Los Alamos Environmental Restoration Records Processing Facility

ER Record I.D.# 70105

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION
Records Processing Facility
ER Records Index Form

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Miscellaneous Comments:
N/A

14241

THIS FORM IS SUBJECT TO CHANGE. CONTACT THE RPF FOR LATEST VERSION. (JUNE 1997)

#70105

January 20, 1999

Mr. Brent Newman
Los Alamos National Lab
P.O. Box 1663
MS J495
Los Alamos, NM 87545

Dear Mr. Newman:

Enclosed is the final report for the LANL Job Number 474R samples that we received on October 10, 1998. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

We are pleased to provide this service to LANL and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

Mark Ankeny
Enclosure

Received by ER-RPF
SEP 14 2001

Daniel B. Stephens & Associates, Inc.
6020 Academy NE, Suite 100 505-822-9400
Albuquerque, NM 87109 FAX 505-822-8877

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Sample ID	Borehole Location ID	Location Description	Depth (ft)
RE16-98-0100	16-2668	Bldg. 300 BH	18.9-19.2
RE16-98-0101	16-2668	Bldg. 300 BH	10.3-10.5
RE16-98-0102	16-2668	Bldg. 300 BH	30.9-31.3
RE16-98-0103	16-2667	SWSC Cut BH	70.3-70.6
RE16-98-0104	16-2667	SWSC Cut BH	88.6-89
RE16-98-0105	16-2667	SWSC Cut BH	100.2-100.5
RE16-98-0106	16-2667	SWSC Cut BH	120-120.5
RE16-98-0107	16-2667	SWSC Cut BH	129.4-129.9
RE16-98-0108	16-2669	90s Line Pond BH	89.6-89.8

from Donna Sharp 4/26/99

Sample ID	Borehole Location ID	Location Description	(ft)
RE16-98-0100	16-2668	Bldg. 300 BH	[illegible] 2 units, partly welded, bottom of unit
RE16-98-0101	16-2668	Bldg. 300 BH	[illegible]-10.5 units, nonvitric atomity, partly welded
RE16-98-0102	16-2668	Bldg. 300 BH	30.9-31.3 unit 4, nonvitric, could be in a surge
RE16-98-0103	16-2667	SWSC Cut BH	70.3-70.6 — densely welded lower unit 4
RE16-98-0104	16-2667	SWSC Cut BH	88.6-89 — densely welded 4t
RE16-98-0105	16-2667	SWSC Cut BH	100.2-100.5 – densely welded 3t
RE16-98-0106	16-2667	SWSC Cut BH	120-120.5 – ~~densely~~ welded 3t – near surge, ~~bottom of 3t~~
RE16-98-0107	16-2667	SWSC Cut BH	129.4-129.9 – unit 3 (top) poorly welded
RE16-98-0108	16-2669	90s Line Pond BH	89.6-89.8 – 4t, densely welded

from Donna Sharp 4/26/99

8/17/99

TA-16 Hydrologic Properties Summary

Borehole	Depth (ft)	Unit	θv	ρb	porosity	Ks cm/sec	welding
Bldg 300	10.5	5	7	2	34.9	1.40E-05	partly
Bldg 300	19	5	4	2	25.8	1.20E-06	partly
Bldg 300	31	4	2	1	51	3.80E-03	surge?
SWSC	70.5	4	8	2	19.8	1.70E-08	densely
90's line	90	4t	7	2	18	2.00E-08	densely
SWSC	89	4t	5	2	16.5	9.80E-09	densely
SWSC	100.5	3t	7	2	18.4	2.80E-08	densely
SWSC	120.5	3t	15	1	46.6	5.00E-04	surge?
SWSC	129.5	3	5	2	35.6	5.80E-05	poorly

David,
Here is the TA-16 Stephens rept.
the next two pages will help you key out whats what.

Brent

Invoice

Daniel B. Stephens & Associates, Inc.

Daniel B. Stephens & Associates, Inc.
Hydrologic Testing and Research Laboratory

Invoice To: Accounts Payable
Los Alamos National Laboratory
TA 3 Bldg 271 DP O1U
Los Alamos, NM 87545

Remit To: Daniel B. Stephens & Associates, Inc.
Attn: Accounts Receivable
P.O. Box 565
Albuquerque, NM 87103
(505) 822-9400

Invoice No.: 989095
Invoice Date: January 20, 1999
Terms: Net 30 days
Project No.: 8844.01

Reference: 474R MR3R080863129

Services For: October - January

Hours or Quantity	Description of Articles Provided or Services Performed	Unit	Unit Price	Sales Amount
9	Hydraulic Properties Package, including: • Sample preparation • Initial volumetric moisture content • Dry bulk density • Calculated total porosity • Saturated hydraulic conductivity • Moisture characteristics (7 pts.) • Calculated unsaturated hydraulic conductivity	Test	$550/test	$4,950.00
18	Sample Preparation	Hour	$50/hr	$900.00
			Subtotal	**$5,850.00**
			Gross Receipts Tax (5.8125%)	$340.03
			Total Amount Due This Invoice	**$6,190.03**

Approved by:

Daniel B. Stephens & Associates, Inc.

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1] (ρ_0, θ, ϕ)	Saturated Hydraulic Conductivity[2]		Moisture Characteristics[3]				Unsaturated Hydraulic Conductivity	Particle Size[4]			Effective Porosity	Particle Density	Air Permeability	Atterberg Limits	Proctor Compaction
		CH	FH	HC	PP	TH	RH		DS	WS	H					
RE16-98-0100	X		X	X	X	X	X	X								
RE16-98-0101	X		X	X	X	X	X	X								
RE16-98-0102	X	X		X	X	X	X	X								
RE16-98-0103	X		X	X	X	X	X	X								
RE16-98-0104	X		X	X	X	X	X	X								
RE16-98-0105	X		X	X	X	X	X	X								
RE16-98-0106	X	X		X	X	X	X	X								
RE16-98-0107	X		X	X	X	X	X	X								
RE16-98-0108	X		X	X	X	X	X	X								

[1] ρ_0 = Initial moisture content, θ = Dry bulk density, ϕ = Calculated porosity
[2] CH = Constant head, FH = falling head
[3] HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, RH = Relative humidity box
[4] DS = Dry sieve, WS = Wet sieve, H = Hydrometer

Daniel B. Stephens & Associates, Inc.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Initial Moisture Content Gravimetric (%, g/g)	Initial Moisture Content Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
RE16-98-0100	2.0	3.9	1.97	2.00	25.8
RE16-98-0101	3.9	6.7	1.73	1.79	34.9
RE16-98-0102	1.8	2.4	1.30	1.32	51.0
RE16-98-0103	3.7	7.8	2.13	2.20	19.8
RE16-98-0104	2.1	4.6	2.21	2.26	16.5
RE16-98-0105	3.3	7.2	2.16	2.23	18.4
RE16-98-0106	10.9	15.4	1.42	1.57	46.6
RE16-98-0107	3.0	5.2	1.71	1.76	35.6
RE16-98-0108	3.3	7.2	2.17	2.24	18.0

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Method of Analysis	
		Constant Head	Falling Head
RE16-98-0100	1.2E-06		X
RE16-98-0101	1.4E-05		X
RE16-98-0102	3.8E-03	X	
RE16-98-0103	1.7E-08		X
RE16-98-0104	9.8E-09		X
RE16-98-0105	2.8E-08		X
RE16-98-0106	5.0E-04	X	
RE16-98-0107	5.8E-05		X
RE16-98-0108	2.0E-08		X

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
RE16-98-0100	0	18.5
	28	18.3
	128	17.9
	15195	0.3
	839828	0.4
	510	13.7
RE16-98-0101	0	31.5
	23	30.3
	129	29.2
	510	24.7
	11728	7.7
	11728	7.2
	6221	5.9
	16113	0.5
	839828	0.4
RE16-98-0102	0	43.1
	7	40.3
	39	38.2
	79	35.5
	255	14.2
	1020	11.4
	6935	1.4
	27433	1.3
	839828	0.3

Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
RE16-98-0103	0	8.9
	49	8.0
	134	7.5
	510	8.3
	11728	6.3
	15297	0.6
	839828	0.6
RE16-98-0104	0	9.3
	55	8.6
	126	8.4
	510	8.1
	6731	2.2
	7547	0.9
	12849	0.4
	839828	0.4
RE16-98-0105	0	9.2
	49	8.7
	130	8.2
	510	7.5
	11728	5.7
	11524	3.4
	14991	3.1
	21926	1.8
	839828	0.4

Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
RE16-98-0106	0	40.2
	17	34.2
	52	30.5
	157	24.3
	510	17.9
	6527	5.4
	839828	0.4
RE16-98-0107	0	28.0
	22	27.8
	56	27.1
	159	26.5
	510	23.5
	11728	15.9
	6425	9.3
	15909	1.8
	839828	0.4
RE16-98-0108	0	8.5
	51	7.8
	127	7.3
	510	7.2
	11728	6.2
	16725	1.3
	839828	0.5

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm⁻¹) Calculated Value	α 95% Confidence Limits Lower	α 95% Confidence Limits Upper	N (dimensionless) Calculated Value	N 95% Confidence Limits Lower	N 95% Confidence Limits Upper	θ_r	θ_s
RE16-98-0100	0.0017	0.0013	0.0020	2.1791	1.4599	2.8983	0.0000	0.1837
RE16-98-0101	0.0017	0.0000	0.0036	1.6021	1.3094	1.8949	0.0000	0.3074
RE16-98-0102	0.0112	0.0008	0.0216	1.7651	1.1055	2.4247	0.0093	0.4215
RE16-98-0103	0.0001	0.0001	0.0001	14.4827	2.6554	26.3099	0.0000	0.0819
RE16-98-0104	0.0007	0.0000	0.0017	2.0922	1.2236	2.9608	0.0000	0.0874
RE16-98-0105	0.0001	0.0000	0.0002	2.8329	0.3221	5.3436	0.0000	0.0841
RE16-98-0106	0.0257	0.0000	0.0544	1.3319	1.1867	1.4770	0.0000	0.3879
RE16-98-0107	0.0014	0.0000	0.0060	1.4175	0.9045	1.9305	0.0000	0.2768
RE16-98-0108	0.0001	0.0001	0.0001	8.8228	3.1893	14.4562	0.0000	0.0772

Raw Laboratory Data & Graphical Plots

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Initial Moisture Content Gravimetric (%, g/g)	Initial Moisture Content Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
RE16-98-0100	2.0	3.9	1.97	2.00	25.8
RE16-98-0101	3.9	6.7	1.73	1.79	34.9
RE16-98-0102	1.8	2.4	1.30	1.32	51.0
RE16-98-0103	3.7	7.8	2.13	2.20	19.8
RE16-98-0104	2.1	4.6	2.21	2.26	16.5
RE16-98-0105	3.3	7.2	2.16	2.23	18.4
RE16-98-0106	10.9	15.4	1.42	1.57	46.6
RE16-98-0107	3.0	5.2	1.71	1.76	35.6
RE16-98-0108	3.3	7.2	2.17	2.24	18.0

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0100
Ring Number: RE16-98-0100
Depth: NA

Test Date: 19-Oct-98

Field weight of sample* (g): 246.76
Tare weight, ring (g): 156.51
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 88.49
Sample volume (cm^3): 45.02
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 3.9
Initial Gravimetric Moisture Content (% g/g): 2.0
Dry bulk density (g/cm^3): 1.97
Wet bulk density (g/cm^3): 2.00
Calculated Porosity (% vol): 25.8
Percent Saturation: 15.1

Comments:

* Weight including tares

Laboratory analysis by: T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0101
Ring Number: RE16-98-0101
Depth: NA
Test Date: 19-Oct-98

Field weight of sample* (g): 206.16
Tare weight, ring (g): 149.68
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 54.36
Sample volume (cm^3): 31.49
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 6.7
Initial Gravimetric Moisture Content (% g/g): 3.9
Dry bulk density (g/cm^3): 1.73
Wet bulk density (g/cm^3): 1.79
Calculated Porosity (% vol): 34.9
Percent Saturation: 19.3

Comments:

*Weight including tares

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0102
Ring Number: RE16-98-0102
Depth: NA

Test Date: 21-Oct-98

Field weight of sample* (g): 432.46
Tare weight, ring (g): 127.90
Tare weight, cap/plate/epoxy (g): 114.08

Dry weight of sample (g): 187.05
Sample volume (cm^3): 144.11
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 2.4
Initial Gravimetric Moisture Content (% g/g): 1.8
Dry bulk density (g/cm^3): 1.30
Wet bulk density (g/cm^3): 1.32
Calculated Porosity (% vol): 51.0
Percent Saturation: 4.7

Comments:

* Weight including tares

Laboratory analysis by: T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0103
Ring Number: RE16-98-0103
Depth: NA

Test Date: 21-Oct-98

Field weight of sample* (g): 285.50
Tare weight, ring (g): 81.76
Tare weight, cap/plate/epoxy (g): 37.01

Dry weight of sample (g): 160.83
Sample volume (cm^3): 75.68
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 7.8
Initial Gravimetric Moisture Content (% g/g): 3.7
Dry bulk density (g/cm^3): 2.13
Wet bulk density (g/cm^3): 2.20
Calculated Porosity (% vol): 19.8
Percent Saturation: 39.4

Comments:

*Weight including tares

Laboratory analysis by: T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0104
Ring Number: RE16-98-0104
Depth: NA
Test Date: 30-Oct-98

Field weight of sample* (g): 295.77
Tare weight, ring (g): 115.87
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 176.25
Sample volume (cm^3): 79.69
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 4.6
Initial Gravimetric Moisture Content (% g/g): 2.1
Dry bulk density (g/cm^3): 2.21
Wet bulk density (g/cm^3): 2.26
Calculated Porosity (% vol): 16.5
Percent Saturation: 27.7

Comments:

*Weight including tares

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0105
Ring Number: RE16-98-0105
Depth: NA
Test Date: 5-Nov-98

Field weight of sample* (g): 291.20
Tare weight, ring (g): 81.86
Tare weight, cap/plate/epoxy (g): 37.15

Dry weight of sample (g): 166.66
Sample volume (cm^3): 77.09
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 7.2
Initial Gravimetric Moisture Content (% g/g): 3.3
Dry bulk density (g/cm^3): 2.16
Wet bulk density (g/cm^3): 2.23
Calculated Porosity (% vol): 18.4
Percent Saturation: 38.9

Comments:

* Weight including tares

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0106
Ring Number: RE16-98-0106
Depth: NA

Test Date: 30-Oct-98

Field weight of sample* (g): 334.67
Tare weight, ring (g): 44.03
Tare weight, cap/plate/epoxy (g): 181.41

Dry weight of sample (g): 98.52
Sample volume (cm^3): 69.57
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol):	15.4
Initial Gravimetric Moisture Content (% g/g):	10.9
Dry bulk density (g/cm^3):	1.42
Wet bulk density (g/cm^3):	1.57
Calculated Porosity (% vol):	46.6
Percent Saturation:	33.1

Comments:

* Weight including tares

Laboratory analysis by: T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0107
Ring Number: RE16-98-0107
Depth: NA

Test Date: 30-Oct-98

Field weight of sample* (g): 248.10
Tare weight, ring (g): 122.04
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 122.36
Sample volume (cm^3): 71.67
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 5.2
Initial Gravimetric Moisture Content (% g/g): 3.0
Dry bulk density (g/cm^3): 1.71
Wet bulk density (g/cm^3): 1.76
Calculated Porosity (% vol): 35.6
Percent Saturation: 14.5

Comments:

*Weight including tares

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0108
Ring Number: RE16-98-0108
Depth: NA
Test Date: 30-Oct-98

Field weight of sample* (g): 285.40
Tare weight, ring (g): 120.40
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 159.73
Sample volume (cm^3): 73.53
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 7.2
Initial Gravimetric Moisture Content (% g/g): 3.3
Dry bulk density (g/cm^3): 2.17
Wet bulk density (g/cm^3): 2.24
Calculated Porosity (% vol): 18.0
Percent Saturation: 39.8

Comments:

*Weight including tares

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Method of Analysis	
		Constant Head	Falling Head
RE16-98-0100	1.2E-06		X
RE16-98-0101	1.4E-05		X
RE16-98-0102	3.8E-03	X	
RE16-98-0103	1.7E-08		X
RE16-98-0104	9.8E-09		X
RE16-98-0105	2.8E-08		X
RE16-98-0106	5.0E-04	X	
RE16-98-0107	5.8E-05		X
RE16-98-0108	2.0E-08		X

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0100
Ring number: RE16-98-0100
Depth: NA

Type of water used: TAP
Backpressure (psi): 0.0
Offset (cm): 1.0
Sample length (cm): 3.10
Sample x-sectional area (cm^2): 14.52
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
11-Nov-98	11:42:40	18.5	70.0	69.0	16420	1.2E-06	1.2E-06
11-Nov-98	16:16:20	18.5	61.4	60.4			
Test # 2:							
16-Nov-98	16:31:40	18.5	99.0	98.0	60110	1.2E-06	1.3E-06
17-Nov-98	09:13:30	19.0	60.9	59.9			
Test # 3:							
17-Nov-98	09:13:30	19.0	60.9	59.9	9160	1.2E-06	1.2E-06
17-Nov-98	11:46:10	19.0	56.8	55.8			

Average Ksat **(cm/sec):** **1.2E-06**

Comments:

Laboratory analysis by: C. Barklow
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0101
Ring number: RE16-98-0101
Depth: NA

Type of water used: TAP
Backpressure (psi): 0.0
Offset (cm): 0.8
Sample length (cm): 2.65
Sample x-sectional area (cm^2): 11.88
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
16-Nov-98	16:25:40	18.5	63.5	62.7	1540	1.4E-05	1.4E-05
16-Nov-98	16:51:20	18.5	55.6	54.8			
Test # 2:							
17-Nov-98	11:07:10	19.0	64.6	63.8	1980	1.5E-05	1.5E-05
17-Nov-98	11:40:10	19.0	53.7	52.9			
Test # 3:							
17-Nov-98	11:40:10	19.0	53.7	52.9	8710	1.3E-05	1.3E-05
17-Nov-98	14:05:20	18.5	26.7	25.9			

***Average Ksat* (cm/sec):** 1.4E-05

Comments:

Laboratory analysis by: C. Barklow
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0102
Ring number: RE16-98-0102
Depth: NA

Type of water used: TAP
Collection vessel tare (g): 10.63
Sample length (cm): 5.08
Sample diameter (cm): 6.01
Sample x-sectional area (cm^2): 28.37

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
26-Oct-98	10:10:22	20.5	7.1	19.4	8.8	60	3.7E-03	3.6E-03
26-Oct-98	10:11:22							
Test # 2:								
27-Oct-98	08:22:48	20.0	7.1	30.0	19.4	132	3.7E-03	3.7E-03
27-Oct-98	08:25:00							
Test # 3:								
27-Oct-98	11:15:53	20.5	6.8	34.8	24.1	157	4.0E-03	4.0E-03
27-Oct-98	11:18:30							

***Average Ksat* (cm/sec):** **3.8E-03**

Comments:

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0103
Ring number: RE16-98-0103
Depth: NA

Type of water used: TAP
Backpressure (psi): 10.0
Offset (cm): 3.6
Sample length (cm): 2.56
Sample x-sectional area (cm^2): 29.61
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
09-Nov-98	12:35:30	19.5	61.5	761.0	83090	1.6E-08	1.6E-08
10-Nov-98	11:40:20	18.5	45.0	744.5			
Test # 2:							
10-Nov-98	11:40:20	18.5	45.0	744.5	75950	1.6E-08	1.7E-08
11-Nov-98	08:46:10	18.0	30.1	729.6			
Test # 3:							
11-Nov-98	08:46:10	18.0	30.1	729.6	86770	1.6E-08	1.7E-08
12-Nov-98	08:52:20	18.5	13.4	712.9			

***Average Ksat* (cm/sec):** **1.7E-08**

Comments:

Laboratory analysis by: C. Barklow
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0104
Ring number: RE16-98-0104
Depth: NA

Type of water used: TAP
Backpressure (psi): 10.0
Offset (cm): 1.1
Sample length (cm): 2.78
Sample x-sectional area (cm^2): 28.64
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
13-Nov-98	11:11:40	18.5	98.7	800.7	266380	9.2E-09	9.5E-09
16-Nov-98	13:11:20	18.5	70.3	772.3			
Test # 2:							
16-Nov-98	13:11:20	18.5	70.3	772.3	11420	9.6E-09	9.9E-09
16-Nov-98	16:21:40	18.5	69.1	771.1			
Test # 3:							
16-Nov-98	16:21:40	18.5	69.1	771.1	60460	9.7E-09	1.0E-08
17-Nov-98	09:09:20	19.0	62.4	764.4			

Average Ksat (cm/sec): **9.8E-09**

Comments:

Laboratory analysis by: C. Barklow
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0105
Ring number: RE16-98-0105
Depth: NA

Type of water used: TAP
Backpressure (psi): 10.0
Offset (cm): 0.2
Sample length (cm): 2.56
Sample x-sectional area (cm^2): 30.11
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
06-Nov-98	16:19:30	19.0	51.6	754.5	72265	2.5E-08	2.6E-08
07-Nov-98	12:23:55	18.0	28.8	731.7			
Test # 2:							
09-Nov-98	10:15:30	18.5	59.2	762.1	8120	3.1E-08	3.1E-08
09-Nov-98	12:30:50	19.5	56.0	758.9			
Test # 3:							
09-Nov-98	12:30:50	19.5	56.0	758.9	79200	2.7E-08	2.8E-08
10-Nov-98	10:30:50	18.5	29.1	732.0			

***Average Ksat* (cm/sec):** **2.8E-08**

Comments:

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Constant Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0106
Ring number: RE16-98-0106
Depth: NA

Type of water used: TAP
Collection vessel tare (g): 11.42
Sample length (cm): 3.75
Sample diameter (cm): 4.86
Sample x-sectional area (cm^2): 18.55

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
06-Nov-98	08:58:56	21.0	2.9	27.4	9.9	1392	5.0E-04	4.9E-04
06-Nov-98	09:22:08							
Test # 2:								
07-Nov-98	11:39:14	20.5	2.8	29.5	18.1	2376	5.5E-04	5.4E-04
07-Nov-98	12:18:50							
Test # 3:								
07-Nov-98	14:20:42	20.0	2.8	21.6	10.2	1536	4.8E-04	4.8E-04
07-Nov-98	14:46:18							

***Average Ksat* (cm/sec):** **5.0E-04**

Comments:

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0107
Ring number: RE16-98-0107
Depth: NA

Type of water used: TAP
Backpressure (psi): 0.0
Offset (cm): 2.0
Sample length (cm): 2.56
Sample x-sectional area (cm^2): 28.04
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
06-Nov-98	14:36:40	19.0	73.5	71.5	3310	5.2E-05	5.3E-05
06-Nov-98	15:31:50	19.0	6.8	4.8			
Test # 2:							
07-Nov-98	12:26:30	18.0	83.9	81.9	2954	5.7E-05	5.9E-05
07-Nov-98	13:15:44	18.0	7.8	5.8			
Test # 3:							
09-Nov-98	10:22:50	18.5	75.1	74.1	3230	6.0E-05	6.2E-05
09-Nov-98	11:16:40	18.5	5.5	3.5			

***Average Ksat* (cm/sec):** **5.8E-05**

Comments:

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Saturated Hydraulic Conductivity
Falling Head Method

Job name: LANL
Job number: 8844.01
Sample number: RE16-98-0108
Ring number: RE16-98-0108
Depth: NA

Type of water used: TAP
Backpressure (psi): 10.0
Offset (cm): 0.6
Sample length (cm): 2.54
Sample x-sectional area (cm^2): 28.95
Reservoir x-sectional area (cm^2): 0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
06-Nov-98	16:26:20	19.0	67.7	770.2	72215	1.7E-08	1.8E-08
07-Nov-98	12:29:55	18.0	52.2	754.7			
Test # 2:							
09-Nov-98	10:36:20	18.5	16.7	719.2	7090	1.9E-08	1.9E-08
09-Nov-98	12:34:30	19.5	15.1	717.6			
Test # 3:							
10-Nov-98	11:34:00	18.5	58.3	760.8	76060	2.2E-08	2.2E-08
11-Nov-98	08:41:40	18.0	38.1	740.6			

Average Ksat (cm/sec): **2.0E-08**

Comments:

Laboratory analysis by: C. Barlow
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
RE16-98-0100	0	18.5
	28	18.3
	128	17.9
	15195	0.3
	839828	0.4
	510	13.7
RE16-98-0101	0	31.5
	23	30.3
	129	29.2
	510	24.7
	11728	7.7
	11728	7.2
	6221	5.9
	16113	0.5
	839828	0.4
RE16-98-0102	0	43.1
	7	40.3
	39	38.2
	79	35.5
	255	14.2
	1020	11.4
	6935	1.4
	27433	1.3
	839828	0.3

Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%. cm^3/cm^3)
RE16-98-0103	0	8.9
	49	8.0
	134	7.5
	510	8.3
	11728	6.3
	15297	0.6
	839828	0.6
RE16-98-0104	0	9.3
	55	8.6
	126	8.4
	510	8.1
	6731	2.2
	7547	0.9
	12849	0.4
	839828	0.4
RE16-98-0105	0	9.2
	49	8.7
	130	8.2
	510	7.5
	11728	5.7
	11524	3.4
	14991	3.1
	21926	1.8
	839828	0.4

Summary of Moisture Characteristics of the Initial Drainage Curve (Continued)

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
RE16-98-0106	0	40.2
	17	34.2
	52	30.5
	157	24.3
	510	17.9
	6527	5.4
	839628	0.4
RE16-98-0107	0	28.0
	22	27.8
	56	27.1
	159	26.5
	510	23.5
	11728	15.9
	6425	9.3
	15909	1.8
	839828	0.4
RE16-98-0108	0	8.5
	51	7.8
	127	7.3
	510	7.2
	11728	6.2
	16725	1.3
	839828	0.5

Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	α (cm⁻¹) Calculated Value	α 95% Confidence Limits Lower	α 95% Confidence Limits Upper	N (dimensionless) Calculated Value	N 95% Confidence Limits Lower	N 95% Confidence Limits Upper	θ_r	θ_s
RE16-98-0100	0.0017	0.0013	0.0020	2.1791	1.4599	2.8983	0.0000	0.1837
RE16-98-0101	0.0017	0.0000	0.0036	1.6021	1.3094	1.8949	0.0000	0.3074
RE16-98-0102	0.0112	0.0008	0.0216	1.7651	1.1055	2.4247	0.0093	0.4215
RE16-98-0103	0.0001	0.0001	0.0001	14.4827	2.6554	26.3099	0.0000	0.0819
RE16-98-0104	0.0007	0.0000	0.0017	2.0922	1.2236	2.9608	0.0000	0.0874
RE16-98-0105	0.0001	0.0000	0.0002	2.8329	0.3221	5.3436	0.0000	0.0841
RE16-98-0106	0.0257	0.0000	0.0544	1.3319	1.1867	1.4770	0.0000	0.3879
RE16-98-0107	0.0014	0.0000	0.0060	1.4175	0.9045	1.9305	0.0000	0.2758
RE16-98-0108	0.0001	0.0001	0.0001	8.8228	3.1893	14.4562	0.0000	0.0772

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample* (g):	88.49
Job Number:	8844.01	*Tare wt., screen & clamp* (g):	2.06
Sample Number:	RE16-98-0100	*Tare wt., ring* (g):	156.51
Ring Number:	RE16-98-0100	*Tare wt., epoxy* (g):	0.00
Depth:	NA	*Sample volume* (cm^3):	45.02

Saturated weight at 0 cm tension* (g): 255.41
Volume of water† in saturated sample (cm^3): 8.35
Saturated moisture content (% vol): 18.55

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	21-Dec-98 / 08:40	255.41	0.00	18.55
	28-Dec-98 / 11:00	255.29	28.10	18.28
	06-Jan-99 / 10:56	255.12	127.70	17.90
Pressure plate:	06-Jan-99 / 08:32	253.24	509.90	13.73

Dry weight of thermocouple sample* (g): 123.55
Tare weight, jar (g): 112.14
Sample bulk density (g/cm^3): 1.97

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	06-Jan-99 / 20:15	123.57	15195.0	0.34

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0100
Ring Number: RE16-98-0100
Depth: NA

Dry weight of relative humidity box sample* (g): 65.77
Tare weight (g): 38.47
Sample bulk density (g/cm^3): 1.97

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 15:00	65.83	839828	0.44

Comments:

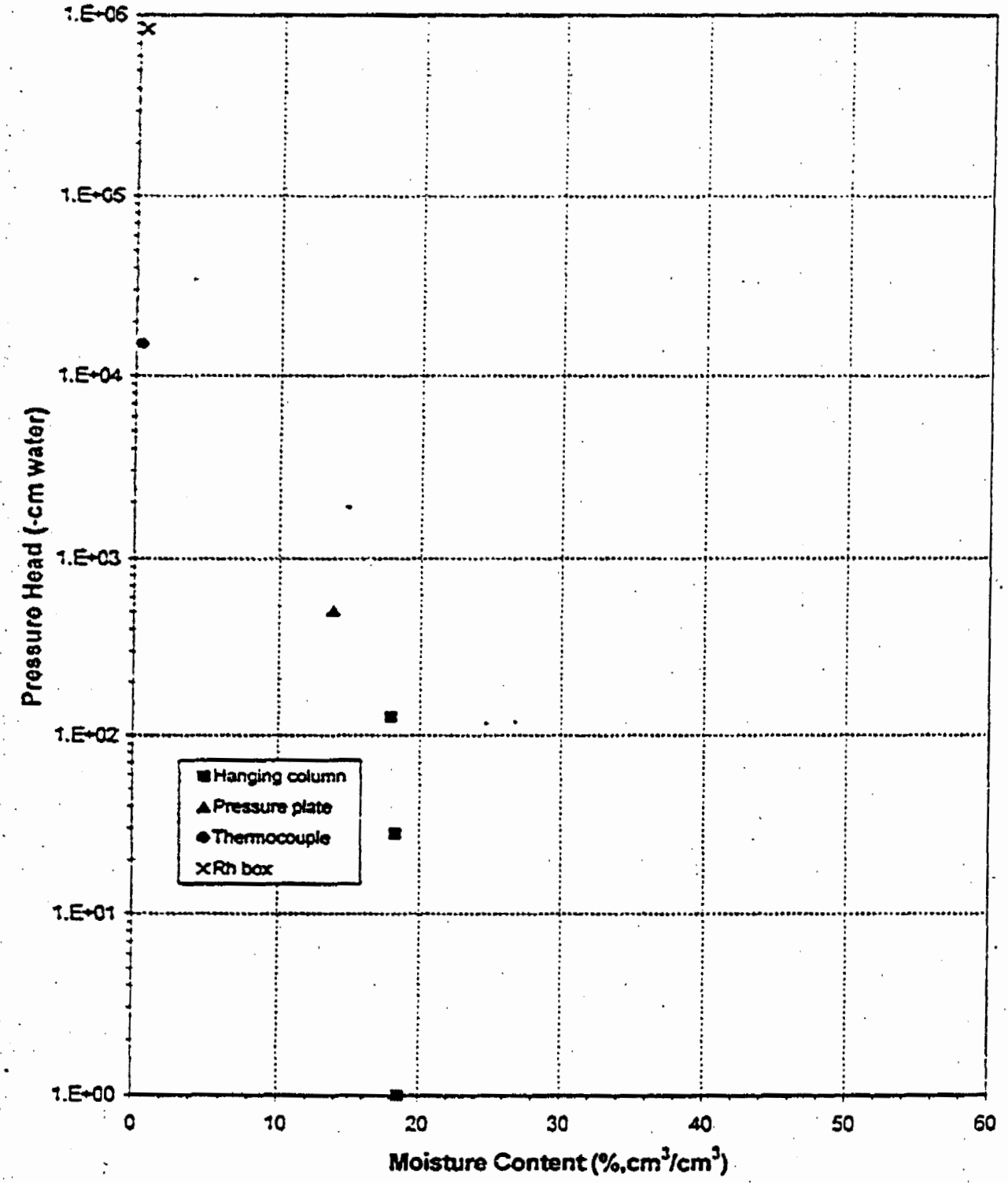
* Weight including tares

† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Water Retention Data Points

