

II GEOLOGICAL SURVEY

1 INTRODUCTION

- 1.1 This report presents the soil investigation results for Small Hydro Study In Sarawak - Core Drilling Material Investigation For Mukoh site.
- 1.2 Its scope is limited to the presentation of factual data obtained from site boring and in-situ testing results.
- 1.3 All site operations and testing were carried out in accordance with the specification as stated in the Contract or under Clients' Site Engineers direct supervision.

2 WORK PROGRAM

Site work commenced on 12 June 1987 and completed on 11 July 1987. The total of six numbers of borehole and nine water pressure tests were carried out. Their borehole locations are shown on Location Plan, see Appendix .

3 FIELD EXPLORATION

3.1 Method of boring

Boreholes were advanced with rotary wash boring method by using water as the drilling fluid. NW size of 76mm inter diameter casings were used to line the borehole walls where encountered soft overburden and other unstable soil formation. During boring work in progress, standard penetration tests were carried out including collected disturbed samples. Detailed boring records and standard penetration test results were also furnished in this report.

3.2 Standard Penetration Test (SPT)

The standard penetration tests were performed in accordance with the specification or as directed by SESCO Engineer on site. This test is to determines the relative density of cohesionless soil and to some extent the consistency cohesive soil. The apparatus consists of a 65 kg hammer with a tripping device that release the hammer at a height of 760mm. The falling energy is then transmitted via an anvil and

drill rod to a standard spoon of 5.08cm outer diameter and 3.49cm inner diameter at the bottom of the cleaned-out borehole. The number of blows to penetrate 450mm into the soil is recorded and the numbers of blow required to penetrate the final 300mm is recorded as 'N' value of SPT. (Excluding first 150mm seating drive).

4 SAMPLING

4.1 Disturbed Soil Samples

Disturbed soil samples were taken from standard penetration test spoon sampler. These representative soil samples were then well labelled and sealed in plastic bag for laboratory test.

5 LABORATORY TEST

All disturbed samples collected from SPT spoon tube were used for soil identification. No specific laboratory test been carried out on the collected soil samples.

LKS/Gg

SUMMARY OF FIELD EXPLORATION AND TEST

(Mukoh)

Section A - Table 1

Borehole No.	Reduced Level (m)	Borehole Depth (m)	Boring in Soil (m)	Rock Coring (m)	Standard Penetration Test (No.)	Water Pressure Test (No.)	Date of Boring
BMK - 1		15.00	1.20	13.80	-	5	27.6 to 30.6.1987
BMK - 2		15.00	3.70	11.30	2	2	2.7 to 3.7.1987
BMK - 3		24.80	18.00	6.80	12	-	19.6 to 22.6.1987
BMK - 4		20.30	17.50	2.80	11	-	10.7 to 11.7.1987
BMK - 5		19.30	-	19.30	-	-	12.6 to 16.6.1987
BMK - 6		24.30	6.70	17.60	4	2	6.7 to 9.7.1987

Section A - Table 2

GEOTECHNIQUE EAST MALAYSIA SDN. BHD.
 LOT 87 JALAN TAN SRI ONG KEE HUI
 KUCHING SARAWAK MALAYSIA

<u>Core Recovery</u>	<u>Modified Core Recovery</u>	<u>RQD</u> (<u>Rock Quality Designation</u>)	<u>Description of Rock Quality</u>
10"	10"	0 — 25	V. Poor
2"		25 — 50	Poor
2"		50 — 75	Fair
3"		75 — 90	Good
4"	4"	90 — 100	Excellent
5"	5"		
3"			
4"	4"		
6"	6"		
4"			
2"			
5"	5"		
50"	34"		
	Core Run = 60"		

Note: If the core is broken by handling or by the drilling process (i.e. the fracture surfaces are fresh irregular breaks rather than natural joint surface), the fresh broken pieces are fitted together and counted as one piece.

Core Recov. = 50/60 = 83%
 RQD = 34/60 = 57%

Section A - Table 3

WEATHERING CLASSIFICATION TABLE

<u>GRADE</u>	<u>TERM</u>	<u>SANDSTONE DESCRIPTION</u>	<u>ARGILLACEOUS DESCRIPTION</u>
I	Fresh	No visible sign of weathering.	No visible sign of weathering.
I	Faintly Weathered	Discolouration only on major discontinuities.	(Term not used).
II	Slightly Weathered	Discolouration may be continuous throughout rock material and on discontinuity surfaces. Rock maybe slightly diminished in strength.	Some indications of chemical discolouration on fracture surfaces.
III	Moderately Weathered	Weathering may extend throughout rock mass, usually totally discoloured. Rock strength diminished. Less than 50% rock decomposed/disintegrated to sand. Rock present either as continuous framework or as corestones. Rock strength diminished.	Rock diminished in strength with zones or partings of silty clay/clayey silt. Discolouration of fracture surfaces and possibly rock mass.
IV	Highly Weathered	Weathering extends throughout Rock mass. Greater than 50% rock decomposed/disintegrated to sand. Rock strength generally greatly diminished. Rock present as discontinuous framework or as corestones.	Weathered to stiff/very stiff silty clay/clayey silt. May contain gradations to very weak rock or lithorelicts.
V	Completely Weathered	Rock material decomposed to sand with possible minor fragments of weak rock. Structure intact.	Weathered to firm silty clay/clayey silt. Essential mass structure intact.
VI	Residual Soil	As above but structure destroyed. (Generally indistinguishable from Colluvium C).	No structure. (Generally indistinguishable from Colluvium C).

