GOVERNMENT OF MALAYSIA

FEASIBILITY STUDY
SMALL SCALE HYDROELECTRIC POWER PROJECTS IN SARAWAK

VOLUME - III
DATA BOOK
FOR
FEASIBILITY STUDY
ON
MUKOH HYDROELECTRIC POWER PROJECT

JULY 1988

JICA

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF MALAYSIA

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VOLUME- Ⅲ

DATA BOOK

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Volume II	Appendix for Feasibility Study on Mukoh Hydroelectric Power Project
Volume III	Data Book for Feasibility Study on Mukoh Hydroelectric Power Project
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1.0 INTRODUCTION

The survey for Mukoh Hydropower Development Scheme was carried out from the 21-4-87 to 15-5-87 and 15-6-87 to 3-7-87.

The purpose of this survey was to provide a 1/500 topographical plan for the intake site and powerhouse site, a 1/1000 topographical plan for the waterway and river profiles and cross sections for the intake and powerhouse sites.

2.0 LOCATION OF SCHEME (APPENDIX I)

The Mukoh Scheme is located on the Sungei Mukoh, a tributary of Sungei Tekalit which in turn is a tributary of Sungei Katibas.

The distance by longboat from Song to the site is about fifty kilometres and it takes about five to six hours.

The approximate distance from the powerhouse site to the intake site is two kilometres and takes about one hour and thirty minutes by longboat. This is the only practical way of getting to the intake site.

3.0 ACCESSIBILITY

The only means of accessibility to the site is by longboat and with the help of the local people. This is because of presence of rapids which would be difficult and dangerous to cross without the experience of the locals.

4.0 SURVEY TEAM

The survey team that went and carried out the survey consisted of the following personnels;

a. Tnay Choon Hua
b. Tan Su Boon (Supervisor)
c. Lucas S. C. Lai (Surveyor)
d. Ng Siau Onn (Technical Assistant)
e. Sangai Ak. Minggat (Technical Assistant)
f. Kho Siu Ang (Technical Assistant)
g. Issa B. Lee (Labourer)
h. Bakar B. Japar (Labourer)
i. Habdol B. Idris (Labourer)
j. Minggu Ak. Minggat (Cook)

Extra manpower was obtained by hiring the local people.

5.0 INSTRUMENTS

The following are the instruments used during the survey;

a.Wild T1 s/n:195664
b.Edm Geodimeter Aga s/n:040016
c.Level Sokkisha B2C s/n:63425
d.1/16 steel band sn:037
e.1/8 steel band c:001
f.Compass Suunto s/n:446483
g.Clinometer Suunto s/n:249026

6.0 SURVEY

The surveyor was to provide topographical survey for the intake,powerhouse and waterway sites.
The initially proposed method of carrying out the survey was by 10m grid levelling for the intake and powerhouse site.
However because of the rugged terrain,it was inpractical to do grid levelling in some areas.Thus the method of cross sectioning by prismatic compass and clinometer was introduced.This was done by getting cross sections from a base line.The points where cross sections were to be taken were carefully selected so that they covered all the areas concerned.Ground features like gullies and huts were picked up and off setted.

a.Traverse

A main traverse control was run from the powerhouse site starting at BM 1 to the intake site at BM 2.
The coordinates for BM 1 were obtained by scaling out from a 1/50,000 map and the orientation was adopted from compass bearing taken to a point mark at a distance away from BM 1. This was because there were no nearby existing land and survey controls survey origin.
The traverse was broken down into two loops.The first loop started at BM 1 and ended at T 122.The second loop started at T 122 and ended at BM 2.
Traverse stations were also established in areas where topographical mapping was required,to pick up bore holes,for stadia stations and base line for grid levelling.

b.Levelling

A level was run from BM 1 to BM 2 to established the reduced level of BM 2.The double run method was used.
The distance of the backsight and foresight were as much as possible kept at approximately equal except on sloped ground.

