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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

PROJECT PAPER

THAILAND

VILLAGE FISH POND DEVELOPMENT PROJECT

(493-0303)

SEPTEMBER 1979

UNCLASSIFIED

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UNITED STATES GOVERNMENT

Memorandum

TO : Distribution

DATE: October 4, 1979

FROM : ASIA/PD/EA, M. K. Sinding

SUBJECT: THAILAND - Village Fish Pond Development Project (493-0303)
Project Paper (Final)

Attached, for your information and files, is subject Project Paper,* approved by Donald D. Cohen, Director, USAID/Thailand. Funds were obligated in September 1979.

Attachment: a/s/

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THAILAND

VILLAGE FISH POND DEVELOPMENT PROJECT

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ABBREVIATIONS, TERMS AND EQUIVALENTS

AID/W	-	Agency for International Development, Washington, D.C.
AIT	-	Asian Institute of Technology, Bangkok
DOF	-	Department of Fisheries
DTEC	-	Department of Technical and Economic Cooperation
EA	-	Environmental Assessment
EIS	-	Environmental Impact Statement
IEE	-	Initial Environmental Examiniation
NEB	-	National Environment Board
NIFI	-	National Inland Fisheries Institute
PID	-	Project Identification Document
PP	-	Project Paper
RTG	-	Royal Thai Government
Sala	-	(Thai word) - a shelter for rest and relaxation
USAID	-	US Agency for International Development
VFPDP	-	Village Fish Pond Development Project

CURRENCY EQUIVALENTS

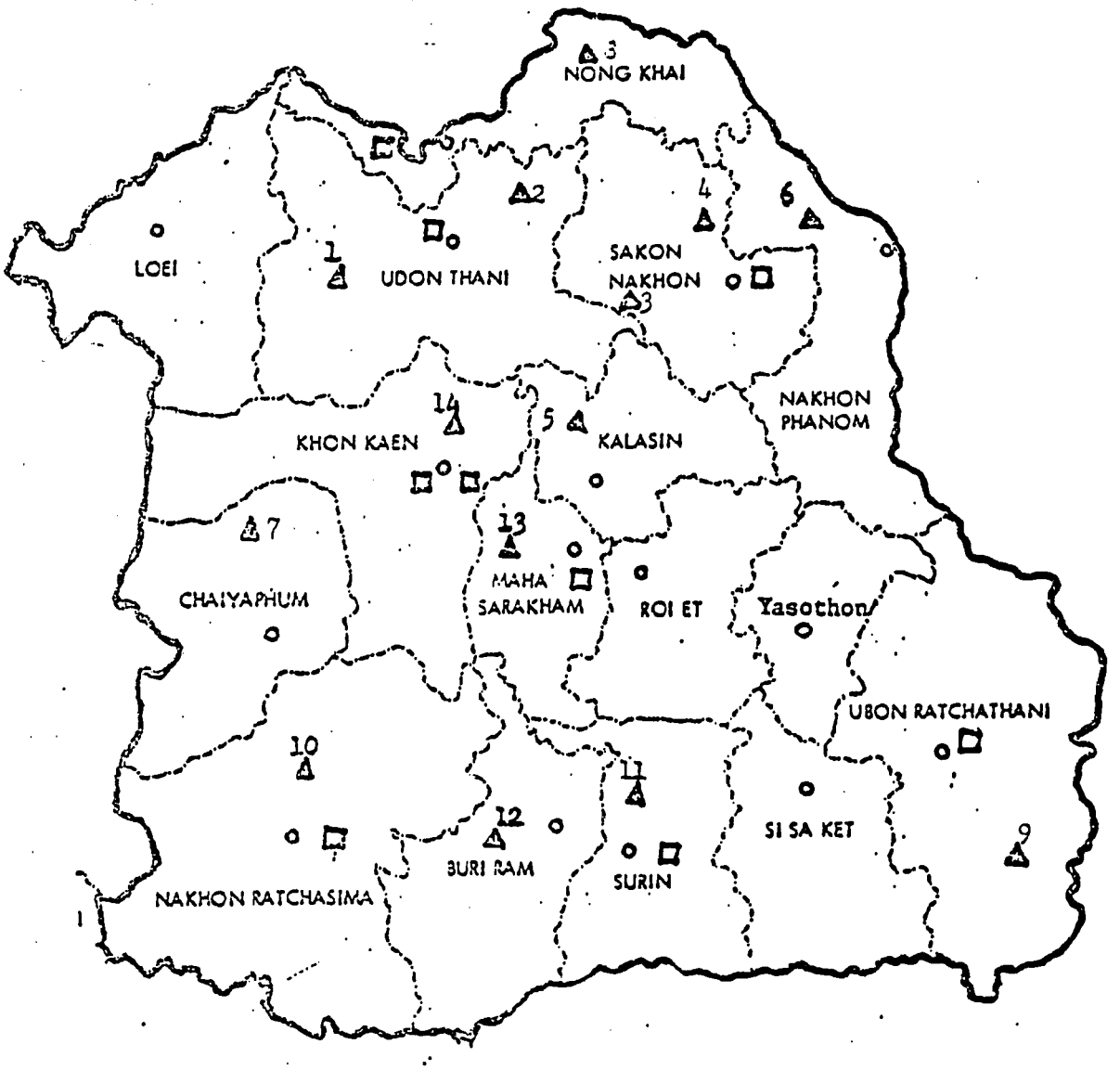
U.S. $1.00	=	Baht (฿) 20.00
Baht (฿) 1.00	=	U.S. 0.05

AREA EQUIVALENTS

1 rai	=	0.16 hectare (40 x 40 meters)
1 hectare (ha.)	=	6.25 rai

CHANGWATS (PROVINCES) IN THE NORTHEAST REGION

OF THAILAND



Existing Fishery Stations

Village Fish Pond Locations

FISH POND LOCATIONS

AND PRINCIPAL CHARACTERISTICS

Locations	Village Characteristics			Pond Characteristics		
	Population Served No. of People/(No. of Villages)		Average Household Income ($) 1/	Required Improvements	Design Surface Area (rai)	Design Storage Capacity
	Total Uses	Fishing Benefits				
						m^3
1. Nong Thum Ban Sai Ngam, Tambon Na Ma Feung, Amphoe Nong Bua Lam Phu, Udorn Thani	865 (1)	865 (1)	Not Available	Strengthen & increase the height of existing embankment and build concrete spillway.	32	51,200 - 64,000
2. Nong Bua Ban Yang Song, Tambon Na Bua, Amphoe Phen, Udorn Thani	464 (1)	464 (1)	592	Strengthen & increase the height of existing embankment and build concrete spillway.	65	90,000 - 104,000
3. Nong Kham Phu Ta Ban Kham Bid, Tambon Kham Bo, Amphoe Waritchaphum, Sakon Nakhon	4,000 (2)	1,400 (1)	792	Strengthen & increase the height of existing embankment and build concrete spillway.	32	64,000 - 76,800
4. Nong Dern Ban Nong Dern, Tambon Chang Ming, Amphoe Phanna Nikhom, Sakon Nakhon	800 (2)	800 (2)	Not Available	Strengthen & increase the height of existing embankment and build concrete spillway.	110	132,000 151,800
5. Nong Kae Ban Non Tao Hai, Tambon Kham Yai, Amphoe Huai Mek, Kalasin	7,536 (7)	1,500 (1)	Not Available	Strengthen & increase the height of existing embankment.	79	94,800 126,400

1/ Information only available for eight locations, where DOF economists conducted surveys in 1979. (Divide by 6 to obtain per capita income).

Locations	Village Characteristics			Pond Characteristics		
	Population Served No. of People/(No. of Villages)		Average Household Income ($)	Required Improvements	Design Surface Area (rai)	Design Storage Capacity
	Total Uses	Fishing Benefits				
						m^3
6. Nong Waeng Ban Klang, Tambon Non Tan, Amphoe Tha Uthen, Nakhon Phanom	3,700 (8)	900 (1)	850	Build additional embankment and spillway.	110	132,000 140,800
7. Nong Fai Mai Ban Fai Mai, Tambon Fai Mai, Amphoe Ban Thaen, Chaiyaphum	2,100 (2)	900 (1)	Not Available	Pond design not received.	75	
8. Nong Bua and Nong Phai Ban Phon Phaeng, Tambon Phon Phaeng, Amphoe Phon Phisai, Nong Khai	4,465 (5)	3,900 (2)	1,361	Build new concrete spillway 30 m. long and new embankment 147.5 m. long.	305	366,000 - 420,900
9. Nong Thung Thoeng Ban Thung Thoeng, Tambon Thung Thoeng, Amphoe Det Udom, Ubon Ratchathani	1,100 (1)	1,100 (1)	1,030	Build new embankment and spillway.	75	
10. Nong Phran Pan Ban Phran Pan, Tambon Thephalai, Amphoe Khong, Nakhon Ratchasima	1,000 (1)	1,000 (1)	805	Strengthen & increase the height of embankment and build concrete spillway.	750	900,000 - 1,125,000

Locations	Village Characteristics			Pond Characteristics		
	Population Served No. of People/(No. of Villages)		Average Household Income ($)	Required Improvements	Design Surface Area (rai)	Design Storage Capacity
	Total Uses	Fishing Benefits				
						m^3
11. Huai Kud Hua Phi Ban Doo, Tambon Chumphon, Amphoe Chumphon Buri, Surin	4,000 (7)	4,000 (7)	1,175	Rebuild and reinforce the embankment.	50	-
12. Nong Pling Ban Nong Pling, Tambon Kok Sa-Ard, Amphoe Lam Plai Mat, Buri Ram	1,300 (7)	1,300 (7)	607	Build embankment and spillway.	110	48,000 - 60,000
13. Nong Pleiy Ban Nong Pleiy, Tambon Mak Kha, King Amphoe Kae Dam, Maha Sarakham	1,000 (2)	1,000 (2)	Not Available	Strengthen & increase the height of existing embankment and build spillway.	60	50,000 - 80,000
14. Nong Chiang Meo Ban Chiang Meo, Tambon Chiang Meo, Amphoe Muang, Khon Kaen	7,300 (4)	3,000 (1)	Not Available	Pond design not received.	100	-
Total	39,630 (50)	22,129 (29)			1,953 rai	

I. PROJECT SUMMARY AND RECOMMENDATION

A. Face Sheet Data

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: [ ] A = ADD, C = CHANGE, D = DELETE

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: THAILAND

4. DOCUMENT REVISION NUMBER: [ ]

5. PROJECT NUMBER (7 digits): 493-0303

6. BUREAU/OFFICE: A. SYMBOL: ASIA; B. CODE: 04

7. PROJECT TITLE (Maximum 40 characters): Village Fish Pond Development

8. ESTIMATED FY OF PROJECT COMPLETION: FY 81

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 1 (Enter 1, 2, 3, or 4); C. FINAL FY 81

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL		434	434		442	442
(GRANT)	( )	(434)	(434)	( )	(442)	(442)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		370	370		287	287
OTHER DONOR(S)						
TOTALS						729

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 80 F. GRANT	E. 1ST FY 80 G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
(1) FN	313B	313		442					
(2)									
(3)									
(4)									
TOTALS				442					

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)					442	
(2)						
(3)						
(4)						
TOTALS					442	

12. IN-DEPTH EVALUATION SCHEDULED: MM 01 YY 82

13. DATA CHANGE INDICATION. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[ ] 1 = NO, 2 = YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Donald D. Cohen

TITLE: Director USAID/Thailand

DATE SIGNED: MM DD YY

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-4 (3-76)

B. Recommendations

It is recommended that funds be approved for the Village Fish Pond Development Project as follows:

Section 103 - Grant	US$442,000
Loan	- 0 -
Total AID Obligation	US$442,000

C. Summary Description

The proposed $442,000 assistance package is intended to assist the Royal Thai Government to provide a minimum of 14 disadvantaged rural communities in the Northeast with year round access to supplemental water supplies and fish protein through techniques which can be readily replicated in the Northeast.

The Project will provide water storage tanks, village seed fish and supplies, nursery pond development and extension services in more productive fish culture practices. Emphasis will be placed on effective village management of the impounded water for multiple uses and increased self-reliance in operation and maintenance of the pond and supply of seed fish. A site team consisting of a fishery extension officer, fish biologist, and community development officer will work closely with village committees in transferring improved aquaculture techniques and developing a sound management system in multi-purpose use of pond water. Upon project completion, increased fish supplies and stored water for domestic and agricultural uses during the dry season will be available for some 3,000 farm families comprising about 20,000 people.

D. Issues

The status of issues raised in the PID review cable (Annex A) is summarized below:

1. Social Concerns

Willingness of villagers to cooperate in pond development was a critical factor in selecting the 14 participating villages from an initial field of 50 potential participants. Procedures for pond development also provide for the participation of the target group in planning the

construction and water regime to be employed, and managing the pond for multi-purpose use. Baseline profiles of several of the participating villages were developed by social scientists contracted from Kasetsart University. These are discussed in the social and economic analyses of this PP.

2. Pond Sites

Only one of the 14 pond sites selected is near a year-round source of water; the others will depend on rainfall and runoff for water storage. The participating villages are in rainfed, not irrigated areas. Water availability for the ponds is discussed in the technical analysis and technical annex.

Possible environmental problems have been minimized by choosing natural swamp depressions on RTG public land for pond sites. This approach also reduces costs and prevents unnessary removal of agricultural land from production. Final engineering design work for the ponds is expected to be completed by October, 1979, in time for the dry season construction period. The RTG's arrangements for engineering and construction supervision have been reviewed by USAID personnel and found acceptable.

3. Purpose and Goal

The project design clearly recognizes the importance of potential domestic uses of pond water. However, in this demonstration phase of a village aquaculture project, we chose to emphasize appropriate helath education (see para 4 below) rather than incorporate innovative filtration/purification techniques.

4. Environmental Analysis

The EA prepared for this Project was discussed with concerned RTG officials and submitted to AID/W. We received AID/W approval of the EA, (State 186931) but related comments reflected concern with possible health impacts of the ponds. The project makes provision for health education activities and intensive site monitoring arrangements to help ensure proper management and to ameliorate sanitation problems. A project manual for village use will include suggested techniques for filtering pond water before it is put to domestic use and the RTG site team (fishery extension officer, fishery biologist, and community development worker) will assist villagers in application of these techniques. These measures will be assessed during the

Project's evaluation to determine their efficacy. Other measures may be taken during project implementation if they appear warranted.

Regarding the possibility of water-borne disease, the U.S. Armed Forces Research Institute of Medical Sciences (AFRIMS) in Bangkok confirmed that the project would have no effect on the incidence of malaria or schistosomiasis in Thailand.

5. Construction Methods

Labor intensive construction methods will be used to the extent practical in accordance with RTG policy which also favors these methods. However, some construction operations, such as compaction, will obviously require machine application.

6. Payment for Labor

Villagers will be paid for labor on dike and spillway construction. However, they will contribute labor on self-help basis for nursery pond construction and in sodding, dredging, and weeding main pond sites. This labor contribution plus their responsibilities for pond management and maintenance, and seed-fish production should assure their sense of ownership of the Project.

7. Training

Details on the training program in support of the proposed budget are contained in Part IV-C, Implementation Plan. The training costs are low, but considered sufficient. In effect, the RTG site teams that will spend 75 days per year in the villages (for two years) will be providing on-the-job training to villagers.

8. Pavillions

Pond pavillions are included in the Project for those communities that desire them.

E. Summary Findings

The results of the technical and financial analyses prepared for this Project indicate that the proposed interventions are technically sound and that the cost projections are realistic and reasonable. The economic, social and environmental analyses all indicate that significant benefit will accrue to the rural poor residents of Northeast Thailand.

II. PROJECT BACKGROUND AND DETAILED DESCRIPTION

A. Statement of Problem

According to a comprehensive report on Small Scale Water Resource Development prepared by the Asian Institute of Technology (AIT) in 1978, about 80 per cent of the rural population in Northeast Thailand do not have access to water from reservoirs and reliable rivers. Adequate water is thus available to them only during the rainy season or through small, local water development projects. The population's remoteness from large reservoirs and reliable rivers limits the potential to produce year round supplies of fish, a traditional and preferred protein food when available. Available data indicate that the per capita fish consumption in Northeast Thailand is approximately 11.5 kgs/person/year vs. a national average of 21 kgs/person/year, suggesting a shortfall in the Northeast of 10 kgs/person/year.

The AIT study and other surveys conclude that the only way to meet the year-round water requirements of most of the population in the Northeast is through the development of small water projects. The term "small water projects" embraces a variety of techniques including small impoundments, dug ponds, wells, diversion weirs, etc. Of these, small to medium size ponds equipped with dikes and spillways, are a often preferred means of meeting the water and nutrition requirements of the people due to their relatively low cost and potential for multiple use.

Northeast villagers on their own initiative or with help from a variety of rural development agencies, have developed a large number of small impoundments. However, these ponds tend to be very small (less than 50 rai) and contain water and fish only for 3 months during and after the seasonal monsoon, thereby servicing community needs at this time. Most have been created solely by community effort through the partial enclosure of natural depressions with relatively low dikes, and few if any have a spillway. These impoundments are usually poorly constructed, have a limited life and are in various states of disrepair. In general the poor Northeast Thai communities lack resources to refurbish or to raise the standard of existing tanks for sustained use.

Despite the number of ponds already in place, the RTG estimates that some 16,000 villages in the Northeast continue to have inadequate water supplies; further, that existing and planned small-scale water resources will serve

only about 7 or 8 percent of them. An accelerated effort is obviously needed to meet the combined basic needs for water and protein in the most deprived area of Thailand.

B. Project Strategy

The project will attempt to increase fish yields that are made possible through the availability of water in a small impoundment. Traditional methods of fish culture produce only a fraction of the total yield that could be realized through proper stocking and harvesting, fertilization, and management of the fish "environment". In addition, the project will attempt to educate villagers in sound pond management practices for multi-purpose use, to understand the trade-offs between use of impounded water for fish production and for domestic and agricultural purposes during the dry season, and to allocate water among the various uses for maximum benefit to the community.

The project assumes three stages of technological transfer, with progressively more sophisticated (and productive) techniques adopted by villagers across the three stages. In stage one, a government service phase, villagers begin to realize higher fish yields by timely stocking, fertilization, and harvesting. Stage two is the self-reliance phase: villagers will begin to approximate optimal fish yields from their ponds, supply domestic and agricultural requirements through controlled allocation of stored water among competing uses and develop the capability to manage the pond and supply seed-fish with minimal government assistance. In stage three, villagers introduce integrated systems of multiple use to further expand the income potential of the pond. The most promising opportunity of this type is an integrated fish-livestock system whereby poultry or pigs are raised in pens built over the pond and their droppings fertilize the pond for fish feeding. The project will focus its efforts on stage one benefits during the first year of implementation, then increasingly try to promote stage two results. By end-of-project, the fourteen participating villages will present a variety of experience in multiple-use water allocation that can be appraised for optimal combinations.

Stage three activities are considered too advanced for this initial project in village aquaculture. Only one community, Ban Nong Dern in Sakon Nakhon, is considered ready for fully integrated systems. The AID grant includes funds for an operations research activity in integrated fishery-livestock-horticulture production at Ban Nong Dern. A multi-departmental committee of the MCAC will visit

Ban Nong Dern in mid-September to discuss the activity with villagers and agree on methodology and the role of each participating agency.

It is planned that the experience of the Village Fish Pond Project, including the operations research activity at Ban Nong Dern, will provide the foundation for an expanded project, Village Fish Ponds II, which the MOAC and USAID are jointly planning for initiation in FY 1981 or FY 1982. The follow-on project will replicate successful aspects of the Village Fish Pond Project and promote optimal multi-purpose use of small water resource facilities in villages throughout Northeast Thailand.

C. Detailed Description

1. General

The proposed Project seeks to address the basic needs for water and protein of the rural poor in Northeast Thailand. It will provide selected villages with year round access to supplemental water and fish protein through the development and improved use of multi-purpose ponds. The Project will finance the construction/upgrading of a minimum of 14 ponds and will also finance ancillary materials, services, and training. The ponds will be used by site communities for raising edible fish and as sources of domestic and irrigation water, and RTG Department of Fisheries (DOF) site teams will assist in pond management and train the villagers in how best to utilize this valuable resource.

Selected sites are located in 12 different provinces representing a cross section of Northeast Thailand. Since only a relatively small number of villages can be helped through this initial effort, particular care has been taken to develop an approach that can be readily replicated throughout the Northeast. The Project will also permit variation in the operation of each sub-project as proposed by the beneficiaries so that a range of management procedures may be tested for follow-on projects.

In order to facilitate maximum community support and involvement, the Project's implementation strategy has the following characteristics:

- The ponds will be small and located on public land that is naturally depressed and swampy.

- Management practices will be simple and basic.

- Use policies will be determined by the communities.

The small size and location of the ponds on swamp land will serve to: (1) confine them to public land; (2) minimize displacement of agriculture land, and (3) hold development costs at a level supportable by rural communities.

The Project will employ practices that are basic and simple and still meet output targets. Initial management practices emphasize fundamental needs. Fish varieties are hardy and need little sophisticated care. Such simplicity will facilitate adoption of the practices by the communities, and familiarity with basic approaches will equip the communities to accept more advanced practices as the communities are ready.

The communities will assume ownership and be responsible for final planning, use policies, and operation and management of the ponds. This involvement is important as a means to instill a sense of responsibility, to inspire local participation in dealing with local problems and to ensure equitable distribution of the benefits.

2. Project Goal

The goal of this Project is to contribute to the nutrition and the quality of life in disadvantaged rural communities of Northeast Thailand. Small, community operated, dry season water storage tanks, managed effectively for optimal fish and water use outputs, can help improve nutrition by providing supplemental protein and provide a base for income improvement.

The goal and its components conform with the priority desires of both the RTG and AID to promote the economic and social advancement of the rural people. Fisheries development--particularly inland fishery--is considered an integral part of the overall national economic and social development plan for Thailand. The Fourth National Economic and Social Development Plan (1977-1981) stipulates that overall fish production, including inland sources, should increase 7-10 per cent per year.

USAID/Thailand's CDSS gives highest priority to assisting people in the rainfed areas of the Northeast and emphasizes small-scale water resource development. The CDSS recognizes this approach as a key component of USAID/RTG strategy in attacking major causes of poverty in the resource poor Northeast.

Progress toward the goal will be indicated by:

- Increases in per capita income deriving from the sales of fish, garden and orchard crops, and surplus rice.
- Decreases in nutrition related diseases.
- Decreases in emigration from the Northeast.

Measurement of these changes will be by comparison of baseline data with the results of periodic evaluations and reports.

A basic assumption and developmental hypothesis of the Project is that multiple-purpose fish tanks will contribute to improvements in nutrition and the quality of life in the communities. Evidence for this assumption is derived from pilot projects (Annex C) where similar tanks made significant contributions to community welfare. Furthermore, as indicated in the AIT studies, "the rural people themselves recognize that sustained village water supplies are priority requirements for community advancement".

Another important assumption necessary for achieving the goal is that the RTG continues to stress improvement in rural quality of life as a national objective and thereby ensure on-going support of the Project. This objective is a top priority in the RTG Fourth Five Year Plan (1977-81).

3. Project Purpose

The purpose of the Project is to provide selected disadvantaged rural communities in the Northeast with year round access to supplemental water supplies and fish protein through techniques which can be readily replicated in the Northeast.

End-of-project conditions will include the following:

a. Adequate dry-season water supply to meet multiple-use requirements:

- Basic needs for domestic and animal consumption

- Producing continual crops of edible fish, yielding either:

  (1) the maximum amount of fish attainable from a tank/annual cycle; or

  (2) a minimum increase of 10 kgs. of fish/annual cycle/person in the community.

b. Increased cultivation of garden and orchard crops and timely initiation of rice nurseries.

c. Self-reliance of villagers to manage the ponds and provide most of seed-fish requirements.

d. Variety of effective community management techniques demonstrated.

e. Empirical evidence available concerning various combinations of multi-purpose pond use for maximum socio-economic benefit to village.

f. Program being extended to other Northeast communities.

Among the key assumptions for achieving the purpose of the project are:

- There will be sufficient water to regularly fill the tanks.

- The water and fish systems will be adequately managed to fulfill the purpose.

- Adequate support services will be provided by the RTG.

The first assumption concerning water availability, is discussed more fully in the Technical Analysis Section III. A.2. In general, the average annual rainfall for the Northeast is 1,500 mm. At this level of precipitations 0.75 km^2 of catchment area could provide 100,000 m^3 of storage. Since most of the tank locations are in natural depressions with catchment areas in excess of 0.75 km^2, sufficient water for filling the tanks is thereby assured. Several, however, will have storage in the range of 50,000 - 70,000 m^3, with correspondingly lower economic benefits. The economic return on these smaller ponds is still highly attractive (refer to the economic analysis, p.26)

Advance discussions with village representatives indicate the enthusiasm and willingness of the local people to manage and maintain the systems for community benefit. Precedence for this kind of participation is established in the project models described in Annex C. Given the carefully developed operational guidelines for the Project, it is reasonable to expect that the community will adequately manage the fish and water systems.

4. Project Outputs

The major outputs linked to the project purpose are the establishment of community ponds, nursery ponds for fingerlings, and an integrated system of multiple water uses at each project location. A supporting output will be village level facilitators trained in practices for managing the ponds to serve both fish production and consumption water needs. Seed fish will also be produced and distributed under the Project. A discussion of each output follows below:

a. Storage Tanks

A total of 14 water storage tanks, one for each of 14 communities, will be constructed under the Project. Most will range in size from 5 to 18 hectares; however, the tanks in Nong Khai and Nakhon Ratchasima will be considerably larger, 50 ha. and 125 ha., respectively. The tanks will be used by the communities for raising food fish and as reservoirs for domestic and irrigation water.

The general plan for developing the Project tanks calls for contractors to construct embankments and a spillway at each site, and for the villagers to contribute labor for weeding, dredging, and sodding. In most cases, pre-existing embankments will be significantly upgraded to increase storage and assure dry season water availability. The

extent of construction is predicated by the amount required to create the largest impoundment feasible but staying within the confines of the public land and a budgetary limit for the site. These conditions generally allow for the maximum height of the embankment to be up to 2 m. above grade and a mean water depth at peak storage of about 1.2 m.

Among variations to the basic impoundment plan that could be applied in some sites are:

- sub-grade excavations at the lower end of the tank for increasing storage; the depth of excavation would be 1 meter and the area would be about 10% or less of the tank area.

- drawdown conduit installed in the spillway at grade level.

- discharge conduits installed in the embankments for delivering water directly to places where it is required.

b. Fish Nursery Ponds

Two 1,000 m.² fish nursery ponds, as described in Annex C, will be built at each location utilizing labor contributed by the villagers. These ponds will be operated by the communities to produce Tilapia and possibly some Puntius seed fish for stocking the tanks. Each pond is designed to yield production lots of 50,000 fingerlings of the size required by the Project. Preliminary estimates indicate that virtually all of the Tilapia seed fish needs for a tank can be met by production from the ponds.

Each pond would be occupied for about 5 months for seed fish production. Afterwards the ponds could be used to produce additional table fish and/or as reservoirs for domestic water supplies.

c. Integrated Water Use System

A plan will be developed for use of the tank water at each location in a manner that will meet target yields of fish while allowing for other uses of storage water. The plans, prepared by DOF with the communities, will include a program for the maintenance and the environmental management of the tanks.

Each water use plan will strive to deploy storage water at a regular rate over the dry season. When demands equal or are in excess of the amount of water available, storage will be used up by the end of April. Where storage exceeds demands, some water remain in the tanks at the end of the dry season. Depending on the amount, this remnant water may be removed to comply with tank maintenance and environmental management.

The fish production component of the plan will entail a program of environmental maintenance, and stocking and harvesting adapted to the annual water regime of a tank. Production targets will be either (1) a minimum increase of 10 kgs. of fish/person in the community/year or (2) the maximum amount of fish attainable from a tank annually. One or the other will apply depending upon the circumstances at a given tank. A reference model showing the fish inputs and outputs as related to regularly decreasing storage over the dry season is presented in Annex C.

Fish yields are expected to range from less than 1,000 to up to 3,000 kgs/ha/annual cycle. The lower yields may be deliberate where target production can be met with less than optimal management; they may also be due to accidental fish losses. The higher yields will be sought where the maximum output of fish is required to meet targets.

d. Area Adjacent to Ponds Brought Under Cultivation

The water use system will include provision for garden and orchard crops, and rice nurseries on land adjacent to the ponds. The estimated potential for such cultivation is 80-100 hectares for all villages combined.

Assumptions germane to the project outputs are:

(1) Adequate Number of Sites

Twenty potential sites have been analyzed to date. Of these, 14 sites have been selected for funding under the AID-financed project.

(2) Availability of Engineering Design Services

The RTG is providing the design services for the tanks and ponds through engineers from DCF and provincial offices. A special "project engineering cell" has been set up by DOF to monitor the Project as explained in Part IV. Completion of survey and design studies is expected by October 1979.

(3) Availability of Contractors

Provincial fisheries officers have made preliminary enquiries to confirm the local availability of contractors to undertake the construction of tanks and ponds. The preferred construction time is during the dry season when local labor is most available and when ground conditions are most suitable.

(4) Continuity of Technical Services

Through the RTG assignment of a "Site Team" to each location, a technical group would be in place to advise the communities on operational procedures and to help obtain service needs from the RTG. The Site Teams will originate from local field offices which will establish continuity although personnel might change overtime. Included in the service needs are regular supplies of seed fish. These will be provided by both the RTG and the communities themselves.

5. Project Inputs

The Project relies on inputs from three sources, the RTG, USAID and the communities, as listed below. Some are in the form of cash while others are inputs in kind. Detailed descriptions of the inputs are provided in other parts of this PP as indicated, identified by reference letters in parentheses following the listed input (where, EA = Economic Analysis, IA = Implementation Arrangements, PO = Project Outputs and TA = Technical Analysis).

a. RTG

(1) co-ordinating committees (IA)

(2) land (EA, TA)

(3) planning and design work (EA, IA)

(4) community training in fish husbandry and tank management (EA, IA)

(5) seed fish (EA, IA, TA)

(6) operations [illegible]

(7) technical advisory teams ("Site Teams") (IA)

b. USAID - provides funds for the following:

(1) construction of the tanks (EA, PO)

(2) operations research

(3) community training programs (EA, TA)

(4) short term technical consultants (IA)

(5) evaluation

c. Communities

(1) participates in design of use plans

(2) through local committee, manages the use, operational requirements of each tank, and distribution of benefits (IA, TA)

(3) labor for nursery pond, sodding, dredging and weeding (IA, TA)

(4) operational manpower (IA, TA)

(5) some seed fish (EA, IA, PO, TA)

(6) support materials (organic fertilizers, rice bran, gasoline for pumps) (EA, TA)

(7) records of water deployment and fish yields (IA).

