FIGURE 3

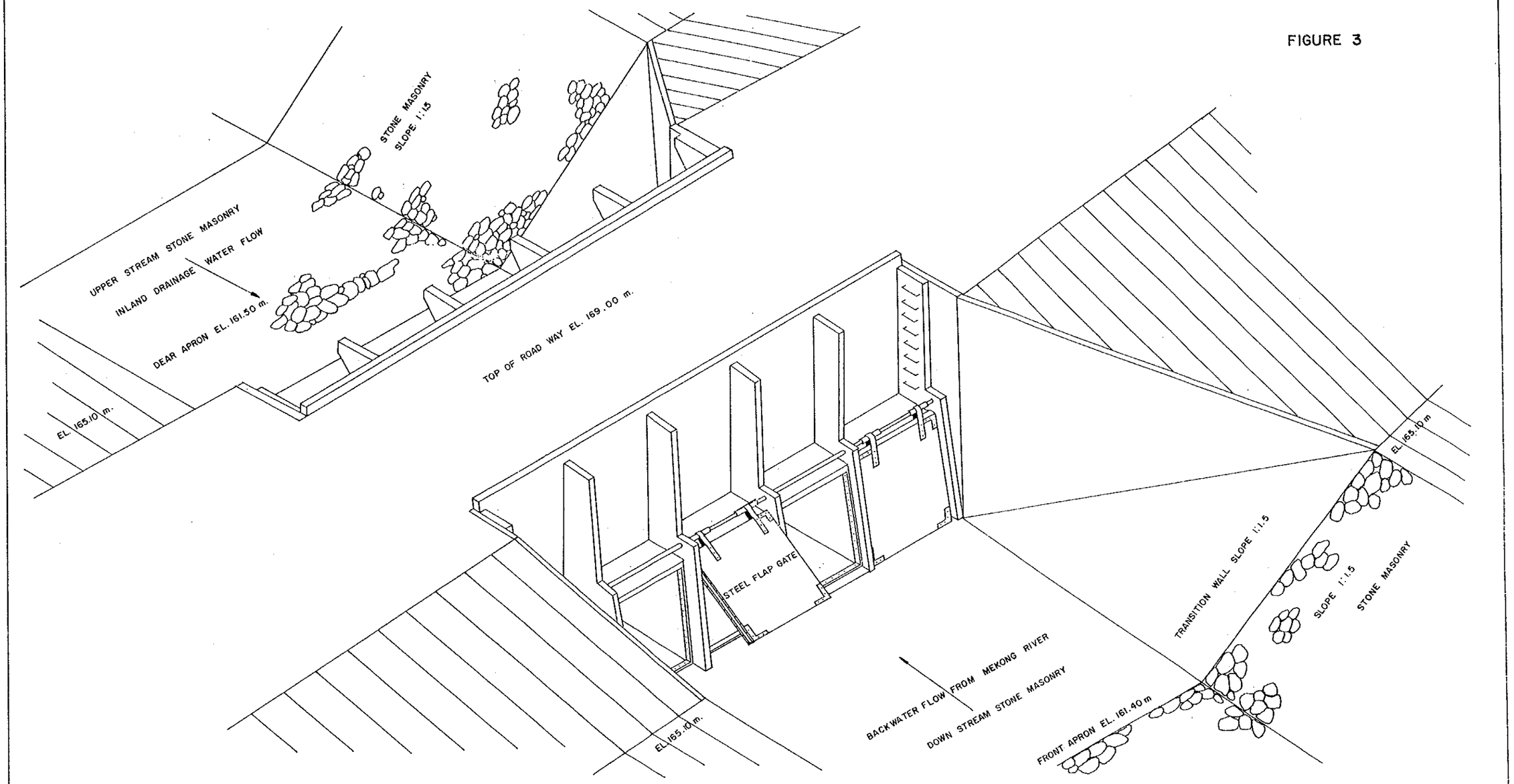

STONE MASONRY
SLOPE 1:1.5
UPPER STREAM STONE MASONRY
INLAND DRAINAGE WATER FLOW
DEAR APRON EL. 161.50 m.
TOP OF ROAD WAY EL. 169.00 m.
EL 165.10 m.
STEEL FLAP GATE
EL 165.10 m.
BACKWATER FLOW FROM MEKONG RIVER
DOWN STREAM STONE MASONRY
FRONT APRON EL. 161.40 m
TRANSITION WALL SLOPE 1:1.5
SLOPE 1:1.5
STONE MASONRY
EL 165.10 m

FIGURE 4.

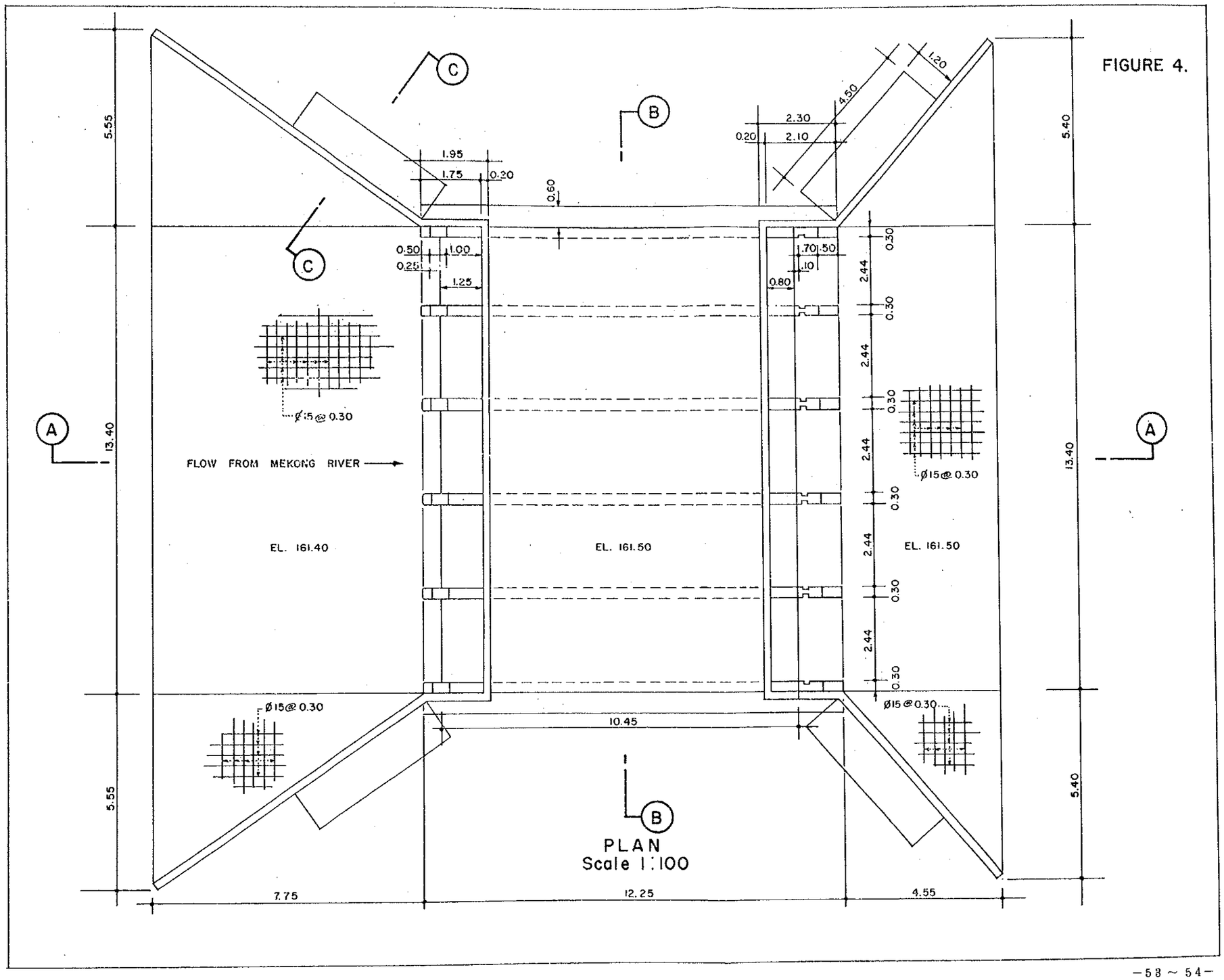
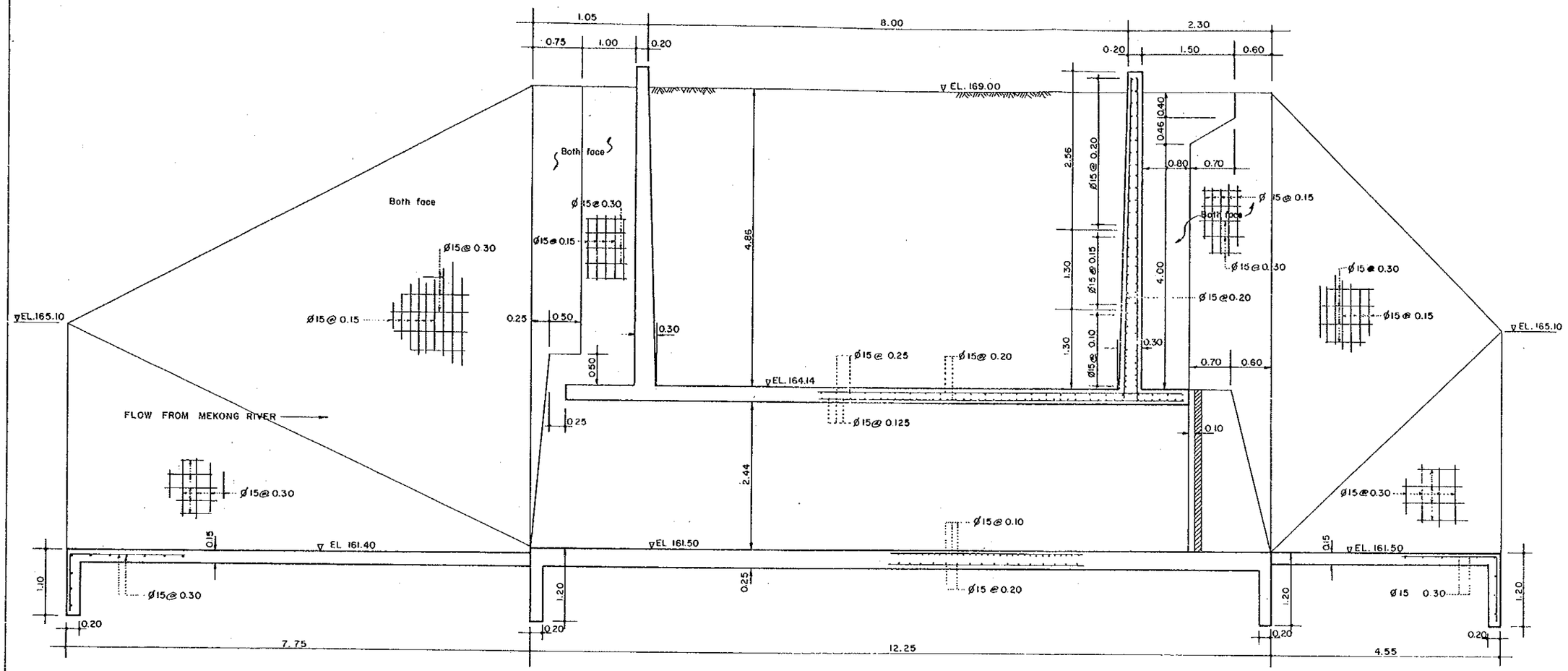

C
B
C
A
A
5.55
13.40
1.95
1.75
0.20
0.60
2.30
0.20
2.10
4.50
1.20
5.40
0.50
0.25
1.00
1.25
0.80
.70
.50
.10
0.30
2.44
0.30
2.44
0.30
2.44
0.30
2.44
0.30
Ø15@0.30
Ø15@0.30
Ø15@0.30
Ø15@0.30
FLOW FROM MEKONG RIVER
EL. 161.40
EL. 161.50
EL. 161.50
10.45
B
PLAN
Scale 1:100
5.55
5.40
7.75
12.25
4.55

FIGURE 5



SECTION A–A
Scale 1 : 50

資料 5

Committee for Coordination of Investigations of the Lower Mekong Basin (Democratic Kampuchea, Lao PDR, Socialist Republic of Viet-Nam and Thailand)

30 September 1977

CASIER SUD FLOOD PROTECTION SCHEME

(Project IV-5.1)

Progress report by the Secretariat

No. 1

CASIER SUD FLOOD PROTECTION SCHEME

Progress Report No.1, 30 September 1977

* * * * * *

Project No. IV-5.1

Site : Houei Deua flood control structure

Date approved : July 1977

Funds granted : US$ 110,000

Funds received : US$ 110,000

Funds disbursed as per 30 September, see Annex 1

1. Action taken by the Mekong Secretarist

1.1 Detailed reconnaissance of the construction site and design of the flood control structure.

1.2 Procurement and shipment of necessary construction materials to the job-site, from Bangkok, as follows :

- . 130 tons cement
- . 45 tons steel bar
- . 400 ky steel wire
- . 940 ky nails
- . 15 sq. m of elastite
- . prefabricated steel gates

(5 sets of flap-gates, 5 sets of sluice-gates) and 5 sets of screens.