The distance between the instrument and the backsight or foresight staff were in all observations less than 100m.
A reduced level of 60.00m was adopted as the starting datum for BM 1.The reduced level of BM 2 was found to be 74.541m.
Levelling was also carried out along the waterway joining the powerhouse and the intake. Levels was taken at every 20m along the traverse line and at every 100m for cross sections and at every gully to be picked up.
Individual level runs was carried out to established the reduced levels of two newly constructed permanemt bench marks named as BM A(67.111m) at the powerhouse site and BM B(82.361m) at the intake site.The bench marks' locations were selected such that they would not be disturbed in future when works were carried out.

c.Tachy survey
The river outline of the mapping area was surveyed out by tacheometric heighting.The instrument was setted up at various selected traverse stations along the riverside to allow total coverage of the area.
Stations were surveyed out along riverside to be used for cross section later on.
River profiles,river cross sections and big boulders were picked up.

d.River profile and cross section survey
The positions of the river profile and cross section were initially measured out along both sides of the river.
Then levels were taken by tachy metric means.The level staff was carried across the river following the marks on the river sides.The staff was usually placed to the river bed but at places where it was deep,a stick was used to measured the depth first and then the staff on the surface of the water.
There were 14 cross sections required,7 at the intake site and 7 at the powerhouse site.These cross sections were marked out from the centreline going from twice at 20m and 40m at both sides.A spot height was taken at 30m from the 40m cross section and at every 20m towards the centreline.
The cross sections were extended up to 50m horizontal distance inland or 50m difference in height depending on the terrain.

e.Waterway profile and cross section survey
Levels for the waterway profile were carried out at every 20m along the traverse line.
Cross sections for the waterway were carried out at every 100m along the traverse line.Width of the cross sections were 50m on the mountain side and 100m or to the river side whichever was nearer.
Gullies were also picked up using steel band,compass and clinometer.

7.0 PERMANENT BENCH MARKS (APPENDIX II)

Two permanent bench marks were constructed.
BM A is located at the powerhouse site and BM B is located at the intake site.
The site for the construction of the bench marks were carefully chosen so that they would not be likely to be disturbed in future.
The bench marks have the words-SESCO BM A/BM B written across the face.
The bench marks were also traverse stations,BM A being named T 209 while BM B was named T 139.
Independent level runs were taken to established the reduced levels of the bench marks individually.

8.0 DIFFICULTIES ENCOUNTERED

a.Mobilisation
Mobilisation had to be done with longboats from Song to the site.The longboats and manpower hired had to be that of the longhouse of the affected areas.These proved to be very expensive and time consuming.These were because of the presence of rapids which demanded the skill and experience to tackle,and the affected longhouse would not allow outsiders to enter.
The survey party had to wait in Song for the people concerned to be notified and arrangements made.
The journey from Song to the site took about five to six hours.

b.Logistic
Logistic posed as the biggest problem faced while carrying out the survey.The locals were very demanding especially where money was concerned.Since mobilisation and local labourers depended on them,they demanded a very if not unrealistic price on wages and transportation.
Such problems could not be overcome.Therefore transportation and local labourers were kept to a minimum.

d.Terrain
The terrain of the areas to be surveyed were mostly very rugged and steep.These was particularly so in the intake site.
Extreme care and cautiousness were taken while getting through the terrain which could be very slippery and dangerous especially after rain.Even with that one of the personnels took a bad fall near the powerhouse site,and had to be rushed to hospital.
The rapids was another difficult task especially after a night of heavy downpour.The longboats capsized on several occasions.Fortunately only minor things were lost and no casualty.

e.Weather (APPENDIX III)
Bad weather accounted for about 25% of the working time.After a day of bad weather the speed of work was slow because slipperyness and a lot of time was wasted in getting through the rapids safely.

9.0 EXTENSION OF AREA SURVEYED
The initial area to be surveyed was extended upon the request of the client.
The survey team therefore had to made a second trip back to the site.
The area extended covered an additional distance of about 300m upstream at the intake site and an additional distance of about 200m downstream at the powerhouse site.

10.0 ACCURACY OF WORK (APPENDIX IV)
The accuracies of the traveres and levels taken comply with that as stated in the specifications.

a.Control Traverse

Route	Chainage	Misclosure
BM 1-T 122	1939	1 : 22,780
T 122-BM 2	1779	1 : 17,083
BM 1-T 217	831	1 : 22,917

Route	Chainage	Misclosure
T 209-T 411	447	1 : 6,186
BM 1-A 5	402	1 : 63,710
T 202-T 302	251	1 : 137,722
T 400-T 501	102	1 : 24,184
T 409-T 602	97	1 : 123,602
BM 2-P 2	233	1 : 94,983

b.Bearing Closure

Route	Misclosure	No. of stns
BM 1-T 122	56" less	28
T 122-BM 2	1" less	25
BM 1-T 217	9" more	19
T 209-T 411	66" less	14
BM 1-A 5	60" more	8
T 202-T 302	11" more	4
T 401-T 501	19" more	5
T 409-T 602	8" more	5
BM 2-P 2	12" less	4

