APPENDIX K

JOB SPECIFICATIONS FOR ASSIGNMENT OF PERSONNEL

1. Assigned Tasks of Personnel

(1) Flood Forecasting Center

General description of tasks assigned for personnel at flood forecasting center are as follows:

Section	Designation	Assignment
Hydlorogy	Chief	General management of the center planning of operation program, formulation of budget scheme, final decision making in forecasting procedure.
	Supervisor	Management of the hydrology section, highly technical decision making (Planning of maintenance, regular inspection, development and formulation of improved forecasting method, training program)
	Engineer	Technical system planning, maintenance and inspection (Gauging Equipment, Improvement of facilities, routine inspection, adjustment and repair)
Telecom	Supervisor	Advisory work, highly technical judgement (Planning of maintenance, regular inspection, improvement and training program)
	Engineer	Technical system planning, maintenance work with technicians (Spares supply plan, instrument maintenance program, periodical inspection, adjustment and repair).
	Technician	Routine maintenance and inspection (Periodical inspection and repair, supply spare parts and consumables)

2. Assignment in Discharge Observation

(1) Discharge Observation by Float

Assignment by Designation

Group Leader: General management of observation procedure including safety measures, designation of observation time, report of measured values

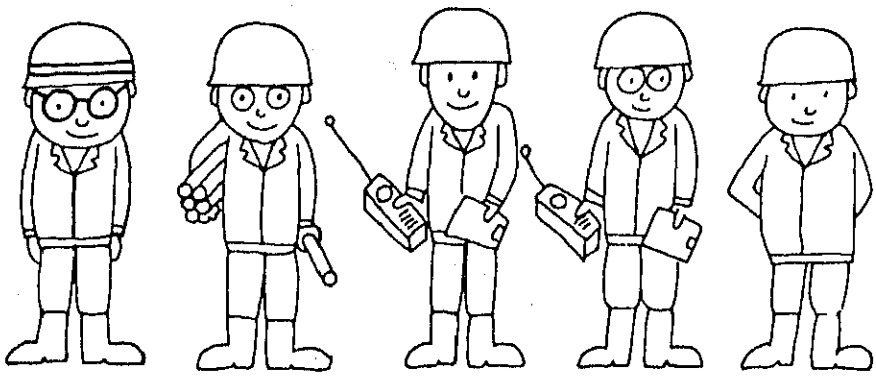
Float Keeper: Selection of specific float for water stage, operation of float dropper

1st Watchman: Report to Second Watchman the time when float passes first line of view

2nd Watchman: Measure the time float takes to travel the distance between first and second line of view

Stage Reader: Take the reading of staff gauges placed at first and second line of view as well as that of standard staff gauge on every hour and at time designated by Group Leader

Group Set-up



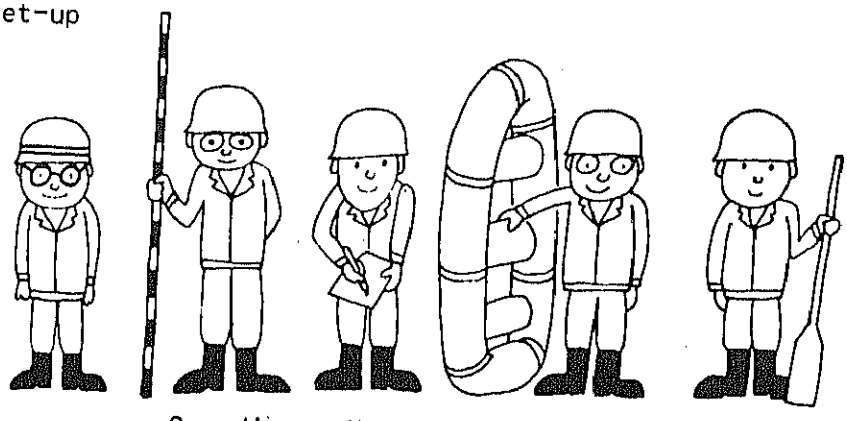
2) Discharge Observation by Current Meter

For discharge measurements to be taken during normal water stage period, procedure stated below could be followed.

Assignment by Designation

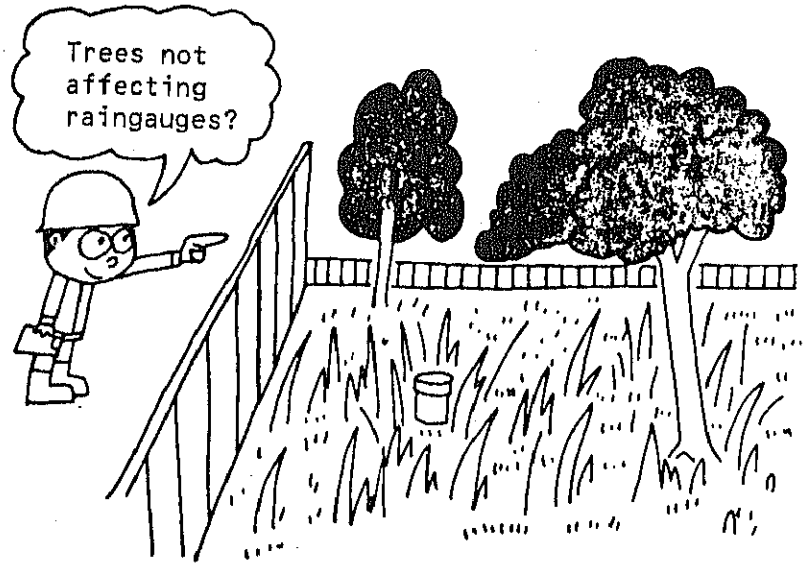
Group Leader:	General Management of observation procedure including safety measures, designation of reference line and observation location
Sounding Man:	Reads the depth of water from rods
Gauge Holder:	Keeps current meter in right position
Note Taker:	Records on field note position of current meter relative to river bank and river bed
Velocity Taker:	Records the velocity reading of current meter on field note
Boat Keeper:	Keeps boat in right position by wires extended from banks
Boat Pilot:	Drives boat to right position and controls it in water

