



## Mekong River Commission

### Report on the RAP Training Workshop and Initial Assessment of Irrigation Scheme Performance



Produced by the Mekong River Commission Secretariat  
Supported by the Ministry of Agriculture, Forestry and Fisheries, Japan

Published in Vientiane, Lao PDR by the Mekong River Commission in September 2007

### **Acknowledgements**

The Mekong River Commission would like to express its gratitude to the Ministry of Agriculture, Forestry and Fisheries, Japan for its support of the Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin (IIEPF) project and for supporting this workshop and following field activities.

We would also like to express our appreciation to the Food and Agriculture Organisation Regional Office for Asia and the Pacific contribution resource persons as lecturers/trainers to the RAP training workshop and their backstopping of the RAP for initial scheme assessment as well as for all the advice related to technical concerns on the implementation of the IIEPF project. We hope that the cooperation will be extended to our future activities.

Our sincere thanks is also offered to the line agencies, working teams and other related staff of the pilot schemes who were always keen to participate in the activities of both the workshop and the assessment. Furthermore we would like to thank to the project managers of pilot schemes for their kind facilitation, which allowed our work to proceed smoothly.

The opinions and interpretations expressed within are those of the authors and presented and do not necessarily reflect the views of the Mekong River Commission.

## Photos of RAP Training Workshop



Opening Remarks



Cambodian Participants



Lao Participants



Thai Participants



Vietnamese Participants

Photos of RAP conducted in the Komping Pouy Scheme



Photos with FWUC



Interviewing farmers



Cross regulator



Explaining to the team



Secondary canal



Main Canal

**Photos of RAP conducted in the Num Houm Scheme**



Reservoir



Observing irrigation structure



Secondary canal



Turnout



Paddy field



Meeting with farmers at village temple

## Photos of RAP conducted in the Huay Luang scheme



Meeting with the project staff



Observing irrigation structure



Inlet structure



Tertiary canal



Main canal



Meeting with farmers

**Photos of RAP conducted in the Go Cong scheme**



Sluice at Long Hai station



Irrigation canal



Water delivered by individual pump



Observing HL 6 sluice



Paddy field



Analysing data

## Table of Contents

1.	Introduction .....	1
2.	Overall schedule .....	2
3.	RAP training workshop .....	3
3.1	Agenda and Participants .....	3
3.2	Opening remarks .....	3
3.3	Initial assessment of development needs.....	3
3.4	Presentation .....	4
3.4.1	Introduction of the Workshop .....	4
3.4.2	Evolution of Irrigation system modernisation .....	5
3.4.3	Lessons learnt from previous RAP activities in the region .....	5
3.4.4	Irrigation project modernisation .....	5
3.4.5	Water management and control.....	6
3.4.6	Water Balance .....	6
3.4.7	Multiple use of water.....	7
3.4.8	Issues of scales in water productivity .....	8
3.4.9	Introduction of RAP (Rapid Appraisal Process) .....	9
3.4.10	How to interpret RAP.....	9
3.4.11	Making a Modernisation plan.....	10
4.	Initial assessment of the pilot schemes in four member countries .....	10
4.1	Introduction .....	10
4.2	Procedures of fieldwork .....	11
4.3	Scheme Outline .....	11
4.3.1	Komping Pouy Irrigation Project, Cambodia .....	12
4.3.2	Num Houm Irrigation Project, Lao PDR.....	14
4.3.3	Huay Luang Irrigation Project, Thailand.....	17
4.3.4	Go Cong Irrigation Project, Vietnam .....	19
4.3.5	Summary of the pilot sites .....	23
4.4	Results by RAP initial assessment .....	25
4.4.1	External Indicators.....	25
4.4.2	Internal Indicators.....	29
4.4.3	IPTRID Indicators .....	40
4.5	Modernisation Plan.....	43
4.5.1	Komping Pouy scheme.....	45
4.5.2	Num Houm scheme .....	45
4.5.3	Huay Luang scheme .....	45
4.5.4	Go Cong scheme.....	45
5.	Conclusions .....	46
5.1	Achievement.....	46
5.2	Lessons Learnt and Recommendations .....	46
5.2.1	Lessons Learnt.....	46
5.2.2	Recommendations .....	47
5.3	Follow-up .....	47
5.3.1	Komping Pouy .....	48
5.3.2	Num Houm .....	49
5.3.3	Huay Luang .....	49
5.3.4	Go Cong.....	50

Table 1: Overall schedule .....	2
Table 2: Summary of 4 schemes .....	24
Table 3: External Indicators .....	26
Table 4: Representing values of internal indicators .....	30
Table 5: Interpretation of internal indicators .....	31
Figure 1: Water Balance Components .....	7
Figure 2: Pilot Project Locations .....	11
Figure 3: Komping Pouy Irrigation Scheme.....	12
Figure 4: Organisation Chart of Komping Pouy irrigation project .....	14
Figure 5: Map of Num Houm Irrigation Project .....	15
Figure 6: Organisation Chart of Num Houm irrigation project.....	16
Figure 7: Huay Luang Irrigation Project .....	17
Figure 8: Organisation Chart of Huay Luang Irrigation Scheme Management .....	19
Figure 9: Organisation Chart of Go Cong Irrigation Project.....	21
Figure 10: Longhai Irrigation Station at Go Cong Irrigation Project.....	22
Figure 11: Typical Cropping Patterns of 4 Pilot Schemes .....	23
Figure 12: Relative Water Supply .....	28
Figure 13: Efficiencies .....	29
Figure 14: Output per unit-irrigated areas, USD/ha .....	42
Figure 15: Output per unit water consumed, USD/m <sup>3</sup> .....	43
Photo 1: Junction between irrigation canals .....	23
Photo 2: Farmers taking water by their portable pump to the field.....	23

## Annexes

Annex 1: Workshop agenda .....	51
Annex 2: List of the participants .....	53
Annex 3: Opening remarks .....	55
Annex 4: Development needs initial assessment .....	57
Annex 5: Handout – Introduction of the workshop .....	65
Annex 6: Handout – Lessons learnt from the previous RAP .....	71
Annex 7: Handout – Multiple use of water .....	85
Annex 8: Handout – A case study in China .....	93
Annex 9: List of members conducted RAP .....	101
Annex 10: Procedures of fieldwork .....	105
Annex 11: Internal indicators .....	111
Annex 12: Modernisation plan – guideline of presentation .....	123
Annex 13: Modernisation plan – presentation handout .....	129
Annex 14: CD including RAP data worksheet of four pilot sites	

## **LIST of ABBREVIATIONS and ACRONYMS**

AEWEPF	Programme to analyse and evaluate water and ecosystem in Asian paddy fields
AIFP	Agriculture, Irrigation and Forestry Programme
CEO	Chief Executive Officer, MRC
CHO gate	Canal Head Orifice gate
CNMC	Cambodia National Mekong Committee
DMPF	Project to Demonstrate the Multi-Functionality of the Paddy Fields over the Mekong River Basin
ESPIM	Evaluation Study of Paddy Irrigation under Monsoon Regime
EC <sub>e</sub>	Threshold saturated paste extract of the crop
FAO	Food and Agriculture Organisation of the United Nations
FAO-RAP	FAO Regional Office for Asia and the Pacific
FWUC	Farmer Water User Community
ICO(s)	Irrigation Community Organiser(s)
IIEPF	Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project
IMC	Irrigation Management Company, Vietnam
INWEPF	International Network for Water and Ecosystem in Paddy Fields
IPTRID	International Programme for Technology and Research in Irrigation and Drainage
ITRC	Irrigation Training and Research Centre of California Polytechnic University
JC	Joint Committee
Kc	Crop Coefficient
LA(s)	Line Agency (ies)
LMC	Left Main Canal
LNMC	Lao National Mekong Committee
MAF	Ministry of Agriculture and Forestry, Lao PDR
MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MCM	million cubic metres
MOWRAM	Ministry of Water Resources and Meteorology, Cambodia
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
MSL	Mean Sea Level
NMC(s)	National Mekong Committee(s)
OPD	Operations Division, MRCS
OPEC	Organisation of the Petroleum Exporting Countries
PDOWRAM	Provincial Department of Water Resources and Meteorology, Cambodia
PIM	Participatory irrigation management
RAP	Rapid Appraisal Process
RID	Royal Irrigation Department, Thailand
RMC	Right Main Canal
SIWRR	Southern Institute of Water Resources Research, Vietnam
TNMC	Thai National Mekong Committee
USD	US dollar
VNMC	Viet Nam National Mekong Committee
WB	World Bank
WSI	Water Saving Irrigation
WUA(s)	Water User Association(s)
WUG(s)	Water User Group(s)

# **Report on RAP training workshop and initial assessment of irrigation scheme performance**

## **1. Introduction**

The Mekong River Commission Secretariat (MRCS) is implementing the project “Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin (IIEPF)” in order to contribute to improve irrigation efficiencies of the schemes through the introduction of basic guidelines covering institutional, managerial and technical aspects of irrigation facilities operation. The project applies the Rapid Appraisal Process (RAP) as a tool to evaluate irrigation system performance.

This report covers the outline of the RAP training workshop and the result of initial scheme assessment conducted prior to the field observation in each selected irrigation scheme in the member countries, which were conducted as a part of the project.

The RAP is a simple but very strong and systematic tool to assess irrigation scheme performance, which was jointly developed by the Irrigation Training and Research Centre (ITRC) of California Polytechnic University and FAO in the late 1990s and since then has been successfully used by FAO and the World Bank in various Asian countries to appraise several irrigation projects.

The methodology uses modern concepts of canal operation and water use efficiencies and is based on the understanding that the irrigation systems operate under a set of physical and institutional constraints and with a certain resource base. The systems are analysed as a series of management levels, each level providing water delivery service through the system’s internal management and control processes to the next lower level, from the bulk water supply to the main canals down to the individual farms or fields.

With the service quality delivered to the farm under economic, agronomic constraints, the system and farmers’ management produces results (crops yields, irrigation intensity, water use efficiency etc.), while symptoms of poor system performance and institutional constraints are manifested as social chaos (water thefts, vandalism), poor condition of infrastructure, poor cost recovery and weak water users associations.

The RAP allows qualified personnel to systematically and quickly determine key indicators of irrigation projects. The RAP can generally be completed with two weeks or less of field and office work provided that some readily available data on the project have been organised by the project authorities in advance.

Key performance indicators from the RAP help to organise perceptions and facts, hence facilitate informed decision regarding

- The potential for water conservation within a project,
- Specific weakness in project operation, management, resources, and hardware,
- Specific modernisation actions that can be taken to improve project performance.

Furthermore, it also provides initial indicators that could be used as benchmarks in order to compare improvements in performance of the system once Modernisation plans are implemented. A good assessment of current situation gives a clear idea on where situation must be improved and helps in prioritising the areas for improvements. The RAP could also be used to compare the performance of the different projects.

The RAP is considered useful for IIEPF as it provides good indication, in relatively short time, of the constraints and bottlenecks in the system and thus helps in identifying options for improvements at different levels of the irrigation system. Among other things, it gives information on the following:

- Water allocation and distribution practices;
- Operation rules and procedures;
- Irrigation efficiencies (conveyance, field, overall project efficiencies);
- Physical infrastructure (hardware) of the system;
- Involvement of water users in the decision making process (stakeholders involvement).

All the above-mentioned information is a part of the detailed data collection work of IIEPF, thus the information from the RAP will complement the data collection and measurement work of IIEPF. Then IIEPF conducted the RAP training workshop and the RAPs themselves in each selected irrigation scheme twice during the project's life.

- Once at the beginning of the project, before the field data measurement work starts; and
- Second time when field data measurement work ends.

These activities were fully supported by FAO Regional Office of Asia and the Pacific (FAO-RAP) under the collaboration framework agreed between MRC and FAO-RAP. Two FAO experts (Mr. Thierry Facon and Dr. Chen Zhijun) joined these activities as lecturers and trainers.

## 2. Overall schedule

A four-day workshop in Vientiane was followed by six days (composed of two days field observation, another two days for data input, analysis and reporting in general and additional two days for transportation except in Lao PDR). The RAPs in four member countries were carried out from the middle of July to the end of August 2006.

Outlined schedule of each activity is as follows:

Table 1: Overall schedule

	Duration	Venue	Resource persons
Workshop	18 to 21 July 2006	MRC conference room	Mr. Facon & Dr. Chen
Lao PDR	24 to 27 July 2006	Nam Houm project, Vientiane province	Dr. Chen
Cambodia	31 July to 5 August 2006	Komping Pouy project, Battambang province	Dr. Chen
Thailand	7 to 12 August 2006	Huay Luang project, Udonthani province	Mr. Facon
Viet Nam	21 to 26 August 2006	Longhai district, Go Cong project, Tien Giang province	Mr. Facon

### **3. RAP training workshop**

#### **3.1 Agenda and Participants**

This four-day workshop basically included four sessions a day, two in the morning and two in the afternoon. The first two days were mainly spent on general information of

- What is the irrigation system modernisation and why it is important,
- Water control methods in order to realise irrigation modernisation, and
- Modern concept of water balance, irrigation efficiency and productivity including multiple use of irrigation water.

Last two days were mainly spent for the RAP itself, which included:

- Outline of the RAP,
- How to interpret indicators from the RAP,
- How to set up modernisation plan from the RAP result, and
- Reviewing filled the RAP worksheet prepared by the participants.

Workshop agenda is attached as Annex 1.

A total of 22 participants attended the Workshop. These included four (4) participants each from member countries, two (2) resource persons from FAO-RAP, one (1) from FAO Lao PDR office and two (2) professional staff and one (1) support staff from the MRC Secretariat.

A list of the participants is given in Annex 2. (Dr. Tu and Dr. Vitoon were absent, although listed.)

#### **3.2 Opening remarks**

The workshop started at 9:00 on Tuesday, 18 July 2006, in the MRC conference room, Vientiane, Lao PDR with an opening statement prepared by Dr. Dao Trong Tu, OPD Director of the MRCS. Since Dr. Tu and other senior staff of AIFP were unfortunately on mission, Mr. Okudaira, on behalf of Dr. Tu, read out the statement.

The statement quickly reviewed the objective and the progress of the project, and then explained two major purposes of this workshop as:

- Contribution to disseminate the RAP to member countries, and
- Expectation to apply the RAP to the IIEPF field activities.

The statement was concluded by the appreciation to FAO and their kind cooperation to the project.

This statement is in Annex 3.

#### **3.3 Initial assessment of development needs**

Prior to the presentations, a questionnaire was distributed to all the participants. This questionnaire was asking three questions as:

- Major objectives to achieve through irrigation system performance improvement,
- Main issues or problems to reach those objectives, and
- Priority actions to achieve those objectives.

The questionnaire, answers and their summary are shown in Annex 4.

15 responses were received. In the result table, the figure means the number of responses. “National” means the response from the national level viewpoint and “project” means the one from the project level.

Regarding measures to achieve improvement of irrigation system performance, answers from Thai participants varied widely from system level management issues for water distribution to social issues such as water fee collection, income generation of water users and environmental issues. Answers from Vietnamese participants mostly concentrated on how to secure water supply including efficient and economical water use. Their answers also cover environmental aspects. As the Lao Government is enhancing PIM (participatory irrigation management) through WUG (water users’ group), their answers put emphasis on improvement of water distribution and enhancement of WUG. Cambodian participants put more emphasis on physical (infrastructure) improvement for water resources development than other three countries.

Insufficient water resources and incomplete irrigation system are a common constraint of all the member countries. Lao PDR again emphasised the weakness of WUG, farmers’ participation and contributions (on water fee) and a weak supporting system of scheme operation including supporting WUG. Answers from Thailand also had the same tendency to point out weak irrigation management system including farmers’ involvement.

As Thailand is a relatively developed country in the region, their objectives for irrigation development is more diversified than other three countries. Through all the questions, Lao PDR puts emphasis on WUG as the key irrigation policy of the country, while Cambodia tended to focus more on physical aspects.

### **3.4 Presentation**

#### ***3.4.1 Introduction of the Workshop***

The first presentation was delivered by Mr. Facon, and introduced and overviewed purposes of the workshop. Mr. Facon referred to the IIEPF project document, especially “Background and Justification” of the project, and emphasised that:

- Regarding irrigation systems in the region, little evidence on their performance is obtained, thus understanding of actual irrigation performance, such as irrigation efficiency, is the first and essential step for system modernisation,
- As irrigation water in paddy fields is used for multiple purposes rather than simple crop production, modernisation should take this multi-functional role into account, and
- Once present constraints and bottlenecks are clearly understood, then improvement for modernisation can be planned and carried out.

He also briefly reviewed:

- The essential concept of the RAP and its detail in terms of technical aspects,

- How the RAP contributes to irrigation system modernisation through evaluation of system performance, which includes,
  - Modern water balance concept,
  - Analysis method of obtained data,
  - Interpretation of the RAP indicators, and
  - How to make recommendations to improve systems.

The presentation handout used for this session is available in Annex 5.

### ***3.4.2 Evolution of Irrigation system modernisation***

Dr. Chen made a presentation on what comprises a modern irrigation system.

- He revealed the constraints of traditional irrigation system as:
  - No control filling the gap between rainfall and evapo-transpiration,
  - Proportional distribution system without reflection of changing demand from command areas,
- He highlighted the requirements of modern system as:
  - Storage for flexible water supply,
  - Flexible water supply reflecting demand, and
  - Efficient water use, i.e. high irrigation efficiency.

Then he concluded that analysis of traditional irrigation systems, recognition of constraints and identification of gaps between present and required functions of the system were the steps of modernisation. To summarise, “Supply driven to demand driven” is the key concept of modernisation.

The presentation handout used for this session is available on

[http://www.watercontrol.org/training/itrc/Evolution%20Modern/page\\_001.htm](http://www.watercontrol.org/training/itrc/Evolution%20Modern/page_001.htm)

Most of the presentation handout used at this workshop is also available on

<http://www.watercontrol.org/training/itrc/contents.htm>, unless it is attached as an Annex.

### ***3.4.3 Lessons learnt from previous RAP activities in the region***

The first afternoon session of the first day presented by Mr. Facon focused on the RAP, its historical background of why it is needed, interventions made by FAO, its application to the South East Asia region, outline of the RAP and the steps needed for assessment and application, and case studies with photos.

The presentation handout used for this session is available in Annex 6.

### ***3.4.4 Irrigation project modernisation***

#### ***Concept of service***

These two sessions were made as a consecutive presentation from the first day afternoon to the second day morning by Mr. Facon.

This presentation started from the explanation of vocabulary used for modernisation. Some of the words and terms he defined and explained briefly were: “Check Structure” “Turnout” “Manual & Automatic” “Remote, Remote Monitoring, Remote Control &

Local Control” “Flow measurement” “Flow Control” “Upstream Control & Downstream Control” “Water Delivery Service.”

Most of these terms are familiar to irrigation engineers, but some of them, such as Remote Monitoring and Remote Control, were not familiar to the participants.

Definitions and brief explanations of this terminology can be obtained from [http://www.watercontrol.org/training/itrc/Vocabulary%20for%20canals/page\\_001.htm](http://www.watercontrol.org/training/itrc/Vocabulary%20for%20canals/page_001.htm).

Mr Facon then moved into what irrigation system modernisation is. The presentation emphasised that the major reason for irrigation projects to exist was to serve the farmers, the obligations of irrigation engineers were to have vision and to plan ahead for the service farmers would need, because farmers may not fully understand modern irrigation technologies, and advancements were required by various external pressures related to the environment.

Irrigation modernisation was explained as a process of technical and managerial upgrading of irrigation schemes, but not a single action nor specific type of hardware. The modernisation process is, as the presentation explained , to identify the present conditions, to define objectives, to develop a plan and to progressively implement the plan.

The benefits of modernisation were crop yield improvement, reduced environmental degradation, and financial self-sufficiency, easier operation of the project and less social conflict.

More detail can be obtained from

[http://www.watercontrol.org/training/itrc/Intro%20to%20Modernization/page\\_001.htm](http://www.watercontrol.org/training/itrc/Intro%20to%20Modernization/page_001.htm)

#### **3.4.5 Water management and control**

This presentation by Mr. Facon was composed of four slide shows obtained from

[http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%201/page\\_001.htm](http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%201/page_001.htm)

[http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%202/page\\_001.htm](http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%202/page_001.htm)

[http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%203/page\\_001.htm](http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%203/page_001.htm)

[http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%204/page\\_001.htm](http://www.watercontrol.org/training/itrc/Upstream%20Control%20part%204/page_001.htm)

which dealt with hydraulic issues. Upstream control was used as an example to explain how to control flow rate through the canal system.

Firstly, the necessity of water level control was explained to ensure constant water delivery to outlet. Then the function of check structures (such as cross regulators) was explained and how to reduce travel time when flow rate has fluctuated. How the accuracy of flow measurement is different between weir and orifice was also explained. Then several types of check structures and methods (or facilities) of flow measurement were introduced with their advantages and disadvantages.

#### **3.4.6 Water Balance**

This presentation by Mr. Facon explained the modern concept of water balance accounting, incorporated in the IIEPF project, with comparison to classical water

balance. A simple and easily understandable presentation can be obtained from [http://www.watercontrol.org/training/itrc/Water%20Balance/page\\_001.htm](http://www.watercontrol.org/training/itrc/Water%20Balance/page_001.htm)

The key concept of this presentation is to compute water inflow and outflow of a predefined three-dimensional spatial boundary within an appropriate temporal boundary (three to five years average computation was recommended.)

The presentation pointed out that errors under classical water balance were non-or improperly defining of spatial and/or temporal boundaries, then it added some rules for water balance accounting “to keep things in perspective”; “to identify confident intervals”; “to use multiple years of data”; “to count water once only, not to double count” and “to be careful with assumed values.”

Figure 1 represents the concept of water balance with its components.

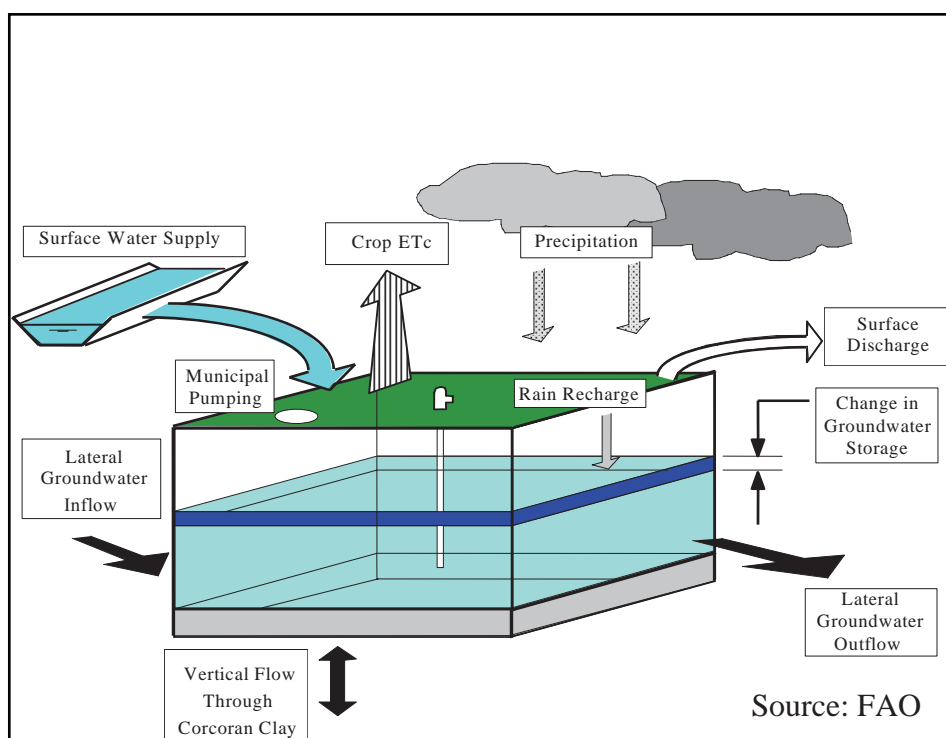


Figure 1: Water Balance Components

### 3.4.7 Multiple use of water

This presentation by Mr. Facon was made replacing the originally planned presentation of “Irrigation efficiency and productivity” as the last session of the second day.

This presentation cited results of research in Sri Lanka. The presentation citing various examples of multiple use of irrigation water (such as domestic use, animal husbandry and fisheries) through impressive photos, and then focused on an irrigation scheme in a semi-arid area located in the southeast part of Sri Lanka. The illustrations revealed a good comparison within and outside of the scheme command area. Outside the command area was covered only by bush because of scarce rainfall. On the other hand a lot of big trees grew within the command area thanks to water supplied by the

irrigation scheme. A water accounting analysis of the Kirindoi Oya irrigation scheme shows that in 1998 48% of water supplied comes from rainfall and 52% from irrigation and 23% is used for irrigation of 8,600ha of rice field, 44% are consumed by 15,500ha of forests. Fallow land consumes 8% and 6% is lost by evaporation, 16% is counted as run-off to the sea and 3% is as excess drainage to lagoons. People in this area gain major benefits from the forest and trees, which the irrigation system supports indirectly. In 1998 the area introduced irrigation system modernisation. This included introduction of a dispersed management system with a reinforced communication system and recycled use of drainage water. As a result, the scheme achieved irrigation intensity rises from 140% to 200% and generated US\$4 million per year with less than US\$100,000 per hectare of investment.

The presentation also briefly introduced another example of scheme modernisation in France in 1980. The scheme originally had low irrigation efficiency and improvements were proposed. However the analysis revealed that infiltration contributed to recharge groundwater in this scheme. So the modernisation plan was adapted to maintain surface irrigation upstream to allow groundwater recharge and to introduce drip irrigation downstream, supplied by pumping from groundwater.

A presentation handout used is made available in Annex 7.

#### **3.4.8 *Issues of scales in water productivity*** **- A case study of Zhanghe irrigation system, China -**

The first presentation on the third day made by Dr. Chen started with several examples of water saving irrigation (WSI) practices in China, and followed to background of a case study as below.

1. How the on-farm water saving irrigation techniques saves water?  
Reducing in application of irrigation water to the field allows reduction in field water input and reduction in percolation and seepage.
2. What's the impact to overall system?  
Less well understood, because the percolation and seepage flowing out of fields (without being depleted by rice) can be reused at some points in the irrigation system.
3. In order to understand if and how farm-level WSI techniques scale up basin-level savings, a case study was conducted in a typical large-size irrigation system with intensive rice area – the Zhanghe irrigation system.

The presentation introduced the Zhanghe irrigation system, the methodology of the study, and Intermittent Submerged Irrigation practice for WSI at the study site. The study concluded that at on-farm level there was: “No significant yield difference between WSI and traditional irrigation, but higher water productivity” and at mezzo scale “Water productivity of irrigation water dropped sharply” and “Other factors become important, such as water storage and other non-rice land uses (roads, houses, trees).” The study also concluded that at sub-basin scale “water productivity of the reservoir water had increased over time because of ‘Economic and institutional reforms initiated in 1978’, ‘Shift in cropping pattern from two to one crop of rice’, ‘Volumetric

pricing of water’, ‘On-farm and system WSI practices’, ‘Development of alternate sources of water (reservoirs, ponds)’ and ‘Recapture and reuse of return flows.’”