1.3 Regular visits by specialists of the Mekong Secretariat to the job-site for discussion and advice during construction.

2. Action taken by Government of the Lao PDR

2.1 Provision of construction materials, including heavy equipment, local materials such as gravel, sand and wood.

2.2 Mobilisation of labour of up to 2000 men.

3. Accomplishments

3.1 Preparation of the foundation.

3.2 Construction of the flood protection levees extending on both sides of the job-site.

3.3 Casting of reinforced concrete for the box-culverts (accomplished

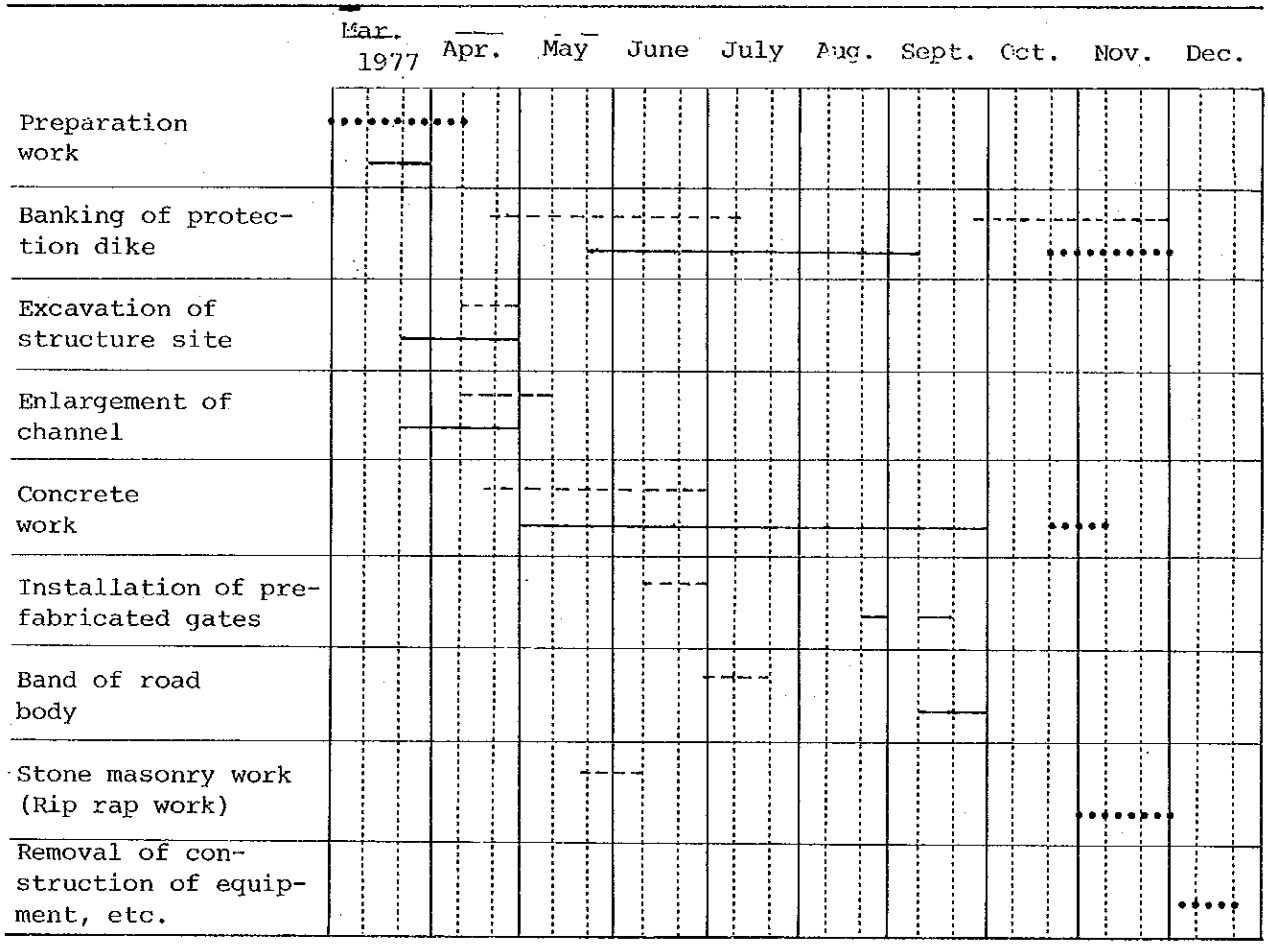
early August).

3.4 Casting of reinforced concrete for the side and wing walls of the culverts (started early August and continuing).

3.5 Installation of flap-gates, sluice-gates and screens.

3.6 Construction of the road body on both sides of the gated structure (started late August).

4. Table showing actual progress in comparison with the construction programme as planned



Note : Planned programme : - - - - - -

Real progress : ————

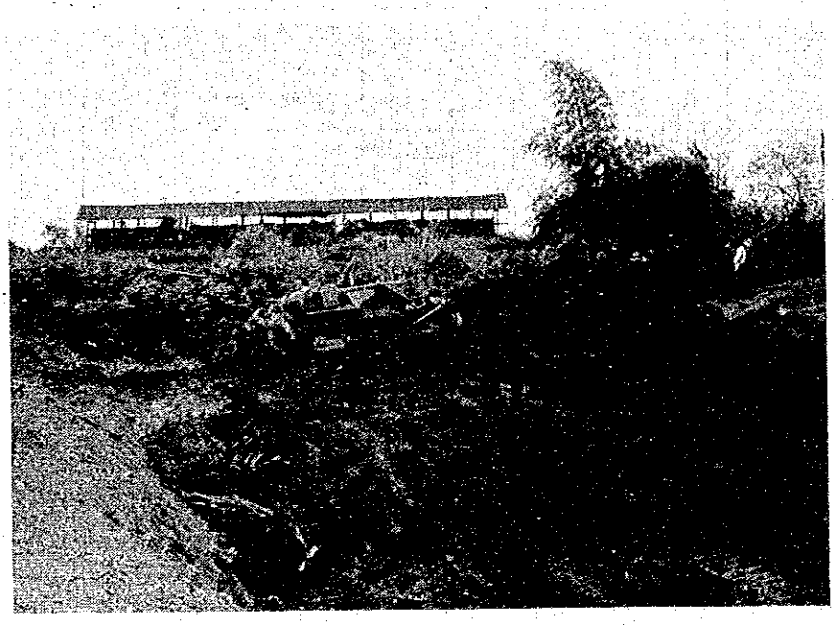
Expected schedule for future : •••••••

5. Expected date of completion of the entire project 31 December 1977

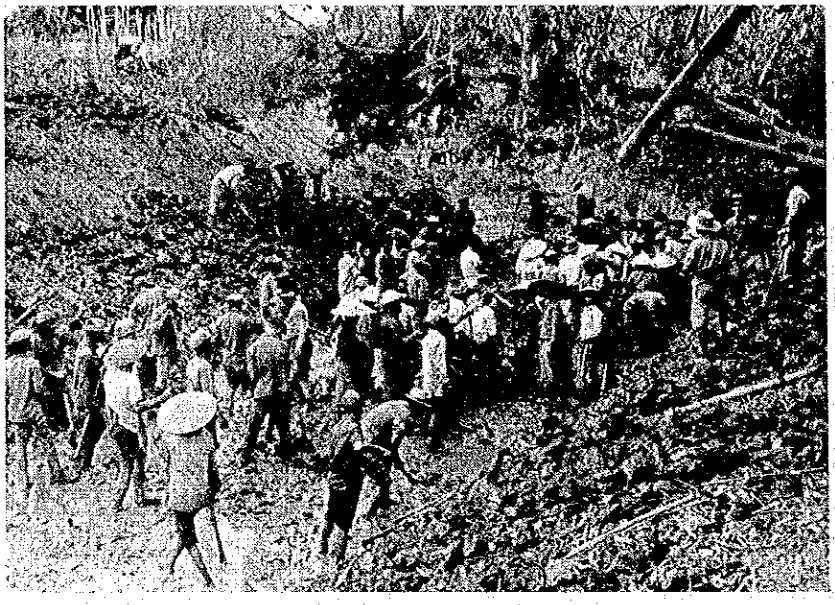
6. Photographs showing progress

6.1 Construction job-site

6.2 Excavation of structure site

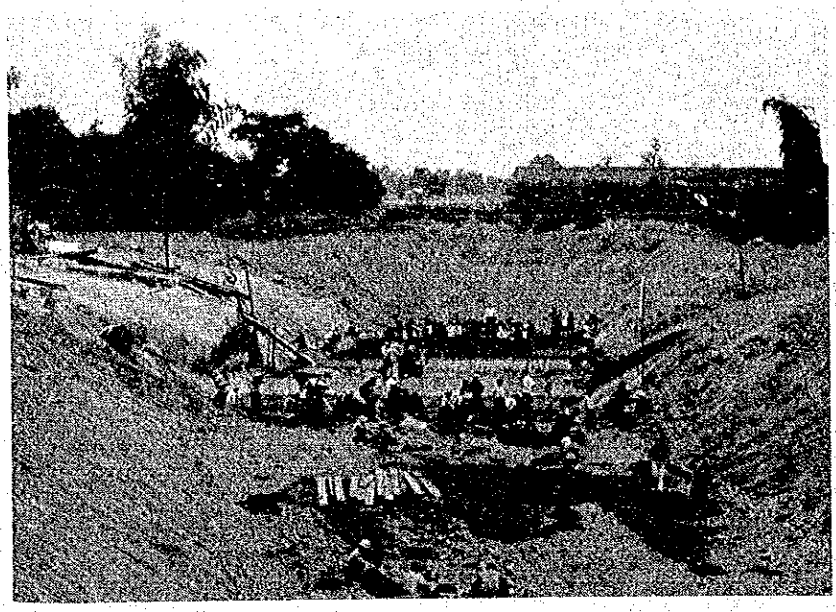


6.3 Enlargement of channel by hand labour



6.4 Improved drainage channel

6.5 Casting of reinforced concrete work



6.6 Situation in early August

Committee for Coordination of Investigations of the Lower Mekong Basin		FUND STATUS REPORT		
Project title: Casier Sud Pioneer Agriculture Project (Water Control Structure at Houei Deua) (Ref: Project No. IV-5.1)		Date of Letter of Agreement -	Fund granted US$110,000.00	Fund received US$110,000.00
Name, title and signature Henry Beyda, Chief Mekong Administrative Section		Period ending 30 September 1977		Date of report 30 September 1977

Expense Classification	Cumulative Funds Received	Commitments	EXPENDITURE			Unexpended Balance
			Cumulative	Current 1/4-30/9/77	Cumulative to date	
Equipment		-	-	$32,791.99	$32,791.99	
Transportation of equipment		-	-	2,823.28	2,823.28	
Advances (for local expenditures)		-	-	10,000.00	10,000.00	
TOTAL	$110,000.00	-	-	$45,615.27	$45,615.27	$64,384.73

資料 6

30 May 1977

PROJECT DATA SHEET

PROJECT MUMBER AND TITLE IV-5.2 HOUEI MAK HIAO FLOOD CONTROL STRUCTURE

Index number and title of related project in Committee's work programme [1] : 2.6.3 IRRIGATION DEVELOPMENT PLANNING, VIENTIANE PLAIN

---

1. BACKGROUND

As mentioned in the project data sheet for project IV-5.1 (Casier Sud Flood Control), the policy of the Government of the Lao PDR is to become self-sufficient in food within the shortest possible time. However, since means of communication as well as transportation are lacking or greatly deficient, it is deemed necessary to aim at regional self-sufficiency. Such a policy is also compatible with the policy of the regional authority in other matters of government. Evidently, the regions with highest population density have highest priority in terms of agricultural development. Among these the Vientiane plain has the highest population density and, within the Vientiane plain, the southern division, including the city of Vientiane has the highest food requirements. However, the high frequency of flooding from the Mekong, causing considerable uncertainty and flood damage is a great obstacle to intensifying food production in that area. Therefore, flood control is the Government's first priority, followed by improved drainage and irrigation respectively.