c.Level Closure

Route	Misclosure(m)
BM 1-BM 2	0.012 less
BM 1-BM A	0.007 more
BM 2-BM B	-

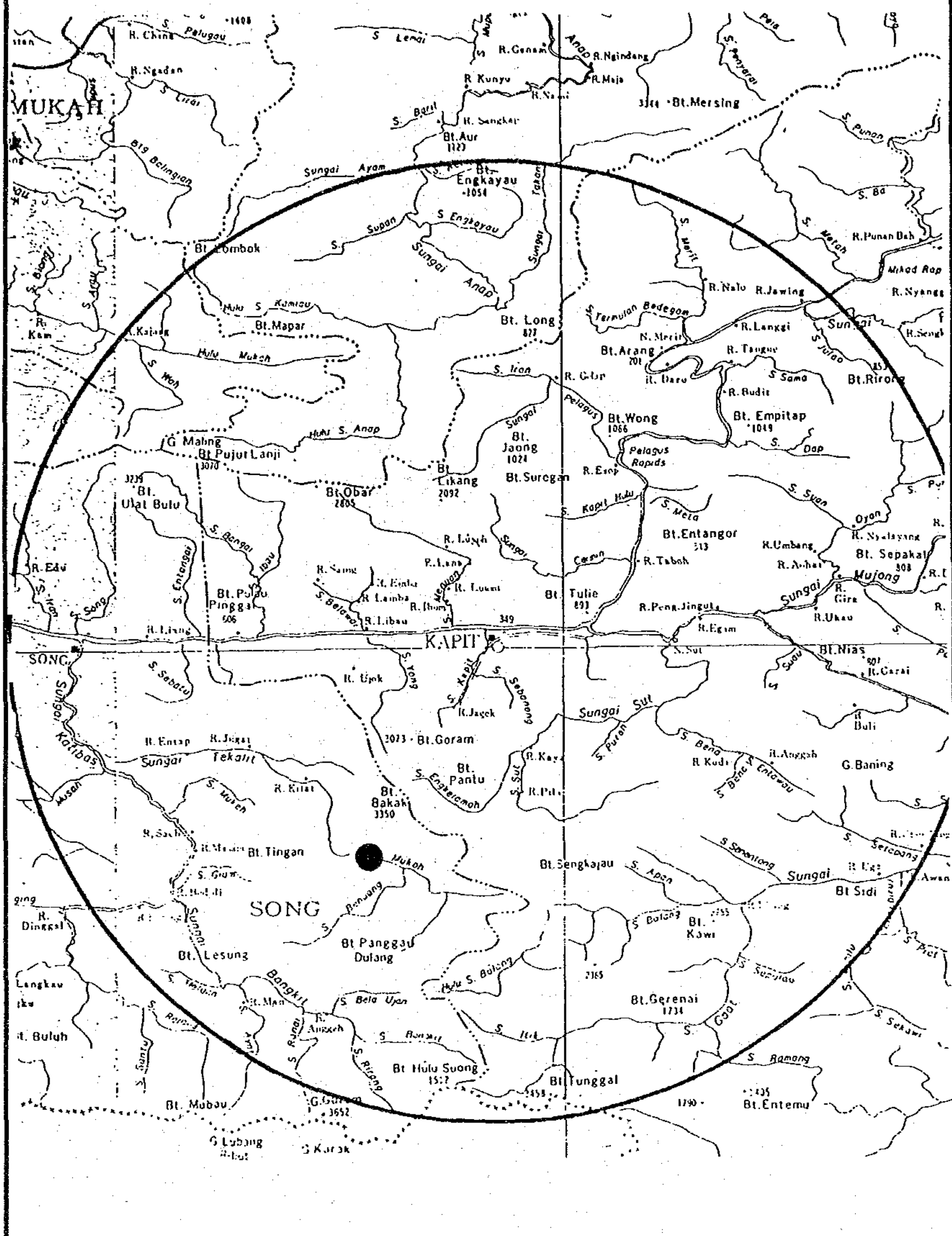
11.0 CONCLUSION

The accuracies of the traverses and levels comply with that required.

The progress of the work was delayed by festive season and the difficulties encountered as stated before.

