## TABLE H-3-13 ANNUAL OPERATION AND MAINTENANCE COST

- Unit ฿ '000 -

| Description | Si Yat System | Tha Lat System | Bang Pakong System | Total |
|---|---|---|---|---|
| Annual Operation and Maintenance Cost | | | | |
| 1 Salaries and Wages | 4,154 | 8,485 | 7,365 | 20,004 |
| 2 Fuel and repair for Equipment | 784 | 1,294 | 1,517 | 3,595 |
| 3 Material Supplies and Repair Cost 1/ | 3,020 | 3,460 | 3,470 | 9,950 |
| 4 General Expenditure 2/ | 239 | 397 | 371 | 1,007 |
| 5 Pump Operation Cost 3/ | | | 4,270 | 4,270 |
| Total | 8,197 | 13,636 | 16,993 | 38,826 |

Notes :
1/ Civil Cost* × 0.01 (1%)
* Diversion Dam, Dam, Pumping Station, Weir Cost are excluded
2/ [1) + 2) + 3)] × 0.03 (3%)
3/ Opetarion hour per pump $\Sigma Q = 2{,}680\ m^3/s \cdot day / year$
$T = 2{,}680 \times 24\ hr / 17.64\ m^3/s = 3{,}650\ hr$
$3{,}650\ hr \times 390\ kw \times 4\ unit = 5{,}694{,}000\ KWH$
$5{,}694{,}000\ KWH \times 0.75\ B/KWH = 4{,}270{,}500\ B / YEAR$

## TABLE H-3-14 SALARY AND WAGE FOR O/M

- Unit ฿ '000 -

| Description | Salary per Annum | Si Yat System | | Tha Lat System | | Bang Pakong System | |
|---|---|---|---|---|---|---|---|
| | | Q'ty | Amount | Q'ty | Amount | Q'ty | Amount |
| 1. Operation Manager | 160 | 1 | 160 | 1 | 160 | 1 | 160 |
| 2. Asst. Operation Manager | 130 | 1 | 130 | 1 | 130 | 1 | 130 |
| 3. Section Chief | 120 | 4 | 480 | 4 | 480 | 4 | 480 |
| 4. Engineer | 100 | 8 | 800 | 11 | 1,100 | 10 | 1,000 |
| 5. Technician | 55 | 4 | 220 | 8 | 440 | 8 | 440 |
| 6. Skill Labor | 36 | 6 | 216 | 6 | 216 | 6 | 216 |
| 7. Labor | 25 | 13 | 325 | 17 | 425 | 17 | 425 |
| 8. Water Master | 72 | 2 | 144 | 4 | 288 | 5 | 360 |
| 9. Asst. Water Master | 60 | 2 | 120 | 4 | 240 | 5 | 300 |
| 10. Foreman | 50 | 4 | 200 | 7 | 350 | 8 | 400 |
| 11. Gate tender | 40 | 9 | 360 | 22 | 880 | 16 | 640 |
| 12. Skill Labor | 36 | 4 | 144 | 6 | 216 | 9 | 324 |
| 13. Labor | 25 | 8 | 200 | 8 | 200 | 10 | 250 |
| 14. Zone Man | 60 | 3 | 180 | 21 | 1,260 | 14 | 840 |
| 15. Labor | 25 | 19 | 475 | 84 | 2,100 | 56 | 1,400 |
| Total | | 89 | 4,154 | 204 | 8,485 | 170 | 7,365 |

## TABLE H-3-15 FUEL AND REPAIR COST FOR O & M EQUIPMENT

SI YAT IRRIGAITON SYSTEM (THA LAT EXPANSION) Unit ฿ '000

| Description | Q'ty | Fuel | | Repair | |
|---|---|---|---|---|---|
| | | Unit Rate | Fuel | Unit Rate | Repair |
| 1. Moter grader, 125 Hp | 1 | 145 | 145 | 90 | 90 |
| 2. Loader / Backhoe | 1 | 135 | 135 | 55 | 55 |
| 3. Steak truck, 4 ton | 1 | 50 | 50 | 10 | 10 |
| 4. Pick up, 2 ton | 2 | 18 | 36 | 9 | 18 |
| 5. Station wagon | 1 | 35 | 35 | 30 | 30 |
| 6. Truck Crane, 15 ton | - | 145 | - | 190 | - |
| 7. Moter bicycle | 14 | 6 | 84 | 2 | 28 |
| 8. Diesel Generating Set, 15 KVA | 1 | 45 | 45 | 7 | 7 |
| 9. 〃 , 5 KVA | - | 15 | - | 4 | 7 |
| 10. 4" Centrifugal Pump | 1 | 6 | 6 | 7 | - |
| 11. Chain Hoist, 5 ton | 1 | - | - | 3 | 3 |
| Total | | | 536 | | 248 |

THA LAT IRRIGATION SYSTEM (THA LAT EXISTING) Unit ฿ '000

| Description | Q'ty | Fuel | | Repair | |
|---|---|---|---|---|---|
| | | Unit Rate | Fuel | Unit Rate | Repair |
| 1. Moter grader, 125 Hp | 1 | 145 | 145 | 90 | 90 |
| 2. Loader / Backhoe | 1 | 135 | 135 | 55 | 55 |
| 3. Steak truck, 4 ton | 3 | 50 | 50 | 10 | 30 |
| 4. Pick up, 2 ton | 4 | 18 | 72 | 9 | 36 |
| 5. Station wagon | 2 | 35 | 70 | 30 | 60 |
| 6. Truck Crane, 15 ton | - | 145 | - | 190 | - |
| 7. Moter bicycle | 44 | 6 | 264 | 2 | 88 |
| 8. Diesel Generating Set, 15 KVA | - | 45 | - | 7 | - |
| 9. 〃 , 5 KVA | 3 | 15 | 45 | 4 | 12 |
| 10. 4" Centrifugal Pump | 3 | 6 | 18 | 7 | 21 |
| 11. Chain Hoist, 5 ton | 1 | - | - | 3 | 3 |
| Total | | | 899 | | 395 |

BANG PAKONG IRRIGATIONS SYSTEM Unit ฿ '000

| Description | Q'ty | Fuel | | Repair | |
|---|---|---|---|---|---|
| | | Unit Rate | Fuel | Unit Rate | Repair |
| 1. Moter grader, 125 Hp | 1 | 145 | 145 | 90 | 90 |
| 2. Loader / Backhoe | 1 | 135 | 135 | 55 | 55 |
| 3. Steak truck, 4 ton | 2 | 50 | 100 | 10 | 20 |
| 4. Pick up, 2 ton | 5 | 18 | 90 | 9 | 45 |
| 5. Station wagon | 2 | 35 | 70 | 30 | 60 |
| 6. Truck Crane, 15 ton | 1 | 145 | 145 | 190 | 190 |
| 7. Moter bicycle | 30 | 6 | 180 | 2 | 60 |
| 8. Diesel Generating Set, 15 KVA | 1 | 45 | 45 | 7 | 7 |
| 9. 〃 , 5 KVA | 2 | 15 | 30 | 4 | 8 |
| 10. 4" Centrifugal Pump | 3 | 6 | 18 | 7 | 21 |
| 11. Chain Hoist, 5 ton | 1 | - | - | 3 | 3 |
| Total | | | 958 | | 559 |

## TABLE H-3-16. BREAKDOWN OF ENGINEERING SERVICE FEE

### 1. General

The engineering service fees consist of cost for consulting services concerned including oversea's training and equipments to be brought. Breakdown of the fees is divided into two phases such as Phase-1 and Phase-2.

Manning schedules for consulting services are classified into two stages such as pre-construction stage and construction supervision stage, tentatively.

### 2. Summary of Engineering Service Fees

Unit: 1,000 baht

| Phase | Foreign Currency | Local Currency | Total |
|---|---|---|---|
| Phase-1 | 174,000 | 42,000 | 216,000 |
| Phase-2 | 160,000 | 34,000 | 194,000 |
| Total | 334,000 | 76,000 | 410,000 |

### 3. Phase-1 Sub-project

#### A) Foreign Currency Portion

| | | |
|---|---|---|
| 1) Remuneration | | (157,500) |
| - Foreign experts | B500 × 240 MM | 120,000 |
| - Local experts | B150 × 250 MM | 37,500 |
| 2) Reimbursable Cost | | (16,500) |
| - International travel expenses | B80 × 50 times | 4,000 |
| - Procurement of equipment | | 2,000 |
| - Other costs related | | 2,500 |
| - Cost for overseas training | | 8,000 |
| Total | | 174,000 |

**B) Local Currency Portion**

| | |
|---|---|
| - Perdiem allowance & accommodation | 20,000 |
| - Office rental | 5,000 |
| - Local staff salary concerned | 9,000 |
| - Reportings | 2,000 |
| - Other costs | 6,000 |
| Total | 42,000 |
| Grand Total | 216,000 |

3) Phase-2 Sub-project

A) Foreign Currency Portion

| | | |
|---|---|---|
| 1) Remuneration | | ( 147,500 ) |
| - Foreign experts | B500 × 220 MM | 110,000 |
| - Local experts | B150 × 250 MM | 37,500 |
| 2) Reimbursable Cost | | ( 12,500 ) |
| - International travel expenses B80 × 50 times | | 4,000 |
| - Procurement of equipment | | 1,000 |
| - Other costs related | | 2,500 |
| - Cost for overseas training | | 5,000 |
| Total | | 160,000 |

**B) Local Currency Portion**

| | |
|---|---|
| - Perdiem allowance & accommodation | 17,000 |
| - Office rental | 4,000 |
| - Local staff salary concerned | 8,000 |
| - Reportings | 2,000 |
| - Other costs | 3,000 |
| Total | 34,000 |
| Grand Total | 194,000 |

# H-4. TECHNICAL EXAMINATION OF BANG PAKONG DIVERSION DAM

## Technical Examination of Bang Pakong Diversion Dam

### 1. National and Social Condition of Bang Pakong River Basin

### 1-1. River condition and hydrology

The Bang Pakong River Basin situated in the east-central part of Thailand, has a catchment of 17,660 sq.km which covers about 3.4 percent of the total national land area.

The Bang Pakong river originating from the northern mountain range of more than 900m in elevation and joining a number of affluents such as the Khlong Phra Sathung, Maenum Hanuman, Nakhon Nayok, and others.

Down the conjunction of the Nakhon Nayok river and the Prachin river, the river is called the Bang Pakong river 120km in length, traverses the broad alluvial plains from east to west and empties into the Gulf of Thailand.

The lower reaches of the river characterized by flat bed slope, meandering channel of limited small flow capacity and low banks with a channel slope of 0.1to 0.5 m per km, affected by tidal movement and suffered frequently from floodings.

Even halfway up the river, it is under the tidal effect and, therefore, flood records are available only from several spots at the upper reaches for relatively short period.

The peak flood discharge occurring once in 10 years of 4,000 to 5,000 cu.m/sec at the mouth of the river was obtained.

### 1-2. Tide and water quality

The tidal levels at the mouth of the Bang Pkong river were actually measured only in flood time in September and October 1983.

During the time, the observed tidal records were as follows :

HWT (High Water Tide) = (+) 1.66 m above sea level
LWT (Low Water Tide) = (-) 1.17 m (ditto)

By non-harmonic analysis method, the tidal levels at Koh Sichan were estimated by the records from 1940 until 1982.

As a result, HHWT (Highest High Water Tide) = (+) 1.84 m
about sea level in 1982

LLWT (Lowest Low Water Tide) = ( - ) 2.48 m
(ditto) in 1951
MHWST (Mean High Water Spring Tide) = ( + )0.88 m
MHWNT (Mean High Water Neap Tide) = ( + )0.57 m
MLWST (Mean Low Water Spring Tide) = ( - )0.75 m
MLWNT (Mean Low Water Neap Tide) = ( - )0.97 m

As design water level at the diversion damsite about 70km upstream of the estuary with river bed slope of 1/100,000, the following values were taken :

Control Water Level = ( + )1.80 m

= ( - )1.50 m

The latest data on physio-chemical properties of Bang Pkong river are available from NEB, published in September 1988. The Study Team also carried out water quality survey in the river to extend the NEB information for the period from December 1989 till June 1990.

Concerning the water contamination in the river, it is concluded preliminarily that the values of pesticides, DO, BOD, and coliform bacteria were rather beyond the standard level of NEB.

It is not owing to the Project implementation, but is very important that the measures /programs for controlling the concentration within the allowable limit should be implemented as soon as possible, otherwise the retained water by the diversion dam may become unsuitable for water utilization.

## 1-3 Water Use (Irrigation, Industry, Domestic/Drinking, Fishery, and others)

### 1) Irrigation water

Irrigation water requirement was calculated with a 10-day time step combining estimated values of water consumption for respective crops, percolation rate, other field water requirements for initial leaching and land preparation, on-field effective rainfall, and water losses due to conveyance and system operation.

Irrigation diversion requirement varies depending upon the availability of effective rainfall. It was extracted from a specific case of water balance study as follows :

Irrigation water requirement

| Irrigation Area | Field Water Requirement | Effective Rainfall | Diversion Water Requirement |
|---|---|---|---|
| 578,000 ha | 4,078.369 MCM | 2,064.116 MCM | 3,606.873 MCM |

### 2) Industrial water

The activities to develop large scale industrial complexes by private sectors are privileged and supported by IEAT and the Board of Investment (BOI). On the other hand, the details of the development programme of small scale factories made by private sectors have been unknown so far.

The water demand projection for the industrial purpose was made by taking the existing water supply method, manufacturing categories, water demand applied for the Eastern Seaboard Industrial Complex and the location of the development into account.

The figures proposed by PWA's long term development scheme are adopted for the estimates of water to be supplied for industrial purpose from the urban water work systems under PWA.

On the other hand, about 20% of municipal water consumption for industrial use is added to estimate total requirement in the areas to be newly developed in the rural area.

Only Bang Pakong and Plaeng Yao areas are specified as the IEAT privileged areas in 10,000 rai (1,600 ha) each, for urgent water supply in the target year of 2,000.

A maximum unit water demand for light industry is estimated at 12 cu.m/day/rai by the agreement of IEAT, NESDB and private sectors.

The total water demand was summed to be 204.158 MCM.

### 3) Domestic / drinking water

Domestic and drinking water supplies in the area are being conducted through waterwork facilities operated by PWA, Sanitary Districts and a few local community units.

The targets of population ratio to be served in the year of 2,000 in urban and rural areas were set up as around 75 to 95% and 60% respectively.

Water demand projection of 12 existing facilities under PWA adopted the figures planned by the authority.

Averaged water consumption in rural area as well as Sanitary Districts, on the other hand, were assumed to be about 150 liter/capita/day in gross.

The rate of total losses due to conveyance, leakage and operation to the gross water demand in urban area is assumed to be 25% in PWA systems as the target.

The reasonable ratio for the rural area, however, will be about 40%. The total water demand was summed to be 115.994 MCM.

#### 4) Fishery water

About 4,000 rai of shrimp ponds extend over the lower reaches of the Bang Pakong river.

In case of a diversion dam construction, fresh water to keep the river salinity contents on a level down to 30 ppt from 33.5 ppt at a maximum, will be needed mainly in dry season.

Existing extent of 4,000 rai in the project area is expected to be expanded to about 8,300 rai (1,350ha) at a maximum.

The fresh water requirement is thus estimated approximately at 14.5 MCM annually.

Besides, about 8,750 rai (1,400 ha) of fresh water fish ponds have been cultivated receiving water from irrigation canals and natural streams, mainly in the existing irrigation project areas of Tha Lat (1,000 ha) and Bang Pakong Left Bank(400ha).

The water demand was estimated at 4.6MCM.

#### 5) Others

The domestic/drinking water supply for the power station of EGAT proposed.

An annual raw water demand of 15 MCM can be included in domestic/ drinking water demand mentioned above.

### 1-4. Regional industry and land use

In the Bang Pakong river basin, the agro-industry processing agricultural products as raw materials is thriving. The industrial sector in the region is divided into two groups in accordance with type of factory.

The first group comprises traditional agro-industries such as rice mill, cassava pellets and tapioca flour factory, sugar factory, pineapple canning factory, etc.

Rice mills are scattered widely in paddy production areas. Local factories are mostly occupied by rice mills of small scale, cassava chip yard, sand crushing plant, concrete block maker, car and engine parts repair shop, lathe-machine-welding factory, ice maker, etc.

The second group contains new comers of modern light industry with high technology and intensive labour, composed mainly of canning packer, vegetable packing-house for export oriented crops, rubber commodity and plywood factories and tropical fruits processing, etc. with modern container yard.

General land use of the basin is clearly defined by its topography. The low flat land in the west is entirely devoted to paddy cultivation with some orchards along the river banks. The upland and mountainous areas in the east are mostly under several upland crops, orchard plantation and forest. (100%)

| | | |
|---|---|---|
| Total river basin | 1,776,000 | ha |

in which.

| | | |
|---|---|---|
| Agricultural area | 993,760 | ha (56%) |

in which

| | | |
|---|---|---|
| Field of paddy, upland crops, orchard and vegetable | 467,290 | ha (27%) |

## 1-5. Navigation and transportation

Inland navigation along the Bang Pakong river around Chachoengsao City is being made mainly by ferryboats in a short distance, because only a few bridges are provided to connect both the banks of the river and road network in the residential area along the riverside is sparsely distributed. The most common system of navigation is to link major municipal areas by ferryboats of 5 to 20 passengers. There are a few navigation systems along the tributaries through navigation lock at the lower reaches of the main river.

The main measures of transportation in the area are road networks. Six routes of the national roads are distributed.