2. OBJECTIVE

The Houei Mak Hiao flood control structure (Fig. 1), like the Houei Deua flood control structure covered by the project data sheet referred to above, is a major structure in the programme for providing better flood control for the Vientiane plain, southern division. The lands in this area consist partly of uplands, which are never flooded, but unproductive because of very low soil fertility and of lowlands which are flooded frequently, but fertile and used mainly for paddy growing. The total paddy area in this division is about 30,000 ha. In addition, there are the riverbanks of recent river alluvium, where a variety of crops are grown. Flood damage of the latter areas occurs with flood frequencies once in five years and over, but flooding of the lowlands occurs almost annually, except in the driest years.

1/ E/CN.11/WRD/MKG/L.394, dated 1 July 1974

At present, through a major effort by the Lao people as well as government officials concerned with the project, the Casier Sud Flood Control Project (including the Houei Deua flood control gate and Casier Sud flood control dike) is being constructed. The work is expected to be completed before the coming flood season.

However, this will still leave the major part of the southern Vientiane plain unprotected. The Houei Mak Hiao flood control structure will help to remedy that situation. Obviously, it should be combined with a flood protection dike along the Mekong river from the Casier Sud area to Houei Mak Hiao, but the work on that dike cannot start before the end of this coming wet season because of limited avilability of heavy equipment and labour at this moment.

It will be noted that the Houei Mak Hiao flood control structure will serve a larger basin area than the one at Houei Deua. The Mekong Secretariat has provided the Government with technical advice regarding the dimensions and the design of the structure. The site (Fig.2) has been selected at a suitable point on the basis of field surveys and discussions with the engineers concerned.

The disign and working drawings have been made in the Mekong Secretariat in collaboration with Lao engineers. Preparations have been completed for the excavation work at the construction site to be started immediately. Ad hoc advice during construction can be provided by Mekong engineers as required.

3. BENEFITS ACCRUING FROM PROJECT COMPLETION

For the five-year flood of the Vientiane plain southern division, the area estimated to be inundated is about 10,000 ha and the ten-year flood will cover all the lowlands. This situation makes paddy production hazardous, but it also precludes intensification, introduction of high yielding varieties of rice, use of fertilizers etc. Therefore the Government is determined to close the Houei Deua with flap-gates, before the coming flood season. It may be difficult to achieve this, but the Prime Minister himself has given orders that must be tried, so all concerned are doing their utmost. The structure will also be provided with sliding gates which are to be closed after the fall of the Mekong in October in order to maintain a minimum water level in the Houei Mak Hiao during the dry season for general purposes of local fisheries, some irrigation by means of low-lift pumps, buffalo wallows, etc.

This year's work constitutes a self-contained project, but it covers the key structure in the overall agricultural development scheme for the Houei basin to be undertaken during subsequent years. The benefit accruing from the

./from the

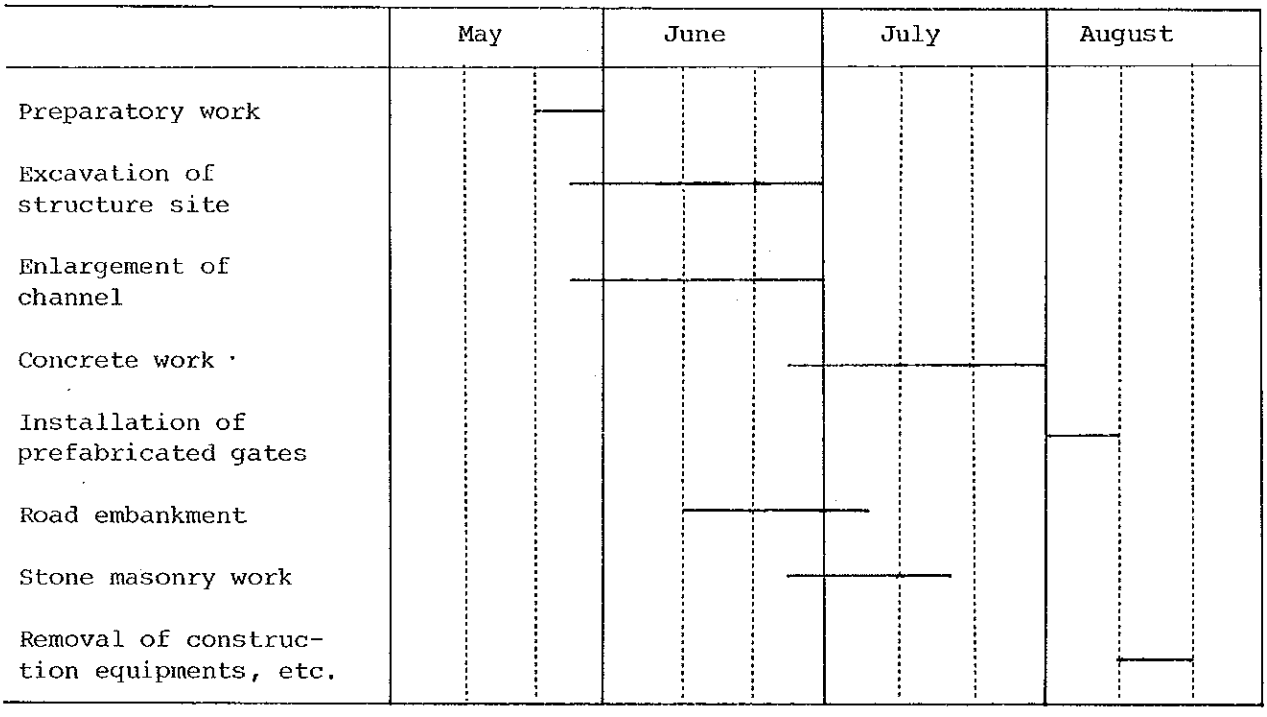
completion of the flood control structure by itself would be negligible unless it is followed by completion of the flood protection dike between Tha Deua and the mouth of the Houei Mak Hiao along the Mekong mainstream.

Since the comprehensive studies for this development scheme have not yet been completed it is not possible to make a correct estimate of the net benefit that would accrue from the completion of the flood protection works (leaving aside the possibilities for improved drainage by means of pumping, diversion and pumping irrigation in the middle course of the Houei Mak Hiao, fishery development, etc.). However, the net benefit of the flood protection works is expected to be very large, perhaps in the order of US$ 500,000 per year on the average.

The Mekong Secretariat is advising the Lao Government on the master programme for the Vientiane plain, southern division including the Houei Mak Hiao basin, and further details on that will be provided as the planning work progresses.

4. CONSTRUCTION PROGRAMME FOR THE HOUEI MAK HIAO FLOOD CONTROL STRUCTURE

1977



5. CONSTUCTION COST FOR THE HOUEI MAK HIAO FLOOD CONTROL STRUCTURE

(Unit: US$)

Items	Cost (US$)
Preparatiory work	2,000
Earthmoving	21,300
Concrete work	42,300
Gate structures	19,000
Stone masonry	6,700
Contingencies	8,700
Total	100,000

Photographs of construction site

1. Existing road at Hoeui Mak Hiao crossing

2. Hoeui Mak Hiao with road-bridge

3. Construction site of the flood control structure

4. Upstream of the construction site

Fig. I LOCATION OF THE HOUEI MAK HIAO WATER CONTROL STRUCTURE IN THE VIENTIANE PLAIN AGRICULTURAL DEVELOPMENT PROJECTS AREA

