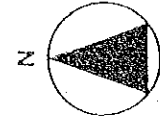


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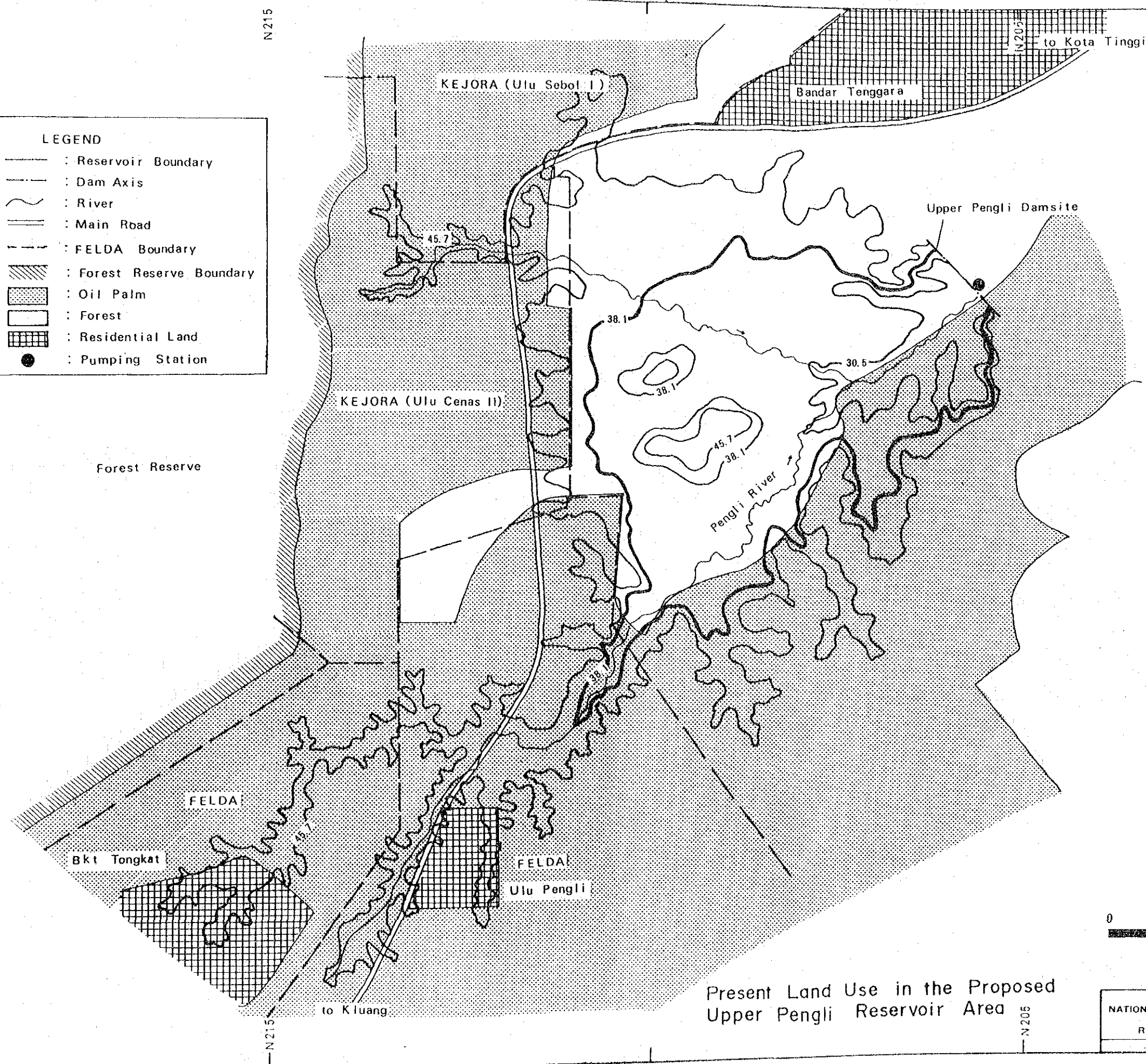
N 215

E 625



**LEGEND**

- : Reservoir Boundary
- : Dam Axis
- : River
- : Main Road
- : FELDA Boundary
- : Forest Reserve Boundary
- : Oil Palm
- : Forest
- : Residential Land
- : Pumping Station



Forest Reserve

Upper Pengli Damsite

Pengli River

FELDA

Bkt Tongkat

FELDA  
Ulu Pengli

Present Land Use in the Proposed  
Upper Pengli Reservoir Area

E 615

E 615

N 215

N 205

SCALE 1 : 50,000



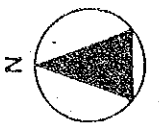
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E 625

N 215

N 205

E 625



Bandar Tenggara

to Kota Tinggi

KEJORA (Pengli Kechil)

Upper Pengli Damsite

KEJORA (Ulu Cenang I)

