GOVERNMENT OF MALAYSIA

NATIONAL WATER RESOURCES STUDY, MALAYSIA

PERLIS-KEDAH-PULAU PINANG REGIONAL WATER RESOURCES STUDY

PART 1

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GOVERNMENT OF MALAYSIA

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PART 1

VOL. 11
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FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

NATIONAL WATER RESOURCES STUDY, MALAYSIA
PERLIS-KEDAH-PULAU PINANG
REGIONAL WATER RESOURCES STUDY
PART 1

LIST OF VOLUMES

ABBREVIATIONS

(1) Organization/Plan

4MP	:	Fourth Malaysia Plan
DID (JPT)	:	Drainage and Irrigation Department
EPU	:	Economic Planning Unit
FELCRA	:	Federal Land Consolidation and Rehabilitation Authority
FELDA	:	Federal Land Development Authority
GSD	:	Geological Survey Department
JICA	:	Japan International Cooperation Agency
MADA	:	Muda Agricultural Development Authority
NEB (LIN)	:	National Electricity Board
NWRS	:	National Water Resources Study
PWD (JKR)	:	Public Works Department
RISDA	:	Rubber Industry Small-Holders Development Authority
WHO	:	World Health Organization

(2) Others

B	:	Benefit
BOD	:	Biochemical Oxygen Demand
C	:	Cost
COD	:	Chemical Oxygen Demand
D&I	:	Domestic and Industrial
dia.	:	Diameter
EIRR	:	Economic Internal Rate of Return
El.	:	Elevation Above Mean Sea Level
Eq.	:	Equation
Fig.	:	Figure
GDP	:	Gross Domestic Product
GNP	:	Gross National Product
H	:	Height, or Water Head
NHWL	:	Normal High Water Level
O&M	:	Operation and Maintenance
Q	:	Discharge
Ref.	:	Reference
SS	:	Suspended Solid

ABBREVIATIONS OF MEASUREMENT

Length

mm = millimeter
cm = centimeter
m = meter
km = kilometer
ft = foot
yd = yard

Area

cm^2 = square centimeter
m^2 = square meter
ha = hectare
km^2 = square kilometer

Volume

cm^3 = cubic centimeter
l = lit = liter
kl = kiloliter
m^3 = cubic meter
gal. = gallon

Weight

mg = milligram
g = gram
kg = kilogram
ton = metric ton
lb = pound

Time

s = second
min = minute
h = hour
d = day
y = year

Electrical Measures

V = Volt
A = Ampere
Hz = Hertz (cycle)
W = Watt
kW = Kilowatt
MW = Megawatt
GW = Gigawatt

Other Measures

% = percent
PS = horsepower
° = degree
' = minute
" = second
°C = degree in centigrade
10^3 = thousand
10^6 = million
10^9 = billion (milliard)

Derived Measures

m^3/s = cubic meter per second
cusec = cubic feet per second
mgd = million gallon per day
kWh = kilowatt hour
MWh = Megawatt hour
GWh = Gigawatt hour
kWh/y = kilowatt hour per year
kVA = kilovolt ampere
BTU = British thermal unit
psi = pound per square inch

Money

M$ = Malaysian ringgit
US$ = US dollar
¥ = Japanese Yen

CONVERSION FACTORS

	From Metric System	To Metric System
Length	1 cm = 0.394 inch 1 m = 3.28 ft = 1.094 yd 1 km = 0.621 mile	1 inch = 2.54 cm 1 ft = 30.48 cm 1 yd = 91.44 cm 1 mile = 1.609 km
Area	1 cm^2 = 0.155 sq.in 1 m^2 = 10.76 sq.ft 1 ha = 2.471 acres k km^2 = 0.386 sq.mile	1 sq.ft = 0.0929 m^2 1 sq.yd = 0.835 m^2 1 acre = 0.4047 ha 1 sq.mile = 2.59 km^2
Volume	1 cm^3 = 0.0610 cu.in 1 lit = 0.220 gal.(imp.) 1 kl = 6.29 barrels 1 m^3 = 35.3 cu.ft 10^6 m^3 = 811 acre-ft	1 cu.ft = 28.32 lit 1 cu.yd = 0.765 m^3 1 gal.(imp.) = 4.55 lit 1 gal.(US) = 3.79 lit 1 acre-ft = 1,233.5 m^3
Weight	1 g = 0.0353 ounce 1 kg = 2.20 lb 1 ton = 0.984 long ton = 1.102 short ton	1 ounce = 28.35 g 1 lb = 0.4536 kg 1 long ton = 1.016 ton 1 short ton = 0.907 ton
Energy	1 kWh = 3,413 BTU	1 BTU = 0.293 Wh
Temperature	°C = (°F - 32)·5/9	°F = 1.8°C + 32
Derived Measures	1 m^3/s = 35.3 cusec 1 kg/cm^2 = 14.2 psi 1 ton/ha = 891 lb/acre 10^6 m^3 = 810.7 acre-ft 1 m^3/s = 19.0 mgd	1 cusec = 0.0283 m^3/s 1 psi = 0.703 kg/cm^2 1 lb/acre = 1.12 kg/ha 1 acre-ft = 1,233.5 m^3 1 mgd = 0.0526 m^3/s
Local Measures	1 lit = 0.220 gantang 1 kg = 1.65 kati 1 ton = 16.5 pikul	1 gantang = 4.55 lit 1 kati = 0.606 kg 1 pikul = 60.6 kg

ANNEX O

LAND USE IN PROPOSED RESERVOIR AREAS

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SPECIAL ABBREVIATIONS

Bhd.; Brehad: Company

Kg ; Kampong: Village

Pdg ; Padang

Sg ; Sungai: River

WL ; Reservoir maximum water level

1. INTRODUCTION

This ANNEX presents the present and potential land use in the proposed reservoir area, and estimate of financial and economic costs expected by creating the proposed reservoirs, based on a survey which was carried out between January 21 and February 28, 1983.

2. PRESENT AND POTENTIAL LAND USE

2.1 The Badak-Temin Reservoir Area

2.1.1 Present land use

The Badak-Temin reservoir area is proposed in the north of the existing Changlun-Sintok road. Its southwestern half is encompassed by rubber plantation and a tin mine is in operation in the southeastern corner as shown in Fig. 1.

A land of 1,544 ha (3,816 acres) along the Changlun-Sintok road between the midway from Changlun and Sintok has been alienated to RISDA. It is cultivated for rubber plantation. Most part of the land located in the north of the Changlun-Sintok road including a part of RISDA's residential area will be flooded, if the Badak-Temin dam is constructed.

A land of 1,943 ha (4,779 acres) extending to the north adjacent to the RISDA area has been alienated to FELDA for a rubber plantation. FELDA is constructing 370 houses for its employees and laborers in the middle of the area. The proposed reservoir will flood southern part of the FELDA area, but it will not affect the new residential area.

A forest reserve encompasses northern and eastern parts of the proposed reservoir area, mostly covering FELDA's rubber plantation.

Some forest between the RISDA area and the Changlun-Sintok road has been alienated to private personnel.

A land of 134 ha (331 acres) has been leased to the Abdullar Ghaffer Mining Co. in the southeastern part of the proposed reservoir area. The lease (PG. 301 Lot 2150) was expired on March 23, 1983 but renewal for 15 years applied is under consideration by the State Government (PTG/KED/G.69/81, G.Pk.868, G.Ku.B/K.081). The mine produced tin ore of 27,285 kg in 1981. According to Ref. 1, there is tin ore of 75% grade at a rate of 206 g/m^3 in a depth of 4.9 m in the workable area of 121 ha on an average; the total deposit is estimated to be 1,221 tons of 75% grade tin ore.

A road is under construction between Padang Sanai and Lake Temin via Sintok by PWD since July 1982. It will be 29.8 km (18.5 miles) in length and 18.3 m (60 ft) in width being paved for the width of 5.5 m (18 ft), when completed in 1984. Part of this road will pass the proposed reservoir area.

The present land use in the proposed Badak-Temin reservoir area is mapped as shown in Plate 1, and it was measured for varying water surface elevation as shown in Table 1.

2.1.2 Potential land use

The future land development plan in and around the proposed Badak-Temin reservoir is indicated in Fig. 2. There is a plan to establish the 6th University on the east of the existing FELDA area.

According to Ref. 1, it is estimated that flat area in the valley of the Badak river has a good potential of tin ore as shown in Fig. 3. The depth in the low-lying land is 5 m. The value of ore is assumed to be the same as in PG. 301.

A mining application (PTG/KED/G.68/81, G.Pk.KP.875, G.Ku.152) supported by the Mines Department for 12 ha (30 acres) adjacent to PG. 301 and a prospecting application (PTG/KED/G.8/82, G.Pk.KP.829, G.Ku.380) for 18,035 ha (44,565 acres) including northeastern part of the proposed reservoir area from Malaysia Mining Corporation are under consideration by the State Government.

2.2 The Sari Reservoir Area

2.2.1 Present land use

The proposed Sari reservoir area is covered by a sugarcane plantation in its low land and there is a tin mine in the northwest margin as shown in Fig. 4.

The Gula Padang Terap Sugarcane Plantation is a company financed by the Ministry of Finance by 72% and by the State Government by 17%. It has sugarcane estates of 6,070 ha (15,000 acres) which is distributed on low-lying lands of the Pdg Terap area to the northeast of Kuala Nerang as shown in Plate 2. The sugar factory of 3,500 cane tons per day is located at Padang Sanai along the Kuala Nerang-Padang Sanai road. It processes sugarcane between January and April at an average rate of 2,500 tons per day. The production target for 1983 is 20,000 sugar tons. The State Government has granted the permission and is taking steps to alienate the land for cultivation by the company. One of the sugarcane estates almost corresponds to the proposed reservoir area, being planted since 1980.

A land of 91 ha (226 acres) in the northwestern part of the proposed reservoir area has been leased to the Syaricat Pintu Wang Melombong Sendirian Berhad (PG. 258 Lot 441 effective until October 1985). The mine produced 26,159 kg of tin ore in 1981. Total deposit of tin ore in this area is estimated to be 277 tons; at a rate of 190/m^3 in a depth of 7.3 m in the workable area of 20 ha, according to Ref. 1.

The proposed reservoir area is totally located in a forest reserve.

The Padang-Sintok-Lake Temin road being under construction as described in 2.1.1 passes the valley in the proposed reservoir area.

The present land use in the proposed Sari reservoir area is mapped as shown in Plate 3, and it is measured for varying water surface as shown in Table 2.

2.2.2 Potential land use

Future land use plan in and around the proposed Sari reservoir area is indicated in Fig. 5. FELDA has a plan to develop a rubber plantation of 3,075 ha, which encompasses the sugarcane estate of the Gula Padang Terap Sugarcane plantation in the objective area. If this plan is implemented, the proposed reservoir area will be totally covered by the FELDA farm, except the northwestern margin where the aforesaid mine is located.

A mineral potential map is shown in Fig. 6.

A lease mining application (PTG/KED/G.24/79, G.Pk.KP.711, G.Ku.L/K.143) for 82 ha (202 acres) on the southeast of PG. 258 was rejected by the State Government but pending the results of appeal. Total tin ore deposit is estimated to be 402 tons; at a rate of 119 g/m^3 in a depth of 5.2 m in the workable area of 65 ha, according to Ref. 1.

Application for prospecting for 161 ha (400 acres, KED/G.42/79) and 18,035 ha (44,565 acres, KED/G.8/82) in the vicinity of the existing mine are under consideration by the State Government.

2.3 The Durian Reservoir Area

2.3.1 Present land use

The proposed Durian reservoir area is mostly encompassed by the northern part of sugarcane estates of the Gula Padang Terap Sugarcane Plantation (see 2.2.1) as shown in Fig. 7. Sugarcane has been planted since 1974. A forest reserve covers eastern part of the proposed reservoir area to a minor extent.

The present land use in the proposed Durian reservoir area is mapped as shown in Plate 4 and it is measured for varying water surface elevation as shown in Table 3.

2.3.2 Potential land use

Future land use plan in and around the proposed Durian reservoir area is indicated in Fig. 8. FELDA has a plan to develop about 1,012 ha in the northeastern part of the proposed reservoir area for rubber plantation. The area is duplicated with a part of the above-mentioned sugar estates.

There is no mining potential as shown in Fig. 9.

2.4 The Tawar-Muda Reservoir Area

2.4.1 Present land use

Two alternative dam sites are investigated for the Tawar-Muda dam; the Tawar-Muda 1 and Tawar-Muda 2. The proposed Tawar-Muda reservoir area is covered by rubber farms in the west and forest in the east as shown in Fig. 10.

RISDA has developed 238 ha (700 acres) in the west of the proposed reservoir area for rubber mini-estate and allotted the land to 141 small holders, who are now registered owners. All the land will be planted by June 1983.

There are small rubber farms of private personnel also in the vicinity of the RISDA area.

Three lands of 858 ha (2,121 acres) in total on the banks of the Muda river between the proposed Tawar-Muda dam and the Muda dam have been alienated to FELCRA for rubber plantation. FELCRA's residential area is located on the left bank of the Muda river, where 16 houses are under construction for 21 staff. Small portions of FELCRA plantation will be affected, if the proposed reservoir is created.

Aur village on the left bank of the Muda river has a population of 550 and 100 houses. It will be affected, if the water level in the proposed reservoir is set at El. 75 m or higher.

An army camp on the left bank of the Muda river will also be affected, if the reservoir water level is set at El. 75 m or higher.

The proposed reservoir area is surrounded by forest reserve, which will be affected by the northern part of the proposed reservoir.

The present land use in the proposed Tawar Muda reservoir area is mapped as shown in Plate 5 and it is measured for varying reservoir water levels as shown in Tables 4 and 5.

2.4.2 Potential land use

Future land development plans are indicated in Fig. 11.

FELCRA has a plan to develop 405 ha (1,000 acres) for expansion of rubber plantation and about 300 ha for a foundation in honor of Tunku Abdul Rahman on the left bank of the Muda river, but these areas will not be affected by the proposed reservoir.

The Veterinary Department has a plan to develop a cattle grazing land of 243 ha (600 acres) to the northeast of the proposed Tawar-Muda dam. A small portion of this land will be affected by the proposed reservoir if the reservoir water level is set at El. 75 m or higher.

There is no mining potential as shown in Fig. 12.

2.5 The Beris Reservoir Area

2.5.1 Present land use

Two alternative dam sites are investigated for the Beris dam; the Beris 1 and Beris 2. The proposed Beris reservoir area is located in the northwest of Kg. Sg. Batang and Kg. Ternas villages which situate along the Nami-Sik road. Northwestern part is covered by a forest reserve and southeastern part is mostly developed for rubber cultivation by small holders as shown in Fig. 13.

Kg. Sg. Batang is populated by 1,200 people, or 200 families, and Kg. Ternas has a population of 300, or 50 families. There are paddy and upland farms near the villages. These villages will be affected, if the reservoir water level is set at El. 70 m or higher. A primary school of 350 pupils in Kg. Sg. Batang will be flooded, if the reservoir water level is higher than El. 75 m.

The Nami-Sik road will be partly flooded by the proposed reservoir.

The present land use in the proposed Beris reservoir area is mapped as shown in Plate 6 and it is measured for varying water surface elevation as shown in Tables 6 and 7.

2.5.2 Potential land use

Future development plans are indicated in Fig. 14.

KEDA is planning the Serai Wangi project for citronella cultivation of 405 ha (1,000 acres), covering northern part of the proposed reservoir area in the forest reserve.

The Forestry Department has a plan to grow teak in an area of 324 ha (800 acres) in the forest reserve, partly located in the proposed reservoir area.

A mining potential map is shown in Fig. 15. A prospecting application (PTG/KED/G.75/81, G.Pk.KP.877, G.Ku.C/K.378) in the northern part of the proposed reservoir area is under consideration by the State Government as shown in Fig. 15. According to Ref. 1, it is, however, estimated that tin ore content in the proposed reservoir area is low and uneconomical to work at, because there is no mining lease and past prospecting permit did not produce any result.

2.6 The Rui Reservoir Area

2.6.1 Present land use

Three alternative dam sites are investigated; the Rui 1, Rui 2 and Rui 3, but the Rui 1 dam is not assumed because its geological condition is definitely in ferreous to those in the others.

The proposed reservoir area is mostly covered by jungle and a tin mine is in operation as shown in Fig. 16.

Kg. Pong is located in the western part of the proposed reservoir area, with population of 120, or 22 families. Kg. Asu of 100 abrigines or 22 families is located near the perimeter of the proposed reservoir area. The former will be flooded, if reservoir water level is set at El. 195 m or higher and the latter will be submerged if reservoir water level exceeds El. 210 m.

There is no forest reserve within the proposed Rui reservoir area.

The Rahman Hydraulic Tin Bhd. operates tin mine near Kelian Intan. Mining certificate 2/72 for about 580 ha is expected to exceed a period of 15 years. Mining certificate 4/74 for 136.72 ha along a tributary joining the Rui river between the proposed Rui 2 and Rui 3 dam sites, will be expired in December 1983 but decision to renew it for another 15 years has been made. This area is being mined and also is used as a disposal area for the Tanah Hitam Mill. Most part of the 4/74 area will be submerged, if Rui 3 dam is constructed.

The Pong power station located near Kg. Pong is a hydropower station owned by the Rahman Hydraulic Tin Bhd. It has been the major source of power supply to the mine and Kelian Intan township. The load exceeded the available power output from the Pong power station between February 1980 and mid-1982. Under these conditions, the Pong power station recorded an annual power output of 10.314 GWh between August 1980 and July 1981. The Pong power station has been operated since 1929 but it is still in good operational condition. The capital cost has been already depreciated and operation and maintenance cost is estimated to be M$0.04/kWh according to the Rahman Hydraulic Tin Bhd. The full supply level of the dam is El. 260.78 m (El. 855 ft) and tailwater level is El. 197.64 m (El. 648 ft). If the proposed Rui reservoir is created, this power station can no longer be operated.

The present land use is mapped as shown in Plate 7 and it is measured for varying water surface elevation as shown in Tables 8 and 9.

2.6.2 Potential land use

There is no land development plan in the proposed reservoir area.

According to Ref. 1, there is a strong possibility of good tin deposit in the vicinity of the existing mine and southwestern part of the proposed reservoir area as shown in Fig. 17. A prospecting permit (PTHP(K)5/75, G.Pk.3-3282, G.Ku.3005) was issued for an area along the Pong river.

The Rahman Hydraulic Tin Bhd. is considering to extract more energy at the Pong power station, either by providing an additional storage or by installing additional generating equipment.

GSD expressed in June 1983 that there is a possibility of uranium deposit in the proposed reservoir area, but neither content nor volume is known. This fact is disregarded herein, because nothing can be quantified yet.

3. LAND ACQUISITION COST

3.1 Basic Assumptions

The land acquisition cost consists of the compensation costs and costs for relocating public facilities from the financial viewpoint.

The compensation costs include those on the agricultural land, forest alienated to private personnel, mines and removal of families. They are spent, either in monetary term or by developing substitutional land, to cover the costs which are necessary for the affected people and enterprises to continue their activities on the substitutional land. Hence the compensation cost should be mostly the costs to develop substitutional land, to reconstruct plant in the substitutional land and to build houses and buildings in the substitutional land.

The public facilities to be relocated are mostly roads but includes schools and offices.

The land acquisition cost is herein estimated based on the present market prices.

3.2 Compensation Cost on Land

The compensation cost on land is considered for the agricultural land, residential land/quarter and alienated forest. The unit price is estimated as shown in Table 10 based on information provided by the head offices concerned and field survey.

(1) Badak-Temin

The present market price of land is M$9,880/ha (M$4,000/acre) for rubber plantation and M$3,710/ha (M$1,500/acre) for forest, according to the information provided by the Jitra Land Office. The price of residential area is assumed to be M$7,410/ha (M$3,000/acre).

(2) Sari and Durian

The proposed Sari and Durian reservoir areas are entirely state land and no land acquisition cost is required for development, according to the K. Nerang Land Office. Gula Padang Terap Sdn. Berhad estimates that the land preparation cost for sugarcane plantation is M$3,710 to 4,940/ha (M$1,500 to 2,000/acre). It is herein assumed that the compensation cost for sugar plantation is M$4,940/ha (M$2,000/acre).

It is assumed that the plantation area remaining as narrow strips in the perimeter of the proposed reservoir areas will not be compensated, though net production value there may be reduced if the reservoirs are created.

(3) Tawar-Muda

The market value of land is assumed to be M$8,650/ha based on the information by the Sik Land Office that it is M$7,410 to 9,880/ha (M$3,000 to 4,000/acre).

(4) Beris

The market value of land is M$12,360 to 14,830/ha (M$5,000 to 6,000/acre) near the Nami-Sik road and M$4,940 to 7,410/ha (M$2,000 to 3,000/acre) according to the information provided by the Sik Land Office. It is herein assumed that the average price of land is M$9,880/ha.

(5) Rui

According to the information provided by the Keroh Land Office, the present value of land is M$4,940 to 7,410/ha (M$2,000 to 3,000/acre) for rubber farm and M$2,470/ha (M$1,000/acre) for paddy. Accordingly, it is assumed that the unit price of land is M$6,180/ha (M$2,500/acre) for rubber, M$2,470/ha (M$1,000/acre) for paddy, and M$3,710/ha (M$1,500/acre) for residential area.

3.3 Compensation Cost on Mine

(1) Badak-Temin and Sari

The existing mines in the proposed Badak-Temin and Sari reservoir areas are located in a vast area of possible mining land. It is expected that these mines can continue their production by shifting the facilities to nearby area.

The annual production of tin in 1981 was 27,285 ore kg in the Abdullar Ghaffer Mining Co., in the Badak-Temin area and 26,159 ore kg in the Syaricat Pintu Wang Melombong Sendirian Bhd. in the Sari area. The investment cost for new plant of equal production capacity is roughly estimated to be M$500,000 each. This investment cost is regarded as the compensation cost, if the existing lease area is totally flooded by the proposed reservoir. The compensation cost for partial flooding is assumed to be proportional to the gross area flooded; unit compensation cost is estimated to be M$3,730/ha for the Badak-Temin area and M$4,630/ha for the Sari area.

(2) Rui

There is neither approved nor applied mining lease in the proposed reservoir area, if Rui 2 dam is constructed. The area of 136.7 ha where mining certificate 4/74 is going to be renewed will be however, entirely submerged, if Rui 3 dam is constructed. This area is predominantly utilized as the tailing area of the Tanah Hitam Mill. It is assumed that the tailing area should be removed to the Ayer Rambong river and other tributaries. The compensation cost is estimated to be in the order of M$5 x 10^6, of which majority is the construction cost of substitutional tailing facilities.