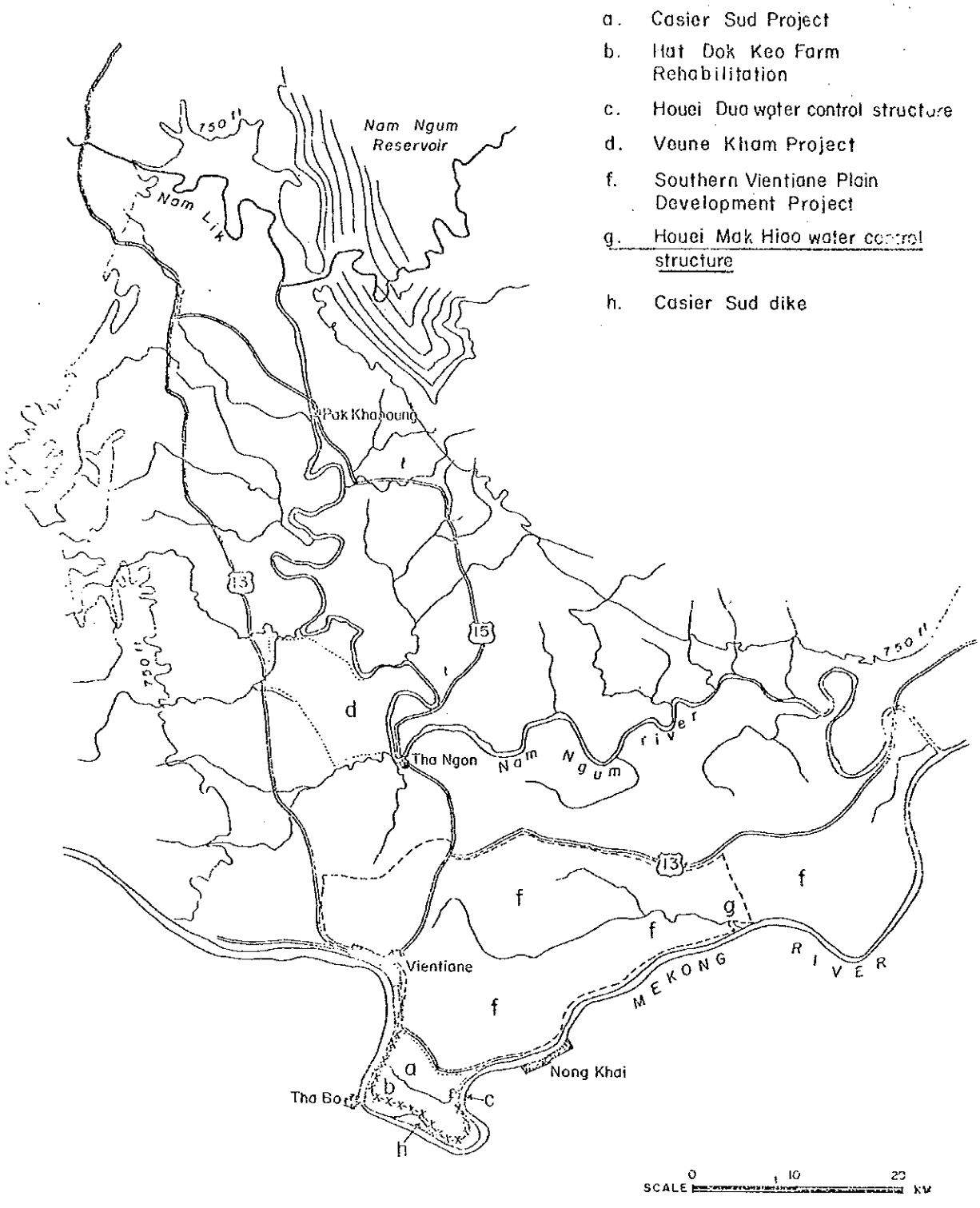
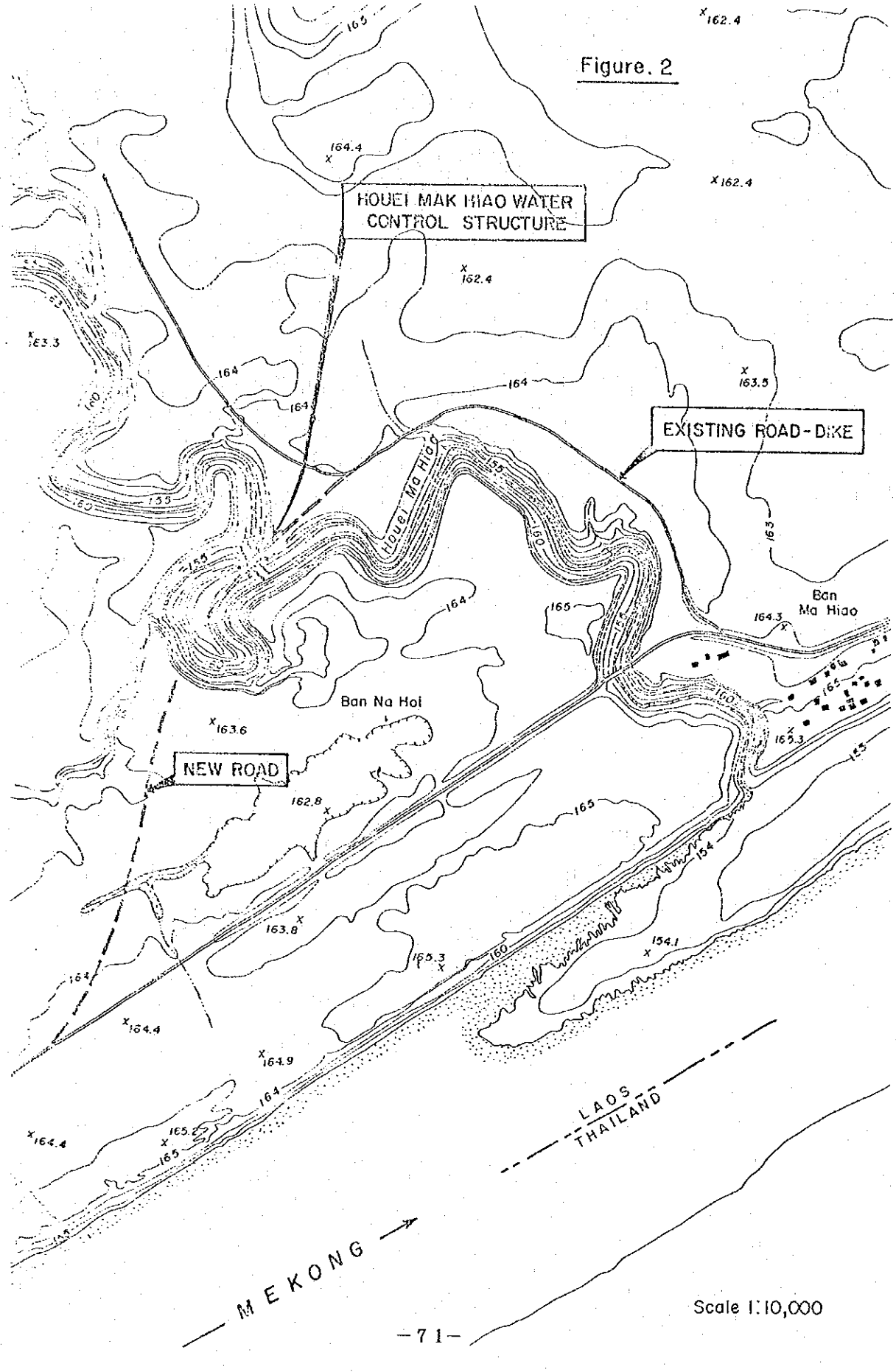


Figure. 2


HOUEI MAK HIAO WATER CONTROL STRUCTURE
EXISTING ROAD-DIKE
NEW ROAD
Houei Ma Hiao
Ban Ma Hiao
Ban Na Hoi
LAOS
THAILAND
MEKONG
Scale 1:10,000

資料 7

Cimmittee for Coordination of Investigations
of the Lower Mekong Basin (Dimocratic Kampuchea,
Lao PDR, Socialist Republic of Viet-Nam and
Thailand)

18 October 1977

HOUEI MAK HIAO FLOOD CONTROL STRUCTURE

(Project IV-5.2)

Progress report by the Secretariat

No. 1

HOUEI MAK HIAO FLOOD CONTROL STRUCTURE

Progress Report No. 1, 18 October 1977

* * * * * *

Project No. IV-5.2

Site : Houei Mak Hiao flood control structure

Date approved : 10 August 1977

Funds granted : US$ 100,000

Funds received: US$ 100,000

Funds disbursed as per 17 October 1977, see Annex 1

1. Action taken by the Mekong Secretariat

1.1 Detailed reconnaissance of the construction site and design of the flood control structure.

1.2 Procurement and shipment of necessary construction material to the job-site, from Bangkok, as follows:

- 180 tons cement
- 70 tons steel bar
- 740 ky steel wire
- 1.360 kg nails
- 32 m^2 of elastite
- prefabricated steel gates (5 sets of flap-gates, 5 sets of sluice-gates) and 5 sets of screens.

1.3 Regular visits by specialists of the Mekong Secretariat to the job-site for discussion and advice during construction.

2. Action taken by Government of the Lao PDR

2.1 Provision of construction material, including heavy equipment, local materials such as gravel, sand and wood.

2.2 Mobilisation of labour of up to 3,600 men

3. Accomplishments

3.1 Excavation of construction site (started late May and accomplished late June)

3.2 Preparation of foundation (accomplished late July)

3.3 Construction of the flood protection levees form existing main road to

the job-site. (Started early June and accomplished middle August).

3.4 Casting of reinforced concrete for the box-culverts (started middle July and accomplished late August).

3.5 Casting of reinforced concrete for the side and wing walls of the structure (started early September and continuing).

3.6 It will be noted that the construction programme "as planned" could not be achieved. However, as indicated in the original request for assistance the programme was from the very beginning considered to be too optimistic and it was anticipated that the work would have to be completed during the next dry season. There is every indication that this will indeed be accomplished and in the meantime the Huai Mak Hiao valley has been successfully protected against the 1977 flood.

4. Table showing actual progress in comparison with the construction programme as planned

Items	1977								1978
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Preparation work									
Banking of protection dike									
Excavation of structure site									
Enlargement of channel									
Concrete work									
Installation of prefabricated gates									
Banking of road body									
Stone masonry work (Rip rap work)									
Removal of construction equipment, etc.									

Note: Planned programme : - - - - - -

Real progress : ————

Expected schedule for future : o o o o o o

5. Expected date of completion of the entire project 31 January 1978

6. Photographs showing progress

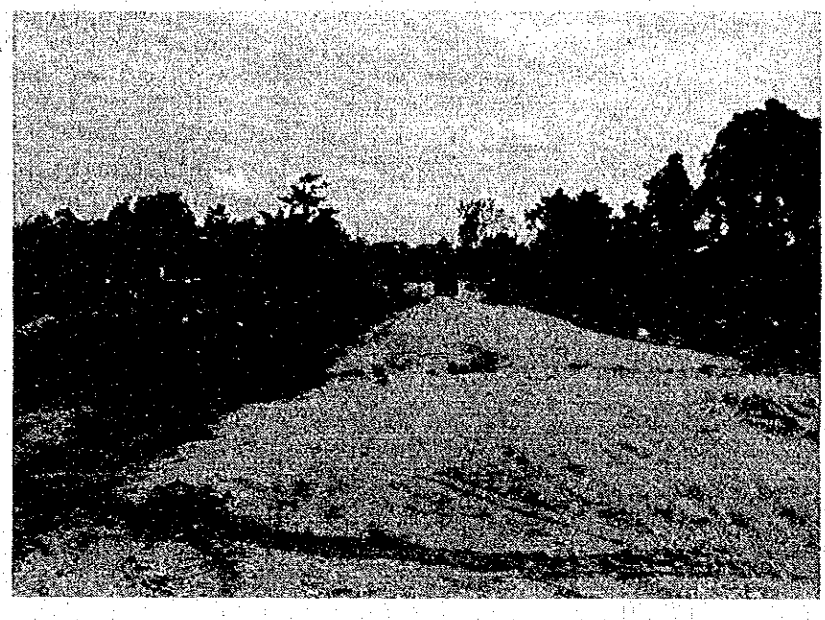
6.1 Excavation of structure site by hand labour

Gentleman in white shirt is Dep. Prime Minister of the Lao P.D.R.

Gentleman is blue shirt is the Deputy Minister of Interior.

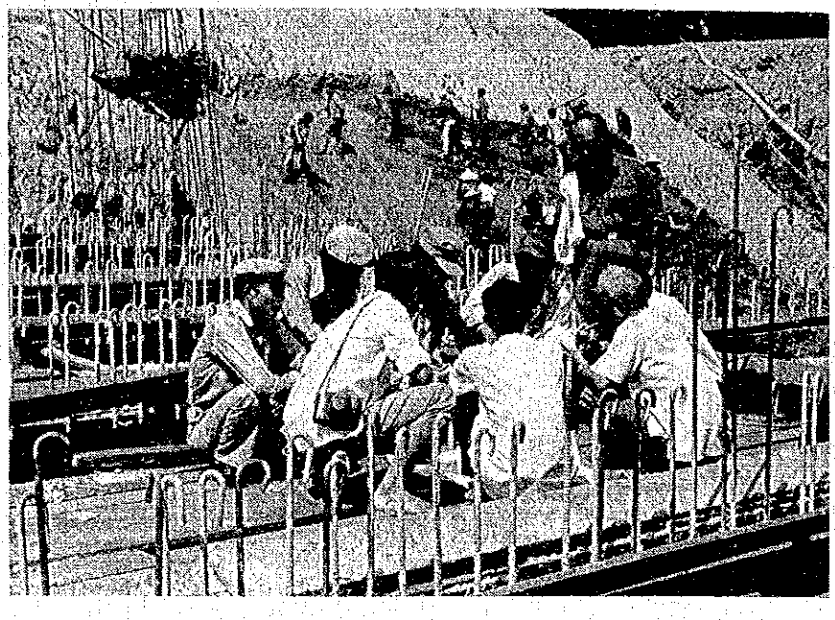
6.2 Excavation of structure site with heavy equipment

