CONFIDENTIAL

SOUTH EAST JOHOR PROJECT TANJONG PENGGERANG AND JOHOR TENGAH REGIONAL MASTER PLAN

FOR

THE GOVERNMENT OF MALAYSIA

AND

THE STATE OF JOHOR

PROGRESS REPORT

No. 5

JUNE 1970

• HUNTING TECHNICAL SERVICES — LAND USE AND AGRICULTURAL CONSULTANTS •

BINNIE AND PARTNERS
CONSULTING ENGINEERS

•

OVERSEAS DEVELOPMENT GROUP
UNIVERSITY OF EAST ANGLIA
SOCIO ECONOMIC STUDIES

•

SHANKLAND COX OVERSEAS
PLANNING CONSULTANTS

SOUTH EAST JOHOR PROJECT TANJONG PENGGERANG AND
JOHOR TENGAH REGIONAL MASTER PLAN

Telephone: 5205
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Our Reference: SEJ/1/CONF/STEER.COM.

677, JALAN PETRI,
P.O. BOX 241,
JOHOR BAHARU,
MALAYSIA.

1st July, 1970.

CONFIDENTIAL

Chief Secretary to the Government,
Prime Minister's Department,
(Economics),
Kuala Lumpur.

Sir,

THE TANJONG PENGGERANG AND JOHOR TENGAH REGIONAL MASTER PLAN PROJECT - FIFTH PROGRESS REPORT

In accordance with the expressed wishes of the Steering Committee at its sixth meeting held on 20th May we are endeavouring, in this report, to indicate progress towards development planning in a more positive manner.

Whilst much yet remains to be done on the analysis of physical data, to be followed by project evaluation and the development of alternative strategies, we will be illustrating, at the next meeting of the Steering Committee, our current thinking on land development and the physical planning possibilities with a set of wall maps with special reference to the Johor Tengah area.

These provisional maps supplement the Terrain, Soils and Land Use Potential in the Johor Tengah Area Report at Appendix A, the notes on Land Development and Physical Planning Possibilities at Appendix B and the progress report as a whole.

We have also included an Interim Report (Appendix C) on a proposed Limestone Project which we regard as a "high priority" project. Finally a report on prospecting, mining and dam construction in the Sungei Linggiu valley is submitted (Appendix D) for discussion during the meeting.

We also intend to present similar Interim Reports in the near future on, livestock, the additional studies required to confirm the view that timbers not presently exploited could become the basis for an early enterprise development, and, possibly, roads.

I have the honour to be, Sir,
Your obedient servant,

(W. Swinson)
Project Manager
SOUTH EAST JOHOR PROJECT

SOUTH EAST JOHOR PROJECT TANJONG PENGGERANG AND
JOHOR TENGAH REGIONAL MASTER PLAN STUDY
FOR THE
GOVERNMENT OF MALAYSIA & THE STATE OF JOHOR

PROGRESS REPORT NO. 5

CONTENTS

PROJECT MANAGEMENT

1. STAFF: additional to Report No. 4.

Post No:	Name:	Designation:	Chargeable Dates:
20	C.B. Edwards	Project Economist	12.5.70 -
-	M. Watkins	Engineering Geologist	1-5.5.70
29	R.J. Spooner	Area Manager	16-23.5.70
SIC 4-8	W.J. Payne	Livestock Consultant	23-31.5.70
	M. Mansell-Moullin	Hydrological Consultant	24.5.70 -

SPECIALIST CONSULTING FIRM:

D. Walton	Resident Planner	18.5.70
J. Kirke	Traffic & Civil Engineer	26.5.70 -

SPECIAL LEAVE OF ABSENCE:

8	R.A.J. Harrison	Agronomist/Fisheries Specialist	3-19.5.70

2. ADMINISTRATION & FINANCE

a) Housing, Offices & Transport: Satisfactory.

b) Equipment: Satisfactory.

c) Staff:

i. 18 temporary enumerators have been engaged for physical planning surveys.

ii. Mrs. Nathaniel, Secretary, left the Project on June 30th. A replacement has been engaged.

iii. The Sports Section remains active.

d) Funds: The eighth and ninth deposits of local funds have been received.

Approval of sterling payments to 30.4.70 has been given.

d) Accounts: The eighth and ninth Statements of Dollar Costs were submitted on the due dates with supporting analysis of expenditure ranking for Aid Reimbursement.

3. SCHEDULE OF WORK

The programme of work is as indicated in the progress chart at cover. However, now that we have moved into the planning stage dates for completion and submission of reports have been set and the following is the agreed time-table.

Progress Reports: Every two months as usual. However, this report will illustrate the progress achieved up-to-date and the general thinking as regards strategy and development tactics as requested at the last meeting of the Steering Committee. See under (4) below.

Interim Reports: To be submitted as and when considered appropriate to advance development activities, and particularly on any high priority projects which can be sufficiently identified for detailed feasibility studies.

Draft Project Report:

Enterprise Reports between:	July to end September 1970
Evaluation of Alternative Strategies for Development between:	August to end November 1970
Production of Draft Report and Review by Principals in United Kingdom:	December 1970
Re-examination, Amendments and Production:	January 1971
To Client(s) - 25 copies:	31 January 1971
Report Discussion:	1-28 February 1971

Final Report/Master Plan: Work on the Master Plan for development of the two regions commences on 1st March for submission end August 1971.

4. SURVEY, MAPS AND REPORTS

The fair drawing and mask preparation of the 1:63,360 Land Use Potential map of Johor Tengah is completed, the letterpress for this and the other 1:63,360 maps comprising the soils and land use series, has been ordered from the Directorate of National Mapping.

In colaboration with the Soils Science Division and the Directorate of National Mapping a Colour Scheme for all these maps has been devised.

Work is in hand on the maps being produced by the Soils section and on the maps required to support the Geological report.

Consultants will, as mentioned under "Progress Reports" above present maps illustrating the current thinking about land development and physical planning possibilities at the next meeting of the Steering Committee. It is stressed that the suggestions are tentative at this stage and have yet to be examined in depth. (Draft Project Report timetable under (3) above and the notes at Appendix B, "Land Development and Physical Planning Concepts" refer.)

During the discussion on the above the following two matters will be raised:

Limestone: An interim report has been submitted and is reproduced at Appendix C. We recommend that the deposit be proved or disproved by core drilling as quickly as possible.

Mining: If it is proposed to dam the Sungei Linggui for water conservation will the Department of Mines require that the area be again prospected for tin before such a dam is constructed. We would advise that the time interval between the decision to construct a dam and completion of such a dam would be about five years. A paper at Appendix D refers.

5. WORKING GROUPS

A meeting was held with the Federal Land Development Authority on the 6th May and discussions on a Livestock enterprise were held between the agricultural consultants and the veterinary and agricultural authorities.

PROGRESS

SECTION A: NATURAL RESOURCES STUDIES

1. SOIL SURVEY

Soil Correlation and Mapping

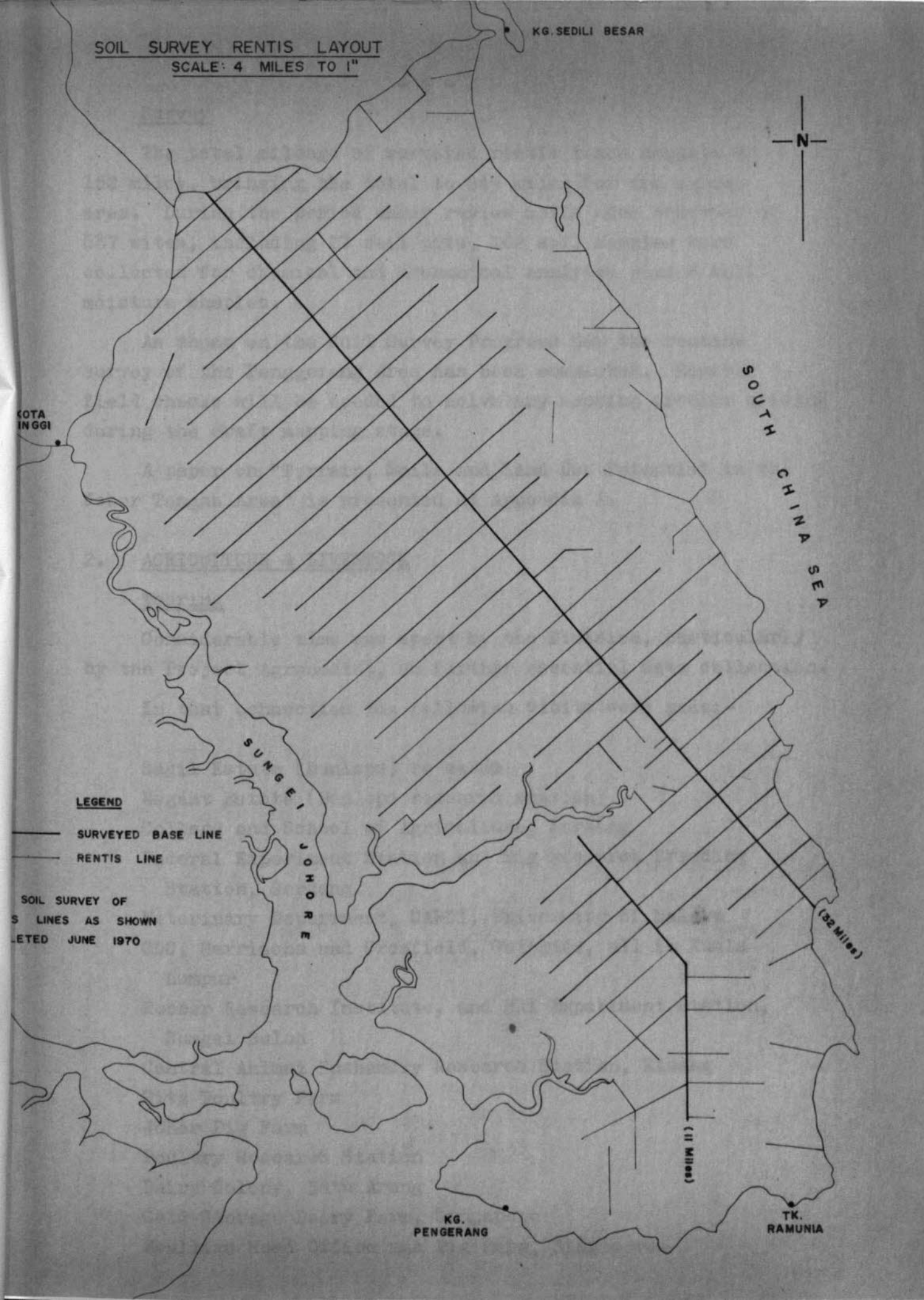
A Soil Surveyor from the Soil Science Division, Department of Agriculture was seconded to the team from 21st-29th May. Due to illness this surveyor had to be withdrawn.

The last field correlation trip in the Penggerang Area will be carried out in the first half of July next.

Terrain Class Maps at a scale of 1:25,000 for the northern half of the Penggerang Area have been reduced to 1:63,360, and a start has been made on the reduction of the Terrain Class Maps covering the southern half of this survey area. Soil mapping at 1:25,000 scale is progressing satisfactorily, the area completed amounts to roughly 175,000 acres. The reduction of the last mentioned maps could be started later in July when certain field checks have been carried out.

Trace Line (Rentis) Cutting

Cutting of the survey rentis lines in the Penggerang Area has been completed, bringing the total mileage for the area to 367.4 miles, with a total of 21.5 miles of cut lines for the period under review.


SOIL SURVEY RENTIS LAYOUT
SCALE: 4 MILES TO 1"
KG. SEDILI BESAR
N
SOUTH CHINA SEA
KOTA
INGGI
SUNGEI JOHORE
LEGEND
SURVEYED BASE LINE
RENTIS LINE
SOIL SURVEY OF
S LINES AS SHOWN
LETED JUNE 1970
(32 Miles)
(11 Miles)
KG.
PENGERANG
TK.
RAMUNIA

Survey

The total mileage of surveyed rentis lines amounts to 162 miles, bringing the total to 349 miles for the survey area. During the period under review soils were observed at 687 sites, including 27 soil pits, 102 soil samples were collected for chemical and mechanical analyses plus 6 soil moisture samples.

As shown on the Soil Survey Progress Map the routine survey of the Penggerang Area has been completed. However field checks will be needed to solve any mapping problem arising during the draft mapping stage.

A paper on "Terrain, Soils and Land Use Potential in the Johor Tengah Area" is presented at Appendix A.

2. AGRICULTURE & LIVESTOCK

Touring

Considerable time was spent by the Division, particularly by the Project Agronomist, on further essential data collection.

In that connection the following visits were made:-

Sagil Estate (Dunlops) re cacao.
Regent Estate (Dunlops research station)
College and School of Agriculture, Serdang
Federal Experiment Station and Pig Research Breeding Station, Serdang
Veterinary Department, MARDI, University of Malaya
CDC, Harrisons and Crosfield, Guthries, all in Kuala Lumpur
Rubber Research Institute, and RRI Experiment Station, Sungei Buloh
Central Animal Husbandry Research Station, Kluang
Ritz Poultry Farm
Johor Pig Farm
Poultry Research Station
Dairy Colony, Batu Arang
Cold Storage Dairy Farm, Singapore
Zeulligs Head Office and Pig Farm, Singapore.

Crop Husbandry

Considerable progress has been made with the drafting of first reports on various types of tapioca enterprises and of annual mixed cropping enterprises. It is expected that these two reports will be passed to the Socio-Economics Division for analysis in early July. A start has been made on the assembly and analysis of data collected on pepper. A draft paper on oil palms from the Socio-Economics Division is being examined and a second, on rubber, is expected from that Division shortly.

The Irrigation Agronomist left the project on 6th June, and is expected to return to Johor early in August. His report indicates that the requirements for irrigation in the project area will be minimal and mostly for specialised purposes covering small areas of land.

Livestock Husbandry

As indicated in the tour diary considerable time was spent with the Livestock Consultant in data collection, familiarisation and discussions with the relevant Government officers and private interests. Dr Payne has indicated his general agreement with the previously expressed views of the Division regarding the prospects for the development of animal production, particularly in the field of dairying. His detailed report is still awaited. On its receipt priority will be given to completing a second draft report on a dairy enterprise.

Fisheries

In early May the internal report on the Inland Fisheries Environment was completed on schedule. This completed the basic studies on the physical environment. This was followed by a paper on the theoretical aspects of biological productivity in ponds. This was to provide more detailed information as a supplement to the former report on the environment.

Further data collection on management and production aspects of pond culture are in progress. In this connection as many as possible of as many differing types of fish culture schemes in Johor are being visited. Schemes which are linked to pig, poultry and vegetable production are receiving special attention.

A preliminary examination of the topographic maps of the project area indicates that Johor Tengah with its more abundant stream systems has a greater potential than the Penggerang peninsula for fish culture projects. A brief inspection of some of the rivers in Tengah were made during the visit of the Conservation Consultant (Dr Wycherley).

The results of the consumer preference survey are now available and it is expected that this will give some indication of the demand for fish products.

