Report No 1035b-IND

Appraisal of Irrigation Project VII Indonesia

April 28, 1976

East Asia & Pacific Projects
Irrigation Division

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CURRENCY EQUIVALENTS

US$1.00	=	Rupiahs (Rp) 415
Rp 100	=	US$0.241
Rp 1 million	=	US$2,409.64

WEIGHTS AND MEASURES - METRIC SYSTEM

1 millimeter (mm)	=	0.039 inches
1 meter (m)	=	39.37 inches
1 kilometer (km)	=	0.62 miles
1 square kilometer (km^2)	=	0.386 square miles
1 hectare (ha)	=	2.47 acres
1 cubic meter (m^3)	=	35.31 cubic feet
1 liter (l)	=	0.264 gallons (USA)
1 liter/second (l/sec)	=	0.035 cubic feet per second
1 kilogram (kg)	=	2.2 pounds
1 metric ton (ton)	=	2,205 pounds

CONVERSION FACTORS FOR RICE

1 ton "dry stalk paddy"	=	800 kg paddy ("paddy gabah")
	=	500 kg milled rice
1 ton paddy (gabah)	=	630 kg milled rice

INDONESIA FISCAL YEAR

April 1 - March 31

ABBREVIATIONS

BIMAS	-	Bimingan Massal Swa Sembada Bahan Makanan
	-	"Mass Guidance for Self-Sufficiency in Foodstuffs"
	-	a farm input-credit package program
BRI	-	Bank Rakyat Indonesia - People's Bank of Indonesia
BULOG	-	Badan Urusan Logistik - "National Logistics Body" - rice procurement agency
BUUD	-	Badan Usaha Unit Desa - Forerunner of KUD as Village Unit Cooperative
DGWRD	-	Director(ate)-General of Water Resources Development
DOLOG	-	Depo Logistik - provincial branch of BULOG
GDP	-	Gross Domestic Product
GOI	-	Government of Indonesia
HYV	-	High-Yielding Variety
INMAS	-	Intensifikasi Massal - "Massive Intensification" - a farm input program
INPRES	-	Instruksi Presiden - "Presidential Instruction" - a rural public works program
IPEDA	-	Iuran Penbangunan Dearah - Land Tax
IRRI	-	International Rice Research Institute
KUD	-	Koperasi Unit Desa - Village Unit Cooperative
MOA	-	Ministry of Agriculture
O & M	-	Operation and maintenance
Pelita	-	Five-Year Development Plan
P_3SA	-	Proykek Perencanaan Pengambangan Sumber - Sumbur Air - Proyek Jratunseluna, an executive body within DGWRD created to program and study water resources development
P_4S	-	Proyek Pengembangan Persawahan Pasang Surut, Jambi and South Sumatera, an executive body within DGWRD created to study tidal lands development
PPL	-	Field Extension Worker
PROSIDA	-	Proyek Irigasi IDA - Agency of DGWRD created to execute IDA-assisted projects
REC	-	Rural Extension Center
TSP	-	Triple Super Phosphate

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APPRAISAL OF IRRIGATION PROJECT VII

SUMMARY AND CONCLUSIONS

i. Agriculture accounts for over 40% of Indonesia's GDP, about 66% of its employment and nearly 80% of its non-oil exports. Rice, which accounts for 30% of agricultural production, is the staple food and, throughout the First Five-Year Plan period (1969-1974), Government programs concentrated on expanding its production. Despite these programs, rice imports continue at a rate in excess of 400,000 tons per year and self-sufficiency in rice has been made a priority goal of the Government's Second Five-Year Plan (1974-1979).

ii. The Government of Indonesia has requested Bank assistance to carry out the proposed project, the seventh Bank-assisted irrigation project aimed at increasing domestic rice production. With the exception of Credit 514-IND, which is assisting in the construction of a new irrigation system, the on-going projects have concentrated on the rehabilitation of existing systems. Construction works on the six on-going projects have been progressing relatively well, although rising costs due to inflation have created budgetary constraints, resulting in delays in project completion. The most serious problem, however, has been the lack of adequate and timely operation and maintenance (O & M) funds. After consultations with the Bank, the Government has allocated in its 1976/77 budget Rp 2, 810 million for O & M of all Bank-assisted irrigation projects. Although this is slightly below the amount required to operate and maintain the systems efficiently, it is a substantial improvement over last year's O & M funding and is consistent with the Government's current budgetary capability.

iii. Tertiary development 1/ is being financed as part of the project works under the fifth and sixth Bank-assisted irrigation projects, but no provision for such development was included in the first four projects. Therefore, the proposed project would introduce tertiary development to 100,000 ha covered by the first four Bank Group-assisted irrigation projects. The level of tertiary development would be similar to that established for the fifth and sixth Bank-assisted projects. The tertiary systems would permit good water control, timely water delivery, a more equitable sharing of water and improved access to individual farms. The improvement in water control and distribution at the farm level would minimize the risk of crop loss and encourage farmers to make investments in improved seed, fertilizer and pesticides, thereby allowing the Government to derive higher benefits from the systems. The second major project component is a new 6,000 ha irrigation system adjacent to the existing Sadang irrigation system in South Sulawesi. It would utilize a diversion weir rehabilitated under the third

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1/ Tertiary development consists of the construction of tertiary and quaternary canals and drains and inspection roads.

project (Credit 220-IND). This component would increase rice production and improve the living conditions of the people in the North Sadang area. Also included in the project are studies and detailed engineering on the Kedungombo storage dam and downstream river improvements, to provide dry-season water and protect lands under the first irrigation project, and preparation of a tidal lands reclamation project and a drainage project for coastal lands. Detailed engineering for the Kedungombo dam, whose technical feasibility and economic viability have been established, would include detailed designs and tender documents for construction under a subsequent project. The project components would require about 3,500 man-months of consultant services, of which 2,900 man-months would be provided by Indonesian consultants.

iv. The estimated cost of the proposed project is US$60 million (Rp 24,900 million), of which US$27.9 million or approximately 47%, would be in foreign exchange. The Bank Loan of US$33 million would finance the foreign exchange component of project works (US$20.2 million) and 80% of the total costs of both foreign and local consultants (US$12.8 million). Vehicles and equipment costing US$2.1 million would be tendered on the basis of international competitive bidding in accordance with Bank Group guidelines. Construction of tertiary systems, which would be spread over a wide area and time span and involves an element of volunteer labor, would be unsuitable for international competitive bidding. The same would apply to the North Sadang project, where civil works (US$6.2 million) could not be grouped efficiently into a single contract large enough to attract international bidders. These works would, therefore, be carried out by locally advertised contracts (US$12.0 million) and by force account (US$10.1 million). Consulting services, mapping and training would cost US$17.2 million. Contingencies would amount to US$18.6 million, of which US$12.8 million would be for expected price increases during the four-year construction period.

v. The Jatiluhur Authority, a semi-autonomous agency successfully carrying out two Bank-assisted projects, would be responsible for one-fourth of the total tertiary development on the Jatiluhur system. PROSIDA, a special unit within the Directorate General of Water Resources Development of the Ministry of Public Works and Electric Power, which is executing the other four Bank-assisted projects, would be responsible for the balance of the tertiary development program. The studies and investigations for subsequent projects would be carried out by consultants responsible to special units of the Directorate General of Water Resources Development.

vi. The economic rate of return on all project investments combined would be about 30%. The rates of return would be 33% for tertiary development and 20% for the North Sadang component. Under a number of adverse assumptions, the rate of return on each part of the project would still exceed 12%.

vii. The proposed project is suitable for a Loan of US$33 million for a term of 25 years, including a six-year grace period. The borrower would be the Government of Indonesia.

I. INTRODUCTION

1.01 The Government of Indonesia (GOI) has requested Bank assistance in financing tertiary development 1/ on 100,000 ha in part of the irrigation systems being rehabilitated with Bank assistance (Credits 127, 195, 220 and 289-IND) and construction of the 6,000 ha North Sadang irrigation system in South Sulawesi. This would be the seventh Bank-assisted project for improving and promoting irrigation development in Indonesia. Five of the six projects concentrated on the rehabilitation of major engineering works of existing irrigation systems to restore their original design capacities in the shortest possible time. They also provided technical assistance in preparing subsequent projects for execution. Only one project (Credit 514-IND) is assisting in the construction of a new irrigation system.

1.02 The feasibility studies for tertiary development were prepared by PROSIDA and, for the North Sadang irrigation system, by PROSIDA assisted by Binnie and Partners (UK). This report is based on the findings of an appraisal mission composed of Messrs. H.J. Tennent, J.T. Caparas, P.V. Applegarth (Bank), P. Judd and P.T. Reddy (consultants), which visited Indonesia in October/November 1975.

II. BACKGROUND

The Economy

2.01 The latest economic report on Indonesia, "Indonesia - Development Aspects and Needs" of April 15, 1975 (708-IND), described and analyzed the structure of production and incomes, the recent changes in the availability of resources and the medium and longer-term outlook for the Indonesian economy. The main findings of the report are summarized in the President's Report for this project.

Rice Production

2.02 Agriculture accounts for over 40% of Indonesia's GDP, about 66% of its employment and nearly 80% of its non-oil exports. Rice, which accounts for 30% of agricultural production, is the staple food and, throughout the First Five-Year Plan period (1969-74), government programs concentrated on expanding its production. Specific efforts included rehabilitating existing irrigation systems, creating fertilizer and rice price support programs, providing funds for research and extension and improving the supply of seed, fertilizer, pesticide and credit. As a result of these efforts, rice production grew from 12.3 million tons in 1969 to 15.5 million tons in 1974. On a per capita basis, production increased at a 2.1% annual rate. Self-sufficiency in rice is a priority government goal for the Second Five Year Plan (Pelita II, 1974-79). However, numerous problems hinder achieving this goal, despite

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the recent progress. Inadequate maintenance threatens to destroy the gains from the recent rehabilitation of irrigation systems; flooding and inadequate drainage sharply reduce rice yields and cause two or three replantings in some areas; and fertilizer does not reach the farmer on a timely basis. Supplies of certified and high-yielding variety seed remain inadequate; numerous changes in the types of insecticides and other inputs supplied through government agricultural support programs confuse farmers and cause them to apply the inputs improperly. Losses to disease and rats remain a serious problem and grain drying and storage facilities are inadequate in many areas. The Government has begun to act on many of these problems, but the development of adequate programs would take some time. The Bank Group is assisting the Government's efforts through a number of projects (paras 4.08 and 5.04).

2.03 Because of the problems discussed above, rice imports are still necessary. Over 1.1 million metric tons were imported in 1974/75. Imports have been sharply reduced in 1975/76, with less than 200,000 tons being imported during the first six months of the year.

2.04 Although production of secondary field crops (palawija), such as groundnuts, maize, cassava, soybeans, and onions, is believed to have declined during the First Plan period partly because of shifts of land use to rice production, their position remains significant. Under the Second Five Year Plan, production would be revitalized, and the Government has recently extended the BIMAS agricultural support program to several of these crops. The Government has also begun research to improve palawija yields.

Project Formulation

2.05 Following nearly thirty years of neglect, virtually the entire 1.5 million ha of Government maintained irrigation systems, which are located mainly in Java, were in need of rehabilitation. Rehabilitation work on about 1.0 million ha was started under Pelita I (1969-1974), with about 840,000 ha on nine major systems being rehabilitated with financial assistace from four Bank Group Credits. Subsequently, two more projects received Bank Group assistance at the start of Pelita II, bringing the total coverage to about 990,000 ha. Work on the Madiun irrigation system, the last major group of systems in need of rehabilitation, is being considered for Bank financing in 1977. Because of the large volume of rehabilitation work to be done on each system, only the most essential works were undertaken to put the systems back in working order. They consisted mainly of reconstructing diversion weirs, dredging main and secondary canals and replacing broken-down structures. By and large, these works were deferred maintenance and they were undertaken with the full realization that once the most pressing rehabilitation works have been completed, further upgrading and improvement of the systems would be required. Having overcome much of the initial rehabilitation backlog, GOI is now turning to the next most urgent task on these systems, namely, construction of tertiary canals.

2.06 When the Bank appraised the first four irrigation rehabilitation projects in Indonesia, it was generally accepted that construction of the

system by the Government would extend down to units serving about 1,000-1,500 ha each. Tertiary canals feeding from outlets provided in these systems were to deliver water to units of about 150-200 ha each. Quaternary canals taking off from the tertiaries were supposed to deliver water to units of about 10-15 ha; below that level, irrigation was to be from field to field. With the exception of the first 50 m of tertiary canals, which were constructed by the Government, there were no cost entries for tertiary and quaternary systems in the rehabilitation projects financed by the Bank since it was assumed, as has been traditional in Indonesia, that farmers would carry out these works using volunteer labor. Drains below the secondary level were similarly excluded from the works to be carried out by the Government. It soon became apparent, however, that the farmers were incapable of executing the works for several reasons. First, the farmers had neither the technical knowledge to set out canal systems to correct lines and grades, nor design experience to locate and build tertiary control structures. Second, construction of control structures required cash outlays, which were often beyond the farmers' means, as well as volunteer labor. Third, although the area of land lost due to construction of the tertiary system was small, it meant a substantial loss to some individual owners. Without at least some minimal arrangements for right-of-way compensation, farmers were unwilling to construct the system. Finally, the recruitment of all farmers in the village to go out and construct the system required at least some organizational support from the Government, which was, however, not forthcoming.

2.07 In an effort to demonstrate to farmers the benefits from tertiary systems, pilot tertiary units serving about 150 ha each were introduced throughout the systems being rehabilitated under the first four Bank-assisted projects. Design imperfections inherent in the earlier systems because of inaccurate maps have been corrected in later schemes as more accurate maps became available and designers' techniques improved. The tertiary systems have, on the whole, operated satisfactorily and have effectively served as demonstration units. Quaternary canals serving 10-15 ha limit the field-to-field distribution of water to no more than 6-10 individual paddy fields. Bicycle and foot paths on canal embankments provide direct access to 40-50% of the farms. In contrast, water drawn from secondary systems without tertiaries travels over 50-100 plots before reaching the farthest fields in the 1,000-1,500 ha command areas of these systems. In nearly all cases, some fields have to be flooded deeper than optimum to cause water to flow to adjoining fields. As a result, water travel time to distant fields is 6-10 times longer and, when the supply is limited, coverage is restricted to no more than 300-500 m beyond the secondary canal. In times of abundant water supply, water travel time has not proved critical, but low-lying fields suffer from flooding due to uncontrolled water releases from other fields. In the absence of adequate internal and project drains, these fields remain flooded for extended periods. In both cases, yields from distant plots are adversely affected and serious water allocation problems are encountered.

2.08 Although farmers were quick to realize the benefits from the tertiary systems, they are still unable to construct them for reasons explained above (para 2.06). GOI has therefore agreed to assume responsibility

for construction of the tertiary systems as part of the project works under the fifth (Credit 514-IND) and sixth (Loan 1100-IND) Bank-assisted irrigation projects. GOI still felt, however, that farmers should participate fully in works they are capable of doing. Under these projects, therefore, the respective executing agencies, Jatilihur Authority and PROSIDA, with assistance from consultants, would design and lay out the tertiary and quaternary canals and drains in their respective project areas, construct the structures by force account or small local contracts, and coordinate the acquisition of rights-of-way, while the farmers would excavate the canals and drains and fill and compact the canal embankments under the direction of the executing agencies. To encourage the farmers to construct tertiaries, the Government would pay them a token wage consistent with prevailing self-help practices in the community. Wages to farmers for excavation and embankment construction would vary from district to district, but would average about Rp 150 per day, which is below the prevailing wage rate of Rp 200 to Rp 300 per day in the construction industry. The organization of the farmers for aided self-help in the construction of the systems, as well as the formation of water user associations to assume responsibility for operation and maintenance (O&M) in tertiary systems of about 150 ha each, would be the responsibility of the provincial district heads and the local village chiefs.

2.09 Under the proposed project, GOI would commence the construction of tertiary systems on the areas rehabilitated by the first four Bank Group assisted projects (Credits 127, 195, 229 and 289-IND). Construction methods and procedures would be identical to those adopted for the fifth and sixth irrigation projects (para 2.08). The area covered by the four irrigation projects is 840,000 ha and practically all of it requires tertiary systems. Tertiary construction on 92,000 ha of this area is being carried out under Loan 1100-IND. In view of constraints in designing and supervising construction of the systems, organizing farmers for aided self-help, forming water user associations to assume responsibility for O & M of the systems and providing agricultural supporting services, the area included in the proposed project would be limited initially to 100,000 ha. Subject to the capability of the involved agencies to construct and provide agricultural services to the completed systems, tertiary construction on the rest of the area could be carried out under future projects.

2.10 The proposed 6,000 ha North Sadang irrigation system is adjacent to, and was originally intended to be part of, the existing Sadang irrigation system. Construction of an intake at Benteng barrage and 4.5 km of the main canal for the system were completed in the early 1940s, but further work on the project was disrupted by World War II. GOI resumed construction of the main canal in 1969 and succeeded in completing about 7.5 km and 25 canal structures before running into a hill of solid rock, which could only be negotiated either by tunneling through rock or by skirting the hill along an open rock-cut. Faced with these costly alternatives and with funds running low, construction was halted. GOI has now requested Bank assistance in completing the system. The alignment of the remaining stretch of main canal would be shifted to avoid costly tunneling and minimize open-rock excavation. Other components of the system, which make up about 85% of this sub-project's cost, would be new.

III. THE PROJECT AREA

3.01 The tertiary development project area includes seven of the nine irrigation systems covered by the first four Bank Group-assisted irrigation projects. The seven systems serve about 720,000 ha (Annex 4, Table 1). Six of the systems are located along the north coast of Java, while the seventh (Sadang) is in South Sulawesi (Map 3627R2). The 100,000 ha to be provided with tertiary distribution systems under the project would be spread through the seven systems. At present, only about 5-10% of these areas have proper water distribution and internal drainage systems down to the quaternary level of 10-15 ha.

3.02 About 2,000 ha of the 6,000 ha in the proposed North Sadang irrigation service area are presently served by a semi-technical irrigation 1/ system, 3,200 ha are rainfed and the remainder are uncultivated low-lying swamplands. Much of the wet-season rice area is subject to flooding. Farmers in some areas have to replant two to three times to obtain a crop.

Climate

3.03 The climate in Java and South Sulawesi is tropical and monsoonal. Temperatures vary only a few degrees around the annual average of 26°C. Day lengths are almost constant throughout the year. The rainy season, during which 70% of the rainfall occurs, extends from November to May (northwest monsoon) and the dry season, from June to October (southeast monsoon). Annual precipitation varies from 1,700-2,900 mm over the project areas. Annex 1 presents rainfall data.

Soils and Topography

3.04 The majority of the project lands lie on a plain along the north coast of Java. Exceptions to these are some lands in Pekalen-Sampean and Sadang (South Sulawesi) which lie inland. The alluvial and volcanic soils prevalent in the project areas respond positively to nitrogenous and phosphatic fertilizers. Approximately 75% of the coastal soils exhibit percolation rates lower than 1.0 mm/day, making them ideal for paddy cultivation. Sugarcane and a variety of secondary crops thrive favorably on these lowland soils when adequate drainage is provided. However, secondary crops grow best on the well-drained upland, lighter soils. The project lands slope from 0-2% near the coast and rise gently to the higher ground inland. Since the areas have been cultivated for many years, the topography presents no problems, except in some low coastal areas and near large river mouths where flooding occurs.

1/ Constructed with Government technical assistance but operated and maintained by farmers.

Population, Farm Size and Land Tenure

3.05 The farm and landless labor population to be served by the 100,000 ha tertiary development component of the project is estimated at 2 million. The number of families is about 330,000. Local census data indicates a population of about 5,400 families and 27,000 people in the North Sadang area.

3.06 Farm size and land tenure data is sketchy. The 1963 Census of Agriculture estimated that the average farm size on Java was around 0.7 ha. More recent samplings indicate an even smaller size, at least in the tertiary development areas. Sample farm sizes ranged from 0.15-5.0 ha, with few farms above 2.0 ha. Farms on Sulawesi are somewhat larger, with the average farmer holding 1.5 ha of paddy and a half-hectare of upland. A rough estimate of the distribution of holdings is as follows:

Tertiary Development Areas, Java

Farm Size (ha)	% of Farms	% of Land
Less than 0.25	30	15
0.25 - 0.50	34	25
0.5 - 1.0	25	30
1.0 - 2.0	10	25
More than 2.0	1	5

Tertiary Development Area, Sadang and North Sadang Area

Less than 1.0	27	12
1.0 - 2.0	48	49
2.0 - 5.0	22	32
More than 5.0	3	7

3.07 There are also significant differences in land tenure between the project areas. In Java, about 35% of the population owns land, 30-35% sharecrop and the remainder work as landless laborers. In most sharecropping arrangements, the tenant and the landowner split the production, input and harvesting costs. The tenant provides the labor and the landlord pays the land tax. Sharecropping arrangements are similar in the Sadang area; however, there is virtually no landless labor. As a result, labor is relatively scarce and the underemployment which so characterizes Javanese agriculture is virtually non-existent. Isolated pockets of surplus labor do exist, apparently due to the effect of poor communications and transport on labor mobility. About 30% of the farmers in Sadang farm their own land, an additional 45% own some of their land and either rent some land to other farmers or farm more themselves as sharecroppers, and 25% sharecrop exclusively.

Agricultural Production

3.08 Paddy is the major wet-season crop in the areas where tertiary and quaternary development would occur. High yielding varieties (HYV's), which

occupy about 75% of the planted area, yield about 3.2 ton/ha, while local irrigated varieties are planted on 20% of the area and yield 1.8 ton/ha. Rainfed paddy, which makes up the remaining 5% of the area, yields 1.5 ton/ha. Except in the Jatiluhur area, only run of the river irrigation water is available during the dry season, which limits cropping intensity throughout the proposed tertiary areas to 145%. Only HYV's are planted in the dry season averaging 3.0 ton/ha of paddy. Total paddy production over the 100,000 ha averages around 420,000 tons per year. A number of secondary (palawija) crops are also grown in the dry season. These crops overcome the limited dry-season rainfall by using residual moisture from the previous paddy crop. The most popular crops include groundnuts, maize, cassava, soyabeans and, in some areas, red onions.

3.09 A few small village irrigation schemes supply water to 2,000 ha of the North Sadang area. The remainder of the area is rainfed (3,200 ha) or too swampy to be cultivated (800 ha). Virtually all of the cultivated area is planted with local varieties of paddy, as the absence of assured water control discourages farmers from planting the more sensitive HYV's. As an additional constraint on production, the few roads in the area are very poor, making access to agricultural inputs and services almost impossible during the rainy season. Wet-season rainfed crops average 1.9 ton/ha, while irrigated crops yield 2.2 ton/ha. In the dry season, the irrigated areas yield 2.0 ton/ha. However, some progressive farmers, using cash inputs, are getting 5.0 to 7.0 ton/ha in areas where the water supply is reasonable and serious flooding does not occur. Total annual production from the area is approximately 12,600 tons. A small amount of palawija crops is also grown in the area. Details of current agricultural production are given in Annex 2.

Storage, Processing and Marketing

3.10 Paddy is sun dried and stored in the farmer's houses. Some villages have no drying floors and farmers experience great difficulty in drying their paddy, especially when heavy rains occur during the harvest season. In some areas, losses to rodents have also been serious. The project areas have sufficient milling capacity to handle current production and expected increases. For example, there are 45 rice hullers in the North Sadang area, with a capacity of 1.0 ton of paddy daily. The rice milled is medium grade, around 35% broken. Rice for home consumption is generally hand-pounded.

3.11 Because the farms are so small on Java, few farmers have any surplus production for sale after supplying home and farm needs. Thus, government officials estimate that only 15-20% of the total crop is sold to middlemen or to farmer cooperatives (BUUD/KUD). In contrast, rice production in the Sadang area exceeds local needs and a significant portion of the total production is exported to other areas of Indonesia. However, even there, officials estimate that 53% of the farmers have less than 2.0 tons of rice to sell, 40% have less than 1.0 ton and 17% have no rice to sell.

3.12 The BUUD/KUD's act as the village-purchasing arm of the Government's paddy/rice marketing agency (BULOG/DOLOG) and buy standard grades of paddy at

fixed-floor prices. The floor price is currently Rp 67.50 (US$0.16) per kilogram of dry paddy. During non-harvest periods, prices on the open market are usually higher than the floor price and individual BUUD/ KUD's have been known to raise their bid prices to compete with the private market. However, many farmers are forced to sell their crop below the floor price during the harvest season. In some cases, inadequate facilities prevent rice from being dried to the 14% moisture-content standard acceptable for government purchases. In other cases, BUUD/KUD's exhaust their credit lines from BULOG, and are unable to obtain cash to pay the farmers. The farmers, who need cash immediately to meet tax payments or to pay off the last season's debts so that they can purchase inputs for the new season, are then forced to sell their paddy on the open market at a discount.

Agricultural Support Program

3.13 About 50% of the tertiary development areas receive subsidized inputs, extension advice and credit through the BIMAS/INMAS program. The BIMAS program provides two different input packages, consisting of credit for fertilizers, seed and pesticides, and a cost of living allowance. INMAS provides similar packages, but without credit and the cost of living allowance. Both programs are reasonably adapted to local requirements.

3.14 Certified paddy seed is produced by the National Seed Corporation at Sukamandi (Credit 246-IND) and is distributed through BUUD's, KUD's and local kiosks at about double the commercial paddy price. Supplies of this seed are limited. Most Districts have one or more local seed farms which are run in conjunction with District Ministry of Agriculture (MOA) personnel. Seed from Sukamandi, supplemented with local seed, is multiplied and sold to farmers at 150% of the commercial paddy price. Extension is provided through the extension staff of the Directorate of Food Crops in the MOA. Although all farmers are entitled to extension services, only recipients of BIMAS packages currently receive extension advice due to the shortage of trained staff. The proposed National Food Crops Extension Project is being designed to help correct this deficiency.

3.15 In North Sadang there is only one BUUD to service the area and the BIMAS program is limited to a few progressive farmers. Due to poor roads, access to agricultural inputs and services is almost impossible during the wet season. The proposed project would upgrade the access roads to permit all-weather use (para 4.07).

Transportation

3.16 National highways and railroads connect the tertiary development areas with the major cities and seaports. The national railway provides reasonably good passenger service through the areas but offers only a limited freight service. The national highways are paved and are generally well maintained. The roads get progressively worse from the national highway down to the provincial, district and village level. The village roads, in many cases, are limited to light vehicular and pedestrian traffic in the wet season. Some

are not passable and, due to poor maintenance, remain so for many months. This makes the transporting of agricultural inputs to the villages extremely difficult, if not impossible, at the time when they are most needed and highlights the need for improving rural roads or constructing adequate storage near the village kiosks.1/ Although it is insufficient to cover the whole network, the INPRES program includes upgrading of some of these roads, and some of the shortages and late delivery problems are being alleviated by a Government program to increase storage space at the BUUD's and KUD's. In North Sadang, the area is served by the main highway, which connects to the ports of Pare Pare and Ujung Pandang. The suspension bridge which controls all traffic into the area has an 8-ton load limit. Most of the village roads are impassable during the wet season.

Operation and Maintenance

3.17 The systems are generally operated at gate settings established from long experience. Constraints to better operation are: (a) lack of dependable communications, which would allow rapid adjustment of canal flows based on local requirements and rainfall; (b) the unwieldy process of lifting large gates with manpower and old-fashioned winches, which would be alleviated by the provision of counterweights and modification of the gate structures; and (c) the insufficiency of measuring devices in primary canal intakes and major secondary bifurcations. The proposed project would deal with the above problems (paras 4.04 and 4.05). The poor state of maintenance of rehabilitated systems turned over by the executing agencies to the Provincial Government is discussed in Chapter V.

IV. THE PROJECT

4.01 The proposed project would comprise:

(a) tertiary development on 100,000 ha in irrigation systems being rehabilitated under Credits 127, 195, 220 and 289-IND, which did not include financial provisions for the construction of these works (Map 3627R3);

(b) construction of a 6,000 ha new irrigation system in North Sadang, adjacent to the Sadang irrigation system, which is being rehabilitated under Credit 220-IND (Map 11867R);

(c) studies and detailed engineering on the Kedungombo storage dam in Central Java, including flood control and drainage works on coastal areas downstream (Map 11728R);

1/ Kiosks are stores which serve as primary sources of agricultural inputs.

(d) studies and detailed engineering for a drainage and inspection roads project, on coastal lands covered by Credits 127 and 220-IND, which did not include financial provisions for these works;

(e) feasibility studies for a tidal lands reclamation project in Sumatera;

(f) training of staff; and

(g) procurement of vehicles and equipment.

Project Works

4.02 Tertiary Development. Tertiary development would be undertaken on 25,000 ha of the Jatiluhur system (Credit 195-IND) and on 75,000 ha distributed over the systems being rehabilitated by PROSIDA (Credits 127, 220 and 289-IND). The works would include about 550 km of tertiary canals, 1,000 km of sub-tertiary canals, 5,500 km of quaternary canals, 4,000 km of tertiary and quaternary drains, 1,500 km of inspection roads and 9,000 canal structures (Annex 4). The various works would involve about 11 Mm^3 of earthwork and would require the acquisition of about 2,400 ha of rights-of way. To facilitate design and construction and good water management during operation, assurances were obtained from the Government during negotiations that: (a) the systems would be constructed in blocks of at least four tertiary units each (about 600 ha); (b) wherever possible even larger blocks would be constructed; (c) farmers in these blocks are willing to join water user associations and undertake construction of tertiaries; and (d) to the extent possible, priority for construction of tertiary blocks would be given to areas where there is a reasonably good water supply and water control in the secondary canal, no flooding occurs, agricultural supporting services would be available and the potential for double cropping exists.

4.03 Upon completion of the works, about 670 tertiary systems of 150 ha each would be added to the existing systems. Water delivery would be controlled at the tertiary and quaternary division boxes, and from there, quaternary canals serving units of 10-15 ha would deliver water down to 6-10 individual plots on a field-to-field basis. Although this is not yet the optimum level of on-farm works, it represents a substantial improvement over the present situation and takes into consideration GOI's budgetary constraints and limited technical capability. The plan of a typical tertiary system is shown in Map 11957R.

4.04 The primary and secondary supply systems to the tertiary development areas would be upgraded by providing additional measuring devices near canal intakes and major bifurcations. Existing gates and gate structures would be modified to facilitate the operation of the gates with motor-driven devices.

4.05 Communications within the existing systems, including the tertiary development areas, would be further upgraded by procuring and installing additional telephone communications equipment. The increased density and wider coverage of the telephone communications network would allow rapid adjustment of canal flows based on local requirements and rainfall.

4.06 Mapping in the Jatiluhur system, which was not included in the earlier Credit (195-IND), would be carried out under the project. Maps accurate enough for the design of tertiary systems would be produced for the Prosida area as well (para 4.14).

4.07 North Sadang System. The existing intake at Benteng barrage, about 12 km of primary canal and 25 canal structures would be rehabilitated and upgraded to permit double cropping of the 6,000 ha service area. New works, consisting of 7 km of primary canal and 6 canal structures; 46 km of secondary canals and 25 canal structures; and 74 km of primary and secondary drains and 25 drainage structures, would be constructed. About 54 km of existing access roads would be upgraded by raising stretches subject to flooding, widening where called for and providing a gravel or crushed-stone base course to permit all-weather use. In addition, the entire service area would be upgraded to the standards of the tertiary development areas by constructing about 420 km of distribution canals, 540 canal structures, 240 km of drains and 90 km of inspection roads. The various works would require about 3.5 Mm^3 of earthwork and the acquisition of 240 ha of rights-of-way.

4.08 Studies and Detailed Engineering: Consultants would be engaged under the project to: (a) undertake studies and detailed designs on the Kedungombo dam and on the flood control and drainage schemes downstream; (b) prepare a drainage project for about 40,000 ha of low-lying coastal lands in Ciujung, Cisedane, Pemali-Comal and Sadang; and (c) prepare a feasibility study for development of tidal lands for smallholder settlers in the provinces of Jambi and South Sumatera (Annex 15).

4.09 The Kedungombo dam across the Serang River would be a sand and gravel-fill structure with a maximum height above streambed of 50 m and an estimated cost of US$70 million (Annex 5, Attachment II). It would regulate flood flows and provide dry-season irrigation for about 35,000 ha in the 47,500 ha Glapan-Sedadi area (Credit 127-IND), which presently grow one crop of rice utilizing the unregulated river flows. Feasibility studies carried out by consultants (NEDECO) and reviewed by the mission have shown that construction of the proposed dam would be technically and economically feasible. Detailed engineering and construction of the dam would take about six years. Detailed designs and associated works to be carried out under the project would prepare the dam for construction under a subsequent project and provide a good basis for estimating project costs. The works would include temporary offices and quarters for GOI personnel, access roads to the damsite and quarry areas, detailed site investigations, and design of project features to tender document stage. Also included would be studies and detailed engineering on downstream flood control and drainage schemes which would benefit about 30,000 ha of the Glapan-Sedadi, Juana, Welahan and Serang coastal areas.

4.10 The feasibility study for development of tidal lands would prepare a gross area of 200,000 ha in South Sumatera province and 100,000 ha in Jambi province for execution under Pelita III (1979-84). Detailed engineering on the drainage project for coastal lands would prepare it for implementation under the forthcoming irrigation project (Irrigation VIII).

Consulting Services

4.11 The design and construction of tertiaries on 100,000 ha spread over seven widely scattered systems would require a large number of engineers, whom PROSIDA and Jatiluhur Authority would be unable to supply from their present staffs. Instead of hiring new engineers and training them for the job, the agencies would engage consultants to design the systems and assist in construction supervision. Since the services involved would require technical skill as well as contact with the farmers at various stages of the work, the engineers would be drawn from a number of local consulting firms experienced in tertiary design and familiar with the tertiary areas. PROSIDA would also engage foreign consultants to: (a) design and supervise construction of the North Sadang irrigation system; and (b) undertake detailed engineering on the drainage and inspection road requirements in the Ciudjung-Cisedane, Pemali-Comal, and Sadang irrigation systems. Consultants for the Kedungombo dam and the tidal reclamation project would be employed by special units 1/ of the DGWRD. To upgrade the capability of local consultants, foreign firms would be encouraged to associate with local firms approved by GOI and the Bank. About 3,500 man-months of consulting services would be required, of which 2,900 would be provided by Indonesian consultants.