The method and cost to compensate for the Pong power station is described in Section 3.6.

3.4 Compensation Cost for Removal

The compensation cost for removal is considered for the residential houses and other buildings. The unit price is estimated as listed in Table 11, based on information provided by the Land Offices concerned and field inspection.

(1) Badak-Temin

Some of residential houses of RISDA will be removed if the Badak-Temin reservoir is created. The compensation cost for removal is estimated to be M$10,000/house.

(2) Sari

For residential houses and workshop of the Syaricat Pintu Wang Melombong Sendirian Berhad, the unit cost for removal is estimated to be M$15,000/house on an average.

(3) Durian

There is neither house nor building within the proposed reservoir area.

(4) Tawar-Muda

The compensation cost of removal in Kg. Aur is assumed to be M$5,000/household. No estimate is made for the army camp.

(5) Beris

The compensation cost of removal in Kg. Sg. Batang and Kg. Ternas is estimated to be M$5,000 to 15,000/household depending on family size. The average cost is assumed to be M$10,000/household.

The relocation cost of the primary school is assumed to be M$400,000 and included in the compensation cost for removal.

(6) Rui

The compensation cost of removal is estimated to be M$3,000 to 6,000/household for Kg. Pong and M$1,000 to 3,000/household for Kg. Asu. The average cost is assumed to be M$4,500/household for Kg. Pong and M$2,000/household for Kg. Asu.

The compensation cost of removal in the mining area is estimated to be M$4,500 to 20,000/house depending on the size and type of building. The compensation cost of removal in the residential area of the Pong power station is assumed to be M$10,000/house.

3.5 Cost for Road Relocation

The construction cost of roads and bridges for relocating public road is estimated based on 1/25,000 map.

The cross section of the proposed road is the same as that of the existing and under construction road; rural road Class-02, double lane but paved only for one line for the Badak-Temin and Sari area, and rural road Class-02, single lane paved, for the Tawar-Muda and Beris area.

The unit construction cost is assumed to be M$1.5 x 10^6/km for the Badak-Temin and Sari and M$0.6 x 10^6 - 0.7 x 10^6/km for the Tawar-Muda and Beris area. The unit price of bridge is assumed to be M$5,400 - 7,800/m.

A relocation road for the Badak-Temin area is proposed along the eastern perimeter of the proposed reservoir as shown in Plate 1. The length of relocation road is estimated to be 3 km in the case that the maximum water surface is at El. 40 m and 7.5 km if the maximum water surface is at El. 50 m.

The relocation road for the Sari area is proposed on the southwest of the proposed reservoir area as shown in Plate 3. The length of the relocation road is estimated to be 8.9 km if the maximum water surface is set at El. 70 m and 9.5 km if the maximum water surface is set at El. 90 m.

The relocation road for the Tawar-Muda area is proposed on the left bank of the Muda river in the upper part of the proposed reservoir area as shown in Plate 5. If the maximum water surface is at El. 71 m, no relocation road is necessary but a 100 m long bridge is constructed. If the maximum water surface is set at El. 81 m. The length of relocation road is 2.5 km in rolling area.

The relocation road for the Beris area is proposed to detour along the east shoreline of the proposed reservoir as shown in Plate 6. If the maximum water surface is set at 70 m, a 300 m long bridge only is constructed across a narrow of the reservoir near Kg. Ternas. If the maximum water surface is at El. 87 m, the length of the relocation road is 7.5 km in a rolling area, and the length of bridge across the narrow of the reservoir is 500 m.

The estimated quantities and construction cost for road relocation are summarized in Table 12.

3.6 Relocation Cost of Primary School

The relocation cost of the primary school in Kg. Sg. Batang is assumed to be M$400,000. This cost is incurred if the maximum reservoir water surface is set to be higher than El. 75 m.

3.7 Compensation on the Pong Power Station

The Pong power station can no longer be operated if the proposed Rui reservoir is create. It is necessary to supply power demand in the Rahman Hydraulic Tin Bhd. through the power transmission network which will be constructed to connect hydropower stations of the proposed Rui dam project with the transmission line system of NEB.

The Pong power station of 2 MW generates 10 GWh annually. According to the Rahman Hydraulic Tin Bhd., the present cost of power is M$0.04/kWh, or M$400,000/y. If the power tariff of NEB (M$12/kW/month + M$0.17/kWh) is applied, the cost of equivalent power is M$2 x 10^6/y. The difference M$1.6 x 10^6/y is the additional cost of power incurred after the completion of the Rui dam, and this amount has to be compensated by the managing authority of the Rui dam, during the estimated life of the Pong power station.

3.8 Land Acquisition Cost for Varying Reservoir Water Level

The Land Acquisition cost for varying reservoir water level is estimated for the proposed reservoir areas as shown in Tables 13 to 20, applying unit prices described in this Chapter to the quantities in Tables 1 to 9.

4. PRODUCTION FORGONE AND ECONOMIC INVESTMENT COST

4.1 Definitions

After a land is flooded by a reservoir, previous production on the land can no longer be continued. This production forgone is a negative economic benefit attributable to the reservoir project. The production forgone is estimated to be the net production value which would be obtained if the project is not implemented. The production forgone is herein estimated only for the agricultural land in the proposed reservoir area. It is assumed that the production forgone of forest and mines in the proposed reservoir areas will be balanced with the expected production on substitutional lands. The production forgone of power at the Pong power station is estimated based on the alternative facilities cost criteria.

The economic investment cost incidental to the land acquisition is such cost that it will not accrue if the land is not acquired. It includes the construction cost of houses for the removed people, relocated roads and removal of mining facilities.

The compensation costs on farmlands, mines and residential land/quarter are all or part of the investment costs on substitutional lands. They are not counted as economic investment costs, because investment on substitutional land will be made, irrespective of the acquisition of the previous land. The construction cost of substitutional tailing facilities for the Rahman Hydraulic Tin Co. is, however, an economic cost, because it will not accrue unless the original land is acquired.

4.2 Assumptions on Land Use

The production forgone is estimated based on the present land use for agricultural purpose. No future development is assumed unless it is definitely committed, because the present land use has been developed as the most beneficial one. This principle is applied herein for the estimate of the production forgone on farmlands.

The agricultural land use in the each proposed reservoir area as shown in Tables 1 to 9 is compatibly assumed.

4.3 Production Forgone on Farmland

Crops grown in the proposed reservoir areas comprise rubber, sugarcane, paddy and upland crops. Net production values of these crops are estimated based on unit value for each crop as shown in Table 21.

The economic farmgate prices of rubber, sugarcane and rice are derived from a projection to 1995 at the 1982 constant price level made by IBRD. The projected economic farmgate prices are M$3,100/ton for dry rubber, M$42/ton for sugarcane, M$609/ton for paddy and M$50/ton for upland crop.

The gross production value is estimated on the basis of unit yield and the above projected farm gate prices. The estimated gross production value of dry rubber is M$2,170/ha for RISDA and smallholders and M$2,790/ha for FELDA. The gross production values of the other crops are estimated to be M$2,058/ha for sugarcane, M$1,400/ha for paddy under rainfed condition and M$500/ha for upland crop.

Net production values which are obtained by subtracting crop production costs from gross production values. The production costs estimated include seeds, fertilizer, agro-chemicals, materials and tools, fuel and oil, draft animal and machinery, employed and family labors, but these exclude taxes, land rent and repayment for initial investment. The net production value estimated is M$1,300/ha for dry rubber in RISDA and smallholders, M$1,915/ha for dry rubber in FELDA, M$510/ha for sugarcane, M$415/ha for paddy and M$200/ha for upland crop.

4.4 Production Forgone of Power at the Pong Power Station

The power value estimated by NWRS is updated to be M$208/kW and M$0.145/kWh. Applying this power value to the present power output of the Pong power station, the gross value of power is estimated to be M$1,870,000/y. Deducting the production cost of M$400,000/y, the production forgone is estimated to be M$1,470,000/y.

4.5 Reduction in Energy Output at the Kenering and Chenderoh Power Stations

The annual inflow at the proposed Rui dam site is estimated to be 250 x 10^6 m^3, most of which will be diverted to the Muda river if the proposed dam is constructed.

Water released downstream the dam will be the river maintenance flow and spillout. The river maintenance flow is set to be 1.4 m^3/s, or 44 x 10^6 m^3/y. Disregarding the spillout, the total runoff reduction in the Rui river is estimated to be 206 x 10^6 m^3/y. This corresponds to 3.6% of the inflow of 5,793 x 10^6 m^3/y at the Kenering power station, and 3.1% of the inflow of 6,624 x 10^6 m^3/y at the Chenderoh power station.

According to Ref. 23, the annual energy output is 367 GWh at the Kenering power station and 211 GWh at the Chenderoh power station. Multiplying these figures by the above-mentioned percentages, the reduction in energy output is estimated to be 13 GWh at the Kenering power station and 7 GWh at the Chenderoh power station; 20 GWh in total.

The primary energy output will not be affected, because the Rui dam will continuously contribute the river maintenance flow which is larger than the minimum natural flow at the Rui dam site.

The economic loss due to the reduction of energy output of 20 GWh is estimated to be M$2.4 x 10^6/y, assuming an unit energy value of M$0.122/kWh.

4.6 Production Forgone for Varying Reservoir Water Level

The production forgone for varying reservoir water level is calculated as shown in Tables 22 to 30.

4.7 Economic Investment Cost for Varying Reservoir Water Level

The economic investment cost for varying water level is calculated as shown in Tables 31 to 37, excluding the transfer payment, which is assumed to be 20% of the financial investment cost.

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4. ANSWER TO QUESTIONNAIRE, Nerang District Office

5. ANSWER TO QUESTIONNAIRE, Sik District Office

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10. LOCATION MAP OF GULA PADANG TERAP SUGARCANE PLANTATION, SEDC

11. LOCATION MAP OF GULA PADANG TERAP SUGARCANE PLANTATION IN SARI AREA, G.P.T. Bhd.

12. BRIEF EXPLANTATION OF DEVELOPMENT OF DIVISION 'K' AND THE KOH MAI AREA, FELDA

13. LAND USE MAP AT PRESENT & LAND USE SCHEME MAP, Sik District Office

14. LOCATION MAP OF RISDA PLANTATION, RISDA

15. LAND USE SCHEME MAP, Sik District Office

16. FELDA SCHEME & LOCATION MAP IN BADAK-TEMIN, SARI & DURIAN, FELDA

17. LOCATION MAP OF UNDER-CONSTRUCTION ROAD BETWEEN JALAN PADANG & LAKA TEMIN VIA SANAI & SINTOK, PWD

18. MINIMUM GEOMETRIC DESIGN CRITERIA NEW ROAD IN RURAL AREAS, PWD

19. COMPENSATION PLANNING OF THE SEMENYIH DAM (ESPECIALLY TO ABORIGINE), SWW

20. PROPERTY MARKET REPORT

21. PROPERTY MARKET REPORT

22. REQUEST FOR MEETING AND DATA COLLECTION (ANSWER TO QUESTIONNAIRE), Rahman Hydraulic Tin Berhad

23. EXTERNAL AID OFFICE GOVERNMENT OF CANADA NEB FINAL DRAFT FEASIBILITY STUDY UPPER PERAK HYDROELECTRIC DEVELOPMENT, Shawinigan Engineering Company Limited, 1966

TABLES

Table 1 PRESENT LAND USE IN THE PROPOSED BADAK-TEMIN RESERVOIR AREA

Land Use		Reservoir Water Level (El. m) 35	40	45	50
1. Rubber					
1.1 RISDA	ha	157.4	430.9	610.0	735.1 (731.8)
1.2 FELDA	ha	-	10.9	55.3	121.2
Sub-total	ha	157.4	441.8	665.3	856.3 (853.0)
2. Sugarcane	ha	-	-	-	-
3. Paddy	ha	-	-	-	-
4. Upland	ha	-	-	-	-
5. Residential Land/Quarter					
5.1 RISDA	ha	-	-	1.3	3.2
6. Forest					
6.1 Unalienated	ha	90.1	180.1	238.7	366.8 (348.1)
6.2 Alienated	ha	24.8	25.7	29.7	31.2
Sub-total	ha	114.9	205.8	268.4	398.0 (379.3)
7. Mine					
7.1 PG. 301	ha	-	-	6.5	41.2
8. Water/Barren	ha	0	0	0	0
Total Land Area	ha	272.3	647.6	941.5	1,298.7 (1,276.7)
9. Houses/Buildings					
9.1 RISDA	nos.	-	-	18	38
10. Road	km	-	0.80	1.40	1.69

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 2 PRESENT LAND USE IN THE PROPOSED SARI RESERVOIR AREA

Land Use		Reservoir Water Level (El. m) 80	85	90	95
1. Rubber	ha	-	-	-	-
2. Sugarcane	ha	130.1	157.1	179.4	195.1
3. Paddy	ha	-	-	-	-
4. Upland	ha	-	-	-	-
5. Residential Land/Quarter					
5.1 Mine	ha	0.4	0.4	0.4	0.4
6. Forest					
6.1 Unalienated	ha	119.0 (116.1)	171.8 (169.8)	234.0 (232.9)	323.2 (322.8)
7. Mine					
7.1 PG. 258	ha	-	0.5	22.1	30.1
8. Water/Barren	ha	0	0	0	0
Total Land Area	ha	249.5 (246.6)	329.8 (327.8)	435.9 (434.8)	548.8 (548.4)
9. Houses/Buildings					
9.1 Mines	nos.	3	3	3	3
10. Road	km	1.51	1.86	2.16	2.85

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 3 PRESENT LAND USE IN THE PROPOSED DURIAN RESERVOIR AREA

Land Use		Reservoir Water Level (El. m) 65	70	75	80
1. Rubber	ha	-	-	-	-
2. Sugarcane	ha	134.3	193.8	250.6	292.0
3. Paddy	ha	-	-	-	-
4. Upland	ha	-	-	-	-
5. Residential Land/Quarter	ha	-	-	-	-
6. Forest					
6.1 Unalienated	ha	95.7	152.0	223.3	325.7
7. Mine	ha	-	-	-	-
8. Water/Barren	ha	1.2	1.2	1.2	1.2
Total Land Area	ha	231.2	347.0	475.1	618.9
9. Houses/Buildings	nos.	-	-	-	-
10. Road	km	5.72	7.44	8.74	9.98

Table 4 PRESENT LAND USE IN THE PROPOSED TAWAR-MUDA RESERVOIR AREA (THE TAWAR-MUDA 1 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m) 65	70	75	80
1. Rubber					
1.1 RISDA & private	ha	68.9	195.7 (171.6)	428.5 (328.1)	543.5 (472.2)
1.2 FELCRA	ha	-	10.5	45.7	100.3
Sub-total	ha	68.9	206.2 (182.1)	474.2 (373.8)	643.8 (572.5)
2. Sugarcane	ha	-	-	-	-
3. Paddy	ha	-	-	3.0	12.1
4. Upland	ha	-	0.1	3.7	5.0
5. Residential Land/Quarter					
5.1 Kg. Aur	ha	-	-	0.8	6.6
5.2 Army camp	ha	-	-	-	2.9
Sub-total	ha	-	-	0.8	9.5
6. Forest					
6.1 Unalienated	ha	54.4	138.7	291.5 (267.8)	511.5 (491.0)
7. Mine	ha	-	-	-	-
8. Water/Barren	ha	24.0	29.9	33.9	37.6
Total Land Area	ha	147.3	374.9 (350.8)	807.1 (683.0)	1,219.5 (1,127.7)
9. Houses/Buildings					
9.1 Kg. Aur	nos.	-	-	-	35
9.2 Army camp	nos.	-	-	-	6
Sub-total	nos.	-	-	-	41
10. Road	km	-	-	-	0.45

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 5 PRESENT LAND USE IN THE PROPOSED TAWAR-MUDA RESERVOIR AREA (THE TAWAR-MUDA 2 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m) 65	70	75	80
1. Rubber					
1.1 RISDA & private	ha	72.9	207.1 (183.0)	444.3 (343.9)	569.9 (493.7)
1.2 FELCRA	ha	-	10.5	45.7	100.3
Sub-total	ha	72.9	217.6 (193.5)	490.0 (389.6)	670.2 (594.0)
2. Sugarcane	ha	-	-	-	-
3. Paddy	ha	-	-	3.0	12.1
4. Upland	ha	-	0.1	3.7	5.0
5. Residential Land/Quarter					
5.1 Kg. Aur	ha	-	-	0.8	6.6
5.2 Army camp	ha	-	-	-	2.9
Sub-total	ha	-	-	0.8	9.5
6. Forest					
6.1 Unalienated	ha	59.5	144.2	297.4 (273.7)	519.0 (497.4)
7. Mine	ha	-	-	-	-
8. Water/Barren	ha	25.9	31.8	35.8	39.5
Total Land Area	ha	158.3	393.7 (369.6)	830.7 (706.6)	1,255.3 (1,157.5)
9. Houses/Buildings					
9.1 Kg. Aur	nos.	-	-	-	35
9.2 Army camp	nos.	-	-	-	6
Sub-total	nos.	-	-	-	41
10. Road	km	-	-	-	0.45

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 6 PRESENT LAND USE IN THE PROPOSED BERIS RESERVOIR AREA (THE BERIS 1 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m) 70	75	80	85
1. Rubber (partly forest)	ha	59.0	163.1	354.1 (343.2)	620.1 (593.6)
2. Sugarcane	ha	-	-	-	-
3. Paddy	ha	6.8	43.8	78.0	113.4
4. Upland	ha	-	2.5	6.5	21.7
5. Residential Land/Quarter					
5.1 Kg. Sg. Batang	ha	-	1.2	12.3	31.0 (24.3)
5.2 Kg. Ternas	ha	-	1.1	1.5	1.5
Sub-total	ha	-	2.3	13.8	32.5 (25.8)
6. Forest					
6.1 Unalienated	ha	141.8	208.3	333.3 (321.8)	472.2 (463.7)
7. Mine	ha	-	-	-	-
8. Water/Barren	ha	5.6	5.6	5.6	5.6
Total Land Area	ha	213.2	425.6	791.3 (768.9)	1,265.5 (1,225.6)
9. Houses/Buildings					
9.1 Kg. Sg. Batang	nos.	14	27	69	114
9.2 Kg. Ternas	nos.	7	23	32	38
Sub-total	nos.	21	50	101	152
10. Road	km	0.10	0.52	1.20	2.30

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 7 PRESENT LAND USE IN THE PROPOSED BERIS RESERVOIR AREA (THE BERIS 2 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m) 70	75	80	85
1. Rubber (partly forest)	ha	59.0	163.1	354.1 (343.2)	620.1 (593.6)
2. Sugarcane	ha	-	-	-	-
3. Paddy	ha	6.8	43.8	78.0	113.4
4. Upland	ha	-	2.5	6.5	21.7
5. Residential Land/Quarter					
5.1 Kg. Sg. Batang	ha	-	1.2	12.3	31.0 (24.3)
5.2 Kg. Ternas	ha	-	1.1	1.5	1.5
Sub-total	ha	-	2.3	13.8	32.5 (25.8)
6. Forest					
6.1 Unalienated	ha	156.1	226.9	358.9 (347.4)	507.1 (498.6)
7. Mine	ha	-	-	-	-
8. Water/Barren	ha	5.6	5.6	5.6	5.6
Total Land Area	ha	227.5	442.2	816.9 (794.5)	1,300.4 (1,260.5)
9. Houses/Buildings					
9.1 Kg. Sg. Batang	nos.	14	27	69	114
9.2 Kg. Ternas	nos.	7	23	32	38
Sub-total	nos.	21	50	101	152
10. Road	km	0.10	0.52	1.20	2.30

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures include those in the isolated area by the proposed reservoir.

Table 8 PRESENT LAND USE IN THE PROPOSED RUI RESERVOIR AREA (THE RUI 2 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m) 225	230	235	240	245
1. Rubber	ha	6.2	7.2	8.6	9.8	9.8
2. Sugarcane	ha	-	-	-	-	
3. Paddy	ha	3.6	3.6	3.6	3.6	3.6
4. Upland	ha	-	-	-	-	-
5. Residential Land/Quarter						
5.1 Kg. Pong	ha	1.8	1.8	1.8	1.8	1.8
5.2 Kg. Asu	ha	-	-	-	-	-
5.3 Power station	ha	0.6	0.8	1.0	1.1	1.1
Sub-total	ha	2.4	2.6	2.8	2.9	2.9
6. Forest						
6.1 Unalienated	ha	541.4	627.8	718.1	844.4	935.4
7. Mine	ha	-	-	-	-	-
8. Water/Barren	ha	20.3	20.6	20.9	21.1	21.3
Total Land Area	ha	573.9	661.8	754.0	881.8	974.3
9. Houses/Buildings						
9.1 Kg. Pong	nos.	23	23	23	23	23
9.2 Kg. Asu	nos.	24	24	24	24	24
9.3 Power station	nos.	4	4	4	4	4
Sub-total	nos.	51	51	51	51	51
10. Road	km	-	-	-	-	-
11. Power Station			Pong Power Station			

Remarks; The hectareage of Kg. Asu could not be estimated.

Table 9 PRESENT LAND USE IN THE PROPOSED RUI RESERVOIR AREA (THE RUI 3 DAM IS ASSUMED)

Land Use		Reservoir Water Level (El. m)				
		220	225	230	235	240
1. Rubber	ha	4.3	6.2	7.2	8.6	9.8
2. Sugarcane	ha	-	-	-	-	-
3. Paddy	ha	3.6	3.6	3.6	3.6	3.6
4. Upland	ha	-	-	-	-	-
5. Residential Land/Quarter						
5.1 Kg. Pong	ha	1.8	1.8	1.8	1.8	1.8
5.2 Kg. Asu	ha	-	-	-	-	-
5.3 Power station	ha	0.1	0.6	0.8	1.0	1.1
5.4 Mine	ha	-	-	-	-	-
Sub-total	ha	1.9	2.4	2.6	2.8	2.9
6. Forest						
6.1 Unalienated	ha	528.3	602.5	708.0	842.2 (826.3)	998.6 (984.5)
7. Mine						
7.1 Certificate 4/74	ha	78.0	92.2	102.6	125.7 (112.9)	133.1 (122.2)
8. Water/Barren	ha	20.1	20.3	20.6	20.9	21.1
Total Land Area	ha	636.2	727.2	844.6	1,033.8 (975.1)	1,169.1 (1,144.1)
9. Houses/Buildings						
9.1 Kg. Pong	nos.	23	23	23	23	23
9.2 Kg. Asu	nos.	24	24	24	24	24
9.3 Power station	nos.	4	4	4	4	4
9.4 Mine	nos.	-	-	3	4	7 (5)
Sub-total	nos.	51	51	54	55	58 (56)
10. Road	km	-	-	-	-	-
11. Power Station		Pong Power Station				

Remarks; Figures between parentheses are net quantities in the proposed reservoir area, while the corresponding figures includes those in the isolated area by the proposed reservoir. The hectareage of Kg. Asu could not be estimated.

