

**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-1**

**MAIN REPORT**

**February 2004**

**Nippon Koei Co., Ltd.**

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**04-18**

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## PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a Study on Comprehensive Recovery Program of Irrigation Agriculture and entrusted the Japan International Cooperation Agency (JICA) with the Study.

JICA selected and dispatched a study team headed by Mr. Kenjiro Yatabe of Nippon Koei Co., Ltd. to the Republic of Indonesia between February 2003 and February 2004.

The team held discussions with officials concerned of the Government of Indonesia, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to those concerned in the Republic of Indonesia for their close cooperation extended to the study.

February, 2004

Shinki Suzuki  
Vice-President  
Japan International Cooperation Agency

February, 2004

Mr. Shinki Suzuki  
Vice-President  
Japan International Cooperation Agency

### LETTER OF TRANSMITTAL

Dear Sir,

With much pleasure we submit herewith the report for "The Study on Comprehensive Recovery Program of Irrigation Agriculture" in the Republic of Indonesia.

The Study was carried out by Nippon Koei Co., Ltd. under contract with JICA. The contract period was 14 months from February 2003 to March 2004. The purpose of the Study was to formulate a Comprehensive Recovery Program for Irrigation Agriculture for the irrigation schemes with a service area of more than 1,000 ha located in the three provinces of North Sumatra, Central Java and South Sulawesi. The Study Team conducted pre-feasibility studies on 141 irrigation schemes with a combined service area of about 540,000 ha to determine a "priority list of irrigation schemes to be rehabilitated", and to prepare "a guideline for rehabilitation of the irrigation facilities". In due consideration of the priority listing, one model scheme in each province was selected for feasibility study. The Study Team carried out the feasibility studies on the model schemes in order to verify "the priority lists of the irrigation schemes" and "the guideline for rehabilitation", as well as to prepare "implementation programs for rehabilitation (action plans)". The Team systematically rearranged and combined these study results to formulate the Comprehensive Recovery Program of Irrigation Agriculture, which presents the sequence of processes, from the initiation of the program to operation of the irrigation system. The study report explains the process for implementing the recovery program for the three target provinces. Nonetheless, it was designed to be generally applicable to most cases of rehabilitation works in the entire country of Indonesia.

We hope this report will help achieve sustainable irrigation development, accelerate the reforms of the national development plan, and contribute to fostering cordial relations and good-will between the nations of Japan and Indonesia.

Finally, we wish to express our deep appreciation and gratitude to the personnel concerned from your Agency. We also appreciate the personnel concerned from your office in Indonesia, the Embassy of Japan in Indonesia, and the Ministry of Settlement and Regional Infrastructure for the courtesies and cooperation extended to us during our field surveys and studies.

Yours sincerely,

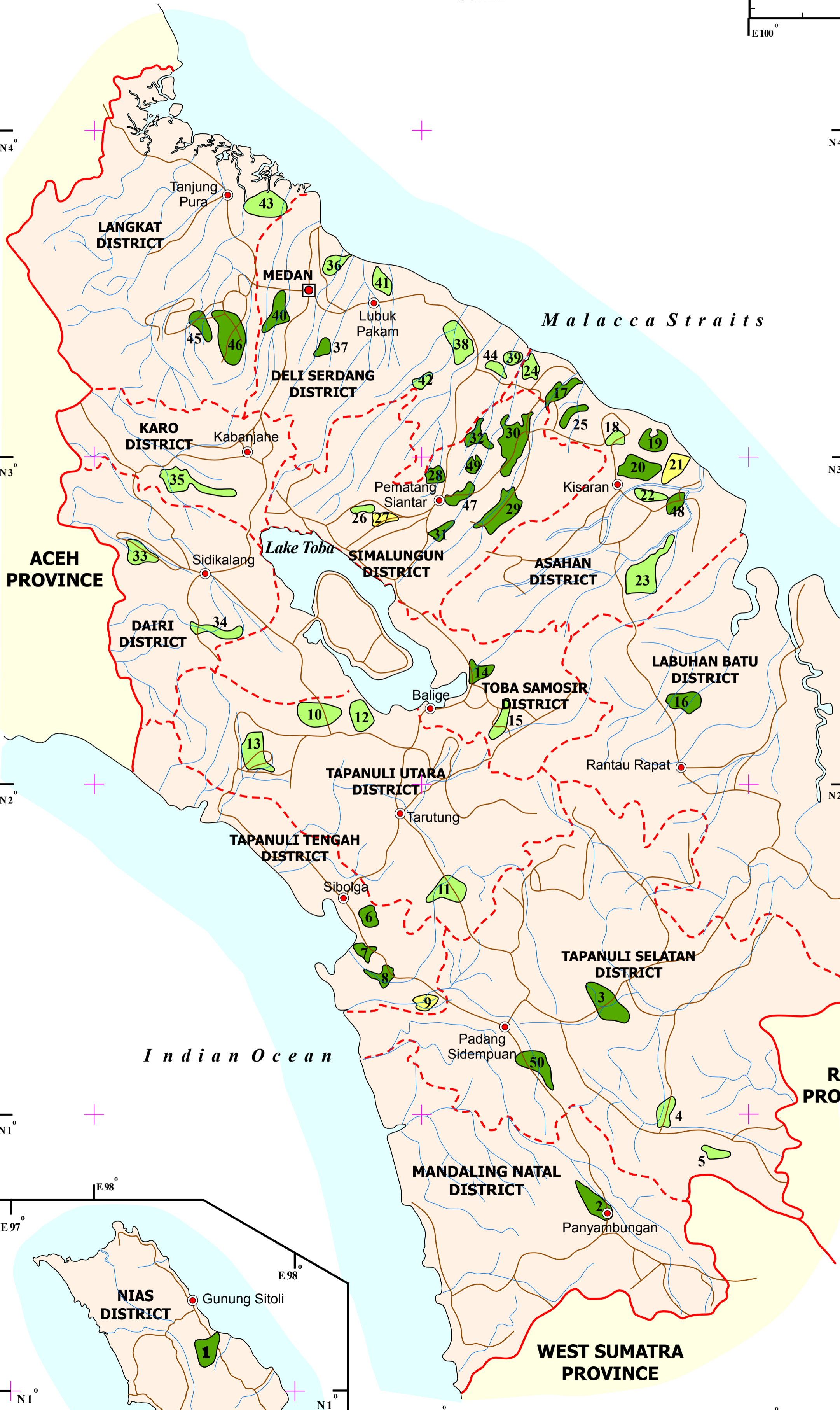
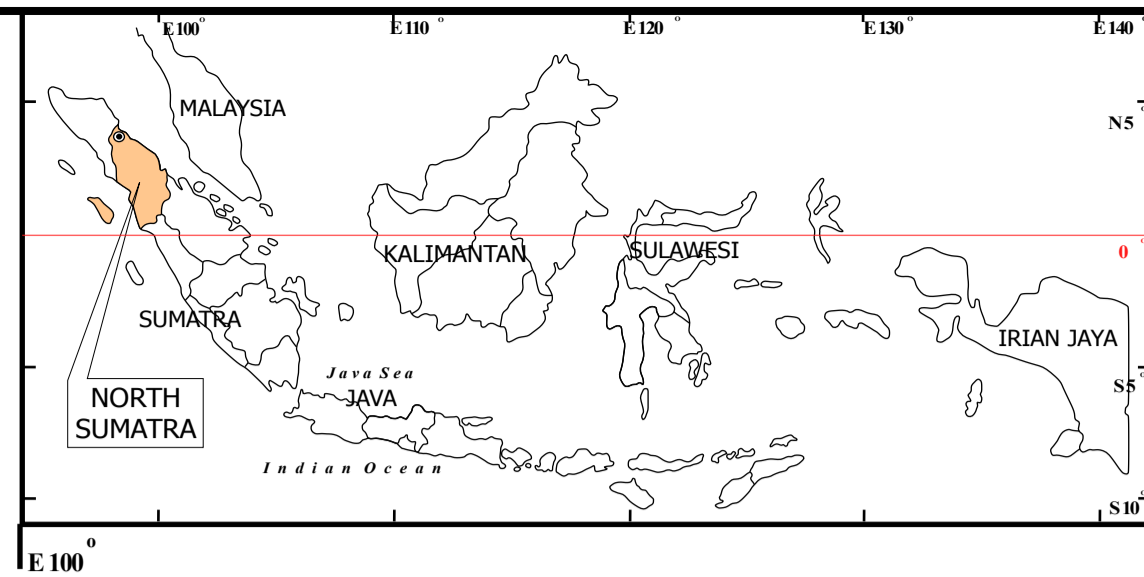
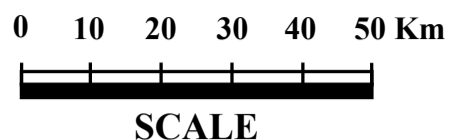
矢田部 權治郎

Kenjiro Yatabe

Team Leader

The Study on Comprehensive Recovery  
Program of Irrigation Agriculture

# Study Area: North Sumatra Province



## Irrigation Scheme

Name of Scheme	Resgitered Area (Ha)		Subject Area (Ha)
1. Gido Sebu	1,258	T	883
2. Batang Gadis	6,628	T	5,575
3. Batang Ilung	4,194	T	3,546
4. Blk Sitongkon/Napa Suron	1,012	ST	500
5. Siborna	1,000	ST	950
6. Siaili Tukka	1,057	T	600
7. Badiri Lopian	1,283	T	899
8. Pandurungan	1,769	T	1,334
9. Sihiong	2,000	NT	779
10. Aek Silang	1,500	ST	1,500
11. Sarulla	2,692	ST	1,692
12. Parmiahnan Hutapaung	1,000	ST	1,000
13. Sinamo	1,000	ST	930
14. Aek Mandosi I	1,060	ST	1,059
15. Simangatasi II	1,515	T	1,514
16. Bulung Ihit	5,000	T	1,355
17. Perkotaan	3,457	T	3,446
18. Sungai Balai	1,185	ST	1,130
19. Panca Arga	2,500	T	2,500
20. Serbangan	2,333	T	2,044
21. Silau Bonto	3,231	NT	967
22. Sungai Silau	1,315	ST	452
23. Padang Mahondang	3,231	ST	2,905
24. Simujur	2,560	ST	2,010
25. Purwodadi	1,635	T	1,635
26. Pentera	1,034	ST	298
27. Simanten Pane Dame	1,000	NT	1,000
28. Penambeang/Panet Tongah BK	1,723	T	1,722
29. Raja Hombang/T. Mangaraja	2,045	T	2,023
30. Kerasaan	5,000	T	4,144
31. Javacolonisasi Prubolonggo	1,030	T	1,015
32. Naga Sompah	1,360	T	1,015
33. Risma Duma	1,522	ST	1,522
34. Lae Ordi	1,200	ST	1,200
35. Parit Lompaten	1,242	ST	1,242
36. Bandar Sidoras	3,017	ST	3,457
37. Namu Rambe	1,036	T	1,036
38. Sei Belutu	5,082	ST	5,076
39. Langau	2,000	ST	1,900
40. Medan Krio	3,016	T	3,000
41. Rantau Panjang	2,309	ST	2,309
42. Pekan Kamis	1,100	ST	1,100
43. Secanggih	1,400	ST	1,400
44. Paya Lobang	1,558	ST	1,558
45. Namu Sira-Sira Kiri	1,350	T	1,350
46. Namu Sira-Sira Kanan	3,953	T	3,953
47. Bah Korah II	1,995	T	1,723
48. Sijambi	1,013	T	1,008
49. Rambung Mera	1,104	T	944
50. Paya Sordang	4,350	T	4,350

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

## LEGEND

- Capital City of Province
- Capital Town of District
- 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

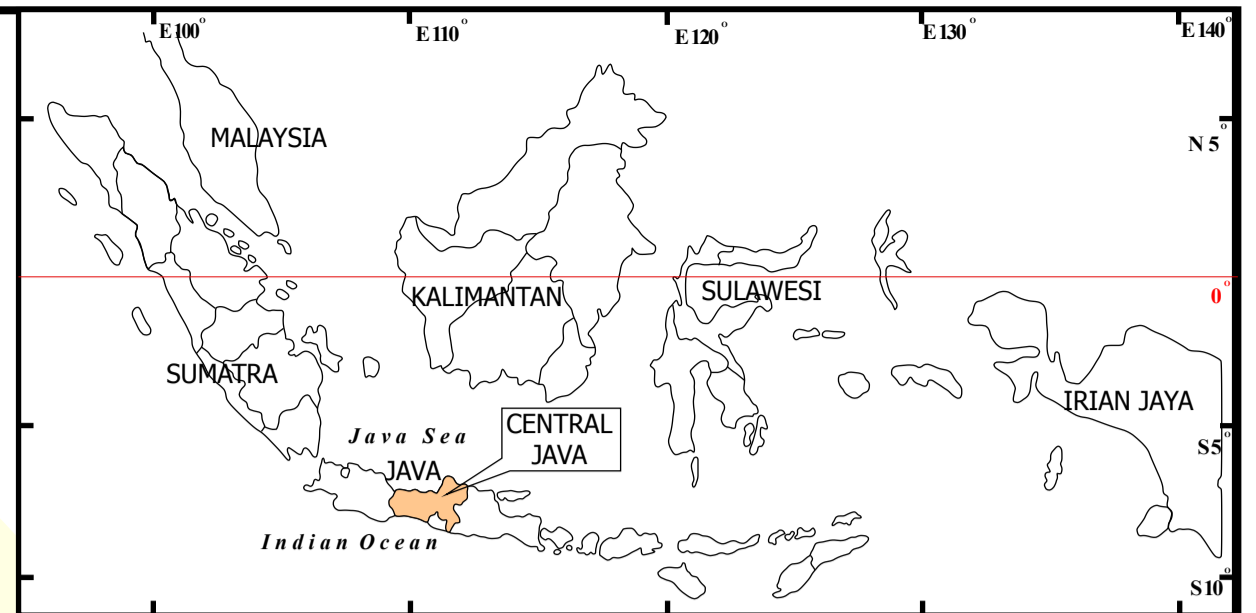
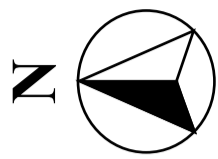
Japan International Cooperation Agency

Location Map of Irrigation Schemes in North Sumatra Province

# Study Area: Central Java Province

0 10 20 30 40 50 Km

SCALE



## Irrigation Scheme

Name of Scheme	Registered Area(Ha)	Subject Area (Ha)
1. Cijalu	1,377	T 1,377
2. Manganti	18,895	T 22,644
3. Serayu	15,869	T 20,795
4. Banjarcayana	4,859	T 5,001
5. Kaligending	2,981	T 2,923
6. Pesucen	1,666	T 1,659
7. Bedegolan	8,430	T 8,401
8. Kedung Putri	4,341	T 4,451
9. Sudagaran	3,665	T 3,665
10. Rebug	1,202	T 1,202
11. Kalimeneng	1,262	T 1,262
12. Kedung GW	1,129	T 1,129
13. Waduk Cengklik	1,579	T 2,120
14. Ploso Wareng	1,100	T 1,100
15. Jaban	1,191	T 1,191
16. Colo Kanan	18,108	T 22,982
17. Bonggo	1,811	T 1,406
18. Pangkalan	1,765	T 654
19. Sentul	1,759	T 1,739
20. Widodaren	3,652	T 2,616
21. Klambu Kanan	10,391	T 6,216
22. Jragung	4,597	T 4,416
23. Guntur	2,020	T 1,543
24. Klambu Kiri	21,419	T 20,738
25. Kedungdowo Kramat	1,250	T 1,250
26. Sungapan Kanan	1,851	T 1,851
27. Mejagung	1,997	T 2,049
28. Sungapan Kiri	5,229	T 5,570
29. Kabuyutan	4,182	T 3,876
30. Babakan	2,181	T 2,528
31. Kemaron Jambe	1,026	T 1,483
32. Jengkelok	6,505	T 6,173
33. Gung	12,999	T 12,641
34. Parakankidang	1,697	T 1,631
35. Kumisik	3,736	T 3,778
36. Pesantren Kletak	4,263	T 3,636
37. Sragi	3,540	T 3,539
38. Sudikampir	1,564	T 1,550
39. Padurekso	2,764	T 2,764
40. Kedung Asem	3,726	T 2,845
41. Bodri	8,538	T 7,710
42. Trompo	1,263	T 1,229
43. Kedung Pengilon	3,134	T 2,686
44. Pasekan	1,078	T 988
45. Kosar	1,617	T 3,243
46. Notog	27,682	T 25,540
47. Sidorejo	14,622	T 5,717
48. Glapan	18,696	T 18,784
49. Klambu Kanan	6,841	T 11,078
50. Kaliwadas	7,520	T 7,722

T : Technical Irrigation

## LEGEND

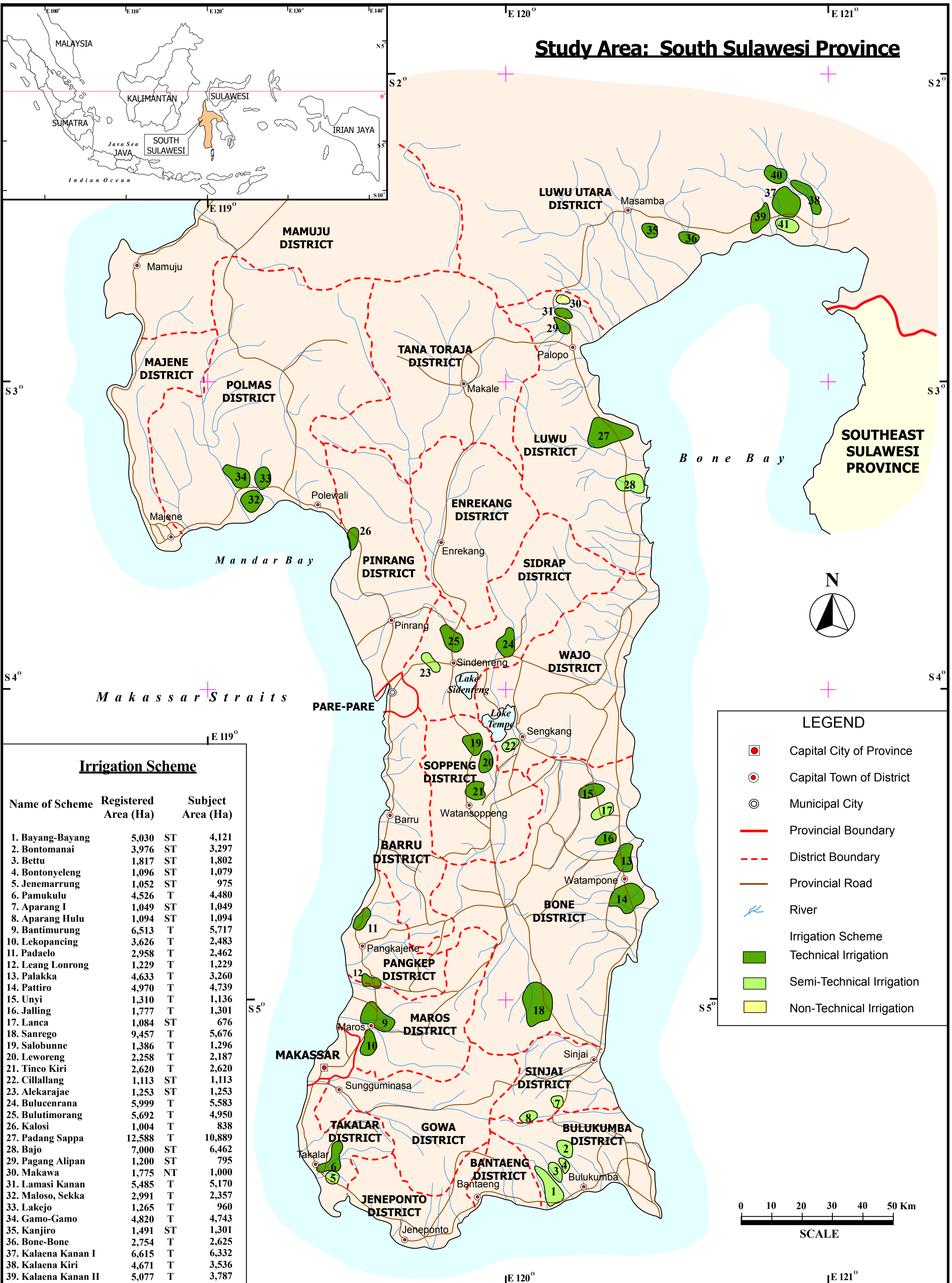
- Capital City of Province
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- Provincial Road
- District Road
- River
- Irrigation Scheme
- Technical Irrigation

The Study on Comprehensive Recovery Program of Irrigation Agriculture

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Location Map of Irrigation Schemes in Central Java Province

# Study Area: South Sulawesi Province



## Irrigation Scheme

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

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

## Conditions of the Water Resources Facilities

**SIDOREJO Headworks**  
(Central Java Province)



Shared with PLN, completed in 1990 Perfect condition.

**BONTOMANAI Headworks**  
(South Sulawesi Province)



Completed in 1988, Structural condition is good, but noticeable sedimentation is observed upstream the headworks due to poor operation of the scoring gates.

**KALOSI Headworks**  
(South Sulawesi Province)



Noticeable sedimentation is observed in front of the weir and intake gate.

**BANDAR SIDORAS Headworks**  
(North Sumatra Province)



Repaired in 1985. Scoring gates are not operational.

**BLK. SITONGKON Headworks**  
(North Sumatra Province)



Completed in 1976. Diversion works and intake structure have been washed away, and hence the water cannot be dammed up.

**LAMASI KANAN Headworks**  
(South Sulawesi Province)



Repaired in 1983. Remarkable leakage is observed through the intake gate.



## Conditions of Canals and Related Structures (1)

### JENGKELOK Scheme (Central Java Province)



Rehabilitated in 1990. Remarkable sedimentation is observed in the main canal, and also the side slope is collapsed.

### MEDAN KRIO Scheme (North Sumatra Province)



Completed in 1978. As there is no inspection road, and there is neither berm nor drainage ditch along the side slope, rain water flows directly into the main canal with mud causing sedimentation in it.

### JENGKELOK Scheme (Central Java Province)



Completed in 1990. Serious sedimentation in the main canal is observed just like Medan Krio, and as a result, due to the reduction of the sectional area of the canal, water level is raised to the crest.

### SIDREJO Scheme (Central Java Province)



Completed in 1990. Collapse of the side slope of the secondary canal is observed due to poor compaction of canal embankment. No repairing is made for a long time.

### LEKOPANCING Scheme (South Sulawesi Province)



Completed in 1990. Serious sedimentation is seen due to inflow of rain and mud into the canal.

### KALAENA KIRI Scheme (South Sulawesi Province)



Completed in 1980. The embankment of the canal is settled due to poor compaction of soil. Temporary measures are adopted by laying sandbags.

## Conditions of Canals and Related Structures (2)

**KALAENA (Rt. BENDUNG) Scheme**  
(South Sulawesi Province)



Completed in 1980. Condition of unlined canal. Serious collapse of the side slopes is observed.

**SEI BELUTU Scheme**  
(North Sumatra Province)



Completed in 1963. Height of the canal embankment is not sufficient.

**BONTOMANIA Scheme**  
(South Sulawesi Province)



Completed in 1998. Condition of division works. It is not operational due to absence of gates. Serious sedimentation is also observed.

**KALAENA (Rt. BENDUNG) Scheme**  
(South Sulawesi Province)



Completed in 1980. Serious sedimentation is observed in front of the division works.

**BULUNG IHIT Scheme**  
(North Sumatra Province)



Completed in 1998. Damaged structure due to poor construction. This is inconvenient for farmers' daily life.

**SEI BELUTU scheme**  
(North Sumatra Province)



Completed in 1963. The division structure is not functioning due to deterioration.

## Conditions of Inspection Roads and Paddy Field (on-farm)

### JENGKELOK Scheme (Central Java Province)



Repaired in 1990. The inspection bridge over the headworks. There is a problem in stability, only 2-ton vehicle is passable.

### SANREGO Scheme (South Sulawesi Province)



Completed in 1990. As the inspection road has not been paved, vehicles are not passable after rain. No maintenance is practiced.

### SIDOREJO Scheme (Central Java Province)



Completed in 1990. Secondary canal. As an inspection road along the canal is not provided, it is difficult to convey farm inputs and outputs.

### SANREGO Scheme (South Sulawesi Province)



Completed in 1990. The inspection road is not maintained. Only small farm machinery is passable.

### BANDAR SIDORAS Scheme (North Sumatra Province)



Condition of paddy field. No farm road is provided.

### APARANG 1 Scheme (South Sulawesi Province)



Leveling works by farm machinery. As there is no farm road, conveyance of farm machinery is difficult.

## SUMMARY

### 1. Introduction

#### 1.1 Authority

1. This is the Final Report of “the Study on the Comprehensive Recovery Program of Irrigation Agriculture” (the Study), that was prepared in February 2003 in accordance with the Scope of Work (S/W) for the Study agreed between the Japan International Cooperation Agency (JICA) and the Ministry of Settlement and Regional Infrastructure (MOSRI) dated April 20, 2001.
2. The report presents the results of the Study on the basis of field/home office works of Phases 1 and 2. The study results of Phase 1 consist of formulation of rehabilitation plan at pre-feasibility study (Pre-F/S) level and prioritization for implementation of rehabilitation, and those of Phase 2 contain the feasibility study (F/S) results of the selected model schemes as well as formulation of a Comprehensive Recovery Program and an Action Plan.

#### 1.2 Background and Objectives

3. As a result of government initiatives in the 1960s promoting measures for irrigation development, the national irrigation area increased to 5,030,000 ha (accounting for 62% of the total paddy field area of 8,110,000 ha) in 1999, and rice production became somewhat stable. However, since the promotion had been a government initiative without the involvement of farmers, problems soon arose, particularly regarding water management and operation and maintenance (O&M) of the irrigation systems.
4. Deterioration of the irrigation facilities and poor distribution of water in the tertiary systems are considered to be among the reasons why the beneficiaries are reluctant to organize water users associations (WUAs). As a result, the irrigation facilities are not fully maintained and functionality of the facilities has declined. In order to break this “vicious circle” it is necessary to give the farmers themselves an incentive to maintain the irrigation facilities by introducing user-friendly facilities. This can be realized by improving (rehabilitating) the facilities with the aim of recovering the function of the irrigation schemes.
5. The objectives set out for the Study are to:
  - (a) Formulate a comprehensive recovery program for irrigation agriculture for irrigation schemes larger than 1,000 ha in area (220 schemes with approximately 779,000 ha) located in the three provinces of North Sumatra, Central Java and South Sulawesi, and

- (b) Carry out technology transfer to Indonesian counterpart personnel through on-the-job training to upgrade their capability for planning and provide a methodology for the rehabilitation of irrigation schemes.

## **2. Development Policies and Programs**

### **2.1 National Agricultural development Plan**

1. Under the State Policy Guideline (GBHN) and the National Development Plan (PROPENAS), the Ministry of Agriculture published a new agriculture development plan for 2000-2004 in November 2000.
2. To contribute towards stable food supply in line with the agricultural development plan, the irrigation sector needs to solve the following problems:
  - the deterioration of irrigation facilities,
  - the malfunction of irrigation facilities due to poor operation and maintenance caused by the unsuccessful hand-over of schemes to water users associations (such handovers were to reduce budgetary burden of maintaining schemes),
  - the conversion of irrigated land to other land uses on the populous Java Island, and
  - the abandonment of irrigation areas on the outer islands.

### **2.2 Current Situation of Decentralization**

3. In 1999, two laws concerning decentralization were enacted, i.e. Law No. 22/1999 on “Regional Governance” and Law No. 25/1999 “Fiscal Balance between the Central Government and its Regions.” These laws have come into effect and decentralization is expected to continue for the next six years.
4. Tasks transferred to the district/municipal governments under the Law No. 22/1999 are generally categorized in terms of implementation, i.e. decentralization task, de-concentration task, and co-administration (or supporting) task.
5. The central, provincial and district/municipal governments are conducting fiscal management of their affairs based on Law No. 25/1999. The revenues of local governments are comprised of balancing funds and special autonomy funds from the central government as well as their own tax revenues. In the initial national budget for 2003, revenue is expected to reach Rp. 336.2 trillion, while expenditure is estimated at Rp. 370.6 trillion. The deficit of Rp. 34.4 trillion is planned to be offset by foreign loans, privatization of state-owned enterprises, and the sale of assets of the Indonesian Bank Restructuring Agency. The total amount of development expenditure covered by foreign loans is Rp.

65.1 trillion. The amount allocated to development and management in the water resources sub-sector is Rp. 2.2 trillion.

### **2.3 Present Situation and Forecasting of Irrigation Administration Policy**

6. The existing water law (UU11/1974) stipulates that water resources are totally controlled by the Minister in charge of the central government in terms of all development and management activities. In accordance with the existing legal framework and the Presidential Instruction No. 3/1999, the management policy for the water resources and irrigation sector has been reformed by the government with foreign assistance led by the World Bank (WB) based on the concept of “transferring authority from government to water users’ association”.
7. To accommodate the current needs and also to anticipate further problems and paradigms shifting in water resources management, the government has prepared the draft Law on Water Resources and submitted it to the House of Representatives in June 2001. The draft Law on Water Resources openly encourages stakeholders to participate in all steps of water resources development and management, from the preparation of strategic policy and plan to the design, construction, operation and maintenance of facilities.
8. In the draft Law on Water Resources, the basic concept for the irrigation management policy is revised from “the transfer of authority from government to water users association” to “the participation of farmers from the beginning to decision-making starting from planning to construction, rehabilitation, upgrading, operation, securing and conservation”.

Focal points are:

- Development/construction and operation and management of irrigation schemes up to secondary system are responsibilities of the Government and the Regional Governments in accordance with their jurisdiction and these activities will be implemented with participation of WUAs.
- Jurisdiction for irrigation management for irrigation schemes located wholly within one district/municipality belongs to district/municipal government. For irrigation schemes located in more than one district/municipality, management authority belongs to the relevant provincial government. If an irrigation scheme is located in more than one province/country, the management authority belongs to the central government.
- Responsibility for funding the construction, operation, and maintenance of tertiary irrigation systems lies with farmers and the community, while the government will provide technical assistance if required.

9. In July 2003, the government decided to revise the Irrigation Management Policy Reform considering on-going deliberations by the DPR regarding the Bill of Law on Water Resources through enforcement of the Decree of Directorate General of Water Resources. The conditions for the formulation of the “comprehensive recovery program of irrigation agriculture” are therefore based on the substance of the draft Law on Water Resources as it has been mostly approved by the House of Representatives as of September 2003.

## **2.4 Tendency and Policy of International Lending Agencies**

10. The World Bank (WB) launched the Country Assistance Strategy for Indonesia in February 2001. The basic strategies of this plan are to support Indonesia’s political and economic transition in a highly uncertain environment, and to support i) economic recovery and broad-based growth, ii) to build national institutions for an accountable government, and iii) to deliver better public services for the poor. The Asian Development Bank (ADB) continues to assist Indonesia based on i) To create and strengthen basic institutions, ii) to support the sustainable recovery and pro-poor growth, iii) to improve regional equity through balanced regional development, iv) to invest in human and social development, and v) to strengthen environmental management. In the case of Japan Bank for International Cooperation (JBIC), six irrigation project financed by the JBIC are under implementation.

## **3. Comprehensive Recovery Program of Irrigation Agriculture**

### **3.1 Introduction**

1. In order to formulate the Comprehensive Recovery Program of Irrigation Agriculture, the subsequent paragraphs deal with the systematic procedures for recovering irrigation system function from “the initial appraisal of needs for the rehabilitation of the irrigation system” to “the planning, designing and constructing the rehabilitated scheme and setting-up of irrigation system management”.

### **3.3 Extent and Contents of the Comprehensive Recovery Program**

2. To be fully executed, the comprehensive recovery program will involve the following three phases: i) initiation phase, ii) midterm phase, and iii) final phase. The major activities of each phase are as follows.
  - I. Initiation Phase (from listing the schemes to formulating an action plan)
    - Preparation of a Master List for rehabilitation

- Screening of schemes by development potential, institutional capability, etc.
  - Field investigation for Pre-F/S
  - Determination of subject area by water resources availability
  - Formulation of development plan
  - Preparation of priority list
  - Preparation of Action Plan
- II. Midterm Phase (feasibility study)
- Execution of feasibility study for implementation
  - Preparation of Implementation Program (I/P)
  - Financial arrangement
- III. Final Phase (from implementing rehabilitation project to setting up O&M of the system)
- Civil work construction
  - Empowerment of WUA
  - Guidance and training for agriculture
  - Operation of the irrigation system
  - O&M and monitoring

#### Project Organization

3. The project organizations to be formed will be a “Forum”, to serve as a program decision making body, and a “Project Office” to serve as a program implementation body. These bodies are to be newly established at the provincial level, which will be responsible for implementing the comprehensive recovery program of irrigation agriculture from the initiation phase to the final phase on the basis of the participatory irrigation management concept.
4. The key role of the Forum is to make decisions on activities to be carried out in each phase and to review and accept the outputs of each phase. The Forum is also responsible for getting final approval from the Governor for its decisions on implementation of the program, including its budgeting and budget implementation plans.
5. The “Functional Recovery Project Office (tentative name)” will be established as one of the functional units attached to Dinas/Sub-Dinas PSDA or Provincial Public Services (PU). It will take full responsibility for implementation and management of all activities in each phase of the recovery program. The Project Office will be composed of about six Sections: the i) Irrigation Assets Management Section, ii) Investigation Section, iii) Irrigation Planning Section, iv) Design Section, v) Construction Management Section, and vi) Agriculture and Farmer’s Organization Support Section.



### 3.4 Outputs of Each Phase of the Program

6. The outputs from the activities in the initiation phase will be: i) a prioritized list of irrigation schemes for rehabilitation, and ii) an Action Plan. The outputs of the midterm phase consist of i) a Feasibility Study (F/S) Report, and ii) a detailed Implementation Program. The outputs of the final phase consist of i) irrigation facilities and systems for which function has been recovered, and ii) appropriate water management associations and empowered farmer's organizations. Periodical monitoring has to be carried out by the provincial agencies concerned for the facilities for which rehabilitation has been completed.

## 4. Pre-Feasibility Study

### 4.1 Study Areas

1. The irrigation schemes to be studied have been examined and determined based on the following criteria.
  - (a) The Study area to be based on the original list presented in the Scope of Work (S/W).
  - (b) Irrigation schemes meeting the following conditions to be excluded from further consideration.
    - Schemes that were recently completed and are functioning appropriately
    - Schemes that have already been selected for rehabilitation by the Government and/or international lending agencies
    - Schemes for which the potential area is too low (less than 1,000 ha), even though they were included in the original list
  - (c) Irrigation schemes that need to be urgently rehabilitated may be added to the list in addition to the original schemes presented in the Scope of Work (S/W).
2. The number and area of irrigation schemes finally selected for the Study in each of the three provinces are summarized in comparison with those of the Inception Stage as shown below:

**Irrigation Schemes selected for the Study**

Province	Inception Stage		Selected Scheme	
	Number of Schemes	Scheme Area (ha)	Number of Schemes	Scheme Area (ha)
North Sumatra	57	125,706	50	108,341
Central Java	98	391,412	50	284,569
South Sulawesi	65	262,329	41	141,984
Total	220	779,447	141	534,894

## 4.2 Preliminary Investigations

3. The purposes of the preliminary investigation of the irrigation systems are i) to finalize 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) to confirm with the related agencies the availability and sources of information.
4. Evaluation indicators for prioritizing the rehabilitation of irrigation networks were prepared respectively for i) water resources facilities, ii) canals and related structures, iii) terminal facilities and on-farm, and iv) inspection roads.
5. Standard rehabilitation methods were prepared, in principle, on the basis of the “Irrigation Design Standards” prepared by the Directorate General of Water Resources Development, Ministry of Public Works in 1986. The standard unit prices were determined referring to recent similar rehabilitation works and bid prices.

## 4.3 Field Investigations

### 4.3.1 Execution of Investigations

6. Based on the results of the investigation, the scale of rehabilitation needs of respective irrigation facilities were classified into the following four 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 serious functionally damaged and replacement or reconstruction is needed.

### 4.3.2 Results and Findings

7. The existing condition of the systems are summarized as shown below.

#### North Sumatra Province

##### (1) Water Resources Facilities

Type of Water Resource Facilities	Number	Condition of Facilities			
		A	B	C	D
Headworks	37*	0	14	14	9
Free Intakes	13	0	0	1	12
Total	50	0	14	15	21

Note: \* The number of settling basins provided is 16.

## (2) Canals

Canals	Length (km)			Condition (Scheme)			
	Lined Canal	Earth Canal	Total	A	B	C	D
Main Canal	115 (35.7%)	206 (64.3%)	321	0	9	17	24
Secondary Canal	223 (31.7%)	482 (68.3%)	705	0	3	12	35
Total	338 (33.0%)	688 (67.0%)	1,026	-	-	-	-

Note: Masonry and concrete lining

## (3) Canal Related Structures

Canals	Total Number of Structures	Condition of Canals (%)			
		A	B	C	D
Main Canal	1,372	0	66	31	3
Secondary Canal	2,790	0	60	34	6

## (4) Inspection Road

Inspection Roads	Number of Schemes providing Inspection Roads and Their Total Length	Condition (scheme)			
		A	B	C	D
Along Main Canal	21 (203km, 63% of total canal length)	0	9	9	3
Along Secondary Canal	23 (356km, 50% of total canal length)	0	0	23	0

## (5) Terminal Facilities and On-farm

Terminal Facilities & On-farm	Condition of terminal facilities and on-farm (%)			
Average of 50 Schemes	A	B	C	D
	0	2	36	62

Central Java Province

## (1) Water Resources Facilities

Type of Water Resources Facilities	Number	Condition of Facilities			
		A	B	C	D
Dam	1	1	-	-	-
Headworks	49*	1	12	33	3
Total	50	2	12	33	3

Note: \* Number of settling basins provided is 16.

## (2) Canals

Canals	Length (km)			Condition (Scheme)			
	Lined	Earth	Total	A	B	C	D
Main Canal	338 (55.8%)	268 (44.2%)	606	0	4	42	2
Secondary Canal	1,213 (56.3%)	943 (43.8%)	2,156	0	1	41	10
Total	1,551 (56.2%)	1,211 (43.8%)	2,762	-	-	-	-

Note: 2 schemes are not provided with a main canal.

## (3) Canal Related Structures

Canals	Total Number of Structures	Condition of Canals (%)			
		A	B	C	D
Main Canal	2,777	5	33	37	25
Secondary Canal	7,117	6	34	37	23

## (4) Inspection Road

Inspection Roads	Number of Schemes providing Inspection Roads and Their Total Length	Condition (scheme)			
		A	B	C	D
Along Main Canal	48 (465km, 77% of total canal length)	0	6	37	6
Along Secondary Canal	48 (1,142km, 53% of total canal length)	0	1	39	8

## (5) Terminal Facilities and On-farm

Terminal Facilities & On-farm	Condition of terminal facilities and on-farm (%)			
	A	B	C	D
Average of 50 Schemes	0	0	96	4

South Sulawesi Province

## (1) Water Resources Facilities

Type of Water Resources Facilities	Number	Condition of Facilities			
		A	B	C	D
Headworks	35 <sup>*1&amp;*2</sup>	0	21	14	0
Free Intakes	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 is supplied from integrated headworks.

## (2) Canals

Canals	Length (km)			Condition (Scheme)			
	Lined	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	-	-	-	-

## (3) Canal Related Structures

Canals	Number of Schemes	Condition of Canals (%)			
		A	B	C	D
Main Canal	41 <sup>*1</sup>	0	2	24	74
Secondary Canal	41 <sup>*2</sup>	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.

## (4) Inspection Road

Inspection Roads	Number of Schemes providing Inspection Roads and Their Total Length	Condition (scheme)			
		A	B	C	D
Along Main Canal	21 (154km, 54% of total canal length)	0	9	9	3
Along Secondary Canal	15 (205km, 25% of total canal length)	0	1	8	6

## (5) Terminal Facilities and On-farm

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

8. Existing conditions of agriculture are summarized as follows.

### North Sumatra Province

#### (1) Overall Cropped Area & Cropping Intensity in Irrigated Fields

Season	Paddy		Palawija		Overall	
	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)
Wet Season	62,565	86	100	0.1	62,665	86
Dry Season	42,987	59	3,905	5	46,892	65
Annual	105,552	145	4,005	6	109,557	151

#### (2) Estimated Current Irrigated Paddy Yields

Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Annual (ton/ha)
Wet Season	3.0 - 5.0	3.8	Dry Season	3.0 - 4.5	4.1	3.9

### Central Java Province

#### (1) Overall Cropped Area & Cropping Intensity in Irrigated Fields

Season	Paddy		Palawija		Sugarcane		Overall	
	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)
Wet Season	245,878	87	20,952	7	9,270	3	276,100	97
Dry Season I	228,798	81	30,356	11	4,828	2	263,982	94
Dry Season II	39,095	14	100,266	36	-	-	139,361	50
Annual	513,771	182	151,574	54	14,098	5	679,443	241

#### (2) Estimated Current Irrigated Paddy Yields

Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Annual (ton/ha)
Wet Season	4.5 - 5.5	5.0	Dry Season	4.0 - 5.0	4.8	4.9

### South Sulawesi Province

#### (1) Overall Cropped Area & Cropping Intensity in Irrigated Fields

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

#### (2) Estimated Current Irrigated Paddy Yields

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

9. The present condition of WUA are summarized as follows.

#### Present Condition of WUA in North Sumatra

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	24	250	8	0	20	115	5	102
50% to 74%	7	44	0	1	5	31	2	5
25% to 49%	6	9	1	0	1	5	0	2
Less than 25%	13	34	1	0	14	10	0	9
Total	50	337	10	1	40	161	7	118

Note : L: Legitimated in local court

N: Not yet legitimated in local court

#### Present Condition of WUA in Central Java

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	37	1,862	0	201	16	1,433	0	212
50% to 74%	8	289	1	46	0	199	0	43
25% to 49%	4	29	0	2	0	18	0	9
Less than 25%	1	4	0	0	0	4	0	0
Total	50	2,184	1	249	16	1,654	0	264

Note : L: Legitimated in local court

N: Not yet legitimated in local court

#### 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

## 4.4 Rehabilitation Plans

### 4.4.1 Basic Concepts

10. The basic concepts followed for formulating rehabilitation plans for the irrigation facilities are as follows:

- (a) Provision of appropriate irrigation infrastructure, that is sustainable and does not require heavy rehabilitation work during the service life of the systems as long as routine O&M are practiced,
- (b) Securing the design discharge throughout the irrigation system and equitable distribution of canals in order to remove constraints on O&M,
- (c) Provision of user-friendly and easy-maintenance canal structures with sufficient water level at each outlet to irrigate farmlands,

- (d) Proper arrangement of measuring devices and outlets (bifurcation/turnouts), considering water distribution and easy O&M,
  - (e) Provision of inspection roads for O&M and farm machinery along main and secondary canals,
  - (f) Provision of farm roads 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.
11. The basic concepts applied for formulating agriculture plans are:
- (a) Formulation of agriculture plans placing emphasis on paddy production,
  - (b) Full consideration of the performance and experiences of irrigation agriculture in advanced schemes, and
  - (c) Improvement of crop productivity and realization of an increase in cropping intensity through the efficient use of irrigation water.
12. The basic concepts adopted for formulating the institutional development plan are as follows:
- (a) Attention to upgrading the existing staff capability based on the new irrigation management policy,
  - (b) The establishment of WUAs to achieve the target of full WUA coverage of irrigation schemes should be accelerated through technical assistance,
  - (c) The strengthening of WUAs to improve their organizational management capacity, their capability to collect, manage, and spend member's fees, and their capacity to operate and maintain of tertiary irrigation system,
  - (d) The role of FWUA/MWUA is to coordinate member WUAs for making common rules for reasonable water allocation to apply to each WUA as well as to collect ideas and data from the member WUAs as inputs to district/municipal governments, and
  - (e) Provision of on-the-job training on operation and maintenance of tertiary irrigation systems to WUA member farmers once irrigation water can be distributed to the concerned tertiary block; guidance on collection and expenditure of WUA member's fee in a more transparent manner.

#### **4.4.2 Irrigation Facilities**

##### **13. Criteria for Rehabilitation**

- (1) Classification of rehabilitation in estimating costs
  - (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) Availability of Water Resources

Data and information such as i) cropping pattern, ii) meteorological records, and iii) river runoff were collected in order to examine the water resources availability whether sufficient or insufficient. Based on the examination, irrigation areas of the respective schemes were determined.

## (3) Development Plan

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. Conversion of water resources facilities from free intake type to weir type has been planned.

14. Cost estimates for the rehabilitation of 141 schemes have been made and the unit costs of rehabilitation per hectare are summarized as follows:

### Rehabilitation Cost per Hectare

Provinces	Number of Schemes	Minimum		Maximum		Average	
		million Rp./ha	US\$/ha	million Rp./ha	US\$/ha	million Rp./ha	US\$/ha
North Sumatra	50	9.6	1,164	44.9	5,428	21.9	2,644
Central Java	50	7.5	907	42.3	5,107	19.5	2,359
South Sulawesi	41	10.3	1,245	27.8	3,360	17.8	2,155

Note: US\$ 1.00 = Rp. 8,279 = ¥ 118.90 as of May 2003.

### 4.4.3 Agricultural Plan

15. The target cropping intensity and cropped area in the three provinces are summarized as follows.

#### Overall Features of Cropped Area & Cropping Intensity in North Sumatra Province

Crop	Cropped Area (ha)				Cropping Intensity (%)	
	Wet	Dry I	Dry II	Annual	Range	Overall
Paddy	88,576	0	69,061	157,637	150 - 200	178
Palawija	0	3,396	6,123	9,519	5 - 30	11
Total	88,576	3,194	74,598	166,368	155 - 200	189



### Overall Features of Cropped Area & Cropping Intensity in Central Java Province

Crop	Cropped Area (ha)				Cropping Intensity (%)	
	Wet	Dry I	Dry II	Annual	Range	Overall
Paddy	264,436	247,679	45,533	557,648	137 - 300	197
Palawija	9,402	18,985	134,695	163,082	0 - 150	58
Sugarcane	9,253	4,828	0	14,081	0 - 27	5
Total	283,091	271,492	180,228	734,811	160 - 240	260

### Overall Features of Cropped Area & Cropping Intensity in South Sulawesi Province

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

#### 4.4.4 Institutional Capacity Building Plan

16. The capacity building plan for district/municipal government staff in charge of irrigation management aims to deliver to these staff a full understanding of the new participatory irrigation management policy as well as the differences between the new policy and the previous PKPI policy promoting the concept of handing over irrigation management authority to water users.
17. For this purpose, a series of technical guidance seminars and workshops is to be held as follows:
  - North Sumatra: 8 districts and 1 municipality,
  - Central Java: 15 districts and 4 municipalities, and
  - South Sulawesi: 11 districts.
18. The main target of the WUA establishment acceleration plan is the Farmers' Group in each non-WUA tertiary block. Socialization meetings and workshops are to be conducted to confirm farmer's awareness of the establishment of and participation in WUAs as well as to identify needs for general guidance about the procedures and practices of WUA establishment. Implementation of the acceleration plan should be commenced in:
  - North Sumatra: 40 tertiary blocks,
  - Central Java: 317 tertiary blocks, and
  - South Sumatra: 159 tertiary blocks.
19. The WUA strengthening plan targets to improve the capacity of WUAs to manage an organization, their capability to collect and spend members fees, and strengthen activities for operation and maintenance of tertiary irrigation systems. The technical assistant program is to be firstly implemented in:
  - 140 "Under developing" WUA and 87 "Not yet developed" WUA,
  - 1,342 "Under developing" WUA and 239 "Not yet developed" WUA, and

- 680 “Under developing” WUA and 62 “Not yet developed” WUA.
20. Establishment of FWUA/MWUA is to be initially promoted for 18 candidate schemes in North Sumatra, 38 candidate schemes in Central Java and 25 candidate schemes in South Sulawesi.
  21. The on-the-job training program on O&M of tertiary irrigation facilities and management guidance program on collection and expenditure of WUA members fees are to be conducted for all irrigation schemes during the project implementation period.
  22. The agricultural extension service strengthening plan consists of the participation of farmer/farmers’ groups and initiatives to provide extension services in the irrigation scheme. The main activities should include farmer/farmer’ group empowerment, staff empowerment, field demonstrations, technical development/trials, class room training, field schools, study tours, workshops and mass guidance.
  23. The institutional capacity building costs, including those for agricultural extension strengthening, are estimated at Rp. 31.7 million for North Sumatra Province, Rp. 99.1 million for Central Java Province, and Rp. 42.5 million for South Sulawesi Province.

#### 4.4.5 Economic Evaluation

24. The project costs of the rehabilitation plans consist of initial investment costs, replacement costs and O&M costs. The project benefit is defined as the difference in net return from crop production between the with-project and the present/before project conditions.
25. The results of the economic evaluation are summarized in the following table.

**Economic Internal Rate of Return (EIRR)**

EIRR	Province		
	North Sumatra	Central Java	South Sulawesi
	No. of Schemes	No. of Schemes	No. of Schemes
20 %	3	0	5
15 - 19 %	7	4	11
10 - 14 %	25	8	23
< 10 %	15	38	2

26. B/C ratios at a discount rate of 10% are summarized as below.

**B/C at Discount Rate of 10%**

B/C	Province		
	North Sumatra	Central Java	South Sulawesi
	No. of Schemes	No. of Schemes	No. of Schemes
1.0	35	12	39
< 1.0	15	38	2

#### 4.5 Prioritization for Implementation of Rehabilitation

27. Prioritization of the nominated rehabilitation works has been based on four major evaluation indicators:

- (1) Impact of rehabilitation on the performance of the irrigation system
- (2) Impact of rehabilitation on agriculture productivity
- (3) Social impact of rehabilitation
- (4) Economic and financial impacts of rehabilitation

28. The distribution of weighting of scores for the four indicators is shown below.

**Evaluation Indicators for Prioritization of Rehabilitation Work**

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

29. The results of prioritization for each province are summarized as follows:

**Summary of Prioritization**

Province	Priority Group					
	I	II	III	IV	V	VI
North Sumatra	6	7	5	3	14	15
Central Java	16	10	12	0	4	8
South Sulawesi	11	6	8	0	11	5

30. The final decision to select the Model Schemes was made in the second steering committee meeting held in Jakarta in July 2003. In the meeting, the following three schemes were selected to be taken up for the feasibility study:

**Features of Selected Areas**

Description	Province		
	North Sumatra	Central Java	South Sulawesi
Irrigation Scheme	Padang Mahondang	Gung	Kalaena Kiri
District	Asahan	Tegal & Kodia	Luwu Utara
Sub-district	Pulo Rakyat	Lebaksui	Mangkutana
Registered Area (ha)	3,231	12,463	4,671

#### 4.6 Action Plan

31. The contents of the action plan have been formulated for the irrigation schemes chosen to be rehabilitated through the Study. The items required to formulate the action plan are listed as follows:

- (a) General (duties and responsibilities of the government),
- (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 and budget implementation.

32. A priority ranking has been assigned for each scheme in the Pre-F/S. Recommendations based on the valuation results for the six (6) groups from Groups I to VI are as follows:

Group I: High priority schemes (Recommended for feasibility study (F/S))

Group II: Second highest priority schemes (Recommended for F/S)

Group III: Third highest priority schemes (Recommended for F/S)

Group IV: Schemes that require re-examination of the availability of water resources before executing a F/S

Group V: Schemes that require organization of a WUA before executing a F/S

Group VI: Schemes that require re-examination of the development methodology before executing a F/S

Of the above classifications, the action plans for Groups I to III are more or less the same, although the timing for initiation of implementation is different, whereas the action plans for Groups IV to VI are not the same due to different constraints.

33. In order to maintain uniformity in the field survey results, there is to be only one F/S package regardless of the scale of the scheme. The study period ranges from 6-18 months depending on the size of the scheme.

Packaging of the construction works is to be made on the basis of the monetary terms that are the decisive factors. The approximate construction cost is Rp. 50,000 million (approximately ¥ 700 million) per package. The construction period for each scheme is determined to be 2 years in principle; however for large areas this may be increased to a maximum of 3 years.

34. An action plan for institutional strengthening consists of an institutional capacity building and staff capability improvement program, a WUA strengthening program, an FWUA and MWUA initial setting-up program, and a WUA establishment acceleration program. These programs are to be conducted in either the initial or mid-term phase. Other components include a training program on operation and maintenance of tertiary irrigation systems and a

guidance program for setting and collection of irrigation water service fees. These two programs are to be carried out in the final stage.

35. The goal of strengthening extension services is to mitigate individual or multiple constraints to agricultural development based on farmer-to-farmer approaches. To achieve this goal, the action plan has to include a series of program components aiming at farmer/farmers' groups and staff empowerment and coping with the implementation schedule of the rehabilitation works of the irrigation scheme. Key program components are field demonstrations, technical trials, classrooms and field school training, study tours, workshops, mass guidance, and so on.

## 5. Feasibility Study for the Selected Model Schemes

A summary of the feasibility study conducted for the three selected schemes is presented in this section.

### 5.1 North Sumatra (Padang Mahodang Scheme)

#### 5.1.1 Present Condition

1. The results of the inventory meant that all facilities were classified into D (to be replaced and/or reconstructed) and can be summarized as follows:
  - (a) Malfunctioning of the free intake
  - (b) Absolute shortage of canal length
  - (c) Inadequate provision and deterioration of irrigation facilities
  - (d) Poor drainage conditions
  - (e) Lack of water management activities
2. The present cropped area and crop yield are estimated as below.

**Current Crop Area and Crop Yields in Padang Mahodang Scheme**

Crops	Wet Season		Dry Season	
	Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)
Irrigated Paddy	350	4.0	163	4.0
Rainfed Paddy <sup>*1</sup>	163	2.5	-	-
Rainfed Paddy	647	2.0	-	-
Palawija (maize composite)	53	3.0	62	3.0

Note <sup>\*1</sup>: Paddy in irrigated fields grown under rainfed conditions

3. The present annual crop productions are estimated at 3,859 tons of paddy and 345 tons of maize as palawija crop.
4. The target for number of WUAs in the scheme is only two, of which one has already been established, though it is currently inactive.

### 5.1.2 Basic Considerations in Formulating the Rehabilitation Plan

5. The basic concepts applied for the formulation of the irrigation system plans were:
  - 1) To provide an intake structure to draw a stable supply of irrigation water throughout the year,
  - 2) To prevent inflow of sediment into the canal from the river,
  - 3) To improve and introduce a technical irrigation network system,
  - 4) To extend the irrigation command area with irrigation facilities,
  - 5) To design diversion/turnout structures by providing water measurement devices for the introduction of an appropriate water management technology,
  - 6) To provide such infrastructures as inspection roads and farm roads for O/M of irrigation facilities and future mechanized farming, and
  - 7) To provide project facilities such as a site operation houses (50m<sup>2</sup>), vehicles, motor cycles, and office equipment for the project office.
6. The basic concepts applied for formulation of the agriculture plans were:
  - 1) Formulation of agriculture plans that place emphasis on paddy production,
  - 2) Exclusion of land planted with tree-crops,
  - 3) Full consideration of performances and experiences of irrigation agriculture in the advanced schemes in North Sumatra Province, and
  - 4) Improvement of crop productivity and realization of an increase in cropping intensity through the efficient use of irrigation water.
7. The current performance of WUAs can be described as “WUA not established yet” due to no sustainable irrigation water supply. The basic concept for promoting WUA establishment is to raise awareness of the necessity, role, function and activities of WUAs in parallel with the implementation of irrigation system rehabilitation works.

### 5.1.3 Development Plan

8. The registered area of the scheme is 3,231 ha. The target area had been almost entirely developed as paddy field in the past, except for an area planted to oil palm estimated at approximately 600 ha. Taking these conditions into account, the target area for the present development plan is determined to be 2,631 ha by excluding oil palm planted land from the project area as shown below.

**Project Area**

Registration Area	3,231 ha
Tree Crop Land (oil palm)	600 ha
Project Area	2,631 ha

## 9. Design of Irrigation Facilities

### Design Condition

- (a) Development area: 2,631 ha,
- (b) Unit water requirement:  $q = 1.16$  liters/s/ha, and
- (c) Design intake discharge:  $Q = 3.157$  m<sup>3</sup>/s

### Diversion Structure

To determine the type of diversion structure, measures to achieve the following conditions were considered taking into account the existing structure:

- (a) Prevention of the inflow of bed load from the river
- (b) Maintenance of stable water intake throughout the year
- (c) The required intake level at the intake site is El. 13.0 m

### Irrigation Canal and Related Structures

Irrigation canals and related structures were designed for the proposed irrigation network. A summary of canal and related structure is as follows.

#### **Summary of Irrigation Canal and Related Structures (New construction)**

Canal	Number	Length (km)	No. of Related Structures
Main	1	9.0	12
Secondary	4	13.0	Not designed

### Drainage Canals and Facilities

Drainage canals and facilities have been designed at a preliminary level and applied to the cost estimate.

10. The target cropped areas and cropping intensities in the scheme are planned as summarized below.

#### **Planned Cropped Area & Cropping Intensity**

Crop	Wet Season		Dry Season		Annual	
	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)
Paddy	2,440	100	1,220	50	3,660	150
Palawija (maize)	-	-	244	10	244	-
Total	2,440	100	1,464	160	3,904	160

Note C.I.: Cropping intensity

11. Target yields are projected at: 5.0 ton/ha for paddy fields currently irrigated in both the wet and dry seasons; 4.0 ton/ha for presently rainfed fields in the wet season; and 4.5 ton/ha for presently rainfed fields in the dry season. The anticipated yield of maize as a palawija crop is 5.0 ton/ha. The annual production increases are estimated at 12,200 tons of paddy and 900 tons of maize.
12. To realize the targets, the institutional strengthening plan consists of two programs, i.e. i) institutional capacity building and staff capability improvement program, and ii) WUA establishment acceleration program. After a WUA is

established, step-upped programs will be implemented as follow-up activities such as WUA strengthening program, FWUA and MWUA establishment program, training program on operation and maintenance of tertiary irrigation systems, and guidance program for setting and collection of irrigation service fees.

#### 5.1.4 Project Cost Estimate

13. Project costs for the proposed project works consist of i) construction cost for rehabilitation, ii) institutional and extension service strengthening, iii) consulting services, and iv) administration costs (salary for the office staff and expenditures for office management). Project costs are estimated at Rp. 48.3 billion as shown in the following table.

**Breakdown of Project Costs**

Work Description	Costs (million Rp.)
I. Construction Cost for Rehabilitation	43,245
II. Institutional and extension service strengthening	865
III. Consulting services	3,087
IV. Administration	1,103
Total	48,300

#### 5.1.5 Project Implementation Schedule

14. The implementation of rehabilitation work for the Padang Mahondang Irrigation Scheme is urgently required to recover the function of the existing irrigation scheme to cope with the progressing deterioration of the facilities. The implementation schedule of the rehabilitation work after completion of the feasibility study is summarized as follows:

- (a) Preparation of the Implementation Program (I/P) and budget arrangements,
- (b) Establishment of a project office,
- (c) Preparation of a detailed design with tender documents including field survey and investigation,
- (d) Tender and selection of contractor(s),
- (e) Execution of civil construction and taking over of completed irrigation scheme, and
- (f) Execution of strengthening program such as institutional and extension services.

#### 5.1.6 Strengthening Program

15. The institutional strengthening and extension service programs will be commenced with the following elements.

- (a) Institutional strengthening program,



- (b) Extension services strengthening program, and
  - (c) Budgeting and budget implementation.
16. The responsibility for planning and design for development, rehabilitation, and upgrading will rest with governments at the central and provincial level to assure the quality of outputs from these works.

### 5.1.7 Project Evaluation

17. The economic and financial evaluations of the rehabilitation Scheme plan is presented as follows.

#### Economic Evaluation

The result of economic evaluation of the project is summarized below.

#### **Results of Economic Analysis**

EIRR	B/C	B - C
17.3%	1.65	25.0 billion Rp.

B/C & B - C at 10% discount rate

#### Financial Evaluation

The capacities of beneficiary farmers to pay have been assessed based on the farm budget analyses on 1 ha of paddy field. The result indicates that increases would enable the farmers to bear their contributions to meeting the cost of O&M of the irrigation system.

## 5.2 Central Java (Gung Scheme)

### 5.2.1 Present Conditions

18. At present, according to the Central Java Provincial Water Resources Office (Dinas PSDA), the irrigation area of the Gung Irrigation Scheme is 14,222 ha, based on an irrigation diagram prepared in 1991. The irrigation area is divided into three sub-areas based on the water supply sources, summarized as follows:
- (a) The sub-area depending on the Gung River, A = 9,871 ha (includes an area of 1,255 ha of the Rawa Downstream System to be supplied from the Gung)
  - (b) The sub-area depending on the Cacaban Reservoir, A = 3,749 ha (includes an area of 1,255 ha located in the Gung area)
  - (c) The sub-area depending on the former Pesayangan Weir (located in the coastal area), A = 1,857 ha
19. According to the “Final Design Note” prepared by Dinas in 1997, the canal system was designed for design discharges per ha as follows:
- Main canal : 0.91 liter/s/ha
  - Secondary canal : 0.82 liter/s/ha
  - Tertiary canal : 0.71 liter/s/ha

The design cropping intensity for these design discharges is paddy (100%) - paddy (100%) - secondary crops (100%).

However, it is not possible for the JICA Study Team to adopt these design discharges, even for this project area where irrigation water management technology is much more advanced than in other areas.

It was assumed that there would be no shortage in water resources for irrigating the scheme in the Pre-F/S Stage. According to the criteria for prioritization of the schemes, the Gung Scheme, which has constraints in water resources, would have been classified into Group-IV or VI. These constraints were not fully understood during the Pre-F/S due to the complicated historical background of the scheme, such as expansion of the irrigation area, construction of additional canals, and development of new water resources to cope with the expansion. As a result, the Gung Scheme was re-classified into Group-I (F/S is recommended to be carried out in the earliest stage).

20. The present cropped area and crop yield are estimated as below.

#### Current Crop Area and Crop Yields in Gung Scheme

Crops	Wet Season		Dry Season I		Dry Season I	
	Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)
Irrigated Paddy	7,660	5.0	3,604	5.0	320	4.5
Rainfed Paddy *1	731	4.0	3,995	4.0	-	-
Rainfed Paddy	-	-	-	-	7,533	1.2
Palawija (maize composite)	1,480 (area for a year)			60.0 (yield for a year)		

Note \*1: Paddy in irrigated fields grown under rainfed conditions.

21. The present annual crop production estimates are 57,760 tons for irrigated paddy, 18,900 tons for maize, 9,040 tons for beans and 88,800 tons for sugarcane.
22. The target number of WUAs for the schemes is 131, of which 129 are already established. The current performance of these WUAs is reported to be that two have the status of “Developed”, 67 have the status of “Under development” and 53 have the status of “Not yet developed”.

#### 5.2.2 Basic Considerations in Formulating the Rehabilitation Plan

23. The Gung Scheme, which consists of three sub-areas, has an area of 14,222 ha in total. This feasibility study was carried out for the irrigation area covered by the Danawarih Headworks. The sub-area targeted for rehabilitation was 9,871 ha; the other sub-areas, A = 4,351 ha, were excluded from the feasibility study. Irrigation water for the area covered by the Danawarih Headworks (9,871 ha) is not guaranteed by the river runoff of the Gung. It was therefore necessary to carry out a water balance study between the river discharge (for dependable discharge of 4 out of 5 years, i.e., 80% probability) at the Danawarih

Headworks site and the water demand based on the cropping pattern and schedule determined for agricultural development. The area that could be irrigated with 80% dependability, as estimated from the water balance study, was 3,906 ha. This represented the target area for which a rehabilitation plan has been formulated.

24. The JICA Study Team and counterpart personnel discussed possible solutions to the target area being smaller than the area served by the Danawarih Headworks. As a result, both parties agreed on the following options:

Case 1: The feasibility study is to be carried out on the condition that the target area is 3,906 ha.

Case 2: The supply of water from the Danawarih weir to the Rawa Downstream System (1,255 ha) is to be stopped. This water could be replaced by supplying water from the Cacaban dam after first extending the dam height; this possible solution is to be examined..

Case 3: New water resources upstream of the Danawarih weir (e.g. construction of Blembeng dam) could be developed.

Case 4: A cropping system more suited to the availability of water (introduction of cash crops) could be adopted.

Case 5: Work quantities and costs for the rehabilitation of the facilities could be estimated for the entire scheme with an area of 9,871 ha.

As discussed above, the study did not address Cases 2, 3 and 4; however, recommendations have been made as seen above.

25. The agricultural plan was formulated for the target area of 3,906 ha assuming that the present cropping pattern and cropped area will be kept unchanged in the future with-project condition.
26. The current performance of WUAs in the scheme can be described as a mix of two statuses, “WUA already established and under development” and “WUA already established but not developed yet”, due to the present limited irrigation water supply condition and the existence of traditional irrigation management customs at terminal level. The basic concept adopted for strengthening the WUA activities is to rationalize the water allocation plan of the whole irrigation system and WUA’s management system.

### 5.2.3 Development Plan

27. The features of the design for rehabilitation of each structure are as follows:

(1) Design Conditions

- (a) Development area:  $A = 3,906$  ha,
- (b) Unit water requirement:  $q = 1.22$  liters/s/ha, and
- (c) Design intake discharge:  $Q = 4.765$  m<sup>3</sup>/s.

- (2) Water Resources Facilities
- (a) Measures to rectify wearing of concrete at water cushion behind the bar screen,
  - (b) Measures for removal of stones and cobbles remaining after floods (adoption of mechanical removal and providing a working area), and
  - (c) Repairing of retaining walls on both sides of foundations.
- (3) Canals and their related structures (main and secondary canals)
- (a) Removal of sand and gravel deposits in the canals,
  - (b) Rehabilitation of the existing concrete lining,
  - (c) Provision of concrete lining for the unlined sections,
  - (d) Rehabilitation of damaged structures,
  - (e) Repairing of gates, and
  - (f) Additional provision of bridges and canal crossing structures.
- (4) Inspection Roads
- (a) Rehabilitation of inspection roads along the main canal,
  - (b) Rehabilitation of inspection roads along the secondary canals and completion of uncompleted inspection roads, and
  - (c) Expansion of farm road networks connecting to villages.

28. The with-project cropped areas and cropping intensities are planned as summarized below.

**Planned Cropped Area & Cropping Intensity**

Crop	Wet Season		Dry Season I		Dry Season II <sup>*3</sup>		Annual	
	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)
Paddy	3,032	78	1,426	37	126	3	4,584	117
Palawija <sup>*1</sup>	289	7	1,581	40	-	-	1,870	47
Palawija <sup>*2</sup>	-	-	-	-	2,981	76	2,981	76
Sugarcane	585	15	-	-	-	-	585	15
Total	3,906	100	3,007	77	3,107	80	10,020	256

Note C.I.: Cropping intensity

\*1: Palawija --- maize    \*2: palawija --- beans (soybeans & mungbeans)

\*3: Excluded from the water balance study

29. Target yields are anticipated at 5.5 ton/ha for irrigated paddy in the wet season and the first dry season and 4.5 ton/ha for irrigated paddy in the second dry season. As for palawija crops, for maize the target yield is 5.5 ton/ha and for beans, 1.2 ton/ha. The annual production increases are estimated at 2,229 tons of paddy and 2,805 tons of maize.

30. To strengthen WUA activities, the following steps are to be taken:

- (a) hold awareness-raising workshops for WUA members to address weaknesses identified in the latest monitoring and evaluation (M&E) record on WUA performance,

- (b) identify technical assistance requirements for improving WUA capacity for organizational management, capability to conduct operation and maintenance of tertiary irrigation systems, and/or activities to set and collect WUA members' fees,
- (c) formulate a list of possible technical assistance components and prepare package programs of technical assistance according to the needs of individual WUAs to improve their capacity, capability and/or activities, and
- (d) estimate the unit cost of each technical assistance component and the total cost of the package program.

#### 5.2.4 Project Cost Estimate

31. The cost estimate for the rehabilitation of the Gung irrigation scheme adopts the same conditions as the Padang Mahondang irrigation scheme in North Sumatra Province. The estimates are as follows:

##### Breakdown of Project Costs

Work Description		Costs (million Rp.)
I.	Construction Cost for Rehabilitation	33,783
II.	Institutional and extension service strengthening	676
III.	Consulting services	2,412
IV.	Administration	861
Total		37,732

#### 5.2.5 Project Implementation Schedule

32. The contents of the project implementation are almost same as the case of the Padang Mahondang irrigation scheme.

#### 5.2.6 Strengthening Program

33. The strengthening programs, both institutional and extension service, are to be executed in the same manner as for the Padang Mahondang irrigation scheme.

#### 5.2.7 Project Evaluation

34. Project evaluation was done in the same manner as for the Padang Mahondang scheme and the result is shown below.

##### Economic Evaluation

The results of economic evaluation of the project are summarized below.

##### Results of Economic Analysis

EIRR	B/C	B - C
6.7%	0.76	-7,430 million Rp.

Note: B/C & B - C at 10% discount rate

##### Financial Evaluation

The capacity of beneficiary farmers to pay service fees has been assessed based on farm budget analyses for 1 ha of paddy field. The result indicates that the

farmers would be able to bear increases to their contributions to the O&M cost of the irrigation system.

### 5.3 South Sulawesi (Kalaena Kiri Scheme)

#### 5.3.1 Present Conditions

35. The field investigation of the irrigation facilities revealed the following problems with the scheme:

- (a) Water flow in the Main Canal is obstructed by collapsed canal banks and vegetation (weeds and small trees). Especially, unlined canals from the division structure BK.Ki 7 to the downstream reach are heavily damaged due to collapse of both banks. Also, seepage and overtopping of water from the canal are observed elsewhere.
- (b) Most of the Secondary Canals are not used at present, and hence O&M is not actually practiced.
- (c) Most of the inspection roads along the Main and Secondary Canals are not utilized due to collapse and damage, especially the secondary canals. They are almost impassable by four-wheel drive vehicle even in the dry season.
- (d) Damage to the gates is not serious, but maintenance such as greasing and painting is not practiced at all.

36. The present cropped area and yield are estimated as follows:

**Current Crop Area and Crop Yields in Kalaena Kiri Scheme**

Crops	Wet Season		Dry Season	
	Area (ha)	Yield (ton/ha)	Area (ha)	Yield (ton/ha)
Irrigated Paddy	2,375	4.0	2,375	4.0
Rainfed Paddy <sup>*1</sup>	832	3.0	-	-

Note <sup>\*1</sup>: Paddy in irrigated fields grown under rainfed conditions

The present annual paddy production in the Scheme is estimated at some 21,500 tons.

37. The target number of WUAs for the scheme is 49, while 29 exist at present. As for current performance of the existing WUAs, 27 are classified as “Under development” and the remaining two are evaluated as “Not yet developed”.

#### 5.3.2 Basic Consideration in Formulating Rehabilitation Plan

38. The rehabilitation plan will be based on field investigation results and discussions with the officials of the provincial government concerned and the project management office as follows:

- (a) To maximize the utilization of potential water and land so as to increase cropping intensity (throughout the year) and crop productivity.

- (b) To utilize existing facilities to the utmost possible extent in due consideration of the factors of durability.
  - (c) To design diversion/turnout structures by providing water measurement devices to introduce appropriate water management technology.
  - (d) To provide infrastructures with inspection roads and farm roads for O&M of irrigation facilities and access for future mechanized farming.
  - (e) To provide project facilities such as site operation houses (50m<sup>2</sup>/house), vehicles, motor cycles, and office equipment for the project office.
39. According to the inventory survey, the main features of the irrigation facilities are as follows:

#### Features of Irrigation Facilities

Facility	Number	Length (km)	No of Structure
Headworks	1	w=104 m (fixed type weir)	Right & left intakes
Main Canal	1	18.989	33
Secondary Canal	9	19.891	17

40. The structural conditions of the main canals are summarized as follows:

#### Condition of Facilities

Facility	Condition				Total
	A	B	C	D	
Canal (km)	3.80	1.95	1.97	11.27	18.99
Structure (nos.)	1	11	21	0	33

41. The basic concepts applied to the formulation of the agricultural plan were:
- (a) Placing an emphasis on paddy production,
  - (b) Re-conversion of cacao planted fields to irrigated paddy fields,
  - (c) Full unitization of irrigation agriculture performances and experiences in the advanced schemes in South Sulawesi Province,
  - (d) Increasing cropping intensity with the available water in the 3<sup>rd</sup> cropping season through rational utilization of irrigation water, and
  - (e) Strengthening of Farmers' Groups (KT) aiming at the promotion of agri-business oriented farming activities in the Scheme.
42. The current status of the performance of WUAs in the scheme can be described as a mix of "WUA already established but not developed yet", due to no sustainable irrigation water supply to part of the beneficiary area. The basic concept for promoting WUA establishment and strengthening is to raise awareness of the need for having WUAs as well as the upgrading of WUA activities in parallel with the implementation of irrigation system rehabilitation.

### 5.3.3 Development Plan

43. As there is no constraint to supplying irrigation water under the present rehabilitation plan, the target area for the present development plan was finally

set at 4,037 ha after excluding the command area of the Polo Secondary Canal (450 ha), where cacao trees at full fruit bearing stage exist as shown below.

#### Development Area

Original Potential Area	4,487 ha
Command Area of Polo Secondary Canal (Cacao Planted Land)	450 ha
Project Area	4,037 ha

44. The features of the rehabilitation of the diversion weir, main canal and related structures of the main canal are summarized as below.