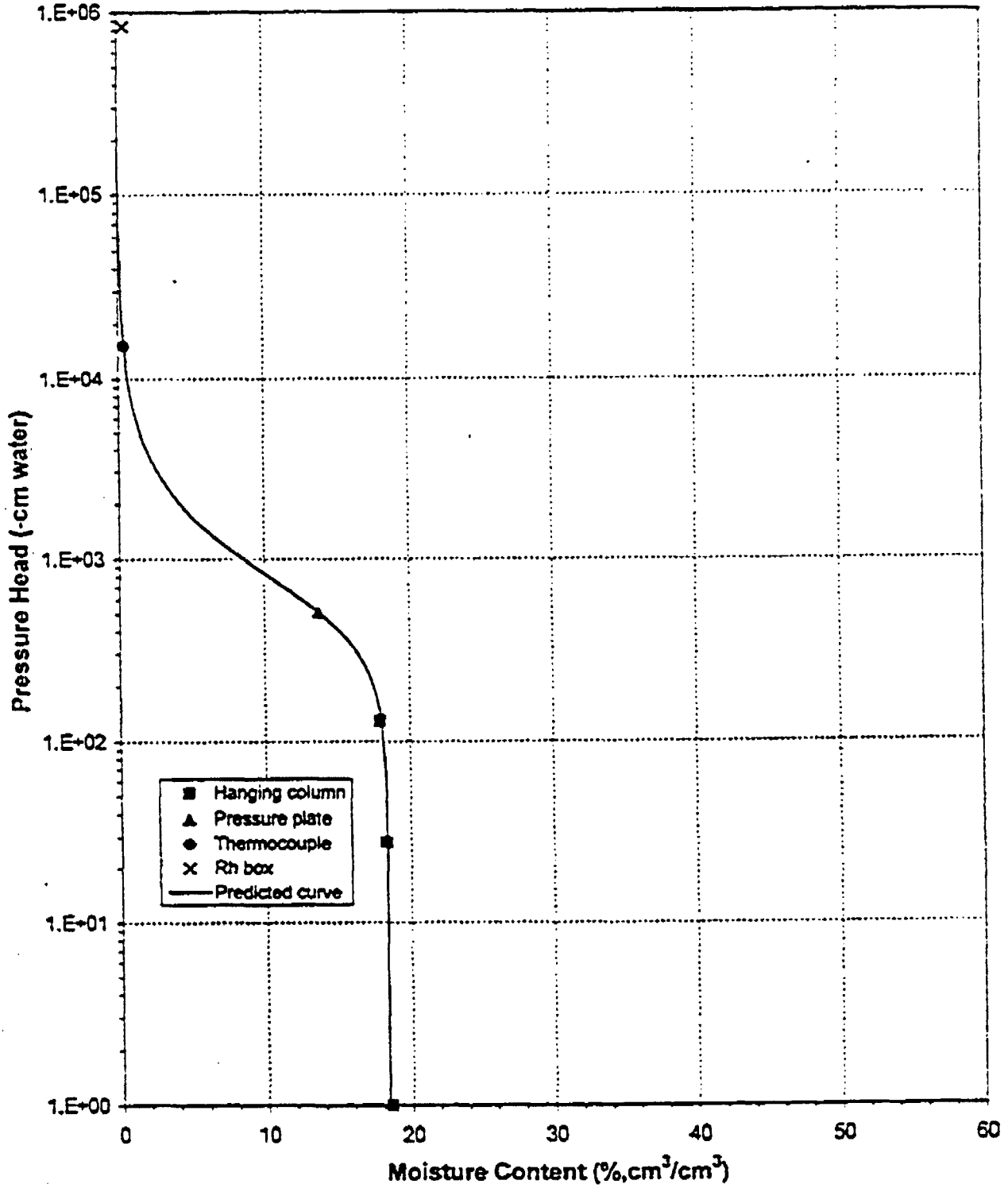
Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

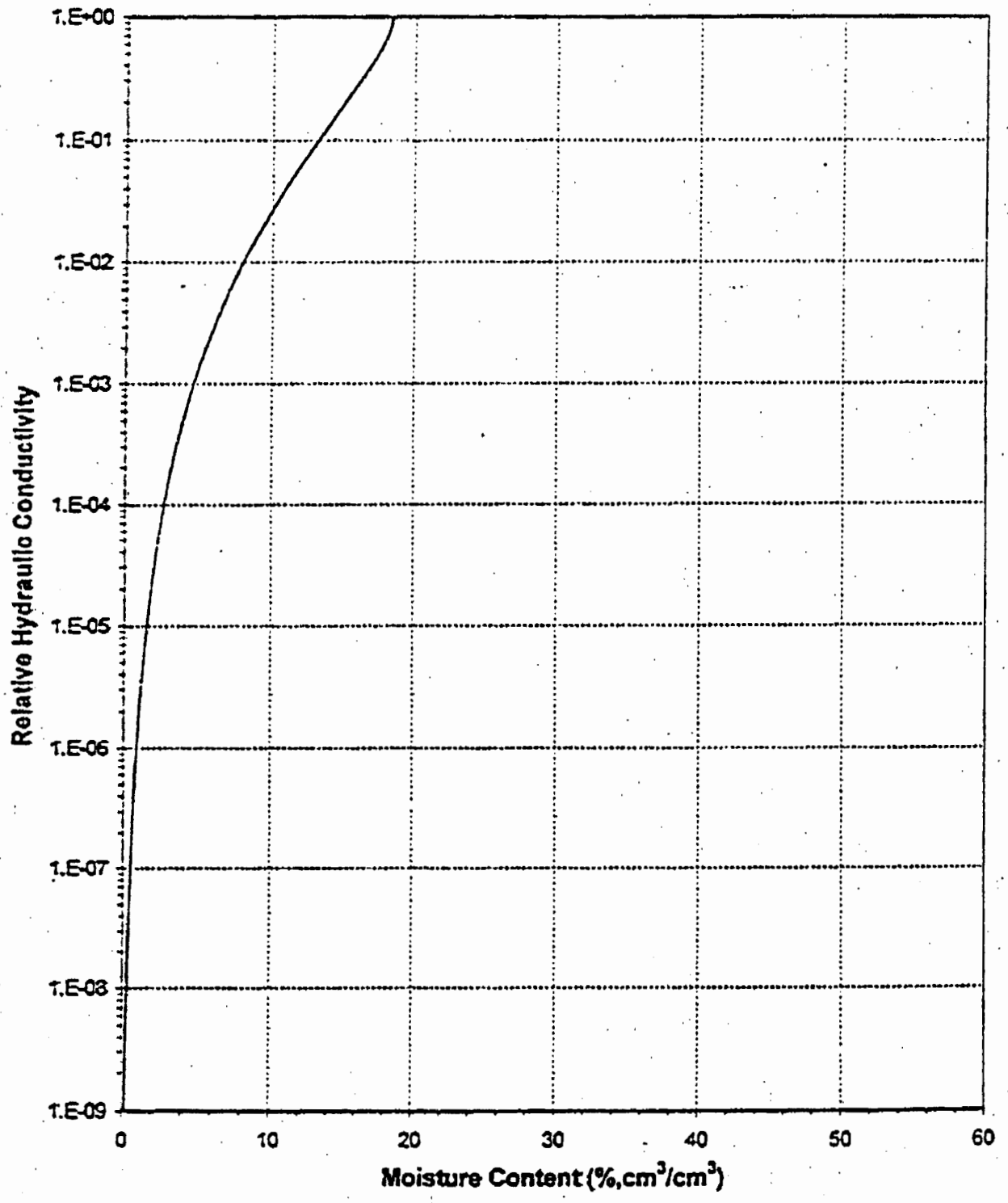
Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

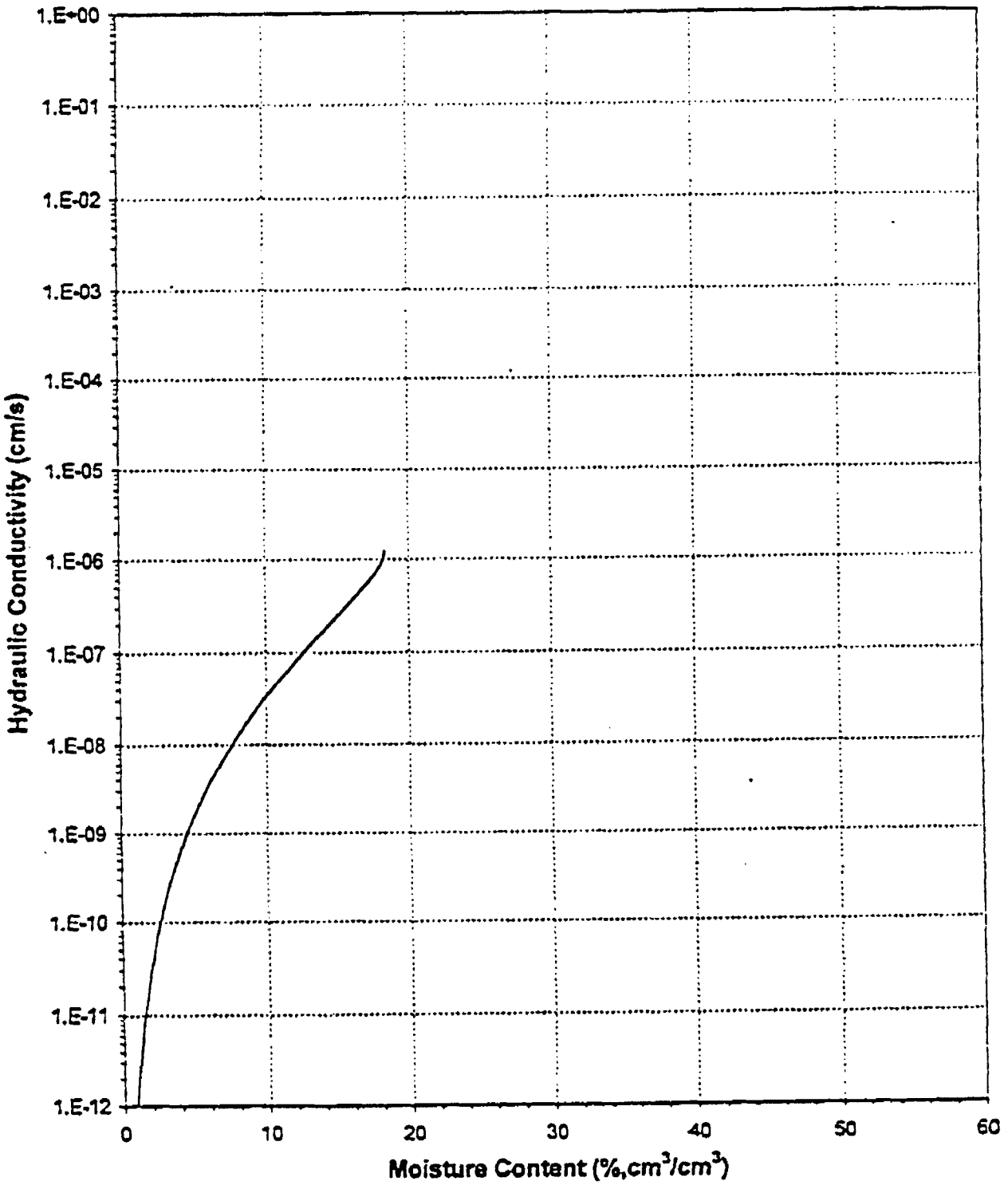
Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

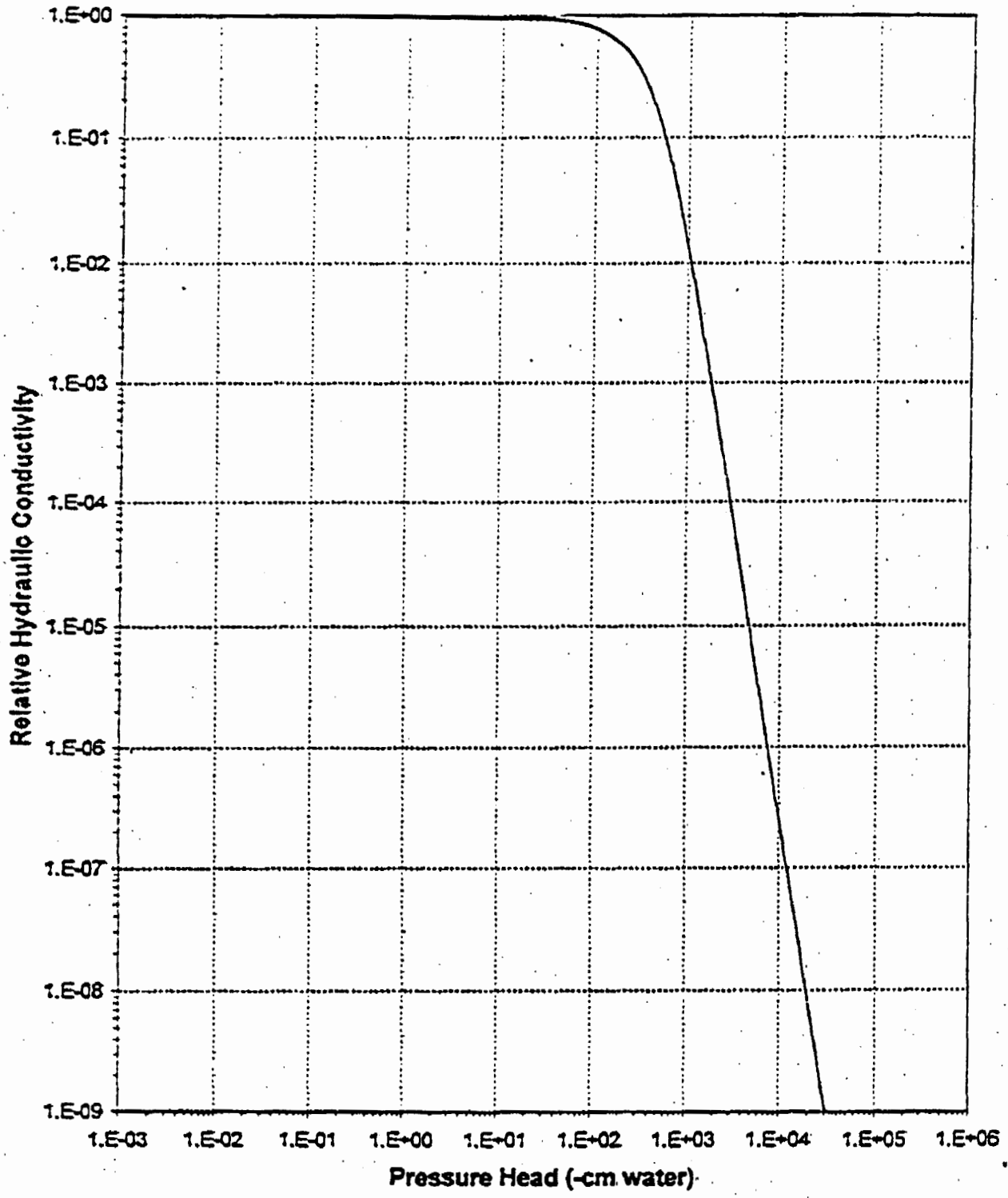
Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

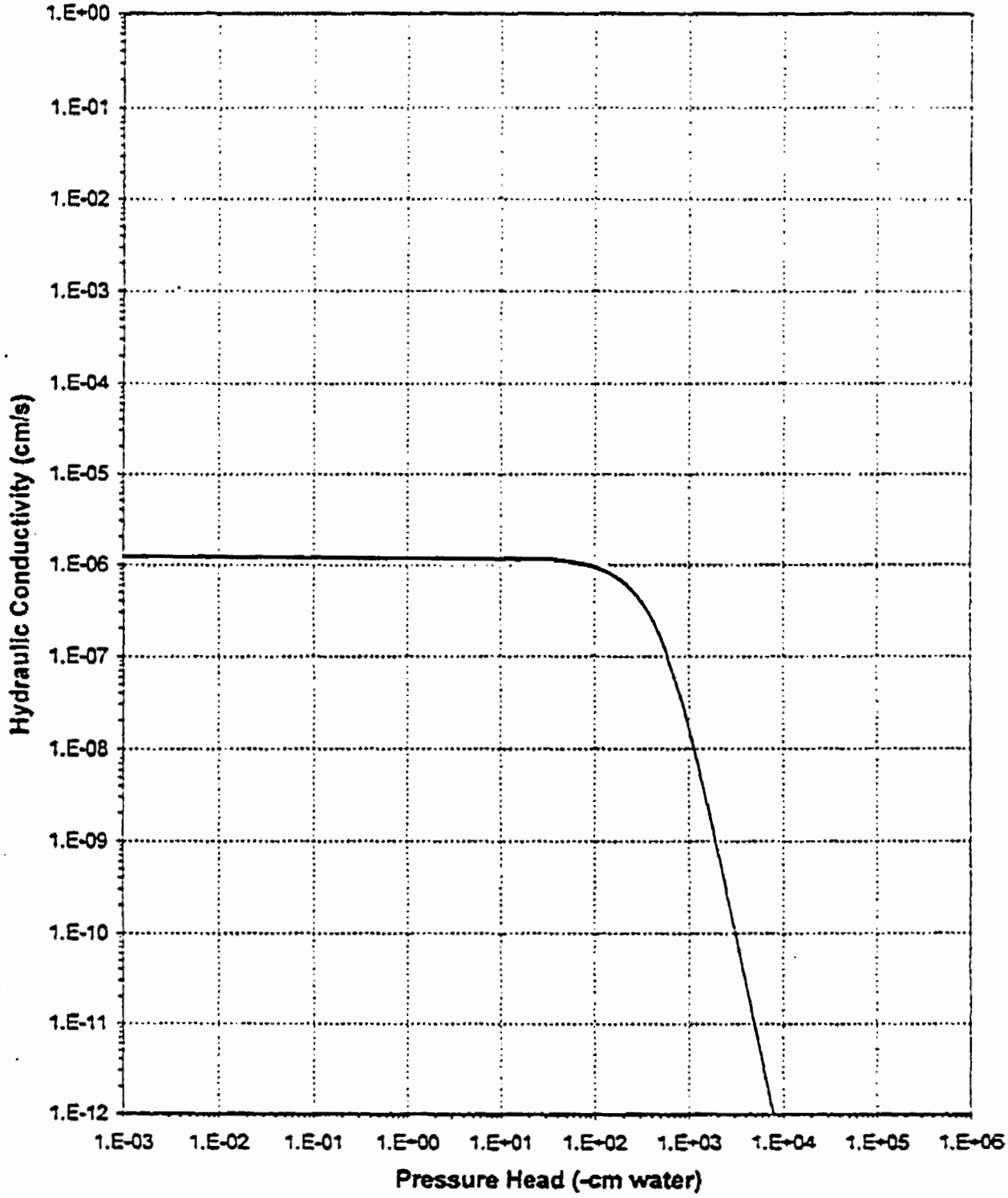
Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0100



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample (g):*	54.36
Job Number:	8844.01	*Tare wt., screen & clamp (g):*	2.01
Sample Number:	RE16-98-0101	*Tare wt., ring (g):*	149.68
Ring Number:	RE16-98-0101	*Tare wt., epoxy (g):*	0.00
Depth:	NA	*Sample volume (cm^3):*	31.49

Saturated weight at 0 cm tension (g):* 215.98
Volume of water† in saturated sample (cm^3): 9.93
Saturated moisture content (% vol): 31.53

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	20-Nov-98 / 17:50	215.98	0.00	31.53
	23-Nov-98 / 10:24	215.58	22.80	30.26
	25-Nov-98 / 15:57	215.25	129.40	29.21
Pressure plate:	30-Nov-98 / 11:15	213.84	509.90	24.73
	11-Dec-98 / 11:36	208.46	11727.70	7.65
	14-Dec-98 / 17:50	208.31	11727.70	7.18

Dry weight of thermocouple sample (g):* 155.13
Tare weight, jar (g): 114.48
Sample bulk density (g/cm^3): 1.73

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	06-Jan-99 / 14:25	156.51	6220.8	5.86
	06-Jan-99 / 20:30	155.24	16112.8	0.47

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0101
Ring Number: RE16-98-0101
Depth: NA

Dry weight of relative humidity box sample* (g): 86.59
Tare weight (g): 40.43
Sample bulk density (g/cm^3): 1.73

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 14:55	86.70	839828	0.43

Comments:

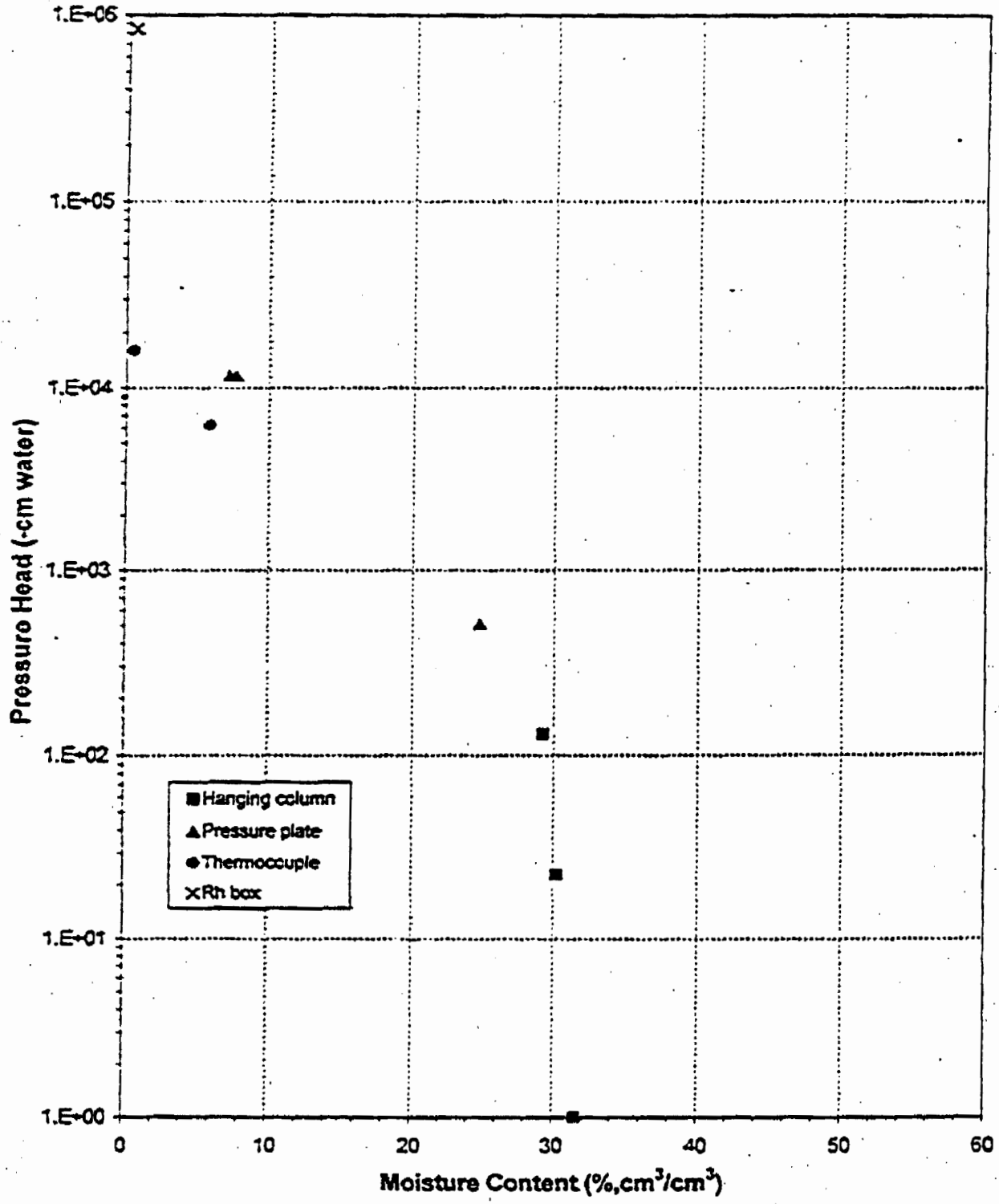
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Water Retention Data Points

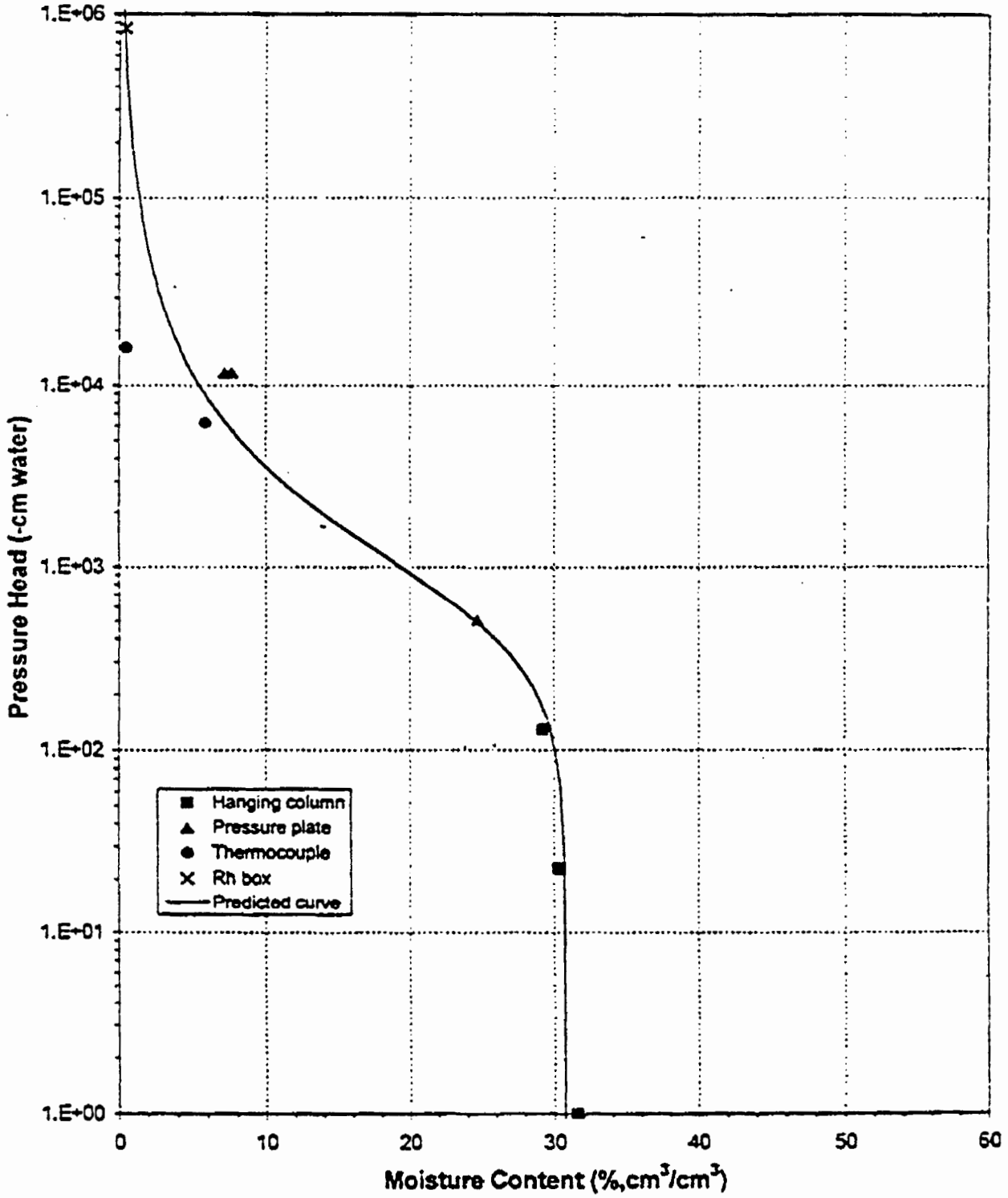
Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