Table 10 UNIT PRICE OF LAND

Unit: M$/ha

	Badak-Temin	Sari	Durian	Tawar-Muda	Beris	Rui
Rubber	9,880	-	-	8,650	9,880	6,180
Sugarcane	-	4,940	4,940	-	-	-
Paddy/upland	-	-	-	8,650	9,880	2,470
Residential land/quarter	7,410	4,940	-	8,650	9,880	3,710
Alienated forest	3,710	-	-	5,000	-	-

Table 11 UNIT PRICE FOR REMOVAL OF RESIDENTIAL HOUSES AND BUILDINGS

Unit: M$/nos.

Item	Unit Price
RISDA in Badak-Temin	10,000
Mine in Sari	15,000
Kg. Aur in Tawar Muda 1 & 2	5,000
Sg. Batang and Kg. Ternas in Beris	10,000
Kg. Pong in Rui 2 & 3	4,500
Kg. Asu in Rui 2 & 3	2,000
Power Station in Rui 2 & 3	4,500 to 20,000
Mine in Rui 3	10,000

Table 12 ESTIMATED QUANTITIES AND CONSTRUCTION COST FOR ROAD RELOCATION

Area	Reservoir Water Level (El. m)	(NHWL)	Length of Road (km)	Length of Bridge(s) (m)	Construction Cost (M10^6$)
Badak-Temin	40	35	3.0	-	4.5
	50	45	7.5	-	11.3
Sari	70	66	8.9	-	13.4
	90	86	9.5	-	14.3
Durian	-	-	-	-	-
Tawar-Muda	71	66	-	100	0.5
	81	76	2.5	-	1.8
Beris	70	66	-	300	1.6
	86	82	7.5	500	7.8
Rui	-	-	-	-	-

Table 13 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED BADAK-TEMIN RESERVOIR AREA

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 35	40	45	50
A. LAND				
1. Rubber				
1.1 RISDA (M$9,880/ha)	1.6	4.3	6.0	7.3
1.2 FELDA (M$9,880/ha)	-	0.1	0.5	1.2
Sub-total	1.6	4.4	6.5	8.5
2. Residential Land/Quarter				
2.1 RISDA (M$7,410/ha)	-	-	0	0
3. Forest				
3.1 Alienated (M$3,710/ha)	0.1	0.1	0.1	0.1
Total	1.7	4.5	6.6	8.6
B. MINE				
1. PG. 301 (M$3,730/ha)	-	-	0	0.2
C. REMOVAL				
1. RISDA (M$10,000/nos.)	-	-	0.2	0.4
D. ROAD RELOCATION	-	4.5	7.9	11.3
Total; A to D	1.7	9.5	14.5	20.1

Table 14 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED SARI RESERVOIR AREA

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 80	85	90	95
A. LAND				
1. Sugarcane (M$4,940/ha)	0.6	0.8	0.9	1.0
2. Residential Land/Quarter				
2.1 Mine (M$4,940/ha)	0	0	0	0
Total	0.6	0.8	0.9	1.0
B. MINE				
1. PG. 258 (M$4,630/ha)	-	0	0.1	0.1
C. REMOVAL				
1. Mine (M$15,000/nos.)	0	0	0	0
D. ROAD RELOCATION	13.9	14.1	14.3	14.5
Total; A to D	14.5	14.9	15.3	15.6

Table 15 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED DURIAN RESERVOIR AREA

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 65	70	75	80
A. LAND				
1. Sugarcane (M$4,940/ha)	0.7	1.0	1.2	1.4
B. MINE	-	-	-	-
C. REMOVAL	-	-	-	-
D. ROAD RELOCATION	-	-	-	-
Total; A to D	0.7	1.0	1.2	1.4

Table 16 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED TAWAR-MUDA RESERVOIR AREA (IF THE TAWAR-MUDA 1 DAM IS CONSTRUCTED)

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 65	70	75	80
A. LAND				
1. Rubber				
1.1 RISDA & private (M$8,650/ha)	0.6	1.7	3.7	4.7
1.2 FELCRA (M$8,650/ha)	-	0.1	0.4	0.9
Sub-total	0.6	1.8	4.1	5.6
2. Paddy (M$8,650/ha)	-	-	0	0.1
3. Upland (M$8,650/ha)	-	0	0	0
4. Residential Land/Quarter				
4.1 Kg. Aur (M$8,650/ha)	-	0	0	0.1
Total	0.6	1.8	4.1	5.8
B. MINE	-	-	-	-
C. REMOVAL				
1. Kg. Aur (M$5,000/nos.)	-	-	-	0.2
D. ROAD RELOCATION	-	0.5	1.2	1.8
Total; A to D	0.6	2.3	5.3	7.6

Table 17 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED TAWAR-MUDA RESERVOIR AREA (IF THE TAWAR-MUDA 2 DAM IS CONSTRUCTED)

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 65	70	75	80
A. LAND				
1. Rubber				
1.1 RISDA & private (M$8,650/ha)	0.6	1.8	3.8	4.9
1.2 FELCRA (M$8,650/ha)	-	0.1	0.4	0.9
Sub-total	0.6	1.9	4.2	5.8
2. Paddy (M$8,650/ha)	-	-	0	0.1
3. Upland (M$8,650/ha)	-	0	0	0
4. Residential Land/Quarter				
4.1 Kg. Aur (M$8,650/ha)	-	-	0	0.1
Total	0.6	1.9	4.2	6.0
B. MINE	-	-	-	-
C. REMOVAL				
1. Kg. Aur (M$5,000/nos.)	-	-	-	0.2
D. ROAD RELOCATION	-	0.5	1.2	1.8
Total; A to D	0.6	2.4	5.4	8.0

Table 18 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED BERIS RESERVOIR AREA

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El.m) 70	75	80	85
A. LAND				
1. Rubber (M$9,880/ha)	0.6	1.6	3.5	6.1
2. Paddy (M$9.880/ha)	0.1	0.4	0.8	1.1
3. Upland (M$9,880/ha)	-	0	0.1	0.2
4. Residential Land/Quarter				
4.1 Kg. Sg. Batang (M$9,880 ha)	-	0	0.1	0.3
4.2 Kg. Ternas (M$9,880/ha)	-	0	0	0
Sub-total	-	0	0.1	0.3
Total	0.7	2.0	4.3	7.7
B. MINE	-	-	-	-
C. REMOVAL				
1. Kg. Sg. Batang (M$10,000/nos.)	0.1	0.3	0.7	1.1
2. Kg. Ternas (M$10,000/nos.)	0.1	0.2	0.3	0.4
Total	0.2	0.5	1.0	1.5
D. ROAD RELOCATION	1.6	3.7	5.7	7.8
E. PRIMARY SCHOOL	-	-	0.4	0.4
Total; A to E	2.5	6.2	11.4	17.4

Remarks; Figures in this table are applicable either the Beris 1 dam or the Beris 2 dam is constructed.

Table 19 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED RUI RESERVOIR AREA (IF THE RUI 2 DAM IS CONSTRUCTED)

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 225	230	235	240	245
A. LAND					
1. Rubber (M$6,180/ha)	0	0	0.1	0.1	0.1
2. Paddy (M$2,470/ha)	0	0	0	0	0
3. Residential Land/Quarter (M$3,710/ha)	0	0	0	0	0
Total	0	0	0.1	0.1	0.1
B. MINE	-	-	-	-	-
C. REMOVAL					
1. Kg. Pong (M$4,500/nos.)	0.1	0.1	0.1	0.1	0.1
2. Kg. Asu (M$2,000/nos.)	0	0	0	0	0
3. Power Station (M$4,500-20,000/nos.)	0	0	0	0	0
Total	0.1	0.1	0.1	0.1	0.1
D. ROAD RELOCATION	-	-	-	-	-
Total; A to D	0.1	0.1	0.2	0.2	0.2

Remarks; $M\$1.6 \times 10^6$/y is additionally required to compensate power cost.

Table 20 ESTIMATED LAND ACQUISITION COST FOR THE PROPOSED RUI RESERVOIR AREA (IF THE RUI 3 DAM IS CONSTRUCTED)

Unit: $M\$10^6$

Land Use	Reservoir Water Level (El. m) 220	225	230	235	240
A. LAND					
1. Rubber (M$6,180/ha)	0	0	0	0.1	0.1
2. Paddy (M$2,470/ha)	0	0	0	0	0
3. Residential Land/Quarter (M$3,710/ha)	0	0	0	0	0
Total	0	0	0	0.1	0.1
B. MINE					
1. Certificate 4/74	5.0	5.0	5.0	5.0	5.0
C. REMOVAL					
1. Kg. Pong (M$4,500/nos.)	0.1	0.1	0.1	0.1	0.1
2. Kg. Asu (M$2,000/nos.)	0	0	0	0	0
3. Power Station (M$4,500-20,000/nos.)	0	0	0	0	0
4. Mine (M$10,000/nos.)	0	0	0	0	0
Total	0.1	0.1	0.1	0.1	0.1
D. ROAD RELOCATION	-	-	-	-	-
Total; A to D	5.1	5.1	5.1	5.2	5.2

Remarks; $M\$1.6 \times 10^6$/y is additionally required to compensate power cost.

Table 21 ESTIMATED ECONOMIC NET PRODUCTION VALUE OF CROP

Crop	Yield (ton/ha)	Price (M$/ton)	Gross Value (M$/ha)	Production Cost (M$/ha)	Net Value (M$/ha)
Rubber					
RISDA & Smallholder	0.7	3,100	2,170	870	1,300
FELDA	0.9	3,100	2,790	875	1,915
Sugarcane	49.0	42	2,058	1,548	510
Paddy (Rainfed)	2.3	609	1,400	985	415
Upland Crop (Cassava)	10.0	50	500	300	200

Table 22 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED BADAK-TEMIN RESERVOIR AREA

Unit: $M\$10^3$

	Reservoir Water Level (El. m)			
	35	40	45	50
Rubber				
1. RISDA	205	560	793	951
2. FELDA	-	21	106	232
Total	205	581	899	1,183

Table 23 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED SARI RESERVOIR AREA

Unit: M10^3

	Reservoir Water Level (El. m)			
	80	85	90	95
Sugarcane	66	80	91	100

Table 24 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED DURIAN RESERVOIR AREA

Unit: M10^3

	Reservoir Water Level (El. m)			
	65	70	75	80
Sugarcane	68	99	128	149

Table 25 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED TAWAR-MUDA RESERVOIR AREA (IF THE TAWAR-MUDA 1 DAM IS CONSTRUCTED)

Unit: M10^3

	Reservoir Water Level (El. m)			
	65	70	75	80
1. Rubber				
1.1 RISDA & Private	90	223	427	614
1.2 FELDA	-	20	88	192
Sub-total	90	243	515	806
2. Paddy	-	-	1	5
3. Upland	-	0	1	1
Total	90	233	517	812

Table 26 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED TAWAR-MUDA RESERVOIR AREA (IF THE TAWAR-MUDA 2 DAM IS CONSTRUCTED)

Unit: M10^3

	Reservoir Water Level (El. m)			
	65	70	75	80
1. Rubber				
1.1 RISDA & private	95	238	447	642
1.2 FELDA	-	20	88	192
Sub-total	95	258	535	834
2. Paddy	-	-	1	5
3. Upland	-	0	1	1
Total	95	258	537	840

Table 27 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED BERIS RESERVOIR AREA (IF THE BERIS 1 DAM IS CONSTRUCTED)

Unit: M$10^3

	Reservoir Water Level (El. m)			
	70	75	80	85
1. Rubber	77	212	446	772
2. Paddy	3	18	32	47
3. Upland	-	1	1	4
Total	80	231	479	823

Table 28 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED BERIS RESERVOIR AREA (IF THE BERIS 2 DAM IS CONSTRUCTED)

Unit: M$10^3

	Reservoir Water Level (El. m)			
	70	75	80	85
1. Rubber	77	212	446	772
2. Paddy	3	18	32	47
3. Upland	-	1	1	4
Total	80	231	479	823

Table 29 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED RUI RESERVOIR AREA (IF THE RUI 2 DAM IS CONSTRUCTED)

Unit: $M\$10^3$

	Reservoir Water Level (El. m)				
	225	230	235	240	245
1. Rubber	8	9	11	13	13
2. Paddy	1	1	1	1	1
3. Power	1,470	1,470	1,470	1,470	1,470
Total	1,479	1,480	1,482	1,484	1,484

Table 30 ESTIMATED PRODUCTION FORGONE IN THE PROPOSED RUI RESERVOIR AREA (IF THE RUI 3 DAM IS CONSTRUCTED)

Unit: $M\$10^3$

	Reservoir Water Level (El. m)				
	220	225	230	235	240
1. Rubber	6	8	9	11	13
2. Paddy	1	1	1	1	1
3. Power	1,470	1,470	1,470	1,470	1,470
Total	1,477	1,479	1,480	1,482	1,484

Table 31 ESTIMATED ECONOMIC INVESTMENT COST FOR THE BADAK-TEMIN RESERVOIR AREA

Unit: $M\$10^6$

	Reservoir Water Level (El. m)			
	35	40	45	50
1. Houses & Buildings	-	-	0.1	0.3
2. Road Relocation	-	3.6	6.3	9.0
Total	-	3.6	6.4	9.3

Table 32 ESTIMATED ECONOMIC INVESTMENT COST FOR THE SARI RESERVOIR AREA

Unit: M$10^6

	Reservoir Water Level (El. m)			
	80	85	90	95
1. Houses & Buildings	0	0	0	0
2. Road Relocation	11.1	11.3	11.4	11.6
3. Mine	0	0	0	0
Total	11.1	11.3	11.4	11.6

Table 33 ESTIMATED ECONOMIC INVESTMENT COST FOR THE DURIAN RESERVOIR AREA

Unit: M$10^6

	Reservoir Water Level (El. m)			
	65	70	75	80
Road Relocation	-	-	-	-

Table 34 ESTIMATED ECONOMIC INVESTMENT COST FOR THE TAWAR-MUDA RESERVOIR AREA (FOR THE TAWAR-MUDA 1 OR 2 DAM)

Unit: M$10^6

	Reservoir Water Level (El. m)			
	65	70	75	80
1. Houses & Buildings	-	-	-	0.1
2. Road Relocation	-	0.4	1.0	1.4
Total	-	0.4	1.0	1.5

Table 35 ESTIMATED ECONOMIC INVESTMENT COST FOR THE BERIS RESERVOIR AREA (FOR THE BERIS 1 OR 2 DAM)

Unit: M10^6

	Reservoir Water Level (El. m)			
	70	75	80	85
1. Houses & Buildings				
1.1 Sg. Batang	0.1	0.2	0.6	0.9
1.2 Kg. Ternas	0.1	0.2	0.3	0.3
Sub-total	0.2	0.4	0.9	1.2
2. Road Relocation	1.3	3.0	4.6	6.2
3. Primary School	-	-	0.3	0.3
Total	1.5	3.4	5.5	7.4

Table 36 ESTIMATED ECONOMIC INVESTMENT COST FOR THE RUI RESERVOIR AREA (IF THE RUI 2 DAM IS CONSTRUCTED)

Unit: M10^6

	Reservoir Water Level (El. m)				
	225	230	235	240	245
1. Houses & Buildings					
1.1 Kg. Pong	0.1	0.1	0.1	0.1	0.1
1.2 Kg. Asu	0	0	0	0	0
1.3 Power station	0	0	0	0	0
Sub-total	0.1	0.1	0.1	0.1	0.1
2. Road Relocation	-	-	-	-	-
Total	0.1	0.1	0.1	0.1	0.1

Table 37 ESTIMATED ECONOMIC INVESTMENT COST FOR THE RUI RESERVOIR AREA (IF THE RUI 3 DAM IS CONSTRUCTED)

Unit: $M\$10^6$

	Reservoir Water Level (El. m)				
	220	225	230	235	240
1. Mine					
1.1 Tailing facilities	4.0	4.0	4.0	4.0	4.0
2. Houses & Buildings					
2.1 Kg. Pong	0.1	0.1	0.1	0.1	0.1
2.2 Kg. Asu	0	0	0	0	0
2.3 Power station	0	0	0	0	0
2.4 Mine	0	0	0	0	0
Sub-total	0.1	0.1	0.1	0.1	0.1
3. Road Relocation	-	-	-	-	-
Total	4.1	4.1	4.1	4.1	4.1

FIGURES

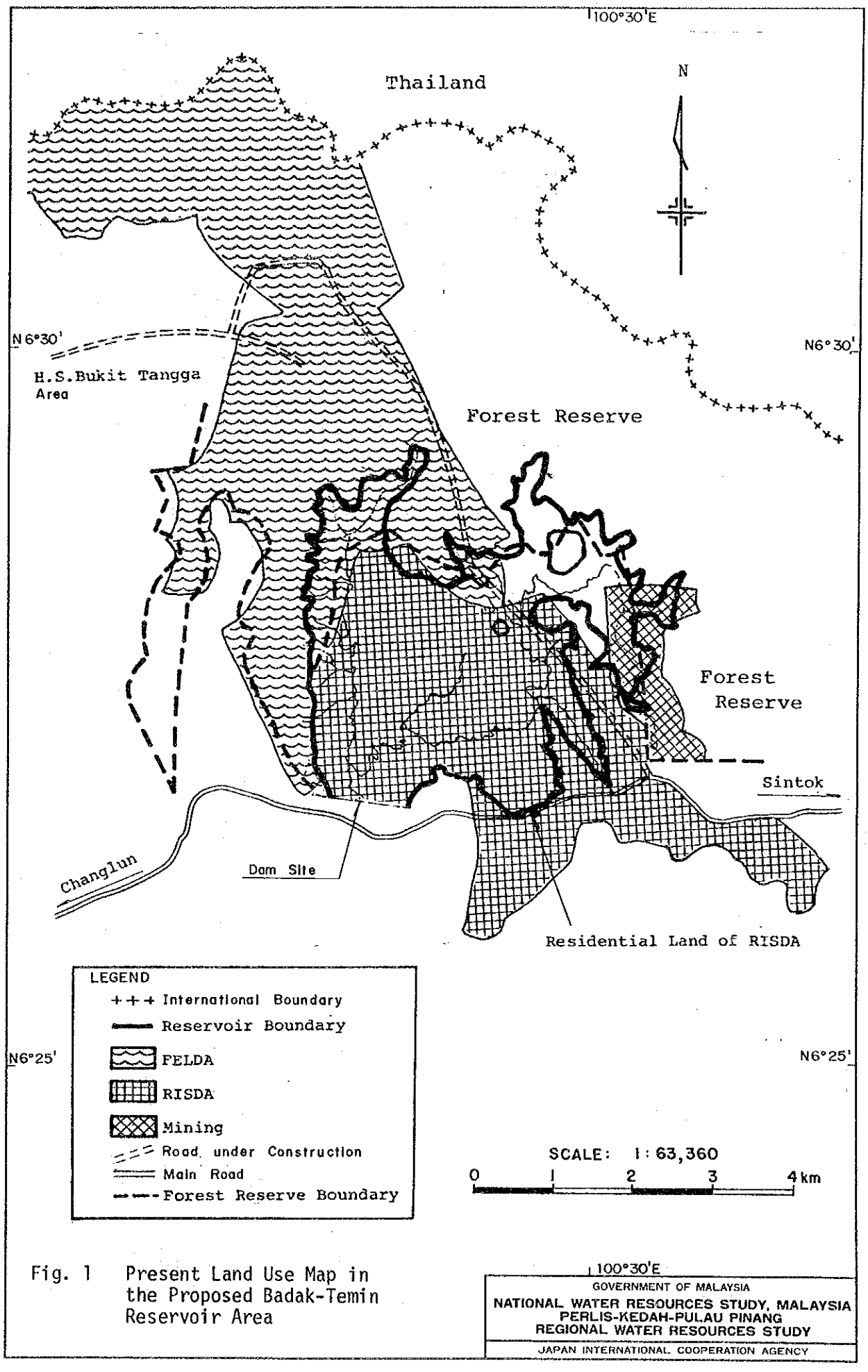

Fig. 1 Present Land Use Map in the Proposed Badak-Temin Reservoir Area

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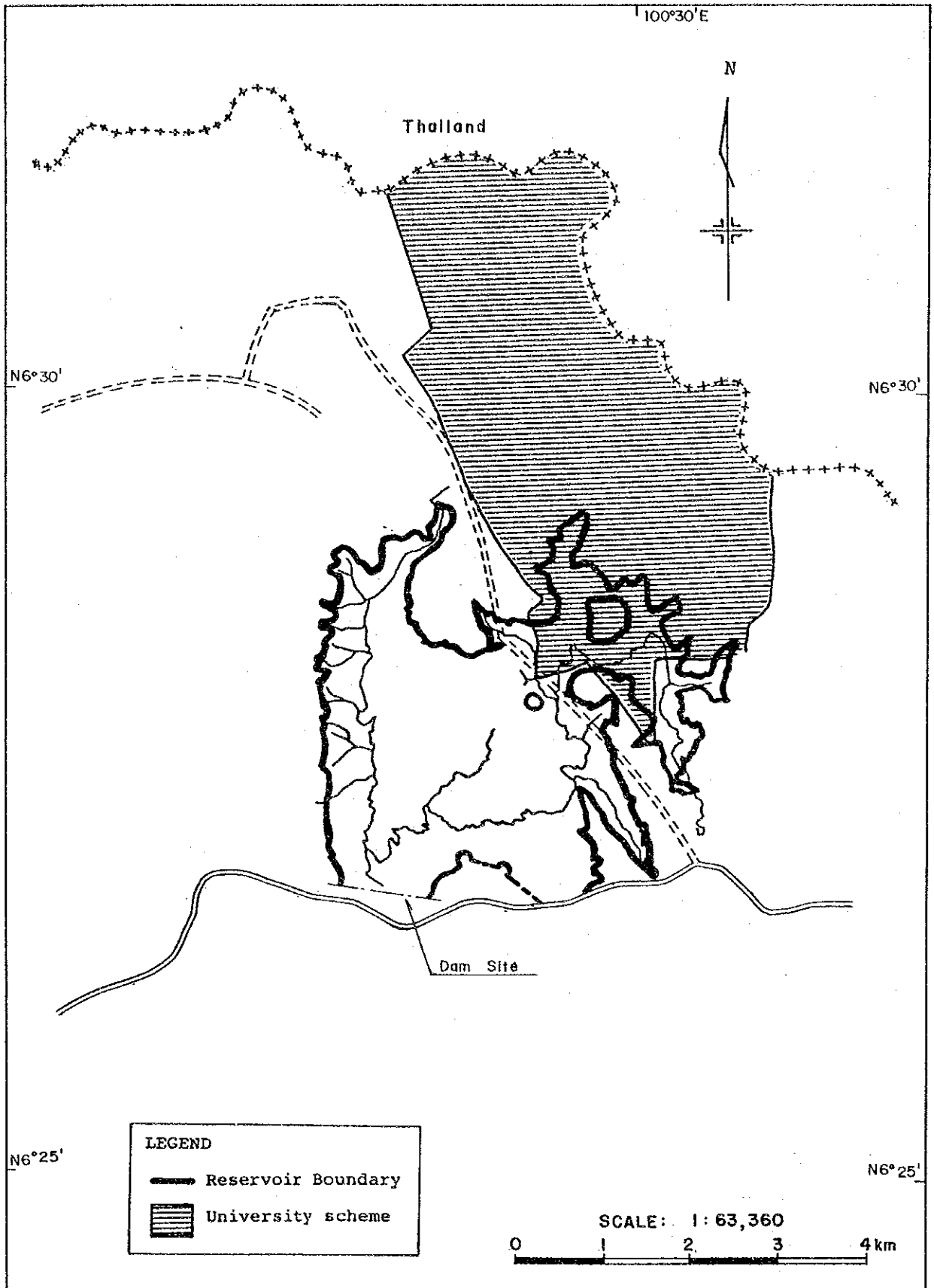