6.3 Construction of the flood protection levees



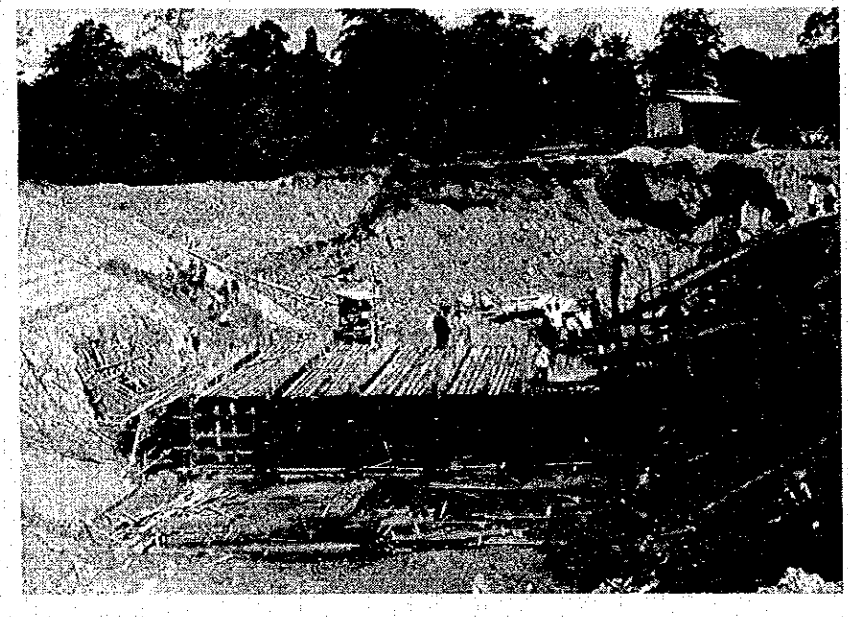
6.4 Completed flood protection levees

6.5 Technical discussion about construction problems



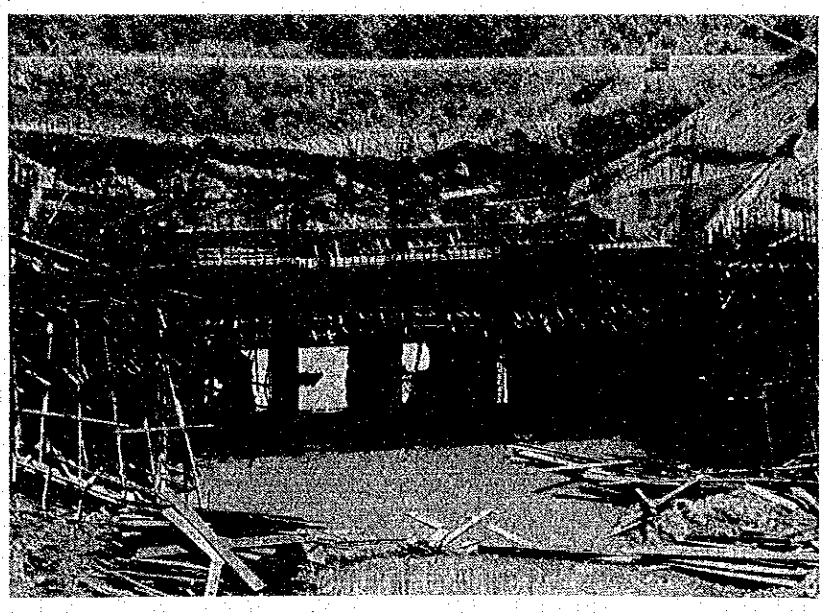
Gentleman in green suit is Deputy Minister of Public Works of the Lao PDR.

6.6 Casting of reinforced concrete work

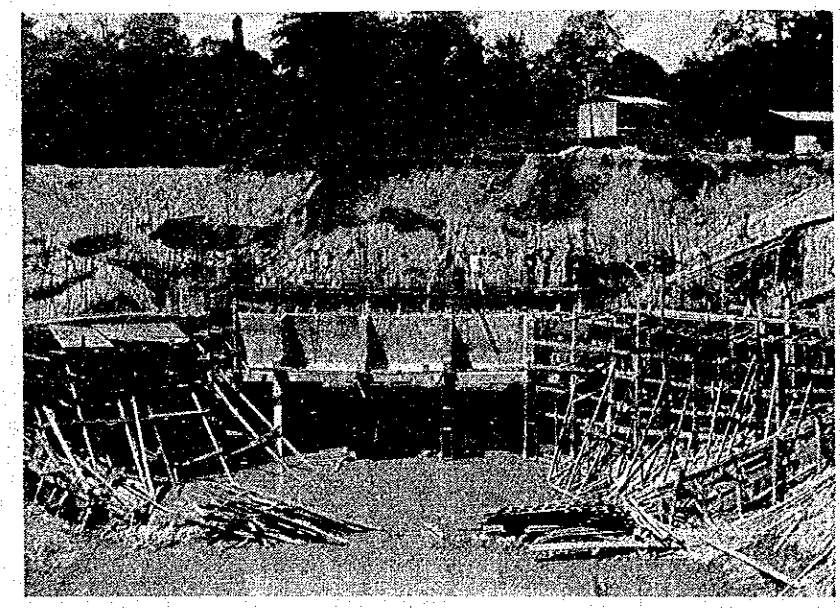


6.7 Situation in early October

1. Scene from upstream



2. Scene from downstream



Committee for Coordination of Investigations of the Lower Mekong Basin	NETHERLANDS GOVERNMENT FINANCIAL ASSISTANCE QUARTERLY FUND STATUS REPORT		
Project title: Houei Mak Hiao Flood Control Structure (Project No. IV-5.2) (Ref: Letter No. 77/ESCAP/743 dd. 10 August 1977)	Date of Letter of Agreement -	Fund granted US$100,000.00	Fund received US$100,000.00
Name, title and signature Henry Beyda, Chief Mekong Administrative Section	Period ending 15 October 1977		Date of report 17 October 1977

Expense Classification	Cumulative Funds Received	Commitments	EXPENDITURE			Unexpended Balance
			Cumulative -	Current 5/7-15/10/77	Cumulative to date	
Preparatory work	$2,000.00	-	-	-	-	$2,000.00
Earthmoving	21,300.00	-	-	-	-	21,300.00
Concrete work	42,300.00	$18,206.90	-	$10,078.76	$10,078.76	14,014.34
Gate structures	19,000.00	14,187.19	-	3,546.80	3,546.80	1,266.01
Stone Masonry	6,700.00	-	-	-	-	6,700.00
Contingencies	8,700.00	-	-	-	-	8,700.00
TOTAL	$100,000.00	$32,394.09	-	$13,625.56	$13,625.56	$53,980.35

資料 8

2 June 1977

PROJECT DATA SHEET

COUNTRY: LAO PDR

PROJECT NUMBER AND TITLE: IV-8 VEUNE KHAM INFRASTRUCTURE

Index number and title of related project in Committee's work programme[1]: 2.6.4 Irrigation development planning, Nam Ngum valley

---

1. BACKGROUND

The Veune Kham project comprises an area of about 8,000 ha on the west bank of the Nam Ngum river in the northern division of the Vientiane plain. The project area consists of 6,000 ha lowlands and 2,000 ha uplands (Fig. 1). The lowlands are largely uncultivated because of the annual flood-hazard. With flood control the lowlands would be suitable for paddy growing, while the uplands, although of relatively low fertility, are suitable for a limited number of upland crops, pastures and forestry.

In the entire northern division of the Vientiane plain about 40,000 ha is subject to chronical flooding. These lands are to be made cultivable with flood control and their productivity is to be further improved with controlled drainage and irrigation at later stages.

Within the Veune Kham project area as such, the Government of the Lao PDR is establishing a state farm. High priority has been given to this endeavour, since it is considered as a pioneering project for the establishment of state farms in other parts of the country, as well as for the reclamation of other floodlands along the Nam Ngum river. Consequently, the Government has requested the Mekong Secretariat to help in providing technical and financial assistance to the project as soon as possible.

In response to this request, the Secretariat has reiviewed conditions of soils, vegetation and hydrology in the Veune Kham project area. On the basis of this review, priorities for construction were discussed with the Government of the Lao PDR, and subsequently adopted.

Meanwhile, the Government has already made a beginning with land clear-

---

1/ Committee for Coordination of Investigations of the Lower Mekong Basin, Semi-Annual Report: 1 January - 30 June 1974, Volume II Work Programme (E/CN.11/WRD/MKG/L. 394, 1 July 1974).

ing, road construction and settling of farmers. Project execution is under the authority of the Vientiane province administration.

2. OBJECTIVE

The ultimate objective within the Veune Kham project perimeter is the development, in the coming six years, of the lowlands for paddy and upland crops growing, and of the uplands for upland crops in limited areas suitable for this purpose as well as for livestock and forestry production. To accomplish this objective, provision will have to be made for flood protection, drainage improvement, rural road system, settlements of the state farm members, land clearing and reclamation for about 5,000 ha net, pumping station on the bank of the Nam Ngum river, and irrigation canal network for year-round irrigation involving some land consolidation.

The immediate, short-term objectives are (1) to make the project area accessible during the wet season by means of the construction of an all-weather bridge across the Houei Nam Khém, (2) further construction of all-weather roads, (3) flood control of those sectors where this can be achieved with limited means, and (4) some irrigation. It is for these immediate objectives that assistance is requested at this time, including especially provision of heavy construction equipment for speedy implementation of these parts of the project where the use of hand-labour is not practicable.

3. BENEFITS ACCRUING FROM PROJECT COMPLETION

Almost all the lands in the project area are new lands to be reclaimed for agriculture. In the first stage of the development project, which would include completion of the immediate short-term objectives mentioned above and subsequent flood protection, about 3,000 ha net will be reclaimed for wet season cropping. Rainfall is sufficient from July through September to sustain a stable yield of 2.5 tons/ha of paddy rice. Diversified upland crops such as sugarcane, maize and sorghum can be grown as from May on river levee soils and cassava and kenaf on the poorer upland soils. The expected net benefit accruing form the completion of the first stage development would be in the order of US$500,000 annually.

In the ultimate development stage, with flood protection and pumping stations for irrigation as well as drainage, about 4,200 ha net will be brought under year-round cropping including two irrigated rice crops per year, and rainfed

and irrigated upland crops such as sugarcane, maize, sorghum, tobacco, vegetable, etc. In addition, long term benefits will derive from livestock development. The expected net benefit accruing from ultimate stage development would be in the order of US$1,500,000 annually.

4. PROPOSED PROGRAMME OF WORK

Assistance is needed for the following items[1]:

(1) An all-weather wooden bridge across the Houei Nam Khém, length 70m, height 15m, and width 6m.[2]

(2) Improvement of the existing main road and construction of other main and feeder roads,
  total length to be improved 8 km, and
  total length to be constructed 35 km.

(3) Flood control system,
  Houei Iyot tract:
    Flood protection dike with 4 gated culverts,
      length 30 m, height 7m, width 5 m, and length of dike about 7 km, with height varying from 0 to 2 m.
  Houei Sa Ngiew tract:
    Flood protection dike with 3 gated culverts,
      length 25 m, height 7 m, width 5 m.
      length of dike about 5 km, with height varying from 0 to 3 m.

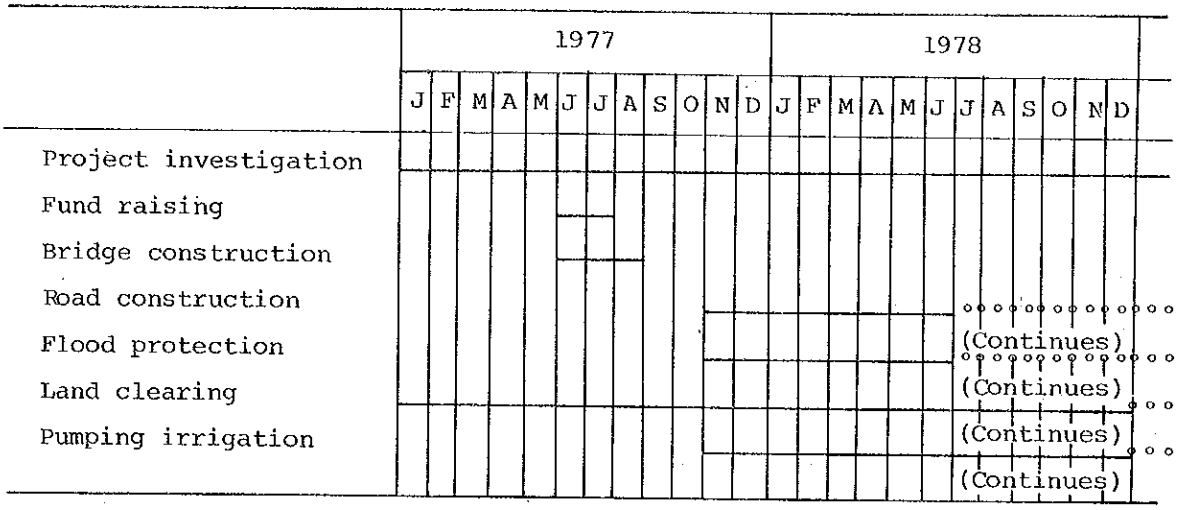
(4) Land clearing and reclamation for about 1,000 ha.