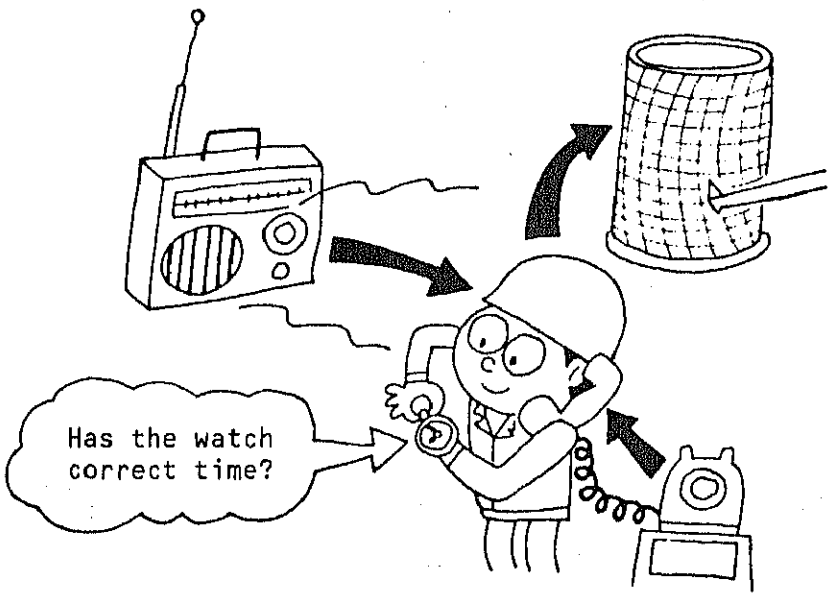
Group Set-up



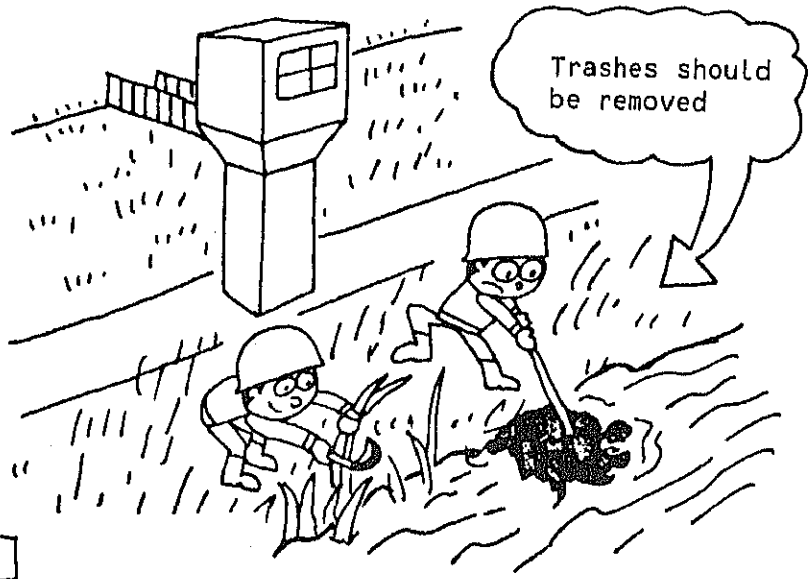
3. Assignment of Gauge Keeper

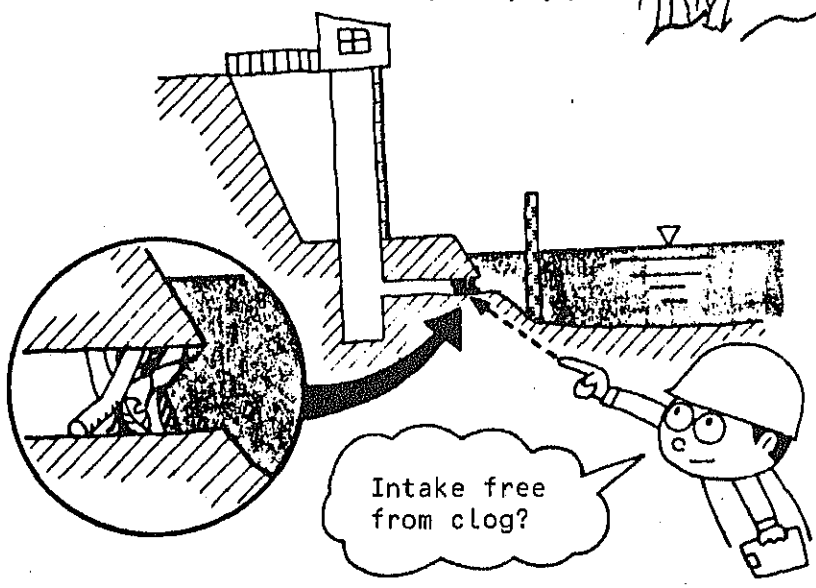
(1) Rainfall Gauging Station





(2) Water Level Gauging Station





APPENDIX L

CHECK LIST FOR GAUGING FACILITIES

1. Rainfall Gauging Facilities

Check lists for the inspection of rainfall gauges are described below.

(1) Is there any dense forest near a gauging station which may affect the rainfall?

(2) Is the distance between the nearest wall or house and the rainfall gauge at least four times the height of the rainfall gauge?

(3) Rain receiver

a) Is the mouth with a diameter of 20cm free from deformation?

b) Is the head horizontal?

c) Is it free from leaves and dust?

d) Are the legs stable?

(4) Is the paint hard to remove?

(5) Does the pen indicate 20 mm on the recording paper when water is poured into the rain gauge to 20 mm?

(6) After the pen indicated 20 mm, does it indicate 0 mm correctly?

(7) Does the water drain completely when the tippig bucket is inverted?

(8) Does the mercury switch operate without fail?

(9) Does the watch indicate correct time?

(10) Does the recording rain gauge require servicing?

(11) Is the recording paper attached properly?

(12) Are the date and time of setting and replacement of the recording paper entered?

(13) Does the pen absorb ink properly? Is the pen point free from dregs?

(14) Is the pen properly fitted into the insertion part?

(15) Is the recorded line in good condition? Does the penholder move up and down smoothly while recording?

(16) Is the glass tube filled with water?

(17) Are entries in the fieldbook correct?

2. Water-Level Gauging Facilities

Check lists for the inspection of water level gauges are described below.

(1) Suiken type water level gauge

a) Is the mouth of intake tube free from clog.

b) Is the mouth of intake tube not dry due to lowering of the river bed during dry season?

c) Does the tower, bridge, and the housing require repairing?

d) Does the recording water level gauge require servicing?

e) Has the clock worked properly? How is the correspondence between the recording time of the water level gauge, the standard clock, and the time of recording tables? Allowable time lag: (4 minutes day).

f) Does the observer or gauge keeper perform regular readings of the staff gauge? Is the clock correct? Are the entries in the field-book correct?

g) Do the recordings have continuity?
Is the paper attached horizontally?

h) Is the recording paper wound up correctly around the socket?

i) Is the paper winding belt tight?

j) Is the ink absorbed properly? Does the ink have the correct color?

k) Is the pen point not clogged? Is it free from dregs and bubbles?

l) Are not the float and weight in contact with the bottom?

m) Are the paper setting and replacement date, time and water levels entered?

n) Is it necessary to remove any surrounding suspended things and grass?

o) Has the water level gauge dried up under the influence of sedimentation?

p) Is the water level gauge in the housing not dusty?

q) Is there any need for oiling or servicing the water level gauge connection and for replenishing the ink?

r) Are there sufficient ink and recording paper?

s) Are the pulley nuts tight?

t) Is there any foreign matter in the well?

u) Are the gear linkage and fastening screws between the water level gauge and the telemeter A-D converter tight?

v) Is the gearing normal

(2) Digital water level gauge and sensing pole gauge

a) General check items are the same as those for the Suiken type water level gauges.

b) Abnormalities of the measuring pole

- ° Are there any cracks or evidences of impact on the PVC tube?
- ° Is the joint between the cable and the PVC tub l free from failures?

c) Is the recording paper properly wound?

d) Is the print out clear?

e) Is the typing ribbob not broken? Is it necessary to replace it?

f) Is not the cushion rubber at the tip of the printing hammer cracked?

g) Checks of remaining recording paper.

h) Checks of the autobalancing device and batteries for specified AC voltage and current settings, positive insertion, specific gravity of battery fluids, terminals, cleanliness, etc.

i) Are the seitches on?

Although digital water level gauges require specialized knowledge for handling, the above-mentioned checks can be performed by any observer.

3. Current Meter

(1) Is the current meter tested once a year?

(2) Is it put into a container while transferred?

(3) Check before and after use for:

a) Properccup rotation.

b) Proper buzzer sound.

c) Proper cord connection and no disconnection.

d) Broken suspended ropes.

e) Proper measuring tapes.

f) Water in the contact part.

g) Contact with naked wires.

h) Weight attachment.

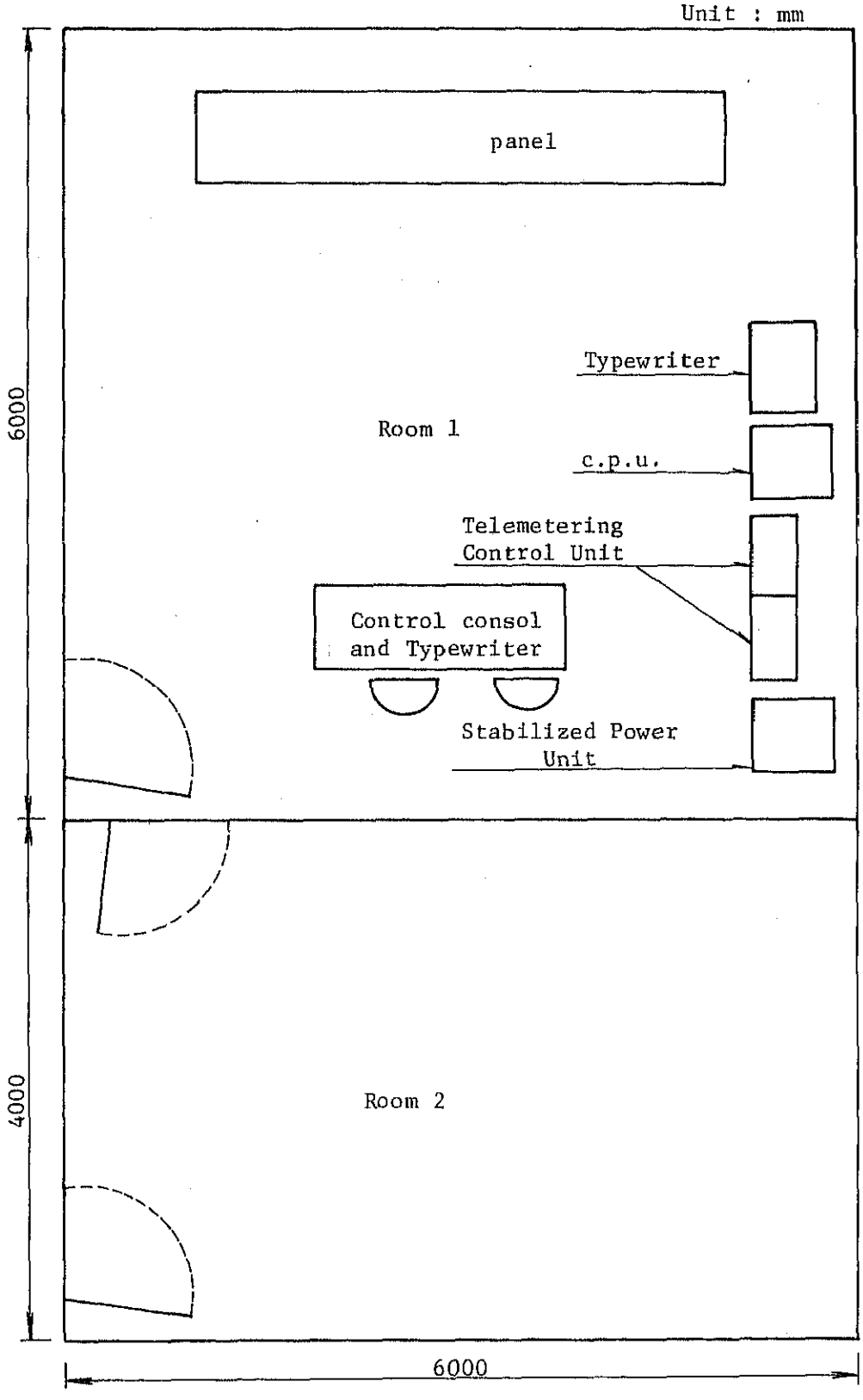
i) Voltage of the dry cells for buzzers.

j) Stained buzzer contact.

