.0	35.670	2052.0	-4.211	111.4
(r3)					5069.0	268.0	50.154	1992.0	-4.838	110.6
(r4)					6517.0	257.0	64.656	1949.0	-5.287	106.1
(r5)					7965.0	273.0	79.104	1908.0	-5.716	112.7
residual shear stress, (r6)					8689.0	0.0	86.890	1908.0	-5.716	0.0
machine speed at 0.5 %/hr.					9125.0	508.0	90.234	1887.0	-5.935	209.7

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-3-2							
SAMPLE NUMBER	19	length,mm	59.50		A	0.308	24.64	148.4
SAMPLE DEPTH,m	24.4-25.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.308	20.96	299.6
TEST DATE	86-03-26	height,mm,	25.20	VOLUME,cc 89.27	C	0.149	19.14	598.9

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
				9147.0	501.3	90.467	1886.2	-5.944	206.9
				9166.0	501.3	90.657	1886.0	-5.946	206.9
				9208.0	491.5	91.097	1886.0	-5.946	202.8
				9230.5	493.0	91.319	1886.0	-5.946	203.5
				9190.5	490.0	90.925	1885.0	-5.956	202.2
				9250.8	487.5	91.533	1884.0	-5.967	201.2
				9271.5	481.8	91.751	1883.0	-5.977	198.8
				9290.0	481.5	91.937	1883.0	-5.977	198.7

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	7	length,mm	59.50		A	0.308	21.32	299.6
SAMPLE DEPTH,m	5.8-6.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	20.01	598.9
TEST DATE	86-04-08	height,mm,(H1)	25.20	VOLUME,cc 89.27	C	0.149	17.90	999.5

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	2430.0	0	0.0	0.0	0.000	2306.0	0.000	0.0
0.33	0.6	1400.0	-2.060	14.0	30.0	0.080	2274.0	-0.300	25.6
0.58	0.8	1220.0	-2.420	43.0	66.5	0.297	2240.0	-0.619	56.7
0.75	0.9	1150.0	-2.560	54.5	77.5	0.390	2230.0	-0.713	66.1
1.00	1.0	1075.0	-2.710	75.0	93.0	0.564	2214.0	-0.863	79.3
2.00	1.4	933.0	-2.994	105.0	111.4	0.827	2192.0	-1.069	95.0
3.00	1.7	858.0	-3.144	138.0	126.0	1.128	2174.0	-1.238	107.5
9.00	3.0	652.0	-3.556	174.0	139.2	1.462	2157.0	-1.398	118.8
25.00	5.0	559.0	-3.742	193.5	143.9	1.647	2150.0	-1.463	122.8
60.00	7.7	532.0	-3.796	214.5	148.5	1.848	2162.0	-1.351	126.7
170.00	13.0	518.0	-3.824	391.0	163.0	3.584	2107.0	-1.867	139.1
328.00	18.1	515.0	-3.830	688.0	162.8	6.554	2080.0	-2.120	138.9
4217.00	64.9	492.0	-3.876	713.0	162.5	6.805	2077.0	-2.148	138.6
peak shear stress at 139.1 kPa				742.0	162.4	7.095	2075.0	-2.167	138.5
end of peak run				777.0	162.2	7.446	2074.0	-2.176	138.4
residual shear stress, by hand			(r1)	2331.0	135.0	23.040	1940.0	-3.433	115.2
			(r2)	3885.0	112.0	38.626	1791.0	-4.831	95.5
			(r3)	5439.0	95.0	54.200	1795.0	-4.794	81.0
			(r4)	6993.0	89.0	69.752	1659.0	-6.069	75.9
			(r5)	8547.0	85.0	85.300	1618.0	-6.454	72.5
residual shear stress,			(r6)	9324.0	0.0	93.240	1611.0	-6.520	0.0
machine speed at 0.5 %/hr.				9334.0	29.0	93.282	1527.0	-7.308	24.7
				9380.8	84.0	93.640	1496.0	-7.598	71.7
				9406.5	102.0	93.861	1484.0	-7.711	87.0
				9863.7	159.5	98.318	1450.0	-8.030	136.1
				9904.5	159.5	98.726	1449.0	-8.039	136.1
				9957.0	159.4	99.251	1448.0	-8.049	136.0
				10015.0	159.2	99.832	1446.0	-8.068	135.8
				10081.0	159.0	100.492	1444.0	-8.086	135.6

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	7	length,mm	59.50		A	0.308	21.32	299.6
SAMPLE DEPTH,m	5.8-6.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	20.01	598.9
TEST DATE	86-04-08	height,mm,(H1)	25.20	VOLUME,cc 89.27	C	0.149	17.90	999.5

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	5239.0	0.000	0.0	0.0	0.000	3099.0	0.000	0.0
0.50	0.7	3900.0	-2.678	22.0	13.5	0.193	3089.0	-0.100	5.6
1.00	1.0	3650.0	-3.178	54.5	84.2	0.377	3075.0	-0.240	34.7
1.50	1.2	3536.0	-3.406	68.5	132.5	0.420	3075.0	-0.240	54.7
2.00	1.4	3422.0	-3.634	80.5	195.5	0.414	3067.0	-0.320	80.7
3.00	1.7	3333.0	-3.812	113.9	248.5	0.642	3051.0	-0.480	102.6
5.00	2.2	3165.0	-4.148	150.6	320.0	0.866	3031.0	-0.680	132.1
9.00	3.0	2960.0	-4.558	189.8	382.9	1.132	3010.0	-0.890	158.0
25.00	5.0	2749.0	-4.980	209.0	410.5	1.269	2999.0	-0.999	169.4
56.00	7.5	2712.0	-5.054	238.0	440.0	1.500	2988.0	-1.109	181.6
165.00	12.8	2689.0	-5.100	410.0	505.0	3.090	2905.0	-1.939	208.4
324.00	18.0	2678.0	-5.122	732.0	565.0	6.190	2815.0	-2.839	233.2
4213.00	64.9	2642.0	-5.194	756.0	569.0	6.422	2810.0	-2.889	234.8
				791.5	563.0	6.789	2802.0	-2.968	232.4
peak shear stress at 116.2 kPa				818.0	563.0	7.054	2798.0	-3.008	232.4
residual shear stress, by hand			(r1)	2454.0	400.0	23.740	2571.0	-5.277	165.1
			(r2)	4090.0	440.0	40.020	2369.0	-7.296	181.6
			(r3)	5726.0	470.0	56.320	2193.0	-9.055	194.0
			(r4)	7362.0	475.0	72.670	2030.0	-10.685	196.0
			(r5)	8998.0	445.0	89.090	1892.0	-12.064	183.7
residual shear stress,			(r6)	9816.6	0.0	98.160	1721.0	-13.773	0.0
machine speed at 0.5 %/hr.				9831.5	12.5	98.290	1718.0	-13.803	5.2
				9885.0	39.7	98.771	1716.0	-13.823	16.4
				9908.8	106.0	98.876	1708.0	-13.903	43.7
				10387.0	571.0	102.728	1661.0	-14.373	235.7
				10428.5	565.5	103.154	1657.0	-14.413	233.4
				10489.5	561.0	103.773	1654.0	-14.443	231.5
				10549.0	560.0	104.370	1651.0	-14.473	231.1
				10607.0	557.0	104.956	1647.0	-14.513	229.9

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	7	length,mm	59.50		A	0.308	21.32	299.6
SAMPLE DEPTH,m	5.8-6.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	20.01	598.9
TEST DATE	86-04-08	height,mm,(H1)	25.20	VOLUME,cc 89.27	C	0.149	17.90	999.5

	Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
	0.00	0.0	3700.0	0.000	0.0	0.0	0.000	1982.0	0.000	0.0
	0.25	0.5	2250.0	-2.900	14.2	15.2	0.112	1970.0	-0.134	6.3
	0.50	0.7	1980.0	-3.440	26.5	18.5	0.228	1968.0	-0.156	7.6
	1.00	1.0	1350.0	-4.700	51.2	114.9	0.282	1968.0	-0.156	47.4
	1.50	1.2	1100.0	-5.200	61.5	155.8	0.303	1968.0	-0.156	64.3
	2.00	1.4	1000.0	-5.400	76.8	209.5	0.349	1969.0	-0.145	86.5
	3.00	1.7	900.0	-5.600	93.8	272.5	0.393	1969.0	-0.145	112.5
	5.00	2.2	530.0	-6.340	120.9	354.5	0.500	1961.0	-0.235	146.3
	75.00	8.7	2060	-7.172	143.5	421.5	0.592	1955.0	-0.302	174.0
	202.00	14.2	2045.0	-7.202	165.4	484.5	0.685	1948.0	-0.380	200.0
	324.00	18.0	2032.0	-7.228	183.5	528.5	0.778	1938.0	-0.492	218.1
	4191.00	64.7	2030.0	-7.232	200.0	567.8	0.864	1929.0	-0.592	234.3
stopped overnight at 1.118 mm					216.0	601.5	0.957	1921.0	-0.682	248.2
restarted at 1.226 mm					244.0	661.0	1.118	1909.0	-0.816	272.8
					244.8	611.0	1.226	1889.0	-1.039	252.2
					249.0	624.0	1.242	1882.0	-1.117	257.5
					286.0	641.2	1.578	1882.0	-1.117	264.6
					313.5	684.5	1.766	1873.0	-1.218	282.5
					349.5	731.0	2.033	1859.0	-1.374	301.7
					390.0	780.0	2.340	1842.0	-1.564	321.9
					430.0	821.5	2.657	1824.0	-1.765	339.0
					445.5	839.0	2.777	1818.0	-1.832	346.3
					486.0	873.9	3.112	1806.0	-1.966	360.7
stopped overnight at 3.27 mm					505.0	890.0	3.270	1798.0	-2.056	367.3
restarted at 3.369 mm					505.2	841.5	3.369	1789.0	-2.156	347.3
					529.0	907.2	3.476	1782.0	-2.235	374.4
					556.5	930.0	3.705	1775.0	-2.313	383.8
					590.4	943.2	4.018	1767.0	-2.402	389.3
					623.1	961.8	4.307	1757.0	-2.514	396.9
peak shear stress at 397.4 kPa					653.0	963.0	4.604	1750.0	-2.592	397.4
					694.9	961.4	5.026	1740.0	-2.704	396.8
end of peak run					728.5	955.0	5.375	1736.0	-2.749	394.1
residual shear stress, by hand				(r1)	2186.0	729.0	20.402	1538.0	-4.961	300.9
				(r2)	3644.0	719.0	35.002	1394.0	-6.570	296.7
				(r3)	5102.0	718.0	49.584	1284	-7.799	296.3
				(r4)	6560.0	725.0	64.150	1176.0	-9.006	299.2
				(r5)	8018.0	719.0	78.742	1064.0	-10.257	296.7
residual shear stress,				(r6)	8747.0	0.0	87.470	971.0	-11.296	0.0
machine speed at 0.5 %/hr.					8764.0	18.0	87.604	962.0	-11.397	7.4
					8784.0	36.4	87.767	961.0	-11.408	15.0
					9270.5	971.0	90.763	934.0	-11.709	400.7
					9335.0	957.5	91.435	935.0	-11.698	395.2
					9408.0	934.0	92.212	932.0	-11.732	385.5

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	7	length,mm	59.50		A	0.308	21.32	299.6
SAMPLE DEPTH,m	5.8-6.0	width,mm	59.50	AREA,mm^2 3540.25	B	0.149	20.01	598.9
TEST DATE	86-04-08	height,mm,(H1)	25.20	VOLUME,cc 89.27	C	0.149	17.90	999.5

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
				9436.5	923.0	92.519	931.0	-11.743	380.9
				9514.0	911.0	93.318	929.0	-11.765	376.0
				9542.0	904.0	93.612	927.0	-11.788	373.1

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2								
SAMPLE NUMBER	20	length,mm	59.50			A	0.308	22.78	198.7
SAMPLE DEPTH,m	20.6-20.8	width,mm	59.50	AREA,mm^2	3540.25	B	0.308	22.02	400.3
TEST DATE	86-04-15	height,mm,(H1)	25.20	VOLUME,cc	89.27	C	0.311	21.15	649.9

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
0.00	0.0	1800.0	0	0.0	0.0	0.000	2100.0	0.000	0.0
0.50	0.7	1130.0	-1.340	2.0	2.9	0.014	2100.0	0.000	2.5
1.00	1.0	840.0	-1.920	16.8	25.0	0.118	2083.0	-0.149	21.3
1.50	1.2	765.0	-2.070	26.0	36.0	0.188	2073.0	-0.237	30.7
2.00	1.4	705.0	-2.190	50.0	56.8	0.386	2065.5	-0.303	48.5
3.00	1.7	660.0	-2.280	73.5	72.0	0.591	2046.0	-0.474	61.4
4.00	2.0	643.0	-2.314	121.5	90.5	1.034	2021.0	-0.694	77.2
5.00	2.2	638.0	-2.324	140.8	95.4	1.217	2012.0	-0.773	81.4
9.00	3.0	621.0	-2.358	167.0	102.0	1.466	2003.0	-0.852	87.0
106.00	10.3	598.0	-2.404	188.0	106.9	1.666	1995.8	-0.915	91.2
130.00	11.4	594.0	-2.412	215.3	112.0	1.929	1987.0	-0.992	95.5
1084.00	32.9	583.0	-2.434	234.0	114.9	2.110	1981.0	-1.045	98.0
				403.0	129.0	3.772	1939.0	-1.414	110.1
peak shear stress at 112.9 kPa				696.5	131.5	6.702	1887.0	-1.870	112.2
				709.0	132.1	6.826	1887.0	-1.870	112.7
end of peak run				739.0	132.3	7.125	1886.3	-1.876	112.9
residual shear stress, by hand			(r1)	2217.0	87.0	21.996	1638.0	-4.056	74.2
			(r2)	3695.0	80.0	36.790	1482.0	-5.426	68.2
			(r3)	5173.0	81.0	51.568	1357.0	-6.523	69.1
			(r4)	6651.0	88.0	66.334	1250.0	-7.463	75.1
			(r5)	8129.0	92.0	81.106	1172.0	-8.147	78.5
residual shear stress,			(r6)	8868.0	0.0	88.680	1108.0	-8.709	0.0
machine speed at 0.5 %/hr.				8870.0	3.0	88.694	1096.0	-8.815	2.6
				8916.0	5.0	89.150	1091.0	-8.859	4.3
				9356.0	137.5	93.285	1002.0	-9.640	117.3
				9387.0	139.0	93.592	1002.0	-9.640	118.6
				9421.0	139.0	93.932	1006.0	-9.605	118.6
				9446.0	140.0	94.180	1006.0	-9.605	119.4
				9475.0	140.4	94.469	1006.0	-9.605	119.8
				9510.0	140.9	94.818	1007.0	-9.596	120.2
				9544.0	141.0	95.158	1007.0	-9.596	120.3
				9565.0	141.1	95.368	1007.5	-9.592	120.4

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	20	length,mm	59.50		A	0.308	22.78	198.7
SAMPLE DEPTH,m	20.6-20.8	width,mm	59.50	AREA,mm^2 3540.25	B	0.308	22.02	400.3
TEST DATE	86-04-15	height,mm,(H1)	25.20	VOLUME,cc 89.27	C	0.311	21.15	649.9

Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
0.00	0.0	2300.0	0.000	0.0	0.0	0.000	2200.0	0.000	0.0
1.00	1.0	1022.0	-2.556	3.0	6.0	0.018	2198.7	-0.012	5.1
1.50	1.2	946.0	-2.708	32.0	67.1	0.186	2179.0	-0.191	57.2
2.00	1.4	915.0	-2.770	40.0	79.0	0.242	2174.0	-0.236	67.4
2.50	1.6	900.0	-2.800	59.5	102.2	0.391	2155.0	-0.409	87.2
3.00	1.7	890.0	-2.820	69.8	113.0	0.472	2144.5	-0.504	96.4
3.50	1.9	883.0	-2.834	76.2	119.3	0.523	2139.8	-0.547	101.8
4.00	2.0	879.0	-2.842	97.5	137.0	0.701	2122.0	-0.708	116.9
7.00	2.6	866.0	-2.868	112.1	148.1	0.825	2110.0	-0.817	126.3
23.00	4.8	847.0	-2.906	134.2	163.5	1.015	2093.0	-0.972	139.5
47.00	6.9	841.0	-2.918	146.0	171.0	1.118	2085.5	-1.040	145.9
3893.00	62.4	810.0	-2.980	176.0	187.3	1.385	2066.3	-1.214	159.8
				184.7	191.6	1.464	2064.0	-1.235	163.5
				200.2	199.3	1.603	2051.6	-1.348	170.0
peak shear stress at 222.7 kPa				226.0	210.0	1.840	2039.0	-1.462	179.2
				267.0	225.5	2.219	2019.0	-1.644	192.4
				396.0	252.0	3.456	1976.0	-2.034	215.0
				692.0	261.0	6.398	1916.0	-2.579	222.7
				728.0	260.0	6.760	1913.0	-2.607	221.8
				745.0	249.9	6.950	1909.0	-2.643	213.2
end of peak run				760.0	249.0	7.102	1908.0	-2.652	212.4
residual shear stress, by hand	(r1)			2280.0	175.0	22.450	1627.0	-5.204	149.3
	(r2)			3800.0	164.0	37.672	1532.0	-6.067	139.9
	(r3)			5320.0	183.0	52.834	1377.0	-7.475	156.1
	(r4)			6840.0	192.0	68.016	1268.0	-8.465	163.8
	(r5)			8360.0	210.0	83.180	1182.0	-9.246	179.2
residual shear stress,	(r6)			9120.0	0.0	91.200	1182.0	-9.246	0.0
machine speed at 0.5 %/hr.				9146.5	65.0	91.335	1182.0	-9.246	55.5
				9172.0	106.0	91.508	1170.0	-9.355	90.4
				9205.8	144.5	91.769	1151.2	-9.526	123.3
				9251.0	186.2	92.138	1136.5	-9.659	158.8
				9449.0	262	93.966	1127.0	-9.746	223.5
				9738.0	266.5	96.847	1023.0	-10.690	227.4
				9764.5	266.3	97.112	1022.0	-10.699	227.2
				9808	266	97.548	1021.0	-10.708	226.9
				9837	265	97.840	1020.7	-10.711	226.1

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS	Proving Ring	Consol Height	Normal Stress
BOREHOLE NUMBER	85-10-2						
SAMPLE NUMBER	20	length,mm	59.50	A	0.308	22.78	198.7
SAMPLE DEPTH,m	20.6-20.8	width,mm	59.50	AREA,mm^2 3540.25 B	0.308	22.02	400.3
TEST DATE	86-04-15	height,mm,(H1)	25.20	VOLUME,cc 89.27 C	0.311	21.15	649.9

	Time (min)	Square Root of Time /(min)	Normal Dial .002mm	Normal Displ. (mm)	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. (mm)	Normal Dial .002mm	Volume Strain (%)	Shear stress (kPa)
	0.00	0.0	4645.0	0.000	0.0	0.0	0.000	2700.0	0.000	0.0
	1.00	1.0	2950.0	-3.390	10.0	32.5	0.035	2697.0	-0.028	28.0
	1.50	1.2	2891.0	-3.508	26.5	73.9	0.117	2688.0	-0.113	63.7
	2.00	1.4	2855.0	-3.580	44.0	110.0	0.220	2674.0	-0.246	94.8
	3.00	1.7	2830.0	-3.630	55.0	133.2	0.284	2667.5	-0.307	114.7
	4.00	2.0	2811.0	-3.668	67.5	153.0	0.369	2654.0	-0.435	131.8
	5.00	2.2	2802.0	-3.686	82.5	175.1	0.475	2640.0	-0.567	150.8
	10.00	3.2	2781.0	-3.728	108.4	219.0	0.646	2620.0	-0.756	188.6
	59.00	7.7	2757.0	-3.776	142.5	254.7	0.916	2596.2	-0.982	219.4
	130.00	11.4	2745.5	-3.799	162.0	271.8	1.076	2586.0	-1.078	234.1
	213.00	14.6	2735.2	-3.820	179.0	291.9	1.206	2577.0	-1.163	251.4
	1294.00	36.0	2722.1	-3.846	211.0	315.0	1.480	2563.0	-1.296	271.3
					233.6	332.8	1.670	2552.0	-1.399	286.7
					241.5	333.5	1.748	2545.0	-1.466	287.3
					470.8	441.8	3.824	2460.0	-2.269	380.6
peak shear stress at 400.5 kPa					750.0	463.5	6.573	2404.0	-2.799	399.3
					793.0	464.7	7.001	2397.9	-2.857	400.3
end of peak run					802.0	464.9	7.090	2396.1	-2.874	400.5
residual shear stress, by hand (r1)					2406.0	378.0	23.304	2104.0	-5.636	325.6
(r2)					4010.0	362.0	39.376	1939.0	-7.196	311.8
(r3)					5614.0	350.0	55.440	1783.0	-8.671	301.5
(r4)					7218.0	370.0	71.440	1655.0	-9.882	318.7
(r5)					8822.0	400.0	87.420	1528.0	-11.083	344.6
residual shear stress, (r6)					9624.0	0.0	96.240	1368.0	-12.596	0.0
machine speed at 0.5 %/hr.					9626.0	8.8	96.242	1363.0	-12.643	7.6
					9644.0	57.9	96.324	1357.0	-12.700	49.9
					9679.0	126.0	96.538	1347.0	-12.794	108.5
					9707.0	173.1	96.724	1340.0	-12.860	149.1
					9739.0	212.8	96.964	1334.0	-12.917	183.3
					9803.0	153.0	97.724	1322.0	-13.031	131.8
					9862.0	284.0	98.052	1324.0	-13.012	244.6
					9915.0	337.0	98.476	1330.0	-12.955	290.3
					10360.0	391.1	102.818	1336.0	-12.898	336.9
					10404.0	391.1	103.258	1335.0	-12.908	336.9
					10418.0	391.0	103.398	1335	-12.908	336.8

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol. Height	Normal Stress
BOREHOLE NUMBER	85-10-2								
SAMPLE NUMBER	28	length,mm	59.50			A	0.043	21.50	302.8
SAMPLE DEPTH,m	29.7-29.9	width,mm	59.50	AREA,mm2	3540.25	B	0.308	20.43	500.0
TEST DATE	86-04-09	height,mm	25.20	VOLUME,cc	89.27	C	0.149	16.02	699.7

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	5700.0	0	0.0	0.0	0.000	3819.0	0.000	0.0
0.50	0.7	4300.0	-2.800	14.0	25.5	0.089	3795.0	-0.223	3.0
1.00	1.0	4220.0	-2.960	28.2	25.9	0.230	3788.0	-0.288%	3.1
2.00	1.4	4153.0	-3.094	37.0	39.0	0.292	3787.4	-0.294%	4.6
2.50	1.5	4134.0	-3.132	58.0	120.5	0.339	3784.1	-0.325%	14.3
3.00	1.7	4120.0	-3.160	90.0	136.0	0.628	3779.0	-0.372%	16.2
4.00	2.0	4092.0	-3.216	132.6	269.0	0.806	3764.0	-0.512%	31.9
14.00	3.7	3946.0	-3.508	152.5	322.6	0.880	3759.0	-0.558%	38.4
32.00	5.7	3893.0	-3.614	186.0	411.0	1.038	3753.0	-0.614%	49.0
182.00	13.5	3864.0	-3.672	210.0	459.8	1.180	3744.9	-0.689%	54.8
353.00	18.8	3856.0	-3.688	232.0	482.0	1.356	3726.0	-0.865%	57.4
1329.00	36.5	3850.0	-3.700	252.0	515.0	1.490	3718.0	-0.940%	61.3
				439.0	767.0	2.856	3643.0	-1.637%	91.3
peak shear stress at 96.7 kPa				747.0	812.2	5.846	3558.0	-2.428%	96.7
				758.0	794.0	5.992	3555.0	-2.456%	94.6
end of peak run				794.0	700.0	6.540	3550.0	-2.502%	83.4
residual shear stress, by hand			(r1)	2382.0	271.0	23.278	3387.0	-4.019%	32.3
			(r2)	3970.0	710.0	38.280	3318.0	-4.660%	84.6
			(r3)	5558.0	682.0	54.216	3268.0	-5.126%	81.2
			(r4)	7146.0	645.0	70.170	3236.0	-5.423%	76.8
			(r5)	8734.6	630.0	86.080	3211.0	-5.656%	75.0
residual shear stress,			(r6)	9528.0	0.0	95.280	3071.0	-6.958%	0.0
machine speed at 0.5 %/hr.				9555.0	13.0	95.524	3049.0	-7.163%	1.5
				9603.0	226.0	95.578	3041.0	-7.237%	26.9
				10083.0	670.0	99.490	2979.0	-7.814%	79.8
				10110.0	772.0	99.556	2976.0	-7.842%	91.9
				10134.0	821.0	99.698	2970.0	-7.898%	97.8
				10169.0	825.0	100.040	2966.0	-7.935%	98.3
				10213.0	827.0	100.476	2963.0	-7.963%	98.5
				10232.0	825.0	100.670	2961.0	-7.981%	98.3

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS			Proving Ring	Consol. Height	Normal Stress
BOREHOLE NUMBER	85-10-2								
SAMPLE NUMBER	28	length,mm	59.50			A	0.043	21.50	302.8
SAMPLE DEPTH,m	29.7-29.8	width,mm	59.50	AREA,mm2	3540.25	B	0.308	20.43	500.0
TEST DATE	86-04-09	height,mm	25.20	VOLUME,cc	89.27	C	0.149	16.02	699.7

	Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
	0.00	0.0	2140.0	0.000	0.0	0.0	0.000	1425.0	0.000	0.0
	0.50	0.7	1150.0	-1.980	10.1	29.5	0.042	1374.0	-0.499	25.2
	1.00	1.0	980.0	-2.320	33.1	71.0	0.189	1350.0	-0.734	60.6
	1.50	1.2	855.0	-2.570	48.0	90.0	0.300	1338.0	-0.852	76.8
	2.00	1.4	820.0	-2.640	58.1	101.5	0.378	1330.0	-0.930	86.6
	2.50	1.6	620.0	-3.040	73.0	114.5	0.501	1319.0	-1.038	97.7
	3.00	1.7	550.0	-3.180	94.5	130.0	0.685	1302.0	-1.204	110.9
	4.00	2.0	435.0	-3.410	119.2	144.0	0.904	1286.0	-1.361	122.8
	5.00	2.2	357.0	-3.566	142.5	154.2	1.117	1272.0	-1.498	131.6
	6.00	2.4	290.0	-3.700	171.2	165.0	1.382	1252.0	-1.694	140.8
	7.00	2.6	2058.0	-3.774	190.0	171.0	1.558	1242.0	-1.791	145.9
	11.00	3.3	1920.0	-4.050	225.5	181.0	1.893	1223.0	-1.977	154.4
	13.00	3.6	1810.0	-4.270	243.0	184.9	2.060	1214.0	-2.066	157.7
	970.00	31.1	1560.0	-4.770	402.5	205.5	3.614	1145.0	-2.741	175.3
peak shear stress at 176.5 kPa					702.5	206.9	6.611	1086.0	-3.319	176.5
					730.0	203.0	6.894	1082.0	-3.358	173.2
					751.5	202.2	7.111	1080.0	-3.377	172.5
end of peak run					780.0	201.5	7.397	1075.0	-3.426	171.9
residual shear stress, by hand				(r1)	2340.0	130.0	23.140	990.0	-4.258	110.9
				(r2)	3900.0	98.0	38.804	940.0	-4.748	83.6
				(r3)	5460.0	85.0	54.430	895.0	-5.188	72.5
				(r4)	7020.0	79.0	70.042	857.0	-5.560	67.4
				(r5)	8580.0	79.0	85.642	828.0	-5.844	67.4
residual shear stress,				(r6)	9360.0	0.0	93.600	607.0	-8.008	0.0
machine speed at 0.5 %/hr.					9379.0	60.6	93.669	607.0	-8.008	51.7
					9418.0	122.0	93.936	593.0	-8.145	104.1
					9476.0	166.8	94.426	581.0	-8.262	142.3
					9641.7	185.0	96.047	563.0	-8.439	157.8
					9682.0	188.2	96.444	559.0	-8.478	160.6
					10062.0	188.5	100.243	550.0	-8.566	160.8
					10114.0	188.3	100.763	547.8	-8.587	160.6
					10138.0	188.3	101.003	547.8	-8.587	160.6
					10151.0	188.3	101.133	547.8	-8.587	160.6

DIRECT SHEAR TESTS

PROJECT NUMBER	851-1298	BOX DIMENSIONS		SAMPLE DIMENSIONS		Proving Ring	Consol. Height	Normal Stress
BOREHOLE NUMBER	85-10-2							
SAMPLE NUMBER	28	length,mm	59.50		A	0.043	21.50	302.8
SAMPLE DEPTH,m	29.7-29.8	width,mm	59.50	AREA,mm2 3540.25	B	0.308	20.43	500.0
TEST DATE	86-04-09	height,mm	25.20	VOLUME,cc 89.27	C	0.149	16.02	699.7

Time min	Square Root of Time / min	Normal Dial .002mm	Normal Displ. mm	Horiz Dial .01mm	P.Ring Dial .002mm	Horiz. Displ. mm	Normal Dial .002mm	Volume Strain %	Shear stress kPa
0.00	0.0	2700.0	0.000	0.0	0.0	0.000	1838.0	0.000	0.0
0.50	0.7	1350.0	-2.700	5.1	17.0	0.017	1689.0	-1.860	7.0
1.00	1.0	1064.0	-3.272	30.0	27.0	0.246	1679.0	-1.985	11.1
1.50	1.2	850.0	-3.700	45.5	58.5	0.338	1675.0	-2.035	24.1
2.00	1.4	580.0	-4.240	61.5	114.5	0.386	1671.0	-2.085	47.3
2.50	1.6	280.0	-4.840	75.0	157.0	0.436	1667.0	-2.135	64.8
3.00	1.7	45.0	-5.310	98.0	214.2	0.552	1657.0	-2.260	88.4
3.50	1.9	3705.0	-5.760	121.0	259.5	0.691	1646.0	-2.397	107.1
4.00	2.0	3534.0	-6.102	143.0	296.2	0.838	1637.0	-2.509	122.2
5.00	2.2	3230.0	-6.710	178.5	349.5	1.086	1622.0	-2.697	144.2
10.00	3.2	2578.0	-8.014	197.5	371.5	1.232	1613.0	-2.809	153.3
15.00	3.9	2441.0	-8.288	232.0	391.8	1.536	1597.0	-3.009	161.7
24.00	4.9	2273.0	-8.715	251.0	427.5	1.655	1586.0	-3.146	176.4
977.00	31.3	1994.0	-9.182	416.0	518.5	3.123	1513.0	-4.057	214.0
				742.0	471.5	6.477	1452.0	-4.819	194.6
peak shear stress at 214.2 kPa				768.0	457.5	6.765	1447.0	-4.881	188.8
				790.0	448.0	7.004	1444.0	-4.919	184.9
end of peak run				809.0	448.0	7.194	1442.0	-4.944	184.9
residual shear stress, by hand			(r1)	2427.0	285.0	23.700	1327.0	-6.379	117.6
			(r2)	4045.0	250.0	39.950	1245.0	-7.403	103.2
			(r3)	5663.0	245.0	56.140	1198.0	-7.990	101.1
			(r4)	7281.0	260.0	72.290	1138.0	-8.739	107.3
			(r5)	8899.0	260.0	88.470	1102.0	-9.188	107.3
residual shear stress,			(r6)	9708.0	0.0	97.080	980.0	-10.712	0.0
machine speed at 0.5 %/hr.				9731.0	9.2	97.292	976.0	-10.762	3.8
				9772.0	34.8	97.650	979.0	-10.724	14.4
				9831.0	91.0	98.128	927.0	-11.373	37.6
				9894.5	396.0	98.153	965.0	-10.899	163.4
				9937.0	434.0	98.502	960.0	-10.961	179.1
				10455.0	376.0	103.798	954.0	-11.036	155.2
				10465.0	376.0	103.898	950.0	-11.086	155.2

APPENDIX 3

SUMMARY OF WATER CONTENT DETERMINATIONS

Samples Received June 20, 1986

SUMMARY OF WATER CONTENT DETERMINATIONS

PROJECT NUMBER 851-1298
PROJECT NAME Gartner Lee/OWMC 4B/85-GT-4
DATE TESTED June 20, 1986

GLA Tare No.	Water Content %
X948	19.1
X943	22.0
X979	25.5
X143	24.6
X245	20.8
X901	30.2
4	28.4
281	22.1
873	21.6
822	23.6
881	20.5
GM63	32.1
S16	18.7
S52	19.7
A56	24.3
N160	20.7
N172	24.7
P34	34.2

E2 GRAIN SIZE DISTRIBUTION CURVES

Appendix E2 presents a summary of the grain size analyses data presented in the Golder Associates (Eastern Canada) Ltd. report. For convenience the data have been plotted separately by geologic unit.

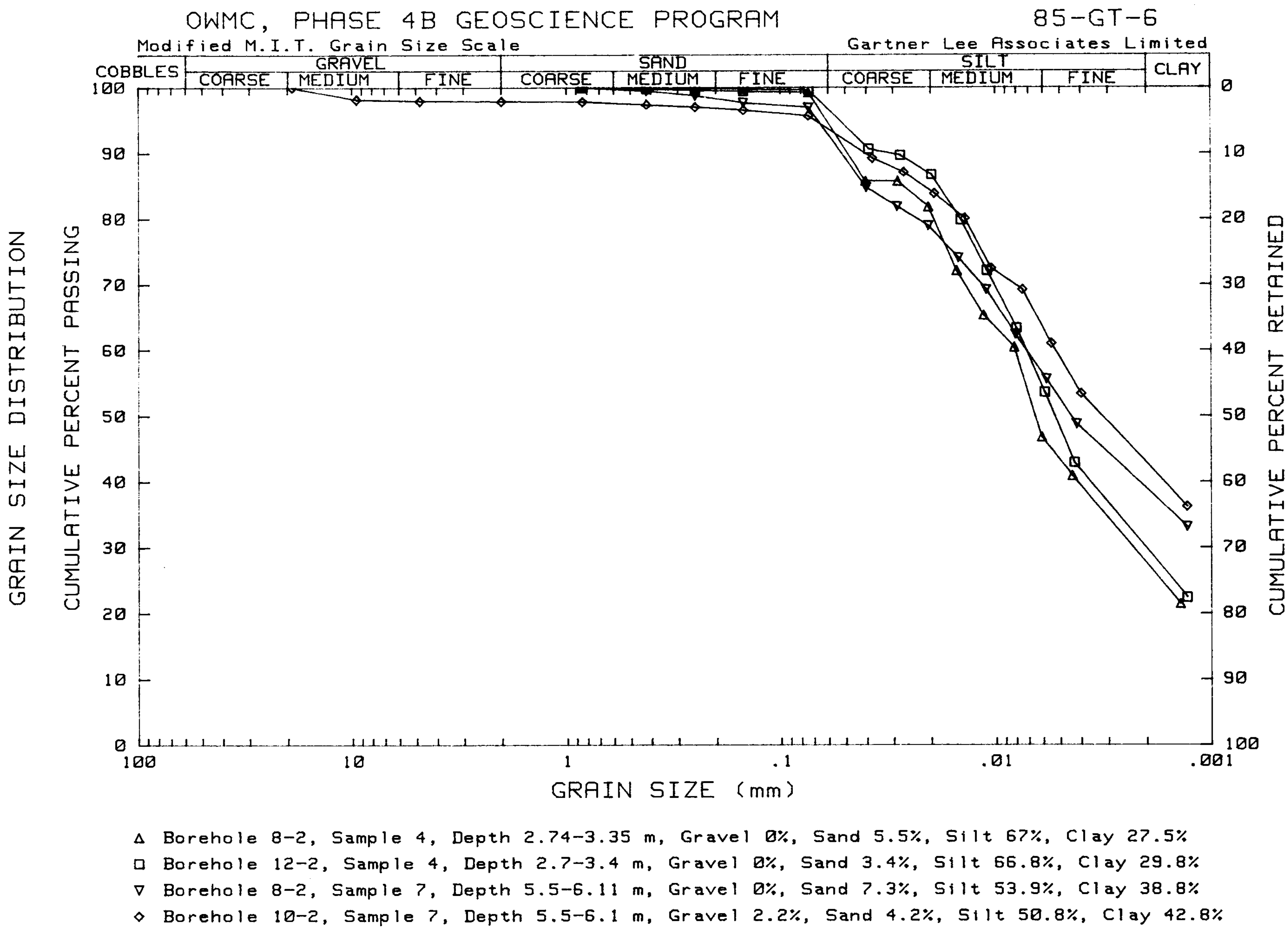
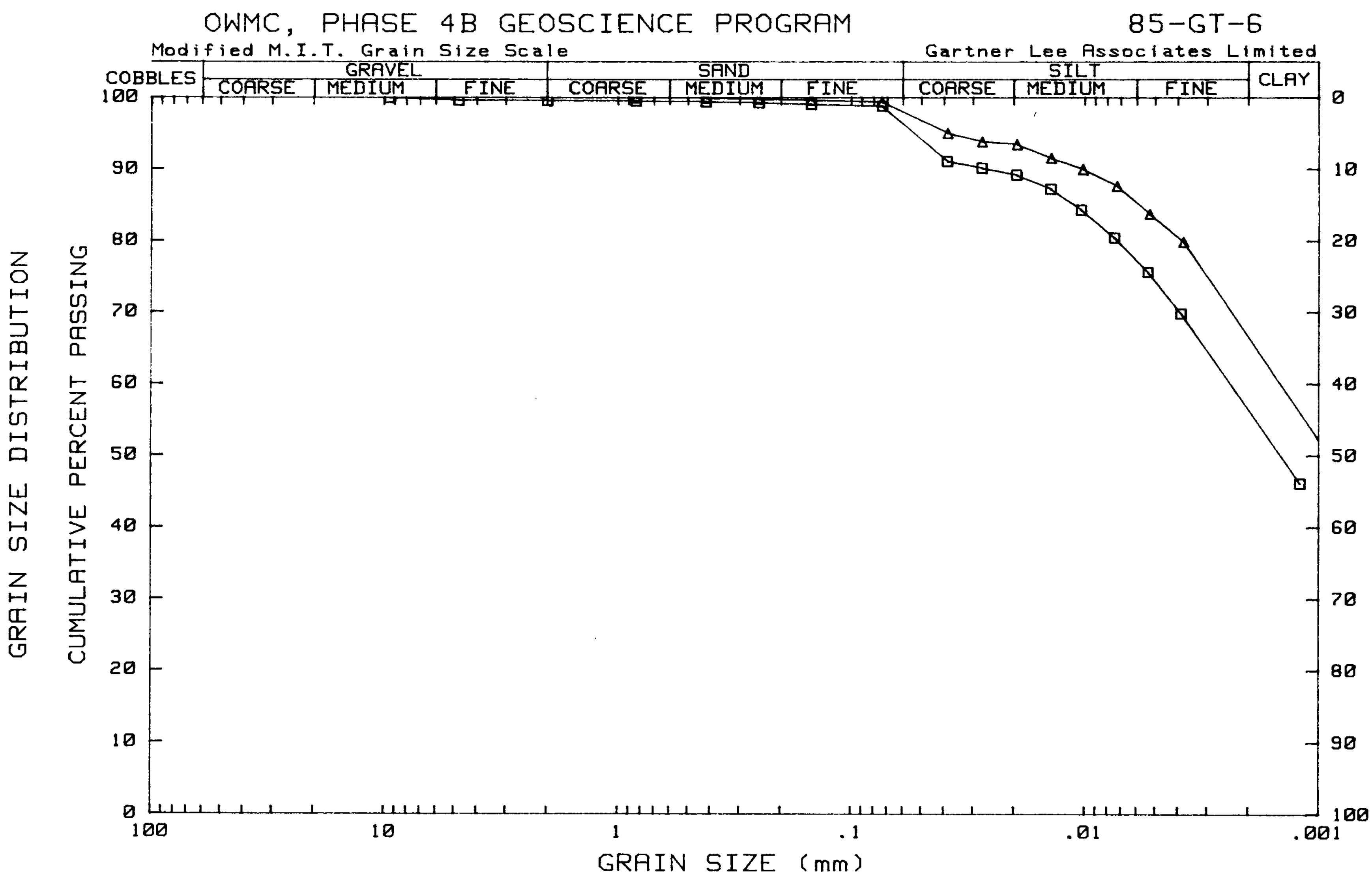


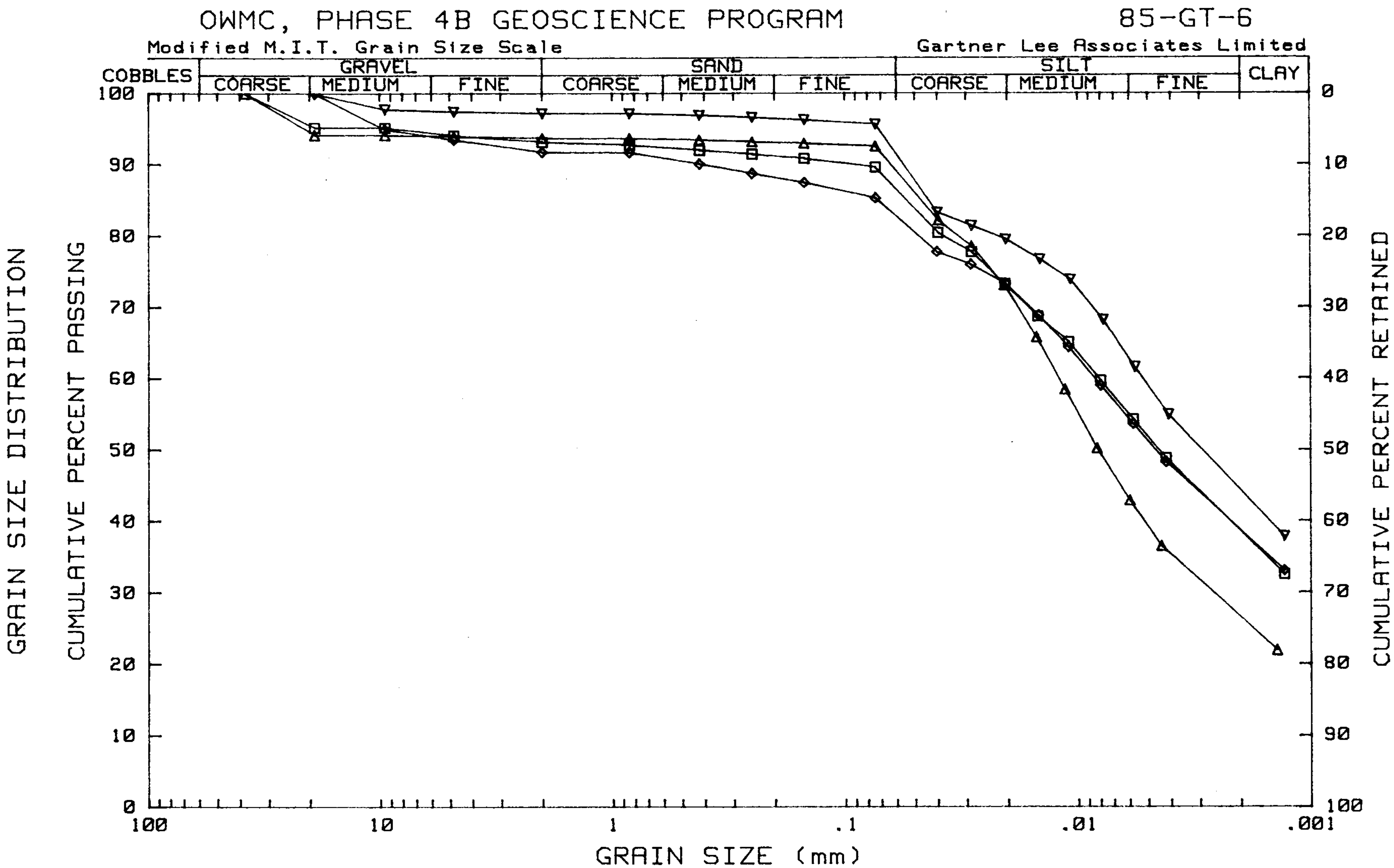
FIGURE E2-1: GRAIN SIZE DISTRIBUTION, UPPER GLACIOLACUSTRINE SUBUNITS 1A AND 1C



△ Borehole 3-2, Sample 6, Depth 4.6-5.2 m, Gravel 0%, Sand 2%, Silt 31.4%, Clay 66.6%

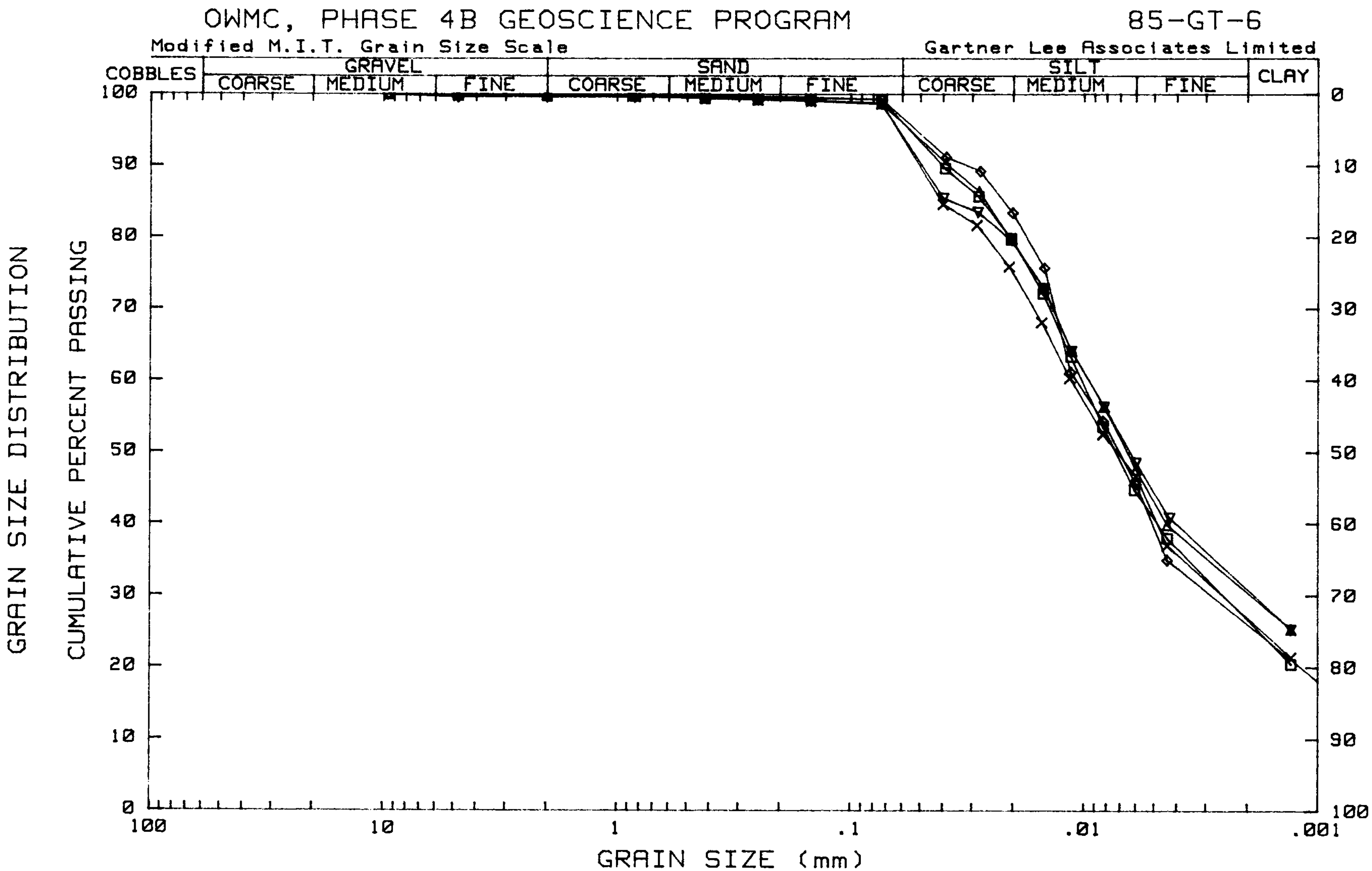
□ Borehole 1-2, Sample 7, Depth 5.03-5.64 m, Gravel .4%, Sand 3.3%, Silt 39.9%, Clay 56.4%

FIGURE E2-2: GRAIN SIZE DISTRIBUTION, UPPER GLACIOLACUSTRINE SUBUNIT 1B



△ Borehole 5-2, Sample 13, Depth 9.76-10.37 m, Gravel 6.3%, Sand 4.6%, Silt 62.6%, Clay 26.5%
□ Borehole 3-2, Sample 11, Depth 12.2-12.8 m, Gravel 6.8%, Sand 6.7%, Silt 48%, Clay 38.5%
▽ Borehole 8-2, Sample 17, Depth 17.68-18.29 m, Gravel 2.8%, Sand 5.8%, Silt 47.2%, Clay 44.2%
◇ Borehole 1-2, Sample 21, Depth 18.74-19.35 m, Gravel 8.3%, Sand 9%, Silt 44.1%, Clay 38.6%

FIGURE E2-3: GRAIN SIZE DISTRIBUTION, HALTON SUBUNITS 2A AND 2B



△ Borehole 1-2, Sample 11, Depth 9.6-10.21 m, Gravel .3%, Sand 3.7%, Silt 65.6%, Clay 30.4%

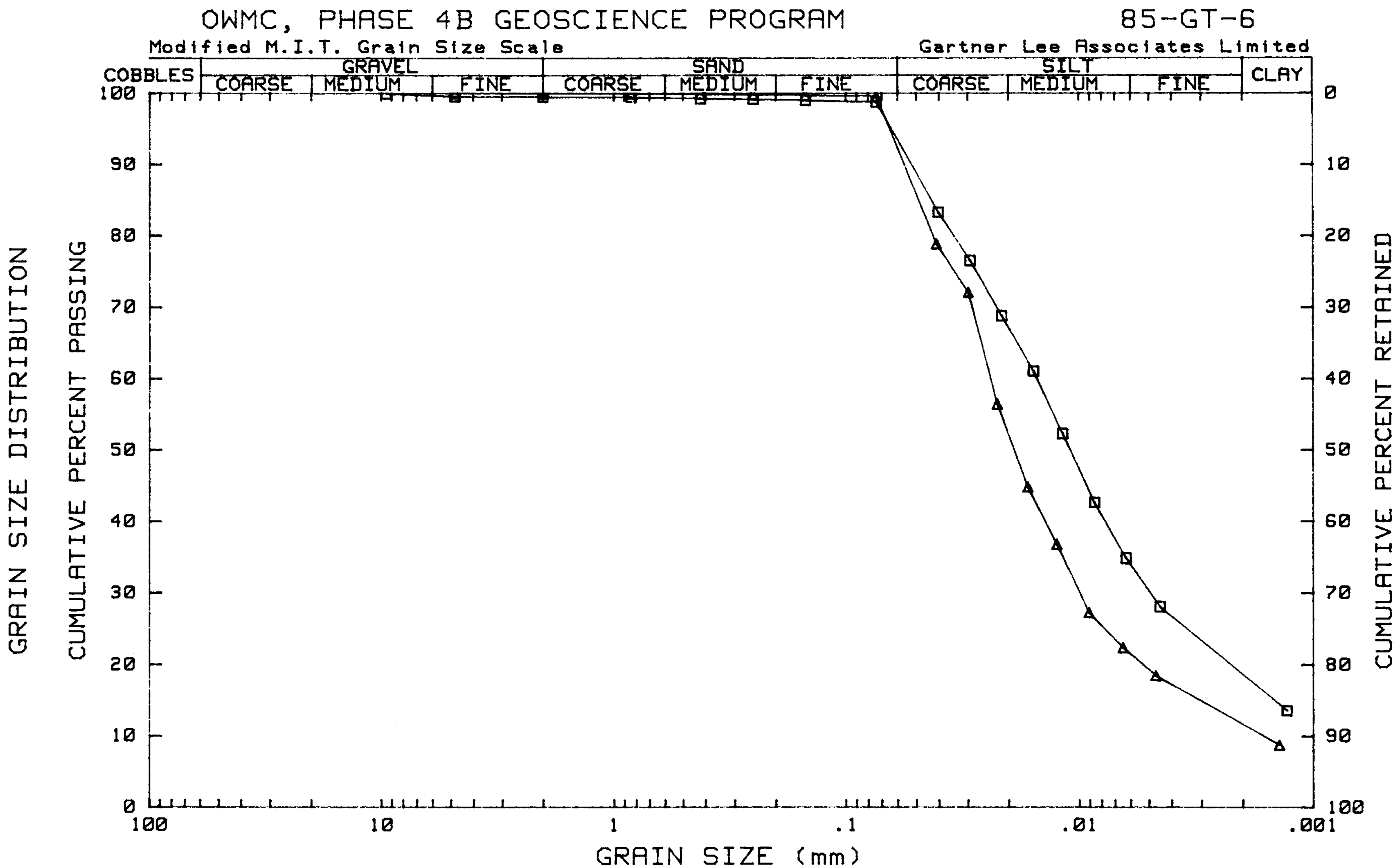
□ Borehole 12-2, Sample 10, Depth 9.6-10.2 m, Gravel 0%, Sand 4%, Silt 69.4%, Clay 26.6%

▽ Borehole 8-2, Sample 12, Depth 11.58-12.19 m, Gravel .3%, Sand 5.6%, Silt 63.3%, Clay 30.8%

◇ Borehole 10-2, Sample 20, Depth 20.3-20.9 m, Gravel .4%, Sand 3%, Silt 70.7%, Clay 25.9%

× Borehole 12-2, Sample 19, Depth 20.3-20.9 m, Gravel .1%, Sand 6.1%, Silt 66.9%, Clay 26.9%

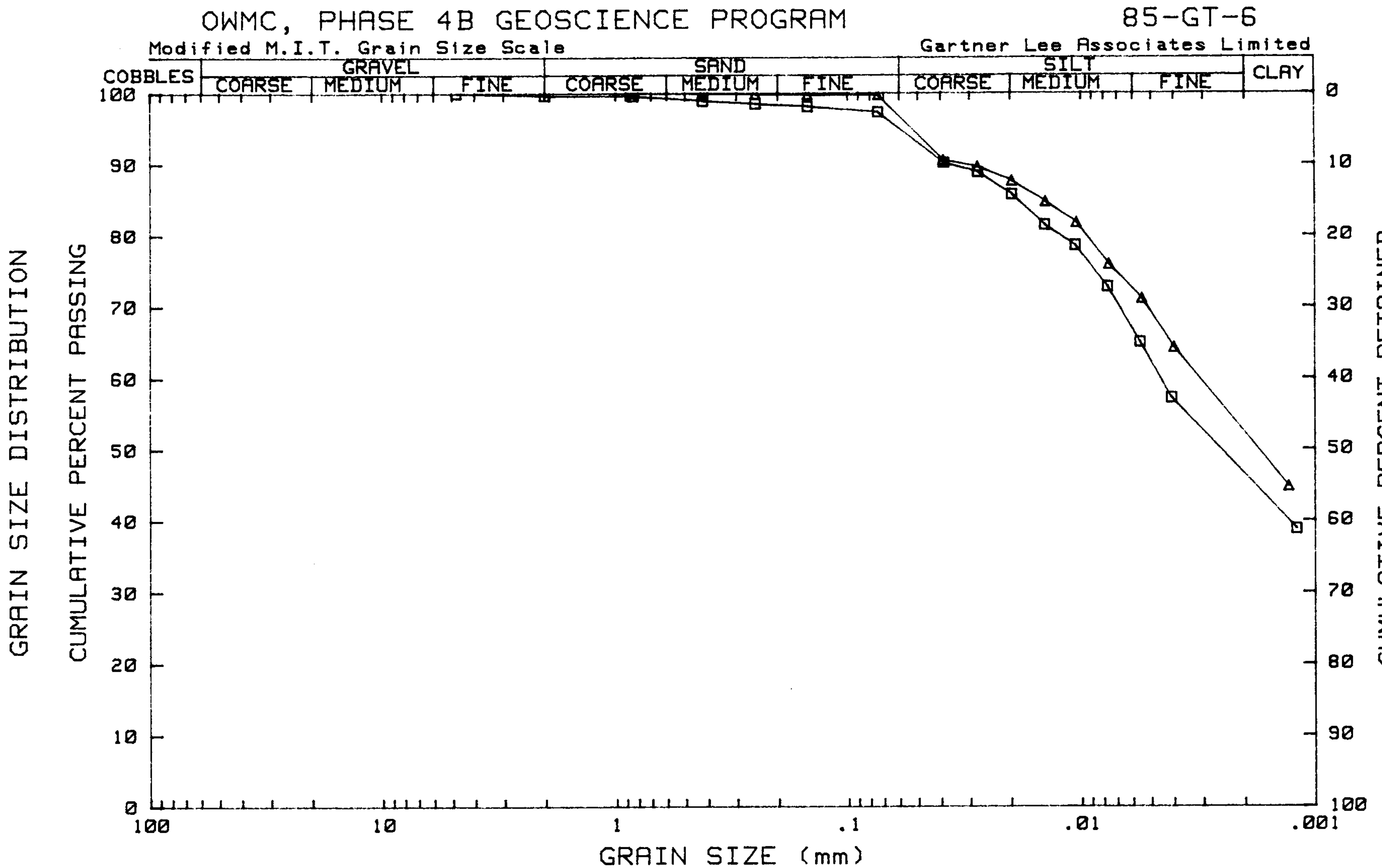
FIGURE E2-4: GRAIN SIZE DISTRIBUTION, HALTON SUBUNITS 2A AND 2B



△ Borehole 10-2, Sample 16, Depth 15.7-16.3 m, Gravel 0%, Sand 7.8%, Silt 80.6%, Clay 11.6%

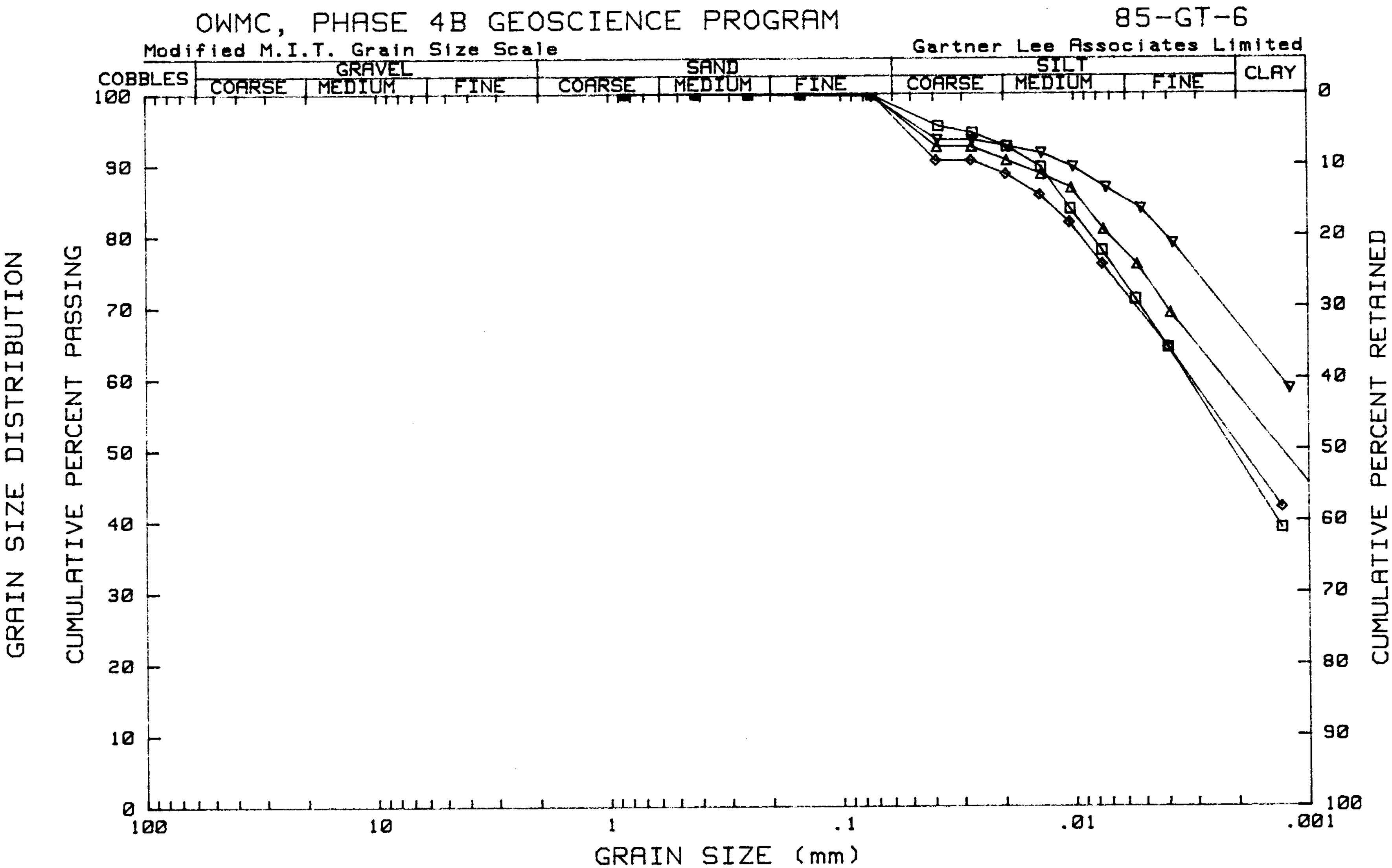
□ Borehole 12-2, Sample 15, Depth 15.7-16.3 m, Gravel .5%, Sand 6.1%, Silt 74.8%, Clay 18.6%

FIGURE E2-5: GRAIN SIZE DISTRIBUTION, HALTON SUBUNIT 2B



△ Borehole 8-2, Sample 22, Depth 23.77-24.38 m, Gravel 0%, Sand 3.3%, Silt 44.4%, Clay 52.3%
□ Borehole 3-2, Sample 19, Depth 24.4-25.0 m, Gravel .4%, Sand 4.6%, Silt 48.5%, Clay 46.5%

FIGURE E2-6: GRAIN SIZE DISTRIBUTION, LOWER GLACIOLACUSTRINE SUBUNIT 3A



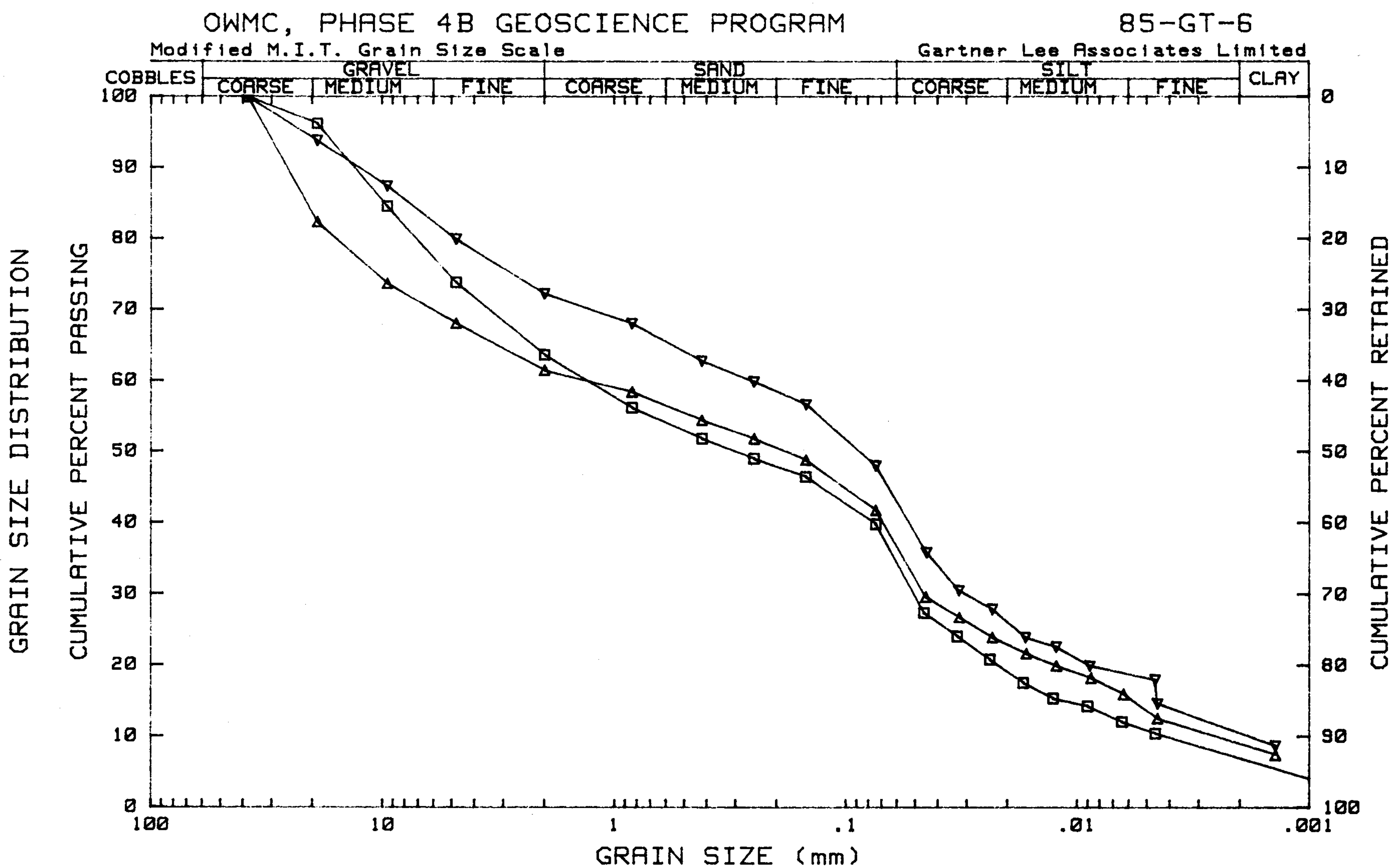
△ Borehole 10-2, Sample 28, Depth 29.4-30.0 m, Gravel 0%, Sand 2.5%, Silt 40.1%, Clay 57.4%

□ Borehole 12-2, Sample 27, Depth 29.4-30.0 m, Gravel 0%, Sand 1.6%, Silt 49.7%, Clay 48.7%

▽ Borehole 1-2, Sample 30, Depth 29.41-30.02 m, Gravel 0%, Sand 2.3%, Silt 30.2%, Clay 67.5%

◇ Borehole 8-2, Sample 27, Depth 29.87-30.48 m, Gravel 0%, Sand 3.2%, Silt 46.3%, Clay 50.5%

FIGURE E2-7: GRAIN SIZE DISTRIBUTION, LOWER GLACIOLACUSTRINE SUBUNIT 3B



△ Borehole 10-2, Sample 30, Depth 32.0-32-5 m, Gravel 38.6%, Sand 24.8%, Silt 27.6%, Clay 9%
□ Borehole 2-2, Sample 27, Depth 32.5-33.0 m, Gravel 36.4%, Sand 29.2%, Silt 27.5%, Clay 6.9%
▽ Borehole 8-2, Sample 30, Depth 32.91-33.50 m, Gravel 27.9%, Sand 29.2%, Silt 32.5%, Clay 10.4%

FIGURE E2-8: GRAIN SIZE DISTRIBUTION, LOWER TILL UNIT 4

APPENDIX F

INSTRUMENTATION AND WATER LEVEL DATA

APPENDIX F

INSTRUMENTATION AND WATER LEVEL DATA

TABLE OF CONTENTS

LIST OF TABLES

F1 MONITOR DETAILS

This appendix provides construction details for each of the ground water monitors installed during the 1985 Phase 4B geoscience program. Monitors are identified by year, location number and monitor number. The protocols for monitor installation were presented in Appendix A2. Appendix A2 also introduces the monitor construction terminology used here.

Table F1-1 summaries the major construction details of the monitors, including monitor inside diameter, ground elevation, stick up (length of monitor pipe above grade), top of monitor elevation, monitor type, and the location of the screen, sand pack and seal. All measurements were taken during the installation of each monitor.

Table F1-1

Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL DEPTH FROM GRADE (m)	SCREENED INTERVAL ELEVATION (m.A.S.L)	SAND PACK DEPTH FROM GRADE (m)	SAND PACK ELEVATION (m.A.S.L)	SEAL DEPTH FROM GRADE (m)	SEAL ELEVATION (m.A.S.L)
1-1	52	96	185.50	0.38	185.88	P	34.40 to 37.50	151.10 to 148.00	34.30 to 37.50	151.20 to 148.00	29.70 to 34.30	155.80 to 151.20
1-2	19	51	185.57	0.52	186.09	P	32.23 to 33.23	153.34 to 152.34	32.00 to 33.23	153.57 to 152.34	20.00 to 32.00	165.57 to 153.57
1-3	19	51	185.32	0.55	185.87	P	25.91 to 26.91	159.41 to 158.41	25.50 to 27.13	159.82 to 158.19	21.00 to 25.50	164.32 to 159.82
1-4	19	51	185.28	0.55	185.83	P	15.24 to 16.24	170.04 to 169.04	15.00 to 16.46	170.28 to 168.82	11.00 to 15.00	174.28 to 170.28
1-5	19	51	185.09	0.60	185.69	S	1.18 to 5.18	183.91 to 179.91	0.91 to 5.48	184.18 to 179.61	0.50 to 0.91	184.59 to 184.18
1-6		102	185.36	0.51	185.87	N	27.13	158.23	26.40 to 27.13	158.96 to 158.23	22.00 to 26.40	163.36 to 158.96
1-7		102	185.30	0.52	185.82	N	16.46	168.84	15.50 to 16.46	169.80 to 168.84	11.00 to 15.50	174.30 to 169.80
1-8	52	102	185.19	0.67	185.86	P	24.40 to 25.00	160.79 to 160.19	none-filter cloth around screen	none-filter cloth around screen	19.50 to 24.38	165.69 to 160.81
1-9	52	102	185.28	0.65	185.93	P	15.24 to 15.84	170.04 to 169.44	none-filter cloth aro-und screen	none-filter cloth aro-und screen	11.00 to 15.24	174.28 to 170.04
1-10	52	203	185.26	0.68	185.94	S	2.33 to 5.33	182.93 to 179.93	2.30 to 5.33	182.96 to 179.93	1.10 to 2.30	184.16 to 182.96
1-11	19	51	185.36	0.67	186.03	P	8.80 to 9.84	176.56 to 175.52	8.50 to 10.14	176.86 to 175.22	5.25 to 8.50	180.11 to 176.86
1-12a		89	185.53	0.86	186.39	N	61.50	124.03	61.13 to 61.60	124.40 to 123.93	47.00 to 61.13	138.53 to 124.40
1-12b		89	185.53	0.86	186.39	N	47.00	138.53	46.50 to 47.00	139.03 to 138.53	37.00 to 46.50	148.53 to 139.03
1-12c	52	96	185.53	0.76	186.29	P	35.40 to 36.40	150.13 to 149.13	35.00 to 37.00	150.53 to 148.53	30.00 to 35.00	155.53 to 150.53
1-13	52	108	185.48	0.56	186.04	P	1.20 to 1.50	184.28 to 183.98	1.20 to 1.50	184.28 to 183.98	1.00 to 1.20	184.48 to 184.28
1-14	52	108	185.44	0.59	186.03	P	2.20 to 2.50	183.24 to 182.94	2.15 to 2.50	183.29 to 182.94	1.00 to 2.15	184.44 to 183.29
1-15	52	108	185.47	0.58	186.05	P	2.70 to 3.00	182.77 to 182.47	2.70 to 3.00	182.77 to 182.47	1.20 to 2.70	184.27 to 182.77
1-16	52	108	185.50	0.60	186.10	P	3.70 to 4.00	181.80 to 181.50	3.70 to 4.00	181.80 to 181.50	0.90 to 3.70	184.60 to 181.80

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of-monitor elevation for pneumatic piezometer are relative to top of prottective casing

Table F1-1 Cont.
Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL DEPTH FROM GRADE (m)	SCREENED INTERVAL ELEVATION (m.A.S.L)	SAND PACK DEPTH FROM GRADE (m)	SAND PACK ELEVATION (m.A.S.L)	SEAL DEPTH FROM GRADE (m)	SEAL ELEVATION (m.A.S.L)
1-17	52	108	185.55	0.56	186.11	P	4.50 to 4.80	181.05 to 180.75	4.50 to 4.80	181.05 to 180.75	0.90 to 4.50	184.65 to 181.05
1-18	52	108	185.54	0.83	186.37	P	5.20 to 5.50	180.34 to 180.04	5.20 to 5.50	180.34 to 180.04	0.80 to 5.20	184.74 to 180.34
1-19	52	108	185.66	0.41	186.07	P	6.00 to 6.30	179.66 to 179.36	6.00 to 6.30	179.66 to 179.36	1.00 to 6.00	184.66 to 179.66
1-20	52	108	185.63	0.40	186.03	P	6.70 to 7.00	178.93 to 178.63	6.65 to 7.00	178.98 to 178.63	1.00 to 6.65	184.63 to 178.98
1-21	52	108	185.59	0.48	186.07	P	7.65 to 7.96	177.94 to 177.63	7.60 to 8.00	177.99 to 177.59	0.75 to 5.60	184.84 to 179.99
1-22	96	159	185.56	0.67	186.23	W	35.30 to 37.30	150.26 to 148.26	35.00 to 37.30	150.56 to 148.26	30.00 to 35.00	155.56 to 150.56
2-1	47	96	185.00	0.62	185.62	P	35.43 to 36.95	149.57 to 148.05	34.00 to 36.95	151.00 to 148.05	27.50 to 34.00	157.50 to 151.00
2-2	19	51	185.03	0.82	185.85	P	31.80 to 32.80	153.23 to 152.23	30.60 to 32.90	154.43 to 152.13	26.50 to 30.60	158.53 to 154.43
2-3	19	51	185.04	0.41	185.45	P	25.80 to 27.00	159.24 to 158.04	25.50 to 27.10	159.54 to 157.94	21.00 to 25.50	164.04 to 159.54
2-4	19	51	185.03	0.61	185.64	P	15.50 to 16.60	169.53 to 168.43	15.00 to 16.60	170.03 to 168.43	9.00 to 15.00	176.03 to 170.03
2-5	19	51	184.91	0.77	185.68	S	2.70 to 5.70	182.21 to 179.21	0.90 to 5.70	184.01 to 179.21	0.80 to 0.90	184.11 to 184.01
3-1	52	96	185.24	0.43	185.67	P	32.00 to 34.69	153.24 to 150.55	31.59 to 34.74	153.65 to 150.50	26.27 to 31.59	158.97 to 153.65
3-2	19	51	185.49	0.97	186.46	P	30.70 to 31.62	154.79 to 153.87	30.40 to 31.70	155.09 to 153.79	26.50 to 30.40	158.99 to 155.09
3-3	19	51	185.52	0.55	186.07	P	26.10 to 27.02	159.42 to 158.50	25.86 to 27.10	159.66 to 158.42	22.80 to 25.86	162.72 to 159.66
3-4	19	51	185.54	0.45	185.99	P	15.40 to 16.32	170.14 to 169.22	14.60 to 16.40	170.94 to 169.14	11.40 to 14.60	174.14 to 170.94
3-5	19	51	185.52	0.63	186.15	S	1.58 to 5.76	183.94 to 179.76	0.85 to 5.84	184.67 to 179.68	0.45 to 0.85	185.07 to 184.67
3-6		102	185.35	0.76	186.11	N	27.38	157.97	26.50 to 27.43	158.85 to 157.92	23.00 to 26.50	162.35 to 158.85
3-7		102	185.43	0.71	186.14	N	16.39	169.04	15.61 to 16.44	169.82 to 168.99	11.84 to 15.61	173.59 to 169.82
3-8	52	102	185.47	0.50	185.97	P	24.01 to 24.62	161.46 to 160.85	none-filter cloth aro-und screen	none-filteter cloth aro-und screen	16.90 to 24.40	168.57 to 161.07

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note. Stickup and top-of-monitor elevation for pneumatic piezometer are relative to top of protective casing

Table F1-1 Cont.
Ground Water Monitor Details

MONITOR NO 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL DEPTH FROM GRADE (m)	SCREENED INTERVAL ELEVATION (m.A.S.L)	SAND PACK DEPTH FROM GRADE (m)	SAND PACK ELEVATION (m.A.S.L)	SEAL DEPTH FROM GRADE (m)	SEAL ELEVATION (m.A.S.L)
3-9	52	102	185.43	0.80	186.23	P	15.20 to 15.80	170.23 to 169.63	none-filter cloth around screen	none-filter cloth around screen	11.00 to 15.20	174.43 to 170.23
3-10	52	76	186.41	0.49	186.90	S	2.30 to 5.30	184.11 to 181.11	2.00 to 5.30	184.41 to 181.11	1.20 to 2.00	185.21 to 184.41
3-11	19	51	185.26	0.58	185.84	P	8.53 to 9.53	176.73 to 175.73	8.40 to 9.75	176.86 to 175.51	4.80 to 8.40	180.46 to 176.86
4-1	47	96	185.43	0.56	185.99	P	37.20 to 38.18	148.23 to 147.25	35.10 to 38.20	150.33 to 147.23	31.65 to 35.10	153.78 to 150.33
4-2	19	51	185.46	0.52	185.98	P	31.90 to 32.80	153.56 to 152.66	31.10 to 32.90	154.36 to 152.56	27.80 to 31.10	157.66 to 154.36
4-3	19	51	185.38	0.56	185.94	P	25.90 to 26.80	159.48 to 158.58	25.90 to 27.10	159.48 to 158.28	22.50 to 25.90	162.88 to 159.48
4-4	19	51	185.38	0:56	185.94	P	15.20 to 16.10	170.18 to 169.28	15.00 to 16.40	170.38 to 168.98	11.80 to 15.00	173.58 to 170.38
4-5	19	51	185.32	0.60	185.92	S	1.61 to 5.50	183.71 to 179.82	0.90 to 5.80	184.42 to 179.52	0.70 to 0.90	184.62 to 184.42
5-1	47	96	185.40	0.80	186.20	P	39.40 to 40.40	146.00 to 145.00	38.00 to 40.40	147.40 to 145.00	30.70 to 38.00	154.70 to 147.40
5-2	19	51	185.44	0.75	186.19	P	34.45 to 35.45	150.99 to 149.99	33.75 to 35.75	151.69 to 149.69	30.50 to 33.75	154.94 to 151.69
5-3	19	51	185.42	0.62	186.04	P	25.82 to 26.82	159.60 to 158.60	25.60 to 26.83	159.82 to 158.59	22.00 to 25.60	163.42 to 159.82
5-4	19	51	185.42	0.61	186.03	P	16.86 to 17.86	168.56 to 167.56	16.50 to 17.86	168.92 to 167.56	13.50 to 16.50	171.92 to 168.92
5-5	19	51	185.37	0.89	186.26	S	1.49 to 5.49	183.88 to 179.88	1.00 to 5.79	184.37 to 179.58	0.75 to 1.00	184.62 to 184.37
6-1	47	96	185.46	1.02	186.48	P	37.22 to 38.74	148.24 to 146.72	36.60 to 38.74	148.86 to 146.72	29.87 to 36.60	155.59 to 148.86
6-2	19	51	185.42	0.54	185.96	P	33.50 to 34.50	151.92 to 150.92	32.50 to 34.50	152.92 to 150.92	29.50 to 32.50	155.92 to 152.92
6-3	19	51	185.38	0.71	186.09	P	26.12 to 27.12	159.26 to 158.26	25.50 to 27.12	159.88 to 158.26	22.00 to 25.50	163.38 to 159.88
6-4	19	51	185.33	0.65	185.98	P	15.24 to 16.24	170.09 to 169.09	14.74 to 16.24	170.59 to 169.09	11.60 to 14.74	173.73 to 170.59
6-5	19	51	185.24	1.03	186.27	S	0.60 to 4.87	184.64 to 180.37	0.60 to 4.87	184.64 to 180.37	0.40 to 0.60	184.84 to 184.64

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of-monitor elevation for pneumatic piezometer are relative to top of protective casing

Table F1-1 Cont.
Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL		SAND PACK		SEAL	
							DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)	DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)	DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)
7-1	47	96	184.37	0.62	184.99	P	37.63 to 38.63	146.74 to 145.74	36.50 to 38.69	147.87 to 145.68	29.50 to 36.50	154.87 to 147.87
7-2	19	51	184.39	0.52	184.91	P	33.90 to 34.90	150.49 to 149.49	33.80 to 35.10	150.59 to 149.29	30.00 to 33.80	154.39 to 150.59
7-3	19	51	184.38	0.48	184.86	P	25.90 to 26.90	158.48 to 157.48	25.80 to 27.10	158.58 to 157.28	21.50 to 25.80	162.88 to 158.58
7-4	19	51	184.34	0.51	184.85	P	15.24 to 16.24	169.10 to 168.10	15.00 to 16.46	169.34 to 167.88	11.50 to 15.00	172.84 to 169.34
7-5	19	51	184.29	0.59	184.88	S	1.49 to 5.49	182.80 to 178.80	0.91 to 5.79	183.38 to 178.50	0.61 to 0.91	183.68 to 183.38
8-1	52	96	184.99	0.29	185.28	P	36.49 to 39.47	148.50 to 145.52	36.30 to 39.47	148.69 to 145.52	29.00 to 36.30	155.99 to 148.69
8-2	19	51	184.92	0.78	185.70	P	32.00 to 33.20	152.92 to 151.72	32.00 to 33.50	152.92 to 151.42	29.00 to 32.00	155.92 to 152.92
8-3	19	51	184.88	0.63	185.51	P	25.83 to 26.83	159.05 to 158.05	25.50 to 27.13	159.38 to 157.75	22.50 to 25.50	162.38 to 159.38
8-4	19	51	184.88	0.68	185.56	P	15.16 to 16.16	169.72 to 168.72	14.80 to 16.46	170.08 to 168.42	11.80 to 14.80	173.08 to 170.08
8-5	19	51	184.97	0.82	185.79	P	1.49 to 5.49	183.48 to 179.48	1.25 to 5.79	183.72 to 179.18	1.00 to 1.25	183.97 to 183.72
8-6		102	184.98	0.62	185.60	N	25.91	159.07	25.25 to 25.91	159.73 to 159.07	22.25 to 25.25	162.73 to 159.73
8-7		102	185.04	0.56	185.60	N	16.76	168.28	16.00 to 16.76	169.04 to 168.28	13.00 to 16.00	172.04 to 169.04
8-8	52	102	185.08	0.56	185.64	P	24.66 to 25.38	160.42 to 159.70	none-filter cloth aro-und screen	none-filter cloth aro-und screen	21.00 to 24.66	164.08 to 160.42
8-9	52	102	185.10	0.55	185.65	P	15.10 to 15.71	170.00 to 169.39	none-filter cloth aro-und screen	none-filter cloth aro-und screen	11.00 to 15.10	174.10 to 170.00
8-10	52	203	185.13	0.59	185.72	S	2.43 to 5.33	182.70 to 179.80	2.13 to 5.48	183.00 to 179.65	1.33 to 2.13	183.80 to 183.00
8-11	19	51	184.93	0.60	185.53	P	8.45 to 9.45	176.48 to 175.48	8.25 to 9.75	176.68 to 175.18	5.25 to 8.25	179.68 to 176.68
9-1	47	96	183.85	0.55	184.40	P	35.85 to 36.85	148.00 to 147.00	34.50 to 37.35	149.35 to 146.50	28.50 to 34.50	155.35 to 149.35
9-2	19	51	183.89	0.60	184.49	P	32.60 to 33.60	151.29 to 150.29	32.00 to 33.70	151.89 to 150.19	28.50 to 32.00	155.39 to 151.89
9-3	19	51	183.90	0.52	184.42	P	25.90 to 26.90	158.00 to 157.00	25.60 to 27.10	158.30 to 156.80	21.00 to 25.60	162.90 to 158.30

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of-monitor elevation for pneumatic piezometer are relative to top of protective casing

Table F1-1 Cont.

Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL		SAND PACK		SEAL	
							DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)	DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)	DEPTH FROM GRADE (m)	ELEVATION (m.A.S.L)
9-4	19	51	183.89	0.52	184.41	P	15.24 to 16.24	168.65 to 167.65	15.00 to 16.46	168.89 to 167.43	11.50 to 15.00	172.39 to 168.89
9-5	19	51	183.86	0.45	184.31	S	1.49 to 5.49	182.37 to 178.37	0.81 to 5.79	183.05 to 178.07	0.45 to 0.81	183.41 to 183.05
10-1	52	96	183.92	0.61	184.53	P	36.85 to 39.85	147.07 to 144.07	36.70 to 40.00	147.22 to 143.92	25.00 to 36.70	158.92 to 147.22
10-2	19	51	184.03	0.47	184.50	P	32.20 to 33.20	151.83 to 150.83	31.60 to 33.50	152.43 to 150.53	28.30 to 31.60	155.73 to 152.43
10-3	19	51	183.94	0.59	184.53	P	25.90 to 26.90	158.04 to 157.04	25.30 to 27.10	158.64 to 156.84	21.00 to 25.30	162.94 to 158.64
10-4	19	51	184.03	0.50	184.53	P	15.24 to 16.24	168.79 to 167.79	14.60 to 16.46	169.43 to 167.57	10.90 to 14.60	173.13 to 169.43
10-5	19	51	183.99	0.79	184.78	S	1.49 to 5.49	182.50 to 178.50	0.91 to 5.79	183.08 to 178.20	0.60 to 0.91	183.39 to 183.08
10-6		102	183.99	0.71	184.70	N	27.10	156.89	26.10 to 27.10	157.89 to 156.89	22.00 to 26.10	161.99 to 157.89
10-7		102	183.92	0.67	184.59	N	16.46	167.46	15.60 to 16.46	168.32 to 167.46	11.40 to 15.60	172.52 to 168.32
10-8	52	102	184.04	0.38	184.42	P	24.40 to 25.00	159.64 to 159.04	none-filter cloth around screen	none-filter cloth around screen	20.00 to 24.40	164.04 to 159.64
10-9	52	102	184.46	0.34	184.80	P	14.85 to 15.45	169.61 to 169.01	none-filter cloth around screen	none-filter cloth around screen	9.00 to 14.85	175.46 to 169.61
10-10	52	76	184.01	0.47	184.48	S	2.85 to 3.66	181.16 to 180.35	2.85 to 3.66	181.16 to 180.35	1.50 to 2.85	182.51 to 181.16
10-11	19	51	184.01	0.60	184.61	P	8.53 to 9.53	175.48 to 174.48	8.45 to 9.75	175.56 to 174.26	4.50 to 8.45	179.51 to 175.56
10-12	19	102	183.74	1.08	184.82	P	14.70 to 15.70	169.04 to 168.04	14.20 to 15.90	169.54 to 167.84	12.70 to 14.20	171.04 to 169.54
11-1	47	96	184.34	0.62	184.96	P	40.47 to 41.45	143.87 to 142.89	39.99 to 41.50	144.35 to 142.84	32.30 to 39.99	152.04 to 144.35
11-2	19	51	184.42	0.67	185.09	P	34.08 to 35.00	150.34 to 149.42	33.60 to 35.10	150.82 to 149.32	30.50 to 33.60	153.92 to 150.82
11-3	19	51	184.41	0.59	185.00	P	27.44 to 28.35	156.97 to 156.06	26.52 to 28.65	157.89 to 155.76	23.40 to 26.52	161.01 to 157.89
11-4	19	51	184.35	0.59	184.94	P	16.78 to 17.70	167.57 to 166.65	16.42 to 18.00	167.93 to 166.35	13.30 to 16.42	171.05 to 167.93

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of-monitor elevation for pneumatic piezometer are relative to top of protective casing

Table F1-1 Cont.
Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL: DEPTH FROM GRADE (m)	SCREENED INTERVAL: ELEVATION (m.A.S.L)	SAND PACK: DEPTH FROM GRADE (m)	SAND PACK: ELEVATION (m.A.S.L)	SEAL: DEPTH FROM GRADE (m)	SEAL: ELEVATION (m.A.S.L)
11-5	19	51	184.35	0.58	184.93	S	1.60 to 5.49	182.75 to 178.86	0.90 to 5.79	183.45 to 178.56	0.70 to 0.90	183.65 to 183.45
12-1	52	96	184.07	0.55	184.62	P	38.00 to 41.00	146.07 to 143.07	38.00 to 41.20	146.07 to 142.87	30.00 to 38.00	154.07 to 146.07
12-2	19	51	183.98	0.49	184.47	P	35.30 to 36.30	148.68 to 147.68	35.00 to 36.60	148.98 to 147.38	31.00 to 35.00	152.98 to 148.98
12-3	19	51	184.18	0.60	184.78	P	25.90 to 26.80	158.28 to 157.38	25.30 to 27.10	158.88 to 157.08	22.13 to 25.30	162.05 to 158.88
12-4	19	51	184.03	0.67	184.70	P	16.80 to 17.70	167.23 to 166.33	16.20 to 18.00	167.83 to 166.03	13.30 to 16.20	170.73 to 167.83
12-5	19	51	183.96	0.65	184.61	S	1.60 to 5.49	182.36 to 178.47	0.91 to 5.79	183.05 to 178.17	0.71 to 0.91	183.25 to 183.05
12-6		102	184.22	0.69	184.91	N	27.10	157.12	26.40 to 27.10	157.82 to 157.12	23.00 to 26.50	161.22 to 157.72
12-7		102	184.11	0.53	184.64	N	17.30	166.81	16.40 to 17.60	167.71 to 166.51	13.00 to 16.40	171.11 to 167.71
12-8	52	102	183.77	0.61	184.38	P	24.55 to 25.15	159.22 to 158.62	none-filter cloth aro- und screen	none-filter cloth aro- und screen	20.00 to 24.38	163.77 to 159.39
12-9	52	102	183.70	0.55	184.25	P	15.25 to 15.85	168.45 to 167.85	none-filter cloth aro- und screen	none-filter cloth aro- und screen	10.00 to 15.25	173.70 to 168.45
12-10	52	203	183.64	0.52	184.16	S	2.30 to 5.33	181.34 to 178.31	2.00 to 5.33	181.64 to 178.31	1.00 to 2.00	182.64 to 181.64
12-11	19	51	183.99	0.70	184.69	P	8.55 to 9.45	175.44 to 174.54	8.30 to 9.75	175.69 to 174.24	4.76 to 8.30	179.23 to 175.69
12-12a		89	184.11	1.09	185.20	N	71.10	113.01	70.00 to 71.30	114.11 to 112.81	50.80 to 70.00 and 71.30 to 72.30	133.31 to 114.11 and 112.81 to 111.81
12-12b		89	184.11	1.09	185.20	N	50.50	133.61	49.80 to 50.80	134.31 to 133.31	40.00 to 49.80	144.11 to 134.31
12-12c	52	96	184.19	0.93	185.12	P	38.90 to 39.90	145.29 to 144.29	38.50 to 40.00	145.69 to 144.19	36.00 to 38.50	148.19 to 145.69
12-13	52	108	183.56	0.47	184.03	P	1.20 to 1.50	182.36 to 182.06	1.15 to 1.52	182.41 to 182.04	0.00 to 1.15	183.56 to 182.41
12-14	52	108	183.59	0.55	184.14	P	2.20 to 2.50	181.39 to 181.09	2.00 to 2.50	181.59 to 181.09	0.00 to 2.00	183.59 to 181.59
12-15	52	108	183.52	0.62	184.14	P	2.70 to 3.00	180.82 to 180.52	2.60 to 3.00	180.92 to 180.52	0.00 to 2.60	183.52 to 180.92

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of monitor elevation for pneumatic piezometers are relative to top of protective casing

Table F1-1 Cont.
Ground Water Monitor Details

MONITOR NO. 85-	MONITOR INSIDE DIAMETER (mm)	BOREHOLE DIAMETER * (mm)	GROUND ELEVATION (m.A.S.L)	STICK UP (m)	TOP OF MONITOR (m.A.S.L)	MONITOR TYPE	SCREENED INTERVAL DEPTH FROM GRADE (m)	SCREENED INTERVAL ELEVATION (m.A.S.L)	SAND PACK DEPTH FROM GRADE (m)	SAND PACK ELEVATION (m.A.S.L)	SEAL DEPTH FROM GRADE (m)	SEAL ELEVATION (m.A.S.L)
12-16	52	108	183.57	0.61	184.18	P	3.70 to 4.00	179.87 to 179.57	3.60 to 4.00	179.97 to 179.57	0.00 to 3.60	183.57 to 179.97
12-17	52	108	183.62	0.57	184.19	P	4.50 to 4.80	179.12 to 178.82	4.40 to 4.80	179.22 to 178.82	0.00 to 4.40	183.62 to 179.22
12-18	52	108	183.68	0.59	184.27	P	5.20 to 5.50	178.48 to 178.18	5.10 to 5.50	178.58 to 178.18	0.00 to 5.10	183.68 to 178.58
12-19	52	108	183.73	0.63	184.36	P	6.00 to 6.30	177.73 to 177.43	5.90 to 6.30	177.83 to 177.43	0.00 to 5.90	183.73 to 177.83
12-20	52	108	183.82	0.52	184.34	P	6.70 to 7.00	177.12 to 176.82	6.60 to 7.00	177.22 to 176.82	0.00 to 6.60	183.82 to 177.22
12-21	52	108	183.97	0.52	184.49	P	7.70 to 8.00	176.27 to 175.97	7.60 to 8.00	176.37 to 175.97	0.00 to 7.60	183.97 to 176.37
12-22	96	159	184.22	0.54	184.76	W	39.00 to 41.00	145.22 to 143.22	24.00 to 35.00 to 37.00 to 38.30	160.22 to 149.22 to 147.22 to 145.92	24.00 to 38.30	160.22 to 145.92
13-1	47	96	185.05	0.67	185.72	P	39.70 to 40.70	145.35 to 144.35	38.10 to 40.85	146.95 to 144.20	33.00 to 38.10	152.05 to 146.95
13-2	19	51	185.14	0.62	185.76	S	1.49 to 5.49	183.65 to 179.65	0.91 to 5.79	184.23 to 179.35	0.60 to 0.91	184.54 to 184.23
14-1	47	96	181.65	0.56	182.21	P	41.60 to 42.60	140.05 to 139.05	39.90 to 42.66	141.75 to 138.99	31.00 to 39.99	150.65 to 141.66
14-2	19	51	181.62	0.59	182.21	S	1.49 to 5.49	180.13 to 176.13	0.90 to 5.79	180.72 to 175.83	0.60 to 0.90	181.02 to 180.72
15-1	47	96	182.75	0.64	183.39	P	38.50 to 39.50	144.25 to 143.25	37.60 to 40.34	145.15 to 142.41	32.00 to 37.60	150.75 to 145.15
15-2	19	51	182.74	1.15	183.89	S	1.63 to 5.63	181.11 to 177.11	1.00 to 5.63	181.74 to 177.11	0.65 to 1.00	182.09 to 181.74
16-1	52	96	185.95	0.51	186.46	P	29.80 to 30.80	156.15 to 155.15	27.80 to 30.80	158.15 to 155.15	20.70 to 27.80	165.25 to 158.15
16-2	19	51	186.09	0.60	186.69	S	1.80 to 5.80	184.29 to 180.29	1.00 to 5.80	185.09 to 180.29	0.75 to 1.00	185.34 to 185.09

(P)-PIEZOMETER (S)-STANDPIPE (N)-PNEUMATIC PIEZOMETER (W)-WELL
(*)-BOREHOLE DIAMETER OPPOSITE SCREENED INTERVAL

Note: Stickup and top-of monitor elevation for pneumatic piezometers are relative to top of protective casing

F2 WATER LEVEL DATA

Water levels are monitored on a regular ongoing basis at all installations. The techniques used for measuring water levels are described in Appendix A3. Initially, water level readings were recorded on a daily basis following the installation of each monitor. As each monitor filled with water and eventually approached anticipated static conditions, monitoring frequency was decreased. All daily monitoring was suspended at the end of the drilling program (approximately March 7, 1986) even though some of the later installations had not reached static conditions. Water levels were measured during March and April only when staff were available on-site.

Water levels were measured on a monthly basis over the period April to October, 1986. The long-term water level measurement program serves to: (a) confirm static levels, and (b) record seasonal fluctuations.

Table F2-1 presents all water level measurements, both during and after the drilling program. All values are in metres above mean sea level (m ASL). Also shown for reference are top-of-pipe elevation, ground elevation, and screened interval elevations for each monitor.

DRILLING LOCATION 85·1

MONITOR #	85-1-1	85-1-2	85-1-3	85-1-4	85-1-5	85-1-6	85-1-7	85-1-8	85-1-9	85-1-10	85-1-11
TOP-OF-PIPE ELEVATION	185.88	186.09	185.87	185.83	185.69	185.87	185.82	185.86	185.93	185.94	186.03
GROUND ELEVATION	185.50	185.57	185.32	185.28	185.09	185.34	185.30	185.19	185.28	195.26	185.36
SCREENED INTERVAL	151.10 148.00	153.34 152.34	159.41 158.41	170.04 169.04	183.91 179.91	158.23	168.04	160.79 160.19	170.04 169.44	182.93 179.93	176.56 175.52
24-Jan-86	176.46		165.85	170.13		164.28	183.63				
27-Jan-86	176.60		168.07	171.83	184.05	166.39	174.47				
28-Jan-86	176.58	175.69	168.65	172.49	184.06	167.73	176.93	161.61	172.18		
29-Jan-86	176.58	175.93	169.33	173.11	184.05	168.44	177.29	161.76	172.27	180.22	
30-Jan-86	176.55	176.16	169.78	173.62	184.03	168.79	177.29	161.83	172.31	180.40	
31-Jan-86	176.46	176.08	170.25	174.00	183.96	169.14	177.11	161.88	172.33	180.68	
03-Feb-86	174.58	175.63	171.90	175.46	183.77	170.20	177.29	162.10	172.47	181.45	
04-Feb-86	175.84	176.61	172.44	176.37	183.71	176.98	177.46	162.17	172.50	181.69	
05-Feb-86	176.71	177.78	172.73	176.12	183.71	171.78	177.64	162.21	172.53	181.83	
06-Feb-86		172.95									
07-Feb-86	176.59	176.54	173.34	176.68	183.39	173.02	177.64	162.39	172.60	182.13	
10-Feb-86	176.63	176.59	174.27	177.46	183.55	175.66	177.99	162.54	172.72	182.52	178.97
11-Feb-86	176.65	176.63	174.52	177.68	183.53	176.01	177.99	162.59	172.76	182.62	179.56
12-Feb-86	175.50	176.33	174.80	177.90	183.50	176.18	178.35	162.66	172.78	182.73	180.07
13-Feb-86	176.72	178.16	175.02	178.09	183.50	176.18	177.99	162.72	172.83	182.82	180.47
14-Feb-86	176.44	176.64	175.22	178.23	183.48	176.18	178.35	162.77	172.87	182.89	180.72
17-Feb-86	176.62	176.64	175.84	178.73	183.46	176.89	178.35	162.97	172.99	183.34	181.51
18-Feb-86	176.63	176.54	175.99	178.87	183.47	176.89	178.35	163.13	173.03	183.44	181.68
19-Feb-86	176.56	176.33	176.16	179.01	183.47	176.89	178.35	163.10	173.07	183.51	181.88
20-Feb-86	176.61	176.41	176.24	179.08	183.44	176.89	178.35	163.14	173.10	183.52	181.99
21-Feb-86	176.60	176.53	176.39	179.21	183.47	177.24	178.70	163.19	173.14	183.54	182.16
24-Feb-86	176.58	176.62	176.54	179.53	183.45	177.60	179.05	163.30	173.26	183.61	182.47
25-Feb-86	176.60	176.62	176.84	179.61	183.45	177.95	179.05	163.45	173.30	183.62	182.55
26-Feb-86	176.68	176.67	176.95	179.70	183.45	177.60	179.23	163.51	173.33	183.67	182.64
27-Feb-86	176.67	176.67	177.05	179.78	183.45			163.56	173.38	183.68	182.73
28-Feb-86	176.65	176.68	177.07	179.82	183.45			163.60	173.40	183.66	182.78
03-Mar-86	176.63	176.68	177.30	180.03	183.55	177.95	179.76	163.79	173.53	183.65	182.91
04-Mar-86	176.63	176.68	177.39	180.10	183.58			163.86	173.57	183.64	182.94
05-Mar-86	176.61	176.68	177.43	180.13	183.58			163.90	173.61	183.64	182.97
06-Mar-86	176.61	176.74	177.53	180.21	183.56			163.97	173.66	183.69	183.01
07-Mar-86	176.63	176.70	177.54	180.23	183.57			164.01	173.68	183.64	183.03
11-Mar-86	176.65	176.69	177.71	180.42	183.50	177.95	180.10	164.26	173.85	183.62	183.12
14-Mar-86											
20-Mar-86		176.62	177.99	180.68	183.58	178.16	180.39				183.09
14-Apr-86	176.25	176.36	178.53	181.22	183.96			162.42	171.28	184.26	183.36
15-Apr-86	176.29	176.38	178.52	181.21							
17-Apr-86	176.30	176.40	178.52	181.21	183.99			161.84	170.86	184.20	183.30
18-Apr-86	176.28	176.36									
21-Apr-86	176.35										
22-Apr-86	176.28	176.34									
07-May-86	176.19	176.31			184.18	177.95	181.52	161.67	170.77	182.28	183.57
23-May-86								162.81	171.66	184.28	
30-May-86	176.17	176.27			184.32	177.60	181.52	163.31	170.98	184.11	183.59
01-Jul-86	176.04	176.13		180.55	184.40	177.60	181.52	164.20	172.62	184.21	
31-Jul-86	175.96	176.05	175.34	181.43	184.28	177.60	180.81	165.66	173.88	184.08	182.34
29-Aug-86	175.97	176.06		181.64	184.09	177.95	181.87	167.86	174.98	183.61	
16-Oct-86	176.16	176.27		181.87	184.15	177.95	181.52	169.05	176.40	184.87	

MONITOR #	85-1-12a	85-1-12b	85-1-12c	85-1-13	85-1-14	85-1-15	85-1-16	85-1-17	85-1-18	85-1-19	85-1-20	85-1-21	85-1-22
TOP-OF-PIPE ELEVATION	186.39	186.39	186.29	186.04	186.03	186.05	186.10	186.11	186.37	186.07	186.03	186.07	186.20
GROUND ELEVATION	185.53	185.53	185.53	185.48	185.44	185.47	185.50	185.55	185.54	185.66	185.63	185.59	185.56
SCREENED INTERVAL	130.53	124.03	150.13 149.13	184.20 183.90	183.24 182.94	182.77 182.47	181.80 181.50	181.05 180.75	180.34 180.04	179.66 179.36	178.93 178.63	177.94 177.63	150.86 140.80
24-Jan-86													
27-Jan-86													
28-Jan-86													
29-Jan-86													
30-Jan-86													
31-Jan-86													
03-Feb-86													
04-Feb-86													
05-Feb-86													
06-Feb-86													
07-Feb-86													
10-Feb-86													
11-Feb-86													
12-Feb-86													
13-Feb-86							181.50	180.91					
14-Feb-86							181.77	181.00					
17-Feb-86			176.59				181.86	181.63			178.62	177.68	
18-Feb-86			176.63				182.02	181.82			178.65	177.69	
19-Feb-86			176.56				182.15	181.98			178.69	177.73	
20-Feb-86	180.53	166.03	176.59				182.22	182.08			178.72	177.74	
21-Feb-86	180.53	166.03	176.60				182.33	182.20			178.80		176.68
24-Feb-86	180.53	166.03	176.57				182.50	182.43		179.27	179.09	177.87	176.59
25-Feb-86			176.62				182.55	182.49		179.78	179.18	177.96	176.61
26-Feb-86			176.64				182.59	182.54		179.29	179.27	178.03	176.67
27-Feb-86			176.63				182.63	182.60		179.29	179.36	178.11	176.67
28-Feb-86			176.62				182.67	182.63		179.31	179.43	178.16	176.63
03-Mar-86	180.53	166.03	176.63				182.74	182.72		179.34	179.69	178.40	176.64
04-Mar-86			176.63				182.76	182.75		179.36	179.78	178.48	176.64
05-Mar-86			176.62				182.78	182.77		179.37	179.85	178.54	176.68
06-Mar-86			176.68				182.81	182.81		179.38	179.94	178.62	176.71
07-Mar-86			176.62				182.83	182.84	179.96	179.39	180.00	178.67	176.64
11-Mar-86	170.71	175.79	176.63			182.45	182.90	182.90	180.01	179.45	180.34	178.97	176.65
14-Mar-86	170.71	175.58											
20-Mar-86	175.72	175.30	176.54										176.54
14-Apr-86			176.27			182.80	183.50	183.38	180.20	179.87	180.65	179.14	176.20
15-Apr-86	175.51	175.54	176.30										176.31
17-Apr-86	175.51	175.54	176.32			182.85	183.51	183.43	180.22	179.91	180.83	179.11	176.32
18-Apr-86			176.28										176.30
21-Apr-86			176.35										176.36
22-Apr-86	175.51	175.09	176.28										176.29
07-May-86	175.86	176.22	176.22		183.13	183.55	183.88	183.83	180.81	180.69	182.25	180.48	176.21
23-May-86					183.51	183.83	184.01	183.97	181.24	181.22	182.80	181.24	
30-May-86	175.86	176.15	176.18		183.31	182.91	183.90	183.49	180.41	179.75	180.35	178.52	176.19
01-Jul-86	175.86	176.15	176.05		183.42	183.46	184.15	184.10	180.49	180.00	182.19	179.38	176.05
31-Jul-86	175.86	176.15	175.94		183.74	183.93	183.99	184.02	181.54	181.30	183.38	181.33	175.96
29-Aug-86	175.86	176.15	175.96		180.08	182.95	183.65	183.40	180.56	179.86	181.05	178.80	175.98
16-Oct-86	175.86	176.15	176.10		182.90	183.27	183.40	183.50	181.11	180.84	183.26	180.87	176.19

TABLE F2-1 WATER LEVEL DATA

DRILLING LOCATION 85-2

MONITOR #	85-2-1	85-2-2	85-2-3	85-2-4	85-2-5
TOP-OF-PIPE ELEVATION	185.62	185.85	185.45	185.64	185.60
GROUND ELEVATION	185.00	185.03	185.04	185.03	184.91
SCREENED INTERVAL	149.57 148.05	153.23 152.23	159.24 158.04	169.53 168.43	182.21 179.21
28-Nov-85	176.60	170.10	174.81	170.01	180.60
29-Nov-85	176.59	173.83	167.83	169.94	181.54
02-Dec-85	176.67	175.53	170.39	170.54	182.50
03-Dec-85	176.62	175.70	170.98	170.61	182.46
04-Dec-85	176.47	175.93	171.72	171.02	182.53
05-Dec-85	176.62	176.07	172.22	171.38	182.56
06-Dec-85	176.60	176.24	172.87	171.86	182.60
09-Dec-85	176.64	176.44	174.13	173.00	182.60
10-Dec-85	176.64	176.43	174.35	173.24	182.65
11-Dec-85	176.68	176.52	174.67	173.68	182.75
12-Dec-85	176.68	176.44	174.93	174.05	182.74
13-Dec-85	176.68	176.51	175.21	174.49	182.77
16-Dec-85	176.73	176.66	175.91	175.58	182.84
17-Dec-85	176.72	176.65	176.02	175.72	182.81
18-Dec-85	176.68	176.67	176.20	176.03	182.81
19-Dec-85	176.66	176.69	176.36	176.27	182.82
20-Dec-85	176.67	176.70	176.47	176.55	182.84
02-Jan-86	176.73	176.83	177.58	179.31	183.02
03-Jan-86	176.70	176.82	177.64	179.45	183.04
06-Jan-86	176.64	176.85	177.80	179.82	183.05
07-Jan-86		176.81	177.81	179.85	
08-Jan-86			177.84	181.00	
09-Jan-86			177.93	180.27	
10-Jan-86			178.00	180.56	
13-Jan-86		176.85	178.04	180.62	183.15
14-Jan-86			178.05	180.63	
15-Jan-86			178.07	180.72	
16-Jan-86			178.09	180.84	
17-Jan-86			178.16	181.13	
20-Jan-86		176.90	178.16	181.11	183.32
21-Jan-86			178.18	181.16	
22-Jan-86			178.20	181.19	
24-Jan-86			178.24	181.49	
27-Jan-86	176.80		178.24	181.48	183.40
28-Jan-86			178.25	181.52	
29-Jan-86		176.91	178.26	181.49	
30-Jan-86			178.28	181.52	
31-Jan-86			178.30	181.72	
03-Feb-86		176.88			183.50
04-Feb-86					
05-Feb-86			178.33	181.76	
10-Feb-86	176.79	176.89	178.38	181.85	183.49
11-Feb-86		176.91			
12-Feb-86		176.89			
13-Feb-86		176.85			
14-Feb-86		176.86			
17-Feb-86		176.87			
18-Feb-86	176.71	176.88	178.44	182.04	183.77
19-Feb-86		176.88			
20-Feb-86		176.87			
24-Feb-86	176.72	176.89	178.40	181.97	183.01
25-Feb-86		176.88			
26-Feb-86		176.91			
27-Feb-86		176.90			
28-Feb-86		176.90			
03-Mar-86		176.90			
04-Mar-86		176.90			
05-Mar-86		176.90			
06-Mar-86		176.90			
07-Mar-86		176.90			
11-Mar-86	176.73	176.90	179.06	181.84	184.00
17-Apr-86	176.39	176.75	181.09	182.01	184.42
07-May-86		177.02	181.70	182.30	184.50
28-May-86	176.31	176.85	181.68	182.46	184.43
01-Jul-86	176.21	176.88	181.67		184.31
31-Jul-86	176.05	176.65	180.87	180.46	184.05
29-Aug-86	176.10	176.50	180.07		183.77
16-Oct-86	176.34		179.45		183.69

DRILLING LOCATION 85-3

MONITOR #	85-3-1	85-3-2	85-3-3	85-3-4	85-3-5	85-3-6	85-3-7	85-3-8	85-3-9	85-3-10	85-3-11
TOP-OF-PIPE ELEVATION	185.67	186.46	186.07	185.99	186.15	186.11	186.14	185.97	186.23	186.90	185.84
GROUND ELEVATION	185.24	185.49	185.52	185.54	185.52	185.35	185.43	185.47	185.43	186.41	185.26
SCREENED INTERVAL	153.24 150.55	154.79 153.87	159.42 158.50	170.14 169.22	183.94 179.76	157.97	169.04	161.46 160.85	170.23 169.63	184.11 181.11	176.73 175.73
11-Dec-85	175.46										
12-Dec-85	175.43										
13-Dec-85	176.47										
16-Dec-85	176.49										
17-Dec-85	176.48	175.44	168.37	169.86							
18-Dec-85	176.46	175.22	169.60	170.32	182.54						
19-Dec-85	176.45	175.34	170.85	170.36	183.05	176.99	183.62				
20-Dec-85	176.47	175.43	171.81	171.13	183.07	176.81	181.44				
02-Jan-86	176.50	175.85	176.94	176.71	182.95	177.12	178.54				
03-Jan-86	176.55	175.82	177.03	176.95	182.97	177.34	178.90				
06-Jan-86	176.55	175.88	177.27	177.66	182.90	176.63	178.72				
07-Jan-86	176.47	175.92	177.29	177.78	183.54	177.12	178.33	164.11	170.69	181.27	
08-Jan-86		175.92	177.35	177.99				164.32	170.72	181.49	
10-Jan-86		175.94	177.46	178.34				164.56	170.76	181.77	
13-Jan-86	176.54	176.00	177.58	178.82	182.97	176.98	180.05	164.90	170.80	182.33	
14-Jan-86		176.01	177.60	178.91				165.06	170.81	182.43	
15-Jan-86		175.99	177.61	178.99				165.17	170.82	182.54	
16-Jan-86		176.03	177.62	179.09				165.30	170.83	182.66	
17-Jan-86		176.06	177.65	179.19				165.40	170.84	182.74	
20-Jan-86		176.17	177.72	179.59	183.07	177.69	178.90	165.73	170.87	183.03	
21-Jan-86		176.21	177.73	179.64				165.82	170.89	183.10	
22-Jan-86		176.14	177.73	179.73				165.94	170.89	183.16	
24-Jan-86		176.13	177.72	179.79				166.09	170.90	183.24	
27-Jan-86	176.58	176.22	177.79	180.00	183.18	177.69	178.19	166.39	170.93	183.43	
28-Jan-86		176.25	177.84	180.10				166.40	170.94	183.47	
29-Jan-86		176.25	177.83	180.14				166.57	170.95	183.51	
30-Jan-86		176.25	177.82	180.16				166.66	170.95	183.54	
31-Jan-86		176.26	177.82	180.18				166.72	170.96	183.55	
03-Feb-86		176.31	177.83	180.28	183.09			167.00	170.98	183.65	
05-Feb-86						178.39	179.42				
10-Feb-86	176.60	176.40	177.87	180.44	183.18	177.69	179.60	167.52	171.03	183.79	
11-Feb-86		176.42	177.87	180.47				167.59	171.04		
12-Feb-86		175.56	177.89	180.48				167.66	171.05		178.62
13-Feb-86		175.53	177.89	180.50				167.84	171.08		179.98
14-Feb-86		175.52	177.90	180.53				167.81	171.06		180.63
17-Feb-86	176.61	175.62	177.91	180.59	183.26	178.04	180.31	168.02	171.09	183.91	182.24
18-Feb-86		175.64	177.92	180.63				168.11	171.10		182.48
19-Feb-86		175.66	177.92	180.62				168.17	171.10		182.51
20-Feb-86		175.68	177.92	180.62				168.19	171.11		182.53
24-Feb-86	176.59	175.77	177.94	180.68	183.31	178.39	179.78	168.47	171.13	184.00	182.76
25-Feb-86		175.79	177.95	180.69				168.63	171.14		182.79
26-Feb-86		175.81	177.95	180.73				168.60	171.15		182.81
27-Feb-86		175.82	177.96	180.73				168.66	171.15		182.82
28-Feb-86		175.84	177.96	180.75				168.70	171.15		182.83
03-Mar-86	176.61	175.89	177.97	180.77	183.36	178.04	179.95	168.91	171.17	184.10	182.85
04-Mar-86		175.91	177.97	180.78				168.97	171.18		182.84
05-Mar-86		175.93	177.97	180.78				169.03	171.19		182.84
06-Mar-86		175.95	177.98	180.83				169.09	171.19		182.89
07-Mar-86		175.95	177.97	180.82				169.15	171.21		182.87
11-Mar-86	176.64	176.03	177.98	180.83	183.43	178.74	180.30	169.39	171.22	184.16	182.88
14-Apr-86	176.26							163.56	170.09	184.65	
17-Apr-86	176.29	176.96	177.96	181.02	183.93	178.39	180.31	163.43	170.06	184.71	183.24
07-May-86	176.20	176.72			184.13	178.75	180.66	163.22	170.14	184.52	183.48
28-May-86						178.39	180.66				
30-May-86	176.17	177.26			184.29			163.31	170.20	185.17	
01-Jul-86	176.02	177.70	177.82	180.59	184.41	178.64	182.07	166.29	170.49	185.34	183.94
31-Jul-86	175.93		177.84	181.12	184.37	178.39	181.37	168.37	170.73	185.34	184.01
29-Aug-86	175.95				184.14	177.94	181.01	170.03	170.94	185.04	183.99
16-Oct-86	176.17		177.13	181.30	184.04	177.69	181.37	172.17	171.32	184.92	183.80

DRILLING LOCATION 85-4

MONITOR #	85-4-1	85-4-2	85-4-3	85-4-4	85-4-5
TOP-OF-PIPE ELEVATION	185.99	185.98	185.94	185.94	185.92
GROUND ELEVATION	185.43	185.46	185.30	185.30	185.30
SCREENED INTERVAL	148.23 147.25	153.56 152.66	159.48 158.58	170.18 169.28	183.71 179.02
10-Jan-86	176.56				
13-Jan-86	176.53				
14-Jan-86	176.56	175.63			
15-Jan-86	176.49	175.74	160.55		
16-Jan-86	176.47	175.67	162.74	170.18	181.50
17-Jan-86	176.49	175.67	164.41	170.22	182.30
20-Jan-86	176.47	175.70	168.66	171.42	182.06
21-Jan-86	176.50	175.69	169.45	171.87	182.80
22-Jan-86	176.51	175.70	170.41	172.52	182.93
24-Jan-86	176.50	175.72	171.61	173.37	182.93
27-Jan-86	176.57	175.77	173.46	175.18	183.02
28-Jan-86	176.55	175.79	173.89	175.59	183.01
29-Jan-86	176.54	175.85	174.29	175.62	183.08
30-Jan-86	176.53	175.85	174.61	176.35	183.01
31-Jan-86	176.52	175.84	174.79	176.62	182.99
03-Feb-86	176.31	175.86	175.64	177.68	183.01
05-Feb-86			175.99	178.21	
07-Feb-86			176.27	178.62	
10-Feb-86	176.59	175.88	176.70	179.19	183.09
11-Feb-86		175.89	176.80	179.34	
12-Feb-86		175.87	176.89	179.48	
13-Feb-86		175.85	177.00	179.63	
14-Feb-86		175.84	177.06	179.73	
17-Feb-86	176.58	175.88	177.20	180.10	183.14
18-Feb-86		175.87	177.33	180.19	
19-Feb-86		175.88	177.41	180.26	
20-Feb-86		175.88	177.43	180.28	
24-Feb-86	176.55	175.92	177.61	180.54	183.20
25-Feb-86		175.92	177.66	180.57	
26-Feb-86		175.93	177.68	180.65	
27-Feb-86		175.95	177.71	180.71	
28-Feb-86		175.95	177.73	180.71	
03-Mar-86	176.59	175.97	177.81	180.82	183.27
04-Mar-86		175.98	177.83	180.85	
05-Mar-86		175.99	177.84	180.87	
06-Mar-86		175.99	177.88	180.94	
07-Mar-86		176.00	177.89	180.92	
11-Mar-86	176.61	176.03	177.96	180.99	183.30
17-Apr-86	176.29	176.44	178.19	181.27	183.26
07-May-86	176.18	176.39	178.19	181.44	184.22
28-May-86	176.13	176.36	178.16	181.53	184.37
01-Jul-86	176.02	176.33	178.14	181.69	184.40
31-Jul-86	175.93	176.29	178.13	181.70	184.24
29-Aug-86	175.95	176.25	178.12	181.79	183.94
16-Oct-86	176.16	176.20	178.02	181.02	183.70

TABLE F2-1 (cont.)

DRILLING LOCATION 85-5

MONITOR #	85-5-1	85-5-2	85-5-3	85-5-4	85-5-5
TOP-OF-PIPE ELEVATION	186.20	186.19	186.04	186.03	186.26
GROUND ELEVATION	185.40	185.44	185.42	185.42	185.37
SCREENED INTERVAL	146.00 145.00	150.99 149.99	159.60 158.60	168.56 167.56	183.00 179.00
13-Dec-85	176.46				
16-Dec-85	176.48				
17-Dec-85	176.49				
18-Dec-85	176.44				
19-Dec-85	176.42				
20-Dec-85	176.44	151.96	159.55		
02-Jan-86	176.48	176.00	172.90	169.28	
03-Jan-86	176.53	176.12	173.56	168.74	184.06
06-Jan-86	176.54	176.34	175.28	59.82	183.93
07-Jan-86	176.43	176.34	175.83	170.75	183.06
08-Jan-86		176.27	175.96	171.81	183.70
10-Jan-86		176.45	176.50	173.17	183.90
13-Jan-86	176.50	176.54	177.21	175.18	184.41
14-Jan-86		176.56	177.33	175.61	183.97
15-Jan-86		176.58	177.49	176.10	183.89
16-Jan-86		176.58	177.64	176.56	183.82
17-Jan-86		176.59	177.74	176.97	183.07
20-Jan-86		176.66	178.07	178.13	183.97
21-Jan-86		176.64	178.15	178.40	183.89
22-Jan-86		176.63	178.20	178.68	183.87
24-Jan-86		176.64	178.41	179.10	183.01
27-Jan-86	176.56	176.71	178.40	179.75	184.02
28-Jan-86		176.69	178.52	179.91	183.96
29-Jan-86		176.73	178.57	180.12	183.93
30-Jan-86		176.72	178.59	180.18	183.06
31-Jan-86		176.71	178.60	180.30	183.00
03-Feb-86		176.71	178.73	180.67	183.07
05-Feb-86			178.78	180.81	
07-Feb-86			178.82	180.97	
10-Feb-86	176.59	176.76	178.87	181.17	183.92
11-Feb-86			178.90	181.22	
12-Feb-86			178.93	181.28	
13-Feb-86			178.97	181.33	
14-Feb-86			178.96	181.41	
17-Feb-86			179.01	181.49	
18-Feb-86	176.12	176.07	179.04	181.53	183.99
19-Feb-86			179.03	181.56	
20-Feb-86			179.03	181.59	
24-Feb-86	176.55	176.80	179.10	181.72	183.90
25-Feb-86			179.10	181.72	
26-Feb-86			179.11	181.75	
27-Feb-86			179.12	181.79	
28-Feb-86			179.14	181.82	
03-Mar-86	176.58	176.90	179.18	181.86	184.01
04-Mar-86			179.16	181.87	
05-Mar-86			179.17	181.87	
06-Mar-86			179.18	181.87	
07-Mar-86			179.19	181.89	
11-Mar-86	176.58	176.86	179.21	181.95	184.01
17-Apr-86	176.27	176.59	179.26	182.07	184.65
17-May-86	176.17	176.51	179.28	182.13	184.57
28-May-86	176.14	176.52	179.32	182.24	184.67
01-Jul-86	176.01	176.45	179.30	182.39	184.49
31-Jul-86	175.94	176.37	179.42	182.46	184.30
29-Aug-86	175.95	176.30	179.47	182.49	184.06
16-Oct-86	176.16	176.42	179.51	182.42	184.32

DRILLING LOCATION 85-6

MONITOR #	85-6-1	85-6-2	85-6-3	85-6-4	85-6-5
TOP-OF-PIPE ELEVATION	186.48	185.96	186.09	185.90	186.27
GROUND ELEVATION	185.46	185.42	185.38	185.33	185.24
SCREENED INTERVAL	148.24 146.72	151.92 150.92	159.26 158.26	170.09 169.09	184.64 180.37
28-Nov-85	176.03				
29-Nov-85	176.24				
02-Dec-85	176.42				
03-Dec-85	176.36	176.36			
04-Dec-85	176.33	176.35	159.50		
05-Dec-85	176.34	176.31	160.24	169.44	182.95
06-Dec-85	176.33	176.31	161.41	169.83	183.24
09-Dec-85	176.38	176.38	164.54	170.07	183.29
10-Dec-85	176.40	176.40	165.30	170.11	183.27
11-Dec-85	176.42	176.40	166.49	170.14	183.33
12-Dec-85	176.42	176.43	167.40	170.16	183.34
13-Dec-85	176.44	176.40	168.65	170.27	183.34
16-Dec-85	176.45	176.46	171.30	170.76	183.39
17-Dec-85	176.46	176.45	171.70	171.01	183.40
18-Dec-85	176.46	176.47	172.44	171.54	183.30
19-Dec-85	176.42	176.42	172.97	171.90	183.35
20-Dec-85	176.44	176.43	173.50	172.32	183.34
02-Jan-86	176.46	176.47	177.54	177.54	183.00
03-Jan-86	176.46	176.48	177.71	177.85	183.37
06-Jan-86	176.51	176.52	178.04	178.57	183.35
07-Jan-86		176.82	178.05	178.70	
08-Jan-86			178.14	178.94	
09-Jan-86			178.14	178.94	
10-Jan-86			178.42	179.38	
13-Jan-86		176.48	178.62	179.88	183.37
14-Jan-86			178.66	179.99	
15-Jan-86			178.63	180.05	
16-Jan-86			178.69	180.17	
17-Jan-86			178.81	180.37	
20-Jan-86		176.36	178.99	180.72	183.47
21-Jan-86			178.94	180.77	
22-Jan-86			178.93	180.86	
24-Jan-86			178.92	180.92	
27-Jan-86	176.56	176.58	179.17	181.24	183.59
28-Jan-86			179.11	181.25	
29-Jan-86			179.11	181.30	
30-Jan-86			179.04	181.33	
31-Jan-86			179.06	181.35	
03-Feb-86		176.26	179.15	181.54	183.51
10-Feb-86	176.55	176.56	179.22	181.76	183.68
11-Feb-86			179.24	181.81	
12-Feb-86			179.24	181.80	
13-Feb-86			179.24	181.85	
14-Feb-86			179.29	181.92	
17-Feb-86			179.31	182.04	
18-Feb-86	176.39	176.39	179.34	182.06	183.70
19-Feb-86			179.34	182.04	
20-Feb-86			179.33	182.06	
24-Feb-86	176.56	176.59	179.34	182.11	183.75
25-Feb-86			179.30	182.09	
26-Feb-86			179.36	182.17	
27-Feb-86			179.35	182.16	
28-Feb-86			179.35	182.17	
03-Mar-86	176.58	176.62	179.33	182.20	183.84
04-Mar-86			179.33	182.20	
05-Mar-86			179.33	182.21	
06-Mar-86			179.44	182.31	
07-Mar-86			179.33	182.24	
11-Mar-86	176.59	176.62	179.31	182.38	183.89
14-Apr-86	176.23	176.25	179.20	182.32	184.30
17-Apr-86	176.28	176.26	179.21	182.35	184.32
07-May-86	176.18	176.17	179.21	182.40	184.39
20-May-86	176.15	176.14	179.18	182.55	184.49
01-Jul-86	175.64	176.03	179.13	182.67	184.30
31-Jul-86	175.93	175.95	179.09	182.60	184.03
29-Aug-86	175.94	176.02	179.05	182.50	183.71
16-Oct-86	176.15	176.14	179.14	182.44	183.72

DRILLING LOCATION 85-7

MONITOR #	85-7-1	85-7-2	85-7-3	85-7-4	85-7-5
TOP-OF-PIPE ELEVATION	184.99	184.91	184.86	184.85	184.80
GROUND ELEVATION	184.37	184.39	184.38	184.34	184.29
SCREENED INTERVAL	146.74 145.74	150.49 149.49	158.48 157.48	169.10 168.10	182.00 178.00
17-Jan-86	176.44				
20-Jan-86	176.35				
21-Jan-86	176.48	150.42	175.84	171.65	
22-Jan-86	176.44	150.73		168.79	178.99
24-Jan-86	176.43	154.97	163.36	169.17	180.51
27-Jan-86	176.51	167.43	168.18	171.31	182.58
28-Jan-86	176.48	169.38	169.26	172.17	182.00
29-Jan-86	176.48	170.96	170.28	173.09	183.17
30-Jan-86	176.40	172.05	171.10	173.82	183.22
31-Jan-86	176.37	172.79	171.69	174.43	183.29
03-Feb-86	176.26	174.86	173.79	176.69	183.29
05-Feb-86		175.40	174.66	177.71	
07-Feb-86		175.80	175.20	178.29	
10-Feb-86	176.53	176.20	176.19	179.40	183.37
11-Feb-86		176.28	176.42	179.65	
12-Feb-86		176.33	176.60	179.87	
13-Feb-86		176.37	176.81	180.09	
14-Feb-86		176.38	177.00	180.24	
17-Feb-86	176.56	176.57	177.65	180.73	183.32
18-Feb-86		176.57	177.88	180.84	
19-Feb-86		176.58	177.93	180.89	
20-Feb-86		176.58	177.97	180.97	
24-Feb-86	176.53	176.65	178.18	181.30	183.49
25-Feb-86		176.66	178.20	181.34	
26-Feb-86		176.68	178.24	181.45	
27-Feb-86		176.70	178.27	181.49	
28-Feb-86		176.71	178.31	181.54	
03-Mar-86	176.55	176.74	178.53	181.64	183.51
04-Mar-86		176.76	178.54	181.66	
05-Mar-86		176.74	178.53	181.69	
06-Mar-86		176.77	178.59	181.76	
07-Mar-86		176.76	178.59	181.72	
11-Mar-86	176.57	176.76	178.62	181.82	183.60
24-Mar-86	176.40	176.76	178.74	181.93	183.39
04-Apr-86	176.22	176.68	179.01	181.89	183.67
14-Apr-86	176.19	176.65	179.05	182.03	183.90
17-Apr-86	176.24	176.67	179.07	182.11	183.90
07-May-86	176.15	176.57	179.14	182.27	184.00
20-May-86	176.12	176.56	179.21	182.34	184.04
01-Jul-86	175.95	176.40	179.31	182.44	183.90
31-Jul-86	175.90	176.40	179.33	182.45	183.70
29-Aug-86	175.91	176.34	179.19	182.35	183.27
16-Oct-86	176.12	176.47	179.22	182.37	183.37

TABLE F2-1 (cont.)

DRILLING LOCATION 85·8

MONITOR #	85-8-1	85-8-2	85-8-3	85-8-4	85-8-5	85-8-6	85-8-7	85-8-8	85-8-9	85-8-10	85-8-11
TOP-OF-PIPE ELEVATION	185.20	185.70	185.31	185.34	185.79	185.60	185.60	185.64	185.63	185.72	185.38
GROUND ELEVATION	184.99	184.92	184.88	184.88	184.97	184.98	185.04	185.08	185.10	185.13	184.93
SCREENED INTERVAL	148.50 145.52	152.92 151.72	158.05 157.05	169.72 168.72	183.40 179.40	159.07	160.20	160.42 159.70	170.00 169.39	182.70 179.80	176.40 175.40
08-Jan-86	176.30										
10-Jan-86	176.45										
13-Jan-86	176.41	154.81									
14-Jan-86	176.44	157.69	161.50								
15-Jan-86	176.40	161.40	162.64	171.47	182.92						179.64
16-Jan-86	176.38	164.00	163.92	172.58	182.14	181.61					180.65
17-Jan-86	176.42	167.41	165.04	173.40	181.98	180.90	168.90	ERR			181.22
20-Jan-86	176.33	172.27	168.40	175.88	181.92	180.55	171.10	160.21	171.90	179.79	181.65
21-Jan-86	176.43	173.09	169.19	176.30	181.88	179.32	170.92	160.47	172.03	179.93	181.61
22-Jan-86	176.31	173.86	170.06	176.86	181.87	179.85	171.00	160.78	172.13	180.07	181.63
24-Jan-86	176.39	174.64	171.20	177.55	181.82	178.79		161.26	170.30	180.29	181.60
27-Jan-86	176.40	175.63	173.05	178.60	181.89	176.34		162.14	172.05	180.77	181.77
28-Jan-86	176.45	175.79	173.51	178.86	181.88	178.79		162.42	172.68	180.93	181.71
29-Jan-86	176.45	175.96	173.94	179.06	181.87	179.14		162.69	172.77	181.07	181.71
30-Jan-86	176.43	176.04	174.29	179.23	181.85	179.14	175.14	162.93	172.85	181.18	181.60
31-Jan-86	176.41	176.12	174.35	179.36	181.85	179.14	176.37	168.12	172.91	181.20	181.68
03-Feb-86	176.25	176.40	175.56	179.83	181.84	179.14	176.02	163.93	173.90	181.67	181.72
05-Feb-86			175.90	180.05		178.44	178.14	164.34	173.52		
07-Feb-86			176.39	180.22				164.81	173.76		
10-Feb-86	176.47	176.69	176.90	180.43	181.90	178.79	178.84	165.51	174.14	182.10	181.75
11-Feb-86			177.03	180.50				165.72	174.25		
12-Feb-86			177.17	180.55				165.93	174.37		
13-Feb-86			177.29	180.60				166.17	174.51		
14-Feb-86			177.30	180.66				166.38	174.59		
17-Feb-86	176.52	176.82	177.68	180.81	181.95	178.44	179.55	167.04	174.95	182.31	181.88
18-Feb-86			177.77	180.83				167.15	175.07		
19-Feb-86			177.84	180.88				167.35	175.16		
20-Feb-86			177.89	180.84				167.51	175.23		
24-Feb-86	176.50	176.90	178.11	180.93	182.04	178.79	179.90	168.26	175.57	182.41	181.88
25-Feb-86			178.18	180.95				168.44	175.65		
26-Feb-86			178.23	180.98				168.62	175.72		
27-Feb-86			178.26	181.00				168.79	175.80		
28-Feb-86			178.29	181.00				168.91	175.85		
03-Mar-86	176.52	176.97	178.40	181.05	182.11	178.79	180.25	169.41	176.07	182.51	181.95
04-Mar-86			178.43	181.07				169.60	176.14		
05-Mar-86			178.45	181.06				169.72	176.20		
06-Mar-86			178.48	181.08				169.89	176.20		
07-Mar-86			178.50	181.07				170.00	176.39		
11-Mar-86	176.52	176.99	178.59	181.12	182.16	178.96	180.25	170.62	176.60	182.57	181.99
17-Apr-86	176.20	176.88	178.88	181.26	182.93	178.09	180.25	164.73	171.86	183.29	182.60
07-May-86	176.12	176.74			183.21			162.37	170.76	182.85	183.09
28-May-86						178.44	180.61				
29-May-86	176.08	176.69			183.41			162.40	170.54	183.62	183.27
01-Jul-86	175.93	176.65	178.28		183.42	175.62	180.96	164.18	174.75	183.54	
31-Jul-86	175.86	176.58	178.89	179.42	183.24	178.09	180.96	164.08	177.38	183.36	182.51
29-Aug-86	175.87	176.51	178.90		183.02	178.09	180.96	164.30	179.04	183.05	
16-Oct-86	176.00	176.65			182.62	178.09	180.96		180.67	182.64	

DRILLING LOCATION 85·9

MONITOR #	85-9-1	85-9-2	85-9-3	85-9-4	85-9-5
TOP-OF-PIPE ELEVATION	184.40	184.49	184.42	184.41	184.81
GROUND ELEVATION	183.85	183.89	183.90	183.89	183.86
SCREENED INTERVAL	148.00 147.00	151.29 150.29	158.00 157.00	168.65 167.65	182.87 178.87
05-Dec-85	176.11				
06-Dec-85	176.18				
09-Dec-85	176.22	176.23			
10-Dec-85	176.24	176.27	158.42		
11-Dec-85	176.25	176.27	158.92	168.71	181.98
12-Dec-85	176.24	176.26	160.97	168.70	182.28
13-Dec-85	176.27	176.29	163.10	168.76	182.38
16-Dec-85	176.25	176.34	167.84	171.32	182.54
17-Dec-85	176.30	176.32	168.67	171.76	182.58
18-Dec-85	176.31	176.32	169.93	172.58	182.58
19-Dec-85	176.26	176.30	170.79	173.13	182.64
20-Dec-85	176.29	176.33	171.47	173.64	182.62
02-Jan-86	176.28	176.32	176.51	178.30	182.58
03-Jan-86	176.29	176.39	176.63	178.46	182.61
06-Jan-86	176.34	176.38	176.90	178.85	166.81
07-Jan-86		176.29	177.05	178.88	
08-Jan-86			177.12	179.03	
10-Jan-86			177.26	179.25	
13-Jan-86		176.44	177.44	179.53	182.47
14-Jan-86			177.47	179.60	
15-Jan-86			177.49	179.66	
16-Jan-86			177.52	179.71	
17-Jan-86			177.57	180.29	
20-Jan-86		176.16	177.69	179.97	182.62
21-Jan-86			177.70	180.01	
22-Jan-86			177.72	180.04	
24-Jan-86			177.75	180.10	
27-Jan-86	176.45	176.49	177.77	180.22	182.55
28-Jan-86			177.81	180.21	
29-Jan-86			177.82	180.27	
30-Jan-86			177.83	180.26	
31-Jan-86			177.82	180.27	
03-Feb-86		176.31	177.87	180.33	182.68
10-Feb-86	176.45	176.50	177.95	180.37	182.68
11-Feb-86			177.96	180.47	
12-Feb-86			177.97	180.40	
13-Feb-86			177.98	180.48	
14-Feb-86			178.00	180.51	
17-Feb-86			178.02	180.54	
18-Feb-86	176.40	176.54	178.04	180.55	182.72
19-Feb-86			178.02	180.56	
20-Feb-86			178.08	180.58	
24-Feb-86	176.49	176.55	178.09	180.61	182.73
25-Feb-86			178.07	180.62	
26-Feb-86			178.09	180.63	
27-Feb-86			178.09	180.63	
28-Feb-86			178.09	180.63	
03-Mar-86	176.52	176.57	178.10	180.64	182.81
04-Mar-86			178.11	180.64	
05-Mar-86			178.12	180.65	
06-Mar-86			178.11	180.67	
07-Mar-86			178.12	180.66	
11-Mar-86	176.54	176.59	178.13	180.68	182.81
17-Apr-86	176.20	176.25	178.18	180.74	183.05
07-May-86	176.10	176.14	178.21	180.76	183.09
28-May-86	176.10	176.10	178.25	180.80	183.12
01-Jul-86	175.92	175.92	178.24	180.25	183.12
31-Jul-86	175.87	175.90	178.24	180.81	183.10
29-Aug-86	175.89	175.90	178.21	180.87	182.95
16-Oct-86	176.08	176.12	178.32	181.08	182.94

TABLE F2-1 (cont.)

DRILLING LOCATION 85·10

MONITOR #	85-10-1	85-10-2	85-10-3	85-10-4	85-10-5	85-10-6	85-10-7	85-10-8	85-10-9	85-10-10	85-10-11	85-10-12
TOP-OF-PIPE ELEVATION	184.53	184.50	184.53	184.53	184.78	184.70	184.59	184.42	184.80	184.48	184.61	184.02
GROUND ELEVATION	183.92	184.03	183.94	184.03	183.99	183.99	183.92	184.04	184.46	184.01	184.01	183.74
SCREENED	147.07	151.83	158.04	168.79	182.50	156.89	167.46	159.64	169.61	181.16	175.48	169.04
INTERVAL	146.07	150.83	157.04	167.79	178.50			159.04	168.61	180.35	174.48	168.04
18-Dec-85	176.24											
19-Dec-85	176.26											
20-Dec-85	176.30	161.86										
03-Jan-86	176.36	176.34	159.66	167.22								
06-Jan-86	176.23	176.36	162.24	170.09	183.45							
07-Jan-86	176.32	176.30	163.78	170.69	183.92	175.34	175.34					
08-Jan-86	176.33	176.30	165.98	171.70	183.31	175.55	173.62	162.22	173.07	178.67		
10-Jan-86	176.39	176.40	168.42	173.28	183.44	175.83	175.21	162.49	173.42	181.29	175.10	
13-Jan-86	176.40	176.43	171.62	175.60	183.40	175.55	175.73	162.94	174.00	183.31	175.41	
14-Jan-86	176.38	176.44	172.13	176.02	183.42	175.20	175.41	163.02	174.12	183.35	175.54	
15-Jan-86	176.34	176.45	172.73	176.48	183.37	175.20	176.61	163.15	174.28	183.33	175.47	
16-Jan-86	176.37	176.46	173.38	177.08	183.37	175.55	177.14	163.31	174.49	183.34	175.51	
17-Jan-86	176.37	176.47	173.73	177.46	183.35	175.90	177.46	163.41	174.57	183.36	175.54	
20-Jan-86	176.21	176.53	174.90	178.54	183.64	176.61	177.60	163.78	175.10	183.56	175.66	
21-Jan-86	176.42	176.51	175.14	178.69	183.64	176.96	177.32	163.89	175.24	183.53	175.73	
22-Jan-86	176.43	176.46	175.38	178.85	183.60	176.61	177.67	164.00	175.37	183.55	176.04	
24-Jan-86	176.35	176.51	175.73	179.13	183.62	176.96	178.02	164.19	175.60	183.52	176.93	
27-Jan-86	176.45	176.68	176.26	179.72	183.63			164.52	176.01	183.57	177.58	
28-Jan-86	176.41	176.57	176.38	179.80	183.55	176.96	178.72	164.61	176.12	183.52	178.07	
29-Jan-86	176.42	176.58	176.50	179.87	183.48	177.31	179.08	164.71	176.25	183.47	178.55	
30-Jan-86	176.27	176.59	176.60	179.89	183.39	176.61	179.00	164.80	176.36	183.39	178.91	
31-Jan-86	176.34	176.57	176.67	179.95	183.36	177.66	179.00	164.87	176.40	183.35	179.15	
03-Feb-86	176.24	176.59	176.97	180.15	183.42			165.18	176.80	183.37	180.05	
05-Feb-86			177.11	180.41		178.02	179.50	165.36	176.99			
07-Feb-86			177.22	180.47				165.51	177.13			
10-Feb-86	176.45	176.64	177.40	180.62	183.52	178.72	179.61	165.78	177.43	183.46	181.07	
11-Feb-86			177.45	180.68				165.86	177.53		181.19	
12-Feb-86			177.50	180.72				165.84	177.63		181.27	
13-Feb-86			177.54	180.79				165.03	177.70		181.37	
14-Feb-86			177.57	180.82				166.10	177.78		181.43	
17-Feb-86	176.49	176.65	177.70	180.93	183.34	178.37	180.13	166.34	178.05	183.32	181.64	
18-Feb-86			177.73	180.98				166.43	178.11		181.67	
19-Feb-86			177.76	180.98				166.43	178.17		181.72	
20-Feb-86			177.78	180.98				166.57	178.24		181.77	
24-Feb-86	176.50	176.69	177.89	181.06	183.68	178.37	180.13	166.87	178.55	183.55	181.93	
25-Feb-86			177.92	181.07				166.96	178.60		181.96	
26-Feb-86			177.95	181.14				167.03	178.67		181.98	
27-Feb-86			177.97	181.14				167.11	178.74		182.00	
28-Feb-86			177.98	181.12				167.16	178.76		182.04	
03-Mar-86	176.51	176.71	178.04	181.15	183.72	178.54	180.49	167.38	178.96	183.39	182.12	
04-Mar-86			178.05	181.17				167.44	179.03		182.11	
05-Mar-86			178.05	181.17							182.14	
06-Mar-86			178.09	181.28				167.61	179.15		182.19	
07-Mar-86			178.10	181.20				167.66	179.18		182.20	
11-Mar-86	176.53	176.72	178.16	181.21	183.72	178.72	180.49	167.98	179.39	183.52	182.25	
04-Apr-86	176.17	176.59	178.31	180.98	183.66	178.02	180.14	160.60	178.68	183.54	182.43	180.44
17-Apr-86	176.20	176.56	178.39	181.11	183.77	177.67	180.14	162.25	179.42	183.70	182.50	180.00
07-May-86	176.10	176.45			183.37	177.67	180.49	160.84	171.10	183.83	182.54	180.96
30-May-86	176.09	176.38			183.57	178.02	180.49	161.00	171.16	183.58	182.48	181.00
01-Jul-86	175.91	176.33	178.00	180.96	183.22	178.37	180.49	164.64	176.63	183.17	182.49	181.02
31-Jul-86	175.86	176.24	178.28	172.31	183.09	178.37	180.49	167.50	178.96	183.08	182.33	180.92
29-Aug-86	175.87	176.20	178.30	172.82	182.91	178.02	180.49	169.99	179.62	182.76	182.31	180.04
16-Oct-86	176.00	176.34	178.85	181.00	180.60	178.02	180.49	173.26	180.68	183.58	182.41	180.92

DRILLING LOCATION 85·11

MONITOR #	85-11-1	85-11-2	85-11-3	85-11-4	85-11-5
TOP-OF-PIPE ELEVATION	184.96	185.09	185.00	184.94	184.93
GROUND ELEVATION	184.34	184.42	184.41	184.35	184.35
SCREENED	143.87	150.34	156.97	167.57	182.75
INTERVAL	142.89	149.42	156.06	166.65	178.06
24-Jan-86	176.40	176.03	155.83		
27-Jan-86	175.45	176.51	164.32		
28-Jan-86	176.41	176.49	166.14	167.12	179.84
29-Jan-86	176.42	176.49	167.92	167.66	181.50
30-Jan-86	176.24	176.44	169.33	168.09	182.80
31-Jan-86	176.34	176.46	170.34	168.67	182.25
03-Feb-86	176.24	176.37	173.73	171.46	182.24
05-Feb-86			180.92	172.91	
07-Feb-86			175.85	174.16	
10-Feb-86	176.47	176.55	176.93	175.76	182.21
11-Feb-86			177.06	176.25	
12-Feb-86			177.22	176.77	
13-Feb-86			177.40	177.00	
14-Feb-86			177.52	177.29	
17-Feb-86			177.88	178.18	
18-Feb-86	176.40	176.57	177.98	178.39	182.80
19-Feb-86			178.01	178.57	
20-Feb-86			178.02	178.68	
24-Feb-86	176.50	176.56	178.21	179.31	182.15
25-Feb-86			178.24	179.37	
26-Feb-86			178.29	179.60	
27-Feb-86			178.30	179.72	
28-Feb-86			178.34	179.70	
03-Mar-86	176.51	176.59	178.37	179.97	182.18
04-Mar-86			178.39	180.06	
05-Mar-86			178.39	180.11	
06-Mar-86			178.44	180.25	
07-Mar-86			178.42	180.23	
11-Mar-86	176.53	176.61	178.46	180.38	182.13
04-Apr-86	176.18	176.27	178.52	180.77	182.26
17-Apr-86	176.20	176.29	178.54	180.83	182.50
07-May-86	176.11	176.20	178.54	180.71	182.73
28-May-86	176.08	176.18	178.53	180.58	182.90
01-Jul-86	175.92	176.00	178.34		182.80
31-Jul-86	175.87	175.97	178.46	177.29	182.73
29-Aug-86	175.87	175.97	178.45		182.53
16-Oct-86	175.97	176.16	178.36		182.40

TABLE F2-1 (cont.)

DRILLING LOCATION 85·12

MONITOR #	85-12-1	85-12-2	85-12-3	85-12-4	85-12-5	85-12-6	85-12-7	85-12-8	85-12-9	85-12-10	85-12-11
TOP-OF-PIPE ELEVATION	184.62	183.98	184.78	184.70	184.61	184.91	184.64	184.38	184.25	184.16	184.69
GROUND ELEVATION	184.07	184.47	184.18	184.03	183.96	184.22	184.11	183.77	183.70	183.64	183.99
SCREENED INTERVAL	146.07 143.07	148.68 147.68	158.28 157.38	167.23 166.33	182.36 178.47	157.12	166.81	159.22 158.62	168.45 167.85	181.34 178.31	175.44 174.54
29-Jan-86						178.95					
30-Jan-86			161.08			178.60	171.38				
31-Jan-86			162.33	136.60		178.25	179.49				
03-Feb-86	176.27		169.85	167.50	182.29	178.25	179.49				179.77
04-Feb-86	176.23		171.38	167.56	182.37	178.25	179.49				180.84
05-Feb-86	176.43		172.30	168.54	182.36	177.89	179.49				181.27
07-Feb-86	176.41		174.10	171.02	182.30	177.89	179.84		168.92	179.36	181.87
10-Feb-86	176.44		175.84	174.49	182.33	176.84	179.49	159.57	169.26	182.46	182.24
11-Feb-86	176.45	165.47	176.12	175.19	182.61	176.84	179.84	159.84	169.32	182.55	182.30
12-Feb-86	174.60	168.40	176.37	175.95	182.79	177.54	180.19	160.12	169.38	182.57	182.34
13-Feb-86	176.35	170.55	176.57	176.61	182.75	177.54	180.19	160.41	169.44	182.56	182.37
14-Feb-86	176.40	171.69	176.64	177.00	182.79	177.89	180.19	160.61	169.48	182.62	182.37
17-Feb-86	176.48	174.28	176.99	178.30	182.81	176.84	179.84	161.47	169.76	182.68	182.46
18-Feb-86	176.52	174.65	177.04	178.57	182.83	176.84	179.84	161.70	169.71	182.70	182.46
19-Feb-86	176.40	174.95	177.12	178.82	182.83	177.19	179.84	161.96	169.76	182.69	182.45
20-Feb-86	176.41	175.12	177.18	179.01	182.78	177.19	179.84	162.18	169.80	182.63	182.41
21-Feb-86	176.52	175.28	177.22	179.18	182.71	176.84	180.01	162.40	169.86	182.63	182.40
24-Feb-86	176.48	175.64	177.48	179.66	182.80	177.19	180.19	163.16	170.03	182.64	182.46
25-Feb-86	176.48	175.70	177.56	179.77	182.81			163.41	170.09	182.64	182.43
26-Feb-86	176.52	175.82	177.66	179.89	182.87			163.64	170.15	182.73	182.48
27-Feb-86	176.65	175.86	177.75	179.98	182.86			163.87	170.20	182.73	182.48
28-Feb-86	176.43	175.87	177.80	180.01	182.83			164.03	170.23	182.69	182.49
03-Mar-86	176.49	176.01	178.05	180.20	182.80	178.42	180.36	164.69	170.39	182.67	182.49
04-Mar-86	176.49	176.05	178.16	180.23	182.81			164.97	170.47	182.67	182.49
05-Mar-86	176.49	176.07	178.22	180.28	182.81			165.13	170.51	182.66	182.48
06-Mar-86	176.51	176.11	178.31	180.33	182.93			165.36	170.57	182.77	182.54
07-Mar-86	176.53	176.11	178.36	180.33	182.83			165.51	170.61	182.71	182.50
11-Mar-86	176.52	176.16	178.73	180.50	182.81	178.42	180.36	166.34	170.84	182.69	182.52
14-Mar-86											
20-Mar-86		176.22	178.79	180.71	182.90	178.60	180.68				182.56
24-Mar-86			178.79	178.73	182.89						182.59
14-Apr-86		176.16	178.81	181.05	183.24						182.88
15-Apr-86		176.17								183.06	
17-Apr-86		176.15	178.81	181.04	183.32	177.90	180.54	166.35	170.40	183.05	182.91
18-Apr-86		176.15									
07-May-86	176.08	176.11			183.10	177.90	180.54	161.72	169.15	183.00	182.87
30-May-86	176.06	176.10			183.19	177.90	180.54	161.59	168.99	183.07	182.82
01-Jul-86	175.90	176.02	178.72	181.36	182.82	178.60	181.25	166.20	171.11	182.80	
31-Jul-86	175.86	175.92	179.02	181.50	182.66	178.95	181.60	164.19	172.82	182.70	180.75
29-Aug-86	175.84	175.86	179.13	181.49	182.34	178.60	181.60	161.17	174.30	182.37	
16-Oct-86	176.10	176.00			182.73	178.60	181.60		176.40	182.63	

MONITOR #	85-12-12a	85-12-12b	85-12-12c	85-12-13	85-12-14	85-12-15	85-12-16	85-12-17	85-12-18	85-12-19	85-12-20	85-12-21	85-12-22
TOP-OF-PIPE ELEVATION	185.20	185.20	185.12	184.03	184.14	184.14	184.18	184.19	184.27	184.36	184.34	184.49	184.76
GROUND ELEVATION	184.11	184.11	184.19	183.56	183.59	183.52	183.57	183.62	183.68	183.73	183.82	183.97	184.22
SCREENED INTERVAL	133.61	113.01	145.29 144.29	182.36 182.06	181.39 181.09	180.82 180.52	179.87 179.57	179.12 178.82	178.40 178.10	177.73 177.43	177.12 176.82	176.27 175.97	145.22 143.22
29-Jan-86													
30-Jan-86													
31-Jan-86													
03-Feb-86													
04-Feb-86													
05-Feb-86													
07-Feb-86													
10-Feb-86					182.14	182.69	182.67	182.55			179.55		
11-Feb-86					182.26	182.73	182.70	182.60	178.51	177.71	180.12	177.93	
12-Feb-86					182.34	182.74	182.71	182.63	178.74	177.87	180.59	178.87	
13-Feb-86					182.41	182.74	182.71	182.66	178.96	178.00	180.95	178.76	176.11
14-Feb-86					182.46	182.80	182.75	182.67	179.11	178.23	181.14	179.01	176.80
17-Feb-86					182.61	182.84	182.78	182.70	179.66	178.78	181.06	179.85	176.50
18-Feb-86					182.64	182.85	182.80	182.72	179.81	178.92	181.20	180.08	176.54
19-Feb-86				182.17	182.60	182.84	182.81	182.71	179.97	179.08	181.46	180.21	176.41
20-Feb-86				182.18	182.69	182.78	182.76	182.71	180.09	179.20	181.50	180.34	176.42
21-Feb-86				182.19	182.71	182.82	182.76	182.71	180.23	179.38	181.69	180.48	176.51
24-Feb-86				182.23	182.75	182.92	182.88	182.77	180.67	179.73	182.00	180.85	176.49
25-Feb-86				182.24	182.78	182.94	182.91	182.80	180.80	179.86	181.90	180.95	176.48
26-Feb-86				182.27	182.79	183.02	183.20	182.84	180.99	180.04	181.96	181.21	176.52
27-Feb-86				182.28	182.83	183.02	183.01	182.86	181.09	180.18	182.06	181.27	176.51
28-Feb-86				182.27	182.83	182.95	182.95	182.85	181.16	180.18	182.08	181.30	176.40
03-Mar-86		155.01		182.30	182.83	182.86	182.80	182.82	181.40	180.54	182.16	181.46	176.49
04-Mar-86				182.31	182.83	182.85	182.84	182.81	181.49	180.65	182.17	181.52	176.48
05-Mar-86			176.47	182.32	182.82	182.84	182.84	182.80	181.53	180.71	182.19	181.54	176.48
06-Mar-86			176.51	182.33	182.83	182.99	182.95	182.82	181.59	180.79	182.20	181.59	176.52
07-Mar-86			176.49	182.34	182.83	182.91	182.91	182.83	181.62	180.84	182.21	181.61	176.50
11-Mar-86	175.16	173.72	176.51	182.37	182.85	182.95	182.96	182.87	181.79	181.11	182.25	181.72	176.50
14-Mar-86	175.16	174.63											
20-Mar-86	175.16	173.93	176.40										176.41
24-Mar-86													
14-Apr-86			176.14										176.15
15-Apr-86	174.81	174.64	176.18	182.45	183.15	183.21	183.19	183.17	181.74	181.09	182.55	181.80	176.19
17-Apr-86	175.16	174.64	176.18	182.37	183.00	183.20	183.20	183.21	181.32	180.66	182.46	181.62	176.20
18-Apr-86			176.15										176.15
07-May-86	175.16	174.99	176.09	182.70	182.90	182.94	182.96	182.96	182.36	182.14	182.72	182.44	176.10
30-May-86	175.52	174.99	176.08	182.30	183.09	183.09	183.00	183.05	180.60	179.76	182.21	180.69	176.00
01-Jul-86	175.52	174.99	175.90	182.21	182.73	182.63	182.60	182.56	182.26	181.83	182.59	182.37	175.90
31-Jul-86	175.87	175.69	175.85	182.27	182.53	182.29	182.27	182.22	182.87	182.23	182.49	182.40	175.86
29-Aug-86	175.16	175.34	175.86		182.25	181.91	181.86	181.70	182.16	182.17	182.31	182.17	175.80
16-Oct-86	175.87	175.34	176.07	182.27	182.70	182.76	182.73		182.07	181.80	182.84		176.06

TABLE F2-1 (cont.)

