NEWLY ESTABLISHED GAUGING STATION

8.1 Mukoh site

(1) General condition

Location map of newly established gauging stations are shown on Ref.1.

(2) Staff gauge

A total of seven (7) metres of staff gauges were installed at the opposite bank of the initial proposed powerhouse site at about 2 km downstream of the intake on 26 July 1987. These consist of three 1-metre long staff gauges which were anchored onto the rock outcrop by rock bolts, a 2-metre long and two (2) 1-metre long staff gauges piled into the ground. The site was chosen in view of the following factors:

a) A pool is present to ensure a recording of waterlevel at extremely low flow

b) The site is easily accessible by observer who lives in the farm but near the gauging site

c) Discharge measurement is possible at the staff gauge site.

d) River cross section would not change because of the rock outcrop at both banks.

Two (2) readings are recorded daily at 6.30 a.m and 6.30 p.m and the maximum and minimum water level observed are 4.35 m and 1.71 m respectively in July 1987 as given in Ref.2.

The reduced level of DID TBM in 59.230 m as related to a bench mark BM1 which is arbitrarily taken as +60.00 m. The zero of the staff gauge corresponds to 53.832 m.

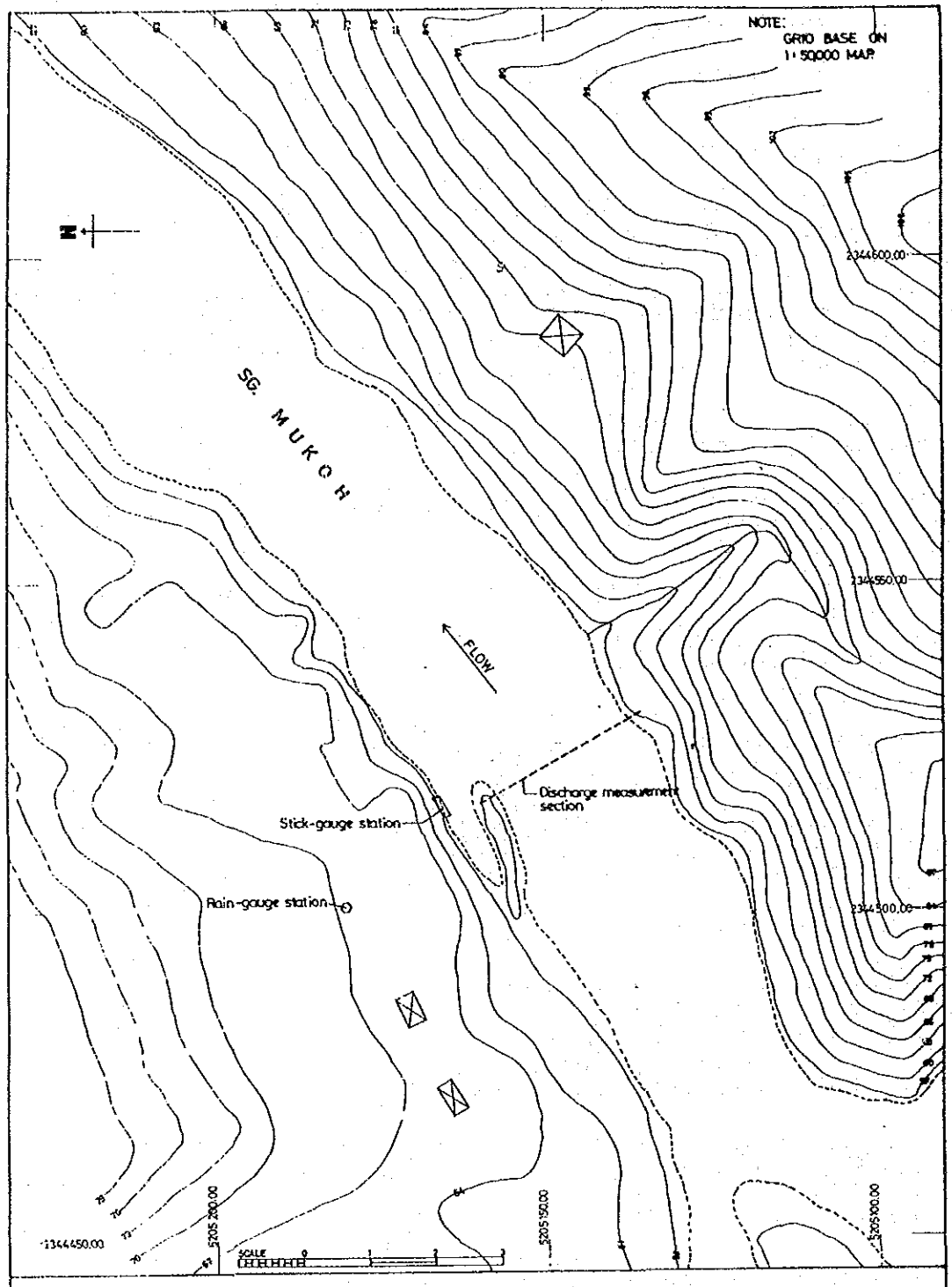
(3) Discharge measurement

A total of 20 discharge measurements were carried out at the staff gauge site between 26 June 1987 to 17 July 1987 for water level ranging from 1.71 m to 2.15 m. Maximum and minimum values measured were 16.3 m^3/sec and 5.8 m^3/sec respectively. Field records are attached as given in Ref.3,4 and 5.

The river cross section and the assumed rating curve where discharge measurement is carried out are shown on Ref.6 and 7.

(4) Rain gauge

A manual raingauge was also installed on 26 June 1987 behind the farm hut near to the staff gauge site. A daily reading of rainfall is also recorded as given in Ref.8. The observed maximum rainfall from July to September, 1987 is 83.2 mm corresponding to flood water level of 4.35 m.