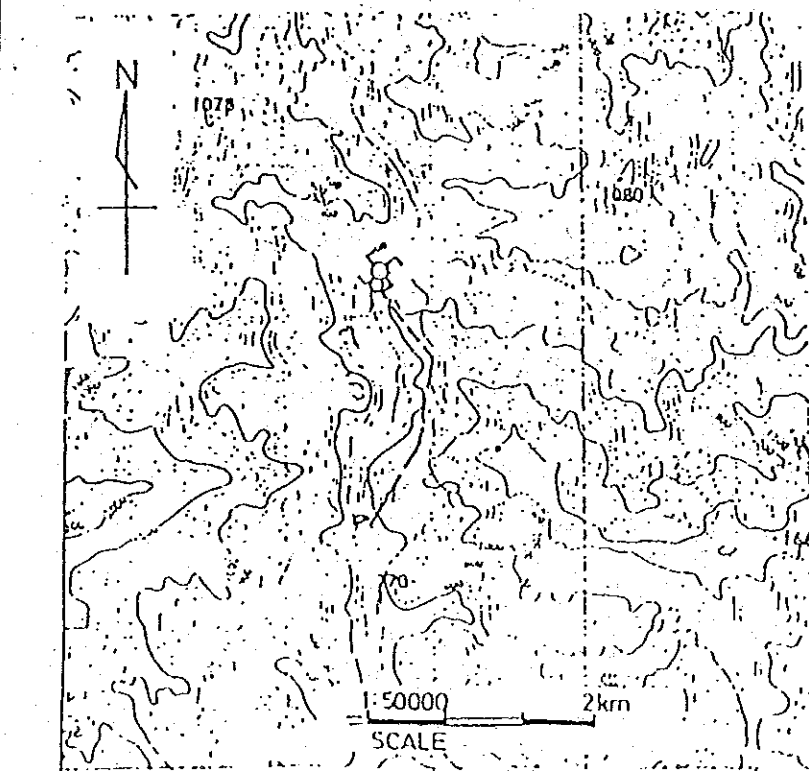
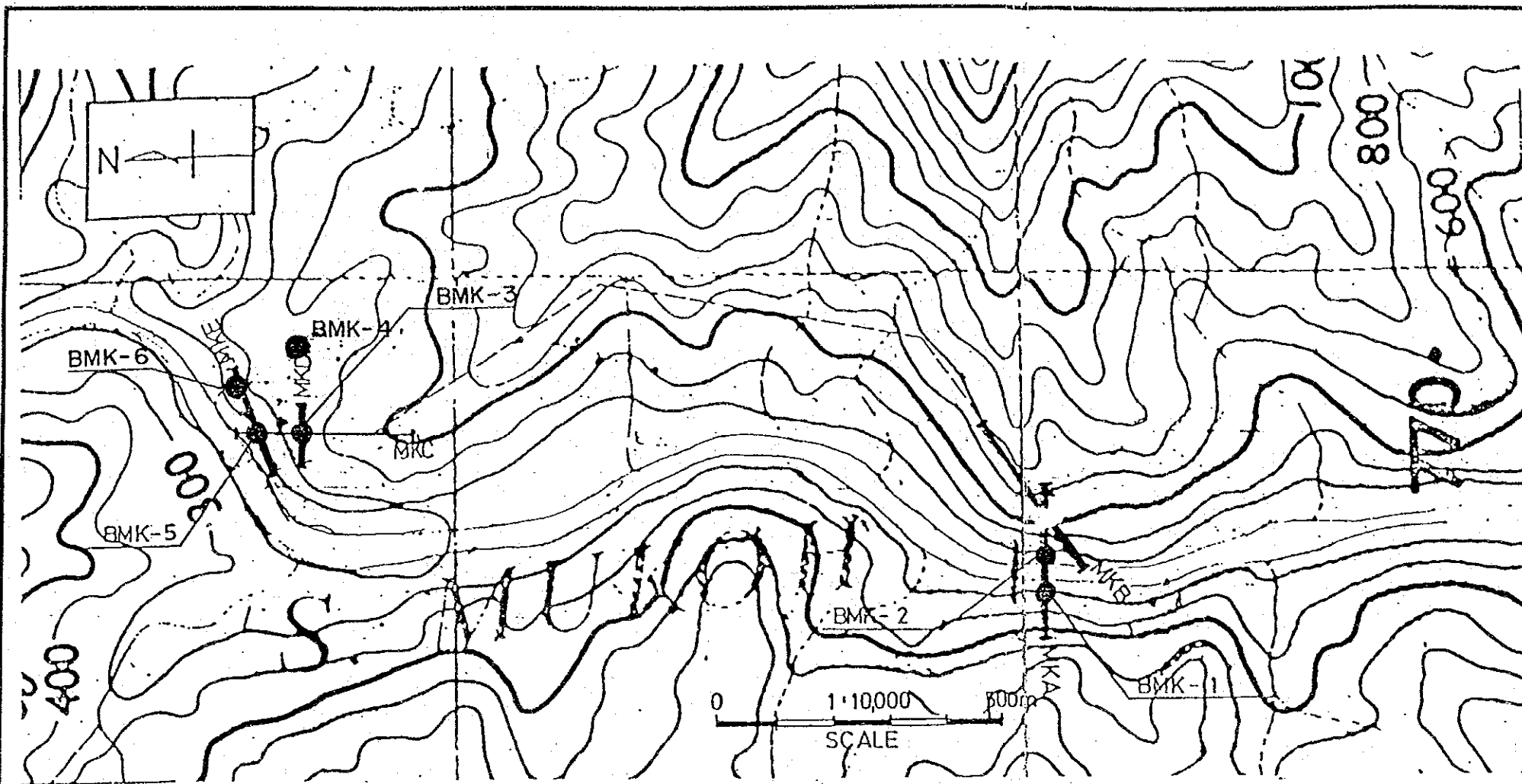
Section A - Table 4 :Colour description

1	2	3
light	pinkish	pink
dark	reddish	red
	yellowish	yellow
	brownish	brown
	olive	olive
	greenish	green
	bluish	blue
		white
	greyish	grey
		black

Section A - Table 5

Recommended symbols for soils and rocks

Soil	Rock				
	Sedimentary		Metamorphic	Igneous	
Made ground		Chalk			Coarsed - grained
Boulders and cobbles		Limestone			Medium - grained
Gravel		Conglomerate			Fine - grained
Sand		Breccia			
Silt		Sandstone			
Clay		Siltstone			
Peat		Mudstone			
NOTE: Composite soil types will be signified by combined symbols, e.g.		Shale			
		Coal			
Silty sand		Pyroclastic (Volcanic ash)			
Gypsum, Rocksalt etc.		Argillaceous			



STATION	COORDINATE		Ht (m)
	E (m)	N (m)	
BMK 1	2344116.819	5203514.868	79.640
BMK 2	2344171.777	5203519.936	81.100
BMK 3	2344526.922	5205028.567	99.818
BMK 4	2344600.031	5205122.900	88.963
BMK 5	2344543.293	5205140.053	56.269
BMK 6	2344582.028	5205154.325	69.944

LEGEND

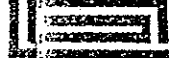
● Drilling Hole

PROJECT
SMALL HYDRO STUDY FOR MUKOH

DRAWING TITLE
BOREHOLE LOCATION PLAN

JOB NO
KSI/87(J18)

DRAWING NO
L . P . I .


 GEOTECHNIQUE EAST MALAYSIA SDN. BHD
 LOT 87, JALAN TAN SRI ONG KEE HUI
 KUCHING, SARAWAK.
 TEL : 243468, 243478
 TELEX : MA 70416 GEOTEC

GOVERNMENT OF MALAYSIA
 FEASIBILITY STUDY
 SMALL SCALE HYDROELECTRIC POWER PROJECT IN SARAWAK
 JAPAN INTERNATIONAL COOPERATION AGENCY

DIAMOND DRILL HOLE -- GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project
 FEATURE Dam Axis
 LOCATION Intake (Left Bank)

CO-ORDINATES E 2344 116.819 m
 N 5203 514.868 m
 SYSTEM S'wak Survey Grid

SURFACE 79.64 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE - colour, grain size, texture Mineral composition	SPT	DEGREE OF WEATHERING	CORE SIZE	ELEVATION	DEPTH	SYMBOLIC LOG	RQD	STRUCTURES	FRACTURE LOG	DRAIN WATER LOSS	GROUNDWATER LEVEL DATE	WATER PRESSURE TEST LUGEON VALUE	EFFECTIVE PRESSURE (BAR)	LUGEON PATTERN
							CORE LOSS % PER LIFT							
Overburden no. coring 1.20 m														
Slaty shale, dark grey, very fine grained interbedded with very thin layer (mm to cm thick) of siltstone in laminated form. (bedding dipping 75° throughout, very regular)								80° Joint, smooth						
								Set of 40° Joint, rough limonite stained 45° Joint rough, black to brown coated.						

DRILL Rotary No. <u>YBM-05</u> Date <u>26.6.87</u> Commented <u>30.6.87</u> Completed	FRACTURE LOG 	EXPLANATION Handed breaks in core per metre Equivalent lengths of core pieces in centimetres	WEATHERING CW - Completely unweathered HW - Highly weathered MW - Moderately weathered SW - Slightly weathered FS - Fresh, with limonite stained joints F - Fresh	Logged <u>VNT</u> Drawn <u>VNT</u> Checked <u>VNT</u> Sheet <u>1</u> of <u>2</u>
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DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project
 FEATURE Dam Axis
 LOCATION Intake (Left Bank)

COORDINATES E 2344 116.819 m
N 5203 514.868 m
 SYSTEM S'wak Survey Grid

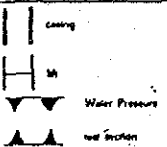
SURFACE 79.64 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING F, FS, SW, MW, HW, V, CV	CORE SIZE ELEVATION DEPTH	SYNTHETIC LOG	ROD CORE LOSS & PEEL LIFT	STRUCTURES JOINTS — spacing, attitude, smoothness aperture, cementing, coating, filling BEDDING, FOLIATION, VEINS, SEAMS, FOLDS, CRUSHED ZONES	FRACTURE LOG	DRILL WATER LOSS GROUT WATER LEVEL DATE	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR)	LUGEON PATTERN
<p>Slaty-shale dark gray, very fine grained interbedded with very thin layer (mm to cm thick) of siltstone in laminated form. (bedding dipping 75° common)</p> <p>75° Joint smooth with little calcite patches</p> <p>END OF CORE 15m</p>			11							
			12							
			13							
			14							
			15							
			6							
			7							
			8							
			9							
			0							