#### Summary of Rehabilitation Works of Irrigation Facilities

Facilities	Works of Rehabilitation
Diversion Weir	<ul style="list-style-type: none"> <li>- Removal of sediment from in front of the intake, scouring sluice and upstream apron</li> <li>- Repair of the stilling basin</li> <li>- Provision of protection works downstream of the stilling basin by concrete blocks and gabion river protection blocks</li> <li>- Provision of a new settling basin near the diversion weir</li> <li>- Repair of gate works and provision of a trash rack in front of the intake</li> </ul>
Irrigation Canals	<ul style="list-style-type: none"> <li>- Removal of accumulated sediment inside the canal</li> <li>- Provision of drainage ditches and facilities at the excavation section of canal</li> <li>- Provision of concrete lining in the unlined sections</li> <li>- Provision of kilometer and hectometer posts for O&amp;M</li> </ul>
Related structures	<ul style="list-style-type: none"> <li>- Repair of gates</li> <li>- Repair/provision of measuring devices</li> <li>- Provision of safety facilities at the siphon and aqueduct</li> <li>- Removal of clogging/sediment inside drainage culverts</li> <li>- Provision of bridges for O&amp;M and for rural infrastructures</li> </ul>
Inspection Roads	<ul style="list-style-type: none"> <li>- Repair of the whole length and provision of gravel pavement</li> <li>- Provision of related facilities such as ditches, drain inlets, and safety facilities</li> </ul>
On-farm Terminal Facilities	<ul style="list-style-type: none"> <li>- Provision of appropriate facilities as standard requirements</li> <li>- Provision of gravel pavement for farm machinery</li> </ul>

45. The target cropped areas and cropping intensities planned for the scheme are as summarized below.

#### Planned Cropped Area & Cropping Intensity

Crop	Wet Season		Dry Season I		Dry Season II		Annual	
	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)
Paddy	4,037	100	-	-	4,037	100	8,074	200
Palawija *1	-	-	404	10	-	-	404	10
Cacao	-	-	-	-	-	-	0	0
Total	4,037	100	404	10	4,037	100	8,478	2100

Note C.I.: Cropping Intensity

\*1: Hybrid maize



46. Target yields are projected at 5.0 ton/ha for irrigated paddy in both the wet and dry seasons; as the same target yield is adopted for hybrid maize as a palawija crop. The annual production increases are estimated at 18,900 tons of paddy and 2,000 tons of hybrid maize.
47. The institutional strengthening plan consists of two programs in the initial stage of project implementation, i.e., i) institutional capacity building and staff capability improvement program, and ii) WUA establishment acceleration program. Following this plan, four programs will be implemented to upgrade WUA activities, i) WUA strengthening program, ii) FWUA and MWUA initial setting-up program, iii) training program on operation and maintenance of tertiary irrigation systems, and iv) guidance program for setting and collection of irrigation service fees.

#### 5.3.4 Project Cost Estimate

48. Project cost of the Kalaena Kiri irrigation scheme was estimated using the same conditions as the other two irrigation schemes. The results are shown in the following table.

**Breakdown of Project Costs**

Work Description		Costs (million Rp.)
I.	Construction Cost for Rehabilitation	54,959
II.	Institutional and extension service strengthening	1,100
III.	Consulting services	3,924
IV.	Administration	1,402
Total		61,385

#### 5.3.5 Project Implementation Schedule

49. The contents of the project implementation are almost same as for the other two irrigation schemes.

#### 5.3.6 Strengthening Program

50. The strengthening programs, both institutional and extension service, are also to be executed in the same manner as for the other two irrigation schemes.

#### 5.3.7 Project Evaluation

51. The project was also evaluated in the same manner as the other two irrigation schemes.

##### Economic Evaluation

The result of economic evaluation of the project is summarized below.

**Results of Economic Analysis**

EIRR	B/C	B - C
12.1%	1.29	13.9 billion Rp.

B/C & B - C at 10% discount rate

### Financial Evaluation

The capacities to pay of beneficiary farmers have been assessed based on the farm budget analyses on 1 ha of paddy field. The result indicates that farmers would be able to bear increases to their contributions to the O&M costs of the irrigation system.

## **6. Guideline for Rehabilitation of Irrigation Facilities**

### **6.1 Prerequisite Conditions**

1. The Guideline was prepared based on the spirit of the draft Law on Water Resources that has been under deliberation in the House of Representatives.
2. The Guideline has been prepared for use by experts in central and local governments and consultants who have about 10 years experience and a basic knowledge of planning, design, and construction of irrigation and drainage development projects. The contents and descriptions of the Guideline are generally applicable to most cases of rehabilitation works in the entire country of Indonesia. However, this does not necessarily mean that the Guideline can be applied uniformly in all cases.

### **6.2 Composition of the Guideline**

3. The composition of the Guideline is as follows:

#### Introduction

- Assumptions
- Scope of the Guideline
- Terminology
- Staged Planning and Prioritization of Irrigation Schemes for Rehabilitation
- Full Participatory Approach
- How to Use the Guideline

#### I. Pre-feasibility Study for Prioritization of Irrigation Schemes

- Stage 01: First Screening of Irrigation Schemes for Rehabilitation
- Stage 02: Pre-F/S Level Field Investigation
- Stage 03: Determination of Subject Area and Second Screening of Irrigation Schemes by Water Resources Availability
- Stage 04: Formulation of Pre-F/S Level Rehabilitation Plan and Third Screening of Irrigation Schemes
- Stage 05: Prioritization of Irrigation Schemes for Rehabilitation and Preparation of Action Plan

## II. Feasibility Study

Stage 06: Formulation of F/S Level Rehabilitation Plan and Preparation of Implementation Program

## III. Implementation

Stage 07: Implementation and Commencement of Operation

### **7. Technology Transfer**

1. One of the objectives of the Study was to carry out technology transfer to Indonesian counterpart personnel through on-the-job training during the Study in order to upgrade their capability for planning and to provide a methodology for the rehabilitation and upgrading of irrigation facilities.
2. For this, the JICA Study Team and counterpart personnel have held a series of meetings and jointly undertaken field investigations at all stages of the Study when making important decisions using materials prepared by the Team.

### **8. Conclusion and Recommendations**

#### **8.1 Conclusion**

1. The Study has drawn conclusions on issues of i) present conditions and necessity of implementation of rehabilitation, ii) comprehensive recovery program of irrigation agriculture, iii) prioritization of implementation of rehabilitation, iv) formulation of Action Plan, and v) F/S of the three model schemes.

#### **8.2 Recommendations**

2. Through the course of the Study, several issues were found to exist that need to be solved. Recommendations to GOI to deal with these problems consist of i) technical level of the irrigation scheme, ii) database, iii) management of irrigation assets, iv) early implementation of the projects, v) establishment of an implementation organization including key role of the Forum, and vi) empowerment of agricultural and institutional capabilities of the beneficiaries.

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

**Volume-1**

**MAIN REPORT**

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## List of Abbreviations

ADB	Asian Development Bank
AESS	Agriculture Extension Services Strengthening
APBN	National Government Budget ( <i>Anggaran Belanja Pendapatan Nasional</i> )
APBD	Local Government Budget ( <i>Anggaran Belanja Pendapatan Daerah</i> )
APO	Agreed Plan of Operation
BAPPENAS	National Development Planning Agency ( <i>Badan Perencanaan Pembangunan Nasional</i> )
BAPEDA	Regional Development Agency ( <i>Badan Perencanaan dan Pembangunan Daerah</i> )
BIPP	Agricultural Extension Information Center ( <i>Balai Informasi dan Penyuluhan Pertanian</i> )
BPP	Rural Extension Center ( <i>Balai Penyuluhan Pertanian</i> )
BPS	Central Bureau of Statistic ( <i>Badan Pusat Statistik</i> )
BPTP	Agriculture Technology Assessment Institute ( <i>Balai Pengkajian Teknologi Pertanian</i> )
BRI	State Owned People's Bank ( <i>Bank Rakyat Indonesia</i> )
Balai PSDA	Water Resources Management Bureau ( <i>Balai Pengelolaan Sumber Daya Air</i> )
DAK	Special Allocation Fund ( <i>Dana Alokasi Khusus</i> )
DAU	General Allocation Fund ( <i>Dana Alokasi Umum</i> )
DD	Deconcentration Fund
DGWR	Directorate General of Water Resources
Dinas PSDA	Water Resources Management Services Office ( <i>Dinas Pengelolaan Sumber Daya Air</i> )
DIP	Budget for Government Project ( <i>Daftar Isian Proyek</i> )
DIPERTA	Food Crops Agriculture Services Office ( <i>Dinas Pertanian Tanaman Pangan</i> )
DPIK	District Irrigation Management Fund ( <i>Dana Penelolaan Irigasi Kabupaten</i> )
DPR	House of Representative ( <i>Dewan Perwakilan Raya</i> )
DWRS	District Water Resources Services Office
EIRR	Economic Internal Rate of Return
FAO	Food and Agriculture Organization of United Nations
FY	Fiscal Year
F/S	Feasibility Study
FWUA	Federation of Water Users' Association ( <i>Gabungan P3A</i> )
GBHN	State Policy Guideline ( <i>Garis-garis Besar Haluan Negara</i> )
GOI	Government of Indonesia
GP3A	Federation of Water Users Association at secondary block level ( <i>Gabungan P3A</i> )

GRDP	Gross Regional Domestic Products
IBRD	International Bank for Reconstruction and Development
IOMP	Irrigation Operation and Maintenance Policy
I/P	Implementation Program
IP3A	Federation of Water Users' Associations at apex scheme level ( <i>Induk P3A</i> )
JICA	Japan International Cooperation Agency
JBIC	Japan Bank for International Cooperation
KIMPRASWIL	Ministry of Settlement and Regional Infrastructure ( <i>Departemen Permukiman dan Prasarana Wilayah</i> )
KIPP	Agricultural Extension Information Office ( <i>Kantor Informasi dan Penyuluhan Pertanian</i> )
KOPTAN	Farmers Cooperative ( <i>Koperasi Tani</i> )
KT	Farmers' Group ( <i>Kelompok Tani</i> )
KUD	Village Unit Cooperatives ( <i>Koperasi Unit Desa</i> )
MOA	Ministry of Agriculture
MOSRI	Ministry of Settlement and Regional Infrastructure
MWUA	Main Federation of Water Users' Association ( <i>IP3A</i> )
NGO	Non Governmental Organization
O&M	Operation and Maintenance
PIP	Participatory Irrigation Management ( <i>Pengelolaan Irigasi Partisipatif</i> )
PKPI	Irrigation Management Policy Reform ( <i>Pembaharuan Kebijakan Irigasi</i> )
PPL	Field Extension Worker ( <i>Penyuluh Pertanian Lapangan</i> )
P3A	Water Users' Association ( <i>Pengempulan Petani Pemakai Air</i> )
PROPENAS	National Development Plan ( <i>Program Pembangunan Nasional</i> )
PWRS	Provincial Water Resources Services Office
PU	Public Services ( <i>Pekerjaan Umum</i> )
RRA	Rapid Rural Appraisal
R/U	Rehabilitation and Upgrade
RUU	Water Resources Law
SCF	Standard Conversion Factor
S/W	Scope of Works
TOR	Terms of Reference
TOT	Training of Trainers
USBR	United States Bureau of Reclamation
UU	National Law ( <i>Undang-undang</i> )
UPT	Technical Implementation Unit ( <i>Unit Pelaksana Teknis</i> )
WATSAL	Water Sector Adjustment Loan
WB	World Bank
WUA	Water Users' Association (P3A)

## Measurement Units

### **Extent**

cm<sup>2</sup> = Square-centimeters (1.0 cm x 1.0 cm)  
m<sup>2</sup> = Square-meters (1.0 m x 1.0 m)  
Km<sup>2</sup> = Square-kilometers (1.0 Km x 1.0 Km)  
a. = Are or Ares (100 m<sup>2</sup> or 0.1 ha.)  
ha. = Hectares (10,000 m<sup>2</sup>)  
ac = Acres (4,046.8 m<sup>2</sup> or 0.40468 ha.)

### **Length**

mm = Millimeters  
cm = Centimeters (cm = 10 mm)  
m = Meters (m = 100 cm)  
Km = Kilometers (Km = 1,000 m)

### **Currency**

US\$ = United State Dollars  
US\$1.0 = Rp.8,279 (as of May, 2003)  
J¥ = Japanese Yen  
J¥1.0 = Rp.69.62 (as of May, 2003)  
Rp. = Indonesian Rupiah

### **Volume**

cm<sup>3</sup> = Cubic-centimeters  
(1.0 cm x 1.0 cm x 1.0 cm or  
1.0 m-lit.)  
m<sup>3</sup> = Cubic-meters  
(1.0 m x 1.0 m x 1.0 m or  
1.0 K-lit.)  
lit. = Liter (1,000 cm<sup>3</sup>)

### **Weight**

gr. = Grams  
Kg = Kilograms (1,000 gr.)  
ton = Metric ton (1,000 Kg)

### **Time**

sec. = Seconds  
min. = Minutes (60 sec.)  
hr. = Hours (60 min.)

# CHAPTER 1 INTRODUCTION

## 1.1 Authority

This is the Final Report of “the Study on the Comprehensive Recovery Program for Irrigation Agriculture” (the Study), that was prepared in December 2003 in accordance with the Scope of Work (S/W) for the Study agreed between the Japan International Cooperation Agency (JICA) and the Ministry of Settlement and Regional Infrastructure (MOSRI) dated April 20, 2001.

The report presents the results of the Study on the basis of field/home office works of Phases 1 and 2. The study results of Phase 1 consist of formulation of a rehabilitation plan at pre-feasibility study (Pre-F/S) level and prioritization for implementation of rehabilitation, and those of Phase 2 contain the feasibility study results of the selected model schemes as well as formulation of a Comprehensive Recovery Program and an Action Plan.

The report consists of eight volumes, namely, Volume-1: Main Report, Volume-2: Guideline for Rehabilitation of Irrigation Facilities, Volumes-3 to 5: Priority List of Irrigation Schemes for Rehabilitation, and Volumes-6 to 8: Development Plan for Three Provinces.

## 1.2 Background and Objectives

### 1.2.1 Background of the Study

The Indonesian economy was heavily damaged by the Asian economic crisis of 1997. Since then, some of the sectors have recovered slightly, and in 2000 all sectors managed to achieve positive growth rates in real terms. However, the GDP per capita in 2000 was U.S.\$728 equivalent, which is only 63% of the GDP per capita in 1996 (U.S.\$1,147). Some economic indicators are showing negative trends, as is evident by the re-appearance of inflation and the decreasing amount of foreign and internal investment.

The contribution from the “Agriculture, Forestry and Fisheries” sector to GDP (Rp. 1.29 quadrillion) in 2000 was 16.9%, which accounts for the second largest share following the manufacturing sector (26.0%). The agriculture, forestry and fisheries sector employs approximately 45% of the total working population and exports from this sector, including processed goods, were equivalent to 16% of the country’s total export earnings. This sector thus contributes significantly to foreign currency earnings in the Indonesian economy. However, the sector is performing with low economic growth and is facing a number of difficulties.

The Guidelines of the State Policy (GBHN) is a fundamental national policy formulated every 5 years in accordance with Article 3 of the Constitution of Indonesia. The current GBHN, established in October 1999, sets the principal direction for agriculture and food supply in Indonesia as: developing a system of food security based on a diversity of food sources, institutions and local cultures as a part of the effort to ensure the availability of food and nutrients in adequate quantity and quality at affordable prices without disregarding the incomes and welfare of farmers and fishermen.

The national development plan (PROPENAS), which was formulated in conformity with the GBHN in November 2000, has attached importance to agricultural development and food security from the viewpoint of the survival of the national industry and economy. The PROPENAS has laid down three sub-programs for i) agribusiness development, ii) improved food self-reliance, and iii) development and management of irrigation. The purposes of the food security development program are:

- (a) To increase the food availability, increasing rice production and decreasing food imports, and
- (b) To develop food diversity by decreasing rice consumption and increasing non-rice food source production.

It is important to note that Indonesia is the third largest producer of rice (following China and India), and is the biggest importer of rice in the world.

As a result of government initiatives in the 1960s promoting measures for irrigation development, the national irrigation area increased to 5,030,000 ha (62% of the total paddy field of 8,110,000 ha) in 1999, and rice production became somewhat stable. However, since the promotion had been a government initiative without the involvement of farmers, problems soon arose, particularly regarding water management and operation and maintenance (O&M) of the irrigation systems. Since 1984, the Government has been examining the possibility of collecting an irrigation management fee (IMF) and O&M cost from the Water Users' Association (WUA) in order to lessen the Government's financial involvement. It has developed the Irrigation Operation and Maintenance Policy, 1987.

The large increase in water demand caused by economic development and population increase has shifted the emphasis of water resources from being a natural resource issue to one of economic resource. In the irrigation field, urgent work is required to increase the efficiency of water use, recover the functionality of irrigation facilities, and realize sound management of facilities in order to attain sustainable irrigation operation.

According to the report prepared in 2001 for the JICA study on “Improvement of Irrigation Management and Empowerment of Water Users’ Association (WUA) for Enhancement of Turnover Program”, about 104,000 WUA have been established. This is equivalent to 37% of the total goal, but of these, only 19 % are active (the ratio of active WUA to the total target is 7.0 %). Also, the report prepared in 1993 for the JICA study on “Formulation of Irrigation Development Program” indicates that approximately 60 % of the tertiary systems in the country are not appropriately functional. Deterioration of the irrigation facilities and poor distribution of irrigation water in the tertiary systems are considered to be among the reasons why the beneficiaries are reluctant to organize WUA. As a result, the irrigation facilities are not fully maintained and hence functionality of the facilities has declined. In order to break this “vicious circle” it is necessary to give the farmers themselves an incentive to maintain the irrigation facilities by introducing user-friendly facilities. This can be realized by improving (rehabilitation and upgrading) the facilities aiming at recovering the function of the irrigation schemes.

### **1.2.2 Framework of the Study**

According to the Minutes of Meetings (M/M) related to the Scope of Work (S/W) for the Study agreed between the Preparatory Study Team organized by JICA and MOSRI, the framework of the Study was decided as follows. Both sides agreed on a basic framework for the Study as in Attachment 2, which is presented in Figure 1.2.1.

- (a) For the optimum plan for irrigation development, it would be necessary to have a participatory approach in the rehabilitation program. This should consider various types of rehabilitation works, i.e. heavy, medium and minor, as well as some irrigation schemes that have specific problems such as severe watershed degradation that is decreasing the irrigated area of schemes.
- (b) Technical recommendations should be made for works needed to complete incomplete irrigation schemes.
- (c) Guidelines for rehabilitation of irrigation facilities should be provided such as to make irrigation schemes function entirely on the basis of farmers’ participation in O&M. The guidelines should show designs and a plan for facilities so that they are easy for farmers to maintain.
- (d) A model rehabilitation project would be needed to demonstrate actual figures for a restored irrigation scheme to better understand of the guidelines mentioned above.

### **1.2.3 Basic Approach to the Study**

The approach to the Study was to ensure that a sustainable irrigation rehabilitation plan could be formulated that would be participatory in respect of both infrastructure and institutional arrangements. This was to be accomplished by increasing the sense of togetherness, belonging and responsibility in government conducted irrigation management through the involvement of WUA.

### **1.2.4 Objectives of the Study**

The objectives set out for the Study are to:

- (a) Formulate a comprehensive recovery program for irrigation agriculture for irrigation schemes with an area of more than 1,000 ha (220 schemes with approximately 779,000 ha) located in the three provinces of North Sumatra, Central Java and South Sulawesi, and
- (b) Carry out technology transfer to Indonesian counterpart personnel through on-the-job training to upgrade their capability for planning and provide a methodology for the rehabilitation of irrigation schemes.

### **1.2.5 Selection of Provinces for the Study**

Rehabilitation of some irrigation schemes is being partly conducted by loans rendered by donor agencies such as the International Bank for Reconstruction and Development (IBRD), the Asian Development Bank (ADB) and Japan Bank for International Cooperation (JBIC) as well as the budget of GOI. However, full-scale rehabilitation works of most of the large-scale irrigation schemes have not commenced yet. It should be noted that many irrigation schemes have been malfunctioning due to poor implementation, operation and maintenance. Nonetheless, most of them were constructed only after 1980. Such problems are common to the entire country. In fact, in the first Steering Committee Meeting held for the discussion of the Inception Report, it was strongly requested by the GOI that the "Guideline for Rehabilitation of Irrigation Facilities" should be general-purpose and applicable all over the country. The GOI has been anxious about the deterioration and poor functioning of irrigation facilities and has been examining a measure devised to deal with such problems. To cope with this situation, the three provinces of North Sumatra, Central Java and South Sulawesi that represent respectively Western, Central and Eastern Regions were selected for the Study.

## **1.3 Terms of Reference (TOR)**

The Study started in February 2003 with the preparation of the Inception Report and is scheduled to be completed in February 2004 with submission of the Final Report.



The Study was carried out in two phases. Phase 1 consisted of home preparatory work, the first field work and the first home work, and Phase 2 consisted of two periods of field work and two periods of home work.

The major components of the first field work and the first home office work in Phase 1 are as follows:

### **1.3.1 Phase 1 Study**

#### (1) First Field Work

- Preparation of an inventory of irrigation schemes,
- Preparation of basic design standards and quantification based on the design standards,
- Investigation of the conditions of agriculture and institutions and preparation of their development plans,
- Preparation of a prioritized list of irrigation schemes,
- Selection of the Model Areas for the feasibility study to be carried out in Phase 2,
- Examination of the guideline for rehabilitation of irrigation facilities, and
- Preparation of Progress Report (1)

#### (2) First Home Office Work

- Preparation of Interim Report

### **1.3.2 Phase 2 Study**

#### (1) Second Field Work

- Study of the rehabilitation program for the selected model schemes,
- Finalization of the guidelines for the rehabilitation of irrigation facilities,
- Preparation of an action plan for the rehabilitation of the irrigation schemes,
- Formulation of a comprehensive recovery program for irrigation agriculture, and
- Preparation of Progress Report (2)

#### (2) Second Home Work

- Preparation of Draft Final Report, and
- Production of material for dissemination seminars

### **1.3.3 Final Report**

#### (1) Third Field Work

- Explanation of the Draft Final Report to GOI, and

- Holding dissemination seminars
- (2) Third Home Work
- Preparation of Final Report, and
  - Preparation of a report on the dissemination seminars

#### **1.4 Contents and Composition of the Report**

A systematic arrangement of “the Priority List of the Irrigation Schemes”, “the Guideline for Rehabilitation of Irrigation Facilities” and “the Action Plan for Recovering Function of Irrigation Facilities” has been made in finalizing the formulation of the Comprehensive Recovery Program for Rehabilitation.

In order to systematically examine and analyze the collected data and information during the field works and home office works in the respective Phases 1 and 2, a comprehensive recovery program for rehabilitation was formulated. This has been used to provide the basic principles for the procedure of compiling consistent outcomes of the Study. This means that as the Study progressed, any need for modification and adjustment to the outputs was reflected in modifications and adjustments to the comprehensive recovery program.

Since the comprehensive recovery program is the basic principle for a series of activities for formulating rehabilitation plans as discussed in the above paragraph, this basic principle is presented in Chapter 3 of this report.

## **CHAPTER 2 DEVELOPMENT POLICIES AND PROGRAMS**

### **2.1 National Agricultural Development Plan**

Under the Guideline of the State Policy (GBHN) and the National Development Plan (PROPENAS), the Ministry of Agriculture published a new agriculture development plan for 2000-2004 in November 2000. The specific character of this development plan is to formulate an agribusiness development program that emphasizes the role of agribusiness in the national economy as well as providing a food security improvement program which realizes a food security system based on regional food resources, institutions, and local cultural diversities. The contents of the food security improvement program are as follows:

- To increase food supply by increasing rice production and reducing food imports,
- To promote food diversity by increasing the production of non-rice food crops,
- To improve food-related institutions by developing and strengthening food-related distribution and marketing systems, and
- To promote the development of the food processing business and industry.

The current trade liberalization has given rise to serious price competition between local and imported rice. Further, other economic sectors are showing signs of economic recovery from the currency crisis, and this recovery has been improving the people's purchasing power. Under such circumstances, the public focus on food policy seems to be shifting to stable food supply rather than food self-sufficiency. In this regard, it is necessary to re-examine the role of the irrigation sub-sector to support the new food policy.

Since 1999, the total and irrigated areas of paddy field have shown decreasing tendency as shown below. Coupled with population pressure, this fact results in decrease in per capita rice supply capacity at national level even though paddy yield has been stable and the supply deficit has been partly supplemented by imported rice.

### Trend of Rice Supply Condition in Indonesia

Item	1999	2000	2001
Whole Paddy Field (000 ha)	8,106	7,787	7,632
Irrigated Paddy Field (000 ha)	5,032	4,869	4,867
Paddy Harvested Area (000 ha)	10,794	10,618	10,419
Dry Paddy Production (000 ton)	48,201	49,207	47,895
Rice Equiv. Volume (000 ton)	31,331	31,985	31,132
Imported Rice (000 ton)	4,725	1,351	1,500
Exported Rice (000 ton)	6	3	0
Rice Supply Volume (000 ton)	36,050	33,333	32,632
Total Population (000 person)	202,821	205,843	208,910
Per Capita Rice Supply (kg/person)	178	162	156

Source: Statistik Indonesia 2002, BPS

To contribute towards stable food supply in line with the agricultural development plan, the irrigation sector needs to solve the following problems:

- the deterioration of irrigation facilities,
- the malfunction of irrigation facilities due to poor operation and maintenance caused by the unsuccessful hand-over to the water users associations for the reduction of budgetary burden,
- the conversion of irrigated land to other land uses on the populous Java Island, and
- the abandonment of irrigation areas on the outer islands.

To improve the above situations, it is a prerequisite to remove a vicious cycle of malfunction of irrigation system and poor operation and maintenance of irrigation facilities. Specifically, it is necessary to put in place such countermeasures as revision of some irrigation areas to an appropriate size, small-scale water resource development, and selection of a structural design manageable for farmers in addition to rehabilitation of deteriorated irrigation facilities. This is required in order to enable water management institutions and users to carry out operation and maintenance of irrigation systems in an efficient and effective manner.

## 2.2 Current Situation of Decentralization

In 1999, two laws concerning decentralization were enacted, i.e. Law No. 22/1999 on “Regional Governance” and Law No. 25/1999 “Fiscal Balance between the Central Government and its Regions.” These laws have come into effect and decentralization is expected to continue for the next six years. Under these laws, the major functions of the central government are limited to five fields, i.e. international relations, national defense/security, justice, finance and religion as well as other fields such as national development planning at macro level, development management policies and natural resources management. Other

authorities have already been transferred to local (district/municipal) governments to a large extent.

The provincial governments supervise and monitor the district and municipal governments through coordination with the central government. The positions of district and municipal governments are therefore parallel to the provincial government in implementing the authorities. Tasks transferred to the district/municipal governments under the Law No. 22/1999 are generally categorized in terms of implementation of the followings:

- decentralized task using its own budget with its own responsibility,
- de-concentrated task with authorities and responsibility transferred from the central government to the district/municipal governments through the province along with necessary budget, and
- co-administration (or supporting) task with responsibility remaining in the central or provincial government along with necessary budget and assigning the district/municipal government to implement task.

The central, provincial and district/municipal governments are conducting their fiscal management based on the Law No. 25/1999. The revenues of local governments comprise the balancing funds from the central governments including revenue sharing, general allocation funds (DAU) and specific allocation funds (DAK) as well as a special autonomy fund and their own tax revenues. The local governments can use DAU for various purposes but DAK for limited purposes.

In the initial national budget for 2003, revenue is expected to be Rp. 336.2 trillion, while expenditure is estimated to be Rp. 370.6 trillion. The deficit of Rp. 34.4 trillion is planned to be offset by foreign loan(s), the privatization of state-owned enterprises and the sale of the assets of the Indonesian Bank Restructuring Agency. The revenue comprises tax revenue for Rp. 254.1 trillion and non-tax revenue for Rp. 82.1 trillion. As the balancing funds amount to Rp.107.5 trillion and the special autonomy fund is Rp. 9.4 trillion, the budget to be transferred to local governments shares 31.5% of the total expenditures.

Out of the expenditure, the total amount of development expenditure is Rp. 65.1 trillion which is covered by foreign loan. The amount allocated to the sub-sector of water resources development and management is Rp. 2.2 trillion.

## 2.3 Present Status and Forecasting of Irrigation Administration Policy

### (1) Revision of Legal Framework of Water Resources Management

According to the existing water law (UU 11/1974), water resources are totally controlled by the minister in charge of the central government concerning development, management, licensing, regulation, authorization, determination and so on, excluding administration of groundwater. The President Habibii Government issued Presidential Instruction (*Inpres* 3/1999) in April 1999 to direct the reform of the water resources and irrigation sector in a comprehensive manner. In line with this, the National Development Planning Agency (BAPPENAS) upgraded the agenda of the inter-ministry deliberation, which had been done by officials concerned, to the preparation of draft Law on Water Resources. In June 2001, a draft legislative proposal was completed. After various amendments, the final bill was formally submitted to the House of Representatives (DPR) by the President in October 2002.

### (2) New Law on Water Resources

The draft Law on Water Resources is formulated to anticipate future problems and paradigm shifts in water resources management such as:

- To enhance integrated water resources management in order to achieve its sustainable utilization,
- To manage water in broader perspectives, i.e. society, ecology and economy as well as for the wealthy of human beings and living creatures,
- To balance conservation and utilization of water resources,
- To shift water resources management from centralist to decentralist,
- To give a better assurance of the basic right of water for all people, and
- To ensure a democratic mechanism and process in policy adoption.

The draft Law on Water Resources openly encourages stakeholders to participate in all steps of water resources development and management from the preparation of strategic policy and plan to the design, construction, operation and maintenance, and in-stream water quality monitoring works. Through deliberation in DPR, the draft has been modified to increase the governments' share of responsibilities and duties concerning water resources management, utilization and conservation aiming at reduction of the heavy burden on water users.

### (3) Principles of Irrigation Management Policy

In the draft Law on Water Resources, the basic concept of irrigation management policy is stated as follows:

- Development/construction and operation and management of irrigation schemes are responsibilities of the Government and the Regional Governments in accordance with their jurisdiction and these activities will be implemented with participation of WUAs,
- As for irrigation management jurisdiction, the management authority of an irrigation scheme which is located in one district/municipality belongs to that district/municipal government. For the case of an irrigation scheme which is located in more than one district/municipality, the management authority belongs to provincial government, while for the case of irrigation scheme which is located more than one province/country, the management authority belongs to central government, and
- Funding for construction and operation and maintenance of tertiary irrigation systems is the responsibility of farmers and community, while the government will provide financial assistance if required.

## **2.4 Tendency and Policy of International Lending Agencies**

### **(1) World Bank**

The World Bank (WB) launched the Country Assistance Strategy for Indonesia in February 2001. The basic strategies of this plan are to support Indonesia's political and economic transition in a highly uncertain environment, and to support the following issues under the overarching goals of reducing poverty and vulnerability in a more open and decentralized environment:

- To sustain economic recovery and promote broad-based growth,
- To build national institutions for an accountable government, which includes legal and judicial reforms, better public financial management, and
- To deliver better public services for the poor.

The basic approach of the WB is not specific to economic sector, but focuses on rural development for alleviating poverty. The approach is shifting from support of technical matters in specific sectors to supporting of institutional aspects including micro-finance. The WB has also given priority to empower farmers' groups in the context of rural development and also to support formulation of development plans by farmers' groups.

### **(2) Asian Development Bank**

The Asian Development Bank (ADB) continues to assist Indonesia based on the following strategies:

- To create and strengthen basic institutions by improving the many relevant areas in the governments,
- To support the sustainable recovery and pro-poor growth by enabling and encouraging private sector development,
- To improve regional equity through balanced regional development, especially targeting the rural areas and less developed islands,
- To invest in human and social development and enhance the role of women, and
- To strengthen environment management to ensure sustainable use of natural resources and prevent adverse environmental impact associated with development.

In October 2003, the ADB newly committed to support the Government of Indonesia by financing/granting US\$ 3.2 billion for the next three years from 2004 to 2006. In this commitment, a “Participatory Irrigation Sector Project” is included with a loan amount of US\$ 19 million and an 8-year project implementation period.

### (3) Japan Bank for International Cooperation

At present, six irrigation projects financed by Japan Bank for International Cooperation (JBIC) are under implementation. These are the Project Type Sector Loan (PTSL) II, Ular Irrigation Rehabilitation Project, Batang Hari Irrigation Project, Way Sekampung Irrigation Project (III), Small Scale Irrigation Management Project (SSIMP) III and Decentralized Irrigation System Improvement Project (DISIMP). The location, project implementation period and loan amount are summarized below.

**List of On-going Irrigation Projects financed by JBIC**

Project	Location	Implementation Period	Loan Amount (Yen million)
PTSL II	12 Provinces in Western and Central Regions	9 years 2001-2009	18,676
Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project (Including Ular Irrigation)	North Sumatra, Central Java and East Java	6 years 2003-2008	14,696
Batang Hari	West Sumatra & Jambi	10 years 1997-2006	13,689
Way Sekampung (III)	Lampung	7 years 1998-2005	9,216
SSIMP III	6 Provinces in Eastern Indonesia	6 years 1998-2004	16,701
DISIMP	8 Provinces in Eastern Region	9 years 2003-2012	27,035



## 2.5 Assumption of Applied Laws and Regulations for the Study

### (1) Key Regulations

Both of the existing Law of Water Resources and the draft Law on Water Resources are framework acts, although the total articles increase from 17 to 97. Therefore, all the subjects included in the draft Law on Water Resources only provide guidelines so that substantive elaboration of almost all subjects is indispensable in regulations with lower sequence of power of legislation under the hierarchy of law. This necessitates that the preparation of the regulations is carried out in parallel with drawing up of the bill. To accommodate this need, the following key regulations have been completely revised and adapted to the philosophy and content of the draft Law on Water Resources:

- Regulation about Water Resources Management, replacing Regulation PP 22/82 on Water Management,
- Regulation for the River Basin Water Resources Corporation, newly prepared, and
- Regulation for Rivers, replacing Regulation PP 35/91 on Rivers.

Another two key regulations on water quality and irrigation were enacted at the end of 2001. These are:

- Regulation PP 82/01 for Water Quality and Control of Water Pollution based on the Law UU 68/97 on Management of Environment, replacing Regulation PP 20/90 on Water Quality Management, and
- Regulation PP 77/01 on Irrigation based on the existing Law UU 11/74 on Water Resources, replacing Regulation 14/87 on Irrigation and Drainage.

The above two regulations are still subject to being reviewed based on the draft Law on Water Resources once it is enacted.

### (2) New Irrigation Management Policy

In the draft Law on Water Resources, the basic concept for the irrigation management policy is changed from “the hand over of authority from government to water users association” to “the participation of farmers from the beginning to decision making starting from planning to construction, rehabilitation, upgrading, operation, securing and conservation”.

Irrigation substance related to farmers’ participation in the draft Law on Water Resources are:

- Farmers, either individually or in group, deserve the right of water usage with permit and without permit,
- Farmers are to participate in the development of irrigation systems or to

- develop systems by themselves in accordance with needs and capability,
- Farmers are to contribute to the formulation of management planning,
- Farmers are to participate in implementation of the operation and maintenance,
- The Government conducts strengthening of farmers' activities such as planning, implementation, monitoring, and operation and maintenance in the form of education and training, research and development, and assistance,
- Farmers are to monitor the implementation of participatory irrigation management, and
- Farmers are responsible for construction and operation and maintenance of tertiary irrigation systems (as proposed by the Government in the Bill of Law on Water Resources).

As clearly decided in the draft Law on Water Resources and approved by DPR, the Government/Regional Governments are responsible for construction and operation and maintenance of primary and secondary irrigation systems by involving the community according to jurisdiction of government.

### (3) Assumption for the Study

According to “Participatory Irrigation Management (*Pengelolaan Irigasi Partisipatif* <PIP>)” provisionally formulated by the assessment and modification team of the Director General of Water Resources of MOSRI as a new idea for irrigation management policy, the concept of PIP is to implement management and/or development based on farmers' participation since they should be involved from the initial idea to the decision making in every stage of planning, construction, rehabilitation, upgrading, operation, securing and conservation as shown in Table 2.5.1 in detail. This PIP aims at the fulfillment of irrigation services to meet the farmers' needs through efforts of upgrading the efficiency and effectiveness of continuous irrigation management. As for the goal, PIP directs to increase the sense of togetherness, the sense of belonging and the sense of responsibility in irrigation management which is conducted by the government with the involvement of water users associations from the initial idea to the decision making.

In due consideration of the recent change in the irrigation management policy resulting from the DPR's deliberation on the draft Law on Water Resources, the basic conditions for the formulation of the “comprehensive recovery program of irrigation agriculture” are based on deliberation results of DPR on the irrigation substance of the draft Law on Water Resources as well as the above new concept of irrigation management policy.

## **CHAPTER 3 COMPREHENSIVE RECOVERY PROGRAM OF IRRIGATION AGRICULTURE**

### **3.1 Introduction**

Systematic arrangement of “the Priority List of the Irrigation Schemes”, “the Guideline for Rehabilitation of Irrigation Facilities” and “the Action Plan for Recovering Function of Irrigation Facilities” has been made in finalizing the Formulation of the Comprehensive Recovery Program for Rehabilitation as discussed in Chapter 1.

In order to examine and analyze systematically the collected data and information during the field works and home office works in the respective Phases I and II, the comprehensive recovery program for rehabilitation has been formulated. This has been used as a basic principle for the procedure of compiling consistent outcomes of the Study. Likewise, when any modification and adjustment of the outputs became necessary as the Study progressed, modification and adjustment of the comprehensive recovery program were made accordingly in parallel with the above activities.

Since the comprehensive recovery program is the basic principle for a series of activities for formulating rehabilitation plans as discussed in the above paragraph, this basic principle is presented in this chapter.

### **3.2 Background**

As a result of government initiatives in the 1960s promoting measures for irrigation development, the whole irrigation area including village irrigation beneficiary areas has increased to around 6.4 million ha in the country to date. A total of 15,474 public irrigation schemes presently cover 5,811,727 ha of paddy fields as a whole. Such promoting measures contribute to the stability of rice production and self-sufficiency, although Indonesia is the largest importer of rice in the world. Operation and Maintenance (O&M) of the irrigation facilities have been carried out through subsidy from the national budget. However, it is not possible to practice appropriate O&M due to a shortage of budget. Since 1984, the government has been examining possible countermeasures, such as collection of irrigation management fees, etc. However, such problems have remained unsolved. On the other hand, irrigation water has not been distributed equitably to the terminal systems due to deterioration and damage of irrigation facilities, and as a result, the facilities are not fully maintained and hence the functionality of the facilities has

been reduced. In order to break this “vicious circle”, it is urgently necessary to rehabilitate and upgrade (R/U) the facilities aiming at recovering the function of the irrigation schemes.

In 1999, the government issued a public declaration of Irrigation Management Policy Reform directed toward implementation of a new policy of “hand over of the authority on irrigation management” with technical assistance under Water Sector Adjustment Loan (WATSAL). Its target was to make WUA financiers and players manage the irrigation network system in a sustainable manner as well as to reduce the financial involvement of the State Budget (APBN) and Regional Budget (APBD). In July 2003, however, the government decided to revise this policy considering the on-going deliberations regarding the Bill of Law on Water Resources in the DPR through enforcement of the Decree of the Directorate General of Water Resources (DGWR), No. 267/KPTS/D/2003. In this regard, the conditions for the formulation of the “comprehensive recovery program of irrigation agriculture” are based on the substance of the draft Law on Water Resources as it has been mostly approved by the DPR by September 2003.

This chapter deals with the systematic procedures for recovering irrigation system function from the “initial appraisal of needs for the rehabilitation of the irrigation system” to the “planning, designing and constructing of the scheme to be rehabilitated and setting-up of irrigation system management” in order to formulate a “comprehensive recovery program of irrigation agriculture”.

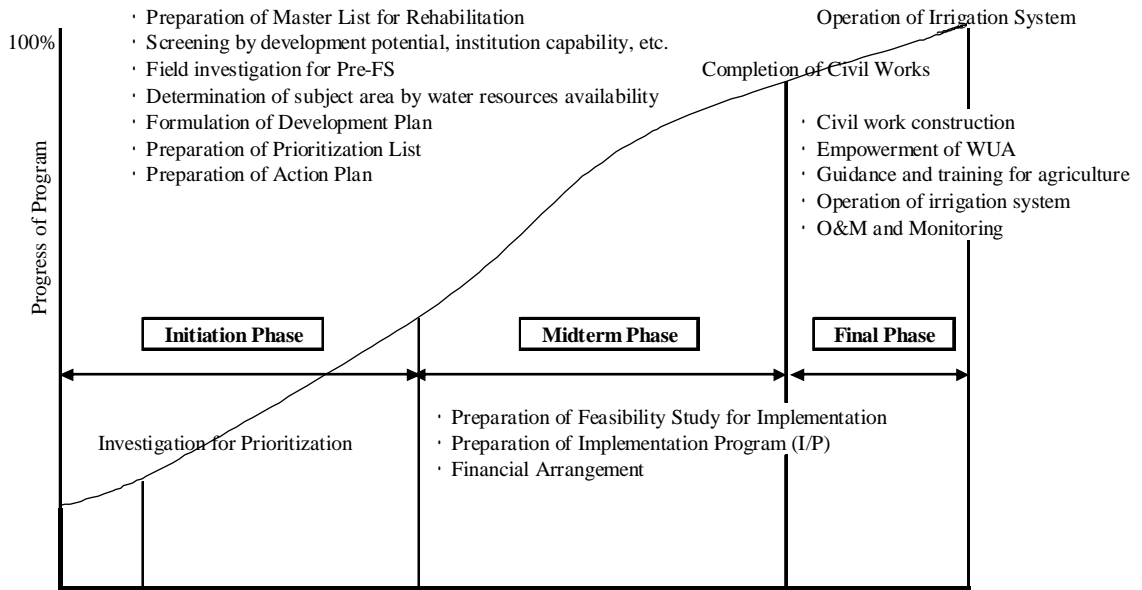
### **3.3 Extent and Contents of Comprehensive Recovery Program**

#### **3.3.1 Program Phase, Cycle and Process**

##### **(1) Program Phase**

To execute the comprehensive recovery program, the sequence of processes, from initiation of the program to operation of the irrigation system, is conceptually shown below:

## Cycle and Phases in Recovery Program of Irrigation System



As discussed above, the process is divided into the following three phases:

- I. Initiation phase
- II. Midterm Phase
- III. Final Phase

Each phase is set apart at a certain number of outputs. The outputs are the work results of each phase, consisting of Pre-F/S report, priority list for implementation of rehabilitation, F/S report, completed scheme, etc. which are tangible and verifiable. The program phase, which is separated by the outputs, is established in order to ensure the appropriate definition of all of the program outputs. In view of the entire program span from initiation to operation, the program phase is established to go through the proper procedure logically. At the end of each program phase, a review of major outputs and work results will be made in order to determine whether the program is to proceed to the next phase or not.

### (2) Program cycle

The Program cycle is to define the following matters:

- Contents of the study items to be carried out in the respective program phases, and
- Name of agencies in charge or to be in charge in the respective program phases.

(3) Process of the function recovery program

The process flow of the function recovery program from the initiation phase to operation is shown in Figure 3.3.1. As seen in the figure, the process of the program is as follows:

- (a) To list the irrigation schemes, of which each registered area is more than 1,000 ha,
- (b) To carry out a 1<sup>st</sup> screening of the schemes based on the establishment status of the WUA, and the availability of water resources,
- (c) To conduct Pre-F/S for the screened schemes,
- (d) To carry out a 2<sup>nd</sup> screening of the schemes based on a verification of availability of water resources,
- (e) To carry out a 3<sup>rd</sup> screening of the schemes based on the evaluation results of technical and social aspects,
- (f) To evaluate indicators for prioritization of rehabilitation and to make a grouping of priority,
- (g) To formulate the Action Plan,
- (h) To conduct F/S,
- (i) To implement rehabilitation projects including detailed design and construction works, and
- (j) To set up operation and maintenance of the irrigation systems in line with the participatory irrigation management policy.

Each process stated above is classified into one of three program phases in view of project cycle as follows:

- From process (a) to process (g) to Initiation Phase,
- Process (h) to Midterm Phase, and
- Process (i) and process (j) to Final Phase

### **3.3.2 Stakeholders of the Program**

The stakeholders of the function recovery program are defined as those (organizations and/or individuals) who are aggressively participating in the project and/or who will be interested (positive or negative) by the implementation of the program. It should be noted that the related stakeholders have usually opposed the interests of each other. One of the most important factors for securing smooth implementation of the program is to solve such problems

Major stakeholders related to the function recovery project are as follows:

- MOSRI, Ministry of Agriculture, Ministry of Home Affairs, BAPPENAS, Ministry of Finance and research institutes from central government authorities,

- Water resources management services office (Dinas/Sub-Dinas PSDA) and its water resources management bureau (Balai PSDA), agricultural services office, BAPPEDA and related agencies from provincial government authorities,
- District water resources services office (DWRS), agricultural services office, BAPPEDA and related agencies from district/municipal government authorities,
- Water users' associations (WUA), its federations (FWUA) and federation groups (MWUA),
- Farmers' groups,
- Universities and NGOs as the third parties, and
- International lending agencies (WB, ADB, JBIC, etc.).

### **3.3.3 Skill and Knowledge required for the Program**

Skill and knowledge required for each phase in the implementation of the program are considered to be as follows. In this regard, special attention has to be paid to the formation of the organization (procurement of human resources).

#### **(1) Skill and knowledge required in the initiation phase**

Related legislation, status of irrigation and agriculture in the project area, irrigation and drainage technology, social and regional economy, WUA, farmers' groups, agro-economy, estimation of work quantities and construction costs, etc.

#### **(2) Skill and knowledge required in the midterm phase**

Irrigation and drainage techniques, agriculture, agro-economy, WUA, farmers' groups, estimation of work quantities and construction costs, loan procedures of respective international lending agencies, etc.

#### **(3) Final phase**

Procurement of consultants, structure design, contract administration, construction supervision, operation and maintenance, agricultural extension, WUA strengthening, etc.

### **3.3.4 Budgeting and Budget Implementation System**

In principle, the current legal framework on budgeting and budget implementation systems are to be followed in each phase of the function recovery program.

The government authority considers that at least 6.4 million ha, which represent 22% of the country's total irrigation area, needs to be rehabilitated. In this connection, the outputs of the Initiation Phase can provide decision makers of government authorities, irrigation water users groups and other stakeholders with

more realistic outlines of the respective irrigation schemes concerning physical requirements for rehabilitation of irrigation systems, potential contribution to national food security and institutional strengthening needs for irrigation water supply and usage bodies. It is, therefore, necessary to conduct the initiation phase activities in a package form on a provincial basis by allocating budget to the sector funds of the MOSRI. The provincial governments are requested to execute initiation phase package programs through the assistant task role.

In order to ensure quality output of the midterm phase, a F/S is also to be conducted in the form of a package based on the output of the initiation phase and according to decisions to be made by stakeholders. Budgeting will be made at the central level after reviewing proposals from the provincial government by the MOSRI.

Budgeting for implementing rehabilitation works for irrigation schemes will be basically made according to the jurisdiction of irrigation management stipulated in the draft Law on Water Resources if internal budget source is considered. If external funding sources are targeted, packaging of the proposed schemes to be rehabilitated is to be made in line with the procedures of the donors concerned.

### **3.3.5 Formation of Organization Structure**

As discussed in Section 3.3.1, the process of the function recovery program from the initiation stage to operation consists of three phases, and the tasks to be done cover manifold events, and the stakeholders are many in the various fields. Special attention has to be paid to setting up new organizational structures in order to complete the program within a certain time with a prescribed quality of inputs. Formation of the organizational structures is considered to consist of (a) function type, (b) matrix type, and (c) project type. In due consideration of the nature of the works, responsibilities of the organization, independency and urgency of the project, a project type (c) is adopted for formulating the function recovery program.

In the formation of the project type organizational structure, careful attention is to be paid to the current legal framework of institutions, and budgeting and budget implementation as well as the jurisdiction of government authorities on irrigation management and the participatory irrigation management policy in line with the draft Law on Water Resources.

### **3.3.6 Project Organization**

#### **(1) Precondition**

The project organizations to be formed will be a “Forum” to serve as a program decision making body, and as a “Project Office” to serve as a program implementation body. These bodies are to be newly established at the provincial



level, which will be responsible for implementing the comprehensive recovery program of irrigation agriculture from the initiation phase to the final phase on the basis of the participatory irrigation management concept.

The Project Office is attached to the water resources services offices as one of functional units in every Province and under the control of the chief in charge of water resources management and utilization.

## (2) Function Recovery Forum

The key role of the Forum is to make the decisions to carry out activities of each Phase, and to review and accept the outputs of each Phase. In this regard, the Forum is to play a 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 Management Services or Sub-Services (Dinas/ Sub-Dinas PSDA)
Member of Forum:	District Regent, Municipal Mayor, Chief of District BAPPEDA, Chief of District Water Resources Services, Chief of Agricultural Services at the provincial and district levels, Chief of relevant services at provincial and district level, Representatives of the WUA, Universities and NGOs

## (3) Function Recovery Project Office

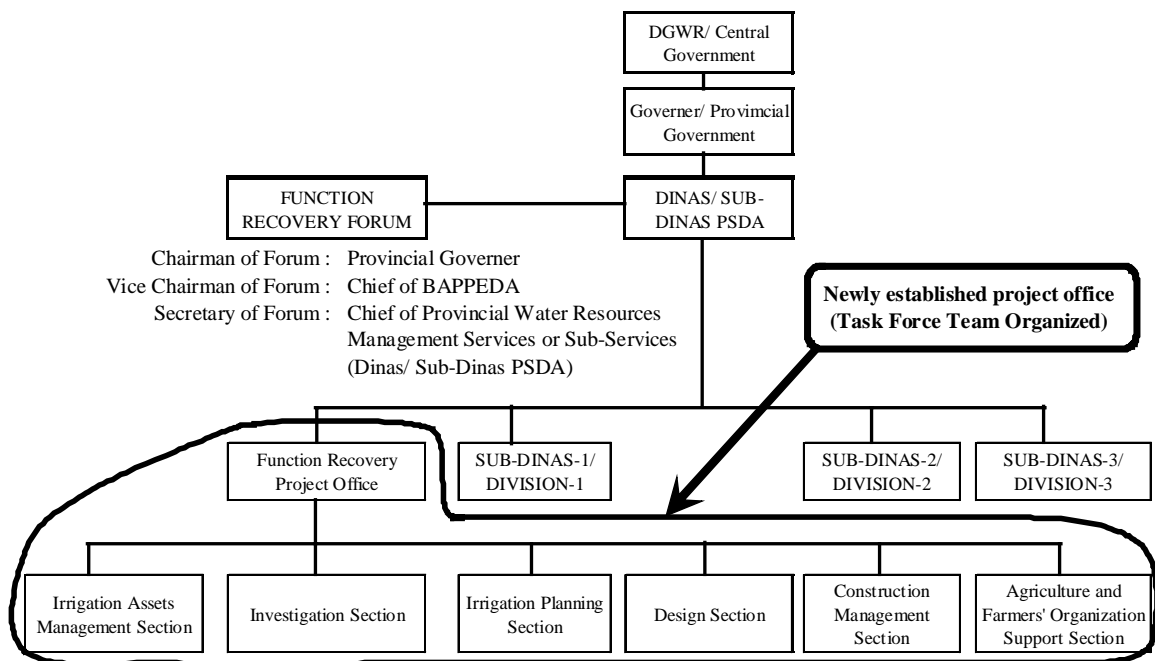
As discussed in the precondition, a "Function Recovery Project Office (tentative name)" will be established under Provincial Water Resources Management Services or Sub-Services Office (Dinas/ Sub-Dians PSDA) or Public Services Office (PU) and take full responsibility of implementation and management of all activities in each phase of the recovery program. The Project Office will be composed of about six Sections, the i) Irrigation Assets Management Section, ii) Investigation Section, iii) Irrigation Planning Section, iv) Design Section, v) Construction Section, and vi) Agriculture and Farmer's Organization Support Section.

The Project Office has to i) maintain a close relationship with the stakeholders of the water users' side, ii) clarify, utilize and manage their ideas and inputs, and iii) has a right to have an 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 all activities of the program. He is expected to have skills as a communicator, negotiator and problem solver.

The overall chart of the organizational formation based on the above precondition is illustrated in Figure 3.3.2, and summarized as shown below:

**Proposed Organization for the Recovery Program of Irrigation Agriculture**



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

### Major Activities of Each Section

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

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.

### 3.4 Inputs and Outputs in Each Phase of the Program

#### 3.4.1 Initiation Phase

The major activities in the initiation phase of the “Function Recovery Program” consist of listing of the irrigation schemes, evaluation for prioritization of rehabilitation, and formulation of the rehabilitation program. The outputs from the activities in the initiation phase will be: (a) a prioritized list of irrigation schemes for rehabilitation, and (b) an Action Plan (Refer to Figure 3.3.1).

#### Process of Activities and Outputs in the Initiation Phase

Stages	Processes	Outputs	Agencies in charge	Ref. No. of Guideline
1. Listing of irrigation schemes to be rehabilitated	- Notice to initiate the project		- DGWR - Forum	Stage 01
	- List target schemes in province and district	- List of irrigation schemes	- Dinas PSDA - Project Office	
	- 1st screening based on evaluation indicators		- Dinas PSDA - Project Office	
	- List irrigation schemes for Pre-F/S	- Master list for Pre-F/S	- Forum - DGWR	
2. Field survey for Pre-F/S	- Preparation of T.O.R for the field survey - Selection of contractors	- T.O.R for field survey - Bid documents and evaluation report	- Dinas PSDA - Project Office	Stage 02
	- Field survey and preparation of report - Examination and approval of the report	- Field investigation report	- Dinas PSDA - Forum	
3. Determination of irrigation area based on availability of water resources at Pre-F/S level	- Analysis of hydrological data, confirmation of water rights, estimation of river runoff of existing schemes - Approximation of availability of river runoff	- Report related to hydrology	- Dinas PSDA - Project Office	Stage 03
	- Estimation of unit field water requirements	- Report related to water requirement	- Dinas PSDA - Project Office	
	- Estimation of irrigable area based on verification of availability of water resources	- Report related to water resources availability	- Dinas PSDA - Project Office	
	- Estimation of irrigation area based on availability of water resources	- Report related to determination of irrigation area	- Dinas PSDA - Project Office	
	- Notice and approval of agencies concerned (2 <sup>nd</sup> screening)	- List of irrigation schemes whose Pre-F/S were completed	- Dinas PSDA - Forum	
4. Formulation of development plan at Pre-F/S	- Preparation of criteria for rehabilitation (Irrigation, agriculture, farmers' organizations)	- Criteria of irrigation facilities, agricultural and institutional development,	- Dinas PSDA - Project Office	Stage 04

(To be continued)

	- Preparation of concepts for rehabilitation (Irrigation, agriculture, farmers' organizations)	- Development concepts for related sectors	- Dinas PSDA - Project Office	
	- Cost estimates for rehabilitation	- Project costs for each sector	- Dinas PSDA - Project Office	
	- Economic evaluation at Pre-F/S level	- Economic internal rate of return for the respective schemes	- Dinas PSDA - Project Office	
	- Selection of schemes for rehabilitation by the comprehensive evaluation of development potentials, etc. (3 <sup>rd</sup> screening)	- List for evaluation of priority for implementation of the schemes	- Dinas PSDA - Forum	
5. Evaluation of priority of implementation	- Preparation of evaluation indicators - Evaluation of priority of implementation of the schemes	- List of priority of implementation	- Dinas PSDA - Forum	Stage 05
	- Formulation of action plan for the respective schemes - Formulation of district or province-wise action plan	- Action plan in district and province	- Dinas PSDA - Forum - DGWR	

The Action Plan prepared in the Pre-F/S stage has to be approved by the Forum, and submitted to the DGWR as the form of proposal to conduct F/S.

### 3.4.2 Midterm Phase

In the midterm phase, a feasibility study will be carried out on the basis of the action plan formulated in the initiation phase. The outputs of this phase consist of: (a) a Feasibility Study Report, and (b) a determined Implementation Program (I/P) as shown in Figure 3.3.1.

**Process of Activities and Outputs in the Midterm Phase**

Stage	Process	Outputs	Agencies in Charge	Ref. No. of Guideline
1. Formulation of development plan at F/S	- Procurement of consultants	- TOR for consulting services - Tender documents and evaluation report	- Dinas PSDA - Project Office - DGWR - Forum	Stage 06 Task 01
	- Confirmation of development plan for each sector (Irrigation, agriculture, farmers' organization, regional society)	- Criteria and objectives of development plan	- Dinas PSDA - Project Office - DGWR	Task 02 Task 03 Task 04
	- Formulation of development plan for each sector	- Development plan for each sector	- Dinas PSDA - Project Office - DGWR	
	- Cost estimate for rehabilitation of each scheme	- Calculation sheet of implementation costs	- Dinas PSDA - Project Office - DGWR	Task 05
	- Project evaluation	- EIRR - Social impacts	- Dinas PSDA - DGWR	Task 06
	- Conducting investigation on environmental impact assessment	- Report on environmental impact assessment	- Dinas PSDA - Project Office	Task 07
	- Preparation of F/S report and its approval	- F/S report	- DGWR - Forum	Task 08
2. Preparation of Implementation Program (I/P)	- Confirmation of budget sources (Internal or external source)	- National Annual Budget	- DGWR - BAPPENAS - International lending agency	Task 09
	- Preparation of I/P	- I/P to be prepared based on the form of the international lending agencies	- Dinas PSDA - Project Office - Forum - International lending agency	
	- Appraisal of the development program for each scheme	- Minutes of discussion - Appraisal report, in case of international lending agencies	- DGWR - BAPPENAS - International lending agencies	
	- Preparation of budget	- Loan agreement in case of international lending agencies	- DGWR - BAPPENAS - International lending agencies	

It is necessary to prepare the I/P for the projects that have to be approved by the agencies concerned before the execution of the projects. Detailed regulations (project implementation organization, contents of the project, construction period, and annual disbursement schedules) for the project implementation have to be given in the I/P.

### 3.4.3 Final Phase

In this phase, operation and maintenance of the irrigation schemes will be carried out in line with the comprehensive function recovery program of irrigation agriculture prepared based on the I/P. The outputs in this phase consist of: (a) irrigation facilities and systems of which function has been recovered, and (b) appropriate water management associations and empowered farmers' organizations as shown in Figure 3.3.1.

**Process of Activities and Outputs in the Final Phase**

Stage	Process	Outputs	Agencies in charge	Ref. No. of Guideline
1. Detailed design of facilities and selection of contractors	- Procurement of consultant(s)	- General and technical specifications - Tendering and evaluation form	- Dinas PSDA - Project Office - DGWR - International lending agencies	Stage 07 Task 01
	- Detailed design of irrigation facilities (including field survey, topographic surveys, etc.) - Preparation of tender documents (pre-qualification and tender) - Selection of contractor(s)	- Design drawings - Tender documents - Tendering and evaluation report	- Dinas PSDA - Project Office - DGWR - International lending agencies	Task 02
	- Final inspection for completion delivery	- Inspection report for completion delivery	- Dinas PSDA - Project Office	
2. Empowerment, training and extension services	- Empowerment of farmers' organizations		- Dinas PSDA - Project Office	Task 03
	- Agricultural extension		- Dinas PSDA - Project Office	Task 04
	- Preparation of manuals for each sector	- Manuals/ guidelines for each sector	- Dinas PSDA - Project Office	Task 05
	- Training and empowerment of members of farmers' organizations under completed scheme	- F/S report	- Dinas PSDA - Project Office	Task 06
3. Monitoring of the project	- Monitoring of irrigation facilities and water management - Monitoring of activities of extension services and WUA	- Annual monitoring reports for each sector	- Dinas PSDA - Project Office - Forum - DGWR	

Periodical monitoring has to be carried out by the provincial agencies concerned for the facilities of which rehabilitation has been completed. The project implementation organization has to establish a system of recording the lessons

learned through the experiences in the implementation of the project, as this is important information.

### 3.5 Implementation Process for the Recovering Function of Irrigation Facilities

The implementation process, consisting of the initiation phase - midterm phase - final phase of “Recovering the Function of Irrigation Facilities” as discussed in Section 3.3, is summarized as follows:

**Implementation Process for the Recovering Function of Irrigation Facilities**

Phase	Stage	Process	Outputs	Agencies in charge
Initiation phase	I. Pre-F/S and evaluation of priority	(1) 1 <sup>st</sup> screening for the implementation of rehabilitation	List of district-wise schemes in a province	DGWR Dinas PSDA Project Office Forum
		(2) Field survey	Field survey report	
		(3) 2 <sup>nd</sup> screening based on verification of the availability of river runoff	List of schemes for Pre-F/S	
		(4) Formulation of the rehabilitation program, and 3 <sup>rd</sup> screening based on the evaluation results	Various study results regarding evaluation of priorities	
		(5) Evaluation of priority schemes, and formulation of the Action Plan	List of prioritized schemes, report on project planning	
Midterm phase	II. Conducting F/S	(1) Conducting F/S, and preparation of Implementation Program	Report on F/S, Report on I/P	DGWR Dinas PSDA Project Office Forum International lending agencies
		(2) Selection of schemes to be rehabilitated, and preparation of budget	Appraisal report, Loan agreement	
Final phase	III. Implementation of the project	(1) Detailed design of irrigation facilities	Design drawings, Tender documents	DGWR Dinas PSDA Project Office Forum International lending agencies
		(2) Execution of construction	Completed project (function recovered system)	
		(3) Strengthening water management organization (WUA, FWUA, MWUA, etc.)	Equitable distribution of irrigation water, and supply to the terminal system	
		(4) Agriculture extension, empowerment of farmers' organization	Increasing farm production, and farm income	
		(5) O&M, and monitoring	Strengthening of WUA, and prevention of malfunction of facilities	



Implementation activities and duties of the respective stakeholders in each phase and each stage of “Recovering the Function of Irrigation Facilities” are systematically arranged as shown in Table 3.5.1.

## CHAPTER 4 PRE-FEASIBILITY STUDY

### 4.1 Study Area

#### 4.1.1 Present Conditions

##### (1) North Sumatra

##### 1) General

North Sumatra Province with a land area of 71,680 km<sup>2</sup> is administratively composed of 14 districts, 6 municipalities, 269 sub-districts and 5,333 villages. The number of districts covered by the target irrigation schemes (the project districts) is 13. The main economic activity of the province and the project districts is an agriculture sector accounting respectively for 31 % and 45 % of the total GRDP in 2000. In the agriculture sector, food crop agriculture is a leading sub-sector accounting for 39 % of the sector GRDP followed by the estate crop's sub-sector in the province. The provincial per capita GRDP in 2000 is estimated at Rp. 5.9 million.

##### 2) Conditions 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 North Sumatra Province in comparison with those of the whole country:

**Classification of Paddy Fields**

Condition of Paddy Field	North Sumatra Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Field	285,700	57.4	4,868,800	62.5
Rainfed Paddy Field	212,300	42.6	2,918,600	37.5
Total	498,000	100	7,787,400	100

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sumatera Utara.

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

The table below shows the area and percentage of the respective categories in North Sumatra 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	North Sumatra Province		Whole Country	
	Area (ha)	(%)	Area	(%)
Technical Systems	71,600	25.0	2,214,300	45.5
Semi-technical Systems	72,300	25.3	979,200	20.1
Simple Systems	141,800	49.7	1,675,300	34.4
Total	285,700	100	4,868,800	100

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sumatera Utara.

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

### 3) Technical Level of Irrigation System

According to data of the Provincial Water Resources Service Office (PWRS), there are 770 government-developed irrigation schemes having potential areas of 299,521 ha in North Sumatra. These schemes comprise 172 technical irrigation schemes with potential irrigation areas of 130,135 ha, 398 semi-technical irrigation schemes with potential areas of 121,421 ha and 200 simple irrigation schemes with potential of 47,965 ha. Regarding the size of irrigation schemes, 635 schemes are less than 500 ha covering 40% of the total potential irrigation areas, while 76 schemes range from 500 ha to 1,000 ha and 59 schemes are more than 1,000 ha. (Refer to ANNEX III (1/3), Part 1, Section 1.3)

In addition, another 276 village irrigation schemes have been developed by communities with the total potential area of 27,151 ha and average size of 98 ha.

### 4) Agricultural and Agro-economic Situations

The agro-demographic features of the province and project districts are estimated based on the Agriculture Census 1993 by Central Bureau of Statistic (*Badan Pusat Statistik/BPS*). The proportion of farm households to the total households is 52% and 50 ~ 92% in the province and the project districts, respectively. The primary farming activity of the farm households in the province is food crop production followed by estate crop production. Food crop farmers are about 81% 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 summarized below: (Refer to ANNEX III (1/3), Part 1, Section 1.4.1)

### Roughly Estimated Land Holding Status in Province

Indicators	Range among Project Districts	Province
Average Farm Land Holding Size/Farm Household	0.62 ~ 1.68 ha	1.00 ha
Average Holding Size of Paddy Field/Farm Household	0.17 ~ 0.60 ha	0.35 ha
Distribution of Farm Household by Holding Size		
- < 0.5 ha	15 ~ 54 %	41 %
- 0.5 ha	46 ~ 85 %	59 %

Source: Agricultural Census, 1993, BPS

The largest farm land category in the province and the project districts is estate crop land occupying about 56% (1,802,000ha) and 57% (1,800,000ha) of the total farm land of 3,243,000ha and 3,202,000ha, respectively. The second largest farm land category is paddy field accounting for 15% of the total both in the province (498,000ha) and the project districts (488,000ha).

Paddy production is by far the most important farming activity in the food crop agriculture sub-sector both in the province and the project districts, representing 71% of the total harvested area with food crops (not including vegetables) in 2001. The second most important food crop in terms of harvested area in the province and project districts is maize accounting for 20% of the total harvested area, followed by tuber crops.

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

Province	Paddy (%)	Maize (%)	Beans <sup>*1</sup> (%)	Tubers <sup>*2</sup> (%)	Total (%)
Province	71	20	4	5	100
Project Districts	71	20	4	5	100

Note: \*1 Includes soybeans, mungbeans & groundnuts, \*2 Includes cassava & sweet potatoes

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sumatera Utara

The production of food crops in 2001 in the province and project districts is summarized below: (Refer to ANNEX III (1/3), Part 1, Section 1.4.3)

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

Province	Paddy	Maize	Beans <sup>*1</sup>	Tubers <sup>*2</sup>
Province	3,111	634	42	626
Project Districts	3,046	630	41	610

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

Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sumatera Utara

#### 5) Agricultural Institutions and Extension

The government agricultural support institutions in the province include the 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*).

The government agricultural support institutional set-up at district level is not consistent with the provincial set-up and there are differences among the districts concerned. The district institutions are placed under the jurisdiction of the district governor, although the technical guidance and support linkages with the central and provincial agencies are still maintained. Differences in organization set-ups between central/province agencies and district agencies present constraints for maintaining coordination and technical support or guidance linkages between province and district and for coordination activities among districts.

Farmers' organizations are important agricultural institutions for the future promotion of regional agriculture development at sub-district and village level. The primary farmers' organization involved in agricultural activities is the Farmers' Group (*Kelompok Tani/KT*). In the province, 39% of KT are classified as primary level (*pemula*), 35% as secondary level (*lanjut*), 21% as middle level (*madya*) and 5% as advance level (*maju*). The activities of KT are generally limited to technical issues, such as scheduling of farming operations, and economic activities, such as group purchasing and marketing, are seldom practiced. General problems encountered by KT are: (i) limited group funds, (ii) not well organized as a group, and (iii) limited economic activities as a group. There are 563 Village Unit Cooperatives (*Koperasi Unit Desa/KUD*) in the province with varying activities from dormant to actively operated status.

One of the main features of the decentralization policy in the agriculture sector is the devolution of agricultural extension activities to the district government. The extension services to farmers in Indonesia are basically provided by Field Extension Workers (*Penyuluhan Pertanian Lapangan/PPL*) of district agricultural agencies, who are to guide and serve farmers through KT in their working area. PPL are deployed on a sub-district basis to Rural Extension Centers (BPP). The number of BPP and PPL in the province is 172 and 1,363, respectively. (Refer to ANNEX III (1/3), Part 1, Section 1.4.4)

#### 6) Institution

In North Sumatra, the water resources and irrigation sector is administered by PWRS. Under the Head of PWRS, four Sub-divisions are set up to handle technical matters and a further seven Technical Implementation Units (UPTs) and Bureau for Water Resources Management (PSDA) are directly controlled as illustrated in Figure 4.1.1. The functions of UPT/PSDA are to implement: 1) operational services to the community, 2) water resources conservation activities, and 3) technical and administrative aspects related to such services and activities.

At district/municipal level, District Water Resources Services (DWRS) and its

branch offices are responsible for implementing irrigation management, providing services to the existing WUA and encouraging water users to establish new WUA. Among problems with which each DWRS is confronted, high levels of vacancies for its staff is the most serious issue as the average vacancy rate is 81%.

A total of 1,359 WUA have already been established in all government developed irrigation schemes out of 2,251 WUA, which is the establishment target set up by PWRS North Sumatra. Due to time-consuming procedures, only 163 WUA have legitimate status through registration in local courts of justice.

Although the average working area of WUA is estimated at 132 ha based on the WUA establishment target, the size of working area varies very widely. WUA with a large size of working area is common in public irrigation schemes developed without close collaboration with beneficiary farmers.

Based on monitoring and evaluation records of PWRS on WUA performance, focusing on organization, water allocation and distribution, irrigation maintenance, financing, physical condition of irrigation and related facilities, and progress on the Government program of WUA promotion and development, 100 WUA rate as “Developed”, 687 WUA as “Under development” and 573 WUA rate as “Not yet developed”. (Refer to ANNEX III (1/3), Part 1, Section 1.5)

#### 7) Financial Condition

The total revenue of 19 district and municipal governments in North Sumatra for 2000 was Rp.1,754 billion, while the total expenditure was Rp.1,624 billion. The actual expenditure for the water resources and irrigation sector amounted to Rp.6,782 million or 1.35% of the total expenditure.

The consolidated per capita provincial revenue for 2001 comprised Rp.64,442 for its own fiscal capacity consisting of its own source revenue, non-tax from natural resources and share taxes and Rp.298,978 for DAU plus contingency. (Refer to ANNEX III (1/3), Part 1, Section 1.6)

#### (2) Central Java Province

##### 1) General

Central Java Province with a land area of 32,544 km<sup>2</sup> is administratively composed of 29 districts, 6 municipalities, 553 sub-districts and 8,550 villages. There are 19 major districts covered by the target irrigation schemes (the project districts). The main economic activity of the province and project districts is the agriculture sector accounting for 31 % and 32 % of the total GRDP, respectively in 2001. In the agriculture sector, the food crop agriculture is a leading sub-sector accounting for

70 % of the sector GRDP followed by the livestock sub-sector. The provincial per capita GRDP is estimated at Rp. 3.5 million.

## 2) Condition of Paddy Fields and Irrigation Systems

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

**Classification of Paddy Fields**

Condition of Paddy Fields	Central Java Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	719,300	72.0	4,868,800	62.5
Rainfed Paddy Fields	279,800	28.0	2,918,600	37.5
Total	999,100	100.0	7,787,400	100.0

Source: Statistic data of BPS (2002), Central Java Province.

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

The table below shows the area and percentage of the respective categories of Central Java 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	Central Java Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Technical Systems	384,400	53.5	2,214,300	45.5
Semi-technical Systems	123,300	17.1	979,200	20.1
Simple Systems	211,600	29.4	1,675,300	34.4
Total	719,300	100.0	4,868,800	100.0

Source: Statistic data of BPS (2002), Central Java Province.

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

## 3) Technical Level of Irrigation System

According to data of PWRS, a total area of 721,675 ha of paddy fields is irrigated by the existing 4,997 government developed irrigation schemes in Central Java and, furthermore, 336,855 ha is provided with irrigation water by numerous village irrigation schemes. About 75% of the former irrigated areas are served by 702 technical irrigation schemes, while 8% are covered by 746 semi-technical irrigation schemes and 17% by 3,549 simple irrigation schemes.

On a district basis, the government developed irrigation schemes are classified into 87 large scale schemes with a potential irrigation area of more than 1,000 ha, 109 middle scale schemes of 500 ha to 1,000 ha and 4,791 small scale schemes of less than 500 ha. Potential irrigation areas of the three classes are 371,707 ha, 75,804 ha and 274,164 ha respectively. (Refer to ANNEX III (2/3), Part 1, Section 1.3)

#### 4) Agricultural and Agro-economic Situations

The agro-demographic features of the province and project districts are estimated based on the Agriculture Census 1993. The proportion of farm households to the total households is 54% and 34 ~ 75% in the province and the project districts, respectively. The primary farming activity of the farm households in the province is food crop production followed by livestock activity. Food crop farmers are some 89% 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 summarized below: (Refer to ANNEX III (2/3), Part 1, Section 1.4.1)

##### **Roughly Estimated Land Holding Status in Province**

Indicators	Range among Project Districts	Province
Average Farm Land Holding Size/Farm Household	0.43 ~ 0.67 ha	0.54 ha
Average Holding Size of Paddy Field/Farm Household	0.11 ~ 0.36 ha	0.23 ha
Distribution of Farm Household by Holding Size		
- < 0.5 ha	62 ~ 83 %	69 %
- 0.5 ha	17 ~ 38 %	31 %

Source: Agricultural Census, 1993, BPS

The largest farm land category in the province and the project districts is paddy fields occupying about 41% (999,000ha) and 45% (718,000ha) of the total farm land of 2,434,000ha and 1,614,000ha, respectively. The second largest farm land category is dry land/gardens accounting respectively for 31% (760,000ha) and 27% (441,000ha) of the total.

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 60% or 68% of the total harvested area with food crops (not including vegetables) in 2001. The second most important food crop in terms of harvested area in the province and project districts is maize accounting for 19% and 15% respectively of the total harvested area, followed by beans.

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

Province	Paddy (%)	Maize (%)	Beans <sup>*1</sup> (%)	Tubers <sup>*2</sup> (%)	Total (%)
Province	60	19	12	9	100
Project Districts	68	15	11	6	100

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

Source: Statistic Data of BPS, Central Java

The productions of food crops in 2001 in the province and project districts are summarized below: (Refer to ANNEX III (2/3), Part 1, Section 1.4.3)



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

Province	Paddy	Maize	Beans <sup>*1</sup>	Tubers <sup>*2</sup>
Province	8,284	1,506	349	3,098
Project Districts	6,120	785	207	1,440

Note: \*1 Includes soybeans, mungbeans & groundnuts, \*2 Includes cassava & sweet potatoes  
 Source: Statistic Data of BPS, Central Java

5) Agricultural Institutions and Extension

The government agricultural support institutions in the province include Food & Horticulture Crops Agriculture Services Office, Estate Crops Services Office, Livestock Services Office and Food Security Mass Guidance Agency. The Agriculture Services Office is composed of four sub-services and UPTD.

The government agricultural support institutional arrangements at district level are not consistent with the provincial arrangements and there are differences among the districts concerned as is the case in North Sumatra. (Refer to ANNEX III (2/3), Part 1, Section 1.4.4)

The primary farmers organization in agricultural activities is KT. In the province, 22% of KT are classified as primary level (*pemula*), 38% as secondary level (*lanjut*), 28% as middle level (*madya*) and 11% as advanced level (*maju*). Their activities and general problems are similar to those in North Sumatra. There are 588 KUD in the province with varying activities from dormant status to actively operated status.

6) Institution

In Central Java, PWRS unit is the prime agency to implement water resources and irrigation management services, especially for handling inter-District technical and administrative aspects. The organization of PWRS in Central Java consists of Head, Administration Division, Sub-service for Program, Sub-service for Construction, Sub-service for Operation and Maintenance, Sub-service for Cooperation and License, and field technical units (*Balai PSDA*).

