APPENDIX — Ⅶ

GEOLOGICAL INVESTIGATION DATA

CONTENT

Ⅶ－1	Geologic Log of Drill Hole	Ⅶ－ 1
Ⅶ－2	Permeability Test in Drill Hole	Ⅶ－25

VII - 1 GEOLOGIC LOG OF DRILL HOLE

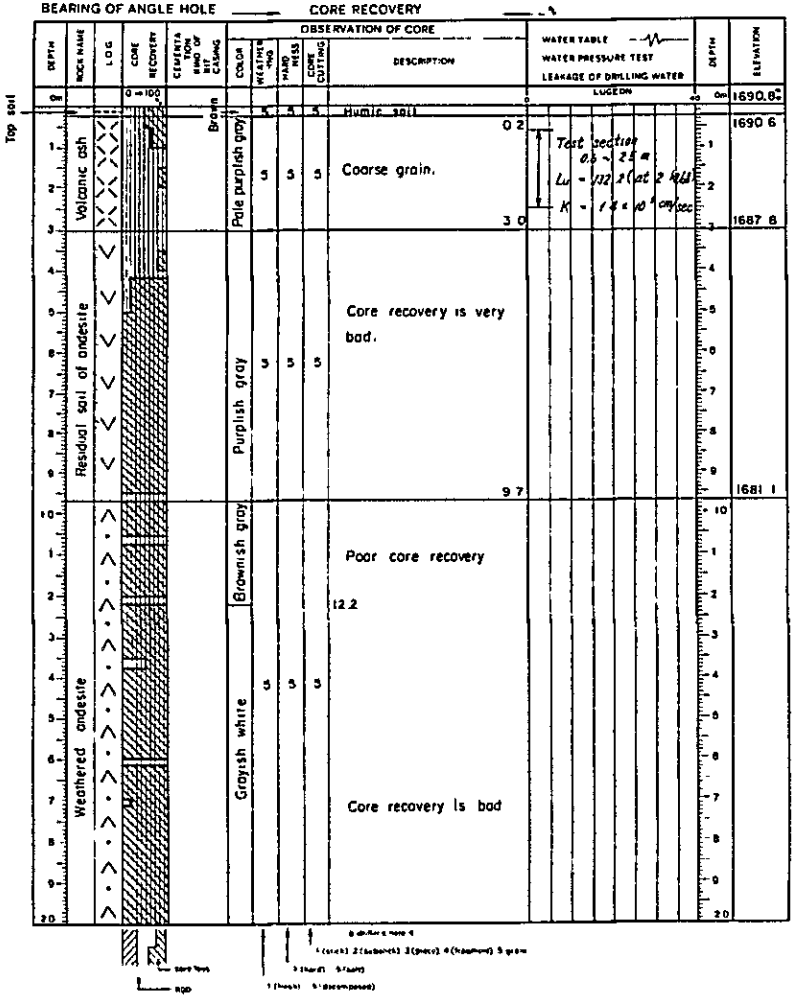
LIST OF DRILL HOLE

Location	Hole name	Length(m)	Elevation	Coordinates		Final sizo of hole	Permeabilrty test
				X	Y		
Dam	DH-206	40m	1690.764	1046,595.330	767,991.770	N X	○
	DH-207	40m	1718.145	1046,501.832	767,970031	N X	○
	DH-208	30m	1679.247	1046,698.464	768,068340	N X	○
	DH-209	40m	1724.202	1046,746.121	768,137.284	N X	○
	DH-210	20m	1647.552	1046,666.218	768,004.564	N X	○
	DH-211	20m				N X	○
	DH-212	20m	1647.249	1046,694.303	767,986028	N X	○
	DH-213	20m	1646.584	1046,616.730	768,051.461	N X	○
	DH-214	50m				N X	○
	Sub. T	280m					
Dike	DDH-101	25m	1715.173			N X	—
	DDH-201	25m	1714.995			N X	—
	DDH-202	25m	1712.161			N X	—
	Sub. T	75m					
Intake	DH- 8	50m	1698.674	1046,666.876	767,750.214	N X	—
	Sub. T	50m					
Surgetank	DH- 9	70m	1718.399			N X	—
	Sub. T	70m					
Cauca Diversion Dam	CDH- 1	30m	1764.286			N X	—
	CDH- 2	30m	1763.787			N X	—
	CDH- 3	10m	1756.253			N X	—
	CDH- 4	30m	1756.817			N X	—
	CDH- 5	30m	1755.880			N X	—
	Sub. T	130m					
Borrow Area	BDH- 1	40m	1738.059	1046,099.641	767,350.251	N X	—
	Sub. T	40m					
Qwarry Site	QDH- 1	100m	1730.197			B X	—
	Sub. T	100m					
Total		745m	21 holes				

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-206 (SHEET 1 OF 2)

LOCATION	Dam site left bank	DEPTH OF HOLE	40.0 m	COMMENCED	14-Jul-'79
ELEVATION	1690.764 m	DEPTH OF OVERBURDEN	9.7 m	COMPLETED	3-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	30.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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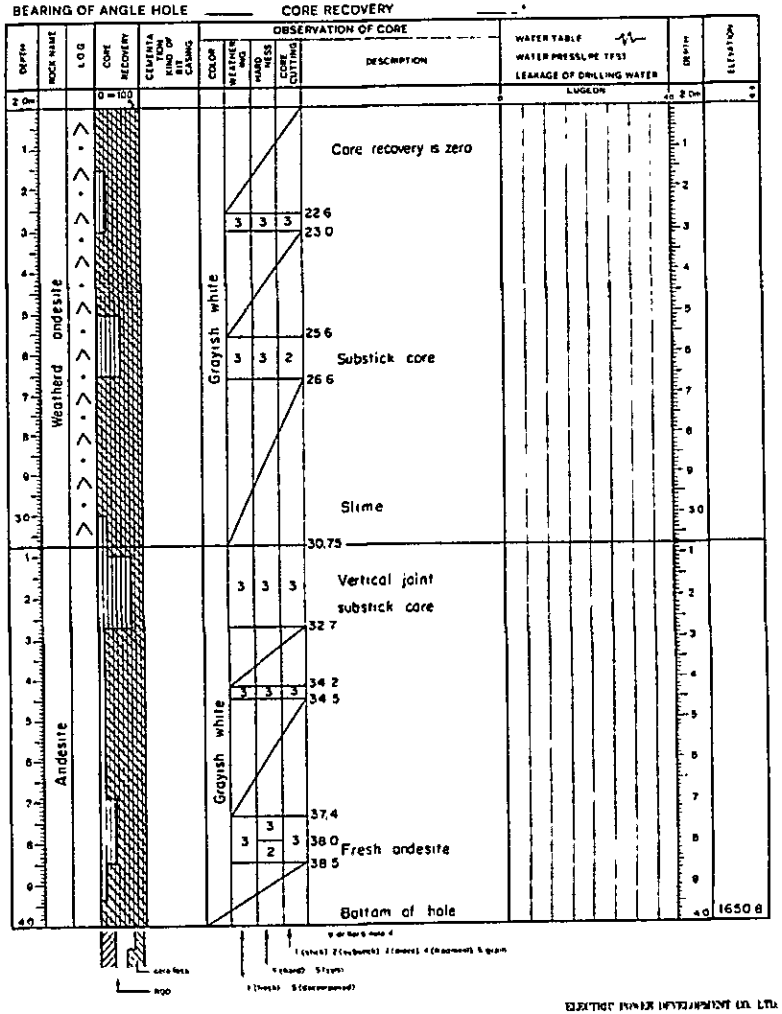
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-206 (SHEET 2 OF 2)

LOCATION	Dam site left bank	DEPTH OF HOLE	40.0 m	COMMENCED	14-Jul-'79
ELEVATION	1690.764 m	DEPTH OF OVERBURDEN	9.7 m	COMPLETED	3-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	30.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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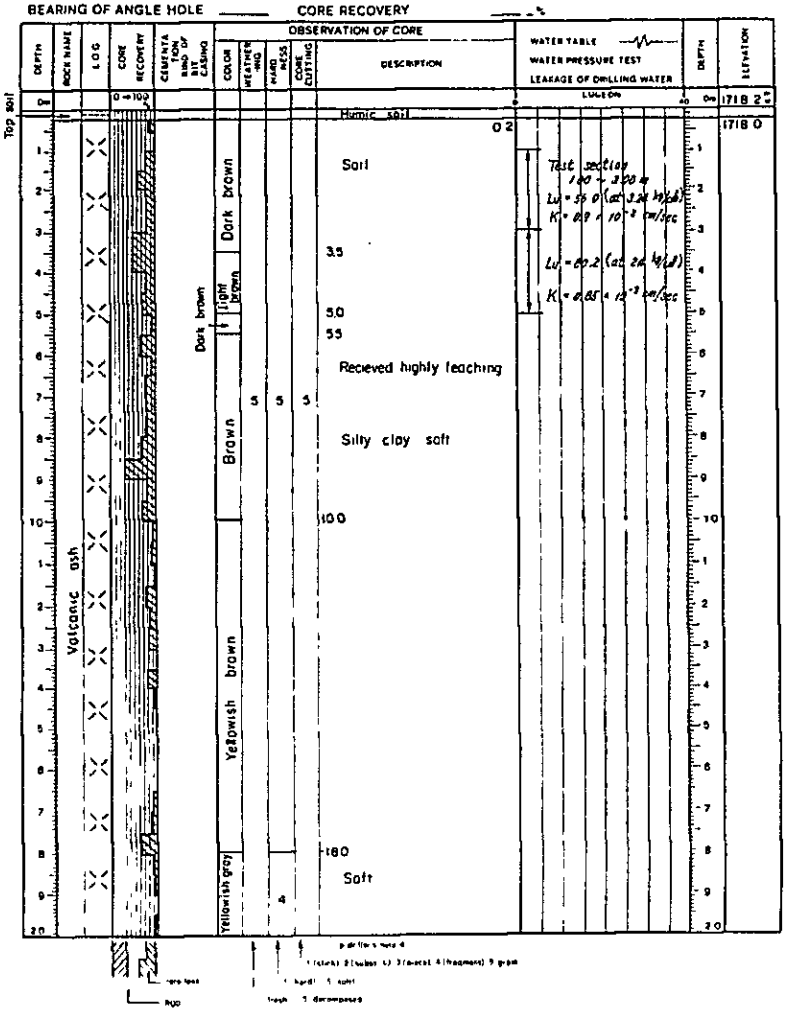
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-207 SHEET 1 OF 2

LOCATION	Dam site left bank	DEPTH OF HOLE	40.0 m	COMMENCED	14-Jul-'79
ELEVATION	1718.145 m	DEPTH OF OVERBURDEN	27.0 m	COMPLETED	25-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	13.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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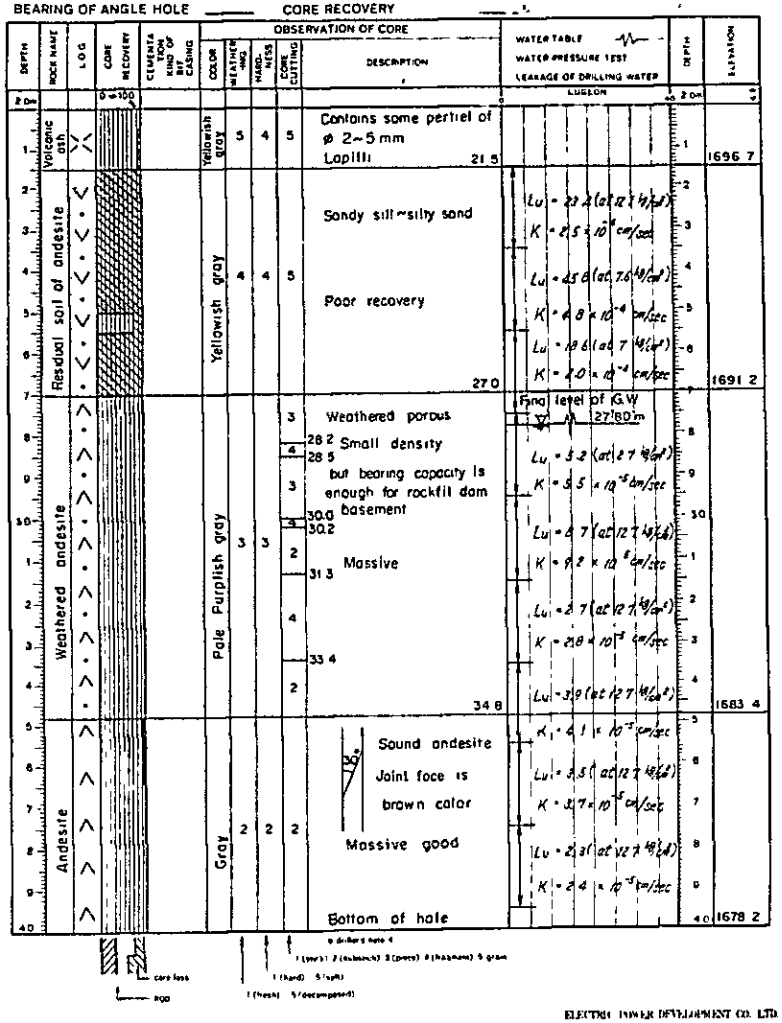
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-207 SHEET 2 OF 2

LOCATION	Dam site left bank	DEPTH OF HOLE	40.0 m	COMMENCED	14-Jul-'79
ELEVATION	1718.145 m	DEPTH OF OVERBURDEN	27.0 m	COMPLETED	25-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	13.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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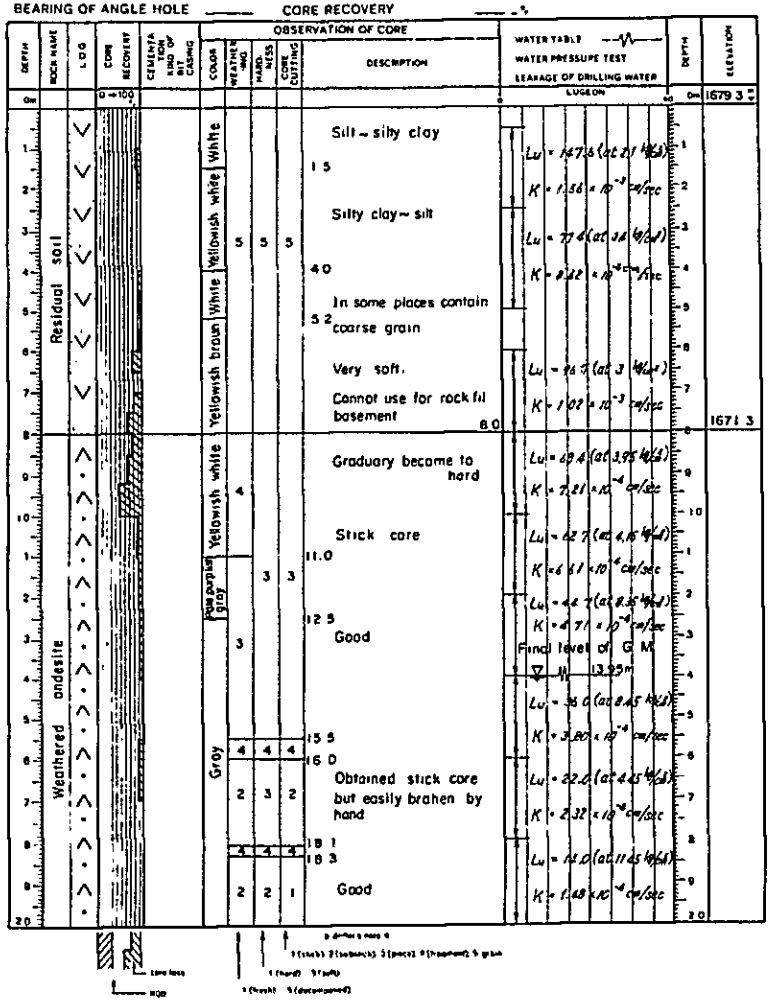
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-208 (SHEET 1 OF 2)

LOCATION	Dam site left bank	DEPTH OF HOLE	30.0 m	COMMENCED	19-Jul-'79
ELEVATION	1679.247 m	DEPTH OF OVERBURDEN	8.0 m	COMPLETED	31-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	22.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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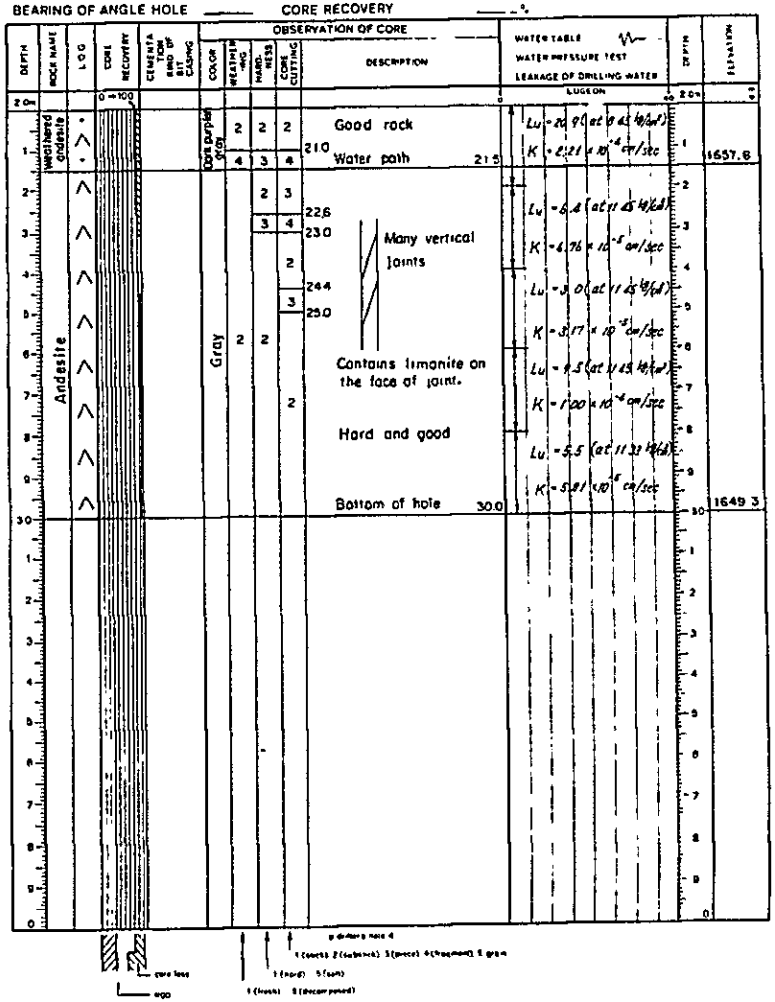
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-208 (SHEET 2 OF 2)

LOCATION	Dam site left bank	DEPTH OF HOLE	30.0 m	COMMENCED	19-Jul-'79
ELEVATION	1679.247 m	DEPTH OF OVERBURDEN	8.0 m	COMPLETED	31-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	22.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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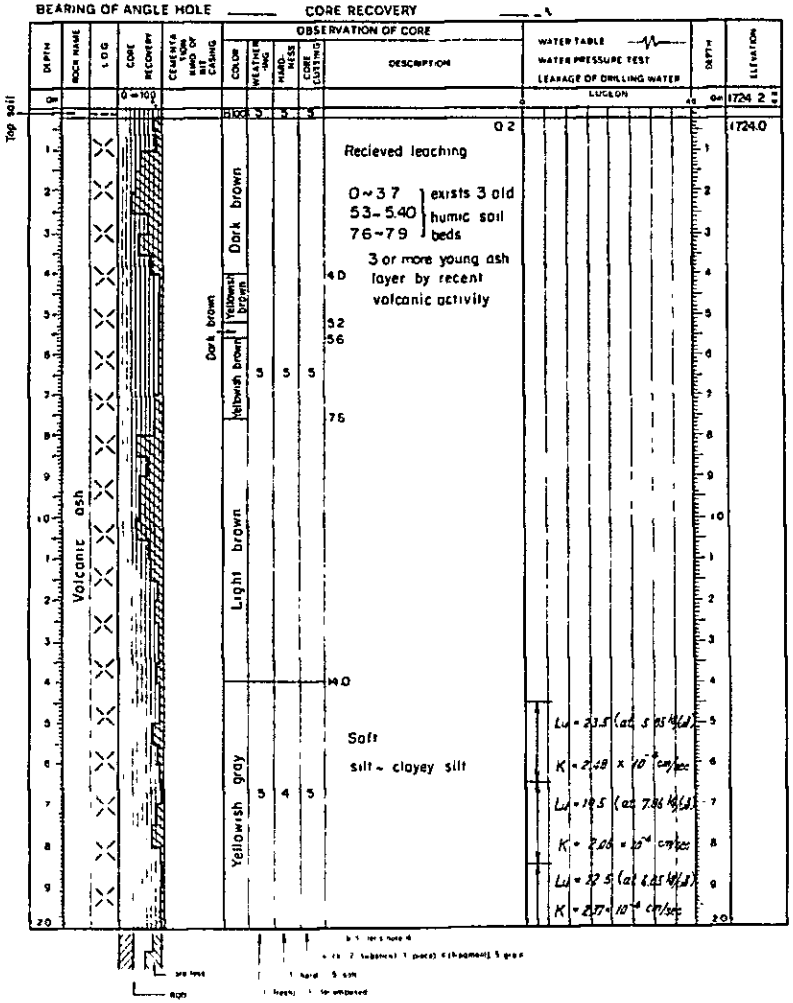
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH 209 (SHEET 1 OF 2)

LOCATION	Dam site right bank	DEPTH OF HOLE	40.0 m	COMMENCED	25 Jun. '79
ELEVATION	1724 202 m	DEPTH OF OVERBURDEN	— m	COMPLETED	13 Jul. '79
COORDINATE		LENGTH OF ROCK DRILLING	— m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		



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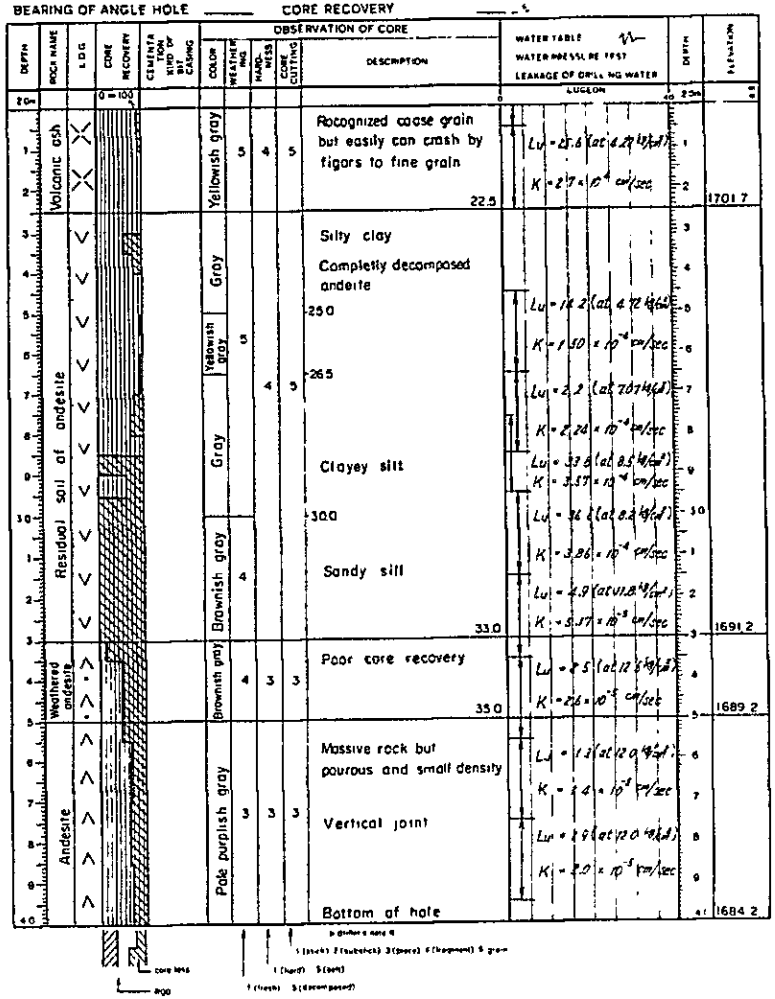
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-209 (SHEET 2 OF 2)

LOCATION	Dam site right bank	DEPTH OF HOLE	40.0 m	COMMENCED	25 Jun. '79
ELEVATION	1724 202 m	DEPTH OF OVERBURDEN	35.0 m	COMPLETED	13 Jul. '79
COORDINATE		LENGTH OF ROCK DRILLING	5.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		



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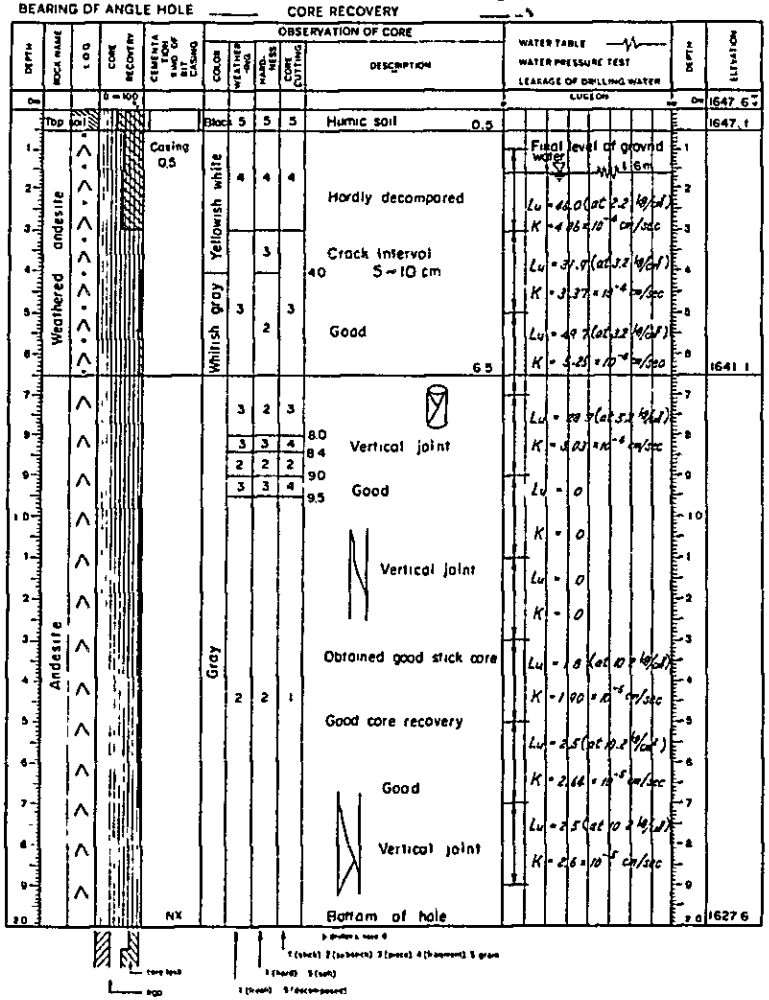
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No OH-210 (SHEET 1 OF 1)

LOCATION	Dam site river bed	DEPTH OF HOLE	20.0 m	COMMENCED	11-Jul-'79
ELEVATION	1647.552 m	DEPTH OF OVERBURDEN	0.5 m	COMPLETED	19-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	19.5 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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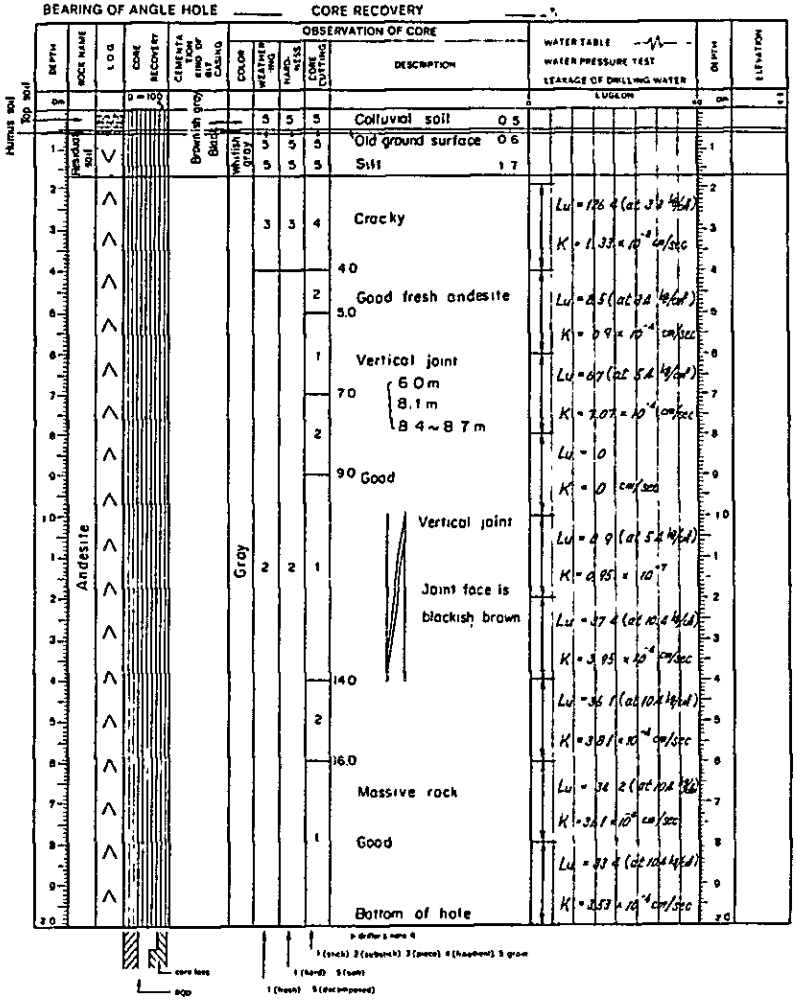
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No OH-211 (SHEET 1 OF 1)

LOCATION	Dam site	DEPTH OF HOLE	20.0 m	COMMENCED	
ELEVATION	m	DEPTH OF OVERBURDEN	1.7 m	COMPLETED	
COORDINATE		LENGTH OF ROCK DRILLING	18.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No DH-212 (sheet 1 of 1)

LOCATION	Dam site	DEPTH OF HOLE	20.0 m	COMMENCED	17 Aug-'79
ELEVATION	1647.249 m	DEPTH OF OVERBURDEN	14.8 m	COMPLETED	31 -Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	5.2 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

OBSERVATION OF CORE

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION / KIND OF BIT / CASING	COLOR	WEATHERING	HARDNESS	CORE CUTTING	DESCRIPTION	WATER TABLE / WATER PRESSURE TEST / LEAKAGE OF DRILLING WATER (LUGEON)	DEPTH	ELEVATION
0m			0=100 %							0 40	0m	1647.3*
	Top soil			Black		5	5	5	Humic soil 0.2			
1					Brownish gray	5	5	5	Colluvial soil 2.9	Final level of G.W. 1.30m	1	1644.4
2											2	
3	River bed gravel								Core recovery is poor		3	
4											4	
5									Slightly obtained andesite gravel		5	
6											6	
7											7	
8						5	4	5	Gravel size 10~20 cm		8	
9											9	
10											10	
1									Poor recovery.		1	
2											2	
3											3	
4						3	3	4	14.8		4	1632.5
5	Andesite				Pale purplish gray				15.0 No core		5	
6									16.0 Slightly weathered rock crackface is brown		6	
7						3	3	3			7	
8									Good rock		8	
9											9	
10									Bottom of hole		20	1627.3

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GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No DH-213 (sheet 1 of 1)

LOCATION	Dam site river bed	DEPTH OF HOLE	20 m	COMMENCED	
ELEVATION	1646.584 m	DEPTH OF OVERBURDEN	11.9 m	COMPLETED	
COORDINATE		LENGTH OF ROCK DRILLING	8.1 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

OBSERVATION OF CORE

DEPTH	ROCK NAME	LOG	CORE RECOVERY	CEMENTATION / KIND OF BIT / CASING	COLOR	WEATHERING	HARDNESS	CORE CUTTING	DESCRIPTION	WATER TABLE / WATER PRESSURE TEST / LEAKAGE OF DRILLING WATER (LUGEON)	DEPTH	ELEVATION
0m			0=100 %							0 40	0m	1646.6*
	Top soil				b.br	5	5	5	Humic soil 0.4			
1					Dark brown	5	5	5	Sandy silt	Final level of G.W. 1.6m	1	1643.9
2									Contained organic material 2.7		2	
3	River deposit								Peble and sand		3	
4						5	5	5	Core recovery is poor		4	
5									4.8 Non recovery		5	
6									6.0		6	
7					Dark grey	5	4	4	6.3 φ 20cm andurite bolder		7	
8						5	3	5	6.5 7.2		8	
9									7.8		9	
10						2	2	3	8.0 Bolder 8.5		10	
1						5	5	5	Non recovery		1	
2									10.4		2	
3						2	2	3	Bolder 11.0		3	
4						5	5	5	Sand and gravel 11.9		4	1634.7
5	Weathered andesite				Purplish grey	4	4	3	Core recovery is poor decomposed 15.0		5	1631.6
6	Andesite				Dark purplish gray				Obtained stick core		6	
7						3	3	3	Core recovery is about 80%		7	
8									Cracked horizontally		8	
9									Cannot be seen vertical joints		9	
20									Bottom of hole		20	1626.6