Some of the inputs are already in place while all others have been committed by the three sources pending implementation of the Project.

D. Other Donors

AID is the only foreign donor currently planning to provide assistance directly targetted at inland fishery development in Northeast Thailand. The Canadian Government earlier supported the Department of Fisheries in establishing the first pilot village fish pond in the Northeast Thailand, in Kalasin Project in 1977. However, the Canadian Government has been unable to continue its assistance due to funding constraints. The AID project proposed in this PP is based on the experience gained with the Kalasin pond project.

The Asian Development Bank (ADB) is supporting the RTG in aquaculture development in Southern and Central Thailand. In late 1978, the ADB signed a $14 million loan for aquaculture development, that includes four subprojects for shrimp and shrimp/fish production, one subproject for fish cage culture in the rivers of Central Thailand, and one subproject for integrated pond culture in Central Thailand. The latter subproject is the one most closely related to the Village Fish Pond Development Project. Accordingly, USAID will follow its progress closely for relevant experience in promoting integrated pond techniques in this project and in design of the follow-on project.

The UNDP/FAO is providing grant assistance to the National Inland Fisheries Institute in research/development of improved techniques of disease control and pond management. A possible shift in orientation of the grant is under discussion involving support for a demonstration fish farm complex to be used for applied research and training of extension workers. USAID will stay informed on the progress of this project and the complementarities between USAID and UNDP assistance.

III. PROJECT ANALYSIS

A. Technical Analysis

1. Land Availability and Characteristics

Each site chosen for the development of a Project tank exists as a natural swamp depression. Most are currently being used by proximate villages for limited fish-production and domestic consumption. The land is officially designated as "public land", but use rights will be ceded to the communities. Preliminary estimates indicate that the 14 improved ponds will occupy a total of 325 hectares of land. Excluding the two largest ponds, the average area covered will be 12 hectares. Current land use of pond sites during the dry season is limited to grazing by water buffalo, although there is a limited capability for arable crops. The land is generally valued at about ฿2,000/rai or ฿12,500/ha.

The sites are flooded regularly every rainy season. Some short term water storage occurs, and villagers have increased retention at many of the sites through the creation of embankments. The surface materials are invariably poorly drained peat and muck soils. Although aquatic vegetation is common, the amount varies considerably from site to site. These land characteristics facilitate the development of tanks which will be located on the natural depressions reworked by excavation and diking. Furthermore, the fine soil materials serve to restrain seepage.

The Project will change the land class from swamp to regulated water impoundment. The income potential of this land will be increased several fold at the marginal expense of foresaking limited agriculture on the tank sites themselves. The Project will greatly augment water storage for use over the dry season and thereby increase the capability for fish production and agriculture use.

Avance discussions with the communities indicate they are very anxious to deploy adjoining private lands for irrigated horticultural uses during the dry season. The specific arrangements for the use of this land and sharing of benefits is a matter of community management.

2. Water Availability

The tanks will be filled with surface catchment water during the rainy season. (May through October). Tank filling thus starts in May. Existing examples show that tanks of the project size would be filled to peak by mid-June. Subsequent surpluses to peak would continue to pass through the system until the end of October. Peak storage for the

dry season would be established in November. Losses from storage due to evaporation, seepage and consumption uses would then follow. The amount attributable to evaporation and seepage is 20% of peak storage thereby leaving 80% for consumption uses from November through April. Water use will be a prerogative of the communities, and amounts deployed will vary from community to community. The Project, however, will encourage a pattern of regular drawdown in the interests of optimization of benefits, tank maintenance, and environmental management.

Water availability vs. requirements is discussed in some detail in Annex C. - Technical Analysis. Given various assumptions concerning consumption requirements for domestic use, irrigation of garden plots and orchards; and irrigation of rice nurseries, it is established that water storage of approximately 100,000 m^3 at the beginning of the dry season will serve the needs of a typical village of 100 families. It is further assumed that a typical managment pattern will be to progressively draw down the stored water across the dry season for domestic and agricultural use to near-total depletion in April, when the pond will be drained and cleaned. These assumptions are utilized in the economic analysis for a typical pond in Part III-B. However, there are trade-offs between these water uses and maintaining water volume for fish-culture. A minimum volume of 50,000 m^3 is required for optimal stocking/harvesting rates. If a village elected to promote maximum fish yields, it would need to place effective restraints on domestic and agricultural use.

In general, the location of the ponds in naturally depressed swampy areas which already serve as catchments during the rainy season assures sufficient water for project objectives. However, the engineering design for each pond will be checked against topographic maps by the USAID engineer for a determination of probable storage. At sites where there are doubts about the adequacy of storage, further field investigations will be carried out before approving disbursements for construction at those sites.

3. Fish Production System

The project's fish production system described in Annex C. entails a program of stocking, harvesting, and environmental maintenance adopted to the annual water regime of a tank.

Polyculture, raising of several compatible species in the same reservoir, will be promoted with tilapia the principal species. Other fish species such as puntius, rohu, and bighead carp will be stocked in combination with tilapia whereever practicable. A schedule for seed fish inputs

and yield outputs, by numbers and species, will be planned for each tank. A reference model for such a schedule is included in Annex C, Table 1.

Apart from stocking and harvesting in accordance with the schedule, fish production will rely on effective management by the communities, to include:

- enriching the water with organic manure; for optimal results, about 4,200 kgs. of buffalo dung, or the equivalent, would be required to fertilize each hectare of water over an annual cycle; a proposed schedule of application is provided in Annex C, 6.

- control on the use of undue amounts of pesticides and herbicides.

- periodic removal of fish in excess of carrying capacities and of wild predator fish.

- periodic removal of aquatic weeds, and enrichment controls to prevent undue algae.

- the application of lime to tank soils that are acidic.

- periodic removal of sediment accumulations.

- periodic drying of large areas of the tank bottom.

The fish management system to be introduced by the project will differ from traditional practice in several important respects:

- poly-culture vs. monoculture.

- periodic stocking and harvesting to exploit the maximum carrying capacity of the pond (defined by water volume and nutrient level) vs. seasonal stocking which is the current norm.

- frequent (daily) fertilization.

- environmental control to maintain high water quality.

It is believed that participating villagers will readily accept these improved practices once they understand their value. Site teams consisting of a fishery extension officer, fish biologist, and in many locales, a community development worker will spend up to 75 days per year in a participating community helping the villagers to understand and apply the new techniques. The DOF's National Inland Fisheries Institute is preparing a project manual for use by these site teams that will cover fishery policy, all technical aspects of pond management, and sanitary uses of pond water for domestic purposes.

Purchased inputs are held to a minimum to promote acceptance; e.g., fertilizer applications will primarily be animal dung available in the village or slurry from compost pits. The critical input, seed fish, will be supplied by fisheries stations during the first year of implementation. Thereafter, villagers will construct their own nursery ponds and be trained to produce their own fingerlings.

4. Assurance of Seed Fish Supplies

Initial supplies of seed fish of prescribed sizes available in accordance with stocking schedules are assured by the RTG (see Implementation Arrangements). If all tanks were operated to yield the maximum fish output consistent with capabilities and optimal management, the annual project demand for seed fish could be about 8,000,000. The actual demand awaits the completion of a detailed operational plan for each of the 14 locations; the total may realistically be in the order of 4,000,000/year.

The RTG fisheries stations slated to serve the Project (Annex C-p.27) are presently producing 41 million fingerlings for existing demands. With budgetary support, chiefly for manpower and some facility expansion, the output could be increased by about 20% to 49 million seed fish/year.

Seed fish requirements at the outset will be met by the RTG stations through:

- reallocating priorities to ensure supplies for the Project.

- increasing present production with additional supplies financed by the RTG.

Tilapia is produced at all of the stations. Puntius is produced at most of the stations but can readily

be added to any station where required. Rohu and bighead carp are only produced at a few stations where the particular expertise has developed. Wherever possible the supplies will originate from the stations closest to a Project site. In the case of rohu and bighead carp, the seed fish will be provided by the stations presently producing the species.

As part of the Project, two fish nursery ponds will be constructed in each participating community, relying primarily on self-help village labor. The potential tilapia seed fish output is 50,000/pond/cycle with two possible production cycles/year. These ponds thereby have the potential to produce a total of 200,000 fish/location or an aggregate of 2,800,000 from ponds built at all locations. Interested villagers will also be trained to produce seed fish through induced spawning with initial equipment and supplies provided by the site teams. The combined output of the Fisheries Stations and village nursery ponds will be sufficient for Project seed fish supplies.

With successful demonstration of community construction and operation of nursery ponds, the Project will encourage communities to build additional ponds on their own. The new ponds could be deployed to produce additional tilapia where required or to even produce puntius.

5. Engineering Plans for Pond Construction

At the request of the Department of Fisheries, provincial-level engineers or technicians (of the Royal Irrigation Department, Accelerated Rural Development Office (ARD) or Fisheries Stations), have prepared designs for nearly two-thirds of the selected sites. Since many of these designs provided insufficient detail, the DOF has agreed to use ARD standard drawings and construction specifications for tank/reservoir projects to prepare final designs for all sites. These ARD standards call for attention to all required detail including location map of each project, contour lines of the site developed from field survey, general plan of dam/embankment, profile of the dam/embankment, spillway and all appurtenant structures, typical cross section, and cross sections of the embankment at every specific station.

Cost estimates for pond construction were also based on the ARD standard drawings and specifications, and are considered adequate for preparing the project budget. Submission of the final engineering design, firm cost estimate, and construction plans will be required as condition precedent to commencing construction on any sub-project for which AID financing is proposed.

Construction will be carried out by local contractors who are fully competent to construct these relatively simple dikes and spillways. The DOF has established adequate arrangements for engineering design and construction supervision, as described in Part IV-A.

B. Economic Analysis

1. Economic Benefits from Fish Ponds

The economic benefits realized from a village fish pond will depend on the specific end uses of the project. Ponds typically provide water for domestic uses, garden and orchard irrigation, and rice nursery irrigation, in addition to fish. In the present analysis, the quantifiable benefits accruing to the communities are increases in:

(1) the availability of dietary fish

(2) garden and orchard crops

(3) rice production

(4) livestock and household water

(5) revenue deriving from sales of surpluses of above.

Another direct benefit accruing to the project is to make more productive use of lands of marginal value where[1/] ponds are situated on land not suited to agriculture. In this case the opportunity cost of land is zero and a formerly unutilized resource becomes productive for the small farmer. If a small amount of formerly planted land is used for the pond, its production in terms of pond value is invariably much higher than the crop value it replaced. Similarly for the benefits from construction wages, some portion of construction wages must be accounted to benefits because unemployed laborers (the opportunity cost of unemployed labor being 0) during off-season can be utilized.

Besides the above economic benefits, a number of socio-economic outcomes should also result from a village fish pond project. For example:

1/ Art W. Kloke & Manu Potaros, Aquaculture as an Integral Part of the Agricultural Farming System - A case Study in the Northeast of Thailand, IPFC Occ. Pap. 1975/4 July, page 7.

a. The level of underemployment in the region will decrease. A pond does not appear to compete seriously for the head of household's time, and underemployed family members can easily contribute the management inputs required. Hence this activity can be carried out to supplement and not substitute for other employment pursuits.

b. Decrease in emigration due to a better water supply and available jobs within the region.

c. Improved public health due to meeting minimum desirable animal protein needs.

Models Tested

The present analysis will examine several variations on a basic production model. The variations are considered necessary since the productive system employed and output efficiency will probably differ significantly between villages.

We have constructed two basic models A and B. Both of these models assume 100,000 m^3 of stored water at the beginning of the dry season which is allocated among different uses as the storage is reduced to minimal levels by April, the end of the dry-season. Fish yields were assumed to range from 2150 kgs/ha/year (the optimal case) to 1,500 kgs/ha/year (70% of optimum) in accordance with the production programs described in Annex C, pages 19, 20. Existing flood fishery yields, from the pond sites were assumed to be negligible - no more than 50 kgs/ha/year, and therefore excluded from the calculations.

In Model A, villagers supply

2/ D.D. Tapiador, Some Notes on Perspectives of Grass-roots Fisheries Development in Asia, IPEC Occ. Pap. 10.10.1077, page 5.

3/ Ibid, page 5.

seed fish from their own nurseries. Model B, like Model A, has agriculture and aquaculture components, but the village fish nurseries portion of the project does not exist and hence the DOF will have to deliver fish seedlings. In both Models A and B, there is the possibility that only 70% of the optimum fish yield will be realized so we report a range for the IRRs of Models A and B. In sensitivity testing of Model A, we have two alternatives: the first alternative is to allocate scarce water resources (scarce since water collection may be 37% below the requirement for all uses) to fish, domestic use and gardens and orchards. The second alternative of Model A is to allocate the water to fish, domestic use and rice nurseries. There is only one sensitivity test for Model B; what happens if DOF fails to deliver any fish seedlings to the village ponds? In schematic form, the models take the following form:

Model A Range	High (100% of Optimum Fish Yield) to Low (70% of Optimum Fish Yield).

Sensitivity Test of Model A

1st Alternative Range	High to Low
2nd Alternative Range	High to Low
Model B Range	High (100% of Optimum Fish Yield) to Low (70% of Optimum Fish Yield).

Sensitivity Test of Model B

Model "A"

First Year Costs

Tank construction[4/]	=	฿494,000
Nursery pond construction	=	30,000
Land (11 ha. x 12,500)	=	137,500
Planning and design	=	140,000
Training	=	13,600
Fish harvesting nets	=	10,000
Fish nursery equipment	=	40,000
Seed fish (250,000 x ฿200 x 1,000)	=	50,000
		฿915,100

4/ Cost estimated by USAID/T engineer.

Annual Costs (Starting Year 2)

Operational and Maintenance	=	฿ 11,654
Seed fish	=	10,300
Equipment depreciation and replacement		15,000
	=	฿ 36,954

First Year Benefits (due to employment of off-season laborers)[5]

Construction wages	=	฿ 77,504

Annual Benefits (Starting Year 2)

1.	Fish:		
	- Optimum yield (23,650 x ฿12)	=	฿283,800
	- 70% optimum (16,555 x ฿12)	=	198,660
2.	Household water (฿1.0/family/day x 180 days = 210 x 180)	=	37,800
3.	Livestock water (assume 1 bovine equivalent/family for 180 days @ ฿0.25 day)	=	9,450
4.	Garden - 2 orchard crops (1/8 rai/family @ ฿500/rai)	=	13,125
5.	Rice nursery (100 families @ ฿600)	=	฿ 60,000
	(a) Opt. fish	=	404,175
	(b) 70% Opt. fish	=	319,035

5/ First year construction costs include approximately ฿194,000 for wages, of which 40% will be earned by village labor that would otherwise be unemployed during the dry season. We therefore assign this value, ฿77,504, as a benefit to net out that portion of the first year construction cost that does not represent a true cost to the economy.

Benefit - Cost Evaluations "Model A"

Yrs.	Cost	Benefit (a)	Benefit (b)
1	915,100	77,504	77,504
2	36,954	404,175	319,035
3	"	"	"
4	"	"	"
'	"	"	"
'	"	"	"
'	"	"	"
10	"	"	"

Model "A" 100% of optimum fish yield

Net P.V. of Benefits at 12%	=	1,068,897
IRR	=	44.85%
B/C	=	2.08

Model "A" 70% of optimum fish yield

Net P.V. of Benefits at 12%	=	593,886
IRR	=	34.77%
B/C	=	1.60

2. **Sensitivity Tests "Model "A"**

Sub-standard rainfall or extra-ordinary seepage/ leakage could reduce the effective storage of the tanks to 65,640 m^3 , or 37% below maximum for providing sufficient water for meeting maximum requirements. Consequently, a water use plan must be used. There are several alternatives applied to the basic model. The first alternative envisions using what scarce water is available for garden and orchard uses while the second alternative would apply the water for rice nursery use.

In both Alternatives (5,000 m^3 will be assigned to fish (nursery pond in year 2.
(45,360 m^3 will be assigned to (domestic uses.

Alternative 1) 15,750 m^3 will be assigned to garden and orchard irrigation; this amount will allow each family to irrigate 1/16 rai of crops.

Alternative 2) 15,000 m^3 will be assigned to rice nursery use; this amount will allow 50 families to irrigate nursery plots.

Note that the first alternative achieves only one-half of the garden/orchard benefits of the standard model, and the second alternative achieves one-half the rice nursery benefits. The results are presented below.

Annual Benefits (1st alternative) (1) + (2) + ½(4)

Fish:	Optimum yield (23,650 x ฿12)	=	฿283,800
	70% optimum (16,555 x ฿12)		198,660
Household water (฿1.0/family/day) x 180 days (= 210 x 180)		=	37,800
Livestock water (assume 1 bovine equivalent/family for 180 days @ ฿0.25/day)		=	9,450
Garden and Orchard crops (1/16 rai/family) @ 500/rai		=	6,562
	(a) opt. fish	=	337,612
	(b) 70% opt. fish	=	252,472

Annual Benefits (2nd alternative) (1) + (2) + ½(5)

Fish:	Optimum yield (23,650 x ฿12)	=	฿283,800
	70% optimum (16,555 x ฿12)	=	198,660
Household water (฿1.0/family/day) x 180 days (=210 x 180)		=	37,800
Livestock water (assume 1 bovine equivalent/family for 180 days @ ฿0.25/day).		=	9,450
Rice nursery (50 families @ ฿600		=	30,000
	(a) opt. fish	=	361,050
	(b) 70% opt. fish	=	275,910

Benefit - Cost Evaluations "Model A" (1st alternative)

Yrs.	Cost	Benefit 100% of Optimum Fish Yield	Benefit 70% of Optimum Fish Yield
1	915,100	77,504	77,504
2	36,954	337,612	252,472
3	"	"	"
4	"	"	"
⋮	⋮	⋮	⋮
15	⋮	⋮	⋮

Model "A" (1st alt.,) 100% of Optimum Fish Yield

Net PV of Benefits at 12%	=	682,256.9
IRR	=	34.9%
B/C	=	1.69

Model "A" (1st alt.,) 70% of Optimum Fish Yield

Net PV of Benefits at 12%	=	277,245.9
IRR	=	29.49%
B/C	=	1.28

Benefit-Cost Evaluations "Model A" (2nd alternative)

Yrs.	Cost	Benefit (a)	Benefit (b)
1	915,100	77,504	77,504
2	36,954	361,050	275,910
3	"	"	"
4	"	"	"
⋮	⋮	⋮	⋮
15	⋮	⋮	⋮

Model "A" (2nd alt., 100% of Optimum Fish Yield

Net PV of Benefits at 12%	=	793,351.5
IRR	=	39.82%
B/C	=	1.80

Model "A" (2nd alt., 70% of Optimum Fish Yield

Net PV of Benefits at 12%	=	388,740.5
IRR	=	34.45%
B/C	=	1.39

Model "B"

The elements of Model "B" are the same as of Model "A" with the exception that there is no fish nursery pond or related equipment. Some 261,000 seed fish thus must be provided annually by the RTG at a cost of ฿52,200/yr. Without the pond 5,000 m^3 of water is available for other consumptive uses; it is assigned as garden and orchard water and is enough to irrigate 4.1 additional rai.

First Year Costs

Tank construction	=	฿494,000
Land	=	137,500
Planning and design	=	140,000
Training	=	13,600
Fish Harvesting Nets	=	10,000
Seed Fish	=	50,000
		฿845,100

Annual Costs (Starting Year 2)

Operation & maintenance	=	5,530
Seed fish	=	52,000
Net depreciation and replacement	=	3,000
		฿ 60,530

First Year Benefits

Same as Model "A"

Annual Benefits

Same as Model "A" except that 4.1 more rai of garden and orchard are irrigated thus increasing benefits by ฿2,000 (a) ฿406,175 or (b) ฿321,035.

Benefit - Cost Evaluations "Model B"

Yrs.	Cost	Benefit 100% of Optimum Fish Yield	Benefit 70% of Optimum Fish Yield
1	845,100	77,504	77,504
2	60,530	406,175	321,035
3	"	"	"
4	"	"	"
⋮	⋮	⋮	⋮
15	"	"	"

Model "B" 100% of Optimum Fish Yield

Net PV of Benefits at 12%	=	958,770
IRR	=	44.92%
B/C	=	1.92

Model "B" 70% of Optimum Fish Yield

Net PV of Benefits at 12%	=	553,759
IRR	=	34.79%
B/C	=	1.53

3. **Sensitivity Tests Model "B"**

In case where there are problems in DOF delivering fish seedings, we assume that all of the 261,000 seed fish are not delivered in Model "B". Therefore, the annual benefits reduce to ฿120,375 and the annual costs reduce to ฿8,530.

Benefit - Cost Evaluation Model "B"

Yrs.	Cost	Benefit
1	845,100	77,504
2	8,530	120,375
3	"	"
⋮	⋮	⋮
15	⋮	⋮

Model "B"

Net PV of Benefits at 12%	=	153,416.56
IRR	=	5.95%
B/C	=	0.81

4. Results of Calculations

The range of economic rates of return both in Model "A" and "B" in the basic case - the benefits and costs will accrue as planned for in the project - are acceptable. (In Model A the range is 45% to 35% while in Model B the range is also 45% to 35%). The sensitivity test IRRs in both alternatives of Model "A" are also acceptable. (The ranges are 35% to 29% and 40% to 34% in alternatives 1 and 2, respectively). The range for IRRs in the basic Model B case is also acceptable in that they carry between 45% and 35%. However, IRR in the Model "B" sensitivity test is not acceptable and the benefit-cost ratio suggests that costs are well over benefits. This test indicates that it is not important who produces fish seedlings from an economic perspective, the village organization or DOF, but fish seedlings must be produced or the project, for the most part, will fail. However, the promotion of village nurseries adds local self-reliance without affecting economic return.

SUMMARY

Model	IRR	B/C
Model "A" Range	45% - 35%	2.08 - 1.60
Sensitivity Tests of Model "A"		
1st Alternative Range	35% - 29%	1.69 - 1.28
2nd Alternative Range	40% - 34%	1.80 - 1.39
Model "B" Range	45% - 35%	1.92 - 1.53
Sensitivity Test of Model "B"	5.95%	0.81

Model "A" - With fish nursery pond

Model "B" - Without fish nursery pond

Range (- Optimum yield from fish production
(- 70% optimum yield from fish production

1st alt.	-	Allocate 37% of maximum requirement water to fish, domestic uses (household - livestock) and garden and orchard.
2nd alt.	-	Allocate 37% of maximum requirement water to fish, domestic uses and rice nursery.
B	-	Seed fish not being delivered in Model B.

C. Social Aspects

1. Beneficiary Analysis

The project is directed at the poor majority within Northeast Thailand which is the poorest region in Thailand. In general, the villages selected for participation in the project do not have adequate year-round supplies of water for domestic consumption, agricultural uses, or meaningful levels of fish production. Most of the households that will benefit from this project are restricted to the possibilities of rainfed farming and derive little income from their land during the long dry season--due primarily to water scarcity. Social scientists from Kasetsart University surveyed ten participating villages and concluded that "judging from housing conditions, income sources, unemployment situation, and the movement of labor out of the village to find jobs elsewhere, seven villages are rather poor and one of these is very poor", applying rural Northeast Thai standards.

Three villages, those in Nong Khai, Nakhon Phanom, and Sakon Nakhon (Ban Nong Dern) were judged to be prosperous, again by Northeast Thai standards. However, as this is a demonstration project, the Department of Fisheries selected these relatively "advanced" villages to provide a variety of experience in what can be achieved through effective pond management. It is expected that these three villages will more readily use the enlarged pond as a multipurpose resource and, with proper support, begin to develop integrated use systems. Ban Nong Dern in Sakon Nakhon, for example, is being assessed as a possible site for a multidepartmental experiment in integrated fish-livestock-horticultural development, to be financed by this project.

Low income was an underlying concern in the selection of participating villages. Aside from technical factors (such as topography and soil characteristics), several other social factors were accorded importance in the selection process: need for additional water, villager willingness to cooperate with a government program, evidence of past cooperation on village projects, and village location accessible to other villages to permit easy observation of the demonstration project. All of these factors are important to the achievement of end-of-project conditions.

2. Social Soundness Analysis

The challenge and potentially great merit of the Village Fish Pond Project is that it is not being conceived on the basis of some laboratory-developed ideal system to which the villagers must adapt. Rather it begins with a consideration of local conditions and potentials with varying degrees of technological sophistication and varying usages possible depending on local conditions and local response and desires. The social analysis therefore should focus initially on existing aquacultural practices in the village in order to gain a better understanding of the potentials for increasing the efficiency of the system so that greater nutritional and income gains can be realized.

Following this approach, the project's social soundness is discussed in three aspects:

a. socio-cultural feasibility,

b. spread effects, and

c. social consequences and benefits.

The following observations are based upon the combined investigations of USAID's social scientist, a TDY social scientist from AID/Washington, and a survey of social aspects in ten of the selected villages by a three-person team contracted from the Faculty of Social Scientists of Kasetsart University.

a. Socio-Cultural Feasibility

There is no doubt that pond improvement in Northeast Thailand is perhaps the single item that Northeast villages in "rainfed" areas most desire and would benefit from in many ways. Apart from the improved protein intake and cash-income from harvesting fish, lack of water is a critical variable for domestic usage, dry season

vegetable gardening, and animals. Furthermore, improved technologies are available that are not prohibitively complex; initial infrastructural investment offers the potential for utilizing local labor and material; and pond and aquacultural improvement can be accomplished in a transformational, step by step manner that increases its likelihood of success and of progressively increased productivity.

Relationships between Fisheries Department personnel and target villagers are generally very good and the Department's efforts are perceived as being of direct assistance to the villagers. If villagers are at all stages included in the decision-making processes, especially in the setting of pond management regulations (i.e. no regulations which the majority in each target village do not themselves wish to have adopted) then participation in each village is likely to be extremely high, approaching 100%.

The largest potential obstacle to implementation lies in the area of village management mechanisms. In addition to regulating pond use and assuring participation in various pond management functions (weeding, cleaning, stocking, feeding, harvesting, etc.), the local committee will be responsible for maintenance and repair of the pond itself. For example, local management must be able to mobilize labor rapidly to repair dike breaches during rainy season flooding.

Field surveys related to project planning examined a variety of cooperative systems and pond management techniques now being used in Northeast Thai villages. An understanding of how these existing systems work should provide an excellent basis both for assessing what incremental changes in local systems might be useful to the villagers as well as suggesting likely system-types villages just starting up with a new pond or newly usable pond might want to adopt. This does not suggest that one should use intensive study in order to determine what is best for the villagers and then go all out to convince them to employ whatever such study suggests. Rather, the approach advocated simply assumes that people can make better decisions when they have better information and that one of the main purposes of the project is to find such information and make it available to the villagers so that they can then make more informed decisions. Hopefully, then, the project will be implemented in such a way as to help people do things for themselves

rather than the government do it for them, especially if the activity (like pond maintenance and seed-fish production) is to be sustained.

It is recommended that the project build on these existing, locally-evolved mechanisms wherever possible. The experience of the project with local management mechanisms will expand on this body of knowledge for later replication of the village fishpond program throughout the Northeast. Because of the critical and variable nature of the local management function, grant funds will be used to contract a Thai social scientist familiar with North-eastern Thai village social organization to assist in training of site teams, to design a monitoring and reporting system on the effectiveness of pond management, and to visit project sites during key periods (e.g., dry-season pond draw-down) in order to assist in local organization and evaluate various local management techniques.

b. Spread Effect

Village sites for the project are geographically dispersed covering 12 provinces in North-eastern Thailand, including many villages on frequently travelled communication routes. While some pond improvement outside target villages might thus spontaneously occur as a result of the project, active RTG participation is crucial in at least 2 aspects: first, in assisting with initial organization and investment for improved construction and, second, for assistance in fingerling supply and extension/education until the pond system can be wholly managed by the village. The lessons learned in this limited scope demonstration project can be used as a basis for a massively expanded fish pond program. The key challenge will be to rapidly develop methodologies whereby all aspects of operation, including fingerling production, can be handled indigenously by the villagers themselves. Site teams initially deployed in project villages can then move on to other villages to spread the program.

The project's emphasis on village self-reliance, thus, is critical to establish the desired spread effect. Otherwise the project reduces to one of pond construction and Fisheries Department management of a significant part of the system cycle. This would mean that possibility for spread effect would be limited by the availability of Fisheries Department personnel and material inputs and would thus severely limit the speed and scope to which the fishpond project can have any significant impact in helping the poor

majority. Even if the Fisheries Department expands significantly and develops a powerful extension service, only a small portion of the poor will benefit unless they can be quickly taught to take over all phases of the management themselves, thus freeing extension personnel for trouble-shooting, advising, and extending the system into new areas.

c. Social Consequences and Benefits

While the project is small-scale and thus will not by itself make major inroads on poverty in the Northeast, the type of approach being pursued can be expected to contribute both to increased income and nutrition, the alleviation of local poverty, the better utilization of land, decreased rural displacement due to local impoverishment, etc. Direct economic benefit will be closely monitored by detailed socio-economic survey.

A principle of the project is that benefits should be shared as widely as possible. Several types of existing management systems have been identified by consultants to the project. These include committee systems, temple-assisted systems, "bidding" systems, etc. In each of these systems, benefits were found to be reasonably equitably distributed. The Thai social scientist contracted under the project should periodically evaluate distribution effects and, where appropriate, recommend benefit-sharing mechanisms to the villagers. Thai villagers themselves are highly conscious of equity considerations in the use of common community resources. Therefore, no problems of monopolization are expected if proper procedures are initiated and the social scientist is consulted.

d. Role of Women

In general, there is a degree of task separation by sex role in the village fish production system. While production involves mostly men up to the harvesting stage, women are primarily responsible for post-harvest processing as well as marketing, and are thus involved in crucial decision-making stages of the system. In addition, women will especially benefit from the increased supply of domestic water for cooking, washing, etc., and the increased protein available will be of particular benefit to pregnant and lactating mothers.