A presentation handout used is made available in Annex 8.

#### **3.4.9 Introduction of RAP (Rapid Appraisal Process)**

The outline and basic concept of the RAP was introduced by Dr. Chen as the second presentation of the third day.

Presentation material used here is made available on

[http://www.watercontrol.org/training/itrc/RAP%20Presentation/page\\_001.htm](http://www.watercontrol.org/training/itrc/RAP%20Presentation/page_001.htm)

Dr. Chen’s presentation started a question to the participants that “What should we do for irrigation system evaluation?” What to evaluate, how to evaluate and how to interpret the results are the key points of successful evaluation, and a standard approach is required for a reliable result. Dr. Chen recommended the RAP approach.

In addition to the presentation, he added that the RAP could cover irrigation schemes with 5,000ha to 500,000ha of command area within a few days to two weeks.

Indicators for comparison between different projects and baselines for specific project improvement were explained as two major functions of the RAP. The RAP provides external and internal indicators as its outputs.

External indicators mainly show physical performance of the irrigation system by various values of rating and internal indicators provide evaluation of managerial and institutional aspects. Another two indicators, IPTRID (International Programme for Technology and Research in Irrigation and Drainage) indicators and WB (World Bank) indicators, are also the outputs from the RAP. The RAP is composed of 14 worksheets in Excel file, which covers entry forms for data related to irrigation water use, such as command area, estimated irrigation efficiency, crop water requirement, rainfall, planted area etc. for three years (sheet 1 to 3), output sheet (sheet 4) for external indicators from sheet 1 to 3, questionnaires to the project office, project employee and water users’ association (sheet 5 to 7), data entry forms for physical and managerial conditions of four layers of irrigation canal system (i.e. main, secondary, tertiary canals and final deliveries) (sheet 8 to 11) and three kind of indicators (i.e. internal, IPTRID and WB) (sheet 12 to 14). (Please refer to the slide #12 and #26 to #37 for more information.)

#### **3.4.10 How to interpret RAP**

This presentation, originally scheduled as the last one of the third day, was conducted on the fourth day by Dr. Chen.

The presentation referred “RAP and Benchmarking, Explanation and Tools” is available on

<http://www.watercontrol.org/tools/rap-eng-2002/contents.htm>

especially “Summary of the Interpretation Process” from

<http://www.watercontrol.org/tools/rap-eng-2002/RAPeng2002p10.htm#summary>

The key steps for modernisation were summarised as

1. Eliminate the discrepancy between “actual” and “stated” service.
2. All levels of staff must understand and adopt the “service mentality.”
3. Examine instructions that are given to operators, and modify them if needed.
4. Understanding of what actually happens in the monitoring system.

5. Communications at all levels.
6. Mobility of staff through better roads, motorcycles, trucks, etc.
7. Flow rate control and measurement at key bifurcation points.
8. Existence of recirculation points or buffer reservoirs in the main canal system. “Loose” water control may be very adequate in the main system”
9. Improved water level control throughout the project.
10. Re-organisation of procedures for ordering and dispersing water.
11. Remote monitoring of buffer reservoirs, drains, and tail ends of canals.
12. Remote manual control of flow rates at the heads of the main canal, and heads of major off takes (turnouts) from the main canal.
13. Provision for spill, and the recapture of that spill from ends of all small canals.

#### **3.4.11 Making a Modernisation plan**

After the explanation of the RAP itself and how to interpret the RAP outputs, the presentation stepped forward to how to set up an irrigation modernisation plan based on finding from the RAP. Presentation material is available on

[http://www.watercontrol.org/training/itrc/Making%20modernization%20plans/page\\_001.htm](http://www.watercontrol.org/training/itrc/Making%20modernization%20plans/page_001.htm)

The presentation started by providing four key concepts for better irrigation service; adequacy, reliability, equity and flexibility, and their definitions in the case of irrigation and drainage. Then it continued to list tools for water control to realise that service as: water level control, flow rate measurement, flow rate control, a communication system and reservoir storage. For modernisation, the presentation suggested selecting the simplest option with good performance for structure type selection and to concentrate problems at the ends of the canals. “Responsiveness” was emphasised as requirement of modern irrigation system to provide better service and then importance of communication in each level was also underlined. The presentation concluded by illustrating several typical modernisation actions. (For detail, please refer from page 51 to 58 of above web site.)

## **4. Initial assessment of the pilot schemes in four member countries**

### **4.1 Introduction**

Following to the RAP training workshop on 18-21 July 2006 in Vientiane, the initial scheme assessment by the RAP was conducted at the pilot project site in each member country. This work was conducted by selected members of IIEPF field observation team of the countries in cooperation with 2 resource persons from FAO and with facilitation by AIFP/MRCS. The members are listed in Annex 9. Some IIEPF field observation team members who had not been trained at the RAP training workshop were also invited to this assessment in order to get familiar with the RAP fieldwork practices.

The purposes of this activity were as follows.

- Initial assessment of performance level of the pilot schemes based on currently available data
- Identification of missing data to complete the final RAP
- On the job training to follow up the RAP training workshop

- Identification of options for scheme improvement

## 4.2 Procedures of fieldwork

Prior to the fieldwork, a discussion was held to fix the schedule of observation and to confirm preparation including appointments with representative farmers in advance. The detail is given in Annex 10.

The field observation started from interviews with the project staff regarding their service to irrigation water users in general and moved to check actual conditions in the field from main canal level down to secondary, tertiary, and farm ditch canal level. At each level, physical conditions of irrigation structures and canals were observed and farmers were interviewed concerning their satisfaction with the services provided by the irrigation project.

## 4.3 Scheme Outline

Initial assessment was conducted at pilot schemes, one in each member country. These are Koming Pouy project of Cambodia, Num Houm project of Lao PDR, Huay Luang project of Thailand, and Go Cong project of Viet Nam. The location of these 4 irrigation projects is shown in Figure 2.

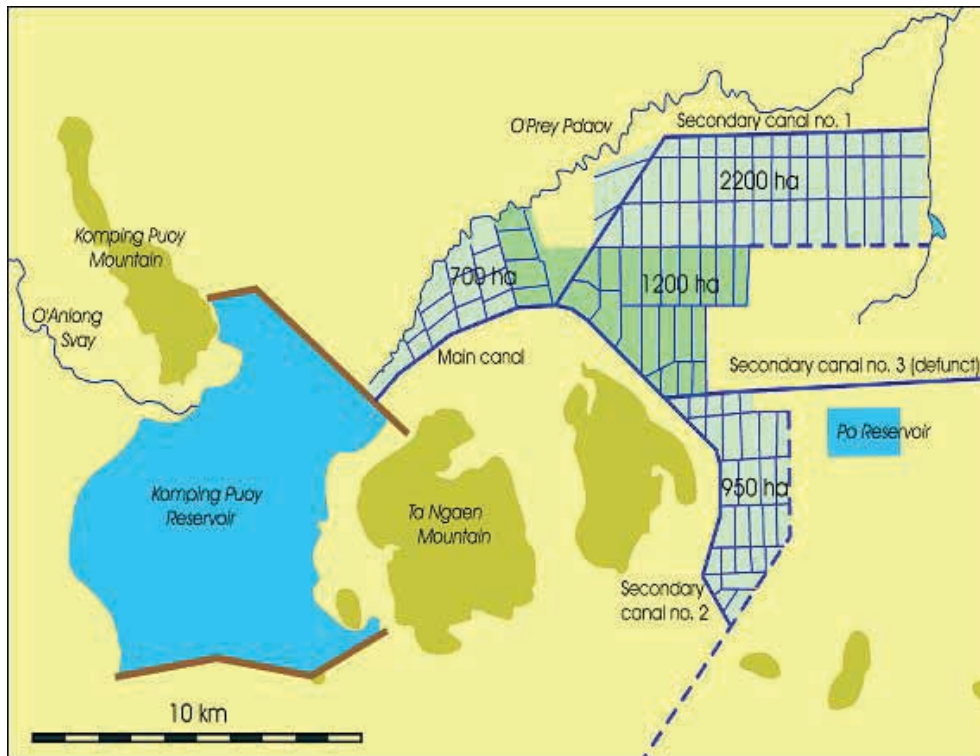


Figure 2: Pilot Project Locations

### 4.3.1 Komping Pouy Irrigation Project, Cambodia

#### (1) Outline

The system was initiated during 1975-1979 with national budget. The project is located in Ta Ngen Village, Ta Kream Commune, Banan District of Battambang Province. It is located approximately 32km west from Battambang town. A schematic plan of the project with photos of major facilities is given in Figure 3 below.



Reservoir



Main Canal

Figure 3: Komping Pouy Irrigation Scheme

#### (2) Physical Conditions

The reservoir is surrounded by Ta Ngen and Komping Pouy mountains with original designed capacity of 110 million cubic metres (MCM). However, the survey conducted in 1999 found that the reservoir had only 90 MCM. Recently the diversion weir was constructed to deliver water from the Mongkol Borey River to the reservoir via a 13km-long canal. These additional structures contribute to increase inflow into the reservoir.

and secure storage with maximum use of the reservoir capacity. The dam is an earth type measuring 6.5 km long, 5 to 8 m high, and 10 to 20 m wide. There are 2 main intakes: the right main canal intake has 10 gate structures and the left main canal intake has 8 gate structures. The right main canal is considered as the most important structure as it has the potential to irrigate large paddy fields up to 10,500 ha. While the left main canal, which has not yet been rehabilitated, has a potential irrigated area of 3,000 ha. Figure 3 shows only the right main canal and its command area.

At present only the right main canal, which was rehabilitated in 2002, is in operation, while the left main canal is permanently closed. The rehabilitation of the right main canal was divided into 3 zones: up-stream zone (with command area of 700ha) and middle-stream zone (1,200ha) supported by Australian government, and down-stream zone (950ha) supported by Japanese government. The end of right main canal will be extended 9km to provide an additional irrigation area of 2,200 ha in the future.

The second dam extends westward from Ta Ngen Mountain and is 7.5 km long, 3 to 4 m high and 4 to 5 m width. It is equipped with 4 outlet structures supplying water to a small area of paddy fields in the south of the reservoir.

### **(3) Irrigation Practices**

Irrigation water supplements water requirements for a total of 3,500 ha of rainy season crops and fully supplies 2,850 ha of dry season crops through the main canal of 9.02 km and 3 secondary canals with a total length of 29 km. Although it was expected that the rehabilitation work would make it possible to cover whole 2,850 ha, only 800ha could be irrigated in 2005 dry season due to limited storage in the reservoir. For the 2007 dry season, from February to May it is expected that the full 2,850 ha can be irrigated.

In the 2005, the yield was 3 tonnes/ha in the wet season and 4 tonnes/ha in the dry season. The water fee rate was US\$10 per ha.

### **(4) Management**

The project is owned by Battambang provincial irrigation office under supervision of the MOWRAM. The Farmer Water Users Community (FWUC) plays important role in the operation and maintenance works in association with MOWRAM staff assigned to the province.

The organisational chart of the project management is shown in Figure 4.

Apart from the main intake, other gates at 16 intakes of tertiary canals are operated by Water Users Groups (at each intake, one WUG is established to be responsible for intake operation and management). Water distribution at farm level is the responsibility of sub-units of WUGs. The project has 96 sub-units with 1,200 members in total.

The FWUC is responsible for whole project management activity under the supervision of the MOWRAM. Before every cultivation season, the MOWRAM staff hold meetings with the community and heads of WUGs to make plans on crop planting, structure maintenance and water distribution. The schedule for operating main gates is planned, discussed and agreed by MOWRAM, FWUC and farmers at this community meeting. The FWUC has 3 main activities: operating the main gate according to the planned

schedule; coordination with MOWRAM; and monitoring water distribution. Management of the lower system including operating gates along the main canal is conducted by the head of each WUG. The head of each WUG also collects water fees from members and submits them to FWUC for system maintenance.

The project faced a shortage of irrigation water in the dry season, which resulted in insufficient water fee collection. Only 50% of total areas contributed water fees in the 2005 dry season, due to insufficient and non-timely water distribution. Low collection rates are especially observed at the areas located far from the main canal.

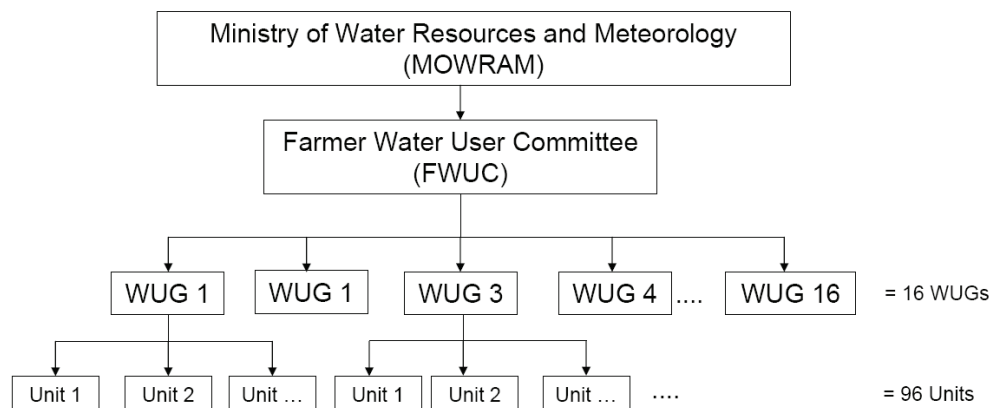


Figure 4: Organisation Chart of Komping Pouy irrigation project

### 4.3.2 Num Houm Irrigation Project, Lao PDR

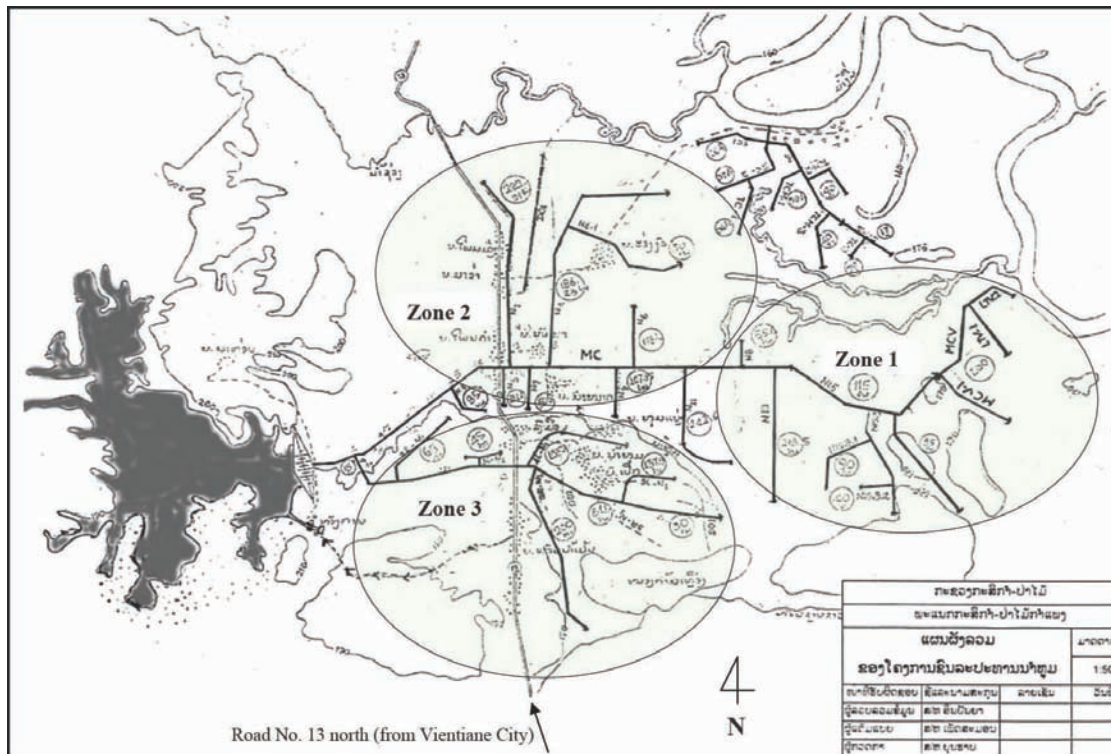
#### (1) Outline

The Num Hum irrigation project is a gravity irrigation system located around 35 km north of Vientiane on Road 13. The schematic map of the project with photos of major facilities is given in Figure 5. The command area covers Naxaythong and Xaythany districts with total planned command area of 2,400 ha. The beneficiary families live in 17 villagers with a total of 19,879 people.

The purpose of the scheme is to supply water mainly for dry season cultivation and as a supplement for wet season cultivation. The command area is classified into 93% of paddy crops, 5% of fishponds, and 2% of cash crops.

The reservoir has a catchment area of 108 km<sup>2</sup> with annual inflow of 149.5 MCM. The maximum storage is 60 MCM (active of 54 MCM, and dead of 6 MCM.) The estimation of maximum flood level is 190.1 m and crest of dam of 192.2 m, spillway at 189.1 m and intake at 178.8 m.

The water is supplied by earth-open canals with total length of 60.635 km, of which the main canal is 9.3 km, the secondary canals are 30.014 km long, the tertiary canals are 16.827 km, and the quarterly canals are 4.5 km. There are 367 structures in total.



Reservoir



Main Canal

Figure 5: Map of Num Houm Irrigation Project

**(2) Background**

Construction of the dam was in 3 phases. Under phase 1 in 1978-82, the work included construction of reservoir, main intake, spillway, main canal and some on-farm canals with an irrigated area of 150 ha. This was financed by the national budget, a loan from OPEC and grant aid from the Japanese Government. Phase 2 (1990-93) comprised construction of a secondary canal and irrigated areas of 400 ha with financial assistance from the Italian Government through the Interim Mekong Committee. In phase 3 (1997-2000), the main canal was extended and the full system was completed, with an irrigated area of 2,400 ha. This was financed by the national budget.

### (3) Irrigation practices

For water distribution practices, water balance is considered before every cultivation season. If storage is kept as high as 189.1m (in other words 60 MCM) at the end of rainy season, a constant amount of water will be supplied continuously with no limitation. However a rotation method is applied when water in the reservoir is insufficient. To do this, the irrigated area is divided into 3 zones as shown in the Figure 5. Cultivation starts at zone 1, followed by zone 2 and 3 at different periods in order to cut peak of water demand. The cultivated areas are limited according to available water. Water delivery is limited to one zone at the same time with regular rotation from zone 1 to zone 3. Some areas are abandoned, especially the areas which are located far away from the canals.

### (4) Management

The project is operated by Num Houm project office belonging to the Agriculture and Forestry Department of Vientiane capital under the Ministry of Agriculture and Forestry. As shown in Figure 6, there are 4 main units under Num Houm project office namely an agriculture and extension unit, an irrigation unit, a livestock unit and a forestry unit. The irrigation unit is fully responsible for irrigation water management through 3 Water User Associations (WUAs). There are 11 WUGs in total working under WUAs, of these there are 960 permanent members and 380 temporary members.

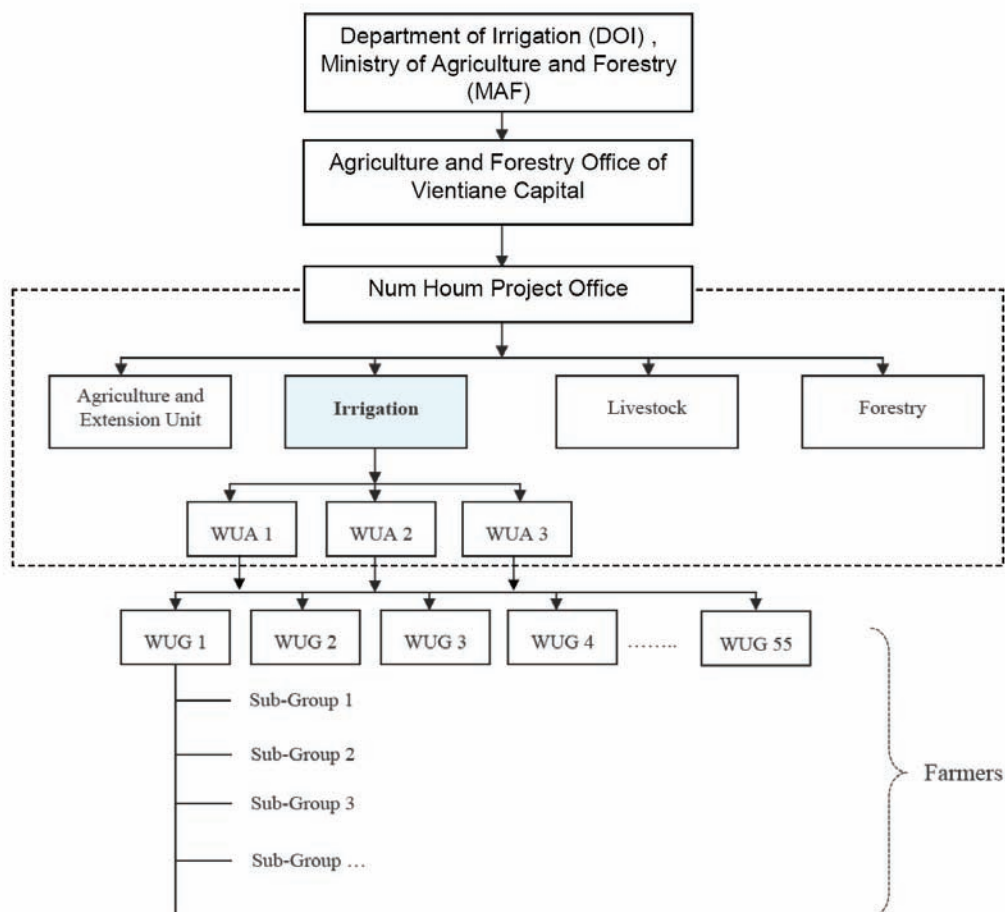


Figure 6: Organisation Chart of Num Houm irrigation project

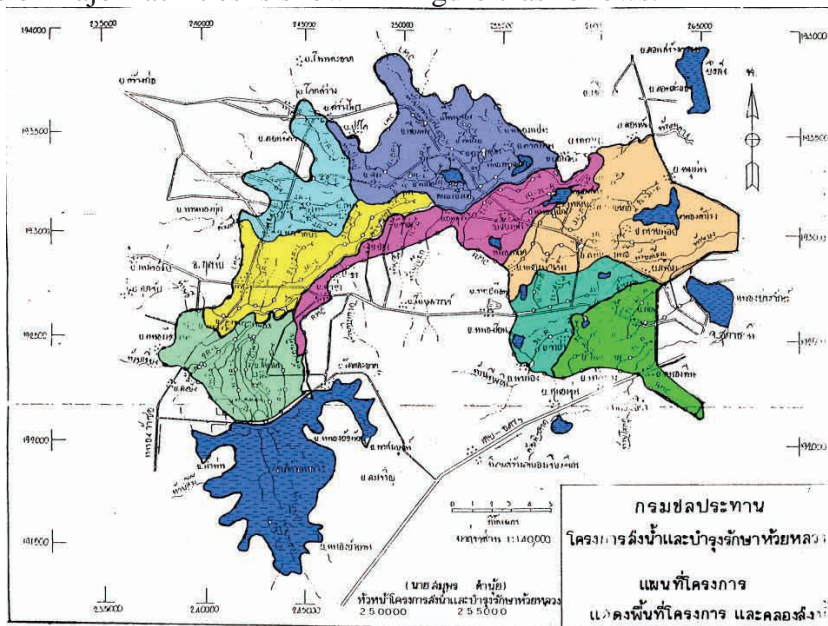
The management and service level are conducted in the following way. The reservoir and the main canal operation is responsibility of the WUAs under the project office. The WUGs are responsible for operating of the secondary canal level coordinating with the project office and their sub groups. The sub groups cover activities at the tertiary and on-farm level. The water fee is collected by head of WUGs.

The obvious constraint of water management is poor canal condition, which causes much water leakage, low skills and know-how of staff in proper management, lack of enforcement regulation, difficulty of water fee collection from farmers due to weakness of participation and weak sense of responsibility of farmers.

### 4.3.3 Huay Luang Irrigation Project, Thailand

#### (1) Outline

The Huay Luang irrigation project is located in the North East of Thailand or the East of Udon Thani Province, Kud Jab district at the topographical coordinates of 17.3N latitude and 102.0E longitude, about 7.5 km west of Udonthani city along the road No.210 between Udonthani and Nong Bua Lamphu provinces. The map of the project with photos of major facilities is shown in Figure 7 as follows.



Left Main Canal



Reservoir

Figure 7: Huay Luang Irrigation Project

## **(2) Background**

There were two phases of construction. The first construction in 1940 completed the reservoir with a designed capacity of 1.5 MCM. This also included the spillway and the Right Main Canal (RMC), however the storage was too small and water availability was not always steady. Since the water scarcity problem was not fully solved especially in dry season, the second construction started in 1970, which included the Left Main Canal (LMC) and a new dam located up stream of the old one.

## **(3) Physical Conditions**

The full system was completed in 1984. The maximum storage of the reservoir is 135.567 MCM and the dead storage is 6.594 MCM. The storage water is not only for irrigation water supply, but also serves for domestic water use in the region.

The total command area is 16,095 ha irrigated by 2 main canals: RMC and LMC with total length of 81.1 km. The RMC with the maximum capacity of 6.1 m<sup>3</sup>/s and 28.5 km long covers irrigated areas of about 8,120 ha and the LMC with the maximum capacity of 6.3 m<sup>3</sup>/s and 52.6 km long covers 7,975 ha. There are 17 lateral canals with a total length of 136 km. The cultivation is divided into 2 seasons: the rainy season usually from June to October and dry season from November to May. The annual average rainfall in this area is around 1308mm.

## **(4) Management**

The project is managed by Huay Luang irrigation project office under the Royal Irrigation Department (RID). For managing water allocation and distribution, the organisation is structured into a Water Master, Assistant Water Master and Zones Man officially under the Chief of Operation and Maintenance of the project office. In addition, Irrigation Community Organisers (ICOs) are employed permanently. The canal network is divided into 4 irrigation management zones in each main canal. There are 501 Water Users Groups in total with 6,600 farmers. Figure 8 shows the organisation chart of the project management.