In principle, operation and maintenance of government developed irrigation schemes are conducted by DWRS in coordination with the WUA concerned. Staff availability attains a sufficient level to meet requirements from irrigation water users.

A total of 6,356 WUA have been established in 4,997 government developed and 502 village irrigation schemes. At present, 2,725 WUA have already been officially approved by *Bupati* for their establishment. However, they are facing difficulties in getting approval of their registration due to the limited capacity of the local courts of justice. As a result, only 159 WUA have been legitimized.

According to monitoring and evaluation record of PWRS on WUA performance, 527 WUA are evaluated as “Developed” and 4,762 WUA as “Under development”, while the remaining 1,067 WUA are ranked at the level of “Not yet developed”. (Refer to ANNEX III (2/3), Part 1, Section 1.5)

#### 7) Financial Condition

The total revenue of 35 district and municipal governments in Central Java for 2000 was Rp. 3,373 billion, while the total expenditure was Rp. 3,166 billion. The actual expenditure for the water resources and irrigation sector amounted to Rp.6,713 million or 0.95% of the total expenditure.

The consolidated per capita provincial revenue for 2001 comprised Rp.41,036 for its own fiscal capacity consisting of its own source revenue, non-tax from natural resources and share taxes and Rp.266,040 for DAU plus contingency. (Refer to ANNEX III (2/3), Part 1, Section 1.6)

#### (3) South Sulawesi Province

##### 1) General

South Sulawesi Province with a land area of 62,362 km<sup>2</sup> 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. 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 2000. In the agriculture sector, food crop 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.

##### 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.

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	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.

3) Technical Level of Irrigation System

According to data of PWRS, 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 in South Sulawesi. 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.

There are 63 large scale irrigation schemes each of which has a potential irrigation area of more than 500 ha. 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. (Refer to ANNEX III (3/3), Part 1, Section 1.3)

4) Agricultural and Agro-economic Situations

The agro-demographic features of the province and project districts are estimated based on the Agriculture Census 1993. The proportion of farm households to the total households is 64% and 62 ~ 80% in the province and the project districts, respectively. The primary farming activity of the farm households in the province is food crop production followed by estate crop production. Food crop 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 summarized below: (Refer to ANNEX III (3/3), Part 1, Section 1.4.1)

### 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

The largest farm land category in the province and the project districts is paddy fields occupying about 32% (629,000ha) and 37% (489,000ha) of the total farm land of 1,970,000ha and 1,343,000ha, respectively. The second largest farm land category is dry land/gardens accounting for 27% (530,000ha) of the total in the province and estate crop land accounting for 26% (348,000ha) in the districts.

Paddy production is by far the most important farming activity in the food crop 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. 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 groundnuts.

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

Province	Paddy (%)	Maize (%)	Beans <sup>*1</sup> (%)	Tubers <sup>*2</sup> (%)	Total (%)
Province	68	20	8	4	100
Project Districts	77	14	7	2	100

Note: \*1. Includes soybeans, mungbeans & groundnuts, \*2. Includes cassava & sweet potatoes  
Source: Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sulawesi Selatan

The production of food crops in 2001 in the province and project districts is shown below: (Refer to ANNEX III (3/3), Part 1, Section 1.4.3)

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

Province	Paddy	Maize	Beans <sup>*1</sup>	Tubers <sup>*2</sup>
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.

## 5) Agricultural Institutions and Extension

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 UPTD.

The government agricultural support institutional arrangements at district level are not consistent with the provincial arrangements and there are differences among the districts concerned as is the case in North Sumatra.

The primary farmers organization in agricultural activities is KT. In the province, 36% of KT are classified as primary level (*pemula*), 44% as secondary level (*lanjut*), 18% as middle level (*madya*) and 3% as advance level (*maju*). Their activities and general problems are similar to those in North Sumatra.

There exist 442 KUD in the province with varying activities from dormant status to actively operated status. The main activities of KUD are distribution of farm inputs, procurement of Paddy, rice milling, supply of daily commodities and deposit and credit services. The number of BPP and PPL in the province as a whole is 201 and 2,111, respectively. (Refer to ANNEX III (3/3), Part 1, Section 1.4.4)

## 6) Institutions

In South Sulawesi, the water resources and irrigation sector is administered by PWRS. Under the Head of PWRS, Sub-divisions are set up to handle technical and administrative matters and Regional Technical Implementation Units (UPTD) as its branch offices are established to conduct water resources management and coordinate with district/municipal governments.

At district/municipal level, DWRS and its branch offices are responsible for implementing irrigation management, providing services to the existing WUA and promoting new WUA establishment. As for staff availability, the vacancy is more or less 50%.

The WUA establishment target set up by PWRS South Sulawesi is 3,302 for 250 government developed irrigation schemes and 1,149 for 1,287 village irrigation schemes. Up to now, 2,224 WUA have been established in government developed irrigation schemes. Because of slow progress of legal registration in local courts of justice, 119 WUA have been legitimized till now.

The latest monitoring and evaluation record on WUA performance in 250 government developed irrigation schemes reveals that 144 WUA are evaluated as “Developed”, 1,183 WUA as “Under development” and 823 WUA as “Not yet developed”. (Refer to ANNEX III (3/3), Part 1, Section 1.5)

#### 7) Financial Condition

The total of 24 district and municipal governments in South Sulawesi for 2000 revenue was Rp.1,537 billion, while the total expenditure was Rp.1,473 billion. The actual expenditure for the water resources and irrigation sector amounted to Rp.5,153 million or 1.02% of the total expenditure.

The consolidated per capita provincial revenue for 2001 comprised Rp.62,910 for its own fiscal capacity consisting of its own source revenue, non-tax from natural resources and share taxes and Rp.376,750 for DAU plus contingency. (Refer to ANNEX III (3/3), Part 1, Section 1.6)

#### **4.1.2 Criteria for Selection of Irrigation Schemes**

The Inception Meetings were held between the PWRS (Dinas Pengelolaan Sumber Daya Air: PSDA) of each province and the Study Team in the initial stage of field investigation. In the meeting, the irrigation schemes to be studied have been examined and determined based on the following criteria:

- (a) The Study area is to 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:
  - Schemes that were recently completed and are functioning appropriately,
  - Schemes for which implementation have been pledged by the Government and/or international donors,
  - Schemes for which potential are too low (less than 1,000 ha), even though they are included in the original list.
- (c) The irrigation schemes that need to be urgently rehabilitated have been added to the list in addition to the original schemes presented in the S/W.

#### **4.1.3 Selected Irrigation Schemes**

##### (1) North Sumatra Province

The original list of irrigation schemes attached to the Inception Report indicates that 57 schemes with a total area of 125,706 ha were to be studied in North Sumatra Province.

Rehabilitation of the capacity and function of 6 irrigation schemes with areas of 17,699 ha will be carried out under JBIC Loan No. IP-476, 'Rehabilitation and O&M Capacity Improvement Project'. Improvement of another 4 irrigation schemes with areas of 5,125 ha is being conducted under ADB Loan, 'Northern

Sumatra Irrigated Agriculture Sector Program (NSIASP)'. In this context, 10 irrigation schemes with areas of 22,824 ha are excluded from the original list.

There were 4 irrigation schemes with areas of 8,261 ha on the original list. As these schemes have not actually been constructed, however, no rehabilitation can be anticipated. Therefore, these schemes have been dropped from the list.

On the other hand, the inventory survey conducted in 2002 by the Dinas PSDA of North Sumatra indicates that there are 7 irrigation schemes newly registered in the list in addition to the original one. As these schemes require rehabilitation works according to the Dinas PSDA, they are to be included for the study.

Accordingly, it was decided to study 50 irrigation schemes with a total area of 108,341 ha in North Sumatra Province as shown in Table 4.1.1.

## (2) Central Java Province

The original list of irrigation schemes attached to the Inception Report shows that 85 schemes with a total area of 391,412 ha were to be studied in Central Java Province.

According to the inventory survey conducted by Dinas PSDA in Central Java Province in 2000, 35 irrigation schemes with a total area of 88,209 ha have to be excluded from the list for the following reasons:

- (a) Technically and economically viable rehabilitation of 12 unimproved irrigation systems with areas of 38,344 ha was completed under IBRD Loan-3762, 'Java Irrigation Improvement and Water Management Project (JIWMP)'. Restoration of the capacity and function of 1 irrigation system (Sedadi) with an area of 14,399 ha was conducted under JBIC Loan IP-476, 'Project Type Sector Loan in Water Resources Development (PTSL)'. Another irrigation scheme (Logung) with an area of 2,821 ha was completed by APBN (state budget). There is 1 good functional irrigation scheme (Senjoyo) with an area of 2,294 ha, that does not need rehabilitation. Since there are 15 irrigation systems with areas of 57,858 ha which were recently completed and are in good condition, they are excluded from the original list.
- (b) There are 2 irrigation schemes that are expected to be implemented in the near future. One (Kali Lanang) with an area of 1,818 ha is listed in the JBIC Loan IP-505, 'Project Type Sector Loan for Water Resources Development (II)', which aims at contribution to the self-sufficiency of rice in Indonesia. The other (Kedungsamak) with an area of 6,678 ha is expected to be implemented by APBN. Therefore, 2 irrigation schemes

with a total area of 8,496 ha are screened out from the original list.

- (c) There are 18 irrigation schemes with an area of 21,855 ha, in which the irrigation potential is too low (less than 1,000 ha) and/or land use has been changed to other purposes.

Accordingly, it was decided to study 50 irrigation schemes with a total area of 284,569 ha in Central Java Province as shown in Table 4.1.2.

### (3) South Sulawesi Province

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 the 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 has 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 with registered irrigation area of 10,066 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 Pengairan in South Sumatra Province 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 4.1.3.

As a result of discussion, the 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

Province	Inception Stage		Selected Schemes	
	Number of Schemes	Scheme Area (ha)	Number of Schemes	Scheme Area (ha)
North Sumatra	57	125,706	50	108,341
Central Java	98	391,412	50	284,569
South Sulawesi	65	262,329	41	141,984
Total	220	779,447	141	534,894

## 4.2 Preliminary Investigations

### 4.2.1 Main Issues Identified

#### (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 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 found on Irrigation Facilities through Preliminary Investigation

Structure	Problems	Causes
Headworks	<ol style="list-style-type: none"> <li>1) The design discharge cannot be taken because of sediment in front of intake.</li> <li>2) The river water level cannot be maintained as designed.</li> <li>3) Intake of river water cannot be appropriately made.</li> <li>4) Operation of gates is difficult due to damage of gates.</li> <li>5) Intake discharge cannot be measured accurately.</li> </ol>	<ol style="list-style-type: none"> <li>1) Sediment exists in front of intake and/or scouring sluice and settling basin is not provided or it is malfunctioning.</li> <li>2) Civil works (intake weir, etc.) are damaged or defective.</li> <li>3) Steel gates or other metal structures are damaged or deteriorated.</li> <li>4) No proper maintenance and repair is being executed.</li> <li>5) No measuring devices (even gauging) are provided.</li> </ol>
Free Intake	<ol style="list-style-type: none"> <li>1) The design discharge cannot be taken because of i) lowering of river water level and ii) sedimentation in front of intake.</li> </ol>	<ol style="list-style-type: none"> <li>1) No fundamental measures, such as provision of weir, have been undertaken against lowering of riverbed.</li> <li>2) No removal of sedimentation located at or in front of intake is undertaken.</li> </ol>

(to be continued)

Canal and related structures	<ol style="list-style-type: none"> <li>1) Irrigation water cannot be conveyed to the tail of the canal.</li> <li>2) Contour canal located in the upstream section of a system is choked with sediment.</li> <li>3) Structures with a service life of more than 30 years are malfunctioning in some irrigation systems.</li> <li>4) Irrigation water is not equitably distributed due to insufficient water supply.</li> <li>5) Less activity on O&amp;M works.</li> </ol>	<ol style="list-style-type: none"> <li>1) This is due to seepage loss, obstruction of flow by sediment, collapse of canal, etc.</li> <li>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.</li> <li>3) Structures are older than service life and no rehabilitation/replacement has been done.</li> <li>4) Due to inadequacy of diversion structure, no proper water management could be done.</li> <li>5) Low density of inspection roads. Crossing facility such as bridge, culvert not in working condition.</li> </ol>
Terminal facility and on-farm	<ol style="list-style-type: none"> <li>1) Irrigation water is not used efficiently due to shortage of provision of canals.</li> <li>2) Drainage is not appropriately practiced due to shortage of provision of tertiary and quaternary drains.</li> <li>3) Transportation of farming input and output is poor.</li> </ol>	<ol style="list-style-type: none"> <li>1) This is due to insufficient density of tertiary and quaternary (feeder) canals.</li> <li>2) This is due to insufficient density of tertiary and quaternary drains.</li> <li>3) Provision of appropriate length of farm road is necessary.</li> </ol>
Inspection road	<ol style="list-style-type: none"> <li>1) O&amp;M are difficult due to poor condition of inspection road along main and secondary canals.</li> <li>2) Transportation of farming input and output is poor due to lack of farm road connecting village with inspection road.</li> </ol>	<ol style="list-style-type: none"> <li>1) Inadequate proper maintenance has been done and related facilities are in a damaged state.</li> <li>2) Low density or no provision of roads.</li> </ol>

## (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 (Indonesian version, JICA 1999)”.

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

### Evaluation Indicators

Facility	Indicators
<b>1. Headworks (Concrete Weir)</b>	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
<b>2. Free Intake</b>	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
<b>3. Canals and Related Structures</b>	
3.1 Canals	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 Structure	1) Gate 2) Leakage on gate 3) Crack on concrete/stone masonry 4) Scouring on structures 5) Settlement 6) Measuring devices
<b>4. Terminal Facilities and On Farm</b>	1) Leakage on canal 2) Sedimentation/mud on canal 3) Density of canal
<b>5. Inspection Roads</b>	1) Condition 2) Density

The method of evaluation of the existing facilities against respective indicators is discussed in Section 4.5.

#### 4.2.2 Technical Specifications for Inventory Survey Work

Draft technical specifications for inventory survey work were prepared during the stage of home preparatory work. They have been reviewed and finalized based on the findings of preliminary investigation executed in the three provinces of North Sumatra, Central Java and South Sulawesi. 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 WUA
- 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

**4.2.3 Examination of Evaluation Standard**

- (1) Standards for Design and Construction

The criteria for the design and construction of rehabilitation are provisionally listed below:

### 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
	Damage/inadequate function of gate, valve, metal works	1) Repair/replace
Headworks/diversion works	Damage 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
	Damage/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

#### (2) 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 in each province.

Examination of evaluation standards consisting of standard rehabilitation methods and procedures for cost estimates are made in detail in Section 4.4.

## **4.3 Field Investigation**

### **4.3.1 Execution of Field Investigation**

#### (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.

#### (2) Procedures

The field investigation, which commenced on April 11, 2003 with a schedule for completion in approximately 2 months, finished on June 11, 2003. The work was conducted by an Indonesian Consultant on a sub-contract basis under the supervision of the JICA Study Team. Major assignments entrusted to the sub-contractor were as follows:

##### (a) Preparatory work

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

##### (b) Field work

- 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 WUA,
- Field investigation of the existing condition of irrigation facilities, evaluation of their functions and analysis of the cause of problems, and
- Preparation of the latest irrigation diagram and the schematic structure diagram of each scheme.

##### (c) Outcomes

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

### **4.3.2 Results and Findings**

#### (1) Irrigation Systems

As discussed in Section 4.2, 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

Based on the results of the investigation, the scale of rehabilitation needs of respective irrigation facilities were classified 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 functionally damaged and replacement or reconstruction is needed.

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

- 1) North Sumatra Province (Refer to ANNEX III (1/3), Part 1, Section 4.2.1)

#### Water Resource Facilities of Each Scheme

Type of water resource facilities and their existing conditions are summarized as shown below:

##### **Condition of Water Resource Facilities**

Type of Water Resource Facility	Number	Condition of Facilities			
		A	B	C	D
Headworks	37*	0	14	14	9
Free Intake	13	0	0	1	12
Total	50	0	14	15	21

Note: \* Number of settling basins provided is 16.

#### Irrigation Canals and Related Structures of Each Scheme

The features of irrigation canals and related structures for each scheme are summarized as shown below:

##### **Canal Types, Lengths and Conditions**

Canals	Length (km)			Condition (Scheme)			
	Lined Canal*	Earth Canal	Total	A	B	C	D
Main Canal	115 (35.7%)	206 (64.3%)	321	0	9	17	24
Secondary Canal	223 (31.7%)	482 (68.3%)	705	0	3	12	35
Total	338 (33.0%)	688 (67.0%)	1,026	-	-	-	-

Note: \* Masonry and concrete lining

### Condition of Related Structures

Canals	Total Number of Structures	Condition of Canals (%)			
		A	B	C	D
Main Canal	1,372	0	66	31	3
Secondary Canal	2,790	0	60	34	6

### Inspection Road along Canal

The existing conditions of inspection roads are summarized as follows:

#### Ratio of Inspection Road to Canal

Inspection Road	Total length of canals (km)	Inspection roads (km)	Ratio (%)
Along Main Canal	320	203	63
Along Secondary Canal	705	356	50
Total	1,025	559	55

#### Condition of Inspection Roads

Inspection Roads	Number of Schemes provided with Inspection Roads	Condition of Roads (nos.)			
		A	B	C	D
Along Main Canal	21	0	9	9	3
Along Secondary Canal	23	0	0	23	0

As seen in the table above, the ratio between the length of irrigation canals with inspection roads and the total length of canals is approximately 50% for both main and secondary canals. In addition, more than 80% of the inspection roads are non-paved and/or damaged, and as a result, most of them are out of service, not only in the wet season but also in the dry season.

### Terminal Facilities and On-farm

The existing condition of terminal facilities and on-farm are 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 50 Schemes	0	2	36	62

The existing conditions of terminal facilities and on-farm were found to be very poor due to low density of canals, farm roads and provision of their related facilities.

- 2) Central Java Province (Refer to ANNEX III (2/3), Part 1, Section 4.2.1)

### Water Resource Facilities of Each Scheme

The type of water resource facilities and their existing condition are summarized as shown below:



### Condition of Water Resource Facilities

Type of Water Resource Facilities	Number	Condition of Facilities			
		A	B	C	D
Dam	1	1	-	-	-
Headworks	49*	1	12	33	3
Total	50	2	12	33	3

Note: \* Number of settling basins provided is 39.

### Irrigation Canals and Related Structures of Each Scheme

Features of irrigation canals and related structures for each scheme are summarized as shown below:

#### Canal Type, Length and Condition

Canals	Length (km)			Condition (Scheme)			
	Lined	Earth	Total	A	B	C	D
Main Canal	338 (55.8%)	268 (44.2%)	606	0	4	42	2
Secondary Canal	1,213 (56.3%)	943 (43.8%)	2,156	0	1	41	10
Total	1,551 (56.2%)	1,211 (43.8%)	2,762	-	-	-	-

Note: 2 schemes are not provided main canal.

#### Condition of Related Structures

Canals	Total Number of Structures	Condition of Canals (%)			
		A	B	C	D
Main Canal	2,777	5	33	37	25
Secondary Canal	7,117	6	34	37	23

### Inspection Road along Canal

The existing condition of inspection roads is summarized as follows:

#### Ratio of Inspection Road to Canal

Inspection Road	Total length of canals (km)	Inspection roads (km)	Ratio (%)
Along Main Canal	606	465	77
Along Secondary Canal	2,156	1,142	53
Total	2,762	1,607	58

#### Condition of Inspection Roads

Inspection Roads	Number of Schemes providing Inspection Roads	Condition of Roads (nos.)			
		A	B	C	D
Along Main Canal	48	0	6	37	6
Along Secondary Canal	48	0	1	39	8

### Terminal Facilities and On-farm

The existing condition of terminal facilities and on-farm are 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 50 Schemes	0	0	96	4

### 3) South Sulawesi Province (Refer to ANNEX III (3/3), Part 1, Section 4.2.1)

#### Water Resource Facilities of Each Scheme

The type of water resource facilities and their existing conditions are summarized as shown below:

#### Condition of Water Resource Facilities

Type of Water Resource Facilities	Number	Condition of Facilities			
		A	B	C	D
Headworks	35 <sup>*1&amp;2</sup>	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.

#### Irrigation Canals and Related Structures of Each Scheme

Features of irrigation canals and related structures for each scheme are summarized as shown below:

#### Canal Types, Lengths and Conditions

Canals	Length (km)			Condition (Scheme)			
	Lined*	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 <sup>*1</sup>	0	2	24	74
Secondary Canal	2,236 <sup>*2</sup>	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.

#### Inspection Road along Canal

The existing condition of inspection roads is 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

### Terminal Facilities and On-farm

The existing condition of terminal facilities and on-farm is 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

- (2) Agriculture and Agro-economy
- 1) North Sumatra (Refer to ANNEX III (1/3), Part 1, Section 4.2.2)

### Present Land Use

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	72,620	74
	Rainfed Paddy Fields	10,536	11
	Non-paddy Fields	11,838	12
	- Upland Fields	2,297	-
	- Tree Crops Land *1	6,371	-
	- Uncultivated Land	3,170	-
2. Non-potential Area for Irrigation	Rainfed Paddy Fields	810	1
	Non-paddy Fields	2,338	2
	- Upland Fields	593	-
	- Tree Crops Land	1,221	-
	- Uncultivated Land	524	-
3. Target Area for Development (Potential Area + Non-potential Area)		98,142	100
4. Non-subject Area for Development *2		9,041	-
5. Registered Area (3 + 4)		107,183	-

Note \*1: Including fish ponds of 643ha. \*2: Including other land use (alih fungsi).

### Cropping Seasons and Pattern

The prevailing cropping patterns in the irrigated fields are double cropping of Paddy (paddy - paddy/fallow). Cultivation of palawija in irrigated fields is rather limited and a cropping pattern of paddy – paddy/palawija is practiced only in about 30% of schemes, mostly to a limited extent. The most common

palawija in the target schemes and province is maize. The prevailing patterns in the target schemes are as summarized below.

Most common: Wet season - dry season: paddy - paddy or paddy/fallow

Second common: Wet season-dry season: paddy- paddy/palawija/fallow

#### Cropped Area and Cropping Intensity

The overall cropped areas and cropping intensities of Paddy and palawija in the 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	62,565	86	100	0.1	62,665	86
Dry Season	42,987	59	3,905	5	46,892	65
Annual	105,552	145	4,005	6	109,557	151

The target irrigation schemes (50 schemes) are classified based on annual cropping intensities of irrigated 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 %	9	18
150 ~ < 180 %	17	34
120 ~ < 150 %	7	14
100 ~ < 120 %	7	14
< 100 %	10	20

Note: \*1. Cropping intensity in irrigated paddy fields

#### Crop Yields and Crop Production

The estimated Paddy yields are summarized as follows:

#### **Estimated Current Irrigated Paddy Yields**

Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Annual (ton/ha)
Wet Season	3.0 - 5.0	3.8	Dry Season	3.0 - 4.5	4.1	3.9

The overall features are presented in the following table:

#### **Overall Crop Productions**

Commodity	Wet Season	Dry Season	Annual
Paddy (ton)	309,000	176,000	485,000
Palawija (maize) (ton)	10,013	6,725	16,738

#### Crop Budget

Crop budgets for different yield levels of irrigated paddy, rainfed paddy and main palawija (represented by maize composite) estimated are summarized below:

### Financial Net Return per ha Assumed

Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)	Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)
Irrigated Paddy	3.5	2,570	Paddy (rainfed)	3.0	2,140
	4.0	3,030	Rainfed Paddy	2.5	1,750
	4.5	3,450	Palawija (maize)	2.5	1,840
	5.0	3,930			

#### Farm Economy

The results of the farm economic analysis made is 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 Fields	1,750 - 6,815	4,558
Rainfed Paddy Fields	only 3 schemes	1,811
Upland Fields	only 2 schemes	1,656

#### Agricultural Support Services and Marketing

The major or prevailing issues on the subjects in the province and the target schemes are as follows:

- (a) Almost all the target schemes are served by field extension workers (PPL) posted in or around the scheme. The number of PPL 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”.
  - (e) The most prevailing marketing channel for paddy is “paddy to collector or middlemen” followed by “paddy to rice mill”.
  - (f) Palawija production in and around the target schemes is extremely limited. The reported most prevailing marketing channel is “sold at local market”.
  - (g) In most schemes, sufficient availability of rice mills is reported under the current marketing practices for paddy.
- 2) Central Java (Refer to ANNEX III (2/3), Part 1, Section 4.2.2)

#### Present Land Use

The overall provincial features are summarized in the following.

### Overall Present Land Uses of Target Schemes

Land Use Category		Area (ha)	Ratio (%)
1. Potential Area for Irrigation	Irrigated Paddy Fields	281,600	99
	Rainfed Paddy Fields	1,491	1
2. Target Area for Development		283,091	100
3. Non-target Area for Development <sup>*1</sup>		1,604	-
4. Total (3 + 4)		284,695	-

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

### Cropping Seasons and Patterns

The prevailing patterns in the target schemes are as summarized below:

#### Most Common

Wet - Dry I - Dry II: paddy - paddy - palawija or palawija/fallow

#### Second Common

Wet - Dry I - Dry II: paddy - paddy - fallow

Wet - Dry I - Dry II: paddy – paddy – paddy or paddy/fallow

### Cropped Area and Cropping Intensity

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		Sugarcane		Overall	
	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)	Area (ha)	Intensity (%)
Wet Season	245,878	87	20,952	7	9,270	3	276,100	97
Dry Season I	228,798	81	30,356	11	4,828	2	263,982	94
Dry Season II	39,095	14	100,266	36	-	-	139,361	50
Annual	513,771	182	151,574	54	14,098	5	679,443	241

The target irrigation schemes (50 schemes) are classified based on annual cropping intensities of irrigated paddy in irrigated paddy fields as follows:

#### Irrigation Schemes by Annual Cropping Intensity of Paddy

Cropping Intensity of Paddy <sup>*1</sup>	No. of Schemes	Proportion (%)
180 %	26	52
150 ~ < 180 %	15	30
120 ~ < 150 %	3	6
100 ~ < 120 %	3	6
< 100 %	3	6

Note: \*1 Cropping intensity in irrigated paddy fields

### Crop Yields and Crop Production

The estimated paddy yields are summarized as follows:

### Estimated Current Irrigated Paddy Yields

Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Cropping Season	Yield Range (ton/ha)	Average (ton/ha)	Annual (ton/ha)
Wet Season	4.5 - 5.5	5.0	Dry Season	4.0 - 5.5	4.8	4.9

The overall features are presented in the following table:

### Overall Crop Productions

Commodity	Wet Season	Dry Season I	Dry Season II	Annual
Paddy (ton)	1,232,000	1,118,000	173,000	2,523,000
Palawija (ton)	62,900	91,100	120,300	274,300
Sugarcane (ton)	603,000	314,000	-	917,000

### Crop Budget

Crop budgets for different yield levels of irrigated paddy, palawija (maize, soybeans & mungbeans) and sugarcane are estimated as summarized below:

### Financial Net Return per Ha Assumed

Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)	Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)
Irrigated Paddy Rice	4.5	2,970	Maize	3.0	1,130
	5.0	3,420	Beans	1.2	1,710
	5.5	3,800	Sugarcane	65.0	2,760

### Farm Economy

The results of the farm economic analyses are 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	4,008 - 9,810	6,678

### Agricultural Support Services and Marketing

The major or prevailing issues are as follows;

- (a) Accessibilities to farm credits depend on irrigation schemes. However, prevailing responses are “no difficulty to receive” or “some difficulty to receive farm credit, but can get” to “almost no access to credits”.
- (b) No difficulties for procurement of farm inputs and quality seeds are reported in most of the target schemes.
- (c) The most prevailing marketing practice for paddy is “sold after harvest at field” followed by “sold paddy after drying”.
- (d) The most prevailing marketing channel for paddy is “paddy to collector or middlemen” followed by “paddy to rice mill”.
- (e) The most prevailing marketing channel for palawija is “sold to

collector or middlemen” followed by “sold at local market”.

(f) In most schemes, sufficient availability of rice mills is reported under the current marketing practices for paddy.

3) South Sulawesi (Refer to ANNEX III (3/3), Part 1, Section 4.2.2)

#### Present Land Use

The overall provincial features are summarized in the following:

#### **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 (Potential Area + Non-potential Area)		123,430	100
4. Non-target Area for Development <sup>*1</sup>		15,087	-
5. Registered Area (3 + 4)		138,517	-

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

#### Cropping Seasons and Pattern

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)

#### Cropped Area and Cropping Intensity

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

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

#### Crop Yields and Crop Production

The estimated paddy yields are summarized as follows:

##### Estimated Current Irrigated Paddy Yields

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

The overall features are presented in the following table:

##### Overall Crop Productions

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

#### Crop Budget

Crop budgets for different yield levels of irrigated paddy, rainfed paddy and palawija are estimated as shown below:

##### Financial Net Return per Ha Assumed

Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)	Commodity	Yield (ton/ha)	Net Return/ha (Rp. 000)
Irrigated Paddy	4.0	3,180	Groundnuts	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			

### Farm Economy

The results of the farm economic analysis are 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

### Agricultural Support Services and Marketing

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 PPL 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.
- (3) Water Users Association (WUA)
- 1) North Sumatra (Refer to ANNEX III (1/3), Part 1, Section 4.2.3)

The WUA establishment target set up by PWRS North Sumatra is 574 in 50 irrigation schemes. The average working area of one WUA is 188 ha with a range from 47 ha at the minimum to 1,616 ha at the maximum.

Up to now, 337 WUA have been established in 50 irrigation schemes. The target realization is 59%. At present, the WUA establishment target ratio is 100% in 18 irrigation schemes, 50% to less than 100% in 13 irrigation schemes and less than 50% in 19 irrigation schemes.

According to the latest monitoring and evaluation (M&E) report, 11 WUA are classified into “Developed”, while 201 are “Under development” and 125 are “Not yet developed”. Due to slow progress of legal arrangement, however, only 57 WUA have been legitimized in the local court of justice.

The present condition of WUA as mentioned above is summarized as shown below.

#### Present Condition of WUA in North Sumatra

WUA Establishment Target Realization Ratio	No. of Scheme	No. of Existing WUA	Performance and Legal Status of Existing WUA					
			Developed		Under Development		Not Yet Developed	
			L	N	L	N	L	N
75% and more	24	250	8	0	20	115	5	102
50% to 74%	7	44	0	1	5	31	2	5
25% to 49%	6	9	1	0	1	5	0	2
Less than 25%	13	34	1	0	14	10	0	9
Total	50	337	10	1	40	161	7	118

Note : L ; Legitimated in local court, N ; Not yet legitimated in local court

#### 2) Central Java (Refer to ANNEX III (2/3), Part 1, Section 4.2.3)

The WUA establishment target set up by PWRS Central Java is 2,598 in 50 irrigation schemes. The average working area of one WUA is 109 ha with a range from 33 ha at the minimum to 247 ha at the maximum.

Up to now, 2,184 WUA have been established in 50 irrigation schemes so that the target realization is 84%. At present, the WUA establishment target ratio is 100% in 22 irrigation schemes, 50% to less than 100% in 23 irrigation schemes and less than 50% in 5 irrigation schemes.

According to the latest M&E report, 250 WUA are classified into “Developed”, while 1,670 are “Under development” and 264 are “Not yet developed”. Due to slow progress of legal arrangement, however, only 17 WUA have been legitimized in the local court of justice.

The present condition of WUA as mentioned above is summarized as shown below.

#### Present Condition of WUA in Central Java

WUA Establishment Target Realization Ratio	No. of Scheme	No. of Existing WUA	Performance and Legal Status of Existing WUA					
			Developed		Under Development		Not Yet Developed	
			L	N	L	N	L	N
75% and more	37	1,862	0	201	16	1,433	0	212
50% to 74%	8	289	1	46	0	199	0	43
25% to 49%	4	29	0	2	0	18	0	9
Less than 25%	1	4	0	0	0	4	0	0
Total	50	2,184	1	249	16	1,654	0	264

Note : L ; Legitimated in local court, N ; Not yet legitimated in local court

3) South Sulawesi (Refer to ANNEX III (3/3), Part 1, Section 4.2.3)

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 ratio is 100% in 7 irrigation schemes, 50% to less than 100% in 23 irrigation schemes and less than 50% in 11 irrigation schemes.

According to the latest M&E report, 66 WUA are classified into “Developed”, while 804 are “Under development” 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 summarized as 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 Development		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

### 4.3.3 Database for Existing Condition of Irrigation Schemes

The existing conditions of irrigation schemes of 3 provinces (141 schemes) have been prepared and presented in ANNEX-II. (Title: Priority List for Rehabilitation of Irrigation Schemes)

## 4.4 Rehabilitation Plans

### 4.4.1 Basic Concepts

#### (1) Irrigation Facilities

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 with 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 systems are itemized as follows:

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

## (2) Agriculture Planning Concept

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

- 1) 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,
- 2) The irrigation agriculture performances and experiences in the advanced schemes among the target schemes of the Study in each province have been fully taken into consideration in the formulation of agriculture plans,
- 3) The plans envisage improvement of crop productivity and realization of an increase of cropping intensity through the efficient use of irrigation water,
- 4) The current agricultural status including crop selection, cropping schedule, cropping pattern and cropping intensity in the target schemes should duly be assessed and taken into planning so that the formulated plans will be sustainable in accordance with beneficiaries' intentions and capabilities,

- 5) 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 3<sup>rd</sup> 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
- 6) 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.

(3) Institutional Development Planning Concept

In line with the irrigation substance of the draft Law on 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 on Water Resources, farmers can participate in any activities related to the above systems as long as they have an established WUA and their willingness, capacity and capability are sufficient to cover their duties.

Therefore the basic concepts of an institutional development plan based on the above policy are as follows:

- 1) Aiming at capacity building of district/municipal government staff in charge of irrigation management, the basic concept is to make staff understand fully the new participatory irrigation management policy and also the difference from the Irrigation Management Policy Reform (PKPI) based on hand-over of authority to water users. In institutional planning, therefore, attention is paid to upgrade the existing staff capability based on the new irrigation management policy and, in case of less staff availability, to fill the vacancies of key positions.
- 2) In the participatory irrigation management policy, the WUA is considered the fundamental body of irrigation water users. In connection with this, the target of WUA establishment set up by each PWRS should be fully realized in parallel with recovery of function of irrigation system. At the moment, this target has not been realized yet in more than two-third of irrigation schemes. In institutional planning, therefore, special efforts for accelerating WUA establishment are to be made to these irrigation schemes.
- 3) According to the M&E record on performance, a WUA already established is classified into one of three categories, i.e. “Developed”, “Under development” and “Not yet developed”. This record clearly reveals that “Under development” and “Not yet developed” WUA still need to improve their capacity to manage organization, their capability to collect and expense member’s fee, and activities to conduct operation and maintenance of tertiary irrigation systems. The focal point in formulating the institutional development plan, therefore, is to

strengthen “Under development” and “Not yet developed” WUA through technical assistance to enable each WUA to overcome its weakness.

- 4) Since the Government Regulation No. 77/2001 on Irrigation was enacted, the organisation of higher-level institutional bodies of irrigation water users was promoted, i.e. the federation of WUA (FWUA) on a secondary canal basis and the main federation of WUA (MWUA) on an apex scheme-level basis. The core of these higher-level bodies should be the WUA, and irrigation water users themselves should act as the main players in organizing such bodies. However, actual promotion activities for FWUA/MWUA establishment seem to depend on a top-down procedure through the channel from the Ministry of Home Affairs to district/municipal governments following the above regulation and the previous PKPI backed up by the World Bank. Such top-down activities have resulted in there being less opportunity for 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 the common rule of reasonable water allocation to each WUA as well as to collect ideas and data from WUA as input for district/municipal governments.
- 5) After completion of rehabilitation work, each WUA is responsible for the operation and maintenance of its tertiary system of the irrigation scheme. In this regard, WUA’s members should master the necessary skills required for optimum operation and maintenance of related irrigation facilities in order to put the irrigation water allocation plan into practice. In formulating the WUA activity plan to meet such requirements, therefore, attention is to be paid to providing WUA members with on-the-job training on the operation and maintenance of their 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 members’ fees in a more transparent manner as well as the preparation of annual financial reports.

#### **4.4.2 Irrigation Facilities**

##### **(1) Criteria for Rehabilitation**

Classification of rehabilitation in estimating costs 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) Availability of Water Resources

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

Data and information such as i) cropping pattern, ii) rainfall, iii) meteorological data, and iv) river runoff were collected in order to examine the water resources availability whether enough or insufficient. Based on the examination, the irrigation areas of the respective schemes were determined.

(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, and their 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
<b><u>Water resource facility</u></b>	
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	

(to be continued)



- 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

#### **Irrigation Canal and Related Structure**

1. General	
- Sedimentation and/or obstruction of flow	Removal of sediment/water plants by periodical maintenance
- Leakage	Replacement of embankment material by impervious material
- 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)

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(to be continued)

<ul style="list-style-type: none"> <li>- Poor function of canal crossing structures (bridge, culvert, cross drain) due to deterioration, clogging by foreign materials, narrow width for traffic</li> </ul>	<p>Reconstruct bridge based on actual traffic load, remove clogged materials/sediments, reconstruct cross drain based on actual site condition</p>
4. O&M Matters	
<ul style="list-style-type: none"> <li>- Difficulty in O&amp;M due to no or less density of inspection roads</li> </ul>	<p>Provision of inspection roads with all weather type design, execution of periodical maintenance of canal and roads</p>
<ul style="list-style-type: none"> <li>- Difficulty in water distribution and management</li> </ul>	<p>Review of irrigation area, irrigation diagram and field water requirement and redesign of canal, if required</p>
<ul style="list-style-type: none"> <li>- Physical operation problems due to breakage of structure</li> </ul>	<p>Repair or replace with new construction</p>

**Drainage Canal**

Natural River/Drainage Canal

<ul style="list-style-type: none"> <li>- Inundation of paddy fields during rainy season due to drainage problem</li> </ul>	<p>Provision of drainage canals and sluices</p>
<ul style="list-style-type: none"> <li>- Physical drainage problem due to sediments, water plants and obstructive materials inside drainage canal</li> </ul>	<p>Periodical maintenance</p>
<ul style="list-style-type: none"> <li>- Physical operation problems due to insufficient number of related structures</li> </ul>	<p>Provision of sluices, bridges, culverts, protection works, etc.</p>

**Terminal Facilities and On-farm**

Facilities/Water Management

<ul style="list-style-type: none"> <li>- Physical operation problems due to low density of irrigation and drainage canals in a tertiary block</li> </ul>	<p>Provision of sufficient irrigation and drainage canals with related structures</p>
<ul style="list-style-type: none"> <li>- Physical operation problems during planting and harvesting</li> </ul>	<p>Provision of farm roads for operation of farm machinery, conveyance of harvested paddy</p>
<ul style="list-style-type: none"> <li>- Physical operation problems of water management due to poor land leveling</li> </ul>	<p>Execution of land leveling and re-layout of irrigation and drainage canals</p>

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2) Rehabilitation Plan

Water Resource Facilities

(a) Type of water resource facilities

The existing intake method of free intakes in North Sumatra (12 schemes) and South Sulawesi (1 scheme) provinces is replaced by the diversion weir type to prevent inflow of sediment loads into the canal and to provide a measure for the bed river degradation in the future.

(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 sediment that flows 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

headworks (North Sumatra: 34 schemes, Central Java: 10 schemes, South Sulawesi: 27 schemes) except where the intake method is direct from the dam reservoir.

(c) Provision of integrated diversion weirs in North Sumatra Province

In order to supply irrigation water throughout the year from adequate and stable water resources, the following existing intake structures (free intake system) in the Asahan District of North Sumatra Province are to be combined and designed as an integrated diversion weir. The source of irrigation water is R. Silau with a catchment area of 150 km<sup>2</sup> at the proposed diversion weir sites. (Silau Irrigation System: Sungai Silau, Sijambi, Bunut Irrigation System: Panca Agra, Serbangan, Silau Bonto)

(d) 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.

(e) Provision of inspection bridges 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 width not less than 3.5m
- 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: 3.5m minimum).

(c) Rehabilitation and provision of related structures

In order to execute proper water management and O&M, 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 are physically damaged/not functioning.

Terminal Facility and On-Farm

(a) Provision of canals, farm roads and related structures

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.

3) 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. (Refer to ANNEX III (1/3), (2/3), (3/3), Part 1, Section 5.2.3)

(4) Cost Estimates

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

- 1) Direct construction cost for rehabilitation
  - i) Water resource facilities
  - ii) Irrigation canals and related facilities
  - iii) Drainage canals and related facilities
  - iv) Terminal facilities and on-farm
  - v) 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 4.4.2 (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 in each province were collected from similar projects under MOSRI. After examination of the costs in each province, all the

costs were found to be the same or similar. Therefore, the same unit prices have been applied for the cost estimates in the three provinces.

#### 4) Cost estimates

Costs for the rehabilitation works for 141 schemes have been estimated and the results are shown in Tables 4.4.1 to 4.4.3. Figures shown in the table below indicate the rehabilitation cost per hectare at a maximum of Rp. 44.9 million or 5,428 US\$/ha and a minimum of Rp. 9.6 million or 907 US\$/ha:

#### Rehabilitation Cost per Hectare

Provinces	Number of Schemes	Rehabilitation Cost					
		Minimum		Maximum		Average	
		Mil. Rp./ha	US\$/ha	Mil. Rp./ha	US\$/ha	Mil. Rp./ha	US\$/ha
North Sumatra	50	9.6	1,164	44.9	5,428	21.9	2,644
Central Java	50	7.5	907	42.3	5,107	19.5	2,359
South Sulawesi	41	10.3	1,245	27.8	3,360	17.8	2,155

(Conversion rate: US\$ 1.00 = Rp. 8,279 = Yen 118.9 as of May 2003.)

### 4.4.3 Agriculture Plan

(1) North Sumatra Province (Refer to ANNEX III (1/3), Part 1, Section 5.3)

#### 1) Agriculture Land Use Plans

Basic principles applied for the land use planning of the subject areas for development are as follows<sup>1</sup>:

#### Basic Principles for Land Use Planning

Present Land Use	Land Use Plan
Irrigated Paddy Fields	Irrigated Paddy Fields
Rainfed Paddy Fields	Irrigated Paddy Fields (converted)
Upland Fields	Irrigated Paddy Fields (converted)
Uncultivated Land	(net area: 70% x gross area)
Tree Crops Land	Not converted

The overall features by province are as follows:

#### Overall Land Use Plans

Land Use Category	Present/Before Project		Future Plan	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	72,620	80	88,576	98
Rainfed Paddy Fields	11,346	13	0	-
Upland Fields	2,890	3	0	-
Uncultivated Land	3,694	4	0	-
Non-irrigable Land <sup>*1</sup>	-	-	1,974	2
Total	90,550	100	90,550	100

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

<sup>1</sup> Assuming irrigation water is sufficient at least to irrigate the entire area in the wet season.

As shown in the table, the increase of irrigated paddy fields of some 16,000 ha (increase of 22% from the present level) is planned as a whole under the Study.

## 2) Planned Cropping Pattern and Cropping Intensity

Under the present Study, the selection of crops to be introduced in the planned cropping patterns has been made basically observing the current cropping patterns prevailing in the target schemes, which represent farmers intention 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 the target schemes based on the farmers' preferences for a crop and the volume of market demands, and
- (b) Maize is selected as a representative palawija in the planned cropping pattern since it is the most common palawija currently cropped in and around the target schemes. From the market demand and profitability, hybrid maize appears to be the most promising crop among palawija.

The two basic cropping patterns (Pattern A & B) have been formulated on the basis of: (i) study of the current irrigation performances in the target areas and (ii) inapplicability of a cropping pattern of continuous triple cropping of paddy (paddy-paddy-paddy) because of the danger for serious infestation of pests & diseases and because of the time required for periodical O&M of irrigation facilities; as explained in the following table:

**Basic Cropping Patterns**

Pattern	Planned Cropping Pattern <sup>*1*2</sup>			Subject Irrigation Schemes
	Wet Season	Dry Season I	Dry Season II	
Pattern A	Paddy (100%)	Palawija	Paddy (100%)	Sufficient water in dry II
Pattern B	Paddy (100%)	Fallow	Paddy/palawija	Insufficient water in dry II

Note: \*1. Wet season: Oct/Nov-Jan/Feb; Dry I: Feb/Mar-Apr/May; Dry II: May/June-Aug/Sep.

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

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

- (a) Target cropped areas and cropping intensities have been determined on the basis of current and past cropped areas and cropping intensities in individual schemes and by setting a minimum target for the intensity of paddy and an envisaged target for the overall intensity<sup>2</sup>
- (b) The minimum target intensity of paddy is set to 150% and an increase of more than 20% of the overall intensity from the current level is targeted,

<sup>2</sup> As the estimation of irrigation areas under the rehabilitation plans was practically not possible due to the limitation of reliable hydrological data.

and

- (c) In addition, the introduction of palawija (represented by maize) to the minimum extent of 5 to 10% in all schemes is envisaged.

In accordance with the above points, the target cropped areas and cropping intensities for individual schemes are 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	88,576	0	69,061	157,637	150 - 200	178
Palawija	0	3,396	6,123	9,519	5 - 30	11
Total	88,576	3,194	74,598	166,368	155 - 200	189

The overall increase of annual cropped area of some 32,900 ha of paddy and 2,500 ha of palawija from the present level is planned under the Study. Further, an overall increase of paddy cropping intensity of 33% and palawija intensity of 5% in irrigated fields is envisaged.

### 3) Target Crop Yields and Crop Production Plans

Target yields of paddy have been assumed for individual schemes based on the current yield levels in the schemes and the yield levels in advanced irrigation schemes are summarized below:

**Target Yields under the Study**

Cropping Season/Crops	Target Yield	
	Range	Overall Average
Wet Season Paddy	4.5 - 5.5 ton/ha	5.1 ton/ha
Dry Season Paddy	4.5 - 5.5 ton/ha	5.1 ton/ha
Maize (hybrid; grain)	-	5.0 ton/ha

The overall average target yield level of 5.1 ton/ha is an increase of 1.2 ton/ha from the present overall average yield of 3.9 ton/ha (including rainfed paddy).

### 4) Crop Budgets and Farm Economy

The planned crop budgets estimated on different yield levels of paddy and maize are as shown in the following table.

**Planned Crop Budget per ha**

Crop/Yield	Gross Return (Rp. 000)	Net Return (Rp. 000)	Crop/Yield	Gross Return (Rp. 000)	Net Return (Rp. 000)
Paddy: 5.5 ton/ha	7,150	4,420	Paddy: 4.5 ton/ha	5,850	3,450
Paddy: 5.0 ton/ha	6,500	3,930	Maize:5.0 ton/ha	5,500	3,490

The farm economic analyses under the present Study have been made on 1 ha of irrigated paddy fields or rainfed paddy fields depending on the present land use of

individual schemes by estimating net farm income from the fields as discussed earlier in Section 4.3.2. The results of the farm economic analyses made on the individual schemes are 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 Fields	5,484 – 9,767	7,341	4,558	2,783
Rainfed Paddy Fields	only 3 schemes	5,599	1,811	3,789
Overall	-	7,170	4,278	2,892

(2) Central Java Province (Refer to ANNEX III (2/3), Part 1, Section 5.3)

1) Agriculture Land Use Plans

Almost all the target irrigation schemes in Central Java are at the completion stage and only three schemes have rainfed paddy fields yet to be irrigated. The overall features by province are as follows:

**Overall Land Use Plans**

Land Use Category	Present/Before Project		Future Plan	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	281,600	99.5	283,091	100
Rainfed Paddy Fields	1,491	0.5	0	-
Total	283,091	100	283,091	100

As shown in the table, the increase of irrigated paddy fields of some 1,500 ha is planned as a whole under the Study.

2) Planned Cropping Pattern and Cropping Intensity

The approaches applied for the formulation of the planned cropping patterns are:

- (a) Selection of crops to be introduced in the planned cropping patterns has been made basically by observing the current cropping patterns prevailing in the subject area, which represent farmers intention and capabilities to a certain extent. In this regard, cropped areas of sugarcane have been kept unchanged from the present level.
- (b) Priority is given to paddy in all schemes considering farmers preferences for a crop and the volume of market demands.
- (c) Expansion of hybrid maize cultivation is envisaged, as it appears to be the most promising crop among palawija.
- (d) Major cropping patterns planned are;
  - Wet - Dry I - Dry II: paddy - paddy - palawija
  - Wet - Dry I - Dry II: paddy – paddy/palawija - palawija
  - Wet - Dry I - Dry II: paddy - paddy – paddy/palawija



In accordance with the planned cropping patterns, the target cropped areas and cropping intensities in the target schemes under the present Study have been planned in accordance with the following:

- (a) Target cropped areas and cropping intensities have been determined on the basis of current and past cropped areas and cropping intensities in individual schemes as is the case in North Sumatra,
- (b) The basic target for a cropping intensity of paddy is 200% or higher. However, an annual paddy intensity of 150% is taken as a minimum target in a few schemes based on the current and past records on intensities of paddy, and
- (c) An increase of 20% of annual intensity from the present levels is also set as a general target under the Study.

In accordance with the points discussed above, the target cropped areas and cropping intensities for individual schemes are 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	264,436	247,679	45,533	557,648	137 - 300	197
Palawija	9,402	18,985	134,695	163,082	0 - 150	58
Sugarcane	9,253	4,828	0	14,081	0 - 27	5
Total	283,091	271,492	180,228	734,811	160 - 240	260

### 3) Target Crop Yields and Crop Production Plans

In principle, target yields of paddy have been assumed for individual schemes by setting an increase of 0.5 ton/ha of paddy yield from the present levels as a target under the present Study as summarized below:

**Target Yields under the Study**

Cropping Season/Crops	Target Yield		Crop	Target Yield
	Range	Overall Avg		
Wet Season Paddy	5.0 - 6.0 ton/ha	5.5 ton/ha	Maize (hybrid)	5.0 ton/ha
Dry Season I Paddy	4.5 - 6.0 ton/ha	5.4 ton/ha	Beans <sup>*1</sup>	1.4 ton/ha
Dry Season II Paddy	4.5 - 5.5 ton/ha	5.0 ton/ha	Sugarcane	65 ton/ha

Note: \*1. Average of soybeans & mungbeans

The overall average target yield level of 5.4 ton/ha is an increase of 0.5 ton/ha from the present overall average yield of 4.9 ton/ha.

### 4) Crop Budgets and Farm Economy

The planned crop budgets estimated on different yield levels of paddy and other crops are as shown in the following table.

### Planned Crop Budget per ha

Crops/Yield	Gross Return (Rp. 000)	Net Return (Rp. 000)	Crops	Gross Return (Rp. 000)	Net Return (Rp. 000)
Paddy: 6.0 ton/ha	7,200	4,250	Maize	4,800	2,120
Paddy: 5.5 ton/ha	6,600	3,800	Beans *1	3,735	2,105
Paddy: 5.0 ton/ha	6,000	3,420	Sugarcane	9,364	2,760
Paddy: 4.5 ton/ha	5,400	2,970			

Note: \*1 Average of soybeans & mungbeans

The farm economic analyses under the present Study have been analyzed on the basis of 1 ha of irrigated paddy field by estimating net farm income from paddy fields as applied for North Sumatra and as discussed earlier in Section 4.3.2. The results of the farm economic analyses made on the individual schemes are 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	6,566 - 11,020	8,450	6,678	1,772

(3) South Sulawesi Province (Refer to ANNEX III (3/3), Part 1, Section 5.3)

1) Agriculture Land Use Plans

The approaches applied for the planning of future (with project) land uses are:

- (a) Land use categories converted to irrigated paddy fields include rainfed paddy fields, upland fields and uncultivated land.
- (b) Tree crop lands were excluded from the subject area for rehabilitation plans as farmers' general reluctance towards the conversion of tree crop lands to paddy fields was identified through the Inventory Survey.

The overall features are as follows:

### Overall Land Use Plans

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.

## 2) Planned Cropping Pattern and Cropping Intensity

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, and
- (b) Basically, palawija currently cropped in a target scheme or its surroundings are selected for crops in the 2<sup>nd</sup> cropping season or crops in the 3<sup>rd</sup> cropping season other than paddy.

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 <sup>*1*2</sup>			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

The target cropped areas and cropping intensities in the target schemes have been planned in the following manner.

- (a) Target cropped areas and cropping intensities are determined on the basis of current and past cropped areas and cropping intensities in individual schemes as is the case in North Sumatra,
- (b) The basic target for cropping intensity of paddy is an introduction of double cropping. A general target intensity of paddy is set to over 170 - 180% and 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, and
- (d) The general target set for an annual cropping intensity of paddy and palawija is 200% or higher.

In accordance with the factors discussed above, the target cropped areas and cropping intensities for individual schemes are 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

### 3) 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 are summarized below.

#### Target Yields under the Study

Cropping Season/Crops	Target Yield		Crop	Target Yield
	Range	Overall Avg		
Wet 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	Groundnuts *1	0.9 ton/ha
Maize (hybrid; grain)	-	5.0 ton/ha	Groundnuts *2	1.2 ton/ha

Note: \*1. Groundnuts without tillage, \*2. Groundnuts with tillage.

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

### 4) Crop Budgets and Farm Economy

The planned crop budgets estimated on different yield levels of paddy and palawija are as shown in the following table.

#### Planned Crop Budget per Ha

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

Note: \*1 Groundnuts without tillage, \*2 Groundnuts with tillage.

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 4.3.2. The results are 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

#### 4.4.4 Institution Capacity Building Plan (Refer to ANNEX-III (1/3), (2/3), (3/3), Part 1, Section 5.4)

##### (1) District/Municipal Government Capacity Building Plan

The capacity building plan for district/municipal government staff in charge of irrigation management aims at their full understanding of the new participatory irrigation management policy as well as the difference from the previous PKPI promoting the concept of hand-over of irrigation management authority to water users. In this regard, a 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 the draft 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 MOSRI, Ministry of Home Affairs and Ministry of Finance.

Following this technical guidance seminar, a 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 the draft Law on Water Resources.

Such seminars and workshops for the technical guideline 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:

- Mandaling Natal, Tapanuli Selatan, Tapanuli Tengah, Toba Samosir, Labuhan Batu, Asahan, Simalunggun, Langkat Districts and Binjai Municipality in North Sumatra,
- Kebumen, Purworejo, Boyolali, Klaten, Sragen, Pati, Demak, Batang, Pemalang, Brebes, Tegal, Kendal, Magelang, Grobogan and Kudus

Districts and Tegal, Pekalongan, Semarang and Magelang Municipalities in Central Java, and

- Takalar, Sinjai, Maros, Pangkajene Kepulauan, Bone, Soppeng, Wajo, Sidenreng Rappang, Luwu, Polewali Mamasa and Luwu Utara Districts in South Sulawesi.

## (2) WUA Establishment Acceleration Plan

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

Although this plan has to cover any irrigation schemes with non-WUA tertiary blocks, its implementation should be commenced from:

- In North Sumatra, 9 candidate schemes in which there remain 40 WUA not yet established,
- In Central Java, 19 candidate schemes in which there remain 317 WUA not yet established, and
- In South Sumatra, 19 candidate schemes in which there remain 159 WUA not yet established.

## (3) WUA Strengthening Plan

The main target of WUA strengthening plan is WUA's board of directors and member farmers. The plan consists of WUA awareness raising workshops and technical assistance to WUA concerning capacity to manage organization, capability to collect and expense members' fees, and activities to conduct operation and maintenance of tertiary irrigation system. The workshop aims at identification of weak points in WUA activities by members themselves on a participatory basis through recapitulation of the M&E record on WUA performance. As for technical assistance, class room training, on-the-job training and mass guidance will be combined in one package program to meet the technical assistant requirements of the respective WUA.

Although the target of this plan is all of the "Under development" and "Not yet developed" WUA, the above package program should be firstly implemented for:

- 140 "Under development" WUA and 87 "Not yet developed" WUA in 18 candidate irrigation schemes in North Sumatra,
- 1,342 "Under development" WUA and 239 "Not yet developed" WUA

- in 38 candidate irrigation schemes in Central Java, and
- 680 “Under development” WUA and 62 “Not yet developed” WUA in 25 candidate irrigation schemes in South Sulawesi.

#### (4) WUA Federation Setting-up Plan

In the irrigation scheme where a 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 a hearing is to be arranged for representatives of the federation focusing on who took an initiative to establish the federation and whether or not the establishment of the federation was backed up by the general will of the WUA in the concerned irrigation scheme. If it is found that the article is based on Government Regulation No. 77/2001 on Irrigation and relevant ministerial decrees with little connection and coordination with member WUA, it is to be confirmed whether the representatives of the federation need technical support from Regional (provincial/district) Government for modification of its article and resetting-up of the FWUA/MWUA.

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

Although a WUA federation setting-up plan needs cover whole irrigation schemes, the first priority should be given over 18 candidate schemes in North Sumatra, 38 candidate schemes in Central Java and 25 candidate schemes in South Sulawesi.

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

As the O&M of tertiary irrigation systems is the responsibility of its 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 an on-the-job training program on O&M of irrigation facilities at tertiary level and a management guidance program on collection and expense of WUA members' fees.

#### (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/farmer 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 the 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

Based on the above unit cost and each subject area of 141 irrigation schemes, the institutional capacity building cost of respective provinces is estimated as follow:

- North Sumatra Rp. 31.7 million for 50 schemes
- Central Java Rp. 99.1 million for 50 schemes
- South Sulawesi Rp. 42.5 million for 41 schemes

**4.4.5 Economic Evaluation** (Refer to ANNEX-III (1/3), (2/3), (3/3), Part 1, Section 5.5)

(1) General

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 project evaluation, an economic internal rate of return (EIRR) and financial return per ha have been examined,
- (c) Project benefits were 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) The exchange rate of Indonesian Rupiah (Rp.) to the US. Dollar (US\$) was taken to be Rp. 8,279 equivalent to US\$ 1.00 (as of May, 2003), and
- (f) Constant prices at 2003 level were used in the evaluation.

(2) Project Costs

The project costs of the 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 4.4.4.

### (3) 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 project benefits expressed as the incremental net return from crop production in the individual schemes are estimated as shown in Table 4.4.5.

### (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 4.4.6 and as summarized below.

#### Economic Internal Rate of Return (EIRR)

EIRR	North Sumatra		Central Java		South Sulawesi	
	No. of Schemes	%	No. of Schemes	%	No. of Schemes	%
20%	3	6	0	-	5	12
15 - 19%	7	14	4	8	11	27
10 - 14%	25	50	8	16	23	56
< 10%	15	30	38	76	2	5

EIRRs of the target schemes in North Sumatra province are in the range of 3.1% to 26.2% and the rates of 35 schemes (70%) out of 50 schemes are calculated at higher than 10%. EIRRs of the schemes in Central Java province are in the range of -1.2% to 17.1% and 12 schemes (24%) out of 50 schemes have EIRR higher than 10%. 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 50 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	North Sumatra		Central Java		South Sulawesi	
	No. of Schemes	%	No. of Schemes	%	No. of Schemes	%
1.0	35	70	12	24	39	95
< 1.0	15	30	38	76	2	5

The incremental returns per ha of the subject area under the with-project conditions are shown in Table 4.4.5 and summarized in the following table.

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

Incremental Return/Ha	North Sumatra		Central Java		South Sulawesi	
	No. of Schemes	%	No. of Schemes	%	No. of Schemes	%
6.0	9	18	1	2	7	17
3.0 - < 6.0	41	82	18	36	30	73
< 3.0	0	-	31	62	4	10

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

**Average Incremental Return per ha of Subject Area**

Province	Return per Ha (Rp.000)		
	Before Project	With-project	Increment
North Sumatra	7,169	12,026	4,857
Central Java	12,879	15,579	2,700
South Sulawesi	8,316	12,889	4,573

The overall average incremental returns per ha of the subject area under the with-project conditions are estimated at Rp. 4,857,000, 2,700,000 and 4,573,000 respectively in North Sumatra, Central Java and South Sulawesi provinces as shown above.

## **4.5 Prioritization for Implementation of Rehabilitation**

### **4.5.1 Flow and Criteria for Prioritization**

#### (1) Flow of Prioritization

The general flow for prioritization is shown in Figure 4.5.1. The procedures for the prioritization are as follows:

#### **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 are more than 1,000 ha proceed to Step-2. If an estimated area is less than 1,000 ha, such scheme shall be categorized into Group-VI.

##### **Step-2**

- 2.1 Evaluation of capacity of WUA of each irrigation scheme and related district government.
- 2.2 If more than 50% against target number of WUA has already established as well as the post of the head of water resources and irrigation services office has been fulfilled by the minimum third rank officer, proceed to Step-3 (1) as shown in Figure 4.5.1. On the other hand, if more than 50% against target number of WUA has not been established and the said post has been vacant or fulfilled by the fourth rank officer, the scheme shall be 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 low 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 an 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

## (2) Criteria for Prioritization

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

- 1) Rehabilitation of irrigation system impact
- 2) Agriculture productivity impact
- 3) Social impact
- 4) Economic and financial impacts

### 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 the actual intake of water vs. designed capacity of intake structure. It is necessary to evaluate the increment of intake of water by improving or repairing the 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, if the intake structure or main canal is heavily damaged for some reasons, the whole system may not function at all. In such a case, evaluation should be made of how much function of the system recovers with limited investment.

“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 by considering both aspects of alleviation of poverty and improvement and new 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.

### 4.5.2 Weights of Evaluation Indicators

Distribution of weighted score for four respective indicators is determined as below:

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

### 4.5.3 Evaluation Results and Database

The results of prioritization for each province are prepared in Table 4.5.1 to 4.5.3 and summarized as follows:

**Summary of Prioritization**

Group	I	II	III	IV	V	VI	Total
North Sumatra	6	7	5	3	14	15	50
Central Java	16	10	12	0	4	8	50
South Sulawesi	11	6	8	0	11	5	41

The database for the prioritization in each scheme is presented in Volume 5, ANNEX-II.

#### 4.5.4 Selection of Model Areas for the Feasibility Study

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

- 1) The scheme of which the irrigation area is more or less the same as the average area of the schemes in each province,
- 2) The scheme of which the condition of topography, situation of agriculture and agro-economy, type of irrigation system/facilities, etc. represents the schemes of each province,
- 3) The scheme of which rehabilitation brings about immediate effects on the recovery of the system (such as damage on the primary canal), and
- 4) The scheme of which rehabilitation gives rise to a great impact on a regional community/economy (schemes located in suburbs of a city or at a large market).

A few proposed irrigation schemes were selected from each province by the Team in due consideration of the above factors. These proposals were further examined in the meetings with the counterpart personnel and the representatives of the Irrigation Service Office at each province. The final decision was made in the second steering committee meeting held in Jakarta. In the meeting, the following three schemes were mutually agreed and determined to be taken up for the model schemes:

**Features of Selected Areas**

Description	Province		
	North Sumatra	Central Java	South Sulawesi
Irrigation Scheme	Padang Mahondang	Gung	Kalaena Kiri
District	Asahan	Tegal & Kodia	Luwu Utara
Sub-district	Pulo Rakyat	Lebaksui	Mangkutana
<b>Existing Condition</b>			
Registered area (ha)	3,231	12,463	4,671
Technical level	Semi Technical	Technical	Technical
Completion year of system	1981 (New)	1998 (Rehabilitation)	1980 (New)
Water resources river	S. Asahan	Kali Gung	Kalaena
Type of water resources facility	Free Intake	Headworks	Headworks

## 4.6 Action Plan

### 4.6.1 General

A 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:

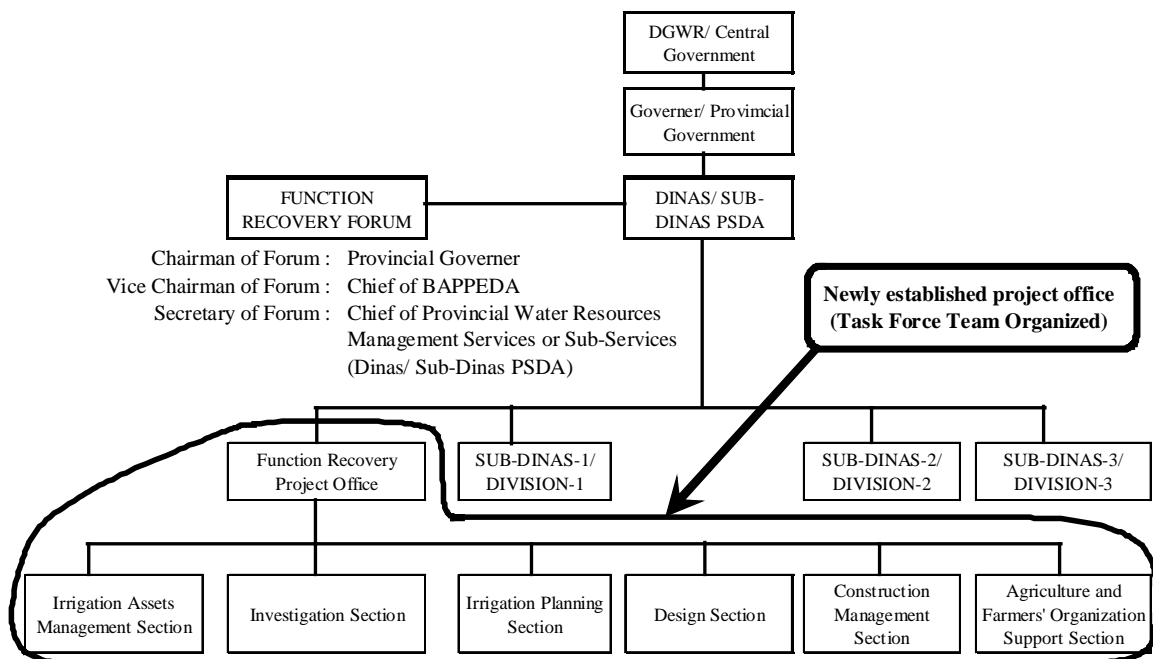
- (a) Organization plan,
- (b) Action plan for recovering function of irrigation facilities,
- (c) Action plan for institutional strengthening,
- (d) Action plan for extension services strengthening, and
- (e) Action plan for budgeting and budget implementation.

### 4.6.2 Organization Plan

#### (1) Precondition

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

#### Proposed Organization for Recovery Program of Irrigation Agriculture



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

The Project Office is to be attached to the provincial water resources services office 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 a 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 Management Services or Sub-Services (Dinas/ Sub-Dinas PSDA)
Member of Forum:	District Regent, Municipal Mayor, Chief of District BAPPEDA, Chief of District Water Resources Services, Chief of Agricultural Services at the provincial and district levels, Chief of relevant services at provincial and district level, Representatives of the WUA, Universities and NGOs

(3) Function Recovery Project Office

As discussed in the precondition, a "Function Recovery Project Office (tentative name)" will be established under Provincial Water Resources Management Services or Sub-Services Office (Dinas/ Sub-Dians PSDA) or Public Services Office (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 Sections, the (a) Irrigation Assets Management Section, (b) Investigation Section, (c) Irrigation Planning Section, (d) Design Section, (e) Construction Management Section, and (f) Agriculture and Farmers' Organization Support Section.

The Project Office has to (i) maintain close relationship with the stakeholders of the water users, (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:

#### **Major Activities of Project Office**

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

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.

### 4.6.3 Action Plan for Recovering Function of Irrigation Facilities

#### (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 for Feasibility Study (F/S))
- Group II: Second high priority schemes (Recommended for F/S)
- Group III: Third high priority schemes (Recommended for F/S)
- Group IV: Schemes that require reexamination of availability of water resources before making a F/S
- Group V: Schemes that require organization of a WUA and empowerment of local government officials before making F/S
- Group VI: Schemes that require reexamination of development methodology before making F/S

Of the above classifications, the action plan for Groups I to III is more or less the same, though timing of initiation of implementation is different, whereas the action plan for Groups IV to VI is not the same due to different constraints. The 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 a WUA and/or local government officials 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 too small, integration of several 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.

(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 Rehabilitation and Upgrading (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 fields are converted to upland fields or orchards 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 and/or local government officials (on the condition that there is no problem in water supply).	- Establishment and empowerment of WUA and/or empowerment of local government officials are urgent (on the condition that there is no problem in water supply).

(to be continued)

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

1) Field Investigation for F/S

In order to maintain uniformity in the field survey results, the number of packages 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 to be 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 areas is 3 years.

(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
North Sumatra	6	7	5	3	14	15	50
Central Java	16	10	12	0	4	8	50
South Sulawesi	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 4.6.1 and Figure 4.6.1. 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.

(5) Status of Basic Information on the Irrigation Schemes

In commencing the Study on the Comprehensive Recovery Program of Irrigated Agriculture, basic information is needed 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.

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

In order to complete the project successfully, the “processing of basic information and preparation of an updated book” is a prerequisite condition. For the implementation of the project, necessary information can be collected through such an updated book, and if further information is required, an 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 books. 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 a rehabilitation plan.

#### **4.6.4 Action Plan for Institutional Strengthening**

##### **(1) Type of Plan**

An Action plan for institutional strengthening consists of the following two program groups:

- One is to be conducted in either the initial or midterm phase prior to the implementation of rehabilitation works on the irrigation system. The 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 the final stage as one of the project components in parallel with rehabilitation works on the irrigation system. The Action plan for this group covers a training program for operation and maintenance of the tertiary irrigation system and a guidance program for collection and expenditure of irrigation management fees.

The overall implementation schedule of the action plan for institutional strengthening is included in Figure 4.6.1.

## (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 decisions to make the necessary arrangements for the program implementation. This Task Force Team is therefore formed of the following members:

- The Chief is to be appointed from the Provincial Water Resources Service Office,
- The Secretary is to be appointed from the 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 WUA, FWUA/MWUA if already organized and Farmers Groups 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 member in charge. As members of this working group, experts are also invited from NGOs and universities in addition to representatives of WUA and FWUA/MWUA if available. This working group is responsible for providing necessary inputs and making decisions and necessary arrangements for the program implementation.

## (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 the capability of those staff in line with the new irrigation management policy.

The first component will be done through undertaking a series of seminars and workshops 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 also be made by the central government.

The second component should reflect 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 as both are 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 consultants, NGOs 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 the majority of WUA have not performed adequately in terms of organization management and financing aspects rather than performance on physical aspects like irrigation facility condition and water allocation utilization. From the initial stage of irrigation system rehabilitation, farmers' participation is a prerequisite, so the capability of each WUA is one of the important key factors for successful implementation of the comprehensive recovery program of irrigation agriculture.

The Task Force Team should be responsible for making necessary arrangements to formulate and implement the WUA strengthening program

by recruiting a consultant as a technical assistant. The Task Force Team and its consultants shall:

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

Budget for implementing the package program for strengthening each 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 arrangements to recruit consultants, NGOs and/or university representatives 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 systems in line with the draft Law on Water Resources. These two groups will represent those member WUA so they should build up transparent channels of communication and good cooperation among WUA, FWUA and MWUA in implementing irrigation management activities. In order to secure appropriate role and function for WUA groups in conformity with the participatory irrigation management policy, therefore, it is necessary to support the initial setting-up of FWUA and MFUA.

The same Task Force Team and its consultant shall:



- collect a list of FWUA/MWUA's and member WUA' legal documents,
- review and confirm the 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 a 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 the package program.

Budget for implementing the 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 arrangements to recruit consultants, NGOs and/or university representatives 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 been established within one irrigation system resulting in a situation where the realization of full-scale management of the irrigation system is still impossible. In such a case, any irrigation scheme with a WUA establishment target realization ratio of less than 50% is to be dropped from the Master List according to the criteria. Further, there are candidate irrigation schemes that have tertiary blocks without any WUA. As long as irrigation water is distributed to the concerned tertiary block, a 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 all tertiary blocks of one irrigation system in an integrated manner.

The same Task Force Team and its consultant shall:

- hold socialization meetings and workshops 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 in a WUA as well as their needs for guidance about the 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 the unit cost of each guidance menu and total cost of a package program.

Budget for implementing a 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 arrangements to recruit consultants, NGOs and/or university representatives 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 systems. For this purpose, however, preparation of a training manual and program should be done in parallel with the final stage of the rehabilitation works. Also the concept of a training program should synchronize the irrigation water allocation plan to tertiary blocks as well as the cropping pattern and planting schedule in the irrigation scheme.

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

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

#### 6) Guidance Program for Collection and Expenditure of Irrigation Water Management Fees

The background of this program is the reconfirmation of each WUA's obligation to operate and maintain its tertiary irrigation system in the draft new Law on Water Resources. Since 1984, farmers have been responsible for paying irrigation service fees to cover the cost for operation and maintenance of tertiary irrigation systems as well as the management cost of the WUA. Due to uncertain realization of an irrigation water allocation plan to each tertiary block of the irrigation system, however, many WUA members put lower priority on their irrigation management fees among annual expenses from their income. As irrigation water supply can be guaranteed as planned after the rehabilitation works are completed, therefore, it is necessary for reluctant farmers to be reminded of their obligation and to encourage them to fulfill their obligation.

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

- identify issues with the book keeping system, fee determination method, payment form, fee collection system and payment schedule,
- identify issues with the fee allocation system to cover administration, operation, maintenance and other miscellaneous costs,
- identify incentives to members,
- formulate a guidance menu list and a package program of guidance menus for collection and expenditure of irrigation management fees, and
- estimate the unit cost of each guidance menu and total cost of the package program.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

In formulating and implementing the guidance program for collection and expenditure of irrigation management fees, the project manager should pay due attention to recruiting a consultant with specific experience matching the above terms.

#### **4.6.5 Action Plan for Extension Services Strengthening**

##### **(1) Formulation of Action Plan**

The goal of strengthening extension services is to mitigate individual or multiple constraints to agricultural development based on farmer-to-farmer approaches. To achieve this 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 groups 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.

(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 institutions (farmers)
Technical guidance team	Agriculture & irrigation agencies of higher jurisdiction, BPTP

(3) Formulation of Implementation Program

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

Constraints for development will be identified by the following means:

- Investigation of 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/farmer 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 multiple development constraints by emphasizing farmer-to-farmer approaches. Element extension programs should be area specific ones tailored to area specific

needs and will include a farmer/farmer group empowerment program, staff 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 an extension services strengthening program, a certain period from 3 to 5 years will be required as shown in Figure 4.6.1, based on the time series for the implementation schedule of element programs, budget requirements and availability as well as staff availability and capability.

#### (4) Implementation of Extension Services Strengthening Program

The extension services strengthening program will be implemented as follows:

- Formulation of an 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 a participatory approach,
- Budget arrangements on the basis of the annual work program formulated above,
- Preparation of a 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 farmers/farmer groups 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: staff of the district agriculture services office, field agriculture & irrigation staff, representatives of WUA 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.

#### **4.6.6 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 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 by 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 need to be implemented by district/municipal government with financial support by DAK to district/municipal government and technical assistance from provincial government, if necessary.