(5) Pumping irrigation,
    Equipment: Two 50-hp mixed flow pumps, lift 16-20 m, capacity 8-32 m^3/min, for irrigable area of 2 × 200 ha = 400 ha;
    Five 20-hp low-lift pumps, lift 7.5 m, capacity 2 m^3/min, for irrigable area of 5 × 20 ha = 100 ha;
    Total irrigable area 500 ha.

1/ The numbering for the following items corresponds to the one in Fig. 1.

2/ The wooden bridge will be constructed by the Ministry of Interior of the Government with use of their own budget and expertise. It is expected to be completed by middle August, 1977.

IMPLEMENTATION SCHEDULE



5. IMPLEMENTATION COST FOR THE VEUNE KHAM INFRASTRUCTURE[a/] (unit:US$)

Item	Construction materials and equipment	Purpose of use	Unit price	Number and quantity	Cost
Construction equipment	(1) Bulldozer D60A with rake blade & ripper	Flood control,	68,000	1	68,000
	(2) Dozer shovel	Road,	36,000	1	36,000
	(3) Dump trucks	Land	12,000	3	36,000
	(4) Spare parts for (1), (2) and (3)	clearing & reclamation		20%	28,000
	Sub - total				168,000
Irrigation equipment	(5) 50-hp mixed flow pumps		10,000	2	20,000
	(6) 20-hp low-lift pumps	Irrigation	1,500	5	7,500
	(7) Spare parts for (5) and (6)			20%	5,500
	Sub - total				33,000
Construction	(8) Wooden bridge[b/]			none [b/]	
	(9) Road system [c/]			none [c/]	
	(10) Flood control Construction materials for gated culverts for Houei Iyot		10,000	4	40,000
	for Huei Sa Ngiew		10,000	3	30,000
	(11) Land clearing and reclamation[c/]			none [c/]	
	Sub - total				70,000

Item	Construction materials and equipment	Purpose of use	Unit price	Number and quantity	Cost
Others	(12) Fuel for the construction equipment		0.23	45,000ℓ	10,500
Contingencies				5%	13,500
Grand total					295,000

a/ Cost for project personnel, labour and overhead costs are not included, as these will be met by the Government.

b/ The bridge will be constructed by the Government with use of its own budget and expertise.

c/ The construction equipment is to be used for earthwork relating to the road system, the flood control system, and land clearing and reclamation.

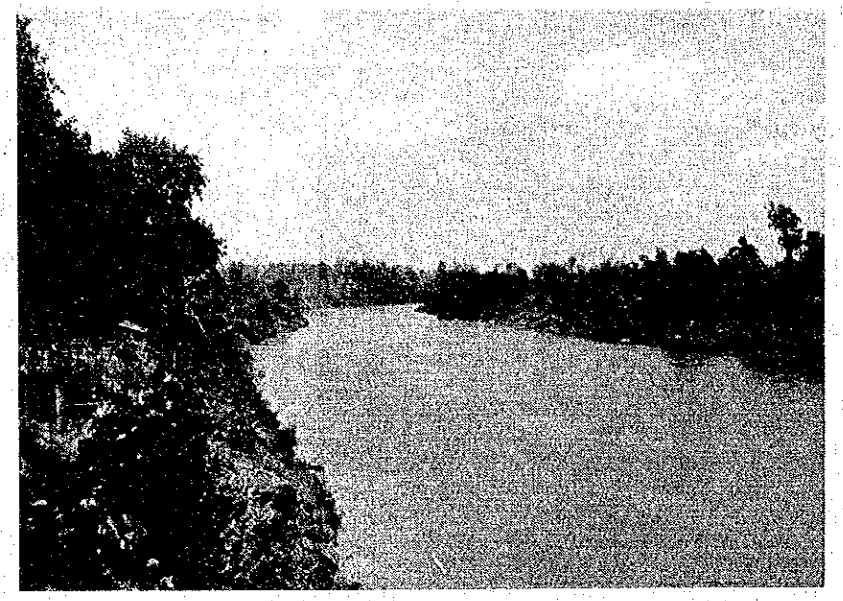
Photographs of the Veune Kham project area.

a. The Houei Iyot

Site for one of he gated culverts.

b. Reclamation of upland soils

The intention is to grow one year upland rice in the ashes; followed by a year maize and then convert the alnd into pasture.

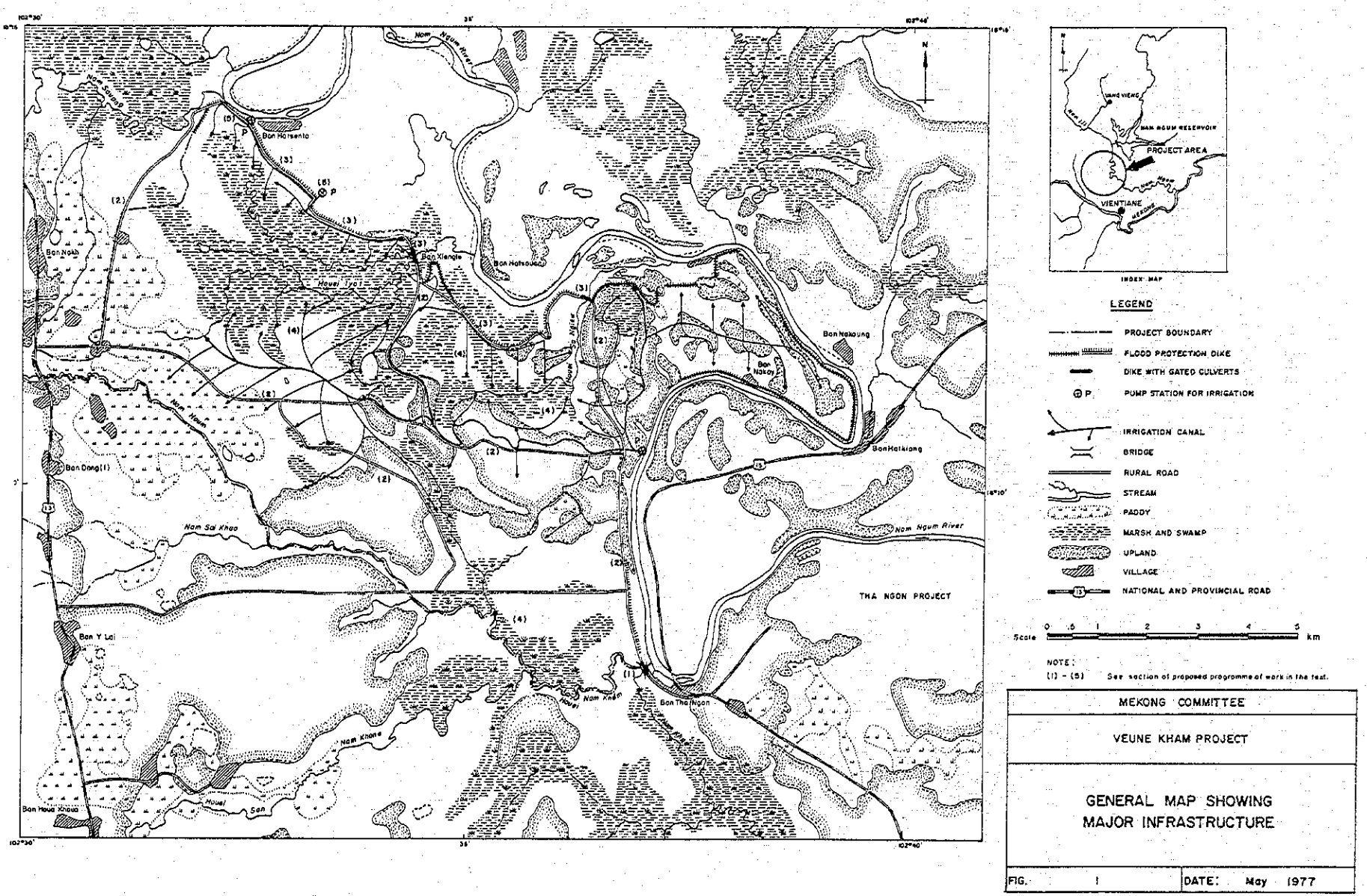


c. The Nam Ngum river

To the left, site for pumping station to be constructed at a later tage.

d. Typical flood-land

Floodlands are easily reclaimable once flood protection is provided.



INDEX MAP

LEGEND

- PROJECT BOUNDARY
- FLOOD PROTECTION DIKE
- DIKE WITH GATED CULVERTS
- P PUMP STATION FOR IRRIGATION
- IRRIGATION CANAL
- BRIDGE
- RURAL ROAD
- STREAM
- PADDY
- MARSH AND SWAMP
- UPLAND
- VILLAGE
- 13 NATIONAL AND PROVINCIAL ROAD

Scale 0 .5 1 2 3 4 5 km

NOTE:
(1) - (5) See section of proposed programme of work in the text.

MEKONG COMMITTEE	
VEUNE KHAM PROJECT	
GENERAL MAP SHOWING MAJOR INFRASTRUCTURE	
FIG. 1	DATE: May 1977

資料 9

10 December 1977

PROJECT DATA SHEET

PROJECT NUMBER AND TITLE: IV-53 MEKONG PUMP IRRIGATION

Index number and title of related project in Committee's work programme[1/]: 2.6.3 IRRIGATION DEVELOPMENT PLANNING, VIENTIANE PLAIN

PROJECT SUMMARY

Establishment of 15 pump stations along the Mekong river bank. Average size of service area per pump station : 340 ha

Total investment cost : US$ 1,160,000

Annual operation and maintenance cost : US$ 305,100

Estimated annual incremental paddy production (first 3 years) :

: 12,000 tons

Estimated annual incremental paddy production (first 3 years)

: 12,000 tons

In social terms the value of the increased food production is invaluable and its role in deviating the need for emerging food supply programmes would seem most encouraging.

1. BACKGROUND

The Vientiane plain is the largest area of lowland in the Lao PDR with a dense population. Of a total population of 450,000, about 150,000 live in the city of Vientiane and other population centers. The total area planted in agricultural crops in the Vientiane plain is estimated to be about 60,000 ha of lowland mainly for growing paddy rice and about 20,000 ha for growing upland crops such as upland rice, tobacco and maize.

The first priority set by the Government of the Lao PDR is to become self-sufficient in food on a regional basis. Consequently, it is realized that, to reach that goal, a major effort must be made in intensifying the use of existing agricultural lands in the Vientiane plain. All the lowlands are already occupied and the forested uplands, with the exception of the river banks, have very poor soil conditions where sustained agriculture is not possible. This means that major water control works will be necessary in order to reach the target.

A three-year programe for overall water resources development, including

---

1/ E/CN. 11/WRD/MKG/L. 394, dated 1 July 1974

flood control, drainage and irrigation is being prepared by the Government of the Lao PDR, with assistance from the Mekong Secretariat. The projects included in the present project data sheet are part of this three-year programme. They are expected to be realized during the dry season of 1978.