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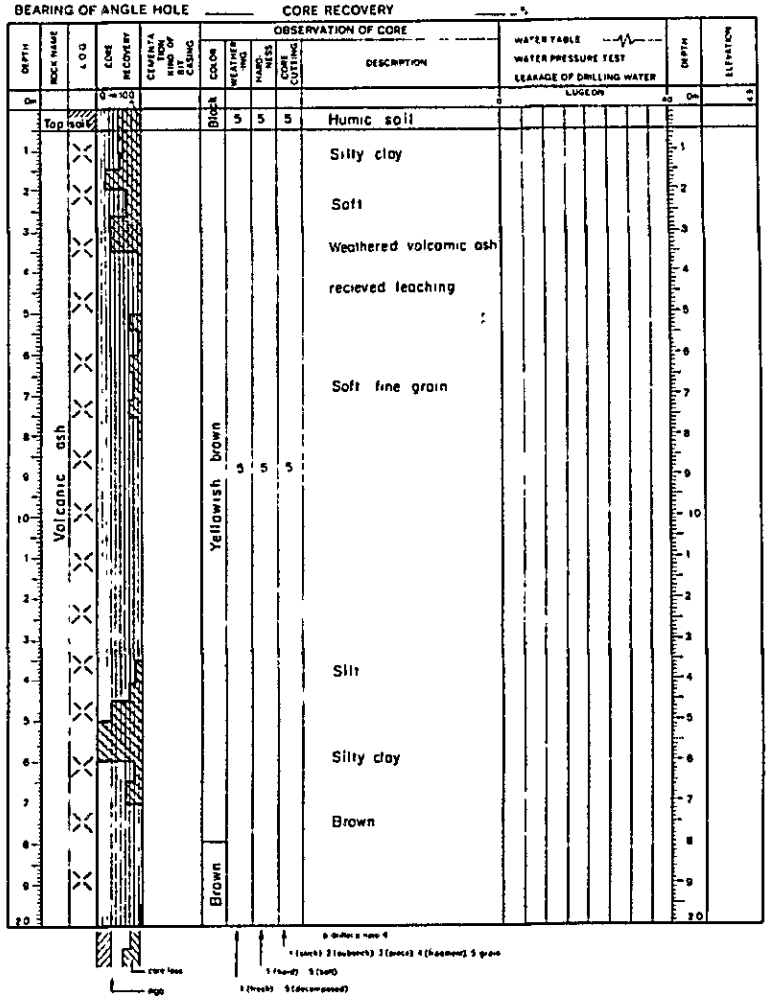
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-214 (SHEET 1 OF 3)

LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 50 m
DEPTH OF OVERBURDEN ____ m
LENGTH OF ROCK DRILLING ____ m
TOTAL LENGTH OF CORE ____ m
CORE RECOVERY ____ %

COMMENCED ____
COMPLETED ____
DRILLED BY ____
LOGGED BY ____



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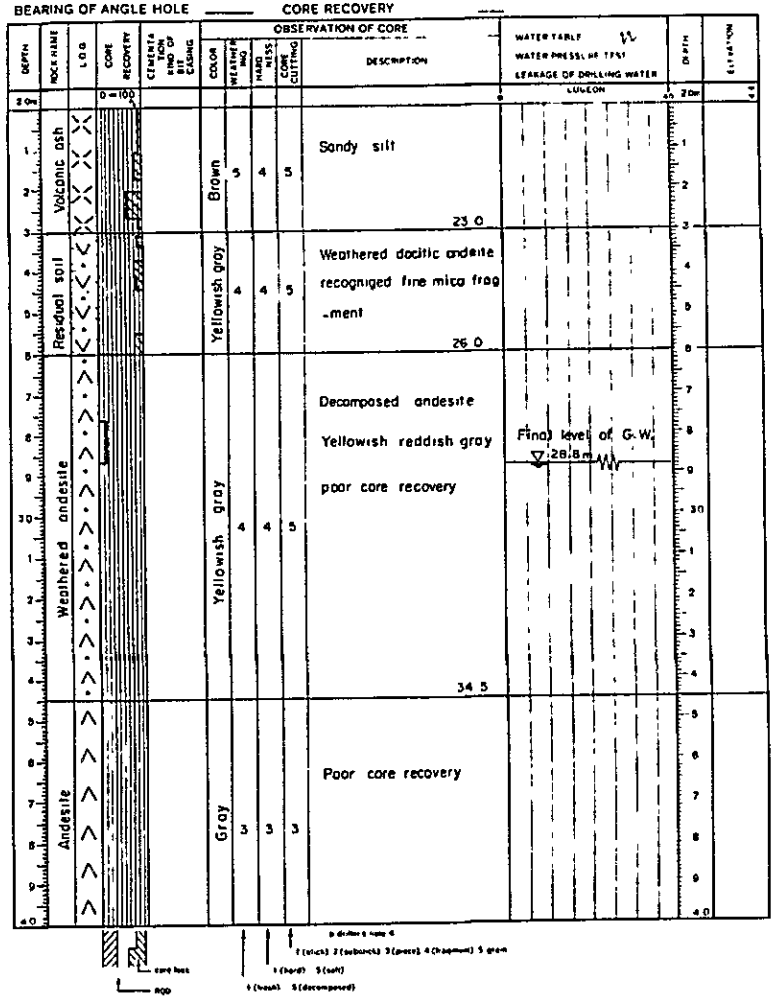
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-214 (SHEET 2 OF 3)

LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 50 m
DEPTH OF OVERBURDEN ____ m
LENGTH OF ROCK DRILLING ____ m
TOTAL LENGTH OF CORE ____ m
CORE RECOVERY ____

COMMENCED ____
COMPLETED ____
DRILLED BY ____
LOGGED BY ____



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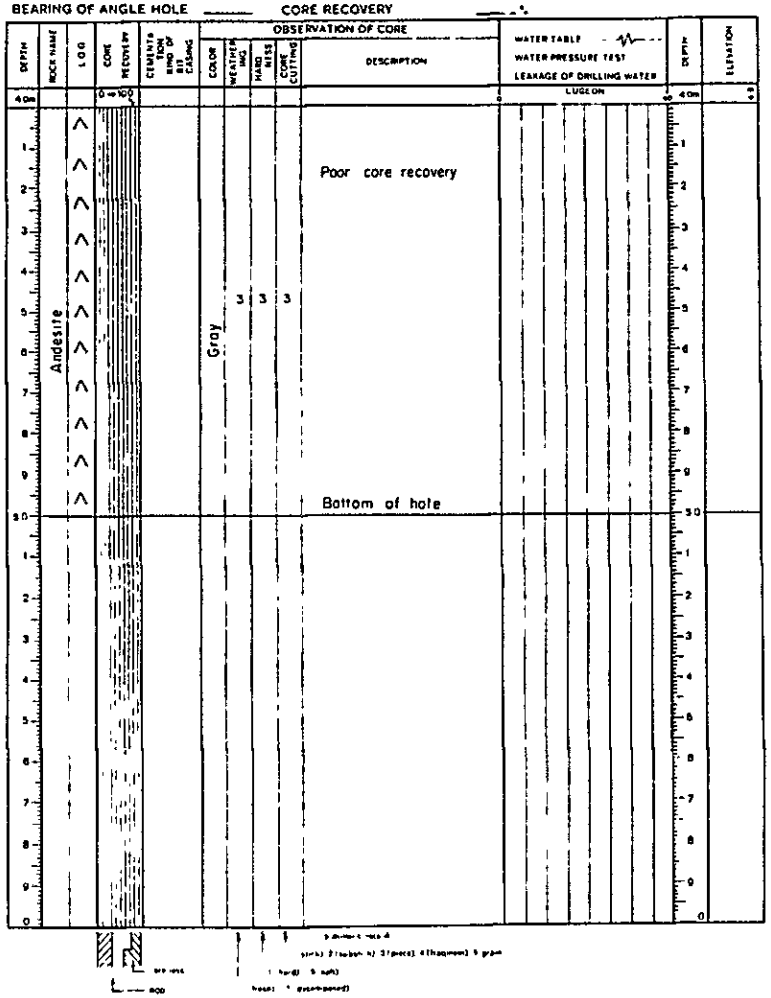
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-214 (SHEET 3 OF 3)

LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 50 m
DEPTH OF OVERBURDEN ____ m
LENGTH OF ROCK DRILLING ____ m
TOTAL LENGTH OF CORE ____ m
CORE RECOVERY ____ %

COMMENCED ____
COMPLETED ____
DRILLED BY ____
LOGGED BY ____



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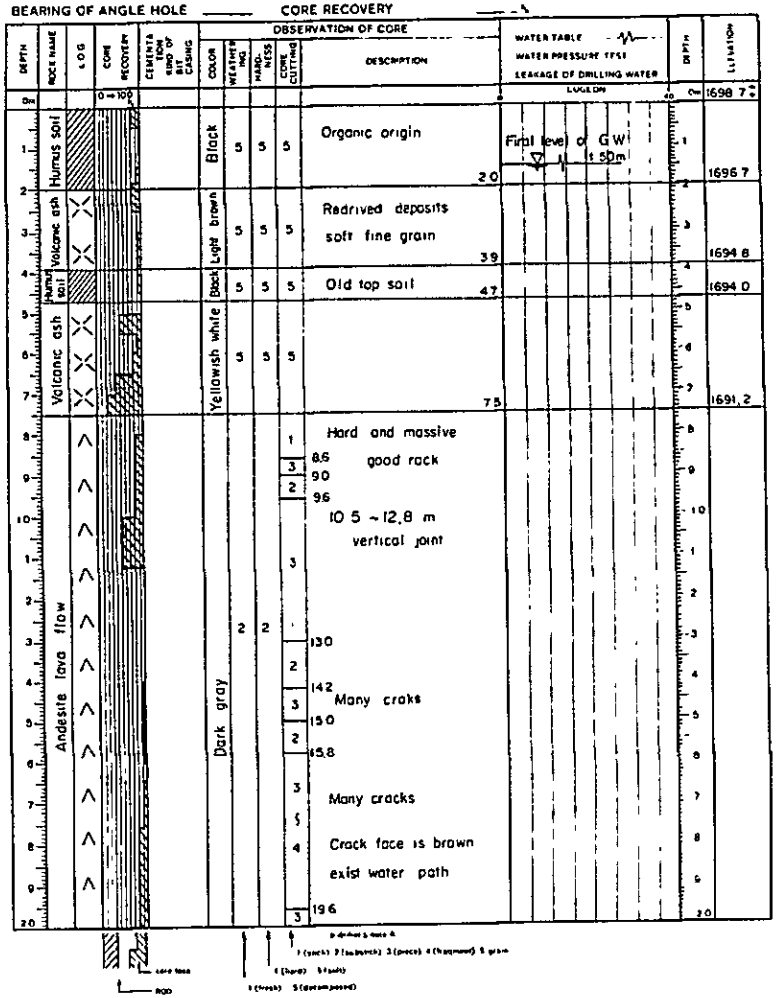
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No DH-8 (SHEET 1 OF 3)

LOCATION Intake
ELEVATION 1698.674 m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 50.0 m
DEPTH OF OVERBURDEN 7.5 m
LENGTH OF ROCK DRILLING 42.5 m
TOTAL LENGTH OF CORE ____ m
CORE RECOVERY ____ %

COMMENCED 3-Jul-'79
COMPLETED 13-Jul-'79
DRILLED BY ____
LOGGED BY ____



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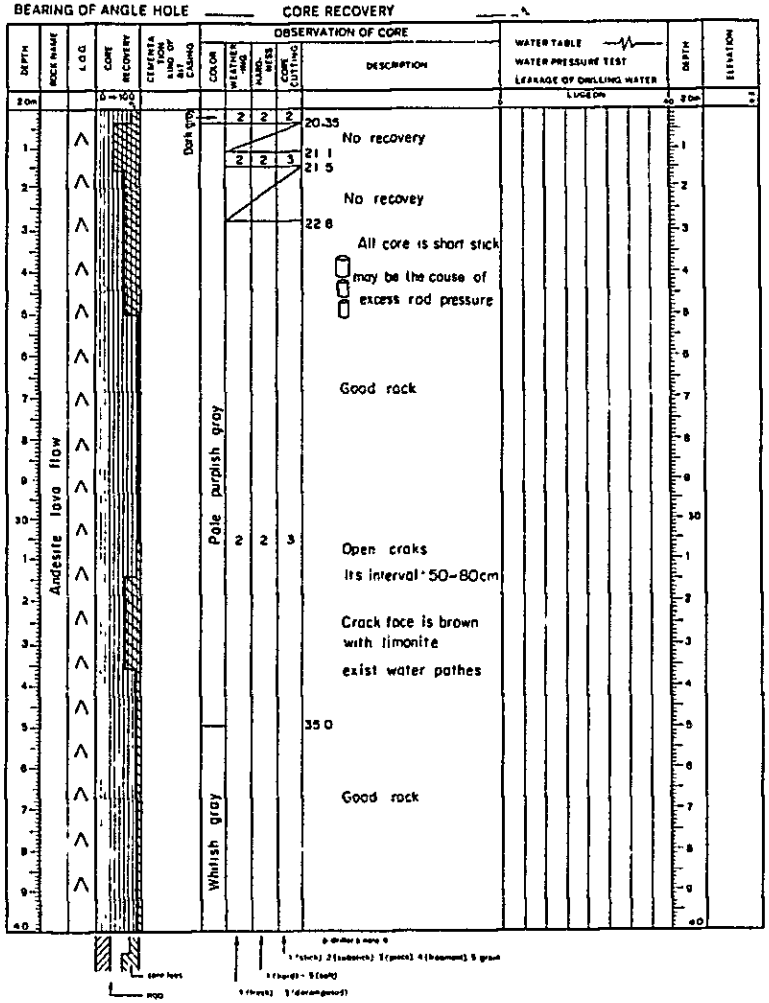
GEOLOGIC LOG OF DRILL HOLE

Jufumito PROJECT — HOLE No DH-8 (SHEET 2 OF 3)

LOCATION	Intake	DEPTH OF HOLE	50.0 m	COMMENCED	3-Jul-'79
ELEVATION	1698.674 m	DEPTH OF OVERBURDEN	7.5 m	COMPLETED	13-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	42.5 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		



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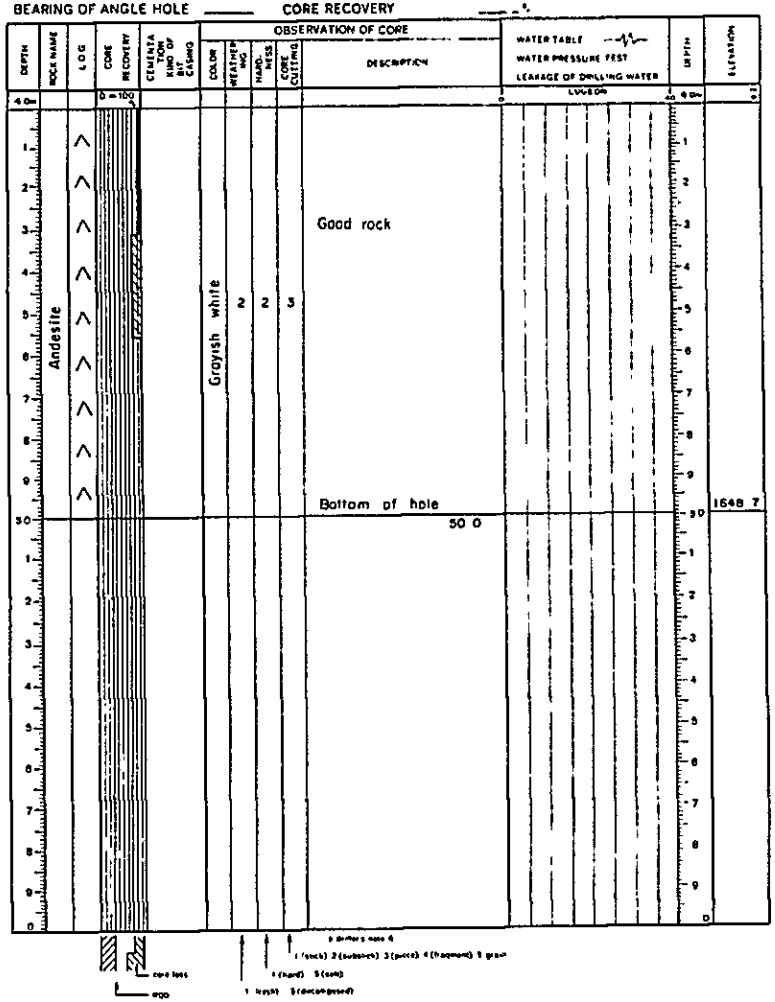
GEOLOGIC LOG OF DRILL HOLE

Jufumito PROJECT — HOLE No DH-8 (SHEET 3 OF 3)

LOCATION	Intake	DEPTH OF HOLE	50.0 m	COMMENCED	3-Jul-'79
ELEVATION	1698.674 m	DEPTH OF OVERBURDEN	7.5 m	COMPLETED	13-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	42.5 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		



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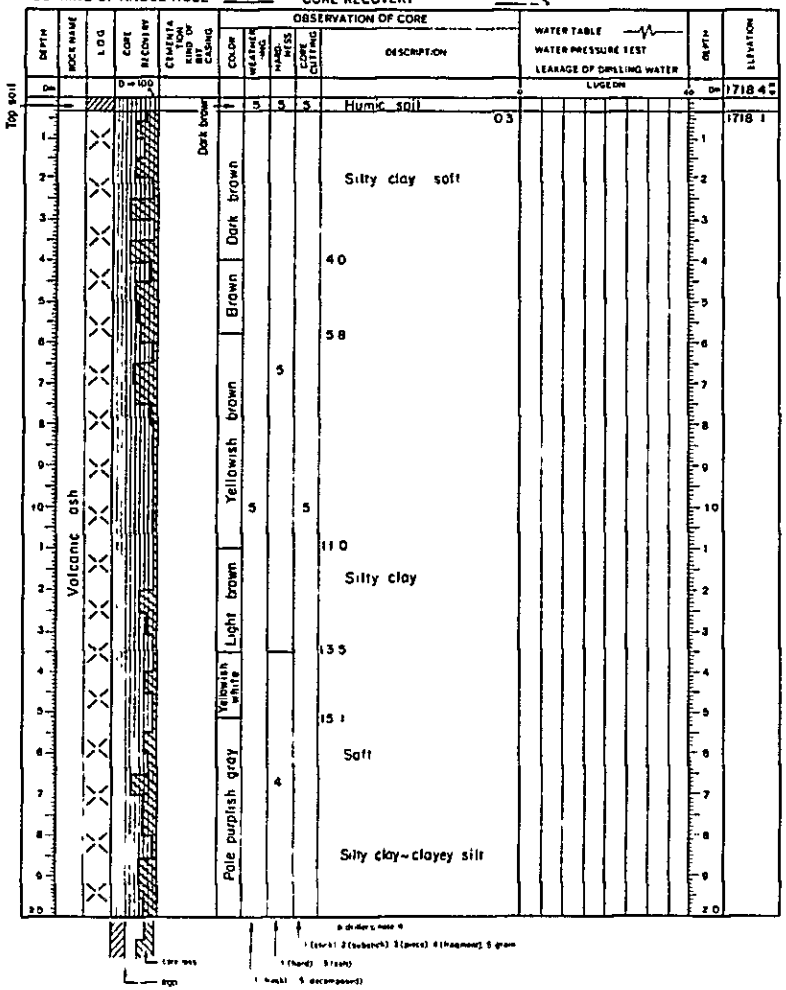
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-9 (SHEET 1 OF 4)

LOCATION	Surge-tank	DEPTH OF HOLE	70.0 m	COMMENCED	5-Jun-'79
ELEVATION	1718.399 m	DEPTH OF OVERBURDEN	32.7 m	COMPLETED	25-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	37.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		



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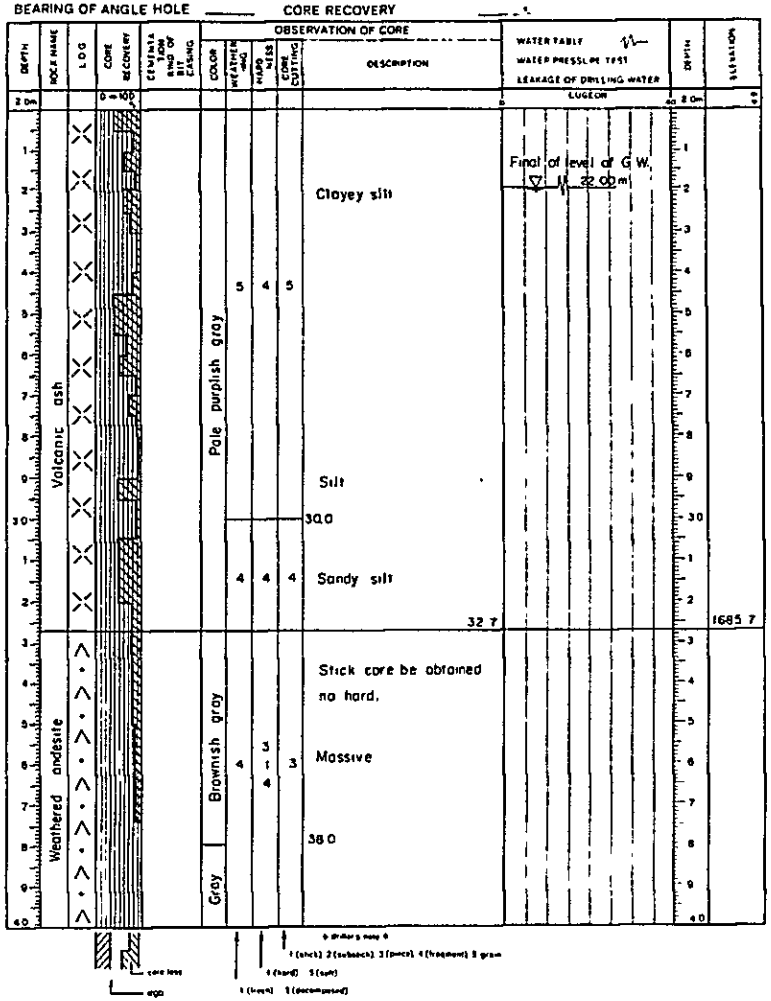
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-9 (SHEET 2 OF 4)

LOCATION	Surge-tank	DEPTH OF HOLE	70.0 m	COMMENCED	5-Jun-'79
ELEVATION	1718.399 m	DEPTH OF OVERBURDEN	32.7 m	COMPLETED	25-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	37.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	— m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	— %		

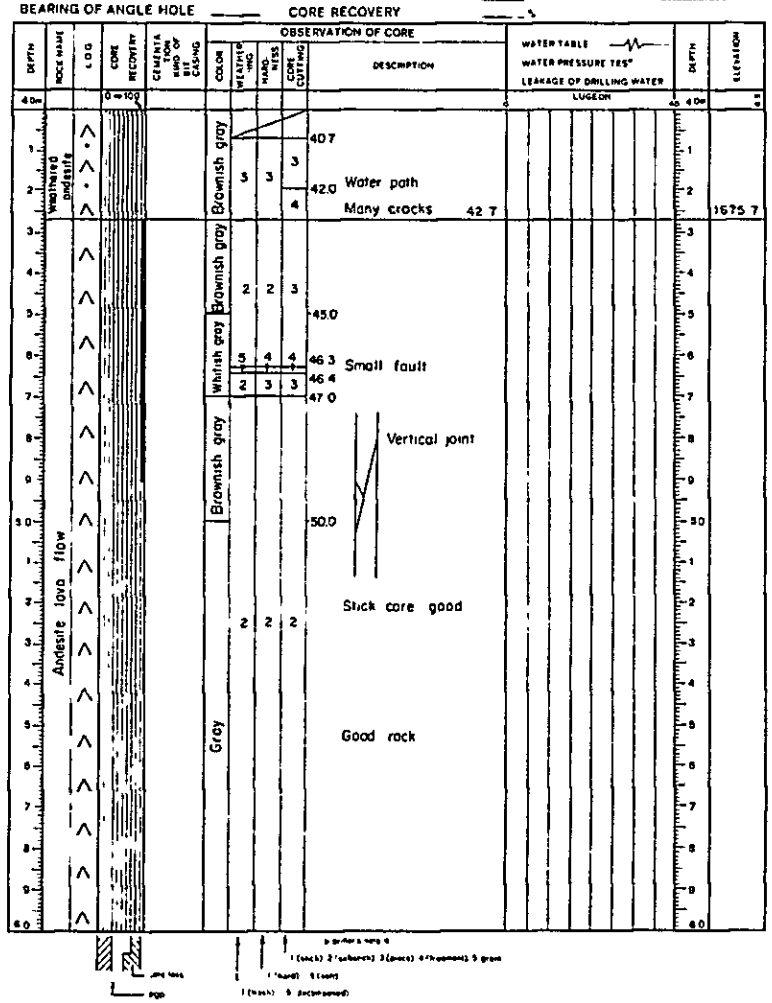


ELECTRIC POWER DEVELOPMENT CO. LTD.
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-9 (SHEET 3 OF 4)

LOCATION	Surge-tank	DEPTH OF HOLE	70.0 m	COMMENCED	5-Jun-'79
ELEVATION	1718.399 m	DEPTH OF OVERBURDEN	32.7 m	COMPLETED	25-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	37.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

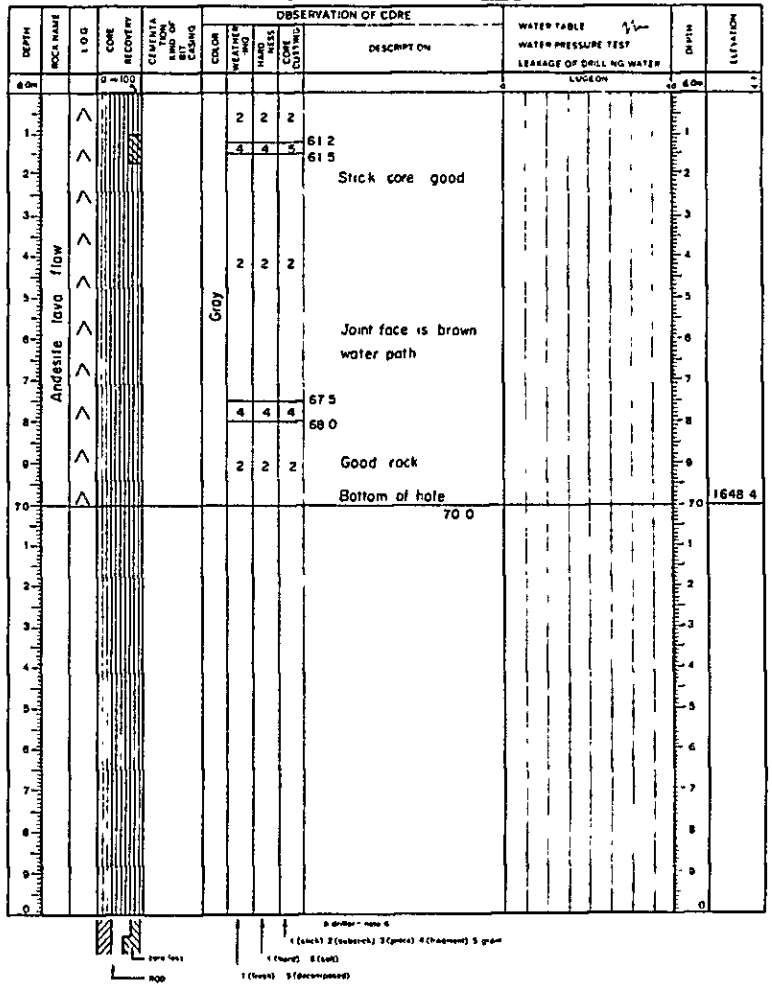


ELECTRIC POWER DEVELOPMENT CO., LTD.
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DH-9 (SHEET 4 OF 4)

LOCATION	Surge-tank	DEPTH OF HOLE	70.0 m	COMMENCED	5-Jun-'79
ELEVATION	1718.399 m	DEPTH OF OVERBURDEN	32.7 m	COMPLETED	25-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	37.3 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO., LTD.
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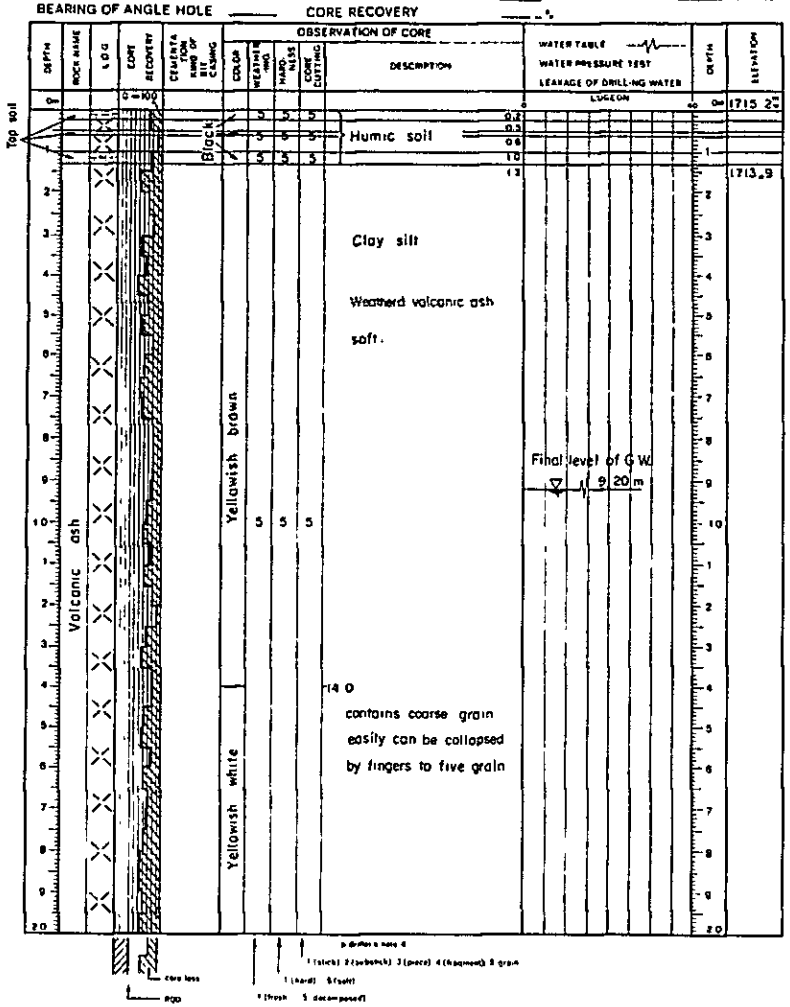
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No ODH-101 (SHEET 1 OF 2)

LOCATION	Oike	DEPTH OF HOLE	25.0 m	COMMENCED	17-May-'79
ELEVATION	1715.173 m	DEPTH OF OVERBURDEN	25.0 m	COMPLETED	22-May-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO. LTD.
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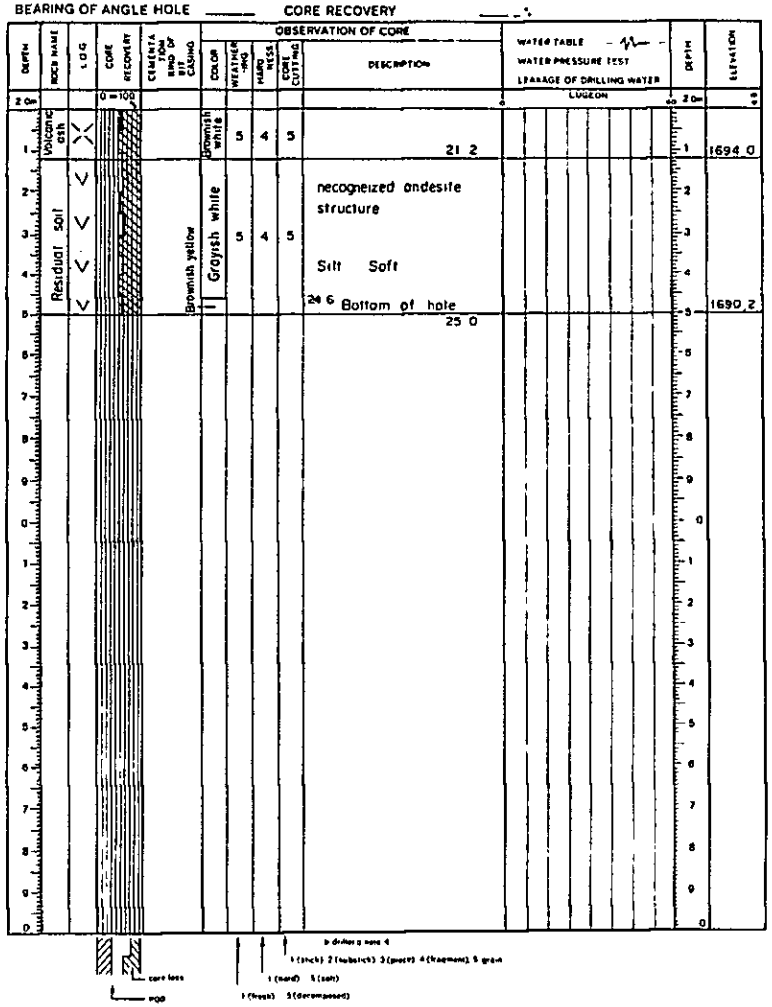
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No ODH-101 (SHEET 2 OF 2)