D. Environmental Analysis

1. Project Status As Related to Environmental Assessment

The environmental analysis is based on the information available at the time the environmental investigations were carried out. Most of the project sites had been selected, and preliminary engineering designs had been completed for five of these. These preliminary designs were being submitted to provincial and village authorities for their review as to technical, economic, and socio-economic feasibility for fitting into the village environment. Some or all of the project tanks may be ready to proceed to construction by about November 1979.

2. Environmental Assessment Methodology

The Environmental Assessment has been prepared to meet the needs of the USAID/EA guidelines and also of the National Environment Board (NEB) of Thailand. The NEB guidelines, which are consistent with those of USAID, have been patterned after the guidelines developed by the U.S. Corps of Engineers/Battelle for evaluation of environmental impacts of water resource development projects. This procedure takes into consideration virtually all identifiable effects of the project, including effects on the natural, physical and ecological resources, on human economic development, and on socio-economic including quality-of-life values. Emphasis is placed on those environmental parameters which are sufficiently affected to require their being taken into consideration in the project decision-making process.

In addition to the information included in the project documents, the Environmental Assessment depended upon use of all known pertinent references in the literature, and upon continuing discussions with representatives of the Department of Fisheries (Dr. Alex Fedoruk) and the National Environment Board (Dr. Pakit Kiravanich). The Environmental Assessment is thus considered to reflect the interests of the concerned RTG agencies together with USAID.

3. Conclusion

a. Tables 4 and 5, included in the full Environmental Assessment report, summarize the findings and

conclusions on the environmental effects of the project, using both the USAID and NEB criteria applicable for such evaluations. Table 4 shows the projected environmental effects, assuming the project will include special inputs in project planning and implementation (not usually included in conventional local practice), so that the project benefits will in fact be realized. These include careful preliminary engineering planning and design, competent final design, competent engineering supervision of construction, and provision of needed special guidance during project operations including periodic monitoring. Satisfactory arrangements for engineering and construction supervision have been planned, as discussed in Part III A. Technical Analysis. Table 5 shows the projected environmental effects assuming these special inputs are not made, i.e., the project is handled in a more-or-less conventional manner.

b. Table 4 shows that the VFPDP, assuming proper planning and implementation,

(1) has virtually no negative effects or impacts on existing natural environmental resources, and while making use of surface water resources, the project will not impair this resource to the detriment of existing wildlife or existing human uses but simply will make more efficient use of this limited resource,

(2) will not result in adverse impacts on existing human development resources or socio-economic values including public health,

(3) will result in marked improvements in village environmental values in terms of improved economic levels, improved socio-economics including enhancement of cooperation among villagers in sharing a beneficial and rewarding public project, markedly improved nutrition, improved agriculture and farm animal production, and improved domestic water supply and resulting benefits to public health.

c. Comparison of Tables 4 and 5 shows that the environmental gains projected in b.(3) above will depend upon and be realized only in proportion to the extent the project is planned, constructed, and operated with reasonable efficiency. Assuming "conventional" planning and implementation, these gains may be significantly depreciated. There still would be virtually no negative environmental effects compared to existing conditions. In other words, should the

project not prove to be economically viable, due to lack of efficiency in planning, construction, and operation, the project's environmental gains would be largely non-realized; however, there still would be virtually no adverse impacts, i.e., environmental conditions in the villages would remain essentially as they are.

d. Should the project be successful, it should pave the way for progressive expansion of its concepts throughout the Northeast region (and elsewhere in Thailand and Southeast Asia), thus resulting in progressively increasing regional environmental gains.

e. The project would not result in any adverse effects judged by USAID's set of criteria on environmentally sensitive issues. In particular, the project will not result in any irreversible commitments of natural resources, nor destroy or significantly alter the existing natural environment, nor result in adverse cultural pattern disturbances.

f. The overall conclusion is that the VFPDP would be highly acceptable from an environmental point of view as well as of high-level importance in demonstrating an effective approach for improving the economic and socio-economic status of poor people in the Northeast. Properly planned and implemented, the benefit/cost ratio for the VFPDP should compare very favorably with alternative methods for gaining the same objectives.

(Note: The complete documentation of the Environmental Analysis is separate from the project paper and Annexes. The full report was submitted to AID/W and RTG agencies under separate cover. AID/W has reviewed the EA and communicated its approval.

E. Financial Plan

1. Overall Financing

The cost estimates for the total project, including both RTG and AID inputs, are shown on Tables 1-3. Details regarding the RTG and AID Projected Expenditures by Fiscal Year can be found in Table 4.

The total Project Cost is $729,000 with the following breakdown by funding source:

RTG	$287,000	39%
AID	$442,000	61%
	$729,000	100%

2. Disbursement Procedures

The Grant amount of $442,000 represents the total AID contribution to this project; any additional funds required to complete the project will be provided by the grantee from other sources. Funds will be made available by USAID to DTEC, in accordance with the existing arrangements between the two agencies. DTEC will be responsible for subsequent release of funds to the Department of Fisheries (DOF) as follows:

a. Costs related to local technical assistance, training, operations research, commodities, etc.

After the Agreement becomes effective, and initial conditions precedent have been satisfied, an initial release of funds for items other than construction as described herein will be made upon submission by DOF, through DTEC, to the Controller, USAID, Office of Finance, of Voucher Standard Form 1034, in original and three (3) copies, requesting disbursement to DTEC of an amount equal to the AID share of anticipated requirements for authorized expenditures, by budget line item, for the first three months of the project. Upon receipt of the advance from USAID, DTEC shall immediately deposit an amount equal to the two months requirements into the DOF account for the above titled expenditures.

TABLE 1

SUMMARY COST ESTIMATE AND FINANCIAL PLAN
(US Dollars)

Project Component	AID Grant		RTG 1/ (LC)		Total	
	FX	LC	DOF	DTEC 2/	FX	LC
1. Tank Development - Embankment - Spillway - Excavation	-	346,000	-	-	-	346,000
2. Fingerling Production	-	-	50,000	-	-	50,000
3. Commodities (pumps, nets, etc.)	-	-	13,000	30,000	-	43,000
4. Technical Assistance (5 p.m.)	10,000	10,000	-	-	10,000	10,000
5. Training	-	13,000	-	-	-	13,000
6. Operations Research	-	20,000	20,000	-	-	40,000
7. Evaluation (consultant - 1 p.m.)	10,000	3,000	-	10,000	10,000	13,000
8. Recurrent Costs - Salaries - Travel and per diem - Maintenance	-	-	57,000	107,000	-	164,000
Sub-Totals	20,000	392,000	140,000	147,000	20,000	679,000
Contingency & Inflaction (7.5%)	-	30,000	-	-	-	30,000
Totals	20,000	422,000	140,000	147,000	20,000	709,000

1/ The RTG contribution does not include valuation of the public land made available for use as fish ponds. This value is estimated to be $200,000 (325 ha. x $12,500/ha).

2/ Contribution from the Counterpart Fund of the Department of Technical and Economic Cooperation.

TABLE 2

COST ESTIMATES FOR A TYPICAL FISH POND*

(Baht)

Description	Amount	Unit	Unit Cost	Total	Remarks
1. Embankment				156,680	Top width Length 295 Height 2 m
Original ground cut	1,160	m^3	10	11,600	
Cut-off trench	1,480	m^3	15	22,200	
Earthfill and compaction	5,120	m^3	24	122,800	
2. Spillway (concrete)				173,770	Length 20m
Earthcut	265	m^3	10	2,650	
Reinforced concrete	90	m^3	1,500	135,000	
Rock riprap	90	m^3	200	18,000	
Riprap w/mortar	18	m^3	450	8,100	
Coarse sand	30	m^3	120	3,600	
Coarse gravel	30	m^3	150	4,500	
U-shape steel 3" x 1½" x 6m	4	ea.	480	1,920	
Total Material Costs				330,450	
Labor 30%				99,135	
Sub-Total				429,585	
Profit and Tax 15%				64,438	
GRAND TOTAL (Rounded)				494,000	By Contract
				US$24,000	

(Note: If less than ฿500,000 bid not required)

Following items will be done by villagers

1. Nursery pond construction
2. Sodding
3. Dredging (deepening the pond)
4. Weed-killing
5. Others

Assume selected soil, aggregates, and labor are available at site.

*Detailed cost estimates for the two largest ponds are shown on Table 2A and 2B.

TABLE 2A

COST ESTIMATES FOR BUNG PHRAN PAN FISH POND NAKHON RATCHASIMA*

(Baht)

Description	Amount	Unit	Unit Cost	Total	Remarks
1. Embankment				335,490	
Original ground cut	2,253	m^3	10	22,530	
Cut-off trench	-	-	-	-	
Earthfill and compaction	13,040	m^3	24	312,960	
2. Spillway (concrete)				185,000	17 m.long
Reinforced concrete	110	m^3	1,500	165,000	
Riprap w/mortar	40	m^3	500	20,000	
Total material costs				520,490	
Labor 30%				156,147	
Sub-total				676,637	
Profit and tax 15%				101,496	
GRAND TOTAL (Rounded)				778,000	

Following items will be done by villagers

1. Nursery pond
2. Sodding
3. Dredging (deepening the pond)
4. Weed-killing
5. Others

*Estimate prepared by USAID Engineer on the basis of the preliminary engineering design.

TABLE 2B

Cost Estimates for Nong Phai and Nong Bua Fish Pond, Nong Khai (Baht) 1/

Item	Description	Amount	Unit	Unit Cost	Total	Remarks
1.	Embankment				96.400	
	Original ground cut	580	m^3	10	5,800	
	Cut-off trench	740	m^3	15	11,100	
	Earth fill & compaction	2,560	m^3	30	76,800	
	Rock riprap w/mortar	4.5	m^3	600	2,700	
2.	Spillway (concrete)				271,780	30 m. long
	Earth cut	400	m^3	10	4,000	
	Earth fill & compaction	740	m^3	15	11,100	
	Reinforced concrete	110	m^3	1,800	198,000	
	Rock riprap	110	m^3	300	33,000	
	Riprap w/mortar	26	m^3	600	15,600	
	Coarse sand	40	m^3	110	4,400	
	Coarse gravel	40	m^3	130	5,200	
	U-shape steel 3" x 1½" x 6m	4	ea	120	480	
	Total material costs				368,180	
	Labor 30%				110,454	
	Sub-total				478,634	
	Profit and tax 15%				71,795	
	Grand Total				550,429	
	(Rounded)				551,000	

Following items will be done by villagers.

1. Nursery pond
2. Sodding
3. Dredging (deepening the pond)
4. Weed-killing
5. Others

1/ Estimate prepared by USAID engineer on the basis of the preliminary engineering design.

TABLE 3

DETAILED COST ESTIMATES FOR ALL PROJECT ELEMENTS

A. USAID Contribution			
1.	Tank development: (see Tables 2,2A,2B) (Embankment and spillway)	$346,000	
2.	Technical Assistance a. 4 p.m. of Thai social scientist=$10,000 b. 1 p.m. of U.S. aquaculture expert=$10,000	$ 20,000	
3.	Operations research (equipment and materials)	$ 20,000	
4.	Training courses: a. Trainers, biologists and extension officers (financed by DOF) b. Local villagers	$ 13,000	
5.	Evaluation: a. 1 p.m. of U.S. expert =$10,000 b. Locally-contracted survey work=$3,000	$ 13,000	
6.	Contingency allowance	$ 30,000	$442,000
B. RTG Contribution			
	Department of Fisheries		
1.	Salary costs (for site team, supervisors, evaluation team, and fish production staff)	$ 57,000	
2.	Seed fish cost (fish station supply of 5.0 million fingerlings)	$ 50,000	
3.	Operations research costs (travel, per diem, local hire)	$ 20,000	
4.	Commodities for village sites (pumps, nets, etc.)	$ 13,000	$140,000
	DTEC Counterpart Contribution		
1.	Per diem, lodging allowances and transportation costs for: a. Site team $70,000 b. Program supervisors $17,000 c. Evaluation team $10,000	$ 97,000	
2.	Service and repair charges	$ 10,000	
3.	Supplies & materials (bentonite, fertilizer, chemicals for local use at village pond site)	$30,000	
4.	Temporary hire wages (incremental staff requirements)	$ 10,000	$147,000
	TOTAL		$729,000

TABLE 4

PROJECTION OF EXPENDITURES BY FISCAL YEAR
(US Dollars)

Project Component	FY 80	FY 81	Total
AID Grant			
1. Tank Development (Embankment, Spillway, Excavation)	346,000	-	346,000
2. Technical Assistance	5,000	15,000	20,000
3. Operations Research	15,000	5,000	20,000
4. Training	6,000	7,000	13,000
5. Evaluation	-	13,000	13,000
Total AID Grant	372,000	40,000	412,000
RTG Costs			
1. Salary, Per Diem, and Transportation Costs	82,000	82,000	164,000
2. Supply of Seed Fish	35,000	15,000	50,000
3. Operations Research	15,000	5,000	20,000
4. Supplies and Materials	23,000	20,000	43,000
5. Evaluation	5,000	5,000	10,000
Total RTG Costs	160,000	127,000	287,000
Sub-Total (AID and RTG)	532,000	167,000	699,000
Contingency and Inflaction Factors (7.5%)	25,000	5,000	30,000
Total Project Costs (rounded)	557,000	172,000	$729,000

As soon as feasible after the end of the first month, and every month thereafter, DOF will submit to DTEC an accounting of the previous month's actual expenditures of the funds advanced by DTEC, certified correct by the project manager, together with a request for reimbursement of such expenditures. DTEC will review the request and reimburse the DOF for the authorized expenditures reported. DTEC will simultaneously forward a copy of the DOF request for reimbursement and Voucher SF-1034 requesting replenishment from USAID for such expenditures.

Beginning with the fourth request for reimbursement and every three months thereafter, reimbursement of the previous month's activity will be contingent on the submission of a quarterly status Report of Project Progress and Report on RTG Project Contribution.

b. Payment for Construction Costs

Following satisfaction of conditions precedent to disbursement for construction of any pond, USAID/Thailand will make an initial payment to DTEC of up to an amount equal to 60% of all signed contracts upon submission by the DOF, through DTEC, to the Controller, USAID, Office of Finance, of Voucher SF-1034 in original and three (3) copies together with one copy each of the signed contracts for which payment is requested.

Subsequent releases equal to 40% of completed contracts will be made upon submission by DTEC to the USAID Controller of Voucher SF-1034 together with copies of certificates signed by Chairman of the Inspection and Acceptance Committee, signifying that a given contract has been satisfactorily completed.

IV. IMPLEMENTATION ARRANGEMENTS

A. Administrative Arrangements

1. Participating Entities

The following five groups will share responsibility for implementation of the Project:

- the DOF will be the principal implementing agency for the Project on behalf of the RTG;

- various provincial government entities will help to coordinate Project activities at a local level;

- DTEC will receive the USAID grant on behalf of the RTG and disburse funds in accordance with project requirements and standard procedures;

- USAID will participate in planning, monitoring and evaluation apart from providing grant funds;

- the farmers, or recipients of the project, will contribute labor, both for wages and on self-help basis, and manage the Pond and related facilities for optimum socio-economic benefit.

2. Administrative Organization

The RTG will establish a multi-tiered administrative structure for project implementation which emphasizes policy planning at the Center, strong participation by provincial and district officers, operational decisions made at field level and principle management functions carried out by the community itself. This structure is described below, illustrated in Figure 1, and detailed further in Annex F.

a. Central Committee - This committee, composed primarily of senior officers of DOF, including representation from USAID and DTEC, will have the following role:

- project policy
- designate government working groups
- relate the project to provinces and provincial governors.

FIGURE I *SUMMARY OF PROVISIONS TO THE PROJECT BY THE PARTICIPATING GROUPS.*

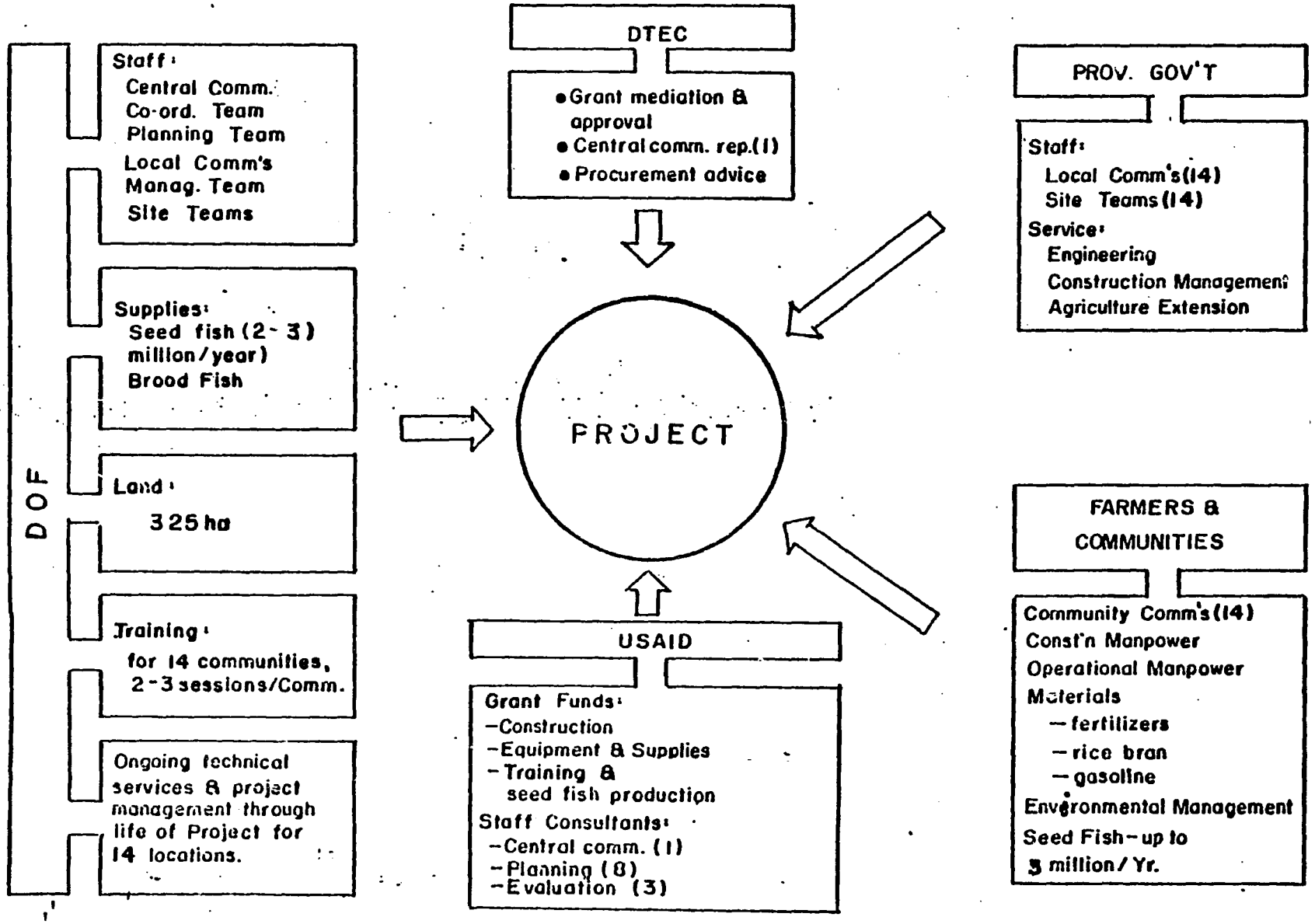
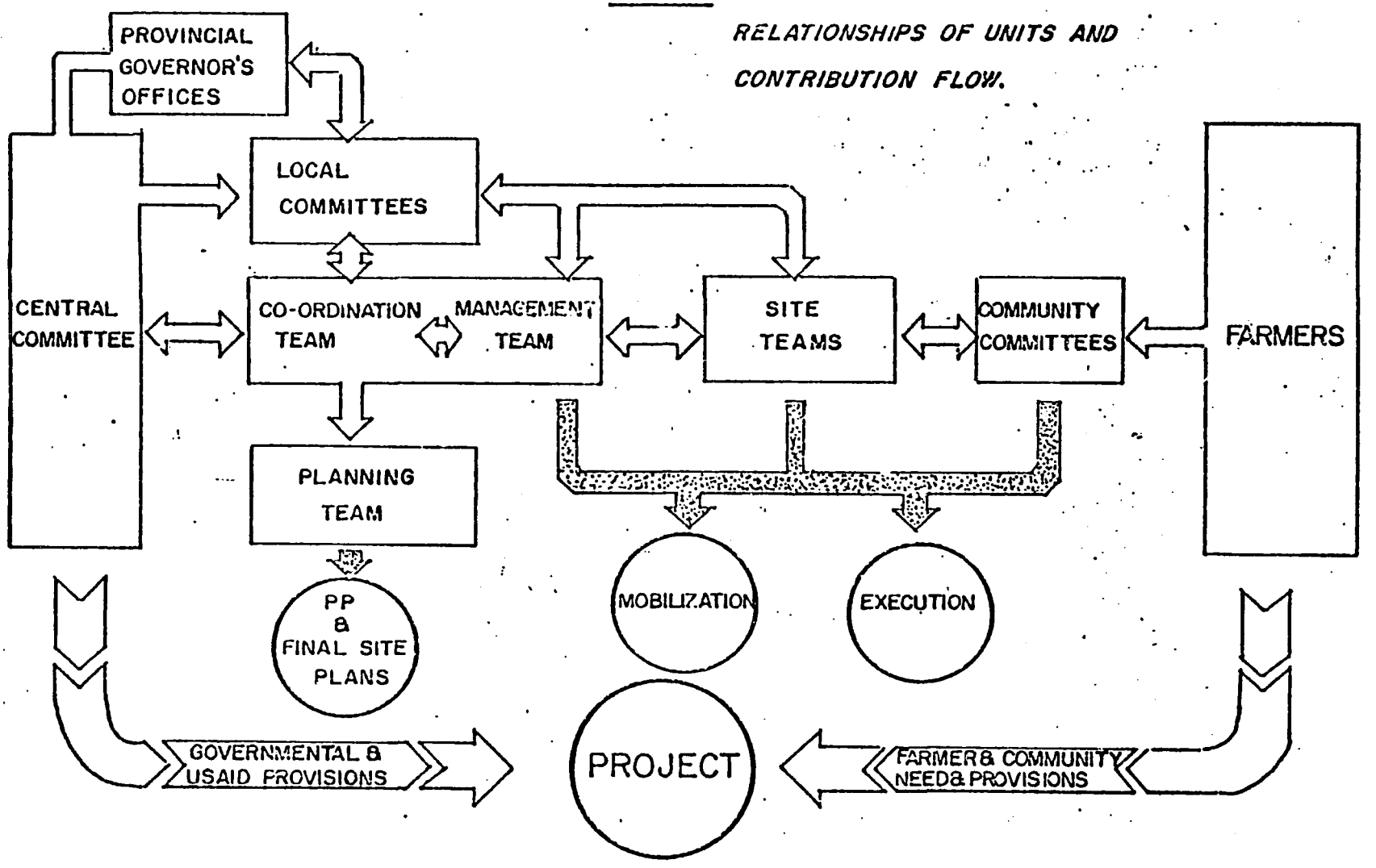


FIGURE I ***ADMINISTRATIVE ORGANIZATION SHOWING RELATIONSHIPS OF UNITS AND CONTRIBUTION FLOW.***



b. Local Committee - One local committee will be established in each participating province. It will be constituted by either the chief of the local fisheries station or the chief fisheries officer, whichever is assigned to a given province, and one or two staff from provincial government offices as designated by the Governor. Its function will be to:

- coordinate project requirements at a provincial or local level.

c. Co-ordination Team - A team composed of two senior DOF biologists has served to:

- coordinate all requirements for preparation of the Project Paper and advancing the Project to the implementation stage.

d. Planning Team - This team, composed of DOF staff, USAID staff, and consultants has served to:

- prepare Project Paper and final site plans.

e. Management Team - This team of three senior DOF biologists will replace the Co-ordination Team when the project is ready for implementation, to be responsible for:

- ongoing management of the project.

f. Site Teams - These will be appointed for each of the fourteen sub-projects. Consisting of one local fisheries biologist, one or two local fisheries extension workers, and for many sites, a local community development officer, each team will be responsible for:

- liaison between the RTG and a participating community;

- providing technical, supervisory and training services to a community.

g. Community Committees - A village committee of 3 to 5 members will be established for each participating community to:

- set use policies and regulations

- supervise pond management and distribution of benefits.

2. Capabilities of the Implementing Agencies

a. DOF

An organization chart of the DOF is presented in Annex F. The key management office is the Division of Freshwater Fisheries which has deployed staff and services for the Project from the National Inland Fisheries Institute (NIFI), Provincial Fisheries Stations, and District Fisheries Offices. The latter three agencies have a total staff of about 700, which includes 125 at the professional level.

NIFI, with a staff of 200 including 50 professionals, is located in Bangkok. The Institute's principal function is to evolve the technology required to promote the development of the inland fisheries. NIFI also provides services to regional fisheries stations. Although relatively young (initiated in 1976), its staff has been drawn from other agencies of DOF; hence, they have a background of practical experience. NIFI, in particular, has experienced fisheries planners which are essential for the proper design and management of the Project. The qualifications of NIFI are detailed in the document "National Inland Fisheries Institute, Inaugural Report, 1976-1978", presented as a supplementary attachment to this PP.

The Deputy Director for Planning of NIFI has been designated Project Manager. He will head a Management Team consisting of two fish biologists (one full-time, one part-time on project) and a finance officer. The Project Manager and two fish biologists will each coordinate project activities in a sub-region of Northeast Thailand.

An RTG Fisheries Station exists in 10 of the 14 Provinces of the Northeast. A District or Provincial Fisheries Office exists in all of the Provinces. The most senior staff member from these offices will be the key person on the local committees set up for each participating province. Such persons are experienced in fisheries management, including field stations, stocking, extension, and research - and are capable of representing interests at the provincial level. Virtually all of the seed fish required from the RTG will be provided by the fisheries stations. The capability of the stations to produce these fish is shown in Annex C.

All but one member of each of the 14 site teams will be appointed from provincial fisheries staff. The appointees will be biologists and fisheries extension officers who are presently working on local fisheries matters. They are qualified professionals. Supervision by the station chiefs and the management team will ensure the appropriate direction where there are shortfalls in the experience of some members of the site team.

b. Provincial Governments

One sub-project each is planned for ten provinces of Northeast Thailand, two provinces, Sakon Nakhon and Udon Thani, will have two sub-projects. The Governors of the participating provinces have been apprised of the project by the Central Committee, and planning and pre-implementation matters are being coordinated through local committees. The role of the provincial governments and local committees is to identify the need for local services and to provide support personnel where required. The latter include engineers to carry out surveys, designs, and cost estimates for the tanks, and community development officers to participate in the site teams. As the highest civil authority in a province, these governments can assure that qualified, capable staff are available to support the project.

c. Farmers

Farmer target groups will have primary responsibility for executing the project; they will plant and harvest fish, deploy water for a variety of uses, produce seed fish, and provide overall pond management. Fishing and water use are well-established activities of the farmers. Special applications, as required, will be introduced to the farmer through training and extension programs, along with demonstration and supervision by site teams. New practices such as seed fish production will also be taught through training and supervision.

d. USAID

USAID's monitoring and support role during project implementation will be carried out through a project committee, chaired by an Agricultural Projects Officer, and including a USAID-employed Thai Assistant Project Officer, sociologist, economist, engineer, generalist project officer, and finance officer. These staff arrangements proved satisfactory during the project preparation phase, and are judged adequate for project implementation.

e. Technical Assistance

To supplement the expertise of the DOF in implementing the project, the AID grant will include $30,000 for technical assistance, to be used as follows:

- Thai social scientist for approximately 4 person months, utilized periodically. $10,000
- foreign fishery expert to participate in Phase II project review (1 person month) $10,000
- foreign fishery expert for "trouble-shooting" purposes (1 person month) $10,000

In addition, USAID will seek arrangements under the DSB/AGR contract with Auburn University (AID/DSAN-0053-Aquaculture) to provide continuing consultant assistance in project implementation and evaluation. Auburn University is already cooperating with the DOF in improving aquaculture extension training programs.

B. Engineering and Construction Supervision

1. Procedures

Although local provincial authorities (ARD, DOF, RID, etc.) under the direction of the Governor will be responsible for engineering plans, contracting, and construction supervision, the DOF's Engineering Section will screen all plans for adequacy and correct them as necessary, and will inspect and ultimately accept (or reject) construction activities. The Engineering Section currently has a total of 35 civil service staff plus a number of other employees. One engineer, the Chief of Water Resources Rehabilitation and Construction Unit, has been assigned to work full time on this Project and he will coordinate with other staff of the Section to ensure engineering soundness.

Survey and design work is approximately 75% complete, as the PP is being finalized. Final review and approval of design is the responsibility of the Engineering Section. On the basis of experience to date, it is probable that designs prepared at the provincial level will still need to be revised, corrected, or standardized as necessary. Prior to construction of each project, the drawings will also be reviewed by USAID, as reflected in the section on conditions precedent.

The construction work will be done primarily by contract but in some cases, force account may be an acceptable substitute. An Agricultural Mobile Construction Service Center for the Northeast was recently established by the Government with 8 fleets (to be increased to 16) of heavy equipment to undertake construction of ponds/tanks/reservoirs and/or rehabilitation. This service can be accessed through provision of funds to cover operating expenses. However, since there is not yet any experience with this service, the project will continue to rely on contractors.

2. Institutional Capability

The Engineering Section has demonstrated its capability to provide the needed engineering services. Last year alone it was allocated $1.0 million equivalent to rehabilitate 12 ponds and carried out the engineering work satisfactorily. The Engineering Section also has responsibility for DOF's overall survey and design work of fisheries related structures, hatcheries/nurseries, buildings, etc.