DRILLING LOCATION 85·13, 85·14, 85·15, 85·16

MONITOR #	85-13-1	85-13-2	85-14-1	85-14-2	85-15-1	85-15-2	85-16-1	85-16-2
TOP-OF-PIPE ELEVATION	185.72	185.76	182.21	182.17	183.39	183.09	186.46	186.69
GROUND ELEVATION	185.05	185.14	181.65	181.62	182.75	182.74	185.95	186.09
SCREENED INTERVAL	145.35 144.35	183.65 179.65	140.05 139.05	180.13 176.13	144.25 143.25	181.11 177.11	156.15 155.15	184.29 180.29
04-Mar-86	176.52	184.17						
05-Mar-86	176.53	184.18						
06-Mar-86	176.54	184.32						
07-Mar-86	176.53	184.22						
11-Mar-86	176.45	184.19	176.50	180.50	176.61	182.23		
14-Mar-86	176.54	184.31	176.49	181.27	176.60	182.30	176.97	181.09
20-Mar-86	176.44	184.33	176.39	181.24	176.50	182.31	176.87	184.76
04-Apr-86			176.16	181.02	176.25	182.98		
17-Apr-86	176.21	184.59	176.18	181.20	176.23	182.55	176.64	185.67
07-May-86	176.12	184.52	176.08	180.75	176.17	182.33	176.58	185.60
30-May-86	176.11	184.40	176.06	180.87	176.09	182.35	176.57	185.68
01-Jul-86	175.93	184.10	175.57	180.55	175.90	181.77	176.49	185.56
31-Jul-86	175.88	180.77	175.06	180.36	175.88	181.50	174.81	185.31
29-Aug-86	175.09	180.30	175.86	180.03	175.98	181.20	176.30	185.12
16-Oct-86	176.00	180.62	176.05	181.19	176.12	182.20	176.60	185.46

TABLE F2-1 (cont.)

APPENDIX G

HYDROGEOLOGIC TEST RESULTS

APPENDIX G

HYDROGEOLOGIC TEST RESULTS

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FIGURE

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TABLE

G1 MONITOR RECOVERY ANALYSIS

Hydraulic conductivity values were determined for many monitors using water level recovery data. A discussion of the methodology and monitor recovery analysis results follows.

G1.1 DATA COLLECTION AND ANALYSIS

Ground water monitors were generally installed in boreholes that were dry or nearly dry. By measuring water levels daily, immediately after installation, it was possible to determine the rate at which the monitors recovered to static levels.

Water level recovery in many of the monitors, particularly those in the unweathered silt and clay, was sufficiently slow to permit the analysis of the daily water level measurement data to provide hydraulic conductivity values. The analysis is based on the method of Hvorslev (1951). The Hvorslev method was originally developed for slug test analysis. However, the recovery of a monitor from dry or nearly dry is equivalent to the withdrawal of a "slug" of water, which is the method used for slug testing.

Figure G1-1 shows the input for a typical example, which includes the observed water levels, and Figure G1-2 presents the data plot, line fitting, and calculations that result in a value of hydraulic conductivity (K) for the unit in which the monitor sand pack is located. Copies of all monitor recovery analyses are contained in an open file report provided to OWMC.

Example Of Typical Monitor Recovery Data

HVORSLEV'S METHOD

Figure G1-1

PROJECT NAME: OWMC
PROJECT NUMBER: 85-GH-9
INSTALLATION ID: 85-8-4
TEST START DATE: 14 JAN 1986
TEST START TIME: 14:00:00
STATIC WATER LEVEL H (mbRP): 4.4
INITIAL WATER LEVEL Ho (mbRP):15.01

DATE	ACTUAL TIME	CUMULATIVE TIME (hours)	WATER LEVEL (mbRP)	H-h / H-Ho
15 JAN 1986	08:00:00	18.00	14.09	.91
16 JAN 1986	09:00:00	43.00	12.98	.81
17 JAN 1986	08:00:00	66.00	12.08	.72
20 JAN 1986	15:00:00	145.00	9.68	.50
21 JAN 1986	13:30:00	167.50	9.26	.46
22 JAN 1986	16:30:00	194.50	8.70	.41
24 JAN 1986	08:00:00	234.00	8.01	.34
27 JAN 1986	15:00:00	313.00	6.96	.24
28 JAN 1986	14:30:00	336.50	6.70	.22
29 JAN 1986	16:00:00	362.00	6.50	.20
30 JAN 1986	14:30:00	384.50	6.33	.18
31 JAN 1986	08:00:00	402.00	6.20	.17
03 FEB 1986	16:00:00	482.00	5.73	.13
05 FEB 1986	10:45:00	524.75	5.51	.10
07 FEB 1986	08:00:00	570.00	5.34	.09
10 FEB 1986	10:30:00	644.50	5.13	.07
11 FEB 1986	11:00:00	669.00	5.06	.06
12 FEB 1986	11:15:00	693.25	5.01	.06
13 FEB 1986	14:50:00	720.83	4.96	.05
14 FEB 1986	08:30:00	738.50	4.90	.05
17 FEB 1986	14:00:00	816.00	4.75	.03
18 FEB 1986	17:00:00	843.00	4.73	.03
19 FEB 1986	15:00:00	865.00	4.68	.03
20 FEB 1986	10:00:00	884.00	4.72	.03
24 FEB 1986	14:00:00	984.00	4.63	.02
25 FEB 1986	14:45:00	1008.75	4.62	.02
26 FEB 1986	15:15:00	1033.25	4.58	.02
27 FEB 1986	14:20:00	1056.33	4.56	.02
28 FEB 1986	09:45:00	1075.75	4.56	.02
03 MAR 1986	11:50:00	1149.83	4.51	.01
04 MAR 1986	14:15:00	1176.25	4.49	.01
05 MAR 1986	10:30:00	1196.50	4.50	.01
06 MAR 1986	14:05:00	1224.08	4.48	.01
07 MAR 1986	09:00:00	1243.00	4.49	.01
11 MAR 1986	10:30:00	1340.50	4.44	0.00

NOTE - mbRP is metres below Reference Point elevation
- h is reading in mbRP

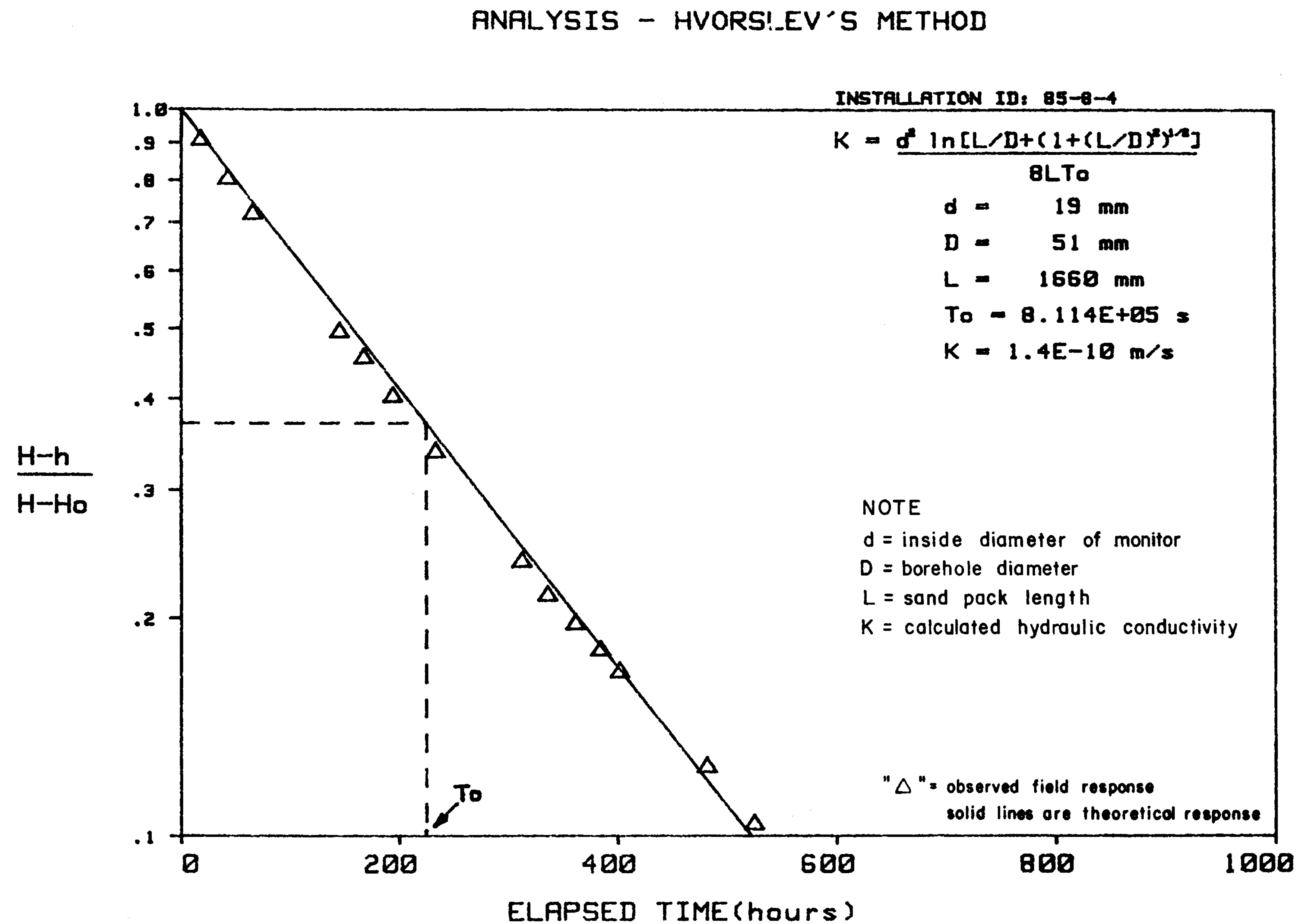


Figure G1-2

Example Analysis Of Monitor Recovery Data

G1.2 RESULTS

The results of all recovery analyses are summarized in Table G1-1. The table lists the calculated value of hydraulic conductivity (K) in metres per second (m/s) for each monitor for which the recovery data was suitable for analysis. Also shown is the range of elevation that the test result represents (i.e. the sand pack interval).

TABLE G1-1: VALUES OF HYDRAULIC CONDUCTIVITY DETERMINED BY RECOVERY ANALYSIS

BOREHOLE	ELEVATION TESTED (m ASL)	HYDRAULIC CONDUCTIVITY K (m/s)
UNWEATHERED SILT AND CLAY		
85-1-4	170.04 - 169.04	1E-10
85-2-4	169.53 - 168.43	9E-11
85-3-4	170.14 - 169.22	8E-11
85-4-4	170.18 - 169.28	1E-10
85-5-4	168.56 - 167.56	1E-10
85-6-4	170.09 - 169.09	8E-11
85-7-4	169.10 - 168.10	2E-10
85-8-4	169.72 - 168.72	1E-10
85-9-4	168.65 - 167.65	1E-10
85-10-4	168.79 - 167.79	1E-10
85-11-4	167.57 - 166.65	1E-10
85-12-4	167.23 - 166.33	2E-10
85-1-3	159.41 - 158.41	1E-10
85-2-3	159.24 - 158.04	1E-10
85-3-3	159.42 - 158.50	2E-10
85-4-3	159.48 - 158.58	2E-10
85-5-3	159.60 - 158.60	2E-10
85-6-3	159.26 - 158.26	1E-10
85-7-3	158.48 - 157.48	2E-10
85-8-3	158.05 - 157.05	1E-10
85-9-3	158.00 - 157.00	2E-10
85-10-3	158.04 - 157.04	2E-10
85-11-3	156.97 - 156.06	2E-10
85-12-3	158.28 - 157.38	2E-10
LOWER TILL		
85-7-2	150.49 - 149.49	4E-10
85-8-2	152.92 - 151.72	3E-10

G2 SLUG TESTING

Slug testing involves displacing water in a monitor and measuring the rate at which the water levels recover to static. The pattern of the water level recovery can be analysed to provide an estimate of hydraulic conductivity. A discussion of the slug testing program at the Preferred Site follows.

G2.1 DATA COLLECTION AND ANALYSIS

The techniques used to perform and collect data for the slug tests are outlined in Appendix A3. Slug tests were attempted at all monitors other than those designated for geochemical sampling.

The pattern of response obtained from several of the monitors did not allow for interpretation using the analysis technique discussed below. These monitors were: 85-1-5, 85-2-4, 85-3-2, 85-3-5, 85-4-2, 85-6-3, 85-6-4, 85-6-5, and 85-10-4. Each of these monitors was tested more than once but no improvement in the data resulted. The reason for the atypical response is not known, but may be related to monitor construction -- for example joint leakage, seal leakage, or blockage by siltation.

Monitor 85-8-1 was not slug tested because property access was denied at the time of testing.

Most of the slug test data was analysed using the method described by Hvorslev (1951). Some of the bedrock monitors which were slug tested, namely those in very high permeability formations, demonstrated an oscillatory response due to inertial effects in the monitor pipe. These tests were analysed using the method developed by van der Kamp (1976). Slug tests performed in standpipes were analysed using the method outlined by Bower and Rice (1976). Figure G2-1 shows typical slug test data collected during a field test. Figure G2-2 illustrates the analysis of the data using the Hvorslev method including calculations used to establish a value of hydraulic conductivity (K) for the formation in which the monitor sand pack is located. Copies of all slug test analyses were provided to OWMC and are contained in an open file report.

Two of the monitors completed in the Lower Till, 85-6-2 and 85-9-2, responded too quickly to measure a detailed water level response profile prior to reaching static level. However, it was possible to record the approximate time at which static water level was reached. This value was used to calculate a lower limit for hydraulic conductivity using the following two data points:

(1) initial reading at a water level calculated by knowing the volume of the slug inserted or withdrawn,

2) reading at the time when "full" recovery was noted, which was taken to represent a water level that corresponds to 90% recovery (conservative estimate to provide lower limit of hydraulic conductivity).

G2.2 RESULTS

Table G2-1 summarizes the results of all slug test analyses. The table lists calculated hydraulic conductivities (K) in

SLUG TEST ANALYSIS

(HVORSLEV'S METHOD)

PROJECT NAME: OWMC
PROJECT NUMBER: 85-GH-9
INSTALLATION ID: 85-9-3
TEST START DATE: 19 MAR 1986
TEST START TIME: 08:54:00
STATIC WATER LEVEL H (mbRP): 6.31
INITIAL WATER LEVEL Ho (mbRP): 5.91

DATE	ACTUAL TIME	CUMULATIVE TIME (hours)	WATER LEVEL (mbRP)	$\frac{H-h}{H-Ho}$
20 MAR 1986	09:05:00	24.18	5.94	.92
20 MAR 1986	15:34:00	30.67	5.96	.88
21 MAR 1986	08:59:00	48.08	6.00	.78
24 MAR 1986	12:58:00	124.07	6.11	.50
24 MAR 1986	16:54:00	128.00	6.12	.48
25 MAR 1986	09:20:00	144.43	6.13	.45
25 MAR 1986	15:23:00	150.48	6.14	.42
26 MAR 1986	06:49:00	165.92	6.15	.40
31 MAR 1986	14:20:00	293.43	6.22	.23
01 APR 1986	08:42:00	311.80	6.23	.20
01 APR 1986	19:14:00	322.33	6.23	.20

NOTE - mbRP is metres below Reference Point elevation
- h is reading in mbRP

Figure G2-1
Example Of Typical Slug Test Data

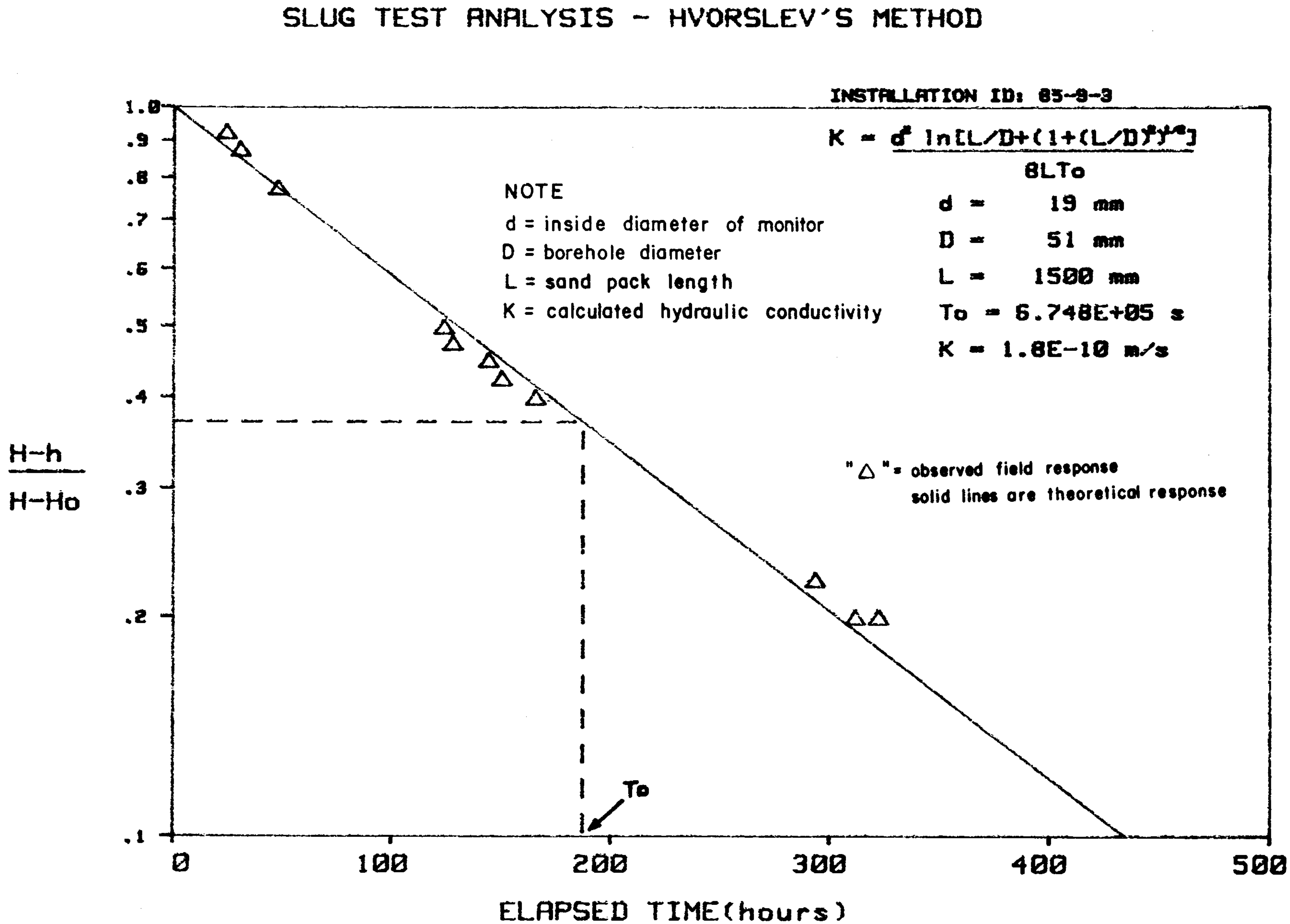


Figure G2-2

Example Analysis Of Slug Test Data

TABLE G2-1: VALUES OF HYDRAULIC CONDUCTIVITY DETERMINED BY SLUG TEST ANALYSIS

BOREHOLE	ELEVATION TESTED (m ASL)	HYDRAULIC CONDUCTIVITY K (m/s)
WEATHERED SILT AND CLAY		
85-1-5 *		--
85-2-5	182.21 - 179.21	6E-9
85-3-5 *		--
85-4-5	183.71 - 179.82	4E-9
85-5-5	183.88 - 179.88	7E-7
85-6-5 *		--
85-7-5	182.80 - 178.80	2E-9
85-8-5	183.48 - 179.48	4E-9
85-9-5	182.37 - 178.37	5E-9
85-10-5	182.50 - 178.50	5E-7
85-11-5	182.75 - 178.86	6E-9
85-12-5	182.36 - 178.47	1E-8
85-13-2	183.65 - 179.65	2E-7
85-14-2	180.13 - 176.13	1E-8
85-15-2	181.11 - 177.11	4E-8
85-16-2	184.29 - 180.29	5E-7
UNWEATHERED SILT AND CLAY		
85-1-11	176.56 - 175.52	5E-10
85-3-11	176.73 - 175.73	2E-9
85-8-11	176.48 - 175.48	1E-9
85-10-11	175.48 - 174.48	2E-10
85-10-12	169.04 - 168.04	2E-9
85-12-11	175.44 - 174.54	2E-9
85-1-4	170.04 - 169.04	1E-10
85-2-4 *		--
85-3-4	170.14 - 169.22	2E-10
85-4-4	170.18 - 169.28	2E-10
85-5-4	168.56 - 167.56	1E-10
85-6-4 *		--
85-7-4	169.10 - 168.10	1E-10
85-8-4	169.72 - 168.72	1E-10
85-9-4	168.65 - 167.65	1E-10
85-10-4 *		--
85-11-4	167.57 - 166.65	3E-10
85-12-4	167.23 - 166.33	3E-10
85-1-3	159.41 - 158.41	8E-11
85-2-3	159.24 - 158.04	4E-10
85-3-3	159.42 - 158.50	4E-10
85-4-3	159.48 - 158.58	1E-10
85-5-3	159.60 - 158.60	2E-10

TABLE G2-1: continued...

BOREHOLE	ELEVATION TESTED (m ASL)	HYDRAULIC CONDUCTIVITY K (m/s)
UNWEATHERED SILT AND CLAY cont...		
85-6-3 *		--
85-7-3	158.48 - 157.48	8E-11
85-8-3	158.05 - 157.05	1E-10
85-9-3	158.00 - 157.00	2E-10
85-10-3	158.04 - 157.04	2E-10
85-11-3	156.97 - 156.06	3E-10
85-12-3	158.28 - 157.38	2E-10
LOWER TILL		
85-1-2	153.34 - 152.34	2E-8
85-2-2	153.23 - 152.23	6E-10
85-3-2 *		--
85-4-2 *		--
85-5-2	150.99 - 149.99	2E-9
85-6-2	151.92 - 150.92	>4E-5
85-7-2	150.49 - 149.49	7E-10
85-8-2	152.92 - 151.72	7E-10
85-9-2	151.29 - 150.29	>7E-5
85-10-2	151.83 - 150.83	7E-10
85-11-2	150.34 - 149.42	4E-8
85-12-2	148.68 - 147.68	7E-10
BEDROCK AQUIFER		
85-1-12	150.13 - 149.13	4E-3
85-2-1	149.57 - 148.05	2E-4
85-3-1	153.24 - 150.55	6E-5
85-4-1	148.23 - 147.25	8E-5
85-5-1	146.00 - 145.00	2E-4
85-6-1	148.24 - 146.72	3E-4
85-7-1	146.74 - 145.74	2E-5
85-8-1 **		--
85-9-1	148.00 - 147.00	2E-3
85-11-1	143.87 - 142.89	2E-4
85-12-1	146.07 - 143.07	2E-3
85-13-1	145.35 - 144.35	4E-5
85-14-1	140.05 - 139.05	1E-5
85-15-1	144.25 - 143.25	8E-5
85-16-1	156.15 - 155.15	6E-4

NOTES: " > " indicates estimated minimum value
* atypical response, not analysed
** no property access, not tested

metres per second (m/s) for all monitors for which suitable data were obtained. Where more than one set of slug test data was analysed, the value reported in Table G2-1 is the geometric mean.

Also shown are the upper and lower elevations for the sand pack which was emplaced around the monitor screen. This range in elevation is considered to be the test interval.

G3 PACKER TESTING

Boreholes 85-1-12 and 85-12-12 were drilled 27 m and 33.4 m (respectively) into the bedrock. Packer equipment was used to seal off successive 3 m intervals of the bedrock in each hole. Testing was then performed to determine static hydraulic head, hydraulic conductivity, and storativity. The analysis techniques and results of the packer testing are presented in this section.

G3.1 DATA COLLECTION AND ANALYSIS

Packer testing was performed by Waterra Hydrogeology Inc. during February 1986. The data collection technique was described in Appendix A3.3.

The initial analysis of the packer test data was performed by Waterra Hydrogeology Inc. using the standard type-curve matching technique of Cooper et al (1967). While this technique is considered to give reasonable estimates of hydraulic conductivity, its authors point out that the calculations may result in unrealistic values of formation storativity (see Section G3.3).

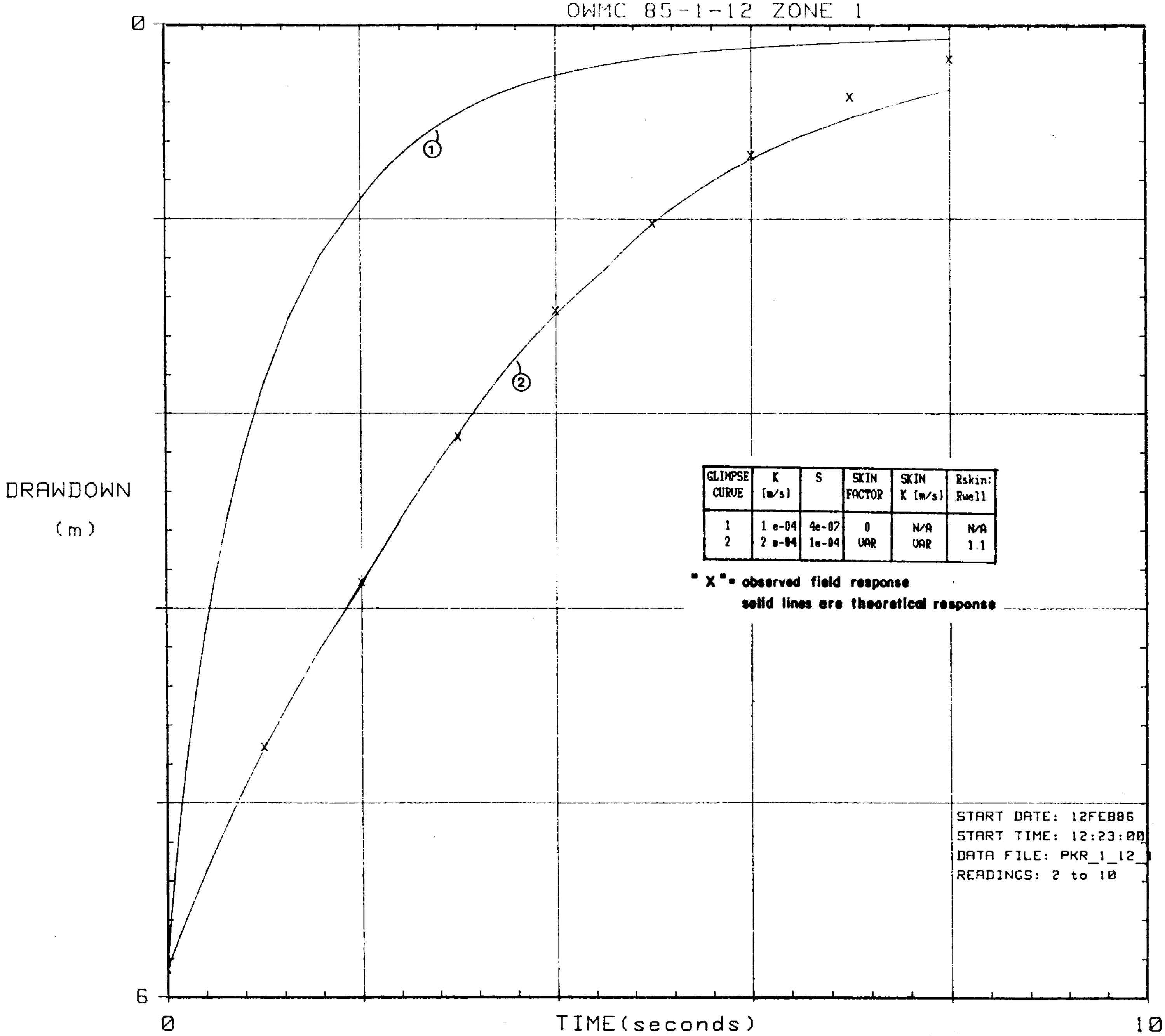
Gartner Lee Limited have developed a computer model named "GLIMPSE" which simulates transient test response in homogeneous porous media. Use of this model permits simulation of stress induced during testing. A detailed description of the GLIMPSE model is provided in McLaren et al. (1985).

Selected test zones were re-analysed using the GLIMPSE model in the following manner. An initial simulation was performed using the value of hydraulic conductivity determined from the type-curve analysis but assigning a more reasonable storativity value (3e-7 to 3e-4). The simulated response was then compared to the actual field response data. The hydraulic conductivity and storativity values were then further adjusted to more closely match the actual field response.

In some cases it was also necessary to include "skin effects" in the simulations, which accounts for disturbance of the test formation due to drilling and development. This was particularly relevant to zones of high hydraulic conductivity and zones whose calculated storativity was unrealistically low. Further discussions with regard to the skin effect may be found in McLaren et al. (1985).

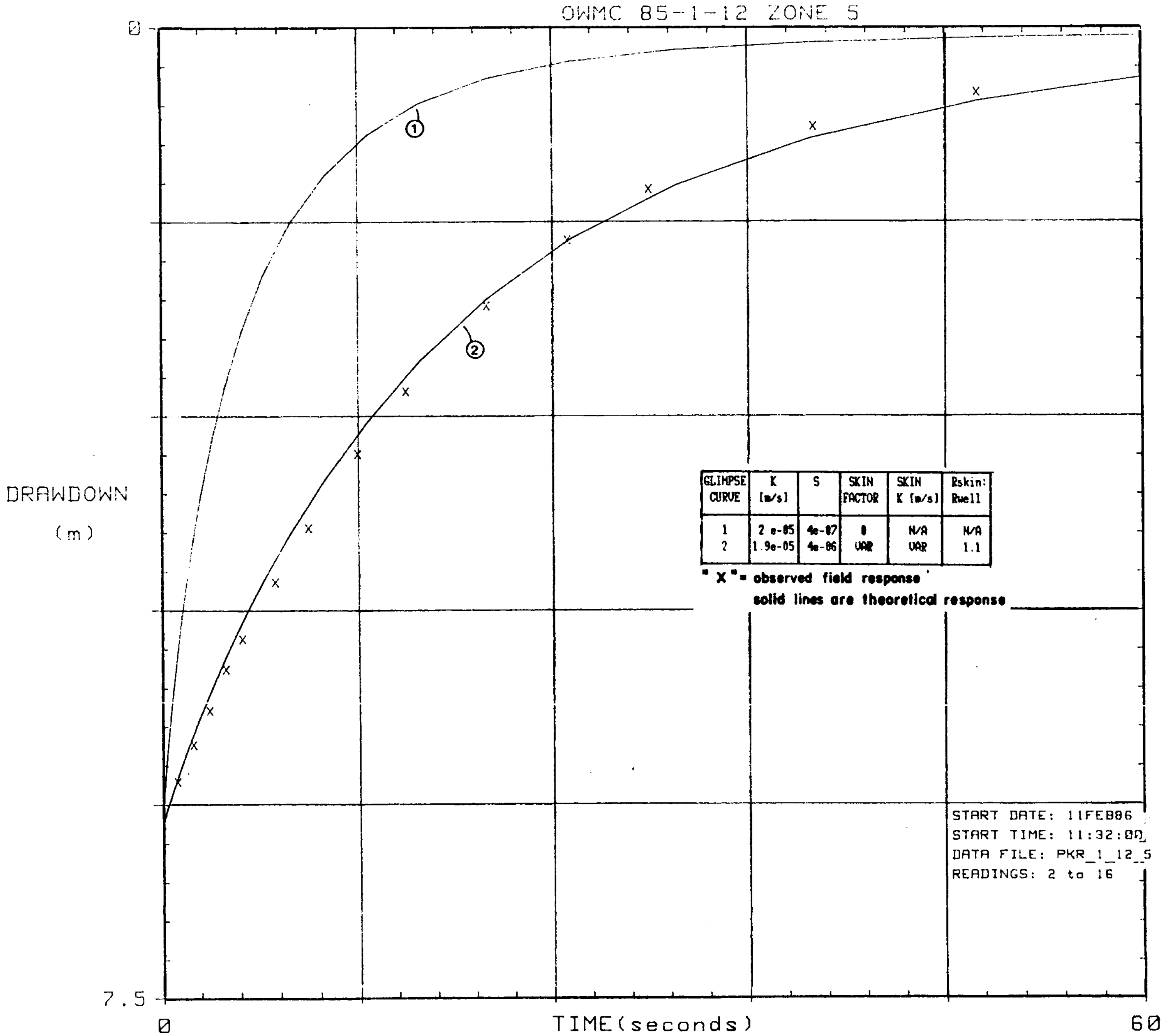
Figures G3-1 to G3-6 illustrate each of the GLIMPSE analyses. In each case the actual field data is represented by the "x" symbols. Curve 1 on each plot is the simulation using the hydraulic conductivity calculated from the type-curve analysis, a storativity value of 4E-7 (indicated by Freeze and Cherry, 1979, to be the lower limit for this type of formation), and not accounting for skin effects. Curve 3, where shown, illustrates a simulation whereby both hydraulic conductivity and storativity were adjusted to give the best possible match to the field data without accounting for skin effects. This was generally only applicable to lower permeability intervals. Curve 2 in each case shows the best possible match to the field data when hydraulic conductivity, storativity, and skin effects are adjusted in the simulation.

Figure G3-1
Glimpse Results For 85-1-12 Interval 1



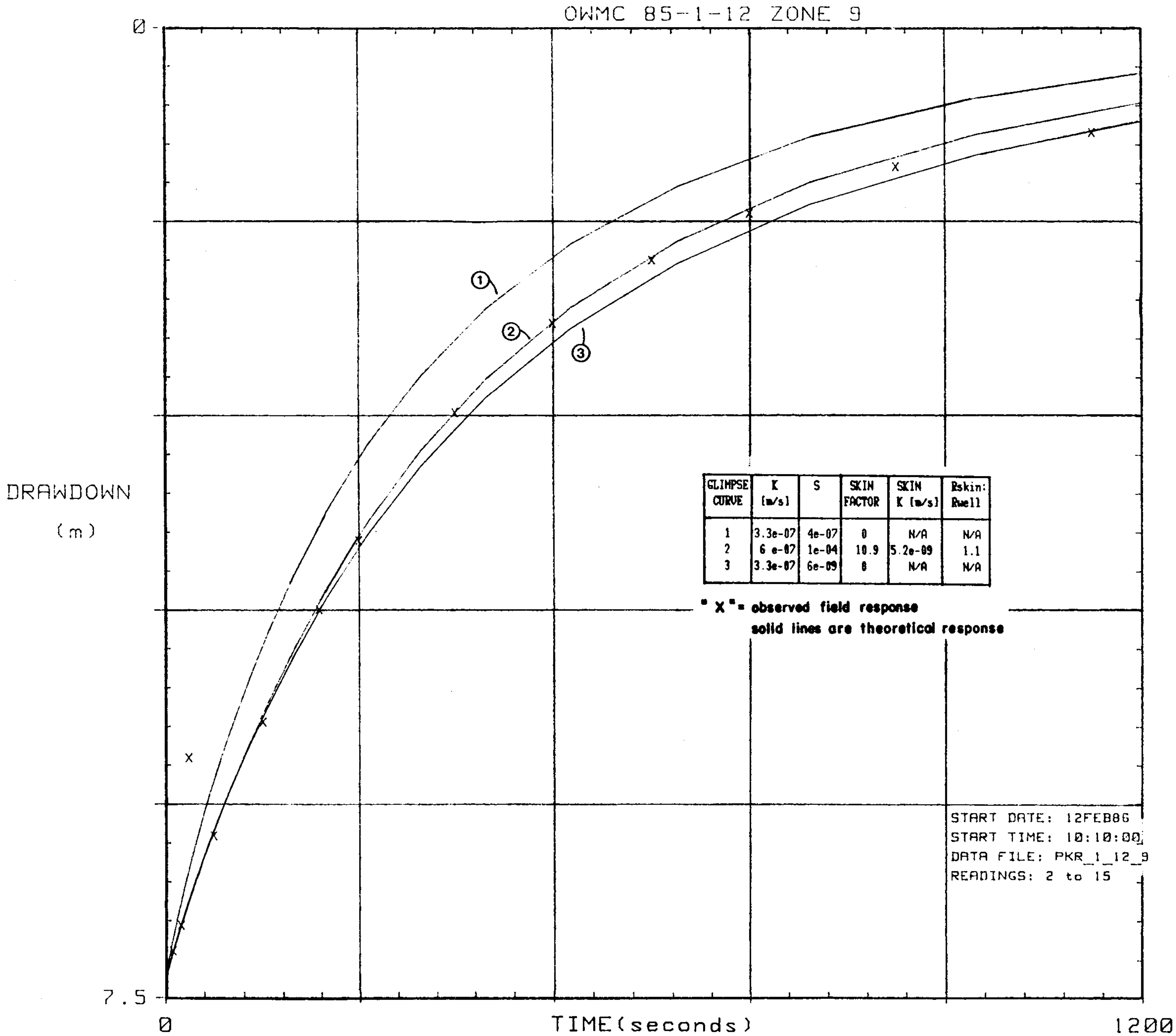
GLIMPSE CURVE	K (m/s)	S	SKIN FACTOR	SKIN K (m/s)	Rskin: Rwell
1	1 e-04	4e-07	0	N/A	N/A
2	2 e-04	1e-04	VAR	VAR	1.1

Figure G3-2
Glimpse Results For 85-1-12 Interval 5



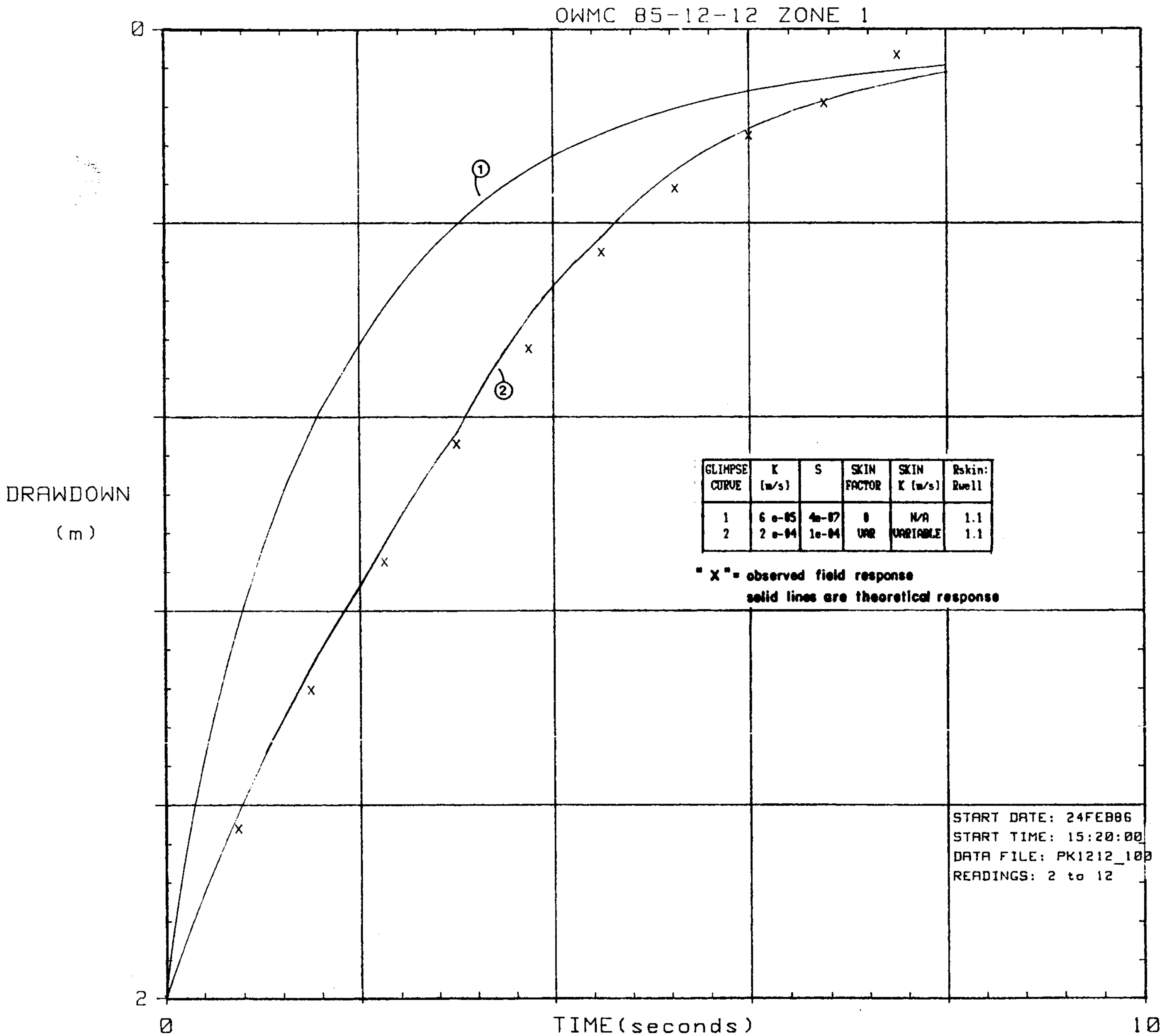
GLIMPSE CURVE	K [m/s]	S	SKIN FACTOR	SKIN K [m/s]	Rskin: Rwell
1	2 e-05	4e-07	0	N/A	N/A
2	1.9e-05	4e-06	VAR	VAR	1.1

Figure G3-3
Glimpse Results For 85-1-12 Interval 9



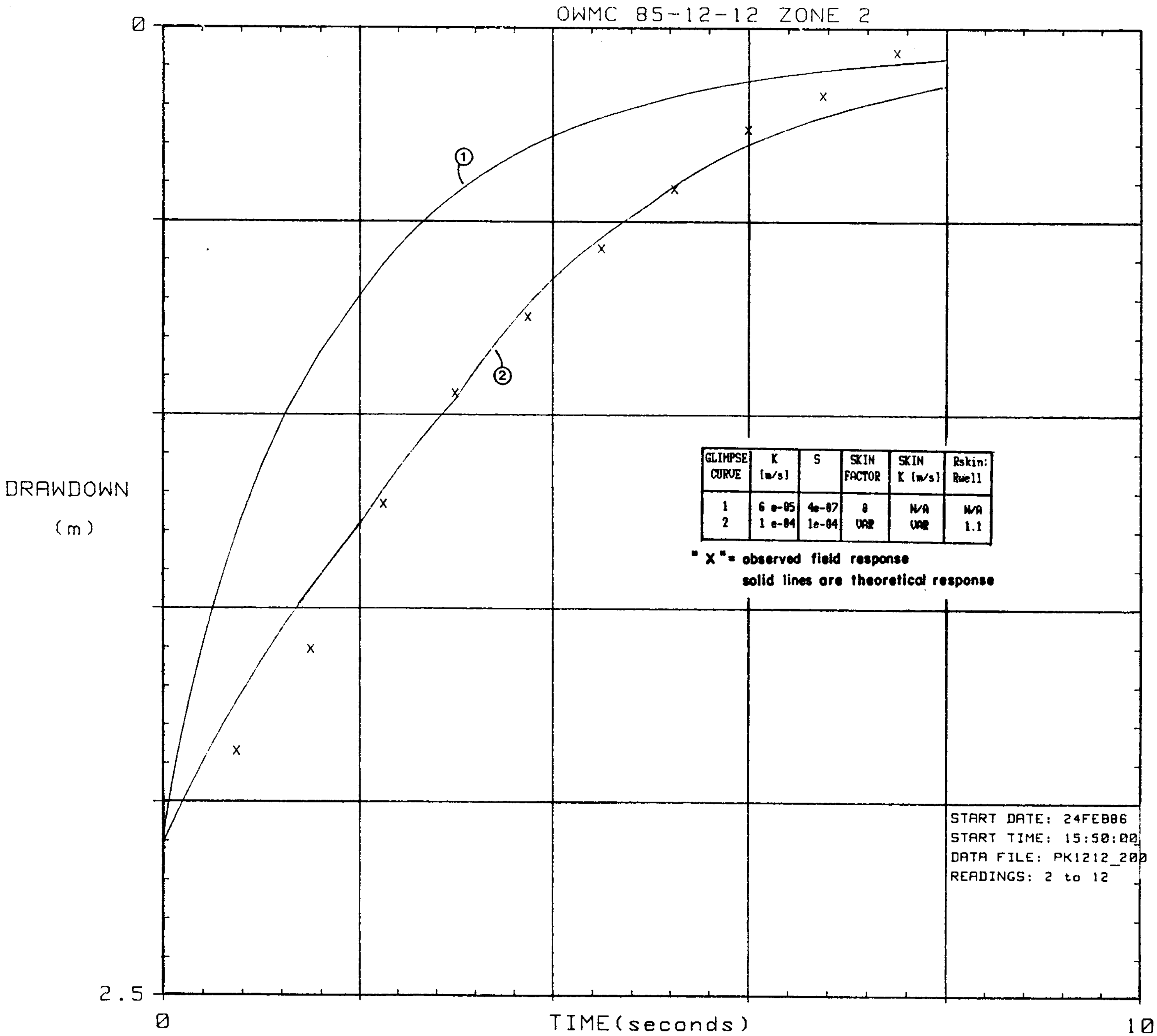
GLIMPSE CURVE	K (m/s)	S	SKIN FACTOR	SKIN K (m/s)	Rskin: Rwell
1	3.3e-07	4e-07	0	N/A	N/A
2	6 e-07	1e-04	10.9	5.2e-09	1.1
3	3.3e-07	6e-09	0	N/A	N/A

Figure G3-4
Glimpse Results For 85-12-12 Interval 1



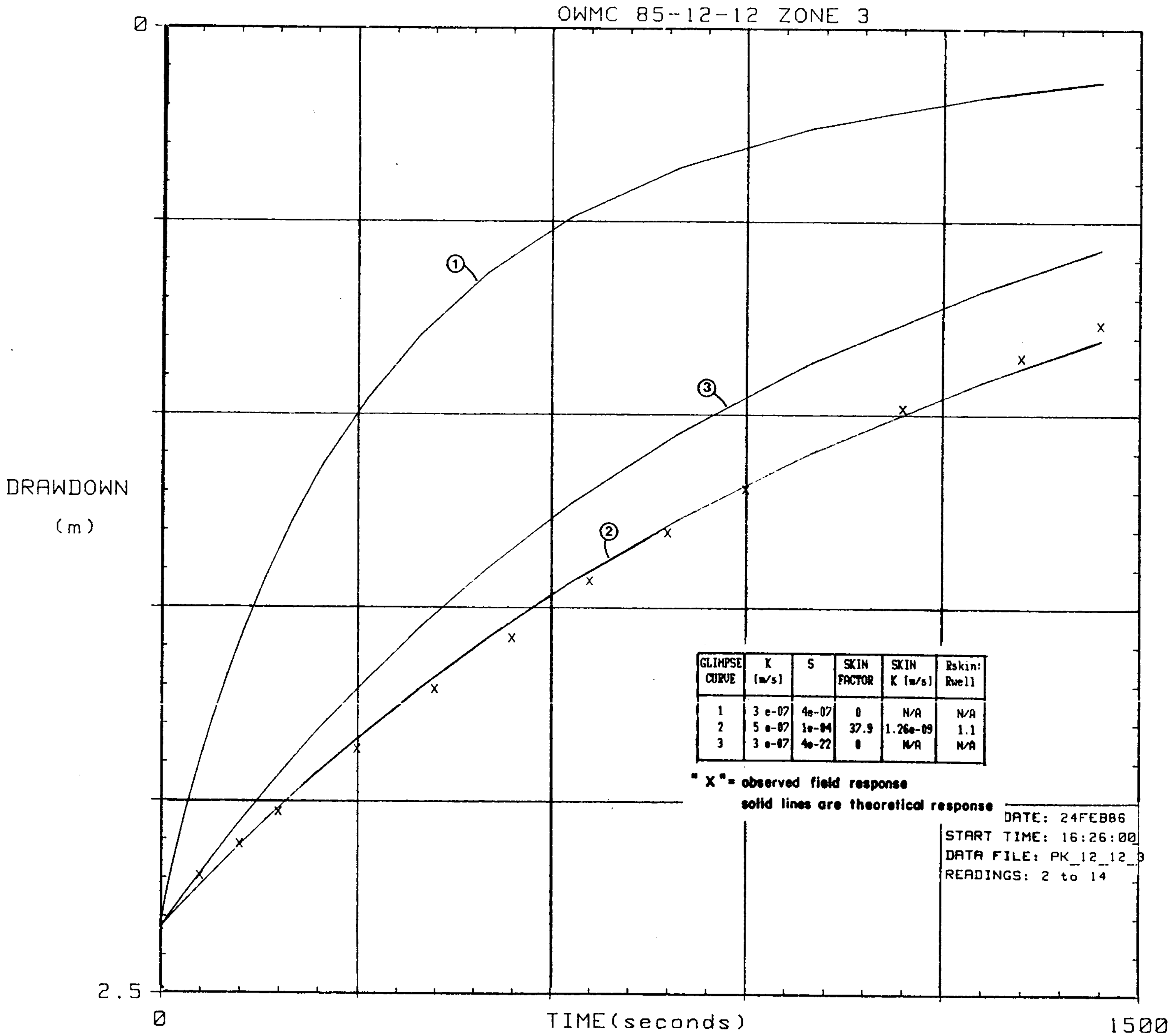
GLIMPSE CURVE	K (m/s)	S	SKIN FACTOR	SKIN K (m/s)	Rskin: Rwell
1	6 e-05	4e-07	0	N/A	1.1
2	2 e-04	1e-04	VAR	VARIABLE	1.1

Figure G3-5
Glimpse Results For 85-12-12 Interval 2



GLIMPSE CURVE	K (m/s)	S	SKIN FACTOR	SKIN K (m/s)	Rskin: Rwell
1	6 e-05	4e-07	0	N/A	N/A
2	1 e-04	1e-04	VAR	VAR	1.1

Figure G3-6
Glimpse Results For 85-12-12 Interval 3



GLIMPSE CURVE	K (m/s)	S	SKIN FACTOR	SKIN K (m/s)	Rskin: Rwell
1	3 e-07	4e-07	0	N/A	N/A
2	5 e-07	1e-04	37.9	1.26e-09	1.1
3	3 e-07	4e-22	0	N/A	N/A

G3.2 RESULTS

Table G3-1 summarizes the results of both the type curve and GLIMPSE model analyses performed on the packer test data. Also presented are static head measurements where these were available from the testing. The type curve results are taken from the Waterra Hydrogeology Inc. report (Section G3-4).

The values of >6E-5 m/s and <3E-11 m/s reported as hydraulic conductivities for the type-curve analysis respectively represent the upper and lower limits of this testing and analysis technique. Storativities were calculated from the type-curve analysis for selected intervals. It should be noted, however, that the results are relatively unreliable and have been included here only for completeness.

For borehole 85-1-12 interval 3 and borehole 85-12-12 interval 8, both constant head and slug test techniques were performed and analysed using the type-curve method. However, only the constant head result is reported here as Waterra Hydrogeology Inc. indicated it to be the more reliable result (Section G3.3).

Comparison of the results obtained from the two analysis techniques shows that the storativities obtained using the GLIMPSE simulation appear more reasonable. The values of hydraulic conductivity calculated by the type-curve method are generally less than about one-half order of magnitude lower than those obtained from the GLIMPSE simulation. This is within the normal range of accuracy in measuring hydraulic conductivity in the field and therefore results of the two analysis techniques are considered to be comparable. It should

TABLE G3-1: SUMMARY OF PACKER TEST ANALYSIS RESULTS

TEST INTERVAL NO.	ELEVATION (m ASL)	STATIC HEAD (m ASL)	TYPE-CURVE ANALYSIS HYDRAULIC COND. (m/s)	TYPE-CURVE ANALYSIS STORATIVITY	GLIMPSE ANALYSIS HYDRAULIC COND. (m/s)	GLIMPSE ANALYSIS STORATIVITY
BOREHOLE 85-1-12						
1	149.53-146.53	175.57	>6e-5	5.7e-22	2.0e-4	4.0e-7
2	146.53-143.53	176.84	>6e-5	5.7e-22		
3	143.53-140.53		1.7e-6			
4	140.53-137.53	176.95	1.7e-6	5.7e-4		
5	137.53-134.53	176.92	2.0e-5	5.7e-22	1.9e-5	4.0e-6
6	134.53-131.53		8.4e-9			
7	131.53-128.53		9.7e-9			
8	128.53-125.53		8.16-9			
9	125.53-122.53	177.20	3.3e-7	5.7e-9	6.0e-7	1.0e-4
BOREHOLE 85-12-12						
1	145.19-142.19	176.45	>6e-5		2.0e-4	1.0e-4
2	142.19-139.19	176.47	>6e-5		1.0e-4	1.0e-4
3	139.19-136.19		2.9e-7		5.0e-7	1.0e-4
4	136.19-133.19	176.46	1.0e-5			
5	133.19-130.19	176.64	>6e-5			
6	130.19-127.19	176.50	>6e-5			
7	127.19-124.19	176.60	1.9e-5			
8	124.19-121.19		9.0e-9			
9	121.19-118.19		7.5e-11			
10	118.19-115.19		>3e-11			
11	114.29-111.79	176.52	9.0e-6			

be recognized that values of hydraulic conductivity resulting from GLIMPSE simulation that are greater than 6E-5 m/s may be subject to inaccuracies resulting from limitations on the testing apparatus in high permeability formations, namely the minimum area available for flow. Consequently, the calculated value may be somewhat lower than the true formation hydraulic conductivity.

G3.3 WATERRA HYDROGEOLOGY INC. REPORT

Included in this section are copies of the report submitted to GLL by Waterra Hydrogeology Inc. The report consists of three letters to GLL, the contents of which are briefly summarized below:

1) February 14, 1986
   - Hydraulic testing procedures
   - Data analysis techniques
   - Results of testing in borehole 85-1-12
   - Slug test data (appended)

2) March 3, 1986
   - Results of testing in borehole 85-12-12
   - Slug test data (appended)

3) June 3, 1986
   - Amendments to earlier letters with respect to upper limit of hydraulic conductivity measurement

WATERRA
HYDROGEOLOGY INC.

February 14, 1986

Mr. Glen Reynolds
GaRTNER Lee Associates Ltd.
Toronto Buttonville Airport
Markham, Ontario, L3P 3J9

Dear Glen:

Attached are the results of the hydraulic tests that were conducted in borehole 85-1-12 at the OWMC site earlier this week.

Using a 3 metre packer spacing, nine seperate intervals of the bedrock formation were tested between a depth of 36 and 63 metres below the ground surface. Hydraulic conductivity values were determined using either the slug-test method or the constant-head test method depending on the permeability of the interval. A brief description of test procedures for these two methods is given below.

HYDRAULIC TESTING PROCEDURES

(1) Lower (or raise) straddle-packer assembly to desired position in borehole.

(2) Lower electronic pressure sensor inside 3/4 inch standpipe to a fixed position (20 metres below the ground surface) and install surface valve and pressure gauge assembly on the top end of the standpipe.

(3) Record the open hole water level and the corresponding pressure sensor output.

(4) Inflate both packers to hydraulically isolate the test interval.

(5) Monitor the pressure sensor output on the data logger and chart recorder. In permeable intervals, the pressure will quickly equilibrate to the static formation pressure. In low permeability intervals, the length of time required to reach equilibrium may exceed several hours or several days. For permeable intervals record equilibrated test interval pressure and conduct a slug-test to determine the hydraulic conductivity value. For the low permeability intervals, an accurate static level cannot be obtained. Conduct a constant-head test to determine the hydraulic conductivity value.

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301 Kent Street, Whitby, Ontario. L1N 4Y5

SLUG-TEST METHOD	CONSTANT-HEAD METHOD
(6) Open valve on top of standpipe. This will instantly release the gas pressure and drop the test interval pressure by 70 Kpa (7 m head)	(6) Open valve on top of standpipe to release gas pressure. Fill the standpipe with water.
(7) Monitor the pressure sensor output until the water level in the standpipe has fully recovered to the original static level	(7) Using a graduated cylinder, add water to the standpipe to maintain the water level flush with the top end of the pipe. Calculate and record the flowrate required to maintain this level.

(8) Deflate packers, remove pressure sensor and move packer assembly to next test interval.

DATA ANALYSIS

The slug test data was analysed using an analytical type-curve matching technique (Cooper et al, 1967). The hydraulic conductivity K is calculated using the formula

$$K = \frac{B\, r_c^2}{t\, b}$$

where B = match curve parameter
t = time match curve parameter
b = length of test interval
r_c = effective radius of standpipe (0.0095 m)

The storage coefficient S can be calculated using the formula

$$S = \alpha r_c^2 / r_s^2$$

where α = matched type curve
r_s = borehole radius

For the constant-head tests, the hydraulic conductivity value K is calculated using the steady-state formula

$$K = \frac{Q \ln(r_i/r_w)}{2\pi \Delta H L}$$

where Q = steady-state flowrate
r_i = radius of influence (5.0 m used for these tests)
r_w = radius of borehole
ΔH = Hydraulic head during injection of water (above static hydraulic head level)
L = length of test interval

A summary of test results is presented in Table 1. The slug-test data for tests No. 1,2,3,4,5, and 9 are plotted on semi-log graph paper (Figure 1) and are also tabulated in Appendix A.

Static hydraulic head values were obtained for intervals 1,2,4,5, and 9. These head values indicate that there is an upward hydraulic gradient component in the rock mass.

For the 9 intervals tested, hydraulic conductivity values ranged from a low of 8.1×10^{-9} m/s (test No. 8) to a high of 1.0×10^{-4}m/s (test No. 1 and 2). I believe these values represent the lower and upper limits of the testing system. Therefore, it is quite likely that the hydraulic conductivity of tests 1 and 2 exceeds 1.0×10^{-4}m/s. Similarly, for tests 6,7, and 8, the hydraulic conductivity could be lower than 8×10^{-9}m/s. Modifications to the testing system would be required to expand the range of hydraulic conductivity measurements.

For test No. 3 (42.0 - 45.0 mbgs) a slug test and a constant-head test were performed. The hydraulic conductivity determined from the slug test was 100 times lower than that of the constant-head test. From the shape of the slug test curve (Figure 1) it is apparent that this interval has an unusually high storage coefficient (5.7×10^{-1}). This suggests the presence of a gas phase in the formation. If this is the case, the higher hydraulic conductivity obtained using the constant head method may be explained by the fact that, under higher testing pressure (approximately 170 kPa), the gas phase would compress and therefore, the hydraulic conductivity would be greater. For this reason, I believe that the constant-head test results are more reliable.

I trust that the information presented here satisfies your requirements. Please call me if you need any clarification or additional information.

Yours sincerely,

R.L. Nadon
Hydrogeologist

WATERRA HYDROGEOLOGY INC.

REFERENCE

Hilton H. Cooper, Bredehoeft, J.D., Papadapulos, I.S.
Response of a Finite-Diameter Well to an Instantaneous Charge of Water. Water Resources Research, Vol.3, No. 1, 1967.

TABLE 1
HYDRAULIC TEST RESULTS

BOREHOLE: 85-1-12
DATE TESTED: FEB. 10, 11, 12, 1986

TEST No.	TEST INTERVAL BELOW G.S (m)	STATIC HEAD BELOW G.S. (m)	SLUG TEST MATCH POINT			CONSTANT HEAD TEST		HYD. CONDUCTIVITY (m/s)	STORAGE COEFFICIENT
			α	β	t (s)	Q (ml/s)	ΔH (m)		
1	36.0 - 39.0	9.96	10^{-20}	1	0.3	—	—	1.0×10^{-4}	5.7×10^{-22}
2	39.0 - 42.0	8.69	10^{-20}	1	0.3	—	—	1.0×10^{-4}	5.7×10^{-22}
3	42.0 - 45.0	—	10^{1}	1	16800.0	—	—	1.8×10^{-9}	5.7×10^{-1}
						6.66	10.34	1.7×10^{-7}	—
4	45.0 - 48.0	8.58	10^{-2}	1	17.5	—	—	1.7×10^{-6}	5.7×10^{-4}
5	48.0 - 51.0	8.61	10^{-20}	1	1.5	—	—	2.0×10^{-5}	5.7×10^{-22}
6	51.0 - 54.0	—	—	—	—	0.33	10.13	$< 8.4 \times 10^{-9}$	—
7	54.0 - 57.0	—	—	—	—	0.38	10.13	$< 9.7 \times 10^{-9}$	—
8	57.0 - 60.0	—	—	—	—	0.32	10.13	$< 8.1 \times 10^{-9}$	—
9	60.0 - 63.0	8.33	10^{-7}	1	90.0	—	—	3.3×10^{-7}	5.7×10^{-9}

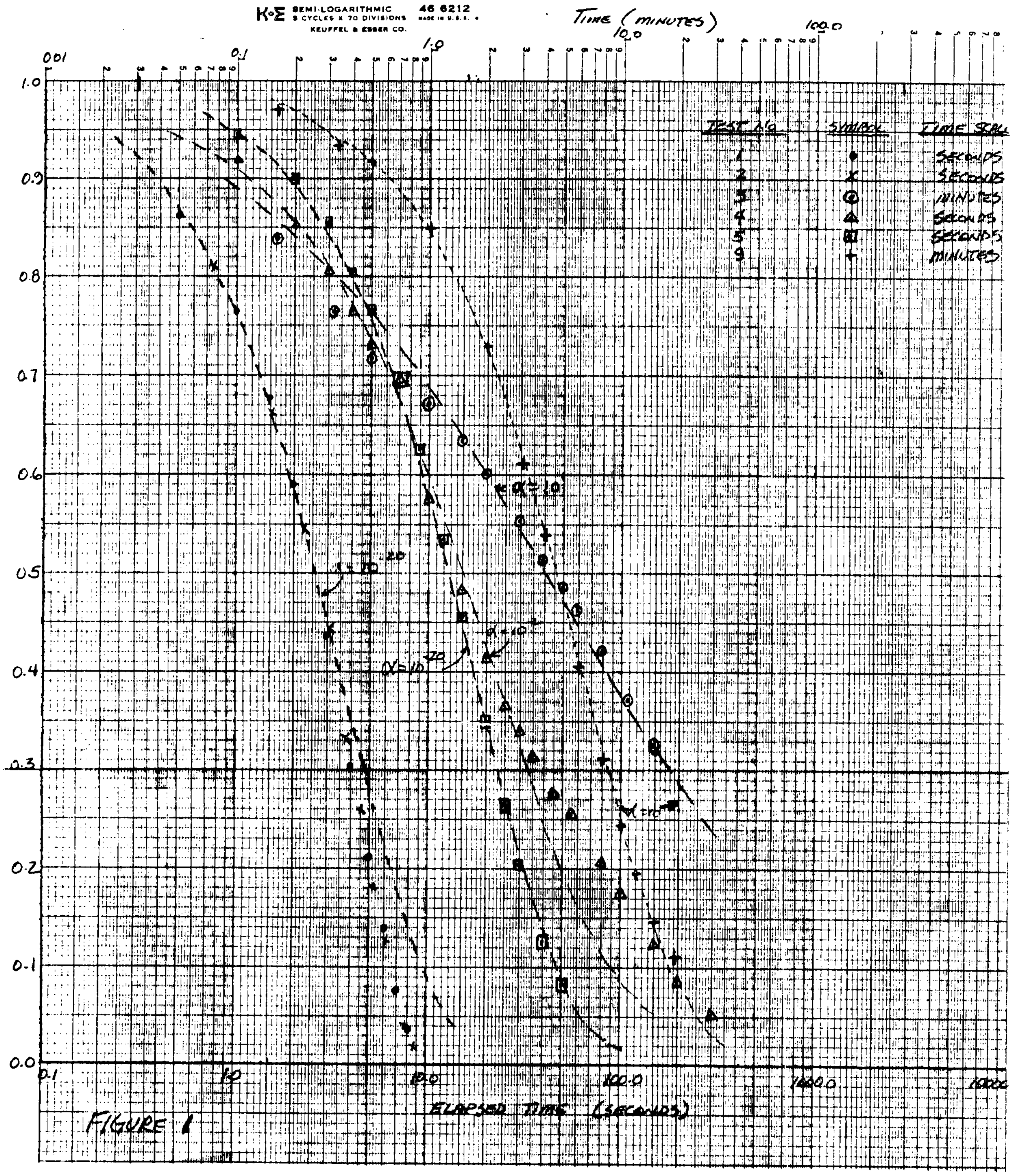
K·Σ SEMI-LOGARITHMIC 3 CYCLES X 70 DIVISIONS KEUFFEL & ESSER CO.
46 6212
TIME (MINUTES)
TEST NO.
SYMBOL
TIME SCALE
1 SECONDS
2 SECONDS
3 MINUTES
4 SECONDS
5 SECONDS
9 MINUTES
ELAPSED TIME (SECONDS)

FIGURE 1

APPENDIX A

SLUG TEST DATA

BOREHOLE No.: 85-1-12 TEST No: 1 TEST INTERVAL: 36 - 39 m Below Gr. Surf.

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-12 REFERENCE POINT: Ground Surface

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_o}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
12:20:00	-3.0	744.1	—	—	—	
12:21:00	-2.0	744.3	—	—	—	
12:22:00	-1.0	744.8	—	—	—	
12:22:30	-0.5	745.0	—	—	—	
12:22:50	-0.166	745.1	—	—	—	
12:23:00	0	480.1	265	1.0		
	(SECONDS)					
	0.5	516.4	228.7	0.862		
	1.0	542.6	202.5	0.764		
	1.5	565.1	180.0	0.679		
	2.0	588.6	156.5	0.590		
	3.0	629.1	116.0	0.438		
	4.0	664.6	80.5	0.304		
	5.0	689.1	56.0	0.211		
	6.0	708.1	37.0	0.140		
	7.0	724.6	20.5	0.077		
12:23:08	8.0	735.1	10.0	0.038		

BOREHOLE No.: 85-1-12 TEST No: 2 TEST INTERVAL: 39 - 42 m Below Gr. Surf.

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-10 REFERENCE POINT: Ground Surface

TIME hr:min:sec	TIME elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_o}$	TEMP. mv	
	Seconds					
	-75	803.0	—	—		
	-0.1	803.0	—	—		
	0	558.0	245.0	1.0		
	0.75	604	199	0.812		
	1.50	640	163	0.665		
	2.25	670	133	0.543		
	3.00	697	106	0.433		
	3.75	722	81	0.331		
	4.50	740	63	0.257		
	5.25	759	44	0.179		
	6.00	773	30	0.122		
	6.75	785	18	0.073		
	7.50	794	9	0.037		
	8.25	800	3	0.012		

BOREHOLE No.: 85-1-12 TEST No: 3 TEST INTERVAL: 42-45m Below Gr. Surf.

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-12 REFERENCE POINT: GROUND SURFACE

TIME hr:min:sec	TIME elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_0}$	TEMP. mv	
11:27:00	-	775.8	—	—		
11:32:00	-5.0	769.0	—	—		
11:36:00	-1.0	765.3	—	—		
11:36:30	-0.5	765.0	—	—		
11:36:50	-0.166	764.6	—	—		
11:37:00	0	493.2	271.4	1.0		
	0.166	536.4	228.2	0.84		
	0.333	557.4	207.2	0.763		
	0.50	569.5	195.1	0.719		
11:38:00	1.0	582.3	182.3	0.672		
	1.5	592.6	172.0	0.634		
	2.0	601.4	163.2	0.601		
11:40:00	3.0	614.5	150.1	0.553		
	4.0	624.3	140.3	0.517		
	5.0	632.3	132.3	0.487		
11:43:00	6.0	639.1	125.5	0.462		
	8.0	650.3	114.3	0.421		
11:48:00	11.0	663.8	100.8	0.371		
11:52:00	15.0	676.2	88.4	0.326		

BOREHOLE No.: 85-1-12 TEST No: 4 TEST INTERVAL: 45.0 - 48.0

TEST ZONE VOL.: — PISTON VOL.: — METRES B.G.S

DATE TESTED: 86-02-11 REFERENCE POINT: GROUND SURFACE

TIME hr:min:sec	TIME elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_0}$	TEMP. mv	
10:30:00	-10.0	814.2	—	—		
10:35:00	-5.0	809.2	—	—		
10:39:00	-1.0	808.6	—	—		
10:39:30	-0.5	808.5	—	—		
10:39:50	-0.166	808.5	—	—		
10:40:00	0	547.9	260.6	1.0		
	SECONDS					
	1.0	568.4	240.1	0.920		
	2.0	585.9	222.6	0.853		
	3.0	597.9	210.6	0.807		
	4.0	608.9	199.6	0.765		
	5.0	617.9	190.6	0.731		
	7.0	625.9	182.6	0.699		
	10.0	657.9	150.6	0.577		
	15.0	682.9	125.6	0.482		
	20.0	700.9	107.6	0.413		
	25.0	712.9	95.6	0.367		
	30.0	719.9	88.6	0.340		
	35.0	726.9	81.6	0.313		
	45.0	735.9	72.6	0.278		
	55.0	741.9	66.6	0.256		
	80.0	754.5	54.0	0.207		
	100.0	762.6	45.9	0.176		
10:43:20	200.0	785.6	22.9	0.087		
	150.0	776.8	31.7	0.122		
	300.0	794.9	13.6	0.052		

BOREHOLE No.: 85-1-12 TEST No: 5 TEST INTERVAL: 48.0-51.0 m Below G.S.

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-11 REFERENCE POINT: Ground Surface

TIME hr:min:sec	elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_0}$	TEMP. mv	
11:29:00	-3.0	806.7	—			
11:31:00	-1.0	806.0	—			
11:31:30	-0.5	805.3	—			
11:31:50	-0.166	805.2	—			
11:32:00	0	525.2	280	1.0	—	
	(SECONDS)					
	1	540.2	265	0.946		
	2	553.2	252	0.900		
	3	565.2	240	0.857		
	4	579.7	225.5	0.805		
	5	590.2	215	0.768		
	7	610.2	195	0.696		
	9	629.2	176	0.628		
	12	655.2	150	0.535		
	15	677.2	128	0.457		
	20	707.2	98	0.350		
	25	730.2	75	0.267		
	30	748.2	57	0.204		
	40	770.2	35	0.125		
	50	782.2	23	0.082		

BOREHOLE No.: 85-1-12 TEST No: 9 TEST INTERVAL: 60m-63m Below G.S.

TEST ZONE VOL.: —— PISTON VOL.: ——

DATE TESTED: 86-02-12 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_o}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
10:00:00	-10.0	822.8	—			
10:05:00	-5.0	828.9	—			
10:09:00	-1.0	827.8	—			
10:09:30	-0.5	827.6	—			
10:09:50	-0.166	827.3	—			
10:10:00	0	493.3	334	1.0		
	0.166	502.8	324.5	0.971		
	0.333	512.1	315.2	0.934		
	0.500	520.3	307.0	0.919		
	1.00	543.3	284.0	0.850		
	2.00	583.3	244	0.730		
	3.066	622.9	204.4	0.612		
	4.0	647.0	180.3	0.540		
	6.0	691.9	135.4	0.405		
	8.0	723.2	104.1	0.311		
	10.0	745.7	81.6	0.244		
	12.0	761.9	65.4	0.196		
	15.0	778.3	49.0	0.147		
	19.0	790.5	36.8	0.110		

WATERRA
HYDROGEOLOGY INC.

March 3, 1986

Mr. Glen Reynolds
Gartner Lee Associates Ltd.
Toronto Buttonville Airport
Markham, Ontario, L3P 3J9

Dear Glen:

Attached are the results of the hydraulic tests that were conducted in borehole 85-12-12 at the OWMC site on February 24 & 25, 1986. The procedures used for testing this borehole were the same as those used for borehole 85-1-12 which are described in my letter of Feb. 14, 1986.

Eleven tests were performed in borehole 85-12-12 at 3-metre intervals between a depth of 39 and 72.4 metres below the ground surface. Where possible, static hydraulic heads were determined and hydraulic conductivity measured by either the slug-test or constant-head test methods. The methods used to analyse the data are described in my letter of Feb. 14, 1986.

The test results are summarised in Table 1. The data for the nine slug tests performed in BH 85-12-12 are plotted on a semi-log graph (Figure 1) and are also listed in seperate tables in Appendix A.

For four test intervals (No. 1,2,4, and 5) hydraulic conductivity values equalled or exceeded the upper limit of the test system (approximately 1 x 10^{-5} m/s). You will note that for tests No. 9 and 10, hydraulic conductivity values lower than 10^{-10} m/s were measured. These low values indicate that the lower limit of the testing system is approximately 3 x 10^{-11} m/s. Therefore, for tests No. 6,7, and 8 performed in borehole 85-1-12, the hydraulic conductivities listed in Table 1 (letter of Feb. 14, 1986) are more likely representative of the formation permeability rather than the lower limit of the testing system (due to rod leakage) as was originally thought to be the case.

I trust that the information presented here satisfies your requirements. Please contact me if you have any questions.

R.L. Nadon
Hydrogeologist

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TABLE 1

HYDRAULIC TEST RESULTS BOREHOLE 85-12-12

TEST No.	INTERVAL M.B.G.S.*	STATIC HEAD M.B.G.S.*	SLUG TEST PARAMETERS α	β	t(s)	CONSTANT HEAD TEST Q(ml/s)	ΔH (m)	HYDRAULIC CONDUCTIVITY (m/s)
1	39.0-42.0	7.74	—	—	—	—	—	> 1×10^{-5}
2	42.0-45.0	7.72	—	—	—	—	—	> 1×10^{-5}
3	45.0-48.0	—	10^{-20}	1	103.2	—	—	2.9×10^{-7}
4	48.0-51.0	7.73	10^{-20}	1	3.0	—	—	1.0×10^{-5}
5	51.0-54.0	7.55	—	—	—	—	—	> 1×10^{-5}
6	54.0-57.0	7.69	—	—	—	—	—	> 1×10^{-5}
7	57.0-60.0	7.59	10^{-20}	1	1.6	—	—	1.9×10^{-5}
8	60.0-63.0	—	10^{-5}	1	768.0	—	—	3.9×10^{-8}
			—	—	—	0.317	8.15	9.0×10^{-9}
9	63.0-66.0	—	—	—	—	0.0027	8.97	7.5×10^{-11}
10	66.0-69.0	—	—	—	—	<0.001	8.86	<2.9×10^{-11}
11	69.9-72.4	7.67	10^{-20}	1	4.0	—	—	9.0×10^{-6}

*M.B.G.S = METRES BELOW GROUND SURFACE

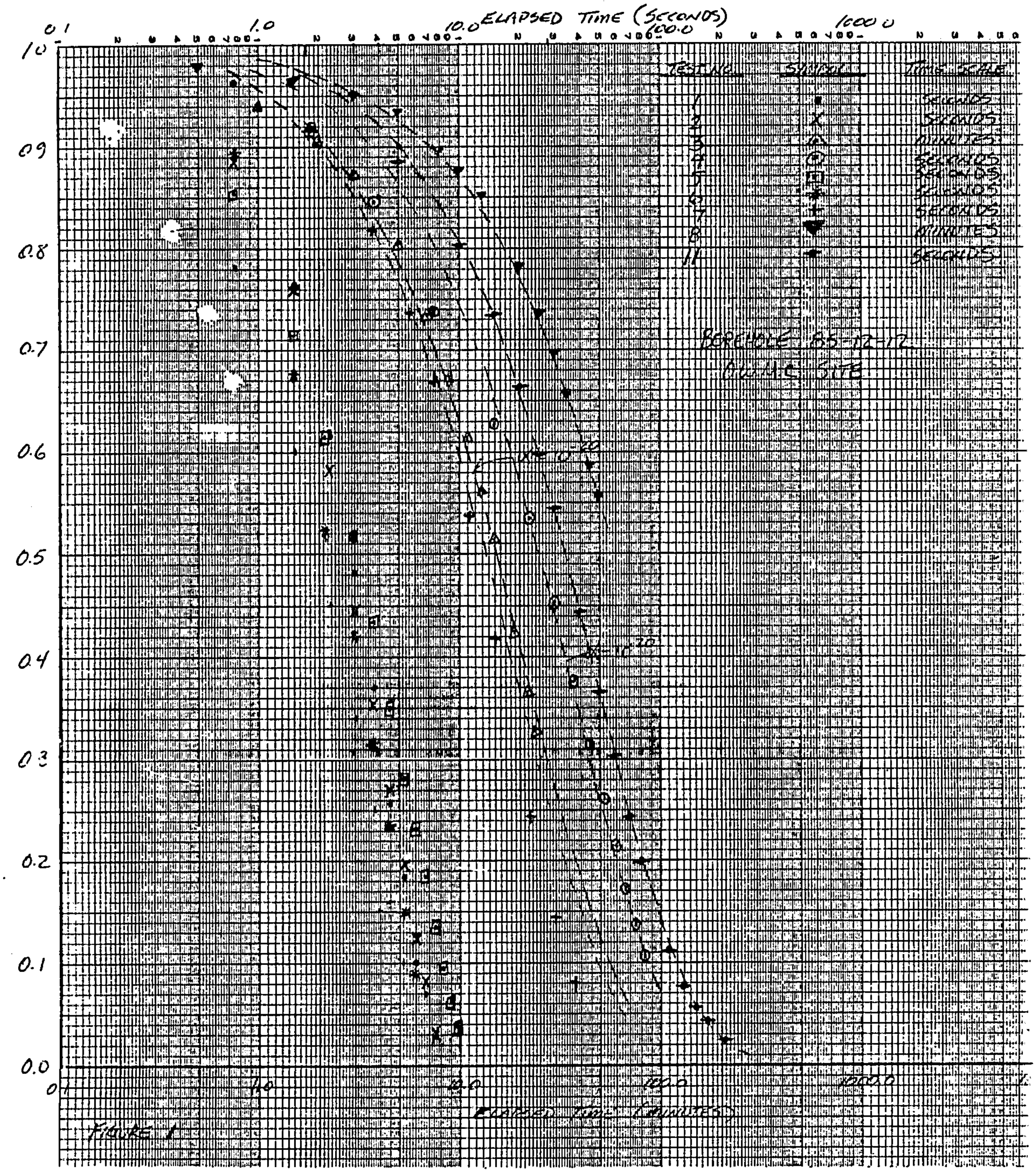

ELAPSED TIME (SECONDS)
0.1
1.0
10.0
100.0
1000.0
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TESTING
SYMBOL
TIME SCALE
SECONDS
MINUTES
BOREHOLE 85-12-12
CUMC SITE
ELAPSED TIME (MINUTES)
FIGURE 1

FIGURE 1

APPENDIX A

SLUG TEST DATA

BOREHOLE No.: 85-12-12 TEST No: 1 TEST INTERVAL: 39 - 42

TEST ZONE VOL.: — PISTON VOL.: — MBGS

DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURF.