DRILL
 Make Rotary
 Type YBM-05
 Date
 Commenced 26.6.87
 Completed 30.6.87

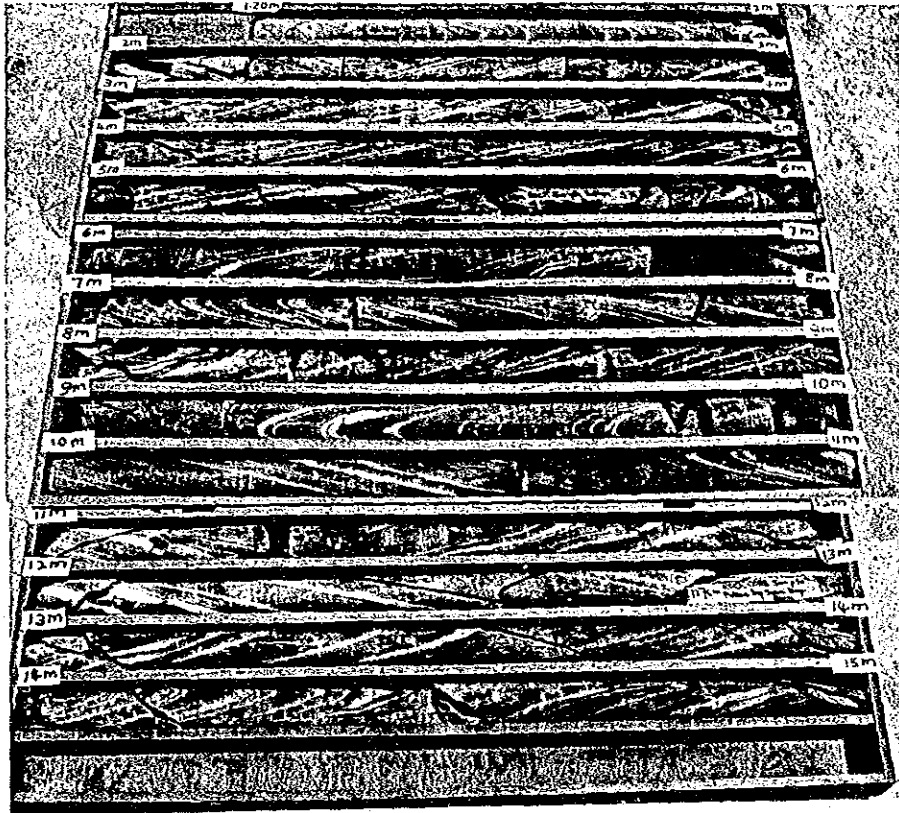
FRACTURE LOG

EXPLANATION
 Mineral breaks in core per metre
 Equivalent lengths of core pieces in containers



WEATHERING
 CW — Completely weathered
 HW — Highly weathered
 MW — Moderately weathered
 SW — Slightly weathered
 Frs — Fresh, with discrete mineral joints
 Fr — Fresh

Logged VNT
 Drawn VNT
 Checked VNT
 Sheet 2 of 2



MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 1

1.20 m - 15.00 m

DIAMOND DRILL HOLE — GEOLOGICAL LOG

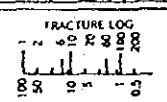
PROJECT Mukoh Small Hydro Project
 FEATURE Dam Axis
 LOCATION Intake (Right Bank)

E 2344 171.777 m
 N 5203 519.936 m
 SYSTEM S'wak Survey Grid

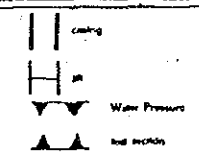
SURFACE 81.10 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING F/S H/S M/W SW CW	SYMBOLIC LOG	ROD CORE LOSS % PER LIFT	STRUCTURES JOINTS — spacing, attitude, smoothness aperture, cementing, coating, filling, BEDDING, FOLIATION, VEINS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR) LUGEON PATTERN
Overburden on coring							
Overburden no coring 3.7m							
Dark grey shale interbedded with thin layer (mm to cm) of silty lime light grey, very fine grained.					<p>Joint</p> <p>Bedding dipping 80°</p> <p>45° Joint warped dark brown coated</p> <p>50° Joint warped black to brown coated</p> <p>55° Joint warped dark brown coated</p> <p>45° Joint planar</p> <p>80° bedding planar, limonite stained</p> <p>50° Joint warped limonite stained</p> <p>65° Joint warped limonite stained</p> <p>60° Joint intersected 75° Joint at right angle, both are rough and limonite stained</p> <p>80° Joint intersected at 75° Joint at right angle, both warped with dark brown coated</p> <p>Crushed rock with steep (high) dipping angle bedding.</p> <p>80° bedding warped dark brown coated crushed rock with high dipping angle bedding common.</p> <p>75° bedding planar brown coated</p> <p>75° bedding, planar with limonite stained fractured rock, most structures along 75° bedding with limonite stained</p> <p>Subvertical Joint, warped with limonite stained</p>		

DRILL
 Make Rotary
 Type YBM-05
 Order
 Commenced 2.7.87
 Completed 3.7.87



EXPLANATION
 Natural breaks in core per mm
 Equivalent lengths of core pieces in centimetres



WEATHERING
 CW — Completely weathered
 HW — Highly weathered
 MW — Moderately weathered
 SW — Slightly weathered
 F/S — Fresh, with limonite stained joints
 F — Fresh