APPENDIX M

EXAMPLE OF FLOOD FORECASTING AND WARNING CENTER (LAYOUT)

Flood Forecasting Room of Master Control Station



APPENDIX N

UNIT PRICE OF HYDROLOGICAL OBSERVATION EQUIPMENT AND STATION HOUSING

Rainfall Gauge (New)

Feb. 1980

No.	Item	Price	Foreign		Local
			Yen (¥	U.S.($)	M$
I Equipment Cost	Rainfall Gauge (w-3.5kg)	Tipping buket raingauge monthly 1mm pulse	117,500	534	
	Modulater (w=0.5 kg)	DC 0~1V, 0~1mA output	275,000	1,250	
	Recorder (w-17.0 kg)	Monthly, moter watch	412,500	1,875	
I	Spare parts	above-mentioned 10%	80,500	366	
II	Shipping	4.5$ (1000 Yen)/kg	21,000	95	
III	Sub total	(I + II)	906,500	(4,120) 4,100	
IV	Installation	(III x 0.15)		650	1,365
V	Indirect expenses	(III x 0.15) Tax. Delivery, Charge, etc.		650	1,365
VI	Sub total	(IV + V)		1,300	2,730
VII	Total	(III + VI)		5,400	2,730

(1$ = 2.1 M$ = 220 Yen)

Water Level Gauge (bubble type)

Feb. 1980

No.	Item / Price		Foreign		Local M$
			Yen (¥)	U.S. ($)	
I Equipment Cost	Bubble gauge unit (w=15 kg)	h = 0 10 m	1,125,000	5,114	
	DC control unit (w=5 kg)	DC 12V	137,500	625	
	Blower unit (w=13 kg)		162,500	739	
	Rack		37,500	170	
	AD converter		44,000	200	
	2" header		20,000	90	
	Recorder (w=23 kg)	Suiken 62 type	652,500	2,966	
	Gear-set		12,500	57	
	Gas cylinder		47,300	215	
	Spare parts	above-mentioned 10%	111,940		
I	Shipping	4.5$ (1000 yen)/kg	60,000	273	
III	Sub total	(I + II)	2,410,740	10,950	
VI	Installation	(III x 0.15)		1,525	3,205.5
V	Indirect expenses	(III x 0.15) Tax. Delivery charge, etc.		1,525	3,205.5
VI	Sub total	(IV + V)		3,050	6,405
VII	Total	(III + VI)		14,000	6,405

(1$ = 2.1M$ = 220 Yen)

Water Level Gauge (float, floatless type) Feb. 1980

No.	Item	Price	Foreign		Local
			Yen (¥)	U.S. ($)	M $
I Equipment Cost	Suiken 62 type (w=23 kg)	AD converter	1,000,000	4,545	
	Gauge wire	ø1mm stainless	2,000	9	
	Spare parts	above-mentioned 10%	100,200	455	
II	Shipping	4.5$ (1000 Yen)/kg	23,000	104	
III	Sub total	(I + II)	1,125,200	5,100	
IV	Installation	(III x 0.15)	152,400	700	1,470
V	Indirect expenses	(III x 0.15) Tax, Delivery charge, etc.	152,400	700	1,470
VI	Sub total	(IV + V)	304,800	1,400	2,940
VII	Total	(III + VI)	1,430,000	6,500	2,940

(1$ - 2.1 M$ - 220 Yen)

Current Meter

Feb. 1980

No.	Item	Price	Foreign		Local
			Yen (¥)	U. S. ($)	M $
I Equipment Cost	Current Meter	0.3 2m/sec 4m/sec with select position	875,000	3,978	
	Measuring pole		9,500	43	
	Cable	20 m	50,000	227	
	Weight		18,750	85	
	Spare parts	above-mentioned 10%	95,250	443	
II	Shipping	4.5$ (1000 Yen)/kg	29,500	134	
III	Sub total	(I + II)	1,078,000	4,900	
IV	Installation	(III x 0.15)	-	-	-
V	Indirect expenses	(III x 0.15) Tax, Delivery charge etc.	154,000	700	1,470
VI	Sub total	(IV + V)	154,000	700	1,470
VII	Total	(III + VI)	1,232,000	5,600	1,470

Staff Gauge (Plastic type) Feb. 1980

No.	Item / Price		Foreign		Local
			Yen (¥)	U.S. ($)	M $
I Equipment Cost	Plastic gauge (w = 14 kg)	1.00m/sheet 10m	75,000	341	
I	Spare parts	above-mentioned 10%	7,500	35	
II	Shipping	4.5$ (1000 Yen)/kg	14,000	64	
III	Sub total	(I + II)	96,500	440	
IV	Installation	(III x 0.15)	14,300	65	136.5
V	Indirect expenses	(III x 0.10) Tax. Delivery charge etc.	7,700	35	73.5
VI	Sub total	(IV + V)	22,000	100	210.0
VII	Total	(III + VI)	118,500	540	210

(1$ - 2.1 M$ - 220 Yen)

Breakdown of Station Housing Construction Cost
Type 2.5 M x 2.5 M Housing

Pay Item	Description	Material				Labor				Total (US$)
		Unit	Q'ty	Unit Cost	Amount	Unit	Q'ty	Unit Cost	Amount	
					US$				US$	
	Temporary work Clearing of site					LS			165.00	
	Earthwork Excavation					M^3	7	3.50	24.50	
	Backfill					M^3	7	1.75	12.25	
	Concrete (1:2:4) (Reinforced)	M^3	4	70.86	283.44	M^3	4	21.00	84.00	
	Concrete hollow blocks									
	6" x 8" x 16"	Pc.	50	0.70	35.00	Pc.	50	0.15	7.50	
	4" x 8" x 16"	Pc.	230	0.55	126.50	Pc.	230	0.15	34.50	
	Reinforcement	Kg	395	1.33	525.35	Kg.	395	0.05	19.75	
	Formwork	M^2	6	23.50	141.00	M^2	6	9.30	55.80	
	Plastering work	M^2	50	0.65	32.50	M^2	50	0.65	32.50	
	Door, Windows & Glass work	LS			1,450.00					
	Steel ladder	Kg	14	1.22	17.08	Kg	14	0.49	6.86	
	Fancing	LS			1,390.00					
				Sub total	4,000.87				442.66	4,443.53
								Indirect Expense (35%)		1,556.47
								Total		6,000.00

APPENDIX O

MANUAL FOR RIVER GAUGING BY HELICOPTER

River Gauging by Helicopter

The author proposes a method of flood-velocity observation by means of floats dropped from a helicopter and photographed, in cases where the natural conditions prevent the employment of normal methods

By M. CAPUCHO VIEIRA

FOR the past three years the author has been in charge of a party engaged in the hydrological survey of the Zambezi River and its tributaries in Portuguese East Africa. Hydrometric work in this region is not easy, particularly during flood seasons, when ground access to most of the places suitably located to provide adequate velocity observations is difficult or impossible, and when the rivers carry hundreds of trees, so that observations by boat become dangerous and the use of current meters practically out of the question. As a study of plans of development very often requires a reasonable knowledge of flood discharge, a method is proposed to observe water velocity under such adverse conditions by using

