Report No. 1129-BA

Burma: Appraisal of the Lower Burma Paddyland Development Project

May 25, 1976

Irrigation and Area Development Division
South Asia Projects Department

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CURRENCY EQUIVALENTS

Since January 1975, the Burmese Kyat has been officially valued at 7.743 to the IMF Special Drawing Right (SDR) and consequently its value floats relative to other currencies. Recently, the US Dollar was valued at 1.20 to the SDR. The following exchange rate between Kyats and Dollars is used throughout this report, except where stated otherwise:

US$1.00	=	Kyat (K) 6.5
K 1.00	=	US$0.15

WEIGHTS AND MEASURES

English/US Units		Metric Units
1 foot (ft)	=	30.48 centimeters (cm)
1 mile (mi)	=	1.609 kilometers (km)
1 acre (ac)	=	0.405 hectare (ha)
1 square mile (sq mi)	=	2,590 square kilometers (km^2)
1 cubic foot (cu ft)	=	28.32 liters (l)
1 cubic yard (cu yd)	=	0.765 cubic meter (m^3)
1 acre-foot (ac-ft)	=	12,344 cubic meters (m^3)
1 cubic foot per second (cusec)	=	0.025 m^3/sec
1 long ton (lg ton)	=	1,016 kilograms (kg)

Burmese Units		English/US Units		Metric Units
1 vis (vi)	=	3.600 lb (.001607 lg ton)	=	1.633 kg
1 pyi (1.302 vi)	=	4.688 lb (.002092 lg ton)	=	2.127 kg
0.2133 pyi (.28 vi)	=	1 pound (lb)	=	0.4536 kg
0.4702 pyi (.612 vi)	=	2.205 lb	=	1 kg
477.9 pyi (622 vi)	=	1 long ton (2,240 lbs)	=	1,016 kg
470.2 pyi (612 vi)	=	0.0942 lg ton (2,205 lbs)	=	1 metric ton (m ton)

1 Basket Paddy	(9.82 pyi)	=	46.0 lbs	(.0205 lg ton)	=	20.9 kg
1 Basket Rice	(16.0 pyi)	=	75.0 lbs	(.0335 lg ton)	=	34.0 kg
1 Bag Rice	(34.1 pyi)	=	160 lbs	(0.714 lg ton)	=	75.6 kg

BURMA FISCAL YEAR

April 1 - March 31

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED

AC	=	Agricultural Corporation
AMD	=	Agricultural Mechanization Department
APS	=	Advance Purchase System
BAB	=	Burma (Myanma) Agricultural Bank
CLC	=	Central Land Committee
GNP	=	Gross National Product
GOB	=	Government of the Socialist Republic of the Union of Burma
Hp	=	Horsepower
HSD	=	High Speed Diesel Fuel
HYV	=	High Yielding Variety (paddy)
ICB	=	International Competitive Bidding
ID	=	Irrigation Department
MAF	=	Ministry of Agriculture and Forests
MEIC	=	Burma (Myanma) Export-Import Corporation
MOC	=	Burma (Myanma) Oil Corporation
MPF	=	Ministry for Planning & Finance
O&M	=	Operation & Maintenance
PEM	=	Project Extension Manager
PIC	=	Project Implementation Committee
PSD	=	Planning and Statistics Department (of MAF)
PU	=	Project Unit
SAMB	=	State Agricultural Marketing Board
SD	=	Survey Department
SLRD	=	Settlement and Land Records Department
SMS	=	Subject Matter Specialist
TC-1	=	Trade Corporation No. 1
TEDM	=	Township Extension Deputy Manager
TEM	=	Township Extension Manager
TPC	=	Township Project Committee
UBB	=	Union of Burma Bank
VB	=	Village Bank
VEM	=	Village Extension Manager
VLC	=	Village Land Committee
VTEM	=	Village Tract Extension Manager
WPSD	=	Working People's Settlement Department

GLOSSARY

Kwin	=	A block of land varying somewhat in size (roughly 1 sq mi) surveyed cadastrally and mapped with a scale of 16 inches = 1 mi.
Mayin	=	Dry season crop (presently rainfed).
Myanma	=	Burma
Pyithu Hluttaw	=	Parliament of Burma.
Tatontum	=	A unit of land workable by a bullock-drawn plow (a plow drawn by a pair of oxen or water buffalo) as determined by the Village Land Committee concerned and which may vary from 10 to 15 ac.

BURMA

APPRAISAL OF THE

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

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This Report is based on the findings of an Appraisal Mission which visited Burma in October/November 1975, comprising Messrs. H.T. Chang, E. Hunting (Bank Group), R. Shukle and R. Auscher (Consultants), and a rural credit mission by Mr. K.C. Cheriyan (FAO/IBRD-CP) in February, 1976.

MAPS

11836 R	-	Location of Project
12016	-	Project Layout in Zinbaung and Letpanbin Islands in the Lower Delta
12017	-	Project Layout in Shwelaung Island in the Middle Delta

BURMA

APPRAISAL OF THE

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SUMMARY AND CONCLUSIONS

i. The agricultural crop sector accounts for 27% of Burma's GDP and 60% of its export, and supports a large share of its domestic manufacturing, transportation and commerce. During the last decade, as a result of the low priority placed on public resource allocation, low price incentives, limited input supplies and inadequate supporting services, agricultural production stagnated. Paddy production increased by 0.2% per year, while population grew by 2.2% per year. Abandoned paddyland now stands at about one million ac in Lower Burma. Rice export has dwindled from 1.3 million tons in 1965 to less than 200,000 tons in 1975.

ii. The Government has recently changed its policy by giving priority to increasing agricultural production--for expanding export (rice and jute) and substituting import (cotton). This project would be the fourth Bank agricultural project in Burma, but the first in a proposed series of improving the existing cultivated land and reclaiming abandoned paddyland in Lower Burma.

iii. The project would: construct minor flood embankments, drains and sluices for 11 islands to protect 120,000 ac of existing farm land from floods and salt water intrusion; reclaim 65,000 ac of abandoned paddyland; provide equipment for construction, maintenance, land reclamation, farming and lift irrigation; construct fertilizer godowns and farm machinery workshops; strengthen agricultural extension and other supporting services; conduct hydrological investigations to identify a series of future paddyland development projects; and prepare a feasibility report for grain storage and handling. The estimated cost of the project is US$54 million equivalent, of which US$25 million or about 46% would be foreign exchange. Except for small off-the-shelf items all contracts for equipment would be awarded after international competitive bidding in accordance with the Bank Group Procurement Guidelines. The civil works, being mainly earthwork, scattered over 11 islands, spanning over 1,200 mi, and subject to seasonal weather interruption, would be constructed by Government force account. Project implementation would take six years.

iv. The primary benefit from the project would be an increase in the production of rice and jute for export with some miscellaneous food crops for improving domestic supplies. About 12,800 existing farm families, and 5,500 landless families who are to be allotted plots of the reclaimed land would benefit directly from the project. Production would increase from the present 68,000 tons of paddy, 2,000 tons of jute and 4,300 tons of miscellaneous crops to 227,000 tons of paddy, 8,000 tons of jute and 27,000 tons of miscellaneous crops at a full development in 1988. Without the project, the corresponding production would be 76,000 tons, 2,500 tons and 4,400 tons, respectively.

v. The net foreign exchange earnings from the incremental rice and jute production would be around US$28 million per year. The economic rate of return of the project would be about 30%. The project is simple in design and construction, quick yielding and low in cost (about US$280 per ac land developed). It can be easily replicated elsewhere in Lower Burma.

vi. The project would substantially improve the conditions of low income farmers. Some 80% of the existing landless families in the polders would obtain their own land to operate on. The project would increase farm incomes two to three times. In addition, through the increase in farm labor requirements, the project would more than double employment opportunities, primarily for the remaining landless families, and consequently would directly improve the earning capacities of more than 75% of all project households. Increased use of farm machinery is planned by the project.

vii. The project is suitable for an IDA credit of US$30 million, which represents the foreign exchange component and about 17% of the local component of project costs. The credit would contribute 56% of the total cost. The Borrower would be the Socialist Republic of the Union of Burma.

BURMA

APPRAISAL OF THE

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

I. INTRODUCTION

1.01 The Government of the Socialist Republic of the Union of Burma (GOB) has requested IDA assistance in financing the first in a series of paddyland development projects. The project would protect 185,000 ac of arable land in the Irrawaddy Delta of the Lower Burma from flooding and salt water intrusion, reclaim abandoned paddyland, strengthen extension and other agricultural supporting services, expand dry season irrigation, construct fertilizer godowns and field machine workshops, provide construction and farm equipment and small low-lift pumps, and finance hydrological investigations and a paddy storage study for planning future projects.

1.02 Following the dialogue between GOB and the 1973 Appraisal Mission for the Irrigation I Project (Credit No. 483-Ba) and the recommendation of the IDA 1974 Economic Mission, this project was identified and prepared by a Government Project Preparation Committee with assistance from two IDA Bank Missions in February 1/ and July 2/, 1975, respectively. This report is based on the findings of an Appraisal Mission which visited Burma in October/November, 1975 comprising Messrs. H.T. Chang, E. Hunting (Bank Group), R. Shukle and R. Auscher (Consultants), and a rural credit study by Mr. K.C. Cheriyan (FAO/IBRD/CP) in February, 1976.

II. BACKGROUND

General

2.01 The Union of Burma, with an area of some 260,000 sq mi, borders India to the north, Bangladesh and the Bay of Bengal to the west, China and Laos to the east and Thailand and Andaman Sea to the south. It has four distinct climatic and topographical regions: the Western and Northern Hills, the Shan Plateau, the Central Region, and the Arakan and Tenasserim Coastal regions. The Central Region is the most densely settled and comprises a fertile lower wet zone, a central dry zone and a northern wet zone. About 27% of the country or 45 million ac, is considered arable, but only some 20 million ac are presently under cultivation. Another 5 million ac are fallow while the remaining 20 million ac are classified as cultivable wasteland, most of which is unsuitable for rice, the staple crop. Forests cover about half of the country and contain many species of valuable timber, particularly teak. Administratively, Burma is divided into seven States and seven Divisions. Each Division and State is subdivided into Townships.

1/ Messrs G.J. Tibor and Hpu.
2/ Messrs. W. Rodger, Hpu, E.D. Hunting, M. Saeed and A. Colliou.

The Economy

2.02 Burma is one of the 25 least-developed countries. Fortunately, it is endowed with very rich natural resources yet to be developed, and its population density is still low (115/mi^2 compared to 485/m^2 of India). Population, estimated around 30 M in 1975, of which 85% is rural, is growing at an annual rate of about 2.2%. National income growth in real terms during the last decade averaged only 2.3% i.e., barely keeping pace with the population growth. As a result, per capita income is static at about US$80 per year. Diminishing rice exports have resulted in a growing scarcity of foreign exchange, a marked contraction of imports, and a relative stagnation of industrial production. To increase revenue earnings, GOB recently has given new emphasis to agriculture, forestry and mining development, aimed primarily at meeting pressing short-term needs through quick yielding investment projects in the three sectors. The GOB has already initiated improvements in its agricultural pricing policies which now incorporate adequate producer incentives for achieving such investment objectives in agriculture.

The Agricultural Sector

2.03 The agricultural crop sector accounts for 27% of the national product,60% of total exports and 67% of the population's employment. Over the last decade, growth in agricultural output averaged a disappointing 1.7% annually. This low rate has been due mainly to: (a) insufficient investments (the whole agricultural sector received only 7% of total public expenditures during the 1971-75 period); (b) low price incentives to farmers until two years ago; (c) shortage of input supplies; and (d) limited public supporting services.

2.04 With paddy production stagnant at 7 to 8 M tons and a 2.2% annual population growth over the last decade, rice exports declined steadily from the pre-war level of three million tons annually to 1.3 M tons in 1965 and to less than 200,000 tons in 1975. In the last three years, rice exports have fluctuated around this level. Unless this trend can be reversed, Burma will cease to be a rice exporting country in the foreseeable future.

2.05 The total cropped area in 1974 was 22.8 M ac which on a net cultivated land area of 19.9 M ac gives a cropping intensity of 115%. Of the cropped area, rice accounts for 55%, oilseeds 19%, pulses 7%, other cereals 5%, fiber crops 2% and other crops 12%. Irrigated land covers only 12% of the net cultivated area, and only 14% of the irrigated area is double cropped, as the present irrigation is mainly from run-of-the-river diversion systems.

2.06 About 8.9 M ac of rice land is located in Lower Burma which with fertile soils and abundant rainfall, has been the main surplus rice producing area in Burma. On the other hand, Upper Burma with 2.8 M ac and hill regions with 0.9 M ac are rice deficit areas. Compared to the pre-war period, there has been an increase of about 300,000 ac of rice area in Upper Burma due to expansion into marginal land. At the same time, however, there has been a

loss of about one million acres of good rice land in Lower Burma due to flooding and salt water intrusion through totally or partially eroded protection embankments (Annex 1).

2.07 The lax in maintenance of the old embankments and abandonment of paddyland began during the World War II when rice export stopped. After independence and land nationalization, the traditional local maintenance force was weakened by the departure from the scene of the former big landlords, and the imported seasonal laborers. A special rice project of the Government managed to restore about 1.2 M ac (out of 1.7 M ac at the peak) of the abandoned land by 1963/64. However, inadequate budget appropriation and limited manpower made available have not been able to meet the rehabilitation and proper annual maintenance works needed. As a result, the area of abandoned paddyland in Lower Burma again increased to about one million acres by 1973/74.

Project Formulation

2.08 The quickest and most inexpensive way of increasing rice production in Burma is to protect farm land from flooding and salt water intrusion and reclaim the abandoned paddyland in Lower Burma by construction of low embankments around islands with drains and sluice gates. The proposed project is the first in a series of paddyland development projects submitted to IDA for financial support. The islands included under this project were selected by GOB and verified by the IDA Identification/ Preparation Missions on the basis of availability of adequate hydrological record for designing the project. The project would also include a delta-wide hydrological investigation to provide information for preparation of similar projects in the future, and a feasibility study for improving paddy storage and handling by both the Government agency and farmers.

III. THE PROJECT AREA

General

3.01 The project area consists of 11 islands located in the southern part of the Irrawaddy Delta; one, Shwelaung (Wakema Township), is located in the middle delta, about 85 mi from the sea, and the other ten--Zinbaung, Letpanbin, Kyet-Pha-Hmwe-Zaung, Myogon, Daw Nyein, Dedalu, Bantbwezu (all in Pyapon Township), Betut (Laputta Township), Alegyun (Ngapudaw Township) and Dauntgyi (Bogale Township), are located in the lower delta, situated less than 50 mi from the sea (Map 11836R). The project would develop a total of 185,000 ac, including 120,000 ac of cultivated land, 62,000 ac of abandoned land and 3,000 ac of cultivable wasteland (Annex 1).

Climate

3.02 The Irrawaddy Delta has a tropical and monsoon climate with three distinct seasons: a rainy season from mid-May to mid-October, a dry cool season from mid-October to mid-February, and a hot humid season from

mid-February to mid-May. Rainfall averages about 100 inches per annum, with a peak from June through August. Temperatures do not vary much during the year. Mean monthly temperatures range from 75°F in January to about 86°F in April, but minimum temperatures may occasionally drop to 60°F in December/ January (Annex 1).

Topography, Soils and Floods

3.03 Shwelaung, the middle delta island, is surrounded by fresh water rivers with a small tidal range but is subject to monsoon high flood levels. During periods of high flooding, river levels are higher than the ground elevation of the island. Deposits from recurrent floods have made the island slightly saucer shaped, higher at the edge and sloping towards the center.

3.04 The other ten islands in the lower delta are surrounded by creeks intermittently saline from semi diurnal tidal intrusion with tidal range of 10-15 ft. Because of this saline water, dry season irrigation and cropping in the coastal area has not been possible.

3.05 In these islands, flood and salt water intrusion through old and almost totally damaged embankments, have caused about 65,000 ac of cultivable land to be completely abandoned, giving way to tall grasses or mangrove trees. Paddy yields on 120,000 ac presently under cultivation have likewise been depressed.

3.06 The project area has three main soil types (Annex 1). The meadow gleyey clay soils are formed on higher land which is presently under cultivation. The meadow swampy soils with high organic matter content and acidity are formed on level low land deeply flooded, (up to 5 ft) during the wet season. Such soils are presently under medium to tall grasses, but can be highly productive when drained and reclaimed. Saline gleyey clay soils, presently under mangroves, are formed on low lying land regularly flooded by tidal salt water. Fortunately, the soluble salts are mainly chlorides and can easily be leached out by monsoon rain. No acid sulfate soils or alkaline soils have been reported.

Farm Size and Land Tenure

3.07 The total population in the project area is about 119,000, aggregated in about 25,000 families. All land belongs to the State, but farmers are given rights to cultivate, which can generally be passed on within the family. Of the 25,000 families in the project area, 51% have land, 27% are landless farm families which form the main source of the hired farm labor, and 22% are non-farm families (Annex 1, Table 4). An average family has about five members, with an equivalent of three adult workers of which two attend to farming. Overall, farm labor supply meets demand in the project areas at present.

3.08 The land nationalization program broke up the extremely large land holdings that existed before independence, but considerable variation exists in "areas farmed" among families. In the project area, the area varies from less than two acres to more than ten acres. In the middle delta island, the average is 6.5 ac, with 42% falling between five to ten acres. In the ten lower delta islands, the average is about 12 ac, with 61% owning ten acres or more. The average of the project is 10 ac (Annex 1, Table 5).

Agriculture

3.09 Rainfed rice is grown on the existing cultivated land throughout the project area during the wet season. Because of flooding (middle delta) and salt water intrusion (lower delta), yields are low, averaging 1,200 to 1,300 lb paddy per ac. Rice is the only crop grown in the lower delta islands. Small acreages of jute, groundnuts, and pulses are grown in the middle delta island during the dry season. Vegetables and fruits are grown around the villages. About one-third of the cultivable land in the project area comprised of low depressions, is abandoned/wasteland. Farm work is mainly done by animal and manual labor. In Shwelaung, farmers are using tractors for land preparation and low-lift pumps for irrigation -- mainly for jute cultivation.

3.10 Present agricultural production from the existing cultivated land in the project area is summarized below (Annex 2).

	Shwelaung (Middle Delta Island)		Ten Lower Delta Islands		Total Project	
	Area (1,000 ac)	Production (1,000 tons)	Area (1,000 ac)	Production (1,000 tons)	Area (1,000 ac)	Production (1,000 ton)
Paddy						
Local Varieties	27.3	15.1	95.3	52.7	122.6	67.8
Jute	8.0	2.1	-	-	8.0	2.1
Groundnuts	0.8	0.3	-	-	0.8	0.3
Pulse	0.1	-	-	-	0.1	-
Others	3.6	4.0	-	-	3.6	4.0
Total Cropped Area	39.8		95.3		135.1	
Net Cultivated Area	32.5		95.3		127.8	
Cropping Intensity	122%		100%		106%	

3.11 Agricultural supporting services including research, extension and provision of seed, fertilizers, pesticides, and other inputs are provided by the Agricultural Corporation (AC). These services are of limited scope and generally inadequate (para. 5.02). Fertilizers are presently allocated only to HYV rice, cotton, jute, tobacco and sugarcane in the country. Farmers

do not own sprayers. In serious pest outbreaks, AC Township Pest Control squads spray for farmers free of charge. The Agricultural Mechanization Department (AMD) has a tractor station in Wakema Township which provides, at subsidized rates, custom tractor service to farmers and maintenance service to tractors and pumps owned by farmer groups in the Shwelaung area (Map 11836R). It has, at present, no service facilities in the ten lower delta islands (para 5.02). Since 1973/74, rural credit to farmers has been provided mainly by advanced purchase schemes (APS): for paddy, by the Trade Corporation One (TC-1); for jute, by the Agricultural Corporation (AC); and other minor crops by Cooperatives. The repayment record is unsatisfactory. In late 1975, GOB decided to form the Burma Agricultural Bank (BAB) and to revive providing rural credit to farmers through Village Banks as was the case prior to 1973/ 1974 (para. 5.03). The new bank was formally established April 1, 1976. Detailed plans for coordinating the responsibilities of BAB-VB, TC-1, AC and the Cooperatives under the new rural credit system, as well as new terms and conditions of loans are now being formulated. Until GOB has been able to work out the details of its new rural credit program and staff pattern, it is not possible for IDA to assess its potential effectiveness. A number of proposals which have been discussed between GOB and IDA are detailed in Annex 10.

Transportation

3.12 The Irrawaddy Delta has an intricate system of rivers, creeks and tidal inlets which are used for navigation. Government godowns, depots and most rice mills are located at small towns along the banks of these waterways. Large public river crafts (Government owned and operated) provide regular service between Rangoon and all important towns, while small river crafts (mostly privately owned) operate local service between the towns and villages. Every family has a small boat. Due to lack of roads inside the islands, transport of farm produce is generally done by shoulder carrying or by oxcart during the dry season, to the nearest waterways for loading onto boats. Farm inputs are similarly handled.

IV. THE PROJECT

Project Description

4.01 The proposed project would protect the 11 selected islands (para 3.01) from flood and tidal instrusions by building or rebuilding embankments, excavating drains and constructing sluice gates, developing a total of 185,000 ac of farm land, including the reclamation of 65,000 ac of abandoned and cultivable wasteland, provide equipment for construction, maintenance, reclamation, farming and lift irrigation, and provide funds for strengthening extension and other agricultural supporting services. It would also carry out a delta-wide hydrological investigation for planning future projects, and a feasibility study for improving paddy storage and handling.

Project Works

4.02 Works to be carried out on the 11 islands are described in detail in Annexes 3 to 7 and summarized below:

(a) Construction of Flood Control and Drainage Facilities (Annex 3).

(i) about 410 mi of earth embankments 1/ involving about 11.4 M cu yd of earthwork;

(ii) about 770 mi of interior drainage channel 1/ enlargement and new excavation, totalling about 11.6 M cu yd of earthwork;

(iii) approximately 90 concrete gated pipe drainage culverts, (4 ft diameter) and 45 reinforced concrete gated drainage sluice structures 1/ varying in width from 15 ft to 150 ft;

(iv) approximately 200 interior drainage channel crossing;

(v) about ten masonry and reinforced concrete regulators in Shwelaung Island for drainage and conservation of water for dry season lift irrigation; and

(vi) buildings for offices, staff quarters and stores for construction and maintenance forces.

(b) Reclamation of 65,000 ac of Abandoned Paddyland 2/

(i) procurement of land clearing equipment including about 24 farm tractors, disk plows and harrows to be operated by AMD tractor station at Shwelaung for initial plowing and harrowing of the reclaimed land, about 400 chain saws to be rented by AMD to land allottees in ten lower delta islands for clearing mangroves and assorted tools for land clearing;

(ii) land clearing on each island;

(iii) cadastral survey and mapping of 65,000 ac of land to be reclaimed and about 11,000 ac to be occupied by embankments and drains, and staking those to be reclaimed into 10 ac plots for allotment; and

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1/ Sample layouts based on three surveyed islands are given in Maps 12016 and 12017.

2/ Locations in three sample polders are shown in Maps 12016 and 12017.

(iv) allotting reclaimed land to about 6,500 families of displaced farmers (about 1,000) and landless people (about 5,500) who would be entitled to receive the tractor and chain saw rental services on medium-term rural credit.

(c) Agricultural Extension Service. The project would establish intensified agricultural services throughout the entire five Townships within which the project areas are located (Annex 5 and Map 11836R). It would provide for:

(i) increasing the existing AC field staff in five townships to a total of 134 Village Extension Managers (VEMs), 22 Village Tract Extension Managers (VTEMs), five Township Extension Deputy Managers (TEDMs), five Township Extension Managers (TEMs), six Subject Matter Specialists (SMSs) and one Project Extension Manager (PEM), to serve about 900,000 ac of cultivated land; each VEM would supervise about 800 families. Recruitment of new officers is not expected to pose any problem.

(ii) carrying out an extension system involving inter alia selection of contact farmers; identification of impact points, scheduled visits of contact farmers by VEM, and scheduled training on impact points according to the cropping calendar (Annex 5);

(iii) procurement of equipment and boats for extension and research;

(iv) operation cost during the six year project implementation period, including funds for conducting field trials, demonstrations, field days, training, printing of extension material, and housing and travel allowances for extension officers; and

(v) fellowships for short-term training of extension officers in neighboring countries.

(d) Strengthening of Input Supply and Agricultural Mechanization Services (Annex 6). The project would provide for:

(i) procurement of low-lift pumps (5 hp), power tillers (7-8 hp) and farm tractors (50 hp), disc plows, disc harrows and rotary cultivators. Some of the pumps would be sold to farmer groups for cash. The remaining pumps and all of the tractors, power tillers and their implements would be sold to farmers' groups on long-term 1/ or medium-term 2/ rural credit (para 5.03 (a)).

1/ Five years or longer.

2/ One to four years.

(ii) construction of four additional fertilizer godowns and seven AMD field workshops and provision of workshop equipment and tools, for servicing the farming and land reclamation equipment (Map 11836R).

(e) Studies for Future Projects (Annex 7). The project would provide:

(i) About 60 man months of consultant services to assist GOB in hydrological investigation, establish hydrological gauging stations throughout the delta, and conduct a reconnaissance survey to identify future projects and draw-up a program for further investigations and studies required for staged development plan of the delta;

(ii) About 35 man months of consultants service to assist GOB in preparing feasibility study of a project for improving paddy storage and handling by the Government as well as by farmers;

(iii) Equipment and boats for hydrological recording and investigations.

Engineering

4.03 The feasibility stage designs of flood embankments, drains, sluice gates and other hydraulic structures in three sample areas of Shwelaung (middle delta) and Zinbaung and Letpanbin (lower delta) were prepared by the ID. These designs and related cost estimates reflect sound engineering. The ID has had extensive experience in the planning, design and construction of these kinds of work for many decades. Prior to implementation, ID would, however, conduct further surveys and prepare final and detailed designs for the work in each polder. Hydrological data available for these designs include 30 years of daily river level record at Shwelaung and long-term tidal records at Elephant Point. These are considered adequate for the design of works on the 11 islands included in the proposed project.

Water Supply, Quality and Demand

4.04 From mid-May to mid-October, rain supplies water to the entire project area. During the middle part of rainy season in August and September, high river levels make drainage from the islands difficult, although with the embankments and sluices, drainage would improve. The Shwelaung Island is surrounded by rivers with fresh water all year round. During the dry season, sluice gates would be operated at daily high tide hours for replenishment of water stored in drains which would be used for pump irrigation. In the lower delta polders, sluice gates would be closed at the end of the monsoon season to retain fresh water and to exclude salt-water intrusion during the dry season.

4.05 The project would expand pump irrigation in Shwelaung Island to 7,000 ac of dry season HYV and 15,000 ac of jute-Hnanga 1/ rotation. The maximum water demand, 17,900 ac-ft would occur in April. A total of 1,300 pumps of 0.7 cusec would supply the requisite 870 cusec total requirement (Annex 8). This amount would be an insignificant withdrawal from the 62,000 cusec dry season flow in the Irrawaddy River. No pump irrigation is planned for the lower delta polder because the conserved water in the drains cannot be replenished, but timely closing of sluice gates would retain fresh water in the drains and keep off the salt water intrusion. The prolonged residual soil moisture would allow the growing of dry season rainfed pulses over about 30% of the cultivated areas.

Implementation Schedule

4.06 The civil works construction is presented in Annex 3, Figure 1. The complete project implementation schedule is presented in Annex 9, Figure 1 and is summarized as follows:

Name of Polders	Year of Construction (FY)	Year of /a Full Acreage Development (FY)	Year of Full Production (Estimated) (FY)
Zinbaung, Letpanbin & Dedalu in Lower Delta	1978	1979	1984
Myogon, Daw Nyein & Bantbwezu in Lower Delta	1979	1980	1985
Shwelaung in Middle Delta	1978-1980	1981	1986
Betut in Lower Delta	1979-1982	1983	1988
Kyet-Pha-Hmwe-Zaung and Alegyun in Lower Delta	1980-1982	1983	1988
Dauntgyi in Lower Delta	1981-1982	1983	1988

/a Completion of land reclamation.

Agreement has been reached with GOB that the Project Director would prepare an annual comprehensive schedule for construction and agricultural implementation activities and the respective budget estimates required for the upcoming financial year, for dispatch to IDA by December 31 of each year.

1/ A local rice variety of high market value (sown in August and harvested in February) traditionally grown in rotation with jute.

Cost Estimates

4.07 Total project cost is estimated at US$54 million equivalent (K 352 million equivalent) of which US$25 million or 46% would be foreign exchange. The cost estimates for imported equipment, vehicles, and foreign consultants and training are based on international prices. Costs of civil works, including flood control and drainage facilities, land clearing, workshops and buildings, are based on recent costs in Burma for similar works. All costs are adjusted to mid-1976 price levels. The taxes and duties (estimated at about K 25 million) on items to be procured under the project would be waived by GOB and are excluded from the estimates. Physical contingencies amounting to 7.5% of total basic project costs, including 15% for civil works, 2% for equipment, and 5% for other basic cost items are added. Contingencies added for subsequent price escalations for equipment and consultants fall from 9% in the first year to 7% in the sixth year, and for civil works and land clearing from 13% in the first year to 10% in the sixth year (Annex 9, Table 3). Detailed project cost estimates are given in Annex 9, Table 1 and are summarized below.

Cost Summary

Item	Local	Foreign	Total	Local	Foreign	Total	% of Total
	---(Kyat Million)--			---(US$ Million)---			
1. Civil Works							
Embankments	18.9	3.9	22.8	2.9	.6	3.5	
Drainage Channels	17.5	3.9	21.4	2.7	.6	3.3	
Channel Structures & Crossings	37.7	8.5	46.2	5.8	1.3	7.1	
Buildings, Workshops, & Godowns	7.1	.7	7.8	1.1	.1	1.2	
Farm land Clearing	3.2	.0	3.2	.5	.0	.5	
Subtotal	84.4	17.0	101.4	13.0	2.6	15.6	29
2. Equipment							
Construction	3.9	76.7	80.6	.6	11.8	12.4	
Farm land Clearing	1.3	3.2	4.5	.2	.5	.7	
Farm Machinery	1.3	16.9	18.2	.2	2.6	2.8	
Agric. Supporting Services	.0	2.0	2.0	.0	.3	.3	
Civil Works O&M	.7	.6	1.3	.1	.1	.2	
Subtotal	7.2	99.4	106.6	1.1	15.3	16.4	31
3. Agricultural Extension and Godown Operation (Six Years)	4.5	.0	4.5	.7	.0	.7	1
4. Civil Works Operation & Maintenance During Construction	3.9	.0	3.9	.6	.0	.6	1
5. Technical Assistance							
Agricultural Extension Training	.0	0.7	0.7	.0	0.1	0.1	
Subtotal	.0	0.7	0.7	.0	0.1	0.1	
6. Engineering and Administration	18.2	.0	18.2	2.8	.0	2.8	5
Basic Project Cost	118.2	117.1	235.3	18.2	18.0	36.2	67
7. Physical Contingencies	13.0	4.6	17.6	2.0	0.7	2.7	5
8. Expected Price Increases	53.0	29.2	82.2	8.1	4.5	12.6	23
Total Project Cost	184.2	150.9	335.1	28.3	23.2	51.5	
9. Preparation for Future Projects							
Hydrological network equipment	3.9	5.2	9.1	0.6	0.8	1.4	
Engineering Consultants & Training	0.7	3.3	4.0	0.1	0.5	0.6	
Grain storage Consultants	0.1	1.8	1.9	0.0	0.3	0.3	
Subtotal	4.7	10.3	15.0	0.7	1.6	2.3	
Physical Contingencies	0.1	0.6	0.7	0.0	0.1	0.1	
Expected Price Increases	0.0	0.7	0.7	0.0	0.1	0.1	
Subtotal	4.8	11.6	16.4	0.7	1.8	2.5	5
Grand Total	189.0	162.5	351.5	29.0	25.0	54.0	100

Financing

4.08 The proposed IDA credit of US$30 million (covering 56% of the total project cost exclusive of customs duties and taxes) would finance the full foreign exchange costs and about 17% of the local costs. The GOB would finance the balance of the project cost, or US$24 million equivalent (K 156 million equivalent) through annual budget appropriations.

Procurement

4.09 All equipment, spares, and materials, totalling an estimated US$18 million including contingencies, would be procured through international competitive bidding (ICB) procedures in accordance with Bank Group Guidelines. A preference limited to 15% of the cif price or the prevailing custom duty, whichever is lower, would be extended to local manufacturers in the evaluation of bids. Small off-the-shelf items costing less than US$20,000 each, which are not suitable for international tendering, would be purchased through normal Government procurement procedures, on the basis of comparing prices from no less than three suppliers. Such purchases would be limited to a total of US$200,000.

4.10 The civil works would be scattered over 11 islands spanning a distance of 1,200 mi and would comprise mainly earthwork (embankments and drains). The drainage sluices and project buildings would be small, simple structures. All these works would be subject to seasonal weather interruption (with 80 inches of rain during rainy season) and would have to be phased so as to cause minimal interruption to cultivation. Under these circumstances they would not be suitable for international competitive bidding in accordance with the Bank Group Guidelines. The ID would carry them out by force account. For several decades, the ID has had extensive experience in designing and constructing similar facilities.

Disbursements

4.11 Disbursements from the proposed IDA credit would cover:

(a) 100% of the foreign expenditures for directly imported equipment, spare parts and construction materials;

(b) 100% of local expenditures (ex-factory cost) for locally manufactured equipment, spare parts and construction materials procured under ICB;

(c) 70% of total expenditures for other equipment, spare parts and construction materials procured locally without ICB (off-the-shelf);

(d) 100% of foreign expenditures for consultants' services and overseas training; and

(e) 50% of local expenditures for civil works excluding construction materials, equipment and spare parts.

Disbursements for civil works which will be carried out by force account would be made against statements of expenditure, the documentation for which would be retained by the ID for review by Supervision Missions. All other disbursements would be made against full documentation. Any saving under the project would be used at the discretion of the Association for other expenditures under the project. The estimated schedules of expenditures and disbursements are given in Annex 9 (Tables 2 and 5).

Accounts and Audits

4.12 All participating Government agencies maintain accounts according to procedures and forms laid down by the Ministry for Planning and Finance (MPF). The auditing of the accounts of Government agencies is the responsibility of the Central Audit and Inspection Office, acting on behalf of the Central Council of People's Inspectors. Agreement has been reached with GOB that:

(a) separate accounts for each project component would be maintained by the respective implementing agencies, and collated by the Project Implementation Committee (PIC) (para 5.04 and Annex 12);

(b) these accounts would be audited annually by an independent auditor and in accordance with procedures satisfactory to IDA; and

(c) PIC would send to IDA copies of the summary of an unaudited annual project account within four months of the end of the fiscal year, to be followed by copies of the audited account and auditor's report within nine months of the end of each fiscal year.

Environmental Effects

4.13 There is no schistosomiasis in Burma. Malaria has been virtually eradicated in Lower Burma. The project works are not expected to have any adverse effect on these two maladies. Reduced flooding, improved drainage, clearing of tall grasses and mangroves would improve environmental and public health conditions in the project area. An intensified extension program would include proper application of pesticides. The effect of enclosure of islands by embankments on the fishery life is not expected to be serious as the main fishing grounds are in the rivers surrounding the islands. The effect, however, would be evaluated by a short-term consultant attached to the hydrological investigation.

V. ORGANIZATION AND MANAGEMENT

Agency Responsibilities

5.01 The Ministry of Agriculture and Forests (MAF) would be responsible for the project. Overall organization of this ministry is presented in Annex 11, Figure 1. The ministry is currently implementing the Irrigation

I Project (Cr. 483-BA) which is proceeding satisfactorily. A total of 11 agencies, seven under MAF and four under other Ministries, would be involved in project implementation.

5.02 The seven agencies under the MAF and their responsibilities are:

(a) Irrigation Department (ID) would be responsible for the planning, design, construction, operation and maintenance (O & M) of all flood control and drainage facilities, and the procurement of construction and O & M equipment. It would also be responsible for conducting the delta-wide hydrological investigations for future projects with assistance from consultants (para. 4.02(e)(i)). ID would organize five units for executing the project civil works: two units for construction; and one each for planning, mechanical engineering, and operation and maintenance (O & M) (Annex 11, Fig. 3), each under an ID Executive Engineer, and all under direct supervision of the Project Director (Annex 11, para 11).

(b) Settlement and Land Records Department (SLRD), assisted by

(c) Survey Department (SD) would survey farms to be displaced by embankment and drains, survey and demarcate land to be reclaimed, and prepare related land records and maps (para 4.02 b).

(d) Central Land Committee (CLC), through Village Land Committees would allot land to displaced farmers and landless farmers in the Townships (para. 4.02 b).

(e) Working People's Settlement Department (WPSD) would organize force account land clearing to supplement family labor of land allottees, and settle some retired servicemens' families in Dauntgyi polder, where the population is sparse (para 4.02 b). Agreement has been obtained from GOB that in land allotment operations, farmers displaced by embankments and drain construction would have the first priority; local landless families and families with insufficient land, second priority; and families of the retired servicemen who have participated in the force account land clearing work of the project, third priority.

(f) Agricultural Corporation (AC) would provide research support, implement the intensified extension program, supply seeds, fertilizers and other input to project farmers, and construct four additional fertilizer godowns in the project area (para 4.02 c & d). Extension work under the project would be coordinated by a Project Extension Manager (PEM) who would report to the AC Irrawaddy Division Manager. Each township would have a Township Extension Manager (TEM) and a Township

Extension Deputy Manager (TEDM) who would supervise the work of two to six Village Tract Extension Managers (VTEMs) each in charge of six Village Extension Managers (VEM). Each VEM would be responsible for about 800 farm families. The PEM would be assisted by three Subject Matter Specialists (SMSs) for plant protection, farm machinery and extension training; they would be stationed in the Pyapon Township. At the township level, there would be three SMSs, two for paddy cultivation, stationed one each at Pyapon and Laputta and one for both paddy and jute cultivation in Shwelaung (Annex 11, Fig. 5 and also Annex 5).

(g) Agricultural Mechanization Department (AMD) would: (i) procure and sell to farmer groups or cooperatives, pumps, power tillers and tractors to be provided by the project; (ii) provide tractor service to farmers and rent power chain saws to land allottees for mangrove clearing; (iii) provide maintenance service for farm machinery and pumps, and (iv) construct, equip and staff seven field workshops in the project area (para 4.02 d).

(h) Present levels of supporting services throughout Burma would be inadequate for intensive agricultural development and GOB would initiate improved services and adequate inputs supplies in areas under such development beginning with this project. Agreement has been obtained from GOB (para 8.01) that:

(i) extension officers would be appointed as specified in para. 4.02 c (i) and these officers would work full time on activities directly related to agricultural extension work prescribed by the project;

(ii) Fertilizers would be supplied for all rice varieties and all crops in the project area at rates to be recommended each year by the extension service;

(iii) each AC Township Pest Control Squad (para 3.11) would stock sufficient pesticides in the project area, on the basis of estimates to be made annually by the extension service. The AC would prepare a plan to charge farmers an increasing portion of the cost of pesticides until the full cost would be recovered, and through PIC would submit the plan to IDA for review within two years after the credit effectiveness.

(iv) in providing tractor and maintenance services to farmers, AMD would charge rates that would cover the O & M, and depreciation costs of the machinery and workshops. The AMD, through PIC, would submit to

IDA within six month from the credit effective date a report on proposed charges and the basis of such charges; and

(v) GOB would supply sufficient quantities of fuel and oil for operating construction, maintenance, and farm equipment as required.

5.03 The four agencies not under the MAF and their responsibilities would be:

(a) Burma Agricultural Bank (BAB), under the Ministry for Planning and Finance (MPF) would provide long-term, medium-term and short-term credit to existing farmers and new land allottees through the village banks (Annex 10). Agreement has been obtained from GOB that procurement of farm machinery for sale to farmer groups on credit would not be made until IDA had agreed to GOB's proposals for a rural credit program in the project area, covering: (1) the terms and conditions for providing long-term, medium-term and short-term credit to farmers, particularly that for buying tractors and power tillers, to be provided by the project; (2) procedures of application, approval, supervision and collection of repayment of loans; and (3) roles to be played by BAB, TC-1, AC, AMD and cooperatives in the new rural credit scheme. Sales of these items should not be required until about 15 months after the project gets underway, by which time IDA should be able to assess the effectiveness of GOB's rural credit program (para 3.11). Agreement has also been obtained from GOB that (1) before the long- and medium-term rural credit program starts to operate in the project area, a special account would be established by BAB for the credit to be provided to project farmer groups for purchasing farm machinery and pumps, and (2) repayments made by farmer groups to the account would be used for activities directly related to agricultural development in the delta area.

(b) The Cooperative Department (CD) under the Ministry of Cooperatives would stock and sell land reclamation hand tools or animal drawn implements to land allottees.

(c) MPF would make annual budget appropriation to ID for operation and maintenance of the project flood control and drainage facilities.

(d) Trade Corporation Number One (TC-1) which handles paddy procurement and domestic supply under the Ministry of Trade (Annex 11), would conduct the feasibility study for the paddy storage and handling project in cooperation with AC.

Project Management

5.04 To coordinate the work of the 11 agencies, a Project Implementation Committee (PIC) would be formed in MAF. The committee would be chaired by the Deputy Minister of MAF and would comprise the heads or senior representatives of all 11 participating agencies as members (Annex 11, Fig. 2). The committee would be responsible for inter-ministerial and inter-agency coordination on policy and important administrative matters. Under the committee, a Project Unit (PU), comprised of senior technical officers of the seven participating MAF agencies as members, would be established. A senior ID officer would be appointed the Project Director of PU, and would serve concurrently as a member secretary of PIC. With adequate supporting staff, he would be responsible for coordinating technical planning and field execution of the various agencies components. Each PU member would be responsible for implementing the project work related to his agency.

5.05 In each of the project townships, a Township Project Committee (TPC) would be formed to coordinate the project works. The committee would comprise Township level officers of the participating agencies as members, an ID engineer as the Chairman and the AC Township Manager as member secretary. After the completion of project construction, the AC Township Manager would serve as the chairman and one other member of the committee as the secretary. The TPC chairman and secretary would be appointed by the PIC chairman. Establishment of PIC and PU would be a condition for credit effectiveness. The TPCs would be established only when construction and land reclamation are ready to begin in the respective townships.

Operation and Maintenance

5.06 For O & M of project flood control and drainage facilities, ID would establish six O & M units; one for Shwelaung and five for the ten lower delta polders, each under supervision of an ID Assistant Engineer or Sub-Assistance Engineer with adequate supporting staff and labor. All six units would be supervised by one Executive Engineer, who in turn, would report to the Project Director (Annex 11, Fig. 4 and Annex 12). The labor crew would be organized in groups of five workmen in the dry season and eight workmen in the wet season. Each group would be responsible for the continuous maintenance of five miles of embankment. The maintenance of the drains would be by earthwork equipment. Construction equipment would be maintained and repaired by ID workshops which have well equipped facilities and qualified mechanics.

5.07 Owners or users of the pumps, power tillers, farm tractors,etc. would cover their own O & M costs. With the seven new field workshops and workshop equipment and tools provided by the project, AMD engineers and technicians would be well equipped to service farm equipment at reasonable costs to the owners.

5.08 The quarters and workshop buildings for ID construction and maintenance units would be maintained by ID, the fertilizer godowns by AC, and the farm equipment workshops by AMD. The O & M costs during the six year implementation period have been included as a GOB contribution to the project cost. Agreement has been obtained from GOB that AC would thereafter continue to appropriate adequate funds from its budget for proper O & M of these godowns (para 8.01 (k)) and AMD would maintain its workshops with proceeds from its services to farmers (para 5.02 (i) (iv)).

Project Monitoring

5.09 Project implementation would involve 11 agencies. Close synchronization of field operations and coordination among agencies would accordingly be crucial to achieving project targets and keeping work progress on schedule. The monitoring system for the project would be built into the regular monthly progress reports by the Township Project Committees to the Project Unit, as well as those by township level officers to their respective headquarters in Rangoon. To avoid burdening the field staff unnecessarily, the monitoring would be concentrated on key indicators of project progress. The Project Unit would collate the township reports into a monthly project progress report to be reviewed by the Project Implementation Committee. PIC would consolidate the monthly reports into quarterly reports for submission to IDA. Work items to be monitored and the format of the quarterly reports would be agreed between GOB and IDA at the beginning of project implementation.

Consulting Services

5.10 Agreement has been reached with GOB that consultants to assist the Government in conducting the delta-wide hydrological investigation and the paddy storage and handling improvement feasibility study (para 4.02 e) would be appointed on terms and conditions satisfactory to GOB and IDA (para 8.01).

VI. FUTURE PRODUCTION, INPUT AND LABOR REQUIREMENTS

Production

6.01 The projected production at full development (FY 1988) is given in detail in Annex 2 and is summarized as follows:

	Shwelaung in Middle Delta		Ten Islands in Lower Delta		Total Project	
	Area (1,000 ac)	Production (1,000 tons)	Area (1,000 ac)	Production (1,000 tons)	Area (1,000 ac)	Production (1,000 tons)
Local Varieties Paddy	27.4	31.7	88.2	95.8	115.6	127.5
HYV Paddy	14.0	20.2	58.8	78.8	72.8	99.0
Subtotal	41.4	51.9	147.0	174.6	188.4	226.5
Jute	15.0	8.0	-	-	15.0	8.0
Groundnuts	5.0	2.7	-	-	5.0	2.7
Pulses	1.0	0.4	44.1	17.7	45.1	18.1
Others	3.6	6.4	-	-	3.6	6.4
Total Cropped Area	66.0		191.1		256.7	
Net Cultivated Area	38.0		147.0		185.0	
Cropping Intensity	174%		130%		134%	

6.02 Production increase from the project area would come from:

(i) expansion of net cultivated area from 127,900 ac to 185,000 ac, a gain of 57,200 ac, or about 45%;

(ii) expansion of total cropped area from 135,000 ac to 256,700 ac through increases in both the net cultivated area and double cropping, a gain of 121,700 ac, or about 90%;

(iii) expansion of HYV rice area from near zero at present to about 39% of the paddy area; and

(iv) crop yield increases through reduction in damages caused by flooding and salt water intrusion, increased irrigated area from 8,000 ac to 220,000 ac, and above all, through strengthening of the extension service and increased use of fertilizers and other inputs.

6.03 Detailed phasing of area expansion, yield and production changes for each polder is presented in Annex 2, Tables 9, 10 and 11. Estimated production levels achievable with and without the project are detailed in Annex 2, Table 14 and summarized below:

	Present (1,000 tons)	Future Without Project (1,000 tons)	Future With Project (1,000 tons)
Paddy	67.8	75.5	226.5
Jute	2.1	2.5	8.0
Groundnuts	0.3	0.4	2.7
Pulses	-	-	18.1
Others	4.0	4.0	6.4

Input Requirement

6.04 Fertilizer consumption in the project area is projected to increase from about 1,000 tons at present to 13,500 tons at full development in FY1988. Detailed phased requirements by crops are presented in Annex 2, Table 13. The projection assumes a slow increase before completion of project construction and land reclamation, but more rapid increase thereafter.

6.05 Quantity-wise no problem is anticipated in seed supply for all crops by AC. The extension program would include also advising farmers on how to keep their own seeds pure and viable, particularly peanuts, until such time that a national seed program becomes effective. Use of pesticides is expected to increase with the expansion of HYV rice and jute in the project area.

Market Prospects

6.06 Rice and jute, the major crops in the Irrawaddy Delta, are internationally traded. The Burmese rice has long established overseas markets, particularly in Asia. With increased production, prospects for recapturing a part of its lost market appear good, even as world market prices have declined from recent shortage-related highs. Production increases for the other crops would be small relative to present volumes and would have a ready domestic market. Analyses of future markets and prices are given in Annex 13.

6.07 Prior to World War II, Burma was the world's leading rice exporter. In addition, rice milling remains one of Burma's major industries. About 50 mills located in nearby towns now serve the area. Milling equipment has deteriorated due to lack of renewal and spare parts. Assisted by Asian Development Bank financing, 135 rice mills will be renovated in the country, and three new mills, 35 new warehouses and one silo complex (for grains other than rice) will be constructed. The constructions and renovations will be country-wide, and concentrated in Lower Burma, but none of these works, however, will take place in the 11 islands covered by this project, except possibly for one rice mill at the edge of Shwelaung. The capacity of milling facilities in the country is expected to be adequate for the increased production from the project area. Existing jute baling capacity located in major towns in producing areas (primarily the middle delta), amounts to about 118,000 tons per year. By 1985, a capacity of about 150,000 tons per year would be needed to handle the anticipated 6,000 ton increase from the project area and about 44,000 ton increase in other areas. With funds provided under

IDA Credit No. 394-BA, AC plans to construct four additional plants which will provide adequate capacity in the middle delta up through the early 1980s. The public and privately owned boats and the existing paddy storage facilities, however, are run-down and would prove insufficient for anticipated future volumes. Paddy handling on farms as well as at TC-1 buying depots is labor-intensive and conducive to losses. The project, therefore, includes funds for a paddy storage and handling project feasibility study to be carried out by GOB with assistance from a foreign consulting firm (para 4.02(e)).