A new railway to connect Chachoengasao with Sttahip is now under construction under the Eastern Seaboard Development Programme. The railway is extended 159 km long in Prachinburi, 54 km in Chachoengaso and 13km in Nakhon Nayok.

## 1-6. Outline of development scheme

The study objectives are to formulate comprehensive water resources development programs in the Bang Pakong River Basin, to put forward balanced areal development and to put priorities on the projects to be implemented in order; in which dam reservoirs are constructed upstreams of the river and its tributaries, a diversion dam is built on the river just upstream of Chachoengasao City, existing irrigation facilities for the irrigation projects are radically modified and new irrigation facilities are also partly built; so as to stabilize water supply for paddy and dry croppings as well as drinkings, industries and fisheries through the year and especially in a dry season to prevent saline water from intruding into the area.

The overall basin study area covers the entire Bang Pkong river Basin of about 17,660 sq.km, and its western border is located 60km east of the capital, Bangkok . In the overall basin study, the river basin development plan was established, and the priorities to be developed were given to respective sub-basin projects.

As the project area with top priority, the two sub-basis, that is, Lower Bang Pakong and Khlong Tha Lat, were selected.

In the two sub-basins, the Feasibility Study area of 60,600 ha was chosen, in which 34,800 ha of existing and 9,100 ha of proposed irrigation areas were included. This study area is located in the western part of the whole Bang Pakong river basin and near the main river and its tributaries, favorable to receive the water to be released from Rabom dam under construction, Si Yat dam, and Bang Pakong diversion dam to be constructed.

## 2. Selection of Bang Pakong Diversion Damsite

### 2-1. General

In accordance with the overall basin for water resources development of Bang Pakong river with a large catchment area of 17,660 sq.km, the new available water of about 3,950 MCM could be developed by means of constructing several storage dams on the upper and middle tributaries of the Bang Pakong river.

Out of 3,950 MCM water, about 3,600 MCM will be used for irrigation in agricultural service areas and the remaining water of 350 MCM will be available for industry, domestic and fishery uses, based on the water allocation plan of the basin study.

However, the downstream section of about 120km from the river mouth of the Bang Pakong is characterized by the very gentle slope of about t 1/100,000 and influenced by saline water intrusion under tidal movement. About 1,140 MCM (shortages of 635MCM in Upper Bang Pakong sub-basin plus 408 MCM in Lower Bang Pakong sub-basin plus 100 MCM of compensatory supply to Right Bank area) of water, out of the total 3,600 MCM for irrigation, to be allocated to downstream service area cannot, therefore, used without a diversion dam which would prevent the saline water intrusion.

Hence, a diversion dam with the following function should be constructed at the downstream section of the Bang Pakong river :

- To prevent the saline water intrusion
- To divert the developed fresh water to the downstream service area
- To release flood water smoothly downstream of the river
- To regulate stored water in the reservoir and to store released water from the storaged reservoirs in the upstream of the diversion dam

The followings area preliminary technical examination of the selection of proposed diversion damsite.

### 2-2. Preliminary Selection of Diversion Damsite

In order to select the suitable site of the diversion dam expecting the above mentioned function, 15 possible damsites were preliminarily proposed at downstream sections of the conjunction point of Bang Pakong and Thha Lat rivers. A preliminarily study to select the representative damsites of middle and lower reach of the river was made the followings, taking into account the water

operation function, construction cost, benefit in service area, environmental impacts, compensation of occupied land and property.

### A) Middle Reach Sites

In total, five possible sites of the diversion dam were preliminarily investigated and compared as shown in Figre H-4-1. Possible sites were comparatively studied on the basis of 1/10,000 scale map, as follows;

| Item | No.1 | No.2 | No.3 | No.4 | No.5 |
|---|---|---|---|---|---|
| *Length of Diversion Channel (km)* | 1.3 | 1.6 | 1.0 | 1.4 | 1.4 |
| Nos. of Houses to be Replaced | 32 | 30 | 31 | 48 | 35 |
| Nos. of Houses to be Compensated | 25 | 12 | 20 | 12 | 18 |
| Length of Road to be Constructed (km) | 4.0 | 2.0 | 3.0 | 3.0 | 5.0 |
| Length of Road to be Rehabilitated (km) | 4.0 | 7.0 | 7.0 | 9.5 | 5.0 |
| Distance from Chachoengasao (km) | 5 | 8 | 12 | 14 | 21 |

The proposed site No.3 as primarily selected due to the low construction cost from the above comparison was excluded since there exists an important temple (Wat Sao Changok) within the vicinity of the construction site. The site No.2 and No.4 were further studied and the site No.2 was selected by taking into account the following reasons;

- Despite that the construction cost at the No.2 site will be slightly higher having relatively longer diversion channel, replacement and compensation costs for houses will be much lower than No.4
- Moreover an important temple (Wat Samarum) exists very closely to the No.4 site
- Connection or access road to be constructed or rehabilitated is also shorter if the site No.2 is selected
- Storage volume of fresh water and distance from beneficiaries are advantageous when the site is selected more downstream.

### B) Lower Reach Sites

Between the river mouth and Bang Pakong bridge on the national road No.34, there are no suitable damsites because many existing factories and quays are situated along the both banks. On the other hand, upstream site to the Chachoengsao city, there are several suitable damsites No.1 to No.10 as shown in the Figure H-4-2.

Topographical features of respective alternatives can be summarized as follows:

FIGURE H-4-1 PROPOSED DIVERSION DAM SITES IN MIDDLE REACHES

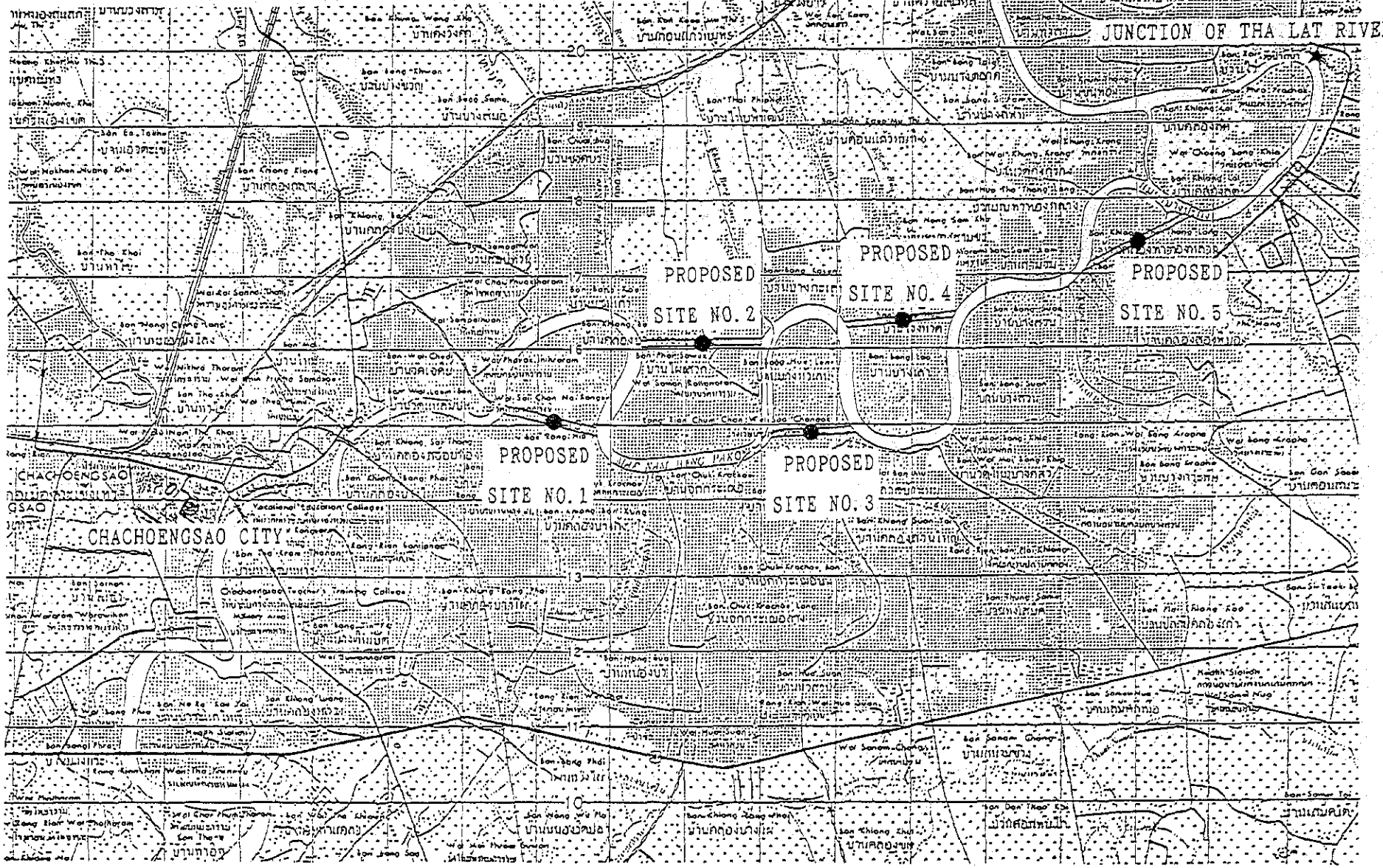


FIGURE H-4-2 PROPOSED DIVERSION DAM SITES IN LOWER REACHES

| Site No. | Topographic Feature |
|---|---|
| No. 1 | The area is favorable to a diversion damsite, mostly flat land with paddy fields average 1.2 m in elevation, sparsely populated. Connecting canal length. L = 1.8 km |
| No.2 | Selecting the connecting canal route in consideration of the stream direction, the canal will become somewhat longer (L = 2.8 km), with low paddy fields average 0.8 m in elevation, sparsely population. |
| No.3 | The area is shrimp farms average 1.2 m in elevation. The connecting canal may be short, however, densely populated on the downstream side, expecting high compensation. L = 1.5 km |
| No.4 | The area of shrimp farms average 1.3 m in elevation, not so densely populated. L = 1.7 km |
| No.5 | The area is paddy fields, average 1.1 m in elevation. Saen Phu Dat town is located upstream of the connecting canal and comparatively densely populated downstream of it. L = 1.5 km |
| No.6 | A large island will be formed by constructing the connecting canal. The area is composed mostly of paddy fields and of some shrimp farms average 1.2 m in elevation comparatively densely populated. L = 1.5 km |
| No.7 | The direction of a diversion dam axis is not favorable. The area consists of paddy fields and shrimp farms in half, average 1.4 m in comparatively high elevation, fairly densely populated. L = 1.4 km |
| No.8 | The area consists of mainly paddy fields and partly of shrimp farms, average 1.1 m in elevation, densely populated. L = 1.8 km |
| No.9 | The direction of a diversion dam axis is not favorable. The area consists of paddy fields average 0.9 m in elevation, densely populated on the downstream side. L = 1.3 km |
| No.10 | The area consists mainly of paddy field and partly of shrimp farm which have been increasing recently, average 1.1 m in elevation, densely populated. L = 1.5 km |

The following sites are excluded from the detailed comparison study due to the geographical disadvantages.

| Damsite | Major Reason to be Excluded |
|---|---|
| No. 2 | The connecting channel must be elongated |
| No. 3 | Many shrimp farms and house are situated |
| No. 6 | Many houses are located |
| No. 7 | Direction of dam axis is not favorable and many houses located |
| No. 8 | Many houses are located |
| No. 9 | Direction of dam axis is not favorable |
| No.10 | Many houses are located |

Accordingly, the alternatives No. 1, 4 and 5 are selected for detailed comparative study. The followings are results of comparative study on the technical and economical view points.

**TABLE H-4-1. COMPARISON OF CONSTRUCTION COST RATIO FOR DIVERSION DAM BY SITE**

(in case that the construction cost for Bang Pakong Diversion Dam at Bang Bang Khwan is assumed to be 1.000)

| Item | | Site No.1 | Site No.4 | Site No.5 |
|---|---|---|---|---|
| 1. Construction Cost for Diversion Dam | | | | |
| 1) Foundation Treatment | (0.15) | 1.85 | 1.75 | 1.55 |
| 2) Civil structure | (0.20) | 1.60 | 1.50 | 1.35 |
| 3) Apron and Reventment | (0.10) | 1.85 | 1.75 | 1.55 |
| 4) Gates | (0.30) | 2.25 | 2.00 | 1.80 |
| 5) Bridge | (0.05) | 2.00 | 1.85 | 1.65 |
| 6) Connecting Canal | (0.10) | 1.90 | 1.65 | 1.30 |
| 7) Temporary Works | (0.10) | 1.85 | 1.75 | 1.55 |
| Total Cosntruction Cost | (1.00) | 1.93 | 1.77 | 1.57 |
| 2. Land Compensation Cost | | | | |
| 1) Area of Connecting Canal (37 ha) | | 67 ha | 58 ha | 47 ha |
| 2) Ratio of Ara of Connecting Canal | (1.00) | 1.8 | 1.6 | 1.3 |

As the result of comparative study, alternative No.5 is technically feasible and economically viable, and No.5 will also be appropriate site from view point of river engineering conditions.

## TABLE H-4-2. SCALE COMOMPARSION OF DIVERSION DAM BY SITE

| Item | Site No. 1 | Site No.4 | Site No.5 |
|---|---|---|---|
| 1. Geographic Feature | It is favorable as diversion damsite, with paddy fields not so densely populated | The major parts of a diversion dam and connecting canal sites consist of shrimp farms. | The area consists of paddy fields. There are Saen Phu Dat town upstream comparatively many houses downstream of the sites. |
| 2. Mean Riverine Sectional Area Upstream and Downstream of the site | 2,870 $m^2$ | 2,630 $m^2$ | 2,310 $m^2$ |
| 3. Mean Riverine width Upstream and down stream of the site | 370 m | 310 m | 300 m |
| 4. Water Depth at the Deepest point of the River | 15 m | 15 m | 13 m |
| 5. Mean Water Depth | 7.8 m | 8.5 m | 7.7 m |
| 6. Riverbed Level for Diversion Weir | ( - ) 9.0 m | ( - ) 9.0 m | ( - ) 9.0 m |
| 7. Water Depth for Weir | 10.3 m | 10.3 m | 10.3 m |
| 8. Weir Width | 280 m | 260 m | 230 m |
| 9. No. of gates | 40m × 7 gates | 40m × 5 gates + 30 m × 2 gates | 40 m × 4 gates + 35 m 2 gates |
| 10. Connecting Canal<br>Canal Width<br>Elongation<br>Excavation Amount | <br>370 m<br>1.8 km<br>6.12 MCM | <br>340 m<br>1.7 km<br>5.27 MCM | <br>310 m<br>1.5 km<br>4.20 MCM |
| 11. Storage capacity | 50 MCM | 45 MCM | 45 MCM |

## 2.3. Detailed Comparative Study for Middle and Lower Sites

### A) General

As the results of the preliminarily study, the following two damsites were selected as the most suitable ones to represent the middle and lower damsites:

(1) Middle damsite (No.2 site) located 70 km far from the river mouth, just upstream of Muang Chachoengsao.

(2) Lower damsite (No.5 site) located at a distance 20 km from the river mouth, upstream of Saen Phu Dat town.

### B) Advantage for Middle Site

#### (1) River Section

Having the catchment areas of 15,400 sq.km and 17,000 sq.km respectively at the Middle and Lower damsites, the flood discharge passing through the Lower site is accordingly larger than that of the Middle site. The present river sections at both sites are as follows:

| River Section | Middle Site | Lower Site |
|---|---|---|
| Average Width | 210 m | 300 m |
| Average Depth | 7.4 m | 7.7 m |
| Average Section Area | 1,500 $m^2$ | 2,310 $m^2$ |

Since the diversion dam has no flood control function, which would cause inundation problem at the upstream service area along the river, the existing river section area should be kept in the design of diversion dam in order to release the flood not so as to raise up the present flood water level. Therefore, the scale and construction cost for the Lower site becomes inevitably larger than those for the Middle site, as shown in Table H-4-3.

#### (2) Intake Water Level

Since the Middle site is placed at a distance about 50 km upstream from the Lower site, the full water level (intake water level) at the Middle site becomes about 50 cm higher than that of the Lower site in accordance with the river slope of 1/100,000. When the irrigation main canal starts the diversion damsite and covers the existing irrigation area, a 50 cm higher head in the Middle site can expand the service area under the gravity irrigation system as compared with the Lower site.