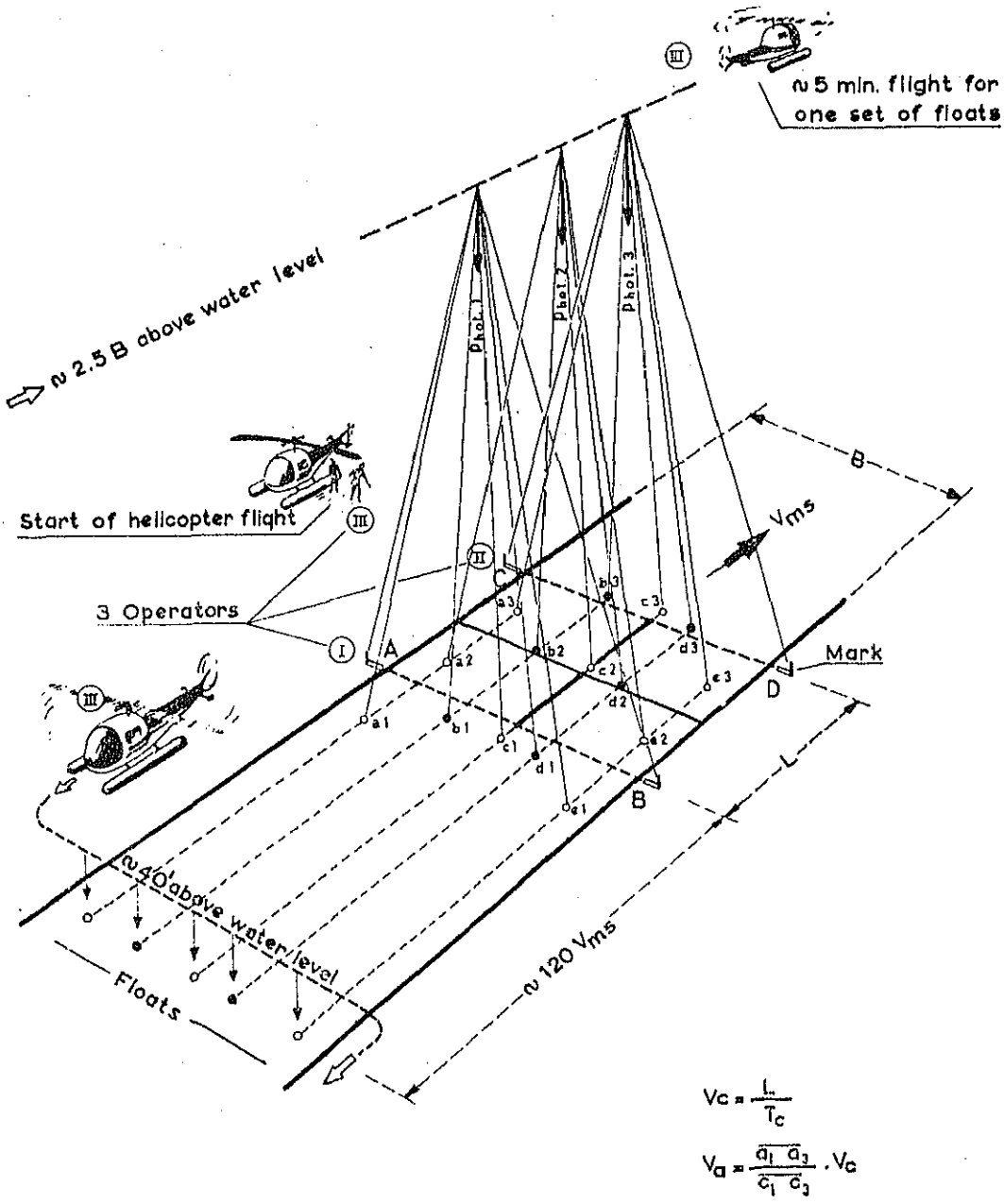


Fig. 1. A sketch of a suggested method of river gauging by helicopter and floats

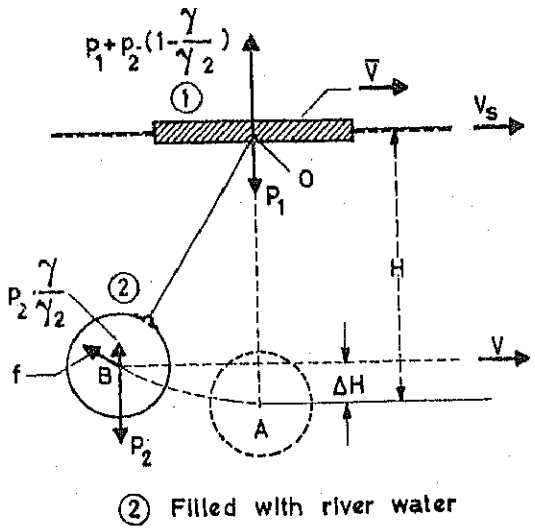


Fig. 2. Illustration of under-surface velocity observation

floats in conjunction with a helicopter. The mean velocity at the gauging section is computed by drawing curves of equal velocity.

Surface-Velocity Observations

The gauging station is prepared during the dry season. Two marks on each river bank define two sections *AB* and *CD* (Fig. 1) for velocity control, between which it is assumed that the mean velocity at any point represents the velocity at the same point of the gauging section. Levels of these four marks are taken with reference to the zero of the gauging scale of the station, and distances *AB*, *AC*, *CD* and *DB* are measured. The cross section of the gauging section is then determined.

The method proposed to observe surface velocity is indicated in Fig. 1 and summarised below:—

(i) A helicopter carries to the station three operators and an adequate quantity of floats.

(ii) Operators I and II, each one with a stopwatch, take up positions close to marks *A* and *C*.

(iii) Operator III, flying in the helicopter, throws down one float and roughly calculates the maximum surface velocity V_{ms}.

(iv) Operator III, flying at about 40 ft. above water level, puts down on the river a set of floats at a distance of about $120V_{ms}$ upstream of section *AB*, in order to provide the helicopter time enough to reach the proper level for taking photographs 1, 2, and 3;

(v) Operators I and II check the time T_c in which float *c* travels the distance *L* from *AB* to *CD*;

(vi) After this, a new set of floats can be operated in the same way.

Velocity of float *c* is given by $V_c = L/T_c$, and the velocity of another float, *a* for instance, is calculated by

$$V_a = \frac{\overline{a_1a_3}}{\overline{c_1c_3}} . V_c$$

$\overline{a_1a_3}$ and $\overline{c_1c_3}$ being taken from photographs 1 and 3.

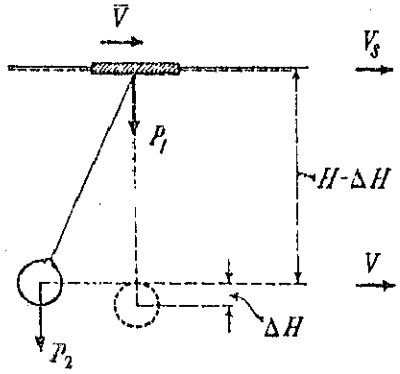
$\frac{P_1}{P_2} = 1$

$\gamma = 1{\cdot}1$

$\gamma_2 = 7{\cdot}2$

$\frac{v}{P_2} = 3{\cdot}47$ cm.³/g.

$g = 980$ cm./sec.²



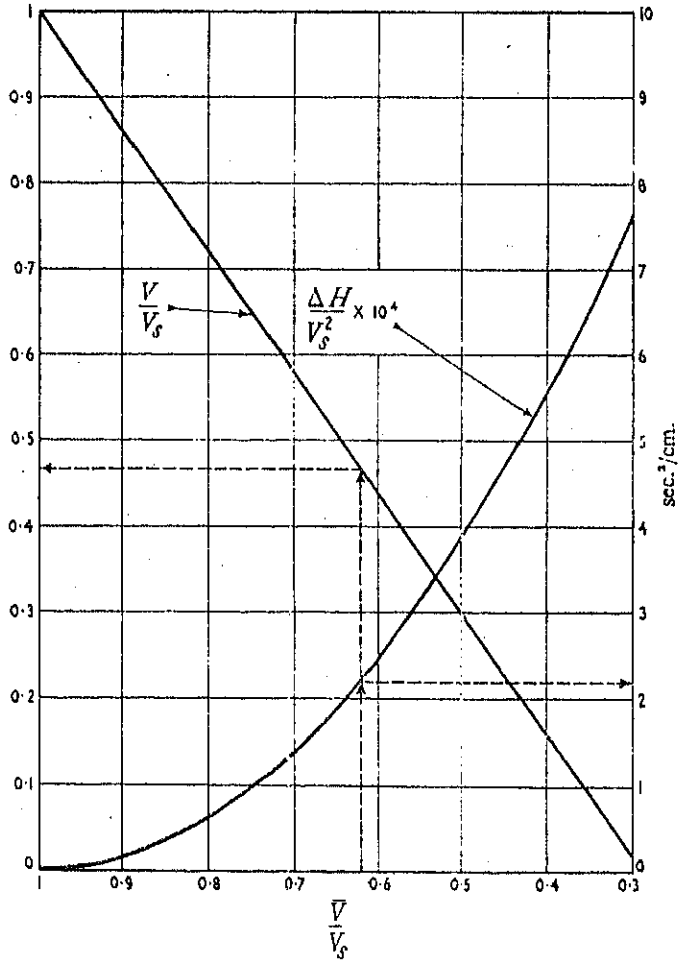


Fig. 3. Calculated graph of V/V_s and $\Delta H/V_s^2$ for a cork float 30 cm. diameter and 3 cm. thick

APPENDIX P

DESCRIPTION OF THE TRAINING COMPONENTS

1. Hydrology Course

This course consisted of lectures, exercises, operation practice and field study.

a) Hydrologic Cycle

- Lectures on basic concepts of hydrologic cycle and workings of its elements including precipitation, run-off, ground water, evaporation and infiltration.