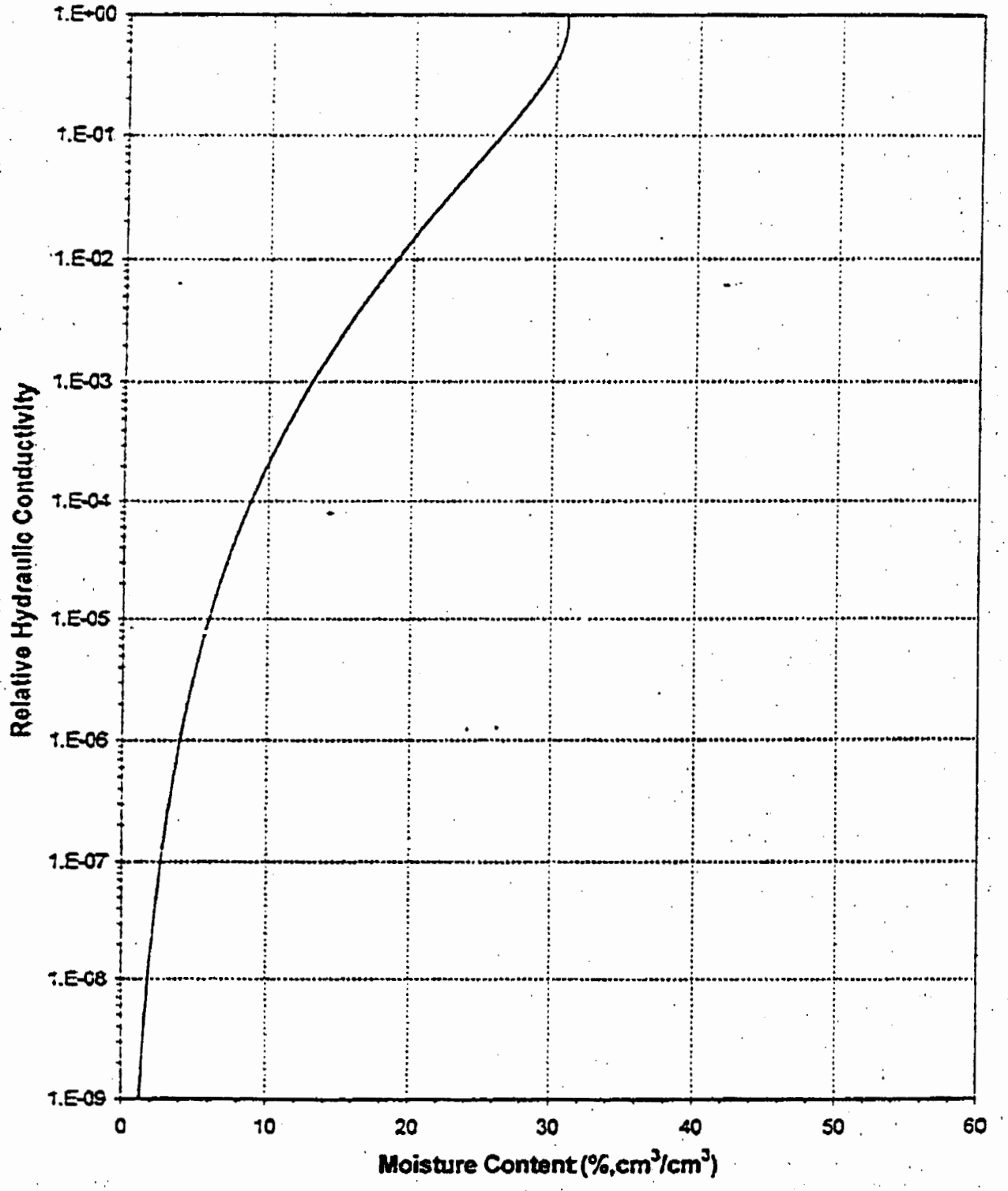
Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

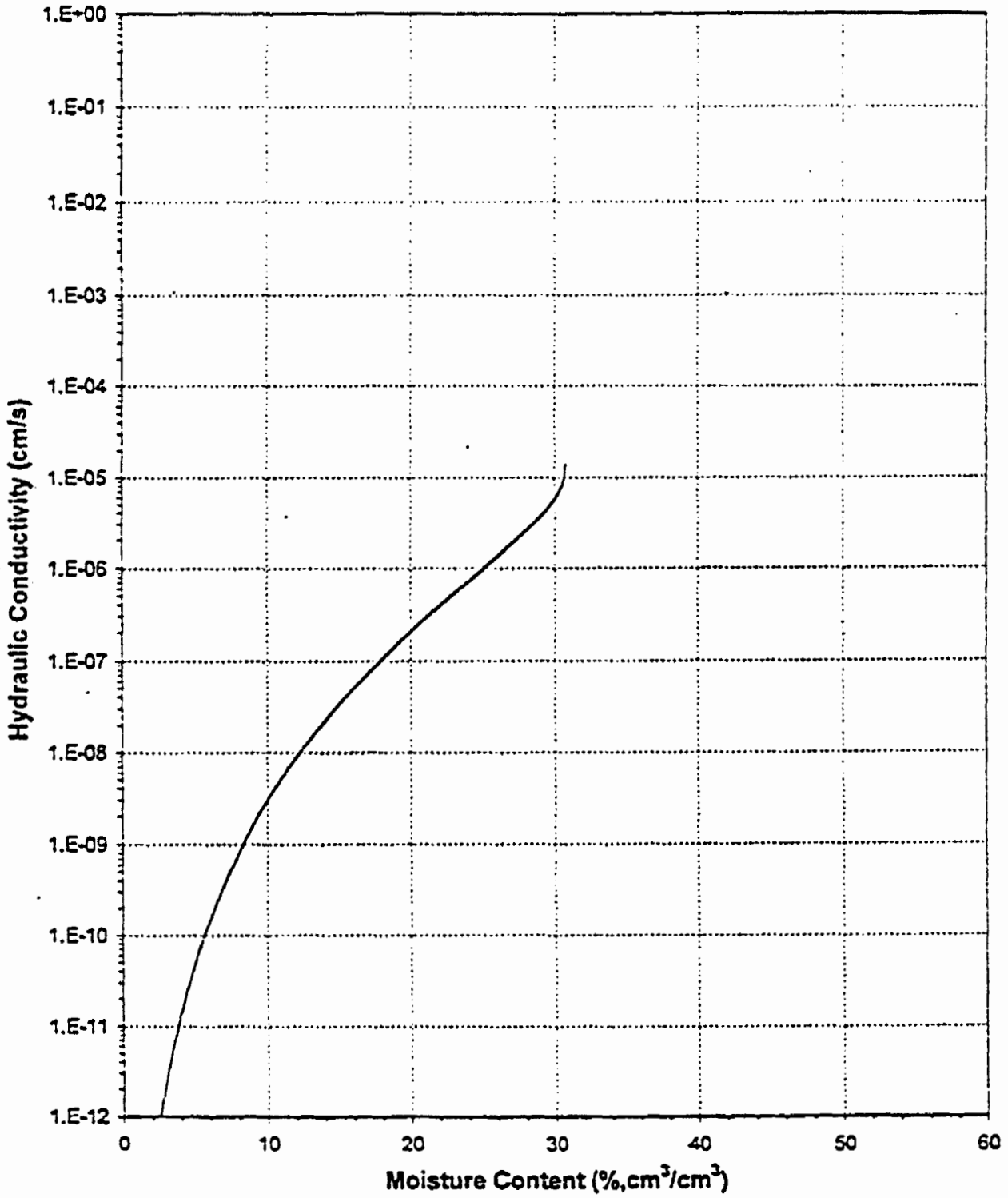
Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

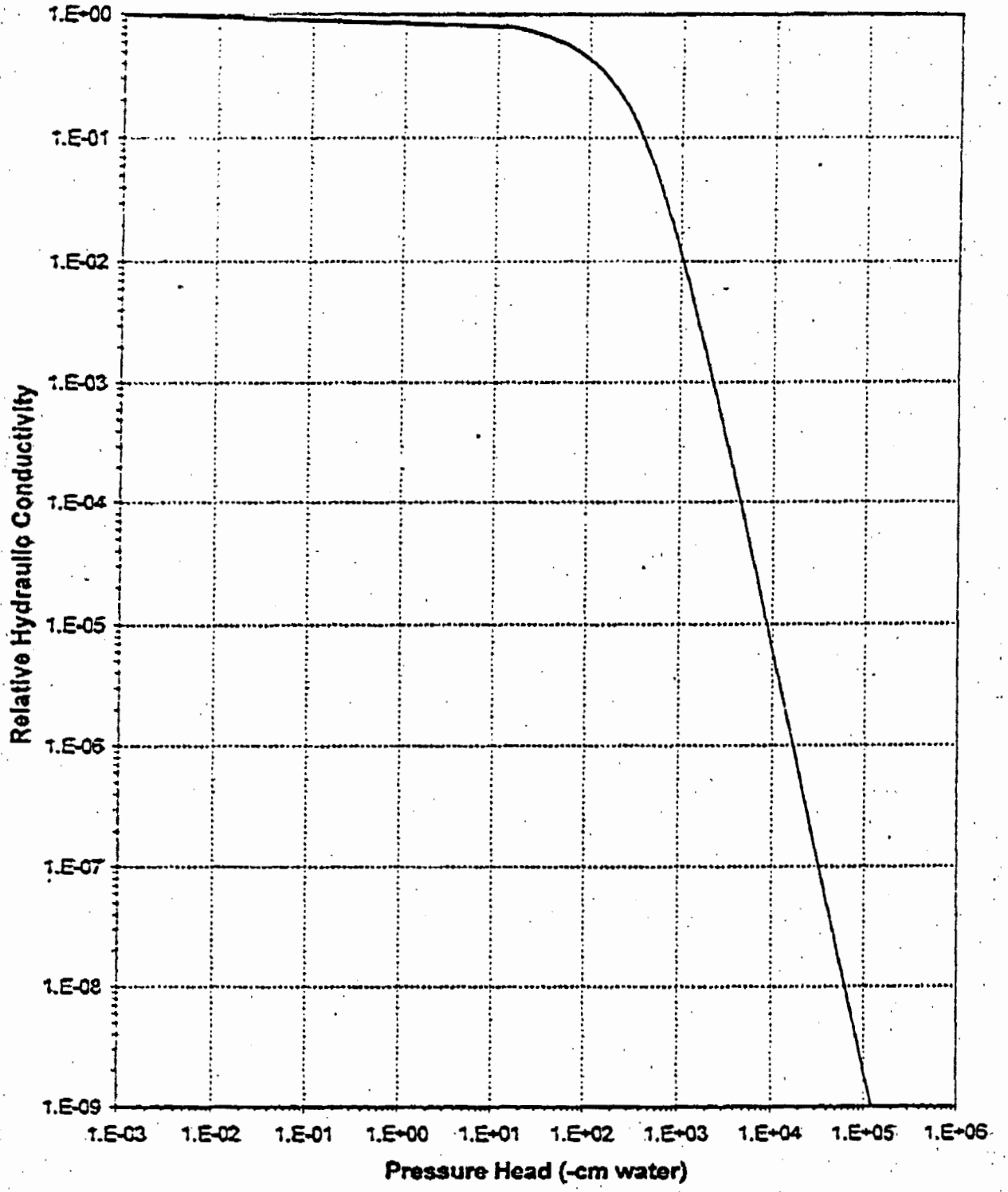
Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

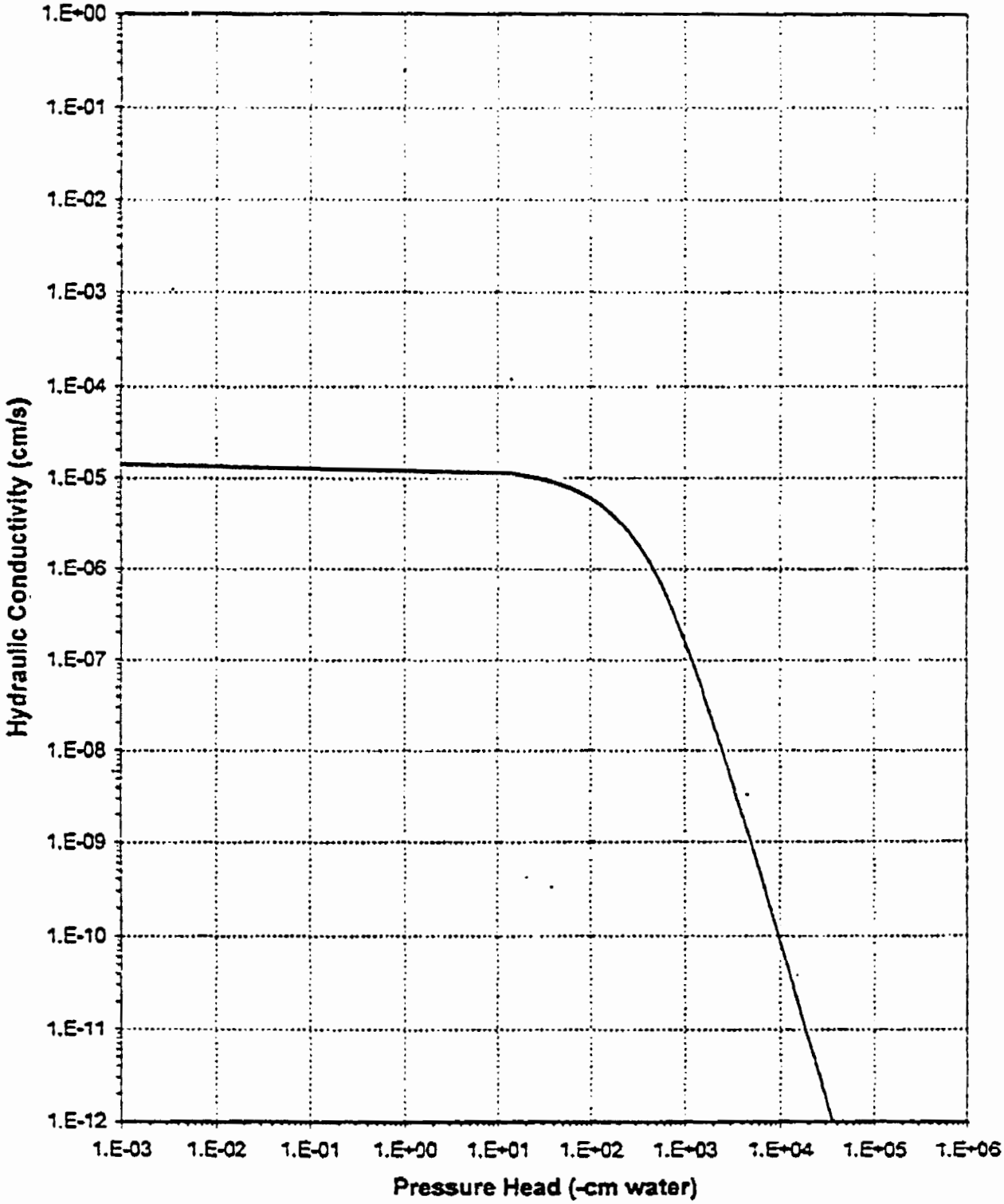
Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0101



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0102
Ring Number: RE16-98-0102
Depth: NA

Dry wt. of sample (g): 187.05
Tare wt., screen & clamp (g): 2.06
Tare wt., ring (g): 127.90
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 144.11

Saturated weight at 0 cm tension* (g): 379.15
Volume of water† in saturated sample (cm^3): 62.14
Saturated moisture content (% vol): 43.12

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	27-Oct-98 / 17:45	379.15	0.00	43.12
	30-Oct-98 / 16:43	375.09	6.80	40.30
	02-Nov-98 / 10:23	372.04	39.40	38.19
	04-Nov-98 / 14:38	368.24	79.20	35.55
Pressure plate:	09-Nov-98 / 12:35	337.53	254.95	14.24
	13-Nov-98 / 10:55	333.44	1019.80	11.40

Dry weight of thermocouple sample* (g): 370.06
Tare weight, jar (g): 205.49
Sample bulk density (g/cm^3): 1.30

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	30-Nov-98 / 18:10	371.86	6934.6	1.42
	19-Nov-98 / 15:10	371.71	27432.6	1.30

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0102
Ring Number: RE16-98-0102
Depth: NA

Dry weight of relative humidity box sample* (g): 68.32
Tare weight (g): 30.41
Sample bulk density (g/cm^3): 1.30

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content^T (% vol)
Relative humidity box:	09-Nov-98 / 12:10	68.41	839828	0.29

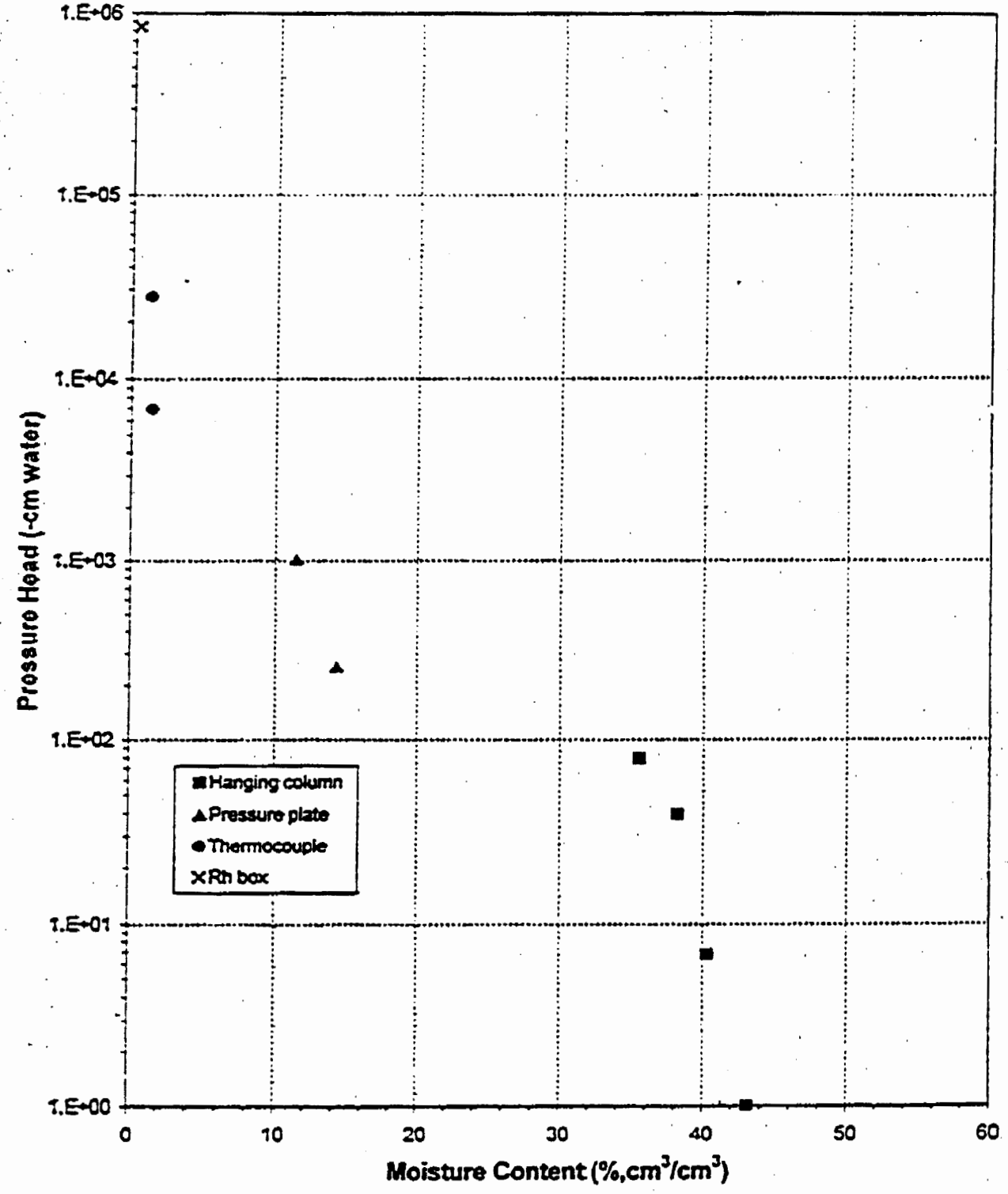
Comments:

* Weight including tares
^{T} Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Water Retention Data Points

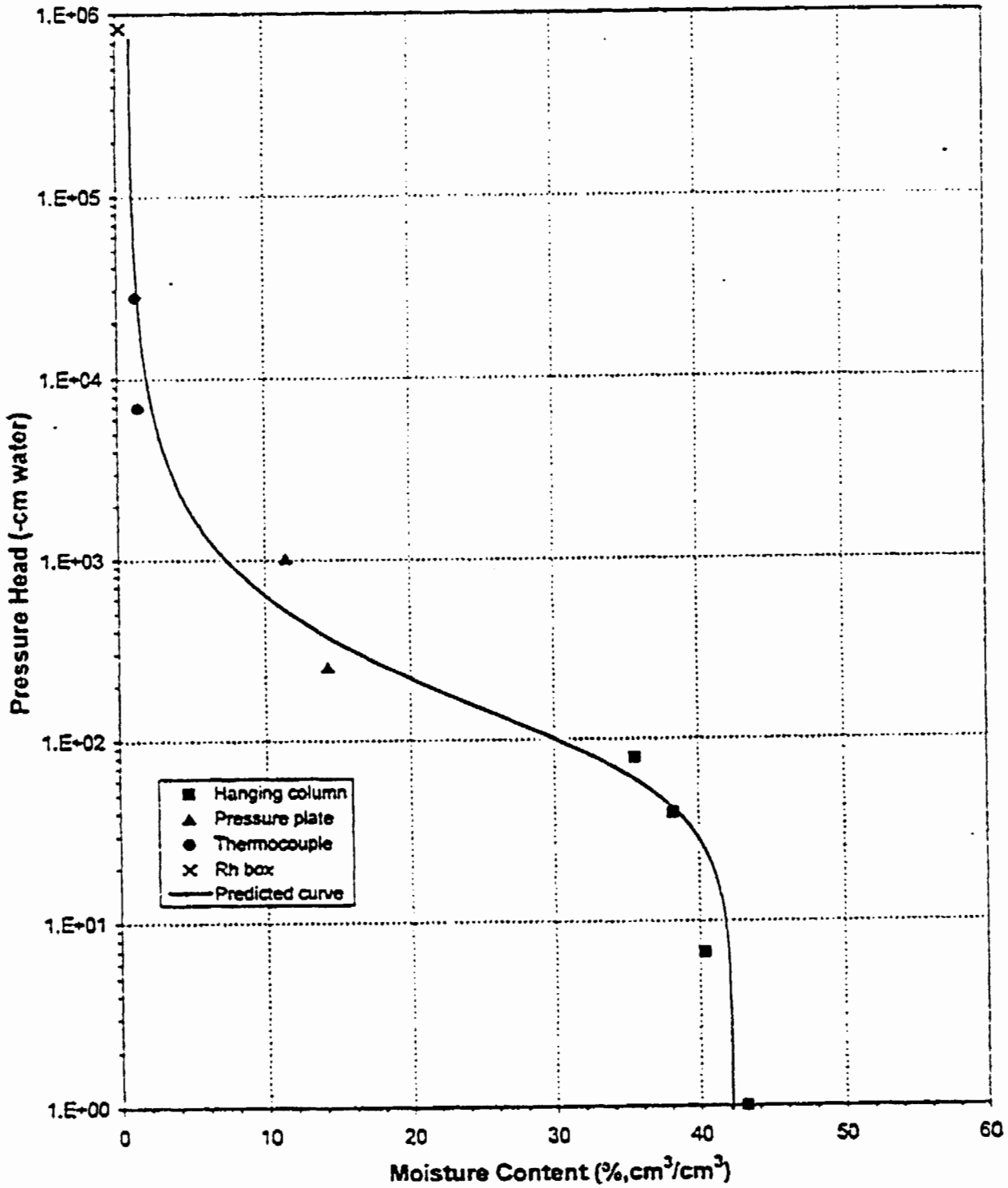
Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

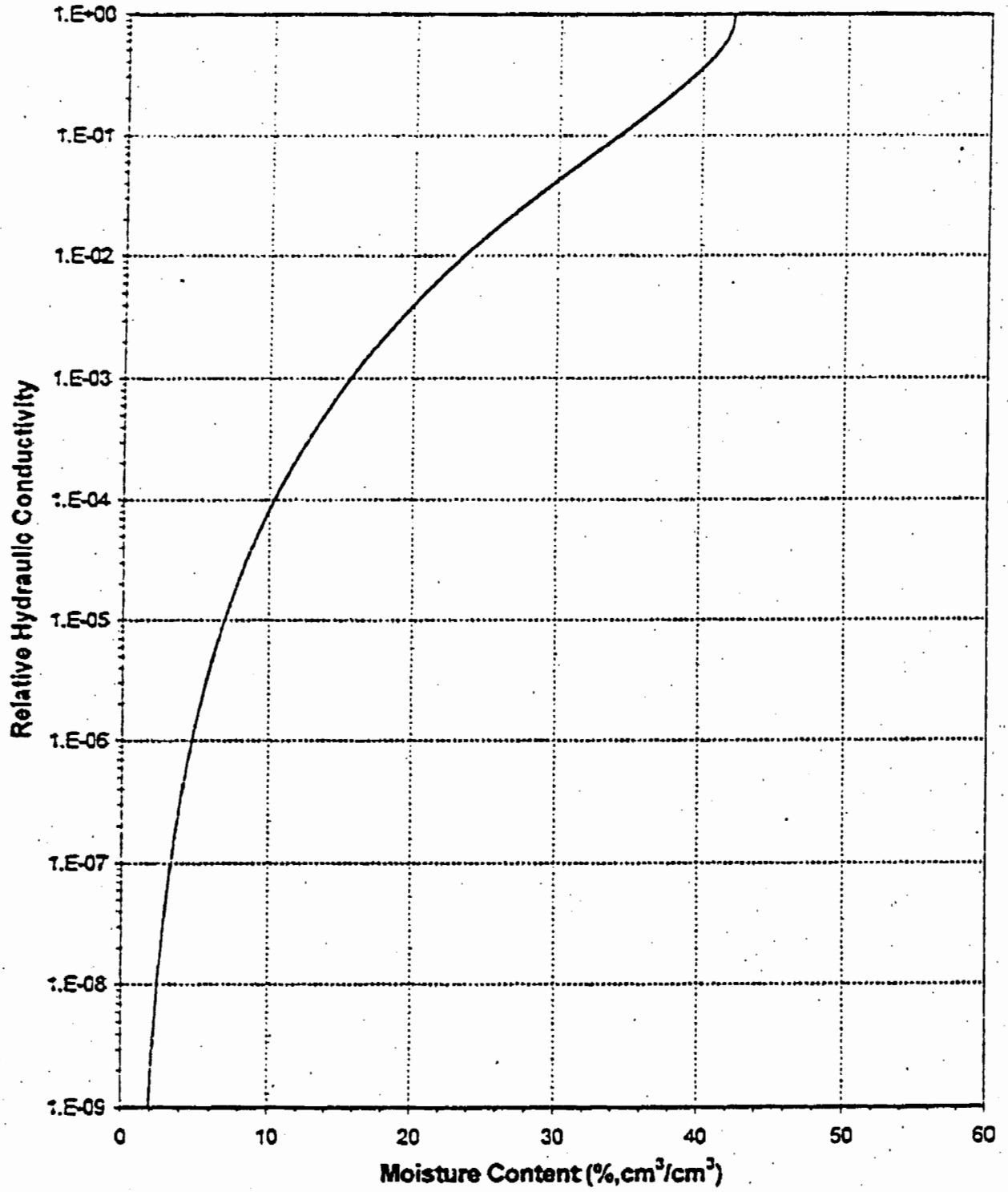
Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

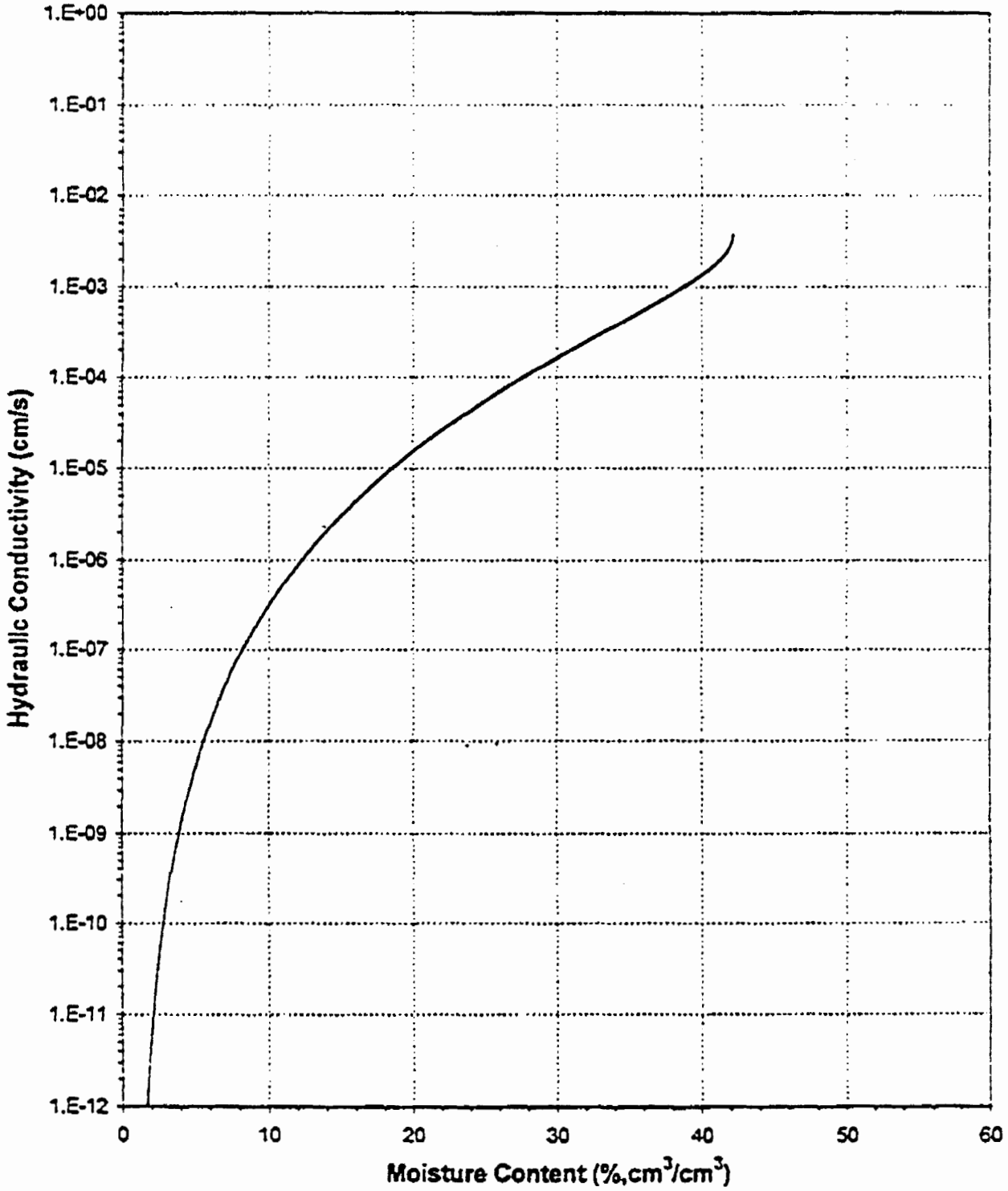
Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

