

Japan International Cooperation Agency (JICA)

**Ministry of Settlement and Regional Infrastructure (MOSRI)
The Republic of Indonesia**

**THE STUDY
ON
COMPREHENSIVE RECOVERY PROGRAM
OF
IRRIGATION AGRICULTURE**

VOLUME-8

ANNEX-III (3/3)

**Development Plan
(South Sulawesi Province)**

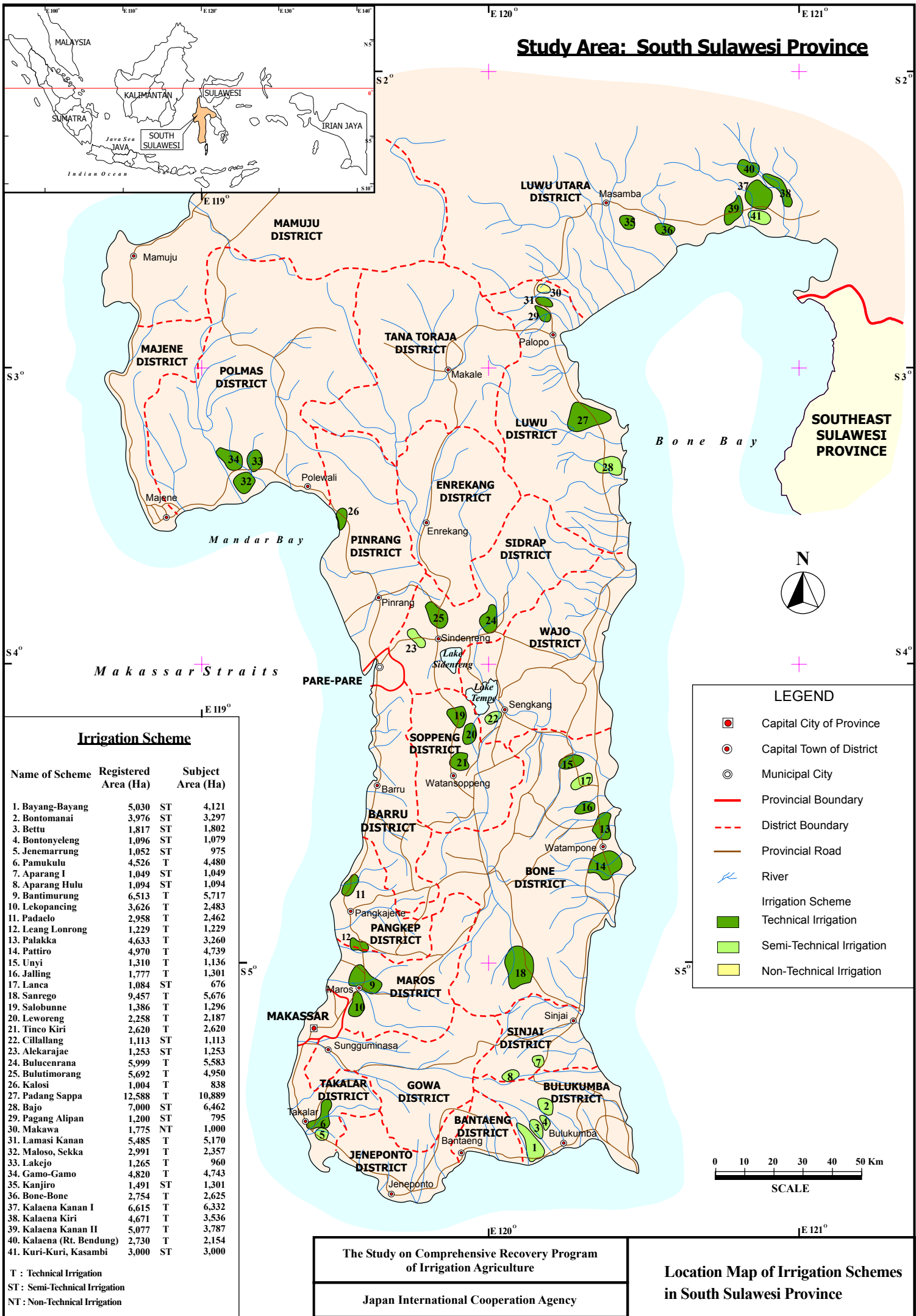
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Study Area: South Sulawesi Province

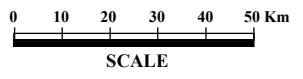
Irrigation Scheme

Name of Scheme	Registered Area (Ha)	Subject Area (Ha)
1. Bayang-Bayang	5,030 ST	4,121
2. Bontomanai	3,976 ST	3,297
3. Bettu	1,817 ST	1,802
4. Bontonyeleng	1,096 ST	1,079
5. Jenemarrung	1,052 ST	975
6. Pamukulu	4,526 T	4,480
7. Aparang I	1,049 ST	1,049
8. Aparang Hulu	1,094 ST	1,094
9. Bantimurung	6,513 T	5,717
10. Lekopancing	3,626 T	2,483
11. Padaelo	2,958 T	2,462
12. Leang Lonrong	1,229 T	1,229
13. Palakka	4,633 T	3,260
14. Pattiro	4,970 T	4,739
15. Unyi	1,310 T	1,136
16. Jalling	1,777 T	1,301
17. Lanca	1,084 ST	676
18. Sanrego	9,457 T	5,676
19. Salobunne	1,386 T	1,296
20. Leworeng	2,258 T	2,187
21. Tinco Kiri	2,620 T	2,620
22. Cilallang	1,113 ST	1,113
23. Alekarajae	1,253 ST	1,253
24. Bulucenrana	5,999 T	5,583
25. Bulutimorang	5,692 T	4,950
26. Kalosi	1,004 T	838
27. Padang Sappa	12,588 T	10,889
28. Bajo	7,000 ST	6,462
29. Pagang Alipan	1,200 ST	795
30. Makawa	1,775 NT	1,000
31. Lamasi Kanan	5,485 T	5,170
32. Maloso, Sekka	2,991 T	2,357
33. Lakejo	1,265 T	960
34. Gamo-Gamo	4,820 T	4,743
35. Kanjiro	1,491 ST	1,301
36. Bone-Bone	2,754 T	2,625
37. Kalaena Kanan I	6,615 T	6,332
38. Kalaena Kiri	4,671 T	3,536
39. Kalaena Kanan II	5,077 T	3,787
40. Kalaena (Rt. Bendung)	2,730 T	2,154
41. Kuri-Kuri, Kasambi	3,000 ST	3,000

T : Technical Irrigation
 ST : Semi-Technical Irrigation
 NT : Non-Technical Irrigation

LEGEND

- Capital City of Province
- Capital Town of District
- Municipal City
- Provincial Boundary
- District Boundary
- Provincial Road
- ~ River
- Irrigation Scheme
- Technical Irrigation
- Semi-Technical Irrigation
- Non-Technical Irrigation



The Study on Comprehensive Recovery Program
 of Irrigation Agriculture
 Japan International Cooperation Agency

Location Map of Irrigation Schemes
 in South Sulawesi Province

**THE STUDY
ON
COMPREHENSIVE RECOVERY PROGRAM
OF
IRRIGATION AGRICULTURE
IN
THE REPUBLIC OF INDONESIA**

Volume-8

**ANNEX-III (3/3)
DEVELOPMENT PLAN
(South Sulawesi Province)**

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PRIORITIZATION OF IRRIGATION SCHEMES**

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Drawings

PART I

***PRE-FEASIBILITY STUDY FOR
PRIORITIZATION OF
IRRIGATION SCHEMES***

CHAPTER 1 STUDY AREA

1.1 General

South Sulawesi Province with a land area of 62,362 km² is administratively composed of 23 districts, 1 municipality, 275 sub-districts and 3,226 villages. The number of districts covered by the target irrigation schemes (the project districts) is 13. Some administrative, demographic and socio-economic features of the province and project districts are presented in Table A-1.1.1 and shown in the following table.

Administrative, Demographic and Socio-economic Features in 2001

Division	Land Area (km ²)	No. of Districts	No. of Sub-districts	Population (1,000)	Household (1,000)
Province	62,362	23	275	7,892	1,795
Project Districts	39,994	13	172	4,410	1,795

Source: Statistic data of BPS, South Sulawesi

The main economic activity of the province and the project districts is an agriculture sector accounting for 39 % and 53 % respectively of the total GRDP. In the agriculture sector, the food crops agriculture is a leading sub-sector accounting for 38 % of the sector GRDP followed by the estate crops sub-sector in the province. The provincial per capita GRDP in 2000 is estimated at Rp. 3.5 million.

1.2 Condition of Paddy Fields and Irrigation Systems

The table below shows the area and percentage of irrigated and rainfed paddy fields to the total paddy fields of South Sulawesi Province in comparison with those of the whole country:

Classification of Paddy Fields

Condition of Paddy Field	South Sulawesi Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	318,800	60.7	4,868,800	62.5
Rainfed Paddy Fields	247,600	39.3	2,918,600	37.5
Total	629,400	100.0	7,787,400	100.0

Source: Laporan Tahunan Dinas Tahun 2001, Dinas Pertanian Tanaman Pangan dan Hortikultura, Sulawesi Selatan.

In the case of the whole country, the areas of each paddy field type exclude those of Maluku and Irian Jaya.

It is seen from the above table that the percentage of irrigated paddy fields in South Sulawesi Province is 60.7, while that of the whole country is 62.5. These

facts indicate that the percentage of irrigated paddy fields in South Sulawesi Province is rather low compared with that of the whole country.

The table below shows the area and percentage of the respective categories for South Sulawesi Province in comparison with those of the whole country based on the Indonesian standards for irrigation system design classification:

Classification of Categories of Irrigation Systems depending on Technical Level

Technical Level	South Sulawesi Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Technical Systems	87,000	27.3	2,214,300	45.5
Semi-technical Systems	82,900	26.0	979,200	20.1
Simple Systems	148,900	46.7	1,675,300	34.4
Total	318,800	100.0	4,868,800	100.0

Source: Laporan Tahunan Dinas Tahun 2001, Dinas Pertanian Tanaman Pangan dan Hortikultura, Sulawesi Selatan.

In the case of the whole country, the areas of Maluku and Irian Jaya are excluded from those of the respective systems.

It is seen from the above table that the percentage of technical systems in South Sulawesi Province is 27.3, while that of the whole country is 45.5. On the other hand, the percentage of simple systems in South Sulawesi Province is 46.7, while that of the whole country is 34.4. These facts indicate that the technical level of irrigation systems in South Sulawesi Province is much lower than that of the whole country.

1.3 Technical Level of Irrigation System

In South Sulawesi the existing potential irrigation areas cover 320,907 ha under 250 government developed irrigation schemes and 182,841 ha by 1,287 village irrigation schemes. The government developed irrigation schemes consist of 57 technical irrigation schemes with potential irrigation areas of 237,657 ha, 132 semi-technical irrigation schemes with potential irrigation areas of 72,981 ha and 61 simple irrigation schemes having potential areas of 10,269 ha as shown in Table A-1.3.1.

There are 63 large scale irrigation schemes each of which has a potential irrigation area of more than 500 ha. As shown in Table A-1.3.2, these schemes cover 260,173 ha or 81% of the potential irrigation area of government developed irrigation schemes. Also, 39 middle scale irrigation schemes with a size of 500 ha to 1,000 ha cover 28,914 ha and 124 small scale irrigation schemes of less than 500 ha extend over 31,723 ha of potential irrigation areas.

1.4 Agricultural and Agro-economic Situations

The agricultural and agro-economic situations of the province and project districts are presented in Table A-1.4.1 and briefed in the followings:

1.4.1 Agro-demography and Land Holding & Tenure

The agro-demographic features of the province and project districts are estimated based on the Agriculture Census 1993 as presented in Table A-1.4.1 and as summarized in the following table:

Agro-demographic Features of the Province in 1993

Agro-demographic Indicators	Range among Project Districts (%)	Province (%)
Proportion of Farm Households to Total Households	62-80	64
Proportion of Farm Households Having Activity in:		
- Food Crops Farming	67-89	82
- Horticulture Crops Farming	9-29	21
- Estate Crops Production	5-66	40
- Livestock	17-64	33

On the basis of the census results, the number of farm households in the province in 2001 is estimated at some 1,140,000 which accounts for about 64% of the total households of about 1,795,000. The primary farming activity of the farm households in the province is food crops production followed by estate crops production. Food crops farmers are some 82% of the total farmers.

The current land holding status in the province and project districts has been roughly estimated based on the number of farm households and the present agricultural land use as shown in Table A-1.4.1 and summarized below:

Roughly Estimated Land Holding Status in the Province

Indicators	Range among Project Districts	Province
Average Farm Land Holding Size/Farm Household	0.86~2.35 ha	1.28 ha
Average Holding Size of Paddy Field/Farm Household	0.35~1.48 ha	0.55 ha
Distribution of Farm Household by Holding Size		
- < 0.5 ha	15~45 %	29 %
- ≥ 0.5 ha	55~85 %	71 %

Source: Agricultural Census, 1993, BPS

1.4.2 Agricultural Land Use

The present agricultural land use of the province and project districts has been studied based on the statistic data of the Provincial Food & Horticulture Crops Agriculture Services Office as shown in Table A-1.4.2. The largest farm land category in the province and project districts is paddy fields occupying about 32 or

37% of the total farm land, followed by estate crop land and dry land/gardens (*tegal/kebun*) accounting for 24 to 27% as summarized below:

Present Agricultural Land Use in the Province in 2001

Land Use Category	Province		Project Districts	
	Area (ha) ^{*1}	Ratio (%)	Area (ha) ^{*1}	Ratio (%)
Paddy Fields	629,400	32 %	488,500	37 %
Home Gardens	146,700	7 %	99,300	7 %
Dry Land/Gardens	529,800	27 %	323,100	24 %
Upland Fields	148,300	8 %	83,400	6 %
Estate Crop Land ^{*2}	516,500	26 %	348,300	26 %
Total Farm Land	1,970,700	100 %	1,342,600	100 %

Note: *1. Rounded figures, *2. Estate operated by public or private firms

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sulawesi Selatan

1.4.3 Food Crops Agriculture

Paddy production is by far the most important farming activity in the food crops agriculture sub-sector both in the province and the project districts, representing 68% and 77% of the total harvested area with food crops (not including vegetables) in 2001 as shown in Table A-1.4.3 and summarized below:

Harvested Area of Food Crops by Proportion in 2001 in Province & Project Districts

Province	Paddy (%)	Maize (%)	Beans ^{*1} (%)	Tubers ^{*2} (%)	Total (%)
Province	68	20	8	4	100
Project Districts	77	14	7	2	100

Note: *1. Includes soybeans, mungbeans & groundnut, *2. Includes cassava & sweet potatoes

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sulawesi Selatan

The second important food crop in terms of harvested area in the province and project districts is maize accounting for 20% and 14% respectively of the total harvested area, followed by groundnut.

The production of food crops in 2001 in the province and project districts is shown in Table A-1.4.3 and summarized below:

Production of Food Crops in 2001 in Province & Project Districts (unit: 1,000t)

Province	Paddy	Maize	Beans ^{*1}	Tubers ^{*2}
Province	4,200	876	127	552
Project Districts	3,457	385	86	215

Note: *1. Includes soybeans, mungbeans & groundnut, *2. Includes cassava & sweet potatoes

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sulawesi Selatan

South Sulawesi Province has been established as the food crops, especially paddy, production base in Indonesia and the project districts as a whole are the major producing areas of food crops in the province.

1.4.4 Agricultural Institutions and Extension

(1) Agricultural Institutions

The government agricultural support institutions in the province include the Food & Horticulture Crops Agriculture Services Office, Estate Crops Services Office, Livestock Services Office and Food Security Agency. The Agriculture Services Office is composed of five sub-services and Technical Implementation Units (*Unit Pelaksana Teknis Daerah/UPTD*) as shown in Figure A-1.4.1. The agricultural institutions in the province and the project districts are shown in Table A-1.4.4.

The government agricultural support institutional arrangements at district level are not consistent with the provincial arrangements and there are differences among the districts concerned. Farmers' organizations are important agricultural institutions for the future promotion of regional agriculture development at sub-district and village level. A number of farmers organizations involved in agricultural activities have been formed in the province. Among these, the major one is the Farmers' Group (*Kelompok Tani/KT*). The numbers of KTs formed in the province and their development status assessed by district agricultural agencies are shown by sub-district in Table A-1.4.4. In the province, 36% of KTs are classified as primary level (*pemula*), 44% as secondary level (*lanjut*), 18% as middle level (*madya*) and 3% as advance level (*maju*). The activities of KTs are generally limited in technical issues as scheduling of farming operations and their economic activities such as group purchasing and marketing are seldom practiced. General problems encountered by KTs are: (i) limited group funds, (ii) not well organized as a group, and (iii) limited economic activities as a group.