2. OBJECTIVES AND ONGOING WORK

The objective is to equip about 5,000 ha of existing paddy fields adjacent to the Mekong river bank with irrigation facilities that would ensure a rainy season crop by means of supplementary irrigation and a dry season crop by means of full irrigation. To this end, 15 pumping sites have been selected on the basis of river bank stability and closeness to the existing paddies. Pump sites and service areas are indicated in Figure 1.

This programme is a follow-up to the flood control works under execution, including the Casier Sud flood control programme (Houei Deua) and Houei Mak Hiao. The Government of the Netherlands has assisted in making this flood control programme possible by making avilable a total of $ 210,000 in grants.

The idea of using water pumped from the Mekong river for increasing agricultural production in the Vientiane plain by means of irrigation has been tested for years at the Mekong Committee-sponsored experimental farm at Hat Dok Keo, near Vientiane, and has been found eminently feasible.

Much of the infrastructure, related to the supply and distribution systems is already being built within the context of people's participation in development. Some sites are equipped with temporary pumps of insufficient capacity. Figures 2-20 give an impression of the situation.

3. THE PROJECT AND PROJECT COSTS

Only standard pump sets, preferable of one type will be used for ease of maintenance. The intention is to equip sites 1-9 with electric pumps, since they will be served by the electric power transmission line with power supplied by the Mekong Committee-sponsored Nam Ngum hydro-power station. The power transmission line will be completed by March 1978. The other stations would have to be equipped with diesel driven pumps that can be re-located as soon as electricity becomes available in the future.

Details about the project costs and technical specifications of the pump sets are indicated in Tables 1 and 2. A typical plan of the pumping stations is shown in Figure 21.

4. OPERATION AND MAINTENANCE

Operation and maintenance will be the responsibility of the local farm cooperatives, supervised by the authorities concerned with the development of the Vicntiane plain. The annual operation and maintenance costs, which are indicated in Table 3, will be met by the Government.

5. ESTIMATED ANNUAL BENEFITS

Only benefits accruing from increased rice production are being considered. Short term benefits (1-3rd year) as well as longer term benefits (4-10th year) are being considered. They ar indicated in Tables 4 and 5.

Table 1 Pump Irrigation Project in the Southern Vientiane Plain Agricultural Development Project estimated cost in US$

No. of stations	Name of Stations	Planning Irrigation Area (ha)	No. of Pumps	Dimension	Unit price of pump	Cost of pump set (1)	Appurtenant structure cost (2) ⁄(1) × 10%	Total cost ⁄(1)+(2)⁄
1	Nong Thong	400	4	Pump	15,000	60,000	6,000	66,000
2	KM. 19	300	3	Size: 250 mmϕ	15,000	45,000	4,500	49,500
3	Tha Deua	500	5	Capacity:10m/min.	15,000	75,000	7,500	82,500
4	Tha Pha	500	5	Motor	15,000	75,000	7,500	82,500
5	Thin Then	400	4	Power: 73 KW	15,000	60,000	6,000	66,000
6	Simano	300	3		15,000	45,000	4,500	49,500
7	Na Long	300	3		15,000	45,000	4,500	49,500
8	Ma Hiao	200	2		15,000	30,000	3,000	33,000
9	Mak Nao	300	3		15,000	45,000	4,500	49,500
	(Sub total)	3,200	32			480,000	48,000	528,000
10	Wong Pho	400	4	Pump	21,000	84,000	8,400	92,400
11	Ban Don	500	5	Size: 250 mmϕ	21,000	105,000	10,500	115,500
12	Na Koung	100	1	Capacity:10m^3/min.	21,000	21,000	2,100	23,100
13	Thoun Loua	150	2	Total head: 25 m	21,000	42,000	4,200	46,200
14	Kao Liao	500	5	Diesel Engine	21,000	105,000	10,500	115,500
15	Nong Da	200	2	Power: 115 HP	21,000	42,000	4,200	46,200
(numbers	(Sub total)	1,850	19			399,000	39,900	438,900
refer	Total 15 stations	5,050	51			879,000	39,900	966,900
to Fig.1)	Spare parts for pump set ⁄(1)×10%⁄					87,900	-	87,900
								(1,054,800)
	Contingency (within 1,054,800×10%)							105,200
	GRAND TOTAL							1,160,000

Table 2

Technical specifictions of pump sets

1. Driving method : Electric motor

a. Pump Type : Mixed flow volute pump

Size : Suction/Discharge 250/250 mmϕ

Capacity : 10 m^3/min

Total head : 25 m

Speed : 1,500 rpm 50 Hz 4 pole

Output : 100 HP

Driving method : Motor directly driven

Accessories : 10 m of suction hose
10 m of discharge hose
20 m of discharge pipe
Others as necessary

b. Motor Rating : 50 Hs, 75KW, 3 phase, 4 pole- (1,450) rpm

Type : Horizontal shaft (outdoor use)

Starting panel : Standing cubicle type outdoor use Star-delts start

Accessories : 35 m of power cable Others as necessary

2. Driving method : Diesel

a. Pump Type : Mixed flow volute pump

Size : Suction/Discharge : 250/250 mmϕ

Capacity : 10 m^3/min

Total head : 25 m

Speed : 1,800 rpm

Output : 100 HP

Driving method : engine directly driven

Accessories : 10 m of suction hose
20 m of discharge hose
20 m of discharge pipe
Others as necessary

b. Diesel Engine Type : 4 cycle, vertical diesel engine

No. of cylinder : 4

Power : 1800 rpm × 115 HP

Starting system : compressed air

Accessories : Fuel tank, Air cleaner, Others as necessary

Tabel 3

Estimated annual operation and maintenance cost

(1) Assumptions

- Life time of pump set : 10 years
- Working days per year : 200 days
- Working hours per day : 8 hours
- Working hours per year : 1,600 hours

(2) Operating cost

a. Operator's cost (to cover 5 pump sets)

51 pump sets/5 × 200 days × 3 US$/day = 6,120 US$

b. Power cost

. Electricity for 32 pump sets

73 KW/ × 1,600 hr × 0.012 US$/KWH × 32 sets = 44,852 US$

. Fuel for diesel engines (19 pump sets)

20 l/hr × 1,600 hr × 0.23 US$/l × 19 sets = 139,840 US$

c. Total operating cost 190,812 US$

= 190,800 US$

(3) Maintenance cost

Coefficient for cost of repair : 1,3

Price of 51 pump sets : 879,000 US$

Maintenance cost

$$\frac{879{,}000 \text{ US\$} \times 1.3}{10 \text{ years}} = 114{,}270$$

= 114,300

(4) Total Operation and Maintenance Cost : US$ 305,100

Table 4

Estimated annual benefits*/

Short term benefits (1st - 3rd year)

(1) Assumptions

- Total planned irrigable area : 5,050 ha

(see Table 1)

- Main crop : Paddy

- Cropping pattern and estimated yield

	At present (without project)		With project	
	Area (ha)	Unit Yield (t/ha)	Area (ha)	Unit Yield (t/ha)
Wet season N-G	1,680	1.0	1,680	1.7
G	3,370	1.0	3,370	1.7
Dry season N-G	-	-	1,680	1.7
G	-	-	3,370	1.7
Total	5,050		10,100	

(2) Estimated benefit (US$)

	At present (without project) Production value (US$)	With Project			
		Production value (US$)	O & M cost (US$)	Net production value (US$)	Benefits (US$)
Wet season N-G	1,680×1.0×120 = 201,600	1,680×1.7×120 = 342,720	Operating cost		
G	3,370×1.0×120 = 404,400	3,370×1.7×120 = 687,480	190,800		
Dry season N-G	-	1,684×1.7×120 = 342,720	Maintenance cost		
G	-	3,370×1.7×120 = 687,480	114,300		
	606,000	2,060,400	305,100	1,755,300	1,149,300

Note N-G : Non-glutinous rice = 1,150,000

G : Glutinous rice

Farm gate price of paddy : 120 US$/t

*/ Simplified analysis, taking into account operation and maintenance costs only. Farm inputs are assumed to remain at present levels.

Table 5

Estimated annual benefits */

Long term benefits (4th - 10th year)

(1) Assumption

- Total planned irrigable area : 5,050 ha

(see Fig. 1)

- Main crop : Paddy

- Cropping pattern and estimated yield

	At present (without project)		With project	
	Area (ha)	Unit Yield (t/ha)	Area (ha)	Unit Yield (t/ha)
Wet season N-G	1,680	1.0	1,680	2.5
G	3,370	1.0	3,370	2.5
Dty season N-G	-	-	1,680	2.5
G	-	-	3,370	2.5
Total	5,050		10,100	

(2) Estimated benefits (US$)

	At present (without project)	With project			
	Production value US$	Production value (US$)	O & M cost (US$)	Net production value (US$)	Benefit (US$)
Wet season N-G	1,680×1.0×120 = 201,600	1,680×2.5×120 = 504,000	Operating cost		
G	3,370×1.0×120 = 404,400	3,370×2.5×120 = 1,011,000	= 190,800		
Dry season N-G		1,680 2.5 120 = 504,000	Maintenance cost		
G		3,370×2.5×120 = 1,011,000	= 114,300		
Total	606,000	3,030,000	305,100	2,724,900	2,118,900

Note N-G : Non-glutinous rice = 2,120,000

G : Glutinous rice

Farm gate price : 120 US$/t

*/ Simplified analysis, taking into account operation and maintenance costs only. Farm inputs are assumed to remain at present levels.