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_0}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
15:15	-5.0	854.9	—	—		
15:19	-1.0	854.8	—	—		
15:19:50	-0.1	854.8	—	—		
15:20	0	773.8	81	1.0		
	(SECONDS)					
	0.75	779.8	75	0.962		
	1.5	792.8	62	0.765		
	2.25	804.8	50	0.617		
	3.0	815.8	39	0.481		
	3.75	824.8	30	0.370		
	4.50	833.8	21	0.259		
	5.25	839.8	15	0.185		
	6.00	844.8	10	0.123		
	6.75	847.8	7	0.086		
	7.50	852.3	2.5	0.030		

BOREHOLE No.: 85-12-12 TEST No: 2 TEST INTERVAL: 42-45 MBGS
TEST ZONE VOL.: — PISTON VOL.: —
DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_0}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
15:47:00	-3.0	852.8	—			
15:49:00	-1.0	852.8	—			
15:49:50	-0.166	852.8	—			
15:50	0	756.8	96	1.0		
	(SECONDS)					
	0.75	767.8	85	0.885		
	1.5	779.8	73	0.760		
	2.25	796.8	56	0.583		
	3.0	809.8	43	0.448		
	3.75	818.8	34	0.354		
	4.50	826.8	26	0.271		
	5.25	833.8	19	0.198		
	6.0	840.8	12	0.125		
	6.75	844.8	8	0.083		
	7.5	849.8	3	0.031		

BOREHOLE No.: 85-12-12 TEST No: 3 TEST INTERVAL: 45-48 mBGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURFACE

TIME hr:min:sec	TIME elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_o}$	TEMP. mv	
16:25:00	-1.0	850.9	—			
16:25:50	-0.166	850.8				
16:26	0	745.0	105.8	1.0		
16:27	1	751.0	99.8	0.94		
	2	754.7	96.1	0.908		
	3	758.5	92.3	0.872		
	5	765.9	84.9	0.802		
	7	773.0	77.8	0.735		
	9	779.6	71.2	0.673		
	11	785.7	65.1	0.615		
	13	791.4	59.4	0.561		
	15	796.5	54.3	0.515		
	19	806.0	44.8	0.423		
	22	812.0	38.8	0.367		
16:50.00	24	815.9	34.9	0.329		

BOREHOLE No.: 85-12-12 TEST No: 4 TEST INTERVAL: 48 - 51 m BGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_o}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
17:10:00	-2.0	853.5	—			
17:11:00	-1.0	853.4				
17:12:00	0	563.4	290	1.0		
	SECONDS					
	3.75	608.4	245	0.845		
	1.875	586.4	267	0.920		
	7.5	639.4	214	0.738		
	15.0	671.4	182	0.628		
	22.5	698.4	155	0.534		
	30.0	722.4	131	0.452		
	37.5	743.4	110	0.379		
	45.0	762.4	91	0.314		
	52.5	777.4	76	0.262		
	60.0	791.4	62	0.214		
	67.5	803.4	50	0.172		
	75.0	813.4	40	0.138		
	82.5	822.4	31	0.107		

BOREHOLE No.: 85-12-12 TEST No: 5 TEST INTERVAL: 51-54 mBGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_0}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
17:40:00	-3.0	858.0	—			
17:42:00	-1.0	858.6	—			
17:42:50	-0.166	858.8				
17:43	0	598.8	260	1.0		
	SECONDS					
	0.75	636.8	222	0.853		
	1.50	672.8	186	0.715		
	2.25	698.8	160	0.615		
	3.0	723.8	135	0.519		
	3.75	745.8	113	0.435		
	4.5	767.8	91	0.350		
	5.25	785.8	73	0.281		
	6.0	798.8	60	0.231		
	6.75	810.8	48	0.185		
	7.50	823.8	35	0.135		
	8.25	833.8	25	0.096		
	9.00	842.8	16	0.061		
	9.75	848.8	10	0.038		

BOREHOLE No.: 85-12-12 TEST No: 6 TEST INTERVAL: 54-57 mBGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-24 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_o}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
18:05:50	-0.166	853.3				
18:06	0	713.3	140	1.0		
	SECONDS					
	0.75	728.3	125	0.893		
	1.5	758.3	95	0.678		
	2.25	780.3	73	0.521		
	3.0	794.3	59	0.421		
	3.75	809.3	44	0.314		
	4.5	820.3	33	0.236		
	5.25	832.3	21	0.15		
	6.0	840.3	13	0.092		
	6.75	847.3	6	0.043		

BOREHOLE No.: 85-12-12 TEST No: 7 TEST INTERVAL: 57-60m mBGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-25 REFERENCE POINT: GROUND SURFACE

TIME hr:min:sec	TIME elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_0}$	TEMP. mv	
18:22:00	-1.0	855.2	—			
18:22:50	-0.166	855.1	—			
18:23:00	0	695.1	160.0	1.0		
	(SECONDS)					
	1.875	708.1	147.0	0.919		
	3.75	724.1	131.0	0.819		
	5.625	737.1	118.0	0.737		
	7.5	748.1	107.0	0.669		
	11.25	769.1	86.0	0.537		
	15.0	788.1	67.0	0.419		
	22.5	816.1	39.0	0.244		
	30.0	832.1	23.0	0.144		
	37.5	842.1	13.0	0.081		

BOREHOLE No.: 85-12-1 TEST No: 8 TEST INTERVAL: 60 - 63 mBGS
TEST ZONE VOL.: — PISTON VOL.: —
DATE TESTED: 86-02-25 REFERENCE POINT: GROUND SURFACE

TIME		PRESSURE	ΔP_2	$\Delta P_2/\Delta P_{2_o}$	TEMP.	
hr:min:sec	elap. (min)	P_2 mv	mv		mv	
9:10:00	-5.0	845.1	—			
9:12:00	-3.0	841.2	—			
9:14:00	-1.0	837.6	—			
9:14:50	-0.166	836.3	—			
9:15:00	0	799.7	36.6	1.0		
	0.5	800.4	35.9	0.980		
	1.5	801.0	35.3	0.964		
	3.0	801.5	34.8	0.950		
	5.0	802.1	34.2	0.934		
	8.0	803.5	32.8	0.896		
	10.0	804.2	32.1	0.877		
	13.0	805.1	31.2	0.852		
	20.0	807.7	28.6	0.781		
	25.0	809.3	27.0	0.737		
	30.0	810.8	25.5	0.696		
	35.0	812.2	24.1	0.658		
	45.0	815.1	21.2	0.589		
	50.0	816.3	20.0	0.556		

BOREHOLE No.: 85-12-12 TEST No: 11 TEST INTERVAL: 69.9–72.4 m BGS

TEST ZONE VOL.: — PISTON VOL.: —

DATE TESTED: 86-02-25 REFERENCE POINT: GROUND SURFACE

TIME hr:min:sec	elap. (min)	PRESSURE P_2 mv	ΔP_2 mv	$\Delta P_2/\Delta P_{2_0}$	TEMP. mv	
17:29:00	-2.0	871.3	—	—		
17:30:00	-1.0	866.0	—	—		
17:30:50	-0.166	865.5	—	—		
17:31:00	0	784.6	80.9	1.0		
	~~0.7~~ SECONDS					
	5	793.8	71.7	0.886		
	10	800.5	65	0.803		
	15	806.0	59.5	0.735		
	20	811.8	53.7	0.664		
	25	817	48.5	0.599		
	30	821.5	44.0	0.544		
	40	829.6	35.9	0.444		
	50	835.9	29.6	0.366		
	60	841.1	24.4	0.302		
	70	845.8	19.7	0.244		
	80	849.3	16.2	0.200		
	110	856.4	9.1	0.112		
	130	859.2	6.3	0.078		
	150	860.9	4.6	0.057		
	170	862.0	3.5	0.043		
	200	863.5	2.0	0.025		

WATERRA
HYDROGEOLOGY INC.

RECEIVED
JUN 19 1986
GARTNER LEE
ASSOCIATES LIMITED

June 16, 1986

Mr. S. Hollinghead
GARTNER LEE ASSOCIATES
Toronto Buttonville Airport
Markham, Ontario
L3P 3J9

Dear Mr. Hollingshead:

As you requested, I have reviewed the borehole hydraulic test data collected at the West Lincoln Site to determine the upper limit of the packer probe system for measuring hydraulic conductivity.

Based on this review, I recommend that hydraulic conductivity values for tests No. 1 and 2 (borehole 85-1-12, letter of Feb. 14, 1986) and tests 1, 2, 5, and 6 (borehole 85-12-12, letter of March 3, 1986) be listed as greater than 5×10^{-5} m/s. The permeability of the above six test zones is greater than this upper limit and too high for the testing system to accurately quantify.

Please call me if you have any other questions.

Yours sincerely,

R.L. Nadon
WATERRA HYDROGEOLOGY INC.

~~1262 DON MILLS ROAD, SUITE 31, NORTH YORK, ONTARIO M3B 2W7 (416) 444-0083~~
301 Kent Street, Whitby, Ontario L1N 4Y5 (416) 666-3467

G4 PUMP TESTING

A pump test was performed in borehole 85-1-22 to determine the hydraulic conductivity of the shallow bedrock aquifer, identified as Zone A. This section describes the analysis and results of the pump test.

G4.1 DATA COLLECTION AND ANALYSIS

The techniques used to perform and collect data from the pump test at the Preferred Site are described in Appendix A3.4 of this report.

The responses measured in the pumping well and at two observation wells were analysed using the Theis method for pumping test data analysis. The method of solution is presented in Kruseman and de Ridder (1970).

G4.2 RESULTS

Data obtained from the pumping test are presented in Tables G4-1 to G4-3. Both pumping and recovery data are included. Selected data from these tables were analysed using the technique identified in Kruseman and de Ridder (1970). The type curves, associated match points, and calculations for each of these analyses are shown in Figures G4-1 to G4-3. The symbol "x" on each plot represents the observed response to pumping, while the solid line is the match plot used for analysis. The results of the pump test analyses are summarized below.

MONITOR NUMBER	DISTANCE FROM PUMPED WELL (m)	TRANSMISSIVITY T (m /s)	STORATIVITY S
85-1-22	-	2.2E-3	-
85-1-12	3.3	1.8E-3	5.8E-4
85-1-1	6.1	2.0E-3	6.7E-5

JOB NAME : OWMC 85-1-22 PUMPED WELL

READING #	READING DESCRIPTION	DATE (DDMMMYY)	TIME (HH:MM:SS)	DEPTH TO WATER (m)
1	START PUMP (Q=7E-4 m^3/s) @ STATIC	22APR86	16:33:00	9.94
2	PUMPING	22APR86	16:33:30	10.09
3	PUMPING	22APR86	16:33:40	10.09
4	PUMPING	22APR86	16:33:50	10.12
5	PUMPING	22APR86	16:34:00	10.10
6	PUMPING	22APR86	16:34:30	10.11
7	PUMPING	22APR86	16:35:00	10.12
8	PUMPING	22APR86	16:35:30	10.13
9	PUMPING	22APR86	16:36:30	10.14
10	PUMPING	22APR86	16:38:00	10.15
11	PUMPING	22APR86	16:40:00	10.16
12	PUMPING	22APR86	16:43:00	10.17
13	PUMPING	22APR86	16:48:00	10.18
14	PUMPING	22APR86	16:58:00	10.19
15	PUMPING	22APR86	17:18:00	10.20
16	PUMPING	22APR86	18:33:00	10.23
17	PUMPING	22APR86	19:33:00	10.25
18	PUMPING	23APR86	08:00:00	10.25
19	PUMPING	23APR86	09:00:00	10.28
20	PUMPING	23APR86	10:15:00	10.28
21	END OF PUMPING	23APR86	10:45:00	10.28

Table G4-1

Pumping Test Data For Pumping Well 85-1-22

JOB NAME : OWMC PUMPTEST LONG 85-1-12

READING #	READING DESCRIPTION	DATE (DDMMMYY)	TIME (HH:MM:SS)	DEPTH TO WATER (m)
1	START PUMP (Q=7E-4 m^3/s) @ STATIC	22APR86	16:33:00	10.00
2	PUMPING	22APR86	16:33:10	10.12
3	PUMPING	22APR86	16:33:20	10.09
4	PUMPING	22APR86	16:33:30	10.11
5	PUMPING	22APR86	16:33:50	10.11
6	PUMPING	22APR86	16:34:00	10.11
7	PUMPING	22APR86	16:34:30	10.13
8	PUMPING	22APR86	16:35:00	10.14
9	PUMPING	22APR86	16:35:30	10.14
10	PUMPING	22APR86	16:36:00	10.15
11	PUMPING	22APR86	16:37:00	10.16
12	PUMPING	22APR86	16:38:00	10.17
13	PUMPING	22APR86	16:40:00	10.18
14	PUMPING	22APR86	16:53:00	10.21
15	PUMPING	22APR86	16:58:00	10.21
16	PUMPING	22APR86	17:03:00	10.21
17	PUMPING	22APR86	17:18:00	10.22
18	PUMPING	22APR86	17:33:00	10.23
19	PUMPING	22APR86	18:33:00	10.26
20	PUMPING	22APR86	19:33:00	10.27
21	PUMPING	22APR86	20:33:00	10.28
22	PUMPING	22APR86	22:33:00	10.28
23	PUMPING	23APR86	08:00:00	10.26
24	PUMPING	23APR86	09:00:00	10.30
25	END PUMPING	23APR86	10:45:00	10.30
26	RECOVERY	23APR86	10:45:10	10.20
27	RECOVERY	23APR86	10:45:20	10.25
28	RECOVERY	23APR86	10:45:30	10.20
29	RECOVERY	23APR86	10:45:40	10.20
30	RECOVERY	23APR86	10:45:50	10.18
31	RECOVERY	23APR86	10:46:30	10.16
32	RECOVERY	23APR86	10:47:00	10.15
33	RECOVERY	23APR86	10:47:30	10.14
34	RECOVERY	23APR86	10:48:00	10.13
35	RECOVERY	23APR86	10:49:00	10.12
36	RECOVERY	23APR86	10:52:00	10.11
37	RECOVERY	23APR86	10:55:00	10.10
38	RECOVERY	23APR86	11:05:00	10.09
39	RECOVERY	23APR86	11:15:00	10.09
40	RECOVERY	23APR86	11:45:00	10.07
41	RECOVERY	23APR86	12:15:00	10.04

Table G4-2

Pumping Test Data For Observation Well 85-1-12

JOB NAME : OWMC PUMPTEST 85-1-1 LONG

READING #	READING DESCRIPTION	DATE (DDMMMYY)	TIME (HH:MM:SS)	DEPTH TO WATER (m)
1	START PUMPING (Q=7E-4 m^3/s)	22APR86	16:33:00	9.58
2	PUMPING	22APR86	16:33:10	9.71
3	PUMPING	22APR86	16:33:20	9.70
4	PUMPING	22APR86	16:33:40	9.70
5	PUMPING	22APR86	16:33:50	9.71
6	PUMPING	22APR86	16:34:00	9.72
7	PUMPING	22APR86	16:34:30	9.73
8	PUMPING	22APR86	16:35:00	9.73
9	PUMPING	22APR86	16:35:30	9.74
10	PUMPING	22APR86	16:36:00	9.75
11	PUMPING	22APR86	16:38:00	9.76
12	PUMPING	22APR86	16:40:00	9.78
13	PUMPING	22APR86	16:43:00	9.78
14	PUMPING	22APR86	16:48:00	9.79
15	PUMPING	22APR86	16:53:00	9.80
16	PUMPING	22APR86	17:18:00	9.81
17	PUMPING	22APR86	17:33:00	9.82
18	PUMPING	22APR86	17:33:00	9.82
19	PUMPING	22APR86	18:33:00	9.85
20	PUMPING	22APR86	19:33:00	9.87
21	PUMPING	22APR86	20:33:00	9.87
22	PUMPING	23APR86	08:00:00	9.86
23	PUMPING	23APR86	09:00:00	9.90
24	END PUMPING	23APR86	10:45:00	9.90
25	RECOVERY	23APR86	10:45:10	9.80
26	RECOVERY	23APR86	10:45:20	9.80
27	RECOVERY	23APR86	10:45:50	9.78
28	RECOVERY	23APR86	10:46:00	9.75
29	RECOVERY	23APR86	10:47:00	9.74
30	RECOVERY	23APR86	10:48:00	9.73
31	RECOVERY	23APR86	10:49:00	9.72
32	RECOVERY	23APR86	10:50:00	9.71
33	RECOVERY	23APR86	10:55:00	9.69
34	RECOVERY	23APR86	11:00:00	9.68
35	RECOVERY	23APR86	11:15:00	9.68
36	RECOVERY	23APR86	11:45:00	9.67
37	RECOVERY	23APR86	12:15:00	9.66
38	RECOVERY	23APR86	13:15:00	9.66
39	RECOVERY	23APR86	15:53:00	9.63

Table G4.3

Pumping Test Data For Observation Well 85-1-1

Figure G4-1
Pumping Test Analysis For 85-1-22

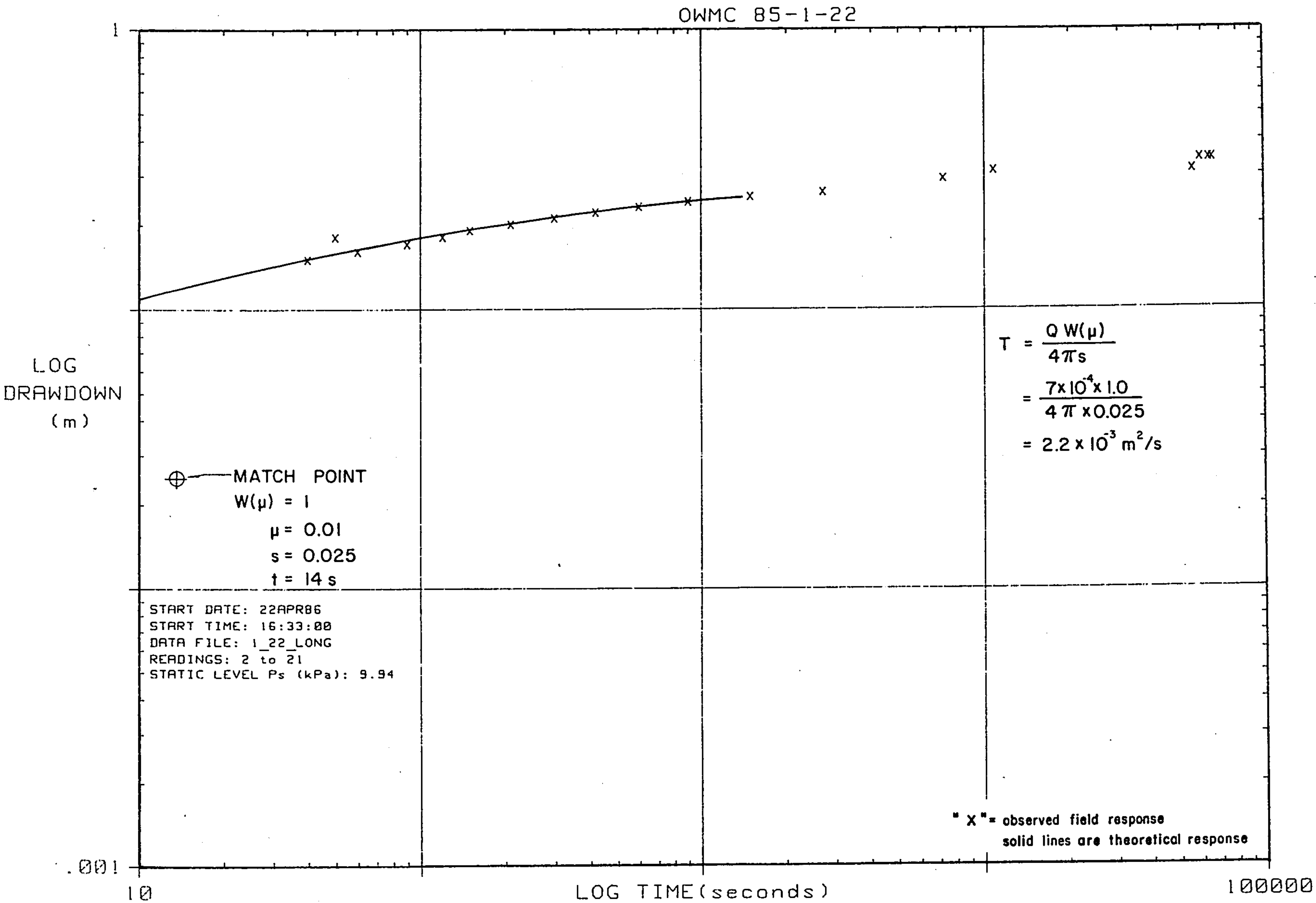


Figure G4-2
Pumping Test Analysis For 85-1-12

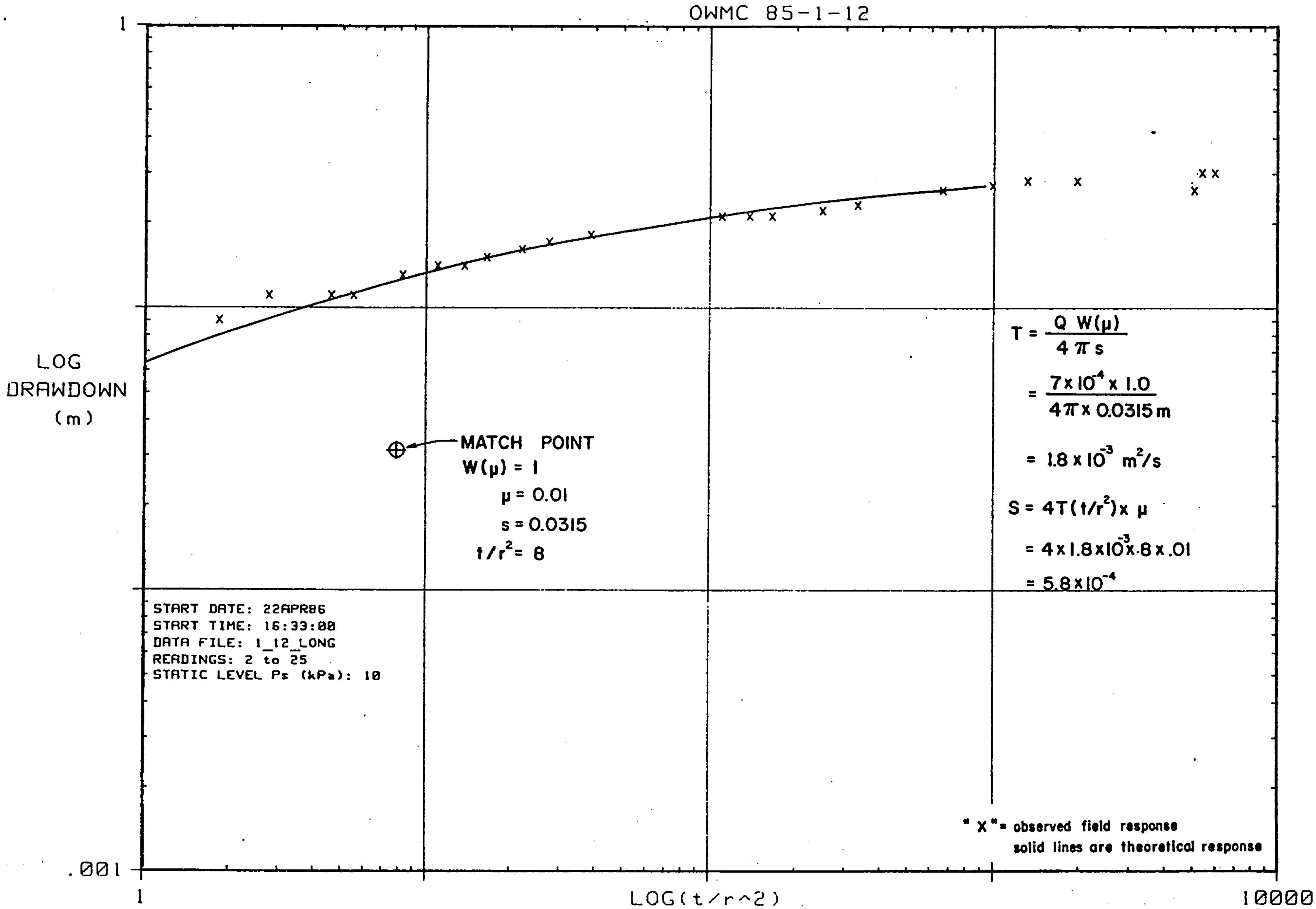
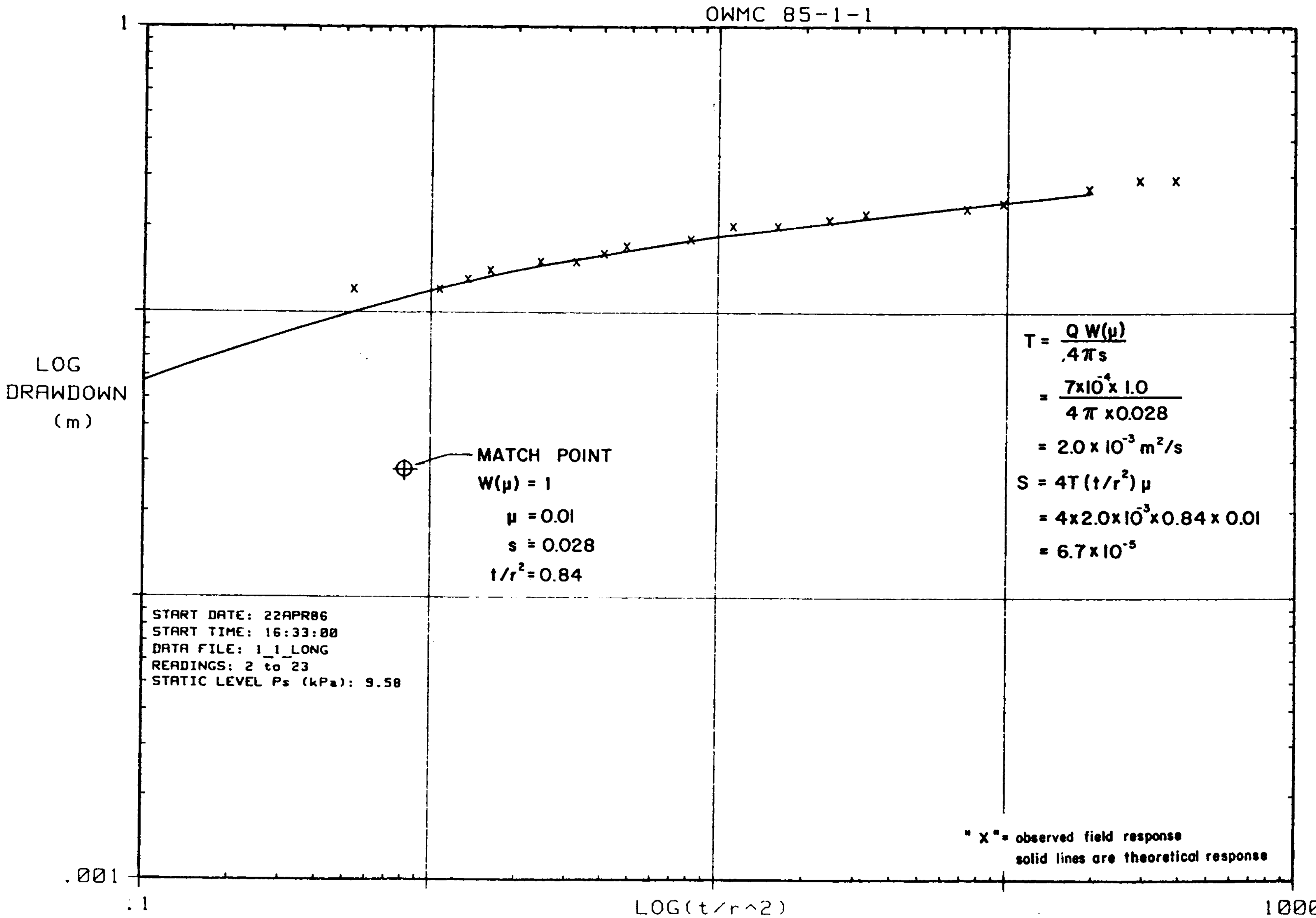


Figure G4-3
Pumping Test Analysis For 85-1-1



The field data proved to be well suited to the Theis curve analysis method for transient flow in a confined aquifer as the match curves are quite close to the observed data. The pumping response suggests that leakage through the aquitard is negligible relative to aquifer flow. Hydraulic conductivity for the bedrock aquifer can be calculated by dividing the tranmissivity obtained from the pumping test by the effective thickness of the aquifer tested. Because the bedrock fractures are predominantly horizontal, related to bedding (Section 2.0), and the test pumping rate was low, the effective thickness of the aquifer is considered to be the 2 m screen length rather than the 6 m thickness of Zone A. The resulting hydraulic conductivity is estimated to be 1E-3 m/s.

G5 LABORATORY TESTING

Golder Associates (Eastern Canada) Limited performed hydraulic conductivity testing on Shelby tube samples provided by GLAL. The purpose and scope of the testing program were presented in Appendix A3.5 of this report.

G5.1 GOLDER ASSOCIATES REPORT

Included in this section is a copy of the report submitted by Golder Associates to Gartner Lee dated July 1986. The contents of the Golder Associates' report are briefly summarized below:

- letter of transmittal for report (July 28, 1986);

- letter of transmittal for corrected copies of Figures 41 and 43 (August 6, 1986), note that these are included in the attached copy;

- introductory letter explaining the contents of the report (July 25, 1986);

- summary of test results (Table 1);

- detailed description of laboratory testing procedure (Appendix A); and

- detailed test results for each sample (Figures 1 to 60).

Note that in Golder Associates' report, hydraulic conductivity is termed "coefficient of permeability" and is reported in units of cm/s rather than m/s. The appropriate conversion factor is 1 m/s = 100 cm/s.

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

TRANSMITTAL LETTER

RECEIVED
JUL 29 1986
Gartner Lee Associates Limited

To Gartner Lee Associates Limited
Toronto-Buttonville Airport
MARKHAM, Ontario
L3P 3J9

ATTENTION: Mr. Steve Hollingshead

Date July 28, 1986
Project No. 861-1121
GLAL No. 85-GH-8

Sent by

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1	Factual Report (bound)	LABORATORY PERMEABILITY TESTING OF CLAY SOILS ONTARIO WASTE MANAGEMENT CORPORATION 4B PROGRAM
1	(unbound)	
		Photographs.

Remarks

Per [signature]
F. A. Rydgren

Form G.A.-0-1

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

TRANSMITTAL LETTER

To Gartner Lee Associates Limited
Toronto-Buttonville Airport
MARKHAM, Ontario
L3P 3J9

ATTENTION: Mr. Steve Hollingshead

Date August 6, 1986
Project No. 861-1121
GLAL No. 85-GH-8

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Quantity	Item	Description
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2 each		Triaxial Permeability Tests
	Figure 41	BH 85-12-8, Sample 1 Vertical
	Figure 43	BH 85-12-8, Sample 1 Horizontal

Remarks
Corrected copies for report.

Per F. A. Rydgren
F. A. Rydgren

Golder Associates

CONSULTING GEOTECHNICAL AND MINING ENGINEERS

FACTUAL REPORT TO

GARTNER LEE ASSOCIATES LIMITED

CONFIDENTIAL

LABORATORY PERMEABILITY TESTING
OF CLAY SOILS

ONTARIO WASTE MANAGEMENT
CORPORATION

4B PROGRAM

Gartner Lee Associates Ref. 85-GH-8

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July, 1986 861-1121

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Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

July 25, 1986 Our ref: 861-1121

Gartner Lee Associates Limited
Toronto-Buttonville Airport
MARKHAM, Ontario
L3P 3J9

ATTENTION: Mr. Steve Hollingshead

RE: LABORATORY PERMEABILITY TESTING
OF CLAY SOILS
ONTARIO WASTE MANAGEMENT CORPORATION
4B PROGRAM
GLAL REF: 85-GH-8

Dear Sirs:

This letter reports the factual results of coefficient of permeability tests carried out on samples of clay soils delivered to our laboratory by Gartner Lee Associates Limited. We understand that the samples were obtained from various sites within the OWMC 4B program. The results of other laboratory testing from the same sites are given in our Report 851-1298 dated May 9, 1986.

LABORATORY TESTING

The coefficient of permeability tests were carried out in our geotechnical laboratory in Mississauga, Ontario, using the testing program as specified by Gartner Lee Associates Limited, letter dated April 29, 1986.

TEST SAMPLES

During the period from December 6, 1985 to March 14, 1986, our laboratory received samples for testing from Gartner Lee Associates. These samples were delivered in 2-7/8 in. Shelby tubes which were sealed with paraffin wax and stored horizontally in our concrete curing room until required for testing.

CONSTANT HEAD PERMEABILITY TESTING

The constant head permeability tests were carried out on pre-selected site/borehole samples, with a vertical direction and horizontal direction test on each sample. The results of these tests are summarized on Table 1 and the computer data information is shown on Figures 1 to 60, inclusive. The figures are assembled by site location sequence 1, 3, 8, 10 and 12.

In addition to the enclosed figures there is an appendix covering the procedure which is used by Golder Associates in carrying out the constant head permeability tests.

Due to the length of the testing program, some preliminary results on Sites 1, 3 and 12 were forwarded to your office on our letter of June 13, 1986, accompanied by laboratory photographs.

We trust that this information is adequate for your purposes. If there are any questions regarding this report, please contact us.

Yours truly
GOLDER ASSOCIATES

F. A. Rydgren

Leo R. Lahti, P. Eng.

FAR/LRL/jm

Enc: Table 1
Figures 1 to 60
Appendix - Constant Head Permeability Test Procedure

TABLE 1

SUMMARY OF COEFFICIENT OF PERMEABILITY TEST RESULTS

FIGURE NO.	SITE NO.	BOREHOLE NO.	SAMPLE NO.	DEPTH (m)	DIRECTION (degrees)	CONSOLIDATION PRESSURE (kPa)	COEFFICIENT OF PERMEABILITY (cm/s)
1, 2	85-1	2	11	10.10	90	99.9	1.44×10^{-8}
3, 4	85-1	2	11	9.82	0	99.9	2.07×10^{-8}
5, 6	85-1	2	17	15.72	90	159.8	5.15×10^{-9}
7, 8	85-1	2	17	15.68	0	159.8	6.17×10^{-9}
9, 10	85-1	2	26	25.32	90	259.8	1.12×10^{-8}
11, 12	85-1	2	26	25.22	0	259.8	1.25×10^{-8}
13, 14	85-1	8	2	4.17	90	48.2	1.68×10^{-8}
15, 16	85-1	8	2	3.97	0	48.2	1.58×10^{-8}
17, 18	85-3	2	15	18.72	90	190.9	1.79×10^{-8}
19, 20	85-3	2	15	18.42	0	190.2	1.65×10^{-8}
21, 22	85-3	2	20	26.35	90	270.1	1.86×10^{-8}
23, 24	85-3	2	20	26.30	0	270.1	1.90×10^{-8}
25, 26	85-8	8	2	4.09	90	44.8	7.54×10^{-9}
27, 28	85-8	8	2	3.99	0	44.8	1.77×10^{-8}
29, 30	85-8	8	6	22.43	90	230.1	1.96×10^{-8}
31, 32	85-8	8	6	22.33	0	230.1	2.19×10^{-8}
33, 34	85-10	2	16	16.22	90	159.8	8.97×10^{-7}
35, 36	85-10	2	16	16.13	0	159.8	1.17×10^{-6}
37, 38	85-10	2	24	25.27	90	259.8	2.67×10^{-8}
39, 40	85-10	2	24	25.02	0	259.8	2.69×10^{-8}
41, 42	85-12	8	1	~~11.13~~ 3.57	90	44.8	3.63×10^{-8}
43, 44	85-12	8	1	~~11.03~~ 3.49	0	44.8	1.54×10^{-8}
45, 46	85-12	8	3	11.13	90	110.2	4.61×10^{-8}
47, 48	85-12	8	3	10.96	0	110.2	2.26×10^{-8}
49, 50	85-12	8	5	21.72	90	230.1	1.68×10^{-8}
51, 52	85-12	8	5	21.69	0	230.1	3.23×10^{-8}
53, 54	85-12	22	2	15.33	90	159.8	2.67×10^{-8}
55, 56	85-12	22	2	15.28	0	159.8	3.75×10^{-8}
57, 58	85-12	22	4	28.60	90	319.7	1.22×10^{-8}
59, 60	85-12	22	4	28.45	0	319.7	2.63×10^{-8}

DIRECTION OF SAMPLE IN DEGREES IS FROM THE HORIZONTAL PLANE.

APPENDIX

CONSTANT HEAD PERMEABILITY TEST PROCEDURE

Ref.: The Triaxial Test, Bishop & Henkel

CONSTANT HEAD PERMEABILITY TEST PROCEDURE

The constant head permeability tests were carried out using the pore water pressure mercury/water triaxial apparatus.

The test samples were extruded from the 2-7/8 in. Shelby tubes and trimmed to test size at 0° or 90° to the horizontal plane. After placing on the cell pedestal, with 80 Kv bauxite filter stones on each end, the samples were encased with high vacuum grease, membrane sheath, high vacuum grease and a second membrane sheath. The triaxial cell was then assembled and filled with water.

Saturation by Back Pressure

The test samples were saturated by back pressures at incremental stages of 70 kPa until a pore pressure B value of 0.96 was obtained.

For a saturation incremental stage, a cell pressure of 70 kPa and a back pressure of 62 kPa is introduced to the sample and allowed to absorb air for about 8 hours prior to increasing to the next increment until saturation has been completed.

Isotropic Consolidation

Upon achieving saturation, the cell pressure was increased above the saturation back pressure to a value that would equal the required effective consolidation pressure.

The sample was then allowed to consolidate for a minimum period of 24 hours, at which time the consolidated sample size was calculated. Using the consolidated length value, a hydraulic gradient of approximately 20 was calculated and the required head pressure was applied to one end of the sample while the saturation back pressure was applied to the opposite end. In order to maintain the original consolidation pressure, the cell pressure was adjusted so that the differences between the head pressure and cell pressure were equal to the required isotropic consolidation.

Permeability Test

Upon completion of the saturation, consolidation and head pressure adjustment stages, the permeability stage proceeds with periodic readings of the inflow and outflow volume change instruments until a stable flow path has been achieved. The coefficient of permeability is then calculated from the flow graphs.

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 1

BOREHOLE NUMBER 85-1-2 PROJECT 861-1121
SAMPLE NUMBER 11 Vertical Direction
SAMPLE DEPTH 10.10 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Layered silty clay and clay with fine gravel

ORIGINAL: LENGTH cm	6.910	CONSOLIDATED: AREA cm2	19.27	WET WEIGHT gm	287.8
DIAMETER cm	4.980	LENGTH cm	6.87	DRY WEIGHT gm	243.5
AREA cm2	19.481	PRESSURE kPA	99.9	VOLUME WATER cc	44.3
VOLUME cc	134.612	HYDRAULIC GRADIENT (p/l)	20.36		

WATER CONTENT initial %	18.20	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	18.60	VOLUME SOLIDS cc	87.590	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.96	VOLUME VOIDS cc	47.022	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.73	VOID RATIO	0.537	SILT FRACTION (.06mm) %	
lb/ft3	112.87	SATURATION %	94.212		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
137.8	130.9	1331	1.0	0.99

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
244.6	144.7	130.9	13.79	2711.276	99.9	113.7

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	Vc cc	aVc cc	Vc cc	aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-02	08:55	0	0	54.00	0.0	36.00	0.0		
86-05-02	14:23	328	19680	53.70	0.30	35.90	0.10	3.86E-08	1.29E-08
86-05-02	16:28	453	27180	53.50	0.50	35.80	0.20	6.76E-08	3.38E-08
86-05-05	08:48	4313	258780	52.50	1.50	34.30	1.70	1.09E-08	1.64E-08
86-05-06	08:54	5759	345540	52.20	1.80	33.70	2.30	8.76E-09	1.75E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 5759
INFLOW,k 3.15E-08
OUTFLOW,k 2.01E-08
AVERAGE,k 2.58E-08

PART 1
MINUTES 5431
INFLOW,k 1.17E-08 cm/s
OUTFLOW,k 1.71E-08 cm/s
AVERAGE,k 1.44E-08 cm/s

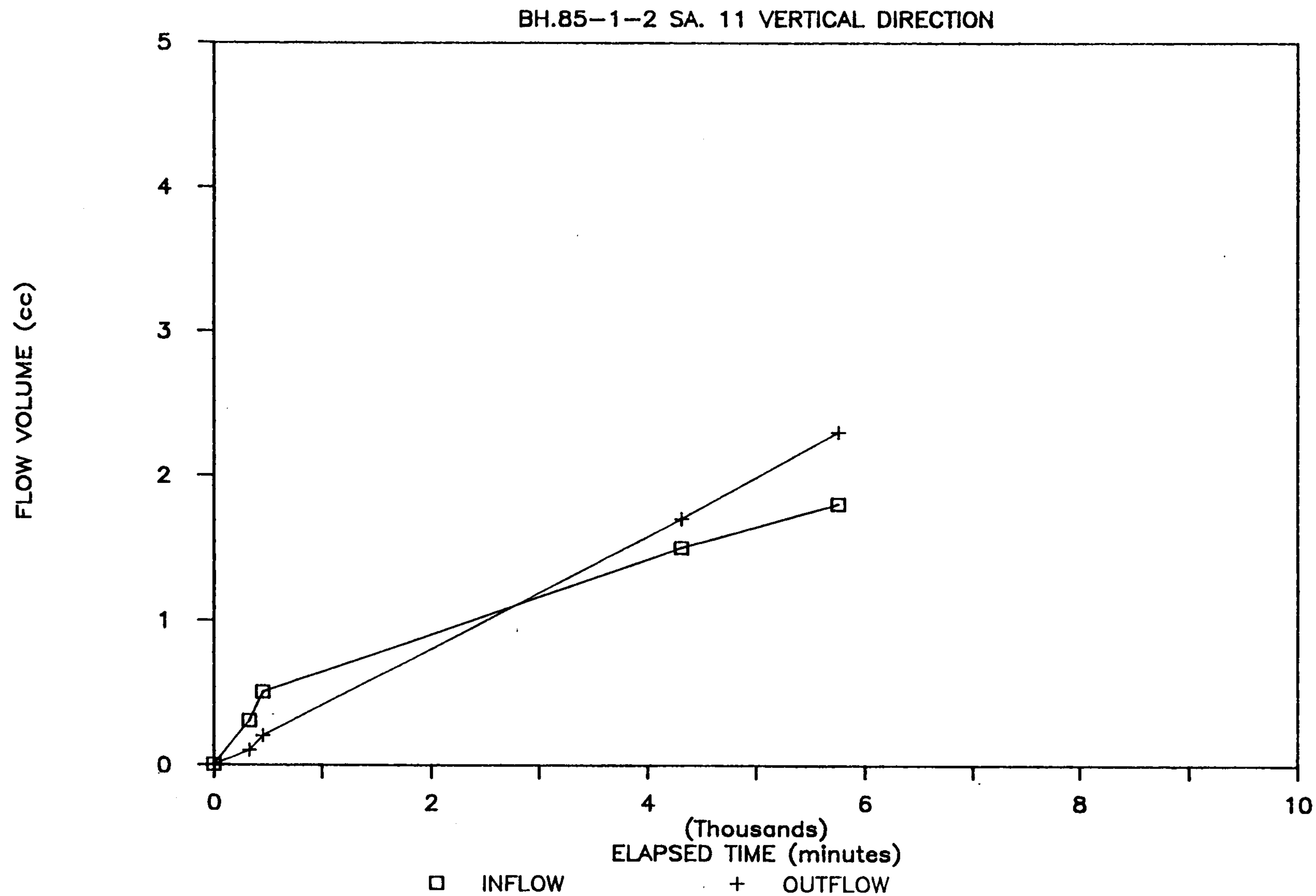
PART 2
MINUTES n/a
INFLOW,k n/a cm/s
OUTFLOW,k n/a cm/s
AVERAGE,k n/a cm/s

AVERAGE,k USE FOR ANALYSES 1.44E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 2

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

FIGURE 3

BOREHOLE NUMBER 85-1-2 PROJECT 861-1121
SAMPLE NUMBER 11 Horizontal Direction
SAMPLE DEPTH 9.82 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Layered silty clay and clay with fine gravel

ORIGINAL: LENGTH cm	4.930	CONSOLIDATED: AREA cm2	19.08	WET WEIGHT gm	209.8
DIAMETER cm	5.010	LENGTH cm	4.86	DRY WEIGHT gm	176.0
AREA cm2	19.716	PRESSURE kPA	99.9	VOLUME WATER cc	33.8
VOLUME cc	97.201	HYDRAULIC GRADIENT (p/l)	19.96		

WATER CONTENT initial %	19.20	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	18.50	VOLUME SOLIDS cc	63.317	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	21.16	VOLUME VOIDS cc	33.884	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.75	VOID RATIO	0.535	SILT FRACTION (.06mm) %	
lb/ft3	112.99	SATURATION %	99.693		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
137.8	130.9	1152	3.0	0.99

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
240.5	140.6	130.9	9.65	1877.818	99.9	109.5

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-02	12:17	0	0	7.60	0.0	66.10	0.0		
86-05-02	15:37	200	12000	7.70	0.10	66.00	0.10	2.16E-08	2.16E-08
86-05-05	08:35	4098	245880	9.40	1.80	63.90	2.20	1.88E-08	2.32E-08
86-05-05	11:38	4281	256860	9.55	1.95	63.80	2.30	3.54E-08	2.36E-08
86-05-05	13:17	4380	262800	9.60	2.00	63.70	2.40	2.18E-08	4.36E-08
86-05-05	15:24	4507	270420	9.70	2.10	63.60	2.50	3.40E-08	3.40E-08
86-05-06	08:53	5556	333360	10.10	2.50	63.20	2.90	1.64E-08	1.64E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
5556	INFLOW,k	2.47E-08
	OUTFLOW,k	2.71E-08
	AVERAGE,k	2.59E-08

PART 1

MINUTES			
3898	INFLOW,k	1.88E-08	cm/s
	OUTFLOW,k	2.32E-08	cm/s
	AVERAGE,k	2.10E-08	cm/s

PART 2

MINUTES			
1458	INFLOW,k	2.07E-08	cm/s
	OUTFLOW,k	2.07E-08	cm/s
	AVERAGE,k	2.07E-08	cm/s

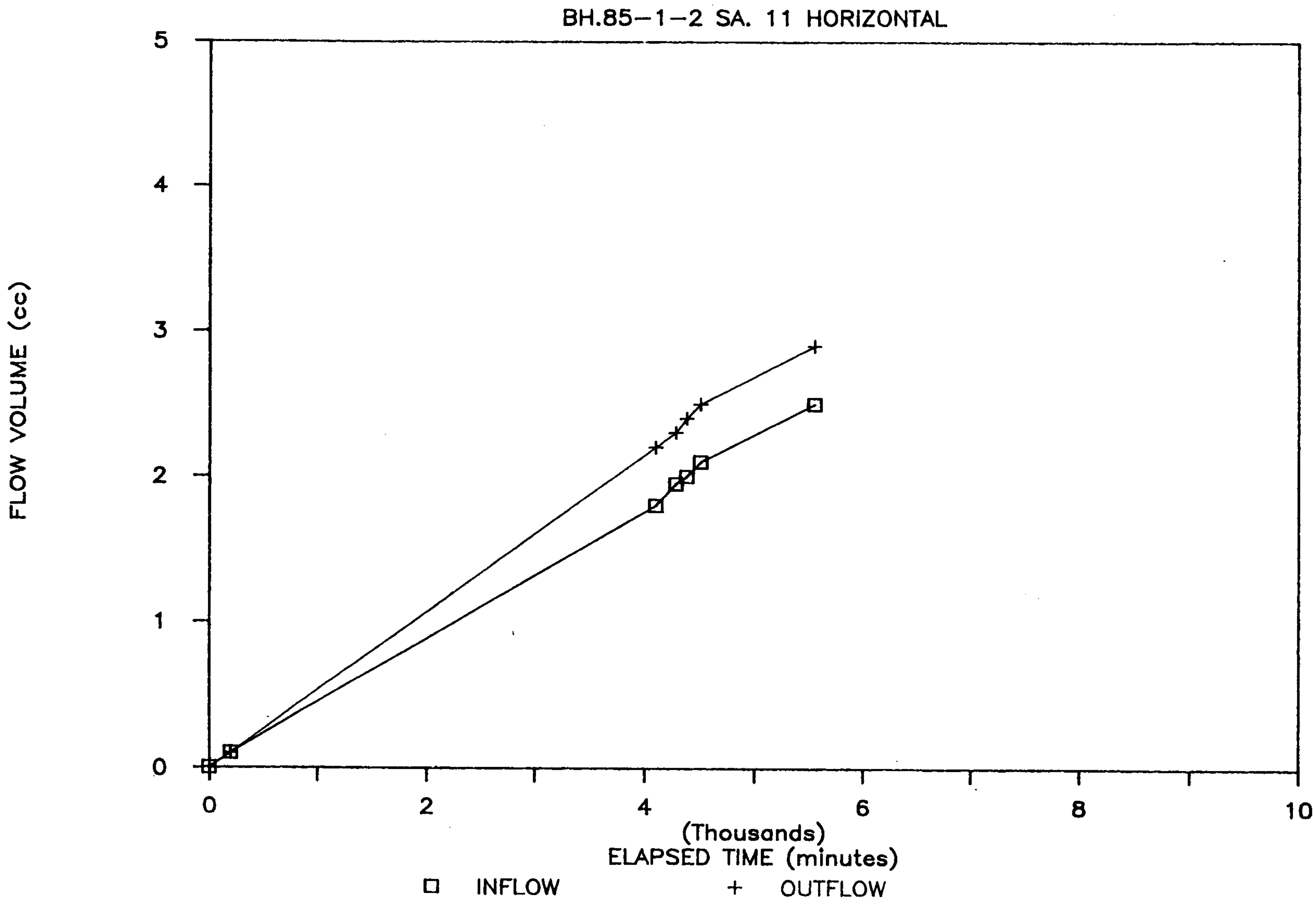
AVERAGE,k USE FOR ANALYSES 2.07E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

Golder Associates



TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 4

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

FIGURE 5

BOREHOLE NUMBER 85-1-2 PROJECT 861-1121
SAMPLE NUMBER 17 Vertical Direction
SAMPLE DEPTH 15.72 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with fine gravel,fissured

ORIGINAL: LENGTH cm	6.850	CONSOLIDATED: AREA cm2	18.47	WET WEIGHT gm	276.2
DIAMETER cm	4.980	LENGTH cm	6.74	DRY WEIGHT gm	224.5
AREA cm2	19.481	PRESSURE kPA	159.80	VOLUME WATER cc	51.7
VOLUME cc	133.443	HYDRAULIC GRADIENT (p/l)	19.50		

WATER CONTENT initial %	23.00	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %
WATER CONTENT final %	22.10	VOLUME SOLIDS cc	80.755	PLASTIC INDEX %
UNIT WEIGHT kN/m3	20.29	VOLUME VOIDS cc	52.687	CLAY FRACTION (.002mm) %
DRY UNIT WEIGHT kN/m3	16.50	VOID RATIO	0.652	SILT FRACTION (.06mm) %
lb/ft3	105.00	SATURATION %	98.126	

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
359.7	199.8	2502	0.3	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
372.7	212.9	199.8	13.09	2467.525	159.8	172.9

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW trns#3 Vc cc	OUTFLOW trns#3 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-08	14:23	0	0	not		1.0020	0.0		
86-05-08	16:46	143	8580	recorded		1.0032	0.04		1.36E-08
86-05-09	08:44	1101	66060			1.0068	0.17		6.09E-09
86-05-09	13:45	1402	84120			1.0092	0.26		1.29E-08
86-05-09	15:48	1525	91500			1.0100	0.28		1.05E-08
86-05-12	09:00	5437	326220			1.0217	0.70		4.85E-09
86-05-12	10:59	5556	333360			1.0228	0.74		1.50E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
	INFLOW,k	
5556	OUTFLOW,k	1.05E-08
	AVERAGE,k	1.05E-08

PART 1

MINUTES			
	INFLOW,k		cm/s
1382	OUTFLOW,k	7.98E-09	cm/s
	AVERAGE,k	7.98E-09	cm/s

PART 2

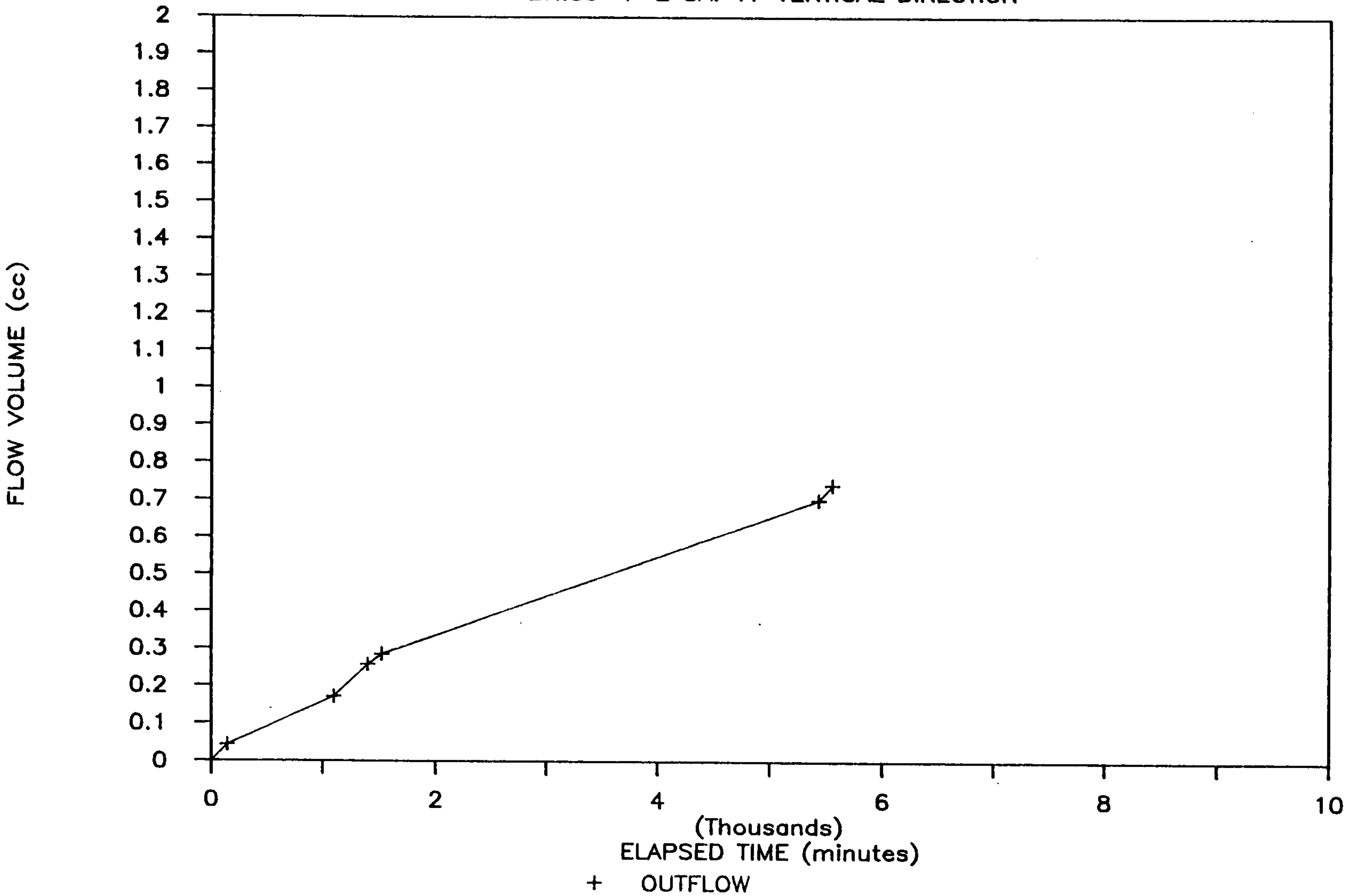
MINUTES			
	INFLOW,k		cm/s
4031	OUTFLOW,k	5.15E-09	cm/s
	AVERAGE,k		cm/s
AVERAGE,k USE FOR ANALYSES		5.15E-09	cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

BH.85–1–2 SA. 17 VERTICAL DIRECTION



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 6

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 7

BOREHOLE NUMBER 85-1-2 — PROJECT 861-1121
SAMPLE NUMBER 17 Horizontal Direction
SAMPLE DEPTH 15.60 m — (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with fine gravel

ORIGINAL: LENGTH cm	4.930	CONSOLIDATED: AREA cm2	21.24	WET WEIGHT gm	204.8
DIAMETER cm	5.240	LENGTH cm	4.89	DRY WEIGHT gm	165.8
AREA cm2	21.568	PRESSURE kPA	159.80	VOLUME WATER cc	39.0
VOLUME cc	106.330	HYDRAULIC GRADIENT (p/l)	19.96		

WATER CONTENT initial %	23.50	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	22.40	VOLUME SOLIDS cc	59.640	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	18.88	VOLUME VOIDS cc	46.690	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.29	VOID RATIO	0.783	SILT FRACTION (.06mm) %	
lb/ft3	97.32	SATURATION %	83.530		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
359.7	199.8	2467	2.1	0.98

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
369.3	209.5	199.8	9.65	2090.401	159.8	169.5

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns.#2 Vc cc	INFLOW trns.#2 aVc cc	OUTFLOW trns#1 Vc cc	OUTFLOW trns#1 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-09	08:46	0	0	0.5647	0.0	1.0106	0.0		
86-05-09	13:42	296	17760	0.5654	0.03	1.0131	0.09	4.44E-09	1.13E-08
86-05-09	15:53	427	25620	0.5657	0.05	1.0143	0.13	4.30E-09	1.23E-08
86-05-12	08:58	4332	259920	0.5817	0.82	1.0282	0.60	7.70E-09	4.76E-09
86-05-12	10:59	4453	267180	0.5818	0.82	1.0288	0.62	1.55E-09	6.63E-09

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 4453

INFLOW,k	8.73E-09	
OUTFLOW,k	8.73E-09	
AVERAGE,k	8.73E-09	

PART 1
MINUTES 4026

INFLOW,k	7.51E-09	cm/s
OUTFLOW,k	4.82E-09	cm/s
AVERAGE,k	6.17E-09	cm/s

PART 2
MINUTES n/a

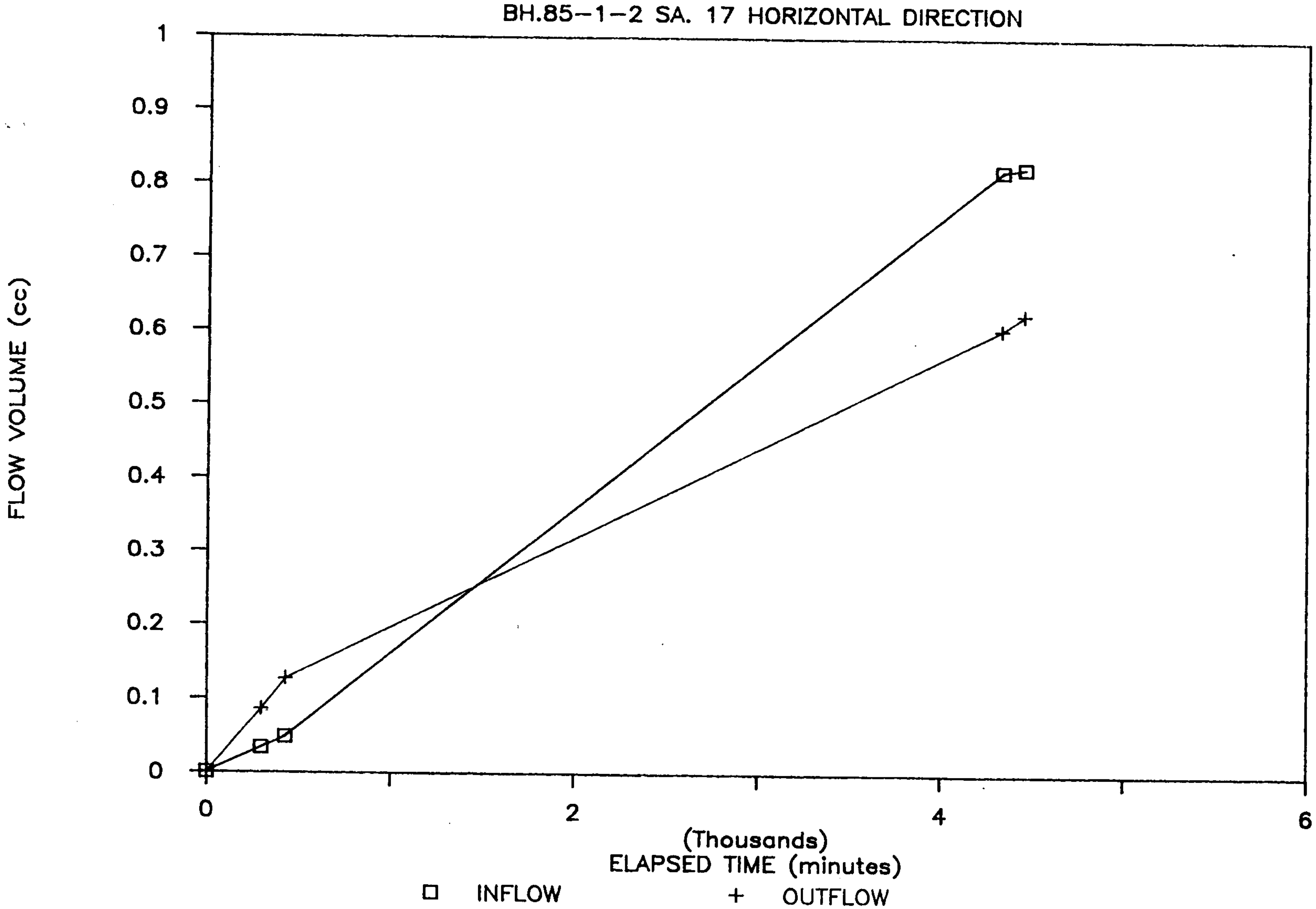
INFLOW,k	n/a	cm/s
OUTFLOW,k	n/a	cm/s
AVERAGE,k		cm/s

AVERAGE,k USE FOR ANALYSES 6.17E-09 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
B time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 8

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 9

BOREHOLE NUMBER 85-1-2 PROJECT 861-1121
SAMPLE NUMBER 26 Vertical Direction
SAMPLE DEPTH 25.32 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with fine gravel

ORIGINAL: LENGTH cm	6.720	CONSOLIDATED: AREA cm2	18.17	WET WEIGHT gm	259.7
DIAMETER cm	4.940	LENGTH cm	6.54	DRY WEIGHT gm	200.3
AREA cm2	19.169	PRESSURE kPA	259.8	VOLUME WATER cc	59.4
VOLUME cc	128.816	HYDRAULIC GRADIENT (p/l)	19.88		

WATER CONTENT initial %	29.70	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %
WATER CONTENT final %	24.70	VOLUME SOLIDS cc	72.050	PLASTIC INDEX %
UNIT WEIGHT kN/m3	19.76	VOLUME VOIDS cc	56.766	CLAY FRACTION (.002mm) %
DRY UNIT WEIGHT kN/m3	15.24	VOID RATIO	0.788	SILT FRACTION (.06mm) %
lb/ft3	96.99	SATURATION %	104.641	

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
459.6	199.8	1599	0.7	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
472.7	212.9	199.8	13.09	2426.920	259.8	272.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-09	08:36	0	0	18.00	0.0	57.20	0.0		
86-05-09	11:00	144	8640	18.00	0.00	57.20	0.00	0.00E+00	0.00E+00
86-05-09	13:45	309	18540	18.10	0.10	57.20	0.00	2.72E-08	0.00E+00
86-05-09	15:53	437	26220	18.10	0.10	57.10	0.10	0.00E+00	3.51E-08
86-05-12	09:01	4345	260700	19.00	1.00	56.00	1.20	1.03E-08	1.26E-08
86-05-12	10:57	4461	267660	19.00	1.00	56.00	1.20	0.00E+00	0.00E+00

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
4461	INFLOW,k	7.51E-09
	OUTFLOW,k	9.55E-09
	AVERAGE,k	8.53E-09

PART 1

MINUTES			
4024	INFLOW,k	1.00E-08	cm/s
	OUTFLOW,k	1.23E-08	cm/s
	AVERAGE,k	1.12E-08	cm/s

PART 2

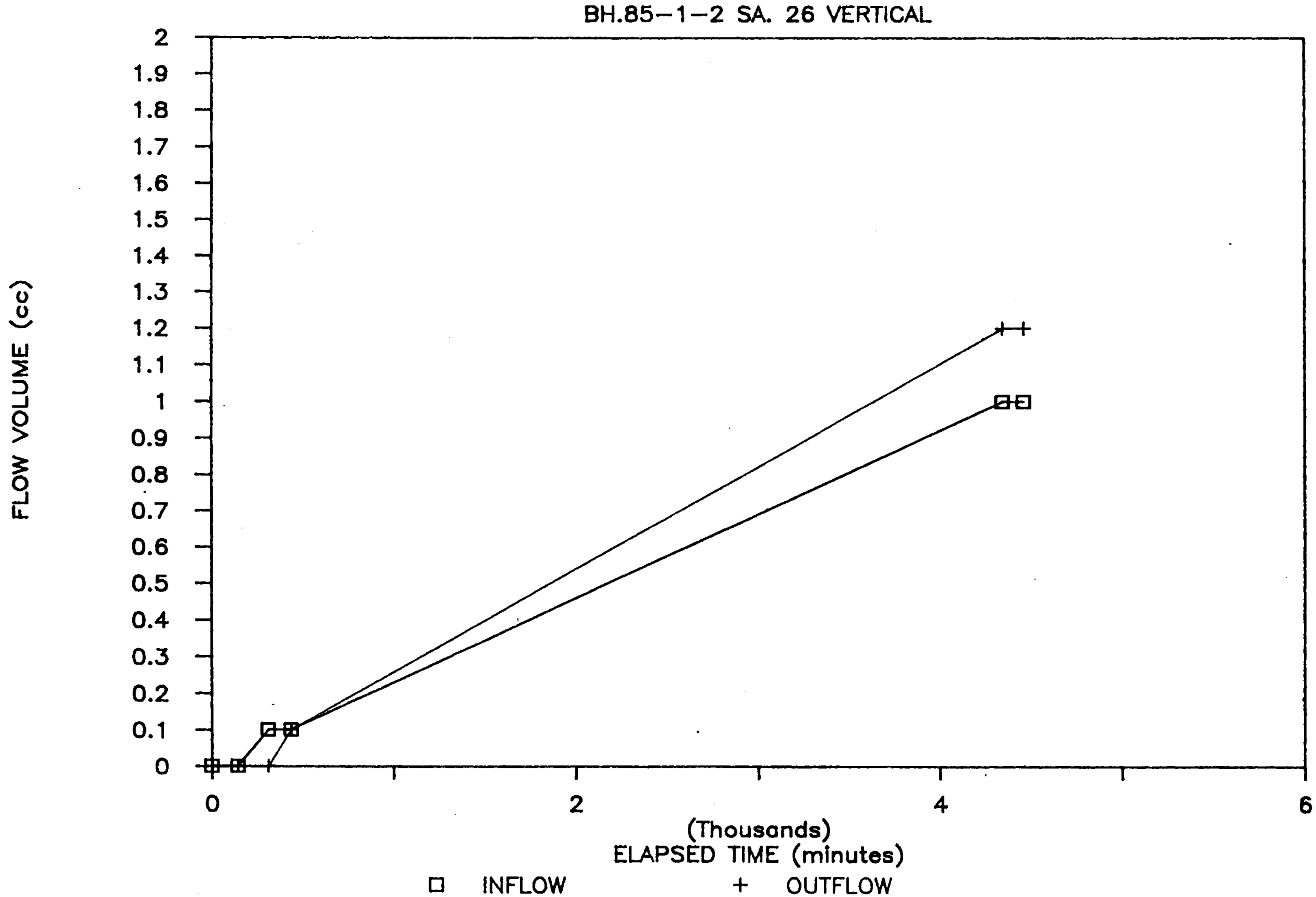
MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 1.12E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 10

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 11

BOREHOLE NUMBER 85-1-2
SAMPLE NUMBER 26 Horizontal Direction
SAMPLE DEPTH 25.22 m
SAMPLE TYPE Silty clay with fine gravel

PROJECT 861-1121

(GLAL PROJECT #85-6H-8)

ORIGINAL: LENGTH cm	6.660	CONSOLIDATED: AREA cm2	17.02	WET WEIGHT gm	247.9
DIAMETER cm	4.780	LENGTH cm	6.49	DRY WEIGHT gm	193.8
AREA cm2	17.947	PRESSURE kPA	259.8	VOLUME WATER cc	54.1
VOLUME cc	119.530	HYDRAULIC GRADIENT (p/l)	19.00		

WATER CONTENT initial %	27.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	23.60	VOLUME SOLIDS cc	69.712	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.33	VOLUME VOIDS cc	49.818	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.90	VOID RATIO	0.715	SILT FRACTION (.06mm) %	
lb/ft3	101.18	SATURATION %	108.596		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
459.6	199.8	1386	0.1	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
472.0	212.2	199.8	12.40	2153.670	259.8	272.1

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-09	08:35	0	0	51.20	0.0	45.60	0.0		
86-05-09	11:00	145	8700	51.10	0.10	45.70	0.10	3.46E-08	3.46E-08
86-05-09	13:46	311	18660	51.05	0.15	45.80	0.20	1.51E-08	3.03E-08
86-05-09	15:54	439	26340	51.00	0.20	45.90	0.30	1.96E-08	3.92E-08
86-05-12	08:55	4340	260400	49.80	1.40	46.60	1.00	1.54E-08	9.01E-09
86-05-12	10:55	4460	267600	49.75	1.45	46.65	1.05	2.09E-08	2.09E-08

COEFFICIENT of PERMEABILITY, k, cm/s

TOTAL FLOW

MINUTES		
4460	INFLOW,k	2.12E-08
	OUTFLOW,k	2.68E-08
	AVERAGE,k	2.40E-08

PART 1

MINUTES			
4021	INFLOW,k	1.56E-08	cm/s
	OUTFLOW,k	9.37E-09	cm/s
	AVERAGE,k	1.25E-08	cm/s

PART 2

MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 1.25E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

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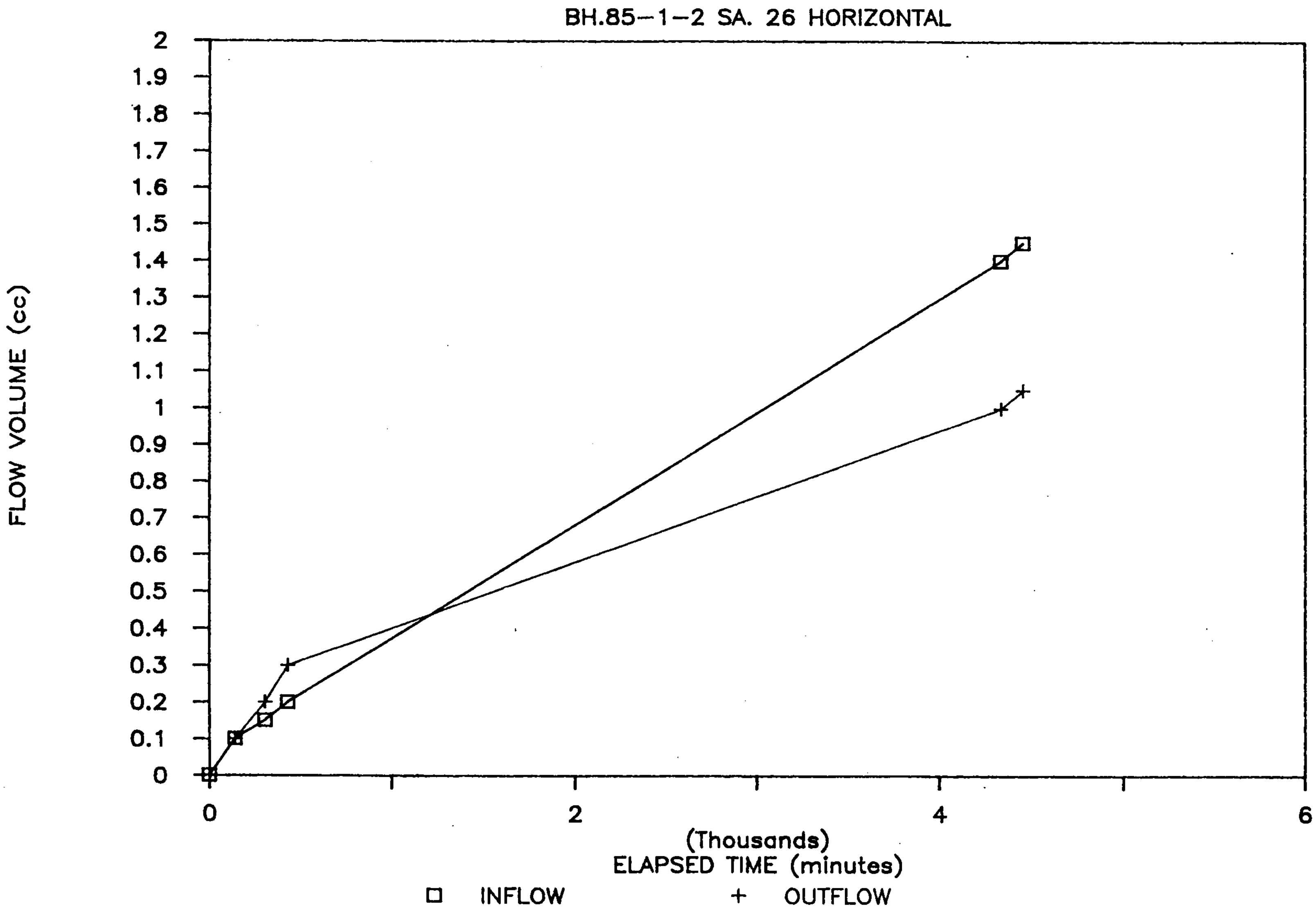


TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 12

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 13

BOREHOLE NUMBER 85-1-8 PROJECT 861-1121
SAMPLE NUMBER 2 Vertical Direction
SAMPLE DEPTH 4.17m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with fine gravel,fissured

ORIGINAL: LENGTH cm	6.590	CONSOLIDATED: AREA cm2	18.96	WET WEIGHT gm	248.8
DIAMETER cm	4.980	LENGTH cm	6.50	DRY WEIGHT gm	190.8
AREA cm2	19.481	PRESSURE kPA	48.23	VOLUME WATER cc	58.0
VOLUME cc	128.378	HYDRAULIC GRADIENT (p/l)	20.28		

WATER CONTENT initial %	30.80	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	32.70	VOLUME SOLIDS cc	68.633	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.80	VOLUME VOIDS cc	59.745	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	14.61	VOID RATIO	0.870	SILT FRACTION (.06mm) %	
lb/ft3	93.02	SATURATION %	97.000		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	1531	1.7	0.99

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
261.1	212.9	199.8	13.10	2534.373	48.2	61.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#4 Vc cc	INFLOW trns#4 aVc cc	OUTFLOW trns#3 Vc cc	OUTFLOW trns#3 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-01	16:42	0	0	0.9111	0.0	0.7338	0.0		
86-05-02	08:55	973	58380	0.8680	1.50	0.7545	0.74	6.59E-08	3.24E-08
86-05-02	14:22	1300	78000	0.8536	2.00	0.7614	0.98	6.55E-08	3.21E-08
86-05-02	16:42	1440	86400	0.8507	2.10	0.7646	1.10	3.08E-08	3.49E-08
86-05-05	09:52	5290	317400	0.8076	3.60	0.8075	2.62	1.66E-08	1.70E-08
86-05-05	13:18	5556	333360	0.8062	3.65	0.8088	2.67	7.83E-09	7.44E-09

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES			
5556	INFLOW,k	3.73E-08	
	OUTFLOW,k	2.47E-08	
	AVERAGE,k	3.10E-08	

PART 1

MINUTES			
4256	INFLOW,k	1.66E-08	cm/s
	OUTFLOW,k	1.70E-08	cm/s
	AVERAGE,k	1.68E-08	cm/s