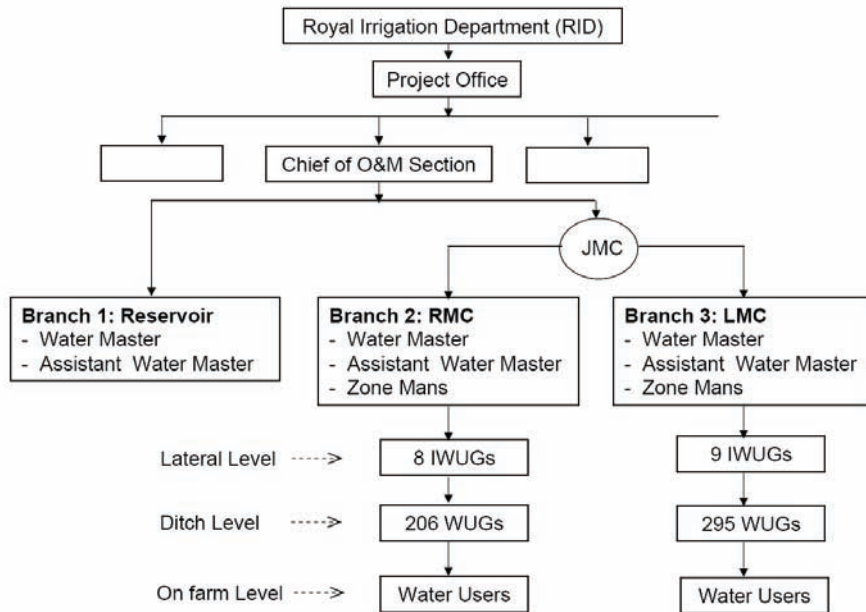


Figure 8: Organisation Chart of Huay Luang Irrigation Scheme Management

#### 4.3.4 Go Cong Irrigation Project, Vietnam

##### 1) *Physical conditions*

The Go Cong project is one of the typical tidal irrigation projects in the Mekong delta region. The project is located in My Tho City, Tien Giang province around 100 km from Ho Chi Minh City. It was initiated in early 1980s and completed in 1990. In 2001 the automatic measurement system for monitoring water level and salinity was installed. The project area covers 3 districts: Go Cong East, Go Cong West and Chogao district. The project area is bounded by a costal line of 166.7 km including 21 km of sea dike on the east and Tien Giang River on the south.

The project was constructed with two main objectives:

- Irrigation and drainage, and
- Prevention of salinity intrusion

The project has command area of 54,000ha and benefits 480,000 farmers in 36 villages of 3 districts. There are 14 canals composed of the main canal network with total length of 157km. The cropping seasons is composed of 3 rice-crops, the same as the typical pattern in the Mekong Delta, including Winter-Spring from mid November to mid March, Summer-Autumn from the beginning of May to the end of August, and Autumn-Winter from the end of August to the beginning of December.

##### 2) *Characteristics of Tidal Irrigation*

In the Go Cong project water is supplied to the system through automatic gates at the main intake from the river. Almost all canals within the irrigation system are linked together and also with natural rivers without any control structure. The classification of

the main, secondary or tertiary canals is not clear, but basically is made by its service area or dimensions.

Irrigation and drainage are practiced as combined activity within very dense canal network. Because of no gate control at on-farm canal level, farmers can take as much water as they need. During high tide period, flow from the Mekong River is diverted into the canal system and most of areas can receive water by gravity because of the high water level in the canals. During low tide period, however, water flows from the canal system back to the river and water levels become low. Farmers usually use their own pumps for providing water to relatively high elevation areas and use natural flow by gravity to relatively low area, depending on the level of water in the canals. Therefore the main point for facility operation is to maintain the canal water level as high as possible for gravity irrigation during each daily tidal cycle in order to avoid pumping cost.

The canals not only serve for irrigation purpose but also for navigation, environmental flows, and on-farm storage and for salinity intrusion prevention.

The same as the other projects in Mekong delta region, the common constraints on water use is inadequate fresh water for irrigation in dry season caused by high salinity (more than 2 g/l observed).

### **3) Management**

In terms of water management, the project authority (Irrigation Management Company-IMC of Go Cong) is responsible for planning water supply, operation of head works (sluices), monitoring gate operation, checking water quality and informing farmers of the gate operation schedule. Water users are in charge of maintenance of on-farm canals. Water is taken to the field individually with their own pumps. Water users pay water fees to IMC via a local tax collector based on contracts between IMC and farmers. The rate is set as unit area per year with different cropping condition as follows.

- US\$12 /ha/year for 2 or 3 rice-crops
- US\$6 /ha/year for 1 rice crop
- US\$6 /ha/year for fruit trees

47% of total water fee collected is allocated to IMC for system maintenance, 45% goes to the Districts, and 8% for tax collectors' salaries. Water fees were collected for around 90% of total command areas in 2005.

The organisation chart of Go Cong project is shown in Figure 9 as follows.

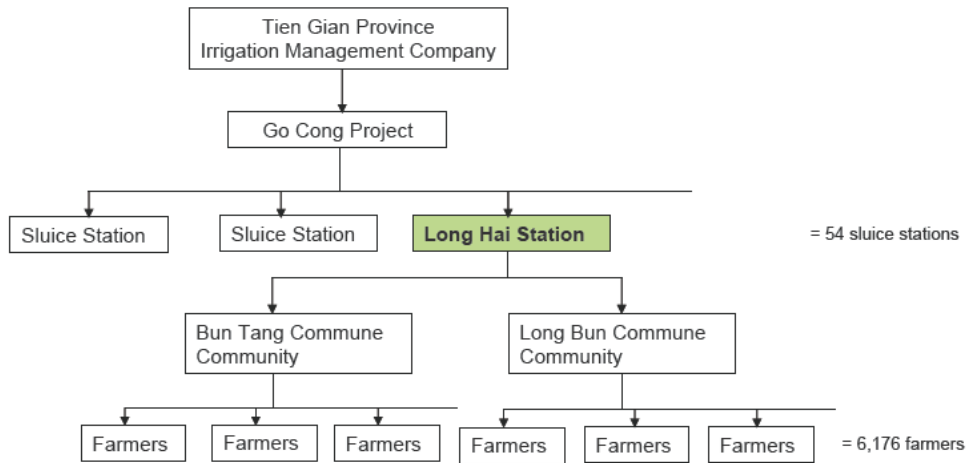


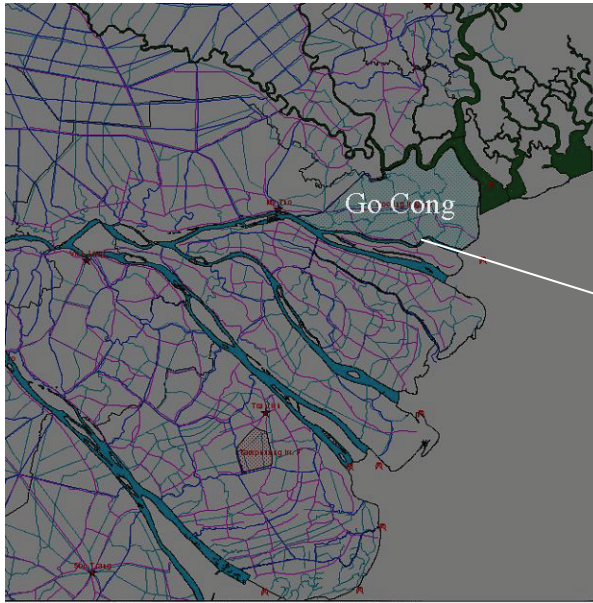
Figure 9: Organisation Chart of Go Cong Irrigation Project

## (2) Longhai Irrigation Station

Considering the limitation of IIEPF framework, it is difficult to fully cover 54,000 ha of the command areas of Go Cong project. Therefore as a subcommand area, Longhai irrigation station area was selected as representative to conduct field observation activities.

### 1) Outline

The Longhai irrigation station is a sub-command area within the Go Cong project as shown in Figure 10. The total area is 924 ha, covering two communes of Long Binh and Binh Tan in Go Cong Tay district. The elevation ranges from 0.85 to 1.2 m above MSL. The total agricultural area is about 667 ha, of which there are 604 ha of rice field and 63 ha of upland crops and perennial plant. There are 1,225 families in the project area with a total of 6,176 people, who mostly rely on agriculture.



Long Hai sluice



Long Hai sluice in side command area

Figure 10: Longhai Irrigation Station at Go Cong Irrigation Project

## 2) *Irrigation Practices*

The Longhai station is managed by the Go Cong IMC, which is responsible for sluice gate operation. There are two main sources of irrigation water supply to the area, one from the main canal number 14 via HL 6 sluice under road No. 6 throughout the year and the other from the Tien River through Longhai sluice. The Longhai sluice not only functions for irrigation purposes, but also for drainage and salinity intrusion prevention as do other tidal irrigation projects in the Mekong delta. From August to November in general water is diverted in through this sluice as the primary irrigation water supply for the area. During this operation period, irrigation practice is set for a 5-days cycle: one day to intake water into system, three days for keeping water in the system and one day for to release water to drain salinity out from the system. During the dry period of December to July, the gate is opened once a week to flush salinity. Gravity irrigation is applicable for about 400 ha during this period.

### 3) *Field Level*

All the junctions between the tertiary, secondary and main canals are open without any control structures as shown in Photo 1. This is a characteristic of the canal system in the delta areas. The agricultural area partially uses gravity irrigation driven by tidal variation. The remaining area is irrigated by pumps. Each farmer has their own pumps and therefore they can use water when they need it (Photo 2). Since farmers manage water distribution individually on their fields by themselves, there is no water user group established in the area.



Photo 1: Junction between irrigation canals



Photo 2: Farmers bring water into their fields using portable pumps

#### 4.3.5 *Summary of the pilot sites*

Table 2 summarises the general information of the four pilot sites and Figure 11 indicates the typical cropping pattern at those pilot sites based on information obtained from the projects' staff.

Project (Country)	2006		2007											
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Komping Pouy (Cambodia)				01/03		23/05			30/07					30/11
				15/02	Dry Season		08/05		01/07	Wet Season			01/11	
Num Houm (Laos)		07/12					07/05		30/07					30/11
	15/11	Dry Season				15/04		01/07	Wet Season			30/10		
Huay Luang (Thailand)			15/01				15/05			15/08				10/12
		15/12	Dry Season			03/04		15/07	Wet Season			30/10		
Gocong/Longhai (Vietnam)		01/12			10/03			15-31/05			15-31/08		15-30/11	
		Winter-Spring						Summer - Spring		Autumn-Winter				

Figure 11: Typical Cropping Patterns of 4 Pilot Schemes

Table 2: Summary of 4 schemes

Figure Items	Komping Pouy Project	Num Houm Project	Huay Luang Project	Go Cong/ Longhai Project
<b>Location</b>	Battambang Province, Cambodia	Vientiane Capital, Lao PDR	Udonthani Province, Thailand	Tien Giang Province, Vietnam
<b>Construction Period</b>	1975	1978 phase 1 1990 phase 2 2000 phase 3	1940 phase 1 1970-84 phase 2	1980 - 1990
<b>Rehabilitation Year</b>	2002	None	2001	None
<b>Irrigation Type</b>	Gravity	Gravity	Gravity	Tidal
<b>Current Command Areas</b>	2,850 ha	2,400 ha - 93% paddy - 5% fishpond - 2% cash crops	16,095 ha (total) 7,975 ha (LMC)	54,000ha (Go Cong) 667 ha (Longhai) - 604 ha paddy - 63 ha cash crops
<b>Number of WUAs</b>	1 FWUC	3 WUAs	2 WUAs	2 Communities (for Longhai station)
<b>Number of WUGs</b>	16 WUGs	55 WUGs	490 WUGs	N.A.
<b>Beneficiaries</b>	1,200 families	19,879 farmers 17 Villages	6,600 farmers	Longhai: 1,225 families 6,176 farmers
<b>Canal Type</b>	Earth	Earth	Lining	Earth
<b>Capacity of Main Canal Intake</b>	16 m <sup>3</sup> /s	7 m <sup>3</sup> /s	6.1m <sup>3</sup> /s (RMC) 6.3m <sup>3</sup> /s (LMC)	25 m <sup>3</sup> /s (Go Cong) 2 m <sup>3</sup> /s (Longhai)
<b>Canal Length</b>	Total: 38.020 Km	Total: 60.727 km 9.3 km (MC) 30.014km (SC) 16.827km (TC) 4.5 km (QC)	Total: 217.1 km 28.5km (RMC) 52.6 km (LMC) 136 km (total laterals)	N.A.
<b>Reservoir Capacity</b>	Max: 110 MCM Active: 90 MCM Dead: 20 MCM	Max. 60 MCM Min. 6 MCM	Max. 118.36 MCM Min. 5.250 MCM	N.A.
<b>Average Yield</b>	3 T/ha (wet season) 4 T/ha (dry season)	3.5 T/ha (wet season) 4.5 T/ha (dry season)	3.4 T/h (wet season) 3.7 T/ha (dry season)	5.55 T/ha (Winter-Autumn) 4.35 T/ha (Summer Autumn) 4.5 T/ha (Autumn-Winter)
<b>Average Annual Rainfall</b>	1,100 mm	1,700mm	1,300 mm	1200 mm
<b>Water Fee Rate</b>	10 US\$/ha/season	15 US\$/ha/season	N.A.	- 12 US\$/ha/year for 3-rice crops - 6 US\$/ha/year for 1- rice crop and fruit tree
<b>% Water Fee Collected</b>	50 % in 2005	46% in 2005	N.A.	90% in 2005
<b>General Constraints</b>	- Water shortage - Poor water distribution - Low Productivity - Inefficient water control measurement -Weak of WUAs	- Poor irrigation Infrastructures - Low skills of O&M - Low % of water fee collection - Low productivity - Weakness of farmers' participation	- Water shortage in dry season - Efficient water control at on-farm level - Lack of farmer's participation	- Shortage of fresh water in dry season due to high salinity -

#### **4.4 Results by RAP initial assessment**

The results obtained from the RAP initial assessment are analysed and summarised into 3 parts: external indicators, internal indicators, and IPTRID indicators. The accuracy largely depends on the reliability of input data and understanding of questions by surveyors. However as some input data was based on assumption, results shown here may not be highly reliable.

##### **4.4.1 External Indicators**

The external indicators are the product from irrigation scheme physical data, which is mainly composed of hydrological data including effective rainfall, project areas, crop type and crop evapo-transpiration, water supply, and production etc. Three-year data was required unless climate conditions were quite similar over 3 years or a longer period. The average values are used for computing external indicators. External indicators are ratios or percentages comparing scheme inputs and outputs and describe its performance, and are various expressions of efficiency related to economic productions, water distribution and crop productions. They do not provide any insight into what must be done to improve performance or efficiency, but will give an indication to conserve water and enhance the environment through improved water management.

The external indicators in 4 pilot projects are shown in Table 3 as follows.

Num Houm and Huay Luang projects use data of 2003-2005, but Komping Pouy project uses only 1-year data of 2005 due to unavailability. Longhai station of Go Cong project also uses 1-year data of 2005 only, because the climate condition was very different during 2003-2005.

Interpretations of some important key values of external indicators shown in the Table 3 are.

##### **(1) Areas**

The total command area is estimated as 10,050 ha in Komping Pouy project; 2,397 ha in Num Houm project; 13,918 ha in Huay Luang project; and 680 ha in Longhai station of Go Cong project. The irrigated crop area in command areas (including multiple cropping a year) were 3,282 ha, 5,199 ha, 15,229 ha, and 2,040 ha in Num Houm, Komping Pouy, Huay Luang, and Longhai of Go Cong project respectively. The irrigated crop area in Komping Pouy project is relatively small compared with the command area. This is because the project is still under rehabilitation. Only 3,282ha was rehabilitated in 1999 and is now ready to be cultivated. Water cannot reach the end of the other remaining area due to deterioration of the irrigation infrastructures.

Table 3: External Indicators

Item Description	Units	Komping Pouy	Num Houm	Huay Luang	Go Cong/ Longhai
<b>Stated Efficiency</b>					
Stated conveyance efficiency (seepage and spills)	%	65	65	57	60
Weighted field irrigation efficiency from stated efficiencies	%	60	58	68	60
<b>Areas</b>					
Physical area of cropland in the command areas (not including double cropping)	Ha	10,050	2,397	13,918	680
Irrigated crop area in the command area	Ha	3,282	5,199	15,299	2,040
Cropping intensity in the command area including double cropping	None	0.33	2.17	1.09	3.00
<b>External sources of water for the command area</b>					
Surface irrigation water inflow from outside the command area (gross at diversion and entry points)	MCM	18	47	65	41
Gross precipitation in the command area	MCM	92	38	172	8
Effective precipitation to irrigated fields (not including salinity removal)	MCM	6	37	93	3
Net aquifer withdrawal due to irrigation in the command area	MCM	0	0	0	0
Total external water supply-including gross ppt.and net aquifer withdrawal, but excluding internal recirculation	MCM	110	85	237	49
<b>Water sources inside the command area</b>					
Internal surface water recirculation/pumping by farmer or project in command area	MCM	0	0	0	0
Gross groundwater pumped by farmers within command area	MCM	0.07	0	0	0
Gross groundwater pumped by Project Authorities within command area	MCM	0	0	0	0
Estimated total internal source water	MCM	0.07	0	0	0
<b>Irrigation water delivered to users</b>					
<i>Internal water sources are assumed to have a conveyance efficiency of:</i>	%	88	88	86	87
Delivery of external surface irrigation water to users-using sated conveyance efficiency	MCM	11.83	30	37	24.61
Delivery of internal source water to users (surface recirculation plus pumping, with assumed conveyance efficiency)	MCM	0	0	0	0
Total irrigation water deliveries to users (external surface irrigation water + internal diversions and pumping water sources), reduced for conveyance efficiencies	MCM	12	30	37	25
<b>Net Field Irrigation requirements</b>					
ET of irrigated crops in the command area	MCM	18	41	90	6
ET of irrigation water in the command area (ET-effective precipitation)	MCM	12	4	-8	2
Irrigation water needed for salinity control (net)	MCM	0	7	0	0
Irrigation water needed for special practices	MCM	0	11	28	1
Total NET irrigation water requirement (ET-eff ppt+ salt control + special practice)	MCM	12	19	26	3
<b>Other key Values</b>					
Flow rate capacity of main canal (s) at diversion points (s) this year	cms	16	7	12	25
Actual peak flow rate of main canal (s) at diversion point (s) this year	cms	5.6	4	8	25
Peak NET irrigation requirement for field, including any special requirements	cms	1.9	5	9	0.3
Peak GROSS irrigation requirement, including all inefficiencies	cms	4.7	12	23	4.0
<b>ANNUAL or One- Time External INDICATORS for the Command Area</b>					
Peak litres/sec/ha of surface irrigation inflows to canal (s) this year	LPS/Ha	0.56	1.16	0.54	36.76
RWS Relative Water Supply for the irrigated part of the command area (To external water supply)/(Field ET during growing seasons + water for salt control-Effective precipitation)	none	9.76	4.52	9.92	15.06
Annual Command Area Irrigation Efficiency [100 x (Crop ET + Leaching needs-Effective ppt)/(Surface irrigation diversions + Net groundwater)]	%	40	41	38	8
Field Irrigation Efficiency (computed)= [Crop ET-Effective ppt + LR water]/[Total Water Delivered to Users] x 100	%	61	63	67	13
RGCC- Relative Gross Canal Capacity – (Peak Monthly Net Irrigation Requirement)/(Main Canal Flow Rate)	none	0.12	0.70	0.72	0.01
RACF – Relative Actual Canal Flow – (Peak Monthly Net Irrigation Requirement)/(Peak Main Canal Flow Rate)	none	0.33	1.15	1.18	0.01
Gross annual tonnage of agricultural production by crop type	m Tons				
Total annual value of agricultural production	\$ US	1,208,375	1,963,258	10,412,142	1,933,920

## **(2) External sources of water for the command area**

The total external water supply coming into the command area is higher in the Huay Luang project, totalling 237 MCM per year, compared with 110 MCM in Komping Pouy project, 85 MCM in Num Houm project, and 49 MCM in Longhai of Go Cong project. These values include gross precipitation and diverted water from the main canal, but do not include internal recirculation into command areas. Due to lack of available information, the circulated use of water resources inside the command area by pumping or other methods is not estimated in this assessment.

It is noted that effective precipitation in Komping Pouy project is relatively low (6MCM), but very high in Num Houm project (37 MCM) compared with gross precipitation in the command area. This is caused by different estimations on effectiveness of rainfall among the projects. Of the gross precipitation 80% in dry season and 40% in wet season are estimated as effective rainfall for Komping Pouy project, but 90% in dry season and 80% in wet season for Num Houm project. While 90% in dry season and 70% in wet season are applied for Huay Luang project, and 70%, 30% and 90% are used for Go Cong project. This estimation of the effective rainfall will be reviewed again for the final RAP assessment.

## **(3) Irrigation water delivered to users**

The total irrigation water delivered to users comprises external surface irrigation water, internal diversions from main canal and pumped water, but this is reduced by assumed conveyance efficiency. The results are 12 MCM, 30 MCM, 37 MCM, and 25 MCM in the Komping Pouy, Num Houm, Huay Luang, and Longhai of Go Cong projects respectively.

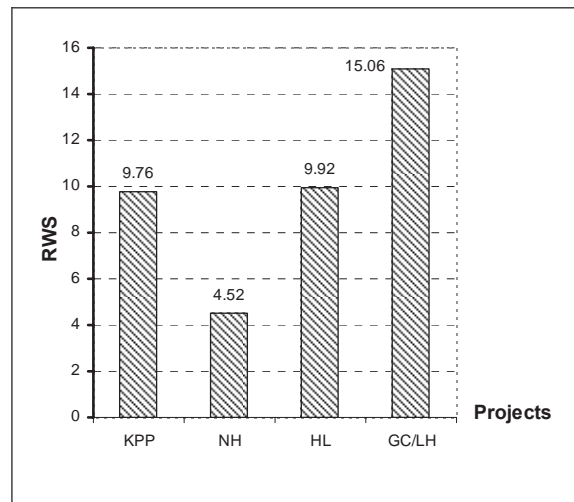
The lowest value is observed in Komping Pouy project. When conducting RAP initial assessment, a huge loss through spillways at the end of canals was observed. This fact can be interpreted that the main canal with an original design capacity for more than 10,000 ha needs excessive water diversions from the reservoir for the current cultivated area of 3,282 ha in order to keep water level high enough to deliver water to secondary and lower level canals. And this leads to the low value of this indicator although a large amount of water seems to be diverted into the command area.

## **(4) Relative Water Supply- RWS**

RWS is defined as the ratio of total external water supply (including gross precipitation and net aquifer withdrawal to the scheme, but excluding internal recirculation) to water required by crops in the command area. Required water is composed of field evapotranspiration plus water for salinity control minus effective precipitation. Based on the information from each project staff member there are no wells being used for irrigation in the system. Therefore, aquifer withdrawal from shallow wells is not examined at this assessment and water for salinity control is considered for Go Cong project only.

The RWS are 9.76 in the Komping Pouy Project, 4.52 in the Num Houm, 9.92 in the Huay Luang project and 15.06 in the Longhai of Go Cong project as given in Figure 12. Most schemes show high value of RWS, which indicates excessive water supply to its demand, is caused by poor water management in general.

However in case of Go Cong project, much water is diverted to the system to keep water level high not only for irrigation but also for navigation, salinity control and so on. That is why the RWS value is high compared with the water requirement. The real amount for irrigation is the amount removed by farmers but is not estimated in this assessment. It will be considered for the final assessment.



Note: KPP: Komping Pouy scheme; NH: Num Houm scheme;  
HL: Huay Luang scheme; GC/LH: Go Cong/Longhai scheme;

Figure 12: Relative Water Supply

## (5) Efficiencies

### 1) Command Area Efficiency:

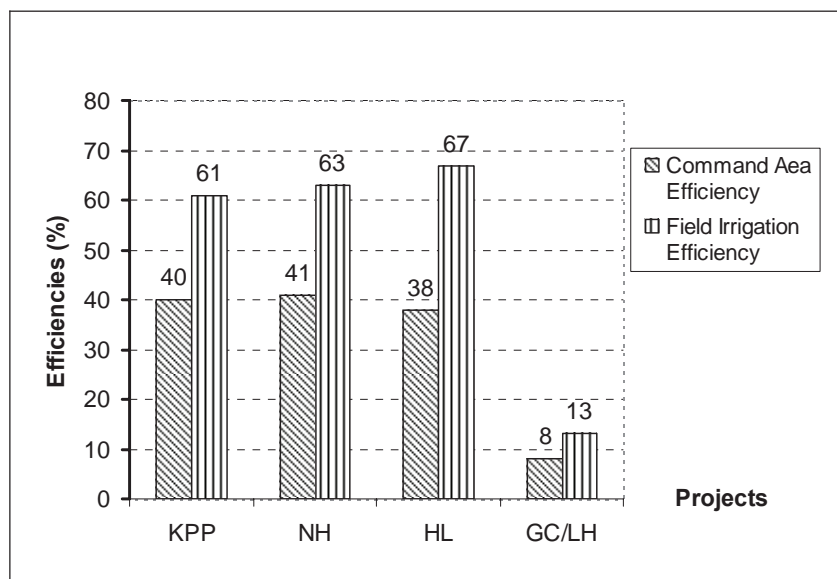
The command area irrigation efficiency is the ratio of system water requirement (crop evapo-transpiration plus leaching needs minus effective precipitation) to total irrigation water diverted into the system, which included surface irrigation and net ground water irrigation, but excluded gross precipitation. Leaching water needs are not counted at most schemes except Go Cong project and ground water supply is not examined for whole schemes.

The command area efficiency is shown in Table 3 and also in Figure 13. The value (around 40%) is not largely different among Komping Pouy, Num Houm and Huay Luang projects, but the value obtained from Go Cong project is very low (8%) compared with the other three schemes. This is caused because recycled use of irrigation water is not properly estimated, only diverted water into the system was considered as explained above.

### 2) Field Irrigation Efficiency:

This is the ratio of water required (by crops) to delivered (to users). Water delivery to the field obtained from diverted water to the system through main canal intake multiplied by conveyance efficiency. The assumed conveyance efficiency ranges from 86-88%.

The field irrigation efficiency is given in Table 3 and Figure 13. Over 60% is obtained in three projects, Komping Pouy, Num Houm and Huay Luang, but 13% only in Go Cong project because of the reason above mentioned.



Note: KPP: Komping Pouy scheme; NH: Num Houm scheme;  
HL: Huay Luang scheme; GC/LH: Go Cong/Longhai scheme;

Figure 13: Efficiencies

#### 4.4.2 Internal Indicators

The internal indicators identify key factors related to water control throughout a project. They describe the level of water delivery service provided to users and examine specific hardware, management techniques and processes used for the control and distribution of water, and then give a detailed perspective of how the system is actually operated, and the water delivery service that is provided at all the levels. The identification of what actions must be taken to improve external indicators (i.e. scheme performance) comes from an examination of internal indicators

The internal indicators are estimated by information from project staff, water user group, and farmers from project level down to canal system and on- farm level. As Annex 11, the results are given by score at each service level. The score ranges from 1-4 (poor-excellent performance). The criteria of judgement and scoring depend on surveyors. Since each pilot scheme is evaluated by different team, some obtained results may not be consistent for comparison among four schemes.