Logged VNT
 Drawn VNT
 Checked VNT
 Sheet 1 of 2

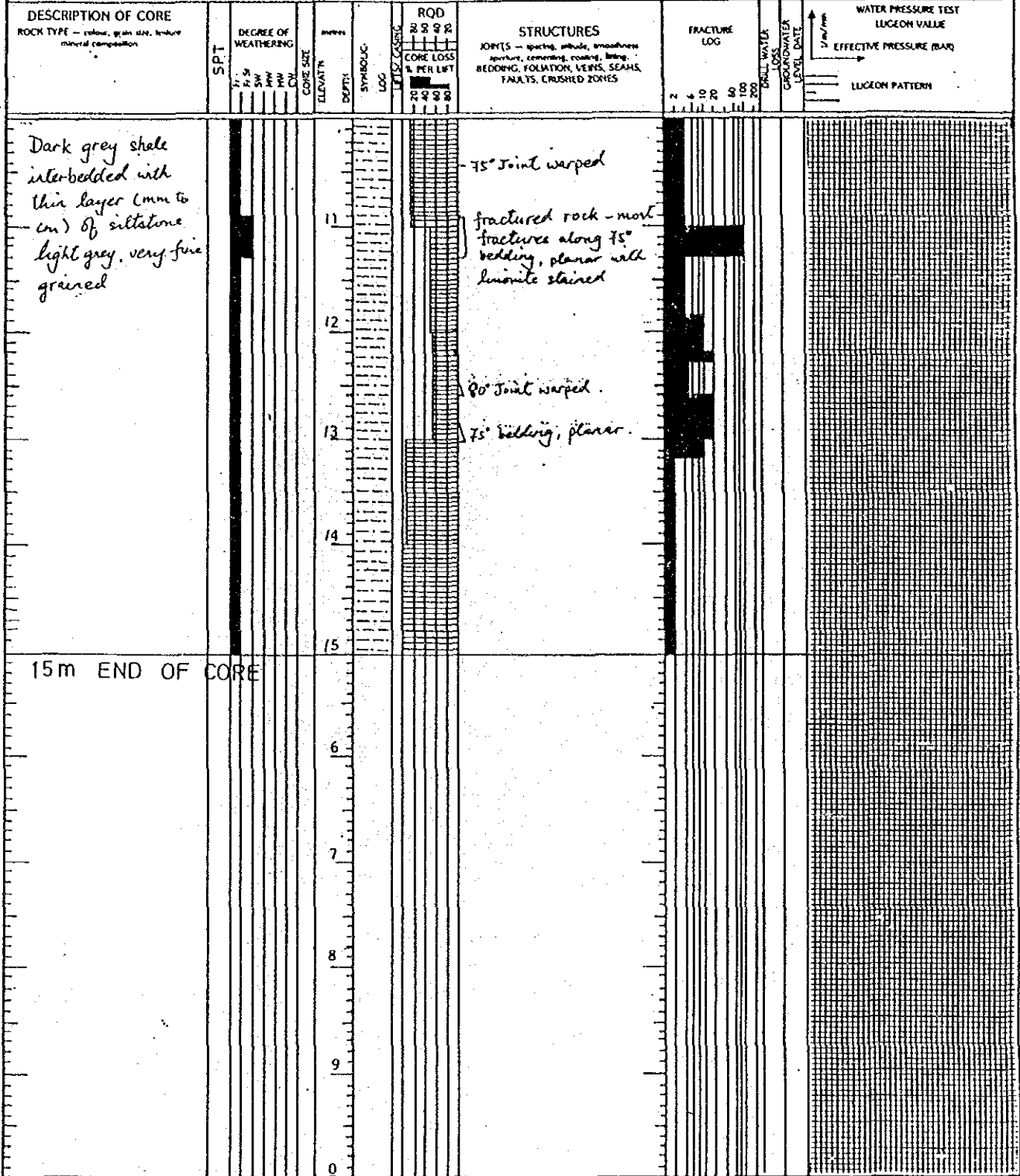
SARAWAK ELECTRICITY SUPPLY CORPORATION

HOLE No. **BMK 2**

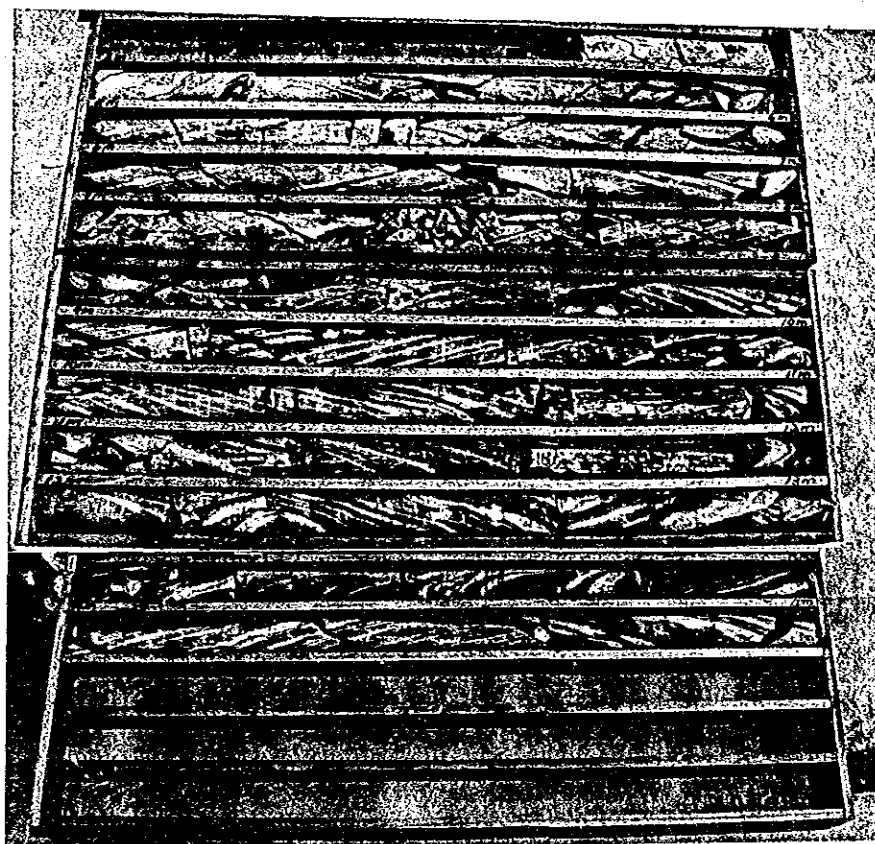
DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project COORDINATES E 2344 177.777 m
 FEATURE Diversion Weir COORDINATES N 5203 519.936 m
 LOCATION Intake (Right Bank) SYSTEM Sarawak Survey Grid

SURFACE 81.10 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION -



DRILL Make <u>Rotary</u> Type <u>YBM-05</u> Drills Commenced <u>2.7.87</u> Completed <u>3.7.87</u>	FRACTURE LOG 	EXPLANATION Natural breaks in core per metre Equivalent lengths of core pieces in centimetres	WEATHERING CW — Completely weathered HW — Highly weathered MW — Moderately weathered SW — Slightly weathered Ffs — Fresh, with limonite stained joints Fr — Fresh	Logged <u>VNT</u> Drawn <u>VNT</u> Checked <u>VNT</u> Sheet <u>2</u> of <u>2</u>
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MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 2

3.70 m - 15.00 m

DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukah Small Hydro Project
 FEATURE Surge Tank
 LOCATION Power House

CO-ORDINATES E 2344 526.922 m
 N 5205 028.567 m
 SYSTEM Siwak Survey Grid

SURFACE 99.82 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING F1 S F2 SW F3 MW F4 SH F5 CW	CORE SIZE ELEVATION DEPTH SYNCHRONIC LOG	ROD CORE LOSS % PER LIFT	STRUCTURES JOINTS — spacing, attitude, smoothness aperture, cementing, coating, filling BEDDING, FOLIATION, VEINS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	DRAINAGE LOSS GROUNDWATER LEVEL DATE	WATER PRESSURE TEST LUCEON VALUE EFFECTIVE PRESSURE (BAR) LUCEON PATTERN
Overburden no coring			1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18					
18.00 m			18					
Shale, grey, very fine grained, cleavage along the bedding common, Quartz veins inter- colated at random direction.			19 20		70° Joint planar. 75° Joint planar quartz patches crushed rock 70° Joint planar 75° Joint planar. crushed rock.			

DRILL
 Make Rotary
 Type YBM-05
 Date
 Commenced 19.6.87
 Completed 22.6.87

FRACTURE LOG

EXPLANATION
 Hand-drawn breaks in core per metre
 Equivalent lengths of core pieces
 in continuous

WEATHERING
 CW — Completely weathered
 HW — Highly weathered
 MW — Moderately weathered
 SW — Slightly weathered
 Fr — Fresh, with limestone natural joints
 Fr — Fresh

Logged VNT
 Drawn VNT
 Checked VNT
 Sheet 1 of 2

DIAMOND DRILL HOLE - GEOLOGICAL LOG

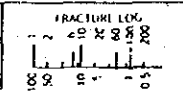
PROJECT Mukoh Small Hydro Project
 FEATURE Surge Tank
 LOCATION Power House

COORDINATES E 2344 526.922 m
 N 5205 028.567 m
 SYSTEM Swak Survey Grid

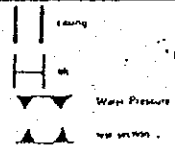
SURFACE 99.82 m
 ELEVATION 90°
 HORIZONTAL DIRECTION