LOCATION	Oike	DEPTH OF HOLE	25.0 m	COMMENCED	17-May-'79
ELEVATION	1715.173 m	DEPTH OF OVERBURDEN	25.0 m	COMPLETED	22-May-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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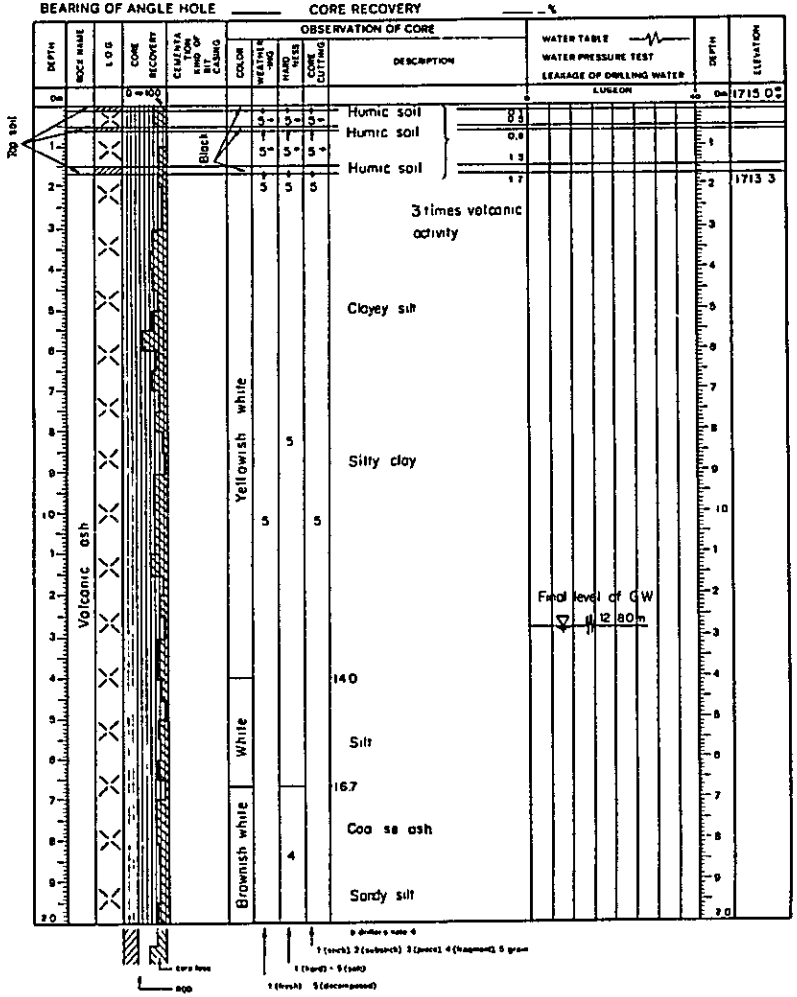
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DDH-102 (SHEET 1 OF 2)

LOCATION	Dike	DEPTH OF HOLE	25.0 m	COMMENCED	24-May-'79
ELEVATION	1714.995 m	DEPTH OF OVERBURDEN	25.0 m	COMPLETED	29-May-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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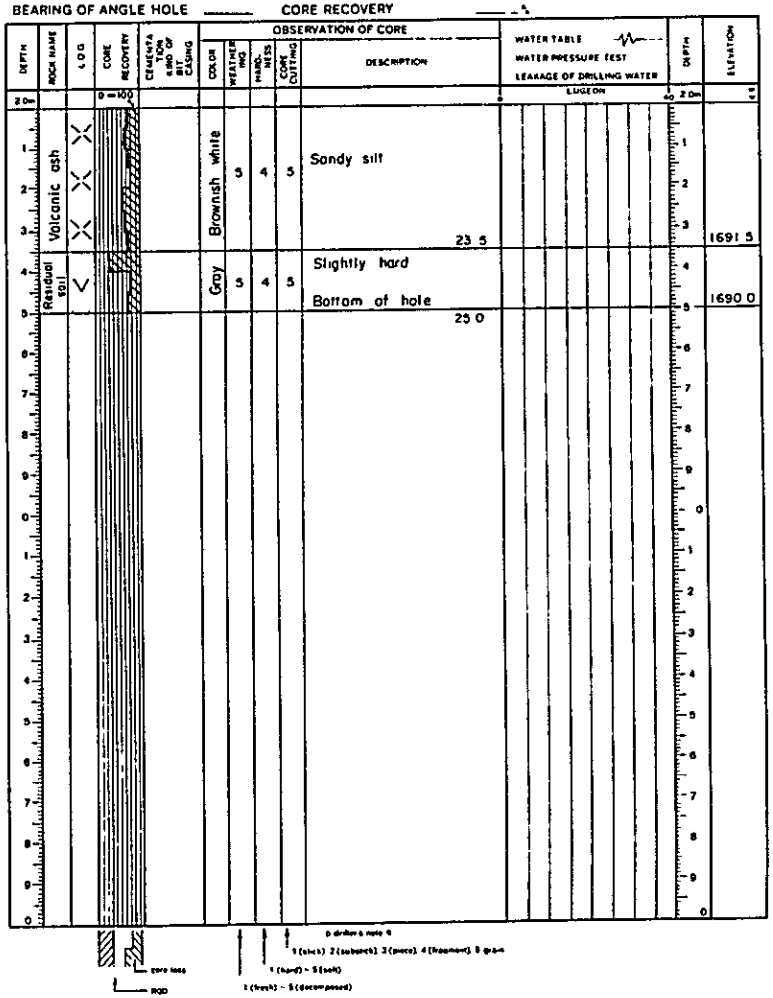
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No DDH-102 (SHEET 2 OF 2)

LOCATION	Dike	DEPTH OF HOLE	25.0 m	COMMENCED	24-May-'79
ELEVATION	1714.992 m	DEPTH OF OVERBURDEN	25.0 m	COMPLETED	29-May-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO., LTD.
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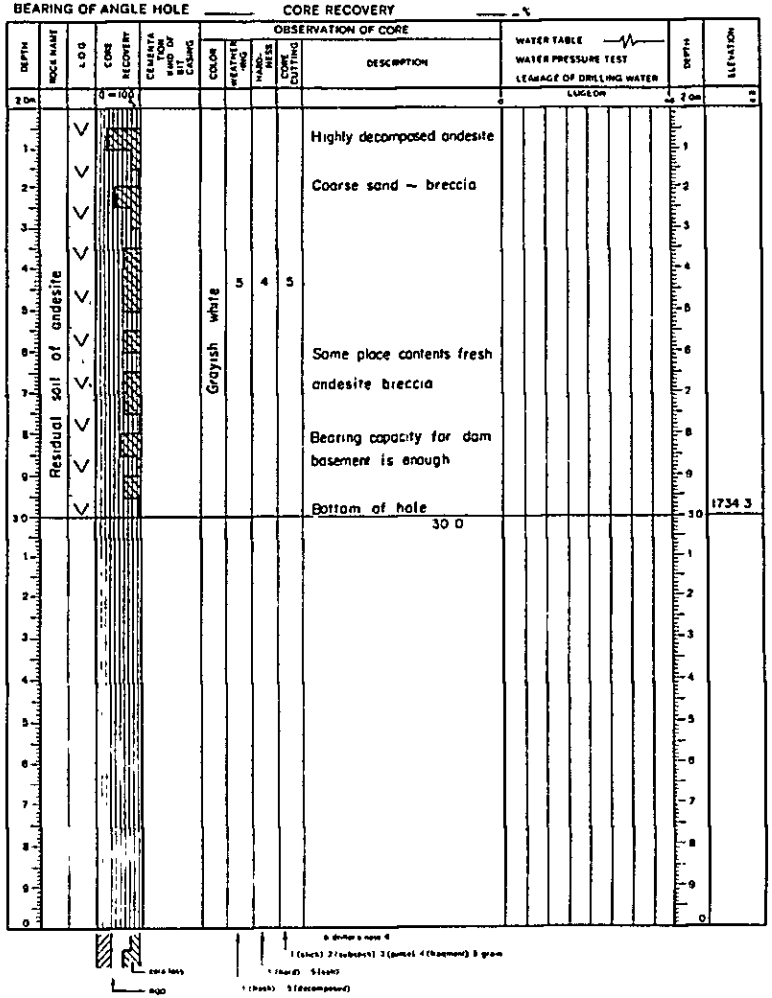
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH-1 (SHEET 2 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	20-Jul-'79
ELEVATION	1764.286 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	4-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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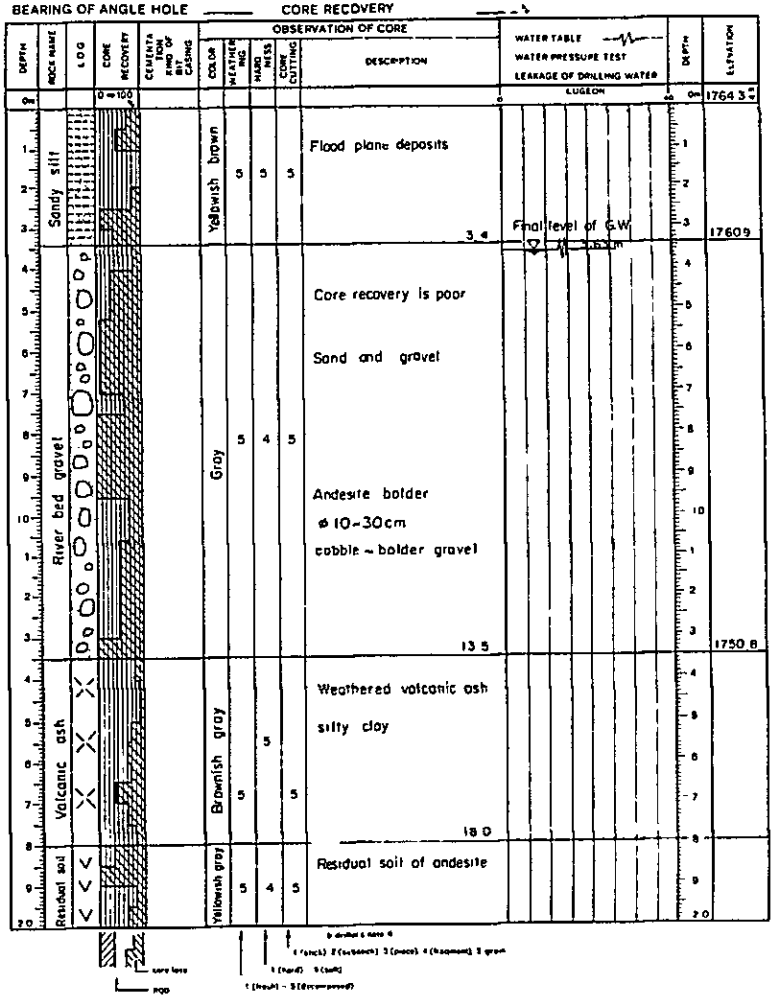
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH-1 (SHEET 1 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	20-Jul-'79
ELEVATION	1764.286 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	4-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO., LTD.
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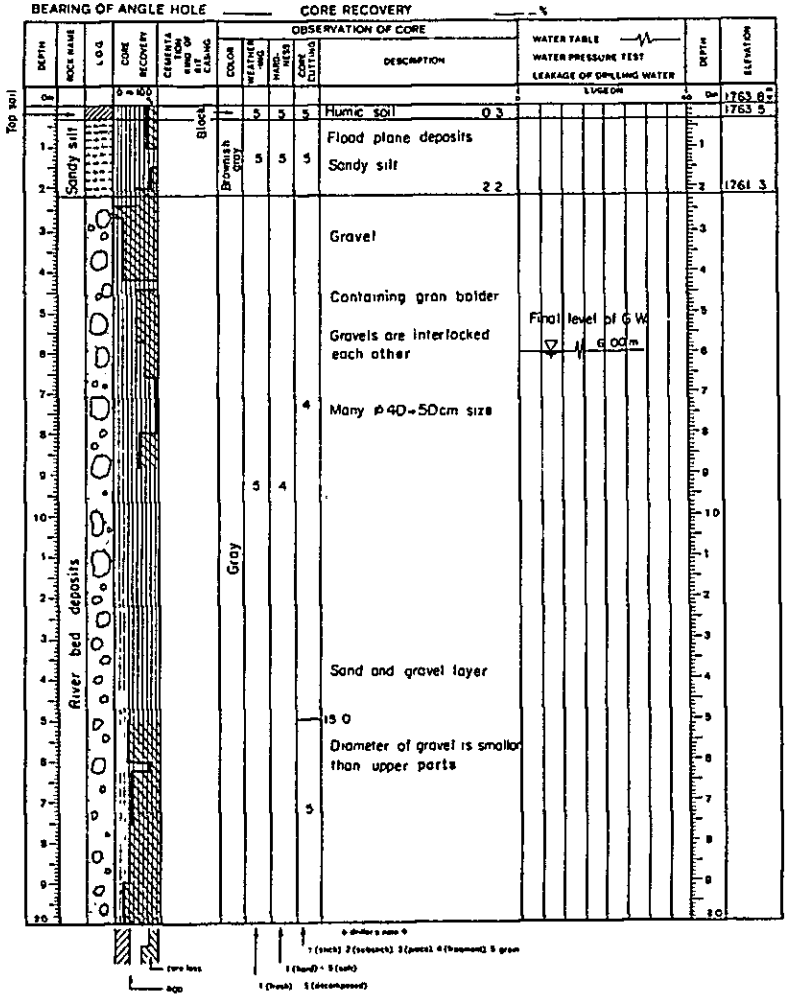
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH-2 (SHEET 1 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	13-Jun-'79
ELEVATION	1763.787 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	6-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

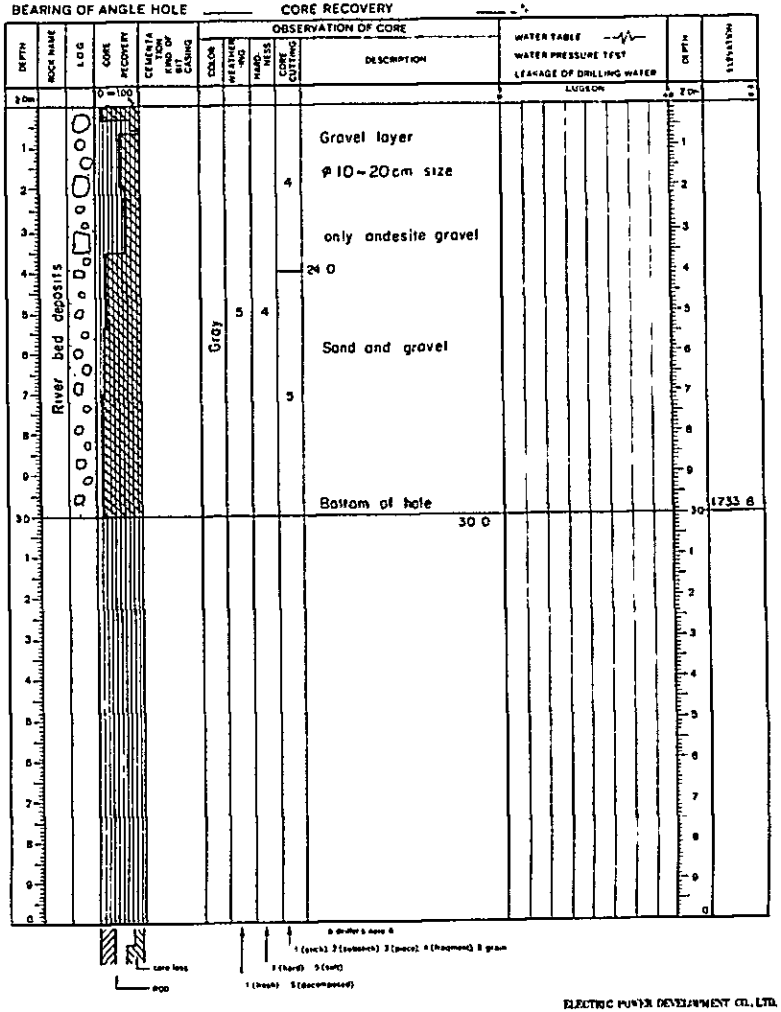


ELECTRIC POWER DEVELOPMENT CO., LTD.
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH-2 (SHEET 2 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	13-Jun-'79
ELEVATION	1763.787 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	6-Jul-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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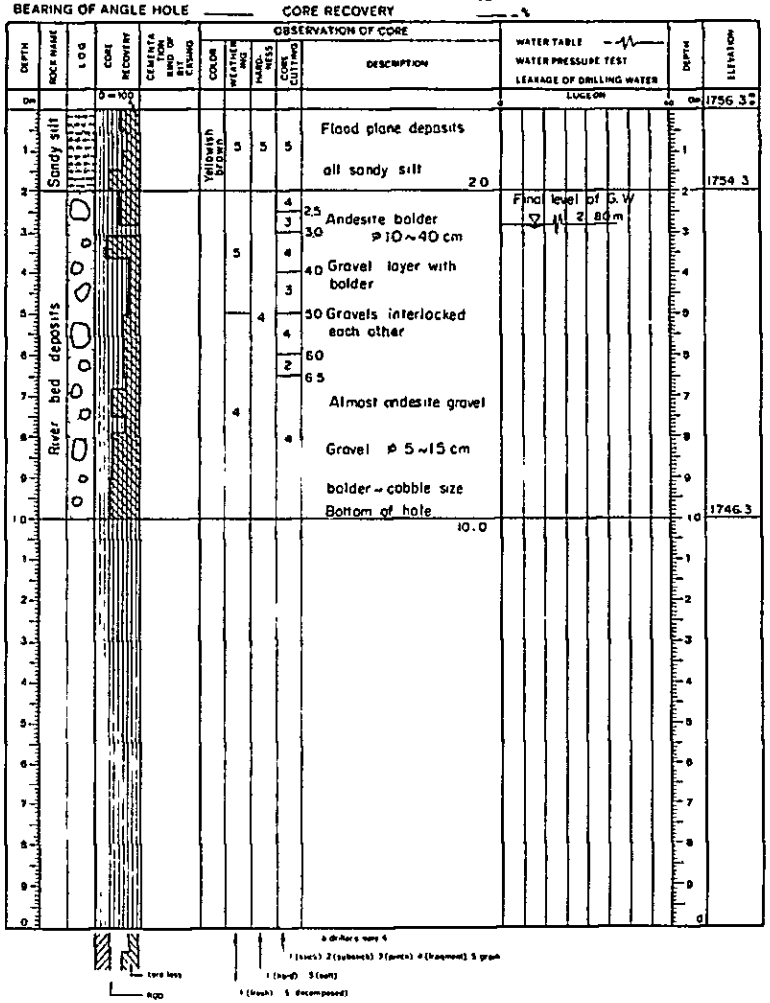
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH - 3 SHEET 1 OF 1

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	10.0 m	COMMENCED	6-Aug-'79
ELEVATION	1756.253 m	DEPTH OF OVERBURDEN	10.0 m	COMPLETED	17-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO., LTD.
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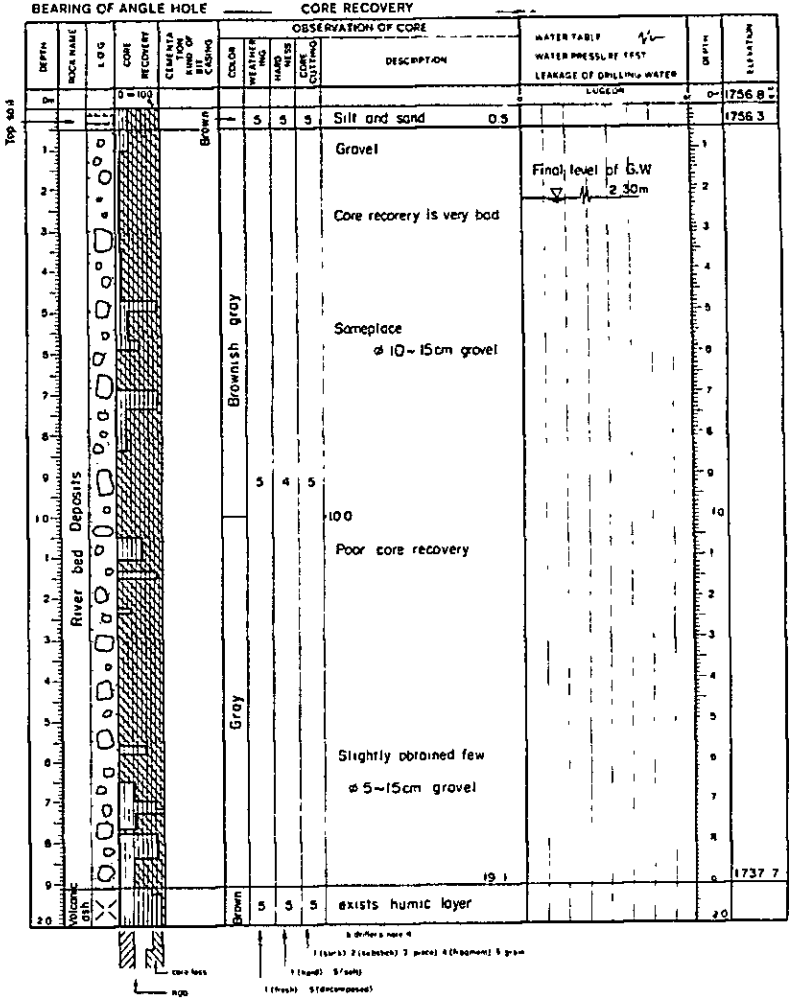
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH - 4 SHEET 1 OF 2

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	23-May-'79
ELEVATION	1756.817 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	30-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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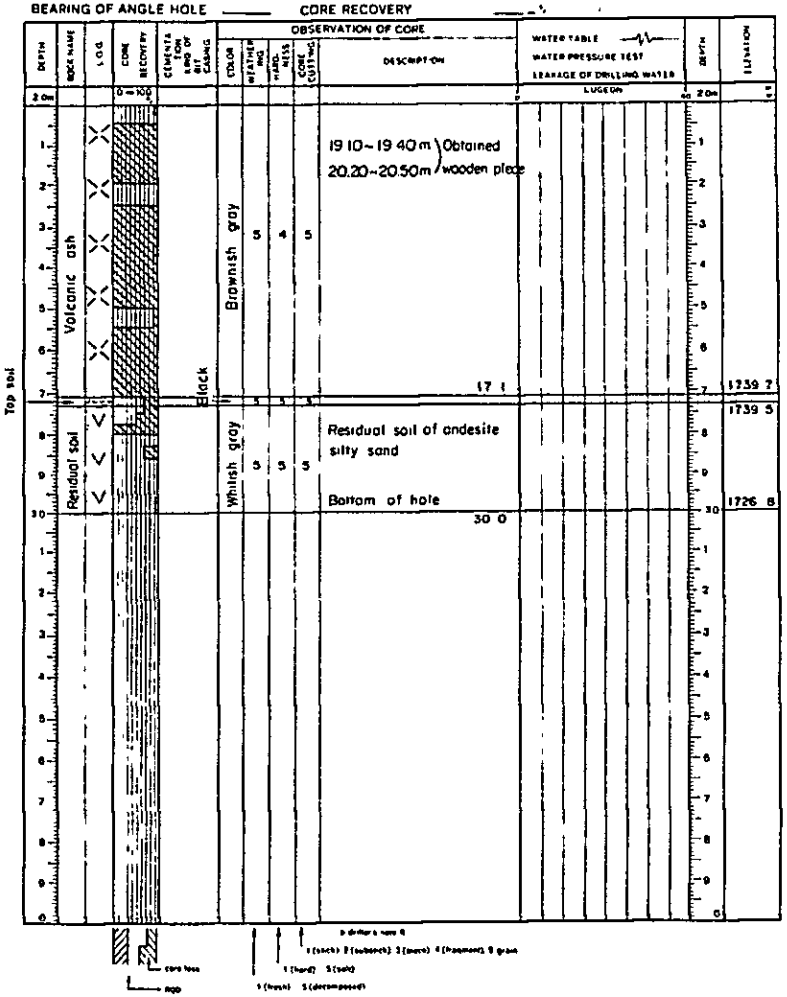
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH - 4 (SHEET 2 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	23 -May- '79
ELEVATION	1756.817 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	30 -Jun- '79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO., LTD.
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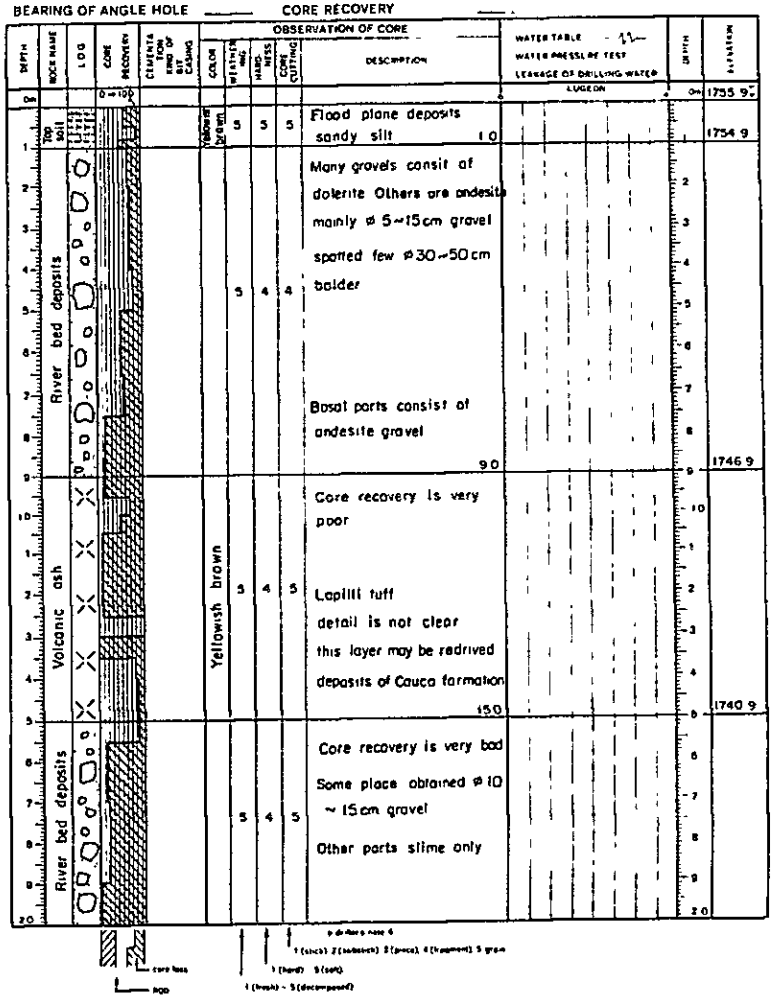
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No CDH- 5 (SHEET 1 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	3 -Aug- '79
ELEVATION	1755.880 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	21 -Aug- '79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

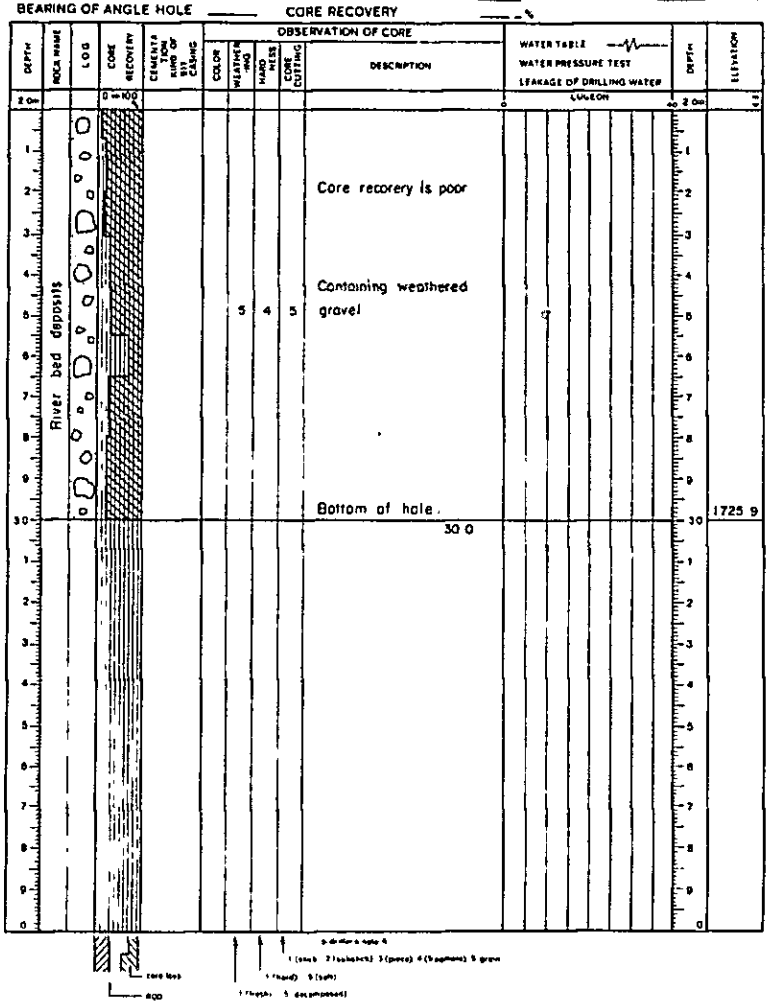


ELECTRIC POWER DEVELOPMENT CO., LTD.
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No CDH - 5 (SHEET 2 OF 2)

LOCATION	Cauca Diversion Dam	DEPTH OF HOLE	30.0 m	COMMENCED	3 -Aug- '79
ELEVATION	1755 880 m	DEPTH OF OVERBURDEN	30.0 m	COMPLETED	12 -Aug- '79
COORDINATE		LENGTH OF ROCK DRILLING	0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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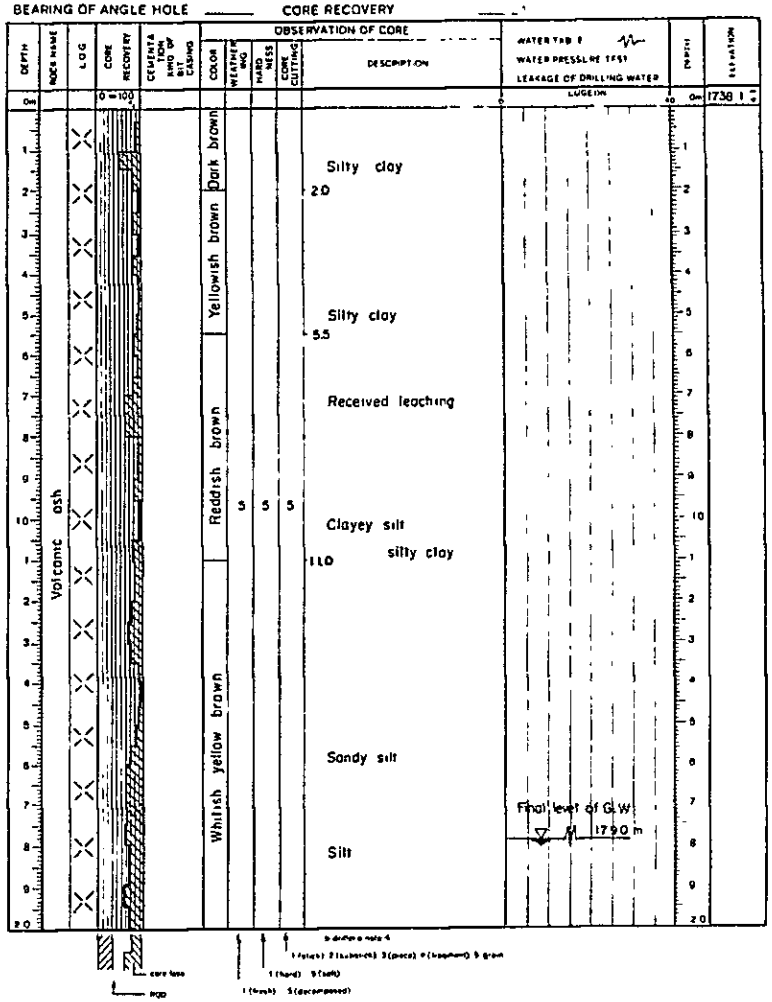
GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No BDH-1 (SHEET 1 OF 2)