##### (1) Representing values of internal indicators

Some major internal indicators values are selected from Annex 11 and summarised as Table 4. Based on Table 4, internal indicators are interpreted as Table 5 below.

Judging from scores obtained from the field investigation in Annex 11, Table 4 and Table 5, the major observations are described as following sections project by project.

Table 4: Representing values of internal indicators

Level of Services	Indicator Name	Score 1- 4 (1: poor; 4 excellent)				Go Cong/ Longhai
		Komping Pouy	Num Houm	Huay Luang		
				RMC	LMC	
Service and social order	<b>Actual:</b> Water delivery to Individual Ownership Units (e.g., field or farm)	1.5	0.9	1.3	1.8	2.7
	<b>Stated:</b> Water delivery to Individual Ownership Units (e.g., field or farm)	1.2	2.0	2.5	2.5	2.7
	<b>Actual:</b> Water delivery service at the most downstream point in the system operated by a paid employee	0.7	0.9	1.4	1.4	2.6
	<b>Stated:</b> Water delivery service at the most downstream point in the system operated by a paid employee	1.7	1.4	0.8	0.8	1.4
	<b>Actual:</b> Water delivery service by main canals to second level canals	1.8	2.2	1.2	1.4	0.0
	<b>Stated:</b> Water delivery service by main canals to second level canals	2.8	1.6	3.3	3.3	1.8
Main Canal	Cross regulator hardware in main canal	1.7	1.9	3.3	1.9	N.A.
	Turnouts from main canal	2.7	1.7	2.8	2.3	N.A.
	Regulating reservoir in the main canal	0.0	0.0	0.0	0.0	N.A.
	Communications for the main canal	1.9	1.9	2.9	2.5	N.A.
	General conditions for the main canal	1.8	2.0	2.6	1.8	N.A.
	Operation of the main canal	2.1	2.1	2.3	2.1	N.A.
2 <sup>nd</sup> Level Canals	Cross regulator hardware (2 <sup>nd</sup> canal level)	1.0	1.3	1.6	1.4	N.A.
	Turnouts from 2 <sup>nd</sup> level canals	3.0	2.3	2.8	3.0	2.7
	Regulating reservoir in the 2 <sup>nd</sup> level canals	0.0	0.0	0.0	0.0	3.7
	Communications for the 2 <sup>nd</sup> level canals	1.6	2.1	2.5	2.7	2.8
	General conditions for the 2 <sup>nd</sup> level canals	1.2	2.0	2.0	2.3	2.4
	Operation of the 2 <sup>nd</sup> level canals	2.4	2.1	2.5	2.3	1.3
3 <sup>rd</sup> Level Canals	Cross regulator hardware (3 <sup>rd</sup> level canals)	1.0	1.0	1.9	1.4	N.A.
	Turnouts from 3 <sup>rd</sup> level canals	2.3	2.0	2.8	2.7	2.7
	Regulating reservoir in the 3 <sup>rd</sup> level canals	0.0	0.0	0.0	0.0	3.3
	Communications for the 3 <sup>rd</sup> level canals	1.2	1.5	2.4	3.1	2.0
	General conditions for the 3 <sup>rd</sup> level canals	2.8	2.0	2.3	1.3	2.0
	Operation of the 3 <sup>rd</sup> level canals	1.8	2.4	2.3	1.3	1.9
Budgets, Employees, WUAs	Budget	0.0	1.2	0.8	0.8	2.0
	Employees	2.0	2.4	2.1	2.1	2.9
	Water User Associations	1.5	1.8	2.0	0.6	0.6
	Mobility and Size of Operations Staff	0.0	3.0	0.0	0.0	0.0
	Computers for billing record management	0.0	0.0	1.0	1.0	1.0
	Computer for canal control	0.0	0.0	0.0	0.0	0.0
Ability of present water delivery service to individual field to support pressurized irrigation method		2.5	2.2	0.0	0.0	3.3
<b>Special indicator that do not have a 0- 4 rating scale</b>						
Turnout density	No. of water users down stream of employee-operated turnout	20	15	12	11	1
Turnout/Operator	(No. of turnouts operated by paid employees)/(paid employees)	1.8	40.6	4.7	4.7	1.5
Main canal chaos	(Actual/Stated) overall service by the main canal	0.64	1.38	0.37	0.43	N.A.
2 <sup>nd</sup> level chaos	(Actual/Stated) overall service at the most downstream point operated by a paid employee	0.41	0.67	1.71	1.17	1.88
Field level chaos	(Actual/Stated) overall service to the individual ownership units	1.23	0.45	0.50	0.71	1.00

Table 5: Interpretation of internal indicators

Service Level	Komping Pouy Project	Num Houm Project	Huay Luang Project	Go Cong Project/ Longhai Station
<b>Service and social order</b>	<ul style="list-style-type: none"> <li>Poor of water delivery service at on-farm level</li> <li>Fair water distribution from main to 2<sup>nd</sup> canal level</li> <li>Good in social order in the canal system operated by employees</li> </ul>	<ul style="list-style-type: none"> <li>Very poor water delivery at on-farm level</li> <li>Good water distribution from main to 2<sup>nd</sup> canal level</li> <li>Poor in social order in the canal operated by employees</li> </ul>	<ul style="list-style-type: none"> <li>Poor of water delivery service at on-farm level</li> <li>Poor water delivery service from main to 2<sup>nd</sup> canal level</li> <li>Very good in social order in the canal by operated employees</li> </ul>	<ul style="list-style-type: none"> <li>Good water delivery service at on-farm level</li> <li>Very poor water deliver service to 2<sup>nd</sup> canal level</li> <li>Good in social order in the canal by operated employees</li> </ul>
<b>Main Canal</b>	<ul style="list-style-type: none"> <li>Poor operation and condition of cross regulators</li> <li>Good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Fair communication system</li> <li>Fair general condition and operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Fair operation and condition of cross regulators</li> <li>Poor condition and operation of turnouts</li> <li>No regulating pond</li> <li>Fair communication system</li> <li>Fair general condition and operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Good condition and operation of cross regulators</li> <li>Good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Very good communication system</li> <li>Good condition and operation of the canal</li> </ul>	<ul style="list-style-type: none"> <li>Not conducted</li> </ul>
<b>2<sup>nd</sup> Level Canals</b>	<ul style="list-style-type: none"> <li>Very poor condition and operation of cross regulators</li> <li>Good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Poor of communication system</li> <li>Poor general condition of canal</li> <li>Good operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Poor condition and operation of cross regulators</li> <li>Good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Fair communication system</li> <li>Fair general condition and operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Poor condition and operation of cross regulators</li> <li>Very good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Good communication system</li> <li>Good general condition and operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>No cross regulators along the canal</li> <li>Good condition of turnouts</li> <li>Very good regulating pond</li> <li>Very good communication system</li> <li>Good general condition of canal</li> <li>Poor operation of canal</li> </ul>
<b>3<sup>rd</sup> Level Canals</b>	<ul style="list-style-type: none"> <li>Very poor condition and operation of cross regulators</li> <li>Good condition and operation of turnouts</li> <li>No regulating pond</li> <li>Poor communication system</li> <li>Good general condition of canal</li> <li>Poor operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Very poor condition and operation of cross regulators</li> <li>Fair condition and operation of turnouts</li> <li>No regulating pond</li> <li>Poor communication system</li> <li>Fair general condition of canal</li> <li>Good operation of canal</li> </ul>	<ul style="list-style-type: none"> <li>Poor condition and operation of cross regulators</li> <li>Very good condition of turnouts</li> <li>No regulating pond</li> <li>Good communication system</li> <li>Fair general condition of canal</li> <li>Good operation of LMC, but poor of RMC</li> </ul>	<ul style="list-style-type: none"> <li>No cross regulators along canal</li> <li>Good condition of turnouts</li> <li>Good regulating pond</li> <li>Fair communication system</li> <li>Fair condition and operation of canal</li> </ul>
<b>Budgets, Employees, WUAs</b>	<ul style="list-style-type: none"> <li>Very weak of budget status</li> <li>Fair status of employee</li> <li>Weak of WUA performance</li> </ul>	<ul style="list-style-type: none"> <li>Weak of budget status</li> <li>Good status of employees</li> <li>Weak of WUA performance</li> </ul>	<ul style="list-style-type: none"> <li>Weak of budget status</li> <li>Fair status of employees</li> <li>Fair performance of WUAs in LMC, but poor in RMC</li> </ul>	<ul style="list-style-type: none"> <li>Fair status of budget</li> <li>Very good status of employee</li> <li>Weak of WUA performance</li> </ul>
<b>Mobility and size of operations staff</b>	<ul style="list-style-type: none"> <li>Poor mobilisation of staff</li> </ul>	<ul style="list-style-type: none"> <li>Good mobilisation of staff</li> </ul>	<ul style="list-style-type: none"> <li>Poor mobilisation of staff</li> </ul>	<ul style="list-style-type: none"> <li>Poor mobilisation of staff</li> </ul>
<b>Computer used in the project</b>	<ul style="list-style-type: none"> <li>No computer used in the project</li> </ul>	<ul style="list-style-type: none"> <li>No computer used in the project</li> </ul>	<ul style="list-style-type: none"> <li>Computers used in the project</li> </ul>	<ul style="list-style-type: none"> <li>Computer used in the project</li> </ul>
<b>Support pressurize irrigation</b>	<ul style="list-style-type: none"> <li>Good to support pressurised irrigation method</li> </ul>	<ul style="list-style-type: none"> <li>Good to support pressurised irrigation method</li> </ul>	<ul style="list-style-type: none"> <li>Poor to support pressurised irrigation method</li> </ul>	<ul style="list-style-type: none"> <li>Very good to support pressurised irrigation method</li> </ul>

## **(2) Komping Pouy Project**

### **1) Service and social order:**

The project has poor water delivery service at on-farm level. The detailed score in Annex 11 indicates that the poor performances are mainly caused by limitation of flexibility and reliability.

The actual operating services which are the responsibility of the paid employee at the most downstream, or tertiary canal in this project, are also relatively poor, particularly compared with what project staff state. Annex 11 shows that the water volume is not controlled and measured properly.

The water delivery service between main and secondary canal levels is almost fair, but lacking equity and that makes the performance lower than average.

### **2) Ratio of observed and started conditions:**

The special indicators shown at the end of Table 4 indicate the gap in the observed and stated conditions as ratios.

In Komping Pouy scheme, the team overestimates performance of the main and the secondary canal levels, but underestimates it at field level. In other words, the scheme functions better than the project managers believe at the main and secondary canal levels, but worse at the field level.

### **3) Cross regulators:**

Poor operations of cross regulators are found in the main canals, especially in the second and the third canal levels. They are still in good physical and operational conditions, because they are newly constructed, however they are not operated and controlled properly. Inappropriate operation of cross regulators has resulted in water fluctuation and inconsistent travel time of flow rate change throughout the canals.

### **4) Turnouts:**

Observation reveals good performances of the turnouts in each canal level. They are operated according to the designed schedule. As the turnouts are regularly maintained, they are still in good condition and function well. The flow rates through turnouts are estimated by operators with existing H-Q curves. The high performance of turnouts is especially found at the second canal level.

The turnout density, which means the ratio of water users by turnouts or outlets, is high in the Komping Pouy scheme with 20 water users per one turnout. However one operator is responsible for approximately 2 outlets only. This means water operators seem sufficient in this scheme.

### **5) Regulating reservoir:**

There is no regulating reservoir in the scheme. Thus the scores Table 4 and Annex 11 shows "0", but it does not mean poor performance.

### **6) Communication:**

The communication performance is poor throughout all levels and particularly in the secondary and lower levels. Lack of communications with higher levels is one reason. The other is poor reliability of voice communications by phone or radio. Furthermore there is no remote monitoring at key spill points such as spills along the canal or canal

end. Mobile phones are not used in the field level except by project officers. Communication is usually made by meeting. Road accessibility along the canals is also poor.

**7) Canal conditions:**

The score of the general conditions of each canal is at average level. Canals show good cross section shape with little erosion on the bank. The maintenance level is also excellent because regular maintenance has been conducted before every cultivation season, although the project is still lacking proper equipment and staff to adequately maintain the canals.

**8) Canal operation:**

The operation of the main canal is evaluated as slightly better than the average level. The reasons are effective water ordering/delivering procedures to adequately meet water demand, appropriate instructions to operators and frequent canal inspections and its reporting system to the offices. However weakness is also found in terms of real time feedback of monitored water distribution between operators of the main regulator and of each gate along the canal.

The operation of secondary canal level is quite good with the same reasons described as before. However one observed weakness is the lack of clear instructions to operators. The third level canal operation is poor compared with other higher levels. Real time feedback of water distribution is poor, water ordering/delivering procedure to meet actual demand is ineffective, and instructions to operators is not clear enough, even though the problems are often checked and reported to the office.

**9) Budgets, employees and WUAs:**

The project has no budget available for system operation and maintenance (O&M). The water fee or any other in kind services to support O& M and modernisation activities has not regularly been collected from water users or allocated by the government. However the project collected water fees from farmers in the 2005 dry season and another budget from ADB and other international sources supporting modernisation is made available at present. Therefore in terms of budget the result may not be reliable and needs further clarification at the final RAP assessment.

The status of the project employees is also at average level. Training concerning system management and water distribution is provided regularly to the staff by foreign technical assistance. Rewards are also provided to the staff when showing excellent performance, although the project does not have documented rules for evaluating project staff performances.

The performance of WUAs is poor. The limited participation of water users contributing to water distribution is the main reason and weak financial status is the other.

**10) Ability to support pressurized irrigation system:**

The score on the ability to support pressurised irrigation to individual fields under the current water delivery service is relatively high in Komping Pouy project compared with Huay Luang project, although the Huay Luang project has better conditions and facilities and is more intensive in terms of water control and management. The differences seem to be caused by inconsistent judgments given by the different evaluators, i.e. RAPs in these two projects were facilitated by different resource

persons of FAO. This issue will be discussed with FAO and clarified and adjusted if necessary at final RAP conducting.

### **(3) Num Houm Project**

#### **1) *Service and social order:***

The water delivery service at on-farm level is relatively poor, although project staff stated it at average level. Volume is not measured through the gates, and water delivery is weak on its flexibility.

Water delivery service at the most downstream points in the system operated by a paid employee (outlet of secondary canal level) is lower than the average level, although the score given by the project staff is higher than the average. Lack of water volume control, its flexibility, reliability and equity is the reason.

The water delivery service from the main to the secondary canals, however, performs higher than the average and higher than stated condition. The equity of water delivery at the inlet of secondary canal is quite high.

The social order in the canal system operated by the paid employees such as “degree to which water delivery are not taken when not allowed,” “lack of vandalism of structure” and “noticeable non-existence of unauthorised turnouts from canal” etc is recognised as low, since scores given in these items are zero (0) as shown in Annex 11.

#### **2) *Ratio of observed and started condition:***

In contrast with the Komping Pouy scheme, the comparison of the scores between actual and stated conditions in Table 4 shows that the condition is underestimated at the main canal and overestimated at the secondary and lower canal levels.

#### **3) *Cross regulators:***

The physical and operational conditions of cross regulators are evaluated as slightly lower than average level along the main canal. Cross regulators can be easily operated by the staff, but water fluctuation is high due to inappropriate operation. At the secondary and third canal levels, the cross regulators show very poor performance. This has been caused by the high water fluctuation along the canals and long travel time of flow rate change resulting from fluctuation throughout these canal levels.

#### **4) *Turnouts:***

Turnout facilities of the main canal are not in good condition. This makes it difficult to run a good operation and to control volume of water. However at the secondary and the third canal levels, they function quite well. They provide for easy operation and controlling flow rate through the gates, but are still lacking in maintenance, especially at the third canal level.

One outlet supplies water for 15 water users which ranks as the second highest among the four schemes and one employed staff covers 40 turnouts each, which could indicate that additional staff are required for appropriate system operation.

#### **5) *Regulating reservoir:***

There is no regulating reservoir in the Num Houm scheme. Thus the score appeared in Table 4 and Annex 11 is “0”, but it does not mean the poor performance.

**6) Communication:**

The communication is evaluated as slightly lower than the average level. Farmers and all the project staff can communicate each other by cell phone. Good dependability of telephone communications and frequent visits by upper level supervisors to the fields are observed, but there is lack of communication between gate operators and both farmers and reservoir operators.

At the secondary canal level, communication is evaluated as slightly higher than the average level. There is frequent communication with the higher level or project staff and dependability through cell phone useage, but still miscommunication occurs between operators and their farmers.

The communication at the third canal level is relatively poor due to the weakness of communication among project staff, operators and farmers.

**7) Canal conditions:**

The physical conditions of the main, the secondary and the third level canals are average. Seepage observed from the canals was not at a critical level. Access by the material suppliers for maintenance is also easy. However the availability of proper equipment and staff to adequately maintain the canal system is still insufficient.

**8) Canal operation:**

The canal operation is evaluated as better than the average level at the entire canal system and especially at the third canal level. Real time feedback from water receivers to suppliers at whole canal levels is secured. Effective water ordering/delivering procedures to meet actual demands in main canal and correct instructions to operators at the secondary and the third level canals are also secured. However water ordering/delivering procedures together with procedure to check and report problems to the office are ineffective or weak at the secondary and the third level canals.

**9) Budgets, employees and WUAs:**

The project budget status is weak. A limited a budget is available which is mostly collected as water fees and mainly spent for operation and maintenance. No budget is available for scheme modernisation and rehabilitation.

The performance of employees is evaluated higher than the average level. Employees have power to make decision by themselves for water allocation based on documented performance rules in the management activity. Operators are provided a higher salary than day labourers.

The function of WUAs is, however, evaluated lower than the average level. Although there is legal basis for the WUAs, participation of water users and project staff in water allocation as well as financial status is weak.

**10) Ability to support pressurized irrigation system:**

This project has shown potential and ability to support pressurised irrigation systems through its present conditions of water distribution practice judged from obtained scores. However, observation has revealed that physical conditions of the project facility is less suitable and water management of the project is less intensive than the Huay Luang scheme, although the project scored higher points than Huay Luang scheme. The same interpretation could be applied as for the Komping Pouy project.

#### **(4) Huay Luang Project**

In case of the Huay Luang project, investigation for internal indicators was conducted by two teams, one on the RMC and the other on the LMC. Therefore the obtained scores vary depending on the judgment of each team. Major findings are described as follows.

##### **1) *Service and social order:***

The water delivery services at on-farm level or to individual ownership unit are poor and worse than the stated conditions, especially at the LMC. The reasons are no volume measurement through the gates, weakness of flexibility in the LMC and lack of water availability in the RMC.

The water delivery services observed at the most down stream point operated by employees seem to perform better than the stated conditions. In particular there is good flexibility, reliability and apparent equity.

The water delivery services by the main canal to the second canal level were evaluated as poor, and worse than the stated conditions. Water control is weak in particular, while the stated conditions gave the full score on this point.

The score representing the social order in the canal system operated by employees is relatively high compared with other schemes, especially in terms of “the noticeable non-existence of unauthorised turnouts from canals” and “lack of vandalism of structures.”

##### **2) *Ratios of observed and started conditions:***

The comparison of the scores between the actual and the stated conditions of the Huay Luang scheme has shown that project managers underestimated at the second canal level, and overestimated at the main and field levels.

##### **3) *Cross regulators:***

The cross regulators are still in good condition and well operated at the main canal level. Although there is some water fluctuation at the RMC, maintenance level is high and travelling of flow rate change is good.

The operation of cross regulators at the secondary and tertiary canals is, however, relatively poor. This is caused by high water fluctuation along these canal levels.

##### **4) *Turnouts:***

Evaluation has given high scores for turnouts for the whole canal levels in general. They are well maintained and in good condition and easy for operators to manipulate. While the observation has found that many Canal Head Orifice (CHO) gates are installed as turnouts of the main and the secondary canal levels, they are not appropriately operated in terms of its theory. CHO gates are composed of two gates as a pair and are supposed to operate together for supplying water smoothly without high water fluctuation.

However only one of those two gates was actually operated and the other was permanently closed. The project staff gave the reason as the fact they have difficulty and limited experience to control them properly.

Special indicators at the end of Table 4 show that one outlet supplies water for 12 water users and one employed staff is responsible for operation of 5 turnouts each, which could be understood that additional staff is not necessarily required for system operation.

5) ***Regulating reservoir:***

There is no regulating reservoir in the Num Houm scheme. Thus the scores appearing in the Table 4 and Annex 11 are “0”, but it does not mean the poor performance.

An old reservoir, because it serves to the RMC as external source, is not considered as regulating reservoir.

6) ***Communication:***

The communication level is good for all the canal levels because of frequent communication with higher levels and supervisors or project staff being maintained. Mobile phones and radios are used for communicating within the project. The project is also equipped with good roads, which allow easy access to each canal level. However, the spill points from the secondary and the third canal levels are not monitored well.

7) ***Canal conditions:***

General physical and operational conditions of the canals are evaluated as better than the average at whole canal levels. Seepage along the canals is controlled well. One of the reasons is concrete lining. The scheme location, not far from the town, allows the project easy access to material suppliers when maintenance work is needed and this helps maintain the canals in good conditions.

However the condition of the RMC seems to be poor concerning maintenance level.

Availability of proper equipment and staff to adequately maintain the canals also seems to be insufficient.

8) ***Canal operation:***

The main and the secondary canals are operated better than the average level. The reasons are that 1) instructions to operators are clear and 2) problems are checked/reported to the office frequently.

The third canal level for the RMC is, however, poor in its operation, as the feedback is not quick enough when water supply does not match with demand.

9) ***Budgets, employees and WUAs:***

The project stated that some budget was available for scheme modernisation and rehabilitation purposes coming mostly from government subsidy, but no budget was available for scheme operation and maintenance purpose, nor was it collected from water users. However the observation has found that the project receives a budget every year from the government for scheme operation and maintenance activities. This contradiction will be reviewed at the final RAP.

The performance of employed staff is evaluated slightly better than the average. The documented rules for evaluating staff performance on a yearly basis are available, and a relatively good salary (compared to day labourers) is paid to operators. But the project is still lacking procedure both to dismiss employees when there is cause and to reward them for their exemplary services.

The performances of WUAs are evaluated as average in LMC, but significantly weak in the RMC. The weakness of the WUAs in the RMC is due to less participation to water distribution practice and weakness of financial status of the groups.

**10) Ability to support pressurised irrigation system:**

The observation has revealed that the present situation of the scheme is not good to support pressurised irrigation because of limited flexibility and reliability to control flow rate properly.

As described in Komping Pouy and Num Houm projects, the observation found that although the Huay Luang project was equipped with better physical facilities such as the gates and the canals in good condition, the score of Huay Luang project for pressurised irrigation is lower than those of Komping Pouy and Num Houm projects. This contradiction is caused by the judgement of different evaluators between these three schemes. The final RAP will carefully review this point.

**(5) Go Cong Project**

As mentioned earlier in this report, the characteristic of this Mekong delta irrigation system is unique among the pilot sites and some RAP indicators may not be effective or appropriate to explain this uniqueness of the project. However an attempt was made to interpret internal indicators and the result is as follows.

**1) Service and social order:**

Due to limitation of the project framework, the RAP assessment was conducted not on the whole Go Cong project area but the Longhai station area only. HL6 (Houng Lo 6) sluice is considered as the inlet of the secondary canal. The water delivery service from main to secondary canal level has been evaluated relatively poor, because the sluice operation with its fixed schedule shows lack of flexibility and reliability. The volume of water through the sluice was also not measured.

However good performance of water delivery to individual fields was observed in spite of no volume measurement. Farmers individually bring water to the fields by their own pumps at any time as they wish. This practice is considered to guarantee high flexibility and apparent equity.

The social order in the canal system operated by paid employees has been evaluated as the highest score since there is high score on “degree to which deliveries are not taken when not allowed,” “noticeable non-existence of unauthorised turnouts from canals” and “lacking of vandalism of structures.”

**2) Ratio of observed and stated conditions:**

In case of Go Cong project, the project managers have underestimated the performances in the second canal level but at field canal level their evaluation is same as that observed. The main canal was not evaluated at this first RAP assessment.

**3) Cross regulators:**

As described earlier, there are no cross regulators along canals. Water level control within the canal system is made by intake gate operation at the secondary canal level only.

**4) Turnouts:**

Assessment was not conducted at the main canal level, thus no result is shown in Annex 11 and Table 4. HL6 (Houng Lo 6) sluices can be considered as turnouts of the main canal, but the result (or score) is not representing whole turnouts along the main canal of the Go Cong scheme.

At the secondary and the third canal levels, pumps of individual farmers have been considered as the turnouts and shown high performance. The pump is usually easy to operate and can be repaired by farmers themselves when a problem occurs. The volume of water supply can also be definitely identified. Therefore the score giving to the turnouts (i.e. pumps) is relatively high.

**5) *Regulating reservoir:***

Although the system has no regulating reservoirs in its design, the canals have a regulating function. Since farmers can take water from the canals when they want to irrigate their own fields, the canals in each level are therefore functioning as regulating ponds and they have shown high performance, especially in terms of operation as well as storage and buffer capacity.

**6) *Communication:***

The level of communication is quite high since there is intensive communication between lower and higher levels (sluice operators and the project staff), and the project staff regularly monitor the sluice gate operation.

**7) *Canal conditions:***

The general conditions of the secondary and the third canal levels have been evaluated as average since there is not much seepage loss. The observation has found that the canal condition is difficult to judge because the canal characteristic is similar to natural rivers. As mentioned in earlier, the canal functions not only for irrigation but also for drainage, navigation, and salinity control purposes. The access to the third canal level is difficult or sometimes impossible by road but easy by boat.

**8) *Canal operation:***

The operation is not required at the secondary canal level because of no control structure, but pump operation is considered as tertiary canal level operation. The performance at tertiary canal level (i.e. pumps) is higher than the average.

**9) *Budgets, employees and WUAs:***

The project has fairly good budget status. Their budget is from water fee collection and from the government support for regular structure maintenance.

The status of employees is also good because of frequent training opportunities for staff, documented operation rules, rewards for employee service and relatively good salary for operators compared to day labourers. Computers are used in the project for billing and recording management data.

The communities are considered as WUAs in this project. Their performance seems to be poor since there is little participation for water distribution and limited ability to influence real-time water deliveries.

**10) *Ability to support pressurized irrigation system:***

The project has high potential and ability to support pressurised irrigation system because pumps are applied in the project and allow for supplying water with pressure. However management procedures and hardware systems will have to change if pressurised irrigation is to be applied.