## TABLE H-4-3. COMPARATIVE TABLE ON ALTERNATIVES PLAN OF DIVERSION DAM

| Description | Unit | Middle site | Lower site | Remarks |
|---|---|---|---|---|
| 1. Available water in the Tha Lat river basin project area | | | | |
| - For irrigation use *1 | MCM | 593.9 | 610.7 *2 | |
| - For industry use | MCM | 160.7 | 160.7 | |
| - For domestic use | MCM | 32.7 | 32.7 | |
| Total | MCM | 787.3 | 804.1 *3 | |
| 2. Beneficial area in F/S study basin | | (150%)*9 | (100%) | |
| - Left bank by Tha Lat weir *4 | ha | 21,100 | 21,100 | |
| - Left bank by gravity from Si Yat dam *4 | ha | (150%) 7,100 | - | |
| - Left bank by Pump from diversion dam *5 | ha | (150%) 14,300*7 | - | |
| - Right bank by gravity from diversion dam *6 | ha | (100%) 10,800*8 | (100%) 82,100 *10 | |
| Total | ha | (140%) 53,300 | (100%) 103,200 | |
| 3. Scale of diversion dam | | | | |
| - Length | m | 65 | 65 | |
| - No.of gate | m | 150 | 230 | |
| - Diversion channel excavation | | 30m×5gtes | 40m×4gates+35m×2gates | |
| Total | M.cu.m | 4.0 | 4.2 | |
| 4. Construction cost | | | | |
| - Diversion dam | m.baht | 1,670.0 | 2,561.7 | |
| - Irrigation canal | m.baht | 1,370.0 | 966.0 | |
| - Compensation for shrimp farm | m.baht | - | 229.5 | |
| - Navigation lock cost | m.baht | - | 114.4 | |
| - Protection for water pollution | m.baht | - | 33.0 | |
| Total | m.baht | 3,040.0 | 3,904.6 | |
| 5. Benefit | | | | |
| - Benefit from agriculture | m.baht | 1,147.8 | 480.2 | |
| - Benefit from industry | m.baht | 192.8 | 192.8 | |
| - Benefit from domestic water | m.baht | 52.3 | 52.3 | |
| Total | m.baht | 1,392.9 | 725.3 | |

Note

*1 : Irrigation component includes water uses for fishery and shrimp farming.
*2 : Includes 16.8MCM of compensatory supply of fresh water for shrimp farming on the right bank of Bang Pakong river.
*3 : Incremental capacity of diversion dam is used 1.12 times a year.
*4 : Irrigated by gravity through irrigation canal.
*5 : Irrigated by pump through irrigation canal.
*6 : Diversion reservoir direct.
*7 : Existing and proposed Bang Pakong Left Bank area.
*8 : To be irrigated by compensatory supply of 100MCM/year in Right Bank area.
*9 : Parenthesis stands for cropping intencity.
*10 : Irrigable area for wet season paddy if water currently allocated to the Bang Pakong Left Bank area, Tha Lat expansion area and double cropping in existing Tah Lat area is used to supplement irrigation in Right Bank area.

### C) Advantage for Lower Site

#### (1) Increase of Reservoir Capacity

In case the diversion dam is placed at the Lower site, the reservoir capacity will become 45 MCM, 15 MCM larger than that of the Middle site, with a incremental storage of 50 km × 300 m = 15 MCM, although the usable water for irrigation and other purposes will be less than 15 MCM when losses due to evaporation especially in dry season is taken into consideration.

#### (2) Direct Water Intake from Diversion Dam Reservoir to Service Area

Some agricultural areas with elevations between 1.0 m and 0.0 m extend along the both banks of the river upstream of the diversion dam. These areas situated mainly on the right bank has been receiving supplemental irrigation water for wet season paddy from return flows from the upper irrigation area, but suffered always from water shortage due mainly to small amount of return flow.

When the diversion dam is constructed and keeps the reservoir water level of 1.0 m to 0.5 m, the above service areas could be irrigated easily by introducing the reservoir water directly through the existing irrigation lateral canals.

In the case that the diversion dam is placed at the Lower site, the service area to be irrigated directly by the reservoir water is more expanded than that of the Middle site. These areas will be as follows:

- Middle Site 10,800 ha on right bank by compensatory water
- Lower Site 82,100 ha on right bank for wet season paddy
- Increased Area 71,300 ha

It is noted here that the above plan is possible, if additional development of water sources other than the Rabom dam, Si Yat dam and the diversion dam are not accompanied, only when the water allocated under the current Feasibility Study to the existing and proposed Bang Pakong Left Bank areas and the Tha Lat expansion area is distributed to the right bank area to supplement irrigation water for wet season paddy.

### D) Disadvantage for Lower Site

#### (1) Compensation for Existing Shrimp Farm

Shrimp farm of about 15,000 rai expands along the both banks downstream of Muang Chachoengsao and feeding shrimp by using brackish water downstream the Bang Pakong river. The shrimp production and income in the area reaches presently as follows:

Production : 0.666 ton/rai × 15,000 rai = 10,000 ton
Gross Income : 147,000 baht/rai × 15,000 rai = 2,200 million baht
Net Income : 51,300 baht × 15,000 rai = 770 million baht

There will be no problem for the existing shrimp farming if the diversion dam is constructed at the Middle site. Compensation for shrimp farm should, however, be required when the dam is constructed at the Lower site, because the diversion dam will not supply brackish water but fresh water only.

Since it is difficult to find the new shrimp farm area for compensation in the further downstream area of the Lower site, the compensation works will be made with the following means:

- Pumping station to lift up the saline water downstream the diversion damsite
- Construction of conveyance canal to supply saline water from pumping station to the existing shrimp farm
- Construction of drainage canal to drain the polluted water from the shrimp pond so as to prevent the waste water from intruding into the diversion reservoir

### (2) Compensation for Navigation

The downstream channel of the Bang Pakong river from the mouth up to Muang Chachoengsao is being utilized frequently for navigation to transport commodity and passenger to the city of Chachoengsao. Therefore, compensation for the existing navigation shall be required in the case that the diversion dam is constructed at the Lower site.

Navigation lock will be provided at the existing river section in consideration of the operation of lock to prevent saline water intrusion into the diversion reservoir, since the dam is to be constructed on the bank area using the existing meandering river course as the diversion channel.

### (3) Protection for Water Pollution

The right bank area located downstream of Muang Chachoengsao has been developing rapidly as the residential and industrial area. In association with the above development, wasted water from industries and city area will be released to the diversion reservoir in the case the diversion dam is constructed at the Lower site.

In order to prevent the intrusion of polluted water into the reservoir, ponds to collect the wasted water and sewerage channel to drain it to the downstream river shall be required.

## E) Comparison of Construction Cost and Benefit for Middle and Lower Dam

In accordance with the above mentioned advantage and disadvantage for Upper and Lower diversion damsites, the required scale of facility, construction cost and benefit were studied as shown in H-4-4 and H-4-5, as summarized below:

| Construction Cost (Preliminary Estimate) | Middle Site | Lower Site | Rate |
|---|---|---|---|
| (1) Diversion Dam | 1,670.0 | 2,561.7 | 1.53 |
| (2) Irrigation Canal | 1,370.0 | 966.0 | 0.71 |
| (3) Compensation for Shrimp Farming | - | 229.5 | - |
| (4) Navigation Lock | - | 114.4 | - |
| (5) Drainage Canal for Polluted Water | - | 33.0 | - |
| Total | 3,040.0 | 3,904.6 | 1.28 |
| Benefit (Net Production Value) | | | |
| (1) Right Bank Compensation Area | 50.3 | 382.0 | 7.59 |
| (2) Tha Lat Area | 556.5 | 98.2 | 0.18 |
| (3) Bang Pakong Left Bank (by Pump) | 541.0 | - | - |
| (4) Industry | 192.8 | 192.8 | 1.00 |
| (5) Domestic Water Supply | 52.3 | 52.3 | 1.00 |
| Total | 1,392.9 | 725.3 | 0.52 |

Note: Unit = million Baht

## F) Conclusion

In accordance with the above study, the diversion damsite should be proposed at the Middle site.

## TABLE H-4-4. CONSTRUCTION COST (PRELIMINARY ESTIMATE)

| Item | Middle | Lower | Ratio |
|---|---|---|---|
| 1. Diversion dam | | | (L/M) |
| 1) Temporary Work | 293.4 | 454.8 | 1.55 |
| 2) Diversion dam | 355.7 | 480.2 | 1.35 |
| 3) River bed, dike pratection | 71.8 | 111.3 | 1.55 |
| 4) Gate | 503.0 | 905.4 | 1.80 |
| 5) Bridg /road | 85.9 | 141.7 | 1.65 |
| 6) Diversion channel | 360.2 | 468.3 | 1.30 |
| Total | 1,670.0 | 2,561.7 | 1.53 |
| 2. Irrigation canal | 143.0 | 0 | |
| 2.1 Phase-I | 261.0 | 0 | |
| 1) Pumping Station | 404.0 | 0 | |
| 2) Main canals | 86.0 | 86.0 | |
| Sub-total | 490.0 | 86.0 | |
| 2.2 Phase-II | | | |
| 1) Weir | 12.0 | 12.0 | |
| 2) Mian canals | 868.0 | 868.0 | |
| Total | 880.0 | 880.0 | |
| Total (2.1+2.2) | 1,370.0 | 966.0 | |
| 3. Shrimp farm compensation | | | |
| For Left Bank 8.000 rain | | | |
| For Left Bank 8,000 rain: 160MCM /180 days = 10.3 $m^3$/sec | | | |
| For Right Bank 10,000 rai : 200MCM/180 days = 12.9 $m^3$/sec | | | |
| 1) Pump for Left | - | 83.5 | |
| 2) Pump for Right | - | 104.0 | |
| Sub-total | - | 187.5 | |
| 3) Canal for Left | - | 20.0 | |
| 4) Canal for Right | - | 22.0 | |
| Sub-total | - | 42.0 | |
| Total | - | 229.5 | |
| 4. Navigation lock | | | |
| 1) Civil Work | - | 47.4 | |
| 2) Gates | - | 67.0 | |
| Total | - | 114.4 | |
| 5. Dreinage canal for water pollutions | - | | |
| 1) Left bank | - | 15.0 | |
| 2) Right bank | - | 18.0 | |
| Total | - | 33.0 | |
| Grand Total | 3,040.0 | 3,904.6 | 1.28 |

## TABLE H-4-5. BENEFIT (NET PRODUCTIONS VALUE) ESTIMATE

Unit : Milion Baht

| Description | Middle Site (Crop intensity 140%) | Lover site (Crop intensity 100%) |
|---|---|---|
| 1. Right bank compension area (Reservoir directly) | | |
| - Irrigable area (ha) | 10,800 | 82,100 ha |
| - Paddy rive per ha NPV : 4,653 Baht | 50.3 | 382.0 |
| 2. Tha Lat area (Canal directly) | | |
| - Irrigable area(ha) | 28,200 | 21,100 |
| - Paddy mange mixed per ha NPV : Baht | 556.5 | - |
| - Paddy rice per ha, NPV: 4,653 Baht | - | 98.2 |
| 3. Bang Pakong Left bank area (Pumping) | | |
| - Irrigable area(ha) | 14,300 | - |
| - Paddy rice mango mixed per ha NPV: | 541.0 | - |
| Total | | |
| Irrigable area (ha) | 10,800+(28,200+14,300)×1.5=74,550ha | 103,200 ha |
| Net production value(M Baht) | 1,147.8 | 480.2 |
| 4. Industry per $m^3$ approx 1.2 Baht | 160.7MCM×1.2=192.8 | 192.8 |
| 5. Drinking per $m^3$ approx 1.6 Baht | 32.7MCM ×1.6=52.3 | 52.3 |
| Total (Million Baht) | 1,392.9 | 725.3 |

## 2.4. Construction Method of Diversion Dam

### A) General

Construction of a diversion dam in a river usually involves the cofferdam works. The Bang Pakong river is relatively narrow for a river of its size, and is therefore deep even at the proposed site, the cofferdam works are quite difficult. Two cofferdam methods, (1) half river closure cofferdam method (HRCC) and (2) complete closure cofferdam and by-path method (CCCB), are proposed for the alternative construction plan of the diversion dam, taking into consideration the size of the river.

### B) Proposed Site for the Diversion Dam

The diversion dam should be located at where straight line sections are possible for both the fore and rear aprons. From view points of operation and maintenance as well as safety reasons, placing the diversion dam on the curve section should be avoided. As shown in the attached figure, the upstream section of Wat Chuknua is therefore suitable. This section is also appropriate judging from the construction of access roads on the banks.

### c) Half River Closure Cofferdam Method (HRCC Method)

The river width at the proposed site is wider than those of the upper and lower stream. However it is still narrow for a river of this class. As mentioned earlier, the river is deep at the proposed site with the depth exceeding 10 m, making difficult sheet pile cofferdam works. Judging also from the scale of river discharge and construction period, the HRCC method may not be applicable with the following reasons:

- Since the conveyance capacity of the river section is reduced to less than half, there is always danger of flooding upstream during wet season.
- Since the sheet pile will be subjected to about 13 m of hydraulic pressure, independent sheet pile work is not possible.
- Additional sheet pile works to prevent seepage is necessary at the foot of the inland side of levee.
- It is necessary to construct temporary access passage on the both sides of the bank.
- Since the river bed is composed of soft clay, improvement work of soil foundation is required.

- The danger is great and damage is irreparable once the flood water enters into the cofferdam.

- For the reasons given above, a larger safety factor should be given for the sheet pile, and adequate reinforcement such as girder beam is accordingly required.

### D) Complete Closure Cofferdam and By-Path Method (CCCB Method)

Since the site of the diversion dam is located at the straight section of the river, the length of the by-path will be about 1.5 km, equivalent to the length of the diversion channel proposed in the original construction plan. The construction work of the dam body will take about two years and the cross-section of the by-path will be 200 m × 10 m, which is about the mean section of the river, in order to reduce compensation cost for the land. Back-filling of the by-path will be conducted after completion of the dam body. Before filling the by-path, it will be necessary to close the both ends. The oil excavated from the by-path construction site must be temporarily piled for about three years and will be used for back-filling. It will, however, be necessary to purchase soil to fill the upper 1 m of the back-filling layer.

Total cost for this method is estimated to be about 2,620 million baht. The disadvantages of this method as compared with the original plan are as follows:

- Two cofferdams, subject to about 13 m of hydraulic pressure, are required.

- Improvement works for oil foundation on the river bed are also required.

- About 1.5 km of by-path is to be excavated and then to be back-filled after construction of the dam.

- About 1.5 $km^2$ of land is required to store temporarily the soil excavated during the by-path construction.

- A temporary or compensatory bridge is to be constructed across the by-path.

- Compensation for the evicted farmers is necessary for the period of construction.

### E) Construction Period

The construction period for the original plan (OP) is the shortest, taking about three years, as the parallel execution of construction works for the dam body an diversion channel is possible. As for the CCCB method, the

closure work and by-path construction will take about 6 years because that the parallel construction of the by-path and cofferdams is not possible, and the whole construction period will be about 7.5 years.

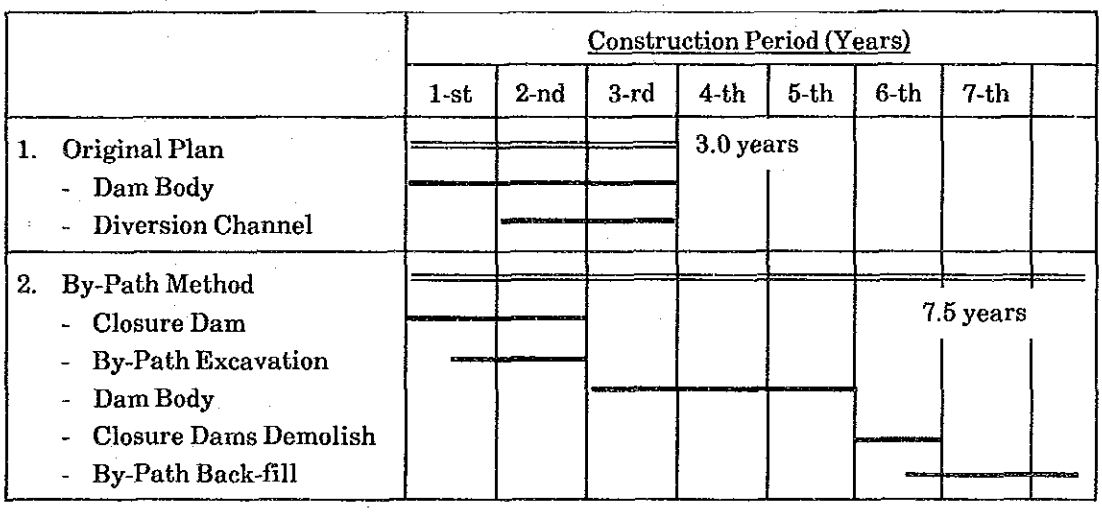
### F) Conclusion

The following table compares the costs and construction periods among the alternative plans:

| Method | Construction Cost | | Construction Period | | Appraisal |
|---|---|---|---|---|---|
| | Million Baht | (rate) | Year | (rate) | |
| Original Plan | 1,820 | (1.00) | 3.0 | (1.00) | 1 |
| CCCB Method | 2,620 | (1.44) | 7.5 | (2.50) | 2 |

The original plan requires a relatively higher compensation cost for the land, however, it is the most economical and technically safe method, and therefore is given the top appraisal.

Construction Period by Construction Method



Construction Cost by Construction Method

Bang Pakong Diversion Dam

| Work Description | Original Plan | By-Path Method |
|---|---|---|
| 1. Temporary Work | 137,663 | 206,520 |
| 2. Diversion Dam Body | 930,447 | 930,447 |
| 3. Connection Bridge & Road | 85,907 | 85,907 |
| 4. Closure Dam | 26,700 | 129,479 |
| 5. Diversion Channel | 333,580 | 333,580 |
| 6. - do - (Back-filling) | - | 585,784 |
| 7. Miscellaneous | 155,703 | 228,283 |
| Total | 1,670,000 | 2,500,000 |

# APPENDIX-I. PROJECT IMPLEMENTATION AND EVALUATION

# APPENDIX-I PROJECT IMPLEMENTATION AND EVALUATION

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## I.3 EVALUATION FOR FEASIBILITY STUDY

### I.3.1 Commodity Price



### I.3.2 Economic Cost Farm Labor



### I.3.3 Crop Budget in Economic Price

## LIST OF FIGURES

# I.1 PROJECT IMPLEMENTATION

**TABLE I-1-1. STAGED WATER RESOURCES DEVELOPMENT PLAN**

| Development Stage | Sub-River Basin | Storage Volume To be Developed | Storage Volume Available | Balance Accumulated |
|---|---|---|---|---|
| | | MCM) | MCM) | MCM) |
| 1) First Stage | LBP | 202 | No.4 dam: 300 | |
| (F/S area) | KTL | 66 | Rabon dam: 40 | |
| (Sub-Total) | | 286 | 340 | (+) 54 |
| 2) Second Stage | LBP | 307 | No.1 dam: 119 | |
| | KPS | 117 | No.8 dam: 470 | |
| | MPP | 58 | | |
| (Sub-Total) | | 482 | 589 | (+) 161 |
| 3) Third Stage | UBP | 768 | No.20 dam: 133 | |
| | UPP | 186 | No.10 dam: 160 | |
| | MHM | 109 | No.11 dam: 86 | |
| | MNN | 260 | No.12 dam: 290 | |
| | | | No.15 dam: 98 | |
| | | | No.18/19 dam: 322 | |
| | | | No.21 dam: 188 | |
| | | | No.22 dam: 98 | |
| (Sub-Total) | | 1,323 | 1,375 | (+) 213 |
| Total | | 2,091 | 2,304 | (+) 213 |

Note: The figures of dam storage volume to be developed include seepage and evaporation losses from proposed storage dams with 10 percent of active storage volumes.