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

In the midterm phase of the function recovery program, it is recommended that the 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 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 the proposed project matching with the financing standard of the international lending agencies. In other words, the central government is to prepare an Implementation Program (I/P) by packaging irrigation schemes proposed by Regional Governments.

## **CHAPTER 5 FEASIBILITY STUDY FOR THE SELECTED MODEL SCHEMES**

### **5.1 North Sumatra (Padang Mahondang Scheme)**

#### **5.1.1 Present Conditions**

(1) Natural Conditions (Refer to ANNEX-III (1/3), Part 2, Section 1.1)

1) Location

The project area lies in the central part of North Sumatra province about 160 km southeast of Medan, the capital city of the province.

2) Climate and Hydrology

The project area lies in the tropical monsoon zone. The annual average temperature is about 26 °C with very little seasonal variation throughout the year. The temperature varies from a maximum of 32 °C to a minimum of 22 °C.

The annual rainfall is about 2,000 mm in the project area, and 2,000 to 3,500 mm to the west towards the mountains. In general the water resources in the area are ample.

The relative humidity is high at 88% on average, ranging between 90% in the highest month and 87% in the lowest.

3) River System and River Runoff

The major river in the project area is the Asahan River. The catchment area of the Asahan River at Pulau Raja site is 4,608 km<sup>2</sup> and annual mean discharge is estimated at 150 m<sup>3</sup>/s. The Asahan River originates from Lake Toba regulating the water level at El. 905 m and runs about 150 km to the Strait of Malacca after joining the Silau River at Tanjung Balai.

4) Topography and Geology

The topography of the project area is mostly wide and flat alluvial plain lower than El. 20 m including lower swampy areas.

The areas between the elevations of 10 m to 15 m have terrace deposits mainly composed of sand and silt forming belts, projected low ridges and isolated islands. Alluvial plain deposits, including those of the vast swampy area, mostly consist of fine silt to clayey soils inter bedded by thin soil layers and organic soil layers.



(2) Socio-economy (Refer to ANNEX-III (1/3), Part 2, Section 1.2)

Administratively the Scheme is located in Pulau Rakyat Sub-district (the project sub-district), one of 17 sub-districts of Asahan District. The beneficiary area of the Scheme extends in 2 villages (the project *desas*: Padang Mahondang and Ofa Padang Mahondang). The administrative area of the project sub-district is 251.0 km<sup>2</sup> and that of the project *desas* is 91.3 km<sup>2</sup>.

The population of the project sub-district was 30,631 and in the project *desas* was 8,088 in 2002. The number of households and the average family size in the sub-district were 6,834 and 4.5 persons, respectively. The same in the *desas* were respectively 2,324 and 3.5. The rural population of the sub-district accounts for 90% of the total.

(3) Present Irrigation and Drainage Condition (Refer to ANNEX-III (1/3), Part 2, Section 1.3)

1) Inventory of the Existing System

Field investigation of the existing irrigation facilities was carried out by the JICA Team prior to formulating the rehabilitation plan in September and October 2003.

The survey results indicate that the existing irrigation scheme in the project area is broadly divided into two areas according to the present agricultural condition. The land with an area of 700 ha is utilized as irrigated paddy fields with semi-technical level irrigation in the wet season and the other land with an area of about 2,200 ha is rainfed paddy.

The Location map of the project area is shown in Figure 5.1.1.

2) Present Conditions and Problems

An inventory of the major existing irrigation and drainage facilities in the project area was drawn up for the preparation of the development plan at the pre-feasibility level. Based on the inventory, structural conditions of all the existing facilities were assessed according to the criteria that categorize the conditions of the existing facilities into four (4) classes on the basis of the degree of deterioration. According to the results of the inventory, all facilities were classified into D (to be replaced and/or reconstructed) and summarized as follows:

- (a) Malfunctioning of the free intake
- (b) Absolute shortage of canal length
- (c) Inadequate provision and deterioration of irrigation facilities
- (d) Poor drainage conditions
- (e) Lack of water management activities

### 3) Operation and Maintenance

The existing scheme was constructed by PWRS North Sumatra and maintained by its branch office at Kisaran. However, no proper operation and maintenance have been practiced since the end of the 1990's after Asahan District Government took over management activities of irrigation schemes.

#### (4) Agriculture (Refer to ANNEX-III (1/3), Part 2, Section 1.4)

##### 1) Agro-demography

The number of farm households of the project sub-district and *desas* in 2002 is estimated at some 3,490 or accounting for 51% of the total households of 6,834 and some 2,160 or accounting for 93 % of the total households of 2,324, respectively. The primary farming activity of the farm households in the sub-district is estate crop production followed by food crop production. In the project *desas* it is food crop production.

The average holding size of paddy fields per farm household in the project *desas* could be assumed at 1.22 ha based on the number of farm households and the areal extent of paddy fields.

##### 2) Land Use

The present land use of the Scheme has been assumed on the basis of the JICA Report<sup>1</sup> and statistical information from the District Agriculture Services Office as shown in the following table.

**Present Land Use of Padang Mahondang Scheme**

Irrigated Paddy Field	Rainfed Paddy Field			Tree Crop Land ( Oil Palm )	Total
	Currently Used	Long Fallow Land			
		Bush	Light Forest		
724 ha	436 ha	736 ha	735 ha	600 ha	3,231 ha
22.4 %	13.5 %	22.8 %	22.7 %	18.6 %	100 %

##### 3) Cropping Pattern and Cropping Intensity

The cropped area and cropping intensity in the nominal paddy field of 2,631 ha of the Scheme have been estimated based on the information provided by the District Water Resources Sub-services and Agriculture Services Offices as shown below.

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<sup>1</sup> Master Plan Study on Lower Asahan River Basin Development, JICA, 1990

### Cropped Area, Cropping Intensity and Cropping Intensity in Padang Mahondang Scheme

Item	Irrigated Paddy	Rainfed Paddy	Palawija	Total	C.I.
Cropped Area: Wet Season	350 ha	810 ha	53 ha	1,213 ha	46%
Cropped Area: Dry Season	163 ha	-	62 ha	225 ha	9%
Cropped Area: Annual	513 ha	810 ha	115 ha	1,438 ha	55%

Note C.I.: Cropping intensity to 2,631 ha.

#### 4) Crop Yield and Production

The present yield levels of paddy and palawija are estimated as follows:

##### Current Crop Yields in Padang Mahondang Scheme

Crops	Wet Season	Dry Season
Irrigated Paddy	4.0 ton/ha	4.0 ton/ha
Rainfed Paddy *1	2.5 ton/ha	-
Rainfed Paddy	2.0 ton/ha	-
Palawija (maize composite)	3.0 ton/ha	3.0 ton/ha

Note \*1: Paddy in irrigated fields grown under rainfed conditions.

On the basis of the estimated yields and the cropped areas, the crop productions at present are estimated as summarized below.

##### Present Crop Production in Padang Mahondang Scheme

Crops	Wet Season	Dry Season	Annual
Paddy (ton)	3,207	652	3,859
Palawija (maize composite) (ton)	159	186	345

#### 5) Farming Practices and Crop Budget

The current prevailing farming practices of paddy are as follows:

##### Farming Practices

Variety	Improved variety: IR 64 & Ciherang (115 days)
Nursery	Seeding rate: 30 kg/ha; period 20 ~ 25 days
Land Preparation	By machinery (hand tractor)
Planting	Manual transplanting (regular/random)
Fertilizer	NPK applied (irrigated field); volume depending
Harvesting	Manual; threshing by power/pedal thresher

Current crop budgets of major crops (irrigated & rainfed paddy and palawija) in the Scheme are estimated as summarized below:

### Financial Net Return per ha

Commodity	Yield (ton/ha)	Gross Return (Rp.000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy <sup>*1</sup>	4.0	5,200	2,170	3,030
Rainfed Paddy <sup>*2</sup>	2.5	3,250	1,500	1,750
Rainfed Paddy <sup>*3</sup>	2.0	2,600	1,390	1,210
Maize (composite)	3.0	3,300	1,050	2,250

Note <sup>\*1</sup>: Wet & dry season paddy.

<sup>\*2</sup>: Paddy grown under rainfed condition in irrigation command area.

<sup>\*3</sup>: Paddy grown in rainfed paddy field.

#### 6) Marketing

The prevailing marketing practice of paddy in the Scheme is “selling paddy just after harvest at field” followed by “selling paddy after drying”. The prevailing marketing channel of paddy is “selling paddy to collector/middleman” followed by “selling paddy to rice mill”.

#### 7) Farm Economy

Because of the limited accessibilities to reliable information sources on farm household incomes and expenditures, the present farm economic analysis has been made on 1 ha of irrigated paddy field or rainfed paddy field by estimating net farm income from the field as follows:

#### Estimated Net Farm Income from 1 ha of Paddy Field

Land Use Category	Net Farm Income ( Rp. 000 )	Cropping Pattern Assumed
Irrigated Paddy Field	4,840	Paddy (1 ha)- paddy (0.47 ha)/palawija (0.17 ha)
Rainfed Paddy Field <sup>*1</sup>	1,750	Paddy (1 ha) – fallow
Rainfed Paddy Field	1,320	Paddy (0.89 ha) – palawija (0.11 ha)

Note <sup>\*1</sup>: Paddy field in irrigation command area, but being under rainfed condition.

#### 8) Agricultural Support Institutions and Farmer’s Organizations

The main government agricultural support institutions providing technical and institutional support in and around the Scheme include Rural Extension Services Center (BPP), District Agriculture Services Office, District Food Security & Agriculture Extension Office, seed farm and Seed Supervision & Certification Branch Office at district level. BPP and Field Extension Workers (PPL) are placed under the District Food Security & Agriculture Extension Office of Asahan District Government.

The major farmer’s organizations involved in agricultural activities are Farmers’ Groups (*Kelompok Tani*/KT) and WUA. In the project sub-district, 48 KT with a total membership of about 1,950 have been formed. Of 48 KT, 13% are classified

as primary level (*pemula*), 52% as secondary level (*lanjut*), 33% as middle level (*madya*) and 2% as advance level (*maju*).

There are 2 KUD, 2 KOPTAN, 1 UPJA and 1 BRI Village Unit in the project sub-district, though the KUD has no activity at present.

#### 9) Agricultural Extension

The number of PPL assigned to BPP in the project sub-district is 5 of which 2 PPL are deployed in and around the Scheme. However, a BPP office in the sub-district has not been established yet and activities of PPL are constrained as well due to limitations of means of transportation, extension materials & equipment and operation funds.

#### (5) Institution (Refer to ANNEX-III (1/3), Part 2, Section 1.5)

##### 1) District Government Authorities

The Asahan District Government, under the control of Regent (*Bupati*), is composed of one secretariat, 24 internal units and 17 external units, having 10,372 civil servants as a whole. These civil servants consist of one first rank officer, 10 second rank, 87 third rank and 329 fourth rank officers as management staff and 9,945 rank-and-file staff. The educational background of civil servants is that the majority (55%) has graduated from senior secondary school followed by diploma graduates (22%) and university graduates (11%).

The revenue and expenditure condition of the Asahan District Government for the last three years from 2000 to 2002 is as summarized below.

#### Revenue and Expenditure

Fiscal Year	Revenue (Million Rp.)	Expenditure (Million Rp.)
2000	119,214	149,189
2001	275,103	307,505
2002	329,108	329,285

Development expenditure as one component of the above expenditure was Rp.52,082 million in 2000, Rp.96,744 million in 2001 and Rp.98,310 million in 2002. The genuine revenues of the Asahan District Government amounted to Rp.14,300 million in 2002.

##### 2) Water Resources and Irrigation Sector Authority

In Asahan District, the water resources and irrigation sector administration is under the jurisdiction of the Settlement and Regional Infrastructure Services (*Dinas KIMPRASWIL*). This organization is composed of five Sub-Services, one Division and five branch offices as shown in Figure 5.1.2.

In the Water Resources Sub-Services (*Sub Dinas*), there are four sections and one bureau to handle administration activities with 75 staff in total. This Sub-Services unit is responsible for management 22 public irrigation schemes including the Padang Mahondang irrigation scheme. Among 22 irrigation schemes, there are nine technical irrigation schemes commanding 13,627 ha, 12 semi-technical irrigation schemes covering 11,991 ha and 1 simple irrigation scheme of 3,231 ha. Budget utilized by the water resources and irrigation sector amounted to Rp.988 million in 1999/00 and Rp.428 million in 2000. The share in the development expenditure was 3.9% in 1999/00 and 1.7% in 2000.

The Asahan Water Resources Sub-Services office is closely coordinated with Bah Bolon – Asahan Water Resources and River Basin Management Unit (*Balai PSDA/UPT*) which is a branch office of the PWRs North Sumatra covering Simalungun and Asahan Districts as well as Pematang Siantar and Tanjung Balai Municipalities, especially concerning in the water resources development planning aspect. In accordance with the framework of water resources development policy as shown in Figure 5.1.3, any proposal for water resources sector development from Asahan District Government is to be reviewed by *Balai PSDA/UPT* Bolon – Asahan. Based on review result, recommendations for implementation are to be fed back to the district government.

### 3) Water Users Association

For the Padang Mahondang irrigation scheme, provincial and district governments set up the target to establish two WUA in the registered area of 3,231 ha. One of the target WUA was established in May 1993 and approved by *Bupati* in June 1993. Since then, however, its performance has been dormant due to a non-functional irrigation system so that there remain only 26 members at present in WUA Padang Mahondang. Of course no representative and board member or director is available. The monitoring and evaluation record on WUA performance made by *Balai PSDA/UPT* Bolon – Asahan reveals that WUA Padang Mahondang is recognized as “Not yet developed”.

The following are major items pointed out by face-to-face interview respondents consisting of eight WUA member farmers and two non-members based on the rapid rural appraisal method:

- This scheme was initially developed on the facility-oriented basis without paying any attention to beneficiary farmer’s needs resulting in that very limited number of farmers were interested in irrigation water since the beginning,
- WUA was also established according to top-down direction,

- No irrigation water is distributed for dry season cropping because the irrigation system does not function at all from intake to tertiary block,
- During the wet season, irrigation water supply is not a critical issue as paddy can grow depending on rainfall,
- Even though the WUA membership fee is stipulated at 25 kg of dry paddy per 1 ha for one crop season in the article of the WUA, nobody wants to follow this rule because no merit can be expected from participation in the WUA due to no guarantee of irrigation water supply,
- Operation and maintenance works at the tertiary level are voluntarily carried out by a limited number of farmers in a part of the irrigation area, and
- To reactivate the WUA and encourage non-member farmers to participate in or establish a WUA, function recovery of the irrigation system is prerequisite in this area and further betterment of drainage conditions is preferable.

#### 4) Federation of WUA

In response to administrative instruction by the Ministry of Home Affairs, the *Bupati* of Asahan District Government has promoted the idea of organizing the existing WUA into a federation in the respective irrigation schemes. In the service area of *Balai* PSDA/UPT Bolon-Asahan, a total of 13 WUA Federations (FWUA) were established and approved by *Bupati* as of January 2001. Although this promotion backed up by the World Bank is in line with PKPI based on Government Regulation No.77/2001 on Irrigation, action actually taken is obviously depending on the top-down system. Therefore, the article of the FWUA is signed by the chief of the village (*Kepara Desa*), not the representative of member WUA. In some cases, no consultation was obtained from representatives of member WUA.

### 5.1.2 Basic Considerations in Formulating Rehabilitation Plan

#### (1) Irrigation (Refer to ANNEX-III (1/3), Part 2, Section 2.1)

##### 1) Rehabilitation Plan for Irrigation Facilities

The rehabilitation plan will be based on the field investigation results and the discussions made with the officials of the provincial government concerned and the project management office as follows:

- (a) To provide an intake structure to draw stable supply of irrigation water throughout the year,
- (b) To prevent inflow of sediment into the canal from the river,
- (c) To improve and introduce a technical irrigation network system,
- (d) To extend the irrigation command area with irrigation facilities,

- (e) To design diversion/turnout structures by providing water measurement devices for the introduction of an appropriate water management technology,
- (f) To provide such infrastructures as inspection roads and farm roads for O/M of irrigation facilities and future mechanized farming, and
- (g) To provide project facilities such as a site operation house (50m<sup>2</sup>), vehicles, motor cycles, and office equipment for the project office.

2) Assessment of Inventory Survey Results

According to the survey results, principal features of the irrigation facilities are as follows:

**Features of Irrigation Facilities**

Facility	Number	Length (km)	No. of Structures
Intake	1	Free intake from Asahan River	1
Main Canal	1	3.575	8
Secondary Canal	3	9.225	17

The main and secondary canals are unlined. The structures on the irrigation canals are made of stone masonry except bridges that are of concrete construction.

On the basis of the results of the investigation, the conditions of the structures have been assessed and classified, by the state of rehabilitation into the following four (4) categories:

- A: Functioning well, no rehabilitation is needed.
- B: Partially damaged/deteriorated, minor rehabilitation is needed.
- C: Not functioning well, large scale rehabilitation is needed.
- D: Seriously damaged, replacement or reconstruction is needed.

As a result of evaluation, conditions of all the structures are classified into category D, because of poor construction and/or deterioration due to no operation for a long time since the end of the 1990s.

Based on the existing irrigation map prepared by the *Balai* and the discussions with PWRS and *Balai* regarding the area for irrigation, the maximum irrigable area is determined to be 2,631 ha in the case that the water source availability is sufficient. Through the water balance study, the irrigation area of 2,631 ha is verified and determined as the subject area.

(2) Agriculture (Refer to ANNEX-III (1/3), Part 2, Section 2.2)

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



- (a) Formulation of agriculture plans placing emphasis on paddy production envisaging contribution to the food security in Indonesia and to introduce a double cropping of paddy as a basic cropping pattern to the greatest possible extent,
  - (b) Tree crop planted land is excluded from the target area of the present rehabilitation plan (farmers' intention to be assessed in detail in further studies to follow),
  - (c) Irrigation agriculture performances and experiences in the advanced schemes in the province are to be fully taken into consideration in the formulation of the agricultural plan,
  - (d) The plan envisages improvement of crop productivity and realization of increase of cropping intensity through the efficient use of irrigation water, and
  - (e) The current agricultural status, including crop selection, cropping schedule, cropping pattern and cropping intensity in the Scheme should be duly assessed and taken into account in planning so that the formulated plans will be sustainable for beneficiaries intentions and capabilities.
- (3) Institutional Strengthening Concept and Target (Refer to ANNEX-III (1/3), Part 2, Section 2.3)

The current performance of WUA in the Scheme can be described as “Not developed yet”. The main reason is the existing physical condition of the irrigation system under which no sustainable irrigation water supply can be guaranteed to farmers according to their requirements. Therefore, full recovery of the irrigation system's function is a precondition to encourage farmers to activate the existing WUA as well as to accelerate establishment of new WUA and participate in these new WUA in non-WUA tertiary blocks. In this regard, the basic concept for promoting WUA establishment in Padang Mahondang irrigation area is to raise farmer's awareness to the necessity of WUA establishment as well as the role, function and activities of the WUA in parallel with implementation of irrigation system rehabilitation works.

Another concept for institutional strengthening is to enable officials of the Asahan District Government to understand and practice the new irrigation management policy and also to improve the capacity of organization units involved in the irrigation management and those staff capabilities in line with the new irrigation management policy.

The target of institutional strengthening is to establish WUA in the service area of each tertiary system of the Scheme when its function is fully recovered.

### 5.1.3 Development Plan

(1) Determination of Irrigation Area (Refer to ANNEX-III (1/3), Part 2, Section 3.1)

1) Project Area

The registered area of the scheme is 3,231ha. The target area had been almost entirely developed as paddy fields in the past, except for an area planted to oil palm estimated at approximately 600 ha. Taking into account the said conditions, the target area for the present development plan is determined to be 2,631 ha by excluding oil palm planted land from the project area as shown below.

**Project Area**

Registration Area	3,231 ha
Tree Crop Land (oil palm)	600 ha
Project Area	2,631 ha

2) Assessment of Water Demands in the Field

The irrigation water requirements have been estimated based on a planning guideline prepared by MOSRI. Consumptive use of water has been estimated on the basis of the modified Penman method proposed by FAO. A percolation rate of 2 mm/day is applied for the dry season paddy, and 1 mm/day for the wet season paddy. The water requirement of land preparation for paddy is assumed to be 150 mm. The overall irrigation efficiency is assumed to be 60%.

On the conditions and assumptions stated in (2) and above, the unit diversion irrigation water requirement for paddy is estimated at 1.16 liters/sec/ha (in May and November).

3) Confirmation of Available Water from the Asahan River

Based on the calculation results stated above, the intake discharge is estimated at  $Q = 3.157 \text{ m}^3/\text{s}$  for the maximum irrigation area of 2,631 ha. The average runoff of the Asahan River is  $112 \text{ m}^3/\text{s}$ , and probable runoff expected 4 out of 5 years is estimated at  $70 \text{ m}^3/\text{s}$ , so the water demand for the project area will be satisfied by the river runoff.

(2) Proposed Project Works (Refer to ANNEX-III (1/3), Part 2, Section 3.2)

1) Conditions of Existing Facilities

#### Free Intake

The existing free intake is not functioning and hence it is completely out of service due to the following conditions/reasons:

- (a) The river water level of the Asahan River during the dry season is lower than the required intake water level and no irrigation water can be drawn off the river.
- (b) Due to the large fluctuation in river water level and lack of facilities such as trash racks, and poor design of location of the intake, the approach channel of the intake has been closed with sand and debris.
- (c) Due to poor maintenance of the approach channel of the intake, large quantities of sediment have been piled up and hence the water inflow to the intake has been stopped.

#### Irrigation Canal and Related Structures

The existing irrigation canal is unlined earth canal 1-2 m wide. Due to poor maintenance, many sediments and trees/grasses are found inside of the canal. As a result, canal flow is blocked off. In addition, collapse of canal slopes are found along the entire length. Related structures, such as division structure, off-take structure, drainage culvert, and bridge have been damaged or are out of order.

#### Inspection Roads

Conditions of inspection roads and other related facilities are very poor and almost impassable through the year.

### 2) Possibility of Rehabilitation of Existing Facilities

As the existing conditions of the irrigation facilities could be described as almost out of order as stated above, large-scale rehabilitation or replacement will be required. The design capacity of existing structures is determined to be sufficient to irrigate 700 to 1,000 ha. Therefore, the rehabilitation and/or upgrading of the existing facilities hardly seem to be possible. Therefore, it is proposed to newly design the system with a development area of 2,631 ha as shown in Figure 5.1.4.

Prior to the design of irrigation facilities, the following considerations have been made:

- (a) Location of the intake should be relocated upstream from the existing site.
- (b) The type of diversion structure shall be a free intake type. Diversion weir type (fixed or barrage type) shall not be considered because of high construction costs and the effect of back water on the upstream.
- (c) Several countermeasures for the prevention of sediment inflow to the intake and achievement of a stable intake of water throughout the year should be considered for the selection of the intake site and the design purpose.

- (d) Canals and related structures are to be designed for irrigation with an area of 2,631 ha.
- (e) The technical level of facilities is to be raised to technical irrigation. (Existing grade is semi-technical or simple level)
- (f) Drainage canals in the northeastern area should be provided with an appropriate capacity.

### 3) Irrigation Diagram

Prior to the design of irrigation facilities, an irrigation diagram was prepared for the irrigation command area of 2,631 ha.

### 4) Design of Irrigation Facilities

#### Diversion Structure

To determine the type of diversion structure, measures to achieve the following conditions were considered taking into account the existing structure:

- (a) Prevention of the inflow of bed load from the river
- (b) Maintenance of stable intake throughout the year
- (c) The required intake level at the intake site is set at El. 13.0 m

The site selection is based on the available topographic map and the profile of the Asahan River that was prepared in 1990 during the detail design of the Asahan flood control project. The bottom elevation of the existing free intake is to be set at El. 11.50 m as a result of the survey by the JICA Team.

The gradient of the Asahan River is estimated at 1/3,000 and the river bed elevation at the existing intake point is about El. 9 m. It seems to be very difficult to draw water off the river without intake of much sediment from the river bed and the river bed elevation is only 2.5 m.

To avoid such design failure, the following design considerations were made:

- (a) To select the location of the proposed intake for drawing water off the river during the low level period, the river bed elevation is to be El. 10 m, which is situated about 3 km upstream from the existing intake.
- (b) To avoid inflow of bed load directly into the canal, a sand trap pond is to be provided in front of the intake gate. A gap of 1 m between the sand trap pond and the intake bed level is required.
- (c) To avoid inflow of bed load during medium to high water level, the width of the intake should be as great as possible.
- (d) In addition to the above design considerations, a settling basin after the intake is considered necessary.

### Irrigation Canal and Related Structures

Based on the proposed irrigation network, a design of irrigation canals and related structures will be made. A summary of proposed canals and related structures is as follows.

#### **Summary of Irrigation Canal and Related Structures (New construction)**

Canal	Number	Length (km)	Related Structure (nos.)
Main	1	9.0	12
Secondary	4	13.0	Not designed

### Drainage Canals and Facilities

Drainage canals and facilities have been designed at a preliminary level and applied to the cost estimate.

#### (3) Agriculture (Refer to ANNEX-III (1/3), Part 2, Section 3.3)

##### 1) Land Use Plan

In the agriculture land use plan, the conversion of the current rainfed fields into irrigated fields and the development of the entire project area into irrigated paddy fields (2,440 ha) are planned as follows:

#### **Land Use Plan**

Land Use Category	Present	With Project	Increment
Irrigated Paddy Fields	724 ha	2,440 ha	1,716 ha
Rainfed Paddy Fields	1,907 ha	-	- 1,907 ha
- Currently Used	436 ha	-	- 436 ha
- Long Fallow Land	1,471 ha	-	- 1,471 ha
Right-of-ways <sup>*1</sup>	-	191 ha	191 ha
Project Area	2,631 ha	2,631 ha	0 ha

Note \*1: Right-of-ways assumed to be 10% of rainfed paddy fields.

##### 2) Planned Cropping Pattern and Schedule

The approaches employed for crop selection and planning of cropping pattern are as follows:

- (a) Paddy has been selected as the main crop in the planned cropping pattern as stated in the development concepts and from farmers' preferences and the volume of market demands. However, the introduction of double cropping of paddy is limited to 50% on the basis of the past cropping records in the Scheme and considering the availability of labor force<sup>2</sup>,

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<sup>2</sup> There is a sufficient number of people in the labor force in the project *desas*, but some of them are worked as estate labor. The possibility to count them as labor force for irrigation farming in the Scheme is to be confirmed.

(b) Maize is selected as a representative palawija to be introduced in the planned cropping pattern since it is the most common palawija currently cropped in and around the Scheme. Further, from the demand/supply condition and profitability of crops, hybrid maize appears to be the most promising crop among palawija. The palawija area has been set at 10% of the paddy fields in the dry season.

The planned cropping pattern and schedule have been formulated on the basis of: i) current cropping pattern & schedule in the Scheme and ii) recommended cropping schedules of the District Agriculture Office, iii) climatic conditions and iv) water balance study.

### 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 scheme under the present Study are planned as summarized below:

**Planned Cropping Pattern & Schedule**

Season	Pattern (Crop & Intensity)	Schedule
Wet Season	Paddy (100%)	Mid. Oct. - end Nov. ~ early Jan. - early Mar.
Dry Season	Paddy (50%)	Beg. May - mid. June ~ early Aug. - Mid. Sep.
	Palawija (maize; 10%)	Mid. Jan. - end Jan. ~ mid Apr. - end Apr.
Annual	Paddy - Paddy/Palawija (160%)	

The increase of annual cropped area of some 2,300 ha of paddy and about 130 ha of palawija from the present level is planned under the Study. Further, the increase of paddy cropping intensity of 100% and of palawija cropping intensity of 6% resulting in an increase of overall intensity of 105% is envisaged.

### 4) Target Crop Yields and Crop Production Plan

Target yields of paddy and palawija are estimated based on yield levels attained by the existing farmers in the Scheme, yield levels in advanced schemes in Asahan District and information on potential yields provided by PPL and also considering poorly drained land conditions of current rainfed fields as shown below.

**Target Yields under the Study**

Cropping Season/Crops	Present Yield	Target Yield	Increase
In Current Irrigated Field			
- Wet Season Irrigated Paddy	4.0 ton/ha	5.0 ton/ha	1.0 ton/ha
- Dry Season Irrigated Paddy	4.0 ton/ha	5.0 ton/ha	1.0 ton/ha
In Current Rainfed Field			
- Wet Season Paddy	2.0 - 2.5 ton/ha	4.0 ton/ha	1.5-2.0 ton/ha
- Dry Season Paddy	-	4.5 ton/ha	-
Palawija (maize) <sup>*1</sup>	3.0 ton/ha	5.0 ton/ha	2.0 ton/ha

Note \*1: Target yield --- hybrid maize; Present yield --- composite maize

## 5) Crop Budgets

The planned crop budgets estimated for irrigated paddy and palawija (maize hybrid) are estimated as summarized below:

**Planned Crop Budget per Ha**

Crops	Crop Season	Yield (ton/ha)	Gross Return (Rp. 000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy	Wet/Dry	5.0	6,500	2,490	4,010
Irrigated Paddy *1	Wet	4.0	5,200	2,170	3,030
	Dry	4.5	5,850	2,410	3,440
Maize (hybrid)	Dry	5.0	5,500	2,240	3,260

Note \*1: Newly irrigated field under the project

## 6) Farm Economy

The farm economic analyses have been made on 1 ha of irrigated paddy field or rainfed paddy field by estimating net farm income from the fields as follows:

**Estimated Net Farm Income from 1ha of Field**

Land Use Category	Net Farm Income (Rp. 000)			Cropping Pattern Assumed
	Present	With Project	Increment	
Irrigated Paddy Field	4,840	6,340	1,500	Paddy (1ha) - paddy (0.5ha) /palawija (0.1ha)
Irrigated Paddy *1	1,750	5,080	3,330	
Irrigated Paddy *2	1,320	5,080	3,760	

Note \*1: Paddy fields in current irrigation command area being under rainfed condition

\*2: Newly irrigated fields from rainfed fields

## 7) Agriculture Extension Services Strengthening Plan

The programs for agriculture extension services strengthening (AESS) formulated to meet the requirements are summarized as follows:

### Institutional Strengthening Package Program

- Establishment of regional & sub-regional task force teams for AESS
- Staff empowerment program (capacity building of regional, sub-regional & extension staff)
- Strengthening of extension facilities (BPP)

### Farmer Organizations Empowerment Package Program

- KT empowerment program
- Formation & empowerment of UPJA

### Technical Guidance Package Program

- Technical development, technical demonstration, farmer/farmer group training, study tour, field school etc.

### Participation Enhancement Package Program

- Workshops at sub-district & district etc.

The implementation of these strengthening programs should be started from the commencement of the construction works for the period of at least 5 years or up to 3 years after the completion of the construction works.

- (4) Institutional Strengthening Plan (Refer to ANNEX-III (1/3), Part 2, Section 3.4)

To realize the targets, the institutional strengthening plan for the Scheme consists of two programs in the initial stage, i.e. institutional capacity building and staff capability improvement program, and WUA establishment acceleration program. After WUA is established, stepped-up programs will be implemented as follow-up activities of WUA. These are the WUA strengthening program, FWUA and MWUA initial setting-up program, on-the-job training program on operation and maintenance of tertiary irrigation systems, and a guidance to set and collect irrigation management fees.

- 1) Institutional Capacity Building and Staff Capability Improvement Program

This program contains two components. One is to enable irrigation officials of the Asahan District to understand and practice the new irrigation management policy. The other is to improve the capacity of organizational units of the Asahan District Government involved in irrigation management and those staff capabilities in line with the new irrigation management policy.

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

The second component should reflect the above nationwide dissemination of the new irrigation policy by the central government. This component will be done as follows:

- To evaluate the capacity of district/municipal government authorities and the capability of those staff 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 budget arrangements for implementing these implementation programs, the main source is the Asahan District 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 consultants, NGOs and universities. Monitoring and supervision of the program implementation should be carried out continuously by relevant organizational units at the provincial level throughout the program implementation stage with periodical reporting on performance and impact of the program implementation.

## 2) WUA Establishment Acceleration Program

To accelerate WUA establishment in the respective tertiary block of the Scheme in order to ensure participatory irrigation management, the program is to be implemented based on the following steps:

- hold socialization meetings and workshops to invite representatives and members of Farmers' Groups that are available in non-WUA tertiary blocks for the purpose of accelerating WUA establishment and promoting participatory irrigation management,
- confirm farmer's awareness of establish and participate in WUA as well as their farmer's needs for guidance about procedures and practices 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 the package program.

Budget to implement the package program for WUA establishment acceleration is to be covering the project financing.

In implementing the WUA establishment acceleration program before starting rehabilitation works, consultants, NGOs and/or university representatives are to be recruited as facilitators and supporters in the irrigation command area.

## 3) WUA Strengthening Program

The WUA Strengthening Program will be conducted based on the following steps:

- hold WUA awareness raising workshops to reconfirm weak points

elaborated from recapitulating data on the M&E record on WUA performance,

- identify technical assistant requirements for improving WUA capacity to manage organization, capability to conduct operation and maintenance of tertiary irrigation systems, and/or activities to set and collect WUA member's fees,
- formulate a technical assistant menu list and make a package program of technical assistance menus according to WUA needs to improve their capacity, capability and/or activities, and
- estimate the unit cost of each technical assistant menu and total cost of the package program.

Budget for implementing the package program for strengthening WUA is to be covered by the project financing.

In implementing the WUA strengthening program before starting rehabilitation works, consultants, NGOs and/or universities are to be recruited as facilitators and implementers in the irrigation scheme area.

#### 4) FWUA and MWUA Initial Setting-up Program

The FWUA and MWUA initial setting-up program will be conducted based on the following steps:

- imbue the local society with the necessity of setting up representative groups of WUA to cope with the participatory irrigation management policy if FWUA/MWUA have 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 Scheme, and
- estimate the unit cost of each guidance menu and total cost of the package program.

Budget for implementing the initial setting-up program of FWUA and MWUA is to be covering by the project financing.

In implementing the initial setting-up of the FWUA and MWUA program, consultants, NGOs and/or university representatives are to be recruited as facilitators and supporters in the irrigation scheme area.

#### 5) Training Program on Operation and Maintenance of Tertiary Irrigation Systems

This training program will be implemented after completing the rehabilitation works of the irrigation systems. For this purpose, however, preparation of training

manuals and programs should be done in parallel with the final stage of rehabilitation works. Also the concept of training programs should synchronize the irrigation water allocation plan to tertiary blocks as well as the cropping pattern and planting schedule in the irrigation command area.

As this training will be done as one of the rehabilitation project components, a consultant under the project manager is to be responsible for preparing training manuals, formulating training programs, estimating training costs and implementing training programs. To ensure effective and efficient implementation of training on operation and maintenance of tertiary irrigation systems, NGOs and other volunteers will be encouraged to become involved in training activities at the field level in addition to the project staff, District Government officials and the consultant.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

#### 6) Guidance Program for Setting and Collection of Irrigation Management Fees

In parallel with preparation of the guidance manuals, the following points will be considered:

- identify issues on book keeping systems, fee determination methods, payment forms, fee collection systems and payment schedules,
- identify issues affecting the fee allocation system to cover administration, operation, maintenance and other miscellaneous costs,
- identify incentives to members,
- formulate a guidance menu list and a package program of guidance menus for setting and collection of irrigation management fees, and
- estimate the unit cost of each guidance menu and total cost of the package program.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

In formulating and implementing the guidance program for setting and collection of irrigation water service charges, special attention will be paid to recruiting a consultant with specific experience matching with the above terms.

#### 7) Cost Estimate for Institutional Strengthening Plan

The overall cost for the proposed institutional strengthening plan in the above is estimated at Rp. 335 million in total. The breakdown of estimated cost is as follows:

- Rp. 10 million for Institutional capacity building and staff capability improvement program for the Water Resources Sub-service of Asahan District *KIMPRASWIL* based on a unit cost of Rp. 5 million and 2-time implementation,
- Rp. 50 million for WUA establishment acceleration program targeting beneficiary farmers in non-WUA tertiary blocks based on a unit cost of Rp. 20,000/ha and the existing WUA coverage area of 2,507 ha,
- Rp. 29 million for WUA strengthening program to reactivate the existing WUA Pahang Mahondang based on a unit cost of Rp. 40,000/ha and WUA coverage area of 724 ha,
- Rp. 65 million for FWUA and MWUA initial setting-up program based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 3,231 ha,
- Rp. 116 million for a training program on operation and maintenance of tertiary irrigation systems based on a unit cost of Rp. 36,000/ha and the proposed recovery area of 3,231 ha, and
- Rp. 65million for a guidance program for setting and collection of irrigation service fees based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 3,231 ha.

(5) Environmental Aspects (Refer to ANNEX-III (1/3), Part 2, Section 3.5)

Environmental assessment is now accepted as a key part of development planning and is as important as economic analysis in project evaluation. In this Study, however, such assessment has not yet been conducted, as the objective of the Study is to recover the function of the existing infrastructures. Nonetheless, environmental assessment for the rehabilitation project is no less important than that of a new development project as far as environmental impact exists. In this regard, it is proposed to carry out environmental assessment prior to the implementation of the project on the basis of the following law and regulation:

- Law No.23/1997 concerning environmental management, and
- Government Regulation No.27/1999 concerning environmental impact assessment

#### **5.1.4 Project Cost Estimate**

(1) Conditions for Cost Estimate (Refer to ANNEX-III (1/3), Part 2, Section 4.1)

Project costs for the proposed project works including construction cost for rehabilitation, consulting services fee, administration cost (salary for the office staff and expenditures for office management), and costs for institutional and extension service strengthening are estimated on the basis of the following conditions:

- (a) All the civil works of the project will be executed on a contract basis. Contractors will be selected through international competitive bidding.
  - (b) Physical contingency of each work is assumed to be 20% in due consideration of the Pre-F/S design level.
  - (c) Price contingency is not counted taking into account the short construction period.
  - (d) Costs for institutional strengthening and extension service strengthening are assumed to be 2% of the total costs of civil works construction.
  - (e) Cost for the consulting services is assumed to be 7% of the costs for civil works and works described in (d) above.
  - (f) Administration cost of the project office is assumed to be 2.5% of the costs for civil works and works described in (d).
  - (g) The exchange rate used for the estimate is US\$1.00 = Yen 118.9 = Rp. 8,279 as of May 2003, and
  - (h) Currency for cost estimate is expressed in Indonesian Rupiah (Rp.)
- (2) Direct Construction the Cost (Refer to ANNEX-III (1/3), Part 2, Section 4.2)

The direct construction cost is estimated based on the calculated work quantities of the proposed project works and unit prices of the works. The unit prices are based on those for similar works quoted in recent engineer's estimates of the North Sumatra Province such as PTSL-II Project.

The direct construction cost is estimated at Rp. 43,245 million (equivalent to US\$ 1,985/ha or Rp. 16.4 million/ha, A= 2,631 ha). The breakdown of direct construction costs is shown in Table 5.1.1 and summarized as follows.

**Summary of Direct Construction Cost**

Work Description	Amount (million Rp.)
I. Intake	4,577
II. Main Canal Works	12,869
III. Secondary Canal Works	12,866
IV. Drainage Works	5,147
V. On-Farm Development	6,216
VI. Project Facilities	1,570
Total	43,245

(3) Other Costs

Other costs are estimated as shown below:

- (a) Costs for the institutional and extension service strengthening:  
Rp. 865x 1,000
- (b) Cost for the consulting services: Rp. 3,087x 1,000
- (c) Administration cost of the project office: Rp. 1,103 x 1,000

(4) Project Costs

Project costs are estimated at Rp. 48.3 billion as shown in the following table:

**Breakdown of Project Costs**

Work Description	Costs (million Rp.)
I. Civil works	43,245
II. Institutional and extension service strengthening	865
III. Consulting services	3,087
IV. Project administration cost	1,103
Total	48,300

**5.1.5 Project Implementation Schedule**

(1) General (Refer to ANNEX-III (1/3), Part 2, Section 5.1)

The implementation of rehabilitation work for the Padang Mahondang Irrigation Scheme is urgently required for the recovery of function of the existing irrigation scheme to cope with progressing deterioration of the facilities. The implementation schedule of the rehabilitation work after completion of the feasibility study is shown in Figure 5.1.5 and briefed as follows:

- (a) Preparation of the Implementation Program (I/P) and budget arrangements,
  - (b) Establishment of project office,
  - (c) Preparation of a detailed design with tender documents including field survey and investigation,
  - (d) Tender and selection of contractor(s),
  - (e) Execution of civil construction and taking over of completed irrigation scheme, and
  - (f) Execution of strengthening program such as institutional and extension services.
- (2) Preparation of I/P and Budget Arrangements (Refer to ANNEX-III (1/3), Part 2, Section 5.2)

Preparation of I/P is to be made by the Dinas PSDA for the submission to DGWR for its approval. DGWR has to make arrangement for budget by means of national fund and/or loan from the international lending agencies.

(3) Establishment of Project Office

The project office so-called “Function Recovery Project Office” is to be established at Dinas PSDA. Organization and staffing are to be restructured and transferred from other divisions. At the same time, “Function Recovery Forum” is also established.

(4) Preparation of Detail Design

Immediately after completion of budget arrangement and office establishment, the detailed design including field survey and field investigation, and preparation of the tender documents are to be followed. Period for the detail design is estimated to be less than 12 months.

(5) Tender and Selection of Contractor(s)

Tender and its schedule are to be as follows:

- Number of contract: 2 contracts
- Tender call to contract signing: 6 months
- Construction period: 2 years

(6) Construction and Taking Over

Immediately after the contract signing, the construction is commenced. The construction management works including supervision work and quality control are to be carried out by the construction section of the project office. The completed scheme of the rehabilitation works is to be inspected, and after verification by the authority, the scheme is taken over by the provincial government for the commencement of operation.

**5.1.6 Strengthening Program** (Refer to ANNEX-III (1/3), Part 2, Section 5.2)

The institutional strengthening and extension service programs will be commenced with the following elements.

(1) Institutional Strengthening Program

Elements of institutional strengthening program are as follows:

- (a) Institutional capacity building and staff improvement program,
- (b) WUA strengthening program,
- (c) FWUA and MWUA initial setting-up program,
- (d) WUA establishment acceleration program,
- (e) Training for operation and maintenance of tertiary irrigation system program, and
- (f) Guidance program for collection and expense of irrigation management fee.

(2) Extension Services Strengthening Program

Elements of extension services strengthening program are as follows:

- (a) Formulation of strengthening program,
- (b) Formulation of task force team,
- (c) Formulation of implementation program, and

(d) Implementation of strengthening program.

(3) 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:

- (a) Arrangement of irrigation management responsibility between irrigation water suppliers and water users,
- (b) Arrangement of irrigation management responsibility among government authorities,
- (c) Funding criteria, and
- (d) 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 (Registered area of the Padang Mahodang Irrigation Scheme is 2,905 ha.) are to be handled by provincial governments in a sense of participatory irrigation management.

### **5.1.7 Project Evaluation**

(1) General (Refer to ANNEX-III (1/3), Part 2, Section 6.1)

The approaches or assumptions applied for the project evaluation are as follows;

- Economic evaluation has been made by estimating project benefits between the without-project and the with-project conditions,
- For the project evaluation, economic internal rate of return (EIRR), financial return per ha, economic benefit-cost ratio (B/C) and economic benefit minus cost (B-C) have been examined,
- For the evaluation, project benefits have been estimated based on crop production benefits and indirect or intangible benefits have not been counted,
- To assess the economic viability of the project to possible changes in project costs, project benefits and build-up period, a sensitivity analysis has been made,
- For financial evaluation of the project, the capacity to pay of beneficiary farmers has been analyzed,



- The without-project condition has been assumed to be the same as the present condition as the reliable prediction or estimation of the without-project condition was not possible and impractical,
  - The useful life of the Project was taken as 30 years from project implementation,
  - The exchange rate of Indonesian Rupiah (Rp.) to US\$ was taken to be Rp. 8,279 equivalent to US\$ 1.00 (as of May, 2003), and
  - Constant prices at 2003 level were used in the economic evaluation, and
- (2) Economic Evaluation (Refer to ANNEX-III (1/3), Part 2, Section 6.2)

1) Project Costs

The project costs for economic evaluation would consist of i) construction cost, ii) institutional & extension services strengthening costs, iii) consulting services cost, iv) administration cost, v) O&M costs, and vi) replacement cost. The economic project costs have been calculated from the financial project costs by applying the standard conversion factor with 0.90.

2) Project Benefits

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 net project benefits are defined as the difference in net return from crop production between the with-project and the with-out project conditions. The without-project condition has been assumed to be the same as the present condition as stated earlier.

The annual economic project benefits at the full development stage (the incremental net production value) have been estimated at Rp. 10.74 billion as summarized below.

**Economic Project Benefits/Incremental Net Production Value <sup>\*1</sup>**

Net Production Value (million Rp.)		
Without Project	With Project	Increment
2,747	13,487	10,740

Note \*1: At full development stage

The benefits would gradually increase up to the full benefit in the 5th year after the completion of construction works.

3) EIRR, B/C and B-C

The flow of annual economic costs and benefits and the results of the economic evaluation (EIRR, B/C & B - C) are summarized below.

**Results of Economic Analysis**

EIRR	B/C	B - C
17.3 %	1.65	Rp. 25.0 billion

B/C & B - C at 10% discount rate

4) Sensitivity Analysis

To examine the sensitivity of project economic viability to changes in project cost, project benefits and build-up period, sensitivity analyses have been made on four cases as follows.

**Results of Sensitivity Analysis**

Case		EIRR (%)
0. No Changes	-	17.3
1. Change in Project Costs	+ 10 %	15.9
2. Change in Project Benefits	- 10 %	15.6
3. Benefit Delay	1 year delay	15.0
4. 1 + 2 + 3	-	12.5

(3) Financial Evaluation (Refer to ANNEX-III (1/3), Part 2, Section 6.2)

The capacities to pay of beneficiary farmers have been assessed based on the farm budget analyses on 1 ha of paddy field under the with and without project condition. These have been made by applying the results of the farm economic analyses made in Section 5.1.1 and 5.1.3, as summarized below:

**Results of Farm Budget Analyses on 1 ha of Paddy Field**

Land Use Category	Net Reserve on 1 ha of Paddy Field (Capacity to Pay: Rp.000))		
	Without Project	With Project	Increase
Irrigated Paddy Field <sup>*1</sup>	4,840	5,710	870
Irrigated Paddy <sup>*2</sup>	1,750	4,060	2,310
Irrigated Paddy <sup>*3</sup>	1,320	4,060	2,740

Note \*1: Farmers with current irrigated fields.

\*2: Farmers with current irrigation command area being under rainfed conditions.

\*3: Farmers with newly irrigated field from rainfed fields.

The incremental capacities to pay per ha of beneficiary farmers are estimated to be Rp. 0.9-2.7 million under the future with project condition. The increases would enable the farmers to bear their contributions to the O&M cost of the irrigation system.

(4) Indirect Benefits and Socio-economic Impacts (Refer to ANNEX-III (1/3), Part 2, Section 6.3)

After implementation of the Project, various indirect benefits and socio-economic impacts are expected to be generated. Such benefits and impacts include: i) creation of employment opportunities, ii) improvement of living standards and increase of purchasing power of farmers resulting from increase of farm incomes, iii) expansion of marketing activities of farm inputs and outputs, and iv) incremental production of paddy of some 12,200 tons under the with-project that will directly contribute to the supply-demand balance of rice and the food security in Indonesia.

## **5.2 Central Java (Gung Scheme)**

### **5.2.1 Present Conditions**

#### (1) Natural Conditions (Refer to ANNEX-III (2/3), Part 2, Section 1.1)

##### 1) Location

The Gung Irrigation Scheme is located in the western part of Central Java Province, situated under Slamet Mountain (a volcano with an elevation of 3,428 m) on the south, and facing the Java Sea on the north.

##### 2) Meteorology and Hydrology

The irrigation area ranges from latitude 6°S to 7°S, and lies in the typical monsoon zone. The annual rainfall in the area is about 1,500 mm, and it is concentrated in the dry season lasting from October to May, and the rainfall pattern exhibits a pattern of distinct wet and the dry seasons. The annual average temperature is about 27°C with very little seasonal variation throughout the year.

##### 3) River System and River Runoff

Irrigation of the Scheme depends mostly on the water of the Gung River. The river has its source in Slamet Mountain, and is a rapidly flowing mountain river with a fall of 3,000 m in 54 km of flow length, and becomes gentle in slope at the estuary. The irrigation area extends about 5 km in the direction of east-west in its upstream basin, and about 10 km in the direction of east-west in its downstream basin, whereas it extends about 25 km in the direction of north-south. The catchment area of the river near the estuary is 156 km<sup>2</sup>, and the design discharge is 514 m<sup>3</sup>/s.

#### (2) Socio-economy (Refer to ANNEX-III (2/3), Part 2, Section 1.2)

Administratively the Scheme is almost entirely located in Tegal District and to an extremely limited extent in Tegal Municipality. The beneficiary area of the Scheme extends in eleven (11) sub-districts (the project sub-districts) of the district. The administrative area of the project sub-districts is 404 km<sup>2</sup>.

The population of the project sub-districts was some 893,000 in 2001. The number of households and the average family size in the project sub-districts were some 205,300 and 4.3 persons, respectively.

#### (3) Present Conditions of the Irrigation Facilities (Refer to ANNEX-III (2/3), Part 2, Section 1.3)

##### 1) General

According to the expansion of the irrigation area as time passed, many water supply canals were constructed in order to supply water to the existing area from the new

schemes that may have surplus water. The irrigation infrastructures of these systems have been added and rehabilitated several times as stated below:

- 1970 : Execution of rehabilitation and upgrading by PROSIDA
- 1988/89 : Execution of rehabilitation and upgrading by APBN
- 1991 : Transfer of the system to the central government
- 1991/92 : Execution of rehabilitation and upgrading by APBN
- 1997/98 : Execution of rehabilitation and upgrading by APBN

At present, according to the Central Java Provincial Water Resources Office (Dinas PSDA), the irrigation area of the Gung Irrigation Scheme is 14,222 ha, based on the irrigation diagram prepared in 1991. The irrigation area is divided into three (3) sub-areas based on the water supply sources as shown in Figure 5.2.1, and summarized as follows:

- (a) The sub-area depending on the Gung river,  $A = 9,871$  ha (includes an area of 1,255 ha of the Rawa Downstream System to be supplied from the Gung)
- (b) The sub-area depending on the Cacaban reservoir,  $A = 3,749$  ha (includes an area of 1,255 ha located in the Gung area)
- (c) The sub-area depending on the former Pesayangan Weir (located in the coastal area),  $A = 1,857$  ha

Cropping intensity of the Gung irrigation area is 77% in the wet season, 36% in the dry season I, and 3% in the dry season II. The cropping intensity of this project area is much lower than that of other areas on Java Island. This fact may be attributed to the absolute shortage of water (problems on availability of water resources) in the project area.

The above (a) was chosen to be followed for the study.

## 2) Basic Information on the Design Conditions of the Irrigation Facilities

According to the “Final Design Note”, the canal system design was made on the basis of design discharge per ha as follows:

- Main canal : 0.91 liter/s/ha
- Secondary canal : 0.82 liter/s/ha
- Tertiary canal : 0.71 liter/s/ha

Cropping intensity with this condition is paddy (100%) - paddy (100%) - secondary crops (100%). Needless to say, it is hardly possible for the JICA Study Team to adopt such design discharge even for this project area where irrigation water management technology is much more advanced than other areas. In other words, the design discharges that seem to be 75% or less than the normal demands could

not irrigate the entire project area (1,400 mm of annual rainfall only) for cropping of paddy with an intensity of 200% and second crops with an intensity of 100%.

Operation and maintenance of the project have been practiced for more than 10 years since it was completed in 1990. Notwithstanding the above, the cropping intensity given in the following table indicates that there are big differences between the planned targets and the actual results (as of 2001), especially in cropping intensity of paddy:

**Cropping Intensity in the Gung Area (%)**

Crops	Wet Season	Dry Season I	Dry Season II	Annual
Irrigated Paddy	78	37	3	117
Palawija	7	40	76	123
Sugar Cane	15	0	0	15
Total	100	77	79	256

- (4) Reason of Selection of the Scheme as a Model Area in Pre-F/S Stage (Refer to ANNEX-III (2/3), Part 2, Section 1.3.3)

Evaluation of the Gung Scheme was based on the field survey results. It was assumed that there would be no shortage in water resources for irrigating the scheme. According to the criteria for the prioritization of the schemes as discussed in the Interim Report, the Gung Scheme, which has constraints in water resources would have been classified into Group-IV or VI. Development plan of the schemes classified into such group would be formulated by decreasing the size of the scheme and/or developing additional water resources. In the case of the Gung Scheme, the fact was not fully understood due to the complicated historical background of the scheme such as expansion of irrigation area, construction of additional canals and development of new water resources (Danawarih headworks) to cope with the expansion. As a result, the Gung Scheme has been classified into Group-I (F/S is recommended to be carried out in the earliest stage).

However, it should be noted that there would exist other schemes under such circumstances in any districts and provinces. In this regard, a feasibility study of the Gung Scheme has been carried out as one of the model cases.

- (5) Inventory Survey of the Conditions of the Facilities (Refer to ANNEX-III (2/3), Part 2, Section 1.3.4)

- 1) Facilities for Investigation

Since land with an area of approximately 4,000 ha has been verified to be irrigated as a result of the water balance study the target area for the rehabilitation is

determined to be 3,906 ha. In order to maximize the effect of rehabilitation, irrigation area located upstream has been selected for rehabilitation of facilities consisting of the headworks, the main canal and the Blue Secondary Canal.

Salient features of the target area are summarized as follows:

#### Features of Major Facilities

Facilities	Type	Scale	Related structures	Remarks
Headworks	Torrent intake type (provided with bar screen)	Length: 70m	Intake structure Gate: 2.5m(w) x 1.8m(h)	Surface damage to concrete crest portion O&M problems after flood
Main canal	Stone masonry (side walls only)	L= 8.9 km Width: 6~4 m Height: 2~0.8m	37 nos.	Most sections are steep slope canals (many chutes, drops) No lining on the bottom
Blue secondary canal	Stone masonry (side walls only)	L= 15.80 km Width: 6~2 m Height: 1~0.7 m	63 nos.	Most sections are steep slope canals (many chutes, drops)

#### 2) Facilities investigated

Inventory survey was carried out in October 2003, prior to the formulation of the rehabilitation plan. The facilities included in the inventory survey were as follows:

Headworks: 1 no. (Weir width:  $W = 70$  m)

Main canal: 1 no. (Length:  $L = 8.9$  km)

Secondary canal: 1 no. (Length:  $L = 15.8$  km)

#### 3) Investigation results

Based on the investigation results, conditions of the facilities, the problems and their causes are summarized below.

**Summary Table of the Conditions of Facilities**

Facilities	Problems	Causes
1. Headworks	- Deterioration of crest due to overtopping of water with sand and gravel	- Flow of a large amount of sand and gravel at high speed
	- High maintenance cost for removal of debris and cobbles in after bay	- Not sufficient flushing function of river water against deposited big stones (more than 1.5 m)
	- Lowering of downstream apron	- No provision of protection work
	- Damage of retaining wall foundation	- Scoring of the foundation by flood
2. Intake	- Obstruction of inflow of intake discharge due to velocity control	- No provision of connecting channel between intake gate and settling basin
	- Leakage from gates	- Poor installation of guides and material of gate leaf
3. Settling basin	- Too high velocity during requirement (less than 0.3 m/s)	- Not appropriate site
4. Main and secondary canals	- Direct inflow of rain water into canal at excavated section	- No provision of berm or drainage ditch/inlet
	- Damage of canal lining due to inflow of drains under lining concrete	- No provision of control structures for drains flowing into canal
	- Backwater from the paddy field to the canal	- No provision of berm or broken berm
	- Narrow flow area due to collapse of side slope of earth canal	- Poor maintenance and mainly no lining section
	- Illegal cultivation inside of canal	- No clear boundary between canal and farm road
	- Sedimentation in gentle gradient section and growing of grasses and trees	- Poor maintenance
5. Related structures	- Damage of foundation due to high velocity, and no provision of velocity control function	- Due to malfunction of drop, and poor design to maintain the appropriate gradient
	- Leakage from gate	- Poor maintenance
	- No provision or damage of safety facilities at the inlet of conduit, aqueduct	- Poor design to maintain the safety facilities

(6) Agriculture (Refer to ANNEX-III (2/3), Part 2, Section 1.4)

1) Agro-demography

The average holding size of paddy field per beneficiary farm household in the Scheme is estimated at about 0.20 ha based on the total paddy fields of about 12,500 ha and the number of beneficiaries of about 63,400.



## 2) Land Use

The Scheme is a completion irrigation scheme and the entire potential area for irrigation was developed for irrigated paddy fields. However, a limited area of the potential area was converted to housing or industrial purposes. The present irrigated area of the Scheme is estimated at 12,365 ha and that of the target area (the project area) of the present rehabilitation plan is at 9,871 ha or 79% of the total as shown below:

### Present Land Use

Gung Scheme	- Irrigated Paddy Fields	12,365 ha
	- Land Converted to Other Uses	98 ha
	- Original Potential Area for Irrigation	12,463 ha
Project Area	- Irrigated Paddy Fields	9,871 ha

## 3) Cropping Pattern and Cropping Intensity

The current cropped area and cropping intensity in the project area assumed on the basis of the past records is shown in the following table:

### Current Cropped Area and Cropping Intensity

Crops	Wet Season		Dry Season I		Dry Season II		Annual	
	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)	Area (ha)	C.I. (%)
Paddy	7,660	78	3,604	37	320	3	11,584	117
Maize	731	7	3,995	40	-	-	4,726	48
Beans	-	-	-	-	7,533	76	7,533	76
Sugarcane	1,480	15	-	-	-	-	1,480	15
Total	9,871	100	7,599	77	7,853	80	25,323	257

Note C.I.: Cropping intensity

## 4) Crop Yield and Production

The present yield levels of crops in the project area are estimated as follows:

### Current Crop Yields in the Project Area

Crops	Wet Season	Dry Season I	Dry Season II
Irrigated Paddy	5.0 ton/ha	5.0 ton/ha	4.5 ton/ha
Maize	4.0 ton/ha	4.0 ton/ha	-
Beans	-	-	1.2 ton/ha
Sugarcane	60 ton/ha		

On the bases of the estimated yields and the cropped area, the present annual crop productions are estimated as shown below:

### Present Crop Production in Project Area

Crops	Annual (ton)
Irrigated Paddy	57,760
Maize	18,900
Beans	9,040
Sugarcane	88,800

#### 5) Farming Practices and Crop Budget

Current prevailing farming practices of paddy are as follows:

##### Farming Practices

Variety	Improved variety: IR 64, Membramo (110-115 days)
Nursery	Seeding rate: 30 kg/ha; period 20 ~ 25 days
Land Preparation	By machinery (hand tractor)
Planting	Manual transplanting (regular)
Fertilizer	NPK applied; volume depending
Harvesting	Manual; threshing by power/pedal thresher

Current crop budgets of major crops in the project area are estimated as summarized in the following table:

##### Financial Net Return per ha

Commodity	Yield (ton/ha)	Gross Return (Rp.000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy <sup>*1</sup>	5.0	6,000	2,590	3,410
Rainfed Paddy <sup>*2</sup>	4.5	5,400	2,470	2,930
Maize	4.0	3,840	1,900	1,940
Beans <sup>*3</sup>	1.2	3,100	1,380	1,720
Sugarcane <sup>*4</sup>	60.0	12,000	9,360	2,640

Note: \*1: Wet & dry season I; \*2: Dry season II; \*3: Average of soybeans & mungbeans;

\*4: Avg. of 1<sup>st</sup> & 2<sup>nd</sup> harvest

#### 6) Marketing

The prevailing marketing practice of paddy in the Scheme is “selling paddy just after harvest at field” followed by “selling paddy after drying”. The prevailing marketing channel of paddy is “selling paddy to collector/middleman” followed by “selling paddy to KUD”.

#### 7) Farm Economy

The present farm economic analysis has been made on 1 ha of irrigated paddy field by estimating net farm income from the field. The result of the farm economic analysis thus made is presented as follows:

### Estimated Net Farm Income from 1ha of Paddy Field

Cropping Pattern Assumed	Cropped Area (ha)	Net Farm Income (Rp. 000)
Wet Season: Paddy/Sugarcane	0.85/0.15 ha	6,620
Dry Season I: Paddy/Maize	0.40/0.40 ha	
Dry Season II: Beans	0.8 ha	

#### 8) Agricultural Support Institutions and Farmer Organizations

The main government agricultural support institutions providing technical and institutional support in and around the Scheme include three Rural Extension Services Centers (BPP; Lebaksiu, Kramat, Pangkah), District Agriculture, Estate Crops and Forestry Services Office, BIMAS Food Security Office and two seed farms. BPP and Field Extension Workers (PPL) are placed under the District Agriculture Services Office.

Major farmer's organizations involved in agricultural activities are Farmer' Groups (*Kelompok Tani/KT*) and WUA. In the project sub-districts, 718 KT have been formed. Of 718 KT, 8% are classified as primary level (*pemula*), 42% as secondary level (*lanjut*), 38% as middle level (*madya*) and 12% as advanced level (*maju*). The common constraint faced by these KT is limitation in cooperation/collaboration in marketing activity (agribusiness activity) as a group.

There are 13 KUD, 30 KOPTAN and 8 UPJA in the project sub-districts. The memberships of the KUD are very large, averaged at some 5,200.

#### 9) Agricultural Extension

The number of PPL assigned to BPP in the project sub-districts is 92 in total. Among these, 53 PPL are deployed in the project sub-districts. However, the activities of PPL are rather limited due to limitations of means of transportation, extension materials & equipment and operation funds.

#### (7) Institution (Refer to ANNEX-III (2/3), Part 2, Section 1.5)

##### 1) District Government Authorities

The Tegal District Government under the control of the Regent (*Bupati*) is composed of one secretariat, 20 internal units and 13 external units, having 6,370 civil servants as a whole. These civil servants consist of one first rank officer, nine second rank, 90 third rank and 240 fourth rank officers as management staff and 6,030 rank-and-file staff. The educational background of civil servants is that the majority (58%) have graduated from senior secondary school followed by diploma graduates (20%) and university graduates (10%).

Revenue of the Tegal District Government was Rp.118,911 million in 1999/00 and Rp.127,086 million in 2000, while expenditure was Rp.113,111 million in 1999/00

and Rp.120,202 million in 2000. The Tegal Municipality Government's revenue was Rp.46,429 million in 1999/00 and Rp.40,506 million in 2000, while its expenditure was Rp.44,675 million in 1999/00 and Rp.38,482 million in 2000.

Out of the above expenditures, Rp. 31,282 million in 1990/00 and Rp. 42,768 million in 2000 were spent as development expenditure in Tegal District including the amount allocated to water resources and irrigation sector was 167 million in 1990/00 and 608 million in 2000. In Tegal Municipality, the development expenditure was 12,026 million in 1990/00 and 9,934 million in 2000, but no budget allocation was made to water resources and irrigation sector.

## 2) Water Resources and Irrigation Sector Authority

In Tegal District, the water resources and irrigation sector administration is under the jurisdiction of the Public Works Services (Dinas PU) as shown in Figure 5.2.2. In the Water Resources Sub-Services (Sub Dinas), there are four sections and one bureau to handle administration activities with 33 staff in total. Under the Water Resources Sub-Services office, there are four branch offices with 168 staff in total. This Sub-Services unit is responsible for 83 public irrigation schemes including the Gun irrigation scheme. Among 83 irrigation schemes, there are 14 technical irrigation schemes commanding 33,017 ha, one semi-technical irrigation scheme covering 434 ha and 68 simple irrigation schemes of 3,597 ha. In order to lighten the heavy burden of O&M staff in each branch, the unit is planning to increase the number of waterman to its final target to appoint one waterman per 100 ha of irrigation area.

Budget allocated to the Water Resources Sub-Services of the Tegal District has drastically increased between 1999/00 and 2002 as follows:

- In 1999/00, the source of budget was limited to APBD from the provincial government, amounting to Rp.1,511 million,
- In 2000, APBD from the provincial government increased to Rp.1,420 million,
- In 2001, Rp.2,950 million from APBD District was added to Rp.1,200 million from APBD province, amounting to Rp.4,150 million,
- In 2002, the budget allocated from APBD District increased to Rp.5,240 million and another Rp.1,325 million was allocated from APBN from the central government, amounting to Rp.6,565 million: and
- In 2003, the budget allocated from APBD District further increased to Rp.15,585 million and Rp.1,000 million was allocated from both the APBN from the central government and the Province APBD, amounting to Rp.17,585 million.

### 3) Water Users' Association (WUA)

It has been reported that the WUA establishment target in the Gun irrigation scheme command area is 131 and its achievement is 129. According to the latest monitoring and evaluation record as of 2000 made by the District Water Resources Sub-Services, two WUA are classified as "Developed", 74 WUA as "Under development" and the remaining 53 WUA as "Not yet developed", and the total WUA's members are 12,491 in the whole Gung Irrigation Scheme area.

Through the inventory under this F/S, it has been confirmed that there are 14 tertiary blocks directly commanded by the Gun main canal and 83 tertiary blocks covered by 15 secondary canals. The total command area is 9,871 ha. Out of these tertiary blocks, a WUA has been established in 78 tertiary blocks of which 12 are directly connected with the main canal and 66 are commanded by 12 secondary canals. Although the remaining 19 tertiary blocks have no WUA, these blocks are under the management of traditional water users group so-called "*Ulu-Ulu*".

The following are major items identified and pointed out by face-to-face interview respondents consisting of 550 WUA member farmers and 20 non-members based on the rapid rural appraisal method:

- In general, each WUA keeps close coordination with the branch of District Water Resources Sub-Services to ensure irrigation water supply to each tertiary block under a three-day rotation system of irrigation water distribution which has been practiced to overcome insufficient water resources,
- In two "Developed" WUA represented by 20 respondents, a board of directors meeting and a general meeting of the WUA are regularly held as stipulated in the articles. Member farmers follow the cropping pattern, planting schedule and water allocation plan. They also positively carry out O&M works of tertiary systems and pay WUA membership fees and administration charges as irrigation management fees,
- With initiatives of "Developed" WUA, the payment method of irrigation service fees is to be changed from "in kind" to "in cash" by modifying the articles of the WUA. Such modification can be legalized with the approval of the head of the Sub-district Office as the branch of District Government,
- In 24 "Under development" WUA represented by 240 respondents, member farmers follow cropping patterns, planting schedules and water allocation plans, although respondents in 16 WUA pointed out that their tertiary irrigation system was not completely functioning. Irrigation

service fees are collected by 23 WUA in the form of “in cash” and the amount of fee ranges from Rp. 60,000/ha to Rp. 120,000/ha according to the size of tertiary block and the number of members,

- In 24 “Not developed yet” WUA represented by 240 respondents, no regular board meeting has been held in two-thirds of the WUA being still affected by the traditional water management custom of “*Ulu-Ulu*”. These WUA also feature less coordination with watermen in implementing a water allocation plan. In the remaining one-third, members do not intend to pay irrigation services fees because they grow sugar cane without irrigation water supply to their paddy fields, and
- In two non-WUA tertiary blocks represented by 20 respondents, leaders of traditional water management groups based on “*Ulu-Ulu*” custom have controlled their territories and don’t intend to reform the legal document of “*Ulu-Ulu*” into the articles of a WUA.

### **5.2.2 Basic Considerations in Formulating Rehabilitation Plan**

- (1) Prerequisite Conditions for the Irrigation Area (Refer to ANNEX-III (2/3), Part 2, Section 2.1)

The Gung Scheme, which consists of three sub-areas as mentioned in Section 5.2.1, has an area of 14,222 ha in total. This feasibility study was carried out for the irrigation area covered by the Danawarih Headworks. The sub-area for the rehabilitation with A = 9,871 ha will be targeted, whereas other sub-areas, A = 4,351 ha, will be excluded from the feasibility study.

- (2) Process of the Determination of the Irrigation Area (Refer to ANNEX-III (2/3), Part 2, Section 2.2)

The irrigation area covered by the Danawarih Headworks on the Gung River is 9,871 ha. However, irrigation of the said area is not guaranteed by the river runoff of the Gung. In this regard, it is necessary to carry out a water balance study between the river discharge (dependable discharge 4 out of 5 years or 80% probability) at the Danawarih Headworks site and the water demand based on the cropping pattern and schedule determined for agricultural development. The irrigation area that is estimated by the water balance study will be the target area for which a rehabilitation plan has been formulated.

- (3) Water Balance Study (Refer to ANNEX-III (2/3), Part 2, Section 2.3)

Through the field survey, it was reported that there is a severe water shortage in the Gung scheme. To evaluate water availability of the scheme, a water balance study was conducted.

## 1) Review of original design

In the original design stage, a unit water requirement was estimated at 0.91 liter/s/ha, which is very small compared with the average value in Indonesia. According to the irrigation service officers of the Gung scheme, it is because of the basic assumptions of original design. In the original design stage, it was assumed that not all of the area would be irrigated for paddy but that it would consist of a mix of irrigation area for paddy and non-irrigation area for sugarcane. Unfortunately, the ratio of planned area of paddy and sugarcane in the original design stage was not available. It was preliminarily estimated by the JICA study team at paddy 60 % and sugarcane 40 %, based on the computed irrigation water requirements.

## 2) Evaluation of present conditions

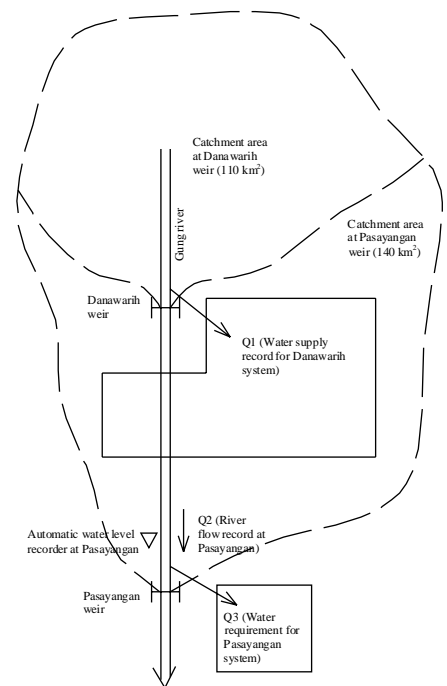
Present conditions of irrigation water supply of the Gung Scheme were analyzed by means of (a) a hydrological water balance model, (b) annual water supply schedule at Danawarih weir, and (c) interview with irrigation service officials.

### (a) Hydrological water balance model

First, available water for the Danawarih system was estimated by using the hydrological model as shown to the right. Second, the irrigation water requirements for the Danawarih system with the present cropping pattern and cropping intensity was computed. Third, a balance calculation between both of them was made. The result of the calculation shows that irrigable area with 100 % water supply to crops and 80 % dependability is 3,906 ha.

### (b) Annual water supply schedule at Danawarih weir

An annual cropping pattern and water supply schedule for the Gung scheme is prepared and published by the Tegal district government. According to the schedule for the year 2002/2003, some water deficit was scheduled with 80 % dependability as shown below. This means that it was originally planned to supply less than 100 % of the water requirement to the area in year 2002/2003.



$$\text{Maximum available water for Danawarih system} = Q1 + Q2 \times 110 / 140 - C$$

**Water Supply Schedule for Danawarih System in year 2002/2003**

Season	Planned paddy area (ha)	Ratio of available water (%)	Irrigable area with 100% supply of water (ha)
Wet	9,249	46	4,254
Dry I	3,635	100	3,635
Dry II	0	-	0

(4) Rehabilitation Plan of the Gung Area (Refer to ANNEX-III (2/3), Part 2, Section 2.4)

As discussed in Section 2.3, the optimal irrigation area covered by the dependable runoff with an 80% probability at the Danawarih Headworks on the Gung river is estimated at 3,906 ha only. This is attributed to the fact that this land was mostly used for sugarcane cultivation in the past, and that the conversion of the land to paddy fields was commenced after 1980. The irrigation facilities in the Gung area are maintained fairly well. (Regarding the actual supply of water, it is necessary to carry out further investigation.)

On the other hand, the result of the Study shows that the Gung area has been classified as the 7<sup>th</sup> highest priority in Central Java Province. Nonetheless, the succeeding study result has indicated that the Gung irrigation area has to be decreased to 40% according to the water balance study.

To cope with this situation, the JICA Study Team had a meeting with the counterpart personnel of MOSRI to discuss the solution of this matter. As a result, both parties have come to the following conclusions:

- Case 1: The feasibility study is to be carried out on the condition that the target area is 3,906 ha (output of the feasibility study).
- Case 2: Issuance of supply of water to the Rawa Downstream System with an area of 1,255 ha from the Danawarih weir is to be stopped. Instead it is proposed to examine the possibility of supplying water from the Cacaban dam. (The countermeasure is to extend the Cacaban dam height.)
- Case 3: It is proposed to develop new water resources upstream of the Danawarih weir (e.g. construction of Blembeng dam).
- Case 4: It is proposed to adopt the cropping system to meet the availability of water (introduction of cash crops).
- Case 5: It is proposed to estimate work quantities and costs for the rehabilitation of the facilities in the entire scheme with an area of 9,871 ha.



As discussed above, this Report does not deal with Cases 2, 3 and 4. However, recommendations have been made as seen above.

(5) Agriculture (Refer to ANNEX-III (2/3), Part 2, Section 2.5)

The agricultural plan was formulated for the target area of 3,906 ha assuming that the present cropping pattern and cropped area in the area will be kept unchanged in the future with-project condition.

(6) Institutional Strengthening Concept (Refer to ANNEX-III (2/3), Part 2, Section 2.6)

As the current situation of WUA performance in the Gung Irrigation Scheme command area can be described as a mix of two statuses, “WUA already established and under development” and “WUA already established but not developed yet”. The main reason is the present limited irrigation water supply condition and the existence of traditional irrigation management customs at terminal level. Therefore, non-physical efforts can be expected to contribute more to equitable use of the limited water resources at the moment. In this regard, the basic concept for strengthening the WUA activities in the Gung Irrigation area is to rationalize the water allocation plan of the whole irrigation system and the WUA management system. In case of the existence of “*Ulu-Ulu*”, the basic concept is to encourage “*Ulu-Ulu*”, leaders and members to utilize the merit of their management system for modernizing their activities and reforming “*Ulu-Ulu*” to WUA.

Another concept for institutional strengthening is to enable irrigation officials in Tegal District to understand and practice the new irrigation management policy and also to improve the capacity of organization units involved in irrigation management and those staff capabilities in line with the new irrigation management policy.

In the target area of 3,906 ha, there are 29 tertiary blocks in which 28 WUA and one “*Ulu-Ulu*” exist.