#### **4.4.3 IPTRID Indicators**

IPTRID (International Programme for Technology Research for Irrigation and Drainage) also defines and provides external indicators. However some indicators are the same as (or duplicated with) the RAP external indicators shown in Table 3. Therefore, Table 6 shows some (but not all) IPTRID external indicators, which are not shown in Table 3.

The explanation does not cover all the indicators, but points out some selected important indicators (marked by **bold and underline** in the following table) as follows.

Table 6: IPTRID Indicators

		Value				Description
Komping Pouy	Num Houm	Huay Luang	Go Cong			
7,317	638	36,928	11,807		Gross revenue collected from water users, including in-kind services, \$US	
<b>489,463</b>	<b>857</b>	<b>1,075,000</b>	<b>8,231</b>		<b>Total management, operation and maintenance cost of project, \$US</b>	
390	311	50,000	2,870		Total annual (Project + WUA) expenditure on system maintenance, \$US	
341	612	576,488	3,486		Total cost of personal in the project and WUAs, \$US	
75	14	127	6		Total number of personal employed by the Project and WUAs	
1,208,375	1,963,258	10,412,142	1,933,920		Total annual value of agricultural production at the farm gate, \$US	
18	41	90	6		Total annual volume of water consumed by the crops (ET)-MCM	
1,811	19,523	4,704	n.a.		Annual irrigation water delivery per unit consumed area (m <sup>3</sup> /ha)	
5,545	9,001	4,299	n.a.		Annual irrigation water delivery per unit irrigated area (m <sup>3</sup> /ha)	
65	65	57	60		Main system water delivery efficiency, %	
6.2	2.1	2.6	n.a.		Annual relative water supply *** does not include rice deep perc ***	
1.0	1.1	0.7	n.a.		Annual relative irrigation supply *** does not include rice deep perc ***	
3.41	0.58	0.54	n.a.		Water delivery capacity	
90	100	36	80		Security of entitlement supply, % received	
<b>0.01</b>	<b>0.7</b>	<b>0.0</b>	<b>1.4</b>		<b>Cost recovery</b>	
0.05	0.49	1.35	0.24		Maintenance cost to revenue ratio	
49	0	77	12		Total MOM cost per unit area (US\$/ha)	
5	44	4,539	581		Total cost per person employed on water delivery (US\$/ha)	
0.78	0.32	n.a.	0.59		Revenue collection performance	
0.0075	0.0058	0.0091	0.0088		Staffing numbers per unit area (Persons/ha)	
0.00062	0.00002	0.00099	n.a.		Average revenue per cubic meter of irrigation water supplied (US\$/m <sup>3</sup> )	
1,208,375	258	10,412,142	1,933,920		Total annual value of agricultural production (US\$)	
120	819	748	2,844		Output per unit serviced area (US\$/ha)	
<b>368</b>	<b>378</b>	<b>684</b>	<b>948</b>		<b>Output per unit irrigated area (US\$/ha)</b>	
0.0664	0.0420	0.1151	n.a.		Output per unit irrigation supply (US\$/m <sup>3</sup> )	
<b>0.0679</b>	<b>0.0480</b>	<b>0.1151</b>	<b>0.3414</b>		<b>Output per unit water consumed (US\$/m<sup>3</sup>)</b>	

\*The following are data items that have been defined by the IPTRID Secretariat in the publication.  
 “Guidelines for Benchmarking Performance in the Irrigation and Drainage Sector”, December 2000.

### (1) O&M cost

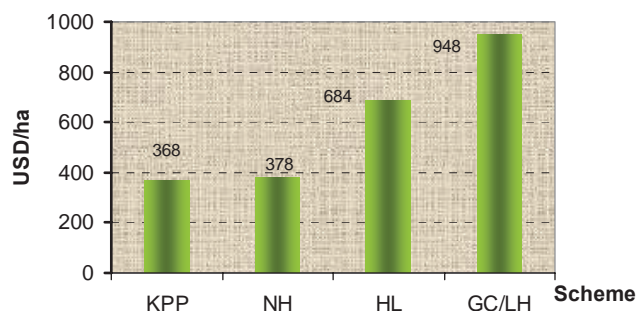
The highest budget is allocated for operation and maintenance cost of the scheme in the Huay Luang project. This project regularly receives running budget for daily O&M. The available O&M budget is lowest in the Num Houm project. This project does not receive budget support for scheme O&M from any sources and other purposes. Although the project is owned by government, the government does not allocate budget. The collected water fee only can be used for all the activities of the scheme management including O&M and staff employment.

### (2) Cost Recovery

The cost recovery rate is the highest in Go Cong project. This might be because the high percentage of water fees (higher than 80%) could be collected every cultivation season in the project. Huay Luang and Komping Pouy projects show low cost recovery rate. Field investigation has revealed that the water fee has not been systematically collected yet and only small amounts needed for canal maintenance are collected from time to time. Although the water fee is collected in Komping Pouy project, it just started in 2006 dry-season cultivation and the collected percentage is still low (around 30%). The rate of water fee is also low (around 0.5 US\$/ha) compared with Num Houm Project in Lao PDR (around 1.2 US\$/ha).

### (3) Output per unit irrigated area, US\$/ha

The highest value is observed in Go Cong project of US\$ 948/ha. The second highest is in Huay Luang project of US\$684/ha. The low values, around half of that in Huay Luang project, are shown in Komping Pouy and Num Houm projects. One of the reasons of high value in Go Cong project is that an intensive cropping system (3 crops a year) is applied. The project has higher production compared with the same area in other projects. The other reason is the higher price of rice in Mekong Delta. In Huay Luang project, although 2 crops a year are produced, as in the other 2 projects, crop diversification is largely practised in the dry season with crops such as soybean, sugarcane etc. These crops are usually sold at higher prices than rice. The price of rice in Thailand is also higher than in Lao PDR and Cambodia. This contributes to the high output from Huay Luang project. The value of output per unit-irrigated areas is presented in the Figure 14 as follows

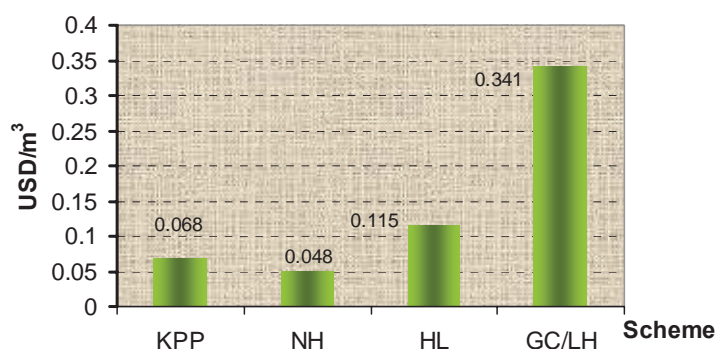


Note: KPP: Komping Pouy scheme; NH: Num Houm scheme;  
HL: Huay Luang scheme; GC/LH: Go Cong/Longhai scheme;

Figure 14: Output per unit-irrigated areas, USD/ha

**(4) Output per unit water consumed, US\$/m<sup>3</sup>**

The result shows that the highest value of US\$0.34/m<sup>3</sup> is recorded in Go Cong project. The reasons would be the highly intensive cropping system with combination of rice and others. The water productivity of Num Houm project is slightly lower than that of Komping Pouy project. Based on field investigation, there is a lot of fish breeding activity practised in Num Houm project, however in this RAP assessment, fish production was not counted due to lack of information. The values of water productivity are shown in Figure 15 as follows.



Note: KPP: Komping Pouy scheme; NH: Num Houm scheme;  
HL: Huay Luang scheme; GC/LH: Go Cong/Longhai scheme;

Figure 15: Output per unit water consumed, US\$/m<sup>3</sup>

**4.5 Modernisation Plan**

Following data collection, input and analysis, the fieldwork teams have prepared short presentations regarding system modernisation plans based on the results obtained from the RAP assessment. The idea of this work is to measure how team members understand the system situation based on interpretation of the RAP results, to brainstorm a modernisation plan and to learn how to propose that plan for implementation.

The guideline to prepare presentations provided to the teams is attached as Annex 12. The vision and objectives of modernising systems, the main problems identified from the RAP results, the strategy and options to improve and modernise systems and estimated costs are the items which were required for inclusion in the presentation.

Table 7 summarises the content of the presentations of three schemes. PowerPoint presentations prepared by the teams are made available in Annex 13. Go Cong scheme did not conduct a presentation, instead focus was put on oral discussion and brainstorming among participants regarding current problems and counter-measures needed to improve and modernise the scheme.

Table 7: Summary of the presentation contents for Modernisation plan

Contents	Komping Pouy Scheme	Num Houm Scheme	Huay Luang Scheme
<b>Vision</b>	<ul style="list-style-type: none"> <li>To ensure enough water for irrigation schemes, reduce water fee to increase income for all the farmers and sustainable management</li> </ul>	<ul style="list-style-type: none"> <li>To be model irrigation system with complete infrastructure, effective management, and empowered WUAs</li> </ul>	
<b>Objectives</b>	<ul style="list-style-type: none"> <li>To improve existing irrigation areas</li> <li>To rehabilitate irrigation areas</li> <li>To empower farmers water users' groups</li> </ul>	<ul style="list-style-type: none"> <li>To increase water use efficiency and productivity</li> <li>To increase farmers' income</li> <li>To achieve sustainable system operation</li> </ul>	<ul style="list-style-type: none"> <li>To improve irrigation water efficiency in each canal level</li> <li>To avoid insufficient water in dry season</li> <li>To strengthen project staff &amp; WUGs</li> <li>To increase productivity</li> </ul>
<b>Major constraints</b>	<ul style="list-style-type: none"> <li>Incomplete infrastructure system</li> <li>Low field irrigation efficiency</li> <li>Low agricultural production</li> <li>Irrigation water drained out of the command area</li> <li>No regulating reservoirs in the command area</li> <li>Lack of communication facilities and procedure</li> <li>Poor physical conditions of on-farm level</li> <li>Inefficient water control and measurement</li> </ul>		<ul style="list-style-type: none"> <li>Farmers do not know the quantity water supplied &amp; received</li> <li>Lacking of flow monitoring equipment</li> <li>Lacking of budget support for system management</li> <li>Supplied water does not meet water demand in some areas</li> <li>Too many structures, difficult to cover whole operation appropriately</li> <li>Some farmers are not active in PIM because they are earning from other sources, not agriculture</li> <li>Some farmers renting land for cultivation make it difficult to manage water fee collection, and make plans for water supply</li> </ul>
<b>Strategies proposed</b>	<ul style="list-style-type: none"> <li>To rehabilitate existing irrigation structures</li> <li>To extend irrigation areas</li> <li>To strengthen capacity of FWUC &amp; WUGs</li> <li>To strengthen O&amp;M</li> </ul>	<p><b>Hardware:</b></p> <ul style="list-style-type: none"> <li>Rehabilitation &amp; improvement of existing irrigation infrastructures including roads, drainage system and on-farm canals</li> <li>Providing water measurement devices for monitoring flow, runoff &amp; spills</li> <li>Improve IT system to improve water distribution</li> <li>Strengthen irrigation facility protection</li> <li>Providing heavy machines for scheme O&amp;M activity</li> </ul> <p><b>Software:</b></p> <ul style="list-style-type: none"> <li>Improve project management plan</li> <li>Add 3 more project staff</li> <li>Strengthen WUAs</li> <li>Increase collecting rate from 32% to more than 90%</li> <li>Improve system operation and service toward more flexible and user oriented model</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building of project staff &amp; WUGs</li> <li>Providing instrument for water allocation monitoring</li> <li>Allocating budget, bonus for working overtime, gasoline, phone card, etc.</li> <li>Making plans for reserving water (regulating reservoir, fishpond, etc)during the shortage period</li> <li>Training to farmers how to estimate water quantity</li> <li>Allocating budget to support activities of agriculture extension, land development, etc, to promote and improve crop yield.</li> </ul>
<b>Cost estimation</b>	US\$ 7,417,500	US\$ 2,249,500	

According to Table 7, Annex 13 and oral discussion of Go Cong scheme, it can be summarised as follows.

#### **4.5.1 *Komping Pouy scheme***

The team has set the modernisation vision as a five year plan which would ensure sufficient water, reduce water fees and increase household incomes. In order to achieve this vision, the team has set objectives to improve existing irrigation infrastructure and irrigated areas and to empower WUGs.

The major constraints of the scheme pointed out are incomplete irrigation infrastructure including drainage systems, low field irrigation efficiency and productivity and lack of water allocation monitoring and communication.

In order to solve these problems, the team has set its main strategy as rehabilitation of existing infrastructures, expansion of irrigated areas and strengthening of project staff, FWUG and O&M activities.

To realise these, the necessary budget is estimated as US\$ 7,417,500. In other words unit cost of approximately US\$2,600/ha for current total irrigated areas of 2,850 ha.

#### **4.5.2 *Num Houm scheme***

The team has shown the vision to step forward to be a model irrigation scheme with complete infrastructure, effective water use and empowered WUAs. To reach this vision, three main objectives have been set: To increase water use efficiency and productivity, to raise farmers' income and to ensure long term sustainability for operation.

The constraints of the project have not been identified. However to achieve the objectives, the strategies have been set and categorised into hardware and software aspects as shown in Table 7. The main strategy focuses on improving infrastructures, IT and communication system as well as monitoring flow as the hardware improvement. For the software improvement strategy, the focus is placed on improvement of the management plan, strengthening WUAs and improving service systems to increase the water fee collection rate.

The necessary budget has been estimated as US\$ 2,249,500 to cover whole strategies proposed, considering total present areas of 2,400 ha and unit cost of approximately US\$ 937/ha, which is less than half of that for Komping Pouy project.

#### **4.5.3 *Huay Luang scheme***

The objectives of modernisation in this project have been set as improving irrigation water efficiency, guaranteeing solving water shortage problems; strengthening WUAs and increasing water productivity.

The major problems of the project have been summarised as Table 7, and concern water allocation, insufficient instrumentation and budget support as well as PIM.

To achieve the objectives, the strategy has also been set as shown in Table 7 with the focus mainly on improvement of water allocation, capacity building and encouraging PIM activity.

The necessary budget has not been estimated for this project.

#### **4.5.4 *Go Cong scheme***

As mentioned earlier, a slide show presentation has not been prepared for this project, however the oral discussion was made for brainstorming ideas among the team regarding current problems and counter-measures to improve and modernize the scheme.

The directors of Go Cong project have pointed out that the current important issues and needs for the project improvement are:

- The saline density in the project area. To prevent and control salinity institution is one of the highest priority issues of the region.
- The characteristic of water level changes in the canal system because this is essential information to set up irrigation schedules for farmers for their cultivation needs. Currently farmers have no idea about how water levels change daily in the canal system. If the water level can be predicted, farmers can choose by pumping or gravity. As pumping cost is very expensive, farmers prefer to control water by gravity to get higher profit.
- In order to improve the project, installation of more gates is proposed in order to control water level more delicately and precisely. This will allow farmers to apply gravity irrigation for longer periods. The operating schedule of the main intakes and other gates within command area also needs careful study in order to produce good coordination in operation for gravity irrigation and also drainage.

## **5. Conclusions**

### **5.1 Achievement**

Although this first RAP assessment needs more improvement in terms of accuracy of input data and quality of analysis, this assessment is considered as a good step to assess irrigation scheme performance and one of the valuable achievements of the IIEPF project. At least the actual situations of pilot schemes have been evaluated and the involved team members have learnt how to evaluate the irrigation scheme performance through this activity. This becomes a good capacity building activity for line agencies. The achievements could be summarised as follows.

- A primary data set of four pilot sites concerning water use and scheme management has been established in a uniform format. This data set can be used as reference for the next assessment and to propose guidelines for more efficient water use.
- The team members have gained deeper understanding of the situation of their own irrigation schemes.
- Involved team members have developed their capacities in terms of up-to-date concepts of irrigation efficiencies and water balance through the training workshop and field level on-the-job training.
- Team members have also developed their capacities in terms of modern tools and procedures to evaluate the system performances by systematic diagnostic procedure that includes both visits to the office to interview the project staff and field evaluation on control structures, operational strategies, communications and water delivery service.

### **5.2 Lessons Learnt and Recommendations**

#### **5.2.1 Lessons Learnt**

The RAP is an effective system to evaluate irrigation system performance over a short period of time. It covers all aspect of performance in both software and hardware of the system. However since the RAP is designed to evaluate large gravity systems, some

indicators are unfortunately not suitable to or applicable with a tidal irrigation system like the one in the Mekong Delta. For example conveyance efficiency cannot be correctly evaluated as the canal system in the Mekong Delta is linked without gate control between each canal level. This point requires further future improvement.

The fieldwork was, in general, planned and organised well by the team. The appointments with farmers and the project staff were made in advance to the fieldwork. During the fieldwork the teams were actively working and keen to learn from the resource persons. However some problems and difficulties were observed during the conducting of the fieldwork as follows.

- The teams had not prepared enough nor read the questionnaire in advance before conducting interviews at the field. It made them confused and wasted time during the fieldwork.
- The teams had not really understood that conducting fieldwork was the teams' responsibility. They did not usually take initiative but followed the resource persons to start each activity.
- If the resource persons could have shown examples how to conduct the RAP, such as how to raise the questions and then suggest to the teams that they do it by themselves, it would have made the fieldwork go more smoothly.
- As the time was limited, the facilitator should make it clear that external information should be analysed advance to fieldwork. Only the problems and unclear points should be checked during the fieldwork.

### **5.2.2 Recommendations**

In order to conduct the final RAP more effectively, some recommendations are made as follows.

- The team should prepare in advance so they have clear understanding of the questionnaire before fieldwork.
- The team should recognise that fieldwork is the responsibility of the team, not others.
- Data input for external indicators should be completed before fieldwork. During the fieldwork, more time should be spent for interviews, data input for internal indicators and its analysis.
- It would be more effective to spend more time in the field in order to obtain more detailed information of the situation and characteristics of the system.
- The different canals should be observed in order to identify and understand more about the system.

### **5.3 Follow-up**

Apart from its purpose as on-the-job training following the training workshop, this initial RAP assessment can also be recognised as a trial assessment with limited, but currently available, data only. After one year (covering one dry and one rainy season crop) data collection for the final RAP is expected to fill in the missing data, to complete all the necessary steps of data input and analysis and to provide full information, interpretation and analysis of the selected pilot schemes. In particular the assumed data such as efficiency, percolation and so on is expected to be replaced for contributing more reliable result.

As some questions and indicators of the RAP are not suitable to evaluate characteristics of the Mekong Delta tidal irrigation system, improvement of the RAP to include some additional indicators to fit with tidal irrigation characteristics is proposed to and recognised by the FAO. The improved version of RAP data sheets is expected to be available for the final RAP.

At the final RAP, whole process of the assessment will be reviewed and revised, if necessary, once again in order to improve it and make it more reliable and applicable. In particular for the assumed data and some unclear points (which have been temporarily filled in this time) need to be replaced by more reliable information. The specific points need to be reviewed for the final RAP assessment is listed as below.

### **5.3.1 *Komping Pouy***

- 3 years (2005, 2006, and 2007) worth of data is required. Only the data of 2005 was filled in this time.
- Actual command area needs to be confirmed. The total command area is considered as 10,050 ha this time, however this value is for whole existing command area, which was operating more than 10 years ago with both right and left main canals. Today only the right main canal is in operation and the total command area of this canal is only 2,859 ha. The issue needs to be clarified next time.
- The data of conveyance and field efficiencies as well as seepage should be replaced by the result of fieldwork analysis.
- Data of  $EC_e$  of irrigation water should be confirmed.
- $K_c$  data should be checked if correct.
- The irrigation water from outside into the command area through irrigation canals and other external sources should be revised because the data filled this time is assumed.
- Water re-circulated within the command area such as water pumping inside of the command area for irrigation should be examined.
- The cropping pattern data should be replaced next time once the IIEPF field observation collects it.
- The calculation of effective rainfall was not reliable yet since a lot of estimation was made. The detail methodology should be identified by external resources such as the FAO.
- Specific water requirements such as water use for land preparation should be checked if correct.
- The result of Relative Water Supply (RWS) of the system seems extremely higher than usual cases. The information should be reviewed.
- All the answers from the project office down to on-farm level should be reviewed through the next interview in order to confirm if the responses are reliable enough.
- The accuracy of flow control and measurement (plus or minus in percentage) should be reviewed since method to estimate this value was not clear enough this time.

- The score given for the ability of present water delivery of scheme to support pressurised irrigation method is higher when compared with the score given to Huay Luang scheme. This score should be reviewed.
- Annual irrigation water delivery per unit consumed area of IPTRID indicators seems too low (1,811 m<sup>3</sup>/ha). This should also be reviewed.

### 5.3.2 *Num Houm*

- Input data need to be reviewed, whether to stay using 3-year data or if 4-year data is needed.
- The data of conveyance and field efficiencies as well as seepage should be replaced by the results of the field observation under the IIEPF project.
- Data of EC<sub>e</sub> of irrigation water should be checked.
- Kc data should be checked if correct.
- The irrigation water coming from outside into the command area through irrigation canals and other external sources should be revised. The water from external sources was not estimated this time.
- Water re-circulated inside command area such water taken from drainage canals through weirs and pumping should be taken into account.
- The cropping pattern needs to be reviewed. The cropping pattern of vegetables should be added.
- The calculation of effective rainfall should be reviewed.
- Some water requirements such as water use for land preparation, water supply for fishpond and vegetable gardens should be considered next time.
- All the answers from the project office down to on-farm level should be reviewed through the next interviews to improve the quality.
- The project budget data should be revised, as it was assumed this time.
- The accuracy of flow control and measurement (plus or minus in percentage) should be reviewed.
- The score to support pressurised irrigation method is higher compared with Huay Luang scheme. This score should be reviewed.
- The estimation of the production should include not only rice, but also fish and other livestock production. There are many fishponds as well as rearing of livestock in the command area using irrigation water, however these kinds of practices have not been taken into account this time.

### 5.3.3 *Huay Luang*

- Input data need to be reviewed, whether to stay using 3-year data or if 4-year data is needed.
- The data of conveyance and field efficiencies as well as seepage should be replaced by the result of field observation work under the IIEPF project.
- Data of EC<sub>e</sub> of irrigation water should be checked. The data this time does not seem reliable.
- The irrigation water coming from outside into command area through irrigation canals as external sources at RMC should be taken into account, as it was not estimated this time. The water taken for domestic use at RMC should also be considered for water balance calculation.

- Water re-circulated inside command area such as from drainage canals by farmers' pumps should be examined, as it was not considered.
- Estimation of effective rainfall needs to be reviewed, especially for different crops such as soybean, sugarcane, lotus etc.
- The answers for internal indicators should be reviewed in order to improve accuracy and reliability.
- The result of gross revenue of IPTRID indicators should be revised because the current result is affected by inaccurate data of the WUA budget.

#### **5.3.4 Go Cong**

- It is recommended that the final RAP assessment cover whole scheme, i.e. it should cover the main canals of Go Cong project, not only the secondary and lower level. The issue should be further discussed with the team.
- Data covering 3 years is requested next time.
- Capacity of the main canal and actual peak of the flow should be reviewed. The data should be replaced by the data recorded by the field observation under the IIEPF project.
- The special water requirements (except for crops) such as water for salinity control and for local navigation should be reviewed and discussed as well as methods to estimate these water uses.
- Ground water use data should be examined.
- External indicators should be reviewed.
- The estimation of actual water diverted and used for crops through the project field observation should be used to evaluate field irrigation efficiency, command area efficiency, relative water supply etc. However the conveyance efficiency cannot be calculated since there is no check structure along canal.
- As suggested by the resource persons from the FAO, additional indicators counting water level in the irrigation canal are important factors affecting the performance of the scheme. These indicators and others to improve the reliability of the scheme assessment should be further developed (through consultation with FAO.)

