

ANNEX X
PROJECT EVALUATION

ANNEX X

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ANNEX - X

PROJECT EVALUATION

1. GENERAL

The economic evaluations are made for selection of the optimum development scale and also for comparison of the high priority projects. Several alternatives of development scale are set out for economic comparison, in terms of (1) dam scale and (2) combination of irrigable area and cropping intensity. Economic evaluations are made through calculation of internal rate of return (IRR).

2. BASIC ASSUMPTION

2.1 Evaluation of Economic Factors

The economic evaluations are made on the following assumptions:

(1) Economic prices for agricultural output and input

The economic prices of farm products such as rice and mungbeans and farm inputs are estimated on the basis of projected international market prices forecasted by IBRD in the long term range in 1983 constant U.S. Dollar.

(2) Economic opportunity cost of farm labour

At present, a large part of farming works are generally operated by family labour. Seasonal labourers required for the planting and harvesting of paddy are mainly hired from small and/or tenant farmers at the rate of ¥50/man-day. The rate of non-laborious works such as fertilization and threshing is about ¥40/man-day. The economic opportunity cost of farm labour is taken as 80% of current wage rates.

(3) Economic opportunity cost of unskilled construction labour

The economic opportunity cost of unskilled construction labour is estimated at ¥40/man-day, considering the kinds of labour work required.

(4) Construction conversion factor (CCF)

The construction conversion factor is taken to be 0.9.

(5) Economic cost

The project cost broadly comprises (1) cost for preparatory works, (2) construction cost for project facilities including the contractor's overhead cost, profit and contract tax, (3) cost for

land acquisition and compensation, (4) administration expenses, (5) expenses for engineering services, (6) physical contingencies and (7) price contingencies. These cost estimates are made on a financial basis as given in ANNEX-IX. All the costs except the contractor's profit, contract tax and price contingencies, are generally regarded as net capital cost. The net capital cost is further converted into the economic project cost by applying the CCF of 0.9.

In addition to the above, the cost for on-farm development is included in the economic project cost. The on-farm development is to be executed by the farmers themselves.

(6) Annual operation and maintenance cost (O&M cost)

The O/M cost is roughly estimated at 2.5% of the economic project cost for irrigation facilities and 0.5% for dam and reservoir.

(7) Project benefits

The project benefits will primarily accrue from the increased crop production due to stable irrigation water supplies. These benefits are estimated as the difference of the annual net production values under future with and without project conditions (for details, see ANNEX-IV).

2.2 Calculation of Internal Rate of Return (IRR)

The internal rate of return is calculated on the following assumptions:

- (1) The construction periods will be seven (7) years including two years for detailed design and preparatory works,
- (2) The economic useful life of the project will be 50 years,
- (3) Only the agricultural benefit is counted in the evaluations, and any indirect or intangible benefits are not taken into account in calculation of IRR,
- (4) The benefit will initially accrue from rehabilitation of existing irrigation facilities in 6th year by 10% of full incremental benefit and 20% in seventh (7th) year, and after completion of dam construction, the annual benefit will increase gradually during the build-up period of 5 years from 60% in 8th year to 100% in 12th year,
- (5) The economic costs and benefits are used in the evaluation, and
- (6) The prevailing exchange rate of US\$1.00=¥27.0=¥240 is used in the project cost estimate.

3. OPTIMIZATION OF DEVELOPMENT SCALE

3.1 Dam Scale

The following three (3) alternative plans are studied for selection of the optimum scale of the proposed dams and reservoirs:

<u>Alternative</u>	<u>Description</u>
D-1	Dam and reservoir sufficiently large enough for assuring the supplemental irrigation water supply to the existing irrigation areas for wet season paddy only.
D-2	Dam and reservoir sufficiently large enough for assuring the supplemental irrigation water supply to the potential maximum irrigable areas for wet season paddy only.
D-3	Potential maximum scale of dam and reservoir.

The irrigable areas under the above conditions are estimated through water balance study. They are summarized below:

Dam	Alter- native	Effective Storage (MCM)	Irrigable Areas			Cropping Intensity (%)
			Existing (ha)	New	Total (ha)	
Upper Mae Wong	D-1	115	36,800	-	36,800	100
	D-2	205	36,800	11,000	47,800	100
	D-3	230	36,800	11,000	47,800*	105**
Lower Mae Wong	D-1	115	36,800	-	36,800	100
	D-2	235	36,800	11,000	47,800	100
	D-3	350	36,800	11,000	47,800*	115**
Khlung Poe	D-1	25	10,600	-	10,600	100
	D-2	45	10,600	7,300	17,900	100
	D-3	96	10,600	7,300	17,900*	140**

* : Potential maximum irrigable area

** : Mung beans are considered as dry season cropping if water is still available after supplemental irrigation for wet season paddy is assured to a maximum extent up to the potential maximum areas.

The project costs, benefits and IRR for the above alternatives are given below:

<u>Project</u>	<u>Alternative</u>	<u>Construction Cost</u> (106฿)	<u>Annual Net Benefit</u> (106฿)	<u>IRR</u> (%)
Upper Mae Wong	D-1	1,794.3	308.0	11.8
	D-2	2,385.0	445.7	12.9
	D-3	2,453.4	461.3	13.0
Lower Mae Wong	D-1	1,521.1	308.0	13.0
	D-2	1,984.6	445.7	14.4
	D-3	1,989.0	492.4	15.2
Khlung Pho	D-1	863.7	79.2	6.5
	D-2	1,247.7	170.6	9.5
	D-3	1,271.4	217.2	11.5

The above economic comparison indicates that the larger dam scale makes the economic viability higher. Considering the above result and the basic concept for development that the endowed water resources should be fully exploited, the alternative D-3 would be selected.

3.2 Irrigable Area and Cropping Intensity

Two (2) alternatives are considered under the condition that dam and reservoir are maximized (alternative D-3);

<u>Alternative</u>	<u>Description</u>
I-1	Supplemental irrigation water supply to the existing irrigation areas with maximum cropping intensity
I-2	Supplemental irrigation water supply to the potential maximum irrigable area with minimum cropping intensity

The irrigable areas and cropping intensity under the above alternatives are as follows:

<u>Project</u>	<u>Alternative I-1</u>		<u>Alternative I-2</u>	
	<u>Existing irrigation area</u>	<u>Cropping*</u>	<u>Potential max. irrigable area</u>	<u>Cropping*</u>
	<u>area</u>	<u>intensity</u>	<u>area</u>	<u>intensity</u>
	(ha)	(%)	(ha)	(%)
Upper Mae Wong	36,800	130	47,800	105
Lower Mae Wong	36,800	140	47,800	115
Khlung Pho	10,600	190	17,900	140

*: Mung beans are considered as dry season cropping if water is still available after supplemental irrigation for wet season paddy.

The results of economic comparison for the above alternatives are summarized as follows:

<u>Project</u>	<u>Alternative</u>	<u>Construction Cost</u> (10 ⁶ ฿)	<u>Annual Net Benefit</u> (10 ⁶ ฿)	<u>IRR</u> (%)
Upper Mae Wong	I-1	2,025.4	380.0	13.0
	I-2	2,453.7	461.3	13.0
Lower Mae Wong	I-1	1,565.7	403.9	15.4
	I-2	1,989.0	492.4	15.2
Khleng Pho	I-1	963.6	141.4	10.3
	I-2	1,271.4	217.2	11.5

No significant difference is recognized, particularly for the cases of Upper and Lower Mae Wong dams, between alternative I-1 and I-2. Such being the situation, the basic concept for development that the endowed land and water resources should be fully utilized with a particular emphasis on improvement of present income disparity, should again considered for selection of better alternatives. With this in view, the alternative I-2 would be selected.

The proposed development plan selected through the alternative studies would be, in conclusion, the potential maximum scale of dam and reservoir coupled with the potential maximum irrigation development in area.

4. PRELIMINARY ECONOMIC EVALUATION FOR HIGH PRIORITY PROJECTS

4.1 High Priority Projects

The proposed development scale of the high priority projects is determined through the alternative studies as follows:

Item	Unit	Mae Wong		Khlung Pho
		Upper	Lower	
1. Dam & Reservoir				
a. Effective Storage	MCM	230	350	96
b. Reservoir Area	km ²	19.5	68.0	32.0
c. Dam Height	m	62.0	38.1	20.9
d. Crest Length	m	780.0	240.0	1,555.0
e. Embankment	MCM	3.40	0.38	0.74
2. Irrigation				
a. Without Project				
- irrigated	ha	23,600	23,600	8,900
- semi-irrigated	ha	13,200	13,200	1,700
- rainfed	ha	11,000	11,000	7,300
(Total)	ha	(47,800)	(47,800)	(17,900)
b. With Project				
- irrigated	ha	47,800	47,800	17,900
- cropping intensity	%	105	115	140

4.2 Preliminary Economic Evaluation

4.2.1 Economic costs

The economic project costs and their annual disbursement for the high priority projects are estimated as follows:

Year	Mae Wong		Khlung Pho (10 ⁶ ฿)
	Upper (10 ⁶ ฿)	Lower (10 ⁶ ฿)	
1st year	55.8	41.2	26.9
2nd year	112.6	160.5	120.0
3rd year	85.5	305.4	112.1
4th year	404.0	292.0	163.9
5th year	725.1	464.8	371.2
6th year	725.1	464.8	342.3
7th year	345.6	260.3	135.0
Total	2,453.7	1,989.0	1,271.4

4.2.2 Annual operation and maintenance costs

The economic O&M costs are estimated on the basis of the project costs as shown below:

<u>Year</u>	<u>Mae Wong</u>		<u>Khlong Pho</u> (10 ⁶ ฿)
	<u>Upper</u> (10 ⁶ ฿)	<u>Lower</u> (10 ⁶ ฿)	
6th year	10.0	10.0	5.0
7th year	20.0	20.0	10.0
8th year	27.0	24.0	13.0
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
50th year	27.0	24.0	13.0

Total	1,191.0	1,062.0	574.0

4.2.3 Project benefits

The project benefits will gradually increase year by year as follows:

<u>Year</u>	<u>Mae Wong</u>		<u>Khlong Pho</u> (10 ⁶ ฿)
	<u>Upper</u> (10 ⁶ ฿)	<u>Lower</u> (10 ⁶ ฿)	
6th year	46.1	46.1	21.7
7th year	92.3	92.3	43.4
8th year	276.8	295.4	130.3
9th year	322.9	344.7	152.0
10th year	369.0	393.4	173.8
11th year	415.2	443.2	195.5
12th year	461.3	492.4	217.2
:	:	:	:
:	:	:	:
:	:	:	:
:	:	:	:
50th year	461.3	492.4	217.2

Total	19,513.0	20,818.7	9,187.5

4.2.4 Evaluation

(1) Internal rate of return (IRR)

Using the costs and benefit estimated in the above, the internal rate of return (IRR) are calculated for each project.