LOCATION OF HYDROLOGICAL NETWORK FOR SG. MUKOH SMALL HYDRO PROJECT

Ref.1 Location Map of Newly Established Gauging Station

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

Ref.2 Daily Discharge Record at Mukoh Site

Station : Sg. Mukoh

Year : 1987 Month : July

Day	Waterlevel(m)	Discharge(m^3/sec)
1	1.98	11.75
2	2.12	13.80
3	1.99	12.00
4	1.94	10.70
5	1.91	9.55
6	1.86	8.60
7	1.82	7.65
8	1.80	7.55
9	1.79	7.45
10	1.84	8.50
11	1.79	7.45
12	1.76	6.75
13	1.75	6.50
14	1.74	6.40
15	1.74	6.40
16	1.73	6.20
17	1.72	6.10
18	1.71	5.90
19	2.03	12.10
20	1.91	9.55
21	1.77	7.00
22	1.81	7.60
23	2.28	16.30
24	1.93	10.10
25	4.18	*721.50
26	4.00	*668.43
27	4.05	*682.94
28	****	
29	****	
30	****	
31	****	
Min	1.71	
Mean	2.11	
Max	4.18	

Notes: Min. and Max. are instantaneous value.
**** Stick gauge damaged by flood
* Discharge values from computed rating curve

DID Hyd. 2

Ref.3 Discharge Measurement Data Sheet (1/3)

Measurement No. 20

DRAINAGE AND IRRIGATION DEPARTMENT

RIVER DISCHARGE MEASUREMENT NOTES

SG. MUKOH SMALL HYDRO-POWER PROJECT

STATION Power House NO. ..... RIVER Sg. Tekalit

Date 1/7/87 Field Party Ismail

Weather Sunny Wind Direction and Force .....

Flow Condition Steady Flow Turbid/Clear, Water Temperature .....°C

Observation Time		*Gauge Reading in metre*			
		Recorder	S. Guage		Correction
Start	10.30		1.98		
Finish	11.14		1.98		
Average					

Change in Gauge Height .....m, Rate of Rise/Fall .....m/hr.

Used Current Meter Seba F512 No. ..... V= .....

Measured from Cableway, Boat, Bridge, Wading. Weight .....Kg./lb.

Measured ..... m. Down/Up stream at .....

DISCHARGE	11.528	cumecs	AREA	21.56	Sq. metres
MEAN VELOCITY	0.535	m/sec	WIDTH	17.5	metres

Remarks: Gauge height of zero flow .....m

Calculated by ..... *Checked by* .... *Date* .....