# **ANNEXES**



# **Annex 1**

## **Workshop agenda**



## ANNOTATED AGENDA

Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong River Basin project (IIEPF)

---- Training Workshop on Rapid Appraisal Process (RAP) ----

MRCS, Vientiane, 18-21 July 2006

<b>Day 1: Tuesday, 18 July 2006</b>			
08.30	09.00	Registration	
09.00	09.10	Opening Remarks	MRCS staff
09.10	09.30	Introduction of participants	
09.30	10.00	Introduction and Overview of Workshop Purposes	Mr. Thierry Facon, Senior Water Management Officer, FAO
10.00	10.30	<i>Coffee Break</i>	
10.45	12.00	Evolution of Modern Irrigation Systems	Dr. Zhijun Chen, Water Resources Development and Conservation Officer FAO
12.00	13.30	<i>Lunch</i>	
13.30	15.00	Lessons learned from previous RAP activities in the region	Mr. Thierry Facon,
15.00	15.15	<i>Coffee Break</i>	
15.15	16.30	Irrigation project Modernization	Mr. Thierry Facon
18.00	19.30	<i>Welcome diner</i>	
<b>Day 2: Wednesday, 19 July 2006</b>			
08.30	10.00	The Concept of Service - Equity, reliability and flexibility	Mr. Thierry Facon
10.00	10.15	<i>Coffee Break</i>	
10.15	12.00	Water measurement and control - Hydraulic Principles: the need to control levels and flows - System design: Upstream and downstream control - Basic structures: orifice and overflows sensitivity	Mr. Thierry Facon
12.00	13.30	<i>Lunch</i>	
13.00	13.30	<i>Confirmation of arrangement for conducting RAP with Lao team</i>	<i>Mr. Facon and MRCS staff</i>
13.30	15.00	Water balance	Mr. Thierry Facon
15.00	15.15	<i>Coffee Break</i>	
15.15	16.30	Irrigation efficiency and productivity	Mr. Thierry Facon
16.30	17.00	<i>Confirmation of arrangement for conducting RAP with Vietnamese team</i>	<i>Mr. Facon and MRCS staff</i>

<b>Day 3: Thursday, 20 July 2006</b>			
08.30	10.00	Evaluation of performance of irrigation projects (RAPs) - Performance assessment and Benchmarking - Rapid Appraisal Process - External Indicators - Internal Indicators	Dr. Zhijun Chen
10.00	10.15	<i>Coffee Break</i>	
10.15	12.00	Details review of the RAP worksheets	Dr. Zhijun Chen
12.00	13.30	<i>Lunch</i>	
13.00	13.30	<i>Confirmation of arrangement for conducting RAP with Cambodia team</i>	<i>Mr. Facon and MRCS staff</i>
13.30	15.00	Details review of the RAP worksheets (continued)	Dr. Zhijun Chen
15.00	15.15	<i>Coffee Break</i>	
15.15	16.30	Interpretation of indicators	Dr. Zhijun Chen
16.30	17.00	<i>Confirmation of arrangement for conducting RAP with Thai team</i>	<i>Mr. Facon and MRCS staff</i>
<b>Day 4: Friday, 21 July 2006</b>			
08.30	10.30	Group discussion (Q&A) by participants & trainers	Mr. Thierry Facon / Dr. Zhijun Chen
10.30	10.45	<i>Coffee Break</i>	
10.45	12.00	Review of data collection for the next conducting RAP	Dr. Zhijun Chen
12.00	13.30	<i>Lunch</i>	
13.30	14.30	Discussion on preparation of the next conducting RA P	Mr. Thierry Facon / Dr. Zhijun Chen MRCS staff
14.30	15.00	<i>Closing Workshop</i>	MRCS staff

**Annex 2**  
**List of participants**



**The Training Workshop on Rapid Appraisal Process (RAP)**  
**18-21 July 2006 at MRCS, Vientiane, Lao PDR**

**LIST OF PARTICIPANTS**

**Cambodia**

- |    |                   |   |
|----|-------------------|---|
| 1. | Mr. Thach Sovanna | Deputy Director of Water Resources Management and Conservation, MOWRAM                |
| 2. | Mr. Sao Samphois  | Deputy Director of Administrator and Human Resources Department, MOWRAM               |
| 3. | Mr. Hong Kimsan   | Deputy Director, Department of Water Resources and Meteorology of Battambang Province |
| 4. | Mr. Meas Peov     | Technical Officer of Agronomy and Agriculture Land Improvement Department, MAFF       |

**Lao PDR**

- |    |                             |   |
|----|-----------------------------|---|
| 5. | Mr. Khammay Vongsathiane    | Deputy Director, Technical Division, Irrigation Department, MAF |
| 6. | Mr. Phouthone Siriphanthong | Deputy Director, Operation and Maintenance Division, MAF        |
| 7. | Mr. Saykham Phengkhammy     | Deputy Chief, Irrigation Section, Vientiane Capital             |
| 8. | Mr. Bounhab Vongvichith     | Project Director, Nam Houm Irrigation Project                   |

**Thailand**

- |     |                             |                               |
|-----|-----------------------------|-------------------------------|
| 9.  | Mr. Suvech Kitchakarn       | Royal Irrigation Department   |
| 10. | Mr. Somsak Vivithkeyoonvong | Royal Irrigation Department   |
| 11. | Mr. Pramote Phuengphian     | Royal Irrigation Department   |
| 12. | Mr. Satit Sueprasertsuk     | Department of Water Resources |

**Viet Nam**

- |     |                    |   |
|-----|--------------------|---|
| 13. | Mr. To Quang Toan  | Senior staff, Southern Institute for Water Resources Research                         |
| 14. | Mr. Pham Duc Nghia | Senior staff, Southern Institute for Water Resources Research                         |
| 15. | Mr. Ung Hong Nghi  | Deputy Director, Company for hydraulic construction exploitation, Tien Giang Province |
| 16. | Mr. Luong Ngoc Lan | Director, Department of Agriculture and Rural Development, Bac Lieu Province          |



# **Annex 3**

## **Opening remarks**



**Opening Remark by Dr. Tu**  
**Training workshop on**  
**Rapid Appraisal Process (RAP) under IIEPF**

**on 18 July 2006 at MRC conference room, Vientiane**

Mr. Facon and Dr. Chen, FAO,  
Distinguished participants,  
Ladies and Gentlemen,

I am honoured, on behalf of Dr. Olivier Cogels, CEO of MRCS, to make the opening speech at the training workshop on “Rapid Appraisal Process” under the project namely “Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project.” This project is supported by the Ministry of Agriculture, Forestry and Fisheries, Japan. First of all, I express my sincere thanks to the MAFF and the Government of Japan for their continuous support to MRC in general and AIFP in particular.

This project aims to improve irrigation efficiency through the introduction of some guidelines covering technical, institutional and managerial aspects. The project organised the first regional workshop at this conference room in early May with active participation from the four member countries, and agreed upon the project concept and activities in general.

This training workshop is organised as a part of the project activities and aiming to transfer the technique to assess irrigation scheme performance. This technique is called “Rapid Appraisal Process” or RAP. I will not talk for too long about RAP, because Mr. Facon and Dr. Chen will give you more information through the training, but this is a very systematic diagnosis tool to assess the performance of the irrigation schemes. This was developed by FAO and has been widely applied to large-scale irrigation schemes.

We are conducting this training workshop with two purposes. The first purpose is to disseminate this strong tool to the irrigation engineers of the member countries and to expect them to apply RAP for their own work. The second purpose is a more direct expectation of the project. Participants of this workshop will contribute better results of the field observation work under the project.

I should emphasise my sincere appreciation to FAO. Without their active support, we could not have organised this training workshop. Mr. Facon and Dr. Chen provided a lot of useful recommendations to my staff since the project formulation stage up to now, and they also kindly accepted our invitation to participate as lecturers. Once again I appreciate FAO's cooperation in the project.

Lastly, through these four days training, I hope all the participants enjoy good health, enjoy staying in Vientiane, and of course, work hard and learn a lot, and improve your skill as irrigation engineers.

Thank you very much.

**Annex 4**  
**Development needs initial**  
**assessment**



**IIEPF training workshop – 18-21 July 2006**  
**Questionnaire**

**Name:**

**Country:**

**National/project:**

For those from the pilot systems, please answer the questions for your system. For those from National Committees, please answer the questions at national level for systems in the Mekong basin in your country

A. List, by order of decreasing priority, the 3 major objectives you would like to achieve by improving the performance of the irrigation system(s) and explain why.

**A.1.**

**A.1.2**

**A.1.3**

B. List, by order of decreasing importance, the 3 main issues or problem areas related to the performance of the irrigation system(s) you need to address to reach the 3 major objectives and explain why.

**B.1.**

**B.1.2.**

**B.1.3**

C. List, by order of decreasing priority, the 3 priority actions you need to implement to address the main issues relate to achieving your objectives for the irrigation system(s) and explain why.

**C.1.**

**C.1.2.**

**C.1.3.**



## HEPE Training Workshop Questionary

Fifteen responses received

### A. The 3 major objectives wish to achieve by improving the performance of the irrigation systems

A1	Vietnam	Provide enough water for irrigation and water supply (3 national) Extend irrigation area (1 project)
	Thailand	Increasing income of water users (1 national) Improve reliability and equity of water supply (1 national) Improve water distribution system at farm level (1 project) Strengthen consultation on water price and use (1 project)
	Laos	Increase irrigation area (1 national) Improve irrigation project and water management (3 national, 2 project)
	Cambodia	Increase the capacity of the reservoir (1 national)
A2	Vietnam	Reduce irrigation cost (3 national) Reduce water loss (1 project)
	Thailand	Improve system efficiency at all-front (1 national, 1 project) Enhance participation of stakeholders in water resources management (1 national) Protect the environment and ecological balance (1 project)
	Laos	Improve WUGs (1 national) Strengthen farmers' participation in irrigation O&M (4 national, 1 project)
	Cambodia	Extend irrigation systems (1 national)
A3	Vietnam	Reduce water pollution (3 national) Reduce irrigation cost (1 project)
	Thailand	Achieve sustainable development (1 national) Improve irrigation efficiency (1 national) Improve water measurement and monitoring (1 project) Achieve reasonable and equally water supply (1 project)
	Laos	Improve WUGs (4 national, 1 project) Realize self-financing for system O&M (1 project)
	Cambodia	Increase water delivery efficiency (1 national)

### B. The 3 main issues/problems related to the performance of irrigation systems need to be addressed

B1	Vietnam	Insufficient water in dry season due to salinity intrusion (3 national, 1 project)
	Thailand	Incomplete irrigation systems (1 national, 2 project) NGO's opposition make large irrigation project development difficult (1 national)
	Laos	Lack of water resources (1 national) Lack of technical support to WUAs (3 national) unequally water distribution (1 project)
	Cambodia	Insufficient water resources (1 national)
B2	Vietnam	Lack of forecasting for salinity intrusion (2 national) Uncomplete irrigation system (1 project) System degradation (1 national)
	Thailand	Unawareness of farmers on the importance of participation (1 national) lack of operation budget for water distribution from reservoir to farm plot (1 project) Lack of integrated management institution (1 project)
	Laos	Lack of irrigation systems for aquaculture (1 national) Lack of funds (3 national, 1 project) Insufficient maintenance due to low water-fee collection rate (1 project)
	Cambodia	Uncomplete irrigation system (1 national)

B3	Vietname	Lack of O&M strategies (3 national) Environment pollution (1 project)
	Thailand	Good management (1 national) Lack of budget and suitable policies (1 national) Lack of structures and equipment for water measurement and modelling (1 project) Lack of farmers participation (1 project)
	Laos	Limited capacity of WUGs (4 national, 1 project) Lack of farmers' participation (1 project)
	Cambodia	Insufficient water in the reservoir (1 national)

### C. The 3 priority actions need to be taken to address the main issues

C1	Vietname	Improve irrigation system (3 national) Change the cropping pattern (1 project)
	Thailand	Training for participants (1 national, 1 project) Develop or improve the existing reservoirs to increase storage capacity (1 national) Increase budget for ditch and dike construction to cover all farm land (1 project)
	Laos	Strengthen technical support to WUGs (5 national) Improve equity of water distribution (1 project)
	Cambodia	Strengthen water resources management and conservation (1 national)

C2	Vietname	Improve water management (3 national) Use water more economically (1 project)
	Thailand	Data collection and make database as the knowledge center (1 national) Strengthen water users' participation (1 national, 1 project) Provide adequate budget for system operation (1 project)
	Laos	Provide financial support (1 project) Establish irrigation development fund (3 national) Empower WUAs (1 project)
	Cambodia	Extend irrigation system (1 national)

C3	Vietname	Improve cooperation between water managers and water users' groups (1 national) Improve operation schedule (1 national)
	Thailand	Provide facilities to farmland (1 national) Strengthen water management (1 national, 1 project) Provide budget for water measurement and modelling (1 project)
	Laos	Empower WUGs (3 national, 1 project) Facilitate sustainable irrigation O&M (1 project)
	Cambodia	Facilitate sustainable irrigation O&M (1 national)

Question A. Three (3) major objectives by improving irrigation system

			Vietnam	Thailand	Laos	Cambodia
Physical	Extend irrigation system	1st 2nd 3rd				1
Physical	Increase reservoir capacity	1st 2nd 3rd				1
Physical	Provide enough water	1st 2nd 3rd	3			
Physical	Extend irrigation area	1st 2nd 3rd	1		1	
Operation	Improve reliability and equity	1st 2nd 3rd		1  1		
Operation	Improve water distribution system/project and management	1st 2nd 3rd		1	5	
Operation	Reduce water loss/Improve system efficiency	1st 2nd 3rd	1	2 1		1
Operation	Improve water measurement and monitoring	1st 2nd 3rd		1		
Management	Reduce irrigation cost	1st 2nd 3rd	3 1			
Management	Realize self-financing system	1st 2nd 3rd				1
Institutional	Enhance stakeholders' participation	1st 2nd 3rd		1	5	
Institutional	Improve WUGs	1st 2nd 3rd			1 4	
Pricing	Strengthen consultation on water price and use	1st 2nd 3rd		1		
Economy	Increase income of water users	1st 2nd 3rd		1		
Environment	Protect environment and ecological balance Reduce water pollution	1st 2nd 3rd		1		
Others	Achieve sustainable development	1st 2nd 3rd			1	

Question B. Three (3) main issues/problems related to system performance

			Vietnam	Thailand	Laos	Cambodia
Physical	Insufficient water	1st 2nd 3rd	4		1	1
Physical	Incomplete irrigation systems	1st 2nd 3rd	1	3	1	1
Physical	System degradation	1st 2nd 3rd	1			
Physical	Lack of measurement structure/equipment	1st 2nd 3rd		1		
Technical	Lack of forecasting for salinity intrusion	1st 2nd 3rd	2			
Management	unequal water distribution	1st 2nd 3rd			1	
Management	Lack of fund (operation budget)	1st 2nd 3rd		1 1	4	
Institutional	Lack of O&M strategy	1st 2nd 3rd	1			
Institutional	Lack of integrated management body Lack of management	1st 2nd 3rd		1 1		
Institutional	Lack of TA to WUAs	1st 2nd 3rd			3	
Institutional	Low rate of water fee collection	1st 2nd 3rd			1	
Institutional	Unawareness of farmers' participation Lack of farmers' participation	1st 2nd 3rd		1 1	1	
Institutional	Limited capacity of WUGs	1st 2nd 3rd				5
Social	NGO's opposition to irrigation development	1st 2nd 3rd		1		
Environment	Environmental pollution	1st 2nd 3rd	1			

Question C. Three (3) priority actions to address the main issues

			Vietnam	Thailand	Laos	Cambodia
Physical	Water resources development	1st			1	
		2nd				
		3rd				
Physical	Improve irrigation system	1st	3			
		2nd				1
		3rd				
Physical	Budget for tertiary level development Provide facilities to farmland	1st			1	
		2nd				
		3rd			1	
Operation	Budget for system operation/measurement and modelling Financial support	1st				
		2nd		1	4	
		3rd		1		
Operation	Improve operation schedule	1st				
		2nd				
		3rd	1			
Operation	Facilitate sustainable O&M	1st				
		2nd				
		3rd			1	1
Management	Equitable water distribution	1st			1	
		2nd				
		3rd				
Management	Economical water use	1st				
		2nd	1			
		3rd				
Management	Improve water management	1st				1
		2nd	3			
		3rd		1		
Management	Data collection and database	1st				
		2nd		1		
		3rd				
Management	Water users' participation Empowerment of WUAs	1st				
		2nd		1	1	
		3rd			4	
Institutional	Strengthen TA to WUGs	1st			5	
		2nd				
		3rd				
Institutional	Cooperation with water manager and water users	1st				
		2nd				
		3rd	1			
Agronomy	Change cropping pattern	1st	1			
		2nd				
		3rd				
Technical	Training	1st			2	
		2nd				
		3rd				



**Annex 5**  
**Introduction of the workshop**



## Training Workshop on Rapid Appraisal Procedure

MRCS, Vientiane  
18-21 July 2006

Improvement of Irrigation Efficiency on  
Paddy Fields in the Lower Mekong River  
Basin Project  
Financed by Gvt of Japan

## Resource Persons

Thierry Facon  
Senior Water Management Officer

Zhijun Chen  
Water Resources Development and Conservation Officer

FAO Regional Office for Asia and the Pacific, Bangkok

[Thierry.Facon@fao.org](mailto:Thierry.Facon@fao.org)

[Zhijun.Chen@fao.org](mailto:Zhijun.Chen@fao.org)

[www.watercontrol.org](http://www.watercontrol.org)

## Context

- Agriculture is the predominant economic sector of the Lower Mekong Basin, employs 85% of the population of about 60 million.
- Further agricultural development is required to feed rapidly growing population of the region.
- Agriculture sector is high on the agenda of each riparian country's development strategy.
- With the growing population and industry in the region, the competition for water between different sectors and even among different crops is also growing and the situation calls for Integrated Water Resources Management (IWRM) at the irrigation system, national and basin levels.

- rice is dominant crop of the Lower Mekong Basin.
- rice is the single biggest user of fresh water in the region.
- lack of rainfall in the dry season and dry spells in the rainy season are among the major constraints to rice production, particularly in rainfed areas, and water productivity in paddy fields remains low in both rainfed and irrigated rice.
- For further development of water resources in the region and investments in irrigation, it is important to increase efficient use of water in paddy fields.

- Irrigation efficiency varies between countries but is low in general.
- Low efficiencies lead to water shortages within the command area of irrigation schemes particularly in the dry season or dry spells during the rainy season.
- Improvements in irrigation efficiency will lead to improved equity in water distribution and minimize the gap between crop water requirement and actual water use.
- Previous studies that provide some kind of estimates mainly analyze field level efficiencies and lack the use of modern and up-to-date concepts of irrigation efficiencies and water balance.
- There is not enough information available in the region on reliable estimates of irrigation efficiencies and actual water use.

- Assessment of irrigation efficiencies alone does not provide insights into how these could be improved.
- An appraisal of selected paddy field irrigation scheme as a whole and at different levels: main system level, distributional level, tertiary level, and field level; and assessment of different components of irrigation system management will provide insights into the constraints causing the low efficiency levels.

- Irrigation schemes provide water also for other uses, such as fish farming, domestic water supply, etc.
- Their requirements should also be considered.
- Paddy fields also provide ecosystem services at basin level (multi-functionality).
- Once the constraints and the bottlenecks are known, only then the improvements for increasing water use efficiency could be identified.

- Rigorous analysis of water use situation in an irrigation system using up-to-date concepts and tools will allow the managers and decision makers to plan targeted improvements in order to improve irrigation efficiencies, which is the main goal of IIEPF.
- Modern methodologies to appraise irrigation projects provide insights in the bottlenecks and help to identify potentials for improvements.
- One such methodology is the Rapid Appraisal Process (RAP), which has been widely used by FAO and the World Bank for evaluating irrigation system performance and prioritizing improvements for modern management of the systems.

### Purposes of the training workshop

- To understand the principles and process of Benchmarking and the Rapid Appraisal Process (RAP):
  - to understand the concepts and technical details of irrigation project modernization
  - to learn how to properly evaluate an irrigation project, using a systematic diagnostic procedure that includes both visits to the district office to interview project staff, and field work evaluating items such as control structures, operational strategies, communications, and water delivery service

- to discuss more in details issues of water balance, efficiencies at different scales and multiple use of irrigation water
- to analyze the collected data, both manually and using computers, and arrive at Benchmarking, and Rapid Appraisal indicators
- to interpret the Benchmark and Rapid Appraisal indicators in terms of the level of water delivery service, including the strengths and weakness in the service provided, and to identify best practices
- to learn how to make specific recommendations and to establish priorities for modernization that will result in improved project performance.
- To prepare and confirm arrangements for the RAP of the pilot projects, which will be carried out after this workshop.

### Some observations

- This workshop will be dominated by lectures, but we will try to make it participatory.
- The workshop will be followed by direct application: you will conduct the RAPs of your systems, perform the analysis and make recommendations.
- First understand the situation.
- Then define objectives.
- Then select the most simple, robust, and economical ways of meeting those objectives.

The RAP assists with this. We do not begin with solutions; we begin by understanding the situation and the objectives.

## Irrigation modernization and benchmarking and management improvement training workshop

- Alor Setar and Langkawi, Kedah, 27 February-7 March 200
- FAO
- DID

## Resource Person

Thierry Facon  
Water Management Officer

FAO-Bangkok  
[Thierry.Facon@fao.org](mailto:Thierry.Facon@fao.org)  
[www.watercontrol.org](http://www.watercontrol.org)

## Context

- Need to drastically improve water resources management in the face of growing water scarcity and increasing population in order to continue on the path of socio-economic development;
- Irrigation management transfer and participatory irrigation management;
- Output and performance oriented management of public agencies;

- Agricultural modernization is one of the key objectives of the Government;
- Irrigation modernization to move towards integrated water resources management and support agricultural modernization;

- The performance of irrigated agriculture needs to be drastically improved:
  - if water demand for feeding the population, agricultural development and satisfying the needs of other sectors is to be met;
  - to achieve socio-economic development goals;
  - To face international competition;
  - For the viability of irrigation systems;
- Modernizing water delivery and irrigation infrastructure to enable and support the institutional change objectives and future water allocation is a priority and substantial investments which are made should serve this purpose.
- We want to know the conditions for successful improvement of OFWM in large-scale system

- Modernization of irrigation systems is a complex and far-reaching process that involves institutional, managerial and technical change and needs to be tailored to local circumstances.
- Staff are not familiar with the underlying concepts to appraise and evaluate appropriate irrigation modernization strategies and investments .
- Good knowledge of the options, tools and techniques for planning and carrying out modernization programmes will be essential during both during projects preparation and implementation.

## Malaysia-DID

- Benchmarking
- International benchmarking programme IPTRID, IWMI
- Holistic benchmarking, World Bank
- Langkawi 2004
- Lodojo, Indonesia: Daud and Anuar

## Objective

On-the-job training in irrigation modernization, management improvement and benchmarking for the staff

To include the RAP as a component of benchmarking

To ensure that future irrigation modernization would:

- be effective, adapted and appropriate
- reflect modern approaches and concepts to the design, operation and management of irrigation schemes
- take stock of international experience
- Support agricultural performance

To apply the new knowledge and idea:

- On the MADA irrigation system
- To discuss application in other systems in the country

## Topics (1)

- Concepts:
  - Inter-related factors within irrigation projects
  - The concept of service
  - Integrated Water Resources Management and Irrigation Modernization
  - Irrigation Management Transfer and Irrigation Modernization
  - Economic and financial evaluation
  - Water balance
  - External indicators that describe irrigation project performance

## Topics (2)

- Concepts:
  - Internal indicators of irrigation projects
  - Rapid Appraisal Procedure (RAP)
  - Comparison with other international projects
  - How to develop a modernization plan
  - Typical actions taken for modernization
  - Management tools
  - Physical tools
  - Water pricing ...

## Topics (3)

- Field Work:
  - Complete a RAP in MADA
  - Develop internal and external indicators for the project
  - Develop a preliminary action plan for the modernization of the project
  - Discuss the applicability of irrigation modernization concepts to other projects in Nepal

### Programme

- Saturday and Sunday 28-29 Feb  
Lectures, Alor Setar
- Monday to Wednesday 1-3 March  
MADA
- Thursday 4 March  
Social tour
- Friday to Sunday 5-7 March  
RAP and modernization plan, Langkawi

### Some observations ...

This will need to be a truly participatory workshop.

At first, it will be dominated by lecture format, but in the end you will:

- make your own assessment of the irrigation project we visit
- develop, discuss and finalize a modernization plan

### Some observations ...

- Sometimes an evaluation sounds critical, but a main purpose of a Rapid Appraisal Process is to learn about what things can be CHANGED to improve performance.

### Some observations ...

- First understand the situation
- Then define objectives.
- Then select the most simple, robust, and economical way of meeting those objectives.

The RAP assists with this. We do not begin with solutions; we begin by understanding the situation and the objectives.

This is how the RAP assists in bringing benchmarking into management processes



**Annex 6**  
**Lessons learnt from the**  
**previous RAP**



**A RAPID APPRAISAL PROCEDURE  
TO ASSESS THE PERFORMANCE  
OF IRRIGATION SYSTEMS:**

**LESSONS FROM A FAO REGIONAL  
IRRIGATION MODERNIZATION  
AND MANAGEMENT TRAINING  
PROGRAMME IN ASIA**

Thierry Facon  
Senior Water Management Officer  
FAO - Bangkok

The need for a massive re-training of  
engineers and managers in irrigation  
agencies, consulting firms and  
Irrigation Service Providers in Asia

- farmers aspire to improved socio-economic well-being, evolve toward more commercial forms of agriculture and face the challenges of globalization
  - water resources management is moving towards integrated water resources management in the river basins, and competition for water from other sectors is intensifying
- =>knowledge and ways and means to design, manage and operate irrigation systems economically for good performance and adequate service to farmers

Why...

- i/ evaluation of the performance of the introduction on modern water control and management practices  
**lack of knowledge of proper options a main reason for the mitigated success of irrigation modernization projects**
- ii/ the disappointing performance of irrigation management transfer and participatory irrigation management projects  
**failure of these reforms to improve service to farmers**
- iii/ lack of attention to operation, design and other technical aspects of irrigation systems  
**technology matters, after all**
- iv/ problems with OFWM projects  
**the need to address all levels within the systems**

An appraisal of initial conditions  
and performance of the systems to  
be transferred or improved

For:

- a definition of the service to be provided both by the irrigation service provider to water users associations (WUAs) and by WUAs to their members
- ways and means to achieve these service goals and improve them in the future
- a better design and strategic planning of physical and management improvements

FAO's Regional Training Program  
on Irrigation Modernization,  
management improvement and  
benchmarking

- disseminating modern concepts of service-oriented management of irrigation systems
- promoting the adoption of effective irrigation modernization strategies in support of agricultural modernization, improvement of water productivity and integrated water resources management

Modernization

- "Irrigation modernization is a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes with the objective to improve resource utilization (labor, water, economics, environmental) and water delivery service to farms."

## Since 2000

- training materials and detailed curricula
- specific tools for the appraisal of irrigation systems for benchmarking and the development of appropriate modernization plans for irrigation systems:

### Rapid Appraisal Procedure

- website: [www.watercontrol.org](http://www.watercontrol.org)
- first training workshop in Thailand in 2000
- Vietnam, Philippines, Nepal, Thailand, Indonesia, Malaysia, Turkmenistan, Pakistan, India (Andhra Pradesh), Afghanistan

### • Thailand

the Royal Irrigation Department of Thailand is using the tools and methodologies introduced by the Program for the appraisal of projects, and has included the training workshops in its regular training program.

### • Vietnam

the World Bank-funded Vietnam Water Resources Assistance Project has a large irrigation modernization component based on the concepts introduced through training at project preparation stage

### • Malaysia

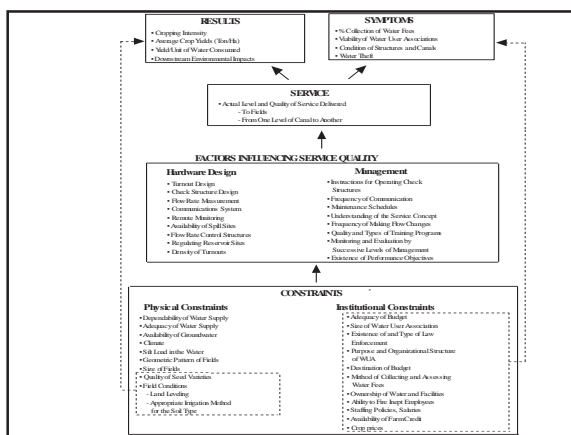
DID has included the training program and its tools in its Quality and Modernization Strategies and national benchmarking programme: proposals for modernization of the systems have to be submitted to decision makers based on modernization plans developed by managers following their training and the appraisal of their systems with the RAP

### • Andhra Pradesh

a core team for training and appraisal of large systems, with inputs into water policy review and water visioning process

## The Rapid Appraisal Procedure (RAP)

- Developed by the Irrigation Training and Research Centre (California Polytechnic University) for a research programme financed by the World Bank on the evaluation of impact on performance of irrigation systems of the introduction of modern control and management practices in irrigation
- Adopted for FAO's training programme
- Further developed to be more user-friendly, focus on water balance, produce IPTRID benchmarking indicators
- Adopted as one of the three tools of the World Bank's holistic benchmarking method
- available in English, Spanish, Thai, Indonesian, Vietnamese, Russian, Chinese



Primary / Sub Indicator	Ranking Criteria	W
<b>Actual water delivery service to individual ownership units (e.g., field or farm)</b>		
Measurement of volumes to the individual units (0-4)	4 - Excellent measurement and control devices, properly operated and recorded. 3 - Reasonable measurement and control devices, average operation. 2 - Useful but poor measurement of volumes and flow rates. 1 - Reasonable measurement of flow rates, but not of volumes. 0 - No measurement of volumes or flows.	1
Flexibility to the individual units (0-4)	4 - Unlimited frequency, rate, and duration, but arranged by users within a few days. 3 - Fixed frequency, rate, or duration, but arranged. 2 - Dictated rotation, but it approximately matches the crop needs. 1 - Rotation deliveries, but on a somewhat uncertain schedule. 0 - No established rules.	2
Reliability to the individual units (0-4)	4 - Water always arrives with the frequency, rate, and duration promised. Volume is known. 3 - Very reliable in rate and duration, but occasionally there are a few days of delay. Volume is known. 2 - Water arrives about when it is needed and in the correct amounts. Volume is unknown. 1 - Volume is unknown, and deliveries are fairly unreliable, but less than 50% of the time. 0 - Unreliable frequency, rate, duration, more than 50% of the time, and volume delivered is unknown.	4
Apparent equity to individual units (0-4)	4 - All fields throughout the project and within tertiary units receive the same type of water delivery service. 3 - Areas of the project receive the same amounts of water, but within an area the service is somewhat inequitable. 2 - Areas of the project receive somewhat different amounts (unintentionally), but within an area it is equitable.	4

## The RAP Excel sheet



## Objectives of RAP

- Provide a basis for making specific recommendations for modernization and improvement of water delivery service
- Provide a baseline for comparison of future performance after modernization
- Benchmarking for comparison against other irrigation projects

## RAP Outputs

- External indicators
  - Examine inputs and outputs of the whole project
- Internal indicators
  - Examine processes and hardware within the project
- IPTRID Benchmark indicators
  - Mostly external indicators

## External Indicators

- Ratios or percentages comparing project inputs and outputs to describe performance
- Expressions of forms of efficiencies related to budgets, water, yields, etc.
- Do not provide insight in how to improve performance

## Example External Indicators

$$\frac{\text{Water Required}}{\text{Total Water Available}}$$
$$\frac{\text{Crop Yield}}{\text{Irrigation Water Delivered to the Fields}}$$

## Internal Indicators

- Identify key factors related to water control throughout a project.
- Define level of water delivery service provided to users.
- Examine specific hardware and management techniques and processes used in the control and distribution of water.