APPENDIX I

LOCALITY PLAN FOR MUKOH



LOCALITY PLAN OF MUKOH

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JAPAN INTERNATIONAL COOPERATION AGENCY

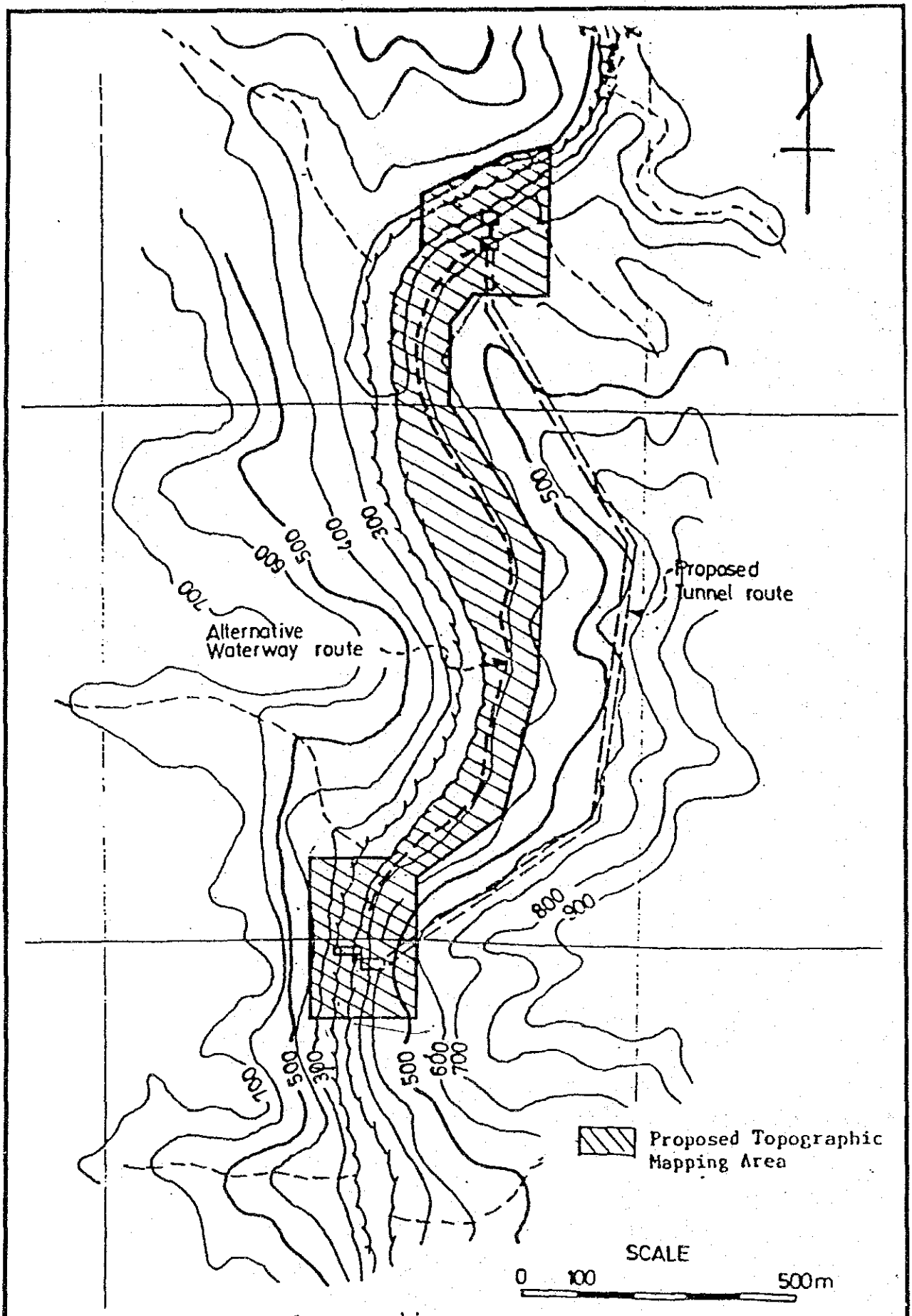

Fig. A.1 Location Map of Topographic Survey Area for MUKOH

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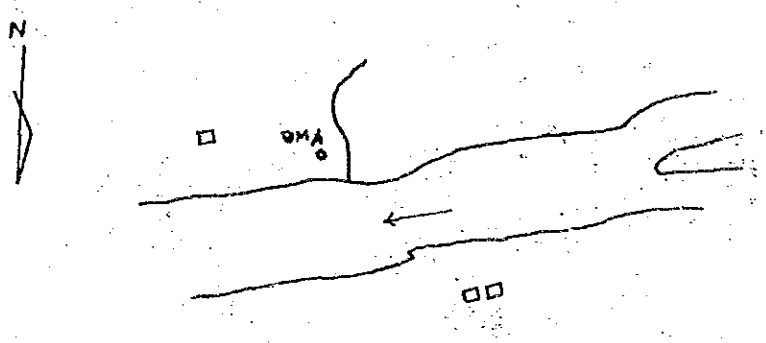
APPENDIX II