Pengli River

Land Use Plan in the Proposed Upper Pengli Reservoir Area

to Kluang




N 215

N 205


E 615

E 615

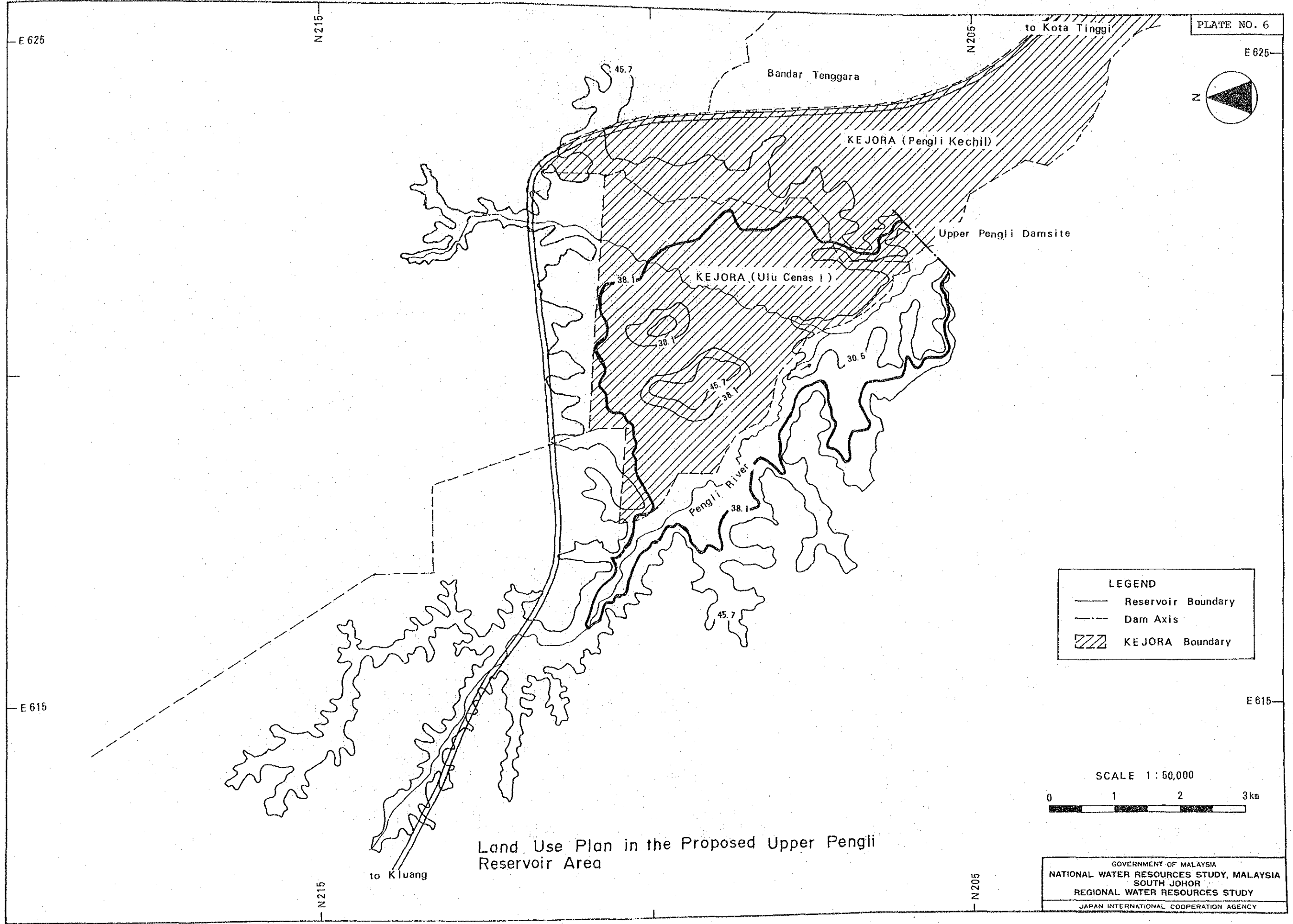
**LEGEND**

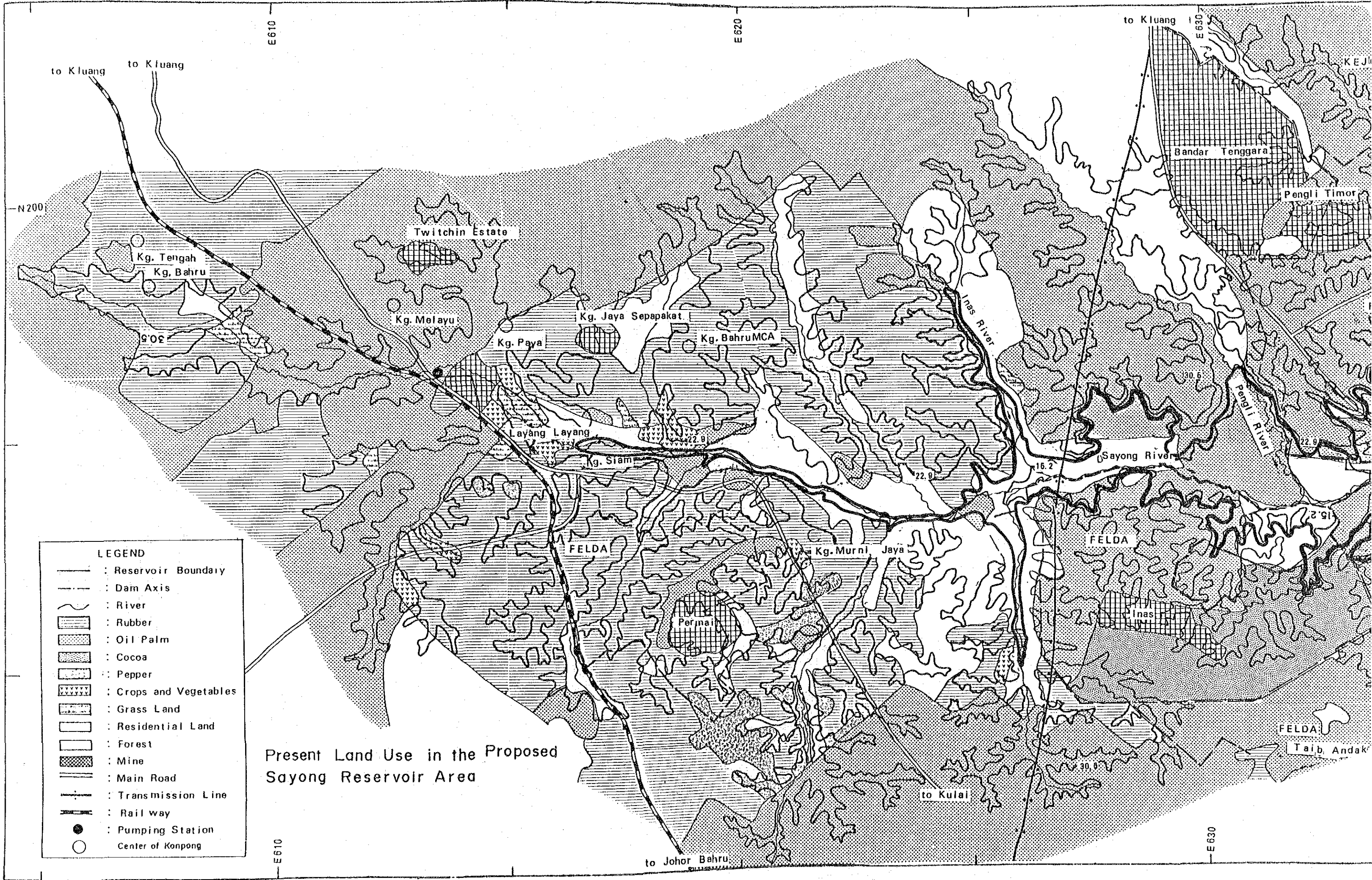
-  Reservoir Boundary
-  Dam Axis
-  KEJORA Boundary

SCALE 1 : 50,000



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to Kluang

to Kluang

N200

E610

E620

E630

Kg. Tengah  
Kg. Bahru

Twitchin Estate

Kg. Melayu

Kg. Jaya Sepapakat

Kg. Bahru MCA

Kg. Paya

Layang Layang

Kg. Siam

Inas River

Sayong River

Pengli River

Bandar Tenggara

Pengli Timor

**LEGEND**

- : Reservoir Boundary
- : Dam Axis
- : River
- [Pattern] : Rubber
- [Pattern] : Oil Palm
- [Pattern] : Cocoa
- [Pattern] : Pepper
- [Pattern] : Crops and Vegetables
- [Pattern] : Grass Land
- [Pattern] : Residential Land
- [Pattern] : Forest
- [Pattern] : Mine
- : Main Road
- : Transmission Line
- : Rail way
- : Pumping Station
- : Center of Konpong

Present Land Use in the Proposed Sayong Reservoir Area

FELDA

FELDA

FELDA

FELDA

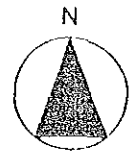
Talb. Andak

to Kulai

to Johor Bahru

E610

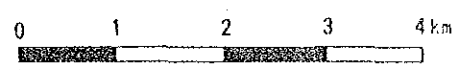
E630



N 200

N 190

SCALE 1:70,000



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SOUTH JOHOR  
REGIONAL WATER RESOURCES STUDY  
JAPAN INTERNATIONAL COOPERATION AGENCY

the Proposed  
rea

to Johor Bahru

to Kulai

E 630

E 620

to Kluang

KEJORA(Ulu Sebol)

Bandar Tenggara

Pengli Timor

to Kota Tinggi

Linggi River

MC 1034

MC 1076

MC 981

MC 1107

MC 1123

Aboriginal  
Kg. Sayong Pinang

FELDA

FELDA

FELDA

FELDA

FELDA

FELDA

FELDA

Taib, Andak

FELDA

FELDA

FELDA

Kg. Siam

Kg. Paya

Kg. Jaya Sepapakat

Kg. Bahru MCA

Layang Layang

Kg. Murni Jaya

Perinjau

Inas

S. Sayong

Kg. Muda Jaya

Linggi River

Sayong River

Pengli River

Jobi River

chin Estate

ayu

22.9

22.9

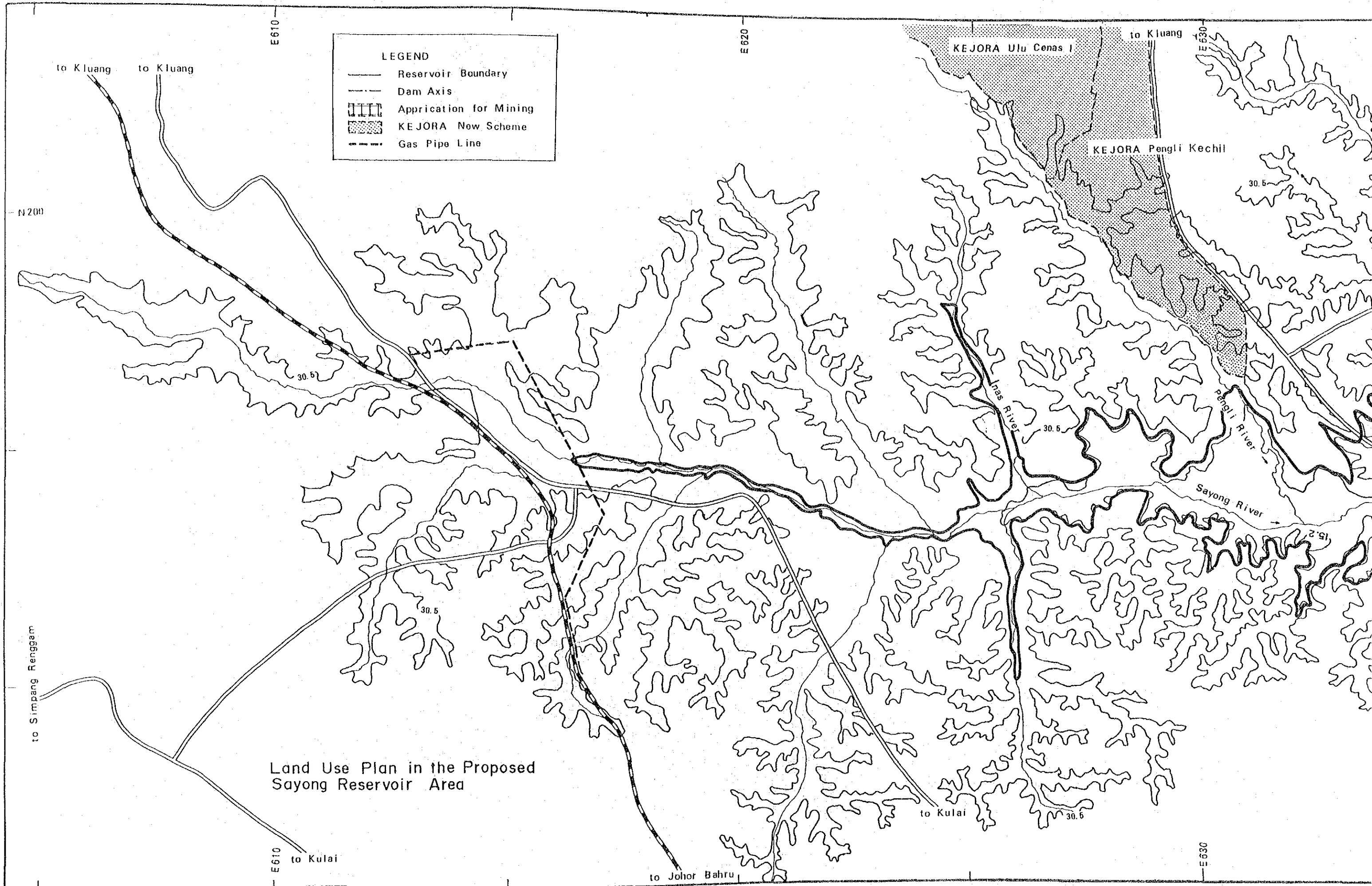
16.2

30.6

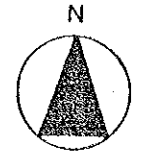
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15.2