4.12 PROSIDA has engaged consultants for detailed engineering of North Sadang on terms and conditions approved by the Bank under Loan 1100-IND. Subject to their satisfactory performance, GOI would extend their tenure under the project to provide assistance during construction. The estimated manpower requirements and draft terms of reference for the other consulting services are presented in Annex 5. Assurances were obtained that consultants acceptable to the Bank would be engaged within eight months of Loan signing on terms and conditions approved by the Bank. The employment of consultants to design and supervise construction of the North Sadang irrigation system would be a condition of effectiveness of the Loan.

Water Supply, Demand and Quality

4.13 Water supply and demand in the service areas of the tertiary development and North Sadang project have been investigated under Credits 127, 195, 220 and 289-IND. The previous studies show that there is sufficient water

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1/ Consultants for Kedungombo dam would be engaged by Proyek Perencanaan Pengembangan Sumber - Sumber Air - Sub Proyek Jratunseluna (P3SA); for the tidal reclamation project, by Proyek Pengembangan Persawahan Pasang Surut, Jambi and South Sumatra (P4S).

supply to meet the demand for 100% cropping intensity in the wet season. The regulated supply available to the Jatiluhur system would permit 90% cropping intensity in the dry season, while the present unregulated state of the other sources would allow 90% cropping intensity in the Sadang and North Sadang service areas and 30% intensity in other areas. Although a slight increase in cropping intensity would result from the improvement in water control and distribution in the tertiary areas, this was ignored in the calculation of benefits. Tests of water samples in the project areas indicate that there are no harmful chemicals in the waters. The water is extremely turbid in the wet season, but years of use have produced no adverse affects on crops grown.

Status of Engineering

4.14 In the PROSIDA tertiary development areas, photogrammetric mapping at 1:10,000 scale is in progress and is being completed under Loan 1100-IND. The preparation of 1:5,000 scale rectified photo mosaics and additional ground surveys required to accurately draw 0.25-0.5 m contours on them would be carried out on 580,000 ha under the project. This work would not be completed until December 1978, but sufficient maps would be prepared to keep pace with design and construction requirements on PROSIDA's systems. Mapping on 200,000 ha of the Jatiluhur system is included in the proposed project. Maps for about 15,000 ha would be produced by March 1977 to meet the scheduled construction of tertiaries in the 1977/78 fiscal year. The rest of the mapping is expected to be completed by April 1978. In the North Sadang service area, aerial photographs have been produced and required ground surveys would be completed by December 1976. Detailed engineering and construction supervision of the various sub-projects would be done with the assistance of local and foreign consultants (para 4.11).

4.15 The feasibility studies for the Kedungombo dam were undertaken by NEDECO, whose site investigations included 20 exploratory drillings to 60 m depth, geologic mapping of the dam and reservoir sites, and exploration of the sources of fill materials. The reservoir created by the dam would innundate about 3,300 ha and displace 3,000 families. GOI has started studying resettlement schemes for these families in conjunction with the resettlement proposals for families who will be displaced from the Jatigede reservoir area. Studies and detailed engineering for Kedungombo dam, which are included in the proposed project, are scheduled to commence about mid-1976 and the engineering design could be sufficiently advanced to permit preappraisal by April 1978. Adequate resettlement proposals prepared by GOI, in conjunction with the studies and detailed designs, would be submitted to the Bank prior to the appraisal of the dam.

Implementation Schedule

4.16 Implementation schedules for tertiary development on the PROSIDA and Jatiluhur systems and for the North Sadang irrigation system are presented in Charts 15534 through 15536. Actual construction would start at the beginning of the 1977 dry season. The period between loan effectiveness and

start of construction would be used to engage consultants, prepare designs and carry out preparatory works. The design and construction period for all sub-projects is four years. The area of tertiary systems which can be designed, laid out, constructed and supplied with essential agricultural inputs and services each year would be monitored to determine the capability of the various agencies involved in carrying out future works. Based on this performance, another tertiary development project could be prepared. The implementation schedule for studies and detailed engineering on the Kedungombo dam and downstream river improvements is shown in Chart 15537. Detailed engineering to tender documents, studies on the flood control and drainage schemes for coastal areas downstream, and construction of associated works will take 2-1/2 years.

Cost Estimates

4.17 Total project costs are estimated at US$60 million, of which US$27.9 million or about 47% is the foreign exchange component. The costs of the project components to be constructed were prepared by PROSIDA and have been based on actual costs of similar works currently in progress in Java. Labor supplied by farmers in the construction of tertiary systems has been valued at Rp 150 per man-day (para 2.08). All estimates were updated by the appraisal mission to mid-1976 prices. Depending on the status of investigations and the complexity of the work, physical contingencies of 10% to 20% have been included. Fifteen percent has been allowed for tertiary development to provide for possible differences in field conditions between the project area and sample areas used in estimating unit costs applied to the 100,000 ha development. In North Sadang, where rehabilitation and construction of irrigation and drainage works are involved, a 20% contingency was applied to the base cost to allow for additional work which may be uncovered after the structures are dewatered. Costs due to expected price increases amount to 21% of the total project cost and assume the following rates of inflation:

	Annual Inflation Rate (%)		
	1976	1977-79	1980
Civil works	13	12	11
Equipment and services	9	8	7

4.18 Details of the project costs are presented in Annex 6 and are summarized below:

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange
	(Rp Million)			(US$ Million)			(%)
Tertiary Development	4,920	2,965	7,885	12.0	7.0	19.0	37
North Sadang Irrigation System	1,930	1,515	3,445	4.6	3.7	8.3	45
Studies and Detailed Engineering	1,690	2,210	3,900	4.1	5.3	9.4	56
Miscellaneous Works and Services	550	1,400	1,950	1.3	3.4	4.7	72
Base Cost Estimate	9,090	8,090	17,180	22.0	19.4	41.4	47
Physical Contingencies	1,340	1,070	2,410	3.1	2.7	5.8	47
Expected Price Increases	2,880	2,430	5,310	7.0	5.8	12.8	47
Total Project Cost	13,310	11,590	24,900	32.1	27.9	60.0	47

Financing

4.19 The proposed loan of US$33 million would finance the foreign exchange component of project works (US$20.2 million) and 80% of the total costs of both foreign and local consultants (US$12.8 million). It would cover 55% of total project costs and 16% of local costs. GOI would provide, in a timely manner, the remaining Rp 11,200 million (US$27 million) to PROSIDA, Jatiluhur Authority, P3SA and P4S out of annual budget appropriations.

Procurement

4.20 Vehicles and equipment for construction and operation, costing about US$2.1 million, would be procured after international competitive bidding in accordance with Bank Group guidelines. A preference equal to 15% of the cif cost of the imported goods or the customs duty, whichever is lower, would be extended to qualified local manufacturers in the evaluation of bids. Small off-the-shelf items costing less than US$10,000 each and limited to a total of US$100,000, which are not suitable for international tendering, would be purchased through normal Government procurement procedures. There are sufficient supplies of such goods to ensure adequate competition. Contracts for vehicles or equipment estimated to cost the equivalent of US$75,000 or more would be submitted to the Bank for review before tendering and award.

4.21 The construction of small structures for the tertiary systems, which are scattered over a wide area and time span, would not be of interest to international contractors. This would be carried out either by force account or small local contracts using labor intensive methods. The excavation of tertiary and quaternary canals and drains, as well as the filling and compaction

of canal embankments, would be done by farmers at reduced wage rates (para 2.08).

4.22 It would be impractical to let works for North Sadang as one contract since: (a) about 15% of the cost of works would be for tertiary construction; (b) the remaining work would be spread over a wide area and would not be big enough to attract international bidders, but it would be too big for most local contractors who would otherwise qualify if the works were broken down into a number of smaller contracts; and (c) construction would be delayed since complete designs and tender documents for the whole system would be needed prior to the advertisement of the works. Assurances were therefore obtained from the Government during negotiations that: (a) the works would be divided into a number of suitably sized contracts which would be let to pre-qualified contractors following usual government procedures satisfactory to the Bank, as the tender documents for each become ready; and (b) price escalation clauses, which are not normally provided in local civil works contracts, would be included in contracts extending beyond one year. For contracts above US$500,000, documents would be submitted to the Bank for review before tendering and award.

Disbursements

4.23 Disbursements would be made at the rate of 100% against the foreign exchange cost of training and directly imported vehicles and equipment, 95% of the ex-factory cost of equipment manufactured locally, 65% for imported equipment locally procured, excluding vehicles, and 40% of total expenditures for locally procured vehicles. To encourage the use of local consultants, disbursements for both foreign and local consultants would be at 100% of foreign expenditures or 80% of total costs, which is roughly equal to the foreign exchange cost of typical foreign consultants. Disbursements for tertiaries would be at the rate of 60% of total costs, and these would be disbursed only if each withdrawal application is accompanied by a certificate from the site engineer stating that the quaternary canals and drains in the tertiary block had also been constructed. The engagement of local consultants for the preparation of design and construction drawings in the first year of tertiary construction would be a condition of disbursement for tertiary systems. Disbursements for other civil works would also be at the rate of 60% of total costs. Disbursements for force account works would be made against a certificate of expenditures, the documentation for which would not be submitted to the Bank for review, but would be retained by the borrower and made available for inspection by the Bank's supervision missions. Disbursements for mapping would be at the rate of 80% of total expenditures. The cost of remaining works and services would be reviewed each year and, based on this review, the above disbursement percentages would be adjusted, if required, to maintain disbursements against outstanding works and services at a meaningful level throughout the construction period. The estimated schedule of expenditures on the project and the disbursement schedule are presented in Annex 7. Disbursements are expected to be completed by December 31, 1981, and any undisbursed balance on this date will be cancelled.

Accounts and Audit

4.24 The accounts of PROSIDA, Jatiluhur Authority, P3SA and P4S are audited annually by the Government's auditors. These auditors have been accepted for the previous six Bank Group assisted irrigation projects and satisfactory audit reports have been received. Assurances were obtained that the above agencies would maintain separate accounts for the project and that audited financial statements, together with the auditors' comments, would be submitted to the Bank within six months of the close of each fiscal year.

Environmental Effects

4.25 The service areas of the existing irrigation systems and North Sadang have been cultivated for many years and no adverse effects are anticipated from the project works. The dependable, controlled drainage in the North Sadang system would, in fact, improve the living conditions of the people, many of whom currently suffer from flooding for extended periods in the wet season and experience shortages of fresh water supply in the dry season. The fishponds located below the project would be less susceptible to overtopping in the wet season and would have a fresh water supply in the dry season. There is no schistosomiasis in the project areas but cholera is prevalent in the flooded areas. The provision of improved drainage would help minimize the incidence of this disease. The use of fertilizers and pesticides is already widespread in the project areas. People are constantly reminded of the toxic effect of pesticides on humans and domestic animals and no adverse effects are envisaged provided care is exercised in their application.

V. ORGANIZATION AND MANAGEMENT

Organization

5.01 Responsibility for implementation of the tertiary development project component would rest with PROSIDA and the Jatiluhur Authority. PROSIDA, a special unit in the Directorate General of Water Resources Development (DGWRD), is presently in charge of works under Credits 127, 220, 289-IND and Loan 1100-IND. Jatiluhur Authority, a semi-autonomous public agency established by the Government to administer the multipurpose development of the Jatiluhur region, is currently in charge of works under Credits 195 and 514-IND. Both agencies would use existing staff and office space built up under the earlier projects. Responsibility for the execution of North Sadang would rest with PROSIDA. Direction at field level would be from the staff of the existing Sadang subproject office, which was strengthened under Credit 220-IND. Preliminary studies and detailed engineering for the Kedungombo dam and the flood control and drainage schemes downstream would be implemented by P3SA, an executive body within DGWRD that is programming and studying water resources development

nationwide. Direction at field level would be through its Jratunseluna 1/ sub-project office, which supervised NEDECO's feasibility studies on the Kedungombo dam, other dams in Central Java, and flood control and drainage schemes for coastal areas downstream of these dams. For P3SA this assignment would, therefore, be a continuation of its earlier work. P4S, another executive body within DGWRD that is responsible for tidal reclamation projects, would supervise the feasibility study for tidal lands development. Charts 15530 , 16017, 16008 and 15533 show the Jatiluhur Authority management structure, the general organization of the DGWRD, the PROSIDA management structure and the organization of services for irrigated agriculture, respectively. The typical PROSIDA organization for each subproject is shown in Chart 8964.

5.02 With their long experience in dealing with Bank-assisted irrigation projects, PROSIDA and Jatiluhur Authority, with the assistance of their consultants, would be capable of carrying out their respective parts of the work. The capability of P3SA to implement the studies and detailed engineering on the Kedungombo dam for the DGWRD was reviewed during appraisal. The present staff, which supervised feasibility studies on the dam, as well as other dams in Central Java, would be able to do their part with the assistance of consultants. The Bank/FAO preparation mission for the tidal lands development feasibility study, which visited Indonesia in March 1976, looked into the capability of P_4S to supervise the study. Based on its findings, the mission has included, as a major objective of the study, the building up of P4S capability in conducting future feasibility studies for tidal swamp land development, and detailed terms of reference for foreign consultants would stress training of P4S counterparts. Assurances were obtained that: (a) all organizations involved in project implementation would be adequately staffed; and (b) GOI would consult with the Bank before appointing a replacement for the General Manager of PROSIDA or the President Director of Jatiluhur Authority.

Training

5.03 To help overcome the shortage of trained and experienced irrigation personnel, the project would continue the training program initiated under earlier projects. The project would include local in-service training of 3 months each for some 250 irrigation O&M personnel and 150 construction supervisors. In addition, consultants engaged under the project would provide in-service planning and design training to the local counterparts designated by the executing agencies. Overseas training would include 2-month study tours to neighboring countries for about 10 senior irrigation engineers; O&M in-service training in Malaysia and Taiwan of 3 months each for about 40 section and sub-section irrigation engineers; and post-graduate training of 12 months each for 10 senior and middle-level planning and design engineers in selected consultants' home offices supplemented, wherever possible, with theoretical courses in nearby universities. Further details of training provided under

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1/ Jratunseluna stands for five river basins in Central Java, namely, Jragung, Tuntang, Serang, Lusi and Juana, integrated development studies for which were started in the early 1970's.

the project are presented in Annex 8. Assurances would be obtained that, within 14 months of Loan signing, GOI would submit the training program to the Bank for consultation before commencing with the program.

Agriculture Support Services

5.04 Supporting services consisting of credit, extension, research, supply of quality seeds, fertilizers and pesticides, and storage and processing facilities would be provided through Bank Rakyat Indonesia (BRI) and MOA. The improvement of these services as tertiary systems are completed would be necessary to maximize benefits from the project. An Agricultural Development Center (ADC) and about eighteen Rural Extension Centers (REC's) will be constructed under Loan 1100-IND in West Java. The proposed National Food Crops Extension Project would intensify and expand extension services further by constructing one REC for about every 10 village units (10,000-12,000 farmers) in nine provinces. Quality seed of improved varieties would be produced by the National Seed Corporation at Sukamandi (Credit 246-IND), multiplied on seed farms located in each province and sold to growers through BUUD's, KUD's and local kiosks. Paddy research would be conducted at the Sukamandi National Research Centers for Paddy and Secondary Crops and at a number of field stations under the direction of the Agency for Research and Development (ARD), established under Loan 1179-IND. Domestic fertilizer production would continue to grow with assistance from the Bank Group (Credit 193-IND and Loan 1089-IND) and fertilizer distribution would be aided by the Fertilizer Distribution Project (Loan 1139-IND). A proposed Bank project currently under prepartion would assist BRI in improving the agricultural credit system (Annex 3).

5.05 MOA's involvement in the tertiary areas would be intensive. MOA officers and extension workers fielded in these areas would assist irrigation engineers from the executing agencies in determining development priorities, help the village chiefs form water user associations and organize farmers to construct the tertiaries, coordinate extension, improve rat and pest control programs and ensure that inputs would be available. The on-going program of the Directorate of Cooperatives to increase storage at BUUD's would be adjusted to support the project areas.

5.06 At full development, demand for fertilizer is expected to rise from its current level of 13,000 tons to 30,000 tons per year, and seed requirements are expected to exceed 4,000 tons per year. Existing fertilizer supply channels could handle the increased demand without difficulty. Disease resistant paddy seed requirements would be met from the production of Government seed farms established in each Province and from planned seed certification projects in the three Provinces of Java. Production credit requirements would also rise after project completion. All farmers in the tertiary areas are expected to become eligible to receive BIMAS/INMAS packages and the coverage in North Sadang, which is minimal at present, is expected to reach 90% at full development. Assurances were obtained that GOI would provide adequate agricultural support services in the project areas, including provision of agricultural extension services and agricultural inputs (improved seed, agricultural chemicals, fertilizers and credit).

Monitoring Benefits

5.07 Project benefits accruing from tertiary development, together with other social aspects, would be monitored in accordance with the monitoring system set up under Loan 1100-IND for all Bank Group-assisted irrigation projects in Indonesia.

Operation and Maintenance

5.08 Operation and maintenance (O&M) of tertiary systems during construction would be the responsibility of PROSIDA and Jatiluhur Authority in their respective project areas. After construction, the systems would be turned over to the Provincial Government and the responsibility for operating and maintaining tertiary systems of about 150 ha each would shift to the water-user association previously organized for each system. The association would collect 40-50 kg of paddy per ha from all beneficiaries to meet the full O & M costs. This is currently being done on a number of pilot tertiary systems with encouraging results. In nearly all cases, the systems are being maintained properly. O & M of the primary and secondary supply systems would still be the Provincial Government's responsibility.

5.09 O & M of the North Sadang system during construction would be PROSIDA's responsibility. After completion of the works, O & M of the main supply and drainage works would revert to the Provincial Government, while O & M for the tertiary systems would shift to the water-user associations.

5.10 Despite improvements in the arrangements for O & M in the ongoing rehabilitation projects, there is still a need for more trained staff, as well as an increase in budgetary allocations. The insufficiency of allocated O & M funds is an issue which has been under discussion with GOI for the last three years. Last year's O & M allocation for PROSIDA's rehabilitated systems amounted to Rp 1,600/ha, which was far below the amount required for proper operation and maintenance of the systems. As a result, several of the rehabilitated canals and structures have reverted to their pre-rehabilitation condition. Following consultations with the Bank, GOI has allocated in its 1976/77 budget about Rp 2,810 million to cover the following O & M requirements:

(a) Rehabilitated systems - Rp 3,800/ha for 218,000 ha in Jatiluhur and Rp 3,200/ha for 468,000 ha on PROSIDA's systems; and

(b) Systems awaiting rehabilitation this year and to be rehabilitated in the next three years - Rp 1,300/ha for 334,000 ha on PROSIDA's systems and Rp 600/ha for 80,000 ha in Jatiluhur, to cover operating costs and minimal repairs required to keep the systems functioning until they are rehabilitated or completely rebuilt (Annex 9).

Although the level of allocated O & M funds is slightly below that required to operate and maintain all systems efficiently, it is a substantial improvement over the previous year's funding and is consistent with the Government's present budgetary capability. This intermediate level of funds would allow the executing agencies to make adjustments in their staffing requirements to cope with their expanded operations. Although there may not be a marked improvement in operating efficiency this year, there should be a significant improvement in maintenance of rehabilitated systems. To ensure the continuing availability of an appropriate level of O & M funds, assurances were obtained that: (a) adequate and timely O & M funds would be allocated in future years for all Bank-assisted irrigation systems; (b) the Central Government will take the necessary steps to ensure that adequate and timely O & M funds are at all times made available to the Provincial Government; and (c) GOI would submit the proposed staffing requirements and annual per hectare O & M budget for each sub-project to the Bank for review by November 30 of each year, and by June 1 of each following year, the approved O & M budget and staffing requirements.

Cost and Rent Recovery

5.11 Taxes. Landowners in Indonesia pay a land tax (IPEDA), which is collected by village heads and turned over to local and provincial administrations for use in public services. As a result of a recent GOI decision to tie disbursements under its local infrastructure development programs (INPRES) to IPEDA collection performance, IPEDA collection rates have improved markedly, and collection targets are being consistently exceeded in a number of areas. A legal basis also exists for localities to levy water charges; however, such charges are assessed only in some areas. In a number of areas in which tertiary development has already taken place, farmers are assessed paddy valued at around Rp 1,000/ha per season. In other areas, water is looked upon as a gift from the Creator for which no fee can be charged.

5.12 A GOI interministerial committee has recommended that through IPEDA farmers should pay a portion of the increase in their incomes resulting from irrigation development. The charges would cover annual operating and maintenance costs and recover a portion of the capital costs. Because IPEDA is assessed as a percentage of the value of production, the amounts collected would increase as yields rise in response to the project. Before rehabilitation of the irrigation systems began, the annual IPEDA rates in the tertiary areas averaged Rp 2,000/ha. Currently, after some rehabilitation, the average rate is between Rp 4,000 and Rp 5,000/ha. When the on-going rehabilitation is completed, the average assessment should increase by Rp 1,250/ha, and following completion of the tertiary development, the amounts assessed are expected to increase further to an average of Rp 7,000/ha. In the North Sadang area, IPEDA currently averages around Rp 4,000/ha, and there would probably be no increase in assessments without the project. With the project, the assessment should climb to an average of Rp 10,500/ha across the project area.

5.13 The cost of the tertiary system would be US$330/ha. Out of this total, GOI would contribute US$250/ha and farmers US$80/ha in the form of labor at reduced wages and donation of land. At full development, contributions by farmers for the operation and maintenance of tertiary systems (para 5.08) are expected to average Rp 2,900/ha (US$7.0/ha). Discounting these contributions and the expected increase in IPEDA collections (para 5.12) at a 10% discount rate over the estimated project life of 30 years, the cost recovery index would be 49%. A further analysis of cost recovery was carried out, taking into account past investments in rehabilitating the main irrigation system. This analysis indicates a 31% cost recovery index. For the North Sadang area, which involves the construction of a new system with extensive drainage works, the cost recovery index would be 13% (for details see Annex 14). Rent recovery indices 1/ were estimated for representative farm models in the tertiary and North Sadang areas. In the tertiary areas, the indices ranged between 25% for a 1.5 ha sharecropper and 76% for a 0.3 ha owner-operator, and in the North Sadang area, between 15% for a 1.0 ha sharecropper and 28% for a 3.0 ha sharecropper. The assumptions made in carrying out this analysis are presented in Annex 14. Since many of these assumptions are subjective, the results discussed below are no more than a rough indication of the farmers' ability to pay project charges.

5.14 Incomes at full development for four different model farms (Annex 13) were compared with the Critical Consumption Level (CCL) 2/ for rural Indonesia, which is estimated at US$88 per capita in Mid-1976 prices. With an average family size of six, the CCL per household is approximately US$530 (Rp 239,000). Even after making allowances for some off-farm income (paras 6.06 and 6.07), the income of nearly 90% of the households benefiting from the project would still be below the CCL at full development. Considering the imprecise nature of the data, the fact that only 10% of project beneficiaries would be in a position to pay somewhat higher project charges, and the administrative and political difficulties of introducing a special tax to capture the relatively small surplus income of this group, the prevailing level of project charges appears appropriate. This conclusion is strengthened by the fact that, in addition to paying increased IPEDA charges and meeting the full O & M costs of the tertiaries, the farmers would also be contributing to the costs of the system by donating land for canals and drains and supplying labor at below market rates. Finally, the burden of other assessments on the farmers is relatively heavy, as they also pay village taxes and a variety of "extra-legal" assessments for mosque construction, public buildings, schools and road maintenance.

1/ The rent recovery index is the ratio of incremental direct payments by a farm family for the project to the incremental "project rent", which is defined as incremental income accruing to the family from the project less the value of family labor, management costs, and allowances for uncertainty.

2/ The critical consumption or relative poverty level is that income level at which basic nutritional, clothing and shelter needs can be met.

5.15 To ensure the farmers' continued contribution towards the maintenance of the system, assurances were obtained that: (a) through IPEDA, GOI, in consultation with the Bank, would establish and collect charges on all irrigated land served by the systems rehabilitated and constructed under the project, at levels consistent with the beneficiaries' capability to pay, to cover the full O & M costs of the systems and recover a reasonable portion of capital costs during the project's useful life; and (b) GOI would submit to the Bank for review every two years the IPEDA rates established and collected for different land classes.

VI. PRODUCTION, MARKET PROSPECTS, PRICES AND FARM INCOME

Production

6.01 After completion of the project, paddy would continue to be the dominant crop in all areas. The total area of irrigated land would remain at 100,000 ha in the tertiary development areas, but would increase from 2,000 to 6,000 ha in the North Sadang project area. Cropping intensity is expected to increase from 126% to 190% in North Sadang, but remain constant at about 145% in the tertiary areas. Despite these relatively small increases in irrigated hectarage and cropping intensity, expected production gains would be substantial. Improved water control and distribution would minimize the risk of crop loss and encourage farmers to make investments in fertilizer, pesticides and improved seed. Recognizing this opportunity for substantial yield increases, GOI would make available expanded credit and more intensive extension services to the project areas. As a result, paddy yields from both wet and dry-season crops would average 3.8 ton/ha in the North Sadang area. Because topography, soil fertility and land tenure vary among the tertiary project areas in Java and Sulawesi, full production yields would also vary; however, it is expected that yields would, on average, be at least 0.7 ton/ha greater than yields obtained through rehabilitation of the primary and secondary systems alone. These yields would be attained five years after tertiary development. Yield increases larger than 0.7 ton/ha might well be achieved, as substantially larger increases have been obtained in pilot tertiary units. However, this conservative estimate has been used in the analysis, because the number and dispersion of the tertiary units may preclude the intensive Government attention given to pilot units and because delays in expected improvements in transportation and the availability of inputs may adversely affect farm output. At full development, total paddy production in the tertiary areas would reach nearly 620,000 tons with the project, compared with 418,000 tons at present, and an expected 517,000 tons after rehabilitation. Total paddy production from the North Sadang area would be nearly 42,000 tons, compared with 13,500 tons at present. Details of present and future yields and production are given in Annex 2.

Market Prospects

6.02 Much of the incremental production from the project would be consumed at the farm level and the balance would be sold through commercial

channels. In 1968-1974, rice imports ranged between 0.5 and 1.25 million tons per annum and, although they have been reduced in the past year following a good harvest and the replenishment of reserves, they continue at a rate in excess of 400,000 tons a year. Future market and price prospects are discussed in more detail in Annex 10.

6.03 Privately-owned rice mills and a number of BUUD/KUD mills process the paddy in the project areas. Excess capacity exists currently in some areas and both the BUUD/KUD's and the private sector have shown themselves responsive to any needs for capacity expansion. Thus, milling facilities are not expected to present a major constraint to marketing.

Prices

6.04 For both the farm budget and economic analysis, farm inputs and outputs have been valued in mid-1976 prices. For rice and fertilizer these prices were derived from the Bank's Commodity Division's forecasts for world prices and adjusted for transportation costs. It is expected that only about 10% of rice production from the project would be milled into higher grade (5%) rice. It is estimated tht 60% would be medium grade (25-35% brokens) and 30% lower grade (42% brokens). Using the world market price forecasts, the equivalent farmgate price for paddy would be US$170/ton in North Sadang and US$178/ton in the tertiary development areas. Historically, the Government has followed a policy of keeping consumer-food prices low by selling imported rice below its cost and keeping domestic floor prices low. To mitigate the effect of this policy on farm income, GOI has simultaneously subsidized fertilizer and pesticide. In the last two years, however, steps have been taken to raise domestic prices in order to encourage rice production. This change in policy, combined with the fall of world prices from the record levels of 1973-74, has brought farmgate prices fairly close to world levels. Thus, the floor price for paddy is now Rp 67.5/kg, as compared with an imputed economic price of Rp 73.7/ kg in tertiary development areas, and Rp 70.4/kg in North Sadang. The subsidies provided for fertilizer and pesticides have similarly been reduced. GOI is expected to continue its efforts to align domestic and world market prices, and consequently it has been assumed that at full development economic and financial prices for inputs and outputs would coincide at the Bank's forecasted world market prices.

Farm Income

6.05 To analyze farm incomes, four farm models have been prepared for the tertiary development areas and two for the North Sadang area. Because sharecropping is common throughout the project area, sharecropped farms have been analyzed separately. Details of these models are contained in Annex 11, and the results can be summarized as follows:

Project Component & Farm Size (ha)	Tenure	Present	Future Without Project	Future With Project	Present	Future Without Project	Future With Project
		(Rp '000)			(US$)		
Tertiary Development Area							
0.15	Owner Operator	30.3	34.6	40.3	73	83	97
	Sharecropper	15.2	17.7	20.7	37	43	50
0.30	Owner Operator	60.7	68.6	80.5	146	165	194
	Sharecropper	30.7	35.2	41.3	74	85	100
0.75	Owner Operator	150.7	171.3	201.3	363	413	485
	Sharecropper	75.9	87.8	103.1	183	212	248
1.50	Owner Operator	285.4	323.1	379.0	688	779	913
	Sharecropper	144.2	165.8	194.3	348	400	468
North Sadang							
1.0	Owner Operator	98.8	104.2	312.7	238	251	754
	Sharecropper	51.4	54.1	161.6	124	130	389
2.0	Owner Operator	196.0	204.8	591.5	472	494	1,426
	Sharecropper	102.0	106.4	306.2	246	256	738

Assuming an average family size of six and excluding income from off-farm activities, per capita farm income in the tertiary areas at present ranges from US$12 to US$115 for owner operators and US$6 to US$58 for sharecroppers. Per capita farm income in North Sadang ranges from US$40 to US$79 for owner operators and US$21 to US$41 for sharecroppers. After completion of the project, farm incomes are expected to increase by 20% over the projected levels without the project. However, even with this increase, per capita income from farming in the tertiary development areas would still be only US$16 to US$152 for owner operators and US$8 to US$78 for sharecroppers. Somewhat higher incomes are expected in the North Sadang area. These expected crop incomes would still be substantially below the estimated current per capita income in Indonesia of US$130 1/ in 1973.

6.06 As is apparent from the above figures, many small farmers do not produce enough food for their own subsistence. Thus, throughout the project areas, sharecroppers and owner operators with small holdings depend on off-farm employment for a substantial portion of their income. They work as laborers in nearby towns and return to their farms seasonally to assist with the more strenuous farm work, such as land preparation. Women and children take care of farm management and harvesting. The magnitude of off-farm income is indicated by farm survey data for the North Sadang area:

1/ World Bank Atlas.

Average Off-Farm Income, North Sadang

Size of Holding	Wet Season (Rp)	Dry Season (Rp)	Total (Rp)	Total (US$)
1.1 - 2.0 ha	8,365	10,190	18,555	45
2.1 - 5.0 ha	18,910	17,660	36,570	88
More than 5.0 ha	5,250	0	5,250	13

6.07 Petty trading is a major source of income for all groups, except the very largest landholders. Farmers in the 2.1-5.0 ha range also receive a substantial amount of off-farm income from operating small businesses.

6.08 No reliable income data for the landless laborers who live in the tertiary development areas are available. However, assuming two full-time workers per family, a wage rate of Rp 200/day, and 200 days/year of available employment, the maximum income of a landless family can be no more than Rp 80,000 or US$195. Because Rp 200 a day may be a high estimate of the peak harvest wage rate, such a rate is unavailable during much of the year, and employment opportunities are limited, US$195 per family probably overstates the income earned by the landless substantially.

6.09 A more precise estimate of the project's impact on income distribution should be available from the monitoring survey under Loan 1100-IND (para 5.07).

VII. BENEFITS AND JUSTIFICATION

7.01 The primary objective of the project is to increase irrigated paddy production on 100,000 ha in Java and Sulawesi through better water control and distribution. It would also provide irrigation to 6,000 ha in the North Sadang area. Following completion of the project, the increase in paddy production is expected to total 130,000 tons and the net incremental value of production would be Rp 6,500 million.

7.02 Assuming a 30-year project life, prices for rice and fertilizer based on the Bank's commodity price projections through 1985, and seasonally adjusted shadow prices for labor, the economic rate of return would be 33% for the tertiary development component and 20% for North Sadang (Annex 13).

7.03 The sensitivity of the rate of return to variations in the important assumptions in the economic analysis was tested (Annex 13). The rates of return are most sensitive to delays in achieving benefits and the failure of yields to reach projected levels. This underscores the importance of government authorities ensuring that the farmers receive the necessary agricultural inputs and extension assistance. However, in none of the tests was the rate of return below 12% for North Sadang or 17% for tertiary development.

7.04 Expanded agricultural opportunities under the tertiary development component would create permanent labor opportunities equivalent to 12,000 man-years (Annex 12). Although this would not fully utilize the labor force projected to be in the area at full development, it would provide an additional source of income to small farmers and sharecroppers, and would tend to discourage migration to the already crowded urban areas. The North Sadang component would provide permanent labor opportunities equivalent to nearly 3,000 man-years. This would employ the entire local labor force during much of the year and might encourage permanent migration to the area from labor surplus areas elsewhere in Indonesia. It would also produce temporary employment for migrant seasonal laborers.

7.05 A substantial majority of the beneficiaries of the project would be small farmers (0.15-2.0 ha) and sharecroppers whose average income would still be considerably less than the national average even at full project development (para 6.05). Landless labor would benefit from increased employment opportunities, as well as from increased yields, as harvest wages are paid as a percentage of the crop. Finally, some benefits would accrue to landlords, many of whom are also small operators farming their own plots. Presumably, a few of the landlord beneficiaries have substantial income from other sources; however, little is known about these people. In any event, only a small portion of the benefits are expected to accrue to them.

7.06 At full project development, gross foreign exchange savings on rice imports would amount to US$22.2 million per year at the projected world market price cif Jakarta. After deducting the incremental cost of fertilizers and chemicals, the net foreign exchange savings as a result of the project would amount to about US$19.0 million per year.