For contracting and construction supervision, three committees will be established: 1) A selection committee, consisting of representatives from provincial authorities, a fishery officer or chief of the fishery station, and engineer. This committee will be appointed by the Provincial Governor. If the construction cost per project does not exceed ₱500,000, the Committee will informally secure at least 3 offers in locale. Should the cost exceed ₱500,000, formal bidding will be required; 2) A construction supervisory committee will include two provincial engineers/technicians and the fishery officer. A technician will be assigned to be resident construction inspector, stationed at the project site throughout the construction period; 3) An inspection and acceptance committee will consist of a DOF representative (Project Director or Engineer), two officials from provincial government and an AID representative. This committee will also make spot checks during the course of construction.

On balance, the procedures established for engineering, contracting, and construction are acceptable, and the implementing agency has adequate capability to carry out these procedures effectively.

C. Implementation Plan

The project implementation plan is illustrated in Figure 2, broken down by phases: planning, mobilization, and execution, as discussed below.

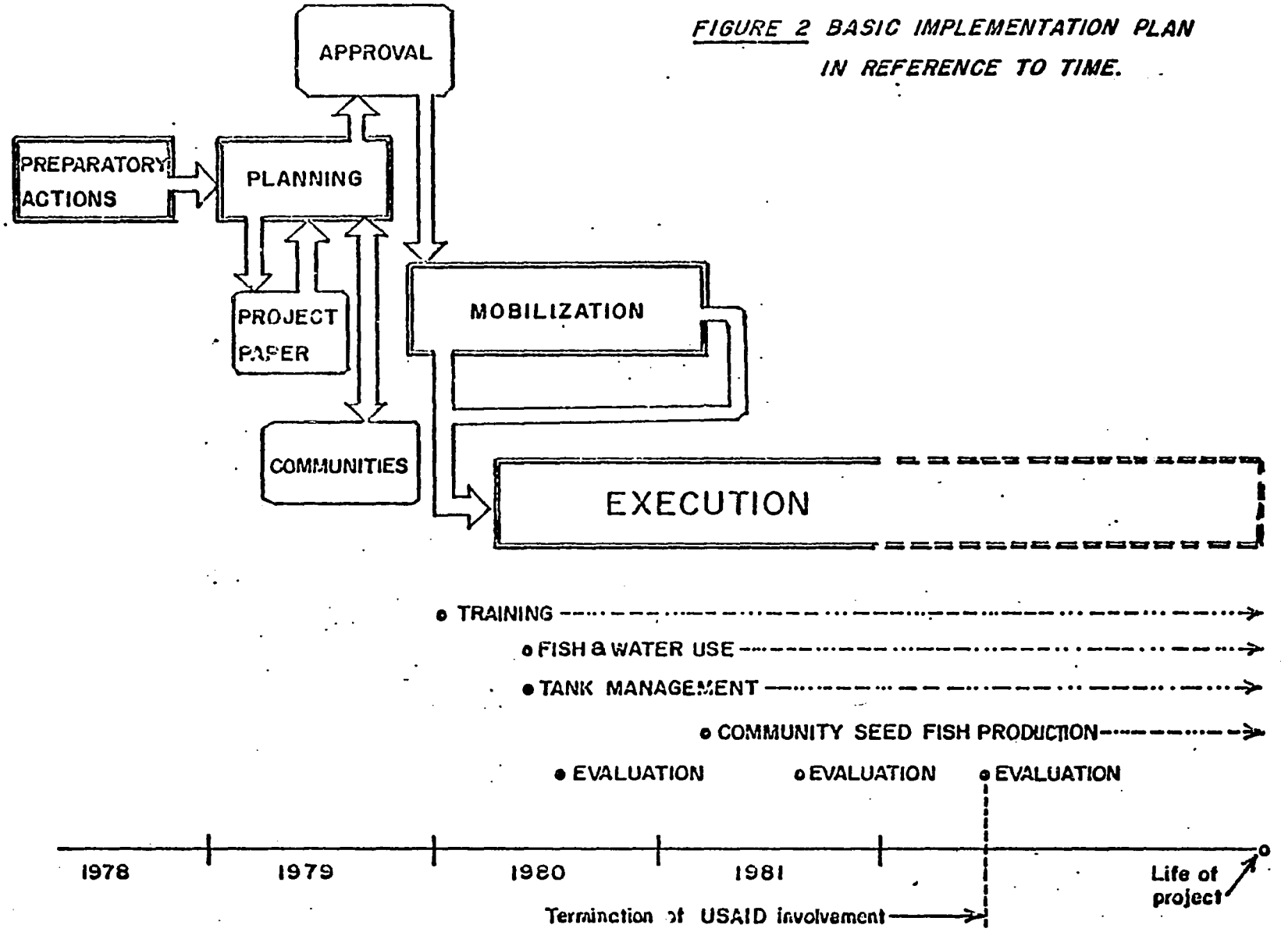
1. Planning

The planning phase of the project, under the direction of the co-ordination team and execution by the planning team, was initiated in February, 1979, with the following concurrent actions:

- start of the PP
- selection of 14 sites from those submitted by local committees.

Site selection was made on the basis of field studies conducted in February, March and April. At this time an economist team of the DOF and team of social scientists contracted by USAID compiled baseline information on participating communities through field interviews.

FIGURE 2 BASIC IMPLEMENTATION PLAN IN REFERENCE TO TIME.



Following selection of sites, the respective local committees then requested engineering services from provincial government offices to (1) prepare basic tank designs and (2) estimate construction costs. Designs and cost estimates for all sites are scheduled to be completed by October 1979.

The PP was therefore completed without full site details for all sub-projects. However, the PP provides sufficient information for overall appraisal of the project and for financial planning. Implementation will proceed on each sub-project when there is an acceptable design, cost estimate and final site plan. The mobilization and execution phases would then be guided by the following implementation plan.

The procedure for the development of final site plans is illustrated in Figure 3. The steps in completing a final site plan are:

a. supply site details (engineering, economic, sociological) to the planning team which will prepare a preliminary site plan using the PP as reference;

b. refer the preliminary site plan to the community for adjustment and acceptance;

c. identify costs and benefits and reconcile with the overall budget; refer to the Central Committee if extraordinary decisions are required;

d. approve final site plan for subsequent action.

2. Mobilization

Mobilizing a site for development entails:

a. constructing the facilities (tank, nursery ponds, sala);

b. procuring equipment and materials;

c. arranging for seed and brood fish from the RTG;

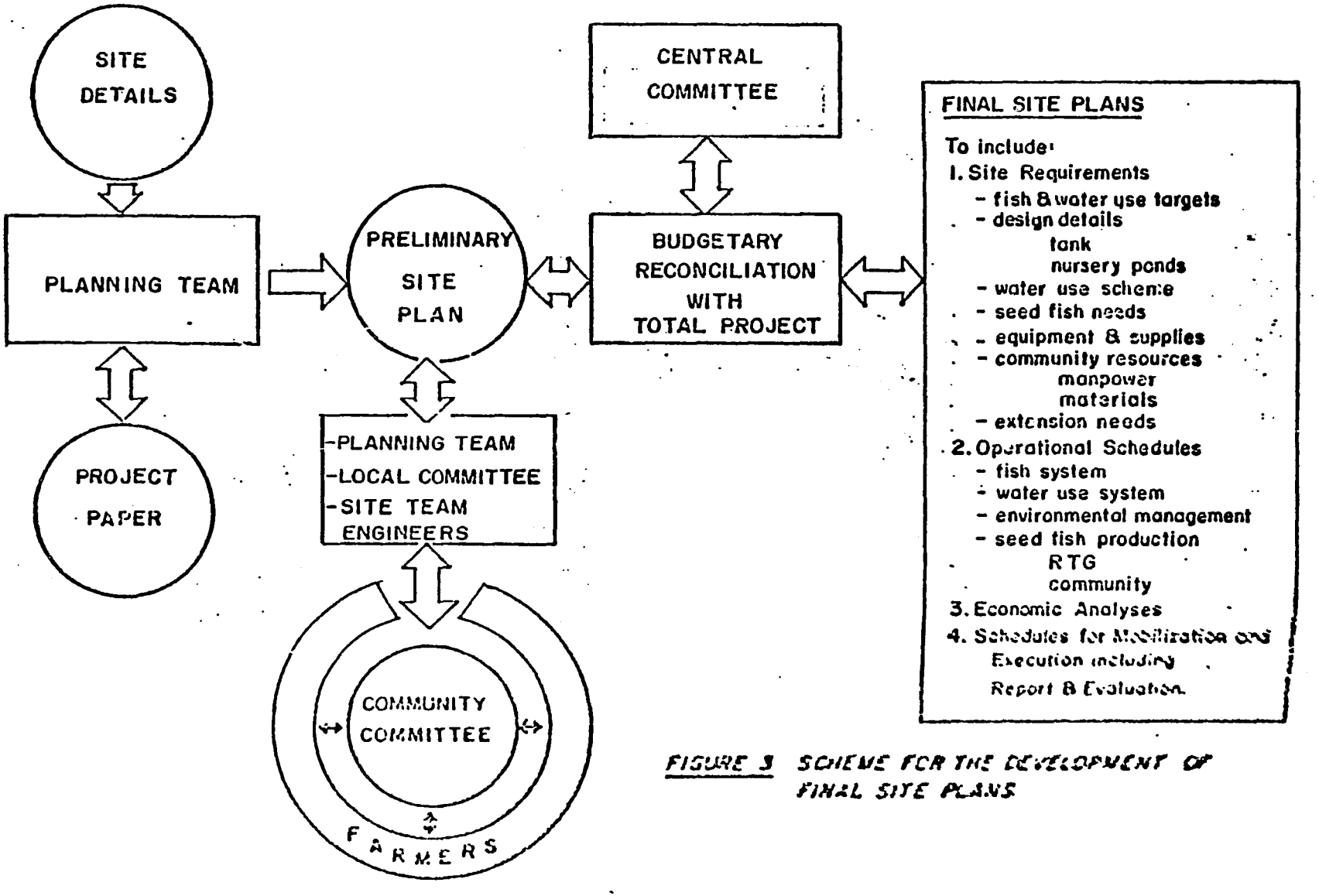


FIGURE 3 SCHEME FOR THE DEVELOPMENT OF FINAL SITE PLANS

d. providing the training and extension services.

This phase of the work is primarily undertaken by site teams under the direction of the management team and the local committees.

The general scheme for mobilization is shown in Figure 4. The schedule for initiation is dependent on project approval by USAID and the RTG and completion of final site plans. If these matters proceed expeditiously, then mobilization for all sites could occur from late 1979 through the first 3 or 4 months in 1980. Delays in approval and/or final information on a site could make it impossible to construct the ponds in the 1979/80 dry season. Mobilization in such a case would be deferred to the following dry season.

3. Execution

Implementation of a particular sub-project would occur as directed by the final site plan, and following site mobilization. Some or all of the sites could be ready for execution in early 1980, others may not be ready until early 1981. The site teams will be instrumental in carrying out project activities during the execution phase, as described in Annex F.

During the first full year of implementation, each site team will spend up to 75 days in its assigned village, assisting in establishing a strong village management operation and in applying improved aquaculture techniques. Every second or third week, the site team will monitor water quality and fish biology (growth rate, reproduction, mortality, etc.). Seed fish will primarily be supplied by the fisheries stations, as first-year emphasis will be on fish stocking/harvesting and environmental management. In the second year, the site team will promote increasing self-reliance by the villagers. Nursery ponds will be established in the villages, and villagers will learn to produce their own fingerlings. The intensive work of site teams should be completed at the end of two years of implementation. Thereafter, unless serious problems arise, fishery station personnel will visit the project villages approximately once a month to monitor continuing progress and offer guidance.

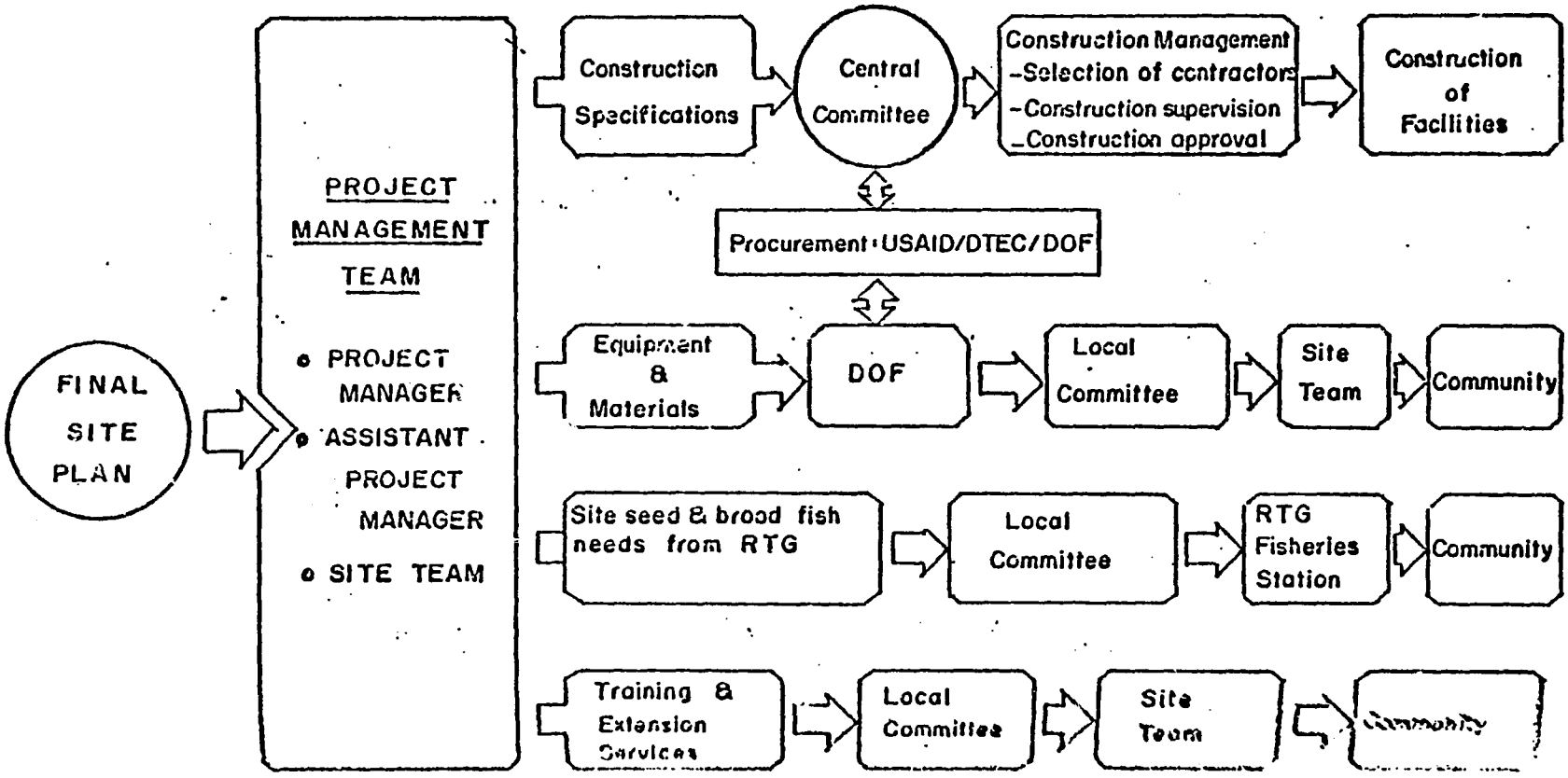


FIGURE 4 MOBILIZATION SCHEME

D. Training Programs

Two levels of training programs will be organized: the first program for training the biologists and extension officers who will be assigned to site teams; and the second program for the villagers.

Training of the biologists and extension officers will be conducted concurrently with construction of the village fish ponds. The National Inland Fisheries Institute and the Extension Section of the DOF's Conservation and Extension Division will cooperate in organizing the training program. In addition, Auburn University, through Dr. R. Schmittou, may be requested to assist with the training course, under an existing AID centrally-funded contract. The course will focus on the technology transfer process and last approximately 5 days.

An on-the-job training program for local people will take place at the site immediately after stocking of fish. Representative villagers will be selected by the village committees to assist the DOF site teams in caring for newly stocked fish. Throughout the exercise, by working closely with fishery experts, these volunteers will learn about proper fish management. Subsequently, the village committees, advised by their local fishery volunteers, will select approximately 15-20 villagers for a fish-culture course. This course will be conducted at near-by fishery stations, with duration of the course to be 5 days. Such training will be conducted quarterly and we anticipate that 50 people from each village, or 5% of the community population, will eventually receive the fish-culture training for each project or associated project area.

Budgets Estimated for Training Program

I. Training for biologists and extension officers

Place : National Inland Fisheries Institute, Bangkok

Trainees : 60 (20 biologists and 40 extension officers)

Duration : 3 days

Budgets : ฿56,400

Allowance/per diem ฿160 per head/day

Travelling (bus) ฿400 per head/round trips

Materials ฿ 20 per head/day

II. Training for local villagers

Place : Near-by Fishery Stations

Trainees: 50 or (50 for each community)

Duration: 5 days

Budgets : ฿260,000 (AID Grant)

Allowance/per diem ฿ 30 per head/day

Travelling (bus) ฿100 per head/round trips

Materials ฿ 10 per head/day

E. Evaluation Plan

RTG and USAID/T will monitor and evaluate the performance of this project through four mechanisms:

- Baseline Survey Reports
- Phase I Review
- Phase II Review
- Joint RTG/USAID Final Evaluation

1. Baseline Survey Reports (CY-79)

The survey is a preimplementation action done by Thai professionals who have surveyed 10 different village sites in the Northeast.

The team consisted of:

Fishery Biologists
Economists
Sociologists

These baseline reports will provide a useful basis for comparison with the results of future periodic evaluations.

2. Phase I Review (FY-80)

The review will take place in June or July 1980, after construction and stocking of fingerlings are completed.

Members of the Phase I Review Team will be:

- Engineers
- Fishery Biologists
- Thai Sociologist (contract)

The Review Team will report on:

- Technical suitability of the pond design
- Adequacy of seed fish supplied by various fishery stations in the Northeast for stocking in the community tanks.
- Stage of adoption of improved fishery management techniques.
- Effectiveness of village committees and patterns of local cooperation

3. Phase II Review (FY-81)

This review will take place in approximately January 1981 after the training programs, fish harvesting and restocking are completed.

Members of the Phase II Review Team will be:

- DOF Economist
- DOF Fishery Biologist
- Thai Sociologist (contract)
- DOF Extension Officers
- USAID representatives
- Contract aquaculture expert

The Review Team will report on:

- Application of improved fishery management techniques, and their result on yield.
- Effectiveness of training program.
- Impact of the project on the well-being of the community.
- Potential for extending the program to other communities through a follow-on project.

4. Joint RTG/USAID final evaluation

The joint RTG/USAID final evaluation will be conducted by a team composed of:

RTG

- DOF Fishery Biologist
- DOF Economist
- Thai Sociologist
- Representative from DTEC

USAID

- USAID/T Representative
- Fishery Expert from AID/W or on contract basis

It is expected that the joint evaluation will take place at least one year after termination of the project. USAID financing to support this evaluation effort will be provided either from a follow-on project or from the Program Development and Support Fund.

The evaluation of project effectiveness and efficiency will be related to the specific goals and objectives of the project,

as described in the Logical Framework. In addition, the evaluation indicators will include:

Ultimate impact of the program on the well being of the community.

Spread effect of the community fishery development program, to help people in other areas of the Northeast.

Funding for Evaluation Activities

The RTG will contribute the local currency equivalent of $10,000 for evaluation activities. During the life of the Project, two project reviews are planned in 1980 and 1981, and an end-of-project RTG/USAID evaluation in 1982. The RTG funds will cover the per diem and travel costs for DOF personnel participating in the evaluation and DOF (or contract) economists to carry out sample surveys for evaluation purposes.

USAID inputs into the evaluation will be:

1. Hiring of 3 Thai sociologists for the baseline survey. (completed - use of Project Development and Support Funds)

2. Mission representatives to participate with the review and evaluation teams.

3. USAID direct-hire or contracted fishery expert to participate in final major evaluation.

The AID grant includes $13,000 for evaluation costs, $10,000 for one person-month of a foreign expert in aquaculture plus $3000 for locally-contracted socio-economic surveys. In addition, USAID will investigate the possibility of accessing the DSB/AGR contract with Aurburn University for assistance in project evaluation.

F. Conditions Precedent, Covenants and Negotiating Status

This project has been collaboratively developed by the Royal Thai Government and USAID. Most issues have already been negotiated to mutual satisfaction and few

remain to delay execution of the project agreement once the funds have been authorized. The following minimal conditions precedent are recommended:

1. Prior to the First Disbursement under the Grant:

   a. Names of representatives

   b. Formal appointment of the members of the Project Management Team

   c. Financial Plan

   d. Implementation and Training Plan, including arrangements for providing adequate engineering services for the project.

   e. Procurement Plan including standard contract format and procedures

2. Prior to any Disbursement for Construction of Each Fish Pond

In addition to the initial conditions precedent having been satisfied, the Grantee shall, unless AID may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID for each fish pond, a final site plan including (a) detailed plans of construction to be carried out to include location, design specifications, contracting arrangmenets and firm cost estimates, (b) a water use plan and regulations approved by villagers, (c) assurances that a village committee is established and operating for the site, (d) evidence that a training program on pond management for the village committee has been established, and (c) a logistical plan to assure an adequate supply of fingerlings to the site.

PID APPROVAL CABLE

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CN: 00222
ACTION: AID
INFO: CDA AD
EC CHRON 8/F

AIDAC

EO 11652: N/A

TAGS:

SUBJECT: PID FOR VILLAGE FISH POND DEVELOPMENT (493-0303)
RESULTS CF APAC CONSIDERATION

AT JULY 10 MEETING, APAC APPROVED PID FOR SUBJECT PROJECT. REQUEST MISSION CONSIDER FOLLOWING ISSUES DURING FINAL PROJECT DESIGN AND PROVIDE APPROPRIATE TREATMENT OF THEM IN PP:

(A) SOCIAL ANALYSIS. AS PID NOTES, KEY TO PROJECT SUCCESS IS SOUND SOCIAL ANALYSIS WHICH WILL INDICATE IN CASE OF EACH PROPOSED VILLAGE THAT VILLAGERS ACCEPT IDEA OF FISH POND AND WILL ASSIST IN ITS CONSTRUCTION AND WILL WORK TOWARD THE EFFECTIVE FUNCTIONING OF LOCAL MANAGEMENT COMMITTEES. BELIEVE THAT SOCIAL SOUNDNESS ANALYSIS FOR THIS PROJECT SHOULD INCLUDE SPECIAL EFFORT TO ESTABLISH GOOD COMPREHENSIVE BASELINE PROFILES OF VILLAGES. SUCH PROFILE WOULD ALLOW EVALUATIONS TO PROVIDE DETAILED ASSESSMENTS OF FACTORS WHICH LED TO RELATIVE SUCCESSES OR FAILURES AMONG PARTICIPATING VILLAGES. APAC DESIRES STRONG SOCIAL SOUNDNESS EFFORT AND WILL ATTEMPT TO RESPOND TO ANY MISSION REQUESTS FOR ASSISTANCE IN LOCATING REQUIRED TALENT IF MISSION CANNOT ARRANGE LOCALLY.

(B) POND SITES. LOCATION OF PONDS WITH REGARD TO ENVIRONMENTAL CONCERNS WILL BE EXTREMELY IMPORTANT ASPECT OF PROJECT. ASSUME THAT REQUIRED WATER RESOURCES ENGINEERING EXPERTISE IS AVAILABLE EITHER IN FRESHWATER FISHERIES DIVISION (FED) OR THROUGH LOCAL CONTRACT. IEE STATES THAT PONDS WILL BE LOCATED NEAR SOURCE OF IRRIGATION WATER (TO ASSURE CONTINUOUS WATER SUPPLY). SUCH A PLAN WOULD SEEMINGLY RESTRICT SITES

TO MORE AFFLUENT AREAS WHICH HAVE IRRIGATED WATER. THIS PLAN IS CONTRARY TO UNDERSTANDING OF RECENT TDY VISITORS WHICH IS THAT PONDS WILL BE LOCATED IN POORER AREAS AND WILL NOT ALWAYS HAVE AVAILABLE YEAR-ROUND SOURCE OF WATER, BUT WILL USUALLY DEPEND ON NATURAL RUN-OFF FOR WATER SUPPLY. IF LATTER SITUATION IS NOT TRUE AND IEE DESCRIPTION IS CORRECT, PLEASE INFORM US IMMEDIATELY SO THAT APPROVAL OF PROJECT CAN BE RECONSIDERED (ALSO IN THIS CASE PLEASE PROVIDE ANY SUPPLEMENTAL INFORMATION WHICH MISSION BELIEVES WILL BE USEFUL IN RECONSIDERATION). DEPENDENCE ON NATURAL RUN-OFF (INSTEAD OF CONTINUOUS FLOW-THROUGH) WILL OBVIOUSLY POSE PROBLEMS WITH REGARD TO WATER MANAGEMENT AND FISH RAISING/ HARVESTING AND PP SHOULD PROVIDE FULL ANALYSIS OF PROBLEMS AND PLANNED SOLUTIONS.

(C) PURPOSE AND GOAL. APAC NOTES THAT PURPOSE AND GOAL HAVE BEEN MISTAKENLY INTERCHANGED ON PID FACE SHEET. BELIEVE THAT PURPOSE STATEMENT ALSO SHOULD INCORPORATE REFERENCE TO PROVISION OF WATER TO VILLAGERS FOR VARIOUS USES, WHICH PID CLEARLY DESCRIBES AS ONE PURPOSE OF PONDS. WITH REGARD TO POTABLE WATER SUPPLY FROM PONDS, HAVE MISSION/FSD CONSIDERED USE OF FRANKEL FILTER WHICH UTILIZES BURNT RICE HULTS IN ACTIVATED CHARCOAL PURIFICATION PROCESS?

(D) ENVIRONMENTAL ANALYSIS (EA). MISSION SHOULD INSURE THAT EA PROVIDES THOROUGH TREATMENT OF HEALTH IMPACTS, WHICH APAC BELIEVES MIGHT BE PARTICULARLY SIGNIFICANT FOR THIS PROJECT. STANDING BODIES OF WATER POSE OBVIOUS DANGERS WITH REGARD TO DISEASE TRANSMISSION: SANITATION PROBLEMS WILL BE GREATER THAN IEE ASSUMES IF PONDS DO NOT HAVE CONSTANT FLOW-THROUGH (PER DISCUSSION IN PARA B ABOVE). CONSIDERATION SHOULD ALSO BE GIVEN TO EDUCATION COMPONENT TO COMBAT LIVER FLUKE AND OTHER DISEASE VECTORS. MISSION IS REMIND OF REQUIREMENT FOR COMPLETED AND ACCEPTED EA PRIOR TO PROJECT AUTHORIZATION FOR KNOWN SITES.

(E) LABOR-INTENSIVE CONSTRUCTION METHODS. WITH REGARD TO EARTHWORKS COMPONENT OF CONSTRUCTION (ITEM 5.1.A ON PAGE 5 OF PID), ASSUME FULL ANALYSIS HAS BEEN (OR WILL BE) PERFORMED ON POSSIBILITIES OF SUBSTITUTING LABOR-BASE FOR HEAVY-EQUIPMENT CONSTRUCTION METHODS TO THE GREATEST EXTENT POSSIBLE.

(F) PAYMENT FOR VILLAGE LABOR FOR CONSTRUCTION. WHILE WE SYMPATHIZE WITH MOTIVE FOR PROPOSAL THAT VILLAGERS BE PAID FOR LABOR INVOLVED IN POND CONSTRUCTION, BELIEVE THIS CAN BE DOUBLE-EDGED SWORD BECAUSE COMPENSATION FOR ALL LABOR WILL

UNCLASSIFIED

TEND TO REDUCE VILLAGERS PERCEPTION OF THEIR STAKE IN PONDS. BELIEVE THIS ISSUE SHOULD BE FULLY DELIVERATED BEFORE FINAL DECISION IS MADE ON DEGREE OF COMPENSATION FOR VILLAGE LABOR INPUTS.

(G) TRAINING BUDGET. THERE WAS SOME QUESTION ABOUT WHETHER DOLS 13,600 AMOUNT PROPOSED FOR TRAINING AND EXTENSION MATERIALS (ITEM D.1.D ON PID, PAGE 10) WOULD BE SUFFICIENT FOR PROJECT OF THIS MAGNITUDE.

(H) BELIEVE VILLAGE PAVILLION, FOR CANADIAN EFFORT, IS IMPORTANT ASPECT OF PROJECT. VILLAGER PERCEPTIONS OF PAVILLION IN NONG ZONG SHOULD BE INVESTIGATED PRIOR TO, AND FINDINGS REPORTED IN, PP. VANCE
BT
#6744

ANNEX B

PROJ: 493-303

DEPARTMENT OF TECHNICAL AND ECONOMIC COOPERATION
Krung Kasem Road, Bangkok, Thailand
Cable : DTEC.

DISTRIBUTION

ACT		INFO
	D	✓
	O/FIN	✓
	EXO	✓
	O/PPE	✓
	O/PDS	✓
✓	O/RD	
	O/HPN	
	O/HRT	
	TRG	
	EMB	
	C&R	✓

No. 1803(1)/15634 August 22, B.E. 2522

Mr. Donald D. Cohen,
Director,
USAID/Thailand.

Dear Mr. Cohen,

Please refer to Mr. Thomas R. Blacka letter dated August 22, 1978, informing us that AID/W has approved the Project Identification Document of the N.E. Village Fish Pond Project and USAID/T has been given authority to begin the design phase (Project Paper) with the Department of Fishery.

We are pleased to inform you that the said project paper has been reviewed and received full support from the ad hoc Project Implementation Committee which was set up by the Department of Fishery on August 8, 1979.

We are, therefore, would be grateful if you could convey this information to the authorities concerned and inform us of the date which would be convenience for the project signing ceremony.

Thank you for your kind cooperation.

Yours sincerely,

(Xujati Pramoolpol)
Director-General

USAID/Division
DEC-I
Tel. 2810966, 2813963

TECHNICAL ANALYSIS DETAILS

I. DIETARY FISH: AVAILABILITY AND NEEDS

Censuses and consumer demand studies (Kroner, 1978, among others) show that the people of the Northeast, or for that matter of all Thailand, obtain at least 50% of their dietary animal protein from fish.