DESCRIPTION OF CORE ROCK TYPE - colour, grain size, texture mineral composition	DEGREE OF WEATHERING SAT F S M H W CW	CORE SIZE ELEVATION DEPTH SYMBOLIC LOG	RQD CORE LOSS % PER FOOT	STRUCTURES JOINTS - spacing, attitude, smoothness APERTURE, cementing, coating, filling BEDDING, FOLIATION, VEINS, SEAMS, TAULTS & CRUSHED ZONES	FRACTURE LOG	WATER PRESSURE TEST LOGEON VALUE EFFECTIVE PRESSURE (BAR) LOGEON PATTERN
Shale, grey, very fine grained, cleavage along bedding common, quartz veins intercalated at random direction		21		Subvertical Joint planar fractured rock.		
		21.75m		80° Joint planar.		
		22		Lost core.		
		22.00m		Subvertical Joint planar.		
		23		80° Joint planar		
24.80m END OF CORE		24		Quartz Vein		
				80° Joint planar.		
				80° Joint planar		
		5				
		6				
		7				
		8				
		9				
		0				

DRILL
 State Rotary
 Type YBM-05
 Date 10.7.87
 Completed 11.7.87



EXPLANATION
 Natural breaks in core per metre
 Equaliser lengths of core pieces in centimetres



WEATHERING
 CW - Completely weathered
 FW - Highly weathered
 HW - Moderately weathered
 SW - Slightly weathered
 F5S - Fresh, with some fine weathered zones
 F5 - Fresh

Logged VNT
 Drawn VNT
 Checked VNT
 Sheet 2 of 2



MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 3

18.00 m - 24.80 m

DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project COORDINATES E 2344.600.031 m SURFACE 88.96 m
 FEATURE Head Tank & Penstock COORDINATES N 5205.122.900 m ELEVATION 90°
 LOCATION Power House SYSTEM S'wak Survey Grid HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING F1 F2 F3 F4 F5 F6	CORE SIZE ELEVATION DEPTH	SYMBOL LOC.	ROD	STRUCTURES Joints — spacing, attitude, smoothness Aperture, cementing, coating, lining BEDDING, FOLIATION, VENS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	DRILL WATER LOSS GROUNDWATER LEVEL GAGE	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR) LUGEON PATTERN
					CORE LOSS & PER LIFT				
Overburden no coring 17.50 m.									
Weathered shale, very fine grained Soft with laminar slain on joints Common, light grey to light brown Note: oxidation stain on cleavage or bedding plane comm			18 19 20			Crushed rock, brown coating common on joints To joint planes Set of 15° joints rough dark brown coated. To bedding laminated crushed rock			

DRILL Max Rotary Tool YEM-05 Date Started 10.7.87 Completed 11.7.87	FRACTURE LOG 	EXPLANATION Natural breaks in core per meter Equivalent lengths of core pieces in centimeters 	WEATHERING CW — Completely weathered HW — Highly weathered MW — Moderately weathered SW — Slightly weathered F5 — Fresh, with laminar stained joints F1 — Fresh 	VNT Logged VNT Drawn VNT Checked VNT Sheet 1 of 2
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DIAMOND DRILL HOLE — GEOLOGICAL LOG

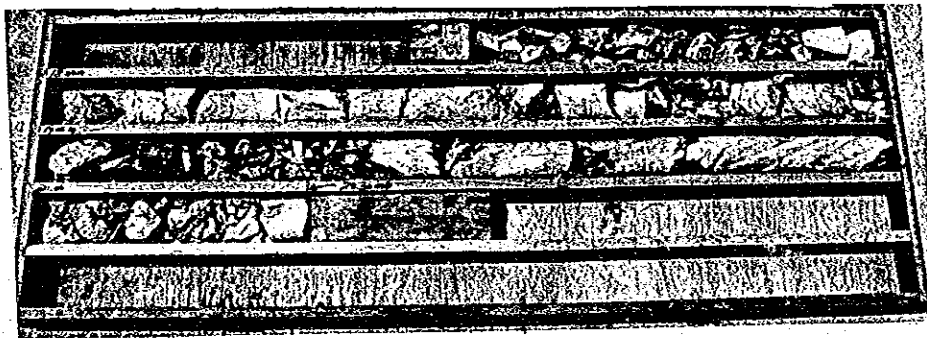
PROJECT Mukoh Small Hydro Project
 FEATURE Head Tank & Penstock
 LOCATION Power House

CO-ORDINATES E 2344.600.031 m
 N 5205.122.900 m
 SYSTEM _____

SURFACE 88.96 m
 ELEVATION _____
 ANGLE FROM 90°
 HORIZONTAL _____
 DIRECTION _____

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture, mineral composition	SPT	DEGREE OF WEATHERING F1 F2 F3 F4 F5 F6 F7 F8 F9 F10	CORE SIZE ELEVATION DEPTH SYMBOLIC LOG	ROD	STRUCTURES JOINTS — spacing, attitude, smoothness, aperture, cementing, coating, filling. BEDDING, FOLIATION, VEINS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	DRILL WATER LOSS GROUT WATER LEVEL DATE	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR) LUGEON PATTERN
				CORE LOSS % PER LIFT				
20.3m END OF CORE				Crushed rock				
			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			0					

DRILL Make Rotary Type YBM-05 Date Commenced 10.7.87 Completed 11.7.87	FRACTURE LOG 	EXPLANATION Manual breaks in core per metre Equivalent lengths of core pieces in centimeters	WEATHERING CW — Completely weathered HW — Highly weathered MW — Moderately weathered SW — Slightly weathered F5F6 — Fresh, with little or no mineralization F1 — Fresh	VNT Logged VNT Drawn VNT Checked VNT Sheet 2 of 2
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MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 4