Conservation

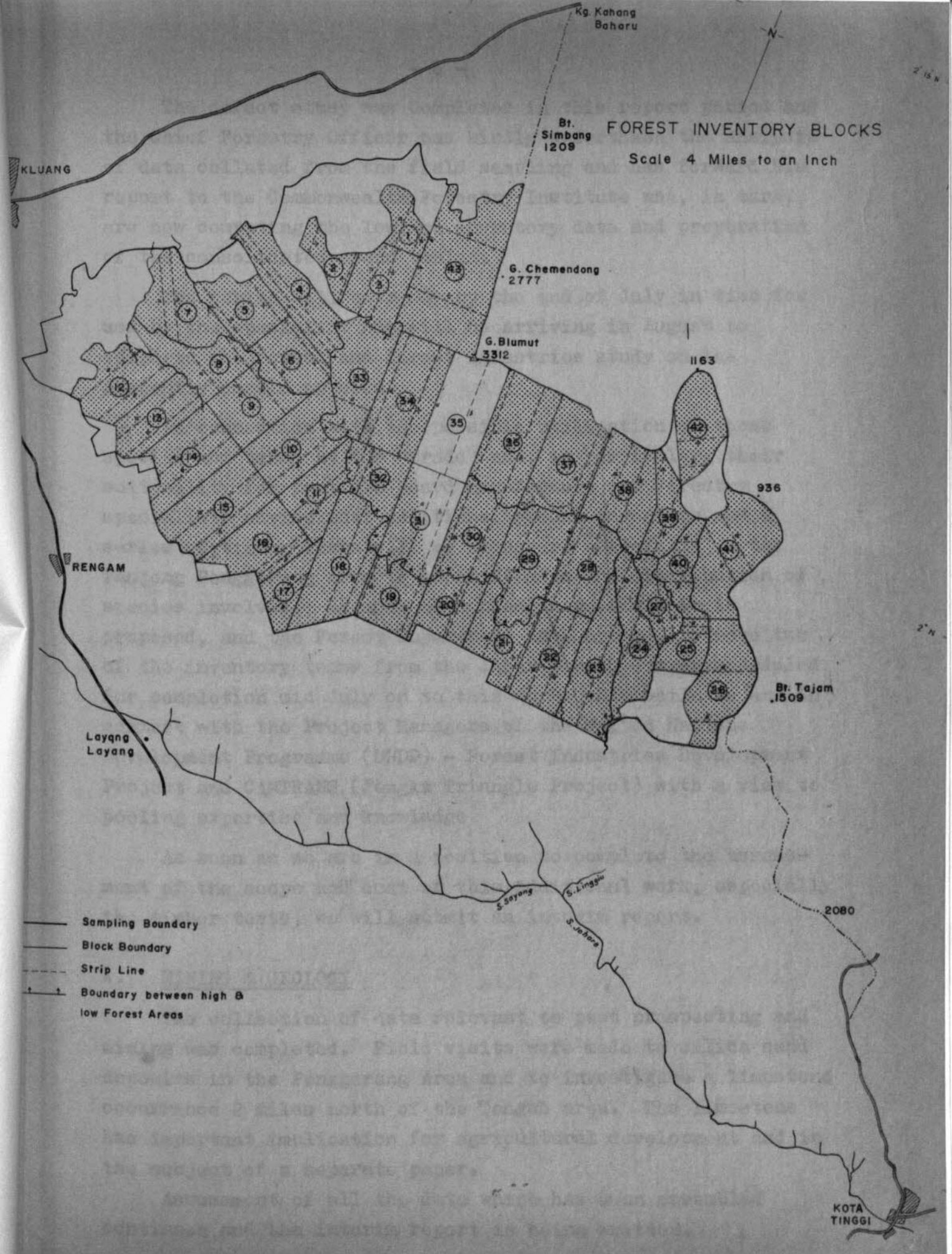
The special consultant spent a full week in the project area during May both in the field and the office. Discussion took place on development of areas suitable for recreational use purposes and as National Parks and Wild Life Reserves and other areas of special scientific interests which should be preserved.

Land Development Concepts

Maps have been prepared for display at the next meeting to indicate the early thinking of the Consultants on possible agricultural enterprises for Johor Tengah. It must be stressed that the map portrays ideas only; all of these ideas will be analysed by the Socio-Economics Division. Notes at Appendix B refer.

3. FORESTRY

The forest inventory of the highland area i.e. land above 500 feet slope will be completed by the 15th July 1970.


Kg. Kahang Baharu
N
2° 15' N
FOREST INVENTORY BLOCKS
Scale 4 Miles to an Inch
Bt. Simbang 1209
KLUANG
G. Chemendong 2777
G. Blumut 3312
1163
936
RENGAM
Bt. Tajam 1509
2° N
Layang Layang
S. Sayong
S. Linggiu
S. Jeharo
2080
KOTA TINGGI
Sampling Boundary
Block Boundary
Strip Line
Boundary between high & low Forest Areas

The defect study was completed in this report period and the Chief Forestry Officer has kindly undertaken the analysis of data collated from the field sampling and has forward his report to the Commonwealth Forestry Institute who, in turn, are now computing the lowland inventory data and preparation of the consolidated stand tables.

The tables will be ready by the end of July in time for use by the specialist who will be arriving in August to complete the forest and forest industries study on the presently usable species.

In connection with the possible utilisation of those species not taken by the "trade" and, in particular, their suitability for particle board manufacture our Forestry specialists advise that additional ground inventory and a series of timber tests will be necessary especially in the Tanjong Penggerang area to identify size and distribution of species involved. As soon as a plan is received it is proposed, and the Forest Department have agreed, to move two of the inventory teams from the Johor Tengah survey scheduled for completion mid July on to this work. Meanwhile we are in contact with the Project Managers of the United Nations Development Programme (UNDP) - Forest Industries Development Project and CANTRANS (Jengka Triangle Project) with a view to pooling expertise and knowledge.

As soon as we are in a position to complete the assessment of the scope and cost of this additional work, especially the timber tests, we will submit an interim report.

4. MINING & GEOLOGY

The collection of data relevant to past prospecting and mining was completed. Field visits were made to silica sand deposits in the Penggerang Area and to investigate a limestone occurrence 2 miles north of the Tengah area. The limestone has important implication for agricultural development and is the subject of a separate paper.

Assessment of all the data which has been assembled continues and the interim report is being written.

5. WATER RESOURCES

Routine operation of the hydrological network and water sampling has continued. Additional water samples have been taken from the Sungei Sembrong Kechil and no further arsenic has been detected. Samples of effluent have been taken at oil palm and rubber factories and are being analysed to give information on their polluting effects in rivers. Details of one analysis on oil palm effluent has been received and this shows a very high suspended solids concentration of about 100,000 parts per million (ppm) and very high Biological Oxygen Demand (BOD) of 18,000 ppm. This is being sent to Binnies in London for study.

The river recessions on different type of catchments that occurred earlier in the year have been carefully studied and an initial comparison of low flows on developed and undeveloped catchments of different size for 5 weeks of insignificant rain has been made. (See end of section). Other factors such as geology and catchment slope may have significance and further studies will be carried out to evaluate such significance. Further detailed examination of the recession curves is being continued leading to evaluation of the change in storage/yield relationship due to development.

Daily flows at the Department of Irrigation and Drainage (DID) gauging station at Rantau Panjang (on the Sungei Johor) (Catchment Area = 440 square miles) for the period of record 1963-69 have been analysed and the results are shown in the form of a flow duration curve, (see end of section). The average flow over this period is of the order of 1600 cusecs. This curve is subject to further refinement as additional fieldwork is carried out and will be used as the basis for estimating the long term run off characteristics at Rantau Panjang and at other points to be selected in the Project Area.

The following estimates of future water demand in year 2000 have been made in areas which may have to be met or partly met from the Project Area. These estimates have been based on the 1957 Census and assuming a population increase of

3½ per cent per annum. Water allocation in the year 2000 has ~~has~~ been taken as:

Urban : 60 gallons/head/day
Semi urban: 40 gallons/head/day
Rural : 20 gallons/head/day

District	Estimated Demand (million gallons per day)(mgd)
Johor Baharu	31
Pontian	8
Kluang	16
Kota Tinggi	6

In addition Singapore are entitled to, up to 250 mgd under the 1962 Agreement.

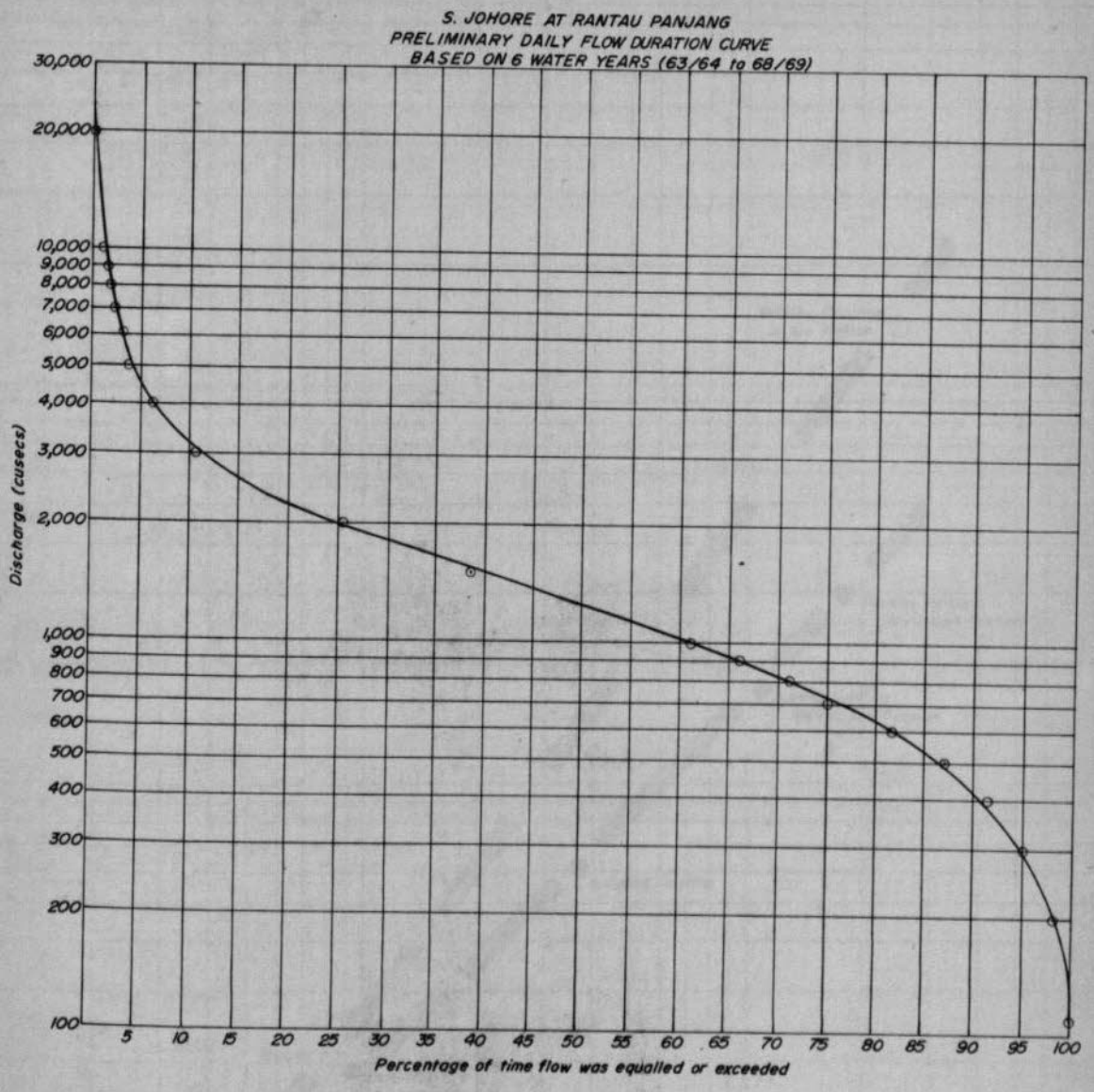
The principal Public Works Department (PWD) supplies within these Districts for which additional sources will be required are:-

PWD Supply	Estimated Demand mgd
Johor Baharu	30
Pontian	8
Kluang	11
Kota Tinggi	2

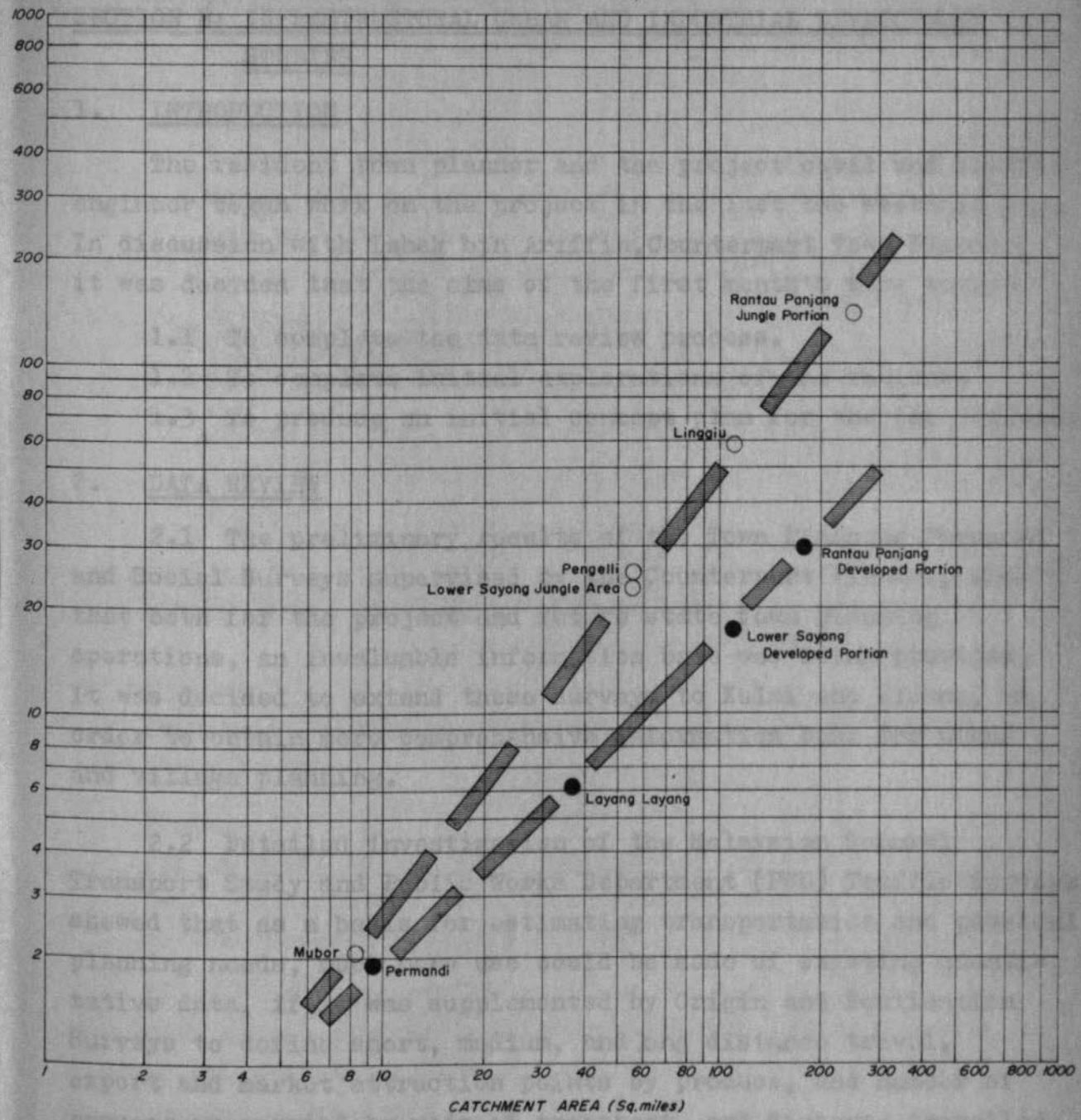
The demands in the Project Area due to development are not yet known but from information at present available may be about 10 mgd for Johor Tengah, and up to about 10 mgd - 20 mgd in Penggerang depending on tourist development.