6.08 Since World War II, GOB has controlled export of paddy, rice and rice products. Up to 1964, procurement and processing of paddy for export and internal distribution were left to private enterprise, with exports controlled by Government. In 1964, GOB took measures to procure, process, and distribute paddy for domestic consumption. It no longer permitted private millers to procure paddy. It licensed one category to custom mill for farmers and a second category to mill on contract for Government, both at charges fixed by Government. The GOB permitted farmers to trade rice, but not paddy, freely within their own townships but required that any other rice trading be done only through the State Agricultural Marketing Board (SAMB) and to TC-1, its successor in 1964. However, since November 1973, GOB has enforced a paddy procurement program throughout the country under a compulsory quota system. Procurement quotas, which must be sold to TC-1 at controlled prices, are scaled to farmers' sown acreages and assessed yields, and range from 7% of farm production for a two acre farm (yield of 30 baskets per ac) to about 65% for a ten acre farm (yield of 70 baskets per ac) (Annex 13 and 15, Table 3).

6.09 Jute is a relatively new crop in Burma, introduced in the mid-1950s by the former Agriculture and Rural Development Corporation. The Corporation undertook to purchase jute at guaranteed prices. The AC, its successor, is in charge of jute development and continues to procure all jute at controlled prices.

Prices

6.10 A substantial rice market exists outside of the procurement system in the form of legal trade within the township as well as reported illicit rice trade across township boundaries and out of the country. Over the years, the relative levels of GOB controlled prices and free market paddy prices have been an important factor influencing the volumes of TC-1 procurement and market trade. Until recently, with low official price levels, TC-1 procurement proved increasingly insufficient to meet domestic requirements among urban, landless, and deficit farm families. As a result, free market prices were forced up relative to TC-1 procurement prices, which further reduced the effectiveness of the procurement program and caused the volume of free market trade to grow (Annex 13, Table 3).

6.11 The GOB in recent years has increased its procurement prices, in 1973 by 40% and again in July, 1974 by 50%. These prices now cover the farmers' costs of production and leave them modest margins on the portions of production taken by the quota (Annex 13, Table 3). Under the new prices, TC-1 procured about 90% of its 1975 target, nearly double the procurement levels in

the previous two years. Margins from selling the remaining portions of their marketable surplus (net of home consumption) on the free market, at prices about 50% above procurement prices, provide incentive for farmers to increase production through adoption of high yielding varieties and increased use of inputs. To ensure that farmer incentive would not be eroded in the future, agreements has been obtained from GOB that periodically it would review and revise, if necessary, the paddy procurement price and would undertake to keep IDA informed in this respect (para. 8.01 (f)).

6.12 Prices used for the economic analysis reflect the opportunities for potential export earnings and import savings which could be realized at projected world market prices. For rice, jute, and fertilizers, which Burma trades on the world market, future price trends are based on the Bank's 1985 world market projections (Annex 13, Table 1). For other crops, future prices are based on present levels and trends of local prices. All are expressed in terms of constant currency, using July 1976 prices as the base (Annex 13, Table 2).

6.13 The official foreign exchange price (US$1 = K 6.5) does not reflect the prevailing supply of and demand for foreign exchange in Burma, since it is maintained by stringent exchange and trade restictions. On the black market, currency is presently traded at rates of K 18 to 20 per US dollar, which, however, partly reflects the higher risk levels associated with such illegal transactions. Because of the non-availability of some data and the poor quality of the available data, the shadow price of foreign exchange could not be calculated using normal World Bank methods. Instead, an alternative procedure was used by adjusting the value of imports to take into account the under recording of imports and by estimating the tariff equivalent of non-tariff restrictions on imports and exports. It was found that in the context of the prevailing tariff structure, including the complete ban on certain imports and the monopoly of certain exports, the lower rate of US$1 = K 13 more realistically reflects the opportunity cost of foreign exchange to the Burmese economy (Annex 13). This rate is used in converting world market prices for the economic analysis.

Labor Supply and Demand

6.14 Estimated on the basis of a 2% annual increase in labor availability, compared to a projected population increase of 2.2% through 1988 (full development), total available labor in the project area would increase from the present about 1.9 million man-days to about 2.6 million man-days per month, or by 37% (Annex 14, Table 1). Without the project, unemployment or underemployment is likely to mount, as the labor demand and supply ratio deteriorates. By increasing the net cultivated land area by about one-third, cropped area by 90%, and granting land to about 80% of the existing landless families, the project would forestall such a trend (Annex 14, Table 2).

6.15 The marginal economic farm wage level under without project conditions is estimated to fluctuate from K 0.5 per man-day in the slack season to a maximum of K 6.0 at the peak season; with the project, the range would be from K 0.7 to almost K 9.0. The implicit average economic wage used for economic analysis is estiamted to be K 4.6 per man-day (Annex 14, Table 3).

Farm Incomes (Annex 15)

6.16 Most farms in the project area are subsistence oriented, consuming most of their own grain, pulse and vegetable produce, and marketing for cash some jute, groundnuts, pulses and/or surplus paddy (partly to fulfill the TC-1 quota). Present average net farming income is about K 200 per ac in the lower delta and about K 300 per ac in the middle delta (Annex 15, Table 4).

6.17 Farming incomes vary primarily according to the cropping patterns dictated by farm land elevations relative to annual flood levels. The project would benefit high and medium elevation farms to a greater extent than low land farms which would continue to be constrained by heavier soils and accumulated rain water at planting or harvesting seasons, though to a much lesser extent than before. Some high elevation middle delta farms, where the present per acre return (from jute-Hnanga or paddy-groundnut rotations) is among the highest, also would benefit to a somewhat lesser extent. For a typical example of 10 ac 1/ farms in the middle and lower delta areas, annual net farm incomes, including the value of produce consumed on the farm, would increase as follows:

	Annual Net Farm Income /a (in constant currency, July 1976)		
	Present (Kyat)	Future (Kyat)	Increase (%)
Lower Delta (10 ac)			
High Elevation	2,700	6,200	230
Medium Elevation	1,900	6,800	360
Low Elevation	1,900	3,500	185
Middle Delta (10 ac)			
High Elevation	3,300	6,100	185
Medium High Elevation	3,300	7,500	230
Medium Low Elevation	2,800	7,200	260
Low Elevation	1,900	3,500	185

/a Cash payment for hired labor and inputs are deducted.

6.18 Thus, in real terms net farming incomes would increase roughly two to three times. Weighted average net incomes would increase to K 750 per ac in the middle delta and to K 650 per ac in the lower delta at full development.

1/ The official basis of land allotment is one tatontum per family, which is a unit of land workable by a plow drawn by a pair of bullocks, about 10 ac to 15 ac (Annex 1, para 16).

Recovery of Costs (Annex 15)

6.19 Under the project, the O & M costs of flood control and drainage facilities would require an annual expenditure of about K 3.1 million, or about K 17 per acre (Annex 12, Tables 2 and 3). At present, GOB appropriates within its budget about K 5 per ac for the O & M of flood protection works, an amount insufficient for satisfactory upkeep of project works. The capital costs of the project investments, excluding the costs of farm machinery to be recovered through the agricultural credit system, amount to about K 1,200 per ac. Recovery of this investment over a 30-year period would be represented by annual costs amounting to K 7.4 million (K 40 per ac) with no cost of capital or to K 23.5 million (K 125 per ac) with cost of capital at 10% per year.

6.20 Under the existing compulsory paddy procurement system, GOB would automatically capture from project farmers a large portion of the incremental benefits derived from the project. The compulsory sale to TC-1 of a portion of their paddy production at low prices relative to the free and export markets, is an implicit taxation on the paddy farmers in the area. From revenues generated from exportation of the incremental production, due to the project, the Government could allocate funds for full O&M as well as capital cost recovery. The compulsory quotas under the procurement system are assessed on the basis of sown acreage and yields obtained (Annex 15). This system would result automatically in the procurement by Government of the major portion (in most cases 80%) of the incremental production due to the project and nearly all possible profit from this portion of future production.

6.21 In its present form, the compulsory procurement system more than meets the cost recovery objectives of the Bank Group water charges policy. The method of taxation is progressive and the tax on incremental income varies in proportion to the farmer's benefit from the project and his ability to pay (Annex 15, para 5). From farmers owning 10 ac under average project conditions, the system would capture 30% to 70% of the "project rent" (Annex 15, Table 5). This represents implicit taxation with a marginal rate of about 45% and average tax rate of about 20%. The GOB rice export of the incremental paddy production under the project would provide additional revenue which after full development would amount to US$23.7 million per year (K 154 million per year at the official exchange rate US$1 = K 6.5 or K 308 million per year at the rate US$1 = K 13.0). After deducting procurement and handling costs, this would leave an amount more than adequate to cover the full costs of O & M and capital recovery (para 6.19 and Annex 15, Table 6).

6.22 With this level of cost recovery and implicit taxation, the residual income of the typical farmer with 10 ac would still increase substantially under the project thereby providing incentives for technical efficiency and on-farm improvements (Annex 15, Table 4). However, any further increase in taxation of the farmers implicit or explicit, would adversely affect incentives to the project farmers. Agreement (para. 8.01 (g)) has been obtained from GOB that:

(a) The Government would ensure that farmers in the project area are left with adequate financial incentives to make necessary investments to increase production, taking into account paddy procurement quotas and prices.

(b) To make project farmers aware that they are paying for the project cost recovery and to prepare for the eventuality that the paddy procurement quota system may someday be abolished, the quota assessed for each farmer would indicate as percentages of the total quota:

(i) payment for O&M;

(ii) annual payment for capital cost recovery; and

(iii) regular sale to TC-1.

(c) The Government would appropriate adequate funds from its annual budget for the Irrigation Department to satisfactorily cover the proper O&M of the project (presently estimated at K 17/ac).

(d) Amounts designated as O&M and capital cost recovery would be reviewed at least annually with IDA; and

(e) If the compulsory procurement were modified or abolished, an alternative system of cost recovery would be formulated and agreed with IDA.

VII. BENEFITS AND JUSTIFICATION

Anticipated Overall Effect

7.01 The project would increase production of existing farms about three times, expand the number of farms by about 30%, and more than double employment opportunities. About 80% of the landless families in the area would obtain their own land.

Value of Crop Production Increase

7.02 Incremental rice and jute production due to the project would represent the following gross annual foreign exchange earnings (in constant US$, July 1976):

	Net Incremental Production (1,000 lg tons)	Rangoon Port Price (US$/lg ton)	Foreign Exchange Earnings (US$ million)
Milled Rice	98.1	260	25.5
Baled Jute	5.5	425	2.3
Total			27.8

Net annual foreign exchange earnings, after deducting the recurrent import costs of fertilizers, pesticides, and equipment spares, would amount to about US$26 million. Taking also into account the local value of production of pulses, groundnuts and other crops, less the costs of production inputs, the total value added to the Burmese economy would amount to about K 295 million per year (Annex 16).

Employment Opportunities

7.03 Under the project, farm labor requirements would more than double. This would mean an increase from 30% at present to about 60% of expected labor availability in the area (Annex 14). Without the project, the level of farm employment would remain about the same but, because of the population growth, the overall employment would fall gradually to less than 25% of expected availability. Consequently, the project would more than double farm employment opportunities, of which landless families would be the prime beneficiaries. Furthermore, the production increases under the project would stimulate additional off-farm wage-earning opportunities in the local processing industries and market centers.

Household Income Effects

7.04 At present, many project farm incomes are close to the low national average. After full development, their income levels would substantially exceed the average assuming parallel growth in the agriculture sector at about 5% per year over the project development period. The proportion of farms producing below subsistence levels (roughly 50% of national average per capita income) would decline from 25% at present to less than 10%. The number of farm workers per net cultivated land area, due to population growth would remain about the same at full development despite the settlement of new farm land. Taking into account the increase in farm wage opportunities, the project would directly improve the earning capacities of more than 75% of all households.

Economic Rate of Return

7.05 The project's economic rate of return is about 30% (Annex 16) based on a 30-year period of analysis and the following major assumptions:

(a) an overall construction period of six years;

(b) full agricultural develoment for each farm reached within five years after land clearing, completion of embankment construction and provision of drainage and for the project as a whole within 11 years after completion of all construction;

(c) exclusion of the cost of equipment and facilities for preparation of further projects;

(d) all farm labor valued at a seasonally adjusted opportunity cost of K 4.6 per man/woman day (roughly two-thirds the average wage for hired labor), (Annex 14);

(e) foreign exchange valued at an economic opportunity rate of US$1 = K 13.0 (Annex 13); and

(f) construction costs, including allowance for physical contingencies, and net crop values expressed in terms of constant currency excluding price increases due to inflation.

7.06 Separate rate of return estimates for the lower and middle delta areas under the base assumptions given above indicate the viability of individual polders. The sensitivity of the estimates to construction and cultivation risks and to changes in prices and other assumptions is as follows:

	Lower Delta	Middle Delta	Project Whole
Base Analysis	33%	24%	30%
Variations			
Construction Costs 25% over estimates:	29%	21%	26%
Yields or prices 15% less than projected:	29%	21%	26%
Net Benefits 25% below estimates:	28%	20%	25%
Construction delayed and benefits slipped 2 years:	26%	20%	23%
Foreign exchange valued at US$1 = K 10.0:	31%	22%	28%
Farm labor valued at K 6 per man-day:	32%	23%	29%

7.07 Consequently, in the unlikely combination of events including construction cost overrun of 25%, slippage of two years, and achievement of only 75% of projected net benefits, the project would still be viable.

Project Replicability

7.08 The total project cost (US$52.4 million) including physical and price contingencies, but excluding cost of conducting studies for future projects, averages only about US$ 280 per ac of land developed. Such low cost development is eminently replicable over a large part of an estimated total of three million acres in the Lower Burma, including about one million acres of abandoned paddyland.

VIII. AGREEMENTS REACHED AND RECOMMENDATIONS

8.01 Agreements on the following major points have been reached with GOB:

(a) GOB would appoint extension officers as specified in para 4.02 c(i) to the project townships and ensure that they would work full time on activities directly related to agricultural extension work prescribed by the project (para 5.02 h(i));

(b) fertilizers would be supplied for cultivation of all rice varieties and all crops in the project area at rates to be recommended each year by the extension service (para. 5.02 h(ii));

(c) each AC Township Pest Control Squad would stock sufficient pesticides in the project area, based on estimates to be made annually by the extension service. The AC, through PIC, would prepare a plan to charge farmers an increasing portion of the cost of pesticides until the full cost would be recovered, and submit the plan to IDA within two years after the credit effectiveness (para 5.02 h(iii));

(d) in providing tractor and maintenance services to farmers, AMD would charge rates that would cover the operation, maintenance, and depreciation costs of the machinery and workshops. The AMD, through PIC, would submit to IDA within six months from credit effectiveness a report on proposed charges and the basis of the proposed charges (para 5.02 h(iv));

(e) procurement of farm machinery and pumps for sale to farmer groups on credit would not be made until IDA had agreed to GOB's proposals covering (para 5.03(a)):

  (1) the terms and conditions for providing long-term, medium-term and short-term credit to farmers, particularly that for purchase of tractors and power tillers provided under the project;

  (2) procedures of application, approval, supervision and collection of repayment of loans; and

  (3) roles to be played by TC-1, AC, AMD and cooperatives in the new rural credit scheme (para 5.03 (a)).

(f) periodically GOB would review and revise, if necessary, the paddy procurement price to maintain adequate incentives to the farmers and would undertake to keep IDA informed in this respect (para 6.11);

(g) regarding the project cost recovery (para 6.22):

(i) GOB would ensure that farmers in the project area are left with adequate financial incentive to make necessary investments to increase production, taking into account paddy procurement quotas and prices.

(ii) to make project farmers aware that they are paying for the project cost recovery, the assessed quota for each farmer would indicate as percentages of the total quota:

(a) payment for O & M;
(b) annual payment for capital cost recovery;
(c) regular sale to TC-1.

(iii) the Government would appropriate adequate funds from its annual budget for the Irrigation Department to satisfactorily cover the proper O & M of the project, presently estimated at K 17 per ac;

(iv) Amounts designated as O & M and capital cost recovery would be reviewed at least annually with IDA, and

(v) if the compulsory paddy procurement system were modified or abolished an alternative system of cost recovery would be formulated and agreed with IDA.

8.02 A condition for credit effectiveness would be the establishment of the Project Implementation Committee and Project Unit (para 5.05).

8.03 With the above agreements, the proposed project is suitable for an IDA credit of US$30 million equivalent on standard IDA terms. The Borrower would be the Socialist Republic of the Union of Burma.

May 25, 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Area Resources

Location

1. The Union of Burma, 1,200 mi long and 575 mi wide, has an area of some 260,000 sq mi. It borders India to the north, Bangladesh and the Bay of Bengal to the west, China and Laos to the east and Thailand and the Bay of Bengal to the south. It has four distinct climatic and topographical regions: the western and northern hills, the Shan Plateau, the central region, and Arakan and Tenesserim coastal regions. The central region which is partly intersected by a mountain range from north to south is the most densely settled and comprises a fertile lower wet zone, a central dry zone and a north wet zone. The Irrawaddy River, navigable for 900 mi, runs in a well-defined north-south course, in the valley of the central region, down to the town of Myanaung at the apex of the great Irrawaddy Delta 150 mi from the sea. South of a line drawn from Rangoon in the east to Bassein in the west, about 80 mi from the sea, the delta forms a typical alluvian fan with rivers reaching the sea through several courses. The project area lies within this southernmost tip of the Irrawaddy Delta (Map 11836R).

2. The rivers are subject to tidal action at least 80 mi inland and to salt water intrusion in the dry season up to about 50 mi from the sea. The project would develop one polder in the middle delta (affected by both flood and tide) and ten in the lower delta (affected by tide only).

Physiography

3. The Irrawaddy Delta including the project area is criss-crossed by an interconnecting network of navigable small rivers and streams which divide the land into innumerable larger or smaller islands. Among other works, the project would construct flood embankments around selected islands for reclamation and development.

4. The islands in the middle delta region are surrounded by fresh water creeks and rivers which have a small tidal range. They are much affected by the monsoon floods; both depth of water and incoming flood flow velocities damage the immature paddy crop. During periods of high flooding, water levels in the surrounding rivers are higher than water levels inside some embanked islands. Deposits from the recurrent floods have formed low natural river levees on surrounding edges of the islands, thus making them slightly saucer-shaped, higher at the edge and sloping towards the center.

5. In the lower delta coastal region, the islands are almost level and surrounded by creeks and rivers which are little affected by monsoon flood stages, but are made, intermittently saline from coastal water intrusion. The semi-diurnal tides have a range of 10 to 15 ft. Islands not protected by embankments are regularly flooded. At the end of the monsoon, with the decrease in river discharge, salt water moves further north into river surrounding islands in the coastal areas. Higher residual salt content in the soil and high spring tidal inundation preclude dry season cropping at present.

6. Although the topography is generally flat, there are localized depressions in most islands. Because of the flood (middle delta) and salt water intrusion (lower delta) through the old and mostly damaged embankments, about 0.41 million ac of such low land in the Irrawaddy Division may be waterlogged seven to nine months, and have been abandoned, giving way to tall grasses or mangrove trees. Lower Burma as a whole has nearly one million acres of abandoned paddy land (Table 1).

Climate

7. The lower Irrawaddy Delta has a humid, tropical climate dominated by the southwest monsoon. There are three distinct seasons: a rainy season from mid-May to mid-October, a dry, cool season from mid-October to mid-February, and hot, dry season from mid-February to mid-May (Table 2). The three months of June through August have from 60% to 65% of the annual rainfall and 23 to 26 rainy days each month. Mean monthly temperatures range from, about 75°F in January to about 86°F in April, but minimum temperature may drop to 60°F in December and January. The rainfall pattern determines the prevailing rice planting season in June/July and harvesting in November/December. Rice sowing in June coincides with frequent rainy days (Table 2) in June through September. Rain water sufficiently leaches salts left behind by tidal salt water intrusion to permit monsoon rice cultivation on drainable higher lands. Yield, however, is depressed by the building up of a salinity beginning in the latter part of October, and severely in years with sub-normal October rainfall.

Soils

8. The dominant soil covering most of the existing cultivated land in both the middle and lower delta project areas is the meadow gleyey clay soil, developed on level land which is: homogenous, clayey; structure less down to 60 inches depth; poorly drained and waterlogged during the rainy seasons; and hard surfaced and cracked during the dry season. Soluble salts, mainly chlorides, and some sulfates, are sufficiently diluted during the wet season, and do not prevent the growth of paddy in the lower delta.

9. Meadow swampy soils have developed on level lowlying land, flooded 5 to 10 ft deep during the wet season. Groundwater is near the surface even during the dry season. These lands are uncultivated, except small areas of

Mayin rice (dry season rice) sown along the edge with receeding floods. Typically these soils have thick decaying organic matter on the surface, 2% to 5% humus content, a lighter structure than the meadow gleyey clay soils, and a strong acidity (pH 4.4-4.7). Under the project, these lands will be drained and reclaimed. With decomposition of organic matter, improved soil oxidation, and lowered acidity these better structured soils can be highly productive.

10. Land of the lower delta close to the sea and salt water carrying rivers develops the saline gleyey soils of mangrove forests. It is level, poorly drained and has a heavy texture. Groundwater is near the surface most of the year. They are reached daily by high tide, and are always saline during the dry season. The upper soil is clayey while the lower soil is loamy clay. They have a leaf liter up to two inches thick and the present pH ranges from 5.6 to 6.3. Under the project, such land would be protected from salt water intrusion, and drained. Standing mangroves would be cleared. The soil would be boggy for about two years, but the land can be planted to paddy by broadcasting. The extent of the abandoned and wasteland reclaimed in different project polders is given in Table 3.

Rural Structure

11. Villages and towns are all built along the edge of the islands; boats are the means of transportation for travelling or for hauling. There are no roads inside the islands, except footpaths between paddies; and along embankments. Farmers build field huts near their farms for monsoon occupation until harvesting and threshing are completed. Hauling between homestead and field huts requires oxen carts, shoulder carrying and small boat transport along the small creeks and rivers. Fishing the internal creeks but mainly in the surrounding rivers is also an important part of the rural life for men, women, and children. Fish, together with rice, forms the standard rural diet.

12. Townships connected by creeks and rivers are the center of the following: economic activities for consumer goods; selling produce; taking delivery of inputs; fuel; obtaining rural credit; and delivering paddy or jute to Government buying centers, etc. Schools and clinics are available in village tract small towns.

Present Land Use and Development Potential

13. The gross area of the 11 project islands is about 247,000 ac of which 205,000 ac is agricultural land including 128,000 ac cultivated, 65,500 ac abandoned and 11,500 cultivable wasteland. Of this, about 185,000 ac, including 120,000 ac of existing cultivated land, 62,000 ac of abandoned land, and 3,000 ac of cultivable wasteland, would be improved and developed as follows:

PROPOSED PROJECT AREA
(1,000 ac net cultivable)

	Middle Delta	Lower Delta	Project Total
Cultivated	32	95	127
Abandoned	5	61	66
Culturable Waste	11	1	12
Total	48	157	205
Of which to be developed	38	147	185

Details are given in Table 3.

Population and Farm Labor Supply

14. The rural population of the project area is about 119,000 persons. Land holding families comprise about half the total and landless families about a quarter of the total. However, in five areas in the lower delta (Letpanbin, Myogon, Daw Nyein, Dedalu, and Bantbwezu) records show that the number of landless exceed the number of farm families. Average family size and numbers of working family members in the project areas are given in Table 4 and summarized below:

	Lower Delta Areas	Middle Delta Areas	All Project Areas
Population	84,064	34,931	118,995
No. of Families			
Farm	7,865 (46%)	4,974 (63%)	12,839 (51%)
Landless /a	4,997 (29%)	1,725 (22%)	6,722 (27%)
Non-farm	4,272 (25%)	1,222 (15%)	5,494 (22%)
Total	17,134 (100%)	7,921 (100%)	25,055 (100%)
No. of Working Adults /b	52,384	25,582	77,966
Average Family Size	4.9	4.4	4.8
Average Adult Workers per family /b	3.0	3.2	3.1

/a Landless families on record are those local residents without land who have registered with Ward/Village Land Committees that they are seeking farm land to cultivate. Other landless are registered as non-farm families.

/b Number of working adults excludes children under ten and adults over age 60. Children ages 10 to 15 are counted as 2/3s of an adult.

Farm Size and Land Tenure

15. Before independence in 1948, tenants of large land holdings farmed the majority of cultivated land using hired labor. After independence, GOB enacted land reform laws which provided for land nationalization, elimination of tenancy, distribution of land to tenants and hired workers, and changes in land taxation. It established Village Land Committee (VLC) to assign cultivation rights and organize the collection of land revenue. Appeals against VLC decisions are made upwards to townships, Land Committees and to the Central Land Committee. Individual land ownership is not permitted except for plantation land growing tree crops. Land rents and absentee ownership are illegal, nor can land be mortaged or taken in lieu of loan repayment.

16. Land allotment is made on the basis of one tatontum per family. (Initially, priority was given to farmers then occupying the expropriated lands). The tatontum is a unit of land workable by a bullock-drawn plow which varies from place to place according to the type of soil, the crops grown and population pressure. It is currently about 12.5 ac in the coastal region and 10 ac in the middle delta (Table 5). Each VLC establishes the size of a tatontum. Land use rights cannot be inherited but VLCs customarily assign rights of deceased cultivators to sons or other members of their families. If land is left idle or abandoned, village committees can assign land use rights to farmers willing to cultivate it.

17. As a result of land reform measures and absence of extremely large land holdings, the size of distribution of holdings in the delta areas which was severely skewed before independence has been somewhat evened. Data supplied by GOB show the following farm size distribution in the project areas:

	Size of Holding (ac)	No. of Farmers (%)	Farmed Area (%)	Average Farm Size (ac)
Middle Delta				
	Less than 2	14.6	3.6	1.7
	2 - 5	32.0	18.8	3.6
	5 - 10	37.1	41.7	7.0
	above 10	16.3	35.9	14.1
		100	100	6.5
Lower Delta				
	Less than 2	5.3	0.4	1.0
	2 - 5	11.9	3.0	3.3
	5 - 10	21.7	12.1	7.4
	above 10	61.1	84.5	18.4
		100	100	12.1

18. Landholders may be categorized roughly into three groups: (1) farmers below the subsistence level who must supplement farming income; (2) farmers whose land provides family requirements plus a small surplus, and (3) farmers with larger holdings who generally employ some hired labor, in many cases some full time employees. The lower delta farmers can only grow one crop. The middle group is comprised of farmers holding about 10 to 12 ac; in the middle delta where soil moisture and lack of salt water intrusion hazard permits more intensive cultivation, this group is comprised of farmers holding 6 to 8 ac. On the basis of the GOB figures on population and distribution of holdings given above, about 40% of the rural population in the project area are farm workers earning all or the bulk of their income as wages paid by others, primarily by large landholders comprising less than 15% of the population.

Cadastral Records and Maps

19. Burma is outstanding among the South Asian countries in its effort for keeping up-to-date the cadastral records and maps done initially by the Burma Survey during the pre-independence years. The mapping unit is a kwin, an area of some 400 to 500 ac. Kwin maps give the boundary of every existing land holding and even parcels within the holding. Each kwin is under the charge of a Village Revenue Officer, who is the front-line officer of the Settlement and Land Records Department of MAF. The kwin maps and corresponding records are being used for assessing paddy yields and determining the compulsory paddy procurement quota of each and every paddy cultivator, as well as for collecting land revenue. Under the project, new kwin maps and records would be prepared for the reclaimed land.

May 1976

ANNEX 1
Table 1

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Area Under Paddy in Burma

(1,000 acres)

Regions	1936-40 Average	After World War II	1963-64	1973-74	Change 1936-40 to 1973-74
A. LOWER BURMA					
1. Pegu and Rangoon Divisions	3,850	N.A.	3,655	3,550	-300
2. Irrawaddy Division	3,630	N.A.	3,410	3,220	-410
3. Tenesserim Coastal region 1/	1,430	N.A.	1,405	1,320	-110
4. Araka Coastal region	990	N.A.	880	820	-170
Total L.Burma	9,900	8,200 2/	9,350	8,920	-990
B. UPPER BURMA 3/	2,490	N.A.	2,190	2,780	+290
Total Lower and Upper Burma	12,390			11,700	-700
C. HILL REGION BURMA 4/	N.A.	N.A.	930	870	N.A.
TOTAL	N.A.	N.A.	12,470	12,570	N.A.

1/ Including Tenesserim Division and Karen and Mon states.

2/ Report of the Union of Burma Land and Agriculture Planning Commission

3/ Including Sagaing, Mandalay and Magwe Divisions and Kachin state.

4/ Including Shan, Kaya and Chin states.

Source: (a) Agricultural statistics of the Government of the Union of Burma 1972
(b) Settlement and Land Records Dept., Burma.

N.A. = not available

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Climatic Data

Monthly Temperature °F.		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total/Average Average
Maubin 1/	Max.	86.6	84.9	96.8	98.3	93.9	87.7	85.7	85.2	86.2	86.5	88.2	85.9	
	Min.	62.5	62.1	67.2	74.8	76.2	76.4	75.8	75.4	76.0	74.4	72.0	58.5	
	Mean	74.6	76.0	82.0	86.6	85.1	82.1	80.8	80.3	81.3	82.3	80.1	75.7	80.6
Bassein 2/	Max.	86.4	90.3	94.5	96.1	92.0	86.6	85.3	85.2	86.2	87.7	86.7	84.7	
	Min.	63.5	65.9	70.9	75.7	77.0	76.1	75.8	75.9	76.0	75.3	72.1	65.3	
	Mean	74.7	77.7	82.8	85.9	84.6	81.5	80.6	80.5	81.1	81.6	79.3	75.0	80.5
Rainfall - In.														
Bassein 2/		0.10	0.20	0.20	1.10	9.60	23.00	25.10	23.70	14.80	7.60	3.10	0.50	109.00
Pyapon 1/		.08	0.17	0.32	1.41	11.11	19.89	21.75	20.60	13.60	7.66	3.19	0.90	100.63
Myaumgnya 1/		.22	0.11	0.15	.132	8.52	20.44	21.43	21.34	14.81	7.68	1.36	0.60	97.72
Mean No. Days with Rain														
Bassein 2/		0.1	0.3	0.3	1.5	11.3	23.4	25.9	24.7	19.7	11.6	4.3	0.6	123.7
Average Humidity														
Maubin 1/		68	62	59	58	75	87	88	89	88	83	77	73	76.0

1/ Ministry of Agriculture and Forests.

2/ The Physical Environment and Agriculture of Burma, American Institute of Crop Ecology, Washington, D.C., 1963.(Data given for Bassein are averages of 60 years of record.)

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Areas

POLDER	TOWNSHIP	GROSS AREA ('000 ac)	CULTURABLE LAND AREA[1] ('000 ac)				CULTURABLE LAND TO BE DEVELOPED ('000 ac)			
			Total	Cultivated	abandoned	Waste	Total	Cultivated	Abandoned	Waste[2]
MIDDLE DELTA										
Shwelaung	Wakema	59.0	48.1	32.5	4.7	10.9	38.0	30.6	4.4	3.0
LOWER DELTA										
Zinbaung	Pyapon	8.0	7.6	4.5	3.1		7.1	4.2	2.9	
Letpanbin	"	14.4	9.0	4.5	4.5		8.4	4.2	4.2	
Kyet-Pha-Hmwe-Zaung	"	30.0	25.0	16.9	8.1		23.5	15.9	7.6	
Myogon	"	9.3	7.0	1.9	5.1		6.6	1.8	4.8	
Daw Nyein	"	3.2	3.0	1.3	1.7		2.8	1.2	1.6	
Dedalu	"	8.4	5.3	1.5	3.8		5.0	1.4	3.6	
Bantbwezu	"	16.0	14.8	8.0	6.8		13.9	7.5	6.4	
Betut	Laputta	54.1	43.3	34.0	8.8	0.5	40.7	32.0	8.3	0.4
Alegyun	Ngapudaw	19.5	16.2	13.1	3.1		15.2	12.3	2.9	
Dauntgyi	Bogale	25.5	25.3	9.6	15.7		23.8	9.0	14.8	
Subtotal		188.4	156.5	95.3	60.7	0.5	147.0	89.5	57.1	0.4
TOTAL		247.4	204.6	127.8	65.4	11.4	185.0	120.1	61.5	3.4

1/ Placement of embankments and structures would consume about 6% of the culturable area.

2/ The remaining culturable waste is too deeply flooded for development under this project.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Population, Family Sizes, and Farm Labor Supplies

Polder	Total Population	Average Size of family	Average No. of Adult Workers per family 1/	Number of Families (Working Adults) 1/ Total	Farm Families	Landless Families 2/	Non farm families
Lower Delta							
Zinbaung	4023	4.3	2.3	942 (2156)	420 (922)	307 (689)	215 (545)
Letpanbin	2847	3.5	2.3	822 (1866)	257 (572)	362 (829)	203 (465)
Kyet-Pha-Hmwe-Zaung	17149	5.3	2.8	3257 (8970)	1250 (3427)	959 (2584)	1048 (2959)
Myogon	2391	4.9	2.6	483 (1269)	142 (370)	221 (579)	122 (320)
Daw Nyein	4988	5.7	2.8	879 (2499)	140 (397).	412 (1175)	327 (927)
Dedalu	2444	5.0	2.7	491 (1327)	124 (336)	242 (653)	125 (338)
Bantbwezu	9881	4.9	2.7	2029 (5435)	747 (2012)	1202 (3214)	80 (209)
Betut	21748	5.8	4.6	3761 (17133)	2973 (13845)	504 (1997)	284 (1291)
Alegyun	12316	3.7	2.4	3365 (7983)	1014 (2566)	623 (1539)	1728 (3878)
Dauntgyi	6277	5.7	3.4	1103 (3746)	798 (2616)	165 (628)	140 (502)
Subtotal	84064	4.9		17134 (52384)	7865 (27063)	4997 (13887)	4272 (11434)
Middle Delta							
Shwelaung	34931	4.4	3.2	7921 (25582)	4974 (16182)	1725 (5772)	1222 (3628)
Total	118995	4.8	3.1	25055 (77966)	12839 (43245)	6722 (19659)	5494 (15062)

1/ Number of working adults excludes children under age 10 and adults over age 60. Children of ages 10 to 15 are counted as two-thirds of an adult. Total number of working adults is given in brackets.

2/ Landless families on record are those local residents without land who have registered with Ward/Village Land Committees that they are seeking farm land for cultivation. Other landless are recorded as non-farmers.

Source: Settlement and Land Records Department.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Present Average Sizes of Farm Holdings & Draft Animal Operations

POLDER	TOWNSHIP	GROSS AREA (1,000 ac)	CULTIVATED AREA (1,000 ac)	EXISTING FARM FAMILIES (no.)	AVER. SIZE HOLDING (ac)	EXISTING CATTLE POP. (draft head)	AVER. AREA PER PAIR (ac)
LOWER DELTA							
Zinbaung	Pyapon	8.0	4.5	420	10.7	709	12.6
Letpanbin	"	14.4	4.5	257	17.5	548	16.4
Kyet-Pha-Hmwe-Zaung	"	30.0	16.9	1,250	13.5	1,986	17.1
Myogon	"	9.3	1.9	142	13.3	127	29.9 1/
Daw Nyein	"	3.2	1.3	140	9.3	375	6.9
Dedalu	"	8.4	1.5	124	12.1	173	17.3
Bantbwezu	"	16.0	8.0	747	10.7	1,301	12.3
Betut	Laputta	54.1	34.0	2,973	11.4	2,096	32.4 1/
Alegyun	Ngapudaw	19.5	13.1	1,014	12.9	1,002	26.1 1/
Dauntgyi	Bogale	25.5	9.6	798	12.0	1,005	19.1
Sub-total		188.4	95.3	7,865	12.1	9,321	20.4
MIDDLE DELTA							
Shwelaung	Wakema	59.0	32.5	4,974	6.5	7,893	8.2
TOTAL		247.4	127.8	12,839	10.0	17,214	14.8

ANNEX 1
Table 5

1/ Appears unrealistically high indicating some statistical error in cattle population.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Present and Future Agricultural Production

General

1. The total cropped area in Burma was 22.8 m ac in 1974, which on a net cultivated land area of 19.9 m ac gives a cropping intensity of 115%. Rice accounts for 55%, oilseeds, 19%, pulses 7%, other cereals 5%, fiber crops 2% and the remaining crops 12% of the total cropped area (Table 1). Irrigated land covers only 12% of the net cultivated area, and only 14% of the irrigated area is double cropped, as the present irrigation is mainly diversion (run-of-the river) systems. About 8.9 M ac of rice land is located in Lower Burma which with fertile soils and dependable rainfall, has been the main surplus rice producing area in Burma, while Upper Burma with 2.8 M ac and hill regions with 0.9 M ac are rice deficit areas. Compared to the pre-war period, there has been an increase of about 300,000 ac of rice area in Upper Burma due to expansion into marginal land, while there has been a loss of about one million acres of good rice land in Lower Burma due to flooding and salt water intrusion through totally or partially eroded protection embankments. During the last decade, even with extension of HYV to about 1.0 M ac, the rice production increased only 0.2%. The 1973 to 1975 average paddy production was about eight million tons.

2. The Irrawaddy Division has the bulk of the delta and about a quarter of the rice area in Burma. Some 40% of the paddyland lost in Lower Burma occured in this division and was due to disrepair of embankments, flooding and salt water intrusion (Annex 1, Table 1). Its present total cropped area is 4.1 M ac, net cultivated area, 3.75 M ac, and cropping intensity, 109%. Rice accounts for 86% of the cropped area, jute 5%, pulses 5%, groundnuts 3%, other 8% (Table 2). Paddy is the only field crop cultivated in the lower Irrawaddy Delta where ten out of 11 project islands will be located, and it is grown only during the wet season. In the middle delta where the project has one island, monsoon rice is still dominant, but the pre-monsoon jute crop with pump irrigation has achieved significance. Some rainfed pulses and groundnuts are grown after rice harvest, as well as some fruits and vegetables on high lands near villages.

Rice

3. There is a main wet season crop and a small winter dry season crop called mayin. The wet season crop includes:

(i) Kankyin with a growing period of 140-150 days and harvesting in October;

(ii) Kauklat with a growing period of 150-170 days and harvesting in November; and

(iii) Kaukkyi with a growing period of 170-200 days and harvesting in December/January.

The mayin crop has a growing period of 140 to 150 days. It is sown around perennial rivers and harvested in March/April. In the Irrawaddy Division, the wet season crop accounts for 99% and dry season crop only 1% of the total rice crop as in the rest of the country (Table 2).

4. Local varieties are of the indica type. There are over one thousand named varieties and many vernacular names may apply to the same variety grown in different localities. These varieties, which attract varying market prices, are classified into five main types based on physical characteristics of the grain. Only three are important in the Irrawaddy Division:

(i) Ngasein - The grains are short, broad, fairly translucent, often with a white belly. This group is the most common and comprises the largest number of varieties, mills fairly well and is the most widely grown type in Lower Burma. It accounts for 50% of the rice crop in the Irrawaddy Division. It also constitutes most exports.

(ii) Medon - This type is next most common. The grain is softer and more chalky than Ngasein, but because of its short, plump, round shape, it mills well. It is popular for home consumption in Lower Burma as well as for export to South East Asia and the Far East. It has a higher domestic price than Ngasein. The highest priced Medon variety is called Ngakywe.

(iii) Emata - The grains are long and slender and therefore break easily in milling. However, it is also hard and translucent so that a more attractice rice emerges after high polishing, and this was exported as Super Sughandi in the pre-war period. Zeeya and Hnanga varieties also belong to this group.

5. The HYV are presently grown on only 5% of the rice cultivated area in the whole country and 4% in the Irrawaddy Division (Tables 3 and 4). Because of poor eating quality, expansion of IR-8 was discouraged by GOB and the area under IR-8 was only 18,000 ac in 1974. On the other hand, the area under IR-5 has expanded from 12,000 ac in 1970 to over 600,000 ac in 1975 and C-63 from 62,000 ac in 1972 to nearly 190,000 ac in 1975 (Table 5). Characteristics of major traditional and HYV varieties in Lower Burma are given in Table 6. The most popular HYV for Lower Burma at present is IR-5, but due to lack of water control less than 1,000 ac of IR-5 out of a total of 600,000 ac grown in the country, are found in the project area.

6. Paddy is reportedly 60% transplanted and 40% broadcast in Lower Burma. The ratio, however, varies greatly between divisions. In the two largest divisions, Irrawaddy and Pegu, about three-fourths are reportedly transplanted (Table 7). But in the lower delta project area, rice is mostly broadcast. All paddy farm work in Lower Burma particularly the lower delta, are done by animal and hand tools. Tractor land preparation and low-lift pump irrigation introduced and used for jute cultivation in the middle delta have recently spread to small areas of dry season irrigated HYV paddy.

7. Jute. Jute has recently become an important crop in Burma. It is grown mainly as a pre-monsoon crop with small pump irrigation in the Irrawaddy Delta along the banks of river channels. Land preparation is done after irrigation in January or February with drafts animals or with tractors rented from the Agricultural Mechanication Department (AMD) or cooperatives. Jute is generally sown in March and harvested in July/August. It is usually followed by Hnanga rice which is transplanted in September as far as water depth permits and harvested in January/February. Early jute sometimes is followed by Ngasein which is harvested in November/December.

Production Constraints

8. Crop Failures: Crop failure is the biggest constraint in Lower Burma. The ten year data from 1963/64 to 1972/73 shows that on average for the country as a whole, about 9% of the total sown acreage of all crops are destroyed totally and 11% have to be sown more than once (Table 8). About 20% of the sown acreage are damaged yearly, and about half of this has to be salvaged by re-seeding. Geographical and crop-wise breakdowns are not available, but since rice forms 55% of the total cropped area of Burma (in Lower Burma 86%) it can be reasonably assumed that it has its proportionate share of the damaged area. In the middle delta, flooding due to rapidly rising rivers wash away or submerge rice seedlings. The jute crop suffers from drought if planted without adequate irrigation and from flood damage at harvest time, losing 25% to 30% of the yield; the average fiber yield per sown acre is only 600 lbs as against 800 lbs per matured acre. In the lower delta, the damage to paddy is caused by daily tidal innundation by sea water. While monsoon rain flushes out salt from drainable land during low tide, salts accumulate in depressions, causing increasing abandonment of paddy cultivation and encroachment of salt tolerant mangroves or grasses.

9. Use of Over-aged Seedlings. Because of the depth of water, the delta farmers generally transplant ten inch to one-foot-tall HYV seedlings and one and quarter foot to one and one half foot tall seedlings of local varieties. Use of over-aged seedlings reduces the number of effective tillers. Moreover seedlings growing tall in nurseries have long basal internodes causing lodging after bearing. Both factors cause lowering of yields.

10. Soil Salinity. Standing rice plants in the lower delta generally show premature yellowing and drying up of lower leaves, with apparent increase in severity with rising soil salinity in October when monsoon rain tapers off. The loss of viable leaves depresses yield. Ngasein is most

tolerant among local varieties. The HYVs are mostly non-tolerant. Soil salinity and lack of moisture during the dry season causes a total fallow of the land; not even pulses can be grown at present.

11. Low Farm Input Use. Official statistics 1/ show that 43,965 tons of urea were programmed for 1.14 M ac of paddy in the 1972-1973 crop year. It means that less than 10% of the 12 M ac of paddy in Burma in that year applied urea at an average rate of 40 lb N per ac. This included perhaps all of the HYV rice and only nursery applications on some native varieties. Urea programmed for the 1973-1974 paddy crop was at about the same level. The percentage of total paddy area applied with phosphate and potash fertilizers and rates of application are equally low. Also delta farmers do not carefully conserve cattle manure and apply it regularly on paddy fields. Growing green manure following paddy harvest in the lower delta is precluded by low soil moisture and high salinity in the dry season. Hispa a leaf-cutting caterpillar and case worms usually appear early in the rice growing season, while stem borers and ear-cutting caterpillars, appear late in the season. Farmers generally own no sprayers or dusters. In severe out-breaks, the Pest Control Squads of the Agricultural Corporation Township Manager's office spray free of charge for farmers. The coverage is usually too small to be effective. Young quasi-sea crabs migrate from the sea into coastal islands at about the end of August, and adult crabs move out to sea by the following July. The latter do considerable damage to young rice plants when they migrate through the field.

12. Fertilizer Shortage. At present, the lack of water control, the salinity problem and the use of over-aged seedlings suppress rice yield response to fertilizers. The correction of adversities by the project would greatly increase rice yield response to fertilizers. Burma uses locally produced urea. It exports some urea and uses the foreign exchange received for importing the needed phosphate and potash fertilizers. Fertilizers are allocated only to HYV rice, cotton, jute, tobacco and sugarcane. As long as GOB is actually short of foreign exchange, the expected increased demand of fertilizers by the project can only be met by cutting down export or reducing allocations to other regions. Both would be undesirable. If projects similar to this one are to be repeated in the delta area, the fertilizer shortage would become a major bottleneck to development.

13. Low Yields of Groundnuts. Groundnuts are harvested in April in Shwelaung. Seeds stored by farmers through the monsoon months (83% - 89% relative humidity June through October) until the planting season in November generally have very low germination of 30% or less. Very poor stand preconditions a very low yield. The hardness of the soil surface during the dry season is also suspected to contribute to the low yield, as it would prevent the flower branches to penetrate the soil to form the groundnut pods. Low yield and high seed price discourages farmers from growing this crop which is much in demand for edible oil and as supplementary food.

1/ Agricultural Statistics, 1971-72, 1972-73, 1973-74, Table 102, Union of Burma 1975.

14. Labor and Farm Power. The average size of farm in the middle delta island is 6.5 ac and in the 10 lower delta islands is 12 ac, which is large by Asian standards. An average farm family has five members with three adult workers, an equivalent of two attend to farm works. With animal and manpower, most families need to hire labor during the peak seasons of land preparation transplanting, harvesting and post-harvesting handling (Annex 14). Hired labor comes from landless families in the villages and other families. When the project increases cultivated area by one-third through land reclamation and allotment to landless families, it is expected that population increase would maintain labor demand and supply at an adequate level. But animal power will become a constraint, unless adequately supplemented by additional tractors and power tillers.

Present Cropping Patterns and Producion

15. The present cropped area for the whole project is about 135,100 ac which on a net cultivated area of 127,800 ac gives a cropping intensity of 106%. This is lower than the average of 109% for the Irrawaddy Division and 115% for the whole country. Rice, almost entirely rainfed, accounts for 90%, jute 6% and others including fruits and vegetables, groundnuts and pulses the remaining 4% of the cropped area. The cropping calendar is shown in Figure 1.

16. Lower Delta. The present cropped area for the ten islands of the lower delta project area totals 95,300 ac which, on a net cultivated area of about 95,300 ac, gives a cropping intensity of about 100%. The only crop grown is rainfed rice which comprises about 60% Ngasein and 40% Ngakywe and other Medon varieties. The crop is mostly broadcast, but in areas well protected from sea water intrusion by embankments it may be transplanted. The yield is generally very low ranging from about 900 lbs to 1,500 lbs per ac. The present cropped area and production are given in Tables 9 and 10 and the summarized extracts are below:

	Area (1,000 ac)	Production (1,000 tons)
Paddy		
Ngasein	57.2	30.6
Ngakywe	38.1	22.1
Other crops	Nil	Nil
Total cropped area	95.3	
Net cultivated area	95.3	
Cropping Intensity	100%	

17. Middle Delta. The total cropped area in the Shwelaung Island in the middle delta is 39,800 ac which on a net cultivated area of 32,500 ac gives a cropping intensity of 122%. Rice accounts for 69%, jute 20%, fruits and vegetables 9%, and groundnuts and pulses 2%. The rice crop is generally transplanted, but flooding frequently delays transplanting and even makes replanting necessary. Yield is generally low (1,000 to 1,500 per ac). The

rice crops include Ngasein, Ngakywe (Medon) and Hnanga (Emata) varieties. Ngasein and Ngakywe are generally transplanted in July/August and harvested in December. Hnanga is generally transplanted in September as a second crop after jute, harvested in January/February, and needs supplementary irrigation. Jute is sown with pump irrigation in March and harvested in August. Some groundnuts and pulses are cultivated with residual soil moisture after harvest of the wet season rice crop.

The present cropped area and production (Tables 9 and 10) is:

	Area (1,000 ac)	Production (1,000 tons)
Paddy		
Ngasein	16.9	9.1
Ngakywe	6.9	4.0
Hnanga	3.5	2.0
Subtotal	27.3	15.1
Jute	8.0	2.1
Groundnuts	0.8	0.3
Pulses	0.1	-
Others including fruits & vegetables	3.6	4.0
Total	39.8	
Net cultivated area	32.5	
Cropping intensity	122%	

Phasing of Development

18. With the intensified extension service to begin as soon as the project begins (Annex 5), full projected crop acreage and yield levels are expected to be reached on the existing cultivated land in five years after the completion of project construction. In the ten lower delta polders, applying intensive cultural practices on the reclaimed land would take a couple of years longer because the boggy soil needs time to firm. However reaching full development on such soils can still be achieved five years after project construction. Full development is projected to reach different polders as follows:

Polder	Year of Construction	Year of Full Acreage Development	Year of Full Production
Zinbaung	1978	1979	1984
Letpanbin	"	"	"
Dedalu	"	"	"
Myogon	1979	1980	1985
Daw Nyein	"	"	"
Bantbwezu	"	"	"
Shwelaung	1978-1980	1981	1986
Kyet-Pha-Hmwe-Zaung	1980-1982	1983	1988
Betut	1979-1982	"	"
Alegyun	1980-1982	"	"
Dauntgyi	1981-1982	"	"

19. A detailed schedule of project construction is given in Annex 3 Fig. 1, that of land reclamation, in Annex 4, Table 2, and that of area and production development in Tables 9, 10 and 11 of this Annex.