VII. RECOMMENDATIONS

8.01 During negotiations, agreement with the Government was reached on the following points:

(a) Consultants acceptable to the Bank would be engaged within eight months of Loan signing on terms and conditions approved by the Bank (para 4.12);

(b) Separate accounts would be kept by PROSIDA, Jatiluhur Authority, P_3SA and P_4S, and the Government auditors would submit audited financial statements and comments to the Bank within six months of the close of each financial year (para 4.24);

(c) Within 14 months of Loan signing, GOI would submit the training program to the Bank for consultation before commencing the program (para 5.03);

(d) Adequate and timely O&M funds would be allocated in future years for all Bank-assisted irrigation systems; the Central Government will take the necessary steps to ensure that adequate and timely O&M funds are at all times made available to the Provincial Government; and GOI would submit the proposed annual per hectare O & M budget and staffing requirements to the Bank for review by November 30 of each year, and by June 1 of each following year, the approved O & M budget and staffing requirements (para 5.10); and

(e) Through IPEDA, GOI, in consultation with the Bank, would establish and collect charges on all irrigated land served by the systems rehabilitated and constructed under the project, at levels consistent with the beneficiaries' capability to pay, to cover the full operation and maintenance costs of the systems and recover a reasonable portion of capital costs during the projects useful life; and GOI would submit to the Bank, for review every two years the IPEDA rates established and collected for different land classes (para 5.15).

8.02 The employment of consultants to design and supervise construction of the North Sadang irrigation system would be a condition of effectiveness of the loan (para 4.12).

8.03 The engagement of local consultants for the preparation of design and construction drawings in the first year of tertiary construction would be a condition of disbursement for tertiary systems (para 4.23).

8.04 The project would be suitable for a Bank Loan of US$33.0 million, with a 25-year maturity and a grace period of six years. The Borrower would be the Government of Indonesia.

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IRRIGATION PROJECT VII

Average Monthly Rainfall Within Project Areas (1968-73) 1/
(Millimeters)

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Way Seputih (Kotabumi)	224	333	313	289	332	251	206	106	111	118	91	176	2,550
Ciudjung (Cisalak Baru)	187	206	293	240	209	254	200	231	103	98	241	182	2,444
Cisedane (Tangerang)	168	143	268	341	208	160	162	79	72	87	79	105	1,872
Jatiluhur (Karawang)	191	189	303	234	207	159	118	72	56	37	45	106	1,717
Rentang (Jatiwangi)	349	367	501	338	484	268	244	76	63	24	66	67	2,847
Pemali-Comal (Brebes)	104	198	412	243	262	130	157	114	77	47	87	43	1,874
Glapan Sedadi (Sedadi)	237	280	306	308	206	152	177	64	80	46	69	151	2,070
Sadang (Pare Pare)	211	327	354	126	220	137	115	115	84	46	99	90	1,809
North Sadang (Pinrang)	168	200	202	263	209	298	251	157	113	75	81	137	2,004

1/ Monthly records for each of the rehabilitation projects for a period of 5 years. Records are available for 1920-1940 and 1956 to the present within project areas at many locations.

ANNEX 1
Table 1

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IRRIGATION PROJECT VII

Present and Projected Cropping Patterns and Production

General

1. The Irrigation Program Survey (Report No. 705-IND) and the appraisal reports of previous irrigation projects in Indonesia have described in some detail the soil, climate, and cultural practices for paddy planting on Java; this information will not be repeated here. However, agricultural conditions in Sulawesi where the North Sadang project is located differ somewhat from those on Java; therefore, a more detailed discussion of the area is presented in this Annex.

2. Climatic data for the project areas are shown in Annex 1. The soil and climate of all areas are considered suitable for growing paddy as a main crop in the wet season, and paddy and/or a variety of secondary crops in the dry season.

Present Cropping Pattern and Yields

3. Tertiary Development Areas All 100,000 ha of the tertiary development areas are planted to paddy during the wet season. Where sufficient water is available in the dry season, paddy is also grown. The present cropping intensity in these areas averages 145%, ranging from 113% in Glapan-Sedadi to 190% in Jatiluhur. As a result of the agricultural extension efforts and improved water control provided by previous Bank projects, high yielding varieties (HYV) are grown on about 75% of the project area. Some of these varieties have proved susceptible to virus diseases and/or insect damage. Therefore, seeds of new varieties, such as IR-20, IR-26, IR-28 and IR-30, which initial tests have shown to be more resistant to disease, are being multiplied and have been distributed and planted in some areas. Research centers in Bogor, Sukamandi, and several substations have been actively involved in this breeding and testing program. HYY yields average 3.2 ton/ha in the wet season, and 3.0 ton/ha in the dry season.

4. Local unimproved and improved varieties are grown on 25% of the cultivated area. Despite lower yields, averaging 1.8 ton/ha, many farmers prefer these varieties for flavor, ease of harvest, and resilience under flooded conditions. As water control improves and yields increase beyond the levels needed for consumption in farmers' immediate households, the percentage of local variety paddy is expected to diminish.

5. Secondary or palawija crops such a tobacco, red onions, maize and groundnuts are planted extensively in much of the project area during the dry season. In some areas, two secondary crops, or a secondary crop and a dry season paddy crop, are harvested during the dry season. Average yields are soyabeans 580 kg/ha, maize 800 kg/ha, groundnuts 630 kg/ha, green peas 540 kg/ha and onions 3,200 kg/ha.

6. North Sadang - Soil survey results indicate that about 6,000 ha of the 8,000 ha gross project area are suitable for rice production. This area consists of 2,000 ha of semi-technical and village irrigated rice land (most of which is double-cropped), 800 ha of low-lying uncultivated swampland and 3,200 ha of rainfed rice land. About 250 ha of the latter is currently double-cropped with palawija in the dry season.

7. Much of the wet season rice area is subject to flooding. Farmers in some areas usually replant 2 or 3 times to obtain a crop. Even in relatively good years, yields are low because there is little incentive to use cash inputs in the absence of water control. Current average yields are estimated at 2.0 ton/ha for irrigated areas and 1.8 ton/ha for rainfed areas in the wet season, and 1.8 ton/ha for irrigated areas and 1.5 ton/ha for rainfed areas in the dry season.

8. Road communications are very poor and obtaining access to markets, agricultural services, and inputs is almost impossible during the rainy season. Unlike Java, labor is short in some areas; although it is surplus in others, mobility is apparently restrained by poor communications and transport.

9. Because of the above constraints, the BIMAS program, which has achieved fairly extensive coverage on Java, is utilized by only a few farmers in the North Sadang area. There is also only one BUUD servicing the area, and problems are encountered with rice drying, storage, and marketing.

Future Cropping Patterns and Yields

10. Tertiary Development Areas. Even in the absence of the project, fairly substantial increases in paddy yields are expected in the proposed tertiary development areas after the completion of the four Bank Group assisted irrigation rehabilitation projects. The coverage of HYV paddy in the wet season is expected to increase to 80% of the total area, as part of the need to plant low-yielding rainfed paddy would be eliminated by some improvement in water control. HYV paddy would continue to be planted in the dry season. Wet season yields of local variety paddy are expected to increase to 2.1 ton/ha, and yields of HYV's might reach an average of 3.8 ton/ha. Dry season HYV yields are also expected to increase to the same 3.8 ton/ha average.

11. Following completion of tertiary and quaternary channels and structures, and using inputs and extension advice, it is estimated that about 85% of farmers would grow HYV's, and the rest would continue to plant

local or national improved varieties. Due to a better regulated water supply, the cropping intensity may increase somewhat. However, in the absence of an increase in the supply of water, such an increase in the area cultivated could only be small; therefore, for the purpose of the economic analysis, the cropping intensity is assumed to remain at 145%. Because of differing topography, soil fertility and land tenure in the project areas, full production yields will vary; however, yields of HYV's should, on average, be at least 0.7 ton/ha greater than yields obtained through rehabilitation of the primary and secondary systems alone. Thus, it is expected that HYV yields would average 4.5 ton/ha. Local variety paddy, for which the potential yield increases are less, would average around 2.3 ton/ha.

12. North Sadang. Only nominal increases in yields can be expected in the North Sadang area without the project. The supply of inputs and credit will increase, but, without guaranteed access to water and improved drainage, farmers will have little incentive to use them. Indeed, without the project, the area may continue to suffer the population losses it has experienced in recent years as families leave to seek better employment opportunities elsewhere and escape the flooded conditions many of them endure throughout the rainy season. By aggravating the existing shortage of labor, such a population decline might actually result in the areas' total agricultural production falling. Cropping intensity would be unchanged, and, assuming some increases in agricultural inputs, rainfed paddy yields might average 1.9 ton/ha in the wet season, and 1.6 ton/ha in the dry season. Paddy irrigated by village irrigation systems would yield around 2.2 ton/ha in the wet season and 2.0 ton/ha in the dry season.

13. With the project, cropping intensity would increase substantially from the present 126%, to 190%. The improved drainage would permit currently swampy areas to be converted to paddy production and the reduction in the risk of flooding and the assurance that water would be available year-round would encourage farmers to farm other uncultivated land. Paddy yields are expected to average 3.8 ton/ha.

Extension and Agricultural Inputs and Future Production

14. The realization of the project's benefits is highly dependent on concurrent improvements in extension, transportation, seed supply, fertilizer and insecticide distribution, and storage and drying facilities at the village level. The agricultural services available to farmers and the efforts being made by the government and the Bank to improve them are described in some detail in Annex 3.

Pests and Diseases

15. Major pests are stemborers, leaf and plant hoppers, gallmidges, army worms and paddy bugs. Chemicals and sprayers are supplied through

the extension service and BUUD/KUD's to combat them. The chemicals used have changed frequently in recent years as more effective compounds have become available, and as some insect species have developed resistance to older types. Blast, bacterial leaf blight and brown spot are the most important bacterial and fungal diseases, and, as discussed above, the Ministry of Agriculture is multiplying and distributing new varieties of seed resistant to them. In many areas, rats are also a problem, causing serious field damage and occasionally reaching plague proportions. In some places, such as the Sadang rehabilitation project area, locally administered rat control programs have been successful in reducing the serious losses suffered in earlier years.

16. Notwithstanding the government programs, certain pest and disease problems continue to reduce yields. The types of pesticides supplied through the BIMAS program often vary, causing confusion among the illiterate farmers who are unable to read the instructions on the bags. Thus, the chemicals which could alleviate the disease problems are often applied at the wrong time or in the wrong quantities. There is also some preliminary evidence that the growth of double cropping through improved irrigation is contributing to the incidence of pests and diseases. With paddy being grown continually, there is no period during the year during which the insects' reproductive cycles are interrupted. Research is currently underway in an attempt to assess the magnitude of this problem.

Harvesting, Drying, and Storage

17. Farmers harvest the rice using ani-ani (small knives) or sickles, and usually thresh the crops by treading on the panicles or beating them on a threshing floor. A few pedal threshers are also present in the project area. The paddy is normally sun-dried, on whatever suitable surface is available. Often this surface is a roadway near the fields and losses due to continually moving the drying rice to avoid traffic can be heavy. Rainfall during the harvest season also contributes to losses. The lack of adequate drying facilities is thus a serious constraint on higher production in many areas. To alleviate this problem, the government has initiated a program to build a large number of drying floors in areas where they are needed.

18. Farmers usually store bagged grain or dry stalk paddy in their homes or on racks in small out-buildings until it is sold or consumed. Some villages also have small communal paddy barns. Grain losses during harvesting, drying and storage have been estimated to be between 15 and 20%. Harvesting, drying, and storage practices are discussed in detail in the Irrigation Program Survey.

Marketing and Transport

19. Typical marketing and transport methods and problems are described in the Irrigation Program Survey. Problems which the farmers have in receiving the government-established floor price for their production are explained in the main body of this appraisal report.

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IRRIGATION PROJECT VII

Summary of Cropping Pattern and Production
Tertiary Development Areas

	Cropped Area			Paddy Production		
	Present	Future Without Project	Future with Project	Present	Future Without Project	Future with Project
	(ha)			(tons)		
Wet Season						
Rainfed	5,000	-	-	7,500	-	-
Local Variety	20,000	20,000	15,000	36,000	42,000	34,500
HYV	75,000	80,000	85,000	240,000	304,000	382,500
Sub-Total	100,000	100,000	100,000	283,500	346,000	417,000
Dry Season						
HYV	45,000	45,000	45,000	135,000	171,000	202,500
Sub-Total	45,000	45,000	45,000	135,000	171,000	202,500
Total	145,000	145,000	145,000	418,500	517,000	619,500
Cropping Intensity	145%	145%	145%			

ANNEX 2
Table 1

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IRRIGATION PROJECT VII

Summary of Cropping Patterns and Production

North Sadang

	Cropped Area			Paddy Production		
	Present	Future Without Project	Future With Project	Present	Future Without Project	Future With Project
	(ha)			(tons)		
Wet Season						
Rainfed 1/	3,150	3,150	-	5,670	5,985	-
Irrigated	1,950	1,950	5,800	3,900	4,290	22,040
Swamp Uncultivated	700	700	-	-	-	-
Sub-total	5,800	5,800	5,800	9,570	10,275	22,040
Dry Season						
Rainfed 1/	250	250	-	375	400	
Irrigated	1,950	1,950	5,200	3,510	3,900	19,760
Sub-total	2,200	2,200	-	3,885	4,300	19,760
Total	7,300	7,300	11,000	13,455	14,575	41,800
Cropping Intensity	126%	126%	190%			

1/ Palawija crops (275 ha wet season and 250 ha dry season) included as rainfed rice for analytical purposes.

ANNEX 2
Table 2

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IRRIGATION PROJECT VII

Agricultural Support Program

Organization

1. The existing agricultural supporting services in irrigation areas of Indonesia have been described in detail in the Irrigation Program Survey (Report No.705-IND) and in the appraisal reports of the previous irrigation projects. Available services are described only briefly in this Annex. The most important Government organizations and programs which support farmers in agriculture include the following:

(a) BIMAS and INMAS: These programs provide farm input packages and credit programs. These programs are discussed in more detail below.

(b) BRI - The Peoples Bank of Indonesia provides credit to farmers and finances the BIMAS program.

(c) BUUD/KUD's: These are government-sponsored farmer cooperatives which purchase paddy at the government-established floor price, sell agricultural inputs, mill rice and provide some extension services. They are described in more detail below.

(d) Ministry of Agriculture - The Ministry has extension staff at the provincial and district level to advise farmers both inside and outside the BIMAS program.

(e) Provincial Irrigation Services - These services operate and maintain the irrigation system down to secondary canal turnout.

(f) Ministry of Interior - Local staff of this ministry administer the tertiary and quaternary canals through the village headman and his staff.

(g) Irrigation Committees - These committees are established at the District, subdistrict and village levels and coordinate all of the above organizations.

BIMAS/INMAS, Extension, and Research

2. The BIMAS program provides eligible farmers with subsidized fertilizers, pesticides, credit, cash allowances for seeds, cost of living, pesticide applications and extension advice. The INMAS program provides subsidized fertilizers and pesticides but no credit, cash allowances or extension services. The village head and BRI representatives determine each farmer's eligibility for BIMAS, evaluating his farm size (5 ha or less) and credit worthiness (not more than 2 years overdue with BIMAS repayments). BIMAS programs are available for paddy, maize, soyabeans, groundnuts, green pea, sorghum and sugarcane. Provincial agricultural officers determine fertilizer and pesticide application rates, which vary according to local requirements.

3. Within the tertiary development areas, between 60 and 70% of the farmers now use BIMAS or INMAS. With the organization of the farmers, adequate extension and the completion of this project, virtually all the farmers in the tertiary areas are expected to use at least the smaller BIMAS package. In North Sadang, where BIMAS/INMAS coverage to date has been minimal, it is expected that about 90% of the farmers would be using BIMAS at the time of full project development.

4. Extension is currently provided through the five Directorates General of Agriculture (Agriculture, Estates, Animal Husbandry, Fisheries, and Forestry). Under a proposed Bank supported National Food Crops Extension Project, existing Rural Extension Centers (REC's) would be improved, and a large number would be established. Densely populated paddy-growing areas would have one REC for each 10 village units. Lower-level extension workers (PPL's) would make contact with farmers through about 20 key farmers and some 100-150 progressive farmers. PPL's would be supervised by middle-level extension workers (PPM's) and the Head of their REC's. Subject matter specialists (SMS's) would support both PPL's and PPM's with technical advice and would assist in a continuous training program.

5. Research for paddy and secondary crops is conducted at the Sukamandi National Research Centers for Paddy and Secondary Crops and at a number of field stations under the direction of a newly established Agency for Research and Development (ARD) within the Ministry of Agriculture (Loan 1179-IND). Outside these research establishments, little adaptive research is carried out and there is a distinct need for verification experiments for all crops. In the future, SMS's will conduct local experiments in conjunction with other extension staff to identify the agricultural practices best suited for each locality, to determine the most suitable varieties of all major crops and to propose workable pest-control programs.

Fertilizer

6. Domestic fertilizer production has grown rapidly with the assistance of the Bank Group (Credit 193-IND and Loan 1089-IND). An additional

fertilizer project is being considered for possible Board presentation in FY77. The increased production from these projects will be used to replace imports which have been at substantial levels in recent years.

7. Distribution of the domestically produced fertilizer is being aided by the Bank-supported Fertilizer Distribution Project (Loan 1139-IND). Two large and six small importers distribute the imported fertilizer. In the past, the distributors supplied farmers through private kiosks in each area. However, in October 1974, the government took over fertilizer distribution and now all fertilizer is supplied to farmers through local BUUD's and KUD's.

8. Supplies of fertilizer are adequate at present throughout the project area. Local shortages may occur, however, due to transport problems in isolated areas and/or lack of storage within villages. The problem of late deliveries is compounded by a government policy which in effect requires one planting season to be completed before shipment for the next season can begin. Some of the shortages and late delivery problems are being alleviated by a government program to increase storage space at the BUUD's and KUD's.

Pesticides

9. Most pesticides are imported, and as result were in short supply in 1974 due to a world-wide shortage. Some firms are now able to formulate the chemicals in Indonesia, which has improved the supply situation somewhat. Pesticides are distributed through the same system as fertilizers, with farmers obtaining them mainly through the BUUD/KUD's.

Seed

10. Certified paddy seed is produced by the National Seed Corporation at Sukamandi (Credit 246-IND) and is distributed through BUUD's, KUD's and local kiosks at about double the commercial paddy price. Supplies of this seed are limited. Most Districts have one or more local seed farms which are run by District agricultural personnel. Seed from Sukamandi, supplemented with local seed, is multiplied and sold to growers at about 150% of the commercial paddy price. Due to the increasing occurrence of "grassy stunt" virus disease, it has become necessary to increase the resistant variety, IR-26, rapidly. This variety, introduced from IRRI in the Philippines, is resistant to the direct sucking damage of the brown plant hoppers which spread the virus. All available seed of IR-26 was multiplied in Java during the 1975 dry season and the resulting seed will be distributed throughout the disease-affected areas in Java, Bali and Sumatera. It is imperative that new disease-resistant varieties continuously be developed since a breakdown in resistance to the disease is a distinct possibility. Two other resistant varieties, IR-28 and IR-30, are also being multiplied at present.

Credit

11. Credit is handled by BRI through branch offices in most village units. It is expected that all village units within the project area will be serviced by a local branch or by a mobile unit by the end of the 1975/76 season. BRI credit is now also available to each BUUD and KUD for the purchase of five mistblowers to control pests in members' fields. Some medium-term credit is available to the same organizations for the purchase of threshers and rice mill equipment. A Bank project to assist BRI in improving the agricultural credit system is currently being prepared.

Farmers' Organizations

12. BUUD's/KUD's. BUUD's are pre-cooperatives which convert to farm cooperatives, or KUD's, when proven viable. It is the aim of GOI to establish one BUUD/KUD per village unit. In many paddy-growing areas the number of cooperatives have almost reached this target, with considerable growth recorded in 1974 and 1975. In 1975, there were more than 1,800 KUD's and about 1,400 BUUD's registered. The cooperatives distribute farm inputs and process and market farm outputs. Some extension advice is given where trained staff are available. They are agents for the distribution of fertilizer and agro-chemicals and also provide threshing, cleaning and milling facilities.

INDONESIA

IRRIGATION PROJECT VII

The Project Works

Tertiary Development

1. Tertiary development would be carried out on 100,000 ha of the Jatiluhur and PROSIDA systems being rehabilitated under Credits 127, 195, 220 and 289-IND (Table 1). The works would include tertiary, sub-tertiary and quaternary canals and structures, inspection roads and tertiary and quaternary drains. The above works would require the acquisition of about 2,400 ha of rights-of-way for some 7,000 km of distribution canals, 9,000 canal structures, 4,000 km of drains and 1,500 km of inspection roads. Farmers in the tertiary areas would do about 11.0 Mm^3 of canal excavation and embankment construction. Further details are developed in Table 2 on a per-hectare basis and for the 100,000 ha development.

2. Accurate 1:5,000 scale maps, with contours drawn at 0.25-0.5 m interval, would be prepared for the tertiary areas. Standard photogrammetric methods, supplemented with ground surveys to obtain the desired accuracy, would be employed to produce the maps. Aerial photographs rectified by the ortho scanning process would constitute the photomosaic of each tertiary area. A diapositive (sepia) of the photomosaic would be produced to enable the printing of any number of maps desired. Survey parties supplied with these maps would identify ground features readily and would thus be oriented quickly. In developed areas where bunds have been laid out, the elevations of the centers of paddy fields would be obtained and marked directly on the maps. In undeveloped areas, where ground features are not well defined, elevations would be obtained by cross-sectioning the field. After enough elevations have been obtained, contours would be drawn on the maps before leaving the area and any gaps in the data, which become apparent as the contours are drawn, would be supplied.

3. PROSIDA and the Jatiluhur Authority, with the assistance of consultants, would design the tertiary systems. Each tertiary canal included in the project would start at the end of the 50 m canal constructed by the Government. The tertiary canals would cover about 150 ha and quaternary canals serving 10-15 ha would deliver water down to 6-10 individual plots on a field-to-field basis. The tertiary units would be arranged to suit, as far as possible, the topography, existing irrigation, road and drainage networks and village and ownership boundaries. The water surface in the quaternaries would be designed to be 10-15 cm higher than field level. Tertiary and quaternary canal lengths would be kept within 2.5 km and 0.5 km, respectively. Water would be drawn exclusively from quaternary canals through plastic or bamboo

pipes, except in cases where strict adherence to this would result in the provision of multiple parallel channels. Field-to-field irrigation would be limited to 6-10 fields and no field would be more than 300 m from a quaternary turnout. Wherever practicable, the drainage water would be collected and redistributed to lower parts of the system. The internal drains would be designed to prevent flooding for more than 72 hours, based on rainfall that would not be exceeded in four out of five years. The supply canals would be designed to deliver the peak dry-season requirement of about 1.3 l/sec/ha. Current designs of canal structures, about 9,000 of which would be needed in the project, would be carefully reviewed to determine the prototypes which would give satisfactory hydraulic performance at reasonable cost and a minimum amount of maintenance during operation. Particular emphasis would be given to outlet transitions which, in pilot tertiary projects, have been observed to require frequent maintenance due to undercutting of soil behind the masonry lining. A transition with slightly flared and tapering vertical wingwalls, which was developed by PROSIDA and model-tested at the hydraulics laboratory in Bandung with favorable results, would be field-tested thoroughly in the project and adopted extensively if proved satisfactory.

4. To facilitate design and construction and to promote good water management during operation, the tertiary systems would be constructed in blocks of at least four units each (about 600 ha). Wherever possible, even larger blocks would be constructed. The location of the blocks within the seven systems would be determined by irrigation engineers from the executing agencies with the assistance of local agriculture and irrigation officers who, during field inspection, would assess: (a) water supply and control in the secondary canal; (b) farmers' willingness to join water user associations and construct tertiaries at reduced wage rates; (c) susceptibility of the area to flooding; (d) presence of topographic constraints which make field-to-field irrigation virtually impossible but which could be overcome with the construction of tertiaries; and (e) availability of agricultural supporting services, namely, extension, BIMAS (inputs), BRI (credit) and BUUD/KUD (cooperatives). After the development priorities are set, the Provincial District Heads (Bupatis) would be informed of the selection of specific areas for implementation in their respective jurisidctions. They, in turn, would instruct the village chiefs (Lurahs) to form water user associations. In this the Lurahs would be assisted by MOA lower-level extension officers (PPL's).

5. After the formation of the water user associations, a preliminary plan of each tertiary system would be prepared in accordance with the criteria described in para 3. This plan would be brought to the field and, in consultation with farmers, checked for workability and practicability. The farmers' constructive suggestions would be considered before finalizing the layout of the system.

6. The acquisition of rights-of-way for canals, drains and inspection roads would commence after the layouts of the systems are finalized.

To expedite land acquisition, the executing agencies would work closely with the responsible agency, the Directorate of Agrarian Affairs in the Directorate General of Government and Local Autonomy. Although the area of land taken up by canals and drains is small, the loss to small landowners could be substantial. For this reason, some minimal arrangements for right-of-way compensation would be made.

7. The village chiefs would organize farmers and landless laborers willing to undertake construction of the tertiaries at reduced wage rates. To facilitate construction and to avoid crop loss, construction would be done in the dry season. Since there would be little opportunity for employment during this period, the consensus among provincial officials interviewed during appraisal was that the Lurahs would be able to organize farmers and landless laborers to work on a rotation basis. The farmers would excavate the tertiary and quaternary canals and drains and fill and compact the canal embankments. The executing agencies would supervise the work done by farmers and construct the structures either by force account or small local contracts. The volume of earthwork involved in a tertiary system of 150 ha would be about 16,000 m^3, while the available work force would be about 350 farmers and landless laborers. Assuming that half of this force works each day and, assuming further that each man could excavate or fill and compact 1.0 m^3/day, the earthwork involved could be accomplished in about 90 days. It would, therefore, be physically possible to construct in one dry season tertiary systems for which funds and drawings are available.

8. Water user associations organized as a prerequisite to the construction of tertiaries would assume responsibility for O & M of the tertiary systems. Rules and regulations defining the rights and obligations of the beneficiaries would be patterned after those of the pilot tertiary units. The association would obtain O & M funds by collecting about 40-50 kg of dry paddy gabay 1/ per ha from all beneficiaries. The amount of paddy collected would be evaluated and adjusted by the association from time to time to suit its needs. The paddy collected would be stored in the village bin and from this, a certain amount would be drawn to pay the permanent employees of the system. The balance would be used to pay farmers and landless laborers designated, on a rotation basis, to perform required maintenance work. This is currently being practiced on a number of pilot tertiary units with encouraging result. In nearly all cases, the tertiary systems are well maintained.

North Sadang Irrigation System

9. Works for this 6,000 ha system would include: (a) rehabilitation and upgrading of the existing intake at Benteng barrage; (b) widening of about 12 km of existing main canal and upgrading of 25 existing canal structures to permit double cropping of the service area; (c) construction of 7 km of

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1/ Unhusked rice, unit of yield used throughout this report.

remaining main canal and 6 canal structures, 46 km of secondary canals and 50 canal structures, and 74 km of primary and secondary drains and 25 drainage structures; (d) upgrading of 54 km of existing access roads; and (d) tertiary development over the entire service area to the same standards adopted for the tertiary development areas. About 240 ha of rights-of-way would be acquired for the canals, drains and inspection roads. Table 3 presents details of the above works; Table 4 develops the cost of works/ha.

10. The canals would be unlined and constructed with side slopes of 1.5:1. A silt trap installed at the head of the intake canal would strip material bigger than 1.0 mm (approximately D 50 size). The various canals would be sized to satisfy peak water requirements under the rotational irrigation scheme adopted for the project, which are 1.35 l/sec/ha at the farmers' field, 1.60 l/sec/ha at the tertiary gate, 1.75 l/sec/ha at the secondary gate and 1.85 l/sec/ha at the main canal intake.

11. Drainage within the project area would be improved by providing safe passage for floods of 10-year return period in streams flowing through the area. The natural channels would be dredged to increase their flood discharges. A dyke would be constructed along the project boundary which is susceptible to flooding during high stage flows of the Sadang River. At points where the dyke crosses the natural channels, gated control structures would be constructed to permit regulation of stream flows. Collector drains emptying into the natural channels would be constructed along the inner toe of the dyke. The crest of the dyke would serve as an operation and maintenance road.

12. Existing access roads to the project area would be upgraded by raising stretches subject to flooding, widening where called for, and providing a gravel or crushed stone base course to permit all-weather use.

Studies and Detailed Engineering

13. Consultants would be engaged under the project to: (a) undertake studies and detailed designs on the Kedungombo dam and on the flood control and drainage schemes downstream; (b) prepare a drainage project for about 40,000 ha of low-lying coastal lands in Ciujung, Cisedane, Pemali-Comal and Sadang; and (c) prepare a feasibility study for developing tidal lands for smallholders settlers in the provinces of Jambi and South Sumatera.

14. The structure on the Serang River would be a sand and gravel-fill dam with a clay core. It would have a maximum height above streambed of 50 m, a crest length of 775 m, a fill volume of 2.5 Mm^3 and an estimated cost of US$70 million. At maximum conservation level the reservoir would have a surface area of 3,300 ha, a gross storage of 490 Mm^3 and a usable storage of 450 Mm^3. Feasibility studies for the dam were undertaken by consultants (NEDECO), whose site investigations included 20 exploratory

drillings to 60 m depth, geologic mapping of the dam and reservoir sites and exploration of the sources of fill materials. Two damsites on the Serang River at Kedungombo and Ngrambat, about 1.5 Km apart, have been proposed. The two sites have similar hydrologic characteristics and would produce almost identical benefits. Major differences which could materially influence the cost of the dam lie in the geological structure of the foundation rocks. The works to be carried out under the project would include improvement of access roads to the damsite and quarries, temporary offices and quarters for GOI personnel, detailed investigations to determine the most suitable damsite, design of project features and preparation of tender documents. The works would also include studies and detailed engineering on downstream flood control and drainage schemes which would benefit about 30,000 ha of the Glapan-Sedadi, Juana, Welahan and Serang coastal areas.

15. Under the project the telephone communications network in existing systems would be further upgraded, primary canal gates and structures would be modified to permit gate operation with motor drives and additional measuring devices in primary canals and major bifurcations would be constructed. These project features would improve the operation of the systems and provide better water control and management.

16. Vehicles and equipment for construction, operation and maintenance would be procured under the project. The equipment list is shown in Table 5.

ANNEX 4
Table 1

INDONESIA

IRRIGATION PROJECT VII

Tertiary Development on Systems Covered by First Four Irrigation Rehabilitation Projects

	Service Area (ha)	Tertiary Development (ha)
I. First Irrigation Rehabilitation Project (Credit 127-IND) 1/		
Cisedane	42,000	6,000
Glapan-Sedadi	47,400	4,500
Rentang	92,000 3/	-
Way-Seputih	25,000 5/	-
Sub-Total, I	206,400	10,500
II. Second Irrigation Rehabilitation Project (Credit 195-IND) 2/		
Jatiluhur	202,000	25,000
III. Third Irrigation Rehabilitation Project (Credit 220-IND) 1/		
Ciujung	24,300	6,000
Pemali-Comal	123,000	21,000
Sadang	54,600	7,500
Sub-Total, III	201,900	34,500
IV. Fourth Irrigation Rehabilitation Project (Credit 289-IND) 1/		
Pekalen-Sampean	229,000	30,000
Total, I-IV	839,300	100,000 4/

1/ Being implemented by PROSIDA.

2/ Being implemented by Jatiluhur Authority.

3/ Tertiary development to be carried out under Loan 1100-IND.

4/ Tertiary development on seven systems with total service area of 722,300 ha to be implemented under present project.

5/ Clearing of half of service area still underway. Excluded from project.

INDONESIA

IRRIGATION PROJECT VII

TERTIARY DEVELOPMENT

Work Items and Quantities

	For 1.0 ha		For 100,000 ha	
	Length	Quantity	Length	Quantity
Earthwork				
Tertiary Canals	5.5 m	4 m^3	550 km	0.4 Mm^3
Sub-tertiary Canals	10 m	10 m^3	1,000 km	1.0 Mm^3
Quaternary Canals	55 m	22 m^3	5,500 km	2.2 Mm^3
Tertiary & Quaternary Drains	40 m	40 m^3	4,000 km	4.0 Mm^3
Inspection Roads	15 m	30 m^3	1,500 km	3.0 Mm^3
Sub-Total	125.5 m	106 m^3	12,550 km	10.6 Mm^3
Structures				
Tertiary Division Boxes	-	0.02 Box	-	2,000 Boxes
Quaternary Division Boxes	-	0.04 Box	-	4,000 Boxes
Other Structures	-	0.03 Box	-	3,000 Boxes
Sub-Total	-	0.09 Box	-	9,000 Boxes
Rights-of-Way				
Canals & Drains	-	240 m^2	-	2,400 ha

ANNEX 4
Table 3

INDONESIA

IRRIGATION PROJECT VII

NORTH SADANG IRRIGATION SYSTEM

Work Items and Quantities

Works	Quantity	Length
Rehabilitation & Upgrading		
Intake	1	
Main Canal		12 km
Rock excavation	5,000 m^3	
Rock hauling	9,000 "	
Common excavation	20,000 "	
Earth fill	45,000 "	
Structures	25	
Access Roads		54 km
New Construction		
Main Canal		7 km
Rock excavation	30,000 m^3	
Rock hauling	60,000 "	
Common excavation	25,000 "	
Earth fill	80,000 "	
Structures	6	
Secondary Canals		46 km
Common excavation	59,000 m^3	
Earth fill	1,200,000 "	
Structures	50	
Primary & Secondary Drains		74 km
Common excavation	1,400,000 m^3	
Structures	25	
Tertiary Development	6,000 ha	
Tertiary canals	24,000 m^3	33 km
Sub-tertiary canals	60,000 "	60 "
Quaternary canals	132,000 "	330 "
Division boxes	540	
Tertiary & quaternary drains	240,000 m^3	240 "
Inspection roads		90 "

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IRRIGATION PROJECT VII

Irrigation Facilities Cost

	US$/ha
I. Tertiary Development (100,000 ha)	
Canals	38
Structures	37
Drains	33
Inspection Roads	18
Total 1/	126
II. North Sadang Irrigation System (6,000 ha)	
Primary & Secondary Canal System 2/	559
Primary & Secondary Drainage System	405
Road System	94
Tertiary Development	126
Total 3/	1,184

1/ Not including contingencies (15%) and engineering, supervision and administration (10%). Farmers' labor for construction of canals and drains valued at Rp 150/day (US$0.36/day).