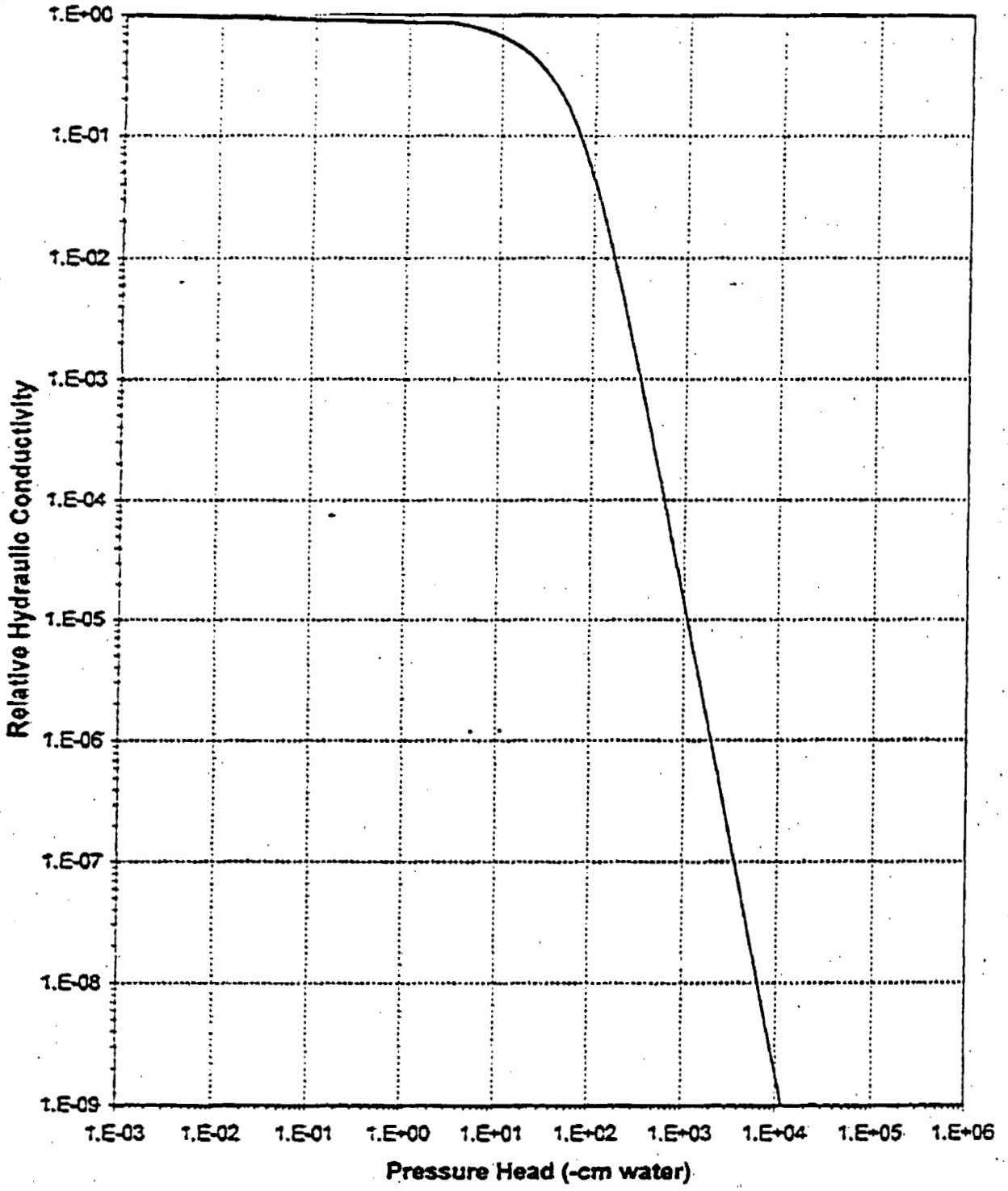
Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

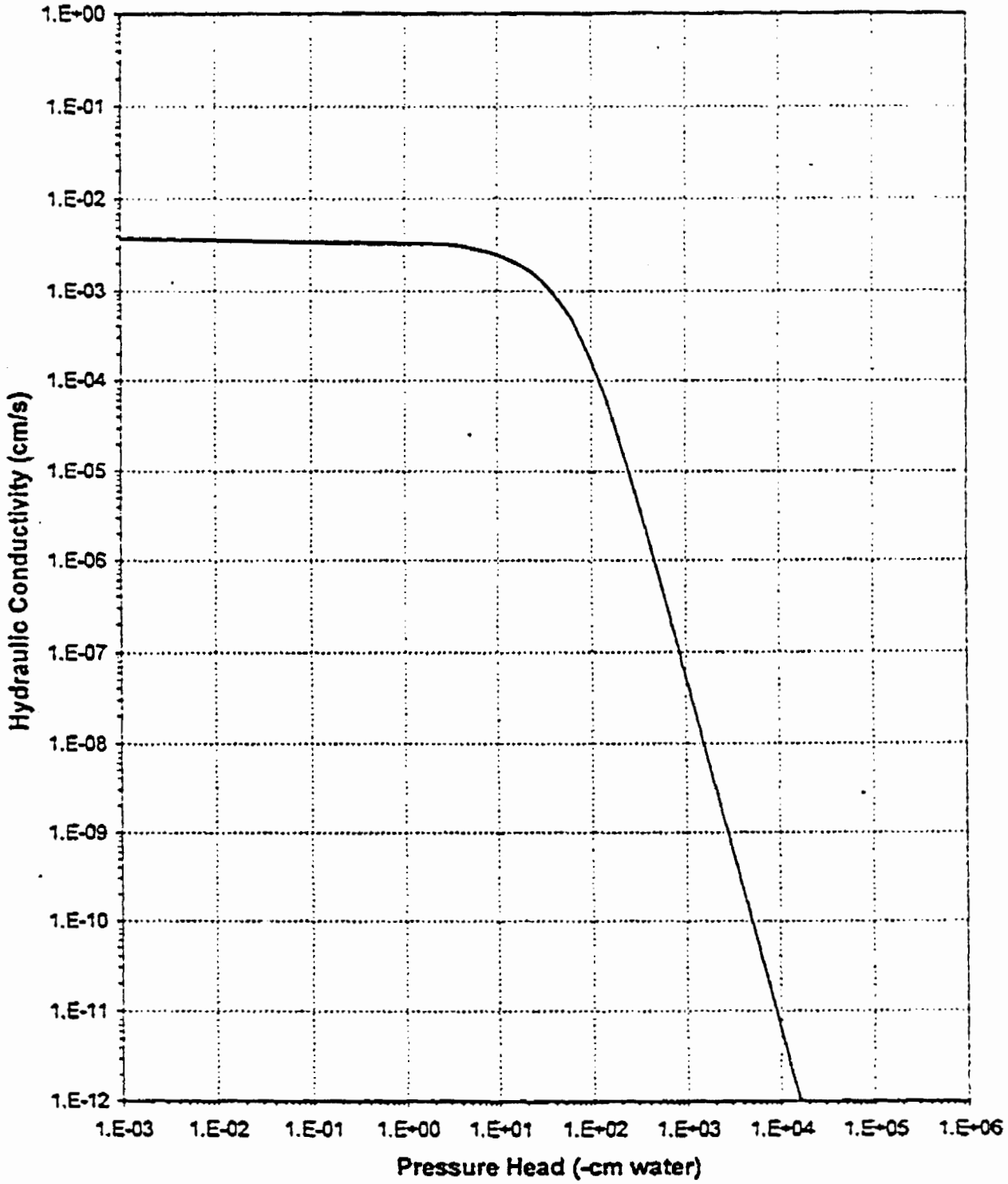
Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0102



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0103
Ring Number: RE16-98-0103
Depth: NA

Dry wt. of sample (g): 160.83
Tare wt., screen & clamp (g): 2.15
Tare wt., ring (g): 81.76
Tare wt., epoxy (g): 37.01
Sample volume (cm^3): 75.68

Saturated weight at 0 cm tension* (g): 288.49
Volume of water† in saturated sample (cm^3): 6.74
Saturated moisture content (% vol): 8.91

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	16-Nov-98 / 13:30	288.49	0.00	8.91
	23-Nov-98 / 12:32	287.84	49.00	8.05
	25-Nov-98 / 16:16	287.42	133.80	7.49
Pressure plate:	30-Nov-98 / 11:15	288.05	509.90	8.32
	12-Nov-98 / 11:35	286.52	11727.70	6.30

Dry weight of thermocouple sample* (g): 129.90
Tare weight, jar (g): 112.48
Sample bulk density (g/cm^3): 2.13

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	14-Jan-99 / 11:05	129.95	15297.0	0.61

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0103
Ring Number: RE16-98-0103
Depth: NA

Dry weight of relative humidity box sample* (g): 59.84
Tare weight (g): 41.71
Sample bulk density (g/cm^3): 2.13

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 15:00	59.88	839828	0.55

Comments:

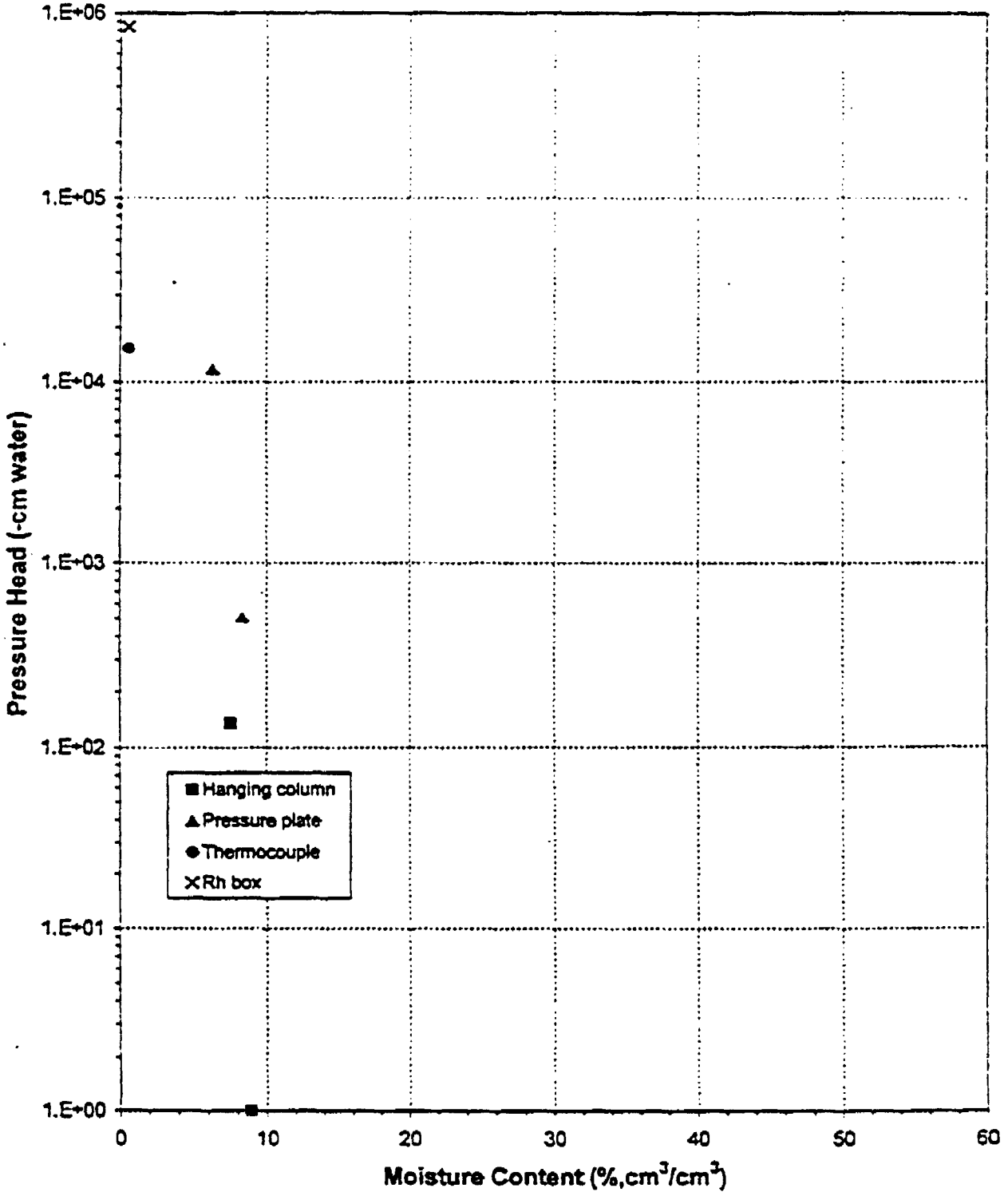
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Water Retention Data Points

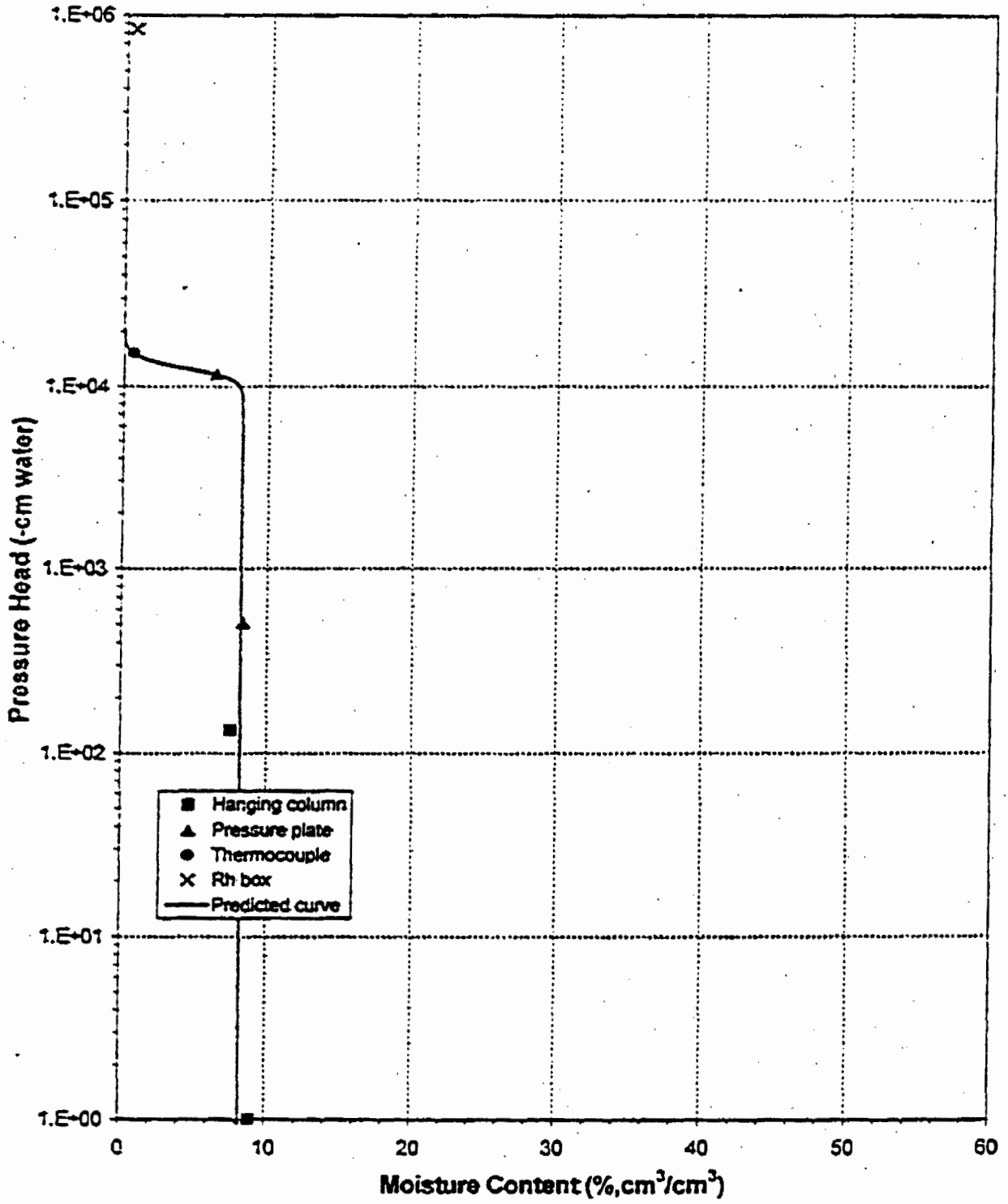
Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

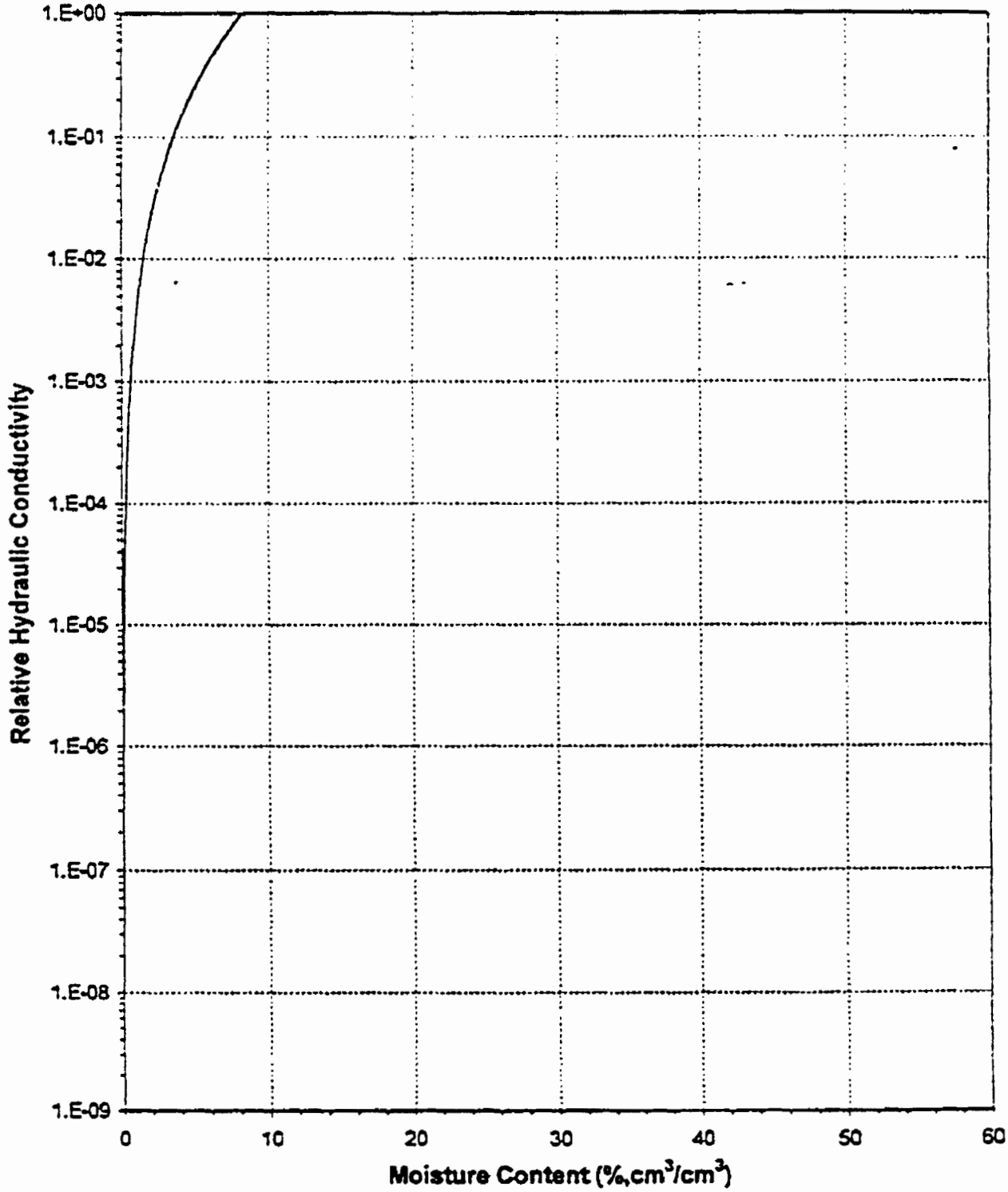
Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

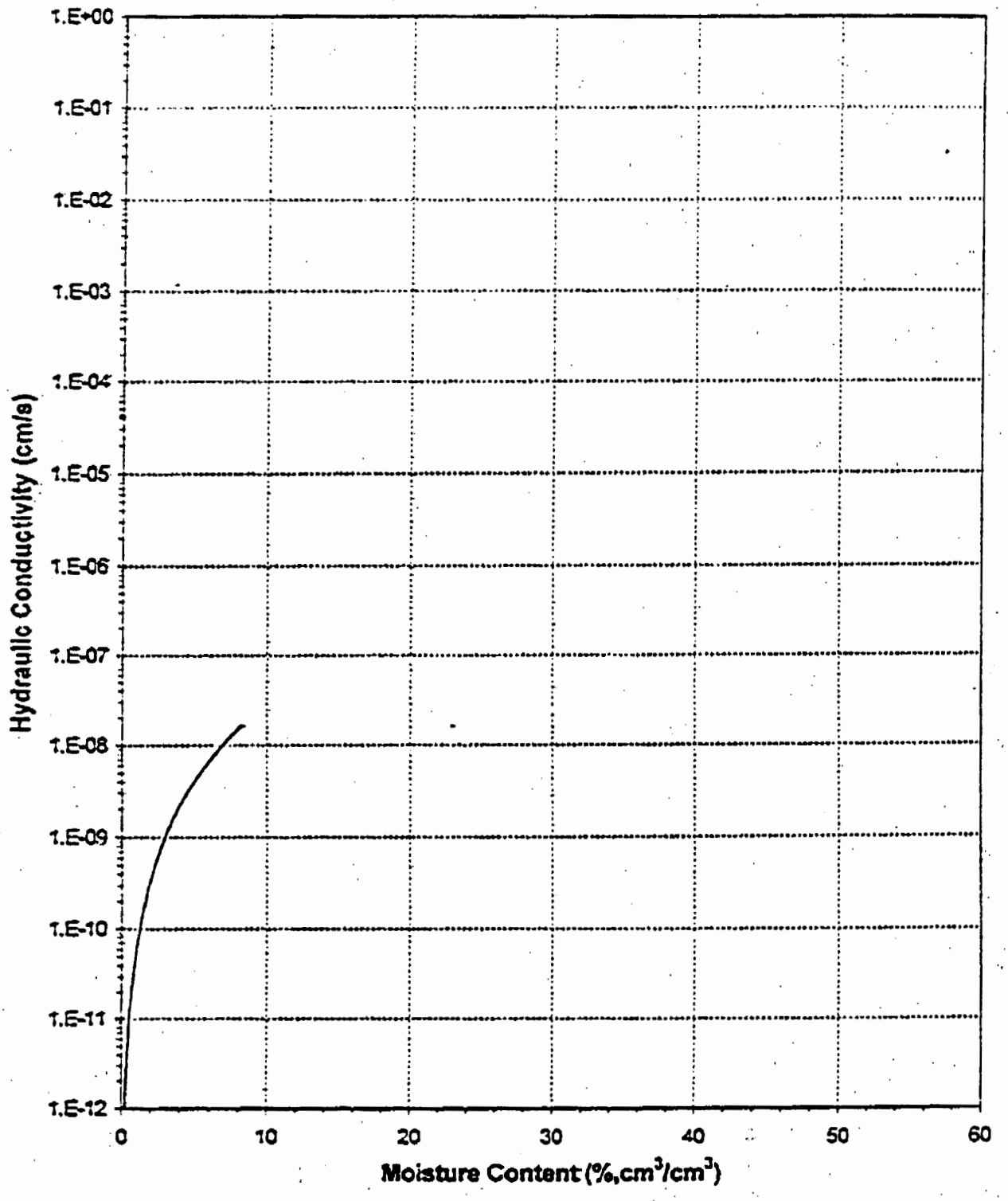
Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

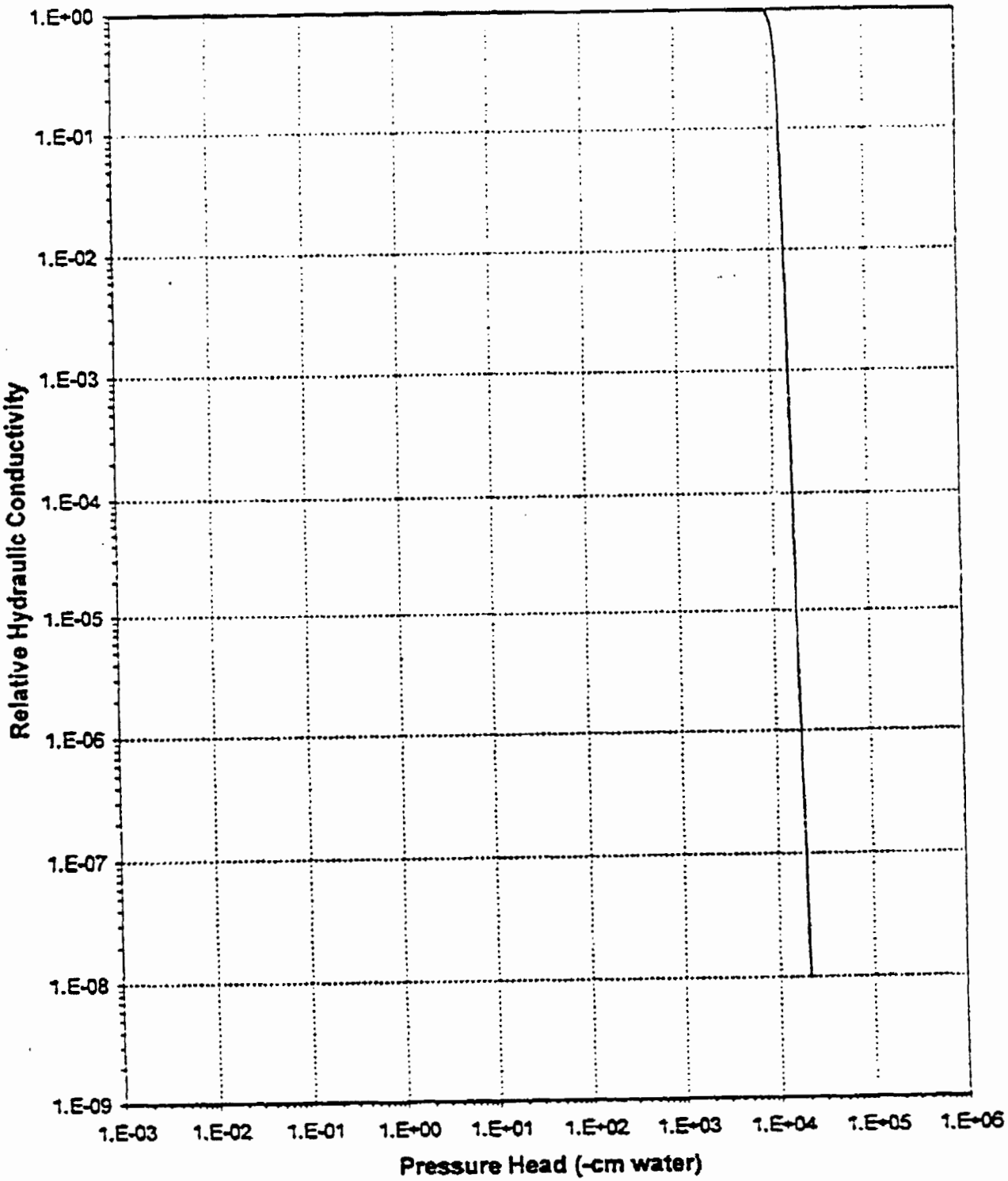
Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

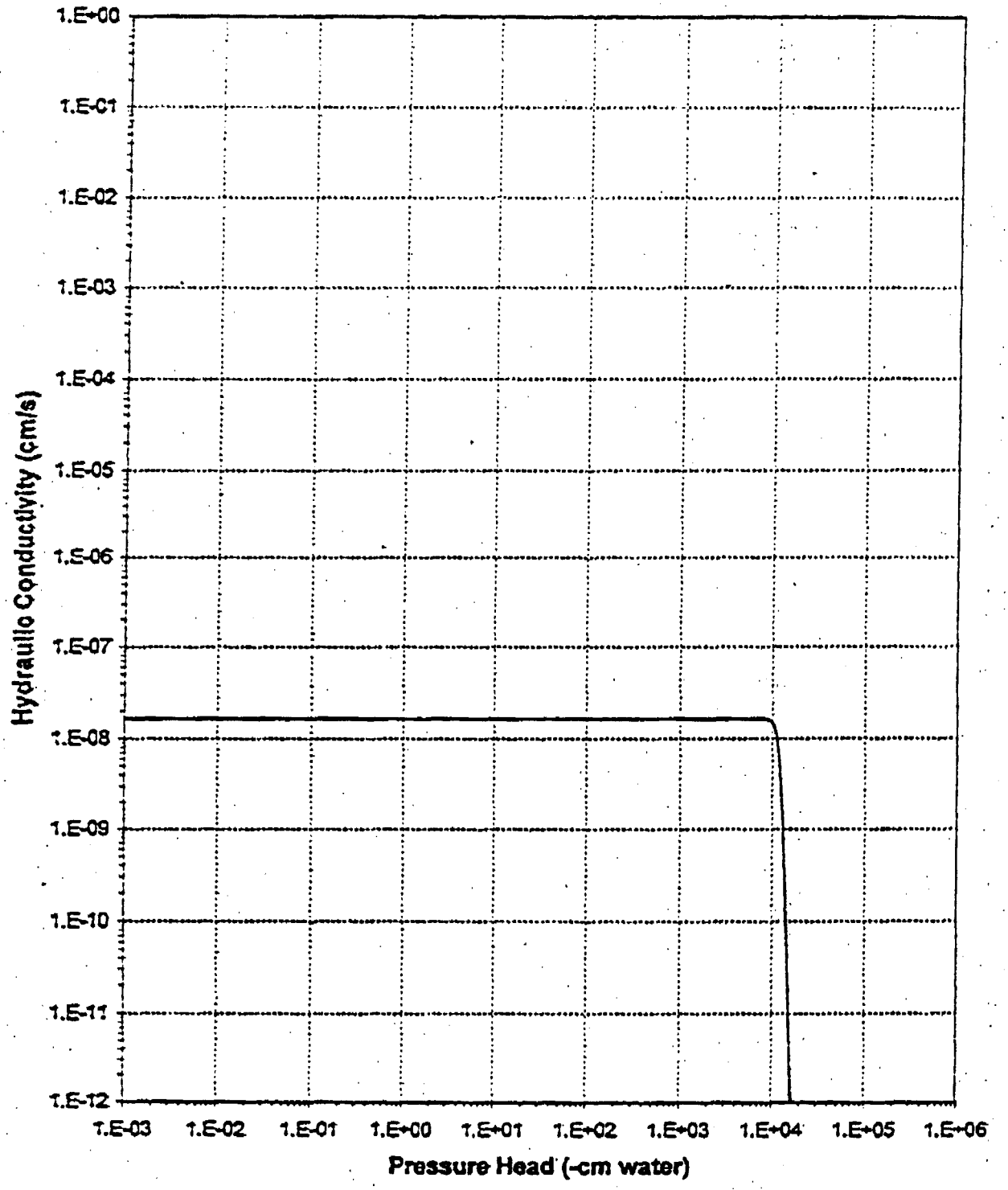
Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs. Pressure Head