Future Cropping Patterns and Production

20. Lower Delta. On completion of the project, the total net cultivable area in the lower delta project area would increase from 95,300 to 147,000 ac entirely cultivated with rice in the wet season. With protection from salt water intrusion and drainage, HYV would cover about 40% of the area, replacing the low yielding Ngasein variety. It is estimated that the rice crop would comprise about 40% Medon (Ngakywe), 40% HYV and only 20% Ngasein. With the gradual elimination of salinity and retention of fresh water in the drains, it is also expected that it would be possible to grow pulses with residual soil moisture on about 30% of the area during the dry season. Future cropped area and production are summarized below:

	Area (1,000 ac)	Production (1,000 tons)
Paddy		
Ngasein	29.4	30.2
Ngakywe	58.8	65.6
HYV	58.8	78.8
Subtotal	147.0	174.6
Pulses	44.1	17.7
Total	191.1	
Net Cultivated area	147.0	
Cropping intensity	130%	

Detailed phasing of paddy area and production changes, by varieties and by islands, is given in Tables 9 and 10, and those for pulses in Table 11.

21. Middle Delta. On completion of the project, the net cultivated area would increase from the present 32,500 ac to about 38,000 ac, the total cropped area, from 39,800 ac to 66,000 ac and cropping intensity, from 122% to 174%. Even after the project construction is completed, the sluice gates of the Shwelaung polder must be kept closed throughout the month of August and September, as water level in surrounding rivers during the period would be higher than inside of the polder. Controlled drainage would resume again in October when rivers rapidly fall. Land use planning in Shwelaung, therefore, takes into consideration the water depth inside of the polder, shown in the following table.

Land Elevation ft	Estimated depth Water Aug./Sept.	Area ac	Cumulative Area ac	Projected wet season land use	Area ac	Cumulative ac
Above 5.5 R.L. 1/	Flood free	14,000	14,000	Embankment	1,950	1,950
				Fruits/veg.	3,600	5,550
5.5 - 5.0	Up to 6"	9,400	23,400	Towns/villages	1,500	7,050
				HYV-HYV	7,000	14,050
5.0 - 4.5	6" to 1'	11,600	35,000	Jute-Hnanga	15,000	29,050
				Medon	6,900	35,950
4.5 - 4.0	1' to 1.5'	8,000	43,000	Ngasein	5,450	41,400
4.0 - 3.5	1.5'to 2'	2,400	45,400			
3.5 - 3.0	2' to 2.5'	6,200	51,600			
3.0 - 2.5	2.5 to 3'	3,400	55,000			
2.5 - less	More than 3'	4,000	59,000			

1/ Reduced level (Assumed Datum Level).

Source of elevation and water depth data: Irrigation Department, with 10% probability rainfall and evapo-transpiration for rice. October, 1975.

22. Excluding areas occupied by embankments, towns and villages, total crop area in the wet season totals 37,950 ac. All HYV fruits and vegetables would be on land flood free during August/September. About 60% of the jute-Hnanga rotation would be on land submerged up to six inches while 40% would be submerged up to 1 ft. Some 85% of Medon would be submerged up to 1 ft; the balance, up to 1.5 ft. All Ngasein would be submerged up to 1.5 ft during the two months in which the sluice gates are closed. Land lower than 4 ft elevation would be left undeveloped and unused.

23. The wet season HYV, Medon and Ngasein generally have nurseries in June and are transplanted in July. Since HYV would be grown on flood free land, bunding and water management would be emphasized by the extension service. If necessary, supplementary irrigation may be supplied by pumping. Planting of Medon and Ngasein would be moved forward somewhat to enable transplanting younger seedlings and allow sufficient plant growth before water depth starts to build up by rain inside of the polder after the sluice gates are closed in August. The present area of Hnanga rice is less than half of that of jute at present, due mainly to the depth of water after the harvest of jute in August or September. Under the project, water in the streams and drains inside of the polder would be regulated. With additional tractors and pumps, planting of jute could be moved forward somewhat, so that younger Hnanga seedlings can be used on 60% of its projected acreage which is expected to be submerged up to six inches during August/September. On the remaining 40%, taller seedlings will have to be used, but even those would be younger than at present (1 ft, 3 inches). Such changes in rice and jute calendars and the use of younger seedlings would be stressed by the extension service.

24. Groundnuts and pulses would follow Ngasein and Medon. Extension would emphasize proper storage of groundnut seeds. Vegetables would be benefitted by improved water supply from the peripheral drain formed by the burrow pits for embankment construction, and the use of fertilizers. It is believed that with irrigation, more than one crop of vegetables can be grown in succession or by relay interplanting on the same land during the dry season. The projected yield increase for fruits/vegetables is expected to come mainly from vegetables. Groundnut and pulse acreage and yield would benefit from improved residual soil moisture due to maintaining water in the drains during the dry season.

25. The project cropped area and production in Shwelaung would be:

	Area (1,000 ac)	Production (1,000 tons)
Paddy		
Ngasein	5.5	5.6
Ngakywe (Medon)	6.9	7.7
Hnanga	15.0	18.4
HYV Wet season	7.0	10.1
HYV Dry season	7.0	10.1
Subtotal	41.4	51.9
Other Crops		
Jute	15.0	8.0
Groundnuts	5.0	2.7
Pulses	1.0	0.4
Fruits & Vegetables	3.6	6.4
Total	66.0	
Net cultivated area	38.0	
Cropping Intensity	174%	

Detailed phasing of paddy area and production changes, by varieties, are given in Tables 9 and 10, and those for other crops, in Table 11.

Future Crop Yields

26. With flood control and drainage, improved water management and cultural practices, adequate supply of inputs, expanded use of HYV seeds and an intensified extension service throughout the project area, crop yields are projected to increase gradually during the construction period and rapidly after the completion of construction and reclamation. The projected increase is summarized below:

	Present Yield (lbs/ac)	Future Yield
Paddy		
Ngasein	1,200	2,300
Ngakywe	1,300	2,500
Hnanga	1,300	2,500
HYV (rainfed)	-	3,000
HYV (irrigated)	-	3,200
Other Crops		
Jute	600	1,200
Groundnuts	900	1,200
Pulses	600	900
Vegetables	2,500	4,000

Detailed phasing of paddy yield, by varieties is given in Table 12.

Increased Supply of Fertilizers

27. To sustain the projected yield level and production, adequate supply of fertilizers would be made to the project farmers not only for HYV rice and jute, but also for local rice varieties, groundnuts, pulses and vegetables. At full development, a total of 13,500 tons of fertilizers would be required, as compared to about 1,000 tons at present. The demand would, however, increase gradually from FY 1977 to FY 1988, as shown in Table 13.

Summary

28. At full development, paddy production is expected to increase from about 68,000 tons per year at present to about 225,000 tons, jute from about 2,000 to 8,000 tons, groundnuts from 300 to 2,700 tons, fruits/vegetables from 4,000 to 5,700 tons, and cropping intensity from 106% to about 134%. Without the project, the expected production is: paddy about 76,000; jute, 2,500; pulses, nil; and fruits/vegetables, 4,000 tons (Table 14).

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ANNEX 2
Table 1

Area Under Main Crops in Burma
(Million Acres)

		Average 1963-65	1966	1967	1968	1969	1970	1971	1972	1973	1974
1.	Paddy	12.35	12.39	12.33	12.19	12.40	12.24	12.29	12.30	12.01	12.57
2.	Other Cereals	1.00	1.16	1.17	1.12	1.02	1.00	0.97	1.05	1.07	1.08
3.	Groundnuts	1.45	1.31	1.13	1.26	1.51	1.51	1.73	1.68	1.56	1.64
4.	Sesamum	1.71	2.00	1.91	2.05	2.04	2.26	2.51	2.29	2.26	2.66
5.	Pulses	1.72	1.71	1.77	1.61	1.75	1.63	1.58	1.78	1.79	1.61
6.	Cotton	0.61	0.57	0.49	0.53	0.39	0.36	0.47	0.55	0.53	0.53
7.	Jute	0.05	0.07	0.07	0.09	0.10	0.10	0.12	0.22	0.29	0.29
8.	Spices	0.22	0.23	0.19	0.20	0.21	0.26	0.24	0.22	0.25	0.22
9.	Tobacco	0.13	0.12	0.14	0.16	0.15	0.13	0.14	0.17	0.16	0.11
10.	Rubber	0.20	0.21	0.22	0.22	0.22	0.22	0.22	0.21	0.21	0.21
11.	Sugarcane	0.11	0.14	0.16	0.15	0.16	0.20	0.24	0.27	0.29	0.24
12.	Tea	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
13.	Fruits & Vegetables	0.64	0.62	0.65	0.66	0.65	0.65	0.65	0.65	0.65	0.65
14.	Others	0.79	0.81	0.86	0.81	0.81	0.88	0.91	0.90	0.90	0.90
	Total Cropped Area	21.09	21.45	21.21	21.17	21.53	21.56	22.19	22.41	22.09	22.83
	Net Cultivated Area	19.42	19.46	19.21	18.93	19.11	19.04	19.33	19.67	19.48	19.93
	Cropping Intensity	109%	110%	110%	112%	113%	113%	115%	114%	113%	115%

Source: Central Statistics Department
Settlement and Land Records Department

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Present Cropping Patterns (1973) in the Irrawaddy Division and the Townships where Project Areas are Located

	Irrawaddy Division		Wakema Township 2/		Pyapon Township 3/		Bogale Township 4/		Laputta Township 5/		Ngaputaw Township 6/	
	000' ac	%	000' ac	%	000' ac	%	000' ac	%	000' ac	%	000' ac	%
1. Paddy												
a. Raincrop	3162	84	146	87	123	97	199	96	168	94	170	93
b. Mayin 1/	58	2	-	-	-	-	-	-	-	-	-	-
Subtotal	3220	86	146	87	123	97	199	96	168	94	170	93
2. Jute	199	5	40	24	-	-	1	-	1	1	-	-
3. Groundnuts	112	3	2	1	-	-	-	-	-	-	-	-
4. Pulses	191	5	3	2	-	-	-	-	-	-	-	-
5. Others	373	10	12	7	4	3	8	4	9	5	12	7
Total Cropped Area	4095	109	203	121	127	100	208	100	178	100	182	100
Net Cultivated Area	3750	100	168	100	127	100	208	100	178	100	182	100
Cropping Intensity		109%		121%		100%		100%		100%		100%

1/ Winter - Dry season rice crop cultivated near perennial water sources.
2/ Middle Delta - Includes Shwelaung project area
3/ Lower Delta - Includes Zinbaung Letpanbin, Kyet-Pha-Hmwe-Zaung, Myogon, Daw Nyein, Dedalu and Bantbwezu project areas.
4/ Lower Delta - Includes Dauntgyi project area.
5/ Lower Delta - Includes Betut project area.
6/ Lower Delta - Includes Alegyun project area.

ANNEX 2
Table 3

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

National Area, Yields and Production of Main Paddy Varieties (1973/74)

Main Varieties of Paddy	Area ('000 ac) Sown	Area ('000 ac) Matured	Yield lb/sown ac	Production '000 tons
Local Varieties				
Ngasein	5,666	5,365	1,410	3,639
Ngakywe	690	671	1,594	499
Medon	1,873	1,824	1,559	1,324
Emata	2,018	1,954	1,571	1,438
Kunni	230	219	1,444	151
Taungdeitpan	317	298	1,282	184
Ziya	287	279	1,682	219
Kaukmyin	266	261	1,351	163
Mayin	132	130	1,564	94
Taungya	452	442	902	185
Sub-total	11,931	11,443	1,496	4,257
HYV				
C-4-63	139	133	2,125	134
IR-8	13	13	2,374	14
IR-5	437	428	2,698	535
Ngwetoe	50	50	2,072	47
Sub-total	639	624	2,517	730
Total	12,570	12,067	1,512	8,626

Source: Second Forecast for 1973-74 of the Settlement and Land Records Department.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Irrawaddy Division Area Yields and Production of Main Paddy Varieties (1973/74)

Main Varieties of Paddy	Area ('000 ac) Sown	Area ('000 ac) Matured	Yield lb/sown ac	Production '000 tons
Local Varieties				
Ngasein	1,582	1,488	1,461	1,178
Ngakywe	479	466	1,666	362
Medon	613	600	1,674	466
Emata	93	90	1,727	73
Kunni	-	-	-	-
Taungdeitpan	-	-	-	-
Ziya	261	254	1,711	203
Kauknyin	15	15	1,481	10
Mayin	35	35	1,960	31
Taungya	-	-	-	-
Sub-total	3,078	2,948	1,663	2,323
HYV				
C4-63	16	16	2,527	18
IR-8	-	-	-	-
IR-5	124	121	2,837	160
Ngwetoe	3	3	2,530	3
Sub-total	143	140	2,790	181
Total	3,221	3,088	1,713	2,504

Source: Second Forecast for 1973-74 of the Settlement & Land Records Department

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Historic National Sown Areas of High Yielding Paddy Varieties
(1,000 ac)

Crop Year Ending June 30	1968	1969	1970	1971	1972	1973 1/	1974 2/	1975 3/
Upper Burma								
IR - 8	3	236	163	7	6	5	9	-
IR - 5	-	-	5	158	76	49	54	53
C4 - 63	-	-	-	-	35	63	176	138
Ngwetoe	-	-	-	2	3	9	31	34
Subtotal	3	236	168	167	120	126	270	225
Lower Burma								
IR - 8	5	175	151	17	5	3	2	-
IR - 5	-	-	7	265	283	317	423	522
C4 - 63	-	-	-	-	27	30	45	48
Ngwetoe	-	-	24	40	33	29	25	34
Subtotal	5	175	182	322	348	379	495	604
States								
IR - 8	-	2	5	1	1	1	7	-
IR - 5	-	-	-	4	6	4	28	28
C4 - 63	-	-	-	-	1	1	38	3
Ngwetoe	-	-	-	-	-	-	1	1
Subtotal	-	2	5	5	8	6	74	32
Union Total								
IR - 8	8	412	319	25	12	9	18	-
IR - 5	-	-	12	427	365	370	605	603
C4 - 63	-	-	-	-	62	94	159	189
Ngwetoe	-	-	24	42	35	38	57	69
Total	8	412	355	494	474	511	839	861

1/ Preliminary Estimate
2/ Provisicnal Actual
3/ Plan

Source: Settlements and Land Records Department

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Plant Characteristics of Rice Varieties to be Grown in the Project Area

Characteristics	Traditional Varieties			HYV 1/			
	Ngasein	Medon	Hnanga	IR5	C4-63	Ngwetoe	Mashuri
Origin	Burma	Burma	Burma	IRRI	UPCA 2/	Burma	Malaysia
Plant Height							
Nursery 3/	1'6"	1'3"	1'3"	10"-12"	10"-12"	1'3"	1'0"
Maturity	4'8"-5'0"	5'0"	5'0"	3'0"-3'6"	3'8"	3'10"-4'0"	3'10"-4'0"
Life Period (day)	140-160	150-170	140-170	125	125	125	135
Photo Sensitivity	High	High	High	Low	Low	Low	Low
Grain Type	Ngasein	Medon	Emeta	Ngasein	Emeta	Emeta	Emeta

1/ Newer short HYVs, such as IR20, IR22, IR24 are not planted in the delta area at present, but they would be tested after the flood depth is under control.

2/ University of Philippines College of Agriculture.

3/ The reported seedling heights are those used by farmers at present in adoptation to uncontrolled flood conditions. They are expected to be reduced after the flood depth can be controlled, particularly the HYVs.

ANNEX 2
Table 6

ANNEX 2
Table 7

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Lower Burma Transplanted and Broadcast Paddy Areas (1969-1974)

	1969/70			1970/71			1971/72			1972/73			1973/74		
	Sown Area (1,000 ac)	T %	B %	Sown Area (1,000 ac)	T %	B %	Sown Area (1,000 ac)	T %	B %	Sown Area (1,000 ac)	T %	B %	Sown Area (1,000 ac)	T %	B %
Pegu	2,300	76	24	2,290	74	26	2,269	74	26	2,218	74	26	2,282	79	21
Rangoon	1,263	35	65	1,263	35	65	1,269	36	64	1,265	36	64	1,278	38	62
Tenasserim I	636	52	48	636	56	44	631	54	46	650	58	42	651	60	40
Tenasserim II	197	4	96	196	4	96	195	5	95	196	6	94	197	6	94
Irrawaddy	3,193	72	28	3,198	73	27	3,186	73	27	3,197	73	27	3,222	74	26
Arakan	801	27	73	800	25	75	807	27	73	806	31	69	814	31	69
Lower Burma	8,389	60	40	8,383	60	40	8,357	60	40	8,332	61	39	8,444	63	37
Kawthoolei	434	96	4	435	96	4	433	96	4	448	96	4	453	95	5

T = Transplanted
B = Broadcast

Source: Settlement and Land Records Department, Ministry of Agriculture.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Crop Area Sown, Destroyed and Matured - Burma Total

(Thousand acres)

Period	Sown			Destroyed			Matured		
	Gross area	Net area	Area sown more than once	Gross area	Net area	Area sown more than once	Gross area	Net area	Area sown more than once
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1936-37/40-41 (average)	18,686	17,469	1,217	1,370	1,026	344	17,316	16,443	873
1963-64	21,536	19,689	1,847	1,824	1,308	516	19,712	18,381	1,331
1964-65	21,649	19,623	2,026	1,073	1,005	68	20,576	18,618	1,958
1965-66	21,684	19,520	2,164	1,892	1,335	557	19,792	18,185	1,607
1966-67	21,374	19,269	2,105	2,054	2,124	530	18,720	17,145	1,575
1967-68	21,367	19,014	2,353	1,693	- -	- -	19,674	- -	- -
1968-69	21,739	19,261	2,478	1,901	- -	- -	19,838	- -	- -
1969-70	21,761	19,219	2,542	1,984	- -	- -	19,777	- -	- -
1970-71	22,338	19,512	2,825	1,585	- -	- -	20,753	- -	- -
1971-72	22,701	19,674	3,027	1,981	- -	- -	20,720	- -	- -
1972-73	22,503	19,482	3,020	2,888	- -	- -	19,615	- -	- -
Average (1963/64 - 1972/73)	21,865	19,426	2,439	1,888			19,978		

Source: Agricultural Statistics, the Socialist Republic of the Union of Burma, 1971-72, 1972-73 and 1973-74. Table 6.

ANNEX 2
Table 8

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Projected Paddy Area by Varieties (1,000 ac)

	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
A. Ngasein												
(1) Middle Delta												
Shwelaung	16.9	18.8	20.6	20.6	18.1	15.6	13.0	10.5	8.0	5.5	5.5	5.5
(2) Lower Delta												
Zinbaung	2.7	4.0	5.5	4.7	3.8	3.1	2.2	1.4	1.4	1.4	1.4	1.4
Letpanbin	2.7	4.7	6.8	5.8	4.8	3.7	2.7	1.7	1.7	1.7	1.7	1.7
Kyet-Pha-Hmwe-Zaung	10.1	9.7	11.6	13.5	13.5	13.5	15.7	13.6	11.3	9.1	6.9	4.7
Myogon	1.1	2.3	3.5	5.1	4.4	3.6	2.8	2.1	1.3	1.3	1.3	1.3
Daw Nyein	0.8	1.1	1.5	2.0	1.7	1.4	1.1	0.9	0.6	0.6	0.6	0.6
Dedalu	0.9	2.6	4.2	3.3	2.7	2.2	1.6	1.0	1.0	1.0	1.0	1.0
Bantbwezu	4.8	6.1	7.7	9.5	8.2	6.8	5.5	4.1	2.8	2.8	2.8	2.8
Betut	20.4	21.4	23.6	23.6	23.6	23.6	24.6	21.3	18.0	14.7	11.4	8.1
Alegyun	7.9	7.5	8.3	9.0	9.0	9.0	9.2	8.0	6.7	5.5	4.3	3.0
Dauntgyi	5.8	5.5	5.5	8.7	11.8	12.9	17.7	15.1	12.5	9.9	7.4	4.8
(Lower Delta Sub-total)	(57.2)	(64.9)	(78.2)	(85.2)	(83.5)	(79.8)	(83.1)	(69.2)	(57.3)	(48.0)	(38.8)	(29.4)
(3) Project Total	74.1	83.7	98.8	105.8	101.6	95.4	96.1	79.7	65.3	53.5	44.3	34.9
B. Medon												
(1) Middle Delta												
Shwelaung	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
(2) Lower Delta												
Zinbaung	1.8	1.6	1.6	1.9	2.1	2.4	2.6	2.9	2.9	2.9	2.9	2.9
Letpanbin	1.8	1.6	1.6	2.0	2.3	2.7	3.0	3.4	3.4	3.4	3.4	3.4
Kyet-Pha-Hmwe-Zaung	6.8	6.2	6.2	6.2	6.2	6.2	6.2	6.8	7.5	8.1	8.8	9.4
Myogon	0.8	0.7	0.7	1.0	1.4	1.7	2.0	2.3	2.6	2.6	2.6	2.6
Daw Nyein	0.5	0.5	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.1	1.1	1.1
Dedalu	0.6	0.6	0.8	1.0	1.3	1.5	1.8	2.0	2.0	2.0	2.0	2.0
Bantbwezu	3.2	3.0	3.0	3.4	3.9	4.3	4.7	5.1	5.6	5.6	5.6	5.6
Betut	13.6	12.8	12.8	12.8	12.8	12.8	13.4	14.0	14.5	15.1	15.7	16.3
Alegyun	5.2	4.8	4.8	4.8	4.8	4.8	5.0	5.2	5.4	5.6	5.9	6.1
Dauntgyi	3.8	3.5	3.5	3.5	3.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5
(Lower Delta Sub-total)	(38.1)	(35.3)	(35.5)	(37.2)	(39.0)	(40.7)	(44.1)	(48.2)	(51.5)	(53.9)	(56.5)	(58.9)
(3) Project Total	45.0	42.2	42.4	44.1	45.9	47.6	51.0	55.1	58.4	60.8	63.4	65.8
C. Hnanga												
(1) Middle Delta Only	3.5	1.6	1.6	1.6	5.8	7.6	9.5	11.3	13.2	15.0	15.0	15.0
D. Wet Season HYV												
(1) Middle Delta												
Shwelaung	-	-	-	-	0.5	1.8	3.1	4.4	5.7	7.0	7.0	7.0
(2) Lower Delta												
Zinbaung	-	-	-	0.6	1.1	1.7	2.3	2.9	2.9	2.9	2.9	2.9
Letpanbin	-	-	-	0.7	1.4	2.0	2.7	3.4	3.4	3.4	3.4	3.4
Kyet-Pha-Hmwe-Zaung	-	-	-	-	-	-	1.6	3.1	4.7	6.3	7.8	9.4
Myogon	-	-	-	0.4	0.9	1.3	1.7	2.2	2.6	2.6	2.6	2.6
Daw Nyein	-	-	-	0.2	0.4	0.6	0.7	0.9	1.1	1.1	1.1	1.1
Dedalu	-	-	-	0.4	0.8	1.2	1.6	2.0	2.0	2.0	2.0	2.0
Bantbwezu	-	-	-	0.9	1.9	2.8	3.7	4.6	5.6	5.6	5.6	5.6
Betut	-	-	-	-	-	-	2.7	5.4	8.1	10.9	13.6	16.3
Alegyun	-	-	-	-	-	-	1.0	2.0	3.0	4.1	5.1	6.1
Dauntgyi	-	-	-	-	-	-	1.6	3.2	4.8	6.4	7.9	9.5
(Lower Delta Sub-total)	-	-	-	(3.2)	(6.5)	(9.6)	(19.6)	(29.7)	(38.2)	(45.3)	(52.0)	(58.9)
(3) Project Total	-	-	-	3.2	7.0	11.4	22.7	34.1	43.9	52.3	59.0	65.9
E. Dry Season HYV												
(1) Middle Delta Only	-	-	-	-	0.5	1.8	3.1	4.4	5.7	7.0	7.0	7.0
F. PADDY TOTAL												
(1) Middle Delta	27.3	27.2	29.1	29.1	31.8	33.7	35.6	37.5	39.4	41.4	41.4	41.4
(2) Lower Delta	95.3	100.3	113.6	125.9	129.0	130.1	147.0	147.0	147.0	147.0	147.0	147.0
(3) Total	122.6	127.5	142.7	155.0	160.8	163.8	182.6	184.5	186.4	188.4	188.4	188.4

Small discrepancies are due to rounding.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Projected Paddy Production by Varieties (1,000 lg ton)

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
A. Ngasein												
(1) Middle Delta												
Shwelaung	9.1	10.4	11.9	12.2	12.6	12.1	11.2	9.9	8.2	5.6	5.6	5.6
(2) Lower Delta												
Zinbaung	1.4	2.2	3.2	3.2	3.0	2.6	2.1	1.5	1.5	1.5	1.5	1.5
Letpanbin	1.5	2.6	3.9	4.0	3.7	3.2	2.6	1.7	1.7	1.7	1.7	1.7
Kyet-Pha-Hmwe-Zaung	5.4	5.2	6.4	7.5	7.8	8.0	9.5	9.5	8.8	8.0	6.4	4.8
Myogon	0.6	1.3	2.0	3.0	3.1	2.8	2.5	2.0	1.4	1.4	1.4	1.4
Daw Nyein	0.4	0.6	0.9	1.2	1.2	1.1	1.0	0.8	0.6	0.6	0.6	0.6
Dedalu	0.5	1.5	2.4	2.3	2.1	1.8	1.5	1.0	1.0	1.0	1.0	1.0
Bantbwezu	2.6	3.4	4.4	5.7	5.7	5.3	4.7	3.9	2.9	2.9	2.9	2.9
Betut	10.9	11.5	13.0	13.6	14.1	14.4	15.6	15.0	14.1	12.8	10.6	8.4
Alegyun	4.2	4.0	4.6	5.2	5.3	5.5	5.9	5.6	5.3	4.8	4.0	3.1
Dauntgyi	3.1	3.0	3.1	5.0	7.0	8.0	11.2	10.6	9.8	8.7	6.9	4.9
(Lower Delta Sub-total)	(30.6)	(35.3)	(43.9)	(50.7)	(53.0)	(52.7)	(56.6)	(51.6)	(47.1)	(43.4)	(37.0)	(30.3)
(3) Project Total	39.6	45.7	55.8	62.9	65.6	64.8	67.8	61.5	55.3	49.0	42.6	35.9
B. Medon												
(1) Middle Delta												
Shwelaung	4.0	4.1	4.3	4.4	5.0	5.6	6.3	7.0	7.7	7.7	7.7	7.7
(2) Lower Delta												
Zinbaung	1.0	1.0	1.0	1.3	1.7	2.2	2.7	3.2	3.2	3.2	3.2	3.2
Letpanbin	1.1	1.0	1.0	1.4	1.9	2.5	3.1	3.8	3.8	3.8	3.8	3.8
Kyet-Pha-Hmwe-Zaung	3.9	3.6	3.7	3.7	3.8	3.8	3.9	4.9	6.1	7.7	9.2	10.9
Myogon	0.5	0.4	0.4	0.7	1.1	1.4	1.8	2.4	2.9	2.9	2.9	2.9
Daw Nyein	0.3	0.3	0.3	0.4	0.5	0.7	0.8	1.0	1.3	1.3	1.3	1.3
Dedalu	0.3	0.3	0.5	0.7	1.0	1.4	1.8	2.2	2.2	2.2	2.2	2.2
Bantbwezu	1.9	1.8	1.8	2.2	2.9	3.5	4.3	5.2	6.2	6.2	6.2	6.2
Betut	7.9	7.4	7.6	7.6	7.9	8.1	8.8	10.0	11.8	14.0	15.9	18.0
Alegyun	3.0	2.8	2.8	2.8	2.9	3.0	3.3	3.7	4.4	5.2	6.0	6.8
Dauntgyi	2.2	2.0	2.1	2.1	2.1	2.2	3.0	3.9	5.3	6.9	8.6	10.5
(Lower Delta Sub-total)	(22.1)	(20.6)	(21.2)	(22.9)	(25.8)	(28.8)	(33.5)	(40.3)	(47.2)	(53.4)	(59.3)	(65.8)
(3) Project Total	26.1	24.7	25.5	27.2	30.8	34.4	39.8	47.3	54.9	61.1	67.0	73.5
C. Hnanga												
(1) Middle Delta only	2.0	0.9	1.0	1.0	4.2	6.3	9.2	12.6	16.2	18.4	18.4	18.4
D. Wet Season HYV												
(1) Middle Delta												
Shwelaung	-	-	-	-	0.5	2.0	3.8	5.9	8.2	10.1	10.1	10.1
(2) Lower Delta												
Zinbaung	-	-	-	0.5	1.1	1.9	2.8	3.8	3.8	3.8	3.8	3.8
Letpanbin	-	-	-	0.6	1.4	2.3	3.3	4.5	4.5	4.5	4.5	4.5
Kyet-Pha-Hmwe-Zaung	-	-	-	-	-	-	1.4	3.1	5.2	7.7	10.5	12.6
Myogon	-	-	-	0.4	0.9	1.5	2.2	2.9	3.5	3.5	3.5	3.5
Daw Nyein	-	-	-	0.2	0.4	0.6	0.9	1.3	1.5	1.5	1.5	1.5
Dedalu	-	-	-	0.4	0.8	1.3	2.0	2.7	2.7	2.7	2.7	2.7
Bantbwezu	-	-	-	0.8	1.9	3.1	4.5	6.2	7.4	7.4	7.4	7.4
Betut	-	-	-	-	-	-	2.4	5.5	9.1	13.3	18.2	21.8
Alegyun	-	-	-	-	-	-	0.9	2.0	3.4	5.0	6.8	8.1
Dauntgyi	-	-	-	-	-	-	1.4	3.2	5.3	7.8	10.6	12.8
(Lower Delta Sub-total)	(-)	(-)	(-)	(2.9)	(6.5)	(10.7)	(21.8)	(35.2)	(46.4)	(57.2)	(69.5)	(78.7)
(3) Project Total	-	-	-	2.9	7.0	12.7	25.6	41.1	54.6	67.3	79.6	88.8
E. Dry Season HYV												
(1) Middle Delta Only	-	-	-	-	0.6	2.2	4.1	6.3	8.2	10.1	10.1	10.1
F. PADDY TOTAL												
(1) Middle Delta	15.1	15.4	17.1	17.6	22.8	28.2	34.7	41.8	48.4	51.8	51.8	51.8
(2) Lower Delta	52.8	55.9	65.1	76.5	85.3	92.2	111.9	127.1	140.7	154.0	165.8	174.8
(3) Total	67.9	71.3	82.2	94.1	108.1	120.4	146.6	168.9	189.1	205.8	217.6	226.4
Annual Increase		+ 3	+ 11	+ 12	+ 14	+ 12	+ 26	+ 22	+ 22	+ 16	+ 11	+ 9
Cumulative			+ 14	+ 26	+ 40	+ 52	+ 78	+100	+122	+138	+149	+158

Small discrepancies are due to rounding.

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Phasing of Crop Production

		FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
1. Cultivated area	1,000 ac												
A. Paddy													
Middle Delta													
(1) Shwelaung	(Wakema)	27.3	27.2	29.1	29.1	31.8	33.7	35.6	37.5	39.4	41.9	41.9	41.9
Lower Delta													
(2) Zinbaung	(Pyapon)	4.5	5.7	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
(3) Letpanbin	"	4.5	6.3	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
(4) Kyet-Pha-Hmwe-Zaung	"	16.9	15.9	17.8	19.7	19.7	19.7	23.5	23.5	23.5	23.5	23.5	23.5
(5) Myogon	"	1.9	3.0	4.2	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
(6) Daw Kyein	"	1.3	1.6	2.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8
(7) Dadalu	"	1.5	3.2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
(8) Bantbwezu	"	8.0	9.1	10.7	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9
(9) Betut	(Laputta)	34.0	34.2	36.4	36.4	36.4	36.4	40.7	40.7	40.7	40.7	40.7	40.7
(10) Alegyun	(Ngapudaw)	13.1	12.3	13.0	13.8	13.8	13.8	15.2	15.2	15.2	15.2	15.2	15.2
(11) Dauntgyi	(Bogale)	9.6	9.0	9.0	12.2	15.3	16.4	23.8	23.8	23.8	23.8	23.8	23.8
Lower Delta Sub-total		(95.3)	(100.3)	(113.6)	(125.9)	(129.0)	(130.1)	(147.0)	(147.0)	(147.0)	(147.0)	(147.0)	(147.0)
Project Paddy Total		122.6	127.5	142.7	155.0	160.8	163.8	182.6	184.5	186.4	188.9	188.9	188.9
B. Jute													
(1) Shwelaung		8.0	6.1	6.1	6.1	9.4	10.5	11.6	12.8	13.9	15.0	15.0	15.0
C. Groundnuts													
(1) Shwelaung		0.8	0.8	0.8	0.8	1.8	2.4	3.1	3.7	4.4	5.0	5.0	5.0
D. Pulses													
(1) Shwelaung		0.1	0.1	0.1	0.1	0.4	0.5	0.6	0.8	0.9	1.0	1.0	1.0
(2) Zinbaung		0.0	0.0	0.0	0.4	0.9	1.3	1.7	2.1	2.1	2.1	2.1	2.1
(3) Letpanbin		0.0	0.0	0.0	0.5	1.0	1.5	2.0	2.5	2.5	2.5	2.5	2.5
(4) Kyet-Pha-Hmwe-Zaung		0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.4	3.5	4.7	5.9	7.1
(5) Myogon		0.0	0.0	0.0	0.3	0.7	1.0	1.3	1.7	2.0	2.0	2.0	2.0
(6) Daw Kyein		0.0	0.0	0.0	0.1	0.3	0.4	0.6	0.7	0.8	0.8	0.8	0.8
(7) Dedalu		0.0	0.0	0.0	0.3	0.6	0.9	1.2	1.5	1.5	1.5	1.5	1.5
(8) Bantbwezu		0.0	0.0	0.0	0.7	1.4	2.1	2.8	3.5	4.2	4.2	4.2	4.2
(9) Betut		0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.1	6.1	8.1	10.2	12.2
(10) Alegyin		0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.5	2.3	3.0	3.8	4.6
(11) Dauntgyi		0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.4	3.6	4.8	6.0	7.1
Lower Delta Sub-total		(0.0)	(0.0)	(0.0)	(2.3)	(4.9)	(7.2)	(14.8)	(22.4)	(28.6)	(33.7)	(39.0)	(44.1)
Project Pulses Total		0.1	0.1	0.1	2.4	5.3	7.7	15.4	23.2	29.5	34.7	40.0	45.1
E. Fruits & Vegetables													
(1) Shwelaung		3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Total All Crops													
Middle Delta		39.8	37.8	39.7	39.7	47.0	50.7	54.5	58.4	62.2	66.5	66.5	66.5
Lower Delta		95.3	100.3	113.6	128.2	133.9	137.3	161.8	169.4	175.6	180.7	186.0	191.1
Project Total		135.1	138.1	153.3	167.9	180.9	188.0	216.3	227.8	237.8	247.2	247.2	247.2
Net Cultivated Area													
Middle Delta		32.5	32.4	34.3	34.3	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Lower Delta		95.3	100.3	113.6	125.9	129.0	130.1	142.7	147.0	147.0	147.0	147.0	147.0
Project Total		127.8	132.7	147.9	160.2	167.0	168.1	180.7	185.0	185.0	185.0	185.0	185.0
Cropping Intensity													
Middle Delta	%	122	117	117	117	124	134	144	154	164	174	174	174
Lower Delta	%	100	100	100	102	104	106	110	115	119	123	127	130
Project Average	%	106	104	104	105	108	112	117	123	129	134	134	134

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Phasing of Crop Production (Continue)

	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
2. Production												
A. Paddy 1,000 lg ton												
Middle Delta												
(1) Shwelaung	15.1	15.4	17.1	17.6	22.8	28.2	34.7	41.8	48.4	51.8	51.8	51.8
Lower Delta												
(2) Zinbaung	2.5	3.2	4.2	5.1	5.9	6.7	7.6	8.5	8.5	8.5	8.5	8.5
(3) Letpanbin	2.5	3.6	4.9	6.1	7.0	7.9	8.9	10.0	10.0	10.0	10.0	10.0
(4) Kyet-Pha-Hmwe-Zaung	9.4	8.8	10.1	11.1	11.6	11.8	14.9	17.5	20.2	23.9	25.9	27.9
(5) Myogon	1.1	1.7	2.4	4.1	4.9	5.4	6.4	7.3	7.8	7.8	7.8	7.8
(6) Daw Nyein	0.7	0.9	1.2	1.7	2.1	2.4	2.7	3.1	3.3	3.3	3.3	3.3
(7) Dedalu	0.8	1.8	2.9	3.4	4.0	4.6	5.2	5.9	5.9	5.9	5.9	5.9
(8) Bantbwezu	4.4	5.2	6.3	8.7	10.4	11.9	13.6	15.3	16.5	16.5	16.5	16.5
(9) Betut	18.8	18.9	20.6	21.2	21.9	22.7	26.9	30.5	35.0	39.9	44.9	48.3
(10) Alegyun	7.3	6.8	7.4	8.0	8.3	8.6	10.0	11.3	13.1	14.9	16.8	18.1
(11) Dauntgyi	5.3	5.0	5.1	7.1	9.2	10.2	15.7	17.7	20.4	23.3	26.2	28.3
Lower Delta Total	(52.8)	(55.9)	(65.1)	(76.5)	(85.3)	(92.2)	(111.9)	(127.1)	(140.7)	(154.0)	(165.8)	(174.6)
Project Paddy Total	67.9	71.3	82.2	94.1	108.1	120.4	146.6	168.9	189.1	205.8	217.6	226.4
B. Jute 1,000 lg ton												
Middle Delta Only	2.1	1.8	1.9	2.0	3.4	4.2	5.2	6.3	7.4	8.0	8.0	8.0
C. Groundnuts 1,000 lg ton												
Middle Delta Only	0.3	0.3	0.3	0.3	0.8	1.1	1.4	1.8	2.3	2.7	2.7	2.7
D. Pulses lg ton												
Middle Delta												
(1) Shwelaung	27	27	27	27	116	163	214	271	354	402	402	402
Lower Delta												
(2) Zinbaung	0	0	0	115	259	429	630	860	860	860	860	860
(3) Letpanbin	0	0	0	137	304	509	744	1,017	1,017	1,017	1,017	1,017
(4) Kyet-Pha-Hmwe-Zaung	0	0	0	0	0	0	313	708	1,179	1,731	2,358	2,833
(5) Myogon	0	0	0	88	199	331	486	663	796	796	796	796
(6) Daw Nyein	0	0	0	18	84	141	206	281	338	338	338	338
(7) Dedalu	0	0	0	80	181	301	442	603	603	603	603	603
(8) Bantbwezu	0	0	0	186	419	698	1,024	1,396	1,675	1,675	1,675	1,675
(9) Betut	0	0	0	0	0	0	545	1,226	2,044	2,998	4,088	4,906
(10) Alegyun	0	0	0	0	0	0	204	458	763	1,120	1,527	1,832
(11) Dauntgyi	0	0	0	0	0	0	319	717	1,195	1,753	2,391	2,869
Lower Delta Total	(0)	(0)	(0)	(624)	(1,446)	(2,409)	(4,913)	(7,929)	(10,470)	(12,991)	(15,653)	(17,729)
Project Pulses Total	27	27	27	651	1,562	2,572	5,127	8,200	10,824	13,393	16,055	18,131
E. Fruits & Vegetables 1,000 lg ton												
Middle Delta Only	4.0	4.2	4.3	4.5	4.8	5.1	5.6	6.0	6.4	6.4	6.4	6.4
3. Yield per ac												
A. Paddy lb/ac (approx. basket/ac)												
Middle Delta Average	1,238 (27)	1,268 (28)	1,316 (29)	1,359 (30)	1,606 (35)	1,869 (41)	2,164 (47)	2,468 (54)	2,721 (59)	2,775 (60)	2,775 (60)	2,775 (60)
Lower Delta Average	1,241 (27)	1,248 (27)	1,284 (28)	1,361 (30)	1,481 (32)	1,587 (35)	1,757 (38)	1,937 (42)	2,144 (47)	2,347 (51)	2,526 (55)	2,660 (58)
Total Project Average	1,240 (27)	1,257 (27)	1,290 (28)	1,360 (30)	1,506 (33)	1,646 (36)	1,842 (40)	2,051 (45)	2,272 (49)	2,440 (53)	2,580 (56)	2,685 (58)
B. Jute lb/ac												
Middle Delta Average	600	650	700	750	800	900	1,000	1,100	1,200	1,200	1,200	1,200
C. Groundnuts lb/ac												
Middle Delta Average	900	900	900	900	950	1,000	1,050	1,100	1,200	1,200	1,200	1,200
D. Pulses lb/ac												
Middle Delta Average	600	600	600	600	650	700	750	800	900	900	900	900
Lower Delta Average	-	-	-	608	661	749	744	793	820	863	900	900
Total Project Average	600	600	600	608	660	748	746	792	822	865	900	900
E. Fruits & Vegetables lb/ac												
Middle Delta Average	2,500	2,600	2,700	2,800	3,000	3,200	3,500	3,750	4,000	4,000	4,000	4,000

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Projected Paddy Yield by Varieties (lb/ac)

	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
A. Ngasein												
(1) Middle Delta	1,200	1,240	1,290	1,330	1,560	1,750	1,930	2,120	2,300	2,300	2,300	2,300
(2) Lower Delta	1,200	1,220	1,260	1,330	1,420	1,482	1,530	1,670	1,840	2,010	2,160	2,300
B. Medon												
(1) Middle Delta	1,300	1,330	1,380	1,430	1,610	1,820	2,060	2,280	2,500	2,500	2,500	2,500
(2) Lower Delta	1,300	1,310	1,340	1,380	1,470	1,590	1,700	1,870	2,050	2,220	2,410	2,500
C. Hnanga												
(1) Middle Delta Only	1,300	1,330	1,380	1,430	1,610	1,830	2,160	2,500	2,750	2,750	2,750	2,750
D. Wet Season HYV												
(1) Middle Delta	-	-	-	-	2,300	2,500	2,750	2,990	3,220	3,220	3,220	3,220
(2) Lower Delta	-	-	-	2,000	2,240	2,500	2,500	2,650	2,720	2,830	2,990	3,000
E. Dry Season HYV												
(1) Middle Delta Only	-	-	-	-	2,500	2,750	2,990	3,220	3,220	3,220	3,220	3,220
F. Project Average												
(1) Middle Delta	1,238	1,268	1,316	1,359	1,606	1,869	2,164	2,468	2,721	2,775	2,775	2,775
(2) Lower Delta	1,241	1,248	1,284	1,361	1,481	1,587	1,757	1,937	2,144	2,347	2,526	2,660
(3) Average	1,240	1,257	1,290	1,360	1,506	1,646	1,842	2,051	2,272	2,440	2,580	2,685

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Table 12

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Projected Fertilizer Requirement

		FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
PADDY													
A. *Ngasein*													
(1) Middle Delta													
(a) Per ac rate	lb/ac												
Urea		10	12	13	15	22	30	37	45	52	60	60	60
TSP		2	2	3	5	11	17	23	29	35	40	40	40
KCL		0	0	0	0	0	1	2	3	4	5	5	5
(b) Requirement	lg ton												
Urea		75	101	120	138	178	209	215	211	186	147	147	147
TSP		15	17	28	46	89	118	133	136	125	98	98	98
KCL		0	0	0	0	0	7	12	14	14	12	12	12
(2) Lower Delta													
(a) Per ac rate	lb/ac												
Urea		10	12	13	15	17	19	22	27	33	40	48	60
TSP		2	2	3	5	7	9	11	13	20	28	32	40
KCL		0	0	0	0	0	0	0	1	1	2	3	5
(b) Requirement	lg ton												
Urea		255	348	454	570	634	677	816	834	844	857	831	788
TSP		51	58	105	190	261	321	408	402	512	536	554	525
KCL		0	0	0	0	0	0	0	31	26	43	52	66
(3) Ngasein Total Requirement	lg ton												
Urea		330	449	574	708	812	886	1,031	1,045	1,030	1,004	978	935
TSP		66	75	133	236	350	439	541	538	637	634	652	623
KCL		0	0	0	0	0	7	12	45	40	55	64	78
B. *Medon*													
(1) Middle Delta													
(a) Per ac rate	lb/ac												
Urea		13	15	18	20	28	36	44	52	60	60	60	60
TSP		5	5	5	5	12	19	26	33	40	40	40	40
KCL		0	0	0	0	1	2	3	4	5	5	5	5
(b) Requirement	lg ton												
Urea		40	46	55	62	86	111	136	160	185	185	185	185
TSP		15	15	15	15	37	59	80	102	123	123	123	123
KCL		0	0	0	0	3	6	9	12	15	15	15	15
(2) Lower Delta													
(a) Per ac rate	lb/ac												
Urea		13	14	16	18	20	30	40	50	60	60	60	60
TSP		5	5	5	5	5	13	22	31	40	40	40	40
KCL		0	0	0	0	0	1	3	4	5	5	5	5
(b) Requirement	lg ton												
Urea		221	221	254	299	348	545	788	1,076	1,379	1,444	1,513	1,578
TSP		85	79	79	83	87	236	433	667	920	963	1,009	1,052
KCL		0	0	0	0	0	18	59	86	115	120	126	131
(3) Medon Total Requirement	lg ton												
Urea		261	267	309	361	434	636	924	1,236	1,564	1,629	1,698	1,763
TSP		100	94	94	98	124	295	513	769	1,043	1,086	1,132	1,175
KCL		0	0	0	0	3	24	68	98	130	135	141	146
C. *Hnanga*													
(1) Middle Delta Only													
(a) Per ac rate	lb/ac												
Urea		15	16	18	20	32	44	56	68	80	80	80	80
TSP		5	6	8	10	18	26	34	42	50	50	50	50
KCL		0	1	3	5	6	7	8	9	10	10	10	10
(b) Requirement	lg ton												
Urea		23	11	13	14	83	149	238	343	471	536	536	536
TSP		8	4	6	7	47	88	144	212	295	335	335	335
KCL		0	1	2	4	16	24	34	45	59	67	67	67
D. Wet Season HYV													
(1) Middle Delta													
(a) Per ac rate	lb/ac												
Urea		-	-	-	-	50	57	65	72	80	80	80	80
TSP		-	-	-	-	40	45	50	55	60	60	60	60
KCL		-	-	-	-	5	7	8	9	10	10	10	10
(b) Requirement	lg ton												
Urea		-	-	-	-	11	46	90	141	204	250	250	250
TSP		-	-	-	-	9	36	69	108	153	188	188	188
KCL		-	-	-	-	1	6	11	18	25	31	31	31
(2) Lower Delta													
(a) Per ac rate	lb/ac												
Urea		-	-	-	50	53	57	60	64	67	72	76	80
TSP		-	-	-	40	42	44	46	48	51	54	57	60
KCL		-	-	-	5	5	5	6	6	7	8	9	10
(b) Requirement	lg ton												
Urea		-	-	-	71	154	244	525	849	1,143	1,456	1,764	2,104
TSP		-	-	-	57	122	189	403	636	870	1,092	1,323	1,578
KCL		-	-	-	7	15	21	53	80	119	162	209	263
(3) Wet Season HYV Total Requirement	lg ton												
Urea		-	-	-	71	165	290	615	990	1,347	1,706	2,014	2,354
TSP		-	-	-	57	138	225	472	244	1,023	1,280	1,511	1,766
KCL		-	-	-	7	16	27	64	98	144	193	240	294

		FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988
E. Dry Season HYV													
(1) Middle Delta Only													
(a) Per ac rate	lb/ac												
Urea		-	-	-	-	50	62	75	87	100	100	100	100
TSP		-	-	-	-	40	45	50	55	60	60	60	60
KCL		-	-	-	-	5	7	8	9	10	10	10	10
(b) Requirement	lg ton												
Urea		-	-	-	-	11	50	104	171	254	313	313	313
TSP		-	-	-	-	9	36	69	108	153	188	188	188
KCL		-	-	-	-	1	6	11	18	25	31	31	31
F. PADDY TOTAL REQUIREMENT	lg ton												
(1) Middle Delta													
Urea		138	158	188	214	369	565	783	1,026	1,300	1,431	1,431	1,431
TSP		28	36	49	68	191	337	495	666	849	932	932	932
KCL		0	1	2	4	21	49	77	107	138	156	156	156
(2) Lower Delta													
Urea		476	569	708	940	1,136	1,466	2,129	2,759	3,366	3,757	4,108	4,470
TSP		136	137	184	330	470	805	1,244	1,705	2,302	2,591	2,886	3,155
KCL		0	0	0	7	15	39	112	197	260	325	402	460
(3) Total													
Urea		614	727	896	1,154	1,505	2,031	2,912	3,785	4,666	5,188	5,539	5,901
TSP		164	173	233	398	661	1,142	1,733	2,371	3,151	3,523	3,818	4,087
KCL		0	1	2	11	36	88	189	304	398	481	558	616
JUTE													
(1) Middle Delta Only													
(a) Per ac rate	lb/ac												
Urea		56	63	70	84	98	112	126	140	154	168	168	168
TSP		28	29	30	33	36	40	44	48	52	56	56	56
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(b) Requirement	lg ton												
Urea		200	172	191	229	411	525	653	800	956	1,125	1,125	1,125
TSP		100	79	82	90	151	188	228	274	323	375	375	375
KCL		0	0	0	0	0	0	0	0	0	0	0	0
GROUNDNUTS													
(1) Middle Delta Only													
(a) Per ac rate	lb/ac												
Urea		5	6	7	8	9	10	17	24	30	30	30	30
TSP		7	8	9	11	13	15	23	31	40	40	40	40
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(b) Requirement	lg ton												
Urea		2	2	3	3	7	11	24	40	59	67	67	67
TSP		3	3	3	4	10	16	32	51	79	89	89	89
KCL		0	0	0	0	0	0	0	0	0	0	0	0
PULSES													
(1) Middle Delta													
(a) Per ac rate	lb/ac												
Urea		0	0	0	0	0	0	7	14	20	20	20	20
TSP		0	0	0	0	0	0	10	20	30	30	30	30
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(b) Requirement	lg ton												
Urea		0	0	0	0	0	0	2	5	8	9	9	9
TSP		0	0	0	0	0	0	3	7	12	13	13	13
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(2) Lower Delta													
(a) Per ac rate	lb/ac												
Urea		0	0	0	3	3	3	6	9	12	16	20	20
TSP		0	0	0	5	5	5	10	15	20	25	30	30
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(b) Requirement	lg ton												
Urea		0	0	0	3	7	10	40	90	153	241	348	394
TSP		0	0	0	5	11	16	66	150	255	376	522	591
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(3) Pulses Total Requirement	lg ton												
Urea		0	0	0	3	7	10	42	95	161	250	357	403
TSP		0	0	0	5	11	16	69	157	267	389	535	604
KCL		0	0	0	0	0	0	0	0	0	0	0	0
FRUITS & VEGETABLES													
(1) Middle Delta Only													
(a) Per ac rate	lb/ac												
Urea		50	53	56	60	68	76	84	92	100	100	100	100
TSP		0	5	10	15	22	29	36	43	50	50	50	50
KCL		0	0	0	0	0	0	0	0	0	0	0	0
(b) Requirement	lg ton												
Urea		80	85	90	96	109	122	135	148	161	161	161	161
TSP		0	8	16	24	35	47	58	69	80	80	80	80
KCL		0	0	0	0	0	0	0	0	0	0	0	0
PROJECT TOTAL REQUIREMENT	lg ton												
(1) Middle Delta													
Urea		420	308	472	542	896	1,223	1,602	2,019	2,484	2,793	2,793	2,793
TSP		131	126	150	186	387	588	816	1,067	1,343	1,489	1,489	1,489
KCL		0	1	2	4	21	49	77	107	138	156	156	156
Sub-total		(551)	(435)	(624)	(732)	(1,304)	(1,860)	(2,495)	(3,193)	(3,965)	(4,438)	(4,438)	(4,438)
(2) Lower Delta													
Urea		476	569	708	943	1,143	1,476	2,169	2,849	3,519	3,998	4,456	4,864
TSP		136	137	184	335	481	821	1,310	1,855	2,557	2,967	3,408	3,746
KCL		0	0	0	0	15	39	112	197	260	325	402	460
Sub-total		(612)	(706)	(892)	(1,278)	(1,639)	(2,336)	(3,591)	(4,901)	(6,336)	(7,290)	(8,266)	(9,070)
(3) GRAND TOTAL													
Urea		896	877	1,180	1,485	2,039	2,699	3,771	4,868	6,003	6,791	7,249	7,657
TSP		267	263	334	521	868	1,409	2,126	2,922	3,900	4,456	4,897	5,235
KCL		0	1	2	4	36	88	189	304	398	481	558	616
Total		(1,163)	(1,141)	(1,516)	(2,010)	(2,943)	(4,196)	(6,086)	(8,094)	(10,301)	(11,728)	(12,704)	(13,508)

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Cropped Areas, Yields and Production

Crops	Present			Future without Project			Future with Project		
	Area (1,000 ac)	Yield lb/ac	Production (1,000 tons)	Area (1,000 ac)	Yield lb/ac	Production (1,000 tons)	Area (1,000 ac)	Yield lb/ac	Production (1,000 tons)
I. Lower Delta (Coastal)									
1. Rice (Paddy)									
Wet season Ngasein	57.2	1200	30.6	57.2	1300	33.2	29.4	2300	30.2
Wet season Medon 1/	38.1	1300	22.1	38.1	1400	33.8	58.8	2500	65.6
Wet season HYV	-	-	-	-	-	-	58.8	3000	78.8
Total Paddy	95.3		52.7	95.3		57.0	147.0		174.6
2. Other Crops									
Pulses	-	-	-	-	-	-	44.1	900	17.7
3. Total All Crops	95.3			95.3			191.1		
4. Net Cultivated Area	95.3			95.3			147.0		
5. Cropping Int4nsity	100%			100%			130%		
II. Middle Delta									
1. Rice (Paddy)									
Wet season Ngasein	16.9	1200	9.1	16.9	1300	9.8	5.5	2300	5.6
Wet season Medon 1/	6.9	1300	4.0	6.9	1400	4.3	6.9	2500	7.7
Wet season Hnanga	3.5	1300	2.0	3.5	1400	2.2	15.0	2750	18.4
Wet season HYV	-		-	-	-	-	7.0	3200	10.1
Dry season HYV	-		-	2.0	2500	2.2	7.0	3200	10.1
Total Paddy	27.3		15.1	29.3		18.5	41.4		51.9
2. Other Crops									
Jute	8.0	600	2.1	8.0	700	2.5	15.0	1200	8.0
Groundnuts	0.8	900	0.3	0.8	1000	0.4	5.0	1200	2.7
Pulses	0.1	600	-	0.1	700	-	1.0	900	0.4
Fruits & Vegetables	3.6	2500	4.0	3.6	2500	4.0	3.6	4000	6.4
Total Other Crops	12.5			12.5			24.2		
3. Total All Crops	39.8			41.8			66.5		
4. Net Cultivated Area	32.5			32.5			38.0		
5. Cropping Intensity	122%			129%			174%		
III. Total Lower & Middle Delta									
Rice (paddy)	122.6		67.8	122.6		75.5	188.4		226.5
Other Crops									
Jute	8.0		2.1	8.0		2.5	15.0		8.0
Groundnuts	0.8		0.3	0.8		0.4	5.0		2.7
Pulses	0.1		-	0.1		-	45.1		18.1
Others	3.6		4.0	3.6		4.0	3.6		6.4
Total all crop	135.1			137.1			256.7		
Net cultivated area	127.8			127.8			185.0		
Cropping Intensity	106%			107%			134.0		

1/ Includes Ngakywe 50% & ordinary Medon 50%

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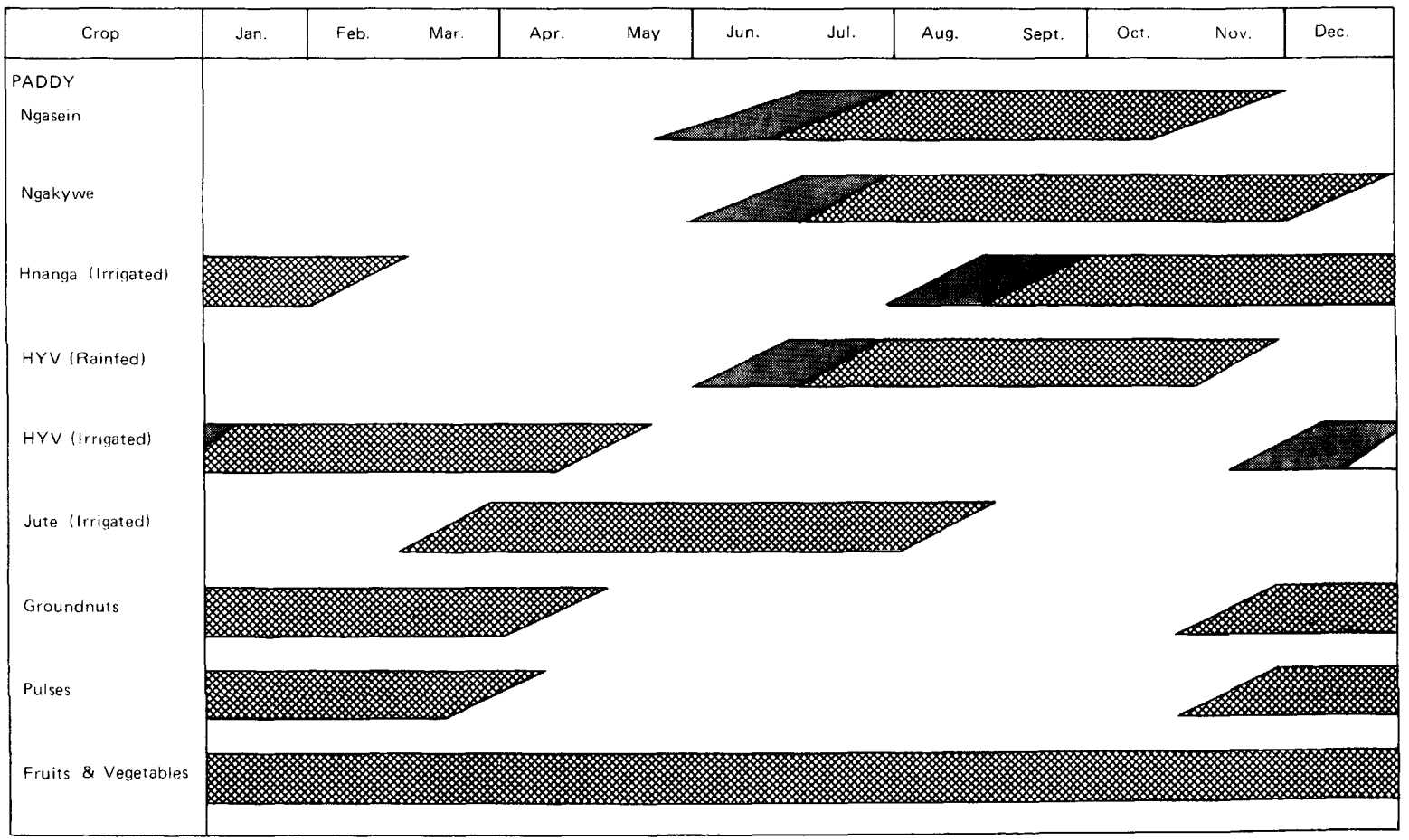
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
Cropping Calendar



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BURMA

LOWER BURMA PADDY LAND DEVELOPMENT PROJECT

Project Civil Works

General

1. The Irrigation Department (ID), which would have overall project responsibility (Annex 12), would construct one polder in the middle delta and ten separate polders in the lower delta (Maps 12016 and 12017). The civil works would include approximately the following:

(a) 410 mi of earth embankments involving 11.4 M cu yds of earthwork;

(b) 770 mi of interior drainage channel enlargement and new excavation, totalling 11.6 M cu yds of earthwork;

(c) 90 concrete pipe drainage culverts (4 ft diameter), each with one flap gate;

(d) 45 reinforced concrete drainage sluice structures varying in width from 15 ft to 150 ft, each with a number of standard-sized openings with flap gates fitted on the river side and slide gates on the inland side;

(e) 20 timber bridges for bullock carts and 180 ft crossings on interior channels;

(f) ten masonry and reinforced concrete channel regulators in Shwelaung Island to control water levels for lift irrigation;

(g) buildings for the offices, staff quarters, and stores for construction operation and maintenance forces;

2. In addition, the Agricultural Corporation (AC) and the Agriculture Mechanization Department (AMD) would construct the following agricultural support facilities (Annex 6):

(i) four fertilizer storage godowns;

(ii) one middle delta tractor workshop and six lower delta power tiller workshops.

3. These works are described below and the estimated quantities for each polder are given in Table 1.

Status of Engineering

4. The ID civil works designs and estimates for this Appraisal Report are based on one inch to one mile maps, existing aerial photographs and sample surveys in Shwelaung middle delta island and the lower delta islands of Zinbaung and Letpanbin (Maps 12016 and 12017). The lower delta islands are most closely represented by Letpanbin conditions. In the design of embankment crest heights and drainage sluices for Shwelaung Island, ID used flood levels based on analysis of 30 years daily stage records at one gauge and hourly records from July through October 1975 at eight gauge points around the island. The ID based flood levels for lower delta polder designs on analysis of long-term coastal tide records and hourly records during the 1975 flood period at seven gauge points in the vicinity.

5. The ID Planning and Design Division would complete surveys and topographic mapping for all 11 polders and planning for eight lower delta polders. It would prepare final designs and cost estimates prior to construction in each polder. The ID would continue to take river stage records year round for Shwelaung Island during construction for use in the final sluice designs and for preparing drainage and irrigation operating requirements at each location. Two ID project construction divisions would prepare the construction programs and set embankment and drain alignments (Annex 12).

Embankments

6. Earth embankments would be constructed and existing embankments rebuilt to provide 3 ft freeboard over river flood levels based on a one-in-ten years frequency for the middle delta polder and the Highest High Water Level (HHWI) for the lower delta polders. Embankment crest heights would range from 5 to 10 ft, averaging about 8 ft on Shwelaung and about 6 ft in the lower delta. All embankments would have 6 ft wide crests, 10 ft wide access roadways and 2.5 to 1 side slopes. The roadways would run about 3 ft below and on the inland side of the crest to provide the most efficient and stable embankment section. Earth fill would be excavated at a minimum of 40 ft from the inland embankment toe and in most places the borrow pits would be used as perimeter drainage channels. Embankments and perimeter drains would range from 120 to 150 ft wide and overall, would occupy 6,000 to 7,000 ac or about 4% of the culturable land.

7. Apart from the embankment fronting Shwelaung town, river banks in the middle and lower delta appear comparatively stable. Because the existing embankment at Shwelaung town would require about 3.4 mi of special revetment works with which there has been little successful experience in Burma, the project would construct a new embankment located on the inland side of town.

Drainage Channels

8. Existing interior channels would be enlarged, realigned and, when necessary, new drainage channels excavated so as to lower interior water levels below the fields within 72 hours following a three day rainstorm of six inches (50% frequency) when river tidal levels at sluice outlets permit discharge at least 50% of the time. This corresponds to a channel design capacity based on about 53 cfs per sq mi of drainage area. Channel depths and dimensions would vary depending on the relative river tidal levels and land elevations as well as on drainage catchment areas. In Shwelaung polder, the river tidal levels would govern the extent to which interior depressed areas could be drained. Excavation, averaging about 15,000 cu yd per channel mi, would include deepening and widening existing channels as well as cutting new channels. Additional land rights of way would amount to less than 2% of the cultivable area.

Drainage Control Structures

9 Outlet control culverts and sluices would be provide where the polder embankments cross key drain outlets. Single 4 ft diameter concrete pipe culverts fitted with a steel flap gate on the river side would be provided at small channels. Reinforced concrete sluice structures with varying numbers of standard-sized gated openings would be provided across large channels. Gate openings would be 4 ft by 7 ft for Shwelaung sluices and 4 ft by 5 ft for lower delta sluices. Each would be fitted with a steel flap gate on the river side and a steel slide gate on the inland side for both drainage and irrigation supply. The structures would include concrete and masonry wing walls, stone-pitched aprons, and where necessary, upstream and downstreams sheetpiling.

10. Channel Regulators. On Shwelaung Island, to regulate the impounded water levels in the interior channels and thus to provide a reservoir for dry season small-pump irrigation supply, check structures would be provided at appropriate watershed points. These would be masonry and reinforced concrete structures fitted with slide gates which would be left open during the monsoon season.

11. Channel Crossings. Crossings for bullock carts and individuals would be provided where required over the perimeter and main drainage channels. Cart crossing would consist of timber bridges arched to permit channel boat traffic. Foot path crossings would consist of small pipe culverts at some drainage channels and high bamboo bridges where boat traffic would pass. The estimated numbers of crossings are based on an average of one bridge per 10,000 ac and one foot crossing per 1,000 ac.

Buildings

12. The project would provide housing and stores for operation and maintenance staff, additional AMD repair workshops, and additional facilities for AC fertilizer distribution points. The O & M buildings would be at five locations (Letpanbin, Dedalu, Alegyun, Dauntgyi and Shwelaung) and would include at each location quarters for officers, staff, and wage labor, an office and a storehouse. These would serve all the polders except Bantbwezu where an O & M unit exists. The proposed buildings are described in Annex 12, Table 4. The additional AMD and AC facilities are described in Annex 6, Tables 1 and 5.

Construction

13. The civil works would be scattered over 11 islands spanning over a distance of 1,200 mi and would be comprised mainly of earthwork (embankments and drains). The drainage sluices and project buildings would be small and simple structures. All these works would be subject to seasonal weather interruption (with 80 inches of rain during rainy season) and would have to be phased so as to cause the least interruption to cultivation. Under these circumstances they would not be suitable for international competitive bidding. The ID would carry them out by force account as they traditionally do, as there is no appropriate contracting industry in Burma. These works are not new to ID; they have had extensive experience in designing and constructing them for several decades.

14. The ID Mechanical Division of about 100 men and operators would use heavy equipment, to be provided by the project for the embankment construction (primarily the draglines and scrapers) and the channel excavation (draglines and existing dredges). The ID would carry out the work each year over the 7 to 8 month dry period from November to June, operating the equipment about 16 hours per day. Two ID project construction divisions of 120 men each, including 15 headquarters staff, 75 field staff, and 30 maintenance staff, would coordinate the construcion program and complete the structures and O & M buildings (Annex 12).

15. Construction of the flood control and drainage facilities for the 11 islands would span over six years, with three islands completed in Year Two, three in Year Three, one in Year Four, and four in Year Six, as detailed in Fig. 1.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Works

Approximate Construction Quantities

Polder	Gross Area	Embankments		Drainage Channels		Sluices		Culverts	Regulators	Crossings[2]		O & M Building Complexes[3]	Land Clearing[4]		
	(000 ac)	(miles)	(000 cu yds)	(miles)	(000 cu yds)	(no.)	(no. openings)	(no.)	(no.)	foot (no.)	cart (no.)	(no.)	by Farmers (000 ac)	by Project (000 ac)	in Total (000 ac)
Lower Delta															
Zinbaung[1]	8.0	15	210	35	400	3	17	3	0	8	0		1.4	1.5	2.9
Letpanbin[1]	14.4	20	490	47	490	3	16	4	0	14	1	1	2.1	2.1	4.2
Kyet-Pha-Hmwe-Zaung	30.0	40	1,040	97	1,050	6	33	9	0	30	3		3.8	3.8	7.6
Myogon	9.3	18	470	30	320	2	10	5	0	10	1		2.4	2.4	4.8
Daw Nyein	3.2	16	420	10	110	1	4	4	0	3	0		.8	.8	1.6
Dedalu	8.4	25	650	27	290	2	9	6	0	8	0	1	1.8	1.8	3.6
Bantbwezu	16.0	20	520	44	470	3	15	5	0	14	1		3.2	3.2	6.4
Betut	54.1	88	2,280	176	1,890	10	60	21	0	55	5		4.3	4.4	8.7
Alegyun	19.5	55	1,430	63	580	4	22	14	0	20	2	1	1.4	1.5	2.9
Dauntgyi	25.5	60	1,560	83	890	5	28	17	0	25	3	1	7.4	7.4	14.8
Subtotal, Lower Delta	188.4	357	9,070	612	6,490	39	214	88	0	187	16	4	28.6	28.9	57.5
Middle Delta															
Shwelaung[1]	59.0	53	2,330	158	5,110	6	61	5	11	60	6	1	3.7	3.7	7.4
Total Project	247.4	410	11,400	770	11,600	45	275	93	11	247	22	5	32.3	32.6	64.9

1/ Estimates for these polders are based on preliminary surveys and engineering layouts. Estimates for the remaining polders are extrapolated on the basis of area and perimeter of each island.

2/ Estimates for all polders are based on 1 cart crossing per 10,000 ac and 1 foot crossing per 1,000 ac.

3/ See Annex 15.

4/ See Annex 2.

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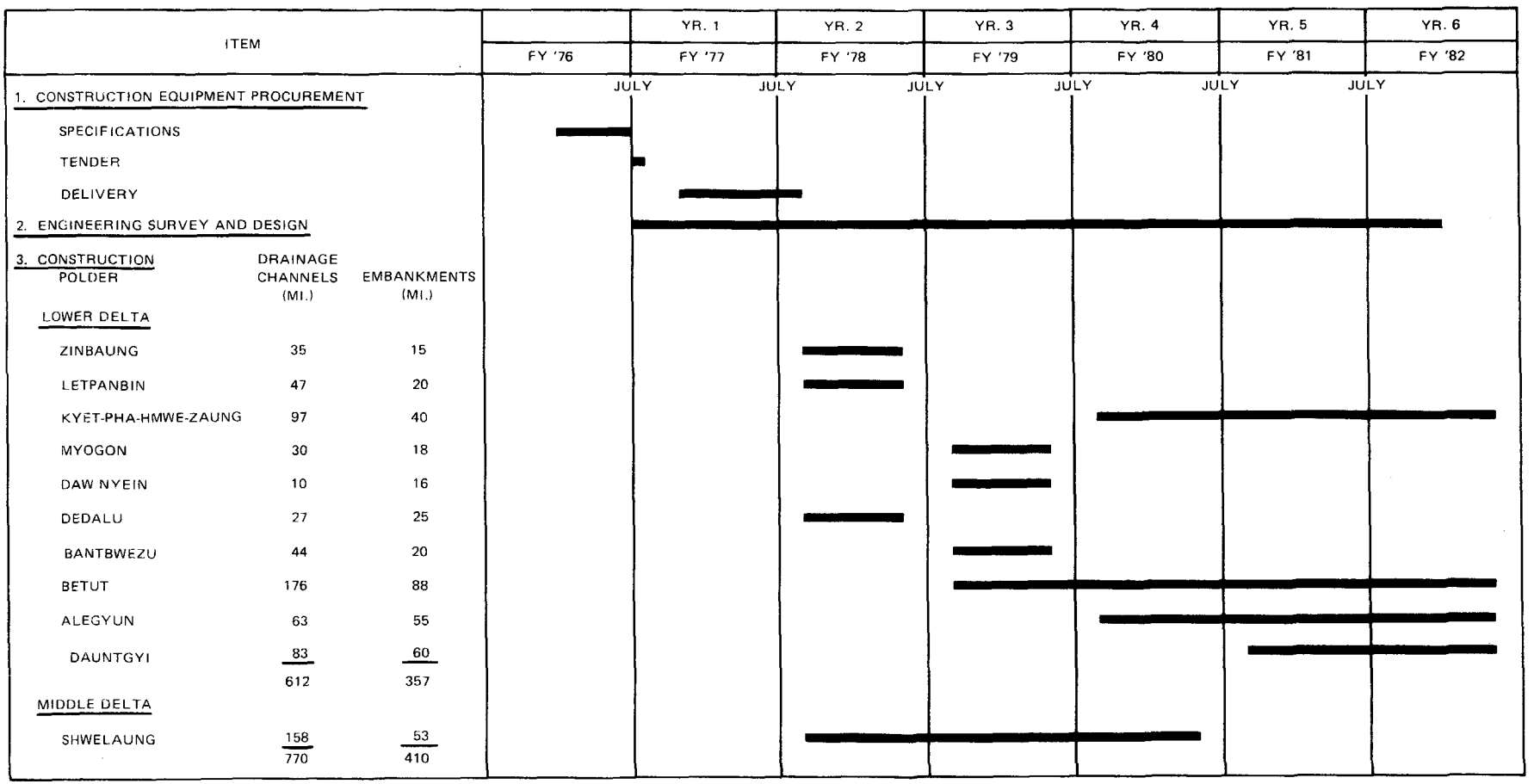
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
CIVIL WORKS CONSTRUCTION SCHEDULE



ANNEX 3
Figure 1

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BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Land Reclamation and Settlement of Landless Families

General

1. The project would develop a total of 185,000 ac of land, comprising 120,000 ac presently cultivated and reclamation of 64,900 ac of abandoned land. These abandoned lands are now under various types of vegetation (Table 1). In the middle delta Shwelaung, land clearing of standing vegetation would be followed by an initial tractor plowing/harrowing. In the lower delta polders, the soils after land clearing are too soft and boggy for use of tractors. For two years, farmers would broadcast paddy between tree stumps without land preparation.

2. The lands were abandoned initially during the Second World War, and subsequently due to change in land tenancy system and local insurgencies. The physical cause was mainly the breakdown of the old embankments. Precisely how much abandoned land can be put back into production before and how much (the low lands) can return to production only after the project embankment construction is completed and the depression drained can be ascertained only after surveys are made. For planning purposes, it has been assumed that about 50% of the abandoned land can be reclaimed before completion of project construction, and the allottees could sow paddy immediately after the land is cleared. On the other 50%, farmers would not be able to grow crops before the project construction is completed, even if the land is cleared, because the deep flood (Shwelaung) or the salinity (lower delta) would still prohibit crop growth.

Land Clearing and Reclamation

3. Grass -- Some abandoned land in Shwelaung has only common short grasses (Table 1). The grass would be burned, and the land plowed up and harrowed by 50 hp tractors. Tall Kaing grass (Saccharum arundinaceum and/or S. spontaneum) also occurs only in Shwelaung. Ten man-days per acre are estimated to be required for clearing the land. The traditional way is for an average family of five (two farm workers) to cut the Kaing, with long blade knives, dip up stump by picks, plow and plant one acre of paddy per year. In the meantime, the family workers seek outside work and fish to sustain the family until enough land is developed. Under the project, each family would be allotted 10 ac. Family labor would be used to clear 5 ac each year for two years, while the initial uprooting, disc plowing and harrowing would be done by tractors provided by the project. This would enable the family to grow 5 ac of land in the first year and have enough time to earn some income from outside work until the first harvest.

4. Kyu/Kyaya -- are stiff bamboo-like plants which occur in both the middle and lower deltas. Some 18 man-days per ac are required to clear them. In Shwelaung, the land would be plowed and harrowed by tractors after land clearing by hand tools. In lower delta polders, the farmers would be able to broadcast directly on the soft land.

5. Mangrove (Heritiara, fomes, Cariops, roxburgluaira, Avicenning Officinalis, Kandelia, rheedii, etc.) -- occurs in all lower delta polders. Light mangrove has trees of 4 inches to 6 inches in diameter; 20 man-days per ac are required to clear them. Medium mangrove has trees of up to six inches to 12 inches in diameter; 24 man-days are required to clear the land, and power chain saws would be needed to cut down the bigger trees. Heavy mangrove has trees over 1 ft in diameter; 32 man-days are required to clear the land. The tree stumps would be left in the ground. The soil would be boggy. Farmers would broadcast paddy between the stumps. In about two years, the roots/stumps would be totally rotten, the soil would firm-up, and regular improved farming practice could then begin.

Phasing of Land Reclamation

6. Land reclamation and land allotment to displaced and landless families would be phased (Table 2) according to the construction schedule of the flood control structures (embankment, drains and sluice gates) for each project polder:

a. Each family would be allotted a 10 ac tract of land, on an average basis of five members in a family, including two adult farm workers.

b. Sufficient families would move onto 50% of the land to be reclaimed one year before or in the first year of project construction. They would be allotted as far as possible land easiest to clear, and would clear the land mainly by family labor, over two or three years.

c. Another group of families would be allotted on the remaining 50% of the land in the year immediately following the completion of project construction. They would finish clearing 10 ac of land in one year, using family labor as much as possible, but would be supplemented by project hired labor and chain saws for felling large mangrove trees. The force-account labor operation would be used.

d. In Shwelaung, initial plowing and harrowing would be done by tractor service to be provided by AMD. In all lower delta polders, farmers would broadcast paddy directly on the cleared land between stumps.

Tool and Equipment Requirement

7. Based on the different types of vegetation to be cleared, quantities of different tools and equipment needed for land reclamation are estimated for each polder and phased over the development period. Table 3 summarizes the requirements and costs for the project as a whole.

Land Allotment

8. Categories of Settlers. Each township has already a name list of "landless families and families with insufficient land." But because the lack of protection against flood and of other forms of support, the land allotment and reclamation has been on a piecemeal basis and gone at a slow pace. Under the project, the work could be speeded up. There would be three main categories of allottees in descending order of allotment priority:

a. Farmers whose land would be occupied by project construction, i.e., the embankments and drain widening, would be given first priority in allotment of the reclaimed land. Exact numbers of families included in this category cannot be estimated until the Irrigation Department has finalized the embankment alignment for each polder. A farmer with most of his land affected should have no choice but to move, while another with only a small portion of his land affected may select to stay.

b. Families with no land or insufficient land whose names are on the township list would have the second priority.

c. Retired soldiers form a small third category. When all categories of allottees are allotted land the remaining land would be allotted to families of retired soldiers. Applicants would be selected from those who participated in the force account mangroves clearing in the project.

9. Procedure of Land Allotment and Settlement. Some nine agencies would participate in this operation as follows:

a. The Irrigation Department would complete its engineering survey and design, and determine the embankments and drainage canal alignments in the field, one year prior to the start of construction.

b. Settlement and Land Records Department (SLRD) would conduct a field survey to determine exactly on the kwin (cadastral) maps the plots which would be affected by the construction alignments. Affected farmers would be informed one crop season before construction and evacuation would take place in the dry season after harvest to avoid loss of the standing crop. Farmers would be given an

option on whether to move, because land next to embankment may be the most valuable. In Shwelaung, for example, such land could grow two crops of HYV with pump irrigation or jute followed by Hnanga rice. A list of evacuees would be finalized by SLRD after consultation with all affected farmers.

c. SLRD, assisted by the Survey Department and using the kwin maps would: (1) survey the abandoned and wasteland and demarcate lands which could be reclaimed and cultivated before and after the project construction is completed; (2) prepare a field alignment map of 10 ac plots showing also the drainage channels and necessary farm roads; (3) stake out the plot boundaries in the field; and (4) when all lands are allocated, prepare new cadastral records and kwin maps.

d. The Agricultural Machinery Department would place orders for imported equipment (tractors and chain saws) for arrival at project sites before the commencement of the dry season (Table 2). The Cooperative Department would place orders from local manufacturers for hand tools for arrival in their local Village Tract Stores before the dry season.

e. The Village Land Committee, would finalize a list of land allotment, based on: (1) area of land and number of plots available for settlement as determined by SLRD and the Survey Department, and (2) the list of displaced families mentioned in b. above and its own list of landless families and families having insufficient land.

The committee would call meetings of the settlers to inform them of the following:

(1) the plot number allotted to each of them;

(2) the availability of tools and selling prices at the local Village Tract Cooperative Stores;

(3) the availability of chain saws for rental from the AMD Tractor Station or workshop and the rental charge and service arrangment (Annex 6);

(4) the availability of tractor service from the Shwelaung AMD Tractor Station for initial plowing and harrowing of the reclaimed land and service charge (Annex 6);

(5) the availability and terms and conditions of medium-term credit from the local village banks for the settlers to buy the hand tools, draft animals, and to pay the chain saw rental and tractor service charges as well as to buy material for building field huts (Annex 10);

(6) the availability and terms and conditions of short-term seasonal production credit at the local village banks (Annex 10);

(7) the availability and selling price of paddy seeds at the local Agricultural Corporation Village Tract Stores for those who need them (Annex 6).

f. The Burma Agricultural Bank would have medium- and short-term credit available at the local village banks for the settlers (Annex 10).

g. The Extension Service of the Agricultural Corporation would prepare and promote a special extension information package for advising settlers on farming the newly reclaimed land (Annex 5).

h. The People's Settlement Department would organize the force account land clearing operations in other polders (para 6 c) in coordination with ID and AMD. It would also administer the settlement of families of retired soldier in the Dauntgyi polder.

i. The various activities mentioned in a-g would be coordinated by the Project Unit at the Central level and by a Township Project Committee at the Township level (Annex 11). Each township committee member would conduct his own activities and meet farmers' requests for services, supplies, equipment and credit according to guidelines laid down by the Project Unit, but report to the committee for coordination.

Compensation and Rural Infrastructure

10. Since the land belongs to the State, no land compensation would be paid to those farmers who would be obliged to evacuate from their present land for the construction of embankments and drainage channels. Nor would there be compensation for the standing crops, because as mentioned in para 9 b evacuation would be made after the rice harvest.

11. Geographically and administratively the abandoned lands form parts of the different surrounding villages and village tracts. The great majority of the residential village houses are built around the edge of the islands, and mostly of woven unplastered bamboo panels hitched to wooden posts, thatched roofs and bamboo-mat floor. Better houses would have metal sheet roofing, and flooring of loose put-on wood boards. Farms are in the polder. During the rainy season, the men would live in simple field houses built on their farms. The displaced farmers and landless families, already have their residential houses in the villages. When allotted land, they do not need to move their houses. They only need to build a field house by themselves (as they always do) with locally available material. Neither would new rural infrastructure be involved, because their children would be attending the same schools and family members would be going to the same clinics in the village tracts where they belong. In the few cases where the farmers must move their house, i.e. because of the embankment construction, they would simply dismantle the houses and rebuild them on land nearby. For the above reasons, no special rural infrastructure constructions are provided under the project.

12. Allottees, however, would be provided with medium-term credit for purchasing tools and rubber boots needed for land clearing, material for building a field hut, and for paying chain saw rentals and tractor service charges (para 9e).

Cost Estimates for Land Reclamation

13. The total cost of land reclamation is estimated to be K 6.8 million (Table 4).

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LAND RECLAMATION

Type of Vegetation to be Cleared

Project polder	Township	Type of Vegetation (1,000 ac)						Total
		Light		Medium		Heavy		
		Grass	Kaing grass	Khu & Khaya grass	Light mangrove	Medium mangrove	Heavy mangrove	
MIDDLE DELTA								
Shwelaung	Wakema	4.2	2.2	1.0	-	-	-	7.4
LOWER DELTA								
Zinbaung	Pyapon	-	-	1.4	0.5	0.6	0.4	2.9
Letpanbin	"	-	-	2.1	0.9	0.7	0.5	4.2
Kyet-Pha-Hmwe-Zaung	"	-	-	3.1	1.4	1.9	1.2	7.6
Myogon	"	-	-	2.5	1.0	0.8	0.5	4.8
Daw Nyein	"	-	-	0.9	0.3	0.3	0.1	1.6
Dedalu	"	-	-	1.9	0.8	0.6	0.3	3.6
Bantbwezu	"	-	-	3.3	1.3	1.2	0.6	6.4
Betut	Laputta	-	-	3.6	1.6	2.2	1.3	8.7
Alegyun	Ngapudaw	-	-	1.6	0.6	0.5	0.2	2.9
Dauntgyi	Bogale	-	-	3.9	4.8	3.8	2.3	14.8
Total		4.2	2.2	25.3	13.2	12.6	7.4	64.9

Source: Project Preparation Unit, Ministry of Agriculture and Forests, November, 1975.

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Land Reclamation

Phasing of Reclamation Settlement and Hired Labor Requirement for Reclamation

Polder	Township	Total	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983
MIDDLE DELTA									
SHWELAUNG	WAKEMA			(----------	----------	----------	)		
1. Area (ac)		7,400	-	1,850	1,850	-	3,700	-	-
2. Family (no)		740	-	370	-	-	370	-	-
3. Hired labor (manday)		0	-	0	0	-	0	-	-
LOWER DELTA									
ZINBAUNG	PYAPON			(-------	)				
1. Area (ac)		2,900	-	1,450	1,450	-	-	-	-
2. Family (no)		290	-	145	145	-	-	-	-
3. Hired labor (manday)		14,300	-	600	13,700	-	-	-	-
LETPANBIN	PYAPON			(-------	)				
1. Area (ac)		4,200	-	2,100	2,100	-	-	-	-
2. Family (no)		420	-	255	165	-	-	-	-
3. Hired labor (manday)		13,000	-	900	12,100	-	-	-	-
KYET-PHA-HMWE-ZAUNG	PYAPON					(----------	----------	)	
1. Area (ac)		7,600	-	-	1,900	1,900	-	-	3,800
2. Family (no)		760	-	-	380	-	-	-	380
3. Hired labor (manday)		29,700	-	-	-	-	-	-	29,700
MYOGON	PYAPON				(-------	)			
1. Area (ac)		4,800	-	1,200	1,200	2,400	-	-	-
2. Family (no)		480	-	240	-	240	-	-	-
3. Hired labor (manday)		13,800	-	-	-	13,800	-	-	-
DAW NYEIN	PYAPON				(-------	)			
1. Area (ac)		1,600	-	400	400	800	-	-	-
2. Family (no)		160	-	80	-	80	-	-	-
3. Hired labor (manday)		3,800	-	-	-	3,800	-	-	-
DEDALU	PYAPON			(-------	)				
1. Area (ac)		3,600	-	1,800	1,800	-	-	-	-
2. Family (no)		360	-	180	180	-	-	-	-
3. Hired labor (manday)		9,400	-	-	9,400	-	-	-	-
BANTBWEZU	PYAPON				(-------	)			
1. Area (ac)		6,400	-	1,600	1,600	3,200	-	-	-
2. Family (no)		640	-	320	-	320	-	-	-
3. Hired labor (manday)		18,200	-	-	-	18,200	-	-	-
BETUT	LAPUTTA				(----------	----------	----------	)	
1. Area (ac)		8,700	-	2,200	2,150	-	-	-	4,350
2. Family (no)		870	-	435	-	-	-	-	435
3. Hired labor (manday)		33,100	-	-	-	-	-	-	33,100
ALEGYUN	NGAPUDAW					(----------	----------	)	
1. Area (ac)		2,900	-	-	725	725	-	-	1,450
2. Family (no)		290	-	-	145	-	-	-	145
3. Hired labor (manday)		7,000	-	-	-	-	-	-	7,000
DAUNTGYI	(BOGALE)						(----------	----------	)
1. Area (ac)		14,800	-	-	-	3,150	3,150	1,100	7,400
2. Family (no)		1,480	-	-	-	740	-	-	740
3. Hired labor (manday)		57,600	-	-	-	-	-	-	57,600
TOTAL PROJECT									
1. AREA (ac)		64,900	-	12,600	15,175	12,175	6,850	1,100	17,000
2. FAMILY (no)		6,490	-	2,025	1,015	1,380	370	-	1,700
3. HIRED LABOR (manday)		199,900	-	1,500	35,200	35,800	-	-	127,400

(----------) Construction schedule, Irrigation Department.

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Tools and Equipment Required For Reclaiming Abandoned Land (Total of 11 Polders)

			TOTAL	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983
1.	Long blade knife	(Dah)	6,070		2,195	1,375	640	160		1,700
	@ K 15	(1,000 K)	(91)		(33)	(21)	(10)	(2)		(25)
2.	Pick axe (Tayun)		2,885		2,005	690	30	160		-
	@ K 30	(1,000 K)	(87)		(60)	(21)	(1)	(5)		(-)
3.	Axe		1,850		45	345	344	-		1,116
	@ K 30	(1,000 K)	(56)		(1)	(11)	(11)	(-)		(33)
4.	Hand saw		480		-	66	94	-		320
	@ K 500	(1,000 K)	(240)		(-)	(33)	(47)	(-)		(160)
5.	Fork		1,104		317	232	126	-		429
	@ K 20	(1,000 K)	(22)		(6)	(5)	(3)	(-)		(8)
6.	Motorized chain saw		400		-	69	75	-		256
	@ K 3,250 1/	(1,000 K)	(1,300)		(-)	(224)	(244)	(-)		(832)
7.	Rubber boots	(pair)	13,266		4,460	2,772	1,382	380		4,272
	@ K 30	(1,000 K)	(398)		(134)	(83)	(42)	(11)		(128)
8.	50 hp wheel tractor		24		12	-	-	12		-
	@ K 82,700 2/	(1,000 K)	(1,985)		(992)	(-)	(-)	(993)		(-)
Total tools/equipment		(1,000 K)	(4,179)		(1,226)	(398)	(358)	(1,011)		(1,186)

1/ @ US$400 per saw, plus 25% spares = US$500 CIF Rangoon = K 3,250.

2/ @ US$6,500 per tractor, plus 25% spares = US$8,125 CIF Rangoon = K 52,800
@ US$2,000 per disc plow, plus 15% spares = US$2,300 CIF Rangoon = K 14,950
@ US$2,000 per disc harrow, plus 15% spares = US$2,300 CIF Rangoon K 14,950
Sub-total, one tractor, one plow, one harrow = K 82,700

ANNEX 7
Table 3

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Estimated Cost of Land Reclamation
(K 1,000)

		Total	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983
Tools & equipment									
Local procurement cost		894		234	174	114	18		354
CIF import cost		3,285		992	224	244	993		832
Total procurement cost 1/		4,179		1,226	398	358	1,011		1,186
Hired labor cost									
1,000 man-days		199.9		1.5	35.2	35.8	-	-	127.4
@ K 8	1,000 K	1,599		12	282	286	-	-	1,019
Administrative cost									
Area	ac	64,900		12,600	15,175	12,175	6,850	1,100	17,000
@ K 15/ac 2/	1,000 K	974		189	227	183	103	17	255
Total 1/		6,752		1,427	907	827	1,114	17	2,460
Local cost		3,467		435	683	583	121	17	1,628
Foreign Exchange cost		3,285		992	224	244	993	-	832

1/ Before taxes, duties, physical and price contingencies, and local handling and transportation.

2/ For work done under para 9, b. c. and e.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Intensified Extension Program

General

1. The present low average crop yields in the project area (lower than the national and District average) are due mainly to the uncontrollable flood depth and salt water intrusion. Removal of adversities by the project construction would be accompanied by introduction of improved cultural practices, HYV and increased double cropping, through an intensified extension program. The 11 project islands are located in five townships, one each in Wakema (middle delta); Laputta, Ngapudaw and Bogale (lower delta); and seven in Pyapon (lower Delta). The GOB has agreed that the new extension system to be adopted under this project would cover not only the project polders but the entire five townships totalling 862,500 cultivated acres and 105,000 farm families (Table 1).

Present Organization

2. Agricultural Extension in Burma headed by a General Manager (GM) Extension, is presently one of the functions of the Agricultural Corporation (AC) headed by a Managing Director (MD). The corporation is also in charge of research, land use planning, seed supply, jute and cotton procurement and supply of inputs. The MD for extension has under him five divisions: Extension; Cereal, Oil and Other Crops; Industrial Crops; and State Farms.

3. The AC staff patterns (at different levels of administration) call for:

a. Division -- A Division Manager with two deputies one for procurement 1/ and one for extension.

b. Township -- A Township Manager with two deputies (same as a). There is a central farm at each township also under his charge.

c. Village -- A dual purpose manager.

1/ Officers for "procurement" are in charge of all business activities, including buying jute fiber and paddy seeds, managing the jute buying depot, fertilizer/pesticides godowns, supplying inputs, etc.

The positions are not always filled, particularly at the village tract and village levels. More often than not one manager has to look after more than one village tract or village. Moreover, AC apparently places more emphasis on procurement of crops, supply of inputs and store keeping and administration; the "extension" Deputy Managers often also spend much time on these duties.

4. A village manager is a high school graduate with ten-months pre-service training at the Township Central Farm. He lives in the village. Since he works for more than one villages and has no transportation, he spends considerable time travelling between villages on foot or by boat. Before rice planting season (March/May), most of his time is devoted to distributing inputs and making advance payments. During the paddy growing season, he joins the Village Revenue Officer three times in making field assessments of farmers' paddy yield for determining each farmer's quota for paddy procurement by the Trade Corporation-1. On the average, he spends about two days a week on statistical reporting and accounting duties. He also attends various local committee meetings: Village Council, Peasant's Council, Land Committee; and he may be asked to serve the Peasant Committee Secretary. In short, he has little time for disseminating the technical advice to farmers in the field. He addresses general assembly meetings of the Village Council which all farmers are required to attend; Village Council members are supposed to further disseminate information to their neighbors.

5. In Shwelaung, each VM supervises on an average some 900 farm families and 4,800 ac of cultivated area. In all lower delta townships each VM has to deal with from 600 to over 1,100 families and from 7,000 to 10,000 ac of cultivated area as shown below:

Township	No. in Position				No. Farm Families Total/Av. per VM		Cultivated Area Total/Av. per VM	
	TM	DTM	VTM	VM	----(1,000)------		---(1,000 ac)---	
Wakena	1	1	1	35	30.5	871	167.9	4.8
Pyapon	1	1	2	18	10.5	583	127.3	7.1
Laputta	1	1	2	20	19.9	995	177.9	8.9
Ngapudaw	-	1	2	20	21.5	1,075	181.8	9.1
Bogale	1	1	2	20	22.2	1,110	207.6	10.4
Total	4	5	11	113	104.6	925	862.5	7.6

Other AC Services in Support of Extension

6. Research -- The Research Division is headed by a separate General Manager of AC. The Agricultural Research Institute (ARI) which conducts basic research, has recently been moved to Yezin, approximately 200 mi north of Rangoon. The Institute is currently assisted by a UNDP project

on rice, cotton, pulses, and soil research and training. Sixteen Central Experimental stations (Central Farms) roughly one to each Division/State, conduct applied adaption research. The Irrawaddy Division Station, which serves the entire project area, is located at Myaungmya in the middle delta, about 35 mi west of the town of Wakema. At present, it has 86 ac of research farm, only one research officer (a paddy specialist) and two technicians.

Extension officers of the township are trained at the Central Farm. There are no Subject Matter Specialists (SMSs) at the Central Farm, the AC division or Township Manager's offices. Research support to extension service in the project area is weak.

7. Seed Supply -- There are two AC Seed Farms in the Division: one at Auk Kwin Gyi in Pyapon Township with about 180 ac of farm and the other at Pan Tha Put in Mabin Township, with about 100 ac of farm. They are operated under the supervision of AC Deputy Township Managers and assisted by the local AC Village Tract Managers. The HYV seeds produced by the AC seed farms are distributed to selected farmer seed growers and seeds produced therefrom are bought back by AC at farm gate prices both at 10% minimum over the TC-1 paddy procurement price. The procurement and distribution of seeds are done by AC extension staff at different levels. The quantity sold to AC as seeds is allowed to off-set farmers' sales quota to TC-1. The seed growers also save on transportation and handling costs which they would otherwise incur in delivering quota paddy to TC-1 buying centers at the Township. The procured seeds are then sold by AC to needy farmers at cost, limited to 150% of TC-1 paddy procurement price for the same variety. The seed program, though deficient in quality control, covers its own cost and can expand quantitatively to meet the project's future seed requirement.

8. Input Supply -- handled also by AC, has been discussed in Annex 13. The shortage of fertilizers is a constraint to intensified agriculture. The requirement for this project can be met by adjustments to be made in the country, but the shortage will become more acute with growing future projects.

Proposed Agriculturel Extension Program

9. Line of Command and Staffing -- The new system would start in the entire area of the five project townships: Wakena, Pyapon, Laputta, Ngapudaw and Bogale. Agricultural extension activities in these five townships would be clearly separated from other activities 1/. All extension officers would spend full time on project extension activities. The existing Special Projects Unit and its staff would be incorporated into the new extension program.

1/ The GOB is considering a plan to separate the research, extension and land use planning functions from AC and form a separate department.

10. Extension work under the project would be coordinated by a Project Extension Manager (PEM) who would report to the AC Irrawaddy Division Manager. Each township would have a Township Extension Manager (TEM) and a Township Extension Deputy Manager (TEDM) who would supervise the work of two to six Village Tract Extension Managers (VTEMs), each in charge of six Village Extension Managers (VEMs). Each VEM would be responsible for about 800 farm families (Table 2, and Annex 12 Figure 5).

11. The PEM would be assisted by three SMSs for plant protection, farm machinery and training; they would be stationed in the Pyapon Township. At the township level, there would be three SMSs, one each for paddy cultivation at Pyapon and Laputta and one for both paddy and jute cultivation in Shwelaung. All extension managers and SMSs would be selected on proven professional merit within the existing AC extension and research staff. Early recruits would be posted in project areas, additional ones ones would serve areas outside of the project until all five Townships would be covered.

12. Training -- All VEMs and VTEMs would be trained once every two weeks on a fixed day. These one-day sessions would be held at one or two convenient locations in each township in groups of at least 15 persons. The TEM would organize the training sessions with the help of the SMS for training. The paddy, plant protection and farm machinery SMS would be responsible for preparing the technical material to be used for each session. In addition, once a month when VEMs come to the Township Office to draw their salaries, they would participate in a joint training session of all VEMs in the township.

13. Training would adopt a "concentration of efforts" approach. Each session would be strictly limited to a few important recommended practices (the impact points) relevant to the following week's activities according to the crop season. Lectures would be limited to one-third of the total scheduled time to allow time for full small group discussions, demonstrations with staff of other agencies on topics current to the impact points taken up at the session, i.e., supply of inputs and credit, marketing, irrigation, flood control, etc.

14. All SMSs would be annually trained at the Central Experiment Station. Before each crop season, all extension staff would attend a training-cum-discussion session for a few days in which they would discuss and receive general guidelines for the coming crop season.

15. Extension personnel, based on work performance would be selected and sent abroad for training and studying at on-going extension projects in neighboring countries.