Further strengthening and establishment of KTs as business entities will become one of the essential factors in the future promotion and development of regional agriculture and for the establishment of agribusiness oriented agriculture in the province.

There exist 442 Village Unit Cooperatives (*Koperasi Unit Desa/KUD*) in the province with varying activities from dormant status to actively operated status. The main activities of KUDs are distribution of farm inputs, procurement of paddy, rice milling, supply of daily commodities and deposit & credit services. General problems encountered by KUDs are similar to those stated in Section 1.1.

(2) Agricultural Extension

The numbers of Rural Extension Centers (*Balai Penyuluhan Pertanian/BPP*) and Field Extension Workers (*Penyuluhan Pertanian Lapangan/PPL*) deployed in the

province and the project districts in 2001 are shown in Table A-1.4.4. The number of BPPs and PPLs in the province as a whole is 201 and 2,111, respectively.

1.4.5 Farm Machinery and Post-harvest Facilities

The numbers of farm machinery including tractor, water pump, thresher, paddy dryer etc. and rice mills possessed in the project districts are shown in Table A-1.4.5. The availability of hand tractors are quite in shortage when land preparation works of all the paddy fields in the districts are to be carried out by machinery. The results of the Inventory Survey indicate sufficiency of rice mills in most of the target schemes.

1.4.6 Non-food Crops Agriculture

The primary non-food crops agriculture in the province is an estate crops sub-sector largely operated by smallholders. Major estate crops include cacao, coffee and cashew nuts. Statistical figures for non-food crops agriculture are shown in Table A-1.4.6.

1.5 Institutions

The promotion for the establishment of WUA has recently been accelerated by PWRS South Sulawesi, both in government developed and village irrigation schemes. The target of establishment in South Sulawesi is 3,302 WUA for 250 government developed irrigation schemes and 1,149 WUA for 1,287 village irrigation schemes. Up to now, 2,224 WUA have been established in government developed irrigation schemes as shown in Table A-1.5.1.

With respect to the current performance of WUA established in government developed irrigation schemes, 144 WUA are developed and 1,183 WUA are under development as a result of PWRS's promotion activities. The remaining 823 WUA have also taken development action although these are classified as not yet developed as shown in Table A-1.5.1. In parallel with physical and non-physical development activities, the established WUA have applied to local courts of justice for legal registration. So far 119 WUA have been legitimized as shown in Table A-1.5.1.

1.6 Financial Condition of District/Municipal Governments

In Table A-1.6.1, financial condition of the respective District and Municipal Governments in South Sulawesi is summarized by using such indicators as per capita income and revenue for 2001 as well as actual receipts and expenditures for

2000. As for the latter indicator, some of financial reports for 2001 are still under internal auditing by officials concerned so that data for 2000 are referred to. In the course of transition period for synchronizing fiscal year with calendar year by the Government, the actual receipts and expenditures for 2000 were born during the 9-month period from April 1 to December 31, 2000.

The consolidated per capita provincial revenue for 2001 comprised Rp.62,910 for own fiscal capacity consisting of own source revenue, non-tax from natural resources and share taxes and Rp.376,750 for general allocation fund (DAU) plus contingency. Among 22 Districts and 2 Municipalities, the own fiscal capacity on per capita basis of 2 Districts and 1 Municipality is over the consolidated provincial level, while the per capita general allocation fund of 10 Districts and 1 Municipality exceeds over the consolidated provincial level.

CHAPTER 2 SELECTION OF IRRIGATION SCHEMES

2.1 Database of Irrigation Schemes prepared by MOSRI

2.1.1 Verification of MOSRI's Database (WRDC)

The Ministry of Settlement and Regional Infrastructure prepared a database for water resources and irrigation systems called "WRDC", which consists of the following components:

- (a) Database for irrigation schemes, crop yield and water users' associations,
- (b) Location map of irrigation schemes, and
- (c) Irrigation diagrams for irrigation schemes.

The WRDC was established in the year 2001. However, the autonomy, accountability and responsibility for operation and maintenance are still unclear according to information from the Directorate of Technical Guidance, MOSRI.

The status of the WRDC is as follows:

- (a) System operation commenced in 2001.
- (b) The number of columns (information to be filled out) is 306 in total.
- (c) The WRDC is composed of administrative division such as Province, District and Sub-district.
- (d) The WRDC is still under preparation and the only information available is the area registered (potential area and non-potential area). Other information such as i) kind of water resources structure/intake, ii) length of canal, and iii) kind and number of related structures have not been input yet.

As a result, it is necessary to collect most of the data from each province and from field investigations, which have been executed on a sub-contract basis.

2.1.2 Contents of the List of Irrigation Schemes

The following basic information is shown in the list, which is provided by the central office of MOSRI and provincial offices:

- (a) Registration Code Number
- (b) Name of irrigation scheme
- (c) Location of irrigation scheme (province, district, sub-district)
- (d) Technical level of irrigation scheme
- (e) Area (potential and non-potential area)

2.2 Criteria for Selection of Irrigation Schemes

The Inception Meetings were held between the Water Resources Management Services Office (Dinas PSDA) of South Sulawesi province and the Study Team in the initial stage of field investigation. In the meeting, the irrigation schemes to be studied were examined and determined based on the following criteria:

- (a) The Study area shall be determined based on the original list presented in the Scope of Work (S/W),
- (b) The irrigation schemes with the conditions stated below shall be excluded from the original list:
 - The schemes which have been recently completed and are functioning appropriately,
 - The schemes for which implementation has been pledged by the Government and/or international donors,
 - The schemes for which potential is too low (less than 1,000 ha), even though they are included in the original list.
- (c) The irrigation schemes that need urgent rehabilitation, have been added to the list in addition to the original schemes presented in the Scope of Work (S/W).

2.3 Definitions

2.3.1 Definition of Land Use and Irrigation Area

The Irrigation Area for the Study is determined by the following formula:

$$\text{Irrigation Area} = (\text{potential area for irrigation} + \text{non-potential area for irrigation}) - (\text{other land use in potential area} + \text{other land use in non-potential area})$$

2.3.2 Definition of Technical Level of Irrigation System

According to the Indonesian standards for irrigation system design, the irrigation area is classified into three categories, depending on their technical levels, namely technical systems, semi-technical systems, and non-technical systems, as explained below:

Standard of Irrigation System

Items	Irrigation system		
	Technical system (T)	Semi-technical system (ST)	Non-technical system (NT)
Main intake	Permanent structure	Permanent structure and semi-permanent structure	Temporary structure
Diversion structure with measuring devices	Good	Fair	Poor
Canal system	Complete independent canal systems for irrigation and drainage	Not complete independent canal systems for irrigation and drainage	Dual function of irrigation and drainage
Tertiary canal system	Well developed	Developed to some extent	Not developed yet
Irrigation efficiency	50 - 60%	40 - 50%	Less than 40%
Size of irrigation area	No limitation	Up to 2,000 ha	Less than 500 ha

2.3.3 Definition of Rehabilitation

The term of rehabilitation is classified into two, “so-called rehabilitation” and “upgrading” according to the definition stated in the table below. Such classification will be applied for all the irrigation schemes to be studied, and for the selection of irrigation schemes for preliminary investigation.

Definition of Rehabilitation

Classification of rehabilitation	Definition of Rehabilitation
1. Rehabilitation	<ol style="list-style-type: none"> 1) Rehabilitation is not accompanied by an increase of irrigation area. 2) Rehabilitation aims at recovering the system designed irrigation capacity (recovering as designed) from the reservoir/intake facilities to the terminal system. 3) Rehabilitation will increase cropping intensity of dry season crops by 0.2 for Java and 0.3 for outer Java. 4) Rehabilitation aims at repairing reservoir/intake facilities, canals and related structures, which are damaged, defective and deteriorated. 5) The grade to be applied to the irrigation system should be technical level.
2. Upgrading	<ol style="list-style-type: none"> 1) It is possible to expand the irrigation area by upgrading existing irrigation facilities. 2) Extension of the irrigation area by means of upgrading can be made within rainfed paddy fields. More than one cropping can be increased. 3) Rehabilitation of the existing facilities is considered to be the same as 2.1) above. However, as rehabilitation aims at upgrading the quality of structures, deterioration can be decreased (life span can be approx. 50 years). 4) Effectiveness of implementation of upgrading works is expected to be high if the extension area is large. 5) The grade to be applied to the irrigation system should be technical level.

Classification of rehabilitation has been carried out based on the collected information from province and determined as indicated in Table A-2.3.1, and summarized as shown in the following table:

Type and Number of Rehabilitation Works

No. of Schemes	Classification of Irrigation Scheme	
	Rehabilitation	Upgrading
41	18	23

2.4 Selected Irrigation Schemes

The original list of irrigation schemes attached to the Inception Report shows that 65 schemes with a total area of 255,025 ha were to be studied in South Sulawesi Province.

According to the inventory survey conducted by Dinas PSDA in South Sulawesi Province in 2001, 35 irrigation schemes with a total area of 120,917 ha are to be excluded from the original list for the following reasons:

- (a) There are 8 irrigation schemes with a total area of 31,902 ha, that were recently completed under JBIC (former OECF) and other donors' loans.
- (b) Development of water resources and irrigation systems for 14 malfunctioning irrigation schemes with a total area of 78,949 ha have been implemented under JBIC Loan, 'Small Scale Irrigation Management Project (III)' or 'Decentralized Irrigation System Improvement in Eastern Region (DISIMP)'.
- (c) There are 6 irrigation schemes listed in the master list of the Inception Report where their potential is too low, as their irrigation area is less than 1,000 ha.

As a result, the number of irrigation schemes to be studied will be 37 with a total irrigation area of 134,108 ha (255,025 ha - 120,917 ha).

However, Dinas PSDA requested that 4 irrigation schemes with a total area of 7,876 ha, registered in the Inventory List prepared in November 2001, be included.

Accordingly it was decided to study 41 irrigation schemes with a total area of 141,984 ha in total in South Sulawesi Province as shown in Table A-2.3.1 and a Location Map attached at the top of this report.

As a result of discussion, number and area of irrigation schemes finally selected for the Study are summarized in comparison with those of the Inception Stage as shown below:

Irrigation Schemes selected for the Study

Inception Stage		Selected Scheme	
Number of Schemes	Scheme Area (ha)	Number of Schemes	Scheme Area (ha)
65	262,329	41	141,984

CHAPTER 3 PRELIMINARY INVESTIGATION

3.1 General Description

3.1.1 Purposes

The purposes of the preliminary investigation for quantification of rehabilitation are as follows:

- (a) Confirmation of the related agencies for the investigation and availability of information and holders (agencies),
- (b) Analysis of the cause of malfunctioning of the irrigation system,
- (c) Collection of basic data necessary for the preparation of evaluation indicators for prioritization of rehabilitation,
- (d) Finalization of technical specification for inventory survey work, and
- (e) Collection and examination of evaluation standards consisting of standard rehabilitation methods, standard unit prices and information on cost estimates.

The purposes of the preliminary investigation for the irrigation systems are (i) finalization of the specifications for the implementation of the quantification of rehabilitation to be entrusted by analyzing the cause of malfunctioning of the irrigation systems, and (ii) confirmation of the related agencies for the investigation and availability of information and holders (agencies).

In preparation of evaluation indicators for prioritization of rehabilitation in an irrigation network, the past study report, “Technical Guideline, Rehabilitation and Upgrading of Irrigation Network (JICA, 1999, original is written in Indonesian) were reviewed in order to summarize the problems with irrigation facilities.

Evaluation indicators for prioritization of rehabilitation in an irrigation network were prepared respectively for (i) headworks, (ii) free intakes, (iii) canals and related structures, (iv) terminal facilities and on-farm, and (v) inspection roads.

Standard rehabilitation methods were prepared on the basis of, in principle, the “Irrigation Design Standards” prepared by the Directorate General of Water Resources Development, Ministry of Public Works in 1986. In addition, whenever necessary, recent design standards prepared by the Ministry of Agriculture, Fisheries and Forestry of Japan, and United States Development of the Interior, Bureau of Reclamation (USBR). The standard unit prices were determined referring to the recent similar rehabilitation works and bid prices.

3.1.2 Selection of Irrigation Schemes for preliminary investigation

The criteria for the selection of schemes for preliminary investigation were as follows:

- (a) Schemes to be selected to represent the types of rehabilitation, i.e., (i) rehabilitation, (ii) upgrading.
- (b) The beneficiary areas to be the average of all schemes, i.e., 2,000 to 3,000 ha.
- (c) WUAs in the schemes must have been established and be functioning.

Sample areas for the preliminary investigation were further discussed and selected as shown in the table below. The Study Team made the investigations at the beginning of March 2003 in collaboration with engineers of Dinas PSDA.

Irrigation Schemes selected for Preliminary Investigation

Item	Schemes	
Irrigation Scheme	Lekopancing	Pamukulu
District	Maros	Takalar
Sub-district	Mandai	Palang Banangky Utara
Registered area (ha)	3,626	4,526
Technical level	Technical	Technical
Completion year of system	1982	1985
Water resources river	S. Lekopancing	Pamukulu
Type of water resources facility	Headworks	Headworks
Settling basin	Not provided	Not provided
Max. intake discharge (m ³ /s)	4.4	7.0
Length of main canal (km)	5.8	17.3
Length of secondary canal (km)	28.4	36.8
Number of WUAs (Target/Established)	67/62	36/35
Number of farmers	5,242	3,966

3.2 Main Issues Identified and Study Agenda

3.2.1 Analysis of Causes of Incompleteness and Defectiveness of Facilities

By means of preliminary investigation and reference to past documents, analysis of the causes of problems with each irrigation scheme was carried out in terms of incompleteness, structural and functional defectiveness and necessity for rehabilitation. The causes thus analyzed were classified into five (5) classes according to the kind of structures. In all cases, the study was carried out for the following:

- (a) Appropriateness of planning and design (including availability of necessary data and information),
- (b) Construction technique and accuracy (including possibility of corner-cutting in the construction works), and
- (c) Operational condition of structures.

A table was prepared listing the structural items, problems with the structures and their causes as shown below.

Problems and their Causes on Irrigation Facilities found through Preliminary Investigation

Structure	Problems	Causes
Headworks	<ul style="list-style-type: none"> 1) The design discharge cannot be taken because of sediment in front of intake. 2) The river water level cannot be maintained as designed. 3) Intake of river water cannot be appropriately made. 4) Operation of gates is difficult due to damage of gates. 5) Intake discharge cannot be measured accurately. 	<ul style="list-style-type: none"> 1) Sediment exists in front of intake and/or scouring sluice and settling basin is not provided or it is malfunctioning. 2) Civil works (intake weir, etc.) are damaged or defective. 3) Steel gates or other metal structures are damaged or deteriorated. 4) No proper maintenance and repair is being executed. 5) No measuring devices (even gauging) are provided.
Free Intake	<ul style="list-style-type: none"> 1) The design discharge cannot be taken because of i) lowering of river water level and ii) sedimentation in front of intake. 	<ul style="list-style-type: none"> 1) No fundamental measures, such as provision of weir, are undertaken against lowering of riverbed. 2) No removal of sedimentation located at or in front of intake is undertaken.
Canal and related structures	<ul style="list-style-type: none"> 1) Irrigation water cannot be conveyed to the tail of the canal. 2) Contour canal located in the upstream section of a system is choked with sediment. 3) Structures with a service life of more than 30 years are malfunctioning in some irrigation systems. 4) Irrigation water is not equitably distributed due to insufficient water supply. 5) Less activity on O&M works. 	<ul style="list-style-type: none"> 1) This is due to seepage loss, obstruction of flow by sediment, collapse of canal, etc. 2) Sediment is flowing into canal from headworks/intake due to improper operation of scouring sluice gate/settling basin or no provision of settling basin. 3) Structures are older than service life and no rehabilitation/replacement has been done. 4) Due to inadequacy of diversion structure, no proper water management could be done. 5) Low density of inspection roads, crossing facility such as bridge, culvert not in working condition.
Terminal facility and on-farm	<ul style="list-style-type: none"> 1) Irrigation water is not used efficiently due to shortage of provision of canals. 2) Drainage is not appropriately practiced due to shortage of provision of tertiary and quaternary drains. 3) Transportation of farming input and output is poor. 	<ul style="list-style-type: none"> 1) This is due to insufficient density of tertiary and quaternary (feeder) canals. 2) This is due to insufficient density of tertiary and quaternary drains. 3) Provision of appropriate length of farm road is necessary.

Inspection road	<ol style="list-style-type: none"> 1) O&M are difficult due to poor condition of inspection road along main and secondary canals. 2) Transportation of farming input and output is poor due to lack of farm road connecting village with inspection road. 	<ol style="list-style-type: none"> 1) Inadequate proper maintenance has been done and related facilities are in a damaged state. 2) Low density or no provision of roads.
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3.2.2 Evaluation Indicators for Rehabilitation Priority

Rehabilitation for the irrigation facilities was to be evaluated by verifying their condition with respect to (i) type, size and condition of headworks/intake, (ii) functional status of canals and their related structures, (iii) condition of terminal facility and on-farm, and (iv) condition of inspection roads.