The calculated results are as shown below:

<u>Project</u>	<u>IRR (%)</u>
Upper Mae Wong	13.0
Lower Mae Wong	15.2
Khlong Pho	11.5

(2) Sensitivity analysis

In order to evaluate further the soundness of the projects under the possible changes in the economic assumptions, the sensitivity analysis is made for the following four (4) cases;

- (a) Case-1 10% cost increase and benefit as schedule,
- (b) Case-2 20% cost increase and benefit as schedule,
- (c) Case-3 10% benefit decrease and cost as schedule, and
- (d) Case-4 10% benefit decrease and 20% cost increase.

The following shows the results of sensitivity analysis:

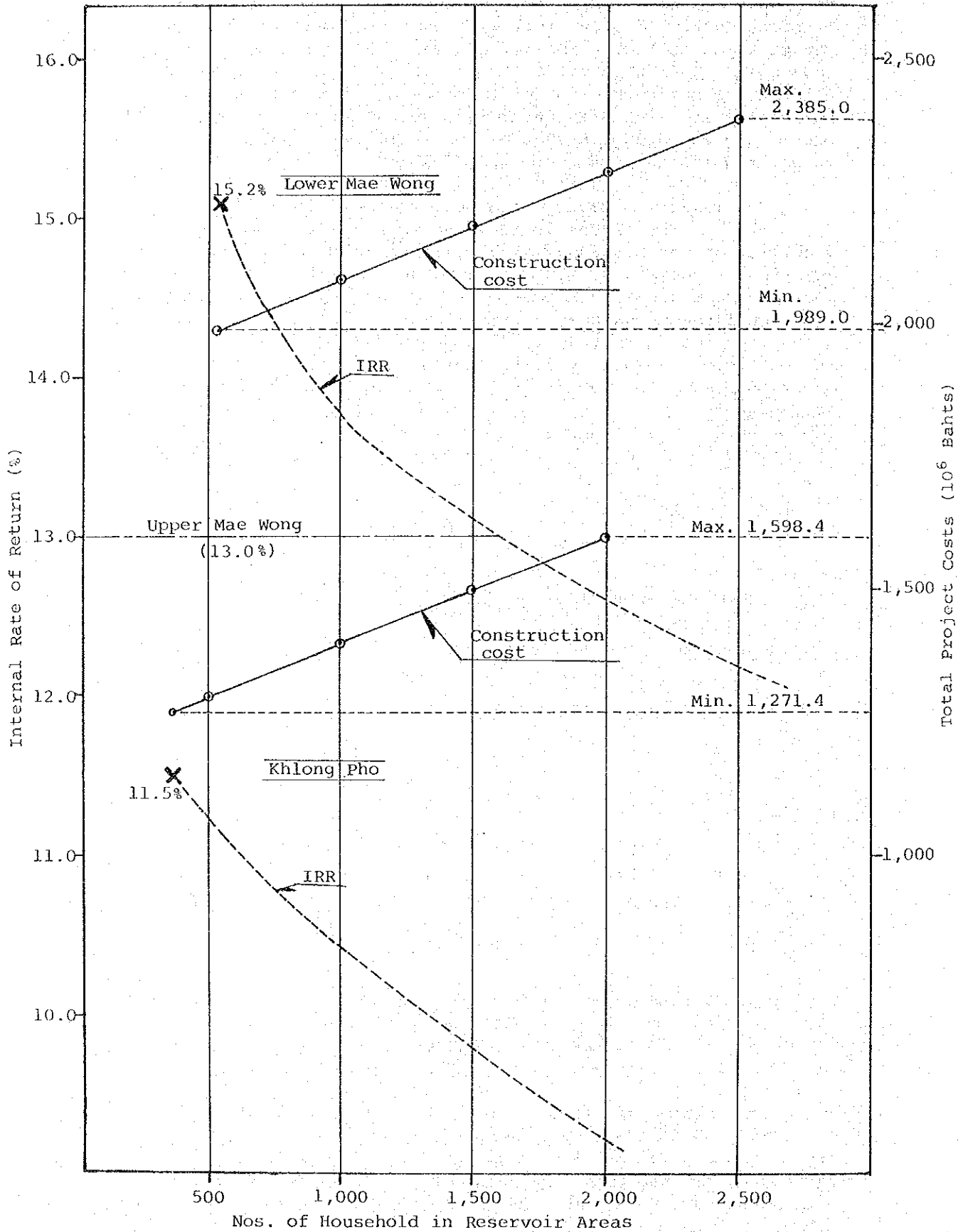
<u>Case</u>	<u>IRR</u>		
	<u>Upper Mae Wong (%)</u>	<u>Lower Mae Wong (%)</u>	<u>Khlong Pho (%)</u>
Case-1	12.1	14.2	10.7
Case-2	11.2	13.3	10.0
Case-3	11.8	13.9	10.4
Case-4	10.2	12.2	8.9

From the above calculated results, it can be said that both of the Upper and Lower Mae Wong Projects will be still economically viable even in the worst case and on the other, the Khlong Pho Project will become questionable in economic feasibility.

The sensitivity analysis is also made for uncertainty in number of household in the prospective reservoir area. Although the official report indicates that there are 40 households living in the Upper Mae Wong reservoir area, 520 in the Lower Mae Wong and 365 in the Khlong Pho, it is generally believed that more number of households are

actually living in the respective reservoir areas, particularly in the Lower Mae Wong and Khlong Pho reservoir areas. The economic evaluations mentioned above were made on the assumption that the official report gives correct number of households. If the actual number of households is different from the official report, the IRR will be changed. The interview with the farmers indicates that about 2,500 households are living in the Lower Mae Wong area and about 2,000 in the Khlong Pho area. Number of household in the Upper Mae Wong area is not significant, ranging from 40 to 80.

The following figure shows the results of sensitivity analysis for number of households in the reservoir areas. The economic viability of the Lower Mae Wong and Khlong Pho projects will drastically decreased with the increased number of household in the reservoir areas. In case of the Lower Mae Wong project, the IRR value will become same as or even lower than that of the Upper Mae Wong project if more than 1,600 households live in the reservoir area. The economic feasibility of the Khlong Pho project would be questionable if the number of household reported by the local people was correct.



5. SOCIO-ECONOMIC IMPACTS

In addition to the direct project benefits counted in the economic evaluation, various secondary and intangible benefits and/or favourable socio-economic impacts are expected from the implementation of the project. The major socio-economic impacts are described hereunder.

(1) Possibility of hydropower generation

The proposed storage dams, especially for the Upper Mae Wong dam, provide a possibility of hydropower development. According to the preliminary study results, about 13,700 MWH of annual energy output will be produced with an installed capacity of 5,000 kW at the Upper Mae Wong dam. The hydropower development potential for the Lower Mae Wong and Khlong Pho dams is rather small compared with the Upper Mae Wong dam, the annual energy outputs estimated for these dams are about 5,300 MWH for Lower Mae Wong dam and 600 MWH for Khlong Pho dam.

(2) Increase of potential fish production

After creation of the reservoirs, the potential fish production will be increased to a great extent, and it would be made possible for the farmers to manage stable aquaculture of valuable fishes. This possibility will be studied during the next stage of the feasibility study.

(3) Foreign exchange earning

After completion of the projects, significant increase in crop production is expected. With the increased production, the marketable surplus of paddy and mung beans will also be increased. The estimated marketable surplus would be:

Surplus for export	Mae Wong		Khlong Pho (ton)
	Upper (ton)	Lower (ton)	
a. Paddy	111,000	111,000	44,000
b. Mung Beans	1,400	4,300	4,300

These surplus would increase the annual amount of exports, resulting in the foreign exchange earning equivalent to around 1,072 million Bahts per annum for Upper Mae Wong, 1,109 million Bahts for Lower Mae Wong and 471 million Bahts for Khlong Pho project.

(4) Increase of employment opportunity

Employment opportunity to the local people will be increased by the project implementation, and a favourable impact will be given to the national economy. Furthermore, the employee will be able to gain more experience, technical know-how, skillfulness in the various working fields. These accumulations would be applied to the future development in the region.

(5) Improvement of local transportation

The local transportation will be improved much by the construction of the operation and maintenance road along the irrigation canals. The expanded road system will not only enhance the economic activity in and around the project area but also contribute to inter-regional accessibility and communication.

(6) Mitigation of flood damages

Flood control is not considered primary in the projects. However, incidental flood control could be realized to some extent by the operation of reservoirs, especially in early part of the wet season.

ANNEX XI
ENVIRONMENTAL CONSIDERATIONS

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ENVIRONMENTAL CONSIDERATIONS

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ANNEX XI

ENVIRONMENTAL CONSIDERATIONS

1. NEB GUIDELINE FOR ENVIRONMENTAL ASSESSMENT

NEB (National Environmental Board) published a manual on "Guidelines for Preparation of Environmental Impact Evaluations" to protect environments from developments in Thailand in 1979. The manual includes general guidelines for all kinds of development and 17 supplementary guidelines for each kind of developments.

The manual asks the development agencies to prepare an IEE report (Initial Environmental Examination) at first stage and to present it to NEB. If NEB judges no major impacts nor any further study are necessary, IEE will usually be the only environmental analysis. If the IEE indicates a follow-up study is necessary, then an EIS (Environmental Impact Study) is to be prepared at next stage.

There are 32 items in total to be studied for the development of dams/reservoirs. They are classified into four categories, i.e., physical resources, ecological resources, human use values and quality of life values (see Table XI-1). This guideline for dams/reservoirs is also applicable to the irrigation and hydroelectric sub-projects. The Ministry for Science, Technology and Energy has defined the magnitude of dams/reservoirs, for which environmental assessment is required, in its Ministerial Regulation determined in September, 1981. They are as follows:

Effective Storage:	More than 100 MCM, or
Reservoir Area in its High Water Level:	More than 15 sq.km, or
Irrigation Area:	More than 128 sq.km (80,000 rais).

According to these criteria, it is necessary for any one of the high priority projects to undertake environmental assessments in their development.