Impact Points

16. Key deficiencies in present farming methods causing low crop yields would be carefully identified. Improvement techniques would be worked out by SMSs and senior extension officers in consultation with research experts. These "impact points" would be emphasized at the

fortnightly VEM/VTEM training sessions. The full range of impact points would be prepared before the project begins. Written hand-outs on such points would be distributed to VEM/VTEM during the training sessions. The overall shortage of fertilizers, pesticides, sprayers, dusters, draft animals, farm power etc. has been discussed in Annex 2. The new extension program would have to face the circumstances and advise farmers on the best use of available resources.

Visits

17. The village would be the basic extension unit for planning of work. Each VEM would work with eight groups of about 100 farm families each. The actual number of families in a group, however, may vary with the village size and accessibility, and would be held flexible so as not to break the village as a working unit.

18. Under the guidance of his superior officers and in consultation with the local Peasant's Council, the VEM would select seven to ten contact farmers from each group. They would be selected from all levels of the village society and for their technical influence on other farmers. Farmers who are active members of the local Peasant Council would be given preference. Contact farmers would be rotated among villagers.

19. The VEM would visit each group of farm families on a fixed day once every two weeks. He would visit the contact farmers in the field during the morning hours as delta farmers generally leave their farm in the early afternoon to avoid the intense heat. Afternoons would be devoted to discussions with the entire group.

20. A VEM would thus devote four days per week for visiting farm groups, completing the eight groups under his charge in two weeks. One day a week, he would attend the training session. Another day would be spent in conducting field demonstrations, answering urgent calls and attending to necessary office work.

21. Each VTEM would supervise about six VEMs and visit each VEM once a week when the latter is visiting farmer groups. He would schedule his visits so as to be able to cover all farmer groups over a period of time. He would check that the VEMs visit schedule was being kept, check the field demonstrations, and assist VEMs and farmers in technical matters. The VEMs would keep a current list of problems that need the VTEM's help.

22. The SMSs would also schedule field visits according to anticipated crop seasonal needs and would keep VTEM's and VEM's informed of their visit schedules in the area.

Transportation

23. The VEMs would reside in a centrally located village. Each VEM would be provided with a small country boat; all VEMs in a township would collectively share two small motorized country boats. Each VTEM would be provided with a small motorized country boat. Each VTEM would have a medium-sized motorized boat which they would share with the township SMSs. The Project Extension Manager (PEM) and his assisting SMSs would share one large and one medium-sized motorized boat. Operation and maintenance costs of the boats and the pick-up during the project implementation period would be included as project costs. A four-wheel drive pick-up would be placed at the disposal of the Project Extension Director for transportation and light hauling.

Paper Work

24. All project extension staff's paper work would be kept to a minimum. The VEMs, particularly, would handle only two kinds of paper work. Written material would be strictly limited to extension material (concerning impact points) received during the fortnightly training sessions. A daily work diary would be kept for records of contact farmers and villages visited and problems observed in the field and raised by farmers. The VTEMs would inspect VEMs diaries. The VTEM, TEM and PEM's report forms would be designed and kept as simple as possible.

Research Support

25. The crop research for the country as a whole is being strengthened by a UNDP Project. The Agricultural Corporation is undertaking to provide a plant protection specialist and a water management agronomist to the Myaungmya Experiment Station for strengthening its present research staff which consists of a paddy specialist. These research officers, together with the six SMSs (para. 11) are expected to significantly improve the flow of available research information to project farmers.

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Project Area as Percentage of Township Total

Township	Project Polder	Total land area 1/	Cultivated Land Area 1/		No. Farm Families	
			Present 1/	Future	Present 1/	Future
		(1,000 ac)	(1,000 ac)	(1,000 ac)		
Wakema		294.1	167.9	173.4	30,478	31,218
	Shwelaung	59.0	32.5	38.0	4,974	5,714
	% of township	(20.0)	(19.4)	(21.9)	(16.3)	(18.3)
Pyapon		216.2	127.3	155.0	10,504	13,614
	Zinbaung	8.0	4.5	7.1	420	710
	Letpanbin	14.4	4.5	8.4	257	677
	Kyet-Pha-Hmwe-Zaung	30.0	16.9	23.5	1,250	2,010
	Myogon	9.3	1.9	6.6	142	622
	Daw Nyein	3.2	1.3	2.8	140	300
	Dedalu	8.4	1.5	5.0	124	484
	Bantbwezu	16.0	8.0	13.9	747	1,387
	SUB-TOTAL	89.3	38.6	66.3	3,080	6,190
	% of township	(41.3)	(30.3)	(42.8)	(29.3)	(45.5)
Laputta		667.3	177.9	184.6	19,926	20,796
	Betut	54.1	34.0	40.7	2,973	3,843
	% of township	(8.1)	(19.1)	(22.0)	(14.9)	(18.5)
Ngapudaw		898.7	181.8	183.9	21,516	21,806
	Alegyun	19.5	13.1	15.2	1,014	1,304
	% of township	(2.1)	(7.2)	(8.3)	(4.7)	(6.0)
Bogale		715.8	207.6	221.8	22,184	23,664
	Dauntgyi	25.5	9.6	23.8	798	2,278
	% of township	(3.6)	(4.6)	(10.7)	(3.6)	(9.6)
Total Township		2,792.1	862.5	918.7	104,608	111,098
Total Project Polders		247.4	127.8	184.0	12,939	19,329
% of Township		(8.9)	(14.8)	(20.0)	(12.3)	(17.4)

1/ Source: Planning and Statistics Department, Ministry of Agriculture and Forests, December, 1975.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Agricultural Extension Service

Proposed Staffing Pattern for Extension Personnel Over The Whole Five Townships Hosting Project Areas 1/

Township	Number of Farm Families	VEM	VTEM	TEM	SMS at Townships Paddy	Project Extension Manager & SMS for Project	Total
Wakema	30,478	37	6	1	1	1 PEM/3 SMS	50
Pyapon	10,504	13	2	1	1		17
Laputta	19,926	26	4	1	1		32
Ngapudaw	21,516	28	5	1			34
Kogale	22,184	30	5	1			36
Sub-total	104,608	134	22	5	3	4	168
Annual Salary Costs 1/							
Salary (Kyat/man year)		2,400	4,200	8,400	8,400	14,400/8,400	
Total (1,000 Kyat)		323	92	42	25	40	522

Note: VEM - Village Extension Manager
VTEM - Village Tract Extension Manager
TEM - Township Extension Manager
PEM - Project Extension Manager
SMS - Subject Matter Specialist

1/ All would be additions to present staffing and staff costs.

ANNEX 5
Table 2

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Agricultural Extension Service

	Item	Estimated Cost (1,000 K)
1.	Equipment 1/	
	Transport	560
	Extension aids	220
	Sub-total	780
2.	Training	
	fellowships for extension personnel (travel to other countries)	650
3.	Staffing & Housing During Implementation (6 years) 2/	
	House rent, 15 quarters @ 6	90
	Staffing	3,130
	Other operating costs	960
	Sub-total	4,180
4.	TOTAL	5,610

1/ See Annex 9.

2/ See Table 4.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Agricultural Extension Service

Annual Operational Costs 1/

		(1,000 Kyat)
1.	Staffing (Table 2)	522
2.	Activities (field trials, plot demonstrations, etc.)	20
3.	Mileage costs, repairs, spare parts	120
4.	Research workers salaries (2)	20
5.	House rental allowance, 15 quarters	15
	Annual total	697

1/ In addition to present staff costs.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Other Agricultural Supporting Services

1. Besides agricultural extension and applied research, training and seed supply (Annex 5), other important agricultural supporting services include the supply of farm inputs, agricultural machinery services and rural credit. This Annex discusses the services to be provided by the Agricultural Corporation (AC) and the Agricultural Mechanization Department to project farmers. Rural Credit is discussed in Annex 10.

Present System of Farm Inputs Supply

2. The main agency for supplying farm inputs in Burma is the AC of the Ministry of Agriculture and Forests (MAF) under the supervision of a General Manager for Procurement, Planning and Statistics. Under the General Manager, there are three divisions: Supply and Distribution; Statistics and Plans; and Procurement and Processing. The AC has jute buying depots in townships where jute is produced under the charge of AC Township Managers and Deputy Managers for procurement. The AC has now 12 small fertilizer godowns in the project area: five in Pyapon, three in Laputta and two each in the other three project townships which are adequate for handling the present amount (Map 11836 R).

3. Under GOB's Four-Year Plan (1974/5-1977/8), targets for crop acreage, production and major input supply are set through a process whereby the targets were initially suggested by villages, compiled and sent up through village tracts, and townships, but modified and finalized by the Ministry of Finance and Planning in consultation with the MAF and supply agencies. The finalized township targets are broken down into village tracts and village targets by the township and Village Tract People's Councils. The planned quantities of farm inputs are procured by AC and distributed according to plan targets to AC township godowns. Quantities of various farm inputs programmed for 1975/76 for the five townships of which the project polders form a part, are as follows:

	Total	Wakema	Pyapon	Laputta	Ngapudaw	Bogale
Fertilizers (1 ton)						
Urea	4,627	2,838	470	367	443	5,095
TSP	1,976	950	244	224	268	290
KCl	118	28	21	14	55	--
Bone meal	1,276	310	258	356	352	--
Improved paddy seeds (basket)	29,910	9,690	6,850	3,260	4,420	5,690
Jute seeds (basket)	1,633	1,594	--	13	--	6

Source: Ministry of Agriculture and Forests

4. The above allocation indicates a fair amount for Wakema (i.e. 38 lbs) of urea per ac of existing cultivated land) owing to the higher fertilizer consumption rate for jute and HYV rice. The lower delta townships average only 8 lbs of urea per ac of existing cultivated land for Pyapon and 5 lb per ac for the other three townships. With such low input availability, there has not been any problem in disposal of all supplies shipped to the townships. With a limited supply, GOB allocates fertilizers in the country officially only to HYV paddy, jute, cotton, sugarcane and tobacco; in the project townships only to HYV paddy and jute. Actually when farmers get fertilizers they apply some on nurseries of local paddy varieties and on vegetables. Since the project area has very little HYV at present, and very little jute in the ten lower delta polders, the present allocation, for which no data is available, is probably negligible.

Construction of New AC Fertilizer Godowns

5. Under the project, the fertilizer requirement is expected to increase slowly during the construction period but sharply after the construction and land reclamation are completed. The estimated fertilizer requirement of the project (13,500 ton at full development) is given in Annex 2. The sum of the requirements for Ngasein, Medon and wet season HYV, about 9,000 lg tons is used for estimating the additional storage capacity needed. Fertilizers for other rice varieties and other crops can be stored in the same godowns in different months (Table 2). The AC would need to construct four new fertilizer godowns over the development period in the project (Map 11836 R). Capital cost is estimated at K 1.87 M and the O & M costs at K 63,000 per godown per year (Tables 1 and 2).

6. Pesticides, gunny sacks and seeds could be stored in the same godowns. Shipping schedules of different inputs and management of godowns would be improved by AC to achieve rapid turnover of the input godown space, so that the existing and the four new godowns at 1,200 ton capacity each would be able to handle about 9,000 tons of fertilizers during the peak requirement season.

Farm Machinery Supply and Service
AMD Tractor Stations

7. The Agricultural Mechanization Department (AMD) of MAF has four tractor stations in or near the project area as follows (Map 11836 R).

Location of Station	In or Near Township
Maubin	Pyapon, Bogale
Myaungmya	Laputta
Wakema	Wakema
Bassein	Ngaputtaw

8. The present distribution of low-lift pumps, tractors, and power tillers in the above townships are as follows:

Township	AMD Self Operated Tractors	Cooperatives & Farmer Groups		
		Tractors	Power Tillers	Low-Lift Pumps
Wakema	60	48	25	1,872
Pyapon	-	2	2	38
Laputta	-	1	-	64
Ngaputtaw	-	8	-	16
Bogale	-	-	1	101
Total	60	59	28	2,091

The number of various equipment items in the project polders, however, is not known except for the pumps, of which there are 270. Only the Wakema Tractor Station has some workshop equipment and a full staff. Those in the lower delta have only hand tools to service the few tractors, power tillers and the pumps belonging to cooperatives and farmer groups.

Sales of Farm Machinery

9. The present procedure of distribution and sales of farm machinery by AMD is as follows:

a. Based on the Four Year Plan, the Central Committee of the Agricultural Sector of MAF decides allocation of the machinery to States/Divisions. The AMD informs the States/Division of their quotas for the year; the States/ Divisions People's Councils of their quotas for the year. The Councils discuss and allocate quotas to townships and inform the AMD head office. The AMD then sends the machinery accordingly to its Tractor Stations of the townships.

b. Farmers, farmer groups or cooperatives who desire to purchase machinery would apply to the Township People's Council through the Village Tract People's Councils. The Economic Affairs Sub-Committee of the Township Council would discuss and decide to which applicants machinery would be sold. Based on the decision, the AMD Tractor Station would sell to the chosen applications. The Township Coucil and the Tractor Station would keep a register of buyers.

c. For buying the tractors, the buyers pay a 10% down payment to AMD, followed by four annual installments of 20% each and a final payment of 10%. For power tillers and low-lift pumps, the downpayment is 50%, and the remainder must be paid in 12 months.

Tractor Service

10. While the AMD Tractor Stations sell other machinery some also have their own tractors. In the project townships, only the Wakema Tractor Station owns 60 tractors, all the Czech "Zwe" model of around 50 hp range. It uses these tractors to provide custom tractor service to farmers at K 18 per ac for plowing and K 12 per ac for one cross-wise harrowing (if the farmer wants a second harrowing, he pays another K 12). These rates are subsidized and are compared to AMD direct operating costs of K 28 and K 17 per ac, respectively, for plowing and harrowing. One reason for AMDs high operation costs is the large number of field staff at the Tractor Stations.

11. One station with 50 tractors, would have 104 men, including:

1	Officer in charge
1	Deputy for field work
1	Deputy for the workshop
10	Mechanics
5	Workshop tradesman
75	Tractor operators
5	Head tractor operators
1	Field supervisor
5	Other staff

The 80 tractor operators (for 50 tractors) are employed the year round, while tractors work hardly 90 days in a year at Wakema. The cooperatives have a lower operating cost because of a much lower overhead. Government policy now is to maintain AMD tractor strength in the country at 4,000 (with annual replacement of 300) and to sell all additional tractors to cooperative or farmer group applicants.

Project Supplied Machinery

12. Under the project, the following numbers of types of machinery would be procured by AMD:

a.	1,000	4 inch low-lift pumps with 5 hp diesel engine (together with existing pumps) for irrigating 7,000 ac dry season HYV rice and 15,000 ac of jute-Hnanga rice rotation in the Shwelaung polder.
b.	500	7 to 8 hp power tillers for supplying farm power to 50% of the reclaimed land in ten lower delta polders, totalling 30,800 ac.
c.	57	50 hp wheel tractors for Shwelaung polder, 24 of which would be kept by the AMD Wakema Tractor Station to provide initial land preparation service to reclaimed land, and later for replacing the existing old tractors at the station. The remaining 33 tractors would be sold to cooperatives or farmer groups in the Shwelaung polder.
d.	33	disc plows for 33 tractors (another 24 disc plows are listed under land reclamation equipment, Annex 4).
e.	17	disc harrows (for dry land preparation) and 16 rotary cultivators -- for paddy land preparation -- for 33 tractors (another 24 harrows listed in Annex 4).
f.	500	quarter ton trailers, one for each power tiller.
g.	400	chain saws for cutting mangrove trees in the lower delta polders.

13. The basis of estimating the quantity is given in Table 3. This machinery is estimated to cost a total of K 17 million before taxes, duties, transportation from port to project area and contingencies. The basis of the cost estimates is given in Table 4.

Maintenance Facilities

14. A maintenance workshop would be built in Shwelaung for servicing tractors and low-lift pumps provided by the project (Map 11836 R). Workshop equipment would be provided (Annex 9, Table 6H). Six simple service shops would be built in the lower delta for servicing power tillers and

and chain saws to be used in two polders. Dauntgyi, Alegyun and Betut, being isolated and belonging to different townships would have their own workshops. The other seven polders, all belonging to Pyapon District would share three workshops centrally located (Map 11836 R). The construction of these seven workshops is estimated to cost about K 1 million. The workshop equipment and tools would cost another K 1 million and miscellaneous items, about K 100,000 (Table 5).

Operation and Maintenance Charges

15. The AMD would charge the services for tractor land preparation, chain saw renting, repair and maintenance of all equipment at rates sufficient to cover the full depreciation and cost of operating and maintaining its department-owned tractors, chain saws and workshops (Main Report para 5.02 G (iv)).

May 1976

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Agricultural Corporation Fertilizer Godown Cost Estimate

1. Capital Cost of one standard AC fertilizer godown with a storage capacity of 1,200 lg tons of fertilizers.

		(K 1,000)
A.	Construction	
1	Godown - 120' x 50' x 15' concrete floor, brick wall, asbestos roofing	450.0
B.	Work Facilities	
1	Weighing scale @ K 1,200	1.2
1	set of fire fighting equipment	14.3
	Kerosine lamps, flash light, drinking water pot, padlocks, etc.	1.3
	Sub-total	16.8
C.	Total Capital Cost for 1 Godown	466.8

2. Capital Cost of 4 Godowns 1,867.2

3. Annual Operation and Maintenance Cost of one 1,200 lg ton godown

		Annually (K 1,000)
A.	Staff Requirement	
1	Godown in charge @ K 210 x 12 months	2.6
1	Asst. godown in charge @ K 150 x 12 months	1.8
1	Office clerk @ K 120 x 12 months	1.5
3	Tally and weighing clerk @ K 120 x 12 months	4.4
3	Gate keeper cum laborer @ K 100 x 12 months	3.6
6	Watchmen cum laborer @ K 100 x 12 months	7.2
	Sub-total	21.1
B.	Overhead (loading and transportation)	
	K 3.5 per 100 viss (0.16 ton)	30.0
C.	Annual Maintenance (2% of construction cost and 15% of original cost of the work facilities)	11.5
D.	Total (A + B + C)	62.6

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Agricultural Corporation Fertilizer Godowns, Cost Estimates 1/

			FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	Total
1.	Projected fertilizer required for Ngasein Medon and Wet Season HYV 2/	(lg ton)	757	885	1,110	1,538	2,042	2,849	4,240	5,563	6,958	7,722	8,430	9,134	
2.	Rounded		800	900	1,100	1,500	2,000	2,900	4,200	5,600	7,000	7,700	8,400	9,100	
3.	No. godown to be constructed 3/		-	1	-	-	-	1	1	-	1	-	-	-	
4.	Capital cost @ 466,800 3/	(1,000 K)	-	467	-	-	-	467	467	-	467	-	-	-	1,868
5.	Annual O & M cost 3/		-	63	63	63	63	126	189	189	252	252	252	252	
6.	Total annual budget requirement	(1,000 K)	-	530	63	63	63	593	656	189	719	252	252	252	

1/ All costs given are before physical and price contingencies.

2/ Represent the largest quantity of fertilizers to be handled during any month of the year.

3/ See Table 1.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Projected Farm Machinery Requirement

		FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	Total	
1. **Low-lift Pump Requirement**															
A. Projected jute area	(1,000 ac)	8.0	6.1	6.1	6.1	9.4	10.5	11.6	12.8	13.9	15.0	15.0	15.0		
No. pumps required @ 20 ac		400	305	305	305	470	525	580	640	695	750	750	750		
B. Project dry season HYV	(1,000 ac)	-	-	-	-	0.5	1.8	3.1	4.4	5.7	7.0	7.0	7.0		
No. pumps required @ 13 ac		-	-	-	-	38	138	238	338	438	538	538	538		
C. Sub-total (A + B)		400	305	305	305	508	663	818	978	1,133	1,288	1,288	1,288		
D. Existing pump and IDA pumps minus amortization		400	500	500	500	500	500	500	500	500	500	500	500		
E. Pumps requirement, jute/rice															
(1) cumulative		-	-	-	-	8	163	318	478	633	788	788	788		
(2) additional, yearly		-	-	-	-	8	155	155	160	155	155	-	-	788	
F. Pumps for replacement, yearly		-	-	50	62	100	-	-	-	-	-	-	-	212	
G. Total additional pumps, yearly (E(2) + F)		-	-	50	62	108	155	155	160	155	155	-	-	1,000	
2. **Power Tillers Required**															
A. Reclaimed area, Lower Delta	(1,000 ac)	-	10.8	13.3	12.8	6.9	1.1	17.0							61.8
B. 50% reclaimed area [1/]	(1,000 ac)	-	5.4	6.6	6.4	3.4	0.5	8.5							30.8
C. No. tillers, by years @ 60 ac/tiller [2/]					90	110	107	57	9	142	-	-	-	515	
3. **Tractor Required**															
A. Projected jute area	(1,000 ac)	8.0	6.1	6.1	6.1	9.4	10.5	11.6	12.8	13.9	15.0	15.0	15.0		
B. Tractors required @ 200 ac/tractor		40	31	31	31	47	53	58	64	70	75	75	75		
C. Existing tractors [3/]		42	42	42	42	42	42	42	42	42	42	42	42		
D. Additional tractors required required															
(1) cumulative		-	-	-	-	5	11	16	22	28	33	33	33		
(2) additional, yearly		-	-	-	-	5	6	5	6	6	5	-	-	33	

1/ Assumed draft animals would supply farm power needed by 50% of the reclaimed land area in the Lower Delta (Annex 2).

2/ In addition to the 33 tractors projected in this Table, 24 more tractors disc plows and harrows would be procured for initial land preparation of the reclaimed land in the Middle Delta (Annex 2, Table 3). After land reclamation work is completed, these 24 tractors would replace the existing old tractors at the Wakema Tractor Station.

3/ The Wakema Tractor Station has now 60 tractors, about 70% of existing jute area in Shwelaung use tractors for land preparation.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Cost Estimates & Schedule of Procurement of Agricultural Equipment [1/]

		FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	Total
1. Low lift pump, 5 hp								
A. number		-	50	62	108	155	625	1,000
B. cost @ K 5,000[2/]	(K 1,000)	-	250	310	540	775	3,125	5,000
2. Power tillers, 7-8 hp								
A. number		-	-	90	110	100	200	500
B. cost @ K 15,000[3/]	(K 1,000)	-	-	1,350	1,650	1,500	3,000	7,500
3. Tractors, 50 hp								
A. number		-	-	-	5	6	22	33
B. cost @ K 53,000[4/]	(K 1,000)	-	-	-	265	318	1,166	1,749
4. Disc plow for tractors								
A. number		-	-	-	5	6	22	33
B. cost @ K 15,000[5/]	(K 1,000)	-	-	-	75	90	330	495
5. Disc harrow for tractors								
A. number		-	-	-	3	3	11	17
B. cost @ K 15,000[5/]	(K 1,000)	-	-	-	45	45	165	255
6. Rotary cultivators for tractors								
A. number		-	-	-	2	3	11	16
B. cost @ K 34,000[6/]	(K 1,000)	-	-	-	68	102	374	544
7. Quarter ton trailer for power tillers								
A. number		-	-	90	110	100	200	500
B. cost @ K 3,000[7/]	(K 1,000)	-	-	270	330	300	600	1,500
8. TOTAL COST[8/]	(K 1,000)	0	250	1,930	2,973	3,130	8,760	17,043

1/ All costs are before taxes, duties and contingencies.

2/ @ US$ 760 per pump CIF Rangoon, including 300 ft hose and 25% spares = K 4,940 (K 5,000).

3/ @ US$1,800 per tiller, plus 25% spares = US$2,250 CIF Rangoon = K 14,625.

4/ @ US$6,500 per tractor, plus 25% spares = US$8,125 CIF Rangoon = K52,800 (K53,000).

5/ @ US$2,000 per disc plow or disc harrow, plus 15% spares = US$2,300 CIF = K 14,950 (K 15,000).

6/ @ US$4,500 per rotivator, plus 15% spares = US$5,175 CIF Rangoon = K 33,634 (K 34,000).

7/ @ US$400 per trailer, plus 15% spares = US$460 CIF Rangoon = K 2,990 (K 3,000).

8/ Not including K 3,192,000 for tractors and chain saws for land reclamation (Annex 2, Tables3 and 4).

ANNEX 6
Table 4

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

AMD Workshop Cost Estimates 1/

		(K 1,000)
1.	Construction cost for 1 workshop at Shwelaung - 100' x 50' x 15' concrete floor, brick walling, asbestos roofing	400.0
2.	Construction cost of one workshop in Lower Delta polders - one 80' x 25' x 15' workshop, concrete floor, brick nogging, CI roofing.	(100.0)
	For 6 workshops	600.0
3.	Workshop equipment and tools for 7 workshops 2/	1,000.0
4.	7 sets of fire fighting equipment and miscellaneous items	100.0
5.	Total	2,100.0

1/ Before taxes, duties and contingencies.

2/ Detailed list, see Annex 9, Table 6 .

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

AMD Workshop Construction & Procurement Schedule

	FY 1977	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	FY 1988	Total
1. Workshop at Shwelaung													
A. number to be constructed				1									1
B. cost @ K 400,000 (1,000 K)				400									400
2. Tool Storage/Dispatch House in Lower Delta													
A. number		2	2			2							6
B. cost @ K 100,000 (1,000 K)		200	200			200							600
3. Equipment & Tools (1,000 K)	33	34	900		33								1,000
4. Firefighting equipment and other items		20	20	40		20							100
5. TOTAL	33	254	1,120	440	33	220							2,100

ANNEX 6
Table 6

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Studies for Future Projects

Introduction

1. This Annex discusses two studies to be conducted by GOB with assistance from foreign consultants for planning and formulating future projects. One is an Irrawaddy Delta-wide hydrological investigation for establishing a series of projects like this project for further development and reclamation of paddyland elsewhere in Lower Burma. The other is to prepare a feasibility study for a first stage project for improving paddy storage and handling (which can also be replicated), aimed at reducing post-harvest loss of paddy both in Government depots/godowns as well as in farmers' storages.

I. Delta-Wide Hydrological Study

Background

2. There is a total of one million acres of abandoned paddyland in Lower Burma (Annex 1, Table 1). In the Irrigation I Project (Credit 483-BA) the minor flood embankments would protect 23,000 ac of farm lands from floods. In the current project, the construction of flood control and drainage facilities would reclaim about 65,000 ac of abandoned/wasteland and protect 120,000 ac of existing cultivated land from flood and salt water intrusion, which are major constraints of Burma's paddy production, If this land ratio holds true, reclaiming one million acres of abandoned/wasteland would benefit about two million acres of existing paddyland as well (out of a total of about 9 M ac in Lower Burma).

3. Discussion between GOB and IDA have led to the following conclusions:

a. It is highly desirable to repeat this project elsewhere in Lower Burma and to develop a series of similar projects for future financing. The project components would by and large be the same for all future projects. Construction would be done mainly by machine. The survey, design and construction techniques are simple and well within the capability of the Irrigation Department. A new project can be started without waiting for the completion of the previous one; in fact, the benefit from

each polder would begin as soon as the construction in that polder is completed.

b. Based on a six year construction period for each project (as in this project) and the staggering of successive project implementation periods, an increased number of engineers, surveyors, technicians and machine operators would be required. However, because sufficient numbers of engineers and technicians are presently unemployed and available in Burma, and the numbers required would not increase all at once, but would be recruited, trained and absorbed into the work force of the Irrigation Department (ID) over four or five years, this would not pose insurmountable difficulties. The management capability of the Department would also increase with time and should not be a problem.

c. The concern is the effect of building more and more polders, and thus constricting river channels during floods, on the river flow, the tidal movement and the consequent changes in overall hydrology and hydraulics in the delta and along the river mouths. A delta-wide hydrological study is deemed necessary for safe planning of the later projects in the series. However, the selection of polders for a second project does not need to wait for the completion of the study. Instead, if the current project begins in FY 1977, the second project can be prepared and appraised in FY 1978 and work can begin in FY 1979.

Outline Plan of Study

4. Hiring of Consultants: A foreign consulting firm or a group of qualified and competent individual consultants would be engaged under the project to assist GOB in conducting the study.

5. Hydrologists -- Two hydrologists would be engaged by the firm as soon as the credit becomes effective.

Duration:	
1 hydrologist	26 months
1 hydrometrist	19 months
Other experts	3 months
Sub-total	48 man-months

These experts would advise and assist ID in procuring and installing hydrological network equipment; establishing a laboratory for water

quality analysis; establishing procedures and training ID staff in the O & M of the network and analyzing and interpreting data collected. They would also advise ID in systematic gathering and compiling of all available information, data and maps necessary for delta development planning.

6. Training of Burmese Hydrologists -- In the first year of project implementation, two ID engineers and two technicians would be selected for receiving training abroad on hydrology and hydrometrics, each for one year. Their training curriculum would be arranged by the selected consulting firm in such a way that the training received would be pertinent to specific works to be done in the Irrawaddy Delta development planning. They would return to Burma in the second year.

7. Delta Development Reconnaissance Team -- A team of experts in fields of delta development engineering, river engineering, land reclamation and soils, irrigation/drainage engineering an land/water use agriculturist (the exact composition of the team would be decided jointly by ID, the consultants and IDA) would visit the delta in the latter part of the study when the hydrologist and hydrometrist are still in the field. By reviewing available hydrological and other pertinent data and maps compiled by ID with assistance from the two hydrologist consultants and field reconnaissance, the team would:

a. Help to establish priorities of islands to be safely included in the third, fourth and fifth projects of about the same size as this project. These five projects would cover a total gross area of about one million ac, including roughly 300,000 to 350,000 ac of abandoned land, or about one-third of the potential area to be developed.

b. Recommend further investigation required for planning further development beyond the fifth project, which will require increasingly sophisticated judgement in all respects. Their recommendations would pinpoint technical problems which will have to be resolved, an estimate of the time and costs required to carry out the necessary surveys and type of equipment needed.

8. The team will spend about six weeks in the field and about three months in report writing. Based on the team's recommendations, GOB could then decide whether it would want to tackle the task of overall delta development beyond the series of five projects. If it wishes to do so, the further investigations required could be attached to the third or fourth project of this series.

9. Cost Estimate -- It is estimated that a total of about 60 man-months of consultant service would be required for conducting this first stage study, including the hydrologist, the hydrometrist, the reconnaissance team, and short-term supporting experts of other fields. Equipment for establishing the hydrological network, the chemical laboratory, surveying, data processing, vehicles and boats and overseas training of local engineers and technicians would cost about US$600,000. Detailed consultant man-months and equipment lists would be prepared by an IDA consultant who has had wide experience in delta hydrology as well as knowledge of the Irrawaddy Delta.

II. Paddy Storage and Handling Feasibility Study

Background

10. Lower Burma produced about 8.5 M tons of paddy in 1975, from which the Government bought 2.8 M tons to supply deficit areas in the country and to use for export (Annex 13, Table 3). The remainder, or about 6 M tons, remained in the delta, mostly in farmers' home storages and used by farmers for family subsistence, and for selling milled rice to small urban consumers.

11. The GOB paddy procurement program, handled by the Trade Corporation No. One (TC-1), is discussed in Annex 13. In the delta, TC-1 owns paddy buying depots in township headquarters and larger towns along the rivers. It may also set up temporary paddy buying stations inside the rice producing islands. The permanent depots have weighing platforms and godowns built mostly of plastered bamboo walls holding about 1,000 tons each, but some smaller ones have corrugated metal sheeting walls and asbestos roofings.

12. At the buying depot, except for the weighing scale and a moisture meter, all other work is done manually. a maximum moisture content of 14% is allowed, but the depots do accept paddy with moisture up to 16% by discounting prices and sun drying the paddy on cement drying ground adjacent to the depot. Transportation has been a constraint; when the depots run out of godown space, paddy is seen piled in open air waiting for shipping.

13. The paddy retained by farmers for home consumption is stored in their houses, in containers made of large bamboo baskets plastered with a mixture of clay and cow dung. For larger farmers, paddy is stored in a partitioned corner of the house built in the same manner. Fortunately, the main rice crop is harvested in late November and December when the dry season has begun. So far the delta farmers have had no paddy drying problems, therefore, they have generally possessed no drying facilities. The stored paddy, however, is subject to rodents and insects, and the top layer is subject to hot and humid air from June through October. With the extension of the dry season HYV (7,000 ac in Shwelaung), which will be harvested and processed in May, farmers will begin to have problems in drying and storing

paddy when storage would begin in the months with highest humidity. Any insufficiency in drying may cause greater loss in storage which the delta farmers have not experienced so far.

14. The proposed study would aim at:

a. improving paddy handling: on-farm, from farms to TC-1 paddy buying depots, at depots, and from depots to mills in Rangoon or other large consumer centers;

b. improving paddy drying and storage; on the farms and at the TC-1 depots; and

c. reducing quantitative and qualitative losses of paddy both on farms and in Government godowns.

15. The study would lead to the formulation of a first phase project. In order that the project could be replicated elsewhere in the country, it is essential that the proposed working facilities and the structure of storage are commensurate with Burma's economical and financial resources. The essence is not necessarily to build all mechanized modern paddy/rice processing/storage complexes in Burma, but rather to introduce sound paddy/rice handling and storage principles and practices into the traditional systems. In principle, locally available material should be used for construction, so that the models successfully demonstrated in the first project could be replicated, with a modest foreign exchange component reserved for equipment and apparatus which must be imported. Proposed practices and facilities for improving paddy handling and storage by farmers would be such that they can be promoted through the extension service and covered by rural credit.

Outline Plan of Study

16. A team of consultants or selected individual specialists would be engaged to assist TC-1 and AC in conducting the study. The team would consist of a team leader (a paddy industry management specialist), and team members who have practical experience and knowledge in:

a. paddy drying equipment and storage structure;

b. paddy quality and rice milling;

c. traditional post-harvest paddy handling and storage problems in monsoon Asian countries;

d. economic and financial analyses.

17. The team leader would make a reconnaissance visit to Burma first to understand the problems, discuss with TC-1 and AC, formulate a detailed work plan and select team members. The team would spend four months (December

through March) in Burma and two months at their headquarters for report preparation. They would concentrate their field study in the delta area, particularly the five townships of this project. For improving on-farm paddy handling and storage, the team would include in its recommendations a detailed step-by-step direction for conducting field tests on the recommended practices and facilities for improving on farm paddy handling and storage, so that it can be tested by local experimental stations or seed farms before introduction to farmers. Some 35 man months of consultant service are estimated to be required.

Cost Estimate

18. The cost of hiring 35 man months of consultants is estimated to be US$280,000. An additional US$20,000 would be provided for purchase of necessary instruments and carrying out local tests and trials as may be necessary for conducting the study.

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BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Water Supply, Quality and Demand

Drainage and Flood Protection

1. The high river levels, which occur between May and October during the southwest monsoon rainy season, impede drainage from the island interiors causing considerable accumulation of rainfall runoff and overbank flood spills until the river levels recede near the end of the monsoon season. Rapid and, on occasion, unexpectedly high river rises washing away or submerging rice seedlings is the main cause of crop failure in the middle delta. In the lower delta, daily tidal inundation by sea water causes recurring low yields. Although monsoon rains flush away salts in the topsoil, saline water accumulates in the interior-depressed areas, restricting paddy cultivation to the high ground, limiting fresh water storage, and promoting gradual encroachment of salt-tolerant mangroves and grasses. Provision of embankments and drains under the project would protect existing crop land and enable the reclamation of the island interiors.

2. In the middle delta, usually during August and September, river levels around Shwelaung Island are so high as to block drainage channels entirely. By mid-October, the polder could then again be drained to field levels. Based on river hydrographs, topographic surveys, and rainfall and evaporation data, the estimated land areas under various maximum flood depths after construction of the Shwelaung polder are given in Annex 2, paragraph 21. About 18,000 ac of the lowest land in Shwelaung will remain undeveloped because of water depth during August and September. In the lower delta, river flood levels are lower and tidal variations are large enough to permit drainage throughout the monsoon season. Available data indicates that after project construction is completed, the accumulation of rainfall runoff in any of these polders would not be so great as to prevent rice cultivation anywhere or the adoption of HYV on higher land in the monsoon season, and about 30% of the area could be sown to pulses.

Water Supply and Quality

3. Rainfall and water lifted from rivers and streams are the main sources of crop water supply for the middle and lower delta islands. Mean annual rainfall is about 96 inches, of which 80% occurs during the southwest monsoon period form mid-May to mid-October, which overlaps the time of annual flood levels in the Irrawaddy Delta.

4. The dry season flow in the Irrawaddy (at Prome) is about 62,000 cusecs. Water elevations around project islands are governed by tidal levels and in the dry season some interior drainage channels receive river water during high tides. 1/ These channels and depressed areas provide potential storage where fresh water is available for dry season lift irrigation. Channel improvements and provision of sluices under the project would enhance the useful storage capacity. Around Shwelaung Island where the surrounding river water is fresh throughout the dry season, carefully scheduled operation of sluice gates would permit daily replenishment of depleted storage at high tides. The future cropping pattern of this island, is therefore planned on the basis of a continuous supply of fresh water being available for dry season irrigation of the projected jute and rice areas.

5. In the lower delta, saline sea water generally is found in the tidal channels in concentrations which gradually decrease with distance away from the coast. The limit of river water unsuited for irrigation moves further inland during the dry season as river levels recede. The interior drainage allows monsoon rains to flush out salts brought by tidal innundation. During the dry season, however, all river channels are at times saline and farmers must block outlets temporarily to prevent saline water entering the interior channels. The use of pump irrigation in the lower delta is negligible at present, and available data is not sufficient to estimate the extent of reliable supplies for pumping. Dry season lift irrigation is therefore not planned for the ten lower delta islands. Provision of sluices under the project would improve channel regulation to prevent saline intrusion and to facilitate interior storage of late monsoon rain and flood water. Year-round studies of water quality in the lower delta would be continued and significantly strengthened by the proposed delta-wide hydrological investigation to be conducted under the project to determine the possible extent of limited dry season lift irrigation in the lower delta islands in the future projects.

Water Demand

6. Present irrigation is mainly along the banks of fresh water rivers and along the larger interior channels in the middle delta islands. This project would expand pump irrigation in Shwelaung Island to about 22,000 ac having a projected cropping pattern as follows:

HYV	7,000 ac
Jute followed by Hnanga	15,000 ac

1/ Tidal action affects river levels as far inland as 80 mi.

7. Crop water requirements based on this pattern have been determined using the Blaney Criddle formula (Table 1). Project requirements, including appropriate field preparation water requirements are estimated using an overall irrigation efficiency of 75%. Overall losses would be small due to the small pump service areas, conveyance over short distances mostly by pipe, and the fact that a large part of field losses would pass to other fields or return to the system. Maximum water demand, for the 22,000 ac, would be an estimated 17,900 ac-ft in April. Based on peak pump operation for ten hours per day, 250 hours per month, a total of 1,300 pump units of 0.7 cusecs each would supply the requisite 870 cusec total capacity. This would include about 550 units for the 7,000 ac of HYV and 750 units for the 15,000 ac of Jute-Hnanga. The 870 cusec maximum project demand would be insignificant compared to the total 62,000 cusec dry season flow in the Irrawaddy River.

8. About 1,000 units including about 200 spares would be supplied under the project. At present, farmers operate 270 pumps in the Shwelaung area, irrigating about 6,000 ac of jute, of which about 2,500 ac are followed by Hnanga paddy. 1/ About 300 additional pumps will be sold in the area under Credit 483-BA. Assuming 15% replacement, about 500 units would be operating prior to project implementation and about 800 additional units would become operative under the project.

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1/ An estimated three-quarters of the present total jute acreage is irrigated. The present average pump command area is relatively high because irrigation is used mainly for initial land preparation and less than adequate supplies are provided later in the growing period.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Water Supply, Quality and Demand

Estimated Pump Water Requirements

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jute - Hnanga Rice (15,000 ac)												
Consumptive Use (in) - Jute	0	1.29	4.19	7.47	9.52	8.36	5.97	0	0	0	0	0
Hnanga	2.31	0	0	0	0	0	0	2.30	5.87	9.02	8.60	2.96
Field Preparation (in)	0	5.00	0	0	0	0	0	0	0	0	0	0
Gross Field Req. (in)	2.31	6.29	4.19	7.47	9.52	8.36	5.97	2.30	5.87	9.02	8.60	2.96
Effective Rainfall (in)[1/]	0.11	0.21	0.25	1.40	6.70	8.70	10.84	9.88	7.28	4.87	2.10	0.49
Net Field Req. (in)	2.20	6.08	3.94	6.07	2.82	0	0	0	0	4.15	6.50	2.47
Pump Requirement (75% eff.) (in)	2.9	8.1	5.3	8.1	3.8	0	0	0	0	5.5	8.7	3.3
Pump Req. (75% eff.) (000 ac-ft)	3.6	10.1	6.6	10.1	4.8	0	0	0	0	6.9	10.9	4.1
HYV Rice (7,000 ac)												
Consumptive Use (in)	2.00	4.42	8.28	11.45	4.61							
Field Preparation (in)	8.00	0	0	0	0							
Gross Field Req. (in)	10.00	4.42	8.28	11.45	4.61							
Effective Rainfall (in)[1/]	0.11	0.21	0.25	1.40	6.70							
Net Field Req. (in)	9.89	4.21	8.03	10.05	0							
Pump Req. (75% eff.) (in)	13.2	5.6	10.7	13.4								
Pump Req, (75% eff.) (000 ac-ft)	7.7	3.3	6.2	7.8	0							
Monthly Pumping Volume (000 ac-ft)	11.3	13.4	12.8	17.9	4.8	0	0	0	0	6.9	10.9	4.1

ANNEX 8
Table 1

1/ Maubin station.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Water Supply, Quality and Demand

Estimated Pump Requirements

	Peak Field Req.	Pumping Time	Peak Pumping Duty @ Irrigation Eff. 60%	75%	90%	Pump Command 1/	Crop Area	No. Pumps
	(in/mo)	(hr/mo)	(ac/cfs)			(ac/unit)	(000 ac)	(units)
Jute	6.1	250	24	30	37	21	15	) 750 2/
Hnanga	6.5	250	23	29	34	20	15	)
HYV	10.1	250	15	18	22	13	7	550
								1,300

1/ For a 0.7 cusec unit with 75% overall application efficiency.

2/ Use 750 units for the 15,000 ac Jute-Hnanga rotation.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Cost Estimates, List of Equipment, Proposed Credit Allocation, Schedule of Expenditures and Disbursements

Contents

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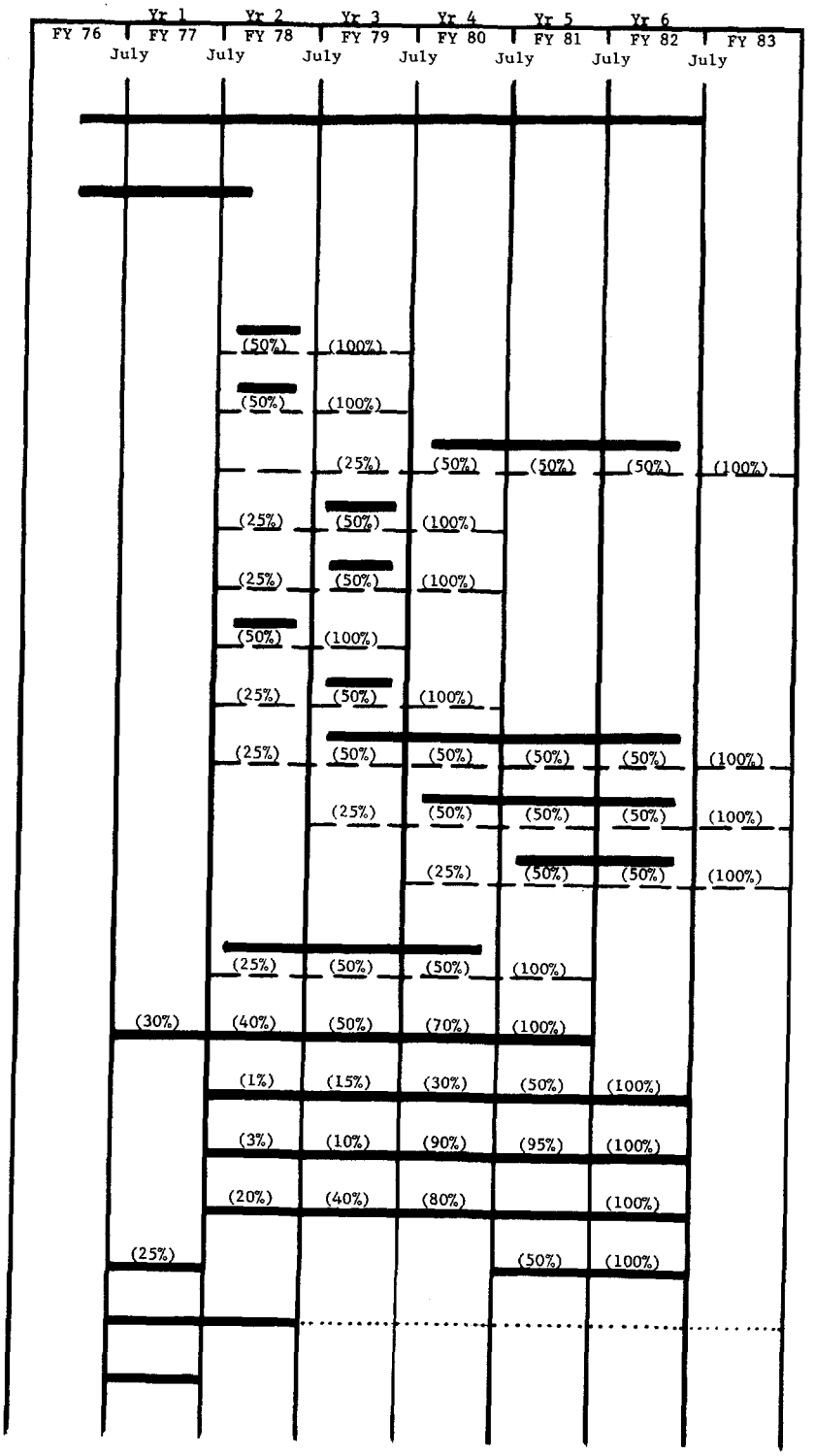
ANNEX 9
Figure 1

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Project Implementation Schedule



1/ Annexes 5 and 6.
2/ Annexes 3 and 4.
3/ GOB would continue data recording after FY 1978.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Cost Estimates

	Quantity	Equipment Cost 1/			Civil Works & Other Costs			Engineering & Administration	Basic Project Cost			F.E.
		Local	Foreign	Total	Local	Foreign	Total	Local	Local	Foreign	Total	
		(US$ Million Equivalent) 2/										(%)
1. Drainage & Flood Protection Works												
Embankments (410 mi)	11.4 M cu yds	.25	5.30	5.55	2.88	.61	3.49	.60	3.73	5.92	9.65	61
Drainage Channels (770 mi)	11.6 M cu yds	.25	5.33	5.58	2.71	.57	3.28	.55	3.51	5.89	9.40	63
Sluices (45)	275 openings	.04	.79	.83	3.57	1.18	4.75	.80	4.41	1.97	6.38	31
Culverts	93 units	.02	.31	.33	1.80	.08	1.88	.33	2.15	.39	2.54	15
Checks & Crossings	11 checks; 22 crossings	.01	.08	.09	.47	.03	.50	.08	.56	.11	.67	16
Subtotal		.57	11.81	12.38	11.43	2.47	13.90	2.36	14.36	14.28	28.64	50
2. Farmland Clearing & Equipment	32,600 ac	.16	.50	.66	.53	.00	.53	.15	.84	.50	1.34	37
3. Farm Machinery												
Irrigation Pumps	1,000 units	.11	.76	.87	.00	.00	.00	.00	.11	.76	.87	87
Power Tillers & Trailers	500 units	.02	.47	.49	.00	.00	.00	.00	.02	.47	.49	96
Tractors & Implements	33 units	.08	1.35	1.43	.00	.00	.00	.00	.08	1.35	1.43	94
Subtotal		.21	2.58	2.79	.00	.00	.00	.00	.21	2.58	2.79	92
4. Agricultural Support												
Tractor Workshops	7 shops	.00	.19	.19	.15	.00	.15	.05	.20	.19	.39	49
Fertilizer Godowns	4 godowns	.00	.00	.00	.07	.00	.07	.01	.08	.00	.08	0
Extension Equipment		.05	.07	.12	.00	.00	.00	.00	.05	.07	.12	58
Extension Service (6 yrs)		.00	.00	.00	.64	.00	.64	.06	.70	.00	.70	0
Fertilizer Godown Operation (6 yrs)		.00	.00	.00	.06	.00	.06	.00	.06	.00	.06	0
Subtotal		.05	.26	.31	.92	.00	.92	.12	1.09	.26	1.35	19
5. Civil Works Operation & Maintenance												
Buildings & Equipment	5 complexes	.07	.16	.23	.82	.12	.94	.16	1.05	.28	1.33	21
O & M during construction		.00	.00	.00	.60	.00	.60	.00	.60	.00	.60	0
Subtotal		.07	.16	.23	1.42	.12	1.54	.16	1.65	.28	1.93	15
6. Technical Assistance												
Agricultural Extension training		.00	.00	.00	.00	.10	.10	.00	.00	.10	.10	100
Basic Project Cost		1.06	15.31	16.37	14.30	2.69	16.99	2.79	18.15	18.00	36.15	50
7. Physical Contingencies 3/		.02	.32	.34	1.88	.35	2.23	.14	2.04	.67	2.71	16
8. Expected Price Increases		.23	2.72	2.95	6.51	1.84	8.35	1.34	8.08	4.56	12.64	36
Total Project Cost		1.31	18.35	19.66	22.69	4.88	27.57	4.27	28.27	23.23	51.50	45
9. Preparation for Future Projects												
Hydrological Engineering Equipment & Transport 4/		.10	.77	.87	.30	.00	.30	.23	.63	.77	1.40	55
Engineering Consultants & Overseas Training		.00	.00	.00	.00	.50	.50	.10	.10	.50	.60	83
Grain Storage and Handling Consultants		.00	.00	.00	.00	.30	.30	.00	.00	.30	.30	100
Subtotal		.10	.77	.87	.30	.80	1.10	.33	.73	1.57	2.30	68
Physical Contingencies		.00	.00	.00	.00	.10	.10	.00	.00	.10	.10	100
Price Increases		.00	.01	.01	.00	.09	.09	.00	.00	.10	.10	100
Subtotal		.10	.78	.88	.30	.99	1.29	.33	.73	1.77	2.50	71
10. GRAND TOTAL		1.41	19.13	20.54	22.99	5.87	28.86	4.60	29.00	25.00	54.00	46

1/ Equipment cost details given in Tables 6A-I.
2/ July 1976; US$ 1 = K 6.5
3/ Includes 15% of civil works costs, 5% of other local costs, and 2% of equipment costs.
4/ Includes equipment and transport for hydrological instrument network and engineering surveys.