Evaluation indicators for the rehabilitation that are to be applied for the investigation for all schemes were prepared based on the findings through the preliminary investigation. Evaluation indicators were further examined and finalized mainly referring to the “Technical Guideline, Rehabilitation and Upgrading of Irrigation Network (JICA 1999)”.

The following are the principal evaluation indicators for the preparation of prioritization for the rehabilitation.

Evaluation Indicators

Facility	Indicators
1. Headworks (Concrete Weir)	<ol style="list-style-type: none"> 1) Crack/damage on crest 2) Erosion and seepage in stilling basin 3) Leakage from foundation 4) Gate/Leakage from gate 5) Sedimentation/mud in front of gate 6) Flushing of sedimentation/mud 7) Settling basin 8) Measuring device
2. Free Intake	<ol style="list-style-type: none"> 1) Lowering of river water level or degradation of riverbed 2) Intake gate/scouring gate 3) Leakage from gate 4) Sedimentation/mud in front of gate 5) Flushing of sedimentation/mud 6) Settling basin
3. Canals and Related Structures	
3.1 Canals	<ol style="list-style-type: none"> 1) Lined or unlined canal 2) Lining of canal, broken or cracked 3) Sedimentation 4) Seepage loss 5) Collapse of canal bank
3.2 Regulating, Conveyance, Crossing, Protection Structures	<ol style="list-style-type: none"> 1) Gate 2) Leakage on gate 3) Crack on concrete/stone masonry 4) Scouring on structures 5) Settlement 6) Measuring devices

4. Terminal Facilities and On-Farm	1) Leakage on canal 2) Sedimentation/mud on canal 3) Density of canal, road
5. Inspection Roads	1) Condition 2) Density

The method of evaluation of the existing facilities against respective indicators is discussed in Chapter 6.

3.2.3 Technical Specifications for Inventory Survey Work

Draft technical specifications for inventory survey work were prepared in initiation stage and finalized based on the findings of preliminary investigation. The composition and contents of the technical specifications are as follows:

Part-I: Inventory of Irrigation Schemes

- 1.1 General
- 1.2 Structure of Water Source
- 1.3 Irrigation Canals
- 1.4 Terminal Facility and On-farm
- 1.5 Socio-economy and Agriculture
- 1.6 Present Condition of WUAs
- 1.7 Rehabilitation Plan

Part-II: Survey for Estimate of Rehabilitation Works

- 2.1 General Layout
- 2.2 Irrigation Diagram
- 2.3 Schematic Layout of Related Structures
- 2.4 Survey Sheets
- 2.5 Quantity Estimate
- 2.6 Photographs

3.2.4 Standards for Design and Construction

For the Evaluation of existing condition and preparation of measures for rehabilitation, the following criteria for the design and construction of rehabilitation is provisionally shown in the below table:

Standards for Design and Construction

Facilities	Condition of structures	Measures for recovery of function
Dam	Leakage from foundation	1) Cement grouting
	Sliding of embankment/ insufficient stability of slope	1) Re-construction 2) Extra embankment
	Damaged/defective spillway/ structure	1) Repair by concrete works
	Insufficient capacity of spillway for flood discharge	1) Extend crest length of spillway
	Damages/inadequate function of gate, valve, metal works	1) Repair/replace
Headworks	Damages due to settlement, broken, washed away, deterioration	1) Reconstruction/renovation
	Insufficient intake capacity	1) Widening of gate 2) Heightening of weir crest
	Influx sediment load	1) Provision of settling basin 2) Increase of basin barrel 3) Proper operation of scouring sluice gates
	Damages/inadequate function of gate and metal works	1) Repair/replace
Irrigation canal	Retarded design capacity	1) Dredging, removal of foreign materials 2) Provision of concrete lining
	Collapsed embankment/lining	1) Re-embankment 2) Provision of concrete lining
	Earth canal	1) Provision of concrete lining with $n = 0.017$
Related structure	Decrepit more than 50 years after construction	1) Replace/reconstruct
	Deflection, settlement and no function for gate operation	1) Replace/reconstruct
	Broken/damaged	1) Repair/replace
	Insufficient load capacity for traffic (bridge, culvert)	1) Replace with required design load ($T = 10, 14, 20$)
	Clogging	1) Remove foreign materials 2) Provision of screen 3) Widening of barrel section

3.2.5 Estimation of Work Quantities and Costs

The work quantities for rehabilitation are estimated by means of site survey works and summarized in each work item. The unit prices of each work item are collected through the actual expenditures and/or average of tender and contracted prices of similar works.

CHAPTER 4 FIELD INVESTIGATION

4.1 Execution of Field Investigation

4.1.1 Works by Indonesian Consultant

The inventory survey work was carried out by an Indonesian Consultant on a sub-contract basis (PPA Consultants), who was selected through competitive bidding. The work was commenced on April 11, 2003 and completed in the middle of June 2003.

4.1.2 Procedures

Major assignments entrusted to the sub-contractor were as follows:

(1) Preparatory work

- (a) Coordination meeting with Dinas and Balai PSDA for the orientation of the investigation methods, and
- (b) Collection of data and information, which were required for field investigation, from said offices.

(2) Field work

- (a) Collection of basic information regarding water resource facilities to the on-farm level of each irrigation and drainage system, agriculture and agro-economy, and status of WUAs,
- (b) Field investigation of the existing condition of irrigation facilities, evaluation of their functions and analysis of the cause of problems, and
- (c) Preparation of the latest irrigation diagram and the schematic structure diagram of each scheme.

(3) Outcomes

- (a) Preparation of investigation report, and
- (b) Estimation of work quantities for rehabilitation work on major irrigation works.

4.2 Results and Findings

4.2.1 Irrigation Systems

As discussed in Chapter 3, field investigations were carried out for the collection of information regarding the condition of the following facilities in order to evaluate the functional status of each irrigation system;

- (a) Particular information (constructed and rehabilitated year, name of the river and catchment area at the location of the water resource

- facilities),
- (b) Water resource facility (dam, headworks, free intake, pumping station),
 - (c) Irrigation canals with related structures (main and secondary canals),
 - (d) Drainage canals and related structures, and
 - (e) Terminal facilities and on-farm

On the basis of the results of the investigation, the irrigation facilities were classified, by the scale of required rehabilitation, into the following four (4) groups:

- A: Facilities are functioning well, and no rehabilitation is needed,
- B: Facilities are partially damaged/deteriorated, and minor rehabilitation is needed,
- C: Facilities are not functioning well, i.e., operation of the system is difficult, and large-scale rehabilitation is needed, and
- D: Facilities are seriously damaged operationally, and replacement or reconstruction is needed.

In order to identify the particular causes of problems and constraints of the existing facilities, detailed evaluation of the facilities was made based on the investigation results as summarized hereinafter.

(1) Water Resource Facilities of Each Scheme

1) Existing conditions

The type of water resource facilities and their existing conditions are detailed in Table A-4.2.1, and summarized as shown below:

Condition of Water Resource Facilities

Type of Water Resource Facilities	Number	Condition of Facilities			
		A	B	C	D
Headworks	35 ^{*1*2}	0	21	14	0
Free Intake	2	0	1	1	0
Others (Spring)	1	0	0	1	0
Total	38	0	22	16	0

Notes: *1. Number of settling basins provided is 12.

*2. Irrigation water for Kalaena Kanan I, II, Rt. Bendung and Kalaena Kiri schemes are supplied from integrated headworks.

In the above table, the condition of facilities which is classified as C is due mainly to their age being more than 30 years and physical operation problems caused by deterioration of their function. In addition, the condition of metal works such as scouring sluice gates, intake gates and trash racks is found to be poor in operation due to deflection of stems, leakage from guide frames and gate leaves themselves.

2) Analysis of causes of problems and constraints

The causes of problems and constraints were analyzed for all the irrigation schemes as detailed in Table A-4.2.2, and their conditions are the same as those of North Sumatra Province and summarized as shown below:

- (a) Physical operation problems due to damage and deterioration of structures,
- (b) Lowering of intake water level due to damage and deterioration of weir or degradation of riverbed in case free intake,
- (c) Inflow of bed loads into canal due to sedimentation upstream of weir resulting in inadequate function of scouring sluice,
- (d) Problem with management due to lack of periodical maintenance of metal works,
- (e) No provision of settling basin or inadequate function due to sedimentation, and
- (f) Operation and management problems with intake gate and introduction of bed loads and soils into canals.

Bontomanai Headworks



Sediments in front of Intake

Kalosi Headworks



Damaged Stilling Basin and Riprap Protection

(2) Irrigation Canals and Related Structures

1) Existing Conditions

Features of irrigation canals and related structures are detailed in Table A-4.2.3 to A-4.2.6 and summarized as shown below:

Canal Types, Lengths and Conditions

Canals	Length (km)			Condition (Scheme)			
	Lined*	Unlined (Earth)	Total	A	B	C	D
Main Canal	158 (55.7%)	126 (44.3%)	285	0	1	10	28
Secondary Canal	274 (34.0%)	533 (66.0%)	806	0	0	3	28
Total	432 (39.6%)	659 (60.4%)	1,091	-	-	-	-

Note: * Masonry and concrete lining

Condition of Related Structures

Canals	Total Number of Structures	Condition of Canals (%)			
		A	B	C	D
Main Canal	1,055* ¹	0	2	24	74
Secondary Canal	2,236* ²	0	0	7	93

Notes: *1: No canal is provided at Lanca and Kuri-Kuri Kasambi schemes.

*2: No canal is provided at Leang Lonrong, Cillallang, Kuri-Kuri Kasambi schemes.

2) Analysis of causes of problems and constraints

The analysis of causes of problems and constraints for all the schemes is detailed as shown in Table A-4.2.7 and summarized as shown below:

- (a) Sedimentation in canals and obstruction in water flow,
- (b) Damage and deterioration of canal lining and structures,
- (c) Leakage from unlined canals and defective lined canals,
- (d) Difficulty with maintenance of canals due to no provision and/or non-trafficable inspection roads,
- (e) Difficulty with O&M due to poor/malfunctioning structures,
- (f) Physical operation problems with regulating structures for water distribution due to deteriorated and/or damaged steel gates, and
- (g) Entering of eroded soil in the excavated canal portion due to no provision of drainage canals and facilities along the canal.

Kalaena (Rt. Bendung) Scheme



Condition of Earth Canal Section

Bontomanai Scheme



Diversion Structure, Sediments and No Control Gates

As seen in the above and Table A-4.2.7, the condition of facilities is almost critical, and hence urgent countermeasures for recovery of function seem to be essential.

(3) Inspection Road along Canal

1) Existing conditions

The existing condition of inspection roads is detailed as shown in Table A-4.2.3, and summarized as follows:

Ratio of Inspection Road to Canal

Inspection Road	Total length of canals (km)	Inspection roads (km)	Ratio (%)
Along Main Canal	285	154	54
Along Secondary Canal	806	205	25
Total	1,091	359	33

Condition of Inspection Roads

Inspection Roads	Number of Schemes providing Inspection Roads	Condition of Roads (scheme)			
		A	B	C	D
Along Main Canal	21	0	9	9	3
Along Secondary Canal	15	0	1	8	6

2) Analysis of causes of problems and constraints

As seen in the above table, the ratio of the length of inspection roads along irrigation canals is estimated at only 33% of the total canal length. In addition, more than 80% of inspection roads are non-paved and/or damaged, and as a result most of them are out of service throughout the year. Low density of inspection roads and their conditions give rise to serious problems with operation and maintenance of canals and related structures and also farming practices, especially in conveyance of agricultural products.

Sanrego Scheme



Condition of Inspection Road

(4) Terminal Facilities and On-farm

The existing condition of terminal facilities and on-farm is detailed as shown in Table A-4.2.7, and summarized as follows:

Existing Condition of Terminal Facilities and On-farm

Terminal Facilities and On-farm	Condition of terminal facilities and on-farm (%)			
	A	B	C	D
Average of 41 Schemes	0	0	49	51

The existing condition of terminal facilities and the condition on-farm are found to be very poor due to low density of canals, farm roads and their related facilities.

Sanrego Scheme

Aparang I Scheme



Farm Road



No farm road for machine farming

4.2.2 Agriculture and Agro-economy

The agriculture and agro-economic investigations were primarily carried out through the Inventory Survey. However, some basic data and information such as crop yields, crop budget and farm economy were separately collected from statistic data and secondary data from agriculture services offices. The present agricultural conditions of the target irrigation schemes thus identified are presented in Table A-4.2.8 and summarized as follows:

(1) Present Land Use

The scheme-wise present land uses of the subject area for development are shown in Table A-4.2.8. The overall provincial features are summarized in the followings:

Overall Present Land Uses of Target Schemes

Land Use Category		Area (ha)	Ratio (%)	
1.	Potential Area for Irrigation	Irrigated Paddy Fields	100,266	81
		Rainfed Paddy Fields	9,840	8
		Non-paddy Fields	1,488	1
		- Upland Fields	264	-
		- Tree Crops Land	530	-
		- Uncultivated Land	694	-
2.	Non-potential Area for Irrigation	Rainfed Paddy Fields	5,927	5
		Non-paddy Fields	5,909	5
		- Upland Fields	4,161	-
		- Tree Crops Land	1,373	-
		- Uncultivated Land	375	-
3.	Target Area for Development	123,430	100	
	(Potential Area + Non-potential Area)			
4.	Non-target Area for Development *1	15,087	-	
5.	Registered Area (3 + 4)	138,517	-	

Note: *1. Including other land use (alih fungsi)

As shown in the table, the potential area accounts for 90% of the target area for the development study and the non-potential area for 10%. The irrigated paddy fields, rainfed paddy fields and non-paddy fields represent 81%, 13% and 6% of the target area, respectively. “Upland fields” is the largest land use category in the non-paddy fields representing 4% of the target area. The target area for development under the Study accounts for 89% of the registered area.

(2) Cropping Seasons and Pattern

Based on the rainfall distribution patterns, South Sulawesi Province is divided into three (3) regions being the western region, eastern region and transitional region. The principal cropping seasons in the province and in the target schemes are composed of three (3) seasons being wet season, dry season I and dry season II. Although there are some area specific variations due to irrigation water supply schedule or availability, rainfall distribution, drainage/flooding etc., the principal cropping calendars in the region are as follows:

Western Region (Cropping Season A)

Wet season: November/December - February/March

Dry season I: April/May - July/August

Dry season II: August/September - October/November

Eastern Region (Cropping Season B)

Wet Season: April/May - July/August

Dry season I: August/September - October/November

Dry season II: November/December - February/March

Transitional Region

Cropping Season A or B depending on rainfall distribution patterns in the scheme areas.

The current cropping patterns introduced in the irrigated paddy fields in the target irrigation schemes are shown in Table A-4.2.8. As shown in the table, the basic cropping patterns are paddy - paddy – palawija/fallow in the western region and paddy - palawija/fallow – paddy in the eastern region. In the schemes in the transitional region, either of the above patterns is introduced depending on the rainfall distribution pattern. Cultivation of palawija in irrigated fields is commonly practiced in the province and a cropping pattern of paddy - fallow - fallow in irrigated field is seldom practiced. Common palawija in the target schemes and the province are maize, groundnut, soybeans and mungbeans. The prevailing patterns in the target schemes are as summarized below:

Most Common

Wet - Dry I - Dry II: paddy - paddy - fallow (western region)

Wet - Dry I - Dry II: paddy - fallow - paddy (eastern region)

Second Common

Wet - Dry I - Dry II: paddy - paddy - palawija/fallow (western region)

Wet - Dry I - Dry II: paddy - paddy/palawija - fallow (western region)

Wet - Dry I - Dry II: paddy - palawija/fallow - paddy (eastern region)

Wet - Dry I - Dry II: paddy - fallow - palawija/fallow (eastern region)

The prevailing pattern in the rainfed paddy fields is paddy – fallow, while cropping of palawija in dry season is also practiced.

(3) Cropped Area and Cropping Intensity

The irrigation performance in the target schemes expressed by cropped area and cropping intensity to the irrigated area are examined based on the monitoring data of provincial and district irrigation agencies obtained through the Inventory Survey. The results are shown in Table A-4.2.8. The overall cropped areas and cropping intensities of paddy and palawija in wet and dry season in irrigated paddy fields are:

Overall Cropped Area & Cropping Intensity in Irrigated Fields in Target Schemes

Season	Paddy		Palawija		Overall	
	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)
Wet Season	94,146	94	14	-	94,160	94
Dry Season I	34,126	34	1,745	2	35,871	36
Dry Season II	39,933	40	5,765	6	45,698	46
Annual	168,205	168	7,524	8	175,729	175

As shown in the Table, the overall cropped area and annual intensity is estimated respectively at some 175,700 ha and 175% to the total irrigated paddy fields of 100,266 ha.