LOCATION	Borrow area	DEPTH OF HOLE	40.0 m	COMMENCED	31 -May- '79
ELEVATION	1738 059 m	DEPTH OF OVERBURDEN	34.0 m	COMPLETED	12 -Jun- '79
COORDINATE		LENGTH OF ROCK DRILLING	6.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



ELECTRIC POWER DEVELOPMENT CO. LTD.
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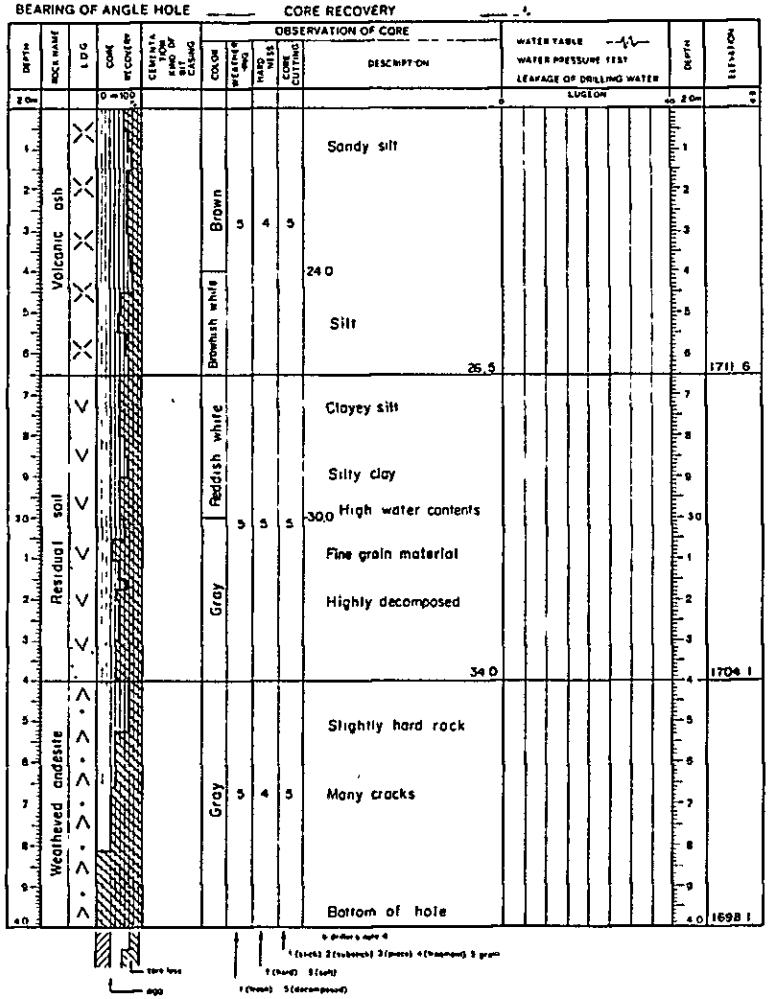
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No BDH-1 (SHEET 2 OF 2)

LOCATION	Borrow area	DEPTH OF HOLE	40.0 m	COMMENCED	31-May-'79
ELEVATION	1738.059 m	DEPTH OF OVERBURDEN	34.0 m	COMPLETED	12-Jun-'79
COORDINATE		LENGTH OF ROCK DRILLING	6.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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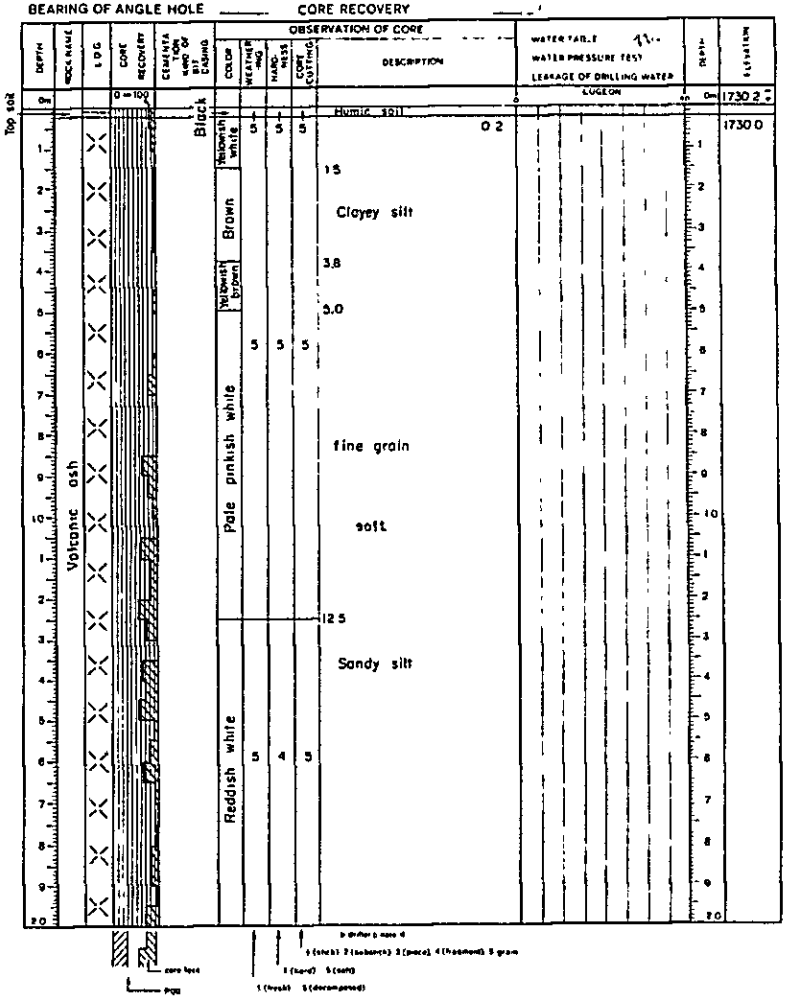
GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT — HOLE No QDH-1 (SHEET 1 OF 5)

LOCATION	Quarry site	DEPTH OF HOLE	100.0 m	COMMENCED	26-Jul-'79
ELEVATION	1730.197 m	DEPTH OF OVERBURDEN	26.0 m	COMPLETED	31-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	74.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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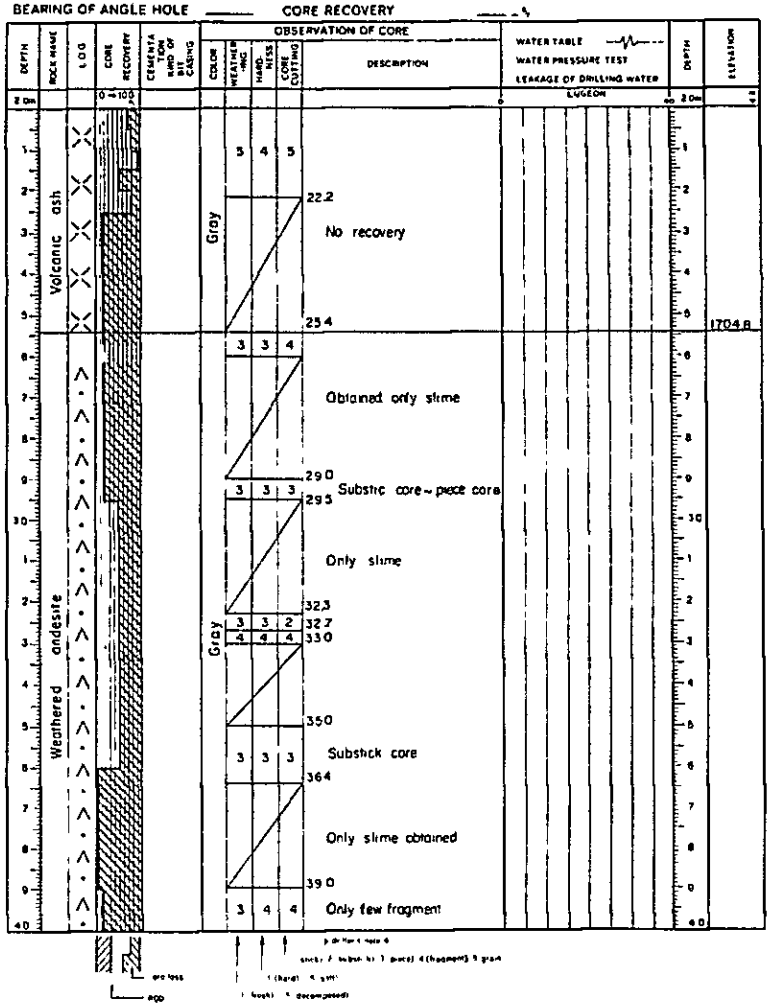
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No ODH-1 (SHEET 2 OF 5)

LOCATION	Quarry site	DEPTH OF HOLE	100.0 m	COMMENCED	26-Jul-'79
ELEVATION	1730.197 m	DEPTH OF OVERBURDEN	26.0 m	COMPLETED	31-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	74.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		

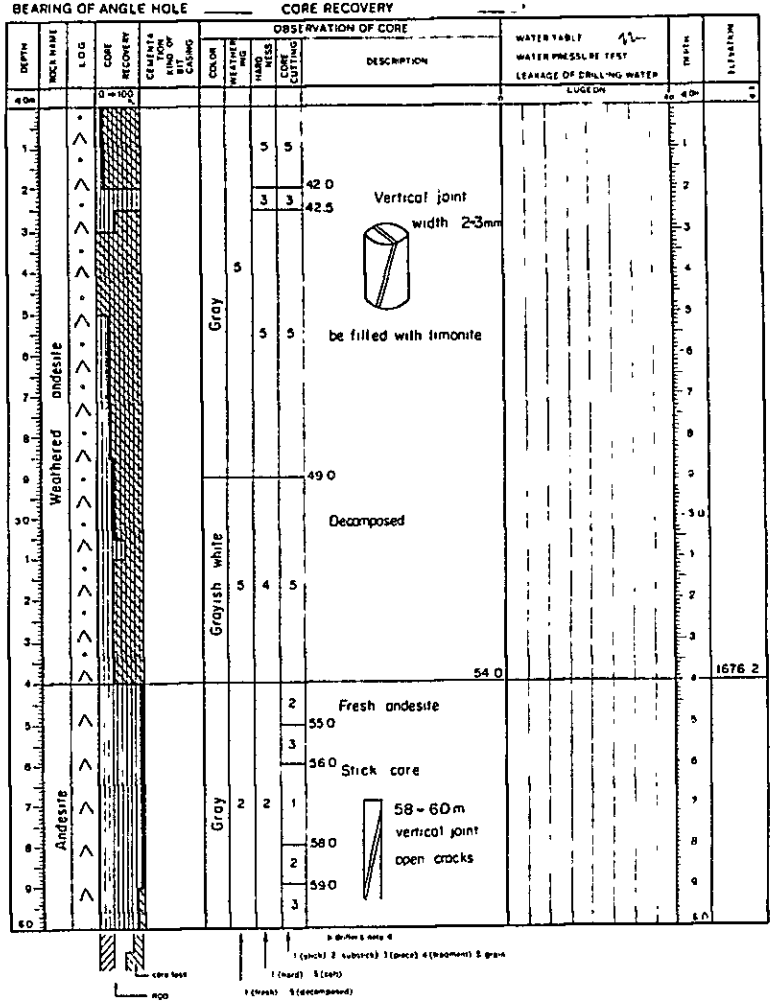


ELECTRIC POWER DEVELOPMENT CO. LTD.
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Julumito PROJECT HOLE No ODH-1 (SHEET 3 OF 5)

LOCATION	Quarry site	DEPTH OF HOLE	100.0 m	COMMENCED	26-Jul-'79
ELEVATION	1730.197 m	DEPTH OF OVERBURDEN	26.0 m	COMPLETED	31-Aug-'79
COORDINATE		LENGTH OF ROCK DRILLING	74.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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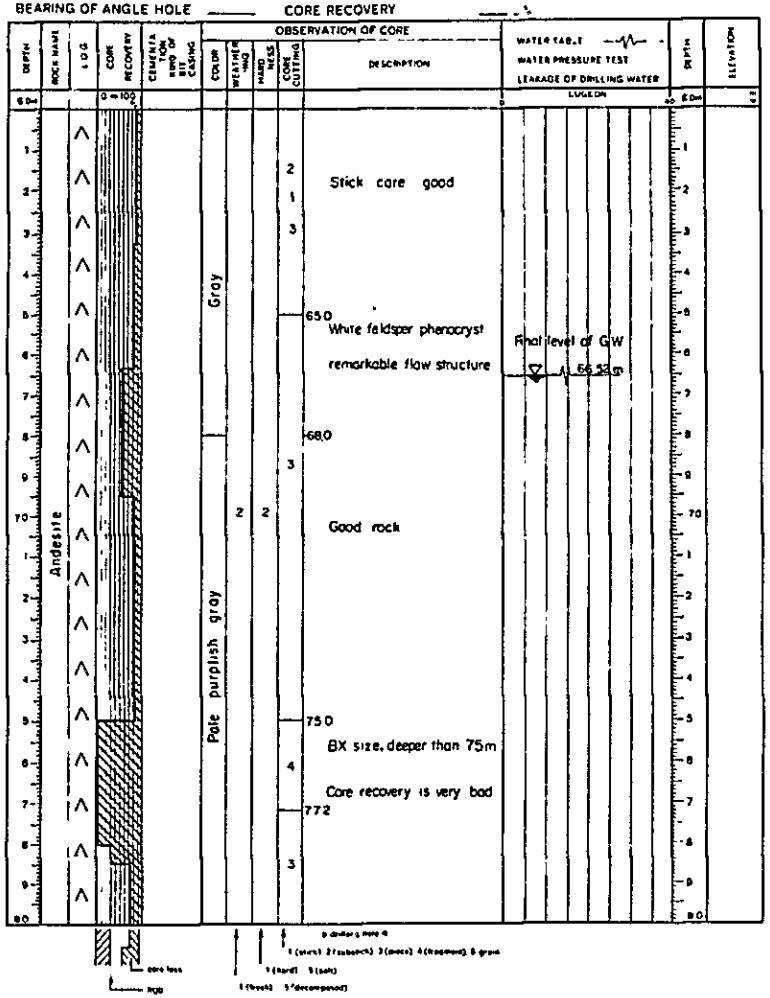
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No ODH-1 (SHEET 4 OF 5)

LOCATION	Quarry site	DEPTH OF HOLE	100.0 m	COMMENCED	26-Jul.-'79
ELEVATION	1730.197 m	DEPTH OF OVERBURDEN	26.0 m	COMPLETED	31-Aug.-'79
COORDINATE		LENGTH OF ROCK DRILLING	74.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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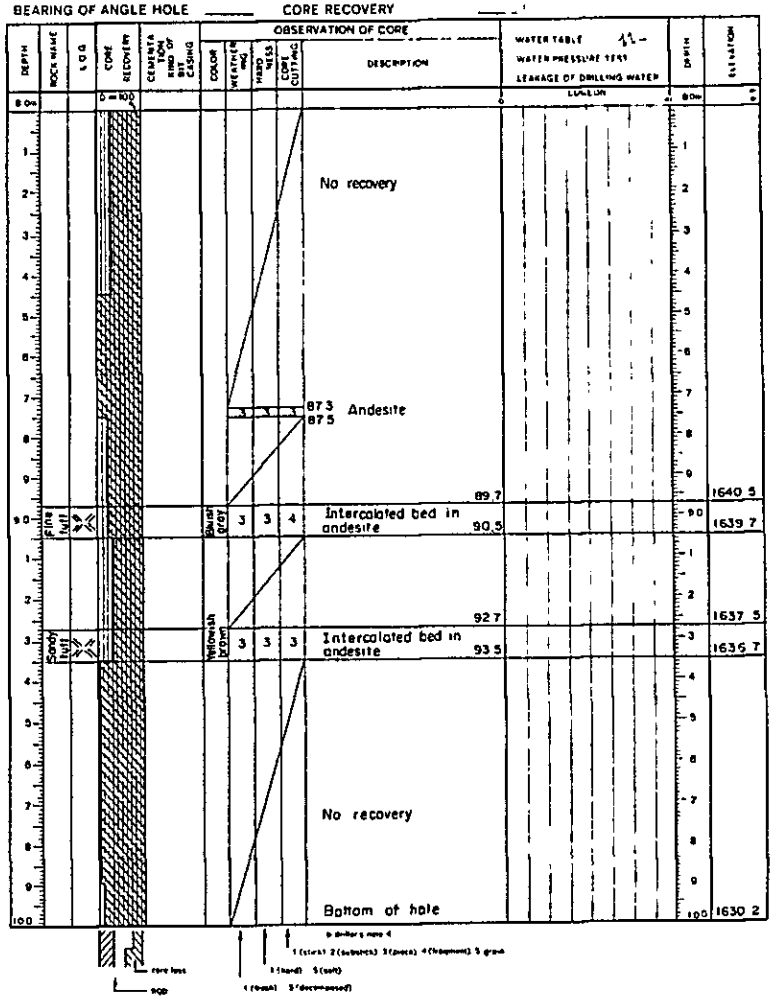
TOKYO JAPAN

GEOLOGIC LOG OF DRILL HOLE

Jutumito PROJECT — HOLE No ODH-1 (SHEET 5 OF 5)

LOCATION	Quarry site	DEPTH OF HOLE	100.0 m	COMMENCED	26-Jul.-'79
ELEVATION	1730.197 m	DEPTH OF OVERBURDEN	26.0 m	COMPLETED	31-Aug.-'79
COORDINATE		LENGTH OF ROCK DRILLING	74.0 m	DRILLED BY	
ANGLE FROM HORIZONTAL	90°	TOTAL LENGTH OF CORE	m	LOGGED BY	
BEARING OF ANGLE HOLE		CORE RECOVERY	%		



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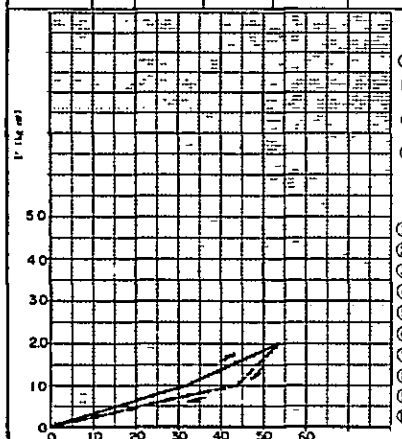
VII - 2 PERMEABILITY TEST IN DRILL HOLE

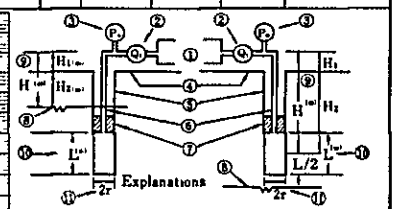
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 1)

Jutumito PROJECT — HOLE No. DH-206

LOCATION: Dam site, left bank
ELEVATION: 1690.764 m
COORDINATE:
ANGLE FROM HORIZONTAL: 90°
BEARING OF ANGLE HOLE:
DEPTH OF HOLE: 40.00 m
DIAMETER OF HOLE: NX cm
DRILLED DEPTH: m
LEVEL OF WATER TABLE: BEFORE T. 2.38 m AFTER T. 2.70 m
TEST DATE: 18 Jul '79
TESTED BY:
DRILLED BY:
CHECKED BY: EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
0.60	2.50	1.9	0.2	2.25	1.0	1.02			32.2	15.78	1.7×10^{-4}
〃		〃	〃	〃	2.0	2.02			53.5	132.2	1.4×10^{-3}
〃		〃	〃	〃	1.0	1.02			43.8	214.7	2.3×10^{-3}





① : Pump — P_e : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_e + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_e : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value ℓ/min/m/kg/cm²
⑩ : Length of test section — L_e : Coefficient of permeability
⑪ : Diamater of hole — K

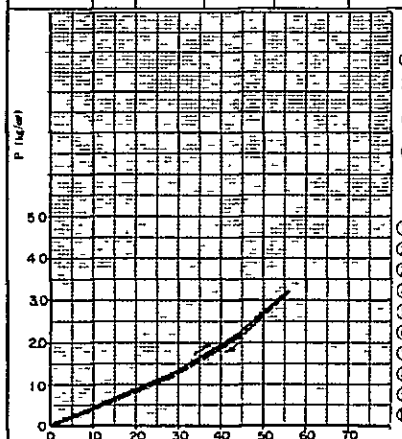
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

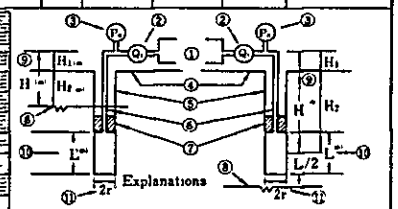
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 11)

Jutumito PROJECT — HOLE No. DH-207

LOCATION: Dam site left bank
ELEVATION: 1718.145 m
COORDINATE:
ANGLE FROM HORIZONTAL: 90°
BEARING OF ANGLE HOLE:
DEPTH OF HOLE: 40.00 m
DIAMETER OF HOLE: NX cm
DRILLED DEPTH: 3.00 m
LEVEL OF WATER TABLE: BEFORE T. 1.76 m AFTER T. 2.28 m
TEST DATE: 15 Jul '79
TESTED BY:
DRILLED BY:
CHECKED BY: EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
1.00	3.00	2.00	0.2	2.23	1.0	1.24			28.8	116.0	1.2×10^{-3}
〃		〃	〃	〃	2.0	2.24			44.0	78.6	0.8×10^{-3}
〃		〃	〃	〃	3.0	3.24			56.0	86.0	0.9×10^{-3}
〃		〃	〃	〃	2.0	2.24			45.0	100.4	1.1×10^{-3}
〃		〃	〃	〃	1.0	1.24			29.4	118.5	1.3×10^{-3}





① : Pump — P_e : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_e + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_e : Water volume per one min
⑨ : Hydrostatic head — : Lugeon value ℓ/min/m/kg/cm²
⑩ : Length of test section — L_e : Coefficient of permeability
⑪ : Diamater of hole — K

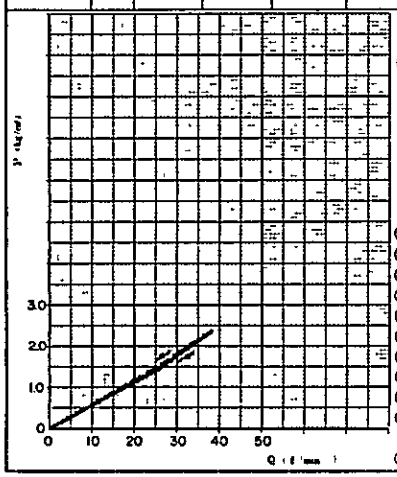
ELECTRIC POWER DEVELOPMENT CO., LTD TOKYO JAPAN

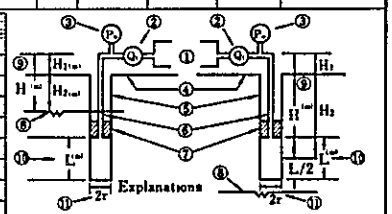
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 11)

Julumito PROJECT HOLE No DH-207

LOCATION Dam site, left bank
ELEVATION 1718.145 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 40.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 5.00 m
LEVEL OF WATER TABLE
BEFORE T 3.25 m AFTER T m
TEST DATE 15 Jul '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
3.0	5.0	2.00	0.2	3.25	1.0	1.4			25.0	89.3	0.94×10^{-3}
〃	〃	〃	〃	〃	2.0	2.4			38.5	80.2	0.85×10^{-3}
〃	〃	〃	〃	〃	1.0	1.4			23.8	85.0	0.90×10^{-3}





① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H'' / 10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_o : Water volume per one min.
L_u : Lugeon value ℓ/mn/m/10^{5}g/cm²
K : Coefficient of permeability

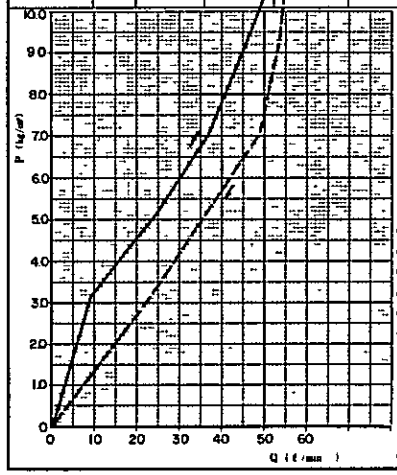
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

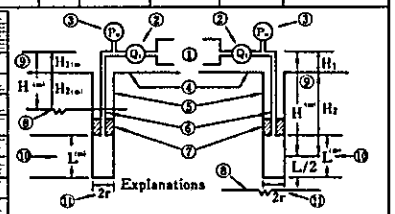
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 11)

Julumito PROJECT HOLE No DH-207

LOCATION Dam site, left bank
ELEVATION 1718.145 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 40.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 30.00 m
LEVEL OF WATER TABLE
BEFORE T 20.51 m AFTER T 11.75 m
TEST DATE 22 Jul '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
21.50	23.50	2.00	0.20	20.51	1.0	3.1			9.0	14.7	1.5×10^{-4}
〃	〃	〃	〃	〃	3.0	5.1			24.2	23.9	2.5×10^{-4}
〃	〃	〃	〃	〃	5.0	7.1			37.2	26.3	2.8×10^{-4}
〃	〃	〃	〃	〃	7.0	9.1			45.2	24.9	2.6×10^{-4}
〃	〃	〃	〃	〃	10.0	12.1			56.6	23.4	2.5×10^{-4}
〃	〃	〃	〃	〃	7.0	9.1			53.2	29.3	3.1×10^{-4}
〃	〃	〃	〃	〃	5.0	7.1			49.2	34.6	3.7×10^{-4}
〃	〃	〃	〃	〃	3.0	5.1			36.2	35.5	3.7×10^{-4}
〃	〃	〃	〃	〃	1.0	3.1			23.2	37.4	3.9×10^{-4}





① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H'' / 10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_o : Water volume per one min.
L_u : Lugeon value ℓ/mn/m/10^{5}g/cm²
K : Coefficient of permeability

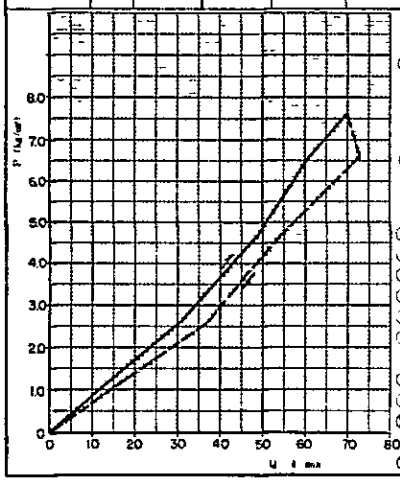
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

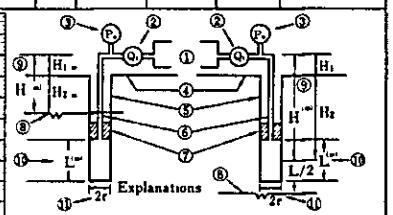
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 11)

Jutumito PROJECT — HOLE No DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00 m — TEST DATE 25 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 40.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T m AFTER.T 16.49m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
23.50	25.50	2.00	0.20	16.49	1.0	2.6			31.0	59.6	6.3×10^{-4}
〃	〃	〃	〃	〃	3.0	4.6			48.2	52.4	5.5×10^{-4}
〃	〃	〃	〃	〃	5.0	6.6			60.8	46.0	4.9×10^{-4}
〃	〃	〃	〃	〃	6.0	7.6			69.6	45.8	4.8×10^{-4}
〃	〃	〃	〃	〃	5.0	6.6			72.6	55.0	5.8×10^{-4}
〃	〃	〃	〃	〃	3.0	4.6			53.8	58.4	6.2×10^{-4}
〃	〃	〃	〃	〃	1.0	2.6			37.2	71.5	7.6×10^{-4}





① Pump — P_o : Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_o Water volume per one min
⑨ Hydrostatic head — Lugeon value ℓ/cm/m/10⁴s/cm
⑩ Length of test section — L_u Coefficient of permeability
⑪ Diameter of hole — K

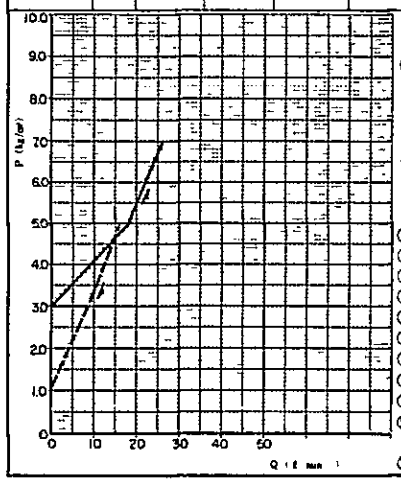
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

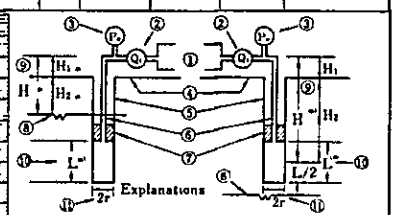
PERMEABILITY TEST IN DRILL HOLE (SHEET 5 OF 11)

Jutumito PROJECT — HOLE No DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00 m — TEST DATE 22 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 30.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 0.15 m AFTER.T 0.15 m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
25.50	27.50	2.00	0.20	0.15	1.0	1.0			0.2	1.0	1.1×10^{-5}
〃	〃	〃	〃	〃	3.0	3.0			0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	5.0			18.2	18.2	1.9×10^{-4}
〃	〃	〃	〃	〃	7.0	7.0			26.0	18.6	2.0×10^{-4}
〃	〃	〃	〃	〃	10.0	10.0			—	—	
〃	〃	〃	〃	〃	7.0	7.0			—	—	
〃	〃	〃	〃	〃	5.0	5.0			15.8	15.8	1.7×10^{-4}
〃	〃	〃	〃	〃	3.0	3.0			9.0	15.0	1.6×10^{-4}
〃	〃	〃	〃	〃	1.0	1.0			0.0	0.0	0.0





① Pump — P_o Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_o Water volume per one min
⑨ Hydrostatic head — Lugeon value ℓ/mn/m/10⁴s/cm
⑩ Length of test section — L_u Coefficient of permeability
⑪ Diameter of hole — K

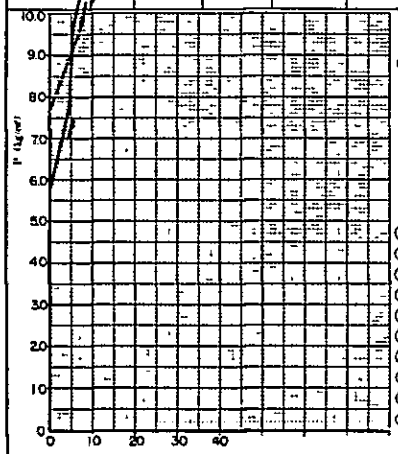
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

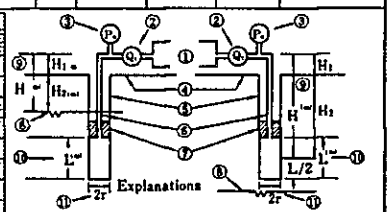
PERMEABILITY TEST IN DRILL HOLE (SHEET 6 OF 11)

Julumito PROJECT — HOLE No. DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00 m — TEST DATE 22 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 30.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 27.00 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
27.50	29.50	2.00	0.20	27.10	1.0	3.7			0.2	0.3	3.2×10^{-6}
〃		〃	〃	〃	3.0	5.7			0.2	0.2	2.1×10^{-6}
〃		〃	〃	〃	5.0	7.7			4.6	3.0	3.2×10^{-5}
〃		〃	〃	〃	7.0	9.7			5.6	2.9	3.0×10^{-5}
〃		〃	〃	〃	10.0	12.7			13.2	5.2	5.5×10^{-5}
〃		〃	〃	〃	7.0	9.7			7.6	3.9	4.1×10^{-5}
〃		〃	〃	〃	5.0	7.7			0.2	0.1	1.1×10^{-6}
〃		〃	〃	〃	3.0	5.7			0.0	0.0	0.0
〃		〃	〃	〃	1.0	3.7			0.4	0.5	5.7×10^{-6}





① : Pump
② Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ Length of test section
⑪ . Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 Depth of Ground water
P : Effective pressure
$P = P_o + H'' / 10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min.
: Lugeon value in ℓ/min/m/10kg/cm²
L_u : Coefficient of permeability
K