Some 5%, or approximately 85,000 MT of the national commercial fish landings, is consumed in the Northeast (DOF Annual Reports). The reason for this small proportion may be simply that the people cannot afford to buy more fish from the commercial source.

Extrapolative estimates on fish yields in the Northeast indicate about 100,000 MT is caught in local reservoir, river and flood fisheries, and retained for home use (Fedoruk, unpubl.).

The two sources thus provide a total of 185,000 MT of fish/year for the region. This amounts to about 11.5 kgs./person/year, gross or round weight of fish, which is substantially below the national average of around 21 kgs/person/yr.

Various estimates of what is the adequate amount of fish for the Thai people have been advanced. The amount present is usually between 25 and 28 kgs/person/year. The derivation of these figures, however, is reflective of supplies rather than of nutritional needs. Davey and Wilson (1971) studied needs from a medical viewpoint and advocate that "for good health in tropical countries the minimum daily consumption of protein must be 1 gm/day/kg of body weight". Furthermore, they state that "40 to 50% of the protein must be "complete" or be of animal origin; the balance can be "incomplete" deriving from vegetable sources". Estimates based on the work of Davey and Wilson (op. cit.) and on Thai consumption patterns indicate that the Thais need 46.8 kgs/person/year of fish (round or gross weight) to maintain a preferred standard of health.

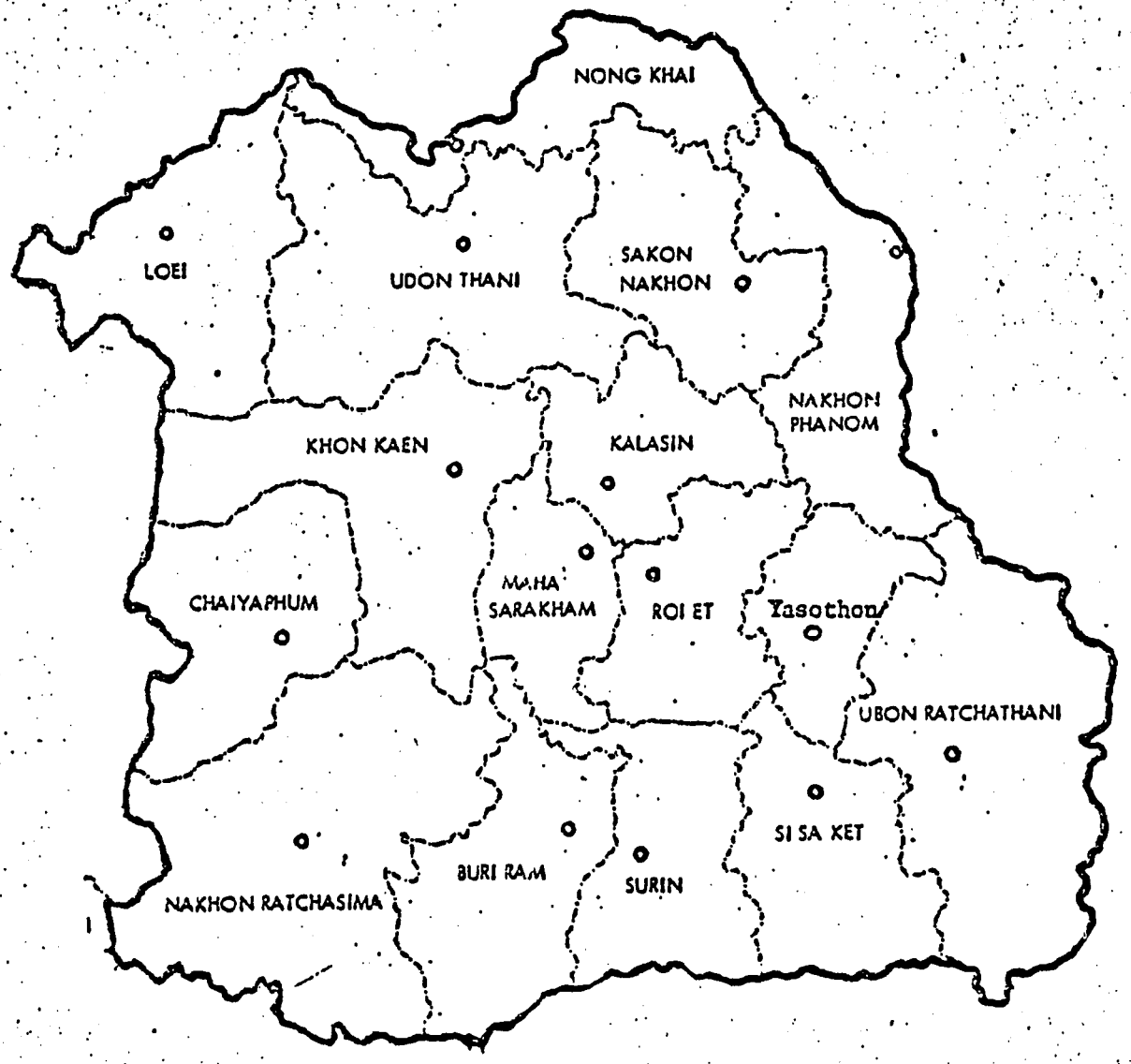


Figure 1. The Changwats in the Northeast Region of Thailand.

TABLE 1. The Distribution of Village Households in the Northeast (1976)

Changwats		Amphoes	Tambons	Villages	Village Households
1.	Nakhon Ratchasima	21	177	2,253	240,570
2.	Burirum	11	93	1,364	137,201
3.	Chaiyaphum	11	78	838	122,748
4.	Loei	9	62	570	60,989
5.	Khon Kaen	15	122	1,571	164,875
6.	Maha Sarakham	9	85	1,207	99,095
7.	Surin	12	98	1,390	128,566
8.	Sisaket	10	136	1,398	139,050
9.	Kalasin	13	66	803	99,140
10.	Roi Et	13	125	1,561	137,040
11.	Yasothon	8	56	605	57,717
12.	Sakon Nakhon	12	83	893	106,113
13.	Nakhon Phanom	13	103	1,057	97,297
14.	Ubon Ratchathani	19	178	2,010	183,277
15.	Udon Thani	17	125	1,585	186,711
16.	Nong Khai	8	60	692	80,427
	TOTAL	201	1,646	19,797	2,040,816

Source: Provincial Electricity Authority, Rural Villages Directory, September 1976 (in Thai).

By whatever count, the people of the Northeast are inadequately supplied with fish. The problem is compounded within the region since there is an unequal distribution of available fish supplies. Most of the commercial fish is concentrated in towns and cities, and, much of the fish, harvested directly for home use is localized around major water bodies (large reservoirs and reliable rivers). Some 15,000 villages are in a circumstance of having considerably less fish than the regional average of 11.5 kgs/person/year; their principal fish source is the seasonal flood fisheries.

The flood fishery occurs annually when wild fish enter flooded lands (fields, ditches, canals, swamps) and the people harvest these fish. The fish first appear in June and disperse and spawn in accordance with the extent of flooding. The recession of flood waters usually culminates in October and November with remaining fish becoming concentrated in residual water. Fishing is continual in the period June through October; it intensifies in November and for the time thereafter that pockets of water and fish wherever there is a prospect of a harvest.

Flood fishery yields in the Northeast are not known but studies show that yields in the Central Plains range from 10 to 13 kgs/rai/year. Granting higher fertility and a longer duration of water in the Central Plains than in the Northeast then yields in the Northeast are reasonably less. For estimation purposes the yields of the Northeast flood fishery are assumed to be 75% of the Central Plains or 7.5 to 9.5 kgs/rai/year.

Because some of the fishing is widespread it is problematical to relate yields to the discrete area of a social group. One measure of the relationship may be established on the basis that each family has 6 rai of rice paddy (the national average) and that this is the production area for flood dispersed fish for that family. The fish yield to each family is thereby 45 to 58.5 kgs/year. Taking the average family size of 6.6 then the fish available from the flood fishery is 6.8 to 8.8 kgs/person/year.

The estimates above show that the amount of fish available to disadvantaged rural communities may be as low as 6.8 and no higher than 11.5 kgs/person/year. The corresponding shortfalls from the national average consumption (21 kgs) are 14.7 and 10 kgs/person/year. Using the requirements for ideal nutrition (46.8 kgs.) as reference then the shortfalls increase to the range 35 to 40 kgs/person/year.

Since the Project proposes to serve the provision of subsistence needs then the shortfall estimates become Project targets. The range, 10 to 40 kgs/person/year, is large and the estimate references are equally valid. Although systems could be designed to produce fish quantities satisfying the upper limit, they would be too complex for application in the Project. Consequently, the lower limit, 10 kgs/person/year, is advocated as the target of the Project. Approaches designed to serve this target would be basic to any advances employed by a community for increasing fish production in the future.

II. MODEL DEVELOPMENTS

1. Nong Sang Kam Community Fish Pond

Nong Sang Kam Community Fish Pond was constructed with funds from, and under, the supervision of Department of Fisheries in 1969. The surface area of the tank is 8.3 ha. This tank not only provides the community with year round water and protein food (fish) but also generates money to develop village utilities. The Project was run by the community committee in consultation with the regional fisheries biologists.

A combination of 3 species, *Cyprinus carpio*, *Tilapia nilotica* and *T. mossambica*, were stocked in 1970 with the density of 625, 770 and 890 individuals per ha., respectively. Average sizes were 5-7 cm. and the total weight of stocking was 142.34 kg. Fertilizers were added in two stages. Both a full range (N-P-K) commercial fertilizer and superphosphate were added at the rate of 120 kgs/ha to the newly infilled tank. Periodic applications of organic manure were subsequently made by the farmers.

Time for harvesting was set when the water levels were at the annual low and while the villagers were free from paddy field work. No fishing was allowed before this time and a fee was charged for fishing. The fee prices were set in accordance to the efficiency of the gear used and ranged from 5-12 Baht.

Total catch of stocked fishes was 2,433.16 kg. and 2,833.28 kg. of wild fish; the combined yield averaged out to 640 kgs/ha. Total fee collected was 9,395 Baht while the total cost of management was 3,710 Baht. Therefore, the potential cost and refund from raising fish in Nong Sang Kam made the profit of 5,685 Baht to the village.

This program of Department of Fisheries serves quite a number of local people. If this co-operative principle can be rapidly extended to other similar villages in the most part of Thailand, it will contribute to increase the standard of living of the rural people of the country.

2. <u>The Nong Zong Fish Community Pond Project</u>

In 1977 the Canadian Embassy in Thailand granted a special fund to assist the Department of Fisheries to establish the fish community pond at Nong Zong, Kalasin Province. The major objectives of this Project were to provide additional dietary protein and ease the shortage of water during the dry period.

The Nong Zong pond is situated about 5 kilometers north of the Khon Kaen - Kalasin Highway, Yang Talad District, Kalasin Province. About 300 families totalling some 1,000 people live around the pond site. Their livelihood is chiefly derived from subsistence agriculture that includes the growing of rice, jute and some livestock. A limited amount of wild fish is harvested from nearby waters to supplement food supplies. Rice and jute crops are based on the availability of water in the rainy season only.

The pond, covering a surface area of about 50 rai (8 hectares), was created by excavation, and diking with the removed earth. It was equiped with a fixed-crest spillway initially designed to hold a pond-water-depth of about 2 meters. Construction, undertaken by local contractors and volunteer help from the community, was completed on July 25, 1977; the tank infilled with rain water in mid September.

In September 21, 1977, the tank was stocked with 60,000 Puntius gonionotus, 28,000 Labeo rohita and 20,000 Tilapia nilotica. Tests made in early October, 1977, indicated that Rohu increased in size to an average length of 12 cm. The other species had apparently not grown enough to be captured by the sampling gear.

A central community committee has been established and served as the managers of the pond as well as setting regulations for water use and fish harvesting. The Kalasin Provincial Fishery Officer was advisor to the committee and was arranged for governmental support inputs as required. The committee comprises the Chairman of the village of Ban-Pon-Sim, the Inspector of the village and four community residents. The intention at the outset was to allow water withdrawals from the pond for domestic purposes only.

Fish was first harvested in February, 1978. Three thousand (3,000) kilogram of fish was caught by the local villagers. L. rohita contributed the greatest to the catch, approximately 60%. The second harvesting was done in March, and 1,000 kg of T. nilotica and P. gonionotus were caught. For both harvesting the local committee allowed the people from other community to join the catch, and the so called guest was charged 10 Baht for each harvesting period. The local committee collected 4,500 Baht from the fee and some part of the earning was used to repair the community road which damaged from the prior flood.

III. WATER AVAILABILITY AND REQUIREMENTS

1. Present Availability of Community Water

About 80% of the villages in Northeast Thailand (Fig. 1), distributed as shown in Table 1, are inaccessible to large existing, and proposed reservoirs and to reliable rivers (AIT, 1978). Adequate water is thus available to them only during the rainy season or through small, local water development projects. This remoteness from large reservoirs and reliable rivers also precludes ready access to year round supplies of fish which is a traditional and preferred protein food when available.

Small water projects can include the development of water reservoirs (= tanks), dug ponds, wells, diversion weires and systems to pump or draw water from remote sources. Of these, only small to medium size tanks equiped with dykes (= embankments) and spillways can meet the water capability requirements of this Project. Some 243 such tanks have been built in Northeast Thailand to-date (Van Liere and Kawai, 1973) and another 890 are under development or are being planned (RID, 1977). Fish have been stocked in most of the existing tanks and undoubtedly will be stocked in future tanks. Fish use, however, has been given an incidental status in these tanks; there is little provision for managing the waters for optimum harvests and for ensuring an equitable distribution of the catch. Nonetheless, some 15,000 villages are in the deprived circumstances and the existing and planned, sustained water tanks serve only about 7 to 8% of them.

Additionally, an untold number of temporary water tanks exist in Northeast Thailand. They are generally small impoundments, less then 50 rai, which concentrate water and fish for about 2½ to 3 months during the recession of seasonal floodwaters thereby serving community needs at that time. Most have been created solely by community effort through the partial enclosure of natural depressions with relatively low dykes; none have a spillway. These impoundments, however, have a limited life and many are in various states of dis-repair. They are shallow, silt-in rapidly and are frequently occluded with weeds. Furthermore they cannot cope with spates and the dykes continually wash-out in places. Although these tanks were developed by the communities themselves, the communities lack the resources to refurbish or to raise the standard of the tanks for sustained use.

2. Water Requirements

Water is presumed continuously available for about 6 months during the wet season. No shortages occur at this time and basic community water needs can be readily met. The water requirements of this Project are thus manifested in tank storage during the dry season that is sufficient to serve community subsistence. The basic water requirements in the period December to May include water for domestic use (people and animals), for some horticulture use and for fish production.

Fish production in the tanks is a non consumptive use of water. Consequently, no allocation of water is ascribed to fish with the exception in a few possible cases of maintaining nursery ponds. (See Item V).

The requirement for domestic use water varies from an absolute minimum of 25 to 200 litres/person/day. Over 6 months, the corresponding amounts are 4.5 to 36 m^3 per person.

There are two perceivably important water requirements for horticulture use relative to this Project: dry season irrigation of garden and orchard plots and irrigation of rice nurseries, in the late dry season and early wet season.

Families in the Northeast commonly grown or attempt to grow vegetable and orchard crops in the dry season or small plots of land ranging from 1/8 rai to 1 rai. The availability of water is a factor determining the success of the crops and the extent under cultivation. Van Liere and Kawai (1973) show that 300 m^3 of storage will provide sufficient water to irrigate 1/4 rai of second crops during the dry season; they estimate that 1/4 rai is the average size of plot managed by a family. With plentiful water, farmers will tend to increase the plot size up to about 3 time (Kaufman, 1971).

Rice is initially planted in nurseries then transplanted to the paddies after the seedlings have matured. Starting to plant nurseries earlier increases the chance of a successful crop. The availability of water for nursery irrigation during May to July would allow early starts.

The average rice paddy area planted by a family is 6 rai. The nursery area required to serve the family plot is 0.4 to 0.3 rai. Nurseries, however, are more effectively operated as communal enterprises with a few large nurseries providing the seedlings for an entire village. Assuming a community of 100 families then the water requirement to irrigate nurseries over 2 to 3 months would be about 30,000 m^3.

The total water requirement to serve basic community needs over the dry season is summarized in Table 2. The amount is about 816 m^3 per family or 81,600 m^3 for a typical village of 100 families comprising 6 members per family. Granting an allowance of about 20% for evaporation and seepage losses then the storage capacity of a tank serving a typical community of 100 families would be in the order of 100,000 m^3 or 1,000m^3 per family.

TABLE 2. Dry Season Water Requirements to Serve Subsistence Needs in Northeast Thailand.

Water Use	Water Requirements (m^3) Per Family (6 members)	Per Village (100 families)
Domestic	27 to 216	2,700 to 21,600
Second Crops	300	30,000
Rice Nursery	300	30,000
	816	81,600

IV. FISH MANAGEMENT SYSTEM

A. Introduction

Dietary fish for a community will be obtained from a flood fishery and a tank fishery. A variety of species is involved; as per Thai practices, all species will be consumed, some fresh, some preserved and some in the form of condiments. The flood fishery is essentially an unregulated fishery while the tank fishery is subject to management controls, including stocking and harvesting, as advised by this Project.

B. Flood Fishery

Wild fish enter flooded lands (fields, ditches, swamps) annually starting in May and June. The fish are harvested from when they first appear until as long as resource lasts. The fishery is generally operable from late

May to December or January following. Some wild fish are expected to enter the project tanks where they will be subject to the controls recommended by the Project. No regulations are proposed for the wild fishery in areas outside of the tanks.

Unless information emerges to the contrary, the Project assumes that each family in a project location obtain 45 to 58.5 kgs, of fish/year from the flood fishery (See Item I). The capability for flood fishery yields varies considerably throughout the Northeast and the assumed values could be significantly off the mark in some locations.

C. Tank Fishery

Although some wild fish will inhabit a tank their contribution to the yield will be nominal. The amount of fish required by the Project will thus be obtainable only through operating the tank as an aquaculture farm with the fundamental inputs of co[illegible]led stocking and management. Keeping inputs basic and relatively simple, to accord with the criteria of the Project, then:

1. Controlled stocking will entail planting seed fish of selected species at predetermined times of the year:

2. management will involve:

a) the regulation of harvesting,
b) the systematic application of fertilizers,
c) the periodic removal of wild carnivorous fish,
d) periodic tank maintenance-removing vegetation and sediments, drying large portions of the bottom surface, and, possibly the application of lime.

The provision of seed and brood fish is assured by DOF. The Project, however, will strive to provide each community with the facility to produce most of their own seed fish. Guidelines for management and stocking will be provided by the Project whereas the actual practices will be undertaken by the communities.

D. Fish Species

The species proposed for the tank fisheries have been chosen on the basis of their cultivability, availability, acceptibility and utility. The use of four species is advocated: Tilapia nilotica ("pla nil" = tilapia"), Puntius gonionotus ("pla tapien" = "puntius"), Labeo rohita ("pla rohu" = "rohu") and Aristhycthys nobilis ("pla jeen" = "bighead carp").

Tilapia will be stocked in every tank with seed fish assured from all the government hatcheries. Furthermore, talapia will be the principal species raised in community operated nursery ponds thus establishing independent seed fish supplies (See Item V). Supplies of tilapia seed fish can be made available at any time of the year.

Whenever practicable, polyculture will be employed to endeavour fish production from all fish niches in a tank. Consequently, the other fish species will be stocked in combination with tilapia.

Puntius and rohu are available at most DOF stations and will also be stocked in every pond where polyculture is employed. Supplies of bighead carp, however, are limited and the species will only be stocked at selected locations. The Project will strive to establish puntius nurseries at each location thereby reducing the demands from DOF hatcheries. Rohu and bighead carp seed fish will be provided annually by DOF. Puntius spawns naturally in May and June but can be readily controlled by induced spawning, hence, seed fish of the length 5 to 8 cm. can be made available in July to September. Rohu and bighead carp spawn in June and July with 10 cm. seed fish being available in September.

These species are well accepted for human consumption. Larger tilapia, rohu and bighead carp (say in excess of 100 gms) are usually eaten fresh. Larger puntius are frequently dried and salted ("pla tapien hang") being preserved for consumption later on. Smaller fish are commonly used to make fish sauce ("nam pla") or fermented fish ("pla ra").

E. Fish Productivity

Fish production in a tank is a function of many factors of which the following are particularly germane to the Project.

- the size of the seed fish when planted
- natural mortality
- carrying capacities for fish
- growth rate of fish
- system of culture
- the quality of the water environment

1. Seed Fish Size

Seed fish size reflects in early mortality and in the time it takes a fish to grow to a given dimension. Generally, the incidence of stocking mortality increases as the size of the seed fish decreases. Experiences in Thailand show that losses of up to 50% occur with 2.5 cm. tilapia seed fish whereas only 10% of 5 cm. seed fish die. Furthermore, a 2.5 cm. tilapia takes about 6½ months to reach 150 gr. while the same size can be attained by a 5 cm. seed fish in 5 months. The larger the seed fish, however, the greater is the nursery time and rearing inputs. Taking mortality, nursery time and growing time into account then the practicable sizes of seed fish for the Project are:

Tilapia	- not less than 5 cm.
puntius	- 5 cm. + (preferably 8 cm.)
rohu	- 10 cm.
bighead carp	- 10 cm.

2. Natural Mortality

Empirical information on aquaculture in Thailand indicates that natural mortality should not exceed 5%/month of surving stock once stocking mortality has taken its toll. The Project thus assumes that mortality will be 10% in the first 30 days after planting and 5%/month thereafter.

3. Carrying Capacity

Other factors being under control then the carrying capacity of the tanks for the given fish species primarily relates to the availability of food. Food for the fish species involved is a function of water fertility. The Project advocates the systematic application of organic fertilizers to ensure the capacity for attaining prescribed levels of food, and, hence, fish production.

Data are not available for preparing carrying capacity formulations. Working estimates of how much fish the systems can carry, however, are available from the results of similar fish culture programs. The values are pragmatic and do not relate numbers and biomass; they simply show from experience how many fish, regardless of size, should be applied to a given area of water. For fertilized waters, such as would be in the tanks, the capacities are:

tilapia	- 10,000/ha.
puntius	- 2,500/ha.
rohu	- 1,250/ha.
bighead carp	- 1,250/ha.

Without augmenting nutrients the capacity and the corresponding production is about 70% of the above.

The loading limits identified above relate to a unit of water area, in this case one hectare. Given that the tank reservoir will be drawn down systematically, the area of water in a tank is not constant. The tanks will be infilled to peak levels for about 4½ months running from mid-June to the end of October. Use of storage water will follow with water volumes and areas reducing steadily to zero levels in April. As the area reduces so does the overall capacity for fish. Since stocking is made at peak levels then capacities for fish will be exceeded as the reductions in area occur.

In order to keep the systems balanced then fish must be removed in correspondence with the changing carrying capacity. The fish involved are relatively fast growing so significant fish production is ongoing. Removal of fish to balance the system is thus manifested in a harvest that is scheduled to ensure optimum production from the system. If the fish are not systematically removed, then capacities will be surpassed and the supernumerary fish will presumable die and not be accountable as yield.

4. Fish Growth

The expected growth of the fish in the tanks is shown in the following table. The parameters derive from DOF studies on small impoundment fisheries, and, they relate to seed fish of the size advocated in Section E.1 and to

water enriched with organic fertilizers. Without the application of fertilizers (and presuming stock densities are reduced accordingly) growth would be protracted by the equivalent of about 30 days.

	Average Weight/Fish (gr.)			
Days after Planting	Tilapia	Puntius	Rohu	Bighead Carp
90	100	-	175	350
120	125	-	200	560
150	150	100	225	1,100
180	175	150	250	1,600
210	200	175	275	2,100
240	225	200	300	-

5. System of Culture

Although polyculture is proposed for the tanks there may be some situations where a mix of species is not applied. This may occur as a result of community electives or a failure to provide the seed fish of species ancillary to tilapia at prescribed times. No problems are apt to occur with tilapia so tilapia at least would be raised solely (monoculture). For reasons not yet fully explained there is a synergistic effect of polyculture that results in higher growth rates of a given species than when raised in a monoculture system. Observations in Thailand show that tilapia in monoculture systems take about 180 days to reach 150 grams as opposed to 150 days in polyculture systems. If monoculture occurs then production expectations would be correspondingly less.

Additional work on tilapia monoculture indicates that loading limits can be increased up to 20,000/ha. In these situations, however, the environment must be carefully controlled otherwise extensive fish losses will occur. The methods of management are relatively advanced and are beyond the application criteria of this Project. Monoculture to produce increased yields thus

remains as a potential prospect for the communities to consider in the future but not as a practice to implement the Project.

Work on puntius also shows that loading limits for the species can be increased to 5,000/ha. if special applications are made to cultivate specific foods in a pond (e.g. gramineous grasses and filamentous algae). Again the methods are too advanced for the Project but the prospect remain for future application.

6. Environmental Quality

Conditions conductive to the survival and production of fish are ensured through management inputs and controls. The specific matters taken into account are presented below.

a. Biocides

The use of pesticides and herbicides in the catchment areas of the tanks is presumed to be very limited. Consequently, there is little likelihood of these biocides concentrating at levels toxic to fish within the tanks. Nonetheless, the communities will be advised that fish and some of these biocides are incompatible. If noxious substances are to be employed extensively then reductions in fish output could follow. Some herbicides and pesticides are not harmful to fish.

b. Fertilization and Eutrophication

Excess applications of fertilizers can lead to relatively high BOD in the water and fish deaths. A schedule of fertilizer application is thus prescribed for each tank by DOF biologists. Compliance with the schedules will ensure that enrichment is controlled in the interests of maintaining fish survival and production.

c. Fish Population and Species

Fish production in the tanks is based on carrying a number of planted fish per ha of water area. Some wild fish will likely enter a tank but are presumed not significant with respect to loading limits. To ensure a balance between numbers and tank area, systematic harvesting will occur according to a schedule.

Amongst the wild fish will be some predators that will feed on planted fish. The toll is unaccountable but is assumed to have little affect on targeted fish production.

With an annual schedule of water drawn-down to zero levels and a program of intensive harvesting during April and May then virtually all fish will be cleaned out of a tank. The removal of undesirable species will thus be effected in preparation for the following cycle of production.

d. Fish Diseases

The level of fish culture programmed in the Project does not entail a stocking density that is conducive to the proliferation of fish parasites and diseases. Nevertheless, some diseases and infestations may occur but probably at an incidence no higher than in wild fisheries. No therapy is prescribed in the case of outbreaks. Contributions to prevention will be applied through efforts to ensure good environmental conditions and disease-free hatchery stock.

e. Vegetation

Excesses of both algae and aquatic weeds (macrophytes) are of concern to the environmental quality of the tanks. Undue algae could occur as a result of over fertilization. Although algae can be controlled by the application of chemicals the practice is risky. Sudden collapses of algal blooms frequently result in heavy depletion of oxygen in the water with consequential fish mortality. Again, the schedules for fertilization are structure to avoid massive build-ups of algae.

Some of the encroachment of macrophytes will be controlled by puntius, rohu and bighead carp which feed on these plants. The drawdown of water to base levels in April and the drying out of the tank bottom will also arrest the advancement of weeds. Nonetheless, the community will be directed to undertake a specific action program for aquatic weed control. Vegetation masses will be removed during the low water period, and, floating weeds such as water hyacinth would be removed as massive growths occur.

f. Liming

The soils of some of the tanks may be acidic thereby constraining fish productivity. Periodic applications of lime may be required during April or May of each year to improve conditions. The rate of lime application could be up to 100 kg/ha.

g. Accumulated Sediments

Accumulations of sediments are expected in the tanks; they will progressively decrease storage capacity and contribute to anoxic conditions. With the advocated schedule of an annual drawdown sediments can be readily removed as part of the community management input. Removed sediments can be applied as dressing for garden plots or even be used as a compost component thereby having by-product benefits.

Sediments deriving from bank erosion can be restrained by vegetating the banks with grasses, shrubs and trees. This practice will be advocated.

h. Anoxic Conditions

The production of organic materials will be relatively high in the tanks. Some of this production will accumulate on the bottom, and, under stagnant conditions, will be subject to anaerobic decay. Compounds toxic to fish and circumstances inhibitary to the recycling of nutrients could arise. The cycle of infilling and drawndown, the periodic exposure and drying of the tank bottom, and, the removal of organic-rich sediments will offset this potential problem.

F. Fertilization

Optimum levels of fish production in the Project depend upon enriching the tank water through the use of fertilizers. Inorganic fertilizers are costly hence the alternative is to fertilize the tanks with indigenous, organic manures. Approaches in similar projects (Item II) and discussions with provincial fisheries officers indicate the feasibility of obtaining the organic manures in the form of animal and vegetable wastes. The simplest method is to collect and apply bovine dung which can be done by the community at nominal cost. Experiences to date show that bovine dung applied at the rate of 20 kgs/ha of water area/day will support the fish production target and not lead to excessive enrichment and undesirable oxygen levels.

About 4,200 kgs. of buffalo dung would be required to fertilize each ha. of water over an annual cycle. No applications would be made in March, April and May when levels are low and the water is extremely stagnant. The proposed schedule of applications in the other months, per ha. of tank area is:

	Amount/Mo. (kgs.)	Amount/day (kgs.)
June	300	10
July	600	20
August	600	20
September	600	20
October	600	20
November	510	17
December	420	14
January	330	11
February	240	8

The availability of adequate quantities of organic manures may be a limiting factor restricting target production in some cases. Although buffalo are prevalent there may be too few in relation to the enrichment needs of larger tanks. Wastes from other animals can also be applied if available. The composition of pig manure is more or less the same as fresh cowdung while both are richer than buffalo dung. Chicken droppings are at least 3 times richer than cowdung or pig manure. Correspondingly less wastes are required from the other animals than from buffalo. Where wastes are limited then the establishment of livestock and poultry production could be considered as a system integrating with fish production.

Several studies demonstrate that liquid manure or slurry from compost is a more effective fertilizer than solid wastes. The use of composting pits to generate the slurry allows the use of many waste substances apart from animal manure. Night soil, pond silt, crop wastes and weeds, such as aquatic plants, can all contribute to top quality compost produced fertilizers. The slurry can be applied to the fish ponds while the sludge makes ideal soil dressing for plant crops. Compost pits could be considered as a means for providing the fertilizers in some locations.