## I.2 EVALUATION

This section contains the following articles, tables and figures:

I. 2.1 Criteria for Project Justification



I.2.2 Irrigation development Project Cost



I.2.3 Cost Allocation Method

I.2.4 Commodity Prices



I.2.5 Crop Budget per ha in Economic Price



I.2.6 Incremental NPV



I.2.7 Farm Economic Survey

TABLE I-2-1 COST BENEFIT RATIO

(unit: million Baht)

| Irrigation Block | Annual Increment NPV | Annual O & M Cost | Annual Benefit | Justifiable Expenditure Value | Project Cost | | B/C |
|---|---|---|---|---|---|---|---|
| | | | | Discount Ratio | | | Discount Ratio |
| | | | | 12% | Financ. | Economic | 12% |
| LBP | 624 | 52.7 | 517.3 | 4,761 | 5,168 | 4,651 | 1.02 |
| KTL | 100 | 6.9 | 93.1 | 776 | 707 | 636 | 1.22 |
| UBP | 1,300 | 97.7 | 1,202.3 | 10,019 | 8,118 | 7,306 | 1.37 |
| MNN | 137 | 54.4 | 82.6 | 688 | 3,379 | 3,041 | 0.23 |
| MPP | 85 | 13.5 | 71.5 | 596 | 822 | 740 | 0.80 |
| MHN | 240 | 21.4 | 218.6 | 1,822 | 3,060 | 2,754 | 0.66 |
| KPS | 239 | 22.4 | 216.6 | 1,805 | 1,957 | 1,761 | 1.02 |
| UPP | 390 | 32.0 | 358.0 | 2.983 | 1,808 | 1,627 | 1.83 |

TABLE I-2-2 TECHNICAL DIFFICULTY ON DAM CONSTRUCTION

| Irrig. Block | Dam Site | Asses Point Dam Base, Core, Construction | Evaluation Grade | Final Asses Point |
|---|---|---|---|---|
| LBP | ① | 8 | B | 2 |
| KTL | ④ | 8 | B | 2 |
| KPS | ⑧ | 7 | C | 1 |
| UPP | ⑩ | 6 | E | 1 |
| | ⑪ | 9 | A | |
| MHM | ⑫ | 6.5 | D | 1 |
| | ⑮ | 8 | B | |
| | ⑱ | 6 | E | |
| | ⑲ | 7 | C | |
| UBP | ⑳ | 8.5 | B | 2 |
| MNN | 21 | 5.5 | E | 1 |
| | 22 | 7 | C | |

Note: 1. Asses point on dam base is 5 point
〃 dam core is 3 point
〃 construction difficulty is 2 point
2. Over 5 asses point is good situation.
Evaluation grade is assessed as the following final point.
A-3, B-2, C-1, D-1, E-0

TABLE I-2-3 SOCIAL DIFFICULTY OF DAM COMPENSATION

| Irrig. Block | Dam Site | Own Right | Household Inundated | Difficulty of Compensation | Asses Point |
|---|---|---|---|---|---|
| LBP | ① | Private | over 500 | C | 1 |
| KTL | ④ | 〃 | 〃 | C | 1 |
| KPS | ⑧ | 〃 | 〃 | C | 1 |
| UPP | ⑩ | 〃 | 〃 | C | 2 |
| | ⑪ | National | 〃 | A | |
| MHM | ⑫ | Private | less 500 | B | 2 |
| | ⑮ | 〃 | over 500 | C | |
| | ⑱ | National | 〃 | A | |
| | ⑲ | 〃 | 〃 | A | |
| UBP | ⑳ | 〃 | 〃 | B | 2 |
| MNN | 21 | 〃 | 〃 | A | 3 |
| | 22 | Private | less 500 | B | |

Note: A : Problem prospected Low 3 point
B : 〃 Medium 2 point
C : 〃 High 1 point

TABLE I-2-4 PRIORITY ON REQUIREMENT TO GOVERNMENT HELP BY TAMBON PEOPLE

| Irrig. Block | Agriculture Water | Consumer Water | Road | Electricity | Asses Point for Point for Agri. & Consum. Water |
|---|---|---|---|---|---|
| LBP | 2 (2) | 3 (1) | 1 (3) | 4 (1) | 3 |
| KTL | 1 (3) | 4 (1) | 2 (2) | 3 (1) | 4 |
| UBP | 1 (3) | 4 (1) | 2 (2) | 3 (1) | 4 |
| MNN | 2 (2) | 4 (1) | 1 (3) | 3 (1) | 3 |
| MPP | 2 (2) | 3 (1) | 1 (3) | 4 (1) | 3 |
| MNH | 2 (2) | 3 (1) | 1 (3) | 4 (1) | 3 |
| KPS | 3 (1) | 3 (1) | 1 (3) | 2 (1) | 2 |
| UPP | 3 (1) | 3 (1) | 1 (3) | 3 (1) | 2 |

Source : Socio - economic survey, 1987, NSO.

Criteria for priority

Priority 1 ···· Asses Point 3
Priority 2 ···· Asses Point 2
Priority 3 ···· Asses Point 1
Priority 4 ···· Asses Point 1

( ) : Assed Point

TABLE I-2-5 PRIORITY ON URGENCY WITH INDUSTRIAL AND DOMESTIC WATER

| Item | LBP | KTL | UBP | MNN | MPP | MNH | KPS | UPP |
|---|---|---|---|---|---|---|---|---|
| Industry Water | High | High | Med. | Med. | Low | Low | Low | Low |
| Domestic water | High | High | Med. | Med. | Low | Low | Low | Low |

Criteria for priority

High urgency ····· Point 3
Medium urgency ····· Point 2
Low urgency ····· Point 1

TABLE I-2-6 INCREMENTAL BENEFIT PER HA

| Irrigation Block | Annual Incremental NPV | Project Area | NPV/ha | High | Medium | Low | Point |
|---|---|---|---|---|---|---|---|
| | $10^6$/Baht | ha | $10^3$/Baht | | | | |
| LBP | 624 | 68,900 | 9.1 | | ○ | | 2 |
| KTL | 100 | 6,900 | 14.5 | ○ | | | 3 |
| UBP | 1,300 | 136,900 | 9.5 | | ○ | | 2 |
| MNN | 137 | 76,400 | 1.8 | | | ○ | 1 |
| MPP | 85 | 16,600 | 5.1 | | | ○ | 1 |
| MHN | 240 | 28,100 | 8.5 | | ○ | | 2 |
| KPS | 239 | 29,700 | 8.0 | | ○ | | 2 |
| UPP | 390 | 43,300 | 9.0 | | ○ | | 2 |
| Total | 3,115 | 406,800 | 7.7 | | | | |

Criteria for priority
- High ····· 3 point
- Medium ····· 3 point
- Low ····· 3 point

TABLE I - 2 - 7 IRRIGATION DEVELOPMENT PROJECT COST BY BLOCK

(unit : million Baht)

| | Dam | Diversion Dam | Irrigation facility | On - Farm | Total Cost |
|---|---|---|---|---|---|
| LBP | 1,943 | 595 | 1,957 | 673 | 5,168 |
| KTL | 178 | - | 444 | 85 | 707 |
| UBP | 3,524 | - | 3,247 | 1,247 | 8,118 |
| MNN | 800 | - | 1,824 | 755 | 3,379 |
| MPP | 199 | - | 457 | 166 | 822 |
| MHM | 445 | - | 2,324 | 291 | 3,060 |
| KPS | 262 | - | 1,398 | 297 | 1,957 |
| UPP | 734 | - | 651 | 423 | 1,808 |
| Total | 8,085 | 595 | 12,302 | 4,037 | 25,019 |

TABLE I-2-8 WEIGHTED ECONOMIC LIFE FOR PROJECT

| Irri. Block | Dam | Diversion | Irri. Canal | On-farm | Total | Weighted Eco. Life |
|---|---|---|---|---|---|---|
| Eco. Life | 80 yrs | 50 yrs | 40 yrs | 40 yrs | | |
| LBP | | | | | | |
| Cost | 1,943 | 595 | 1,957 | 673 | 5,168 | |
| Deprec. cost | 24.3 | 11.5 | 48.9 | 16.8 | 101.5 | 51 years |
| KTL | 178 | | | | | |
| Cost | 206 | - | 444 | 8.5 | 707 | |
| Deprec.Cost | 2.2 | | 11.1 | 2.1 | 15.4 | 46 |

## I-2-9. Cost Allocation Methods

1. Investment cost and O & M of the Si Yat Dam and the Diversion Dam are allocated to irrigation component and industry and domestic water component, in order to clarify the size of investment cost to be borne by each related agency and estimate the water costs.

2. Cost allocation method is internationally used by Separable Cost Alternative Justifiable Expenditure method. This method was already adapted to the Feasibility study on Khlong Thap Ma Dam and Khlong Yao Dam Scheme, 1983.

3. Separable Cost Alternative Justifiable Expenditure Method is illustrated as follows.

Example of Cost Allocation

| Item | Irrigation | Industry Water | Domestic Water | Total |
|---|---|---|---|---|
| a. Alternative Cost | 1,250 | 800 | 700 | 2,750 |
| b. Justifiable Expenditure Value | 1,170 | 800 | 700 | 2,670 |
| c. Smaller Either of a. and b. | 1,170 | 800 | 700 | 2,670 |
| d. Specific Cost | 250 | 320 | 280 | 850 |
| e. c - d | 920 | 480 | 420 | 1,820 |
| f. Separable Cost | 700 | 180 | 120 | 1,000 |
| g. Remaining Benefit | 220 | 300 | 300 | 820 |
| h. % of g. | 26.8 | 36.6 | 36.6 | 100.0 |
| i. Remaining Benefit | 160.8 | 219.6 | 219.6 | 600 |
| j. Allocated Cost (f + i) | 860.8 | 399.6 | 339.6 | 1,600 |
| k. Burden Ratio % | 53.80 | 24.98 | 21.22 | 100.00 |

($10^6$ Baht)

I. Alternative Cost: Alternative facility is schemed at the same place as the project dam. Alternative facility for industry water and domestic water would be selected from dam, wear and pump station.

II. Justifiable Expenditure Value: Justifiable expenditure value in irrigation sector is estimated based on annual incremental net production value. Justifiable expenditure value in industry water

production value. Justifiable expenditure value in industry water sector and domestic water sector are the same value as the alternative cost.

III. Separable Cost: The following method is illustrated as follows.

| Sector | Maximum Burden Cost | | | | |
|---|---|---|---|---|---|
| | Alternative Cost | | Specific Cost | | |
| Irrigation | 1,250 | - | 250 | = | 1,000 |
| Industry Water | 800 | - | 320 | = | 480 |
| Domestic Water | 700 | - | 280 | = | 420 |

| Sector | Common Facility Cost | | Maximum Burden Cost | | Separable Cost |
|---|---|---|---|---|---|
| Irrigation | 1,600 | - | ( 480 + 420) = | | 700 |
| | | | Industry W. Domestic W. | | |
| Industry Water | 1,600 | - | (1,000 + 420) = | | 180 |
| | | | Irrigation Domestic W. | | |
| Domestic Water | 1,800 | - | (1,000 + 480) = | | 320 |
| | | | Irrigation Industry W. | | |

IV. After completion construction of common facilities, each sector should be simultaneously benefited. However, benefits growing in advanced investment sector will be delayed. Hence, in order to assist this disadvantageous sector, the following discounts will be adopted.

(c - d) mentioned above table / $(1 + i)^n$

n : time lag between completion period of common facilities and growing period of a part of benefits

i : interest rate

4. Cost allocation method will be convertible to other methods in the following cases.

I. Adaptation of Separable Cost Alternative Justifiable Expenditure method is very un-proper.

II. Urgent necessity to water supply by sector is very different.

5. Other method are considered as the following cases.

I. Priority burden methods

II. Alternative cost allocation

III. Annually used water quantity allocation

IV. Dam capacity by sector allocation

TABLE I-2-10 COMMODITY PRICES

| Item | Unit | Socio-Agro. Economic Survey (1989) | Other Statistics | Economic Price (2000) |
|---|---|---|---|---|
| Paddy | Baht/ton | 3,726 to 4,595 | 4,170 | 3,255 |
| Soybean | " | n.a | 8,920 | 6,440 |
| Mungbean | " | n.a | 7,570 | |
| Groundnut | " | n.a | 5,000 | 5,000 |
| Maize | " | 2,658 | | 2,870 |
| Cassava | " | 647 | | |
| Mango | Baht/kg | 6 to 28 | 5.9 to 10 | |
| | | | | |
| (Vegetable) | | | | |
| Kale | Baht/ton | 10,000 | 2,500 | |
| Chinese Cabbage | " | n.a | 1,500 | |
| Green Bean | " | n.a | 4,000 | |
| Tomato | " | n.a | 2,000 | |
| Cucumber | " | n.a | 2,000 | |
| Watermelon | Baht/one piece | n.a | 5,000 | |
| Sweet Corn | Baht/ton | n.a | 2,500 | |
| Baby Corn | Baht/kg | n.a | 20(with shell) | |
| Pumpkin | Baht/ton | n.a | 3,000 | |
| Chilly | " | n.a | 4,500 | |
| Kunchai | " | 12,800 | | |
| | | | | |
| (Fertilizer) | | | | |
| Urea (46%) | Baht/ton | 5,700 | | 8,280 |
| DAP (18-46-0) | " | | | 10,400 |
| Potassium | Chloride (60%) | | | 5,550 |
| 16-20-0 | " | 4,713 | 5,500 | 6,000 |
| 15-15-15 | " | 5,600 | 5,700 | 6,420 |
| 16-16-16 | " | n.a | 6,000 | 6,850 |
| 16-24-12 | " | | n.a | 7,730 |
| Manure | " | | 1,800 | |
| Lime | " | n.a | 264 | |
| | | | | |
| (Seed) | | | | |
| Paddy | Baht/kg | 4.06 to 4.19 | | |
| Maize | " | 8.71 | | |
| Mungbean | " | 48 | | |
| Cassava | Baht/1,000/pc. | 42 | | |
| Chinese Kale | Baht/ℓ | 75 | | |
| Kunchai | " | 94 | | |
| | | | | |
| (Chemical) | | | | |
| Pesticide | | | | |
| Paddy | Baht/rai | 2.0 to 0.45 | 180 to 200 Baht/ℓ | |
| Maize | " | 20 | 180 to 200 Baht/ℓ | |
| Cassava | " | 1.9 | | |
| Mango | " | 50 | | |
| Herbicide | | | | |
| Paddy | Baht/rai | 1.2 to 26.9 | 80 Baht/ℓ | |
| Maize | " | - | | |
| Cassava | " | 16.2 | | |
| Mango | " | - | | |

| Item | Unit | Socio-Agro. Economic Survey (1989) | Other Statistics | Economic Price (2000) |
|---|---|---|---|---|
| (Machine) | | | | |
| Hired (Small) | Baht/hour | | | |
| Paddy | " | 72 to 119 | | |
| Maize | " | 52 | | |
| Cassava | " | 195 | | |
| Mango | " | 19 | | |
| Hired (Large) | | | | |
| Paddy | Baht/hour | 199 to 227 | | |
| Maize | " | 137 | | |
| Cassava | " | 260 | | |
| Mango | " | 84 | | |
| (Oil) | | | | |
| Gasoline | Baht/ℓ | 4.2 to 3.9 | | |
| Lubricant | " | 21 to 23 | | |
| (Labor) | | | | |
| Hired Labor | | | | |
| Paddy | Baht/day | 64.3 to 78.8 | | |
| Maize | " | 50 | | |
| Cassava | " | 195 | | |
| Mango | " | 55.4 | | |
| (Average exclud. Cassava) | | (56.5) | | |
| Family Labor | | | | |
| Paddy | Baht/day | 48.3 to 70.1 | | |
| Maize | " | 40.3 | | |
| Cassava | " | 32.7 | | |
| Mango | " | 32.4 | | |
| (Average) | | (38.4) | | |

Note: Paddy figures show both of transplanting paddy and broadcasting paddy

ex.