Angle Coefficient	Distance from initial point	Width	Depth	Observation Depth	Revolutions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Adjusted for ice, angle etc	AREA	DISCHARGE
L/B	0	1	0.10			60					
	2	2	1.09	0.65	91	60	0.492	0.497		2.18	1.083
					93	60	0.502				
	4	2	1.06	0.64	121	60	0.648	0.638		2.12	1.353
					117	60	0.627				
	6	2	1.52	0.91	106	60	0.570	0.578		3.04	1.757
					109	60	0.586				
	8	2	1.67	1.00	114	60	0.612	0.602		3.34	2.011
					110	60	0.591				
	10	2	1.56	0.94	70	60	0.383	0.368		3.12	1.148
					64	60	0.352				
	12	2	1.28	0.77	108	60	0.580	0.567		2.56	1.452
					103	60	0.554				
	14	2	1.42	0.85	98	60	0.528	0.518		2.84	1.471
⊙					94	60	0.508				
	16	1.75	1.35	0.81	97	60	0.523	0.531		2.36	1.254
					100	60	0.539				
	17.50	0.75	0.80								
		17.5								21.56	11.528

DID Hyd. 2

Ref.4 Discharge Measurement Data Sheet (2/3)

Measurement No. 23

DRAINAGE AND IRRIGATION DEPARTMENT

RIVER DISCHARGE MEASUREMENT NOTES

SG. MUKOH SMALL HYDRO-POWER PROJECT

STATION Power House NO. ..... RIVER Sg. Tekalit

Date 2/7/87 Field Party Ismail

Weather Cloudy Wind Direction and Force .....

Flow Condition Steady Flow Turbid/Clear. Water Temperature .....°C

Observation Time		*Gauge Reading in metre*			
		Recorder	S. Guage		Correction
Start	8.28		2.14		
Finish	9.05		2.12		
Average					

Change in Gauge Height .....m, Rate of Rise/Fall .....m/hr.

Used Current Meter Seba F512 No. ..... V= .....

Measured from Cableway, Boat, Bridge, Wading. Weight .....Kg./lb.

Measured ..... m. Down/Up stream at .....

DISCHARGE	16.278	cumecs	AREA	23.49	Sq. metres
MEAN VELOCITY	0.693	m/sec	WIDTH	17.2	metres

Remarks: Gauge height of zero flow .....m

Calculated by ..... *Checked by* ..... *Date* .....

Angle Coefficient	Distance from initial point	Width	Depth	Observed depth	Revolutions	Time in seconds	VELOCITY At point	VELOCITY Mean in vertical	Adjusted for hor. angle or	AREA	DISCHARGE
L/B	0	1	0.10								
	2	2	1.31	0.79	127	60	0.680	0.691		2.62	1.810
					131	60	0.702				
	4	2	1.17	0.70	157	60	0.841	0.860		2.34	2.012
					164	60	0.878				
	6	2	1.70	1.02	133	60	0.712	0.728		3.40	2.475
					139	60	0.744				
	8	2	1.84	1.10	138	60	0.739	0.742		3.68	2.731
					139	60	0.744				
	10	2	1.74	1.04	121	60	0.648	0.633		3.48	2.203
					115	60	0.617				
	12	2	1.24	0.74	129	60	0.691	0.699		2.48	1.734
					132	60	0.707				
	14	2	1.60	0.96	108	60	0.580	0.580		3.20	1.856
⊙					108	60	0.580				
	16	1.60	1.43	0.86	119	60	0.638	0.638		2.29	1.460
					119	60	0.638				
	17.20	0.6	1.0								
										23.49	16.278
		17.2									

.0 .10 .20 .30 .40 .50 .60 .70 .75 .80

.85 .90 .92 .94 .96 .97 .98 .99 .100 .99 .98 .97 .96 .94 .92 .90 .85

DID Hyd. 2

Ref.5 Discharge Measurement Data Sheet (3/3)

Measurement No. 30

DRAINAGE AND IRRIGATION DEPARTMENT

RIVER DISCHARGE MEASUREMENT NOTES

SG. MUKOH SMALL HYDRO-POWER PROJECT

STATION Power House NO. ..... RIVER Sg. Tekalit

Date 17/7/87 Field Party Ismail, Chai & 3 workers

Weather Sunny Wind Direction and Force .....

Flow Condition ..... Turbid/Clear, Water Temperature .....°C

Observation Time		Gauge Reading in metre			Correction
		Recorder	S. Guage		
Start	11.00		1.72		
Finish	11.35		1.72		
Average					

Change in Gauge Height .....m, Rate of Rise/Fall .....m/hr.

Used Current Meter ..... No. ..... V= .....

Measured from Cableway, Boat, Bridge, Wading. Weight .....Kg./lb.