G. Production Program

A schedule for seed fish inputs and yield outputs will be developed for each tank. Each schedule will be structured in relation to:

i) the water use plan

ii) the availability of seed fish

iii) the degree of fulfilling the optimum fertilization schedule

iv) a fish production output that is based on:

-- either yielding the maximum of amount of fish attainable from the tank, or

-- yielding a minimum of 10 kgs. of fish/person in the community.

The basic assumption inherent in a schedule is that the fishery will be managed by the community in accordance with the program designed for that fishery by DOF.

A reference model for fish production under optimal conditions from a hectare of tank area is presented in Table 1. The model identifies the program for attaining the maximum yield of fish from a unit area of tank using relatively simple and basic approaches. Fulfillment relies on:

1. DOF and/or the community providing seed fish of the size prescribed in Section E.1 and planting them as follows:

	Numbers/ha. of Tank Area				
	Tilapia	Puntius	Rohu	Bighead	Total
June	5,000	0	0	0	5,000
July	5,500	2,500	0	0	8,000
August	0	0	0	0	0
September	4,000	0	1,250	1,250	6,500
October	5,000	0	0	0	5,000
	19,500	2,500	1,250	1,250	24,500

TABLE 1. Reference Model: Schedule of Fish Inputs and Outputs/ha of Tank Area

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Water Area (% Peak)	(0.1)	0.5	1.0	1.0	1.0	1.0	0.85	0.7	0.55	0.4	0.25	0.1	(0.1)	
Tilapia														
Capacity (no's/ha)		5,000	10,000	10,000	10,000	10,000	8,500	7,000	5,500	4,000	2,500	1,000		
Stock A: in (no's)		5,000	4,500	4,225	4,050	1,000								
out (no's (kg))					3000(300)	1000(125)								
Stock B: in			5,500	5,000	4,750	4,514	2,626							
out						1750(175)	2626(328)							
Stock C: in					4,000	3,600	3,420	3,250						
out								3250(325)						
Stock D: in						5,000	4,500	4,225	4,050	1,000				
out									3000(300)	1000(125)				
Yield (kg's/ha)					300	300	328	325	300	125				1,678
Puntius														
Capacity		1,250	2,500	2,500	2,500	2,500	2,125	1,750	1,375	1,000	650	250		
Stock A: in			2,500	2,250	2,138	2,032	1,931	1,837	1,746	1,089	560	247		
out									600(90)	500(87)	300(90)	247(80)		
Yield									90	87	90	80		347
Rohu														
Capacity		625	1,250	1,250	1,250	1,250	1,050	875	685	500	325	125		
Stock A: in					1,250	1,125	1,060	965	915	490	275	120		
out									400(80)	200(45)	150(27)	120(33)		
Yield									80	45	27	33		185
Bighead Carp														
Capacity		625	1,250	1,250	1,250	1,250	1,050	875	685	500	325	125		
Stock A: in					1,250	1,125	1,060	965	915	390	275	120		
out									500(280)	100(110)	150(240)	120(252)		
Yield									280	110	240	252		882
TOTAL YIELD (kg's/ha)					300	300	328	325	750	367	357	365		3,092

2. The community harvesting the fish as follows:

	Kgs/ha. of Tank Area				
	Tilapia	Puntius	Rohu	Bighead	Total
September	300	0	0	0	300
October	300	0	0	0	300
November	328	0	0	0	328
December	325	0	0	0	325
January	300	90	80	280	750
February	125	87	45	110	367
March	0	90	27	240	357
April	0	80	33	252	365
	1,678	347	185	882	3,092

3. The community adding fertilizers in accordance with the schedule provided in Section F.

4. The community maintaining environmental quality as addressed in Section E.6.

The model could be fulfilled in some locations but could be constrained in others for a number of reasons. Amongst the possible reasons and the consequences are:

a. Scarcity of Bighead Carp

The supplies of bighead carp seed fish are limited. DOF assures some but not enough to stock all tanks at all times. Without this species in a tank optimal fish yields would reduce to about 2,210 kgs/ha.

b. Under-Fertilization

If prescribed water enrichment is nct achieved then fish production will be less than the optimal level. The degree will depend upon the amount of enrichment that occurs. Given no supplementary enrichment then yields would be:

With bighead carp 2,164 kgs/ha.

Without bighead carp 1,547 kgs/ha.

c. Under-sized Seed Fish

Smaller than the prescribed seed fish size will protract the production scheduled in the model. The effect will relate to the specific size of the seed fish employed. Production could be reduced by as much as 30% if small but viable seed fish were stocked. Given that the water was enriched, yield expectation might be in order identified in "2" above. Without enrichment then yields from stocking with small fish would reduce to:

With bighead carp	1,542 kgs/ha.
Without bighead carp	1,083 kgs/ha.

d. Monoculture

If the species mix were not available for polyculture then Tilapia only could be grown. Optimum annual yields from a pulse fishery (staggered stockings and harvests) could be as high as 2,400 kgs/ha. of Tilapia where the water was fertilized. With no enrichment yields could be about 1,680 kgs/ha. If undersized seed fish were used then yeilds could be as low as 1,100 kgs/ha.

e. Water Regimes

Deviations from a systematic water drawdown scheme could have diverse affects on fish production. The consequences will depend on the degree and direction of change. If drawdown is faster than the prototype schedule, production will be less than shown by the optimal model. If substantial amounts of water remain in the tank over the tail end of the dry season then fish production could be higher than model values.

f. Environmental Maintenance

Failure to maintain the environmental quality of the tanks will have various effects on fish production depending upon specific circumstances. For the most part yields would decrease as the quality of the environment decreased. In extreme cases, of sustained oxygen depletion or the occurrence of toxic substances, fish losses could be high and yields could be very low.

g. Harvest Management

Obtaining optimal yields depends upon a specific schedule of harvesting. Exceeding the schedule, in time and/or quantity, would tend to reduce overall production. Insufficient harvesting at prescribed times could result in arrested production.

V. FISH NURSERY PONDS

1. Introduction

The Project will strive to build two fish nursery ponds at each location. Although initially advanced to produce tilapia seed fish the ponds will be equally suited for producing puntius seed fish. The yield capability of each pond is a function of size and will be adapted within limits to the seed fish requirements of a given tank. No pond will be developed to produce crops of less than 25,000 tilapia or 30,000 puntius fingerlings, or more than 50,000 tilapia or 60,000 puntius fingerlings. Two crops of tilapia and one of puntius are possible within a time frame consistent with serving the annual seed fish requirements of a tank.

The production of puntius requires some specific provisions not required for tilapia production. The Project will attempt to supply the total puntius facility if budget allows and depending upon the community choice to undertake puntius seed fish production.

Depending on the operational alternative applies and the size of the tank to be stocked the output from the ponds could supply most of the tilapia and all of the puntius seed fish needs. In some cases surpluses could be produced; the extra seed fish can be allocated to local intensive fish culture operations or even distributed to public waters.

The duration that the ponds would be occupied for seed fish production ranges from 2 months (in the case of a single puntius crop) to 7 months (if successive crops of tilapia and/or puntius are produced). Afterwards the ponds could be used to produce table fish or as additional reservoirs for consumption water.

2. Provisions

A. Project

The Project will provide the following items for establishing the fish nursery component at the location:

i) Ponds (based on a cost assumption of ฿15/m the construction cost of a tank will range from ฿7,500 to ฿15,000)

ii) Equipment and Materials

a) One small pump (8", 15h.p.)/location for filling and emptying the ponds; estimated cost is ฿10,000/pump.

b) Nets - 2x fingerling seines, 2x harvesting seines and 7x retainer nets/location; total cost is ฿18,000/location.

c) Bentonite as a pond sealant, if required; about ฿1,000/pong.

d) Miscellaneous materials, if required (lime, fertilizer, insecticide, supplemental feed); total cost about ฿2,000/location.

e) Optimal equipment for producing puntius seed fish, total cost about ฿5,000/location.

iii) Brood fish - tilapia brood fish will be provided by the RTG if required but the communities should be available to obtain their own from the tank; puntius brood fish must be supplies by the RTG.

iv) Training of selected community personnel in fish husbandry methods.

v) Operational plans and guidelines specific to the locations.

B. Community

The provisions required by the communities for the nursery ponds are:

i) Operational manpower.

ii) Organic manure as fertilizer (up to 200 kgs/ pond over 4 months)

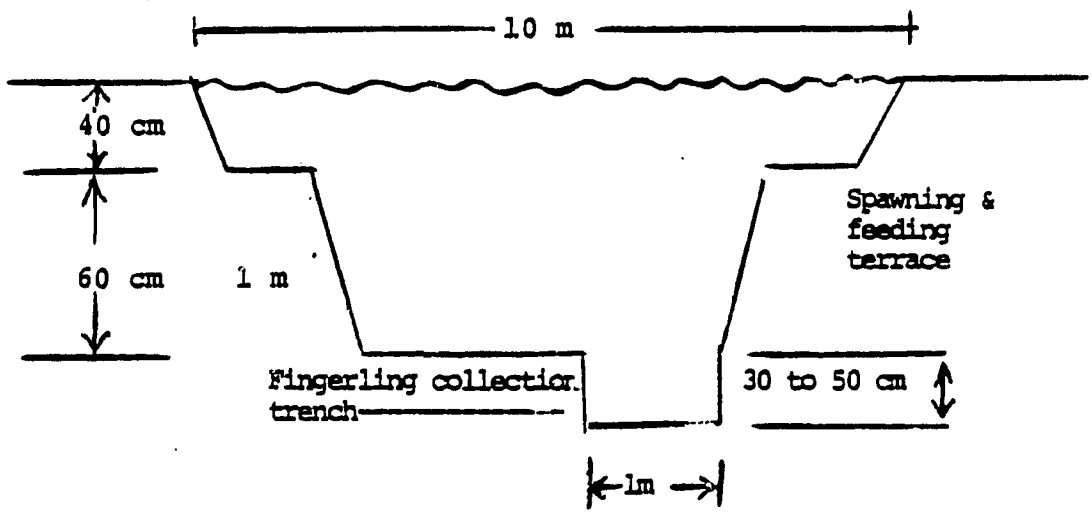
iii) Fuel for running the water pumps.

iv) Supplemental feed, if required (could entail up to 100 kgs. of rice bran/pond for tilapia or puntius; if puntius fry are reared then up to 100 chicken eggs could be required to feed the fry).

v) Tilapia brood fish (collected from the tank).

3. Pond Design

The design of the fish nursery ponds proposed for the Project is in keeping with the design that is recommended by the DOF for fish farmers. Each pond would be about 10 metres wide and 1 deep; the length would vary from 50 to 100 metres. The essential characteristics are shown in the following cross section figure of a pond:



There is no inlet or outlet. The ponds are filled and emptied by pumping.

4. Tilapia

Tilapia will spawn naturally in the ponds using the "spawning terrace" for the purpose. If adequate vegetation does not occur on the terraces then artificial substrates such as "plastic straw" could be added until the vegetation establishes. Fry will range through the pond until they are ready for capture. The feed will be phytoplankton ensured by the systematic application of fertilizers (organic manure or "superphosphate", if required). Fingerlings are harvested by drawing down the water and seining fish from the collection trench where they become concentrated.

About 90 male and 60 female brood fish will be required to ensure each fingerling output of 25,000. These brood fish can be captured from the tank fishery when operational. Stock can also be provided by the local RTG fisheries stations particularly when genetically controlled stock is employed. Some brood may have to be held in retaining nets while sufficient stock is being marshalled or when the ponds are being infilled and treated.

Previous schemes by the DOF show that tilapia fingerlings will reach about 5 cms in length by 60 days after the brood spawn. Food may be a factor determing the growth. If sufficient fertilizer is not available then a wet meal made with rice bran could be used to supplement feed. Up to 100 kgs of organic manure would suffice to fertilize a pond for a 60 day period. If rice bran were the only food then a maximum of 2 kgs/day would be required.

5. Puntius

Through induced spawning methods the RTG fisheries stations can supply gravid puntius brood any time in the period January to July. If a community elected to produce puntius fingerlings then ripened brood would be provided by the stations. Spawning, however, must be completed artificially by extracting the sex products from the males and females and combining them. The fertilized eggs are then incubated in equipment provided by the Project. The alevins and fry then must be raised for about 10 to 15 days in small rearing tanks also provided by the Project. Afterwards the fry are transferred to the nursery ponds where they are raised to fingerlings reaching 5 cm in about 45 days.

About 4 puntius males and 6 females would be required to yield 30,000 fingerlings. Rice bran meal or commercial broiler (chicken) feed is required to feed the brood fish. Puntius fry are readily sustained on crumbled, boiled egg yolk. About 50 eggs (chicken) would be required to sustain 30 - 35,000 fry for up to 10 days.

Once in the nursery ponds puntius will feed on microscopic and macroscopic vegetation. Fertilizers will ensure the vegetation. If shortages occur then rice bran meal, broken rice or commercial animal foods can be used as a supplement.

6. Pond Management

a. Personnel

The community will assume responsibility for operating the nursery ponds but will be assisted by operational guidelines, training and the RTG task force assigned to a location. The community personnel involved with the nursery ponds will be amongst those receiving training in fish husbandry at a local fisheries station. The manpower requirements are continual over the time that fingerlings are in production. Consequently, the communities will be encouraged to assign one or two people to the task and commit their input on a sustained basis.

b. Predator Control

Insect predators are a standing threat to survival of very young fish. Each pond, therefore, must be treated beforehand to remove such insects. This can be accomplished by applying short-life insecticides or dispersing kerosene or oil on the surface of the pond then removing it by ignition or skimming after 2 or 3 days.

Some predators will inhabit a pond after the fish are enplaced. Control of these predators is difficult until the pond is drained and treated for a subsequent fish crop.

c. Seepage

Depending upon the soils used to form the basin relatively large water losses could occur due to seepage. In the case of porous soils sealants such as bentonite could be applied.

d. Vegetation and Sediments

Excess vegetation and sediments are not apt to present problems. Where necessary, they can be removed when ponds are drained to facilitate harvesting.

e. Over Enrichment

A program of fertilization will be prepared by the RTG task force for each location. The amounts applied will be regulated to ensure that over-fertilization resulting in fish losses does not occur.

f. Water Supplies

Water for the nursery ponds will be drawn from the community tanks. During the latter part of the dry season, available water may be limited to sub-grade reservoirs in the tanks. The locational relationship between the ponds and a tank is important in planning to ensure ready water supplies. Although the pond water requirement is relatively small, use of storage water must still take the pond needs into account and safeguard an allotment for pond use.

7. Operational Plan

Assuming a regulated water regime and fish inputs and outputs as shown in Table 1, Item IV, then tilapia seed fish requirements could be met by producing two successive crops from each nursery pond. A reference schedule for this production is presented in Table 1 below. The brood fish for the first crops in ponds A and B could be acquired from the tank fishery. Since the tank would be fished out by May, then brood for second crops might not be available from this source unless collected earlier and retained in "keeper nets". Alternatively, the brood for second crops could be obtained from local DOF fishery stations.

If the smallest sized ponds (50 m. in length) were employed, this plan could supply 100,000 tilapia fingerlings, whereas the maximum sized ponds (100 m. in length) could supply 200,000 fingerlings. Ponds in the size and output range above could meet the maximum tilapia seed fish requirements for all tanks up to 10 hectares in area.

Preliminary estimates indicate that 10 tanks will be 10 hectares or smaller. Consequently, the tilapia seed fish needs of these tanks could be readily met by the adjacent nursery ponds. Five tanks will range from 11 to 13 hectares; their seed fish needs could also be met by nursery ponds if stocking rates were less than the optimum.

Five tanks will be considerably larger than the above ranging from 17 to 121 hectares. In some cases 200,000 tilapia fingerlings might suffice to meet target fish yields. In others, additional seed fish would be required; these would be provided by the local RTG fisheries station.

With the reference schedule of Table 1, Item IV, only one stocking of puntius fingerlings is required each year. The maximum single crop output from a nursery pond could range from 30 to 60,000 seed fish. This amount would fill the requirements for tanks ranging from less than 12 and up to 24 hectares, or 17 of the 20 tanks. Puntius seed fish production, however, may only be attainable the expense of one crop of tilapia. It is deemed theoretically possible to raise fingerling crops of the two species simultaneously but this practice has not yet been adequately tested.

The matter of raising a crop of puntius fingerlings is relegated to decision by the communities in concert with the respective RTG task forces.

VI. SEED FISH PRODUCTION

1978 Seed Fish Production From RTG Fisheries Station Scheduled to Serve the Project

Station	Present Annual Production	Potential Annual Production (20% increase)
Nong Khai	6,700,000	8,000,000
Ubon Ratchathani	4,500,000	5,500,000
Udon Thani	6,000,000	7,200,000
Sakon Nakhon	2,200,000	2,600,000
Khon Kaen	6,300,000	7,500,000
Maha Sarakham	4,000,000	4,800,000
Surin	1,400,000	1,700,000
Nakhon Ratchasima	3,100,000	3,700,000
NIFI	7,000,000	8,400,000
	41,200,000	49,400,000

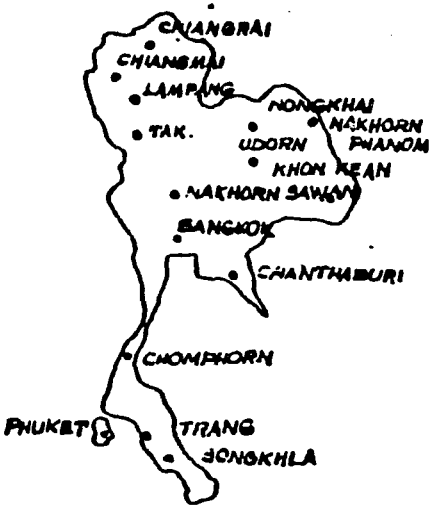
Table 1. Operational Schedule for Obtaining Two Crops of Tilapia Seed Fish from each Fish Nursery Pond.

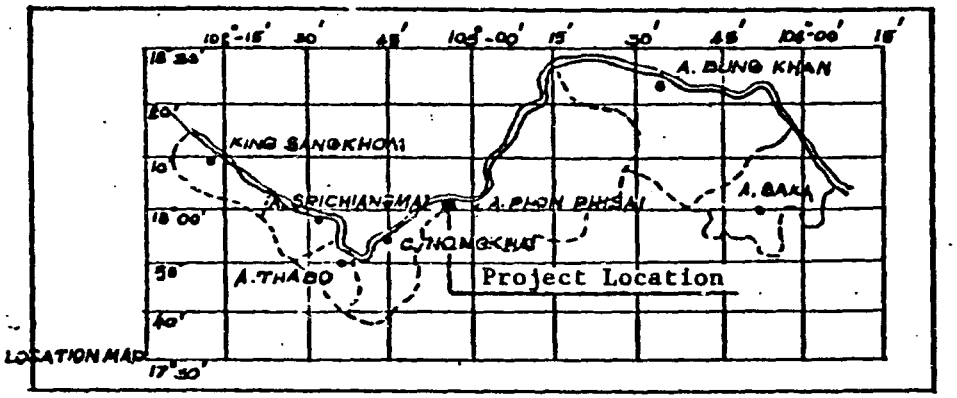
	Feb.	Mar.	Ap.	May	June	Jly	Aug.	Sept.	Oct.
Pond A:									
Crop 1.									
1. Collect & retain brood		●							
2. Infill & treat pond water		●							
3. Stock brood			●						
4. Remove & plant seed fish					●				
Crop 2									
1. Collect & retain brood (outside?)					●				
2. Infill & treat pond water					●				
3. Stock brood						●			
4. Remove & plant seed fish								●	
Pond B:									
Crop 1									
1. Collect & retain brood			●						
2. Infill & treat pond water				●					
3. Stock brood						●			
4. Remove & plant seed fish									
Crop 2									
1. Collect & retain brood (outside?)						●			
2. Infill & treat pond water						●			
3. Stock brood						●			
4. Remove & plant seed fish								●	

KINGDOM OF THAILAND

---------- PROJECT

CHANGWAT NONGKHAI

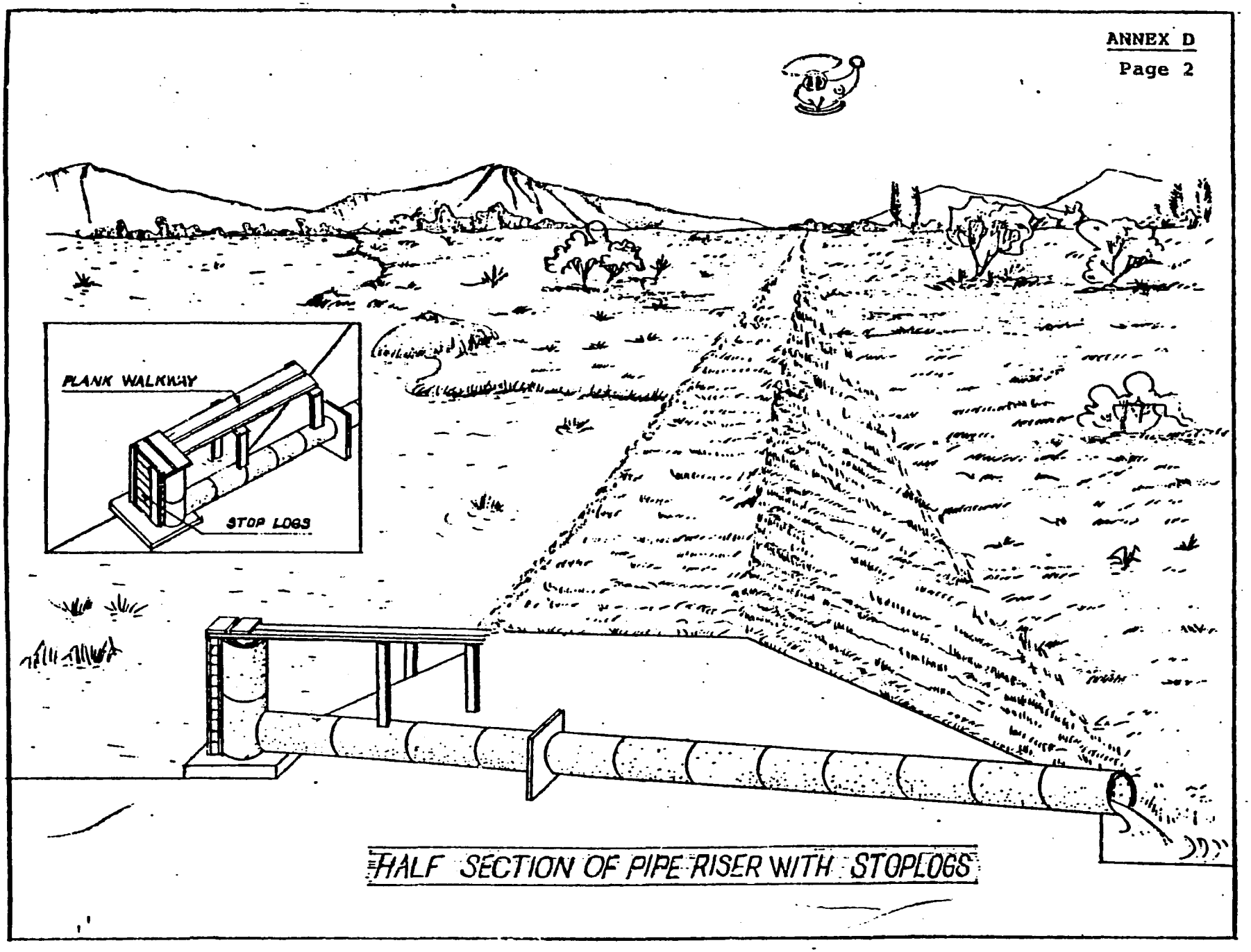




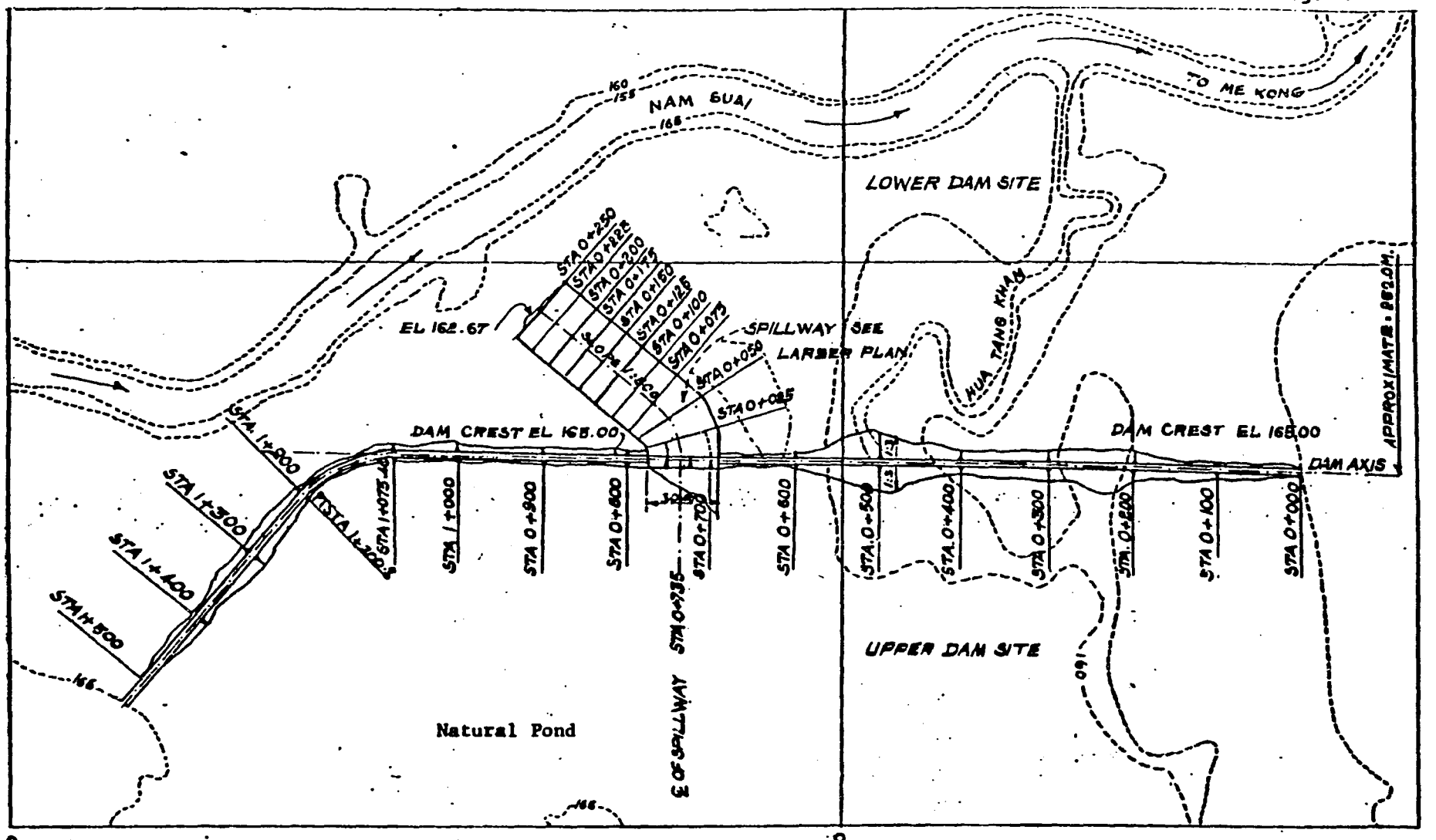
LOCATION MAP

INDEX OF SHEETS

SHEET NO.	CONTENTS
1	TITLE SHEET LOCATION MAP
2	PLAN OF DAM
3	PROFILE TYPICAL CROSS-SECTION
4	SPILLWAY DETAILS
5,6,7,8	CROSS SECTION OF DAM



HALF SECTION OF PIPE RISER WITH STOPLOGS

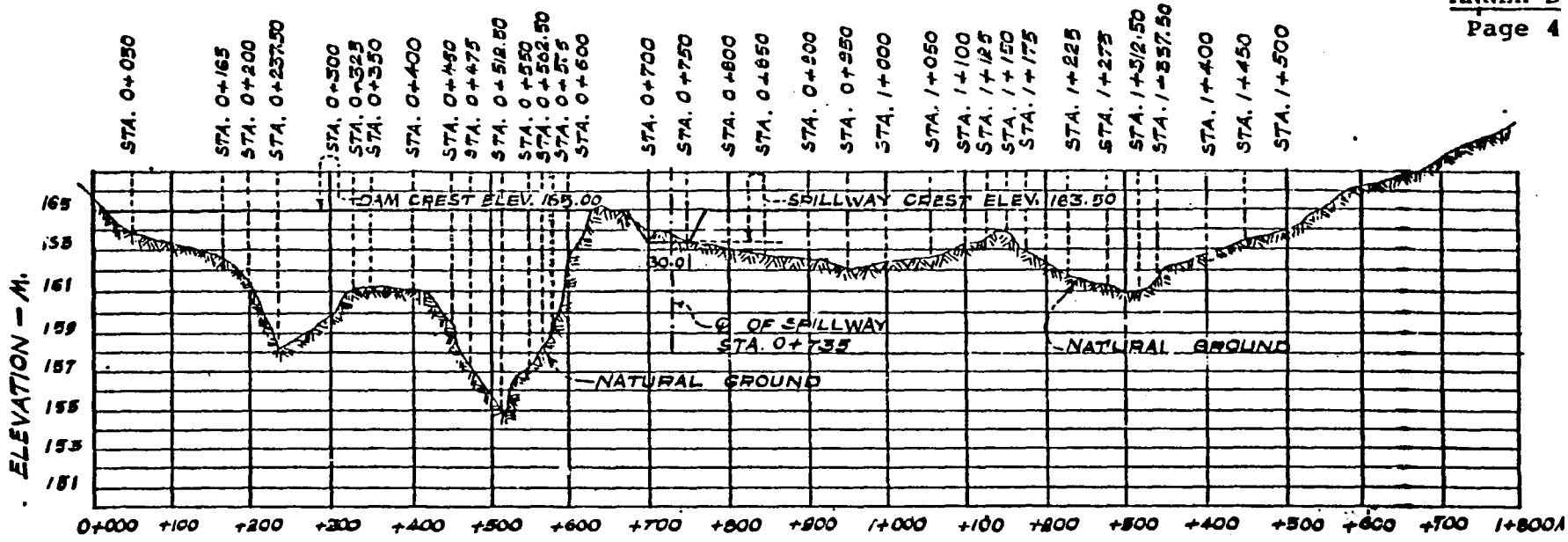


NOTE
1 THIS CONTOUR MAP IS ENLARGED SCALE FROM THE MAP OF PAMONG PROJECT SCALE 1:10,000
2. CONTOUR LINE SHOWN ON THE MAP ARE 5.00M. INTERVAL