- Concepts on uniform and non-uniform flow and Manning's equation for the primary understanding of hydraulics.

- Study tour to C.T.I. Engineering Kawagoe Hydraulics Laboratory.

b) Processing of Hydrologic Data

- Lectures on methods of rainfall and water level measurement

- Arrangement of data by Suiken format. Excercise on data reading and arrangement using recording sheet

- Lectures on data checking and compensation methods

- Lectures on calculation of mean rainfall in a basin

- Brief explanation on statistical and probability analysis of data

c) Discharge Measurement

- Lectures on methods of discharge measurement and use of measuring equipments and fieldbook for entering discharge measurement data

- Arrangement of collected data and preparation of H-Q rating curve

- Brief explanation of river surveying

d) Run-off Analysis

- Lectures on run-off phenomena and working mechanism from precipitation to run-off

- Run-off analysis after mathematical model by use of rational formula, unit hydrograph method, tank model and storage function model

- Fundamental formula for tank model and its application for run-off calculation of a basin

- Lecture and exercise on preparation of coaxial correlation diagram as possible solution to run-off forecasting problems

e) Flood Forecasting

- Lectures on run-off prediction in a flood forecasting system

- Brief explanation on rain prediction methods

- Flood forecasting methods using tank model and coaxial diagram with attention to forecast error and forecast time and their significance in flood forecasting

- Exercise for preparation of coaxial correlation diagram using data from Kiso River

- Exercise for tank model method by simulation with help of computer

f) Computer Programming

- Lectures on fundamental theories of computer programming
- " BASIC " language programming
- Lectures on FORTRAN language and exercises on tank model simulation and multiple regression analysis

g) Administration of Gauging Facilities

- Lectures on operation and maintenance of rain and water level gauges

h) General Description of Telecommunication

- Lectures on basics and general ideas of telecommunication

2. Telecommunication Course

The course consisted of lectrures, practice, exercises, for the following subject on the equipment, and field reconaissance.

a) Basic approach and knowledge about Hydrology

b) Outline of Telecommunication

- Description in details about frequency allocation
- Radio wave propagation (VHF, UHF and SHF band) and radio interference
- maintenance briefing of the radio set, outline of the system's composition

c) Telemetering System in General

- Description of Telemetry
- Operation of the system
- Signals used on calling outside station
- Pulses corresponding to calling signals
- Station details including description on master, gauging and monitor stations

d) VHF Radio Equipment

- Lecture on transmitter and receiver details on the standard level
- Practical training on signal tracing, test and adjustment of VHF radio used on telemetering system

e) Logic Circuit

- Brief description of logic, gates and its uses in the telemetering sy tem
- Boolean algebra, flip-flops and counter

f) Test Instruments

- Practice on use of level meter, calling tester, code checker, signal generator and synchroscope

g) Gauging Station

- Lecture on circuit composition functions of each circuit, pulse code, signalling and calling system, inspection points and pulse checking method for each module

- Frequency series transmission

- Practice on testing, adjustment, and signal and level tracing

h) Practice on Method of Troubleshooting on Gauging Station

- Trouble isolation and detection method using telemetry code checker, calling signal meter and synchroscope

- Actual application of pulse comparison method of maintenance and repair

i) Raingauge and Recorder

- Lecture and practice on operation, adjustment and maintenance

- Recording chart replacement method and principle of mercury swtich

j) Repeater Stations

- Lecture on circuit configuration types of repeater and block diagram illustrations

- Practice on operation and level and voltage measurements

- Location of test points and squelch adjustments

k) Master Station

- Lecture on composition, function and operation

- Explanation of calling sequences of the remote stations

- Practice on actual operation and observation of the unit

- Hardware of the Master Station, including unit by unit description of each module and block diagram explanations

- Software of Master Station including principle of programming, operational codes, octal, hexa and binary counting, basic programming and code meaning

1) Routine Maintenance

- Lecture on the installation, handling and maintenance of telemetering equipment

- Practical training on the wire wrapping method and coaxial cable connector for better workmanship

APPENDIX Q

MINUTES OF MEETINGS

LIST OF MINUTES

No.	Date	Place	Departments Involved	Page
1	1 Nov	Kota Kinabalu	SEPU, DID, Telecoms	Q - 1
2	27 Nov	do	DID	Q - 4
3	27 Nov	do	Telecoms	Q - 7
4	29 Nov	do	DID	Q - 9
5	30 Nov	Kuching	DID	Q - 10
6	30 Nov	do	Telecoms	Q - 11
7	15 Dec	do	DID	Q - 12
8	20 Dec	Kuala Lumpur	EPU, DID, Telecoms	Q - 14
9	7 Mar	do	DPU, DID, Telecoms	Q - 19

Meeting on "Technical Feasibility Study Report for Flood Forecasting and Warning System in Sabah" held at the Economic Planning Unit Conference Room on 1st November, 1979 at 10:30 a.m.

In Attendance: -

1.	Joseph Yeoh Hoh Hoh	(Chairman) Drainage & Irrigation
2.	Azizan bin Husain	State Economic Planning Unit
3.	Vincent Gadalon	State Economic Planning Unit
4.	Maznah Ghani	State Economic Planning Unit
5.	Leilie Chong	Telecommunications
6.	Liew Sak Lin	Telecommunications
7.	Paul Hii	Drainage & Irrigation
8.	V. Thiagarajah	Drainage & Irrigation
9.	Akira Yuasa	Japanese Survey Team
10.	Toyoharu Hiruma	Japanese Survey Team
11.	Yasuo Koiwai	Japanese Survey Team
12.	Tatsuo Hamaguchi	Japanese Survey Team
13.	Hiroomi Nakao	Japanese Survey Team
14.	Yoshiharu Nakagawa	Japanese Survey Team
15.	Takashi Ushijima	Japanese Survey Team
16.	Teiji Maeda	Japanese Survey Team

Minutes

The Director of Drainage and Irrigation Sabah (chairman) opened the meeting by welcoming all present. He further stated that the meeting is presently confined to only Technical Departments to discuss the Preliminary Report submitted by the Japan International Cooperation Agency. He then introduced the State Government officers and the Japanese Team.

For the benefit of all present the chairman gave a background of the project.

He also stated that the DID Headquarters in K.L. after prior consultation with the Federal E.P.U. had decided to extend a telemetric Flood Forecasting System to Sabah and Sarawak on the lines of the system run in Peninsula. The Japanese Government was approached to provide assistance to conduct the technical feasibility studies for the setting up of such a system.

In the case of Sabah, although several river basins suffer from annual floods, the Sg. Kinabatangan was chosen because it is the most seriously affected besides being the most suitable, by virtue of its catchment size and sheer isolation. The chairman added that there were three ways in which the State Government could obtain funds for subsequent implementation of the project. They are:

(1) Free Japanese aid to lesser developed countries.

(2) Japanese loan credit at soft rates.

(3) Aid from elsewhere.

Since Malaysia was not considered a lesser developed country, it did not qualify for the first type. Funds for the project would thus be sought under the Fourth Malaysia Plan.

The Japanese Team leader, Mr. Akira Yuasa, then thanked the State Government officials for the cooperation extended to his team. He said the purpose of the project was important as not only flood causes damage but also hampers development.

Then various members of the Japanese Team presented the Technical Feasibility Study Inception Report.

Encik Azisan of SEPU then asked whether the present study would lead to another report or could the project be implemented after this study. The Japanese Team after a lengthy discussion stated that after their present study, their report would form a basis for implementation of the project. The suppliers of the equipment would provide the working plans of the project for direct implementation.

The Telecoms representative wanted to know the extent of their involvement. The chairman replied that Telecoms would have to provide only maintenance service for the telemetric equipment and a new relay station to be set up at Balat, which would feed the information into the Telecoms Station at Trig Hill (Sandakan) for onward transmission via the existing communication service between Sandakan and K.K.

Telecoms stated that they would prefer unattended stations with 2/3 months periodical visits. To another question, the Japanese Team replied that they would recommend standby equipment and that power supply will be through solar batteries.

It was also recommended that this Team should make firm proposals regarding training of staff, both from the DID and the Telecoms.