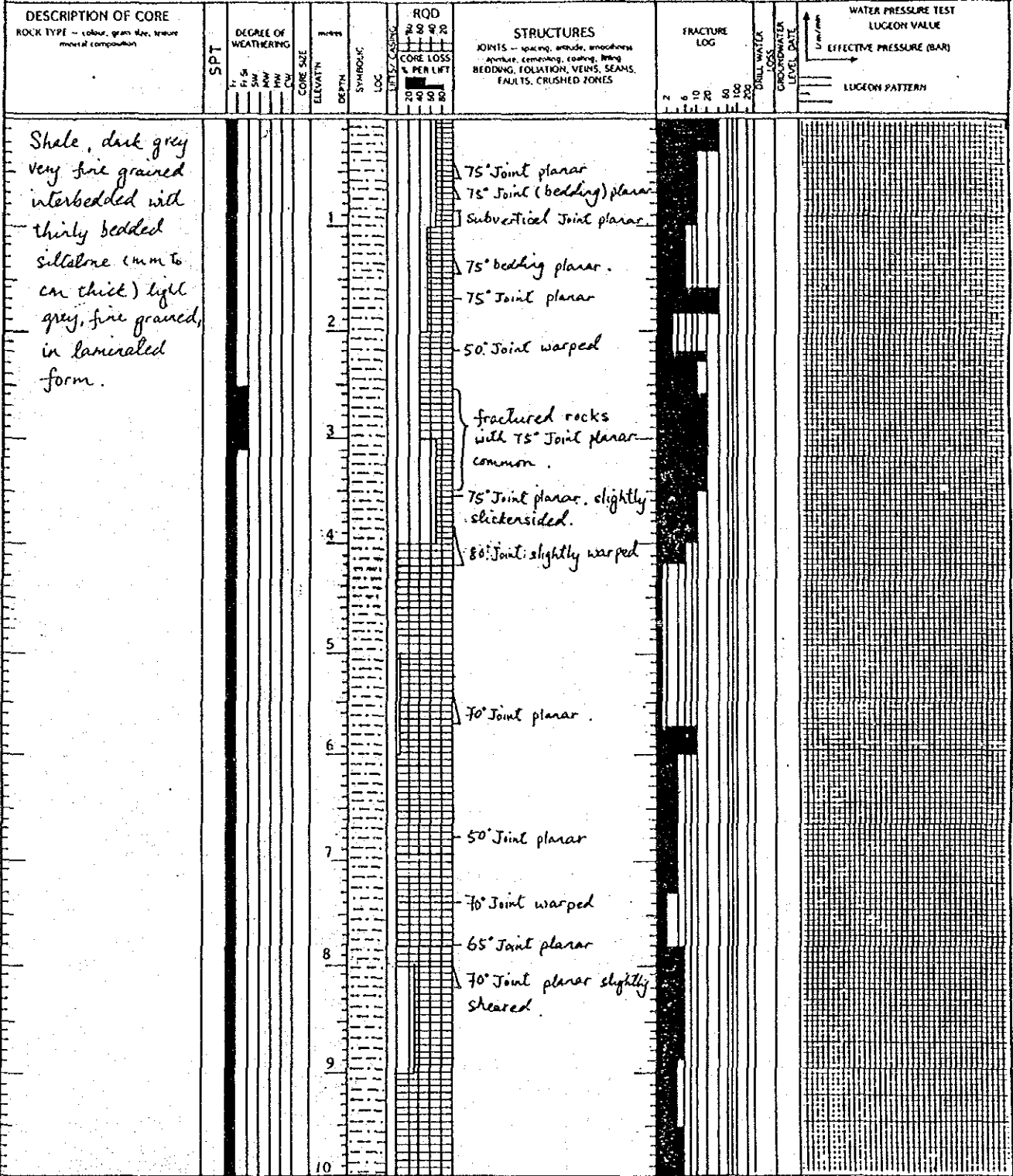
17.00 m - 20.30 m

DIAMOND DRILL HOLE — GEOLOGICAL LOG

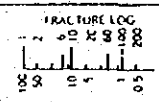
PROJECT Mukoh Small Hydro Project
 FEATURE Power Station
 LOCATION Power House

CO-ORDINATES E 2344 543.295 m
 N 5205 140.053 m
 SYSTEM S'wak Survey Grid

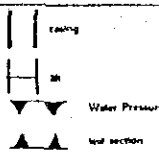
SURFACE 56.27 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION



Make **Rotary**
 Type **YBM-05**
 Date **12.6.87**
 Completed **16.6.87**



EXPLANATION
 Natural breaks in core per metre
 Equivalent lengths of core pieces
 in centimetres



WEATHERING
 CW — Completely weathered
 HSH — Highly weathered
 MW — Moderately weathered
 SW — Slightly weathered
 F.S. — Fresh, with laminar stained joints
 F. — Fresh

Logged **VNT**
 Drawn **VNT**
 Checked **VNT**
 Sheet **1** of **2**

DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project
 FEATURE Power Station
 LOCATION Power House

E. 2344 543.295 m
 CO-ORDINATES N. 5205 140.053 m
 SYSTEM S'wak Survey Grid

SURFACE 56.27 m
 ELEVATION ANGLE FROM 90°
 HORIZONTAL DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING F.P.S. SW MW HW CW	CORE SIZE ELEVATION DEPTH SYMBOLIC LOG	ROD CORE LOSS % PER LIFT	STRUCTURES JOINTS — spacing, attitude, smoothness nature, cementing, coating, filling BEDDING, FOLIATION, VEINS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	WATER LOSS DRILL WATER GAS/WATER LEVEL DATE	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR) LUGEON PATTERN	
									ROD
Shale, dark grey Very fine grained interbedded with thinly bedded siltstone (mm to cm thick) light grey. fine grained in laminated form. + Irregular quartz veins common					70° Joint planar.				
					75° Joint planar				
					fractured rock with subvertical Joint common.				
					45° Joint planar.				
					80° Joint planar				
					60° Joint warped				
					Quartz vein.				
					fractured rock with subvertical Joint common.				
					Subvertical Joint warped slightly slickensided				
					Subvertical Joint warped slightly slickensided				
					Set of 75° Joint planar slickensided 80° Joint planar slicken- sided.				
					80° Joint planar slicken- sided.				
	END OF CORE 19.3m								

DRILL Make Rotary Type YBM-05 Date 12.6.87 Commenced 16.6.87 Completed	FRACTURE LOG 	EXPLANATION Natural breaks in core per metre Equivalent lengths of core pieces in centimetres	WEATHERING CW — Completely weathered HW — Highly weathered MW — Moderately weathered SW — Slightly weathered FrS — Fresh, with laminae stained joints Fr — Fresh	Logged VNT Drawn VNT Checked VNT Sheet 2 of 2
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MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 5

0.00 m - 19.30 m

DIAMOND DRILL HOLE -- GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project
 FEATURE Power Station
 LOCATION Power House

CO-ORDINATES E 2344 582.028 m
 N 5205 154.325 m
 SYSTEM S'wak Survey Grid

SURFACE 69.94 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE - colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING	ELEVATION meters	DEPTH meters	SYMBOLIC LOG	ROD CORRECTION CORE LOSS % PER LIFT	STRUCTURES JOINTS - spacing, attitude, smoothness partings, cementing, coating, bedding BEDDING, FOLIATION, VEINS, SEAMS, FAULTS, CRUSHED ZONES	FRACTURE LOG	DRILL WATER LOSS GROUNDWATER LEVEL DATE	WATER PRESSURE TEST LUGEON VALUE EFFECTIVE PRESSURE (BAR)	LUGEON PATTERN
Overburden no coring 2.5m				2							
Sandstone light grey coarse grained "Boulder"				3							
				4							
				5							
				6							
				7							
				8							
Dark grey shale, very fine grained interbedded with light grey silt- stone, fine grained and quartz veins intercolated through- out the whole core				9			Crushed rock with brown-black coating on joints common				
				10			45' Joint rough limonite stain				

DRILL
 Make **Rotary**
 Type **YBM-05**
 Date
 Started **6.7.87**
 Completed **9.7.87**

FRACTURE LOG
 Natural breaks in core per meter
 Equivalent lengths of core pieces
 in centimeters

EXPLANATION
 casing
 bit
 Water Pressure
 see section

WEATHERING
 CW - Completely weathered
 HW - Highly weathered
 MW - Moderately weathered
 SW - Slightly weathered
 F/S - Fresh, with little or no mineral partings
 F - Fresh