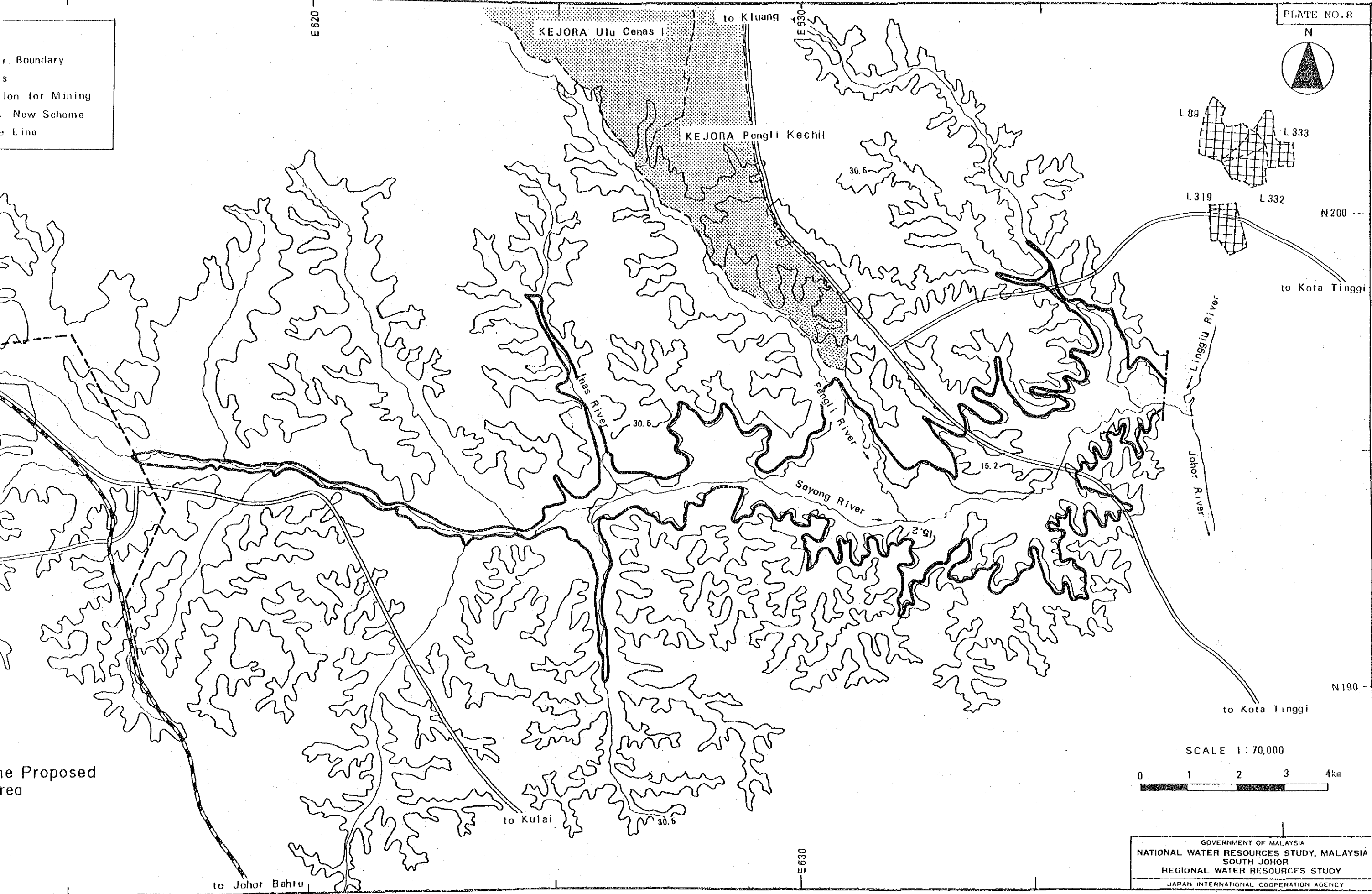
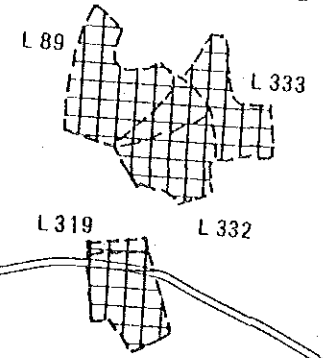
30.6



Land Use Plan in the Proposed Sayong Reservoir Area



r. Boundary  
s  
ion for Mining  
New Scheme  
p Line



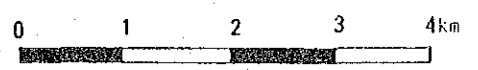
N 200

to Kota Tinggi

N 190

to Kota Tinggi

SCALE 1 : 70,000

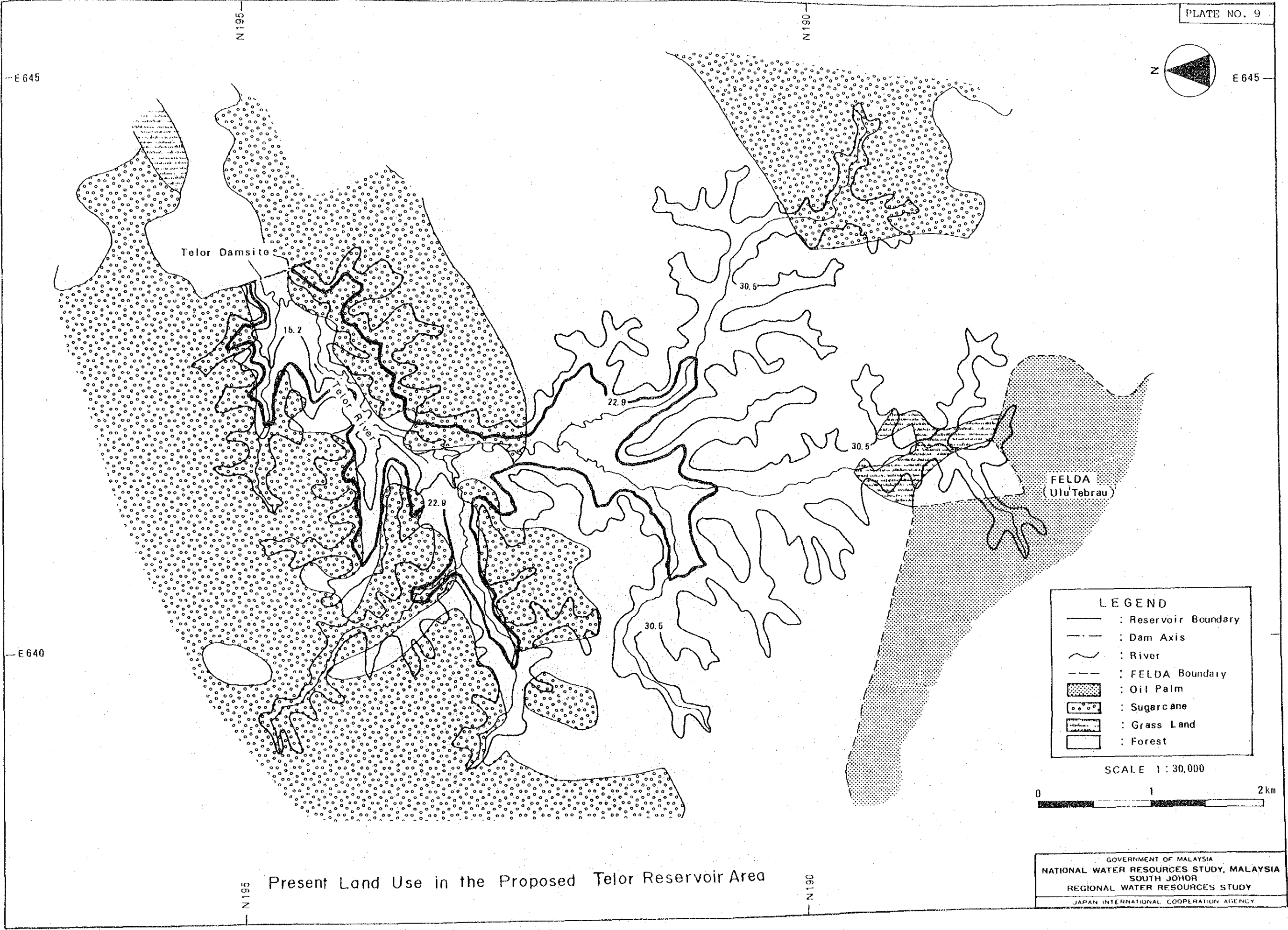
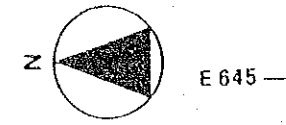