2/ All new except 12 km of primary canal which would require upgrading.

3/ Not including contingencies (20%) and engineering, supervision and administration (10%).

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IRRIGATION PROJECT VII

Equipment List

Description	Quantity	Unit	Rate	Amount
			(US$)	
I. Tertiary Development (PROSIDA)				
Four-Wheel Drive Vehicles	15	No	6,000	90,000
Motorcycles	25	No	1,000	25,000
Bicycles	100	No	150	15,000
Hot-Dip Galvanizing Bath & Accessories	7	No	10,000	70,000
Steel for Gates	350	Tons	500	175,000
Zinc for Galvanizing	36	Tons	1,000	36,000
Office Equipment	L.S.	-	-	43,000
Hydrological Equipment	L.S.	-	-	42,000
Telephone Communications Equipment	L.S.	-	-	800,000
Sub-Total				1,296,000
II. Tertiary Development (Jatiluhur)				
Four-Wheel Drive Vehicles	10	No	6,000	60,000
Motorcycles	30	No	1,000	30,000
Bicycles	30	No	150	4,500
Sub-Total				94,500
III. North Sadang Irrigation				
Office Equipment	L.S.	-	-	14,000
8" Dredge with Pipes	1	No	250,000	250,000
Draglines (3 cu. yd.)	2	No	80,000	160,000
Stone Crusher	1	No	20,000	20,000
Station Wagons	4	No	8,000	32,000
Motorcycles	12	No	1,000	12,000
Bicycles	30	No	150	4,500
Sub-Total				492,500
Total				1,883,000
Rounded				1.9 Million

INDONESIA

IRRIGATION PROJECT VII

Consulting Services

Tertiary Development

1. PROSIDA and the Jatiluhur Authority would undertake tertiary development on 75,000 ha and 25,000 ha of their respective project areas. GOI would engage local consultants under terms of reference (TOR) and conditions acceptable to the Bank to undertake detailed designs and assist in the supervision of construction of the tertiary systems. Draft TOR for local consultants are presented in Attachment I. The consultants would be engaged for four years and it is estimated that a total of 2,000 man-months of consulting services would be required, of which 1,200 man-months would be for design and construction engineers while 800 man-months would be for draftsmen.

North Sadang Irrigation System

2. Consultants have been engaged under Loan 1100-IND to undertake detailed engineering and prepare tender documents suitable for competitive bidding. Subject to the consultants' satisfactory performance, their tenure would be extended under the project to provide assistance in the supervision of construction.

Kedungombo Dam and Downstream Improvements

3. The consultants would review the feasibility studies prepared by Dutch consultants (NEDECO), undertake additional geological investigations, if required, and prepare designs and cost estimates of comparable structures on the two possible damsites (Annex 4) before making a final selection of the most suitable damsite. After site selection, detailed designs of the appropriate project features would be made and tender documents suitable for international competitive bidding would be prepared. In addition, the consultants would review NEDECO's studies on the Serang floodway and other flood control and drainage schemes for the coastal areas downstream of the dam. Subsequent to this review, the consultants would undertake detailed engineering on the appropriate flood control and drainage works for the Glapan-Sedadi, Juana, Welahan and Serang coastal areas. Draft TOR for consulting services are shown in Attachment II. P3SA, an executive body within DGWRD, would supervise the consultants' work. In line with the Government's policy of upgrading the capability of local consultants, foreign consulting firms would be encouraged to associate with local firms. The consultants would be retained for two years and, out of the estimated total of 800 man-months of consulting services required, 400 man-months would be for expatriates and home office staff; 400 man-months, for local consultants.

Drainage and Inspection Roads

4. In the coastal plains of the Ciudjung, Cisedane, Glapan-Sedadi, Pemali-Comal (Java), and Sadang (South Sulawesi) irrigation systems, some 40,000 ha of low-lying lands presently suffer from flooding, and are inaccessible in the wet season, and part of the dry season due to the poor quality of the roads and paths. As a result, crop losses are high and fish and farm products are marketed at great expense and difficulty. To remedy the situation, PROSIDA undertook a feasibility study on the coastal drainage works and inspection roads for these areas with the intention of including them in the present project. Due to the incomplete preparation of surveys and engineering designs, however, these works were excluded from the project. PROSIDA is currently completing the studies. Consultants to be engaged under the project would review PROSIDA's studies, undertake detailed engineering and prepare the works for execution under a forthcoming project. Draft TOR for consulting services are presented in Attachment III. The consultants would be supervised by PROSIDA and would be engaged for a period of 18 months. It is estimated that out of the 400 man-months of consulting services required, 100 man-months would be for expatriates and home office staff, and 300 man-months, for local consultants.

Tidal Swamp Lands Development

5. The Government of Indonesia plans to develop one million hectares of tidal swamp lands in Sumatera and Kalimantan under the second and third five-year plans, of which about 250,000 ha would be developed under Pelita II. Some 35,000 ha of pilot projects at five locations have been developed to date and transmigrants from Java and Bali settled on farms of about 2 ha each. GOI has asked Bank assistance in preparing a feasibility study for development under Pelita III of a gross area of 200,000 ha in South Sumatera province and 100,000 ha in Jambi province of Sumatera. Because of the complex relationships of soils, topography, tidal ranges and salinity, the study would be conducted over a 24-month period of which the first half would be devoted mainly to collection and interpretation of physical data and establishment of physical parameters for development.

6. Foreign consultants would be employed to assist the DGWRD in executing the study, coordinating study inputs and strengthening P4S, the executive body within DGWRD that will implement the study, by building up its capability in engineering design and preparation of projects for further development of tidal swamp lands. The bulk of the investigations to be carried out under the study, however, would be carried out by contract with local consultants. The consultants would inventory a gross area of 300,000 ha, prepare a master plan and feasibility study for a net area, probably in the order of one-third to one-half the gross area, and prepare detailed engineering designs suitable for tender or start of force account construction for some 20,000 ha best suited for initial development. About 500 man-months of consulting services would be required, of which 100 man-months would be for foreign consultants, office staff; 400 man-months, for local consultants. Additional details are in Annex 15.

TERTIARY DEVELOPMENT

Draft Terms of Reference for Local Consultants

Introduction

1. PROSIDA and the Jatiluhur Authority would undertake tertiary development 1/ on 75,00 ha and 25,000 ha of their respective project areas. Tertiary systems would average about 150 ha while quaternary units would be 10-15 ha each. Below the quaternary canals, water delivery would still be on a field-to-field basis. Tertiary systems would be constructed in areas where there is a reasonably good supply and water control in the secondary canal, no flooding occurs, the farmers agree to the construction of tertiaries at reduced wage rates (aided self-help), agricultural supporting services would be available, and the potential for double cropping exists. To facilitate design and construction and to promote good water management during operation, tertiary systems would be constructed in blocks of at least four tertiary units each (about 600 ha). Wherever possible, even larger blocks would be constructed. Farmers in these blocks should be willing to join water-user associations and construct tertiaries at reduced wage rates.

2. GOI would engage the services of local consultants under terms of reference and conditions approved by IBRD to design the tertiary systems and assist PROSIDA and the Jatiluhur Authority in supervising construction. The services of consultants would extend over a 4-year period.

Scope of Services

3. The consultants' duties shall be as follows:

(a) review and modify, where necessary, standard designs and working drawings for tertiary and quaternary canals, drains, division boxes and inspection roads;

(b) determine size and select contiguous areas over which tertiary development would be carried out in each sub-project;

(c) prepare map layout of on-farm works on selected areas, identify ownership of plots of land traversed and, in consultation with farmers, check workability of system before finalizing the scheme;

1/ Tertiary development consists of the construction of tertiary and quaternary canals and drains and inspection roads.

(d) assist in supervising field layout and construction of canals and structures, including earthwork undertaken by farmers;

(e) investigate the additional telephone communication requirements of the PROSIDA sub-projects and prepare proposals for suitable networks; and

(f) prepare designs of water measuring devices for main canal intakes and major secondary canal bifurcations and modify designs of major gates and structures to facilitate the raising and closing of gates with motor-driven devices.

4. Particular emphasis shall be placed on the design of tertiary and quaternary division boxes and other canal structures, about 9,000 of which would be constructed in the project areas. These structures should give satisfactory hydraulic performance at reasonable cost and a minimum amount of maintenance during operation. Current designs of outlet transitions adopted for canal structures in pilot tertiary projects, which were observed to require frequent maintenance due to undercutting of the soil behind the transitions should be able to adapt to changes in the regime of the canals they serve without being damaged. A transition with slightly flared and tapered vertical wingwalls, which was developed by Prosida and model-tested at the hydraulics laboratory in Bandung with promising results, should be field-tested thoroughly and used extensively in the project areas if found satisfactory.

5. The tertiary systems shall be arranged to suit, as far as possible, the topography, existing irrigation, road and drainage networks, and village and ownership boundaries. The water surface in the quaternaries shall be designed to be 10-15 cm higher than field level. Tertiary and quaternary canal lengths shall be kept within 2.5 km and 0.5 km, respectively. Water shall be drawn exclusively from quaternary canals through plastic or bamboo pipes, except in cases where strict adherence to this would result in the provision of multiple parallel channels. Field to field irrigation shall be limited to 6-10 fields and no field shall be more than 300 m from a quaternary turnout. Wherever practicable, drainage water shall be collected and redistributed to lower parts of the system. The internal drains shall be designed to prevent flooding for more than 72 hours, based on a rainfall that would not be exceeded in 4 out of 5 years. The distribution canals shall be designed to deliver the peak dry season requirement of about 1.3 liters per second per ha. Inspection roads on canal embankments shall be designed for motorcycles and three-wheeled vehicles. The filling and compaction of canal embankments by hand methods shall be thorough enough to allow passage of these vehicles without sloughing.

6. The preliminary layout of each tertiary system shall be checked for workability and practicability with farmers in the system concerned. The constructive suggestions of farmers shall be considered before finalizing the layout of the system.

Services to be Provided by GOI

7. Services and facilities that would be made available to the consultants would include the following:

(a) counterpart professional and clerical staff, as may be required, for the proper execution and coordination of the consultants' duties;

(b) suitably furnished office spaces near the project areas and reasonably furnished quarters or compensation therefore;

(c) service vehicles including drivers and the cost of maintenance and operation required in the conduct of official duties. Consultants would import duty free the vehicles and equipment required for start-up after prudent shopping;

(d) all available studies, data, photographs, surveys, maps, drawings and other information pertinent to the execution of the consultants' work; and

(e) telephone, telegraph, postal expenses, printing and reproductions required by the consultants in the performance of the work.

Procedure for Submitting Proposals

8. Consulting firms invited to submit proposals are requested to provide in detail the following:

(a) description of the firm, including its background and experience in the work described above, list of past and present contracts for work of similar nature with a brief description of each, the scope of consultancy services undertaken and qualifications of key personnel;

(b) composition of the team to be assigned to the project, indicating the positions and detailed job description for each of the names, qualifications and professional experience of each expert to be assigned to the positions;

(c) terms and conditions under which the duties and responsibilities described in paragraph 3 through 6 above would be carried out;

(d) proposed schedule of personnel assignments and an estimate of the number of man-months;

(e) category and number of counterpart personnel desired to be provided by GOI to assist the consultants; and

(f) list of vehicles and equipment anticipated to be required in carrying out the consultants' responsibilities.

Reporting

9. The consultants shall prepare and submit a progress report at the end of each quarter giving a description of the team's activities during the reporting period and a brief description of the proposed employment of the team during the subsequent reporting period (20 copies to GOI; 5 copies to IBRD).

KEDUNGOMBO DAM AND DOWNSTREAM IMPROVEMENTS

Draft Terms of Reference for Consulting Services

Introduction

1. The Directorate General of Water Resources Development (DGWRD) has programmed the construction of a storage dam on the Serang River which would regulate flood flows and provide water supply to permit double cropping of about 35,000 ha of the service area of the Glapan-Sedadi irrigation system in Central Java. The project feasibility report was prepared by GOI with the assistance of Consultants (NEDECO), whose site investigations included 20 exploratory drillings to 60m depth, geologic mapping of the dam and reservoir sites and exploration of the sources of fill materials for a sand and gravel-fill dam with a central core. Two damsites on the Serang River at Kedungombo and Ngrambat, about 1.5 km apart, were investigated. The two sites have similar hydrologic characteristics and are capable of producing almost identical benefits. Major differences which could signficantly affect the cost of the dam lie in the geological structure of the foundation rocks. Additional geological investigations, design studies and comparative cost estimates would be required to determine the most suitable damsite.

2. The project features are summarized below:

Dam

Type	Sand and gravel-fill with central core.
Max. height	51.5 m
Crest level	89.5 m
Crest length, dam	775 m
Crest length, dike	280 m
Total volume	2.5 Mm^3

Reservoir

Catchment area	607 Km^2
Max. conservation level	85.0 m
Gross storage at El. 85.0	490 Mm^3
Area at El. 85.0	3,300 ha
Estimated 30-year siltation	60 Mm^3

Hydrology

Annual Runoff (avg.)	725 Mm^3
Spillway Design Flood	
Peak Discharge	3,900 m^3/sec
Volume	127.5 Mm^3

3. GOI would engage the services of Consultants under TOR and conditions acceptable to the Bank to determine the most suitable damsite. After the selection of the damsite, detailed designs would be made and tender documents suitable for international competitive bidding would be prepared. In addition, the consultants would undertake detailed studies of the Serang floodway and other alternative flood control and drainage schemes, which would benefit about 25,000 ha in two valleys below the dam. The studies would be supervised for the DGWRD by the Directorate of Irrigation (DOI). The Consultants' services would extend over a 2-year period.

Data and Studies Available to the Consultants

4. The DOI will make the following studies and data available to the consultants:

(a) Ngrambat Dam Feasibility Study Report (NEDECO), 1975;

(b) Basic data used in preparing the report; and

(c) Technical Evaluation of Feasibility Studies for Jragung Dam and Ngrambat Dam (Tudor Engineering Co.) May 1974.

Selection of Most Suitable Damsite

5. Additional geological investigations, design studies and cost estimates would be undertaken to determine the most suitable damsite. Consideration would be given to the most appropriate structures consistent with the geological and hydrological features of the two sites when costs of development are compared. The results of these studies would be presented in a Project Design Report, which would be due nine months after the consultants commence work.

Design Studies

6. The following studies would pertain to the design of the dam and appurtenant works and the safety of the reservoir:

(a) review design of structures proposed in 1975 report and modify structures where necessary to ensure safety or achieve savings in cost;

(b) institute and supervise a program of site investigations designed to remove all major uncertainties regarding the adequacy of the foundation for all major structures and provide an adequate basis for final design;

(c) establish earthquake design criteria for the major structures and determine the need for special provisions in their design;

(d) investigate sources of construction materials and determine available quantities, physical and chemical properties and processing requirements; and

(e) review geological mapping of reservoir site and undertake any additional mapping required to assess and study remedial measures required to protect potentially unstable slopes and possible leakage paths.

Hydrologic Studies

7. The following studies would pertain to the hydraulic design of the spillway, diversion tunnel and flood control and drainage schemes downstream of the dam:

(a) review and modify, where necessary, the spillway design flood, construction flood and design floods for the flood control and drainage schemes downstream, taking into account the appropriate return periods consistent with the function and type of construction of the structures involved;

(b) undertake flood routing studies to determine the required capacity of the spillway, diversion tunnel and other downstream river improvements;

(c) review the volume of reserved flood control storage in the reservoir (available up to March 1) and its effect on the design capacity of the flood control and drainage schemes downstream and on the filling of the reservoir at the end of the wet season of each year;

(d) review the reservoir sedimentation studies and the estimate of the rate of storage depletion due to reservoir sedumentation;

(e) review the adequacy of the proposed reservoir outlets to draw down the reservoir in emergencies, and propose modifications where necessary;

(f) prepare a program for hydraulic model tests on the spillway, and assist GOI in supervising the tests; and

(g) determine area of periodically flooded land which would benefit from proposed flood control and drainage downstream of the dam and present and projected states of agriculture in the benefit area.

Detailed Design and Tender Documents

8. After GOI's concurrence with the recommended damsite and the flood control and drainage schemes for the Glapan-Sedadi, Juana, Welahan and Serang coastal areas, the consultants would prepare contract designs, specifications, bills of quantities and tender documents suitable for international competitive bidding. The consultants would assist GOI in the prequalification of bidders, invitations to tender and in the evaluation of bids received. Some of the above design and hydrologic studies would be continued where necessary to provide additional information needed for design purposes. Cost estimates would be developed in more detail to provide GOI with an "Engineer's Estimate" prior to the receipt of bids.

Consulting Services During Construction

9. Depending upon the satisfactory execution of the above services, it is GOI's policy to extend the tenure of the consultants under terms and conditions acceptable to the Bank to prepare the construction drawings, supervise construction and prepare as-built drawings.

Services to be Provided by GOI

10. Services and facilities that would be made available to the consultants would include the following:

(a) counterpart professional and clerical staff, as may be required, for the proper execution of the consultants' duties;

(b) suitably furnished office space in Semarang including adequate office equipment and supplies that may be required for the proper execution of the consultants' work. Temporary office space would be provided at the site;

(c) housing at or near the damsite for personnel assigned to the field. Reasonably furnished living quarters or compensation, therefore, would be provided for the consultants' personnel in Semarang;

(d) service vehicles including drivers and the cost of maintenance and operation required in the conduct of official duties. Vehicles and equipment required for start-up would be provided by consultants;

(e) all available studies, data, photographs, maps, drawings, reports and other information pertinent to the execution of the consultants' work;

(f) such available laboratory facilities, drilling equipment, testing devices, apparatus, instruments, etc., that may be required by consultants in relation to studies and tests; and

(g) telephone, telegraph, cable and postage expenses required by consultants in the performance of the work.

11. GOI will exempt or bear the cost of any taxes, duties, fees, levies and other impositions imposed on the consultants' personnel (other than personnel who are citizens or permanent residents of Indonesia) under the laws and regulations of Indonesia or any political subdivision or agency thereof in respect of:

(a) any payments made to the consultants' personnel in connection with carrying out the agreed services; and

(b) any equipment, materials and supplies brought into Indonesia for purposes of carrying out the services and which, after having been brought into Indonesia, will subsequently be withdrawn therefrom. Such importations shall include personal and household effects of the consultants' personnel, but shall be exclusive of foodstuffs, beverages and automobiles.

12. GOI will also:

(a) facilitate prompt clearance through customs of any equipment, materials or supplies required for the services and of the personal effects of the consultants' personnel;

(b) ensure that the consultants' personnel and their dependents are promptly provided with any necessary entry and exit visas, residence permits, exchange permits and travel documents required for their stay in Indonesia; and

(c) issue all necessary permits and authorizations for carrying out the services.

Procedure for Submitting Proposals

13. Consulting firms invited to submit proposals are requested to provide in detail the following:

(a) description of the firm, including its background and experience in the work described above; list of past and present contracts for work of similar nature with a brief description of each and the scope of consultancy services undertaken; and qualifications of key personnel;

(b) composition of the team to be assigned to the project both in the field and in the home office, indicating the positions and detailed job description for each and the names, qualifications and professional experience of each expert to be assigned to the positions;

(c) terms and conditions under which the duties and responsibilities described in paragraphs 5 through 8 above would be carried out;

(d) proposed schedule of personnel assignments and an estimate of the number of man-months;

(e) category and number of counterpart personnel and other local staff desired to be provided by GOI to assist the consultants;

(f) arrangements consultants will make to utilize local expertise. The policy of GOI is to utilize the services of local consultants to the maximum degree in project planning, design and supervision. The degree to which expertise will be utilized will be a factor in the evaluation of the proposal; and

(g) list of vehicles and equipment anticipated to be required in carrying out the consultants' responsibilities.

General

14. The following general remarks are given for the consultants' consideration in the preparation of his proposal:

(a) in all aspects of the work the consultants shall make the greatest possible effort to initiate transfer of knowledge and experience and provide on-the-job training to Indonesian project personnel;

(b) the consultants shall provide all translation services necessary to accomplish the required engineering services;

(c) the consultants shall provide calculators, drafting equipment and reproduction facilities for their own use;

(d) the consultants' expatriate project personnel should adapt themselves as quickly as possible to the local living and working conditions;

(e) the metric system shall be exclusively applied in all design works, drawings and calculations. Technical reports shall be submitted in English and Indonesian. Descriptive letterings in drawings shall be printed or written in English and Indonesian;

(f) proficiency in English is essential for all members of the consultants' team; and

(g) periodic inspection visits to Indonesia should be made by senior officials of the consulting firm during the course of the assignment. One of them should be designated as the project sponsor.

Reporting

15. The consultants shall prepare and submit the following reports, identifying the source of information and data and stating the countepart contribution:

(a) a progress report at the end of each quarter, giving a description of the team's activities during the reporting period, a summary of interim findings and brief description of the proposed employment of the team during the subsequent reporting period (20 copies to GOI, five copies to IBRD);

(b) a Project Design Report due nine months after commencement of work, presenting his findings, recommendations, justification for his choice of the damsite and the appropriate structures at the chosen damsite; and

(c) a Project Design report on the flood control and drainage works downstream of the dam, due 12 months after the consultants commence work.

INDONESIA

IRRIGATION PROJECT VII

COASTAL DRAINAGE AND INSPECTION ROADS

Draft Terms of Reference for Consulting Services

Introduction

1. In the coastal plains of the Ciujung, Cisedane, Glapan-Sedadi, Pemali-Comal (Java) and Sadang (South Sulawesi) irrigation systems, some 40,000 ha of low-lying lands are subject to flooding, are inaccessible in the wet season and are hardly accessible even during the dry season due to the poor quality of the roads and paths. As a result, inspection and maintenance of the irrigation and drainage works as well as the marketing of fish and farm products has proved extremely difficult. To remedy the situation, PROSIDA has initiated studies on the additional coastal drainage works and inspection roads required in these areas.

2. GOI would engage consultants under TOR and conditions approved by the Bank to review the studies made by PROSIDA. Particular emphasis would be placed on the benefit areas, the present state of agriculture in these areas, the drainage schemes and their estimated construction costs. Subsequent to this review, the consultants would undertake detailed engineering designs and prepare tender documents for the execution of the works. The consultants would be retained for a period of 18 months under the direction of PROSIDA.

Data and Studies Available to the Consultants

3. GOI would make available all maps, surveys, geological and hydrologic studies and reports pertinent to the work prepared by PROSIDA as well as its consultants under previous rehabilitation projects.

Scope of Services

4. The following would be required to verify the economic viability of the proposed works:

(a) review of all existing data, surveys, reports and studies;

(b) collection of additional data, if required;

(c) review of design discharge of proposed drainage works taking into account the appropriate return periods consistent with the type of structures involved and the benefits derived;

(d) review of the benefit areas, the present state of agriculture in these areas and the projected state of agriculture after the construction of the proposed works;

(e) review of preliminary design of structures and cost estimates; and

(f) review of economic justification of the proposed works.

5. Following review by the Bank and subject to the economic justification of the proposed works, the consultants would undertake the following services:

(a) prepare detailed designs of the coastal drainage works and inspection roads in each sub-project;

(b) prepare tender documents for the works; and

(c) develop cost estimates in more detail to provide GOI with an "Engineer's Estimate" prior to the receipt of bids.

Services to be Provided by GOI

6. Services and facilities that would be made available to the consultants would include the following:

(a) counterpart professional and clerical staff, as may be required, for the proper execution of consultants' duties;

(b) suitably furnished office space in Jakarta including adequate office equipment and supplies that may be required for the proper execution of the consultants' work;

(c) housing at or near the project areas for personnel assigned to the field. Reasonably furnished living quarters or compensation, therefore, would be provided for the consultants' personnel in Jakarta;

(d) service vehicles including drivers and the cost of maintenance and operation required in the conduct of official duties;

(e) all available studies, data, photographs, maps, drawings, reports and other information pertinent to the execution of the consultants' work;

(f) such available laboratory facilities, testing devices, apparatus, instruments, etc., that may be required by consultants in relation to studies and tests; and

(g) telephone, telegraph, cable and postage expenses required by consultants in the performance of the work.

7. GOI will exempt or bear the cost of any taxes, duties, fees, levies and other impositions imposed on the consultants' personnel (other than personnel who are citizens or permanent residents of Indonesia) under the laws and regulations of Indonesia or any political subdivision or agency thereof in respect of:

(a) any payments made to the consultants' personnel in connection with carrying out the agreed services; and

(b) any equipment, materials and supplies brought into Indonesia for purposes of carrying out the services and which, after having been brought into Indonesia, will subsequently be withdrawn therefrom. Such importations shall include the personal and household effects of the consultants' personnel, but shall be exclusive of foodstuffs, beverages and automobiles.

8. GOI will also:

(a) facilitate prompt clearance through customs of any equipment, materials or supplies required for the services and of the personal effects of the consultants' personnel;

(b) ensure that the consultants' personnel and their dependents are promptly provided with any necessary entry and exit visas, residence permits, exchange permits and travel documents required for their stay in Indonesia; and

(c) issue all necessary permit and authorizations for carrying out the services.

Procedures for Submitting Proposals

9. Consulting firms invited to submit proposals are requested to provide in detail the following:

(a) description of the firm, including its background and experience in the work described above; list of past and present contracts for work of similar nature with a brief description of each and the scope of consultancy services undertaken; and qualifications of key personnel;

(b) composition of the team to be assigned to the project both in the field and in the home office, indicating the positions and detailed job description for each and the names, qualifications and professional experience of each expert to be assigned to the positions;

(c) terms and conditions under which the duties and responsilities described in paragraphs 4 and 5 above would be carried out;

(d) proposed schedule of personnel assignments and an estimate of the number of man-months;

(e) category and number of counterpart personnel and other local staff desired to be provided by GOI to assist the consultants;

(f) arrangements consultants will make to utilize local expertise. The policy of GOI is to utilize the services of local consultants to the maximum degree in project planning, design and supervision. The degree to which such expertise will be utilized will be a factor in the evaluation of the proposal; and

(g) list of vehicles and equipment anticipated to be required in carrying out the consultants' responsibilities.

General

10. The following general remarks are given for the consultants' consideration in the preparation of his proposal:

(a) in all aspects of the work the consultants shall make the greatest possible effort to initiate transfer of knowledge and experience and provide on-the-job training to Indonesian project personnel;

(b) the consultants shall provide all translation services necessary to accomplish the required engineering services;

(c) the consultants shall provide calculators, drafting equipment and reproduction facilities for their own use;

(d) the consultants' expatriate project personnel should adapt themselves as quickly as possible to the local living and working conditions;

(e) the metric system shall be exclusively applied in all design works, drawings and calculations. Technical reports shall be submitted in English and Indonesian. Descriptive lettering in drawings shall be printed or written in English and Indonesian;

(f) proficiency in English is essential for all members of the consultants' team; and

(g) periodic inspection visits to Indonesia should be made by senior officials of the consulting firm during the course of the assignment. One of them should be designated as the project sponsor.

Reporting

11. The consultants shall prepare and submit the following reports, identifying the source of information and data and stating the counterpart contribution:

(a) a progress report at the end of each quarter, giving a description of the team's activities during the reporting period, a summary of interim findings and a brief description of the proposed employment of the team during the subsequent reporting period (20 copies to GOI, five copies to IBRD); and

(b) a Project Feasibility Report due eight months after commencement of work, presenting their review findings, recommendations and justification for the proposed works.

INDONESIA

IRRIGATION PROJECT VII

Estimated Consulting Requirements

	Man-Months
I. Tertiary Development (100,000 ha)[1/]	
Team Leader	45
Design Engineers (20)	900
Draftsmen (20)	800
Construction Engineers (7)	255
Total Manpower Requirements[2/]	2,000
II. North Sadang Irrigation System	
A. Expatriates	
Team Leader	18
Planning Engineer	8
Hydrologist	5
Flood Control Engineer	10
Hydraulic Engineer	6
Irrigation Engineer	7
Home Office Support	6
Sub-Total	60
B. Local Consultants	
Design Engineers (5)	100
Draftsmen (6)	140
Sub-Total	240
Total Manpower Requirements[2/]	300

1/ Consultants will prepare design and construction drawings for about 150,000 ha to enable implementing agencies to select development priorities according to criteria in para 4.02.

2/ Presented for estimating purposes only. GOI or the consultants may vary these figures.

	Man-Months
III. Kedungombo Dam & Improvements Downstream	
A. Expatriates	
Team Leader	26
Engineering Geologist	19
Planning Engineer	24
Design Engineers (4)	92
Hydrologist	24
Flood Control Engineer	26
Hydraulic Engineer	26
Irrigation Engineer	36
Specifications Engineer	15
Cost Estimator	25
Home Office Support	87
Sub-Total	400
B. Local Consultants	
Design Engineers (10)	240
Draftsmen (8)	160
Sub-Total	400
Total Manpower Requirements[1/]	800

1/ Presented for estimating purposes only. GOI or the consultants may vary these figures.

	Man-Months
IV. Drainage & Inspection Roads, PROSIDA	
A. Expatriates	
Team Leader	18
Planning Engineer	12
Geologist	8
Drainage Engineer	16
Hydrologist	12
Design Engineer	12
Specifications Engineer	8
Cost Estimator	8
Home Office Support	6
Sub-Total	100
B. Local Consultants	
Design Engineers (8)	130
Draftsmen (10)	170
Sub-Total	300
Total Manpower Requirements[1/]	400

1/ Presented for estimating purposes only. GOI or the consultants may vary these figures.

INDONESIA

IRRIGATION PROJECT VII

Cost Estimate[1/]

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange Component
	(Rp Million)			(US$ Million)			(%)
I. Tertiary Development, PROSIDA							
Civil Works (75,000 ha):							
Earthwork 2/	1,030	260	1,290	2.5	0.6	3.1	20
Structures	540	540	1,080	1.3	1.3	2.6	50
Mapping & Surveys 3/	160	630	790	0.4	1.5	1.9	80
Sub-Total	1,730	1,430	3,160	4.2	3.4	7.6	45
Land Acquisition 4/	955	-	955	2.3	-	2.3	0
O&M During Construction	85	40	125	0.2	0.1	0.3	30
Administration & Supervision	140	25	165	0.3	0.1	0.4	15
Consulting Services 5/	730	185	915	1.8	0.4	2.2	20
Sub-Total	3,640	1,680	5,320	8.8	4.0	12.8	31
Vehicles & Equipment 6/	-	205	205	-	0.5	0.5	100
Base Cost	3,640	1,885	5,525	8.8	4.5	13.3	34
Physical Contingencies, 15%	550	280	830	1.3	0.7	2.0	34
Expected Price Increases 7/	1,205	620	1,825	2.9	1.5	4.4	34
Total	5,395	2,785	8,180	13.0	6.7	19.7	34
II. Tertiary Development, Jatiluhur							
Civil Works (25,000 ha):							
Earthwork 2/	330	85	415	0.8	0.2	1.0	20
Structures	190	185	375	0.5	0.4	0.9	50
Mapping & Surveys 8/	175	695	870	0.4	1.7	2.1	80
Sub-Total	695	965	1,660	1.7	2.3	4.0	58
Land Acquisition 4/	330	-	330	0.8	-	0.8	0
O&M During Construction	30	10	40	0.1	-	0.1	30
Administration & Supervision	25	15	40	0.1	-	0.1	15
Consulting Services 5/	200	50	250	0.5	0.1	0.6	20
Sub-Total	1,280	1,040	2,320	3.2	2.4	5.6	25
Vehicles & Equipment 6/	-	40	40	-	0.1	0.1	100
Base Cost	1,280	1,080	2,360	3.2	2.5	5.7	44
Physical Contingencies, 15%	210	165	375	0.5	0.4	0.9	44
Expected Price Increases 7/	440	350	790	1.1	0.8	1.9	44
Total	1,930	1,595	3,525	4.8	3.7	8.5	44

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange Component
	(Rp Million)			(US$ Million)			(%)
III. North Sadang Irrigation System, PROSIDA							
Civil Works (6,000):							
Preliminary Works	30	10	40	0.1	-	0.1	30
Main Canal	145	145	290	0.4	0.3	0.7	50
Secondary Canals	435	190	625	1.0	0.5	1.5	30
Irrigation Structures	105	105	210	0.2	0.3	0.5	50
Tertiary Development	230	100	330	0.6	0.2	0.8	30
Primary & Secondary Drains	310	310	620	0.7	0.8	1.5	50
Drainage Structures	125	125	250	0.3	0.3	0.6	50
Inspection Roads	125	85	210	0.3	0.2	0.5	40
Sub-Total	1,505	1,070	2,575	3.6	2.6	6.2	42
Land Acquisition 4/	165	-	165	0.4	-	0.4	0
O&M During Construction	55	25	80	0.1	0.1	0.2	30
Administration & Supervision	105	20	125	0.3	-	0.3	15
Consulting Services 9/	100	190	290	0.2	0.5	0.7	65
Sub-Total	1,930	1,515	3,235	4.6	3.2	7.8	41
Vehicles & Equipment 6/	-	210	210	-	0.5	0.5	100
Base Cost	1,930	1,515	3,445	4.6	3.7	8.3	45
Physical Contingencies, 20%	410	335	745	0.9	0.9	1.8	45
Expected Price Increases 7/	685	560	1,245	1.6	1.4	3.0	45
Total	3,025	2,410	5,435	7.1	6.0	13.1	45
IV. Studies & Detailed Engineering							
Associated Works, P3SA	80	85	165	0.2	0.2	0.4	50
Consulting Services:							
Kedungombo Dam & Downstream Improvements, P3SA	500	1,160	1,660	1.2	2.8	4.0	70
Drainage & Inspection Roads, PROSIDA	190	350	540	0.5	0.8	1.3	65
Tidal Reclamation, P4S	920	615	1,535	2.2	1.5	3.7	40
Base Cost	1,690	2,210	3,900	4.1	5.3	9.4	56
Physical Contingencies	110	140	250	0.3	0.3	0.6	56
Expected Price Increases	400	510	910	1.0	1.2	2.2	56
Total	2,200	2,860	5,060	5.4	6.8	12.2	56

	Local	Foreign	Total	Local	Foreign	Total	Foreign Exchange Component
	(Rp Million)			(US$ Million)			(%)
V. Miscellaneous Works & Services							
Civil Works:							
Gate Modifications, PROSIDA	175	405	580	0.4	1.0	1.4	70
Measuring Devices, PROSIDA	200	465	665	0.5	1.1	1.6	70
Sub-Total	375	870	1,245	0.9	2.1	3.0	70
Training:							
PROSIDA	50	115	165	0.1	0.3	0.4	70
Jatiluhur Authority	40	85	125	0.1	0.2	0.3	70
Sub-Total	465	1,070	1,535	1.1	2.6	3.7	70
Telephone Communications Equipment, PROSIDA	85	330	415	0.2	0.8	1.0	80
Base Cost	550	1,400	1,950	1.3	3.4	4.7	72
Physical Contingencies	60	150	210	0.1	0.4	0.5	72
Expected Price Increases	150	390	540	0.4	0.9	1.3	72
Total	760	1,940	2,700	1.8	4.7	6.5	72
GRAND TOTAL	13,310	11,590	24,900	32.1	27.9	60.0	47

1/ Based on end-1975 prices updated to mid-1976 prices.