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Project Expenditure Schedule

		76/77	77/78	78/79	79/80	80/81	81/82	Total
		(Million Kyat equivalent)						
1.	Equipment							
	(i) Construction & clearing	85.1	0.0	0.0	0.0	0.0	0.0	85.1
	(ii) Farm machinery, agricultural supporting services & O & M	0.2	0.4	2.8	3.7	3.9	10.5	21.5
	Subtotal	85.3	0.4	2.8	3.7	3.9	10.5	106.6
2.	**Civil Works**	0.0	23.3	21.3	20.3	18.3	18.2	101.4
3.	Extension & Godown Operation	0.8	0.8	0.8	0.9	0.9	1.0	5.2
4.	Civil Works O & M	0.0	0.0	0.4	0.7	1.4	1.4	3.9
5.	Engineering and Admin.	4.6	4.6	3.6	2.7	1.8	.9	18.2
6.	Physical Contingencies	9.1	2.9	2.9	2.8	2.6	3.2	23.5
	Subtotal	99.8	32.0	31.8	31.1	28.9	35.2	258.8
7.	Expected Price Increases	4.4	6.5	11.0	15.5	18.4	26.3	82.1
	Total, Project	104.2	38.5	42.8	46.6	47.3	61.5	340.9
8.	Preparation for Future Projects							
	(i) Engineering	3.6	3.6	0.0	0.0	0.0	0.0	7.2
	(ii) Grain Storage	2.0	0.0	0.0	0.0	0.0	0.0	2.0
	Subtotal	5.6	3.6	0.0	0.0	0.0	0.0	9.2
9.	Physical Contingencies	0.4	0.3	0.0	0.0	0.0	0.0	0.7
10.	Expected Price Increases	0.2	0.5	0.0	0.0	0.0	0.0	0.7
	Total, Preparation	6.2	4.4	0.0	0.0	0.0	0.0	10.6
11.	Grand Total	110.4	42.9	42.8	46.6	47.3	61.5	351.5

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Price Contingencies

Year	Annual Rate of Price Increase (%)	Accumulated Compound Rate of Price Increase 1/ (%)	Basic Expenditures 2/ This Project	Basic Expenditures 2/ Preparation For Future Projects	Price Contingencies This Project	Price Contingencies Preparation For Future Projects
			(million Kyat equivalent)			
			Equipment and Consultants			
1976/77	9	4	93.8	6.0	3.8	0.2
1977/78	8	12	0.4	4.0	0.0	0.5
1978/79	8	21	3.1	0.0	0.7	0.0
1979/80	8	30	4.1	0.0	1.2	0.0
1980/81	7	40	4.3	0.0	1.7	0.0
1981/82	7	49	11.6	0.0	5.7	0.0
	Subtotal	11	117.3	10.0	13.1	0.7
			Civil Works and Local Costs			
1976/77	13	7	6.0	-	0.4	-
1977/78	13	21	31.6	-	6.8	-
1978/79	12	36	28.7	-	10.7	-
1979/80	12	52	27.0	-	14.4	-
1980/81	10	67	24.6	-	16.7	-
1981/82	10	85	23.6	-	20.0	-
	Subtotal	49	141.5	-	69.0	-
Grand Total		32	258.8	10.0	82.1	0.7

1/ From July 1976.
2/ Including physical contingencies.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Proposed Credit Allocation

Category	Description	Amount Allocated (US$ million)	Percentage Financing
I	Civil Works	7.9	50% of total expenditures.
II	Equipment	17.3	100% of foreign expenditures for directly imported equipment and spare parts;
			100% of the ex-factory cost for locally manufactured equipment and spare parts;
			70% of expenditures for locally procured equipment, spare parts and construction materials.
III	Overseas Training	0.2	100% of foreign expenditures.
IV	Consultants' Services	0.8	100% of foreign expenditures.
V	Unallocated	3.8	
	Total	30.0	

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Credit Disbursement Schedule

IDA Fiscal Year and half-year	Disbursements (US$ million)	Accumulated Disbursements (US$ million)
1977		
1st	0.0	0.0
2nd	20.0	20.0
1978		
1st	0.8	20.8
2nd	0.8	21.6
1979		
1st	0.8	22.4
2nd	0.8	23.2
1980		
1st	0.8	24.0
2nd	0.8	24.8
1981		
1st	0.8	25.6
2nd	0.8	26.4
1982		
1st	0.8	27.2
2nd	2.8	30.0

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Item	Quantity	Unit Cost	Total Cost Foreign	Total Cost Local	Total Cost Total
	(no.)	(US$1/)	------(000 US$1/) -------		
1. Civil Works Construction					
a. Heavy Equipment					
Draglines (2 cu yds)	18	220,000	3,960	200	4,160
Back-hoes (1.5 cu yd)	5	165,000	825	45	870
Scrapers, self-propelled (9 cu yds)	15	71,500	1,072	53	1,125
Tractors (140 hp)	12	77,000	925	45	970
Mobile Generators	20	9,000	180	5	185
Tipper trucks (6 ton)	20	11,000	220	11	231
Diesel tank trucks	5	11,000	55	2	57
Low Bed Trailers (50-ton)	2	83,000	165	9	174
Barges, with two 210 hp outboard motors	2	99,000	198	10	208
Subtotal			7,600	380	7,980
b. Miscellaneous Equipment	1	(Table 6B)	340	12	352
c. Transport	1	(Table 6B)	1,140	40	1,180
d. Field Workshop Equipment & Supplies	2	(Table 6C)	372	21	393
Subtotal			9,452	453	9,905
e. Spare Parts (25%)			2,363	112	2,475
Total, Construction			11,815	565	12,380
2. Civil Works Operation & Maintenance					
a. Transport	1	(Table 6D)	131	69	200
b. Telephone System	1	(Table 6D)	28	1	29
c. Miscellaneous	1	(Table 6D)	1	0	1
Total, O&M			160	70	230
3. Land Clearing					
a. Tractors and implements	24	(Table 6E)	305	15	320
b. Tools	1	(Table 6E)	200	140	340
Total, Land Clearing			505	155	660
4. Farm Machinery					
a. Irrigation Pumps	1,000	(Table 6F)	760	110	870
b. Tractors & Implements	33	(Table 6F)	466	24	490
c. Power Tillers & Trailers	500	(Table 6F)	1,355	75	1,430
Total, Farm Machinery			2,581	209	2,790
5. Agriculture Support					
a. Extension Transport	1	(Table 6G)	46	40	86
b. Miscellaneous	1	(Table 6G)	26	8	34
c. AMD Workshops Equipment	1	(Table 6H)	187	3	190
Total, Agriculture Support			259	51	310
6. Technical Assistance					
a. Hydrological Network Equipment		(Table 6I)	605	100	705
b. Engineering Survey Equipment		(Table 6J)	165	0	165
Total, Technical Assistance			770	100	870
7. GRAND TOTAL			16,090	1,150	17,240

1/ July 1976; US$1 = K 6.5

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Miscellaneous Construction Equipment and Transport

Item	Quantity	Unit Cost	Total Foreign Cost
Equipment		------	(US$[1]) ---------
1. Concrete Mixer (14/10 cu ft)	10	6,600	66,000
2. Concrete Mixer (10/7 cu ft)	10	3,300	33,000
3. Concrete Mixer (7/5 cu ft)	3	2,330	7,000
4. Centrifugal Pump (4", 300 gpm)	100	500	50,000
5. Vibrator with gasoline engine	20	450	9,000
6. Arc Welding Set	5	5,400	27,000
7. Diesel Generator (15 KV)	5	8,800	44,000
8. Sludge Pumps	20	4,600	92,000
9. Bar Cutting & Bending Machine	3	4,000	12,000
Total			340,000
Transport			
1. Cargo Barges	4	53,000	212,000
2. Tug Boats	2	264,000	528,000
3. Inspector Vehicles	12	8,000	96,000
4. Station Wagons	6	9,000	54,000
5. Marine Engines (twin 120 h.p.)	10	22,000	220,000
6. Outboard Propulsion Units (45 h.p.)	30	1,000	30,000
Total			1,140,000

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Construction Field Workshop and Supplies

	Item	Quantity	Unit Cost	Total Foreign Cost
			------ (US$1/)	---------
1.	Lathe, Machine 22"	1	27,500	27,500
2.	Lathe, Machine 16"	1	16,500	16,500
3.	Bench Drill ¾" to 1"	1	1,300	1,300
4.	Bench Drill 1/16" to ¾"	1	850	850
5.	Bench Grinding Machine 12"	2	650	1,300
6.	Wet valve refacers	1	650	650
7.	Valve seat grinder set.	1	350	350
8.	Welding Machine (Arc)	2	6,000	12,000
9.	Gas welding machine set	2	450	900
10.	Compressor 350 cft	1	3,800	3,800
11.	Battery charger	1	400	400
12.	Battery Tester	1	100	100
13.	Inflator head & gauge	4	60	240
14.	Nozzle Tester set	1	1,100	1,100
15.	Vice 8"	3	170	510
16.	Vice 4"	2	130	260
17.	Chain Block 5 tons	1	350	350
18.	Chain Block 1½ tons	1	120	120
19.	Track pin press, 100 tons portable	1	6,600	6,600
20.	Generator, 30 KW	1	8,800	8,800
21.	Tap & Die sets	6	220	1,320
22.	Heavy duty industrial Box Socket	1 set	900	900

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Item	Quantity	Unit Cost	Total Foreign Cost
		------- (US$[1/])	----------
23. Shop master Mechanic Tool box	3 sets	6,600	19,800
24. Mechanic General Purpose Tool set	3 sets	3,300	9,900
25, Tractor Tool set	1 set	2,750	2,750
Subtotal			118,300
26. Main Workshop Supplies	1 set	67,700	67,700
Total			186,000

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Civil Works O&M Equipment

Item	Quantity	Unit Cost (US$[1/])	Foreign (000' US$[1/])	Local (000' US$[1/])	Total (000' US$[1/])
Transport					
1. Inboard diesel 60 H.P. engine	10	10,000	100.0	4.5	104.5
2. Motor boat hulls	10	5,500	--	55.0	55.0
3. Van pick-up	5	3,500	17.5	1.0	18.5
4. Motorcycles	15	900	13.5	0.5	14.0
5. Bicycles	100	80	--	8.0	8.0
Total			131.0	69.0	200.0
Telephone system					
1. Main system (25 phones)	3	3,300	9.9	0.6	10.5
2. Extension (10 phones)	3	2,200	6.6	0.4	7.0
3. Telephone cable	1		11.0	0.5	11.5
Total			27.5	1.5	29.0
Miscellaneous					
1. Kerosene Lanterns	100		1		1.0

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Equipment List

Land Clearing Equipment

Item	Quantity	Unit Cost	Total Cost		
			Foreign	Local	Total
	(no.)	US$1/	----- (000 US$1/)		----
Tractors and Implements					
50 hp unit		6,500			
Tractor spare parts (25%)		1,625			
Disc plow		2,000			
Disc harrow		2,000			
Plow & harrow spare parts (15%)		600			
Total	24	12,725	305	15	320
Tools					
Motorized chain saw		400			
Chain saw spare parts (25%)		100			
Subtotal	400	500	200	0	200
Long blade knife	6,070	2.3	0	14	14
Pick Axe	2,890	4.5	0	13	13
Axe	1,850	4.9	0	9	9
Hand saw	480	79.2	0	38	38
Fork	1,100	2.7	0	3	3
Rubber boots (pairs)	13,300	4.7	0	63	63
Total			200	140	340

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Farm Equipment

Item	Quantity (no.)	Unit Cost (US$[1/])	Total Cost Foreign	Total Cost Local (000 US$[1/])	Total Cost Total
Irrigation Pumps					
1. 300 gpm/30ft lift pump (4 in) 5 hp diesel engine Skid mounting Suction hose & foot valve Tools and 2 fuel cans		530			
2. 300 ft of Delivery Hose (4 in)		80			
3. Spare Parts (25%)		150			
Total	1,000	760	760	110	870
Power Tillers					
4. 7-8 hp unit		1,800			
5. Spare Parts (25%)		450			
Total	500	2,250	1,125	55	1,180
Trailers for Power Tillers					
6. Quarter-ton unit		400			
7. Spare parts (15%)		60			
Total	500	460	230	20	250
Tractors					
8. 50 hp units		6,500			
9. Spare parts (25%)		1,620			
Total	33[2/]	8,120	268	12	280
Implements for Tractors					
10. Disc plow		2,000			
11. Disc harrow (half @ $2,000) & Rotivator (half @ $4,500)		3,200			
12. Spare Parts (15%)		800			
Total	33	6,000	198	12	210

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2/ In addition to 24 sets of tractors and implements for land clearing (Table 5).

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Equipment List

Agricultural Extension Equipment

Item	Quantity	Unit Cost	Total Cost		
			Foreign	Local	Total
	(no.)	(US$[1/])	-----	(000 US$[1/])	-----
Transport					
Large Motorized Boat					
Hull		5,000			
Engine		10,000			
Subtotal	1	15,000	15	1	16
Motorized Country Boats	6	2,500	9	6	15
Small Boats with Outboard Engines	32	1,050	16	18	34
Small Boats	134	105	0	14	14
Four Wheel Drive Vehicle	1	7,000	6	1	7
Total			46	40	86
Miscellaneous					
Audio-Visual Aids			11	3	14
Office Equipment			2	2	4
Research Equipment			13	3	16
Total			26	8	34

1/ July 1976; local costs expressed in Dollars at the exchange rate US$1 = 6.5

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List
AMD Workshops Equipment

Item	Quantity	Unit Cost (US$)	Total Cost (US$)
A. Tractor Workshop (Shwelaung)			
1. General Tools			
(a) Electric Bench Grinder	1	760	760
(b) Heavy Duty Bench Drill	1	1,180	1,180
(c) Breast Drill ½" Capacity 3 Jaw Chuck	1	65	65
(d) Valve Refacer Machine	1	660	660
(e) Valve Seat Grinder	1	330	330
(f) Hand Press	1	200	200
(g) Feeler Gauge 1½" to 25 thousandth	2	5	10
0.05 to 0.80 mm	4	5	20
(h) Stud Extractor Range			
1/4" - 5/8" dia	1	15	15
5/8" - 1" dia	1	10	10
(i) Tap & die set: (ins. & mm)	2	360	720
(j) Vices Jaw Width 4"	2	25	50
Jaw Width 6"	2	35	70
(k) Torque Wrench	3	140	420
(l) Cylinder Gauge	1	120	120
(m) Micrometer Set	2	110	220
(n) Vernier Caliper	5	10	50
Subtotal			4,900
2. Lifting and Moving			
(a) Mobile Gantry 3.5 Tons Capacity	1	850	850
(b) Hydraulic Jack (4 Tons)	1	85	85
(c) Chain Hoist 3.5 Tons Capacity	1	760	760
(d) High Lift Floor Crane	1	630	630
Subtotal			2,325
3. Welding			
(a) Electric Arc Transformer Welder	1	2,640	2,640
(b) Portable Arc Welder	1	2,640	2,640
(c) Gas Welding Set	1	450	450
Subtotal			5,730
4. Diesel Engine Servicing			
(a) Injection Pump Test Bench	1	6,770	6,770
(b) Bench Nozzle Tester	1	200	200
(c) Compression Tester	1	90	90
Subtotal			7,060
5. Electrical			
(a) Armature Growler Tester	1	250	250
(b) Battery Charger	1	660	660
(c) Battery Cell Tester	3	60	180
(d) Hydrometer	6	10	60
Subtotal			1,150
6. General Servicing			
(a) Washing Machine	1	1,060	1,060
(b) Air Compressor	1	3,300	3,300
(c) Grease Gun	10	10	100
(d) Vulcanizer	1	790	790
Subtotal			5,250
7. Painting			
(a) Spray Gun	1	15	15

Item	Quantity	Unit Cost (US$)	Total Amount (US$)
A. Tractor Workshop (Shwelaung) (continued)			
8. Machine Shop			
(a) Lathe Machine ... 630 mm	1	2,180	2,180
(b) Lathe Machine ... 400 mm	1	1,690	1,690
(c) Hack-Saw Machine Capacity 6" dia	1	1,720	1,720
Subtotal			5,590
9. Blacksmith Tools			
(a) Mechanic Tool Kit	10 sets	460	4,600
(b) Blacksmith Tool	2 sets	1,690	3,380
(c) Fan Forge	1 set	380	380
Subtotal			8,360
10. Electrical Power Unit			
(a) Electrical Generating Set	2	4,740	9,480
11. Engine Repair			
(a) Crankshaft Grinding Machine	1	26,000	26,000
(b) Line Boring Machine	1	15,590	15,590
(c) Con-rod Boring Machine	1	14,090	14,090
(d) Up-Right Boring Machine	1	22,420	22,420
(e) Vertical Horning Machine	1	24,240	24,240
Subtotal			102,340
12. Firefighting			
(a) Pump	1 set	2,500	2,500
Subtotal, Shwelaung Workshop			154,700
B. Power Tiller Workshops (Lower Delta)			
13. Tools			
(a) Mechanic Tool Kit	5	125	625
(b) Nozzle Tester	1	40	40
(c) Tap and Die Set	1	300	300
(d) Bench Drill (Manual)	1	340	340
(e) Bench Grinder (Manual)	1	85	85
(f) Table Vice	2	25	50
(g) Valve Seat Cutter Grinder	1	350	350
(h) Portable Welding Machine	1	1,100	1,100
Subtotal			2,890
14. Firefighting			
(a) Pump	1 set	2,500	2,500
Subtotal, one workshop			5,390
Subtotal, Six Lower Delta Workshops			32,340
15. Total			
(a) Tractor Workshop (Shwelaung)			154,700
(b) Six Power Tiller Workshops (Lower Delta)			32,340
GRAND TOTAL			187,040

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Equipment List

Hydrological Instrument Network Equipment

	Local (US$ equiv.)	Foreign (US$)	Total Cost (US$ equiv.)
Equipment			
1. Echosounders for hydrometric surveys 3 Nos. @ US$5,000	0	15,000	15,000
2. Current meters (15 Nos, @ US$2,000) (5 Nos, @ US$4,000) Sediment meters (15 Nos, @ US$2,500) Salinity meter (15 Nos, @ US$2,000)	0	117,500	117,500
3. Laboratory equipment meter quality US$ 7,500 Sediment Analysis US$ 5,000	0	12,500	12,500
4. Hydrometeorological stations including rain fall recorder evaporation pan etc.	0	20,000	20,000
5. Sextants, clocks and stop watches 20 Nos, @ US$1,500	0	30,000	30,000
6. Levelling instruments, theodolites, etc. for topographic survey	0	10,000	10,000
7. Automatic water level recorders 15 Nos. including spares, @ US$2,500	0	37,500	37,500
8. Desk calculators, Electronic calculators, Hand punch for punching computer cards. L.S.	0	10,000	10,000
9. Tools, machines to be used in small workshop for repair of hydrological instruments and construction of small boats	0	7,500	7,500
Sub-total, equipment	0	260,000	260,000
Survey Vessels and Vehicles			
10. Engines and parts for three survey vessels	0	204,000	204,000
11. Small launches, 3 Nos.	0	60,000	60,000
12. Small boat engines, 6 Nos.	0	60,000	60,000
13. Motor jeeps, 3 Nos.	0	21,000	21,000
Sub-total, vessels and vehicles	0	345,000	345,000
Structures			
14. Concrete towers and bridges for water level recorders, 15 Nos.	100,000	0	100,000
TOTAL, Hydrological Equipment	100,000	605,000	705,000

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Equipment List

Engineering Survey Equipment

	Item	No.	Unit Cost	Total
			------ US$ -----	
	Survey instruments			
1.	Levels	70	715	50,000
2.	Theodolite	10	2,500	25,000
3.	Electronic distancer	2	13,000	26,000
4.	Plane table with alidade	40	825	33,000
5.	Stadia staves	100	70	7,000
6.	Leveling staves	100	70	7,000
7.	Electronic calculators	40	62	2,500
8.	Storeroom airconditioner	6	830	5,000
	Subtotal			155,500
	Office equipment			
9.	Electrostatic copier	1	2,200	2,200
10.	Electrostatic copier paper, etc.	1	Ls.	1,100
11.	Tracing paper 42" x 30 yds	1	Ls.	700
12.	Photographic contact printing paper for aerial photos	1	Ls.	4,400
13.	Stationery, drawing pencils, erasers, and graph, semi-log, probability, tracing papers, etc.		Ls.	1,100
	Subtotal			9,500
	Total			165,000

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Rural Credit

General

1. This Annex discusses the present situation of Agricultural Credit in the project area, and presents a set of specific recommendations on rural credit arrangements made by an FAO/IBRD/CP Mission. These recommendations as detailed in paras 8 through 25 are being considered by the Government.

Present Situation

2. The Union of Burma Bank (UBB) and the village banks were financing farmers, until about 1972/73, in the five townships (Pyapon, Laputta, Nyapudow, Bogale and Wakema) in which the project area is situated. No financing was done by UBB and the village banks after the 1972 monsoon season in Pyapon, Laputta, Ngapudow and Bogale townships, and after the 1973 monsoon season in Wakema township. The reasons for this withdrawal from the financing activity was the entry of cooperatives initially, and the Trade Corporation No. 1 (TC-1) from 1974/75, in the financing of paddy farmers under the "advance purchase system" (APS) introduced by the Government in 1973/1974. The TC-1 is now making cash advances at the rate o K 35 per ac at sowing and K 15 per ac at harvest to paddy farmers.

3. Jute farmers in the area were being financed by the Agricultural Corporation (AC) which provided inputs (seed, fertilizers and pesticides) on credit. From 1974/75, AC was limiting its credit activity to advances under APS (K 75 at harvest time) and jute farmers have now to buy inputs by paying cash.

4. The cooperatives are now advancing, under APS, to farmers growing a series of crops other than paddy and jute, 70% of the estimated value of production, 55% after the crops have been sown and 15% at harvest. However, the total area under these crops in the project area is small.

5. The record of UBB and the village banks in financing farmers in the five townships has been poor. As on 31.3.75, UBB and the village banks had a total amount of K 15.8 million outstanding and overdue from the farmers in the five townships, as shown below; the corresponding amount overdue from farmers in the project area was reported to be K 3.1 million.

Township	Amount Outstanding and Overdue: Whole Township	Project Area in Township
	(K million)	
Pyapon	2.97	1.35
Laputta	3.06	0.61
Ngapudow	2.29	0.41
Bogale	5.48	0.43
Wakema	1.97	0.28
Total	15.77	3.08

6. No collections have been received from farmers after the withdrawal of UBB and village banks from the field of financing. The amounts advanced and received in the five townships during the period 1970/1971 to 1973/1974 and the amounts outstanding and overdue at the end of each year are as follows:

Year	Amount Advanced	Amount Recovered	Amount Outstanding and Overdue
	(K million)		
1970/1971	5.3	4.7	13.5
1971/1972	5.3	3.9	14.9
1972/1973	3.1	2.3	15.7
1973/1974	0.2	0.2	15.8
1974/1975	-	-	15.8

Setting Up of a New Agricultural Bank

7. Under the Banking Law of the Socialist Republic of Burma, 1975 which was passed on 12 November 1975, a new bank called the Myanma (Burma) Agricultural Bank (BAB) was to be set up to take over the functions at present carried out by the Agricultural Finance Division of UBB. The new bank was scheduled to begin in the spring of 1976. The bank's equity capital was to be of the order of K 40 million and it was to have reserves amounting to K 20 million. It was also to hold deposits of village banks amounting to K 104 million, formerly held in UBB. Whether the new bank will also take over all the outstanding loans of the Agricultural Finance Division is not yet clear. If it does, it will, in its balance sheet, show a borrowing of K 287.5 M from UBB and a loan outstanding (including interest) of K 344.6 M. As a good part of these loans may prove to be unrealizable, the resulting loss will wipe out the bank's equity capital and reserves. The Vice-Chairman of the UBB has stated that the amount due to UBB will be treated as an interest-free working capital contribution against which future losses on lendings prior to formation of the BAB could be set off.

8. The Board of UBB has already recommended that the Government should permit BAB to charge village banks 6% interest on short-term loans, as against the 3% interest which UBB was charging. This would mean that the rate of

interest payable by the farmer would be 12%, the village banks' margin being retained at 6%. The interest margin of the BAB would be 6% less the rate payable on future borrowings from UBB, which is yet to be determined.

Credit Arrangements Under the Project

9. It is the Government's intention that BAB and the village banks function as the sole agency to provide credit to farmers in Burma. In the project area this becomes all the more necessary as, in addition to short-term production credit, the farmers have to be advanced medium-and long-term 1/ credit for purchase of draft animals, tractors, or power tillers, and farmer who are to reclaim abandoned wasteland may require such credit for hiring tractor service, renting chain saws or buying hand tools. In order to enable BAB and village banks to carry out this function, IDA has suggested to GOB that the the following steps to reorganize the activities of the various agencies providing agricultural services would appear advisable:

(1) TC-1, AC and the Cooperatives are making advances to farmers under APS. Such advances should be made only at pre-harvest time and should be limited to cover the expenses the farmer has to incur for harvesting, storage and transport to the buying centers of these marketing agencies.

(2) BAB and village banks would provide short-term credit to the farmers to meet all cultivation costs up to harvesting stage. Such credit would be made in kind for material inputs purchasable by the farmer from the Agricultural Corporation (AC). The BAB and the village banks would also provide the medium-long-term credit required by the farmer, the necessary farm equipment (draft cattle, tractors/power tiller and pump where required) being supplied by the AC.

(3) The marketing agencies (TC-1 for paddy, AC for jute and the Cooperatives for other crops) would agree to deduct from the sale proceeds of the farmer the amounts due to be paid to the credit agency (both on the short-term loan account and the annual installments of medium-long-term loans) in addition to the pre-harvest advances made by them, and pay the credit agency the amount due to it.

1/ A medium-term loan in Burma is a loan with period of maturity ranging from one to four years; long-term loan stands for loans with a period of maturity five years and above.

(4) Several of the 12,800 farmers in the project area are already indebted to the village banks on account of loans availed of in earlier years and which have now become overdue. The amount under default is reported to be about K 3.1 M. The BAB and village banks should be permitted to reschedule such outstanding amounts.

(5) UBB and the village banks are unable to proceed against defaulting members of village banks, for recovery of loans overdue, under the Lower Burma Land Revenue if the Township People's Council objects to such action. In future financing, except where such defaults occur due to drought, floods or other natural calamities and where the Township People's Council object to action under the Lower Burma Land Revenue Act, the Council should agree to guarantee their assistance in recovering the amount within six months.

10. In regard to (1) and (3) above, discussions with TC-1 showed that it was agreeable to the change of procedure suggested above. This would involve a modification of the contract now entered into by TC-1 with the farmer. As regards AC, BAB and the village banks were agreeable to taking over the entire financing of jute farmers as it provides the only marketing outlet for raw jute. The need for production credit for other minor crops may not arise as the main income of the farmer would be from paddy and jute. The operations of the Cooperatives may not thus affect those of the credit agencies but if similar coordination could be effected in this case also, it would be beneficial.

11. As regards (2), the procedure to be followed would be for the Village Tract and Village Managers (procurement) of AC to prepare a farm plan for each farmer with the assistance of the Field Supervisors of BAB. The latter would then assist the farmer in preparing his loan applications for the short-term loan for each season and a loan application for the medium-term loan. The proforma for the farm plan would be devised by the Project Unit in consultation with AC; the proforma for the loan applications would be drawn up by BAB.

12. The UBB's Agricultural Finance Division is prepared to adopt the procedure suggested in (4) above in regard to old loans.

13. In regard to (1), (3) and (5), as action involves more than one Ministry, Cabinet approval for the procedure recommended would be necessary.

Lending Procedure

14. The UBB is agreeable to the following loan procedure being followed in the project area. Once a loan application is prepared, it would be sent to the village bank which would forward it to the Village Land Committee for certification of the area under cultivation by each farmer. Thereafter the Village Bank Committee would recommend the loan and forward the loan applications to the Township Branch Office of BAB for sanction. After sanction,

loan accounts for each farmer would be opened in the books of the village banks. The farmer would obtain his supply of inputs from AC and on presentation of receipts by the farmer, AC would be paid directly by the financing bank and the farmer's loan account debited. Cash loans for payment of wages to hired labor would be disbursed by the village bank directly to the farmer. After harvest, the field staff of the financing bank and/or the paid Secretary of the village bank would assist the farmer in transporting his produce to the buying depot of the marketing agency and would be present at the time of sale. The marketing agency concerned (TC-1 and AC) would make a payment of the amount due to the village bank, by check drawn on the financing bank.

15. The UBB has laid down the conditions relating to security against which loans would be advanced to farmers by village banks. The security for short-term loans would be personal guarantees by two other cultivators; for medium-and long-term loans additional security in the form of hypothecation of asset purchased would be taken. Loans by BAB to village banks would be guaranteed by the Village Bank Committee.

16. The loans advanced to a farmer would be such that his annual repayment due on all loans would not exceed 60% of the value of his gross produce.

17. The rate of interest payable by the farmer on short-term loans is presently 9% but UBB has recommended that this should be raised to 12%. The GOB has also to decide the interest to be charged on medium-and long-term loans.

18. The UBB is prepared to adopt the scales of finance recommended by the project Implementation Committee, for each crop in the project area. This would be considerably higher than present scales of finance.

19. As the loan procedure in the project area would be different from what is now practiced elsewhere in the country and would involve coordination with the input supply and marketing agencies, IDA has suggested that UBB undertake to draft detailed loaning procedures for adoption in the project area.

Staff Requirements

20. The Township Offices of UBB are inadequately staffed and no conveyance is provided to staff members to visit farmers. The IDA has suggested to UBB that creation of a field staff unit at each Township Office would be essential for supervision of credit operations. The village banks have at present no staff, and village bank accounts are frequently being maintained at the Township Offices of UBB. A paid Secretary would be appointed in each village bank.

21. There are 70 village bank servicing the 11 islands in the project. At the rate of one Field Supervisor (FS) for ten village banks, a total of seven FSs would have to be appointed, the salary and allowances payable per FS being on the order of K 3,000 per annum. Each FS will be on field visits for about 20 days each month and would, on completion of his field trip, submit a report on his findings to the Manager of the Township Office of

the bank. Transport in the project area is both by boat and by cycles. A total of seven bicycles and five boats powered by outboard motors are required. The Township Offices of BAB have at present no equipment for maintenance of accounts. Two hand-operated calculators to each BAB Township Office would be needed to maintain accounts up-to-date.

22. The 70 village banks would require 70 paid secretaries at a cost of K 2,500 per annum per secretary.

23. The cost of staff and equipment needed is as follows:

	Total Cost (K)	Foreign Exchange (US$)
Capital Costs		
7 bicycles at K 1,200 per bicycle /a	9,100	1,400
5 boats at K 11,000 per boat /b	55,000	5,000
10 calculating machines /c	6,025	924
Total	70,125	7,324
Annual Costs		
Staff Salary		
7 field supervisors at K 3,000 per FS	21,000	
70 village bank secretaries at K 2,500 per secretary	175,000	
5 boat operators at K 1,800 per operator	9,000	
Operating Costs		
Boat operating costs at K 600 per boat	3,000	
	208,000	

24. At the rate of K 200 per ac short-term loan, each village bank will have a gross annual turnover of about K 0.5 M which would yield a net income from interest margin of K 25,000 assuming that the loan is outstanding for nine months. The secretary's cost could thus be easily met from this income. The Township Offices will have gross annual turnover, on the average, of about K 7 M and at interest margin of 3% will have a net income of K 0.14 M. The additional staff proposed could thus be supported from income earnings.

25. However, the BAB and village banks will not initially be earning sufficient profits to pay for the staff or purchase the equipment/vehicles needed. It is therefore necessary for the project to meet the capital costs (vehicles and equipment) and the annual costs for a three year period. The actual amount required to be disbursed annually will depend on the phasing proposed and the number of polders brought under the project each year.

26. The amounts to be provided in the project are as follows:

	Local Cost (K)	Foreign Exchange (US$)
Capital Costs	22,400	7,324
Annual Costs	608,000	-
	630,400	7,324

May 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Organization and Management

Background

1. According to the Burmese Constitution (January 1974 National Referendum), the Pyithu Hluttaw (Parliament) is vested with the supreme executive, legislative and judicial authority, and the Burmese Socialist Program Party is the only authorized political party. Cabinet decisions are subject to approval by the Central People's Council or even the Party Central Executive Committee unless on matters for which the Cabinet has been delegated power to make final decision. Members of the Central People's Council are elected by Parliament from among candidates nominated by the Party.

2. There is a People's Council at each Division/State (14), Township (314), Village Tract and Village/Ward. At each level, the Party has three committees: the Peasant Council, the Workers Council and the Youth Organization.

3. The Township People's Council is the key of local administration. It has under it three committee: Executive, Judicial and Inspectors. The Executive Committee has an Economic Affairs Sub-Committee, the current major function of which is to implement the Four Year Plan. The Council and its committees have their respective secretariats headed by Ministry officers. The Department, and Corporation officers who would participate in implementing the Lower Burma Paddyland Development Project are members of sub-committees or sub-sub-committees of the Executive Committee of the Township People's Council, and work within the framework of the Council and Committees.

4. Below the Township level, officers of some Departments are still present, such as the AC village tract and village managers, the SLRD village revenue officers, the Village Tract Cooperative Store manager, etc., but other Departments may or may not have any officer at these levels. Likewise, the Village Tract and Village People's Councils, their committees, and the Party committees at these levels have much fewer occasions to make decisions. They generally carry out instructions received from the Township Councils.

5. The Land Committee is unique in that the Central Land Committee resides within the MAF and is chaired by its Deputy Minister. The other members include representatives from the Central Peasant's Council, Central Labor Council, Cooperative Department, Central Law Office, etc. There are Land Committees in each Division, Township, Village Tract and Village. These committees settle disputes relating to land rights.

6. The Party committees at all levels are advisory to the People's Councils and provide a forum for peasants, workers and youth. The Department and Corporation officers also attend meetings when required.

Agency Responsibilities

7. The National People's Council has authorized the Cabinet to prepare and proceed with Bank financed projects. The overall implementation responsibility for this project would rest with the MAF (MAF Organization Chart, Figure 1).

8. A total of 11 agencies, seven under MAF and four under other ministries, would be involved in project implementation. The seven agencies under the MAF and their responsibilities would be as follows:

a. Irrigation Department (ID) would be responsible for the planning, design, construction, operation and maintenance (O&M) of all flood control and drainage facilities, and the procurement of construction and O & M equipment. It would also be responsible for conducting the delta-wide hydrological study for planning future projects with assistance from consultants (Annex 3).

b. Settlement and Land Records Department (SLRD) and Survey Department (SD) would survey farms to be displaced by embankment and drains, survey and demarcate land to be reclaimed, and prepare related cadastral records and maps (Annex 4).

Central Land Committee (CLC), through Village Land Committees would allot land to displaced farmers and landless farmers in the Townships (Annex 4). Working People's Settlement Department (WPSD) would organize force account land clearing to supplement family labor of land allottees, and settle some retired servicemens' families in Dauntgyi polder, where the population is sparce (Annex 4).

c. Agricultural Corporation (AC) would provide research support, implement the intensified extension program, supply seeds, fertilizers and other inputs to project farmers, and construct four additional fertilizer godowns in the project area (Annexes 5 and 6).

Agricultural Mechanization Department (AMD) would procure and sell to farmer groups or cooperatives the pumps, power tillers and tractors to be provided by the project, provide tractor service to farmers, rent power chain saws to land allottees for mangrove clearing, provide maintenance service for farm machine and pumps and construct, equip and staff seven field workshops in the project area (Annex 6).

d. Four agencies not belonging to MAF would also be involved: the new Burma Agricultural Bank (BAB), under the Ministry of Planning and Finance (MPF), would provide long- medium-and short-term credit to existing farmers and new land allottees through the village banks (Annex 10). The Cooperative Department (CD) under the Ministry of Cooperatives would stock and sell land reclamation and/or animal drawn tools to land allottees (Annex 10). The MPF would make annual budgetary appropriation to ID for O & M of the project flood control and drainage facilities, and determine the recovery of project capital cost.

Trade Corporation Number One (TC-1) which handles paddy procurement and domestic supply under the Ministry of Trade, would conduct in coordination with AC the feasibility study for the paddy storage and handling project with assistance from consultants (Annex 11).

9. Project implementation would involve:

(a) construction of flood control structures and establishment of an effective O & M system for such structures;

(b) reclamation of abandoned/wasteland and allotting to qualified families;

(c) strengthening various agricultural supporting services for realizing the projected changes in cropping pattern and yield increases; and

(d) deciding and implementing a system for assessing and appropriating O & M costs and recovery of capital cost of the project.

10. Of the above tasks, (a) can be decided and implemented by ID alone, (b) and (c) would involve a number of agencies and the phasing of each agency's work would be conditioned by the project construction schedule. A great deal of frequent interagency coordination will be needed. Item (d) would require agreement and close coordination between MAF and MPF. From time to time, the Project Implementation Committee (PIC) would need to seek endorsements from the Minister, the Cabinet or even the National People's Council. A longer lead time would be allowed for planning all steps to be taken. Once the project and the various measures for implementation are endorsed by the National People's Council, the Division, the Township, Village Tract and Village People's Councils would follow the decisions made.

Project Management

11. To coordinate the work of the 11 agencies, a Project Implementation Committee (PIC) would be formed in MAF. This committee would be

chaired by the Deputy Minister of MAF and would comprise the road or senior representatives of all 11 participating agencies and the Director General of the Planning and Statistics Department of MAF as members (Fig. 2). The committee would be responsible for inter-ministerial and inter-agency coordination and for securing necessary endorsement of project matters by the Minister, the Cabinet, the Central People's Council and other Authorities. Under the Committee, a Project Unit (PU) would be established, and comprised of senior technical officers of the seven MAF participating agencies as members. A senior ID officer would be appointed the Project Director of PU, who would serve concurrently as the member secretary of PIC. With adequate supporting staff, he would be responsible for coordinating technical planning and field operation of the various agencies components. Each PU member would be responsible for implementing the project work related to his agency.

12. In each of the five project townships, a Township Project Committee (TPC) would be formed to coordinate the project works. The Committee would comprise township level officers of the participating agencies as members. The ID engineer would serve as the chairman and the AC Township Manager as member secretary during the construction period. After the completion of construction, the AC Township Manager would be the chairman, and another member officer will serve as the secretary.

Civil Works Construction Organization

13. The flood control works construction organization of the Irrigation Department is shown in Figure 3.

14. The construction of fertilizer godowns would be handled by the AC under the supervision of its General Manager for Administration. The construction of field workshops and tractor stations would be handled by the Agricultural Mechanization Department under the supervision of its Director for Equipment Utilization.

15. Actual maintenance work to be done has been discussed in Annex 12. Based on that, the project would have one maintenance laborer per mile of embankment in the dry season and two laborers per mile during the monsoon months. The work crew would be organized in groups of five men, responsible for 5 mi of embankment during the dry season. In the wet season, when daily work is to be done, nine men would work as a team. Under an Executive Engineer, six maintenance units would organized, one for Shwelaung and five for the ten coastal polders. Tentatively, the staff of the six units would be grouped as follows:

Unit No.	Polder
1	Shwelaung
2	Zinbaung, Letpanbin, Kyet-Pha-Hmwe-Zaung
3	Myogon, Daw Nyein, Dedalu
4	Bantbwezu
5	Betut, Algyun
6	Dauntgyi

Unit No. 4 would be the existing O&M headquarters at Pyapon; the other five would be established as soon as the construction of polders was completed. The laborers and sluice operators would be stationed in the polders.

16. The staffing pattern of the maintenance units for Shwelaung, Zinbaung and Letpanbin polders for which the project designs are completed are given in Figure 4 as examples.

17. Owners or users of the pumps, power tillers, farm tractors etc. would meet their own O&M costs. With the seven new field workshops and workshop equipment and tools provided by the project, AMD engineers and technicians would be well equipped to service the equipment at reasonable costs to the owners.

18. The quarters and workshop buildings for ID construction and maintenance units would be maintained by ID, the fertilizer godowns by AC, and the farm equipment workshops by AMD. Operation and maintenance costs have been provided for the six year project implementation period.

Extension Service Organization

19. The extension service organization is discussed in Annex 5. The organization chart of the proposed system is shown in Figure 5 of this Annex.

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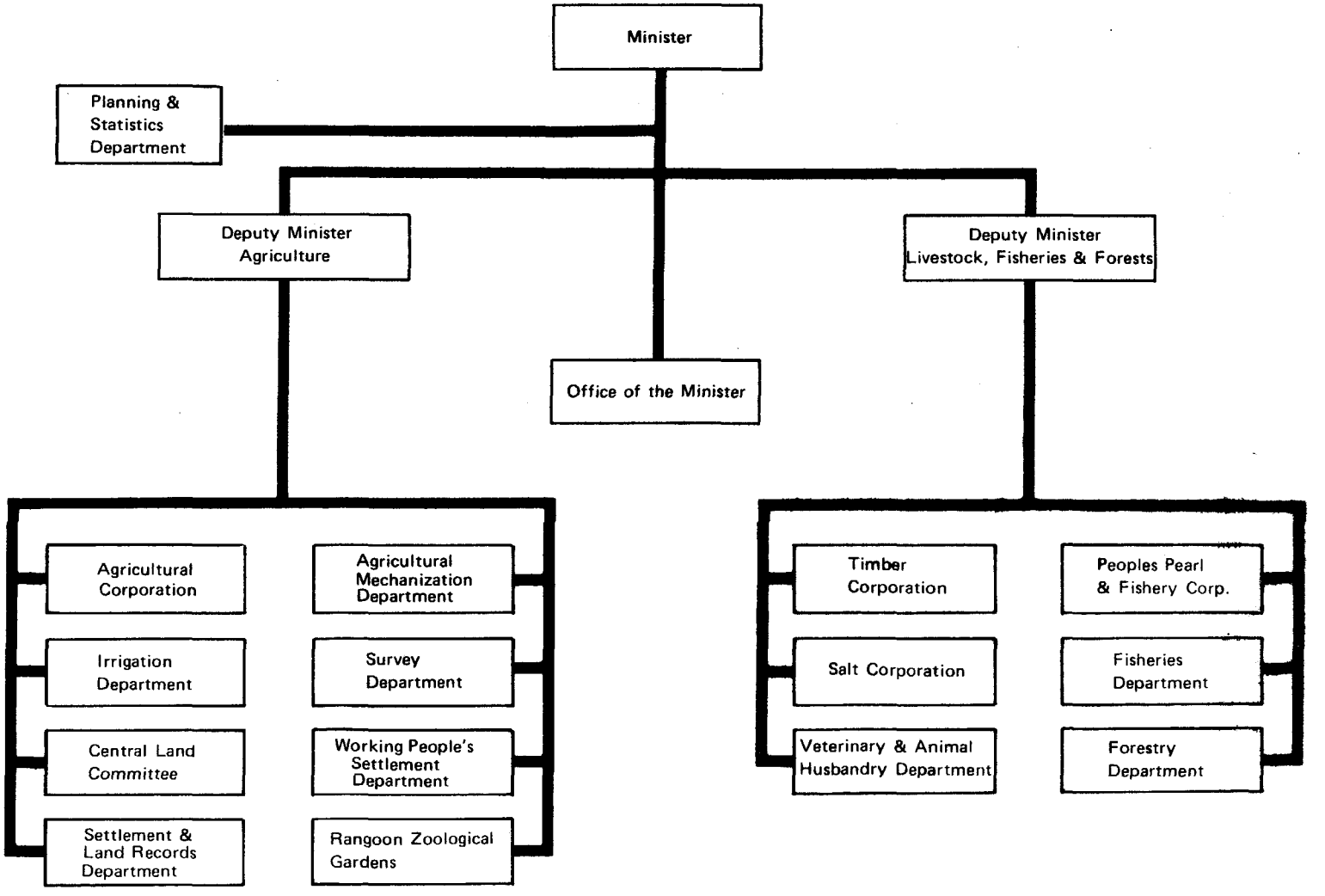
ANNEX 11
Figure 1

BURMA
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
The Ministry of Agriculture and Forests Organization Chart



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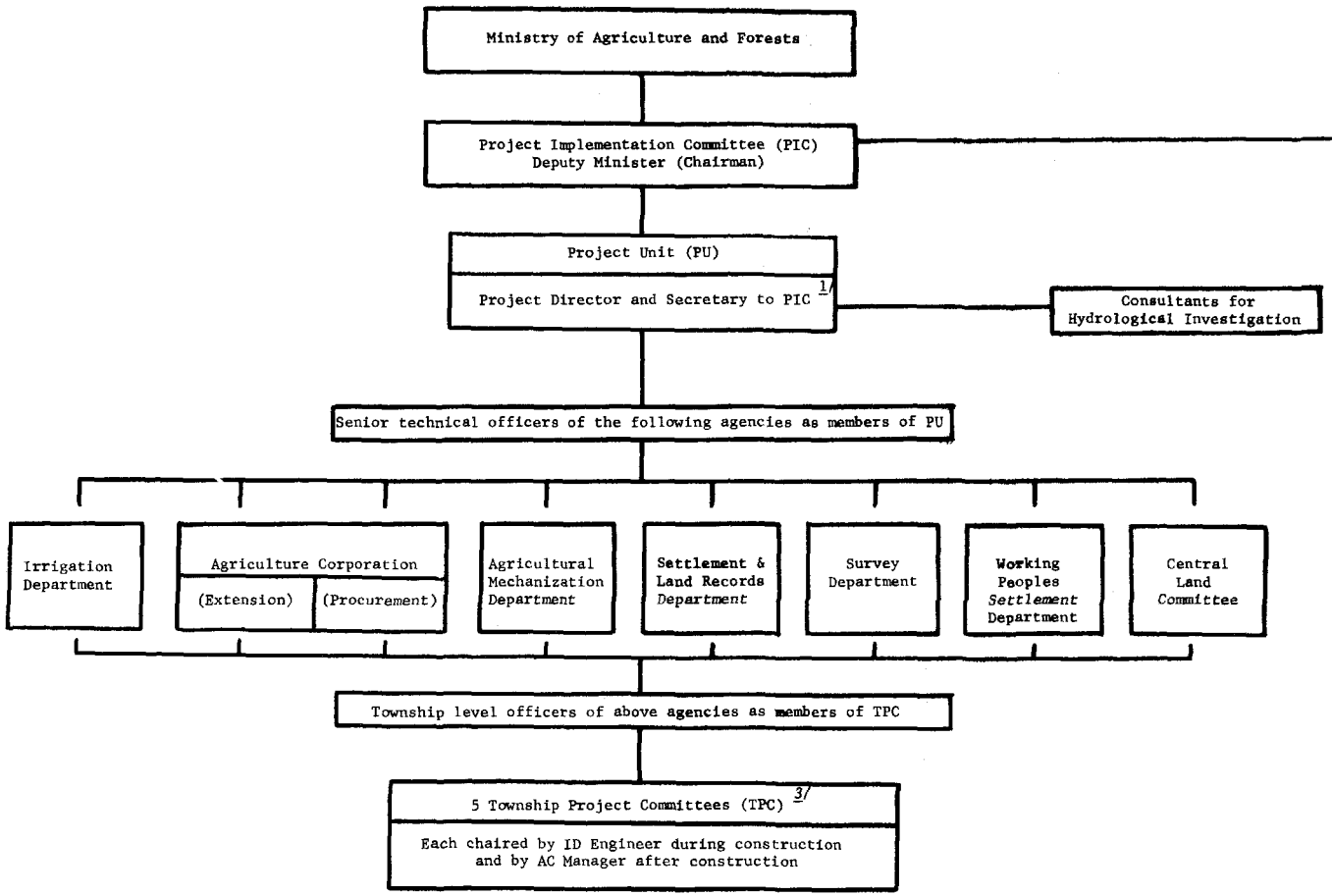
ANNEX 11
Figure 1

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Proposed Project Organization



Members

(1) Director General, Planning and Statistics Department (PSD).