Fig. 2 Land Use Plan Map in the Proposed Badak-Temin Reservoir Area

100°30'E

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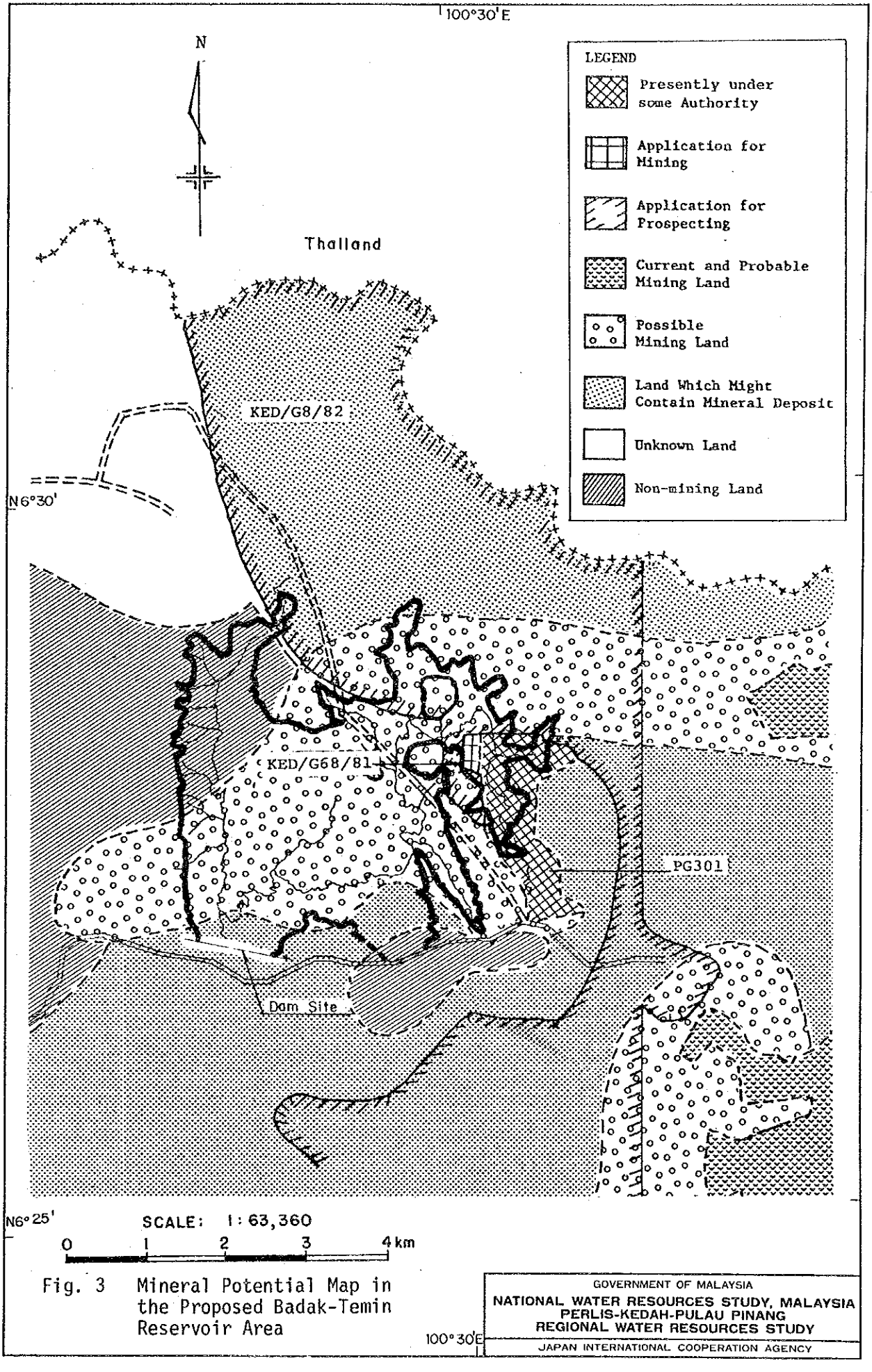

Fig. 3 Mineral Potential Map in the Proposed Badak-Temin Reservoir Area

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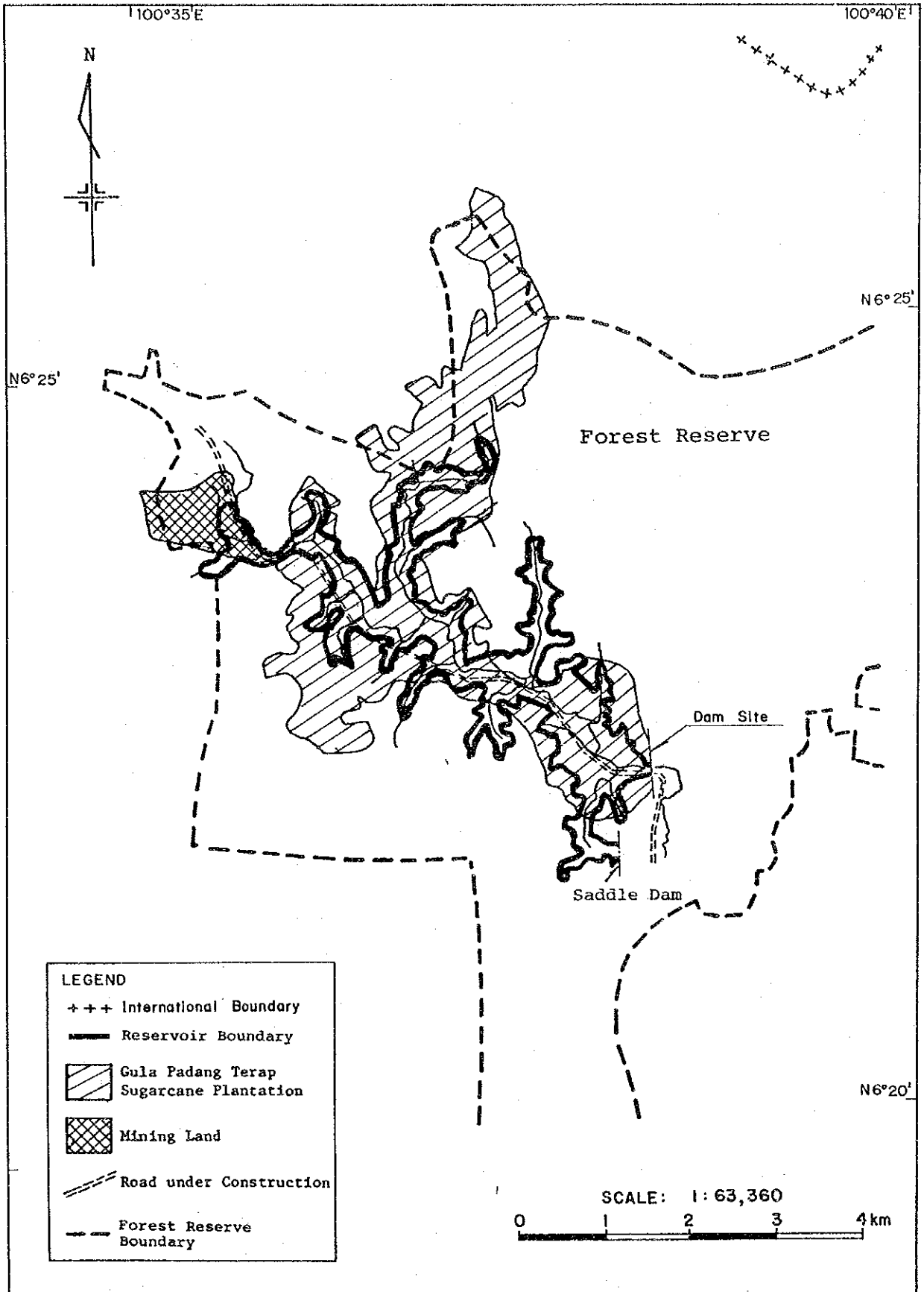

Fig. 4 Present Land Use Map in the Proposed Sari Reservoir Area

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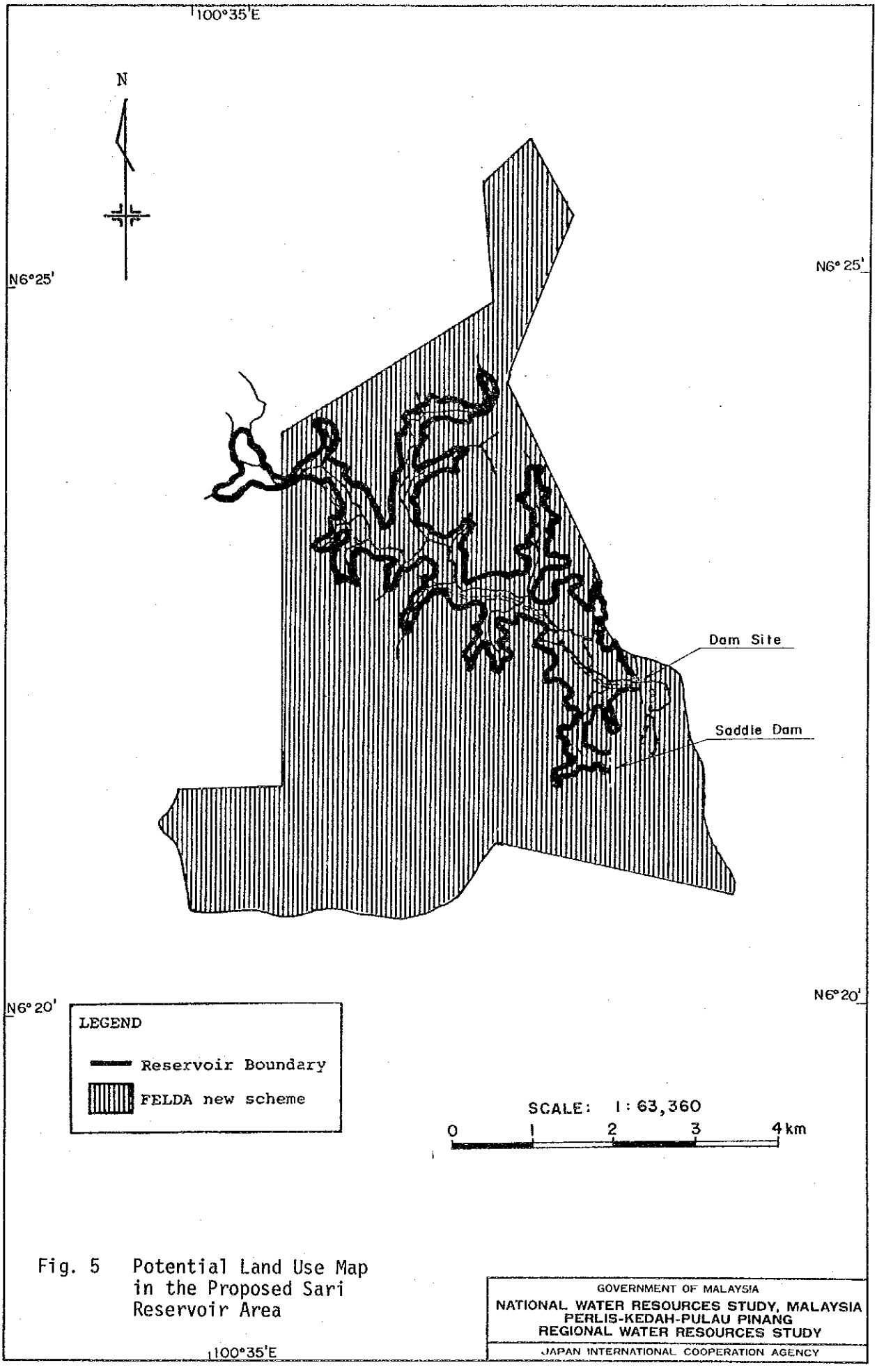

Fig. 5 Potential Land Use Map in the Proposed Sari Reservoir Area

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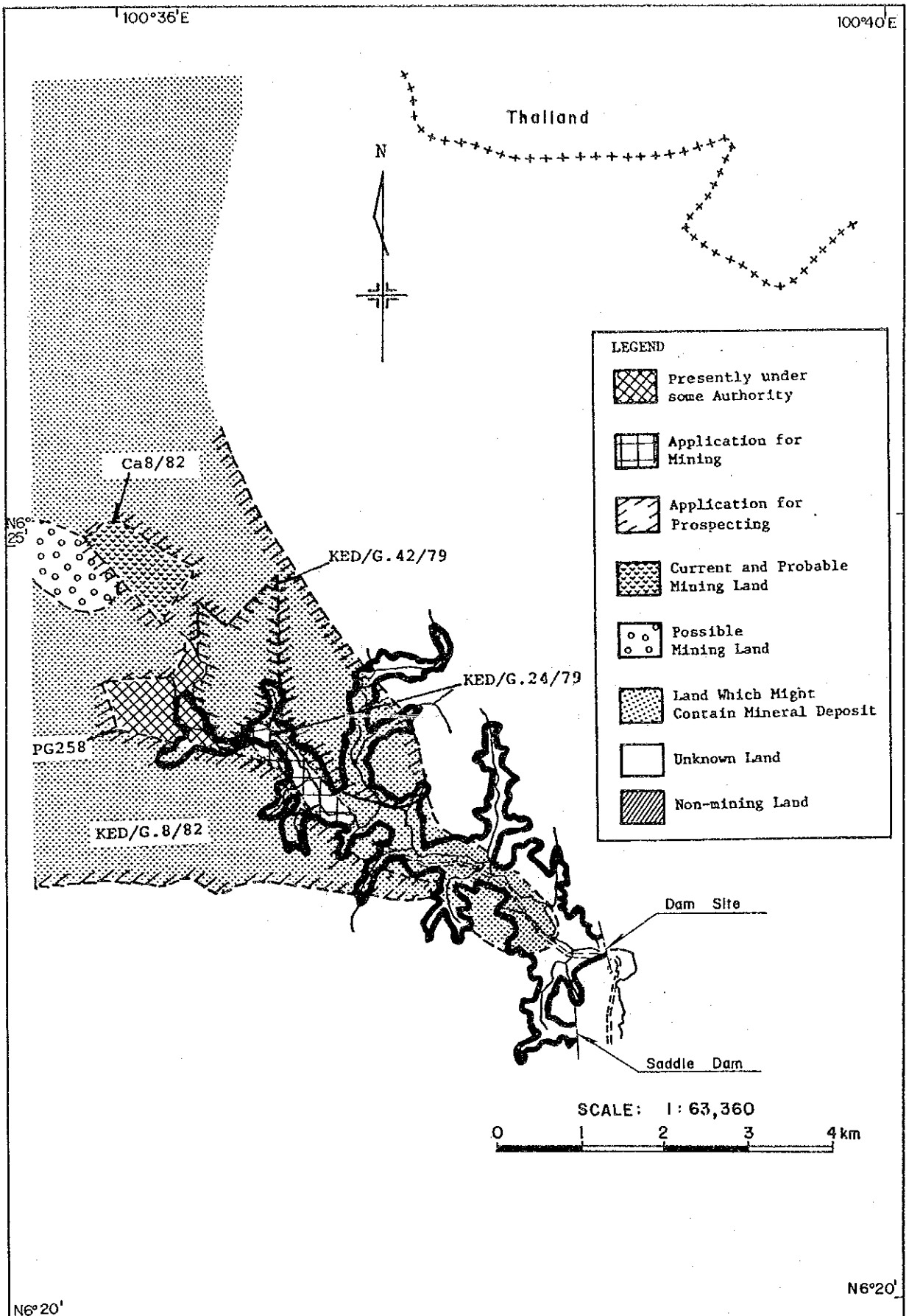

Fig. 6 Mineral Potential Map in the Proposed Sari Reservoir Area

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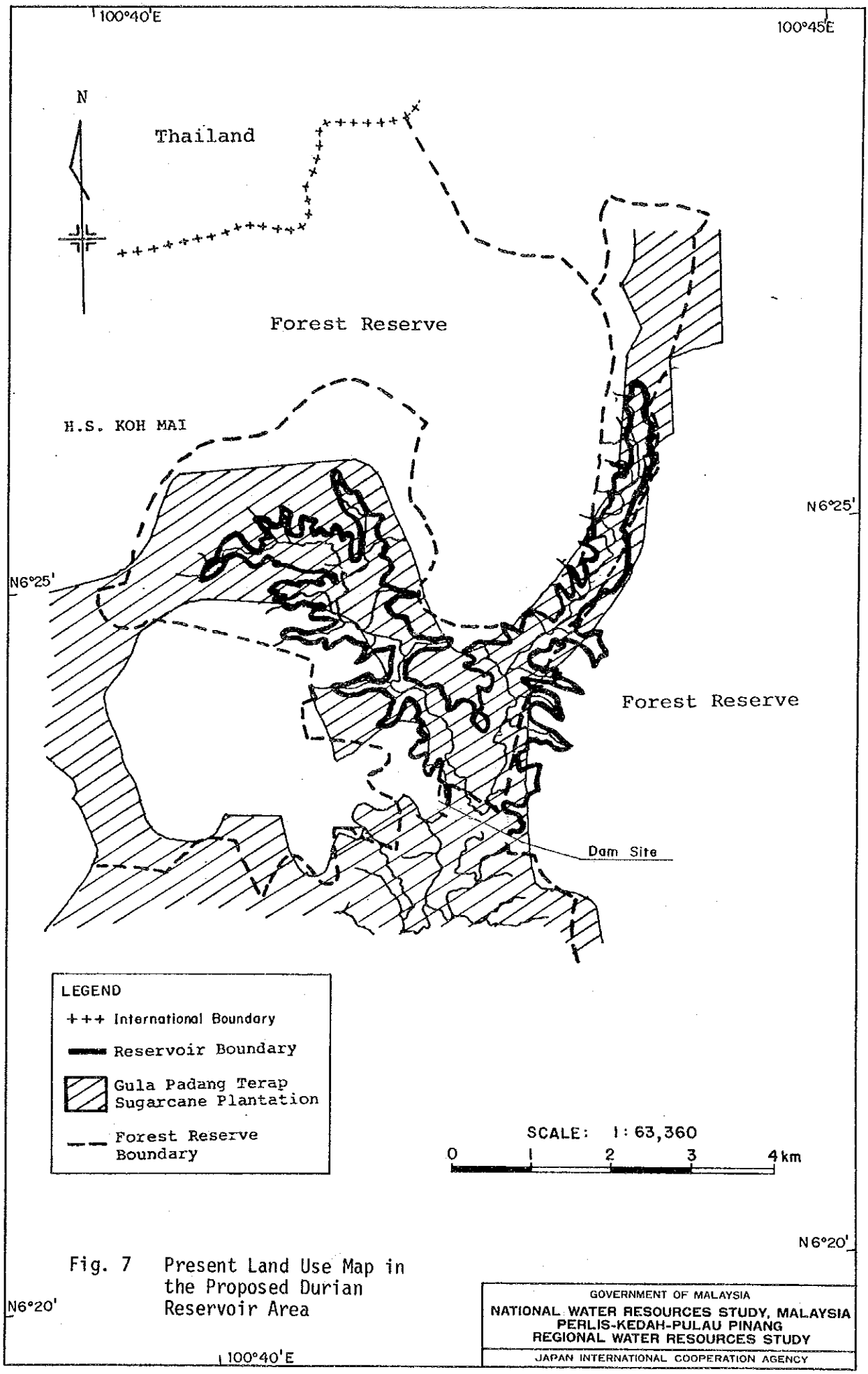