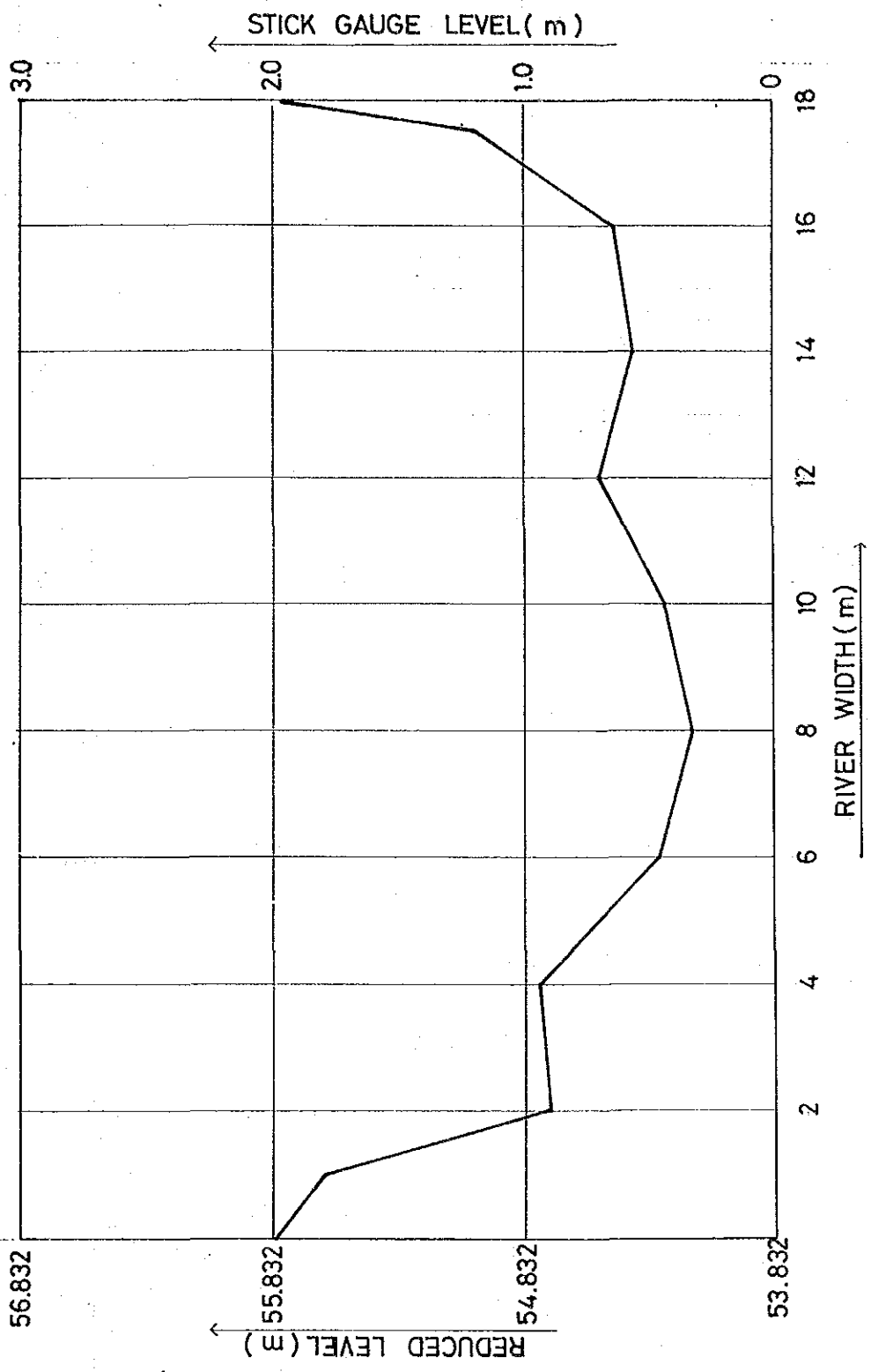
Measured ..... m, Down/Up stream at .....

DISCHARGE	5.845	cumecs	AREA	19.76	Sq. metres
MEAN VELOCITY	0.296	m/sec	WIDTH	17.5	metres

Remarks: Gauge height of zero flow ..... m

Calculated by ..... Checked by ..... Date .....