Naturally, the annual cropping intensities vary largely depending on irrigation schemes due mainly to availability of irrigation water in dry seasons. The target

irrigation schemes (41 schemes) are classified based on annual cropping intensities of paddy in irrigated paddy fields as follows:

Irrigation Schemes by Annual Cropping Intensity of Paddy

Cropping Intensity of Paddy ^{*1}	No. of Schemes	Proportion (%)
≥ 180 %	15	37
≥ 150 ~ < 180 %	15	37
≥ 120 ~ < 150 %	8	20
≥ 100 ~ < 120 %	3	7
< 100 %	0	-

Note: *1 Cropping intensity in irrigated paddy fields

Further, there appear to be some differences in the intensities according to the technical level of irrigation schemes. The annual cropping intensities of irrigated paddy by the technical levels of the target irrigation schemes are:

- Technical irrigation schemes (27 nos): 114% - 200%; average 167%
- Semi-technical irrigation schemes (13 nos): 100% - 200%; average 174%
- Non-technical irrigation schemes (1 no.): 160%

In rainfed paddy fields, single cropping of paddy in the wet season is prevailing in the target irrigation schemes, while, a part of the field areas is used for palawija cultivation in the dry season. Accordingly, under the present Study, the current cropping intensity in the rainfed paddy fields is assumed on the basis of the findings of the Inventory Survey and information provided by the Provincial Agriculture Services Office, as shown below:

- Wet season: Paddy 100%
- Dry season: Palawija 20%

The overall cropped area and cropping intensity in the target area for development are shown in Table A-4.2.8.

(4) Crop Yields and Crop Production

The current paddy yield levels of the individual target schemes are estimated by analyzing yield data obtained through the Inventory Survey, BPS crop cutting survey results by sub-district, BPS statistical information on sub-district reported in *Kabupaten dalam Angka*, and statistic information on paddy yield by district reported by the Provincial Agriculture Services Office. The estimated paddy yields adopted in the present Study are shown in Table A-4.2.9 together with yield data used for the estimates. The estimated paddy yields are summarized as follows:

Estimated Current Irrigated Paddy Yields

Cropping Season	Yield Range (t/ha)	Average (t/ha)	Cropping Season	Yield Range (t/ha)	Average (t/ha)	Annual (t/ha)
Wet Season	3.5 - 4.5	4.2	Dry Season	4.0 - 5.0	4.3	4.2

The yield level of rainfed paddy and palawija is assumed based on the findings of the Inventory Survey and statistic information as follows:

Unit Yields of Rainfed Paddy and Palawija

Rainfed Paddy	Groundnut	Maize	Soybeans	Mungbeans
2.5 t/ha	0.7 t/ha	2.5 t/ha	1.0 t/ha	0.8 t/ha

The current crop production in the individual target schemes is estimated from the estimated cropped areas and crop yields as shown in Table A-4.2.8. The overall features are presented in the following table:

Overall Crop Productions

Commodity	Wet Season (ton)	Dry Season I (ton)	Dry Season II (ton)	Annual (ton)
Paddy	430,000	143,000	174,000	747,000
Palawija (maize)	11,100	4,900	11,800	27,800

(5) Crop Budget

Crop budgets for different yield levels of irrigated paddy, rainfed paddy and palawija are estimated as shown in Table A-4.2.10

Financial Net Return per ha Assumed

Commodity	Yield (t/ha)	Net Return/ha (Rp.000)	Commodity	Yield (t/ha)	Net Return/ha (Rp.000)
Irrigated Paddy	4.0	3,180	Groundnut	0.7	1,860
	4.5	3,670	Maize	2.5	1,560
	5.0	4,120	Soybeans	1.0	1,930
	5.5	4,600	Mungbeans	0.8	1,980
Rainfed Paddy	2.5	1,850			

(6) Farm Economy

In accordance with the procedure applied in the case of North Sumatra, the present farm economic analysis has been made on 1 ha of irrigated paddy field or rainfed paddy depending on the present land use of individual schemes by estimating net farm income from the field. The results of the farm economic analysis thus made are presented in Table A-4.2.11 and summarized below:

Estimated Net Farm Income from 1ha of Field

Land Use Category	Net Farm Income from Paddy Field (Rp.000)	
	Range	Average
Irrigated Paddy Field	3,407 - 7,790	5,770
Rainfed Paddy Field	only 3 schemes	2,162

(7) Agricultural Support Services and Marketing

The present statuses of agricultural institutions, support services and food crops marketing in the individual schemes identified through the Inventory Survey are presented in Table A-4.2.12. The major or prevailing issues on the subjects in the province and the target schemes are as follows:

- (a) All the target schemes are served by field extension workers (PPL) posted in or around the schemes. The number of PPLs assigned basically depends on the size of the schemes.
- (b) Accessibility to farm credits depends on irrigation schemes and varies from “no difficulty to receive” to “almost no access to credits”.
- (c) No difficulties for procurement of farm inputs and quality seeds are reported in most of the target schemes.
- (d) The most prevailing marketing practice for paddy is “sold after harvest at field” followed by “sold paddy after drying” and “sold after milling”.
- (e) The most prevailing marketing channel for paddy is “paddy to collector or middlemen” followed by “paddy to rice mill”.
- (f) The most prevailing marketing channel for palawija is “sold to collector or middlemen” followed by “sold at local market”.
- (g) Sufficient availability of rice mills is reported in almost all schemes under the current marketing practices for paddy.

(8) Development Constraints

The agricultural development constraints in the individual schemes identified through the Inventory Survey are presented in Table A-4.2.12. The major or prevailing issues in the target schemes are enumerated as follows:

Engineering Issues

The primary constraint reported here is “water shortage in dry season” in most schemes followed by “poor O&M at main & 2ndry canals”.

Agronomic Issues

“Farmers not following recommended farming practices” is the most prevailing agronomic constraint reported followed by “rat attack”.

Paddy Marketing Issues

“Low marketing prices” is the most prevailing constraint in paddy marketing followed by “limited bargaining power of farmers”.

Palawija Marketing Issues

“Low marketing prices” is the most prevailing constraint in palawija marketing followed by “unstable marketing prices”.

Farmer Organization (KT) Issues

“Most members are not active”, “managerial capability of KTs” and “no collaboration among KTs” are the main constraints reported.

Extension Services Issues

The prevailing ones are “implementation of extension programs is limited”, “shortage of operational funds of PPLs” and “extension activities of PPLs are limited”.

4.2.3 Water Users’ Associations (WUAs)

The WUA establishment target set up by PWRS South Sulawesi is 1,381 in 41 irrigation schemes. The average working area of one WUA is 88 ha with a range from 47 ha at the minimum to 262 ha at the maximum.

Up to now, 978 WUA have been established in 41 irrigation schemes so that the target realization is 71%. At present, the WUA establishment target ration is 100% in 7 irrigation schemes, 50% to less than 100% in 23 irrigation schemes and less than 50% in 11 irrigation schemes.

Regarding performance of WUA, PWRS South Sulawesi has annually prepared monitoring and evaluation (M&E) report taking into account organization, water allocation and distribution, irrigation maintenance, financing, physical condition of irrigation and related facilities, and Government program on WUA promotion and development. According to the latest M&E report, 66 WUA are classified into “Developed”, while 804 are “Under developing” and 108 are “Not yet developed”. Due to slow progress of legal arrangement, however, only 21 WUA have been legitimized in the local court of justice.

The present condition of WUA as mentioned above is shown in Table A-4.2.13 and summarized as shown below.

Present Condition of WUA in South Sulawesi

WUA Establishment Target Realization Ratio	No. of Scheme	No. of Existing WUA	Performance and Legal Status of Existing WUA					
			Developed		Under Developing		Not Yet Developed	
			L	N	L	N	L	N
75% and more	22	729	6	60	15	600	0	48
50% to 74%	8	107	0	0	0	82	0	25
25% to 49%	10	142	0	0	0	107	0	35
Less than 25%	1	0	0	0	0	0	0	0
Total	41	978	6	60	15	789	0	108

Note : L; Legitimated in local court

N ; Not yet legitimated in local court

4.3 Database for Existing Conditions of Irrigation Schemes

Existing conditions of irrigation schemes of South Sulawesi provinces (41 schemes) are prepared and presented in ANNEX-II (3/3). (Title: Priority List of Irrigation Schemes for Rehabilitation)

CHAPTER 5 REHABILITATION PLAN

5.1 Basic Concepts

5.1.1 Rehabilitation Plan

For the proper management of irrigation schemes, it is necessary to carry out improvement of irrigation infrastructures, to operate and maintain the systems appropriately, and to upgrade the organization of management of water resources and water supply, farming technology, etc. as well as to recognize the significance of irrigated agriculture. For this, important items to be considered are (i) preparation of a rehabilitation plan in due consideration of both aspects of agriculture and organization, (ii) improvement of crop productivity which can be capable of paying the irrigation management fee, and (iii) strengthening of water users' associations.

The basic concepts for the formulation of rehabilitation of facilities to recover the irrigation system are itemized as follows:

- (a) Provision of appropriate irrigation infrastructures with sufficient sustainability, which does not require heavy rehabilitation works during the service life of the systems as far as routine O&M are practiced,
- (b) Securing of design discharge throughout the irrigation system and equitable distribution of canals in order to remove constraints of O&M,
- (c) Provision of user-friendly and easy-operation and maintenance canal structures with sufficient water level at each outlet to irrigate farmlands,
- (d) Proper arrangement of measuring devices and outlets (diversion structure/turnout), considering water distribution methods and easy O&M,
- (e) Provision of inspection roads along main and secondary canals for O&M and farm machinery,
- (f) Provision of farm roads in on-farm level connecting with inspection roads and villages, and
- (g) Provision or renewal of irrigation offices and gate-keeper houses at water resource facilities and canals with transportation equipment.

5.1.2 Agriculture Plan

The basic concepts applied for the formulation of the agriculture plans for the present Study are as enumerated below.

- (a) The formulation of agriculture plans placing emphasis on paddy

- production envisaging contribution to food security in Indonesia and setting a double cropping of paddy as a basic cropping pattern,
- (b) The irrigation agriculture performances and experiences in the advanced schemes among the target schemes of the Study in each province have been to be fully taken into consideration in the formulation of agriculture plans,
 - (c) The plans envisage improvement of crop productivity and realization of an increase of cropping intensity through the efficient use of irrigation water,
 - (d) The current agricultural status including crop selection, cropping schedule, cropping pattern and cropping intensity in the target schemes should dully be assessed and taken into planning so that the formulated plans will be sustainable in accordance with beneficiaries intentions and capabilities,
 - (e) The rational utilization of irrigation water resources is to be emphasized. In this regard, the increase of cropping intensity with the available water in the 3rd cropping season (cropping season following or between the double crops of paddy) to a possible extent is envisaged. The consensus of beneficiaries should be sought at the project detail design stage for this, and
 - (f) It is assumed that there will be no constraints on farm labor availability as almost all the target areas for development are existing paddy fields.

5.1.3 Institutional Aspects

(1) New Irrigation Management Policy

In line with the irrigation substance of the draft Law of Water Resources, all irrigation management activities of main and secondary systems of irrigation schemes are under the full responsibility of the Government and/or Regional Governments. Based on the participatory irrigation management policy that is a new concept in the draft Law of Water Resources, farmers can participate in any activities related to the above systems as long as they have established WUA and their willingness, capacity and capability are sufficient to do.

Operation and maintenance works of tertiary irrigation systems including fund arrangement are the full responsibility of WUA. Although the Government in its Bill of Law on Water Resources proposed the House of Representatives (DPR) that tertiary irrigation system development cost shall be shouldered by WUA, DPR has made several counter proposals to share fully or partly the said cost by the Government. This issue is under deliberation in DPR at moment.

(2) Regional Government Capacity Building on Irrigation Management

In South Sulawesi, Balai PSDA as branch offices of PWRS is responsible for water resources management and technical assistance to district/municipal government which is principally responsible for irrigation water usage management. At present, the respective district/municipal governments considerably fulfill staff allocated to manage 250 public irrigation schemes throughout the province. Taking into account this situation, therefore, the concept of district/municipal government capacity building in this study is to upgrade the existing staff capability based on the new irrigation management policy.

(3) WUA Establishment Acceleration

In the participatory irrigation management policy, WUA is considered the fundamental body of irrigation water users. In connection with this, the target of WUA establishment set up by PWRS South Sulawesi should be fully realized in parallel with recovery of function of irrigation system. At moment, 403 WUA in 34 irrigation schemes have not been established yet. In institutional planning to accelerate WUA establishment, therefore, primary attention is to be paid to these irrigation schemes.

(4) WUA Strengthening

Out of 978 WUA already established in 41 irrigation schemes, the current performance of 804 WUA is evaluated as “Under developing” and 108 as “Not yet developed”. This monitoring and evaluation record clearly reveals that these WUA still need to improve their capacity to manage organization, capability to collect and expense member’s fee, and activities to conduct operation and maintenance of tertiary irrigation system. The focal point in formulating institutional plan, therefore, is to be technical assistance to “Under developing” and “Not yet developed” WUA to overcome its weakness.

(5) Setting-up of WUA Federation

Since the Government Regulation No. 77/2001 on Irrigation was enacted, it was promoted to organize higher-level institutional bodies of irrigation water users, i.e. federation of WUA (FWUA) on secondary canal basis and main federation of WUA (MWUA) on apex scheme-level basis. Although the core of these higher-level bodies should be WUA and irrigation water users themselves should act as the main player in organizing such bodies, actual promotion activities for FWUA/MWUA establishment in South Sulawesi seem to depend on top-down procedure through the channel from the Ministry of Home Affairs to

district/municipal governments following the above regulation and the previous Irrigation Management Policy Reform (PKPI) backed up by the World Bank. Such top-down activities result in that there has been less opportunity of consulting with WUA representatives about FWUA/MWUA establishment.

In institutional planning under this study, therefore, the basic concept is to be set up in such way that the role of FWUA/MWUA is to coordinate member WUA concerning common rule of reasonable water allocation to each WUA as well as to collect ideas and data from WUA as input materials to district/municipal governments.

(6) WUA Activity in Operation and Maintenance Stage

After completion of rehabilitation work, WUA is responsible for operation and maintenance of tertiary system of irrigation scheme. In this regard, WUA's members should master necessary skills required for optimum operation and maintenance of related irrigation facilities to practice irrigation water allocation plan.

In formulating WUA activity plan to meet such requirements, attention is paid to provide WUA's members with on-the-job training on operation and maintenance of tertiary irrigation system once irrigation water can be distributed to the concerned tertiary block. Further activity is considered to be guidance on collection and expenses of WUA member's fee in more transparent manner as well as preparation of annual financial report.

5.2 Irrigation Facility

5.2.1 Criteria for Rehabilitation

(1) Classification of rehabilitation in estimating cost

Classification of rehabilitation is based on the degree of defectiveness and deterioration as follows:

- (a) Class A: Facilities are functioning well: In this case, no rehabilitation cost is incurred.
- (b) Class B: Facilities are partially damaged/deteriorated, and minor rehabilitation is needed. In this case, rehabilitation cost is estimated to be 30% of the new construction cost.
- (c) Class C: Facilities are not functioning well, i.e., operation of the system is difficult and large-scale rehabilitation is needed. In this case, the rehabilitation cost is estimated to be 50% of the new construction cost.

(d) Class D: Facilities are seriously damaged with respect to operation. In this case, the rehabilitation cost is estimated to be equivalent to the replacement and new reconstruction cost.

(2) Headworks

1) Design criteria for rehabilitation of civil works

- (a) More than 50 years: Class D is applied,
- (b) From 30 to 50 years: Class C is applied,
- (c) From 20 to 30 years: Classes B to D are applied depending on the condition, and
- (d) Less than 20 years: Classes B to D are applied depending on the condition.

2) Design criteria for rehabilitation of steel gates and other metal works

- (a) More than 20 years: Class D is applied, and
- (b) Less than 20 years: Class C to D are applied depending on the condition.

3) Other design criteria

- (a) Provision of a settling basin with a sand flush function
- (b) Provision of a device for measuring discharge,
- (c) Provision of an operation bridge, and
- (d) Provision of a water level gauging staff.