Fig. 7 Present Land Use Map in the Proposed Durian Reservoir Area

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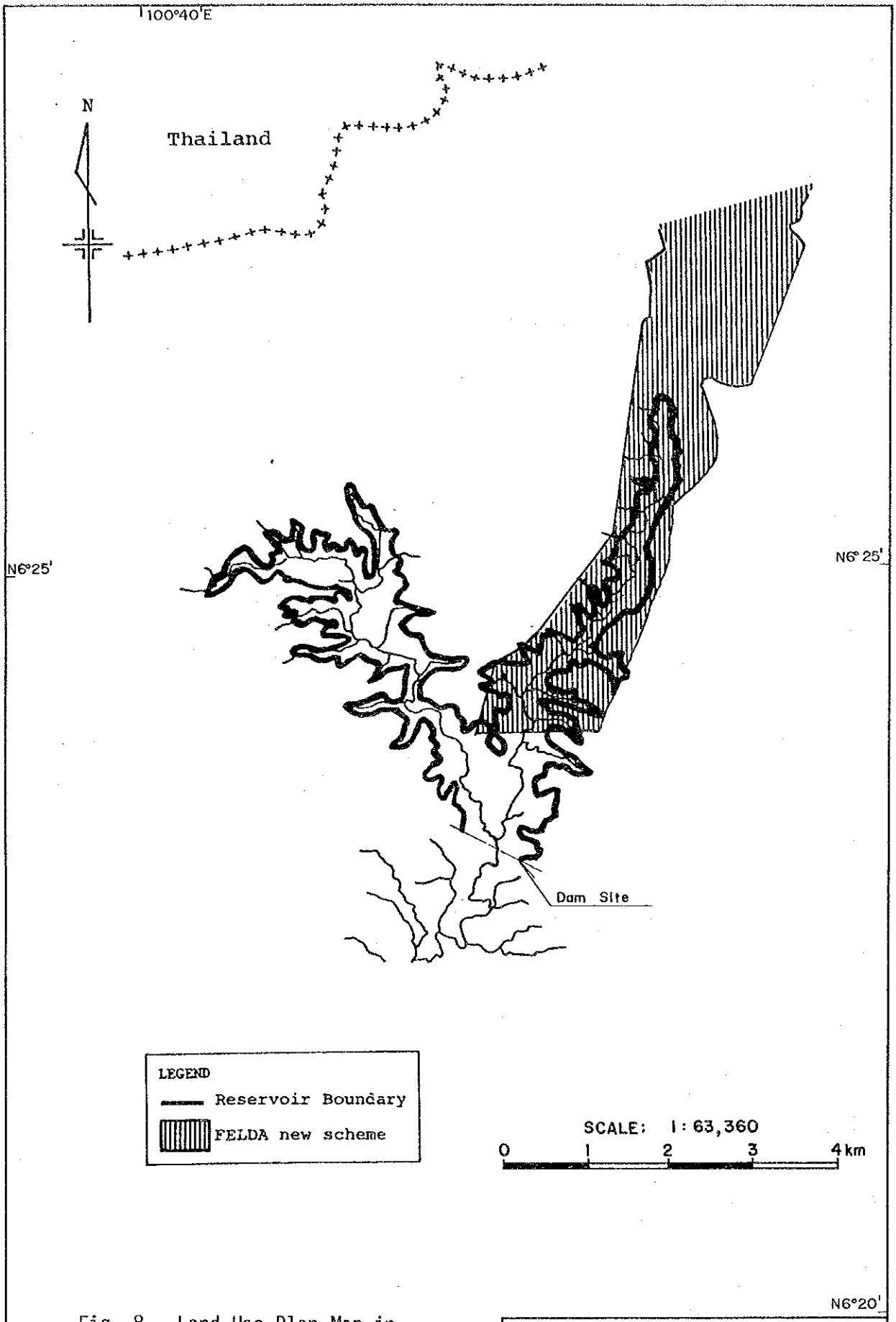

Fig. 8 Land Use Plan Map in the Proposed Durian Reservoir Area

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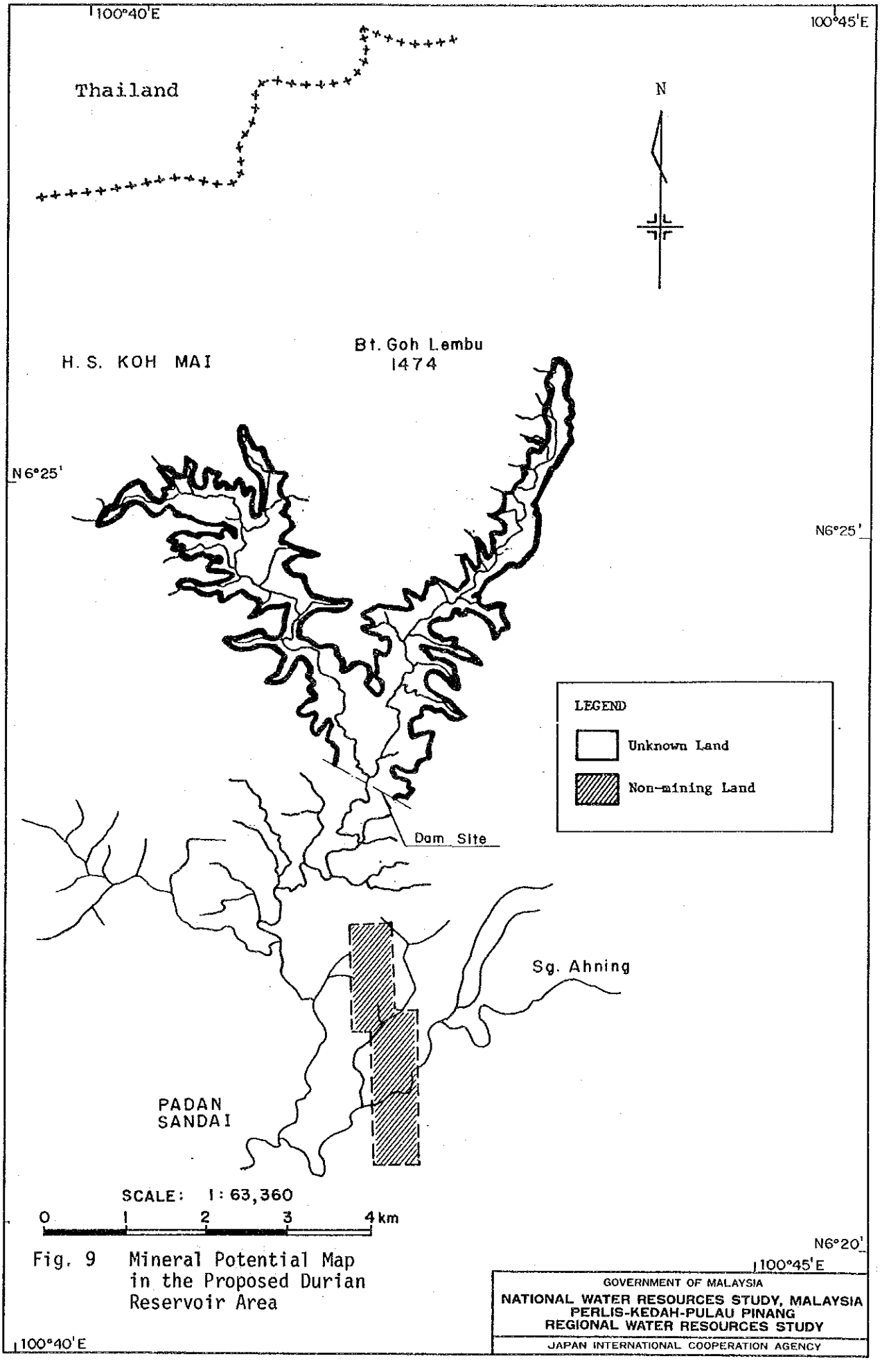

Fig. 9 Mineral Potential Map in the Proposed Durian Reservoir Area

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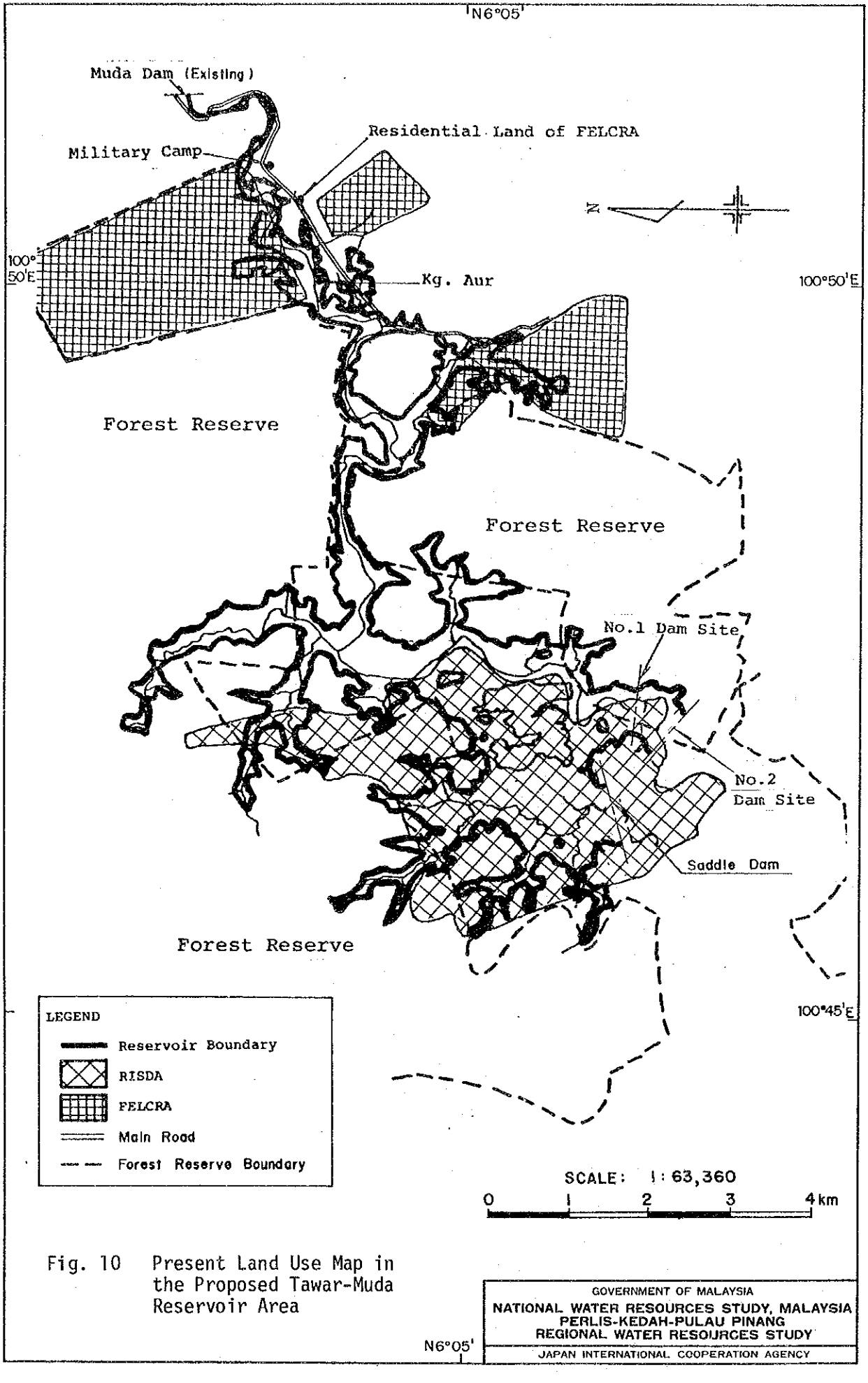

Fig. 10 Present Land Use Map in the Proposed Tawar-Muda Reservoir Area

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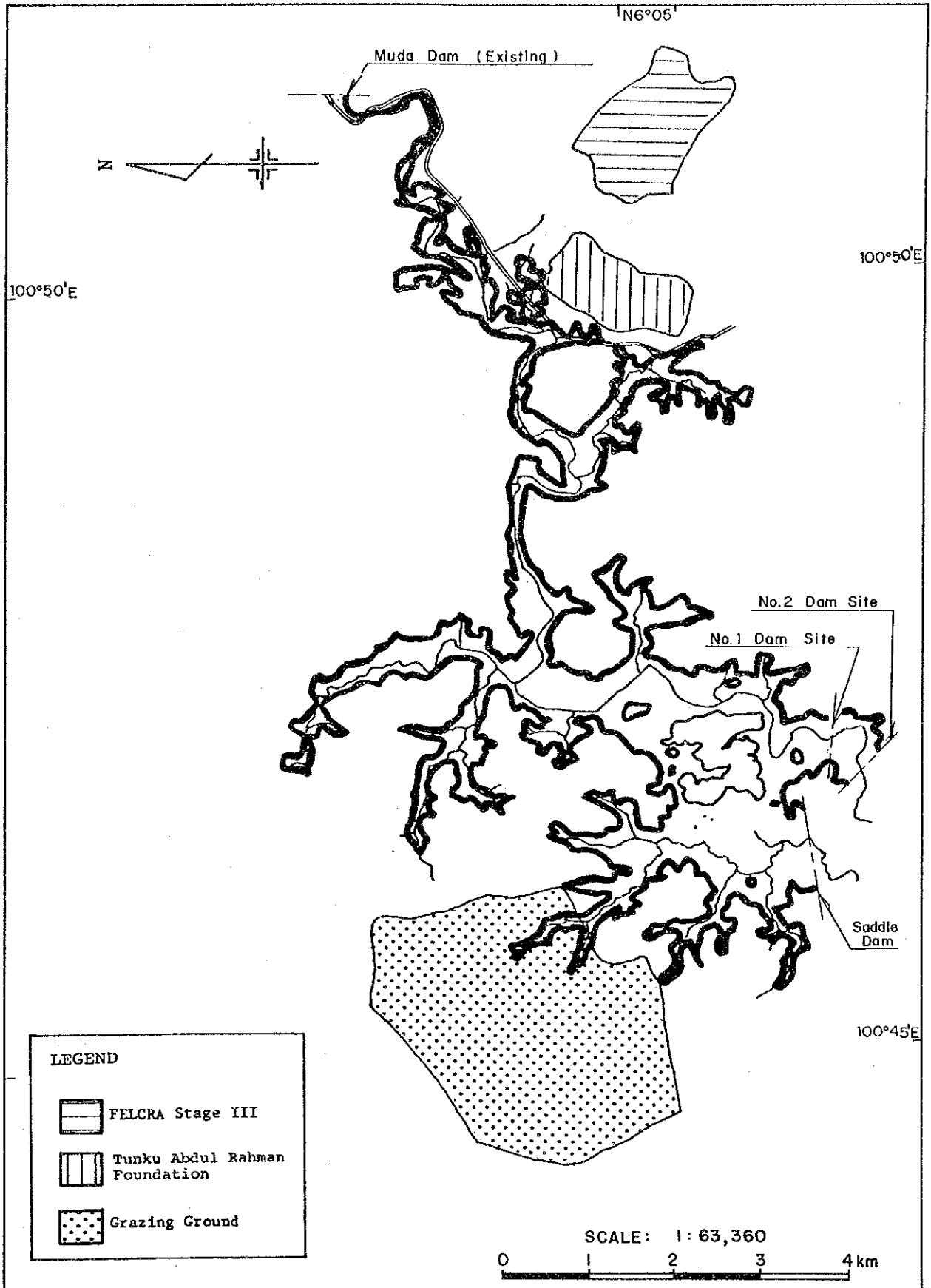

Fig. 11 Land Use Plan Map in the Proposed Tawar-Muda Reservoir Area

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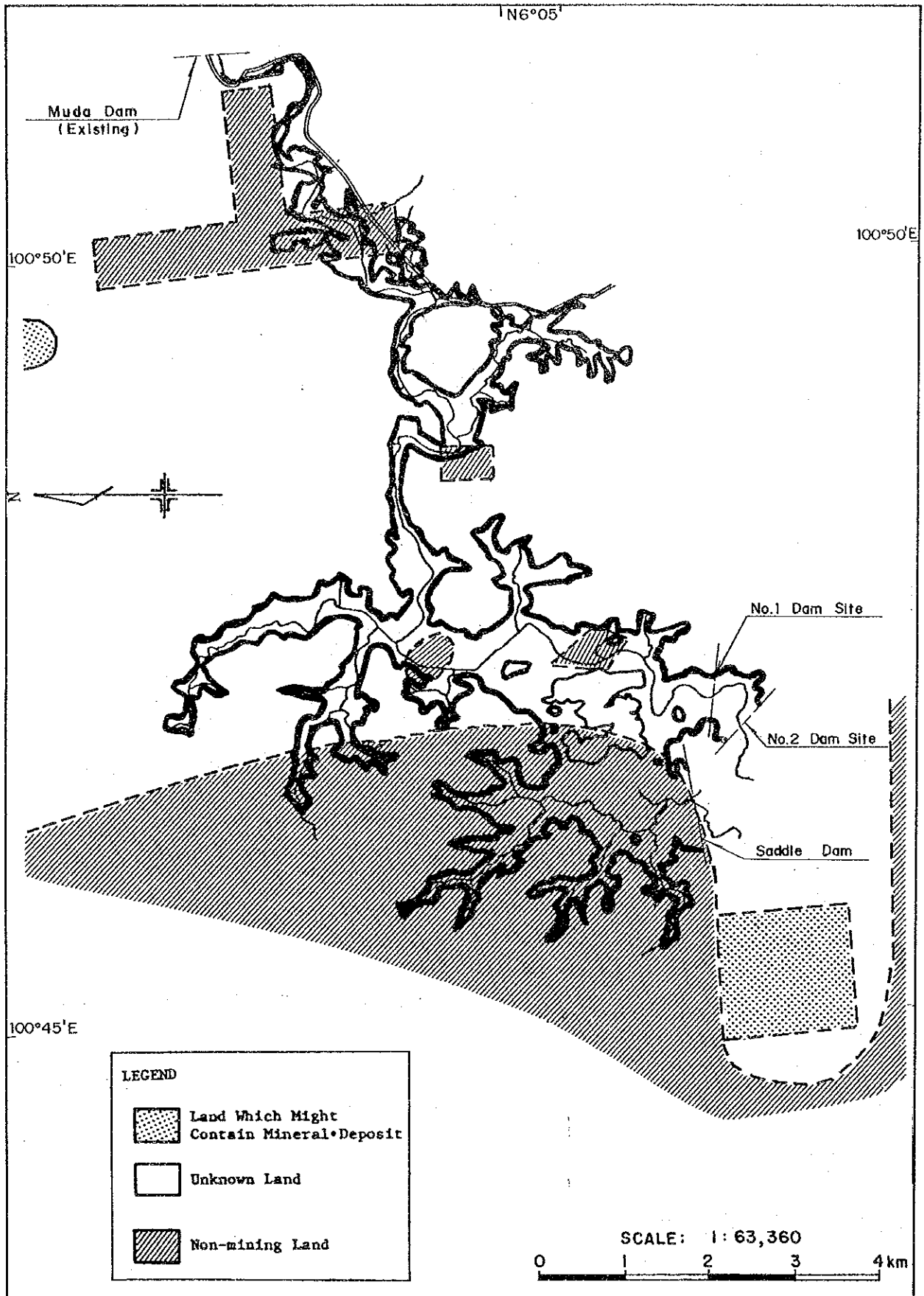

Fig. 12 Mineral Potential Map in the Proposed Tawar-Muda Reservoir Area

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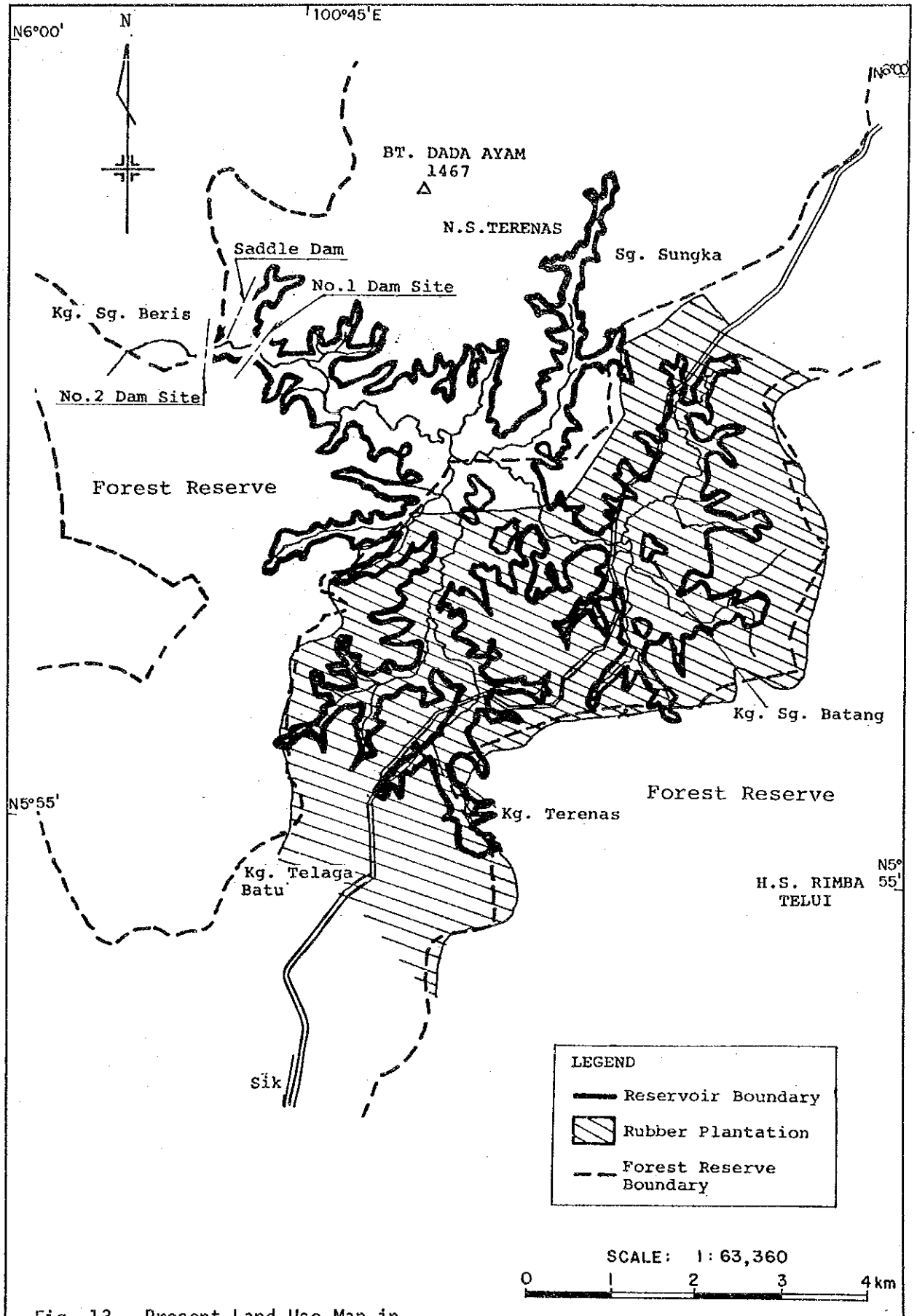