Environmental impacts and countermeasures are studied for all the items required in the said guideline with the present small knowledge obtained through the limited time of the pre-feasibility study. The preliminary assessment on each item of impacts is given in Chapter 2 of this Annex. Other aspects on physical and ecological resources and compensation/resettlement are discussed in Chapter 3, 4 and 5. Technical studies on hydrology, water quality, soils, geology/seismology, erosion/sedimentation, climate, agriculture, power generation, and land use are presented more in detail in other Annexes.

2. PRELIMINARY ASSESMENT ON ENVIRONMENTAL IMPACTS

The anticipated environmental impacts affected by the projects are roughly studies with the present small knowledge obtained through the limited time of the pre-feasibility study.

2.1 Physical resources

- (1) By the operation of the proposed dam, the pattern of river flow will be remarkably changed in the downstream of the dam site. However, the irrigation water from the dam is once released to the river channel and taken at the downstream diversion weirs to the irrigation areas. Thus, it is expected that the future river flow will become more steady than the present natural river flow and contribute to maintenance of river channel fisheries, local navigation, domestic water use, etc. The situation of the present river water quality will not be turned worse.
- (2) Exploitation of water resources by a storage dam and irrigation development will increase the potential of groundwater in the whole basin, particularly in the downstream area of the Sakae Krang river. The present observation of groundwater in the area should be continued for future development.
- (3) A storage dam on a river will change the transportation mechanism of sediment in the river system. In the upstream of the dam, sediment will be trapped in the reservoir and the channel bed of rivers flowing into the reservoir will be elevated because of back sand at the edge of the reservoir. The elevation of river bed will cause flooding in the riparian area at the reservoir edge. The compensation of the land to be damaged will be a possible solution. In the dam design, it is planned that the lands of reservoir rim whose altitude is lower than the dam crest elevation (2 to 4 m higher than the full water level) are to be compensated, and the cost was counted in the project cost.

On the contrary, in the downstream of the dam site, reduction in sediment supply will cause a degradation of the river bed. Careful consideration will be taken in the design of such structures as diversion weir and bridge on the downstream river channel of dam site.
- (4) The proposed projects have been formulated and designed on the basis of technical assessment on present condition of soils and geology in order to minimize the environmental impacts in future. Serious impacts are not therefore anticipated.

2.2 Ecological resources

In general, some impacts to fauna and flora are conceivable. It is however quite difficult to assess such impacts, because there have not been any studies of fauna and flora in the relevant river basins. The areas to be submerged by the dams, particularly the Lower Mae Wong and Khlong Pho, mostly consist of the cultivated lands, scrub and artificial forests. The respective reservoir areas of 68 km² and 32 km² for Lower Mae Wong dam and Khlong Pho dam are rather small as compared with their total catchment areas of 950 km² and 394 km², and therefore serious impacts to fauna and flora are not anticipated. On the other, the reservoir area of the Upper Mae Wong dam is mostly covered by artificial and partially virgin forests, and some effects to wild animal would be conceivable. Further study may be required in this region. Actually, however, the anticipated impacts are negligible since the reservoir area of 19.5 km² is extremely small compared with the total catchment area of 612 km².

2.3 Human use value

- (1) Irrigation will improve the present low land productivity and increase crop production in the Sakae Krang river basin. The increased crop production may accelerate the further development of agro-industries and marketing activities in the area. It will also increase the employment opportunity.
- (2) The dam construction will increase the potential of aquaculture particularly in the downstream due to improved water flow during the dry season, and will also provide a new possibility of sizable aquaculture in the reservoir.
- (3) The proposed dam will create the possibility of hydropower development. The estimated annual energy outputs are about 13,700 MWH for the Upper Mae Wong dam, about 5,300 MWH for the Lower Mae Wong dam and about 600 KWH for the Khlong Pho dam. The hydropower generation will contribute to rural electrification.
- (4) Although the proposed plan does not include flood control in its purpose, dams will reduce the peak discharges to a some extent and will mitigate the flood damages to crops and rural life.
- (5) The regulated water flow resulting from the dam construction will improve the water supplies for domestic uses. Rehabilitation of the existing canal system will also improve the situation. New construction of irrigation canals in the rainfed area will provide the farmers with easy access to domestic water.

- (6) The inspection roads which will be constructed along the irrigation canals, will enhance the economic activities in the area. The improvement of road network will give favourable impacts to socio-economic aspects of the area.
- (7) No significant impacts will be anticipated in other aspects of human use value.

2.4 Quality of life values

- (1) Resettlement problems are considered most serious, particularly for the Lower Mae Wong dam and Khlong Pro dam as their reservoir areas are occupied by villagers. As shown in Table XI-2, it is officially reported that there are 520 households in Lower Mae Wong and 365 households in Khlong Pro area. It seems, however, that more than those number of households are living in the reservoir areas. It is generally believed by the local people that there are about 2,500 households in Lower Mae Wong and about 2,000 household in the Khlong Pho area. A part of these villagers have land ownership called Sor Tor Kor, which is subject to compensation. Moreover this, the resettlement area is not easily found in the vicinity of proposed reservoir unless the reserved forest area is to be sacrificed.
- (2) The proposed projects will largely contribute to the improvement of rural economy and also uplift the rural living standard. The construction of dam and reservoir will provide the rural communities with new recreation areas. The cultural/historical heritages and anachaeological treasures in the reservoir areas, will be checked.

3. PHYSICAL, ECOLOGICAL AND OTHER ENVIRONMENTAL CHARACTERISTICS

3.1 Soil Erosion

The present condition of soil erosion in Thailand was investigated by the Land Development Department, MOAC in 1981. The soil erosion of study area is discussed on the basis of their investigation results as follows:

The following equation was used for estimation of the soil erosion loss.

$$A = RKLSCP$$

- where, A: Soil loss
R: Rainfall erosivity index
K: Soil erodibility factor
LS: Slope factor
C: Vegetation cover factor
P: Erosion control practice factor

In calculation of soil loss, following values of the vegetation cover factor were employed:

1. Forest:	0.001
2. Rubber Plantation of Fruit Orchard:	0.01
3. Rice:	0.65
4. Maize and Cotton:	0.06
5. Sorgum:	0.65
6. Cassava:	0.60
7. Pineapple:	0.50
8. Sugar Cane:	0.40

The distribution of erosion rate thus calculated is shown in Fig. XI-1. The encroached upland has highest erosion rate, from 20 to 966 t/rai/yr (from 7,800 to 377,000 m³/km²/yr sediment using the apparent specific weight of 1.6 g/cm³). The middle part of the Mae Wong River has moderate erosion rate (from 5 to 20 t/rai/yr; from 2,000 to 7,800 m³/km²/yr). The eastern part of the study area, which is located in the downstream of alluvial plain, has very slight or slight erosion rate (from 0.01 to 5 t/rai/yr; from 4 to 2,000 m³/km²/yr).

3.2 Fish

Species of fishes were investigated by interviews to local farmers. Questionnaire were limited only to common species because of language barrier. These data collection were made during October and November, 1984. Locations of data collection are shown in Fig. XI-2.

Catfish, snake fish, tortoise, shrimp and crab are found in every place. Eel and shell are found at most places. Goby, crawfish, and loarch are not found at most places (Table XI-3).

Fishes are taken by nets, hooks, or traps by farmers in all water surfaces such as rivers, streams canals, ponds, and reservoirs for farmers' major protein food, as shown in Fig. XI-3. Part C is a picture showing that two young children are using their net in a small muddy pond near Huai Rang Dam site in Fig. XI-3. Part A and B are pictures showing scenes of Bangkok's famous Sunday Market selling catfishes, gobies, wild pigs, frogs, snakes, and birds.

3.3 Wildlife

Frog, snake, rabbit, and birds are identified at every place (Table XI-4). Monkey and wild pig tend to be found in the upland or mountain and not in the lower plains. One farmer told that there are barking deers, elephants, wild buffalos, tigers, peacocks, cobras and others are found in the mountaneous area of Huai Rang reservoirs.

3.4 Forests

Forests of the study area are, in general, found within the forest reserves of Forestry Department, MOAC. The distribution of forest reserves is shown in Fig. XI-4 (source: Forestry Department, MOAC). Western part of the study area and some monadonocks are designated as forest reserves.

The proposed reservoir/dam sites are included in the forest reserves except Huai Rang. A wildlife conservation area (Huai Ka Kaeng) exists west of Thap Salao River. Major part of the Thap Salao River is not included in the forest reserve.

These forest reserves have been encroached by farmers for logging and cultivation, especially in the lower part such as alluvial and diluvial plains where the slope is small and cultivation is possible. In case of Mae Wong - Mae Poen Forest Reserve, cultivated land were found as shown in Fig. XI-5 (A). But in the upstream areas, dense natural tropical forests were also found as shown in Fig. XI-5 (B). Using the areal photos and landsat images, Forestry Department investigated the area of encroachment in the Mae Wong - Mae Poen Forest Reserves (Fig. XI-6). The investigation estimated that the encroached area increased from 7% of total reserve area in 1963 to 43% in 1983 (Table XI-19). This forest was proclaimed to be a forest reserve in 1958 (Ministrial Proclamation No. 12).

The depletion of forest area should be clarified and its influence on the environment should be studied. Severe restrictions should be employed for the illegal encroachment.

3.5 People's Living Condition

Socio-economic characteristics of the area are studied on the basis of data collected by interviews to local people. The collected data are given in Table XI-5. In all the proposed dams, Buddhism is the only religion. Although many species of cultivation are found such as rice, corn, sugar cane, beans, peanut, cassava, sorguam, banana and jute, rice is not usually found in upland terrain. Species of live-stocks are cow, water buffalo, pig, chicken, duck, etc. Ethnically speaking, most people living in the proposed reservoir/dam sites are Thais except Kilians in Khun Kaew or Huai Rang. In the Mae Lae Tambon, the existence of hill tribesmen is reported in official data. Taboos are not found in any area.

Drinking water is supplied by stream, well, pond, and rain. Detailed numbers of households, population, schools, etc. for Lower Mae Wong by official data are shown in Table XI-6. Village statistics of two (2) Bans in Tambon Khok Kwai, Amphoe Ban Rai are shown in Table XI-7.

4. RESETTLEMENT AND COMPENSATION

4.1 Basic Principle and General Procedure

4.1.1 Basic principle

Properties subject to compensation are divided into two categories; (1) land and (2) movable properties (see Table XI-8). In case of reservoir/dam constructions, RID compensates those who have land ownerships in the reservoir area by giving them another lands for their resettlement. There are four types of legal land ownership; (1) Title Deed, (2) Pre-Registered Title Deed, (3) Nor Sor 3 and (4) Sor Kor 1 and two types of habitual land ownership; (5) Sor Tor Kor and (6) Por Bor Tor 5 (see Table XI-9). RID usually compensates those who have Title Deed, Pre-Registered Title Deed, Nor Sor 3, Sor Kor 1, and Sor Tor Kor. For those who have Por Bor Tor 5, RID does not compensate for land.