(3) Canals and related structures

1) Proposed ratio of canals and structures

The proposed ratio of the canal length and number of related structures to the original design is determined as shown in the following table:

Proposed Ratio of Canals and Structures

Canal works	Classification of canal	Technical	Semi-technical	Non-technical
Canal length	Main canal	1	1.1	1.2
	Secondary canal	1	1.2	1.5
No. of structures	Main canal	1.1	1.2	1.3
	Secondary canal	1.2	1.35	1.5

2) Standardization of canals based on discharge in m³/sec (refer to the Irrigation Design Standard prepared by DGWRD in 1986)

Construction costs for lining canals have been estimated based on the following classified standards:

Standardization of Canals by Discharge(Unit: m³/sec)

0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2 - 4	4 - 6	6 - 8
8 - 10	10 - 15	15 - 20	20 - 25	25 - 30	30 - 35	more than 35

Notes: Canal; lined with concrete, side slope; 1:1.25, longitudinal slope; 1/5,000, n = 0.017

3) Design criteria for inspection roads

It is proposed to provide inspection roads with gravel metaling along the main and secondary canals. The total width of the inspection road is 5.0 m and the effective width is 3.0 m both main and secondary canals. The thickness of gravel metaling is 0.20 m.

4) Standard canal section

For the standard canal section including inspection road, refer to the Irrigation Design Standard prepared by DGWRD in 1986. Typical canal sections for cost estimation are as follows:

- (a) Type A: New construction,
- (b) Type B: Main canal without existing inspection road,
- (c) Type C: Main canal with existing inspection road,
- (d) Type D: Main and secondary canals along existing provincial road,
- (e) Type E: Secondary canal without inspection road, and
- (f) Type F: Secondary canal with existing inspection road.

5) Design criteria for rehabilitation of canals

Cost estimation for rehabilitation of canals is based on the typical canal section and the degree of defectiveness and deterioration as follows:

- (a) Based on the above type of canal section, cost is estimated at the assumption of concrete lining reinforced with PVC fiber mesh,
- (b) More than 20 years: Class D is applied,
- (c) From 10 to 20 years: Class C is applied, and
- (d) Less than 10 years: Classes B to D are applied depending on the condition.

6) Related canal structures

Cost estimates for rehabilitation of related structures have been based on the same standards as headworks, both for civil and metal works.

7) Other design criteria

- (a) Provision of a watercourse section to prevent inflow from outside of the canal during rainfall,
- (b) Provision of discharge measuring devices for appropriate water

management,

- (c) Replacement or renewal of bridges or crossing structures with required design loads (T-10 to T-20 class),
- (d) Provision of hectometer, kilometer posts and name plates for structures for operation and maintenance, and
- (f) Provision of safety facilities for traffic and humans (safety rope, handrail, etc.).

(4) Terminal facilities and on-farm

A design criterion for terminal facility and on-farm is as follows:

- (a) Provision of tertiary and quaternary (feeder) canals and related structures with appropriate density,
- (b) Provision of farm roads with appropriate density, and
- (c) Provision of field drains with appropriate density.

(5) Project facilities

It is proposed that gate-keeper houses at major diversion structures with an area of 50 m² be provided.

- (a) From 1,000 ha to 2,000 ha: 2 gate-keeper houses,
- (b) From 2,000 ha to 5,000 ha: 4 gate-keeper houses,
- (c) From 5,000 ha to 10,000 ha: 8 gate-keeper houses, and
- (d) More than 10,000 ha: 10 gate-keeper houses.

(6) Office equipment

It is proposed that field cars (4WD, 3,000cc class), motor cycles (125cc class), and computers, copy machines and consumables as office equipment be provided.

For field cars,

- (a) From 1,000 ha to 5,000ha: 2 field cars,
- (b) From 5,000 ha to 10,000 ha: 5 field cars, and
- (c) More than 10,000 ha: 7 field cars.

For motor cycles

- (a) From 1,000 ha to 2,000 ha: 10 motor cycles,
- (b) From 2,000 ha to 5,000 ha: 20 motor cycles,
- (c) From 5,000 ha to 10,000 ha: 30 motor cycles, and
- (d) More than 10,000 ha: 40 motor cycles.

For computer, copy machine and consumables

- (a) From 1,000 ha to 2,000 ha: Rp. 100 million,
- (b) From 2,000 ha to 5,000 ha: Rp. 150 million,

- (c) From 5,000 ha to 10,000 ha: Rp. 250 million, and
- (d) More than 10,000 ha: Rp. 400 million.

5.2.2 Availability of Water Resources

It is understood that the cropping intensity of some irrigation schemes in South Sulawesi Province is not necessarily 200%. In other words, cropping intensity in the rainy season is more or less 100% in any schemes, whereas cropping intensity in the dry season is sometimes less than 100% due mainly to the shortage of river runoff.

It is a common practice in the planning stage to determine the irrigation area in the wet and dry season by means of a water balance study between the water demand of the proposed cropping pattern and the availability of water resources. As such information is not available, it is not possible to review the cropping intensity through previous study reports.

The Ministry of Settlement and Regional Infrastructure has been preparing the database for water resources and irrigation systems called “WRDC”. The WRDC was established in the year 2001. However, the autonomy, accountability and responsibility are still unclear. It is also understood that discharge measurement of river runoff is not being done systematically in this country. As a result the database on water resources has not been prepared by WRDC, and consequently it was not possible to collect information necessary for carrying out a water balance study.

Consequently, information on water resources and irrigable area of the schemes furnished by the Dinas PSDA/project offices have been adopted for the determination of the possibility for water supply for the schemes in Pre-F/S stage.

5.2.3 Development Plan

(1) Countermeasures for recovery of function

The existing condition of irrigation systems from the water resource facilities to the terminal facilities and on-farm has been examined and analyzed for the establishment of a rehabilitation plan. Problems and constraints are detailed in Section 4.2.1 and its countermeasures for the recovery of function of the facilities are proposed as summarized below:

Countermeasures for Recovery of Function

Causes of Problems and Constraints	Countermeasures for Recovery
<u>Water resource facility</u>	
1. Weir, flood way, scouring sluices: civil works	
- Crack or damage on weir crest	Repair by chemical/cement grouting or filling concrete
- Leakage from foundation, settlement of weir	Grouting or adding concrete on weir crest
- Inclination, settlement and deflection of pier	Reconstruction
- Settlement and washed away apron and/or stilling basin	Reconstruction
- Fallen down, inclined, or washed away retaining wall	Reconstruction
- Washed away riprap, concrete block	Provision of additional protection works
- Physical O&M problems due to deterioration	Replacement and reconstruction
2. Weir, flood way, scouring sluices: gate and metal works	
- Leakage from guide frame	Repair or replacement of guide frames seal rubber and other members
- Lower strength against design requirement	Replace or strengthen with additional steel members
- Physical operation problem due to deflection, breakage, deterioration	Replacement of parts, replacement of all, paint, oil to hoist gear
3. Intake, free intake: civil works	
- Insufficient diversion water due to sedimentation at and around intake	Removal of sediments through proper maintenance and operation of scouring sluices and intake gates during flood
- Physical operation problems due to breakage of structure	Repair or replace with new construction
- Inflow of bed loads into canal	Proper operation of scouring sluice, provision of settling basin
4. Intake: gate and metal works	
- Leakage from gates and guide frames	Repair or replace guide frames and other members
- Physical operation problems due to breakage or deterioration	Replace or strengthen with additional steel members
5. Others	
- Difficulty in water distribution/water management	Provision of measuring devices, water level gauging staff, and proper operation of intake gate
- Difficulty in O&M	Provision of access road, operation house, inspection bridge and necessary facilities/equipment for O&M
<u>Irrigation Canal and Related Structure</u>	
1. General	
- Sedimentation and/or obstruction of flow	Removal of sediment/water plants by periodical maintenance
- Leakage	Replacement of embankment material by impervious material

(to be continued)

- Collapse Provision of drainage ditch along canal, provision of cross drain, redesign of canal slope
 - General O&M problems Provision of inspection roads, kilometer and hectometer posts, name plate of respective structures
2. Canal Works
- Leakage, cracks, collapse Replace with concrete canal lining with provision of under and side drains
 - Physical O&M problems due to deterioration, unlined Provision of concrete lining, inspection roads
3. Related Structures
- Poor function of discharge control facilities (diversion structure, off-take) due to deterioration of structure both civil and gate works Repair or reconstruct structure with water management facilities such as measuring devices, staff, gauge
 - Poor function of water conveyance facilities (siphon, aqueduct, drop) due to deterioration, breakage, leakage Repair, replace, provide protection facilities, maintenance facilities (blow-off for siphon)
 - Poor function of canal crossing structures (bridge, culvert, cross drain) due to deterioration, clogging by foreign materials, narrow width for traffic Reconstruct bridge based on actual traffic load, remove clogged materials/sediments, reconstruct cross drain based on actual site condition
4. O&M Matters
- Difficulty in O&M due to no or less density of inspection roads Provision of inspection roads with all weather type design, execution of periodical maintenance of canal and roads
 - Difficulty in water distribution and management Review of irrigation area, irrigation diagram and field water requirement and redesign of canal, if required
 - Physical operation problems due to breakage of structure Repair or replace with new construction

Drainage Canal

Natural River/Drainage Canal

- Inundation of paddy fields during rainy season due to drainage problem Provision of drainage canals and sluices
- Physical drainage problem due to sediments, water plants and obstructive materials inside drainage canal Periodical maintenance
- Physical operation problems due to insufficient number of related structures Provision of sluices, bridges, culverts, protection works, etc.

Terminal Facilities and On-farm

Facilities/Water Management

- Physical operation problems due to low density of irrigation and drainage canals in a tertiary block Provision of sufficient irrigation and drainage canals with related structures
 - Physical operation problems during planting and harvesting Provision of farm roads for operation of farm machinery, conveyance of harvested paddy
 - Physical operation problems of water management due to poor land leveling Execution of land leveling and re-layout of irrigation and drainage canals
-

(2) Rehabilitation plan

1) Basic Concept for Rehabilitation Plan

Rehabilitation plans are to be designed for all the schemes in accordance with the rehabilitation criteria discussed in Section 5.2.1. For the rehabilitation plans the following measures were considered and applied.

Water Resource Facilities

(a) Type of water resource facilities

The existing intake method of free intake is replaced by the headworks type to prevent inflow of sediment loads into the canal and to provide a measure for the bed river degradation in the future. (1 scheme)

(b) Provision of settling basin to all the headworks

As analyzed in the previous section, the major problems of operation and maintenance of irrigation canals is caused by sediments that flow into the canal from the river not only during the flood time but also under the normal flow condition of the river. To prevent sediment loads flowing into the irrigation canal, it is proposed to provide settling basin structures for all the headworks except where the intake method is direct from the dam reservoir. (27 schemes)

(c) Replacement of steel gates for scouring sluice and intake

One of the major causes of sedimentation in front of the intake and of inflow into the irrigation canal is judged to be the physical operation problems of both steel gates due to damage and deterioration. To remove this major cause, replacement and/or large scale repair of gates is to be executed.

(d) Provision of inspection bridge and measuring devices

The following facilities are to be provided with appropriate operation and maintenance as well as discharge control structures:

- Inspection bridge having effective wide not less than 3.5 m.
- Measuring devices such as gauging staff, measuring devices with instruments.

Canals and Related Structures

(a) Provision of concrete lining

In order to make provision for proper water management and to decrease O&M costs, including repairing works, it is proposed to provide concrete

lining for both the main and secondary canals for rehabilitation of non-lined canals.

(b) Provision of inspection road

In order to carry out proper O&M and to contribute to the agricultural activities and distribution of products, the inspection roads along the canals are to be rehabilitated or newly provided. The road design should be all-weather type with pavement (effective width: 3.5 m in minimum).

(c) Rehabilitation and provision of related structures

In order to execute proper water management and O&M, the related structures are to be rehabilitated and/or newly provided. Steel gates associated with the control structures (diversion and off-take structures) are to be replaced by new ones in cases where they have deteriorated (over the age of their service design) and/or physically damaged/not functioning.

Terminal Facility and On-Farm

In order to support proper water management and post harvest activities, the terminal facilities including canals, farm roads and related structures are to be rehabilitated or provided new.

2) Features of rehabilitation plan

Based on the basic rehabilitation plan mentioned above in 1), rehabilitation designs at the pre-feasibility study level were made for the irrigation systems from the water resource facilities to terminal facilities including on farm development. The features of the rehabilitation plan for each scheme are shown in Tables A-5.2.1 and Figure A-5.2.1, respectively.

5.2.4 Cost Estimates

Cost estimates for the rehabilitation works have been made for the following five items:

- (1) Direct construction cost for rehabilitation
 - (a) Water resource facilities
 - (b) Irrigation canals and related facilities
 - (c) Drainage canals and related facilities
 - (d) Terminal facilities and on-farm
 - (e) Project facilities (Field office and office equipment)

(2) Work quantities

Work quantities for the rehabilitation including reconstruction and/or new construction have been estimated based on the field investigation and the rehabilitation design described in Section 5.2.1.

(3) Unit prices

Material costs, labor wages, and unit prices of respective construction items have been collected through the field investigation. In addition to the survey results, the actual engineer's cost estimates were collected from similar projects under MOSRI. After examination of the costs, all the costs were found to be the same or similar. Therefore, the same unit prices have been applied for the cost estimates.

(4) Cost estimates

Costs for the rehabilitation works for 41 schemes have been estimated and the results are shown in Tables A-5.2.2. Figures shown in the table below indicate the rehabilitation cost per hectare at a maximum of 3,360 US\$/ha and a minimum of 1,245 US\$/ha:

Rehabilitation Cost per Hectare

Number of Schemes	Unit	Minimum	Maximum	Average
41	US\$/ha	1,245	3,360	2,155
	million Rp./ha	10.3	27.8	17.8

Note: Conversion rate US\$ 1.00 = Rp. 8,279 as of May 2003.

5.3 Agriculture Plans

5.3.1 Agriculture Land Use Plans

The approaches employed in the planning of future land uses under the Study are as follows:

- (a) The subject areas for the present agriculture land use plans are the irrigation development areas determined through the irrigation development study.
- (b) Land use categories converted to irrigated paddy fields include rainfed paddy fields, upland fields and uncultivated land.
- (c) Tree crop lands have been excluded from the subject area for the rehabilitation plan because of farmers' general reluctance towards the conversion of tree crops lands to paddy fields as identified through the Inventory Survey.
- (d) No changes in areas have been assumed in the existing paddy fields.

The agricultural land use plans of the subject areas in the individual target schemes are shown in Table A-5.3.1. The overall features by province are as follows:

Overall Land Use Plans of Subject Areas

Land Use Category	Present/Before Project		Future Plan	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	100,266	82	119,880	99
Rainfed Paddy Fields	15,767	13	0	-
Upland Fields	4,425	4	0	-
Uncultivated Land	1,069	1	0	-
Non-irrigable Land ^{*1}	-	-	1,647	1
Total	121,527	100	121,527	100

Note: *1. Non-paddy fields (gross) – Converted paddy fields (net)

As shown in the table, the increase of irrigated paddy fields of some 19,600 ha (increase of 20% from the present level) is planned as a whole under the Study.

5.3.2 Planned Cropping Pattern and Schedule

Under the present Study, the selection of crops to be introduced in the planned cropping patterns in the target irrigation schemes has been made basically observing the current cropping patterns prevailing in the subject area, which representing farmers intension and capabilities to a certain extent. The crop selection has been made as follows;

- (a) The introduction of double cropping of paddy is envisaged in all target schemes from the farmer's preferences for a crop and the volume of market demands,
- (b) Basically, palawija currently cropped in a target scheme or its surroundings are selected for crops in the 2nd cropping season or crops in the 3rd cropping season other than paddy. Further, growth duration of palawija and the length of the 3rd cropping season affected by the 1st cropping season (wet season) or the length of the 2nd cropping season (dry season I) affected by the start of the 3rd cropping season (dry season II) are considered for the selection of palawija, and
- (c) From the national economic aspect, maize appears to be the most promising crop among palawija.

The selected crops in the target schemes under the present Study are shown in Table A-5.3.2

The two basic cropping patterns each for the western region (Pattern IA & IB) and for the eastern region (Pattern IIA & IIB) have been formulated on the basis of:

- i) study on the current irrigation performances in the target schemes and
- ii) inapplicability of cropping pattern of continuous triple cropping of paddy

(paddy-paddy-paddy) because of danger for serious infestation of pest & diseases and because of time required for periodical O&M of irrigation facilities as explained in the following table.

Basic Cropping Patterns

Pattern	Planned Cropping Pattern ^{*1*2}			Subject Irrigation Schemes
	Wet Season	Dry Season I	Dry Season II	
Western Region				
Pattern IA	Paddy (100%)	Paddy (100%)	Palawija	Sufficient water in dry I
Pattern IB	Paddy (100%)	Paddy/palawija	Fallow	Insufficient water in dry I
Eastern Region				
Pattern IIA	Paddy (100%)	Palawija	Paddy (100%)	Sufficient water in dry II
Pattern IIB	Paddy (100%)	Fallow	Paddy/palawija	Insufficient water in dry II

Note: *1. Western region: Wet season:Nov/Dec-Feb/Mar; Dry I:Apr/May-July/Aug; Dry II: Aug/Sep-Oct/Nov.