BENCH MARK DESCRIPTION

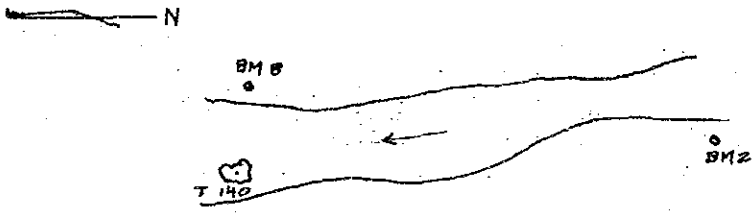
BENCH MARK DESCRIPTION

BM A



BM A is a permanent bench mark constructed near the powerhouse site.The construction of the bench mark was as specified and has the word SESCO BM A written across the face.
The bench mark is sited on a hillside,approximately 10m to a stream which is towards the upper river.
Heading down river is a hut which is approximately 55m from the bench mark,and across the river are two hut which are next to each other and approximately 80m from the bench mark.

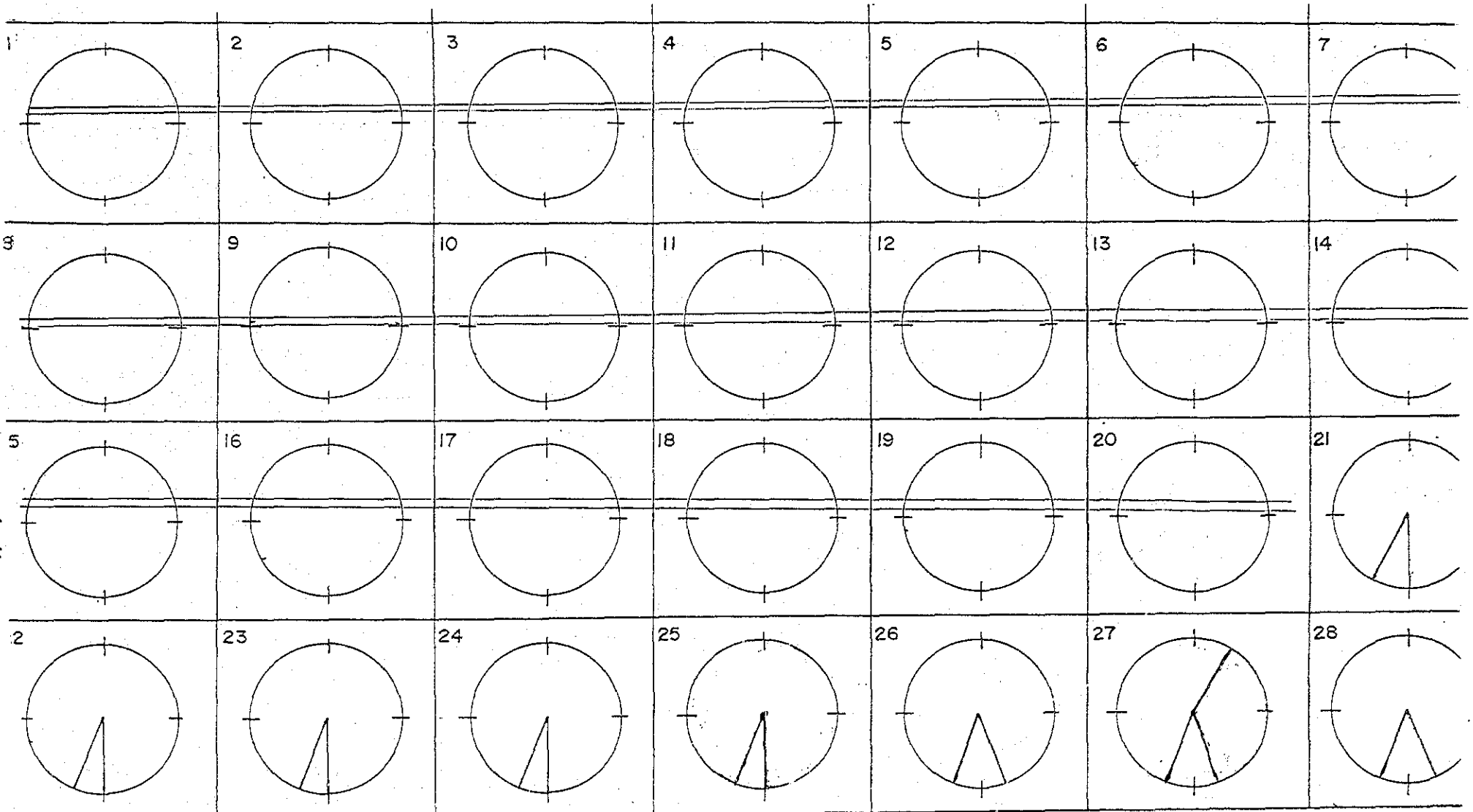
BM B