° Unit price : Baht/ton

3,726 to 4,595

Transplant Broadcast

° Seed : Baht/kg

4.06 to 4.19

Transplant Broadcast

° Family labour : Baht/day

48.3 to 70.1

Transplant Broadcast

TABLE I-2-11 FINANCIAL AND ECONOMIC PRICE STRUCTURE OF PADDY

- 1989 Constant Price -

| | Item | | Unit | 1989 Financial | 1989 Economic | 2000 Financial | 2000 Economic |
|---|---|---|---|---|---|---|---|
| 1) | W.B. projection price in 2000 at 1985 Constant price (5% broken white rice, FOB Bangkok) | 1/ | US$/ton | 203 | 203 | 166 | 166 |
| 2) | Converted to 1989 constant price | 2/ | US$/ton | 304 | 304 | 248 | 248 |
| | | | | 7,752 | 7,752 | 6,324 | 6,324 |
| 3) | Converted to Thai Baht | 3/ | Baht/ton | 7,520 | 7,520 | 6,135 | 6,135 |
| 4) | Adjusted to average grade | 4/ | " | 200 | 175 15/ | 200 | 175 15/ |
| 5) | Less:Port charge | | | | | | |
| | Rice premium | 5/ | " | 350 | - | 285 | - |
| | Exporter tax | 6/ | " | 380 | - | 310 | - |
| | Exporter's margin | 7/ | " | 400 | 370 16/ | 330 | 300 16/ |
| | Wholesaler's margin | 8/ | " | 200 | 185 16/ | 160 | 145 16/ |
| | Transportation Cost | | | | | | |
| | Bangkok to Chachoengsao | 9/ | " | 75 | 65 15/ | 75 | 65 15/ |
| 6) | Ex-mill price of rice | | " | 5,915 | 6,725 | 4,775 | 5,450 |
| 7) | Ex-mill price of paddy | 10/ | " | 3,820 | 4,345 | 3,210 | 3,660 |
| 8) | Less:Milling tax | 11/ | " | 270 | - | 220 | - |
| | Miller's margin | 12/ | " | 270 | 250 16/ | 220 | 200 |
| | Merchant's margin | 13/ | " | 200 | 180 16/ | 175 | 160 |
| | Transport cost farm gate to mill | 14/ | " | 50 | 45 15/ | 50 | 45 |
| 9) | Farm gate price of paddy | | | | | | |
| | | | -Baht/mt | 3,030 | 3,870 | 2,545 | 3,255 |
| | | | -Baht/mt | 119 | 152 | 100 | 128 |

Note: 1/..... Commodity prices and price projections in 1985 constant Dollars, July 11,1989, IBRD.
2/..... G-5, GNP Deflator 1985 = 100, 1989 = 149.55 in Inflation Indices, IBRD

3/..... US$1.0 = Baht 25.50.
4/..... Adjustment ratio is estimated at 97% as the following table.

ESTIMATION OF AVERAGE GRADE TO BE ADJUSTED

- Export Rice -

(MT. 1,000 Baht)

| Item | | 1983 | 1984 | 1985 | 1986 | 1987 | Average | Grade Adjusted |
|---|---|---|---|---|---|---|---|---|
| 5% | Quantity | 85,692 | 84,741 | 123,005 | 238,353 | 258,871 | | |
| | Value | 520,674 | 499,175 | 670,424 | 1,119,740 | 1,323,040 | | |
| | Baht/t | 6,076 | 5,891 | 5,450 | 4,698 | 5,111 | 5,455 | 100 |
| White Rice Total | | | | | | | | |
| | Quantity | 2,576,948 | 3,414,278 | 2,877,716 | 3,613,300 | 3,244,597 | | |
| | Value | 14,769,172 | 19,049,973 | 16,346,317 | 16,258,840 | 16,339,061 | | |
| | Baht/t | 5,731 | 5,580 | 5,680 | 4,500 | 5,036 | 5,305 | 97 |
| Share of 5% Quantity | | 3.3% | 2.5% | 4.3% | 6.6% | 8.0% | | |

Source: Agricultural Statistics of Thailand 1987/88, Page 149, MOAC, Thailand

(Note: Continue)

5/ ..... Currently Baht 400/mt for 100% and 5%, Baht 350 for 10% and 15%, Baht 250 for 20% to 45%.

6/..... Export tax is 5% of export price.

7/..... Data on business margin is based on the Rice Trading Report, NESDB, 1983.
Exportor margin was about 20% of ex-mill price of rice in 1980.
But this margin couldn't be realized due to the low FOB price.
According to this facts, margin is assumed at about 7% of ex-mill price.

8/..... According to the Rice Trading Report, NESDB, 1983, wholesaler margin is assumed at about 3.5% of ex-mill price.

9/..... From Bangkok to Project Area.
Chachoengsao - BKK 75km, Chonburi - BKK 80 km, Nakon Nayok - BKK 102 km.
Prachinburi - BKK 127 km, Transportation cost is estimated at 1 Baht/km.

10/..... Rice Conversion rate classified by size of rice mills are as follows according to the Rice Trading Report, NESDB, 1983.
Small size 64.6%, medium size 66.7%, large size 67.2%.
In this study, the conversion rate of small size is used for 1989, and that of medium size 2000.

11/..... 7% value of ex-mill price of paddy.

12/..... Approximately 7% of paddy output before tax.

13/..... Approximately 7% of import price of paddy at mill.

14/..... Average distance from project area to mill in Chachoengsao City is assumed at about 50 km.

15/..... Conversion factor, 0.87 of transportation is applied.

16/..... Conversion factor of business margin is applied on standard conversion factor 0.92.

TABLE I-2-12 PRICE STRUCTURE FOR SOYBEAN

- 1989 Constant Price -

| | Item | | 2000 Unit | 2000 Financial | 2000 Economic |
|---|---|---|---|---|---|
| 1) | W.B. Projection price in 2000 at 1985 constant price (US Soybean, CIF Rotterdam) | 1/ | US$/ton | 150 | 150 |
| 2) | Convert to 1989 constant price | 2/ | " | 224 | 224 |
| 3) | C.I.F. Bangkok | 3/ | " | 290 | 290 |
| 4) | Convert to Thai Baht | 4/ | Baht/ton | 7,395 | 7,395 |
| 5) | Business tax | 5/ | " | 370 | - |
| 6) | Port handling charge | | " | 200 | 175 |
| 7) | Transport cost to oil mill | | " | 150 | 130 |
| 8) | Importers margin | 6/ | " | 425 | 390 |
| 9) | Wholesale price in Bangkok | | " | 8,540 | 8,090 |
| 10) | Quantity adjustment | | " | 7,690 | 7,280 |
| 11) | Transport/handling Chachoengsao to Bangkok | | " | 75 | 60 |
| 12) | Marketing costs | | " | 500 | 460 |
| 13) | Local merchant margin | | " | 350 | 320 |
| 14) | Farm gate price of soybean | | " | 6,765 | 6,440 |

Note: 1/: Commodity price and price projections in 1985 constant Dollars, July 11, 1989, IBRD.
2/: Inflation Indies, IBRD, 1985 = 100, 1989 = 149.55
3/: Flight and insurance charge are assumed.
4/: US$1.0 = Baht 25.50
5/: Assumed at about 5% of CIF Price.
6/: Assumed at about 5% of wholesale price in BKK.

TABLE I-2-13 PRICE STRUCTURE FOR MUNGBEAN

| | Item | | 1988 Unit | 1988 Financial | 1988 Economic |
|---|---|---|---|---|---|
| 1) | FOB price, BKK | | Baht/ton | 10,317 | |
| 2) | Port handling | | " | 20 | |
| 3) | Charges for keeping | 1/ | " | 98 | |
| 4) | Insurance | | " | 9 | |
| 5) | Transport port to ship | | " | 33 | |
| 6) | Weighing charge | | " | 20 | |
| 7) | Truck handling | | " | 10 | |
| 8) | Exporter margin | 2/ | " | 800 | |
| 9) | Exporter marketing cost | 3/ | " | 420 | |
| 10) | Adjustment cost | 4/ | " | 1,050 | |
| 11) | Wholesale price, BKK | | " | 7,857 | |
| 12) | Transport cost Prachinburi to BKK | | " | 130 | |
| 13) | Local merchant margin | 5/ | | 367 | |
| 14) | Farm gate price of mungbean | | " | 7,360 | |

Note: 1/: six months = 182 days 0.067 Baht/bag/day
2/: interest (16.5%, six month), margin and profit
3/: selection 20 Baht/bag, weight loss 5%
4/: rejected bean
5/: about 5% of farm gate price
Source: Department of Farm Economy, MOAF, Thailand

TABLE I-2-14 PRICE STRUCTURE FOR MAIZE

- 1988 Constant Price -

| | Item | | 2000 Unit | 2000 Financial | 2000 Economic |
|---|---|---|---|---|---|
| 1) | FOB, Bangkok | 1/ | US$/ton | 142 | 142 |
| 2) | Convert to Thai Baht | | Baht/ton | 3,620 | 3,620 |
| 3) | Port handling charge | | " | 180 | 150 |
| 4) | Transport port to ship | | " | 30 | 25 |
| 5) | Exporter margin | | " | 210 | 195 |
| 6) | Export tax | | " | 180 | - |
| 7) | Wholesale price in Bangkok | | " | 3,020 | 3,250 |
| 8) | Transport Prachinburi to Bangkok | | " | 130 | 115 |
| 9) | Truck handling cost | | " | 30 | 25 |
| 10) | Local merchant margin | | " | 260 | 240 |
| 11) | Farm-gate price of maize | | " | 2,600 | 2,870 |

Note: 1/: W.B. projection price at 1985 constant price
1988 ... 77 US$/ton, 2000 ... 73 US$/ton
FOB Bangkok at 1988 ... 3,830 Baht/ton = 150 US$/ton
" 2000 .... 150 x 73/77 = 142 US$/ton

TABLE I-2-15 PRICE STRUCTURE FOR CASSAVA

| | Item | | 1989 Financial (Baht/ton) | 1989 Economic (Baht/ton) |
|---|---|---|---|---|
| 1) | Pallets, FOB, Bangkok | 1/ | 3,140 | 3,140 |
| 2) | Business tax | | 55 | - |
| 3) | Exporter's cost and margin | 2/ | 140 | 130 |
| 4) | Pellets' delivered godown price | | 2,945 | 3,010 |
| 5) | Delivering cost to godown | | 40 | 35 |
| 6) | Pelletizing cost | | 100 | 92 |
| 7) | Filler cost | | 30 | 28 |
| 8) | Saving on chip requirement | | 50 | 45 |
| 9) | Pelleter's margin | | 50 | 45 |
| 10) | Chips, delivered pelletiser | | 2,675 | 2,765 |
| 11) | Transport | | 210 | 185 |
| 12) | Chips pre-delivered to pelleter | | 2,465 | 2,580 |
| 13) | Chippers margin | 3/ | 615 | 645 |
| 14) | Chips after dring | | 1,850 | 1,935 |
| 15) | Cost of root weight loss (60%) | | 1,110 | 1,160 |
| 16) | Chipping cost | | 10 | 9 |
| 17) | Transportation cost farm-gate to chip mill | | 150 | 130 |
| 18) | Root fresh farm-gate price | | | |
| | Chonburi | | 645 | 695 |
| | Chachoengsao | | 570 | 615 |
| | Prachinburi | | 560 | 605 |
| | Average | | 590 | 640 |

Note: 1/ .... Average price Jan. to Nov. 1989, Office of Agri. Economics
2/ .... 4.5% of FOB price
3/ .... 25% of chips pre-delivered to pelleter

TABLE I--2-16 PRICE STRUCTURE FOR UREA (N; 46%)

| Item | | Unit | 1989 | | 2000 | |
|---|---|---|---|---|---|---|
| | | | Financial | Economic | Financial | Economi |
| 1) FOB, Urea, NW Europe in 1985 constant price | 1/ | US$/ton | 119 | 119 | 130 | 130 |
| 2) Convert to 1989 constant | 2/ | " | 178 | 178 | 194 | 194 |
| 3) Freight (US$70) & insurance (2% of FOB price) | | " | 74 | 74 | 74 | 74 |
| 4) CIF price at Bangkok port | | " | 252 | 252 | 268 | 268 |
| 5) Convert to Thai Baht | | Baht/ton | 6,425 | 6,425 | 6,835 | 6,835 |
| 6) Commission fee | 3/ | " | 15 | 14 | 15 | 14 |
| 7) Taxes expenses | 4/ | " | 115 | - | 125 | - |
| 8) Port Expenses | 5/ | " | 320 | 295 | 340 | 295 |
| 9) Godown expenses | 6/ | " | 60 | 55 | 60 | 55 |
| 10) Import/factory price | | " | 6,935 | 6,789 | 7,375 | 6,999 |
| 11) Marketing costs and margins | 7/ | " | | | | |
| a. Transport costs | | | 170 | 150 | 170 | 150 |
| b. Storage costs | | | 90 | 80 | 90 | 80 |
| c. Bagging costs | | | 220 | 200 | 220 | 200 |
| d. Handling costs | | | 200 | 185 | 200 | 185 |
| e. Physical losses | | | 40 | 35 | 40 | 35 |
| f. Taxes, levies, cutom duties | | | 110 | - | 110 | - |
| g. Interest charges | | | 35 | - | 35 | - |
| h. Other costs | | | 200 | 185 | 200 | 185 |
| i. Importers margin | | | 35 | 30 | 35 | 30 |
| j. Wholesale margin | | | 180 | 165 | 180 | 165 |
| k. Retail margin | | | 245 | 225 | 245 | 225 |
| (Sub-total) | | | (1,525) | (1,255) | (1,525) | (1,255) |
| 12) Transport cost from farm to shop | | Baht/ton | 30 | 25 | 30 | 25 |
| 13) Farm-gate price of Urea | | " | 8,490 | 8,069 | 8,950 | 8,280 |
| 14) Farm-gate price of nutrient | | " | 18,455 (N) | 17,540 (N) | 19,455 (N) | 18,000 (N) |

Note : 1/···· Commodity prices and price projections in 1985 constant Dollars, July 11, 1989, IBRD.
2/···· IBRD, Inflation indices, 1985=100, 1989=149.55
3/···· Commission fee is about 0.25% of CIF price. Source is Fertilizer market, Division of Agricultural economic research, Agricultural Statistics Office.
4/···· Income tax and municipal tax. Source is ibid 3/.
5/···· Port fee, Expenses on receiving merchandise, freight on small bout, labor cost for carrying to small boat, labor cost for carrying to godown and survey expenses.
6/···· Godown is average three month usage.
7/···· Marketing Costs and margins are estimated based on Fertilizer advisory, Development and Information Network for Asia and the Pocific, ESCAP/FAO/UNIDO, 1985/86.

TABLE I-2-17 PRICE STRUCTURE FOR DAP (18-46-0) AND POTASSIUM CHLORIDE (K 60)

| Item | Unit | DAP 1989 | | Potassium Chloride 2000 | |
|---|---|---|---|---|---|
| | | Financial | Economic | Financial | Economic |
| 1) FOB, in 1985 constant | US$/ton | 194 | 194 | 75 | 75 |
| 2) Convert to 1989 constant | " | 290 | 290 | 112 | 112 |
| 3) Freight (US$70) & insurance (2% of FOB) | " | 76 | 76 | 72 | 72 |
| 4) CIF price at Bangkok port | " | 366 | 366 | 184 | 184 |
| 5) Convert to Thai Baht | Baht/ton | 9,330 | 9,330 | 4,690 | 4,690 |
| 6) Commission fee | " | 20 | 18 | 10 | 18 |
| 7) Taxes expenses | " | 160 | - | 80 | - |
| 8) Port Expenses | " | 465 | 427 | 230 | 212 |
| 9) Godown expenses | " | 60 | 55 | 60 | 55 |
| 10) Import/factory price | " | 10,035 | 9,830 | 5,070 | 4,975 |
| 11) Marketing costs and margins | " | | | | |
| a. Transport costs | | 170 | 150 | 170 | 150 |
| b. Storage costs | | 90 | 80 | 90 | 80 |
| c. Bagging costs | | - | - | - | - |
| d. Handling costs | | 105 | 100 | 105 | 100 |
| e. Physical losses | | - | - | - | - |
| f. Taxes, levies, custom duties | | 105 | - | 105 | - |
| g. Interest charges | | 20 | | 20 | - |
| h. Other costs | | 130 | 120 | 130 | 120 |
| i. Importers margin | | 60 | 55 | 60 | 55 |
| j. Wholesale margin | | 15 | 15 | 15 | 15 |
| k. Retail margin | | 30 | 25 | 30 | 25 |
| (Sub-total) | | (725) | (545) | (725) | (545) |
| 12) Transport cost from farm to shop | Baht/ton | 30 | 25 | 30 | 25 |
| 13) Farm-gate price of blend | " | 10,790 | 10,400 | 5,795 | 5,550 |
| 14) Farm-gate price of nutrient | " | 15,850 (P) | 15,570 (P) | 9,660 (K) | 9,240 (K) |