Logged **VNT**
 Drawn **VNT**
 Checked **VNT**
 Sheet **1** of **3**

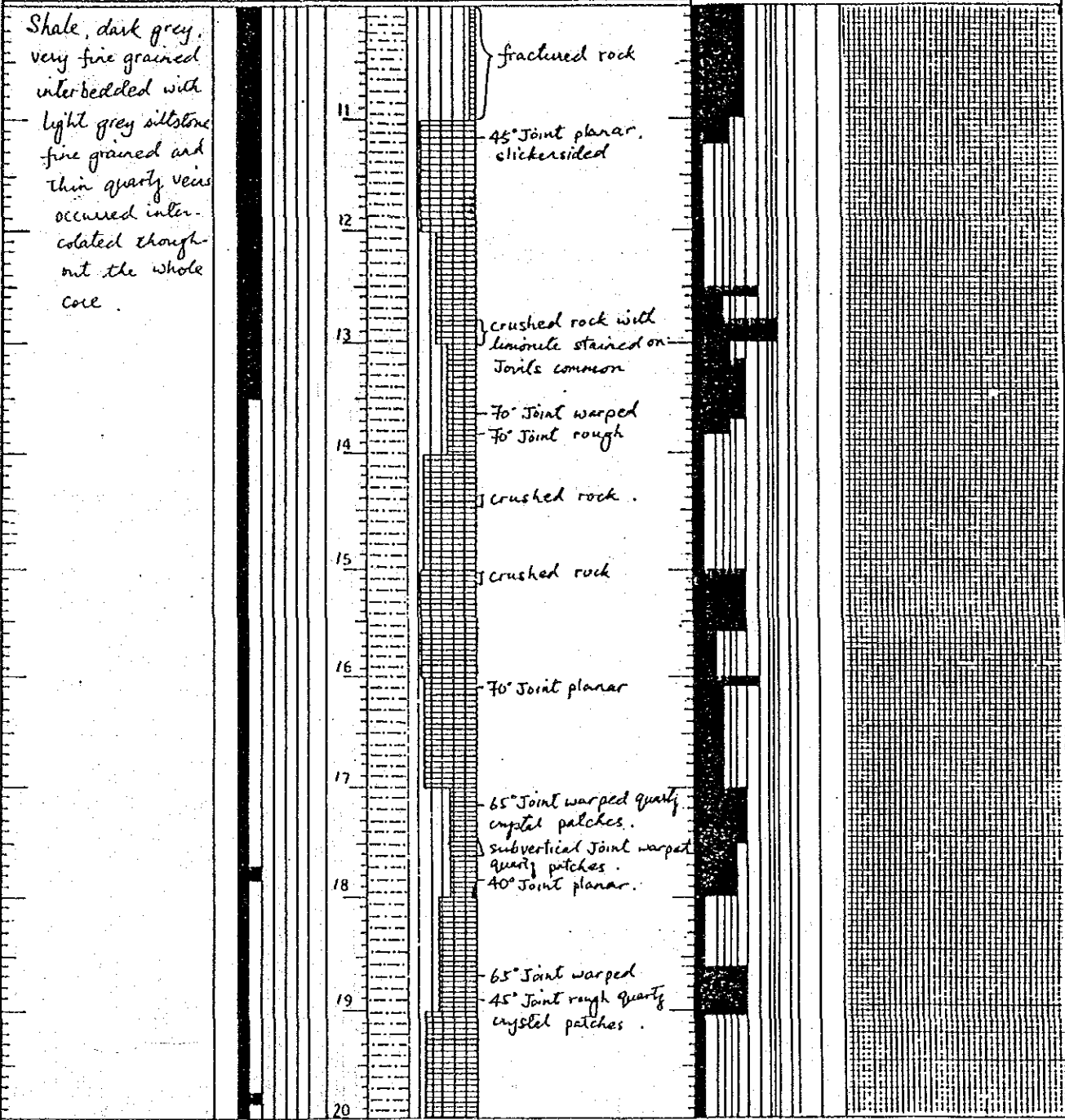
DIAMOND DRILL HOLE — GEOLOGICAL LOG

PROJECT Mukoh Small Hydro Project
 FEATURE Power Station
 LOCATION Power House

COORDINATES E 2344 582.028 m
N 5205 154.325 m
 SYSTEM S'wak Survey Grid

SURFACE 69.94 m
 ELEVATION
 ANGLE FROM 90°
 HORIZONTAL
 DIRECTION

DESCRIPTION OF CORE ROCK TYPE — colour, grain size, texture mineral composition	SPT	DEGREE OF WEATHERING	CORE SIZE	ELEVATION	DEPTH	SYMBOLIC LOG	ROD	STRUCTURES	FRACTURE LOG	DRIILL WATER	GROUNDWATER LEVEL DATE	WATER PRESSURE TEST LUCEON VALUE EFFECTIVE PRESSURE (BAR)	LUCEON PATTERN
							CORE LOSS % PER LIFT						



HOLE Make Rotary Type YBM-05	FRACTURE LOG 	EXPLANATION Natural breaks in core per metre Equivalent lengths of core pieces in centimetres Casing M Water Pressure Red section	WEATHERING CW — Completely weathered HW — Highly weathered MW — Moderately weathered SW — Slightly weathered F/SI — Fresh, with limonite stained joints Fc — Fresh	Logged VNT Drawn VNT Checked VNT Sheet 2 of 3
Dates Commenced 6.7.87 Completed 9.7.87				

DIAMOND DRILL HOLE -- GEOLOGICAL LOG

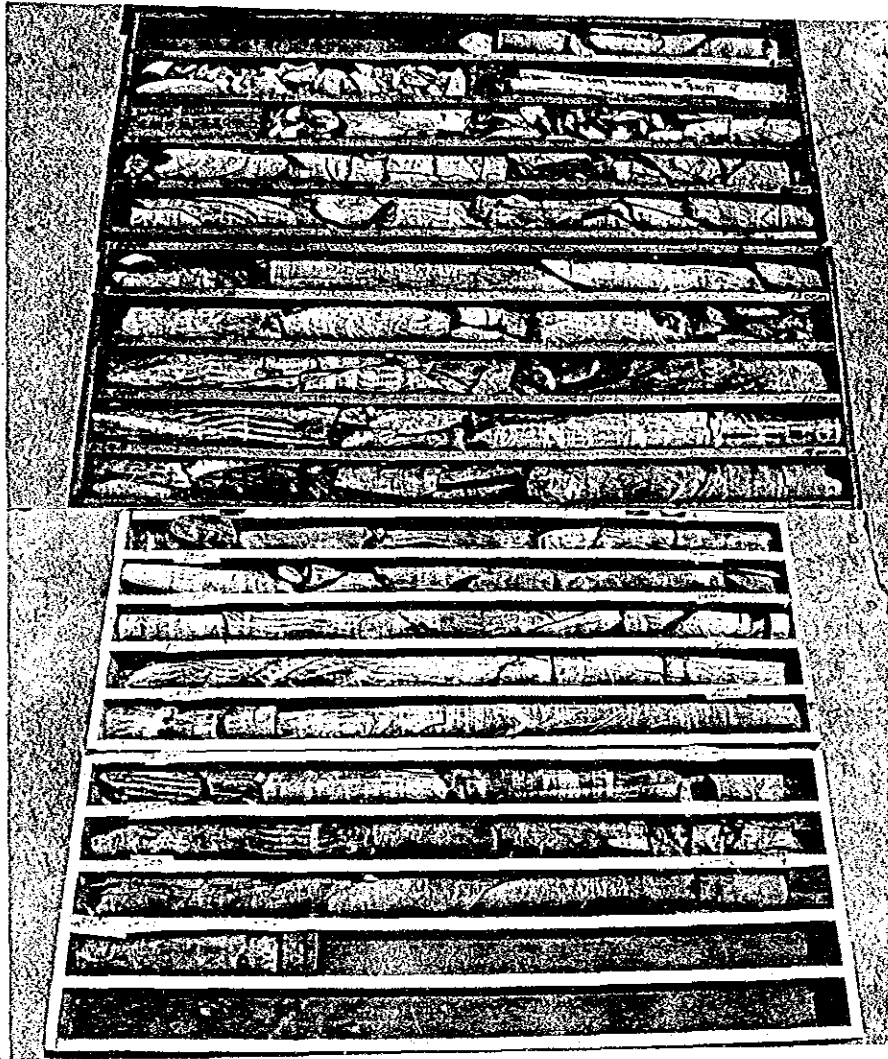
PROJECT: Mukah Small Hydro Project
 FEATURE: Power Station
 LOCATION: Power House

COORDINATES: E 2344 582.028 m
 N 5205 154.325 m
 SYSTEM: S'wak Survey Grid

SURFACE: 69.94 m
 ELEVATION ANGLE FROM: 90°
 HORIZONTAL DIRECTION: ---

DESCRIPTION OF CORE ROCK TYPE - color, grain size, texture, mineral composition	SPT	DEGREE OF WEATHERING	ELEVATION meters	DEPTH meters	SYMBOLIC LOG	RQD % CORRECTION CORE LOSS % PER LIFT	STRUCTURES Joints - spacing, attitude, smoothness, aperture, cementing, coating, filling Banding, foliation, veins, seams, faults, crushed zones	FRACTURE LOG	DRILL WATER LOSS GROUNDWATER LEVEL DATE	WATER PRESSURE TEST LOGEON VALUE EFFECTIVE PRESSURE (BAR) LOGEON PATTERN
- do -				21			85° bedding smooth, slickensided			
				22			85° bedding smooth, slickensided slightly fractured due to transportation			
				23			subvertical joint wavy			
				24			fractured due to transportation			
24.30 m End of Core				5						
				6						
				7						
				8						
				9						
				0						