Eastern region: Wet season: Apr/May-July/Aug; Dry I: Aug/Sep-Oct/Nov. Dry II: Nov/Dec-Feb/Mar

*2. (%): cropping intensity in the season

A cropping pattern of paddy (intensity 100%) - fallow - paddy (intensity <100%) in irrigation schemes with insufficient water supply in the dry season II has not been planned aiming at efficient use of irrigation water as stated in the basic concepts (Section 5.1.2). The planned cropping patterns for the individual target schemes are presented in Table A-5.3.2.

5.3.3 Planned Cropped Area and Cropping Intensity

In accordance with the planned cropping pattern and the selected crops discussed earlier, the target cropped areas and cropping intensities in the target schemes under the present Study have been planned in accordance with the following manners.

- (a) Target cropped areas and cropping intensities are determined on the basis of current and past cropped areas and cropping intensities in individual schemes,
- (b) The basic target for the cropping intensity of paddy is an introduction of double cropping and a general target intensity of paddy is set to over 170 - 180%. While, 150% is taken as a minimum target in a few schemes,
- (c) Promotion of palawija cultivation in all the target schemes envisaged, especially of hybrid maize,
- (d) The general target set for an annual cropping intensity of paddy and palawija is 200% or higher, and
- (e) In accordance with the manners discussed above, the target cropping intensities for individual schemes have been determined as presented in Table A-5.3.3

In accordance with the planned cropping pattern and the selected crops discussed earlier, the cropped area and cropping intensity have been planned as presented in Table A-5.3.2 and summarized in the following table:

Overall Features of Cropped Area & Cropping Intensity

Crop	Cropped Area (ha)				Cropping Intensity (%)	
	Wet	Dry I	Dry II	Annual	Range	Overall
Paddy	118,890	44,487	56,701	220,078	150 - 200	184
Palawija	0	12,917	12,520	25,437	10 - 40	21
Total	118,890	57,404	69,221	245,515	160 - 240	205

5.3.4 Target Crop Yields and Crop Production Plans

Target yields of paddy are assumed for individual schemes based on the current yield levels in or around the schemes and the yield levels in advanced irrigation schemes as shown in Table A-5.3.2 and are summarized below.

Target Yields under the Study

Cropping Season/Crops	Target Yield		Crop	Target Yield
	Range	Overall Avg		
W Season Paddy	4.5 - 5.5 ton/ha	5.1 ton/ha	Soybeans	1.4 ton/ha
Dry Season I Paddy	5.0 - 5.5 ton/ha	5.2 ton/ha	Mungbeans	1.2 ton/ha
Dry Season II Paddy	5.0 - 5.5 ton/ha	5.3 ton/ha	Groundnut ^{*1}	0.9 ton/ha
Maize (hybrid; grain)	-	5.0 ton/ha	Groundnut ^{*2}	1.2 ton/ha

Note: *1. Groundnut with no tillage, *2. Groundnut with tillage

The overall average target yield level of 5.2 t/ha is an increase of 1.1 t/ha from the present overall average yield of 4.1 t/ha (including rainfed paddy).

On the basis of the target crops yields and the planned cropping pattern, the with-project crop production plans have been formulated for individual target schemes as shown in Table A-5.3.2. As shown in the table, the production increase of 391,000 tons of paddy as a whole is estimated under the with-project condition.

5.3.5 Crop Budgets

The planned crop budgets estimated based on the planned farming practices of paddy and palawija are detailed in Table A-4.2.10. For groundnut, both intensive practice with-tillage and practice without tillage have been planned. The planned crop budgets for paddy and palawija are summarized in the following table.

Planned Crop Budget per ha

Crops	Return (Rp.000)		Crops	Return (Rp.000)	
	Gross	Net		Gross	Net
Paddy			Soybeans	3,780	2,600
- Yield 5.5 t/ha	7,150	4,600	Mungbeans	4,080	2,950
- Yield 5.0 t/ha	6,500	4,120	Groundnut *1	5,280	3,110
- Yield 4.5 t/ha	5,850	3,670	Groundnut *2	3,960	2,430
Maize (hybrid)	5,000	2,820			

Note: *1 Groundnut with no tillage, *2 Groundnut with tillage

5.3.6 Farm Economy

The farm economic analyses under the present Study have been made on 1 ha of irrigated paddy field or rainfed paddy field depending on the present land use of individual schemes by estimating net farm income from paddy fields as applied for North Sumatra and as discussed earlier in Section 4.2.2.

The results of the farm economic analyses thus made on the individual schemes are presented in Table A-5.3.4 and summarized below:

Estimated Net Farm Income from 1ha of Field

Land Use Category	Net Farm Income(Rp.000)			Incremental Net Income Average (Rp.000)
	With-Project		Present	
	Range	Average	Average	
Irrigated Paddy Field	6,102 – 10,354	8,734	5,770	2,964
Rainfed Paddy Field	only 3 schemes	7,663	2,162	5,501
Overall		8,661	5,524	3,137

5.4 Institutional Capacity Building

(1) District/Municipal Government Capacity Building Plan

The focal point of capacity building of district/municipal district government staff in charge of irrigation management is to make staff understand fully the new participatory irrigation management policy and also the difference from the previous irrigation management policy reform based on hand-over of authority to water users. For this purpose, technical guidance seminar will be held in each capital town/city by facilitators consisting of PWRS task force team, consultant and if necessary staff of central line ministries. Materials to be distributed to all attendants are outline papers of new Law on Water resources, Amendment of Government Regulation on Irrigation (Regulation No.77/2001 to be modified) and relevant ministerial decrees (also to be modified) of Ministry of Settlement and Regional Infrastructure, Ministry of Home Affairs and Ministry of Finance.

Following this technical guidance seminar, workshop is to be held to review and modify decrees of Regent/Mayor related to water resources and irrigation as well as job descriptions of officials concerned of district/municipal government about irrigation management in line with the spirit of new Law on Water Resources. In this workshop, discussion should be made among facilitators and attendants regarding how to put the priority over fulfillment of vacant posts taking into account salient features of irrigation schemes located in the concerned district/municipality.

Such seminar and workshop for the technical guidance need to be held in all districts and municipalities in the province. To ensure effective and efficient dissemination of the new irrigation management policy, however, the technical guidance should be carried out with more compact scale. Considering the availability of capable facilitators for technical guidance, therefore, the technical guidance is to be started from the following districts and municipalities where the selected 141 irrigation schemes are located:

Takalar, Sinjai, Maros, Pangkajene Kepulauan, Bone, Soppeng, Wajo, Sidenreng Rappang, Luwu, Polewali Mamasa and Luwu Utara Districts as 25 candidate irrigation schemes are located in these districts and municipalities.

(2) WUA Strengthening Plan

The main objective of WUA strengthening is to make all member farmers be aware of role of WUA and responsibility of its membership in the concerned irrigation scheme. In this connection, the basic concept of WUA strengthening plan is to identify weak points of WUA activities by members themselves on the participatory basis by recapturing monitoring and evaluation record of WUA performance focusing on administrative, financial and operational aspects.

The main targets of WUA strengthening plan are WUA's board of directors and member farmers. The plan consists of WUA awareness raising workshop and technical assistance to WUA concerning capacity to manage organization, capability to collect and expense member's fee, and activities to conduct operation and maintenance of tertiary irrigation system. As for technical assistance, class room training, on-the-job training and mass guidance will be combined in one package program to meet technical assistant requirements of the respective WUA.

Although the target of this plan is 804 "Under developing" WUA and 108 "Not yet developed" WUA, the above package program should be implemented for 680 "Under developing" WUA and 62 "Not yet developed" WUA in 25 candidate irrigations.

(3) WUA Federation Setting-up Plan

In the irrigation scheme where WUA federation has been organized, its role and function are to be confirmed through review of its article from the viewpoint of new participatory irrigation management policy. Also hearing is to be made to representatives of the federation focusing on who took an initiative to establish the federation and whether or not the establishment of federation was backed up by the general will of WUA in the concerned irrigation scheme. If the article is based on Government Regulation No. 77/2001 on Irrigation and relevant ministerial decrees as well as less connection and coordination with member WUA are found, it is confirmed whether the representatives of federation need technical support from Regional (provincial/district) Government for modification of its article and resetting-up of FWUA/MWUA.

For the case of new establishment of FWUA/MWUA, socialization workshop is to be held by the Provincial task force team aiming in order to make WUA and its members understand fully the necessity as well as the role and function of FWUA/MWUA in line with the irrigation substance of new Law on Water Resources. To support WUA for smooth establishment and initial setting-up of FWUA/MWUA, the Provincial task force team is to act as a facilitator.

Although WUA federation setting-up plan needs cover 41 irrigation schemes, the first priority should be given over 25 candidate schemes.

(4) WUA Establishment Acceleration Plan

The main target of WUA establishment acceleration plan is farmers' group in each tertiary block where no WUA has been established although irrigation water can be distributed to the concerned block. For this purpose, Provincial task force team is to invite representatives and members of Farmers' Group to socialization meeting and workshop aiming at confirmation of their awareness to establishment of and participation to WUA as well as their needs for general guidance about procedure and practice of WUA establishment.

Although this plan has to cover 403 WUA not yet established in 34 irrigation schemes, its implementation should be commenced from 19 candidate schemes in which there remain 159 WUA not yet established.

(5) On-the-job O&M Training and Management Guidance

As O&M of tertiary irrigation system is the responsibility of WUA, training programs are to be implemented during the implementation period of rehabilitation works in the respective irrigation schemes in order to enable WUA member farmers to carry out physical activities smoothly and non-physical

activities properly. The main menu is on-the-job training program on O&M of irrigation facilities at tertiary level and management guidance program on collection and expense of WUA member's fee.

(6) Strengthening of Extension Services

To strengthen extension services based on the area specific concept in order to accommodate farmer's needs, promote farmer/farmers' group participation and to take initiatives in the execution of extension services in the irrigation scheme, the main activities are to include farmer/farmers' group empowerment, staff empowerment, field demonstration, technical development/trial, class room training, field school, study tour, workshop and mass guidance.

(7) Cost Estimate for Institutional Capacity Building

The unit cost of each institutional capacity building plan is estimated at preliminary level as follows:

District/municipal government capacity building plan	Rp.10,000,000/time
WUA strengthening plan	Rp.40,000/ha
WUA Federation Setting-up Plan	Rp.20,000/ha
WUA Establishment Acceleration Plan	Rp.20,000/ha
On-the-job O&M Training	Rp.100,000/ha
WUA Management Guidance	Rp.20,000/ha
Strengthening of Extension Services	1% of rehabilitation cost

Taking into account the above unit cost, target and established numbers of WUA, and subject area of irrigation scheme, institutional capacity building cost has been estimated and the result is as shown in Table A-5.4.1.

5.5 Economic Evaluation

5.5.1 General

The economic evaluation of the present Study has been made to assess the economic viability by comparing the project costs and the incremental project benefits between the present/before project conditions and the with-project conditions as the reliable prediction or estimation of the without-project conditions was not possible and impractical. The approaches or assumptions applied for the economic evaluation are as follows;

- (a) Economic evaluation has been made by estimating project benefits between the present/before project and the with-project conditions,
- (b) For economic evaluation, economic internal rate of return (EIRR), financial gross return per ha have been examined,

- (c) Project benefits are estimated based on crop production benefits and indirect or intangible benefits have not been counted,
- (d) The useful life of the Project was taken as 30 years from project implementation,
- (e) Exchange rate of Indonesian Rupiah (Rp.) to US. Dollar (US\$) was taken to be Rp. 8,279 equivalent to US\$ 1.00 (as of May 2003);
- (f) Constant prices at 2003 level were used in the economic evaluation, and

5.5.2 Project Costs

The project costs of the individual rehabilitation plans consist of initial investment costs, replacement costs and O&M costs. The economic project costs calculated from the financial project costs by applying standard conversion factor of 0.90, as shown in Table A-5.5.1

5.5.3 Project Benefits

(1) Economic Prices of Farm Inputs and Outputs

Economic prices of farm inputs and outputs were estimated in order to evaluate the expected project benefits. Economic prices of trade goods such as rice, maize, soybeans, groundnuts and fertilizers were estimated on the basis of the projected world market prices of these commodities forecast by the World Bank. Non-trade goods were valued at financial prices which were estimated on the basis of current market or farm gate prices. Farm labor was valued at the shadow wage rate of 0.80. The economic prices of farm inputs and outputs applied for the economic evaluation are presented in Table B-6.2.2 and B-6.2.3.

(2) Project Benefits

Only the crop production benefits are assessed as the project benefits as stated earlier. The net project benefits are defined as the difference in net return from crop production between the with-project and the present/before project conditions. The economic crop budgets applied for the estimation of the net return under the Study are as presented in Table A-5.5.2. The project benefits expressed as the incremental net return from crop production in the individual schemes are estimated as shown in Table A-5.5.3.

5.5.4 Results of Economic Evaluation

The results of the economic evaluation (EIRR, B/C, B - C & incremental gross return per ha) are presented in Table A-5.5.4 and as summarized below.

Economic Internal Rate of Return (EIRR)

EIRR	No. of Schemes	Ratio (%)
$\geq 20\%$	5	12
15 - 19%	11	27
10 - 14%	23	56
$< 10\%$	2	5

EIRRs of the schemes in South Sulawesi province are in the range of 8.5% to 22.8% and the rates of 39 schemes (95%) out of 41 schemes are calculated at higher than 10%.

B/C ratios at a discount rate of 10% are summarized in the following table.

B/C at Discount Rate of 10%

B/C	No. of Schemes	Ratio (%)
≥ 1.0	39	95
< 1.0	2	5

The incremental gross returns per ha of the subject area under the with-project conditions are shown in Table A-5.5.4 and summarized in the following table.

Incremental Gross Return per ha (Rp. million; Financial Value)

Incremental Return/Ha	No. of Schemes	Ratio (%)
≥ 6.0	7	17
3.0 - < 6.0	30	73
< 3.0	4	10

Overall average gross returns per ha and incremental gross returns per ha are estimated as shown in the following table.

Average Incremental Gross Return per ha of Subject Area

Gross Return per ha (unit: Rp.000)		
Before Project	With-project	Increment
8,316	12,889	4,573

The overall average incremental gross returns per ha of the subject area under the with-project conditions are estimated at Rp. 4,573,000 respectively as shown above.

5.6 Database for Rehabilitation Plan

The databases for the rehabilitation plan of 41 irrigation schemes are shown in Volume 5, ANNEX-II (3/3).

CHAPTER 6 PRIORITIZATION FOR IMPLEMENTATION OF REHABILITATION

6.1 Flow of Criteria for Prioritization

6.1.1 Flow of Prioritization

The general flow for prioritization of Rehabilitation Projects is shown in Figure A-6.1.1.

The procedure for the prioritization is described as below:

First Screening

Step-1

- 1.1 Collection of data on existing irrigation schemes with a registered area of more than 1,000 ha.
- 1.2 If the area of both the registered area and the estimated area were more than 1,000 ha proceeded to Step-2. If an estimated area was less than 1,000 ha, such scheme has been categorized into Group-VI.

Step-2

- 2.1 Evaluation of capacities of WUA of each irrigation schemes and related district governments.
- 2.2 If more than 50% against target number of WUAs has been already established as well as the post of head of water resources and irrigation service office has been fulfilled by the third or higher rank officer, proceeded to Step-3 (1). On the other hand, if more than 50% against target number of WUAs has not been established or the said post has been vacant or fulfilled by the fourth rank officer, the scheme has been categorized into Group-V.

Step-3

- 3.1 Information on water resources and irrigable area of the scheme furnished by the Dinas PSDA/project office has been adopted for the determination of the possibility for water supply for the scheme.
- 3.2 If the water resources was considered to be sufficient for the scheme according to such information, an inventory survey and pre-F/S have been carried out.
- 3.3 If the water resources were considered to be insufficient for the scheme according to the information, proceeded to Step-3 (2).
- 3.4 In case that there was a possibility of reformulation of water resources development plan, the scheme has been categorized into Group-IV. On the

other hand, if there was no possibility of reformulation of water resources development plan, the scheme has been categorized into Group-VI.

Second Screening

Step-4

4.1 If there are such problems as low technical sustainability (high construction cost and low economic feasibility) and less contribution to the society, such scheme shall be categorized into Group-VI.

Step-5

5.1 Evaluation indicators for prioritization consist of issues of: (a) irrigation, (b) agricultural productivity, (c) society, and (d) economic and financial impacts.

5.2 Based on the comprehensive examination of the above evaluation indicators in pre-F/S, priority of the schemes to be rehabilitated shall be determined and listed.

Priority

Based on the priority list thus prepared, recommendation of implementation procedure is made as follows:

Group-I: Recommended as the first priority

Group-II: Recommended as the second priority

Group-III: Recommended as the third priority

Group-IV: Recommended to reformulate water resources development plan

Group-V: Recommended to accelerate WUA establishment and to empower district government officials concerned

Group-VI: Recommended to formulate development method by other categories

6.1.2 Criteria for Prioritization

Prioritization of rehabilitation works has been based on following four major evaluation indicators:

(a) Rehabilitation of irrigation system impact

(b) Agriculture productivity impact

(c) Social impact

(d) Economic and financial impacts

It should be noted that the status of water users' association has not been included in the evaluation indicators due to the reasons stated in the box in the next stage.