RID always compensates those who live in the reservoir/dam area for their movable (if not uneconomical) properties even if they do not have formal land ownerships. Movable properties include houses, fruits tree, woods, crops, wells, etc. Compensation is done by giving them the relocation cost. If it is uneconomical to move the properties such as big banana trees, cash for compensation is paid to the owner. RID also compensates public facilities and other agencies' land. Public facilities include schools, temples, roads, bridges, power lines, government offices, etc.

4.1.2 General procedure

General compensation procedure is as follows:

- (a) Marking of compensation area of dam/reservoir,
- (b) Measurement of each applicant's plot,
- (c) Investigation on and documentation of the area and land ownership
- (d) Establishment of Committee of Purchasing and Price Setting, organized by MOAC and Ministry of Interior and Cooperatives.
- (e) Preparation of resettlement area, and
- (f) Evacuation of properties by the assistance of RID.

Three criteria are considered to decide the compensation price. They are local environment, local land tax, and up-to-date market price. When Sor Tor Kor is found within the area, RID will, at first, contact the agency concerned such as Forestry Department, and the negotiation begins for compensation with the evacuees. Although compensation for land is not paid for those who have Por Bor Tor 5, they are given from $\text{฿}600/\text{rai}$ (North-Eastern) to $\text{฿}1,100/\text{rai}$ (Central). Compensation for movable properties is also paid.

Then the residents do not consent to the evacuation, RID can ask for the use of Confiscate Law. RID can expropriate the land and evacuate the movable properties at their own cost.

4.2 Inventory of Properties

Inventory of properties were investigated by two methods, (1) collection of official data at provincial and district offices and (2) interviews to local people such as heads of villages. These data collection were made during October and November, 1984.

The inventory for compensation and related data collected are shown in (Table XI-10 to XI-14).

The major inventory are shown in Table XI-2 for five reservoir/dams. The number of households by official data are about 4 times greater than those by interview data. Those dams which have more households by official data, also have more households by the interview data. Lower Mae Wong area has the largest number of households, 520, and Upper Mae Wong area has the least number of households, 40, according to official data. The real inventory seems to be equal to or greater than the official data, because all the people in the area are illegal encroachers of the Forestry Department's land and newcomers are still increasing.

4.3 Unit Price for Relocation

4.3.1 House

According to the interview to local people, selling prices of present houses varied widely from ¥5,000 to ¥1,000,000 per house, averaging ¥30,000/house. The general tendency is that remoter the location is, poorer the quality and size of the house is. In the center of Ban Taling Sun in Lower Mae Wong, a big market owner boosted his building as ¥1,000,000.

In case of Thap Salao Project, RID made a detailed investigation of relocation cost for structures (houses). Relocation cost is the sum of costs for decomposition, transportation to resettlement area, reconstruction and compensation for deterioration of house materials. It is not a cost for building a new house. The investigation result by the Committee of Purchasing and Price Setting, are about ¥15.1 million as shown in Table XI-15 for the 314 households. The permanent, semi-permanent, and temporary houses' relocation cost are ¥81,900, ¥40,000, and ¥29,400, respectively (1983 price). Pictures and characteristics of semi-permanent and temporary houses are shown in Figs. XI-7 and XI-8.

4.3.2 Vegetation

In case of the Thap Salao Project, the compensation cost for vegetation was decided as shown in Table XI-16. In case of grown-up banana trees, as it is uneconomical to move, if not impossible, $\text{P}30/\text{tree}$ is paid and $\text{P}15/\text{tree}$ is paid for immature trees. For rice, $\text{P}1,200/\text{rai}$ is paid, but no money was paid if it is possible to harvest after some days before the construction, even if evacuation has already started.

4.3.3 Total cost

In case of the Thap Salao Reservoir/Dam Project, the total cost comprising the compensation cost for vegetation, relocation of structures, relocation of public facilities, survey and management cost, and contingency cost are shown in Table XI-17. The evacuation includes 314 households, one school, and one temple.

Major part of the compensation (80 %) is paid for relocation of structures (private houses). If total compensation is divided by the number of households, the unit cost is as follows;

$$\frac{\text{P}19,020,650}{314} = \text{P}60,575/\text{household}$$

5. RESETTLEMENT PROGRAM

The resettlement program of the Thap Salao Dam Reservoir Project is reviewed. A preliminary proposal for the resettlement program is then presented hereunder based on the results of field surveys and interviews to related agencies and references.

5.1 Resettlement Program for Thap Salao Dam/Reservoir Project

In case of Thap Salao Project, the forest reserve area which locates about 10 km away from dam site, is selected for the resettlement area. In the area, there are already illegal encroachers of 152 households. As a result, two groups are involved in this resettlement program, 162 households from reservoir/dam site and pre-existing 152 households within the resettlement area.

To carry out the resettlement program, three subcommittees are organized. They are land allocation committee, compensation committee, and evacuation committee. The land plot preparation involves measurement and landmarking, forest clearing and land leveling, draw lots for allocation, temporary water supply, main pipe line, sedimentation tank, water distribution system, roads, headquarter, temple, school, pavillion, etc. Compensation involves property investigation, problem judgement, budget preparation, public relation, compensation, etc. Relocation involves subsistence fund issuance and resettlement operation. Occupation training involves delivery of seeds, preparation of temporary officers, delivery of fertilizer, preparation of training documents, etc.

Total budget of the resettlement program was about 91 M\$ at 1983 price and the program spans over 7 years.

5.2 Problems in Resettlement Program

5.2.1 Follow-up investigation of evacuees

It is necessary to confirm the validity of the BID's policies of conventional resettlement programs. One of the methods for confirmation is to make a follow-up investigation of evacuees from existing reservoirs. The minimum requirement for the resettlement is that resettlers will share in the benefits of the project and be at least, as well off as for without project conditions. If the program fails, another forest encroachment may be initiated by the resettlers. Following three items should be investigated.

(1) Percentage of original resettlers

Percentage of original resettlers to the present population in the resettlement areas should be investigated.

(2) Annual income of resettlers

Annual income of resettlers who received about 10 rai (1.6 ha) for cultivation, which is the cabinet's resolution on provision of land for evacuated people in irrigation project areas as of 1977. Field survey of the present study shows that most farmers cultivate more than 30 rai. It is also reported that careful use of irrigation water, appropriate use of certified seeds and fertilizer are necessary for 13 rai (2 ha) of upland to produce B14,400 of annual income.

(3) Motive of leaving resettlement area

Reason or motive for evacuees' leaving the resettlement area should be studied. Post evacuees from Nam Pong Reservoir, Northeast, were found in Ban Noen Somboon near the dam site of Khlong Pho area in the present study. They may be fortune hunters traveling from one wilderness to another seeking for illegal income and compensation, or they may be dropouts of the resettlement.

5.2.2. Resettlement program of Uthai Thani province

Uthai Thani Province has a land reform program of 200,000 rai (32,000 ha) which indicates a possibility of accepting evacuees from the prospective reservoir areas. This should be carefully studied.

6. RECOMMENDATIONS FOR FURTHER STUDY

Environmental assessment is a time and money-consuming task. To avoid unnecessary or duplicate study, it is, at present, very important for RID to examine the NEB's manual and contact NEB to negotiate what kind of assessment is needed for the present study.

REFERENCES

1. Environmental Impact Investigation of Huai Thap Salao Reservoir Project (Prepared for RID), 1983, ISRTT (in Thai).
2. Information of Kao Shon Kun-Upper Area in Forest Reserve Area, Tambon Mae Rae and Tambon Huai Nam Horn, Lat Yao District, 1984, Lat Yao District Office, Nakhon Sawan Province, (Survey result report, in Thai).
3. Document of Project of Withdrawal of Forest Reserve Status in which there are Community Settled, 1984 unpublished, Devition of Forest Reserve Land Management, Forestry Department, MOAC (in Thai).
4. Soil Erosion in Thailand, 1981, Land Development Department, MOAC (in Thai).
5. Manual of NEB Guidelines for Preparation of Environmental Impact Evaluations, 1979, National Environmental Board.

Table XI-1 ENVIRONMENTAL PARAMETERS FOR ANALYSIS OF DAM AND RESERVOIR PROJECTS
(INCLUDING IRRIGATION AND HYDROELECTRIC SUB-PROJECTS)

Environmental Resource	Physical Resources						Ecological Resources						Human Use Values												Quality of Life Values								
	Surface Water Hydrology	Surface Water Quality	Ground Water Hydrology	Ground Water Quality	Soils	Geology/Sedimentation	Erosion/Sedimentation	Climate	Fisheries	Aquatic Biology	Terrestrial Wildlife	Forests	Agriculture/Irrigation (if applicable)	Aquaculture	Water Supply	Navigation	Recreation	Power (if applicable)	Flood Control	Dedicated Area Uses	Industry	Agro-Industry	Mineral Development	Highways/Railways	Land Use	Socio-Economic	Resettlement	Cultural/Historical	Aesthetic	Archaeological	Public Health	Nutrition	
Project Component	A	3	2	2	1	-	3	1	(3)	(3)	2	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	3	-	-	(2)	(2)	3	(3)	3	1	(5)	1	(2)	(3)	
	B	3	-	3	-	2	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	3	-	-	-	-	1	-
Irrigation	A	1	3	2	-	3	-	2	(3)	(3)	1	-	(3)	(3)	(3)	(1)	-	-	-	-	(2)	(2)	-	1	3	(3)	-	-	-	-	-	(2)	(3)
	B	2	3	3	1	3	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Hydroelectric Power and Transmission	A	-	-	-	-	-	1	-	-	1	3	1	-	-	-	-	3	-	-	-	3	2	-	-	3	(3)	-	-	-	2	-	-	-
	B	1	-	1	1	2	2	1	-	1	1	3	-	-	-	-	-	-	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-

NOTES: (a) (A) means significant impact of project on environmental resources, whereas (B) means impact of the environment on the project.

(b) Numerical value of 3 means probable major impact, 2 means intermediate, and 1 means significant but relatively minor.

(c) Numbers in parentheses indicate effects are mostly enhancement of environmental. Numbers in double parentheses represent combination of adverse and beneficial effects. Numbers without parentheses represent either adverse or beneficial effects.