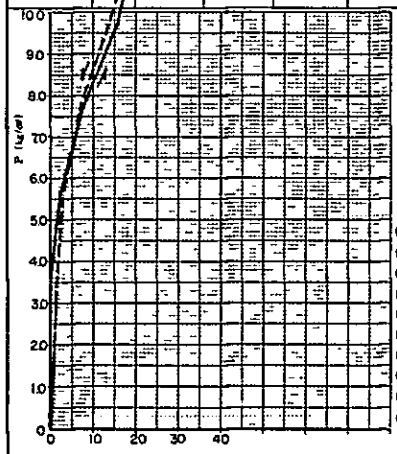
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

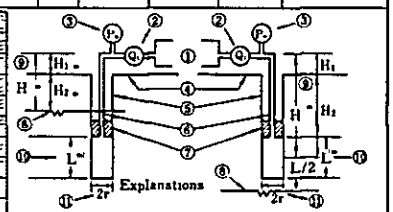
PERMEABILITY TEST IN DRILL HOLE (SHEET 7 OF 11)

Julumito PROJECT — HOLE No. DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00 m — TEST DATE 25 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 40.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 27.00 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u Lugeon	K (cm/sec)
29.50	31.50	2.00	0.20	27.00	1.0	3.7			0.4	0.5	5.3×10^{-6}
〃		〃	〃	〃	3.0	5.7			2.4	2.1	2.2×10^{-5}
〃		〃	〃	〃	5.0	7.7			7.4	4.8	5.1×10^{-5}
〃		〃	〃	〃	7.0	9.7			15.6	8.0	8.5×10^{-5}
〃		〃	〃	〃	10.0	12.7			22.0	8.7	9.2×10^{-5}
〃		〃	〃	〃	7.0	9.7			13.8	7.1	7.5×10^{-5}
〃		〃	〃	〃	5.0	7.7			7.0	4.5	4.8×10^{-5}
〃		〃	〃	〃	3.0	5.7			3.0	2.6	2.8×10^{-5}
〃		〃	〃	〃	1.0	3.7			1.8	2.4	2.6×10^{-5}





① : Pump
② Flow meter
③ : Pressure gauge
④ Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ . Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ Diamater of hole

P_o : Gauge pressure
H_1 Height of Pressure gauge
H_2 ' Depth of Ground water
P Effective pressure
$P = P_o + H'' / 10$. $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min
Lugeon value in ℓ/min/m/10kg/cm²
L_u ' Coefficient of permeability
K

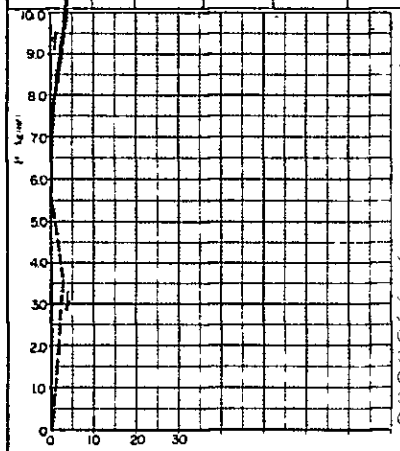
ELECTRIC POWER DEVELOPMENT CO., LTD TOKYO JAPAN

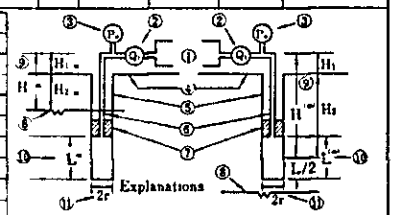
PERMEABILITY TEST IN DRILL HOLE (SHEET 8 OF 11)

Julumito PROJECT — HOLE No DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00m — TEST DATE 25 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 40.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 2700m AFTER T m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
31.50	33.50	2.00	0.20	27.00	1.0	3.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	5.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	7.7			0.8	0.5	5.3×10^{-6}
〃	〃	〃	〃	〃	7.0	9.7			3.2	1.7	1.8×10^{-5}
〃	〃	〃	〃	〃	10.0	12.7			6.8	2.7	2.8×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			3.6	1.9	2.0×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			0.4	0.3	3.7×10^{-6}
〃	〃	〃	〃	〃	3.0	5.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	1.0	3.7			2.8	3.8	4.0×10^{-5}





Explanations

①	Pump	P_o	:Gauge pressure
②	Flow meter	H_1	. Height of Pressure gauge
③	Pressure gauge	H_2	. Depth of Ground water
④	Ground surface	P	Effective pressure
⑤	Drill hole		$P = P_o + H'' / 10$. $H = H_1 + H_2$
⑥	Injection pipe	t	.Injected time
⑦	Packer	Q_t	.Water volume during time in "t"
⑧	Water table		
⑨	Hydrostatic head	Q_o	Water volume per one min
⑩	Length of test section	L_u	.Lugeon value ℓ/mn/m/10^4t/m
⑪	Diamater of hole	K	Coefficient of permeability

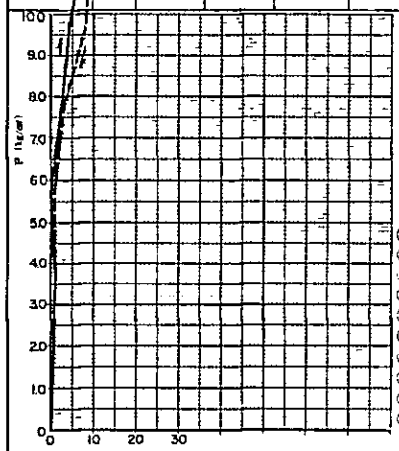
ELECTRIC POWER DEVELOPMENT CO LTD TOKYO JAPAN

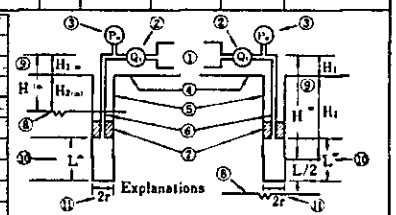
PERMEABILITY TEST IN DRILL HOLE (SHEET 9 OF 11)

Julumito PROJECT — HOLE No DH-207

LOCATION Dam site, left bank — DEPTH OF HOLE 40.00 m — TEST DATE 25 Jul '79
ELEVATION 1718.145 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 40.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 2700 m AFTER T m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
33.50	35.50	2.00	0.20	27.00	1.0	3.7			1.2	1.6	1.7×10^{-5}
〃	〃	〃	〃	〃	3.0	5.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	7.7			2.6	1.7	1.8×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			4.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	10.0	12.7			9.8	3.9	4.1×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			6.2	4.2	4.5×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			3.0	1.9	2.1×10^{-5}
〃	〃	〃	〃	〃	3.0	5.7			0.8	0.7	7.4×10^{-6}
〃	〃	〃	〃	〃	1.0	3.7			1.2	1.6	1.7×10^{-5}





Explanations

①	Pump	P_o	Gauge pressure
②	Flow meter	H_1	Height of Pressure gauge
③	Pressure gauge	H_2	Depth of Ground water
④	Ground surface	P	Effective pressure
⑤	Drill hole		$P = P_o + H'' / 10$ $H = H_1 + H_2$
⑥	Injection pipe	t	Injected time
⑦	Packer	Q_t	Water volume during time in "t"
⑧	Water table		
⑨	Hydrostatic head	Q_o	Water volume per one min
⑩	Length of test section	L_u	Lugeon value ℓ/mn/m/10^4t/m
⑪	Diamater of hole	K	Coefficient of permeability

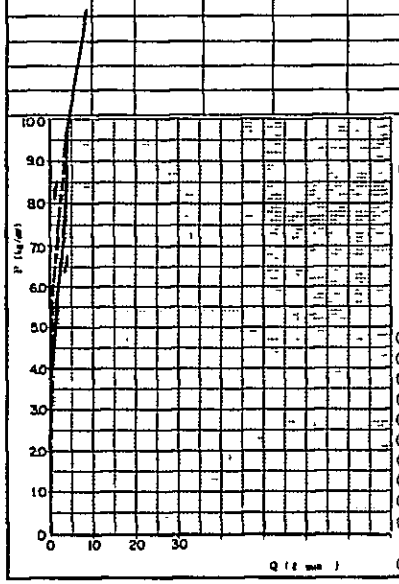
ELECTRIC POWER DEVELOPMENT CO LTD TOKYO JAPAN

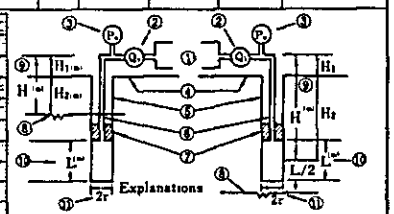
PERMEABILITY TEST IN DRILL HOLE (SHEET 10 OF 11)

Jujumito PROJECT — HOLE No. DH-207

LOCATION: Dam site, left bank
ELEVATION: 1718.145 m
COORDINATE:
ANGLE FROM HORIZONTAL: 90°
BEARING OF ANGLE HOLE:
DEPTH OF HOLE: 40.00m
DIAMETER OF HOLE: NX cm
DRILLED DEPTH: 40.00 m
LEVEL OF WATER TABLE: BEFORE T 27.00m AFTER T ___ m
TEST DATE: 25 Jul '79
TESTED BY:
DRILLED BY:
CHECKED BY: EPDC

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_1 (ℓ)	Q_o (ℓ/min)	L_o (Lugeon)	K (cm/sec)
35.50	37.50	2.00	0.20	27.00	1.0	3.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	5.7			2.0	1.8	1.9×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			3.6	2.3	2.5×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			4.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	10.0	12.7			8.8	3.5	3.7×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			4.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			2.0	1.3	1.4×10^{-5}
〃	〃	〃	〃	〃	3.0	5.7			0.6	0.5	5.3×10^{-6}
〃	〃	〃	〃	〃	1.0	3.7			0.4	0.5	5.3×10^{-6}





①: Pump
②: Flow meter
③: Pressure gauge
④: Ground surface
⑤: Drill hole
⑥: Injection pipe
⑦: Packer
⑧: Water table
⑨: Hydrostatic head
⑩: Length of test section
⑪: Diamater of hole

P_o: Gauge pressure
H_1: Height of Pressure gauge
H_2: Depth of Ground water
P: Effective pressure $P = P_o + H'/10$, $H = H_1 + H_2$
t: Injected time
Q_1: Water volume during time in "t"
Q_o: Water volume per one min.
L_o: Lugeon value in ℓ/min/m/10^4kg/cm²
K: Coefficient of permeability

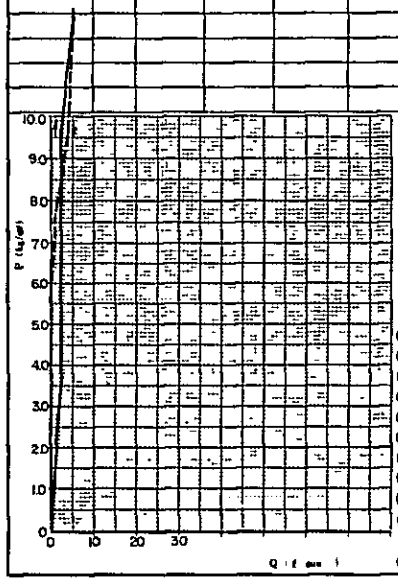
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

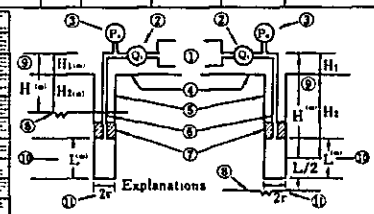
PERMEABILITY TEST IN DRILL HOLE (SHEET 11 OF 11)

Jujumito PROJECT — HOLE No. DH-207

LOCATION: Dam site, left bank
ELEVATION: 1718.145 m
COORDINATE:
ANGLE FROM HORIZONTAL: 90°
BEARING OF ANGLE HOLE:
DEPTH OF HOLE: 40.00m
DIAMETER OF HOLE: NX cm
DRILLED DEPTH: 40.00m
LEVEL OF WATER TABLE: BEFORE T 27.00m AFTER T ___ m
TEST DATE: 24 Jul '79
TESTED BY:
DRILLED BY:
CHECKED BY: EPDC

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_1 (ℓ)	Q_o (ℓ/min)	L_o (Lugeon)	K (cm/sec)
37.50	39.50	2.00	0.20	27.00	1.0	3.7			2.4	3.2	3.4×10^{-5}
〃	〃	〃	〃	〃	3.0	5.7			2.2	1.9	2.0×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			2.6	1.7	1.8×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			2.8	1.4	1.5×10^{-5}
〃	〃	〃	〃	〃	10.0	12.7			5.6	2.3	2.4×10^{-5}
〃	〃	〃	〃	〃	7.0	9.7			4.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	5.0	7.7			1.2	0.8	8.2×10^{-6}
〃	〃	〃	〃	〃	3.0	5.7			0.0	0.0	0.0
〃	〃	〃	〃	〃	1.0	3.7			0.0	0.0	0.0





①: Pump
②: Flow meter
③: Pressure gauge
④: Ground surface
⑤: Drill hole
⑥: Injection pipe
⑦: Packer
⑧: Water table
⑨: Hydrostatic head
⑩: Length of test section
⑪: Diamater of hole

P_o: Gauge pressure
H_1: Height of Pressure gauge
H_2: Depth of Ground water
P: Effective pressure $P = P_o + H'/10$, $H = H_1 + H_2$
t: Injected time
Q_1: Water volume during time in "t"
Q_o: Water volume per one min
L_o: Lugeon value in ℓ/min/m/10^4kg/cm²
K: Coefficient of permeability

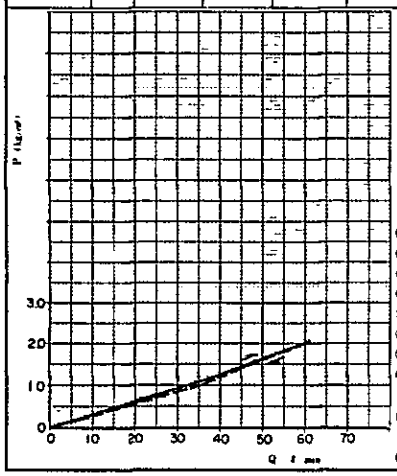
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

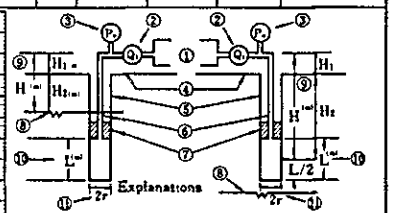
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 17)

Jutumito PROJECT — HOLE No. DH-208

LOCATION Dam site, right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 30.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 3.00 m
LEVEL OF WATER TABLE BEFORE T 0.40 m AFTER T 2.70 m
TEST DATE 20 Jul '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_1 (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
0.50	2.50	2.00	0.7	0.4	1.0	1.1	5	17.8	3.56	16.18	1.71×10^{-3}
〃	〃	〃	〃	〃	2.0	2.1	5	31.0	6.20	14.76	1.56×10^{-3}
〃	〃	〃	〃	〃	1.0	1.1	5	18.8	3.76	17.09	1.80×10^{-3}





① Pump — P_e Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 . Depth of Ground water
④ Ground surface — P 'Effective pressure
⑤ Drill hole — $P = P_e + H'' / 10$, $H = H_1 + H_2$
⑥ Injection pipe — t .Injected time
⑦ Packer — Q_1 'Water volume during time in "t"
⑧ Water table
⑨ Hydrostatic head — Q_e :Water volume per one min.
⑩ Length of test section — :Lugeon value in ℓ/min/m/10^{-6}kg/cm² — L_e 'Coefficient of permeability
⑪ Diamater of hole — K

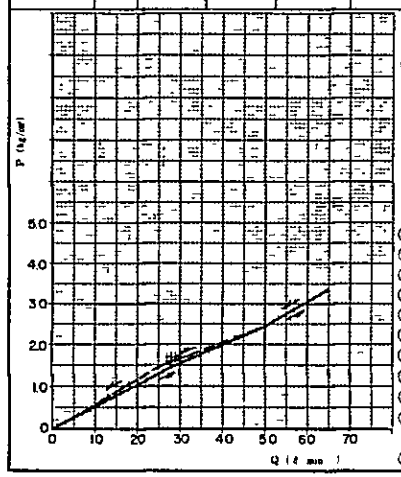
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

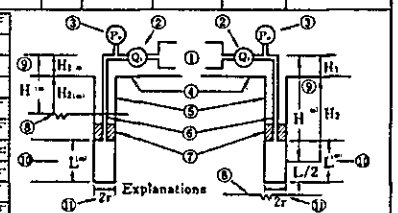
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 17)

Jutumito PROJECT — HOLE No DH-208

LOCATION Dam site, right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 30.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH m
LEVEL OF WATER TABLE BEFORE T 3.5 m AFTER T 4.5 m
TEST DATE 21 Jul '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_1 (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
2.50	5.00	2.50	0	3.5	1.0	1.4	5	13.8	2.76	7.88	8.79×10^{-4}
〃	〃	〃	〃	〃	2.0	2.4	5	25.3	5.06	8.43	9.37×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	32.9	6.58	7.74	8.62×10^{-4}
〃	〃	〃	〃	〃	2.0	2.4	5	25.4	5.08	8.46	9.46×10^{-4}
〃	〃	〃	〃	〃	1.0	1.4	5	12.3	2.46	7.03	7.83×10^{-4}





① 'Pump — P_e 'Gauge pressure
② 'Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 . Depth of Ground water
④ 'Ground surface — P .Effective pressure
⑤ : Drill hole — $P = P_e + H'' / 10$ $H = H_1 + H_2$
⑥ 'Injection pipe — t :Injected time
⑦ : Packer — Q_1 :Water volume during time in "t"
⑧ Water table
⑨ Hydrostatic head — Q_e :Water volume per one min
⑩ Length of test section — :Lugeon value in ℓ/min/m/10^{-6}kg/cm² — L_e Coefficient of permeability
⑪ . Diamater of hole — K

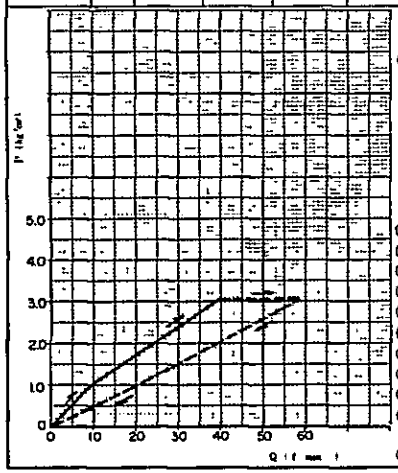
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

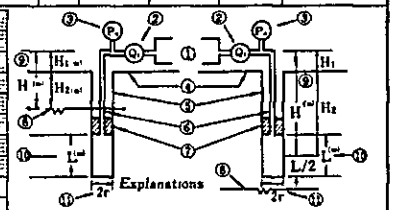
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 17)

Jujumito PROJECT — HOLE No. DH-208

LOCATION	Dam site, right bank	DEPTH OF HOLE	30.00 m
ELEVATION	1 679.247 m	DIAMETER OF HOLE	NX cm
COORDINATE		DRILLED DEPTH	8.50 m
ANGLE FROM HORIZONTAL	90°	LEVEL OF WATER TABLE	
BEARING OF ANGLE HOLE		BEFORE T 2.00m AFTER T 2.00m	
TEST DATE	7 Jul '79		
TESTED BY			
DRILLED BY			
CHECKED BY	EPDC		

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
6.00	8.00	2.00	0	2.0	1	1.02	5	4.7	9.4	46.1	4.9×10^{-4}
〃	〃	〃	〃	〃	3	3.02	5	20.2	40.4	66.9	7.06×10^{-4}
〃	〃	〃	〃	〃	3	3.02	5	29.2	58.4	96.7	1.02×10^{-3}
〃	〃	〃	〃	〃	1	1.02	5	10.5	21.0	102.9	1.09×10^{-3}





① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H_{(m)}/10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min.
: Lugeon value ℓ/min/m/10^{-4}kg/cm²
L_e : Coefficient of permeability
K

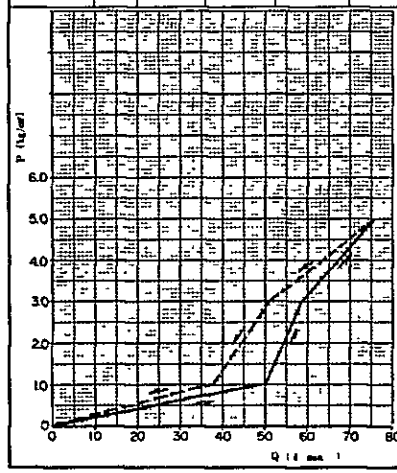
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

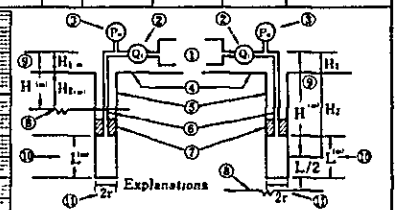
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 17)

Jujumito PROJECT — HOLE No DH-208

LOCATION	Dam site right bank	DEPTH OF HOLE	30.00 m
ELEVATION	1 679 247 m	DIAMETER OF HOLE	NX cm
COORDINATE		DRILLED DEPTH	9.00 m
ANGLE FROM HORIZONTAL	90°	LEVEL OF WATER TABLE	
BEARING OF ANGLE HOLE		BEFORE T 3.35 m AFTER T 3.9 m	
TEST DATE	24 Jul '79		
TESTED BY			
DRILLED BY			
CHECKED BY	EPDC		

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
7.00	9.00	2.00	0	3.35	1.0	1.03	5	25.2	50.4	244.7	2.58×10^{-3}
〃	〃	〃	〃	〃	3.0	3.03	5	29.5	59.0	97.4	1.03×10^{-3}
〃	〃	〃	〃	〃	5.0	5.03	5	38.2	76.4	75.9	8.02×10^{-4}
〃	〃	〃	〃	〃	3.0	3.03	5	25.5	51.0	84.6	8.88×10^{-4}
〃	〃	〃	〃	〃	1.0	1.03	5	19.2	38.4	186.4	1.97×10^{-3}





① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H_{(m)}/10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min
: Lugeon value ℓ/min/m/10^{-4}kg/cm²
L_e : Coefficient of permeability
K

ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 5 OF 17)

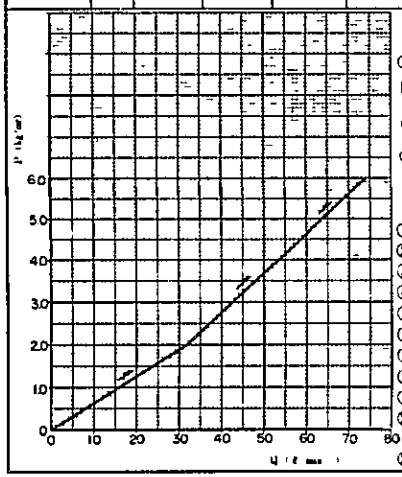
Jujumito PROJECT HOLE No DH-208

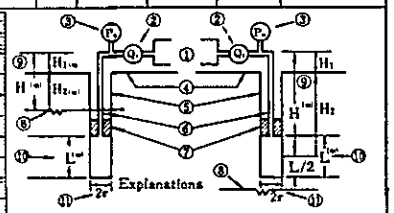
LOCATION Dam site right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE

DEPTH OF HOLE 30 00m
DIAMETER OF HOLE NX cm
DRILLED DEPTH m
LEVEL OF WATER TABLE
BEFORE T m AFTER T 13.95m

TEST DATE 1 Aug '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
8.00	10.00	2.00	0.50	9.00	1.0	1.95	2	64	32.0	82.1	8.66×10^{-4}
〃		〃	〃	〃	3.0	3.95	2	108	54.0	68.4	7.21×10^{-4}
〃		〃	〃	〃	5.0	5.95	1	74	74.0	62.2	6.56×10^{-4}





① : Pump
② : Flow meter
③ Pressure gauge
④ Ground surface
⑤ Drill hole
⑥ Injection pipe
⑦ Packer
⑧ Water table
⑨ Hydrostatic head
⑩ Length of test section
⑪ Diamater of hole

P_e : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_e + H \cdot 1/10,\ H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min.
L_e : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
K : Coefficient of permeability

ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 6 OF 17)

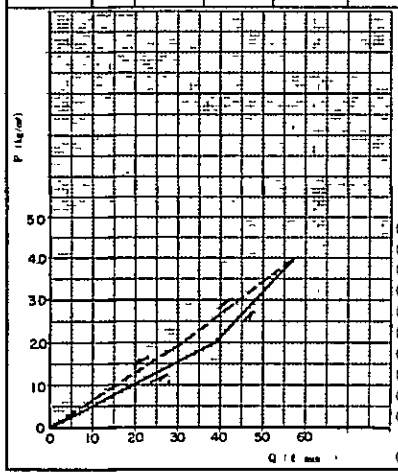
Jujumito PROJECT HOLE No DH-208

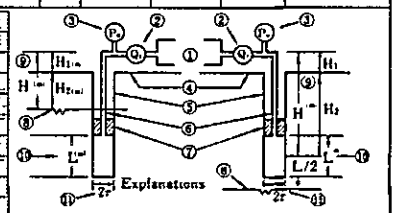
LOCATION Dam site right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE

DEPTH OF HOLE 30 00m
DIAMETER OF HOLE NX cm
DRILLED DEPTH m
LEVEL OF WATER TABLE
BEFORE T 13.95m AFTER T m

TEST DATE 1 Aug '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
9.00	11.00	2.00	0.50	10.00	1.0	2.05	5	197	39.4	96.1	1.01×10^{-3}
〃		〃	〃	〃	3.0	4.05	5	286	57.2	70.6	7.45×10^{-4}
〃		〃	〃	〃	1.0	2.05	5	158	31.6	77.1	8.13×10^{-4}





① : Pump
② : Flow meter
③ Pressure gauge
④ Ground surface
⑤ Drill hole
⑥ Injection pipe
⑦ Packer
⑧ Water table
⑨ Hydrostatic head
⑩ Length of test section
⑪ Diamater of hole

P_e : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_e + H \cdot 10,\ H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min.
L_e : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
K : Coefficient of permeability

ELECTRIC POWER DEVELOPMENT CO., LTD TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 7 OF 17)

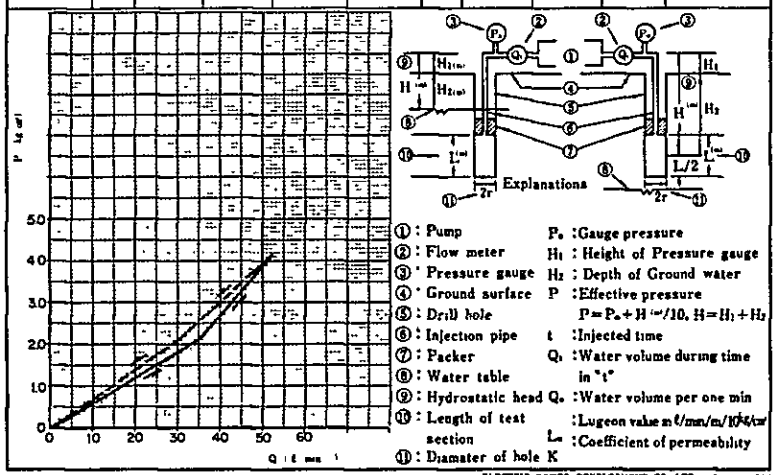
Julumito PROJECT HOLE No DH-208

LOCATION Dam site, right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE

DEPTH OF HOLE 30.00m
DIAMETER OF HOLE NX cm
DRILLED DEPTH m
LEVEL OF WATER TABLE
BEFORE T. 13.95m AFTER T. m

TEST DATE 1 Aug '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
10.00	12.00	2.00	0.50	11.00	1.0	2.15	5	179	35.8	83.3	8.79×10^{-4}
〃		〃	〃	〃	3.0	4.15	1	52	52.0	62.7	6.61×10^{-4}
〃		〃	〃	〃	1.0	2.15	5	156	31.2	72.6	7.66×10^{-4}



① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H'/10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_o : Water volume per one min
L_u : Lugeon value ℓ/min/m/10^{4}kg/cm²
K : Coefficient of permeability

ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 8 OF 17)

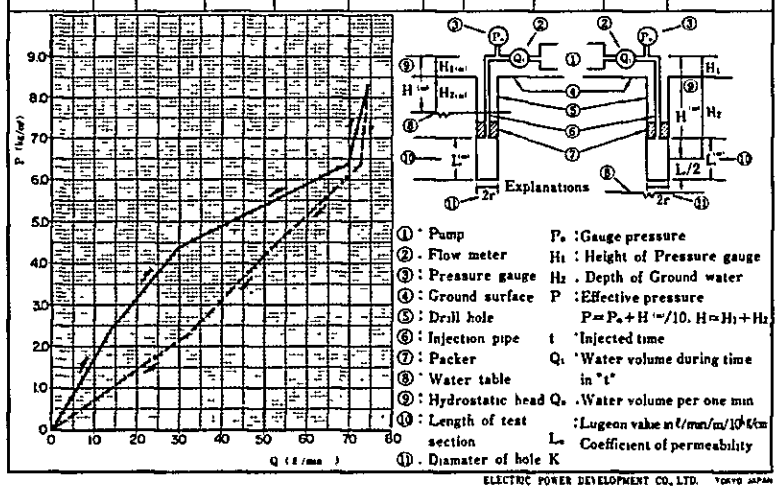
Julumito PROJECT HOLE No DH-208

LOCATION Dam site, right bank
ELEVATION 1 679 247 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE

DEPTH OF HOLE 30.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH m
LEVEL OF WATER TABLE
BEFORE T 13.95m AFTER T m

TEST DATE 31 Jul '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
12.00	14.00	2.00	0.50	13.00	1.0	2.35	5	69	13.8	29.4	3.10×10^{-4}
〃		〃	〃	〃	3.0	4.35	5	148	29.6	34.0	3.59×10^{-4}
〃		〃	〃	〃	5.0	6.35	5	346	69.2	54.5	5.75×10^{-4}
〃		〃	〃	〃	7.0	8.35	5	373	74.6	44.7	4.71×10^{-4}
〃		〃	〃	〃	5.0	6.35	5	363	72.6	57.2	6.03×10^{-4}
〃		〃	〃	〃	3.0	4.35	5	259	51.8	59.5	6.28×10^{-4}
〃		〃	〃	〃	1.0	2.35	5	166	33.2	70.6	7.46×10^{-4}



① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H'/10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_o : Water volume per one min
L_u : Lugeon value ℓ/min/m/10^{4}kg/cm²
K : Coefficient of permeability

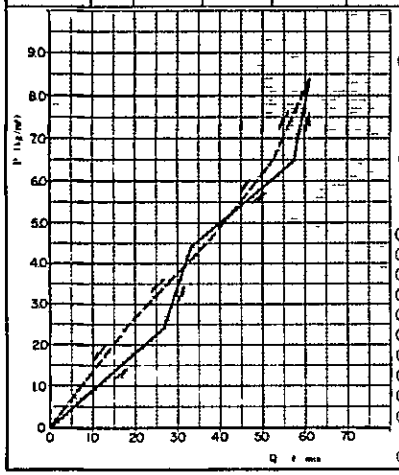
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

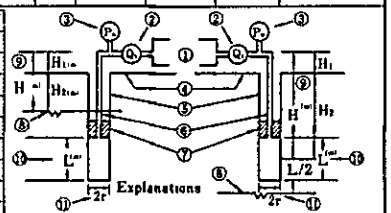
PERMEABILITY TEST IN DRILL HOLE (SHEET 9 OF 17)

Jutumito PROJECT — HOLE No DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00m — TEST DATE 1 Aug '79
ELEVATION 1 679 247 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 13.95m AFTER T m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
14.00	16.00	2.00	0.50	13.95	1.0	2.45	5	135	27.0	55.1	5.82×10^{-4}
〃		〃	〃	〃	3.0	4.45	5	167	33.4	37.5	3.96×10^{-4}
〃		〃	〃	〃	5.0	6.45	5	287	57.4	44.5	4.70×10^{-4}
〃		〃	〃	〃	7.0	8.45	5	304	60.8	36.0	3.80×10^{-4}
〃		〃	〃	〃	5.0	6.45	5	262	52.4	40.6	4.28×10^{-4}
〃		〃	〃	〃	3.0	4.45	5	183	36.6	41.1	4.34×10^{-4}
〃		〃	〃	〃	1.0	2.45	5	90	18.0	36.7	3.87×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H^{cm}/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ : Hydrostatic head — : Lugeon value in ℓ/mn/m/10^{-4}kg/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diamater of hole — K

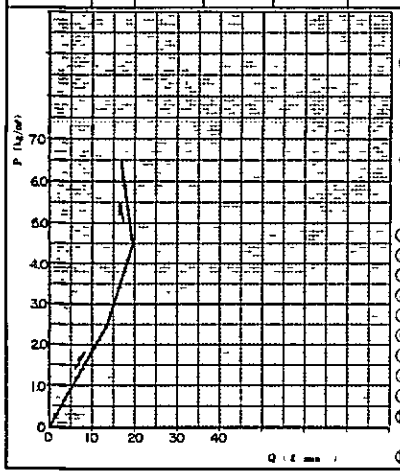
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