### **5.2.3 Development Plan**

(1) Formulation of Rehabilitation Plan (Refer to ANNEX-III (2/3), Part 2, Section 3.1)

Design for rehabilitation works has been carried out for the irrigation area of 3,906 ha. The design has been based on results of the survey of the existing conditions of the facilities. The design has been made in consideration of (a) judgment of the degree of deterioration of the facilities based on the photographs, (b) preparation of the design drawings of the facilities for rehabilitation, and (c) estimate of work

quantities and construction costs. Contents of the design of rehabilitation for each structure are as follows:

#### Design Condition

- (a) Development area: 3,906 ha
- (b) Unit design water requirement:  $q = 1.22$  liters/s/ha
- (c) Design intake discharge:  $Q = 4.765$  m<sup>3</sup>/s

#### Water Resources Facilities

- (a) Measures to rectify wearing of concrete at water cushion behind the bar screen,
- (b) Measures for removal of stone and cobbles remaining after flood (adoption of mechanical removal and providing a working area), and
- (c) Repairing of retaining walls at both sides of the foundation.

#### Canals and their related structures (main and secondary canals)

- (a) Removal of sand and gravel deposits in the canals,
- (b) Rehabilitation of the existing concrete lining,
- (c) Execution of concrete lining for the unlined sections,
- (d) Rehabilitation of the damaged structures,
- (e) Repairing of gates, and
- (f) Additional provision of bridges and canal crossing structures.

#### Inspection Roads

- (a) Rehabilitation of inspection roads along the main canal,
- (b) Rehabilitation of inspection roads along the secondary canals and completion of the inspection roads which are uncompleted, and
- (c) Expansion of farm road networks connecting to villages.

Based on the design drawings thus prepared, quantification of rehabilitation works has been made. The work quantities for the secondary canals, for which an inventory survey was not conducted, have been estimated in proportion to the length of canals for which work quantities have been actually estimated based on the inventory survey.

#### (2) Agriculture (Refer to ANNEX-III (2/3), Part 2, Section 3.2)

The agriculture plan has been formulated for the target area of 3,906 ha assuming that the present cropping pattern and cropped area will be kept unchanged and assuming that crop yield levels will be increased with the improvement of irrigation supply under the rehabilitation plan.

#### 1) Land Use Plan

No change in agriculture land use is planned under the Study as shown below.

### Project Area

Land Use Category	Present (ha)	With Project (ha)
Irrigated Paddy Field	3,906 ha	3,906 ha

#### 2) Planned Cropping Pattern, Cropped Area and Cropping Intensity

In accordance with the planned cropping pattern, the with-project cropped areas and cropping intensities are planned as summarized below:

#### Planned Cropped Area & Cropping Intensity

Crop	Wet Season		Dry Season I		Dry Season II <sup>*3</sup>		Annual	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Paddy	3,032	78	1,426	37	126	3	4,584	117
Palawija <sup>*1</sup>	289	7	1,581	40	-	-	1,870	47
Palawija <sup>*2</sup>	-	-	-	-	2,981	76	2,981	76
Sugarcane	585	15	-	-	-	-	585	15
Total	3,906	100	3,007	77	3,107	80	10,020	256

Note <sup>\*1</sup>: Palawija --- maize <sup>\*2</sup>: palawija --- beans (soybeans & mungbeans)

<sup>\*3</sup>: Excluded from the water balance study

No changes in cropped area and cropping intensity between the present and with project conditions are planned as assumed earlier.

#### 3) Target Crop Yields and Crop Production Plan

Target yields of paddy and maize in the “wet season” and “dry season I” have been estimated by assuming an improvement of irrigation water supply under the with project condition, based on yield levels attained by advanced farmers in the Scheme and on information on potential yields provided by District Agriculture Office. Yield levels of sugarcane and beans are assumed to be unchanged from the present levels as no improvement of irrigation water supply under the project can be expected. The target yields under the with-project conditions are estimated as shown below.

#### Target Yields under the Study

Cropping Season/Crops	Present Yield	Target Yield	Increase
Wet Season Irrigated Paddy	5.0 ton/ha	5.5 ton/ha	0.5 ton/ha
Dry Season I Irrigated Paddy	5.0 ton/ha	5.5 ton/ha	0.5 ton/ha
Dry Season II Irrigated Paddy	4.5 ton/ha	4.5 ton/ha	-
Palawija (maize)	4.0 ton/ha	5.5 ton/ha	1.5 ton/ha
Palawija (beans) <sup>*1</sup>	1.2 ton/ha	1.2 ton/ha	-
Sugarcane	60.0 ton/ha	60.0 ton/ha	-

Note <sup>\*1</sup>: Average of soybeans & mungbeans

On the basis of the target crops yields and the planned cropping pattern, the with-project crop production increases are estimated to be 2,229 tons of paddy and 2,805 tons of maize.

#### 4) Crop Budgets

The planned crop budgets per ha for irrigated paddy, palawija and sugarcane are estimated as summarized in the following table:

**Planned Crop Budget per Ha**

Crops	Yield (ton/ha)	Gross Return (Rp. 000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy *1	5.5	6,600	2,820	3,780
Irrigated Paddy *2	4.5	5,400	2,470	2,930
Maize	5.5	5,500	2,770	2,730
Beans	1.2	3,180	1,460	1,720
Sugarcane *3	60.0	12,000	9,360	2,640

Note \*1: Wet season & Dry season I; \*2: Dry season II; \*3: Average of 1<sup>st</sup> & 2<sup>nd</sup> harvest

#### 5) Farm Economy

The farm economic analysis has been made on 1 ha of irrigated paddy field by estimating net farm income from the fields as discussed earlier in Section 5.2.1 as follows:

**Estimated Net Farm Income from 1ha of Field**

Net Farm Income (Rp.000)			Cropping Pattern Assumed
Present	With Project	Increment	
6,620	7,590	970	Paddy:1.25ha/maize:0.40ha/beans:0.80ha/sugarcane:0.15ha *1

Note \*1: Paddy: wet season & dry season I: 0.85 & 0.40 ha

#### 6) Agriculture Extension Services Strengthening Plan

Major constraints for the attainment of the agriculture development targets stated in the previous sections are rather non-technical issues and include:

- (a) Farmers Groups (KT) yet to be empowered to a great extent, especially toward the introduction of agri-business oriented farming activities in collaboration among group members and groups (Constraints 1),
- (b) Insufficient capability of extension staff especially in post-harvest & marketing aspects, limitation of operation funds & means of transportation and coverage of extension services and limited activities of PPL (Constraints 2), and
- (c) Improvement of product quality as a further step of the irrigated paddy farming in the Scheme should be targeted through the introduction of agri-business oriented farming activities and the promotion of partnership between KT and business sectors (Constraints 3).

The programs for agriculture extension services strengthening (AESS) formulated to meet the requirements discussed in the section above are summarized as follows:

Institutional Strengthening Package Program (Constraint 2)

- Establishment of regional & sub-regional task force team for AESS
- Staff empowerment program (capacity building of regional, sub-regional & extension staff)

Farmer Organization Empowerment Package Program (Constraint 1 & 3)

- Agribusiness Promotion Package Program
- Partnership Promotion Package Program

- (3) Institutional Strengthening Plan (Refer to ANNEX-III (2/3), Part 2, Section 3.3)

The institutional strengthening plan for the target area of 3,907 ha in the Scheme consists of four programs, i.e. institutional capacity building and staff capability improvement program, and WUA strengthening program, FWUA and MWUA initial setting-up program, and on-the-job training program on operation and maintenance of tertiary irrigation systems.

1) Institutional Capacity Building and Staff Capability Improvement Program

This program contains two components. One is to enable irrigation officials of the Tegal District to understand and practice the new irrigation management policy. The other is to improve the capacity of organization units of the Tegal District Government involved in irrigation management and those staff capabilities in line with the new irrigation management policy.

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

The second component should reflect the above nationwide dissemination of the new irrigation policy by the central government. This component will be done as follows:

- To evaluate the capacity of district/municipal government authorities and the capability of those staff 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 the central/provincial governments, 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 budget arrangements for implementing these programs, the main source is the Tegal District Government budget to cover the cost for institutional capacity building and staff capability improvement, while the supplemental source is the 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 consultants, NGOs and universities. Monitoring and supervision of the program implementation should be carried out continuously by relevant organization units at the provincial level throughout the program implementation stage with periodical reporting on performance and impacts of the program implementation.

## 2) WUA Strengthening Program

The WUA Strengthening Program will be conducted based on the following steps:

- hold WUA awareness raising workshops to address weak points elaborated from the recapitulating data on the latest monitoring and evaluation (M&E) record on WUA performance,
- identify technical assistant requirements for improving WUA capacity to manage organization, capability to conduct operation and maintenance of tertiary irrigation systems, and/or activities to set and collect WUA member's fees,
- formulate a technical assistant menu list and make a package program of technical assistance menus according to WUA needs to improve its capacity, capability and/or activities, and
- estimate the unit cost of each technical assistant menu and total cost of the package program.

Budget for implementing the package program for strengthening WUA is to be covered by the project financing.

In implementing the WUA strengthening program before starting rehabilitation works, consultants, NGOs and/or university representatives are to be recruited as facilitators and implementers in the irrigation scheme area.

## 3) FWUA and MWUA Initial Setting-up Program

The FWUA and MWUA initial setting-up program will be conducted based on the following steps:

- imbue the local society with the necessity of setting up representative groups of WUA to cope with the participatory irrigation management

- policy if an 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 an FWUA/MWUA according to the current situation in the Scheme, and
  - estimate the unit cost of each guidance menu and total cost of the package program.

Budget for implementing the initial setting-up program of FWUA and MWUA is to be covered by the project financing.

In implementing the initial setting-up of the FWUA and MWUA program, consultants, NGOs and/or university representatives are to be recruited as facilitators and supporters in the irrigation scheme area.

#### 4) Training Program on Operation and Maintenance of Tertiary Irrigation Systems

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

As this training will be done as one of the rehabilitation project components, a consultant under the project manager is responsible for preparing training manuals, formulating training programs, estimating training costs and implementing training programs. To ensure effective and efficient implementation of training on the operation and maintenance of tertiary irrigation systems, NGOs and other volunteers will be encouraged to become involved in training activities at the field level in addition to the project staff, District Government officials and consultant.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

#### 5) Cost Estimate for Institutional Strengthening Plan

The overall cost for the proposed institutional strengthening plan in the above is estimated at Rp. 249 million in total. The breakdown of estimated cost is as follows:

- Rp. 15 million for Institutional capacity building and the staff capability improvement program for the Water Resources Sub-service of the Tegal District based on a unit cost of Rp. 5 million and 3-time implementation,
- Rp. 78 million for the WUA strengthening program to upgrade each WUA

based on a unit cost of Rp. 20,000/ha considering the existing level and WUA coverage area of 3,907 ha,

- Rp. 78 million for the FWUA and MWUA initial setting-up program based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 3,907 ha, and
- Rp. 78 million for a training program on operation and maintenance of tertiary irrigation systems based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 3,907 ha,

(4) Environmental Aspects (Refer to ANNEX-III (2/3), Part 2, Section 3.4)

Environmental assessment is now accepted as a key part of development planning and is as important as economic analysis in project evaluation. In this Study, however, such assessment has not yet been conducted, as the objective of the Study is to recover the function of the existing infrastructures. Nonetheless, environmental assessment for the rehabilitation project is no less important than that of a new development project as far as environmental impact exists. In this regard, it is proposed to carry out environmental assessment prior to the implementation of the project on the basis of the following law and regulation:

- Law No.23/1997 concerning environmental management, and
- Government Regulation No.27/1999 concerning environmental impact assessment

#### 5.2.4 Project Cost Estimate

(1) Conditions for Cost Estimate (Refer to ANNEX-III (2/3), Part 2, Section 4.1)

Project cost estimate of the Gung irrigation scheme is made with the same condition of Padang Mahondang irrigation scheme described in Section 5.1.4.

(2) Direct Construction Cost (Refer to ANNEX-III (2/3), Part 2, Section 4.2)

The direct construction cost is estimated at Rp. 33,783 million (equivalent to US\$ 1,045/ha or Rp. 8.7 million/ha, A= 3,906 ha). The breakdown of direct construction costs is shown in Table 5.2.1 and summarized as follows.

**Summary of Direct Construction Cost**

Work Description	Amount (million Rp.)
I. Headworks	5,581
II. Main Canal Works	963
III. Secondary Canal Works	16,146
IV. Drainage Works	1,711
V. On-Farm Development	7,812
VI. Project Facilities	1,570
Total	33,783



- (3) Other Costs
  - (a) Costs for the institutional and extension service strengthening:  
Rp. 659 x 1,000
  - (b) Cost for the consulting services: Rp. 2,291 x 1,000
  - (c) Administration cost: Rp. 775 x 1,000
- (4) Project Costs

The project costs are estimated at 37.7 billion as shown in the table below:

**Breakdown of Project Costs**

Work Description	Amount (million Rp.)
I. Civil works	33,783
II. Institutional and extension service strengthening	676
III. Consulting services	2,412
IV. Project administration cost	861
Total	37,732

**5.2.5 Project Implementation Schedule** (Refer to ANNEX-III (2/3), Part 2, Section 5.2.1)

The contents of the project implementation are almost same as the case of the Padang Mahondang scheme in North Sumatra Province as described in Section 5.1.5. Figure 5.2.3 shows the implementation schedule of the Gung irrigation scheme.

**5.2.6 Strengthening Program** (Refer to ANNEX-III (2/3), Part 2, Section 5.2.2)

The strengthening programs both institutional and extension service are to be executed in the same manner as the Padang Mahondang irrigation scheme in North Sumatra Province as described in Section 5.1.6.

**5.2.7 Project Evaluation**

The project evaluation of the Gung irrigation scheme is also made with the same manner as of the Padang Mahondang irrigation scheme. Results of evaluation are as stated below.

- (1) Project Benefits (Refer to ANNEX-III (2/3), Part 2, Section 6.2.2)

**Economic Project Benefits/Incremental Net Production Value <sup>\*1</sup>**

Net Production Value (million Rp.)		
Without Project	With Project	Increment
31,946	35,892	3,947

Note \*1: At full development stage

The benefits would gradually increase up to the full benefit in the 5<sup>th</sup> year after the completion of construction works.

- (2) EIRR, B/C and B-C (Refer to ANNEX-III (2/3), Part 2, Section 6.2.3)

**Results of Economic Analysis**

EIRR	B/C	B – C (million Rp.)
6.7%	0.76	-7,430

Note: B/C & B - C at 10% discount rate

- (3) Sensitivity Analysis (Refer to ANNEX-III (2/3), Part 2, Section 6.2.4)

**Results of Sensitivity Analysis**

Case		EIRR (%)
0. No Changes	-	6.7
1. Change in Project Costs	+ 10%	5.8
2. Change in Project Benefits	- 10%	5.6
3. Benefit Delay	1 year delay	5.9
4. 1 + 2 + 3	-	4.1

- (4) Financial Evaluation (Refer to ANNEX-III (2/3), Part 2, Section 6.3)

**Results of Farm Budget Analyses on 1 ha of Paddy Field**

Land Use Category	Net Reserve from 1Ha of Paddy Field (Capacity to Pay: Rp. 000)		
	Without Project	With Project	Increase
Irrigated Paddy Field	6,620	7,660	1,040

The incremental capacities to pay per ha of beneficiary farmers are estimated to be Rp. 1.0 million under the future with project condition. The increases would enable the farmers to bear their contributions to the O&M cost of the irrigation system.

- (5) Indirect Benefits and Socio-economic Impacts (Refer to ANNEX-III (2/3), Part 2, Section 6.4)

Expected major indirect benefits and socio-economic impacts include: i) improvement of living standards of farmers and ii) incremental production of paddy of some 2,200 tons under the with-project that will directly contribute to the supply-demand balance of rice and the food security in Indonesia.

## 5.3 South Sulawesi (Kalaena Kiri Scheme)

### 5.3.1 Present Conditions

(1) Natural conditions (Refer to ANNEX-III (3/3), Part 2, Section 1.1)

1) Location

The project area, the Kalaena Kiri Scheme, lies in Luwu Timur district of South Sulawesi province. Major cities situated near the project area are Woto and Maleku.

2) Meteorology and Hydrology

The annual rainfall is about 3,700 mm, and it is concentrated from December to July. However, it is difficult to distinguish between the wet season and the dry season. The annual average temperature is about 26.8°C, with very little seasonal variation throughout the year. The monthly average temperature varies from a maximum of 27.3°C in October to a minimum of 25.8°C in August.

The annual river runoff of the Kalaena River is approx. 70 m<sup>3</sup>/s, and the peak river runoff is observed in January to March every year, whereas the runoff in the dry season ranges between 47 m<sup>3</sup>/s and 50 m<sup>3</sup>/s.

3) River System and River runoff

The Kalaena river (total length: approx. 150 km) is the water resource for the irrigation of the project area, of which the catchment area at the intake site is approx. 1,070 km<sup>2</sup>. An intake weir is provided about 15 km upstream in the estuary of the Kalaena to irrigate both banks of the river. The registered area of the Kalaena Kiri Scheme extending to the left bank is 4,552 ha, whereas that of Karaena Kanan Scheme extending to the right bank is 14,422 ha. The intake structure site is approx. El. 40 meters above mean sea level, and that of the lowland area of the scheme is approx. El. 10 meters.

(2) Socio-economy (Refer to ANNEX-III (3/3), Part 2, Section 1.2)

Administratively the Scheme is located in Mangkutana and Angkona Sub-districts (the project sub-districts) of Luwu Utara District. The beneficiary area of the Scheme extends in seven villages (the project *desas*: 5 *desas* of Mangkutana & 2 *desas* of Angkona). The administrative area of the project sub-districts is 1,490 km<sup>2</sup> and that of the project *desas* is 415 km<sup>2</sup>.

The population of the project sub-districts was 42,143 and of the project *desas* was 13,896 in 2001. The number of households and the average family size in the sub-districts were 10,703 and 3.9 persons, respectively. In the *desas* they were

respectively 3,632 and 3.8. The rural population of the sub-district is 90% of the total.

(3) Present Conditions of the Irrigation Facilities (Refer to ANNEX-III (3/3), Part 2, Section 1.3)

1) General Situation

According to the Design Report prepared for the Irrigation Network in 1997, the general features of the irrigation and drainage facilities of the Kalaena Kiri Scheme are as follows.

**General Features of Irrigation and Drainage Facilities prepared in 1997**

Diversion Weir	1 no. (diversion weir with fixed weir, length of the weir: 104 m, construction: 1980)
Design intake discharge	8.5 m <sup>3</sup> /s for Kalaena Kiri scheme
Irrigation canals	Main canal: 19 km, Secondary canal: 9 nos.; 20km
Drainage canals	Main drainage canal: 10 km, Others: 8.5 km
Structures	42 nos. in irrigation canals, 8 nos. in drainage canals

Irrigation development projects for the Kalaena Kanan and Kalaena Kiri Schemes had commenced in 1980. Higher priority was given to the Kalaena Kanan Scheme as the beneficiary area was expected to be as large as 14,000 ha. Implementation of the Kalaena Kiri project was commenced in 1990. However, construction was concentrated only on the main and secondary canals and the major related structures of the main canal.

2) Investigation of the Existing Facilities

A field investigation of the existing irrigation facilities was carried out by the JICA Study Team during September and October 2003 in order to formulate the rehabilitation plan. The facilities subject to investigation are as follows: (Investigation results will be detailed in Section 3.2.)

- Diversion weir: 1 only
- Main canal: 1 only (total length: 19 km) and related structures
- Secondary canals: 4 canals (total length: 10 km) and related structures

The general layout of the existing condition is shown in Figure 5.3.1.

3) Present Conditions and Problems

The field investigation of the irrigation facilities has revealed the following problems exist with the Schemes.

- (a) Water flow in the Main Canal is obstructed by the collapse of canal banks and vegetation (weeds and small trees). In particular, unlined canals from the division structure BK.Ki 7 to the downstream reach are

heavily damaged due to collapse of both banks. Also, seepage and overtopping of water from the canal were observed elsewhere.

- (b) Most of the Secondary Canals are not used at present, and hence O&M is not actually practiced.
- (c) Most of the inspection roads along the Main and Secondary Canals are not utilized due to collapse and damage, especially at the secondary canals. They are almost impassable by a car with four-wheel drive even in the dry season.
- (d) Damage to the gates is not so serious, but maintenance such as greasing and painting is not practiced at all.

#### 4) Operation and Maintenance System

A water users association has been established in the tertiary blocks. Nonetheless, operation and maintenance systems are not active due to the following reasons:

- (a) Decrease of irrigated areas due to reduced function of irrigation facilities, and hence shortage of water.
- (b) Insufficient knowledge of water management and O&M of facilities.

#### (4) Agriculture (Refer to ANNEX-III (3/3), Part 2, Section 1.4)

##### 1) Agro-demography

The number of farm households of the project sub-districts and *desas* in 2002 was estimated at some 9,200 or accounting for 86% of the total households of 10,703 and some 2,910 or accounting for 80 % of the total households of 3,632, respectively.

The current land tenure status in the project sub-districts and *desa* is assumed to be nearly the same as the features of the Mangkutana Sub-district and the 5 project *desas* of Mangkutana. The land tenure status in the project *desas* accordingly assumed is owner and owner-cum-tenant farmers 95% and farm laborers 5%. The average holding size of paddy fields per beneficiary farm household in the Scheme is roughly estimated at about 1.4 ha based on the total area of paddy fields of about 4,000 ha and the number of beneficiary households of about 2,800.

##### 2) Land Use

The present land use of the Scheme has been estimated on the basis of the information provided by the branch offices of the District PSDA Sub-Services and by the village chiefs of the project *desas* as summarized below:

### Present Land Use

Paddy Field: Potential Area for Irrigation				Land Converted to Cacao Field	Original Potential Area for Irrigation
Irrigated Paddy Field	Rainfed Condition <sup>*1</sup>	Cacao Planted Field	Total		
2,375 ha	832 ha	830 ha	4,037 ha	450 ha	4,487 ha
59 %	21 %	21 %	100 %	-	-

Note \*1: Paddy field in irrigation command area being under rainfed condition.

### 3) Cropping Pattern and Cropping Intensity

The cropped area and cropping intensity in irrigated fields and in paddy fields being under rainfed conditions are similarly estimated based on the information provided by the District PSDA Sub-Services and the information provided by the village chiefs of the project *desas* as summarized below:

#### Cropped Area and Cropping Intensity

Crops/Items	Irrigated Paddy Field (2,791ha)	Rainfed Paddy Field (1,246ha)	Total (4,037ha)
Wet Season Paddy	2,375 ha	832 ha	3,207 ha
Dry Season Paddy	2,375 ha	-	2,375 ha
Annual Paddy	4,750 ha	832 ha	5,582 ha
Annual Cropping Intensity of Paddy	170 %	67 %	138 %
Cacao	416 ha	414 ha	830 ha
Overall Annual Cropping Intensity	185 %	100 %	159 %

Rainfed paddy field: Paddy field in irrigation command area being under rainfed condition.

### 4) Crop Yield and Production

The present yield levels of paddy in the Scheme are estimated as follows:

#### Current Crop Yields

Crops	Wet Season	Dry Season
Irrigated Paddy	4.0 ton/ha	4.0 ton/ha
Rainfed Paddy <sup>*1</sup>	3.0 ton/ha	-

Note \*1: Paddy in irrigated fields grown under rainfed conditions.

The present annual paddy production in the Scheme is estimated at some 21,500 tons as summarized below:

#### Present Crop Production

Crops	Wet Season (ton)	Dry Season (ton)	Annual (ton)
Irrigated Paddy	9,500	9,500	19,000
Rainfed Paddy <sup>*1</sup>	2,496	-	2,496
Total	11,996	9,500	21,496

Note \*1: Paddy in irrigated fields grown under rainfed conditions

### 5) Farming Practices and Crop Budget

The current prevailing farming practices of paddy are as follows:

### Farming Practices

Variety	Improved variety: Ciliwung & Sintanur (115 days)
Nursery	Seeding rate: 30 kg/ha; period 20 ~ 25 days
Land Preparation	By machinery (hand tractor)
Planting	Manual transplanting (regular); 20 x 20 cm
Fertilizer	NPK applied; volume depending
Harvesting	Manual; threshing by power/pedal thresher

Current crop budgets of major crops (irrigated & rainfed paddy) in the Scheme are as summarized in the following table:

### Financial Net Return per ha

Commodity	Yield (ton/ha)	Gross Return (Rp.000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy *1	4.0	5,200	2,030	3,170
Rainfed Paddy	3.0	3,900	1,480	2,420

Note \*1: Wet & dry season paddy

#### 6) Marketing

The prevailing marketing practice of paddy in the Scheme is “selling paddy just after harvest at field” followed by “selling rice after milling”. The prevailing marketing channel of paddy is “selling paddy to collector/middleman” followed by “selling paddy to KUD”.

#### 7) Farm Economy

The present farm economic analysis has been made on 1 ha of irrigated paddy field or rainfed paddy field by estimating net farm income from the field as follows:

### Estimated Net Farm Income from 1ha of Paddy Field

Land Use Category	Net Farm Income (Rp. 000)	Cropping Pattern Assumed
Irrigated Paddy Field	6,340	Double cropping of paddy (1 ha)
Rainfed Paddy Field	2,420	Single cropping of paddy (1 ha)

#### 8) Agricultural Support Institutions and Farmer Organizations

The main government agricultural support institutions providing technical and institutional support in and around the Scheme include two Rural Extension Services Centers (BPP), District Agriculture Services Office (yet to be established), Agricultural Extension Information Center (BIPP; yet to be established) and two seed farms. BPP and Field Extension Workers (PPL) will be placed under the BIPP.

Major farmer’s organizations involved in agricultural activities are Farmers’ Groups (*Kelompok Tani*/KT) and WUA. In the project 5 *desas* in Mangkutana sub-district, 22 KT with a total membership of about 623 are formed. Of 22 KT,

50% are classified as primary level (*pemula*), 45% as secondary level (*lanjut*) and 5% as middle level (*madya*).

There are 4 KUD and 10 KOPTAN in the project sub-district, though no UPJA is formed and no BRI Village Unit is operated in the project sub-district.

#### 9) Agricultural Extension

The number of PPL assigned to BPP in the project sub-districts is 13 and out of them 5 PPL are deployed in and around the Scheme. However, the activities of PPL are rather limited due to limitations of means of transportation, extension materials & equipment and operation funds. Extension programs scheduled in and around the Scheme in 2003 include an Intensification Quality Improvement Project (PMI: 100 ha) and a demonstration of the use of organic fertilizer.

#### (5) Institutional (Refer to ANNEX-III (3/3), Part 2, Section 1.5)

##### 1) District Government Authorities

The Luwu Utara District Government under the control of the Regent (*Bupati*) is composed of two secretariats, 17 internal units, 16 external units and 25 branches, having 5,048 civil servants as a whole. These civil servants consist of one first rank officers, 171 second rank, 1,520 third rank and 3,356 fourth rank officers and rank-and-file staff.

Actual receipts of the Luwu Utara District Government in 2000, when it was separated from the former Luwu District, were Rp.62,794 million mostly granted by the Provincial Government. On the other hand, actual expenditures in 2000 amounted to Rp.56,360 million. Out of these expenditures, Rp.19,019 million was allocated to development expenditures and only Rp. 100 million was distributed to water resources and the irrigation sector.

##### 2) District Water Resources Services Office

In Luwu Utara District, public administration of water resources and irrigation management aspects is the responsibility of the District Settlement and Rural Infrastructure Services through its Water Resources Management Sub Services. As illustrated in Figure 5.3.2, four sections are established with 29 staff under these Sub Services to manage irrigation schemes located in Luwu Utara District. This Sub-Services unit is responsible for 13 public irrigation schemes including the Karaena Kiri irrigation scheme. Among 13 irrigation schemes, there are six technical irrigation schemes commanding 22,710 ha and one semi-technical irrigation scheme covering 995 ha. Budget allocated to water resources and irrigation management in 2003 amounted to Rp.3,248 million including Rp.1,803 million from the APBD District.



Similar to other districts/municipalities in South Sulawesi, the planning mechanism of the water resources sector consists of two channels. One is a top-down development planning framework from national and provincial to district level, while the other is a bottom-up planning framework from village to district through sub-district. Specifically, the *Bupati* is responsible for reviewing any proposal from village/water users by referring to national, provincial and river basin water resources development and management policy frameworks. Prior to implementation, the *Bupati* should also ask for consultation of provincial agencies concerned and also feed back their recommendations to its proposed plan.

### 3) Water Users' Association (WUA)

It has been reported that the WUA establishment target in the Scheme is 49 and its achievement is 29. According to the latest monitoring and evaluation record made by the District Water Resources Management Sub Services office, 27 WUA are classified as "Under development and the remaining two WUA as "Not yet developed".

Through the inventory under this F/S, it has been confirmed that there are 33 tertiary blocks directly commanded by the main canal and 48 tertiary blocks covered by 14 sub/secondary canals. Out of these tertiary blocks, a WUA has been established in 30 tertiary blocks of which 22 are directly served by the main canal and 8 are commanded by 5 sub/secondary canals. Therefore, another 51 WUA have to be established. In 9 tertiary blocks commanded by Polo secondary canal, farmers have planted oil palm. Along the most downstream secondary canals, Bedo and Sarikko, only one WUA exists within 15 tertiary blocks.

Through face-to-face interview surveys with 110 WUA member farmers in 13 tertiary blocks and 28 non-member farmers based on the rapid rural appraisal method, it is confirmed that 1,205 farmers in total are the existing members of 30 WUA at present. The following are major items confirmed and pointed out by face-to-face interview respondents of 110 WUA member farmers:

- In 13 WUA interviewed, the board of directors is active in accordance with its articles and its member farmers are sure to attend its annual meeting,
- In 12 WUA where irrigation water is provided, cropping patterns, crop planting schedules and water allocation plans are prepared and practiced every crop season. In 1 WUA without irrigation water supply, because it is located in the most downstream part of the scheme, no crop planting and water allocation plans are available,
- In the above 12 WUA, a maintenance program for the irrigation facility

is prepared and practiced where facilities function. Coordination meetings with watermen of Luwu Utara District Settlement and Rural Infrastructure Services are regularly maintained. In the WUA located in the downstream area, the irrigation facility has been damaged but no rehabilitation plan has been prepared yet,

- Among 110 respondent members, only 2 farmers who are members of the board of directors have paid Rp. 150,000/ha as seasonal contribution to the WUA. The remaining 108 respondents have not paid membership fees or irrigation water charges in cash or in kind. The reason is that the contribution and compulsory maintenance work are considered to offset each other, and
- Beneficiary farmers are transmigrants from different locations in Java, Bali, Lombok and Sulawesi so that their behavior toward and awareness of operation and maintenance of tertiary systems also reflects their own customs and way of thinking. It is therefore very difficult to practice on-farm level irrigation water management activities in a uniform manner.

Focal points of responses from 28 farmers who are not WUA members are as follows:

- All respondents are forced to grow paddy under rainfed conditions and are looking forward to receiving irrigation water to their paddy fields as they have good experience of irrigated farming before they transmigrated to the Scheme,
- They know the purpose and function of the WUA as well as member's duties, especially their obligation for operation and maintenance of the tertiary system,
- Farmers who have planted cacao on their paddy fields prefer paddy cultivation because cacao productivity is below their expectation, and
- They intend to participate in a WUA when it is established.

### **5.3.2 Basic Considerations in Formulating Rehabilitation Plan**

(1) Irrigation (Refer to ANNEX-III (3/3), Part 2, Section 2.1)

1) Rehabilitation Plan for Irrigation Facilities

The rehabilitation plan will be based on field investigation results and the discussions with the officials of the provincial government concerned and the project management office as follows:

- (a) To maximize the utilization of potential of water and land so as to increase cropping intensity (throughout the year) and crop productivity.

- (b) To utilize existing facilities to the utmost possible extent in due consideration of the factors of durability.
- (c) To design diversion/turnout structures by providing water measurement devices to introduce an appropriate water management technology.
- (d) To provide infrastructures with inspection roads and farm roads for O/M of irrigation facilities and access for future mechanized farming.
- (e) To provide project facilities such as site operation houses (50m<sup>2</sup>/house), vehicles, motor cycles, and office equipment for the project office.

According to inventory survey results, the main features of the irrigation facilities are as follows:

#### Features of Irrigation Facilities

Facility	Number	Length (km)	No of Structures
Diversion Weir	1	w=104 m (fixed type weir)	Right & left intakes
Main Canal	1	18.989	33
Secondary Canal	9	19.891	17

The main canal is lined with masonry for about 7.7 km from the diversion weir and the remaining 11.3 km is unlined canal with a trapezoidal section. The structures on the irrigation canals consist of 19 diversion structures, 3 drops made of stone masonry, and bridges, a siphon and a drainage culvert made of reinforced concrete.

The structural condition of the facilities was investigated and assessed based on the following classification:

- A: Functioning well, no rehabilitation is needed.
- B: Partially damaged/deteriorated, minor rehabilitation is needed.
- C: Not functioning well, large-scale rehabilitation is needed.
- D: Seriously damaged, replacement or reconstruction is needed.

The structural conditions of the main canals are summarized as follows:

#### Condition of Facilities

Facility	Condition				Total
	A	B	C	D	
Canal (km)	3.80	1.95	1.97	11.27	18.99
Structure (nos.)	1	11	21	0	33

Based on the irrigation map prepared by the Balai, discussion was undertaken between the Dinas PSDA and the Balai in order to determine the maximum irrigation area. As a result, 4,037 ha will be irrigated if the water resource availability is sufficient. (It was verified that the land with an area of 4,037 ha will

be irrigated through the water balance study made, and hence, the subject area is fixed at 4,037 ha.)

(2) Agriculture (Refer to ANNEX-III (3/3), Part 2, Section 2.2)

The basic concepts applied for the formulation of the agricultural plan under the present Study are as enumerated below.

- (a) The formulation of agricultural plans by placing emphasis on paddy production envisaging contribution to food security in Indonesia and setting a double cropping of paddy as a basic cropping pattern. A general consensus of the representatives of beneficiaries of the Scheme was obtained for this at the preliminary public consultation meeting held during the Phase II Study. The exception applied for the beneficiaries in the area (command area of Polo Secondary Canal, 450 ha) where cacao trees at fruit bearing stage are planted. This secondary canal was closed for a long period to protect cacao trees from wet injury and no tertiary development was carried out.
- (b) Re-conversion of cacao planted fields to irrigated paddy fields is planned based on the general consensus for the re-conversion attained (on the condition that irrigation water supply for double cropping of paddy is ensured) by the representatives of all beneficiary *desas* except for the command area of the Polo Secondary Canal at the said public consultation meeting.
- (c) The irrigation agriculture performances and experiences in the advanced schemes in South Sulawesi Province are to be fully taken into consideration in the formulation of the agriculture plan.
- (d) The current agricultural status including crop selection, cropping schedule, cropping pattern and cropping intensity in the target schemes should duly be assessed and taken into account in the planning so that the formulated plans will be sustainable for 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 3<sup>rd</sup> cropping season (cropping season following or between the double crops of paddy) is to be achieved to the greatest possible extent, to which the consensus of beneficiaries should be sought at a subsequent project stage.
- (f) Major constraints for the attainment of the agriculture development targets are to be duly addressed to the greatest possible extent in the agricultural extension services strengthening. To this effect,

strengthening of Farmers' Groups (KT) should be emphasized aiming at the promotion of agri-business oriented farming activities in the Scheme.

- (3) Institution Strengthening Concept (Refer to ANNEX-III (3/3), Part 2, Section 2.3)

The current situation of WUA performance in the Scheme can be described as a mixed status of "WUA already established but not developed yet" and "WUA not established yet". The main reason is the present function of the irrigation system under which sustainable irrigation water supply can only be guaranteed to a part of the beneficiary area resulting in limited fulfillment of farmers' water requirements. Therefore, full recovery of the irrigation system's function is a precondition to encourage farmers to accelerate establishment of WUA and participate in WUA to be newly established. Amongst farmers in non-WUA tertiary blocks of the Scheme it is necessary to pay special attention to familiarity with irrigated farming practices and awareness of the duty of WUA members. Promotion to accelerate WUA establishment is to be started when implementation of rehabilitation works is decided. Farmers presently planting cacao on their paddy fields intend to convert from cacao to paddy if irrigation water supply is guaranteed after the function of the irrigation scheme is fully recovered.

Another concept for institutional strengthening is to enable irrigation officials in Luwu Utara District to understand and practice the new irrigation management policy and also to improve the capacity of organization units involved in irrigation management and those staff capabilities in line with the new irrigation management policy.

The target of institutional strengthening is to establish WUA in the whole service area of the Scheme and to practice collection of irrigation management fees as membership fees of WUA in the form of either "in cash" or "in kind".

### **5.3.3 Development Plan**

- (1) Determination of Irrigation Area (Refer to ANNEX-III (3/3), Part 2, Section 3.1)

- 1) Intake Discharge Available from the Kalaena River

To assess the required intake discharge for the Kalaena Kanan and Kiri Schemes, a preliminary estimate was made with the following conditions:

Area: Total 18,500ha (Kanan 14,000 ha, Kiri 4,500 ha)

Design diversion requirement:  $Q = 1.60$  liters/s/ha (maximum)

Based on the above conditions, the maximum diversion discharge at the diversion weir site is estimated at approximately 30 m<sup>3</sup>/s (Right: 23 m<sup>3</sup>/s, Left 7 m<sup>3</sup>/s). Judging from the average runoff of 58 m<sup>3</sup>/s, water demand for the Kalaena Project (Kanan and Kiri) will be satisfied by the river runoff.

## 2) Project Area

As there is no constraint to supply irrigation water under the present rehabilitation plan, the target area for the present development plan was finally determined to be 4,037 ha by excluding the command area of the Polo Secondary Canal (450 ha), where there are cacao trees at the full fruit bearing stage, as shown below:

**Project Area**

Original Potential Area	4,487 ha
Command Area of Polo Secondary Canal (Cacao Planted Land)	450 ha
Project Area	4,037 ha

The rehabilitation of the irrigation system and the development of irrigated paddy fields in the entire project area are proposed under the present rehabilitation plan aiming at the recovery of sustainable irrigation agriculture in the area and the improvement and enhancement of land productivity of the project area.

## 3) Assessment of Water Demand in the Field

The irrigation water requirements have been estimated based on a planning guideline prepared by MOSRI. Consumptive use of water has been estimated on the basis of the modified Penman method proposed by FAO. A percolation rate of 2 mm/day is applied for the dry season paddy, and 1 mm/day for the wet season paddy. The water requirement for land preparation for paddy is assumed to be 150 mm. The overall irrigation efficiency is assumed to be 60%.

On the conditions and assumptions stated above, the unit diversion irrigation water requirement for paddy is estimated at 1.55 liters/s/ha (in August).

## 4) Confirmation of Available Water from the Kalaena River

Based on the calculation results stated above, the intake discharge at the intake weir site is estimated at  $Q_L = 6.257 \text{ m}^3/\text{s}$  for the maximum irrigation area of 4,037 ha, and  $Q_R + Q_L = 28 \text{ m}^3/\text{s}$  for the total irrigation area of 18,037 ha including the right bank area. As the average runoff of the Kalaena river is 58 m<sup>3</sup>/s, and probable runoff expected 4 out of 5 years is estimated at 30 m<sup>3</sup>/s, water demand for the both project areas of Kalaena will be satisfied by the river runoff.

- (2) Rehabilitation Plan for Irrigation Facilities (Refer to ANNEX-III (3/3), Part 2, Section 3.2)

Grade of Rehabilitation

Design of rehabilitation of irrigation facilities has been carried out on the basis of the inventory survey results of the respective irrigation facilities. Design of rehabilitation has been made considering a) an estimate of the degree of damage of facilities by using the survey results and the photos, b) preparation of design drawings for rehabilitation, and c) an estimate of quantities and costs. All the existing facilities are classified into 4 rehabilitation grades, namely RG1 to RG4.

Rehabilitation Plan

The features of the rehabilitation of the respective facilities consisting of the diversion weir, main canal and related structures of the main canal are summarized below:

**Summary of Rehabilitation Works on Irrigation Facilities**

Facilities	Works of Rehabilitation
1. Diversion Weir	<ul style="list-style-type: none"> <li>- Removal of sediment in front of the intake, scouring sluice and upstream apron</li> <li>- Repair of the stilling basin</li> <li>- Provision of protection works downstream of the stilling basin by concrete blocks and gabion river protection blocks</li> <li>- Provision of a new settling basin near the diversion weir</li> <li>- Repair of gate works and provision of a trash rack in front of the intake</li> </ul>
2. Irrigation Canals	<ul style="list-style-type: none"> <li>- Removal of sedimentation inside of the canal</li> <li>- Provision of drainage ditch and facilities at the excavation section of canal</li> <li>- Provision of concrete lining in the unlined section</li> <li>- Provision of kilometer and hectometer posts for O&amp;M</li> </ul>
3. Related structures	<ul style="list-style-type: none"> <li>- Repair of gates</li> <li>- Repair/provision of measuring devices</li> <li>- Provision of safety facilities at the siphon and aqueduct</li> <li>- Removal of clogging/sedimentation inside of the drainage culvert</li> <li>- Provision of bridges for O&amp;M and for rural infrastructures</li> </ul>
4. Inspection Roads	<ul style="list-style-type: none"> <li>- Repair of whole length and provision of gravel pavement</li> <li>- Provision of related facilities such as ditches, drain inlets, and safety facilities</li> </ul>
5. On-farm Terminal Facilities	<ul style="list-style-type: none"> <li>- Provision of appropriate facilities as standard requirements</li> <li>- Provision of gravel pavement for farm machinery</li> </ul>

- (3) Agriculture (Refer to ANNEX-III (3/3), Part 2, Section 3.3)

1) Land Use Plan

The entire project area had once been developed for irrigated paddy fields with tertiary facilities in the past. Parts of the paddy fields are under rainfed conditions

and planted with young cacao trees at present. In the agriculture land use plan, the recovery of paddy fields currently under rainfed conditions and the re-conversion of cacao planted fields into irrigated paddy fields are envisaged as follows:

**Land Use Plan**

Land Use Category	Present (ha)	With Project (ha)	Increment (ha)
Irrigated Paddy Field	2,375	4,037	1,662
Rainfed Paddy Field	832	-	- 832
Cacao Planted Paddy Field	830	-	- 830
Project Area	4,037	4,037	0
Tree Crop Land (alih fungsi)	450	450	0
Original Potential Area	4,487	4,487	0

The re-conversion of cacao planted fields is the general consensus of the representatives of subject beneficiary *desas* as stated earlier.

## 2) Planned Cropping Pattern and Schedule

Under the present Study, the selection of crops to be introduced in the planned cropping pattern has been made basically observing the current cropping patterns prevailing in the Scheme, which represent farmers' intention 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 the whole Scheme from the farmers' preferences for a crop and the volume of market demands. As most of the beneficiaries are transmigrants from Java, Bali and Lombok, it is expected that the introduction of the double cropping will be achieved as planned,
- (b) For the rational utilization of irrigation water resources, the increase of cropping intensity with the available water in the cropping season between the double crops of paddy (dry season I) by introducing palawija is envisaged to a possible extent, and
- (c) Maize, palawija currently cropped in the Scheme or its surroundings, was selected as a crop in the 2<sup>nd</sup> cropping season following the 1<sup>st</sup> paddy. Maize (hybrid) has been selected as it appears to be the most promising crop among palawija from national economic and marketing view points. The palawija area has been set at 10% of the scheme area in the dry season I.

The planned cropping pattern and schedule have been formulated on the basis of: i) current cropping pattern & schedule in the Scheme, ii) recommended cropping schedules of an agriculture agency, iii) climatic conditions and iv) water balance study.



### 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 scheme under the present Study are planned as summarized below:

**Planned Cropped Area & Cropping Intensity**

Crop	Wet Season		Dry Season I		Dry Season II		Annual	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Paddy	4,037	100	-	-	4,037	100	8,074	200
Palawija *1	-	-	404	10	-	-	404	10
Cacao	-	-	-	-	-	-	0	0
Total	4,037	100	404	10	4,037	100	8,478	210

Note \*1: Hybrid maize

The increase of annual cropped area of some 2,500 ha of paddy and about 400 ha of palawija from the present level is planned under the Study. Further, an increase of paddy cropping intensity of 62%, of palawija cropping intensity of 10% and of overall intensity of 51% is envisaged. A decrease of cacao planted area of 830 ha will result of the re-conversion of the area.

### 4) Target Crop Yields and Crop Production Plan

Target yields of paddy and palawija have been estimated based on yield levels attained by advanced farmers in the Scheme, yield levels in advanced irrigation schemes in Luwu Utara District and information on potential yield levels provided by the Extension Coordinator as shown below.

**Target Yields under the Study**

Cropping Season/Crops	Present Yield	Target Yield	Increase
Wet Season Irrigated Paddy	4.0 ton/ha	5.0 ton/ha	1.0 ton/ha
Dry Season Irrigated Paddy	4.0 ton/ha	5.0 ton/ha	1.0 ton/ha
Wet Season Rainfed Paddy *1	3.0 ton/ha	-	-
Palawija (hybrid maize)	-	5.0 ton/ha	-
Cacao (dry bean) *2	Not fruiting	-	-

Note \*1: Paddy grown being under rainfed condition in irrigation command area

\*2: Fruiting age: from 3<sup>rd</sup> year to over 20th year --- yield level 0.6 ~ 1.7 ton/ha

On the basis of the target crop yields and the planned cropping pattern, production increases of some 18,900 tons of paddy and 2,000 tons of palwija (maize) are estimated under the with-project condition. On the other hand, the annual decreases of production volumes of cacao bean are estimated to be in the range of 500 to 1,400 tons from the without project condition.

## 5) Crop Budgets

The planned crop budgets per ha for irrigated paddy and palawija (maize hybrid) are estimated as summarized in the following table:

**Planned Crop Budget per ha**

Crops	Yield (ton/ha)	Gross Return (Rp. 000)	Production Cost (Rp. 000)	Net Return (Rp. 000)
Irrigated Paddy (wet/dry season)	5.0	6,500	2,380	4,120
Maize (hybrid)	5.0	5,000	2,180	2,820

## 6) Farm Economy

The farm economic analyses have been made on 1 ha of irrigated paddy field or rainfed paddy field by estimating net farm income from the fields as discussed earlier in Section 5.3.1 as shown below.

**Estimated Net Farm Income from 1ha of Field**

Land Use Category	Net Farm Income (Rp. 000)			Cropping Pattern Assumed
	Present	With Project	Increment	
Irrigated Paddy Field	6,340	8,522	2,182	Paddy (1ha) - maize (0.1ha)
Rainfed Paddy Field	2,420	8,522	6,102	- paddy (1ha)

## 7) Agriculture Extension Services Strengthening Plan

The programs for agriculture extension services strengthening (AESS) formulated to meet the requirements are summarized as follows:

### Institutional Strengthening Package Program

- Establishment of regional & sub-regional task force team for AESS
- Staff empowerment program (capacity building of regional, sub-regional & extension staff)
- Strengthening of extension facilities (BPP)

### Farmer Organization Empowerment Package Program

- KT empowerment sub-program
- UPJA formation sub-program
- Agribusiness promotion package program

### Technical Guidance Package Program

- Technical development, technical demonstration, farmer/farmer group training, study tour, field school etc.

### Participation Enhancement Package Program

- Workshops at sub-district & district etc.

The implementation of these strengthening programs should be started from the commencement of the construction works for the period of at least 5 years or up to 3 years after the completion of the construction works.

- (4) Institutional Strengthening Plan (Refer to ANNEX-III (3/3), Part 2, Section 3.4)

The institutional strengthening plan for the Scheme consists of two programs in the initial stage, i.e. institutional capacity building and staff capability improvement program, and WUA establishment acceleration program. For each WUA already established, four programs will be implemented to upgrade WUA activities. These are WUA strengthening program, the FWUA and MWUA initial setting-up program, on-the-job training program on operation and maintenance of tertiary irrigation systems, and guidance program for setting and collection of irrigation service fees. For each WUA to be newly established, these four programs will be also carried out as follow-up measures in parallel with implementation of the rehabilitation works of the irrigation scheme.

- 1) Institutional Capacity Building and Staff Capability Improvement Program

This program contains two components. One is to enable irrigation officials of Luwu Utara District to understand and practice the new irrigation management policy. The other is to improve the capacity of organization units of Luwu Utara District Government involved in irrigation management and those staff capabilities in line with the new irrigation management policy.

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

The second component should reflect the above nationwide dissemination of the new irrigation policy by the central government. This component will be done as follows:

- To evaluate the capacity of district/municipal government authorities and the capability of those staff 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 budget arrangements for these implementation programs, the main source is the Luwu Utara District Government budget to cover the cost for institutional capacity building and staff capability improvement, while the supplemental source is the 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 consultants, NGOs and universities. Monitoring and supervision of the program implementation should be carried out continuously by relevant organization units at the provincial level throughout the program implementation stage with periodical reporting on performance and impact of the program implementation.

## 2) WUA Establishment Acceleration Program

To accelerate WUA establishment up to the target level in the Scheme in order to ensure participatory irrigation management, the program is to be implemented based on the following steps:

- hold socialization meetings and workshops to invite representatives and members of Farmers' Groups which are available in non-WUA tertiary blocks for the purpose of accelerating WUA establishment and promoting participatory irrigation management,
- confirm farmer's awareness for establish and participate in WUA as well as farmer's needs for guidance about procedures and practices 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 the unit cost of each guidance menu and the total cost of the package program.

Budget to implement the package program for WUA establishment acceleration is to be covered by the project financing.

In implementing the WUA establishment acceleration program before starting rehabilitation works, consultants, NGOs and/or university representatives are to be recruited as facilitators and supporters in the irrigation command area.

## 3) WUA Strengthening Program

The WUA Strengthening Program will be conducted based on the following steps:

- hold WUA awareness raising workshops to address weak points elaborated from recapitulating data on the latest monitoring and evaluation (M&E) record on WUA performance,
- identify technical assistant requirements for improving WUA capacity to manage organization, capability to conduct operation and maintenance of tertiary irrigation systems, and/or activities to set and collect WUA member's fees,
- formulate a technical assistant menu list and make a package program of technical assistance menus according to WUA needs to improve its capacity, capability and/or activities, and
- estimate the unit cost of each technical assistant menu and the total cost of the package program.

Budget for implementing the package program for strengthening WUA is to be covered by the project financing.

In implementing the WUA strengthening program before starting rehabilitation works, consultants, NGOs and/or university representatives are to be recruited as facilitators and implementers in the irrigation scheme area.

#### 4) FWUA and MWUA Initial Setting-up Program

The FWUA and MWUA initial setting-up program will be conducted based on the following steps:

- imbue the local society with the necessity of setting up representative groups of WUA to cope with the participatory irrigation management policy if an 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 an FWUA/MWUA according to the current situation in the Scheme, and
- estimate the unit cost of each guidance menu and the total cost of the package program.

Budget for implementing the initial setting-up program of an FWUA and MWUA is to be covered by the project financing.

In implementing the initial setting-up of the FWUA and MWUA program, consultants, NGOs and/or university representatives are to be recruited as facilitators and supporters in the irrigation scheme area.

#### 5) Training Program on Operation and Maintenance of Tertiary Irrigation Systems

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

As this training will be done as one of the rehabilitation project components, a consultant under the project manager is responsible for preparing training manuals, formulating training programs, estimating training costs and implementing training programs. To ensure effective and efficient implementation of training on operation and maintenance of tertiary irrigation systems, NGOs and other volunteers will be encouraged to become involved in training activities at the field level in addition to the project staff, District Government officials and consultant.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

#### 6) Guidance Program for Setting and Collection of Irrigation Management Fee

In parallel with preparation of the guidance manuals, the following points will be considered:

- identify issues with book keeping systems, fee determination methods, payment forms, fee collection systems and payment schedules,
- identify issues affecting fee allocation systems to cover administration, operation, maintenance and other miscellaneous costs,
- identify incentives to members,
- formulate a guidance menu list and a package program of guidance menus for collection and expenditure of irrigation service fees, and
- estimate the unit cost of each guidance menu and the total cost of the package program.

Budget arrangements based on the consultant's cost estimate are the responsibility of the project manager.

In formulating and implementing the guidance program for collection and expenditure of irrigation service fees, special attention will be paid to recruit a consultant with specific experience matching with the above terms.

#### 7) Cost Estimate for Institutional Strengthening Plan

The overall cost for the proposed institutional strengthening plan in the above is estimated at Rp. 396 million in total. The breakdown of estimated cost is as follows:

- Rp. 10 million for Institutional capacity building and staff capability improvement program for the Water Resources Sub-service of Luwu Utara District *KIMPRASWIL* based on a unit cost of Rp. 5 million and 2-time implementation,
- Rp. 33 million for a WUA establishment acceleration program targeting beneficiary farmers in non-WUA tertiary blocks based on a unit cost of Rp. 20,000/ha and the existing WUA coverage area of 1,662 ha,
- Rp. 48 million for a WUA strengthening program to upgrade WUA based on a unit cost of Rp. 20,000/ha considering the existing level and WUA coverage area of 2,375 ha,
- Rp. 81 million for an FWUA and MWUA initial setting-up program based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 4,037 ha,
- Rp. 143 million for a training program on operation and maintenance of tertiary irrigation systems based on a unit cost of Rp. 35,400/ha and the proposed recovery area of 4,037 ha, and
- Rp. 81 million for a guidance program for setting and collection of irrigation management fees based on a unit cost of Rp. 20,000/ha and the proposed recovery area of 4,037 ha.

(5) Environmental Aspect (Refer to ANNEX-III (3/3), Part 2, Section 3.5)

Environmental assessment is now accepted as a key part of the development planning and is as important as economic analysis in project evaluation. In this Study, however, such assessment has not been conducted, as the objective of the Study is to recover the function of the existing infrastructures. Nonetheless, environmental assessment for a rehabilitation project is no less important than that of a new development project as far as environmental impact exists. In this regard, it is proposed to carry out an environmental assessment prior to the implementation of the project on the basis of the following law and regulation:

- Law No.23/1997 concerning environmental management, and
- Government Regulation No.27/1999 concerning environmental impact assessment

#### **5.3.4 Project Cost Estimate**

(1) Condition for Cost Estimate (Refer to ANNEX-III (3/3), Part 2, Section 4.1)

Project cost estimate of the Kalaena Kiri irrigation scheme is made with the same conditions of other 2 irrigation schemes described in Sections 5.1.4 and 5.2.4.

(2) Direct Construction Cost (Refer to ANNEX-III (2/3), Part 2, Section 4.2)

The direct construction cost is estimated at Rp. 54,959 million (equivalent to US\$ 1,740/ha or Rp. 14.4 million/ha, A= 4,037 ha). The breakdown of direct construction costs is shown in Table 5.3.1 and summarized as follows:

**Summary of Direct Construction Cost**

Work Description	Amount (million Rp.)
I. Headworks	6,800
II. Main Canal Works	18,778
III. Secondary Canal Works	15,670
IV. Drainage Works	3,445
V. On-Farm Development	8,697
VI. Project Facility	1,570
Total	54,959

(3) Other Costs

(a) Costs for the institutional and extension service strengthening:

Rp. 1,100 x 1,000

(b) Cost for the consulting services: Rp. 3,924 x 1,000

(c) Administration cost: Rp. 1,402 x 1,000

(4) Project Costs

The project costs are estimated at 61.4 billion as shown in the table below:

**Breakdown of Project Costs**

Work Description	Amount (million Rp.)
I. Civil works	54,959
II. Institutional and extension service strengthening	1,100
III. Consulting services	3,924
IV. Project administration cost	1,402
Total	61,385

**5.3.5 Project Implementation Schedule** (Refer to ANNEX-III (3/3), Part 2, Section 5.2.1)

The contents of the project implementation are almost same as the case of the schemes in North Sumatra and Central Java Provinces as described in Sections 5.1.5 and 5.2.5. Figure 5.3.3 shows the implementation schedule of the Kalaena Kiri irrigation scheme.

**5.3.6 Strengthening Program** (Refer to ANNEX-III (3/3), Part 2, Section 5.2.2)

The strengthening programs both institutional and extension service are also to be executed in the same manner with 2 irrigation schemes in North Sumatra and Central Java Provinces as aforesaid in Sections 5.1.6 and 5.2.6.



### 5.3.7 Project Evaluation

The project evaluation of the Kalaena Kiri irrigation scheme is also made with the same manner as of the aforesaid 2 irrigation schemes. Results of evaluation are as stated below.

- (1) Project Benefits (Refer to ANNEX-III (3/3), Part 2, Section 6.2.2)

#### Economic Project Benefits/Incremental Net Production Value \*<sup>1</sup>

Net Production Value (million Rp.)		
Without Project	With Project	Increment
15,532 ~ 23,608	35,107	11,499~19,575

\*1: At full development stage

The benefits would gradually increase up to the full benefit in the 5<sup>th</sup> year after the completion of construction works

- (2) EIRR, B/C and B-C (Refer to ANNEX-III (3/3), Part 2, Section 6.2.3)

#### Results of Economic Analysis

EIRR	B/C	B - C
12.1%	1.29	Rp. 13.9 billion

B/C & B - C at 10% discount rate

- (3) Sensitivity Analysis (Refer to ANNEX-III (3/3), Part 2, Section 6.2.4)

#### Results of Sensitivity Analysis

Case		EIRR (%)
0. No Changes	-	12.1
1. Change in Project Costs	+ 10%	11.4
2. Change in Project Benefits	- 10%	10.5
3. Benefit Delay	1 year delay	10.4
4. 1 + 2 + 3	-	8.5

- (4) Financial Evaluation (Refer to ANNEX-III (3/3), Part 2, Section 6.3)

#### Results of Farm Budget Analyses on 1 ha of Paddy Field

Land Use Category	Net Reserve on 1 Ha of Paddy Field (Capacity to Pay:Rp. 000))		
	Without Project	With Project	Increase
Irrigated Paddy Field * <sup>1</sup>	6,340	7,670	1,330
Irrigated Paddy * <sup>2</sup>	2,420	6,820	4,400

\*1: Farmers in current irrigated field

\*2: Farmers in current irrigation command area being under rainfed condition

The incremental capacities to pay per ha of beneficiary farmers are estimated to be Rp. 1.3-4.4 million under the future with project condition. The increases would enable the farmers to bear their contributions to the O&M cost of the irrigation system.

(5) Indirect Benefits and Socio-economic Impacts (Refer to ANNEX-III (3/3), Part 2, Section 6.4)

Expected major indirect benefits and socio-economic impacts are: i) creation of employment opportunities, ii) improvement of living standards and increase of purchasing power of farmers resulted from increase of farm incomes, iii) expansion of marketing activities of farm inputs and outputs, and iv) incremental production of paddy of some 18,900 tons under the with project that will directly contribute to the supply-demand balance of rice and the food security in Indonesia.

## **CHAPTER 6 GUIDELINE FOR REHABILITATION OF IRRIGATION FACILITIES**

### **6.1 Prerequisite Conditions**

The Guideline for Rehabilitation of Irrigation Facilities is the main focus in the Recovery Program of Irrigation Agriculture (RPIA). The approaches and institutional frameworks for the RPIA have to be established by the Indonesian Authority in line with the irrigation management policy which is under modification aiming at adjustment to the spirit of the draft Law on Water Resources that has been under deliberation in the House of Representatives. Therefore, at the stage of the preparation of the Guideline, the concrete concepts for the frameworks had not yet been established. Accordingly, the following assumptions have been applied to the preparation of the Guideline:

- (a) The definition of “Irrigation Management” is a comprehensive activity covering from planning to design, construction, rehabilitation, upgrading, operation, maintenance and securing of irrigation systems as well as quality conservation of irrigation water;
- (b) The basic concept of Irrigation Management is to have farmers’ participation in every stage of the above-mentioned Irrigation Management activities through input of initial ideas, agreement of decision making and, among others, shouldering of responsibility for construction, operation and maintenance of tertiary irrigation systems;
- (c) Irrigation Management is to be done on an irrigation scheme basis, not an administration unit basis;
- (d) Farmers are, in principle, represented by the Chairman and Technical Directors of Water Users Associations (WUA) established in every tertiary block of an irrigation scheme;
- (e) If WUA have been organized into a Federation of WUA (FWUA) as commanded by one secondary canal of the irrigation scheme, the Chairman of the FWUA acts as one of the stakeholders for the water users. In the case that FWUA have been organized into a Main Federation of WUA (MWUA) as an apex scheme-level organization, the Chairman of the MWUA is also considered as one of the stakeholders for the water users;
- (f) Authority and responsibility for Irrigation Management among government institutions concerned are to be arranged as below:
  - Irrigation schemes with a command area of less than 1,000 ha and located within one District/Municipality under the jurisdiction of

- district/municipal government,
  - Irrigation schemes commanding 1,000 ha and more and located in one Province as well as inter-Districts/Municipalities irrigation schemes with a command area of 500 - 1,000 ha and located in more than one District/Municipality under the jurisdiction of provincial government, and
  - Irrigation schemes located in more than one Province under the jurisdiction of central government.
- (g) In performing Irrigation Management activities, budget allocation criteria as well as budget utilization mechanisms and procedures should be followed once all relevant government regulations and ministerial decrees are adjusted to the spirit of the draft Law on Water Resources;
- (h) Rehabilitation of irrigation systems as one of the Irrigation Management activities should be conducted based on the above-mentioned jurisdiction as well as the participatory irrigation management concept; and
- (i) Rehabilitation of irrigation systems should be conducted step-by-step starting from justification of irrigation system rehabilitation needs to implementation of rehabilitation works followed by monitoring and evaluation.

## **6.2 Anticipated Classes of Users and Regions of Guideline**

The Guideline has been prepared for experts in central and local governments and consultants who have about 10 years experience and a basic knowledge of planning, design, and construction of irrigation and drainage development projects.

The contents and descriptions of the Guideline are generally applicable to most cases of rehabilitation works in the entire country of Indonesia. However, this does not necessarily mean that the Guideline can be applied uniformly in all cases.

## **6.3 Composition of the Guideline**

The composition of the Guideline is as follows:

### Introduction

- Assumptions
- Scope of the Guideline
- Terminology
- Staged Planning and Prioritization of Irrigation Schemes for Rehabilitation
- Full Participatory Approach
- How to Use the Guideline

### I. Pre-feasibility Study for Prioritization of Irrigation Schemes

Stage 01: First Screening of Irrigation Schemes for Rehabilitation

Stage 02: Pre-F/S Level Field Investigation

Stage 03: Determination of Subject Area and Second Screening of Irrigation Schemes by Water Resources Availability

Stage 04: Formulation of Pre-F/S Level Rehabilitation Plan and Third Screening of Irrigation Schemes

Stage 05: Prioritization of Irrigation Schemes for Rehabilitation and Preparation of Action Plan

### II. Feasibility Study

Stage 06: Formulation of F/S Level Rehabilitation Plan and Preparation of Implementation Program

### III. Implementation

Stage 07: Implementation and Commencement of Operation

The Guideline is presented in Volume 2, ANNEX-I to this Report.

## CHAPTER 7 TECHNOLOGY TRANSFER

### 7.1 General

The technology transfer is the one of main object on the Study. The object of the technology transfer is that:

“Carry out technology transfer to Indonesian counterpart personel through on-the-job-training during the Study in order to upgrade their capability for planning and provide a methodology for the rehabilitation of irrigation schemes.”

### 7.2 The First Field Work in Phase 1

#### 7.2.1 Counterparts

The field work of Phase 1 commenced on February 23, with a schedule for completion on July 15, 2003. During this period, the following four (4) counterparts have been assigned:

**Counterparts and Their Tasks**

No.	Counterpart Tasks	Name
1.	Chief Counterpart	Ir. Bambang Sudiby, MSc
2.	Irrigation Engineer	Ir. Tagor Pane, ME
3.	Agronomist	Ir. Slamet Sugeng, MSc
4.	Institutional Expert	Ir. Sudarmanto

#### 7.2.2 Technology Transfer during the First Field Work

- (1) Evaluation of the bidding results of entrusted works to an Indonesian consultant

Bidding for the entrusted works to an Indonesian consultant consisting of (i) inventory survey of irrigation facilities, and (ii) collection of information on institutional and agricultural conditions was made during the period from end of March to beginning of April, 2003.

The Study Team together with the Counterpart Personnel carried out an evaluation of the bidding results for these entrusted works. The major work conducted by the Study Team together with the counterpart personnel was as follows:

- (a) Evaluation of submitted documents,
  - (b) Checking of implementation organization,
  - (c) Evaluation of bid prices, and
  - (d) Overall evaluation and selection of contractor.
- (2) Preparation of list for the irrigation schemes to be studied

The Study team, together with the counterpart personnel, examined the criteria for the selection of the schemes to be studied. The criteria thus finalized are as follows:

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

(3) Contents of Progress Report (1)

The Study Team and the counterpart personnel had a series of meetings regarding the contents of Progress Report (1), definition, criteria, conditions, etc. for the rehabilitation. The major topics discussed and agreed to are as follows:

- (a) Service life after renewal of dam, headworks, canals, related structures, gates and metal work, etc.
  - (b) Definition of rehabilitation, consisting of rehabilitation, upgrading and completion of works,
  - (c) Conditions and requirements for rehabilitation of facilities,
  - (d) Design criteria to be applied: Irrigation design standard prepared by DGWR in 1986, latest Japanese design criteria of MOAFF and USBR, and
  - (e) Conditions of project evaluation.
- (4) Flow of prioritization and evaluation indicators

The counterpart personnel and the Study Team had a series of meetings regarding the flow of prioritization and evaluation indicators. The major points agreed to are as follows:

Both parties agreed that the prioritization of rehabilitation works should be based on four major evaluation indicators as follows:

- (a) Impact of rehabilitation of the irrigation system,
- (b) Agricultural impact,

- (c) Social impact, and
  - (d) Economic and financial impacts.
- (5) Supervision of the sub-contractor

The counterpart personnel, together with the members of the Study Team, visited the field as often as possible. The major activities for on-the-job training are as follows:

- 1) Supervision of the inventory survey for irrigation facilities including:
    - (a) Collection of basic information regarding water resource facilities to the on-farm level of each irrigation and drainage system,
    - (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 for each scheme.
  - 2) Supervision of the collection of data and information regarding agriculture including:
    - (a) Scheme-wise present land uses of the target areas for development,
    - (b) Principal cropping patterns in the target schemes,
    - (c) Irrigation performances in the target schemes expressed by cropping area and cropping intensity,
    - (d) Current crop yield levels of the target schemes,
    - (e) Crop budgets for major commodities in the target schemes, and
    - (f) Present status of agricultural institutions, support services and food crops marketing in the individual schemes.
  - 3) Supervision of the collection of data and information regarding water users' associations including:
    - (a) Status of establishment of WUA, target versus accomplishment,
    - (b) Status of registration in the local court of justice, target versus accomplishment, and
    - (c) Status of activities, active or non-active.
- (6) Explanation of the study results and selection of Model Areas in the respective provinces

The counterpart personnel together with the members of the Study Team visited the Dinas PSDA of each province. The major activities for on-the-job training are as follows:

- 1) Explanation of the study results including:



- (a) Rehabilitation plans for irrigation infrastructures consisting of basic concepts of rehabilitation, criteria for rehabilitation including availability of water resources, irrigation facilities, and cost estimates,
  - (b) Development plans for agriculture and agro-economy consisting of an agricultural land use plan, proposed cropping patterns and schedules, planned cropping area and cropping intensity, target crop yield and crop production plan, and
  - (c) Institutional development plans consisting of WUA establishment and federation, arrangement of operation and maintenance works, empowerment of irrigation management institution, and arrangement of fund source.
- 2) Explanation of the evaluation results of the priority of the schemes for implementation of rehabilitation.
  - 3) Selection of Model Areas for the feasibility study.

### **7.3 The Second and Third Field Works in Phase 2**

#### **7.3.1 Counterparts**

The field work of Phase 2 commenced on September 24, 2003 with a schedule for completion on November 18, 2003. The field work aimed at conducting the Feasibility Studies for the three irrigation schemes of Padang Mahondang in North Sumatra Province, Gung in Central Java Province and Kalaena Kiri in South Sulawesi Province. During this period, the following counterparts have been assigned:

**Counterparts and Their Tasks**

No.	Counterpart Tasks	Name
1.	Chief Counterpart	Ir. A. Tommy M. Sitompul, M. Eng.
2.	Irrigation Engineer	Ir. Tagor Pane, M. Eng.
3.	Agronomist	Ir. Slamet Sugeng, M. Sc.
4.	Institutional Expert	Ir. Suharto Sarwan

#### **7.3.2 Technology Transfer during the Second Field Work**

- (1) Execution of the field works

The counterpart personnel, together with the members of the Study Team, visited the field as often as possible. The major activities for on-the-job training are as follows:

- (a) Collection of additional information for preparation of F/S,
- (b) Confirmation of development plan at model scheme sites, and

(c) Discuss with Dinas PSDA and Balai PSDA regarding constraints and its countermeasures.

(2) Examination of the topics to be discussed in the Steering Committee Meeting for the Interim Report

The counterpart personnel and the Study Team had meetings regarding the topics to be discussed in the Steering Committee Meeting for the explanation of Interim Report. The major points agreed to are as follows:

- (a) Work schedule for the Study,
- (b) Comments to the Interim Report made by the JICA Advisory Committee,
- (c) Contents of the Interim Report in comparison with Progress Report (1),
- (d) Subjects/contents to be revised in accordance with the modification of the Irrigation Management Policy Reform, and
- (e) The Study to be conducted in the Second Field Work.

(3) Preparation of Discussion Materials for the 4<sup>th</sup> Steering Committee Meeting

The counterpart personnel, together with the members of the Study Team, prepared discussion materials for the 4<sup>th</sup> Steering Committee meeting. The major activities for on-the-job training are as follows:

- (a) Rehabilitation plans for irrigation infrastructures consisting of the basic concept of rehabilitation, criteria for rehabilitation, including availability of water resources, irrigation facilities, and cost estimates,
- (b) Development plans for agriculture and agro-economy consisting of agricultural land use plans, proposed cropping patterns and schedules, planned cropping area and cropping intensity, target crop yield and crop production plans, and
- (c) Institutional development plans consisting of WUA establishment and federation, arrangement of operation and maintenance works, empowerment of the irrigation management institution, and arrangement of fund sources.

### **7.3.3 Technology Transfer Seminar held during the Third Field Work**

The Third Field Work in Phase 2 commenced on January 25, 2004, and it was finished on February 1, 2004. The main activities for the technology transfer during this period were as follows: i) the Technology Transfer Seminar held on January 27, 2004, and ii) the Fifth Steering Committee Meeting held on January

30, 2004. The technology transfer was made concerning the contents of the Draft Main Report and the Draft Rehabilitation Guideline. The participants to the technology transfer seminar were, from the Indonesian side, officials of the Ministry of Settlement and Infrastructure, Ministry of Agriculture, BAPPENAS, Dinas PSDA of the respective provinces of North Sumatra, Central Java and South Sulawesi, and from the Japanese side, the Deputy Resident Representative of the JICA Indonesia Office and the JICA experts attached to the Directorate General of Water Resources.

## **CHAPTER 8 CONCLUSION AND RECOMMENDATIONS**

### **8.1 Conclusion**

#### **8.1.1 Present Conditions and Necessity of Implementation of Rehabilitation**

##### **(1) General**

As a result of government initiatives in the 1960s promoting measures for irrigation development, the total area under irrigation has increased to approximately 6.4 million ha in 1999. Such promoting measures have contributed to the stability of rice production and self-sufficiency. However, since the promotion had been a government initiative without the involvement of farmers, problems soon arose, particularly regarding water management and operation and maintenance (O&M) of the irrigation systems. According to the report prepared in 2001 for the JICA study on “Improvement of Irrigation Management and Empowerment of Water Users’ Association for Enhancement of Turnover Program”, establishment of WUA is only 37% of the goal, but of these, only 19% are active. Also, the report prepared in 1993 for the JICA study on “Formulation of Irrigation Development Program” indicates that approximately 60 % of the tertiary systems are not appropriately functional. Deterioration of the irrigation facilities and poor distribution of irrigation water in the tertiary systems are considered to be among the reasons why the beneficiaries are reluctant to organize WUA. As a result, the irrigation facilities are not fully maintained and hence functionality of the facilities reduces. In order to break this “vicious circle” it is necessary to give the farmers themselves an incentive to maintain the irrigation facilities by introducing user-friendly facilities.

##### **(2) Present Status of Irrigation Facilities**

In order to understand the status of malfunction and deterioration of the facilities, an inventory survey has been conducted under the Study for the existing systems including water resources facilities, main and secondary canals with related structures and tertiary systems to the on-farm level. As a result, it has been revealed that all the 141 schemes need rehabilitation and upgrading to recover their functionality. Especially, 70% of the primary structures such as intake facilities and main canals require rehabilitation, and one half of these need to be repaired urgently. Those systems that were used for 20-30 years following completion have severely deteriorated and many of them have not been functioning for a long time. This is caused by the excess of utilization over the service life of the facilities, improper design and poor operation and maintenance. The field survey has also indicated

that inflow of sand and mud, and sedimentation in the canals due to poor management organization has caused obstruction of flow of irrigation water.

### (3) Present Agricultural Conditions

For fields under irrigation, the current level of average paddy yield per crop season ranges between 3.5 ton/ha and 5.0 ton/ha in North Sumatra province, from 4.5 to 5.5 ton/ha in Central Java province, and 3.5 to 4.5 ton/ha in South Sulawesi province. The average yield reduces to 2.0 to 2.5 ton/ha in the rainfed paddy fields and non-irrigated paddy field due to shortage of water supply during the cropping season. Regarding the technical level of the irrigation systems in Indonesia, irrigation areas classified as technical systems is 25.0% of the total in North Sumatra province, 53.5% in Central Java province and 27.3% in South Sulawesi province. The difference in paddy yield between Java and that of the outer islands is attributed to the skill in water management and operation and maintenance of irrigation facilities. In any case, as irrigation water has not been distributed equitably to the terminal systems due to the low technical level of irrigation systems, the actual paddy yield is rather low. Nonetheless the agricultural development potential is high. Average cropping intensity is as low as 145% in the provinces of North Sumatra, 182% in Central Java and 168% in South Sulawesi. Such low cropping intensity can be drastically increased by means of distributing water equitably to the terminal systems.

### (4) Present Institutional Status

Irrigation management administration is the responsibility of the Dinas PSDA of each province. At the scheme level, the irrigation systems are managed by either Dinas PSDA, Water Resources Service Center (Balai PSDA) at district level, or its branch offices. The ratios of WUA already established to the target to be established for the respective provinces are as low as 3% in North Sumatra, 11% in Central Java, and 7% in South Sulawesi. Technical and institutional support in and around the schemes are provided by the district government agricultural support institutions. However, the number of workers available for technical and institutional support is insufficient to meet the requirement.