2/ Based on paying farmers Rp 150/day.

3/ Photogrammetric mapping being done under Loan 1100-IND. Photo mosaics and ground surveys on 580,000 ha to be done under the project.

4/ Land valued at Rp 50/m^2 ($1,200/ha).

5/ Based on preparing design and construction drawings for 150,000 ha at billing rates of $1,500/man-month for local engineers and $450/man-month for local draftsmen, and includes consultants' specialized equipment and miscellaneous expenses.

6/ See Annex 5, Table 4.

7/ See Table 2.

8/ To be done under the project on gross area of about 250,000 ha.

9/ Includes services based on billing rates of $6,000-$7,000/man-month for expatriates, $1,200-$1,500/man-month for local engineers and $450/man-month for local draftsmen; vehicles and specialized equipment to be procured by consultants; and miscellaneous expenses.

ANNEX 6
Table 2

INDONESIA

IRRIGATION PROJECT VII

Expected Price Increases

	Indonesian Fiscal Year				Total Cost
	1976-77	1977-78	1978-79	1979-80	
	(%)				
Annual Inflation Rate[1/]					
Civil Works	13	12	12	11	
Equipment & Services	9	8	8	7.5	
	(US$ Million)				
I. Tertiary Development, PROSIDA					
Civil Works	0.1	0.8	1.4	1.6	3.9
Equipment & Services	-	0.1	0.2	0.2	0.5
Total	0.1	0.9	1.6	1.8	4.4
II. Tertiary Development, Jatiluhur					
Civil Works	-	0.3	0.5	0.9	1.7
Equipment & Services	-	-	0.1	0.1	0.2
Total	-	0.3	0.6	1.0	1.9
III. North Sadang Irrigation System, PROSIDA					
Civil Works	0.1	0.5	1.0	1.2	2.8
Equipment & Services	-	0.1	-	0.1	0.2
Total	0.1	0.6	1.0	1.3	3.0
IV. Studies & Detailed Engineering					
Civil Works	-	-	0.1	-	0.1
Equipment & Services	-	0.8	1.3	-	2.1
Total	-	0.8	1.4	-	2.2
V. Miscellaneous Works & Services					
Civil Works, PROSIDA	0.1	0.2	0.3	0.4	1.0
Equipment & Services	-	0.1	0.1	0.1	0.3
Total	0.1	0.3	0.4	0.5	1.3
GRAND TOTAL	0.3	2.9	5.0	4.6	12.8

1/ Calculated by compounding estimated rate of price increase in prior year and one-half the rate of increase in year concerned.

INDONESIA

IRRIGATION PROJECT VII

Proposed Allocation of Proceeds of Loan

	Cost		Loan
	Total	Foreign	Amount
	(US$ Million)		
I. Civil Works for Tertiary Networks:			
PROSIDA 1/	6.5	2.1	4.6
Jatiluhur Authority	1.9	0.6	1.3
Physical Contingencies	0.5	0.2	-
Expected Price Increases	1.0	0.3	-
Sub-Total	9.9	3.2	5.9 3/
II. Other Civil Works:			
PROSIDA 2/	9.4	5.3	6.9
P_3SA	0.4	0.2	0.3
Physical Contingencies	1.1	0.5	-
Expected Price Increases	1.2	0.5	-
Sub-Total	12.1	6.5	7.2 4/
III. Vehicles & Equipment:			
PROSIDA	1.0	1.0	1.1
Jatiluhur Authority	0.1	0.1	0.1
Physical Contingencies	-	-	-
Expected Price Increases	0.1	0.1	-
Sub-Total	1.2	1.2	1.2 5/
IV. Consulting Services:			
Tertiary Development, North Sadang & Drainage Project, PROSIDA	4.2	1.7	3.8
Tertiary Development, Jatiluhur	0.6	0.1	0.5
Kedungombo Dam & Downstream Improvements, P_3SA	4.0	2.8	3.6
Tidal Reclamation Project, P_4S	3.7	1.5	3.3
Physical Contingencies	-	-	-
Expected Price Increases	1.5	1.0	-
Sub-Total	14.0	7.1	11.2 6/
V. Mapping & Surveys:			
PROSIDA	1.9	1.5	2.0
Jatiluhur Authority	2.1	1.7	2.2
Physical Contingencies	0.4	0.3	-
Expected Price Increases	0.8	0.6	-
Sub-Total	5.2	4.1	4.2 7/

	Cost		Loan
	Total	Foreign	Amount
	(US$ Million)		
VI. Training:			
PROSIDA	0.4	0.3	0.3
Jatiluhur Authority	0.3	0.2	0.2
Physical Contingencies	-	-	-
Expected Price Increases	-	-	-
Sub-Total	0.7	0.5	0.5 8/
VII. Unallocated:			
Balance of Physical Contingencies	3.8	1.7	0.9
Balance of Expected Price Increases	8.2	3.3	1.9
Land Acquisition	3.5	-	-
O&M During Construction	0.6	0.2	-
Administration & Supervision	0.8	0.1	-
Sub-Total	16.9	5.3	2.8
Total	60.0	27.9	33.0

1/ Includes tertiaries in PROSIDA systems and in North Sadang.

2/ Includes North Sadang, gate modifications, measuring devices and telephone communications network on PROSIDA systems.

3/ Disbursements will be 60% of total expenditures.

4/ Disbursements will be 60% of total expenditures.

5/ Disbursements will be 100% of foreign expenditures for directly imported goods and equipment, 95% of ex-factory costs for locally manufactured equipment, 65% of total expenditures for locally procured imported goods and equipment, excluding vehicles, and 40% of total expenditures for locally assembled vehicles.

6/ Disbursements will be 100% of foreign expenditures or 80% of total expenditures.

7/ Disbursements will be 80% of total expenditures.

8/ Disbursements will be 100% of foreign expenditures. During negotiations, representatives of the concerned agencies agreed to share training funds as follows: PROSIDA, US$0.25 million; Jatiluhur Authority, US$0.15 million; and P_3SA, US$0.10 million.

INDONESIA

IRRIGATION PROJECT VII

Schedule of Expenditures

Item	Indonesian Fiscal Year 1976-77	1977-78	1978-79	1979-80	Total Cost
	(US$ Million)				
I. Tertiary Development, PROSIDA	2.2	5.6	6.3	5.6	19.7
II. Tertiary Development, Jatiluhur	0.9	2.2	2.9	2.5	8.5
III. North Sadang Irrigation System, PROSIDA	1.3	3.7	4.0	4.1	13.1
IV. Studies and Detailed Engineering	0.7	6.3	5.2	-	12.2
V. Miscellaneous Works & Services	0.8	2.0	2.0	1.7	6.5
Total	5.9	19.8	20.4	13.9	60.0

ANNEX 7
Table 1

INDONESIA

IRRIGATION PROJECT VII

Schedule of Expenditures

	Indonesian Fiscal Year				Total
	1976-77	1977-78	1978-79	1979-80	Cost
	(US$ Million)				
I. Tertiary Development, PROSIDA					
Civil Works	0.8	2.2	2.5	2.1	7.6
Land Acquisition	0.5	0.8	0.7	0.3	2.3
O&M During Construction	-	-	0.1	0.2	0.3
Administration & Supervision	-	0.1	0.1	0.2	0.4
Sub-Total	1.3	3.1	3.4	2.8	10.6
Consulting Services	0.4	0.7	0.7	0.4	2.2
Vehicles & Equipment	0.2	0.3	-	-	0.5
Base Cost	1.9	4.1	4.1	3.2	13.3
Physical Contingencies, 15%	0.2	0.6	0.6	0.6	2.0
Expected Price Increases	0.1	0.9	1.6	1.8	4.4
Total	2.2	5.6	6.3	5.6	19.7
II. Tertiary Development, Jatiluhur					
Civil Works	0.4	1.1	1.3	1.2	4.0
Land Acquisition	0.2	0.2	0.3	0.1	0.8
O&M During Construction	-	-	-	0.1	0.1
Administration & Supervision	-	-	0.1	-	0.1
Sub-Total	0.6	1.3	1.7	1.4	5.0
Consulting Services	0.1	0.3	0.2	-	0.6
Vehicles & Equipment	-	0.1	-	-	0.1
Base Cost	0.7	1.7	1.9	1.4	5.7
Physical Contingencies, 15%	0.2	0.2	0.4	0.1	0.9
Expected Price Increases	-	0.3	0.6	1.0	1.9
Total	0.9	2.2	2.9	2.5	8.5

	Indonesian Fiscal Year				Total Cost
	1976-77	1977-78	1978-79	1979-80	
	(US$ Million)				
III. North Sadang Irrigation System, PROSIDA					
Civil Works	0.6	1.7	2.0	1.9	6.2
Land Acquisition	0.1	0.1	0.1	0.1	0.4
O&M During Construction	-	-	0.1	0.1	0.2
Administration & Supervision	-	0.1	0.1	0.1	0.3
Sub-Total	0.7	1.9	2.3	2.2	7.1
Consulting Services	0.1	0.3	0.2	0.1	0.7
Vehicles & Equipment	0.1	0.3	-	-	0.5
Base Cost	1.0	2.5	2.5	2.3	8.3
Physical Contingencies, 20%	0.2	0.6	0.5	0.5	1.8
Expected Price Increases	0.1	0.6	1.0	1.3	3.0
Total	1.3	3.7	4.0	4.1	13.1
IV. Studies & Detailed Engineering					
Associated Works	0.1	0.2	0.1	-	0.4
Consulting Services	0.5	5.0	3.5	-	9.0
Base Cost	0.6	5.2	3.6	-	9.4
Physical Contingencies, 10%	0.1	0.3	0.2	-	0.6
Expected Price Increases	-	0.8	1.4	-	2.2
Total	0.7	6.3	5.2	-	12.2
V. Miscellaneous Works & Services					
Civil Works, PROSIDA	0.3	0.9	0.9	0.9	3.0
Training	-	0.2	0.3	0.2	0.7
Equipment	0.3	0.5	0.2	-	1.0
Base Cost	0.6	1.6	1.4	1.1	4.7
Physical Contingencies, 10%	0.1	0.1	0.2	0.1	0.5
Expected Price Increases	0.1	0.3	0.4	0.5	1.3
Total	0.8	2.0	2.0	1.7	6.5
GRAND TOTAL	5.9	19.8	20.4	13.9	60.0

ANNEX 7
Table 3

INDONESIA

IRRIGATION PROJECT VII

Schedule of Disbursements

Bank Fiscal Year & Semester	Accumulated Disbursements (US$ M)
1977	
1st	0.2
2nd	0.8
1978	
1st	1.2
2nd	3.9
1979	
1st	5.0
2nd	11.9
1980	
1st	14.0
2nd	24.4
1981	
1st	26.7
2nd	32.4
1982	
1st	33.0

INDONESIA

IRRIGATION PROJECT VII

Training

1. There is a shortage of trained and experienced personnel in almost all agricultural and irrigation activities in Indonesia. Those trained prior to World War II are either retired or nearing retirement and there is a shortage of qualified personnel to replace them and to fill new positions created to bring the number of staff to the level required to meet the needs of the various systems. Inspite of the training program started under earlier Credits, some deficiencies still exist. The present project would continue the training program to help correct the remaining deficiencies.

Overseas Training

2. O&M In-Service Training. Some 20 section and sub-section irrigation engineers would be sent to Malaysia for three months each to work on selected systems with counterparts of equivalent level. In addition, a similar batch of irrigation engineers would be sent to Taiwan. Malaysia and Taiwan would be suitable training countries because of the similarity of cultural practices and the high standard of O&M activities in these countries. Slots for about 24 engineers would be allocated to PROSIDA and 16 to the Jatiluhur Authority.

3. Study Tours. Six PROSIDA and four Jatiluhur Authority senior irrigation engineers would be sent on study tours of two months each to neighboring countries. The study tours would take place in the early years of project implementation and the countries covered would be Japan, Taiwan, Malaysia and the Philippines.

4. Post Graduate Training. Six PROSIDA and four Jatiluhur Authority senior and middle level planning and design engineers would undergo post graduate training of 12 months each in their particular fields of specialization in the home offices of selected foreign consultants. Wherever possible, the training would be supplemented with theoretical courses offered by nearby universities.

Local Training

5. O&M In-Service Training. Training for about 250 irrigation foremen and sub-foremen drawn from the PROSIDA and the Jatiluhur Authority systems would consist of one month of classroom training using audio-visual systems and equipment, which would be supplied to the Surabaya Institute under Loan 1100-IND, and two months of actual field work, which would be supervised by O&M experts engaged under Loan 1100-IND.

6. Construction Supervision Training. Training for about 150 construction foremen and sub-foremen nominated by PROSIDA and the Jatiluhur Authority would include one month training at the Surabaya Institute, using audiovisual systems and equipment, and two months of actual field work under the supervision of consultants for the various on-going projects.

7. Planning and Design In-Service Training. All contracts for consulting services under the project would contain a clause enjoining the expatriate personnel to train their local counterparts. This practice, which had been carried out under previous projects, had proved effective in upgrading the capability of the Indonesian staff.

ANNEX 2
Table 1

INDONESIA

IRRIGATION PROJECT VII

Operation and Maintenance

Current Allocation of O & M Funds

		Rp/ha
1.	Civil Works (Repairs done by contract)	960
2.	Salary Incentives 1/	160
3.	Purchase of Materials	320
4.	Surveys and Design 2/	48
5.	Miscellaneous	112
	Total 3/	1,600

1/ Given to personnel of executing agencies. Salary incentives are withdrawn after rehabilitated system is turned over to Provincial Government.

2/ For estimating extent of maintenance required (desilting, embankment, reshaping, etc.) and design of damaged structures, if required.

3/ From Central Government. In addition, Provincial Government allocates Rp 900/ha to cover salaries of personnel above irrigation supervisor, for a total of Rp 2,500/ha.

INDONESIA

IRRIGATION PROJECT VII

Operation and Maintenance

Estimate of Currently Required O & M Funds [1]

		Rp/ha
1.	Salaries, Irrigation Supervisors and below	873
2.	Annual desilting	500
3.	Canal repairs, trimming and sodding	125
4.	Maintenance of headworks, structures, gates, masonry linings, etc.	1,115
5.	Transport	50
6.	Administration	37
7.	Housing & Office	13
8.	Workshops	150
9.	Inspection roads	133
10.	Communications	28
11.	Hydrological Stations	110
12.	Maintenance of Drainage works	670
	Sub-Total	3,804
13.	Contingencies	196
	Total [2]	4,000 [3]

1/ Supplied by PROSIDA.

2/ From Central Government. In addition, Provincial Government allocates Rp 900/ha to cover salaries of personnel above irrigation supervisor, for a total of Rp 4,900/ha.

3/ May vary by ± Rp 500 depending upon size and shape of system.

INDONESIA

IRRIGATION PROJECT VII

OPERATION AND MAINTENANCE

1976/77 Budgetary Allocation for Bank-Assisted Projects[1/]

Status of Systems Covered	PROSIDA SYSTEMS			JATILUHUR SYSTEM			Total Funds
	Area (ha)	Allocated Funds (Rp/ha)	Allocated Funds (Rp Million)	Area (ha)	Allocated Funds (Rp/ha)	Allocated Funds (Rp Million)	(Rp Million)
Rehabilitated Up to FY 75/76 4/	467,935	3,200	1,497.4	218,000	3,800	828.4	2,325.8
Being Rehabilitated in FY 76/77 5/	113,345	1,223	138.6	17,743	1,600	28.4	167.0
Awaiting Rehabilitation 6/	221,074	1,366	302.0	62,000 7/	245	15.2	317.2
Total	802,354 2/		1,938.0	297,743 3/		872.0	2,810.0

1/ From Central Government (does not include Provincial Government budget).

2/ Includes about 67,000 ha outside the Bank-assisted systems.

3/ Includes about 45,000 ha outside the Bank-assisted systems.

4/ Would require full O&M funds.

5/ Would require operating funds until they are shut down for rehabilitation.

6/ Would require operating funds plus funds for urgent repairs to keep systems functioning until they are rehabilitated.

7/ Village irrigation systems in the Jatiluhur Extension area whose works would be completely rebuilt. Low level of funds to cover relatively small operating cost.

ANNEX 6
Table 3

INDONESIA

IRRIGATION PROJECT VII

Marketing Prospects and Prices

Market Prospects

1. One of the basic goals of Government agricultural policy is to attain self-sufficiency in rice. Although the underlying data are limited, the Central Bureau of Statistics estimates that rice production grew at an annual rate of 4.8% from 1968 (11.7 million tons) to 1974 (15.5 million tons). The government forecasts similar growth during Pelita II (The Second Five-Year Plan (1974-79), with rice production equalling 18.2 million tons in 1978/79. The Government has not published an estimate for rice demand during Pelita II, but local officials estimate that demand will grow at 4% to 18.8 million tons in 1978, the last year of the plan, from a 1971 base of 14.3 million tons. If this estimate is correct, 600,000 tons of imports would be needed in 1978 and substantial imports would continue to be required in subsequent years. Thus, no difficulties are foreseen in marketing the additional rice from the project areas. Much of the incremental production will be consumed at the farm level, while the remainder will be transported to the rice deficit areas traditionally fed through imports.

Prices

2. Stabilization Efforts. Fluctuating seasonal rice/paddy prices are a major Government concern. Fluctuations are caused by an uneven seaonal supply plus poor transport facilities between surplus and deficit regions on the one hand, and a constant demand throughout the year on the other. Since 1968 the Government Agency, BULOG/DOLOG (Board of Logistics Affairs/ Logistics Depot), has operated a price stabilization scheme for rice and paddy. By buying paddy and rice at the village and mill level, and by stockpiling and/or selling this and imported rice at the wholesale level, BULOG/ DOLOG has maintained a price floor for producers and a price ceiling for consumers. The Government regulates the floor price to encourage production, and the ceiling price to control inflation.

3. As discussed in the main body of this report, BULOG/DOLOG has a major problem insuring that farmers receive the floor price for paddy, particularly during the wet season harvest. The large volume, excessive moisture content and/or impurity of the paddy, and insufficient storage slow down or impede BUUD/KUD purchases. Recently BULOG/DOLOG and the Department of Cooperatives have taken a number of steps to speed up the buying of farmers' paddy. These include slightly lowering paddy quality requirements; buying rice and paddy, reversing an earlier decision to buy only paddy; expanding godown building programs at the village, village

unit, district, and provincial levels; and beginning to construct drying floors at the village and village unit level. They have also improved the reporting of prices and stocks to headquarters, made loans for moisture meters and other equipment to BUUD/KUD's and rice surveyors working for DOLOG and increased the payment to DOLOG rice surveyors to Rp 100 per ton. Other changes BULOG/DOLOG has made to increase its efficiency include establishing a Bureau of Stocks and Preservation to maintain grain stocks which are now held for an average of six months and establishing a Bureau of Research and Development to reduce paddy/rice losses after harvest.

Rice Price

4. Subsidy. By selling imported and locally procured rice on the domestic market at below cost, the Government has maintained both the price floor and ceiling below world market levels since 1968. As a result it has subsidized consumers in urban and rural deficit areas. Although the government has moved to raise domestic prices to world market levels in the last two years, some subsidy remains. The subsidy in 1976 can be roughly calculated as follows: the Bank's commodity analysts estimate the 1976 price for Thai rice 5% brokens at $400/ton and 25%-35% brokens at around $190/ton. Weighting the rice produced by the quality generally produced by Indonesian rice mills and by the Bank analysts' estimated prices results in an fob Bangkok price of $285/ton. Adding $27 ocean freight and handling charge gives a price to wholesalers of $312. Assuming the government sells to wholesalers at Rp 120 (US$0.29) per kg, the subsidy per ton is approximately $23.

5. Assumptions. The following assumptions have been used to estimate present and future farmgate prices in the economic analysis. Because the Bank projects the world market price of Thai rice to fall at constant 1976 prices, the price of rice of the quality produced by Indonesian mills has been projected to fall from $285 at present to $250 a ton in the 1980-85 period. The corresponding farmgate prices would fall from Rp 73,700/ton to Rp 65,000/ton in North Sadang. Urea and phosphate fertilizer prices are also assumed to fall, in accordance with Bank projections. It has also been assumed that between 1976 and 1985 the Government would be successful in raising agricultural prices to a level which equates them and the world farm gate price. However, because it is expected that the government would continue to reduce price fluctuations by maintaining floor prices which apply nationwide, financial farmgate prices may vary slightly from the economic farmgate price in some areas. Thus, it is estimated that in 1985, the financial farmgate price in North Sadang will be $157/ton and the economic farmgate price will be only $151/ton (in 1976 prices). Tables 1 through 3 show the present and projected price structures for rice, urea, and phosphate used in the economic analysis.

Shadow Price for Foreign Exchange

6. During the analysis of the proposed project, a foreign exchange shadow rate was calculated. The difference between the calculated rate and the current financial rate is less than 3%. Because the determination of shadow rates is necessarily imprecise, and since, in this case, the shadow rate had an insignificant effect on the economic rate of return, the official exchange rate has been used throughout the analysis.

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IRRIGATION PROJECT VII

Rice Price Structure, 1976 and 1985

Rice	Tertiary Development Areas				North Sadang			
	1976		1985		1976		1985	
	Rp/ton	US$/ton	Rp/ton	US$/ton	Rp/ton	US$/ton	Rp/ton	US$/ton
Export price Thai 5%-42% brokens mix fob Bangkok[1/]	118,275	285	103,750	250	118,275	285	103,750	250
Ocean freight & insurance	8,700	21	8,700	21	8,700	21	8,700	21
Port handling, storage & transport to wholesalers	2,500	6	2,500	6	2,500	6	2,500	6
Transport mill to wholesaler	(2,500)	(6)	(2,500)	(6)	(11,600)	(28)	(10,400)	(25)
Rice price ex-mill, project area	126,975	306	112,450	271	117,875	284	104,550	252
Paddy equivalent price (63% rice recovery)	80,000	193	71,000	171	74,300	179	65,900	159
Milling costs less value of by-products	3,000	7	3,000	7	3,000	7	3,000	7
Handling & transport costs, farm to mill	3,300	8	3,000	7	900	2	800	2
Farm-gate paddy price	73,700	178	65,000	157	70,400	170	62,100	150
(Financial farm-gate price)[2/]	(67,500)	(163)	(65,000)	(157)	(67,500)	(163)	(65,000)	(157)

1/ Assumed rice quality: 10% of production, 5% brokens; 60% medium grade, 25%-35% brokens; and 30% lower grade, 42% brokens. Prices assumed in 1985 (in constant mid-1976 prices), 5% brokens US$355/ton, 25%-35% brokens US$240/ton and 42% brokens US$230/ton.

2/ Financial prices lower than economic prices for rice in 1976 reflect the Government's former policy of keeping prices low internally compared to high world-market prices. As world-market prices fall in real terms, according to Bank commodity price forecasts, and as the Government raises domestic prices, distortions between internal and world prices are expected to be eliminated.

ANNEX 10
Table 1

INDONESIA

IRRIGATION PROJECT VII

Urea Price Structure, 1976 and 1985

Urea	Tertiary Development Area				North Sadang			
	1976		1985		1976		1985	
	Rp/ton	US$/tonq	Rp/ton	US$/ton	Rp/ton	US$/ton	Rp/ton	US$/ton
World export price[1/]	83,000	200	70,550	170	83,000	200	70,550	170
Ocean freight & insurance	8,300	20	2,900	7	8,300	20	3,800	9
Unloading & distribution costs to BUUD kiosk	14,500	35	14,500	35	15,800	38	14,500	35
Transport, kiosk to farm	3,000	7	3,000	7	1,200	3	850	2
Farm-gate urea price	108,800	262	90,950	219	108,300	261	89,700	216
(Financial farm-gate price[2/]	(80,000)	(193)	(90,950)	(219)	(80,000)	(193)	(90,950)	(219)

1/ Export price 1976 fob Tokyo; 1985 fob Palembang.

2/ Financial prices lower than economic prices for urea in 1976 reflect the Government's former policy of keeping food prices low internally compared to high world-market prices. As world-market prices fall in real terms, according to Bank commodity price forecasts, and as the Government raises domestic prices, distortions between internal and world prices are expected to be eliminated.

ANNEX 10
Table 2

INDONESIA

IRRIGATION PROJECT VII

T.S.P. Price Structure, 1976 and 1985

T.S.P.	Tertiary Development Area				North Sadang			
	1976		1985		1976		1985	
	Rp/ton	US$/ton	Rp/ton	US$/ton	Rp/ton	US$/ton	Rp/ton	US$/ton
World export price	66,400	160	59,000	142	66,400	160	59,000	142
Ocean freight & insurance	8,300	20	8,300	20	8,300	20	8,300	20
Unloading & distribution costs to BUUD kiosk	14,500	35	14,500	35	15,800	38	14,500	35
Transport, kiosk to farm	3,000	7	3,000	7	1,200	3	850	2
Farm T.S.P. price	92,200	222	84,800	204	91,700	221	82,650	199
(Financial farm-gate price)[1/]	(80,000)	(193)	(84,800)	(204)	(80,000)	(193)	(84,800)	(204)

1/ Financial prices lower than economic prices for T.S.P. in 1976 reflect the Government's former policy of keeping food prices low internally compared to high world-market prices. As world-market prices fall in real terms, according to Bank commodity price forecasts, and as the Government raises domestic prices, distortions between internal and world prices are expected to be eliminated.

ANNEX 10
Table 3

INDONESIA

IRRIGATION PROJECT VII

Crop and Farm Budgets

1. Annex 2 contains the present and projected cropping patterns. This Annex shows separately for the tertiary development and North Sadang areas:

(a) Production costs for types of paddy now planted, and in the future "with" and "without" the project (Tables 1 and 2). Present costs and input utilization rates are based on interviews with farmers and government officials. In the absence of the project, little change in the level of inputs is expected in the North Sadang area. Inputs would increase substantially in tertiary development areas even without the project because of the rehabilitation of primary and secondary systems now going on under the first four Bank Group assisted irrigation rehabilitation projects. The input levels for future "with project" conditions are based on levels recommended for the BIMAS program, and on the assumption that some increased mechanization will occur in the North Sadang area.

(b) Monthly labor requirements based on cropping calendars for the wet and dry seasons (Tables 3 and 4). With or without the project, there would be no change in the labor requirement for land preparation or planting in tertiary development areas. Labor required for crop management, including such activities as weeding, fertilizer and pesticide application and harvesting would increase even without the project as a result of rehabilitation. With the project, labor requirements for these activities would be around 10% above the amount required without the project. In North Sadang, labor requirements should increase slightly without the project, primarily because of improved crop management techniques. With the project, labor requirements per hectare are expected to be above current levels, but slightly below the levels required without the project, because of an expected increase in mechanical cultivation. Total labor requirements for the area would increase, however, because of the increased hectarage brought under cultivation as a result of the project.

(c) Crop budgets at present, and with and without the project (Tables 5 and 6).

(d) Farm budgets for typical family farms of 0.15, 0.30, 0.75, and 1.5 ha (tertiary development areas on Java) and 1.0 ha and 2.0 ha (North Sadang) (Tables 7, 8 and 9). Because sharecropping is common throughout the project areas, sharecropped farms have been analyzed independently. Crops other than rice are excluded from the tertiary development analysis because they are relatively unimportant in areas meeting the criteria for tertiary development and will, presumably, be eliminated in the future when double cropping of rice is possible. To the extent palawija is grown in the project area, present farm incomes and incomes without the project are understated. Secondary crops have been considered in the North Sadang analysis, being estimated at 275 ha rice equivalent in the wet season and 250 ha in the dry season. Labor costs include only hired labor, not farm family labor, and were determined for non-harvest periods by calculating the excess of total monthly labor requirements over an estimated maximum of 40 man-days of family labor per farm per month. Families were assumed to provide 20% of harvest labor. Land taxes, payable by landowners only, were estimated in accordance with IPEDA procedures. A table summarizing Tables 7 through 9 is contained in paragraph 6.05 in the main body of the text.

INDONESIA

IRRIGATION PROJECT VII

Rice Crop Production Costs[1]

Tertiary Development Area

	Present				Future Without Project			Future with Project		
	Wet Season			Dry Season	Wet Season		Dry Season	Wet Season		Dry Season
	Rainfed	Irrigated		Irrigated	Irrigated		Irrigated	Irrigated		Irrigated
	Local Variety	Local Variety	HYV	HYV	Local Variety	HYV	HYV	Local Variety	HYV	HYV
Cash Inputs (Rp/ha)[2]										
Cultivation	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500	13,500
Seed	3,100 (2,800)	3,100 (2,800)	2,200 (2,000)	2,200 (2,000)	2,700	1,950	1,950	2,700	1,950	1,950
Fertilizer	1,000 (800)	7,900 (6,800)	13,600 (11,600)	13,600 (11,600)	9,450	18,350	18,350	13,800	23,850	23,850
Agro-chemicals	400 (300)	3,250 (1,700)	6,500 (3,400)	6,500 (3,400)	4,550	7,200	7,200	6,500	9,600	9,600
Harvesting	3,300 (3,000)	4,000 (3,600)	7,100 (6,500)	6,600 (6,100)	4,100 (4,100)	7,400 (7,400)	7,400 (7,400)	4,500 (4,500)	8,800 (4,500)	8,800 (4,500)
Other	1,000	2,000	2,000	2,000	2,000	2,000	2,000	6,000	6,000	6,000
Interest	- (1,100)	- (1,600)	- (1,900)	- (1,900)	- (1,900)	- (2,600)	- (2,600)	- (2,300)	- (3,100)	- (3,100)
Total Cash Inputs	22,300 (22,500)	33,750 (32,000)	44,900 (40,900)	44,400 (40,500)	36,300 (38,200)	50,400 (53,000)	50,400 (53,100)	47,000 (49,300)	63,700 (66,800)	63,700 (66,800)
Labor Inputs (man-day/ha)										
Land preparation	48	53	53	50	53	53	50	53	53	53
Planting	40	40	40	40	40	40	40	40	40	40
Crop management	42	62	79	82	67	87	90	72	97	97
Harvesting	40	45	58	58	50	60	60	55	70	70
Total Labor Inputs	170	200	230	230	210	240	240	220	260	260

1/ Economic prices based on world market prices for rice and fertilizer for use in economic analysis. Figures in parentheses are financial prices.

2/ Based on the following assumptions:

(a) Cultivation — Animal 60% @ Rp 800/day
Hand Labor 40%

(b) Seed Rate — Local Variety 35 kg/ha; HYV 25 kg/ha

(c) Fertilizer — Present: Urea @ Rp 108.8/kg (Rp 80); T.S.P. @ Rp 92.2/kg (Rp 80)
Future: Urea @ Rp 91.0/kg; T.S.P. @ Rp 84.8/kg

(d) Agro chemicals - Lump sum for Diazanon, spraying and rat control

(e) Harvesting - Threshing and drying @ 3% of production value

(f) Other - Includes O&M charges for tertiary and quaternary units, on the average 45 kg paddy/ha

(g) Interest - @ 1% per month for 7 months on production credit (assumed to be 90% of all cash inputs except harvesting, canal maintenance and land tax payments).

ANNEX 11
Table 1

INDONESIA

IRRIGATION PROJECT VII

Rice Crop Production Costs [1/]

North Sadang Area

Cash Inputs (Rp/ha) [2/]	Present			Future Without Project			Future with Project	
	Wet Season		Dry Season	Wet Season		Dry Season	Wet Season	Dry Season
	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated	Irrigated	Irrigated	Irrigated
Cultivation	19,950	20,750	20,750	20,350	20,750	20,750	21,200	21,200
Seed	3,000 (2,800)	3,000 (2,800)	3,000 (2,800)	2,600 (2,700)	2,600 (2,700)	2,600 (2,700)	1,900 (1,950)	1,900 (1,950)
Fertilizer	2,960 (2,400)	4,930 (4,000)	4,930 (4,000)	2,800 (2,850)	4,150 (4,100)	4,150 (4,100)	17,430 (16,900)	17,430 (16,900)
Agro-Chemicals	1,250 (500)	1,250 (500)	1,250 (500)	1,250 (500)	1,250 (500)	1,250 (500)	5,670 (2,350)	5,670 (2,350)
Harvesting	12,670 (12,150)	12,700 (12,150)	11,800 (12,150)	11,800 (12,350)	13,650 (14,300)	12,400 (13,000)	23,600 (24,700)	23,600 (24,700)
Other	1,000	2,000	2,000	2,000	2,000	2,000	6,000	6,000
Interest	(1,600)	(1,800)	(1,800)	(1,700)	(1,800)	(1,800)	- (2,700)	- (2,700)
Total Cash Inputs	40,830 (40,400)	46,010 (45,350)	44,630 (44,000)	40,800 (42,450)	44,400 (46,150)	43,150 (44,850)	75,800 (75,800)	75,800 (75,800)
Labor Inputs (man-days/ha)								
Land Preparation [3/]	56	60	60	58	60	60	24	24
Planting	25	31	31	27	35	35	48	48
Crop Management	29	38	40	30	41	43	53	53
Harvesting [3/]	32	42	42	34	44	44	50	50
Total Labor Inputs	142	171	173	149	180	182	175	175

1/ Economic prices based on world market prices for rice and fertilizer for use in economic analysis. Figures in parentheses are financial prices.