## Benchmarking

- a systematic process for achieving continued improvement in the irrigation sector through comparisons with relevant and achievable internal or external goals, norms, and standards
- Goal: to improve the performance within an irrigation scheme by measuring its performance against its peers and its own mission and objectives
- the benchmarking process should be a continuous series of measurement, analysis, and changes to improve the performance of the schemes

## For benchmarking to go beyond measurement and analysis, on to the implementation of changes and improvement stages

- significant acceptance by project personnel
- identification of weaknesses and potential changes
- knowledge of options for change

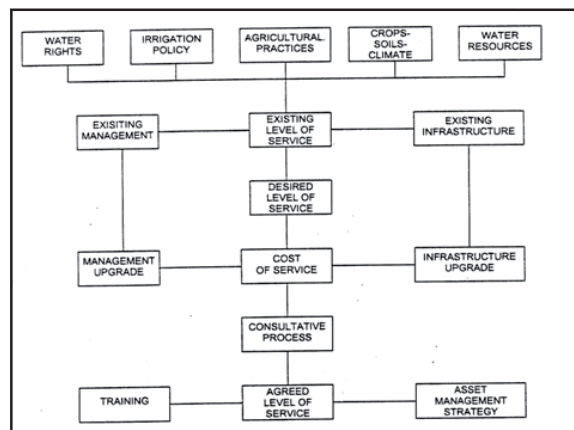
- The RAP is incorporated into the training program that integrally involves local management and operation and maintenance staff.
- Staff:
  - learn the concepts of modernization and service orientation
  - are provided with a toolbox of options
  - evaluate their own project with the RAP

## At the end of the training

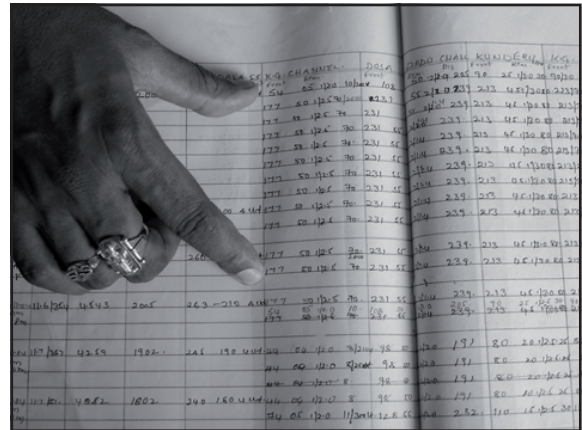
- internal and external indicators are developed for the project and compared with other projects
- local staff develop a modernization strategy and a priority list for changes in software and hardware based on the internal process and service indicators (which appraise all factors that affect system performance and service delivery in a systematic and standardized manner)
- to improve specific characteristics of service delivery at specific levels and address constraints
- to achieve improvement objectives, defined by the external performance indicators.

## The plans

- Very short term with very limited budget
- Short term with limited budget
- Medium term with more substantial budget
- Software and hardware
- Step-wise approach
- All actions justified by improvement in service



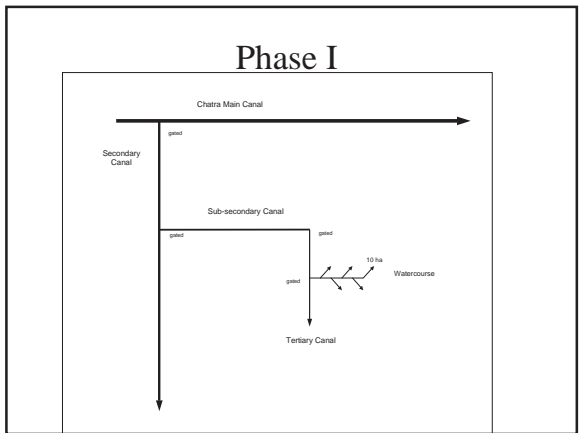
# The appraised systems

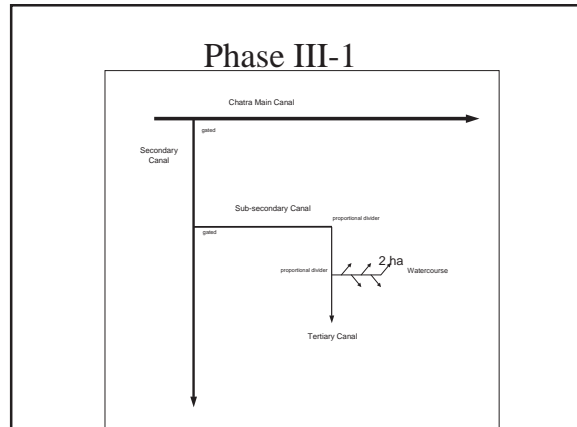
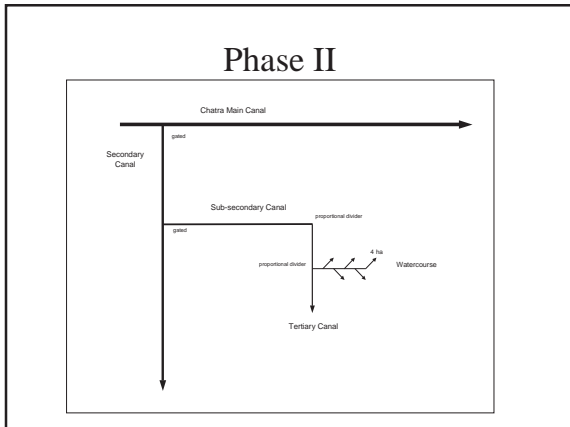












### Internal indicators

Internal Indicator	Gated System Stage I (Group A)	Proportional Flow Stage III – Phase I (Group B)	Undeveloped Area Stage III (Group C)
Actual service to individual fields	0.9	1.8	1.3
Actual service to most downstream point operated by a paid employee (tertiary canal level)	0.5	1.4	1.2
Actual service by main canal to secondary canals	1.7	2.6	0.9
Overall Index of cross regulators in third level canals	1.7	2.2	1.1

### Plan before workshop

- Another phase of command area development Phase III-2 using the same concept of structured design in the undeveloped area

- ### Issues
- **FUNDING**
    - Irrigation Service Fee (ISF) collection rate is very low (1)
    - The official O&M budget is inadequate and the timing of release is delayed (3)
    - The role of cost sharing of rehabilitation with WUG/WUC/WUCCC (9)
  - **CHATRA MAIN CANAL**
    - Water delivery service is not equitable from main canal to secondary canals (2)
    - Operating rules for the cross regulators in the main canal (5)
    - Operation of the hydropower station is done by a separate agency (10)
  - **POOR LEVEL OF SERVICE** (4)
    - The quality of service at all levels of the canal system needs significant improvement
  - **CHAOS**
    - Care and protection of all canals (vandalism, cattle, etc.) (7)
    - Illegal diversions and field outlets that do not match the layout of fields (8)
  - **WATER SUPPLY** (6)
    - During the winter and spring seasons the water supply is reduced by 50-70%
  - **COMMUNICATION** (9)
    - Ineffective or unclear communication between secondary canals and Headworks
    - The decision making process and coordination between water users and DOI

- ### New Water Management Strategies
- to transform SMIP into a service-orientated organization with a re-configured strategy of managing its surface water and groundwater resources.**
- Winter/Spring – better matching of available water supplies and demand through crop diversification, crop planning, and improved water supply forecasting, among others
  - Increase the equity at the tailend of the Chatra Main Canal by better control and monitoring of flows into the secondary canals
  - Drainage re-circulation at the secondary canals. (Ones that are close together)
  - Conjunctive use as a supplementary supply in areas not served by canals

### **First Stage Action Items (2004)**

- Chatra Main Canal – new operating rules for constant water level control at each cross regulator and training staff for implementation
- Maintenance – there are various structures such as siphons, control gates, aqueducts, etc., that require immediate repair or replacement.
- Communication – the communication difficulties among operators and key control points, especially along the main canal, will be solved by purchasing new equipment and closer coordination with WUG operators and laborers.
- Meaningful information for operations and planning (e.g., flow rate into main canal, flow rate into the secondary canals, sensitivity analysis of cross regulators, monitoring drainage flows including both timing and locations)
- Care and protection of structures with cooperation from WUG, WUC, WUCCC

### **Remarks on the plan**

- achievable steps that the SMIP managers, engineers, and operational staff can implement very quickly with a minimum of investment
- recommendations target the operation of the Chatra Main Canal because improving the quality of service further downstream in the system is only possible once equity is established with the secondary canals that serve the Undeveloped areas.
- this new approach, centered on restoring order to the main and secondary canals, is intended lay a foundation for future participatory management of SMIP.

### **Summary findings**

- high level of chaos (difference between stated policies and actual policies)
- high level of anarchy (subversion of policies) varies from system to system
- Recent investments following standard standards or investment strategies (command area development) have poor results in terms of performance, control and service.

### **discipline and institutional issues , but many of the problems can be traced to:**

- Problems in initial design;
- Exporting of design concepts outside of their area of validity;
- Difficulty to control and operate the systems;
- Layouts with confused hierarchies;
- Serious flaws in operation strategies and instructions to staff;
- Inconsistencies between operating rules at various levels;
- Inconsistencies between operating rules and farmers' requirements;
- Changes in farmers' requirements not reflected by changes in system policies;
- Poor quality of water delivery service to farms;
- Lack of flexibility at all levels;
- Staffing policies;
- Poor training of staff at all level, in particular, poor understanding of unsteady flow hydraulics.

- Standard project improvement projects, as reflected in pre-training proposals, usually fail to address these issues.
- Modernization proposals for the irrigation systems that were appraised, prior to the training workshops, usually failed to establish a linkage between system-level objectives and proposals and stated objectives for the introduction of improved or innovative irrigation technologies at farm level, or between new performance objectives and proposed reform of the management and institutional setup.

### **Plans prepared by the trainees differ very significantly from their plans prior to the workshop.**

- new technical options
- balanced investment in upgrading the capacity of management and farmers and in infrastructure, in infrastructure, communication and mobility for operation staff
- planned investment in infrastructure focuses much more on control and measurement as a priority
- Priority: changes in instructions to field staff for operation of control structures
- changes in internal organization
- improved procedures for ordering of deliveries
- an initial focus on restoring and improving water level control in the upper levels of the systems as prerequisites for further improvements and investments in the lower levels.
- the remote monitoring of spills, drains, and flow-rates at major offtakes as a basis for the establishment of feedback mechanisms, as well as for a better understanding of the water balance of the systems.

## The challenge

- Asian large surface irrigation systems suffer from a legacy of poor design, degraded infrastructure and poor management and stagnation in the face of rapid transformations of agriculture and pressure on their water supply.

- The challenge is to transform these systems from supply driven to demand-driven responsive systems, improve their financial, environmental, technical and service performance to significantly increase control, reliability, equity and flexibility

- Financing all this would require considerable investments while rice prices are expected to remain low in the medium term and present financing arrangements do not cover operation and maintenance costs, let alone investments in upgrading of management capacity and infrastructure.
- It is imperative that increased attention should be paid to the quality and type of investment.

The main lesson from the FAO Regional Modernization Training Program is a paradox

- this challenge is both under-estimated and over-estimated

## Under-estimated

- there has been in the recent past excessive reliance in policy reform, institutional reform, improved control technology, improved management, economic incentives and instruments or on-farm water management as measures which would single-handedly deliver improved performance or service.
- The detailed appraisal of the irrigation systems which were investigated through the Regional Training Program indicates that a complex and articulated mix of changes in all these fields would be in fact required;
- the actual performance of the systems, particularly in terms of service delivery, is frequently over-estimated.

## Over-estimated

- there exists a considerable potential for significantly improving system performance and service with the adoption of simple and low-cost measures, provided that:
  - an increased focus on all details of operation, management and design is adopted
  - planners and managers are aware of better options that are now available, through training and capacity building.

- when irrigation planners and managers are presented with these options which they were not aware of and when, furthermore, they work together in developing proposals based on a detailed appraisal of the systems, they embrace them

far-ranging and comprehensive reform or substantial investment will be needed.

- but it is possible to initiate a process of transformational change with immediate benefits to farmers, in terms of service, and managers, in terms of ease of operation
- this will allow the necessary reform agenda and investment programs to be:
  - more strategically focused,
  - achievable in a realistic step-wise approach,
  - more easily implemented,
  - acceptable to the various stakeholders
  - able to adapt to rapidly changing circumstances.

### The Rapid Appraisal Procedure and benchmarking

- It has been argued that the RAP cannot be considered as performance benchmarking on the ground that it focuses on planning investment in modernization of water control infrastructure, requires well-trained and experienced engineers, does not lend itself to regular application on a large number of schemes and does not use comparison, over time and between schemes, as the basis for identifying performance gaps and planning improvements.

### The RAP:

- uses comparison over time and between schemes
- assesses all processes of management and operation as well as hardware
- can be and is applied over a large number of schemes (Thailand, Vietnam, Malaysia)
- can be a useful and critical component of a national benchmarking program aiming at improvement of sectoral performance if used at the inception of the program, when systems managers develop their strategic plans or system upgrading plans, or to evaluate the impact of improvement projects, as is the case in Malaysia.

### The RAP requires well-trained and experienced engineers

- Any significant improvement in the sector's performance in Asia will require well-trained and experienced planners, designers, managers and operators.
- FAO and national irrigation agencies in Thailand, Malaysia and Andhra Pradesh, introduce the RAP within a training program where trainees appraise their own systems with the support of a team of expert appraisers and trainers from the central office.
- Support from a core team of expert appraisers and trainers, who are also external to the system, is essential for quality control of the Rapid Appraisal Procedure.

### The RAP and management

- The benchmarking process will only be applied where managers "embrace the goal of pursuing best management practices within a service oriented management system" and this implies a focus on the quality and cost-effectiveness of service delivery (Malano, 2004).
- This is the most original feature and central message of the Rapid Appraisal Procedure.
- By concentrating on service interfaces between the different levels, the RAP facilitates taking into account the objectives and concerns of the operators at all levels, from the upper level managers, to the Water Users Associations which may exist in the system, to the farmers who receive service from them.

## Focus on control infrastructure

- in the perspective of service delivery, control, operating rules, and management responsiveness.
- poor selection and operation of the systems' control structures play a decisive role in system service performance.
- decisions on control structures (their maintenance, their operation, their replacement) are therefore critical management decisions
- poor decisions on infrastructure or sterile investment programmes that will not yield desired performance or service improvements are simply poor management decisions.

## Asset serviceability

- “the serviceability of an asset (that is, its ability to perform its function) is often assumed to be directly related to its condition. But this can be a misleading assumption. In practice, assets very often continue to perform their function quite satisfactorily even though their condition is significantly deteriorated. On the other hand there are frequent instances when an asset which is generally in excellent condition is rendered unserviceable by a very minor fault. It is the serviceability therefore which dictates the urgency of the work needed to restore the asset to its fully functional state” (IIS-ODA, 1995).
- Asset surveys assessing the condition and serviceability of structures are focused on the asset's condition and needs for repairs or maintenance.

## An asset can be brand new and perform poorly because of:

- poor design (a Rominj gate for instance or a measuring flume which is too wide)
  - any decision that does not lead to the replacement with a different design (Rominj gate) or modification (measuring flume) of the asset will be a poor asset management decision
- poor operation
  - Not changing instructions to the operators will not lead to an improved serviceability of the asset

## The RAP and serviceability

- design and operation problems are significant in the systems
- focus on quality of control with and interactions between control structures, and on actual operation of these structures
- The RAP: a useful and critical addition to asset management methods which focus on asset serviceability as

## Future development of the tool

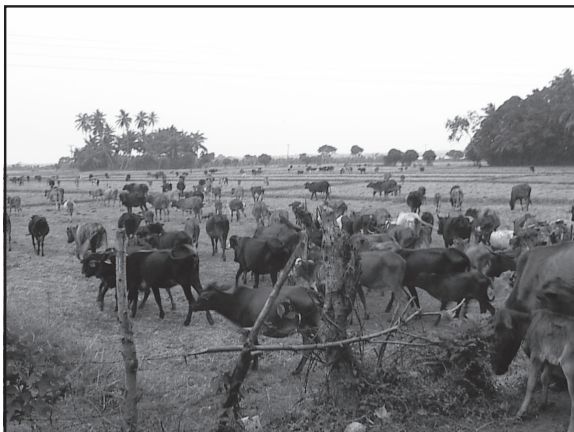
- developing additional indicators to better address:
  - drainage and water disposal services
  - the multiple roles provided by the irrigation systems.

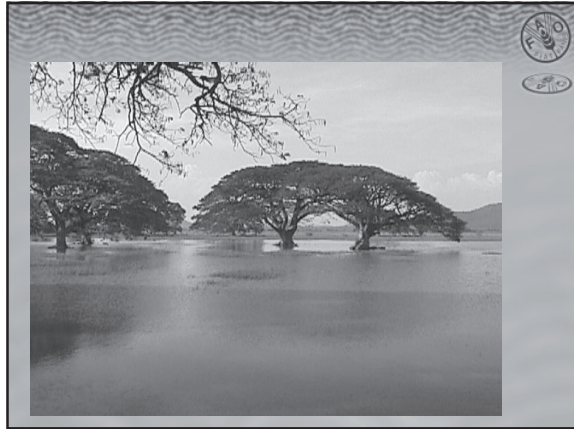
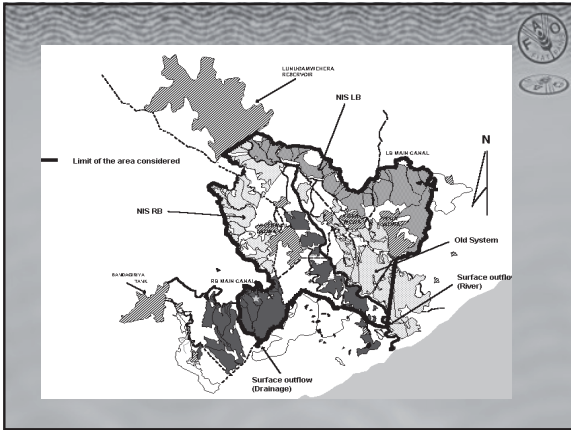
THANK YOU FOR YOUR  
ATTENTION

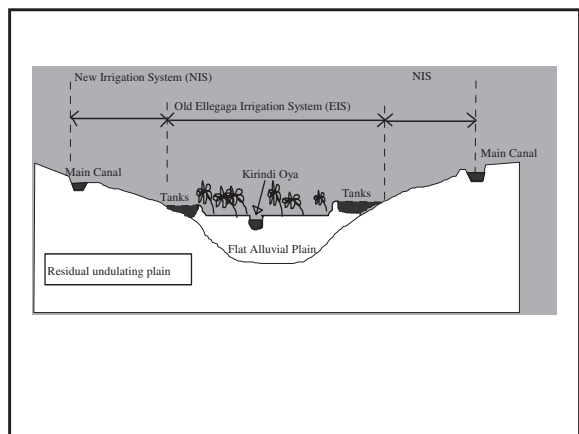
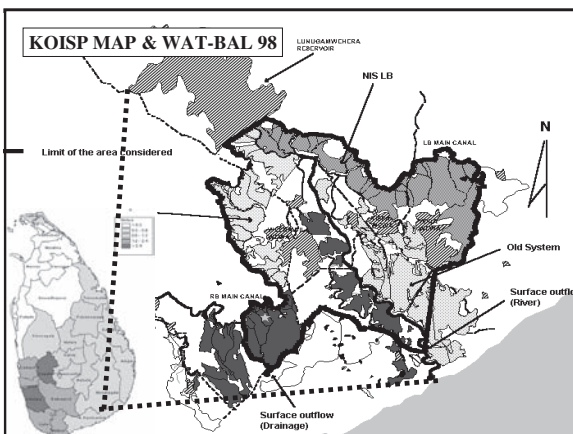
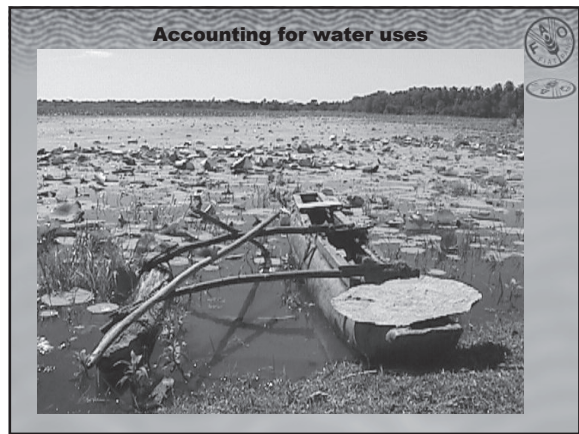
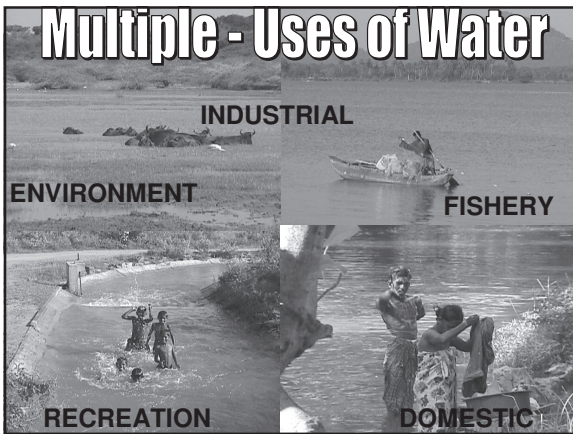
**Annex 7**  
**Multiple use of water**

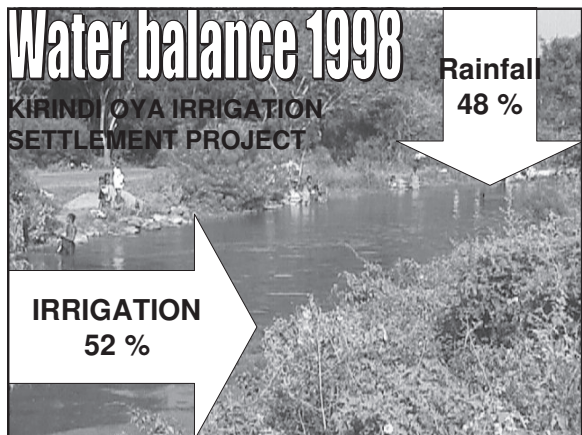
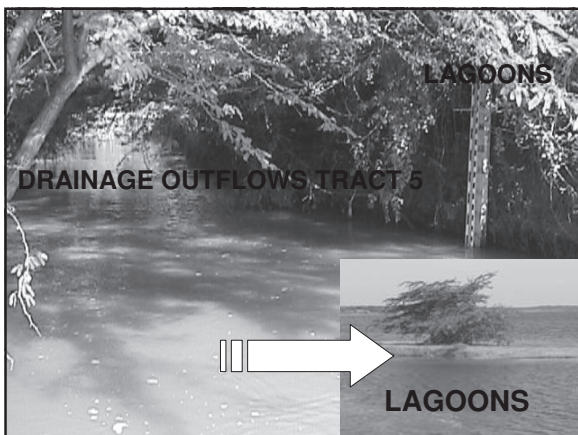
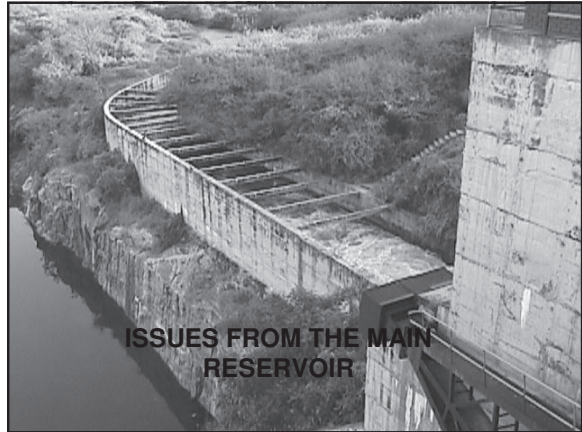