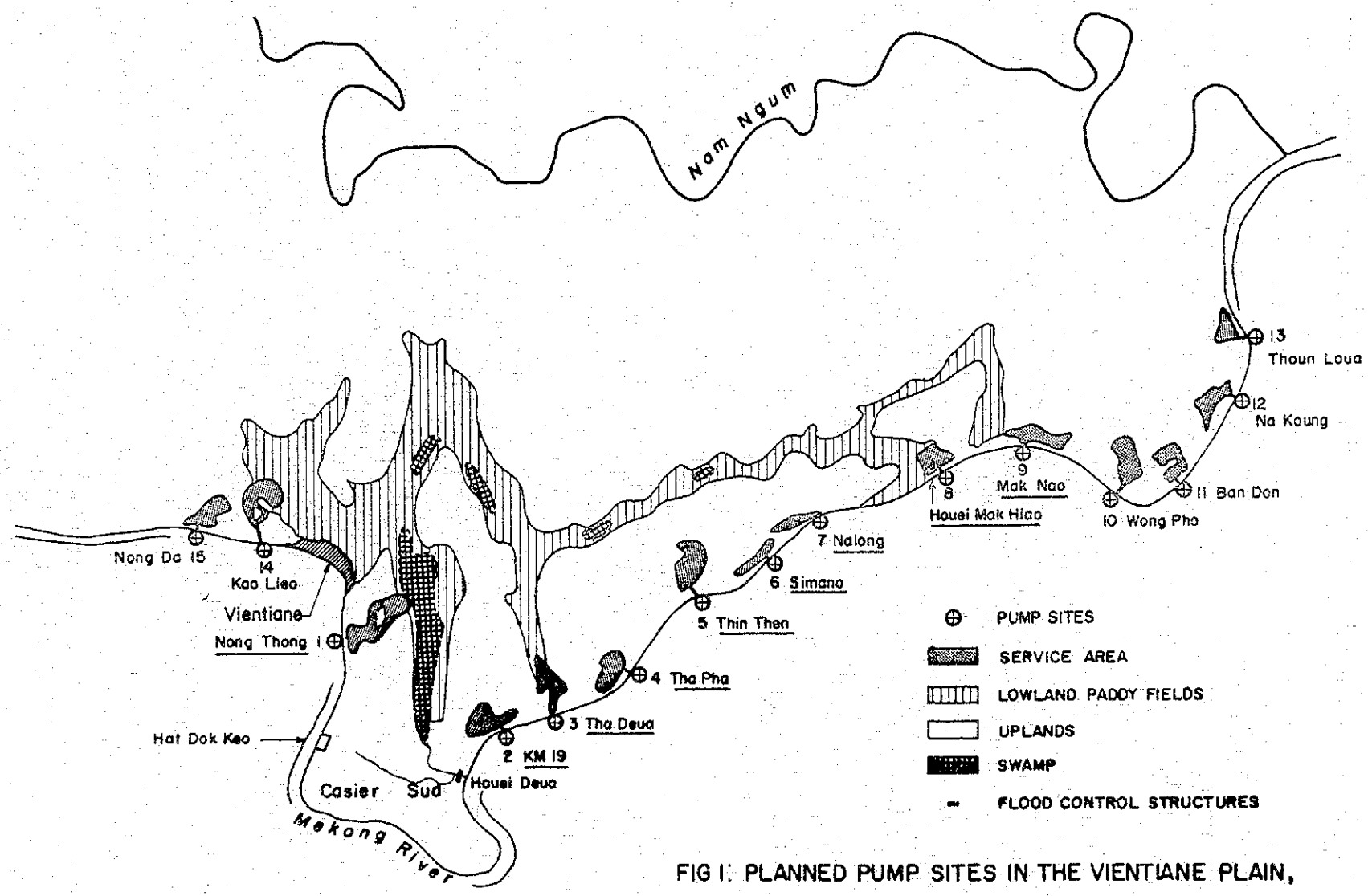
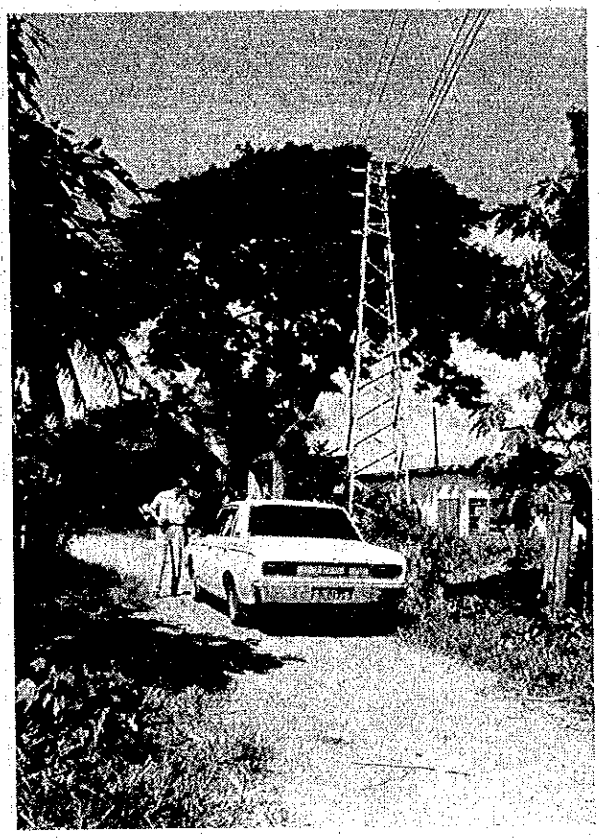


FIG 1: PLANNED PUMP SITES IN THE VIENTIANE PLAIN, SOUTHERN DIVISION.

Illustrations of project sites

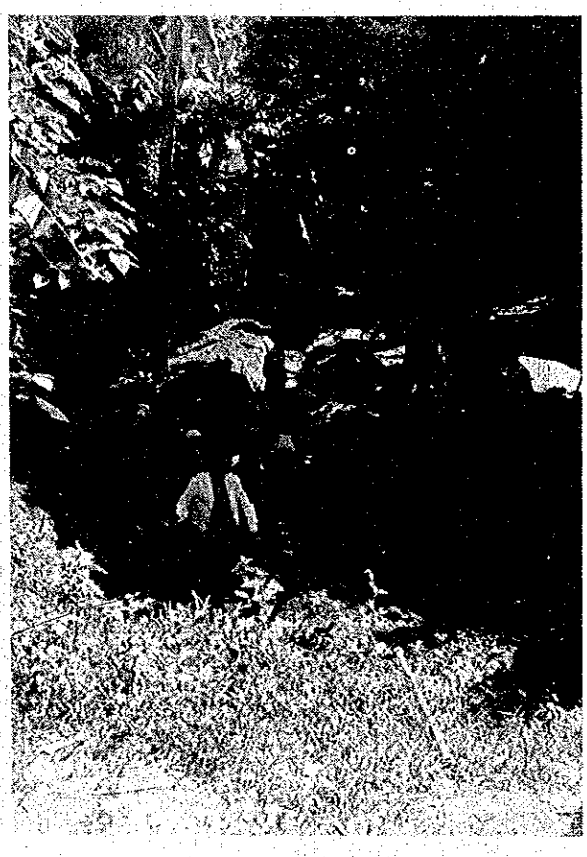
(for location, see fig.1)



(2) Electric power line

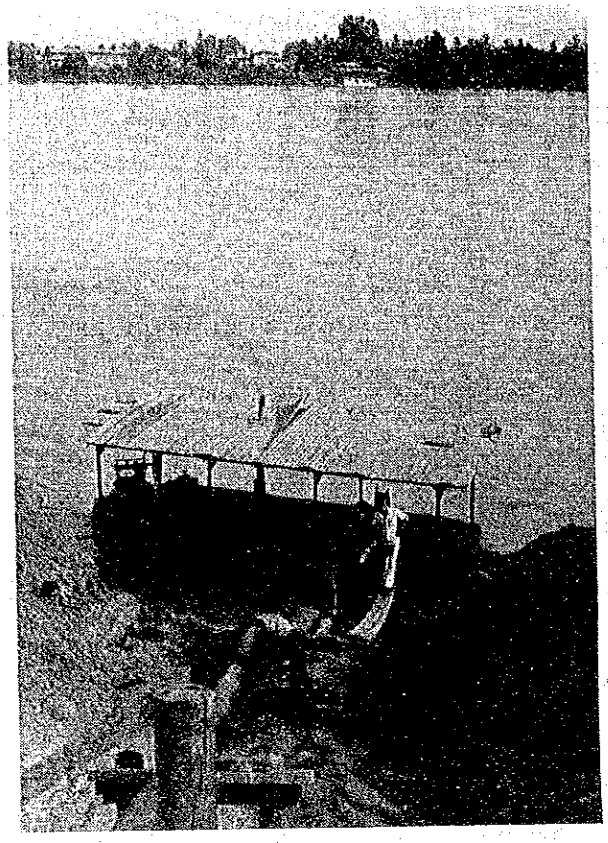
No. 1 Nong Thong Project site

(3) Pump station site

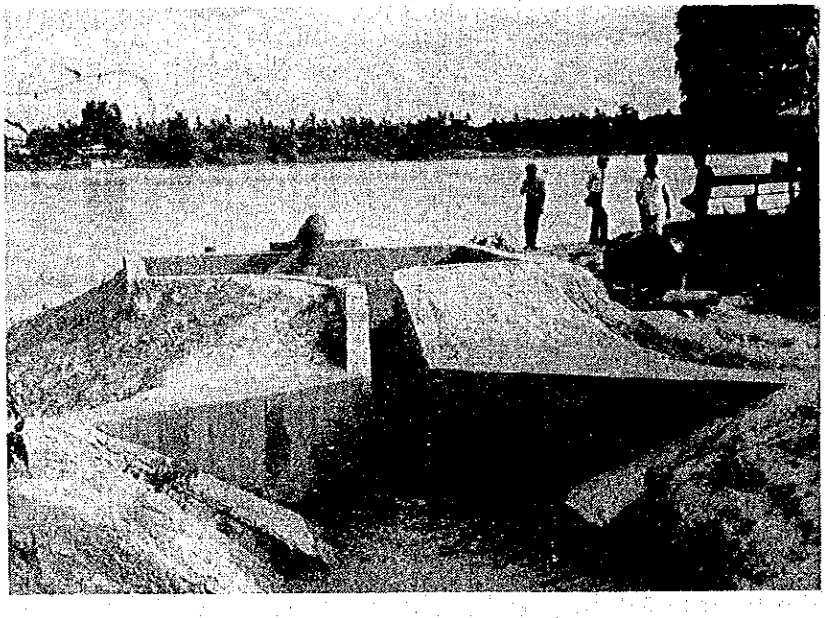


(4) Digging the supply canal by villagers

No. 2 : Km 19 project

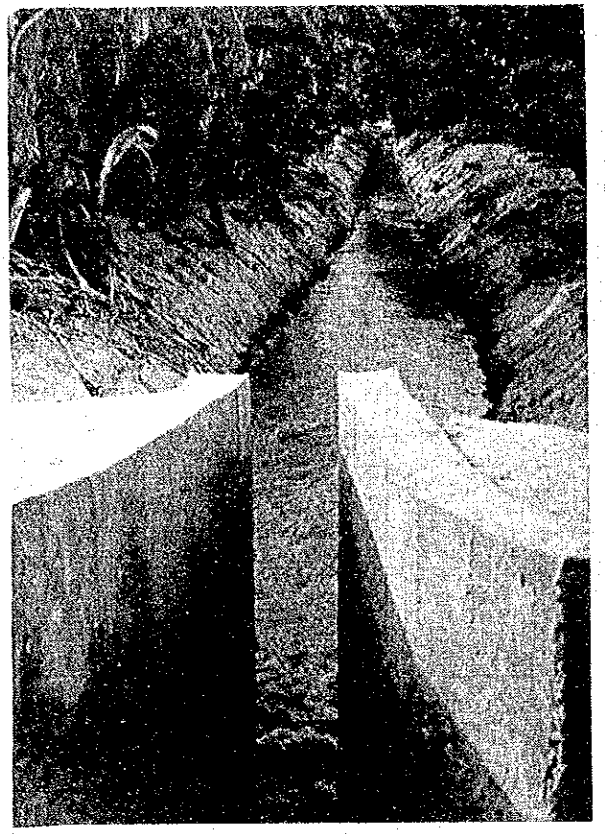


(5) Pump station site



(6) Inlet basin

No. 2 : KM 19 project



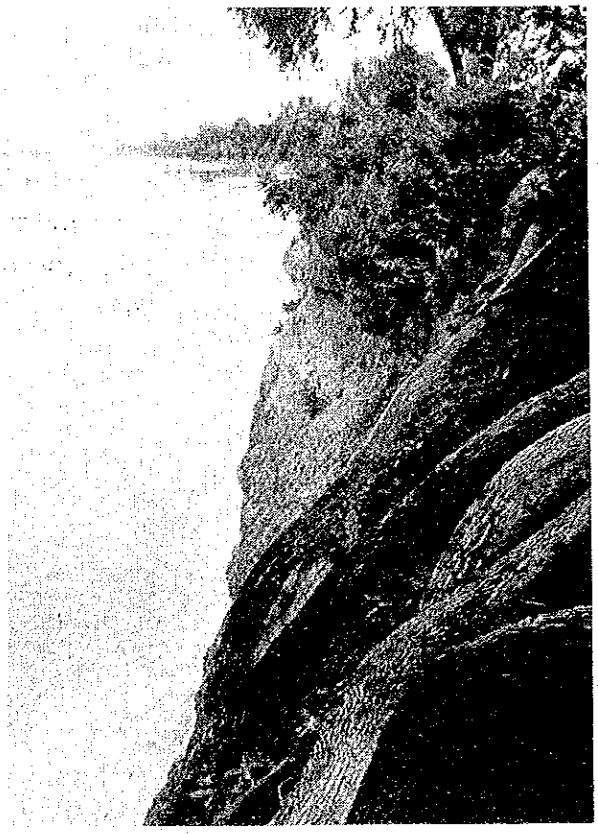
(7) Canal from inlet basin

(8) Canal to requlating pond

No. 3 : Tha Deua

(9) Canal from inlet basin to requlating pond

No. 4 : Tha Pha project



(10) Pump station site

No. 4 : Tha Pha project

(11) Paddy field to be irrigated (present situation, Oct. 1977)

(12) Paddy field, present situation (October 1977)