Fig. 13 Present Land Use Map in the Proposed Beris Reservoir Area

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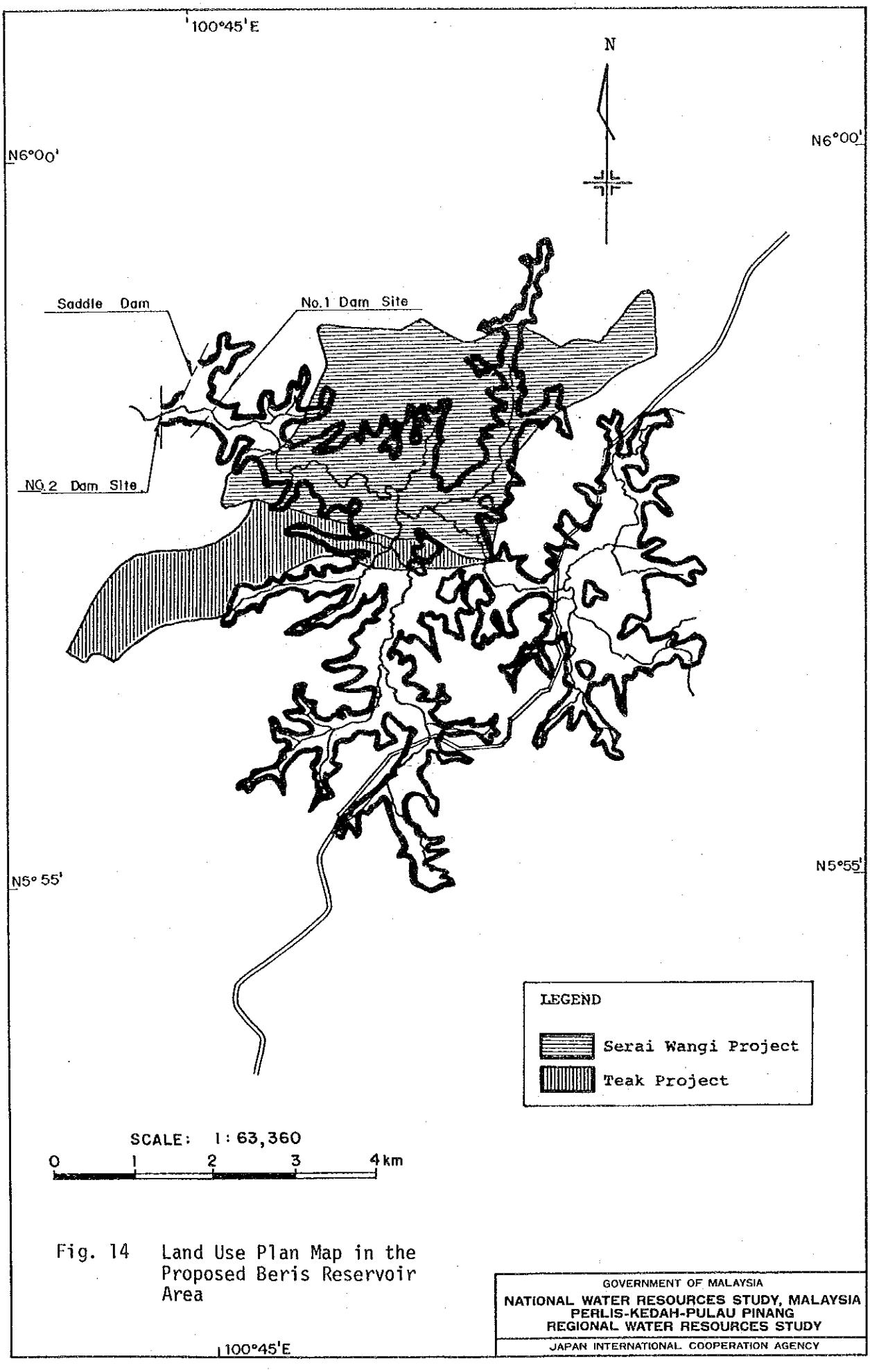

Fig. 14 Land Use Plan Map in the Proposed Beris Reservoir Area

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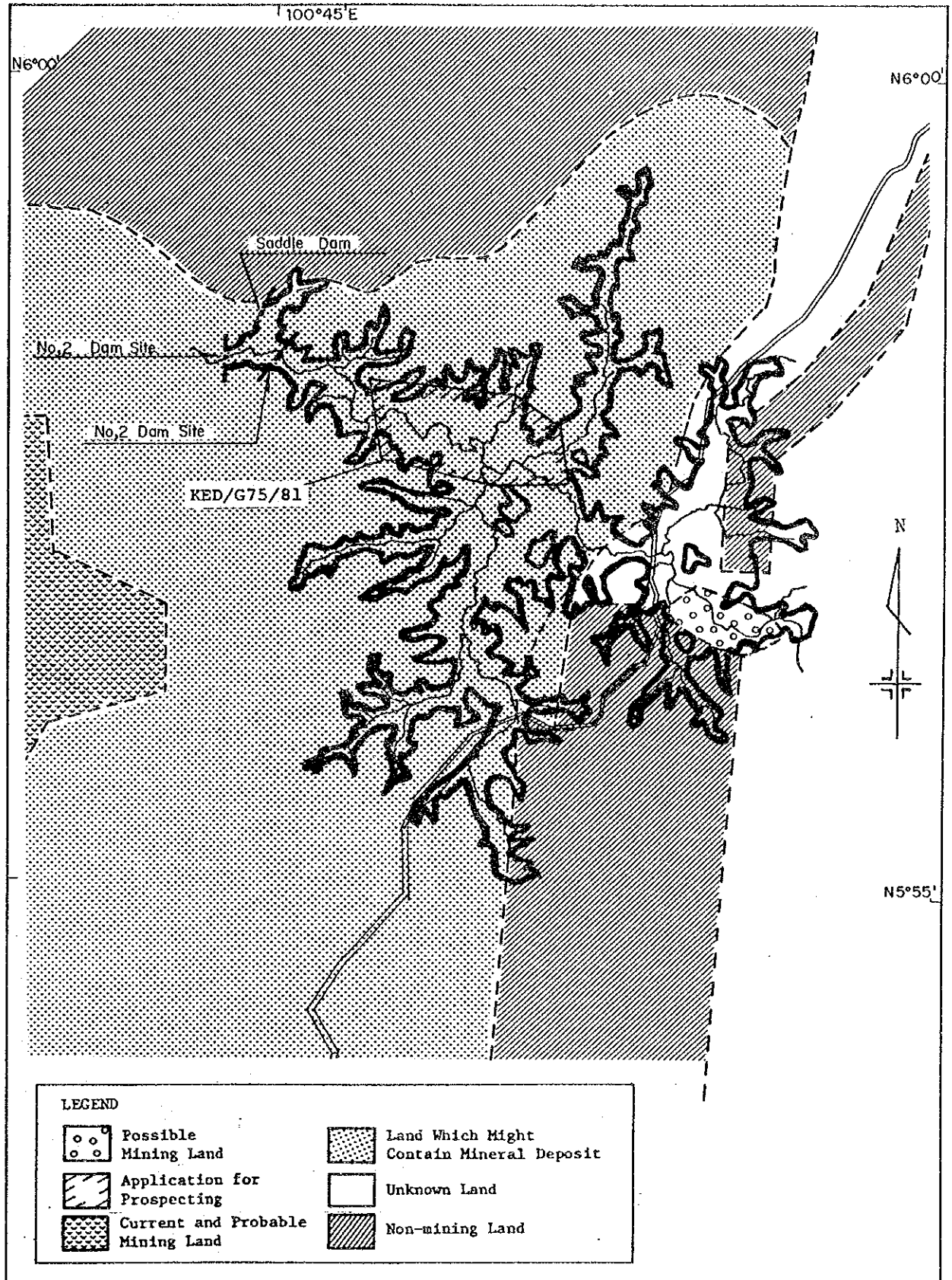

Fig. 15 Mineral Potential Map in the Proposed Beris Reservoir Area

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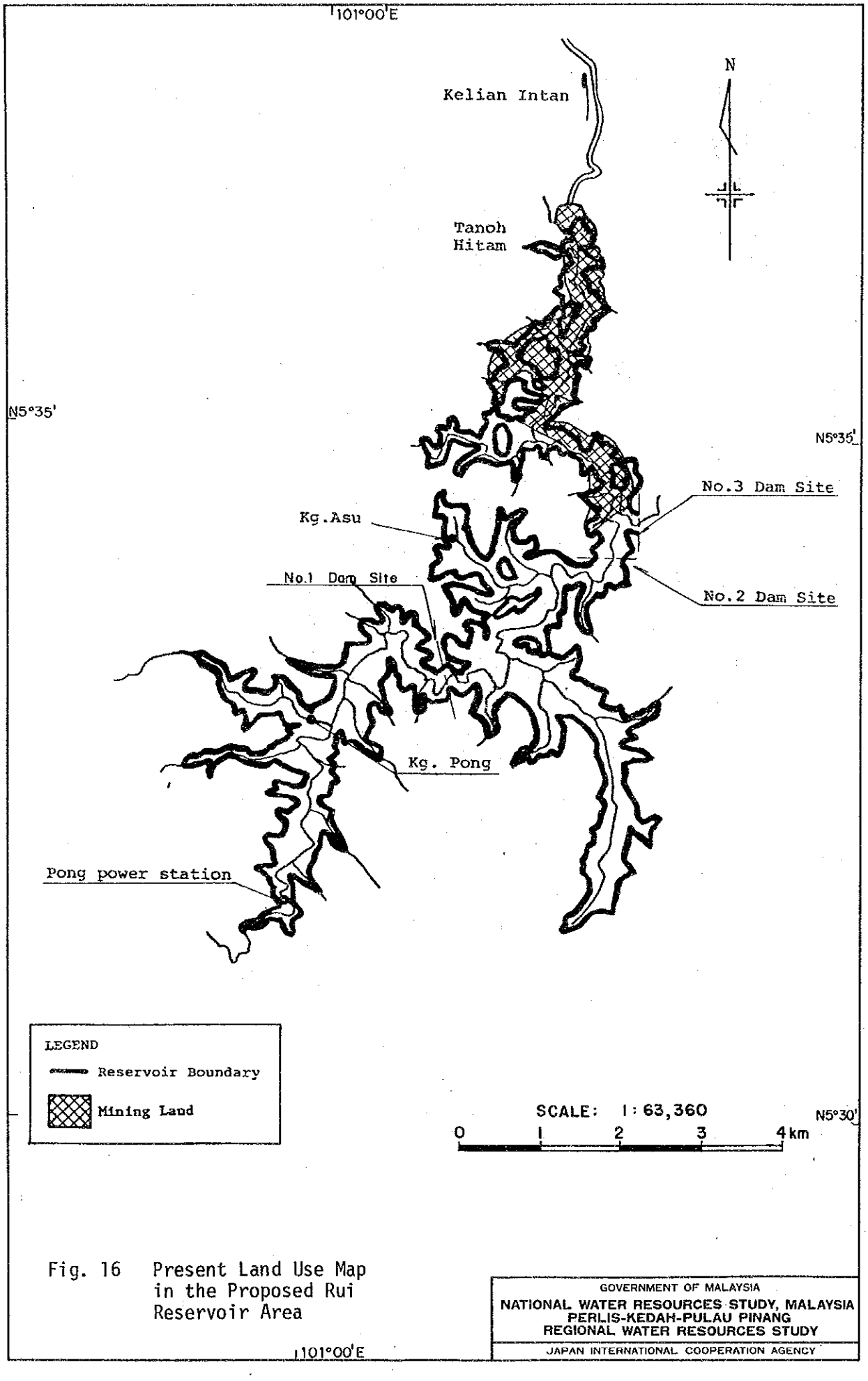

Fig. 16 Present Land Use Map in the Proposed Rui Reservoir Area

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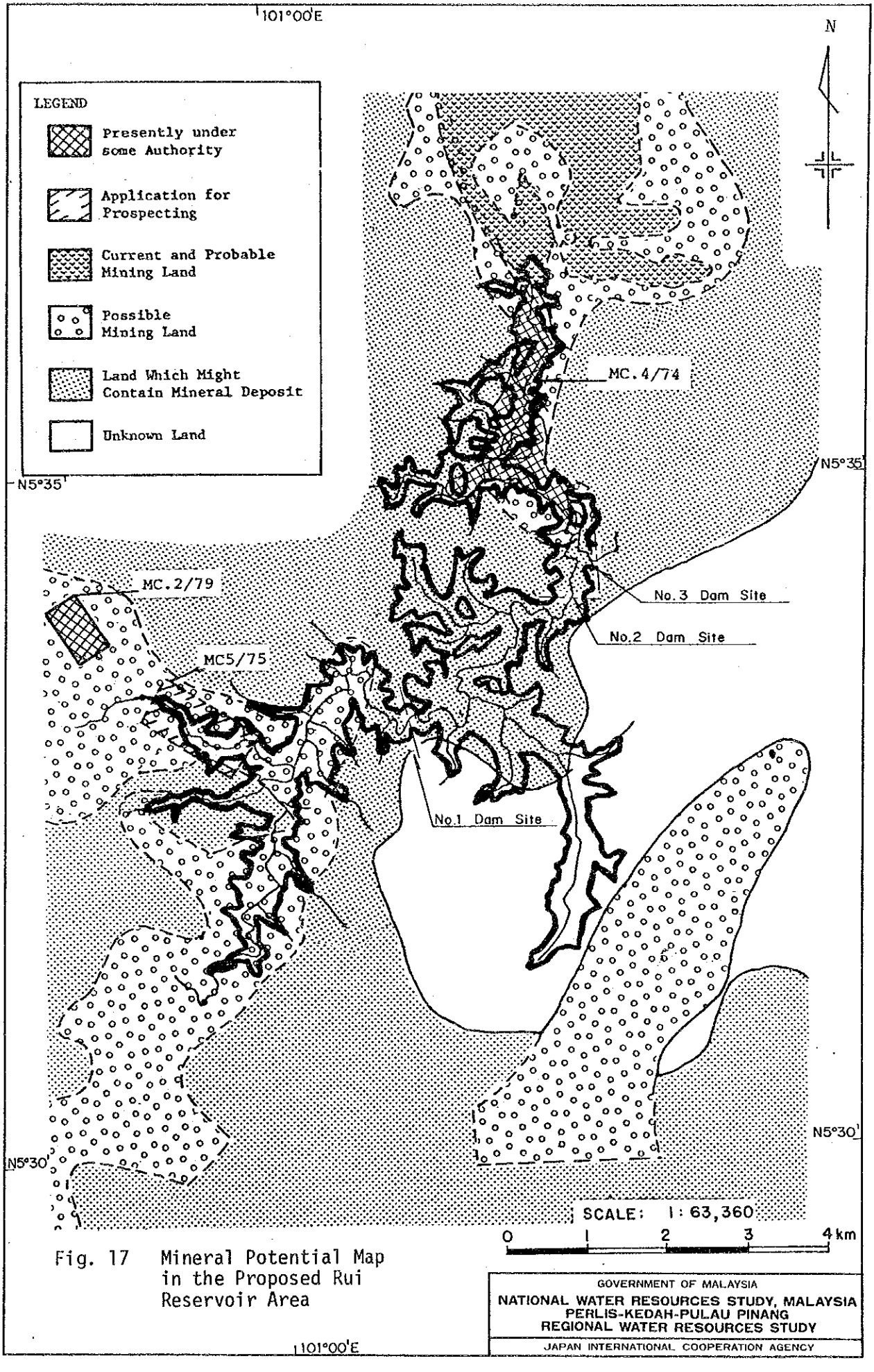
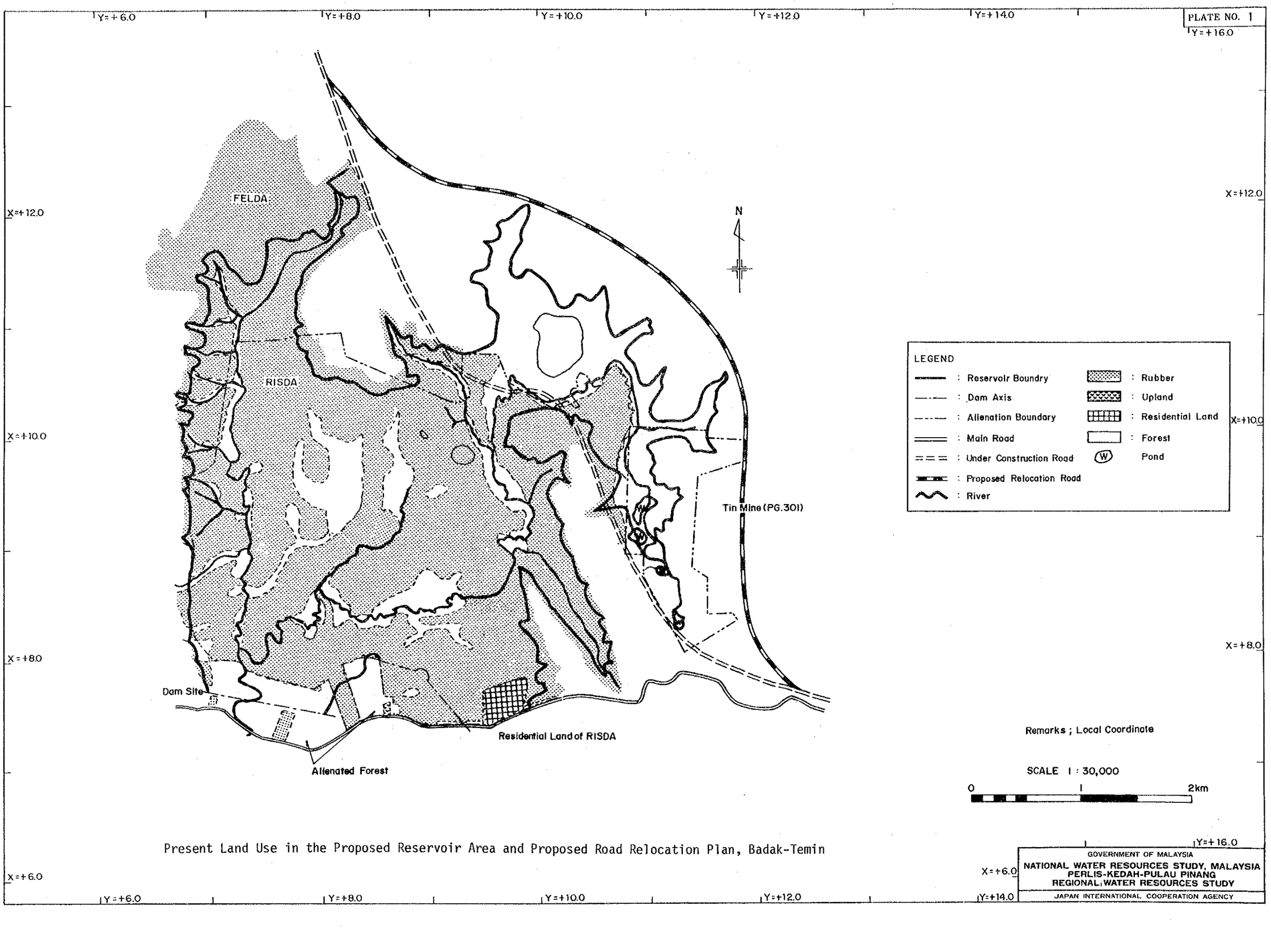


Fig. 17 Mineral Potential Map in the Proposed Rui Reservoir Area

PLATES

PLATE NO. 1



Present Land Use in the Proposed Reservoir Area and Proposed Road Relocation Plan, Badak-Temin

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PLATE NO. 2

100°35'E 100°40'E 100°45'E 100°50'E

N6°30'

N6°25'

N6°20'

K-DIVISION

H-DIVISION

A-DIVISION

B-DIVISION

C-DIVISION

D-DIVISION

E-DIVISION

F-DIVISION

G-DIVISION

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

Sari Dam

Durian Dam

Padang Sanai Sugar factory

Kuala Nerang-Kg. Pdg. Sanai Road

Kuda Nerang

N

LEGEND

: Plantation Boundary

: Proposed Reservoir

: Main Road

0 1 2 3 4 km

Gura Padang Terap Sugarcane Plantation

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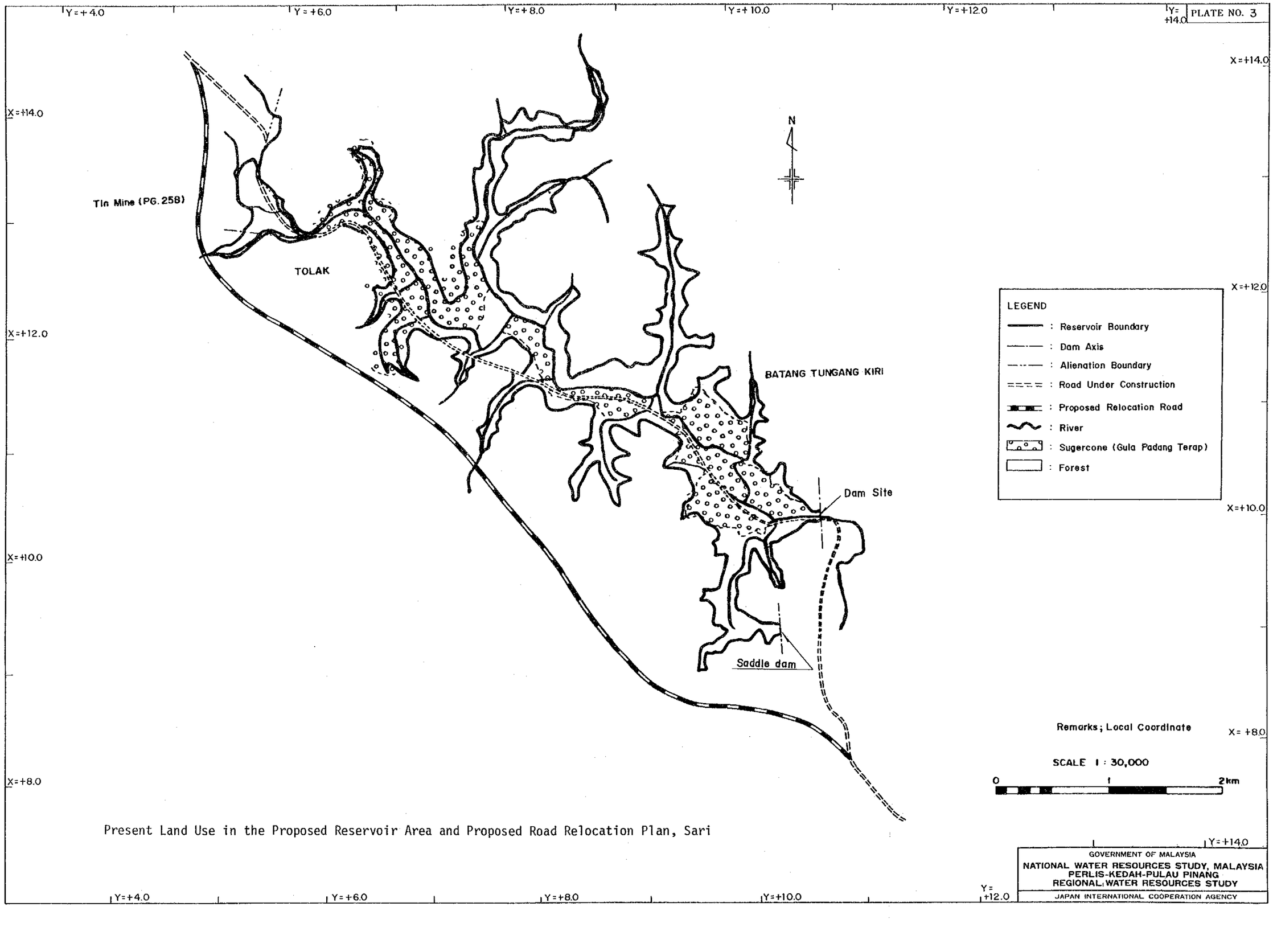
PLATE NO. 3