he Proposed  
rea

to Kulai

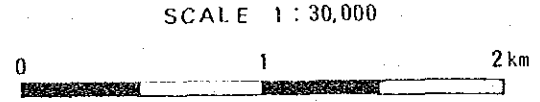
to Johor Bahru

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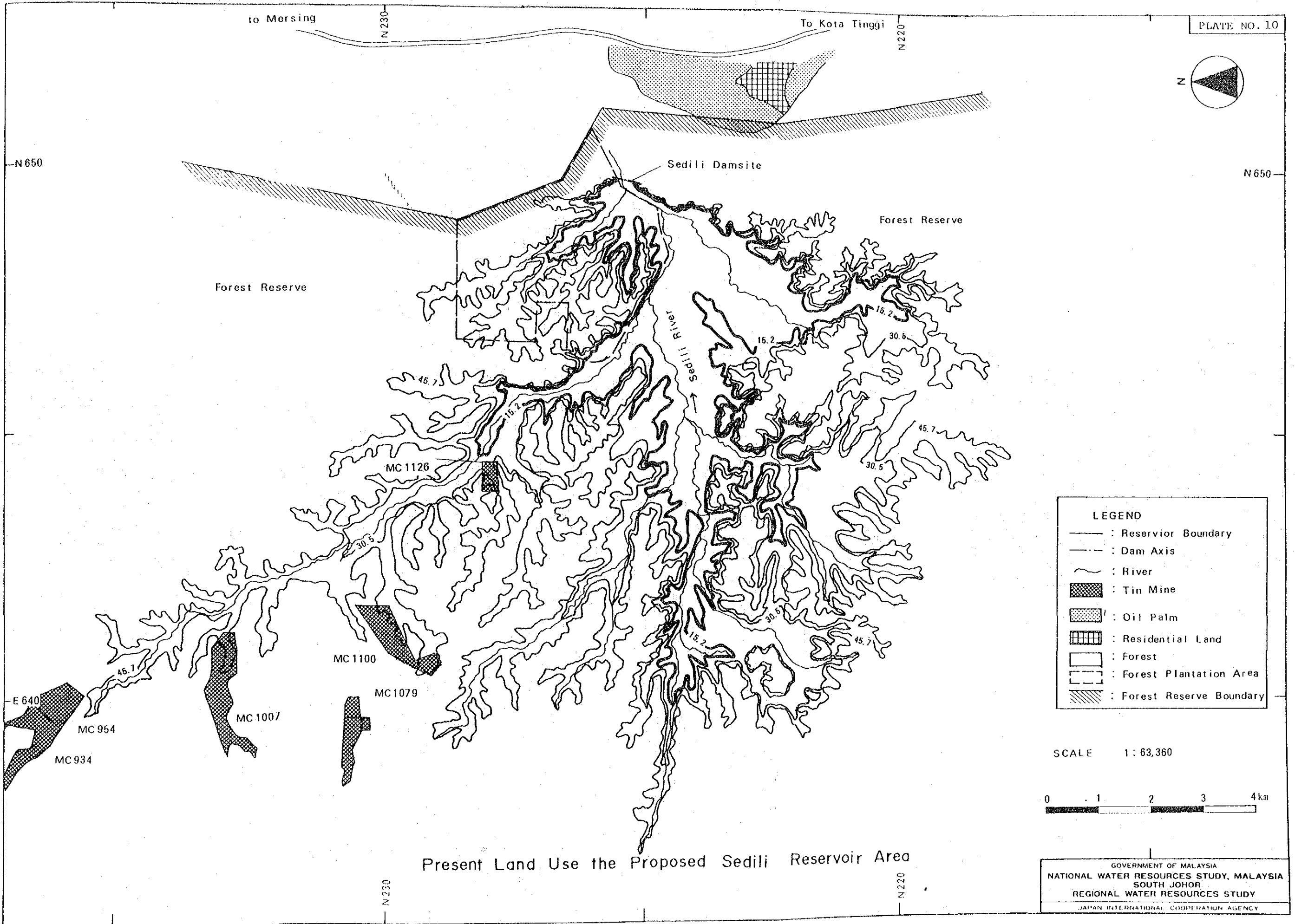
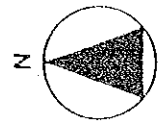
**LEGEND**

- : Reservoir Boundary
- - - : Dam Axis
- ~ : River
- - - : FELDA Boundary
- [Dotted pattern] : Oil Palm
- [Small circles pattern] : Sugarcane
- [Horizontal lines pattern] : Grass Land
- [Blank box] : Forest



Present Land Use in the Proposed Telor Reservoir Area

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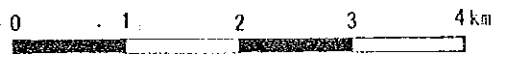


Present Land Use the Proposed Sedili Reservoir Area

**LEGEND**

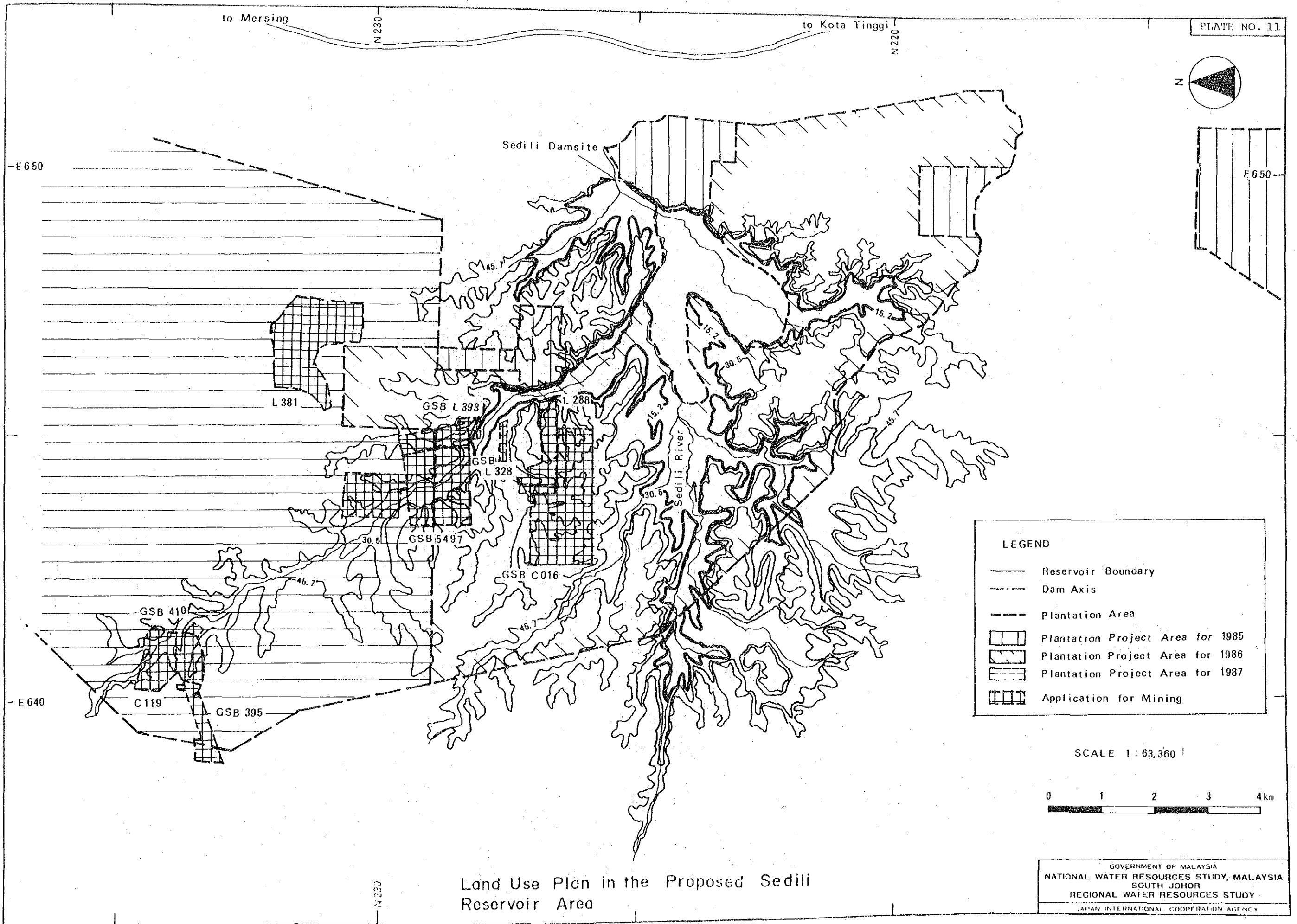
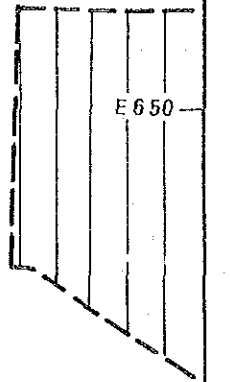
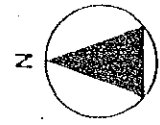
- : Reservoir Boundary
- - - : Dam Axis
- ~ : River
- [Cross-hatch] : Tin Mine
- [Dots] : Oil Palm
- [Grid] : Residential Land
- [White] : Forest
- [Dashed] : Forest Plantation Area
- [Hatched] : Forest Reserve Boundary