2/ Based on the following assumptions:

		Present & Future Without Project	Full Development
(a)	Cultivation	Mechanized - 50% @ Rp 8,750/ha	80% @ Rp 14,000/ha
		Hand Labor - 50% @ Rp 200 day x # of days	20% @ Rp 300 day x 24 days
(b)	Seed Rate	Local Variety - 35 kg/ha; HYV 25 kg/ha	Local variety @ 35 kg/ha
(c)	Fertilizer	Irrigated - 50 kg Urea	170 kg Urea, 40 kg TSP
		Rainfed - Present 30 kg urea; future 35 kg urea	--
(d)	Agro-chemicals	- Lump sum.	
(e)	Harvesting	- Cutting by hand and threshing at 10% of farmgate value.	
(f)	Other	- Includes O&M charges for tertiary and quaternary units.	
(g)	Interest	- @ 1% per month for 7 months on production credit (assumed to be 90% of all cash inputs except harvest, maintenance and land tax payments).	

3/ Labor costs included under cash inputs.

INDONESIA

IRRIGATION PROJECT VII

Monthly Labor Requirements for Various Paddy Crops (man-days/ha) 1/

Tertiary Development Areas

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wet Season Rainfed Paddy														
Local Variety	P	32	30	7	21	20	16					14	30	170
Irrigated Paddy														
Local Variety	P	37	35	10	25	25	20					16	32	200
	$\bar{W}$	38	36	11	28	28	21					16	32	210
	W	38	36	12	31	30	24					16	33	220
HYV	P	42	40	36	35	26						17	34	230
	$\bar{W}$	44	42	37	37	28						17	35	240
	W	46	44	43	42	32						17	36	260
Dry Season Irrigated Paddy														
HYV	P				9	28	57	38	34	50	14			230
	$\bar{W}$				9	28	59	40	37	52	15			240
	W				10	29	61	41	42	59	18			260

1/ P = Present; $\bar{W}$ = Future without project; and W = Future with project.

ANNEX 11
Table 3

ANNEX 11
Table 4

IRRIGATION PROJECT VII

Monthly Labor Requirements for Various Paddy Crops (man-days/ha) 1/

North Sadang

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Wet Season														
Rainfed	P		11	45	31	19	14	22						142
	$\bar{W}$		12	46	33	19	15	24						149
Irrigated	P		12	49	37	25	19	29						171
	$\bar{W}$		12	50	41	26	20	31						180
	W		5	28	49	35	23	35						175
Dry Season														
Rainfed	P	4	26	3					4	55	23	20	7	142
	$\bar{W}$	5	27	3					4	59	23	21	7	149
Irrigated	P	5	34	4					5	62	25	28	10	173
	$\bar{W}$	6	35	4					5	65	26	30	11	182
	W	6	40	5					3	48	23	37	13	175

1/ P = Present, $\bar{W}$ = Future without project; and W = Future with project.

INDONESIA

IRRIGATION PROJECT VII

Rice Crop Budgets

Tertiary Development Area[1/]

	Present				Future Without Project			Future with Project		
	Wet Season			Dry Season	Wet Season		Dry Season	Wet Season		Dry Season
	Rainfed	Irrigated		Irrigated	Irrigated		Irrigated	Irrigated		Irrigated
	Local Variety	Local Variety	HYV	HYV	Local Variety	HYV	HYV	Local Variety	HYV	HYV
Yield (ton/ha)	1.5	1.8	3.2	3.0	2.1	3.8	3.8	2.3	4.5	4.5
Farm-Gate Price (Rp/ton)	67,500	67,500	67,500	67,500	65,000	65,000	65,000	65,000	65,000	65,000
Gross Value of Production (Rp/ha)	101,250	121,500	216,000	202,500	136,500	247,000	247,000	149,500	292,500	292,500
Production Costs Excluding Labor (Rp/ha)	22,500	32,000	40,900	40,500	38,200	53,000	53,100	49,300	66,800	66,800
Net Value of Production Excluding Labor (Rp/ha)	78,750	89,500	175,100	162,000	174,100	194,000	193,900	100,200	225,700	225,700
Labor Requirements (man-days/ha)	170	200	230	230	210	240	240	220	260	260

1/ Financial costs and prices are used based on Annex 11, Table 1.

INDONESIA

IRRIGATION PROJECT VII

RICE CROP BUDGETS

NORTH SADANG AREA 1/

	Present			Future Without Project			Future With Project	
	Wet Season		Dry Season	Wet Season		Dry Season	Wet Season	Dry Season
	Rainfed	Irrigated	Irrigated	Rainfed	Irrigated	Irrigated	Irrigated	Irrigated
Yield (ton/ha)	1.8	2.0	1.8	1.9	2.2	2.0	3.8	3.8
Farm Gate Price (Rp/ton)	67,500	67,500	67,500	65,000	65,000	65,000	65,000	65,000
Gross Value of Production (Rp/ha)	121,500	135,000	121,500	123,500	143,000	130,000	247,000	247,000
Production Costs Excluding some Labor (Rp/ha) 2/	40,400	45,350	44,000	42,450	46,150	44,850	75,800	75,800
Net Value of Production Excluding Labor (Rp/ha)	81,100	89,650	77,500	81,050	96,850	85,150	171,200	171,200
Labor Requirements (man-days/ha)	142	171	173	149	180	182	175	175
Labor Requirements for Planting and Crop Management (man-days/ha)	54	69	71	57	76	78	101	101

1/ Financial costs and prices are used, based on Annex 11, Table 2.

2/ Includes labor costs of land preparation and harvesting.

ANNEX 11
Table 6

INDONESIA

IRRIGATION PROJECT VII

Farm Budgets

Tertiary Development Area

	Unit	0.15 ha Farm						0.3 ha Farm					
		Present		Fut. W/out Proj.		Fut. With Proj.		Present		Fut. W/out Proj.		Fut. With Proj.	
		Own-Oper.	Sharecr.	Own-Oper.	Sharecr.	Own-Oper.	Sharecr.	Own-Oper.	Sharecr.	Own-Oper.	Sharecr.	Own-Oper.	Sharecr.
Cropped Area													
Wet Season													
Rainfed Local Variety	ha	.01	.01	-	-	-	-	.02	.02	-	-	-	-
Irrigated Local Variety	ha	.03	.03	.03	.03	.02	.02	.06	.06	.06	.06	.05	.05
Irrigated HYV	ha	.11	.11	.12	.12	.13	.13	.22	.22	.24	.24	.25	.25
Dry Season HYV	ha	.07	.07	.07	.07	.07	.07	.14	.14	.14	.14	.14	.14
Total Cropped Area	ha	.22	.22	.22	.22	.22	.22	.44	.44	.44	.44	.44	.44
Cropping Intensity	%	145	145	145	145	145	145	145	145	145	145	145	145
Total Paddy Production	tons	.63	.63	.78	.78	.93	.93	1.26	1.26	1.55	1.55	1.86	1.86
Gross Value of Production	Rp'000	42.5	42.5	50.7	50.7	60.5	60.5	85.1	85.1	100.8	100.8	120.9	120.9
Sharecropper's Payment to Land Owner 1/	Rp'000	-	19.6	-	23.3	-	27.8	-	39.1	-	46.3	-	55.6
Production Costs 3/	Rp'000	8.5	4.3	11.2	5.6	14.3	7.2	17.1	8.5	22.4	11.2	28.6	14.3
Hired Farm Labor Costs													
Harvest 2/	Rp'000	3.4	3.4	4.1	4.1	4.8	4.8	6.8	6.8	8.1	8.1	9.7	9.7
Other	Rp'000	-	-	-	-	-	-	-	-	-	-	-	-
Net Value of Production	Rp'000	30.6	15.2	35.4	17.7	41.4	20.7	61.3	30.7	70.3	35.2	82.6	41.3
Land Tax (IPEDA)	Rp'000	.3 4/	-	.8	-	1.1	-	.6	-	1.7	-	2.1	-
Net Crop Income	Rp'000	30.3	15.2	34.6	17.7	40.3	20.7	60.7	30.7	68.6	35.2	80.5	41.3

1/ Landlord and sharecropper share equally gross production less harvesting costs, and production costs. Landlord pays land tax.

2/ Non-family labor at 8% of Gross Production.

3/ Include O&M for tertiary and quaternary units, table 1 annex 11.

4/ Land tax rate before any irrigation rehabilitation is commenced.

ANNEX 11
Table 7

INDONESIA

IRRIGATION PROJECT VII

FARM BUDGETS

Tertiary Development Areas (2)

		0.75 ha Farm						1.5 ha Farm					
		Present		Future without Project		Future with Project		Present		Future without Project		Future with Project	
	Unit	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper
Cropped Areas													
Wet Season													
Rainfed	ha	.04	.04	-	-	-	-	.08	.08	-	-	-	-
Irrigated Local Variety	"	.15	.15	.15	.15	.11	.11	.30	.30	.30	.30	.23	.23
Irrigated HYV	"	.56	.56	.60	.60	.64	.64	1.12	1.12	1.20	1.20	1.27	1.27
Dry Season HYV	"	.34	.34	.34	.34	.34	.34	.68	.68	.68	.68	.68	.68
Total Cropped Area	"	1.09	1.09	1.09	1.09	1.09	1.09	2.18	2.18	2.18	2.18	2.18	2.18
Cropping Intensity	%	145	145	145	145	145	145	145	145	145	145	145	145
Total Paddy Production	tons	3.14	3.14	3.88	3.88	4.66	4.66	6.28	6.28	7.76	7.76	9.32	9.32
Gross Value of Production	Rp'000	212.0	212.0	252.2	252.2	302.9	302.9	423.9	423.9	504.4	504.4	605.8	605.8
Sharecropper's Payment to Landowner 1/	"	-	97.5	-	116.0	-	139.3	-	195.0	-	232.0	-	278.6
Production Costs	"	42.5	21.5	56.0	28.0	71.5	36.0	85.0	42.5	112.0	56.0	14.3	72.0
Hired Farm Labor Costs													
Harvest 2/	"	17.0	17.0	20.2	20.2	24.2	24.2	33.9	33.9	40.4	40.4	48.5	48.5
Other 3/	"	.3	.1	.5	.2	.6	.3	16.6	8.3	20.4	10.2	24.8	12.4
Net Value of Production	"	152.2	75.9	175.5	87.8	206.6	103.1	288.4	144.2	331.6	165.8	389.5	194.3
Land Tax (IPEDA)	"	1.5	-	4.2	-	5.3	-	3.0	-	8.5	-	10.5	-
Net Crop Income	"	150.7	75.9	171.3	87.8	201.3	103.1	285.4	144.2	323.1	165.8	379.0	194.3

1/ Landlord and sharecropper share equally gross production, less harvesting costs, and production costs. Landlord pays land tax.
2/ Non-family labor at 8% of gross production.
3/ Based on 40 man-days per month maximum availability of family labor.

ANNEX 11
Table 8

INDONESIA

IRRIGATION PROJECT VII

FARM BUDGETS

NORTH SADANG

		1.0 ha Farm						2.0 ha Farm					
		Present		Future without Project		Future with Project		Present		Future without Project		Future with Project	
		Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper	Owner Operator	Share-cropper
Cropped Area													
Wet Season													
Rainfed	ha	.54	.54	.54	.54	-	-	1.08	1.08	1.08	1.08	-	-
Irrigated	"	.34	.34	.34	.34	1.00	1.00	.68	.68	.68	.68	2.00	2.00
Dry Season													
Rainfed	"	.04	.04	.04	.04	-	-	.08	.08	.08	.08	-	-
Irrigated	"	.34	.34	.34	.34	.90	.90	.68	.68	.68	.68	1.80	1.80
Total Cropped Area	"	1.26	1.26	1.26	1.26	1.90	1.90	2.52	2.52	2.52	2.52	3.80	3.80
Cropping Intensity	%	126	126	126	126	190	190	126	126	126	126	190	190
Total Paddy Production	tons	2.32	2.32	2.52	2.52	7.22	7.22	4.64	4.64	5.04	5.04	14.44	14.44
Gross Value of Production	Rp'000	156.6	156.6	163.8	163.8	469.3	469.3	313.2	313.2	327.6	327.6	938.6	938.6
Sharecropper's Payment to Landowner 1/	"		78.3		81.9		234.6		156.6		163.8		469.3
Production Costs	"	53.8	26.9	55.6	27.8	144.0	72.0	107.6	53.8	111.2	55.6	288.0	144.0
Hired Farm Labor Costs	"	-	-	-	-	2.1	1.1	1.6	.8	3.6	1.8	38.1	19.1
Net Value of Production	"	102.8	51.4	108.2	54.1	323.2	161.6	204.0	102.0	212.8	106.4	612.5	306.2
Land Tax (IPEDA)	"	4.0	-	4.0	-	10.5	-	8.0	-	8.0	-	21.0	-
Net Crop Income	"	98.8	51.4	104.2	54.1	312.7	161.6	196.0	102.0	204.8	106.4	591.5	306.2

1/ Landlord and sharecropper share equally gross production less harvesting costs, and production costs. Landlord pays land tax.

ANNEX 11
Table 9

INDONESIA

IRRIGATION PROJECT VII

Farm Labor Analysis

Labor Supply

1. Comprehensive, reliable statistics on population and labor force in the tertiary development areas do not yet exist. Using data from local government officials, the 1971 population census, and the 1963 agricultural census, the rural population of the tertiary development area is estimated at around 2 million. This consists of about 220,000 farm families and 110,000 families of landless laborers. The estimated population of North Sadang is 27,000, based on District census data and a recent agricultural survey. The number of families is estimated at 5,400; there is no landless labor. Assuming each family supplies two full-time workers, the total number of farm workers is 10,800 in North Sadang and 440,000 in the tertiary development areas. 220,000 landless laborers would also be available to work in the tertiary development areas. If each worker is available to work 240 days per year, or 20 days a month, the total annual labor supply is 158.4 million man-days in tertiary areas and 2.6 million man-days in North Sadang. The labor supply available each month would thus average 13.2 million man-days in the tertiary development areas and 216,000 man-days in North Sadang.

2. The rural labor force is estimated to be growing at a 1.8% annual rate in tertiary development areas. Continued growth at this rate would mean that a rural labor force of 775,000 would be available at full project development in 1985. This is equivalent to 186 million man-days a year, or 15.5 million man-days a month. The population of North Sadang has declined in recent years, as families have moved to other areas to escape the flooded conditions and seek better employment opportunities elsewhere. It is expected that this decline would cease if the project were implemented and, for the purposes of the analysis, it is assumed that the labor force stabilizes at current levels.

Labor Demand

3. Estimates of average monthly and annual labor requirements per ha for different rice crops at present, and in the future "with" and "without" the project are shown in Annex 11, Tables 3 and 4. The reasons for the expected changes in labor demand are discussed in paragraph 1 (b) of the same annex. Estimates of total monthly and annual labor requirements are given in Tables 1 and 2 of this annex. The present annual requirement in tertiary development areas is around 32.5 million man-days, or only about 20% of the estimated supply. Although the data is admittedly limited, this indicates the current massive underemployment in the area. With full development, the labor required would grow 14%, or 4.5 million man-days, to 37.1 million man-days, still only 20% of the projected labor force. Thus,

even with the project, no progress can be claimed in reducing the rural unemployment. However, without the project, the situation would be worse, with only 18% of the labor available being utilized.

4. In North Sadang, present labor requirements are estimated at around 1.5 million man-days annually, and the labor utilization rate is 44%. With the project, labor requirements would grow 65% to 1.9 million man-days or 75% of the available labor.

5. The demand for labor in both project areas has a pronounced seasonal pattern, with peak season requirements in tertiary areas being some eight times those of lower demand months. In peak months, only 28% of the available labor is utilized in tertiary areas; however, in North Sadang, labor demand in the peak month (March) actually exceeds available supply by almost 15%. With the project, potential demand will exceed supply in at least three months of the year, and approximate full employment in several others. The likely result will be a reduction in the number of the local population migrating to the timber concessions in East Kalimantan for work in the off season, an increase in the number of days worked by family members and an in-migration of transient labor to North Sadang in periods of peak demand, growth in the permanent population of the area, and/or increased mechanization. Given these probable occurrences, it is expected that there will be sufficient labor available in the project area to meet demand at full production.

Economic Cost of Farm Labor

6. Detailed information on wages actually paid in the project areas is limited. Even if it were available, wages paid probably would not reflect the true cost of labor to the economy, for much of the work is done by unpaid family labor or in exchange for work done by other farmers. Also, in some cases, wage rates may be set by custom rather than market forces, and labor mobility is limited. Therefore, the economic cost of labor can only be roughly approximated. In North Sadang, the peak agricultural wage rate is around Rp 300/day without meals. Because the local supply of labor is insufficient to meet demand during this period, this wage is believed to accurately reflect the wage rate needed to attract labor from other areas. The peak wage varies among the different tertiary areas, ranging from Rp 150 to Rp 500/day (for the most difficult labor), with the average peak rate being around Rp 225/day. However, unemployment is substantial even during this peak season, and it is unlikely that this rate reflects the economic cost of labor. Rather, it may be that social custom and a recognition by employers of the laborers' subsistence needs support wages at this level. Data on non-peak season wages and on wages available from alternative types of employment are also limited; generally, however, these wages are lower than peak season wages, and undoubtedly, the cost of labor to the economy is lower during these periods than during the periods of higher employment.

7. Despite the data limitations, the following analysis attempts to estimate an opportunity cost of labor in the project areas, taking into account generally prevailing rural unemployment and the large seasonal

fluctuation in labor demand. It does not attempt to adjust for intertemporal or interpersonal income distribution effects nor to value leisure. The marginal opportunity cost of farm labor in the project areas can be approximated by S-shaped curves (Charts 15116R and 15114R). The opportunity cost is positive at all levels of labor demand and increases as more farm labor is employed. The increase is slow at high levels of unemployment, but becomes faster as the labor supply becomes fully used. At full employment in the project areas, the opportunity cost is assumed to be equal to the market wage. As labor demand increases beyond this level, the opportunity cost continues to rise until it is some 10% to 15% above the prevailing full employment wage. At this level, it remains constant for subsequent demand increases, indicating that wages of this level would attract large numbers of farm laborers from other areas.

8. Three straight-line segments can reasonably approximately each S-shaped curve and three points determine the curves' position. Point A on each chart represents the minimum opportunity cost of farm labor and includes the economic value of alternative employment (casual non-farm labor, fishing, house repairs), plus the value of additional food required because of the more strenuous farm work with the project. The mission estimates this opportunity cost at Rp 120 per man-day for North Sadang and Rp 100 per man-day in the tertiary development areas. Point B indicates where the opportunity cost equals the market wage and rural labor is fully employed. The point is at Rp 260 per man-day for North Sadang and Rp 210 per man-day for tertiary development areas. Point C indicates the point at which the wage rate is sufficiently high that laborers are attracted to meet any increases in demand, thus, to the right of this point, the opportunity cost and market wage remain constant. For North Sadang, this wage is estimated at Rp 300 per day; for tertiary areas, Rp 230 per day.

9. The monthly marginal opportunity cost may be read directly from the curve at the corresponding level of labor demand. With the project, the opportunity costs vary from Rp 121 per man-day to Rp 300 per man-day in North Sadang, and from Rp 101 per man-day to Rp 106 per man-day in tertiary development areas. The total economic cost of labor is the area under the curve at each level of employment. The economic cost of labor in 1985 without the project and with full project development is calculated for each project area in Tables 3 and 4. These tables can be summarized as follows:

	Future Without Project	Future With Project	Incremental Costs
	(Rp M)		
Tertiary areas	3,492	3,796	304
North Sadang	167	299	132

These are equivalent to pricing the incremental employment at a shadow wage rate of Rp 105 per man-day in tertiary areas, and Rp 185 per man-day in North Sadang.

INDONESIA

IRRIGATION PROJECT VII

Total Monthly Labor Requirements ('000 Mandays) 1/

Tertiary Development Areas

	Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present														
Wet Season														
Rainfed	5,000	160	150	35	105	100	80					70	150	850
Irrigated Local Variety	20,000	740	700	200	500	500	400					320	640	4,000
Irrigated HYV	75,000	3,150	3,000	2,700	2,625	1,950						1,275	2,550	17,250
Dry Season														
Irrigated HYV	45,000				405	1,260	2,565	1,710	1,530	2,250	630			10,350
Total		4,050	3,850	2,935	3,635	3,810	3,045	1,710	1,530	2,250	630	1,665	3,340	32,450
Future Without Project														
Wet Season														
Irrigated Local Variety	20,000	760	720	220	560	560	420					320	640	4,200
Irrigated HYV	80,000	3,520	3,360	2,960	2,960	2,240						1,360	2,800	19,200
Dry Season														
Irrigated HYV	45,000				405	1,260	2,655	1,800	1,665	2,340	675			10,800
Total		4,280	4,080	3,180	3,925	4,060	3,075	1,800	1,665	2,340	675	1,680	3,440	34,200
Future With Project														
Wet Season														
Irrigated Local Variety	15,000	570	540	180	465	450	360					240	495	3,300
Irrigated HYV	85,000	3,910	3,740	3,655	3,570	2,720						1,445	3,060	22,100
Dry Season														
Irrigated HYV	45,000				450	1,305	2,745	1,845	1,890	2,655	810			11,700
Total		4,480	4,280	3,835	4,485	4,475	3,105	1,845	1,890	2,655	810	1,685	3,555	37,100

1/ Data from Annex 11, Table 3. Totals may not add due to rounding.

ANNEX 12
Table 1

INDONESIA

IRRIGATION PROJECT VII

Total Monthly Labor Requirements ('000 Man-days) 1/

North Sadang

	Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Present														
Wet Season														
Rainfed	3,150		35	142	98	60	44	69						447
Irrigated	1,950		23	96	72	49	37	57						333
Dry Season														
Rainfed	250	1	7	1					1	14	6	5	2	36
Irrigated	1,950	10	66	8					10	121	49	55	20	337
Total		11	131	247	170	109	81	126	11	135	55	60	72	1,153
Future Without Project														
Wet Season														
Rainfed	3,150		38	145	104	60	47	76						469
Irrigated	1,950		23	98	80	51	39	60						351
Dry Season														
Rainfed	250	1	7	1					1	15	6	5	2	37
Irrigated	1,950	12	68	8					10	127	51	59	21	355
Total		13	136	252	184	111	86	136	11	142	57	64	23	1,212
Future With Project														
Wet Season														
Irrigated	5,800		29	162	284	203	133	203						1,015
Dry Season														
Irrigated	5,200	31	208	26					16	250	120	192	68	910
Total		31	237	188	284	203	133	203	16	250	120	192	68	1,925

1/ Data from Annex 11, Table 4. Totals may not add due to rounding.

ANNEX 12
Table 2

INDONESIA

IRRIGATION PROJECT VII

Economic Cost of Farm Labor At Full Project Development

Tertiary Development Area

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Labor Requirement ('000 man-days)	W 1/	4,480	4,280	3,835	4,485	4,475	3,105	1,845	1,890	2,655	810	1,685	3,555	37,100
	$\bar{W}$ 2/	4,280	4,080	3,180	3,925	4,060	3,075	1,800	1,665	2,340	675	1,680	3,440	34,200
Marginal Opportunity Cost (Rp/man-day)	W	106	106	105	106	106	104	102	102	103	101	102	105	
	$\bar{W}$	106	105	104	105	105	104	102	102	103	101	102	104	
Economic Cost of Farm Labor (Rp million)	W	461	441	393	462	461	317	186	191	269	81	170	364	3,796
	$\bar{W}$	441	418	324	402	416	314	182	168	238	68	170	351	3,492
Incremental Economic Cost of Farm Labor (Rp million)	W-$\bar{W}$	20	23	69	60	45	3	4	23	31	13	0	13	304

1/ W = Future with project.

2/ $\bar{W}$ = Future without project.

ANNEX 12
Table 3

INDONESIA

IRRIGATION PROJECT VII

Economic Cost of Farm Labor at Full Project Cost

North Sadang

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Labor Requirement	W 1/	31	237	188	284	203	133	203	16	250	120	192	68	1,925
('000 man-days)	$\bar{W}$ 2/	13	136	252	184	111	86	136	11	142	57	64	23	1,212
Marginal Opportunity Cost	W	122	285	225	300	244	156	244	121	300	139	229	124	
(Rp/man-day)	$\bar{W}$	121	159	300	219	127	124	159	121	166	123	123	122	
Economic Cost of Farm Labor	W	3.8	39.7	27.2	53.6	30.8	16.7	30.8	1.9	43.4	14.8	28.1	8.3	299.1
(Rp million)	$\bar{W}$	1.6	17.2	44.0	26.3	13.6	10.5	17.2	1.3	18.2	6.9	7.8	2.8	167.4
Incremental Economic Cost of Farm Labor (Rp Million)	$W-\bar{W}$	2.2	22.5	-16.8	27.3	17.2	6.2	13.6	.6	25.2	7.9	20.3	5.5	131.7

1/ W = Future with project.

2/ $\bar{W}$ = Future without project.

ANNEX 12
Table 4

INDONESIA

IRRIGATION PROJECT VII

Economic Analysis

Benefits

1. Expected paddy yields are shown in Annex 2. Annex 10 explains expected prices as derived from Bank forecasts, Annex 11 details production costs, and Annex 12 labor requirements. Tables 1, 2, and 3 of this Annex show the net value of production of the project areas at present, and in the future without and with the project, before costing labor. The value of production at full development is compared with the value of production without the project in Table 4 to determine the incremental value of the project at full development.

Investment Costs

2. Investment costs were calculated in mid-1976 prices. Total investments costs included in the analysis were $28.2 million for the tertiary development areas and $10.0 million for North Sadang. These costs are as explained in Annex 6, and include price contingencies but not inflation. Annual O & M costs of the North Sadang system are expected to average around Rp 5,500/ha at full development, while maintenance costs for the tertiary and quaternary systems in tertiary development areas are estimated at Rp 750/ha per season, or Rp 1,500/ha a year.

Development Period

3. Tertiary development areas: Under the project's implementation schedule, 6% of the project area will be improved in 1977, 33% by 1978, 70% by 1979, and 100% by 1980. Benefits from an area will commence one year after tertiaries are constructed, and the maximum projected yields should be achieved by 1985, nine years after construction commences.

4. North Sadang. Primary and secondary works are scheduled to be completed by 1979; the full system including tertiaries is expected to be finished by the following year. In the analysis, it was assumed that increased yields would not commence until the system is linked with Bentang barrage in 1979; however, some increases may occur sooner as roads and drainage are improved and support services begin to flow into the area in anticipation of the project. Crops are assumed to achieve the maximum projected yields by 1985.

Economic Rate of Return

5. Using the foregoing assumptions and discounting project benefits and costs over a 30-year period, the economic rate of return is 20% for North Sadang and 33% for the tertiary development component (Table 5). The economic rate of return on all project components combined would be about 30%. Feasibility studies reviewed by the mission during appraisal show that the economic rate of return from the development of the Kedungombo damsite for irrigated paddy production would be 16%.

Sensitivity Analysis

6. Several of the basic assumptions made in the economic analysis have been varied in order to examine their impact on the rate of return. These factors were chosen to test the project's sensitivity to delays in the realization of benefits, cost overruns, failure to achieve projected yields, increases in the price of rice, and a higher than projected opportunity cost of farm labor. Some of these tests and the resulting economic rates of return are summarized below:

	North Sadang	Tertiary Development
Two-year delay in the realization of benefits	16%	23%
Construction costs overrun estimates by 20%	18%	28%
Construction costs overrun 25%, and benefits are delayed two years	14%	20%
Yields fall below projected levels by 25%	14%	23%
Yields fall below projected levels by 25%, and benefits are delayed two years	12%	17%
Farmgate paddy price increases 25%	26%	42%
Farm labor valued at market wages	19%	30%
Project benefits cease after 20 years	19%	33%

7. As the figures indicate, the rates of return are most sensitive to delays in the realization of benefits. Lower than expected yields also affected the rates fairly significantly, while increases in construction and labor costs or a decrease in the period over which benefits are received have relatively little effect. Therefore, government authorities must insure that construction delays are minimal and that the farmers receive the necessary agricultural inputs and extension assistance.

INDONESIA

IRRIGATION PROJECT VII

Value of Present Production

	Cropped Area (ha)	Yield (ton/ha)	Production (tons)	Farm Gate Price (Rp/ton)	Gross Value of Production (Rp million)	Production Costs (Rp/ha)	Gross Costs of Production (Rp million)	Net Value of Production (Rp million)
Tertiary Development Areas								
Wet Season								
Rainfed paddy	5,000	1.5	7,500	73,700	553	21,300	102	446
Local variety paddy	20,000	1.8	36,000	73,700	2,653	33,757	675	1,978
HYV paddy	75,000	3.2	240,000	73,700	17,688	44,900	3,368	14,320
Dry Season								
HYV paddy	45,000	3.0	135,000	73,700	9,950	44,400	1,998	7,592
Total	145,000		418,500		30,844		6,148	24,696
North Sadang								
Wet Season								
Rainfed paddy 1/	3,150	1.8	5,670	70,400	399	39,830	125	274
Irrigated paddy	1,950	2.0	3,900	70,400	275	44,010	86	189
Dry Season								
Rainfed paddy 1/	250	1.5	375	70,400	26	37,700	9	17
Irrigated paddy	1,950	1.8	3,510	70,400	247	42,630	83	164
Total	7,300		13,455		947		303	644

1/ Palawija crops (275 ha wet season and 250 ha dry season) included as rainfed rice for analytical purposes.

ANNEX 13
Table 1

INDONESIA

IRRIGATION PROJECT VII

Value of Future Production without Project

	Cropped Area (ha)	Yield (tons/ha)	Production (tons)	Farm Gate Price (Rp/ton)	Gross Value of Production (Rp M)	Production Costs (Rp/ha)	Gross Costs of Production (Rp M)	Net Value of Production (Rp M)
Tertiary Development Areas								
Wet Season								
Local variety paddy	20,000	2.1	42,000	65,000	2,730	36,300	726	2,004
HYV paddy	80,000	3.8	304,000	65,000	19,760	50,400	4,032	15,728
Dry Season								
HYV paddy	45,000	3.8	171,000	65,000	11,115	50,400	2,268	8,847
Total	145,000		517,000		33,605		7,026	26,579
North Sadang								
Wet Season								
Rainfed paddy 1/	3,150	1.9	5,985	62,100	372	38,800	122	250
Irrigated paddy	1,950	2.2	4,290	62,100	266	42,400	83	183
Dry Season								
Rainfed paddy 1/	250	1.6	400	62,100	25	36,900	9	16
Irrigated paddy	1,950	2.0	3,900	62,100	242	41,150	80	162
Total	7,300		14,575		905		294	611

1/ Palawija crops (275 ha wet season and 250 ha dry season) included as rainfed rice for analytical purposes.

ANNEX 13
Table 2

INDONESIA

IRRIGATION PROJECT VII

Value of Future Production with Project

	Cropped Area (ha)	Yield (tons/ha)	Production (tons)	Farm Gate Price (Rp/ton)	Gross Value of Production (Rp M)	Production Costs (Rp/ha)	Gross Costs of Production (Rp M)	Net Value of Production (Rp M)
Tertiary Development Areas								
Wet Season								
Local variety paddy	15,000	2.3	34,500	65,000	2,243	43,000 1/	645	1,598
HYV paddy	85,000	4.5	382,500	65,000	24,863	59,700 1/	5,075	19,788
Dry Season								
HYV paddy	45,000	4.5	202,500	65,000	13,163	59,700 1/	2,687	10,476
Total	145,000		619,500		40,269		8,407	31,862
North Sadang								
Wet Season								
HYV paddy	5,800	3.8	22,040	62,100	1,369	69,800 2/	405	964
Dry Season								
HYV paddy	5,200	3.8	19,760	62,100	1,227	69,800 2/	363	864
Total	11,000		41,800		2,596		768	1,828

1/ Excluding funds for tertiary maintenance.

2/ Excluding funds for operation & maintenance.

ANNEX 13
Table 3

INDONESIA

IRRIGATION PROJECT VII

Incremental Value of Production

(Rp Million)

	Tertiary Development Areas		North Sadang	
	Future without Project	Future with Project	Future without Project	Future with Project
Total Net Value of Production before Costing Labor	26,579	31,862	611	1,828
Less Imputed Labor Cost 1/	3,492	3,796	18	38
Total Net Value of Production	23,087	28,066	593	1,790
Net Incremental Value of Production at Full Project Development		4,979		1,197

1/ To avoid double counting the figures for North Sadang, exclude the cost of hired labor for cultivation and harvesting included in the costs of production.

ANNEX 13
Table 4

INDONESIA

IRRIGATION PROJECT VII

Economic Costs And Benefits
(US$ '000)

Project Component	Year	Project Cost			Incremental Project Benefits
		Capital	O & M	Total	
Tertiary Development Area	0(1976)	3,635	25	3,660	0
	1(1977)	10,045	110	10,155	675
	2(1978)	9,010	230	9,240	3,410
	3(1979)	5,535	325	5,860	5,930
	4(1980)		360	360	9,675
	5(1981)		360	360	11,300
	6(1982)		360	360	11,550
	7(1983)		360	360	11,750
	8(1984)		360	360	11,900
	9-29(1985-2005)		300	300	11,998
				Economic Rate of Return = 33%	
North Sadang	0(1976)	1,220	5	1,225	0
	1(1977)	3,185	20	3,205	0
	2(1978)	2,975	45	3,020	0
	3(1979)	2,630	65	2,695	1,177
	4(1980)		77	77	1,752
	5(1981)		77	77	2,139
	6(1982)		77	77	2,515
	7(1983)		77	77	2,727
	8(1984)		77	77	2,827
	9-29(1985-2005)		77	77	2,884
				Economic Rate of Return = 20%	

ANNEX 13
Table 5

INDONESIA

IRRIGATION PROJECT VII

Cost and Rent Recovery

1. The cost of the tertiary system amounts to US$330/ha. Out of this total, GOI would contribute US$250/ha and farmers US$80/ha in the form of labor at reduced wages and donation of land. There would be no increase in the O & M cost of the main system as a result of the project but maintenance expenditures on the tertiary system would amount to US$7/ha (Rp 2,900/ha). These costs would be borne by the farmers (para 5.08). In addition, as a result of increased rice production following completion of the tertiary system, IPEDA rates in the project area would be raised by about US$4/ha (Rp 1,600/ha) over what they would have been without the project. When discounting these costs and payments by the farmers at a 10% discount rate over a period of 30 years, the cost recovery index would be 49%.