Telecoms confirmed that the 70.38 MHZ frequency can be used for the current tests but to legalise future operation, another application would have to be made by DID. However the actual operating frequency could only be finally decided after tests. Replying to a question from the chairman the Telecom's representative quoted a figure of approx. $175/- per mile/year rental and operating costs would be in the order of 5% of Equipment cost. However he added that adequate spares should be stocked.

The chairman then requested the Team to present a comprehensive working paper, including design and estimated costs so that the Government could take a dicision on the matter.

Since there was no other business the meeting adjourned at 11:55 a.m.

Meeting on Survey Memorandum of Flood Forecasting
and Warning System in Sabah held at
D.I.D. Office, Nov.27,1979

Attendance:

1. Paul Hii	Drainage and Irrigation
2. Akira Yuasa	Japanese Survey Team
3. Yasuo Koiwai	
4. Tatsuo Hamaguchi	
5. Teiji Maeda	
6. Toyoharu Hiruma	
7. Takashi Ushijima	
8. Hidetomi Oi	UN Typhoon Commitee Secretariat

Subject:

1. Submission of Survey memorandum on Flood Forecasting and Warning System in Sabah.
2. Enquiries made by Survey Team.
3. Enquiries made by D.I.D.
4. Others

1. Findings of field survey conducted between 5 and 20 November were reported in a memorandum and was submitted to D.I.D. D.I.D. shall make comments and inquiries on the contents after studying the memorandum. Japanese Team requested D.I.D. for another meeting in Kuching, since the director and other concerned officials of the D.I.D. were not available then.

2. Enquiries made by Survey Team are:
   1) Master Flood Forecasting Center (MFFC) and Flood Forecasting Center (FFC).

      The Survey Team is planning to propose MFFC to be located in Kota Kinabalu and FFC in Sandakan, i.e. FFC serving solely as flood forecasting and warning office for Kinabatangan River, and MFFC as the main flood forecasting office for Sabah, should the operation be extended to other rivers. The Team is interested in the availability of personnel and facilities and this would-be location of the

offices. The Team would like to propose a new organization provided the above are available.

2) Method of Warning

The Team has the following plans as to warning method:

a. Warning apparatus installed along the river

This plan would cost very much and its effect is reduced in severe rains.

b. Warning by patrol vehicles and boats with the aid of warning radio installed at D.I.D. Kuamut Office

This plan, however, will not operate at night and poses problems to personnels attending the vehicles. The effect of warning is limited to areas along the river.

c. Warning by radio receivers lent to kampung chiefs

The warning sent by the radio will spread from the chiefs throughout the kampungs. This system can be operated at fairly low cost. Some problem may arise from jurisdiction of districts since D.I.D. will be sending the warnings directly to kampungs. If there can be changes in the jurisdiction so that warning can be sent simultaneously from the D.I.D. and the Police, this plan will work satisfactory. The equipments lent to the chiefs are to be collected at the end of rainy season for maintenance.

As to warning system at large, the Team shall further study the one in operation in West Malaysia.

3. Enquiries and requests made by D.I.D.

1) Approximate cost of the project is needed to be informed as the project will be proposed for the Fourth Malaysian Plan.

2) Organization of personnel at MFFC is requested to be proposed.

3) Training program is requested to be proposed.

As to the above, the Team was not able to answer immediately due to their reporting schedule. The Team, however, is willing to cooperate as much as possible. The reporting schedule is as follows:

Submission of draft final report ... March, 1980

Malaysian Government is requested to give comments on the above.

Submission of final report ... June, 1980

4. Others

The Team is planning to propose a FFC in the existing D.I.D. office in Sandakan. The office space, however, is rather small. Mounting of antenna pole (5m long) is needed. The team is interested to know if there is any regulation for such installation. Although rather small in space, the Team considers it appropirate to place FFC at the exiting D.I.D. office. Some problems remain unsolved for such matters as the installation of emergency power generator, antenna pole mounting and other difficulties arising from the structures of the Sandakan City Board Building. If it is ever possible to construct a new facility for FFC, the Team has in mind of proposing one at Trig Hill. The Team recommends, however, to have the FFC placed in the existing office with the addition of space (rooms), if possible.

The questions and requests made above are to be further discussed and decisions made in another meeting to be held in Kuching during the Team's stay there. It is imperative that the Director of the D.I.D. attend the meeting in Kuching for the survey team views it necessary that these matters be settled before the draft final report can be worked on.

MINUTES FROM THE MEETING

1. Date: 27hb. November, 1979

2. Place: Telecoms Office, Kota Kinabalu

3. Attendance:

Mr. Harold Read	Telecoms
Mr. Leslie Chong	
Mr. Liew Sak Lim	
Mr. H. Oi	Typhoon Com/U.N.
Mr. A. Yuasa	Survey Team
Mr. H. Nakao	
Mr. T. Maeda	
Mr. Y. Nakagawa	
Mr. Y. Koiwai	
Mr. T. Ushijima	

4. Summary

1) Rentals

M$ 175.00 mile/yr

2) Nature of Lease

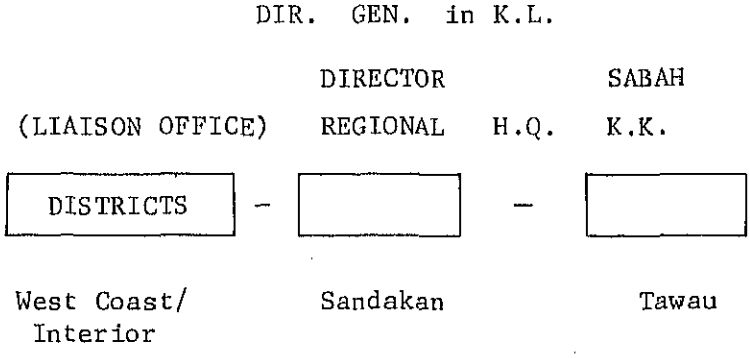
Exclusive, full year basis

3) Organization of the Telecoms

a. Telecoms, a Government Department is responsible for looking after the use of frequencies in Sabah.

b. 1,000 members in Sabah, of which up to 800 are technical staff. Five technicians are now in Sandakan who are able to look after telemetry.

ORGANIZATION



4) Circuit configuration of microwave link from Sandakan to K.K.

a. Necessary adjustments can be made

To suit the nature of data being sent, signal level and other circuit conditioning in accordance with CCITT.

b. Data signalling bit rate

Up to 9,600 bit/sec.
(This flood forecasting net work will send only up to 50 bit/sec of data).

c. Reliability

Transmittion well secured against rain/fading losses. Some lightning problems experienced.

d. Maintenance

Telemeter lines should be taken care of by the customer. As for the repair, equipments should be supplied with replacement circuit cards for on the spot remedy.

e. Frequency Allocation

Controlled by jointly committee of Telecoms and Army Telecoms of Brunei, Singapore and Malaysia.

3rd Meeting with D.I.D. Sabah

Place: Sabah D.I.D. Office Director's Room

Date : November 29, 1979, from 11:30 to 12:30

Attendance:		
	Daniel Wong	D.I.D. Deputy Director
	Paul Hii	Hydrology Engineer
	Akira Yuasa	Japanese Survey Team
	Toyoharu Hiruma	"
	Tatsuo Hamaguchi	"
	Yasuo Koiwai	"
	Hiroomi Nakao	"
	Yoshiharu Nakagawa	"
	Hidetomi Oi	UN Typhoon Committee Secretariat

Subject: 1. Enquiries made by Survey Team
2. Brief Explanation of Survey Memorandum

1. Location of MFFC and FFC

D.I.D. understood the meaning of the Team proposing FFC in Sandakan. However, as the Flood Disaster Committee will be organized in Kota Kinabalu, a Senior Engineer shall be assigned for his task in Kota Kinabalu. Therefore D.I.D. Sabah thinks it more appropriate to place Master Control Center in Kota Kinabalu and the decisions made in Kota Kinabalu with warning if necessary. The Team has agreed to that opinion and has decided to place FFC in Kota Kinabalu and a Monitoring Center in Sandakan. We finally decided that use of telephone line between Sandakan and Kota Kinabalu is more economical than the dispatchment of an engineer to Sandakan.

2. Method of Warning

Of three proposed plans the one in which warning is sent to kampung chiefs by radio was decided most appropriate due to reliability and economical advantage over other plans. D.I.D. has agreed to further investigate the extent of warning equipment needed.

3. Explanation on Survey Memorandum

Subjects related to hydrology was explained by Mr. Hamaguchi and telecommunication by Mr. Nakao.