PART 2

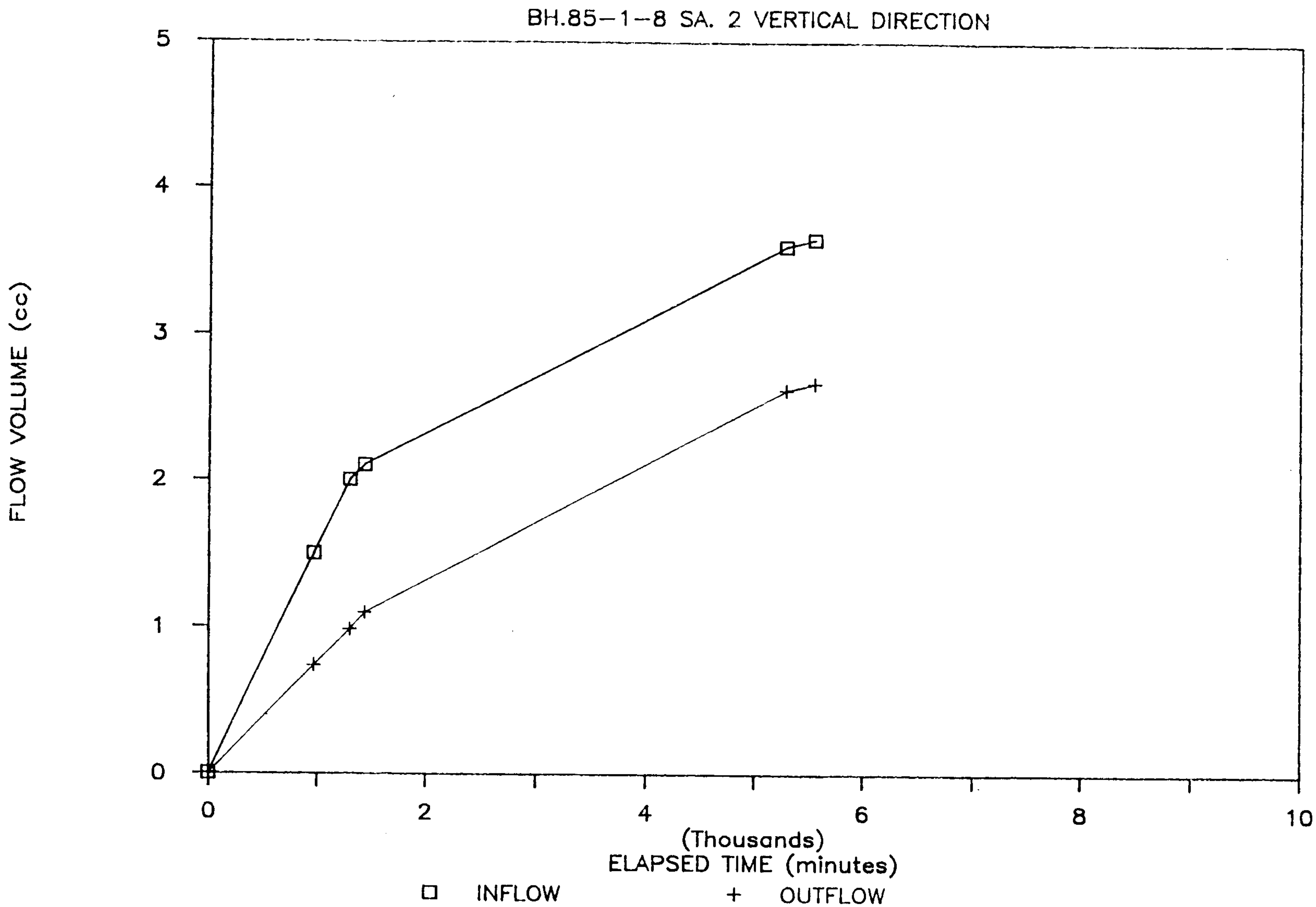
MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 1.68E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 14

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 15

BOREHOLE NUMBER 85-1-8 — PROJECT 861-1121

SAMPLE NUMBER 2 Horizontal Direction

SAMPLE DEPTH 3.97 m — (GLAL PROJECT #85-GH-8)

SAMPLE TYPE Silty clay with fine gravel,fissured

ORIGINAL: LENGTH cm	5.100	CONSOLIDATED: AREA cm2	19.23	WET WEIGHT gm	197.7
DIAMETER cm	4.980	LENGTH cm	5.07	DRY WEIGHT gm	156.1
AREA cm2	19.481	PRESSURE kPA	48.2	VOLUME WATER cc	41.6
VOLUME cc	99.352	HYDRAULIC GRADIENT (p/l)	19.41		

WATER CONTENT initial %	26.60	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	29.10	VOLUME SOLIDS cc	56.151	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.51	VOLUME VOIDS cc	43.201	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.41	VOID RATIO	0.769	SILT FRACTION (.06mm) %	
lb/ft3	98.09	SATURATION %	96.295		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	1560	3.9	0.99

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
257.7	209.5	199.8	9.70	1903.175	48.2	57.9

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#2 Vc cc	INFLOW trns#2 aVc cc	OUTFLOW trns#1 Vc cc	OUTFLOW trns#1 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-01	11:56	0	0	0.6413	0.0	0.0193	0.0		
86-05-01	14:25	149	8940	0.6405	0.03	0.0224	0.11	8.67E-09	3.17E-08
86-05-01	16:41	285	17100	0.6400	0.05	0.0252	0.20	5.93E-09	3.14E-08
86-05-02	08:55	1259	75540	0.6299	0.41	0.0405	0.73	1.67E-08	2.39E-08
86-05-02	14:21	1585	95100	0.6293	0.44	0.0441	0.85	2.97E-09	1.60E-08
86-05-02	16:43	1727	103620	0.6288	0.45	0.0468	0.94	5.68E-09	2.90E-08
86-05-05	08:52	5576	334560	0.5989	1.54	0.0917	2.48	1.25E-08	1.78E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
5576	INFLOW,k	8.75E-09
	OUTFLOW,k	2.51E-08
	AVERAGE,k	1.69E-08

PART 1

MINUTES			
136	INFLOW,k	5.93E-09	cm/s
	OUTFLOW,k	3.14E-08	cm/s
	AVERAGE,k	1.86E-08	cm/s

PART 2

MINUTES			
5291	INFLOW,k	1.25E-08	cm/s
	OUTFLOW,k	1.91E-08	cm/s
	AVERAGE,k	1.58E-08	cm/s

AVERAGE,k USE FOR ANALYSES 1.58E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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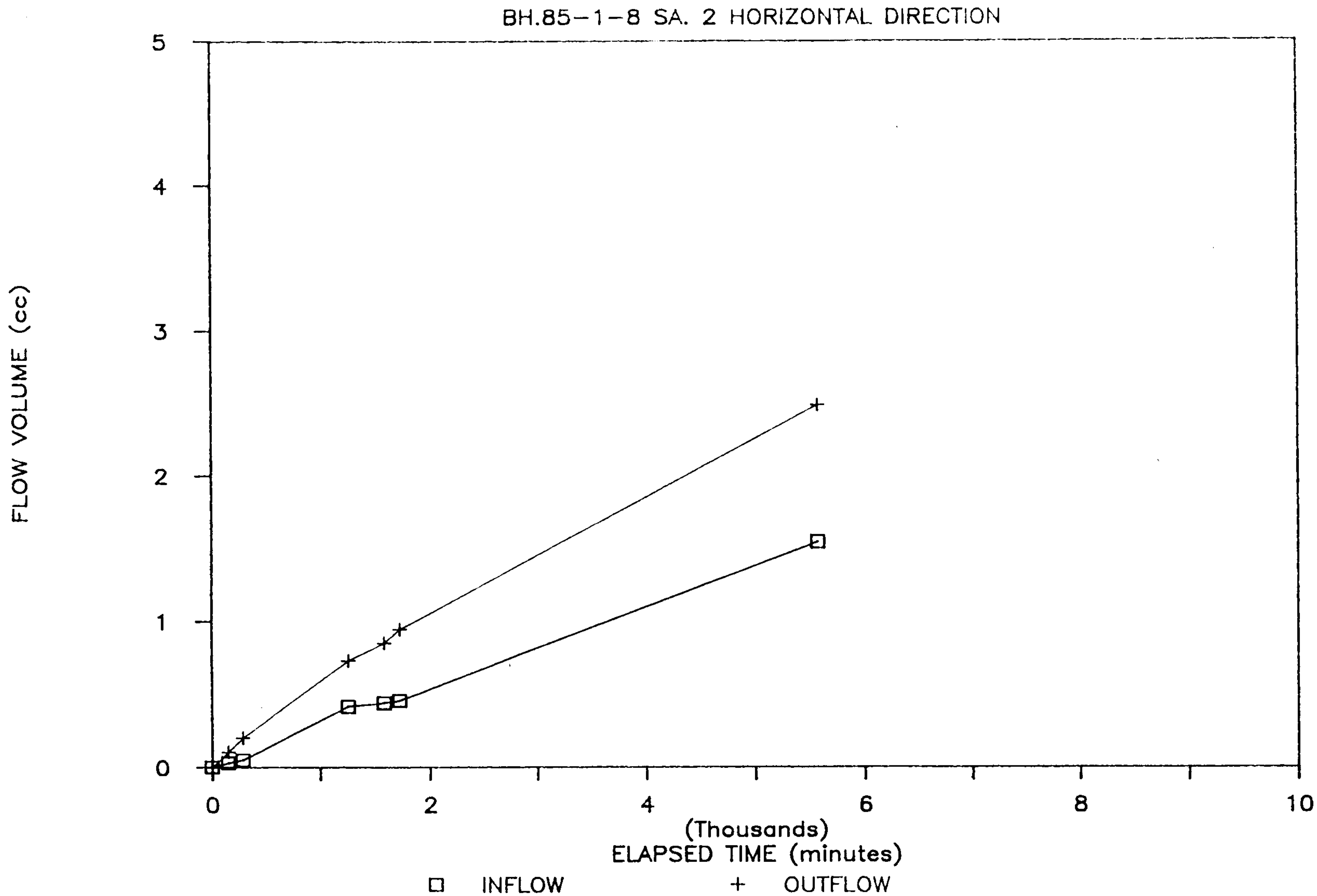

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 16

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 17

BOREHOLE NUMBER 85-3-2 — PROJECT 861-1121
SAMPLE NUMBER 15 Vertical Direction
SAMPLE DEPTH 18.72 m — (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silty clay with gravel,till like

ORIGINAL: LENGTH cm	6.510	CONSOLIDATED: AREA cm2	19.26	WET WEIGHT gm	262.4
DIAMETER cm	5.010	LENGTH cm	6.43	DRY WEIGHT gm	211.1
AREA cm2	19.716	PRESSURE kPA	190.90	VOLUME WATER cc	51.3
VOLUME cc	128.352	HYDRAULIC GRADIENT (p/l)	19.45		

WATER CONTENT initial %	24.30	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	22.90	VOLUME SOLIDS cc	75.935	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.04	VOLUME VOIDS cc	52.417	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.13	VOID RATIO	0.690	SILT FRACTION (.06mm) %	
lb/ft3	102.65	SATURATION %	97.965		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	260.7	1353	1.3	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
472.0	281.1	268.7	12.41	2439.079	190.9	203.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-29	08:37	0	0	3.10	0.0	71.20	0.0		
86-05-30	08:41	1444	86640	3.70	0.60	70.40	0.80	1.93E-08	2.43E-08
86-05-30	14:30	1793	107580	3.80	0.70	70.20	1.00	1.26E-08	2.52E-08
86-05-30	16:35	1918	115080	3.85	0.75	70.20	1.00	1.76E-08	0.00E+00
86-05-31	14:07	3210	192600	4.40	1.30	69.70	1.50	1.87E-08	1.70E-08
86-06-02	10:18	5861	351660	5.50	2.40	68.60	2.60	1.82E-08	1.82E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
5861	INFLOW,k	1.70E-08
	OUTFLOW,k	1.70E-08
	AVERAGE,k	1.70E-08

PART 1

MINUTES			
4417	INFLOW,k	1.79E-08	cm/s
	OUTFLOW,k	1.79E-08	cm/s
	AVERAGE,k	1.79E-08	cm/s

PART 2

MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 1.79E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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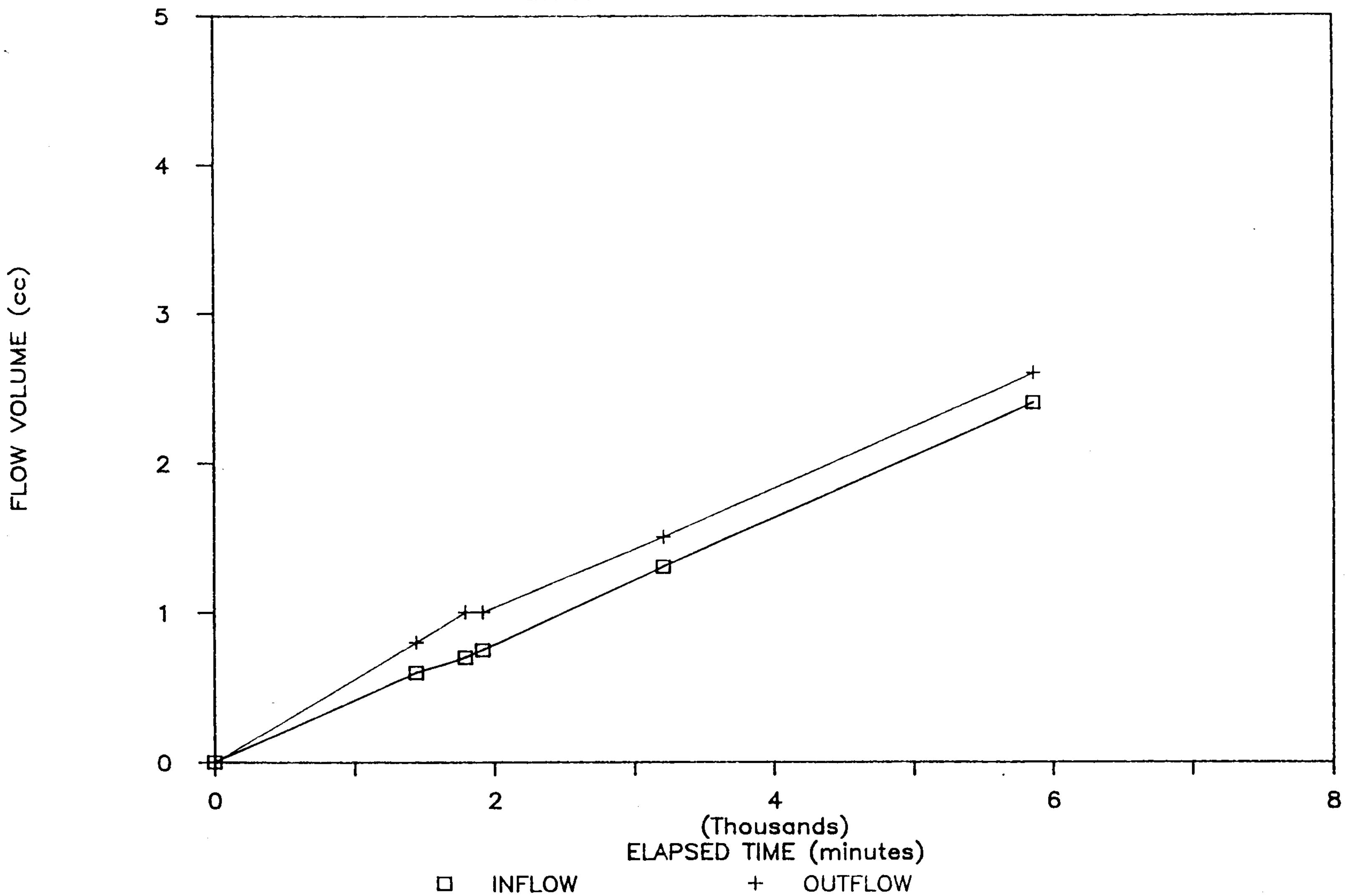
BH.85-3-2 SA. 15 VERTICAL DIRECTION



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 18

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 19

BOREHOLE NUMBER 85-3-2
SAMPLE NUMBER 15 Horizontal Direction
SAMPLE DEPTH 18.420 m
SAMPLE TYPE Silty clay with fine gravel

PROJECT 861-1121

(GLAL PROJECT #85-GH-8)

ORIGINAL: LENGTH cm	5.500	CONSOLIDATED: AREA cm2	18.63	WET WEIGHT gm	216.2
DIAMETER cm	4.930	LENGTH cm	5.43	DRY WEIGHT gm	176.2
AREA cm2	19.091	PRESSURE kPA	190.20	VOLUME WATER cc	40.0
VOLUME cc	105.003	HYDRAULIC GRADIENT (p/l)	19.19		

WATER CONTENT initial %	22.70	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	21.40	VOLUME SOLIDS cc	63.381	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.18	VOLUME VOIDS cc	41.622	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.45	VOID RATIO	0.657	SILT FRACTION (.06mm) %	
lb/ft3	104.71	SATURATION %	96.079		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
137.8	130.9	403	0.2	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
331.4	141.2	130.9	10.34	1966.397	190.2	200.5

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-29	16:45	0	0	60.00	0.0	62.50	0.0		
86-05-30	08:43	958	57480	60.20	0.20	62.60	0.10	9.61E-09	4.80E-09
86-05-30	14:40	1315	78900	60.40	0.40	62.70	0.20	2.58E-08	1.29E-08
86-05-31	16:33	2868	172080	60.70	0.70	63.00	0.50	8.89E-09	8.89E-09
86-06-02	10:17	5372	322320	61.60	1.60	63.90	1.40	1.65E-08	1.65E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
5372	INFLOW,k	1.09E-08
	OUTFLOW,k	1.08E-08
	AVERAGE,k	1.08E-08

PART 1

MINUTES			
1910	INFLOW,k	1.20E-08	cm/s
	OUTFLOW,k	9.64E-09	cm/s
	AVERAGE,k	1.08E-08	cm/s

PART 2

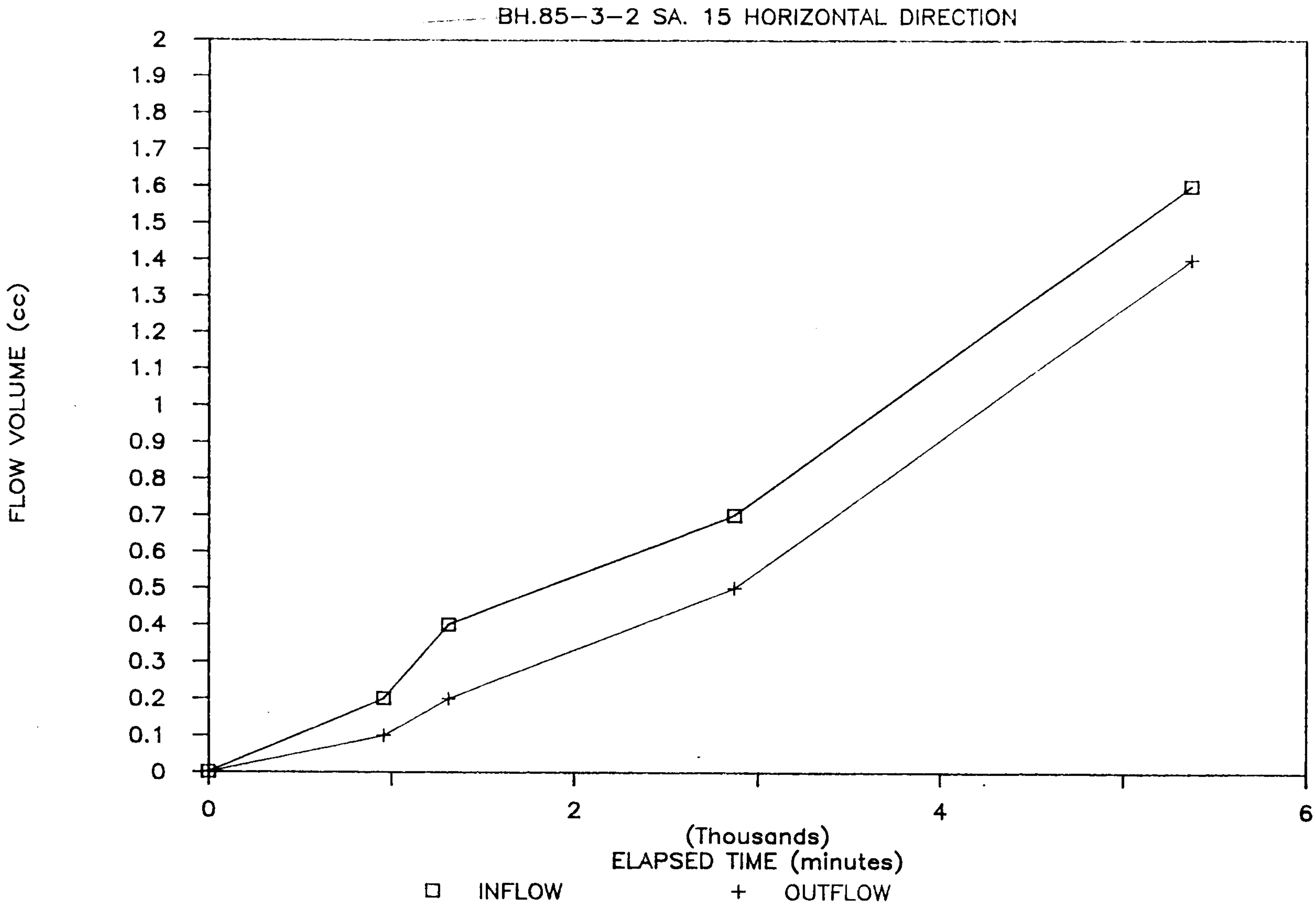
MINUTES			
2504	INFLOW,k	1.65E-08	cm/s
	OUTFLOW,k	1.65E-08	cm/s
	AVERAGE,k	1.65E-08	cm/s

AVERAGE,k USE FOR ANALYSES 1.65E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 20

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 21

BOREHOLE NUMBER 85-3-2
SAMPLE NUMBER 20 Vertical Direction
SAMPLE DEPTH 26.35 m
SAMPLE TYPE Silty clay with fine gravel

PROJECT 861-1121

(GLAL PROJECT #85-6H-8)

ORIGINAL: LENGTH cm	6.270	CONSOLIDATED: AREA cm2	18.42	WET WEIGHT gm	230.3
DIAMETER cm	4.970	LENGTH cm	6.11	DRY WEIGHT gm	168.1
AREA cm2	19.403	PRESSURE kPA	270.09	VOLUME WATER cc	62.2
VOLUME cc	121.654	HYDRAULIC GRADIENT (p/l)	19.06		

WATER CONTENT initial %	36.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %
WATER CONTENT final %	35.90	VOLUME SOLIDS cc	60.468	PLASTIC INDEX %
UNIT WEIGHT kN/m3	18.56	VOLUME VOIDS cc	61.186	CLAY FRACTION (.002mm) %
DRY UNIT WEIGHT kN/m3	13.56	VOID RATIO	1.012	SILT FRACTION (.06mm) %
lb/ft3	86.29	SATURATION %	101.657	

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	2557	4.0	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
550.5	280.4	268.7	11.71	2201.332	270.1	281.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	aVc cc	OUTFLOW Vc cc	aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	OUTFLOW cm/s
86-06-06	13:08	0	0	18.75	0.0	59.20	0.0		
86-06-06	16:48	220	13200	18.70	0.05	59.20	0.00	1.05E-08	0.00E+00
86-06-07	11:56	1368	82080	18.35	0.40	58.40	0.80	1.41E-08	3.22E-08
86-06-09	08:36	4048	242880	17.60	1.15	57.00	2.20	1.29E-08	2.42E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 4048
INFLOW,k 1.88E-08
OUTFLOW,k 1.88E-08
AVERAGE,k 1.88E-08

PART 1
MINUTES 1148
INFLOW,k 1.41E-08 cm/s
OUTFLOW,k 3.22E-08 cm/s
AVERAGE,k 2.32E-08 cm/s

PART 2
MINUTES 2680
INFLOW,k 1.29E-08 cm/s
OUTFLOW,k 2.42E-08 cm/s
AVERAGE,k 1.86E-08 cm/s

AVERAGE,k USE FOR ANALYSES 1.86E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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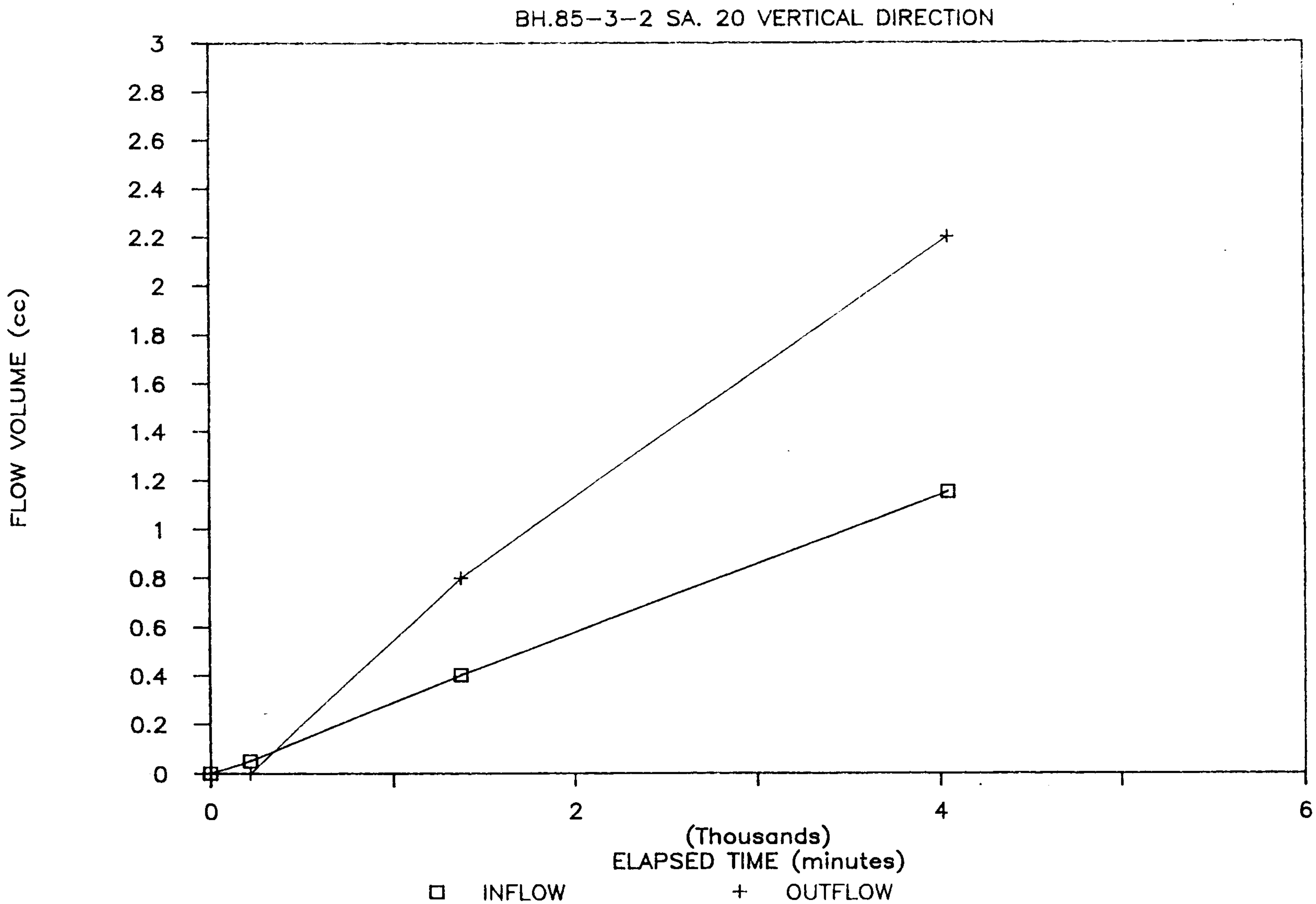

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 22

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 23

BOREHOLE NUMBER 85-3-2 PROJECT 861-1121
SAMPLE NUMBER 20 Horizontal Direction
SAMPLE DEPTH 26.35 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with fine gravel

ORIGINAL: LENGTH cm	5.690	CONSOLIDATED: AREA cm2	19.33	WET WEIGHT gm	229.6
DIAMETER cm	5.090	LENGTH cm	5.55	DRY WEIGHT gm	175.4
AREA cm2	20.351	PRESSURE kPA	270.09	VOLUME WATER cc	54.2
VOLUME cc	115.796	HYDRAULIC GRADIENT (p/l)	19.77		

WATER CONTENT initial %	30.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %
WATER CONTENT final %	30.00	VOLUME SOLIDS cc	63.094	PLASTIC INDEX %
UNIT WEIGHT kN/m3	19.44	VOLUME VOIDS cc	52.703	CLAY FRACTION (.002mm) %
DRY UNIT WEIGHT kN/m3	14.85	VOID RATIO	0.835	SILT FRACTION (.06mm) %
lb/ft3	94.52	SATURATION %	102.841	

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	2539	3.3	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
549.8	279.7	268.7	11.02	2174.197	270.1	281.1

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-06	16:36	0	0	2.90	0.0	51.20	0.0		
86-06-07	11:53	1157	69420	3.30	0.40	51.00	0.20	1.47E-08	7.35E-09
86-06-09	08:35	3839	230340	4.30	1.40	49.70	1.50	1.59E-08	2.06E-08
86-06-09	10:25	3949	236940	4.40	1.50	49.60	1.60	3.87E-08	3.87E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
	INFLOW,k	2.22E-08
3949	OUTFLOW,k	2.22E-08
	AVERAGE,k	2.22E-08

PART 1

MINUTES			
	INFLOW,k	1.59E-08	cm/s
2682	OUTFLOW,k	2.06E-08	cm/s
	AVERAGE,k	1.82E-08	cm/s

PART 2

MINUTES			
	INFLOW,k	1.68E-08	cm/s
2792	OUTFLOW,k	2.13E-08	cm/s
	AVERAGE,k	1.90E-08	cm/s
	AVERAGE,k USE FOR ANALYSES	1.90E-08	cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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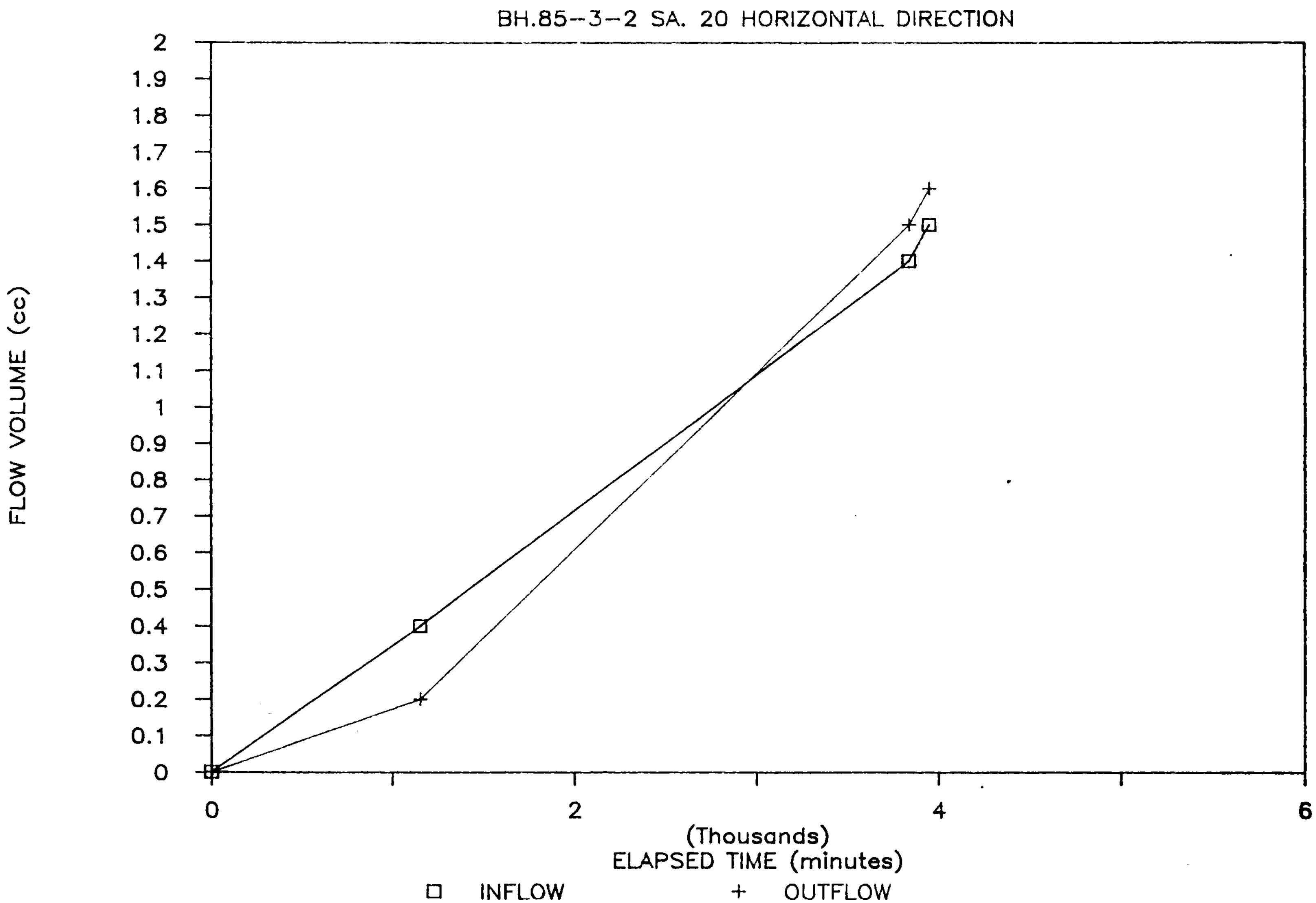

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 24

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 25

BOREHOLE NUMBER 85-8-B
PROJECT 861-1121
SAMPLE NUMBER 2 Vertical Direction
SAMPLE DEPTH 4.09 m
(GLAL PROJECT #85-GH-8)
SAMPLE TYPE Clayey silt to silty clay occasional silt seams pockets of gypsium

ORIGINAL: LENGTH cm	5.780	CONSOLIDATED: AREA cm2	19.41	WET WEIGHT gm	232.4
DIAMETER cm	5.030	LENGTH cm	5.71	DRY WEIGHT gm	198.5
AREA cm2	19.874	PRESSURE kPA	44.78	VOLUME WATER cc	33.9
VOLUME cc	114.871	HYDRAULIC GRADIENT (p/l)	19.46		

WATER CONTENT initial %	17.10	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	18.90	VOLUME SOLIDS cc	71.403	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.83	VOLUME VOIDS cc	43.468	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.93	VOID RATIO	0.609	SILT FRACTION (.06mm) %	
lb/ft3	107.79	SATURATION %	77.919		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
137.8	130.9	1440	2.7	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
186.7	141.9	130.9	11.02	2183.195	44.8	55.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-06	09:11	0	0	71.00	0.0	64.00	0.0		
86-06-06	13:09	238	14280	71.10	0.10	64.00	0.00	1.83E-08	0.00E+00
86-06-06	16:49	458	27480	71.20	0.20	64.00	0.00	1.98E-08	0.00E+00
86-06-07	11:57	1606	96360	71.20	0.20	64.30	0.30	0.00E+00	1.14E-08
86-06-09	08:37	4286	257160	71.30	0.30	64.40	0.40	1.63E-09	1.63E-09
86-06-09	17:05	4794	287640	71.40	0.40	64.50	0.50	8.58E-09	8.58E-09
86-06-10	08:42	5731	343860	71.50	0.50	64.70	0.70	4.65E-09	9.30E-09

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 5731
INFLOW,k 5.15E-09
OUTFLOW,k 5.15E-09
AVERAGE,k 5.15E-09

PART 1
MINUTES 4048
INFLOW,k 2.15E-09 cm/s
OUTFLOW,k 4.31E-09 cm/s
AVERAGE,k 3.23E-09 cm/s

PART 2
MINUTES 1445
INFLOW,k 6.03E-09 cm/s
OUTFLOW,k 9.05E-09 cm/s
AVERAGE,k 7.54E-09 cm/s

AVERAGE,k USE FOR ANALYSES 7.54E-09 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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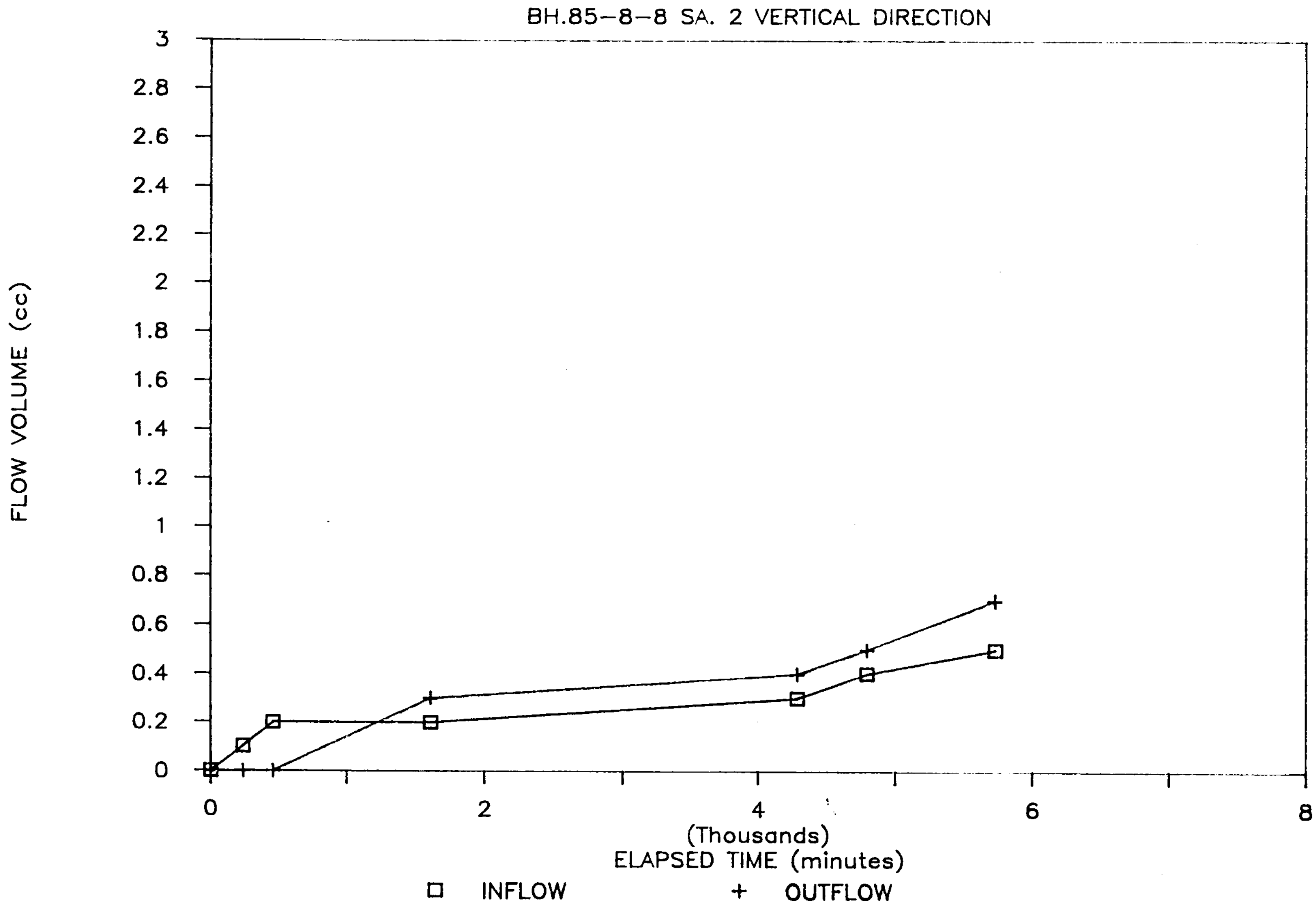

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 26

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 27

BOREHOLE NUMBER 85-8-8 PROJECT 861-1121
SAMPLE NUMBER 2 Horizontal Direction
SAMPLE DEPTH 3.99 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Clayey silt to silty clay occasional gypsium pockets

ORIGINAL: LENGTH cm	5.130	CONSOLIDATED: AREA cm2	19.95	WET WEIGHT gm	206.2
DIAMETER cm	5.070	LENGTH cm	5.10	DRY WEIGHT gm	163.2
AREA cm2	20.191	PRESSURE kPA	44.80	VOLUME WATER cc	43.0
VOLUME cc	103.581	HYDRAULIC GRADIENT (p/l)	20.55		

WATER CONTENT initial %	26.30	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	27.40	VOLUME SOLIDS cc	58.705	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.51	VOLUME VOIDS cc	44.876	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.45	VOID RATIO	0.764	SILT FRACTION (.06mm) %	
lb/ft3	98.34	SATURATION %	95.753		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	1620	5.3	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
323.8	279.0	268.7	10.33	2103.687	44.8	55.1

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-11	08:39	0	0	16.10	0.0	59.00	0.0		
86-06-11	10:26	107	6420	16.10	0.00	59.10	0.10	0.00E+00	3.78E-08
86-06-11	12:00	201	12060	16.00	0.10	59.20	0.20	4.30E-08	4.30E-08
86-06-11	13:24	285	17100	16.00	0.10	59.40	0.40	0.00E+00	9.62E-08
86-06-11	15:13	394	23640	16.00	0.10	59.50	0.50	0.00E+00	3.71E-08
86-06-11	16:47	488	29280	15.90	0.20	59.50	0.50	4.30E-08	0.00E+00
86-06-12	09:21	1482	88920	15.40	0.70	59.90	0.90	2.03E-08	1.63E-08
86-06-12	15:00	1821	109260	15.00	1.10	60.00	1.00	4.77E-08	1.19E-08
86-06-13	10:34	2995	179700	14.60	1.50	60.40	1.40	1.38E-08	1.38E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 2995
INFLOW,k 3.20E-08
OUTFLOW,k 3.20E-08
AVERAGE,k 3.20E-08

PART 1
MINUTES 2507
INFLOW,k 2.10E-08 cm/s
OUTFLOW,k 1.45E-08 cm/s
AVERAGE,k 1.77E-08 cm/s

PART 2
MINUTES n/a
INFLOW,k n/a cm/s
OUTFLOW,k n/a cm/s
AVERAGE,k n/a cm/s

AVERAGE,k USE FOR ANALYSES 1.77E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

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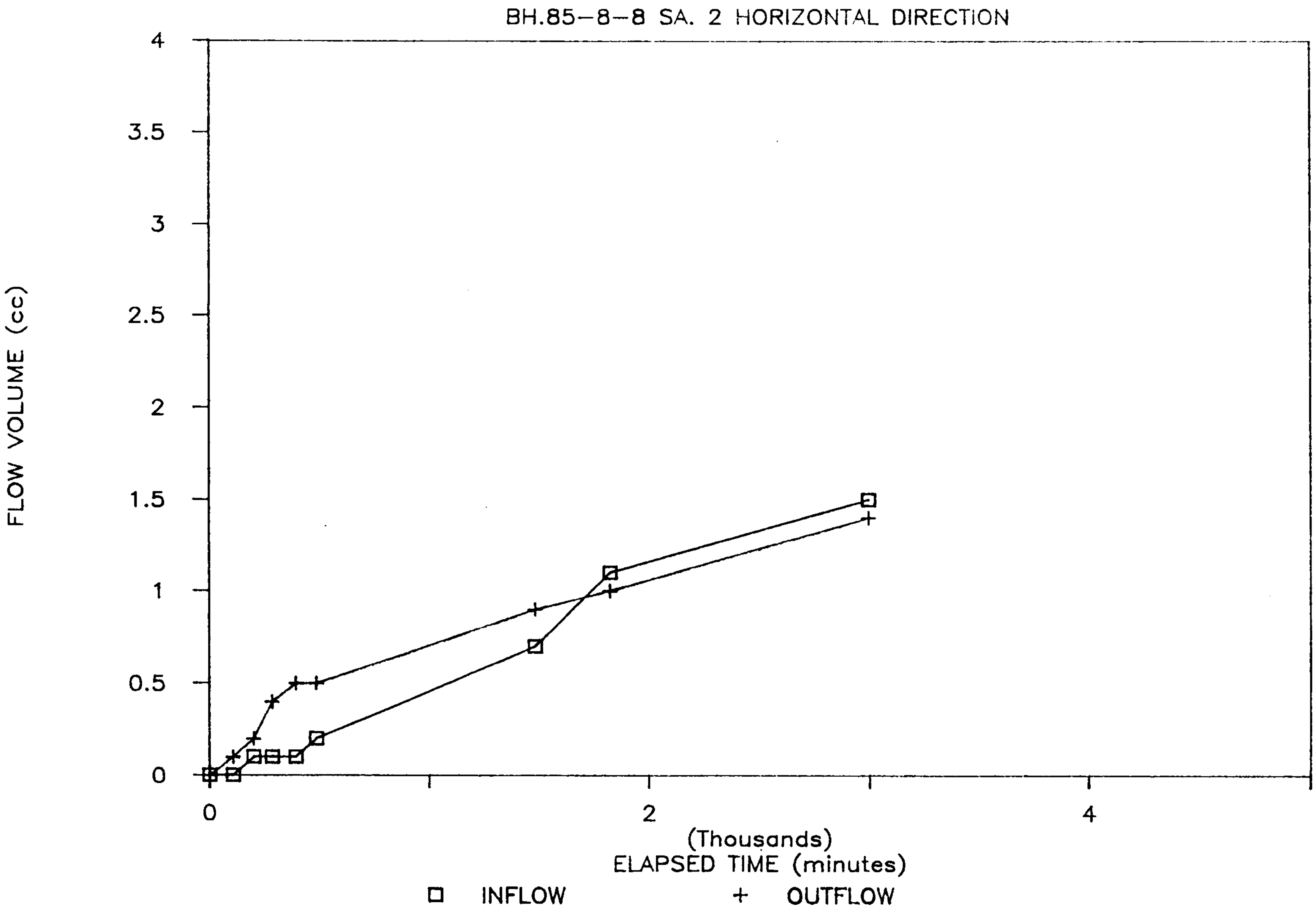

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 28

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 29

BOREHOLE NUMBER 85-8-8 PROJECT 861-1121
SAMPLE NUMBER 6 Vertical Direction
SAMPLE DEPTH 22.43 m (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silty clay trace gravel occasional silt seams

ORIGINAL: LENGTH cm	6.720	CONSOLIDATED: AREA cm2	18.56	WET WEIGHT gm	251.9
DIAMETER cm	4.970	LENGTH cm	6.57	DRY WEIGHT gm	195.5
AREA cm2	19.403	PRESSURE kPA	230.13	VOLUME WATER cc	56.5
VOLUME cc	130.385	HYDRAULIC GRADIENT (p/l)	19.88		

WATER CONTENT initial %	28.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	28.70	VOLUME SOLIDS cc	70.309	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	18.94	VOLUME VOIDS cc	60.076	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	14.70	VOID RATIO	0.854	SILT FRACTION (.06mm) %	
lb/ft3	93.54	SATURATION %	94.031		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	2520	1.4	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
511.9	281.8	268.7	13.09	2479.012	230.1	243.2

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	aVc cc	OUTFLOW Vc cc	aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-13	10:53	0	0	51.80	0.0	59.20	0.0		
86-06-13	14:13	200	12000	51.90	0.10	59.10	0.10	2.21E-08	2.21E-08
86-06-13	16:11	318	19080	52.00	0.20	59.00	0.20	3.74E-08	3.74E-08
86-06-13	16:50	357	21420	52.00	0.20	59.00	0.20	0.00E+00	0.00E+00
86-06-14	15:23	1710	102600	52.60	0.80	58.40	0.80	1.96E-08	1.96E-08
86-06-15	11:17	2904	174240	53.20	1.40	58.00	1.20	2.22E-08	1.48E-08
86-06-16	08:38	4185	251100	53.80	2.00	57.40	1.80	2.07E-08	2.07E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW MINUTES			PART 1 MINUTES		
4185	INFLOW,k	1.91E-08	1510	INFLOW,k	2.05E-08 cm/s
	OUTFLOW,k	1.91E-08		OUTFLOW,k	2.05E-08 cm/s
	AVERAGE,k	1.91E-08		AVERAGE,k	2.05E-08 cm/s

PART 2 MINUTES		
2475	INFLOW,k	2.14E-08 cm/s
	OUTFLOW,k	1.78E-08 cm/s
	AVERAGE,k	1.96E-08 cm/s
AVERAGE,k USE FOR ANALYSES		1.96E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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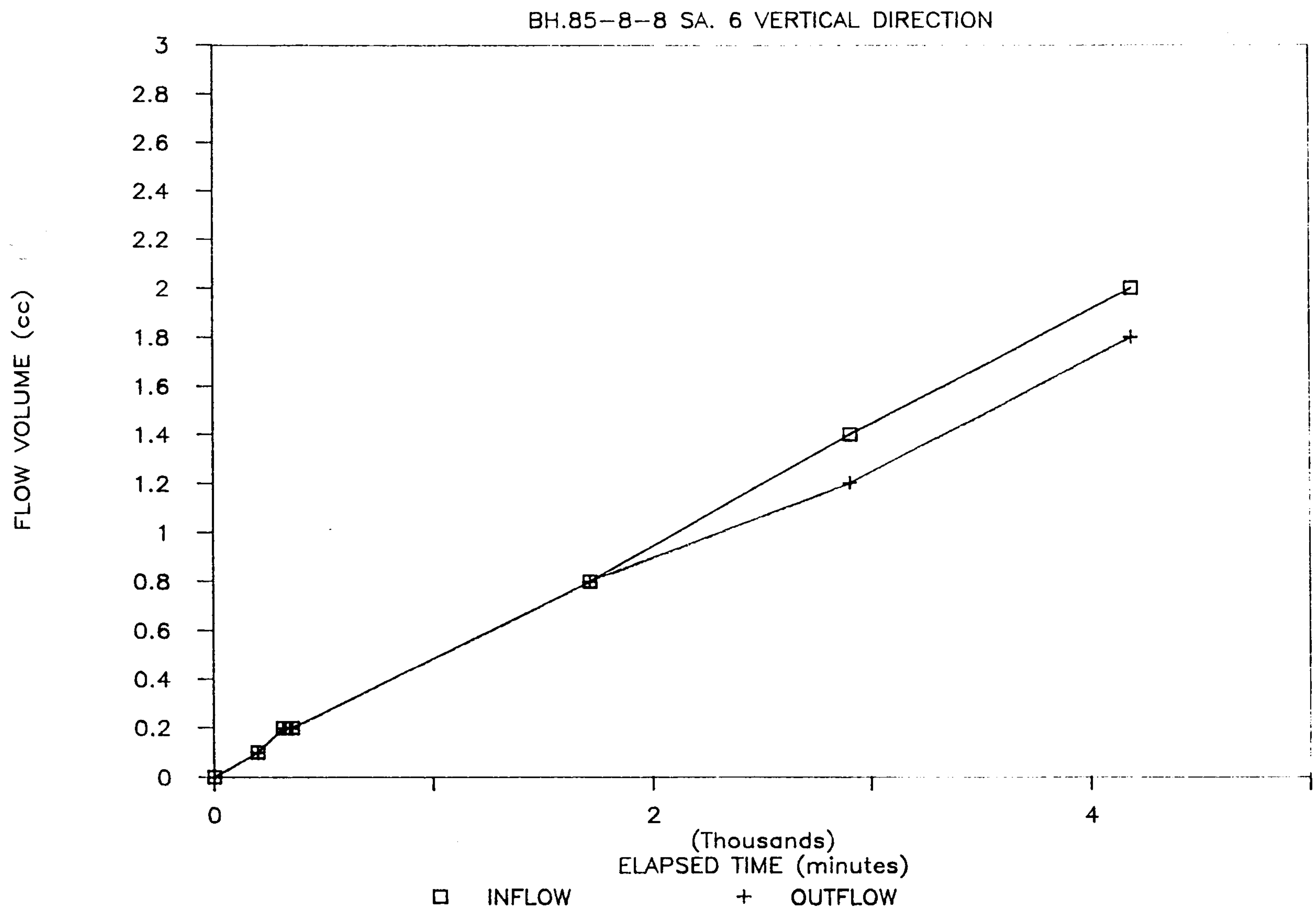

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 30

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 31

BOREHOLE NUMBER 85-8-8 PROJECT 861-1121
SAMPLE NUMBER 6 Horizontal Direction
SAMPLE DEPTH 22.33 m (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silty clay occasional silt seams

ORIGINAL: LENGTH cm	4.910	CONSOLIDATED: AREA cm2	18.71	WET WEIGHT gm	187.7
DIAMETER cm	5.010	LENGTH cm	4.78	DRY WEIGHT gm	143.8
AREA cm2	19.716	PRESSURE kPA	230.13	VOLUME WATER cc	43.9
VOLUME cc	96.806	HYDRAULIC GRADIENT (p/l)	20.04		

WATER CONTENT initial %	30.50	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	29.10	VOLUME SOLIDS cc	51.727	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.81	VOLUME VOIDS cc	45.080	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	14.56	VOID RATIO	0.871	SILT FRACTION (.06mm) %	
lb/ft3	92.71	SATURATION %	97.361		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	2520	3.7	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
508.5	278.4	268.7	9.65	1841.403	230.1	239.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-13	09:30	0	0	9.50	0.0	67.10	0.0		
86-06-13	16:52	442	26520	9.60	0.10	67.40	0.30	9.79E-09	2.94E-08
86-06-14	15:27	1797	107820	10.20	0.70	68.20	1.10	1.92E-08	2.55E-08
86-06-15	11:25	2995	179700	10.70	1.20	68.90	1.80	1.81E-08	2.53E-08
86-06-16	09:01	4291	257460	11.30	1.80	69.60	2.50	2.00E-08	2.34E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 4291

INFLOW,k	2.59E-08	
OUTFLOW,k	2.59E-08	
AVERAGE,k	2.59E-08	

PART 1
MINUTES 3849

INFLOW,k	1.91E-08	cm/s
OUTFLOW,k	2.47E-08	cm/s
AVERAGE,k	2.19E-08	cm/s

PART 2
MINUTES n/a

INFLOW,k	n/a	cm/s
OUTFLOW,k	n/a	cm/s
AVERAGE,k	n/a	cm/s
AVERAGE,k USE FOR ANALYSES	2.19E-08	cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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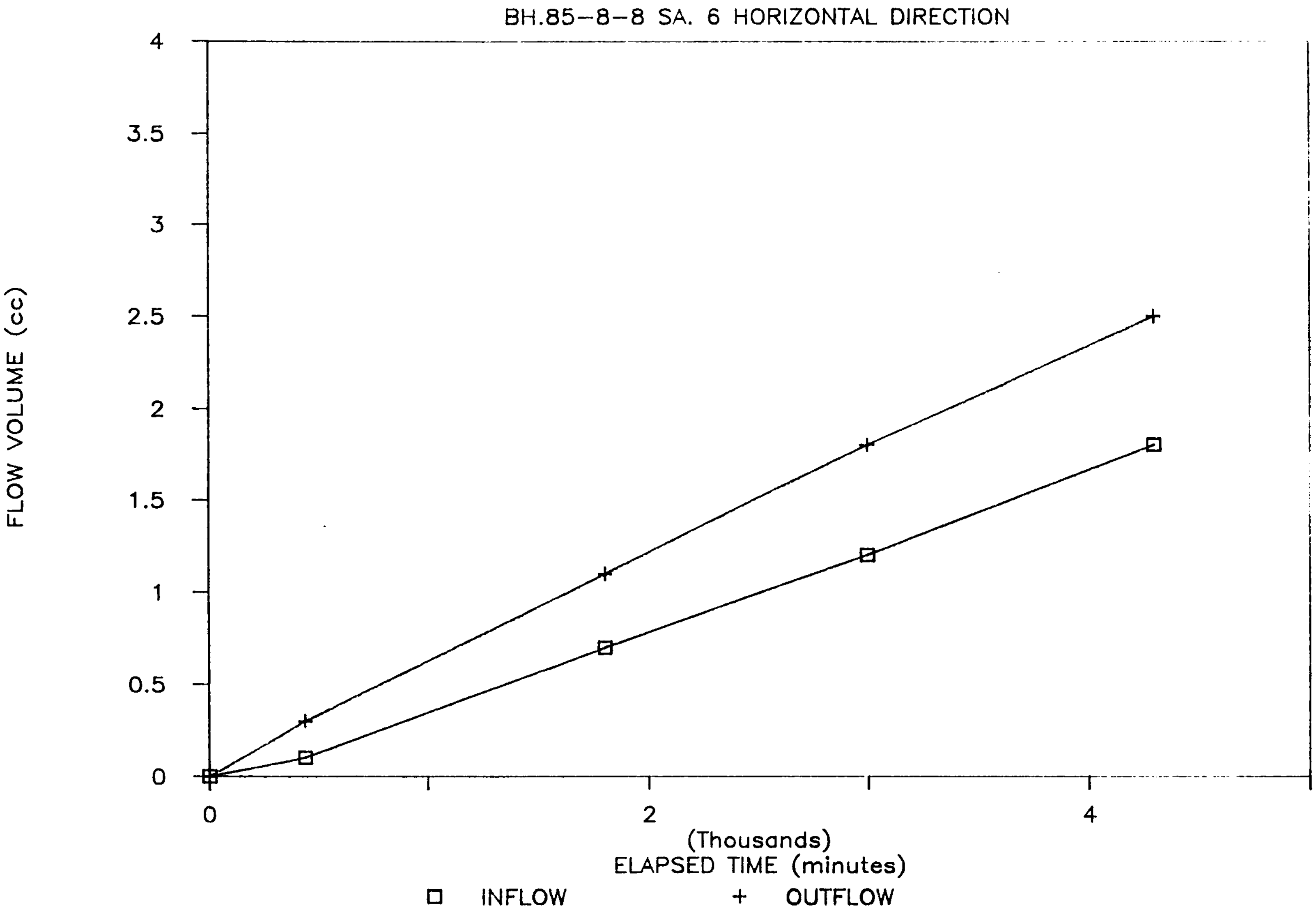
Golder Associates



TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 32

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 33

BOREHOLE NUMBER 85-10-2 PROJECT 861-1121
SAMPLE NUMBER 16 Vertical Direction
SAMPLE DEPTH 16.22 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silt to clayey silt trace fine sand

ORIGINAL: LENGTH cm	6.950	CONSOLIDATED: AREA cm2	18.41	WET WEIGHT gm	283.6
DIAMETER cm	4.870	LENGTH cm	6.91	DRY WEIGHT gm	238.6
AREA cm2	18.630	PRESSURE kPA	159.85	VOLUME WATER cc	45.0
VOLUME cc	129.476	HYDRAULIC GRADIENT (p/l)	19.22		

WATER CONTENT initial %	18.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %
WATER CONTENT final %	16.50	VOLUME SOLIDS cc	85.827	PLASTIC INDEX %
UNIT WEIGHT kN/m3	21.47	VOLUME VOIDS cc	43.649	CLAY FRACTION (.002mm) %
DRY UNIT WEIGHT kN/m3	18.06	VOID RATIO	0.509	SILT FRACTION (.06mm) %
lb/ft3	114.95	SATURATION %	103.096	

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	6840	0.8	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
441.6	281.8	268.7	13.09	2458.977	159.8	172.9

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-20	08:46	0	0	20.70	0.0	79.00	0.0		
86-06-20	09:12	26	1560	20.30	0.40	78.60	0.40	7.20E-07	7.20E-07
86-06-20	09:47	61	3660	19.60	1.10	77.80	1.20	9.37E-07	1.07E-06
86-06-20	10:33	107	6420	18.80	1.90	77.00	2.00	8.14E-07	8.14E-07
86-06-20	11:43	177	10620	17.50	3.20	75.70	3.30	8.70E-07	8.70E-07
86-06-20	13:44	298	17880	15.20	5.50	73.20	5.80	8.90E-07	9.60E-07
86-06-20	14:15	329	19740	14.70	6.00	72.60	6.40	7.55E-07	9.06E-07

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
329	INFLOW,k	8.92E-07
	OUTFLOW,k	8.92E-07
	AVERAGE,k	8.92E-07

PART 1

MINUTES			
303	INFLOW,k	8.66E-07	cm/s
	OUTFLOW,k	9.27E-07	cm/s
	AVERAGE,k	8.97E-07	cm/s

PART 2

MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 8.97E-07 cm/s

NOTES

Membrane not sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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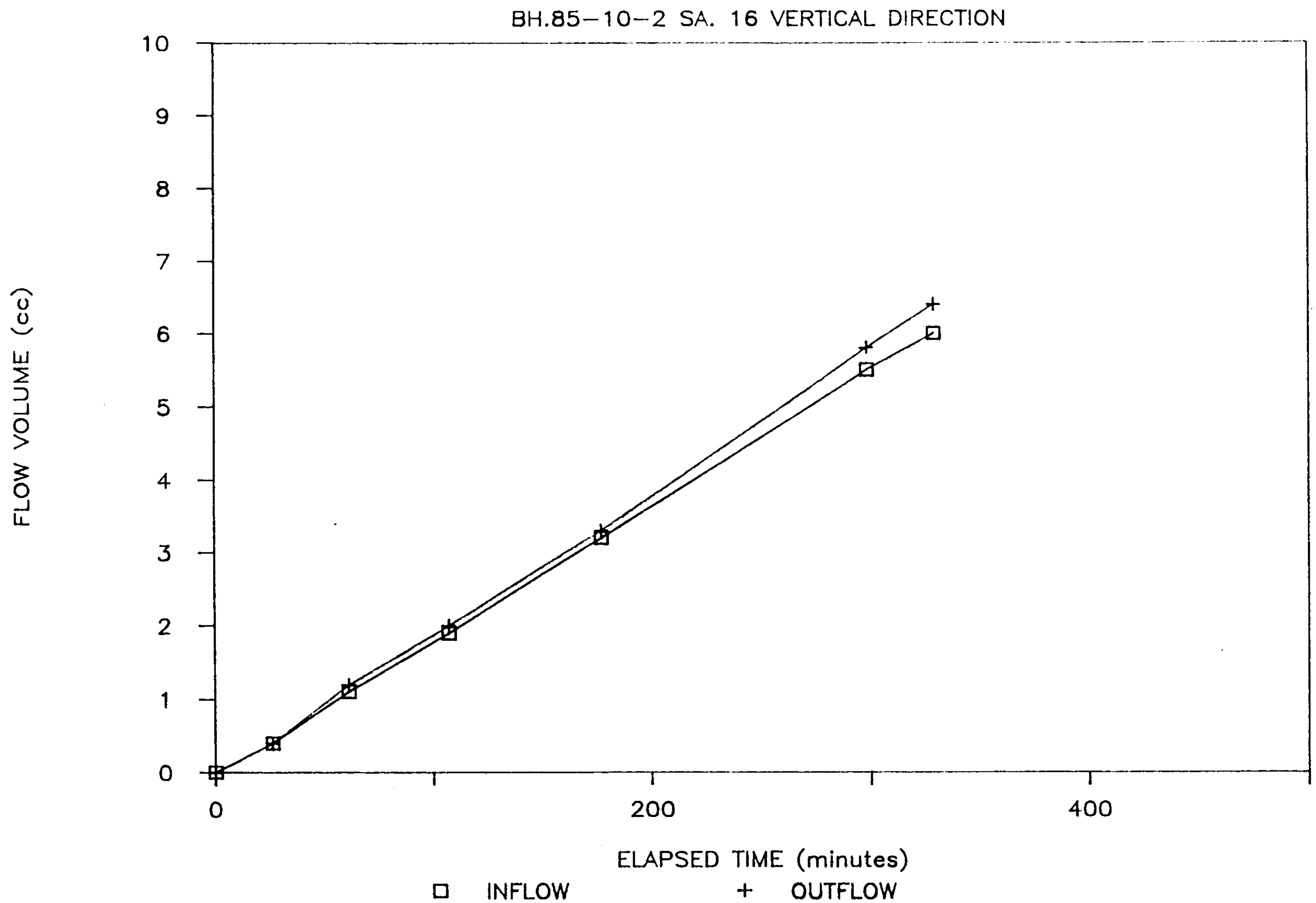

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 34

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 35

BOREHOLE NUMBER 85-10-2 PROJECT 861-1121
SAMPLE NUMBER 16 Horizontal Direction
SAMPLE DEPTH 16.13 m (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silt to clayey silt trace fine sand

ORIGINAL: LENGTH cm	5.210	CONSOLIDATED: AREA cm2	19.84	WET WEIGHT gm	231.5
DIAMETER cm	5.100	LENGTH cm	5.13	DRY WEIGHT gm	195.0
AREA cm2	20.431	PRESSURE kPA	159.85	VOLUME WATER cc	36.5
VOLUME cc	106.445	HYDRAULIC GRADIENT (p/l)	20.24		

WATER CONTENT initial %	18.70	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	16.00	VOLUME SOLIDS cc	70.144	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	21.32	VOLUME VOIDS cc	36.301	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.96	VOID RATIO	0.517	SILT FRACTION (.06mm) %	
lb/ft3	114.33	SATURATION %	100.549		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	4000	0.9	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
438.9	279.0	268.7	10.33	2092.088	159.8	170.2

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-24	10:41	0	0	76.40	0.0	56.90	0.0		
86-06-24	11:44	63	3780	78.30	1.90	55.00	1.90	1.23E-06	1.23E-06
86-06-24	12:29	108	6480	79.60	3.20	53.60	3.30	1.18E-06	1.27E-06
86-06-24	13:38	177	10620	81.60	5.20	51.60	5.30	1.18E-06	1.18E-06
86-06-24	14:35	234	14040	83.10	6.70	50.00	6.90	1.08E-06	1.15E-06

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
234	INFLOW,k	1.21E-06
	OUTFLOW,k	1.21E-06
	AVERAGE,k	1.21E-06

PART 1

MINUTES			
171	INFLOW,k	1.15E-06	cm/s
	OUTFLOW,k	1.19E-06	cm/s
	AVERAGE,k	1.17E-06	cm/s

PART 2

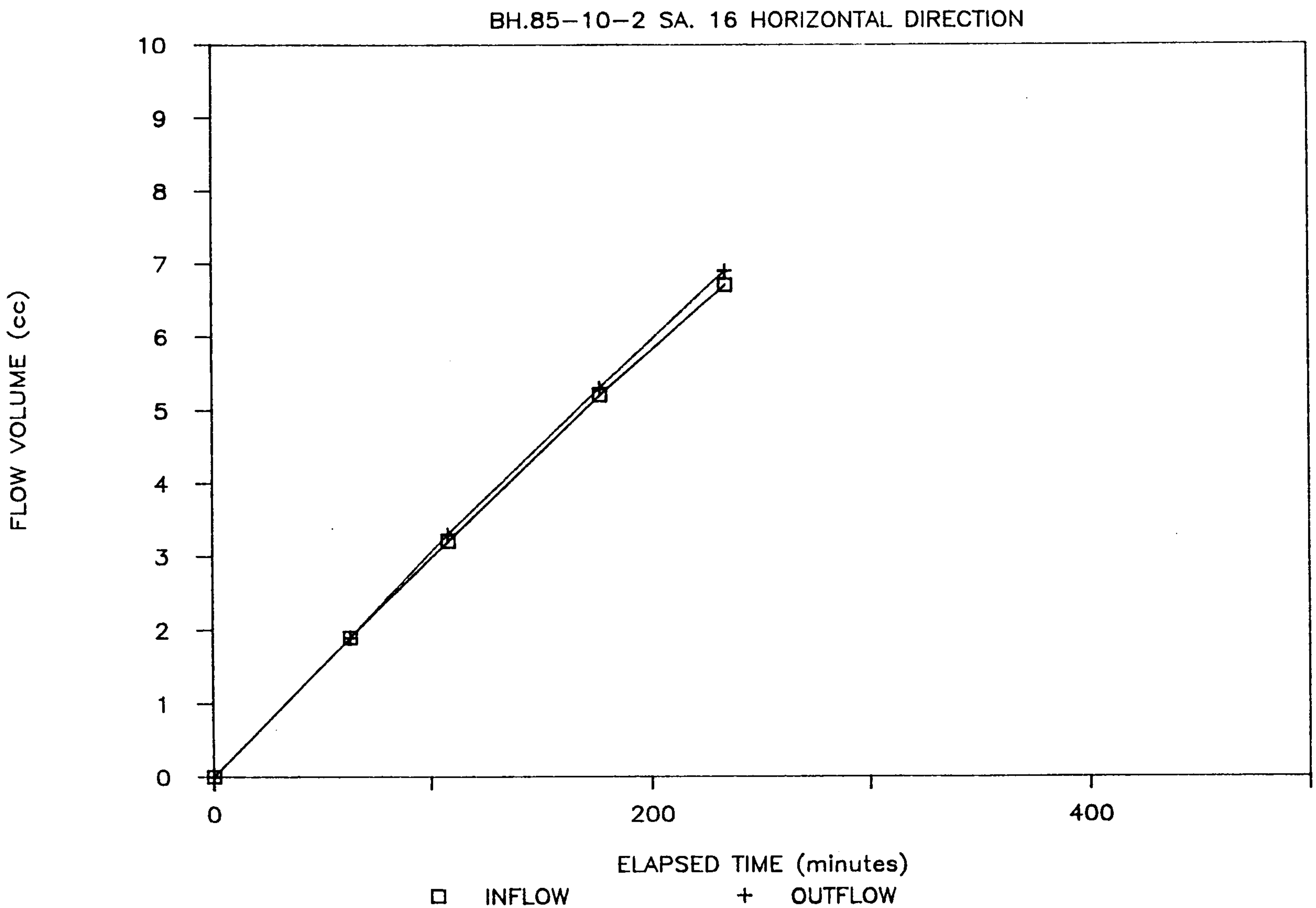
MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 1.17E-06 cm/s

NOTES

Membrane not sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 36

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 37

BOREHOLE NUMBER 85-10-2 PROJECT 861-1121
SAMPLE NUMBER 24 Vertical Direction
SAMPLE DEPTH 25.27 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay occasional silt seams

ORIGINAL: LENGTH cm	5.820	CONSOLIDATED: AREA cm2	19.32	WET WEIGHT gm	220.7
DIAMETER cm	5.050	LENGTH cm	5.72	DRY WEIGHT gm	174.7
AREA cm2	20.032	PRESSURE kPA	259.75	VOLUME WATER cc	54.0
VOLUME cc	116.587	HYDRAULIC GRADIENT (p/l)	19.33		

WATER CONTENT initial %	30.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	31.70	VOLUME SOLIDS cc	62.842	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.23	VOLUME VOIDS cc	53.746	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	14.69	VOID RATIO	0.855	SILT FRACTION (.06mm) %	
lb/ft3	93.52	SATURATION %	100.529		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	2520	4.7	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
470.6	210.8	199.8	11.02	2173.072	259.8	270.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-06-21	12:54	0	0	17.20	0.0	61.40	0.0		
86-06-23	08:36	2622	157320	15.90	1.30	60.20	1.20	2.17E-08	2.01E-08
86-06-23	15:43	3049	182940	15.80	1.40	59.60	1.80	1.03E-08	6.16E-09
86-06-23	16:54	3120	187200	15.70	1.50	59.50	1.90	6.18E-08	6.18E-08
86-06-24	08:36	4062	243720	15.20	2.00	59.20	2.20	2.33E-08	1.40E-08
86-06-24	12:00	4266	255960	15.10	2.10	59.00	2.40	2.15E-08	4.30E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 4266
INFLOW,k 4.01E-08
OUTFLOW,k 4.01E-08
AVERAGE,k 4.01E-08

PART 1
MINUTES 2622
INFLOW,k 2.17E-08 cm/s
OUTFLOW,k 2.01E-08 cm/s
AVERAGE,k 2.09E-08 cm/s

PART 2
MINUTES 1644
INFLOW,k 2.13E-08 cm/s
OUTFLOW,k 3.20E-08 cm/s
AVERAGE,k 2.67E-08 cm/s

AVERAGE,k USE FOR ANALYSES 2.67E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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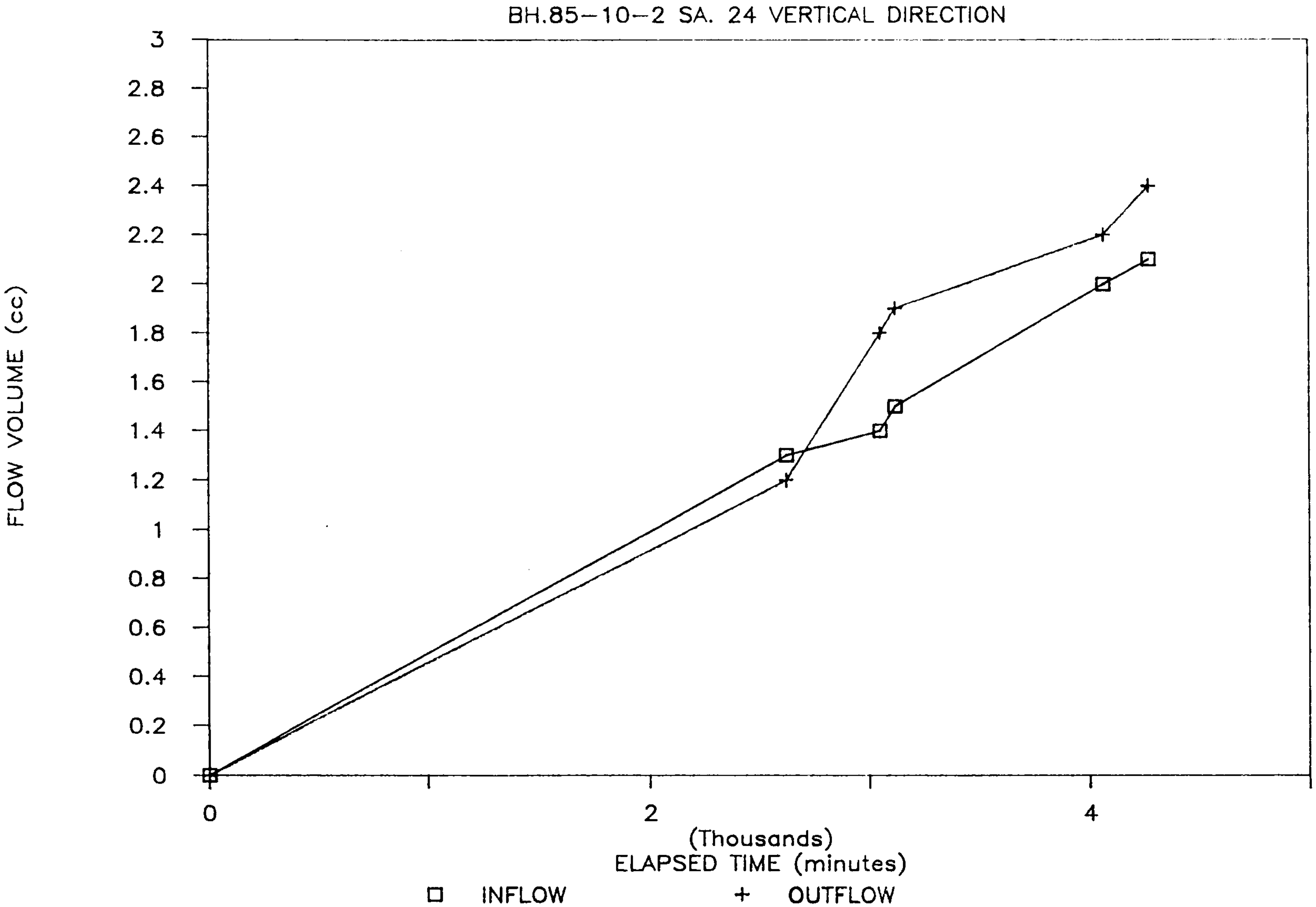

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 38

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 39

BOREHOLE NUMBER 85-10-2 — PROJECT 861-1121
SAMPLE NUMBER 24 Horizontal Direction
SAMPLE DEPTH 25.02 m — (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay occasional silt seams

ORIGINAL: LENGTH cm	5.160	CONSOLIDATED: AREA cm2	18.44	WET WEIGHT gm	211.9
DIAMETER cm	4.960	LENGTH cm	5.04	DRY WEIGHT gm	168.7
AREA cm2	19.325	PRESSURE kPA	259.75	VOLUME WATER cc	43.2
VOLUME cc	99.715	HYDRAULIC GRADIENT (p/l)	19.07		

WATER CONTENT initial %	25.60	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	28.40	VOLUME SOLIDS cc	60.683	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.83	VOLUME VOIDS cc	39.031	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.59	VOID RATIO	0.643	SILT FRACTION (.06mm) %	
lb/ft3	105.58	SATURATION %	110.680		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	1380	7.9	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
469.2	209.5	199.8	9.65	1814.830	259.8	269.4

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-07-01	15:30	0	0	58.20	0.0	13.40	0.0		
86-07-02	08:43	1033	61980	57.40	0.80	14.00	0.60	3.58E-08	2.69E-08
86-07-02	12:20	1250	75000	57.30	0.90	14.30	0.90	2.13E-08	6.40E-08
86-07-02	16:39	1509	90540	57.10	1.10	14.40	1.00	3.57E-08	1.79E-08
86-07-03	09:11	2501	150060	56.60	1.60	14.90	1.50	2.33E-08	2.33E-08
86-07-03	16:36	2946	176760	56.40	1.80	15.20	1.80	2.08E-08	3.12E-08
86-07-04	09:28	3958	237480	55.80	2.40	15.80	2.40	2.74E-08	2.74E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
3958	INFLOW,k	3.18E-08
	OUTFLOW,k	3.18E-08
	AVERAGE,k	3.18E-08

PART 1

MINUTES			
2925	INFLOW,k	2.53E-08	cm/s
	OUTFLOW,k	2.85E-08	cm/s
	AVERAGE,k	2.69E-08	cm/s