(2) Director General, Irrigation Department (ID).

(3) Managing Director, Agriculture Corporation (AC).

(4) Director General, Agricultural Mechanization Department (AMD).

(5) Director General, Land Records and Settlement Department (LRSD).

(6) Director General, Survey Department (SD).

(7) Director General, Working People's Settlement Department (WPSD).

(8) Secretary, Central Land Committee (CLC)

(9) Representative of Burma Agricultural Bank (BAB).

(10) Representative of Cooperative Department (CD).

(11) Representative ofMinistry of Planning and Finance (MPF).

(12) Representative of Trade Corporation No. 1 (TC-1). 2/

(13) Project Director, Member Secretary.

1/ A senior Irrigation Department Engineer.

2/ Consultants for feasibility study for paddy storage and handling project would be attached to TC-1.

3/ In Wakema, Laputta, Ngapudaw, Pyapon and Bogale Townships.

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ANNEX 11
Figure 2

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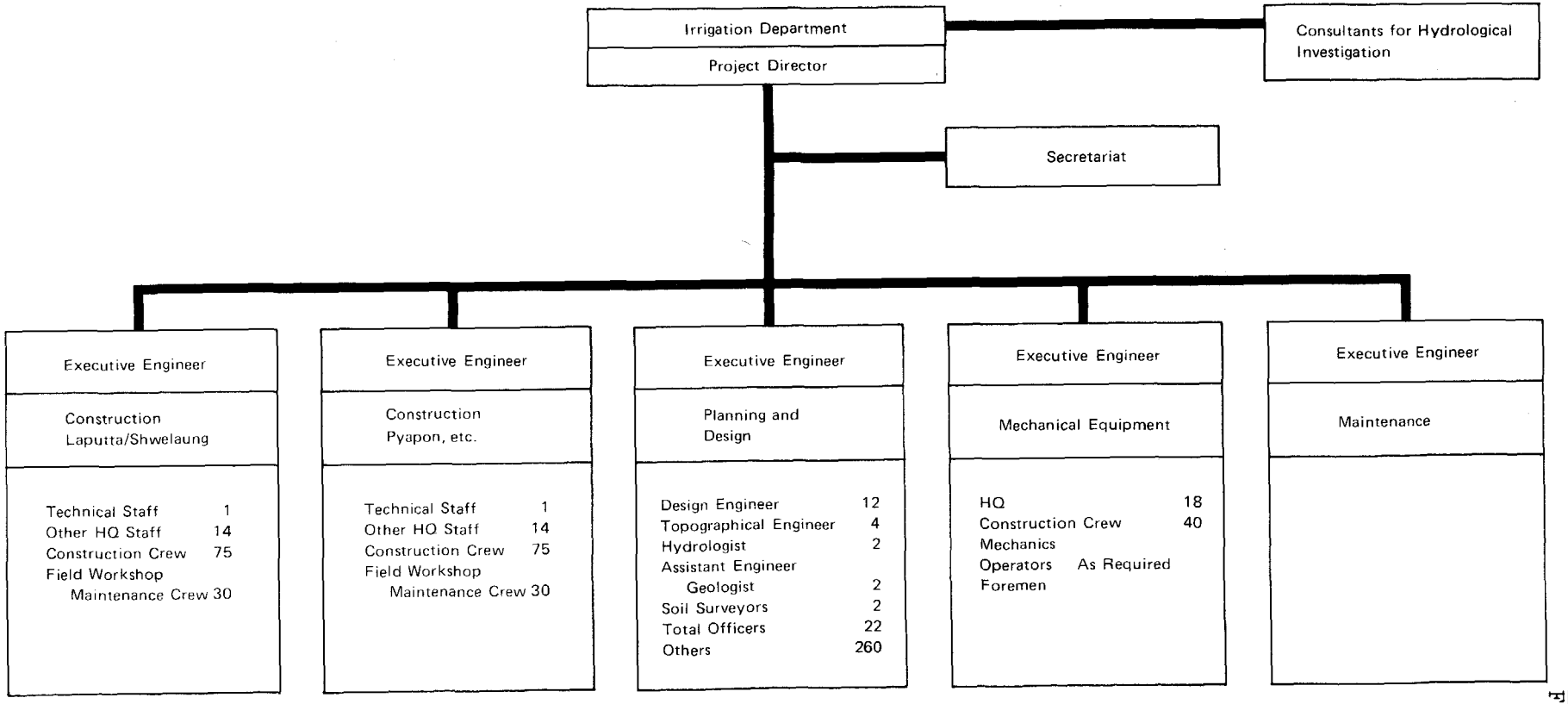
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
Flood Control Structures Construction Organization



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ANNEX 11
Figure 3

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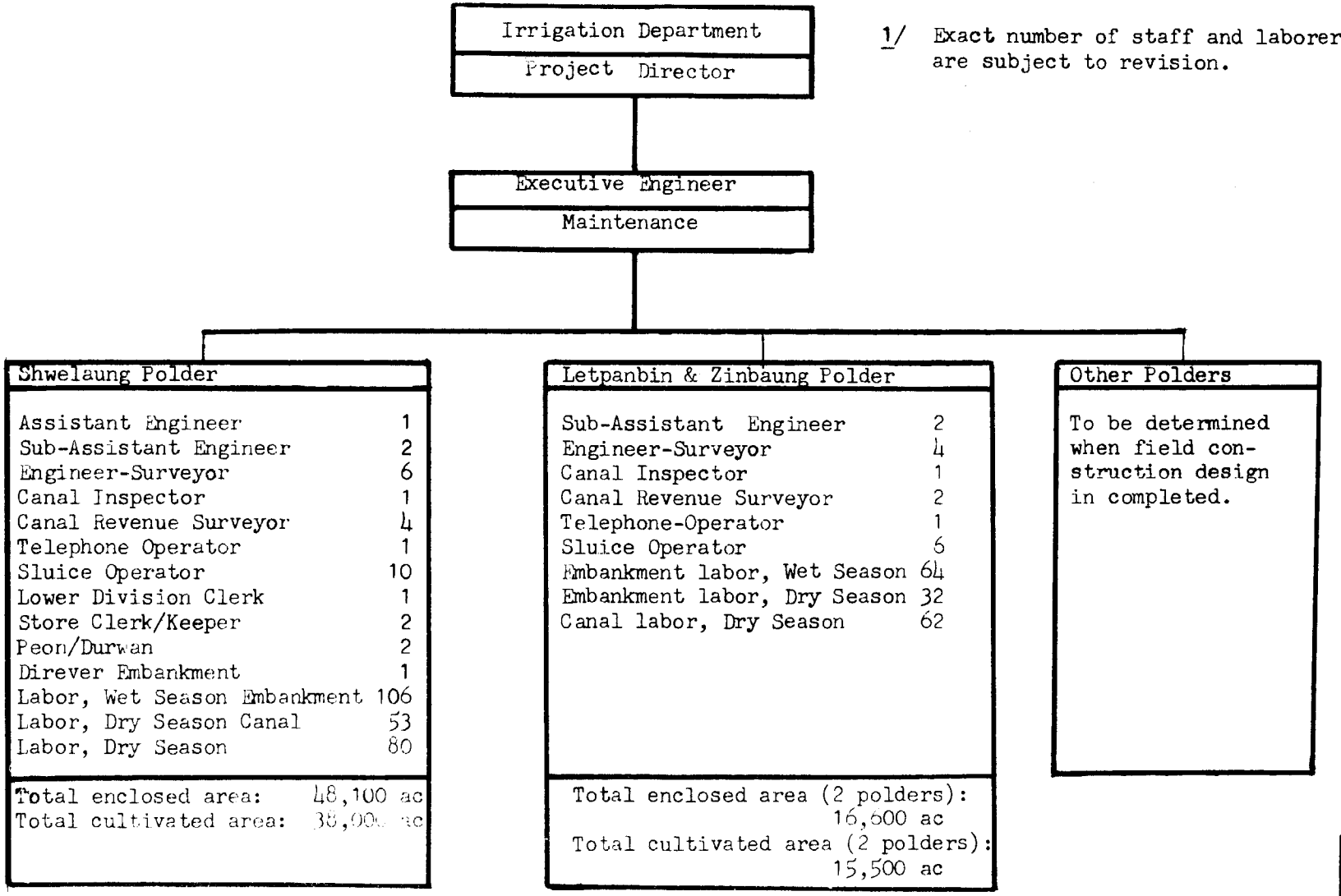
LOWER BURMA PADDY LAND DEVELOPMENT PROJECT

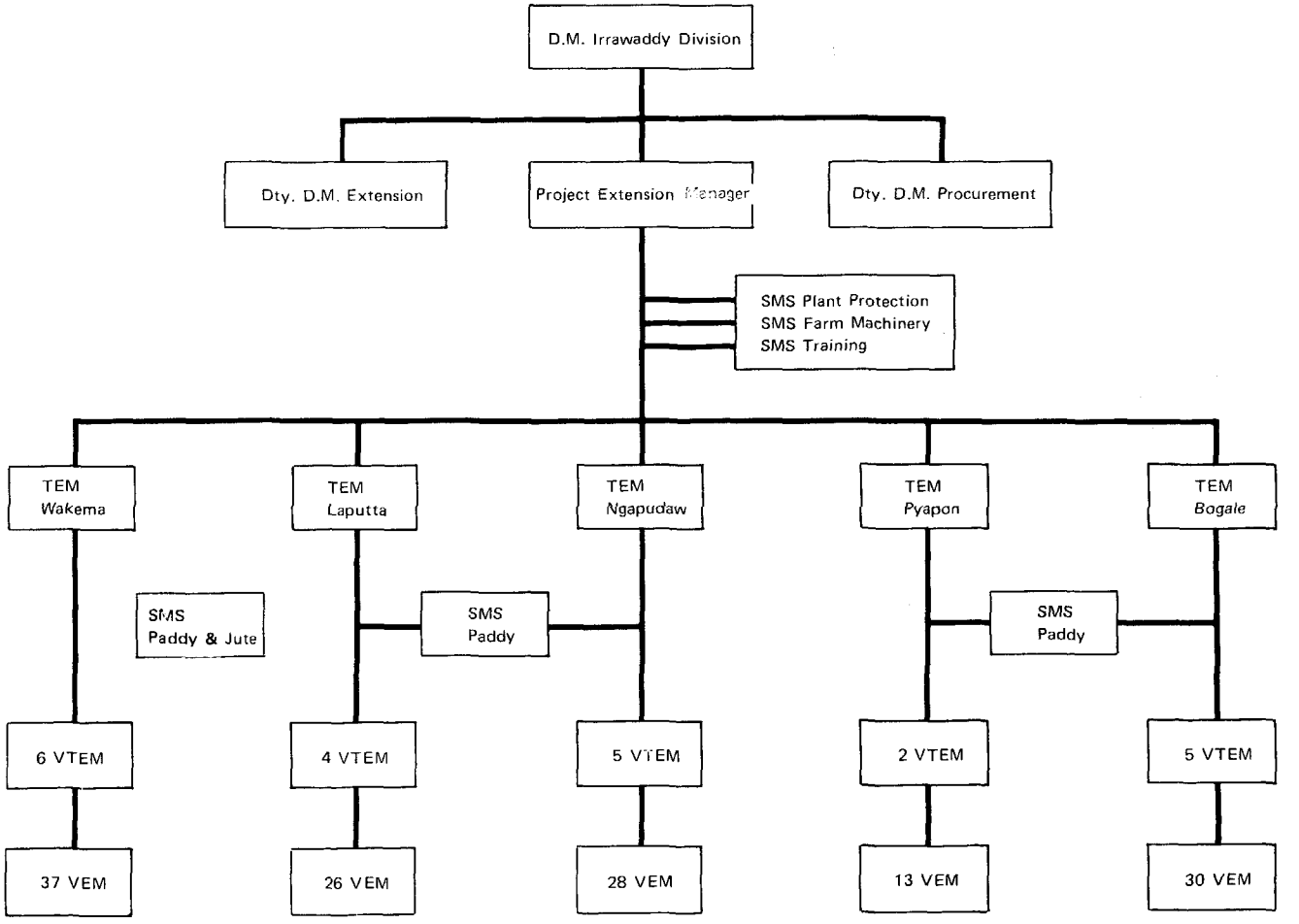
Examples of Flood Control Structure Operation & Maintenance Organization[1/]



1/ Exact number of staff and laborers are subject to revision.

ANNEX 11
Figure 4

BURMA
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
Organization Chart of the Proposed Extension Program



D.M. – Division Manager

Dty. D.M. – Deputy Division Manager

SMS – Subject Matter Specialist

TEM – Township Extension Manager

VTEM – Village Tract Extension Manager

VEM – Village Extension Manager

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BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Operation and Maintenance

Existing Works

1. Embankments. Prior to World War II, the large land owners built and maintained the minor embankments. After the war and the nationalization of land, the many small farmers had neither the skill, resources nor the cohesion without strong local leadership to maintain these works communally, apart from simple flood defenses bordering individual fields. Consequently, embankment deterioration resulted in large scale paddyland abandonment.

2. In 1957, GOB commenced construction of minor river and tidal flood protection embankments and since 1970 vested the maintenance responsibility in the Irrigation Department (ID) whose annual O&M budget allocation (K 5 per ac of land protected) is, however, inadequate to fully maintain these works, which are also deteriorating.

3. Drainage Channels. The pre-war land owners built and maintained simple drainage networks and sluice gates, which deteriorated in the post-war period. At present, there are few formal drainage schemes and maintenance in the project area is largely restricted to the GOB-built projects at Laputta and Zinbaung. No separate budgetary allocation is made for drainage, the costs of which are met from within the K 5/ac allocation for embankments.

Small Irrigation Pumps O&M

4. Small irrigation pump O&M is with the farmer owners. Under Credit 483-BA, a small repair center is to be set up at Wakema which will service pumps in the Schwelaung polder. The O&M costs based on current AMD information are set out in Table 1.

Embankments and Channels O&M

5. Recurrent Costs. Adequate maintenance would require that, during each dry season, work crews make routine inspections and repairs to restore the embankment side slopes and crest elevations 1/ after periodic settling and damage from cattle, rain wash, and rodent and pest

1/ Crest settlement and erosion amounts to about three inches per year.

burrows; and that they free channels of weeds and siltation and repair sluice gates and structures. They also would complete major repairs occassioned by flood damage. During the monsoon season, they would make frequent embankment inspections and carry out emergency earthwork repairs to provide continuous protection for monsoon season crops. Work crews, which would carry out a large part of the work by manual labor, would comprise a team of five men during the dry season and nine men during the flood season. Such a crew would be responsible for about 5 mi of embankment.

6. Key large sluices would require operators in residence. At Shwelaung where the normal drain flow would reverse at times to provide river water for irrigation, special operating instructions would be worked out for each sluice and set out in an operators' manual.

7. Six O&M units comprising housing and office buildings for the engineer, crews and operators serving the project area would be located as follows:

	O&M Unit	Polders served
1.	(proposed)	Middle Delta - Shwelaung
2.	(proposed)	Lower Delta - Zinbaung
		Letpanbin
		Kyet-Pha-Hmwe-Zaung
3.	(proposed)	Lower Delta - Myogon
		Daw Nyein
		Dedalu
4.	(existing)	Lower Delta - Bantbwezu
5.	(proposed)	Lower Delta - Betut
		Alegyun
6.	(proposed)	Lower Delta - Dauntgyi

8. The O&M cost estimates for the project embankments, drainage channels, and control structures for the middle and lower delta polders are shown in Tables 2 and 3, respectively. The ID plans to refine the estimates after the construction is complete and periodically thereafter as a basis for the requisite budget allocations which GOB has agreed to make.

9. Maintenance activity would begin the first season after construction of each polder section is completed. In addition to providing requisite repairs and protection, the initial maintenance periods would provide training for personnel. The project capital costs include the cost of O&M during the project implementation.

10. Buildings and Equipment. The project capital costs also include the cost of buildings and imported equipment required for the maintenance staff and crews. The cost of a typical housing and building unit, five of which the project would provide, is shown in Table 4. Equipment requirements are given in Annex 9.

May 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Operation and Maintenance

Small Irrigation Pumps

Item	Cost per Unit (Kyat)
Fuel 250 gals for operation of 1,000 hours per year	875
Average repair cost per year	400
Farmers' average transport costs for fuel	43
Farmers' average transport cost for repairs	50
Total	1,368

O&M Cost per hour = K 1.4

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Operation and Maintenance

Middle Delta Polder (Shwelaung) Annual O&M Cost

A. Staff Costs

	Personnel	Nos.	Monthly Salary (Kyat)	Average Annual Cost (Kyat)
1.	Assistant Engineer	1	800	9,600
2.	Sub-Assistant Engineer	2	560	13,440
3.	Engineering Surveyor	6	360	25,920
4.	Canal Inspector	1	420	5,040
5.	Lower Division Clerk	1	180	2,160
6.	Store Clerk	1	300	3,600
7.	Store Keeper	1	200	2,400
8.	Peon	1	100	1,200
9.	Durwan	1	100	1,200
10.	Driver	1	200	2,400
11.	Labor (rainy season): embankments (53 mi)	106	100	63,600
	Labor (dry season): (a) embankments (53 mi)	53	100	31,800
	(b) channels	80	100	48,000
12.	Channel Revenue Surveyor	4	360	17,280
13.	Telephone Operator	1	180	2,160
14.	Sluice Operators	10	100	12,000
	Subtotal (38,000 ac)			241,800

B. Materials, Fuel, and Equipment Running Costs

1.	Embankment	(1% of civil works cost)	45,500
2.	Drainage channels	(1% of civil works cost)	93,600
3.	Staff quarters maintenance	(2% of civil works cost)	24,800
4.	Sluice structures		
	(i) Main sluices	(2% of civil works cost)	136,600
	(ii) Culvert sluices	(2% of civil works cost)	85,800
	Subtotal (38,000 ac)		386,300

C. Total 628,100

D. Cost per acre K 17 per ac

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Operation and Maintenance

Lower Delta Polders Annual O&M Cost

A. Staff Costs (Letpanbin & Zinbaung Polders)

Personnel	Nos.	Monthly Salary (Kyat)	Average Annual Cost (Kyat)
1. Sub-Assistant Engineer	2	560	13,440
2. Canal Inspector	1	420	5,040
3. Engineering Surveyor	4	360	17,280
4. Channel Revenue Surveyor	2	360	8,640
5. Sluice Keeper	6	100	7,200
6. Telephone Operator	1	100	1,200
7. Labor (rainy season): embankments (35 mi)	70	100	42,000
Labor (dry season): (a) embankments (35 mi)	35	100	21,000
(b) channels	62	100	37,200
Subtotal (15,500 ac)			153,000

B. Staff Cost per acre — K 9.9 per ac

C. Materials, Fuel and Equipment Running Costs (all Lower Delta Polders)

1. Embankments (1% of civil works costs)	181,400
2. Drainage Channels (1% of civil works costs)	119,600
3. Buildings (2% of civil works costs)	97,600
4. Sluices and Culverts (2% of civil works costs)	704,600
Subtotal (147,000 ac)	1,103,200

D. Materials & Fuel Cost per ac — K 7.5 per ac

E. Total Cost per ac — K 17 per ac

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Operation and Maintenance

O&M Building Costs
(One O&M Unit)

	Item	No.	Unit Cost (1,000 Kyat 1/)	Total Cost (1,000 Kyat 1/)
1.	Assistant Engineer Quarter 1,500 sq ft each Concrete floor & wood frame Brick nogging walls Asbestos sheet roof	1	53	53
2.	Sub-Assistant Engineer Quarter (same as A.E. Quarter)	2	53	106
3.	Assistant Engineer Office 1,170 sq ft each Concrete floor and wood frame Brick and asbestos sheet walls Asbestos sheet roofing	1	60	60
4.	Staff Quarter 575 sq ft each Wood floor and frame Corrugated iron sheet and board walls Corrugated iron sheet roofing	8	12	96
5.	Laborers' Quarter (dormitory) 1,725 sq ft each Wood floor and frame Board and brick nogging walls Corrugated iron sheet roofing	20	37.2	744
6.	Store godown 300 sq ft each Concrete floor and wood frame Corrugated iron sheet walls Corrugated iron sheet roofing	1	15	15
	Total			1,074

1/ July 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Market Prospects, Prices, Processing, and Storage

General

1. Rice and jute, the major crops in the Irrawaddy Delta, are internationally traded. Burmese rice has long established markets, particularly in Asia and the quality of Burmese jute production ranks relatively high. Export prospects for additional rice and jute production, therefore, is good even as world market prices have declined from their present shortage-related highs. Production increases for the other crops would be small relative to present volumes and would have a ready domestic market.

2. Future price estimates for rice, jute, and other internationally traded commodities and fertilizers are based on Bank projections (dated March 1976) of world market price trends through 1985 (Table 1), and for other crops and input commodities are based on present levels and historic trends of local prices. All are expressed in terms of constant currency, using July 1976 prices as the base. The economic and financial analyses use both present and future prices to reflect anticipated changes in long term supply and demand relationships for each commodity. Farm gate price estimates for the financial farm budget analyses take into account prevailing taxes, subsidies, and other Government controls. The estimates for the economic analysis, to reflect the opportunity values of potential exports or import savings, are derived from world market prices using an exchange rate of US$1 = K 13.0 which reflects the opportunity value of foreign exchange in the economy. The estimates for each commodity (Table 2) are discussed below.

3. The official foreign exchange price US$1 = K 6.5 does not reflect the prevailing supply of and demand for foreign exchange in Burma since it is maintained by very stringent exchange and trade restrictions. On the black market, foreign currency is traded at rates between 18 to 20 Kyats per US Dollar, partly reflecting the risk premium associated with such illegal transactions. Because of the non-availability of disaggregated data and the poor quality of the available aggregative data, the World Bank procedures for calculating the shadow prices of foreign exchange could not be followed. More particularly, the non-availability of such data as input coefficients and disaggregated data on traded and non-traded inputs, precluded the estimation of usual conversion factors. Instead, an alternative procedure was used. This procedure involved the estimation of exports and imports that were likely to prevail if trade restrictions were removed. Exports and imports were disaggregated by commodity and free trade flows estimated by using

relevant price elasticities and the tariff equivalent of trade restrictions. Assuming that Burma has no monopoly power in foreign trade and that the exchange rate that prevails in free trade would reflect the opportunity cost of a marginal unit of foreign exchange, a shadow price of foreign exchange was calculated. The rate of K 13.00 = US$1.00 thus calculated is used to convert world prices into prices for economic analyses of the project.

Rice

4. Market Prospects. Prior to World War II, Burma was the world's leading rice exporter, producing around five million tons of rice annually and exporting 3 to 3.5 million tons of rice and rice products including rice brokens and rice bran. Production did not regain pre-war levels until 1964 when 4.8 million tons were produced from 12.6 M. Over the last decade, production and sown area remained static, except in 1966 and 1972 when poor monsoons were experienced. Meanwhile, domestic consumption rose steadily at about 3.1% per annum, faster than the population increase, with the result that exportable surpluses have been sharply reduced to only less than half a million tons, a margin vulnerable to climatic adversities. Without significant gains in yields or cropped areas, Burma would cease to have a rice surplus by 1980.

5. Future implementation of a vigorous agricultural development program (involving mainly expansion of the irrigated area and increased use of high yielding varieties and fertilizers) could increase production somewhat faster than population about at a rate likely to be below 3% per annum. With future reduction in Government subsidies of consumer prices, per capita rice consumption is likely to level off at the present relatively high levels. Under this assumption, the project production increase would result in a gain in exportable surplus. Consequently, an export situation is used in estimating the opportunity price for the economic analysis.

6. World production is expected to increase at about the same rate as world demand. International trade, which represents only a small proportion of the total production, is expected to decline somewhat, assuming moderate gains towards foodgrain self-sufficiency in developing countries and an overall decline in coarse grain imports by developed countries for remilling.

7. The values of Burma rice exports, which were sold mostly under Government-to-Government contracts, until recently were well below world market levels as shown in the following table:

	Burma Unit Export Prices	World Market Prices (35-40% Brokens)
	(US$/M ton)	
1972	80	110
1973	125	245
1974	400	380
1975 (Jan-Aug.)	275	277

In 1974 and 1975, the unit prices of Burma exports corresponded roughly to the fob prices for Thai rice of 35-42% brokens quality, about 70% below the price for Thai 5% brokens. This relationship is used in estimating export prices for the economic analysis.

8. Government Market Controls. Since 1946, GOB has controlled to varying degrees paddy prices and rice exports in official channels. Prior to the 1960s, however, private domestic markets were not controlled. Over the next decade to 1973, the distribution of rice was a state monopoly. Farmers were not allowed to trade paddy freely within their townships, but otherwise surpluses had to be sold to the State Agricultural Marketing Board (SAMB) and to Trade Corporation No. 1 (TC-1), its successor in 1964. The TC-1 purchased paddy directly and through cooperatives, milled it and distributed it throughout the country and to the Myanma Export-Import Corporation (MEIC) for export. Between 1964 and 1973, the share of total marketed paddy bought by State agencies fell from 80% to 30%. in 1973, the cooperatives were given sole responsibility for the domestic rice trade, except for shipments to the rice deficit hill areas of Upper Burma and the military. Procurement for these areas and for export remains the responsibility of TC-1.

9. The TC-1 operates between 700 and 900 buying depots throughout the country, including one for every 10 to 15 villages in the project areas. Farmers now must sell to TC-1 a share of their harvest (paddy) which is based on TC-1 and LRSD assessments of paddy acreage, land productivity, and yields. The TC-1 owns or controls the rice mills, and GOB prohibits farmers from selling paddy except to TC-1, at controlled prices, or within the townships of origin.

10. An Advance Purchase System (APS) is closely linked with the compulsory paddy procurement program. If farmers lack cash for consumption needs, for hiring labor, or for purchasing crop inputs and cannot get credit or better terms elsewhere, they may enter into contracts with TC-1 for future delivery of paddy. Under the APS, TC-1 currently advances K 50 per ac, of which K 35 is advanced at time of land preparation and the balance of K 15 at harvest time. Farmers not able to fulfill such contracts, due to unusually poor harvest, are permitted to meet their obligations the following year. Advances then become interest free loans. The TC-1 presently claims about 85% recovery rate on their loans.

11. Free Market. A large rice market now exists outside of Governmental restrictions. The relative levels of GOB controlled prices and free market paddy prices have been an important factor influencing the volume of sales under Government procurement and in the markets. As shown in Table 3, after 1963 when the two price levels were about the same, the ratio of GOB to free market prices declined to as low as 28% and GOB procurement also declined from about half the paddy crop to less than 20%. Information on the volume of trade in free market channels is not available. However, Government supplies from procurement over this period proved less and less sufficient to meet demand among urban and landless rural families and persons in deficit areas. As a result, free market prices were forced up, which reduced the effectiveness of the TC-1 procurement program and caused the volume of free market trade to grow.

12. Procurement and Free Market Prices. For the 1974 crop, GOB increased the procurement price by nearly 40% to K 293 per ton and, for the 1975 crop gain by 50% to K 438 per ton. In 1974 and 1975, TC-1 maintained a two-tiered price system: a low price for amounts within the assessed quota and a high price for amounts over the quota. As a result, in 1975 TC-1 achieved 90% of its procurement target, about 20% at over quota prices. Procurement prices and free market prices between 1964 and 1975 are shown in Table 3. At appraisal in November 1975, the free market prices had declined to about K 660 per lg ton, about 50% above the procurement price, as the result of falling export prices, increased domestic production, and more effective procurement and domestic distribution by TC-1.

13. Milling. Rice milling is one of Burma's major industries. There are presently 800 mills in the country of which 12 belong to cooperatives, 35 to TC-1 and the rest to private owners, although mill operation and charges are controlled by GOB. Total national milling capacity of some 4 to 7 million tons of rice annually, concentrated mostly in Irrawaddy and Pegu Divisions (including Rangoon), is only about half utilized due to inadequate paddy deliveries. However, because of the poor physical condition of many mills, the rated capacity may somewhat overstate actual capacity. Only 26 mills can produce superfine quality (5% to 10% broken) rice, about 100 can produce medium quality (15% to 25% broken) rice while the remainder can only produce low quality (35% to 42% broken) rice, with considerable losses. Although GOB continues to build new mills, the low-controlled milling charges (K 13 per lg ton for Government-owned paddy and K 26 per lg ton for privately owned paddy) cover only operating costs and leave nothing for maintenance or rehabilitation. Storage facilities for about 2 M tons of paddy annually, about 60% owned by TC-1 and 40% by the private sector, demand are in many cases falling into disrepair. The TC would like to rehabilitate the industry and provide modern storage, drying and milling equipment.

14. Paddy from the project areas is milled mainly at Laputta, Pyapon Ngaputaw and Wakema where at present there are 51 mills have a combined rated capacity of 640 lg tons per 24 hours (20 owned by TC-1 and 31 owned privately). Some paddy from project areas is also milled at Bagale and Bassein. Most of these mills produce low quality and some produce medium

quality rice. Milling output at these qualities includes 64% to 66% rice (whole grain and large brokens), 3% to 4% residual brokens, and 4% to 5% bran (Table 2). A mill ratio of 0.65 has been used in estimating farm gate prices. Some of these facilities will be renovated and new facilities constructed in these areas with Asian Development Bank assistance, and milling and storage facilities for production increases under the project therefore would be adequate.

15. Storage. Up to 1964, procurement and processing of paddy for export and internal distribution were left to private enterprise. Mills located in the rural areas were collection centers and acted as transfer storage facilities for on-shipment of milled rice to the major exporters in Rangoon. After 1964, private millers were no longer permitted to procure paddy. The GOB controlled milling charges and nationalized some existing mills and also constructed new milling facilities. As the export volume subsequently declined, private capital formation from the export trade evaporated, and mill receipts under controlled charges no longer covered the full costs of operation, maintenance, repair and replacement of facilities. Consequently, storage and milling facilities have fallen into disrepair. At present, within the Irrawaddy and Pegu Divisions, roughly 4,000 warehouse units with an estimated 2 M tons of annual storage capacity exist, about 60% of which are owned by TC-1 and the remainder by the private sector. This capacity is barely adequate for the present relatively low volumes of trade currently handled by TC-1. Under a program to expand paddy production throughout the delta, the suitability of present off-farm storage must be reappraised.

16. A sizable portion of annual production remains on the farm for home consumption and seed. Large farmers are often able to construct within their homes reasonably secure bin-type structures to hold the annual stock of paddy. Small farmers, however, retain their family supply in suboptimal containers woven from local materials and lined with a clay-cow dung mixture. Under traditional cultivation patters, paddy is harvested in the dry season, mainly in November-February. However, stored quantities whether in homes or in warehouses, are still exposed to high humidity levels for approximately six months after the initiation of the monsoons in May-June. Losses during this time are particularly costly for the subsistence farmer with no feasible loss margins in his stocks.

Jute

17. Market Prospects. From 1962 to 1973, jute production expanded from less than 5,000 tons to 90,000 tons. By 1973, exports had reached 50,000 tons. Production dropped to 39,000 tons in 1975 in response to insufficient supplies of seeds due to flood damage to seed supplies in 1974, inadequate fuel supplies because of transport problems, and preference of growing paddy after paddy procurement prices were increased.

18. World market prospects for jute are poor. Synthetic substitutes have continued to take over more and more of the major end-uses of jute in the industrialized West. Thus, the fall in demand in the developed countries since the late 1960s is expected to continue. Demand in the centrally-planned countries has been increasing quite rapidly but, excepting China, this is expected to slow down with the switch to synthetics, the full impact of which will be felt in the 1980s with the completion of large increases in production capacity for synthetic resins in Eastern Europe and the USSR. In the developing countries, particularly the producing countries themselves, demand is expected to grow more rapidly to handle growing agricultural output. Growth in total world demand is estimated to be positive but small, lower than the estimated growth in production. However, although Burma exports raw jute, it imports at least 30% of its jute bag requirements, the rest being domestically produced. At present, an acute shortage of jute bags exists. With projected increase of rice export, the incremental jute production from the project would have a ready market.

19. Government Market Control. The AC, which is in charge of jute development, procures all jute production. It provides seeds, fertilizers and K 100 per ac (as of 1974) in cash, interest free, and buys back raw jute at rural collection centers. The Government has recently announced a 50% increase in the 1976 procurement price (to K 1,500 per lg ton) to generate increased jute production. Similarly, release of a new variety capable of increasing yields by about 20% and maturing in 120 days instead of 150 could make jute production more attractive. Procurement prices (1975) varied by grade: from K 1,026 per lg ton for first quality (mostly C, D, & E grades) to K 777 per lg ton for second quality (E2 and rejections) to K 311 per lg ton for cuttings. Although in recent years, 90% of all jute bought from farmers has been graded first quality, it is frequently downgraded when exported. So exported prices for the economic analysis are derived from projected prices for D grade quality.

20. Baling -- Burma presently has 13 baling presses in Rangoon and other major towns throughout the production areas with total annual capacity of 118,000 lg tons. Production in 1975 was estimated at about 100,000 tons. With incremental production from the project areas of 5,700 lg tons and an assumed increase of 44,000 lg tons from outside the project areas, baling capacity would have to increase to about 150,000 lg tons by 1985. The Irrigation I project (IDA Credit No. 394-BA) includes funds for constructing four additional jute baling plants with an annual capacity of 7,000 tons each at sites determined by AC, which will provide adequate capacity up through the early 1980s.

Groundnuts

21. Marketing -- Burma is short of vegetable oils, and traditionally has imported large quantities for edible purposes. Post-war imports averaged about K 30 million annually, rose to K 163 million in 1965, and dropped rapidly to almost zero in 1971 because of foreign exchange restrictions. Groundnuts and sesamum are the main oilseeds produced domestically, and in

terms of area sown nationally are next to paddy in importance. Until 1966, production was stagnant, hovering around 300,000 tons of unshelled nuts and 60,000 tons of sesamum. To encourage increased production, the Government limited imports, and favorably controlled oilseed marketing thus maintaining relatively attractive prices. Produce prices for groundnuts as well as for sesamum were decontrolled in 1967. As a result, output increased 50% for groundnuts and 100% for sesamum by 1971 -- a good example of price response. Groundnut production fell again below 400,000 tons in 1973 because of the 1972 drought, but rose to 461,000 tons during the 1975 season. Acreage of groundnuts increased by 200,000 during 1965-1975 mainly through utilization of the crop to follow paddy in more intensive rotational patterns. Farmers can obtain advanced purchase system (APS) of up to 70% of the contract value for produce marketed through cooperatives.

22. Prices -- Producer prices for unshelled nuts have fluctuated between K 900 and K 1,450 per ton for the last six years and for oil, the wholesale price has fluctuated between K 3,000 and K 6,500 per ton. For comparison, in Thailand, producer prices have been around US$100 to US$120 per ton for unshelled nuts and US$300 to US$450 per ton for exported oil, which are in the same range as the Burmese prices converted at the shadow exchange rate. Farm gate prices for the financial and economic analyses are shown in Table 2.

Pulses and Vegetables

23. Vegetables and pulses are sold freely by farmers. Most pulses marketed through cooperatives are eventually exported. Producers are eligible for APS amounting to 70% of the contract value of pulses to be delivered to TC-1 as cooperatives. Representative producer prices over the last few years have been K 1,820 per ton for pulses and K 2,300 per ton for vegetables.

Fertilizers

24. About three quarters of the fertilizer used in 1972/73, about 86,000 tons, was urea manufactured in Burma in two plants each with a capacity of 60,000 tons per year. Phosphate fertilizer (TSP) and other chemical inputs (M of P and pesticides) are imported by Trade Corporation No. 22 through MEIC. Fertilizer consumption increased from about 25,000 tons annually in the early 1960s to about 100,000 tons in 1972 and has remained relatively stable since then. however, high prices on the black market suggest the demand substantially exceeds supplies.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Market Prospects, Prices, Processing, and Storage

World Market Prices[1/]
(in Constant Dollars, July 1976)

	1976	1985
Rice - 5% Brokens ($/m ton fob Bangkok)	300	368
Jute - White D. ($/m ton fob Chittagong)	310	425
Urea - 40% N, bagged ($/m ton fob Japan)	140	175
TSP - 60% P_2O_5 ($/m ton fob US Gulf)	90	125
Muriate of Potash - 60% K ($/m ton fob Vancouver)	60	65

1/ IBRD Economic Analysis and Projections, March, 1976.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Market Prospects, Prices, Processing, and Storage

Estimated Prices for the Financial and Economic Analyses
(in constant Kyat, July 1976)

	1976		1990	
	Financial 1/	Economic 2/	Financial 1/	Economic 2/
Crop Produce (Kyat/lg ton)				
Ngasein	438	1,510	438	1,935
HYV	438	1,510	438	1,935
Hnanga	466	1,600	466	2,050
Medon	527	1,810	527	2,320
Jute	1,600	3,360	1,600	4,850
Groundnuts	1,780	2,500	1,780	2,500
Pulses	1,820	1,820	1,820	1,820
Fruits and Vegetables	2,300	2,300	2,300	2,300
Fertilizers (Kyat/lg ton)				
Urea	360	2,305	360	2,760
TSP	1,280	1,915	1,280	2,370
Muriate of Potash	440	1,395	440	1,460

1/ Procurement prices, where applicable.
2/ Estimated from world market prices using the shadow exchange rate US$1=K13.0.

ANNEX 13

Table 3

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Market Prospects, Prices, Processing and Storage

Paddy Prices and Government Procurement Ratios

	Paddy Prices 1/			Production and Procurement		
	GOB Controlled Price to Farmers (Kyat/lg ton)	Free Market Price 2/ (Kyat/lg ton)	Ratio of GOB Price to Free Market Price (%)	Paddy Production (m lg tons)	GOB Procurement (m lg tons)	Ratio of GOB Procurement to Production (%)
1964	156	162	96	7.7	4.0	57
1965	156	156	100	8.4	4.0	48
1966	169	243	70	7.9	3.2	41
1967	171	680	25	6.5	2.0	31
1968	179	646	28	7.6	2.2	29
1969	179	449	40	7.9	3.0	38
1970	179	247	72	7.9	3.0	38
1971	179	285	63	8.0	3.0	38
1972	185	545	34	8.0	2.2	28
1973	213	750	28	7.2	1.2	17
1974	292	793	37	8.5	1.5	18
1975	438	914	48	8.4	2.8	33

Sources: Report to the Pyithu Hluttaw, various years and the Planning Department. Central Statistical Organization.
H.V. Richter, "The Union of Burma," in R.T. Shand (ed.), Agricultural Development in Asia, (Berkeley; University of California Press), 1969.

1/ Prices for quota deliveries, Ngasein variety.

2/ Seasonal variation about 10%.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Farm Labor Supply and Demand

Area Occupations

1. About 50% of project area families are farmers and nearly 30% in addition are landless families who rely on farm wage earnings for most of their annual incomes. About 20% of the families are primarily involved in other occupations such as fishing, transport, and village commerce (including, in the lower delta, some producers of salt from sea water).

2. The employment impact of this project on landless workers and small farmers who rely on wage earnings can be only roughly assessed. Most project farms are within close proximity to one of the many river transport routes cutting the area. Trade related to agriculture and fishing provide off-farm employment for landless and small farmers during slack periods. Employment levels and participation rates have not been surveyed, but are assumed to be small in view of the relatively low level of such activity and the members of families involved fully in these activities.

Agricultural Labor Supply

3. Project Area Population. Data presented here was obtained from the Settlement and Land Records Department, from field interviews, and from the Central Statistics and Economics Department. The 1975 rural population and farm and landless labor supplies in the project area village tracts are summarized below:

	Lower Delta Areas	Middle Delta Areas	All Project Areas
Population	84,064	34,931	118,995
No. of Families			
Farm	7,835 (46%)	4,974 (63%)	12,809 (51%)
Landless /a	4,982 (29%)	1,725 (22%)	6,707 (27%)
Non-farm	4,257 (25%)	1,222 (15%)	5,479 (22%)
Total	17,074(100%)	7,921(100%)	24,995(100%)
No. of Working Adults /b	52,384	25,582	77,966
Average Family Size	4.9	4.4	4.8
Average Adult Workers per Family /b	3.0	3.2	3.1

/a Landless families on record are those local residents without land who have registered with Ward/Village Land Committees that they are seeking farm land to cultivate. Other landless are registered as non-farm families.

/b Number of working adults excludes children under ten and adults over age 60. Children ages 10 to 15 are counted as two-thirds of an adult.

Source: Settlement and Land Records and Settlement Department

4. The population growth rate in 1975 was an estimated 2.2% per year based on the national average. Such a rate is expected to continue over the next 10 to 15 years. Because of low levels of economic activity, urban areas have not grown significantly faster than rural areas in the past decade. Rural population and labor force growth in the delta, therefore, is projected at 2.0% for this analysis.

5. Labor Force. Married and single women generally participate in all farm field activities except very heavy work. The project area farm labor force is estimated to be about 40,000 adults, or equivalent, and the landless labor force about 21,000. Allowing time for fishing and cooking and home chores for women and children, the estimated number of full farm working days per family ranges from about 60 adult-days per month during most of the year to about 75 adult days per month for one or two months of peak agricultural activity.

6. Monthly Labor Supplies. Present and projected labor supplies, based on the asusmptions above, are given in Table 1. During months of peak farm activity, some local residents classified as non-farmers also work in the fields. For the analysis, at such times farm and landless labor supplies are supplemented by up to 50% of the availability of other labor. On this basis, project labor supplies would be as follows:

	Project Population (persons)	Agricultural Labor Force (adults)	Peak Labor Supply ('000 man-days/mo.)
1976	121,400	61,700	1,700
1980	131,100	66,800	1,840
1984	142,000	72,200	2,000
1988	153,900	78,300	2,200
1990	160,000	81,400	2,300

Agricultural Labor Demand

7. Field Requirements. Peak field activity occurs at present in June, July and December. This peak field activity would occur at the same times, and also in November under the project. In all months, except June, requirements would increase from two to ten times and over the year would more than double (240%). Estimated average mothly requirements over the project are given in Table 2 based on the per acre crop labor requirements given in Annex 15.

Marginal Economic Cost of Project Field Labor

8. Most of the farm labor, particularly in the slack seasons, is supplied without wages by family members. In most months, field requirements are not sufficient to fully occupy the labor force. Although some farm work other than cultivation is required in addition, the average opportunity cost of labor is less than the prevailing wage of K 6 per man-day paid to hired labor during times of heavy activity. On the other hand, because of the availability of some off-farm employment, the average opportunity cost exceeds the marginal subsistence value.

9. The project economic cost of crop production labor is taken as the sum of labor costs at varying wage levels between these extremes as determined month by month according to the seasonal level of demand. The scarcity of data on alternative employment opportunities and wage levels makes the evaluation of economic farm wage rates extremely subjective. The marginal labor cost for this analysis is estimated on the basis of the hypothetical labor demand curve (Figure 1). The curve is a plot of the estimated marginal economic wage as a function of the labor demand supply ratio reflecting the variation in wage levels discussed above:

(a) At minimum employment levels, the marginal economic wage would be K 0.5 per man-day about 15% of the market rate, exceeding by 50% the value of additional consumption needed for a family member without alternative employment to undertake field work;

(b) At a monthly employment level equivalent to the present maximum slack season employment level (60% of the slack

field labor supply), the marginal wage would be K 6 per man-day which is the average market rate taking into consideration available non-farm wages.

(c) At a monthly employment level corresponding to the present peak employment level (78% of the peak field labor supply), the marginal wage would be K 8 per man-day.

10. Based on monthly demand estimates, marginal wage levels from Figures 1 are shown in Table 2. The annual labor cost is the sum of monthly labor costs at various wage levels up to the marginal wage. The incremental labor cost due to the project, accordingly, amounts to K 33 million, which implies an overall shadow wage rate for additional project field labor of K 4.6 per man-day.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Farm Labor Supply and Demand

	Labor Supplies at Present (1975) (1,000 man-days/month)1/			Labor Supplies at Full Development (1,000 man-days/month)1/		
	Farm & Landless	Others2/	Total	Farm & Landless	Others2/	Total
Lower Delta						
Zinbaung	55	16	71	74	22	96
Letpanbin	46	15	61	63	21	84
Kyet-Pha-Hmwe-Zaung	166	79	245	224	106	330
Myogon	27	9	36	37	12	49
Daw Nyein	41	25	66	56	33	89
Dedalu	27	9	36	37	13	50
Bantbwezu	146	6	152	197	8	205
Betut	261	21	282	352	29	381
Alegyun	123	130	253	166	175	341
Dauntgyi	72	10	82	134	14	148
Subtotal	964	320	1,284	1,340	433	1,773
Middle Delta						
Shwelaung	502	92	594	678	124	802
Project Total	1,466	412	1,878	2,018	557	2,575

1/ Peak availability. During slack periods, estimated availability would be 80% of this.
2/ Potential full availability including time for other occupations as well as farm wage work. About 50% would be available in months of peak activity.

ANNEX 14
Table 1

ANNEX 14
Table 2

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Farm Labor Supply and Demand

Seasonal Demand in Relation to Supply

	Farm Demand (1,000 man-days)		Supply (1,000 man-days)	Demand/Supply Ratio %	
	W	W		W	W
January	71	800	1,610	4	50
February	149	395	1,610	9	25
March	79	774	1,610	5	48
April	73	208	1,610	5	13
May	98	270	1,610	6	17
June	993	946	1,610	62	59
July	1,255	2,090	2,300	55	91
August	457	1,552	2,018	28	77
September	345	1,114	1,610	21	69
October	327	605	1,610	20	38
November	165	1,349	2,018	10	67
December	1,237	2,338	2,300	54	100
Annual total	5,249	12,441	21,516	24	58

Increment in project field labor requirements: 7,192,000 man-days.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Farm Labor Supply and Demand

Marginal Economic Project Labor Cost

	Marginal Economic Wage Level (K/man-day)		Sum of Labor Cost at all Wage Levels (1,000 K)	
	$\bar{W}$	W	$\bar{W}$	W
January	.5	4.5	35	1,800
February	.7	1.2	90	336
March	.5	4.5	35	1,935
April	.5	.7	35	125
May	.5	.8	35	176
June	6.1	5.9	3,000	3,027
July	5.2	8.8	3,263	9,719
August	1.5	7.8	457	6,441
September	1.0	7.2	172	4,289
October	1.0	2.4	165	491
November	.2	7.2	82	5,194
December	5.0	8.0	3,092	9,937
Total annual labor cost			10,461	43,470
Incremental labor cost				33,009

Implicit average economic wage: K33,009,000/7,192,000 man-days

= K4.6 per man-day

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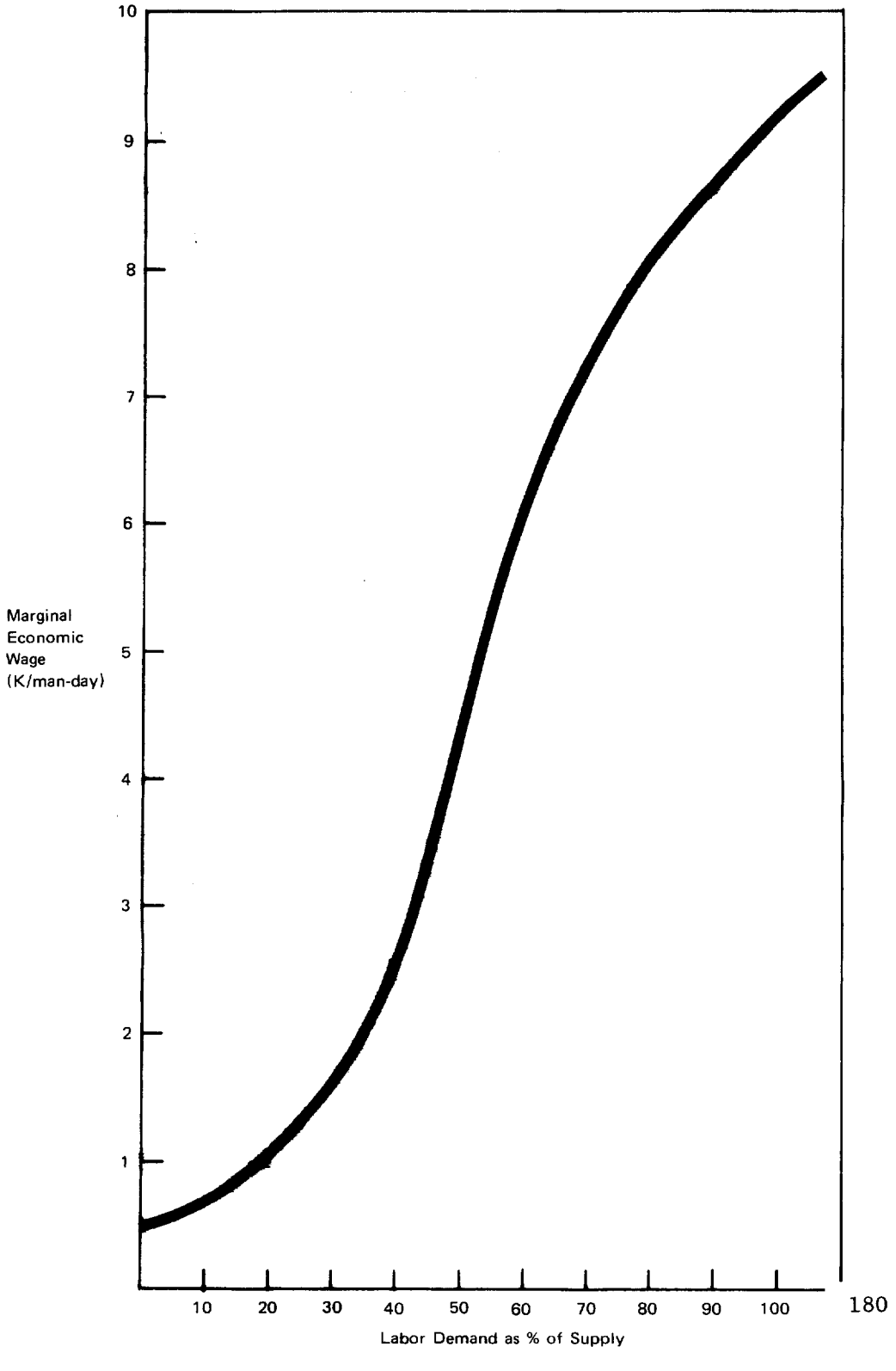
LOWER BURMA PADDYLAND DEVELOPMENT PROJECT
Farm Labor Supply and Demand
Marginal Economic Wage



World Bank—15950

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Net Farm Incomes

Crop Inputs Requirements

1. Crop input levels for use in the farm budget analyses are based on information provided by AC, members of the project preparation unit and farmer interviews in the project areas. Per acre yields, inputs requirements, crop values and inputs costs are shown in Table 1. Estimated net crop values are based on the following assumptions:

(a) Fertilizers and Pesticides. Demand for fertilizers presently exceeds the supply (fertilizers purchased at current subsidized prices are often resold at much higher prices). With the increased support in the area under the project extension service, fertilizer demand, and consequent crop yields, are expected to increase further (Table 1). Use of pesticides also would increase. Supply and distribution in the project area is expected to improve markedly over the development period sufficient to meet the growth in project requirements. The costs of these requirements have been included at subsidized prices.