Angle Coefficient	Distance from initial point	Width	Depth	Observation depth	Revolutions	Time in seconds	VELOCITY: At point	VELOCITY: Mean in vertical	Adjusted for bar. angle etc	AREA	DISCHARGE
L/B	0										
	2	2	0.8	0.48	48	60	0.269	0.269		1.60	0.430
					48	60	0.269				
	4	2	0.87	0.52	61	60	0.336	0.342		1.74	0.595
					63	60	0.347				
	6	2	1.35	0.81	55	60	0.305	0.484		2.70	1.307
					57	60	0.315				
	8	2	1.43	0.86	59	60	0.326	0.331		2.86	0.947
					61	60	0.336				
	10	2	1.32	0.79	46	60	0.268	0.269		2.64	0.710
					48	60	0.269				
	12	2	1.07	0.64	63	60	0.347	0.337		2.14	0.721
					59	60	0.326				
	14	2	1.18	0.71	35	60	0.201	0.204		2.36	0.481
⊙					36	60	0.206				
	16	2	1.16	0.70	53	60	0.295	0.282		2.32	0.654
					48	60	0.269				
	17.5	1.5	0.7							1.40	
										19.76	5.845
		17.5									



Ref.6 River Cross Section at Waterlevel Gauging Station

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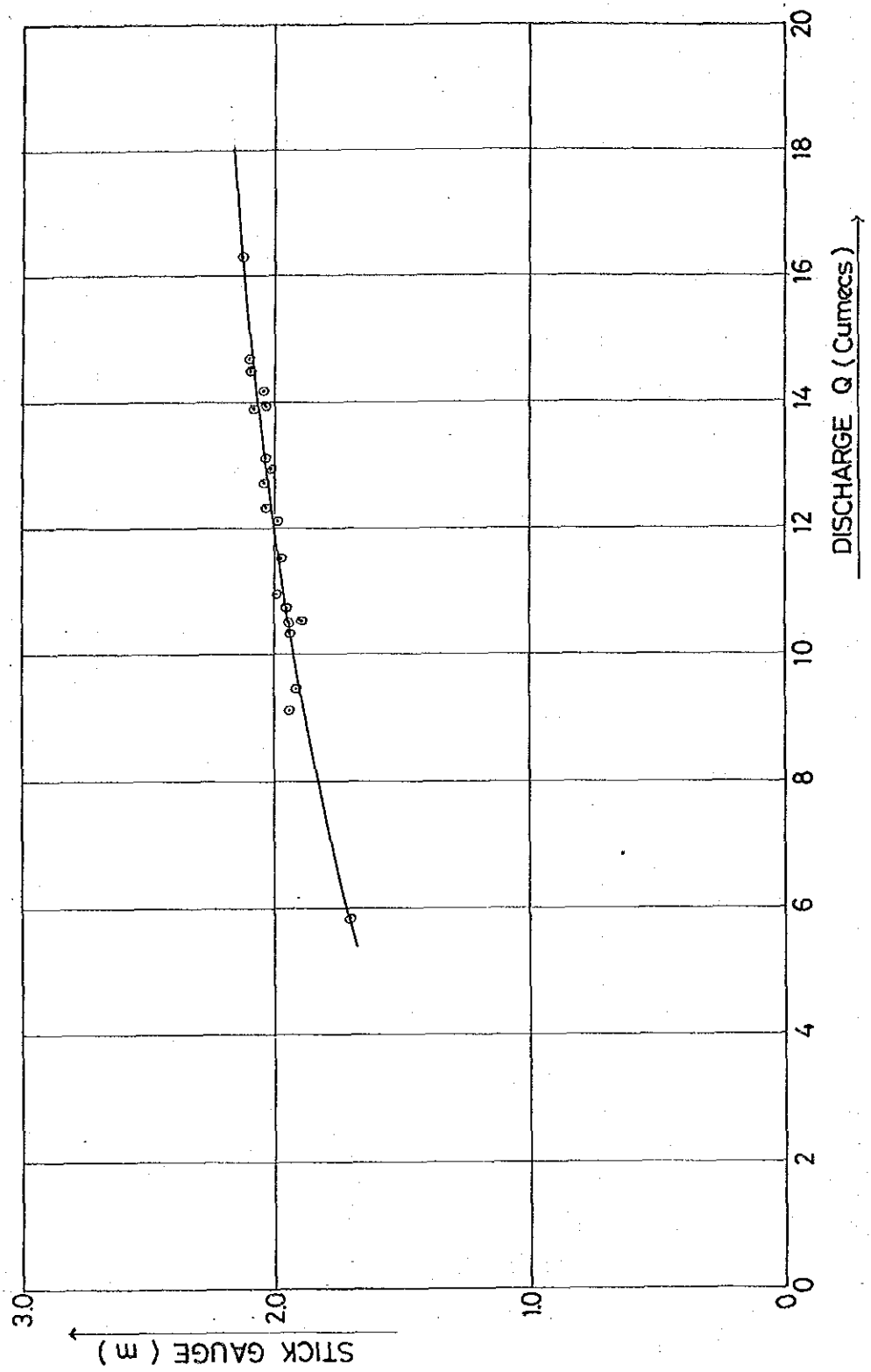