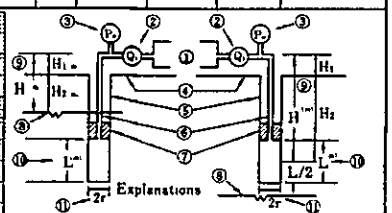
PERMEABILITY TEST IN DRILL HOLE (SHEET 10 OF 17)

Jutumito PROJECT — HOLE No. DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00m — TEST DATE 31 Jul '79
ELEVATION 1 679 247 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 13.95m AFTER T. m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
16.00	18.00	2.00	0.50	13.95	1.0	2.45	5	69	13.8	28.2	2.98×10^{-4}
〃		〃	〃	〃	3.0	4.45	5	98	19.6	22.0	2.32×10^{-4}
〃		〃	〃	〃	5.0	6.45	5	17	17.0	13.2	1.39×10^{-4}





① Pump — P_o Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_o + H^{cm}/10$, $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_o Water volume per one min
⑨ Hydrostatic head — Lugeon value in ℓ/mn/m/10^{-4}kg/cm²
⑩ Length of test section — L_u Coefficient of permeability
⑪ Diamater of hole — K

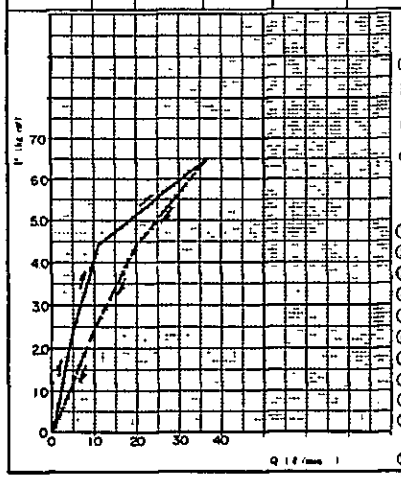
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

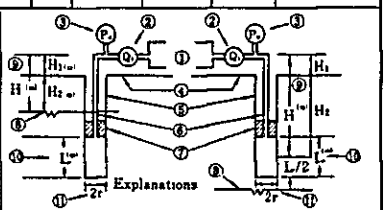
PERMEABILITY TEST IN DRILL HOLE (SHEET 11 OF 17)

Jutumito PROJECT — HOLE No DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00 m — TEST DATE 1 Aug '79
ELEVATION 1 679.247 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 13.95 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
16.00	18.00	2.00	0.50	13.95	1.0	2.45	5	26	5.2	10.6	1.12×10^{-4}
〃	〃	〃	〃	〃	3.0	4.45	5	57	11.4	12.8	1.35×10^{-4}
〃	〃	〃	〃	〃	5.0	6.45	5	182	36.4	28.2	2.98×10^{-4}
〃	〃	〃	〃	〃	5.0	6.45	5	183	36.6	28.4	3.00×10^{-4}
〃	〃	〃	〃	〃	3.0	4.45	5	102	20.4	22.9	2.42×10^{-4}
〃	〃	〃	〃	〃	1.0	2.45	5	52	10.4	21.2	2.24×10^{-4}





①: Pump — P_e: Gauge pressure
②: Flow meter — H_1: Height of Pressure gauge
③: Pressure gauge — H_2: Depth of Ground water
④: Ground surface — P: Effective pressure
⑤: Drill hole — $P = P_e + H^{m}/10$, $H = H_1 + H_2$
⑥: Injection pipe — t: Injected time
⑦: Packer — Q_t: Water volume during time in "t"
⑧: Water table — Q_e: Water volume per one min.
⑨: Hydrostatic head — 'Lugeon value in ℓ/min/m/10^{4}kg/cm²
⑩: Length of test section — L_e: Coefficient of permeability
⑪: Diamater of hole — K

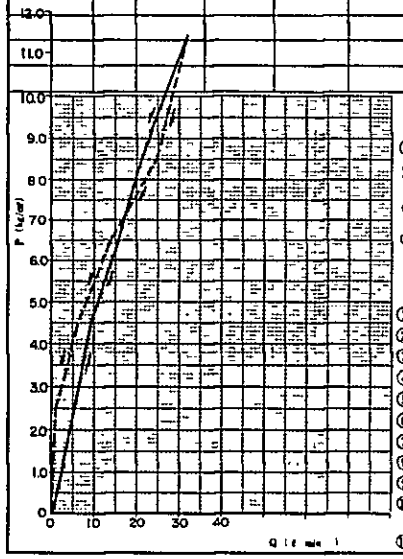
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

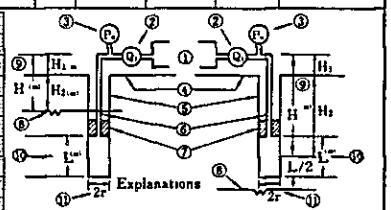
PERMEABILITY TEST IN DRILL HOLE (SHEET 12 OF 17)

Jutumito PROJECT — HOLE No DH-208

LOCATION Dam site right bank — DEPTH OF HOLE 30.00 m — TEST DATE 31 Jul '79
ELEVATION 1 679.247 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 13.95 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
18.00	20.00	2.00	0.50	13.95	1.0	2.45	5	27	5.4	11.0	1.16×10^{-4}
〃	〃	〃	〃	〃	3.0	4.45	5	46	9.2	10.3	1.09×10^{-4}
〃	〃	〃	〃	〃	5.0	6.45	5	78	15.6	12.1	1.28×10^{-4}
〃	〃	〃	〃	〃	7.0	8.45	5	103	20.6	12.2	1.29×10^{-4}
〃	〃	〃	〃	〃	10.0	11.45	5	160	32.0	14.0	1.48×10^{-4}
〃	〃	〃	〃	〃	7.0	8.45	5	121	24.2	14.3	1.51×10^{-4}
〃	〃	〃	〃	〃	5.0	6.45	5	68	13.6	10.5	1.11×10^{-4}
〃	〃	〃	〃	〃	3.0	4.45	5	30	6.0	6.7	7.07×10^{-5}
〃	〃	〃	〃	〃	1.0	2.45	5	3	0.6	1.2	1.27×10^{-5}





①. Pump — P_e: Gauge pressure
②: Flow meter — H_1. Height of Pressure gauge
③: Pressure gauge — H_2 ' Depth of Ground water
④ ' Ground surface — P 'Effective pressure
⑤. Drill hole — $P = P_e + H^{m}/10$, $H = H_1 + H_2$
⑥: Injection pipe — t: Injected time
⑦: Packer — Q_t: Water volume during time in "t"
⑧: Water table — Q_e: Water volume per one min
⑨: Hydrostatic head — 'Lugeon value in ℓ/min/m/10^{4}kg/cm²
⑩. Length of test section — L_e. Coefficient of permeability
⑪: Diamater of hole — K

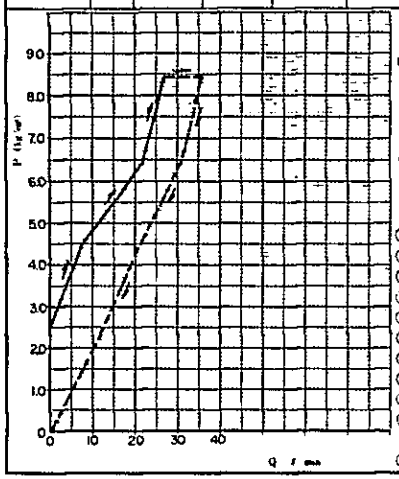
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

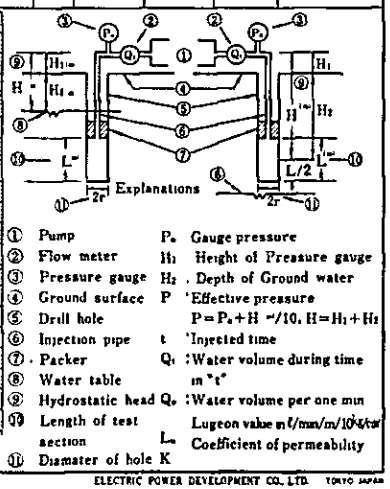
PERMEABILITY TEST IN DRILL HOLE (SHEET 13 OF 17)

Jutumito PROJECT — HOLE No. DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00 m — TEST DATE 31 Jul '79
ELEVATION 1679.247 m — DIAMETER OF HOLE NX sm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 13.95 m AFTER.T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_o (Lugeon)	K (cm/sec)
20.00	22.00	2.00	0.50	13.95	1.0	2.45	5	0	0	0	0.0
〃	〃	〃	〃	〃	3.0	4.45	5	36	7.2	8.1	0.55×10^{-6}
〃	〃	〃	〃	〃	5.0	6.45	5	108	21.6	16.7	1.76×10^{-6}
〃	〃	〃	〃	〃	7.0	8.45	5	133	26.5	15.7	1.66×10^{-6}
〃	〃	〃	〃	〃	7.0	8.45	5	177	35.4	20.9	2.21×10^{-6}
〃	〃	〃	〃	〃	5.0	6.45	5	153	30.6	23.7	2.50×10^{-6}
〃	〃	〃	〃	〃	3.0	4.45	5	103	20.6	23.1	2.44×10^{-6}
〃	〃	〃	〃	〃	1.0	2.45	5	64	12.8	26.1	2.75×10^{-6}





① Pump — P_o Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P 'Effective pressure
⑤ Drill hole — $P = P_o + H = /10$, $H = H_1 + H_2$
⑥ Injection pipe — t 'Injected time
⑦ Packer — Q_t :Water volume during time in "t"
⑧ Water table — Q_o :Water volume per one min
⑨ Hydrostatic head — L_o Lugeon value in ℓ/mn/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

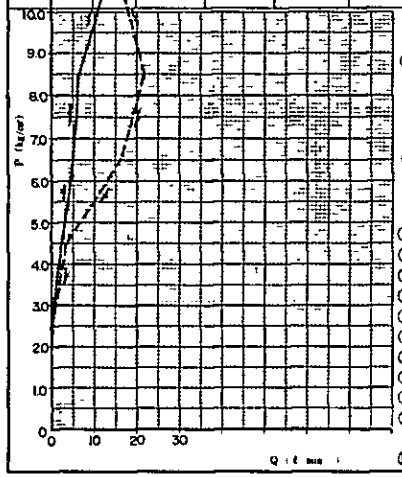
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

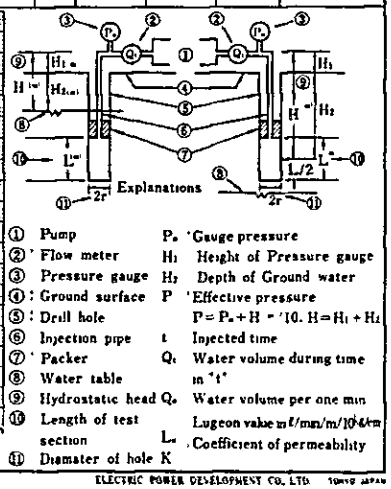
PERMEABILITY TEST IN DRILL HOLE (SHEET 14 OF 17)

Jutumito PROJECT — HOLE No DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00 m — TEST DATE 31 Jul '79
ELEVATION 1679.247 m — DIAMETER OF HOLE sm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 13.95 m AFTER.T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_o (Lugeon)	K (cm/sec)
22.00	24.00	2.00	0.50	13.95	1.0	2.45	5	0	0	0	0.0
〃	〃	〃	〃	〃	3.0	4.45	5	12	2.4	2.7	2.85×10^{-6}
〃	〃	〃	〃	〃	5.0	6.45	5	25	5.0	3.9	4.12×10^{-6}
〃	〃	〃	〃	〃	7.0	8.45	5	32	6.4	3.8	4.01×10^{-6}
〃	〃	〃	〃	〃	10.0	11.45	5	73	14.6	6.4	6.76×10^{-6}
〃	〃	〃	〃	〃	7.0	8.45	5	107	21.4	12.7	1.34×10^{-6}
〃	〃	〃	〃	〃	5.0	6.45	5	80	16.0	12.4	1.31×10^{-6}
〃	〃	〃	〃	〃	3.0	4.45	5	18	3.6	4.0	4.22×10^{-6}
〃	〃	〃	〃	〃	1.0	2.45	5	2	0.4	0.8	8.44×10^{-8}





① Pump — P_o 'Gauge pressure
② 'Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ : Ground surface — P 'Effective pressure
⑤ : Drill hole — $P = P_o + H = '10$, $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ 'Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_o Water volume per one min
⑨ Hydrostatic head — L_o Lugeon value in ℓ/mn/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

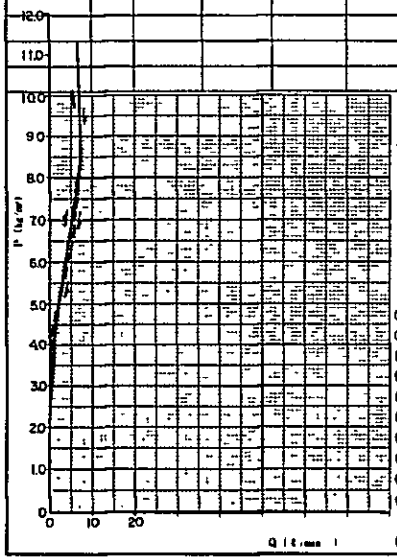
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

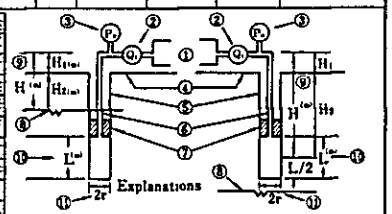
PERMEABILITY TEST IN DRILL HOLE (SHEET 15 OF 17)

Jujumito PROJECT — HOLE No DH-208

LOCATION Dam site, right bank — DEPTH OF HOLE 30.00 m — TEST DATE 31 Jul '79
ELEVATION 1 679.247 m — DIAMETER OF HOLE ____ cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH ____ m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T 13.95 m AFTER T ____ m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
24.00	26.00	2.00	0.50	13.95	1.0	2.45	5	0	0	0	0.0
〃	〃	〃	〃	〃	3.0	4.45	5	8	1.6	1.8	1.90×10^{-5}
〃	〃	〃	〃	〃	5.0	6.45	5	22	4.4	3.4	3.59×10^{-5}
〃	〃	〃	〃	〃	7.0	8.45	5	38	7.6	4.5	4.75×10^{-5}
〃	〃	〃	〃	〃	10.0	11.45	5	34	6.8	3.0	3.17×10^{-5}
〃	〃	〃	〃	〃	7.0	8.45	5	37	7.4	4.4	4.64×10^{-5}
〃	〃	〃	〃	〃	5.0	6.45	5	26	5.2	4.0	4.22×10^{-5}
〃	〃	〃	〃	〃	3.0	4.45	5	5	1.0	1.1	1.16×10^{-5}
〃	〃	〃	〃	〃	1.0	2.45	5	0	0	0	0.0





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H^{(m)}/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — L_u : Lugeon value in ℓ/mm/m/10^4kg/cm²
⑩ : Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

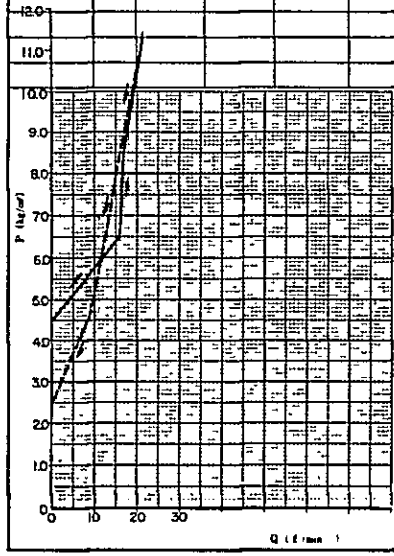
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

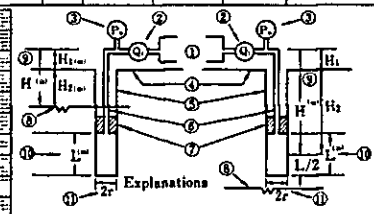
PERMEABILITY TEST IN DRILL HOLE (SHEET 16 OF 17)

Jujumito PROJECT — HOLE No DH-208

LOCATION Dam site right bank — DEPTH OF HOLE 30.00 m — TEST DATE 30 Jul '79
ELEVATION 1 679 247 m — DIAMETER OF HOLE NX cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH ____ m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T 13.95 m AFTER T ____ m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
26.00	28.00	2.00	0.50	13.95	1.0	2.45	5	0	0	0	0.0
〃	〃	〃	〃	〃	3.0	4.45	5	1	0.2	0.2	2.11×10^{-6}
〃	〃	〃	〃	〃	5.0	6.45	5	79	15.8	12.2	1.29×10^{-4}
〃	〃	〃	〃	〃	7.0	8.45	5	83	16.6	9.8	1.03×10^{-4}
〃	〃	〃	〃	〃	10.0	11.45	5	109	21.8	9.5	1.00×10^{-4}
〃	〃	〃	〃	〃	7.0	8.45	5	80	16.0	9.5	1.00×10^{-4}
〃	〃	〃	〃	〃	5.0	6.45	5	64	12.8	9.9	1.04×10^{-4}
〃	〃	〃	〃	〃	3.0	4.45	5	43	8.6	9.7	1.02×10^{-4}
〃	〃	〃	〃	〃	1.0	2.45	5	1	0.2	0.4	4.22×10^{-6}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H^{(m)}/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ : Hydrostatic head — L_u : Lugeon value in ℓ/mm/m/10^4kg/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

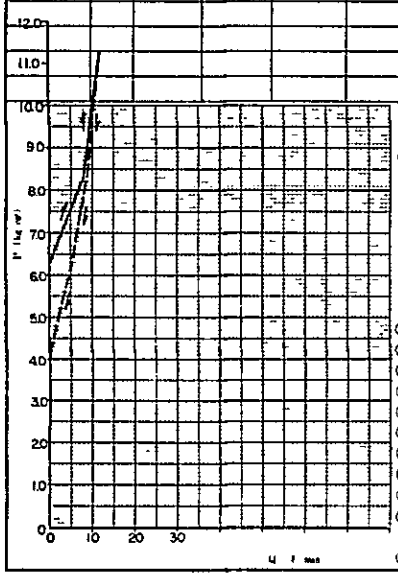
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

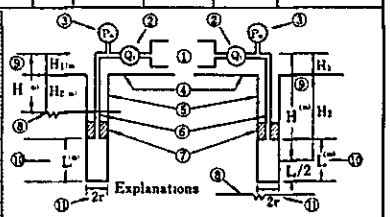
PERMEABILITY TEST IN DRILL HOLE (SHEET 17 OF 17)

Julumito PROJECT HOLE No DH-208

LOCATION Dam site, right bank | DEPTH OF HOLE 30.00 m | TEST DATE 30 Jul '79
ELEVATION 1 679 247 m | DIAMETER OF HOLE NX cm | TESTED BY
COORDINATE | DRILLED DEPTH m | DRILLED BY
ANGLE FROM HORIZONTAL 90° | LEVEL OF WATER TABLE | CHECKED BY EPDC
BEARING OF ANGLE HOLE | BEFORE T 12.30 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
28.00	30.00	2.00	1.00	12.30	1.0	2.33	5	0	0	0	0.0
〃	〃	〃	〃	〃	3.0	4.33	5	1	0.2	0.2	2.1×10^{-6}
〃	〃	〃	〃	〃	5.0	6.33	5	0	0	0	0.0
〃	〃	〃	〃	〃	7.0	8.33	5	40	8.0	4.8	5.07×10^{-5}
〃	〃	〃	〃	〃	10.0	11.33	5	62	12.4	5.5	5.81×10^{-5}
〃	〃	〃	〃	〃	7.0	8.33	5	43	8.6	5.2	5.49×10^{-5}
〃	〃	〃	〃	〃	5.0	6.33	5	32	6.4	5.1	5.38×10^{-5}
〃	〃	〃	〃	〃	3.0	4.33	5	1	0.2	0.2	2.1×10^{-6}
〃	〃	〃	〃	〃	1.0	2.33	5	0	0	0	0.0





① Pump — P_o : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_o : Water volume per one min.
⑨ Hydrostatic head — L_u : Lugeon value m ℓ/mm/m/10^4ℓ/cm
⑩ Length of test section — K : Coefficient of permeability
⑪ Diameter of hole

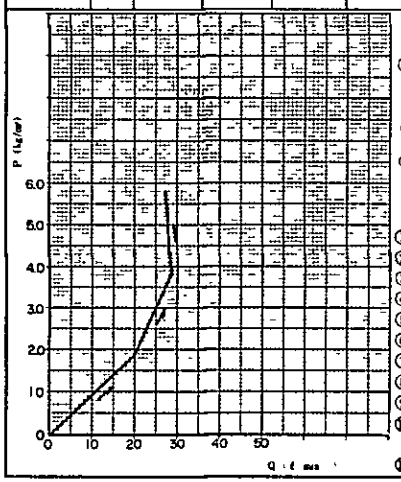
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

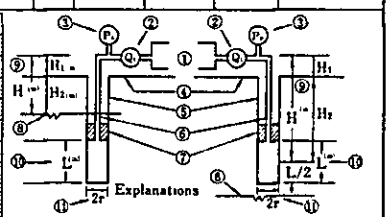
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 12)

Julumito PROJECT HOLE No DH-209

LOCATION Dam site, right bank | DEPTH OF HOLE 40.00 m | TEST DATE 30 June '79
ELEVATION 1724.202 m | DIAMETER OF HOLE NX cm | TESTED BY
COORDINATE | DRILLED DEPTH m | DRILLED BY
ANGLE FROM HORIZONTAL 90° | LEVEL OF WATER TABLE | CHECKED BY EPDC
BEARING OF ANGLE HOLE | BEFORE T 6.93 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
14.50	16.50	2.00	1.62	6.93	1.0	1.85			20.0	54	5.70×10^{-4}
〃	〃	〃	〃	〃	3.0	3.85			29.0	37.7	3.98×10^{-4}
〃	〃	〃	〃	〃	5.0	5.85			27.5	23.5	2.48×10^{-4}





① Pump — P_o : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_o : Water volume per one min.
⑨ Hydrostatic head — L_u : Lugeon value m ℓ/mm/m/10^4ℓ/cm
⑩ Length of test section — K : Coefficient of permeability
⑪ Diameter of hole

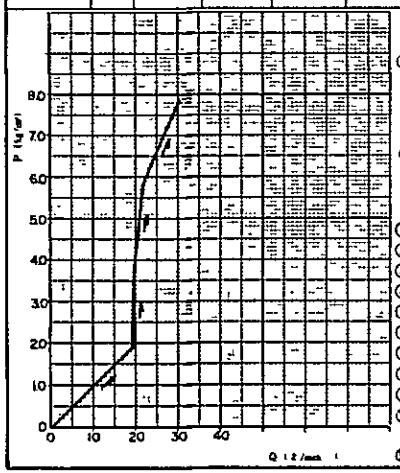
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

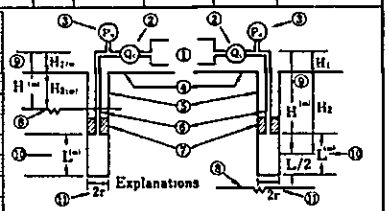
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 12)

Jutumito PROJECT — HOLE No DH-209

LOCATION Dam site right bank — DEPTH OF HOLE 40.00 m — TEST DATE 30 June '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 7.04m AFTER T 10.92m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
16.50	18.50	2.00	1.52	7.04	1.0	1.86			19.2	51.6	5.45×10^{-4}
〃		〃	〃	〃	3.0	3.86			19.8	25.6	2.70×10^{-4}
〃		〃	〃	〃	5.0	5.86			21.8	18.6	1.96×10^{-4}
〃		〃	〃	〃	7.0	7.86			30.6	19.5	2.06×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value in ℓ/mn/m/10^{4}g/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diameter of hole — K

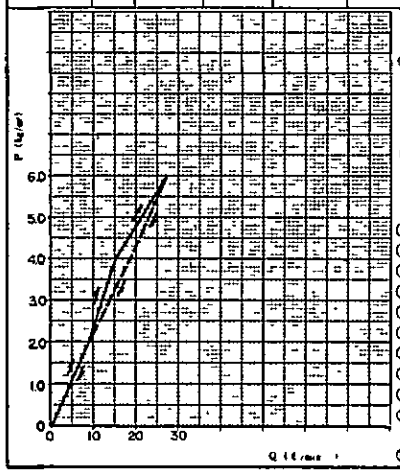
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

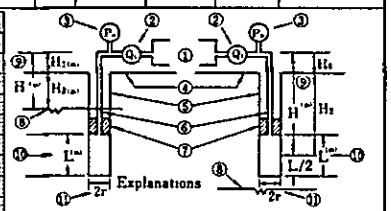
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 12)

Jutumito PROJECT — HOLE No. DH-209

LOCATION Dam site right bank — DEPTH OF HOLE 40.00 m — TEST DATE 3, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 9.03m AFTER T 10.37m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
18.50	20.50	2.00	1.52	9.03	1.0	2.05			8.8	21.5	2.27×10^{-4}
〃		〃	〃	〃	3.0	4.05			15.0	18.5	1.95×10^{-4}
〃		〃	〃	〃	5.0	6.05			27.2	22.5	2.37×10^{-4}
〃		〃	〃	〃	3.0	4.05			18.6	23.0	2.43×10^{-4}
〃		〃	〃	〃	1.0	2.05			8.6	21.0	2.22×10^{-4}





① Pump — P_o : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ Hydrostatic head — : Lugeon value in ℓ/mn/m/10^{4}g/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ Diameter of hole — K

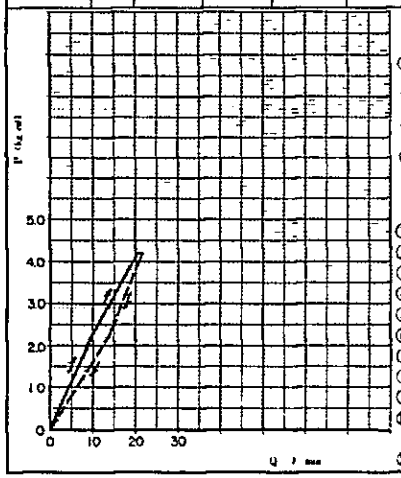
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

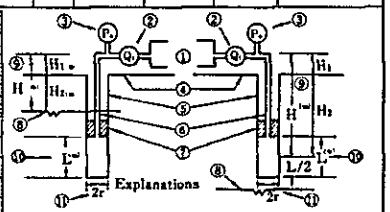
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 12)

Julumito PROJECT — HOLE No DH-209

LOCATION Dam site.right bank — DEPTH OF HOLE 40.00 m — TEST DATE 3, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 10.76 m AFTER T 12.22 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
20.50	22.50	2.00	1.52	10.76	1.0	2.22			10.0	22.5	2.37×10^{-4}
〃	〃	〃	〃	〃	3.0	4.22			20.6	24.4	2.58×10^{-4}
〃	〃	〃	〃	〃	3.0	4.22			21.6	25.6	2.70×10^{-4}
〃	〃	〃	〃	〃	1.0	2.22			12.4	27.9	2.94×10^{-4}





① Pump — P_e Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min.
⑨ Hydrostatic head — Lugeon value ℓ/min/m/10^{5}g/cm²
⑩ Length of test section — L_e : Coefficient of permeability
⑪ Diameter of hole — K

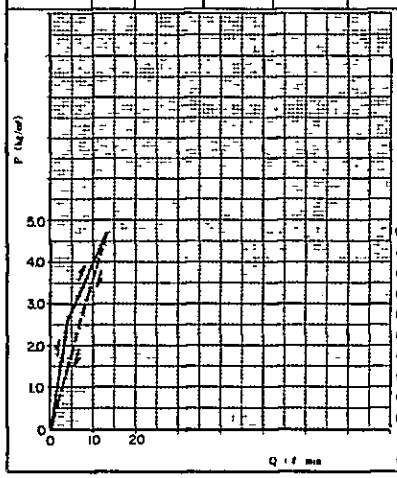
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

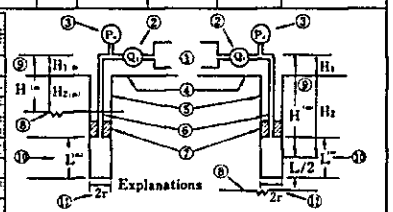
PERMEABILITY TEST IN DRILL HOLE (SHEET 5 OF 12)

Julumito PROJECT — HOLE No DH-209

LOCATION Dam site right bank — DEPTH OF HOLE 40.00 m — TEST DATE 5, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 15.70 m AFTER T 10.65 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_e (Lugeon)	K (cm/sec)
24.50	26.50	2.00	1.52	15.70	1.0	2.72			4.2	7.7	8.13×10^{-5}
〃	〃	〃	〃	〃	3.0	4.72			13.2	14.0	1.48×10^{-4}
〃	〃	〃	〃	〃	3.0	4.72			13.4	14.2	1.50×10^{-4}
〃	〃	〃	〃	〃	1.0	2.72			7.4	13.6	1.44×10^{-4}





① Pump — P_e Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min.
⑨ Hydrostatic head — Lugeon value ℓ/min/m/10^{5}g/cm²
⑩ Length of test section — L_e : Coefficient of permeability
⑪ Diameter of hole — K

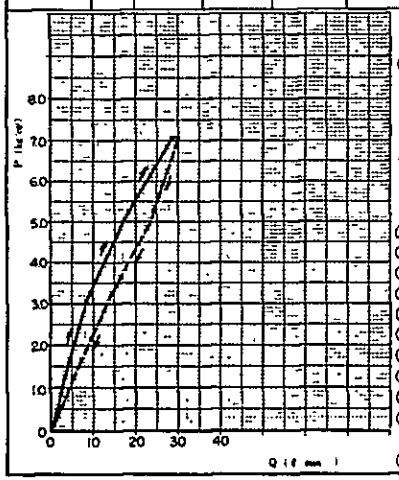
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

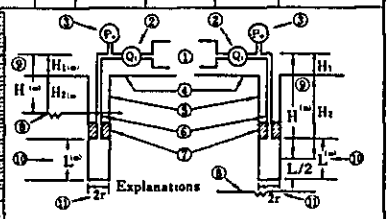
PERMEABILITY TEST IN DRILL HOLE (SHEET 6 OF 12)

Julumito PROJECT — HOLE No DH-209

LOCATION Dam site, right bank — DEPTH OF HOLE 40.00 m — TEST DATE 6 July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 19.20 m AFTER T. 13.00 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
26.50	28.50	2.00	1.52	19.20	1.0	3.07			8.4	13.7	1.45×10^{-4}
〃	〃	〃	〃	〃	3.0	5.07			17.6	17.4	1.84×10^{-4}
〃	〃	〃	〃	〃	5.0	7.07			28.6	20.2	2.13×10^{-4}
〃	〃	〃	〃	〃	5.0	7.07			30.0	21.2	2.24×10^{-4}
〃	〃	〃	〃	〃	3.0	5.07			23.8	17.6	1.86×10^{-4}
〃	〃	〃	〃	〃	1.0	3.07			13.4	21.8	2.30×10^{-4}





① : Pump
② : Flow meter
③ : Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ : Packer
⑧ : Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ : Diamater of hole

P_o : Gauge pressure
H_1 : Height of Pressure gauge
H_2 : Depth of Ground water
P : Effective pressure
$P = P_o + H'' / 10$, $H = H_1 + H_2$
t : Injected time
Q_t : Water volume during time in "t"
Q_e : Water volume per one min.
L_u : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
K : Coefficient of permeability

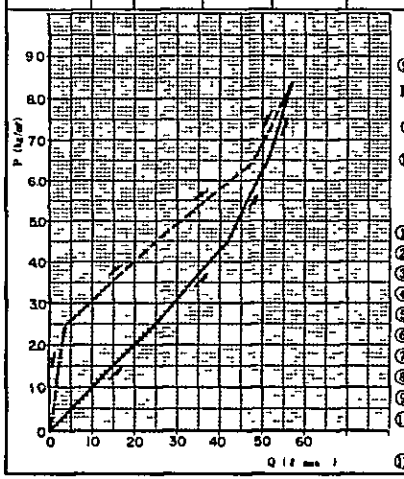
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

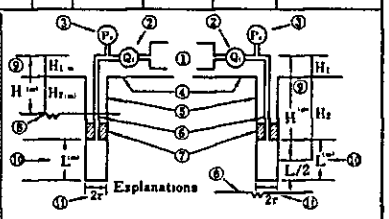
PERMEABILITY TEST IN DRILL HOLE (SHEET 7 OF 12)