1st Meeting with D.I.D. Sarawak

Place: Sarawak D.I.D. Headquarters, Conference Room

Date: November 30, 1979, from 9:30 to 10:30

Attednace:		
	Foong Ka Nim	Director, D.I.D. Sarawak
	Joseph Ting	Deputy Director, D.I.D. Sarawak
	Tserng Goong Farn	Hydrologist, D.I.D.
	Then Thiat Khiong	Acting W.S. (Hydrology) D.I.D.
	Akira Yuasa	Leader, Japanese Survey Team
	Noboru Sakuma	Hydrologist
	Toyoharu Hiruma	River Planning Engineer
	Yasuo Koiwai	Telecommunications Engineer
	Hiroomi Nakao	Telecommunications Engineer
	Teiji Maeda	Telecommunications Engineer
	Yoshiharu Nakagawa	Telecommunications Engineer
	Takashi Ushijima	Liaison Officer

Minutes:

The Director of Drainage and Irrigation, Sarawak opened the meeting by welcoming all present. The team leader of the Survey Team then introduced the members of the mission. For the benefit of all present, copies of inception report was submitted by the Survey Team. The report together with the field survey itinerary was studied carefully, and brief explanations were made by the Survey Team on some topics.

The Survey Team stated that instead of unit price of materials, construction cost of housing per square feet is required. They also stated that information on machinery procurement may not be necessary because large scale construction is not expected. On the use of testing frequency for radio, 70. 525 MHZ was confirmed as permitted. Use of Mt. Serapi facilities was to be further discussed that afternoon with the Telecoms (Refer to minutes from the meeting with Telecoms).

Concerning the placement of flood forecasting center, it was acknowledged that there is no need to place it in the Headquarters including a monitoring facility. The Flood Forecasting Center shall be located in D.I.D. Depot in Bintawa where the Hydrology Division is.

Upon request made by the Survey Team for detailed cross section surveying of the river at observation stations, D.I.D. has agreed to conduct the work on several locations and send the results by the end of January, 1980. The Survey Team was also informed that cross section surveying has already been conducted at Serian Water Level Station.

Meeting with Telecom Department, Sarawak

Place: Telecom Department Conference Room

Date: November 30, 1979, from 11:00 to 12:00

Attendance:		
	Chan Hick Ping	Telecoms Department
	Ronny Ong Tiang Lam	" "
	Tserng Goong Farn	D.I.D. Sarawak
	Then Thiat Khiong	" "
	Akira Yuasa	Japanese Survey Team
	Noboru Sakura	"
	Toyoharu Hiruma	"
	Yasuo Koiwai	"
	Hiroomi Nakao	"
	Teiji Maeda	"
	Yoshiharu Nakagawa	"
	Takashi Ushijima	"

Subject: Use of Mount Serapi Station (Telecoms) for Radio Propagation Test.

Minutes:

Upon opening the meeting, the members of the Survey Team were introduced by the Team Leader to the Telecoms engineer. Telecommunication Engineers of the Survey Team then went on with the enquiries concerning the use of Mt. Srapi facilities. The following are the answers given by the Telecoms.

1) Test outside the building atop Mt. Serapi is impossible due to limited space.

   Use of building rooftop and second floor will be made available for test purposes. However, a cable of 20m long will be necessary to connect the rooftop and second floor rooms.

2) No other facilities or equipment shall be provided.

3) Station building is three stories-high, each having 15 feet height.

4) To reach the station, trip to troposcatter station below the summit station can be made by vehicles. To climb further up to the building on summit, it is required to use 600 steps which can be covered by walking twenty minutes.

5) Equipment for the testing can be kept inside the building during the test period.

6) The use of Mt. Serapi station as relay station for flood forecasting and warning system in Sadong River basin shall be further discussed before implementation between the Telecoms Department and the D.I.D., based on the proposal made by this Survey Team.

MINUTES OF MEETING ON FLOOD FORECASTING AND WARNING SYSTEM IN SARAWAK HELD ON 15TH DECEMBER, 1979 AT D.I.D. HQ.

PRESENT

Director	- Mr. Foong Ka Nim	- Chairman
Deputy Director	- Joseph Ting	- Vice Chairman
Stenographer	- Jennifer Goh	- Secretary
S.E.E. (DP)	- Ngo Tok Pin	- Member
Hydrologist	- Tserng Goong Farn	- "
E.A. (Hydrological)	- Then Thiat Khiong	- "
Team Leader	- Akira Yuasa	- "
Hydrologist	- Noboru Sakuma	- "
River Planning Engineer	- Toyoharu Hiruma	- "
Telecommunication Engineer	- Yasuo Koiwai	- "
Telecommunication Engineer	- Hiroomi Nakao	- "
Telecommunication Engineer	- Teiji Maeda	- "
Telecommunication Engineer	- Yoshiharu Nakagawa	- "
Liaison Officer	- Takashi Ushijima	- "

Chairman's Speech

The Chairman took the opportunity to welcome all those present, especially the JICA Mission Team to the meeting. The main aim was to discuss the flood forecasting and warning system in the Sadong River Basin.

Confirmation of Technical Feasibility Study Memorandum

The Technical Feasibility Study memorandum was read and confirmed with the following amendments: -

In Page 4 under (1) 1-1 Target Area:
"Target Area shall cover majority floodplain area of the Sadong River Basin which was affected by the highest flood occurred in January 1976. Locations such as Tebakang, Serian, Tanah Puteh, Sebamban and Gedong will be included."

Under 1-2 Warning Point:
"According to the target area above, warning point selected are to be at Tebakang, Serian, Tanah Puteh , Sebamban and Gedong."

MATTERS ARISING

In Page 9 under 2-3 Discharge Measurement:
Locations under Para. 2 - Cableway is to be installed in Meringgu mainly due to the high flood flow.

Technical Report

The Report would be submitted to the State Government for final consideration as to which method, out of the three enlisted in the report they would adopt.

There being no other business, the meeting adjourned with Chairman thanking each and every one of the mission team for their good work they had carried out in D.I.D. Sarawak. On behalf of the JICA Mission team, the Team Leader, Mr. Akira Yuasa also thanked the Department staff for their kind cooperation.

(JOSEPH TING)
for Chairman,
Flood Forecasting & Warning System
in Sarawak.

Dated 15th December, 1979.

MEETING ON
TECHNICAL FEASIBILITY STUDY FLOOD FORECASTING
AND WARNING SYSTEM IN SABAH AND SARAWAK

Date:	20th December, 1979	
Time:	9.30 a.m.	
Venue:	D.I.D. Conference Room	
Chairman:	Mr. Sieh Kok Chi	- D.I.D.
Secretary:	Mr. Teh Siew Keat	- D.I.D.
Present:	Mr. Mohd. Aminuddin Hashim	- E.P.U.
	Mr. Rusli Bin Habib	- Telecom
	Mr. Xavier Goh Khen Wah	- Telecom
	Mr. Ong Hai Seng	- Telecom
	Mr. Tan King Seng	- D.I.D.
	Mr. Akira Yuasa (Leader)	- Japanese Survey Team
	Mr. Noboru Sakuma	- " " "
	Mr. Yasuo Koiwai	- " " "
	Mr. Hiroomi Nakao	- " " "
	Mr. Toyoharu Hiruma	- " " "
	Mr. Teiji Maeda	- " " "
	Mr. Yoshiharu Nakagawa	- " " "
	Mr. Takashi Ushijima	- " " "
	Mr. Ozawa	- Embassy of Japan
	Mr. Tanimoto	- Colombo Plan Expert
	Mr. Yatsuda	- JICA

1. Opening Remark by Chairman

The Chairman welcomed all those present. He apologised on behalf the Deputy Director General of D.I.D., who, as a result of the postponement of the meeting from 18th December to 20th December, 1979, was unable to chair the meeting due to other commitment. The Chairman also informed that D.I.D. and Telecom Officers from Sabah and Sarawak were unable to attend the meeting due to non availability of air-line seats to Kuala Lumpur.

2. Introduction of Members of the Meeting

Mr. Yuasa leader of the Japanese Survey Team introduced his team members. Others present were introduced by the Chairman or self introduced.

3. Opening Remark by Japanese Survey Team Leader

Mr. Yuasa informed the meeting that the Survey Team has successfully completed the technical freasibility study, having spent 1 month in Sabah and 3 weeks in Sarawak. He expressed his gratitude to Sabah and Sarawak Officers for their cooperation in the study and also thanked Federal D.I.D. for their kind advice.

4. Time Schedule for Preparation of Final Report

Draft Final Report is to be ready by beginning of March 1980 while the Final Report, after comments by Malaysia, is to be ready by beginning of June, 1980.

5. Report on the Study

The Survey Team pointed out that the feasibility study was carried out only from technical point of view. No consideration was given to social economic aspects. The Team then reported according to a 'Memorandum of Works' distributed during the meeting. Comments or discussion on the report are as follows: -

5.1 Kinabatangan River Basin

(i) Flood Forecasting Method

Forecasting by stage correlation method is recommended. Forecast at Kuamut is to be based on water level observation at Tangkulap and Ulu Kuamut. The lag time is in the order of 2 - 3 hours pending further analysis. D.I.D. expressed that use of Tongod will improve available warning time.