### (5) Necessity of Implementation of Rehabilitation

As discussed above, irrigation systems in Indonesia have deteriorated and the systems are malfunctioning and need urgent rehabilitation. Recovery of functionality does not mean simply repairing the damaged structures and portions. It should be conducted comprehensively, considering, not only the service life of the existing systems, but also the local natural and social conditions prevailing. The

rehabilitation plan has to be formulated efficiently and urgently in consultation with the agencies and organizations concerned.

In order to promote the realization of the rehabilitation works of the irrigation schemes at the earliest possible date, “the Comprehensive Recovery Program of Irrigation Agriculture” has been prepared as discussed hereinafter.

### **8.1.2 Comprehensive Recovery Program of Irrigation Agriculture**

#### **(1) Composition of the Comprehensive Recovery Program**

The plan for implementation of the rehabilitation program for the existing irrigation facilities has been prepared as a sequence of processes, from initiation of the program to operation of the irrigation system. It is divided into the following three phases: i) initiation phase; ii) midterm phase; and iii) final phase, and is formulated as “the Comprehensive Recovery Program for Irrigation Agriculture”. Major activities of each phase are as follows:

##### **I. Initiation Phase**

- (a) Preparation of the Master List of irrigation schemes with registered areas of more than 1,000 ha,
- (b) First screening of the schemes by establishment ratio of WUA and institutional capacity of the local governments for the implementation of rehabilitation, etc. and the water resources potential,
- (c) Field investigation for Pre-F/S,
- (d) Second screening by the evaluation results of water resources availability,
- (e) Formulation of a development plan at the Pre-F/S level, and third screening by the evaluation results of the Pre-F/S,
- (f) Prioritization of implementation of the schemes, formation of a priority list, and preparation of an action plan.

##### **II. Midterm Phase (F/S)**

- (a) Execution of F/S and preparation of Implementation Program (I/P), and
- (b) Determination of the schemes to be rehabilitated and budgeting therefore.

##### **III. Final Phase (from implementation of the rehabilitation project to setting up O&M of the system)**

- (a) Execution of detailed design,
- (b) Execution of the civil construction,
- (c) Execution of an empowerment program for the WUA,
- (d) Execution of an empowerment program for the agriculture extension

- services, and
  - (e) Operation and monitoring of the irrigation system.
- (2) Prioritization of Implementation of Rehabilitation

Prioritization of rehabilitation works has been based on the following four (4) major evaluation indicators:

- (a) Present condition of irrigation facilities,
- (b) Agriculture productivity,
- (c) Society, and
- (d) Economic and financial impacts.

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

**Number of Schemes classified based on Priority of Rehabilitation**

Priority Group	I	II	III	IV	V	VI	Total
North Sumatra	6	7	5	3	14	15	50
Central Java	16	10	12	0	4	8	50
South Sulawesi	11	6	8	0	11	5	41

- (3) Formulation of the Action Plan

The items that are required to formulate the action plan are as follows:

- (a) Action plan for recovering function of irrigation facilities,
- (b) Action plan for organization of WUA and local governments, strengthening of institutional capacity of WUA and local governments for the implementation of rehabilitation,
- (c) Action plan for extension services strengthening, and
- (d) Action plan for budgeting and budget implementation.

A priority ranking has been assigned for each scheme in the Pre-F/S as follows:

- Group I: High priority schemes (Recommended to execute a F/S)
- Group II: Second highest priority schemes (Recommended to execute a F/S)
- Group III: Third highest priority schemes (Recommended to execute a F/S)
- Group IV: Schemes that require reexamination of the availability of water resources before executing a F/S
- Group V: Schemes that require organization of a WUA and/or empower district government officials before executing a F/S
- Group VI: Schemes that require reexamination of development methodology before executing a F/S

- (4) Selection of Model Schemes

Model schemes to be taken up in the F/S were selected from the results of the prioritization of irrigation schemes for implementation as shown below:

#### Features of Selected Schemes

Descriptions	Provinces		
	North Sumatra	Central Java	South Sulawesi
Irrigation Scheme	Padang Mahondang	Gung	Kalaena Kiri
District	Asahan	Tegal & Kodia	Luwu Utara
Sub-district	Pulo Rakyat	Lebaksui	Mangkutana
Existing Conditions			
Registered area (ha)	3,231	12,463	4,671
Technical level	Semi Technical	Technical	Technical
Completion year of system	1981 (New)	1998 (Rehabilitation)	1980 (New)
Water resources river	S. Asahan	Kali Gung	Kalaena
Type of water resources facility	Free Intake	Headworks	Headworks

### 8.1.3 Results of the F/S of the Model Areas

The results of the F/S for the three schemes of Padang Mahondang in North Sumatra Province, Gung in Central Java Province and Kalaena Kiri in South Sulawesi Province in comparison with the existing conditions are shown in the following table:

#### Comparison between Existing Conditions and the Results of the F/S

Descriptions	Name of Schemes					
	Padang Mahondang		Gung		Kalaena Kiri	
	Existing	F/S	Existing	F/S	Existing	F/S
1. Registered Area (ha)	3,231	2,631	9,871 (12,463)*1	3,906	4,043	4,037
2. Technical Level	Semi-tech.	Technical	Technical	Technical	Technical	Technical
3. Intake Facilities	Free intake	Free intake (new)	Weir	Weir (Reh.)	Weir	Weir (Reh.)
4. Unit Demand (liter/s/ha)	n.a.	1.20	0.90	1.22	1.50	1.55
5. Gross Demand (m <sup>3</sup> /s)	0.60	3.16	5.40	4.77	8.00	6.26
6. Main Canal (km)	3.60	9.00	13.50	3.50	17.10	19.00
7. Secondary Canal (km)	9.20	13.00	37.00	5.00	17.30	14.40
8. Paddy Yield (ton/ha)	4.0	5.0	5.0	5.5	4.0	5.0
9. Cropping Intensity (%)	55	160	256	256	159	210
10. Cost Estimate (US\$/ha)	-	1,985	-	1,045	-	1,740
11. EIRR (%)	-	17.3	-	6.7	-	12.1

Note \*1: 9,871 ha is the irrigation area covered by the Gung River.

## 8.2 Recommendations

### 8.2.1 Technical Level of the Irrigation Scheme

In order to fulfill the requirements of the basic concept applied for the formulation of rehabilitation and upgrading plans of the irrigation system in the Pre-F/S, a rather



high technical standard of irrigation facilities has been proposed for sufficient sustainability. Preliminary design of the irrigation system has been thus executed with provision of concrete lining for the entire length of main and secondary canals, user-friendly and easy operation and maintenance structures, inspection roads along the main and secondary canals, farm roads connecting with inspection roads in on-farm level systems, etc.

On the other hand, due to restrictions of budget and other constraints, it is not necessarily adopt all the basic concepts in the execution of rehabilitation and upgrading of the existing facilities at the same time. One of the choices, for instance, is that existing unlined canals would not need lining with concrete if they can be maintained in a stable condition by means of appropriate operation and maintenance. Therefore, it is recommended to formulate applicable implementation schedules for rehabilitation under the various constraints and implement the works step by step.

### **8.2.2 Irrigation Systems**

#### **(1) Database of the Irrigation Schemes**

It is essential to collect basic data for the rehabilitation plan to be prepared as a sequence of processes from the initiation of the program to investigation and design. It is urgently necessary to establish a database and process data for the initiation of the program. Such database has to be updated periodically and the latest one has to be appropriately managed. In this regard, it is recommended that such information be systematically compiled for all the irrigation schemes.

#### **(2) Management of the Irrigation Assets**

It is commonly acknowledged that the irrigation systems will deteriorate at a so-called exponential function of time and finally they will lose all functionality as an irrigation system. When rehabilitation and improvement of the facilities are made in appropriate time, it is possible to elongate the service life of the system with minimum costs incurred. In this regard, it is recommended that asset management of the irrigation network be carried out frequently for implementation planning, for financing the operation and maintenance, for rehabilitation and for improvement of the irrigation network in order to ensure the security of the irrigation network as well as the sustainability of its function.

#### **(3) Early Implementation of the Project**

Deterioration of the irrigation facilities and poor distribution of irrigation water in the tertiary systems are considered to be among the reasons why the beneficiaries are reluctant to organize WUA. As a result, the irrigation facilities are not fully

maintained and hence functionality of the facilities is reduced. In order to break this “vicious circle” it is necessary to formulate a Project to check the continual deterioration of the irrigation facilities. Accordingly, to counter these constraints on the irrigation schemes, R/U of irrigation facilities and institutional and agricultural extension development plans are proposed in the Project. In this regard, it is strongly recommended that urgent corrective measures be undertaken for the situation in the critical schemes. Otherwise the functionality of many of them will not be recovered. Farmers are also very anxious for the implementation of the Project, for the preservation of the schemes according to the field investigation results in Phase I and II. Many of the Projects are verified to be technically sound and economically feasible with EIRR with more than 12%.

### **8.2.3 Project Implementation Organization**

#### **(1) Implementation Organization**

For the implementation of a project, it is necessary to organize a project implementation organization. In this regard, it is proposed to establish a “Function Recovery Project Office (tentative name)” under the Provincial Water Resources Services Office (PWRS) to take full responsibility for implementation and management of all activities in each phase of the recovery program. The Office will be composed of six sections, i) Irrigation Assets Management Section, ii) Investigation Section, iii) Irrigation Planning Section, iv) Design Section, v) Construction Management Section, and vi) Agriculture and Farmers’ Organization Support Section.

#### **(2) Key Role of the Forum**

The project type organizations are to be formed with a “Forum” to serve as a program decision making body and a “Project Office” to serve as a program implementation body. These bodies are to be newly established at the provincial level and will be responsible for implementing the comprehensive recovery program for irrigation agriculture from the initiation phase to the final phase on the basis of the participatory irrigation management concept. The Project Office is attached to the water resources services office in every Province and under the control of the chief in charge of water resources management and utilization, even though his office is one of organizational units of the provincial public services office.

### **8.2.4 Agricultural Development**

Aiming at an appropriate practice of an irrigation water allocation plan based on a cropping schedule, it is recommended to strengthen and upgrade the existing

agricultural extension services on an area basis, especially, a mass guidance/campaign, workshop and farmer/farmers' groups training or empowerment are considered essential.

### **8.2.5 Institutional Development**

#### **(1) Participatory Irrigation Management**

In line with the participatory irrigation management policy to be re-formulated based on the spirit of the draft Law on Water Resources, it is recommended to clarify the sharing of responsibilities between the irrigation water suppliers and the users concerning irrigation management as well as to perform irrigation management activities through smoothing mutual understanding and encouraging water users' positive involvement.

#### **(2) Capacity Strengthening Programs in Java Island**

In Java, it is recommended that capacity building programs be conducted for local government staff in charge of irrigation management in order to enable them to understand and execute the participatory irrigation management policy. For water users, it is recommended that WUA strengthening programs be conducted for the purpose of encouraging them to be involved in irrigation system recovery program formulation, improving operation and management skills after irrigation facilities are rehabilitated, and carrying out management of WUA in a fair manner. It is also recommended to encourage leaders and members of traditional water users groups to modernize their organizations through reforming their rules to match the concept of the water users' association.

#### **(3) Capacity Strengthening Programs in the Outer Islands**

In outer islands of Java, it is recommended that capacity building programs be conducted for local government staff in charge of irrigation management in order to enable them to understand and execute the participatory irrigation management policy as well as to upgrade their skill in operation of irrigation systems. It is also recommended that institutional strengthening programs be conducted, aiming at establishment and activation of WUA, with top priorities being the promotion of involvement in irrigation system recovery program formulation, improvement of operation and management skills after irrigation facilities are rehabilitated, and fair management of water users associations.

## *Tables*

**Table 2.5.1 Arrangement of Role in Irrigation Management Activities (1/2)**

Item No.	Activity	Government/ Regional Government	Farmers' Representative/ WUA	Remarks
<b>1. INITIATION</b>				
1.1	Ideas/Suggestion/Study on Irrigation Development	Facilitate and socialize	1) Giving ideas 2) Participating	For locations where farmers or future owners are already available.
<b>2. PLANNING</b>				
2.1	System Planning	Legalize	1) Giving inputs 2) Agreeing	Including the institutional frame and future financing system.
2.2	Detail Design	Legalize	Giving inputs	
2.3	Financing	Responsible		
<b>3. CONSTRUCTION</b>				
3.1	Procurement	Responsible	1) Conducting social control 2) Delivering complaints	Farmers role as public community
3.2	Implementation	Responsible for primary and secondary system	1) Responsible for tertiary system 2) Participating in monitoring facility construction works	
3.3	Financing	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May participate in primary and secondary system	
3.4	Submission of the Work	Accepting the work	Giving inputs	
<b>4. UPGRADING (1/2)</b>				
4.1	System Planning	Legalize	1) Giving inputs 2) Agreeing	Including the institutional frame and future financing system.
4.2	Detail Design	Legalize	Giving inputs	
4.3	Financing	Responsible		
4.4	Procurement	Responsible	1) Conducting social control 2) Delivering complaints	Farmers role as public community
4.5	Implementation	Responsible	1) Participating in implementation of: - Sub-contract - Self-management 2) Participating in monitoring	
4.6	Financing	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May participate in primary and secondary system	

**Table 2.5.1 Arrangement of Role in Irrigation Management Activities (2/2)**

Item No.	Activity	Government/ Regional Government	Farmers' Representative/ WUA	Remarks
4. UPGRADING (2/2)				
4.7	Submission of the Work	Accepting the work	Agreeing	
5. OPERATION				
5.1	Estimation of Available Water	Responsible	1) Giving inputs 2) Suggesting	
5.2	Planning on Cropping Pattern	1) Formulating 2) Legalizing	Agreeing	
5.3	Planning on Water Allocation	1) Formulating 2) Legalizing	Agreeing	
5.4	Operation Implementation	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May help operation implementation of secondary system 3) Conducting social control for primary and secondary system	
5.5	Financing	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May help operation implementation of secondary system 3) Conducting social control for primary and secondary system	
6. MAINTENANCE				
6.1	Inventory of Irrigation Network Condition	Responsible	Giving inputs	
6.2	Maintenance Planning	1) Formulating 2) Legalizing	Agreeing	
6.3	Maintenance Implementation	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May share some part of maintenance works for primary and secondary system with compensation	Packaging of farmers' role
6.4	Financing	Responsible for primary and secondary system	1) Responsible for tertiary system 2) May participate in primary and secondary system	
7. SECURING				
7.1	Securing	Responsible for primary and secondary system	Responsible for tertiary system	
8. CONSERVATION				
8.1	Irrigation Water Quality Conservation	Responsible for primary and secondary system	Responsible for tertiary system	

**Table 3.5.1 Work Process, Task and Responsibility in Respective Phases**

Stage	Task	Responsibility Matrix								
		DGWRD	Governor /Province	Forum Chairman	Forum Member	DINAS/ Sub-Dinas PSDA	Project Office	WUA	International Lending Agency	
<b>INITIATION PHASE : PRE-FEASIBILITY STUDY FOR PRIORITIZATION OF IRRIGATION SCHEMES</b>										
<b>01 First Screening of Irrigation Schemes for Rehabilitation</b>										
	01	Preparation of Original List of Irrigation Schemes in the Province		C	C	C	A	B	D	
	02	First Screening of Irrigation Schemes and Preparation of Draft Master List			C		A	B		
<b>02 Pre-Feasibility Study Level Field Investigation</b>										
	01	Preparation of Technical Specification and Contract with Consultant for Pre-FS			A	C	A	B		
	02	Field Investigation on Irrigation System					A	B	D	
	03	Field Investigation on Agriculture and WUAs					A	B	D	
	04	Preparation and Assessment of Draft Field Investigation Report					A	B		
	05	Finalization and Socialization of Field Investigation Result					A	B	D	
<b>03 Determination of Subject Area and Second Screening of Irrigation Schemes by Water Resources Availability</b>										
	01	Confirmation of Available Water for the Scheme			A	C	A	B		
	02	Estimation of Water Requirement					A	B		
	03	Determination of Subject Area by verification of water resources availability					A	B	D	
	04	Second Screening of Irrigation Scheme by Water Resources Availability			A	C	B	B	D	
<b>04 Formulation of Pre-F/S Level Rehabilitation Plan and Third Screening of Irrigation Schemes</b>										
	01	Analyzing Requirement for Easy O/M Irrigation System					A	B	D	
	02	Pre-F/S Level Irrigation System Rehabilitation Plan					A	B	D	
	03	Pre-F/S Level WUIs Empowerment Plan					A	B	D	
	04	Pre-F/S Level Agriculture Plan					A	B	D	
	05	Pre-F/S Level Project Cost Estimate					A	B		
	06	Pre-F/S level Economic Evaluation					A	B		
	07	Third Screening of Irrigation Schemes by Development Potential			A	C	B	B	D	
<b>05 Prioritization of Irrigation Schemes for Rehabilitation and Preparation of Action Plan</b>										
	01	Prioritization of Irrigation Schemes by Weighted Scoring Method	C	C	A	C	B	B	D	
	02	Formulation of Action Plan for Each Scheme			B	C	A	B	D	
	03	Formulation of Overall Action Plan	A	C	A	C	A	B	D	
<b>MIDTERM PHASE : FEASIBILITY STUDY</b>										
<b>06 Formulation of F/S Level Rehabilitation Plan and Preparation of Implementation Program</b>										
	01	Preparation of Terms of References (T.O.R) for Procurement of Consultant and Selection of Consultant for F/S	A				A	B		C
	02	F/S Level Irrigation System Rehabilitation Plan	A		A	B	A	B	D	C
	03	Participatory Approach to WUIs and Formulation of F/S Level WUIs Empowerment Plan			A	C	B	B	D	C
	04	F/S Level Agriculture Plan			A	C	B	B	D	C
	05	F/S Level Project Cost Estimation			A	C	B	B	D	C
	06	F/S Level Economic Evaluation			A	C	B	B	D	C
	07	Environmental Assessment					A	B	D	C
	08	Socialization of F/S Result and Preparation of F/S Report	A		A	C	B	B	D	C
	09	Preparation of Implementation Program (I/P) and Arrangement of Project Budget	A	C	C	C	B	B	A	
<b>FINAL PHASE : IMPLEMENTATION</b>										
<b>07 Implementation and Commencement of Operation</b>										
	01	Procurement of Consultant and preparation of detailed design	A				B	B	A	
	02	Rehabilitation of Irrigation Scheme			A	C	A	B	D	
	03	WUIs Empowerment					A	B	D	D
	04	Extension Service Strengthening					A	B	D	D
	05	Preparation of Tools and Manuals					A	B	D	D
	06	Operation and Maintenance					A	B	D	D

Remarks: A: Full responsibility for decision  
 B: Responsible to task force  
 C: Ideas/ Inputs and agreeing  
 D: Examination and assent

**Table 4.1.1 Selected Irrigation Schemes : North Sumatra**

No.	Irrigation Scheme	District	Technical Level <sup>*1</sup>	Registered Area (ha)	Classification of Rehabilitation <sup>*2</sup>
1,	Gido Sebu	Nias	T	1.258	REH
2,	Batang Gadis	Mandaling Natal	T	6.628	REH
3,	Batang Ilung	Tapanuli Selatan	T	4.194	REH
4,	Blk Sitongkon/Napa Suron	Tapanuli Selatan	ST	1.012	REH
5,	Siborna	Tapanuli Selatan	ST	1.000	UPG
6,	Siaili Tukka	Tapanuli Tengah	T	1.057	UPG
7,	Badiri Lopian	Tapanuli Tengah	T	1.283	REH
8,	Pandurangan	Tapanuli Tengah	T	1.769	UPG
9,	Sihiong	Tapanuli Tengah	NT	2.000	UPG
10,	Aek Silang	Tapanuli Utara	ST	1.500	UPG
11,	Sarulla	Tapanuli Utara	ST	2.692	UPG
12,	Parmiah Hutapaung	Tapanuli Utara	ST	1.000	UPG
13,	Sinamo	Tapanuli Utara	ST	1.000	UPG
14,	Aek Mandos I	Toba Samosir	ST	1.060	UPG
15,	Simangatasi II	Toba Samosir	T	1.515	REH
16,	Bulung Ihit	Labuhan Batu	T	5.000	REH
17,	Perkotaan	Asahan	T	3.457	UPG
18,	Sungai Balai	Asahan	ST	1.185	REH
19,	Panca Arga	Asahan	T	2.500	UPG
20,	Serbangan	Asahan	T	2.333	REH
21,	Silau Bonto	Asahan	NT	3.231	UPG
22,	Sungai Silau	Asahan	ST	1.315	UPG
23,	Padang Mahondang	Asahan	ST	3.231	UPG
24,	Simujur	Asahan	ST	2.560	UPG
25,	Purwodadi	Asahan	T	1.635	REH
26,	Pentara	Simalungun	ST	1.034	UPG
27,	Simantin Pane Dame	Simalungun	NT	1.000	UPG
28,	Panambean / Panet Tongah BK	Simalungun	T	1.723	REH
29,	Raja Hombang / T. Mangaraja	Simalungun	T	2.045	REH
30,	Kerasaan	Simalungun	T	5.000	UPG
31,	Javacolonisasi/Purbogondo	Simalungun	T	1.030	REH
32,	Naga Sompah	Simalungun	T	1.360	REH
33,	Risma Duma	Dairi	ST	1.522	UPG
34,	Lae Ordi	Dairi	ST	1.200	UPG
35,	Parit Lompaten	Karo	ST	1.242	UPG
36,	Bandar Sidoras	Deli Serdang	ST	3.457	UPG
37,	Namu Rambe	Deli Serdang	T	1.036	REH
38,	Sei Belutu	Deli Serdang	ST	5.082	REH
39,	Langau	Deli Serdang	ST	2.000	UPG
40,	Medan Krio	Deli Serdang	T	3.016	UPG
41,	Rantau Panjang	Deli Serdang	ST	2.309	REH
42,	Pekan Kamis	Deli Serdang	ST	1.100	UPG
43,	Secanggang	Langkat	ST	1.400	UPG
44,	Paya Lobang	Deli Serdan/Tebing Tinggi	ST	1.558	UPG
45,	Namu Sira-sira Kiri	Langkat/Binjai	T	2.250	REH
46,	Namu Sira-sira Kanan	Langkat/Binjai	T	4.100	REH
47,	Bah Korah II	Simalungun/Siantar	T	1.995	REH
48,	Sijambi	Asahan/Tanjung Balai	T	1.013	UPG
49,	Rambung Mera	P. Siantar/Simalungun	T	1.104	REH
50,	Paya Sordang	Tapanuli Sel/Mandailing Natal	T	4.350	UPG
	<b>Total</b>			<b>108.341</b>	<b>UPG: 29 REH: 21</b>

Remarks:

- |                     |                     |
|---------------------|---------------------|
| *1. T : Technical   | *2 UPG: Upgrading   |
| ST : Semi Technical | REH: Rehabilitation |
| NT : Non Technical  |                     |



**Table 4.1.2 Selected Irrigation Schemes : Central Java**

No.	Irrigation Scheme	District	Technical Level * <sup>1</sup>	Registered Area (ha)	Classification of Rehabilitation * <sup>2</sup>
1,	Cijalu	Cilacap	T	1.377	REH
2,	Mangganti	Cilacap	T	18.895	REH
3,	Serayu	Cilacap	T	15.869	REH
4,	Banjarcahyana	Banjarnegara	T	4.859	REH
5,	Kaligending	Kebumen	T	2.981	REH
6,	Pesucen	Kebumen	T	1.666	REH
7,	Bedegolan	Kebumen	T	8.430	REH
8,	Kedung Putri	Purworejo	T	4.341	REH
9,	Sudagaran	Purworejo	T	3.665	REH
10,	Rebug	Purworejo	T	1.202	REH
11,	Kalimeneng	Purworejo	T	1.262	REH
12,	Kedung GW	Purworejo	T	1.129	REH
13,	Waduk Cengklik	Boyolali	T	1.579	REH
14,	Ploso Wareng	Klaten	T	1.100	REH
15,	Jaban	Klaten	T	1.191	REH
16,	Colo Kanan	Sragen	T	18.108	REH
17,	Bonggo	Sragen	T	1.811	REH
18,	Pangkalan	Pati	T	1.765	REH
19,	Sentul	Pati	T	1.759	REH
20,	Widodaren	Pati	T	3.652	REH
21,	Klambu Kanan	Pati	T	10.391	REH
22,	Jragung	Demak	T	4.597	REH
23,	Guntur	Demak	T	2.020	REH
24,	Klambu Kiri	Demak	T	21.419	REH
25,	Kedungdowo Kramat	Batang	T	1.250	REH
26,	Sungapan Kanan	Pemalang	T	1.851	REH
27,	Mejagong	Pemalang	T	1.997	REH
28,	Sungapan Kiri	Pemalang	T	5.229	REH
29,	Kabuyutan	Brebes	T	4.182	REH
30,	Babakan	Brebes	T	2.181	REH
31,	Kemaron Jambe	Brebes	T	1.026	REH
32,	Jengkelok	Brebes	T	6.505	REH
33,	Gung	Tegal & Kodia Tegal	T	12.999	REH
34,	Parankidang	Tegal & Kodia Tegal	T	1.697	REH
35,	Kumisik	Tegal & Kodia Tegal	T	3.736	REH
36,	Pesantren Kletak	Pekalongan & Kodia P.	T	4.263	REH
37,	Sragi	Pekalongan & Kodia P.	T	3.540	REH
38,	Sudikampir	Pekalongan & Kodia P.	T	1.564	REH
39,	Padurekso	Pekalongan & Kodia P.	T	2.764	REH
40,	Kedung Asem	Kendal & Kodia Semarang	T	3.726	REH
41,	Bodri	Kendal & Kodia Semarang	T	8.538	REH
42,	Trompo	Kendal & Kodia Semarang	T	1.263	REH
43,	Kedung Pengilon	Kendal & Kodia Semarang	T	3.134	REH
44,	Pasekan	Magelang dan Kodia Mag.	T	1.078	REH
45,	Kosar	Batang / Pekalongan	T	1.617	REH
46,	Notog	Brebes / Tegal	T	27.682	REH
47,	Sidorejo	Grobogan / Boyolali	T	14.622	REH
48,	Glapan	Grobogan / Demak	T	18.696	REH
49,	Klambu Kanan	Grobogan / Kudus / Pati	T	6.841	REH
50,	Kaliwadas	Pekalogan / Pemalang	T	7.520	REH
	<b>Total</b>			<b>284.569</b>	<b>REH: 50</b>

Remarks:

\*1. T : Technical  
ST : Semi Technical  
NT : Non Technical

\* UPG: Upgrading  
2. REH: Rehabilitation

**Table 4.1.3 Selected Irrigation Schemes: South Sulawesi**

No.	Irrigation Scheme	District	Technical Level <sup>*1</sup>	Registered Area (ha)	Classification of Rehabilitation <sup>*2</sup>
1.	Bayang-Bayang	Bulukumba	ST	5.030	UPG
2.	Bontomanai	Bulukumba	ST	3.976	UPG
3.	Bettu	Bulukumba	ST	1.817	REH
4.	Bontonyeleng	Bulukumba	ST	1.096	UPG
5.	Jenemarrung	Takalar	ST	1.052	REH
6.	Pamukulu	Takalar	T	4.526	UPG
7.	Aparang 1	Sinjai	ST	1.049	REH
8.	Aparang Hulu	Sinjai	ST	1.094	UPG
9.	Bantimurung	Maros	T	6.513	REH
10.	Lekopancing	Maros	T	3.626	REH
11.	Padaelo	Pangkep	T	2.958	UPG
12.	Leang Lonrong	Pangkep	T	1.229	REH
13.	Palakka	Bone	T	4.633	REH
14.	Pattiro	Bone	T	4.970	UPG
15.	Unyi	Bone	T	1.310	REH
16.	Jalling	Bone	T	1.777	REH
17.	Lanca	Bone	ST	1.084	REH
18.	Sanrego	Bone	T	9.457	UPG
19.	Salobunne	Soppeng	T	1.386	REH
20.	Leworeng	Soppeng	T	2.258	REH
21.	Tinco Kiri	Soppeng	T	2.620	REH
22.	Cillallang	Wajo	ST	1.113	UPG
23.	Alekarajae	Sidrap	ST	1.253	REH
24.	Bulucenrana	Sidrap	T	5.999	UPG
25.	Bulutimorang	Sidrap	T	5.692	REH
26.	Kalosi	Pinrang	T	1.004	UPG
27.	Padang Sappa	Luwu	T	12.588	UPG
28.	Bajo	Luwu	ST	7.000	UPG
29.	Pagang Alipan	Luwu	ST	1.200	REH
30.	Makawa	Luwu	NT	1.775	UPG
31.	Lamasi Kanan	Luwu	T	5.485	UPG
32.	Maloso, Sekka	Polmas	T	2.991	UPG
33.	Lakejo	Polmas	T	1.265	REH
34.	Gamo-Gamo	Polmas	T	4.820	UPG
35.	Kanjiro	Luwu Utara	ST	1.491	UPG
36.	Bone-Bone	Luwu Utara	T	2.754	REH
37.	Kalaena Kanan I	Luwu Utara	T	6.615	UPG
38.	Kalaena Kiri	Luwu Utara	T	4.671	UPG
39.	Kalaena Kanan II	Luwu Utara	T	5.077	UPG
40.	Kalaena (Rt. Bendung)	Luwu Utara	T	2.730	UPG
41.	Kuri-Kuri, Kasambi	Luwu Utara	ST	3.000	UPG
	<b>Total</b>			<b>141.984</b>	<b>UPG: 23 REH: 18</b>

Remarks:

\*1. T : Technical  
ST : Semi Technical  
NT : Non Technical

\*2. UPG: Upgrading  
REH: Rehabilitation

**Table 4.4.1 Irrigation System Rehabilitation Cost of the Schemes: North Sumatra**

No.	Irrigation Scheme	District	Technical Level <sup>1)</sup>	Registered Area (ha)	Subject Area (ha)	Area Increment (ha)	Age of the Facilities (years)	Irrigation System Rehabilitation Cost (million Rp.)										Rehabilitation Cost per ha (US\$/ha)	
								Water Resources Facility			Irrigation Works			Drainage Works	On-Farm Development	Project Facilities	Total		
								Dam/Headworks	Settling Basin	Sub-total	Canals	Related Structures	Sub-total						
1	Gido Sebea	Nias	T	1.258	883	-375	11	1.183	449	1.632	8.611	1.697	10.308	1.031	1.810	1.260	16.041	2.194	
2	Batang Gadis	Mandailing Natal	T	6.628	5.575	-1.053	11	272	3.572	3.843	49.300	20.679	69.979	6.998	11.429	2.590	94.838	2.055	
3	Batang Ilung	Tapanuli Selatan	T	4.194	3.546	-648	11	232	2.554	2.786	38.329	12.519	50.848	5.085	7.269	1.570	67.559	2.301	
4	Blk Sitongkon/Napa Suron	Tapanuli Selatan	ST	1.012	500	-512	27	7.402	1.380	8.782	8.536	1.139	9.674	967	1.025	1.260	21.709	5.244	
5	Siborna	Tapanuli Selatan	ST	1.000	950	-50	19	8.935	1.497	10.432	17.359	1.344	18.702	1.870	2.129	1.260	34.394	4.373	
6	Sialli Tukka	Tapanuli Tengah	T	1.057	600	-457	17	2.984	1.380	4.363	3.484	1.712	5.195	520	1.407	1.260	12.745	2.566	
7	Badiri Lopian	Tapanuli Tengah	T	1.283	899	-384	14	4.673	1.497	6.170	6.153	2.741	8.894	889	1.843	1.260	19.057	2.560	
8	Pandurangan	Tapanuli Tengah	T	1.769	1.334	-435	19	1.140	1.614	2.754	15.946	4.727	20.674	2.067	2.888	1.260	29.644	2.684	
9	Sihiong	Tapanuli Tengah	NT	2.000	779	-1.221	19	1.684	1.497	3.181	7.721	3.732	11.453	1.145	3.339	1.260	20.379	3.160	
10	Aek Silang	Tapanuli Utara	ST	1.500	1.500	0	13	5.358	2.084	7.442	5.942	993	6.935	693	5.791	1.260	22.121	1.781	
11	Sarulla	Tapanuli Utara	ST	1.692	1.692	0	28	1.090	2.084	3.175	5.665	641	6.307	631	4.938	1.260	16.310	1.164	
12	Parmiah Hutapaung	Tapanuli Utara	ST	1.000	1.000	0	10	1.027	1.497	2.524	12.112	2.565	14.676	1.468	2.716	1.260	22.645	2.735	
13	Simamo	Tapanuli Utara	ST	1.000	930	-70	34	843	1.497	2.340	7.698	4.875	12.573	1.257	2.332	1.260	19.762	2.567	
14	Aek Mandos I	Toba Samosir	ST	1.060	1.059	-1	10	814	1.614	2.428	5.084	1.490	6.574	657	2.355	1.260	13.276	1.514	
15	Simangatasi II	Toba Samosir	T	1.515	1.514	-1	11	1.027	2.084	3.112	8.669	1.530	10.199	1.020	3.104	1.260	18.694	1.491	
16	Bulung Ihit	Labuhan Batu	T	5.000	1.355	-3.645	5	272	625	897	8.047	384	8.431	843	2.778	1.260	14.209	1.267	
17	Perkotaan	Asahan	T	3.457	3.446	-11	14	1.376	1.277	2.653	62.483	3.842	66.325	6.633	7.119	1.570	84.300	2.955	
18	Sungai Balai	Asahan	ST	1.185	1.130	-55	5	1.183	1.614	2.797	12.707	1.153	13.861	1.386	2.317	1.260	21.620	2.311	
19	Panca Arga	Asahan	T	2.500	2.500	0	10	52.328 <sup>2)</sup>	2.906	55.234	8.478	1.386	9.864	986	5.469	1.570	73.123	3.533	
20	Serbangan	Asahan	T	2.333	2.044	-289	10	42.761 <sup>2)</sup>	2.374	45.136	18.948	5.394	24.342	2.434	4.190	1.570	77.672	4.590	
21	Silau Bonto	Asahan	NT	3.231	967	-2.264	10	20.171 <sup>2)</sup>	1.120	21.291	8.232	4.936	13.168	1.317	4.894	1.260	41.930	5.237	
22	Sungai Silau	Asahan	ST	1.315	452	-863	32	7.552 <sup>3)</sup>	528	8.080	6.841	1.588	8.429	843	1.702	1.260	20.314	5.428	
23	Padang Mahondang	Asahan	ST	3.231	2.905	-326	22	13.353	2.554	15.907	14.221	1.675	15.896	1.590	7.073	1.570	42.036	1.748	
24	Simujur	Asahan	ST	2.560	2.010	-550	18	7.272	2.084	9.356	15.478	1.360	16.838	1.684	4.536	1.570	33.984	2.042	
25	Purwodadi	Asahan	T	1.635	1.635	0	14	1.270	2.084	3.354	24.815	7.319	32.134	3.213	3.352	1.260	43.313	3.200	
26	Pentara	Simalungun	ST	1.034	298	-736	12	1.139	0	1.139	6.863	475	7.338	734	1.404	1.260	11.875	4.813	
27	Simantin Pane Dame	Simalungun	NT	1.000	1.000	0	14	3.385	1.497	4.881	2.680	175	2.854	285	5.125	1.260	14.406	1.740	
28	Panambean / Panet Tengah BK	Simalungun	T	1.723	1.722	-1	12	1.183	0	1.183	19.579	10.849	30.429	3.043	3.530	1.260	39.445	2.767	
29	Raja Hombang / T. Mangaraja	Simalungun	T	2.045	2.023	-22	9	1.260	0	1.260	35.068	8.497	43.565	4.357	4.147	1.570	54.899	3.278	
30	Kerasaan	Simalungun	T	5.000	4.144	-856	15	1.260	3.063	4.323	76.382	6.335	82.717	8.272	9.341	1.570	106.222	3.096	
31	Javacolonisasi/Purbogondo	Simalungun	T	1.030	1.015	-15	14	1.144	484	1.628	14.505	5.206	19.712	1.971	2.081	1.260	26.651	3.172	
32	Naga Sompah	Simalungun	T	1.360	1.015	-345	16	3.477	1.614	5.091	16.917	3.335	20.252	2.025	2.081	1.260	30.709	3.654	
33	Risma Duma	Dairi	ST	1.522	1.522	0	21	1.144	2.084	3.228	20.762	9.570	30.332	3.033	5.750	1.260	43.603	3.460	
34	Lae Ordi	Dairi	ST	1.200	1.200	0	14	688	1.614	2.302	19.080	1.601	20.681	2.068	5.630	1.260	31.941	3.215	
35	Parit Lompaten	Karo	ST	1.242	1.242	0	20	635	1.614	2.249	31.778	5.306	37.084	3.708	2.871	1.260	47.172	4.588	
36	Bandar Sidoras	Deli Serdang	ST	3.457	3.457	0	18	10.171	2.554	12.725	52.665	5.132	57.797	5.780	7.597	1.570	85.468	2.986	
37	Namu Rambe	Deli Serdang	T	1.036	1.036	0	37	814	1.614	2.428	18.106	4.366	22.472	2.247	2.124	1.260	30.532	3.560	
38	Sei Belutu	Deli Serdang	ST	5.082	5.076	-6	40	7.035	3.063	10.098	34.923	1.280	36.203	3.620	10.406	2.590	62.917	1.497	
39	Langau	Deli Serdang	ST	2.000	1.900	-100	24	11.171	2.084	13.255	7.618	814	8.432	843	4.279	1.260	28.070	1.784	
40	Medan Krio	Deli Serdang	T	3.016	3.000	-16	25	825	2.554	3.379	28.435	7.100	35.534	3.553	6.325	1.570	50.362	2.028	
41	Rantau Panjang	Deli Serdang	ST	2.309	2.309	0	33	4.673	2.084	6.757	24.650	8.396	33.046	3.305	4.733	1.570	49.412	2.585	
42	Pekan Kamis	Deli Serdang	ST	1.100	1.100	0	33	4.257	1.614	5.871	8.146	1.428	9.574	957	2.347	1.260	20.010	2.197	
43	Secanggih	Langkat	ST	1.400	1.400	0	18	4.257	2.084	6.341	35.709	2.159	37.868	3.787	3.119	1.260	52.375	4.519	
44	Paya Lobang	Deli Serdan/Tebing Tinggi	ST	1.558	1.558	0	22	814	2.084	2.898	14.254	940	15.194	1.519	3.345	1.260	24.217	1.877	
45	Namu Sira-sira Kiri	Langkat/Binjai	T	2.250	1.350	-900	24	460	625	1.085	20.507	4.686	25.193	2.519	2.768	1.260	32.825	2.937	
46	Namu Sira-sira Kanan	Langkat/Binjai	T	4.100	3.953	-147	24	916	766	1.682	44.920	13.893	58.813	5.881	8.104	1.570	76.050	2.324	
47	Bah Korah II	Simalungun/Siantar	T	1.995	1.723	-272	12	1.376	625	2.001	20.137	9.061	29.198	2.920	3.532	1.260	38.911	2.728	
48	Sijambi	Asahan/Tanjung Balai	T	1.013	1.008	-5	10	21.054 <sup>3)</sup>	1.472	22.526	9.087	1.994	11.082	1.108	2.201	1.260	38.177	4.575	
49	Rambung Mera	P. Siantar/Simalungun	T	946	944	-2	16	1.318	449	1.768	21.227	5.347	26.574	2.657	1.935	1.260	34.194	4.375	
50	Paya Sordang	Tapanuli Sel/Mandailing Natal	T	4.350	4.350	0	11	1.376	919	2.295	37.191	14.655	51.847	5.185	9.108	1.570	70.004	1.944	
<b>Total</b>				<b>107.183</b>	<b>90.550</b>	<b>-16.633</b>			<b>272.034</b>	<b>80.031</b>	<b>352.065</b>	<b>1.002.050</b>	<b>224.019</b>	<b>1.226.070</b>	<b>122.607</b>	<b>211.688</b>	<b>69.690</b>	<b>1.982.120</b>	<b>146.401</b>
Average					1.811		18											2.644	
Rp. per ha								3.004	0.884	3.888	11.066	2.474	13.540	1.354	2.338	0.770	21.890		
Itemized Total																			
				T : 25															
				ST : 22															
				NT : 3															

Note: 1): T: Technical, ST: Semi-technical, NT: Non-technical

2): Water will be supplied from integrated headworks for Panca Arga, Serbangan, and Silau Bonto schemes.

3): Water will be supplied from integrated headworks for Sungai Silau and Sijambi schemes.

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

**Table A-4.4.2 Irrigation System Rehabilitation Cost of the Schemes: Central Java**

No.	Irrigation Scheme	District	Technical Level <sup>1)</sup>	Present Irrigation Area (ha)	Subject Area (ha)	Area Increment (ha)	Age of the Facilities (years)	Irrigation System Rehabilitation Cost (million Rp.)										Rehabilitation Cost per ha (US\$/ha)		
								Water Resources Facility			Irrigation Works			Drainage Works	On-Farm Development	Project Facilities	Total			
								Dam/Headworks	Settling Basin	Sub-total	Canals	Related Structures	Sub-total							
1.	Cijalu	Cilacap	T	1.377	1.377	0	16	814	2.876	3.691	22.417	15.541	37.958	3.796	2.823	1.260	49.527	4.344		
2.	Mangganti	Cilacap	T	22.644	22.644	0	6	1.376	4.459	5.835	166.447	55.041	221.488	22.149	46.420	3.600	299.493	1.598		
3.	Serayu	Cilacap	T	20.795	20.795	0	9	117	3.981	4.098	379.125	93.241	472.366	47.237	42.986	3.600	570.286	3.313		
4.	Banjarcayana	Banjarnegara	T	5.001	5.001	0	17	0	0	0	72.960	55.919	128.879	12.888	10.252	2.590	154.609	3.734		
5.	Kaligending	Kebumen	T	2.923	2.923	0	4	1.260	1.277	2.537	15.693	13.249	28.943	2.894	5.992	1.570	41.936	1.733		
6.	Pesucen	Kebumen	T	1.659	1.659	0	1	0	0	0	10.512	9.875	20.387	2.039	3.401	1.260	27.087	1.972		
7.	Bedegolan	Kebumen	T	8.401	8.401	0	5	1.454	2.936	4.390	73.192	21.241	94.433	9.443	17.222	2.590	128.078	1.841		
8.	Kedung Putri	Purworejo	T	4.451	4.451	0	15	863	3.063	3.926	39.025	28.527	67.551	6.755	9.181	1.570	88.983	2.415		
9.	Sudagaran	Purworejo	T	3.665	3.665	0	13	999	2.554	3.553	45.091	7.357	52.448	5.245	7.513	1.570	70.329	2.318		
10.	Rebug	Purworejo	T	1.202	1.202	0	15	1.183	807	1.990	18.655	3.101	21.756	2.176	2.464	1.260	29.645	2.979		
11.	Kalimeneng	Purworejo	T	1.262	1.262	0	19	1.183	1.380	2.562	11.929	7.705	19.634	1.963	2.587	1.260	28.007	2.681		
12.	Kedung GW	Purworejo	T	1.129	1.129	0	64	9.611	1.614	11.226	14.277	15.661	29.938	2.994	2.314	1.260	47.732	5.107		
13.	Waduk Cengklik	Boyolali	T	2.120	2.120	0	3	2.365	1.732	4.097	19.800	15.532	35.332	3.533	4.346	1.570	48.878	2.785		
14.	Ploso Wareng	Klaten	T	1.100	1.100	0	11	814	807	1.621	6.912	3.197	10.109	1.011	2.255	1.260	16.257	1.785		
15.	Jaban	Klaten	T	1.191	1.191	0	11	635	1.614	2.249	12.652	13.881	26.533	2.653	2.442	1.260	35.137	3.564		
16.	Colo Kanan	Sragen	T	22.982	22.982	0	18	1.726	13.269	14.995	280.537	158.585	439.122	43.912	47.113	3.600	548.742	2.884		
17.	Bonggo	Sragen	T	1.406	1.406	0	18	7.272	2.084	9.356	13.120	9.849	22.970	2.297	2.882	1.260	38.766	3.330		
18.	Pangkalan	Pati	T	654	654	0	10	1.144	1.380	2.523	5.078	4.906	9.984	998	1.341	1.260	16.106	2.975		
19.	Sentul	Pati	T	1.739	1.739	0	11	1.183	1.042	2.225	13.856	5.173	19.029	1.903	3.565	1.260	27.982	1.944		
20.	Widodaren	Pati	T	2.616	2.616	0	13	1.454	1.074	2.529	23.596	7.378	30.974	3.097	5.363	1.570	43.533	2.010		
21.	Klambu Kanan	Pati	T	6.216	6.216	0	11	1.172	1.786	2.958	109.983	23.015	132.998	13.300	12.743	2.590	164.589	3.198		
22.	Jragung	Demak	T	4.416	4.416	0	14	635	3.063	3.698	39.536	10.216	49.752	4.975	9.053	1.570	69.048	1.889		
23.	Guntur	Demak	T	1.543	1.543	0	24	993	2.084	3.077	13.749	6.913	20.662	2.066	3.163	1.260	30.229	2.366		
24.	Klambu Kiri	Demak	T	20.738	20.738	0	11	1.376	3.981	5.357	184.041	65.531	249.573	24.957	42.513	3.600	326.000	1.899		
25.	Kedungdowo Kramat	Batang	T	1.250	1.250	0	27	1.628	2.759	4.387	8.376	4.498	12.874	1.287	2.563	1.260	22.371	2.162		
26.	Sungapan Kanan	Pemalang	T	1.851	1.851	0	3	693	625	1.318	12.144	2.051	14.195	1.420	3.795	1.260	21.987	1.435		
27.	Mejagung	Pemalang	T	2.049	2.049	0	11	814	1.042	1.856	16.325	6.831	23.155	2.316	4.200	1.570	33.097	1.951		
28.	Sungapan Kiri	Pemalang	T	5.570	5.570	0	3	1.148	1.072	2.220	33.918	9.070	42.988	4.299	11.433	2.590	63.530	1.378		
29.	Kabuyutan	Brebes	T	3.876	3.876	0	17	993	1.277	2.270	44.874	23.221	68.095	6.810	7.946	1.570	86.691	2.702		
30.	Babakan	Brebes	T	2.528	2.528	0	11	814	1.042	1.856	25.799	3.969	29.768	2.977	5.182	1.570	41.354	1.976		
31.	Kemaron Jambe	Brebes	T	1.483	1.483	0	12	814	1.042	1.856	27.760	10.906	38.666	3.867	3.274	1.260	48.923	3.985		
32.	Jengkelok	Brebes	T	6.173	6.173	0	13	814	1.786	2.600	60.125	21.166	81.291	8.129	12.655	2.590	107.265	2.099		
33.	Gung	Tegal & Kodia Tegal	T	12.641	12.641	0	5	1.628	4.242	5.870	39.293	14.854	54.147	5.415	25.914	3.600	94.946	907		
34.	Parakankidang	Tegal & Kodia Tegal	T	1.631	1.631	0	9	814	1.042	1.856	9.969	2.836	12.805	1.280	3.344	1.260	20.545	1.521		
35.	Kumisik	Tegal & Kodia Tegal	T	3.778	3.778	0	11	1.318	1.277	2.595	34.011	7.104	41.115	4.112	7.745	1.570	57.137	1.827		
36.	Pesantren Kletak	Pekalongan & Kodia P.	T	3.636	3.636	0	8	1.260	1.277	2.537	47.370	10.158	57.528	5.753	7.454	1.570	74.841	2.486		
37.	Sragi	Pekalongan & Kodia P.	T	3.539	3.539	0	29	1.183	2.554	3.737	41.824	5.754	47.578	4.758	7.255	1.570	64.897	2.215		
38.	Sudikampir	Pekalongan & Kodia P.	T	1.550	1.550	0	28	1.318	1.042	2.361	26.022	7.894	33.915	3.392	3.178	1.260	44.105	3.437		
39.	Padurekso	Pekalongan & Kodia P.	T	2.764	2.764	0	88	9.479	2.554	12.033	23.235	15.274	38.509	3.851	5.666	1.570	61.629	2.693		
40.	Kedung Asem	Kendal & Kodia Semarang	T	2.845	2.845	0	13	814	2.084	2.898	25.201	11.714	36.915	3.692	5.935	1.570	51.010	2.166		
41.	Bodri	Kendal & Kodia Semarang	T	7.710	7.710	0	13	912	5.617	6.529	59.590	18.473	78.063	7.806	15.806	2.590	110.793	1.736		
42.	Trompo	Kendal & Kodia Semarang	T	1.229	1.229	0	13	1.172	2.759	3.932	8.758	1.848	10.606	1.061	2.519	1.260	19.378	1.904		
43.	Kedung Pengilon	Kendal & Kodia Semarang	T	2.686	2.686	0	13	1.172	4.168	5.341	22.868	3.525	26.393	2.639	5.506	1.570	41.450	1.864		
44.	Pasekan	Magelang dan Kodia Mag.	T	988	988	0	12	1.183	748	1.931	7.425	9.125	16.735	1.674	2.025	1.260	23.625	2.888		
45.	Kosar	Batang / Pekalongan	T	3.243	3.243	0	28	993	1.277	2.270	48.709	16.099	64.808	6.481	6.648	1.570	81.777	3.046		
46.	Notog	Brebes / Tegal	T	25.540	25.540	0	31	1.725	6.635	8.359	579.209	123.397	702.606	70.261	52.357	3.600	837.183	3.959		
47.	Sidorejo	Grobogan / Boyolali	T	5.717	5.717	0	13	232	0	232	50.850	52.504	103.354	10.335	11.720	2.590	128.232	2.709		
48.	Glapan	Grobogan / Demak	T	18.784	18.784	0	26	1.824	7.178	9.002	105.830	22.899	128.730	12.873	38.507	3.600	192.712	1.239		
49.	Klambu Kanan	Grobogan / Kudus / Pati	T	11.078	11.078	0	13	1.454	2.545	3.999	62.520	10.488	73.008	7.301	22.710	3.600	110.618	1.206		
50.	Kaliwadas	Pekalongan / Pemalang	T	7.722	7.722	0	29	1.454	1.761	3.216	133.287	17.210	150.497	15.050	15.830	2.590	187.182	2.928		
<b>Total</b>				<b>283.091</b>	<b>283.091</b>	<b>0</b>		<b>77.285</b>	<b>118.268</b>	<b>195.553</b>	<b>3.147.475</b>	<b>1.083.690</b>	<b>4.231.165</b>	<b>423.116</b>	<b>581.101</b>	<b>97.320</b>	<b>5.528.255</b>	<b>123.081</b>		
Average Rp. per ha							16				0,273	0,418	0,691	11,118	3,828	14,946	1,495	2,053	0,344	19,528
Itemized Total			T : 50 ST : 0 NT : 0																	

Note: 1) T: Technical, ST: Semi-technical, NT: Non-technical

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

**Table A-4.4.3 Irrigation System Rehabilitation Cost of the Schemes: South Sulawesi**

No.	Irrigation Scheme	District	Technical Level <sup>1)</sup>	Registered Area (ha)	Subject Area (ha)	Area Increment (ha)	Age of the Facilities (years)	Irrigation System Rehabilitation Cost (million Rp.)										Rehabilitation Cost per ha (US\$/ha)	
								Water Resources Facility			Irrigation Works			Drainage Works	On-Farm Development	Project Facilities	Total		
								Dam/Headworks	Settling Basin	Sub-total	Canals	Related Structures	Sub-total						
1.	Bayang-Bayang	Bulukumba	ST	5.030	4.121	-909	29	4.078	3.063	7.141	51.580	3.073	54.653	5.465	9.348	1.570	78.177	2.291	
2.	Bontomanai	Bulukumba	ST	3.976	3.297	-679	5	1.824	1.908	3.732	23.740	11.800	35.540	3.554	9.050	1.570	53.445	1.958	
3.	Bettu	Bulukumba	ST	1.817	1.802	-15	20	1.027	2.084	3.112	15.534	4.687	20.221	2.022	3.694	1.260	30.308	2.032	
4.	Bontonyeleng	Bulukumba	ST	1.096	1.079	-17	13	1.183	1.614	2.797	9.340	974	10.314	1.031	3.024	1.260	18.427	2.063	
5.	Jenemarrung	Takalar	ST	1.052	975	-77	28	1.280	1.497	2.777	10.633	1.182	11.815	1.181	1.999	1.260	19.032	2.358	
6.	Pamukulu	Takalar	T	4.526	4.480	-46	18	1.280	3.063	4.343	49.514	24.914	74.428	7.443	9.362	1.570	97.146	2.619	
7.	Aparang I	Sinjai	ST	1.049	1.049	0	28	1.047	1.614	2.661	15.225	1.893	17.118	1.712	2.150	1.260	24.901	2.867	
8.	Aparang Hulu	Sinjai	ST	1.094	1.094	0	18	1.096	1.614	2.710	8.046	1.543	9.589	959	2.713	1.260	17.232	1.903	
9.	Bantimurung	Maros	T	6.513	5.717	-796	17	1.824	4.442	6.266	52.140	18.552	70.692	7.069	11.720	2.590	98.337	2.078	
10.	Lekopancing	Maros	T	3.626	2.483	-1.143	21	1.318	2.084	3.403	24.569	8.451	33.020	3.302	5.090	1.570	46.385	2.256	
11.	Padaelo	Pangkep	T	2.958	2.462	-496	27	1.144	2.084	3.228	19.156	7.945	27.101	2.710	5.382	1.570	39.991	1.962	
12.	Leang Lonrong	Pangkep	T	1.229	1.229	0	15	1.454	2.759	4.213	11.620	3.018	14.638	1.464	2.519	1.260	24.095	2.368	
13.	Palakka	Bone	T	4.633	3.260	-1.373	23	1.144	766	1.910	27.391	17.402	44.794	4.479	6.683	1.570	59.436	2.202	
14.	Pattiro	Bone	T	4.970	4.739	-231	76	5.583	3.063	8.646	68.300	33.367	101.667	10.167	9.771	1.570	131.821	3.360	
15.	Unyi	Bone	T	1.310	1.136	-174	19	1.144	1.614	2.758	17.840	5.311	23.151	2.315	2.329	1.260	31.813	3.383	
16.	Jalling	Bone	T	1.777	1.301	-476	18	1.047	1.614	2.661	13.226	5.044	18.270	1.827	2.667	1.260	26.685	2.478	
17.	Lanca	Bone	ST	1.084	676	-408	11	1.270	1.497	2.767	6.233	3.336	9.569	957	1.386	1.260	15.938	2.848	
18.	Sanrego	Bone	T	6.618	5.676	-942	13	1.260	3.572	4.832	73.190	21.831	95.021	9.502	12.110	2.590	124.055	2.640	
19.	Salobunne	Soppeng	T	1.386	1.296	-90	74	3.571	1.614	5.186	14.656	4.497	19.153	1.915	2.657	1.260	30.171	2.812	
20.	Leworeng	Soppeng	T	2.258	2.187	-71	9	1.628	3.464	5.092	7.746	2.612	10.358	1.036	4.483	1.570	22.539	1.245	
21.	Tinco Kiri	Soppeng	T	2.620	2.620	0	9	1.376	625	2.001	29.057	1.938	30.995	3.100	5.371	1.570	43.037	1.984	
22.	Cillallang	Wajo	ST	1.113	1.113	0	35	1.172	2.876	4.049	10.316	1.195	11.511	1.151	2.749	1.260	20.720	2.249	
23.	Alekarajae	Sidrap	ST	1.253	1.253	0	28	1.027	1.614	2.642	16.987	2.313	19.299	1.930	2.569	1.260	27.700	2.670	
24.	Bulucenrana	Sidrap	T	5.999	5.583	-416	55	11.740	3.572	15.312	55.975	15.177	71.152	7.115	11.940	2.590	108.109	2.339	
25.	Bulutimorang	Sidrap	T	5.692	4.950	-742	9	814	1.531	2.345	39.994	5.398	45.393	4.539	10.148	1.570	63.995	1.562	
26.	Kalosi	Pinrang	T	1.004	838	-166	23	814	1.497	2.311	7.375	674	8.049	805	1.985	1.260	14.411	2.077	
27.	Padang Sappa	Luwu	T	12.588	10.889	-1.699	15	1.260	2.545	3.805	75.364	20.910	96.274	9.627	35.672	3.600	148.978	1.653	
28.	Bajo	Luwu	ST	7.000	6.462	-538	12	935	3.572	4.506	74.749	14.331	89.079	8.908	13.758	2.590	118.841	2.221	
29.	Pagang Alipan	Luwu	ST	1.200	795	-405	7	1.027	449	1.476	5.107	2.021	7.128	713	1.630	1.260	12.207	1.855	
30.	Makawa	Luwu	NT	1.775	1.000	-775	22	1.096	1.497	2.593	6.363	2.475	8.839	884	2.112	1.260	15.687	1.895	
31.	Lamasi Kanan	Luwu	T	5.485	5.170	-315	20	1.270	1.531	2.801	56.471	18.417	74.889	7.489	11.249	2.590	99.018	2.313	
32.	Maloso, Sekka	Polmas	T	2.991	2.357	-634	7	1.027	2.084	3.112	17.725	6.619	24.344	2.434	5.060	1.570	36.520	1.872	
33.	Lakejo	Polmas	T	1.265	960	-305	17	1.090	1.497	2.587	4.803	1.094	5.897	590	1.968	1.260	12.302	1.548	
34.	Gamo-Gamo	Polmas	T	4.820	4.743	-77	7	1.260	4.638	5.898	30.903	1.778	32.680	3.268	10.939	1.570	54.355	1.384	
35.	Kanjiro	Luwu Utara	ST	1.491	1.301	-190	9	635	1.614	2.249	12.758	4.894	17.652	1.765	2.720	1.260	25.646	2.381	
36.	Bone-Bone	Luwu Utara	T	2.754	2.625	-129	20	1.454	1.614	3.069	25.346	8.049	33.395	3.339	5.381	1.570	46.754	2.151	
37.	Kalaena Kanan I	Luwu Utara	T	6.615	6.332	-283	23	365	0	365	55.791	22.885	78.677	7.868	13.281	2.590	102.780	1.961	
38.	Kalaena Kiri	Luwu Utara	T	4.043	3.536	-507	23	552	766	1.319	42.280	14.383	56.664	5.666	7.545	1.570	72.763	2.486	
39.	Kalaena Kanan II	Luwu Utara	T	5.077	3.787	-1.290	23	218	0	218	34.711	8.546	43.257	4.326	8.130	1.570	57.501	1.834	
40.	Kalaena (Rt. Bendung)	Luwu Utara	T	2.730	2.154	-576	23	589	625	1.214	19.578	4.390	23.967	2.397	4.585	1.570	33.734	1.892	
41.	Kuri-Kuri, Kasambi	Luwu Utara	ST	3.000	3.000	0	10	1.090	2.554	3.644	33.142	12.625	45.767	4.577	7.178	1.570	62.736	2.526	
<b>Total</b>				<b>138.517</b>	<b>121.527</b>	<b>-16.990</b>			<b>66.014</b>	<b>81.736</b>	<b>147.750</b>	<b>1.174.476</b>	<b>351.544</b>	<b>1.526.020</b>	<b>152.602</b>	<b>274.105</b>	<b>67.250</b>	<b>2.167.727</b>	<b>90.572</b>
Average							21											2.155	
Rp. per ha									0,543	0,673	1,216	9,664	2,893	12,557	1,256	2,256	0,553	17,837	
Itemized Total			T : 26 ST : 14 NT : 1																

Note: 1) T: Technical, ST: Semi-technical, NT: Non-technical

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

**Table 4.4.4 Economic Project Costs of Rehabilitation Plans: 3 Provinces**

(Unit: million Rp.)

North Sumatra					Central Java					South Sulawesi				
Irrigation Scheme	Subject Area (ha)	Initial Investment Cost (Economic Price)	Running Cost		Irrigation Scheme	Subject Area (ha)	Initial Investment Cost (Economic Price)	Running Cost		Irrigation Scheme	Subject Area (ha)	Initial Investment Cost (Economic Price)	Running Cost	
			Incremental O&M Cost	Replacement (every 10 years)				Incremental O&M Cost	Replacement (every 10 years)				Incremental O&M Cost	Replacement (every 10 years)
1, Gido Sebu	883	18.749	88	1.254	1, Cijalu	1.377	57.277	138	1.254	1, Bayang-Bayang	4.121	91.125	412	1.558
2, Batang Gadis	5.575	110.783	558	2.566	2, Mangganti	22.644	351.596	2.264	3.570	2, Bontomanai	3.297	62.495	330	1.558
3, Batang Ilung	3.546	78.750	355	1.558	3, Serayu	20.795	660.956	2.080	3.570	3, Bettu	1.802	35.432	180	1.254
4, Blk Sitongkon/Napa Suron	500	25.094	50	1.254	4, Banjarcahyana	5.001	179.003	500	2.566	4, Bontuyeleng	1.079	21.555	108	1.254
5, Siborna	950	39.789	95	1.254	5, Kaligending	2.923	49.176	292	1.558	5, Jenemarrung	975	22.209	98	1.254
6, Siaili Tukka	600	14.869	60	1.254	6, Pesučen	1.659	31.690	166	1.254	6, Pamukulu	4.480	112.980	448	1.558
7, Badiri Lopian	899	22.208	90	1.254	7, Bedegolan	8.401	149.909	840	2.566	7, Aparang 1	1.049	105.255	105	1.558
8, Pandurungan	1.334	34.495	133	1.254	8, Kedung Putri	4.451	103.622	445	1.558	8, Aparang Hulu	1.094	20.192	109	1.254
9, Sihiong	779	23.677	78	1.254	9, Sudagaran	3.665	81.966	367	1.558	9, Bantimurung	5.717	114.843	572	2.566
10, Aek Silang	1.500	25.944	150	1.254	10, Rebug	1.202	34.447	120	1.254	10, Lekopancing	2.483	54.104	248	1.558
11, Sarulla	1.692	19.363	169	1.254	11, Kalimeneng	1.262	32.593	126	1.254	11, Padaelo	2.462	46.776	246	1.558
12, Parmiah Hutapaung	1.000	26.354	100	1.254	12, Kedung GW	1.129	55.128	113	1.254	12, Leang Lonrong	1.229	28.101	123	1.254
13, Sinamo	930	23.027	93	1.254	13, Waduk Cengklik	2.120	56.822	212	1.558	13, Palakka	3.260	69.341	326	1.558
14, Aek Mandos I	1.059	15.650	106	1.254	14, Ploso Wareng	1.100	19.078	110	1.254	14, Pattiro	4.739	152.780	474	1.558
15, Simangatasi II	1.514	22.025	151	1.254	15, Jaban	1.191	40.731	119	1.254	15, Unyi	1.136	36.903	114	1.254
16, Bulung Ihit	1.355	16.829	136	1.254	16, Colo Kanan	22.982	637.114	2.298	3.570	16, Jalling	1.301	31.095	130	1.254
17, Perkotaan	3.446	97.881	345	1.558	17, Bonggo	1.406	44.966	141	1.254	17, Lanca	676	18.553	68	1.254
18, Sungai Balai	1.130	25.231	113	1.254	18, Pangkalan	654	18.738	65	1.254	18, Sanrego	5.676	144.274	568	2.566
19, Panca Arga	2.500	25.007	250	1.558	19, Sentul	1.739	32.745	174	1.254	19, Salobunne	1.296	35.084	130	1.254
20, Serbangan	2.044	41.401	204	1.558	20, Widodaren	2.616	50.889	262	1.558	20, Leworeng	2.187	26.689	219	1.558
21, Silau Bonto	967	31.111	97	1.254	21, Klambu Kanan	6.216	190.890	622	2.566	21, Tincó Kiri	2.620	50.323	262	1.558
22, Sungai Silau	452	31.461	45	1.254	22, Jragung	4.416	80.783	442	1.558	22, Cillallang	1.113	24.194	111	1.254
23, Padang Mahondang	2.905	49.284	291	1.558	23, Guntur	1.543	35.244	154	1.254	23, Alekarajae	1.253	32.238	125	1.254
24, Simujur	2.010	39.727	201	1.558	24, Klambu Kiri	20.738	381.227	2.074	3.570	24, Bulucenrana	5.583	125.981	558	2.566
25, Purwodadi	1.635	50.260	164	1.254	25, Kedungdowo Kramat	1.250	26.136	125	1.254	25, Bulutimorang	4.950	75.199	495	1.558
26, Pentara	298	13.759	30	1.254	26, Sungapan Kanan	1.851	25.923	185	1.254	26, Kalosi	838	16.866	84	1.254
27, Simantin Pane Dame	1.000	16.921	100	1.254	27, Mejagong	2.049	38.726	205	1.558	27, Padang Sappa	10.889	174.818	1.089	3.570
28, Panambeán / Panet Tongah BK	1.722	45.863	172	1.254	28, Sungapan Kiri	5.570	74.933	557	2.566	28, Bajo	6.462	138.601	646	2.566
29, Raja Hombang / T. Mangaraja	2.023	63.679	202	1.558	29, Kabuyutan	3.876	100.781	388	1.558	29, Pagang Alipan	795	14.326	80	1.254
30, Kerasaan	4.144	123.245	414	1.558	30, Babakan	2.528	48.361	253	1.558	30, Makawa	1.000	18.388	100	1.254
31, Javacolonisasi/Purbogondo	1.015	30.948	102	1.254	31, Kemaron Jambe	1.483	56.626	148	1.254	31, Lamasi Kanan	5.170	115.416	517	2.566
32, Naga Sompah	1.015	35.594	102	1.254	32, Jengkelok	6.173	125.237	617	2.566	32, Maloso, Sekka	2.357	42.762	236	1.558
33, Risma Duma	1.522	50.549	152	1.254	33, Gung	12.641	113.612	1.264	3.570	33, Lakejo	960	14.497	96	1.254
34, Lae Ordi	1.200	37.075	120	1.254	34, Parakankidang	1.631	24.189	163	1.254	34, Gamo-Gamo	4.743	64.084	474	1.558
35, Parit Lompaten	1.242	54.530	124	1.254	35, Kumisik	3.778	66.904	378	1.558	35, Kanjiro	1.301	29.905	130	1.254
36, Bandar Sidoras	3.457	99.222	346	1.558	36, Pesantren Kletak	3.636	87.122	364	1.558	36, Bone-Bone	2.625	54.581	263	1.558
37, Namu Rambe	1.036	35.399	104	1.254	37, Sragi	3.539	75.700	354	1.558	37, Kalaena Kanan I	6.332	120.162	633	2.566
38, Sei Belutu	5.076	74.044	508	2.566	38, Sudikampir	1.550	51.134	155	1.254	38, Kalaena Kiri	3.536	84.705	354	1.558
39, Langau	1.900	32.906	190	1.254	39, Padurekso	2.764	71.665	276	1.558	39, Kalaena Kanan II	3.787	67.325	379	1.558
40, Medan Krio	3.000	58.853	300	1.558	40, Kedung Asem	2.845	59.537	285	1.558	40, Kalaena (Rt. Bendung)	2.154	39.495	215	1.558
41, Rantau Panjang	2.309	57.504	231	1.558	41, Bodri	7.710	129.857	771	2.566	41, Kuri-Kuri, Kasambi	3.000	73.021	300	1.558
42, Pekan Kamis	1.100	23.376	110	1.254	42, Trompo	1.229	22.700	123	1.254					
43, Secanggang	1.400	60.547	140	1.254	43, Kedung Pengilon	2.686	48.530	269	1.558					
44, Paya Lobang	1.558	28.365	156	1.254	44, Pasekan	988	27.473	99	1.254					
45, Namu Sira-sira Kiri	1.350	38.143	135	1.254	45, Kosar	3.243	94.915	324	1.558					
46, Namu Sira-sira Kanan	3.953	88.626	395	1.558	46, Notog	25.540	968.345	2.554	3.570					
47, Bah Korah II	1.723	45.253	172	1.254	47, Sidorejo	5.717	149.072	572	2.566					
48, Sijambi	1.008	42.940	101	1.254	48, Glapan	18.784	227.874	1.878	3.570					
49, Rambung Mera	944	39.557	94	1.254	49, Klambu Kanan	11.078	130.967	1.108	3.570					
50, Pava Sordang	4.350	81.853	435	1.558	50, Kaliwadas	7.722	217.327	772	2.566					
<b>Total</b>	<b>90.550</b>	<b>2.187.721</b>	<b>9.055</b>	<b>69.276</b>	<b>Total</b>	<b>283.091</b>	<b>6.440.238</b>	<b>28.309</b>	<b>96.588</b>	<b>Total</b>	<b>121.527</b>	<b>2.606.671</b>	<b>12.153</b>	<b>67.074</b>

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture



**Table 4.4.6 Results of Economic Evaluation of Rehabilitation Plans: 3 Provinces**

North Sumatra					Central Java					South Sulawesi				
Irrigation Scheme	Subject Area (ha)	EIRR (%)	B/C *1	B - C (Rp. million) *1	Irrigation Scheme	Subject Area (ha)	EIRR (%)	B/C *1	B - C (Rp. million) *1	Irrigation Scheme	Subject Area (ha)	EIRR (%)	B/C *1	B - C (Rp. million) *1
1, Gido Sebu	883	14,5%	1,41	7.199	1, Cijalu	1.377	4,8%	0,59	-20.929	1, Bayang-Bayang	4.121	12,1%	1,19	15.967
2, Batang Gadis	5.575	11,7%	1,15	15.766	2, Mangganti	22.644	7,5%	0,79	-70.178	2, Bontomanai	3.297	14,2%	1,39	22.763
3, Batang Lung	3.546	11,2%	1,10	7.338	3, Serayu	20.795	1,7%	0,39	-360.535	3, Bettu	1.802	14,2%	1,38	12.564
4, Blk Sitongkon/Napa Suron	500	3,1%	0,50	-11.520	4, Banjarcayana	5.001	5,2%	0,62	-61.508	4, Bontonyeleng	1.079	17,2%	1,67	13.634
5, Siborna	950	8,3%	0,86	-5.032	5, Kaligending	2.923	6,8%	0,75	-11.589	5, Jenemarrung	975	20,7%	2,04	21.734
6, Siaili Tukka	600	12,5%	1,21	3.005	6, Pesucen	1.659	14,2%	1,37	11.107	6, Pamukulu	4.480	13,7%	1,35	36.255
7, Badiri Lopian	899	11,8%	1,15	3.176	7, Bedegolan	8.401	6,4%	0,71	-40.964	7, Aparang I	1.049	8,5%	0,88	-3.277
8, Pandurungan	1.334	11,5%	1,13	4.051	8, Kedung Putri	4.451	9,1%	0,92	-7.352	8, Aparang Hulu	1.094	14,3%	1,38	7.416
9, Sihiong	779	11,0%	1,09	2.025	9, Sudagaran	3.665	9,4%	0,95	-3.958	9, Bantimurung	5.717	11,4%	1,13	13.646
10, Aek Silang	1.500	18,2%	1,79	20.079	10, Rebug	1.202	6,1%	0,70	-9.648	10, Lekopancing	2.483	15,0%	1,48	23.946
11, Sarulla	1.692	23,0%	2,31	25.235	11, Kalimeneng	1.262	6,8%	0,75	-7.635	11, Padaelo	2.462	21,6%	2,20	53.118
12, Parniahan Hutapaung	1.000	12,7%	1,23	5.807	12, Kedung GW	1.129	-1,2%	0,28	-35.929	12, Leang Lonrong	1.229	18,3%	1,79	20.836
13, Sinamo	930	13,9%	1,34	7.536	13, Waduk Cengklik	2.120	8,9%	0,90	-4.988	13, Palakka	3.260	15,6%	1,55	35.037
14, Aek Mandos I	1.059	18,4%	1,78	11.848	14, Ploso Wareng	1.100	7,0%	0,77	-4.175	14, Pattiro	4.739	9,4%	0,95	-6.919
15, Simangatasi II	1.514	21,1%	2,06	22.532	15, Jaban	1.191	0,6%	0,36	-23.728	15, Unyi	1.136	10,3%	1,03	1.005
16, Bulung Ihit	1.355	18,5%	1,77	12.812	16, Colo Kanan	22.982	3,2%	0,48	-299.425	16, Jalling	1.301	14,3%	1,39	11.323
17, Perkotaan	3.446	8,8%	0,90	-8.727	17, Bonggo	1.406	3,5%	0,52	-19.602	17, Lanca	676	11,3%	1,11	1.976
18, Sungai Balai	1.130	10,6%	1,05	1.246	18, Pangkalan	654	4,5%	0,59	-7.173	18, Sanrego	5.676	12,2%	1,20	27.029
19, Panca Arga	2.500	26,2%	2,57	40.099	19, Sentul	1.739	7,8%	0,82	-5.481	19, Salobunne	1.296	11,0%	1,09	2.838
20, Serbangan	2.044	13,6%	1,33	12.589	20, Widodaren	2.616	13,9%	1,37	17.402	20, Leworeng	2.187	20,4%	1,98	25.565
21, Silau Bonto	967	11,7%	1,15	4.391	21, Klambu Kanan	6.216	1,9%	0,41	-101.396	21, Tinco Kiri	2.620	13,3%	1,31	14.510
22, Sungai Silau	452	4,5%	0,58	-11.948	22, Jragung	4.416	15,0%	1,48	35.833	22, Cillallang	1.113	22,8%	2,24	29.316
23, Padang Mahondang	2.905	19,4%	1,92	44.403	23, Guntur	1.543	4,7%	0,60	-13.058	23, Alekarajae	1.253	16,1%	1,57	17.123
24, Simujur	2.010	14,0%	1,37	14.037	24, Klambu Kiri	20.738	8,7%	0,88	-40.884	24, Bulucenrana	5.583	13,3%	1,31	36.368
25, Purwodadi	1.635	7,3%	0,78	-9.940	25, Kedungdowo Kramat	1.250	9,3%	0,94	-1.393	25, Bulutimorang	4.950	15,7%	1,55	38.868
26, Pentara	298	7,0%	0,76	-3.057	26, Sungapan Kanan	1.851	17,1%	1,65	16.243	26, Kalosi	838	14,9%	1,43	6.973
27, Simantin Pane Dame	1.000	13,1%	1,27	4.526	27, Mejagong	2.049	6,2%	0,71	-10.572	27, Padang Sappa	10.889	12,6%	1,24	39.807
28, Panambea / Panet Tengah BK	1.722	9,9%	0,99	-527	28, Sungapan Kiri	5.570	13,0%	1,27	19.284	28, Bajo	6.462	13,5%	1,33	41.882
29, Raja Hombang / T. Mangaraja	2.023	11,1%	1,10	5.733	29, Kabuyutan	3.876	8,4%	0,86	-12.547	29, Pagang Alipan	795	17,5%	1,69	9.552
30, Kerasaan	4.144	11,4%	1,13	14.145	30, Babakan	2.528	6,9%	0,75	-11.089	30, Makawa	1.000	16,6%	1,60	10.671
31, Javacolonisasi/Purbogondo	1.015	8,0%	0,84	-4.655	31, Kemaron Jambe	1.483	11,3%	1,12	5.945	31, Lamasi Kanan	5.170	11,6%	1,14	15.444
32, Naga Sompah	1.015	11,0%	1,09	2.850	32, Jengkelok	6.173	14,0%	1,38	43.863	32, Maloso, Sekka	2.357	13,3%	1,29	11.664
33, Risma Duma	1.522	9,4%	0,95	-2.564	33, Gung	12.641	16,1%	1,59	66.259	33, Lakejo	960	16,5%	1,58	8.231
34, Lae Ordi	1.200	9,0%	0,92	-2.877	34, Parakankidang	1.631	15,1%	1,46	10.696	34, Gamo-Gamo	4.743	18,8%	1,84	53.318
35, Parit Lompaten	1.242	8,9%	0,91	-4.408	35, Kumisik	3.778	13,5%	1,32	19.962	35, Kanjiro	1.301	12,1%	1,18	5.016
36, Bandar Sidoras	3.457	10,9%	1,08	6.903	36, Pesantren Kletak	3.636	3,0%	0,48	-41.263	36, Bone-Bone	2.625	13,5%	1,31	15.876
37, Namu Rambe	1.036	9,8%	0,98	-666	37, Sragi	3.539	3,8%	0,53	-32.657	37, Kalaena Kanan I	6.332	12,9%	1,27	30.218
38, Sei Belutu	5.076	17,9%	1,78	54.735	38, Sudikampir	1.550	0,6%	0,36	-29.648	38, Kalaena Kiri	3.536	13,2%	1,30	23.284
39, Langau	1.900	19,5%	1,90	28.486	39, Padurekso	2.764	1,8%	0,42	-38.370	39, Kalaena Kanan II	3.787	22,4%	2,29	82.098
40, Medan Krio	3.000	12,2%	1,20	10.813	40, Kedung Asem	2.845	8,8%	0,90	-5.779	40, Kalaena (Rt. Bendung)	2.154	16,3%	1,60	22.409
41, Rantau Panjang	2.309	13,6%	1,34	17.798	41, Bodri	7.710	8,1%	0,84	-19.515	41, Kuri-Kuri, Kasambi	3.000	14,2%	1,39	26.996
42, Pekan Kamis	1.100	11,5%	1,13	2.862	42, Trompo	1.229	7,1%	0,77	-4.866					
43, Secanggih	1.400	10,5%	1,05	2.616	43, Kedung Pengilon	2.686	9,2%	0,93	-3.024					
44, Paya Lobang	1.558	17,8%	1,73	19.766	44, Pasekan	988	8,8%	0,90	-2.479					
45, Namu Sira-sira Kiri	1.350	12,2%	1,19	6.785	45, Kosar	3.243	2,5%	0,45	-47.538					
46, Namu Sira-sira Kanan	3.953	14,1%	1,39	31.711	46, Notog	25.540	5,1%	0,60	-347.085					
47, Bah Korah II	1.723	9,1%	0,92	-3.183	47, Sidorejo	5.717	6,3%	0,70	-41.045					
48, Sijambi	1.008	8,6%	0,89	-4.462	48, Glapan	18.784	12,6%	1,24	52.384					
49, Rambung Mera	944	6,2%	0,70	-10.803	49, Klambu Kanan	11.078	12,5%	1,24	29.752					
50, Paya Sordang	4.350	14,9%	1,46	35.435	50, Kaliwadas	7.722	1,2%	0,37	-123.708					