(1) Rehabilitation of irrigation system impact

Rehabilitation of irrigation system impact consists of following three items:

- (a) Utilization of resources potential
- (b) Urgency of rehabilitation
- (c) Sustainability

“Utilization of resources potential” means that actual intake of water vs. designed capacity of intake structure. It is necessary to evaluate increment of intake of water by improving or repairing intake structure, and as a result how much irrigation area can be increased.

“Urgency of rehabilitation” means recovery of function of irrigation scheme, which was not functioning due to disorders of the facilities, by means of rehabilitation. For instance, intake structure or main canal is heavily damaged by some reasons, all the system may not function at all. In such case, evaluation should be made in such a manner that how much function of the system recovers with limited investments.

“Sustainability” does not necessarily depend on structure stability, but it is one of the most important indicators of the effect of rehabilitation. Evaluation of sustainability should be based on the extension of project life.

(2) Agriculture productivity impact

Agriculture productivity impact consists of following three items:

- (a) Increase of irrigation area
- (b) Cropping intensity
- (c) Crop yield

Evaluation of agriculture productivity impact shall be made in terms of increments of irrigation area, crop yield and cropping area.

(3) Social impact

Social impact consists of following two items:

- (a) Increase of beneficiaries
- (b) Improvement of rural infrastructures

Evaluation of social impact shall be made both aspects of alleviation of poverty and improvement and newly provision of rural infrastructures.

(4) Economic and financial impacts

Evaluation of economic feasibility shall be carried out based on Economic Internal Rate of Return (EIRR) and evaluation of financial viability shall be based on analysis of agriculture gross return.

6.2 Weights of Evaluation Indicators

Distribution of weighted score for four respective indicators is determined as below and details are shown in Table A-6.2.1.

Evaluation Indicator		Weighted Score
1.	Issue of Irrigation Indicator	50
1.1	Utilization of irrigation potential	(10)
1.2	Urgency of rehabilitation	(25)
1.3	Sustainability	(15)
2.	Issue of Agriculture Productivity	20
2.1	Current cropping intensity	(10)
2.2	Current unit yield of paddy	(10)
3.	Issue of Society	15
3.1	Number of beneficiaries	(7.5)
3.2	Provision of social infrastructure	(7.5)
4.	Issue of Economic and Financial Impact	15
4.1	Feasibility (EIRR)	(7.5)
4.2	Agriculture gross return per hectare	(7.5)

6.3 Evaluation Results

The evaluation was made for 41 schemes and the evaluation results are finally classified into Group I, II, III, IV, V and VI as shown in Table A-6.2.2 and summarized below, and high priority is given in the schemes classified into from Groups I to III.

Summary of Prioritization

Priority Group						
I	II	III	IV	V	VI	Total
11	6	8	0	11	5	41

The database for the prioritization in each schemes is presented in Volume 5, ANNEX-II (3/3).

6.4 Selection of Model Scheme for the Feasibility Study

Selection of model scheme to be taken up for the feasibility study has been comprehensively made considering not only the evaluation results of prioritization but also the following factors:

- (a) The scheme of which irrigation area is more or less the same as the average area of the 41 schemes,
- (b) The scheme of which condition of topography, situation of agriculture

and agro-economy, type of irrigation system/facilities, etc. represents the subject schemes,

- (c) The scheme of which rehabilitation brings about immediate effects on the recovery of the system (such as damages on the primary canal)
- (d) The scheme of which rehabilitation gives rise to a great impact on a regional community/economy (schemes located suburbs of a city or at large market)

A few proposed irrigation schemes were selected by the Team in due consideration of the above factors. This proposal was further examined in the meetings with the counterpart personnel and the representatives of Dinas PSDA. Finally, Kalaena Kiri Scheme was selected and determined to be taken up fro the model schemes. The general features of Kalaena Kiri Scheme are as follows:

Features of Selected Areas

Irrigation Scheme	Kalaena Kiri
District	Luwu Utara
Sub-district	Mangkutana
Existing Condition	
Registered area	4,671 ha
Technical level	Technical
Completion year of system	1980
Water resources river	Kalaena River
Type of water resources facility	Headworks
Settling basin	Provided
Max. intake discharge (m ³ /s)	8.0
Length of main canal (km)	17.1
Length of secondary canal (km)	17.3
Number of WUAs (Target/Established)	55/40
Number of farmers	2,234
Development Plan in Pre-F/S Level	
Subject area (ha)	3,536
Water resources facility	Headworks (Rehabilitation)
Settling basin	Rehabilitation
Length of main canal (km)	14.9
Length of secondary canal (km)	15.1
Rehabilitation cost: Total (million Rp.)	72,763
Rehabilitation cost: Per hectare (million Rp.)	20.6 (US\$2,486/ha)
Economic internal rate of return (%)	13.2

CHAPTER 7 PREPARATION OF ACTION PLAN

7.1 Action Plan

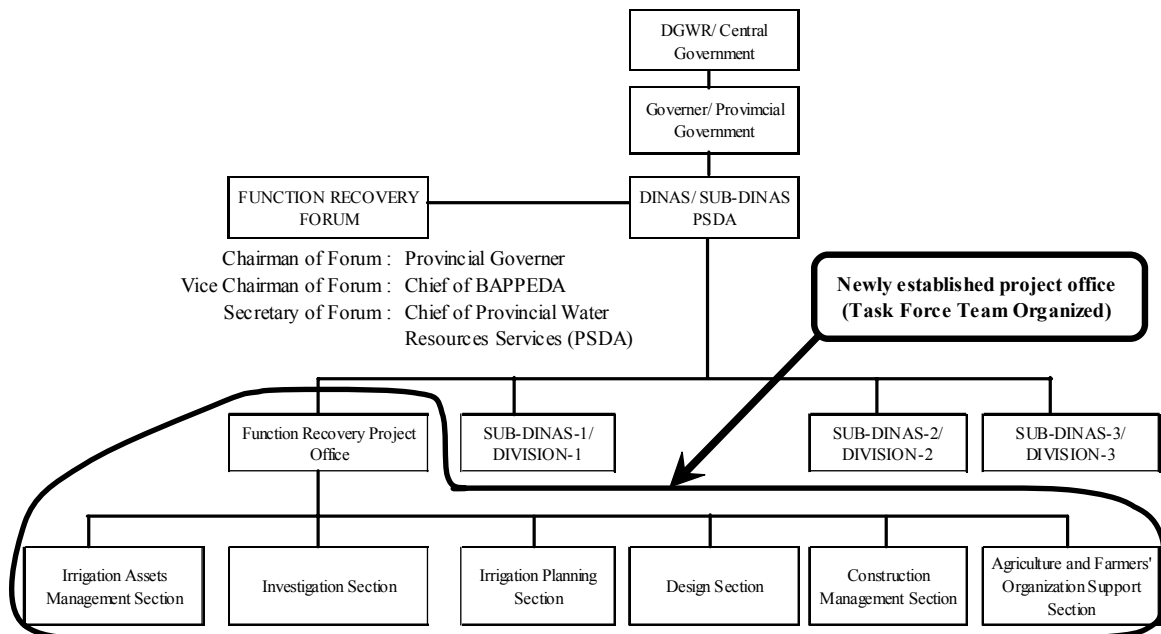
The priority ranking has been made for each irrigation scheme in the preliminary feasibility study. The action plan for rehabilitation work after the prioritization should be prepared with following contents:

- (a) Organization plan,
- (b) Action plan for recovering function of irrigation facilities,
- (c) Action plan for institutional strengthening,
- (d) Action plan for extension services strengthening, and
- (e) Action plan for budgeting.

7.2 Organization Plan

(1) Precondition

The organization for the recovery program is proposed as illustrated below:



Proposed Organization for Recover Program of Irrigation Agriculture

The organization is to be formed of “Forum” as a decision making body and “Project Office” as an implementation body. These bodies are to be newly established at provincial level, which are responsible for implementing the comprehensive recovery program of irrigation agriculture from the initiation phase to the final phase on the basis of participatory irrigation management concept.

The Project Office is attached to provincial water resources service as one of functional units and under the control of the chief in charge of water resources management and utilization.

(2) Function Recovery Forum

The Forum is to play facilitator's role in collecting ideas and inputs to the function recovery program at the respective Phases from water users and other stakeholders. The Forum is also responsible for getting final approval from the Governor about its decisions on implementation of the program including budgeting and budget implementation plans. The Forum will be composed of the following members:

Chairman of Forum:	Provincial governor
Vice chairman of Forum:	Chief of BAPPEDA
Secretary of Forum:	Chief of Provincial Water Resources Services (PSDA)
Member of Forum:	District Regent, Municipal Mayor, Chief of District BAPPEDA, Chief of District Water Resources Services, Chief of Agriculture Services at provincial and district level, Chief of relevant services at provincial and district level, Representative of Water Users' Association, University and NGO

(3) Function Recovery Project Office

As discussed in the precondition, "Function Recovery Project Office (tentative name)" will be established under PSDA or Public Services (PU) and take full responsibility of implementation and management of all activities in each phase of the recovery program. The Project Office will be composed of about six (6) Sections such as (a) Irrigation Assets Management Section, (b) Investigation Section, (c) Irrigation Planning Section, (d) Design Section, (e) Construction Section, and (f) Agriculture and Farmers' Organization Support Section.

The Project Office has to (i) maintain close relationship with the stakeholders of water user side, (ii) clarify, utilize and manage their ideas and inputs, and (iii) has a right of influence on their demands for the successful completion of the project. The Project Office will organize various task force teams to carry out specific activities under the direction of the Forum.

In implementing and managing the recovery program, the project manager is a leader of the working group, and his leadership has to be displayed in any activity of the program. He is expected to have skills as communicator, negotiator and problem solver.

Major activities of the respective sections stated above are as follows:

Project Manager	<ol style="list-style-type: none"> 1. The person in charge of implementation of the project. 2. Responsible for negotiation with related agencies, and obtaining consensus. 3. Responsible for implementation schedule. 4. Responsible for drawing up and expending budget for the implementation of the project.
Irrigation assets management section	<ol style="list-style-type: none"> 1. Responsible for managing/safekeeping and updating of irrigation facilities account book. 2. Collection and assessment of information of irrigation facilities from the subordinate agencies (Kabupaten).
Investigation section	<ol style="list-style-type: none"> 1. Confirmation of consistency of the account book and the existing status of irrigation facilities. 2. Supervision of observation and collection/classification of meteorological and hydrological (river runoff) data. 3. Periodical investigation on the status of irrigation facilities and preparation of report. 4. Conducting inventory survey of the existing facilities, which are necessary for formulating the rehabilitation program.
Irrigation planning section	<ol style="list-style-type: none"> 1. Analysis of data on meteorology and hydrology (river runoff). 2. Formulation of rehabilitation plan based on the investigation results. 3. Prioritization of irrigation schemes based on the rehabilitation plan and the construction cost. 4. Preparation of manual of water management and O&M, and guidance of the manual 5. Conducting investigation on environmental impact assessment, and obtaining permits for implementation of the project.
Design section	<ol style="list-style-type: none"> 1. Preparation of design report and bill of quantities, and tender documents including drawings. 2. Conducting design modification during the construction of irrigation facilities.
Construction section	<ol style="list-style-type: none"> 1. Selection of contractors (from tendering to contract signing). 2. Supervision of construction works. 3. Inspecting completion of work, and supervising the project works during the guarantee period.
Agriculture and farmers' organization support section	<ol style="list-style-type: none"> 1. Collection and classification of information on the WUA and related organizations. 2. Collection and classification of information on agriculture and agro-economy required for formulating rehabilitation program. 3. Establishment and support of the program on agriculture and agro-economy. 4. Establishment and support of the program on the empowerment of institutional organization.

The activities stated above will change in accordance with the implementation progress of activities in each phase of the program. It will become necessary to employ specialized and qualified consultants (Indonesian and/or international) as required.

7.3 Action Plan for Recovering Function of Irrigation Facilities

7.3.1 Action Plan based on the Priority Group

Recommendations based on the evaluation results for the six (6) groups from Groups I to VI are as follows

- Group I: High priority schemes (Recommended making F/S)
- Group II: Second high priority schemes (Recommended making F/S)
- Group III: Third high priority schemes (Recommended making F/S)
- Group IV: Schemes that require reexamination of availability of water resources before making F/S
- Group V: Schemes that require empowerment of WUA or district government before making F/S
- Group VI: Schemes that require reexamination of development methodology before making F/S

Of the above classification, action plan for Groups I to III is more or less the same, though timing of initiation of implementation is different, whereas action plan for Groups IV to VI is not the same due to different constraints. Action plan for each group is as follows:

Groups I to III:

- Procurement of consultants for making F/S,
- Execution of F/S,
- Preparation of implementation program for each scheme,
- Appropriation of funds for the rehabilitation,
- Procurement of consultants for detailed design and construction supervision,
- Field investigation and topographic survey, etc., for detailed design, and preparation of detailed design,
- Preparation of tender documents including drawings,
- Selection of contractor(s),
- Supervision of construction, and
- Final inspection for completion delivery and O/M of the system.

Group IV:

- Procurement of consultants for field survey and study on development plan,
- Preparation of alternative development plan,
- Execution of F/S based on the alternative plan, and
- Activities to be followed are the same as Groups I to III stated above.

Group V:

- Promotion of the organization of WUA to the required level,
- Promotion of the organization of district government to the required level,
- Classification of schemes to Groups I to III or Group VI, and
- Activities to be followed are the same as Groups I to III stated above.

Group VI:

- Procurement of consultants for field survey and study on development plan,
- Preparation of alternative development plan (If the registered area is less too small, integration of plural schemes or exclusion from the list are to be considered.),
- Execution of F/S based on the alternative plan, and
- Activities to be followed are the same as Groups I to III stated above.

7.3.2 Evaluation of Each Scheme and Confirmation of Development Plan

Evaluation of each scheme in terms of issues/problems and their countermeasures are summarized as follows:

Priority of Rehabilitation of the Schemes, Issues/ Problems and Countermeasures

Group	Priority of Rehabilitation	Issues and Problems	Countermeasures
I	High priority (Recommend F/S)	- Poor function of basic structures - No problem in water resources facilities	- Recovery of function by R/U of basic structures.
II	Second priority (Recommend F/S)	- Poor function of the system due to deterioration - Malfunction of terminal system - No problem in water resources facilities	- 30-50% of facilities needs R/U. - Replacement or repairing of gates is necessary. - New construction or rehabilitation of inspection road is necessary.
III	Third priority (Recommend F/S)	- Malfunction of the system due to deterioration - No function of terminal system - No problems in water resources facilities	- More than 50% of facilities need R/U. - Rehabilitation of terminal system is urgent.
IV	Re-examination	- Water is not distributed to the terminal system due to shortage of river runoff. - Paddy field is converted to upland field or orchard due to shortage of water.	- Development of new water resources - Integration of schemes - Conversion of crops to be cultivated to meet irrigable area.
V	Re-examination	- Poor functions and activities of WUA or district government (on the condition that there is no problem in water supply).	- Establishment and empowerment of WUA or empowerment of district government is urgent (on the condition that there is no problem in water supply).

VI	Re-examination	<ul style="list-style-type: none"> - Registered area with less than 1,000 ha (recommended by JICA Study Team) - Absolute shortage of water resources - Low effect on investment - Low motivation of farmers in practicing farming 	<ul style="list-style-type: none"> - Development of new water resources - Conversion of crops to meet irrigation area
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7.3.3 Packaging of Field Survey and Construction Works

(1) Field Investigation for F/S

In order to maintain the uniformity of field survey results, number of package of F/S is one (1) regardless of the scale of the schemes. The study period ranges from 6-18 months depending on size of the schemes.

(2) Construction Works

Packaging of the construction works is made on the basis of monetary terms that are the decisive factors. The approximate construction cost is Rp. 50,000 million (approximately J¥ 700 million) per package. The construction period of one scheme is determined to be 2 years in principle, however, that of large area is 3 years.

7.3.4 Implementation Schedule

The irrigation schemes in the province are classified based on the evaluation of rehabilitation priority as shown below:

Number of Schemes classified based on Priority of Rehabilitation

Group	I	II	III	IV	V	VI	Total
Number	11	6	8	0	11	5	41

Based on the priority group and major features of the schemes stated in the above table, the implementation schedule together with the said information are summarized in Table A-7.3.1 and Figure A-7.3.1. It should be noted that the implementation schedules of the F/S and construction works of the schemes classified into Groups IV, V and VI are not presented in the report because various kinds of survey and study are required before commencing F/S.