TABLE I-2-18 CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | (Transplanting) Paddy (wet) w/o Project | | | (Broadcasting) Paddy (wet) w/o Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (ton/ha) | (Baht/t) | (Baht) | (ton/ha) | (Baht/t) | (Baht) |
| 1. GPV | 2.364 | 3,255 | 7,695 | 2.364 | 3,255 | 7,695 |
| 2. Cost | | | | | | |
| - Seed | 50 k | 3,900 | 195 | 84 k | 3,900 | 328 |
| - Fertilizer | | | | | | |
| Urea | 4.8 k | 8,280 | 40 | 1.5 k | 8,280 | 12 |
| DAP | | | | | | |
| 16-20-0 | 114 k | 6,000 | 684 | 140 | 6,000 | 840 |
| 12-24-12 | | 6,420 | | | | |
| 15-15-15 | 0.04 k | 6,420 | 1 | 1.2 | 6,420 | 8 |
| 20-20-0 | 0.4 k | 6,720 | 3 | 5.3 | 6,720 | 36 |
| Dung | | | | | | |
| Lime | | 264 | | | | |
| - Agro-chemical | | | | | | |
| Pesticide | | | 12 | | | 3 |
| Herbicide | | | 7.4 | | | 27 |
| - Machine | (32.22 hr) | Baht/hr | | (8.85 hr) | Baht/hr | |
| Hire (Small) | 2.5 hr | 72 | 180 | 0.56 hr | 119 | 67 |
| Hire (Large) | 0.75 | 199 | 149 | 3.19 | 227 | 724 |
| Own (Small) | 28.8 | 24 | 691 | 4.63 | 24 | 111 |
| Own (Large) | 0.17 | 55 | 9 | 0.47 | 220 | 103 |
| - Oil | | | | | | |
| Gasoline | 42 ℓ | 4.2 Baht/ℓ | 176 | 3.1 ℓ | 4.2 Baht/ℓ | 13 |
| Lubricant | 1 ℓ | 21 | 21 | 0.14 ℓ | 21 | 3 |
| - Labor | 46.6 day | 48Baht/day | 2,237 | 22.9 day | 48 Baht/day | 1,099 |
| Hire | (16.3) | | | (7.2) | | |
| Family | (25.0) | | | (11.8) | | |
| Total Cost | | (64%) | 4,405 | | | 3,374 |
| 3. NPV | | | 3,290 | | | 4,321 |

## CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | (Transplanting) Paddy (wet) with Project | | | (Broadcasting) Paddy (Dry) with Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 4.0 | 3,255 | 13,020 | 4.5 | 3,255 | 14,648 |
| 2. Cost | | | | | | |
| - Seed | 63 k | 3,900 | 246 | 94 k | 3,900 | 367 |
| - Fertilizer | | | | | | |
| Urea | 63 k | 8,280 | 522 | 63 k | 8,280 | 522 |
| DAP | | | | | | |
| 16-20-0 | 280 k | 6,000 | 1,680 | 280 k | 6,000 | 1,680 |
| 12-24-12 | | | | | | |
| 15-15-15 | | | | | | |
| Dung | | | | | | |
| Lime | 1.26 t | 264 | 333 | 1.26 t | 264 | 333 |
| - Agro-chemical | 2 times | | | 2 times | | |
| Pesticide | | | 24 | | | 6 |
| Herbicide | | | 15 | | | 55 |
| - Machine | 98.3 hr | Baht/hr | | 25 hr | Baht/hr | |
| Hire (Small) | 7.6 | 72 | 547 | 1.6 | 72 | 115 |
| Hire (Large) | 2.3 | 199 | 458 | 9.0 | 199 | 1,791 |
| Own (Small) | 87.9 | 24 | 2,110 | 13.0 | 24 | 314 |
| Own (Large) | 0.5 | 55 | 28 | 1.3 | 55 | 72 |
| - Oil | | | | | | |
| Gasoline | | | | | | |
| Lubricant | | | | | | |
| - Labor | 70 day | 48Baht/day | 3.360 | 60 day | 48Baht/day | 2,880 |
| Hire | ( Socio - agro economy survey, sample with hight yield ) | | | | | |
| Family | | | | | | |
| | | | | | (56 %) | |
| Total Cost | | (72 %) | 9,323 | | | 8,135 |
| 3. NPV | | | 3,697 | | | 6,513 |

## CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | (Broadcasting) Paddy (wet) with Project | | | Maize (wet) with Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 4.0 | 3,255 | 13,020 | 1.6 | 2,870 | 4,592 |
| 2. Cost | | | | | | |
| - Seed | 94 k | 3,900 | 367 | 21 k | 8,710 | 183 |
| - Fertilizer | | | | | | |
| Urea | 63 k | 8,280 | 522 | 30 k | 8,280 | 248 |
| DAP | | | | | | |
| 16-20-0 | 280 k | 6,000 | 1,680 | | | |
| 12-24-12 | | | | | | |
| 15-15-15 | | | | 70 k | 6,420 | 449 |
| Dung | | | | | | |
| Lime | 1.26 t | 264 | 333 | 1 t | 264 | 264 |
| - Agro-chemical | 2 times | | | | | |
| Pesticide | | | 6 | | | |
| Herbicide | | | 55 | | | 125 |
| - Machine | 25 hr | Baht/hr | | hr | | |
| Hire (Small) | 1.6 | 72 | 115 | 5.0 | 52 | 260 |
| Hire (Large) | 9.0 | 199 | 1,791 | 7.0 | 137 | 959 |
| Own (Small) | 13.1 | 24 | 314 | 7.0 | 24 | 168 |
| Own (Large) | 1.3 | 55 | 72 | | | |
| - Oil | | | | | | |
| Gasoline | | | | 6.3 ℓ | 4.2 | 26 |
| Lubricant | | | | | | |
| - Labor | 60 day | 48Baht/day | 2,880 | 30 day | 48 | 1,440 |
| Hire | | | | | | |
| Family | | | | | | |
| Total Cost | | | 8,135 | | | 4,122 |
| 3. NPV | | | 4,885 | | | 470 |

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Soybean with Project | | | Mungbean with Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 1.857 | 6,440 | 12,075 | 1.125 | 7,360 | 8,280 |
| 2. Cost | | | | | | |
| - Seed | 44 k | 4,800 | 211 | 50 k | 4,800 | 240 |
| - Fertilizer | | | | | | |
| Urea | | | | | | |
| DAP | | | | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | 156 k | 7,730 | 1,205 | 156 k | 7,730 | 1,205 |
| 15-15-15 | | | | | | |
| Dung | | | | | | |
| Lime | 1.26 t | 264 | 333 | 1.26 t | 264 | 333 |
| - Agro-chemical | | | | | | |
| Pesticide | | | | | | |
| Herbicide | | | | | | |
| - Machine | 49 hr | | | 40 hr | | |
| Hire (Small) | (30%) 15 | 52 | 780 | (30%) 12 | 52 | 624 |
| Hire (Large) | (35%) 17 | 137 | 2,329 | (35%) 14 | 137 | 1,918 |
| Own (Small) | (35%) 17 | 24 | 408 | (35%) 14 | 24 | 336 |
| - Oil | | | | | | |
| Gasoline | 6 ℓ | 4.2 | 24 | 5 ℓ | 4.2 | 21 |
| Lubricant | | | | | | |
| - Labor | 56 day | 48 | 2,688 | 53 day | 48 | 2,544 |
| Hire | | | | | | |
| Family | | | | | | |
| Total Cost | | (66 %) | 7,978 | | (87 %) | 7,221 |
| 3. NPV | | | 4,097 | | | 1,059 |

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Groundnuts with Project | | | Cassava with Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 1.857 | 5,000 | 9,375 | 13.0 | 640 | 8,320 |
| 2. Cost | | | | priece | (Baht) | |
| - Seed | 75 k | 4,800 | 360 | 8,500 | 0.042 | 357 |
| - Fertilizer | | | | | | |
| Urea | | | | | | |
| DAP | | | | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | 156 k | 7,730 | 1,205 | | | |
| 15-15-15 | | | | | | |
| Dung | | | | | | |
| Lime | 1.26 t | 264 | 333 | | | |
| - Agro-chemical | | | | | | |
| Pesticide | | | | | | 12 |
| Herbicide | | | | | | 100 |
| - Machine | 32 hr | | | 8.5 hr | | |
| Hire (Small) | (30%) 10 | 52 | 520 | 3.0 | 195 | 585 |
| Hire (Large) | (35%) 11 | 137 | 1,507 | 4.4 | 260 | 1,144 |
| Own (Small) | (35%) 11 | 24 | 264 | 1.1 | 24 | 26 |
| | | | (Animal) | 1.3 day | 90 | 117 |
| - Oil | | | | | | |
| Gasoline | 5 ℓ | 4.2 | 21 | 3.1 ℓ | 4.2 | 13 |
| Lubricant | | | | 2 ℓ | 21 | 42 |
| - Labor | 70 day | 48 | 3,360 | 62.8 day | 48 | 3,014 |
| Hire | | | | (38) | | |
| Family | | | | (23.8) | | |
| Total Cost | | (81 %) | 7,570 | | (65 %) | 5,410 |
| 3. NPV | | | 1,805 | | | 2,910 |

Note : Yield for Cassava is average of those in 8 Irrigation Blochs.

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Mango w/o Project | | | Mango with Project | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| | (6 Year) | | | | | |
| 1. GPV | 3.132 | 5,900 | 18,480 | 12.42 | 5,900 | 73,280 |
| 2. Cost | plants | | | | | |
| - Seed | 180 k | | | | | |
| - Fertilizer | | | | | | |
| Urea | | | | 139 k | 8,280 | 1,150 |
| DAP | 280 k | 10,400 | 2,912 | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | | | | | | |
| 15-15-15 | 156 k | 6,420 | 1,002 | | | |
| Dung | | | 280 | 2.78 t | 1,800 | 5,004 |
| Lime | | | | 1.26 t | 264 | 333 |
| - Field ridge | | | | | | 2,000 to 2,400 |
| - Agro-chemical | | | | | | |
| Pesticide | | | 4,500 | | | 6,000 |
| Herbicide | (88.9 hr) | | | (100 hr) | | |
| | 4.7 hr | 19 | | 5 hr | 20 | |
| - Machine | 2.8 hr | 84 | | 5 hr | 85 | |
| Hire (Small) | 81.4 hr | 24 | 90 | 90 hr | 25 | 100 |
| Hire (Large) | | | 235 | | | 425 |
| Own (Small) | | | 1,954 | | | 2,250 |
| | 37.5 ℓ | 4.2 | | | | 7,000 |
| - Oil | 1.6 ℓ | 21 | | | | |
| Gasoline | | | 158 | | | |
| Lubricant | 56.3 day | 48 | 34 | (100 day) | 48 | |
| | (37) | | | | | |
| - Labor | (19.3) | | 2,702 | | | 4,800 |
| Hire | | | | | | |
| Family | | | | | | |
| | | | | | | (29,062) |
| Total Cost | | | 13,867 | | | (29,462 |
| 3. NPV | | | 12,019 | | | (44,218) |
| | | | =12,020 | | | 43,818 |
| | | | | | | (44,220) |
| | | | | | | =43,820 |

Note: Yield w/o Project is based on Secio - Agro Economic Survey
NPV 43,820 Baht... new orchard from forest land
44,220 Baht ... new orchard from paddy field
46,220 Baht ... existing orchard

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Green bean | | | Baby corn | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 9.3 | 4,000 | 37,200 | 0.625 | 20,000 with shell | 12,500 |
| 2. Cost | | | | | | |
| - Seed | 25 k | 40 | 1,000 | 19 k | 30 | 570 |
| - Fertilizer | | | | | | |
| Urea | 31 k | 8,280 | 257 | 31 k | 8,280 | 257 |
| DAP | | | | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | | | | | | |
| 15-15-15 | 220 k | 6,420 | 1,412 | 220 k | 6,420 | 1,412 |
| Dung | 10 t | - | | 10 t | - | |
| Lime | 1.26 t | 264 | 333 | 1.26 t | 264 | 333 |
| - Agro-chemical | | | 750 | | | 560 |
| Pesticide | | | | | | |
| Herbicide | | | | | | |
| - Machine | | | | | | |
| Hire (Small) | | | | | | |
| Hire (Large) | | | | | | |
| Own (Small) | 15 hr | 24 | 360 | 15 hr | 24 | 360 |
| - Oil | | | | | | |
| Gasoline | | | | | | |
| Lubricant | | | | | | |
| - Labor | 51.3 day | 48 | 2,462 | 56.8 day | 48 | 2,726 |
| Hire | | | | | | |
| Family | | | | | | |
| Total Cost | | (18%) | 6,574 | | (78%) | 6,218 |
| 3. NPV | | | 30,626 | | | 6,282 |

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Sweet Corn | | | Chilli | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 6.0 | 2,500 | 15,000 | 3.0 | 4,500 | 13,500 |
| 2. Cost | | | | | | |
| - Seed | 19 k | 30 | 570 | 0.6 t | 200 | 120 |
| - Fertilizer | | | | | | |
| Urea | | | | 31 k | 8,280 | 257 |
| DAP | | | | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | | | | | | |
| 15-15-15 | 315 k | 6,420 | 2,022 | 220 k | 6,420 | 1,412 |
| Dung | 10 t | - | | 10 t | - | |
| Lime | 1.26 t | 264 | 333 | 1.26 t | 264 | 333 |
| - Agro-chemical | | | 560 | | | 560 |
| Pesticide | | | | | | |
| Herbicide | | | | | | |
| - Machine | | | | | | |
| Hire (Small) | | | | | | |
| Hire (Large) | | | | | | |
| Own (Small) | 18 hr | 24 | 432 | 15 hr | 24 | 360 |
| - Oil | | | | | | |
| Gasoline | | | | | | |
| Lubricant | | | | | | |
| - Labor | 40.4 day | 48 | 1,939 | 82.1 day | 48 | 3,941 |
| Hire | | | | | | |
| Family | | | | | | |
| Total Cost | | (39 %) | 5,856 | | (52 %) | 6,983 |
| 3. NPV | | | 9,144 | | | 6,517 |

CROP BUDGET PER HA IN ECONOMIC PRICE

| Crop | Tomato | | | Chinese Cabbage | | |
|---|---|---|---|---|---|---|
| Item | Quantity | Price | Value | Quantity | Price | Value |
| | (t/ha) | (Baht/t) | (Baht) | (t/ha) | (Baht/t) | (Baht) |
| 1. GPV | 12.0 | 2,000 | 24,000 | 12.0 | 1,500 | 18,000 |
| 2. Cost | | | | | | |
| - Seed | 0.3 k | 1,500 | 450 | 3.2 k | 110 | 325 |
| - Fertilizer | | | | | | |
| Urea | - | | | 31 k | 8,280 | 257 |
| DAP | | | | | | |
| 16-20-0 | | | | | | |
| 12-24-12 | | | | | | |
| 15-15-15 | 220 k | 6,420 | 1,412 | 220 k | 6,420 | 1,412 |
| Dung | 10 t | - | | 10 t | - | |
| Lime | 1.26 t | 264 | 333 | 1.26 t | 264 | 333 |
| - Agro-chemical | | | 560 | | | 750 |
| Pesticide | | | | | | |
| Herbicide | | | | | | |
| - Machine | | | | | | |
| Hire (Small) | | | | | | |
| Hire (Large) | | | | | | |
| Own (Small) | 19 hr | 24 | 456 | 25 hr | 24 | 600 |
| - Oil | | | | | | |
| Gasoline | | | | | | |
| Lubricant | | | | | | |
| - Labor | 60 day | 48 | 2,880 | 57.4 day | 48 | 2,755 |
| Hire | | | | | | |
| Family | | | | | | |
| Total Cost | | (25 %) | 6,091 | | (36 %) | 6,459 |
| 3. NPV | | | 17,909 | | | 11,541 |

TABLE I-2-19 GROWING MODEL FOR VEGETABLE WITH THE PROJECT

(1) Sequntaial cropping system on three plots per hectrare of arable land.

Actual planting acreage

| | | | |
|---|---|---|---|
| Plot 1 | : | 1.0 ha × 0.4 = 0.4 ha | Green bean - baby corn |
| Plot 2 | : | 1.0 ha × 0.3 = 0.3 ha | Sweet corn - Chilli |
| Plot 3 | : | 1.0 ha × 0.3 = 0.3 ha | Tomato - Chinese Cabbay |

(2) N.P.V per ha. with Project 28,300 Baht

| | | | | | | |
|---|---|---|---|---|---|---|
| Plot 1 | Green bean | 30,626 | Baht/ha | × 0.4 ha = | 12,250 | Baht |
| 〃 | Baby corn | 6,282 | 〃 | × 0.4 ha = | 2,513 | |
| Plot 2 | Sweet corn | 9,144 | 〃 | × 0.3 ha = | 2,743 | |
| 〃 | Chilli | 6,517 | 〃 | × 0.3 ha = | 1,955 | |
| Plot 3 | Tomato | 17,909 | 〃 | × 0.3 ha = | 5,373 | |
| 〃 | Chinese cabbage | 11,541 | 〃 | × 0.3 ha = | 3,462 | |
| | Total | | | | 28,296 | |
| | | | | = | 28,300 | |

(3) N.P.V per ha with Project

| Crop | Per Ha GPV/wp÷1.2 | P. C | NPV | Area | NPV |
|---|---|---|---|---|---|
| | Baht | Baht | Baht | ha | Baht |
| Green bean | 31,000 | 6,574 | 24,426 | 0.4 | 9,770 |
| Baby corn | 10,420 | 6,282 | 4,138 | 0.4 | 1,655 |
| Sweet corn | 15,500 | 5,856 | 6,644 | 0.3 | 1,993 |
| Chilli | 11,250 | 6,983 | 4,267 | 0.3 | 1,280 |
| Tomato | 20,000 | 6,091 | 13,909 | 0.3 | 4,173 |
| Chinese Cabbage | 15,000 | 6,459 | 8,541 | 0.3 | 2,562 |
| Total | | | | 2.0 | 21,433 |
| | | | | | = 21,400 |