Note \*1: At discount rate of 10%

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture



**Table 4.5.1 Priority Ranking for Rehabilitation : North Sumatra**

Irrigation Scheme	Utilization of Irrigation Potential	Function of Water Resources Facility	Function of Main Canal	Function of Secondary Canal	Function of On-farm	Factor of Deterioration by Year of Construction	Technical Level	Current Cropping Intensity	Current Unit Yield of Paddy	Contribution to Regional Economy	Provision of social infrastructure	EIRR	Rate of Increase of Agricultural Return	Total Score	Ranking	Classified Group
1 Gido Sebu						Group VI (Subject area is less than 1,000 ha)										Group VI
2 Batang Gadis	(3)	(3)	(3)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(4)	(3)	(3)	54,4	17	Group III
3 Batang Ilung	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(2)	(3)	(3)	58,8	15	Group III
4 Blk Sitongkon/Napa Suron						Group VI (Subject area is less than 1,000 ha)										Group VI
5 Siborna						Group VI (Subject area is less than 1,000 ha)										Group VI
6 Siaili Tukka						Group VI (Subject area is less than 1,000 ha)										Group VI
7 Badiri Lopian						Group VI (Subject area is less than 1,000 ha)										Group VI
8 Pandurungan	(3)	(1)	(1)	(1)	(2)	(3)	(3)	(2)	(2)	(3)	(1)	(3)	(2)	76,2	2	Group I
9 Sihiong						Group VI (Subject area is less than 1,000 ha)										Group VI
10 Aek Silang						Group V (Accerlation of WUAs establishment)										Group V
11 Sarulla						Group V (Accerlation of WUAs establishment)										Group V
12 Parmiahn Hutapaung						Group V (Accerlation of WUAs establishment)										Group V
13 Sinamo						Group VI (Subject area is less than 1,000 ha)										Group VI
14 Aek Mandos I	(3)	(2)	(3)	(1)	(1)	(4)	(2)	(1)	(2)	(4)	(2)	(2)	(1)	74,7	4	Group I
15 Simangatasi II	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(2)	(2)	(4)	(1)	(1)	(1)	73,3	5	Group I
16 Bulung Ihit	(3)	(3)	(1)	(1)	(2)	(4)	(3)	(3)	(3)	(4)	(4)	(2)	(3)	59,7	14	Group III
17 Perkotaan	(3)	(3)	(2)	(2)	(3)	(4)	(3)	(3)	(3)	(4)	(4)	(4)	(3)	53,7	18	Group III
18 Sungai Balai	(3)	(2)	(1)	(1)	(2)	(4)	(2)	(3)	(3)	(4)	(1)	(3)	(3)	66,9	6	Group I
19 Panca Arga						Group IV (Reformulation of development plan)										Group IV
20 Serbangan						Group IV (Reformulation of development plan)										Group IV
21 Silau Bonto						Group V (Accerlation of WUAs establishment)										Group V
22 Sungai Silau						Group IV (Reformulation of development plan)										Group IV
23 Padang Mahondang	(1)	(1)	(1)	(1)	(3)	(2)	(2)	(1)	(1)	(4)	(2)	(1)		87,5	1	Group I
24 Simujur	(2)	(1)	(1)	(1)	(3)	(2)	(2)	(2)	(2)	(4)	(4)	(3)	(2)	76,0	3	Group I
25 Purwodadi	(3)	(2)	(1)	(1)	(2)	(4)	(3)	(3)	(3)	(1)	(4)	(4)	(3)	63,2	9	Group II
26 Pentara						Group VI (Subject area is less than 1,000 ha)										Group VI
27 Simantin Pane Dame						Group V (Accerlation of WUAs establishment)										Group V
28 Panambean / Panet Tongah BK	(3)	(3)	(2)	(1)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	59,8	12	Group II
29 Raja Hombang / T. Mangaraja	(3)	(3)	(2)	(1)	(1)	(4)	(3)	(3)	(3)	(4)	(1)	(3)	(2)	63,4	8	Group II
30 Kerasaan	(3)	(2)	(1)	(1)	(3)	(3)	(2)	(3)	(4)	(4)	(3)	(2)		64,4	7	Group II
31 Javacolonisasi/Purbogondo	(3)	(3)	(2)	(1)	(2)	(4)	(3)	(3)	(3)	(4)	(3)	(4)	(3)	56,8	16	Group III
32 Naga Sompah						Group VI (High rehabilitation cost)										Group VI
33 Risma Duma						Group VI (Less facility was provided)										Group VI
34 Lae Ordi						Group V (Accerlation of WUAs establishment)										Group V
35 Parit Lompaten						Group VI (High rehabilitation cost)										Group VI
36 Bandar Sidoras						Group V (Accerlation of WUAs establishment)										Group V
37 Namu Rambe						Group VI (High rehabilitation cost)										Group VI
38 Sei Belutu						Group V (Accerlation of WUAs establishment)										Group V
39 Langau						Group V (Accerlation of WUAs establishment)										Group V
40 Medan Krio						Group V (Accerlation of WUAs establishment)										Group V
41 Rantau Panjang						Group VI (Less facility was provided)										Group VI
42 Pekan Kamis						Group V (Accerlation of WUAs establishment)										Group V
43 Secanggih						Group VI (High rehabilitation cost)										Group VI
44 Paya Lombang						Group V (Accerlation of WUAs establishment)										Group V
45 Namu Sira-sira Kiri	(3)	(3)	(2)	(2)	(1)	(3)	(3)	(2)	(3)	(4)	(4)	(3)	(2)	61,4	10	Group II
46 Namu Sira-sira Kanan	(3)	(3)	(2)	(2)	(3)	(3)	(2)	(3)	(4)	(4)	(3)	(2)		60,8	11	Group II
47 Bah Korah II						Group V (Accerlation of WUAs establishment)										Group V
48 Sijambi						Group V (Accerlation of WUAs establishment)										Group V
49 Rambung Mera						Group VI (Subject area is less than 1,000 ha)										Group VI
50 Paya Sordang	(3)	(3)	(2)	(1)	(2)	(4)	(3)	(3)	(3)	(4)	(3)	(2)		59,8	12	Group II
Average														64,8		
Itemized Total	(1)	1	3	6	12	6	0	0	1	1	2	5	1	3		Group I :
	(2)	1	5	10	6	11	0	4	7	4	0	2	3	7		Group II :
	(3)	16	10	2	0	1	6	14	10	13	2	1	10	8		Group III :
	(4)	0	0	0	0	0	12	0	0	0	14	10	4	0		Group IV :
																Group V :
																Group VI :

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

Group I: First priority group (Ranking 1 - 6)

Group II: Second priority group (Ranking 7 - 12)

Group III: Third priority group (Ranking 13 - 18)

Group IV: Reformulation of water resources development plan

Group V: Accerlation of WUAs establishment

Group VI: Development by other category or method

**Table 4.5.2 Priority Ranking for Rehabilitation : Central Java**

Irrigation Scheme	Utilization of Irrigation Potential	Function of Water Resources Facility	Function of Main Canal	Function of Secondary Canal	Function of On-farm	Factor of Deterioration by Year of Construction	Technical Level	Current Cropping Intensity	Current Unit Yield of Paddy	Contribution to Regional Economy	Provision of social infrastructure	EIRR	Rate of Increase of Agricultural Return	Total Score	Ranking	Classified Group
1 Cijalu	Group VI (High rehabilitation cost)															Group VI
2 Mangganti	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(2)	(4)	(3)	57,3	28	Group III
3 Serayu	(3)	(3)	(1)	(1)	(2)	(4)	(3)	(4)	(3)	(4)	(2)	(4)	(3)	57,7	26	Group II
4 Banjarcayana	Group VI (High rehabilitation cost)															Group VI
5 Kaligending	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(4)	(4)	(3)	54,3	36	Group III
6 Pesucen	(3)	(4)	(3)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(2)	(3)	(3)	55,4	33	Group III
7 Bedegolan	(3)	(3)	(3)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	57,4	27	Group III
8 Kedung Putri	(3)	(2)	(2)	(2)	(2)	(3)	(3)	(3)	(3)	(4)	(4)	(4)	(3)	57,8	24	Group II
9 Sudagaran	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	60,8	12	Group I
10 Rebug	(3)	(2)	(1)	(1)	(1)	(3)	(3)	(3)	(3)	(4)	(2)	(4)	(3)	63,8	4	Group I
11 Kalimeneng	(3)	(2)	(2)	(2)	(2)	(3)	(3)	(4)	(3)	(4)	(2)	(4)	(3)	58,8	20	Group II
12 Kedung GW	Group VI (High rehabilitation cost)															Group VI
13 Waduk Cengklik	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(2)	(3)	(4)	(4)	(4)	(3)	58,3	23	Group II
14 Ploso Wareng	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(4)	(4)	(3)	54,3	36	Group III
15 Jaban	Group VI (High rehabilitation cost)															Group VI
16 Colo Kanan	(3)	(2)	(1)	(2)	(2)	(3)	(3)	(4)	(3)	(4)	(4)	(4)	(3)	57,2	30	Group III
17 Bonggo	(3)	(1)	(2)	(2)	(2)	(3)	(3)	(4)	(3)	(4)	(4)	(4)	(3)	57,8	24	Group II
18 Pangkalan	Group VI (Subject area is less than 1,000 ha)															Group VI
19 Sentul	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	60,8	12	Group I
20 Widodaren	Group V (Acceralation of WUAs establishment)															Group V
21 Klambu Kanan	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(3)	(4)	(3)	55,8	32	Group III
22 Jragung	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(1)	(3)	(4)	(1)	(2)	(3)	67,8	2	Group I
23 Guntur	Group V (Acceralation of WUAs establishment)															Group V
24 Klambu Kiri	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(2)	(4)	(3)	55,3	34	Group III
25 Kedungdowo Kramat	(3)	(2)	(2)	(1)	(2)	(3)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	63,3	5	Group I
26 Sungapan Kanan	(3)	(3)	(3)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(4)	(2)	(3)	55,9	31	Group III
27 Mejagong	Group V (Acceralation of WUAs establishment)															Group V
28 Sungapan Kiri	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(2)	(3)	(3)	58,8	20	Group II
29 Kabuyutan	(3)	(2)	(2)	(2)	(2)	(3)	(3)	(2)	(3)	(4)	(2)	(4)	(3)	62,8	6	Group I
30 Babakan	(3)	(2)	(2)	(1)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	61,8	9	Group I
31 Kemaron Jambe	Group VI (High rehabilitation cost)															Group VI
32 Jengkelok	(3)	(2)	(2)	(1)	(1)	(4)	(3)	(1)	(3)	(4)	(1)	(3)	(3)	67,9	1	Group I
33 Gung	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(2)	(3)	(4)	(4)	(2)	(3)	61,3	11	Group I
34 Parakankidang	(3)	(2)	(3)	(2)	(2)	(4)	(3)	(2)	(3)	(4)	(4)	(2)	(3)	58,9	19	Group II
35 Kumisik	(3)	(2)	(2)	(1)	(2)	(4)	(3)	(2)	(3)	(4)	(4)	(3)	(3)	60,8	12	Group I
36 Pesantren Kletak	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(2)	(4)	(3)	57,3	28	Group III
37 Sragi	(3)	(2)	(2)	(2)	(2)	(3)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	62,3	8	Group I
38 Sudikampir	(3)	(2)	(2)	(1)	(2)	(3)	(3)	(3)	(3)	(4)	(2)	(4)	(3)	61,8	9	Group I
39 Padurekso	(3)	(2)	(1)	(1)	(2)	(1)	(3)	(3)	(3)	(4)	(2)	(4)	(3)	66,2	3	Group I
40 Kedung Asem	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(1)	(4)	(3)	58,8	20	Group II
41 Bodri	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	60,8	12	Group I
42 Trompo	(3)	(1)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	62,8	6	Group I
43 Kedung Pengilon	(3)	(2)	(2)	(2)	(2)	(4)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	60,8	12	Group I
44 Pasekan	Group VI (Subject area is less than 1,000 ha)															Group VI
45 Kosar	Group V (Acceralation of WUAs establishment)															Group V
46 Notog	Group VI (High rehabilitation cost)															Group VI
47 Sidorejo	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(4)	(4)	(3)	52,3	38	Group III
48 Glapan	(3)	(2)	(2)	(2)	(2)	(3)	(3)	(4)	(3)	(4)	(2)	(3)	(3)	60,3	17	Group II
49 Klambu Kanan	(3)	(3)	(2)	(2)	(2)	(4)	(3)	(4)	(3)	(4)	(3)	(3)	(3)	55,3	34	Group III
50 Kaliwadas	(3)	(3)	(2)	(2)	(2)	(3)	(3)	(3)	(3)	(4)	(1)	(4)	(3)	60,3	17	Group II
Average														59,5		
Itemized Total	(1)	0	2	4	8	2	1	0	2	0	0	13	0	0	Group I :	16
	(2)	0	24	30	29	36	0	0	5	0	0	12	4	0	Group II :	10
	(3)	38	11	4	1	0	11	38	20	38	0	2	6	38	Group III :	12
	(4)	0	1	0	0	0	26	0	11	0	38	11	28	0	Group IV :	0
															Group V :	4
															Group VI :	8

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

Group I: First priority group (Ranking 1 - 13)

Group II: Second priority group (Ranking 14 - 26)

Group III: Third priority group (Ranking 27 - 38)

Group IV: Reformulation of water resources development plan

Group V: Acceralation of WUAs establishment

Group VI: Development by other category or method

**Table 4.5.3 Priority Ranking for Rehabilitation : South Sulawesi**

Irrigation Scheme	Utilization of Irrigation Potential	Function of Water Resources Facility	Function of Main Canal	Function of Secondary Canal	Function of On-farm	Factor of Deterioration by Year of Construction	Technical Level	Current Cropping Intensity	Current Unit Yield of Paddy	Contribution to Regional Economy	Provision of social infrastructure	EIRR	Rate of Increase of Agricultural Return	Total Score	Ranking	Classified Group
1 Bayang-Bayang	Group V (Accerallation of WUAs establishment)														Group V	
2 Bontomanai	Group V (Accerallation of WUAs establishment)														Group V	
3 Bettu	Group V (Accerallation of WUAs establishment)														Group V	
4 Bontonyeleng	Group V (Accerallation of WUAs establishment)														Group V	
5 Jenemarrung	Group VI (Subject area is less than 1,000 ha)														Group VI	
6 Pamukulu	(3)	(2)	(2)	(1)	(2)	(3)	(3)	(2)	(2)	(4)	(4)	(3)	(1)	68,3	16	Group II
7 Aparang I	(3)	(3)	(1)	(1)	(1)	(3)	(2)	(3)	(3)	(4)	(1)	(4)	(3)	65,5	19	Group III
8 Aparang Hulu	(3)	(2)	(1)	(1)	(1)	(3)	(2)	(3)	(3)	(4)	(1)	(3)	(3)	69,0	12	Group II
9 Bantimurung	(3)	(2)	(1)	(2)	(1)	(3)	(3)	(3)	(3)	(4)	(2)	(3)	(3)	64,3	21	Group III
10 Lekopancing	(3)	(3)	(1)	(1)	(2)	(3)	(3)	(2)	(3)	(4)	(2)	(2)	(2)	67,7	17	Group II
11 Padaelo	(3)	(3)	(2)	(1)	(2)	(3)	(3)	(2)	(2)	(3)	(4)	(1)	(1)	70,8	4	Group I
12 Leang Lonrong	(3)	(3)	(1)	(1)	(2)	(3)	(3)	(2)	(3)	(4)	(1)	(2)	(2)	69,2	8	Group I
13 Palakka	(3)	(3)	(1)	(1)	(2)	(3)	(3)	(2)	(3)	(4)	(1)	(2)	(2)	69,2	8	Group I
14 Pattiro	(3)	(2)	(1)	(1)	(2)	(1)	(3)	(3)	(3)	(4)	(1)	(4)	(2)	69,2	8	Group I
15 Unyi	(3)	(3)	(1)	(1)	(2)	(3)	(3)	(3)	(3)	(4)	(1)	(3)	(3)	64,2	22	Group III
16 Jalling	(3)	(3)	(2)	(1)	(2)	(3)	(3)	(2)	(3)	(4)	(1)	(3)	(2)	66,3	18	Group III
17 Lanca	Group VI (Subject area is less than 1,000 ha)														Group VI	
18 Sanrego	(3)	(3)	(1)	(1)	(1)	(4)	(3)	(3)	(2)	(3)	(1)	(3)	(2)	69,3	7	Group I
19 Salobunne	(3)	(2)	(1)	(1)	(2)	(1)	(3)	(3)	(3)	(4)	(1)	(3)	(2)	70,7	6	Group I
20 Leworeng	(3)	(2)	(3)	(2)	(1)	(4)	(3)	(3)	(3)	(4)	(1)	(1)	(3)	64,5	20	Group III
21 Tinco Kiri	(3)	(3)	(1)	(1)	(1)	(4)	(3)	(3)	(3)	(4)	(1)	(3)	(3)	63,3	24	Group III
22 Cillallang	(1)	(2)	(1)	(1)	(2)	(2)	(2)	(2)	(1)	(1)	(1)	(1)	(1)	91,0	1	Group I
23 Alekarajae	Group V (Accerallation of WUAs establishment)														Group V	
24 Bulucenrana	(3)	(2)	(2)	(1)	(2)	(1)	(3)	(3)	(3)	(3)	(1)	(3)	(2)	70,8	4	Group I
25 Bulotimorang	(3)	(2)	(2)	(1)	(1)	(4)	(3)	(2)	(3)	(4)	(1)	(2)	(2)	68,9	13	Group II
26 Kalosi	Group VI (Subject area is less than 1,000 ha)														Group VI	
27 Padang Sappa	(2)	(3)	(1)	(1)	(2)	(3)	(3)	(1)	(2)	(2)	(1)	(3)	(2)	78,7	2	Group I
28 Bajo	Group V (Accerallation of WUAs establishment)														Group V	
29 Pagang Alipan	Group VI (Subject area is less than 1,000 ha)														Group VI	
30 Makawa	Group V (Accerallation of WUAs establishment)														Group V	
31 Lamasi Kanan	(3)	(2)	(1)	(1)	(2)	(3)	(3)	(3)	(2)	(3)	(2)	(3)	(3)	69,2	8	Group I
32 Maloso, Sekka	(3)	(3)	(2)	(1)	(1)	(4)	(3)	(3)	(3)	(3)	(1)	(3)	(3)	63,4	23	Group III
33 Lakejo	Group VI (Subject area is less than 1,000 ha)														Group VI	
34 Gamo-Gamo	(1)	(3)	(2)	(1)	(2)	(4)	(3)	(2)	(2)	(2)	(1)	(2)	(2)	77,3	3	Group I
35 Kanjiro	(3)	(2)	(1)	(2)	(4)	(2)	(3)	(2)	(4)	(1)	(3)	(3)	(3)	68,5	15	Group II
36 Bone-Bone	Group V (Accerallation of WUAs establishment)														Group V	
37 Kalaena Kanan I	Group V (Accerallation of WUAs establishment)														Group V	
38 Kalaena Kiri	(3)	(3)	(1)	(1)	(2)	(3)	(3)	(3)	(2)	(3)	(2)	(3)	(2)	68,7	14	Group II
39 Kalaena Kanan II	Group V (Accerallation of WUAs establishment)														Group V	
40 Kalaena (Rt. Bendung)	(3)	(3)	(2)	(2)	(2)	(3)	(3)	(3)	(2)	(3)	(4)	(2)	(3)	63,3	24	Group III
41 Kuri-Kuri, Kasambi	Group V (Accerallation of WUAs establishment)														Group V	
Average													69,3			
Itemized Total	(1)	2	0	15	22	9	3	0	1	0	1	18	3	3	Group I :	11
	(2)	1	11	9	3	16	1	4	9	10	2	4	6	12	Group II :	6
	(3)	22	14	1	0	0	14	21	15	15	7	0	14	10	Group III :	8
	(4)	0	0	0	0	7	0	0	0	15	3	2	0		Group IV :	0
															Group V :	11
															Group VI :	5

Source: JICA Study Team for the Study on Comprehensive Recovery Program of Irrigation Agriculture

Group I: First priority group (Ranking 1 - 9)

Group II: Second priority group (Ranking 10 - 17)

Group III: Third priority group (Ranking 18 - 25)

Group IV: Reformulation of water resources development plan

Group V: Accerallation of WUAs establishment

Group VI: Development by other category or method

**Table 4.6.1 Breakdown of Area, Cost, Construction Package for Recovery Program on Action Plan -1/3 : North Sumatra**

Priority Group	Scheme No.	Irrigation Scheme	District	Subject Area (ha)	Const. Cost (Bil. Rp.)	Nos. of Contract.		Const. Period (Year)
						F/S	Construction	
I	PI-1	Pandurungan	Tapanuli Tengah	1.334	30	1	1	2
	PI-2	Aek Mandos I	Toba Samosir	1.059	13	1	1	2
	PI-3	Simangatasi II	Toba Samosir	1.514	19	1	1	2
	PI-4	Sungai Balai	Asahan	1.130	22	1	1	2
	PI-5	Padang Mahondang	Asahan	2.905	42	1	2	2
	PI-6	Simujur	Asahan	2.010	34	1	1	2
	Total I			9.952	160	6	7	
II	PII-1	Purwodadi	Asahan	1.635	43	1	1	2
	PII-2	Panambean / Panet Tengah BK	Simalungun	1.722	39	1	1	2
	PII-3	Raja Hombang / T. Mangaraja	Simalungun	2.023	55	1	1	2
	PII-4	Kerasaan	Simalungun	4.144	106	1	2	2
	PII-5	Namu Sira-sira Kiri	Langkat/Binjai	1.350	33	1	1	2
	PII-6	Namu Sira-sira Kanan	Langkat/Binjai	3.953	76	1	2	2
	PII-7	Paya Sordang	Tapanuli Sel/Mandailing Natal	4.350	70	1	2	2
Total II			19.177	422	7	10		
III	PIII-1	Batang Gadis	Mandailing Natal	5.575	95	1	2	2
	PIII-2	Batang Ilung	Tapanuli Selatan	3.546	68	1	1	2
	PIII-3	Bulung Ihit	Labuhan Batu	1.355	14	1	1	2
	PIII-4	Perkotaan	Asahan	3.446	84	1	2	2
	PIII-5	Javacolonisasi/Purbogondo	Simalungun	1.015	27	1	1	2
Total III			14.937	288	5	7		
IV	PIV-1	Panca Arga	Asahan	2.500	73	1	N.A	
	PIV-2	Serbangan	Asahan	2.044	78	1	N.A	
	PIV-3	Sungai Silau	Asahan	452	20	1	N.A	
	Total IV			4.996	171	3		
V	PV-1	Aek Silang	Tapanuli Utara	1.500	22	1	N.A	
	PV-2	Sarulla	Tapanuli Utara	1.692	16	1	N.A	
	PV-3	Parmiah Hutapaung	Tapanuli Utara	1.000	23	1	N.A	
	PV-4	Silau Bonto	Asahan	967	42	1	N.A	
	PV-5	Simantin Pane Dame	Simalungun	1.000	14	1	N.A	
	PV-6	Lae Ordi	Dairi	1.200	32	1	N.A	
	PV-7	Bandar Sidoras	Deli Serdang	3.457	85	1	N.A	
	PV-8	Sei Belutu	Deli Serdang	5.076	63	1	N.A	
	PV-9	Langau	Deli Serdang	1.900	28	1	N.A	
	PV-10	Medan Krio	Deli Serdang	3.000	50	1	N.A	
	PV-11	Pekan Kamis	Deli Serdang	1.100	20	1	N.A	
	PV-12	Paya Lombang	Deli Serdan/Tebing Tinggi	1.558	24	1	N.A	
	PV-13	Bah Korah II	Simalungun/Siantar	1.723	39	1	N.A	
Total V			26.181	496	14			
VI	PVI-1	Gido Sebu	Nias	883	16	1	NA	
	PVI-2	Blk Sitongkon/Napa Suron	Tapanuli Selatan	500	22	1	NA	
	PVI-3	Siborna	Tapanuli Selatan	950	34	1	NA	
	PVI-4	Siaili Tukka	Tapanuli Tengah	600	13	1	NA	
	PVI-5	Badiri Lopian	Tapanuli Tengah	899	19	1	NA	
	PVI-6	Sihiong	Tapanuli Tengah	779	20	1	NA	
	PVI-7	Sinamo	Tapanuli Utara	930	20	1	NA	
	PVI-8	Pentara	Simalungun	298	12	1	NA	
	PVI-9	Naga Sompah	Simalungun	1.015	30	1	NA	
	PVI-10	Risma Duma	Dairi	1.522	44	1	NA	
	PVI-11	Parit Lompaten	Karo	1.242	47	1	NA	
	PVI-12	Namu Rambe	Deli Serdang	1.036	31	1	NA	
	PVI-13	Rantau Panjang	Deli Serdang	2.309	49	1	NA	
	PVI-14	Secanggang	Langkat	1.400	52	1	NA	
	PVI-15	Rambung Mera	P. Siantar/Simalungun	944	34	1	NA	
Total VI			15.307	443	15			
	Grond Total		90.550	1.980				

**Table 4.6.1 Breakdown of Area, Cost, Construction Package for Recovery Program on Action Plan -2/3 : Central Java**

Stage No.	Scheme No.	Irrigation Scheme	District	Subject Area (ha)	Const. Cost (Bil. Rp.)	Nos. of Contract		Construction Period (Year)
						F/S	Construction	
I	PI-1	Sudagaran	Purworejo	3.665	70	1	2	2
	PI-2	Rebug	Purworejo	1.202	30	1	1	2
	PI-3	Sentul	Pati	1.739	28	1	1	2
	PI-4	Jragung	Demak	4.416	69	1	2	2
	PI-5	Kedungdowo Kramat	Batang	1.250	22	1	1	2
	PI-6	Kabuyutan	Brebes	3.876	87	1	2	2
	PI-7	Babakan	Brebes	2.528	41	1	1	2
	PI-8	Jengkelok	Brebes	6.173	107	1	3	2
	PI-9	Gung	Tegal & Kodia Tegal	12.641	95	1	2	3
	PI-10	Kumisik	Tegal & Kodia Tegal	3.778	57	1	2	2
	PI-11	Sragi	Pekalongan & Kodia P.	3.539	65	1	2	2
	PI-12	Sudikampir	Pekalongan & Kodia P.	1.550	44	1	1	2
	PI-13	Padurekso	Pekalongan & Kodia P.	2.764	62	1	2	3
	PI-14	Bodri	Kendal & Kodia Semarang	7.710	111	1	3	2
	PI-15	Trompo	Kendal & Kodia Semarang	1.229	19	1	1	2
	PI-16	Kedung Pengilon	Kendal & Kodia Semarang	2.686	41	1	1	3
	Total I			60.746	948	16	27	
II	PII-1	Serayu	Cilacap	20.795	570	1	12	4
	PII-2	Kedung Putri	Purworejo	4.451	89	1	2	2
	PII-3	Kalimeneng	Purworejo	1.262	28	1	1	2
	PII-4	Waduk Cengklik	Boyolali	2.120	49	1	1	2
	PII-5	Bonggo	Sragen	1.406	39	1	1	2
	PII-6	Sungapan Kiri	Pemalang	5.570	64	1	2	2
	PII-7	Parakankidang	Tegal & Kodia Tegal	1.631	21	1	1	2
	PII-8	Kedung Asem	Kendal & Kodia Semarang	2.845	51	1	1	3
	PII-9	Glapan	Grobogan / Demak	18.784	193	1	4	4
	PII-10	Kaliwadas	Pekalogan / Pemalang	7.722	187	1	4	3
	Total II			66.586	1.291	10	29	
III	PIII-1	Mangganti	Cilacap	22.644	299	1	6	4
	PIII-2	Kaligending	Kebumen	2.923	42	1	1	2
	PIII-3	Pesucen	Kebumen	1.659	27	1	1	2
	PIII-4	Bedegolan	Kebumen	8.401	128	1	3	2
	PIII-5	Ploso Wareng	Klaten	1.100	16	1	1	2
	PIII-6	Colo Kanan	Sragen	22.982	549	1	11	4
	PIII-7	Klambu Kanan	Pati	6.216	165	1	3	3
	PIII-8	Klambu Kiri	Demak	20.738	326	1	7	4
	PIII-9	Sungapan Kanan	Pemalang	1.851	22	1	1	2
	PIII-10	Pesantren Kletak	Pekalongan & Kodia P.	3.636	75	1	2	2
	PIII-11	Sidorejo	Grobogan / Boyolali	5.717	128	1	3	2
	PIII-12	Klambu Kanan	Grobogan / Kudus / Pati	11.078	111	1	3	3
	Total III			108.945	1.888	12	42	
IV	Nil							
V	PV-1	Widodaren	Pati	2.616	44	1	N.A	
	PV-2	Guntur	Demak	1.543	30	1	N.A	
	PV-3	Mejagung	Pemalang	2.049	33	1	N.A	
	PV-4	Kosar	Batang / Pekalongan	3.243	82	1	N.A	
		Total V			9.451	189	4	
VI	PVI-1	Cijalu	Cilacap	1.377	50	1	N.A	
	PVI-2	Banjarcayana	Banjarnegara	5.001	155	1	N.A	
	PVI-3	Kedung GW	Purworejo	1.129	48	1	N.A	
	PVI-4	Jaban	Klaten	1.191	35	1	N.A	
	PVI-5	Pangkalan	Pati	654	16	1	N.A	
	PVI-6	Kemaron Jambe	Brebes	1.483	49	1	N.A	
	PVI-7	Pasekan	Magelang dan Kodia Mag.	988	24	1	N.A	
	PVI-8	Notog	Brebes / Tegal	25.540	837	1	N.A	
	Total VI			37.363	1.214	8		
	Grand Total			283.091	5.530			

**Table 4.6.1 Breakdown of Area, Cost, Construction Package for Recovery Program on Action Plan -3/3 : South Sulawesi**

Priority Group	Scheme No.	Irrigation Scheme	District	Subject Area (ha)	Const. Cost (Bil. Rp.)	Nos. of Contract		Const. Period (year)
						F/S	Construction	
I	PI-1.	Padaelo	Pangkep	1.802	40	1	1	2
	PI-2.	Cillallang	Wajo	1.113	21	1	1	2
	PI-3.	Gamo-Gamo	Polmas	4.743	54	1	1	2
	PI-4.	Bulucenrana	Sidrap	5.583	108	1	2	3
	PI-5.	Padang Sapa	Luwu	10.889	149	1	3	3
	PI-6.	Lamasi Kanan	Luwu	5.170	99	1	2	3
	PI-7.	Pattrio	Bone	4.739	132	1	3	2
	PI-8.	Sanrego	Bone	5.676	124	1	3	3
	PI-9.	Palakka	Bone	3.260	59	1	1	2
	PI-10.	Salobunne	Soppeng	1.296	30	1	1	2
	PI-11.	Pamukulu	Takalar	4.480	97	1	2	2
	Total I			48.751	913	11	20	
II	PII-1.	Aparang Hulu	Sinjai	1.094	17	1	1	2
	PII-2.	Leang Lonrong	Pangkep	1.229	24	1	1	2
	PII-3.	Pamukulu	Takalar	4.480	97	1	2	2
	PII-4.	Bulotimorang	Sidrap	4.950	64	1	2	2
	PII-5.	Kanjiro	Luwu Utara	1.301	26	1	1	2
	PII-6.	Kalaena Kiri	Luwu Utara	3.536	73	1	2	2
	Total II			16.590	301	6	9	
III	PIII-1.	Aparang I	Sinjai	1.049	25	1	1	2
	PIII-2.	Bantimurung	Maros	2.483	98	1	2	2
	PIII-3.	Unyi	Bone	1.136	32	1	1	2
	PIII-4.	Jalling	Bone	1.301	27	1	1	2
	PIII-5.	Leworeng	Soppeng	2.187	23	1	1	2
	PIII-6.	Tinco Kiri	Soppeng	2.620	43	1	1	3
	PIII-7.	Maloso, Sekka	Polmas	2.357	37	1	1	2
	PIII-8.	Kalaena (Rt. Bendung)	Luwu Utara	2.154	34	1	1	2
	Total III			15.287	319	8	9	
IV		Nil						
V	PV-1.	Bayang-Bayang	Bulukumba	4.121	78	1	N.A	
	PV-2.	Bontonami	Bulukumba	3.297	53	1	N.A	
	PV-3.	Bontonyeleng	Bulukumba	1.079	18	1	N.A	
	PV-4.	Bettu	Bulukumba	1.802	30	1	N.A	
	PV-5.	Alekarajae	Sidrap	1.253	28	1	N.A	
	PV-6.	Bajo	Luwu	6.462	119	1	N.A	
	PV-7.	Makawa	Luwu	1.000	16	1	N.A	
	PV-8.	Kalaena Kanan II	Luwu Utara	3.787	58	1	N.A	
	PV-9.	Kuri-Kuri Kasambi	Luwu Utara	3.000	63	1	N.A	
	PV-10.	Bone-Bone	Luwu Utara	2.625	2	1	N.A	
	PV-11.	Kalaena Kanan I	Luwu Utara	6.332	103	1	N.A	
	Total V			34.758	568	11	N.A	
VI	GVI-1.	Jenemarrung	Takala	975	19	1	N.A	
	GVI-2.	Lanca	Bone	676	16	1	N.A	
	GVI-3.	Kalosi	Pinrang	838	14	1	N.A	
	GVI-4.	Pagang Alipan	Luwu	795	12	1	N.A	
	GVI-5.	Lakejo	Polmas	960	12	1	N.A	
	Total VI			4.244	73	5		
	Grand Total			106.576	1.946			

**Table 5.1.1 Breakdown of Cost Estimate on Padang Mahondang Irrigation Scheme**

(1/2)

	Work Description	Unit	Quantity	Unit Price (Rp.)	Amount (Rp.)
<b>I. Intake</b>					
1.1	Construction of New Intake				
1.1.1	Embankment of dike	m3	1.200	30.000	36.000.000
1.1.2	Sod facing to dike	m2	500	6.000	3.000.000
1.1.3	Excavation of intake	m3	3.000	13.000	39.000.000
1.1.4	Concrete works	m3	500	350.000	175.000.000
1.1.5	Form works	m2	1.500	100.000	150.000.000
1.1.6	Reinforcement bars	ton	20	6.000.000	120.000.000
1.1.7	Gabion mattress	m3	300	500.000	150.000.000
1.1.8	Backfill/embankment	m3	1.500	30.000	45.000.000
1.1.9	Gate works	ton	4	30.000.000	120.000.000
1.1.10	Metal works	ton	2	20.000.000	40.000.000
1.1.11	Dewatering works	day	60	7.500.000	450.000.000
1.1.12	Contingency (20%)				265.600.000
	Sub-total				1.593.600.000
1.2	Settling Basin				
1.2.1	Excavation	m3	16.000	13.000	208.000.000
1.2.2	Backfill	m3	8.500	30.000	255.000.000
1.2.3	Concrete 18N	m3	600	350.000	210.000.000
1.2.4	Concrete 13N	m3	40	320.000	12.800.000
1.2.5	Reinforcement bars	ton	60	6.000.000	360.000.000
1.2.6	Form	m2	4.100	100.000	410.000.000
1.2.7	Gate works	ton	3	40.000.000	120.000.000
1.2.8	Stoplog	ton	1	20.000.000	10.000.000
1.2.9	Contingency (20%)				317.160.000
	Sub-total				1.902.960.000
1.3	Access Road from National Highway	m	1.500	600.000	900.000.000
	Contingency (20%)				180.000.000
	Sub-total				1.080.000.000
	Total I				4.576.560.000
<b>II. Main Canal Works</b>					
2.1	Main Canal, Canal Works				
2.1.1	Excavation	m3	21.000	13.000	273.000.000
2.1.2	Embankment, dike	m3	172.000	30.000	5.160.000.000
2.1.3	Lining concrete	m3	5.700	400.000	2.280.000.000
2.1.4	Sod facing	m2	44.000	6.000	264.000.000
2.1.5	Contingency (20%)				1.595.400.000
	Sub-total				9.572.400.000
2.2	Main Canal, Structure Works				
2.2.1	Excavation	m3	1.800	13.000	23.400.000
2.2.2	Embankment/backfill	m3	800	30.000	24.000.000
2.2.3	Concrete	m3	1.100	400.000	440.000.000
2.2.4	Form	m2	5.000	100.000	500.000.000
2.2.5	Reinforcement bars	ton	80	6.000.000	480.000.000
2.2.6	Gate	ton	12	30.000.000	360.000.000
2.2.7	Metal works	ton	2	20.000.000	40.000.000
2.2.8	Contingency (20%)				373.480.000
	Sub-total				2.240.880.000
2.3	Main Canal, Inspection Road				
2.3.1	Gravel pavement	m3	8.000	100.000	800.000.000
2.3.2	Related facilities (10% of above)	lot	1	80.000.000	80.000.000
2.3.3	Contingency (20%)				176.000.000
	Sub-total				1.056.000.000
	Total II				12.869.280.000

**Table 5.1.1 Breakdown of Cost Estimate on Padang Mahondang Irrigation Scheme**

(2/2)

	Work Description	Unit	Quantity	Unit Price (Rp.)	Amount (Rp.)
<b>III.</b>	<b>Secondary Canal (4 nos. of SC)</b>				
3.1	Secondary Canal, Canal Works				
3.1.1	Excavation	m3	3.000	13.000	39.000.000
3.1.2	Embankment, dike	m3	180.000	30.000	5.400.000.000
3.1.3	Lining concrete	m3	5.900	400.000	2.360.000.000
3.1.4	Sod facing	m2	36.000	6.000	216.000.000
3.1.5	Contingency (20%)				1.603.000.000
	Sub-total				9.618.000.000
3.2	Secondary Canal, Structure Works				
3.2.1	Excavation	m3	1.600	13.000	20.800.000
3.2.2	Embankment/backfill	m3	600	30.000	18.000.000
3.2.3	Concrete	m3	1.100	400.000	440.000.000
3.2.4	Form	m2	4.700	100.000	470.000.000
3.2.5	Reinforcement bars	ton	70	6.000.000	420.000.000
3.2.6	Gate	ton	16	30.000.000	480.000.000
3.2.7	Contingency (20%)				369.760.000
	Sub-total				2.218.560.000
3.3	Secondary Canal, Inspection Road				
3.3.1	Gravel pavement	m3	7.800	100.000	780.000.000
3.3.2	Related facilities (10 % of above)	lot	1	78.000.000	78.000.000
3.3.3	Contingency (20%)				171.600.000
	Sub-total				1.029.600.000
	Total III				12.866.160.000
<b>IV.</b>	<b>Drainage Works</b>				
4.1	20 % of (II+III)	L.S	1	5.147.088.000	5.147.088.000
	Total IV				5.147.088.000
<b>V.</b>	<b>On-Farm Development</b>				
5.1	Irrigated Paddy Field	ha	724	2.000.000	1.448.000.000
5.2	Land for reclamation	ha	1.907	2.500.000	4.767.500.000
	Total V				6.215.500.000
<b>VI.</b>	<b>Project Facility</b>				
6.1	Gate keepers house	house	4	30.000.000	120.000.000
6.2	Field cars	nos.	3	300.000.000	900.000.000
6.3	Motor cycle	nos.	20	20.000.000	400.000.000
6.4	Office equipment	L.S	1	150.000.000	150.000.000
	Total VI				1.570.000.000
	<b>Grand Total</b>				<b>43.244.588.000</b>



**Table 5.2.1 Breakdown of Cost Estimate on Gung Irrigation Scheme**

Work Description	Unit	Quantity	Unit Price (Rp.)	Amount (Rp.)
<b>I. Diversion Weir</b>				
1.1 Rehabilitation of Weir				
1.1.1 Excavation, rock	m3	1.800	60.000	108.000.000
1.1.2 Concrete works, K-23N	m3	900	400.000	360.000.000
1.1.3 Concrete works, K-18N	m3	4.000	350.000	1.400.000.000
1.1.4 Form works	m2	15.000	100.000	1.500.000.000
1.1.5 Metal works	ton	35	25.000.000	875.000.000
1.1.6 Masonry works	m3	300	200.000	60.000.000
1.1.7 Access road of weir	m3	500	150.000	75.000.000
1.1.8 Concrete works for intake	m3	50	500.000	25.000.000
1.1.9 Dewatering works	day	60	7.500.000	450.000.000
1.1.10 Physical contingency (15% of above)	L.S			727.950.000
Total I				5.580.950.000
<b>II. Main Canal Works</b>				
2.1 Main Canal, Canal Works				
2.1.1 Excavation	m3	15.000	13.000	195.000.000
2.1.2 Lining concrete	m3	250	400.000	100.000.000
2.1.3 Physical contingency (15% of above)	L.S			44.250.000
Sub-total				339.250.000
2.2 Main Canal, Structure Works				
2.2.1 Excavation	m3	500	13.000	6.500.000
2.2.2 Embankment/backfill	m3	500	30.000	15.000.000
2.2.3 Concrete	m3	160	400.000	64.000.000
2.2.4 Form	m2	500	100.000	50.000.000
2.2.5 Reinforcement bars	ton	25	6.000.000	150.000.000
2.2.6 Gate	ton	4	30.000.000	120.000.000
2.2.7 Metal works	ton	2	20.000.000	40.000.000
2.2.8 Physical contingency (15% of above)	L.S			66.825.000
Sub-total				512.325.000
2.3 Main Canal, Inspection Road				
2.3.1 Preparatory works	m2	10.000	6.000	60.000.000
2.3.2 Gravel pavement	m3	1.050	500.000	525.000.000
2.3.3 Related facilities (10% of above)	lot	1		58.500.000
2.3.4 Physical contingency (15% of above)	L.S			96.525.000
Sub-total				111.003.750
Total II				962.578.750
<b>III. Secondary Canal (2 nos. of SC)</b>				
3.1 Secondary Canal, Canal Works				
3.1.1 Excavation	m3	106.800	13.000	1.388.400.000
3.1.5 Lining concrete	m3	6.400	400.000	2.560.000.000
3.1.6 Physical contingency (15% of above)	L.S			592.260.000
Sub-total				4.540.660.000
3.2 Secondary Canal, Structure Works				
3.2.1 Excavation	m3	900	13.000	11.700.000
3.2.2 Embankment/backfill	m3	600	30.000	18.000.000
3.2.3 Concrete	m3	300	400.000	120.000.000
3.2.4 Form	m2	1.500	100.000	150.000.000
3.2.5 Reinforcement bars	ton	22	6.000.000	132.000.000
3.2.6 Gate	ton	14	30.000.000	420.000.000
3.2.7 Physical contingency (15% of above)	L.S			127.755.000
Sub-total				979.455.000
3.3 Secondary Canal, Inspection Road				
3.3.1 Preparatory works	m2	100.000	6.000	600.000.000
3.3.2 Gravel pavement	m3	15.600	500.000	7.800.000.000
3.3.3 Related facilities (10 % of above)	lot	1	672.000.000	840.000.000
3.3.4 Physical contingency (15% of above)	L.S			1.386.000.000
Sub-total				10.626.000.000
Total III				16.146.115.000
<b>IV. Drainage Works</b>	L.S	1	1.710.869.375	1.710.869.375
10 % of (II+III)				
<b>V. On-Farm Development</b>				
5.1 Irrigated Paddy Field	ha	3.906	2.000.000	7.812.000.000
Total V				7.812.000.000
<b>VI. Project Facility</b>				
6.1 Gate keepers house	house	4	30.000.000	120.000.000
6.2 Field cars	nos.	3	300.000.000	900.000.000
6.3 Motor cycle	nos.	20	20.000.000	400.000.000
6.4 Office equipment	L.S	1	150.000.000	150.000.000
Total VI				1.570.000.000
<b>Grand Total</b>				<b>33.782.513.125</b>

**Table 5.3.1 Breakdown of Cost Estimate on Kalaena Kiri Irrigation Scheme**

(1/2)

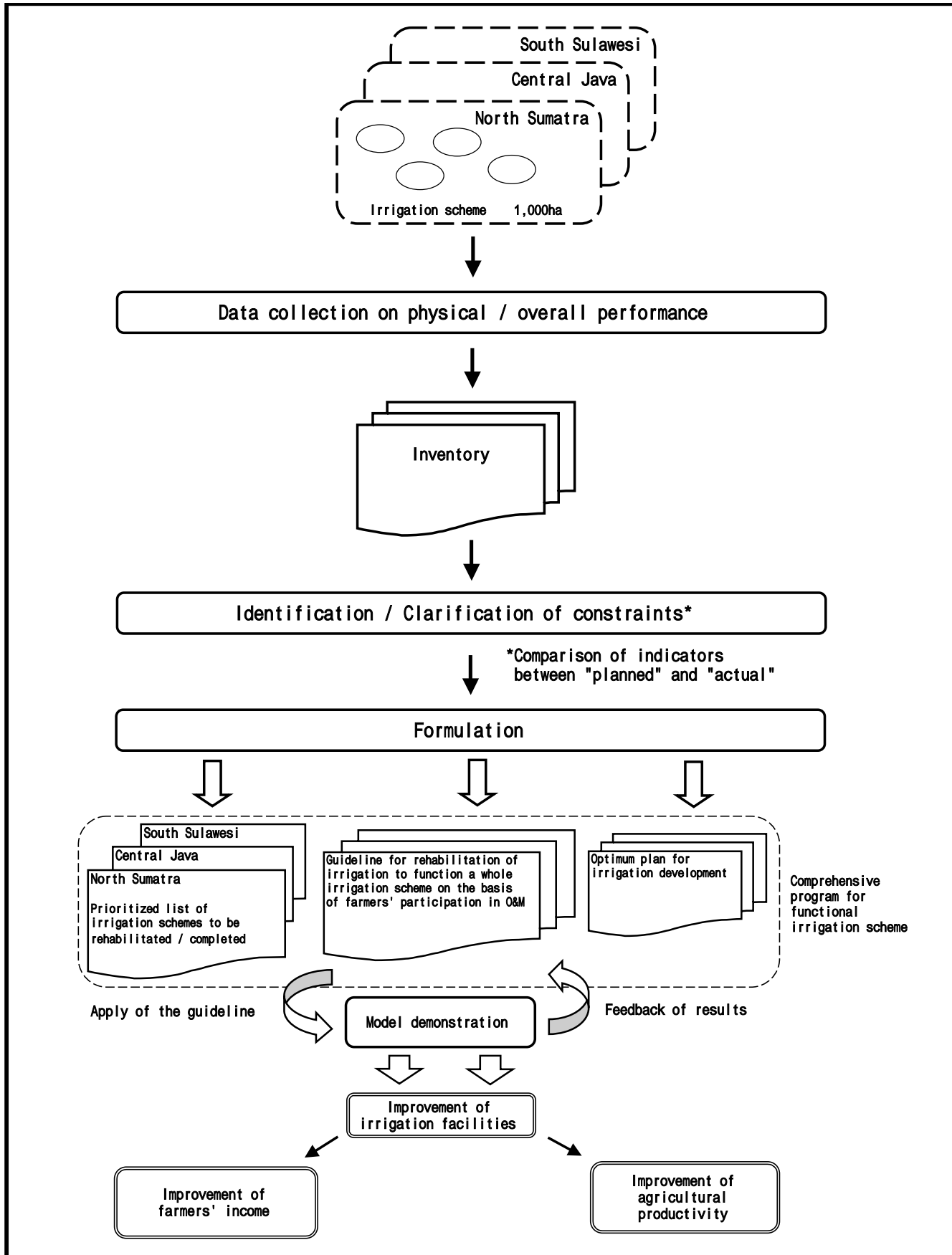
Work Description	Unit	Quantity	Unit Price (Rp.)	Amount (Rp.)
<b>I. Diversion Weir</b>				
1.1 Rehabilitation of Weir				
1.1.1 Removal of sedimentation	m3	2.000	30.000	60.000.000
1.1.2 Concrete works for bridge	m3	50	500.000	25.000.000
1.1.3 Pavement works for bridge	m3	50	500.000	25.000.000
1.1.4 Repair of overflow weir	m3	600	800.000	480.000.000
1.1.5 Concrete blocks	m3	1.200	500.000	600.000.000
1.1.6 Gabion mattress	m3	3.400	500.000	1.700.000.000
1.1.7 Gate works	ton	6	40.000.000	240.000.000
1.1.8 Concrete works for intake	m3	50	500.000	25.000.000
1.1.9 Dewatering works	day	60	7.500.000	450.000.000
1.1.10 Contingency (15%)				540.750.000
Sub-total				4.145.750.000
1.2 Settling Basin				
1.2.1 Excavation	m3	18.000	13.000	234.000.000
1.2.2 Backfill	m3	8.500	30.000	255.000.000
1.2.3 Concrete 18N	m3	1.000	350.000	350.000.000
1.2.4 Concrete 13N	m3	60	320.000	19.200.000
1.2.5 Reinforcement bars	ton	100	6.000.000	600.000.000
1.2.6 Form	m2	6.400	100.000	640.000.000
1.2.7 Gate works	ton	5	40.000.000	200.000.000
1.2.8 Stoplog	ton	1	20.000.000	10.000.000
1.2.9 Contingency (15%)				346.230.000
Sub-total				2.654.430.000
Total I				6.800.180.000
<b>II. Main Canal Works</b>				
2.1 Main Canal, Canal Works				
2.1.1 Excavation	m3	103.000	13.000	1.339.000.000
2.1.2 Excavation, existing canal	m3	56.000	25.000	1.400.000.000
2.1.3 Embankment, dike	m3	94.000	30.000	2.820.000.000
2.1.4 Embankment, inside	m3	56.000	50.000	2.800.000.000
2.1.5 Lining concrete	m3	8.500	400.000	3.400.000.000
2.1.6 Sod facing	m2	40.000	6.000	240.000.000
2.1.7 Contingency (15%)				1.799.850.000
Sub-total				13.798.850.000
2.2 Main Canal, Structure Works				
2.2.1 Excavation	m3	4.200	13.000	54.600.000
2.2.2 Embankment/backfill	m3	2.200	30.000	66.000.000
2.2.3 Concrete	m3	1.300	400.000	520.000.000
2.2.4 Form	m2	3.500	100.000	350.000.000
2.2.5 Reinforcement bars	ton	90	6.000.000	540.000.000
2.2.6 Gate	ton	22	30.000.000	660.000.000
2.2.7 Metal works	ton	3	20.000.000	60.000.000
2.2.8 Contingency (15%)				337.590.000
Sub-total				2.588.190.000
2.3 Main Canal, Inspection Road				
2.3.1 Preparatory works	m2	115.000	6.000	690.000.000
2.3.2 Gravel pavement	m3	12.000	100.000	1.200.000.000
2.3.3 Related facilities (10% of above)	lot	1		189.000.000
2.3.4 Contingency (15%)				311.850.000
Sub-total				2.390.850.000
Total II				18.777.890.000

**Table 5.3.1 Breakdown of Cost Estimate on Kalaena Kiri Irrigation Scheme**

(2/2)

Work Description	Unit	Quantity	Unit Price (Rp.)	Amount (Rp.)
<b>III. Secondary Canal (9 nos. of SC)</b>				
3.1 Secondary Canal, Canal Works				
3.1.1 Excavation	m3	0	13.000	0
3.1.2 Excavation, existing canal	m3	64.000	25.000	1.600.000.000
3.1.3 Embankment, dike	m3	80.000	30.000	2.400.000.000
3.1.4 Embankment, inside	m3	64.000	50.000	3.200.000.000
3.1.5 Lining concrete	m3	7.500	400.000	3.000.000.000
3.1.6 Sod facing	m2	77.000	6.000	462.000.000
3.1.7 Contingency (15%)				1.599.300.000
Sub-total				12.261.300.000
3.2 Secondary Canal, Structure Works				
3.2.1 Excavation	m3	900	13.000	11.700.000
3.2.2 Embankment/backfill	m3	600	30.000	18.000.000
3.2.3 Concrete	m3	300	400.000	120.000.000
3.2.4 Form	m2	1.500	100.000	150.000.000
3.2.5 Reinforcement bars	ton	22	6.000.000	132.000.000
3.2.6 Gate	ton	14	30.000.000	420.000.000
3.2.7 Contingency (15%)				127.755.000
Sub-total				979.455.000
3.3 Secondary Canal, Inspection Road				
3.3.1 Preparatory works	m2	120.000	6.000	720.000.000
3.3.2 Gravel pavement	m3	12.000	100.000	1.200.000.000
3.3.3 Related facilities (10 % of above)	lot	1	672.000.000	192.000.000
3.3.4 Contingency (15%)				316.800.000
Sub-total				2.428.800.000
Total III				15.669.555.000
<b>IV. Drainage Works</b>				
4.1 10 % of (II+III)	L.S	1	3.444.744.500	3.444.744.500
Total IV				3.444.744.500
<b>V. On-Farm Development</b>				
5.1 Irrigated Paddy Field	ha	2.791	2.000.000	5.582.000.000
5.2 Paddy field under rain fed condition	ha	1.246	2.500.000	3.115.000.000
Total V				8.697.000.000
<b>VI. Project Facility</b>				
6.1 Gate keepers house	house	4	30.000.000	120.000.000
6.2 Field cars	nos.	3	300.000.000	900.000.000
6.3 Motor cycle	nos.	20	20.000.000	400.000.000
6.4 Office equipment	L.S	1	150.000.000	150.000.000
Total VI				1.570.000.000
<b>Grand Total</b>				<b>54.959.369.500</b>

## *Figures*

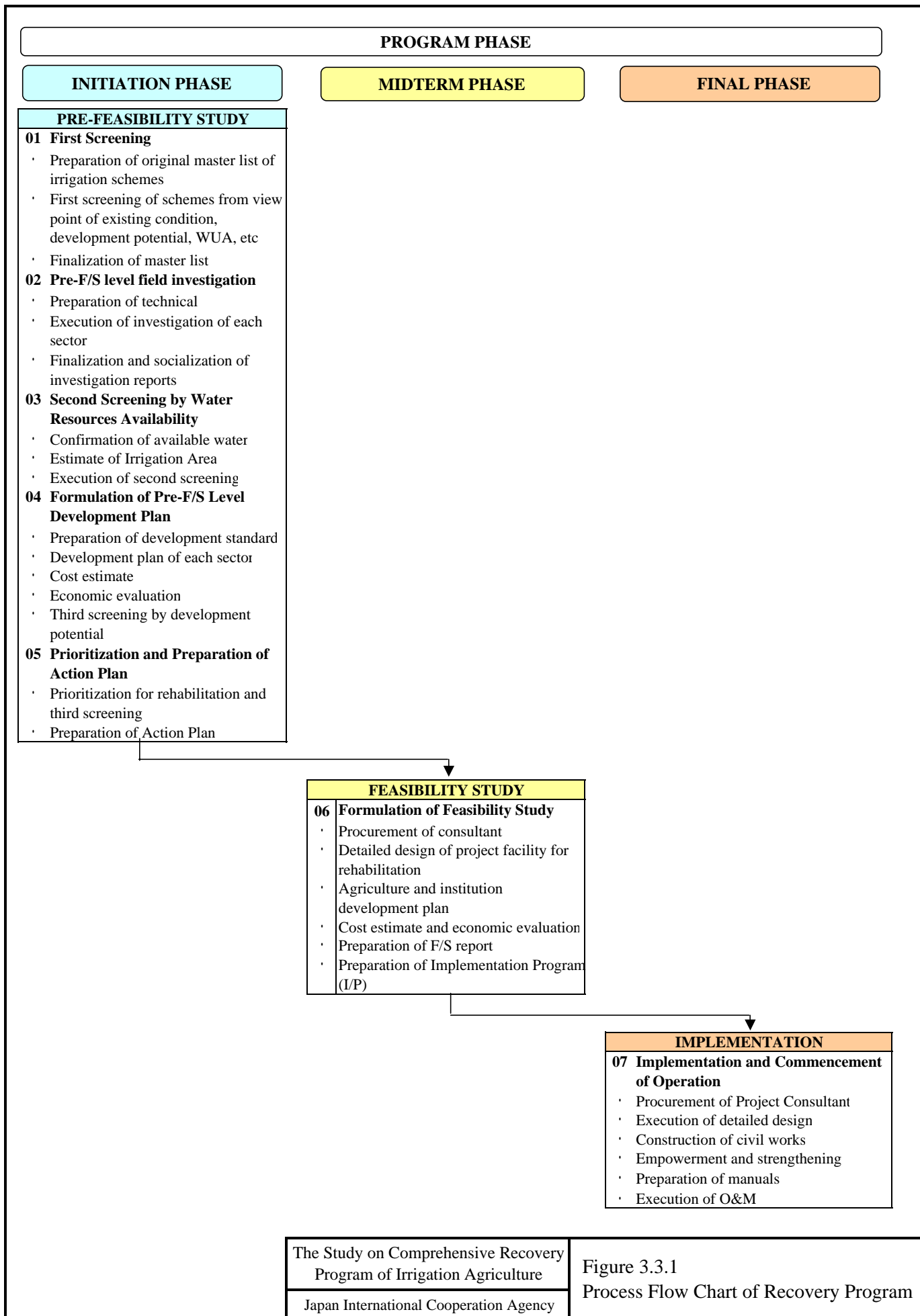


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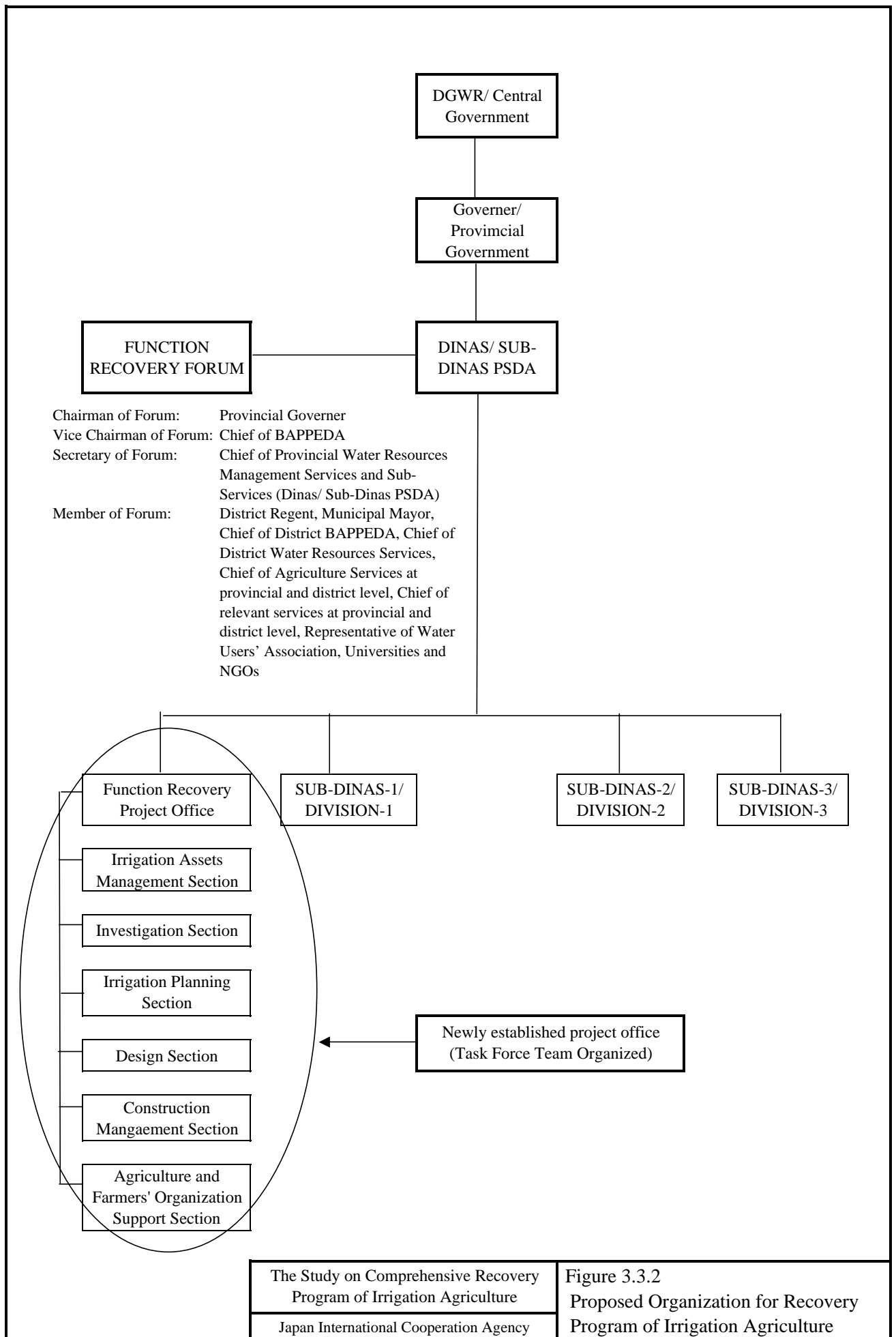
Figure 1.2.1

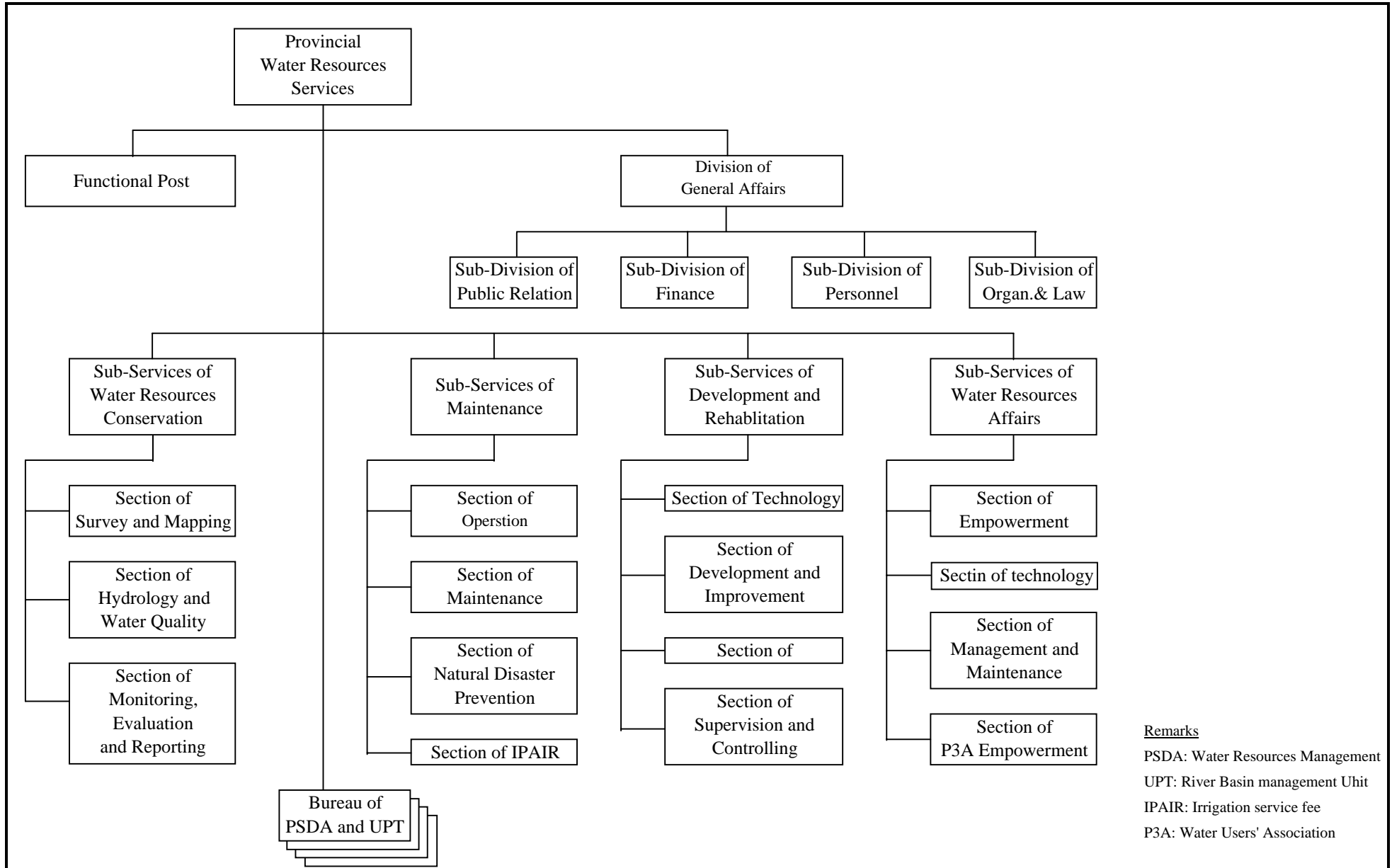
Framework of the Study



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Figure 3.3.1  
Process Flow Chart of Recovery Program





Remarks  
 PSDA: Water Resources Management  
 UPT: River Basin management Uhit  
 IPAIR: Irrigation service fee  
 P3A: Water Users' Association

**Figure 4.1.1 Organization Chart of Provincial Water Resources Services : North Sumatra**



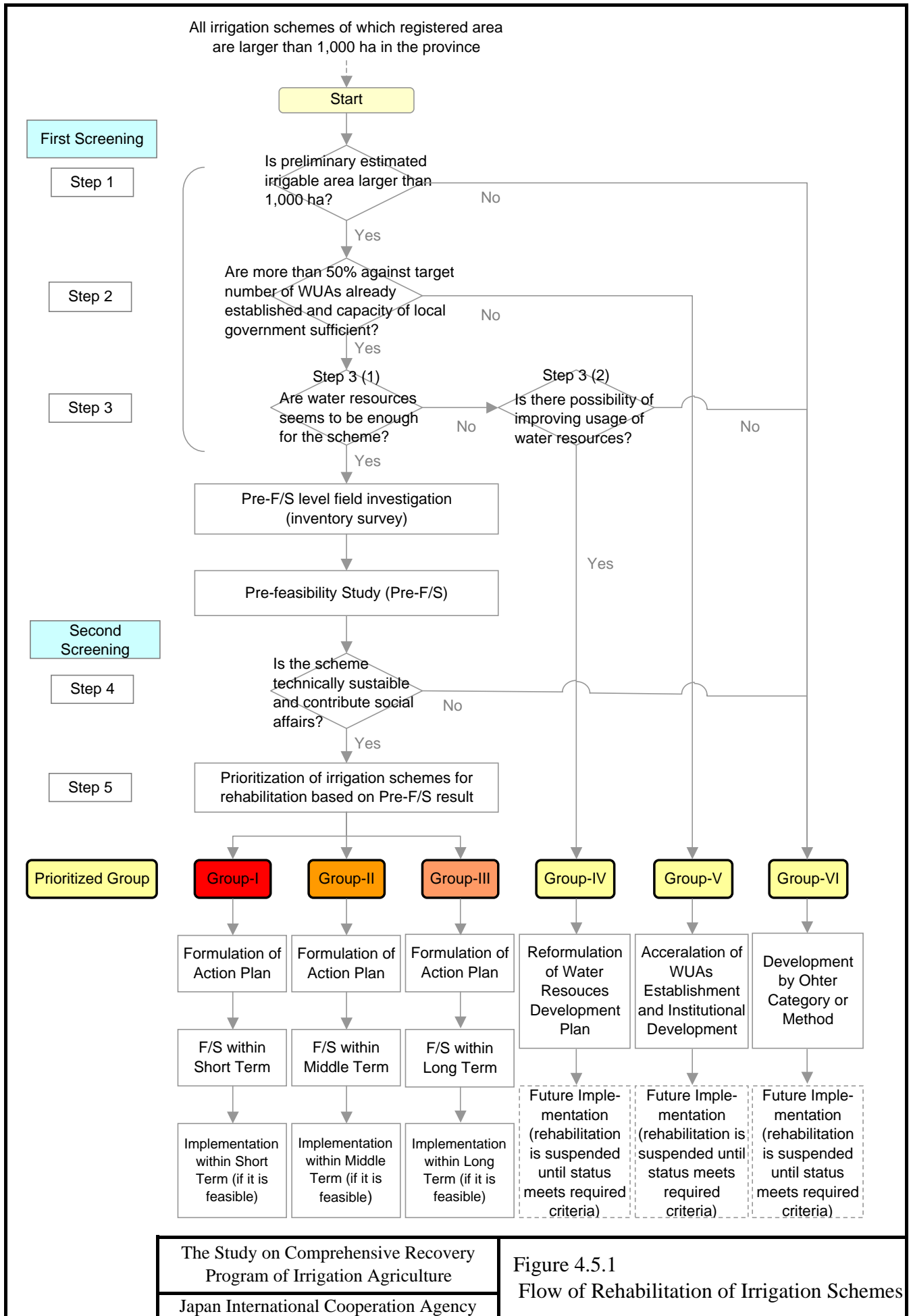


Figure 4.5.1  
Flow of Rehabilitation of Irrigation Schemes

Figure 4.6.1 Action Plan of Recovery Program of Irrigation Agriculture -1/3: North Sumatra

Priority Group	Phase	Work Description	Pre-F/S		Year from commencement of Midterm Phase																	
			1st	2nd	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th			
-	Initiation	Pre-Feasibility	- Preparation of Master List	█																		
			- Pre-F/S level Field Investigation	█	█																	
			- Second Screening by Water Resources Availability		█	█																
			- Formulation of Pre-F/S level Development Plan		█	█																
			- Prioritization			█	█															
			- Preparation of Action Plan				█	█														
I.	Midterm	Feasibility Study	- Procurement of Consultant			█	█															
			- Preparation of F/S				█	█														
			- Financial Arrangement					█	█													
	Final	Implementation	- Procurement of Consultant																			
			- Detailed Design							█	█											
			- Tender								█	█										
			- Construction									█	█	█	█							
- Guidance, training etc.											█	█	█	█								
II.	Midterm	Feasibility Study	- Procurement of Consultant																			
			- Preparation of F/S																			
			- Financial Arrangement																			
	Final	Implementation	- Procurement of Consultant																			
			- Detailed Design																			
			- Tender																			
			- Construction																			
- Guidance, training etc.																						
III.	Midterm	Feasibility Study	- Procurement of Consultant																			
			- Preparation of F/S																			
			- Financial Arrangement																			
	Final	Implementation	- Procurement of Consultant																			
			- Detailed Design																			
			- Tender																			
			- Construction																			
- Guidance, training etc.																						
IV.	Midterm	Review and Preparation of Development Plan																				
V.	Midterm	Institutional Capacity Building																				
VI.	Midterm	Review and Preparation of Development Plan																				