PART 2

MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 2.69E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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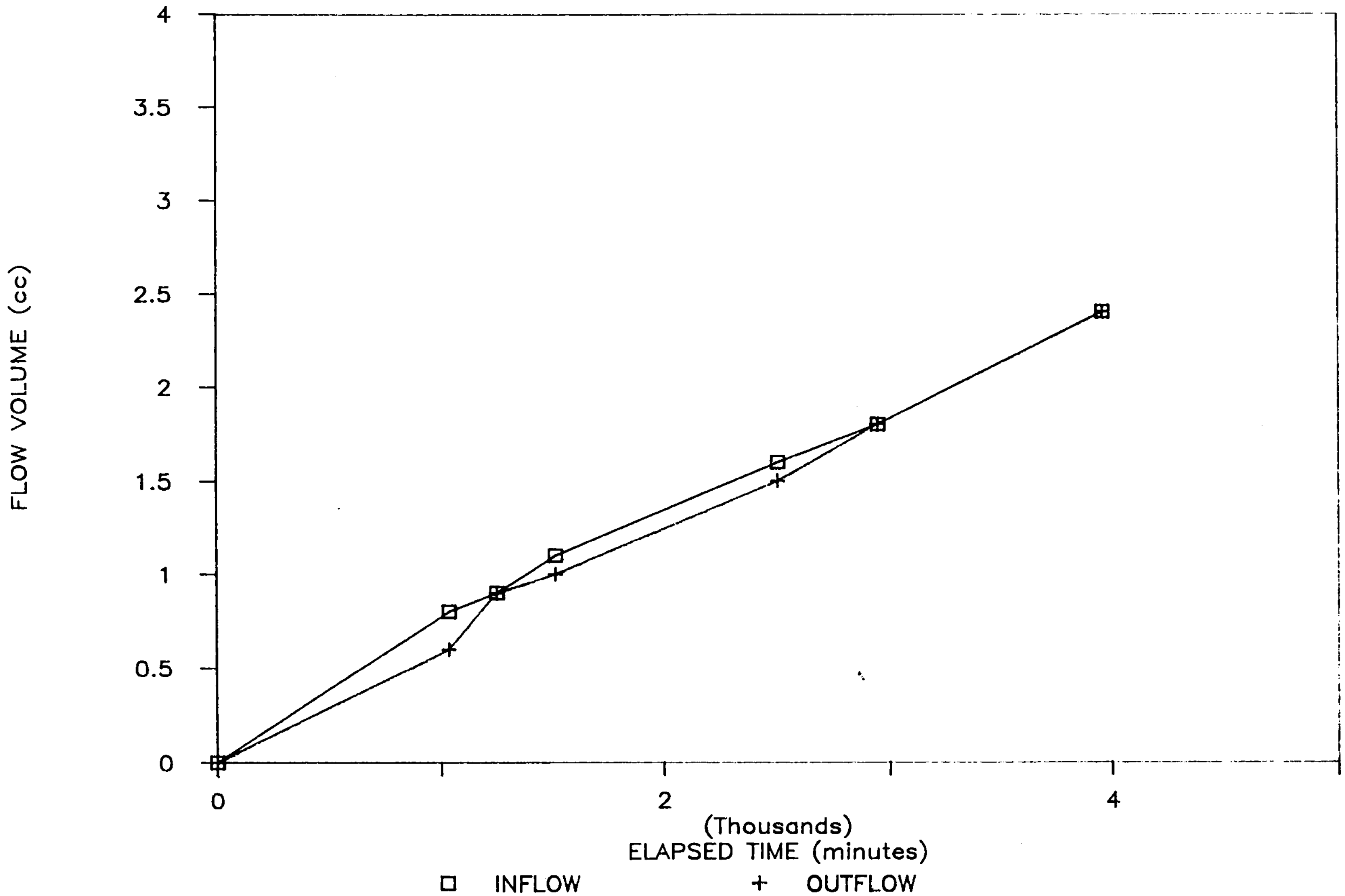
BH.85-10-2 SA. 24 HORIZONTAL DIRECTION



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 40

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 41

BOREHOLE NUMBER 85-12-8 PROJECT 861-1121

SAMPLE NUMBER 1 Vertical Direction

SAMPLE DEPTH 3.57 m (GLAL PROJECT #85-GH-8)

SAMPLE TYPE Silty clay with clayey silt pockets

ORIGINAL: LENGTH cm	7.490	CONSOLIDATED: AREA cm2	19.94	WET WEIGHT gm	317.2
DIAMETER cm	5.050	LENGTH cm	7.47	DRY WEIGHT gm	266.6
AREA cm2	20.032	PRESSURE kPA	44.78	VOLUME WATER cc	50.6
VOLUME cc	150.041	HYDRAULIC GRADIENT (p/l)	19.71		

WATER CONTENT initial %	19.00	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	19.30	VOLUME SOLIDS cc	95.899	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.72	VOLUME VOIDS cc	54.142	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.42	VOID RATIO	0.565	SILT FRACTION (.06mm) %	
lb/ft3	110.86	SATURATION %	93.458		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
175.7	130.9	1281	3.1	0.98

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
190.2	145.4	130.9	14.47	2943.686	44.8	59.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#4 Vc cc	INFLOW trns#4 aVc cc	OUTFLOW trns#3 Vc cc	OUTFLOW trns#3 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-14	15:37	0	0	0.8566	0.0	0.6801	0.0		
86-05-14	16:58	81	4860	0.8592	0.09	0.6830	0.10	4.72E-08	5.39E-08
86-05-15	09:07	1050	63000	0.8878	1.09	0.7118	1.13	4.34E-08	4.40E-08
86-05-15	11:54	1217	73020	0.8914	1.21	0.7169	1.31	3.17E-08	4.60E-08
86-05-15	16:16	1479	88740	0.8972	1.41	0.7248	1.59	3.26E-08	4.54E-08
86-05-16	08:48	2471	148260	0.9202	2.21	0.7501	2.49	3.41E-08	3.84E-08

COEFFICIENT of PERMEABILITY, k, cm/s

TOTAL FLOW

MINUTES		
2471	INFLOW,k	4.57E-08
	OUTFLOW,k	4.57E-08
	AVERAGE,k	4.57E-08

PART 1

MINUTES			
1398	INFLOW,k	4.00E-08	cm/s
	OUTFLOW,k	4.50E-08	cm/s
	AVERAGE,k	4.25E-08	cm/s

PART 2

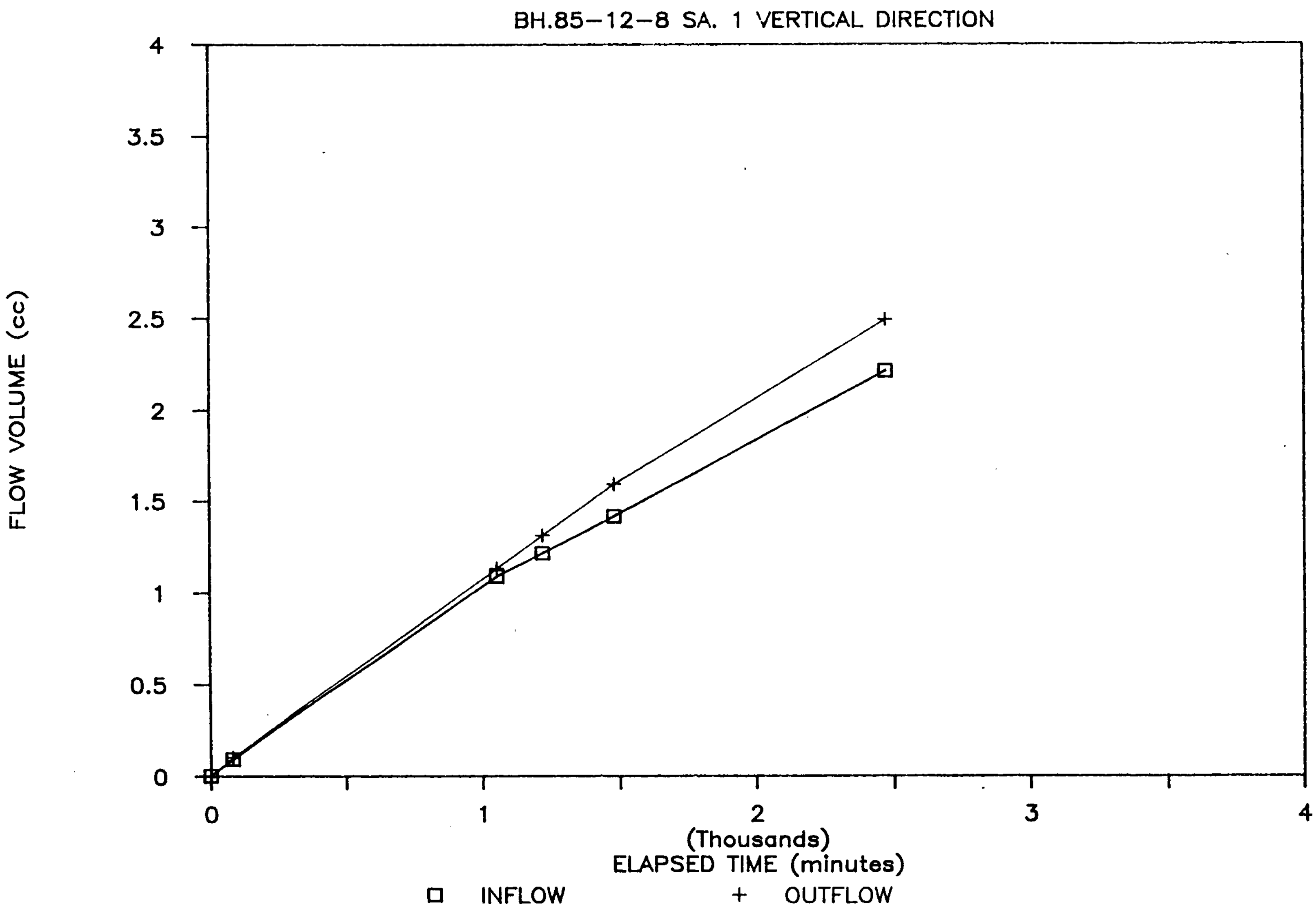
MINUTES			
992	INFLOW,k	3.41E-08	cm/s
	OUTFLOW,k	3.84E-08	cm/s
	AVERAGE,k	3.63E-08	cm/s

AVERAGE,k USE FOR ANALYSES 3.63E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 42

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 43

BOREHOLE NUMBER 85-12-8 PROJECT 861-1121
SAMPLE NUMBER 1 Horizontal Direction
SAMPLE DEPTH 3.49 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with clayey silt pockets, fissured

ORIGINAL: LENGTH cm	5.710	CONSOLIDATED: AREA cm2	19.80	WET WEIGHT gm	240.8
DIAMETER cm	5.040	LENGTH cm	5.69	DRY WEIGHT gm	201.5
AREA cm2	19.953	PRESSURE kPA	40.23	VOLUME WATER cc	39.3
VOLUME cc	113.931	HYDRAULIC GRADIENT (p/l)	19.70		

WATER CONTENT initial %	20.90	SPECIFIC GRAVITY	2.700	LIQUID LIMIT %	
WATER CONTENT final %	19.50	VOLUME SOLIDS cc	72.482	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.72	VOLUME VOIDS cc	41.449	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.14	VOID RATIO	0.572	SILT FRACTION (.06mm) %	
lb/ft3	109.09	SATURATION %	94.814		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
175.7	130.9	1260	3.1	0.98

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
190.2	141.9	130.9	11.02	2227.061	40.2	59.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#1 Vc cc	INFLOW trns#1 aVc cc	OUTFLOW trns#2 Vc cc	OUTFLOW trns#2 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-16	08:47	0	0	1.0042	0.0	0.6606	0.0		
86-05-16	12:08	201	12060	1.0035	0.02	0.6575	0.11	5.09E-09	2.39E-08
86-05-16	16:22	455	27300	1.0031	0.04	0.6549	0.21	2.30E-09	1.58E-08
86-05-17	14:25	1778	106680	0.9836	0.71	0.6339	0.97	2.15E-08	2.46E-08
86-05-19	15:09	4702	282120	0.9621	1.44	0.6111	1.80	1.07E-08	1.21E-08
86-05-20	11:20	5913	354780	0.9490	1.89	0.5994	2.22	1.58E-08	1.50E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 5913

INFLOW,k	1.83E-08	
OUTFLOW,k	1.83E-08	
AVERAGE,k	1.83E-08	

PART 1
MINUTES 4135

INFLOW,k	1.22E-08	cm/s
OUTFLOW,k	1.29E-08	cm/s
AVERAGE,k	1.26E-08	cm/s

PART 2
MINUTES 1211

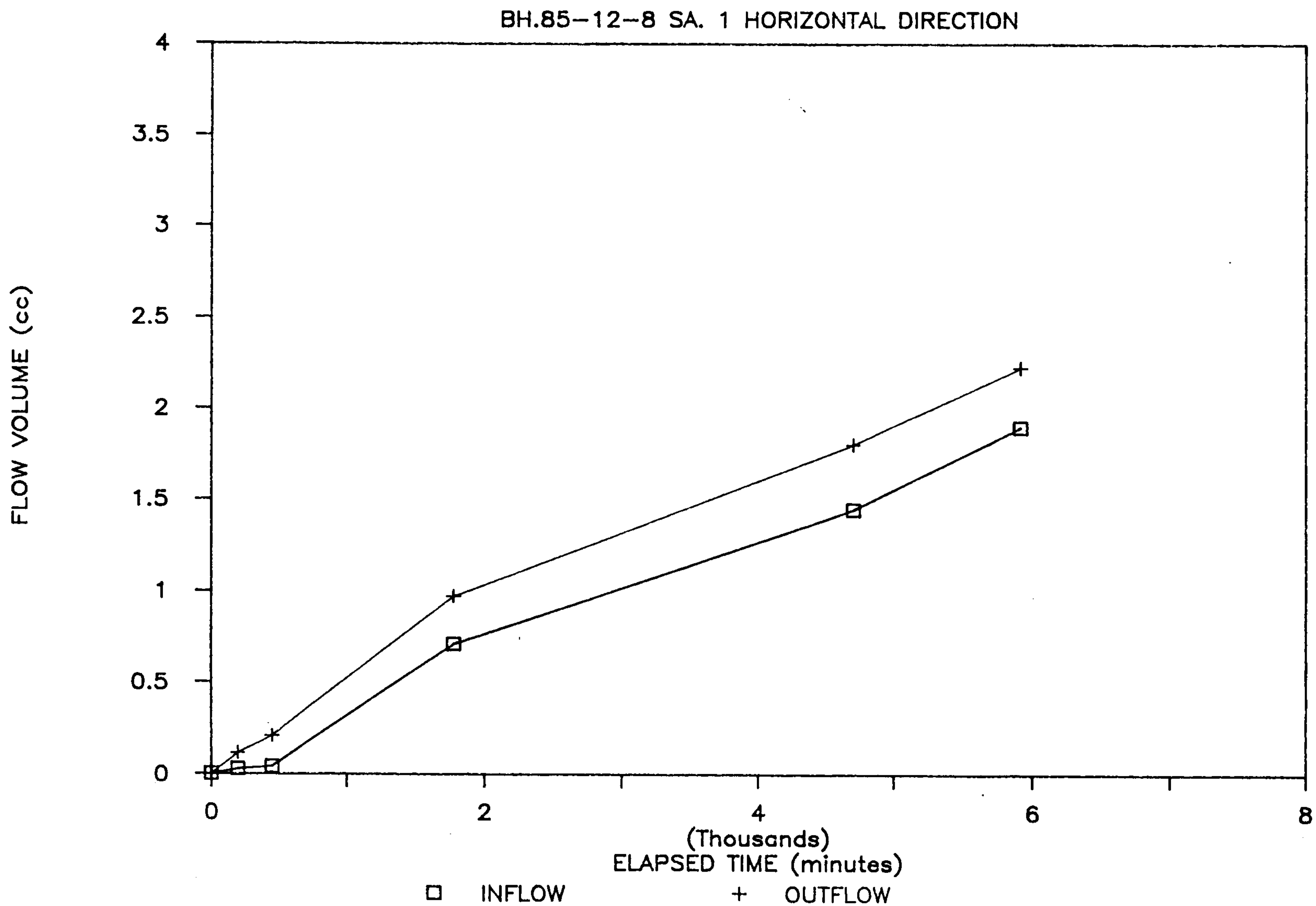
INFLOW,k	1.58E-08	cm/s
OUTFLOW,k	1.50E-08	cm/s
AVERAGE,k	1.54E-08	cm/s

AVERAGE,k USE FOR ANALYSES 1.54E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 44

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 45

BOREHOLE NUMBER 85-12-8 PROJECT 861-1121
SAMPLE NUMBER 3 Vertical Direction
SAMPLE DEPTH 11.13 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with clayey silt pockets.fine gravel

ORIGINAL: LENGTH cm	6.620	CONSOLIDATED: AREA cm2	18.77	WET WEIGHT gm	270.2
DIAMETER cm	4.950	LENGTH cm	6.54	DRY WEIGHT gm	224.9
AREA cm2	19.247	PRESSURE kPA	110.24	VOLUME WATER cc	45.3
VOLUME cc	127.413	HYDRAULIC GRADIENT (p/l)	20.18		

WATER CONTENT initial %	20.10	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	20.50	VOLUME SOLIDS cc	80.899	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.79	VOLUME VOIDS cc	46.514	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.31	VOID RATIO	0.575	SILT FRACTION (.06mm) %	
lb/ft3	110.18	SATURATION %	97.369		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
241.1	130.9	1267	0.8	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
254.2	144.0	130.9	13.09	2507.061	110.2	123.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-14	15:35	0	0	47.20	0.0	64.80	0.0		
86-05-14	17:00	85	5100	47.30	0.10	64.70	0.10	5.11E-08	5.11E-08
86-05-15	09:15	1060	63600	48.00	0.80	63.30	1.50	3.12E-08	6.24E-08
86-05-15	11:39	1204	72240	48.10	0.90	63.10	1.70	3.02E-08	6.04E-08
86-05-15	16:37	1502	90120	48.30	1.10	62.70	2.10	2.92E-08	5.84E-08
86-05-16	08:50	2475	148500	49.20	2.00	61.50	3.30	4.02E-08	5.36E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 2475
INFLOW,k 5.72E-08
OUTFLOW,k 5.72E-08
AVERAGE,k 5.72E-08

PART 1
MINUTES 975
INFLOW,k 3.12E-08 cm/s
OUTFLOW,k 6.24E-08 cm/s
AVERAGE,k 4.68E-08 cm/s

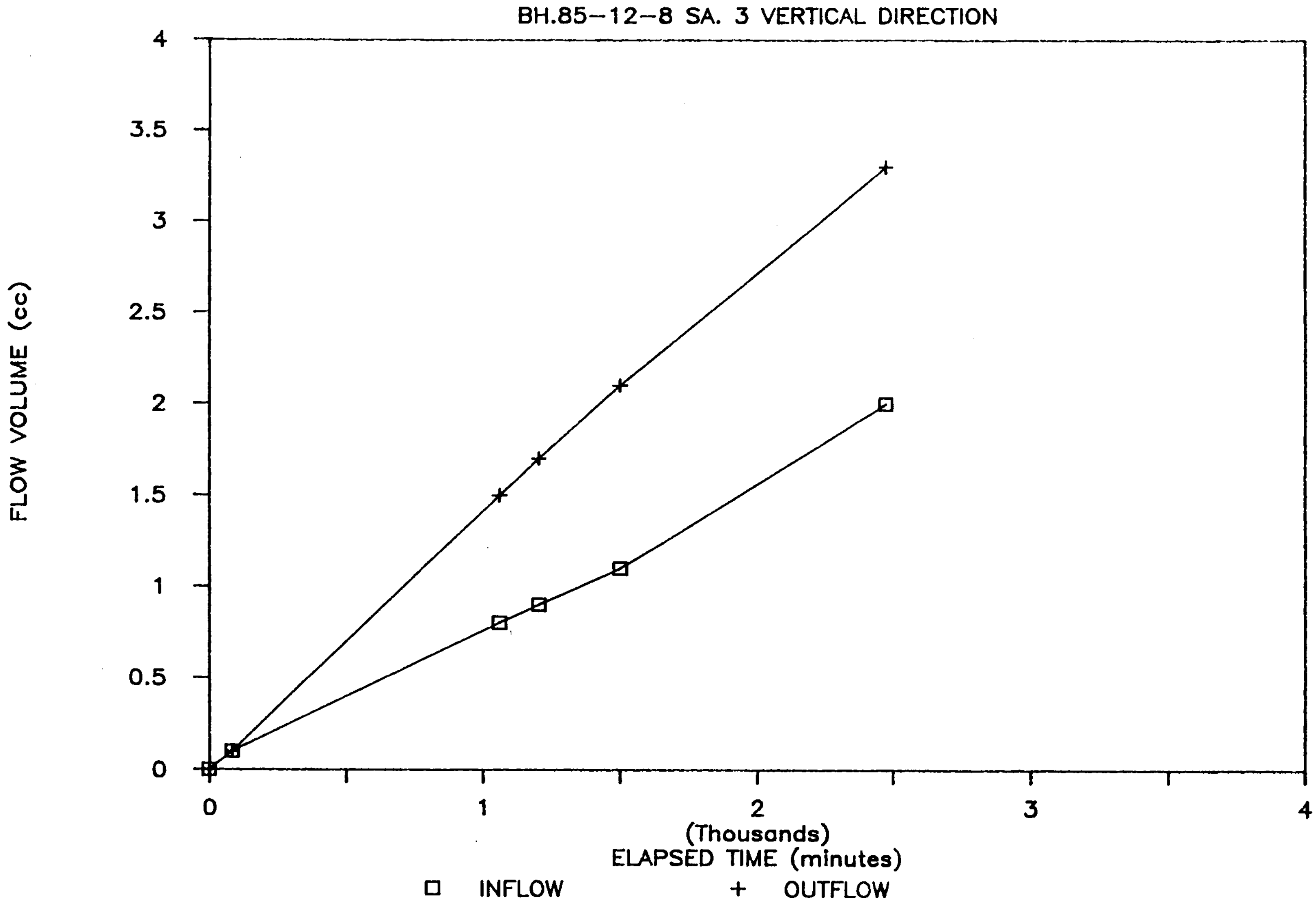
PART 2
MINUTES 1271
INFLOW,k 3.69E-08 cm/s
OUTFLOW,k 5.53E-08 cm/s
AVERAGE,k 4.61E-08 cm/s

AVERAGE,k USE FOR ANALYSES 4.61E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 46

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 47

BOREHOLE NUMBER 85-12-8 — PROJECT 861-1121
SAMPLE NUMBER 3 Horizontal Direction
SAMPLE DEPTH 10.96 m — (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silty clay with clayey silt pockets.fine gravel

ORIGINAL: LENGTH cm	5.970	CONSOLIDATED: AREA cm2	17.34	WET WEIGHT gm	217.8
DIAMETER cm	4.720	LENGTH cm	5.94	DRY WEIGHT gm	179.8
AREA cm2	17.500	PRESSURE kPA	110.24	VOLUME WATER cc	38.0
VOLUME cc	104.473	HYDRAULIC GRADIENT (p/l)	20.02		

WATER CONTENT initial %	21.10	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	20.90	VOLUME SOLIDS cc	64.676	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.44	VOLUME VOIDS cc	39.797	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.88	VOID RATIO	0.615	SILT FRACTION (.06mm) %	
lb/ft3	107.43	SATURATION %	95.510		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
241.1	130.9	1274	1.2	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
252.9	142.6	130.9	11.71	2072.264	110.2	121.9

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-14	15:36	0	0	8.00	0.0	77.40	0.0		
86-05-14	16:58	82	4920	8.10	0.10	77.40	0.00	5.83E-08	0.00E+00
86-05-15	09:09	1053	63180	8.40	0.40	77.00	0.40	1.48E-08	1.97E-08
86-05-15	11:34	1198	71880	8.40	0.40	77.00	0.40	0.00E+00	0.00E+00
86-05-15	16:15	1479	88740	8.50	0.50	76.90	0.50	1.70E-08	1.70E-08
86-05-16	08:43	2467	148020	9.00	1.00	76.40	1.00	2.42E-08	2.42E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
2467	INFLOW,k	1.22E-08
	OUTFLOW,k	1.22E-08
	AVERAGE,k	1.22E-08

PART 1

MINUTES			
971	INFLOW,k	1.48E-08	cm/s
	OUTFLOW,k	1.97E-08	cm/s
	AVERAGE,k	1.72E-08	cm/s

PART 2

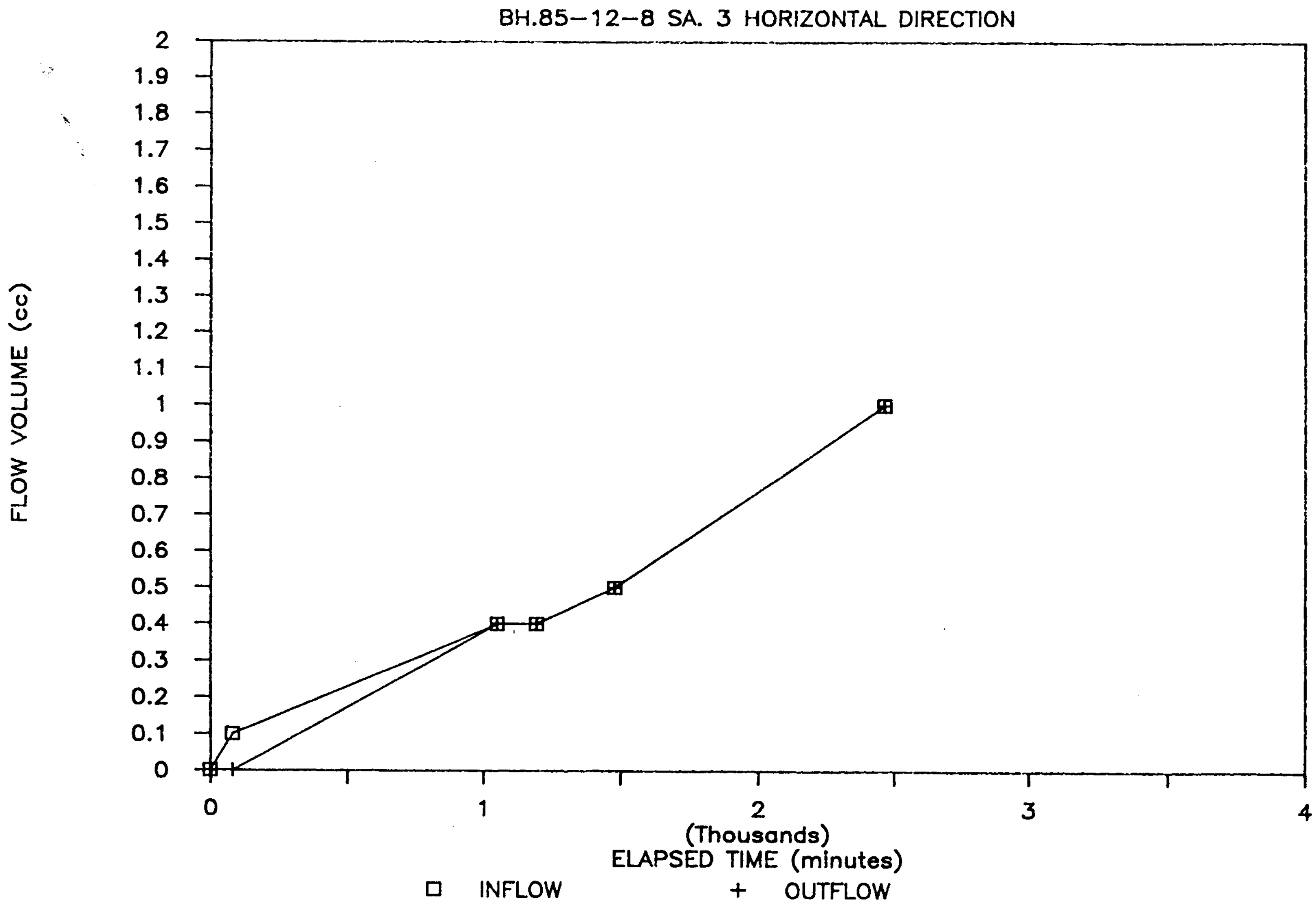
MINUTES			
1269	INFLOW,k	2.26E-08	cm/s
	OUTFLOW,k	2.26E-08	cm/s
	AVERAGE,k	2.26E-08	cm/s

AVERAGE,k USE FOR ANALYSES 2.26E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 48

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 49

BOREHOLE NUMBER 85-12-8 — PROJECT 861-1121
SAMPLE NUMBER 5 Vertical Direction
SAMPLE DEPTH 21.72 m — (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with gravel,till like

ORIGINAL: LENGTH cm	6.520	CONSOLIDATED: AREA cm2	19.20	WET WEIGHT gm	269.8
DIAMETER cm	5.000	LENGTH cm	6.45	DRY WEIGHT gm	221.4
AREA cm2	19.637	PRESSURE kPA	230.13	VOLUME WATER cc	48.4
VOLUME cc	128.036	HYDRAULIC GRADIENT (p/l)	19.42		

WATER CONTENT initial %	21.90	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	20.90	VOLUME SOLIDS cc	79.640	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.66	VOLUME VOIDS cc	48.396	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.95	VOID RATIO	0.608	SILT FRACTION (.06mm) %	
lb/ft3	107.87	SATURATION %	100.000		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	5640	0.3	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
511.2	281.1	268.7	12.41	2431.481	230.1	242.5

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#3 Vc cc	INFLOW trns#3 aVc cc	OUTFLOW trns#4 Vc cc	OUTFLOW trns#4 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-21	15:01	0	0	0.6936	0.0	1.1307	0.0		
86-05-22	08:47	1066	63960	0.7019	0.30	1.1178	0.45	1.23E-08	1.86E-08
86-05-22	13:52	1371	82260	0.7075	0.49	1.1142	0.57	2.89E-08	1.82E-08
86-05-22	16:50	1549	92940	0.7104	0.60	1.1118	0.66	2.57E-08	2.07E-08
86-05-23	09:15	2534	152040	0.7215	0.99	1.1040	0.93	1.77E-08	1.22E-08
86-05-23	16:45	2984	179040	0.7356	1.50	1.0939	1.28	4.93E-08	3.45E-08
86-05-26	08:45	6824	409440	0.7749	2.90	1.0503	2.80	1.61E-08	1.75E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
6824	INFLOW,k	2.03E-08
	OUTFLOW,k	2.03E-08
	AVERAGE,k	2.03E-08

PART 1

MINUTES			
483	INFLOW,k	2.77E-08	cm/s
	OUTFLOW,k	1.91E-08	cm/s
	AVERAGE,k	2.34E-08	cm/s

PART 2

MINUTES			
3840	INFLOW,k	1.61E-08	cm/s
	OUTFLOW,k	1.75E-08	cm/s
	AVERAGE,k	1.68E-08	cm/s

AVERAGE,k USE FOR ANALYSES 1.68E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

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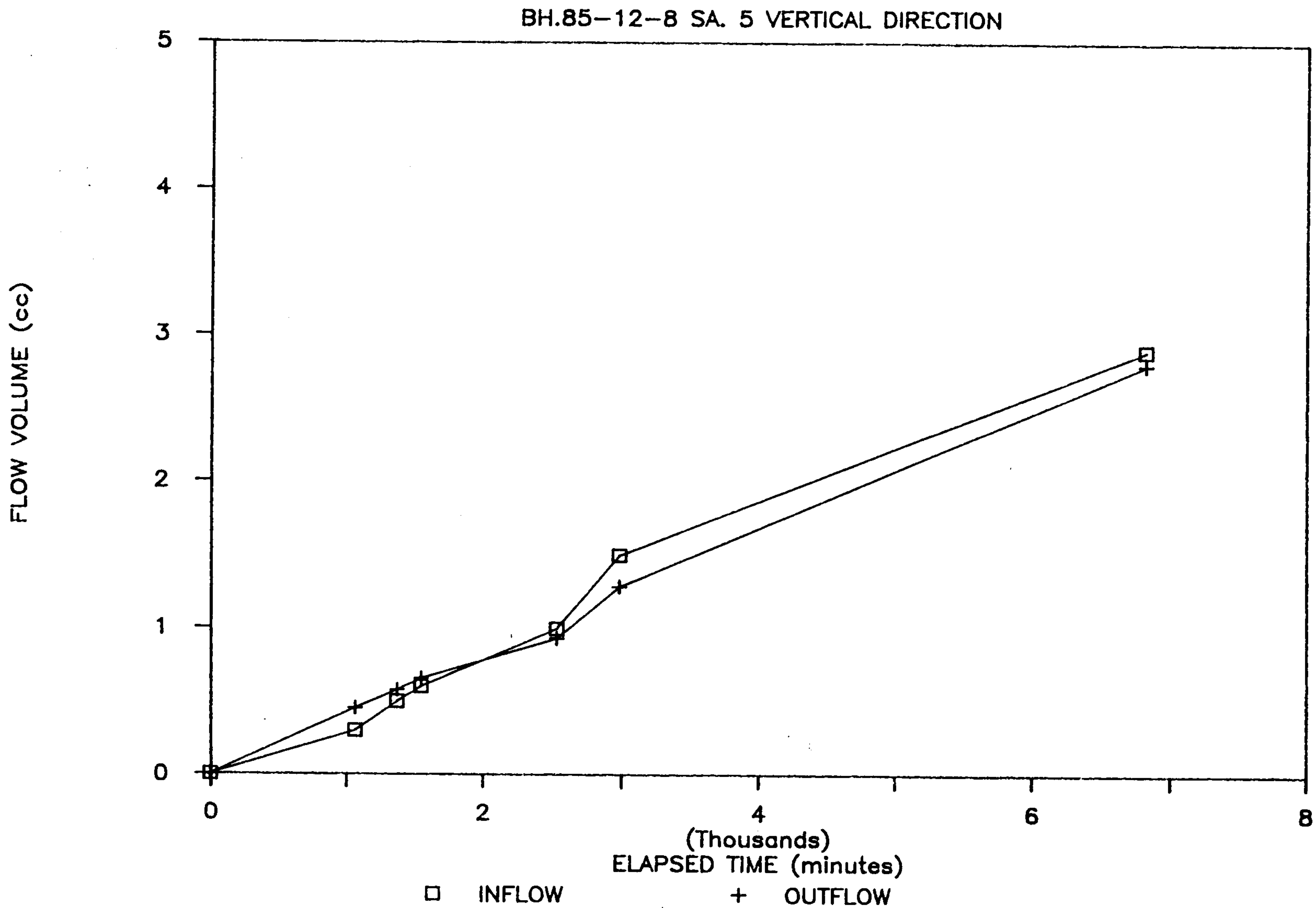

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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 50

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 51

BOREHOLE NUMBER 85-12-8 PROJECT 861-1121
SAMPLE NUMBER 5 Horizontal Direction
SAMPLE DEPTH 21.69 m (GLAL PROJECT #85-6H-8)
SAMPLE TYPE Silty clay with fine gravel,till like

ORIGINAL: LENGTH cm	5.290	CONSOLIDATED: AREA cm2	17.32	WET WEIGHT gm	216.9
DIAMETER cm	4.950	LENGTH cm	5.03	DRY WEIGHT gm	177.7
AREA cm2	19.247	PRESSURE kPA	230.13	VOLUME WATER cc	39.2
VOLUME cc	101.815	HYDRAULIC GRADIENT (p/l)	18.60		

WATER CONTENT initial %	22.10	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	21.90	VOLUME SOLIDS cc	63.921	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.88	VOLUME VOIDS cc	37.894	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.10	VOID RATIO	0.593	SILT FRACTION (.06mm) %	
lb/ft3	108.87	SATURATION %	103.446		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
567.7	337.6	240	1.9	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
577.4	347.3	337.6	9.65	1704.602	230.1	239.8

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#1 Vc cc	INFLOW trns#1 aVc cc	OUTFLOW trns#2 Vc cc	OUTFLOW trns#2 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-22	08:47	0	0	1.2380	0.0	0.5924	0.0		
86-05-22	13:52	305	18300	1.2319	0.21	0.5805	0.43	3.37E-08	6.98E-08
86-05-22	16:49	482	28920	1.2282	0.34	0.5811	0.41	3.53E-08	*********
86-05-23	09:16	1469	88140	1.2056	1.11	0.5620	1.10	3.86E-08	3.46E-08
86-05-23	16:44	1917	115020	1.1973	1.40	0.5533	1.42	3.13E-08	3.47E-08
86-05-26	08:43	5756	345360	1.1236	3.92	0.4890	3.76	3.24E-08	2.99E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES			
5756	INFLOW,k	3.26E-08	
	OUTFLOW,k	3.26E-08	
	AVERAGE,k	3.26E-08	

PART 1

MINUTES			
5274	INFLOW,k	3.35E-08	cm/s
	OUTFLOW,k	3.12E-08	cm/s
	AVERAGE,k	3.23E-08	cm/s

PART 2

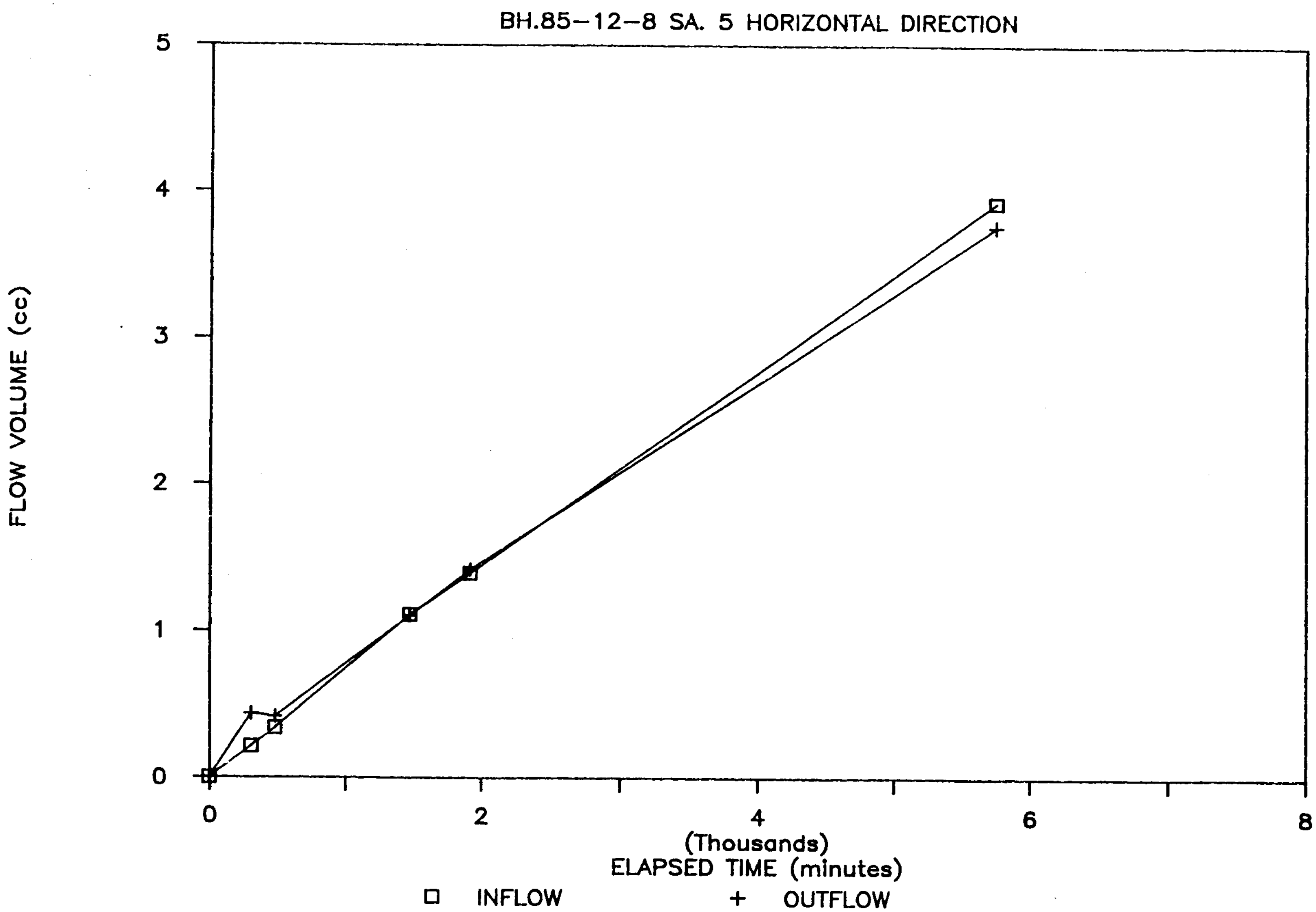
MINUTES			
n/a	INFLOW,k	n/a	cm/s
	OUTFLOW,k	n/a	cm/s
	AVERAGE,k	n/a	cm/s

AVERAGE,k USE FOR ANALYSES 3.23E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 52

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 53

BOREHOLE NUMBER 85-12-22 — PROJECT 861-1121
SAMPLE NUMBER 2 Vertical Direction
SAMPLE DEPTH 15.33 m — (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with gravel,till like

ORIGINAL: LENGTH cm	6.400	CONSOLIDATED: AREA cm2	19.27	WET WEIGHT gm	262.8
DIAMETER cm	5.000	LENGTH cm	6.34	DRY WEIGHT gm	216.6
AREA cm2	19.637	PRESSURE kPA	159.85	VOLUME WATER cc	46.2
VOLUME cc	125.680	HYDRAULIC GRADIENT (p/l)	19.79		

WATER CONTENT initial %	21.30	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	22.60	VOLUME SOLIDS cc	77.914	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.50	VOLUME VOIDS cc	47.766	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	16.90	VOID RATIO	0.613	SILT FRACTION (.06mm) %	
lb/ft3	107.57	SATURATION %	96.721		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	5415	4.6	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
441.0	281.1	268.7	12.41	2440.345	159.8	172.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-21	16:15	0	0	4.60	0.0	77.00	0.0		
86-05-22	08:45	990	59400	5.20	0.60	76.20	0.80	2.62E-08	3.50E-08
86-05-22	13:53	1298	77880	5.40	0.80	76.00	1.00	2.81E-08	2.81E-08
86-05-22	16:45	1470	88200	5.50	0.90	75.80	1.20	2.52E-08	5.03E-08
86-05-23	09:11	2456	147360	6.00	1.40	75.00	2.00	2.20E-08	3.51E-08
86-05-23	16:35	2900	174000	6.30	1.70	74.60	2.40	2.93E-08	3.90E-08
86-05-26	08:41	6746	404760	8.50	3.90	72.20	4.80	2.48E-08	2.70E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 6746
INFLOW,k 3.58E-08
OUTFLOW,k 3.58E-08
AVERAGE,k 3.58E-08

PART 1
MINUTES 1466
INFLOW,k 2.36E-08 cm/s
OUTFLOW,k 3.54E-08 cm/s
AVERAGE,k 2.95E-08 cm/s

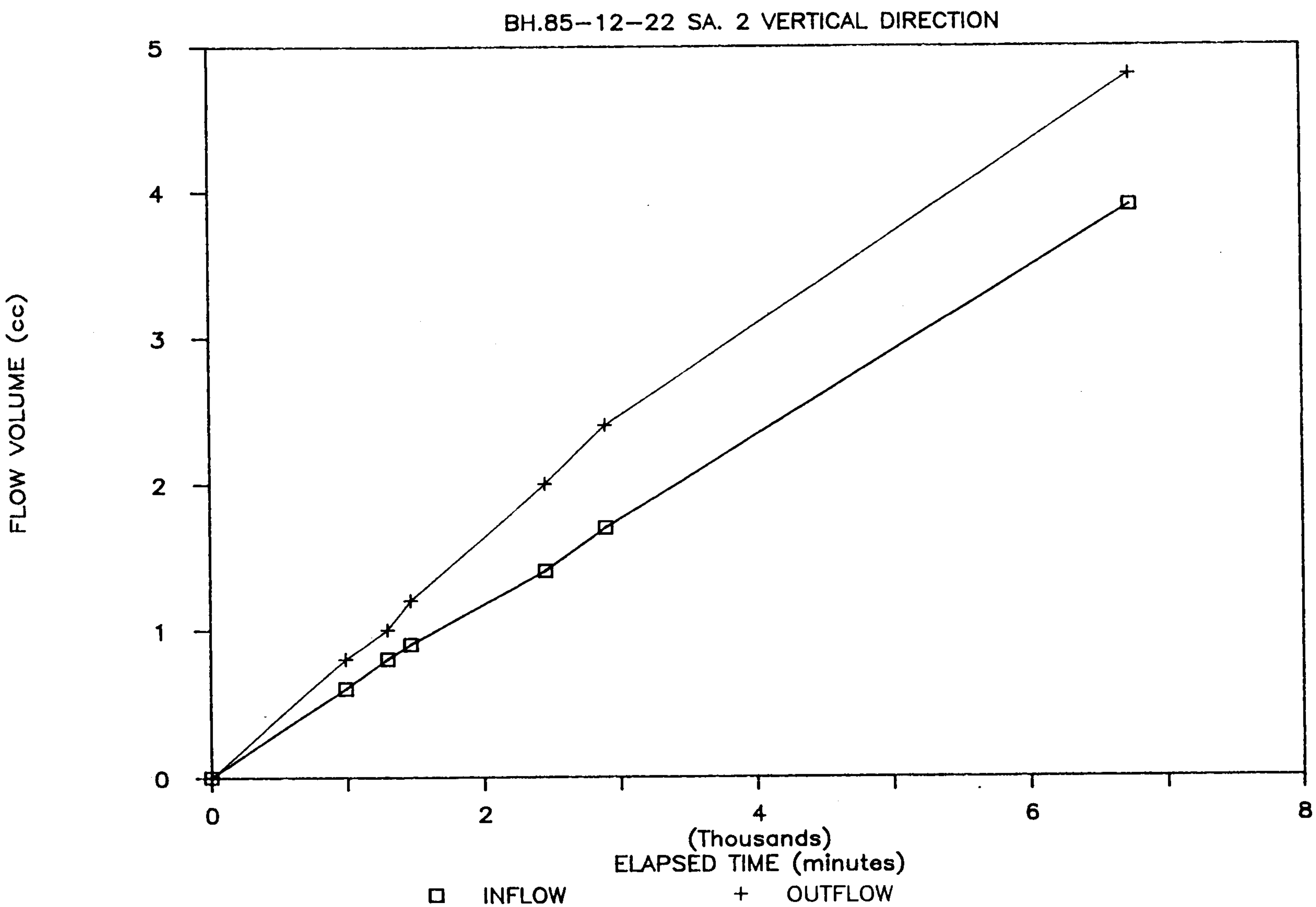
PART 2
MINUTES 4290
INFLOW,k 2.52E-08 cm/s
OUTFLOW,k 2.83E-08 cm/s
AVERAGE,k 2.67E-08 cm/s

AVERAGE,k USE FOR ANALYSES 2.67E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 54

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 55

BOREHOLE NUMBER 85-12-22 PROJECT 861-1121
SAMPLE NUMBER 2 Horizontal Direction
SAMPLE DEPTH 15.28 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE Silty clay with gravel,till like

ORIGINAL: LENGTH cm	6.270	CONSOLIDATED: AREA cm2	20.08	WET WEIGHT gm	272.2
DIAMETER cm	5.100	LENGTH cm	6.22	DRY WEIGHT gm	232.0
AREA cm2	20.431	PRESSURE kPA	159.85	VOLUME WATER cc	40.2
VOLUME cc	128.101	HYDRAULIC GRADIENT (p/l)	20.20		

WATER CONTENT initial %	17.30	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	16.70	VOLUME SOLIDS cc	83.453	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	20.83	VOLUME VOIDS cc	44.648	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	17.76	VOID RATIO	0.535	SILT FRACTION (.06mm) %	
lb/ft3	113.04	SATURATION %	90.037		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
275.6	268.7	5634	0.6	0.97

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
441.0	281.1	268.7	12.41	2542.923	159.8	172.3

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW Vc cc	INFLOW aVc cc	OUTFLOW Vc cc	OUTFLOW aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-21	16:17	0	0	59.10	0.0	58.80	0.0		
86-05-22	08:45	988	59280	60.00	0.90	57.80	1.00	3.71E-08	4.13E-08
86-05-22	13:54	1297	77820	60.20	1.10	57.60	1.20	2.64E-08	2.64E-08
86-05-22	16:47	1470	88200	60.40	1.30	57.40	1.40	4.71E-08	4.71E-08
86-05-23	09:18	2461	147660	61.30	2.20	56.40	2.40	3.70E-08	4.11E-08
86-05-23	16:37	2900	174000	61.60	2.50	56.00	2.80	2.79E-08	3.71E-08
86-05-26	08:45	6748	404880	65.00	5.90	52.20	6.60	3.60E-08	4.03E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 6748
INFLOW,k 3.89E-08
OUTFLOW,k 3.89E-08
AVERAGE,k 3.89E-08

PART 1
MINUTES 5760
INFLOW,k 3.54E-08 cm/s
OUTFLOW,k 3.96E-08 cm/s
AVERAGE,k 3.75E-08 cm/s

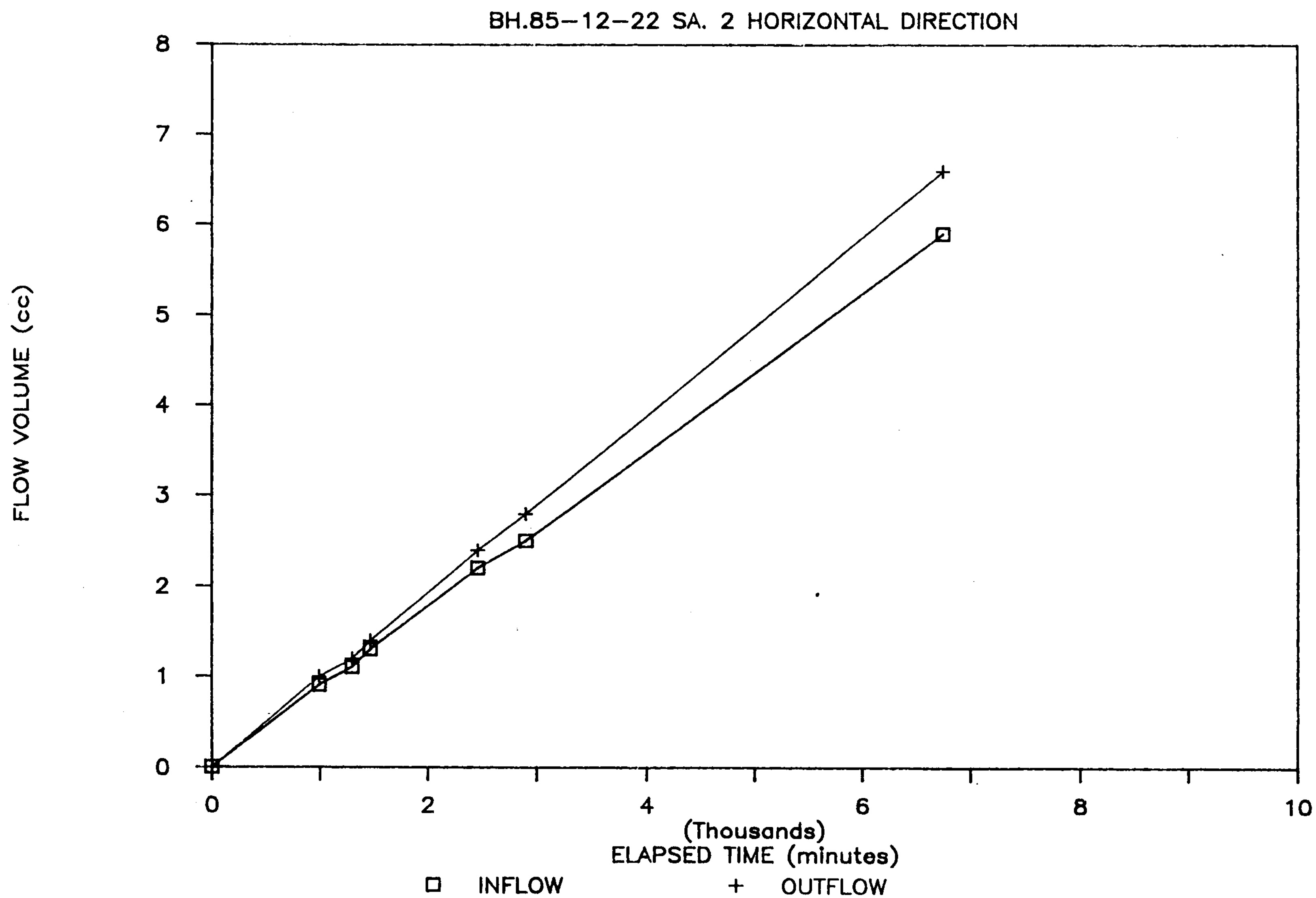
PART 2
MINUTES n/a
INFLOW,k n/a cm/s
OUTFLOW,k n/a cm/s
AVERAGE,k n/a cm/s
AVERAGE,k USE FOR ANALYSES 3.75E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

Golder Associates



TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 56

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 57

BOREHOLE NUMBER 85-12-22 PROJECT 861-1121
SAMPLE NUMBER 4 Vertical Direction
SAMPLE DEPTH 28.6 (GLAL PROJECT #85-6H-8)
SAMPLE TYPE silty clay to claey silt with fine gravel

ORIGINAL:	LENGTH cm	6.450	CONSOLIDATED: AREA cm2	19.18	WET WEIGHT gm	257.6
	DIAMETER cm	5.010	LENGTH cm	6.36	DRY WEIGHT gm	202.6
	AREA cm2	19.716	PRESSURE kPA	319.70	VOLUME WATER cc	55.0
	VOLUME cc	127.169	HYDRAULIC GRADIENT (p/l)	19.63		

WATER CONTENT initial %	27.10	SPECIFIC GRAVITY	2.780	LIQUID LIMIT %	
WATER CONTENT final %	25.40	VOLUME SOLIDS cc	72.878	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.85	VOLUME VOIDS cc	54.291	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.62	VOID RATIO	0.745	SILT FRACTION (.06mm) %	
lb/ft3	99.44	SATURATION %	101.250		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	1340	1.5	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
531.9	212.2	199.8	12.41	2428.948	319.7	332.1

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#4 Vc cc	INFLOW trns#4 aVc cc	OUTFLOW trns#3 Vc cc	OUTFLOW trns#3 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-29	08:40	0	0	1.0710	0.0	0.6339	0.0		
86-05-29	16:43	483	28980	1.0750	0.14	0.6378	0.14	1.26E-08	1.25E-08
86-05-30	08:33	1433	85980	1.0836	0.44	0.6400	0.22	1.37E-08	3.60E-09
86-05-30	14:45	1805	108300	1.0864	0.54	0.6426	0.31	1.14E-08	1.09E-08
86-05-31	14:25	3225	193500	1.0974	0.92	0.6515	0.63	1.18E-08	9.74E-09
86-06-02	09:03	5783	346980	1.1189	1.67	0.6732	1.40	1.28E-08	1.32E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW
MINUTES 5783
INFLOW,k 1.25E-08
OUTFLOW,k 9.99E-09
AVERAGE,k 1.12E-08

PART 1
MINUTES 1322
INFLOW,k 1.31E-08 cm/s
OUTFLOW,k 5.64E-09 cm/s
AVERAGE,k 9.37E-09 cm/s

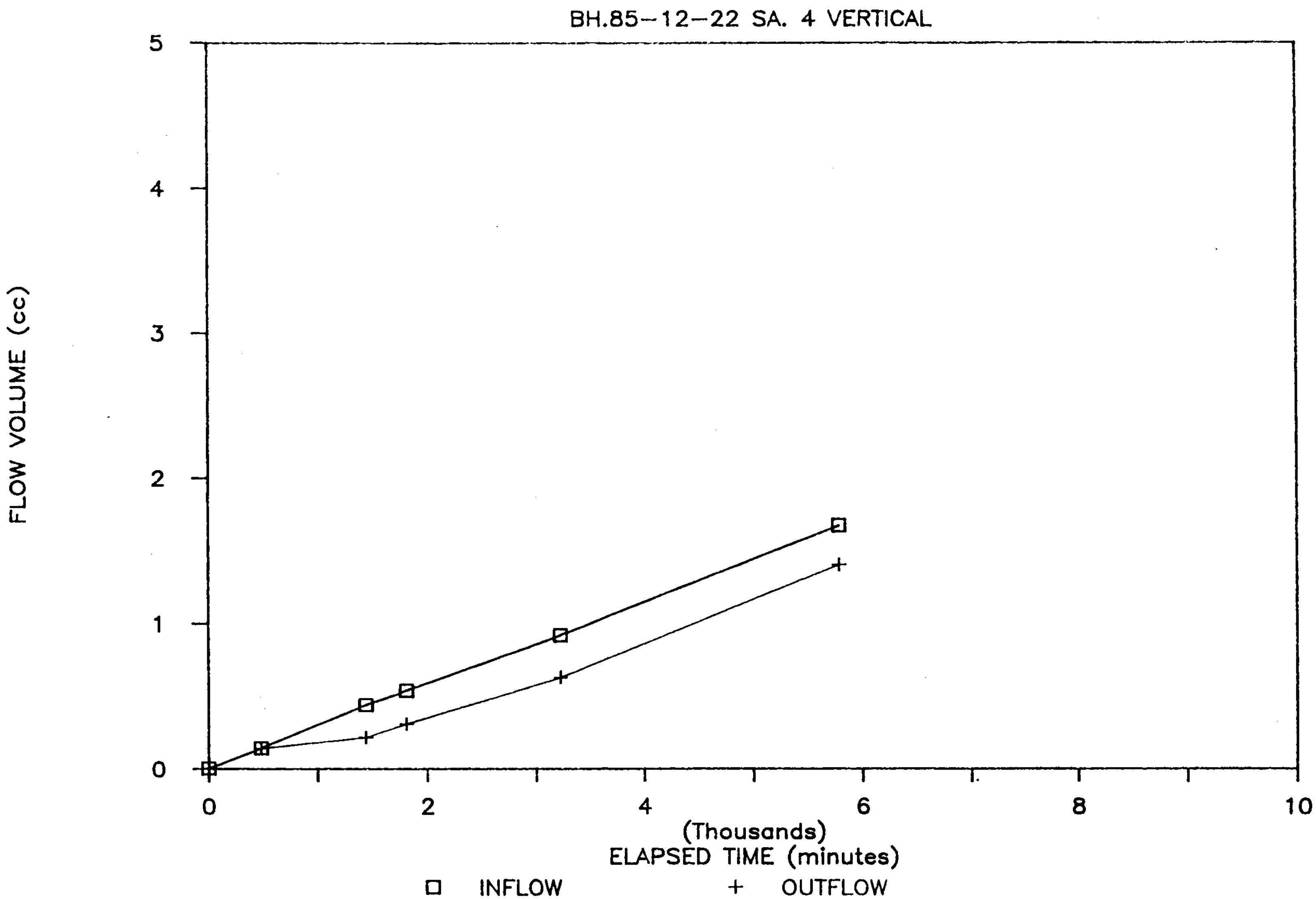
PART 2
MINUTES 3978
INFLOW,k 1.24E-08 cm/s
OUTFLOW,k 1.20E-08 cm/s
AVERAGE,k 1.22E-08 cm/s

AVERAGE,k USE FOR ANALYSES 1.22E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease.
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates



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TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST
SHEET 2 OF 2

FIGURE 58

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 1 OF 2

FIGURE 59

BOREHOLE NUMBER 85-12-22 PROJECT 861-1121
SAMPLE NUMBER 4 Horizontal Direction
SAMPLE DEPTH 28.45 m (GLAL PROJECT #85-GH-8)
SAMPLE TYPE silty clay to claey silt with fine gravel

ORIGINAL: LENGTH cm	5.930	CONSOLIDATED: AREA cm2	18.74	WET WEIGHT gm	231.5
DIAMETER cm	4.980	LENGTH cm	5.82	DRY WEIGHT gm	184.4
AREA cm2	19.481	PRESSURE kPA	319.70	VOLUME WATER cc	47.1
VOLUME cc	115.521	HYDRAULIC GRADIENT (p/l)	20.17		

WATER CONTENT initial %	25.50	SPECIFIC GRAVITY	2.700	LIQUID LIMIT %	
WATER CONTENT final %	24.10	VOLUME SOLIDS cc	66.331	PLASTIC INDEX %	
UNIT WEIGHT kN/m3	19.65	VOLUME VOIDS cc	49.190	CLAY FRACTION (.002mm) %	
DRY UNIT WEIGHT kN/m3	15.66	VOID RATIO	0.742	SILT FRACTION (.06mm) %	
lb/ft3	99.66	SATURATION %	95.833		

SATURATION by BACK PRESSURE (achieved)

Cell Pressure kPa	Back Pressure kPa	Test Duration min	Volume Water cc	B Value
206.7	199.8	1339	1.1	0.96

PERMEABILITY TEST CONDITIONS

Cell Pressure kPa	Head Pressure kPa	Back Pressure kPa	Effective Head Pressure kPa	Constant Ah	Effective Confining Pressure Top kPa	Effective Confining Pressure Base kPa
531.2	211.5	199.8	11.72	2241.487	319.7	331.4

DATE YY-MM-DD	CLOCK time	ELAPSED TIME min.	ELAPSED TIME sec.	INFLOW trns#4 Vc cc	INFLOW trns#4 aVc cc	OUTFLOW trns#3 Vc cc	OUTFLOW trns#3 aVc cc	DAILY PERMEABILITY RESULTS INFLOW cm/s	DAILY PERMEABILITY RESULTS OUTFLOW cm/s
86-05-29	08:42	0	0	0.7674	0.0	0.6090	0.0		
86-05-29	16:41	479	28740	0.7620	0.18	0.5939	0.55	1.67E-09	4.96E-08
86-05-30	08:40	1438	86280	0.7457	0.74	0.5708	1.39	2.52E-08	3.79E-08
86-05-30	14:42	1800	108000	0.7420	0.87	0.5608	1.75	1.52E-08	4.35E-08
86-05-31	14:26	3224	193440	0.7214	1.58	0.5302	2.86	2.15E-09	3.38E-08
86-06-02	09:02	5780	346800	0.6881	2.72	0.4787	4.74	1.93E-08	3.17E-08

COEFFICIENT of PERMEABILITY,k, cm/s

TOTAL FLOW

MINUTES		
5780	INFLOW,k	1.96E-08
	OUTFLOW,k	3.93E-09
	AVERAGE,k	2.94E-08

PART 1

MINUTES			
1321	INFLOW,k	2.25E-08	cm/s
	OUTFLOW,k	3.94E-08	cm/s
	AVERAGE,k	3.09E-08	cm/s

PART 2

MINUTES			
3980	INFLOW,k	2.01E-08	cm/s
	OUTFLOW,k	3.24E-08	cm/s
	AVERAGE,k	2.63E-08	cm/s

AVERAGE,k USE FOR ANALYSES 2.63E-08 cm/s

NOTES

Membrane sealed onto sample with vacuum grease,
Consolidation prior to start of permeability test,
0 time after 1440 minutes of permeability run.
Data by F.A.R.

Golder Associates

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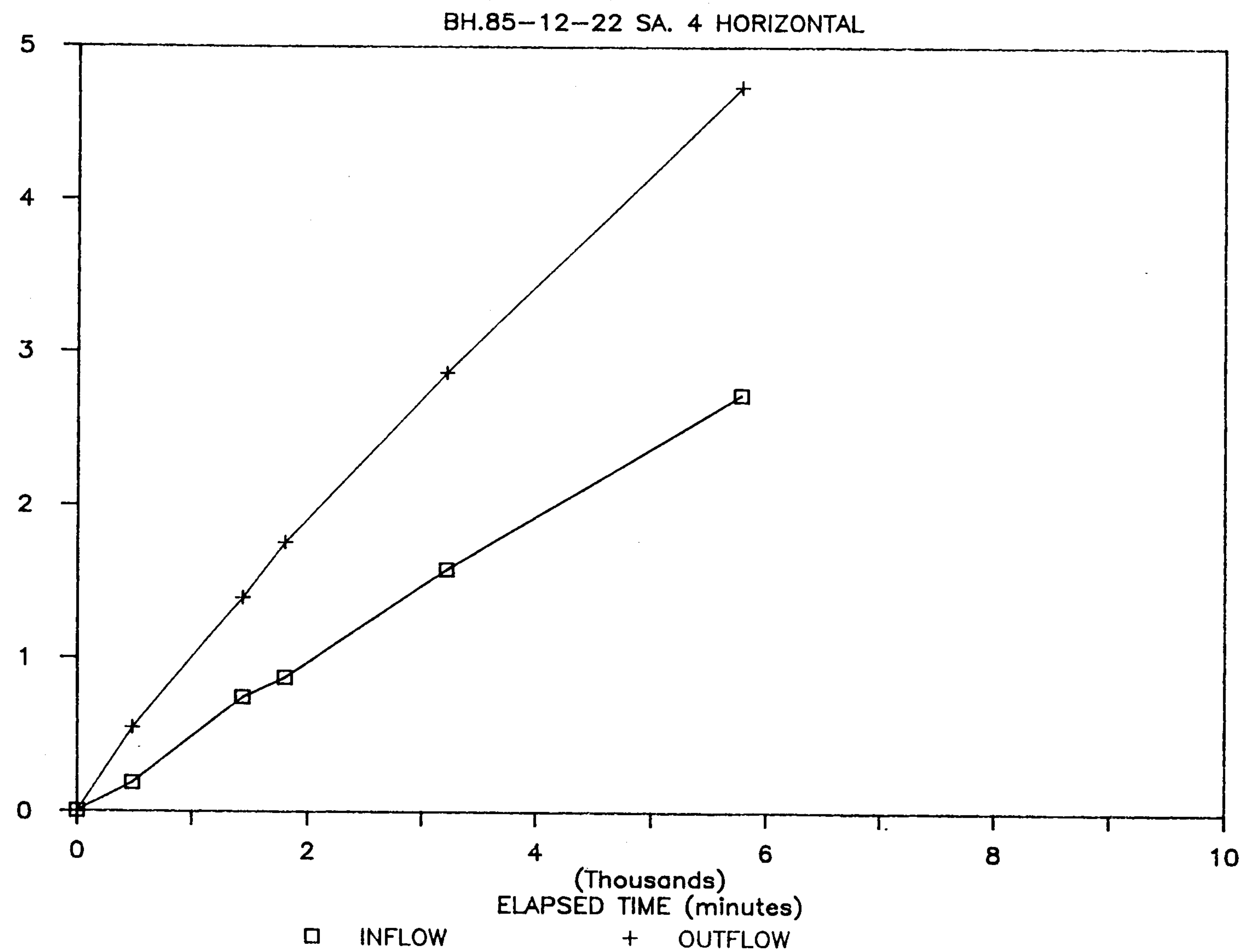

TRIAXIAL PERMEABILITY (CONSTANT HEAD) TEST

SHEET 2 OF 2

FIGURE 60

APPENDIX H

GROUND WATER USE INFORMATION

APPENDIX H

GROUND WATER USE INFORMATION

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H1 SUMMARY OF WATER WELL DATA

H1.1 EXPLANATION OF WATER WELL DATA

Copies of original Water Well Records obtained from the Ontario Ministry of the Environment (MOE) was used for the following data summary and are on file.

Measurements, dimensions, and quantities on the Water Well Records are in Imperial units but are presented in metric units in the summary.

Water well locations were plotted on 1:10,000 scale maps for this project and elevations were re-estimated based on the more accurate contours on these maps. Well elevations are above sea level (ASL) and are estimated to the nearest metre. Well locations were checked in the field during the Water Use Survey and are shown on Figure 5-1 (in map pocket). Well number 2729 could not be located and is not shown on Figure 5-1.

Wells are arranged in numerical order on Table H1-1 according to the assigned well number.

TABLE H1-1, SUMMARY OF WATER WELL DATA

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
430	Beliak, S. Con. 2, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.)	180	May 1964	159	34.4	Fresh	33.8	4.6	9.1	0.8	Stock	0.0 33.8	33.8 34.4	Blue Clay Grey Shale
431	Gracey, C. Con. 2, Lot 16 West Lincoln Twp. (Formerly Gainsborough Twp.)	177	Aug 1958	127	36.3	Fresh	36.3	0.6	0.6	1.3	Stock and Domestic	0.0 36.3	36.3 36.6	Clay Shale
446	Beamer, C., Con. 3, Lot 19, West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Sep 1962	159	35.1	Fresh	34.1	9.1	12.2	0.8	Stock and Domestic	0.0 34.1	34.1 35.4	Blue Clay Grey Limestone
447	Veandermeulen, J., Con. 3, Lot 20 West Lincoln Twp. (Formerly Gainsborough Twp.)	183	Dec 1960	159	37.2	Fresh	36.6	7.6	13.7	0.8	Stock and Domestic	0.0 36.6	36.6 37.2	Clay Limestone
448	Boradyn, A., Con. 3, Lot 20, West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Dec 1967	159	33.8	Fresh	33.8	9.1	10.7	1.2	Stock	0.0 29.0 32.9	29.0 32.9 33.8	Clay Clay, Gravel Gravel

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TABLE H1-1, SUMMARY OF WATER WELL DATA

Sheet 2 of 6

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
466	Sarantakos, O., Con. 4, Lot 16 West Lincoln Twp. (Formerly Gainsborough Twp.)	186	Sep 1964	159	30.2	Fresh	29.3	9.1	9.8	1.2	Stock	0.0 29.0	29.0 31.4	Blue Clay Limestone
467	Skladas, J. Con. 4, Lot 16 West Lincoln Twp. (Formerly Gainsborough Twp.)	187	Jul 1966	159	32.3	Fresh	31.4	6.7	7.6	0.8	Stock	0.0 9.1 31.1	9.1 31.1 32.6	Brown Clay Blue Clay Grey Limestone
468	Morris, R. Con. 4, Lot 18 West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Dec 1965	159	34.4	Fresh	32.9	8.5	11.6	1.1	Stock	0.0 29.9 32.3	29.9 32.3 32.4	Clay Clay, Gravel Niagara Rock
469	Beamer, O., Con. 4, Lot 19, West Lincoln Twp. (Formerly Gainsborough Twp.)	186	Jun 1954	143	29.6	Fresh	27.7	9.1	9.1	1.3	Stock	0.0 27.7	27.7 29.6	Clay, Boulders Niagara Rock
1794	Katsoulis, A. Con. 4, Lot 20, West Lincoln Twp. (Formerly Gainsborough Twp.)	185	May 1968	159	36.6	Fresh	35.1	8.8	10.7	0.8	Domestic and Stock	0.0 7.3 32.9 35.1	7.3 32.9 35.1 36.9	Brown Clay Blue Clay Blue Clay, Gravel Grey Limestone

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TABLE H1-1, SUMMARY OF WATER WELL DATA

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
1800	Vandervelde, M.	186	Aug 1968	159	30.2	Fresh	29.6	9.5	19.8	0.8	Domestic	0.0	4.6	Brown Clay
	Con. 4, Lot 16										and	4.6	13.7	Blue Clay
	West Lincoln Twp.										Stock	13.7	29.3	Red Clay
	(Formerly Gainsborough Twp.)											29.3	30.5	Grey Limestone
1867	Flameling, Y.	184	Apr 1969	159	35.1	Fresh	35.1	9.1	12.8	0.8	Domestic	0.0	12.2	Brown Clay
	Con. 3, Lot 17										and	12.2	33.5	Red Clay
	West Lincoln Twp.										Stock	33.5	34.8	Sand, Packed
	(Formerly Gainsborough Twp.)											34.8	35.1	Gravel
1961	Augustyn, A.	182	Dec 1969	159	39.6	Fresh	39.9	10.7	11.6	1.1	Domestic	0.0	31.1	Clay
	Con. 2, Lot 18,										and	31.1	35.1	Stones
	West Lincoln Twp.										Stock	35.1	39.6	Sand and Gravel, Packed
	(Formerly Gainsborough Twp.)											39.6	39.9	Rock
2004	Skladas, J.	187	Aug 1970	159	30.8	Fresh	29.9	11.6	13.7	0.8	Domestic	0.0	6.7	Brown Clay, Packed
	Con. 4, Lot 16										and	6.7	23.8	Blue Clay, Soft
	West Lincoln Twp.										Stock	23.8	29.9	Red Clay, Pebbles
	(Formerly Gainsborough Twp.)											29.9	30.9	Grey Limestone, Layered
2124	Fois, H.	178	Oct 1971	159	40.2	Fresh	36.0	8.5	29.0	0.5	Stock	0.0	6.7	Brown Clay, Packed
	Con. 2, Lot 17,											6.7	19.8	Grey Clay, Soft
	West Lincoln Twp.											19.8	27.4	Red Clay, Soft
	(Formerly Gainsborough Twp.)											27.4	35.1	Brown Clay, Gravel, Hard
												35.1	36.0	Grey Hardpan, Gravel, Hard
												36.0	40.2	Grey Rock, Layered

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TABLE H1-1, SUMMARY OF WATER WELL DATA

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
2164	Boulton, Ron Con.4, Lot 19 West Lincoln Twp. (Formerly Gainsborough Twp.)	187	Apr 1972	159	26.2	Fresh	26.5	9.8	9.8	0.8	Domestic	0.0 3.1 22.9 24.4 25.9	3.1 22.9 24.4 25.9 26.5	Brown clay Blue Clay Stones, Clay Stones, Gravel Rock
2306	Ellis, G. Con. 2, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.)	178	Aug 1973	159	34.7	Fresh	34.8	6.1	11.6	1.2	Stock	0.0 25.9 34.4	25.9 34.4 34.8	Grey Clay Red Clay, Gravel Shale and Gravel
2330	Beamer, K. Con.3, Lot 19, West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Dec 1973	159	32.3	Fresh	32.3	9.1	13.7	0.8	Domestic	0.0 11.6 31.7	11.6 31.7 32.3	Brown Clay, Packed Red Clay, Soft Grey Shale, Broken
2348	Vandervelde, E., Con. 4, Lot 20 West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Mar 1974	159	33.5	Fresh	32.2	8.5	13.7	0.8	Domestic	0.0 9.8 20.7 32.0	9.8 20.7 32.0 33.8	Brown Clay, Packed Red Clay, Soft Grey Clay, Gravel Hard Grey Limestone, Layered
2391	Kapellas, A., Con. 3, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.	186	Sep 1975	159	30.5	Fresh	30.5	11.6	12.2	-	Domestic	0.0 29.9	29.9 30.5	Grey Clay Shale

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TABLE H1-1, SUMMARY OF WATER WELL DATA

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
2531	Boradyn A. Con. 3, Lot 20 West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Jun 1976	159	33.8	Fresh	33.8	9.8	12.2	1.1	Domestic and Stock	0.0 1.5 9.1 32.0 32.9	1.5 9.1 32.0 32.9 33.8	Brown Clay, Packed Grey Clay, Dense Brown Clay, Packed Brown Clay, Gravel, Packed Grey Shale, Layered
2729	Tency Poultry Farms Limited Con. 4, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.) (not able to locate)	186	Nov 1978	159	31.7	Fresh	31.1	10.7	14.6	1.5	Domestic	0.0 28.0 30.5	28.0 30.5 31.7	Grey Clay Clay, Gravel Niagara Rock
2755	Devries, R., Con. 4, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.)	186	Apr 1979	159	29.6	Fresh	29.6	9.5	13.7	1.1	Stock	0.0 9.1 29.1 29.4	9.1 29.1 29.4 31.7	Grey Clay, Packed Brown Clay, Dense Grey Shale, Layered Grey Limestone, Layered
2837	Emanuele, J. Con. 1, Lot 16, West Lincoln Twp. (Formerly Gainsborough Twp.)	178	Jul 1980	152	35.1	--	34.4	4.9	24.4	0.8	Stock	0.0 29.0 34.1	29.0 34.1 35.1	Gray Clay Clay and Stone Rock
2858	Scheunder, D.F. Con. 2, Lot 19, West Lincoln Twp. (Formerly Gainsborough Twp.)	183	Jan 1981	198	38.7	Fresh	38.7	7.6	19.8	1.1	Domestic	0.0 2.7 21.3 25.0 38.7	2.7 21.3 25.0 38.7 39.3	Brown Clay Grey Clay Red Clay Clay, Gravel Rock

TABLE H1-1, SUMMARY OF WATER WELL DATA

MOE WELL No.	OWNER NAME & LOCATION	GROUND ELEV'N (m ASL)	DATE DRILLED MN YR	WELL DIAM (mm)	WATER FOUND (m)	WATER QUALITY	CASING DEPTH (m)	STATIC LEVEL (m)	PUMPING LEVEL (m)	PUMP RATE (L/s)	WATER USE	FROM (m)	TO (m)	MATERIALS DESCRIPTION
2924	Burow, F. Con. 4, Lot 20, West Lincoln Twp. (Formerly Gainsborough Twp.)	185	Jul 1982	152	31.7 32.6	Fresh	30.5	9.8	10.7	1.51	Domestic	0.0 28.0 30.5	28.0 30.5 32.6	Gray Clay Clay and Gravel Niagara Rock

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H2 SUMMARY OF WATER USE DATA

H2.1 EXPLANATION OF WATER USE DATA

The following includes water use information obtained from residents in the vicinity of the Preferred Site which is summarized on Table H2-1. The bulk of this information was obtained from a door-to-door survey completed in August and September 1986. Examples of the field survey forms are shown in Figures H2-1 and H2-2. Supplementary information was provided from the Phase 4A field survey.

TABLE H2-1

SUMMARY OF WATER USE DATA

EXPLANATORY NOTES

1.	Assessment Roll No.	- the number assigned to a parcel of land for tax purposes, see Map H2-1
2.	Lot	- lot number situated in the Township of West Lincoln
3.	Conc.	- concession number situated in the Township of West Lincoln
4.	Water Source	- source of water supply used on the parcel of land as follows:

Dr - drilled well
Du - dug/bored well
Cr - cistern, rainwater
Ct - cistern, trucked water
Cr,t- cistern, rainwater and trucked water
P - pond
S - stream or creek
Sp - spring

5. Water Treatment	- type of water treatment as follows: c - chlorination s - water softener f - filter uv - ultra violet light o - other d - distillation n - none
6. Potable	- domestic drinking water use
7. Non-Potable	- domestic water use other than drinking, such as washing, bathing, cleaning and toilet use,
8. Stock	- stock watering, including all types of farm animals
9. Other	- other types of water use, including irrigation, spraying, wash water for cleaning barns and equipment, commercial and community use
10. Not Used	- includes abandoned as well as potentially usable water sources
11. Remarks	- general comments on water use, water quality and related comments

NOTE: Water Consumption estimated for the following:

Residential water use - 275 L/d/person*

Lawn/Garden Watering - 1100 L/household/d**

Drinking Water - 2 L/d/person***

Agricultural water use

- Milk cow (including washing)	136 L/d*
- Steer/Dry Cow	55 L/d*
- Horse	55 L/d*
- Hog	7 L/d*
- Sheep	7 L/d*
- Chickens (100)	23 L/d*
- Turkeys (100)	45 L/d*
- Dog (kennel use per dog)	10 L/d***
- Rabbit	2 L/d***
- Goat	7 L/d***
- Geese (100)	45 L/d***
- Ferret	2 L/d***

Commercial water use

- Oxbow Restaurant	5000 L/d***
- Wellandport Community Centre (based on 3000 L/d on weekends)	857 L/d***

* from Manual of Policy, Procedures and Guidelines for Private Sewage Disposal Systems (MOE, 1982).