2. A further analysis of cost recovery was carried out, taking into account past investments in rehabilitating the main irrigation system. These costs, expressed in mid-1976 unit prices, amount to approximately US$300/ha. Incremental O & M costs as a result of these works are US$4/ha (Rp 1,600/ha) while incremental IPEDA rates would be US$7/ha (Rp 3,000/ha). Assuming that rehabilitation of the main system is completed in year one and that construction of the tertiary system is completed in year four, and discounting the costs and payments associated with both systems at 10% over 30 years, the cost recovery index would be 31%.

3. For the North Sadang Project, construction costs, including the tertiary system, amount to US$1,700/ha, while incremental O & M costs would amount to US$15/ha (Rp 6,100/ha) for the main and tertiary systems. Farmers' contributions would amount to US$80/ha for construction of the tertiary system (para 1), US$7/ha (Rp 2,900/ha) for maintenance of the tertiary systems and US$16/ha (Rp 6,500/ha) in incremental IPEDA payments. When discounting these costs and payments by the farmers at a 10% discount rate over a period of 30 years, the cost recovery index would be 13%.

4. Rent recovery indices were estimated for representative farm models in the tertiary and North Sadang areas. The assumptions made in carrying out this analysis are presented in Table 1. Since many of the assumptions made in deriving this index are subjective, the results are no more than a rough indication of the farmers' ability to pay project charges.

5. Incomes at full development for four different model farms (Annex 13) were compared with the Critical Consumption Level (CCL) for rural Indonesia, which is estimated at US$88 per capita in mid-1976 prices. With an average family size of six, the CCL per household is approximately US$530 (Rp 239,000).

Even after making allowances for some off-farm income (paras 3.06 and 3.07), the income of nearly 90% of the households benefiting from the project would still be below the CCL at full development. Considering the imprecise nature of the data, the fact that only 10% of project beneficiaries would be in a position to pay somewhat higher project charges, and the administrative and political difficulties of introducing a special tax to capture the relatively small surplus income of this group, an increase in the level of the prevailing project charges would be inappropriate.

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IRRIGATION PROJECT VII

Rent Recovery
(Rp '000)

	Tertiary Development				North Sadang			
	0.3 ha		1.5 ha		1 ha		3 ha	
	Owner-Operator	Share-cropper	Owner-Operator	Share-cropper	Owner-Operator	Share-cropper	Owner-Operator	Share-cropper
Incremental - gross value of incremental farm production	20.1	10.1	101.4	50.7	305.5	152.8	916.5	458.4
- less incremental cash production costs 1/	7.8	3.9	43.5	21.8	90.5	45.3	271.5	135.9
Sub-total	12.3	6.2	57.9	28.9	215.0	107.5	645.0	322.5
- less imputed family labor value 2/	2.0	2.0	2.1	2.1	33.9	33.9	161.4	161.4
- less imputed farmers management 3/	1.0	0.5	5.1	2.5	15.3	7.6	45.9	22.9
- less imputed return on own capital 4/	0.6	0.6	3.0	3.0	2.5	2.5	7.5	7.5
- less allowance for risk/uncertainty 5/	4.0	2.0	20.2	10.1	61.2	30.6	183.6	91.7
- less miscellaneous 6/	3.0	0.5	15.2	2.5	45.8	22.9	137.4	22.9
Rent Surplus	1.7	0.6	12.3	8.7	56.3	10.0	109.2	16.1
Incremental - water charges (O&M)	0.9	0.4	4.4	2.2	2.9	1.5	8.7	4.5
- additional land taxes (IPEDA)	0.4	-	2.0	-	6.5	-	19.5	-
- total direct charges / (10) + (11) /	1.3	0.4	6.4	2.2	9.4	1.5	28.2	4.5
Rent Recovery / (12) ÷ (9) / (%)	76	67	52	25	17	15	26	28

1/ Assumes no depreciation costs.
2/ At market wage rates. Tertiary Development Areas @ 225 Rp/day, North Sadang @ 300 Rp/day.
3/ At 5% of Gross Incremental farm production.
4/ Total Rp 20,000/ha for tertiary area, and Rp 25,000/ha for complete rehabilitation and North Sadang, at 10% annual.
5/ At 20% of Gross Incremental farm production.
6/ At 15% of Gross Incremental farm production, including 10% as taxes for village administration and 5% for storage losses; sharecroppers would not pay any incremental village taxes.

INDONESIA

IRRIGATION PROJECT VII

Feasibility Study for Development of Tidal Swamp Lands

Introduction

1. The Government of Indonesia (GOI) has identified some 5 million ha of tidal swamp lands, mainly in Sumatera and Kalimantan, and constructed pilot tidal reclamation projects totalling some 35,000 ha between 1969 and 1974 (Pelita I). The pilot projects have been used to settle transmigrants from Java and Bali on small holdings mainly for growing paddy. These projects were established at minimum cost, without fixed water control structures in the tidal areas where drainage is effected by a network of canals, which also provide the only means of transport in much of the area. Under Pelita II the Government plans to develop 250,000 ha primarily by force account construction with excavating equipment on hand or to be provided under bilateral agreements. Pelita III beginning in April 1979 calls for developing another 750,000 ha.

2. Having given high priority to development of tidal swamps and to their settlement by transmigrants, GOI has asked for World Bank assistance in preparing a feasibility study for development under Pelita III of a gross area of 200,000 ha (Karang Agung) in South Sumatera province and 100,000 ha (Lagan) in Jambi province adjacent to lands to be developed under Pelita II. Pilot projects developed in the vicinity total about 25,000 ha. The amount of spontaneous development mainly by the Buginese from South Sulawesi is not precisely known, but is several times that developed under the pilot projects. Experience on the pilot projects and the soils surveys carried out to date on other lands in the vicinity have identified potential problems from deep peat soils and underlying acid sulphate soils (catclays). In the case of catclays, water levels would have to be closely managed to prevent their drying out. Deep peat soils may subside considerably during early years through compaction and oxidation and may be better suited to growing crops other than paddy. Additionally, little is known of vertical tidal ranges and salinity intrusion in the many coastal streams and estuaries during low rainfall periods. While initial development aims at single cropping during the rainy season, salinity may be a constraint to growing a second crop during the dry season over parts of the area.

Objectives

3. Making full use of experience from work already done, the feasibility study would prepare a plan, complete with estimated costs, for development of a low cost project for small-holder farmers (2 ha) with minimum civil works to produce a single crop during the rainy season. The study

would inventory a gross area of 300,000 ha, including areas of spontaneous development, prepare a master plan and feasibility study for development of a net area of 100,000 to 150,000 ha, and prepare detailed engineering design suitable for tender or start of force account construction for about 20,000 ha. Specifically the study would:

(a) prepare an inventory of the land and water resources of the gross area;

(b) collect and analyze information from on-going pilot projects and experience of spontaneous settlers;

(c) establish the physical parameters and agronomic and other constraints to development;

(d) delineate areas suitable for growing paddy and for other crops;

(e) determine the minimum services to be provided such as schools, domestic water supply, transport, health services, etc.;

(f) determine the agricultural input and extension services package to be provided to project settlers and to the adjacent spontaneous settlers and how it should be carried out;

(g) assess the technical and economic feasibility of developing the net area (estimated to be one-third to one-half the gross area) and prepare a full feasibility report; and

(h) prepare detailed engineering designs ready for tender or force account construction for about 20,000 ha (10,000 ha in each province).

Implementation

4. The study would be carried out over a 24-month period, from June, 1976 through May, 1978, by P_4S, a special unit of the Directorate of Swamps in the Directorate General for Water Resources Development (DGWRD), with consultant assistance. Several components of the study would be carried out by contract with local consultants, and foreign consultants would be employed to assist P_4S in executing the study, coordinating study inputs and strengthening the Directorate of Swamps by building up their capability in engineering design and preparation of projects for further development of tidal swamp lands. The feasibility report would be completed in May, 1978. An interim report and a master plan for the project would be prepared by October, 1977. It would be reviewed with the Bank prior to preparation of detailed engineering design for those areas to be developed initially (paras 11 and 13). The study components would be carried out as follows:

(a) aerial photography and topographic surveys - by contract with commercial firms;

(b) soils surveys - by contract with the University of Bogor as local consultant;

(c) hydrographic surveys - as part of broader survey and training program under Netherlands bilateral assistance;

(d) agro-economic surveys and settlement studies - the Agro-Economic Surveys of Indonesia (SAE), an inter-ministerial research organization, would carry out the agro-economic surveys by contract and the settlement studies would be carried out by DGWRD with foreign consultant assistance; and

(e) engineering design - by contract with University of Bandung as local consultant.

5. The Netherlands bilateral assistance would build up the capability of the Institute of Hydraulic Engineering (a directorate under the DGWRD) to carry out, among other things, the essential vertical tide and salinity measurements. The study would build up the capability of the University of Bogor to carry out the soil surveys particularly as a part of coordinated planning. More importantly it would build up the capability of the Directorate of Swamps to carry out the planning and engineering design for tidal swamp land development. The work to be done under the study by contract with the University of Bandung should be carried out in Jakarta.

6. Because of the complex nature of tidal swamp development, the fact that the study inputs would be carried out under several separate contracts and the need for close coordination with on-going programs of other government agencies in the project areas, a Steering Committee would be established to coordinate the preparation activities. With the Director General of Water Resources Development as chairman, the committee would be comprised of representatives from the ministries of agriculture, transmigration and forestry; BAPPENAS; and the universities at Bogor and Bandung. The committee would meet at intervals of about six months to check progress of the feasibility study and to coordinate the preparation with the related governmental programs.

Terms of Reference

7. Topographic Surveys. Aerial photography would be carried out to a scale of 1:20,000 from which rectified photomosaics, scale 1:10,000, would be prepared. The necessary horizontal and vertical controls would be established and cross-jungle leveling would be done at 1 km intervals with levels taken at 100 m intervals along each traverse cut through the jungle. Permanent bench marks would be set at 1,000 m intervals to an accuracy of

± 2 cm and temporary pegs set at 100 m intervals to an accuracy of ± 10 cm. These levels would be plotted on the photomosaics as a basis for contour lines and topographic maps to be prepared as needed in engineering design and layout of water control facilities.

8. Soils Surveys. Soils surveys would be carried out along the cross-jungle traverses required for the topographic surveys. To minimize recutting, soils surveys should be conducted immediately after topographic surveys and in no case later than 2 months after the original traverses are cut. Soil samples would be taken at 500 m intervals at the topographic survey pegs or the bench marks, recording the depth of peat and other soil layers and water level below ground surface. Laboratory analyses of samples taken would be limited to pH, conductivity and organic matter to determine the amount and type of organic matter and the presence or absence of potential acid sulphate layers. Where the survey indicates deep peat (one meter or more) or potential acid sulphate soils at less than 50 cm depth, samples should be taken at 250 m intervals. Soil maps would be prepared at a scale of 1:10,000 showing the agriculturally significant soil types and delineating potential problem areas i.e. deep peat and/or acid sulphate soils. Areas where these potential problem soils exceed 30% of the total would be excluded from the project.

9. Hydrographic Surveys. Automatic water level recording stations would be established at a total of 30 locations on the streams and estuaries of the two project areas. These stations would measure vertical tide ranges and water samples would be taken over a 12-month period from September 1976 to establish water level parameters and would be continued thereafter through the 2-year study period. Water samples would be collected and measured for salinity at surface, mid-depth and full depth at appropriate time intervals to establish the saline tidal zone.

10. Agro-Economic Surveys and Settlement Studies. The standard agro-economic surveys conducted would identify present farmer income in the area, marketing and production costs, agricultural practices and constraints to increasing production. Questionnaires would be designed for transmigrant farmers on the pilot projects and for spontaneous settlers in the study areas. Two surveys would be made, one in the rainy season and one in the dry season on about 250 farms in each of the two provinces (Jambi and South Sumatera) and further divided as appropriate to cover both transmigrants and spontaneous settlers. Agronomic information would be collected and analyzed from the two operating test farms (Puding and Upang). Settlement studies covering community development aspects (transportation, schools and health facilities, etc.) and how to provide domestic water would be carried out over a 12-month period at 4 test centers of about 100 ha each. These test centers would be established on existing transmigrant pilot projects in the two study areas to determine the minimum services to be provided transmigrants and to test several water control regimes (para 11).

11. Planning and Design. The physical data of paras 7-10 would be interpreted and a development plan would be prepared for the net area. This would include construction and testing of alternative minimum water control

systems on the 100 ha test centers (para 10) and their manipulation to dispose of excess rainfall and maintain tidal inflow at desired levels. From the soils, topographic and hydrographic data, areas suitable for development would be delineated and an engineering plan would be tailored for the particular water regimes; water control systems would be designed and cost estimates prepared for the total net area. The plan would provide water control for a single crop during the rainy season on 2-ha size farms, but would recognize in project layout that a later stage would provide water for a second crop in the dry season where possible. Detailed engineering designs and specifications would be prepared ready for tender or force account construction for some 20,000 ha (10,000 ha in each province) covering those portions of the study area best suited for initial development.

Consultants Services

12. The DGWRD would select a consulting firm to assist them with directing and coordinating the study components and in preparing the development plan and the feasibility report suitable for financing decision. These services are expected to amount to 100 man months of foreign consultant time. Additionally, about 435 man months of local consultants services would be utilized in the contracts for study components. Table 1 presents the breakdown of consultants services by specialists and man months.

13. A major objective of the study is to build up GOI capability in conducting a feasibility study for tidal swamp land development, and detailed terms of reference for foreign consultants would stress training of GOI counterparts in the required specialities. The consultants would assist DGWRD in monitoring and directing the work of local consultants in soils surveys, topographic mapping and agro-economic surveys; in interpreting data; in designing water control systems; in preparing a project development plan; and in preparing the detailed engineering designs and the feasibility study. The interim report and master plan for development would be reviewed with the Bank before proceeding with the detailed engineering designs. Among other things, the consultants would review what crops other than rice could be grown; determine the required level of agricultural supporting services; recommend minimum infrastructure to be provided, specifically as regards tranportation, schools, health and domestic water supply; and review settlement schedules, the role of the Directorate General of Transmigration and when the project should be turned over to normal government apparatus.

Costs and Financing

14. The study is expected to cost US$6.7 million including the US$3.0 million hydrographic survey assistance to be carried out by the Netherlands government. The remaining US$3.7 million (foreign exchange US$1.5 million) is included in the total costs of Annex 6 and a breakdown of study component costs is shown in Table 2 of this annex.

INDONESIA

IRRIGATION PROJECT VII

Tidal Swamp Lands Development
Consultants Services for Feasibility Study

Foreign Consultants	Man-Months
Co-study leader	23
Topographer	6
Soil scientist	10
Agronomist	9
Agro-economist	6
Domestic water supply specialist	3
Settlement specialist	6
Senior design engineer	10
Design engineer	6
Plant engineer	9
Unallocated	12
Sub-Total	100
Local Consultants	
Soil surveys	180
Agro-economic surveys	35
Planning & engineering design	220
Sub-Total	435
Total[1/]	535

1/ Presented for estimating purposes, composition of teams and man-months to be determined by GOI and consulting firms.

INDONESIA

IRRIGATION PROJECT VII

Tidal Swamp Lands Development
Feasibility Study Costs

Component	Total Cost 4/ (US$ '000)	Foreign Exchange (US$ '000)
1. Topographic surveys	330	70
2. Soil surveys	1,200	340
3. Agro-economic surveys	150	20
4. Planning & engineering design	870	250
5. Settlement studies 1/	60	10
6. Foreign consultant services 2/	1,090	810
Total (exclusive of hydrographic surveys)	3,700	1,500
Hydrographic surveys 3/	(3,000)	(2,400)

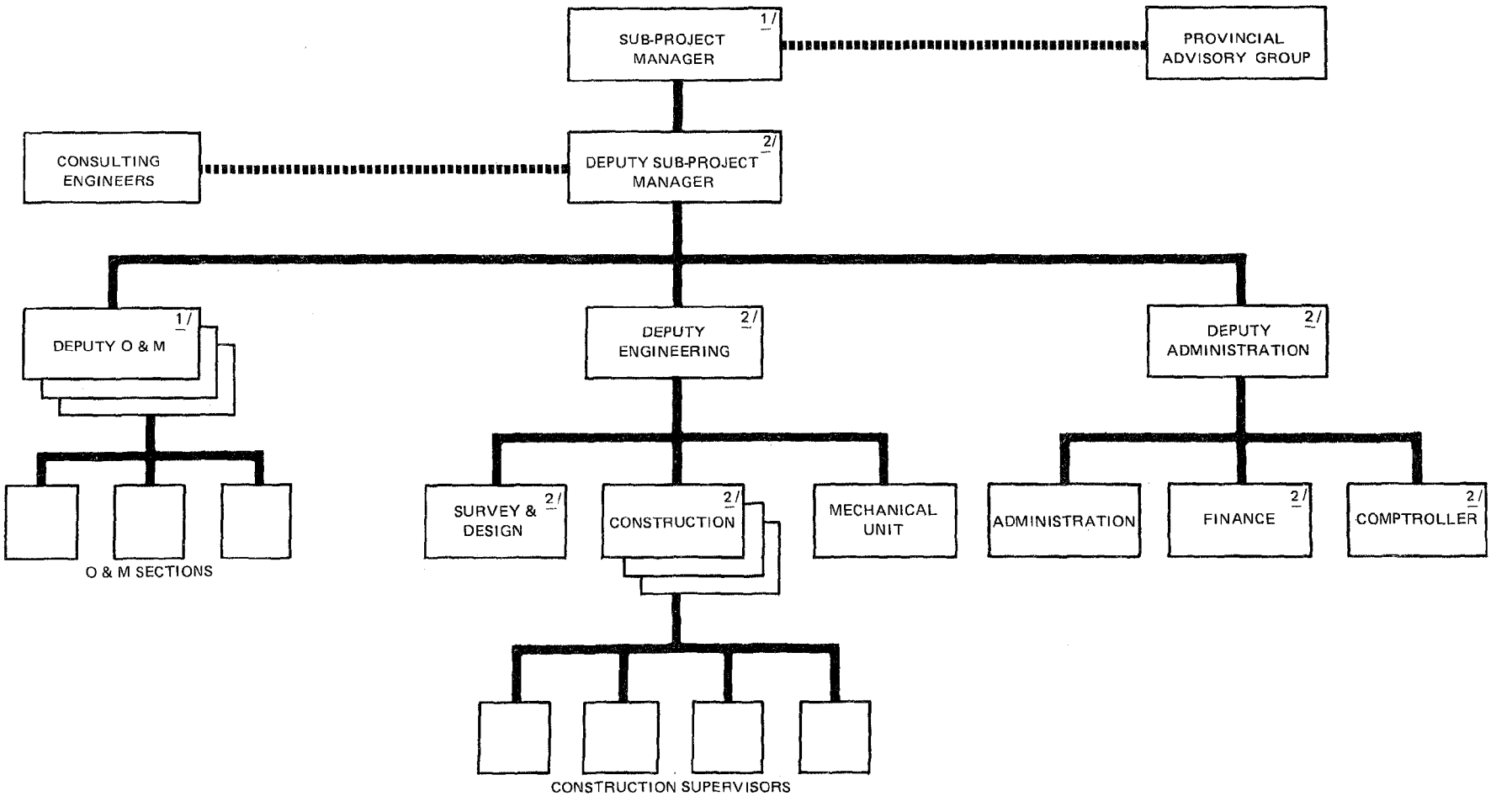
1/ To be carried out by foreign consultants.

2/ Includes foreign consultant costs only and US$250,000 of specialized equipment to be purchased by the consultant. Local consultant costs are included under items 2, 3 and 4 (see Table 1).

3/ Broader in scope and longer time (36 months) than the feasibility study and includes training component.

4/ Cost estimates are based on US$6,500/man-month for foreign consultants and US$1,000 to US$1,200/man-month for local consultants.

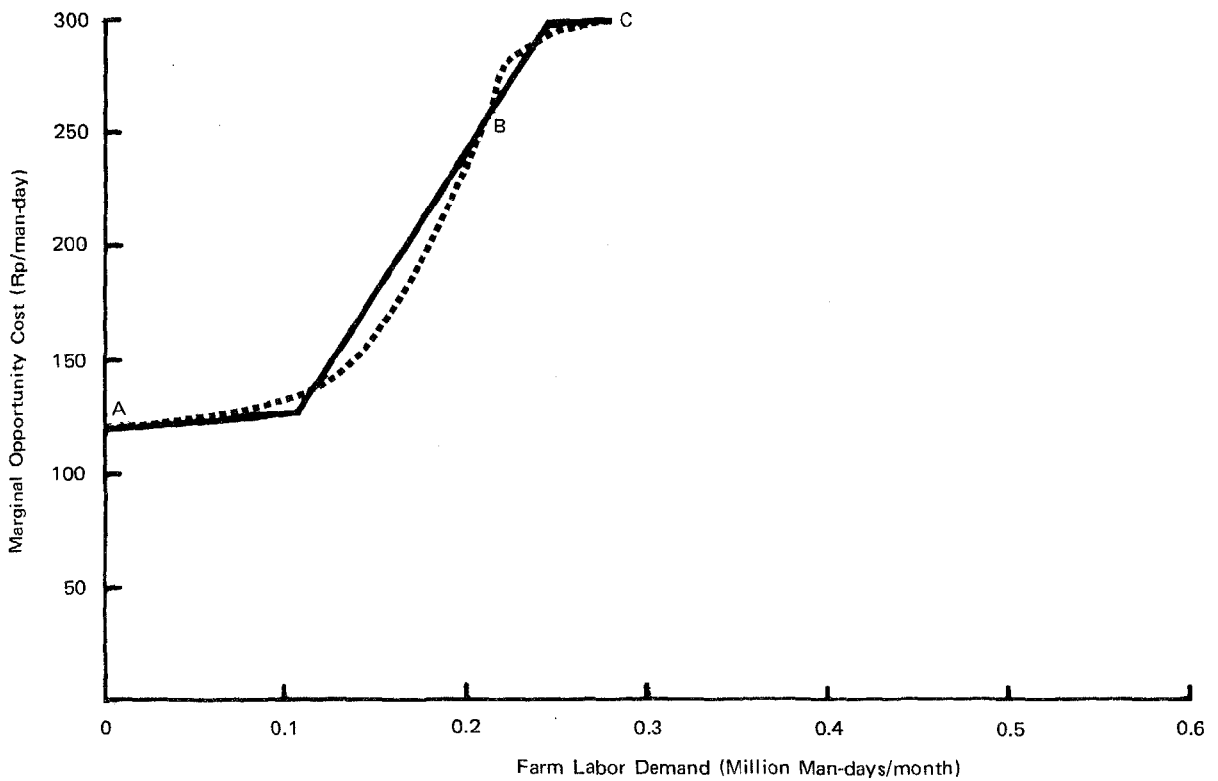
INDONESIA
IRRIGATION PROJECT VII
PROSIDA SUB-PROJECT ORGANIZATION
FOR TERTIARY DEVELOPMENT AND SADANG (NORTH SADANG)



1/ PROVINCIAL STAFF
2/ PROSIDA STAFF

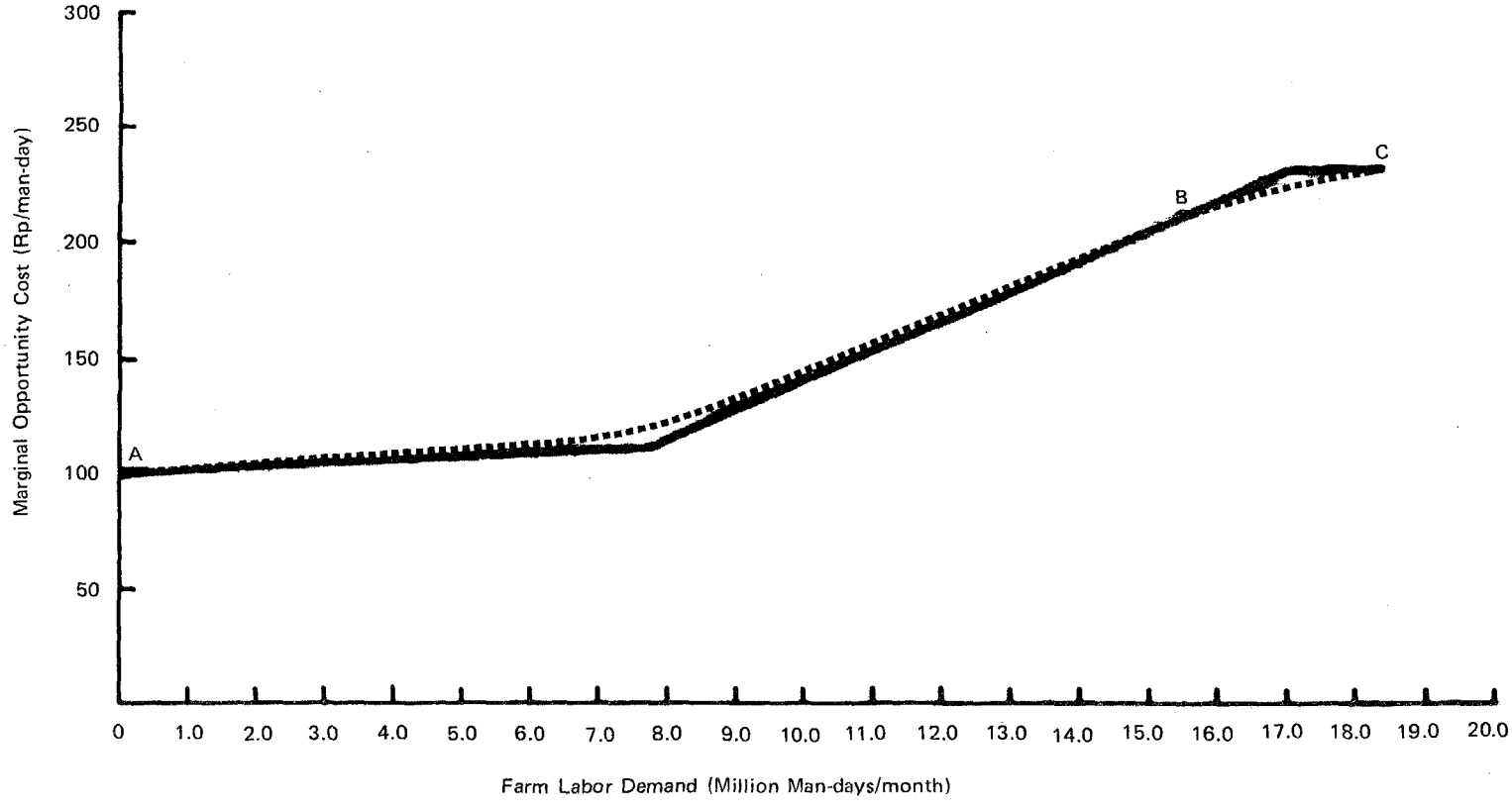
World Bank–8964

INDONESIA
IRRIGATION PROJECT VII
ESTIMATED OPPORTUNITY COST CURVE FOR FARM LABOR
NORTH SADANG



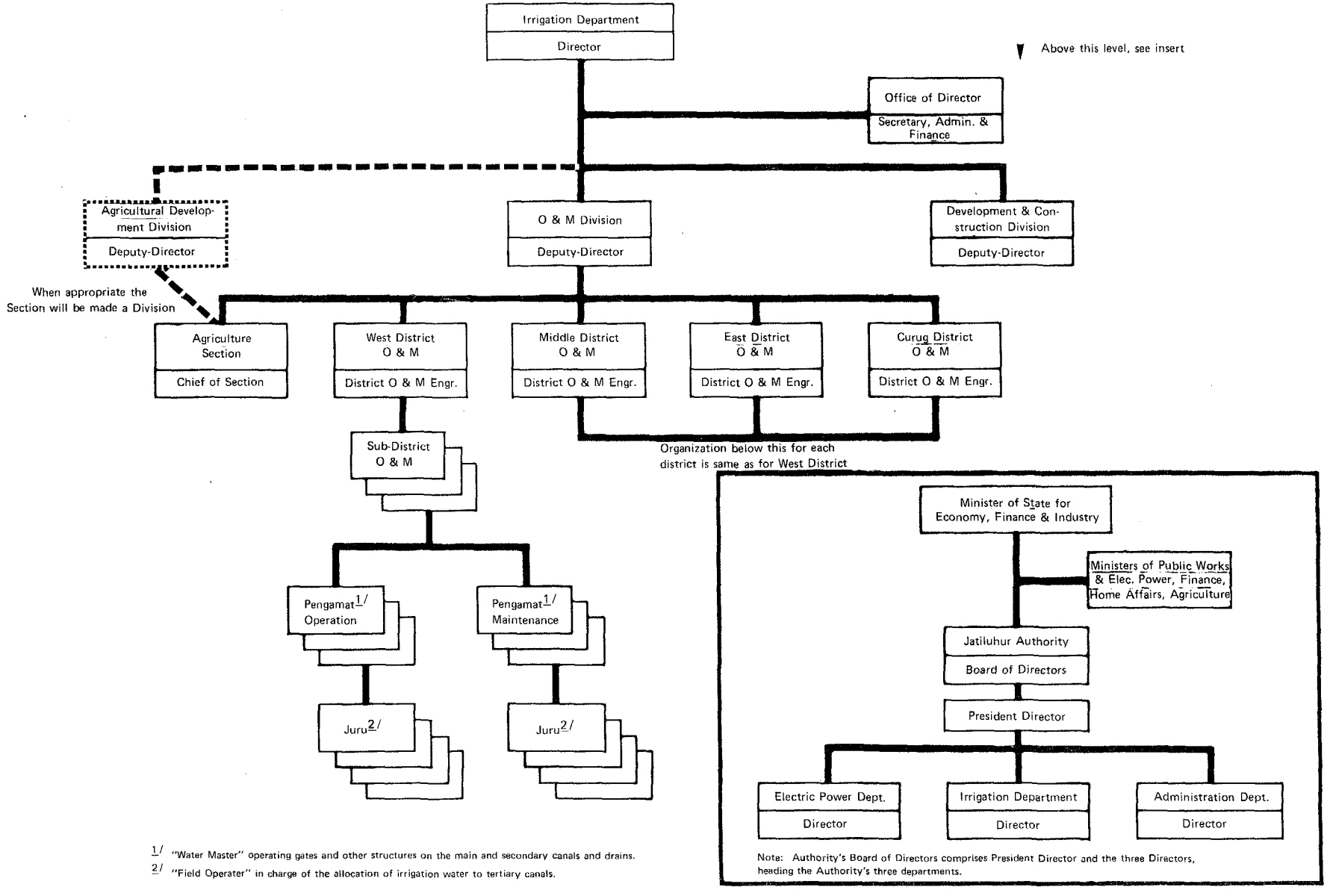
World Bank--15114(R)

INDONESIA
IRRIGATION PROJECT VII
ESTIMATED OPPORTUNITY COST FOR FARM LABOR
TERTIARY DEVELOPMENT



World Bank—15116(R)

INDONESIA
IRRIGATION PROJECT VII
O & M ORGANIZATION (IRRIGATION) OF JATILUHUR AUTHORITY

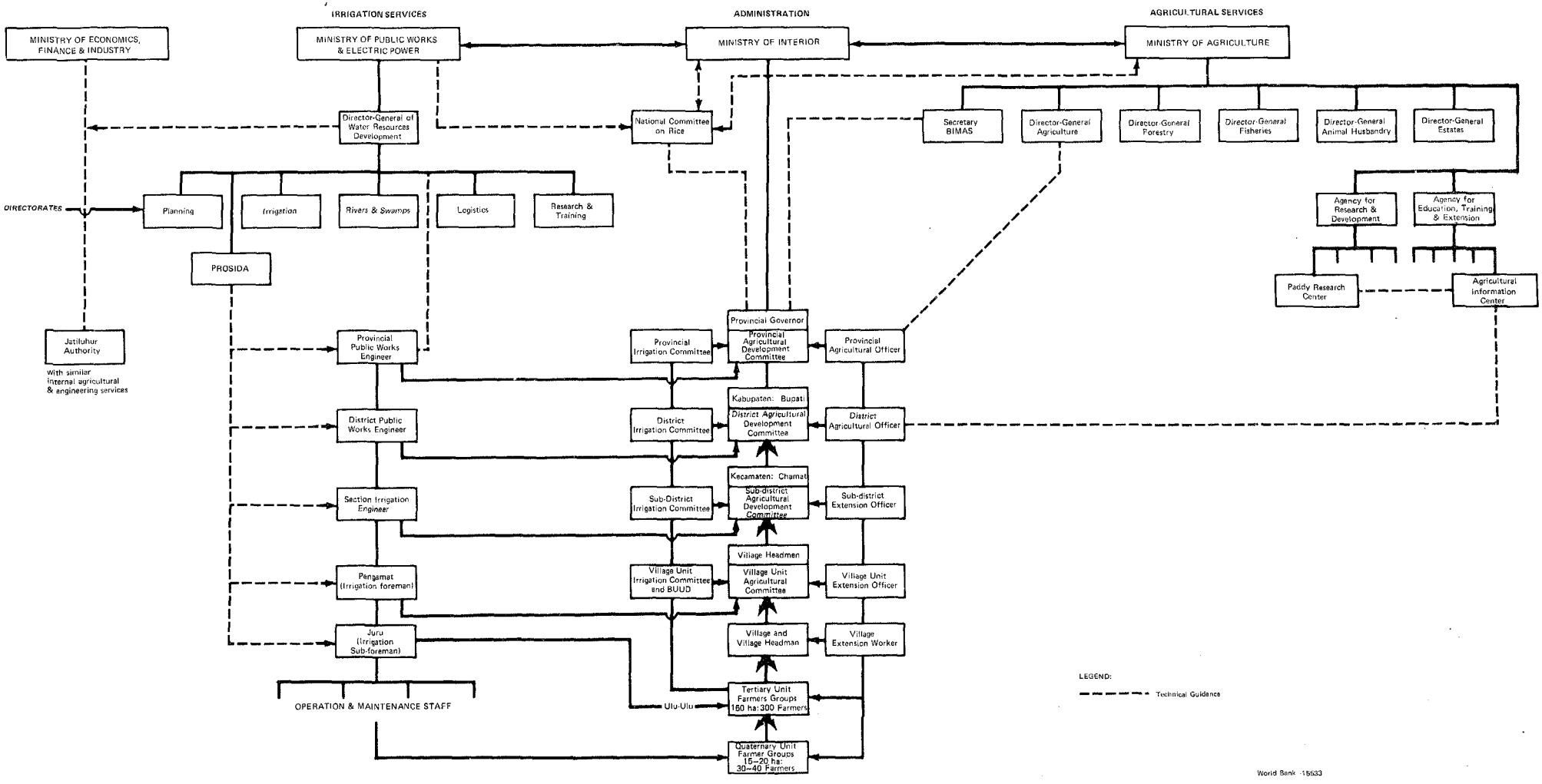


1/ "Water Master" operating gates and other structures on the main and secondary canals and drains.