TABLE I-2-20 ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | LBP | ① |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,480 | 3.697 | 3.290 | 0.407 | 10.78 | |
| | | (B.C) 26,920 | 4.885 | 4.321 | 0.564 | 15.18 | |
| | | Total (53,400) | | | | | |
| | Maize | 2,200 | 0.470 | - | 0.47 | 1.03 | |
| | Cassava | (-) 2,200 | - | 3.833 | (-) 3.833 | (-) 8.43 | |
| | Vegetable | (Exist) 7,300 | 28.3 | 21.4 | 6.9 | 50.37 | |
| | | (New) 1,300 | 28.3 | - | 28.3 | 36.79 | |
| | | (8,600) | | | | | |
| | Wets. Total | | | | | (105.72) | |
| Dry | Paddy | (B.C) 15,500 | 6.513 | - | 6.513 | 100.95 | |
| | Soybean | 8,000 | 4,097 | - | 4.097 | 32.78 | |
| | Mungbeea | 5,500 | 1.059 | - | 1.059 | 5.82 | |
| | Grund nuts | 5,400 | 1.805 | - | 1.805 | 9.75 | |
| | Orchard | 4,900 | 46.220 | 15.716 | 30.504 | 149.47 | |
| | | | | | | | |
| | Cassava | (-) 2,000 | | | | | |
| | Vegetable | 8,600 | 28.3 | - | 28.3 | 243.38 | |
| | | | | | | | |
| | Dry. Total | | | | | (542.15) | |
| Grand Total | | | | | | 647.87 | = 648 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | KTL | ② |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 2,040 | 3.697 | 1.952 | 1.745 | 3.56 | |
| | | (B.C) 1,260 | 4.885 | 2.983 | 1.902 | 2.40 | |
| | | Total (3,300) | | | | | |
| | Maize | 1,700 | 0.470 | - | 0.47 | 0.80 | |
| | Cassava | (-) 1,700 | - | 4.338 | (-) 4.338 | 7.37 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (-) (0.61) | |
| Dry | Paddy | (B.C) 1,200 | 6.513 | - | 6.513 | 7.82 | |
| | Soybean | 1,600 | 4.097 | - | 4.097 | 6.56 | |
| | Mungbeea | 600 | 1.059 | | 1.059 | 0.64 | |
| | Grund nuts | 500 | 1.805 | | 1.805 | 0.90 | |
| | Orchard | 2,000 | 43.820 | - | 43.820 | 87.64 | |
| | | | | | | | |
| | Cassava | (-) 1,600 | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | (103.56) | |
| Grand Total | | | | | | 102.95 | = 103 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | MNN | ④ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 34,850 | 3.697 | 2.968 | 0.729 | 25.41 | |
| | | (B.C) 41,550 | 4.885 | 3.999 | 0.886 | 36.81 | |
| | | Total 76,400 | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (62.22) | |
| Dry | Paddy | (B.C) 15,000 | 6.513 | - | 6.513 | 97.70 | |
| | Soybean | - | | | | | |
| | Mungbeea | - | | | | | |
| | Grund nuts | - | | | | | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | (97.70) | |
| Grand Total | | | | | | 159.92 | = 160 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | UBP | ③ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 55,390 | 3.697 | 1.363 | 2.334 | 129.28 | |
| | | (B.C) 59,710 | 4.885 | 2.394 | 2.491 | 148.74 | |
| | | Total (115,100) | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) 8,500 | 28.3 | 21.4 | 6.9 | 58.65 | |
| | | (New) 4,500 | 28.3 | - | 28.3 | 127.35 | |
| | | (13,000) | | | | | |
| | Wets. Total | | | | | (464.02) | |
| Dry | Paddy | (B.C) 26,300 | 6.513 | - | 6.513 | 171.29 | |
| | Soybean | 23,500 | 4.097 | - | 4.097 | 96.28 | |
| | Mungbeea | 8,800 | 1.059 | - | 1.059 | 9.32 | |
| | Grund nuts | 8,800 | 1.805 | - | 1.805 | 15.88 | |
| | Orchard | 8,800 | 46.220 | 18.908 | 27.312 | 240.35 | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | 13,000 | 28.3 | - | 28.3 | 367.9 | |
| | | | | | | | |
| | Dry. Total | | | | | (901.02) | |
| Grand Total | | | | | | 1,365.04 | = 1,365 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | MPP |
|---|---|

⑤ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 10,320 | 3.697 | 1.031 | 2.666 | 27.51 | |
| | | (B.C) 5,180 | 4.885 | 2.062 | 2.823 | 14.62 | |
| | | Total (15,500) | | | | | |
| | Maize | 700 | 0.470 | - | 0.470 | 0.33 | |
| | Cassava | (-) 700 | - | 2.479 | (-) 2.479 | (-) 1.74 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (44.17) | |
| Dry | Paddy | (B.C) 1,600 | 6.513 | | 6.513 | 10.42 | |
| | Soybean | 5,500 | 4.097 | - | 4.097 | 22.53 | |
| | Mungbeea | 1,500 | 1.059 | - | 1.059 | 1.59 | |
| | Grund nuts | 1,500 | 1.805 | - | 1.805 | 2.71 | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | Cassava | (-) 600 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (51.40) | |
| Grand Total | | | | | | 95.57 | = 96 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | MHN |
|---|---|

⑥ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 21,600 | 3.697 | 1.542 | 2.155 | 46.55 | |
| | | (B.C) - | - | - | - | - | |
| | | Total (21,600) | | | | | |
| | Maize | 3,400 | 0.470 | - | 0.470 | 1.60 | |
| | Cassava | (-) 3,400 | - | 2.623 | 2.623 | (-) 8.92 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Wets. Total | | | | | (53.38) | |
| Dry | Paddy | (B.C) 21,600 | 6.513 | | 6.513 | 13.68 | |
| | Soybean | 10,700 | 4.097 | | 4.097 | 43.84 | |
| | Mungbeea | 1,700 | 1.059 | | 1.059 | 1.80 | |
| | Grund nuts | 1,700 | 1.805 | - | 1.805 | 3.07 | |
| | Orchard | 2,900 | 44.22 | - | 44.22 | 128.24 | |
| | | | | | | | |
| | Cassava | (-) 3,100 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | Paddy (wet) | (-) 2,900 | - | 1.542 | (-) 1.542 | (-) 4.47 | |
| | Dry. Total | | | | | (200.31) | |
| Grand Total | | | | | | 253.69 | = 254 |

## ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | KPS |
|---|---|

⑦ Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 15,430 | 3.697 | 2.603 | 1.094 | 16.88 | |
| | | (B.C) 6,270 | 4.885 | 3.634 | 1.251 | 7.84 | |
| | | Total (21,700) | | | | | |
| | Maize | 3,800 | 0.470 | - | 0.470 | 1.79 | |
| | Cassava | (-) 3,800 | - | 2.653 | 2.623 | (-) 10.08 | |
| | Vegetable | (Exist) 1,800 | 28.3 | 21.4 | 6.9 | 12.42 | |
| | | (New) 600 | 28.3 | - | 28.3 | 16.98 | |
| | | (2,400) | | | | | |
| | Wets. Total | | | | | (45.83) | |
| Dry | Paddy | (B.C) 2,200 | 6.513 | - | 6.513 | 14.33 | |
| | Soybean | 8,000 | 4.097 | | 4.097 | 32.78 | |
| | Mungbeea | 3,200 | 1.059 | | 1.059 | 3.39 | |
| | Grund nuts | 3,200 | 1.805 | | 1.805 | 5.78 | |
| | Orchard | 1,600 | 44.22 | - | 44.22 | 70.75 | |
| | | 500 | 46.22 | 12,020 | 34.20 | 17.10 | |
| | Cassava | (-) 3,500 | | | | | |
| | Vegetable | 2,400 | 28.3 | - | 28.3 | 67.92 | |
| | Paddy (wet) | (-) 1,600 | | 2.603 | (-) 2.603 | (-) 4.16 | |
| | Dry. Total | | | | | (207.89) | |
| Grand Total | | | | | | 253.72 | = 254 |

ALTERNATIVE DEVELOPMENT PLAN-1

| Irrigation Block | UPP |
|---|---|

⑧ Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,410 | 3.697 | 1.617 | 2.080 | 54.93 | |
| | | (B.C) 6,190 | 4.885 | 2.648 | 2.237 | 13.85 | |
| | | Total (32,600) | | | | | |
| | Maize | 4,600 | 0.470 | - | 0.470 | 2.16 | |
| | Cassava | (-) 4,600 | - | 2.472 | 2.472 | (-) 11.37 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) 1,200 | 28.3 | - | 28.3 | 33.96 | |
| | Paddy | (-) 1,200 | | 1.617 | (-) 1.617 | (-) 1.94 | |
| | Wets. Total | | | | | (95.04) | |
| Dry | Paddy | (B.C) 3,300 | 6.513 | - | 6.513 | 21.49 | |
| | Soybean | 12,700 | 4.097 | - | 4.097 | 52.03 | |
| | Mungbeea | 3,700 | 1.059 | - | 1.059 | 3.92 | |
| | Grund nuts | 3,900 | 1.805 | - | 1.805 | 7.04 | |
| | Orchard | 3,500 | 44.200 | - | 44.200 | 154.70 | |
| | | | | | | | |
| | Cassava | (-) 4,200 | | | | | |
| | Vegetable | 3,000 | 28.3 | - | 28.3 | 84.90 | |
| | Paddy | (-) 4,70 | | 1.617 | | (-) 7.60 | |
| | Dry. Total | | | | | (316.48) | |
| Grand Total | | | | | | 411.52 | = 412 |

TABLE I-2-21 ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | LBP | ① |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,480 | 3.697 | 3.290 | 0.407 | 10.78 | |
| | | (B.C) 26,920 | 4.885 | 4.321 | 0.564 | 15.18 | |
| | | Total (53,400) | | | | | |
| | Maize | 2,200 | 0.470 | - | 0.47 | 1.03 | |
| | Cassava | (-) 2,200 | - | 3.833 | (-) 3.833 | (-) 8.43 | |
| | Vegetable | (Exist) 7,300 | 28.3 | 21.4 | 6.9 | 50.37 | |
| | | (New) 1,300 | 28.3 | - | 28.3 | 36.79 | |
| | | (8,600) | | | | | |
| | Wets. Total | | | | | (105.72) | |
| Dry | Paddy | (B.C) 9,600 | 6.513 | - | 6.513 | 62.52 | |
| | Soybean | 8,000 | 4.097 | - | 4.097 | 32.78 | |
| | Mungbeea | 5,500 | 1.059 | - | 1.059 | 5.82 | |
| | Grund nuts | 5,400 | 1.805 | - | 1.805 | 9.75 | |
| | Orchard | 4,900 | 46.220 | 12.753 | 33.467 | 164.0 | |
| | | | | | | | |
| | Cassava | (-) 2,000 | | | | | |
| | Vegetable | 8,600 | 28.3 | - | 28.3 | 243.38 | |
| | | | | | | | |
| | Dry. Total | | | | | (518.25) | |
| Grand Total | | | | | | 623.9 | = 624 |

## ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | KTL | ② |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 2,040 | 3.697 | 1.952 | 1.745 | 3.56 | |
| | | (B.C) 1,260 | 4.885 | 2.983 | 1.902 | 2.40 | |
| | | Total (3,300) | | | | | |
| | Maize | 1,700 | 0.470 | - | 0.47 | 0.80 | |
| | Cassava | (-) 1,700 | - | 4.338 | (-) 4.338 | 7.37 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (-) ( 0.61 ) | |
| Dry | Paddy | (B.C) 700 | 6.513 | - | 6.513 | 4.56 | |
| | Soybean | 1,600 | 4.097 | - | 4.097 | 6.56 | |
| | Mungbeea | 600 | 1.059 | | 1.059 | 0.64 | |
| | Grund nuts | 500 | 1.805 | | 1.805 | 0.90 | |
| | Orchard | 2,000 | 43.820 | - | 43.820 | 87.64 | |
| | | | | | | | |
| | Cassava | (-) 1,600 | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | (100.3) | |
| Grand Total | | | | | | 99.69 | = 100 |

## ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | MNN | ④ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|---|
| | | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) | 34,850 | 3.697 | 2.968 | 0.729 | 25.41 | |
| | | (B.C) | 41,550 | 4.885 | 3.999 | 0.886 | 36.81 | |
| | | Total | 76,400 | | | | | |
| | Maize | | - | | | | | |
| | Cassava | | - | | | | | |
| | Vegetable | (Exist) | - | | | | | |
| | | (New) | - | | | | | |
| | | | | | | | | |
| | Wets. Total | | | | | | (62.22) | |
| Dry | Paddy | (B.C) | 11,500 | 6.513 | - | 6.513 | 74.90 | |
| | Soybean | | - | | | | | |
| | Mungbeea | | - | | | | | |
| | Grund nuts | | - | | | | | |
| | Orchard | | - | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | Vegetable | | - | | | | | |
| | | | | | | | | |
| | Dry. Total | | | | | | (74.90) | |
| Grand Total | | | | | | | 137.12 | = 160 |

## ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | UBP | ③ |
|---|---|---|

### Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 55,390 | 3.697 | 1.363 | 2.334 | 129.28 | |
| | | (B.C) 59,710 | 4.885 | 2.394 | 2.491 | 148.74 | |
| | | Total (115,100) | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) 8,500 | 28.3 | 21.4 | 6.9 | 58.65 | |
| | | (New) 4,500 | 28.3 | - | 28.3 | 127.35 | |
| | | (13,000) | | | | | |
| | Wets. Total | | | | | (464.02) | |
| Dry | Paddy | (B.C) 16,400 | 6.513 | - | 6.513 | 171.29 | |
| | Soybean | 23,500 | 4.097 | - | 4.097 | 96.28 | |
| | Mungbeea | 8,800 | 1.059 | - | 1.059 | 9.32 | |
| | Grund nuts | 8,800 | 1.805 | - | 1.805 | 15.88 | |
| | Orchard | 8,800 | 46.220 | 18.908 | 27.312 | 240.35 | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | 13,000 | 28.3 | - | 28.3 | 367.9 | |
| | | | | | | | |
| | Dry. Total | | | | | (836.54) | |
| Grand Total | | | | | | 1,300.56 | = 1,300 |

ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | MPP |
|---|---|

⑤ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 10,320 | 3.697 | 1.031 | 2.666 | 27.51 | |
| | | (B.C) 5,180 | 4.885 | 2.062 | 2.823 | 14.62 | |
| | | Total (15,500) | | | | | |
| | Maize | 700 | 0.470 | - | 0.470 | 0.33 | |
| | Cassava | (-) 700 | - | 2.479 | (-) 2.479 | (-) 1.74 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (44.17) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 5,500 | 4.097 | - | 4.097 | 22.53 | |
| | Mungbeea | 1,500 | 1.059 | - | 1.059 | 1.59 | |
| | Grund nuts | 1,500 | 1.805 | - | 1.805 | 2.71 | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | Cassava | (-) 600 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (40.98) | |
| Grand Total | | | | | | 85.15 | = 85 |

## ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | MHN |
|---|---|

⑥ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 21,600 | 3.697 | 1.542 | 2.155 | 46.55 | |
| | | (B.C) - | - | - | - | - | |
| | | Total (21,600) | | | | | |
| | Maize | 3,400 | 0.470 | - | 0.470 | 1.60 | |
| | Cassava | (-) 3,400 | - | 2.623 | 2.623 | (-) 8.92 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Wets. Total | | | | | (53.38) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 10,700 | 4.097 | | 4.097 | 43.84 | |
| | Mungbeea | 1,700 | 1.059 | | 1.059 | 1.80 | |
| | Grund nuts | 1,700 | 1.805 | - | 1.805 | 3.07 | |
| | Orchard | 2,900 | 44.220 | - | 44.220 | 128.24 | |
| | | | | | | | |
| | Cassava | (-) 3,100 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | Paddy (wet) | (-) 2,900 | - | 1.542 | (-) 1.542 | (-) 4.47 | |
| | Dry. Total | | | | | (186.63) | |
| Grand Total | | | | | | 240.01 | = 240 |

## ALTERNATIVE DEVELOPMENT PLAN-2

Irrigation Block | KPS ⑦ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 15,430 | 3.697 | 2.603 | 1.094 | 16.88 | |
| | | (B.C) 6,270 | 4.885 | 3.634 | 1.251 | 7.84 | |
| | | Total (21,700) | | | | | |
| | Maize | 3,800 | 0.470 | - | 0.470 | 1.79 | |
| | Cassava | (-) 3,800 | - | 2.653 | 2.623 | (-) 10.08 | |
| | Vegetable | (Exist) 1,800 | 28.3 | 21.4 | 6.9 | 12.42 | |
| | | (New) 600 | 28.3 | - | 28.3 | 16.98 | |
| | | (2,400) | | | | | |
| | Wets. Total | | | | | (45.83) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 8,000 | 4.097 | | 4.097 | 32.78 | |
| | Mungbeea | 3,200 | 1.059 | | 1.059 | 3.39 | |
| | Grund nuts | 3,200 | 1.805 | | 1.805 | 5.78 | |
| | Orchard | 1,600 | 44.22 | - | 44.22 | 70.75 | |
| | | 500 | 46.22 | 12.020 | 34.20 | 17.10 | |
| | Cassava | (-) 3,500 | | | | | |
| | Vegetable | 2,400 | 28.3 | - | 28.3 | 67.92 | |
| | Paddy (wet) | (-) 1,600 | | 2.603 | (-) 2.603 | (-) 4.16 | |
| | Dry. Total | | | | | (193.56) | |
| Grand Total | | | | | | 239.39 | = 239 |