** assumes lawn and garden area of 0.1 ha and 100 mm soil moisture deficit from June - August.

*** estimated water consumption.

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
5-122	20	4	Dr	n	✓	✓				- MOE well 2924. Household water use 2750 L/d - dog kennel water use 100 L/d
			Dr	n					✓	- MOE well 1794, for future kennel use.
			P (6)	n					✓	- Ponds for future recreational use, i.e., trailer park.
5-123	20	4	Dr	n	✓	✓	✓			- No MOE record - Well supplies 2 homes, - household water use 3850 L/d, supplies residence on 5-123-1 and 5-123 - Livestock use 820 L/d
			Dr	f	✓	✓				- MOE well 2348, supplies duplex household water use 2750 L/d
			P(3)						✓	- Previously supplied cattle.
5-123-1	20	4								- See 5-123
5-124	20	4	Cr,t P	n	✓	✓			✓	- Household water use 1925 L/d - Planned to dig out pond
5-125	19	4	Cr	f	✓	✓				- Household water use 4125 L/d
			Cr P	n		✓			✓	- Cistern for watering garden - Pond not used
5-140	20	4								- No water use, cultivated land
6-111	21	2	Dr	n			✓			- No MOE record, well drilled about 40 years ago, well depth 40.2m, depth to bedrock 39.0m, original static water level 4.3m - Livestock water use 2750 L/d - Good water quality, no sulphur smell, contains minerals - Drop in water level about 6.1m during Welland Canal construction.
			Dr						✓	- Abandoned
			Cr,t	n	✓	✓				- Household water use 2200 L/d
6-114 (interview refused)	20	3	Dr C		✓*	✓*	✓*			- MOE well 447, 37.2m deep, *use reported as domestic and stock on well record. - Interview refused - Oil/gas well reported on MNR Map. F-16
6-149	21	1	Du						✓	- No MOE record, very old well - Stone lined well, filled in and abandoned - Old homestead on property was torn down.
6-177	21	1								- No water supply at Bethel Church - Water is brought in.
6-198	21	2	Dr	n			✓			- No MOE record, well at least 25 years old and about 48.8m deep, current SWL is about 7.6m, livestock water use 5500 L/day - Water quality hard and sulphurous
			Du	n	✓	✓				- No MOE record, very old hand dug well about 6 to 9m deep, static water level near surface, supplies house occasionally and for watering flowers

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
6-198 (cont'd)			Cr,t	n	✓	✓				- Household water use 2475 L/d, includes supply from dug well
			Cr,t	n	✓	✓				- Household water use 1925 L/d (for rented residence on property)
			P (3)	n			✓		✓✓	- Livestock drink from one pond, variable water use - 2 ponds not used
6-227	21	1	Cr		✓	✓				- Household water use 1375 L/d
6-255	21	1	Dr						✓	- No MOE record, very old well, not used
			Dr						✓	- No MOE record, very old well, abandoned, buried under soil
			Du	c	✓	✓				- No MOE record, very old stone lined well, used as cistern - Well diameter about 3m, well depth 4.6 to 6.1m - Household water use 1925 L/d
			P						✓	- Spring fed pond about 1.2m deep previously supplied cattle and for watering garden.
6-270	21	1	Cr,t	n	✓	✓				- Household water use 2200 L/d
6-302	20	3	Dr	n	✓	✓				- MOE well 2531, well depth 33.8m, household water use, 2750 L/d - Good water quality, no sulphur smell, no rust staining
			Dr	n	✓	✓	✓			- MOE well 448, livestock water use 4665 L/d occasional domestic use - Good water quality, slight rust staining, water quality is hard.
			Cr	n			✓			- Secondary source for turkey barns, usage included with well No. 448
7-2	21	1	Dr						✓	- No MOE record, gas well drilled in 1920's, was flowing very sulphury water, was plugged with wooden stump and abandoned.
			Dr						✓	- No MOE record, flowing water well reported along west side of property near old buildings that were torn down, well plugged and covered over - Not sure if drilled or dug well
										- Seepage area reported on property. See Fig.5-1
7-3-5	21	1	Cr,t	f	✓	✓	✓			- Household water use 1650 L/d - Livestock water use 330 L/d
7-14	19	2	Dr						✓	- No MOE record - Well 75 years old - Well depth 28.7m, bedrock at 28.0m - Water quality good, no sulphur smell, water becomes murky before storms - Water level dropped about 2.1m during Welland Canal construction in 1969 - Previously used well for cattle, planned for cattle use in future.
	19	2	Cr,t	n	✓	✓				- Household water use 2475 L/d
			P	n					✓	- Not used, previously used by cattle

TABLE H2-1

SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-15	19	2	Dr	s,f	✓	✓				- MOE well 2858 - 39.3m deep - High iron and sulphur content, household water use 8172 L/d - Noticeable increase in iron and sulphur content after earthquake in 1982 or 1983, reported that several farms in area had similar problems
			Dr						✓	- No MOE record, well is about 60 years old, water quality was good, well is capped and abandoned
			Cr			✓				- Cistern for washing vehicles only, variable usage
			P					✓		- Pond water used for spraying
			Du						✓	- No MOE record - Dug well is very old, likely built with house - About 9m deep - Water quality good, harder than rainwater - Was used for drinking and non-potable domestic use was disconnected from house in 1980 - Dug well not used
7-16	19	2								- Cultivated field
7-20	18	2	Dr						✓	- No MOE record - Greater than 50 years old, abandoned, collapsed at surface
			Du						✓	- No MOE record - About 50 years old, not used - Dug well diameter about 0.9m
			C						✓	- Not used - Was previously filled with water from sump pump in basement and used for drinking and non-potable domestic use - Residence vacant at time of survey
7-21	18	2	Dr	n		✓	✓			- MOE well 1961 - 39.9m deep - Water quality hard, no sulphur odour - Livestock water use 2750 L/d - Also supplies toilet in house
			Dr						✓	- No MOE record, very old well, 5cm diameter casing - Water level dropped in 1969 during Welland Canal construction - Had to abandon well and construct new well
			Cr,t		✓	✓				- Household water use 1650 L/d
			P						✓	- Not used
7-22	18	2	C						✓	- Abandoned cistern at old homestead site - Field is cultivated
			P						✓	- Not used
7-92	20	1	Du	n	✓	✓				- No MOE record, well completed in 1982 - Well diameter is 0.9m and 9.1m deep, static water level about 6.1m - Household water use 1650 L/d
	20	1	P (on 7-143)	c,f	✓	✓				- Pond located on north side of 7-143, supplies house on 7-92 household water use included with dug well, chlorine added periodically, water filtered through gravel bed into wet well at pond. - Pond is 4.3m deep

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-93	20	1	S	n			✓			- Cattle occasionally drink from Welland River - Livestock water use is variable
			P						✓	- Pond was previously used for cattle, not currently used.
7-93-1	19	1	P (on 7-143)	f	✓	✓	✓			- Pond located on south side of 7-143 - Water filtered through gravel bed into wet well at pond, pond is 4.3m deep - Household water use 2475 L/d - Livestock use on 7-143
7-93-2	19	1								- Vacant land - No interview
7-93-3	20	1	P (on 7-94)	n		✓				- Pond on 7-94 supplies residence on 7-93-3 and 7-94, water taken from pond via wet well - Household water use 1650 L/d for residence on 7-93-3 - Bottled water for drinking is brought in - Previously used pond water for drinking
7-94 (interview refused)			P			✓				- Pond supplies residence on 7-94 and 7-93-3 - Water taken via wet well - Pond previously used for drinking, was discontinued 2 years ago - Pond is about 10 - 15 years old, was cleaned out 4 years ago - Water level fluctuates but has never gone dry
			Du						✓	- Dug well is stone lined, use not known - Interview refused, information provided by neighbour
			C						✓	- Cistern abandoned
7-94-1	17	1								- Cultivated land - No interview
7-94-5	18	2	S	n						- Welland River occasionally used for watering cattle and agricultural spray water - Water usage is variable - Springs reported near Welland River at south end of property
7-95	17	1	Cr,t	n	✓	✓				- Household water use 1925 L/d
7-95-1	17	1	Du	n		✓	✓			- No MOE record, well completed in 1983 or 1984, well is 16.8m deep, well was dry immediately after completion - Livestock water use 680 L/d, well serves primarily stock, emergency house supply, project increased water use
			Cr,t	d	✓	✓				- Household water use 1925 L/d, distill drinking water
7-96	17	1	Sp	c	✓	✓		✓		- Spring is flowing year round, chlorine occasionally added, some nitrate in water - Water quality turns bad in spring when Welland River floods area around water supply - Household water use, 2475 L/d - Also used for irrigation occasionally
			S	n				✓		- Welland River used for irrigation, variable usage.

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-97	16	1	Dr	n			✓			- MOE well 2837 - Well depth 35.1m - Faint sulphur smell to water - Livestock water use 510 L/d
			Du						✓	- No MOE record, water level near surface - Not used
			Cr,t	n	✓	✓				- Household water use 2200 L/d
			P (3)	n			✓			- 3 ponds on property used by animals, pond depths 1.5 - 1.8m - Livestock, water use is variable
7-97-5	16	1	Cr,t	n	✓	✓				- Household water use 1650 L/d
7-98	16	1	Cr,t	c	✓	✓				- Usage for community is variable, groups of up to 200 people served on weekends - Water use 857 L/d
			C						✓	- Not used
7-99	16	1	Dr	n	✓	✓				- No MOE record - Well completed several years ago, well is 34.7m deep, static water level 4.3m - Water quality is hard, no sulphur smell - Used for house
			Cr,t	n	✓	✓				- Cistern used for house - Total household water use 1925 L/d - Gas well on property
7-143	19	1	Dr						✓	- No MOE record, very old well, 36.6m deep - 5cm diameter surface pipe - Not used, serves as emergency supply for house, previously supplied cattle
			Dr						✓	- No MOE record, very old well - 15cm diameter well casing - Livestock water use 10880 L/d
			Cr,t	n	✓	✓				- Household water use 2200 L/d
			P	c	✓	✓				- On north side of property, supplies 4 residences on properties 7-92, 7-144, 7-240 and 7-240-5
			P		✓	✓	✓			- On south side of property - Supplies residence on 7-93-1 and barn on 7-143 - Backup source of water for cattle
7-144	20	1	Du						✓	- No MOE record, stone lined dug well is very old, well is 4.6 to 6.1m deep. - Well not used
			Cr			✓				- Rain filled cistern supplies house, household water use included with pond
			P (on 7-143)	n	✓	✓				- Pond on 7-143 supplies household on 7-144, water pumped from pond via wet well, water filtered through gravel bed, pond is 4.3m deep - Household water usage 2475 L/d
7-145	18	1	Dr						✓	- No MOE record, well is old, and 36.6m deep, well is not used
			P						✓	- Not used - No residence on property

TABLE H2-1

SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-148	17	1	Dr	f	✓	✓	✓			- No MOE record, well completed 9 years ago, 25.9m deep, current static water level 7.6 to 9.1m - Water quality is high in iron, no sulphur smell - Household water use 2200 L/d - Livestock water use 350 L/d
			Du						✓	- no MOE record, stone lined, not used, water level about 0.9 m from surface, well diameter 1.5 to 1.8 m.
			Du						✓	- Abandoned and filled in - Gas well on property
7-149	16 17	1 1	Dr	n	✓	✓	✓			- No MOE record, 15cm diameter casing, current static water level 6.7m, supplies poultry barns and back-up water supply to one residence, also supplies 7-149-5 - Livestock water use 5400 L/d - Household water use included with cistern
			Dr						✓	- Abandoned
			Ct			✓	✓			- Livestock water use included with drilled well
			Cr,t		✓	✓				- Household water use 2475 L/d
			Cr,t		✓	✓				- Supplies second residence household water usage 2040 L/d
			P							- Abandoned and filled in
										- Spring reported along Beaver Creek, was used in past by other residents
7-149-5	17	1	Dr (on 7-149)	n	✓	✓				- Well on 7-149 supplies grain elevators, water use variable - Spring reported on property, drained by tile bed
7-149-6	17	1	Cr,t	n	✓	✓				- Household water use 1925 L/d - Gas well on property
7-150	16	1	Cr,t	n	✓	✓				- Household water use 1375 L/d
7-150-1	16	1	Cr,t	n	✓	✓				- Household water use 1925 L/d
7-150-5	16 17	1 1								- Cultivated field
7-151	16	1	Cr	n	✓	✓	✓			- Household water use 2200 L/d, backup supply for livestock
			S				✓			- Creek and cistern supply a couple of horses - Livestock water use 110 L/d
7-152	16	1	Du				✓			- No MOE number, well is more than 10 years old, was not used by previous owner, occasionally used for livestock on 7-151
			Cr		✓	✓				- Household water use 1650 L/d
			P			✓				- Pond used for watering garden
7-153	16	1	Cr,t	c,f	✓	✓				- Household water use 2475 L/d
7-154	16	1	Cr,t	n	✓	✓				- Water usage 2475 L/d - Plan to construct larger cistern, and plan to build swimming pool in near future
			S							- Beaver Creek used for watering garden
7-223	16 17	1 1	P						✓	- Pond not used
			S						✓	- Stream not used

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-240	20	2	Dr	n					✓	- No MOE record, more than 20 years old, not currently used, was used for livestock and agricultural spray water - Well depth 36.6m
			Dr						✓	- No MOE record, old well, surface pipe diameter 5cm, well was flowing and supplied cattle, well no longer flows and is not used.
			Du	n	✓	✓				- No MOE record, stone lined hand dug well, 9.1m deep - Household water use 2200 L/d
			C						✓	- Abandoned cistern
			P (on 7-143)	c	✓	✓				- Pond on 7-143 supplies residence on 7-240 - Pond is 4.3m deep, water pumped from pond via wet well, water filtered through gravel bed - Water usage included with dug well - Chlorine occasionally added to pond
7-240-5	20	2	Du	n	✓	✓				- No MOE record, well completed 1982, 9.1 m deep - Water slowly filled well after completion - Well provides a backup water supply for household use.
			P (on 7-143)	c	✓	✓				- Pond on 7-143 supplies residence on 7-240-5 - Pond is 4.3m deep, water pumped from pond via wet well, water filtered through gravel bed - Primary supply to residence - Household water use 2475 L/d
7-244	17	2	Dr	n			✓			- no MOE record, more than 20 years old, about 30.5m deep - Water quality hard, occasionally has sulphur smell - Livestock water use 11,500 L/d
			Dr	n			✓			- MOE well 2124, 40.2m deep, current static water level is about 18.3m - Water use included above
			Cr,t	n	✓	✓				- Household water use 2200 L/d
			Cr,t	n			✓			- Livestock water use included with drilled wells
			P	n		✓				- Pond used for watering lawns and gardens, water use is variable
										- Two gas wells on property
7-245	16	2	Dr	n	✓	✓	✓			- MOE well 2306, 34.7m deep - Supplies household during winter, household water use 1650 L/d - Livestock water use 190 L/d - Water pressure dropped when gas well completed on adjacent property
			Dr						✓	- No MOE record, very old well previously used for barn, abandoned
			Cr	n	✓	✓				- Supplies household in summer, household water use included with drilled well
			Cr	n		✓				- Separate cistern for toilet
7-246	16	2	Du						✓	- No MOE record, very old well filled with refuse, abandoned
			Du						✓	- No MOE record, very old well, water level at surface, abandoned

TABLE H2-1

SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
7-247	16	2	Dr	n			✓			- MOE record 431, well completed in 1958, well depth 31.1 - 32.3m, well completed 0.6m into bedrock - Originally was flowing well, stopped flowing when gas well drilled on property to southwest, current static water level is about 3m from surface - Livestock water use 4200 L/d - Water level in well dropped during Welland Canal construction.
			Dr						✓	- No MOE record, very old well originally flowing well, filled in and abandoned 29 years ago
			Du	n	✓	✓				- No MOE record, very old, stone lined, dug well, static water level at about 3 m from surface
			Cr,t		✓	✓				- Household water use 1650 L/d including dug well water use.
			C						✓	- Abandoned cistern
			P						✓	- Pond not used
			S						✓	- Previously cattle would drink from ditch running through property - Not used at present
7-264	20	2	Dr	n			✓			- No MOE record, well drilled about 15 years ago, 39.6m deep, static water level in well is about 7.3m - Livestock usage 5500 L/d - Water has sulphur smell, can't use for washing vehicles, leaves white film, good supply, never runs out of water.
			Cr,t	n	✓	✓				- Household water use 1925 L/d
			S						✓	- Not used
7-268	17	3	P						✓	- Not used
7-269	18	2								- No water use reported
7-270	17	2								- No water use reported - Spray water obtained from pond on adjacent property, ~17,800 L used for spraying from adjacent property in 1986.
			P						✓	- Not used
7-271	17	2	Cr,t	f,d	✓	✓		✓		- Household water use 2750 L/c - Cistern occasionally used for agricultural spray water
			P (2)	n				✓		- 2 ponds used for agricultural spray water, 68,100 to 90,800 L of spray water used in 1986
7-272	16	2	Dr	c,s		✓	✓			- MOE well 430, well depth 34.4m - Livestock water use 8670 L/d
			Dr						✓	- No MOE record, previously supplied house, abandoned
			C						✓	- Not used - Use bottled water for potable supply
10-11	19	4	Dr	n	✓	✓	✓			- MOE well 469, well depth 29.6m - Livestock water use 5250 L/d - Household water use 3025 L/d
10-11-1	19	4								- No water use reported, is vacant lot

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
10-11-2	19	4	Dr (on 10-11)	s	✓	✓				- MOE well 469, located on adjacent property, 10-11 supplements household water supply
			Ct	s	✓	✓				- Household water use 2200 L/d
10-11-5	19	4	Cr,t	c	✓	✓				- Household water use 1650 L/d - Planned increase in water use, i.e., swimming pool to be built
10-16	18	4	Dr						✓	- No MOE record, well completed in 1948 or 1949, 30.5m deep - Original static water level 6.1m from ground surface - Well was previously used to supply barn, not presently used
			Ct		✓	✓				- New cistern recently completed - Household water usage 1650 L/d
			C						✓	- Old cistern 2.4m diameter and 3.0m deep, water had sulphur smell, most noticeable in spring, was constructed as shallow dug well, has been abandoned and filled in.
	18	4	P						✓	- Pond not used
10-16-5	18	4	Cr,t	n	✓	✓	✓			- Household use 2200 L/d - Livestock use 3 L/d
10-17	18	4	Dr	n	✓	✓				- No MOE record, well appears to be old, well depth 45.7m - Household use 2200 L/d - Plan to have livestock in near future
10-17-1	18	4								- Vacant land, no interview
10-76	19	3	Dr	c			✓			- No MOE record, well completed in 1982, 37.5m deep - Water quality 80 grains of hardness (1142 ppm) - Livestock water use reported as 6800 L/d - Well water became murky in 1984 when drilling of test holes along Schram Road for OWMC - Well completed to top of a rock shelf, original static water level about 9.1m from surface
			Dr						✓	- No MOE record, well drilled in 1964, well depth 38.4m - Noticeable sulphur content in water, 112-118 grains of hardness (1598 - 1684 ppm) - Well not used.
			Dr						✓	- No MOE record, old well located under silo, about 18.3m deep, well abandoned
			Cr,t	n	✓	✓				- Household water use 2760 L/d
10-77 (interview refused)	19	3	Cr,t		✓	✓				- Interview refused for Phase 4B study, information from interview completed for Phase 4A study - Cistern built about 1883, cistern is 4.6m deep and 1.5m wide, is brick lined - Mostly rainwater in cistern - Water quality hard, no distinct taste - Residence is occupied on part-time basis
10-80 (partial interview)	18	3								- Partial interview completed - Refusal to complete interview - Cultivated land, old homestead site at west end of property - No apparent water use

TABLE H2-1
SUMMARY OF WATER USE DATA

1 Assessment Roll No.	2 Lot	3 Concession	4 Water Source	5 Water Treatment	6 Water Use: Potable	7 Water Use: Non-Potable	8 Water Use: Stock	9 Water Use: Other	10 Water Use: Not Used	11 REMARKS
10-81	17	3	Dr	n		✓	✓			- MOE well 1867, well depth 35.1m - Livestock usage 414 L/d - Well supplies washroom in house - Original static water level 9.1m
			Cr	n	✓	✓				- Household water use 1925 L/d
			P	n			✓			- Occasional use of pond water by cattle, livestock water use included with drilled well.
10-82	16 17	3 3	Dr	n	✓	✓	✓			- No MOE well record, well drilled more than 20 years ago, well depth 36.6m, - Current static water level is 6.1m - Livestock water use 3575 L/d, household water use, see cistern
	16 17	3 3	Cr	n	✓	✓				- Household water use 2200 L/d
10-84	15	3	Dr (on 10-86)	n	✓	✓				- Well located on 10-86 - Household water use 2200 L/d
10-85	15	3	Dr (on 10-86)	n	✓	✓				- Well located on 10-86 - Household water use 2200 L/d
10-86	15	3	Dr	n			✓			- No MOE record, well about 70 years old, well depth 32.0m, bedrock found at 30.5m, original static water level about 2.1m, current static water level about 5.2m - Livestock water use 920 L/d - Water quality hard with high iron, water gets cloudy during spring
			C						✓	- Abandoned cistern.
10-100	19	3	Dr	n	✓	✓	✓			- MOE well 446, well depth 35.4m - Water quality good, no sulphur smell - Household water use 1110 L/d - Supplies cattle in winter - Livestock water use is variable
			P (2)	n			✓		✓	- One pond supplies cattle during summer, one pond not used - Livestock water use is variable
										- Gas well on property
			C			✓				- Non potable household use 1365 L/d
10-101	19	3	Dr	n	✓	✓				- MOE well 2330, well depth 32.3m - Household water use 2475 L/d - Water quality hard with some rust staining, excellent quality - Water turned black with sulphur smell after oil and gas well drilled on adjacent property 4 to 5 years ago, water is now clear and sulphur smell not as noticeable.
			Cr	n		✓				- Cistern used for washing only
10-103	19	3	Ct	n		✓				- Household usage 1650 L/d - Commercial (garage) water use not known - Buy distilled water for drinking
10-105	18	3	Dr	c,s	✓		✓			- No MOE record, well drilled about 40 years ago, well depth 36.6m - Household water use 1650 L/d - Livestock water use 2590 L/d - Well supplies livestock in winter - Treated well water smells sulphury
			Cr,t	n	✓	✓				- Household usage included with drilled well
			P	n			✓			- Supplies livestock in summer, livestock water use included with drilled well.

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
10-106	17 18	3 3	Dr	n	✓	✓				- No MOE record, well depth is ≥42.7m - Household usage 1375 L/d - Well was previously used to supply livestock
			Dr						✓	- No MOE record, well depth is 27.4m - Well is presently not used - Well was used last year by neighbour for livestock watering as emergency supply - Gas well reported in Phase 4A study
			C						✓	- Cistern at east side of house not used
			P						✓	- Not used
10-108	17	3	Cr,t	n	✓	✓				- Household water use 1650 L/d
10-110	16	3	Dr	c,s,f	✓	✓	✓			- No MOE record, well completed in 1958-59, well depth about 31.4 to 32.0m - Livestock water use 6900 L/d - Household water use 1650 L/d - Drinking water is distilled
10-110-1	16	3	Dr	s,d	✓	✓				- MOE well 2391, well depth 30.5m - Household water use 2200 L/d
10-111	15	3	Du	f,uv	✓	✓				- No MOE record, well completed more than 80 years ago, well diameter 1.2m - Water at top of well in spring drops to near bottom of well in summer - Household usage 1650 L/d - Bacteria contamination of well after highway widened and ditch moved closer to well, ultraviolet light installed as result of complaint
10-155	19	4								- Cultivated field
10-156	19	4	Ct	n	✓	✓				- Household water use 2200 L/d - Planning to use rainwater when eavestroughing is finished
			Du						✓	- No MOE record, very old well, brick lined, about 2.4m deep, was previously used for watering garden, has been abandoned and filled in.
10-158	19	4	Cr,t	n	✓	✓				- Household use 1375 L/d
			C						✓	- Cistern at barn was previously used for horses, not used at time of study
10-160	18	4	Dr				✓			- MOE well 468, supplies livestock (note; information from interview during Phase 4A, no mention of well during Phase 4B interview)
			Dr				✓			- No MOE record, supplies livestock (note; information from interview during Phase 4A, no mention of well during Phase 4B interview)
			Ct	s	✓	✓				- Household water use 2475 L/d
			P				✓			- Livestock water use from pond and drilled wells to 9,000 L/d
			Du						✓	- No MOE record, stone lined well, not used, water level observed at about 1.2m from surface in August 1986.
10-161	17 18	4 4	Dr/Du						✓	- No MOE record, well is older than 15 years old, well is not used, not sure if dug or drilled well
			P						✓	- Previously used for agricultural spray water, shallow pond about 0.3m deep, dries up in summer
										- Property is vacant

TABLE H2-1
SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
10-162	17	4	Dr/Du						✓	- No MOE record, old well reported near barn has been abandoned, no other information available, not sure if dug or drilled.
			Cr,t	n	✓	✓				- Household water usage 2200 L/d
			P (2)	n			✓			- Livestock water use 12,245 L/d - Pond behind barn 3.7m deep - Pond near road 1.8m deep
10-163	16	4	Du(2)	n		✓				- No MOE records, two dry wells excavated by backhoe, gravel backfill around dry wells, both wells are 7.0m deep - 1.8m of crumbly clay overlying blue "gummy" clay - Small seep of water encountered at 6.1m, flow of water noted from southeast to northwest from a point about 0.16cm in diameter at southeast side of excavation - Dug wells supply toilet in house only, water is contaminated from driveway runoff
			Ct	n	✓	✓				- Household water use 2200 L/d
			C						✓	- Not used, became contaminated when new ditch constructed along highway
10-164	16	4	Cr,t	n	✓	✓				- Household water usage 1650 L/d
			C						✓	- Old cistern contaminated with soap is not used
10-165	16	4								- No interview, absentee landowner, part-time residents on property
10-166	16	4	Dr	n	✓	✓	✓			- MOE well 2755, well depth 31.7m - Household water use 1650 L/d - Livestock water use 508 L/d - No sulphur taste in water
10-168	16	4	Dr (On 10-169)					✓		- Severed lot with barn, no livestock in barn, water use is variable, water supplied from drilled well on 10-169
10-169	16	4	Dr	n	✓	✓	✓			- MOE well 466, well depth 31.4m - Household water use 2200 L/d - Livestock water use 10,050 L/d
10-170	16	4	Dr	n	✓	✓	✓			- MOE well 1800, well depth 30.5m - Household water use 1925 L/d - Livestock water use 400 L/d
10-171	16	4	Dr	n	✓	✓	✓			- MOE well 467, well depth 32.6m - Household water use 1650 L/d - Livestock water use 22,165 L/d
			Dr	n	✓	✓				- MOE well 2004, well depth is 30.6 m - Household water use 2475 L/d
			Dr	n	✓		✓			- No MOE record, well completed in March 1986, well depth 34.1m - Original static water level about 7.3m - Well tested at 7.58 L/sec. - Well used for drinking water by workers - Livestock water use 88,000 L/d
			P						✓	- Pond previously used for livestock, pond water was chlorinated, not presently used
10-171-5	16	4	Dr	n	✓	✓				- No MOE record, well depth about 33.5m - Supplies restaurant, 100-200 people served per day - Commercial water use 5000 L/d (estimated)

TABLE H2-1

SUMMARY OF WATER USE DATA

1	2	3	4	5	6	7	8	9	10	11
					Water Use					
Assessment Roll No.	Lot	Concession	Water Source	Water Treatment	Potable	Non-Potable	Stock	Other	Not Used	REMARKS
10-172	15	4	Cr,t	f	✓	✓	✓			- Household water use 2200 L/d - Livestock water use, 246 L/d - Drinking water filtered
			P				✓			- Keeps a few ducks in pond
10-172-5	15	4	Dr				✓			- No MOE record, located at barn - No interview, could not locate owner - Information provided by neighbour - assumed to be used for livestock water, quantity not estimated
10-227	19	4								- Vacant building lot
10-228	19	4	Dr		✓	✓				- MOE well 2164, well depth 26.5m - Household use 2200 L/d
10-235	17	4								- Cultivated field
10-236	17	4	Dr	s,f	✓	✓		✓		- No MOE record, well is very old - Well depth about 27.4m - Household water use 2200 L/d - Good water quality - Unspecified acricultural water use
10-237	17	4								- Cultivated field
10-238	16	4	Du						✓	- No MOE record, old stone lined well, is abandoned and filled in.
10-239	16	4	Du						✓	- No MOE record, stone lined well, is abandoned and filled in
			Cr,t		✓	✓				- Cistern for gun club use at clubhouse, water usage is variable
10-241	15	4	Dr	n					✓	- No MOE record, well drilled with portable power auger to 9.4m depth, thin gravel layers about 0.1m thick encountered at depths of 6.7m and 7.6m - Water encountered at 6.1m - Static water level about 1.8m when well completed - Well not used, clay pushed up inside bottom of casing - Bring in drinking water

FIGURE H2-1

EXAMPLE FORM

OWMC PHASE 4B

WATER USE AND WATER WELL STUDY

CONTACT RECORD

Interview No. :

Assessment Roll No. :

Interviewee :

Date	Time	Caller	Comments

General Comments

OWMC PHASE 4B

WATER USE AND WATER WELL STUDY

CONDUCTED BY

GARTNER LEE ASSOCIATES LIMITED

PROJECT 85 - GW - 1

AUGUST 1986

QUESTION	RESPONSE

INTERVIEW INFORMATION

1 Name of the respondent? ____________________

2 Respondent's address? ____________________

____

Ontario, _____ _____

Telephone no ( ) -

3 Interviewers name ____________________

4 Date of interview? (YY.MM.DD) __________

5 Time of interview? (military time) __________

LOCATION INFORMATION

6 Study Area?

1 = Site

2 = Adjacent

3 = Vicinity

4 = Access Roads

QUESTION | RESPONSE

LAND OWNERSHIP INFORMATION

To be filled out for each block of assessed land.

7 Assessment Roll Number? ____

Owners Name & Address?

____

____

____

Lot ____
Conc ____
TWP ____

Ontario, ___ ___

Owners Telephone No.

(___) ___-____

8 Assessment Roll Number? ____

Owners Name & Address?

____

____

____

Lot ____
Conc ____
TWP ____

Ontario, ___ ___

Owners Telephone No.

(___) ___-____

9 Assessment Roll Number? ____

Owners Name & Address?

____

____

____

Lot ____
Conc ____
TWP ____

Ontario, ___ ___

Owners Telephone No.

(___) ___-____

10 Assessment Roll Number? ____

Owners Name & Address?

____

____

____

Lot ____
Conc ____
TWP ____

Ontario, ___ ___

Owners Telephone No.

(___) ___-____

QUESTION | RESPONSE

WATER USE INFORMATION

11 How many **water wells** are on this property ? (Mark their locations on the base map) ______

12 How many **oil or gas wells** are on this property ? (Mark their locations on the base map) ______

13 What is your source of **potable** or **drinking water**? ______

- 1 = Drilled well
- 2 = Hand dug well
- 3 = Bored well
- 4 = Cistern (truck water)
- 5 = Cistern (rain filled)
- 6 = River or stream
- 7 = Municipal supply
- 8 = Ponds
- 9 = Other ______

14 How many people use the drinking water at this property? ______

15 What is your source of **non-potable domestic water**? ______

- 1 = Not applicable
- 2 = Drilled well
- 3 = Dug or bored well
- 4 = Cistern (truck water)
- 5 = Cistern (rain filled)
- 6 = River or stream
- 7 = Municipal supply
- 8 = Ponds
- 9 = Other ______

16 What is your source(s) of **agricultural** water? ______

- 1 = Not applicable
- 2 = Drilled well
- 3 = Dug or bored well
- 4 = Cistern (truck water)
- 5 = Cistern (rain filled)
- 6 = River or stream
- 7 = Municipal supply
- 8 = Ponds
- 9 = Other ______

17 How many pigs use this water supply? ______

18 How many cattle use this water supply? ______

19 How many chickens use this water supply? ______

20 How many other animals are there on this property?

Type ______ Number ______
______ ______
______ ______

21 Do you use a septic tank and weeping field at this property? Y / N / N/A

QUESTION		RESPONSE
22	What is the distance between the weeping field and your drinking water well?	________ (m)
23	Do you have an (agricultural) waste tank on this property?	Y / N / N/A
24	What is the distance between the waste tank and the drinking water well?	________ (m)
25	Would you allow sampling of your well/cistern water for laboratory analysis at some later time?	Y / N / N/A

QUESTION	RESPONSE

WELL INFORMATION

To be filled out for each well : water, gas/oil, active or not.

26 Type of well? ____________
- 1 = Water well - domestic and drinking
- 2 = Water well - domestic nonpotable
- 3 = Water well - agricultural use
- 4 = Gas or oil well
- 9 = Other type ____________

27 Does the well have an official identification number? ____________
(e.g. MOE water well number)

28 Where is the well located?
Lot? ____________
Concession? ____________
Township? ____________
UTM Coordinates ____________
(Mark the location on the base map)

29 What is the status of the well? ____________
- 1 = In use 2 = Abandoned
- 3 = Planned for future use
- 4 = Unlikely to be used in the future

30 If not used, what is the reason? ____________
- 1 = Insufficient QUANTITY
- 2 = Poor QUALITY
- 3 = Other reason ____________

WELL CONSTRUCTION DETAILS

31 When was the well constructed? ____________

32 Who installed it? ____________

33 How was it installed? ____________
- 1 = Drilled 2 = Bored or augered
- 3 = Dug by hand 4 = Dug by backhoe
- 5 = Other method ____________

34 What is the casing DIAMETER? ____________ (m)

35 What is the well DEPTH? ____________ (m)

36 What is the elevation of the casing collar? ____________ m a.s.l.

37 What was the original static water level? ____________ (m)
(metres below grade)

QUESTION		RESPONSE
38	What is the current static water level? (metres below grade)	______ (m)
39	How is the top of the well finished? 1 = Casing above grade 2 = Casing at grade 3 = Casing below grade (in an open pit) 4 = Pump house over well 5 = Covered by concrete slab or housing (well pit) 6 = Well seal or pitless adaptor 7 = Open casing 8 = Plugged casing 9 = Casing pulled (open hole) 10 = Other	______ ______
40	Is the well casing accessible (for sampling)?	Y /N
41	Is the well casing vented to the atmosphere?	Y / N
42	What type of pump is in the well? 1 = Submersible 2 = Deep well (jet pump) 3 = Shallow (jet pump) 4 = Hand pump 9 = Other	______ ______
43	How old is the pump? When was it installed?	______ ______
44	How is it lubricated? 1 = Oil 2 = Grease 3 = Water	______
45	What is the depth of the pump intake?	______ (m)
46	What is the pumping rate?	______ (L/s gpm)

QUESTION	RESPONSE

TANKS, TREATMENT AND TROUBLES

47 What type of permanent storage tank do you use? ________
1 = Galvanised steel 2 = Glass lined steel
3 = Plastic 4 = Concrete
5 = Concrete with plastic liner
9 = Other ________________

48 What is the capacity of the storage tank? ________ litres gallons

49 Do you use a (a) Chlorinator? Y / N

(b) Water softener Y / N

(c) Filter Y / N

(d) Other water treatment Y / N ________________

50 Is the treated water used for domestic or agricultural uses ? ________________

51 What type of filter do you use? ________
1 = Sand 2 = Activated carbon
3 = Cartridge
9 = Other ________________

52 Have you had any problems with this well? Y / N

53 What year did the problem occur? ________

54 What was the problem? ________
1 = Insufficient water 2 = Pump failure
3 = Plugging of the well 4 = Well interference
5 = Poor water quality 6 = Contamination
9 = Other ________________

57 Has any government agency been notified about the problem? e.g. MOE ________________

58 Has the problem been corrected? Y / N

58 How was it corrected? ________
1 = Well deepened 2 = Pump repaired
3 = New well constructed 4 = Water treatment
9 = Other ________________

FIGURE H2-2

EXAMPLE FORM

OWMC PHASE 4B
SURFACE DRAINAGE, WATER USE SURVEY

CONDUCTED BY
GARTNER LEE ASSOCIATES LIMITED

PROJECT 86-_____

AUGUST, 1986

WATER USE

1 How many **streams**, creeks and drainage swales are there on this property?
(please mark their locations and directions of flow on the base map)

2 How many **ponds** are there on this property?
(please mark their locations on the base map)

3 Do the animals on this property drink directly from the stream? Y / N
Does the stream supply an adequate water supply for year round use? Y / N
If not...do you know when and why the supply is inadequate?

4 Do the animals on this property drink directly from the pond? Y / N
Does the pond supply an adequate water supply for year round use? Y / N
If not...do you know when and why the supply is inadequate?

5 Do you irrigate from the streams and pond on this property? Y / N
Is there an adequate water supply for your irrigation? Y / N
If not...do you know why the supply is inadequate?

SURFACE DRAINAGE AND FLOODING

Comment : please ensure that the streams, creeks and drainage swales are marked on the base map, including the direction of flow.

6 What is the maximum depth of water flowing in the swales, creeks and ditches on this property?

Are there any significant high water marks? Y / N
Where and what are they?

When were these observed (dates)?

How many years have you been observing floods on this property?

7 Does flooding present a problem in the ditches and swales on your land?
(Please mark the locations of the flooding on the base map.)

8 Are any of the flooding problems associated with buildings on your property?
If so... where, when and how frequently?

9 If you have flooding in the vicinity of your buildings, is this because of an overflow from a nearby stream or because of poor drainage in the vicinity of the building?

10 Do any of the local roads get flooded?
(Please mark the locations on the base map.)

What time of year does this flooding take place?
How frequently does it take place?

11 Have any of the local bridges or culverts been improved or reconstructed in recent years?
Where are they located on the basemap?

12 Does soil erosion present a problem on this property?
If so....where? Please mark the location on the base map.

Have any conservation measures been taken to correct the erosion problems?
If so....what and where?

13 Do the streams flow all year round?
Which ones dry up?
How long are these streams dry ?
(say, how many weeks in the year)

14 Are crops normally grown through the field swales? Y / N

Are there any places on the property where cropping is not possible because of poor drainage?
If so...where?

15 Have you ever consulted the Conservation authority, the Ministry of the Environment, the Ministry of Natural Resources, the Ministry of Agriculture or any other government agency regarding flooding or soil erosion on this property?
If so... which agency, when and why?

16 What portion of this property is drained by tiles?
Please mark the area on the map, showing the layout and the location of the outlet, if possible?

APPENDIX I

SUPPORTING CALCULATIONS

APPENDIX I

SUPPORTING CALCULATIONS

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TABLE

I1 GROUND WATER FLOW CALCULATIONS

This appendix provides the methodology and results of ground water flow calculations. These calculations are based on porosities, hydraulic conductivities, and hydraulic gradients determined by hydrogeologic testing, geotechnical testing, and water level measurements during the geoscience program.

I1.1 METHODOLOGY

Specific discharge (v) is the rate of ground water discharge through a porous medium per unit area perpendicular to the flow direction. It can be calculated using the following one-dimensional form of Darcy's Law (Freeze and Cherry, 1979, p. 16):

$$v = Ki$$

where K = hydraulic conductivity (m/s)

i = hydraulic gradient

Furthermore, the average linear ground water velocity is expressed as (Freeze and Cherry, 1979, p. 71):

$$\bar{v} = \frac{v}{n}$$

where n = porosity

I1.2 RESULTS

The results of the ground water flow calculations are presented in Table I1-1. For each unit or subunit, values of hydraulic conductivity, hydraulic gradient, and porosity are summarized. These are presented in Sections 3.2 and 3.3. The resulting values of specific discharge and average linear ground water velocity are tabulated both in m/a and mm/a.

No calculations were possible for the weathered silt and clay, since the hydraulic conductivity and hydraulic gradient are highly variable and the fracture porosity is unknown. Flow in the weathered silt and clay is further discussed in Appendix I2-4.

TABLE I1-1: SUMMARY OF GROUND WATER FLOW CALCULATIONS

HYDROSTRATIGRPAHIC UNIT	MEAN HYDRAULIC CONDUCTIVITY K (m/s)	AVERAGE HYDRAULIC GRADIENT i	AVERAGE POROSITY n	SPECIFIC DISCHARGE v		AVERAGE LINEAR GROUND WATER VELOCITY $\bar{v}$	
				m/a	mm/a	m/a	mm/a
AQUITARD Weathered Silt and Clay*	-	-	-	-	-	-	-
Unweathered Silt and Clay	2E-10	0.25 downward	0.41	0.0016	1.6	0.0038	3.8
Lower Till	2E-8	0.25 downward	0.16	0.16	160	0.099	990
BEDROCK AQUIFER Zone A	2E-4	0.0002 southward	0.01**	1.3	1300	130	130,000
Zone B	2E-7	not measured	-	-	-	-	-
Zone C	>2E-5	0.0003 southward	0.05***	>0.19	>190	>3.8	>3800
Zone D	<2E-9	not measured	-	-	-	-	-
Zone E	2E-6	0.0005 southward	0.05***	0.032	32	0.63	631

Notes: 1 m/s = 3.1536E7 m/a
1 mm/s = 3.1536E10 mm/a

Equations: $v = Ki$, $\bar{v} = \frac{v}{n}$

* This unit has variable hydraulic conductivity, variable hydraulic gradient (transient), and an unknown fracture porosity, no calculations possible

** Fracture porosity estimated using method of Snow (1968) for given hydraulic conductivity and fracture set spacings of 50 mm estimated from field borehole logs.

*** Assumed porosity based on field observations

I2 GROUND WATER FLOW MODELLING

I2.1 INTRODUCTION

Ground water flow at the Preferred Site was modelled using the two-dimensional, finite element flow model called FLONET. The FLONET model is documented in Section I2.2. The purpose of the modelling was twofold:

(1) to confirm the deep ground water flow pattern interpreted from the hydrogeologic field data, and,

(2) to establish the nature of shallow (surficial) ground water flow.

Ground water flow at the Preferred Site can be subdivided into shallow and deep flow. Shallow flow is transient in that it is constantly changing in response to changing climatic conditions (i.e. rainfall, evapotranspiration etc.). This is reflected in changes in the water table elevation, which were observed in the shallow standpipe monitors (see Section 3.3.3.2 for a discussion of seasonal water table fluctuations and Appendix F2 for detailed water level measurements). Deep ground water flow through the unweathered silt and clay and bedrock aquifer is considered to be at steady state since the monitors showed only minor fluctuations once they had reached static water levels (Appendix F2). In essence, the shallow flow acts as a buffer for deep flow. Because of this important distinction, deep and shallow ground water flow were separately modelled. The methodology and results are presented in Sections I2.2 and I2.3 respectively.

I2.2 FLONET MODEL DOCUMENTATION

This section presents a summary documentation of the FLONET model. It includes sections containing a technical description of the model (I2.2.1), the theory on which FLONET is based (I2.2.2), and finally a discussion of the model verification (I2.2.3).

I2.2.1 TECHNICAL DESCRIPTION

AUTHORS: E.O. Frind and G.B. Matanga,
Groundwater Research Institute,
Department of Earth Sciences,
University of Waterloo

COMPUTER SYSTEM/LANGUAGE: IBM 4341/FORTRAN
ATARI 520ST/BASIC
HEWLETT PACKARD 9816/BASIC

MODIFICATIONS:

- Conversion to the Atari 520ST/BASIC microcomputer by E.A. Sudicky of the Groundwater Research Institute, University of Waterloo.
- Conversion to the Hewlett Packard 9816/BASIC microcomputer with input/output modifications by R.G. McLaren of Gartner Lee Associates Limited.

MODEL TYPE/FEATURES:

- numerical, finite element
- steady-state groundwater flow
- 2-dimensional in cross-section
- porous medium can be heterogeneous and anisotropic
- two-step solution procedure; first step solves for hydraulic head distribution, second step solves for stream function distribution
- hydraulic head solution step can be iterative in order to seek the position of the water table

ASSUMPTIONS:

- flow is governed by the Laplace equation
- flow is restricted to be parallel to the plane of the cross-section (i.e. no flow into or out of the face of the cross-section)

- the profile is fully saturated

INPUT PARAMETERS:

- finite-element grid data:
  1) node co-ordinates
  2) element incidences

- element properties:
  1) hydraulic conductivity in X-direction
  2) hydraulic conductivity in Y-direction
  3) angle of principal direction of permeability

- boundary conditions for hydraulic head and stream function solutions

- optional grid deformation data for iterative calculation of water table position.

OUTPUT:

- a printout of all input data and calculated hydraulic heads, stream functions, average linear ground-water velocities and for the hydraulic head solution, boundary fluxes.

- grid plots (node and element data)

- contour plots of hydraulic head and/or stream functions

- plot of average linear ground water velocity vectors.

REFERENCE: Frind, E.O. and Matanga, G.B., 1985. The dual formulation of flow for contaminant transport modelling: 1. Review of theory and accuracy aspects. Water Resources Research, vol. 21, no. 2, pp. 159-169.

I2.2.2 THEORY

A comprehensive review of the mathematical theory, finite-element formulation, and model development is provided in Frind and Matanga (1985).

I2.2.3 MODEL VERIFICATION

FLONET was verified at the Groundwater Research Institute, University of Waterloo, by its authors. Further verification testing was performed by Gartner Lee following modifications to the model. This consisted of comparison to exact analytical solutions. Gartner Lee's verification was subsequently checked by Ed Sudicky of the Groundwater Research Institute.

I2.3 DEEP GROUND WATER FLOW MODELLING

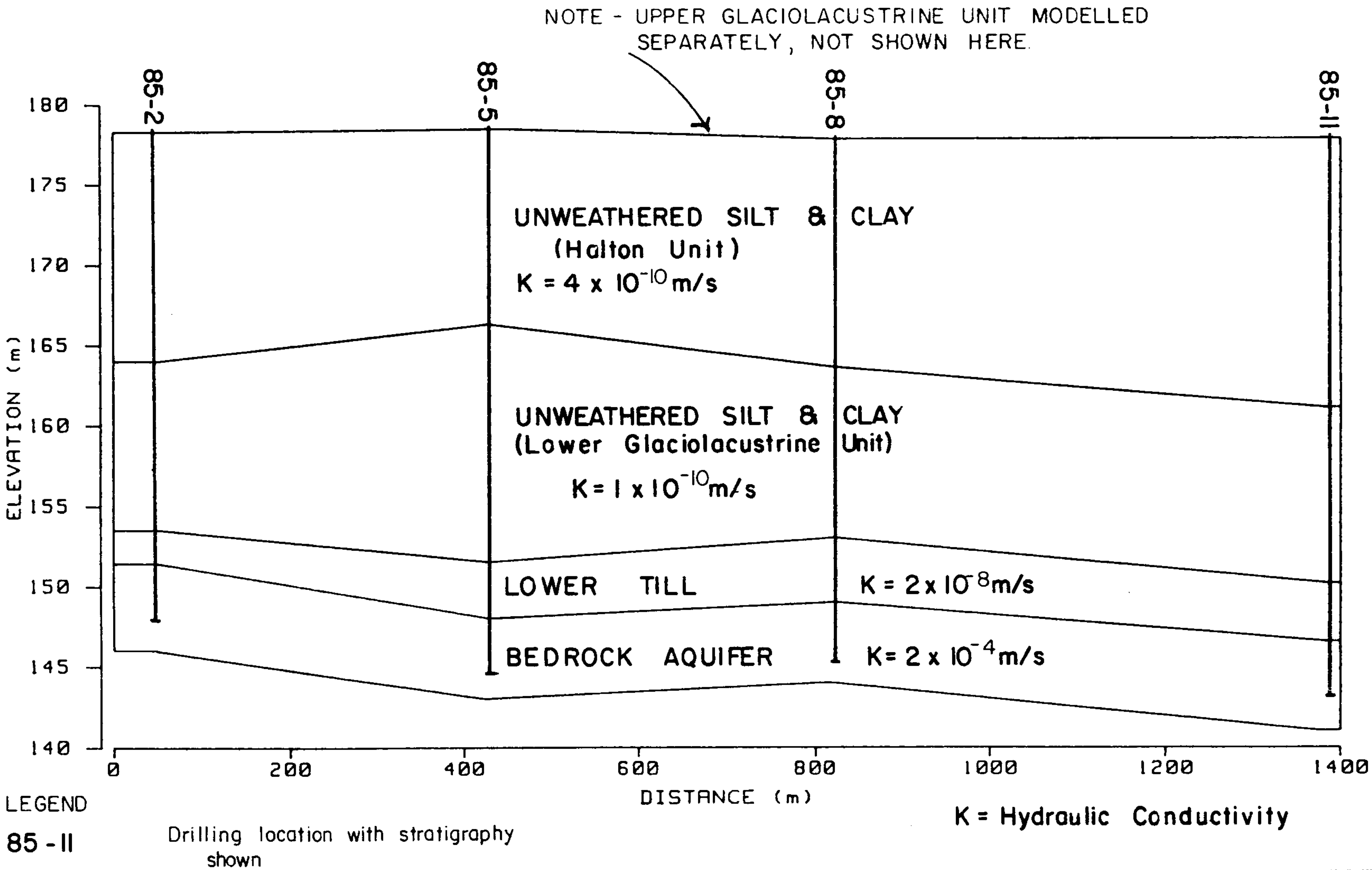
Deep ground water flow was modelled in order to confirm the flow pattern interpreted from the hydrogeologic field data. The comparison is contained in Section 3.3.4. This appendix provides details of the modelling.

A north-south cross-section through the middle of the Preferred Site was chosen so that the results would be comparable to Figure 3-6. Figure I2-1 illustrates the cross-section and the four drilling locations that lie along the section. The geologic boundaries shown in Figure I2-1 were interpreted from the stratigraphic boreholes at these drilling locations, which are also shown. The Upper Glaciolacustrine unit, which contains the shallow flow zone, was modelled separately (Appendix I2.4) and is therefore not shown here.

Hydraulic conductivity values for each geologic unit are shown on Figure I2-1. The values for the Lower Till and Bedrock

Figure I2-1

DEEP FLOW MODELLING CROSS-SECTION AND MATERIAL PROPERTIES



Aquifer are average values determined by hydrogeologic testing, as discussed in Sections 3.2.4 and 3.2.5. Only the upper 6 m (Zone A) of the Bedrock Aquifer was modelled since it is underlain by a lower permeability aquitard (Zone B) that tends to isolate it (Section 3.3.3.2).

The hydraulic conductivities of the Halton Unit and Lower Glaciolacustrine Unit were 4E-10 m/s and 1E-10 m/s respectively in the simulation. These are within the range of hydraulic conductivities resulting from hydrogeologic testing in the unweathered silt and clay, and also produces the same geometric mean of 2E-10 m/s (Section 3.2.3). The values were adjusted slightly from the mean value so that the modelling would produce a closer match with observed hydraulic heads, and probably represents a slight degree of overall variability that was not observed in the hydrogeologic testing at specific depths.

Figure I2-2 illustrates the finite element mesh that was used in the modelling. The elements were triangular and each corner represents a nodal point. Figure I2-3 shows the boundary conditions that were applied to the finite element mesh. The vertical boundaries of the aquitard are assumed to be impermeable; that is, no ground water flow occurs across these boundaries. This is consistent with the predominantly downward gradient in the aquitard below the weathered zone (Section 3.3.3.2). The bottom of the cross-section was also an impermeable boundary based on the presence of a bedrock aquitard (Zone B).

A constant value of hydraulic head was assigned to all nodes along the top of the section and at each end of the bedrock aquifer. The head values were based on observed

Figure I2-2

DEEP FLOW MODELLING FINITE ELEMENT MESH

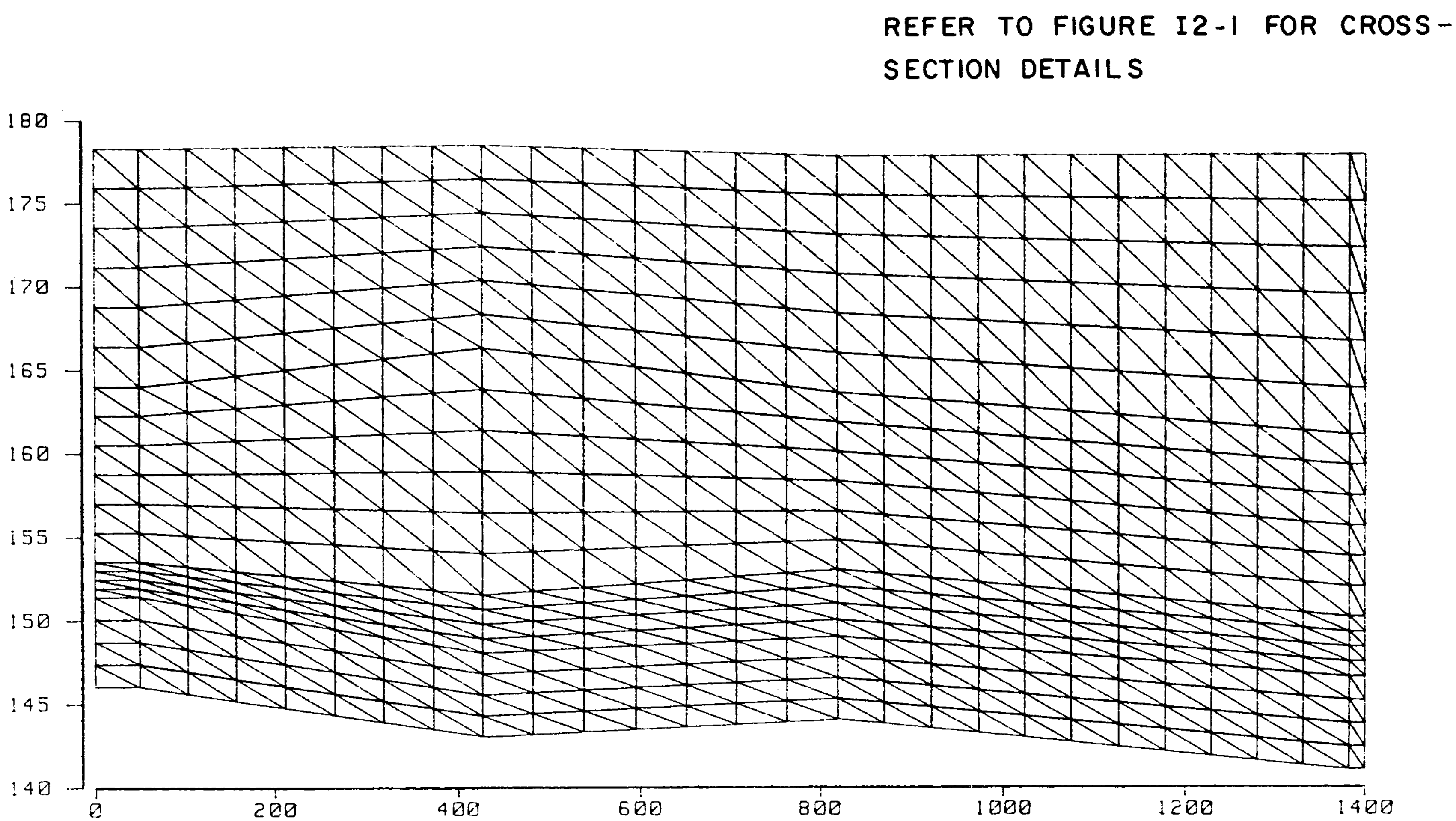
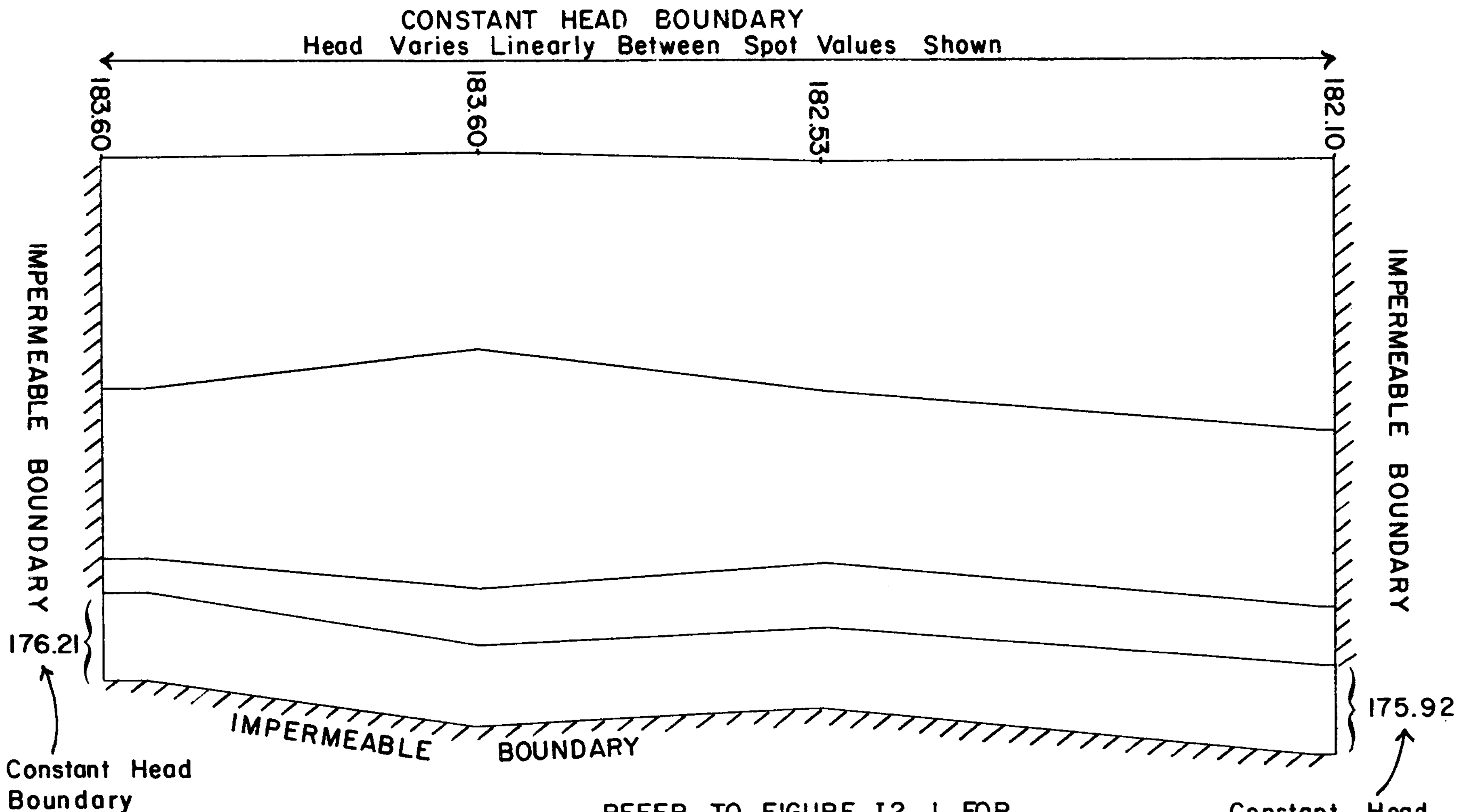


Figure I2-3

DEEP FLOW MODELLING BOUNDARY CONDITIONS



REFER TO FIGURE I2-1 FOR CROSS-SECTION DETAILS

ALL HEAD VALUES ARE mASL

hydraulic heads in the ground water monitors during June 1986 (Figure 3-6 and Appendix F2). Constant head boundaries allow ground water to flow across the boundaries. The rate of flow is calculated by the model.

Figure I2-4 illustrates the results of the ground water flow modelling. Equipotential contours (lines of equal hydraulic head) are shown. Ground water flow is perpendicular to these contours, although the vertical exaggeration of the cross-section must be accounted for.

The specific discharges (total ground water flow quantity per unit area perpendicular to flow) crossing the constant head boundaries are shown in Figure I2-4. Comparison of these specific discharges with those calculated using the one-dimensional Darcy's Law equation, shown in Table I1-1, indicates excellent agreement. This confirms that flow in the aquitard and bedrock aquifer can be considered as predominantly vertical and horizontal respectively.

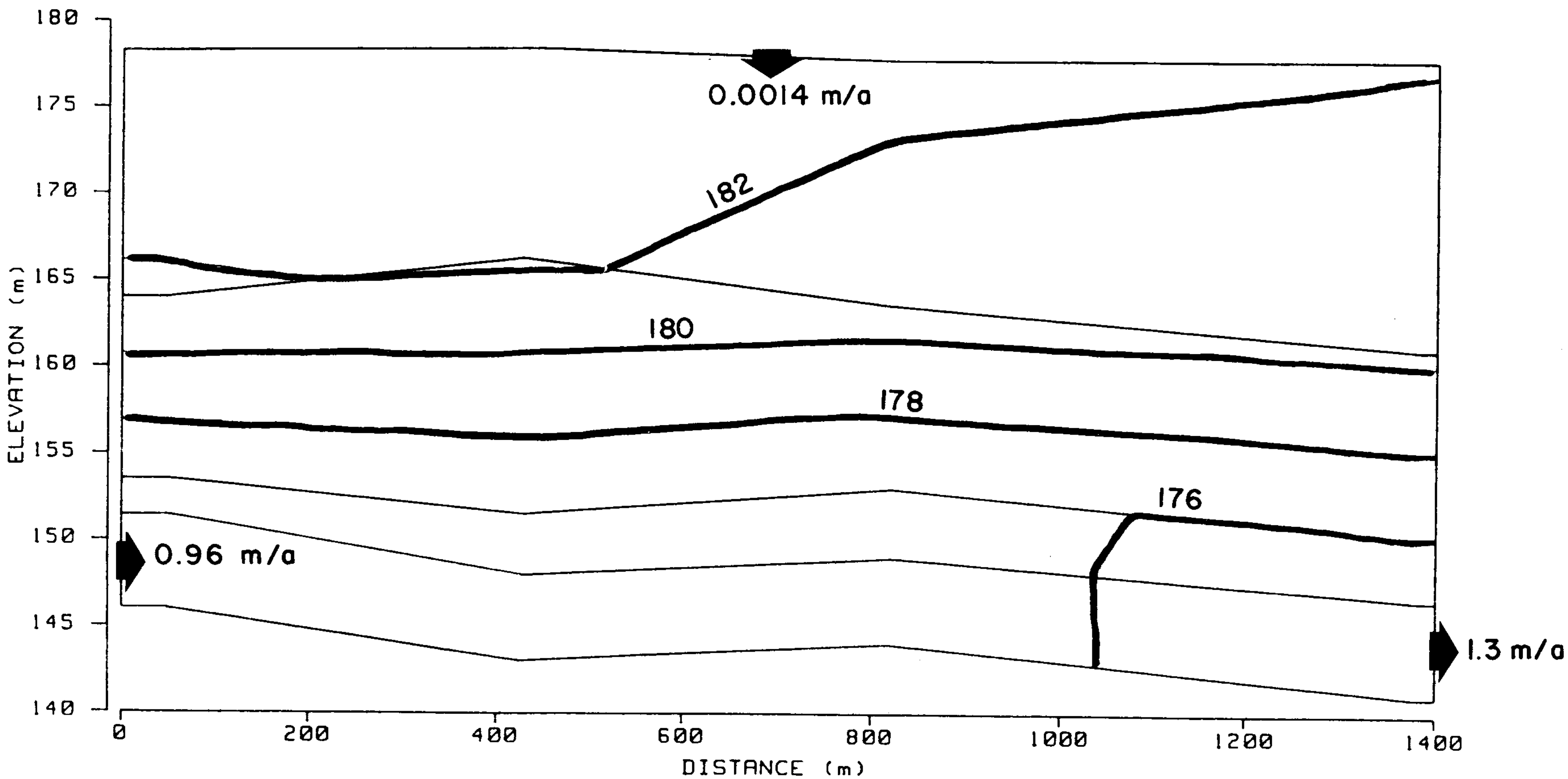
I2.4 SHALLOW GROUND WATER FLOW MODELLING

Shallow ground water flow is known to be transient at the Preferred Site, evidenced by water table fluctuations. One extreme of the range of flow conditions exists when there is infiltration recharging the water table. This occurs during rainfall or snowmelt, for example. The water table is expected to rise quickly to ground surface during recharge as the open fractures, which have a relatively small volume, fill with water. The silt and clay matrix, however, may be much slower to saturate due to its low hydraulic conductivity. Under this condition, the local ridge and swale topography controls

Figure I2-4

DEEP FLOW MODELLING RESULTS - HYDRAULIC HEAD DISTRIBUTION

REFER TO FIGURE I2-1 FOR CROSS-SECTION DETAILS



1.3 m/a Average specific discharge crossing constant head boundary

180 Equipotential (equal hydraulic head) contour

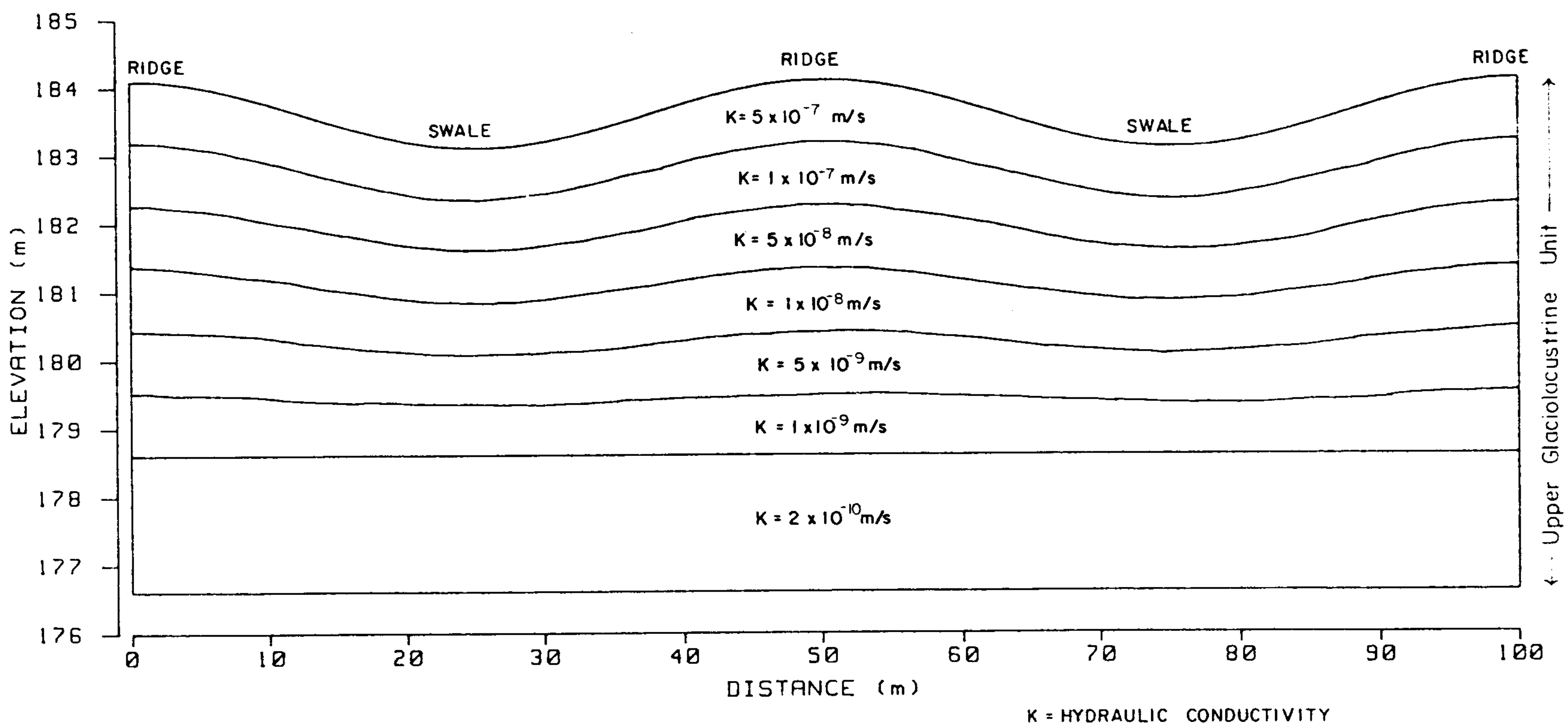
ground water flow, with recharge at the ridges discharging in the swales. Again because the fractures are volumetrically small, this transient flow condition is expected to dissipate quickly once the recharge ceases. Therefore, the high water table scenario exists essentially only during recharge events, which is a relatively small portion of the year. This scenario was modelled and the results are presented here.

The other extreme of shallow flow occurs between recharge events, the largest portion of the year. During this time, the water table generally exists below the base of the swales. It is expected to be flat to gently undulating in a mute expression of local topography. The water levels measured in the standpipes at the Preferred Site represent this condition (Appendix F2). Because the resulting local lateral gradients are small and because the water table is deeper in the weathered zone where bulk hydraulic gradients are lower, local ground water movement is expected to be very limited. Also, intermediate or regional scale shallow flow is expected to be limited since the site and surrounding area are very flat topographically.

The purpose of modelling shallow flow was to establish the nature of the flow pattern under recharge conditions. The generic cross-section shown in Figure I2-5 was established to represent a typical north-south section through the ridge and swale topography. The overall relief is 1 m and the frequency of the ridges is 50 m, which are typical of the site topography. A total width of 100 m was modelled, and the depth of the section represents the depth to the base of the Upper Glaciolacustrine Unit in the vicinity of drilling location 85-12, which was used as a basis for comparison.

Figure I2-5

SHALLOW FLOW MODELLING CROSS-SECTION AND MATERIAL PROPERTIES



Figures I2-5 also shows the material properties specified in the modelling. The hydraulic conductivity was stepped from 5E-7 m/s near surface down to 2E-10 m/s at the base of the section to represent the transition from weathered to unweathered silt and clay. This was felt to be realistic based on the observed decrease in fracture frequency with depth from the surface.

Figure I2-6 illustrates the finite element mesh used in the modelling. Triangular elements were used with the nodes occurring at each corner. Figure I2-7 presents the specified boundary conditions. The left and right boundaries were impermeable since they occur beneath ridge peaks which act as local flow divides; because of the symmetry no flow crosses these boundaries. The lower boundary was specified as a constant flux boundary. The flux value was 0.0014 m/a, a value which resulted from the deep flow modelling (see Figure I2-4). The ground surface was specified as a constant head boundary, with the head values equal to the topographic elevation. This simulates a water table at surface, which is the expected recharge scenario.

Figure I2-8 presents the hydraulic head distribution that resulted from the simulation. This clearly shows hydraulic head to be reasonably constant with depth. This trend was also noted at the two drilling locations where detailed water level monitoring was undertaken in the weathered silt and clay; namely 85-1 and 85-12 (see Figures 3-3 and 3-4, and Appendix F2). Constant hydraulic head with depth suggests predominantly lateral flow.

Figure I2-6

SHALLOW FLOW MODELLING FINITE ELEMENT MESH

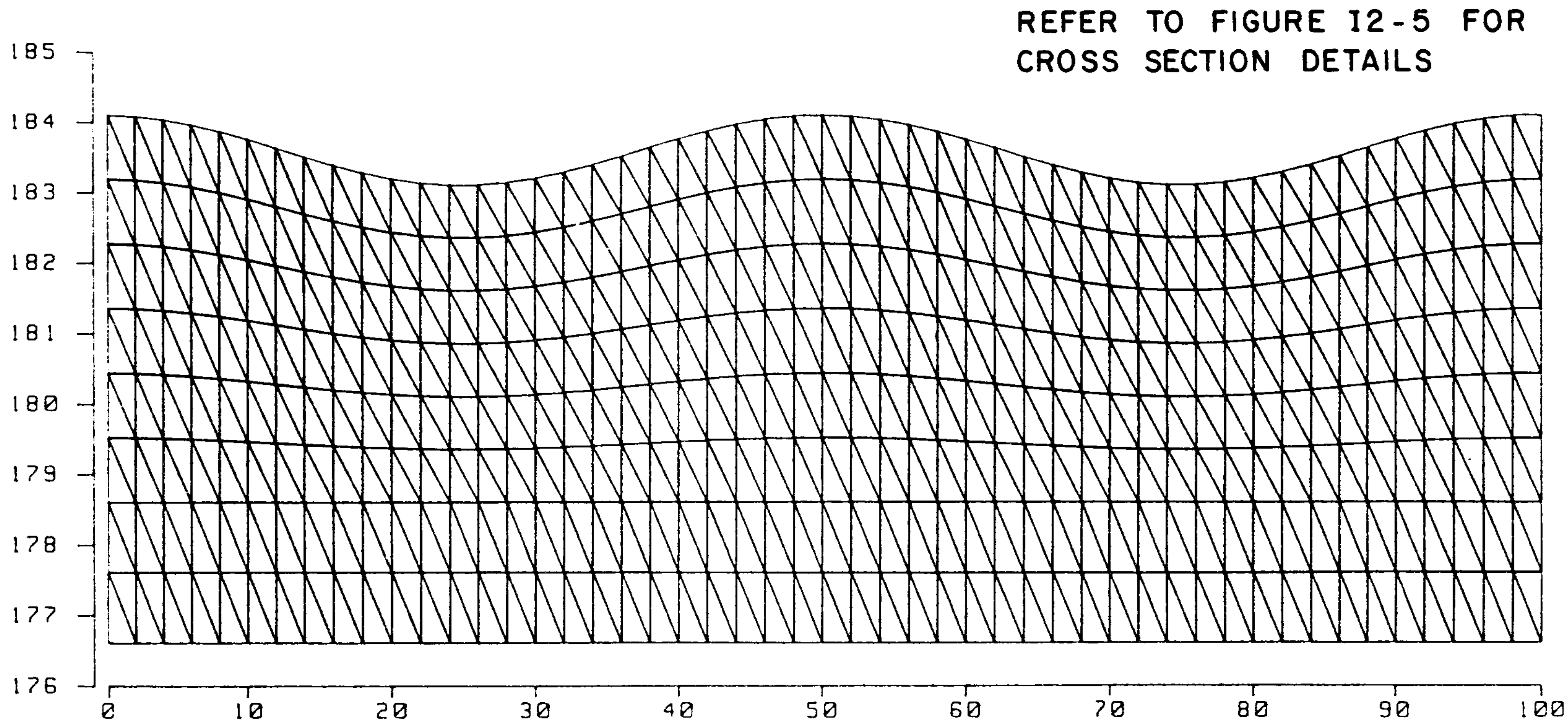
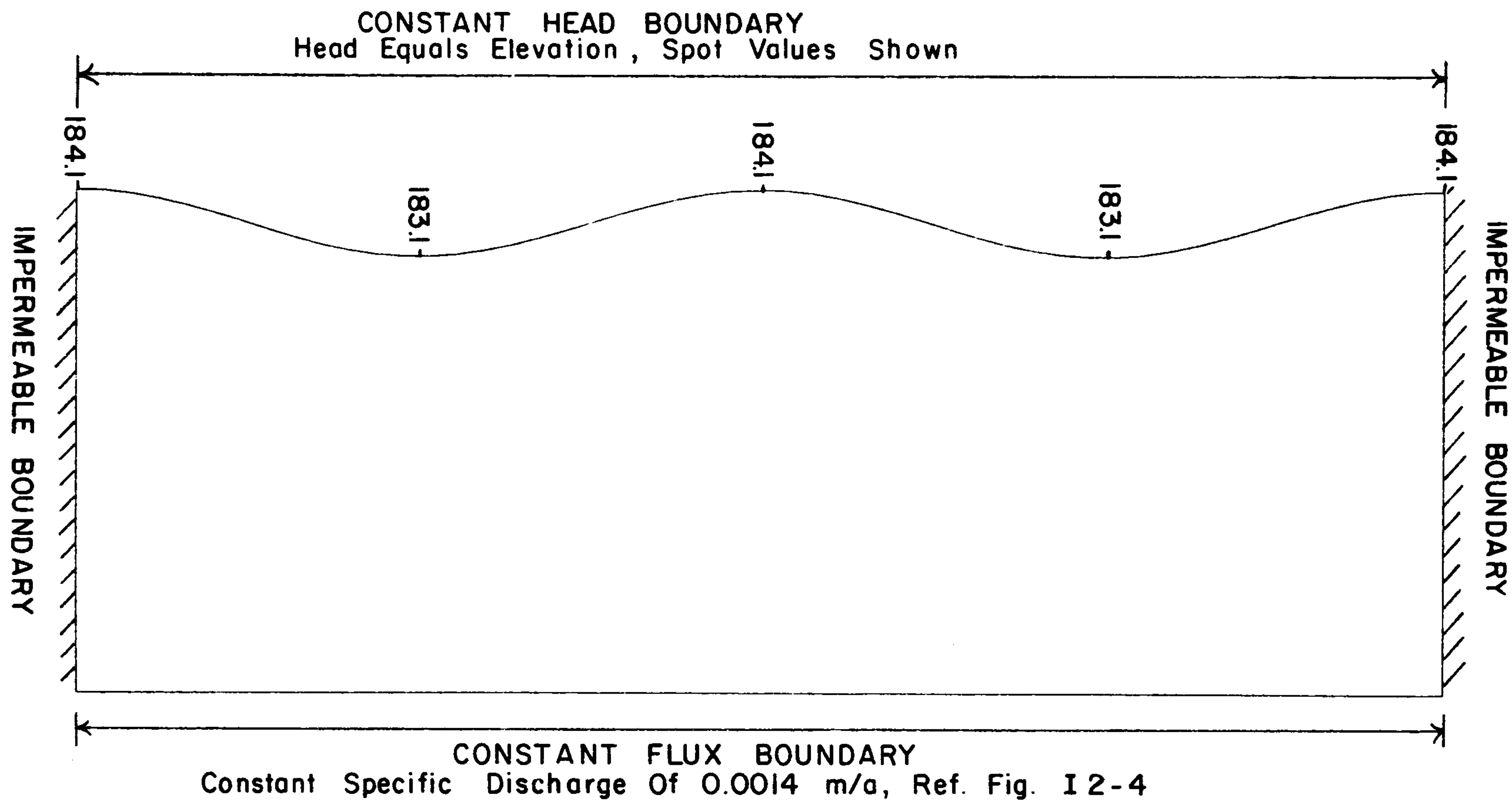


Figure I2-7

SHALLOW FLOW MODELLING BOUNDARY CONDITIONS

REFER TO FIGURE I2-5 FOR CROSS-SECTION DETAILS

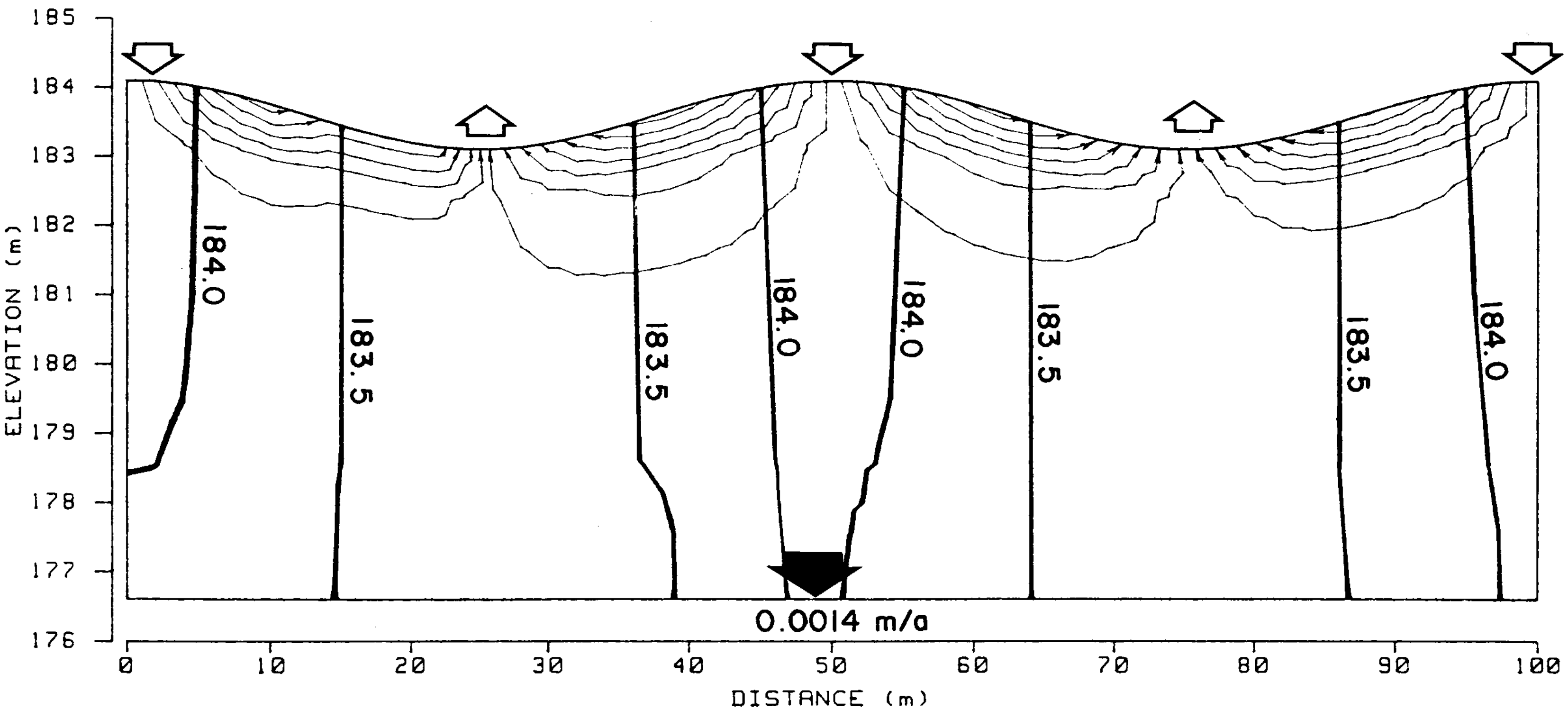


ALL HEAD VALUES ARE mASL

Figure I2-8

SHALLOW FLOW MODELLING RESULTS - HYDRAULIC HEAD AND STREAMLINE DISTRIBUTIONS

AVERAGE SPECIFIC RECHARGE RATE AT RIDGES = 0.092 m/a
AVERAGE SPECIFIC DISCHARGE RATE AT SWALES = 0.079 m/a



Discharge Area

Recharge Area

Average Specific Discharge Crossing Lower Boundary

Refer To Figure I2-5 For Cross Section Details

183.5 Equipotential (equal hydraulic head) Contour (mASL)

Streamline Showing Example Flow Path

Streamline distributions were also calculated using the FLONET model to better define the actual flow pattern. The results are shown in Figure I2-8. Streamlines show examples of the actual paths of ground water flow. They are calculated such that there is an equal discharge of ground water between any two adjacent streamlines. Thus, closer streamline spacing is indicative of greater flow quantities. Examination of Figure I2-9 suggests that the bulk of recharge occurs at the ridges and the bulk of the discharge occurs at the swales. Flow from ridges to swales is predominantly in the upper 3 metres. As expected, a very small proportion of the recharge is transmitted to depth. In fact, the specific discharge below 3 m depth is so small that no streamlines occur within the 100 m cross-section width.