Present Land Use in the Proposed Reservoir Area and Proposed Road Relocation Plan, Sari

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PLATE NO. 4

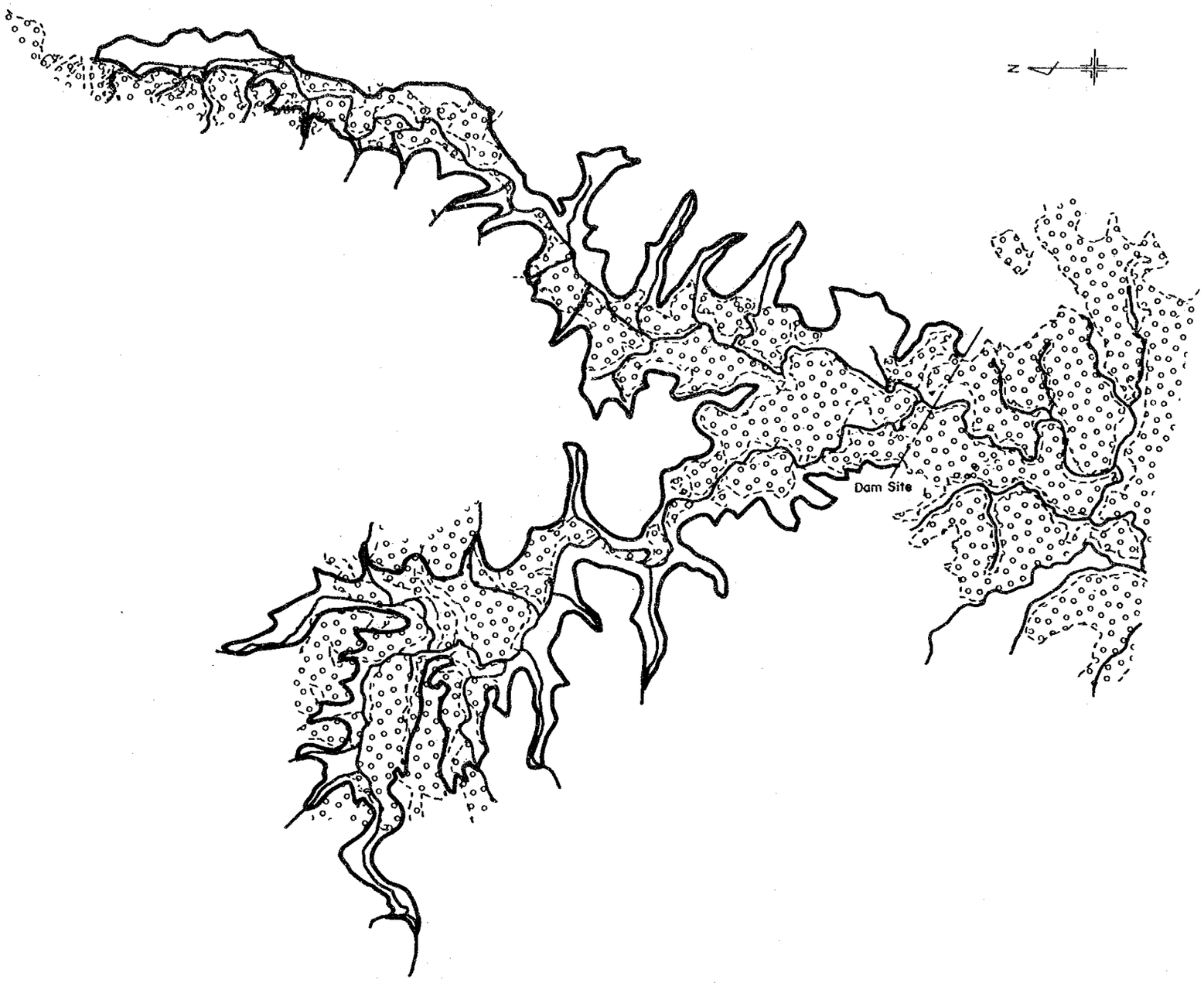
X=+16.0 X=+14.0 X=+12.0 X=+10.0 X=+8.0 X=+6.0

Y=+22.0

Y=+20.0

Y=+18.0

Y=+16.0



LEGEND

- : Reservoir Boundry
- : Dam Axis
- : River
- : Sugarcane (Gula Padang Terap)
- : Forest

Remarks ; Local Coordinate

SCALE 1 : 30,000

0 1 2km

Present Land Use in the Proposed Reservoir Area, Durian

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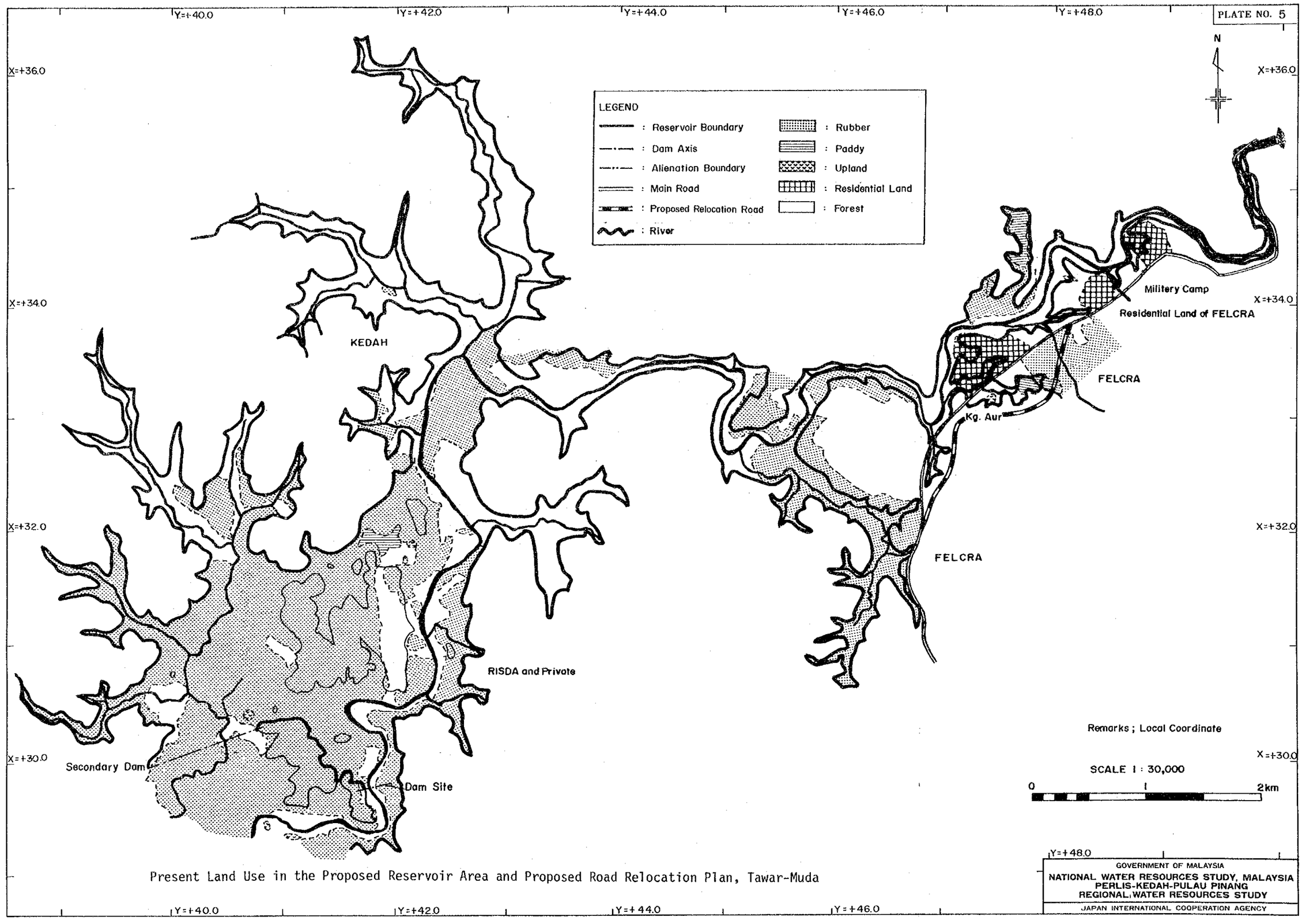
PLATE NO. 5



Present Land Use in the Proposed Reservoir Area and Proposed Road Relocation Plan, Tawar-Muda

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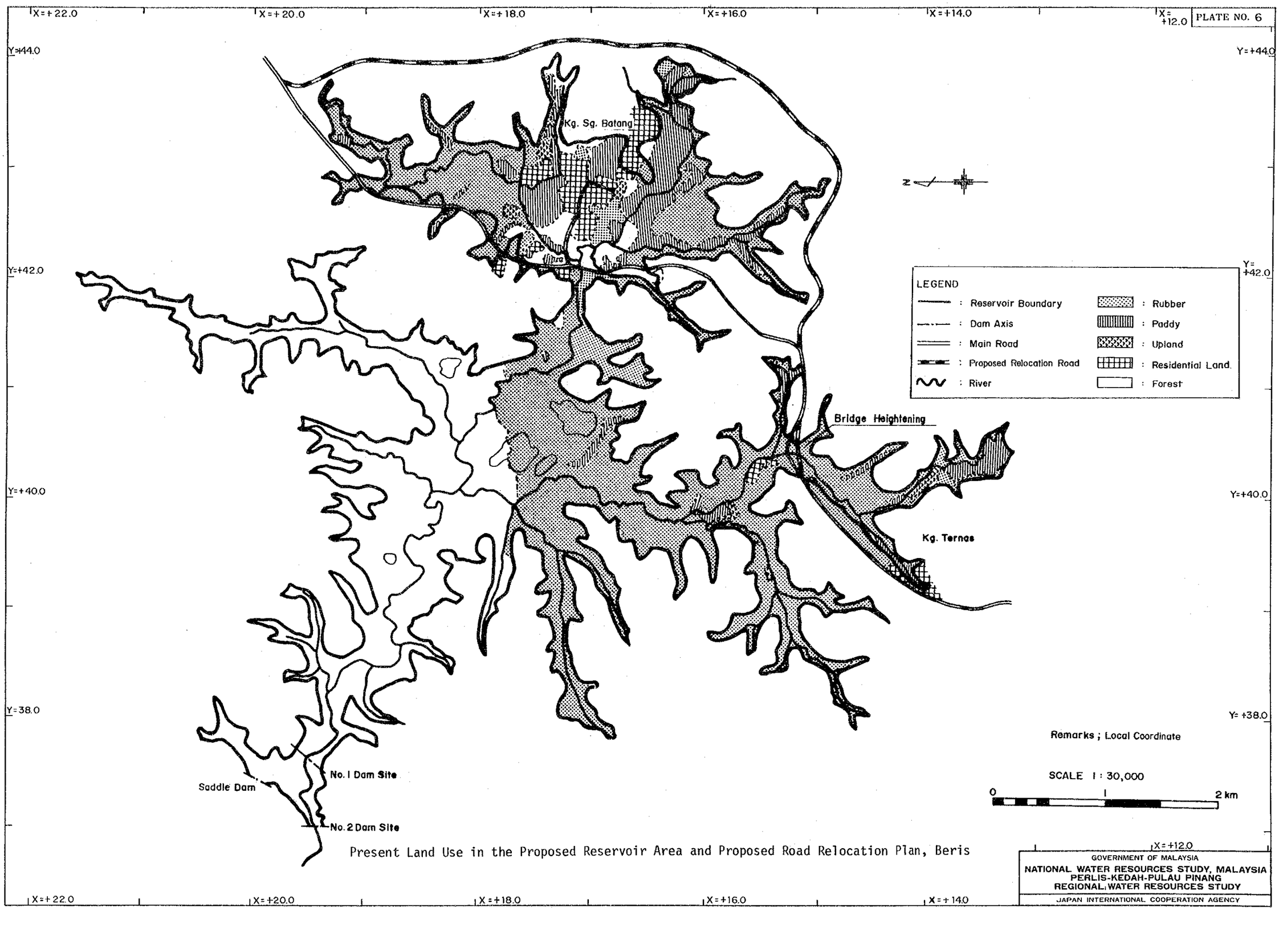
PLATE NO. 6



Present Land Use in the Proposed Reservoir Area and Proposed Road Relocation Plan, Beris

GOVERNMENT OF MALAYSIA
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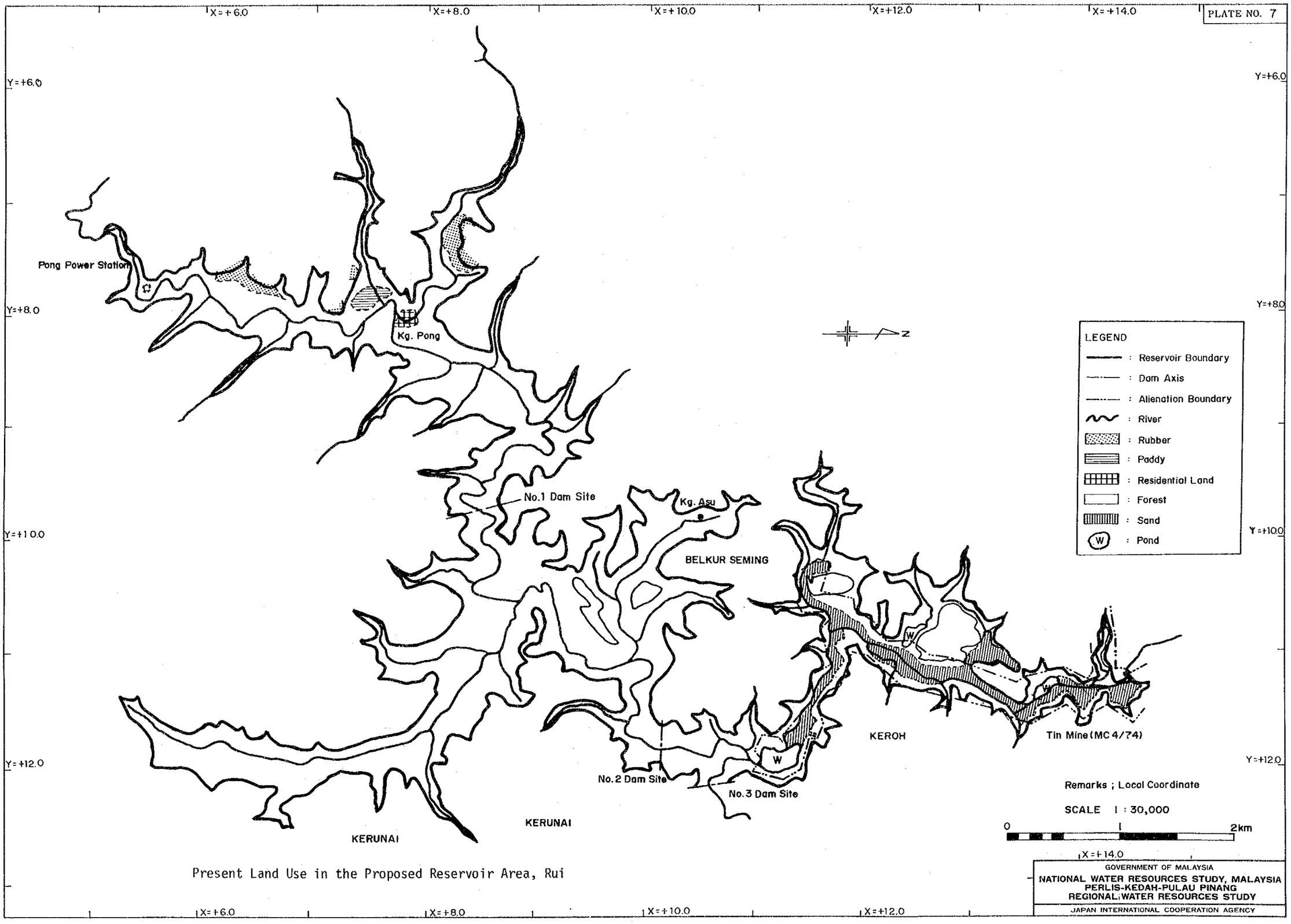
PLATE NO. 7



Present Land Use in the Proposed Reservoir Area, Rui

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ANNEX P

ENVIRONMENTAL IMPACT OF PROPOSED SOURCE FACILITIES

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SPECIAL ABBREVIATIONS

Pdg.; Padang

Kg. ; Kampong: Village

Sg. ; Sungei : River

1. INTRODUCTION

This ANNEX presents the results of the environmental study to disclose possible environmental effects of the proposed dams. The study is based on the field inspection and interviews at and in the vicinity of the proposed dam sites and existing dams in January and February 1983 and documents and information provided by relevant authorities.

2. RIVER ENVIRONMENT IN THE VICINITY OF THE PROPOSED DAM SITES

The locations visited for the field inspection and interview are plotted in Figs. 1 and 2.

2.1 River Channel and Instream Water

(1) Badak-Temin

The Temin river runs from the north to the south in an open valley developed for rubber cultivation. Grasses, shrubs and bamboo groves form a narrow strip along the river. The low water channel of the Temin river of 8 m in width and 1 m in water depth at the dam site cuts alluvial deposit of muddy sand. Instream water is turbid and yellowish brown colored with suspended solids. The Badak river joins the Temin river from the about 300 m upstream of the dam site east. Its low water channel is covered with coarse sand and instream water is clear, 2 km upstream of the confluence of the two rivers.

(2) Sari

The Sari river runs in a narrow valley at the dam site. The flow section of 5 m in width and 0.5 m in depth is observed. Rocks are exposed in the riverbed. Water is clear.

(3) Durian

The Durian dam site is located immediately downstream of the confluence of the Seraya river and Durian Burona river. The river channel of muddy sand is 8 m in width and 1 m in water depth at the dam site. Water is yellowish brown and relatively clear. Shrub and bamboo form a strip along the river. Riverbed is covered by angular gravels with relatively clear water, in the Seraya river and Durian Burona river above the confluence. Water in the Durian river is slightly colored but not turbid near Kg. Pdg. Sanai, about 7 km downstream of the dam site.

(4) Tawar-Muda

The Muda river flows in a rather open valley which is covered with grasses, shrubs and coppices. The riverbed of 10 to 15 m in width and 1 m in water depth is covered with coarse sand with rock outcrops. Water is colored but not turbid.

(5) Beris

The Beris river flows in a valley which is covered with grasses and shrubs. The river channel is 20 m in width and 1 m in water depth being covered with pebbles with rock outcrops at the dam site. The river deposit is coarse sand in upper stretch near Kg. Sg. Batang. Water is clear but slightly greenish.

(6) Rui

There are 3 alternative dam sites. Riverbed is covered with angular gravels at the 3 sites. The low water channel is 20 to 30 m in width and 1 m in water depth. Water is clear but slightly yellowish green.

2.2 Water Plants

Water plants are rarely observed in the rivers of the proposed dam sites.

Filamentous green alga (*Spirogyra* species or related species) is recognized in the Sari river, 1 km upstream of the proposed Sari dam site and in the Rui river, 5 km downstream of the proposed Rui 3 dam site.

Submerged plant (*Hydrilla verticillata* or related species) is found in the Rui river, near the tailrace outlet of the Pong power station.

A kind of water hyacinth is observed in a natural pond near Kg. Pong.

2.3 Fish Fauna

Fish fauna is poor in the upper mountain streams in the Region.

The fish fauna downstream of the proposed dam sites is summarized as shown in Tables 1 and 2, according to the results of NWRS.

2.4 Wildlife

There is no information on wildlife of monumental importance, economic value or harm in and around the proposed reservoir areas. Furthermore, there is no record of specific feeding or nursery ground of wildlife according to Ref. 2 published in 1968.

2.5 Water Use

(1) Fish catch

There is no full-time fisherman and people catch fish mostly for home consumption, generally when water is plenty. Normally used are the casting net, gill net, spear, fish trap (bubu) and fishing rod.

Importance of local fish in the upper basin area has reduced, due to inflow of fishes in the lower basin area and marine fishes, with the development of road network.

(2) Domestic water use

Interview at 8 villages located downstream of the proposed dam sites and 3 villages within proposed reservoir areas resulted that domestic water in these villages is untreated water collected from dug wells, or pipelines installed in small tributaries or, in some cases, directly from a river as shown in Table 3.

(3) Navigation

River traffic is lacking in the vicinity of the proposed dam site, because the rivers are small and often involve shallow rapids.

2.6 Public Health

There were incidences of malaria in Kg. Ct. Setul, Kg. Pahit, Kg. Tanjong Piring and Kg. Batang during the field survey. The government has been undertaking eradication program against malaria in rural areas and suspected victims of malaria are hospitalized for immediate medical attention. Under these circumstances, people no longer consider that malaria is a serious disease.

Cholera occurred in Kg. Tanjong Piring and Kg. Batang several years ago. A few cholera cases were reported in Simpang Empat near Alor Setar and the health officers strengthened anti-cholera action, according to a local newspaper in January 1983.

According to the Director of the Kedah State Medical and Health Services, there were a few cases of filariasis in the lowland area in the central Kedah, but there is no reported case of filariasis in the upper basin areas. Furthermore, it is informed by the same source that there has been no reported case of schistosomiasis or other water-borne disease.

2.7 Historical and Archeological Assets

According to Ref. 3 published in 1936, a stone implement made of quartzite was discovered in the course of dredging in the Padang Pelandok tin mine near Kg. Sintok (see Fig. 2). It is either a big arrow head or a small spear head. The age of the implement is unknown.

According to Ref. 4 published in 1936, there are numerous remains such as stone implements and molluscan shells in a number of rock shelters on the southeastern slope of Mt. Baling.