BM B is a permanent bench mark constructed near the intake site.The bench mark was constructed as specified and has the word SESCO BM B wrritten across the face.
The bench mark is sited on the hillside approximately 10m from the river.Directly across the river is T 140 which is on top of a large boulder,approximately 50m away.
The location of the bench mark is approximately 230m downstream from BM 2.

APPENDIX III

WEATHER CHART



WEATHER CHART

PROJECT : MUKOH HYDRO POWER

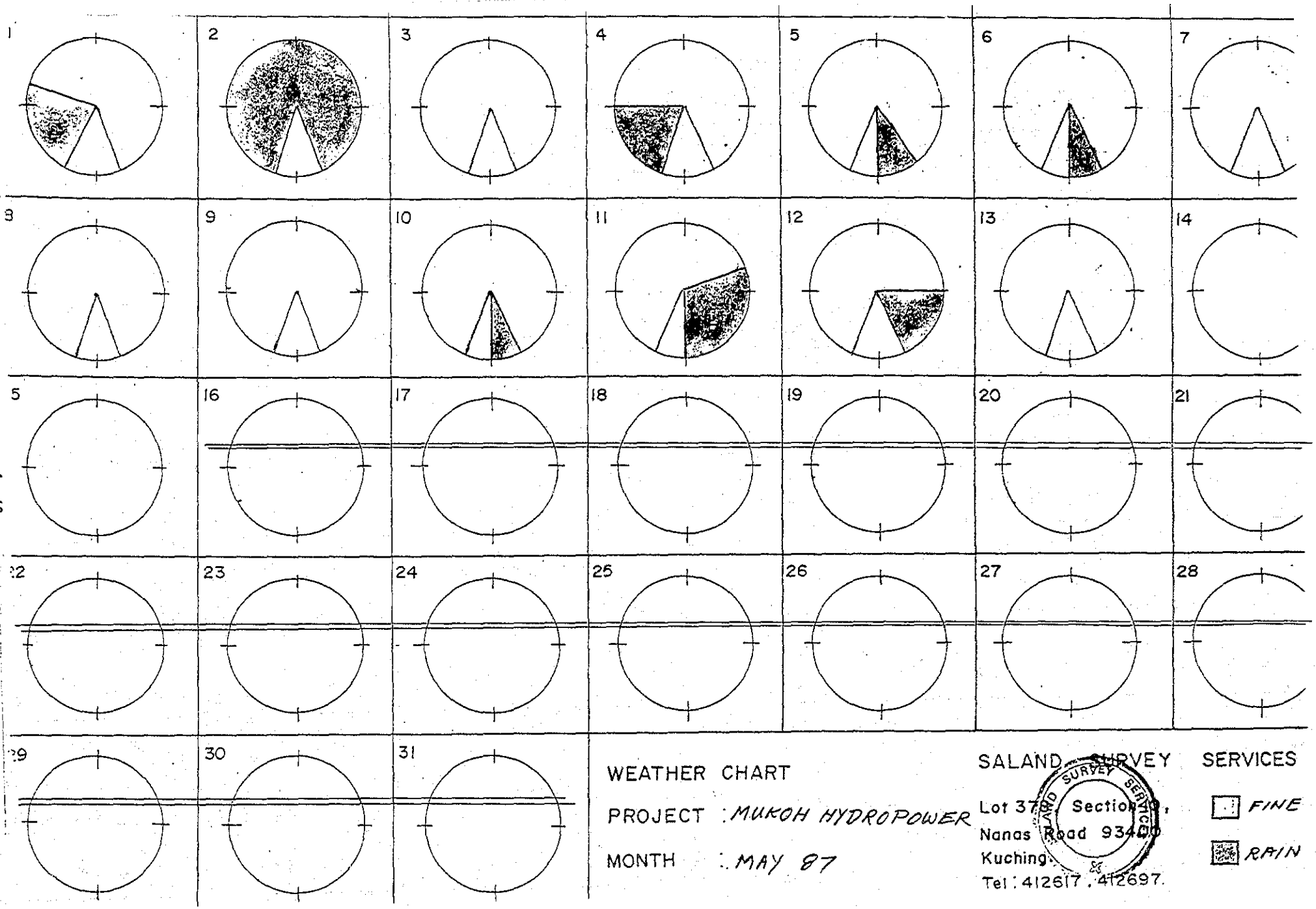
MONTH : APRIL 87

SALAND SURVEY SERVICES

Lot 378, Section 30,
Nanas Road 93400
Kuching.
Tel : 412617 . 412697.