(ii) Radio Interference

Telecom expressed concern that there might be interference with their radio/TV transmission. Discussion with Regional Director and check by Telecom is therefore necessary.

(iii) Warning System

Three cases or methods were proposed namely (a) by Siren fixed at site, (b) by patrol car and boat along river and (c) by radio reciver to Kampong Chief. Sabah indicated preference over case (c). However, frequency for such radio

link is yet to be determined. Survey Team will provide more information on warning system in Final Report.

(iv) Durability of Instruments

The Survey Team was requested to include information on durability of telemetric equipment in Final Report.

(v) Relay Station

Encik Rusli questioned whether Bt. Garam could be a better choice than Balat for locating the relay station, considering the possibility of the access to Mt. Balat being cut off during monsoon. Another advantage is the availability of electricity supply at Bt. Garam. The Survey Team replied that judging from topography of the area, Bt. Garam appears not as suitable as Mt. Balat.

5.2 Sadong River Basin

(i) Forecasting Method

Due to insufficient data, stage correlation method is proposed for the time being. D.I.D. expressed the need to also consider the contribution of Batang Krang in the forecast at Gedong. Survey Team will supply reasons in Final Report for its exclusion.

(ii) Radio Inteference

As in 5.1(ii).

(iii) Warning System

The same three cases as for Kinabatangan River Basin were proposed. However, Sarawak has yet to indicate prefereence. Sarawak shall be asked to comment on this matter on receipt of the Draft Final Report.

(iv) Relay Station at Mt. Serapi

Encik Rusli informed that the space at Mt. Serapi Telecom Station is rather limited. The Regional Director Telecoms

will have to be further consulted on this matter.

(v) Radio Link between Mt. Serapi and Kayan River

The Survey Team indicated that the proposed water level site for future expansion on the Kayan River was at the road bridge from Tebedu to Serian.

The Final Report will confirm the exact location of the link at Kayan River.

5.3 General

(i) Plan for Future Improvement

Due to insufficient hydrological data, the Survey Team will develop forecasting methods or methodology based on stage correlation (with rainfall in some cases) only. However, the Survey Team will include in the Final Report a proposals to improve the forecasting methods and hence the necessary hydrological network and telecommunication systems.

(ii) Training for Maintenance of Telecommunication System

Encik Rusli emphasised the need to include in the Final Report a training programme for the Telecom staff to maintain the telecommunication system, and also the coordination between D.I.D. and Telecom in the overall maintenance of the system.

(iii) Rainfall Network

While telemetric stations are required to give real time data, D.I.D. viewed that non-telemetric gauges which require little maintenance, could be considred in the network design, especially in Kinabatangan River Basin, for future development of forecasting models.

(iv) Radio Frequency

Final Report will include recommendation of radio-frequency band to be used in actual operation of the flood

forecasting and warning systems.

(v) Scope of Work

The Chairman drew the attention of the Survey Team to the Scope of Work outlined in the Inception Report, especially on the Analytical work to be carried out in Japan. He singled out the following as important for inclusion in the Final Report.

a) Hydrological Analysis
b) Telemetric Radio Circuit Design to facilitate calling of tenders.
c) Cost Estimates

The meeting ended at 11.30 a.m.

Meeting on Draft Final Report 'Feasibility Study on Flood Forecasting and Warning System in Sabah and Sarawak'

Date:	7th March, 1980	
Time:	2.30 p.m.	
Venue:	D.I.D. Conference Room	
Chairman:	Mr. Cheong Chup Lim	D.I.D. HQ.
Present:	Mr. Akira Yuasa	Japanese Mission
	Mr. Kazuhiko Takayama	Japanese Mission
	Mr. Noboru Sakuma	Japanese Mission
	Mr. Yomio Ishii	Japanese Mission
	Mr. Mohd. Aminuddin Hashim	E.P.U.
	Mr. Chong Beng Tiat	Telecoms
	Mr. Ong Hai Seng	Telecoms
	Mr. H. Abe	J.I.C.A.
	Mr. S. H. Thavaraj	D.I.D. HQ.
	Mr. Joseph Yeoh	D.I.D. Sabah
	Mr. Joseph Ting	D.I.D. Sarawak
	Mr. Seih Kok Chi	D.I.D. HQ.
	Mr. Teh Siew Keat	D.I.D. HQ.
	Mr. Ahmad Fuad b. Embi	D.I.D. HQ.
	Mr. Tadashi Tanimoto	Colombo Plan Expert

Action

1. Welcome and Introduction

The Chairman extended a warm welcome to the Survey Team and all others present. Mr. Yuasa introduced members of the Mission while the rest of the members of the meeting were either introduced by the Chairman or self-introduced.

2. Confirmation of Minutes of Meeting held on 20th December, 1979.

The meeting accepted the minutes without amendments.

Action

3. Matters Arising

3.1 Time Schedule for Preparation of Final Report

Discussion on this item was defered until after the presentation and discussion of the Draft Final Report.

4. Presentation and briefing of Draft Final Report by Japanese Mission

After introductory remarks by Mr. Yuasa, the Mission went on to present the Report. The Chairman then invited for comments and discussion from members of the meeting. The comments and discussion are recorded in the following paragraphs.

5. Comments and Discussion

5.1 Telecoms

(i) On staff requirement for the Flood Forecasting Centre recommended by Japanese Mission, Telecoms will ask their Regional Offices to comment. — Telecoms

(ii) The Telecoms expressed concern over the use of Mt. Balat for a Repeater Station. The Japanese Mission informed that technically, it is essential to use Mt. Balat instead of other hill sites. Moreover, an access road to Mt. Balat is available.

(iii) The Telecoms also expressed concern over some of the radio paths, which have been accepted as good by the Japanese Mission. The Chairman requested Telecoms to include this in their written comments. — Telecoms

	Action
5.2 D.I.D.	
Warning System	
(i) In answer to D.I.D. Sarawak, the Japanese Mission said it is possible to have a combination of different Cases of Warning Systems in one forecasting System. D.I.D. Sarawak will indicate their preference or provide suggestion for each warning point so that the Japanese Mission could include recommendations and cost estimates in the Appendix of the Final Report.	Sarawak
(ii) Similarly, D.I.D. Sabah will indicate their needs or provide suggestion for each warning point so that the Final Report could ensure completeness in presenting a flood forecasting and warning system.	Sabah
Cost Estimates	
(iii) Estimated costs are US$1,359,000 for Kinabatangan and US$737,000 for Sadong. D.I.D. felt that the estimates are high. The Japanese Mission will comment on the possibility of replacing some of the imported equipment with locally manufactured equipment, with a view to reduce the cost estimates.	Japanese Mission
(iv) In response to question on maintenance cost estimate and life span of the telemetric equipment, the Japanese Mission said in Japan the annual maintenance cost (on spares alone) is about 5% of the capital cost and the life span is about 10 years.	
Personnel Requirement of Flood Forecasting Centre	
(v) The Japanese Mission was requested to include the Final Report outline of duties for the	

	Action
4 hydrology engineers and 4 telecommunication engineers recommended for the Flood Forecasting Centre	Japanese Mission
Flood Forecaeint Methods	
(vi) On the alternative forecasting system for Kinabatangan, the D.I.D. made the following comments: -	
(a) Kuamut could be more significant than Balat as a telemetric water level station in view of the higher population and the need for real-time feedback of the flood station.	
(b) Tongod could be more suitable than Tungkulap in view of a longer warning time.	
The Mission took note of the above comments	Japanese Mission
(vii) The flood forecasting model for Kuamut (K-1) has not considered backwater effect from Milan River. The Japanese Mission took note of the above.	Japanese Mission
Damages from Flood	
(viii) The losses in the Kinabatangan River Basin was corrected from M$200,000,000 to M$200,000 in 1967 and M$100,000,000 to M$100,000 in 1971.	Japanese Mission
6. Deletion	
Section paragraph of item (ii) Pg II-112 is to be deleted.	
7. Draft Final Report	
Telecoms was given 3 copies, EPU 2 copies, D.I.D. Sabah 2 copies, D.I.D. Sarawak 2 copies and D.I.D. HQ. 1 copy of the Report.	

	Action
8. Time Schedule for Comments and Final Report	
(i) Written comments on the Draft Final Report from the various Department are to be collated by D.I.D. and forwarded to E.P.U. by 7.4.80. E.P.U. will transmit the comments to the Japanese Mission through the J.I.C.A. Office bedore 10.4.80.	Telecoms, E.P.U. D.I.D.
(ii) The Final Report is to be ready by early July, 1980.	Japanese Mission
9. The Chairman thanked all members for their participation. The meeting ended at 6.00 p.m.	

Minutes recorded by
Ir. Teh Siew Keat