Table XI-2 INVENTORY OF COMPENSATION FOR EACH RESERVOIR

No.	Reservoir	Household	Land Ownership	School	Temple
1	Upper Mae Wong	40 (80)	(Sor Tor Kor)	0 (0)	0 (1)
2	Lower Mae Wong	520 (2,460)	Sor Tor Kor	8 (11)	5 (13)
3	Khlong Pho	365 (1,967)	Sor Tor Kor	3 (+)	4 (+)
4	Huai Rang	218 (930)	(Por Bor Tor 5)	(+)	(+)
5	Khun Kaew	105 (83)	(Por Bor Tor 5)	1 (+)	0 (0)

* Data in parenthesis were given by local people's interviews.

Other data are official data by responsible agencies.

(+) means more than 1.

Table XI-3

INTERVIEW RESULTS OF AQUATIC RESOURCES SURVEY

1984

Station Number	A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8
Date of Interview	Oct. 24	Oct. 24	Oct. 24	Oct. 25	Oct. 26	Nov. 8	Nov. 8	Nov. 8
District	Lat Yao	Lat Yao	Lat Yao	Lat Yao	Nong Chang Lan Sak	Ban Rai	Ban Rai	Ban Rai
Name of Village	Ban Taling Sung	Ban Wang	San Ban Sadao Sai	Non Sung Bung	Head Wear	Ban Samaip Ban Kud Jaaroeik	Ban Khok Kwai	Ban Khok Kwai
Name of Watershed	Mae Wong	Mae Wong	Mae Wong	Khlong Pho	Thap Salao Huai Rang	Khun Kaew	Khun Kaew	Khun Kaew
Main Land Use of Area	Forest	Paddy	Paddy	Paddy & Forest	Paddy	Upland	Forest	Forest
General Feature Code	2 Af	2 Br	2 Br	2 Br	2 Br	2 Bm	2 Af	2 Af
Goby	N	N	N	E	N	N	N	N
Carp	E	E	E	E	E	E	E	E
Catfish	E	E	E	E	E	E	E	E
Snake Fish	E	E	E	E	E	E	E	E
Crawfish	N	N	N	N	N	N	N	N
Eel	E	E	E	E	E	E	E	E
Loarch	N	N	N	N	N	N	N	N
Tortoise	E	E	E	E	E	E	E	E
Shrimp	E	E	E	E	E	E	E	E
Crab	E	E	E	E	E	E	E	E
Shell	E	E	E	E	E	E	E	E
Purpose of Catching	Family Use	Family Use	Family Use	Family Use	Family Use	Family Use	Family Use	Family Use
Method	Net	Net	Net	Net	Net	Net	Net	Net
	Hook	Hook	Hook	Hook	Hook	Hook	Hook	Hook
	Trap	Trap	Trap	Trap	Trap	Trap	Trap	Trap
Historical Change	none						decrease in aquatic resources	

* Blunk : no answer given

N : not exist

E : exist

Table XI-4

INTERVIEW RESULTS OF WILDLIFE SURVEY

1984

Station Number	W 1	W 2	W 3	W 4	W 5	W 6
Date of Interview	Oct. 24	Oct. 24	Oct. 24	Oct. 24	Nov. 8	Nov. 8
District (Amphoe)	Lat Yao	Khlong Khung	Lat Yao	Lat Yao	Lan Sak	Ban Rai
Name of Village	Ban Taling Sung	Ban Nong Plong	Ban Sadao Sai	Non Sung Bung	Ban Samsip	Ban Kud Jaarok
Name of Watershed	Mae Wong	Mae Wong	Mae Wong	Khlong Pho	Huai Rang	Khun Kaew
Main Land Use of Area	Paddy	Paddy & Upland	Paddy	Paddy & Forest	Upland	Forest
General Feature Code	Bm	2 Bm	0 Br	2 Br	2 Bm	2 Af
Grass Hopper						
Monkey	N	E	N	N	E	E
Frog	E	E	E	E	E	E
Snake	E	E	E	E	E	E
Wild Pig	E	E	N	N	E	E
Rabbit	E	E	E	E	E	E
Cicade						
Bird	E	E	E	E	E	E
Bird	E	E	E	E	E	E
Other Species					*	

N : not exist E : exist

* : Barking deers, elephants, wild buffallos, tigers, peacocks, cobras, ets are found in the mountain.

Table XI-5 SOCIAL, ECONOMIC, AND OTHER CHARACTERISTICS OF PROPOSED DAM

Item	Upper Mae Wong	Lower Mae Wong	Khlong Pho	Huai Rang	Khun Kaew
Date of Survey	Nov. 6, 1984	Oct. 24, 1984 Nov. 6, 1984	Nov. 7, 1984	Nov. 8, 1984	Nov. 8, 1984
Data Year	1984	1984	1984	1984	1984
Interviewer Status	Head of Ban Taling Sun	Head of Ban Taling Sun	Deputy Head of Ban Mahnai & others	Wife of Head of Ban Samsip	Farmer of Bankud Jaaroeek
Name (age)	Mr. Rum (50)	Mr. Rum, etc. (50)	Mr. Boonsri Ponaka (50)	Mrs. Yoopin Butama (20)	Mr. Jae Bong Kok (40)
Province (Changwat)	Nakhon Sawan Kamphaeng Phet	Nakhon Sawan Kamphaeng Phet	Nakhon Sawan	Uthai Thani	Uthai Thani
District (Amphoe)	Lat Yao Khlong Khlung	Lat Yao Khlong Khlung	Lat Yao	Lan Sak	Ban Rai
Number of Villages	3	more than 4	9		6
Mean Annual Income for a Household, Baht		15,000 - 30,000	10,000 - 20,000	10,000	
Religion	Buddhism	Buddhism	Buddhism	Buddhism	
Species of Cultivation	rice, corn, banana	rice, corn, bean	rice, corn, bean, jute, sorgum	bean, sorgum	rice, corn.
Species of Livestock	cow, chicken	cow, waterbuffalo, pig, chicken, duck	waterbuffalo, pig, chicken, duck	waterbuffalo, pig, chicken, ox	waterbuffalo
Ethnic Group	Thai	Thai	Thai	Karian & Normal Thai	
Taboo	none	none	none	none	none
Water Supply	stream	well, river	pond, well, stream	stream	
Health Condition					
Time of Settlement	10 - 20 yrs ago	50 yrs ago still increasing	5 - 10 yrs ago	18 yrs ago	Mr. Jae was born here. So the settlement time is more than 40 yrs ago.

Table XI-6

OFFICIAL DATA OF PEOPLE AND HOUSEHOLD
IN LOWER MAE WONG

Drainage Basin	Village (Ban)	Household	Population	School	Temple	Medical Facility
Mae Wong	Pran Ngoen	15	50	3	3	1
	Taling Sung	120	700			
	Noi Grup	25	105			
	Hin Dad GRUP	25	95			
	Pan Na La Kor Pand Sud	70	350			
Mae Le	Pang Sarn	65	400			
	Khlong Sai	30	200	1	1	
	Pi Chit	30	120	1		
	Nong Mai	30	150	1		
	Sub Ma Prang	50	200	1	1	
	Fa Tang	20	90	1		
	Pung Kanoon					
	Yod Huai Kaew	10	50			
	Nor Nung Nor Sam	30	120			
Total		520	2,630	8	5	1

Source : Lat Yao District Office, Nakhon Sawan
(Survey period, November, 1984)

Table XI-7 VILLAGE STATISTICS (1/2) BAN THONG HANG

Data Year		1984
Province	(Changwat)	Uthai Thani
District	(Ampho)	Ban Rai
Sub-District	(Tambon)	Khok Kwai
Village	(Ban)	Thong Hang
Population	Family	99
	Male	335
	Female	312
	Total	645
Village Area	rai	1,500
	ha	
Public Area	rai	75
	ha	
Distance from District Office	km	35
Number of Poor Family		-
Recreation Area		-
Respected Person (Leadership)	Head of Village	Mr. Seri Khlong Hang
	Others	Mr. Jong Prong Gae Pong Mrs. Lar Gae Pong Mr. Yang Poo Kao Man
People's Need		Well Roads to village; between Khlong Wai - Poomen
Road	Earth Road	-
	Laterite Road	1 road
	Asphalt Road	-
	Concrete Road	-
Livestock	Ox/Cow	-
	Water Buffalo	20
	Duck	30
	Chicken	500
	Pig	150
Well	Hand-dug Deep Well	-
	Hand-dug Shallow Well	1
	Machine-dug Deep Well	-
Public Facility	Temple	3
	School	

Data source ; Ban Rai District Office, Uthai Thani Province
(Original is written in Thai.)

Table XI-7 VILLAGE STATISTICS (2/2) BAN LAWA

Data Year		1984
Province	(Changwat)	Uthai Thani
District	(Ampho)	Hue Kot
Sub-District	(Tambon)	Khok Kwai
Village	(Ban)	Lawa
Population	Family	197
	Male	427
	Female	481
	Total	909
Village Area	rai	13,050
Public Area	ha	
	rai	-
Distance from District Office	ha	
	km	62
Number of Poor Family		
Recreation Area		
Respected Person (Leadership)	Head of Village Others	Mr. Sumruay Arsa
People's Need		Road between Lawa & Poome Power Line Pond for Domestic Use
Road	Earth Road	-
	Laterite Road	-
	Asphalt Road	-
	Concrete Road	-
Livestock	Ox/ Cow	4
	Water Buffalo	145
	Duck	25
	Chicken	2,955
	Pig	10
Well	Hand-dug Deep Well	
	Hand-dug Shallow Well	2
	Machine-dug Deep Well	
Public Facility	Temple School	

Data source ; Ban Rai District Office, Uthai Thani Province
(Original is written in Thai)

Table XI-8 PROPERTIES SUBJECT TO COMPENSATION

Category	Condition	Method
Land	Land Ownership	Giving a resettlement area
Movable Properties {	None	If movable, the relocation cost is paid such as a house. If not movable, compensation money is paid such as big banana trees.
House		
Fruit		
Tree		
Crop		
Well		

Source: Land Ownership Sub-Division, Law and Land Division, RID

Table XI-9 LAND OWNERSHIPS IN THAILAND

No	Name	Compensation		Legal Ground	Existence of Certificate	Tax	Right			
		Land	Movable Properties				Use	Rent	Sale	Inheritance
1	Title Deed	Yes	Yes	Land Code 1954	Yes	Yes	Full	Full	Full	C3
2	Pre-Registered Title Deed	Yes	Yes	Land Code 1954	Yes	Yes	Full	Full	Full	C3
3	Nor Sor 3	Yes	Yes	Land Code 1954	Yes	Yes	C1	Full	C2	C3
4	Sor Kor 1	Yes	Yes	Land Code 1954	Yes	Yes	C1	Full	C4	C4
5	Sor Tor Kor	Yes (Conditional)	Yes	Gov. Agencies' permit *	Yes (permit)	Yes	Full	No	No	Full
6	Por Bor Tor 5	No	Yes	No (illegal)	No	Yes	Full	No	No	No

Source : Land Ownership Sub-Devison, Law and Land Division, RID

* Public Welfare Department has Loyal Registration of Land Allocation for Cultivation (1972) and Forestry Department, MOA, has Loyal Registration of Forestry for their ground of permittance.