Sample Number: RE16-98-0103



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample* (g):	176.25
Job Number:	8844.01	*Tare wt., screen & clamp* (g):	1.94
Sample Number:	RE16-98-0104	*Tare wt., ring* (g):	115.87
Ring Number:	RE16-98-0104	*Tare wt., epoxy* (g):	0.00
Depth:	NA	*Sample volume* (cm^3):	79.69

Saturated weight at 0 cm tension* (g): 301.45
Volume of water† in saturated sample (cm^3): 7.39
Saturated moisture content (% vol): 9.27

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	22-Dec-98 / 08:15	301.45	0.00	9.27
	26-Dec-98 / 10:55	300.92	54.70	8.61
	30-Dec-98 / 14:38	300.72	125.60	8.36
Pressure plate:	04-Jan-99 / 08:31	300.55	509.90	8.14

Dry weight of thermocouple sample* (g): 170.23
Tare weight, jar (g): 114.54
Sample bulk density (g/cm^3): 2.21

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	06-Jan-99 / 20:20	170.78	6730.7	2.18
	11-Jan-99 / 16:00	170.46	7546.5	0.91
	14-Jan-99 / 10:36	170.34	12849.5	0.44

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0104
Ring Number: RE16-98-0104
Depth: NA

Dry weight of relative humidity box sample* (g): 83.44
Tare weight (g): 37.09
Sample bulk density (g/cm^3): 2.21

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 14:55	83.53	839828	0.44

Comments:

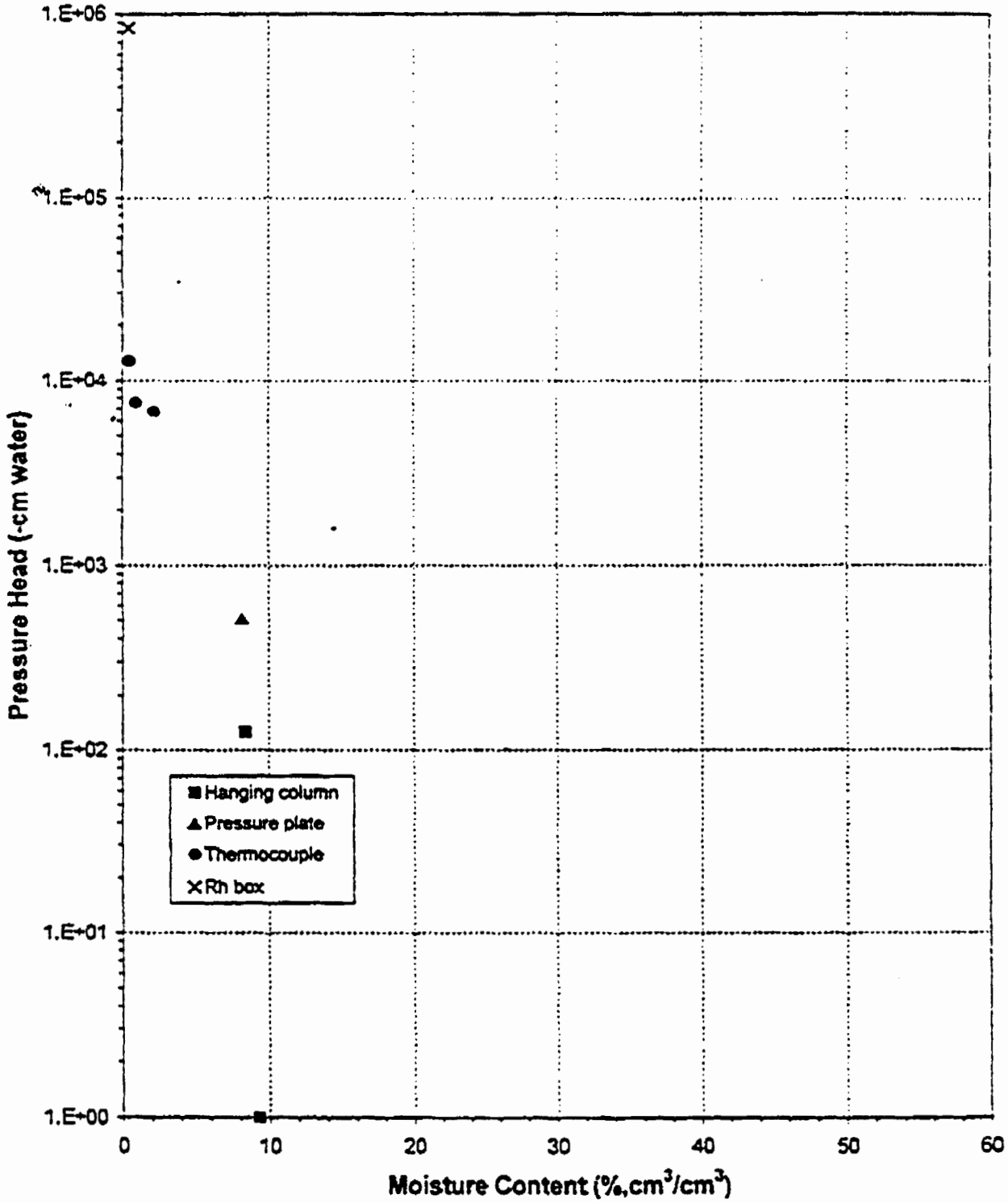
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Water Retention Data Points

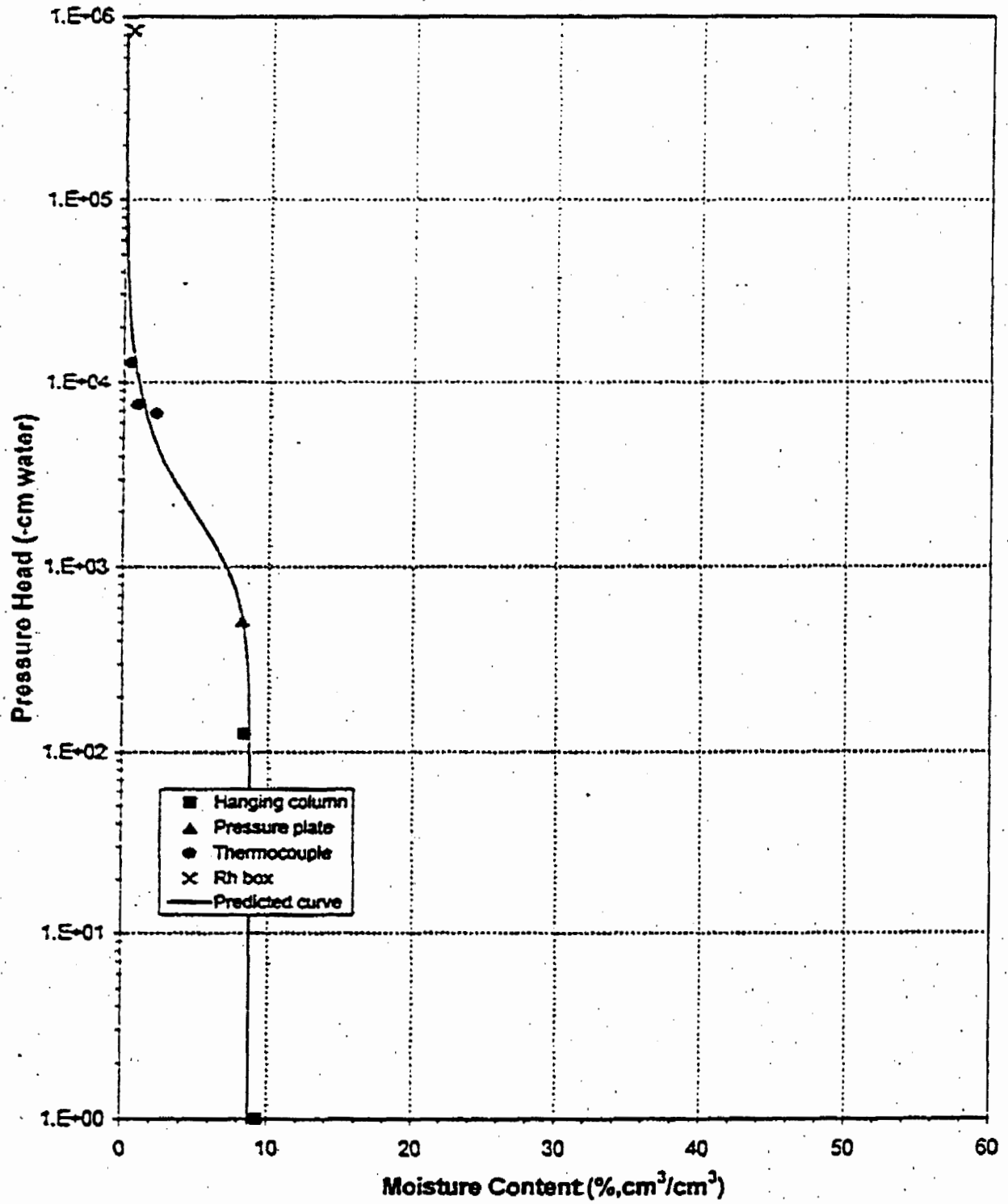
Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

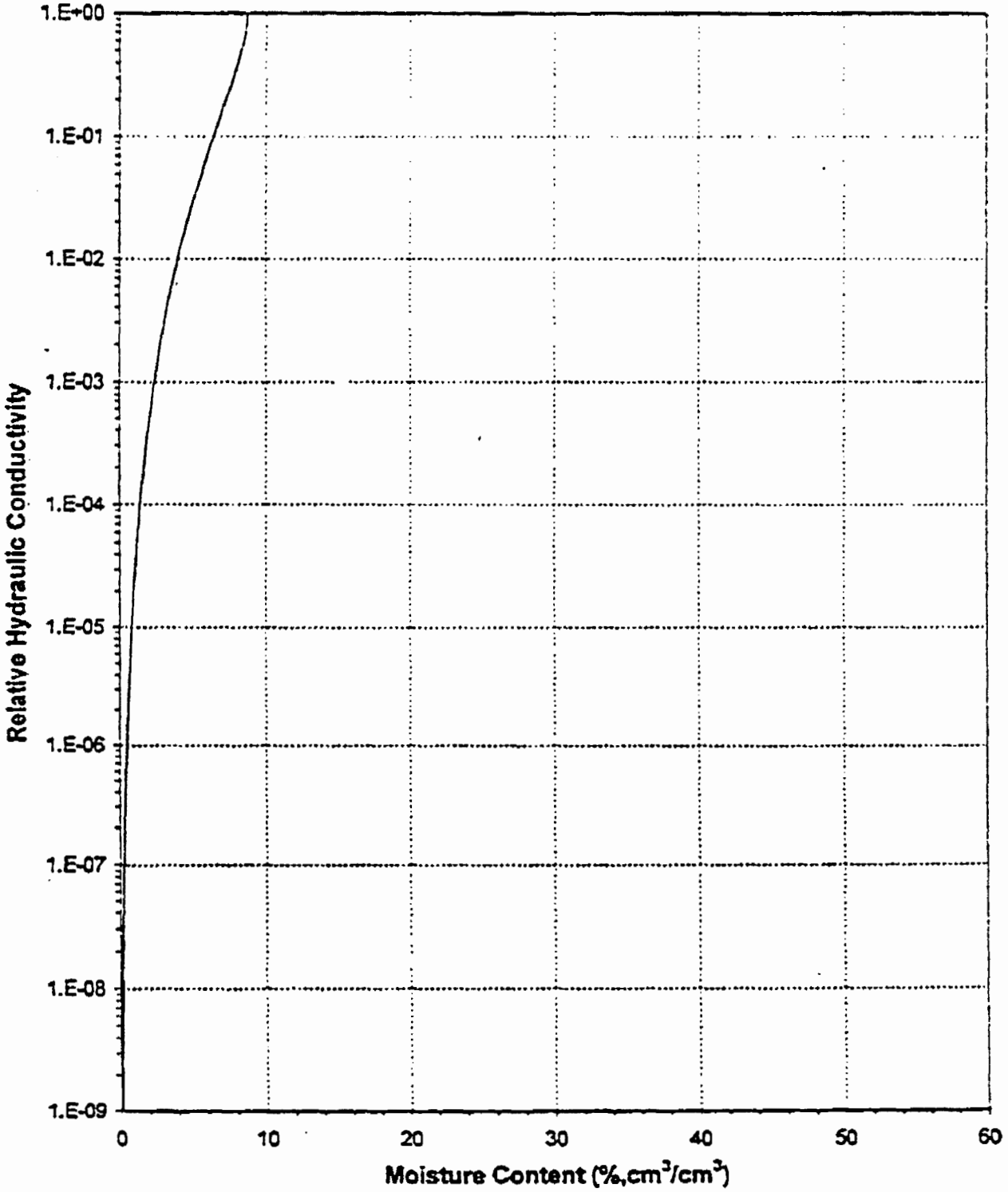
Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

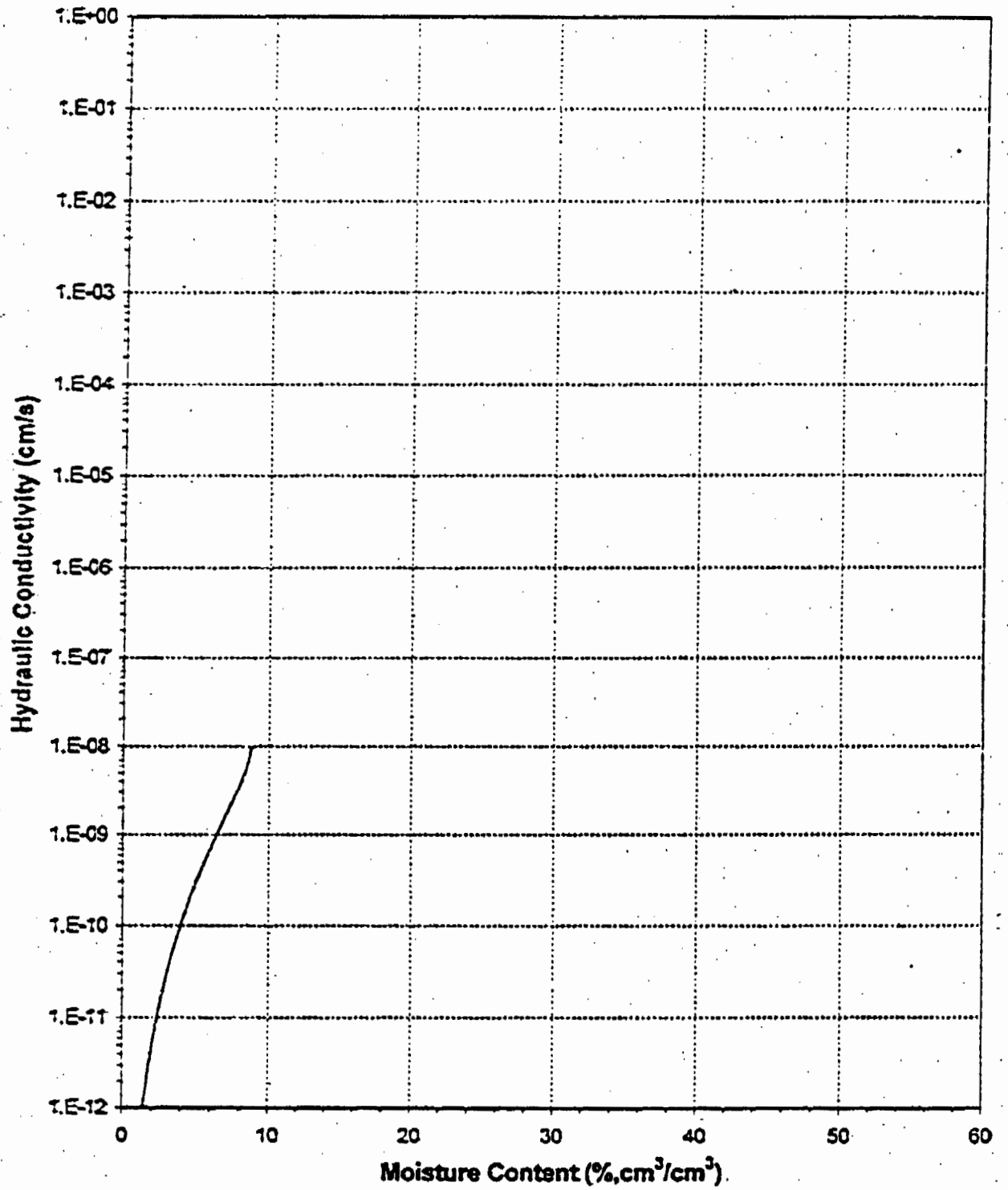
Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

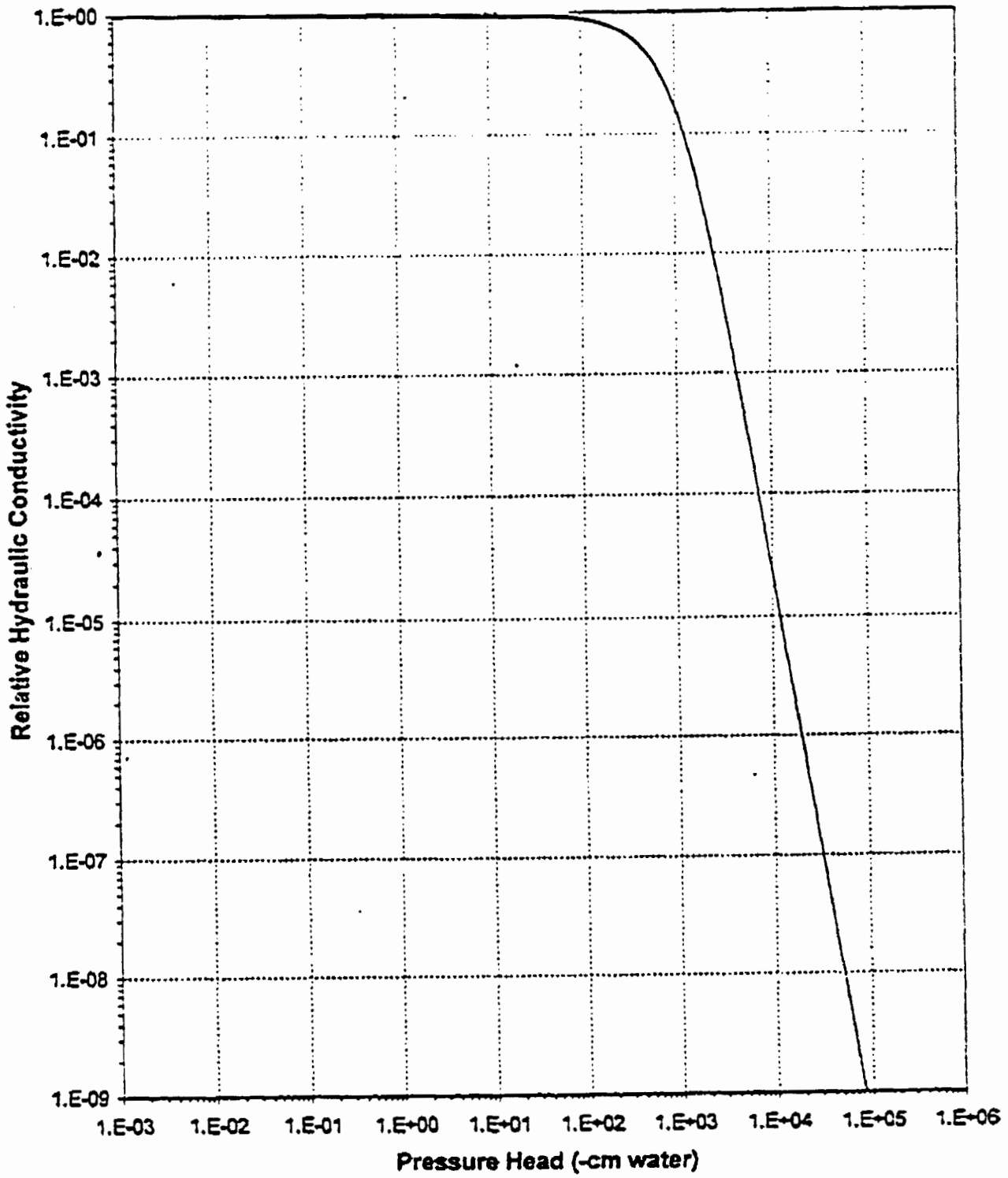
Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

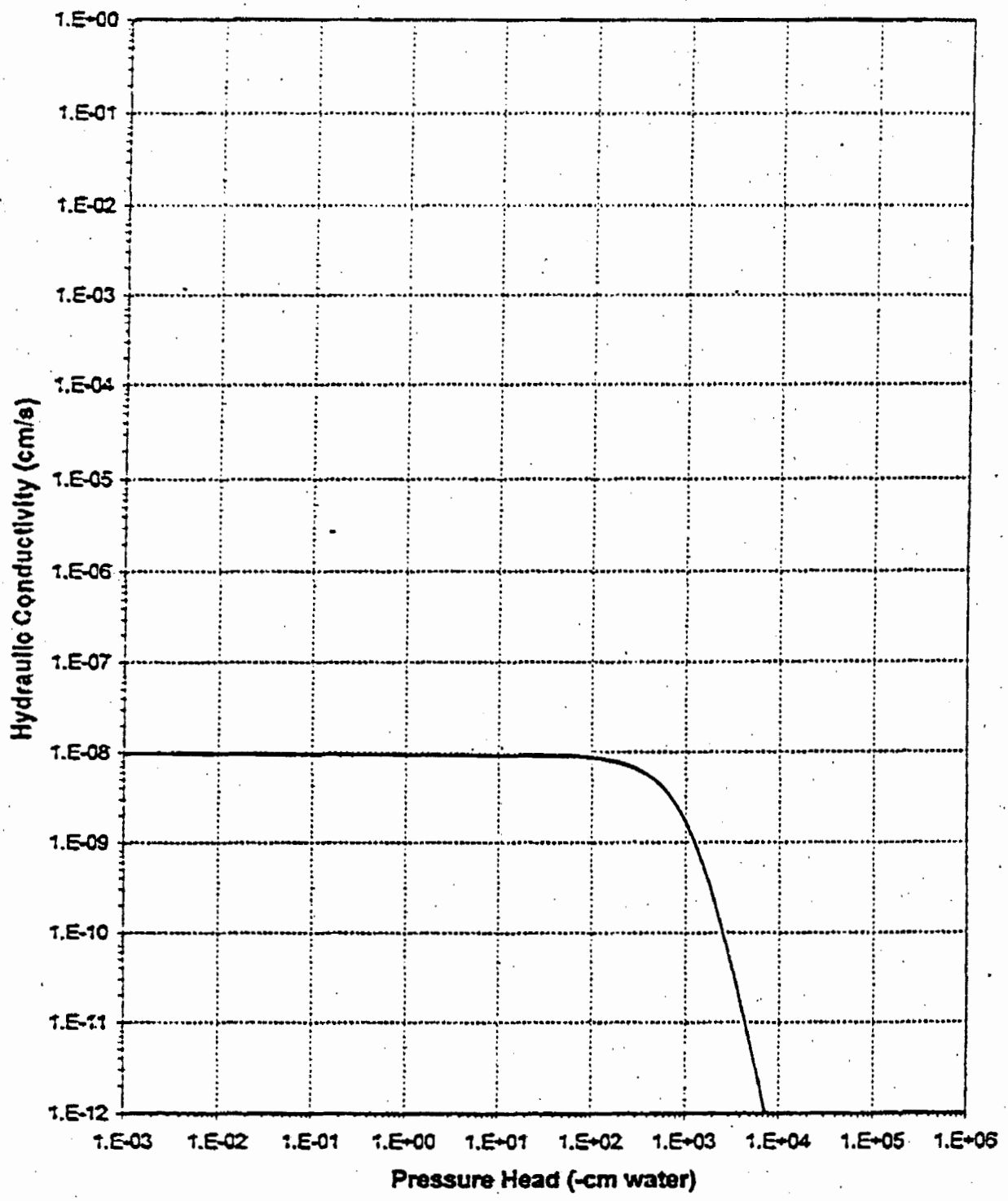
Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0104



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample* (g):	166.66
Job Number:	8844.01	*Tare wt., screen & clamp* (g):	1.99
Sample Number:	RE16-98-0105	*Tare wt., ring* (g):	81.86
Ring Number:	RE16-98-0105	*Tare wt., epoxy* (g):	37.15
Depth:	NA	*Sample volume* (cm^3):	77.09

Saturated weight at 0 cm tension* (g): 294.78
Volume of water† in saturated sample (cm^3): 7.12
Saturated moisture content (% vol): 9.24

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	11-Nov-98 / 11:30	294.78	0.00	9.24
	13-Nov-98 / 11:06	294.38	48.80	8.72
	16-Nov-98 / 14:45	294.00	129.80	8.22
Pressure plate:	30-Nov-98 / 11:15	293.42	509.90	7.47
	11-Dec-98 / 11:32	292.06	11727.70	5.71

Dry weight of thermocouple sample* (g): 192.88
Tare weight, jar (g): 111.64
Sample bulk density (g/cm^3): 2.16

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	12-Jan-99 / 12:10	194.17	11523.7	3.43
	14-Jan-99 / 10:41	194.04	14991.1	3.09
	12-Jan-99 / 09:48	193.57	21925.7	1.84

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, In

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0105
Ring Number: RE16-98-0105
Depth: NA

Dry weight of relative humidity box sample* (g): 65.66
Tare weight (g): 40.22
Sample bulk density (g/cm^3): 2.16

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 14:55	65.71	839828	0.42

Comments:

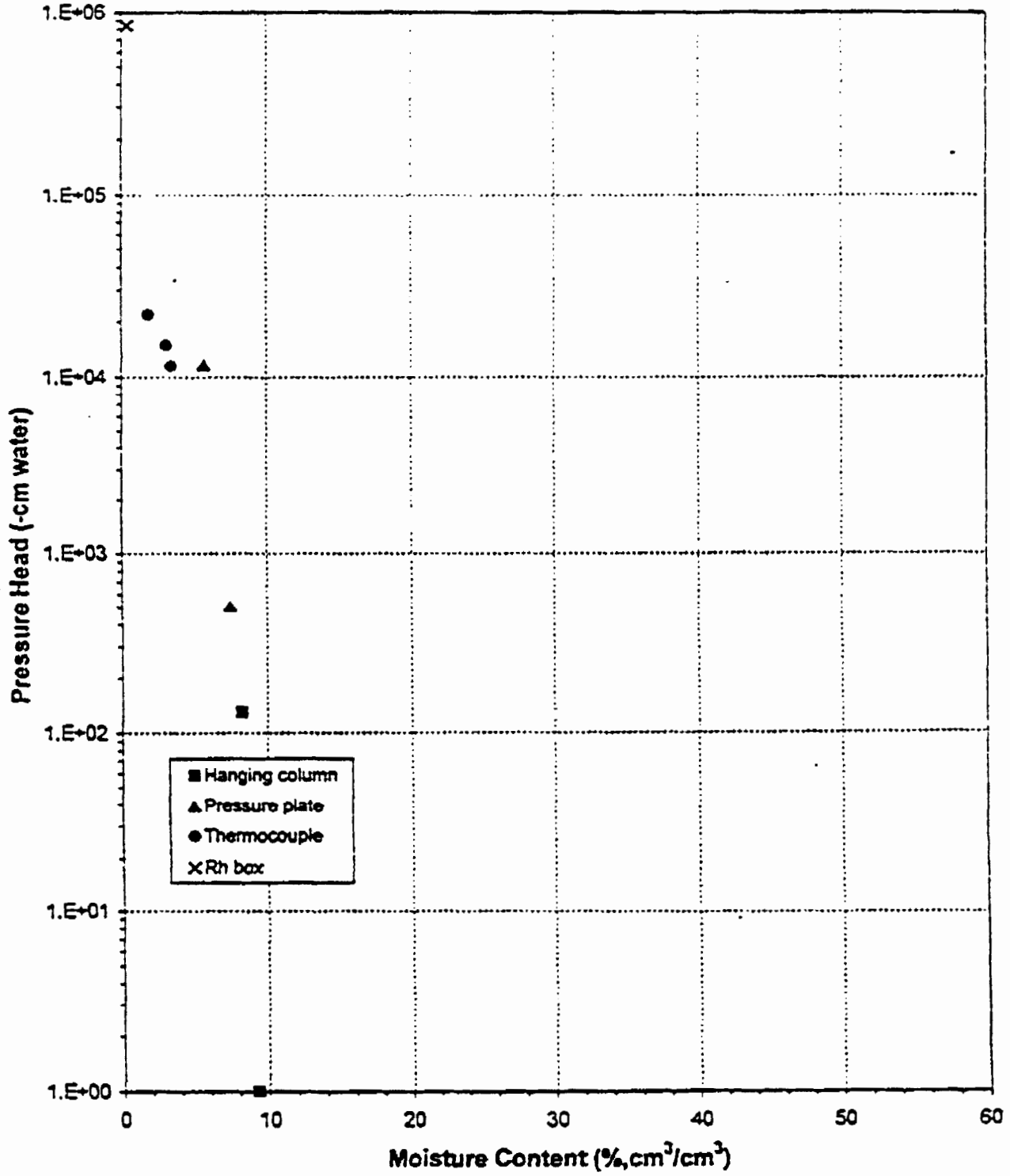
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Water Retention Data Points