FINE

RAIN



WEATHER CHART

PROJECT : MUKOH HYDROPOWER

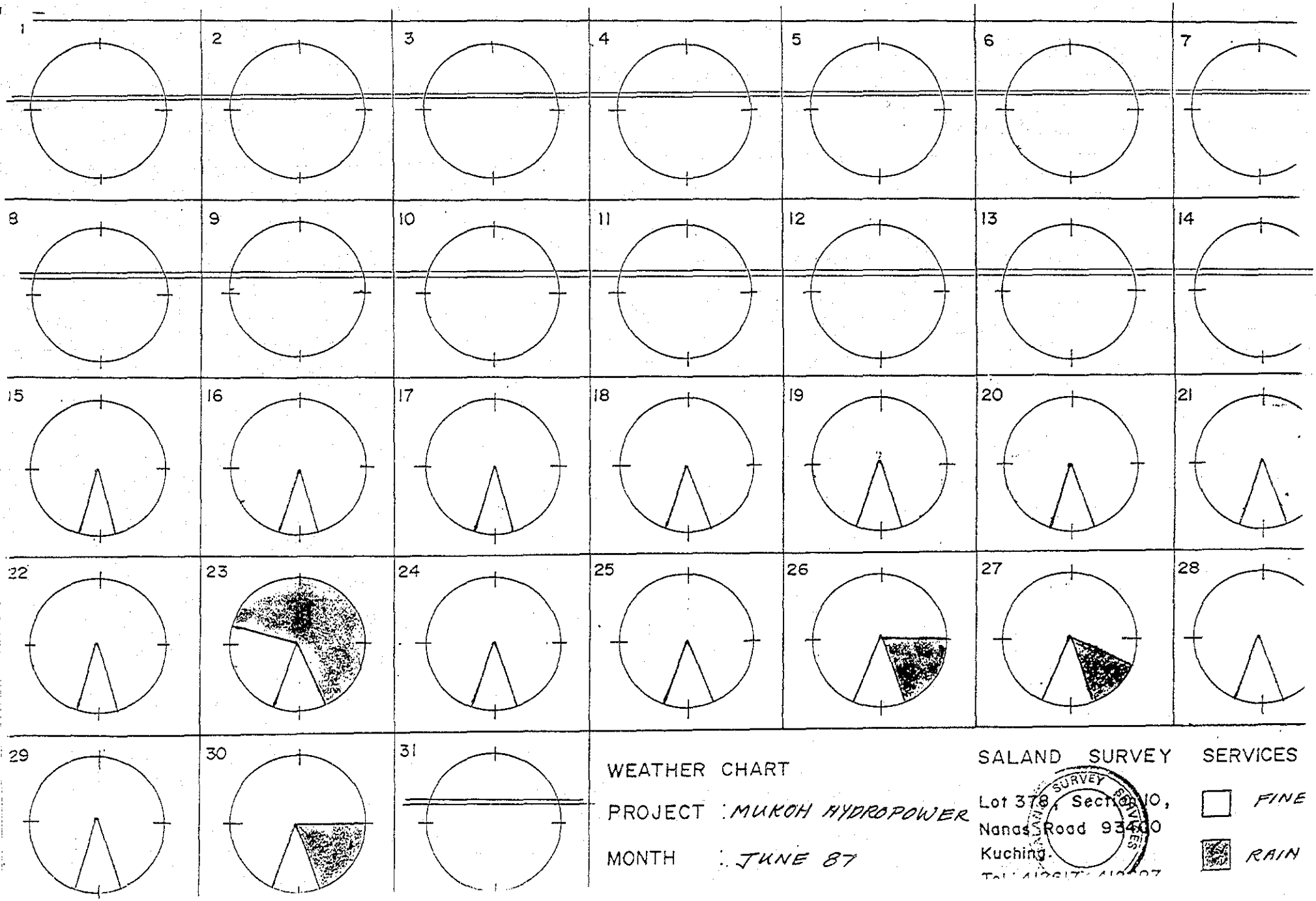
MONTH : MAY 87

SALAND SURVEY SERVICES

Lot 37, Section 64,
Nanas Road 93400
Kuching
Tel : 412617 . 412697.