C1 : Five years consecutive use is required. C2 : Public notice for 30 days at the district office is required. C3 : Public notice for 60 days at the district office is required. C4 : Public notice for 60 days at the district office is required, and it will transfer the title to Nor Sor 3.

Table XI-10 PROPERTIES SUBJECT TO COMPENSATION (1)

(1/5) Upper Mae Wong Dam

Item	Data Source	Official Data *	Interview Data
Date of Survey		Nov. 7, 1984	Nov. 6, 1984
Data Year		1984	1984
Person in Charge	Status Name (age)	District Officer of Lat Yao District Mr. Watana	Head of Ban Taling Sun Mr. Rum (50)
Province (Changwat)		Lertdhamtavi Nakhon Sawan,	Kamphaeng Phet
District (Amphoe)		Lat Yao,	Khlung Khlung
Number of Villages (Bans)			3
Number of Households		40	80
Price of House, Baht			
Population		300	480
Area of Cultivated Land, rai		11,000	
Number of School			0
Number of Temple			1
Number of Medical Facilities			
Number of Factories (mills)			0
Legal Land Ownership			Sor Tor Kor
Names of Villages (Bans)			Huai Wao Sob Kob Muang Sambung

* Survey is limited to Huai Wao vicinity.

Table XI-11

PROPERTIES SUBJECT TO COMPENSATION (2)

(2/5) Lower Mae Wong Dam

Item	Data Source	Official Data	Interview Data
Date of Survey		Nov. 7, 1984	Oct.24, Nov.6, 1984
Data Year		1984	1984
Person in Charge	Status Name (age)	District officer of Lat Yao District Mr. Watana Lertdhamtavi	Head of Ban Taling Sun Mr. Rum (50)
Province (Changwat)		Nakhon Sawan	Kamphaeng Phet
District (Amphoe)		Lat Yao	Khlong Khlung
Number of Villiages (Bans)		16	more than 4
Number of Households		520	2,460
Price of House, Baht			20,000
Population		2,630	13,000 - 18,000
Area of Cultivated Land, rai		50,000	
Number of School		8	11
Number of Temple		5	13
Number of Medical Facilities		1	2
Number of Factories (mills)			5
Legal Land Ownership		Sor Tor Kor	Sor Tor Kor
Names of Villages (Bans)		Pran Ngoen Taling Sung Noi Grup Hin Dad Group Pan Na La Kor Pand Sud Pang Sarn Khlong Sai Pi Chit Nong Mai Sub Ma Prang Fa Tang Pung Kanoon Yod Huai Kaew Nor Nung Nor Sam	Taling Sung, LY Mo Som Boon, KK Nong Pong, KK Kokaew, KK

Table XI-12 PROPERTIES SUBJECT TO COMPENSATION (3)

Item	Data Source	(3/5) Khlong Pho	Dam
		Official Data	Interview Data
Date of Survey		Nov. 7, 1984	Nov. 7, 1984
Data Year		1984	1984
Person in Charge	Status Name (age)	District officer of Lat Yao District Mr. Watana Lertdhamtavi Nakhon Sawan	Deputy Head of Ban Mahnai Mr. Boonsri Ponaka (50)
Province (Changwat)		Nakhon Sawan	
District (Amphoe)		Lat Yao	
Number of Villiages (Bans)		6	9
Number of Households		365	1,967
Price of House, Baht			8,000 - 10,000
Population		1,475	
Area of Cultivated Land, rai		15,000	30 /household
Number of School		3	more than 1
Number of Temple		4	more than 1
Number of Medical Facilities		1	more than 1
Number of Factories (mills)			more than 11
Legal Land Ownership		Sor Tor Kor	Sor Tor Kor
Names of Villages (Bans)		Pang Sak (30) Kao Mae Ka See (100) Tha Na Kood (50) Pana Swan (120) Pak Don (25) Pang Shai (40) () Household Survey is limited to Khlong Pho stream.	Noen Somboon (250) Khlong Pho Patana (100) Hhong Pawatai (100) Khlong Pho (200) Panaswan (300) Mahnai (667) Tamagood (200) Hnong Mai (100) Pang Wai (50) () Household

Table XI-13

PROPERTIES SUBJECT TO COMPENSATION (4)

(4/5) Huai Rang

Dam

Item	Data Source	Official Data	Interview Data
Date of Survey		Nov. 9, 1984	Nov. 8, 1984
Data Year		1984	1984
Person, Status in Charge Name (age)		Deputy Chief of the Lan Sak District	Wife of Head of Ban Sam sip Mrs. Yoopin Butama (20)
Province (Changwat)		Uthai Thani	
District (Amphoe)		Lan Sak	
Number of Villiages (Bans)			7
Number of Households		218	930
Price of House, Baht			
Population			
Area of Cultivated Land, rai			
Number of School			more than 1
Number of Temple			more than 2
Number of Medical Facilities			
Number of Factories (mills)			
Legal Land Ownership			Por Bor Tor 5
Names of Villages (Bans)		Pang Kwai (16) Sao Thong (*) Pong Sam Sip (*) Pong Ma Kaa (44) Chum Ta Klee (*) Sab Pa Kang (*)	Pang Kwai (250) Sao Thong (30) Sam Sip (300) Pong Ma Kaa (180) Shoom Taklee (20) Pa Fa (30) Sab Pa Kang (120)
		* Total 158 () ; Tax Paying Household	() Household

Table XI-14

PROPERTIES SUBJECT TO COMPENSATION (5)

(5/5) Khun Kaew

Dam

Item	Data Source	Official Data	Interview Data
Date of Survey		Nov. 8, 1984	Nov. 8, 1984
Data Year		1984	1984
Person in Charge	Status Name (age)	Deputy Chief of District Ban Rai Mr. Mana Burranasint	Farmer of Ban Kud Jaaroek Mr. Jae Bong Kok (40)
Province (Changwat)		Uthai Thani	
District (Amphoe)		Ban Rai	
Number of Villages (Bans)		5	6
Number of Households		105	83
Price of House, Baht			
Population			
Area of Cultivated Land, rai		5 - 30	(8)
Number of School		1	1
Number of Temple		0	
Number of Medical Facilities		0	none
Number of Factories (mills)			none
Legal Land Ownership			Por Bor Tor 5
Names of Villages (Bans)		Ban Kud Ja Roek (15) Ban I Sa (20) Ban Huai Ruam (23) Ban Khlong Kien (8) Ban Sai Bur (39)	Ban Kud Jaaroek (18) Ban I Sa (7) Ban Huai Loum (10) Ban Khlong Kien (8) Ban Sai Bur (10) Ban Khong Hang (30)
		() ; Household	() ; Household
Tambon		Khok Kwai	

Table XI-15 RELOCATION COST FOR STRUCTURES (Houses)
FOR THAP SALAO RESERVOIR

Type	Number of Households	Average Cost (Baht)	Cost (Baht)
1 (Permanent)	81	81,900	6,633,900
2 (Semi-permanent)	155	40,000	6,200,000
3 (Temporary)	78	29,400	2,293,200
Total	314		15,127,100

Source: Ref. 1
Cost: 1983 price

Table XI-16 COMPENSATION COST OF VEGETATION

(Unit: 1 Baht)

Species	Cost
Banana	30 (mature)/tree, 15 (mature)/tree
Papaire	55 (mature)/tree, 35 (mature)/tree
Coconut	500 (mature)/tree, 300 (mature)/tree
Sorgum	500/rai
Corn	1,000/rai
Rice	1,200/rai
Mung bean	1,600/rai
Soy bean	1,500/rai

Source: Ref. 1
Cost: 1983 price

Table XI-17 TOTAL COMPENSATION COST FOR
THAP SALAO RESERVOIR

Item	Cost (Baht)	%
Vegetation (Fruit Trees)	219,800	1
Re-Location of Structures (Houses)	15,201,700	80
Re-Location of Public Facilities	1,070,000	6
Survey and Management Cost	800,000	4
Contingency 10%	1,729,150	10
Total	19,020,650	100

For the 314 households, 1 school, and 1 temple.
Cost: 1983 price

Table XI-18 Roughly Estimated Compensation Cost
for Each Reservoir/Dam

No.	Name of Reservoirs	Number of Households	Cost in M฿
1	Upper Mae Wong	40 (80)	2.4 (4.8)
2	Lower Mae Wong	520 (2,460)	31.5 (149.0)
3	Khlong Pho	365 (1,967)	22.1 (119.2)
4	Huai Rang	218 (930)	13.2 (56.3)
5	Khun Kaew	105 (83)	6.4 (5.0)

Date in the parenthesis based on local people's interview data.