We can confirm that there is sufficient water available to meet these demands although some storages will be required. Possible storage sites in the Johor Tengah area will be displayed at the next Steering Committee.

Studies are continuing to evaluate the most economic source for the above demands.


S. JOHORE AT RANTAU PANJANG
PRELIMINARY DAILY FLOW DURATION CURVE
BASED ON 6 WATER YEARS (63/64 to 68/69)
Discharge (cusecs)
30,000
20,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percentage of time flow was equalled or exceeded

COMPARISION OF LOW FLOWS IN PROJECT REGIONS FEBRUARY, MARCH 1970



LEGEND

○ Primary Jungle Catchments

● Developed Catchments

N.B.:- All data above has been obtained from within the Project Area and indicates the preliminary estimated flows of various catchments 5 weeks after a storm of approximately 1–2 inches with no following rainfall. Much more detailed work is now being done to determine whether these figures are infact truly representative, it is possible that other latent characteristics (eg. Geology, slope, etc) could account for at least some of this difference

In connection with the hydrological network established for our current studies a preliminary assessment of a future network, to continue after our fieldworks finish next February/March, has been submitted to Economic Planning Unit (EPU) for budgetary purposes.

SECTION B: INFRASTRUCTURAL URBAN AND INDUSTRIAL DEVELOPMENT STUDIES

1. INTRODUCTION

The resident town planner and the project civil and traffic engineer began work on the project in the last two weeks in May. In discussion with Ishak bin Ariffin, Counterpart Town Planner, it was decided that the aims of the first month's work were:-

1.1 To complete the data review process.

1.2 To complete initial explorations of the regions.

1.3 To produce an initial concept plan for the two regions.

2. DATA REVIEW

2.1 The preliminary results of the Town Planning Physical and Social Surveys supervised by the Counterpart Planner, showed that both for the project and future state town planning operations, an invaluable information base was being provided. It was decided to extend these surveys to Kulai and Kluang, in order to obtain more comprehensive information base for urban and village planning.

2.2 Detailed investigation of the Malaysian General Transport Study and Public Works Department (PWD) Traffic Surveys, showed that as a basis for estimating transportation and physical planning needs, much more use could be made of existing quantitative data, if it was supplemented by Origin and Destination Surveys to define short, medium, and long distance travel, export and market attraction points by produce, and number of passengers carried by mode of transport, and distance travelled.

There were two alternatives for the scale of this Survey:-

1. Within the project and survey resources to link the surveys to two stations - one on Route 1; the other just south west of Kota Tinggi. This will be the minimum survey sufficient to produce reliable information for the Transportation Planning of the Project

Areas. It was, therefore, decided to conduct such a Survey in July/August of this year in conjunction with the Socio-Economic Division.

2. An Origin and Destination Survey at all or most of the existing survey stations around the project areas. Such a Survey would provide an invaluable basis for transportation and physical planning forcasting at State, Regional and Local Levels. Unfortunately project survey and analysis resources are totally inadequate for such surveys, but we would recommend that both in traffic surveys and analysis of national routes attention be given to producing information of the type outlined above in the future. The information then produced will provide an invaluable basis for decisions about the economic viability of various national transport alternatives for the Second Malaysia Plan:-

Example 1

The Future of Route 1 - National Expressway or Gradual Expansion and Improvement.

Example 2

Produce likely to be attracted to a New National Port at Johor Baharu.

Example 3

Any Requests to the World Bank for Loans to undertake such major developments are likely to produce a demand for such surveys before a loan is granted.

2.3 Other necessary information has been collected, or requested and is awaited from other Government Departments. Further information collection from available resources will be requested as the jobs proceed into detail.

3. EXPLORATIONS OF THE REGIONS

The general exploration of the two regions by the planners and traffic engineers is now complete. These will be supplemented by future visits into the regions to test the practicability of proposals as they emerge - e.g. Key Bridging points, tourist development roads and sites, etc.

4 INITIAL REGIONAL DEVELOPMENT CONCEPT PLAN

A short study of the factors listed below enabled us to outline some ideas about growth and development at a national and state scale, as a context for planning the two regions.

Population growth (West Coast, Johor Baharu)
Urbanisation & Industrialisation - Johor Baharu, Kluang, Kulai
Agricultural Land Development - South East Johor, South East Pahang etc.
Water Conservation - Singapore, Johor Baharu, Kluang
Tourism & Recreation - Apparent demand, internationally, nationally, and Singapore
Transportation - Road, Rail, Air
Route 1, Railway, New National Port and Airstrip, linkages to and from Kuala Lumpur, South East Pahang, Singapore, etc.

Appendix B describes the various factors that have been taken into account in producing this initial plan. This will be illustrated and described at Steering Committee.

SECTION C: SOCIO-ECONOMIC ASPECTS AND INSTITUTIONAL INFRA-STRUCTURE

Each strategy for the development of the Project area will combine a number of "enterprises" - agricultural activities, fisheries, forestry, mineral, tourism, processing of agricultural and forest products and other industrial activities. These will require inputs of goods and services - marketing, transport, public utilities, etc., services of Government departments and other agencies, and supplies of factors of production.

During months 9 and 10, the Socio-economic Division continued work on the preparation and analysis of material on these various enterprises - activities and inputs - on organisation, and sources of trained personnel.

Internal draft papers were prepared on:

Market reviews: milk, tapioca, soyabeans, sorghum, oilcakes and meals

Rubber processing

Palm oil profitability and optimum replanting dates

Transport - survey and preliminary analysis of existing data

Flooding at Kota Tinggi

Provision of Social Services in Johor

Malaria

Nutrition

Vocational training opportunities for skilled and semi-skilled workers

Agricultural education

Agricultural extension services

Federal Land Development Authority (FLDA) - personnel, training; and other aspects
FLDA - phasing of settlers' payments
Muda Irrigation Scheme
"High productivity" agriculture
Preliminary paper on industry in South East Johor

Recommendations were prepared for EPU on the Tanjong Penggerang Highway and the investigation of Limestone.

Sociological field studies (described in Progress Report No. 4): the investigators' field work reports are 90 per cent complete. The analysis of this and other material is in progress and is planned to be completed by the start of month 12.

Tables from the Socio-economic Survey 1967/68 were received in May, giving data on employment and unemployment for West Malaysia as a whole. Data on a regional basis and on other subjects are still awaited.

Economic evaluation of "enterprises" began in month 9 with the work on palm oil profitability (described in Progress Report No. 4). The results of the first two sets of computer runs have been received and a revised version of the paper on palm oil profitability and sensitivity analysis will be prepared in July for discussion with EPU. Net Present Value (NPV) has been calculated at discount rates of 10 per cent, 15 per cent and 20 per cent. A similar economic evaluation is now being done on rubber, and will be applied to other possible activities, organised in various ways, as the quantative data and information on technical constraints becomes available.

Consideration has been given to the problems of combining various "enterprises", in various sequences and phasing, and with various organisations, into "alternative strategies" for the development of the Project areas and for linked production inside and outside these areas. Although it is possible, and necessary for planning, to go some way in considering these problems in general and in abstract and in studying the

implications for organisation at various levels, at some point this ceases to be worthwhile without specific case material. Emphasis at this stage is therefore on the production and analysis of that material.

Work in the next 2-3 months will continue to concentrate on:-

a) the economic analysis (project evaluation) of quantitative data on specific "enterprises" and linked production, organised in various ways;
b) the examination of various organisations at the field or settlement level, in the light of assessments of social implications and information about possible activities;
c) the preliminary study of possible combinations of enterprises, sequences and phasing, and organisations, into alternative strategies, and the practicability of their implementation given availability of factors and administrative and other constraints.

APPENDIX A TO
PROGRESS REPORT NO. 5

TERRAIN, SOILS AND LAND USE POTENTIAL IN THE JOHOR TENGAH AREA

INTRODUCTION

The soil investigations of this area have been carried out by the Soil Science Division, Department of Agriculture, and the Terrain Class and Soil Maps have also been compiled by the above Division. The crop suitability criteria and Land Use Potential Map have been produced by this Project. The crop suitability criteria have been worked out in close co-operation with the Soil Science Division and the Land Use Potential Map is based on the soil and terrain maps supplied by them.

The information on terrain and soils contained in this note are based on a Draft Report compiled by the Soil Science Division, Department of Agriculture.

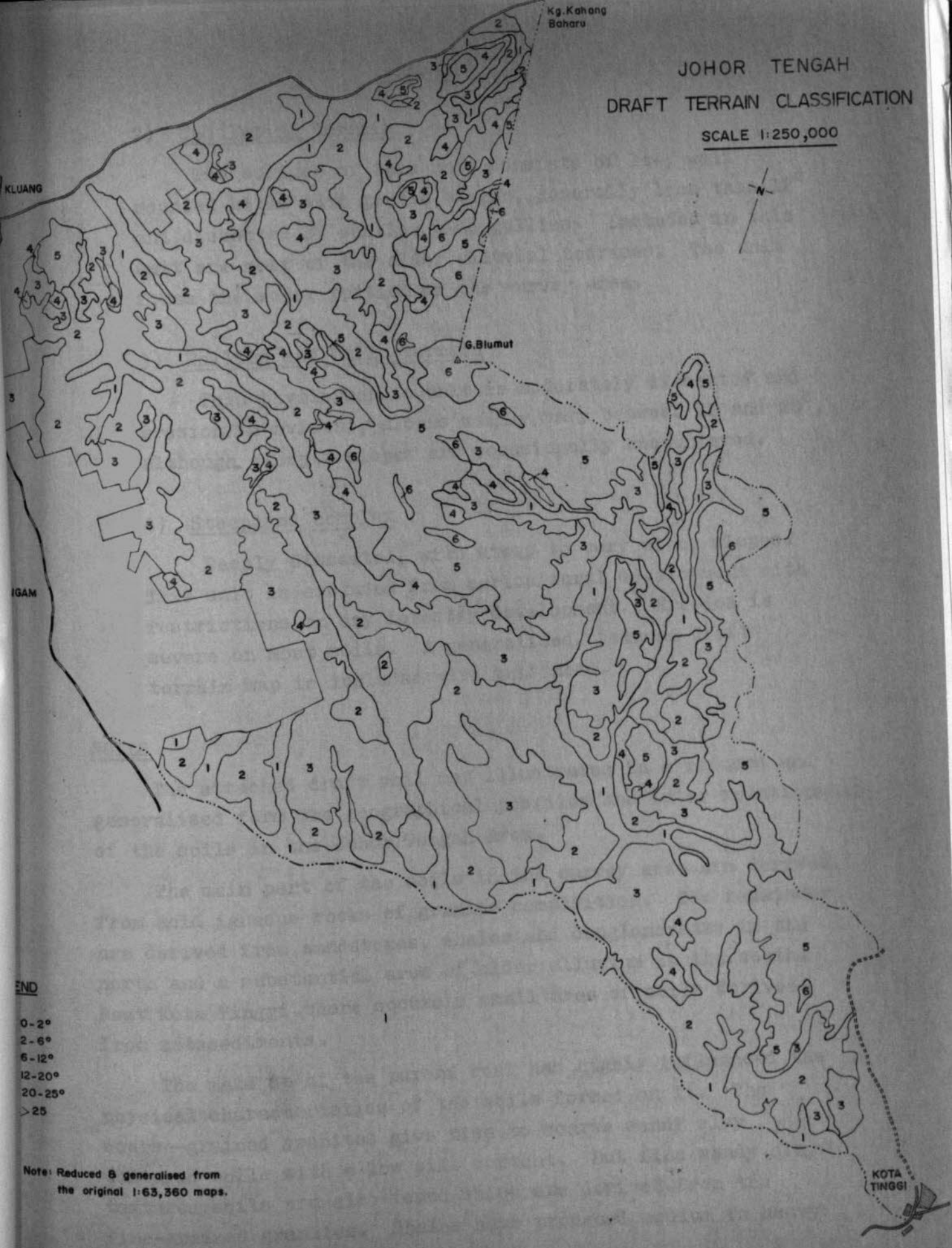
TERRAIN CLASSIFICATION

The Physiography of the survey area can be divided into four broad units.

1) Flood plains C1.
2) Undulating terrain C2, C3
3) Rolling to hilly terrain C4
4) Steepland Complex. C5, C6

1) Flood plains

The river flood plains are generally rather narrow belts bordering the larger rivers. These rivers are very sluggish and meander through the area. The flood plains are commonly subject to serious flooding during certain times of the year, drainage is poor to imperfect. Terrain slope varies between 0 and 2^{o}.


JOHOR TENGAH
DRAFT TERRAIN CLASSIFICATION
SCALE 1:250,000
N
Kg. Kahang Baharu
KLUANG
G. Blumut
KOTA TINGGI
END
0-2°
2-6°
6-12°
12-20°
20-25°
>25
Note: Reduced & generalised from the original 1:63,360 maps.

2) Undulating terrain

The surface of this unit consists of low, well rounded hills with gentle slopes, generally less than 12° and dissected by shallow wide gullies. Included in this unit are most of the older alluvial terraces. The unit forms the major portion of the survey area.

3) Rolling and hilly terrain

This physiographic unit is moderately dissected and erosion is evident, slopes mainly vary between 12 and 20°, although steeper slopes are occasionally encountered.