7.3.5 Status of Basic Information on the Irrigation Schemes

In commencing the Study on the Comprehensive Recovery Program of Irrigated Agriculture, basic information such as irrigation area, irrigation diagram, dimension of canals and related structures, intake water record, meteorological

and hydrological data. Needless to say, the Study largely depends on the availability of such basic data and their accuracy.

One of the most important tasks of the Study is to collect the basic information. However, many schemes are equipped with neither basic information nor detailed information. To cope with this situation, it was necessary to visit the branch offices of the Provincial Water Resources Management Services Office (Dinas PSDA), nonetheless plenty of documents have been scattered and lost.

The comprehensive recovery project is expected to be certain that the function of facilities can be easily recovered, as most of the existing schemes.

In order to complete successfully the project, the “processing of basic information and preparation of the updated book” is prerequisite condition. For the implementation of the project, necessary information can be collected through such updated book, and if further information is required, additional field survey would be necessary, which is to be added to the book.

It is recommended that the Dinas PSDA should supervise such activities and be responsible for keeping book. In other words, it is urgently necessary for Dinas PSDA to update the information regarding meteorology, hydrology, conditions of irrigation facilities, irrigated area, crop production, etc., which can be furnished for the formulation of rehabilitation plan.

7.4 Action Plan for Institutional Strengthening

7.4.1 Type of Plan

Action plan for institutional strengthening consists of the following two (2) program groups:

- The one is to be conducted in either initial or midterm phase prior to the implementation of rehabilitation works of irrigation system. Action plan for this group includes institutional capacity building and staff capability improvement program, WUA strengthening program, FWUA and MWUA initial setting-up program, and WUA establishment acceleration program; and
- The other is to be carried out in final stage as one of the project components in parallel with rehabilitation works of irrigation system. Action plan for this group covers training program on operation and maintenance of tertiary irrigation system, and guidance program for collection and expense of irrigation water service charge.

The overall implementation schedule of action plan for institutional strengthening is included in Figure A-7.3.1.

7.4.2 Formulation of Task Force Team for Institutional Strengthening

For conducting the action plan of the first group, a Task Force Team will be established by the Provincial Government. In principle, this Task Force Team is responsible for providing initial ideas/needs and making decision to take necessary arrangement for the program implementation. This Task Force Team is therefore formed of the following members:

- Chief is to be appointed from Provincial Water Resources Service Office;
- Secretary is to be appointed from Provincial Water Resources Service Office; and
- Members are to be appointed from Provincial and District/Municipal Water Resources Service Offices as well as representatives of WUAs, FWUA/MWUA if already organized and Farmers' Group in non-WUA.

For carrying out the action plan of the second group, a working group will be organized under the control of the rehabilitation project manager and led by a senior project staff in charge. As members of this working group, experts are also invited from NGO and universities in addition to representatives of WUAs and FWUA/MWUA if available. This working group is responsible for providing necessary inputs and making decision and necessary arrangement for the program implementation.

7.4.3 Elements of Action Plans for Institutional Strengthening

(1) Institutional Capacity Building and Staff Capability Improvement Program

This program contains two (2) components. One is to enable irrigation officials at regional level to understand and practice the new irrigation management policy. The other is to improve the capacity of organization units of district/municipality government involved in irrigation management and those staff capability in line with the new irrigation management policy.

The first component will be done through undertaking a series of seminar and workshop to be facilitated by the central government after the legal framework of water resources and irrigation management is completed. Its program formulation and budget arrangement will be also made by the central government.

The second component should reflect to the above nationwide dissemination of the new irrigation policy by the central government. This component will be done by the Task Force Team at provincial level and consultants as follows:

- To evaluate the capacity of district/municipal government authorities and the capability of those staff, both involved in irrigation management activities;
- To identify needs for improving institutional capacity and staff capability to cope with the new irrigation management policy as well as supporting requirements for fulfillment of such needs through technical assistance by central/provincial government; and
- To formulate implementation programs on institutional capacity building and staff capability improvement for the respective district/municipal government authorities involved in irrigation management.

Regarding the budget arrangement for these implementation programs, the main source is district/municipal government budget to cover the cost for institutional capacity building and staff capability improvement, while the supplemental source is provincial government budget to cover the cost for implementation of the supporting menus.

In implementing the institutional capacity building and staff capability improvement program, a group of trainers will be organized by inviting well experienced specialists from consultant, NGO and universities. Monitoring and supervision of the program implementation should be carried out continuously by relevant organization units at provincial level throughout the program implementation stage with periodical reporting on performance and impact of the program implementation.

(2) WUA Strengthening Program

The background of this program is the existence of many irrigation schemes where majority of WUAs have yet shown good performance in terms of organization management and financing aspects other than physical aspects like irrigation facility condition and water allocation utilization. From the initial stage of irrigation system rehabilitation, farmers' participation is prerequisite so that the capability of WUA is one of important key factors for successful implementation of the comprehensive recovery program of irrigation agriculture.

The Task Force Team should be responsible for making necessary arrangement to formulate and implement WUA strengthening program by recruiting consultant as technical assistant. The Task Force Team and its consultants shall:

- hold WUAs' awareness raising workshop to reconfirm weak points elaborated from recapitulated the latest monitoring and evaluation (M & E) record on WUA's performance;
- confirm establishment of WUA Federation (FWUA) at secondary level and federations group at primary level (MWUA) as well as non-WUA tertiary system within the irrigation scheme;
- carry out interview survey to WUAs' representatives of all WUAs in the irrigation scheme if the latest M & E record shows the condition of more than three years ago, and update M & E record;
- identify technical assistant requirements for improving WUA's capacity to manage organization, capability to conduct operation and maintenance of tertiary irrigation system, and/or activities to collect and expense WUA members' fee;
- formulate a technical assistant menu list and make a package program of technical assistance menus according to WUA's needs to improve its capacity, capability and/or activities; and
- estimate unit cost of each technical assistant menu and total cost of package program.

Budget for implementing package program for strengthening WUA is to be arranged by Regional Government according to its jurisdiction.

In implementing the WUA strengthening program before starting rehabilitation works, the Task Force Team shall make necessary arrangement to recruit consultant, NGO and/or universities as facilitators and implementers in the irrigation scheme area.

(3) FWUA and MWUA Initial Setting-up Program

The background of this program is the current change in the operation and maintenance responsibility of primary and secondary irrigation system in line with the draft of new Law on Water Resources. These two groups will represent those member WUAs so that they should build up transparent channel and good cooperation among WUAs, FWUAs and MWUA in implementing irrigation management activities. In order to secure appropriate role and function of WUAs' groups in conformity with the participatory irrigation management policy, therefore, it is necessitated to support initial setting-up of FWUA and MFUA.

The same Task Force Team and its consultant shall:

- collect list of FWUA/MWUA, list of member WUAs, legal documents;
- review and confirm role and function of FWUA/MWUA compared with the participatory irrigation management policy;

- socialize the necessity of setting up representative groups to WUA to cope with the participatory irrigation management policy if FWUA/MWUA has not been established;
- formulate a guidance menu list and make a package program of guidance menus to support initial setting-up of FWUA/MWUA according to the current situation in the irrigation scheme; and
- estimate unit cost of each guidance menu and total cost of package program.

Budget for implementing package program for initial setting-up of FWUA and MWUA is to be arranged by Regional Government according to its jurisdiction.

In implementing the initial setting-up of FWUA and MWUA program before starting rehabilitation works, the Task Force Team shall make necessary arrangement to recruit consultant, NGO and/or universities as facilitators and supporters in the irrigation scheme area.

(4) WUA Establishment Acceleration Program

The background of this program is the existence of tertiary blocks where no WUA has yet established within one irrigation system resulting in that the realization of full-scale management of irrigation system is still impossible. In such case, any irrigation scheme with WUA establishment target realization ration of less than 50% is to be dropped from Master List according to the criteria. Further, there are candidate irrigation schemes which have tertiary blocks without WUA. As long as irrigation water is distributed to the concerned tertiary block, WUA should be established as a terminal body of water users. Therefore, it is indispensable for accelerating WUA establishment up to the target level in each irrigation scheme in order to ensure participatory irrigation management in the whole tertiary blocks of one irrigation system in an integrated manner.

The same Task Force Team and its consultant shall:

- hold socialization meeting and workshop to invite representatives and members of farmers' groups which are available in non-WUA tertiary blocks provided with irrigation water, for the purpose of accelerating WUA establishment and promoting participatory irrigation management;
- confirm farmers' awareness to establishment of and participation to WUA as well as their needs for guidance about procedure and practice of WUA establishment;
- formulate a guidance menu list and make a package program of guidance menus to accelerate WUA establishment in non-WUA

- tertiary blocks to which irrigation water is distributed; and
- estimate unit cost of each guidance menu and total cost of package program.

Budget for implementing package program for WUA establishment acceleration is to be arranged by Regional Government according to its jurisdiction.

In implementing the WUA establishment acceleration program before starting rehabilitation works, the Task Force Team shall make necessary arrangement to recruit consultant, NGO and/or universities as facilitators and supporters in the irrigation scheme area.

(5) Training Program on Operation and Maintenance of Tertiary Irrigation System

This training program will be done after completing the rehabilitation works of irrigation system. For this purpose, however, preparation of training manual and program should be done in parallel with the final stage of rehabilitation works. Also the concept of training program should synchronize irrigation water allocation plan to tertiary blocks as well as cropping pattern and planting schedule in the irrigation scheme.

As this training will be done as one of rehabilitation project components, consultant under the project manager is responsible for preparing training manuals, formulating training program estimating training cost and implementing training program. To ensure effective and efficient implementation of training on operation and maintenance of tertiary irrigation system, NGO and other volunteers will be encouraged to involve in training activities at field level in addition to the project staff, Regional Government officials and consultant.

Budget arrangement based on consultant's cost estimate is the responsibility of the project manager.

(6) Guidance Program for Collection and Expense of Irrigation Water Service Charge

The background of this program is the reconfirmation of WUA's obligation to operate and maintain tertiary irrigation system in the draft of new Law on Water Resources. Since 1984, farmers have been responsible for paying irrigation service fee to cover the cost for operation and maintenance of tertiary irrigation system as well as management cost of WUA. Due to uncertain realization of irrigation water allocation plan to each tertiary block of the irrigation system, however, many WUA members put lower priority over their irrigation service fees among annual expenses from their income. As irrigation water supply can be

guaranteed as planned after the rehabilitation works completed, therefore, it is needed for reluctant farmers to remind their obligation and to encourage them to fulfill their obligation.

In parallel with preparation of training manual on operation and maintenance of tertiary irrigation system, the project consultant shall:

- identify issues on book keeping system, fee determination method, payment form, fee collection system and payment schedule;
- identify issues fee allocation system to cover administration, operation, maintenance and other miscellaneous cost;
- identify incentives to members;
- formulate a guidance menu list and a package program of guidance menus for collection and expenses of irrigation water service fee; and
- estimate unit cost of each guidance menu and total cost of package program.

Budget arrangement based on consultant's cost estimate is the responsibility of the project manager

In formulating and implementing the guidance program for collection and expense of irrigation water service charge, the project manager should pay his due attention to recruit a consultant with specific experiences matching with the above terms.

7.5 Action Plan for Extension Services Strengthening

7.5.1 Formulation of Action Plan

The goal of strengthening extension services is to mitigate individual or plural constraints to agricultural development based on farmer-to-farmer approaches. To reach the goal, it is prerequisite to formulate a strategic action plan tailored to area specific needs. Therefore, the action plan has to include a series of program menus aiming at farmer/farmers' group and staff empowerment. Formulation of the action plan for strengthening extension services also has to be well synchronized with the implementation schedule of rehabilitation works of the irrigation scheme. Key program menus are field demonstration, technical trial, classroom and field school training, study tour, workshop, mass guidance, and so on.

7.5.2 Formulation of Task Force Team for Extension Services Strengthening

For implementing the action plan, a Regional Task Force Team for strengthening extension services will be established by Regional Government. This Task Force Team is formed of the following members:

Chief	Regional agriculture services agencies
Secretary	Regional agriculture services agencies
Member	Irrigation services agencies Water users associations (farmers)
Technical guidance team	Agriculture & irrigation agencies of higher jurisdiction; BPTP

7.5.3 Formulation of Implementation Program

An implementation program of the action plan for strengthening extension services will be formulated stepwise as below:

Constraints for development will be identified by the following means:

- Investigation on the present agriculture conditions and identification of constraints to be mitigated for the attainment of the targets set in the agriculture plan; and
- Field confirmation of the constraints by the research-extension dialog team.

Approaches and countermeasures or technologies will be introduced by establishment of:

- Approaches for the mitigation of the constraints identified;
- Countermeasures for the mitigation of the constraints identified; and
- Agriculture technologies for the mitigation of the constraints identified.

Based on the extension system employed in a district, the modified system accommodating area specific conditions and needs should better be worked out by emphasizing promotion of farmer/farmers' group's participation and initiatives in the execution of extension services in the irrigation scheme.

Element extension programs will be formulated for the mitigation of individual or plural development constraints by emphasizing farmer-to-farmer approaches. Element extension programs should be area specific ones tailored to area specific needs and will include farmer/farmers' group empowerment program, staffs empowerment program, field demonstration program, technical development or trial program, training program in class and in field (field school), study tour, workshop, mass guidance and so on.

For implementing extension services strengthening program, a certain period from 3 to 5 years will be required as shown in Figure A-7.3.1, based on the time series for implementation schedule of element programs, budget requirement and availability as well as staff availability and capability.

7.5.4 Implementation of Extension Services Strengthening Program

The extension services strengthening program will be implemented as follows:

- Formulation of annual work program for the strengthening of extension services in individual irrigation schemes based on the action plan for strengthening of extension services and through participatory approach;
- Budget arrangement on the basis of the annual work program formulated above;
- Preparation of detail agreed plan of operation for the implementation of strengthening programs accommodated in the budgets through participatory approaches of stakeholders involved in the implementation of the programs;
- Extension materials or materials required for the implementation of the programs accommodated in APO should be prepared in time for the execution of the programs;
- Based on the establishment or development of agriculture technologies to be introduced, simple extension materials to be distributed to farmer/farmers' group should be prepared;
- Implementation of the programs for the strengthening of extension services should better be carried out by a working Team organized for the implementation of the programs in individual irrigation schemes. The Working Team should be composed of: staffs of district agriculture services office, field agriculture & irrigation staffs, representatives of WUAs and representatives of participants of the programs;
- Monitoring & supervision of the program implementation by the Task Force Team should be carried out continuously throughout the program implementation stage; and
- Monitoring of the program implementation and impacts should be made by the Working Team under the supervision of the Task Force Team. Periodical reporting of the results and findings of such monitoring activities should be institutionalized.

7.6 Action Plan for Budgeting and Budget Implementation

In discussing the preparation of budget proposals and implementing of budget to be allocated to the function recovery program, special attention has to be paid to the following key issues related to the modified irrigation management policy in line with the draft of new Law on Water Resources:

- Arrangement of irrigation management responsibility between irrigation water suppliers and water users;
- Arrangement of irrigation management responsibility among government authorities;
- Funding criteria; and
- Mechanism of budget arrangement and utilization

Among irrigation management activities, the responsibility of planning and design works for development, rehabilitation and upgrading purposes is arranged to governments at central and provincial level to assure quality of outputs from these works. Regarding implementation of physical works, it can be considered that the budget availability, staff capability and contractor capacity are crucial factors at district/municipal level. Therefore, it can be considered rational that irrigation schemes commanding more than 1,000 ha are to be handled by provincial governments in a sense of participatory irrigation management.

Although irrigation schemes covering 500 to 1,000 ha are to be dropped from the function recovery program, rehabilitation and upgrading works of such schemes needs to be implemented by district/municipal government with financial support by the Special Allocation Fund to district/municipal government (*DAK*) and technical assistance from provincial government, if necessary.

Budgeting for activities in the initiation and midterm phase of the function recovery program for the irrigation scheme with the scale of more than 1,000 ha is recommended to be made at central level. For allocating APBN of Ministry of Settlement and Regional Infrastructure, therefore, it is required to make a package of the initiation phase activities on provincial basis. It is also recommended that, after budget is allocated, provincial government is to execute initiation phase package plans through assistant task.

In the midterm phase of the function recovery program, it is recommended that Ministry of Settlement and Regional Infrastructure takes an initiative for budgeting after scrutinizing provincial governments' proposals for undertaking F/S and packaging priority schemes. Similar procedures of budgeting and budget implementation are also recommended.

Budgeting for implementing rehabilitation works of irrigation schemes will be basically made according to the jurisdiction of irrigation management stipulated in the draft of new Law on Water Resources if internal budget source is considered. If external funding sources are targeted, it is recommended to consider the scale of proposed project matching with the financing standard of the donor agencies. In other words, central government is to prepare an implementation program (I/P) by packaging irrigation schemes proposed by Regional Governments.