(b) Seed. Average annual cultivation requirements are given in Table 1. Farm owners generally use their harvest for seed and purchase only when necessary. The average annual seed cost, however, has been included as a proportion of the annual value of crop production.

(c) Power. The requirements for power used in field preparation, harvesting, threshing, subsequent operations and carting in this analysis are in terms of bullock-pair days (Table 1). Most farmers own or share ownership of a pair of bullocks. Others hire them at a rate of about K 6 per day. This rate roughly covers the average cost of upkeep, feed, and depreciation for one pair, assuming a purchase price of 6,000 to 7,000 Kyat per pair and a useful working life of eight years. (Feed costs are negligible in the delta where marginal grass land is sufficient for year round feed requirements.) Some farmers may use farm machinery for some operations but the cost per acre is not expected to differ by more than 15%.

(d) Irrigation. Pump operating costs for dry season HYV, Jute and Hnanga are based on the irrigation pumping requirements computed in Annex 8, Table 1. Average operating costs, including HSD fuel, oil, grease, maintenance and parts are estimated at K 2.1 per ac-inch (K 1.7 per hour). Per acre crop irrigation costs on this basis are as follows:

	(K/ac)
Jute	53
Hnanga	43
HYV	92

(e) Labor. Per acre cultivation labor requirements by crop and by month are given in Table 2. These cover the requirements for harvesting, threshing, and subsequent operations and include the requirements for bullock drivers.

Net Farm Incomes

2. The GOB requires that farmers sell a portion of their paddy harvest to TC-1 at fixed prices (para 4). Farm incomes are computed using two paddy prices: the fixed procurement price applied to the compulsory quota (computed using Table 3) and a free market price applied to the remaining production. Other crops are valued at controlled prices where applicable (Annex 13).

3. Net farm incomes for typical farms (Table 4) are estimated using the net crop values given in Table 1 and the assumptions discussed below:

(a) Models. The average farm size in the project area is 10 ac: in the ten lower delta islands 12 ac, and in the middle delta island 6 ac (Annex 1). The model farms at different land elevations in the lower and middle deltas reflect the variation in cropping patterns dictated by annual flood levels. The current official basis for land allotments is one tatontum per family, a unit of land workable by one pair of bullocks, of about 10 ac. This size is used in the models.

(b) Farm Working Population. The average size family in the middle and lower delta is about five persons (Annex 1).

(c) Family Labor Supply. Allowing time for cooking and home chores for women and children and fishing, the average number of family workers is equivalent to about three persons. This includes persons between ages 10 and 60, with persons under age 15 counted only as two-thirds. The estimated number of equivalent full farm working days per family on this basis would range from about 60 days per month during most of the year and 75 days per month for one or two months of peak agricultural activity.

(d) Hired Labor Requirements. Labor is hired at times of peak activity to supplement family labor for land preparation, transplanting, harvesting, jute retting and post-harvest handling. Due to variations in planting time occasioned by different land elevations relative to flood depths, farmers generally are able to fill part of their outside requirements on an exchange basis. The per acre requirements shown in Table 2 take this into account. Hired labor requirements are estimated month by month in relation to total monthly requirements and family labor availability. The net cost is estimated using the market wage of K 6 per man-day.

(e) Irrigation Capital Costs. The capital cost of the 0.7 cusec pumps amortized at 10% over a six year service life is estimated at Kyat 200 per year. Assuming average pump command areas of about 13 ac for HYV and 20 ac for jute/Hnanga (Annex 8), average capital recovery costs would amount to between K 10 and 15 per ac per year.

(f) Land Clearing. Initial costs of clearing new farms is treated separately as part of the project investment costs.

(g) Taxes. The Consolidated Land Revenue Tax is K 2 per ac.

Compulsory Procurement

4. Paddy. Since November 1973, GOB has enforced a paddy procurement program throughout the country. By law, farmers are compelled to sell at TC-1 buying depots a minimum part of their harvest (a quota) at relatively low prices (Annex 13). The compulsory quotas are scaled in each case to the farmers sown paddy acreage and assessed yield. A committee of local officials from SLRD, AC, etc., around planting time, visit villages and fields and review with village leaders each farmer's cultivation plans and yield prospects. On their first visit, they agree on tentative paddy quotas with each farmer. Again before the harvest, they visit the area and agree on firm quotas for the season.

5. Based on assessed acreage and yield, the farm quota is determined by published schedule (Table 3). In all cases, it leaves sufficient allowance for home consumption. As shown below, the schedule is progressive, taking an increasing proportion of the harvest:

Compulsory Quotas in Relation to Harvest

(a) For 10 ac Holding

Yield (baskets/ac)	20	30	40	50	60	70
Harvest (baskets)	200	300	400	500	600	700
Quota (baskets)	33	117	199	282	365	448
Quota as % of Harvest	17%	39%	50%	56%	60%	64%
Quota Increment (baskets)	-	82	83	83	83	83
Harvest Increment (baskets)	-	100	100	100	100	100
Marginal Quota Rate	-	82%	83%	83%	83%	83%

(b) At Yield of 30 Baskets Per Ac

Size Holding (ac):	2	5	10	15	20	25
Harvest (baskets)	60	150	300	450	600	750
Quota (baskets)	4	30	117	215	307	396
Quota as % of Harvest	7%	20%	39%	48%	51%	53%
Quota Increment (baskets)	-	26	87	98	92	89
Harvest Increment (baskets)	-	90	150	150	150	150
Marginal Quota Rate	-	29%	58%	65%	61%	59%

Note: 1 basket of paddy weighs 46 lbs.

6. Jute. The Agriculture Corporation procures virtually all jute production at controlled prices below equivalent world market prices. Although it sets no farm quotas, it regulates the procurement price in relation to paddy prices so as to control overall production levels.

Project Cost Recovery

7. Under the project, the O & M costs of flood control and drainage facilities would require an annual expenditure of about K 3.1 million, or about K 17 per acre (Annex 12, Tables 2 and 3). At present, GOB appropriates within its budget about K 5 per ac for the O & M of flood protection works, an amount insufficient for satisfactory upkeep of project works. The capital costs of the project investments, excluding the costs of farm machinery to be recovered through the agricultural credit system, amounts to about K 1,200 per acre. Recovery of this investment over a 30-year period would be represented by annual costs amounting to K 7.4 million (K 40 per ac) with no cost of capital or to K 23.5 million (K 125 per ac) with cost of capital at 10% per year.

Repayment Capacity

8. A farmer's ability to pay such charges in general would be determined by his production increases due to the project, the prevailing farm gate commodity prices and adequate increases in net farm income as

incentives to increase production. A measure of this, the project rent, is the portion of his increase in net farm income due to the project which would be available after taking into account suitable rewards for family labor and management and a margin for cultivation risks. Suitable rewards for family labor and management should include adequate farm production incentives. Such incentives are speculative and in practice would vary depending on local alternative income opportunities. In this report, family labor is valued at K 6 per man-day, the market opportunity cost for wage labor, and rewards for management are 10% of the residual farm income. In the absence of studies of the variance in crop yields and market price projections, a margin for cultivation risks is taken as 10% of the gross crop income. Table 5 gives the project rent estimates for the farm models.

9. Through price regulation, GOB holds down prices of the major farm products, rice and jute, as a means to lower consumer prices primarily for landless wage earners and urban residents. In relation to market prices and to prices which would prevail if GOB were to impose no import or export restrictions, this price regulation comprises an implicit tax on farmers who must sell at least a part of their production to GOB. 1/ As a result of the paddy quota procurement, which would take roughly 80% of the farmers' incremental production, farmers are subject to a marginal tax rate on value of production of about 45% (in relation to the market price 50% over the procurement price). The effect in terms of the model farm budgets is shown in Table 5. Under the quota system, GOB would capture 30% to 70% of the project rent depending on the farmer's crop mix.

10. Farmers' abilities to pay would reach such levels only after full development should they achieve the anticipated increases in yields and cropped areas. During the interim, project farm incomes would increase gradually, more rapidly for some farmers than for others. Actual capabilities to pay water charges, therefore, should be based on field recorded increases in farm water supplies and production and increases in farm incomes evaluated using prevailing actual farm gate prices. Benchmark assessments of farm production and incomes would be required before construction completion. Subsequently, new assessments would be required periodically to adjust for actual increases and changes in price levels.

11. Amounts which farmers could pay would depend on the relative levels of procurement and open market (or export price equivalent) prices and on which agricultural pricing policy GOB would follow in the future. The analysis for this report is based on a market price 50% above the procurement price, the relationship which prevailed at the time of appraisal. The market price at that time was close to the export price equivalent. The relative price levels should be reviewed periodically and adjusted as necessary.

1/ In addition, farmers must sell their remaining surplus production in markets where prices, although usually higher than procurement prices, still are controlled indirectly through price restrictions on end products.

12. In its present form, the compulsory procurement system more than meets the cost recovery objectives of the Bank Group water charges policy. The method of taxation is progressive and the tax on incremental income varies in proportion to the farmer's benefit from the project and his ability to pay (Annex 15, para 5). From farmers owning 10 ac under average project conditions, the system would capture 30% to 70% of the "project rent" (Table 5). This represents implicit taxation with a marginal rate of about 45% and an average tax rate of about 20%. The GOB rice export of the incremental paddy production under the project would provide additional revenue which after full development would amount to US$23.7 million per year (K 154 million per year at the official exchange rate, US$1 = K 6.5 or K 308 million per year at the rate US$1 = K 13.0). After deducting procurement and handling costs, this would leave an amount more than adequate to cover the full costs of O & M capital recovery (Table 6).

May 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Per Acre Yields, Inputs Requirements, Crop Values and Inputs Costs

Paddy Crops

	NGASEIN (Rainfed)			MEDON (Rainfed)			HYV (Rainfed)			HNANGA (with supplementary irrig.)			HYV (Irrigated)		
	P	W	W	P	W	W	P	W	W	P	W	W	P	W	W
I. Yield & Crop Value															
Yield (lbs/ac)	1200	1300	2300	1300	1400	2500	-	-	3000	1300	1400	2750	-	2500	3200
Value k/ac	234(809)	254(1123)	450(1987)	306(1050)	329(1450)	587(2589)	-	-	587(2591)	270(929)	291(1281)	572(2517)	-	489(2160)	626(2764)
II. Material Inputs & Costs															
1. Fertilizers															
Urea - (lb/ac)	10	15	60	13	20	60	-	-	80	15	20	80	-	50	100
- K/ac	2(10)	2(19)	10(74)	2(14)	3(25)	10(74)	-	-	13(99)	2(16)	3(25)	13(99)	-	8(62)	16(123)
TSP - (lb/ac)	2	5	40	5	5	40	-	-	60	5	10	50	-	40	60
- K/ac	1(2)	3(5)	23(43)	3(4)	3(5)	23(43)	-	-	34(64)	3(5)	6(11)	29(53)	-	23(43)	34(64)
MP - (lb/ac)	-	-	5	-	-	5	-	-	10	-	5	10	-	5	10
- K/ac	-	-	1(3)	-	-	1(3)	-	-	2(6)	-	1(3)	2(6)	-	1(3)	2(6)
2. Pesticides - K/ac	-	-	5(10)	-	-	5(10)	-	-	10(15)	-	-	5(10)	-	10(15)	30(40)
3. Seed (lb/ac)	50	50	40	50	50	40	-	-	40	50	50	40	-	40	40
- K/ac	13(42)	13(54)	10(43	16(50)	16(65)	13(52)	-	-	10(43)	14(45)	14(57)	11(46)	-	10(43)	10(43)
4. Contingencies (25%) K/ac	4(14)	5(20)	12(43)	5(17)	6(24)	13(46)	-	-	17(57)	6(15)	6(24)	15(55)	-	13(44)	23(69)
5. Irrigation (plus 10% cont.)	-	-	-	-	-	-	-	-	-	45(45)	45(45)	45(45)	-	100(100)	100(100)
Total Cost of Material Inputs	20(68)	23(98)	61(216)	26(85)	28(119)	65(228)	-	-	86(284)	70(126)	75(165)	120(314)	-	165(310)	215(445)
III. Net Crop Value															
K/ac (Before labor costs)	215(741)	231(1025)	389(1771)	279(965)	301(1331)	522(2361)	-	-	501(2307)	200(803)	216(1116)	454(2203)	-	324(1850)	411(2319)
IV. Annual Labor Input															
Mandays/ac	25	25	27	25	25	28	-	-	40	26	27	36	-	40	44
Woman days/ac	11	11	14	11	12	15	-	-	18	11	12	14	-	14	16
Animal days/ac	10	10	12	10	10	12	-	-	12	10	10	12	-	11	12

Notes:
1. Values used for the economic analysis are shown in parenthesis.
2. Present and future alternatives: P - Present
   W - Future without the project.
   W - Future with the project

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Per Acre Yields, Inputs Requirements, Crop Values and Inputs Costs
Jute and Other Crops

	JUTE			PULSES			GROUNDNUTS			VEGETABLES		
	P	W	W	P	W	W	P	W	W	P	W	W
I. Yield & Crop Value												
Yield (lb/ac)	600	700	1200	600	700	900	900	1000	1200	2500	2500	4000
Value k/ac	429 (900)	500 (1516)	857 (2598)	487 (487)	568 (568)	731 (731)	715 (1004)	795 (1116)	954 (1340)	2568 (2568)	2568 (2568)	4108 (4108)
II. Materials Inputs & Costs												
1. Fertilizers												
Urea - (lb/ac)	56	70	168	-	-	20	5	10	30	50	50	100
- k/ac	9 (58)	11 (86)	27 (207)			3 (25)	1 (5)	2 (12)	5 (37)	21 (50)	21 (50)	42 (100)
TSP - (lb/ac)	28	30	56	-	-	30	7	15	40	-	-	50
- k/ac	16 (24)	17 (32)	32 (59)			17 (32)	4 (6)	9 (16)	23 (42)			21 (50)
MP - (lb/ac)	-	-	-	-	-	-	-	-	-	-	-	-
- k/ac												
2. Pesticides												
- k/ac	-	-	20 (25)	-	-	15 (20)	-	-	10 (25)	-	-	-
3. Seed (lb/ac)	10	10	10	30	30	30	100	100	100	50	50	50
- k/ac	11 (23)	11 (33)	11 (33)	30 (30)	30 (30)	30 (30)	100 (140)	100 (140)	100 (140)	64 (64)	64 (64)	64 (64)
4. Contingencies (25%) - k/ac	9 (25)	10 (38)	18 (81)	8 (8)	8 (8)	16 (27)	26 (38)	28 (42)	37 (61)	26 (34)	26 (34)	38 (64)
5. Irrigation (plus 10% cont.)	60 (60)	60 (60)	60 (60)	-	-	-	-	-	-	-	-	-
Total Cost of Material Inputs	105 (190)	109 (249)	148 (465)	38 (38)	38 (38)	81 (133)	131(189)	138 (210)	185 (305)	111 (148)	111 (148)	165 (228)
III. Net Crop Value												
k/ac (Before labor costs)	324 (710)	391 (1267)	709 (2133)	449 (449)	530 (530)	650 (650)	584 (815)	657 (906)	769 (1035)	2457 (2420)	2457 (2420)	3943 (3830)
IV. Annual Labor Input												
Man days/ac	20	23	40	17	18	20	27	28	32	60	60	80
Woman days/ac	25	25	40	3	4	4	23	23	28	40	40	60
Animal days/ac	5	5	7	4	4	5	12	12	14	10	10	10

NOTES: 1. Values uses for the economic analyes are shown in parenthesis.
2. Present and future alternatives: P - Present
W - Future without the project
W - Future with the project

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes
Labor Requirements by Month
(man-days per ac)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Paddy														
Ngasein (rainfed)	P	-	-	-	-	-	8	10	3	2	2	1	10	36
	W	-	-	-	-	-	8	10	3	2	2	1	10	36
	W	-	-	-	-	-	8	12	4	2	2	2	11	41
Medon (rainfed)	P	-	-	-	-	-	8	10	3	2	2	1	10	36
	W	-	-	-	-	-	8	10	3	2	2	1	10	36
	W	-	-	-	-	-	8	12	4	2	2	2	13	43
HYV (rainfed)	P	-	-	-	-	-	-	-	-	-	-	-	-	-
	W	-	-	-	-	-	-	-	-	-	-	-	-	-
	W	-	-	-	-	-	-	10	12	7	4	8	15	56
Hnanga (with supplementary irrigation)	P	8	4	-	-	-	-	-	8	10	3	2	2	37
	W	8	6	-	-	-	-	-	8	10	3	2	2	39
	W	10	9	-	-	-	-	-	8	12	3	4	4	50
HYV (irrigated)	P	-	-	-	-	-	-	-	-	-	-	-	-	-
	W	8	12	4	6	8	16	-	-	-	-	-	-	54
	W	8	14	6	6	8	18	-	-	-	-	-	-	60
Jute	P	-	2	6	6	6	1	8	8	8	-	-	-	45
	W	-	2	6	6	7	1	8	9	9	-	-	-	48
	W	-	3	9	10	10	1	15	16	16	-	-	-	80
Pulses	P	1	-	9	-	-	-	-	-	-	-	10	-	20
	W	1	1	10	-	-	-	-	-	-	-	10	-	22
	W	2	1	11	-	-	-	-	-	-	-	10	-	24
Groundnut	P	3	3	18	-	-	-	-	-	-	-	22	4	50
	W	3	3	19	-	-	-	-	-	-	-	22	4	51
	W	4	4	25	-	-	-	-	-	-	-	22	5	60
Vegetables	P	10	-	5	5	10	-	-	-	-	30	15	15	90
	W	10	10	5	5	10	-	-	-	-	30	15	15	100
	W	15	20	10	5	20	-	-	-	10	30	15	15	140

Note: P - Present
W - Without Project
W - With Project

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Compulsory Paddy Quota Deliveries

(baskets paddy)[1/]

Sown Area (ac)	Yield (baskets/ac)								
	20	25	30	35	40	45	50	55	
2	4	4	4	5	6	6	12	18	
5	8	11	30	48	65	83	101	119	
8	16	47	80	112	142	174	205	234	
10	33	75	117	159	199	241	282	324	
12	50	100	150	200	249	299	349	398	
15	80	147	215	281	347	414	481	547	
18	107	187	268	348	427	507	587	667	
20	126	216	307	397	486	576	666	756	
25	171	283	396	508	621	733	846	958	
30	216	351	486	621	756	891	1,026	1,161	
50	396	621	846	1,071	1,296	1,521	1,746	1,971	
	60	65	70	75	80	85	90	95	100
2	24	30	36	42	48	54	60	66	72
5	137	155	173	191	209	227	245	263	281
8	265	296	328	359	390	421	452	484	515
10	365	407	448	490	531	573	614	656	697
12	448	498	548	598	647	647	747	797	847
15	614	681	748	814	881	948	1,015	1,081	1,148
18	748	828	908	988	1,068	1,148	1,228	1,308	1,388
20	846	936	1,008	1,116	1,206	1,296	1,386	1,476	1,566
25	1,071	1,183	1,273	1,408	1,521	1,633	1,746	1,858	1,971
30	1,296	1,431	1,539	1,701	1,836	1,971	2,106	2,241	2,376
50	2,196	2,421	2,601	2,871	3,096	3,321	3,546	3,771	3,996

Effective October 1975

1/ One basket of paddy weighs 46 lbs.

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LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes
Lower Delta Farms (10 ac each)

	High Elevation Farm			Medium Elevation Farm			Low Elevation Farm		
	P	W	W	P	W	W	P	W	W
Cropped Area (ac)									
Ngasein	-	-	-	10	10	-	10	10	10
Medon	10	10	-	-	-	10	-	-	-
HYV (rainfed)	-	-	10	-	-	-	-	-	-
Pulses	-	-	3	-	-	3	-	-	-
Total Cropped Area	10	10	13	10	10	13	10	10	10
Overall Intensity (%)	100	100	130	100	100	130	100	100	100
Paddy Production and Quota									
Pounds per ac	1,300	1,400	3,000	1,200	1,300	2,500	1,200	1,300	2,300
Baskets (Bkts)[1/] per ac	28	30	65	26	28	54	26	28	50
Quota (Bkts)	100	117	407	83	100	320	83	100	282
Surplus (Bkts)[2/]	183	187	245	178	183	223	178	183	218
Total (Bkts)	283	304	652	261	283	543	261	283	500
Gross Production Value (K)									
Paddy Quota	1,079	1,265	3,663	748	899	3,456	748	899	2,538
Paddy Surplus[3/]	2,966	3,035	3,321	2,415	2,480	3,619	2,415	2,480	2,956
Other	0	0	2,193	0	0	2,193	0	0	0
Total	4,045	4,300	9,177	3,163	3,379	9,268	3,163	3,379	5,494
Production Costs (K)									
Material Inputs[4/]	-260	-280	-1,103	-200	-230	-893	-200	-230	-610
Animal Power	-600	-600	-810	-600	-600	-810	-600	-600	-720
Subtotal	-860	-880	-1,913	-800	-830	-1,703	-800	-830	-1,330
Hired Labor Costs									
Family Labor (m-d)	290	290	385	290	290	382	290	290	310
Hired Labor (m-d)	70	70	175	70	70	120	70	70	100
Hired Labor (K)	-420	-420	-1,050	-420	-420	-720	-420	-420	-600
Land Revenue Tax (K)	-20	-20	-20	-20	-20	-20	-20	-20	-20
Net Farm Incomes (K)	2,745	2,980	6,194	1,923	2,109	6,825	1,923	2,109	3,544
Increase over Present			3,449			4,902			1,621

Note: P - Present
W - Future without project
W - Future with project

1/ One basket of paddy weighs 46 lbs.
2/ Includes paddy retained by farmer for consumption and seed (about 60 Bkts).
3/ Valued at market price 50% above the procurement price, a price close to the world market equivalent.
4/ Includes costs of fertilizers, pesticides, seed and contingencies of 25%.
5/ Including 10% interest.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Middle Delta Farms (10 ac each)

	High Elevation Farm			Medium-high Elev. Farm			Medium-low Elev. Farm			Low Elevation Farm		
	P	$\bar{W}$	W	P	$\bar{W}$	W	P	$\bar{W}$	W	P	$\bar{W}$	W
Cropped Area (ac)												
Wet season (rainfed)												
Ngasein	-	-	-	-	-	-	-	-	-	10.0	10.0	10.0
Medon	-	-	-	10.0	10.0	-	10.0	10.0	10.0	-	-	-
Jute	10.0	10.0	10.0	-	-	10.0	-	-	-	-	-	-
Dry season												
Hnanga	4.4	4.4	-	-	-	10.0	-	-	-	-	-	-
HYV (irrigated)	-	-	10.0	-	-	-	-	-	-	-	-	-
Groundnuts	-	-	-	1.2	1.2	-	-	-	4.0	-	-	-
Pulses	-	-	-	-	-	-	0.2	0.2	-	-	-	-
Total Cropped Area	14.4	14.4	20.0	11.2	11.2	20.0	10.2	10.2	14.0	10.0	10.0	10.0
Overall Intensity (%)	144	144	200	112	112	200	102	102	140	100	100	100
Paddy Production and Quotas												
Pounds per ac	1,300	1,400	3,200	1,300	1,400	2,750	1,300	1,400	2,500	1,200	1,300	2,300
Baskets (Bkts)[1] per ac	28	30	70	28	30	60	28	30	54	26	28	50
Quota (Bkts)	16	17	448	100	117	365	100	117	320	83	100	282
Surplus (Bkts)[2]	108	118	248	183	187	233	183	187	223	178	183	218
Total (Bkts)	124	135	696	283	304	598	283	304	543	261	283	500
Gross Production Value (K)												
Paddy Quota	153	163	4,031	1,079	1,265	3,492	1,079	1,265	3,456	748	899	2,538
Paddy Surplus[3]	1,552	1,694	3,362	2,966	3,035	3,344	2,966	3,035	3,619	2,415	2,480	2,956
Other	4,290	5,000	8,570	858	954	8,570	97	114	3,816	0	0	0
Total	5,995	6,857	15,963	4,903	5,254	15,406	4,142	4,414	10,890	3,163	3,379	5,494
Production Costs (K)												
Material Inputs[4]	-1,358	-1,420	-3,630	-417	-446	-2,680	-268	-288	-1,390	-200	-230	-610
Animal Power	-564	-564	-1,140	-686	-686	-1,140	-605	-605	-1,056	-600	-600	-720
Sub-total	-1,922	-1,984	-4,770	-1,103	-1,132	-3,820	-873	-893	-2,446	-800	-830	-1,330
Hired Labor Costs												
Family Labor (m-d)	504	513	600	345	346	660	292	292	472	290	290	310
Hired Labor (m-d)	109	139	800	75	75	640	70	70	198	70	70	100
Hired Labor (K)	-654	-834	-4,800	-450	-450	-3,840	-420	-420	-1,188	-420	-420	-600
Irrigation Pump Costs (K)	-100	-100	-250	0	0	-250	0	0	0	0	0	0
Land Revenue Tax (K)	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Net Farm Incomes (K)	3,299	3,919	6,123	3,330	3,652	7,476	2,829	3,081	7,236	1,923	2,109	3,544
Increase over Present			2,824			4,146			4,407			1,621

Note P = Present
$\bar{W}$ = Future without project
W = Future with project

1/ One basket of paddy weighs 46 lbs.
2/ Includes paddy retained by farmer for consumption and seed (about 60 Bkts).
3/ Valued at market price 50% above the procurement price.
4/ Includes costs of fertilizers, pesticides, seed, contingencies of 25% and irrigation operating costs.
5/ Including 10% interest.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Project Rents for Lower Delta Farms (10 ac)

	High Elevation Farm (Kyat)				Medium Elevation Farm (Kyat)				Low Elevation Farm (Kyat)			
	Without Compulsory Quota		With Compulsory Quota		Without Compulsory Quota		With Compulsory Quota		Without Compulsory Quota		With Compulsory Quota	
	W	W	W	W	W	W	W	W	W	W	W	W
Gross Income	4,934	11,031	4,300	9,177	3,834	11,006	3,379	9,268	3,834	6,780	3,379	5,494
Certain Income (90%)	4,441	9,928	3,870	8,259	3,451	9,905	3,041	8,341	3,451	6,102	3,041	4,945
Expenses												
Production Costs	-880	-1,913	-880	-1,913	-830	-1,703	-830	-1,703	-830	-1,330	-830	-1,330
Hired Labor	-420	-1,050	-420	-1,050	-420	-720	-420	-720	-420	-600	-420	-600
Family Labor	-1,740	-2,310	-1,740	-2,310	-1,740	-2,310	-1,740	-2,310	-1,740	-1,860	-1,740	-1,860
Fixed Costs 1/	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20
Subtotal	-3,060	-5,293	-3,060	-5,293	-3,010	-4,753	-3,010	-4,753	-3,010	-3,810	-3,010	-3,810
Net Income	1,381	4,635	810	2,966	441	5,152	31	3,588	441	2,292	31	1,135
Management Fee	-138	-464	-138	-464	-44	-515	-44	-515	-44	-229	-44	-229
Excess Income	1,243	4,171	672	2,502	397	4,637	-13	3,073	397	2,063	-13	906
Incremental Excess Income		2,928		1,830		4,241		3,086		1,666		919

Increment Without Quota (Project Rent)	2,928 (100%)	4,241 (100%)	1,666 (100%)
Increment With Quota (Retained by Farmer)	-1,830 (63%)	-3,086 (73%)	-919 (55%)
Portion taken by Quota (Rent Recovery)	1,098 (37%)	1,155 (27%)	747 (45%)

1/ Land tax

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Project Rents for Middle Delta Farms (10 ac)

	High Elevation Farm (Kyat)				Medium-High Elevation Farm (Kyat)				Medium-Low Elevation Farm (Kyat)				Low Elevation Farm (Kyat)			
	Without Compulsory Quota		With Compulsory Quota		Without Compulsory Quota		With Compulsory Quota		Without Compulsory Quota		With Compulsory Quota		Without Compulsory Quota		With Compulsory Quota	
	₩	W	₩	W	₩	W	₩	W	₩	W	₩	W	₩	W	₩	W
Gross Income	6,939	18,003	6,857	15,963	5,888	17,150	5,254	15,406	5,048	12,628	4,414	10,890	3,834	6,780	3,379	5,494
Certain Income (90%)	6,245	16,202	6,171	14,367	5,299	15,435	4,729	13,865	4,543	11,365	3,973	9,801	3,451	6,102	3,041	4,945
Expenses																
Production Costs	-1,984	-4,770	-1,984	-4,770	-1,132	-3,820	-1,132	-3,820	-893	-2,446	-893	-2,446	-830	-1,330	-830	-1,330
Hired Labor	-834	-4,800	-834	-4,800	-450	-3,840	-450	-3,840	-420	-1,188	-420	-1,188	-420	-600	-420	-600
Family Labor	-3,078	-3,600	-3,078	-3,600	-2,076	-3,960	-2,076	-3,960	-1,752	-2,832	-1,752	-2,832	-1,740	-1,860	-1,740	-1,860
Fixed Costs 1/	-120	-270	-120	-270	-20	-270	-20	-270	-20	-20	-20	-20	-20	-20	-20	-20
Subtotal	-6,016	-13,440	-6,016	-13,440	-3,678	-11,890	-3,678	-11,890	-3,085	-6,486	-3,085	-6,486	-3,010	-3,810	-3,010	-3,810
Net Income	229	2,762	155	927	1,621	3,545	1,051	1,975	1,458	4,879	888	3,315	441	2,292	31	1,135
Management Fee	-23	-276	-23	-276	-162	-355	-162	-355	-146	-488	-146	-488	-44	-229	-44	-229
Excess Income	206	2,487	132	651	1,459	3,190	889	1,620	1,312	3,391	742	2,827	397	2,063	-13	906
Incremental Excess Income		2,281		519		1,731		731		3,079		2,085		1,666		919

Increment Without Quota (Project Rent)	2,281 (100%)	1,731 (100%)	3,079 (100%)	1,666 (100%)
Increment With Quota (Retained by Farmer)	-519 (23%)	-731 (42%)	-2,085 (68%)	-919 (55%)
Portion taken by quota (Rent Recovery)	1,762 (77%)	1,000 (58%)	994 (32%)	747 (45%)

1/ Includes land tax and irrigation pump capital charges including 10% interest.

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Net Farm Incomes

Increase in Project Production and Additional Net GOB Export Revenues

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988-2006
Project Production ('000 lg. tons)													
Paddy	67.9	67.9	71.3	82.2	94.1	108.1	120.4	146.6	168.9	189.1	205.8	217.6	226.4
Jute	2.1	2.1	1.8	1.9	2.0	3.4	4.2	5.2	6.3	7.4	8.0	8.0	8.0
Increase in GOB Procurement ('000 lg. tons) 1/													
Paddy	.0	.0	2.7	11.4	21.0	32.2	42.0	63.0	80.8	97.0	110.3	119.8	126.8
Jute	.0	.0	-.3	-.2	-.1	1.2	2.0	2.9	4.0	5.0	5.5	5.5	5.5
Additional GOB Export Revenues (US$ M)													
Rice	.0	.0	.4	1.7	3.1	4.9	6.6	10.0	13.1	16.1	18.7	20.2	21.4
Jute	.0	.0	-.1	-.1	.0	.5	.8	1.2	1.7	2.1	2.3	2.3	2.3
Total	.0	.0	.3	1.6	3.1	5.4	7.4	11.2	14.8	18.2	21.0	22.5	23.7
Additional Procurement Costs (Kyat M) 2/													
Paddy	.0	.0	-1.8	-7.6	-14.1	-21.6	-28.1	-42.2	-54.1	-65.0	-73.9	-80.3	-85.0
Jute	.0	.0	+ .6	+ .4	- .2	- 2.5	- 4.0	- 6.2	- 8.5	-10.6	-11.7	-11.7	-11.7
Total	.0	.0	-1.2	-7.2	-13.9	-19.1	-24.1	-36.0	-45.6	-75.6	-85.6	-92.0	-96.7
Project Costs (Kyat M) 3/													
Annual O & M	.0	.0	.0	- .3	- .7	-1.4	-1.4	-3.1	-3.1	-3.1	-3.1	-3.1	-3.1
Capital Repayment Charges	.0	.0	.0	-2.3	-5.3	-10.6	-10.6	-23.5	-23.5	-23.5	-23.5	-23.5	-23.5
Total	.0	.0	.0	-2.6	-6.0	-12.0	-12.0	-26.6	-26.6	-26.6	-26.6	-26.6	-26.6
Net Additional GOB Revenues (Kyat M)													
At US$ 1 = K 6.5	.0	.0	.8	.6	.3	4.0	12.0	10.2	24.0	16.1	24.3	27.7	30.8
At US$ 1 = K13.0	.0	.0	2.7	11.0	20.4	39.1	60.1	83.0	120.2	134.4	160.8	173.9	184.8

1/ 80% of incremental paddy production, 95% of incremental jute production.
2/ Includes costs of procurement, milling, handling, and transport.
3/ The buildup of O&M and capital repayment costs is according to the date of completion of polder construction. The annual capital repayment charges over a 30 year period would recover project costs including 10% interest.

ANNEX 15
Table 9

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Economic Analysis

1. The project economic benefits and costs are compared in the rate of return analysis incorporating the following assumptions:

(a) Agricultural Benefits. This analysis includes the primary benefits from incremental crop production due to the project (the difference between projected levels "with" and "without" the proposed facilities and services). Secondary benefits from additional trade and transport in rural areas are not included. The future cropped areas and yields are discussed in Annex 2 and per acre crop input requirements are given in Annex 15. The net production values (Table 1) are determined using prices which reflect opportunities for potential export earnings at projected world market prices (Annex 13).

(b) Investment Costs include the costs of embankments, drainage channels, structures, buildings, land clearing and farm machinery and pumps net of taxes, duties and allowances for future price escalation. The expenditure schedules (Table 2) are based on the construction schedule given in Annex 3, Figure 1. The costs for preparation of future projects is not included.

(c) Exchange Rate. The foreign components of the investment and operating costs and the international prices used in making the farm gate price estimates are valued in domestic currency at a shadow exchange rate of US$1 = K 13.00. As discussed in Annex 13, this reflects more realistically than the official rate, the scarcity of foreign exchange for domestic investments.

(d) Pricing of Labor. Farm family and hired labor are evaluated at a seasonally adjusted opportunity cost. Over a full year, this cost averages an estimated K 4 per man-day, about two-thirds of the peak market wage. Unskilled construction labor is valued at market wages.

(e) Production Development Phasing. Full agricultural development for each farm is expected to be reached five years after completion of the drainage works (including embankments, sluices, and channels) and land clearing in each area. Phasing of development over the 11 polders follows the construction and land clearing implementation schedule given in Annex 9, Figure 1. Full development would occur gradually over a period of 11 years after construction has commenced.

(f) Land Acquisition. Agricultural land to be taken for project works has been valued at its opportunity cost based on the resulting loss of crop production. The value of the loss is reflected in the difference in future net production values "with" and "without" the project.

Economic Rate of Return

2. Based on the foregoing assumptions and a 30-year period of analysis, the economic rates of return for the project areas are as follows:

Lower Delta	Middle Delta	Project Whole
33%	24%	30%

3. The sensitivity of these estimates to alternative assumptions is given in Table 3.

May 1976

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Economic Analysis

Economic Benefit Streams
(in constant Kyat, July 1976) 1/

	Lower Delta (Million K)		Middle Delta (Million K)		Project Total (Million Kyat)
Future Net Production Values:					
With Project		311		116	427
Without Project		90		43	133
Net Benefit		221		73	294
Benefit Development Streams:	(%)	(MK)	(%)	(MK)	(MK)
Year 1 (FY 77)	0	0	0	0	0
2	2	4	0	0	4
3	10	22	4	3	25
4	19	42	6	4	46
5	27	60	20	15	55
6	32	71	35	26	97
7	49	108	53	40	148
8	61	135	73	55	190
9	72	159	91	67	226
10	83	183	100	73	256
11	93	206	100	73	279
12-30	100	221	100	73	294

1/ US$1 = K 13.0

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Economic Analysis

Economic Cost Streams
(in constant Kyat, July 1976) 1/

	Lower Delta		Middle Delta		Project Total	
	Project Cost	Operation & Maintenance	Project Cost	Operation & Maintenance	Project Cost	Operation & Maintenance
	(Million Kyat)					
Year 1 (FY 77)	120	0	70	0	190	0
2	32	0	25	0	57	0
3	23	0	14	0	37	0
4	23	0	14	0	37	0
5	26	0	-	1	26	1
6	25	0	-	1	25	1
7-30	-	3	-	1	-	4

1/ US$1 = K 13.0

ANNEX 16
Table 3

BURMA

LOWER BURMA PADDYLAND DEVELOPMENT PROJECT

Economic Analysis

Sensitivity Analysis

	Lower Delta	Middle Delta	Project Whole
Base Rates of Return	33%	24%	30%
Variations			
Capital Costs Increased 25%	29%	21%	26%
Benefits delayed 2 years	26%	20%	23%
O & M Costs Increased 300%	30%	21%	27%
Net Benefits Decreased 25%	28%	20%	25%
Yields 15% less than projected	29%	21%	26%
Foreign Exchange valued at US$1 = K10.0	31%	22%	28%
Farm Labor valued at K6 per man-day	32%	23%	29%

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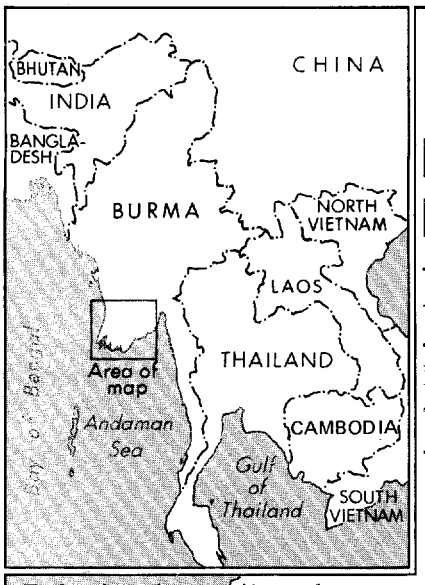
BURMA

LOWER BURMA PADDY LAND DEVELOPMENT PROJECT

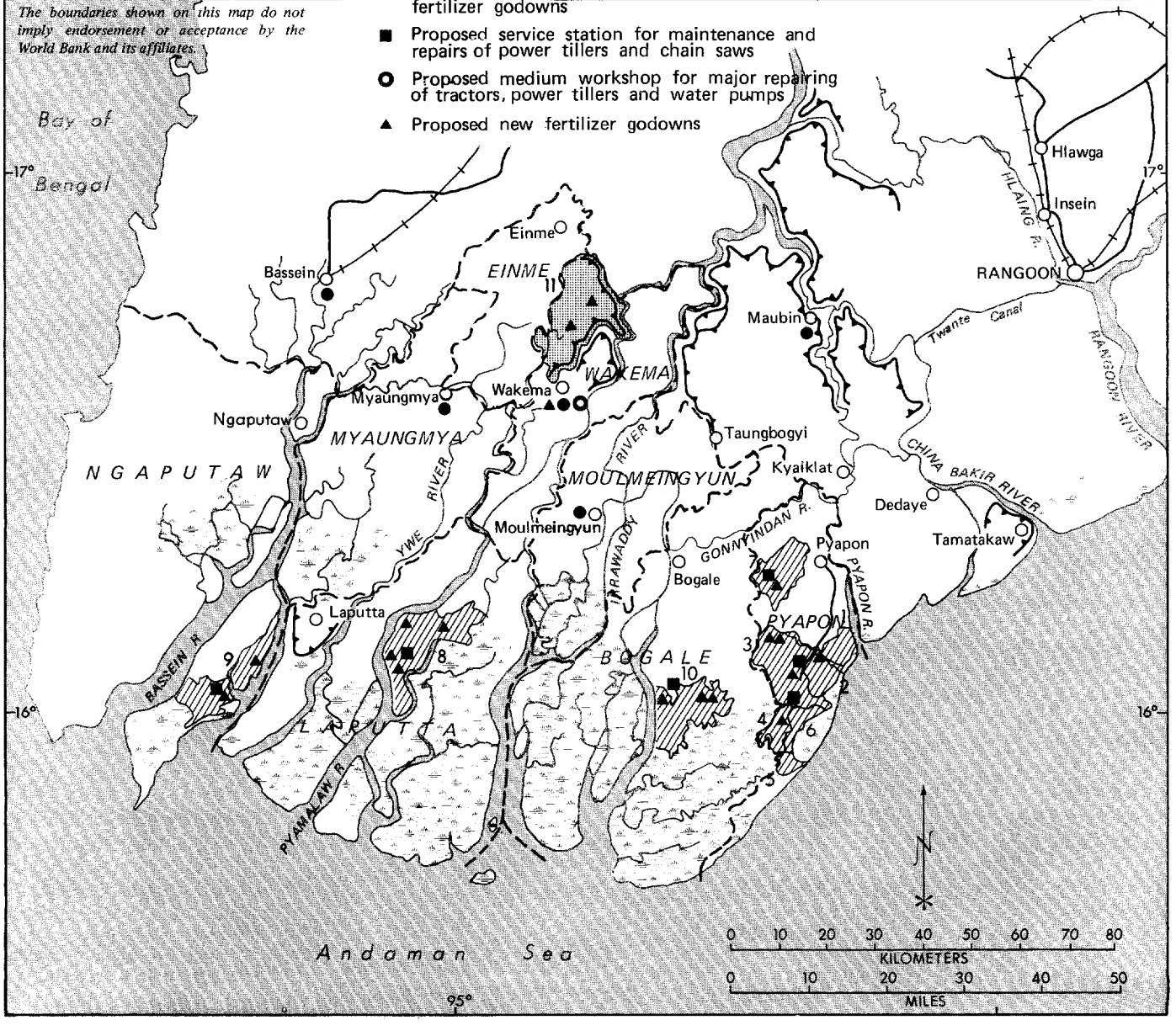
LOCATION OF PROJECT



Middle delta project area
Lower delta project areas
Roads
Railways
Embankments
Swamps
Rivers
Township boundaries
Existing tractor stations
Existing AC fertilizer godowns
Proposed service station for maintenance and repairs of power tillers and chain saws
Proposed medium workshop for major repairing of tractors, power tillers and water pumps
Proposed new fertilizer godowns

PROJECT AREAS No.	Name	TOWNSHIP Name	CULTURABLE LAND AREA (1,000 acres) Cultivated	Abandoned	Waste	Total
LOWER DELTA						
1	Zinbaung	Pyapon	4.5	3.1	-	7.6
2	Letpanbin	"	4.5	4.5	-	9.0
3	Kyetpamwezaung	"	16.9	8.1	-	25.0
4	Myogon	"	1.9	5.1	-	7.0
5	Dawnyein	"	1.3	1.7	-	3.0
6	Dedalu	"	1.5	3.8	-	5.3
7	Banbwezu	"	8.0	6.8	-	14.8
8	Betut	Laputta	34.0	8.8	0.5	43.3
9	Alegyun	Ngaputaw	13.1	3.1	-	16.2
10	Daunggyi	Bogale	9.6	15.7	-	20.4
	Subtotal		95.3	60.7	0.5	156.5
MIDDLE DELTA						
11	Shwelaung	Wakema	32.5	4.7	10.9	48.1
	TOTAL		127.8	65.4	11.4	204.6

The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.



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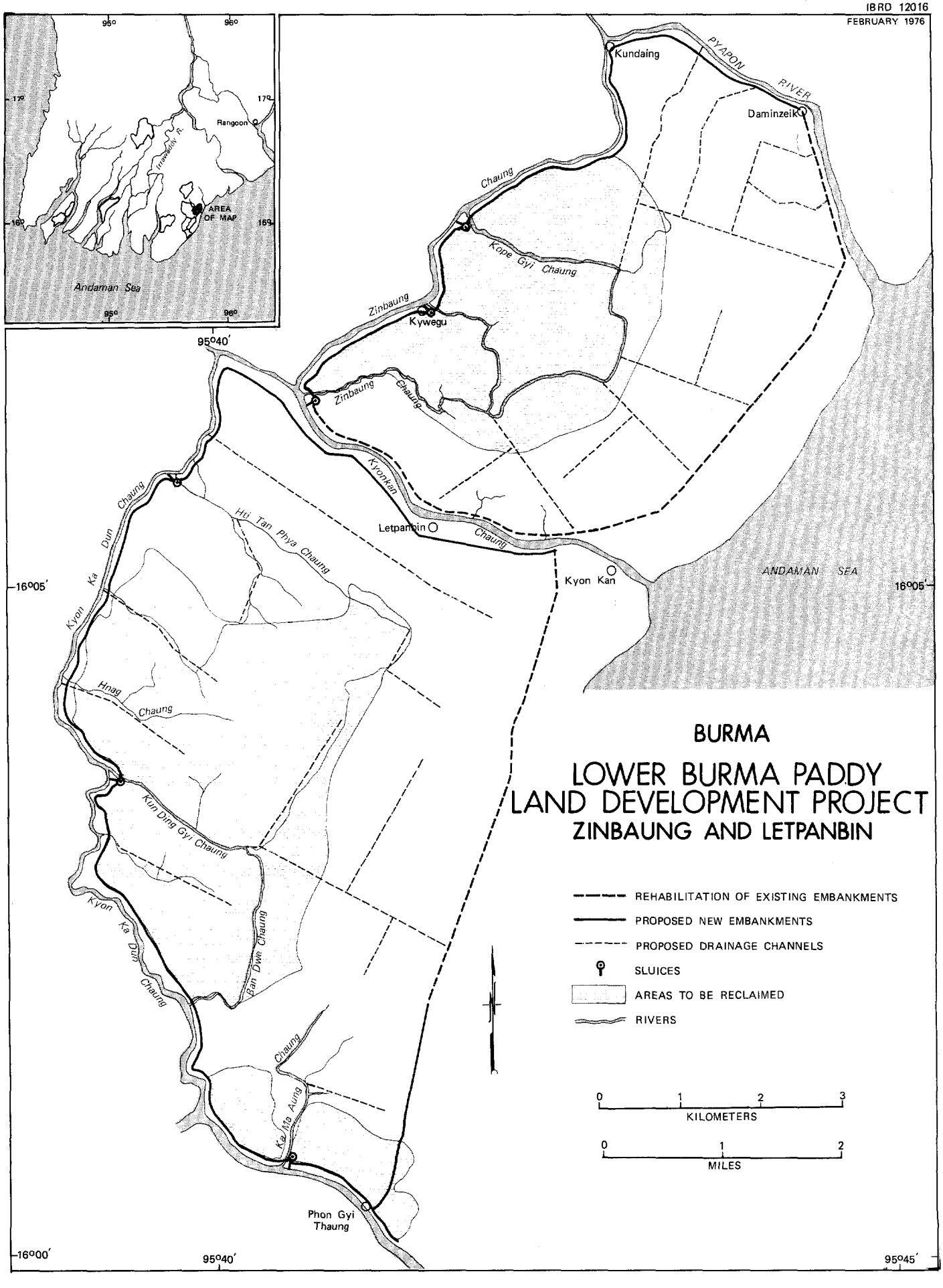

BURMA

LOWER BURMA PADDY LAND DEVELOPMENT PROJECT

ZINBAUNG AND LETPANBIN

REHABILITATION OF EXISTING EMBANKMENTS
PROPOSED NEW EMBANKMENTS
PROPOSED DRAINAGE CHANNELS
SLUICES
AREAS TO BE RECLAIMED
RIVERS

0 1 2 3
KILOMETERS

0 1 2
MILES

IBRD 12017
FEBRUARY 1976