4) Steepland complex

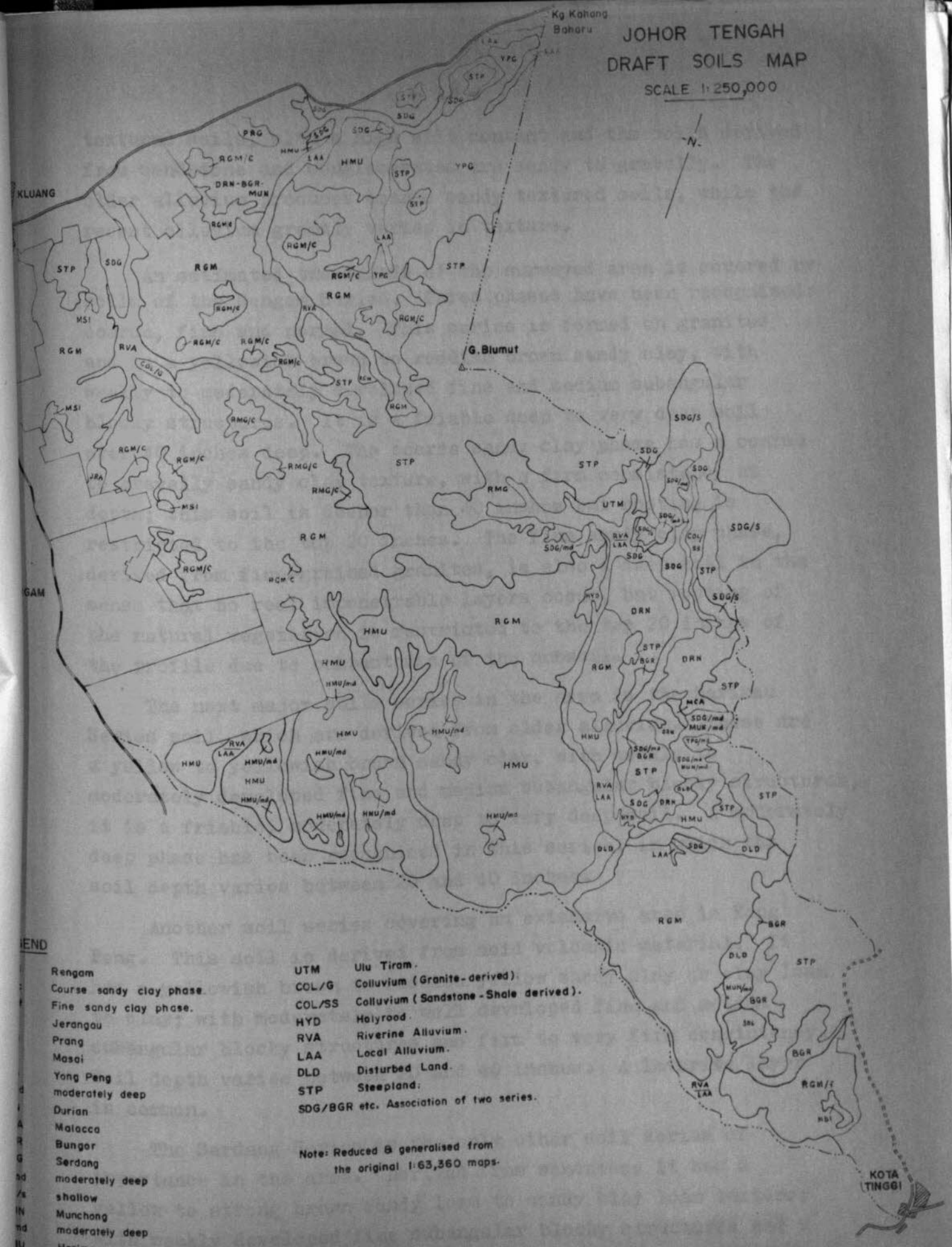
Deeply dissected, with steep to very steep slopes. This unit is excluded from agricultural development with restrictions on any forestry development. Erosion is severe on most soils. A generalised, reduced draft terrain map is included with this note.

SOILS

The attached draft soil map illustrates in a reduced and generalised form the geographical position and inter-relationship of the soils in the Johor Tengah Area.

The main part of the soils in the survey area are derived from acid igneous rocks of granite composition. The remainder are derived from sandstones, shales and conglomerates in the north and a substantial area of older alluvium in the south. Neat Kota Tinggi there occurs a small area of soils derived from metasediments.

The make up of the parent rock has highly influenced the physical characteristics of the soils formed on it. The coarse-grained granites give rise to coarse sandy clay textured soils with a low silt content. But fine sandy clay textured soils are also found which are derived from the fine-grained granites. Shales have produced medium to heavy



END

	Rengam
	Course sandy clay phase.
	Fine sandy clay phase.
	Jerangau
	Prang
	Masai
	Yong Peng
md	moderately deep
	Durian
A	Malacca
R	Bungor
G	Serdang
md	moderately deep
/s	shallow
IN	Munchong
md	moderately deep
IU	Harimau
md	moderately deep

UTM	Ulu Tiram.
COL/G	Colluvium (Granite-derived).
COL/SS	Colluvium (Sandstone-Shale derived).
HYD	Holyrood.
RVA	Riverine Alluvium.
LAA	Local Alluvium.
DLD	Disturbed Land.
STP	Steepland.

SDG/BGR etc. Association of two series.

Note: Reduced & generalised from the original 1:63,360 maps.

textured soils, with a high silt content and the soils derived from sandstone and conglomerates are sandy to gravelly. The older alluvium produces coarse sandy textured soils, while the recent alluvium greatly varies in texture.

An estimated two-thirds of the surveyed area is covered by soils of the Rengam Series. Three phases have been recognised: coarse, fine and normal. This series is formed on granites and is a yellowish brown to reddish brown sandy clay, with weakly to moderately developed fine and medium subangular blocky structures. It is a friable deep to very deep soil over 40 inches deep. The coarse sandy clay phase has a coarse to gravelly sandy clay texture, with a firm consistency at depth; this soil is deeper than 40 inches but rooting is restricted to the top 20 inches. The fine sandy clay phase, derived from fine-grained granites, is also a deep soil in the sense that no real impenetrable layers occur, but rooting of the natural vegetation is restricted to the top 20 inches of the profile due to compactness of the subsoil.

The next major soils series in the area is the Harimau Series soil, which are derived from older alluvium. These are a yellow to yellowish brown sandy clay, with weakly to moderately developed fine and medium subangular blocky structures, it is a friable, moderately deep to very deep soil. A moderately deep phase has been recognised in this series, in which the soil depth varies between 20 and 40 inches.

Another soil series covering an extensive area is Yong Peng. This soil is derived from acid volcanic material. It has a yellowish brown to reddish yellow sandy clay or clay loam to clay; with moderately to well developed fine and medium subangular blocky structures and firm to very firm consistency. Soil depth varies between 20 and 40 inches. A laterite layer is common.

The Serdang Series is the only other soil series of importance in the area. Derived from sandstone it has a yellow to strong brown sandy loam to sandy clay loam texture; with weakly developed fine subangular blocky structures and a friable consistency. Three depth phases have been recognised.

The nutrient status of most soils found in the survey area is low to very low because of intense weathering and leaching. The recent alluvial soils (Riverine and Local Alluvium) however are chemically richer due to frequent and continuous addition of weatherable minerals.

LAND USE POTENTIAL

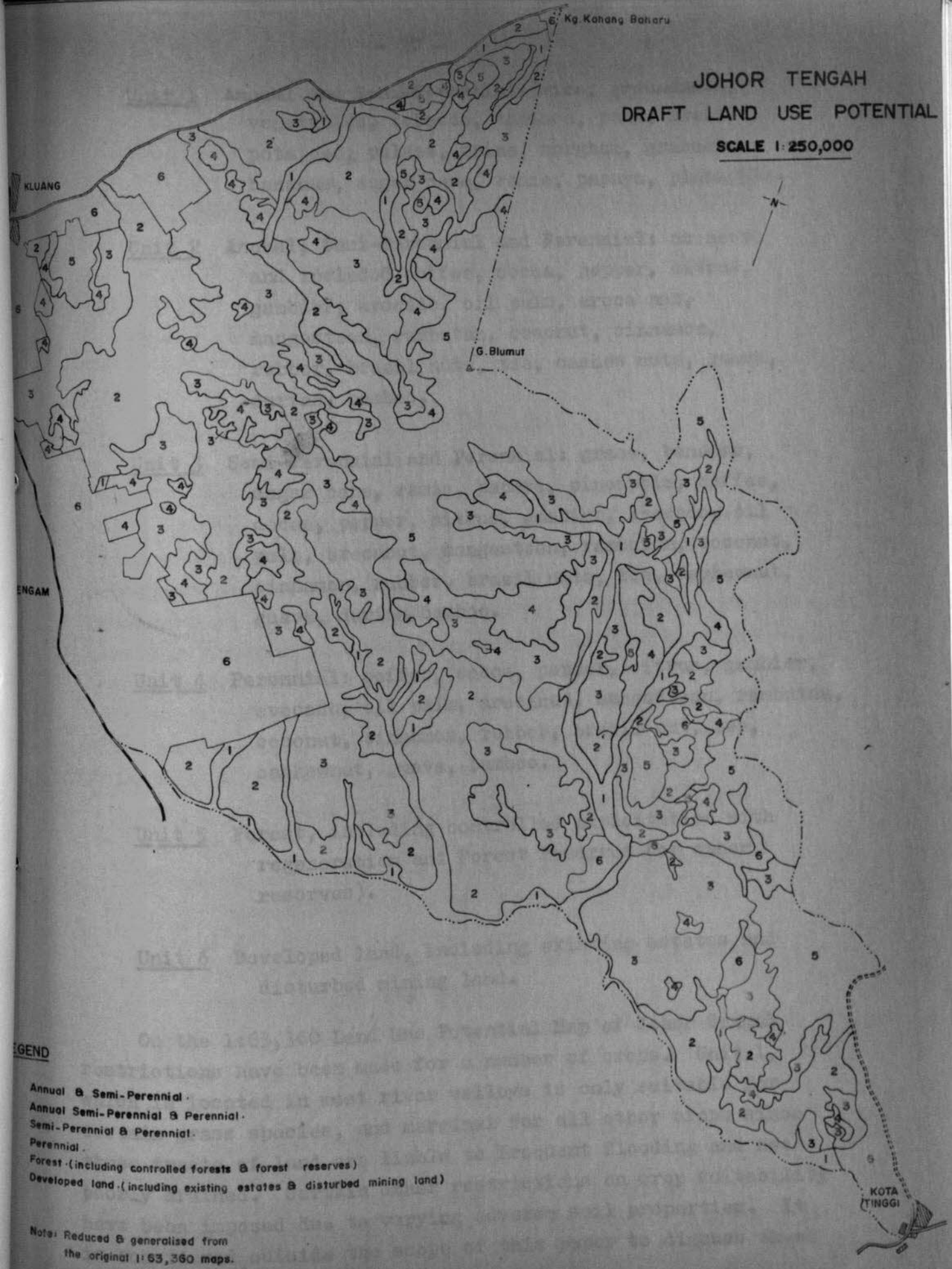
The attached draft Land Use Potential Map illustrates the agricultural Land Use Potential in the survey area, mining and forestry potential have at this stage not been included. The percentage area figures given below are based on the total area covered by the soil survey conforming to the boundaries as stated in the Terms of Reference. It must be emphasized that some alienated land and all of the committed land has been surveyed and therefore is included in the figures below.

Table

Unit No.	Categories	Percentage
1	Annual and Semi-Perennial	8
2	Annual, Semi-Perennial and Perennial	24
3	Semi-Perennial and Perennial	29
4	Perennial	8
5	Forest (controlled forests and/or forest reserves)	17
6	Developed land (including existing estates and disturbed mining land)	14
		100

The above table shows that 69 per cent is suitable for agricultural development (mining and forestry permitting).

The crops which could, from an environmental point of view, be grown in the area are as follows:


JOHOR TENGAH
DRAFT LAND USE POTENTIAL
SCALE 1:250,000
N
Kg. Kahang Baharu
KLUANG
G. Blumut
KOTA TINGGI
EGEND
Annual & Semi-Perennial.
Annual Semi-Perennial & Perennial.
Semi-Perennial & Perennial.
Perennial.
Forest (including controlled forests & forest reserves)
Developed land (including existing estates & disturbed mining land)
Note: Reduced & generalised from the original 1:63,360 maps.

Unit 1 Annual and Semi-Perennial: rice, groundnuts, vegetables, tobacco, tapioca, yams, sweet potatoes, pulses, maize, sorghum, grasses, bananas, sugar cane, ramie, papaya, pineapple.

Unit 2 Annual, Semi-Perennial and Perennial: as above and included coffee, cocoa, pepper, citrus, gambier, avocado, oil palm, areca nut, mangosteen, rambutan, coconut, cinnamon, rubber, brazil nuts, tea, cashew nuts, guava, durian, bamboo,

Unit 3 Semi-Perennial and Perennial: grass, bananas, sugar cane, ramie, papaya, pineapple, coffee, cocoa, pepper, citrus, gambier, avocado, oil palm, arecanut, mangosteen, rambutan, coconut, cinnamon, rubber, brazil nuts, tea, cashewnut, guava, durian, bamboo.

Unit 4 Perennial: coffee, cocoa, pepper, citrus, gambier, avocado, oil palm, arecanut, mangosteen, rambutan, coconut, cinnamon, rubber, brazil nut, tea, cashewnut, guava, bamboo.

Unit 5 Forest, including controlled exploitation with regeneration and Forest reserves (or other reserves).

Unit 6 Developed land, including existing estates and disturbed mining land.

On the 1:63,360 Land Use Potential Map of Johor Tengah restrictions have been made for a number of crops. Unit 1, which is located in most river valleys is only suitable for certain grass species, and marginal for all other crops since these tracts of land are liable to frequent flooding and are poorly drained. Certain other restrictions on crop suitability have been imposed due to varying adverse soil properties. It is considered outside the scope of this paper to discuss these limitations at this stage.

APPENDIX B

NOTES ON LAND DEVELOPMENT AND PHYSICAL PLANNING CONCEPTS

IT MUST BE EMPHASISED THAT THIS IS THE FIRST DRAFT CONCEPT PLAN. IT WILL BE SUBJECT TO TESTING, CHANGE, ADAPTATION AND DEVELOPMENT AS FURTHER RESULTS FROM DETAILED STUDIES BY ALL PROJECT GROUPS BECOME AVAILABLE.

1. MAJOR LAND USES - JOHOR TENGAH AREA

1.1 General

The abundant, well distributed and often heavy rainfall, the steep nature of much of the topography, the general poverty of most of the soils, the need to consider water conservation, all impose constraints on agricultural production, placing a premium on land use systems aimed at soil conservation and protection. In arriving at the percentages of land in the various potential land use units (Appendix A) this need for soil conservation has been kept constantly in mind, and the following criteria have been specifically applied:-

1) Annual crops should not be grown outside slopes 0^{o}-6^{o}.
2) Semi-perennial crops such as sugar cane, bananas, ramie, should not be grown on slopes greater than 12^{o}.
3) Perennial agricultural crops should not be grown on slopes of more than 20^{o}.

Thus land above 20^{o} slope must either be left untouched, or in some places, may possibly be used for a carefully controlled forestry programme.

The map shows these steep lands as reserved for possible development as a national park. The expediency, practicability and economic feasibility of combining this concept with a controlled forestry programme will be one of the alternatives to be considered.

SOUTH EAST JOHORE

- MASTER VILLAGES FOR GROUPS OF VILLAGES
- TOWN EXPANSION SCHEMES
- EXISTING ROADS
- PROPOSED ROADS
- MAJOR FOREST RESERVES
- (T) TOURIST DEVELOPMENT AREAS

The illustrated map also shows five possible reservoir areas in the Johor Tengah region which may form part of the water development resources. It is emphasised that these are dam sites which at present look the most promising and the extent of storage required is not yet known.