There are archeological remains in Sg. Bujang on the southern foot of Mt. Jerai near Gurun. Ancient paths therefrom to the north along the present railway line and to Pattani on the west coast of Thailand via Baling are postulated according to Ref. 5 published in 1980.

3. ENVIRONMENTAL CONDITION IN EXISTING RESERVOIRS

3.1 Water Quality

Odor of hydrogen sulphide is recognized in the river courses just below the Pedu dam and Temengor dam, among the Klang Gates, Langgat, Ayer Itam, Chenderoh, Bersia and Muda dams.

According to Ref. 1, dissolved oxygen concentration sharply reduces with depth in a zone of 6 to 7 m in depth in the Temengor reservoir. It is 7 to 8 mg/l above this zone, while it is 1 to 3 mg/l below the zone. Hydrogen sulphide is produced by unaerobic decomposition of submerged trees and other organic substance such a condition of deficient oxygen as in the bottom zone of the Temengor reservoir. It is assumed that hydrogen sulphide occurs in any reservoir, for several years after the initial filling. Hydrogen sulphide is toxic to aquatic life and tends to acidify water. The concentration of hydrogen sulphide, however, seems to be very low, because there has been neither corrosion of metalwork of dam facilities nor complaint by any inhabitant in relation to hydrogen sulphide.

3.2 Ecological Aspects

Water in the existing reservoirs are low lucid and greenish or yellowish in color. This fact indicates the existence of phytoplankton.

The perimeters of existing reservoirs are covered with grasses and bushes or exposed as barren slopes. No water plant is recognized in the existing reservoirs of the Klang Gates, Langgat, Ayer Itam, Temengor, Bersia, Pong, Pedu and Muda dams. Aquatic macrophytes (*Hydrilla verticillata* and *Echhornia crassipes*) grew along the periphery of the Chenderoh, according to Ref. 1, but they could not be found in the present survey.

Fish fauna in the Chenderoh, Muda and Pedu, and Temengor reservoirs is listed in Ref. 1 as summarized in Tables 1 and 2. The difference between the fish fauna in the rivers in the vicinity of the proposed dams and that in the existing reservoirs is insignificant. Cyprinid fishes, however, are large in size in the reservoirs compared with those in the rivers.

3.3 Fisheries

Some of the man-made lakes are utilized for fisheries.

Fisheries in the Bukit Merah reservoir are participaced by 1,000 people of 5 nearby villages. Out of them, 100 people are professional fishermen. Fishes caught are *Osteochilus hasselti*, *Cyclocheilitheys* species, *Puntius schwanefeldi*, *Labiobarbus lineatus*, *Channa striata*, *Mystus nemurus*, *Oxyeleotris marmoratus*, and *Wallago attu*. Annual landing has been estimated to be more than 22 tons, according to Ref. 1.

The fisheries in the Chenderoh reservoir feed 13 nearby villages. There are about 40 fishing boats with outboard engines. Fishes caught include *Thynnichthys thynnoides*, *Mystus nemurus*, *Pangasius pangasius*, *Pangasius micronemus*, *Puntius bulu*, *Puntius schwanefeldi*, *Channa micropeltes*, *Oxyeleotris marmoratus*, *Probarbus jullieni*, *Hampala macrolepidota*, and *Notopterus notopterus*, according to Ref. 1. Undertaken a program to introduce exotic fishes into the Chenderoh reservoir by the Fisheries Department, the reservoir was stocked with 225,000 fry of *Puntius gonionotus* and 22,000 fry of *Cyprinus carpio* between 1978 and 1982.

Although fisheries in most reservoirs are restricted, there seems to be good fisheries potential in the existing reservoirs. For instance, there are a large number of game fishes such as *Channa micropeltes*, *Hampala macrolepidota*, *Tor tambroides* and *Acrossocheilus hexagonolepis* according to Ref. 1.

4. ENVIRONMENTAL IMPACTS BY THE PROPOSED DAMS

The environmental impacts by the proposed dams are assessed based on the present conditions in the vicinity of the proposed reservoir areas and in existing reservoirs.

Hydrogen sulphide will be probably produced in the reservoirs for several years after the completion of dam but its concentration will not be hazardous. Clearing the land prior to the creation of reservoir may reduce the occurrence of hydrogen sulphide. No harmful bloom of phytoplankton or water plant is expected, because such problem has been recognized in the existing reservoirs.

Lentic water body with a large surface area of the proposed reservoirs will provide a high potential of fish production. Not only indigenous fishes will increase but also exotic fishes can be introduced, though some migratory fishes might disappear. It is possible to develop fisheries and fish culture in the proposed reservoirs.

The proposed reservoir will be operated so that river flow will be increased in the dry season and decreased in the flood season. That will provide a favorable environment for fish life.

Trapping sedimentation by a reservoir will cause a degradation of riverbed in some length of downstream river stretch. This effect will, however, be small because sediment yield in the Region is low.

Change in wildlife, even if caused by the proposed reservoir, will not be important.

No adverse effect of proposed dams on public health is foreseen, because no disease has tended to be rampant after the construction of the existing dams.

Materials are too few to assume any archeological assets in the proposed reservoir areas.

In summary, the proposed reservoir will create a favorable environment for lake fisheries and fish life in the downstream river stretches. Adverse effects will be negligibly small except that some migratory fishes will be reduced.

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TABLES

Table 1 FISH SPECIES IN THE VICINITY OF THE PROPOSED DAM SITES AND IN EXISTING RESERVOIRS (1/2)

Scientific Name	Local Name	Edibility	Rivers in the Vicinity of Proposed Dam Site: Bahna (Badak-Temin)	Sanai (Sari/Durian)	Nami (Tawar-Muda/Beris)	Baling (Rui)	Lalang (Rui)	Existing Reservoirs: Chenderoh	Temengor	Muda/Pedu
SYNBRANCHIDAE										
Fluta alba		-	*	*	*	-	-	-	-	-
CYPRINIDAE CULTRINAE										
Chela sp.	Lalang	-	-	-	-	-	-	*	*	-
Macrochirichthys macrochirus	Parang	*	-	-	-	-	-	*	*	-
CYPRINIDAE BARBINAE										
Acrossocheilus deauratus		*	-	*	-	-	-	-	-	-
Acrossocheilus hexagonolepis	Tengas	*	*	*	*	*	*	-	*	*
Balanticheilus melanopterus	Hangus	*	-	-	-	-	*	-	*	-
Cyclocheilichthys apogon	Barbless, Temperas	*	-	*	*	*	-	*	*	-
Cyclocheilichthys armatus	Temperas	*	-	-	-	-	-	*	-	*
Epalzeorhynchus kallopterus	Semilang Batang	-	-	-	-	-	-	*	-	-
Epalzeorhynchus siamensis		-	-	-	-	-	-	*	-	-
Hampala macrolepidota	Sebarau	*	*	*	*	*	-	*	*	*
Labiobarbus lineatus	Common Kawan	-	-	-	-	-	-	*	*	*
Labiobarbus ocellatus		-	-	-	-	-	*	-	-	-
Leptobarbus hoeveni		*	-	-	*	-	-	-	-	-
Hystacoleucus marginatus	Sia	-	-	-	-	*	-	*	-	-
Osteochilus hasselti	Terbol	*	-	-	*	*	*	*	*	*
Osteochilus melanopleura	Kelabu	*	-	-	-	-	-	*	-	-
Osteochilus vittatus	Rong	*	-	-	-	*	*	*	-	-
Probarbus jullieni	Temelian	*	-	-	-	-	-	*	-	-
Puntius binotatus	Lampan	*	*	*	*	*	-	-	-	-
Puntius birtwistlei	Lampan	*	-	-	-	-	-	*	-	-
Puntius bulu	Tenggalan	*	-	-	-	-	-	*	*	-
Puntius daruphani	Kerai Kunyit	*	-	-	-	-	-	*	*	-
Puntius gonionotus	Lampan Jawa	*	*	*	*	*	-	*	*	*
Puntius lateristriga	Lampan	*	-	*	*	-	*	-	-	-
Puntius orphoides	Lampan	*	-	-	-	*	-	-	-	-
Puntius schwanefeldi	Lampan Sungei	*	-	-	*	-	-	*	*	*
Thylognathus sp.	Jemerong	-	-	-	-	-	-	-	*	-
Thynnichthys thynnoides	Lomah	-	-	-	-	-	-	-	*	-
Tor tambroides	Kelah	*	-	-	-	-	*	-	*	*

Remarks: *: Present, -: Absent

Table 2 FISH SPECIES IN THE VICINITY OF THE PROPOSED DAM SITES AND IN EXISTING RESERVOIRS (2/2)

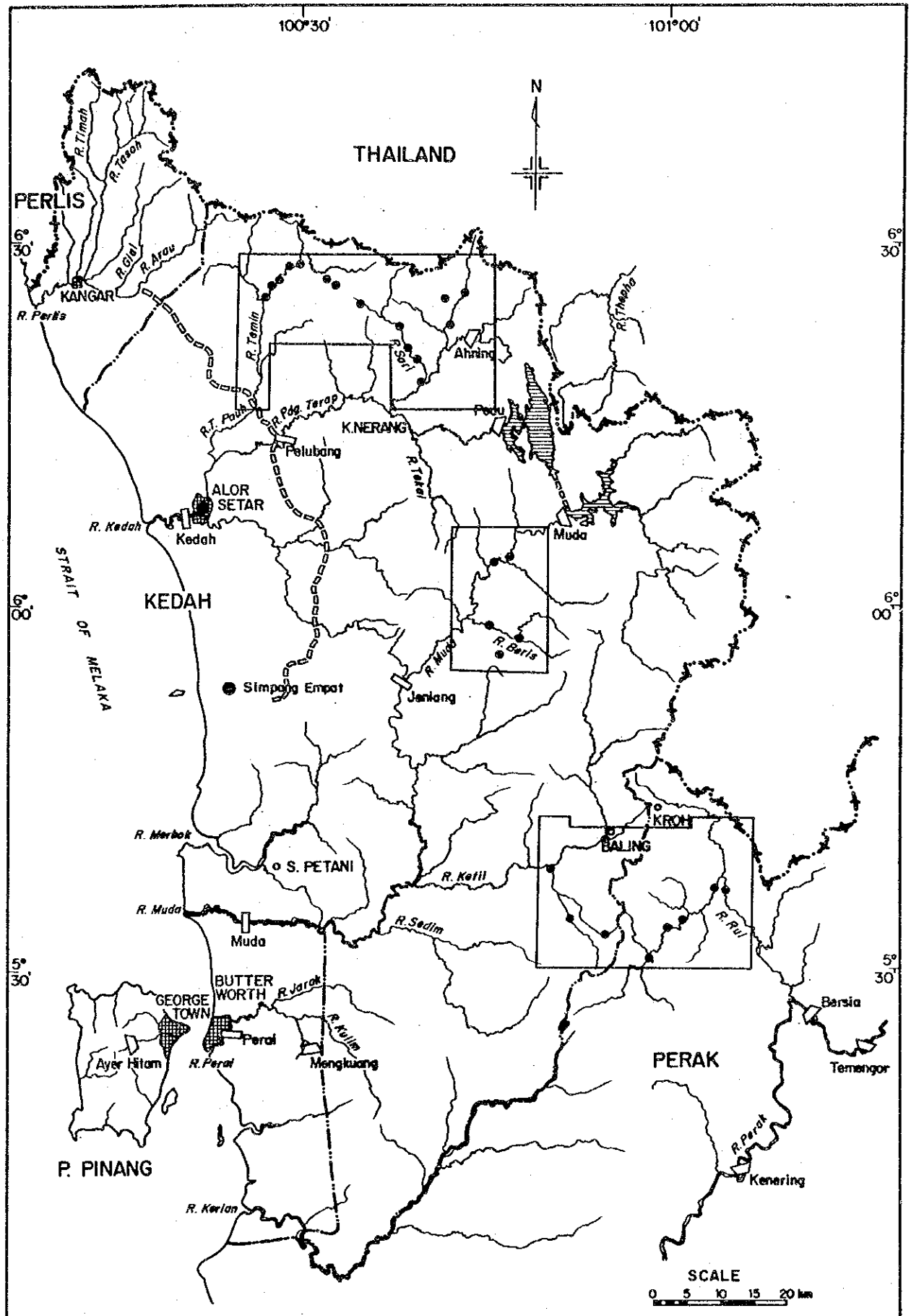
Scientific Name	Local Name	Edibility	Rivers in the Vicinity of Proposed Dam Site: Bahna (Badak-Temin)	Sanai (Sari/Durian)	Nami (Tawar-Muda/Beris)	Baling (Rui)	Lalang (Rui)	Existing Reservoirs: Chenderoh	Temengor	Muda/Pedu
DANIOINAE										
Luciosoma setigerum	Nyuar	-	-	-	-	-	-	*	-	-
Luciosoma trinema	Barbless Nyuar	-	-	-	-	-	-	-	-	*
Rasbora eithoveni	Susu batang	-	*	*	*	*	-	-	-	-
Rasbora elegans		-	*	*	*	*	*	-	-	-
Rasbora trilineata	Seluang	-	-	-	*	-	-	-	-	-
Rasbora vaillanti		-	-	-	-	-	-	*	-	-
Rasbora sp. (unspecified)		-	*	*	*	*	*	-	-	-
COBITIDAE										
any cobitid other than *Botia*, such as *Adantopsis*		-	-	*	-	-	-	-	-	-
SILURIDAE										
Kryptopterus sp.		-	*	*	-	*	-	-	-	-
CLARIIDAE										
Clarias batrachus	Keli	*	*	*	*	*	-	-	-	*
PANGASIDAE										
Pangasius micronemus	Lawang	*	-	-	-	-	-	*	-	-
Pangasius pangasius	Patin	*	-	-	-	-	-	*	-	-
BAGRIDAE										
Mysteus nemurus	Baung	*	*	*	*	*	*	*	*	*
Mysteus planiceps	Baung Akar	*	-	-	-	-	-	-	*	-
Mysteus wycki	Tengku lolah	*	-	-	-	-	-	*	-	-
CHANNIDAE										
Channa lucius	Bujuk	*	*	*	-	*	-	-	*	*
Channa marulius	Kerendang	*	-	-	-	-	-	-	*	-
Channa micropeltes	Toman	*	-	-	*	-	-	-	*	-
Channa striata	Aruan, Haruan	*	*	*	*	*	-	-	-	-
ANABANTIDAE										
Anabas testudineus		*	*	*	-	*	-	-	-	-
BELONTIDAE										
Betta splendens		-	*	*	-	*	-	-	-	-
Trichogaster pectoralis		*	*	*	-	-	-	-	-	-
Trichogaster trichopterus		*	*	*	-	*	*	-	-	-
Trichopsis vittatus		-	*	*	*	*	-	-	-	-
OSPHRONEMIDAE										
Osphronemus goramy	Kalui	*	*	*	-	*	*	*	*	*
PRISTOLEPIDAE										
Pristolepis fasciatus	Patong	-	-	*	*	-	-	*	*	*
CICHLIDAE										
Tilapia mossambica		-	*	-	-	-	*	-	-	-
OTHERS										
Helostoma temuninckii	Gorami	-	-	-	-	-	-	-	-	*
Mastacembelus erythrotaenia	Tilan	-	-	-	-	-	-	*	-	-

Remarks; *: Present, -: Absent

Table 3 DOMESTIC WATER SOURCES IN THE VICINITY OF THE PROPOSED DAM SITES

Dam Site	Name of Village	Domestic Water Source
Badak-Temin	Kg. Pandang	Well
Badak-Temin	Kg. Ct. Setul	Small tributary & well
Sari	Kg. Pdg. Nyior	Well
Durian	Kg. Pdg. Sanai	Sg. Pdg. Sanai & well
Tawar-Muda	Kg. Tanjong Piring	Sg. Muda & well
Beris	Kg. Batang	Small tributary & well
Beris	Kg. Beris	Small tributary
Rui	Kg. Lalang	Sg. Rui and small tributary
Rui	Kg. Pahit	Sg. Pahit and well
Rui	Kg. Pong	Small tributary

FIGURES



Remark : Detail maps of enclosed areas are shown in Fig. 2.

Fig. 1 Location Map of Field Survey and/or Interview Survey

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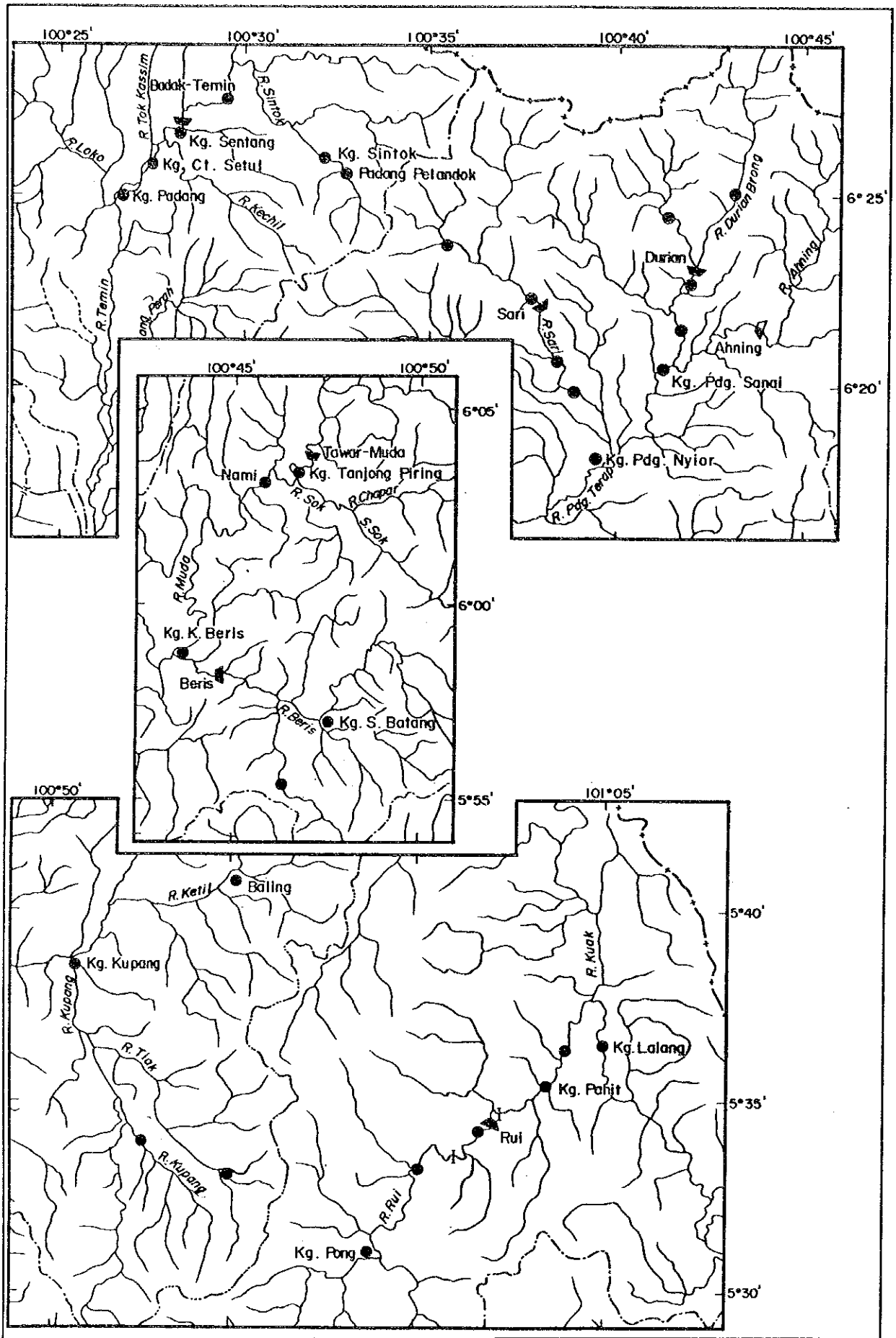

Fig. 2 Detail Location Maps of Field Survey and/or Interview Survey

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ANNEX Q

LEGAL AND INSTITUTIONAL ARRANGEMENT

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APPENDIX

1. INTRODUCTION

The objective of the study for the legal and institutional sector is to make recommendations for the administrative systems and arrangements required for the development and management of water resources within the Region in accordance with polices and principles of the Federal and State Governments. It includes the organizational structure and responsibility for implementing and managing the water resources system. The study aims to follow, develop and modify the Master Action Plan (MAP), which is one of the final outcome of National Water Resources Study (NWRS) to meet the actual and prospective situation and demand within the area.

2. IDENTIFICATION OF ADMINISTRATIVE ISSUES

2.1 Administrative Necessities

Existing water resources facilities such as dam reservoirs and barrages cannot satisfy all water demand within the Region. Water users in the downstream area sometimes cannot take sufficient water in a drought period, due to water takings on the upper area. Water deficit will be expanded in future because of expected increase of demand in D&I water supply and minor irrigation schemes.

The water demand and supply shall be balanced to a sufficient extent for the promotion of regional socio-economic development and upgrading welfare of inhabitants. Administrative measures to maintain and promote reasonable and equitable water use shall be taken as an indispensable part of the national development policy. For balancing water demand and supply within the Region, both integrated implementation and management of water resources development facilities and establishment of rational water using system are indispensable. Relevant management of the water resources, including the control of surface and groundwater takings, rationalization of water use, dam reservoir operation and flood mitigation are also inevitable.

Water balance study revealed that it is economically unfeasible to establish a balanced condition of water resources development in the Kedah river basin alone. Inter-basin water diversion from Muda river basin was judged to be required. Water demand in the down reaches of the Muda river, which consists of the demand in the State of Pulau Pinang and the State of Kedah may not be satisfied when an operation of the additional transfer system will not be properly managed. The Muda river also has to satisfy the most part of the water demand within the State of Pulau Pinang, which is scarcely endowed with the potentiality of water resources development.

Water resources development as well as management of water supply facilities has been undertaken by several government agencies separately so far. However it will be more appropriate and efficient to plan and undertake cooperative and multipurpose development projects to meet the future demand within the area, instead of carrying them out independently by each agency. Furthermore integrated management of existing and proposed facilities shall be inevitable. As development of more than two water resources facilities will be required to satisfy the water demand within the area in the immediate future, integrated operation is inevitable to fulfil the planned performance and establish stable water supply.

Conservation of groundwater resources is also necessary in specific area, for it consists of an important part of the source for D&I water supply. Flood mitigation scheme should be implemented. Activity which is harmful to the river management such as deviation of water course, stone or sand digging from the riverbed and pollutant discharge shall be also controlled. Additional arrangements will be required in the implementation of interstate or international diversion schemes, which shall be implemented in near future.