2/ "Field Operater" in charge of the allocation of irrigation water to tertiary canals.

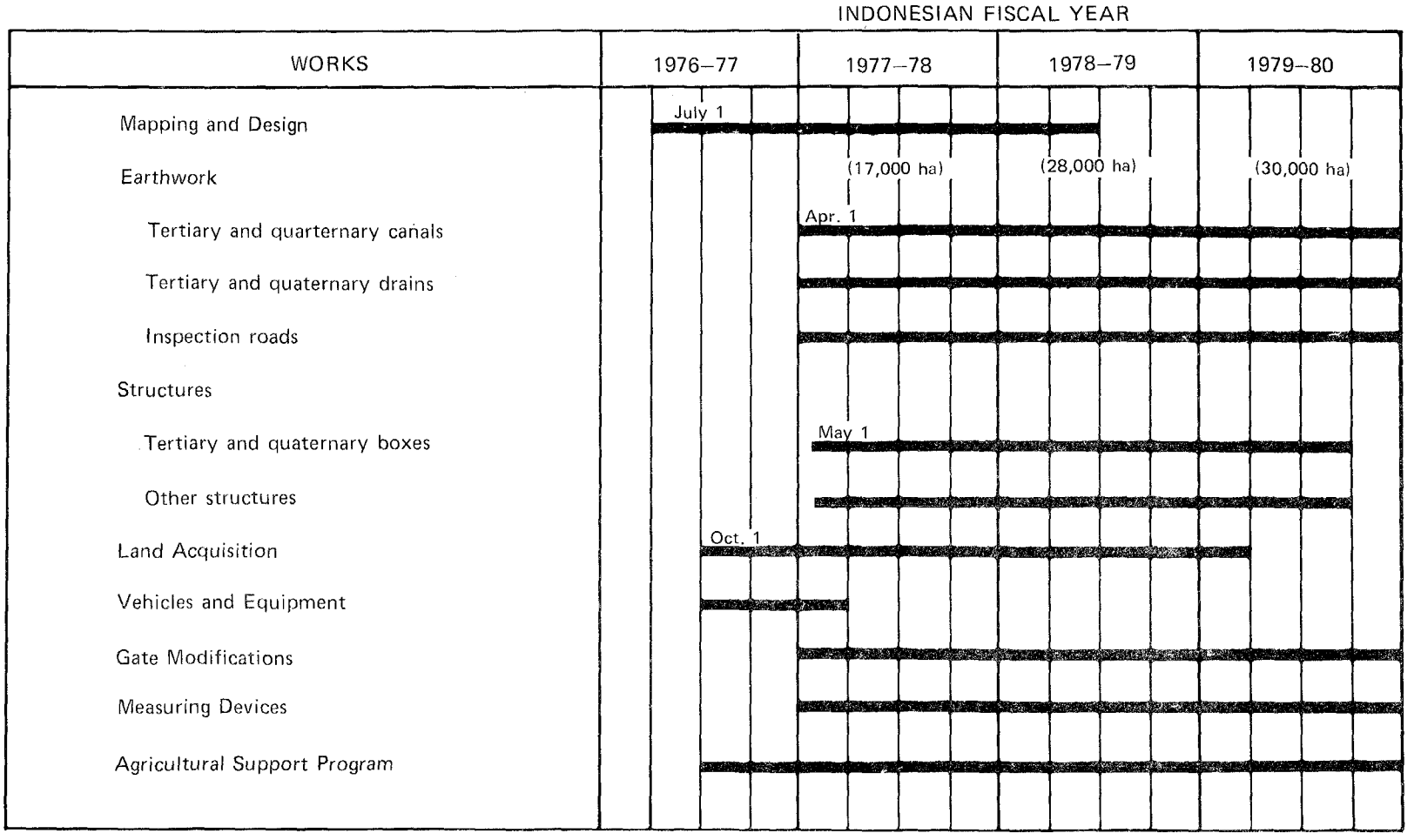
World Bank—15530

INDONESIA
IRRIGATION PROJECT VII
ORGANIZATION OF SERVICES FOR IRRIGATED AGRICULTURE



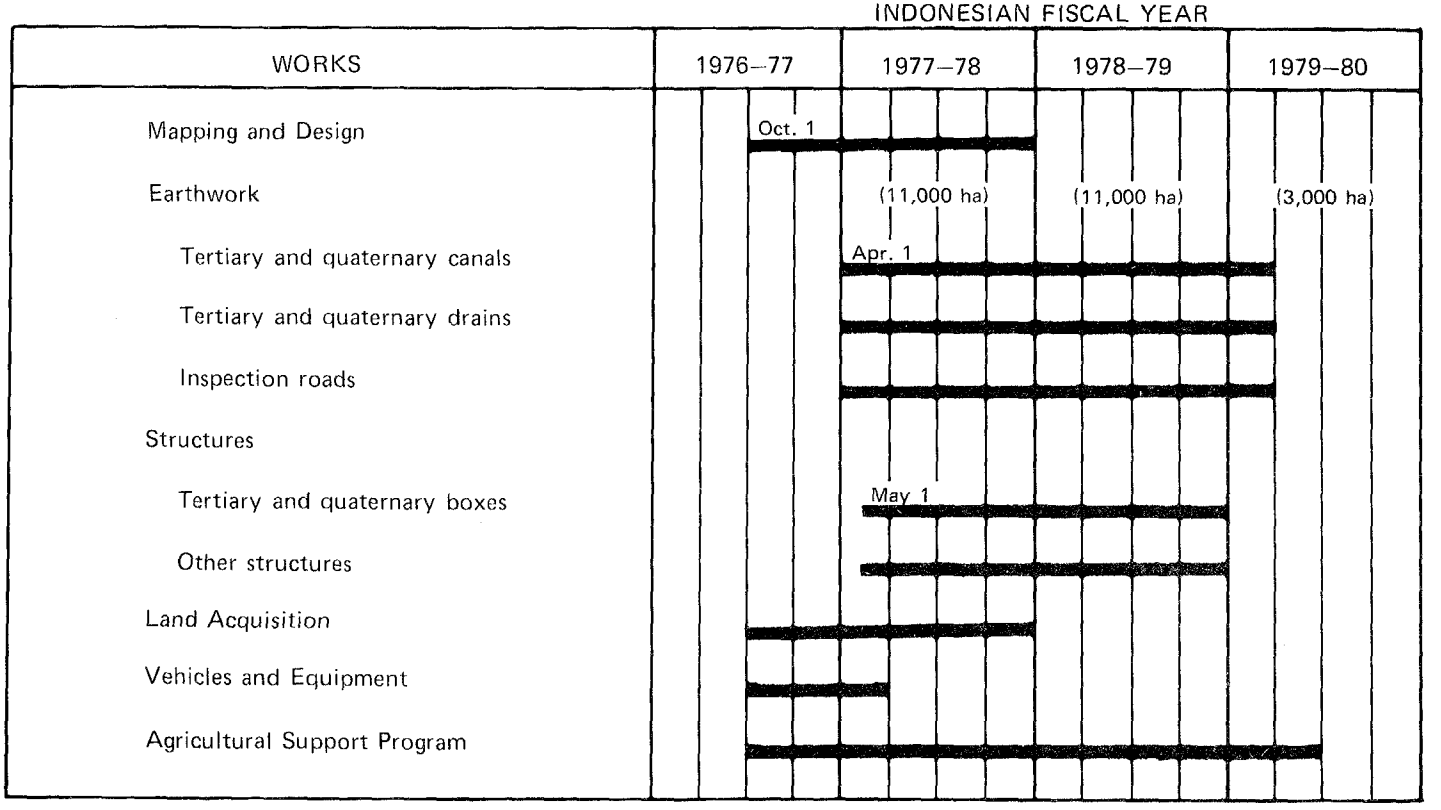
World Bank -15533

INDONESIA
IRRIGATION PROJECT VII
TERTIARY DEVELOPMENT ON PROSIDA SYSTEMS
DESIGN AND CONSTRUCTION SCHEDULE



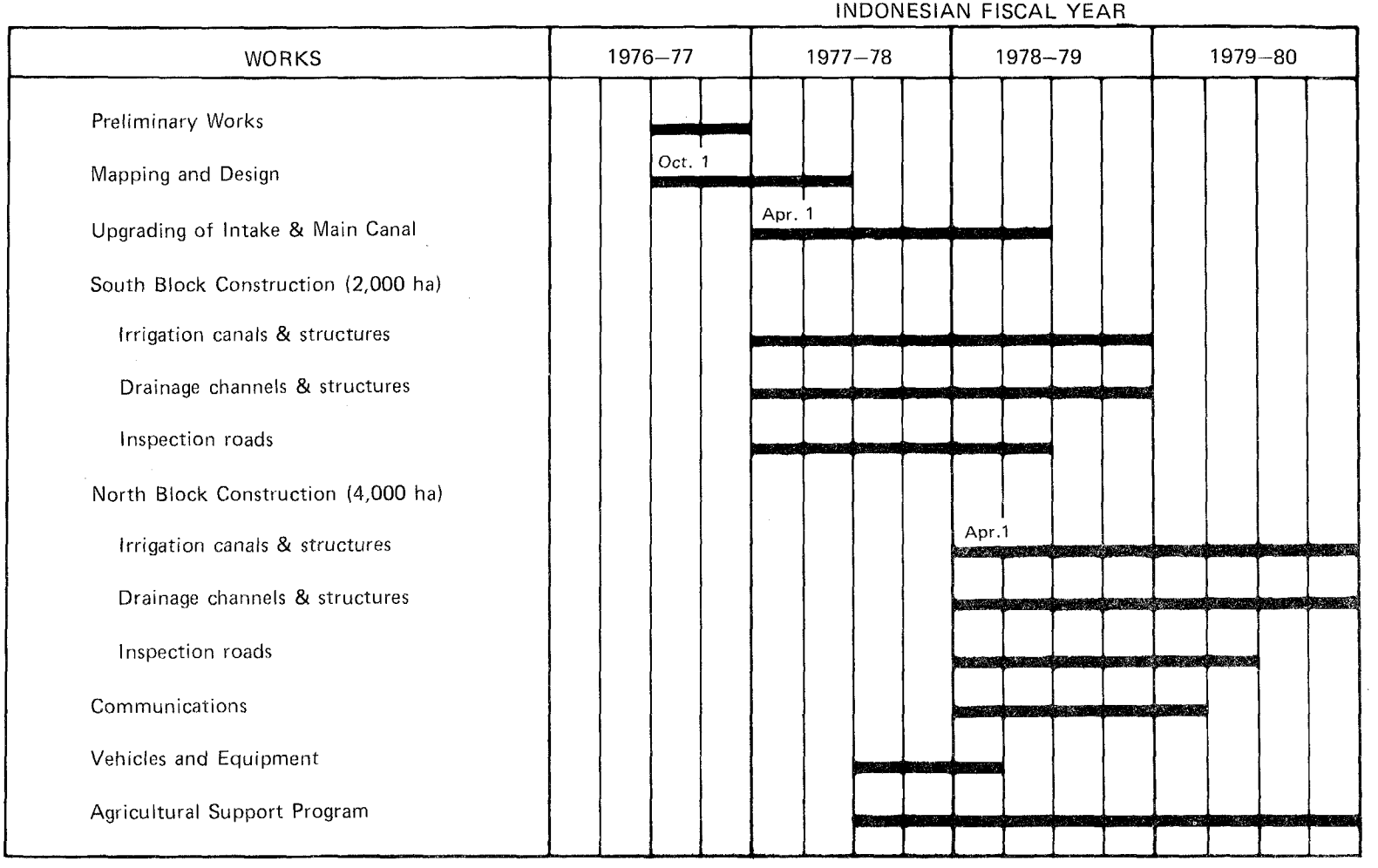
World Bank–15534

INDONESIA
IRRIGATION PROJECT VII
TERTIARY DEVELOPMENT ON JATILUHUR SYSTEM
DESIGN AND CONSTRUCTION SCHEDULE



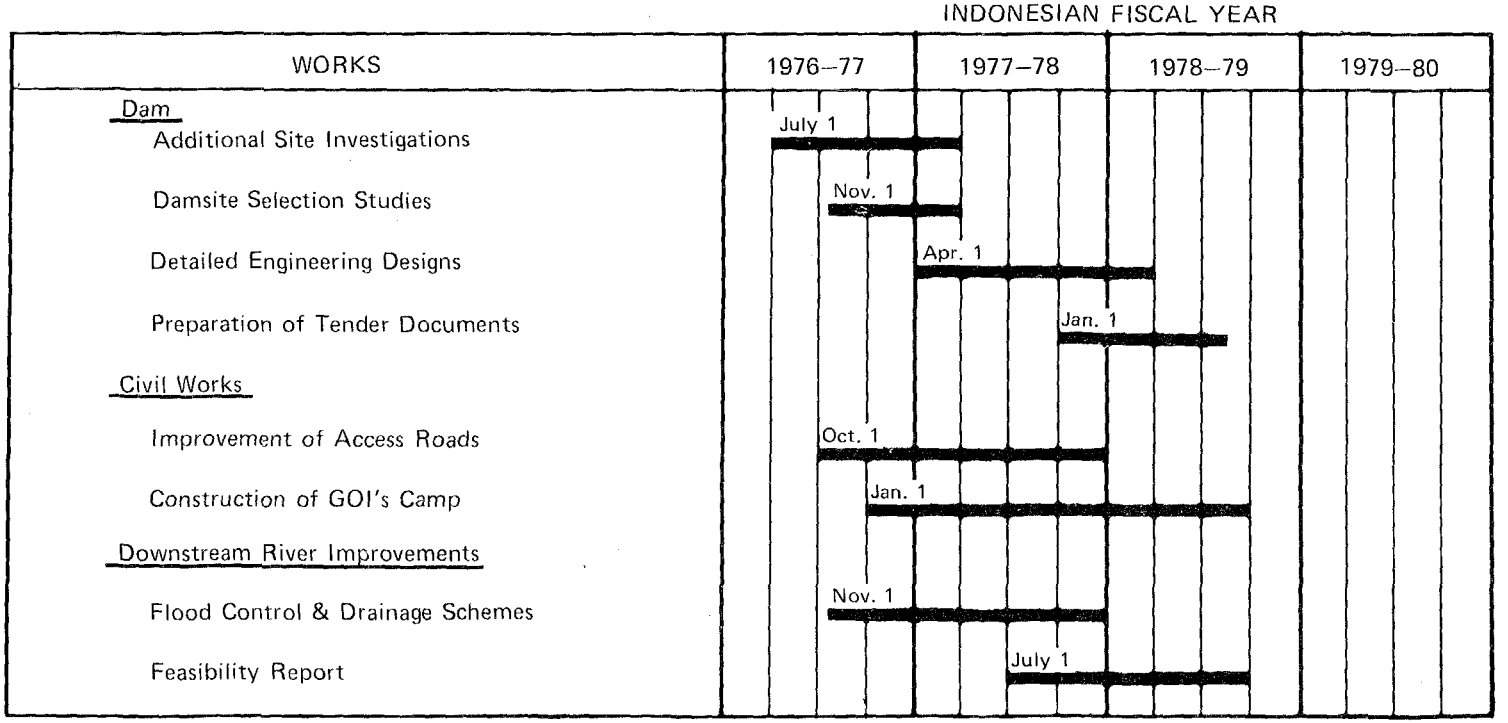
World Bank–15535

INDONESIA
IRRIGATION PROJECT VII
NORTH SADANG IRRIGATION SYSTEM
DESIGN AND CONSTRUCTION SCHEDULE



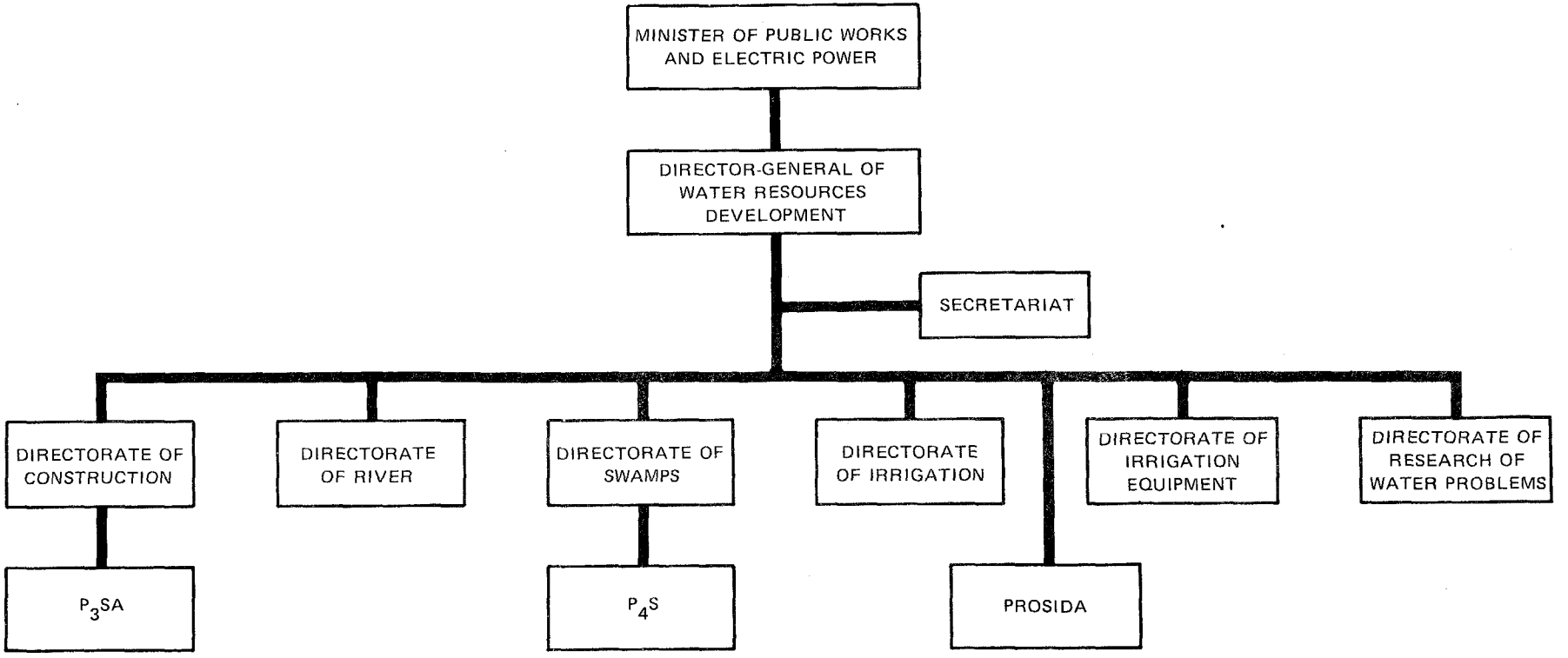
World Bank–15536

INDONESIA
IRRIGATION PROJECT VII
PRELIMINARY WORKS KEDUNGDMBD DAM
DESIGN AND CONSTRUCTION SCHEDULE



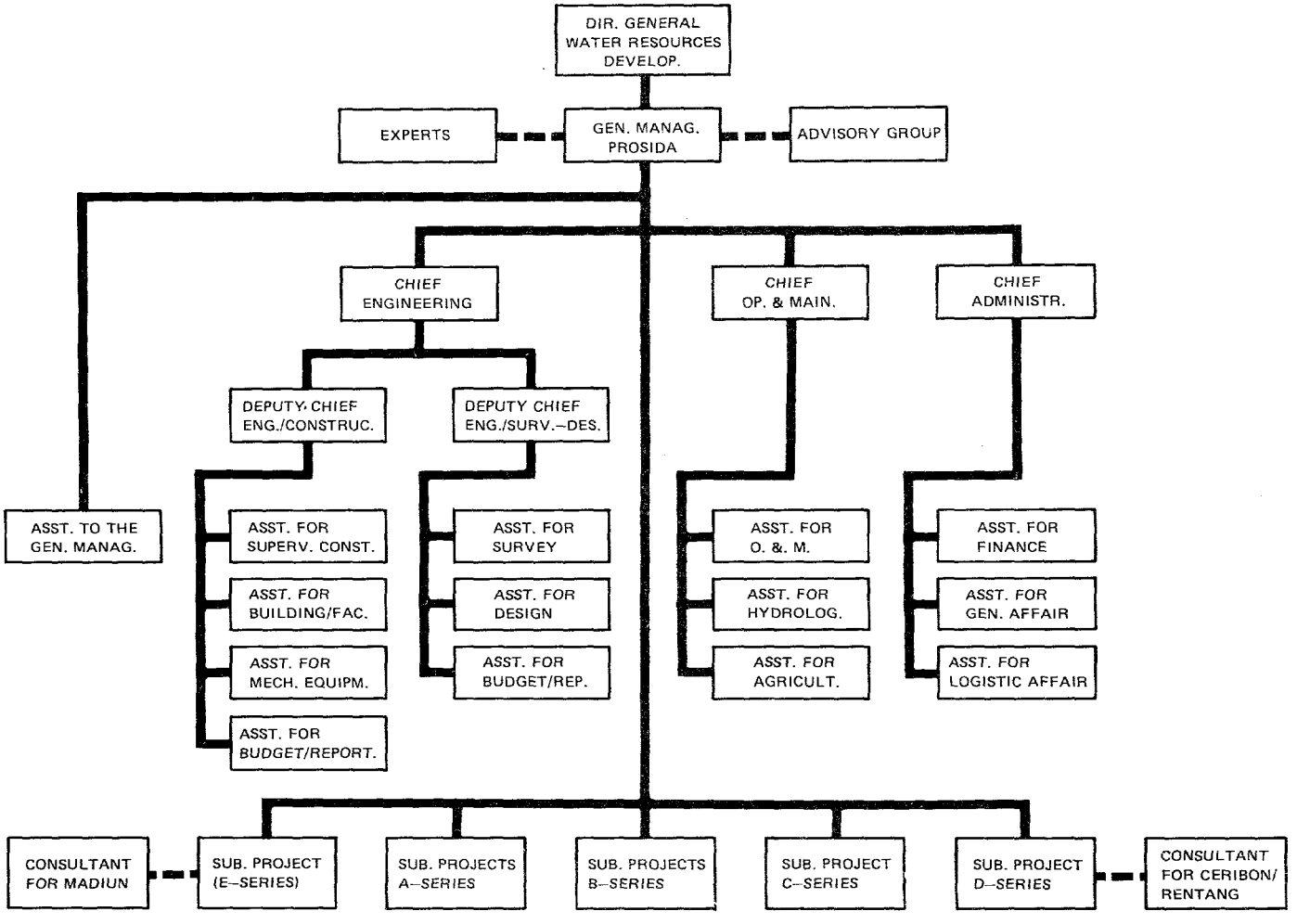
World Bank–15537

INDONESIA
IRRIGATION PROJECT VII
WATER RESOURCES ORGANIZATION CHART



World Bank–16017

INDONESIA IRRIGATION PROJECT VII
PROSIDA
MANAGEMENT ORGANIZATION



World Bank–16008

IBRD 3627R3
FEBRUARY 1976

INDONESIA

IRRIGATION PROJECT VII
LOCATION MAP

IRRIGATION REHABILITATION PROJECT II - V — Executed by Jatiluhur Authority
IRRIGATION REHABILITATION PROJECT I
IRRIGATION REHABILITATION PROJECT III
IRRIGATION REHABILITATION PROJECT IV
IRRIGATION REHABILITATION PROJECT VI
} Executed by Prosida
JATIGEDE DAM PROJECT – Executed under Directorate of Irrigation
GROUNDWATER EXPLORATION PROJECT
FUTURE MADIUN IRRIGATION REHABILITATION
RAILWAYS

NOTE: Irrigation project VII includes tertiary development on 100,000 ha of seven sub-projects plus North Sadang and preliminary works for Kedungombo Dam.

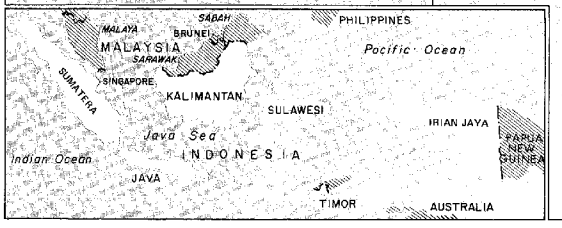
Makassar Strait
Java Sea
Indian Ocean
SUMATERA
BANGKA
BELITUNG
KALIMANTAN
SULAWESI
MADURA
BALI
LOMBOK
SUMBAWA
FLORES
SUMBA
JAVA

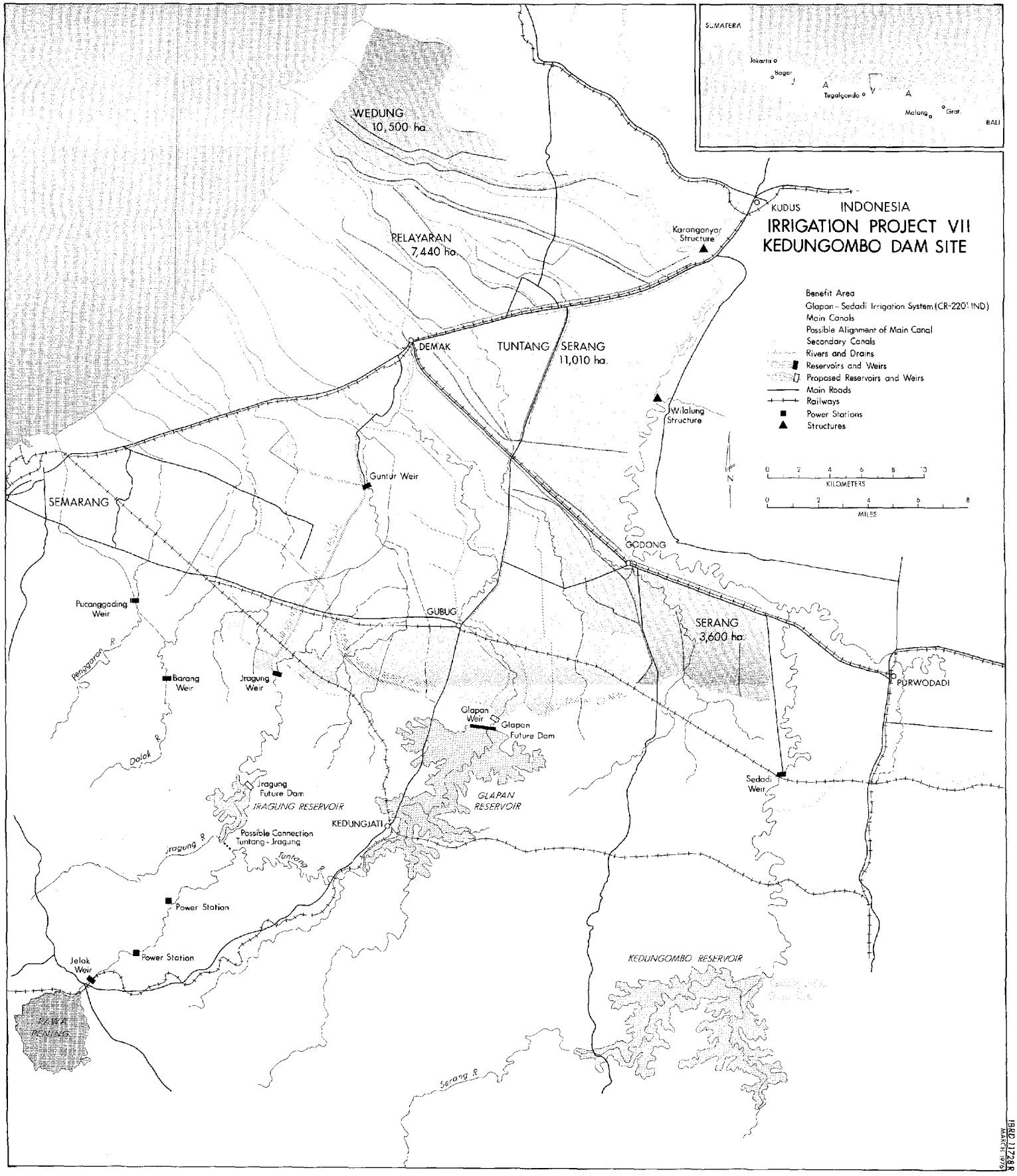
Palembang
WAY SEPUTIH SUB-PROJECT 25,000 ha
Menggala
Terusan R.
Way Seputih R.
Bandarjaya
Gunungsugih
Sukadana
Telukbetung
T.D. = 6,000 ha CIUJUNG SUB-PROJECT 24,300 ha
T.D. = 6,000 ha CISEDANE SUB-PROJECT 42,000 ha
T.D. = 25,000 ha JATILUHUR PROJECT 253,000 ha
RENTANG SUB-PROJECT 92,000 ha
T.D. = 21,000 ha PEMALI-COMAL SUB-PROJECT 123,000 ha
T.D. = 4,500 ha GLAPAN-SEDADI SUB-PROJECT 47,400 ha
GROUNDWATER STUDY AREA 2,500 km²
Merak
Serang
Labuhan
Jakarta
Bogor
Bandung
Indramaju
CIREBON PROJECT 86,000 ha
Cirebon
Tegal
Pekalongan
Semarang
Kudus
Demak
Serang R.
Demak R.
Tuntang R.
Ciujung R.
Cisadane R.
Citarum R.
Pemali R.
Comal R.
JATIGEDE DAM
Teluk Pelabuhan Ratu
Bumiaju
Wonosobo
Cilacap
Pameungpeuk
Jogjakarta
Surakarta
Madiun
Surabaya
SAMPEAN BARU IRRIGATION SCHEME
T.D. = 30,000 ha PEKALEN–SAMPEAN PROJECT 229,000 ha
Banjuwangi
Jember
Ujung Pandang
Parepare
Sadang R.
NORTH SADANG SUB-PROJECT 6,000 ha
SADANG SUB-PROJECT 54,600 ha
T.D. = 7,500 ha

4°S
8°S
108°E
112°E
116°E
120°E

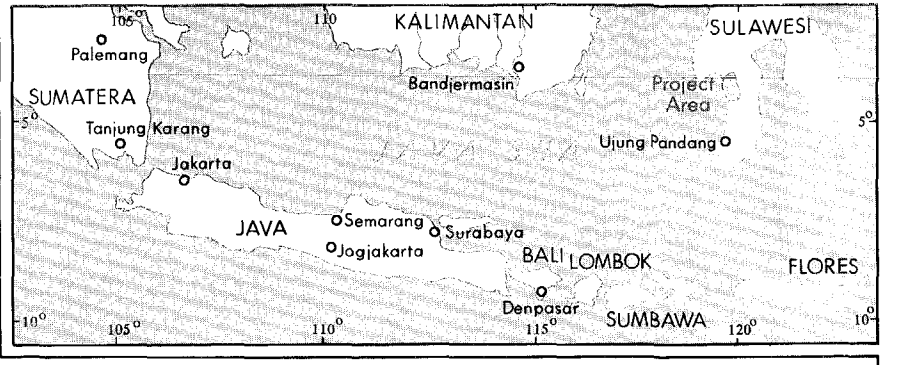
0 50 100 150 200 MILES
0 100 200 300 KILOMETERS

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





IBRD 11728R
MARCH 1976



INDONESIA

IRRIGATION PROJECT VII
NORTH SADANG IRRIGATION SYSTEM

- Existing Main Canals and Structures
- New Main and Secondary Canals
- New Tertiary and Quaternary Canals
- Drains
- Barrage
- Existing Primary Roads
- Existing Secondary Roads
- Proposed Roads
- Rivers

N

KILOMETERS 0 1 2 3 4 5 6

MILES 0 1 2 3 4

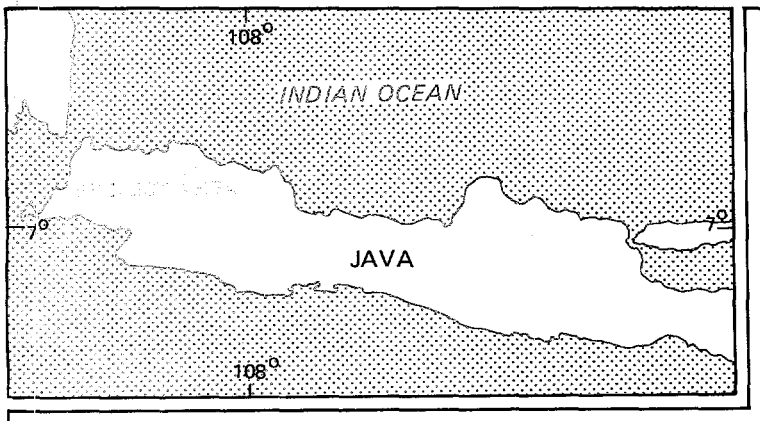
BENTENG BARRAGE

To Rappang

To Ujung Pandang

To Ujung Pandang

IBRD 11867R
APRIL 1976



INDONESIA

IRRIGATION PROJECT VII

TYPICAL TERTIARY DEVELOPMENT

- Proposed control structure
- Proposed tertiary and quarternary drains
- Proposed quarternary canals
- Proposed tertiary canals
- Existing secondary canal
- Existing control structure
- Existing roads
- Existing Railroad
- Built-up areas
- River