Julumito PROJECT — HOLE No. DH-209

LOCATION Dam site, right bank — DEPTH OF HOLE 40.00 m — TEST DATE 9 July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 13.48 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
27.50	29.50	2.00	1.52	13.48	1.0	2.5			25.2	50.4	5.32×10^{-4}
〃	〃	〃	〃	〃	3.0	4.5			42.0	46.7	4.93×10^{-4}
〃	〃	〃	〃	〃	5.0	6.5			51.4	39.5	4.17×10^{-4}
〃	〃	〃	〃	〃	7.0	8.5			57.6	33.8	3.57×10^{-4}
〃	〃	〃	〃	〃	5.0	6.5			48.4	37.2	3.93×10^{-4}
〃	〃	〃	〃	〃	3.0	4.5			24.6	27.3	2.68×10^{-4}
〃	〃	〃	〃	〃	1.0	2.5			3.8	7.6	8.02×10^{-5}





① : Pump
② : Flow meter
③ Pressure gauge
④ : Ground surface
⑤ : Drill hole
⑥ : Injection pipe
⑦ ' Packer
⑧ - Water table
⑨ : Hydrostatic head
⑩ : Length of test section
⑪ Diamater of hole

P_o : Gauge pressure
H_1 Height of Pressure gauge
H_2 . Depth of Ground water
P : Effective pressure
$P = P_o + H'' / 10$, $H = H_1 + H_2$
t : Injected time
Q_t ' Water volume during time in "t"
Q_e : Water volume per one min.
L_u : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
K : Coefficient of permeability

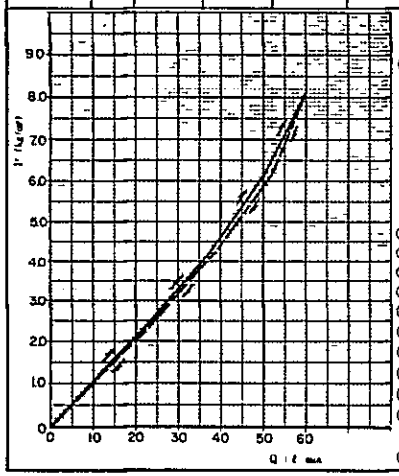
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

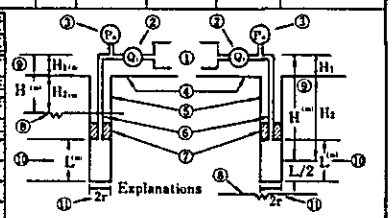
PERMEABILITY TEST IN DRILL HOLE (SHEET 8 OF 12)

Julumito PROJECT — HOLE No. DH-209

LOCATION Dam site, right bank — DEPTH OF HOLE 40.00 m — TEST DATE 9, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T m AFTER T 10.38 m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
29.50	31.50	2.00	1.52	10.38	1.0	2.2			21.0	47.7	5.03×10^{-4}
〃		〃	〃	〃	3.0	4.2			37.4	44.5	4.70×10^{-4}
〃		〃	〃	〃	5.0	6.2			50.4	40.6	4.29×10^{-4}
〃		〃	〃	〃	7.0	8.2			60.0	36.6	3.86×10^{-4}
〃		〃	〃	〃	5.0	6.2			52.4	42.3	4.46×10^{-4}
〃		〃	〃	〃	3.0	4.2			38.6	45.9	4.84×10^{-4}
〃		〃	〃	〃	1.0	2.2			21.6	49.1	5.18×10^{-4}





① Pump — P_o : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_o : Water volume per one min.
⑨ Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^{-4}kg/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

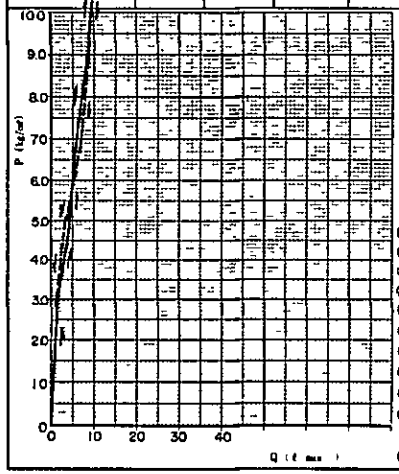
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

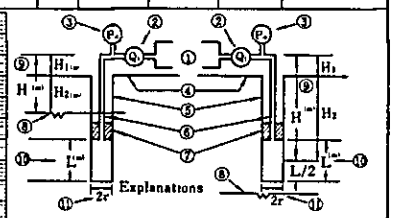
PERMEABILITY TEST IN DRILL HOLE (SHEET 9 OF 12)

Julumito PROJECT — HOLE No DH-209

LOCATION Dam site, right bank — DEPTH OF HOLE 40.00 m — TEST DATE 11, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 16.40 m AFTER T 17.11 m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
31.50	33.50	2.00	1.52	15.40	1.0	2.8			1.4	2.5	2.64×10^{-5}
〃		〃	〃	〃	3.0	4.8			4.6	4.8	5.07×10^{-5}
〃		〃	〃	〃	5.0	6.8			5.6	4.1	4.33×10^{-5}
〃		〃	〃	〃	7.0	8.8			8.2	4.7	4.96×10^{-5}
〃		〃	〃	〃	10.0	11.8			11.6	4.9	5.17×10^{-5}
〃		〃	〃	〃	7.0	8.8			8.4	5.1	5.38×10^{-5}
〃		〃	〃	〃	5.0	6.8			6.0	6.0	6.33×10^{-5}
〃		〃	〃	〃	3.0	4.8			3.2	3.2	3.38×10^{-5}
〃		〃	〃	〃	1.0	2.8			1.8	1.8	1.90×10^{-5}





① Pump — P_o : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_o : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^{-4}kg/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

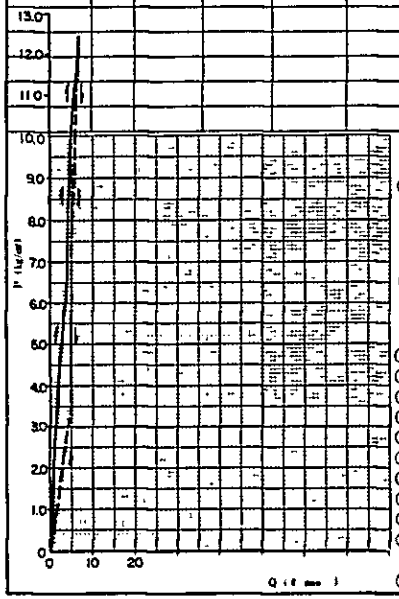
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

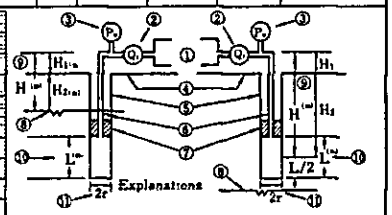
PERMEABILITY TEST IN DRILL HOLE (SHEET 10 OF 12)

Jutumito PROJECT — HOLE No. DH-209

LOCATION Dam site right bank — DEPTH OF HOLE 40.00 m — TEST DATE 12, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T m AFTER T 23.80m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_e (Lugeon)	K (cm/sec)
33.50	38.50	2.00	1.52	23.80	1.0	3.5			1.6	2.3	2.4×10^{-5}
〃	〃	〃	〃	〃	3.0	5.5			3.0	2.7	2.8×10^{-5}
〃	〃	〃	〃	〃	5.0	7.5			4.2	2.6	3.0×10^{-5}
〃	〃	〃	〃	〃	7.0	9.5			4.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	10.0	12.5			6.2	2.5	2.6×10^{-5}
〃	〃	〃	〃	〃	7.0	9.5			5.8	3.0	3.2×10^{-5}
〃	〃	〃	〃	〃	5.0	7.5			4.4	2.9	3.1×10^{-5}
〃	〃	〃	〃	〃	3.0	5.5			4.6	3.3	3.5×10^{-5}
〃	〃	〃	〃	〃	1.0	3.5			5.0	7.1	7.5×10^{-5}





① Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value in ℓ/min/m/10^{5}g/cm²
⑩ : Length of test section — L_e : Coefficient of permeability
⑪ : Diamater of hole — K

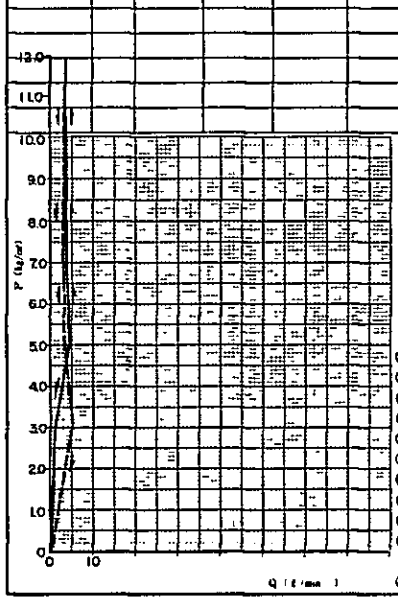
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

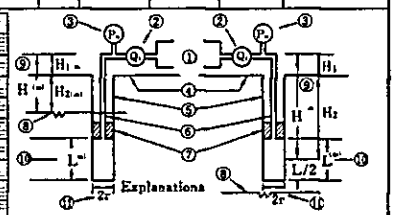
PERMEABILITY TEST IN DRILL HOLE (SHEET 11 OF 12)

Jutumito PROJECT — HOLE No. DH-209

LOCATION Dam site right bank — DEPTH OF HOLE 40.00 m — TEST DATE 12, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 19.15 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_e (Lugeon)	K (cm/sec)
35.50	37.50	2.00	1.52	19.15	1.0	3.0			1.0	1.7	1.8×10^{-5}
〃	〃	〃	〃	〃	3.0	5.0			4.4	4.4	4.6×10^{-5}
〃	〃	〃	〃	〃	5.0	7.0			3.2	2.3	2.4×10^{-5}
〃	〃	〃	〃	〃	7.0	9.0			3.2	1.8	1.9×10^{-5}
〃	〃	〃	〃	〃	10.0	12.0			3.2	1.3	1.4×10^{-5}
〃	〃	〃	〃	〃	7.0	9.0			2.4	1.3	1.4×10^{-5}
〃	〃	〃	〃	〃	5.0	7.0			2.6	1.9	2.0×10^{-5}
〃	〃	〃	〃	〃	3.0	5.0			3.4	3.4	3.6×10^{-5}
〃	〃	〃	〃	〃	1.0	3.0			5.2	8.7	9.2×10^{-5}





① Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value in ℓ/min/m/10^{5}g/cm²
⑩ : Length of test section — L_e : Coefficient of permeability
⑪ : Diamater of hole — K

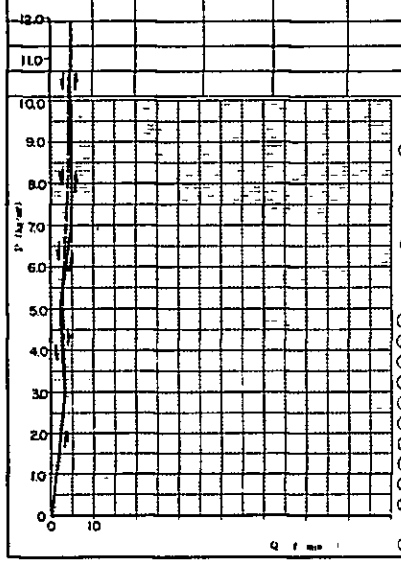
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

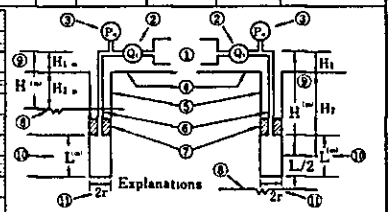
PERMEABILITY TEST IN DRILL HOLE (SHEET 12 OF 12)

Julumito PROJECT — HOLE No. DH-209

LOCATION Dam site, right bank — DEPTH OF HOLE 40.00 m — TEST DATE 12, July '79
ELEVATION 1724.202 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 19.15 m AFTER.T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
37.50	39.50	2.00	1.52	19.15	1.0	3.0			3.2	5.3	5.6×10^{-5}
〃	〃	〃	〃	〃	3.0	5.0			2.0	2.0	2.1×10^{-5}
〃	〃	〃	〃	〃	5.0	7.0			4.8	3.4	3.5×10^{-5}
〃	〃	〃	〃	〃	7.0	9.0			4.4	2.4	2.5×10^{-5}
〃	〃	〃	〃	〃	10.0	12.0			4.6	1.9	2.0×10^{-5}
〃	〃	〃	〃	〃	7.0	9.0			4.0	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	5.0	7.0			3.4	2.4	2.5×10^{-5}
〃	〃	〃	〃	〃	3.0	5.0			2.2	2.2	2.3×10^{-5}
〃	〃	〃	〃	〃	1.0	3.0			3.4	5.7	6.0×10^{-5}





① Pump — P_o Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_e Water volume per one min.
⑨ Hydrostatic head — L_u Lugeon value in ℓ/min/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

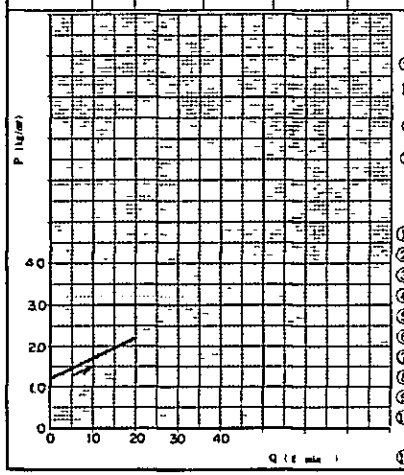
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

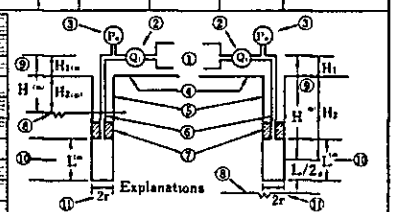
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 10)

Julumito PROJECT — HOLE No DH-210

LOCATION Dam site right bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE.T 1.75 m AFTER.T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
1.00	3.00	2.00	0.40	1.75	1.0	1.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	2.0	2.2	4	8.1	20.3	46.0	4.86×10^{-4}
〃	〃	〃	〃	〃	3.0	3.2	—	—	—	—	
〃	〃	〃	〃	〃	2.0	2.2	5	9.5	19.0	43.2	4.56×10^{-4}
〃	〃	〃	〃	〃	1.0	1.2	—	—	—	—	





① Pump — P_o Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_e Water volume per one min
⑨ Hydrostatic head — L_u Lugeon value in ℓ/min/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

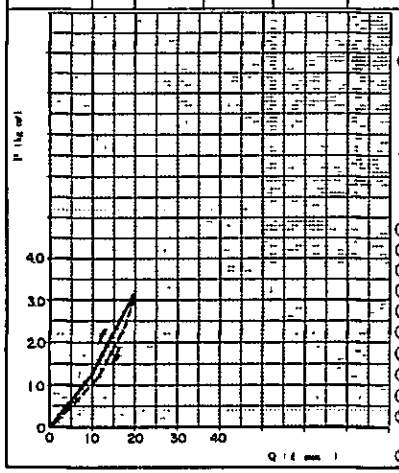
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

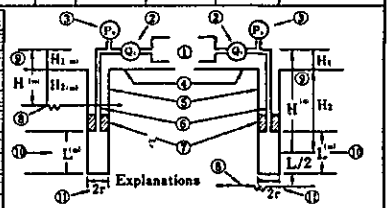
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 10)

Jujumito PROJECT — HOLE No DH-210

LOCATION Dam site right bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
3.00	5.00	2.00	0.40	1.70	1.0	1.2	5	5.0	10.0	4.17	4.40×10^{-4}
〃	〃	〃	〃	〃	2.0	2.2	5	7.5	15.0	3.41	3.60×10^{-4}
〃	〃	〃	〃	〃	3.0	3.2	5	10.2	20.4	3.19	3.37×10^{-4}
〃	〃	〃	〃	〃	2.0	2.2	5	8.6	17.2	3.91	4.13×10^{-4}
〃	〃	〃	〃	〃	1.0	1.2	5	5.9	11.8	4.92	5.19×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_e : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value in ℓ/mm/m/10^4kg/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diamater of hole — K

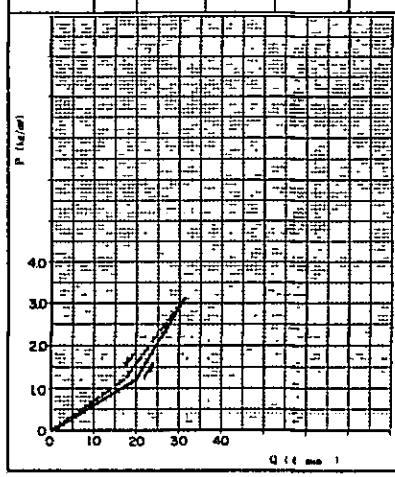
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

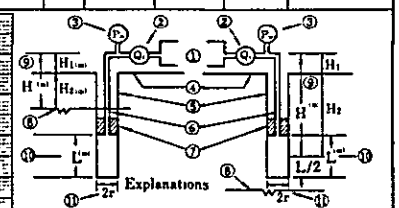
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 10)

Jujumito PROJECT — HOLE No DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
5.00	7.00	2.00	0.40	1.70	1.0	1.2	5	10.2	20.4	8.50	8.97×10^{-4}
〃	〃	〃	〃	〃	2.0	2.2	5	12.7	25.4	5.77	6.09×10^{-4}
〃	〃	〃	〃	〃	3.0	3.2	5	15.9	31.8	4.97	5.25×10^{-4}
〃	〃	〃	〃	〃	2.0	2.2	5	12.3	24.6	5.59	5.90×10^{-4}
〃	〃	〃	〃	〃	1.0	1.2	5	8.8	17.6	7.33	7.74×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_e : Water volume per one min.
⑨ : Hydrostatic head — : Lugeon value in ℓ/mm/m/10^4kg/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diamater of hole — K

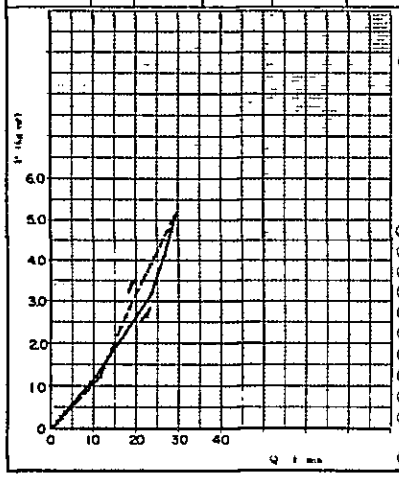
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

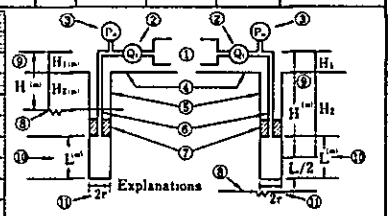
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 10)

Jujumito PROJECT HOLE No DH-210

LOCATION Dam site, left bank
ELEVATION 1647.552 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 1.70 m AFTER T m
TEST DATE 30 Aug '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
7.00	9.00	2.00	0.40	1.70	1.0	1.2	5	5.3	10.6	44.2	4.66×10^{-4}
〃	〃	〃	〃	〃	3.0	3.2	5	11.9	23.8	37.2	3.93×10^{-4}
〃	〃	〃	〃	〃	5.0	5.2	5	14.9	29.8	28.7	3.03×10^{-4}
〃	〃	〃	〃	〃	3.0	3.2	5	9.9	19.8	30.9	3.26×10^{-4}
〃	〃	〃	〃	〃	1.0	1.2	5	5.6	11.2	46.7	4.93×10^{-4}





① Pump — P_e Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_e + H'^{m}/10$. $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min.
⑨ Hydrostatic head — L_u : Lugeon value m ℓ/mn/m/10^5g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

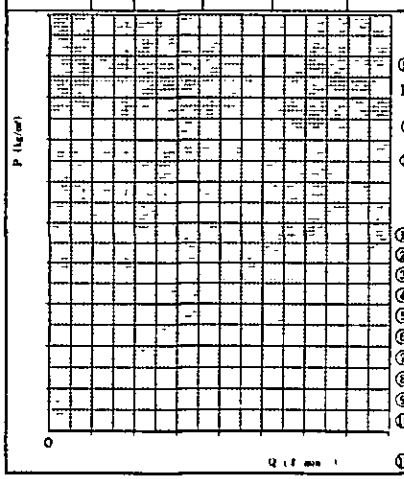
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

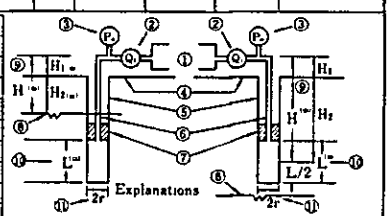
PERMEABILITY TEST IN DRILL HOLE (SHEET 5 OF 10)

Jujumito PROJECT HOLE No DH-210

LOCATION Dam site, left bank
ELEVATION 1647.552 m
COORDINATE
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE
DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 1.70 m AFTER T m
TEST DATE 30 Aug '79
TESTED BY
DRILLED BY
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
9.00	11.00	2.00	0.40	1.70	1.0	1.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	5.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	1.0	1.2	5	0	0.0	0.0	0.0





① Pump — P_e Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H'^{m}/10$. $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value m ℓ/mn m 10^5g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

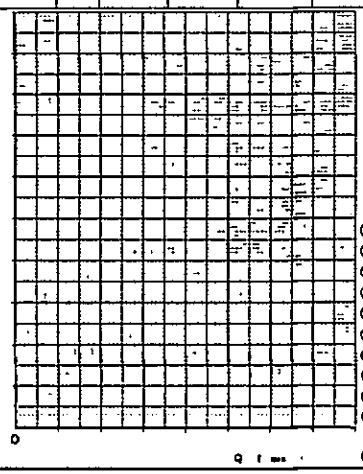
ELECTRIC POWER DEVELOPMENT CO LTD TOKYO JAPAN

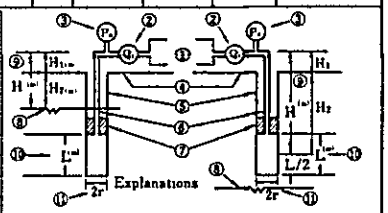
PERMEABILITY TEST IN DRILL HOLE (SHEET 6 OF 10)

Julumito PROJECT — HOLE No. DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 2000 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
11.00	13.00	2.00	0.40	1.70	1.0	1.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	5.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	1.0	1.2	5	0	0.0	0.0	0.0





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ : Hydrostatic head — L_u : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
⑩ : Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

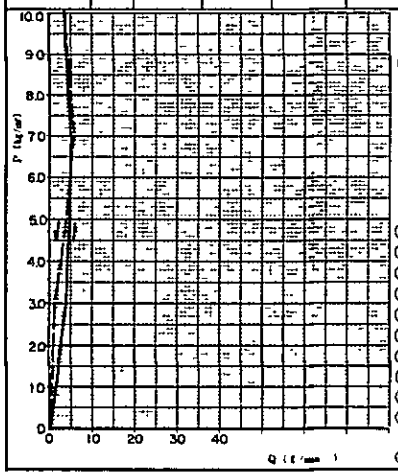
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

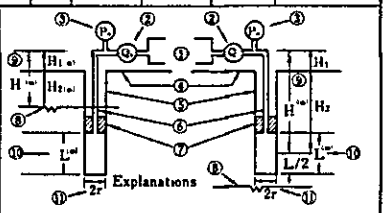
PERMEABILITY TEST IN DRILL HOLE (SHEET 7 OF 10)

Julumito PROJECT — HOLE No. DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 2000 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
13.00	15.00	2.00	0.52	1.70	1.0	1.2	5	9	1.8	7.5	7.92×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	23	4.6	7.2	7.60×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	25	5.0	4.8	5.07×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	23	4.6	3.2	3.38×10^{-5}
〃	〃	〃	〃	〃	10.0	10.2	5	18	3.6	1.8	1.90×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	28	5.6	3.9	4.12×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	21	4.2	4.0	4.22×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	9	1.8	2.8	2.96×10^{-5}
〃	〃	〃	〃	〃	1.0	1.2	5	4	0.8	3.3	3.48×10^{-5}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — L_u : Lugeon value in ℓ/min/m/10^{-4}kg/cm²
⑩ : Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

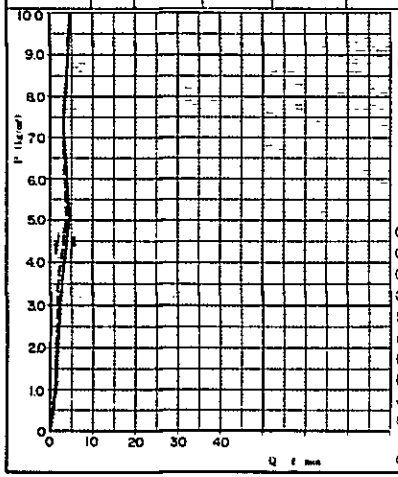
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

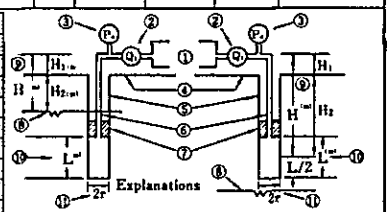
PERMEABILITY TEST IN DRILL HOLE (SHEET 8 OF 10)

Julumito PROJECT — HOLE No DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
15.00	17.00	2.00	0.52	1.70	1.0	1.2	5	6	1.2	5.0	8.28×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	12	2.4	3.8	4.01×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	23	4.6	5.0	5.28×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	15	3.0	2.1	5.50×10^{-5}
〃	〃	〃	〃	〃	10.0	10.2	5	25	5.0	2.5	2.64×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	15	3.0	2.1	2.22×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	20	4.0	3.8	4.01×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	8	1.6	2.5	2.64×10^{-5}
〃	〃	〃	〃	〃	1.0	1.2	5	7	1.4	5.8	6.12×10^{-5}





① Pump — P_e : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H'' / 10$. $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^5g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

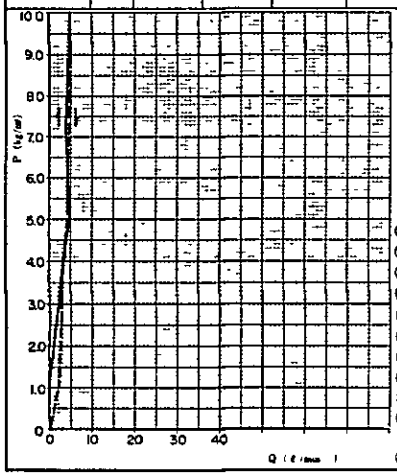
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

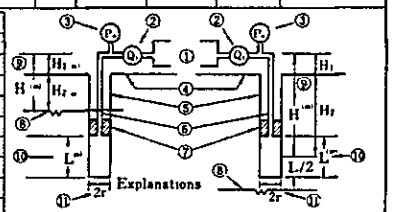
PERMEABILITY TEST IN DRILL HOLE (SHEET 9 OF 10)

Julumito PROJECT — HOLE No DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.70 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
17.00	19.00	2.00	0.52	1.70	1.0	1.2	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	12	2.4	3.8	4.0×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	25	5.0	4.8	5.1×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	17	3.4	2.4	2.5×10^{-5}
〃	〃	〃	〃	〃	10.0	10.2	5	25	5.0	2.5	2.6×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	21	4.2	2.9	3.1×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	22	4.4	4.2	4.4×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	14	2.8	4.4	4.6×10^{-5}
〃	〃	〃	〃	〃	1.0	1.2	5	12	2.4	10.0	10.6×10^{-5}





① Pump — P_e : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H'' / 10$. $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^5g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

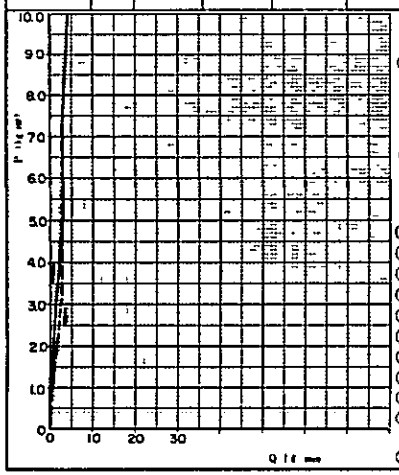
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

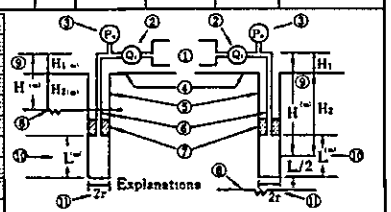
PERMEABILITY TEST IN DRILL HOLE (SHEET 10 OF 10)

Julumito PROJECT — HOLE No DH-210

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1647.552 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T m AFTER T 1.68 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
18.40	20.00	1.60	0.52	1.68	1.0	1.2	5	8	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.2	5	10	2.0	3.9	3.9×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	18	3.6	4.3	4.3×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	15	3.0	2.6	2.6×10^{-5}
〃	〃	〃	〃	〃	10.0	10.2	5	22	4.4	2.7	2.7×10^{-5}
〃	〃	〃	〃	〃	7.0	7.2	5	15	3.2	2.7	2.7×10^{-5}
〃	〃	〃	〃	〃	5.0	5.2	5	16	3.2	3.9	3.9×10^{-5}
〃	〃	〃	〃	〃	3.0	3.2	5	15	3.0	5.9	5.9×10^{-5}
〃	〃	〃	〃	〃	1.0	1.2	5	3	0.6	3.1	3.1×10^{-5}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^{-4}kg/cm²
⑩ : Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

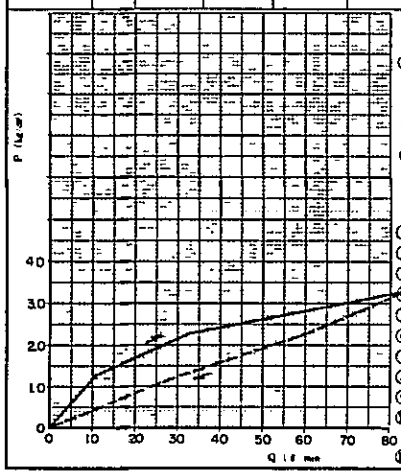
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

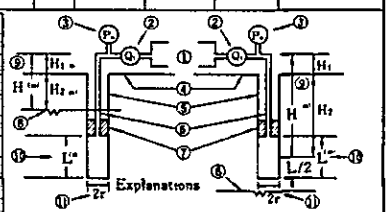
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 9)

Julumito PROJECT — HOLE No DH-211

LOCATION Dam site left bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH 20.00 m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 3.65 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
2.00	4.00	2.00	0.45	3.00	1.0	1.3	5	55	11.0	42.3	4.46×10^{-4}
〃	〃	〃	〃	〃	2.0	2.3	5	171	34.2	74.3	7.84×10^{-4}
〃	〃	〃	〃	〃	3.0	3.3	5	417	83.4	126.4	13.34×10^{-4}
〃	〃	〃	〃	〃	2.0	2.3	5	303	60.6	131.7	13.90×10^{-4}
〃	〃	〃	〃	〃	1.0	1.3	5	160	32.0	123.1	12.99×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ : Hydrostatic head — L_u : Lugeon value ℓ/mn/m/10^{-4}kg/cm²
⑩ : Length of test section — K : Coefficient of permeability
⑪ : Diamater of hole

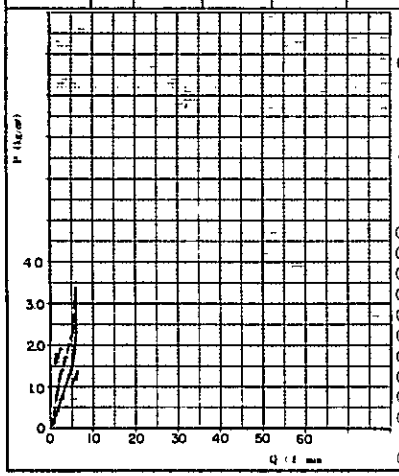
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

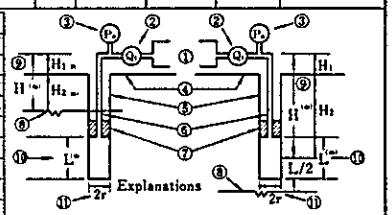
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 9)

Jutumito PROJECT HOLE No. DH-211

LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____
DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 3.65 m AFTER T ____ m
TEST DATE 29 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
4.00	6.00	2.00	0.45	3.65	1.0	1.4	5	25	5.0	17.9	1.89×10^{-4}
〃		〃	〃	〃	2.0	2.4	5	30	6.0	12.5	1.32×10^{-4}
〃		〃	〃	〃	3.0	3.4	5	29	5.8	8.5	0.90×10^{-4}
〃		〃	〃	〃	2.0	2.4	5	27	5.4	11.3	1.19×10^{-4}
〃		〃	〃	〃	1.0	1.4	5	13	2.6	9.3	0.98×10^{-4}





① : Pump
② Flow meter
③ ' Pressure gauge
④ Ground surface
⑤ Drill hole
⑥ ' Injection pipe
⑦ Packer
⑧ Water table
⑨ ' Hydrostatic head
⑩ ' Length of test section
⑪ Diamater of hole