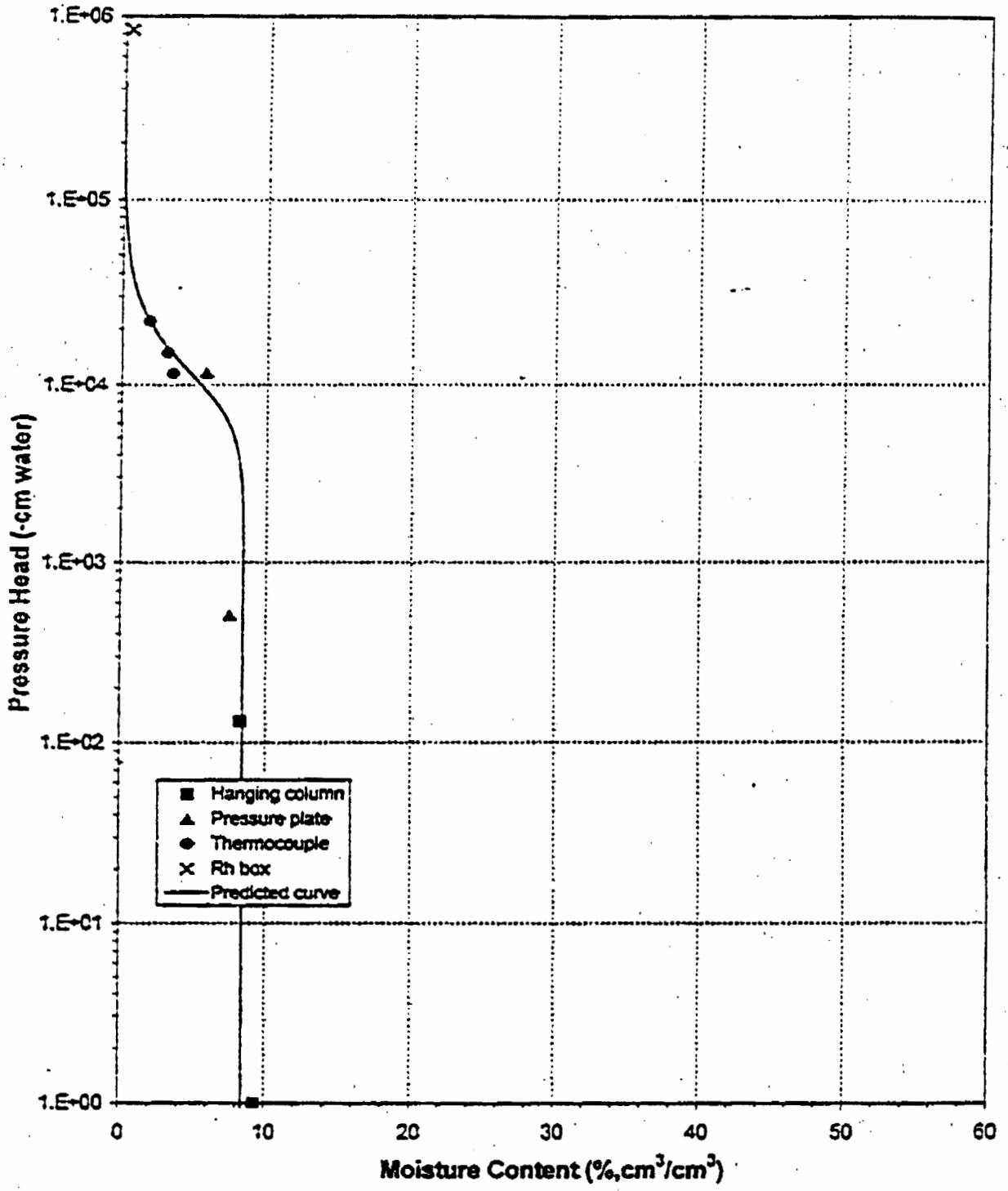
Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

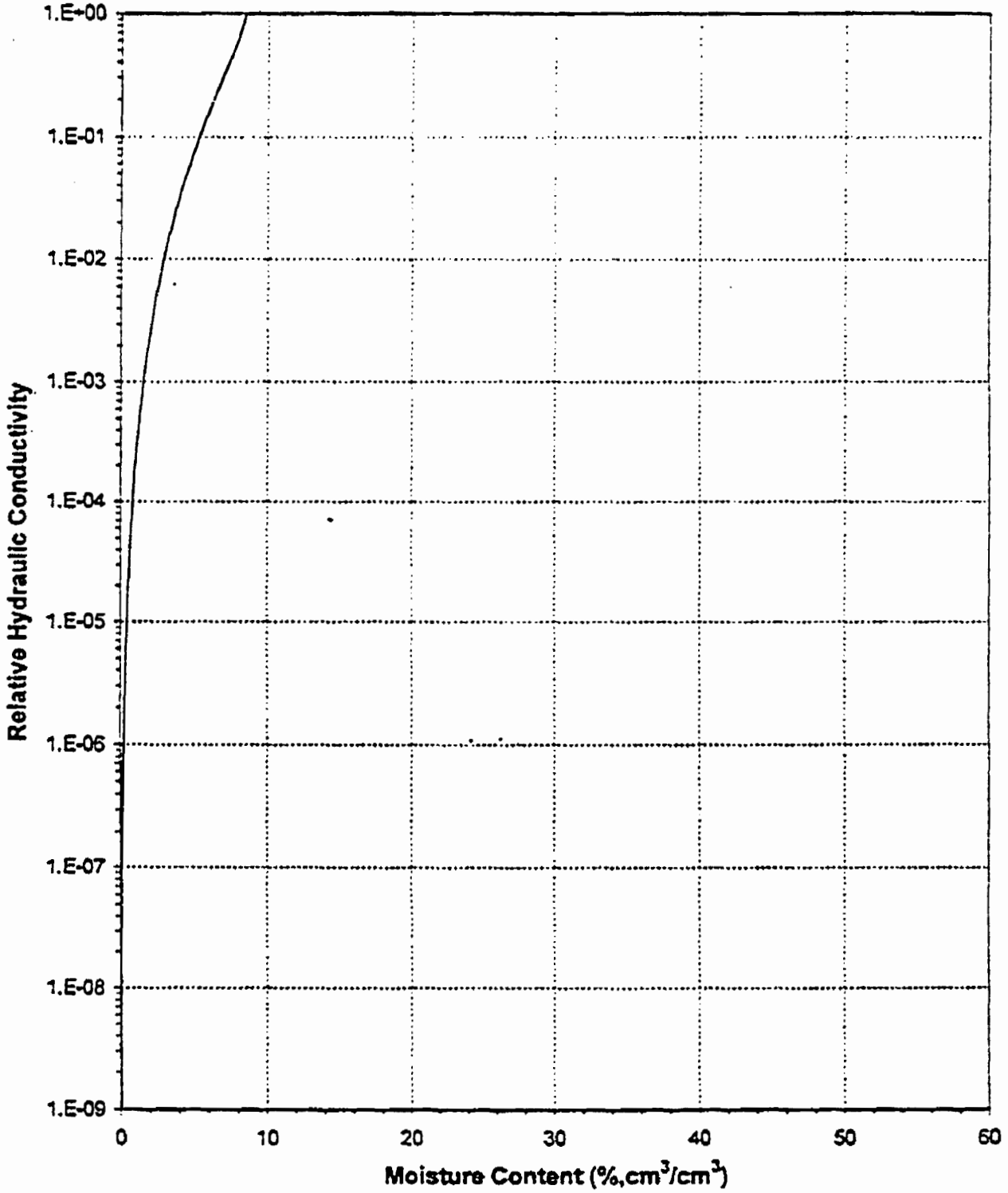
Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

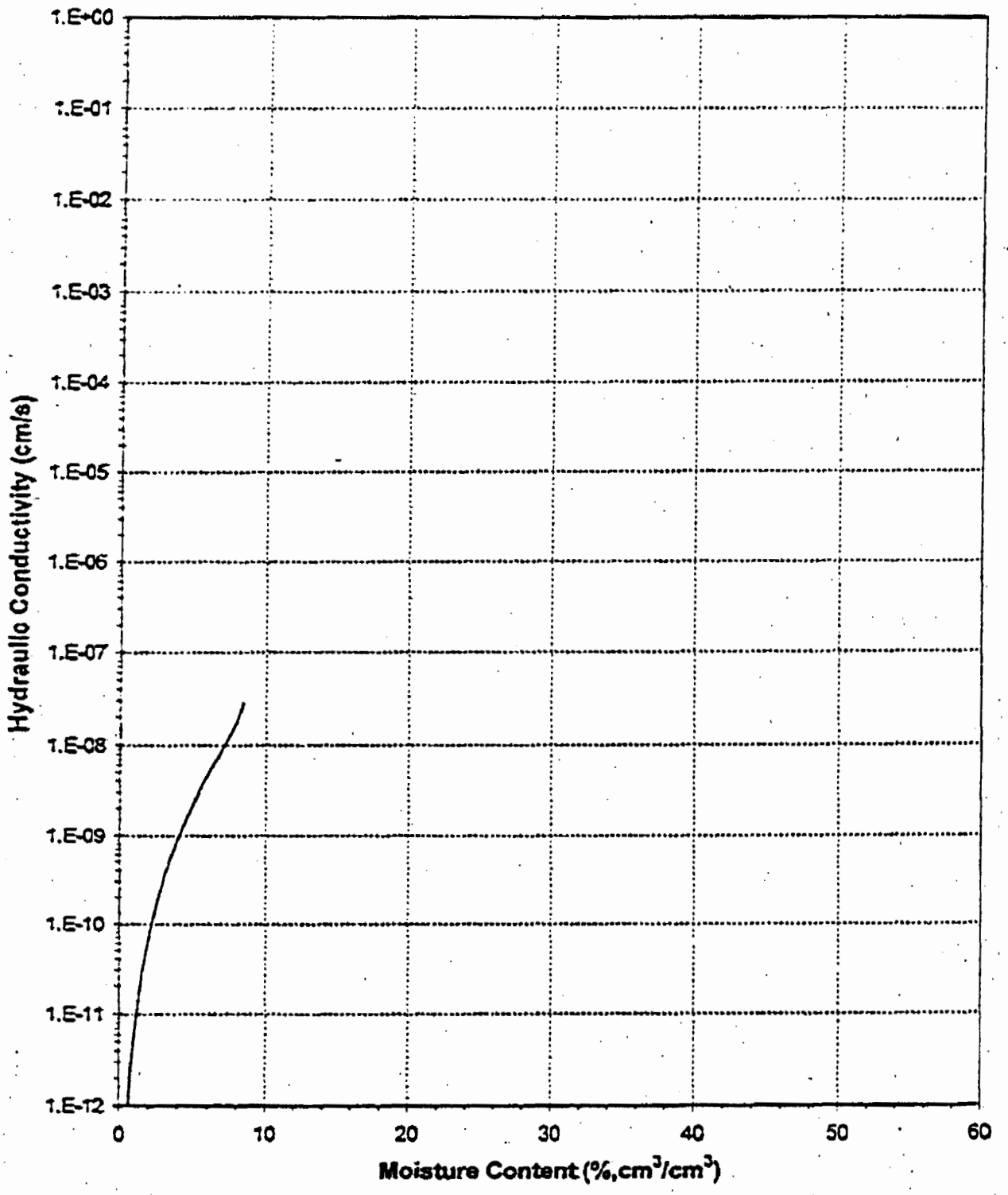
Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

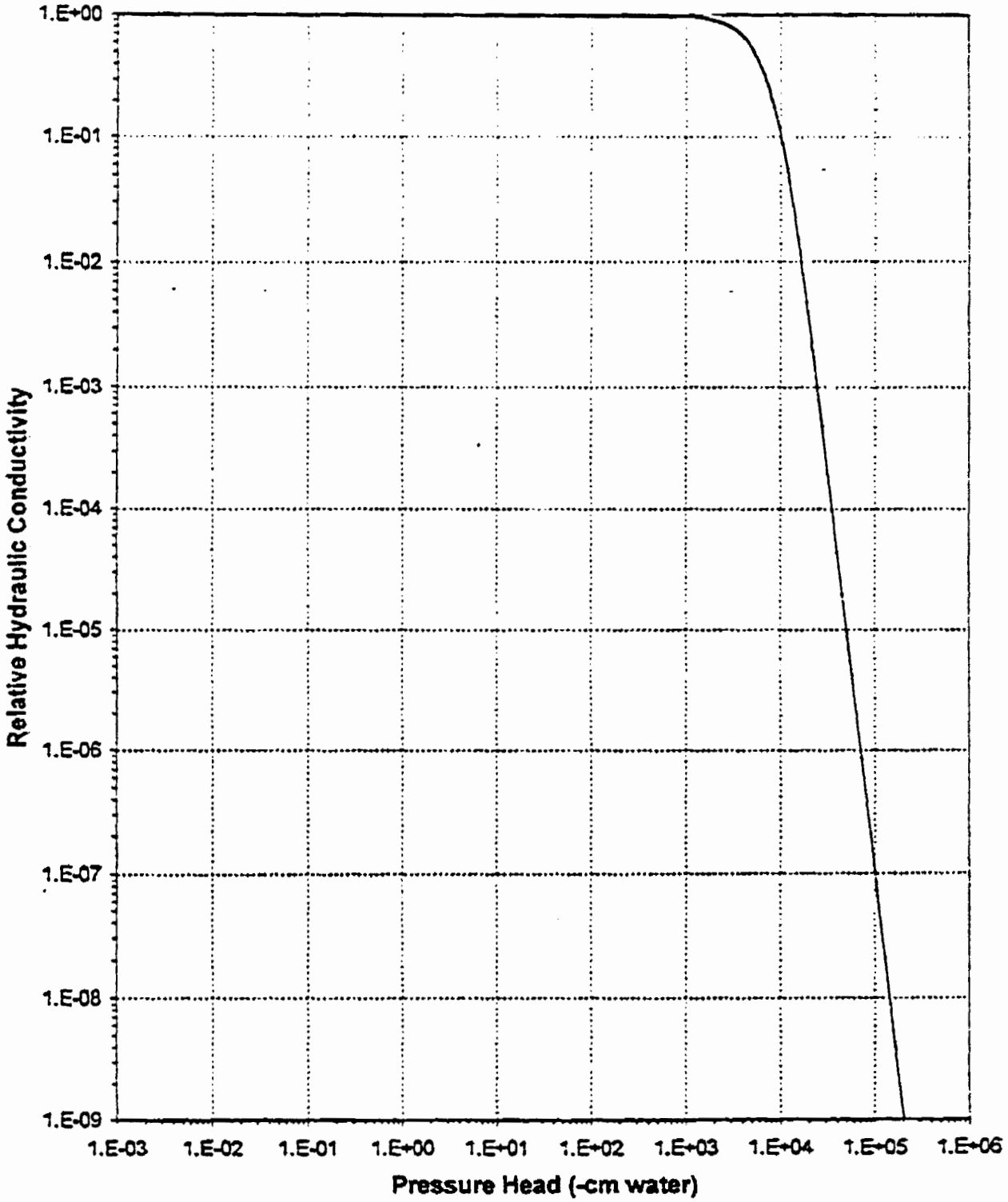
Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

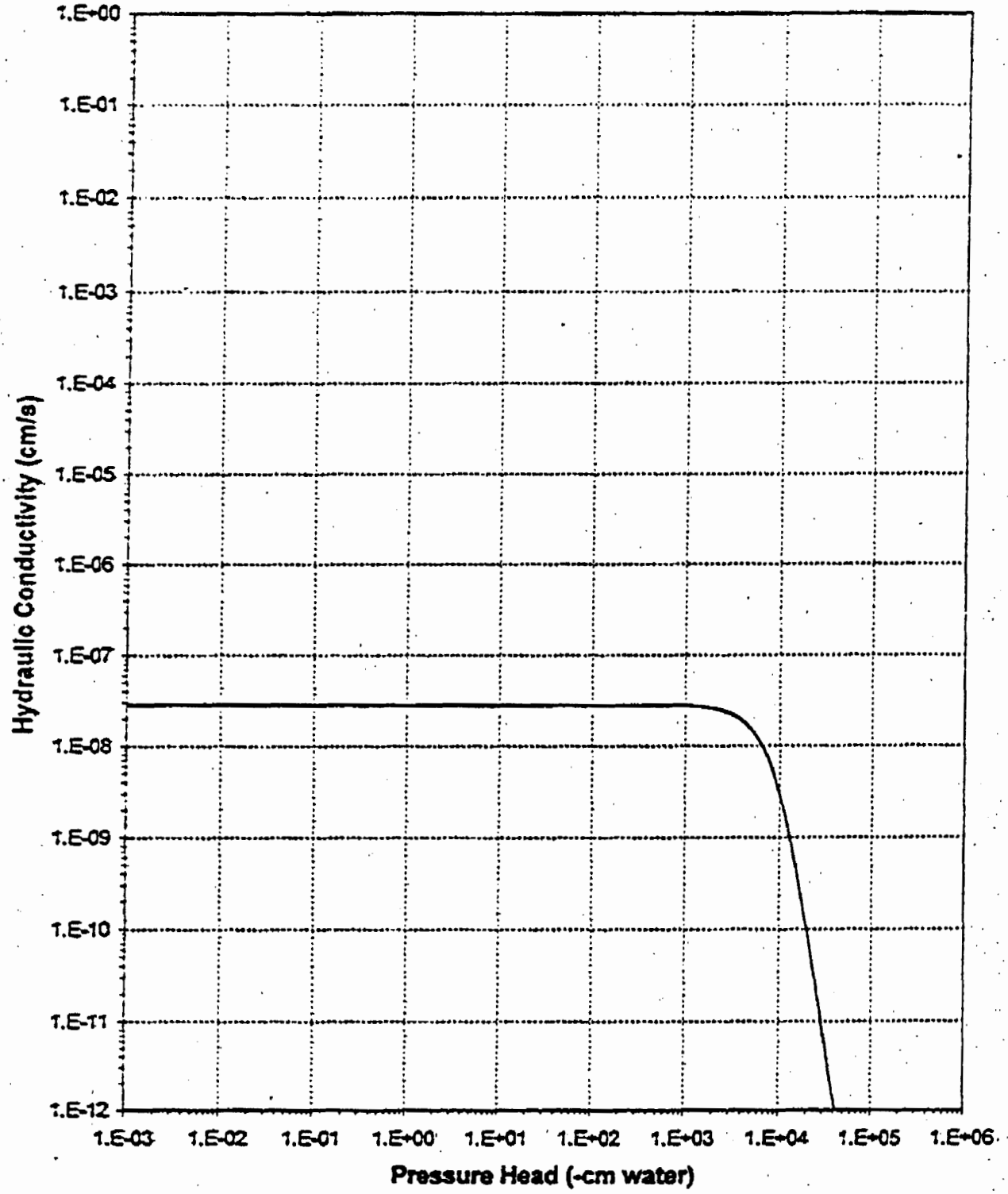
Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0105



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0106
Ring Number: RE16-98-0106
Depth: NA

Dry wt. of sample (g): 98.52
Tare wt., screen & clamp (g): 1.90
Tare wt., ring (g): 44.03
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 69.57

Saturated weight at 0 cm tension* (g): 172.43
Volume of water† in saturated sample (cm^3): 27.98
Saturated moisture content (% vol): 40.22

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	10-Nov-98 / 08:00	172.43	0.00	40.22
	13-Nov-98 / 11:02	168.22	16.80	34.17
	16-Nov-98 / 14:42	165.66	52.20	30.49
	20-Nov-98 / 14:30	161.35	156.90	24.29
Pressure plate:	30-Nov-98 / 11:10	156.90	509.90	17.90

Dry weight of thermocouple sample* (g): 168.54
Tare weight, jar (g): 113.31
Sample bulk density (g/cm^3): 1.42

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	19-Nov-98 / 12:25	170.66	6526.7	5.44

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0106
Ring Number: RE16-98-0106
Depth: NA

Dry weight of relative humidity box sample (g):* 57.01
Tare weight (g): 40.60
Sample bulk density (g/cm^3): 1.42

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	09-Nov-98 / 12:12	57.06	839828	0.43

Comments:

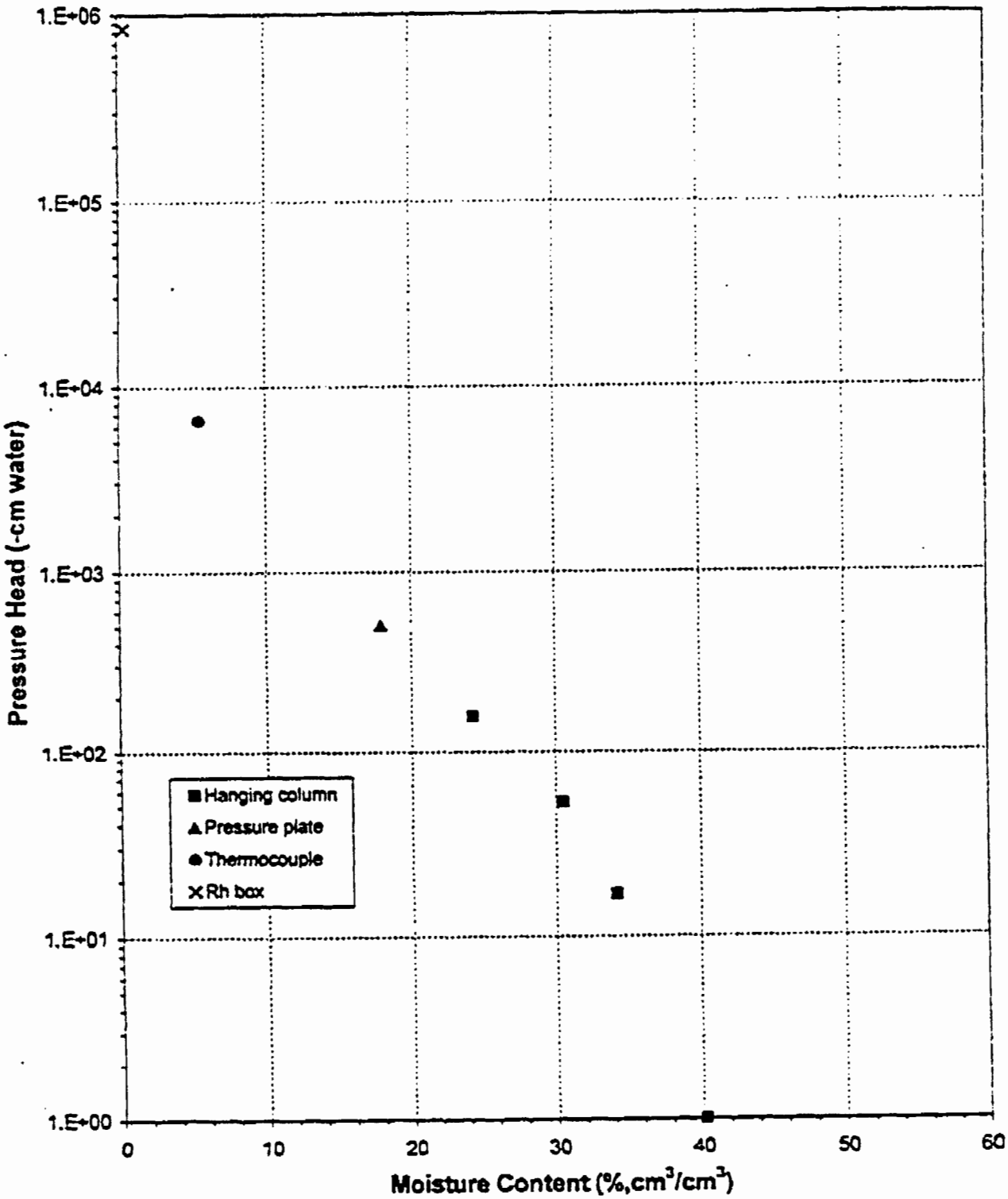
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