Cost : 1983 price

Table XI-19 Historial Changes of Encroached Area
in Mae Wong - Mae Poen Forest Reserve

Year	Encroached Area			Investigation Method
	rai	ha	%	
1963	78,594	12,600	7	areal photo
1975	210,860	33,700	20	landsat image
1982	459,532	73,500	43	landsat image

Total area is 1,080,725 rais or 172,900 ha.

source : Ref. 3

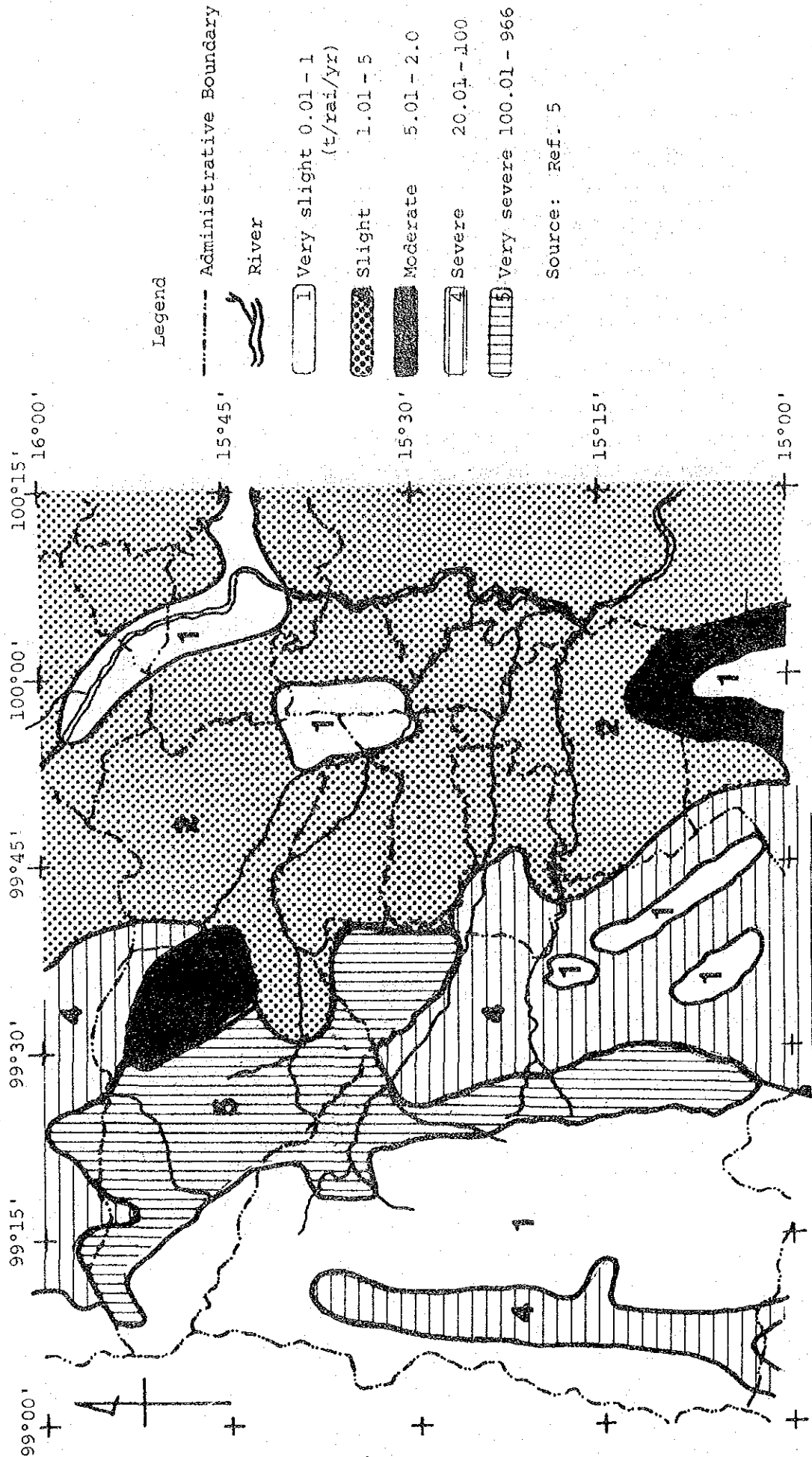


Fig.XI-1 Soil Erosion of Study Area

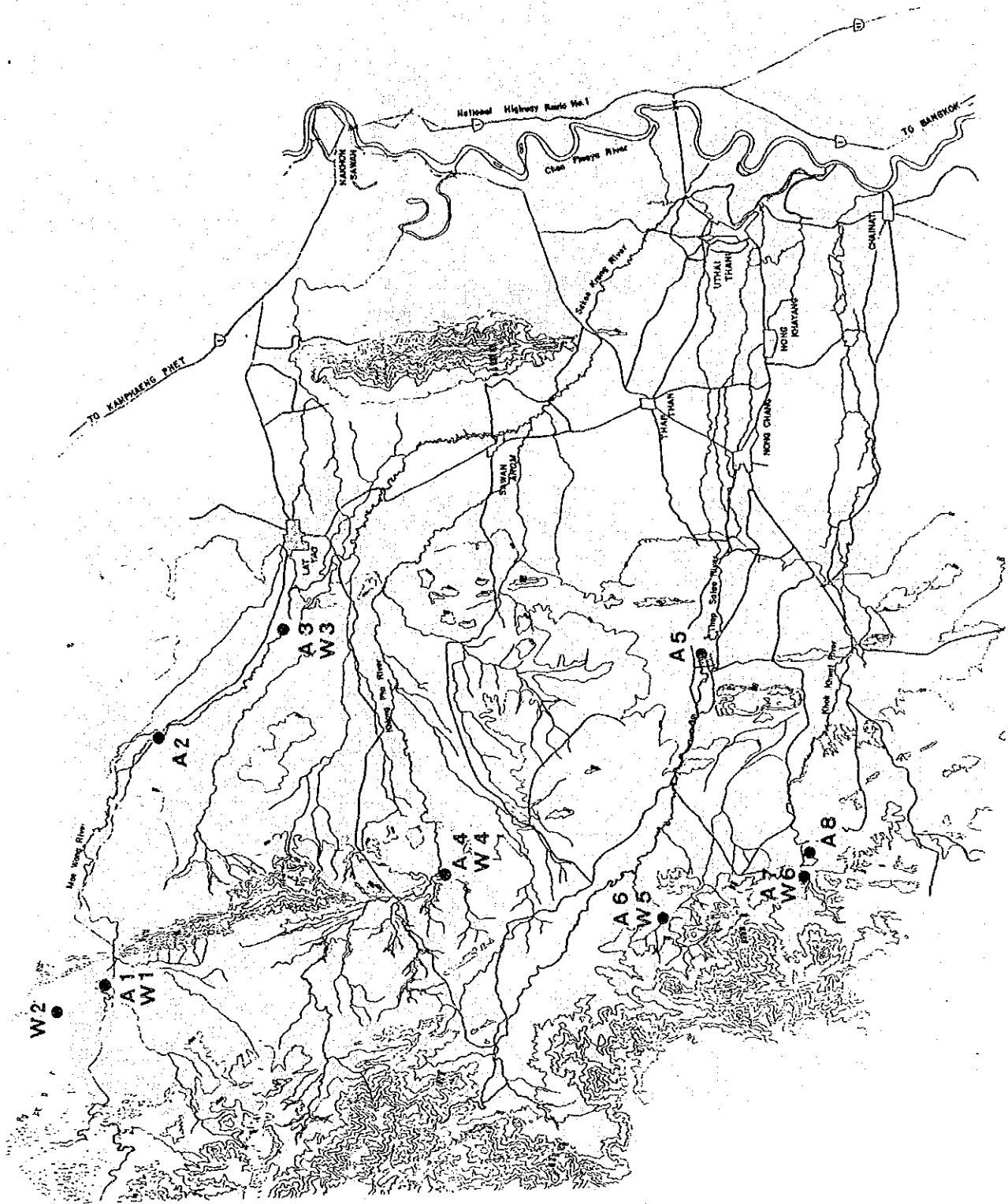
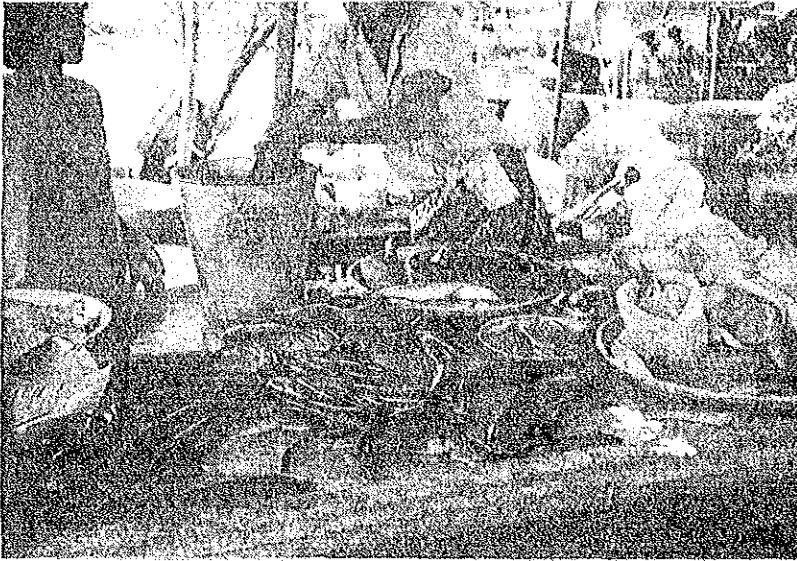


Fig. XI-2 Location of Interviews About Fishes and Wildlives



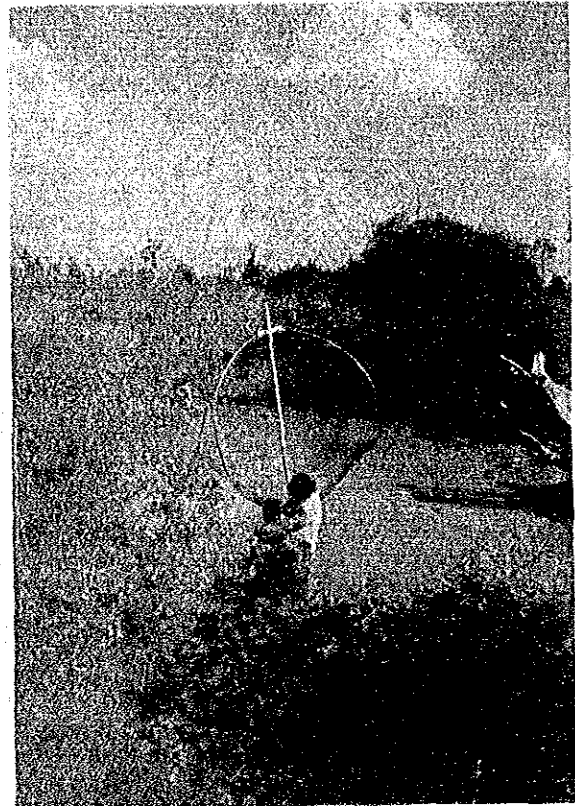
(A) Fresh fishes on sale
in Bangkok's Sunday
Market.

(October, 1984)



(B) Fresh meats on sale in
Bangkok's Sunday Market
(October, 1984)

wild pig, frog, snake, bird



(C) Fishing by net in a small
ditch near Huai Rang dam
site.

Fig. XI-3 Scenes of Net-fishing and Fishes and Meats on Sale.