GENERAL PLAN

0 12.5 75 125 250 375 500 625M

GRAPHIC SCALE

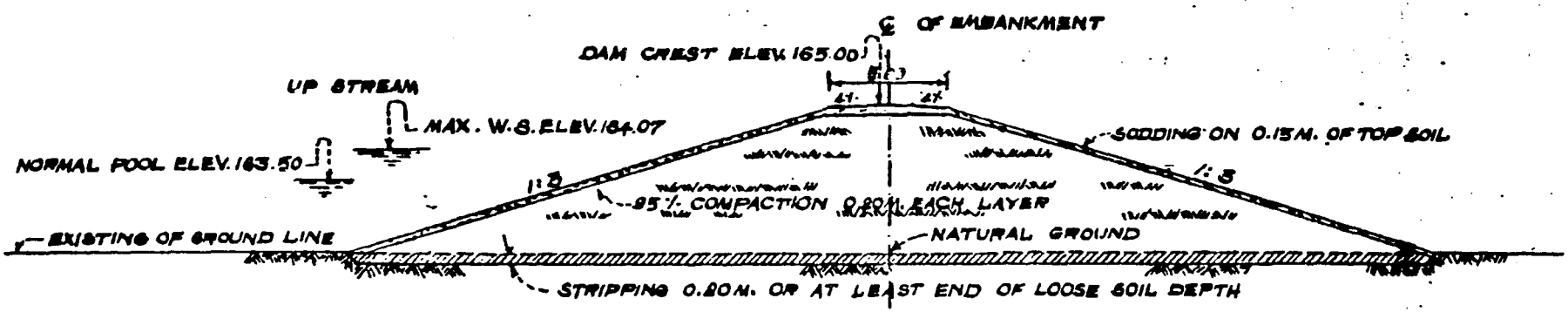


DISTANCE – M

SECTION ALONG DAM AXIS

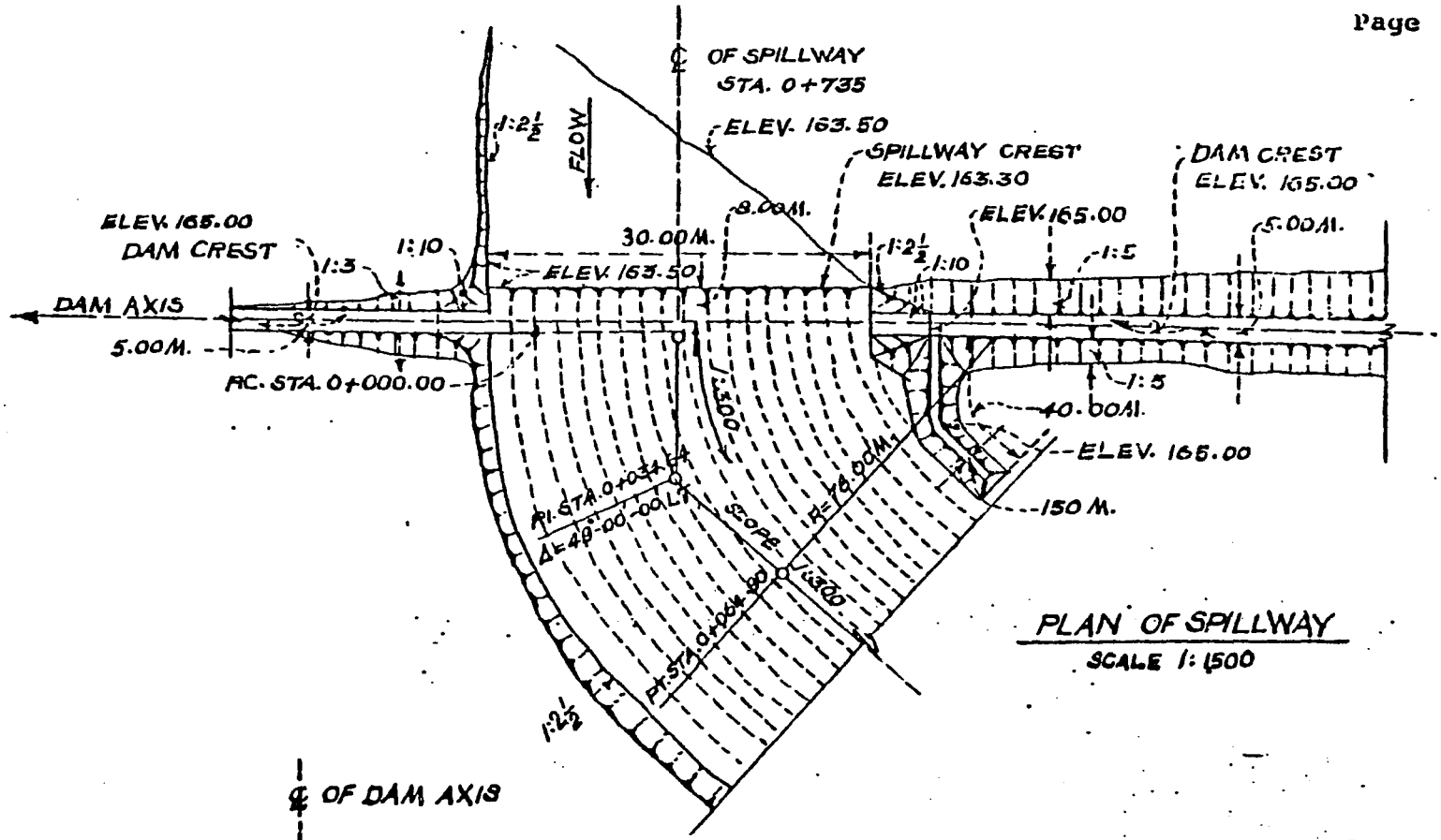
HORIZONTAL SCALE 1:7,500

VERTICAL SCALE 1:300

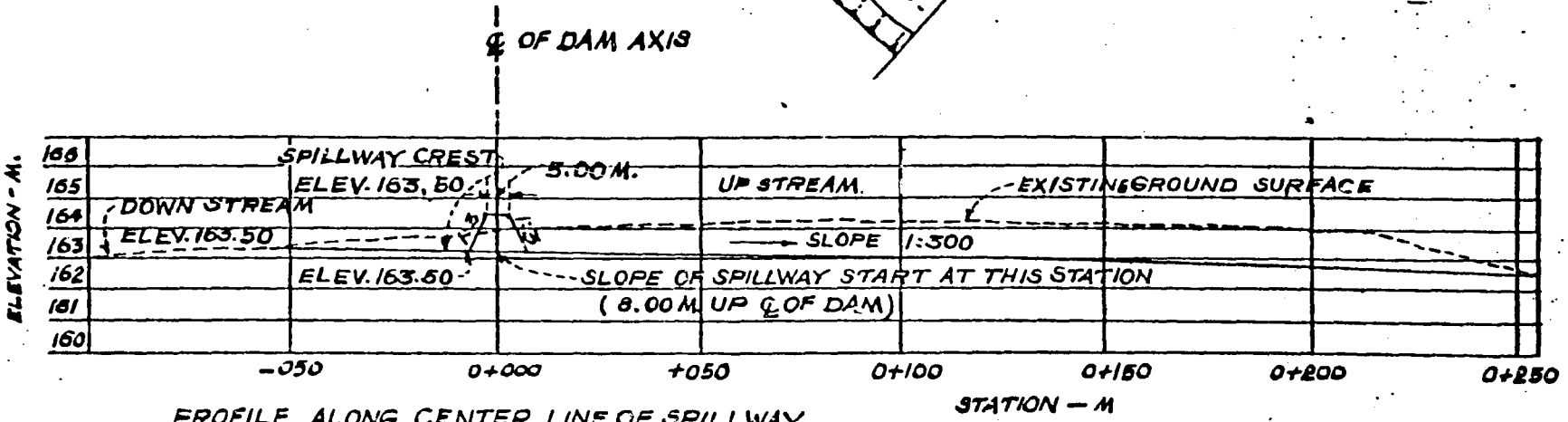


TYPICAL DAM SECTION

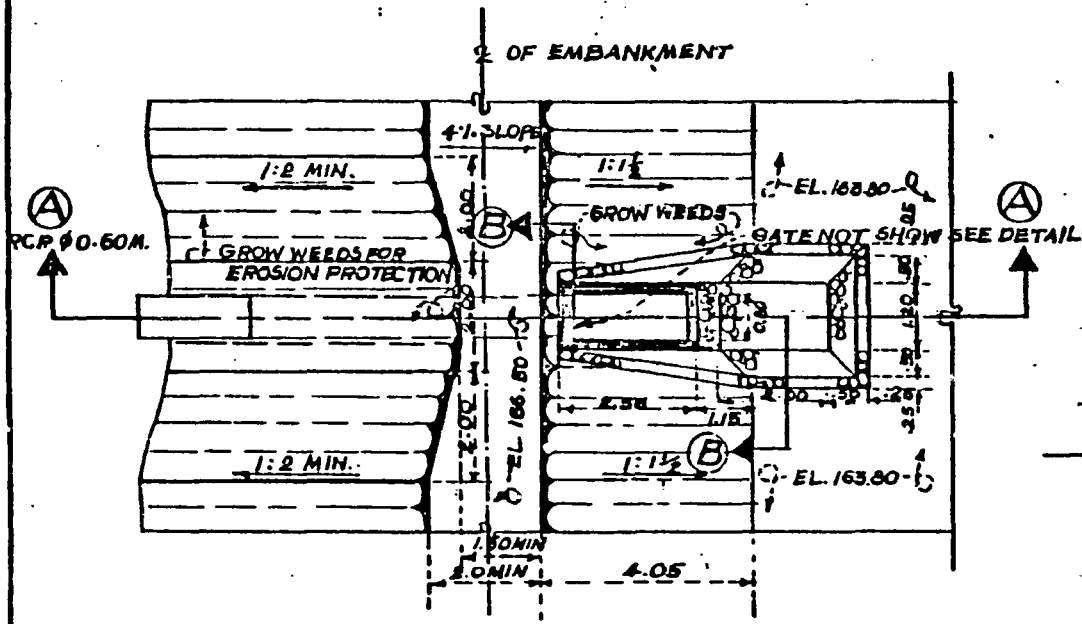
SCALE 1:250



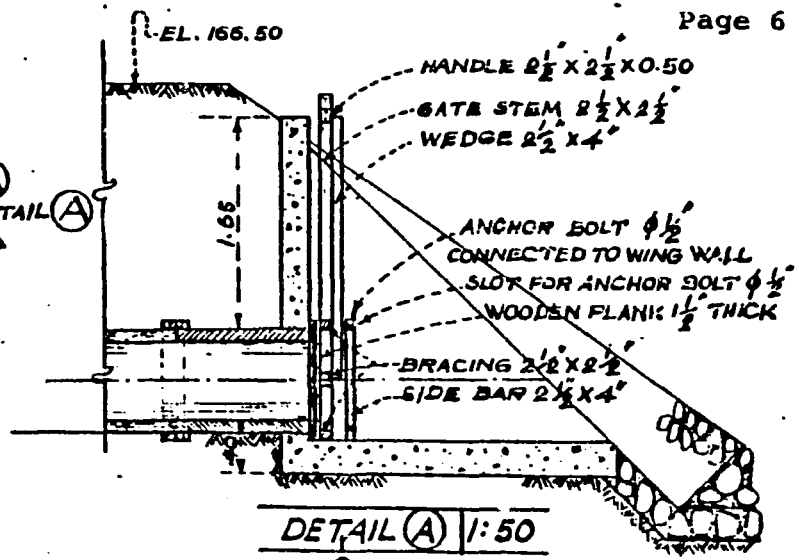
PLAN OF SPILLWAY
SCALE 1:1500



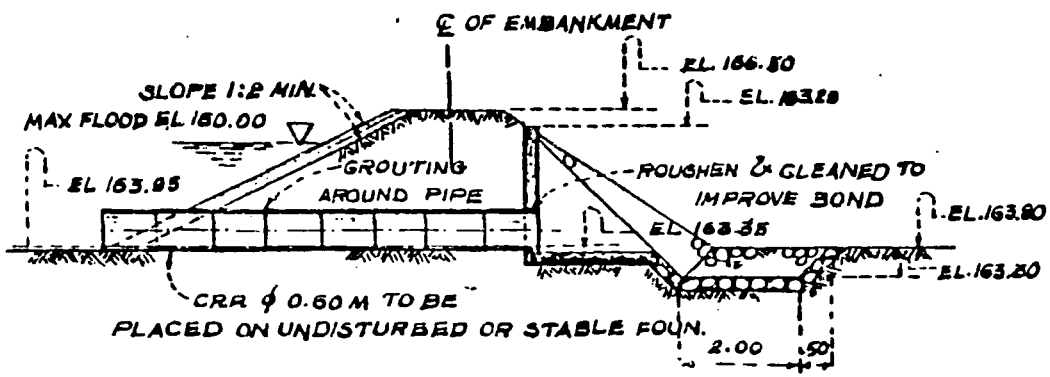
PROFILE ALONG CENTER LINE OF SPILLWAY
HORIZONTAL SCALE 1:1,500
VERTICAL SCALE 1:800



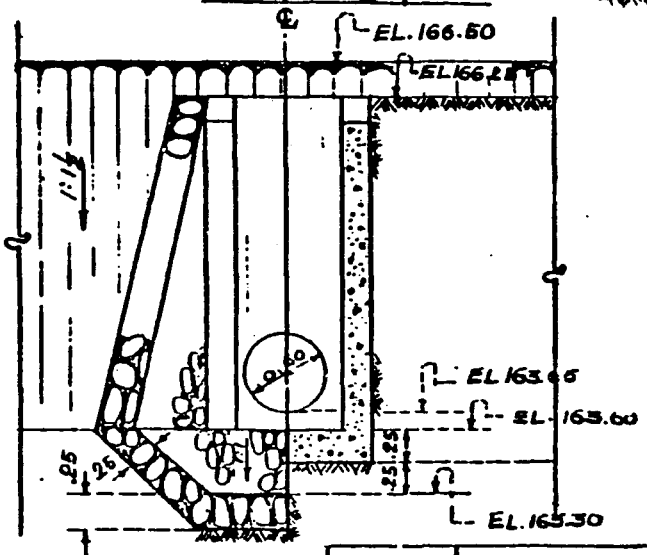
PLAN | 1:125



DETAIL (A) | 1:50

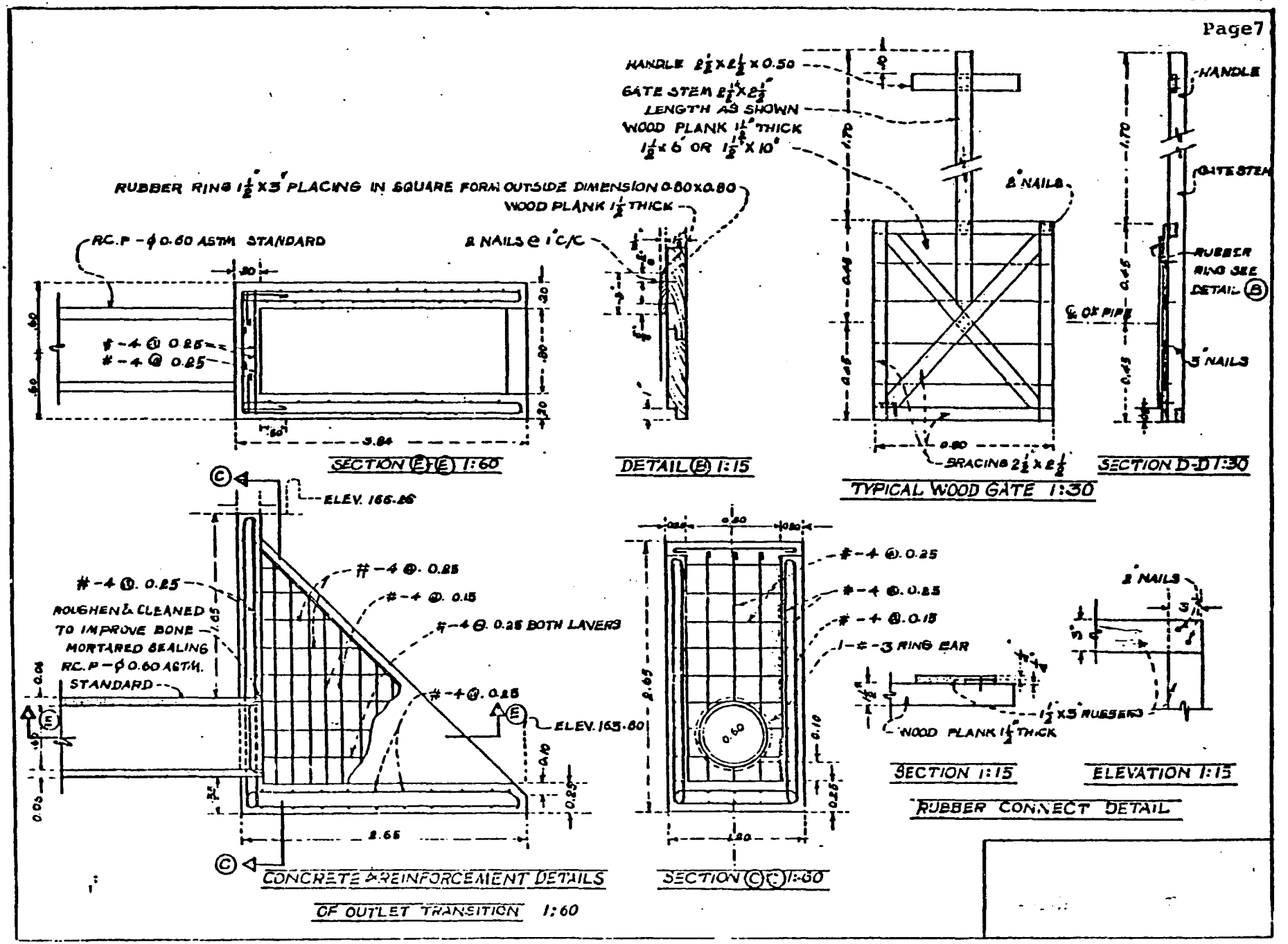


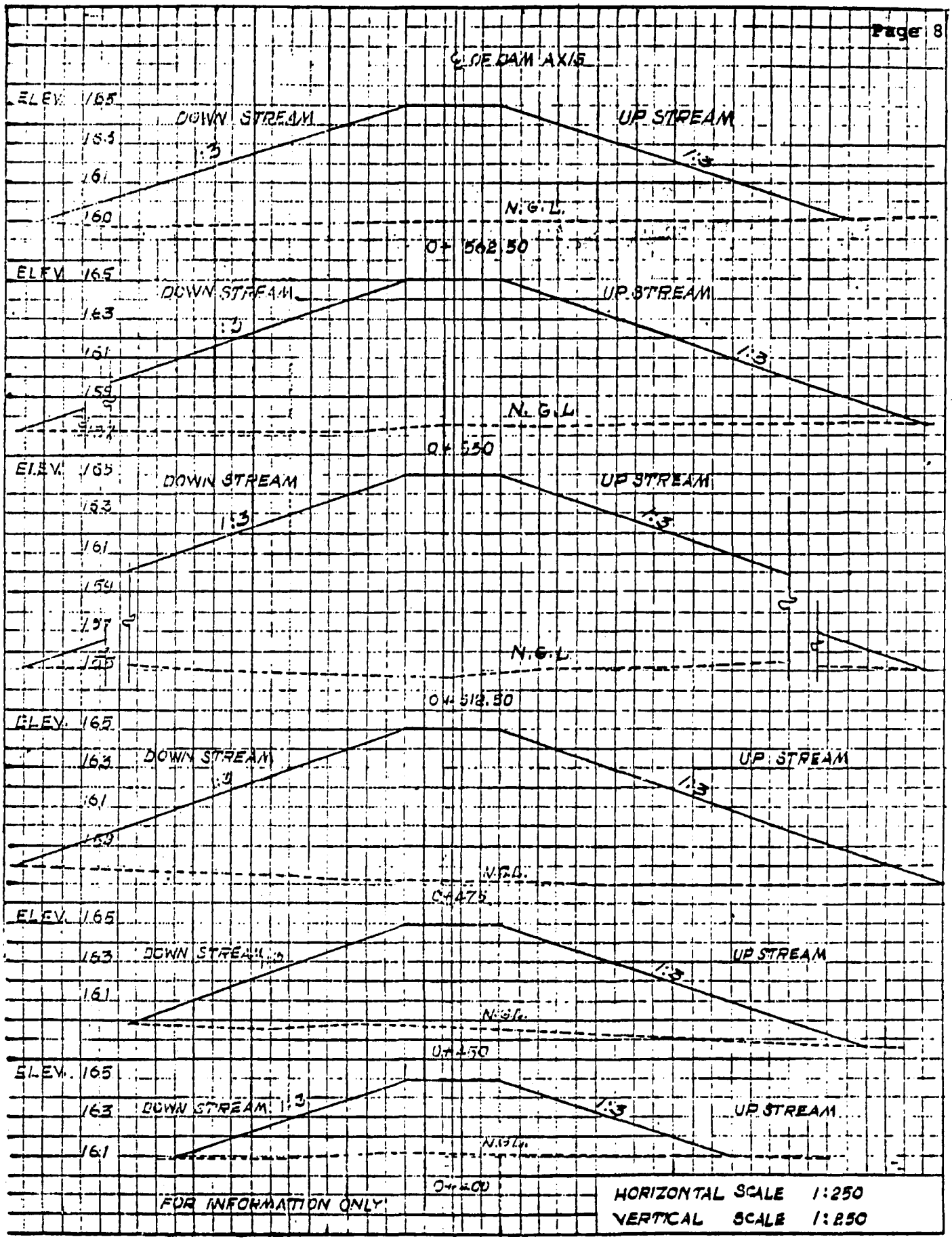
SECTION (A)-(A) | 1:125

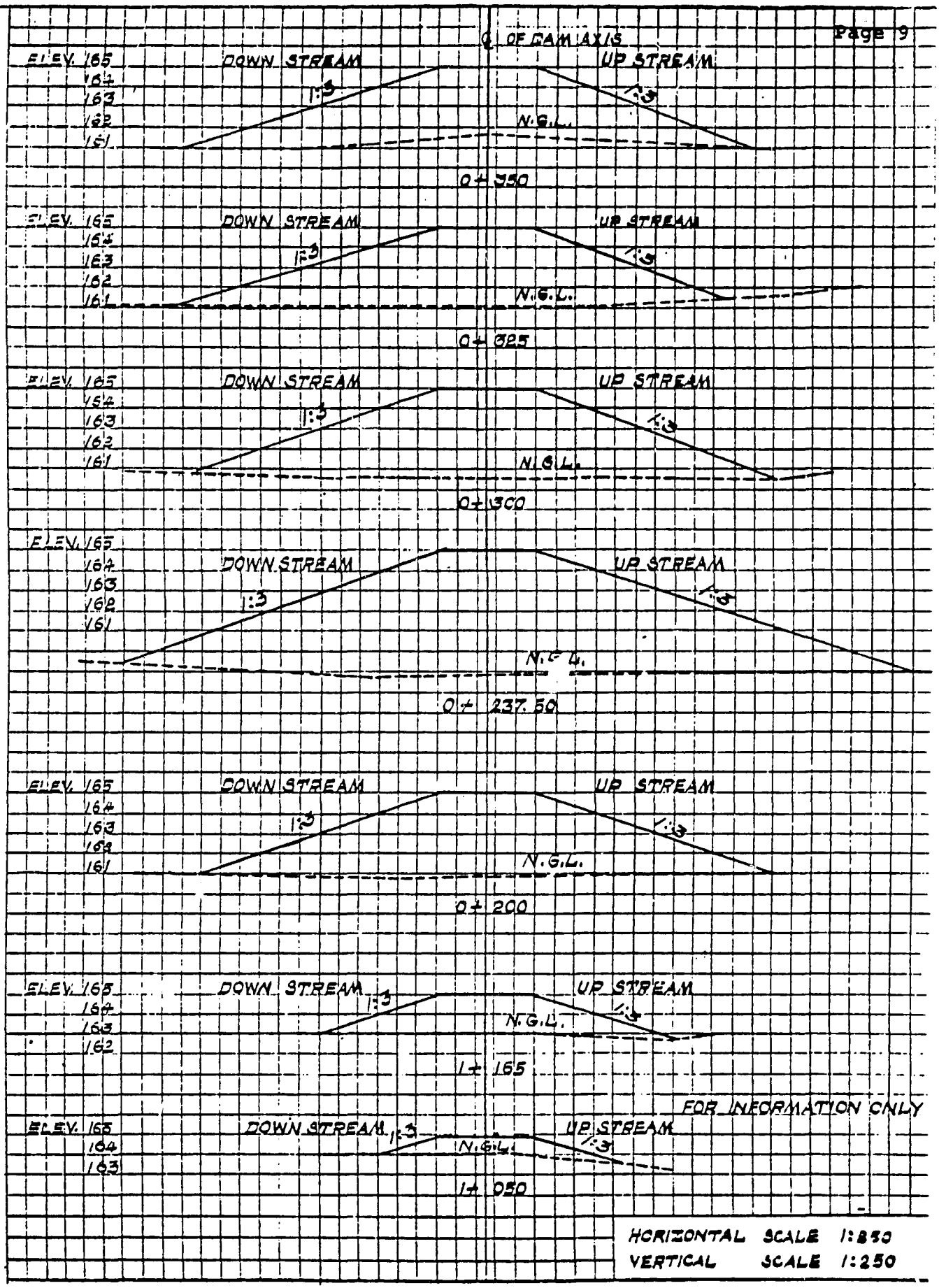


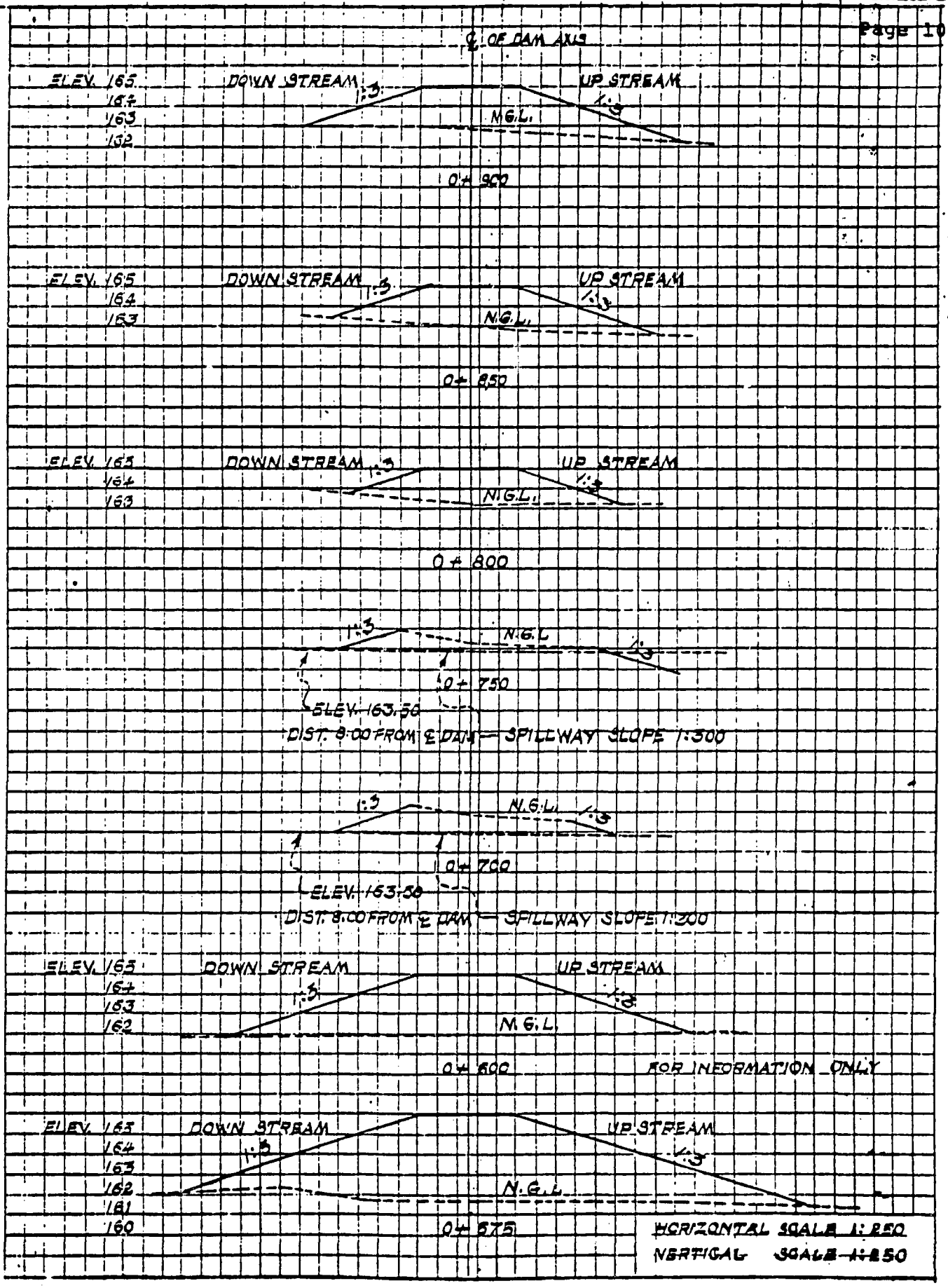
SECTION (B)-(B) | 1:50

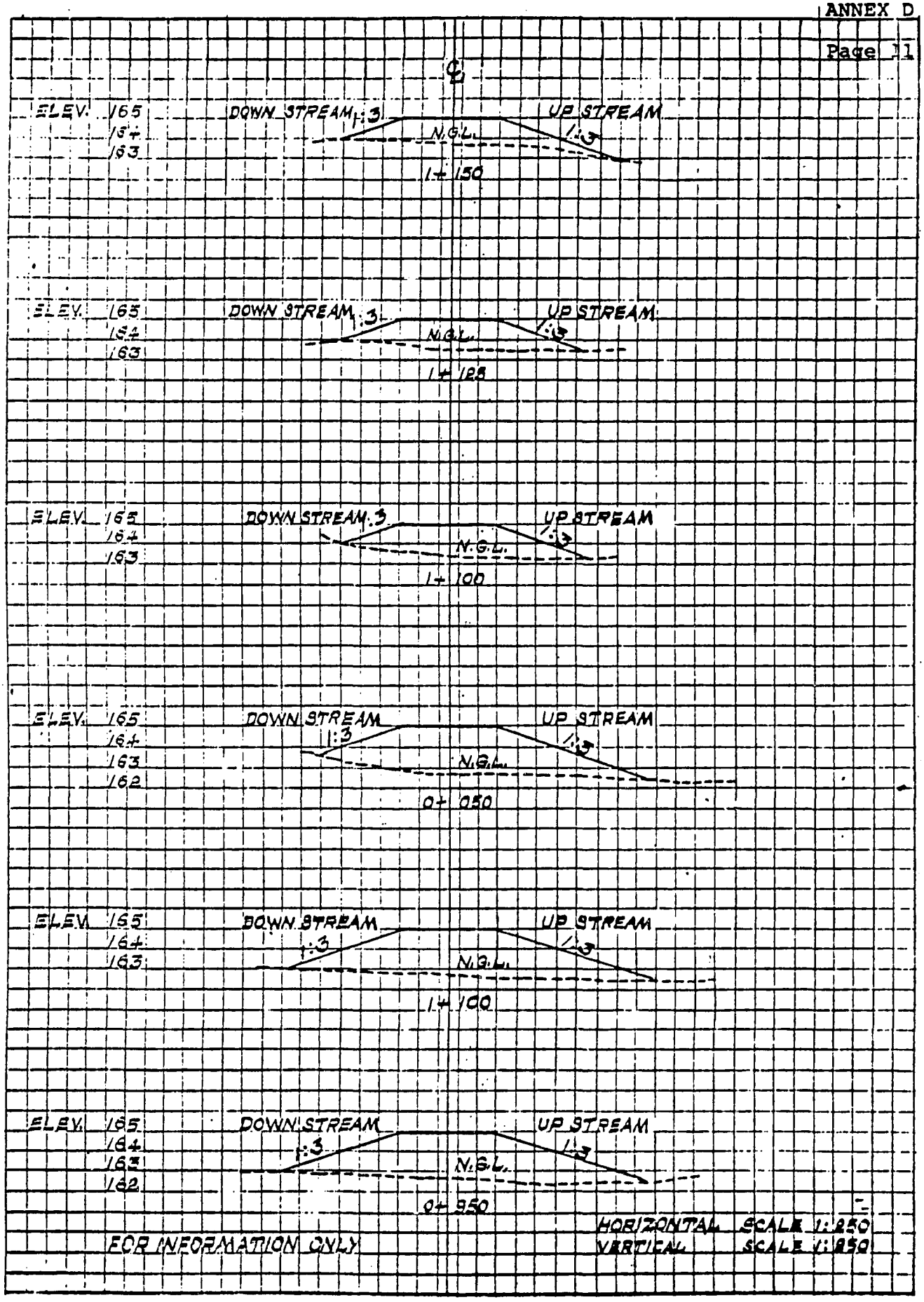
	PROJ. NONGKHAI
SURVEY	
DESIGN	
DRAFT	
DATE	
SHEET NO	