SCALE 1 : 63,360



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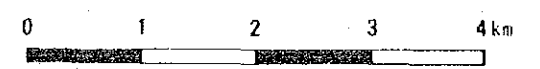




**LEGEND**

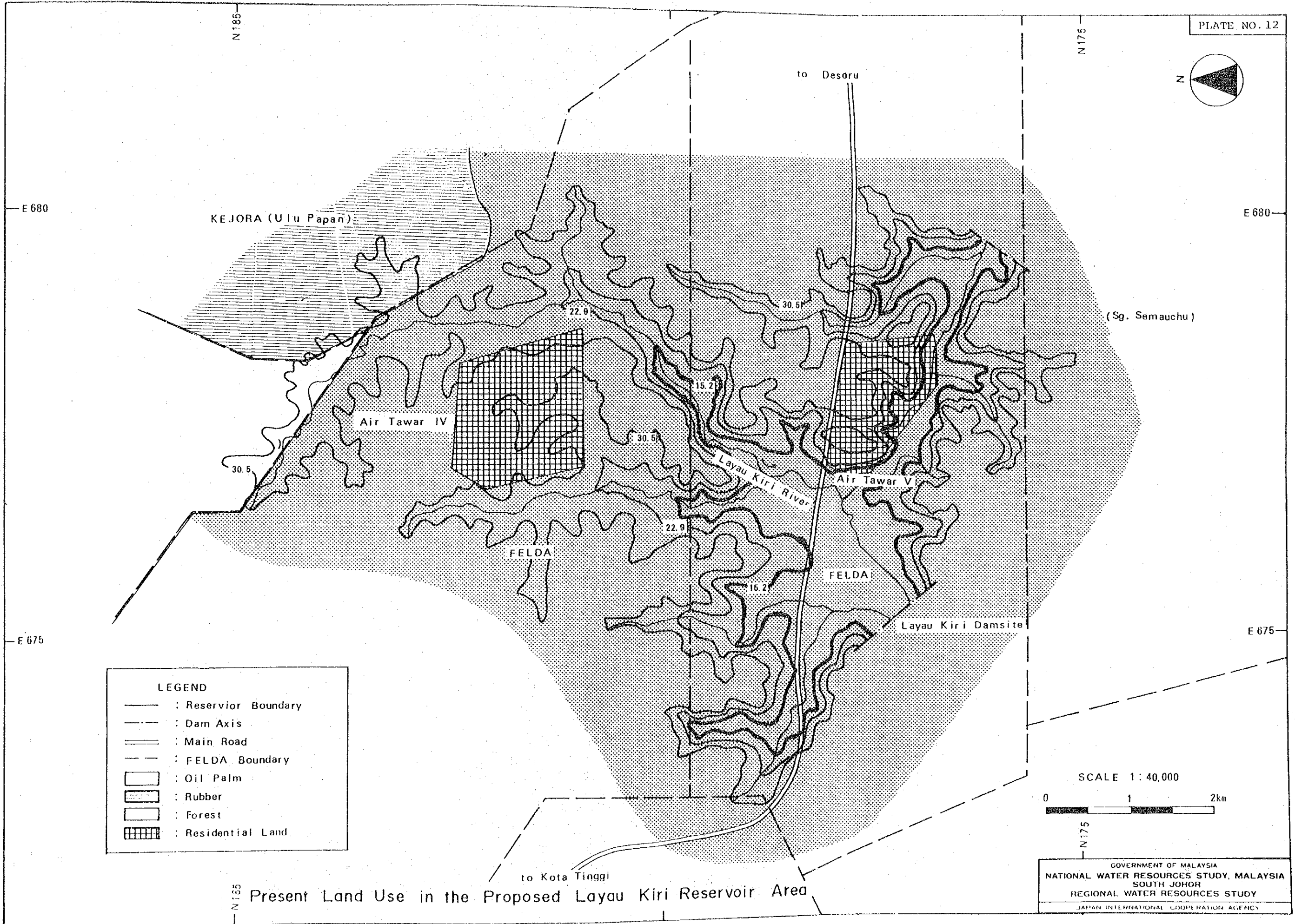
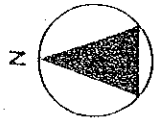
- Reservoir Boundary
- - - Dam Axis
- - - Plantation Area
- [Grid Pattern 1] Plantation Project Area for 1985
- [Grid Pattern 2] Plantation Project Area for 1986
- [Grid Pattern 3] Plantation Project Area for 1987
- [Grid Pattern 4] Application for Mining

SCALE 1 : 63,360



Land Use Plan in the Proposed Sedili Reservoir Area

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**LEGEND**

- : Reservoir Boundary
- : Dam Axis
- : Main Road
- : FELDA Boundary
- : Oil Palm
- ▨ : Rubber
- : Forest
- ▤ : Residential Land

SCALE 1 : 40,000

0 1 2km

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Present Land Use in the Proposed Layau Kiri Reservoir Area



***ANNEX N***  
***ENVIRONMENTAL IMPACT OF***  
***PROPOSED PLAN***



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## 1. INTRODUCTION

### 1.1 Objectives of the Study

The objectives of the Study are to assess the environmental impact of the proposed plan and to discuss the measures to remedy the adverse effect if any based on the survey of recent river environment and environmental impact found at the existing dams.

This ANNEX N is discussed mainly on inland fishery, fish fauna, wildlife, forestry, public health, historical and archaeological assets, inland navigation and agricultural chemicals.

The Study was carried out from 19th of September to 17th of August, 1985 in Malaysia and from 18th of August to 16th of September, 1985 in Japan.

### 1.2 Method of the Study

Following two methods were taken for the Study.

(1) Collection of data and information from the relevant offices concerned

The main government offices visited in Johor State are as follows:

- Department of Environment
- Department of Fisheries
- Department of Wildlife and National Parks
- Department of Forestry
- Department of Agriculture (Crop Protection Office)
- Department of Health (Vector Control Office)
- Department of Tourism
- Department of Religion
- Dam operation offices at Semberong, Macap, and Layang dams

While in Kuala Lumpur, data were collected at the following governmental offices;

Department of Environment

Department of Fisheries

Department of Wildlife and National Parks

National Museum

Universiti Pertanian Malaysia

(2) Interview survey and site reconnaissance

Data to assess the river environment from the ecological point of view is quite limited because basic biological observation and monitoring are seldom. And interview survey and site reconnaissance survey was carried out in order to reinforce the limited data and to confirm the collected data.

Among various ecological factors, fish fauna was selected as the representative items of environmental conditions because of reasons mentioned below.

- 1) Generally fish occupy the highest trophic level in the river and its composition and production are thought to be representing the characteristics of river ecosystem.
- 2) Fish are one of the most popular aquatic animal and those identifications seem to be easier than other organisms.

The activities of inland fishery were also surveyed by interview because statistics on capture fishery in the river are not present in the proposed area.

The respondents to fish fauna and inland fishery interview were selected and identified through the information of the village chief or the fisheries officers among local fishermen living in the vicinity of river and dam reservoir. At each place several respondents were interviewed together.

Further interview survey and site reconnaissance were carried out for other study items such as public health, inland navigation, etc. The respondents include village chieives and local people.

The locations of interview survey and/or site reconnaissance are shown in Fig. 1.



## 2. PRESENT ENVIRONMENTAL CONDITIONS IN THE VICINITY OF THE PROPOSED DAMSITES

### 2.1 General River Environment

#### 2.1.1 Johor river system

##### 1) Sayong river

The Sayong river forms a main tributary of the Johor river system together with the Linggiu river. It rises from Renggam forest and runs eastward until the confluence of the Linggiu river or at about 90 km upstream from Kota Tinggi. The proposed Sayong damsite is located on the Sayong river 0.5 km upstream from the confluence. The Sayong Pinang aborigine reserve is settled at the left bank of the damsite.

In the upstream area of the proposed damsite, a wide marshy area is covered by natural vegetation, while its surroundings and catchment area have well developed for the agricultural lands mainly as oil palm estates.

The width of low flow channal at the damsite is about 15 m with the depth of about 1.5 m. The soils of riverbed are mainly sandy silt. The water color is usually grayish brown at the damsite and no water plant was observed.

##### 2) Linggiu river

The proposed Linggiu damsite is located on the Linggiu river 15 km upstream from the confluence with the Sayong river. The damsite and its catchment area are consist of the forest, a part of which is covered by Kluang forest reserve extension producing various logs such as Shorea (Meranti), Dyobalanops (Kapur), etc.

The width of low flow channel at the damsite is about 20 m. The soils of river bed are clayey to sandy silt. The water color was observed to be light brown and no water plant was observed.