The main purpose of the storage sites at present envisaged is as follows:

S. Kahang : future water supply for Kluang

S. Pengelli (two sites) : water supply for part of the Project Area

S. Linggiu : Regulation of downstream flows in the Sungei Johor

S. Pelepah : Future water supply to Kota Tinggi

The potential agricultural land is that with an average overall slope of 20^{o} or less, and comprises 69 per cent of the area (Appendix A).

1.2 Agriculture

The plentiful and well distributed rains, together with an average of about 5½ hours sunshine per day, produce excellent conditions for rapid and luxuriant vegetative growth. Grass, root crops and many tree crops are well suited to these conditions; grain crops less so, though satisfactory yields of these too can be obtained if proper attention is paid to the crop calendar and good cultural standards are observed. However, the climatic conditions which favour vegetative growth are also those most favourable for weeds, for the multiplication of many insect pests and for the rapid development of numerous fungal and bacterial diseases. The excessive rainfall has also endowed the project area with thoroughly leached and nutrient impoverished soils. Thus the agricultural requirements of fertilisers and agricultural chemicals are likely to be higher than in most environments and costs of production will be above average. To compensate for these higher unit costs it will be necessary to concentrate on crops that are likely to give higher than average unit values.

Owing to the past, almost exclusive, attention to rubber and oil palms, little information is available about the commercial feasibility of other activities. There are also great gaps in the technical information needed for developing many of them. Because our terms of reference lay emphasis on the desirability of agricultural diversification we have given considerable thought to the possible enterprises that can or might be expected to flourish and we have divided them into four groups as follows:-

1) Enterprises known to be commercially exploitable immediately and on a large scale. Rubber, oil palms.
2) Enterprises known to be commercially exploitable immediately; market limited. Pineapples, pepper, vegetables, coconuts, pork, poultry, cassava.
3) Enterprises known in the project area and/or showing promise in trials; and with apparently adequate markets. Considered suitable for commercial feasibility testing. Other starchy root crops e.g. sweet potatoes, Chinese yams, for starch and animal feedstuffs. Grass for manufacture into animal feeds, and for conversion through livestock into meat and dairy products. Goat meat production. Fish culture for fresh fish and fishmeal. Sorghum and legum grains, groundnuts, tea, some fruit crops, e.g. guava, papaya, rambutans for canning and fresh markets.
4) Enterprises thought worthy of trial, but requiring research and experimentation before being tested on a commercial scale. Cocoa, coffee, avocado pears, seedless limes, ramie, gambier, derris.

It can be seen that rubber and oil palms are the only two enterprises for which all the conditions required for immediate, large scale commercial exploitation are considered to be adequately met. For these two enterprises only can immediate and rapid expansion be confidently and unreservedly recommended. In order to ensure that suitable land for alternative enterprises will be available later if and when

their commerical feasibility is proved, it is now recommended that immediate expansion of oil palms and rubber should be confined to lands with an average overall slope between 6° and 20°. Most of these lands lie in reasonably close proximity to the existing developed estates or are easily accessible from the skeleton road system shown on the map.

It has been assumed that in this system the main road crossing the Sayong river and proceeding north-west will be started at its southern end and that the land with slopes 6°-20° will be developed as the road advances. Thus this category of land in the southern part of Johor Tengah is at present envisaged as being planted with oil palms wherever possible and alternatively with rubber.

At the same time provision is made for the early establishment of an enterprise research and experiment station and for two enterprises to test the commercial feasibility of growing annual crops. One of these enterprises should have as its main purpose the study of the social and organisational problems likely to arise in integrating settlements composed of annual and perennial crop units. East of Kluang, alongside the road to Mersing and accessible from it, an area of land eminently suited for grassland production has been earmarked for a commercial feasibility trial on dairying, which should also be established at once.

The enterprise pattern that will ultimately emerge will depend on the results of the experimental work and commercial feasibility trials. Assuming that some of the possible enterprises will be shown in time to be technically and commercially feasible, the map shows a progressively more diversified pattern as the development proceeds northwards.

2. REGIONAL ROADS

2.1 The criteria for designing a regional communication system were:-

i) A wide area of developable land to be opened up on either side of new regional roads.

ii) Direct linkages into the existing and probable future Federal Road Network to allow immediate access of produce to export points and markets.

iii) A system that could be phased to allow staged agricultural development.

iv) A system which routed traffic away from areas of urban growth and possible congestion.

v) Ease, speed, and economy of construction in relation to topography, geology, and soil characteristics.

After testing a number of networks in each region, our initial conclusions based on information available at present only are:-

2.2 Johor Tengah

The extension of the Kulai FLDA regional road north-westwards, crossing the Sungei Sayong, running to the east and north of the Sungei Pengelli, through to join

i) a new link from the existing Kluang/Mersing road near Kampong Gajah to the existing Simpang Rengam/Rengam Kluang road near Rengam and

ii) a link off the latter to a possible hill station development on Gunong Blumut.

These routes, the existing state, federal, and private road systems in and around this region, and new secondary roads to be developed would allow access to all potential agricultural development areas in these regions.

2.3 Tanjong Penggerang

The soil surveys for this area are not yet complete, and therefore the proposals put forward at this stage are even more tentative.

The continuance of the FLDA route Tanjong Penggerang highway southwards to meet the existing road at the southern

end of the peninsula, near Tanjong Ramunia, bridging the head of the Lebam, near the confluence with the Sungei Chemangar and Sungei Chemaran.

A new route running east/west from this road through the area south of the Sungei Lebam and north of the Sungei Bebina to a carferry, for linking across the Sungei Johor to a new road to the port area.

A new road between the east of the Penggerang hills and the swamp area adjacent to the coast, from the Kota Tinggi/ Mersing road 2 miles south of the Jason Bay turnoff to join the Penggerang highway $\frac{3}{4}$ miles north of the Lebam.

A tourist development road system to serve beach development from Tanjong Balau southwards, with links to the Penggerang highway.

3. URBAN GROWTH AND INDUSTRIALISATION

Although Johor Baharu is outside the project areas, the extent and form of its growth and development, will have a major influence on their development. Johor Baharu is a growth centre. It appears to be extending itself in a linear form along Route 1 (Tampoi-Scudai) and land to the east of Johor Baharu to the Sungei Tebrau is now largely developed.

This growth is progressively overloading both the southern end of the national communication systems and the town's roads.

The proposals for further industrial development, port facilities, possibly expanding into a new major port, airstrip, and Tebrau barrage, and the inter-relation between the town and Singapore, mean that a bold and imaginative plan for the development of Johor Baharu over the next thirty years is called for urgently.

As a part of our concept plan we have in diagrammatic form illustrated the sort of pattern of growth we would expect.

Kluang, with good access to Route 1 and on the railway, appears to be an expanding town, and a number of industrial developments around it have taken place in recent years. Smaller scale but similar growth is apparent at various points along Route 1, particularly around Kulai.

Our preliminary ideas are that further industrial and urban growth may be located at Kulai and Kluang and the plan shows diagrammatically how these settlements could be extended in the regional development context.

A major question is the future of Kota Tinggi. Our surveys indicate net outward population migration. However the produce from South East Pahang from the future development of Mersing-Jemaluang and Tanjong Penggerang will probably result in a growth of its service function. This combined with the flooding problem has led us to indicate diagrammatically an extension area to the existing town.

In our initial pattern of village development, we have indicated a master village for each group of villages. The master villages would have a concentration of industrial, social, commercial and transportation functions, and might at future date expand their industrial activities sufficiently to become expanding towns.

4. TOWN AND VILLAGE DEVELOPMENT PATTERN

Possible variations and combinations in topography, soil suitability, scale and type of enterprise, and timing, together with the need for further town and traffic planning analysis, and for testing by the socio-economic divisions, make the proposals put forward at this time extremely tentative.

However from testing various size village catchment areas from 4 to 16 square miles with various assumptions about acres per worker, workers per family, average family size and age structures, we concluded in general:-

4.1 A master village near the regional road system for each group of villages was required - industrial location and employment, provision of services - markets, shopping, education, recreation. No village should be further than 7 miles from such a centre.

The average total area served by each village for all purposes should be approximately 9 square miles, but this could vary by up to 20 per cent in either direction depending on locally opportunities or constraints.

A village of this size could support a good primary school, have a reasonable range of social and commercial facilities, and provide good access for work in the agricultural area around it.

The population of such a village would be about 3000 assuming 15 per cent non agricultural development land, 10 acres per worker, 1 worker per family and 6 persons per family. The population would be about 2000 assuming 1.5 workers per family, i.e. 15 acres per family.

5. TOURISM AND RECREATION

The potential market for tourism will be investigated to test the viability of three major possible projects, and to identify the appropriate form, scale and timing of their development.

5.1 Coastal Resort on the China Sea Coast, (from Tanjong Balau to Tanjong Punggai). A resort here would have:

i) Twelve miles of clean extensive white sand beaches, even at high tide, clear water, developable land behind the beaches.

ii) Beach capacity at European and Caribbean standards = 85,000 people.

iii) Suitable sites for hotels - casino complexes, weekend houses, parks, golf courses; hunting, fishing and other sporting activities; forest reserve inland. Swimming and water sport potential excellent.

iv) Water supply from a protected catchment on the Sungei Lebam.

If developed to allow for 40,000 tourists maximum at any point in time, at least 20,000 jobs would be created and a town of possibly over 100,000 people based on the tourist development complex might be needed.

Car access from Johor Baharu or Singapore would be either by road via Kota Tinggi, or much quicker, (1½-2 hours from Singapore), by road and new car ferry across the Sungei Johor. Alternatively the existing passenger ferry from Changi to Penggerang may be used.

5.2 Gunong Blumut Hill Station and Golf Course

The development of a hill station complex along a ridge 2250 feet to 2500 'OD 1 mile east of the peak, with a possible golf course site, alongside the road leading to the complex between 1000 feet and 1200 feet. This could be within 1½-2 hours drive of the causeway.

5.3 Lombong Waterfalls, Parkland and Lakeside Development

A possible dam site to supply water to the Kota Tinggi area is at Lombong, above the waterfalls, near to existing PWD intake. This could create a lake at the head of the waterfalls, which could be approached from Lombong by a new road round the hills. Water sports, adequate car parking facilities, a golf course site, and walks through a forest reserve to the peak of Gunong Muntahak (2080 feet) would be possible.

With the further development of restaurants, an hotel and chalets, the Lombong waterfall area could thus be extended to make a large tourist recreational development in an attractive waterside parkland.

6. PHASING

6.1 Agricultural Land Development

The two major factors affecting the timing of agricultural development are:

i) Economic evaluation and resource availability.
ii) Access to suitable land.

6.2 Johor Tengah

The main area of agricultural land to be developed should be opened up by building the main Tengah highway northwards from the Kulai complex, across a new bridge over the Sungei Sayong.

A new bridge across the Sungei Johor to the area to the north east of the existing FLDA Kulai complex, would allow the early development of an area mainly suitable for perennial crops. This indeed could be the first area to be developed.

6.3 Tanjong Penggerang

As the soil survey for this area is still to be completed, and the decision to extend the Penggerang highway from the existing FLDA road to the southern end of the peninsula at an early date has already been made, and as the work on tourism has to go much further, we would not at present postulate a phasing plan for the road pattern.

6.4 Phased Village Development

The phased construction of the villages would have certain advantages.

i) It would allow for the natural growth of the village.
ii) It would give a more balanced population structure in relation to the provision of social services, etc.
iii) It would allow for a more flexible reaction to opportunities for diversification.

The disadvantages would be:-

i) Full use of investment in basic infrastructure and of land would not be made at the earliest possible time.

ii) The initial village would not at an early date be able to support the full range of services etc., its residents would like, and at a later date be able, to support.

We will therefore study how through time various combinations and sequences of agricultural and other activities can yield a satisfactory compromise and balance between the advantages and disadvantages outlined above.

7. IMPLEMENTATION

In producing this concept plan, and considering the various elements within it, we have tried to relate the constraints of land suitability and likely available development resources as closely as possible to what we anticipate will be the needs of those likely to become residents of the two regions.

The concept plan is not orientated to any particular type of development authority. The aim is that it should be flexible enough to be capable of implementation by any or all of the various existing or other new development agencies.

8. SOCIO-ECONOMIC CONSIDERATIONS

8.1 The ideas outlined above on land development and physical planning have yet to be subjected to economic evaluation and considered in the light of the sociological findings and explorations of alternative organisations. These ideas are now being worked out in detailed papers on each possible agricultural activity (each "enterprise"), organised in various ways, in order that this economic and social evaluation can proceed.

As these papers appear and each enterprise is evaluated separately, the work of combining these enterprises into "alternative strategies", with various sequences, phasing and organisations, can go ahead in concrete terms.

This flexibility can be a common characteristic of all strategies at this stage, but this may need to be revised or qualified when further implications have been worked out.

The second characteristic common to all strategies, at this stage, is the objective of maximising (within constraints) the Net Present Value (at "social values" of resources) of production in the project areas themselves and in closely linked production (processing of inputs and outputs) outside.

Among the "social values" of resources a "shadow wage" will be used - reflecting the present and prospective serious unemployment of unskilled labour. The constraints will include supply and demand constraints and constraints implied by the objectives of the New Economic Policy and other policy objectives and preferences.

Even if the pattern of crops and other activities were virtually dictated by physical and technical considerations, alternative strategies could be formulated which would differ in rate of development, sequence, organisation (including public/private sector proportions), costs in terms of resources and in terms of public finance, and in the main output characteristics - incomes and income distribution, employment and its distribution, and the timing of these outputs.

The strategies for the project areas could also differ in the extent to which they include development of industry in the project areas themselves.

8.2 Industrial development

This can be considered in four classes:

1. Processing of primary products of the project areas is likely to be the most important in terms of output, employment creation and capital employed.
2. Industries primarily serving markets in the project areas.
3. Further processing of crops beyond the stage to which production is carried at present.
4. Other industries primarily serving markets outside the project areas.

To date, we have paid most attention to the first group of industries.

Assessment of the industries in group 2 must wait until the possible patterns of primary activities in the project areas become clearer.

On class 3 - further processing - our present view is that more resources than is the case at present should be devoted to developing further processing of primary products in Malaysia. But the specific location of this class of industry is for wider consideration than in the context of the areas of the South East Johor Project alone. The same applies to class 4 - industry serving markets outside the project area.

There is, at present, a strong tendency for industry to move to urban areas and this is encouraged by certain present Government policies (e.g. by the location of industrial estates in Johor). So long as this concentration of industry in or near to urban areas continues to be favoured by industrialists and acceptable to Government, industries in classes 3 and 4 are unlikely to move to the South East Johor Project areas (with the possible exception of Kluang). The development and location of these industries should be considered in the context of the national economy, or of the State of Johor as a whole, and therefore depend primarily on the plans of the Federal and State Government agencies concerned.

This is one example of differences between planning the development of areas of currently undeveloped and unpopulated land and planning for a region, state or country with an already settled population, partially unemployed. The reasons for promoting industrial development in the latter do not apply in the former, particularly when the areas have no compelling advantages for industrial production.