FINE

RAIN



WEATHER CHART

PROJECT : MUKOH HYDROPOWER

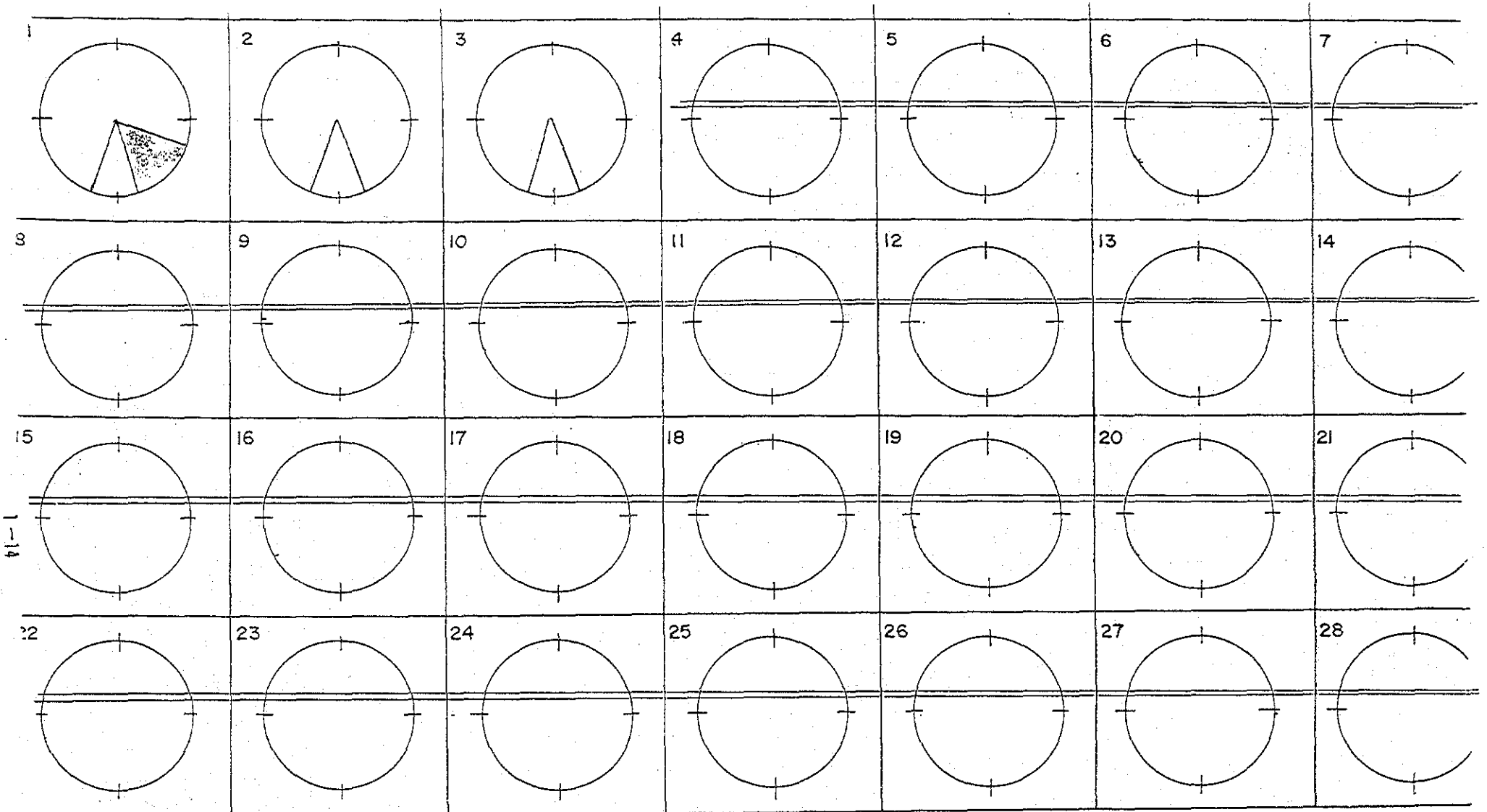
MONTH : JUNE 87

SALAND SURVEY SERVICES

Lot 378, Section 10,
Nanas Road 93400
Kuching.
Tel: 412617, 412827

FINE

RAIN



WEATHER CHART

PROJECT : MUKOH HYDROPOWER

MONTH : JULY 87

SALAND SURVEY

Lot 378 Section 19
Nanas Road 93400
Kuching.
Tel: 412617 412697

SERVICES

FINE

RAIN