Ref.7 Assumed Rating Curve at Waterlevel Gauging Station

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

Ref.8 Daily Rainfall Record at Mukoh Site

Station: Sg. Mukoh

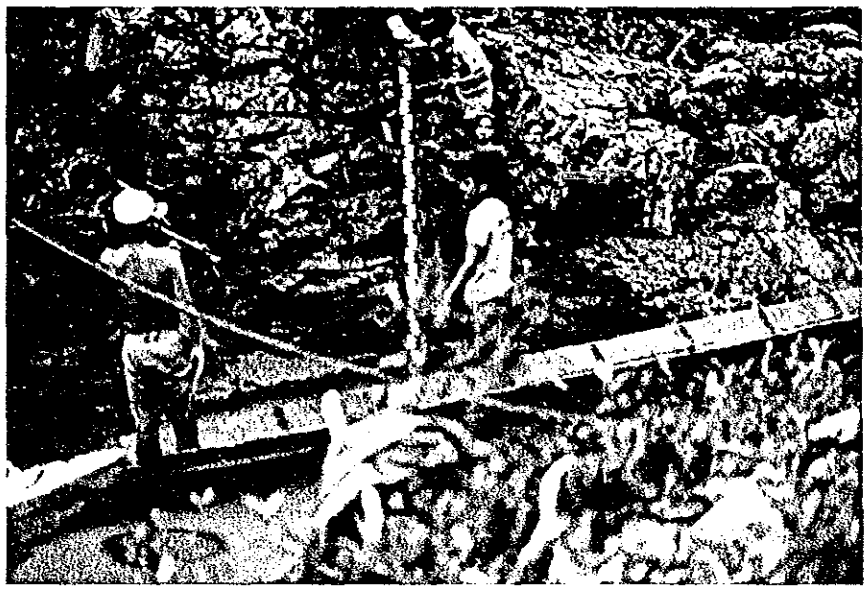
Year : 1987 Month : June to August

(Unit : mm)

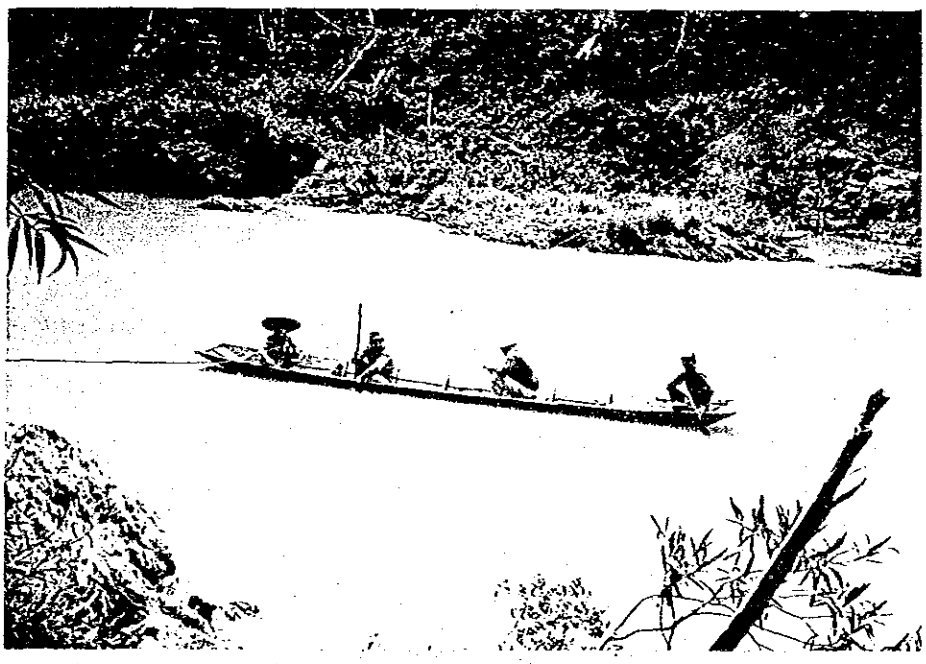
Day	June	July	August
1		53	52
2		54	40
3		0	30
4		0	53
5		0	0
6		0	0
7		1	1
8		0	10
9		0	10
10		0	15
11		0	12
12		0	0
13		0	0
14		0	0
15		0	0
16		0	0
17		0	25
18		10	0
19		0	0
20		0	0
21		55	0
22		50	52
23		0	10
24	2	83	0
25	3	50	0
26	37	40	0
27	32	23	0
28	0	0	0
29	0	0	0
30	23	0	0
31		1	