ALTERNATIVE DEVELOPMENT PLAN-2

| Irrigation Block | UPP |
|---|---|

⑧ Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,410 | 3.697 | 1.617 | 2.080 | 54.93 | |
| | | (B.C) 6,190 | 4.885 | 2.648 | 2.237 | 13.85 | |
| | | Total (32,600) | | | | | |
| | Maize | 4,600 | 0.470 | - | 0.470 | 2.16 | |
| | Cassava | (-) 4,600 | - | 2.472 | 2.472 | (-) 11.37 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) 1,200 | 28.3 | - | 28.3 | 33.96 | |
| | Paddy | (-) 1,200 | | 1.617 | (-) 1.617 | (-) 1.94 | |
| | Wets. Total | | | | | (95.04) | |
| Dry | Paddy | (B.C) | | | | | |
| | Soybean | 12,700 | 4.097 | - | 4.097 | 52.03 | |
| | Mungbeea | 3,700 | 1.059 | - | 1.059 | 3.92 | |
| | Grund nuts | 3,900 | 1.805 | - | 1.805 | 7.04 | |
| | Orchard | 3,500 | 44.200 | - | 44.200 | 154.70 | |
| | | | | | | | |
| | Cassava | (-) 4,200 | | | | | |
| | Vegetable | 3,000 | 28.3 | - | 28.3 | 84.90 | |
| | Paddy | (-) 4,70 | | 1.617 | | (-) 7.60 | |
| | Dry. Total | | | | | (294.99) | |
| Grand Total | | | | | | 390.03 | = 390 |

TABLE I-2-22 ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | LBP | ① |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,480 | 3.697 | 3.290 | 0.407 | 10.78 | |
| | | (B.C) 26,920 | 4.885 | 4.321 | 0.564 | 15.18 | |
| | | Total (53,400) | | | | | |
| | Maize | 2,200 | 0.470 | - | 0.47 | 1.03 | |
| | Cassava | (-) 2,200 | - | 3.833 | (-) 3.833 | (-) 8.43 | |
| | Vegetable | (Exist) 7,300 | 28.3 | 21.4 | 6.9 | 50.37 | |
| | | (New) 1,300 | 28.3 | - | 28.3 | 36.79 | |
| | | (8,600) | | | | | |
| | Wets. Total | | | | | (105.72) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | 8,000 | 4.097 | - | 4.097 | 32.78 | |
| | Mungbeea | 5,500 | 1.059 | - | 1.059 | 5.82 | |
| | Grund nuts | 5,400 | 1.805 | - | 1.805 | 9.75 | |
| | Orchard | 4,900 | 46.220 | 15.716 | 30.504 | 149.47 | |
| | | | | | | | |
| | Cassava | (-) 2,000 | | | | | |
| | Vegetable | 8,600 | 28.3 | - | 28.3 | 243.38 | |
| | | | | | | | |
| | Dry. Total | | | | | (441.20) | |
| Grand Total | | | | | | 546.92 | = 547 |

## ALTERNATIVE DEVELOPMENT PLAN-3

Irrigation Block | KTL ②

### Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 2,040 | 3.697 | 1.952 | 1.745 | 3.56 | |
| | | (B.C) 1,260 | 4.885 | 2.983 | 1.902 | 2.40 | |
| | | Total (3,300) | | | | | |
| | Maize | 1,700 | 0.470 | - | 0.47 | 0.80 | |
| | Cassava | (-) 1,700 | - | 4.338 | (-) 4.338 | 7.37 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (-) (0.61) | |
| Dry | Paddy | (B.C) - | 6.513 | - | - | - | |
| | Soybean | 1,600 | 4.097 | - | 4.097 | 6.56 | |
| | Mungbeea | 600 | 1.059 | | 1.059 | 0.64 | |
| | Grund nuts | 500 | 1.805 | | 1.805 | 0.90 | |
| | Orchard | 2,000 | 43.820 | - | 43.820 | 87.64 | |
| | | | | | | | |
| | Cassava | (-) 1,600 | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | (95.74) | |
| Grand Total | | | | | | 95.13 | = 95 |

## ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | MNN | ④ |
|---|---|---|

Incremental NPV

*(Unit) million Baht*

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 34,850 | 3.697 | 2.968 | 0.729 | 25.41 | |
| | | (B.C) 41,550 | 4.885 | 3.999 | 0.886 | 36.81 | |
| | | Total 76,400 | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (62.22) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | - | | | | | |
| | Mungbeea | - | | | | | |
| | Grund nuts | - | | | | | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | | |
| Grand Total | | | | | | 62.22 | = 62 |

## ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | UBP | ③ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 55,390 | 3.697 | 1.363 | 2.334 | 129.28 | |
| | | (B.C) 59,710 | 4.885 | 2.394 | 2.491 | 148.74 | |
| | | Total (115,100) | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) 8,500 | 28.3 | 21.4 | 6.9 | 58.65 | |
| | | (New) 4,500 | 28.3 | - | 28.3 | 127.35 | |
| | | (13,000) | | | | | |
| | Wets. Total | | | | | (464.02) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | 23,500 | 4.097 | - | 4.097 | 96.28 | |
| | Mungbeea | 8,800 | 1.059 | - | 1.059 | 9.32 | |
| | Grund nuts | 8,800 | 1.805 | - | 1.805 | 15.88 | |
| | Orchard | 8,800 | 46.220 | 18.908 | 27.312 | 240.35 | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | 13,000 | 28.3 | - | 28.3 | 367.9 | |
| | | | | | | | |
| | Dry. Total | | | | | (729.73) | |
| Grand Total | | | | | | 1,193.75 | = 1,194 |

## ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | MPP |
|---|---|

⑤ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 10,320 | 3.697 | 1.031 | 2.666 | 27.51 | |
| | | (B.C) 5,180 | 4.885 | 2.062 | 2.823 | 14.62 | |
| | | Total (15,500) | | | | | |
| | Maize | 700 | 0.470 | - | 0.470 | 0.33 | |
| | Cassava | (-) 700 | - | 2.479 | (-) 2.479 | (-) 1.74 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (44.17) | |
| Dry | Paddy | (B.C) - | | | | 10.42 | |
| | Soybean | 5,500 | 4.097 | - | 4.097 | 22.53 | |
| | Mungbeea | 1,500 | 1.059 | - | 1.059 | 1.59 | |
| | Grund nuts | 1,500 | 1.805 | - | 1.805 | 2.71 | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | Cassava | (-) 600 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (40.98) | |
| Grand Total | | | | | | 85.15 | = 85 |

## ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | MHN | ⑥ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 21,600 | 3.697 | 1.542 | 2.155 | 46.55 | |
| | | (B.C) - | - | - | - | - | |
| | | Total (21,600) | | | | | |
| | Maize | 3,400 | 0.470 | - | 0.470 | 1.60 | |
| | Cassava | (-) 3,400 | - | 2.623 | 2.623 | (-) 8.92 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Wets. Total | | | | | (53.38) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 10,700 | 4.097 | | 4.097 | 43.84 | |
| | Mungbeea | 1,700 | 1.059 | | 1.059 | 1.80 | |
| | Grund nuts | 1,700 | 1.805 | - | 1.805 | 3.07 | |
| | Orchard | 2,900 | 44.220 | - | 44.220 | 128.24 | |
| | | | | | | | |
| | Cassava | (-) 3,100 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | Paddy (wet) | (-) 2,900 | - | 1.542 | (-) 1.542 | (-) 4.47 | |
| | Dry. Total | | | | | (186.63) | |
| Grand Total | | | | | | 240.01 | = 240 |

## ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | KPS |
|---|---|

⑦ Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 15,430 | 3.697 | 2.603 | 1.094 | 16.88 | |
| | | (B.C) 6,270 | 4.885 | 3.634 | 1.251 | 7.84 | |
| | | Total (21,700) | | | | | |
| | Maize | 3,800 | 0.470 | - | 0.470 | 1.79 | |
| | Cassava | (-) 3,800 | - | 2.653 | 2.623 | (-) 10.08 | |
| | Vegetable | (Exist) 1,800 | 28.3 | 21.4 | 6.9 | 12.42 | |
| | | (New) 600 | 28.3 | - | 28.3 | 16.98 | |
| | | (2,400) | | | | | |
| | Wets. Total | | | | | (45.83) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 8,000 | 4.097 | | 4.097 | 32.78 | |
| | Mungbeea | 3,200 | 1.059 | | 1.059 | 3.39 | |
| | Grund nuts | 3,200 | 1.805 | | 1.805 | 5.78 | |
| | Orchard | 1,600 | 44.22 | - | 44.22 | 70.75 | |
| | | 500 | 46.22 | 12.020 | 34.20 | 17.10 | |
| | Cassava | (-) 3,500 | | | | | |
| | Vegetable | 2,400 | 28.3 | - | 28.3 | 67.92 | |
| | Paddy (wet) | (-) 1,600 | | 2.603 | (-) 2.603 | (-) 4.16 | |
| | Dry. Total | | | | | (193.56) | |
| Grand Total | | | | | | 239.39 | = 239 |

ALTERNATIVE DEVELOPMENT PLAN-3

| Irrigation Block | UPP |
|---|---|

⑧ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,410 | 3.697 | 1.617 | 2.080 | 54.93 | |
| | | (B.C) 6,190 | 4.885 | 2.648 | 2.237 | 13.85 | |
| | | Total (32,600) | | | | | |
| | Maize | 4,600 | 0.470 | - | 0.470 | 2.16 | |
| | Cassava | (-) 4,600 | - | 2.472 | 2.472 | (-) 11.37 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) 1,200 | 28.3 | - | 28.3 | 33.96 | |
| | Paddy | (-) 1,200 | | 1.617 | (-) 1.617 | (-) 1.94 | |
| | Wets. Total | | | | | (95.04) | |
| Dry | Paddy | (B.C) | | | | | |
| | Soybean | 12,700 | 4.097 | - | 4.097 | 52.03 | |
| | Mungbeea | 3,700 | 1.059 | - | 1.059 | 3.92 | |
| | Grund nuts | 3,900 | 1.805 | - | 1.805 | 7.04 | |
| | Orchard | 3,500 | 44.200 | - | 44.200 | 154.70 | |
| | | | | | | | |
| | Cassava | (-) 4,200 | | | | | |
| | Vegetable | 3,000 | 28.3 | - | 28.3 | 84.90 | |
| | Paddy | (-) 4,70 | | 1.617 | | (-) 7.60 | |
| | Dry. Total | | | | | (294.99) | |
| Grand Total | | | | | | 390.03 | = 390 |

TABLE I-2-23 ALTERNATIVE DEVELOPMENT PLAN-4

| Irrigation Block | LBP | ① |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 26,480 | 3.697 | 3.290 | 0.407 | 10.78 | |
| | | (B.C) 26,920 | 4.885 | 4.321 | 0.564 | 15.18 | |
| | | Total (53,400) | | | | | |
| | Maize | 2,200 | 0.470 | - | 0.47 | 1.03 | |
| | Cassava | (-) 2,200 | - | 3.833 | (-) 3.833 | (-) 8.43 | |
| | Vegetable | (Exist) 7,300 | 28.3 | 21.4 | 6.9 | 50.37 | |
| | | (New) 1,300 | 28.3 | - | 28.3 | 36.79 | |
| | | (8,600) | | | | | |
| | Wets. Total | | | | | (105.72) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | - | - | - | - | - | |
| | Mungbeea | 1,000 | 1.059 | - | 1.059 | 1.06 | |
| | Grund nuts | 1,000 | 1.805 | - | 1.805 | 1.81 | |
| | Orchard | 4,900 | 46.220 | 15.716 | 30.504 | 149.47 | |
| | | | | | | | |
| | Cassava | (-) 2,000 | | | | | |
| | Vegetable | 8,600 | 28.3 | - | 28.3 | 243.38 | |
| | | | | | | | |
| | Dry. Total | | | | | (395.72) | |
| Grand Total | | | | | | 501.44 | = 501 |

## ALTERNATIVE DEVELOPMENT PLAN-4

Irrigation Block | KTL | ②

### Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 2,040 | 3.697 | 1.952 | 1.745 | 3.56 | |
| | | (B.C) 1,260 | 4.885 | 2.983 | 1.902 | 2.40 | |
| | | Total (3,300) | | | | | |
| | Maize | 1,700 | 0.470 | - | 0.47 | 0.80 | |
| | Cassava | (-) 1,700 | - | 4.338 | (-) 4.338 | 7.37 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (-) (0.61) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | 1,000 | 4.097 | - | 4.097 | 4.10 | |
| | Mungbeea | 300 | 1.059 | | 1.059 | 0.32 | |
| | Grund nuts | 300 | 1.805 | | 1.805 | 0.54 | |
| | Orchard | 2,000 | 43.82 | - | 43.82 | 87.64 | |
| | | | | | | | |
| | Cassava | (-) 1,600 | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | (92.6) | |
| Grand Total | | | | | | 91.99 | = 92 |

## ALTERNATIVE DEVELOPMENT PLAN-4

| Irrigation Block | MNN | ④ |
|---|---|---|

Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 34,850 | 3.697 | 2.968 | 0.729 | 25.41 | |
| | | (B.C) 41,550 | 4.885 | 3.999 | 0.886 | 36.81 | |
| | | Total 76,400 | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (62.22) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | - | | | | | |
| | Mungbeea | - | | | | | |
| | Grund nuts | - | | | | | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | - | | | | | |
| | | | | | | | |
| | Dry. Total | | | | | | |
| Grand Total | | | | | | 62.22 | = 62 |

## ALTERNATIVE DEVELOPMENT PLAN-4

Irrigation Block | UBP ③

### Incremental NPV

(Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 55,390 | 3.697 | 1.363 | 2.334 | 129.28 | |
| | | (B.C) 59,710 | 4.885 | 2.394 | 2.491 | 148.74 | |
| | | Total (115,100) | | | | | |
| | Maize | - | | | | | |
| | Cassava | - | | | | | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | - | - | - | - | |
| | | (500) | | | | | |
| | Wets. Total | | | | | (281.47) | |
| Dry | Paddy | (B.C) - | - | - | - | - | |
| | Soybean | 1,000 | 4.097 | - | 4.097 | 4.10 | |
| | Mungbeea | 1,100 | 1.059 | - | 1.059 | 1.16 | |
| | Grund nuts | 1,000 | 1.805 | - | 1.805 | 1.81 | |
| | Orchard | 2,900 | 46.22 | 18.908 | 27.312 | 79.20 | |
| | | | | | | | |
| | | | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (100.42) | |
| Grand Total | | | | | | 381.89 | = 382 |

## ALTERNATIVE DEVELOPMENT PLAN-4

| Irrigation Block | MPP |
|---|---|

⑤ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 10,320 | 3.697 | 1.031 | 2.666 | 27.51 | |
| | | (B.C) 5,180 | 4.885 | 2.062 | 2.823 | 14.62 | |
| | | Total (15,500) | | | | | |
| | Maize | 700 | 0.470 | - | 0.470 | 0.33 | |
| | Cassava | (-) 700 | - | 2.479 | (-) 2.479 | (-) 1.74 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (44.17) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | | - | - | - | - | |
| | Mungbeea | 300 | 1.059 | - | 1.059 | 0.32 | |
| | Grund nuts | 300 | 1.805 | - | 1.805 | 0.54 | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | Cassava | (-) 600 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (15.01) | |
| Grand Total | | | | | | 59.18 | = 59 |

## ALTERNATIVE DEVELOPMENT PLAN-4

| Irrigation Block | MPP |
|---|---|

⑤ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 10,320 | 3.697 | 1.031 | 2.666 | 27.51 | |
| | | (B.C) 5,180 | 4.885 | 2.062 | 2.823 | 14.62 | |
| | | Total (15,500) | | | | | |
| | Maize | 700 | 0.470 | - | 0.470 | 0.33 | |
| | Cassava | (-) 700 | - | 2.479 | (-) 2.479 | (-) 1.74 | |
| | Vegetable | (Exist) 500 | 28.3 | 21.4 | 6.9 | 3.45 | |
| | | (New) - | | | | | |
| | | | | | | | |
| | Wets. Total | | | | | (44.17) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | | - | - | - | - | |
| | Mungbeea | 300 | 1.059 | - | 1.059 | 0.32 | |
| | Grund nuts | 300 | 1.805 | - | 1.805 | 0.54 | |
| | Orchard | - | | | | | |
| | | | | | | | |
| | Cassava | (-) 600 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Dry. Total | | | | | (15.01) | |
| Grand Total | | | | | | 59.18 | = 59 |

## ALTERNATIVE DEVELOPMENT PLAN-4

Irrigation Block | MHN ⑥ Incremental NPV (Unit) million Baht

| Season | Crop | Cropped Area (ha) | N.P.V per ha 1,000 Baht | | | Incremental NPV | |
|---|---|---|---|---|---|---|---|
| | | | w. p | w/o p | Increment | | |
| Wet | Paddy | (T.P) 21,600 | 3.697 | 1.542 | 2.155 | 46.55 | |
| | | (B.C) - | - | - | - | - | |
| | | Total (21,600) | | | | | |
| | Maize | 3,400 | 0.470 | - | 0.470 | 1.60 | |
| | Cassava | (-) 3,400 | - | 2.623 | 2.623 | (-) 8.92 | |
| | Vegetable | (Exist) - | | | | | |
| | | (New) 500 | 28.3 | - | 28.3 | 14.15 | |
| | | | | | | | |
| | Wets. Total | | | | | (53.38) | |
| Dry | Paddy | (B.C) - | | | | | |
| | Soybean | 1,000 | 4.097 | | 4.097 | 4.10 | |
| | Mungbeea | 1,100 | 1.059 | | 1.059 | 1.16 | |
| | Grund nuts | 1,000 | 1.805 | - | 1.805 | 1.81 | |
| | Orchard | 2,900 | 44.22 | - | 44.22 | 128.24 | |
| | | | | | | | |
| | Cassava | (-) 3,100 | | | | | |
| | Vegetable | 500 | 28.3 | - | 28.3 | 14.15 | |
| | Paddy (wet) | (-) 2,900 | - | 1.542 | (-) 1.542 | (-) 4.47 | |
| | Dry. Total | | | | | (144.99) | |
| Grand Total | | | | | | 198.37 | = 198 |