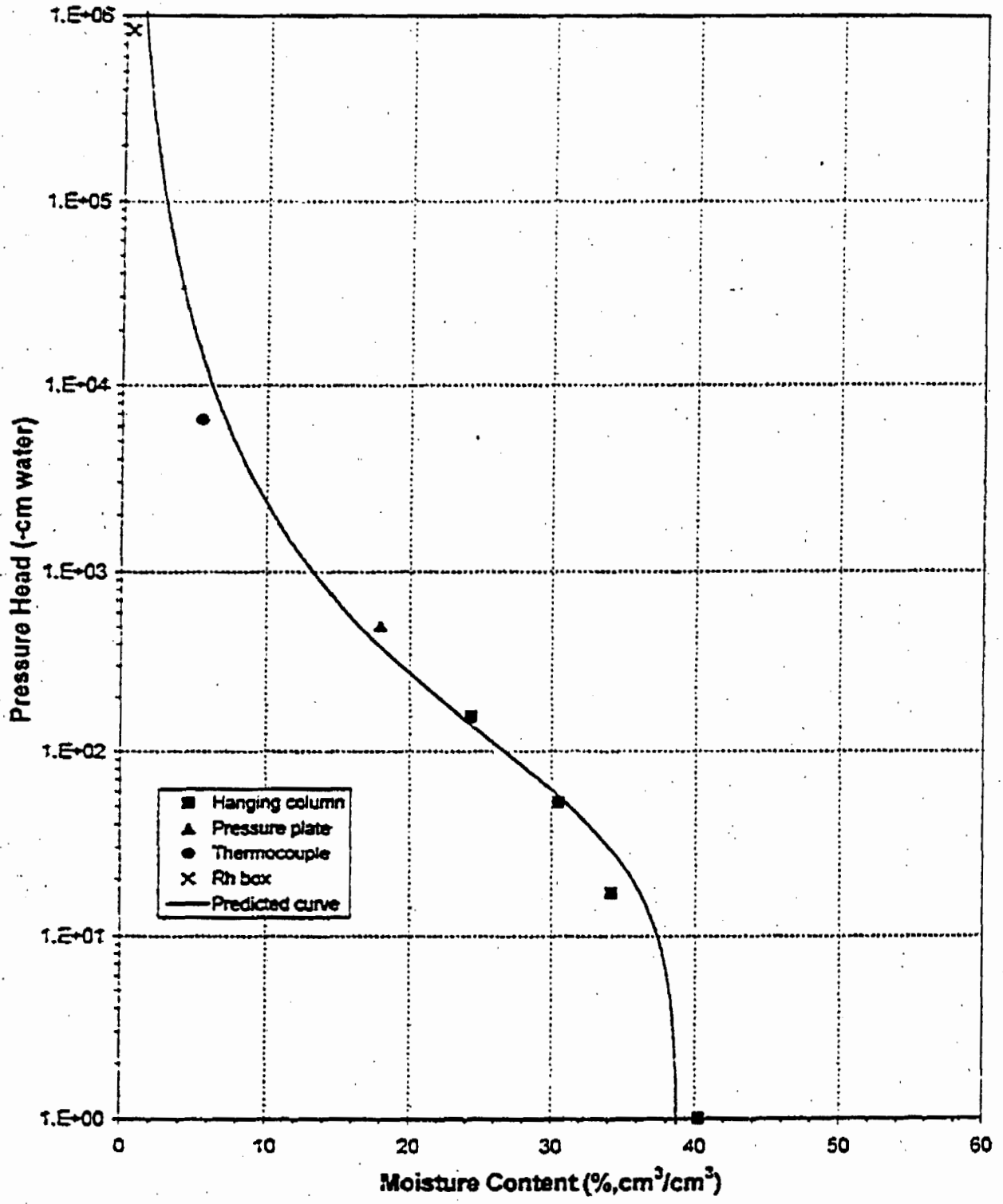
Water Retention Data Points

Sample Number: RE16-98-0106



Predicted Water Retention Curve and Data Points

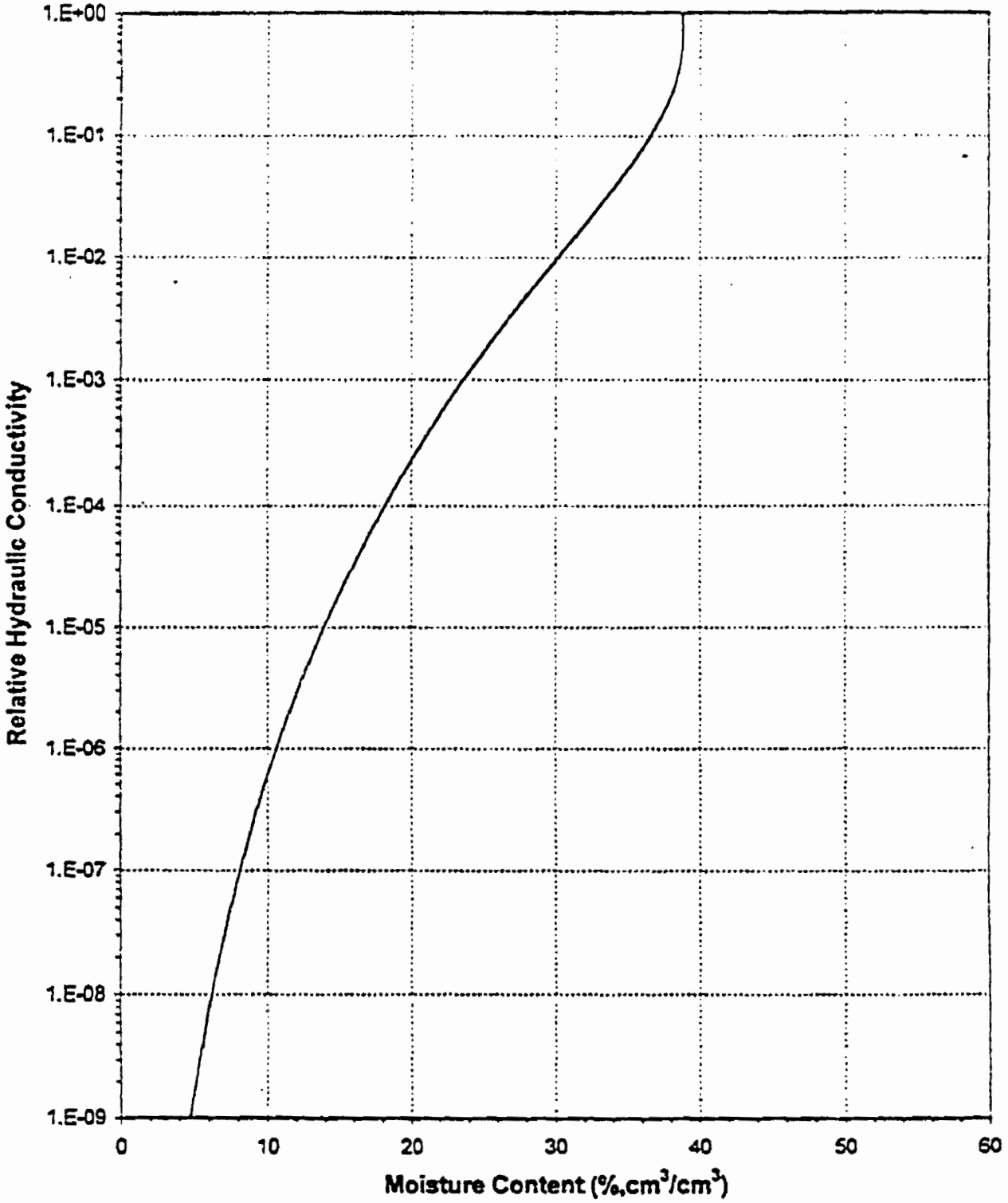
Sample Number: RE16-98-0106



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

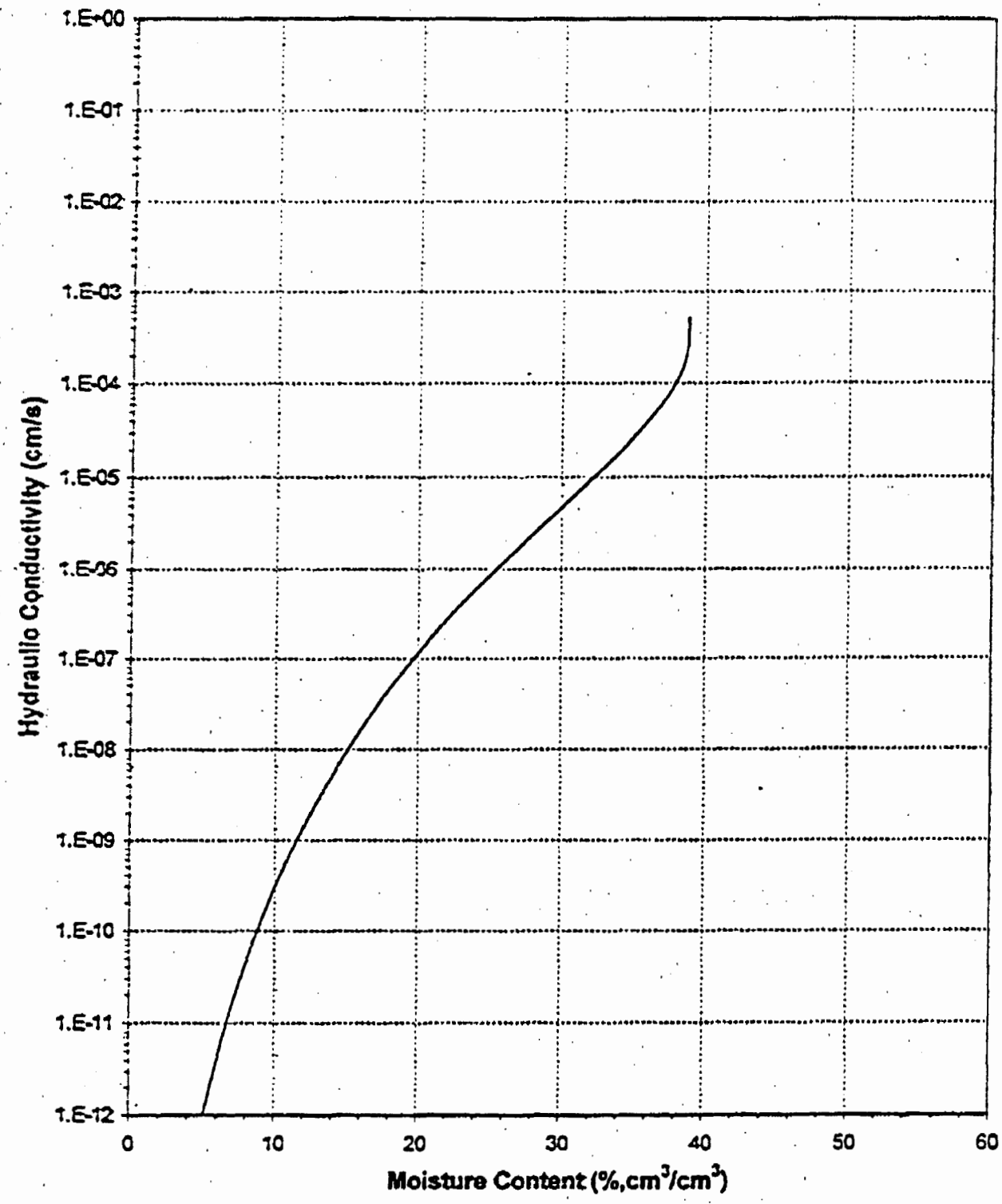
Sample Number: RE16-98-0106



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

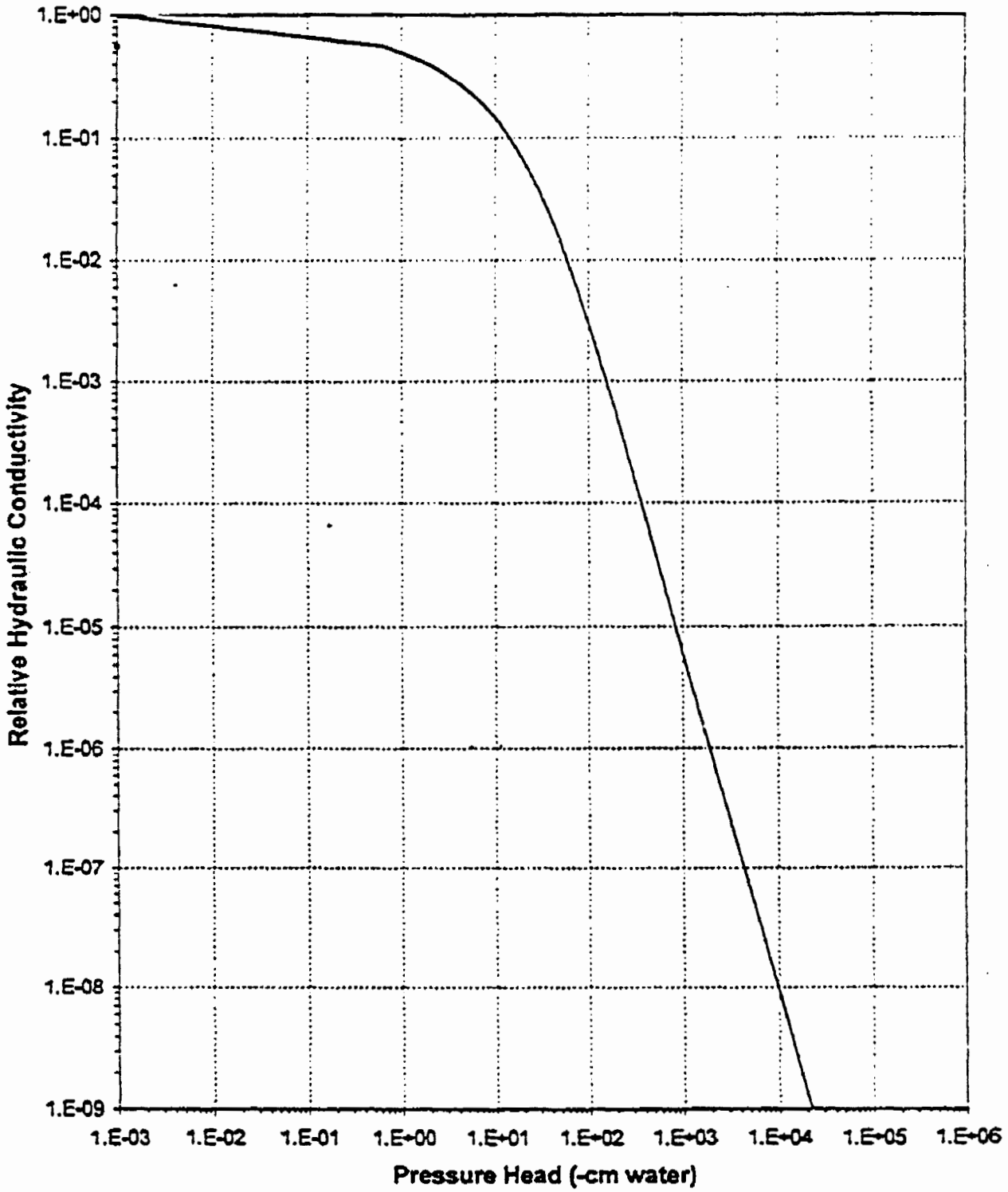
Sample Number: RE16-98-0106



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

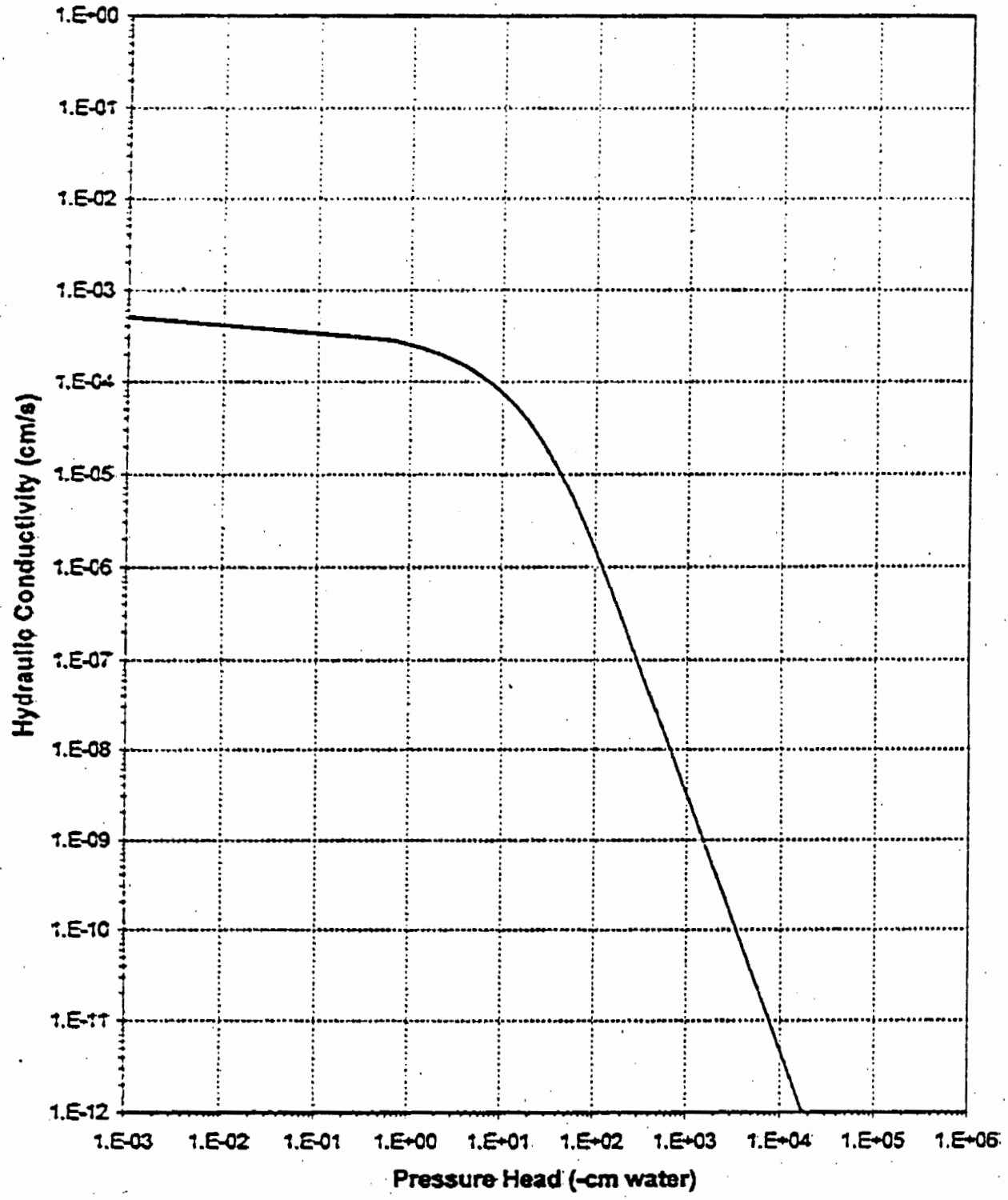
Sample Number: RE16-98-0106



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0106



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Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample (g):*	122.36
Job Number:	8844.01	*Tare wt., screen & clamp (g):*	2.40
Sample Number:	RE16-98-0107	*Tare wt., ring (g):*	122.04
Ring Number:	RE16-98-0107	*Tare wt., epoxy (g):*	0.00
Depth:	NA	*Sample volume (cm^3):*	71.67

Saturated weight at 0 cm tension (g):* 266.84
Volume of water† in saturated sample (cm^3): 20.04
Saturated moisture content (% vol): 27.96

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	11-Nov-98 / 11:45	266.84	0.00	27.96
	16-Nov-98 / 14:51	266.70	22.00	27.77
	20-Nov-98 / 14:36	266.19	55.60	27.06
	23-Nov-98 / 12:30	265.77	158.70	26.47
Pressure plate:	30-Nov-98 / 11:15	263.65	509.90	23.51
	11-Dec-98 / 11:33	258.22	11727.70	15.93

Dry weight of thermocouple sample (g):* 167.68
Tare weight, jar (g): 112.81
Sample bulk density (g/cm^3): 1.71

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	06-Jan-99 / 14:15	170.66	6424.7	9.27
	06-Jan-99 / 20:25	168.27	15908.9	1.84

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0107
Ring Number: RE16-98-0107
Depth: NA

Dry weight of relative humidity box sample* (g): 84.76
Tare weight (g): 46.36
Sample bulk density (g/cm^3): 1.71

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 15:00	84.86	839828	0.45

Comments:

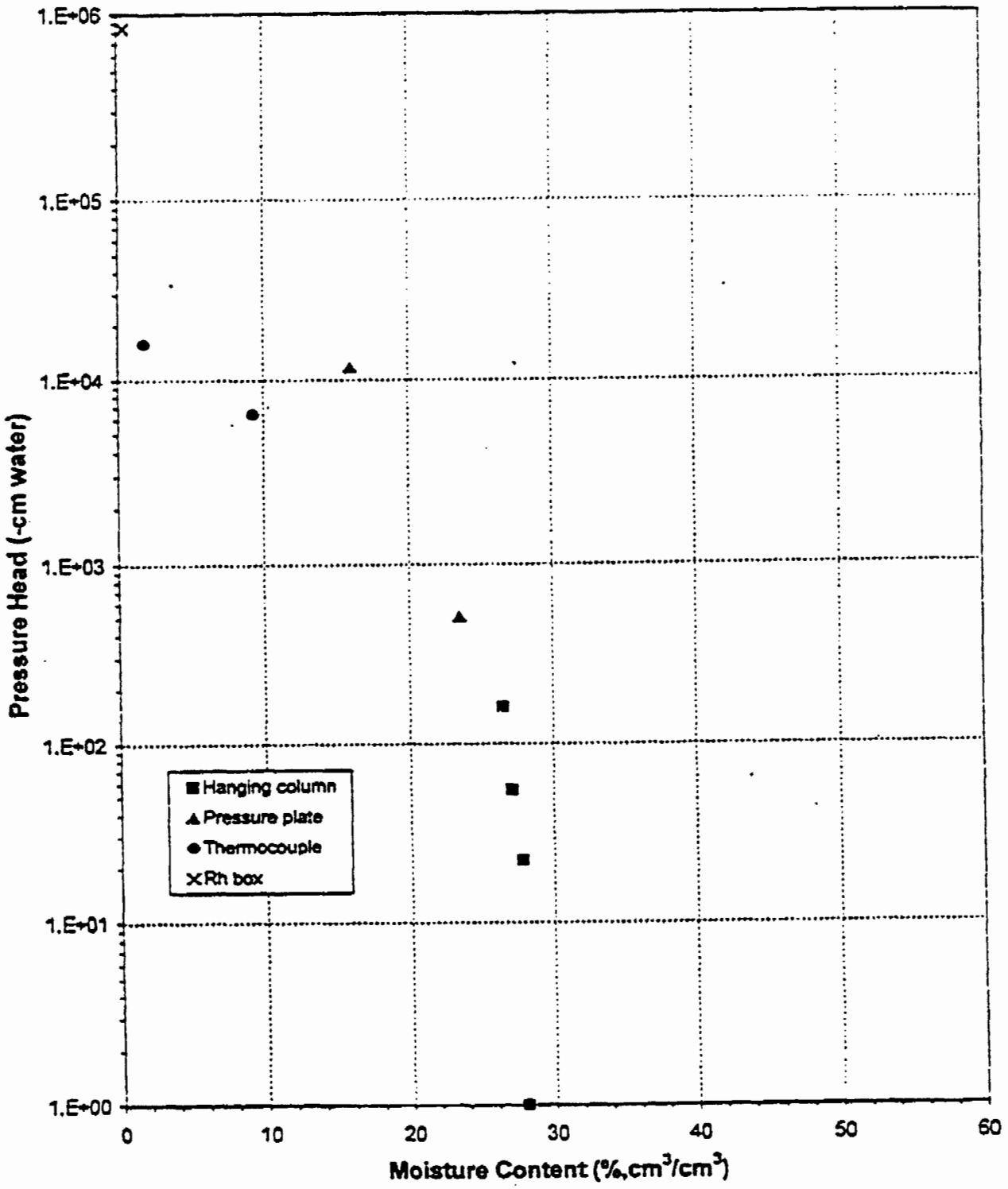
* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Water Retention Data Points

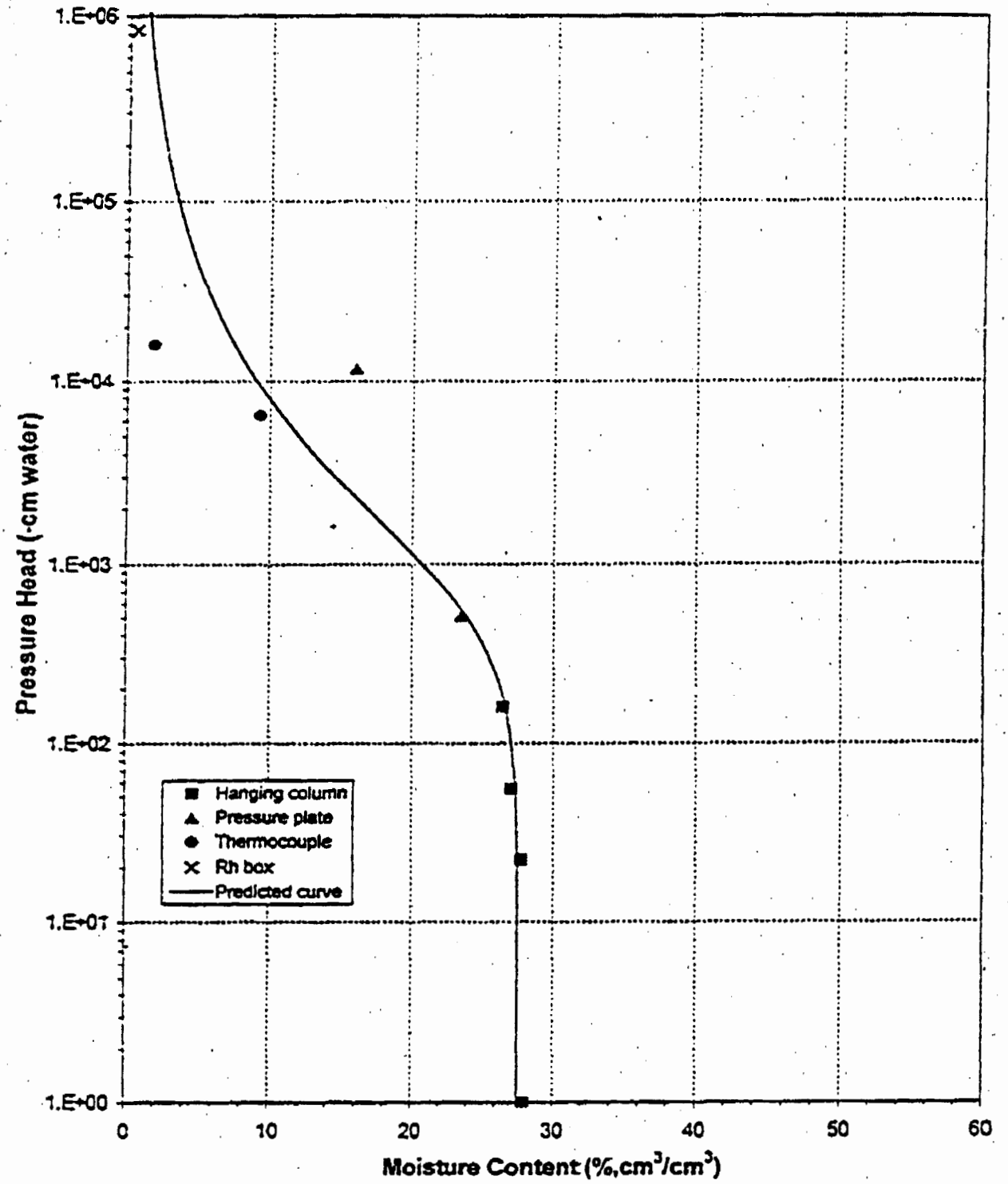
Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Predicted Water Retention Curve and Data Points

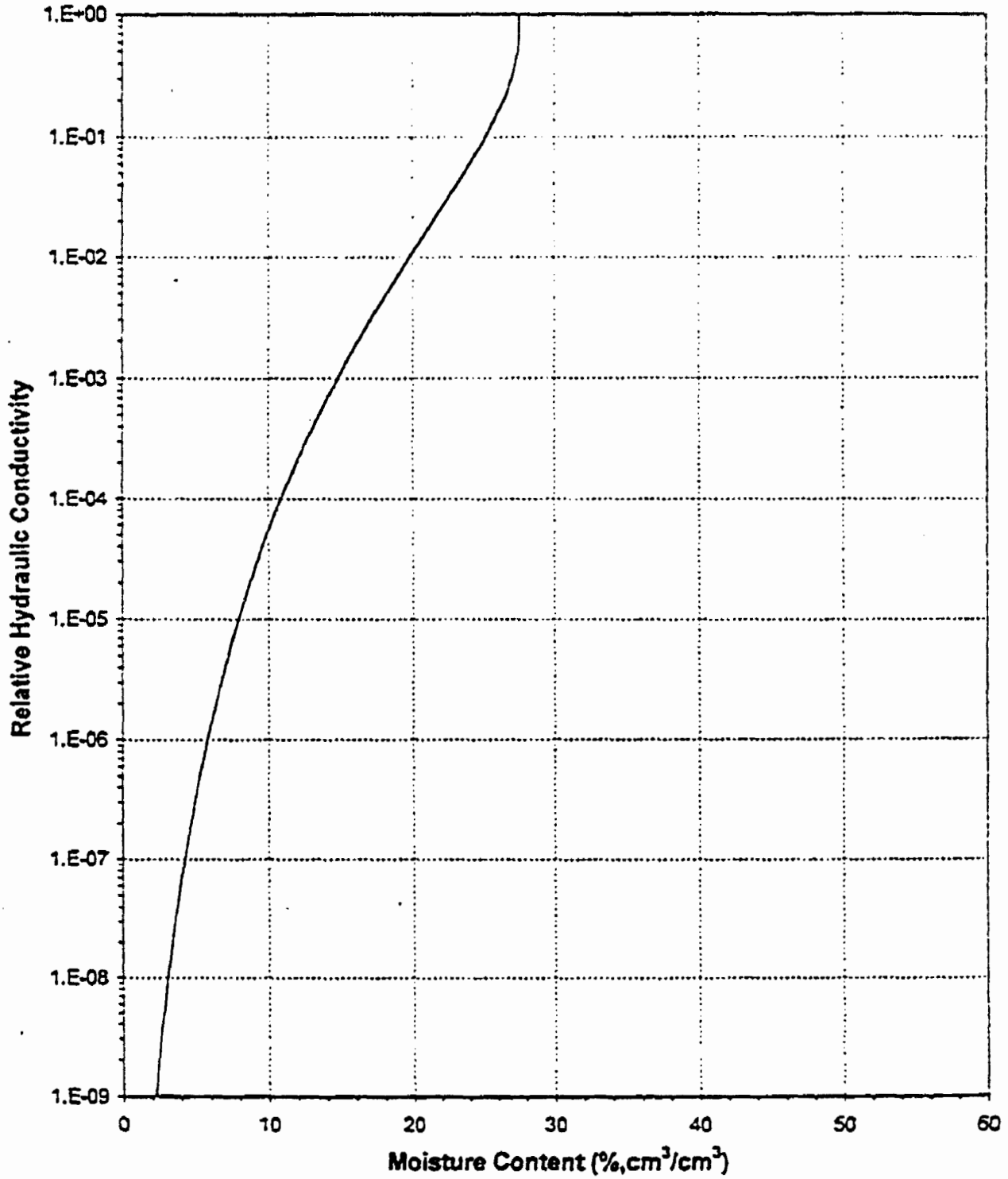
Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

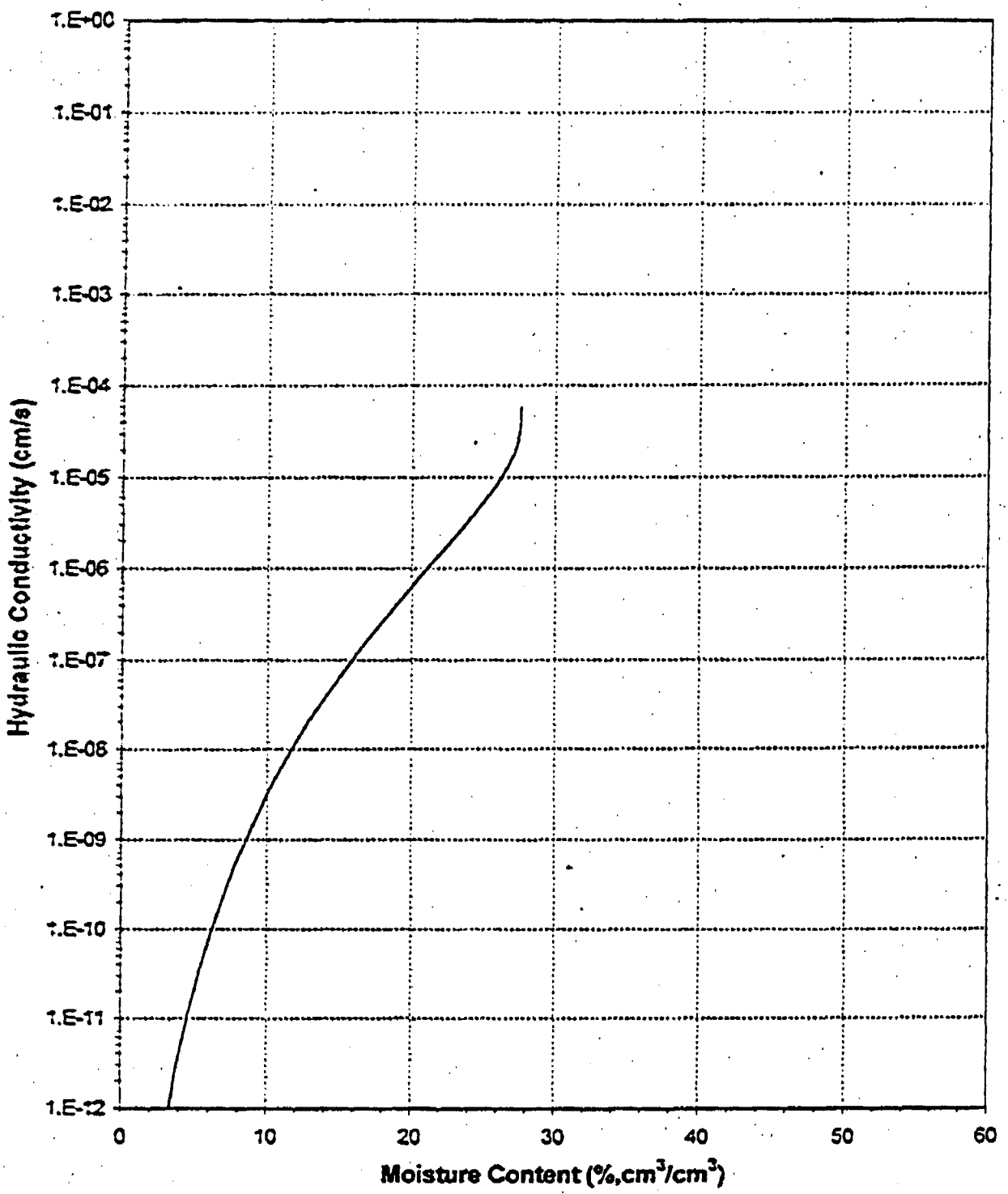
Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