COLLECTION OF WATER SAMPLE FOR ANALYSIS

RAIN GAUGE BEHIND THE FARM HUT NEAR TO THE STAFF GAUGE SITE



SETTING UP OF STAFF GAUGE



RIVER DISCHARGE MEASUREMENT AT STAFF GAUGE

8.2 Medamit-2 site

(1) General condition

Drainage & Irrigation Department, Limbang assists to undertake the installation and maintenance of the hydrological station at the site.

(2) Staff gauge

A total of 5 m of staff guages are proposed at Lubok Lalang about 29 km along river course downstream and 8.5 km downstream in the air distance of the intake site. The site was chosen in view of the following reasons:-

a) There is no inhabitance in the vicinity of the intake area and the nearest logging camp is situated at Lubok Lalang where educated observers can be easily employed

b) The site is easily accessible by observer residing at logging camp

c) Discharge measurement is possible at staff gauge site

d) A safe and secure location with vertical face of rock outcrop for anchoring of staff gauges is also possible.

As the station is located further downstream from the dam site an additional 34 km^2 of the catchment area is incurred as to the catchment area of the proposed hydro scheme.

(3) Discharge meansurement

A total of eight (8) discharge measurements were carried out at the staff guage site from 29 June 1987 to 15 September 1987 and the maximum and minimum values measured were 15.76 m^3/sec and 5.58 m^3/sec respectively. The typical data sheet is given in Ref.1.

Water level was not indicated in the attached discharge measurement data sheet since staff guages are yet to be installed.

River cross section at Waterlevel gauging station is shown on Ref.2.

(4) Rain gauge

A manual rain gauge with wind shield will be installed to replace the existing logging camp's rain gauge at Lubok Lalang. Three years of daily readings from 1983 to 1986 and seven years of monthly readings from 1979 to 1986 were available from the past record.

DID Hyd. 2

Ref.1 Typical Discharge Measurement Data Sheet

Measurement No. 1

DRAINAGE AND IRRIGATION DEPARTMENT

RIVER DISCHARGE MEASUREMENT NOTES

STATION LUBOK LALANG NO. - RIVER SG. MEDAMIT

Date 29/06/87 Field Party AWG. BAKIR

Weather - Wind Direction and Force -

Flow Condition - Turbid/Clear, Water Temperature -°C

Observation Time		*Gauge Reading in metre*			
		Recorder	S. Guage		Correction
Start	1200				
Finish	1220				
Average	1210				

Change in Gauge Height -m, Rate of Rise/Fall -m/hr.

Used Current Meter A.OTT KEMPTEN No. C31-00 V= Ref. *

Measured from Cableway,(Boat,) Bridge, Wading. Weight 20 Kg./Bx

Measured m. Down/Up stream at

DISCHARGE	8.12	cumecs	AREA	53.40	Sq. metres
MEAN VELOCITY	0.15	m/sec	WIDTH	36.00	metres