8.2 Organisations

For convenience, three levels of organisation affecting the development of the Project areas may be distinguished:-

1. The organisation of overall responsibility for and authority (with command of finance) over the new land development programme in West Malaysia, including South East Johor, at the level of Federal Government, or in specific Ministries, in relationship with State Governments.
2. The organisation of planning and control of development and production, within the present geographical boundaries of the South East Johor Project areas, and of linked production and other associated activities outside these present geographical boundaries.
3. Selection of agencies for implementation and the organisation of individual "enterprises" - settlement schemes of various kinds, sponsored, assisted or wholly managed by Government agencies, public sector estates, private sector estates, independent smallholders etc.

These three levels are interdependent.

The selection of implementing agencies and organisation of individual enterprises (3) depends largely on evidence of differences in production, economic and social characteristics. Some of the potential agricultural activities have substantial economics of scale; others may have, once commercial feasibility has been tested. Some can be organised to give either high output and low employment or high employment but lower output. Some lend themselves to the creation of organisations which offer careers with promotion prospects and a gradually developing range of skilled jobs at various levels. The preference for flexible organisations, able to respond to changing conditions and to move to higher net output and incomes as technical knowledge advances and the skills of

the labour supply are developed, has already been mentioned. But identification of the real choices to be made awaits specific quantitative information about the activities.

One choice, which depends partly on that information, is the choice of proportions of private sector, public sector and joint public/private participation.

The design of organisations for planning and control of development of the areas and of later production depends in part on the choices of implementing agencies, and particularly on the public/private division. At one extreme it is possible to envisage the development of the project areas as being undertaken by an assortment of agencies no different from those which have undertaken development in Johor in the past 15 years. In that case attention would be concentrated on measures to strengthen the organisations for planning and control of development in the State of Johor as a whole, with benefits spread over the larger areas of the state. At the other end of the range is the establishment of special machinery for planning and control and implementation in the project areas alone. Choices lie within this range; but all require some strengthening of planning and control of development at the State level, since developments within the project areas depend heavily on other developments and services provided from outside.

APPENDIX C

INTERIM REPORT
AN INVESTIGATION OF A LIMESTONE DEPOSIT - GUNONG SUMALAYANG SOUTH EAST JOHOR

1. INTRODUCTION

In common with most soils in Malaysia those in South-east Johor are acidic in nature. Before these soils can be used to successfully produce possible diversification crops, this acidity must be reduced. The most common agent for this purpose is limestone, applied to the soil in a powdered form. Supplies of lime are currently available from Kuala Lumpur however an occurrence of suitable limestone has been investigated close to the Project area. Development of this deposit would influence the feasibility of diversification and it is recommended that a more detailed investigation of this deposit be made.

2. THE REQUIREMENT FOR AGRICULTURAL LIME

Soils in the humid tropics are normally highly acid and those in South East Johor are no exception. The average pH's of soils in the area range from 4.4 to 5.0. The effect of these conditions on agricultural crop production varies from crop to crop. The major reason for adverse effects of low pH on some crops is that they do not efficiently take up other required nutrients from the soil in such conditions and growth is therefore stunted.

A number of crop failures in maize and sorghum trials have been reported by the Federal Experiment Station (FES) because of low pH levels. Responses to applications of lime have been shown both by FES[1] and Rubber Research Institute (RRI)[2] in a series of trials on maize, sorghum, groundnuts and soyabeans, and both these bodies recommend use of lime for these crops. One maize trial carried out by the RRI[2] gave the following results:-

Treatment	Yield lb/ac.	Additional lb/ac.	Crop Value ($)	Cost of Additional Lime $35/ton	$60/ton
5 cwt Mg lime	1908				
10 cwt "	2504	596	57.50	8.75	15.00
15 cwt "	2806	302	26.09	8.75	15.00
20 cwt "	3027	221	19.09	8.75	15.00

In addition 2 cwt double superphosphate, 2 cwt urea and ¾ cwt muriate of potash were applied.

The precise amount of lime indicated as optimal in trials varied somewhat according to initial soil conditions. In general, however, the major diversification crops have been found to require soil pH in the following ranges for satisfactory growth:-

Crop	pH range for satisfactory crop growth
Rubber	4.5-6.0
Oil Palm	5.0-6.5
Maize	5.5-7.5
Sorghum	5.5-7.5
Soyabeans	6.0-7.0
Groundnuts	6.5-7.5
Sweet Potato	5.5-7.5
Tapioca	6.0-7.5

In order therefore for a range of short-term crops to be grown it is advisable for the pH of the soil to be raised to a level in the region of 5.5-6.5. The most common method of doing this is by application of limestone. The quantities required for this purpose vary depending upon the structure of the soil, but for soils typical of the South East Johor Area, with initial pH's of about 4.7, a first application of 2-3 tons of lime per acre would be required. This would have to be supplemented by periodic further additions of lime averaging one-third to a half of the initial dressing per year, i.e. about one ton per year.

3. AVAILABILITY OF LIMESTONE

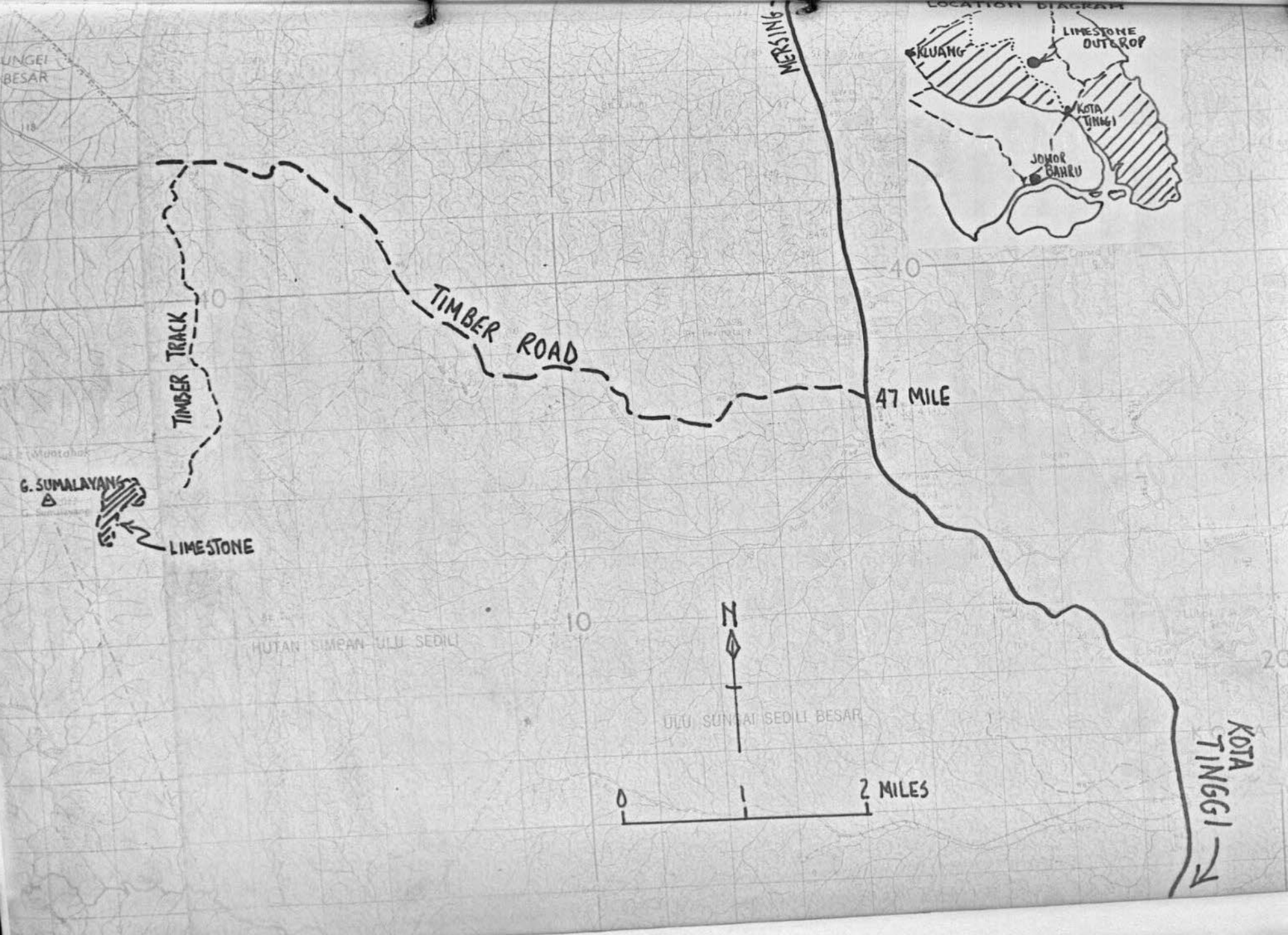
At the present time the nearest available source of supply to Johor is the Kuala Lumpur area and lime supplied to Johor would cost about $50 per ton, transportation accounting for 40% of the cost. At this price level, liming can amount to up to 20 percent of the cost of establishing the crops mentioned above. Any reduction in the cost of lime would obviously be an important factor in increasing the feasibility of diversifying away from oil palm and rubber in the South Johor Area.

The nearest known occurrence of limestone lies approximately 2 miles outside the Project area, 17 miles north east of Kota Tinggi, on the eastern slopes of Gunong Sumalayang. This occurrence was discovered in 1966 and is described by Rajah in the memoir (1969 - unpublished), which accompanies the one inch to one mile Geological Survey map of the area (Sheet No. 125). A preliminary reconnaissance of the limestone area was made by the Consultants geologist on May 26th, and as a result of this visit a more detailed investigation was made on the 4th, 5th and 6th of June.

4. ACCESS AND TOPOGRAPHY

Access is by means of a good timber road west from its junction with the Kota Tinggi - Mersing road at the 47th mile post Figure 1. Approximately 7 miles west of the junction the timber road crosses the forest reserve boundary. From this point an old timber track proceeds southwards for 2½ miles to the Sungei Sedili. Access from here to the limestone area is by traversing 1 to 2 miles upstream in the Sungei Sedili and its tributaries. Numerous badly overgrown timber tracks exist in the area and are shown in the accompanying map Figure 2.

The area investigated is situated on the eastern slope of Gunong Sumalayang (2017 feet), the average gradient of which is 1 in 5. The area is deeply dissected by tributaries flowing east-southeast or southeast into the Sungei Sedili, which in this area flows northeastwards.


LOCATION DIAGRAM
LIMESTONE OUTCROP
KLUANG
KOTA TINGGI
JOHOR BAHRU
MERSING
TIMBER ROAD
TIMBER TRACK
47 MILE
G. SUMALAYANG
LIMESTONE
HUTAN SIMPAN ULU SEDILI
ULU SUNGAI SEDILI BESAR
N
0
1
2 MILES
KOTA TINGGI

5. GEOLOGY

Figure 2 has been specially prepared from aerial photographs since the existing topographic maps are completely inadequate for detailed geological mapping. The map also shows the geological succession and rock types in the area studied. Two hypothetical sections have been drawn to show the geological structure of the area, (Figs. 3 and 4).

The oldest rocks in the area make up the Dohol Formation which includes the Sumalayang Limestone Member. Below the limestone the Dohol Formation consists of mainly argillaceous (muddy) sediments which show varying degrees of alteration due to regional metamorphism (a process under which rocks are subjected to pressure and/or heat). As one moves upwards towards the limestone the argillaceous rocks become progressively more calcareous, reflecting a progressive change to limestone conditions at the time of deposition. This same trend is demonstrated in the Sumalayang Limestone itself, which at its base (towards the eastern end of the outcrop), tends to be black due to contamination by muddy and carbonaceous sediment. Higher up the limestone gradually becomes more pure.

The Dohol Formation above the limestone is probably in general similar to that below, although we consider that immediately above the limestone it tends to be arenaceous (sandy).

Overlying the Dohol Formation are two other rock formations, in ascending order these are the Sedili Volcanics and the Panti (Tebak) Sandstone. According to Rajah, each is separated from the formation which preceeds it by an unconformity (i.e. a gap or discontinuity in deposition). Neither the Panti Sandstone nor the Sedili Volcanics were examined in detail in the field, though both are recogniseable on the aerial photographs. In addition numerous boulders of Panti Sandstone and Sedili Volcanics were seen in stream beds and on slopes in the area. The entire area is more or