Also shown on Figure I2-8 are average specific infiltration and discharge rates at surface, and the specific discharge from the base of the section. As expected, the specific discharge from the base of the Upper Glaciolacustrine Unit shown in Figure I2-8 equals the average specific recharge to the Halton Unit shown in Figure I2-4.

I3 WATER BUDGET

Water budget calculations are used to partition quantities of water that reach the ground surface as precipitation. The pathways by which precipitation can be routed include surface runoff, evapotranspiration, shallow flow to surface water systems, and ground water recharge.

A water budget has been prepared for the Preferred Site using long term meteorological data from Welland, Ontario. The results are representative of average long term conditions only. The results are summarized in Table I3-1.

The method detailed by Thornthwaite and Mather (1957) was used for the water budget calculation. This technique assumes that the soil moisture is depleted in a nonlinear manner and replenished in a linear manner, and calculates a value for actual evapotranspiration based on the precipitation and the change in moisture status of the soil.

The mean annual precipitation at Welland is 938 mm. (Note: all values are per unit surface area). The potential evapotranspiration is calculated to be 637 mm/a. However, when the soil moisture storage is considered, the average actual evapotranspiration is calculated to be only 558 mm/a, leaving a water surplus, when subtracted from the precipitation, of 380 mm/a. While the bulk of this water (estimated to be about 243 mm/a) is likely to leave the site as runoff during the spring snowmelt, the remainder of approximtely 137 mm/a will result as direct surface runoff during rainfall, or infiltrate into the ground.

TABLE I3-1: WATER BUDGET CALCULATION

LOCATION: Welland, Ontario

METHOD: Thornthwaite and Mather (1957),
Nonlinear Loss of Soil Moisture

CALCULATED MINIMUM ANNUAL SNOWMELT RUNOFF
(Based on Thornthwaite and Mather 1957): 243 mm/a

SOIL MOSTURE STORAGE: 100 mm/a

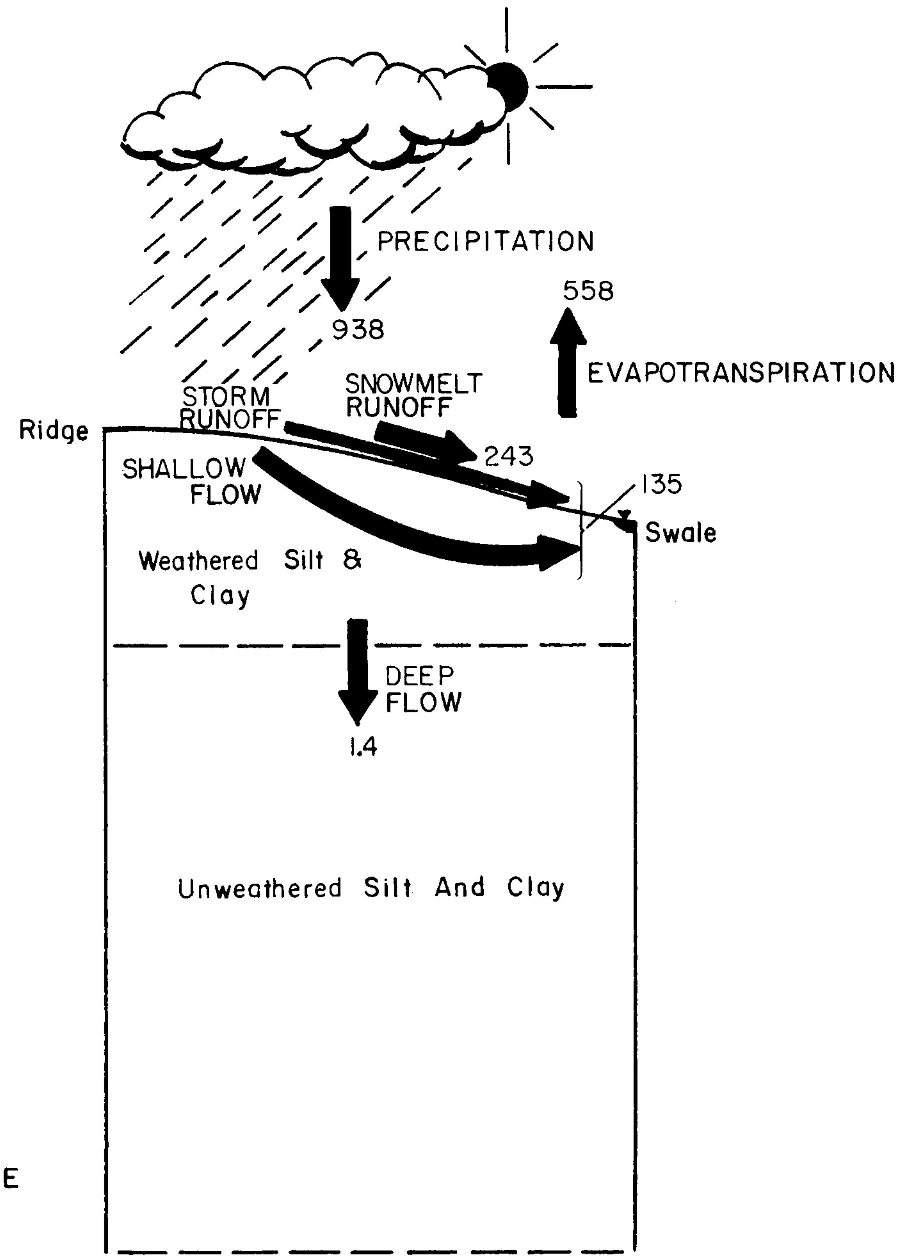
MONTH	MEAN TEMP	MEAN PRECIP	POTENTIAL EVT	ACTUAL EVT	SURPLUS WATER
Jan.	-4.9	83.0	0	0	1
Feb.	-4.5	68.2	0	0	1
Mar.	0.5	84.6	1	1	66
Apr.	7.2	77.5	34	34	152
May	13.2	71.6	78	78	76
June	18.7	72.2	117	106	38
July	21.5	61.1	139	94	19
Aug.	20.7	91.2	123	99	10
Sep.	16.7	85.5	84	84	5
Oct.	10.8	70.8	46	46	2
Nov.	4.8	79.9	15	15	6
Dec.	-1.7	92.4	0	0	3
Year		938.0	637	558	380

It is known from ground water modelling that an average of slightly less than 2 mm/a flows through the unweathered silt and clay unit to recharge the bedrock aquifer (Section 3.2.3). Deducting this from the 137 mm/a identified as infiltration results in a total of about 135 mm/a that is discharged to the local surface drainage system by direct rainfall runoff or by lateral flow in the local flow system to the surface drainage swales.

Figure I3-1 shows a schematic summary of the water budget calculations presented in this section.

Figure I3-1

Schematic Diagram Of Water Budget Calculations



NOT TO SCALE

Values are millimeters per year per unit area.
Calculations represent long term averages only.

APPENDIX J

GROUND WATER CHEMISTRY RESULTS

GROUND WATER CHEMISTRY RESULTS

TABLE OF CONTENTS

TABLE J1-1

SUMMARY OF GROUND WATER CHEMISTRY DATA:

GENERAL CHEMISTRY AND MAJOR IONS

Table J1-1 presents the results of field and laboratory analyses of general chemical indicators and major ions on ground water samples from the Preferred Site. Major ions were considered to be those parameters whose concentrations consistently exceeded 1 mg/L. The general chemical indicators of pH, temperature and electrical conductivity were measured in the field. All other parameters on Table J1-1 are the results of laboratory analyses. All concentrations are in mg/L (ppm) unless otherwise noted.

Also included in Table J1-1 is the percent charge balance. This was calculated from the major ions using the equation:

$$(\sum \text{meq/L cations} - \sum \text{meq/L anions})/(\sum \text{meq/L cations} + \sum \text{meq/L anions}) \times 100$$

where $\sum$ means to sum all of the numbers and meq/L means miliequivalents per litre. The percent charge balance can be either positive or negative depending on whether cations or anions are in excess. The cations included in the calculation were Ca^{+2}, K^{+}, Mg^{+2}, Na^{+} and Sr^{+2}. The anions included were F^{-}, Cl^{-}, SO_4^{-2} and alkalinity (as HCO_3^{-}). To convert alkalinity as $CaCO_3$ to HCO_3 divide by 0.8202. The percent charge balance is used as a check on the accuracy of the analyses. As per standard practice, analyses with charge balances in excess of 10% were considered invalid.

TABLE J1-1 : SUMMARY OF GROUND WATER CHEMISTRY DATA: GENERAL CHEMISTRY AND MAJOR IONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLE	COMMENTS	GENERAL CHEMISTRY AND MAJOR IONS pH in field	Temperature in field (DEG C)	Conductivity in field (umhos/cm)	Total Dissolved Solid (mg/L)	Alkalinity (mg/L as CaCO3)	Dissolved Inorganic Carbon (mg/L)	Ca (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	Si (mg/L)	Sr (mg/L)	F (mg/L)	Cl (mg/L)	SO4 (mg/L)	CHARGE BALANCE %
85-1-1	34.4 to	17-Jun-86	I	7.77	10	1990	2060	60	15	255	< 1	96.8	162	4.09	5.62	2.18	17.5	1190	2.4
	37.5	26-Aug-86	I	7.32	10	1920	2270	50	22	252	< 1	99.1	149	4.13	5.68	1.95	18.9	1190	1.8
85-1-3	25.91 to	17-Jun-86	D	9.88	11	1450	1160	59	16	46.2	18	20.7	211	2.36	1.25	1.09	30.5	710	-10.2
	26.91	26-Aug-86	D	9.29	13	1400	1230	34	12	53.1	8	20.7	194	2.67	1.43	1.05	31.8	575	-2.2
85-1-10	2.33 to	17-Jun-86		7.01	11	6460	8940	652	150	369	6	1130	329	7.81	7.55	4.91	18.2	5540	-1.2
	5.33	26-Aug-86		7.03	12	6100	11200	639	180	335	5	1090	292	6.42	7.33	4.68	17.5	5280	-1.7
85-1-11	8.8 to	17-Jun-86		7.49	13	5040	6170	284	75	284	6	503	690	18.5	6.47	3.45	19	4000	-2.2
	9.84	26-Aug-86		7.62	12	5000	6540	328	100	307	7	531	605	13.4	6.91	3.48	20.3	3700	0.8
85-1-14	2.2 to	17-Jun-86		7.80	13	3440	3520	880	240	60.5	5	505	249	6.66	3.28	2.91	8.2	1560	4.9
	2.5	11-Sep-86		7.76		5680 *	4380	819	176							2.31	7.4	1610	
85-1-15	2.7 to	17-Jun-86	E	7.93	13	3860	3520	846	220	113	6	543	328	16.6	3.35	2.91	7.5	2000	4.8
	3	11-Sep-86		7.28		6240 *	4750	854	170	54.8	2	454	261	4.69	2.79	2.65	6.5	1820	-3.7
85-1-16	3.7 to	17-Jun-86		7.46	12	5700	6760	758	160	198	9	883	460	6.83	5.65	4	11	4250	0.9
	4	11-Sep-86		7.25		105000 *	7820	868	100	206	5	884	435	5.5	5.56	3.76	9.4	3800	3.6
85-1-17	4.5 to	17-Jun-86		7.36	12	6320	8090	678	155	365	11	1010	431	6.99	7.31	4.73	12.3	5060	0.4
	4.8	11-Sep-86		6.97		11600 *	9020	650	36	325	6	1020	367	5.54	7.6	5.28	11	4570	3.4
85-1-18	5.2 to	17-Jun-86		7.34	10	8090	10400	594	175	426	14	1110	923	7.17	8.9	6.36	17.5	7500	-4.8
	5.5	11-Sep-86		7.75		15900 *	12200	648	55	380	9	1030	907	5.46	8.41	6.67	15.9	6370	
85-1-19	6 to	17-Jun-86	E	7.41	10	7470	10600	530	50	473	15	1110	866	25.2	8.95	5.45	18.7	7000	-1.3
	6.3	11-Sep-86		7.27		15200 *	11400	538	34	321	7	945	706	5.02	7.44	7.55	18.8	6230	-6.2
85-1-20	6.7 to	17-Jun-86		7.49	12	7460	10200	446	35	393	9	1040	763	7.26	9.05	5.82	18.5	6560	-2.6
	7	11-Sep-86		7.17		14300 *	11100	434	81	377	6	1070	694	7.27	8.56	6.94	18.2	5970	1.3

For explanation of comments see last page of this table.

TABLE J1-1 : SUMMARY OF GROUND WATER CHEMISTRY DATA: GENERAL CHEMISTRY AND MAJOR IONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLE	COMMENTS	GENERAL CHEMISTRY AND MAJOR IONS: pH in field	Temperature in field (DEG C)	Conductivity in field (umhos/cm)	Total Dissolved Solid (mg/L)	Alkalinity (mg/L as CaCO3)	Dissolved Inorganic Carbon (mg/L)	Ca (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	Si (mg/L)	Sr (mg/L)	F (mg/L)	Cl (mg/L)	SO4 (mg/L)	CHARGE BALANCE %
85-1-21	7.65 to	17-Jun-86		7.41	13	7450	9990	426	115	383	10	1130	697	6.88	9.21	5.82	19.5	6810	-2.8
	7.96	11-Sep-86		7.42		14500 *	12300	400	75	315	6	964	523	4.99	7.7	6.94	18.5	6180	-7.6
85-2-4	15.5 to	12-Jun-86	F	7.78	12	1750	2510	208	52	175	6	181	314	5.93	3.61	2.18	24	1530	3.2
	16.6	26-Aug-86		7.73	13	3175	3060	100	26	145	2	92.4	495	4.37	3.8	2.19	20.7	1770	-3.6
85-3-1	32 to	12-Jun-86		7.33	13	2300	2480	89	25	378	3	114	138	3.99	8	2.67	41.2	1370	4.4
	34.69	26-Aug-86		7.58	10	2150	2870	91	24	336	1	112	131	3.73	7.9	2.27	42.4	1520	-3.9
85-3-10	2.3 to	12-Jun-86		7.05	13	9560	13100	618	110	423	11	1760	545	6.63	10.4	7.27	10.5	9370	-4.5
	5.3	26-Aug-86		7.23	11	10000	19600	632	172	393	7	1710	466	6.01	10.1	7.6	11.4	8630	-3.2
85-8-1	36.49 to	18-Jun-86		7.54	10	2420	2540	64	17.5	353	4	107	148	3.75	8.97	2.73	43	1500	-1.1
	39.47	18-Jun-86	A	7.54	10	2420	2520	54	17	359	3	108	157	3.6	8.98	2.54	40	1500	0.5
		21-Aug-86		7.3	10	2100	2960	62	11	363	3	115	146	4.09	9.41	2.18	45.9	1540	-0.7
		21-Aug-86	A	7.3	10	2100	2660	62	40	358	4	110	148	4.21	8.95	2.14	45.7	1590	-3.0
85-8-4	15.16 to	18-Jun-86		8.01	10	4320	4440	72	19	352	4	283	505	3.82	7.43	2.36	27.5	3120	-3.2
	16.16	21-Aug-86		7.73	12	4250	5050	82	11	336	3	295	512	4.3	7.66	2.74	28.1	2990	-0.8
85-8-8	24.66 to	18-Jun-86		8.04	11	1450	1180	40	12	91.1	< 1	31.4	206	3.29	1.98	1	36.2	760	-4.5
	25.38	18-Jun-86	A	8.04	11	1450	1200	40	12.5	92.9	1	31.7	204	3.21	1.93	1.18	33.2	760	-4.2
		21-Aug-86		8.19	11	1600	1160	36	13	91.2	2	37.3	193	3.64	1.91	0.97	37.3	690	-0.2
		21-Aug-86	A	8.19	11	1600	1260	36	8	87.4	2	36.1	185	3.29	1.84	0.99	36	710	-3.4
85-8-10	2.43 to	18-Jun-86		7.21	11	7410	14700	648	165	401	9	1410	342	5.86	7.93	6	8.5	7370	-4.7
	5.33	18-Jun-86	A	7.21	11	7410	10500	606	165	403	9	1520	348	5.88	8.07	5.82	8.5	6680	2.9
		21-Aug-86		6.95	11	7000	12200	662	160	413	10	1460	343	7.09	8.65	6.11	8.8	6370	5.0
		21-Aug-86	A	6.95	11	7000	11600	592	170	412	11	1450	337	7.05	8.54	5.88	9.1	6270	4.0
85-8-11	8.45 to	18-Jun-86		7.42	13	8670	12000	556	140	392	13	1540	578	6.59	8.24	6.73	16.7	8120	-2.6
	9.45	21-Aug-86		7.12	12	8800	13800	554	137	400	13	1470	675	9.26	8.76	6.86	22.4	7550	0.4

For explanation of comments see last page of this table.

TABLE J1-1 : SUMMARY OF GROUND WATER CHEMISTRY DATA: GENERAL CHEMISTRY AND MAJOR IONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLE	COMMENTS	GENERAL CHEMISTRY AND MAJOR IONS: pH in field	Temperature in field (DEG C)	Conductivity in field (umhos/cm)	Total Dissolved Solid (mg/L)	Alkalinity (mg/L as CaCO3)	Dissolved Inorganic Carbon (mg/L)	Ca (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	Si (mg/L)	Sr (mg/L)	F (mg/L)	Cl (mg/L)	SO4 (mg/L)	CHARGE BALANCE %
85-10-1	36.85 to	12-Jun-86		7.3	11	2660	2780	86	25	382	3	124	179	4.63	9.99	2.51	49.9	1620	-9.6
	39.85	26-Aug-86		7.44	11	2300	2720	66	16	341	2	113	158	4.15	9.34	2.25	49.1	1650	-5.3
85-10-10	2.85 to	12-Jun-86	H	7.49	12	1010	762	424	135	108	2	61.6	56	6.19	0.718	0.87	4	181	2.2
	3.66	26-Aug-86	H	7.4	12	1080	780	438	112	94.7	< 1	70.9	57	8.98	0.988	0.68	3.3	174	2.3
85-11-4	16.78 to	12-Jun-86	G	8.39	12	1900	2260	57	12.5	113	15	44	282	3.11	2.98	1.45	32.5	1810	-28.9
	17.7	26-Aug-86		8.47	13	2550	2220	32	7	145	9	56.1	394	3.08	3.13	1.89	34	1420	-3.3
85-12-1	38 to	10-Jun-86		7.68	13	2410	2[illegible]60	54	15	335	4	96.5	169	3.78	9.75	2.22	29.2	1370	2.8
	41	10-Jun-86	B	7.68	13	2410	2580	49	22.5	345	5	99.9	155	3.89	9.84	2.36	28.7	1370	3.3
		21-Aug-86		7.35	10	2200	2620	54	20	325	1	101	149	4.26	9.95	2.14	31.9	1420	-0.6
		21-Aug-86	B	7.35	12	2200	2960	50	15	330	< 1	100	147	4.11	9.7	2.17	32.3	1420	-0.4
85-12-8	24.55 to	10-Jun-86		8.05	13	1110	920	58	16.5	46.7	< 1	15.7	179	3.38	0.991	0.91	18.8	540	-5.9
	25.15	10-Jun-86	B	8.05	13	1110	842	51	16	42.3	< 1	14.7	235	4.02	1.11	0.94	19.3	510	5.2
		21-Aug-86		8.55	10	1300	806	54	16	46.6	1	17.9	160	3.46	0.947	0.83	21.3	400	63.7
		21-Aug-86	B	8.55	10	1300	958	59	6	46.8	< 1	18.3	161	3.65	0.973	0.92	20.9	410	65.2
85-12-10	2.3 to	10-Jun-86		7.37	13	9680	13600	690	210	434	9	1880	409	6.97	10.7	6.54	7.8	8190	2.9
	5.33	10-Jun-86	B	7.37	13	9680	13600	704	210	428	9	1860	408	6.81	10.7	6.72	7.3	8370	1.4
		21-Aug-86		6.93	11	9500	18700	738	170	420	9	1790	372	7.41	11.3	7.31	10	8230	0.0
		21-Aug-86	B	6.93	11	9500	16500	706	200	420	6	2450	369	6.73	11.4	7.09	10	8040	8.7
85-12-11	8.55 to	10-Jun-86		7.51	12	7130	9680	452	130	421	12	841	740	8.39	7.86	4.73	14.1	5620	-1.3
	9.45	26-Aug-86		7.7	13	5000	10000	462	115	390	11	766	1060	8.54	8.08	5.14	17.1	5490	2.2
85-12-13	1.2 to	10-Jun-86		7.46	12	5580	7160	274	74	410	2	729	326	7.73	5.82	3.64	4	4250	0.3
	1.5																		
85-12-14	2.2 to	10-Jun-86		7.45	12	9300	12700	558	35	388	6	1840	388	6.48	9.83	6.73	5.9	6880	8.7
	2.5	11-Sep-86		7.78	11	19200 *	17100	594	51	328	2	1620	333	6.73	9.13	8.05	8.1	8560	-7.1

For explanation of comments see last page of this table.

TABLE J1-1 : SUMMARY OF GROUND WATER CHEMISTRY DATA: GENERAL CHEMISTRY AND MAJOR IONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLE	COMMENTS	GENERAL CHEMISTRY AND MAJOR IONS: pH in field	Temperature in field (DEG C)	Conductivity in field (umhos/cm)	Total Dissolved Solid (mg/L)	Alkalinity (mg/L as CaCO3)	Dissolved Inorganic Carbon (mg/L)	Ca (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	Si (mg/L)	Sr (mg/L)	F (mg/L)	Cl (mg/L)	SO4 (mg/L)	CHARGE BALANCE %
85-12-15	2.7 to	10-Jun-86		7.5	12	8960	13600	466	145	398	4	1770	369	6.97	9.12	6.91	8.9	8560	-1.7
	3	11-Sep-86		7.52	12	17800 *	14900	442	43	377	2	1810	354	7.42	10.1	8.05	10.2	7780	3.3
85-12-16	3.7 to	10-Jun-86		7.36	12	9170	12600	566	165	405	7	1590	478	7.98	8.79	6.73	8.7	8120	-2.4
	4	11-Sep-86		7.2	11	17600 *	15100	608	58	414	5	1760	436	7.24	10.8	7.5	10.8	7570	4.4
85-12-17	4.5 to	10-Jun-86		7.3	12	8560	11200	620	185	386	10	1440	537	6.86	8.4	6	8.7	7560	-2.7
	4.8	11-Sep-86		7.14	10	16000 *	13700	606	36	362	7	1480	484	6.61	9.18	6.94	10.1	6610	3.5
85-12-18	5.2 to	10-Jun-86		7.16	12	9290	12500	732	230	398	14	1720	523	6.31	10.4	6.91	12	8560	-2.3
	5.5	11-Sep-86		6.92	10	18300 *	15600	696	43	382	10	1800	575	5.92	11.5	8.33	14.4	7690	4.8
85-12-19	6 to	10-Jun-86		7.6	12	9260	12500	716	230	408	15	1550	747	6.99	9.95	6.73	13.6	8440	-2.6
	6.3	11-Sep-86		6.95	11	17800 *	14900	680	47	380	10	1590	708	5.64	10.5	7.78	15.4	7610	2.3
85-12-20	6.7 to	10-Jun-86		7.36	12	8890	12600	732	230	406	14	1630	558	6.95	10.3	6.73	14.3	8310	-2.5
	7	11-Sep-86		7.08	10	17400 *	15000	694		399	9	1670	505	6.29	10.5	7.67	16.4	7430	2.9
85-12-21	7.7 to	10-Jun-86		7.64	12	7460	12300	656	190	421	12	1170	516	7.58	9.26	5.45	17.4	6870	-5.3
	8	11-Sep-86		6.89	10	14300 *	11700	663	118	409	7	1210	521	6.54	9.85	6.11	18.5	5970	2.0

EXPLANATION OF COMMENTS - TABLE J1-1 :

A - field duplicate sample
B - field split sample
C - laboratory duplicate
D - results rejected because of high pH
E - results rejected because of sediment in sample
F - results rejected - tritium in sample indicates mixture with near surface water
G - results rejected - ion balance > 10%
H - results rejected - diluted by surface run off due to leakage through surface seal
I - results rejected - probable dilution by drilling water
* - these conductivities values were measured in the laboratory of Barringer Magenta Ltd.

TABLE J1-2

SUMMARY OF GROUND WATER CHEMISTRY DATA:

MINOR CATIONS AND ANIONS

Table J1-2 presents the results of laboratory analyses of ground water samples from the Preferred Site for minor ions. All concentrations are in mg/L except sulphide, which is in ug/L (ppb).

TABLE J1-2 : SUMMARY OF GROUND WATER CHEMISTRY DATA: MINOR CATIONS AND ANIONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	COMMENTS	MINOR CATIONS Ag (mg/L)	Al (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	Pb (mg/L)	Th (mg/L)	Ti (mg/L)	V (mg/L)	Zn (mg/L)	Zr (mg/L)	MINOR ANIONS Br (mg/L)	NO2 (mg/L)	NO3 (mg/L)	PO4 (mg/L)	S (mg/L)
85-1-1	34.4 to	17-Jun-86		<.005	<.01	0.387	<.005	<.0005	<0.001	<.05	0.04	<.008	0.42	0.03	<.2	0.05	<.5	<.05	<.05	<.005	<.005	0.21	<.05	<.5	<.2	<.5	<10	6
	37.5	26-Aug-86		<.005	<.01	0.396	<.005	<.0005	<0.001	<.05	0.05	<.008	0.39	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-1-3	25.91 to	17-Jun-86	C	<.005	0.14	0.278	0.025	<.0005	<.01	<.05	0.02	0.024	0.22	<.01	<.2	<.05	<.5	<.05	<.05	<.005	<.005	0.82	<.05	<.5	<.2	0.8	<1	6
	26.91	26-Aug-86	C	<.005	0.08	0.328	0.015	<.0005	<.01	<.05	<.01	<.008	0.05	<.01	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-1-10	2.33 to	17-Jun-86	D	<.005	0.34	0.273	0.015	<.0005	<.01	<.05	<.01	<.008	2.77	0.19	<.2	0.07	0.9	<.05	<.05	0.014	<.005	0.1	<.05	<.5	<.2	<.5	<10	8
	5.33	26-Aug-86		<.005	<.01	0.274	0.006	<.0005	<0.001	<.05	0.1	<.008	0.31	0.17	<.2	0.07	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-1-11	8.8 to	17-Jun-86		<.005	0.07	0.486	0.082	<.0005	<.01	<.05	0.06	0.011	1.4	0.17	<.2	0.07	0.6	<.05	<.05	0.01	<.005	0.53	<.05	<.5	<.2	<.5	<10	11
	9.84	26-Aug-86		<.005	<.01	0.402	0.007	<.0005	<0.001	<.05	0.11	<.008	1.26	0.29	0.2	0.06	0.7	<.05	0.1	<.005	0.017	<.05	<.05	<.5	<.2	<.5	<10	<2
85-1-14	2.2 to	17-Jun-86		<.005	0.51	0.149	0.023	<.0005	<.01	<.05	0.05	0.014	0.84	0.02	<.2	0.05	0.6	<.05	<.05	0.01	0.012	0.55	<.05	<.5	<.2	2.2	<10	5
	2.5	11-Sep-86																						<.5	<.2	1.2	<10	
85-1-15	2.7 to	17-Jun-86	D	<.005	7.78	0.255	0.053	0.0006	<0.001	<.05	0.15	0.051	14	0.34	<.2	0.07	1	<.05	<.05	0.15	0.033	0.67	<.05	<.5	<.2	4.8	<10	14
	3	11-Sep-86		0.01	<.01	0.469	0.009	<.005	<.01	<.05	0.08	<.008	0.12	<.01	<.2	<.05	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	3	<10	<2
85-1-16	3.7 to	17-Jun-86		<.005	0.07	0.388	0.011	0.0007	<.01	<.05	0.04	0.018	0.62	<.01	<.2	0.07	0.8	<.05	<.05	<.005	0.008	0.72	<.05	<.5	<.2	3	<10	11
	4	11-Sep-86		0.007	<.01	0.517	<.005	<.0005	<.01	<.05	0.08	<.008	0.06	<.01	<.2	<.05	0.6	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	1.2	<10	<2
85-1-17	4.5 to	17-Jun-86		<.005	0.41	0.43	0.006	<.0005	<.01	<.05	0.03	0.016	0.92	0.08	0.2	0.08	0.8	<.05	<.05	0.005	0.01	<.05	<.05	<.5	<.2	<.5	<10	9
	4.8	11-Sep-86		<.005	0.07	0.541	<.005	<.0005	<.01	<.05	0.08	<.008	0.2	0.07	<.2	0.05	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-1-18	5.2 to	17-Jun-86	D	<.005	1.24	0.403	0.013	<.0005	<.01	<.05	0.02	0.028	2.51	0.17	0.2	0.1	0.9	<.05	<.05	0.025	0.006	<.05	<.05	<.5	<.2	<.5	<10	8
	5.5	11-Sep-86		<.005	<.01	0.465	<.005	<.0005	<.01	<.05	0.07	<.008	0.2	0.12	<.2	0.07	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	4.3	<10	
85-1-19	6 to	17-Jun-86	D	<.005	11.7	0.427	0.04	0.0011	<.01	<.05	0.05	0.105	20.9	0.67	<.2	0.11	1.7	<.05	<.05	0.32	0.026	0.08	<.05	<.5	<.2	<.5	<10	5
	6.3	11-Sep-86		<.005	0.08	0.431	<.005	<.0005	<.01	<.05	0.08	<.008	0.3	0.1	<.2	0.06	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	6.3	<10	<2
85-1-20	6.7 to	17-Jun-86		<.005	<.01	0.451	0.005	0.0006	<.01	<.05	0.04	0.014	0.27	0.26	<.2	0.09	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	8
	7	11-Sep-86		<.005	0.33	0.561	<.005	<.0005	<.01	<.05	0.08	<.008	0.15	0.15	<.2	0.07	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	3.5	<10	<2
85-1-21	7.65 to	17-Jun-86		<.005	0.08	0.486	0.016	<.0005	<.01	<.05	0.02	0.016	0.52	0.27	<.2	0.12	0.9	<.05	<.05	<.005	0.012	<.05	<.05	<.5	<.2	<.5	<10	9
	7.96	11-Sep-86		<.005	0.44	0.514	<.005	<.0005	<.01	<.05	0.08	<.008	0.14	0.11	<.2	0.07	0.8	<.05	<.05	<.005	0.007	<.05	<.05	<.5	<.2	1.7	<10	<2

For explanation of comments see last page of this table.

TABLE J1-2 : SUMMARY OF GROUND WATER CHEMISTRY DATA: MINOR CATIONS AND ANIONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	COMMENTS	MINOR CATIONS Ag (mg/L)	Al (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	Pb (mg/L)	Th (mg/L)	Ti (mg/L)	V (mg/L)	Zn (mg/L)	Zr (mg/L)	MINOR ANIONS Br (mg/L)	NO2 (mg/L)	NO3 (mg/L)	PO4 (mg/L)	S (ug/L)
85-2-4	15.5 to	12-Jun-86	E	<.005	<.01	0.399	0.026	<.0005	0.002	<.05	0.06	0.028	0.11	0.07	0.3	0.07	0.5	<.05	0.1	<.005	<.005	0.63	<.05	<.5	<.2	<.5	<10	
	16.6	26-Aug-86		0.011	<.01	0.342	0.019	<.0005	<0.001	<.05	0.05	<.008	0.12	0.13	0.4	<.05	0.6	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-3-1	32 to	12-Jun-86		<.005	<.01	0.468	0.006	<.0005	<0.001	<.05	0.05	<.008	0.2	0.02	<.2	0.07	<.5	<.05	<.05	<.005	<.005	0.11	<.05	0.5	<.2	<.5	<10	7
	34.69	26-Aug-86		0.008	<.01	0.443	<.005	<.0005	<0.001	<.05	0.06	<.008	0.17	0.02	<.2	<.05	<.5	<.05	0.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	160
85-3-10	2.3 to	12-Jun-86		<.005	0.24	0.462	<.005	<.0005	<.01	<.05	<.01	<.008	0.19	<.01	<.2	0.1	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<5
	5.3	26-Aug-86		<.005	<.01	0.442	<.005	<.0005	<.01	<.05	0.08	<.008	0.12	<.01	<.2	0.09	1.1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-8-1	36.49 to	18-Jun-86		<.005	<.01	0.462	0.009	0.0005	<0.001	<.05	0.05	<.008	0.26	0.03	0.3	0.07	0.6	<.05	0.08	<.005	0.014	0.37	<.05	<.5	<.2	<.5	<10	<5
	39.47	18-Jun-86	A	<.005	0.05	0.462	0.01	<.0005	0.02	<.05	0.05	<.008	0.3	0.03	0.2	0.07	0.6	<.05	<.05	<.005	0.009	0.41	<.05	<.5	<.2	<.5	<10	<5
		21-Aug-86		<.005	<.01	0.461	<.005	<.0005	<0.001	<.05	0.05	<.008	0.38	0.02	<.2	0.05	0.6	<.05	<.05	<.005	0.011	4.85	<.05	<.5	<.2	<.5	<10	41
		21-Aug-86	A	<.005	<.01	0.479	0.005	<.0005	0.01	<.05	0.06	<.008	0.32	0.02	0.2	0.06	0.6	<.05	0.11	<.005	0.015	0.7	<.05	<.5	<.2	<.5	<10	34
85-8-4	15.16 to	18-Jun-86		<.005	<.01	0.34	0.013	<.0005	0.002	<.05	0.07	0.018	0.2	0.21	0.3	0.07	0.6	<.05	<.05	<.005	0.012	0.69	<.05	<.5	<.2	<.5	<10	5
	16.16	21-Aug-86		<.005	<.01	0.364	0.013	<.0005	<0.001	<.05	0.09	<.008	0.12	0.25	<.2	0.07	0.6	<.05	0.06	<.005	0.006	<.05	<.05	<.5	<.2	<.5	<10	<2
85-8-8	24.66 to	18-Jun-86		<.005	<.01	0.359	0.008	<.0005	<.01	<.05	0.02	<.008	0.04	0.03	<.2	<.05	<.5	<.05	<.05	<.005	<.005	0.62	<.05	<.5	<.2	<.5	<1	6
	25.38	18-Jun-86	A	<.005	<.01	0.352	0.01	<.0005	<.01	<.05	0.02	<.008	0.03	0.03	<.2	<.05	<.5	<.05	<.05	<.005	0.008	0.63	<.05	<.5	<.2	<.5	<1	8
		21-Aug-86		<.005	<.01	0.36	0.014	<.0005	<.01	<.05	0.03	<.008	0.04	0.03	<.2	<.05	<.5	<.05	0.08	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
		21-Aug-86	A	<.005	0.11	0.359	0.012	<.0005	<0.001	<.05	0.03	<.008	0.05	0.04	0.2	<.05	<.5	<.05	0.11	<.005	0.008	<.05	<.05	<.5	<.2	<.5	<10	<2
85-8-10	2.43 to	18-Jun-86		<.005	0.01	0.273	0.006	<.0005	<.01	<.05	<.01	0.012	0.14	<.01	0.2	0.1	0.9	<.05	<.05	<.005	0.007	0.38	<.05	<.5	<.2	<.5	<10	11
	5.33	18-Jun-86	A	<.005	<.01	0.268	<.005	0.0006	<.01	<.05	<.01	0.013	0.14	<.01	<.2	0.1	0.9	<.05	<.05	<.005	<.005	0.26	<.05	<.5	<.2	<.5	<10	22
		21-Aug-86		0.005	<.01	0.283	<.005	0.0005	<.01	<.05	0.64	0.009	0.16	<.01	<.2	0.11	0.9	<.05	0.07	<.005	0.017	0.05	<.05	<.5	<.2	<.5	<10	<2
		21-Aug-86	A	0.01	<.01	0.287	<.005	0.0008	<.01	0.07	0.62	0.014	0.18	<.01	0.4	0.11	1	<.05	0.16	<.005	0.025	<.05	<.05	<.5	<.2	<.5	<10	<2
85-8-11	8.45 to	18-Jun-86		<.005	<.01	0.473	0.015	<.0005	<.01	<.05	<.01	<.008	0.18	0.4	<.2	0.1	0.9	<.05	<.05	<.005	<.005	0.46	<.05	<.5	<.2	<.5	<10	14
	9.45	21-Aug-86	D	<.005	<.01	0.623	0.04	<.0005	<.01	<.05	0.64	0.01	1.12	0.41	<.2	0.11	1	<.05	<.05	0.014	0.017	<.05	<.05	<.5	<.2	<.5	<10	<2

For explanation of comments see last page of this table.

TABLE J1-2 : SUMMARY OF GROUND WATER CHEMISTRY DATA: MINOR CATIONS AND ANIONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	COMMENTS	MINOR CATIONS																				MINOR ANIONS				
				Ag (mg/L)	Al (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	Pb (mg/L)	Th (mg/L)	Ti (mg/L)	V (mg/L)	Zn (mg/L)	Zr (mg/L)	Br (mg/L)	NO2 (mg/L)	NO3 (mg/L)	PO4 (mg/L)	S (mg/L)
85-10-1	36.85 to	12-Jun-86		<.005	0.05	0.525	0.01	<.0005	<0.001	<.05	0.06	<.008	0.21	0.04	<.2	0.07	0.5	<.05	<.05	<.005	0.009	<.05	<.05	0.7	<.2	<.5	<10	7
	39.85	26-Aug-86		0.007	<.01	0.441	<.005	<.0005	<0.001	<.05	0.06	<.008	0.21	0.03	<.2	<.05	<.5	<.05	<.05	<.005	0.01	<.05	<.05	<.5	<.2	<.5	<10	<2
85-10-10	2.85 to	12-Jun-86	F	<.005	<.01	0.06	0.05	<.0005	<0.001	0.05	0.03	0.009	0.06	<.01	<.2	<.05	<.5	0.14	<.05	<.005	0.006	<.05	<.05	<.5	<.2	15.8	<1	5
	3.66	26-Aug-86	F	0.009	0.71	0.09	0.049	<.0005	<.01	<.05	0.04	<.008	0.83	0.02	<.2	<.05	<.5	<.05	<.05	0.034	<.005	<.05	<.05	<.5	<.2	14.2	<10	<2
85-11-4	16.78 to	12-Jun-86	G	<.005	0.41	0.321	0.031	<.0005	<.01	<.05	0.03	<.008	0.64	0.03	<.2	<.05	<.5	<.05	<.05	0.006	<.005	0.05	<.05	0.6	<.2	<.5	<10	6
	17.7	26-Aug-86		0.007	<.01	0.305	0.014	<.0005	<0.001	<.05	0.04	<.008	0.06	0.05	0.3	<.05	<.5	<.05	0.08	<.005	0.012	<.05	<.05	<.5	<.2	<.7	<10	<2
85-12-1	38 to	10-Jun-86		<.005	0.05	0.464	0.005	<.0005	<0.001	<.05	0.04	<.008	0.2	0.03	<.2	0.06	0.6	<.05	<.05	<.005	0.01	<.05	<.05	<.5	<.2	<.5	<10	<5
	41	10-Jun-86	B	<.005	0.03	0.45	0.007	<.0005	0.02	<.05	0.05	<.008	0.24	0.03	0.2	0.05	<.5	<.05	<.05	<.005	0.013	<.05	<.05	<.5	<.2	<.5	<10	<5
		21-Aug-86		<.005	<.01	0.421	0.006	<.0005	<0.001	<.05	0.06	<.008	0.2	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
		21-Aug-86	B	0.006	<.01	0.458	<.005	<.0005	0.02	<.05	0.05	<.008	0.2	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-8	24.55 to	10-Jun-86		<.005	<.01	0.376	0.012	<.0005	<.01	<.05	0.01	<.008	0.02	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	5
	25.15	10-Jun-86	B	<.005	<.01	0.428	0.014	<.0005	<.01	<.05	<.01	<.008	0.04	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<1	<5
		21-Aug-86		<.005	0.11	0.375	0.013	<.0005	<.01	<.05	0.01	<.008	0.02	0.02	<.2	<.05	<.5	<.05	0.08	<.005	0.006	<.05	<.05	<.5	<.2	<.7	<10	<2
		21-Aug-86	B	<.005	0.08	0.373	0.012	<.0005	<.01	<.05	<.01	<.008	0.03	0.02	<.2	<.05	<.5	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-10	2.3 to	10-Jun-86		<.005	0.2	0.311	<.005	0.0007	<.01	<.05	<.01	<.008	0.15	<.01	<.2	0.12	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	7
	5.33	10-Jun-86	B	<.005	0.05	0.317	<.005	0.0008	<.01	<.05	<.01	<.008	0.15	<.01	0.2	0.12	1.1	<.05	<.05	<.005	0.017	<.05	<.05	<.5	<.2	<.5	<10	8
		21-Aug-86		<.005	<.01	0.343	<.005	<.0005	<.01	<.05	0.7	<.008	0.18	<.01	0.2	0.1	1	<.05	<.05	<.005	0.014	<.05	<.05	<.5	<.2	1.2	<10	<2
		21-Aug-86	B	0.012	<.01	0.334	0.005	<.0005	<.01	<.05	0.11	<.012	0.13	<.01	0.2	0.1	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-11	8.55 to	10-Jun-86		<.005	0.06	0.495	0.013	<.0005	<.01	<.05	0.05	<.008	0.18	0.65	<.2	0.11	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<5
	9.45	26-Aug-86		<.005	<.01	0.402	0.006	<.0005	0.002	<.05	0.11	0.012	0.66	0.77	0.3	0.08	0.7	<.05	0.1	0.008	0.023	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-13	1.2 to 1.5	10-Jun-86		<.005	0.46	0.154	0.019	<.0005	<.01	<.05	0.05	0.041	0.5	0.03	<.2	0.07	0.9	<.05	<.05	<.005	<.005	0.12	<.05	<.5	<.2	<.5	<10	
85-12-14	2.2 to	10-Jun-86		<.005	0.08	0.233	<.005	0.0007	<.01	0.08	<.01	0.017	0.17	<.01	0.3	0.11	1	<.05	<.05	<.005	0.014	<.05	<.05	<.5	<.2	<.5	<10	<5
	2.5	11-Sep-86		<.005	0.02	0.265	<.005	0.0005	<.01	<.05	0.07	0.013	0.32	0.04	<.2	0.09	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	1.2	<10	<2

For explanation of comments see last page of this table.

TABLE J1-2 : SUMMARY OF GROUND WATER CHEMISTRY DATA: MINOR CATIONS AND ANIONS

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	COMMENT	MINOR CATIONS Ag (mg/L)	Al (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	P (mg/L)	Pb (mg/L)	Th (mg/L)	Ti (mg/L)	V (mg/L)	Zn (mg/L)	Zr (mg/L)	MINOR ANIONS Br (mg/L)	NO2 (mg/L)	NO3 (mg/L)	PO4 (mg/L)	S (ug/L)
85-12-15	2.7 to	10-Jun-86		<.005	0.06	0.26	<.005	0.0008	<.01	<.05	<.01	0.012	0.15	<.01	0.3	0.1	1	<.05	<.05	<.005	0.009	<.05	<.05	<.5	<.2	<.5	<10	6
	3	11-Sep-86		<.005	0.25	0.29	<.005	<.0005	<.01	<.05	<.05	0.013	0.3	<.01	<.2	0.09	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-16	3.7 to	10-Jun-86		<.005	<.01	0.313	<.005	<.0005	<.01	<.05	<.01	0.009	0.15	<.01	<.2	0.1	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<5
	4	11-Sep-86		<.005	<.01	0.33	<.005	<.0005	<.01	<.05	0.05	<.008	0.32	<.01	<.2	0.08	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-17	4.5 to	10-Jun-86		<.005	0.06	0.327	<.005	0.0005	<.01	<.05	<.01	0.012	0.13	<.01	<.2	0.1	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	5
	4.8	11-Sep-86		<.005	0.04	0.339	<.005	<.0005	<.01	<.05	0.07	<.008	0.28	<.01	<.2	0.07	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	4.5	<10	<2
85-12-18	5.2 to	10-Jun-86		<.005	<.01	0.494	<.005	0.0008	<.01	<.05	<.01	0.012	0.16	0.27	0.2	0.12	1	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<5
	5.5	11-Sep-86		<.005	<.01	0.612	<.005	<.0005	<.01	<.05	0.04	<.008	0.32	0.3	<.2	0.08	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-19	6 to	10-Jun-86		<.005	<.01	0.499	<.005	0.0006	<.01	<.05	<.01	0.018	0.15	0.1	0.2	0.11	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<5
	6.3	11-Sep-86		<.005	<.01	0.571	<.005	<.0005	<.01	<.05	<.05	<.008	0.3	0.1	<.2	0.07	0.8	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	3	<10	<2
85-12-20	6.7 to	10-Jun-86		<.005	<.01	0.521	0.005	0.0008	<.01	0.05	<.01	0.02	0.18	0.23	0.3	0.14	1.1	<.05	<.05	<.005	0.017	<.05	<.05	<.5	<.2	<.5	<10	8
	7	11-Sep-86		<.005	0.22	0.647	0.005	<.0005	<.01	<.05	0.05	<.008	0.29	0.26	<.2	0.07	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2
85-12-21	7.7 to	10-Jun-86		<.005	<.01	0.469	0.008	0.0006	<.01	<.05	0.01	0.018	0.13	0.32	<.2	0.09	0.9	<.05	<.05	<.005	0.009	<.05	<.05	<.5	<.2	<.5	<10	8
	8	11-Sep-86		0.012	0.06	0.658	0.005	<.0005	<.01	<.05	0.08	<.008	0.3	0.37	<.2	0.07	0.9	<.05	<.05	<.005	<.005	<.05	<.05	<.5	<.2	<.5	<10	<2

EXPLANATION OF COMMENTS - TABLE J1-2 :

A - field duplicate sample
B - field split sample
C - results rejected because of high pH
D - results rejected because of sediment in sample
E - results rejected - tritium in sample indicates mixture with near surface water
F - results rejected - diluted by surface run off due to leakage through surface seal
G - results rejected - ion balance > 10%

TABLE J1-3

SUMMARY OF GROUND WATER CHEMISTRY DATA:
ORGANIC COMPONENTS AND ISOTOPES

Table J1-3 presents the results of laboratory analyses on ground water samples from the Preferred Site for selected organic components and isotopes. The organic components were dissolved organic carbon (as mg/L) and methane (as parts per million by volume). The reader is referred to Appendix B3.1.2 for a discussion of the variability in the dissolved organic carbon results, and to Appendix B3.1.3 for a discussion of the variability in methane results. The isotopes analyzed were oxygen-18 (^{18}O), deuterium (^{2}H) and tritium (^{3}H). Oxygen-18 and deuterium results are expressed in the standard δ $^{o}/oo$ format with respect to SMOW. This is the difference (δ) in isotopic ratios ($^{18}O/^{16}O$) and ($^{2}H/^{1}H$) of the sample in parts per thousand (per mil or $^{o}/oo$) with respect to Standard Mean Ocean Water (SMOW). The tritium (^{3}H) results are expressed in Tritium Units (T.U.) where 1 T.U. equals 1 tritium atom in 10^{18} hydrogen atoms. The tritium results include analyses at three different levels of detection. Direct counting results have an analytical error of $\pm$ 6 to 8 T.U. Enriched counting results have an analytical error of $\pm$ 0.7 to 1.2 T.U. Results from enriched counting of low level activity have an analytical error of $\pm$0.1 T.U.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

			ORGANIC COMPONENTS		ISOTOPES		
MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	Dissolved Organic Carbon E (mg/L)	Methane (ppm by volume)	Oxygen 18 (o/oo SMOW)	Deuterium (o/oo SMOW)	Tritium (T.U.)
85-1-1	34.4 to	17-Apr-86					<6 +/- 6
	37.5	17-Jun-86	16.5		-10.49	-78.7	
		20-Aug-86			-10.34 +/- 0.12 C	-73.4 +/- 0.4 C	
		20-Aug-86 B			-10.54 B	-73.9	
		26-Aug-86	16.5	56.3			1.3 +/- 0.7
		18-Sep-86		56.8			
85-1-3	25.91 to	14-Apr-86					96 +/- 8
	26.91	17-Jun-86	21		-12.83	-89.8	<6 +/- 8
		30-Jul-86					<6 +/- 8
		26-Aug-86	13	40.5 D			
		18-Sep-86		62.9			1.7 +/- 8
85-1-10	2.33 to	17-Apr-86					<6 +/- 8C
	5.33	17-Jun-86	99		-9.52	-70	<6 +/- 7
		26-Aug-86	18	5.8 D			
		18-Sep-86		10.5			
85-1-11	8.8 to	17-Jun-86	62		-10.36	-78.6	<6 +/- 8
	9.84	30-Jul-86					<6 +/- 8
		26-Aug-86	9.5	9.3 D			
		18-Sep-86		22			
85-1-14	2.2 to	17-Jun-86	14.5		-8.86	-61.4	35 +/- 7
	2.5	11-Sep-86	11				
		18-Sep-86		5.8			
85-1-15	2.7 to	17-Apr-86					<6 +/- 6
	3	17-Jun-86	32		-8.97	-61.2	<6 +/- 7
		11-Sep-86	10				10.0 +/- 1.0
		18-Sep-86		11.9			
85-1-16	3.7 to	17-Apr-86					<6 +/- 6
	4	17-Jun-86	54		-8.86	-63.3	<6 +/- 7
		11-Sep-86	9				1.5 +/- 0.7
		18-Sep-86		3			

For explanation of A, B, C etc. see last page of this table.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

			ORGANIC COMPONENTS		ISOTOPES		
MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	Dissolved Organic Carbon E (mg/L)	Methane (ppm by volume)	Oxygen 18 (o/oo SMOW)	Deuterium (o/oo SMOW)	Tritium (T.U.)
85-1-17	4.5 to	17-Apr-86					<6 +/- 6
	4.8	17-Jun-86	55		-8.94	-64.9	<6 +/- 7
		11-Sep-86	10				2.4 +/- 0.9
		18-Sep-86		4.7			
85-1-18	5.2 to	17-Apr-86					<6 +/- 6
	5.5	17-Jun-86	17		-9.06	-66.7	<6 +/- 8
		11-Sep-86	6				<0.8 +/- 0.7
		18-Sep-86		4.4			
85-1-19	6 to	17-Apr-86					<6 +/- 6
	6.3	17-Jun-86	8.5		-9.49	-68.4	<6 +/- 7
		11-Sep-86	6				<0.8 +/- 0.8C
		18-Sep-86		4.8			
85-1-20	6.7 to	17-Apr-86					<6 +/- 6
	7	17-Jun-86	29		-9.55	-67.9 +/- 0.3 C	<6 +/- 7
		11-Sep-86	5				<0.8 +/- 0.8
		18-Sep-86		105			
85-1-21	7.65 to	17-Apr-86					<6 +/- 6
	7.96	17-Jun-86	27		-10.06	-72	<6 +/- 7
		11-Sep-86	3.5				<0.8 +/- 0.8
		18-Sep-86		7.9			
85-2-4	15.5 to	12-Jun-86	27		-10.65	-78.9	64 +/- 8
	16.6	30-Jul-86					<6 +/- 8
		20-Aug-86			11.0 +/- 0.04 C		<6 +/- 8
		26-Aug-86	15.5	24.2 D			
		18-Sep-86		58.6			
							1.6 +/- 0.6

For explanation of A, B, C etc. see last page of this table.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

			ORGANIC COMPONENTS		ISOTOPES		
MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	Dissolved Organic Carbon E (mg/L)	Methane (ppm by volume)	Oxygen 18 (o/oo SMOW)	Deuterium (o/oo SMOW)	Tritium (T.U.)
85-3-1	32 to	15-Apr-86					<6 +/- 6
	34.69	12-Jun-86	20		-10.17	-75.1 +/- 0.8 C	
		20-Aug-86			-10.65	-77.1 +/- 0.6 C	
		26-Aug-86	12.5	79.2 D			
		18-Sep-86		126.8			2.6 +/- 0.9
85-3-10	2.3 to	17-Apr-86					<6 +/- 6
	5.3	12-Jun-86	39		-8.42	-64.4	8 +/- 7
		26-Aug-86		3.5 D			
		18-Sep-86		4.6			
85-8-1	36.49 to	15-Apr-86					<6 +/- 7C
	39.47	18-Jun-86	55		-11.07 +/- 0.04 C	-80.40 C	
		18-Jun-86 A	36		-11.03 A	-79.7 A	
		20-Aug-86			-11.16	-79.4 +/- 0 C	
		26-Aug-86	30	105.6 D			
		26-Aug-86 A	42	118.3 A, D			
		18-Sep-86		100.6			<0.8 +/- 0.7
		18-Sep-86 A		138.2 A			
85-8-3	25.83 to	17-Oct-86		105.6			
	26.83						
85-8-4	15.16 to	15-Apr-86					104 +/- 8
	16.16	18-Jun-86	78		-11.6	-82.5	<6 +/- 7
		30-Jul-86					<6 +/- 8
		21-Aug-86	31	44.3 D			
		18-Sep-86		82			3.1 +/- 0.8
85-8-8	24.66 to	18-Jun-86	23		-12.95	-91	19 +/- 7
	25.38	18-Jun-86 A	5.5		-12.92 A	-94.9 +/- 2.7 C	19 +/- 7
		14-Jul-86					<6 +/- 7
		21-Aug-86	16	4.8 D			
		21-Aug-86 A	27	5 A, D			
		18-SEP-86		4.2			1 +/- 0.8
		18-SEP-86 A		4.4 A			<0.8 +/- 0.8
85-8-10	2.43 to	15-Apr-86					<6 +/- 7
	5.33	18-Jun-86	70		-9.04	-63.2 +/- 1.1 C	35 +/- 7
		18-Jun-86 A	23 A		-9.04 A	-61.8 A	
		21-Aug-86	31	2.5 D			
		21-Aug-86 A	35	2.4 A, D			
		18-Sep-86		6.2			
		18-Sep-86 A		6.3 A			
85-8-11	8.45 to	18-Jun-86	21		-10.06	-71.9	<9 +/- 8 C
	9.45	30-Jul-86					<9 +/- 8 C
		21-Aug-86	26	9.8 D			
		18-Sep-86		20.6			

For explanation of A, B, C etc. see last page of this table.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	ORGANIC COMPONENTS: Dissolved Organic Carbon E (mg/L)	ORGANIC COMPONENTS: Methane (ppm by volume)	ISOTOPES: Oxygen 18 (o/oo SMOW)	ISOTOPES: Deuterium (o/oo SMOW)	ISOTOPES: Tritium (T.U.)
85-10-1	36.85 to	15-Apr-86					<6 +/- 7
	39.85	12-Jun-86	4		-11.28	-82.9	
		20-Aug-86			-11.4	-82.6	
		26-Aug-86	7	37.6 D			
		18-Sep-86		68.5			<0.8 +/- 0.8
85-10-10	2.85 to	15-Apr-86					45.5 +/- 9 C
	3.66	12-Jun-86	35		-8.74	-62.5	
		26-Aug-86	40	5.3 D			
		18-Sep-86		6.3			
85-11-4	16.78 to	12-Jun-86	48	34.3	-13.31	-95.2	<6 +/- 8
	17.7	30-Jul-86					10 +/- 8
		26-Aug-86	17.5				
		18-Sep-86		125 +/- 0.7 C			<0.8 +/- 0.7
85-12-1	38 to	15-Apr-86					<6 +/- 7
	41	10-Jun-86	16	247.6	-11.2	-82.1	
		10-Jun-86 B	18.5 B	289.4 B	-11.06 B	-82.4 B	
		20-Aug-86			-11.38	-80.7	
		21-Aug-86	10	127.7 D			
		21-Aug-86 B	21	131.2 B, D			
		18-Sep-86		539.6			<0.8 +/- 0.8
		18-Sep-86 B		466.9 B			
85-12-3	25.9 to	17-Oct-86		258			
	26.8						
85-12-8	24.55 to	10-Jun-86	30	290.8	-13.21	-96.9	<6 +/- 7
	25.15	10-Jun-86 B	17 B	311.1 B	-13.4	-92.7	<6 +/- 7
		14-Jul-86					<6 +/- 7
		14-Jul-86 B					
		21-Aug-86	21	2.2 D			
		21-Aug-86 B	21	4.2 B, D			
		18-Sep-86		10.7			<0.8 +/- 0.7
		18-Sep-86 B		7 B			<0.8 +/- 0.8
85-12-10	2.3 to	15-Apr-86					14 +/- 7
	5.33	10-Jun-86	29	2.5	-9.13 +/- 0.16 C	-63	
		10-Jun-86 B	30 B	2.5 B	-9.01 B	-63.5 B	
		21-Aug-86	49	2.9 D			
		21-Aug-86	30	3.2 B, D			
		18-Sep-86		4.6			
		18-Sep-86 B		4.6 B			

For explanation of A, B, C etc. see last page of this table.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

			ORGANIC COMPONENTS		ISOTOPES		
MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	Dissolved Organic Carbon E (mg/L)	Methane (ppm by volume)	Oxygen 18 (o/oo SMOW)	Deuterium (o/oo SMOW)	Tritium (T.U.)
85-12-11	8.55 to	10-Jun-86	45	18.6	-10.63	-78.7	<6 +/- 8
		30-Jul-86					<6 +/- 8
	9.45	26-Aug-86	20				
		18-Sep-86		23.4			
85-12-13	1.2 to	15-Apr-86					42 +/- 7
	1.5	10-Jun-86	50	1.1	-8.26	-61.8	
85-12-14	2.2 to	15-Apr-86					56 +/- 7
	2.5	10-Jun-86	45	3.4	-8.92	-62.7 +/- 1.1 C	
		11-Sep-86	8				
		18-Sep-86		2.1			
85-12-15	2.7 to	15-Apr-86					25 +/- 7
		15-Apr-86 B					39 +/- 7
	3	10-Jun-86	48	3.7	-9.05	-61.4	
		11-Sep-86	9				
		18-Sep-86		2.2			
85-12-16	3.7 to	15-Apr-86					23 +/- 7
	4	10-Jun-86	43	3.4	-9.31 +/- 0.05 C	-63.8	
		11-Sep-86	10				
		18-Sep-86		2.7			
85-12-17	4.5 to	15-Apr-86					20 +/- 7
	4.8	10-Jun-86	50	5.2	-9.51	-68.8	
		11-Sep-86	10				
		18-Sep-86		10.9			
85-12-18	5.2 to	15-Apr-86					<6 +/- 7
	5.5	10-Jun-86	43	6.5	-9.84	-73.2	
		02-Jul-86					0.25 +/- 0.10
		11-Sep-86	10.5				
		18-Sep-86		6			

For explanation of A, B, C etc. see last page of this table.

TABLE J1-3 : SUMMARY OF GROUND WATER CHEMISTRY DATA: ORGANIC COMPONENTS AND ISOTOPES

MONITOR #	SCREENED INTERVAL (depth in m)	DATE SAMPLED	ORGANIC COMPONENTS: Dissolved Organic Carbon E (mg/L)	ORGANIC COMPONENTS: Methane (ppm by volume)	ISOTOPES: Oxygen 18 (o/oo SMOW)	ISOTOPES: Deuterium (o/oo SMOW)	ISOTOPES: Tritium (T.U.)
85-12-19	6 to	15-Apr-86					<6 +/- 7
	6.3	10-Jun-86	40	7.7	-10	-71.7	
		02-Jul-86					0.14 +/- 0.10
		11-Sep-86	10				
		18-Sep-86		6.2			
85-12-20	6.7 to	15-Apr-86					<6 +/- 8 A
	7	10-Jun-86	26	4.6	-10.33	-75.5	
		02-Jul-86					-0.05 +/- 0.10
		11-Sep-86	15				
		18-Sep-86		7.5			
85-12-21	7.7 to	15-Apr-86					11 +/- 7
	8	15-Apr-86 B					<6 +/- 7
		10-Jun-86	19	14.5	-10.94	-77.9	
		02-Jul-86					0.11 +/- 0.10
		11-Sep-86	4				
		18-Sep-86		12			

Explanatary footnotes for Table J1-3 :

A - FIELD DUPLICATE SAMPLE

B - FIELD SPLIT SAMPLE

C - AVERAGE OF TWO LABORATORY DUPLICATES

D - RESULT SUSPECT BECAUSE OF INCORRECT EQUILIBRATION PERIOD AT LABORATORY

E - ANALYSIS METHODOLOGY SUSCEPTIBLE TO CONSIDERABLE VARIABILITY

TABLE J1-4

ORGANIC "PRIORITY POLLUTANT" SCAN - MONITOR 85-12-1

JULY 2, 1986

Table J1-4 presents laboratory analysis results for a partial organic "priority pollutant" scan on one ground water sample taken from monitor 85-12-1 on July 2, 1986. The list of organic "priority pollutants" was determined by the United States Environmental Protection Agency and represents compounds which are common ground water, drinking water or surface water contaminants as well as common or toxic by-products of industrial and agricultural processes. The analysis presented in Table J1-4 did not include pesticide, PCB, dioxin or dibenzofuran "priority pollutants". All analyses are provided in ug/L (ppb). A laboratory blank water sample was also analyzed to provide a check on the analytical methods.

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TABLE J1-4:
PRIORITY POLLUTANT SCAN - MONITOR 85-12-1 - JULY 2, 1986

VOLATILE ORGANICS
Conc. = ppb

VOLATILE COMPOUNDS	MDL (ppb)	LAB WATER BLANK	85-12-1			
DICHLORODIFLUOROMETHANE	2.0	--	--	--	--	--
CHLOROMETHANE	2.0	--	--	--	--	--
VINYL CHLORIDE	2.0	--	--	--	--	--
BROMOMETHANE	2.0	--	--	--	--	--
CHLOROETHANE	2.0	--	--	--	--	--
TRICHLOROFLUOROMETHANE	2.0	--	--	--	--	--
1,1-DICHLOROETHYLENE	1.0	--	--	--	--	--
DICHLOROMETHANE	1.0	--	--	--	--	--
T-1,2-DICHLOROETHYLENE	1.0	--	--	--	--	--
1,1-DICHLOROETHANE	1.0	--	--	--	--	--
CHLOROFORM	1.0	TR	--	--	--	--
1,2-DICHLOROETHANE	1.0	--	--	--	--	--
1,1,1-TRICHLOROETHANE	1.0	--	--	--	--	--
BENZENE	0.5	TR	1.9	--	--	--
CARBON TETRACHLORIDE	1.0	--	--	--	--	--
1,2-DICHLOROPROPANE	1.0	--	--	--	--	--
BROMODICHLOROMETHANE	1.0	--	--	--	--	--
TRICHLOROETHYLENE	1.0	--	--	--	--	--
1,3-DICHLOROPROPENE(Z)	1.0	--	--	--	--	--
1,3-DICHLOROPROPENE(E)	1.0	--	--	--	--	--
1,1,2-TRICHLOROETHANE	1.0	--	--	--	--	--
TOLUENE	0.5	TR	--	--	--	--
DIBROMOCHLOROMETHANE	1.0	--	--	--	--	--
TETRACHLOROETHYLENE	1.0	--	--	--	--	--
CHLOROBENZENE	0.5	--	--	--	--	--
ETHYL BENZENE	0.5	--	--	--	--	--
P & M XYLENE	0.5	TR	--	--	--	--
BROMOFORM	1.0	--	--	--	--	--
O-XYLENE	0.5	--	--	--	--	--
1,1,2,2-TETRACHLOROETHANE	1.0	--	--	--	--	--
1,3-DICHLOROBENZENE	1.0	--	--	--	--	--
1,4-DICHLOROBENZENE	1.0	--	--	--	--	--
1,2-DICHLOROBENZENE	1.0	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	1.0	--	--	--	--	--

TR = TRACE AMOUNT DETECTED
-- = NONE DETECTED
MDL = METHOD DETECTION LIMIT

4813-EX

BASE/NEUTRAL EXTRACTABLES
Conc. = ppb

TABLE J1-4: PRIORITY POLLUTANT SCAN - MONITOR 85-12-1 - JULY 2, 1986

BASE NEUTRAL COMPOUNDS	MDL (ppb)	TRAV BLANK	85-12-1			
BIS(2-CHLORO ETHYL)ETHER	1.0	--	--	--	--	--
1,4-DICHLOROBENZENE	1.0	--	--	--	--	--
1,3-DICHLOROBENZENE	1.0	--	--	--	--	--
BIS(2-CHLOROISOPROPYL)ETHER	1.0	--	--	--	--	--
1,2-DICHLOROBENZENE	1.0	--	--	--	--	--
NITROBENZENE	1.0	--	--	--	--	--
N-NITROSO-DI-N-PROPYL-AMINE	3.0	--	--	--	--	--
HEXACHLOROETHANE	1.0	--	--	--	--	--
ISOPHORONE	1.0	--	--	--	--	--
BIS(2-CHLORO ETHOXY)METHANE	2.0	--	--	--	--	--
NAPHTHALENE	1.0	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	1.0	--	--	--	--	--
HEXACHLOROBUTADIENE	1.0	--	--	--	--	--
HEXACHLOROCYCLOPENTADIENE	1.0	--	--	--	--	--
2-CHLORONAPHTHALENE	1.0	--	--	--	--	--
2,6-DINITROTOLUENE	2.0	--	--	--	--	--
DIMETHYL PHTHALATE	2.0	--	--	--	--	--
ACENAPTHYLENE	1.0	--	--	--	--	--
ACENAPTHENE	1.0	--	--	--	--	--
2,4-DINITROTOLUENE	2.0	--	--	--	--	--
DIETHYL PHTHALATE	2.0	--	--	--	--	--
9H FLUORENE	1.0	--	--	--	--	--
4-CHLOROPHENYL PHENYL ETHER	1.0	--	--	--	--	--
N-NITROSO DIPHENYLAMINE	4.0	--	--	--	--	--
1,2-DIPHENYL HYDRAZINE	5.0	--	--	--	--	--
4-BROMOPHENYL PHENYL ETHER	1.0	--	--	--	--	--
HEXACHLOROBENZENE	1.0	--	--	--	--	--
PHENANTHRENE	1.0	--	--	--	--	--
ANTHRACENE	1.0	--	--	--	--	--
DI-N-BUTYL PHTHALATE	1.0	--	--	--	--	--
FLUORANTHENE	1.0	--	--	--	--	--
BENZIDENE	5.0	--	--	--	--	--
PYRENE	2.0	--	--	--	--	--
BUTYL BENZYL PHTHALATE	2.0	--	--	--	--	--
CHRYSENE	2.0	--	--	--	--	--
BENZO(A)ANTHRACENE	2.0	--	--	--	--	--
3,3-DICHLOROBENZIDENE	5.0	--	--	--	--	--
BIS(2-ETHYL HEXYL)PHTHALATE	2.0	--	--	--	--	--
DI-N-OCTYL PHTHALATE	2.0	22.0	13.1	--	--	--
BENZO(A)PYRENE	2.0	--	--	--	--	--
BENZO(K)FLUORANTHENE	2.0	--	--	--	--	--
BENZO(B)FLUORANTHENE	2.0	--	--	--	--	--
DIBENZO(AH)ANTHRACENE	2.0	--	--	--	--	--
BENZO(GHI)PERYLENE	2.0	--	--	--	--	--
INDENO(123-CD)PYRENE	2.0	--	--	--	--	--

TR = TRACE AMOUNT DETECTED
-- = NONE DETECTED
MDL = METHOD DETECTION LIMIT

4813-ACID
TABLE J1-4
PRIORITY POLLUTANT SCAN - MONITOR 85-12-1 - JULY 2, 1986

ACID EXTRACTABLES
Conc. = ppb

ACID COMPOUNDS	MDL (ppb)	TRAV BLANK	85-12-1			
PHENOL	3.0	--	--	--	--	--
2-CHLOROPHENOL	2.0	--	--	--	--	--
2,4,DIMETHYL PHENOL	2.0	--	--	--	--	--
P-CHLORO-M-CRESOL	5.0	--	--	--	--	--
2,4-DICHLOROPHENOL	2.0	--	--	--	--	--
2,4,6-TRICHLOROPHENOL	2.0	--	--	--	--	--
2-NITROPHENOL	5.0	--	--	--	--	--
4-NITROPHENOL	5.0	--	--	--	--	--
2,4-DINITROPHENOL	3.0	--	--	--	--	--
4,6-DINITRO-O-CRESOL	5.0	--	--	--	--	--
PENTACHLOROPHENOL	2.0	--	--	--	--	--

TR = Trace Amount Detected
-- = None Detected
MDL = Method Detection Limit

TABLE J1-5

OXYGEN-18, DEUTERIUM AND CHLORIDE RESULTS FROM PORE WATER SQUEEZING

Table J1-5 present laboratory analysis results for chloride (in mg/L) and the isotopes oxygen-18 and deuterium (in δ °/oo SMOW) on ground waters (or pore waters) "squeezed" from soil samples. See the write-up of Table J1-3 for an explanation of δ °/oo SMOW. Shelby tube soil samples taken from various depths in the overburden at locations 85-1-22 and 85-12-12 were used for pore water squeezing. Pore water squeezing techniques are described in Appendix B1.5.

TABLE J1-5 : OXYGEN-18, DEUTERIUM AND CHLORIDE RESULTS FROM PORE WATER SQUEEZING

SHELBY TUBE NO.	DEPTH RANGE (m)	MIDPOINT DEPTH (m)	$\delta^{18}O$ (o/oo smow)	$\delta^{2}H$ (o/oo smow)	Cl (mg/L)
LOCATION 85-1 (soil samples collected from borehole 85-1-22)					
1	1.52 to 2.13	1.83	-8.55	-60.9	8.7
2	3.05 to 3.66	3.36	-8.83	-63.5	42.2
3	4.57 to 5.18	4.88	-9.04	-65.6	29.4
4	6.1 to 6.71	6.41	-9.50	-70.2	30.4
5	9.14 to 9.76	9.45	-10.00	-75.3	28.2
7	12.19 to 12.8	12.50	-10.64	-79.0	28.7
9	15.85 to 16.46	16.16	-11.53 +/- 0.22 B	-80.4	25.2
	15.85 to 16.46	16.16	-11.41 A	-79.6 A	26.0 A
10	18.29 to 18.9	18.60	-12.01	-88.5	26.6
11	21.33 to 21.95	21.64	-12.28 +/- 0.06 B	-89.4	33.0
13	24.38 to 24.99	24.69	-13.07	-92.0	30.1
14	27.43 to 28.04	27.74	-13.02	-92.3	34.8
16	30.48 to 31.09	30.79	-13.09	-92.7	31.1
	30.48 to 31.09	30.79	-13.07 A	-93.4 A	29.4 A
LOCATION 85-12 (soil samples collected from borehole 85-12-12)					
1	1.52 to 2.13	1.83	-9.12 +/- 0.22 B	-61.1	20.1
2	3.05 to 3.65	3.35	-9.63	-63.6	81.1
3	4.57 to 5.18	4.88	-9.90	-68.8	27.5
4	6.1 to 6.71	6.41	-10.07	-70.2	29.5
5	9.14 to 9.75	9.45	-11.17	-76.9	18.6
	9.14 to 9.75	9.45	-11.06 A	-78.7 A	18.5 A
6	12.19 to 12.8	12.50	-11.7 +/- 0.06 B	-78.5	18.2
7	15.24 to 15.85	15.55	-12.22	-82.8	17.8
8	18.29 to 18.9	18.60	-12.72	-86.1	19.0
9	21.34 to 21.95	21.65	-13.13	-91.4	21.1
	21.34 to 21.95	21.65	-13.17 A	-93.7 A	20.9 A
10	24.38 to 24.99	24.69	-13.60	-95.6	23.5
11	27.43 to 28.04	27.74	-13.82	-95.9	23.6
12	30.48 to 31.08	30.78	-13.92	-99.4	23.0
13	33.53 to 34.14	33.84	-13.99	-100.9	22.5

A - Pore water from duplicate squeezing of soil sample
B - Laboratory duplicate analysis