P_e Gauge pressure
H_1 Height of Pressure gauge
H_2 Depth of Ground water
P 'Effective pressure
$P = P_e + H'^{m}/10$, $H = H_1 + H_2$
t 'Injected time
Q_t :Water volume during time in "t"
Q_e :Water volume per one min
L_u :Lugeon value in ℓ/mn/m/10^{-6}g/cm²
K 'Coefficient of permeability

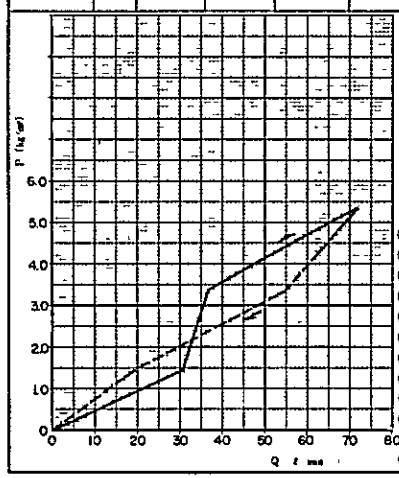
ELECTRIC POWER DEVELOPMENT CO, LTD. TOKYO JAPAN

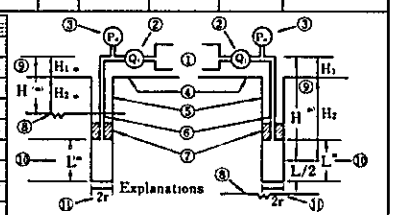
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 9)

Jutumito PROJECT HOLE No DH-211

LOCATION Dam site, left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____
DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 3.65 m AFTER T ____ m
TEST DATE 29 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
6.00	8.00	2.00	0.45	3.65	1.0	1.4	5	15.3	3.06	10.93	1.15×10^{-3}
〃		〃	〃	〃	3.0	3.4	5	18.4	3.68	5.41	5.71×10^{-4}
〃		〃	〃	〃	5.0	5.4	5	36.2	7.24	6.70	7.07×10^{-4}
〃		〃	〃	〃	3.0	3.4	5	27.6	5.52	8.12	8.57×10^{-4}
〃		〃	〃	〃	1.0	1.4	5	9.5	1.90	6.79	7.17×10^{-4}





① Pump
② Flow meter
③ ' Pressure gauge
④ Ground surface
⑤ ' Drill hole
⑥ Injection pipe
⑦ Packer
⑧ ' Water table
⑨ ' Hydrostatic head
⑩ Length of test section
⑪ ' Diamater of hole

P_e Gauge pressure
H_1 Height of Pressure gauge
H_2 Depth of Ground water
P :Effective pressure
$P = P_e + H'^{m}/10$, $H = H_1 + H_2$
t Injected time
Q_t Water volume during time in "t"
Q_e 'Water volume per one min
L_u Lugeon value in ℓ/mn/m/10^{-6}g/cm²
K Coefficient of permeability

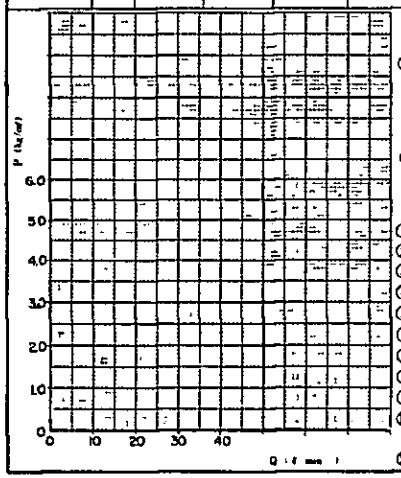
ELECTRIC POWER DEVELOPMENT CO LTD. TOKYO JAPAN

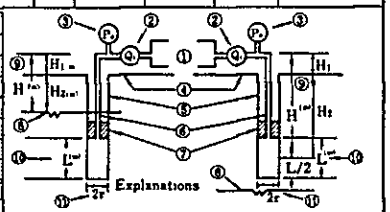
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 9)

Jutumito PROJECT — HOLE No. DH-211

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION ____ m — DIAMETER OF HOLE NX cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH 20.00 m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T 3.65 m AFTER T ____ m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
8.00	10.00	2.00	0.45	3.65	1.0	1.4	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.4	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	5.0	5.4	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	3.0	3.4	5	0	0.0	0.0	0.0
〃	〃	〃	〃	〃	1.0	1.4	5	0	0.0	0.0	0.0





Explanations

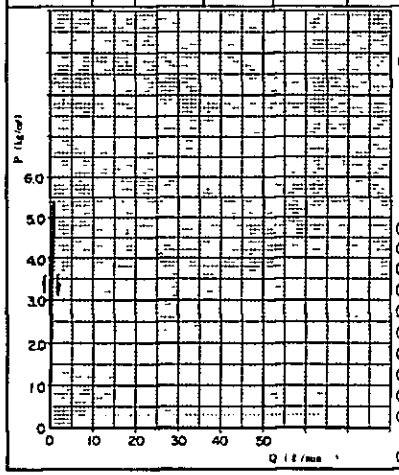
①: Pump — P_o: Gauge pressure
②: Flow meter — H_1: Height of Pressure gauge
③: Pressure gauge — H_2: Depth of Ground water
④: Ground surface — P: Effective pressure
⑤: Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥: Injection pipe — t: Injected time
⑦: Packer — Q_t: Water volume during time in "t"
⑧: Water table — Q_o: Water volume per one min.
⑨: Hydrostatic head — L_u: Lugeon value in ℓ/min/m/10^{-4}cm
⑩: Length of test section — K: Coefficient of permeability
⑪: Diamater of hole

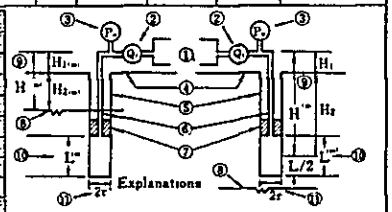
PERMEABILITY TEST IN DRILL HOLE (SHEET 5 OF 9)

Jutumito PROJECT — HOLE No DH-211

LOCATION Dam site, left bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION ____ m — DIAMETER OF HOLE NX cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH 20.00 m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T 3.65 m AFTER T ____ m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
10.00	12.00	2.00	0.45	3.65	1.0	1.4	5	1	0.2	0.7	7.4×10^{-6}
〃	〃	〃	〃	〃	3.0	3.4	5	3	0.6	0.9	9.5×10^{-6}
〃	〃	〃	〃	〃	5.0	5.4	5	5	1.0	0.9	9.5×10^{-6}
〃	〃	〃	〃	〃	3.0	3.4	5	3	0.6	0.9	9.5×10^{-6}
〃	〃	〃	〃	〃	1.0	1.4	5	0	0.0	0.0	0.0





Explanations

①: Pump — P_o: Gauge pressure
②: Flow meter — H_1: Height of Pressure gauge
③: Pressure gauge — H_2: Depth of Ground water
④: Ground surface — P: Effective pressure
⑤: Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥: Injection pipe — t: Injected time
⑦: Packer — Q_t: Water volume during time in "t"
⑧: Water table — Q_o: Water volume per one min.
⑨: Hydrostatic head — L_u: Lugeon value in ℓ/min/m/10^{-4}cm
⑩: Length of test section — K: Coefficient of permeability
⑪: Diamater of hole

PERMEABILITY TEST IN DRILL HOLE (SHEET 6 OF 9)

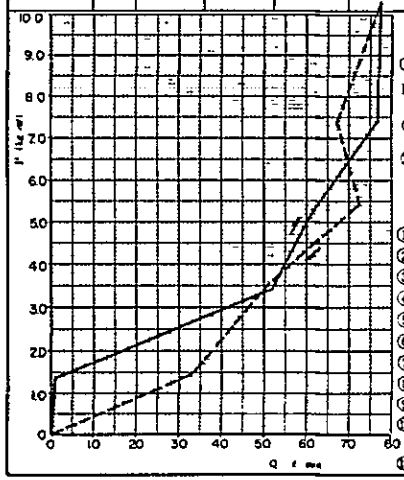
Jutumito PROJECT HOLE No DH-211

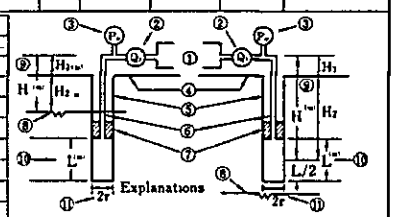
LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 3.65m AFTER T ____ m

TEST DATE 29 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
12.00	14.00	2.00	0.41	3.65	1.0	1.4	5	3	0.6	2.1	0.22×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	259	51.8	76.2	8.04×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	310	62.0	57.4	6.06×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	384	76.8	51.9	5.48×10^{-4}
〃	〃	〃	〃	〃	10.0	10.4	5	389	77.8	37.4	3.95×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	337	67.4	45.5	4.80×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	361	72.2	66.9	7.06×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	249	49.8	73.2	7.73×10^{-4}
〃	〃	〃	〃	〃	1.0	1.4	5	163	32.6	116.4	1.23×10^{-3}





① Pump — P_e : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H'' / 10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value in ℓ/min/m/10^4g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 7 OF 9)

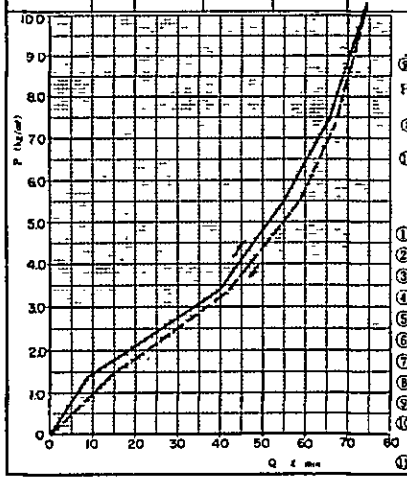
Jutumito PROJECT HOLE No DH-211

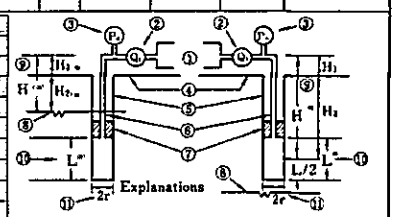
LOCATION Dam site left bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH 20.00 m
LEVEL OF WATER TABLE
BEFORE T 3.65m AFTER T ____ m

TEST DATE 29 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
14.00	16.00	2.00	0.41	3.65	1.0	1.4	5	45	9.0	32.1	3.39×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	201	40.2	59.1	6.24×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	272	54.4	50.4	5.32×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	324	65.8	43.8	4.62×10^{-4}
〃	〃	〃	〃	〃	10.0	10.4	5	375	75.0	36.1	3.81×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	336	67.2	45.4	4.79×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	290	58.0	53.7	5.67×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	211	42.2	62.1	6.55×10^{-4}
〃	〃	〃	〃	〃	1.0	1.4	5	73	14.6	52.1	5.50×10^{-4}





① Pump — P_e : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 : Depth of Ground water
④ Ground surface — P : Effective pressure
⑤ Drill hole — $P = P_e + H'' / 10$, $H = H_1 + H_2$
⑥ Injection pipe — t : Injected time
⑦ Packer — Q_t : Water volume during time in "t"
⑧ Water table — Q_e : Water volume per one min
⑨ Hydrostatic head — L_u : Lugeon value in ℓ/min/m/10^4g/cm²
⑩ Length of test section — K : Coefficient of permeability
⑪ Diamater of hole

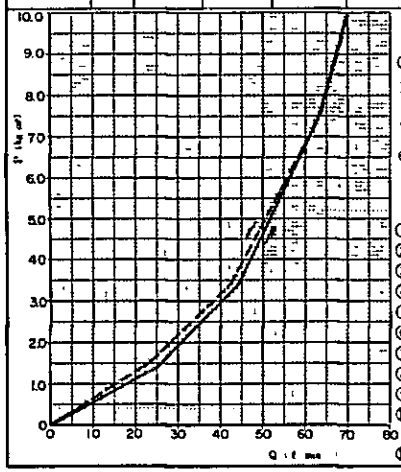
ELECTRIC POWER DEVELOPMENT CO LTD TOKYO JAPAN

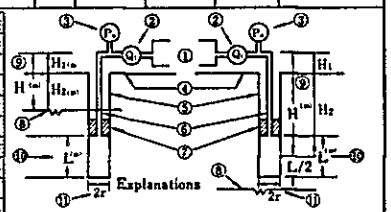
PERMEABILITY TEST IN DRILL HOLE (SHEET 8 OF 9)

Jutumito PROJECT — HOLE No DH-211

LOCATION Dam site left bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION ____ m — DIAMETER OF HOLE NX cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH 20.00 m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T 3.65m AFTER T ____ m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
16.00	18.00	2.00	0.41	3.65	1.0	1.4	5	12.8	25.6	91.4	9.65×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	22.1	44.2	65.0	6.66×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	26.9	53.8	49.8	5.26×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	31.5	63.0	42.6	4.50×10^{-4}
〃	〃	〃	〃	〃	10.0	10.4	5	35.6	71.2	34.2	3.61×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	31.6	63.2	42.7	4.51×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	26.4	52.8	48.9	5.16×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	21.1	42.2	62.1	6.55×10^{-4}
〃	〃	〃	〃	〃	1.0	1.4	5	11.3	22.6	80.7	8.52×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min.
⑨ : Hydrostatic head — 'Lugeon value in ℓ/mn/m/10^{-4}kg/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diamater of hole — K

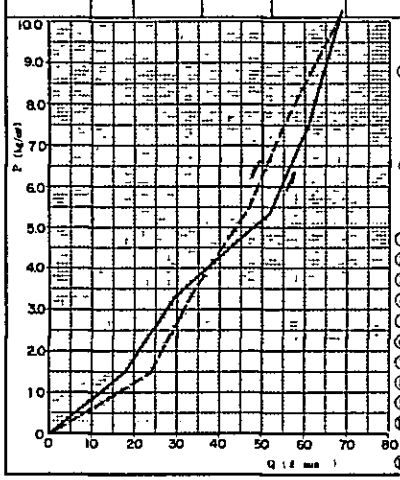
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

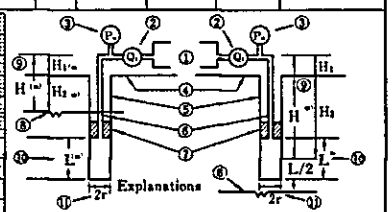
PERMEABILITY TEST IN DRILL HOLE (SHEET 9 OF 9)

Jutumito PROJECT — HOLE No DH-211

LOCATION Dam site,left bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION ____ m — DIAMETER OF HOLE NX cm — TESTED BY ____
COORDINATE ____ — DRILLED DEPTH 20.00 m — DRILLED BY ____
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE ____ — BEFORE T ____ m AFTER T 3.40m

Test section(m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_o (ℓ/min)	L_u (Lugeon)	K (cm/sec)
18.00	20.00	2.00	0.41	3.40	1.0	1.4	5	8.8	17.6	62.9	6.64×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	15.1	30.2	44.4	4.69×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	26.1	52.2	48.3	5.10×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	30.4	60.8	41.1	4.34×10^{-4}
〃	〃	〃	〃	〃	10.0	10.4	5	34.7	69.4	33.4	3.53×10^{-4}
〃	〃	〃	〃	〃	7.0	7.4	5	27.3	54.6	36.9	3.89×10^{-4}
〃	〃	〃	〃	〃	5.0	5.4	5	23.3	46.6	43.1	4.55×10^{-4}
〃	〃	〃	〃	〃	3.0	3.4	5	16.9	33.8	49.7	5.25×10^{-4}
〃	〃	〃	〃	〃	1.0	1.4	5	11.7	23.4	83.6	8.82×10^{-4}





① : Pump — P_o : Gauge pressure
② : Flow meter — H_1 : Height of Pressure gauge
③ : Pressure gauge — H_2 : Depth of Ground water
④ : Ground surface — P : Effective pressure
⑤ : Drill hole — $P = P_o + H'''/10$, $H = H_1 + H_2$
⑥ : Injection pipe — t : Injected time
⑦ : Packer — Q_t : Water volume during time in "t"
⑧ : Water table — Q_o : Water volume per one min
⑨ : Hydrostatic head — : Lugeon value in ℓ/mn/m/10^{-4}kg/cm²
⑩ : Length of test section — L_u : Coefficient of permeability
⑪ : Diamater of hole — K

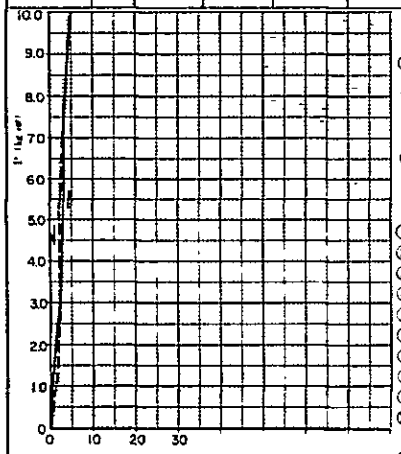
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

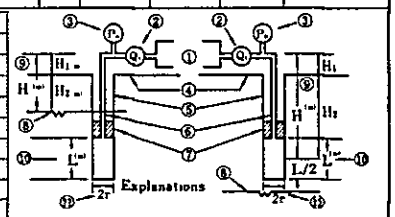
PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 2)

Jutumito PROJECT — HOLE No DH-212

LOCATION Dam site, right bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION 1647.249 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 1.25 m AFTER T. 1.30 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
11.50	17.00	5.50	0	1.25	1.0	1.125	5	4	0.8	1.3	1.7×10^{-5}
〃	〃	〃	〃	〃	3.0	3.125	5	14	2.8	1.6	2.1×10^{-5}
〃	〃	〃	〃	〃	5.0	5.125	5	17	3.4	1.2	1.6×10^{-5}
〃	〃	〃	〃	〃	7.0	7.125	5	15	3.0	0.8	1.1×10^{-5}
〃	〃	〃	〃	〃	10.0	10.125	5	25	5.0	0.9	1.2×10^{-5}
〃	〃	〃	〃	〃	7.0	7.125	5	16	3.2	0.8	1.1×10^{-5}
〃	〃	〃	〃	〃	5.0	5.125	5	13	2.6	0.9	1.2×10^{-5}
〃	〃	〃	〃	〃	3.0	3.125	5	11	2.2	1.3	1.7×10^{-5}
〃	〃	〃	〃	〃	1.0	1.125	5	9	1.8	2.9	3.8×10^{-5}





Explanations

① : Pump		P_o	: Gauge pressure
② : Flow meter		H_1	: Height of Pressure gauge
③ : Pressure gauge		H_2	: Depth of Ground water
④ : Ground surface		P	: Effective pressure
⑤ : Drill hole			$P = P_o + H_1/10$, $H = H_1 + H_2$
⑥ : Injection pipe		t	: Injected time
⑦ : Packer		Q_t	: Water volume during time in "t"
⑧ : Water table			
⑨ : Hydrostatic head		Q_e	: Water volume per one min
⑩ : Length of test section		L_u	: Lugeon value in ℓ/min/m/10^{-4}kg/cm² Coefficient of permeability
⑪ : Diameter of hole		K	

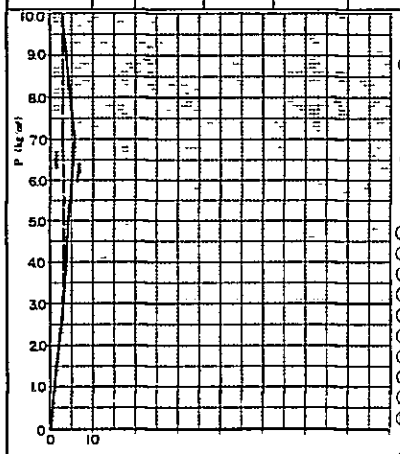
ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

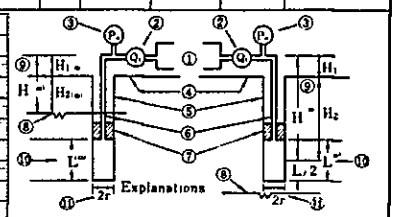
PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 2)

Jutumito PROJECT — HOLE No DH-212

LOCATION Dam site, right bank — DEPTH OF HOLE 20.00 m — TEST DATE 29 Aug '79
ELEVATION 1647.249 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 1.30 m AFTER T. 1.25 m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
17.00	19.00	2.00	0.20	1.50	1.0	1.15	5	6	1.2	5.2	5.49×10^{-5}
〃	〃	〃	〃	〃	3.0	3.15	5	16	3.2	5.1	5.38×10^{-5}
〃	〃	〃	〃	〃	5.0	5.15	5	22	4.4	4.3	4.54×10^{-5}
〃	〃	〃	〃	〃	7.0	7.15	5	27	5.4	3.8	4.01×10^{-5}
〃	〃	〃	〃	〃	10.0	10.15	5	16	3.2	1.6	1.69×10^{-5}
〃	〃	〃	〃	〃	7.0	7.15	5	14	2.8	2.0	2.11×10^{-5}
〃	〃	〃	〃	〃	5.0	5.15	5	18	3.6	3.5	3.69×10^{-5}
〃	〃	〃	〃	〃	3.0	3.15	5	15	3.0	4.8	5.07×10^{-5}
〃	〃	〃	〃	〃	1.0	1.15	5	4	0.8	3.5	3.69×10^{-5}





Explanations

① Pump		P_o	: Gauge pressure
② Flow meter		H_1	: Height of Pressure gauge
③ Pressure gauge		H_2	: Depth of Ground water
④ Ground surface		P	: Effective pressure
⑤ Drill hole			$P = P_o + H_1/10$, $H = H_1 + H_2$
⑥ Injection pipe		t	: Injected time
⑦ Packer		Q_t	: Water volume during time in "t"
⑧ Water table			
⑨ Hydrostatic head		Q_e	: Water volume per one min
⑩ Length of test section		L_u	: Lugeon value in ℓ/min/m/10^{-4}kg/cm² Coefficient of permeability
⑪ Diameter of hole		K	

ELECTRIC POWER DEVELOPMENT CO. LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 1 OF 4)

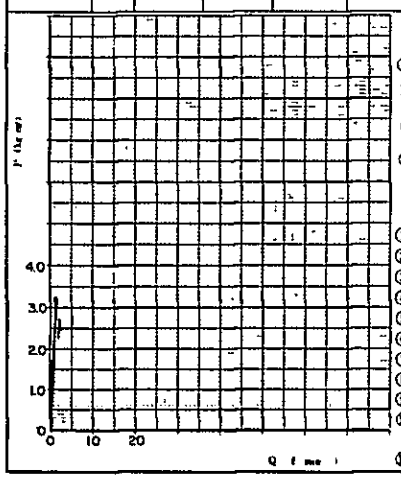
Jutumito PROJECT HOLE No DH-213

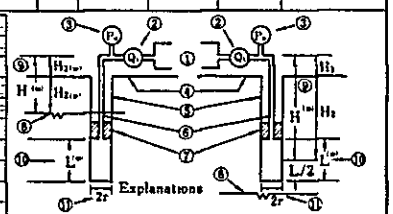
LOCATION Dam site, right bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH ____ m
LEVEL OF WATER TABLE
BEFORE T 1.80 m AFTER T ____ m

TEST DATE 30 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
12.00	14.00	2.00	0.80	1.80	1.0	1.26	5	3	0.6	2.4	2.53×10^{-5}
〃	〃	〃	〃	〃	3.0	3.26	5	8	1.6	2.5	2.64×10^{-5}





①: Pump
②: Flow meter
③: Pressure gauge
④: Ground surface
⑤: Drill hole
⑥: Injection pipe
⑦: Packer
⑧: Water table
⑨: Hydrostatic head
⑩: Length of test section
⑪: Diamater of hole

P_o: Gauge pressure
H_1: Height of Pressure gauge
H_2: Depth of Ground water
P: Effective pressure
$P = P_o + H'''/10$. $H = H_1 + H_2$
t: Injected time
Q_t: Water volume during time in "t"
Q_e: Water volume per one min
: Lugeon value in ℓ/min/m/10^{-6}kg/cm²
L_u: Coefficient of permeability
K

ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

PERMEABILITY TEST IN DRILL HOLE (SHEET 2 OF 4)

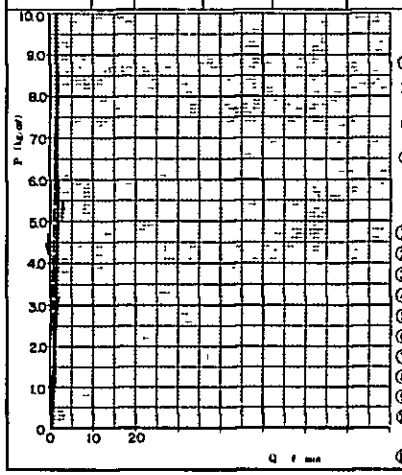
Jutumito PROJECT HOLE No DH-213

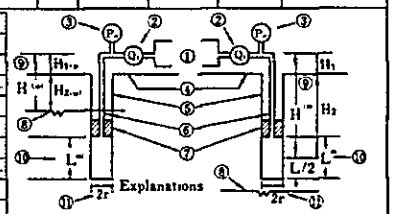
LOCATION Dam site, right bank
ELEVATION ____ m
COORDINATE ____
ANGLE FROM HORIZONTAL 90°
BEARING OF ANGLE HOLE ____

DEPTH OF HOLE 20.00 m
DIAMETER OF HOLE NX cm
DRILLED DEPTH ____ m
LEVEL OF WATER TABLE
BEFORE T 1.80 m AFTER T ____ m

TEST DATE 30 Aug '79
TESTED BY ____
DRILLED BY ____
CHECKED BY EPDC

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_o (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
14.00	16.00	2.00	0.80	1.80	1.0	1.26	5	5	1.0	4.0	4.22×10^{-5}
〃	〃	〃	〃	〃	3.0	3.26	5	9	1.8	2.8	2.96×10^{-5}
〃	〃	〃	〃	〃	5.0	5.26	5	8	1.6	1.5	1.58×10^{-5}
〃	〃	〃	〃	〃	7.0	7.26	5	8	1.6	1.1	1.16×10^{-5}
〃	〃	〃	〃	〃	10.0	10.26	5	10	2.0	1.0	1.06×10^{-5}
〃	〃	〃	〃	〃	7.0	7.26	5	8	1.6	1.1	1.16×10^{-5}
〃	〃	〃	〃	〃	5.0	5.26	5	5	1.0	1.0	1.06×10^{-5}
〃	〃	〃	〃	〃	3.0	3.26	5	2	0.4	0.6	0.63×10^{-5}
〃	〃	〃	〃	〃	1.0	1.26	5	8	1.6	6.3	6.65×10^{-5}





①: Pump
②: Flow meter
③: Pressure gauge
④: Ground surface
⑤: Drill hole
⑥: Injection pipe
⑦: Packer
⑧: Water table
⑨: Hydrostatic head
⑩: Length of test section
⑪: Diamater of hole

P_o: Gauge pressure
H_1: Height of Pressure gauge
H_2: Depth of Ground water
P: Effective pressure
$P = P_o + H'''/10$. $H = H_1 + H_2$
t: Injected time
Q_t: Water volume during time in "t"
Q_e: Water volume per one min
: Lugeon value in ℓ/min/m/10^{-6}kg/cm²
L_u: Coefficient of permeability
K

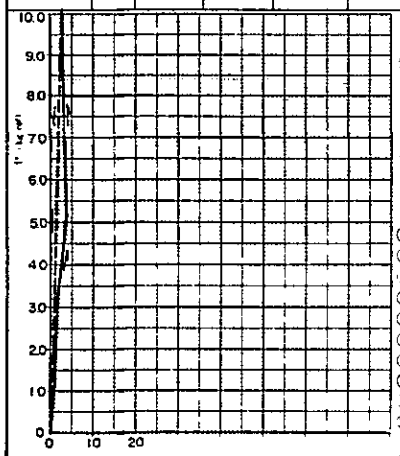
ELECTRIC POWER DEVELOPMENT CO., LTD. TOKYO JAPAN

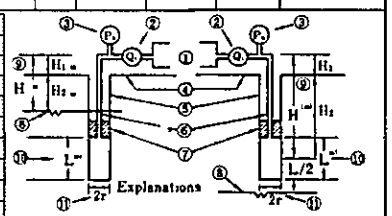
PERMEABILITY TEST IN DRILL HOLE (SHEET 3 OF 4)

Jujumito PROJECT — HOLE No. DH-213

LOCATION Dam site, right bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1646.584 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T. 1.80 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
16.00	18.00	2.00	0.80	1.80	1.0	1.26	5	6	1.2	4.8	5.07×10^{-5}
〃		〃	〃	〃	3.0	3.26	5	7	1.4	2.1	2.22×10^{-5}
〃		〃	〃	〃	5.0	5.26	5	19	3.8	3.6	3.80×10^{-5}
〃		〃	〃	〃	7.0	7.26	5	14	2.8	1.9	2.01×10^{-5}
〃		〃	〃	〃	10.0	10.26	5	13	2.6	1.3	1.37×10^{-5}
〃		〃	〃	〃	7.0	7.26	5	10	2.0	1.4	1.48×10^{-5}
〃		〃	〃	〃	5.0	5.26	5	8	1.6	1.5	1.58×10^{-5}
〃		〃	〃	〃	3.0	3.26	5	5	1.0	1.5	1.58×10^{-5}
〃		〃	〃	〃	1.0	1.26	5	4	0.8	3.2	3.38×10^{-5}





① : Pump — P_e : Gauge pressure
② Flow meter — H_1 : Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_e + H \cdot /10$. $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_e Water volume per one min
⑨ Hydrostatic head — L_u Lugeon value ℓ/min/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

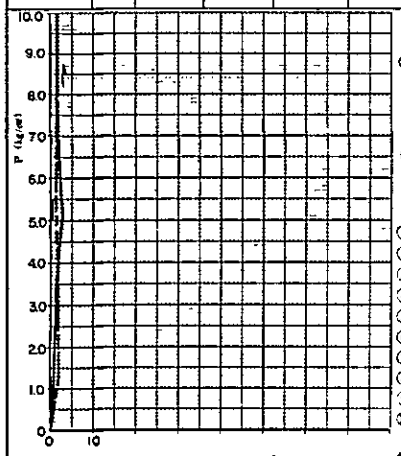
ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN

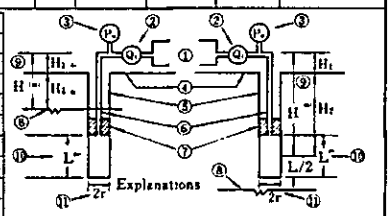
PERMEABILITY TEST IN DRILL HOLE (SHEET 4 OF 4)

Jujumito PROJECT — HOLE No. DH-213

LOCATION Dam site, right bank — DEPTH OF HOLE 20.00 m — TEST DATE 30 Aug '79
ELEVATION 1646.584 m — DIAMETER OF HOLE NX cm — TESTED BY
COORDINATE — DRILLED DEPTH m — DRILLED BY
ANGLE FROM HORIZONTAL 90° — LEVEL OF WATER TABLE — CHECKED BY EPDC
BEARING OF ANGLE HOLE — BEFORE T 1.80 m AFTER T m

Test section (m) From	To	L (m)	H_1 (m)	H_2 (m)	P_e (kg/cm²)	P (kg/cm²)	t (min)	Q_t (ℓ)	Q_e (ℓ/min)	L_u (Lugeon)	K (cm/sec)
16.00	20.00	2.00	0.80	1.80	1.0	1.26	5	6	1.2	4.8	5.07×10^{-5}
〃		〃	〃	〃	3.0	3.26	5	8	1.6	2.5	2.64×10^{-5}
〃		〃	〃	〃	5.0	5.26	5	14	2.8	2.7	2.85×10^{-5}
〃		〃	〃	〃	7.0	7.26	5	8	1.6	1.1	1.16×10^{-5}
〃		〃	〃	〃	10.0	10.26	5	9	1.8	0.9	0.95×10^{-5}
〃		〃	〃	〃	7.0	7.26	5	7	1.4	1.0	1.06×10^{-5}
〃		〃	〃	〃	5.0	5.26	5	9	1.6	1.5	1.58×10^{-5}
〃		〃	〃	〃	3.0	3.26	5	9	1.6	2.5	2.64×10^{-5}
〃		〃	〃	〃	1.0	1.26	5	10	2.0	7.9	8.34×10^{-5}





① Pump — P_e Gauge pressure
② Flow meter — H_1 Height of Pressure gauge
③ Pressure gauge — H_2 Depth of Ground water
④ Ground surface — P Effective pressure
⑤ Drill hole — $P = P_e + H \cdot /10$. $H = H_1 + H_2$
⑥ Injection pipe — t Injected time
⑦ Packer — Q_t Water volume during time in "t"
⑧ Water table — Q_e Water volume per one min
⑨ Hydrostatic head — L_u Lugeon value ℓ/min/m/10^{-6}kg/cm²
⑩ Length of test section — K Coefficient of permeability
⑪ Diamater of hole

ELECTRIC POWER DEVELOPMENT CO. LTD TOKYO JAPAN