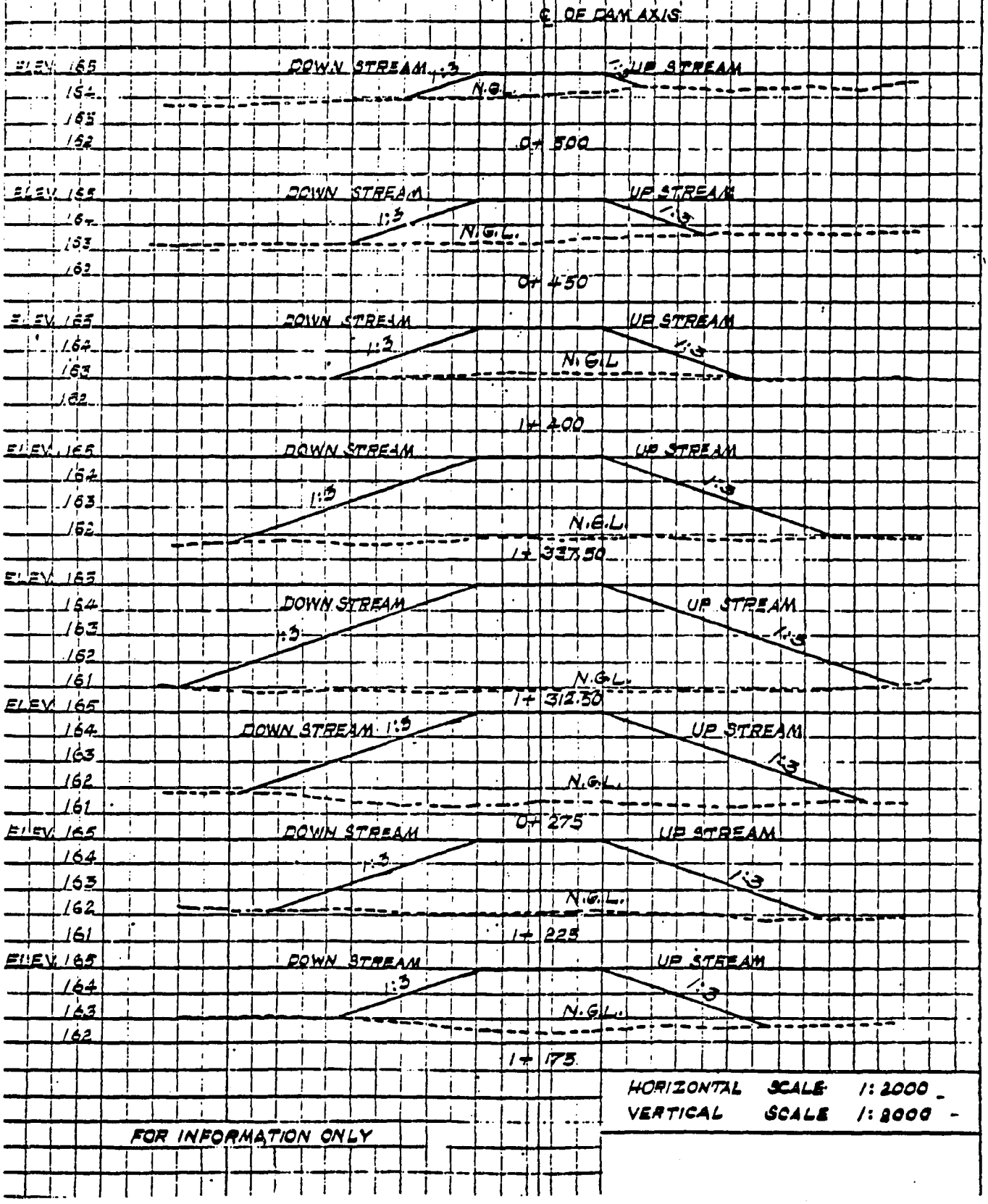

HANDLE 2½"x2½"x0.50
GATE STEM 2½"x2½"
LENGTH AS SHOWN
WOOD PLANK 1½" THICK
1½"x6" OR 1½"x10"
RUBBER RING 1½"x3" PLACING IN SQUARE FORM OUTSIDE DIMENSION 0.80x0.80
WOOD PLANK 1½" THICK
R.C.P - ϕ 0.60 ASTM STANDARD
8 NAILS @ 1" C/C
8" NAILS
HANDLE
GATE STEM
RUBBER RING SEE DETAIL (B)
℄ OF PIPE
5" NAILS
BRACING 2½"x2½"
SECTION (E)-(E) 1:60
DETAIL (B) 1:15
TYPICAL WOOD GATE 1:30
SECTION D-D 1:30
ELEV. 166.26
#-4 @ 0.25
ROUGHEN & CLEANED TO IMPROVE BONE MORTARED SEALING
R.C.P - ϕ 0.60 ASTM. STANDARD
#-4 @ 0.15
#-4 @ 0.25 BOTH LAYERS
ELEV. 165.60
1-#-3 RING EAR
WOOD PLANK 1½" THICK
1½"x3" RUBBER
SECTION 1:15
ELEVATION 1:15
RUBBER CONNECT DETAIL
CONCRETE REINFORCEMENT DETAILS
OF OUTLET TRANSITION 1:60
SECTION (C)-(C) 1:60


℄ OF DAM AXIS
ELEV. 165
163
161
160
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+562.50
ELEV. 165
163
161
159
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+550
ELEV. 165
163
161
159
157
155
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+512.50
ELEV. 165
163
161
159
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+475
ELEV. 165
163
161
DOWN STREAM
UP STREAM
1:3
N.G.L.
0+450
ELEV. 165
163
161
DOWN STREAM 1:3
1:3
UP STREAM
N.G.L.
0+400
FOR INFORMATION ONLY
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:250


℄ OF DAM AXIS
ELEV. 165
164
163
162
161
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
0+350
ELEV. 165
164
163
162
161
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
0+325
ELEV. 165
164
163
162
161
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
0+300
ELEV. 165
164
163
162
161
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
0+237.50
ELEV. 165
164
163
162
161
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
0+200
ELEV. 165
164
163
162
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
1+165
FOR INFORMATION ONLY
ELEV. 165
164
163
DOWN STREAM
UP STREAM
1:3
1:3
N.G.L.
1+050
HORIZONTAL SCALE 1:850
VERTICAL SCALE 1:250


℄ OF DAM AXIS
ELEV. 165
164
163
162
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+900
ELEV. 165
164
163
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+850
ELEV. 165
164
163
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+800
1:3
N.G.L.
1:3
0+750
ELEV. 163.50
DIST. 8.00 FROM ℄ DAM — SPILLWAY SLOPE 1:300
1:3
N.G.L.
1:3
0+700
ELEV. 163.50
DIST. 8.00 FROM ℄ DAM — SPILLWAY SLOPE 1:300
ELEV. 165
164
163
162
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+600
FOR INFORMATION ONLY
ELEV. 165
164
163
162
161
160
DOWN STREAM
1:3
UP STREAM
1:3
N.G.L.
0+575
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:250


℄
ELEV. 165
164
163
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+150
ELEV. 165
164
163
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+125
ELEV. 165
164
163
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+100
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
0+050
ELEV. 165
164
163
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+100
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
0+050
FOR INFORMATION ONLY
HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:250


℄ OF DAM AXIS
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
0+500
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
0+450
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+400
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+337.50
ELEV. 165
164
163
162
161
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+312.50
ELEV. 165
164
163
162
161
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
0+275
ELEV. 165
164
163
162
161
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+225
ELEV. 165
164
163
162
DOWN STREAM 1:3
UP STREAM 1:3
N.G.L.
1+175
HORIZONTAL SCALE 1:2000
VERTICAL SCALE 1:2000
FOR INFORMATION ONLY

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

ANNEX E

Life of Project:
From FY 1979 to FY 1981
Total U.S. Funding $442,000

Project Title & Number: Village Fish Pond Development (493-0303)

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1)	Measures of Goal Achievement: (A-2)	(A-3)	Assumptions for achieving goal targets: (A-4)
Improve the nutrition and quality of life of the rural poor.	1. Decrease in nutrition related diseases in rural areas. 2. Increase in per capita income among rural poor. 3. Decrease in migration from Northeast Thailand.	RTG reports	Selected village fish pond sites will augment village social, nutritional and economic needs. Improvement in rural quality of life remains a priority national objective.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1979 to FY 1981
Total U.S. Funding $442,000

Project Title & Number: Village Fish Pond Development (493-0303)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: (B-1)	Conditions that will indicate purpose has been achieved: End of project status. (B-2)	(B-3)	Assumptions for achieving purpose: (B-4)
Provide selected villages in water-deficient areas of Northeast Thailand with year-round access to supplemental water supplies and fish protein through techniques that can be readily replicated throughout the Northeast.	In minimum of 14 villages in Northeast Thailand: 1. Water for domestic and livestock uses during dry season adequate to meet basic needs. 2. Net increase in agricultural production from supplemental crops and timely initiation of rice nurseries. 3. Fish production yielding minimum increase of 10 kgs per capita per annual cycle. 4. Self reliance of villagers to manage pond and provide most of seed-fish requirements. 5. Variety of successful community management techniques demonstrated. 6. Empirical evidence on most advantageous multiple use regimes for socio-economic benefit to village. 7. Plans underway to replicate program in other areas of Northeast.	1. Baseline surveys and evaluation 2. Project reports 3. Site visits	1. Villagers will maintain proper pond management. 2. Sufficient rainfall or other water to fill ponds. 3. Little or no damage to dikes and spillways due to floods. 4. Adequate coordination among Fisheries Department and other agencies to provide needed agricultural extension services. 5. Adequate supply of agricultural inputs. 6. Security is not a problem.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1979 to FY 1981

Project Title & Number: Village Fish Pond Development (493-0308) Total U.S. Funding $442,000

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs: (C-1)	Magnitude of Outputs: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
1. Multipurpose fish ponds established.	1. 14 fish ponds.	1. Fisheries reports	1. Adequate number of appropriate sites found in timely manner.
2. Pond user groups organized and trained in pond O & M and integrated farming techniques.	2. 14 groups organized and trained.	2. Site inspections	2. Provincial authorities provide necessary A & E services in timely manner.
3. Seed fish produced and distributed to pond user groups.	3. 5 million seed fish.		3. Qualified contractors available to do construction work.
4. Nursery ponds established.	4. 28 nursery ponds.		4. Low turnover among trained Fisheries Department personnel.
5. Additional area adjacent to ponds brought under cultivation.	5. 80-100 hectares cultivated with garden or orchard crops.		5. Fisheries Department and cooperating agencies continue to view project as high priority.
			6. Hatcheries capable of meeting needs for seed fish.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1979 to FY 1981
Total U.S. Funding $442,000

Project Title & Number: Village Fish Pond Development (493-0303)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs: (D-1)	Implementation Target (Type and Quantity) (D-2)	(D-3)	Assumptions for providing inputs: (D-4)
AID-Fund for:	(See detailed description and financial plan)	1. Planning and Budget documents.	Timely provision of personnel and funds.
1. Pond development.		2. Reports.	
2. Fingerling production and distribution.			
3. Training costs.			
RTG			
1. Land for ponds (selected sites).			
2. Program supervision and management.			
3. Field personnel.			
Communities			
1. Operational manpower			
2. Support materials			
3. Administration and Management.			
4. Local labor for			
- nursery ponds			
- dredging, sodding, etc. of ponds.			

Components of the Administrative Structure of the Project

1. Central Committee

A. Functions

i. set policies for the Project

ii. designate working committees and teams, and assign tasks

iii. liaise between RTG offices (including Provincial Offices) and with USAID

iv. make ultimate budgetary decisions

B. Duration

With the exceptions indicated below a Central Committee will be in force through the life of the Project.

C. Members

Director-General of DOF - Chairman
Director of Freshwater Fisheries Division, DOF
Director of NIFI, DOF
Director of the Finance Division, DOF
Director of Fisheries Conservation and Extension, DOF
Chief, Engineering Section, DOF
DTEC Officer dealing with USAID programs
USAID representative
Project Co-ordinator, DOF - interim appointment until replaced by a Project Manager
Assistant Project Co-ordinator, DOF - also interim until replaced by an Assistant Project Manager

2. Local Committee (one for each Province in which Project developments will occur)

A. Functions

i. Liaise Project matters between the Central Committee or the Project Co-ordinator (or Manager and the Provincial Governor's office.

ii. Mediate Project requirements in a Province

a) locate proposed sites

b) engineering services
c) construction contractors
d) construction sub-committees (contractor selection, construction supervision and construction approval)
e) seed fish and brood fish supplies from RTG stations
f) local purchases
g) training and extension services.

iii. Maintain a file on the Project which will include progress accounts, and the disposition of equipment and materials purchased for the Project.

B. Duration

In force through the life of the Project

C. Members

Chief of the local RTG fisheries station or the Chief Provincial Fisheries Officer, DOF Staff as designated by the Provincial Governor (e.g. Community Development Officers).

3. Project Co-ordination Team

A. Functions

i. Mediate all matters relating to planning between the Planning Team and the Local Committees, DOF, USAID and DTEC.

ii. Co-ordinate inputs for the preparation of the Project Paper.

iii. Prepare the Project for implementation through the Project Manager Team.

B. Duration

About 6 months in the first half of 1979 or until replaced by the Project Manager Team.

C. Members

Project Co-ordinator and Assistant Project Coordinator as designated by the Central Committee.

4. Planning Team

A. Functions

i. select proposed sites
ii. prepare the Project Paper
iii. prepare the final site plans.

B. Duration

About 8 months in the first part of 1979.

C. Members

Project Co-ordination Team
Project Officers, USAID

Consultants:
a) Sociologists - USAID, Kasetsart University
b) Economists - RTG, USAID
c) Environmental impact assessment
d) Planning assistant - RTG (USAID)

Site Teams - in preparation of respective final site plans only.

5. Project Management Team

A. Functions

i. mobilize the Project
ii. co-ordinate implementation
iii. provide ongoing liaison between the Central Committee, the Local Committees and the Site Teams
iv. maintain progress records, undertake periodic evaluations and provide corresponding reports.

B. Duration

Through the life of the Project

C. Members

Project Manager and Assistant Manager as designated by the Central Committee Site Team for their respective locations.

6. Site Teams (one for each Project development except where one team may be involved with more than one development)

A. Functions

i. communicate the Project to the villages at selected locations.

ii. coordinate the organization of community committees.

iii. mediate community matters to the final site plans and to Project management.

iv. arrange for equipment and supply needs for a site.

v. provide technical direction in tank and nursery pond management (fertilizing, stocking, harvesting, weed control, etc.) and in associated land uses (garden crops, etc.).

vi. organize and conduct training programs and workshops.

vii. maintain records and provide progress reports.

viii. prepare and release extension manuals.

B. Duration

Through the life of the Project.

C. Members

Local government staff comprising one fisheries biologist, one or two fisheries extension workers and one community development officer.

7. Community Committees

A. Functions

i. relate farmers needs to the Project.

ii. determine use policies for the resources established by the Project.

iii. arrange for community inputs.

iv. direct operational management of the tanks

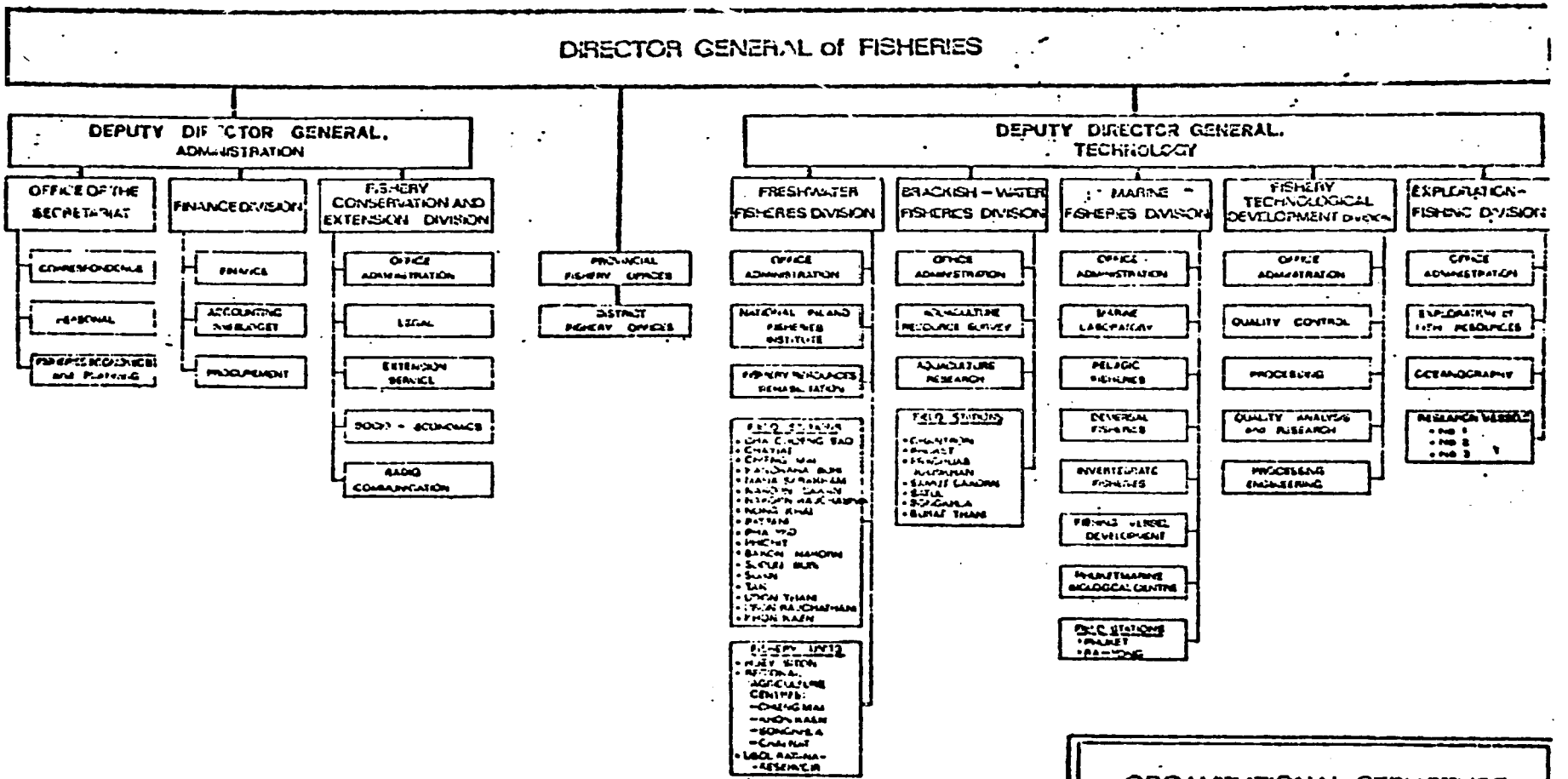
v. govern the distribution of benefits.

B. Duration

Through the life of the Project.

C. Members

Three to five people of the villages forming a community who are acknowledged leaders.



ORGANIZATIONAL STRUCTURE
DEPARTMENT of FISHERIES,
MINISTRY of AGRICULTURE AND
COOPERATIVES

NOVEMBER, 1977

ANNEX G

Thailand - Village Fish Pond Development Project Certification

Pursuant to Section 611 (e) of the Foreign Assistance Act of 1961, as Amended

I, Donald D. Cohen, principal officer of the Agency for International Development in Thailand, having taken into account among other things the maintenance and utilization of projects in Thailand previously financed or assisted by the U.S. and the commitment of the Royal Thai Government to carry out an effective fisheries program, do hereby certify that in my judgement Thailand has the financial and human resources capability to implement, maintain, and utilize effectively the subject Village Fish Pond Development Project.

Date

Donald D. Cohen
Director, USAID/Thailand

STATUTORY CHECKLIST

I COUNTRY CHECKLIST

A. General Criteria for Country Eligibility	A. General Criteria for Country
1. FAA Sec. 116. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in consistent pattern of gross violations of internationally recognized human rights?	Yes. N/A.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent narcotics drugs and other controlled substances (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	No.
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	Yes.

4.	FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) debt is not denied or contested by such government?	No
5.	FAA Sec 620(e) (1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No
6.	FAA Sec. 620(a), 620(f); FY 79 App. Act, Sec. 108), 114 and 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?	No. No.
7.	FAA Sec. 620(i). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	(a) No. (b) No.

8.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	
9.	FAA Sec. 620(l). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	The investment guaranty program is in effect.
10.	FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters:	No such seizures have taken place.
	a. has any deduction required by the Fishermen's Protective Act been made?	a) N/A
	b. has complete denail of assistance been considered by AID Administrator?	b) N/A
11.	FAA Sec. 620(q); FY 79 App. Act, Sec. 603	
	a. Is the government of the recipient country in default for more than 6 months on interest or principal of any AID loan to the country?	a. No.
	b. Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds?	b. No.

12.	FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems?	Development Assistance Grant Funds are proposed In any cases, yes, as reported in annual report on implementation of Sec. 620(s).
13.	FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No. N/A
14.	FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?	Not in arrears.
15.	FAA Sec. 620A: FY 79 App. Act. Sec. 607 Has the country granted sanctuary from prosecution to any individual or group which has committed in act of terrorism?	Not to the knowledge of the Mission.
16.	FAA Sec. 666. Does the country object, on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?	No.

17. FAA Sec. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it detonated a nuclear device after August 3, 1977 although not a "nuclear-weapon State" under the nonproliferation treaty?	No.
B. Funding Criteria for Country Eligibility	Funding Criteria for Country
1. Development Assistance Country Criteria	
a. FAA Sec. 102(b)(4). Have criteria been established and taken into account to assess commitment progress of country in effectively involving the poor in development, on such indexes as: (1) increase in agricultural productivity through small-farm labor intensive agriculture, (2) reduced infant mortality, (3) control of population growth, (4) equality of income distribution, (5) reduction of unemployment, and (6) increased literacy?	Yes, See FY 1979. CDSS.
b. FAA Sec. 104(d)(1). If appropriate, is this development (including Sahel) activity designed to build motivation for smaller families through modification of economic and social conditions supportive of the desire for large families in programs such as education in and out of school, nutrition, desease control, material and child health services, agricultural production, rural development, and assistance to urban poor?	This project will address malnutrition problems by providing access to additional fish protein.

II. PROJECT CHECKLIST

A. General Criteria for Project

1. FY 79 App. Act Unnumbered; FAA Sec. 653 (b); Sec. 634A.

   a. Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project;
   b. is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure)?

   The project was not included in AID's 1979 Congressional Presentation. A notification of the project was accordingly sent to Congress on August 13, 1979, and expired with no objection on August 27, 1979. Assistance is within OYB.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $1[illegible],000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

   Agreed standard plans and firm cost estimates are incorporated into the Project Paper.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

   No further legislative action is required.

4. FAA Sec. 611(b); FY 79 App. Act Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973?

   All relevant standards and criteria have been met.

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	N/A
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The project is a small pilot effort and should have no significant effect on any of these items.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise)	See above.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. and utilized to meet the cost of contractual and other services.	The Royal Thai Government contribution to this project will exceed 25 percent. These are no U.S. owned local currencies available for this project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	The project will utilize standard RTG procurement regulations which require securing at least three offers for small (less than $25,000) subprojects and formal bidding for large subprojects.
12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar, or competing commodity?	The project is not for this purpose.

B. Funding Criteria for Project

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-	a. This project was designed as a "bottom up" effort with the local rural beneficiaries participating in the planning, construction and operation/ maintenance of the multi purpose ponds.

intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

(b) Local pond user committees are being established at each site to assist the local people develop user policies and regulations and supervise pond management.
(c) This is essentially a self-help project which aims to improve the quality of life of the rural poor.
(d) Women of child bearing age will especially benefit since improved nutrition and more adequate domestic water supplies are major objectives of the project.
~~(e) a~~ successful project should lead to replication in neighboring countries.

b. FAA Sec. 103, 103A, 104, 105, 106, 107. Is assistance being made available: (include only applicable paragraph which corresponds to source of funds used. If more than one fund source is used for project, include relevant paragraph for each fund source).

1) (103) for agriculture, rural development or nutrition; if so, extent to which activity is specifically designed to increase productivity and income of rural poor; (103A) if for agricultural research, is full account taken of needs of small farmers;

The project purpose is directed at increasing agricultural production and fish production in poor rural areas thus leading to an increase in per capita income among the rural poor.

c. (107) Is appropriate effort placed on use of appropriate technology?	Yes, technology is suited to the rural Northeast of Thailand.
d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?	Yes, per the PP financial plan.
e. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"?	This is a two year project.
f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental and political processes essential to self-government.	The project responds to the most often expressed felt need of the rural poor in Northeast Thailand: the desire for more water. It incorporates technical assistance to villagers to help them develop the skills necessary to properly manage ponds for maximum economic return.
g. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase or productive capacities and self-sustaining economic growth?	Yes, these are major objectives.

2. Development Assistance Project Criteria (Loans only)

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan including reasonableness of repayment prospects.	N.A
b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	N.A.

3. Project Criteria Solely for Economic Support Fund

a. FAA Sec. 531(a). Will this assistance support promote economic or political stability? To the extent possible, does it reflect the policy directions of section 102?	N.A.
b. FAA Sec. 533. Will assistance under this chapter be used for military, or paramilitary activities?	N.A.

ANNEX I

DRAFT - Project Authorization and Request for Allotment of Funds

Country: Thailand

Project Name: Village Fish Pond Development

Project Number: 493-0303

Pursuant to Part I, Chapter I, Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Grant to the Kingdom of Thailand, the "Cooperating Country", of not to exceed four hundred forty two thousand United States Dollars (US $442,000) to help in financing certain local currency costs of supplies and fish pond constructions required for the Project as described in the following paragraph.

The Project consists of establishing fourteen village fish ponds in depressed rural areas of Northeast Thailand which will benefit 4,200 families for the purpose of providing sufficient water for (a) producing continual crops of dietary fish, (b) domestic needs of people and animal during the dry season, and (c) supporting some dry season horticulture. The entire amount of the A.I.D. financing herein authorized for the Project will be obligated when the Project Agreement is signed.

I hereby authorize the initiation of negotiation and execution of the Project Agreement in accordance with A.I.D. regulations and Delegation of Authority subject to the following essential terms and covenants and major conditions; together with such other terms and conditions as A.I.D. may deem appropriate.

Signature: _____

Donald D. Cohen
Director
USAID/Thailand

_____

Date