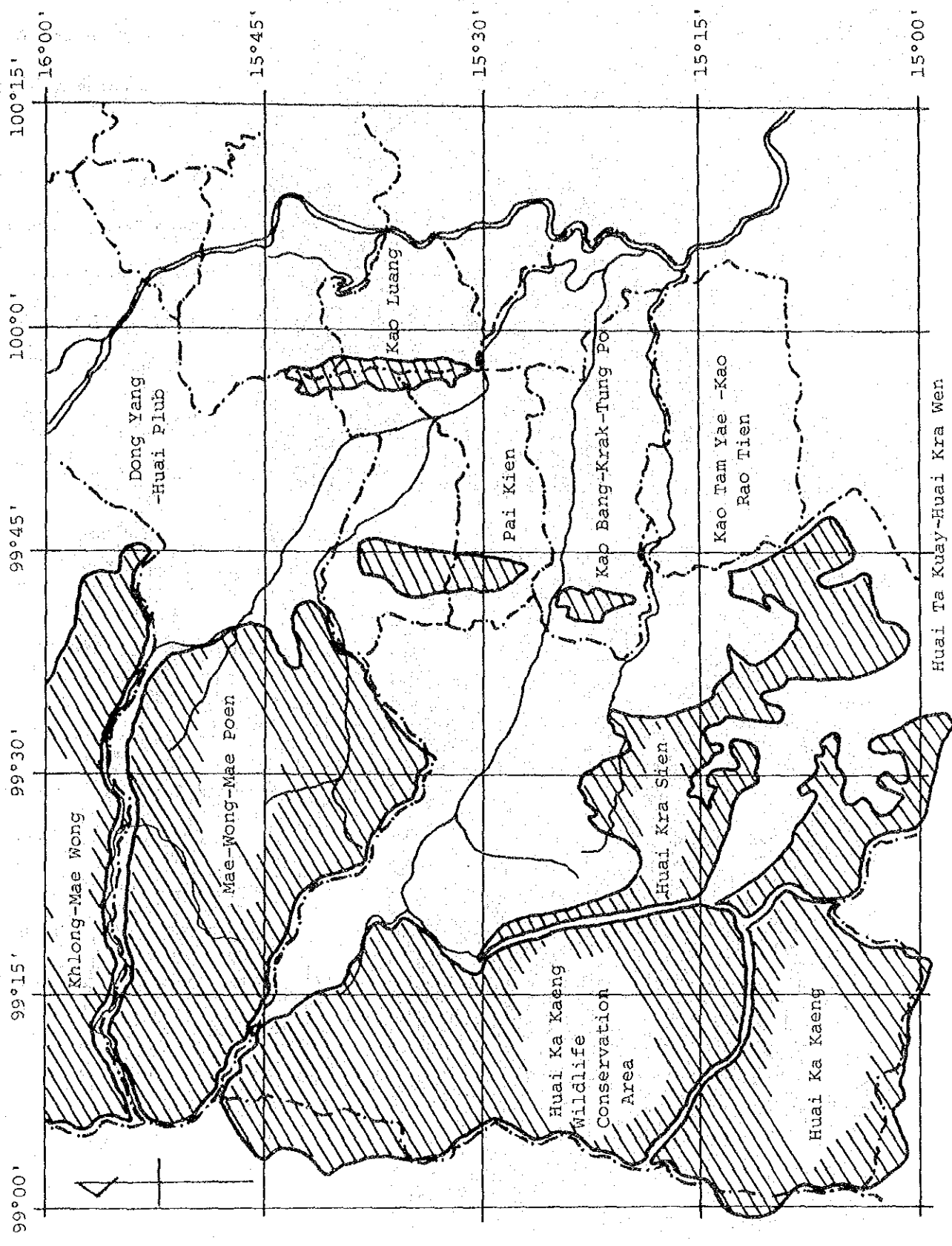


Fig. XI-4 Forest Reserve Area Source: Forestry Department, MOAC



(A) Encroached Area in
Lower Mae Wong

Although cultivated
(Mung Bean), there
are big isolated
trees in the farmland.
They survived through
logging and burning.

(Nov. , 1984)



(B) Natural Forest Area in
Upper Mae Wong

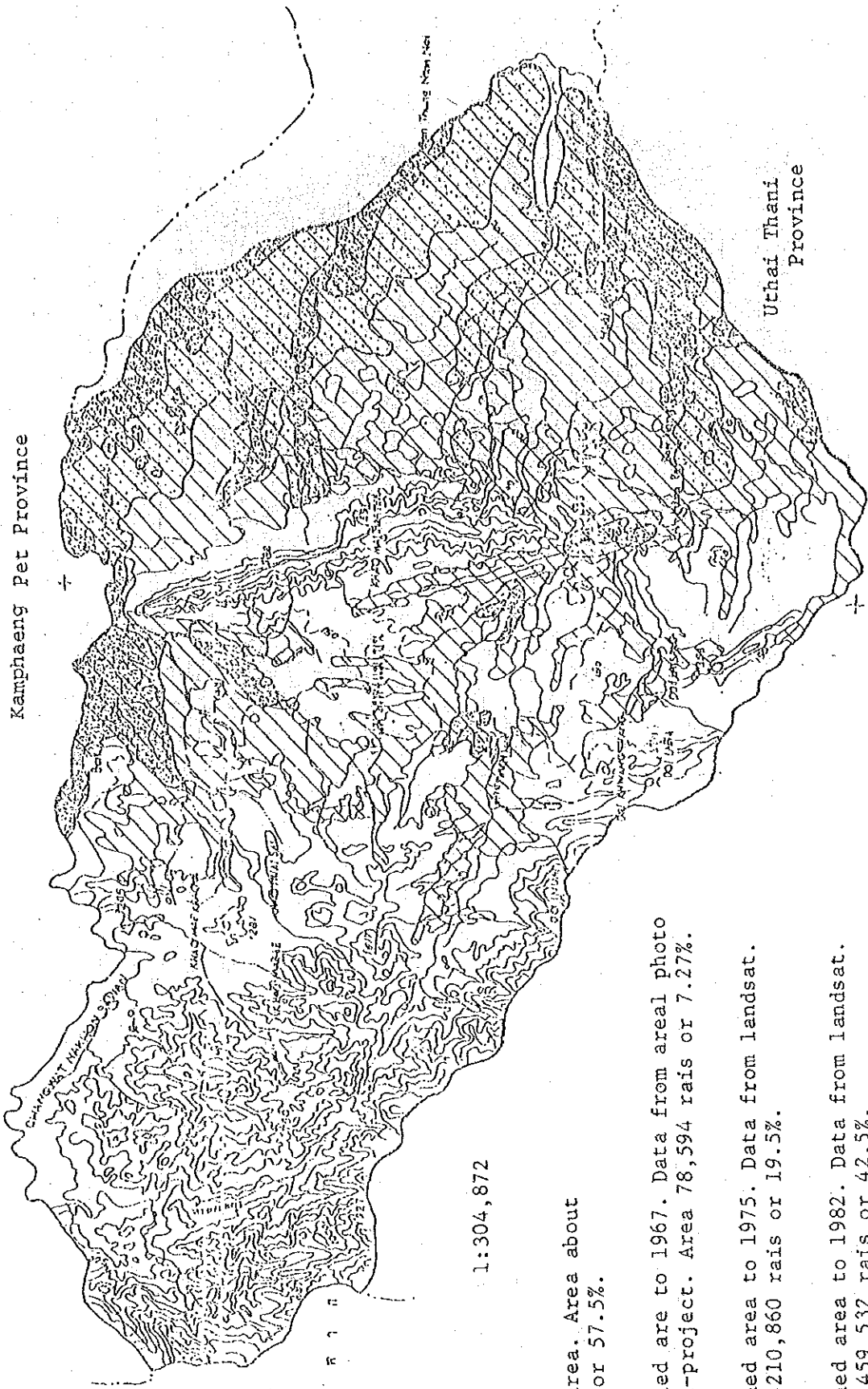
Besides the road, a dense
natural forest is found.
The tractor carries cans
of rubber resin, which is
taken from natural rubber
trees.

(Nov. , 1984)

Fig. XI-5 Pictures Showing Encroached Area and Natural Forest
in the Mae Wong - Mae Poen Forest Reserve, Lat Yao
District, Nakhon Sawan Province

Kamphaeng Pet Province

Uthai Thani Province



1:304,872

Forest area. Area about 621,193 or 57.5%.

Encroached area to 1967. Data from areal photo of Vap61-project. Area 78,594 rais or 7.27%.

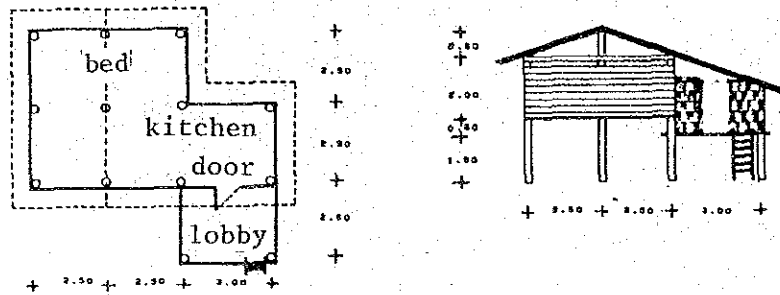
Encroached area to 1975. Data from landsat. Area of 210,860 rais or 19.5%.

Encroached area to 1982. Data from landsat. Area of 459,532 rais or 42.5%.

(Total area 1,080,725 rais)



Fig. XI-6 Encroached Area in Mae Wong-Mae Poen Forest Reserve, Lat Yao District, Nakhon Sawan Province.



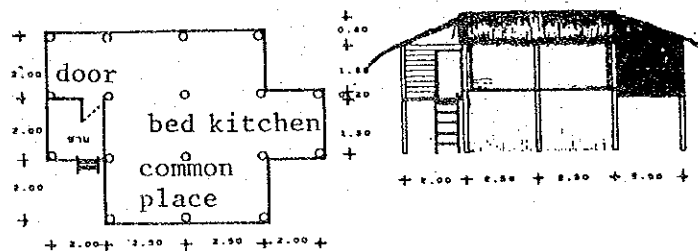
average floor area	40 m ² /house
compensation	₱ 1,000 /m ²
approximate compensation	₱ 40,000 /house
	(1983 price)

material

- roof ; galvanized iron
- wall ; hard wood , bamboo , galvanized iron
- floor ; hard wood

source : Ref. 1

Fig. XI-7 Semi Permanent Type of House



average floor area	42 m ² /house
compensation	₱ 700 /m ²
approximate compensation	₱ 29,400 /house
	(1983 price)

material

- roof ; grass (lalang) or nipa leaves
- wall ; hard wood and bamboo
- floor ; hard wood

Source ; Ref. 1

Fig. XI-8 Temporary Type of House