3) Johor river

In the vicinity of Kg. Rantau Panjang located about 8 km downstream from the confluence with Sayong and Linggiu rivers, the lowland rain forest is growing along the river. The vegetation consisting the lowland rain forest are said to be no less than 8,000 species of flowering plants and at least 2,500 of these are trees such as Balanocarpus (Chengal), Shorea (Meranti), Vatica (Resak) and Dipterocarpus (Keruing). There are also various types of climbers, among which are numerous species of Rattan (Calamus spp.).

The width of low flow channel is about 50 m and the depth of water is assumed to be 1.5 m by the height of fishing gear.

In the vicinity of Kota Tinggi, natural vegetation along the river is poor according to the urbanization. The trash and silt were sedimented in the river bed. The width of low flow channel is about 100 m.

The Johor river water is polluted by domestic waste water and effluent water from rubber producing factories and palm oil mills according to ANNEX F. Water plant is poor in the Johor river.

#### 2.1.2 Sedili Besar river system

1) Ulu Sedili river

The Ulu Sedili river is one of the main tributaries of Sedili Besar river system. The proposed Sedili damsite is located on the Ulu Sedili river at 3 km from the bridge of the national highway linking Kota Tinggi and Mersing. The damsite and its catchment area are all covered by forest reserve named as Ulu Sedili forest reserve extension. The kinds of log produced are almost same as that of Linggiu area. The plantation of trees such as Acacia mangium,

Gmelina arborea, and Albizzia falcataria is carried out in the vicinity of the damsite.

The width of low flow channel is 30 m with the river bed of sandy silt. The water color was light brown and no water plant was observed.

## 2) Sedili Besar river

The Sedili Besar river is formed by the inflow of the four main upstreams such as Ulu Sedili river, Segamat Kiri river, Segamat Kanan river and Ambot river from the west. In the vicinity of the confluence of these rivers, the oil palm estates have developed especially in the area along the national highway.

The vegetation surrounding the river or in the marshy area is characterized as lowland rain forest with marshy area in the middle stream and lowland rain forest associated with the Nipah palm in the downstream near Kg. Segundol. The width of low flow channel is about 80 m in middle reach and 100 to 150 m in downstream. Water plant is poor, while the filamentous green alga (Spirogyra spp. or related species) were found in the stagnant shallow stream in the downstream.

Sedili Besar river is not so polluted because there are only a few pollutant sources.

## 2.2 Inland Fishery

Inland fishery in Johor river system is carried out in the downstream of Sayong Pinang. Few fishermen go fishing in Linggiu river. Inland fishery in Sedili Besar river system is carried out mainly in the downstream from the junction with Kayu Ara river. In rainy season some fishermen go fishing in its upstream but not operate around proposed Sedili damsite.

Characteristics of inland fishery in both river system are similar and summarized in Table 1.



In the middle stream, mainly Mystus (Baung), Osteochilus (Ikan Terbol), Cyclocheilichthys (Temperas) and freshwater prawn, Macrobrachum resenberqii (Udang datang) were caught by set net, fish trap, gill net, etc. in rainy season. In lower stream freshwater prawn and Mystus were mainly caught by fish trap, bait and scoop net in all year round especially in dry season.

Generally, inland fishery in these areas is operated by so-called part-time fishermen who have another main job. Usually a catch of fish per day is around several to 10 kg. Operational days are 5 to 7 days in peak season and 0 to 3 days in another season depending on the river condition. In peak season many fishermen from neighbouring towns, i.e., Kluang, Kota Tinggi, Johor Bahru, are gathering in the fishing ground.

According to the result of interviewed survey, recent fish catch seems to be decreased especially in Sayong and Johor river.

### 2.3 Fish Fauna

The species which were said to be present at least in 2 places carried out interview out of each 3 places in Johor and Sedili Besar river systems are adopted as the preliminary fish fauna as shown in Tables 2 and 3.

The composition of fish by fish group in Johor river system is 12 genera and 23 species of Cypriniformes (Group of carp), 7 genera and 11 species of Siluriforms (Group of catfish) and 14 genera and 17 species of Non-ostariophsi (Other than carp and catfish groups) or 33 genera and 51 species in total. That in Sedili Besar river system is 11 genera and 23 species of Cypriniformes, 9 genera and 15 species of Siluriforms and 19 genera and 24 species of Non-Osteriophsi or 39 genera and 62 species in total.

The number of fish species in Sedili Besar river is rather larger than that of Johor river. This may be attributable to the

difference in number of Siluriforms and Non-Ostariophsi. However, since most species confirmed are overlapping together, the fundamental fish fauna in both river systems are considered to be same. The popular fish genera in both river systems are Resbora (Ikan Seluang, Susur Batan), Cyclocheilichthys (Ikan Temperas) and Osteochilus (Ikan Terbol) of Cypriniformes, Clarias (Ikan Binga, Ikan Keli), Wallago (Ikan Tapah) and Mystus (Baung) of Siluriforms, and Channa (Haruan, Bujok), Trichogaster (Ikan Sepat), and Helostoma (Temakang) of Non-Ostariophsi.

When the fish species occurring in Johor and Sedili Besar river systems are combined and divided by their ecological features, Tables 4 and 5 could be obtained. Most of fish are carnivorous or omnivorous and their main habitats are mountain stream and brook, stagnant water and river non-migratory. For the feed of these fish, it is known that terrestrial insects and fruit of trees contribute significantly.

The ecosystem in Johor and Sedili Besar river systems seems to be characterized by predominance of non-migratory species, which are able to maintain their life cycle in the certain stretches of the river. Several migratory species, i.e., Labepobarbus hoevenii (Ikan Jelawat) and Hampala macrolepidota (Ikan Sebatau) are occasionally caught in both Johor and Sedili rivers, however the famous river migratory species in Malaysia such as Tor tambroides (Ikan Kelah), and Pangasius spp. (Patin) were not found.

In Sedili Besar river, it is confirmed that Scleropages formosus (Ikan Kelasa; Arowana), which is one of the species included in "Appendix I of Convention of International Trade in Endangered Species of Wild Fauna and Flora", are still living in good number. The fish collectors from the urban area sometimes come to catch this fish for sale in the upstream and middle stream reaches of Sedili Besar river. At present the practical regulation for the conservation of the fish has not been established according to the Fisheries Department and of Wildlife Department. The Scleropages formosus is said to be caught in downstream reach of Johor river, but is very few in number.

#### 2.4 Wildlife and Forestry

Among the existing wildlife reserves Endau-Kota Tinggi wildlife reserve (West) is partly covers the proposed Linggiu dams site. This reserve was established overlapping with Kluang and Lenggong forest reserve and has been actually controlled by Department of Forestry. The Department of Wildlife and National Parks proposed new wildlife reserves as shown in Table 6. Location of the existing and proposed wildlife reserves in the Region are shown in Fig. 2 with location of existing forest reserves. Main principles of new reserves are as follows:

- 1) to establish G. Belumut wildlife reserve instead of the existing Endau-Kota Tinggi wildlife reserve (west), and strengthen conservation measures under Department of Wild Life and National Parks.
- 2) to conserve Endau-Kota Tinggi wildlife reserve (east) as Mersing wildlife reserve. (Agreement of Johor State is not obtained)
- 3) to consolidate Segamat wildlife reserve as Endau-Rompin National Park extending to the Pahang State and to make it a center of wildlife conservation in southern part of Peninsular Malaysia.

The important wild animal to be protected and inhabited around Endau-Kota Tinggi wildlife reserve are listed in Table 7 based on the information from the State wildlife officer.

Sumatran rhinoceros, which is said to be endangered animal in Malaysia, still live in the proposed reserves in Johor. Followings are the estimated number of Sumatran rhinoceros according to Ref. 7.

Proposed reserve	1979	1982
Endau-Rompin	8-15	20-25
G. Belmut	-	2-3
Mersing	-	2-3

Estimated number of elephant is 77 in Johor State according to Ref. 7. Recent survey by Elephant Welfare Unit in Kluang indicates that 15 to 21 heads live around Endau-Kota Tinggi wildlife reserve.

The proposed Linggiu and Sedili dam reservoirs will submerge a part of Kluang forest reserve extension overlapping with Endau-Kota Tinggi wildlife reserve (west) and Ulu Sedili forest reserve extension, respectively. These forest reserves function as not only logging production ground but also natural habitats for wild animal.

## 2.5 Public Health

Malaria cases in Johor State reported by regular inspection are continuously decreased in recent ten years as shown in Fig. 3. However in 1985 cases tend to increase in Kluang, Mersing, Kota Tinggi and Johor Bahru as shown in Table 8. When malaria was identified, the vector control office under Department of Health immediately provides suitable medicine, i.e., Chloroquine, injection of Quinine in resistive case and spread disinfectant, i.e., DDT, Malataiyon to the residence. Moreover regular fogging of disinfectant to the dangerous swamps and reservoirs is continued by the same office.

The occurrence of endemic filariasis is concentrated in Segamat and Muar districts as shown in Table 9. Infection of filariasis is scanty in vicinity of the proposed sites.