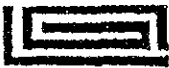
DRILL Make: Rotary Type: YB1-05 Date: 6.7.87 Commenced: 9.7.87 Completed:	FRACTURE LOG 	EXPLANATION Natural breaks in core per metre Equivalent lengths of core pieces in centimeters 	WEATHERING CW - Completely weathered MW - Moderately weathered SW - Slightly weathered FSt - Fresh, with distinct, well defined joints Fr - Fresh 	Logged: VNT Drawn: VNT Checked: VNT Sheet: 3 of 3
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MUKOH SMALL HYDRO-ELECTRIC PROJECT

DIAMOND DRILL HOLE BMK 6

2.50 m - 24.30 m



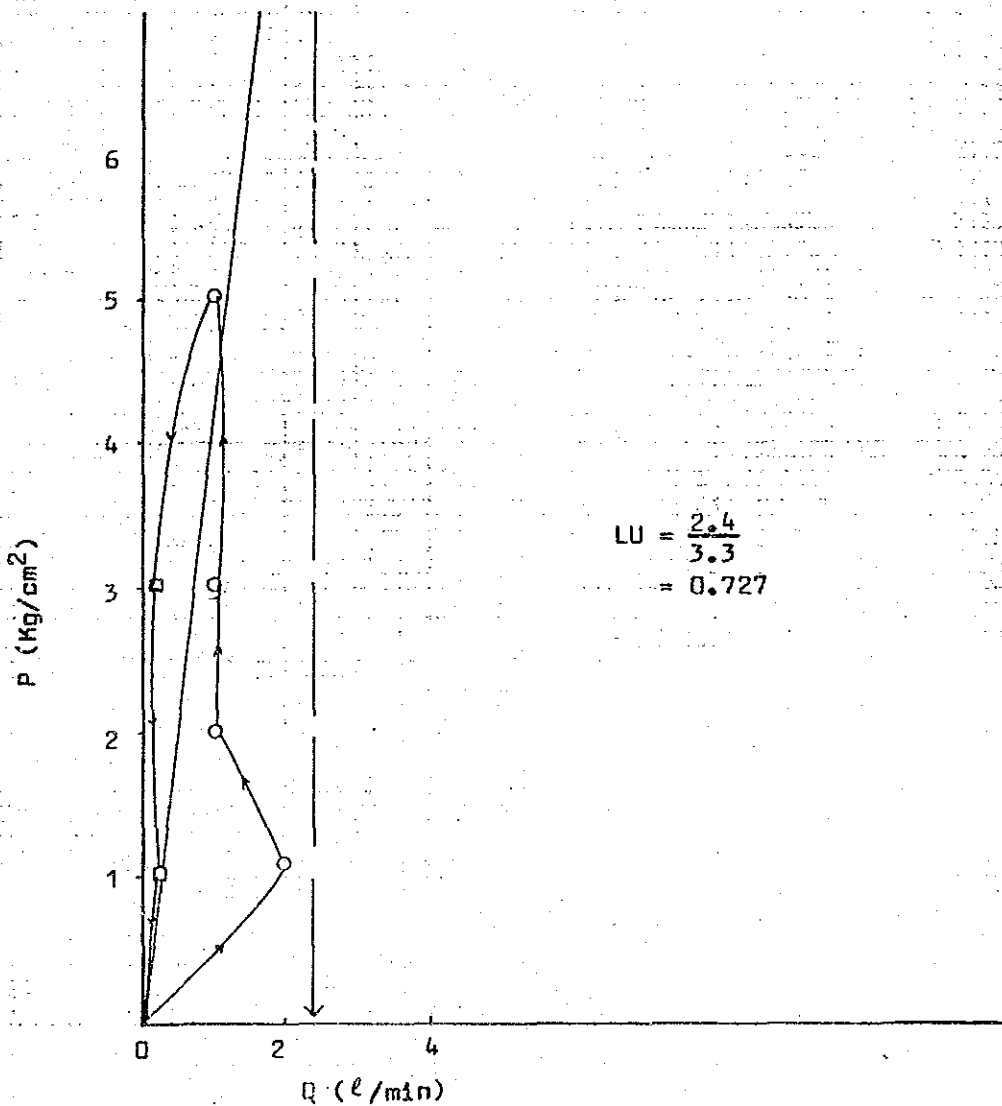
WATER PRESSURE TEST IN DRILL HOLE			HOLE NO.: BMK 1 (Test 1)	
Project: Small Hydro Study For Mukoh			Coordinates:	
Location: Mukoh			Date of Test: 26-6-1987	
Job No : KSI/87(J18)			Reporter: T.W.T.	
Borehole	Elevation G. D. (m):		Diameter (mm): 75mm	
	Dip Angle (°): 90°		Bearing (°):	
Test Section	Stage No:			GEOLOGY: Slightly weathered to fresh grey fine grained thinly bedded SILTSTONE occasionally laminated with calcite veins, iron stained joints along bedding plane at 2.20m and 2.70m, bedding dip 70° to 80°
	Depth	Packer (m)	2.20	
		Hole Bottom (m)	5.50	
	Elev.	Packer (m)		
		Hole Bottom (m)		
Length, L (m):				
Height of Gauge (m): 0.40				
Water Head (m): 1.0			Temp. of Injected Water °C: 26	
Pump	Model, Type: SP 40B		Flow Meter	Type:
	Max. Discharge (l/min): 105 l/min			Min. Precision (l): 1
	Max. Pressure (g/cm ²): 40,000		Pressure Gauge	Min. Reading (g/cm ²): 500
Type of Packer: Hydraulically inflated single packer		Max. Reading (g/cm ²): 20,000		
<p>*Effective Pressure (Kg/cm²) $P = P_a + 1/10 (h-h_l)$ where, $h = h_1+h_2$ h_l = head loss</p> <p>** Lugeon Value (l/min/m/10kg/cm²) = $Lu = 10Q/PL$</p>				
<p>Unsaturated Strata:</p>			<p>Saturated Strata:</p>	

Project: Small Hydro Study For Mukoh

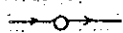
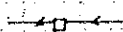
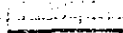
Job No: KSI/87(J18)

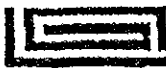
Type of Test: Water Pressure Test in drill hole

Test No: BMK1/Test 1 (2.20 - 5.50m)



Remarks:-

-  Discharge of increasing pressure
-  Discharge of decreasing pressure
-  Average



WATER PRESSURE TEST IN DRILL HOLE									
Project: Small Hydro Study For Mukoh							Hole No: BMK 1 (Test 1)		
Job No: KSI/87(J18)							Date of Test: 26-6-1987		
Stage No:							Depth of Packer (m): 2.20		Reporter: T.W.T.
							Depth of hole bottom (m): 5.50		Test Length (m): 3.30
Time			Gauge Pressure Kg/cm ²	Effective Pressure Kg/cm ²	Integrated	Water pumped-in			Remarks
Hr.	Min	Elapsed (min)				Sectional l/min	Constant rate l/min	Lugeon Value	
17	30	1	1	1.14		4	4	5.32	2 l/min
		1	1			4	4		
		1	1			2	2		
		1	1			2	2		
		1	1			3	3		
		1	1			3	3		
		1	1			2	2		
		1	1			1	1		
		1	1			1	1		
17	41	1	2	2.14		2	2	1.42	1 l/min
		1	2			1	1		
		1	2			1	1		
		1	2			0	0		
		1	2			1	1		
		1	2			1	1		
		1	2			1	1		
		1	2			1	1		
		1	2			1	1		
17	52	1	3	3.14		1	1	0.97	1 l/min
		1	3			0	0		
		1	3			0	0		
		1	3			1	1		
		1	3			1	1		
		1	3			2	2		
		1	3			1	1		
		1	3			1	1		
		1	3			0	0		
		1	3			1	1		