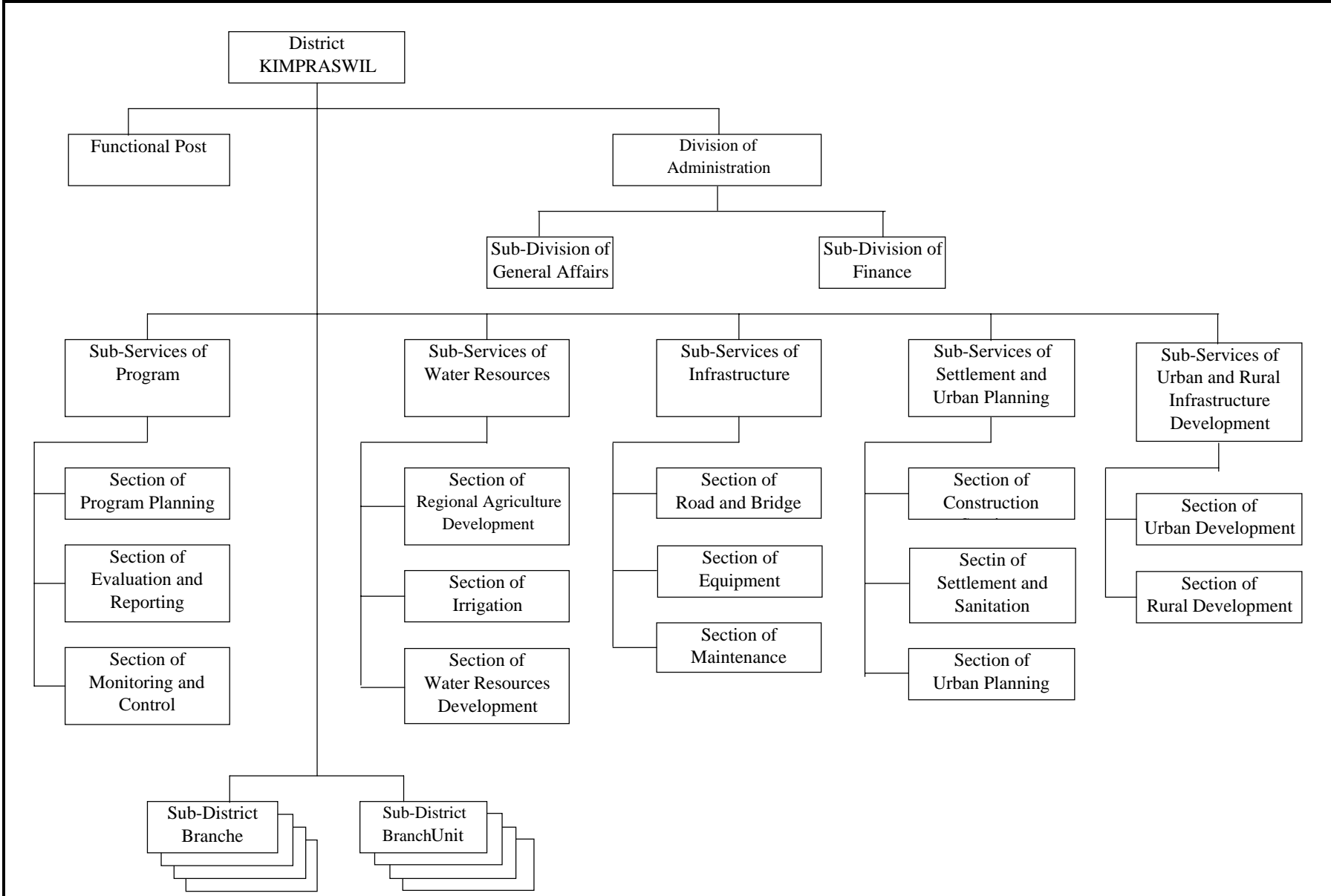
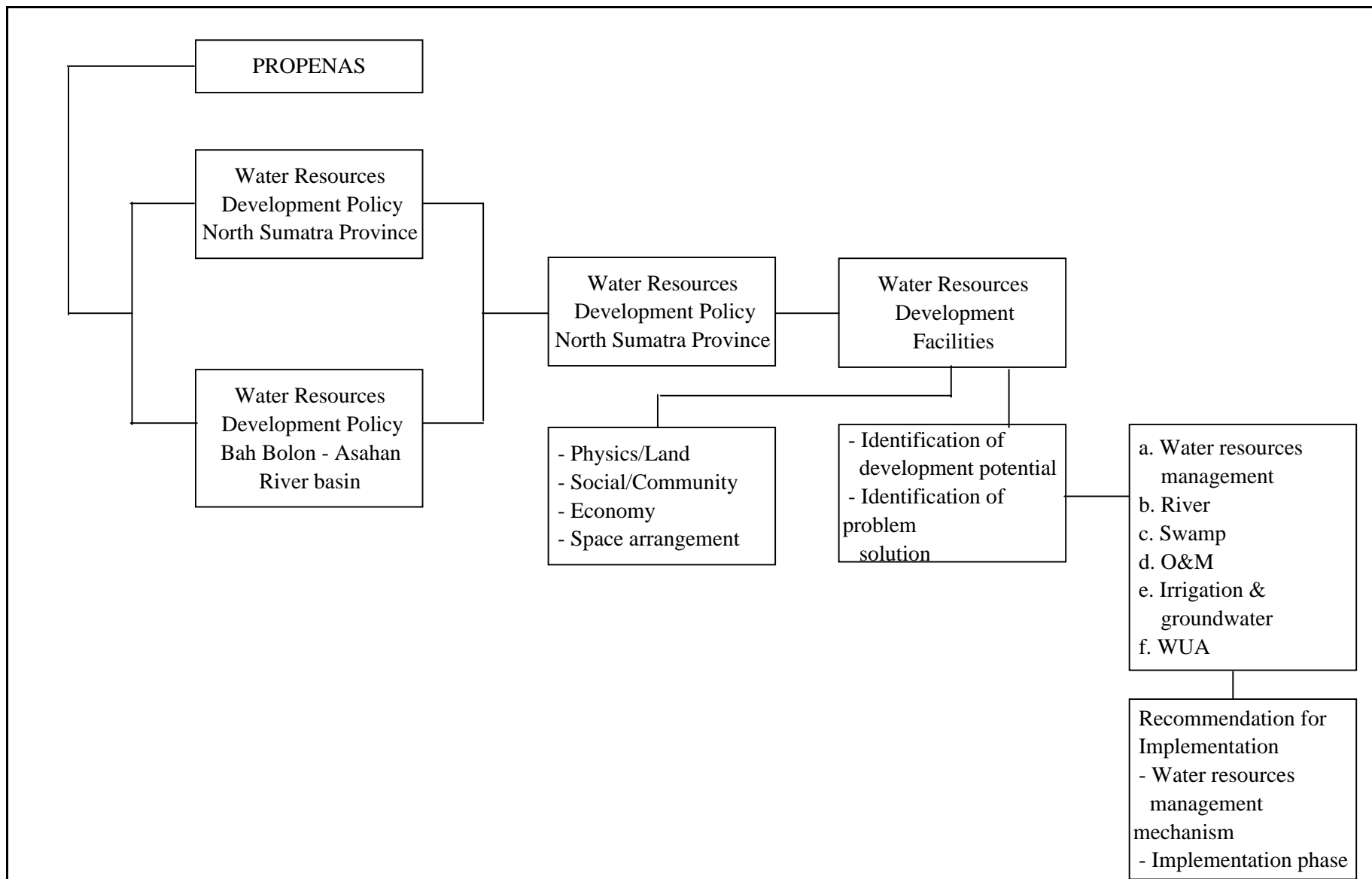
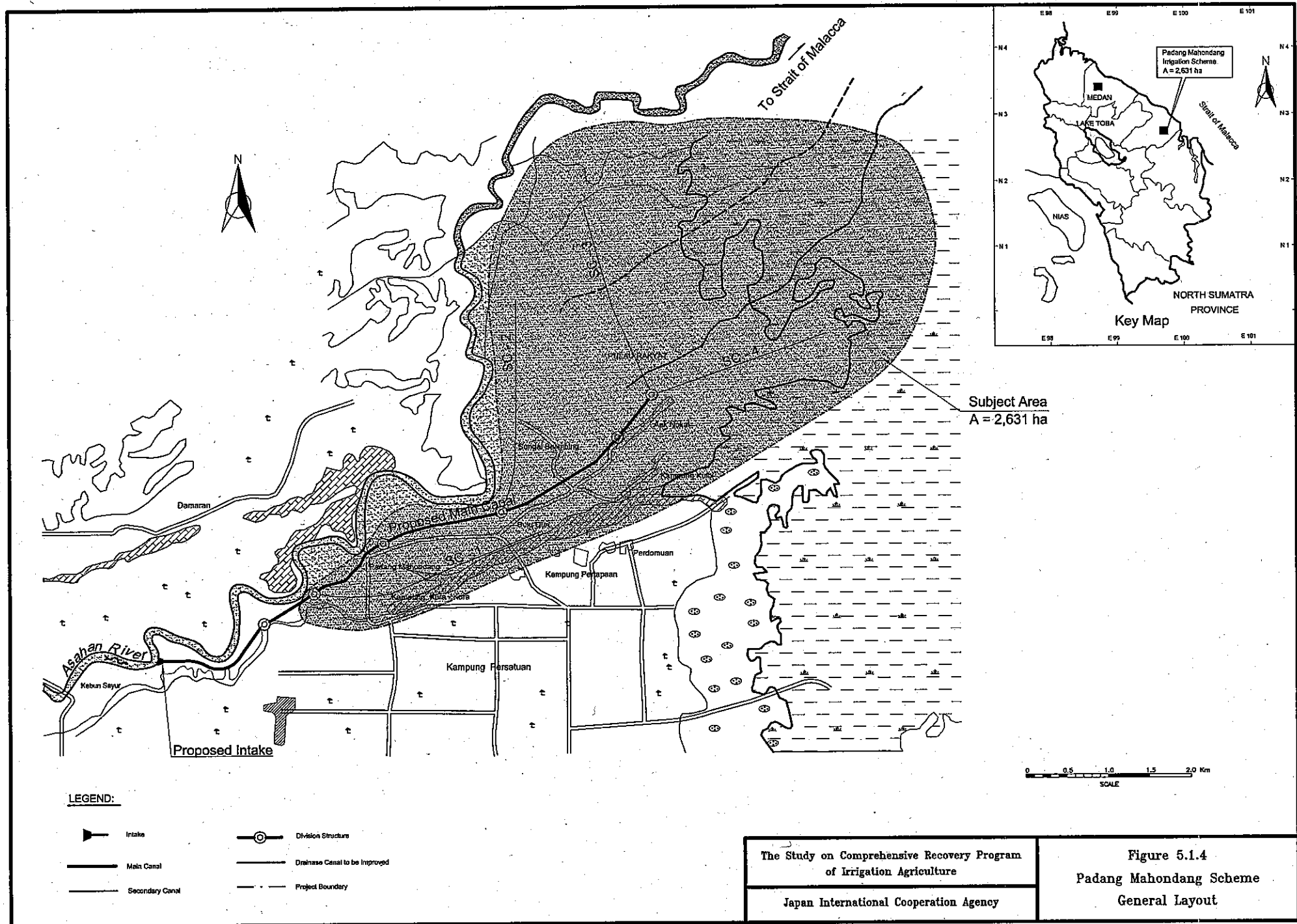


Figure 5.1.2 Organization Chart of Settlement and Regional Infrastructure, Asahan



**Figure 5.1.3 Water Resources Development Policy Framework in North Sumatra**



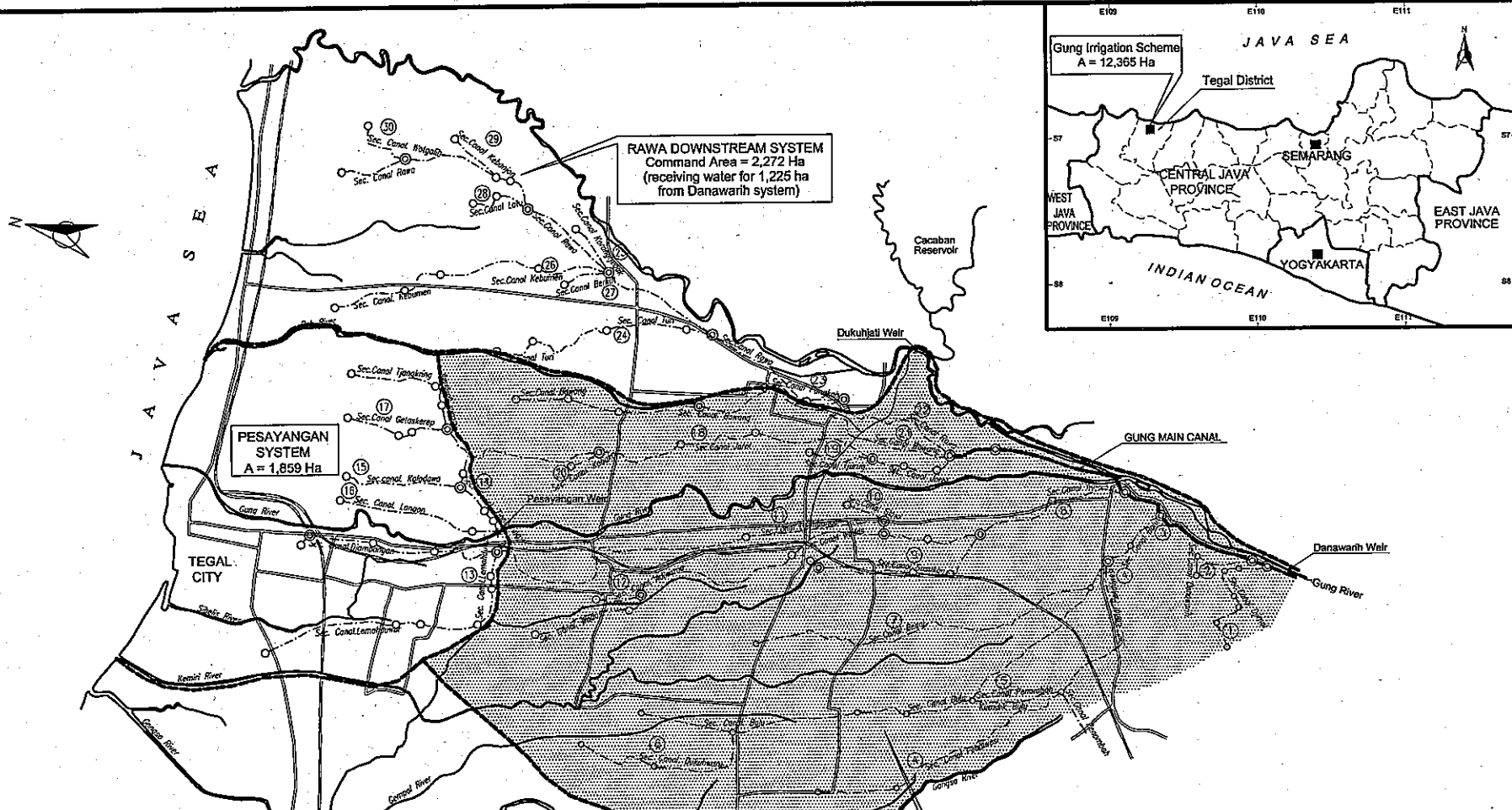
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Figure 5.1.4  
Padang Mahondang Scheme  
General Layout

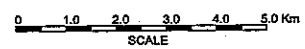


**Figure 5.1.5 Implementation Program of Rehabilitation Work for Padang Mahondang Irrigation Scheme**

Phase	Sector	Item of Implementation		Year from Commencement of Midterm Phase										
		Item	Works	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
Midterm	1. Irrigation/ Civil Works	Feasibility Study	Procurement of consultant	■										
			Preparation of F/S	■										
			Preparation of Implementation Schedule	■										
	2. Institution	Strengthening Program	Government staff	■										
			Water Users Association	■										
			Initial setting-up of FWUA and MWUA	■										
	3. Project Budget		Budget arrangement	■										
Final	1. Irrigation/ Civil Works	Implementation	Procurement of consultant		■									
			Detailed design			■								
			Tender for procurement of contractor				■							
			Civil works for rehabilitation					■	■	■	■			
	2. Institution	Training and Guidance	O&M for tertiary and on-farm						■	■				
			Collection of irrigation management fees and accounting						■	■				
	3. Extension Service													
		Formulation of task force team			■									
		Formulation of strengthening program				■								
		Identification and confirmation of constraints			■									
		Countermeasures or technology to be introduced for mitigation of constraints				■								
		Preparation of detailed program for strengthening				■								
		Implementation of program												
		Preparation of annual program						■	■					
		Budget arrangement						■	■					
		Preparation of detailed agreed plan of operation							■	■				
		Preparation of extension materials							■	■				
		Implementation of program, monitoring and evaluation								■	■	■	■	■



- |                           |              |               |            |
|---------------------------|--------------|---------------|------------|
| ① Djimat                  | ⑩ Slawi      | ⑱ Langon      | ⑲ Jarot    |
| ② Danawarih               | ⑪ Djembangan | ⑳ Getaskerep  | ⑳ Tjurug   |
| ③ Bulu                    | ⑫ Adiwarna   | ㉑ Kabukan     | ㉑ Bawang   |
| ④ Pendikwasi-Kumisik Bulu | ⑬ Lemahduwur | ㉒ Rawa        | ㉒ Pangkah  |
| ⑤ Penambah                | ⑭ Tjangkrik  | ㉓ Dukuhtaru   | ㉓ Turt     |
| ⑥ Dukuhtaru               | ⑮ Kaladawa   | ㉔ Karangjagak | ㉔ Turf     |
| ⑦ Begat                   |              | ㉕ Kebumen     | ㉕ Berkat   |
| ⑧ Wadas                   |              | ㉖ Latu        | ㉖ Kebanjon |
| ⑨ Susukan                 |              | ㉗ Tjankrik    | ㉗ Wolgath  |
|                           |              | ㉘ Djambangan  |            |



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

LEGEND:

- River
- Division Structure
- Orfak
- Boundary of Irrigation System
- Main Canal
- Secondary Canal
- Irrigation Area of Danawarih System
- Weir

Figure 5.2.1  
Central Java Province  
Gung Irrigation Scheme  
General Layout

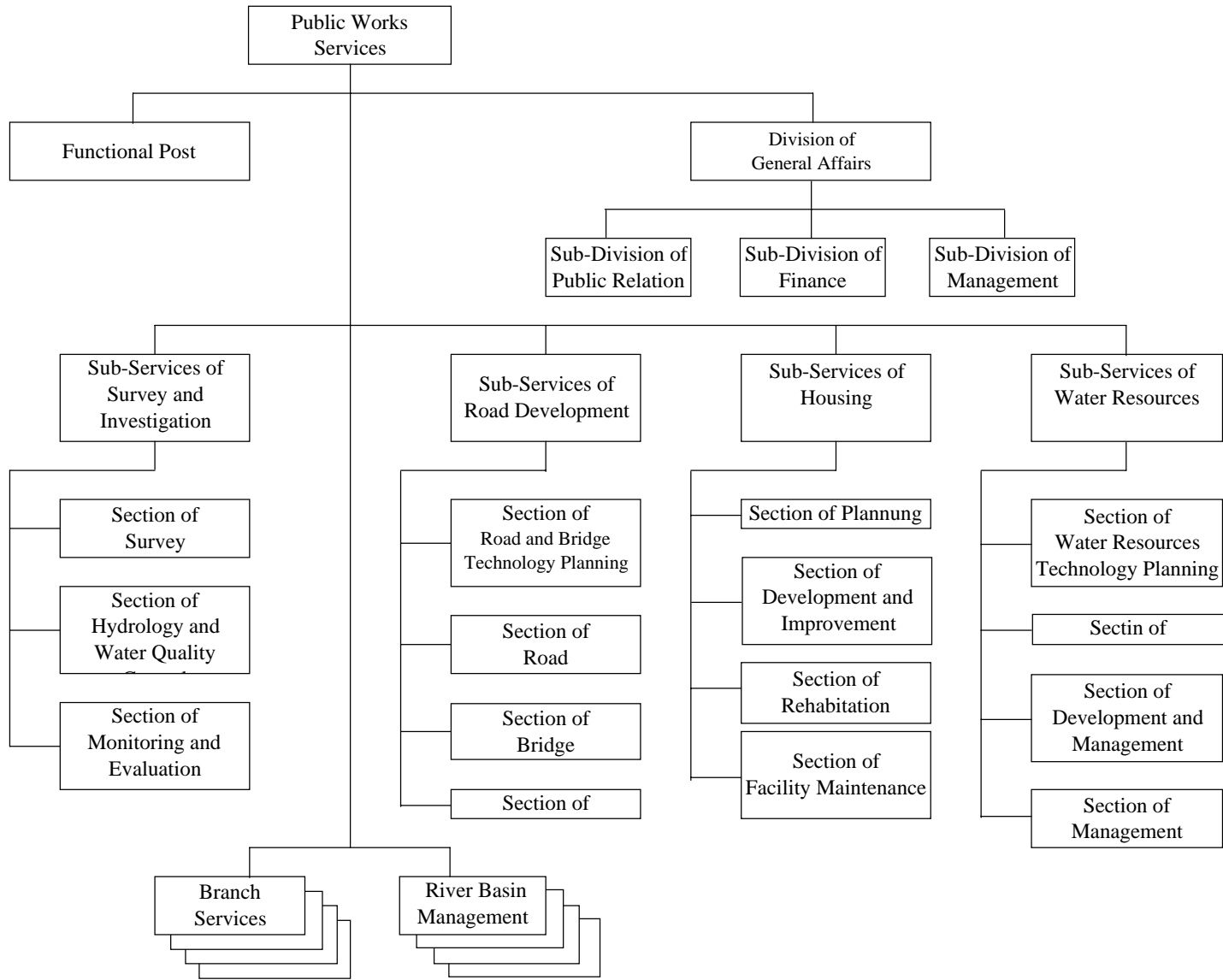
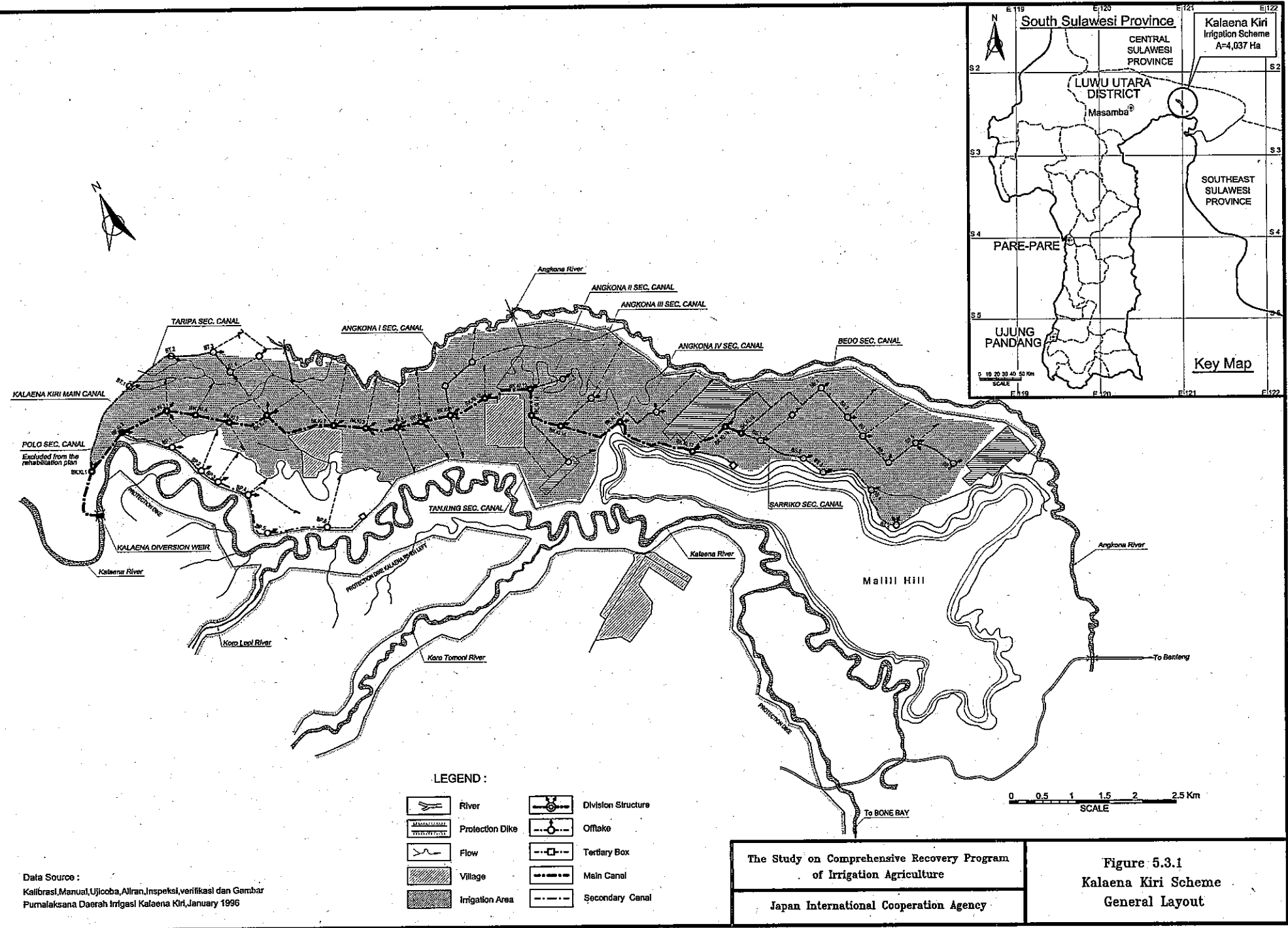


Figure 5.2.2 Organization Chart of Public Works Services, Tegal

**Figure 5.2.3 Implementation Program of Rehabilitation Work for Gung Irrigation Scheme**

Phase	Sector	Item of Implementation		Year from Commencement of Midterm Phase										
		Item	Works	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
Midterm	1. Irrigation/ Civil Works	Feasibility Study	Procurement of consultant	■										
			Preparation of F/S	■	■									
			Preparation of Implementation Schedule	■	■									
	2. Institution	Strengthening Program	Government staff	■	■									
			Water Users Association	■	■									
			Initial setting-up of FWUA and MWUA	■	■									
	3. Project Budget		Budget arrangement	■	■									
Final	1. Irrigation/ Civil Works	Implementation	Procurement of consultant		■									
			Detailed design			■	■							
			Tender for procurement of contractor				■							
			Civil works for rehabilitation				■	■	■	■				
	2. Institution	Training and Guidance	O&M for tertiary and on-farm						■	■				
			Collection of irrigation management fees and accounting							■	■			
	3. Extension Service													
		Formulation of task force team				■								
		Formulation of strengthening program												
		Identification and confirmation of constraints				■								
		Countermeasures or technology to be introduced for mitigation of constraints				■								
		Preparation of detailed program for strengthening				■								
		Implementation of program												
		Preparation of annual program						■	■					
		Budget arrangement						■	■					
		Preparation of detailed agreed plan of operation							■	■				
		Preparation of extension materials							■	■				
		Implementation of program, monitoring and evaluation							■	■	■	■	■	■



Data Source :  
 Kalibrasi,Manual,Ujicoba,Allran,Inspeksi,verifikasi dan Gambar  
 Purnalaksana Daerah Irigasi Kalaena Kiri, January 1996

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

Figure 5.3.1  
 Kalaena Kiri Scheme  
 General Layout

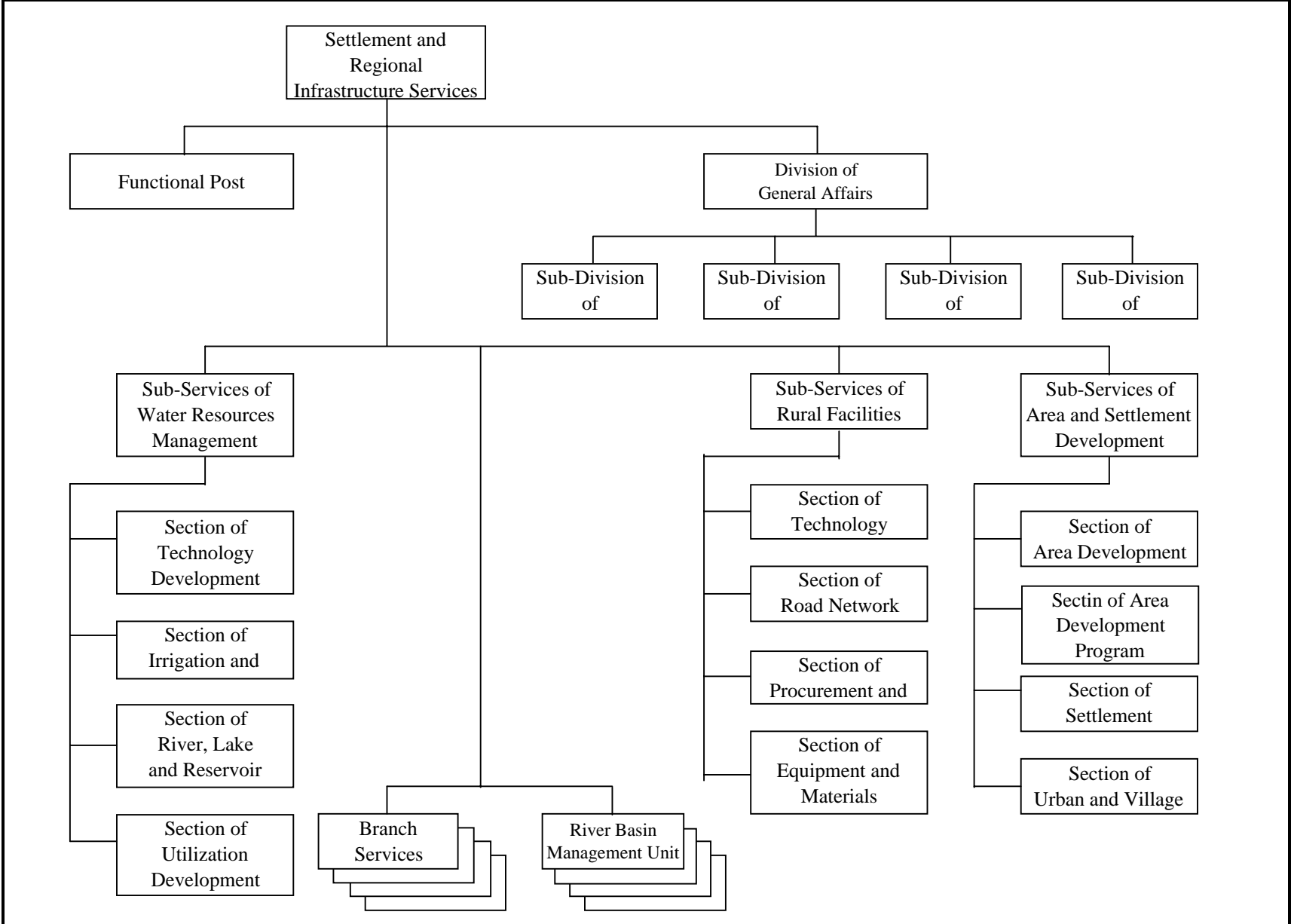


Figure 5.3.2 Organization Chart of Settlement and Regional Infrastructure Services, Luwu Utara District

**Figure 5.3.3 Implementation Program of Rehabilitation Work for Kalaena Kiri Irrigation Scheme**

Phase	Sector	Item of Implementation		Year from Commencement of Midterm Phase										
		Item	Works	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
Midterm	1. Irrigation/ Civil Works	Feasibility Study	Procurement of consultant	■										
			Preparation of F/S	■										
			Preparation of Implementation Schedule	■										
	2. Institution	Strengthening Program	Government staff	■										
			Water Users Association	■										
			Initial setting-up of FWUA and MWUA	■										
	3. Project Budget		Budget arrangement	■										
Final	1. Irrigation/ Civil Works	Implementation	Procurement of consultant		■									
			Detailed design			■								
			Tender for procurement of contractor				■							
			Civil works for rehabilitation					■	■	■	■			
	2. Institution	Training and Guidance	O&M for tertiary and on-farm						■	■				
			Collection of irrigation management fees and accounting						■	■				
	3. Extension Service		Formulation of task force team			■	■							
		Formulation of strengthening program												
		Identification and confirmation of constraints			■	■								
		Countermeasures or technology to be introduced for mitigation of constraints				■	■							
		Preparation of detailed program for strengthening				■	■							
		Implementation of program												
		Preparation of annual program						■	■					
		Budget arrangement						■	■					
		Preparation of detailed agreed plan of operation							■	■				
		Preparation of extension materials							■	■				
		Implementation of program, monitoring and evaluation								-	-	-	-	

## *Attachments*



***Attachment-1***

***Scope of Work for the Study on Comprehensive  
Recovery Program of Irrigation Agriculture***

Scope of Work  
for  
the Study on  
**Comprehensive Recovery Program of Irrigation Agriculture  
in the Republic of Indonesia**  
agreed upon between  
**Directorate General of Water Resources  
Ministry of Settlement and Regional Infrastructure**  
and  
**Japan International Cooperation Agency**

Jakarta, April 20, 2001

*Roestam*  
\_\_\_\_\_  
Dr. Roestam Sjarief  
Director of Water Resources Management  
Ministry of Settlement and Regional  
Infrastructure

*川口 明彦*  
\_\_\_\_\_  
Mr. Akihiro KAWADA  
Leader  
The Preparatory Study Team  
Japan International Cooperation Agency

## I. INTRODUCTION

In response to the request of the Government of the Republic of Indonesia (hereinafter referred to as "GOI"), the Government of Japan decided to conduct the Study on Comprehensive Recovery Program of Irrigation Agriculture in the Republic of Indonesia (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan. Accordingly, the Japan International Cooperation Agency (hereinafter referred to as JICA), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of Indonesia.

The present document sets forth the scope of work with regard to the Study.

## II. OBJECTIVES OF THE STUDY

The overall goal of the Study is increase farming productivity on deteriorated irrigated area resulting in self-sufficiency in rice production and increment of farmers' income.

The objectives of the Study are as follows:

- (1) To formulate a comprehensive program for functional irrigation scheme toward irrigation agriculture development.
- (2) To carry out technology transfer to Indonesian counterpart personnel through on-the-job training in the course of the Study.

## III. STUDY AREA

The Study shall cover irrigation schemes whose irrigated area is more than 1,000 ha in three (3) provinces of North Sumatra, Central Java and South Slawesi. The total irrigable area shall be approximately 778,000 ha (Refer to the location map attached as Annex 1).

## IV. SCOPE OF THE STUDY

In order to achieve the objectives above, the Study shall consist of the following items.

### 1. Data collection and analysis

- 1.1 Review the existing projects, studies and the national / regional development plans relevant to the Study
- 1.2 Collect and Review the existing data and information relevant to the Study
- 1.3 Carry out the inventory survey of irrigation schemes on the following items:
  - (1) Location and topography
  - (2) Watershed/catchment degradation
  - (3) Condition of irrigation and drainage infrastructures
  - (4) Irrigation system performance
  - (5) Agricultural support service
  - (6) Review of the existing cropping pattern, farming practices and crop yields
  - (7) Assessment of farmer's economy
  - (8) Effectiveness of O&M works
  - (9) others
- 1.4 Carry out the field survey to get additional data
- 1.5 Design of an outline of a database of the inventory

### 2. Analysis of results of the inventory survey

- 2.1 General review
  - (1) Assessment and evaluation of whole irrigation schemes
  - (2) Identify and clarify the constraints and potentials
- 2.2 Study on irrigation and drainage
  - (1) Assessment of the irrigation and drainage infrastructures

- (2) Reassessment of actual irrigation efficiency based on the past operation records
- (3) Study on resources of irrigation water
- (4) Study on the integrated water management system
- (5) Study on rehabilitation & upgrading of existing irrigation and drainage infrastructures

3. Formulation of a comprehensive program for functional irrigation scheme on following components:
- 3.1 Prioritized list of irrigation schemes to be rehabilitated
  - 3.2 Guideline for rehabilitation of irrigation facilities to function a whole irrigation scheme on the basis of farmers' participation in O&M (including model demonstration)
  - 3.3 Optimum plan for irrigation development
  - 3.4 Others

- 4. Prepare Conclusion and Recommendation
- 5. Organize workshop(s)/seminar(s)

#### V. STUDY SCHEDULE

The Study shall be carried out in accordance with the Tentative Work Schedule attached as Annex 2.

#### VI. REPORTS

JICA shall prepare and submit the following reports, written in English, to GOI;

- |                    |  |
|--------------------|--|
| Inception Report   | : Twenty (20) copies at the commencement of the Study  |
| Interim Report     | : Twenty (20) copies at the middle of the Study  |
| Draft Final Report | : Twenty (20) copies at the end of the Study   |
|                    | GOI side shall submit written comments on the Draft Final Report to JICA in one (1) month after the receipt of the report. |
| Final Report       | : Forty (40) copies in two (2) months after the receipt of comments on the Draft Final Report from GOI                     |

#### VII. UNDERTAKING OF THE GOI

1. To facilitate the smooth conduct of the Study, GOI shall take necessary measures, as listed below;
- (1) Secure the safety of the Study Team,
  - (2) Permit the members of the Study Team to enter, leave and sojourn in Indonesia for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,
  - (3) Exempt the members of the Study Team from taxes, duties and other charges on equipment, machinery and other materials to be brought into and out of Indonesia for the conduct of the Study,
  - (4) Exempt the members of the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study,
  - (5) Provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced into Indonesia from Japan in connection with the implementation of the Study,
  - (6) Secure permission for the Study Team(s) to enter private properties or restricted areas for the conduct of the Study,
  - (7) Secure permission for the Study Team to take all data and documents, including photographs and maps, relevant to the Study out of Indonesia to Japan, and
  - (8) Provide medical services as needed. Its expenses will be chargeable to members of the Study Team.
2. GOI shall bear claims, if any arises, against members of the Study Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Study Team.

3. Directorate General of Water Resources, Ministry of Settlement and Regional Infrastructure (hereinafter referred to as "MoSRI") shall act as the counterpart agency to the Study Team and also as the coordinating body in relations with other governmental and non-governmental organizations for the smooth implementation of the Study.

4. MoSRI shall, at its own expense and in cooperation with other organizations concerned, provide the Study Team with the following:

- (1) Available data and information related to the Study,
- (2) Counterpart personnel,
- (3) Suitable office space and necessary equipment in Jakarta and the Study area, and
- (4) Credentials or identification cards.

#### VIII. UNDERTAKING OF JICA

For the implementation of the study, JICA shall take the following measures;

- (1) Dispatch, at its own expense, study teams to Indonesia, and,
- (2) Pursue technology transfer to the Indonesian counterpart personnel in the course of the study.

#### IX. CONSULTATION

JICA, MoSRI shall maintain constant communication and consult with each other in respect of any matters that may arise from or in connection with the Study.



***Attachment-2***

***Minutes of Meetings on the Scope of Work  
for the Study***

**Minutes of Meetings on the Scope of Work**  
**for**  
**the Study on**  
**Comprehensive Recovery Program of Irrigation Agriculture**  
**in the Republic of Indonesia**  
**agreed upon between**  
**Directorate General of Water Resources**  
**Ministry of Settlement and Regional Infrastructure**  
**and**  
**Japan International Cooperation Agency**

Jakarta, April 20, 2001

*Roestam Sjarief*  
\_\_\_\_\_  
Dr. Roestam Sjarief  
Director of Water Resources Management  
Ministry of Settlement and Regional  
Infrastructure

*川田 明彦*  
\_\_\_\_\_  
Mr. Akihiro KAWADA  
Leader  
The Preparatory Study Team  
Japan International Cooperation Agency

## I. INTRODUCTION

In response to the request of the Government of Indonesia, the Preparatory Study Team headed by Mr. Akihiro KAWADA (hereinafter referred to as "the Team"), was sent to Indonesia by the Government of Japan through the Japan International Cooperation Agency (hereinafter referred to as "JICA"), from April 10 to April 20, 2001 for the purpose of discussing and confirming the Scope of Work for the Study on Comprehensive Recovery Program of Irrigation Agriculture in the Republic of Indonesia (hereinafter referred to as "the Study").

The Team held a series of discussions with the relevant authorities of the Government of Indonesia represented by Mr. Roestam Sjarief, Director of Water Resources Management, Ministry of Settlement and Regional Infrastructure (hereinafter referred to as "MoSRI").

As a result of the discussions, the Indonesian side and the Team agreed on the Scope of Work for the Study.

The following are the main issues discussed and agreed upon by both sides in relation to the Scope of Work for the Study. The list of participants and resource persons in the series of meetings is attached as Annex 1.

## II. RESULTS OF DISCUSSIONS

### 1. Framework of the Study

- (1) Both sides agreed on a basic framework of the Study as in Annex 2.
- (2) Both sides agreed definitions of key words of the Study as follows:

**Rehabilitation** is defined as repair works for the damaged portions of the existing irrigation system in order to recover the system's designed irrigation capacity. Those works are not accompanied by the increase of irrigation area. The effect of repair on paddy production varies much, depending on the damaged portion and grade of damage. Some schemes require reconstruction of weir and others need repair works only for tertiary boxes. Rehabilitation works may bring paddy production increase through yield increase as well as increase in cropping intensity. It is estimated that rehabilitation will increase cropping intensity of dry season crop by 0.20 for Java and 0.30 for outer Java.

**Upgrading** is defined as improvement of the existing system which is accompanied by the expansion of irrigation area. Objective land to be irrigated is usually rainfed paddy field and/or newly reclaimed land. More than one cropping of paddy will be possible after completion of the system.

**Completion works** is defined as continuation of construction of existing incomplete irrigation schemes. Adequate and coordinated land and tertiary development are required. The opportunity to expand the irrigated area should have high priority because it would be relatively low in cost, take advantage of large sunk investments in existing irrigation infrastructure, and can be implemented quickly.

### Optimum Plan for Irrigation Development

- Recommendation on participatory approach of rehabilitation program considering various type of rehabilitation works, i.e., heavy, medium and minor as well as some irrigation schemes that have specific area problems such as a severe watershed degradation that decreasing irrigated area of schemes
- Technical recommendation on completion irrigation works of incomplete irrigation schemes.

**Guideline for rehabilitation of irrigation facilities to function a whole irrigation scheme on the basis of farmers' participation in O&M** shows designs and plan maintenance-easy facilities to farmers.

**Model demonstration** is to show an actual figure of irrigation scheme rehabilitated for better understanding of the guideline mentioned above.

- (3) MoSRI requested survey on potential of irrigation schemes and volume/character of necessary rehabilitation for irrigation schemes whose irrigated area is more than 1,000ha in three (3) provinces. MoSRI is going to utilize the output of the study as guidance in planning of irrigation development and management in Indonesia, especially for funding and prioritizing of rehabilitation and completion works of irrigation schemes. The output will support the real application and implementation of the "Water Management Turnover Program".
- (4) Both sides agreed that the study should focus on equitable water distribution to the tail of the irrigation scheme.
- (5) Both sides agreed that North Sumatra, Central Java, and South Sulawesi should be the target areas of the Study in view of necessity of rehabilitation and its effect.
- (6) MoSRI promised to make its best efforts to realize enough collaboration by agricultural section of provincial as well as district governments.
- (7) MoSRI agreed that the inventory system for main irrigation facilities developed by the Irrigation Engineering Service Center (I.E.S.C.) should be fully utilized for the inventory survey in the Study.

## 2. Steering Committee

Regarding the item 3, "VII. UNDERTAKING OF THE GOI" of the Scope of Work, the both sides agreed that it is necessary to establish the Steering Committee for the smooth and efficient implementation of the Study.

## 3. Equipment, facilities and others necessary for the Study

MoSRI side promised to provide the team for the Study with desks, chairs and the use of one telephone with facsimile function in a suitable office space within the building of Ministry of Settlement and Regional Infrastructure in Jakarta.

MoSRI promised to make its best effort to provide the team for the Study with desks, chairs and the use of one telephone with facsimile function in a suitable office space in each province as required.

MoSRI requested that the following equipments and materials for the Study be provided by JICA. The Team promised to convey the request to the JICA headquarters.

- Vehicle, fuel, driver
- Photocopy machine
- Personal computer

## 4. Training of counterpart personnel

MoSRI requested the counterpart training in Japan for effective technology transfer. The Team promised to convey the request to the JICA headquarters.

## 5. Report

The both sides agreed that the Final Report should be opened to the public.

## I. LIST OF PARTICIPANTS

### Indonesian side:

#### Ministry of Settlement and Regional Infrastructure (Directorate General of Water Resources)

Dr. Soenarno Director General

#### Directorate of Water Resources Management

Mr. Roestam Sjarief Director  
 Mr. Sutardi Chief Sub-Directorate of Water Resources Conservation  
 Mr. Ridwan Rahman Staff of Chief Sub-Directorate of River Basin Management  
 Mr. Djoko Sudjatniko Staff of Chief Sub-Directorate of Water Resources Conservation  
 Mrs. Sondang Nelli Staff of Chief Sub-Directorate of Water Resources Institution

#### Directorate of Technical Guidance

Mr. Agus Suprpto K. Chief of Sub-Directorate of Performance Evaluation

#### Directorate of Water Resources, Eastern and Western Region

Mr. Mansye Nahumury Staff of Sub-Directorate of Technical Planning, Eastern Region  
 Mrs. Ety H. Staff of Sub-Directorate of Technical Planning, Western Region

#### Ministry of Agriculture

Mr. Tangkas Pandjaitan Directorate of Farm Business Facilities  
 Mr. Sadar Purwanto Directorate of Irrigation Water Management  
 Mr. Amier Hariono Directorate of Irrigation Water Management  
 Mr. Wahyu Ma'no Staff of Directorate General of Agricultural Facilities  
 Mr. Arief Budiman Staff of Directorate General of Agricultural Facilities

### Japanese side:

#### Preparatory Study Team

Mr. Akihiro KAWADA Leader  
 Mr. Gentaro TANAKA Agricultural Infrastructure  
 Mr. Junichi HANAI Coordinator

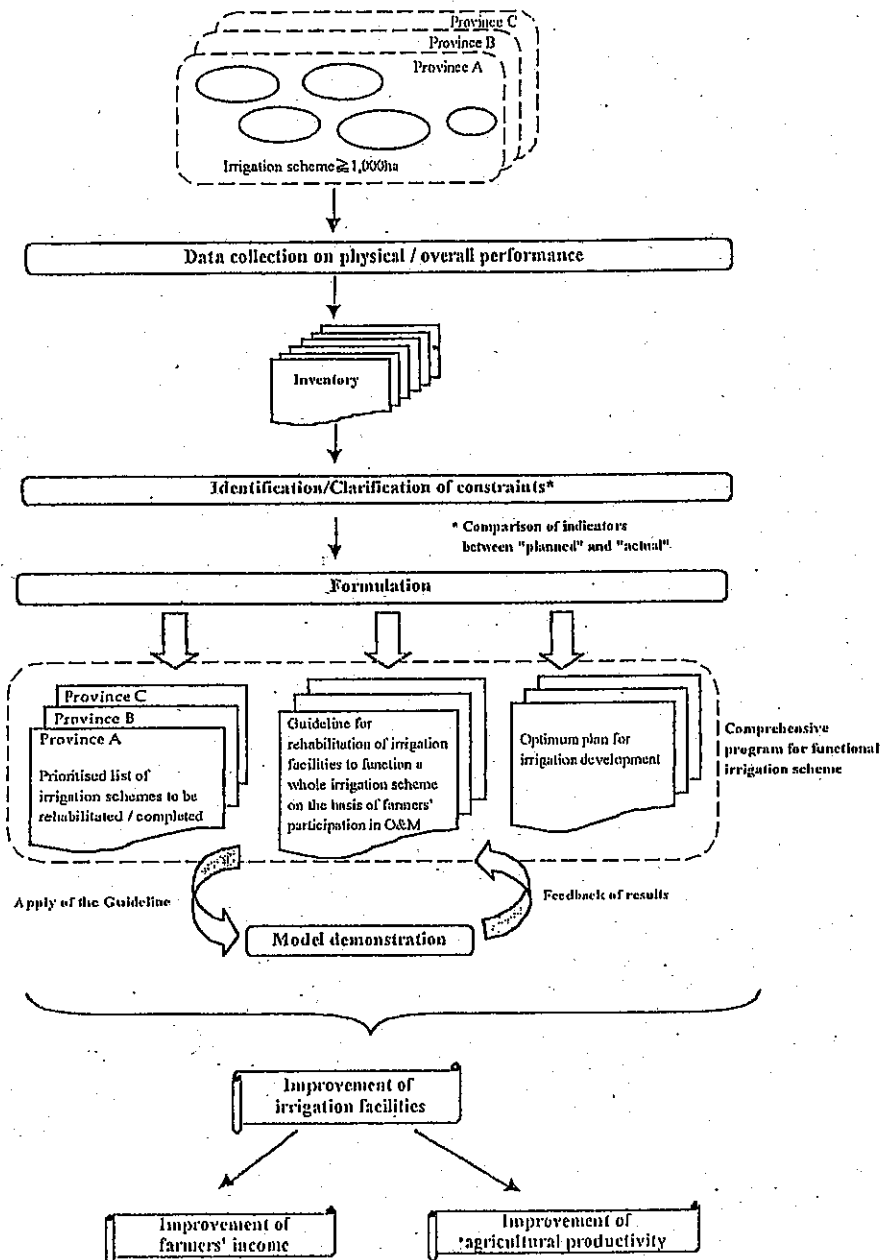
#### JICA Indonesia Office

Mr. Hirofumi HOSHI Assistant Resident Representative

#### JICA Expert

Mr. EGAMI Hiroshi Directorate General of Water Resources Development,  
 Ministry of Settlement and Regional Infrastructure (MoSRI)  
 Mr. SATO Masahito Ministry of Agriculture

Frame Work of the Study





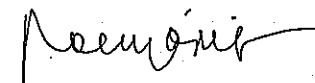
***Attachment-3***

***Minutes of Meetings on Inception Report  
for the Study***

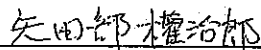
MINUTES OF MEETINGS  
ON  
INCEPTION REPORT  
FOR  
THE STUDY  
ON  
COMPREHENSIVE RECOVERY PROGRAM  
OF  
IRRIGATION AGRICULTURE

AGREED UPON  
BETWEEN  
MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta  
February 27, 2003

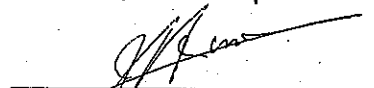


Dr. Roestam Sjarief  
Director General of Water Resources  
Ministry of Settlement and Regional  
Infrastructure



Mr. Kenjiro YATABE  
Leader of the Study Team  
Japan International Cooperation Agency

Witnessed by:



Mr. Junichi HANAI  
Leader of the Monitoring Team  
Japan International Cooperation Agency

## 1. Introduction

In accordance with the Scope of Work and the Minutes of Meetings for the Study on the Comprehensive Recovery Program of Irrigation Agriculture in the Republic of Indonesia (hereinafter referred to as "the Study") agreed on April 20, 2001 at Jakarta between the Government of the Republic of Indonesia (hereinafter referred to as "GOI") represented by the Ministry of Settlement and Regional Infrastructure (hereinafter referred to as "MOSRI") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA dispatched a study team (hereinafter referred to as "the Team") headed by Mr. Kenjiro YATABE and a monitoring team headed by Mr. Junichi HANAI to commence the Study from February 23, 2003.

Prior to the commencement of the field works, the Team held a series of discussions with the relevant authorities of GOI.

On February 25, the Steering Committee meeting was held to discuss the contents of the Inception Report for the Study (List of attendants is attached in Appendix-1).

On February 26, the follow-up meeting was held between MOSRI and the Team for confirmation of the work schedule, plan of operation as well as the undertaking of GOI.

On February 27, the wrap-up meeting was held as the second Steering Committee meeting. As a result of the discussions, the Indonesian side and the Team agreed with the contents of the Inception Report for the Study.

The followings are the major issues and points discussed and agreed upon by both sides.

## 2. Major Issues and Points Discussed and Agreed

### 2.1 Plan of Operation of the Study

MOSRI placed a special emphasis on the following government policies, government decrees and relevant reports. The Team agreed that those shall be fully reflected for the implementation of the Study.

#### Policy

- Decentralization of Administration
- Turnover of Irrigation Management

- Empowerment of Water Users' Associations

Government Regulation and Ministerial Decree

- Law No. 22/1999
- Government Regulation No. 77/2001
- Minister of Home Affairs Decree No. 50/2001
- Minister of Settlement and Regional Infrastructure Decree No. 529/KPTS/M/2001

Study reports

- Formulation of Irrigation Development Program (JICA, 1993)
- Special Studies for Establishment of Frameworks on Policy Reform in Water Resources Sector (JBIC, 2000)
- Improvement of Irrigation Management and Empowerment of Water Users' Association for Enhancement of Turnover Program (JICA, 2001)
- Sector Program Development Studies for Agriculture and Fisheries (JICA, 2002)

- (2) MOSRI and the Team agreed that "the Guidelines for Rehabilitation of the Irrigation Schemes" formulated by the Study should be applicable for all the provinces of Indonesia.
- (3) MOSRI and the Team agreed that the basic data of irrigation schemes such as topographical map, as-built drawing and irrigation diagram is essential. In this regard, the number of schemes to be covered by the Study may be reviewed and reconsidered in accordance with the results of inventory and other reasons subject to confirmation of MOSRI.

## 2.2 Undertaking of GOI

To facilitate the smooth execution of the Study, GOI shall undertake the necessary measures.

In this regard, MOSRI and the Team agreed upon:

### (1) Counterpart Personnel

Following counterpart personnel are assigned to the Team at the central office and

each provincial office as soon as possible.

- Chief Counterpart
- Irrigation Engineer
- Agronomist
- Institutional Expert

The Team put emphasis on the counterpart personnel costs such as travel allowance should be borne by GOI. MOSRI promised to make efforts to allocate necessary budget for the Study.

### (2) Equipment

The equipment to be procured by the Team is used only for the Study. The use of equipment after completion of the Study shall be discussed between MOSRI and JICA Indonesia Office.

### (3) Steering Committee Meeting

The Steering Committee Meeting shall be held regularly in accordance with the work schedule as presented in the Inception Report for the Study.

**List of Attendants****Indonesian Side:****Ministry of Settlement and Regional Infrastructure**

Mr. Bambang Sudibyo Chief of Sub Directorate Irrigation, Groundwater, Swamp & Costal Area, Directorate of Technical Guidance

Ms. Irama A. Chief of Sub Directorate Preparation of Policy & Strategy, Directorate of Technical Guidance

Mr. S. R. Lengkong Chief of Sub Directorate Cante Wil Timur, SDA Wil Timur

Mr. Dhono Bantolo Chief Section of Performance EV. II, Directorate of Technical Guidance

Mr. Rochadi Masyhadi Chief Section of Cantek Barat, SDA Wil Barat

Mr. Darwin L. Chief Section of Data Preparation Subdata of Policy & Strategy, Bintek SDA

Mr. Asbarisyah Chief Section of Irrigation and Grand Water, Bintek

Mr. Prabowo P. Chief Section of Swamp and Costal, Bintek

Mr. Adi Pramudyo Staff of Sub Directorate IARTP, Directorate of Technical Guidance

Mr. Hardiyatno Cante Wil Tengah, SDA Wil Tengah

Mr. Danang Baskoro Staff Irrigation, Bintek

Mr. Hendy. S. Staff, Bintek

**Ministry of Agriculture**

Mr. Amier Hartono Chief of Irrigation Program

Mr. M. Samsul Huda Section of MSE

**Ministry of Home Affairs**

Mr. Hidatar Staff of Bangda

Mr. Iwan Kurniawan Staff of Bangda

**National Development Planning Agency**

Mr. Aryawan Sub Directorate

**Japanese Side:****JICA Study Team**

Mr. Kenjiro YATABE Team Leader / Development Plan

Mr. Shigeo ANDO Irrigation / Agriculture Infrastructure

Mr. Yutaka MATSUMOTO Farmer's Organization / Participatory Development

Mr. Mitsuru NANAKUBO Coordinator

**JICA Monitoring Team**

Mr. Junichi HANAI Agricultural Development Study Division, Agriculture, Forestry and Fisheries Development Study Department, JICA Headquarter

**JICA Indonesia Office**

Ms. Machiko KAMIYA Assistant Resident Representative, JICA Indonesia Office

**JICA Expert**

Mr. Hiroshi EGAMI Directorate General of Water Resources, Ministry of Settlement and Regional Infrastructure (MOSRI)

Mr. Noriharu USUKI Directorate General of Agricultural Facilities, Ministry of Agriculture (MOA)

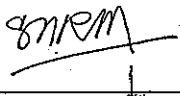
***Attachment-4***

***Minutes of Meeting on Progress Report (1)  
for the Study***

MINUTES OF MEETING  
ON  
SECOND STEERING COMMITTEE MEETING  
FOR  
THE STUDY  
ON  
COMPREHENSIVE RECOVERY PROGRAM  
OF  
IRRIGATION AGRICULTURE

AGREED UPON  
BETWEEN  
MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta  
July 8, 2003

  
Ms. Sri Nurumi  
Director of Technical Guidance  
Directorate General of Water Resources  
Ministry of Settlement and Regional  
Infrastructure

  
Mr. Kenjiro YATABE  
Leader of the Study Team  
Japan International Cooperation Agency

MINUTES OF MEETING  
ON  
PROGRESS REPORT (1)  
OF  
THE STUDY ON COMPREHENSIVE RECOVERY PROGRAM OF  
IRRIGATION AGRICULTURE

DATE: July 8, 2003  
TIME: 10:00 to 11:30 a.m.  
PLACE: Conference Room of Ministry of Settlement and Regional  
Infrastructure, Jakarta  
PARTICIPANTS: Name of all the participants as per attached Attachment 1

The meeting was convened to explain and discuss the Progress Report (1) on the Study on Comprehensive Recovery Program of Irrigation Agriculture, being submitted to the Government of Indonesia on July 7, 2003 by the JICA Study Team. The Report defines the provisional results of Phase I Study.

The meeting was chaired by the Director of Water Resources in East Region, Ir. Eddy A. Djadjadiredja, Dipl. HE, on behalf of Director of Technical Guidance, Ms. Sri Nurumi. The chairperson presented general agenda of the meeting.

The Team Leader of the JICA Study Team made a presentation of the contents of Progress Report (1).

The discussion was made between the Indonesian side and the Japanese side. The followings are the major issues and points discussed and agreed upon by both sides.

1. Plan of Operation of the Study

1. The contents of Progress Report (1) were agreed by the Indonesian side.
2. Both parties confirmed that the schemes to be studied in Phase II are as follows:

Province	District	Year Constructed	Name of Irrigation Scheme	Subjected Area (ha)
North Sumatra	Asahan	1981	Padang Mahondang	2,905
Central Java	Tegal, Kodia	1991/92	Gung	12,641
South Sulawesi	Luwu Utara	1980	Kalaena Kiri	3,536

3. The Indonesian side suggested that the agricultural support service program should be prepared for the above three irrigation schemes in Phase II.
4. The Indonesian side suggested that the involvement of farmer water users' institutions in the recovery program should be considered in Phase II.

## 2. Undertaking of GOI

To facilitate the smooth execution of the Study, GOI should undertake the necessary measures as follows:

1. Reassignment of counterpart personnel and budget allocation for field trips.
2. Collection of data and information (design documents, as-built drawings, etc.) required for the detailed study of the said three schemes before the commencement of the second field work.
3. Provision of larger office space to accommodate at least 12 persons consisting of six Japanese experts and six local staffs.

## List of Attendants

### Indonesian Side:

#### **Ministry of Settlement and Regional Infrastructure**

- Mr. Eddy Djadjadiredja      Director of Water Resources in Eastern Region, Directorate of Water Resource
- Mr. A. Tommy M. S          Chief of Sub Directorate Irrigation, Groundwater, Swamp & Coastal Area, Directorate of Water Resources
- Mr. Bambang Subyandono      Chief Section of Sub Directorate of Technical Planning, Directorate of Water Resources in Western Region
- Mr. Gindo Hasibuan          Chief of Sub Provincial Services for Water Resources Conservation, North Sumatra Province
- Mr. M. Ghazi                  Chief of Sub Provincial Services for Irrigation Program, Central Java Province
- Mr. Eko Yudianto              Chief Section of Water Resource Management, Central Java Province
- Mr. Tagor Pane                Counterpart
- Mr. Sudarmanto                Counterpart

#### **Ministry of Agriculture**

- Mr. Amier Hartono          Chief of Sub Directorate of Irrigation Utilization
- Mr. M. Samsul Huda          Chief Section of MSC

#### **Ministry of Home Affairs**

- Mr. Suyanto                  Staff of Bangda
- Mr. Bakti N                    Staff of Bangda

#### **National Development Planning Agency**

- Mr. M. Irfan Saleh          Sub Directorate of Planning

### Japanese Side:

#### **JICA Study Team**

- Mr. Kenjiro YATABE          Team Leader / Development Plan

Mr. Shigeo ANDO Irrigation / Agriculture Infrastructure  
Mr. Yutaka MATSUMOTO Farmer's Organization / Participatory Development  
Mr. Takashi SHIRAKI Agriculture/ Agro-economy  
Mr. Mitsuru NANAKUBO Coordinator

**JICA Indonesia Office**

Ms. Machiko KAMIYA ARR, JICA Indonesia

**JICA Expert**

Mr. Noriharu USUKI Directorate General of Water Resources, Ministry of  
Settlement and Regional Infrastructure (MoSRI)

Mr. Tsutomu ASADA Directorate General of Water Resources, Ministry of  
Settlement and Regional Infrastructure (MoSRI)



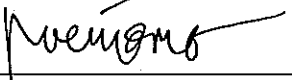
***Attachment-5***

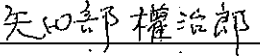
***Minutes of Meeting on Interim Report  
for the Study***

MINUTES OF MEETING  
ON  
THE INTERIM REPORT  
FOR  
THE STUDY  
ON  
COMPREHENSIVE RECOVERY PROGRAM  
OF  
IRRIGATION AGRICULTURE

AGREED UPON  
BETWEEN  
MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta  
October 17, 2003

  
Dr. Roestam Sjarief  
Director General of Water Resources  
Ministry of Settlement and Regional  
Infrastructure

  
Mr. Kenjiro Yatabe  
Leader of JICA Study Team  
Japan International Cooperation Agency

MINUTES OF MEETING  
ON  
THE INTERIM REPORT  
FOR  
THE STUDY ON COMPREHENSIVE RECOVERY PROGRAM OF  
IRRIGATION AGRICULTURE

Date: October 17, 2003  
Time: 9:30 to 11:30 a.m.  
Place: Conference Room of the Ministry of Settlement and Regional  
Infrastructure, Jakarta  
Participants: Name of all the participants as per appended to Attachment

The meeting was held to explain and discuss the contents of the Interim Report of the Study on the Comprehensive Recovery Program of Irrigation Agriculture, being submitted to the Government of Indonesia by the JICA Study Team through Japan International Cooperation Agency in August 2003. The Report defines the interim results of Phase I Study.

The meeting was chaired by the Director of Technical Guidance, Ir. Ibu Sri Nurumi. The chairperson presented general agenda of the meeting.

The Team Leader of the JICA Study Team, Mr. Kenjiro Yatabe, made a presentation of the contents and composition of the Interim Report.

The followings are the major issues and topics discussed and agreed upon by both sides:

1. **Topics discussed**
  1. Work schedule of the Study,
  2. Comments to the Interim Report made by the JICA Advisory Committee,
  3. Contents of the Interim Report in comparison with Progress Report (1),
  4. Subjects/contents to be revised in accordance with the modification of Irrigation Management Policy Reform, and
  5. The Study to be conducted in the Second Field Work.

2 **Plan of Operation of the Study**

1. The contents of the Interim Report were generally agreed by the Indonesian side. Comments made by the Kimpraswil and the response to them made by the JICA Study Team are as follows:

(1) Kimpraswil: Regarding "Classification of categories of irrigation systems", the same presentation is made for both provinces of North Sumatra and South Sulawesi.

JICA Study Team: Revision will be made in the Progress Report (2).

(2) Kimpraswil: Regarding "Evaluation indicators for prioritization", it seems that rather high score is given to "Urgency of rehabilitation".

JICA Study Team: The weighted scores were initially determined by the counterpart meeting, and they were approved by the Second Steering Committee Meeting in Indonesia and the JICA Advisory Committee Meeting in Japan.

(3) Kimpraswil: Regarding "the same valuation indicators", it seems to be necessary to include the effect of irrigation efficiency.

JICA Study Team: Such effect is already included as "Recovery of function of irrigation facilities".

2. The Kimpraswil has agreed that the adjustment of the description of "Irrigation Management Policy Reform" in the JICA Report is based on the Bill of Law on Water Resources under discussion and assumption of adjustment to be made for the Presidential Instruction No. 3, the Government Regulation No. 77, and other Ministerial Regulations concerned.

3. However, the Kimpraswil is of the opinion that as far as the pending issues of the Bill (regarding shouldering of construction cost for irrigation facility at tertiary system) are settled through the discussion to be made in the Commission IV of the House of Representatives from October 27, 2003, the JICA Report should be adjusted based on the cleared article.

3. **Undertaking of GOI**

The field work in Phase II commenced on September 24, with the schedule for completion on November 18, 2003. During this period, the following counterparts have been assigned:

**Counterparts and Their Tasks**

No.	Counterpart Tasks	Name
1.	Chief Counterpart	Ir. A. Tommy M. Sitempul, M. Eng.
2.	Irrigation Engineer	Ir. Tagor Pane, M. Eng.
3.	Agronomist	Ir. Slamet Sugeng, M. Sc.
4.	Institutional Expert	Ir. Suharto Sarwan

**List of Attendants**

**Indonesian Side:**

**Ministry of Settlement and Regional Infrastructure**

- Ms. Sri Nurumi Director of Technical Guidance, Directorate General of Water Resources
- Mr. A. Tommy M. S. Chief of Sub Directorate Irrigation, Groundwater, Swamp & Coastal Area, Directorate of Technical Guidance, Directorate General of Water Resources
- Mr. Syafrudin Chief Section of Irrigation, Groundwater, Swamp & Coastal Area, Directorate of Technical Guidance, Directorate General of Water Resources
- Mr. Willy AF Chief of Directorate of Technical Guidance, Directorate General of Water Resources
- Mr. Prasadanto Chief of Sub Directorate of Central Region II, Directorate General of Water Resources
- Mr. Edy Wahyono Chief Section of East Region II, Directorate General of Water Resources
- Mr. S. R. Lengkong Chief of Sub Directorate of Cantek East Region, Directorate General of Water Resources
- Mr. Suprpto Chief of Sub Directorate of West Region II, Directorate General of Water Resources
- Ms. Etty H Chief of Sub Directorate of Cantek West Region, Directorate General of Water Resources
- Mr. M Ghazi Chief of Sub Provincial Services for Irrigation Program, Central Java Province
- Mr. Eko Yunianto Chief Section of Water Resource Management, Central Java Province
- Mr. Tagor Pane Counterpart, Directorate General of Water Resources

**Ministry of Home Affairs**

- Mr. Henry E Staff of BANGDA

**National Development Planning Agency**

Ms. Gusti Rosvia          Staff of Directorate of Irrigation

Ms. Tirta S                Staff of Directorate of Irrigation

**Japanese Side:**

**JICA Indonesia Office**

Ms. Machiko KAMIYA    ARR, JICA Indonesia

**JICA Expert**

Mr. Tsutomu ASADA     Directorate General of Water Resources, Ministry of  
Settlement and Regional Infrastructure (MoSRI)

**JICA Study Team**

Mr. Kenjiro YATABE     Team Leader / Development Plan

Mr. Shigeo ANDO        Irrigation / Agriculture Infrastructure

Mr. Yutaka MATSUMOTO Farmer's Organization / Participatory Development

Mr. Takashi SHIRAKI    Agriculture/ Agro-economy

Mr. Jun TSURUI         Design, Cost Estimate/ Project Evaluation

Mr. Mitsuru NAKAKUBO- Coordinator


***Attachment-6***

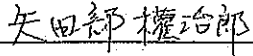
***Minutes of Meeting on Progress Report (2)  
for the Study***

MINUTES OF MEETING  
ON  
PROGRESS REPORT (2)  
FOR  
THE STUDY  
ON  
COMPREHENSIVE RECOVERY PROGRAM  
OF  
IRRIGATION AGRICULTURE

AGREED UPON  
BETWEEN  
MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta  
November 13, 2003

  
Ibu Ir. Sri Nurumi  
Director of Technical Guidance  
Directorate General of Water Resources

  
Mr. Kenjiro Yatabe  
Leader of JICA Study Team  
Japan International Cooperation Agency

MINUTES OF MEETING  
ON PROGRESS REPORT (2)  
FOR THE STUDY ON COMPREHENSIVE RECOVERY PROGRAM  
OF IRRIGATION AGRICULTURE

Date: November 13, 2003  
Time: 10:00 to 12:00 a.m.  
Place: Conference Room of the Ministry of Settlement and Regional  
Infrastructure, Jakarta

Participants: Name of all the participants as per appended to Attachment

The meeting was held to explain and discuss the contents of Progress Report (2) of the Study on the Comprehensive Recovery Program of Irrigation Agriculture, being submitted to the Government of Indonesia by the JICA Study Team on November 10, 2003. The Report defines the provisional results of the Second Field Work in Phase II.

The meeting was chaired by the Director of Technical Guidance, Ibu Ir. Sri Nurumi. The chairperson presented general agenda of the meeting.

The Team Leader of the JICA Study Team, Mr. Kenjiro Yatabe, made a presentation of the contents and composition of the Progress Report (2).

The followings are the major issues and topics discussed and agreed upon by both sides:

1. **Topics discussed**
  1. Contents of the Study in the Second Field Work (Sept. 24 to Nov. 18, 2003),
  2. Adjustment of Progress Report (2) related to the draft new Law on Water Resources,
  3. Feasibility Study on three Model Schemes,
  4. Formulation of Comprehensive Recovery Program of Irrigation Agriculture,
  5. Action Plan of Recovery Program, and
  6. Conclusion on Progress Report (2).

2 **Plan of Operation of the Study**

The contents of Progress Report (2) have been generally accepted by the Indonesian side. Comments made by the Kimpraswil and MOA, and the response to them made by the JICA Study Team are as follows:

- (1) Kimpraswil: According to the "Study for Formulation of Irrigation Development Program in the Republic of Indonesia" prepared by JICA in 1993, it is stated in the report that approx. 60% of the tertiary system are not functioning at all.

JICA Study Team: It is proposed that the tertiary system is to be rehabilitated fully so as to function 100%, and such expenditure is estimated in the construction cost for rehabilitation.

- (2) Kimpraswil: How long is it necessary to carry out support for O&M of the tertiary system?

JICA Study Team: It is estimated that the training of staffs of the irrigation offices of the district governments will take one year at least.

Kimpraswil: In the pre-feasibility study on the Padang Mahodang Scheme, the intake structure was proposed to be Headworks with weir. Why did you change to the Free Intake as the intake structure?

JICA Study Team: In the stage of the pre-feasibility study for the Padang Mahodang Scheme, no information was available for determining the type of intake structure. To cope with this, the JICA Study Team requested the JICA head office to arrange budget in the Second Field Work for carrying out topographic and geological investigations at the intake site. As a result, it was found that the site is not preferable for the construction of a weir across the river. Detailed study is made to determine the type of the intake structure, and as a result, Free Intake has been adopted as stated in Progress Report (2).

- (4) MÓA: Micro finance facility should be proposed in the Draft Final Report.

JICA Study Team: The micro finance facility will be incorporated in the Draft Final Report.

- (5) Kimpraswil: In the preparation of Project Implementation Organization, it is preferable to refer to the existing organizational structure in Indonesia.

JICA Study Team: Proposed Project Implementation Organization will be modified according to the existing ones.

- (6) Kimpraswil: The JICA Study Team should formulate development program for upgrading and expansion of the Gung Scheme.

JICA Study Team: Recommendation will be made for such development program in the Draft Final Report. However, preparation of new development plan is not possible because there is no information regarding topographic map, geological data, river condition, etc.

## List of Attendants

### Indonesian Side:

#### Ministry of Settlement and Regional Infrastructure

Ms. Sri Nurumi	Director of Technical Guidance, Directorate General of Water Resources
Ms. Etty H	Chief of Sub Directorate of Cantek West Region, Directorate General of Water Resources
Mr. Tagor Pane	Counterpart, Directorate General of Water Resources
Mr. Slamet Sugeng	Counterpart, Directorate General of Water Resources

#### Ministry of Agriculture

Mr. M. Samsul Huda	Chief Section of MSC
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#### National Development Planning Agency

Mr. Candra	Staff
Ms. Via	Staff

### Japanese Side:

#### JICA Indonesia Office

Ms. Machiko KAMIYA	ARR, JICA Indonesia
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#### JICA Expert

Mr. Tsutomu ASADA	Directorate General of Water Resources, Ministry of Settlement and Regional Infrastructure (MoSRI)
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#### JICA Study Team

Mr. Kenjiro YATABE	Team Leader / Development Plan
Mr. Shigeo ANDO	Irrigation / Agriculture Infrastructure
Mr. Yutaka MATSUMOTO	Farmer's Organization / Participatory Development
Mr. Takashi SHIRAKI	Agriculture/ Agro-economy
Mr. Jun TSURUI	Design, Cost Estimate/ Project Evaluation
Mr. Mitsuru NANAUBO	Coordinator

***Attachment-7***

***Minutes of Meeting on Draft Final Report  
for the Study***



MINUTES OF MEETING  
ON  
THE DRAFT FINAL REPORT  
FOR  
THE STUDY  
ON  
COMPREHENSIVE RECOVERY PROGRAM  
OF  
IRRIGATION AGRICULTURE

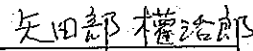
AGREED UPON  
BETWEEN  
DIRECTORATE GENERAL OF WATER RESOURCES  
MINISTRY OF SETTLEMENT AND REGIONAL INFRASTRUCTURE  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Jakarta

January 30, 2004



Ibu Ir. Sri Nurumi  
Director of Technical Guidance  
Directorate General of Water Resources  
Ministry of Settlement and Regional Infrastructure



Mr. Kenjiro Yatabe  
Leader of the JICA Study Team  
Japan International Cooperation Agency

MINUTES OF MEETING  
ON THE DRAFT FINAL REPORT  
FOR THE STUDY ON COMPREHENSIVE RECOVERY PROGRAM  
OF IRRIGATION AGRICULTURE

Date: January 30, 2004  
Time: 9:00 a.m. to 10:30 a.m.  
Place: Conference Room of the Ministry of Settlement and Regional  
Infrastructure, Jakarta  
Participants: Name of all the participants as per appended to Attachment

1. General

The meeting was held to explain and discuss the contents of Draft Final Report of the Study of the Comprehensive Recovery Program of Irrigation Agriculture, being submitted to the Government of Indonesia by Japan International Cooperation Agency (JICA) on January 6, 2004. The Report defines the results on the Study on the basis of the field/home office works of Phases I and II.

The Steering Committee Meeting to discuss the Study on the Comprehensive Recovery Program of Irrigation Agriculture was chaired by Ibu Ir. Sri Nurumi, the Director of Technical Guidance. The chairperson presented general agenda of the meeting.

The Team Leader of the JICA Study Team, Mr. Kenjiro Yatabe, made a presentation of the contents and composition of the Draft Final Report.

The followings are the major issues and topics discussed and agreed upon by both sides:

2. Topics discussed

1. Objectives, Schedule and Outputs of the Study,
2. Revision of Irrigation Management Policy, and Modification of the Contents of the Draft Final Report,
3. Comparison between the Results of Pre-F/S and F/S,
4. Irrigation Assets Management Procedure,
5. Formulation of Comprehensive Recovery Program of Irrigation Agriculture,
6. Action Plan of Recovery Program,
7. Guideline for Rehabilitation of Irrigation Facilities, and
8. Conclusion and Recommendations of the Draft Final Report.