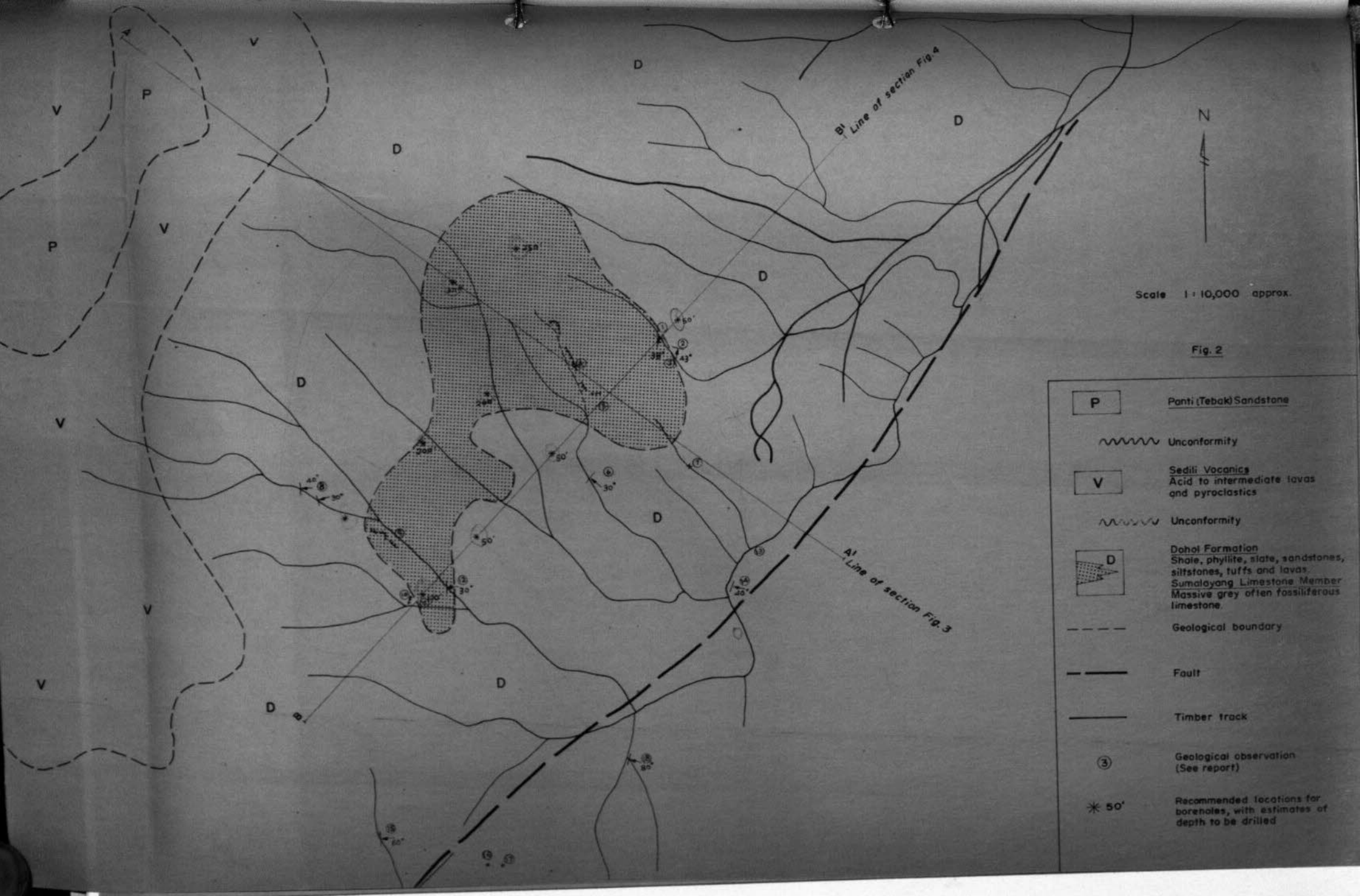
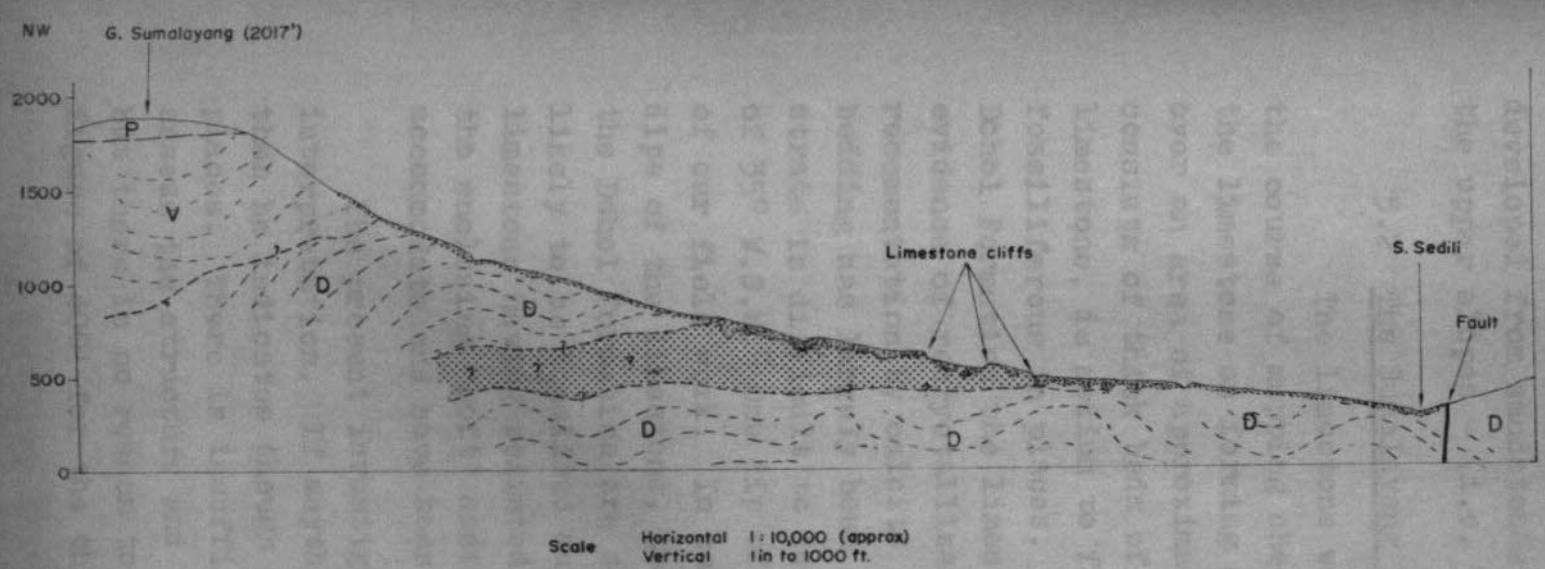
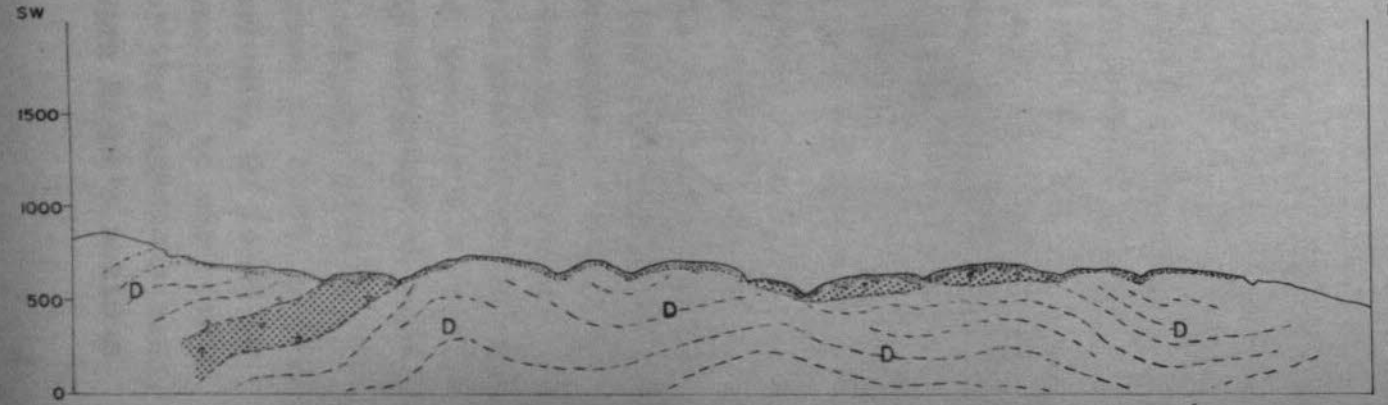

B
Line of section Fig.4
A'
Line of section Fig.3
N
Scale 1 : 10,000 approx.
Fig. 2
P
Panti (Tebak) Sandstone
Unconformity
V
Sedili Vocanics
Acid to intermediate lavas and pyroclastics
Unconformity
D
Dohol Formation
Shale, phyllite, slate, sandstones, siltstones, tuffs and lavas.
Sumalayang Limestone Member
Massive grey often fossiliferous limestone.
Geological boundary
Fault
Timber track
③
Geological observation
(See report)
50'
Recommended locations for boreholes, with estimates of depth to be drilled

Fig. 3



Scale Horizontal 1 : 10,000 (approx)
Vertical 1 in to 1000 ft.

Fig. 4



LEGEND

- Colluvial Material (Boulders of Panti Sandstone and Sedili Volcanics)
- P — Panti (Tebak) Sandstone
- V — Sedili Volcanics
- D — Dohol Formation with Sumalayang Limestone Member

less covered with thick vegetation and soil cover. The soils do not have the characteristic dark red colour of limestone soils and it is considered that they have been developed from sandstones and volcanics which occur on the upper slopes - (i.e. the soils are colluvial).

5.2 The Sumalayang Limestone

The limestone was discovered by Rajah in 1966 in the course of mapping sheet 125. In his memoir he describes the limestone as forming sporadic isolated crags and scars over an area of approximately one quarter square mile. It consists of thick beds of massive pale grey to black limestone, is medium to fine grained and is highly fossiliferous in places. In common with the rest of the Dohol Formation the limestone has been metamorphosed; evidence of recrystallization, brecciation and subsequent recementation by calcite is commonly found. The original bedding has largely been obliterated and the dip of the strata is difficult to determine, Rajah's records show dips of 35° W.S.W. One dip of 43° NNE was recorded in the course of our field work. In contrast to the seemingly regular dips of the limestone, those of the enclosing sediments of the Dohol Formation are steep and irregular. These are likely to be localised and could be due to the harder limestone having resisted folding to a greater extent than the enclosing 'soft' sediments, which have been forced to accommodate and have been more highly contorted as a result.

The present investigation substantiates Rajah's interpretation. If anything the outcrop is slightly longer than he indicates though somewhat narrower, at least in places. There is insufficient information to accurately assess the structure and thickness of the limestone mass, but there is no reason to disagree with Rajah's maximum figure of 400' for the thickness.

(2) Grey argillites - dip 43° N.N.E.

(3) Boulder of grey limestone. Abundant tufa deposits occur in stream bed.

(4) Limestone crags adjacent to old river bed - total estimated limestone thickness 110 feet.

(5) Limestone outcrop near but above present stream.

(6) Limestone occurrence seen by Rajah but not now visible.

(7) Limestone boulders in stream.

(8) Argillites dip west.

(9) Limestone crags outcrop for 100 yards - total estimated height 100 feet.

(10) Outcrop of coarse sandstone - height 10 feet. Probably overlies limestone.

(11) Limestone outcrop.

(12) Grey limestone outcrop dips 30° west - height 20 feet.

(13) Tufa deposit at confluence of stream and Sungei Sedili.

(14) Calcareous argillites dipping 40° W.N.W.

(15) Dark Grey chloritic slate dips 60° W.

(16) Metaquartzite.

(17) Grey limestone.

(18) Grey lithic arenite dips 80° W.

6. OUTLINE FEASIBILITY

As the preceding description has indicated it is not possible without further exploration, to estimate the extent of the limestone deposit, the amount of overburden to be removed and the preliminary work necessary to establish a satisfactory working face before extraction could begin. Any estimate of production costs at this stage must be viewed as extremely tentative.

(a) Access to Site. Access to the quarry would probably require expenditures on road works of the following order:-

(a) Improvements to timber road, 7 miles at $40,000 per mile = $280,000

(b) Construction and/or improvement of 4 miles of gravel road to quarry at $50,000 per mile = $200,000

Total = $480,000.

(b) Production of crushed limestone.

Contract charges in similar conditions indicate that extraction costs would be of the following order:-

Removal of overburden	=	$1.00 per ton lime
Blasting	=	$1.50 per ton lime
Transport to crusher	=	$1.25
Crushing	=	$6.00
Total	=	$9.75

Initial site works of the order of $200,000 might be necessary to create a working face before large scale extraction could begin.

Assuming bagging and storage costs of $10 per ton and road transport charges of 15 cents per ton-mile delivered, prices for bagged limestone from the Johor deposit would be approximately those shown in the table below. These are compared with estimated prices for similar supplies from Kuala Lumpur.

Delivered to:	Johor ($ per ton)	Kuala Lumpur ($ per ton)
Penggerang	30	60
Johor Bahru	35	50
Pontian	40	55
Tengah	35	55

The actual quantity of limestone demanded in South Johor will depend upon the type of cropping pattern adopted in the area. About 150,000 acres in the South East Johor project area appear suitable for annual or semi-perennial crops which are likely to require about 1 ton of lime per acre of crop per year. This alone could create a demand for 150,000 tons per year by about 1985. Demands from other potential and existing agricultural and industrial users in South Johor could well amount to an additional 50,000 tons. Assuming a saving of $20 per ton over supply from elsewhere in Malaysia these demands would imply an annual saving by 1985 of about $4,000,000 per annum.

7. CONCLUSIONS AND RECOMMENDATIONS

The preliminary investigations show that the Sumalayang Limestone can be made accessible for quarrying at low cost. The investigations also confirm that the limestone is suitable for agricultural purposes and that the demand for agricultural quality lime in Johor is likely to increase. An initial cost analysis indicates that obtaining this limestone supply locally could result in an annual saving of $3 - 4,000,000 by 1985.

A complete assessment of the economic worth of developing a quarry would require a more detailed investigation to assess the size and nature of the deposit and the amount of overburden involved. Such an investigation would necessitate drilling which should be supervised by an experienced geologist. An investigation of this nature would be outside the Scope of Work of the present project but if the possibility of diversification crops is to be properly considered in the Master Plan it will be essential to have a clear estimate of the production costs and quantity of this limestone before the draft report stage. This means that the limestone investigation is a high priority project.

It is, therefore, recommended that a detailed investigation by drilling be put in hand as soon as possible, preferably whilst the consultants geologist is with the project to supervise the work and to make the assessment.

The map (figure 2) shows a preliminary pattern of holes which should be modified for depth and location by the geologist as the drilling proceeds. It is estimated that some 1600 feet of drilling will be required, to evaluate the deposit.

ACKNOWLEDGEMENTS

We would like to acknowledge Enche Fateh Chand, Senior Geologist of the Malaysian Geological Survey, who collaborated in the field work and writing of this report. Also Enche Amran bin Nali, Junior Geological Assistant, without whose help the field work would have been more protracted.

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APPENDIX D

DAM CONSTRUCTION IN THE LINGGIU VALLEY - MINING IMPLICATIONS

1. INTRODUCTION

The purpose of this paper is to describe the geology of the Linggiu Valley area, to outline its mineral potential and to make recommendations for the timing of prospecting and mining in the event of a water storage reservoir being constructed which would flood possible mining land. It must be stressed that at this stage no definite plans for dam construction exist.

A map has been included which shows the geology of the area and has been taken from the geological map (sheet No. 125) produced by S.S. Rajah of the Malaysian Geological Survey. Current mining, results of panned mineral concentrates and other data are from a variety of sources.

2. GEOLOGY

2.1 Drainage - The area is drained by the Sungei Linggiu which with its tributaries (Sentroh, Tebak and Tempenis) flows east-southeast then south across the area.

2.2 Rock Types and Geologic History - The rock types are shown in chronological order on the enclosed map. The oldest rocks in the area, make up part of the Dohol Formation and are of Middle Permian age. They consist of a mixture of volcanic rocks and sediments which have been laid down in a marine environment. The volcanics are lavas and pyroclastics (rock debris of varying particle size ejected from volcanoes). The sediments range from fine grained shales, mudstones and siltstones to coarser grained sandstones, grits and metaquartzites. The sediments are thought to have been deposited in fairly deep

POSSIBLE S. LINGGIU DAM SITE
CATCHMENT AREA AND GEOLOGY

N

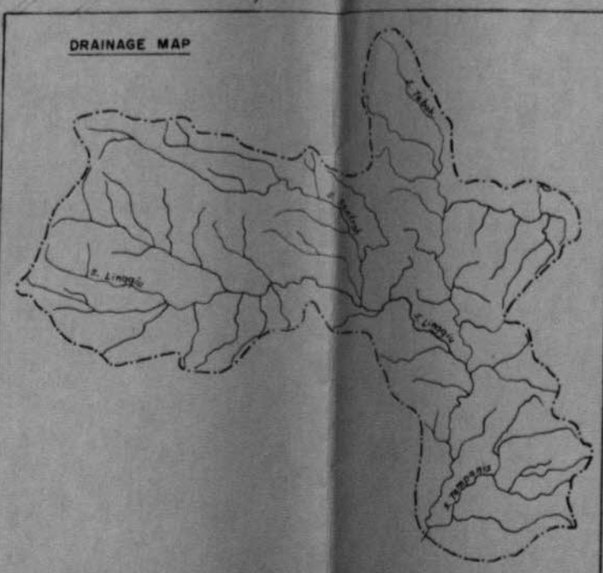
SCALE ONE INCH TO A MILE
OR 1:63,360

Gr P L V D

LEGEND

RECENT	River & Swamp Alluvium, Colluvium — sand, silt, clay & gravel	
LOWER CRETACEOUS	Panti (Tebak) Sandstone, massive crossbedded sandstone, greenish grey and maroon mudstone and grit intercalations	P
UPPER PERMIAN	Granite	Gr
UPPER PERMIAN	a) Sedili Volcanic Formation — acid to intermediate tuffs and lavas b) Linggiu Formation — Sandstones, siltstones, conglomerates, shales, tuffs and lavas	a V, b L
MIDDLE PERMIAN	Dahol Formation — Shales, phyllites, slates, micaceous siltstones, sandstone, grit, metaquartzites, tuffs and lavas	D
METAMORPHIC ROCKS	Contact zones around granite	
Geological boundary		
Fault		
High tin value — from panned heavy mineral concentrates (>0·15 k.p.c.y. or >5% tin in concentrates weighing more than 1 gram)		*
High tin value — from boreholes of private prospectors (values >0·25 k.p.c.y.)		•
Tin mining areas — leases or certificates		
Prospected areas		
Dam site		
Dam catchment		
Approximate limit of impounded water		

DRAINAGE MAP



water, in a geosyncline, (a basin of deposition of usually elongate form caused by a downwarping of the earth's crust). Characteristically geosynclines show the deposition of a great thickness and variety of material in a basin which is continually sinking over a very long period of time.