No cholera and schistosomiasis cases are recorded in Johor State except when transported from another area. It is known that non-quarantine Indonesian people sometimes bring cholera and other water borne disease.

The vector control officer in Johor State suggested that Johor is one of the most advanced area in Malaysia in a sence of malaria elimination and people today may not worry about serious infection or treatment of water borne desease.

## 2.6 Historical and Archaeological Assets

The Johor River basin is rich in history. After the fall of Malacca in 1511 by the intrusion of Portuguese, the Malacca royal family fled to Johor basin and fought against the further attack of Portuguese. There is a number of historical graveyards and archaeological assets in this era.

The Museum Department under Ministry of Culture, Youth and Sport has surveyed these remains in Kota Tinggi district and submitted to the State Government of Johor the list of historical sites as shown in Table 10.

There are Makam Tujuh and Malam Dua nominated in the said list of agreement at Sayong Pinang on the Left bank of about 200 to 300 meters from the river edge and about 4 km upstream of the proposed dams site.

Recently the fort remain and several graveyards were confirmed at Sayong Pinang near the Makam Tujuh. This fort is thought to be the remain of the second capital city of the Johor Empire from 1535 to 1540 after the Telor fort, which has not been discovered. The rough sketch of this fort remain prepared by Malacca office under the Federal Museum Department is shown in Fig. 4.

The surroundings of these historical remains are oil palm estates and now there are few tourists visiting these historical sites at Sayong Pinang.

The Linggiu river is suggested to be the site of Black Stone Fort, which is mentioned in Malay Annals and belonging to the pre-

sultanate era. However recent topographical survey failed to discover the actual assets.

There is no record of the important history along Sedili Besar river. Hence no archeological survey has been conducted.

## 2.7 Inland Navigation

Regular passenger boats navigate in the downstream reach of Johor river and Sedili Besar river taking following routes;

### Johor river

- 1) between Kong kong and Tg. Surat
- 2) between Kong kong and Tg. Buai
- 3) between Kong kong and Tg. Sengat

### Sedili Besar river

between K. Sedili and the opposite side of Sedili Besar River

At upper stream from Kota Tinggi of Johor river, there is no regular or irregular boat service for passenger or goods transportation. On the other hand, the water around Kota Tinggi forms a good fishing ground of freshwater prawn (Udang datang), and small fishing boats with out-board engine are frequently passing through the river. The bases of fishing boats are Kg. Kelantan, Kg. Makan and Kg. Tembiuh.

In lower Sedili Besar river, small boats with out-board engine are operated for routine transportation of passengers and goods between the villages located around left side tributaries, i.e., Kg. Perepot, Kg. Simpang, Kg. Tenggahan, and the opposite side villages beside the main road, i.e., Kg. Padang, Kg. Segundol. Before construction of the main road, navigation from the above villages to Mawai which is about 22 km upstream was performed but now already ceased.

These navigation routes are shown in Figs. 5 and 6.

## 2.8 Agricultural Chemicals

The amount of chemicals for agriculture sold in Johor State is M\$2 x 10<sup>6</sup> in 1984 according to the crop protection office, and main items are as follows.

Herbicide (Weedcide)	70%
Insecticide	10%
Pungicide	6%
Rodenticide	4%

Herbicide is used in the routine work for oil palm and rubber plantation areas. According to the regulation of Ministry of Agriculture (Ref. 12), herbicides for oil palm is recommended as shown in Table 11. In case of MSMA (Monosodium methanearsonate) with Sodium chlorate 2.5 to 5.0 kg/ha are recommended to spray around the tree 4 times a year. The Paraquat, which is highly toxic herbicide with acute oral LD<sub>50</sub> (rat) of 150 mg/kg, is now considered to be banned to use according to the Agriculture Department in Johor. In the said reference, kind and dosage of various pesticides are summarized by crop and by disease.

Department of Agriculture has performed the seminar or training for the farmers on the agriculture technology including the usage of the suitable pesticide. However the actual quantity of agricultural chemicals used has not been surveyed, and at present monitoring of these chemicals effluent to the river is not carried out.

### 3. ENVIRONMENTAL IMPACT OF THE EXISTING DAMS

#### 3.1 Reservoir Area

##### 3.1.1 General condition of the dam reservoirs

The general conditions of Macap dam, Semberong dam and Layang dam were surveyed and are described in Table 12.

The main land use of the catchment area are rubber estate and forest in Macap dam, swamp forest in Semberong dam, and rubber and oil palm estate in Layang dam. At present, water quality is maintained in good quality according to the dam operation officers at the damsites except a part of Macap dam.

At the west part of Macap dam, it is said that the water quality is going to be deteriorated by the water inflow, probably containing agricultural chemicals from the vegetable culture land which recently established near the reservoir.

Odor such as Hydrogen sulphite was not recognized at any dam reservoirs in the present site reconnaissance.

##### 3.1.2 Inland fishery and fish fauna

It is generally admitted that faunatical change should be assumed at least 3 years after the drastic environmental change. The typical changes in fish species was confirmed at Macap dam, which was impounded in 1982. Before and after impoundment of the dam is summarized in Table 13 based on the interview to 3 parttime fishermen being resident in FELDA Air Hitam.

The certain species such as Clarias, Prohagorus, Trichogaster and Oxyleotris, whose main habitat are all stagnant water, increased instead of Hampala, Mystus and Mastacembelus, whose main habitats are river migratory or river non-migratory. The migratory freshwater prawn, Macrobrachum resenbergtii has disappeared after the dam



construction. On the other hand, Osteochilus whose main habitat is river non-migratory is found still plenty and is one of the dominant species as same as before impoundment.

The Department of Fisheries introduced various exotic species, i.e., Puntius gonionotus (Lampan jawa), which is one of the most popular aquaculture species in Johor, Common carp, Cyprinus carpio and Tilapia spp. These species have increased and are now good target species for fishing in the reservoir. The cage culture of Puntius gonionotus was conducted in Macap dam by using 2 net cages of each 20 feet x 20 feet in area and 8 feet in depth and about 80 kg of fish per cage were harvested in 1984. However, this attempt is now interrupted because the fish was stolen in this year.

The part-time fishermen in FELDA Air Hitam usually go fishing after the end of daily job in rubber estate and catch about 80 kg of fish/month/person on an average.

Almost same impacts were suggested in the Semberong and the Layang dam reservoirs through the interview to the fishermen or the dam operation officers. The new species as mentioned above were also stocked and settled in the both reservoirs.

Generally, these dam reservoirs provide good fishing ground for the local people as recreation fishing as well as commercial fishing including aquaculture.

### 3.1.3 Wildlife and forestry

There were no forest reserve nor wildlife reserve on the existing reservoirs. No wildlife conservation programme is indicated in Ref. 6.

It is said that the Malaysian deer such as Sembur deer and Barking deer, which are both nominated as protected wild animal in Protection and Wildlife Act, 1972, inhabit around the Semberong dam reservoir and many pheasants inhabit around the Layang dam reservoir, according to the State wildlife officer. However, no information was

obtained to judge the impact of the dam construction on these wild animals.

#### 3.1.4 Public health

At the Layang dam, the communities of water plant, i.e., Chlorophyllum spp., Hydrilla spp. or the related species were observed along the reservoir. The growth of water plant in the stagnant water provide preferred breeding habitat for snails which carry Schistosomiasis.

However at present snails were not observed and significant occurrence of water borne disease was not recognized in the vicinity of the existing dam reservoir not only by the interview survey but also by the information from the vector control officer.

The impact on this matter is therefore judged to be negligible at present, although continuous investigation should be necessary.

#### 3.1.5 Historical and archaeological assets

No important historical and archaeological assets are indicated on the existing dam reservoirs according to Ref. 10 and Table 10. The problem on this matter is therefore judged to be nothing.

#### 3.1.6 Agricultural chemicals

In the Layang river the concentration of pesticide in 1983 was under the limitation of measurement (not determined: ND) though that of detergents was ND to 0.2 ppm according to Ref. 15.

The catchment area of Layang dam consists of 60% of rubber and 40% of oil palm estates, and yet the effect of agricultural chemicals to the river water quality or reservoir water quality seems to be not significant.

### 3.2 Downstream of the Damsite

#### 3.2.1 Change of river condition in downstream

PWD is monitoring pH of river water in the Benut river about 9 km downstream from the Macap dam. According to the monitored data, the present pH varied for pH 6.0 to 6.8 in dry season. It had varied from pH 5.5 to 6.5 before the dam come into operation. The dam is considered to have contributed in the improvement of water quality. No distinctive difference has been observed by the habitants in downstream reach area from Macap dam.

At Kg. Semberong about 20 km downstream of the Semberong damsite, it was reported by the part-time fisherman who kept diary of the river condition that:

- 1) water color changed more brownish or yellowish after dam construction,
- 2) however, visible turbidity did not increase during the dam construction.

Runoff in the downstream reach of the Layang dam decreased its variability. It fluctuates from 0.9 to 1.5 m<sup>3</sup>/s. No distinctive effect of stabilized flow is detected so far.