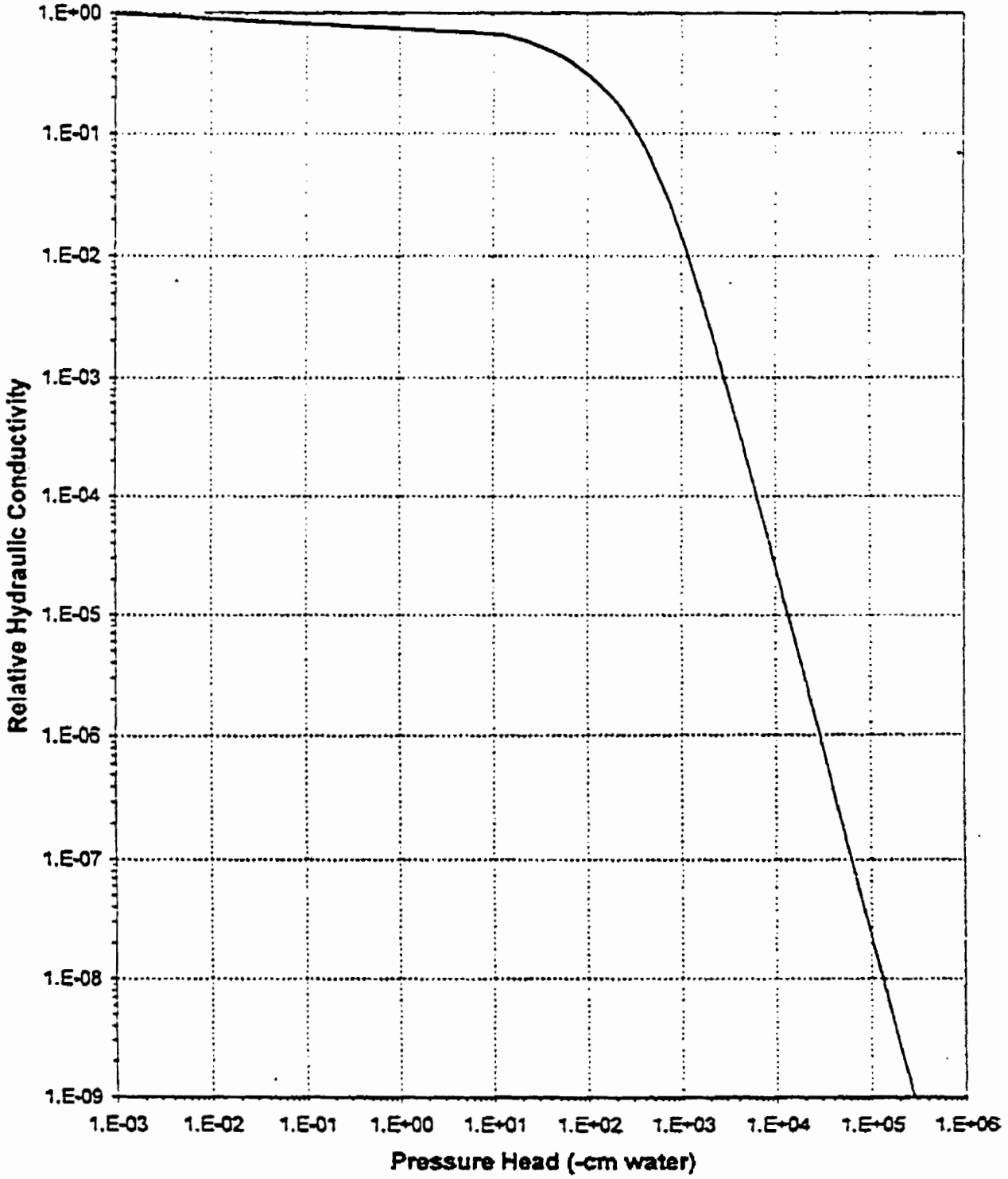
Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

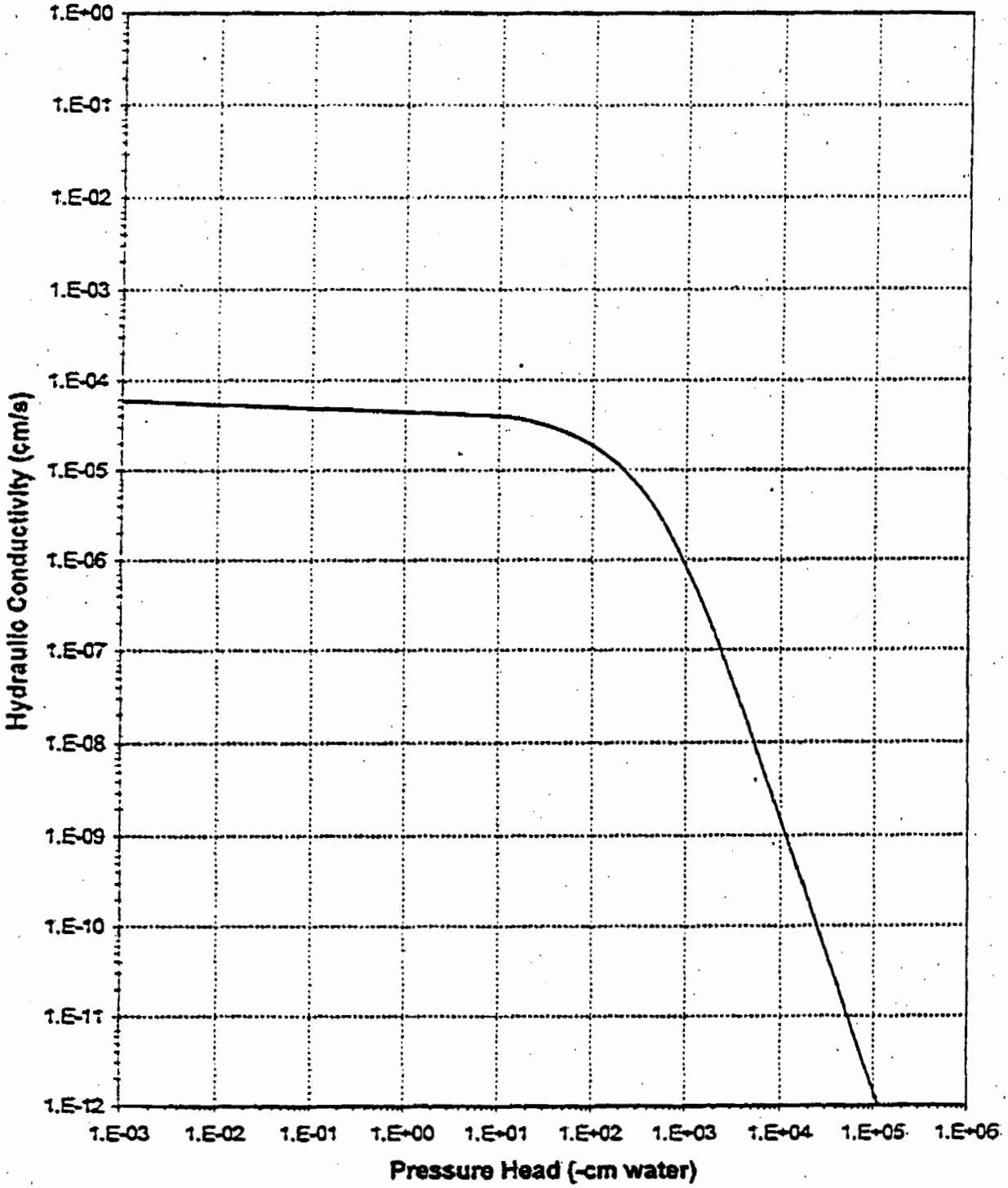
Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0107



Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name:	LANL	*Dry wt. of sample* (g):	159.73
Job Number:	8844.01	*Tare wt., screen & clamp* (g):	1.87
Sample Number:	RE16-98-0108	*Tare wt., ring* (g):	120.40
Ring Number:	RE16-98-0108	*Tare wt., epoxy* (g):	0.00
Depth:	NA	*Sample volume* (cm^3):	73.53

Saturated weight at 0 cm tension* (g): 288.25
Volume of water† in saturated sample (cm^3): 6.25
Saturated moisture content (% vol): 8.50

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	11-Nov-98 / 15:30	288.25	0.00	8.50
	13-Nov-98 / 11:15	287.77	51.00	7.85
	16-Nov-98 / 14:55	287.39	127.30	7.33
Pressure plate:	30-Nov-98 / 11:10	287.29	509.90	7.19
	11-Dec-98 / 11:30	286.59	11727.70	6.24

Dry weight of thermocouple sample* (g): 185.88
Tare weight, jar (g): 112.93
Sample bulk density (g/cm^3): 2.17

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Thermocouple:	14-Jan-99 / 18:37	186.33	16724.7	1.34

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: A. Stewart/T. Gere
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.

Moisture Retention Data

Relative Humidity Box

(Main Drainage Curve)

Job Name: LANL
Job Number: 8844.01
Sample Number: RE16-98-0108
Ring Number: RE16-98-0108
Depth: NA

Dry weight of relative humidity box sample* (g): 102.13
Tare weight (g): 39.84
Sample bulk density (g/cm^3): 2.17

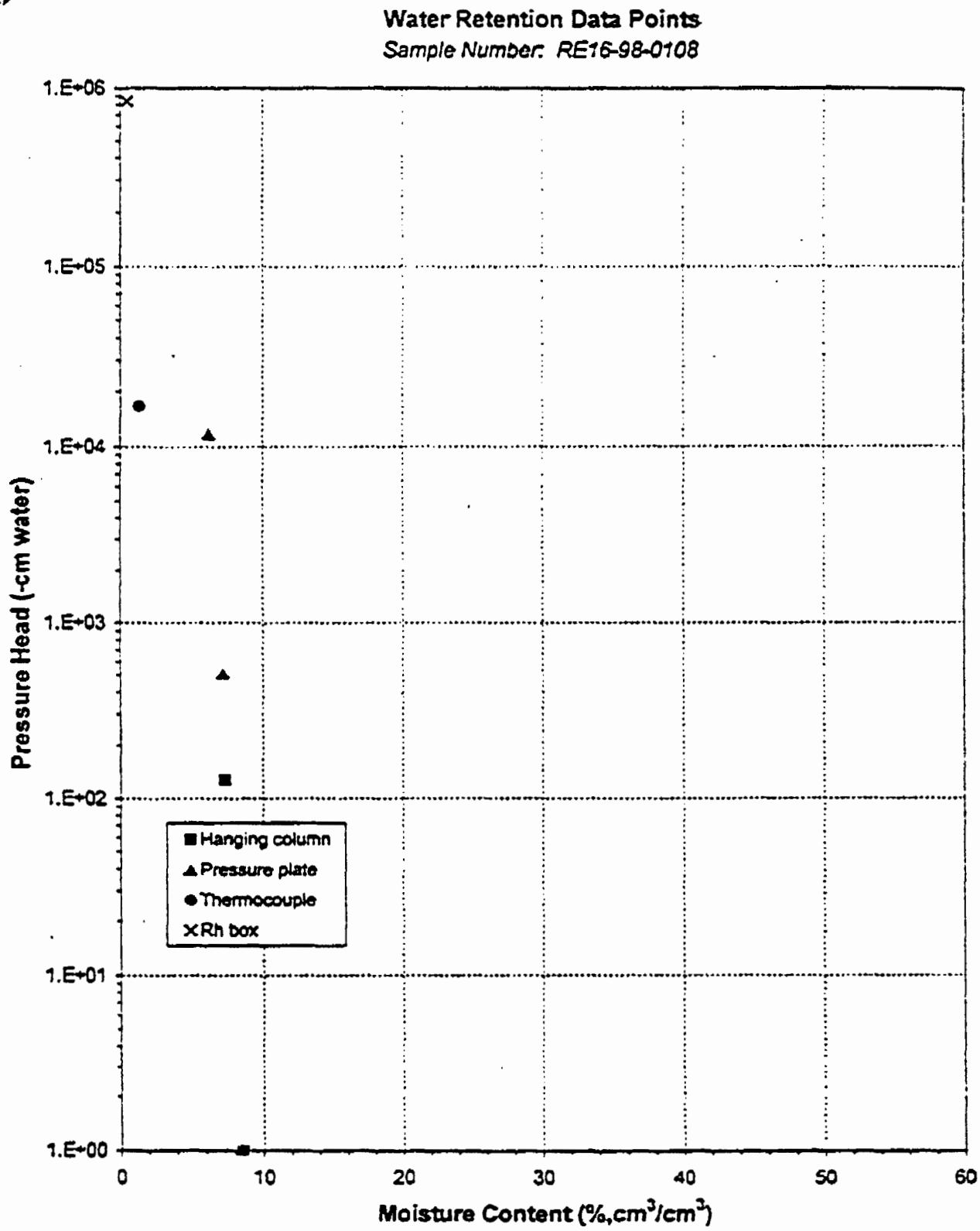
	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	02-Dec-98 / 14:55	102.27	839828	0.50

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

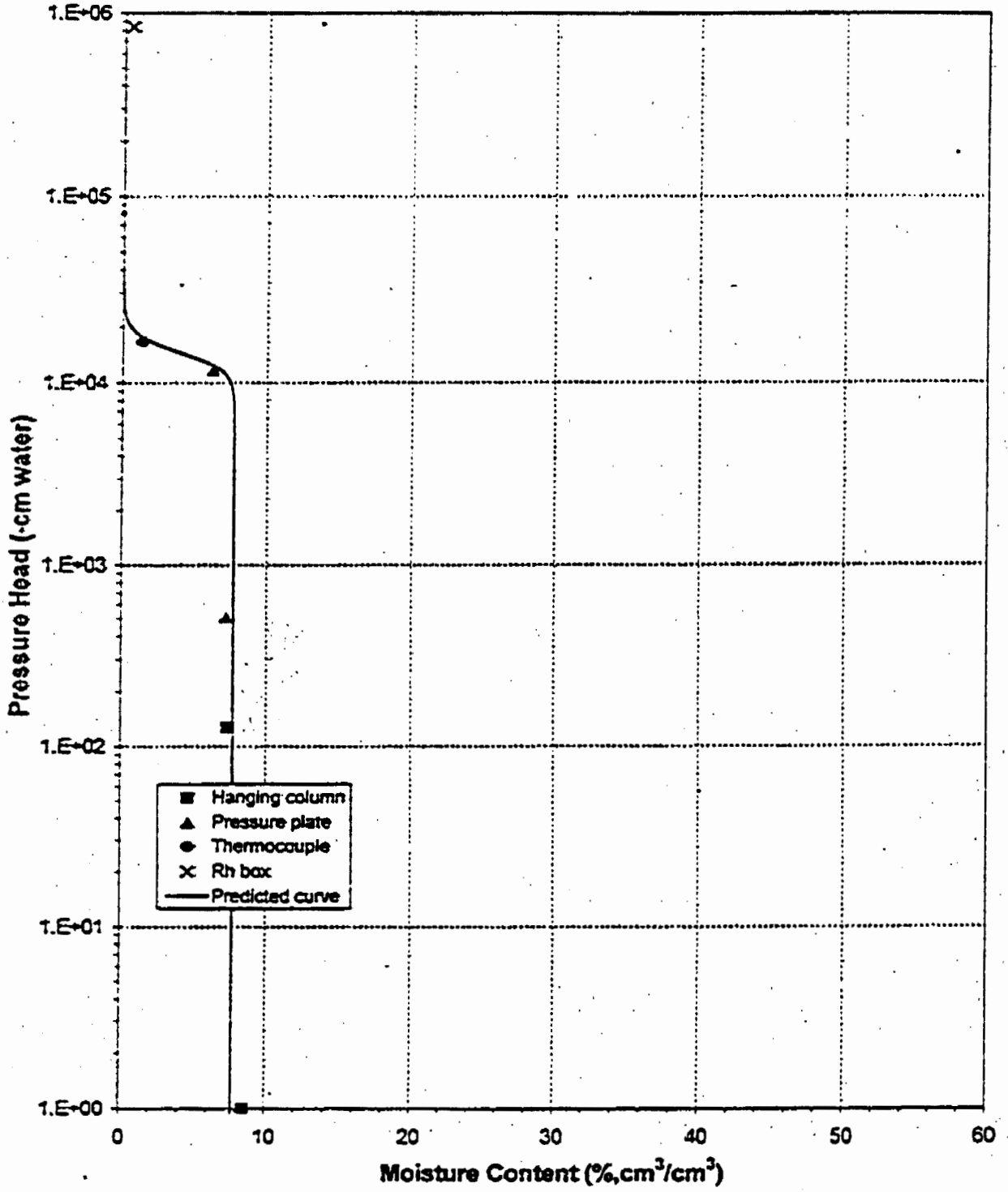
Laboratory analysis by: A. Stewart
Data entered by: M. Podvoyski
Checked by: J. Kelsey

Daniel B. Stephens & Associates, Inc.



Predicted Water Retention Curve and Data Points

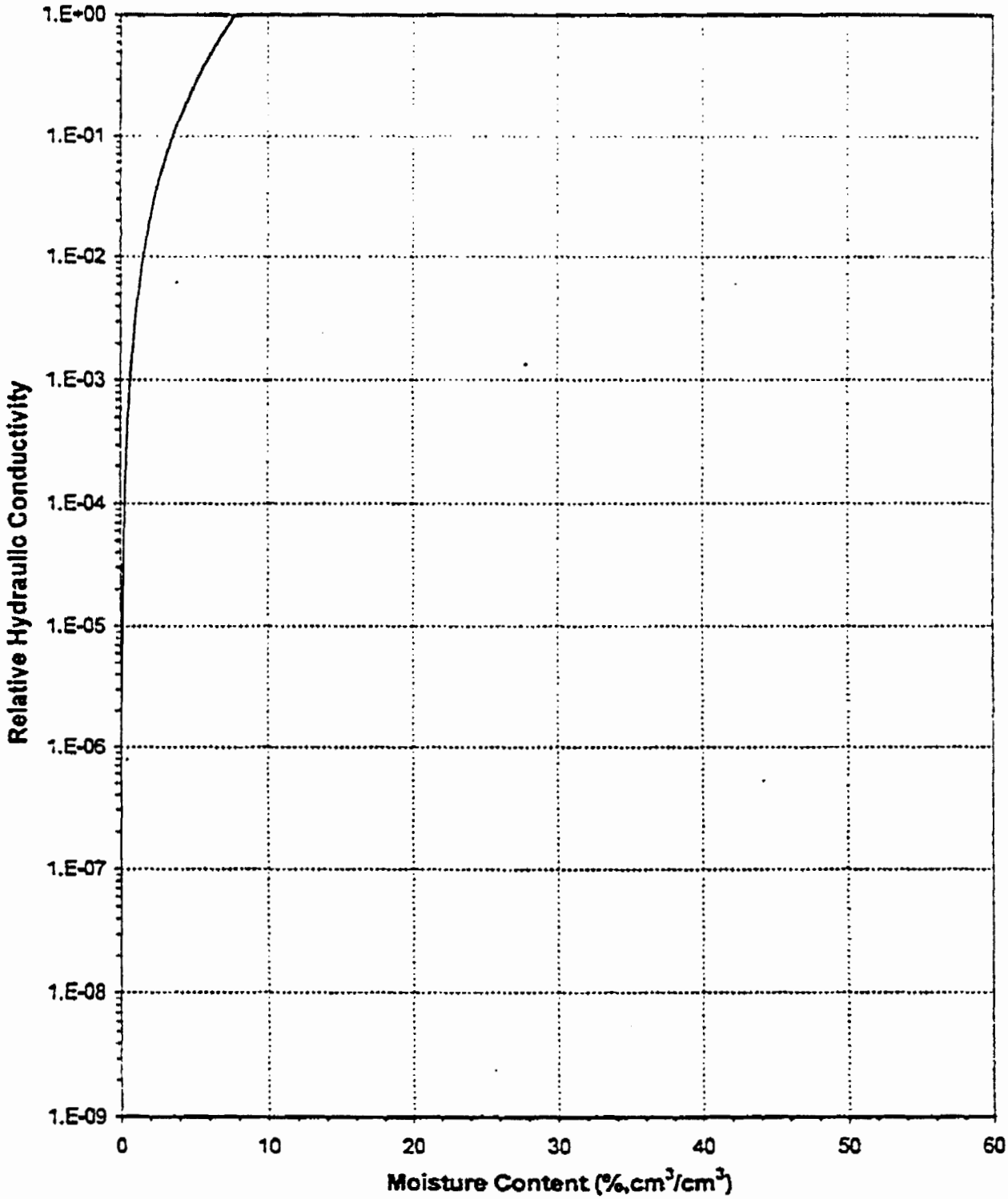
Sample Number: RE16-98-0108



Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Moisture Content

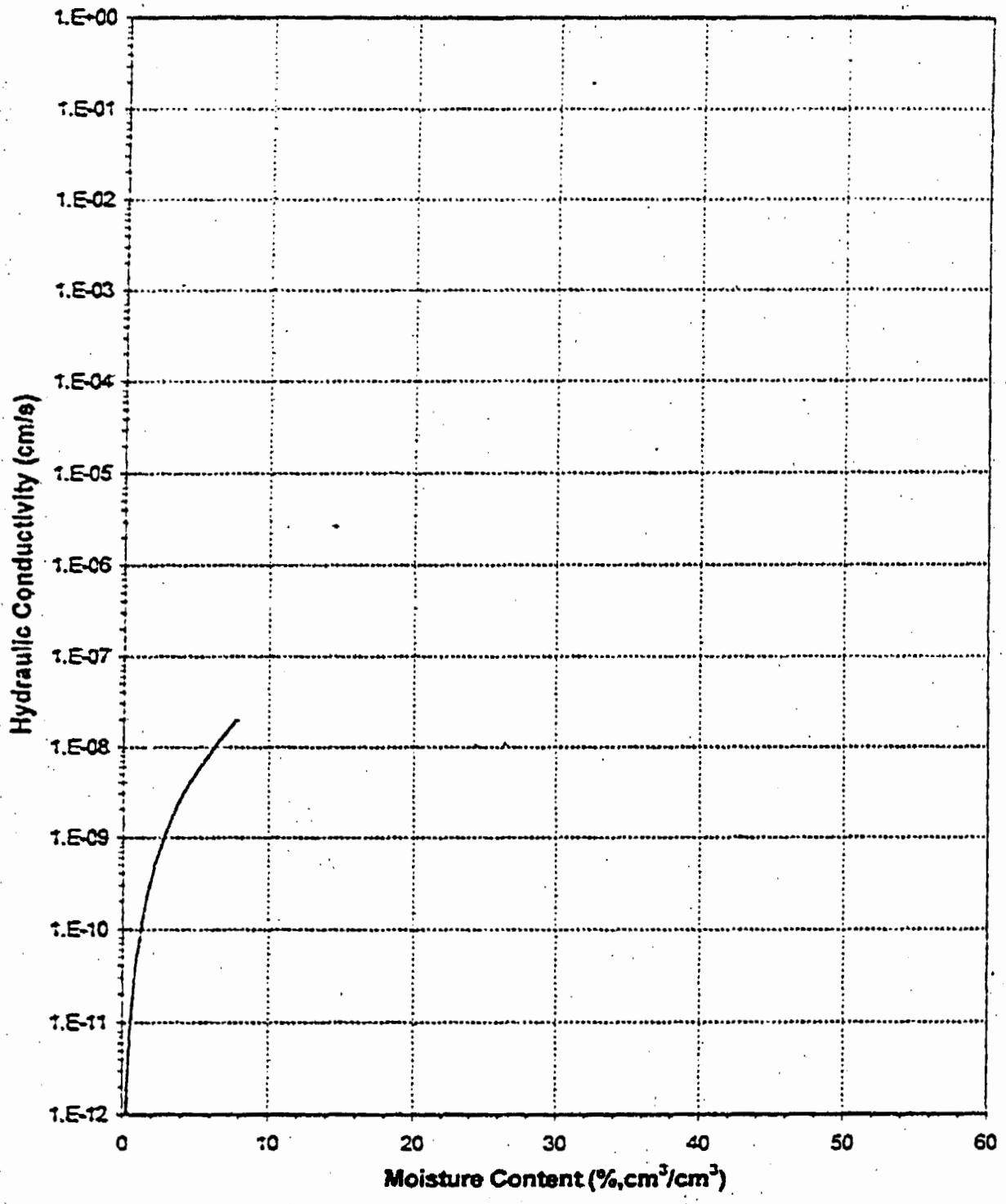
Sample Number: RE16-98-0108



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Moisture Content

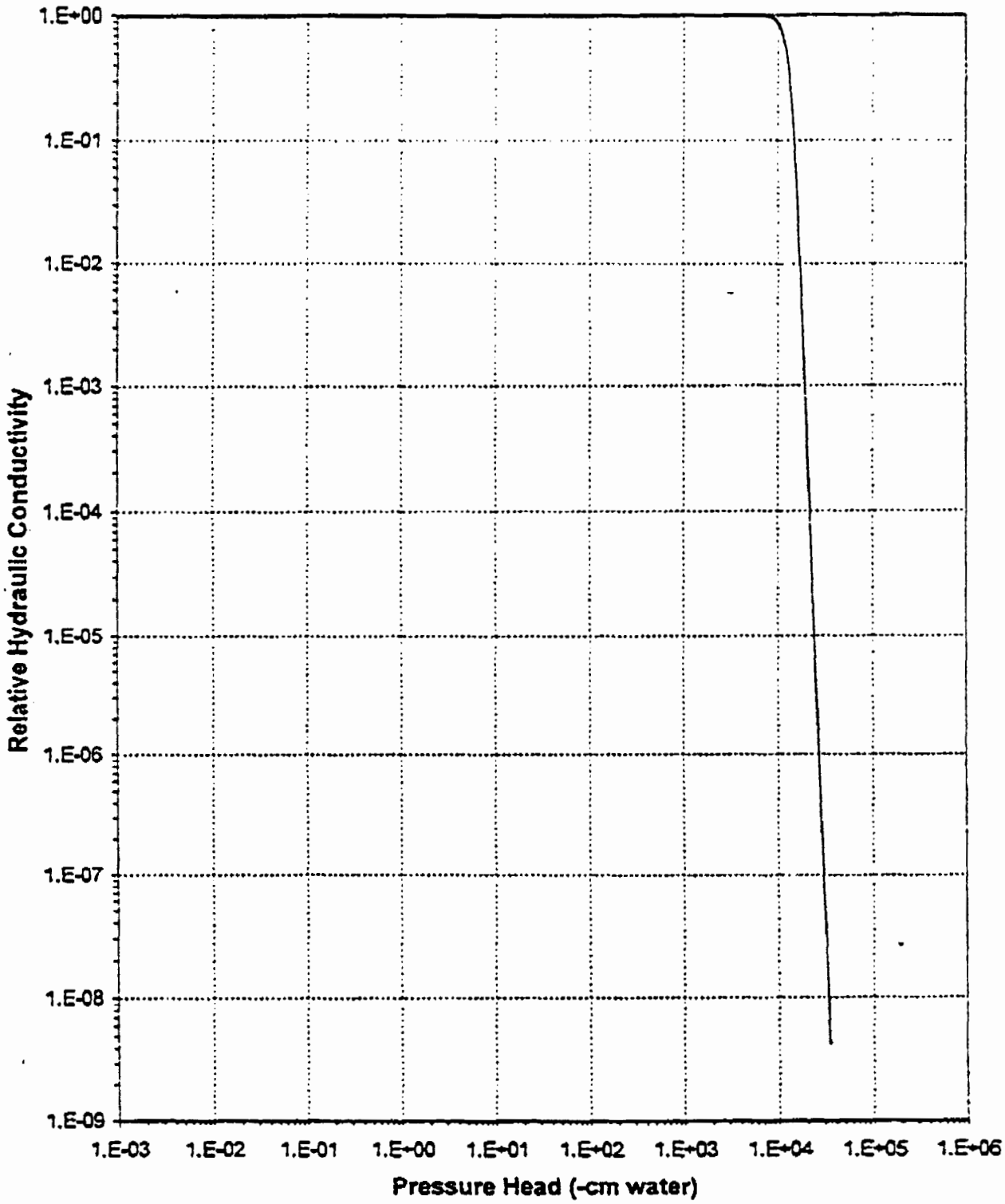
Sample Number: RE16-98-0108



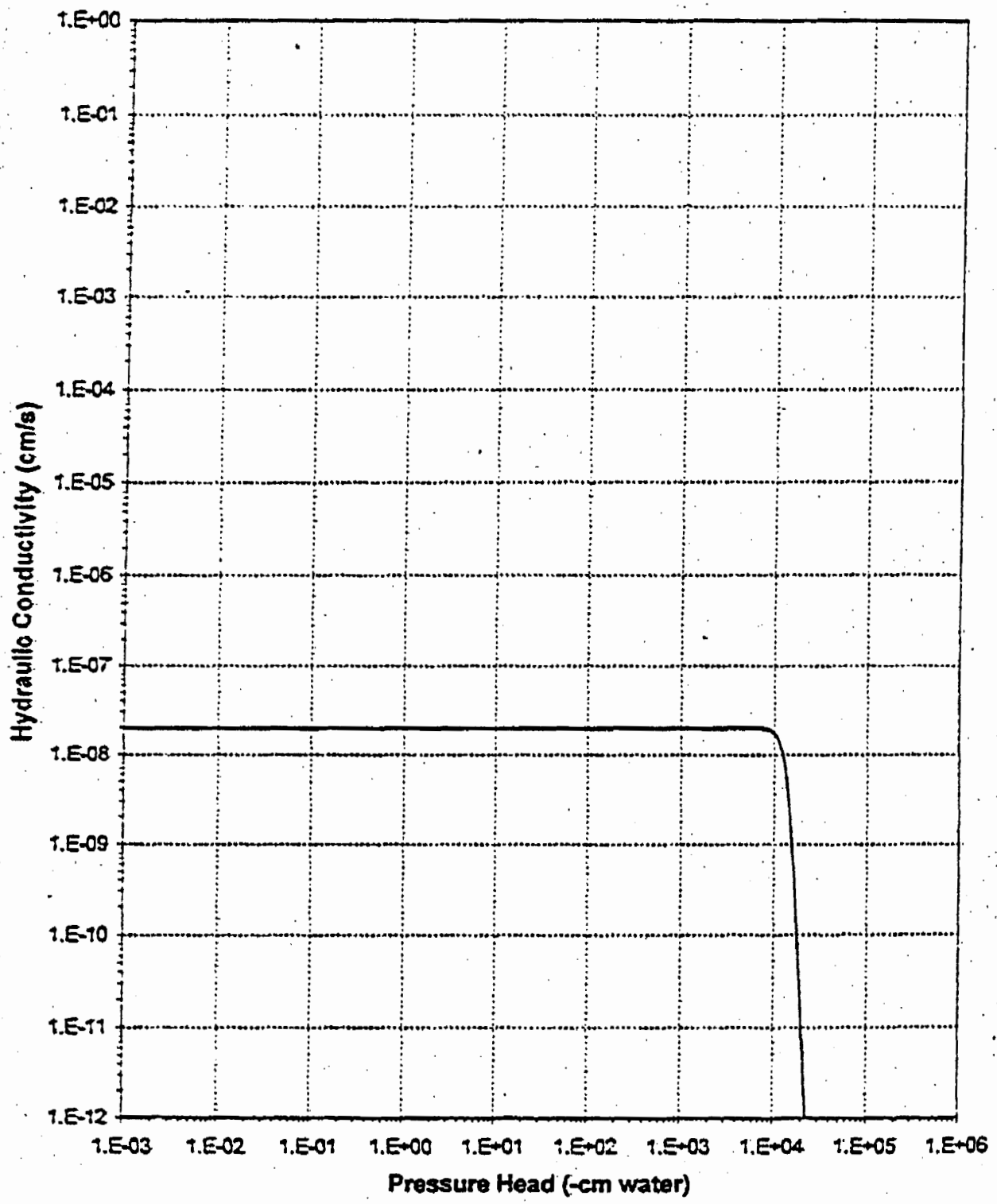
Daniel B. Stephens & Associates, Inc.

Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: RE16-98-0108



Daniel B. Stephens & Associates, Inc.

Plot of Hydraulic Conductivity vs Pressure Head

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