At a later stage, the sediments deposited in the geosyncline were highly folded, and due to the accompanying pressure and/or heat, were metamorphosed. Rocks which were originally shales and sandstones became phyllites and quartzites etc. Temporary elevation of these rocks above the surface of the sea allowed erosion to take place, and has resulted in a gap in the sedimentary sequence relative to the overlying rocks.

The Dohol Formation is overlain by sandstones, siltstones, conglomerates, shales tuffs and lavas of the Linggiu Formation, which are in turn are overlain, at least in part, by pyroclastics and lavas of the Sedili Volcanic Formation. The two formations are thought to be Upper Permian in age, and represent a return to conditions of sedimentation in the geosyncline; this time in a largely shallow water, probably near shore environment.

The next stage in the geological history is marked by the intrusion of large masses of granite. These were emplaced in molten form at considerable depth beneath the older rocks. Also at this time the older rocks were subjected to further earth movements with folding, faulting and uplift of the rock mass leading to further period of erosion, and the development of another unconformity, this time relative to the overlying Lower Cretaceous Panti (Tebak) Sandstone Formation.

The Panti rocks are characteristically massive, cross-bedded sandstones, with occasional beds of maroon or greenish-grey mudstone.. The sediments closely resemble those laid down in present day lake, river and delta environments.

The youngest rocks in the area are the gravels, sands, silts and clays which made up the recent river and swamp alluvia. It is these rocks which have up to the present been the most important from an economic stand point.

Rocks intermediate in age between Cretaceous and Recent occur near the area under discussion.

3. ECONOMIC GEOLOGY

3.1 Mineralization

In common with much of Malaysia, the dominant mineral deposits in the area are of terite in Recent river alluvium The cassiterite has been derived from an igneous granite like parent material. The classical conception of mineral genesis in these circumstances, is that from an original molten mass, the main rock forming minerals crystallise out to form the bulk of the granite. The rock forming minerals are the more obvious light and dark crystals (quartz, felspar, mica etc.), which are readily visible in granites. When the great part of the molten rock has solidified, a residual liquor remains which is essentially a hot aqueous solution often charged with gases, and containing a wide variety of metallic and non-metallic elements. In general terms these elements have a large ion size and will not fit readily into the crystal structure of the rock forming minerals. They, therefore, tend to be concentrated in the residuum. Emplacement of granites tends to be associated with periods of instability in the earth's crust and this together with contraction due to cooling tends to shatter the rocks into which the granite was intruded. It is into the cracks and fissures so developed, that the residual liquors are injected and later crystallise to give valuable mineral deposits. Normally it is the outer zone of the granite mass (the hood) and the zone of altered country rocks, (the contact zone), adjacent to the granite which carry the most valuable mineral deposits. The junctions between granite and the rocks into which they were intruded are called contact zones. They are usually characterised by country rocks which have been altered by heat and/or the introduction of minerals from the granite mass.

The positive correlation between contact zones and mineralization is well demonstrated in the southeast of the area. Tin mining here is directly related to the minerals in alluvium transported westward from the contact zone , by the westerly flowing tributaries of the S. Tempenis.

Inevitably detailed study of individual occurrences, reveals processes and deposits which are much more diverse and complex than those outlined above. However, the forgoing picture is sufficiently accurate for the purposes of the present discussion.

3.2 Mining

Deposits resulting from the type of mineralization described above can be lode mined (the extraction of minerals from the solid rock), provided the mineral veins or disseminations are not too thinly dispersed. When minerals are sparsely distributed, the amount of rock which has to be removed, crushed and beneficiated to produce a saleable commodity is too large for the mining operation to run at a profit. The situation is not static, but in general, lode mines tend to be more subject to the vagaries of world mineral prices, than do other types of mines.

Although extremely rich veins, which have been lode mined, do occur in the West Malaysia (e.g. Klian Intan and Sungei Lembing mines), they tend to be rare. So far as is known, the enormous tin deposits which have been worked in the country by alluvial methods, result almost entirely from lodes, which could not be worked in situ, at least at the present price of tin. Increased demand for tin, the exhaustion of alluvial deposits and new mining methods, could make the working of tin from these low grade lodes, profitable in years to come.

There is no record of any lode mining in the area under discussion, and the chances of revealing any workable lodes of tin, even assuming modern techniques and large capital expenditure are remote at the present time.

Current mining in the area is of cassiterite, by alluvial gravel pump mining methods. The valuable minerals which occur in the river alluvium, have been deposited there after having been "lode mined" and partly "beneficiated" by the natural processes of tropical weathering and erosion.

Cassiterite is being produced by two adjacent mines in the valley of the Sungei Tempenis, (Mining certificate Numbers 715 and 679; Tin Control Numbers 342 and 357). The current combined production of these mines is 82 piculs per month. Total production in 1968 and 1969 was 1097 and 1018 piculs respectively, with a labour force of 20 - 30. There are derelict tin mines southwest (MC767) and northeast (MC668) of the producing mines. It is not known by the Mines Department whether these are worked out, or just uneconomical at the present price of tin. The largest mine, to the southwest, has not been worked for several years. Applications have been made to work ground to the northwest and southeast of the existing mines, no prospecting results have been filed with these applications. The two new areas are not new finds of workable mineral, but represent upstream extensions of the alluvium which is being worked at the present time. It is noteworthy that one of the areas mentioned, that to the northwest, would be under water if the land was flooded to the 100 feet contour mark.

Estimates of the potential of the mining area cannot be made. No estimates of volume of alluvium and total tin content were made at the time of prospecting. Nor is it known how much ground has been worked.

3.3 Past Prospecting and Areas with Economic Mineral Potential

Most of the prospecting which has been done is in the southwest of the area i.e. from some three miles north of the Linggiu-Tempenis confluence southwards. The reasons for this are twofold; firstly, greatest interest for prospectors, always centres round existing mining land; and secondly, that the ground further north is in a Forest or Game Reserve and no prospecting has been allowed in recent years.

Prospecting in the Reserve area has been of a sporadic and most unsatisfactory type. One very large area (3840) was prospected in 1936. Its investigation consisted of six separate traverses at approximately 1 mile intervals running east across the alluvial tracts of the Linggiu and subsidiary drainages. The boreholes in one traverse showed nil to trace values of cassiterite in an area which subsequently become a tin mine. This typifies the prospecting which has been done and shows the inadvisability of attempting to make an assessment based on old records.

Significantly high values of cassiterite 0.25 katis per cubic yard (kpcy) in boreholes of private prospectors; and values greater than 0.15 kpcy or 5 per cent (in samples greater than 1 gram) indicated in samples of heavy mineral concentrates taken by the Geological Survey are shown in Figure 1. The groups of high values in the area south and north east of the Tempenis-Linggiu confluence are interesting. Prospecting in these areas was carried out in 1961 and no further work was done though the prospecting results look very promising.

In the formation of valuable alluvial deposits, the spacial and time relationships between the rocks in an area and the rivers draining them is obviously vitally important. The primary cassiterite deposits (i.e. lode/

deposits) are related to the granites, therefore any rocks deposited after the granite cannot contain primary cassiterite. The Panti Sandstone bears this relationship to the granite, and is itself at least in part, an ancient alluvial deposit. Its constituent sediments result from the weathering and erosion of the older rocks and as might be expected, they contain grains of cassiterite which were removed long ago from mineralized zones similar to those which are being eroded today. The sandstone contains only trace amounts of cassiterite and no economic concentration of this mineral will result from the erosion of the Panti rocks. In other words, any alluvium associated with drainages confined entirely to the Panti Sandstone, will not bear cassiterite in workable amounts. All the tributaries of the Sungei Tebak drain Panti Sandstone and/or Sedili Volcanics. The latter being older than the granite could contain primary cassiterite deposits, but the indications from the work of Rajah (1969 unpublished) are that the granite in this area is at depth, and that no mineralized zones occur within the area of the Tebak drainage system. Although the Geological Survey records a significant value from panned concentrates, in one of the eastern tributaries, we do not regard the river alluvium above point A (fig. 1 drainage map), as of first ranking importance for cassiterite deposits. For the same reasons we regard it as unlikely that any of the tributaries between point A and the Sungei Tempenis (except the upper reaches of the Linggiu itself), will have deposited cassiterite in their alluvial tracts. Therefore, the prospects of finding cassiterite in the lower reaches of the Linggiu are not promising, and any workable cassiterite found there will have been transported from the west of the area by the Linggiu itself. Reasonably intensive prospecting of the alluvium east of the lower reaches of the Linggiu confirms this hypothesis.

The tributaries of the Sentroh (marked B and C on Fig.1., drainage map) are draining Panti Sandstones and will not contain workable cassiterite values. The most northerly tributaries of this river are eroding the southern tip of a contact zone between granite and the Linggiu rocks, and are therefore of prime importance.

According to the geological map, the remaining drainages in the area are on granite, and so far as is known no contact zones exist. The process of mineralization due to granites was explained in general terms above. It is important in generalizing, however, not to regard the granite mass as having a regular domed or hemispherical contact with the enclosing rocks. The contact is extremely irregular and usually shows upward pointing projections of granite (cupolae) and corresponding downward projections (cusps) of country rocks. Subsequent erosion can produce small numerous small isolated outcrops of granite (the tips of cupolae) surrounded by country rocks; or in the case of deeper erosion, patches of country rocks surrounded by granite. In the case of even more extreme erosion all the country rocks and contact zones are removed leaving the outer (hood) mineralized zone of the granite or the granite core itself. Mineralized and eroded contact zones due to granites or similar rocks are notoriously difficult to locate in heavily vegetated country such as the jungles of West Malaysia. It seems certain that the high values of cassiterite found by the Geological Survey in the headwaters of the Linggiu (Location D on the drainage map) are derived from an obscured, possibly small, mineralized zone within the main granite mass. The foregoing evidence underlines the importance of prospecting all alluvium derived from granite areas and not only that related to obvious contact zones.

The evaluation can be further complicated by multiple intrusion. In this case a granite possibly bearing valuable minerals, is intruded into an existing granite

and here the contact and mineralized zones are even difficult to recognise. Here again it is essential to prospect all alluvium which has resulted from the erosion of granites.

Very little is known about alluvial minerals other than cassiterite in the area. The Geological Survey have noted high values of xenotime (an Yttrium phosphate mineral which contains in addition rare earth elements, thorium and uranium) as well as ilemnite source of titanium, Zircon etc. These minerals occur in the heavy mineral concentrates with cassiterite, and are minor constituents of granites, from which they are derived. The heavy mineral concentrate produced as a by-product of tin mining is called amang - it could contain the valuable minerals mentioned above. According to the Mines Department no amang is marketed from this area; it follows that amang dumps exist and these should be prospected.

Nothing is known of any primary mineralization other than cassiterite. Wolframite (tungsten mineral) and more rarely molybdenite and bismuth are often associated with cassiterite. These have not been found in the area under discussion, though flakes of wolframite have been seen in the Linggiu tin field to the south of the area. Molybdenite and bismuthite tend to decompose easily and are not normally found in alluvial deposits.

4. CONCLUSIONS AND RECOMMENDATIONS

Virtually nothing is known about mineralization other than cassiterite. Primary (lode) cassiterite can virtually be neglected at the present time owing to the difficulty of finding economic deposits. Alluvial mining is being carried on at present in the Sungei Tempenis drainage system, the upper reaches are tin bearing and will no doubt be prospected and worked in due course. The tributaries of the Sungei Tebak; the east and west tributaries of the lower reaches of the Sungei Linggiu; and the tributaries

of the Sungei Sentroh (marked B and C on the drainage map) are eroding rocks which either do not carry p imary cassiterite (e.g. Panti Sandstone), or rocks where mineralized zones are unlikely to be found at the surface, due to deep burial of the granite. The remaining tributaries of the Sungei Sentroh are of major importance, particularly the two which are eroding a known contact zone which could be mineralized.

It is impossible to assess the potential of drainages on granite due to the difficulty of identifying remnants of mineralized or contact zones.

If and when it is decided that a water storage reservoir be created, prospecting and any resultant mining should be phased to begin at least five years before construction commences and to be completed during this period. In the light of present information the order of priority for prospected areas should be:-

1) Upper reaches of Sungei Tempenis and its tributaries (this will probably be worked in the next 10 years in any case).

2) The northern tributaries of the Sungei Sentroh (i.e. those in the vicinity of a known contact zone)

3) All drainages on granite

4) Depending on the results of (2) and (3) - the lower reaches of the Sungei Linggiu

5) Any remaining drainages.

The tracts of alluvium in the area are not particularly large, so any widespread destruction of land, such as is seen in the larger tin fields of West Malaysia will not occur. However, in areas of outstanding scenic or agricultural importance, there is no reason why provisions cannot be made for restoring the soil after any mining which takes place. Obviously this will cost money, and

will be one of the economic factors to be taken into account before mining commences.

We recommend that prospecting and mining rights be given to one or two large companies. The present system of allocating small areas to individual companies is not likely to give efficient prospecting or mining. A large company is more likely to employ a trained prospector or geologist who will ensure a uniformity of prospecting and assaying over the area. He would also determine whether any of the other heavy minerals (e.g. ilmenite, xenotime, monazite etc.), are present in workable quantities.

ACKNOWLEDGEMENT

Wewould like to acknowledge the assistance of Enche Fateh Chand, Senior Geologist of the Malaysian Geological Survey, who collaborated in the collection and assessment of the data for this report.

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	PP 78/63
	PP 190/61
	FP 28/68
	PP 60/68
	FP 1/67
	FP 29/67

PLAN OF OPERATION & MONTHLY PROGRESS CHART

SOUTH EAST JOHOR PROJECT