#### 3.2.2 Inland fishery and fish fauna

There were several fishermen from the neighboring towns in the downstream of Macap dam, but after dam construction, they transferred the fishing ground to the dam reservoir because the fish production in new reservoir became higher than that in the downstream with decreased water flow. At Benut about 7 km upstream from the mouth of Benut river, where several full-time fishermen are still engaged in inland fishery, fish catch have been decreasing conspicuously after 1982 in their major target species such as Mystus spp. and Wallago spp. or freshwater prawn, Macrobrachium resenberri. Number of fishermen decreased to about one-fifth during the recent several years for the decreased fish catch as well as various changes in socio-economic circumstances.

At Kg. Semberong, number of fishermen operating in the river become scarce after dam construction due to the decreased fish catch. The Change of fish fauna is indicated in Table 14 based on the interview to fisherman. Although several stagnant water species increased, fish catch have allegedly decreased to about one third.

In Layang river, no inland fishery is carried out now. It is said that people living along the river conducted small scale inland fishery before the dam construction but they were already emigrated to other places.

Generally, inland fishery in downstream of existing dams seemed to be damaged to a certain extent by the dam construction due to the relatively high reduction ratio of fish catch and consequent decrease in fishermen.

### 3.2.3 Public health

At present no significant water borne disease is recognized in downstream villages of the existing dams. The vector control officer indicates no specific increase of water borne disease.

The impact on this matter seems to be negligible at present, although continuous investigation should be necessary.

### 3.2.4 Inland navigation

No regular navigation was on operation in the Benut and Layang rivers except by small fishing boats. The impact of Macap and Layang scheme on this matter, therefore, is considered negligible. No information on the inland navigation was available regarding the Semberong river.



## 4. ENVIRONMENTAL IMPACT OF PROPOSED PLAN

### 4.1 General Description of Proposed Plan

The proposed dams studied in this ANNEX such as Sayong dam, Linggiu dam and Sedili dam are planned to contribute to the water supply system in Johor Bahru and Kota Tinggi district. The basic principle of this system is to intake the water discharged from Sayong and Linggiu dams at Kg. Tai Hong located in Johor river about 5 km upstream from Kota Tinggi. The discharged water from Sedili dam is planned to be abstracted at Kg. Mawai.

It is noted that water flow in the river stretches between the damsite and the intake place will be increased in dry season.

### 4.2 Water Quality

The proposed Linggiu and Sedili dam reservoirs with maximum depth of about 10 to 15 m will not cause serious deterioration of the bottom layer due to harmful substances, such as Hydrogen sulphyte, ammonium ion, dissolved heavy metal produced by the unaerobic decomposition at least first several years after impoundment.

Since the proposed normal maximum water depth is less than 6 m, no serious deterioration of bottom layer will not take place in Sayong reservoir. BOD<sub>5</sub> concentration was projected to be about 5 ppm in 1995 in some tributaries which flow into the reservoir. The concentration will be diluted by the reservoir area. Further decomposition of oxidation demand source will advance in the reservoir due to aeration effect.

Effect of the effluent of agriculture chemicals is negligible in Linggiu and Sedili dam reservoirs. Moreover that in Sayong dam, whose catchment area consists of 47.6% of forest and 41.9% of oil palm estates, will be less than that in Layang dam mentioned in 3.1.6.

### 4.3 Inland Fishery and Fish Fauna

#### 4.3.1 Reservoir area

The most important retreated impact to inland fishery are supposed to be the reduction of Mystus spp. (Baung) and freshwater prawn Macrobrachum resenbergii. On the contrary stagnant water species indicated in Tables 4 and 5 may be increased based on the result observed in the existing reservoirs.

The Department of Fisheries prepared a report on the fisheries in reservoir titled the Prospects of Fisheries in DID Impoundments in 1983, which indicated that about 15 kg/ha/year of fish production is prevailing in local reservoirs by open water stocking (Capture fishery).

Since proposed dams are planned to function as a source facility of domestic water supply, the stocking of fish will be more recommendable than intensive aquaculture, which is worried to accelerate eutrophication of the reservoir.

The reservoirs will play a good fishing ground for local people when water quality is maintained as derived in ANNEX F and no intrusion of toxic matter.

#### 4.3.2 Downstream of the damsite

The remarkable retreated impacts are represented by the following two items.

- 1) The disappearance of present fishing ground in Sayong Pinang and generation of new fishing ground in the reservoir area by the construction of Sayong dam
- 2) The decrease of freshwater prawn Macrobrachum resenbergii. This impact will be caused by the decrease or deterioration of the spawning ground in downstream from water intake

point, Kg. Tai Hong in Johor river and Mawai in Sedili Besar river due to the decrease of river flow.

This prawn migrate from the brackishwater zone to the upstream reaches of the river. The spawning is taken place in the brackishwater zone containing seawater around 10 to 40% throughout the year, especially in the beginning of rainy season.

Macrobrachum resenbergtii can be bred in captivity, however it will require a huge facility to produce baby prawn to compensate the natural production. The reliable way to remedy the impact is to construct the suitable scale hatchery in the vicinity and dispatch the juvenile for inland aquaculture pond as well as the stocking in the river.

No other impact can be foreseeable referring to the case of existing dams.

The protected fish species Scleropages formosus could survive both in the reservoir and in the downstream reaches of rivers. A reservoir may provide a suitable habitat to the fish.

#### 4.4 Wildlife and Forest

The center of protected wildlife is situated around G. Belumut where the new wildlife reserve has been proposed. Hence Linggiu dam reservoir going to submerge the lower reach of the existing Endau-Kota Tinggi wildlife reserve, the impact to the habitat of protected wildlife cannot be denied. At least certain habitats for small animal will be submerged.

The impact by the Sayong dam may be negligible because important natural habits are few around the proposed reservoir.



#### 4.5 Historical and Archaeological Assets

The historical assets located in Sayong Pinang such as Makam Tujuh and Makam Dua will be submerged by Sayong reservoir, if the measures to transfer them are not taken.

The following procedures should be necessary for moving these remains:

- 1) Formulation and presentation of the proposal to the State Government by the Kota Tinggi District Office in charge of the district religious office,
- 2) Agreement of the State Government in charge of the Religious Department,
- 3) Asking for an approval of the Sultan in Johor by the State Government, and
- 4) Approval of the Sultan.

The impact by the Linggiu dam is to submerge Black Stone Fort allegedly existing in the proposed reservoir.

The impact by the Sedili dam on this matter may be none.

#### 4.6 Public Health

The harmful effect on the public health by the proposed plan is judged to be negligible based on the following findings.

- 1) At present, no incidence of diffusion of water born disease in the State of Johor.
- 2) Taking into account the bionomics of mosquitos, their preferred breeding habitats are like small muddy pools and small water containers as bamboo pale splits and various dishes. The water liable to be often disturbed by wave are of minor importance according to Ref. 16.

- 3) It is known that Bilharzia, one of the schists carrying snail is absent in acid water. The mean pH of the proposed damsites was pH 5.0 to 5.5 in 1983 and water impound cannot be the cause of Schistosomiasis.

#### 4.7 Inland Navigation

The proposed plan will not damage the inland navigation of regular passenger boats nor fishing boats even if water is abstracted, because most of the boats have shallow draft of about 50 cm with out-board engine.



## 5. CONCLUSION

Following impact are conceivable as the main effects of construction, impoundment and operation of the proposed dams.

### Sayong dam

- 1) Submergence of the historical assets, if no measure is taken to relocate them.
- 2) Disappearance of present fishing ground in Sayong Pinang.
- 3) Reduction of important migratory species for inland fishery, especially freshwater prawn, Macrobrachum resenberqii.
- 4) Change of fisheries activity following the change of fish fauna and fish production in the reservoir area and the downstream.

### Linggiu dam

- 1) Submergence of the natural habitats for small animal and interference of the movement of large animal.
- 2) Same as above 3).
- 3) Same as above 4).
- 4) Possible submergence of historical asset.

### Sedili dam

Same as the case of Linggiu dam except for item 4)

Further study and investigation should be carried out on the following items.

- 1) Study on the watershed management and continuous monitoring of water quality,
- 2) Evaluation of fisheries resources based on the statistical survey,
- 3) Archaeological survey to confirm the location of historical site along the Linggiu river and the consideration of feasibility for the movement thereof,

- 4) Zoological survey around the Linggiu and Sedili damsites,  
and
- 5) Continuous monitoring of water borne disease.

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# ***TABLES***





Table 1 CHARACTERISTICS OF INLAND FISHERY IN JOHOR  
AND SEDILI BESAR RIVERS

Fishing Ground	Dominant Fish Species Caught	Main Fishing Gear Used	Fishing Season
Upper stream	Fisheries activities are few.		
Middle stream <sup>1)</sup>	Baung (kind of cat fish) Terbol (kind of carp) Temperas (kind of carp) Udang (freshwater prawn)	Set net, Fish trap, Gill net, Cast net	Rainy season
Lower stream <sup>2)</sup>	Udang (freshwater prawn) Baung (kind of cat fish)	Fish trap, Bait and scoop net	All year round or dry season

Remarks: 1) Location No. 1, 2 and 4 in Fig. 1.  
2) Location No. 3, 5 and 6 in Fig. 1.