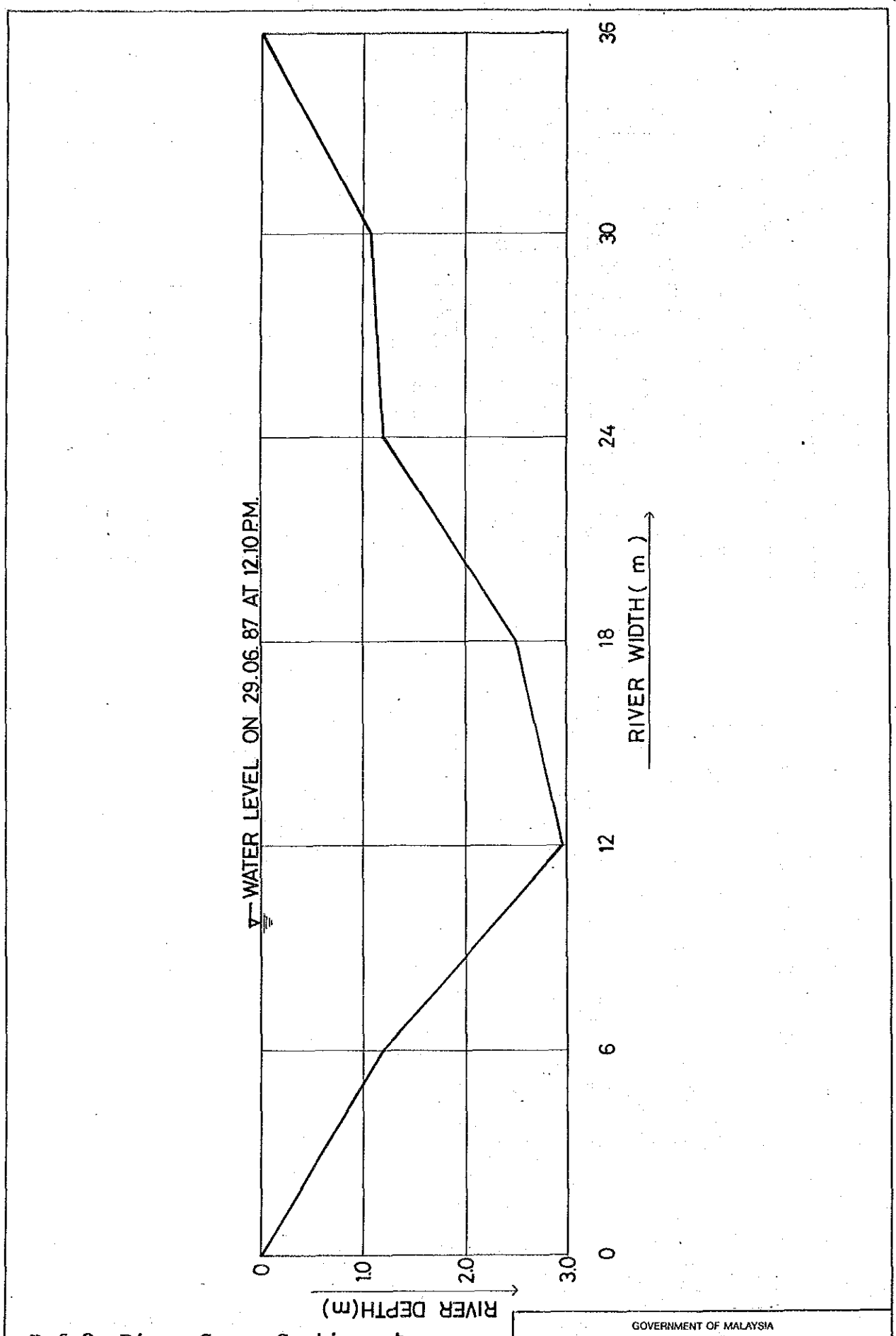
Remarks: Gauge height of zero flow m

* V = (i) $\frac{0.441}{t}$ + 0.023 (0.040 to 0.155 m/s)

(ii) $\frac{0.514}{t}$ + 0.001 (0.155 to 5.00 m/s)

Calculated by *Checked by* *Date*

Angle Coefficient	Distance from initial point (m)	Width (m)	Depth (m)	Revolutions (m)	Revolutions	Time in seconds	VELOCITY at points	VELOCITY Mean in vertical	Adjusted for bor, angle or	AREA SQ. m	DISCHARGE cumecs
LB	0	6	0	0	0		0			0	0
	6	6	1.18	0.24	1	50	0.03	0.05		7.08	0.35
				0.94	5	50	0.07				
	12	6	2.95	0.59	11	50	0.12	0.11		17.70	1.95
				2.36	9	50	0.10				
	18	6	2.50	0.50	25	50	0.26	0.24		15.00	3.60
				2.00	21	50	0.22				
	24	6	1.20	0.24	21	50	0.22	0.21		7.20	1.51
				0.96	19	50	0.20				
	30	6	1.07	0.21	6	50	0.08	0.11		6.42	0.71
				0.86	14	50	0.14				
RB	36	0	0	0	0	50	0			0	0
		36.00								53.40	8.12



Ref.2 River Cross Section at Waterlevel Gauging Station

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