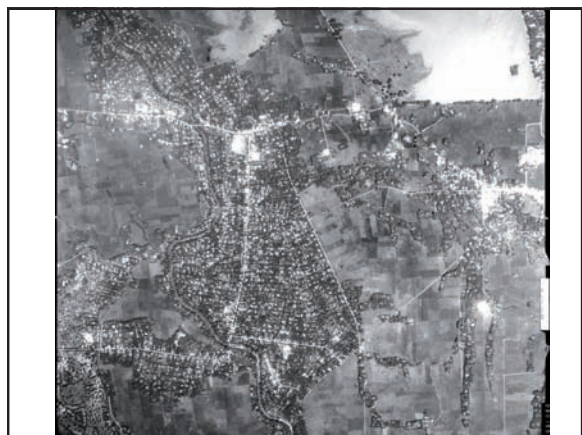
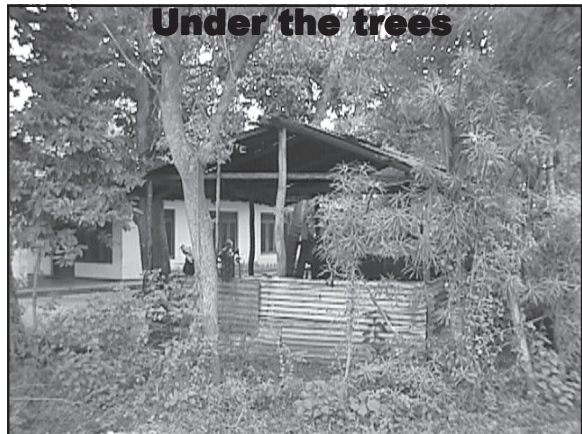
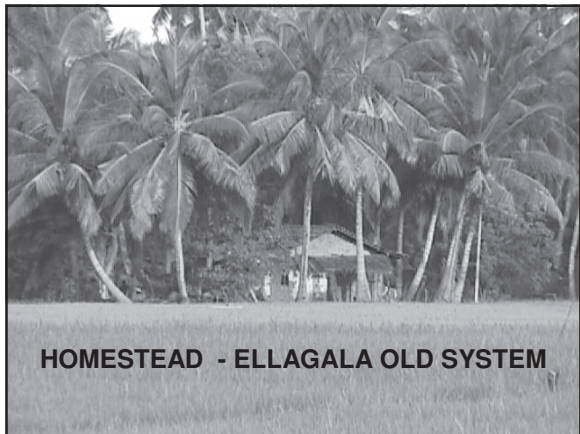
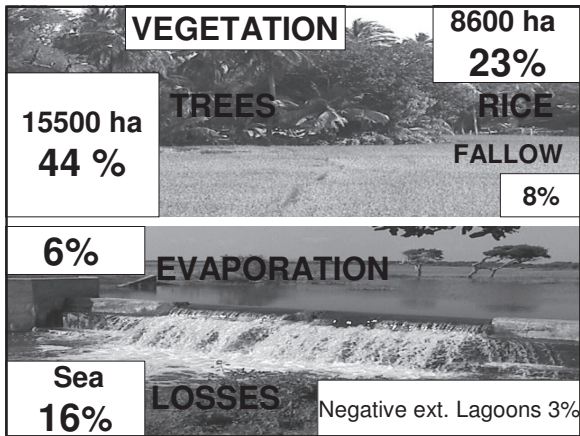
**MULTIPLE USES OF WATER IN IRRIGATION SYSTEMS**

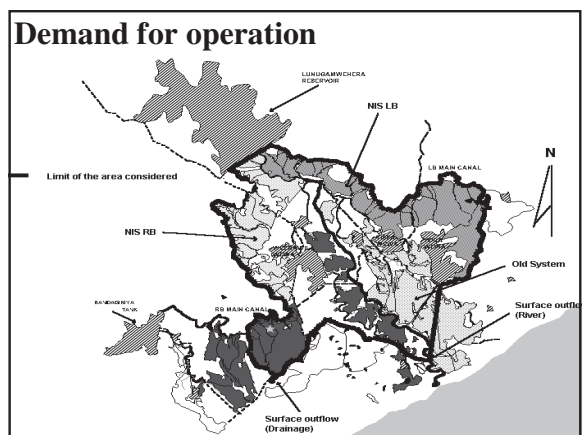
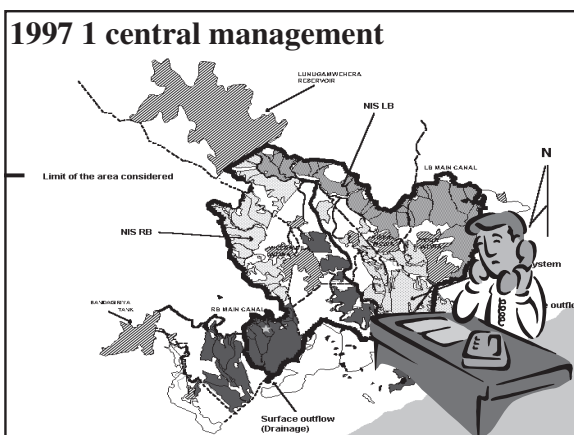
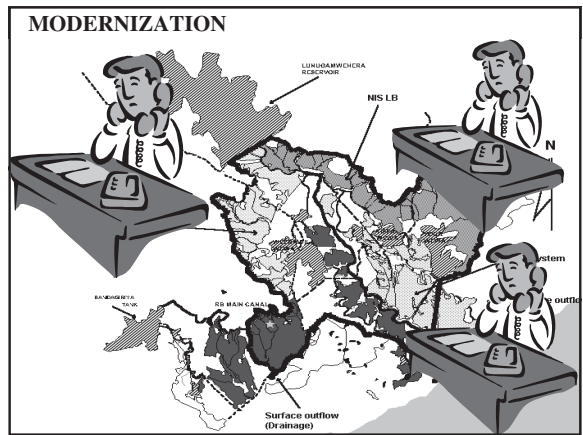
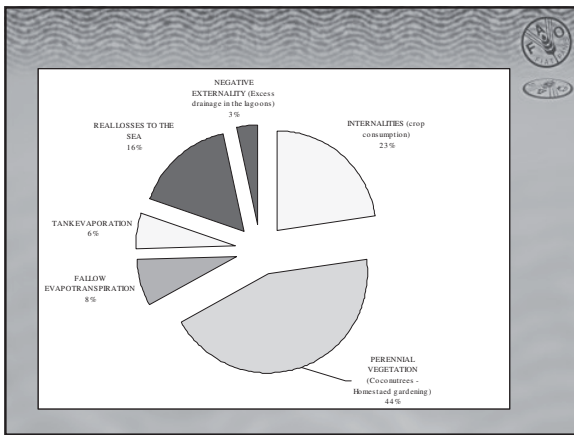


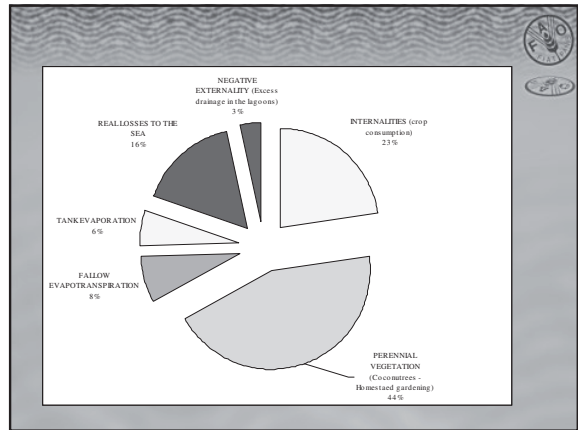
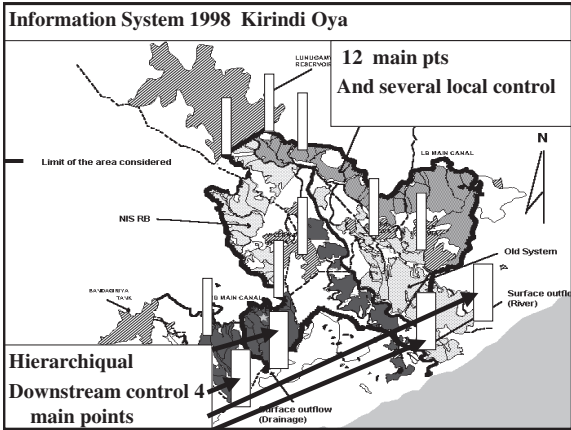












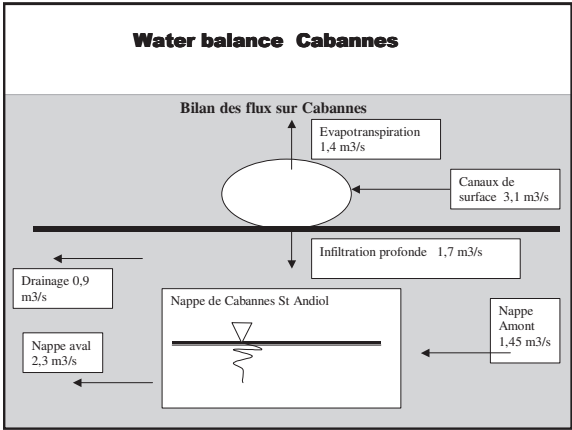
**Achievement = Irrigation intensity raises from 140% to 200 %**  
**5000 farmers (new system) = from 1 to 2 crops/year**  
**4 millions \$/year generated**  
**Cost= less than 100 000 \$ ha.**  
**Still pending = institutional set up for Xuse and high externalities**

**IRRIGATION MODERNISATION  
FRANCE - CABANNES 13 1980**

**Surface system**

**groundwater overuse**

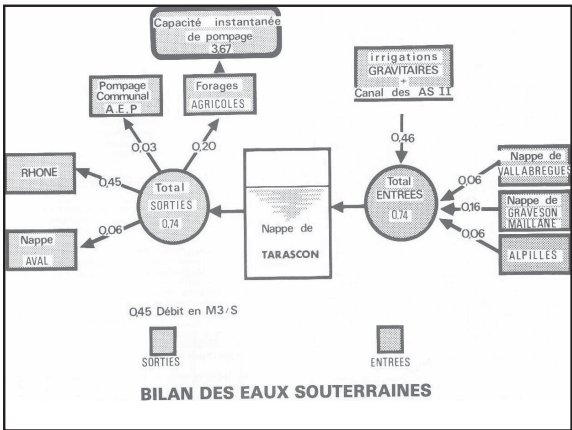
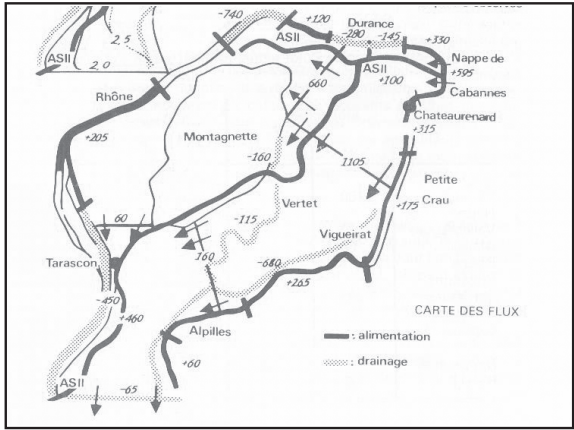
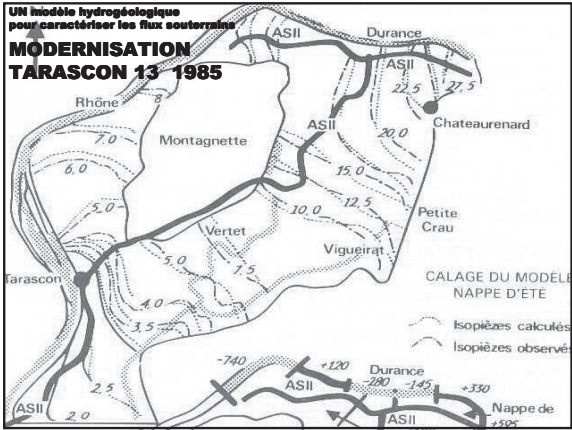
**need for modernization**



**CONCLUSION (1981)**

**Surface irrigation maintained in upstream part to allow groundwater recharge**

**Modernization in downstream part with drip irrigation supplied by pumping from groundwater**



**Annex 8**  
**A case study in China**



## Issues of scales in water productivity

*A case study of Zhanghe Irrigation System, China*

## Brief introduction of water saving irrigation practices in China

"Water saving irrigation" is a general term. For paddy rice, there are different forms of WSI practices in different parts of China.

- In Guangxi Province (South of China) ---- "Thin- Shallow- Wet - Sundrying"
- In Shandong Province (East of China) ---- "Control Irrigation"
- In Zhejiang Province (East of China) ---- "Thin- Exposure"
- In Hubei and Hunan Provinces (Centre China) ---- "Intermittent Submerged Irrigation"

Actually, they are similar but not the same

## Questions

1. How the on-farm WSI techniques save water?  
Reducing in the application of irrigation water to the field allows reduction in field water input and reduction in percolation and seepage (S&P).
2. What's the impact to overall system?  
Less well understood. Because the S&P flowing out of the farm without being depleted by rice can be recovered and reused at some points in the irrigation system
3. In order to understand if and how farm-level WSI techniques scale up basin-level savings, a case study was conducted in a typical large-size irrigation system with intensive rice area, Zhanghe Irrigation System (ZIS).

## Introduction of Zhanghe Irrigation System

### Zhanghe Reservoir

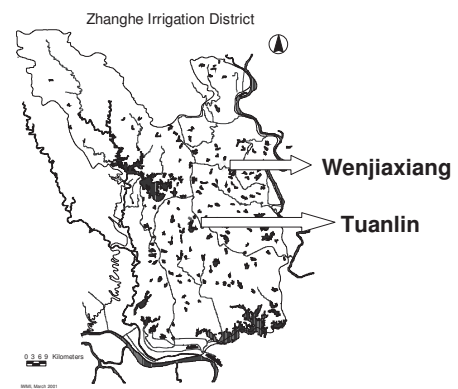
Located about 200 km west of Wuhan, Central China  
Catchment area 2212km<sup>2</sup>  
Total storage capacity 2.035 billion m<sup>3</sup>

### Zhanghe Irrigation System

Total area 5540km<sup>2</sup>; irrigated area 160,000ha  
Tens of thousands of medium & small-size reservoirs, ponds and pump stations  
Annual average precipitation 960 mm  
Main crops: rice and wheat/rapeseed

## Project Location

### Zhanghe Irrigation District



## Methodology

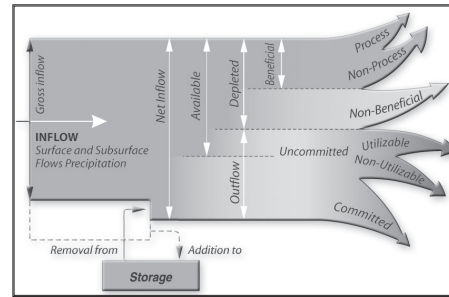
### Site selection

- Sub-basin scale: Zhanghe Irrigation System
- Main canal command scale:
- Mezzo sites and field scale:
  - Tuanlin (TL): 3 micro sites with WSI
  - Wenjiaxiang (WJX): 3 micro sites without WSI

### Performance indicators (*Water accounting*)

- $PW_{inflow} = \text{Productivity} / \text{Net inflow}$
- $PW_{ET} = \text{Productivity} / \text{ET}$
- $PW_{irrigation} = \text{Productivity} / \text{Irrigation}$

## Water accounting developed by IWMI



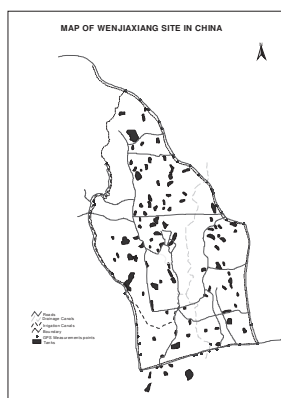
## Methodology

### Data collection

During the rice-growing season from May to September, the six micro-sites were monitored everyday.

The observations and measurements included:

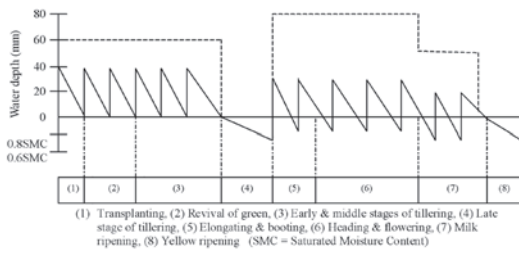
- Daily water levels in lysimeters, plastic tubes and wooden sticks
- Discharges of irrigation and drainage
- Yield



## Water Saving Irrigation Practices in ZIS

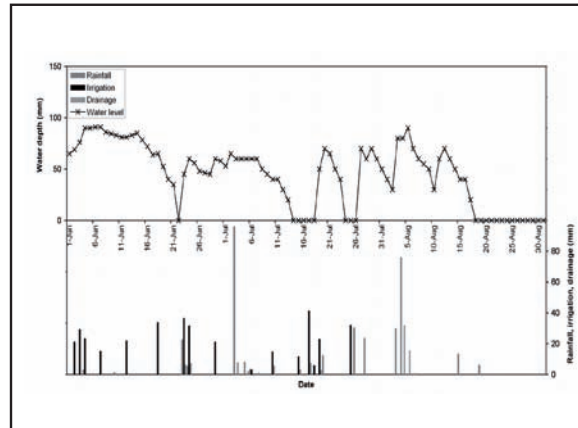
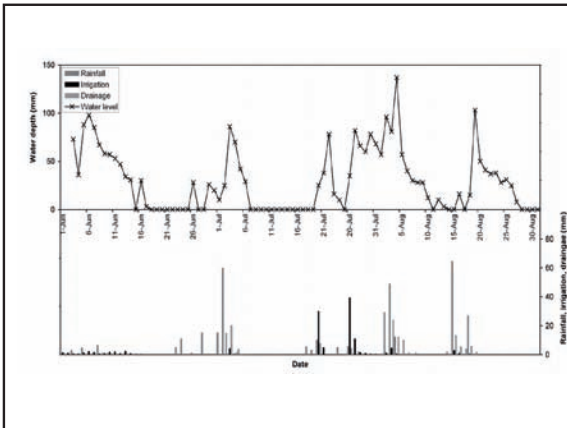
- Water saving irrigation practices in ZIS: intermittent submerged irrigation
- What is ISI
- Now Intermittent Submerged Irrigation has been spread in ZIS

## Water Saving Irrigation Practices in ZIS



## How do the farmers practice ISI?

- Water levels measured at field level to assess the actual farmer practice
- WSI practices at field level; to what extent do farmers practice ISI?



## On-farm Water Productivity

Water accounting at field scale in Tuanlin and Wenjiaxiang

## On-farm Water Productivity

### On-farm Water Productivity

#### Conclusion

1. The farmers used water (irrigation + rainfall) carefully: high depleted fraction
2. Farmers' practices were similar to ISI, but not the exactly the same
3. Farmers captures most rainfall
4. Water productivity per unit irrigation water is higher for ISI than traditional practice
5. No significant yield difference between WSI and traditional irrigation, but higher water productivity

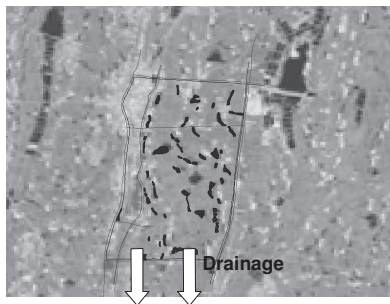
### Water Productivity at Mezzo Scale

### Water Productivity at Mezzo Scale

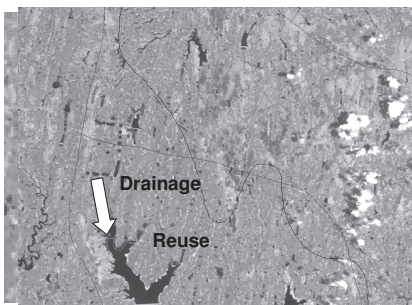
#### Conclusion

- The depleted fraction of gross inflow ranges from 0.09 to 0.20, much lower than that at the field scale
- Water productivity of irrigation water dropped sharply
- Other factors become important, such as water storage and other non-rice land uses (roads, houses, trees)
- What happens to the drainage water?

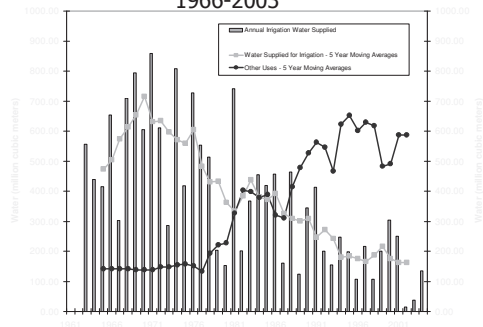
### Water Productivity at Mezzo Scale



### Water Productivity at Mezzo Scale



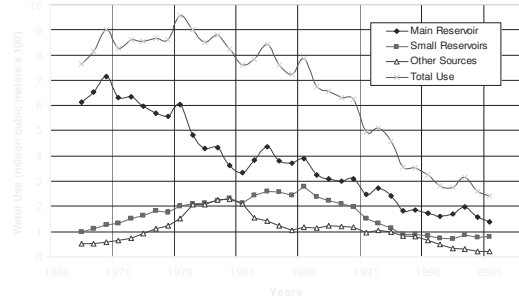
Zhanghe Reservoir, Hubei, China  
Water allocation for irrigation and other uses, 1966-2003



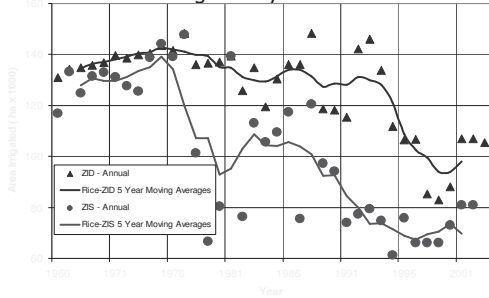
### Water inflow and releases from Zhanghe reservoir

Average Water Uses (10000 m <sup>3</sup> )								
Period	Irrigation	Industrial	Municipal	Hydro-electric	Flood control	Evaporation	Inflow	Rainfall (mm)
1966-78	60325	518	0	1135	113	12434	69387	952
1979-88	36245	3659	93	5277	11358	11943	75275	967
1989-01	22077	4789	1647	27596	15260	12171	88162	945
2002-04	6235	6348	2622	42760	3337	7953	78613	868

### Zhanghe Irrigation District, Hubei, China Water supplied for irrigation by source



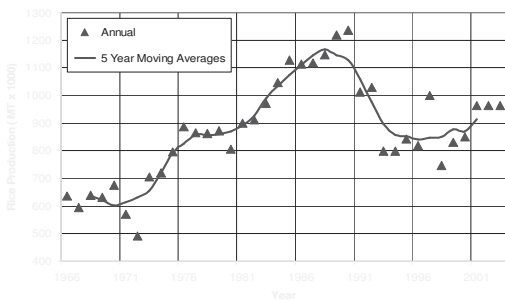
### Rice area irrigated by ZIS and ZID



### Command area irrigated by ZID and ZIS (1000 ha units)

Period	Command area		Area irrigated in ZID		Area irrigated by ZIS	
	Total	Rice	Total	Rice	Total	Rice
1966-78	150	138	143	138	134	130
1979-88	156	142	140	134	103	100
1989-01	143	125	126	112	82	76
2002-04	123	113	85	82	40	40

### Annual rice production in Zhanghe Irrigation District (1966-2001)



### Command area irrigated by ZID and ZIS (1000 ha units)

Period	Command area		Area irrigated in ZID		Area irrigated by ZIS	
	Total	Rice	Total	Rice	Total	Rice
1966-78	150	138	143	138	134	130
1979-88	156	142	140	134	103	100
1989-01	143	125	126	112	82	76
2002-04	123	113	85	82	40	40

Changes in irrigated area, planted area, production and yield in ZID and productivity of ZIS irrigation water

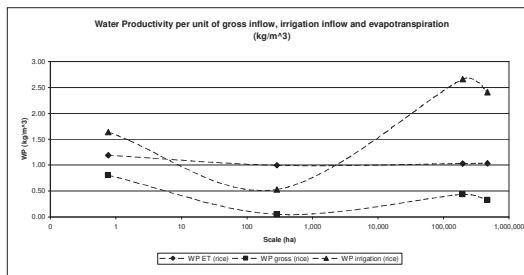
Period	Irrigated area ha X 1000	Rice area ha X 1000	Rice production Mt x 1000	Rice yield t/ha	Water supplied Mm <sup>3</sup> /100	Yield kg/cubic
1986-78	138	173	698	4.04	3.50	0.82
1979-88	134	149	1001	6.72	7.74	1.29
1989-01	112	118	994	7.98	3.55	2.35
2002-04	107	107	894	8.33	2.13	4.20

Sub-basin scale

Conclusion

- Water productivity of reservoir water increased over time
- The increase in WP has been due to several factors:
  - Economic and institutional reforms initiated in 1978
  - Shift in cropping pattern from two to one crop of rice
  - Volumetric pricing of water
  - On-farm and system WSI practices, such as ADWI
  - Development of alternate sources of water (reservoirs, ponds)
  - Recapture and reuse of return flows
- Real water savings took place

WP Trends over Scales



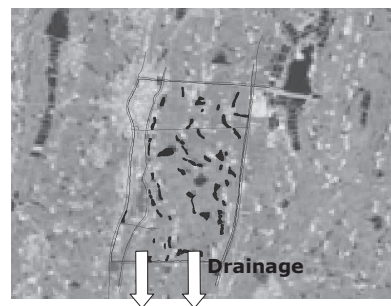
Scaling Up – Field Scale

- Water saving techniques reduce water deliveries to the field, without significantly changing yield resulting in higher water productivity per unit irrigation water
- Farmers use water (irrigation + rainfall) carefully
- Farmers capture most rainfall

Scaling Up – Mezzo Scale

- Water productivity per unit irrigation water is consistently higher under water saving techniques, however much lower than at field scale
- The total water consumed was only 9 to 20% of the total inflow, much lower than at field scale
- Other factors such as considerable drainage outflow, water storage and other non-rice land uses (roads, houses, trees) play an important role

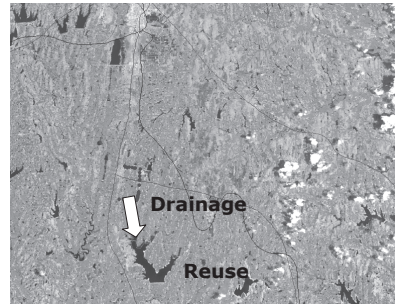
Scaling Up – Mezzo Scale



### Scaling Up - Main Canal Command Scale

- Water productivity per unit of irrigation water increased dramatically (3 to 6 times)
- Water recapturing and reuse is reflected
- Other land uses gain importance at this scale

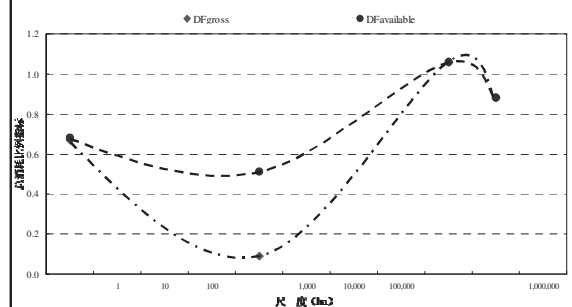
### Scaling Up - Main Canal Command Scale



### Scaling Up - Sub-Basin Scale

- Water productivity per unit of irrigation water decreased
  - However some data uncertainty about volume of irrigation water

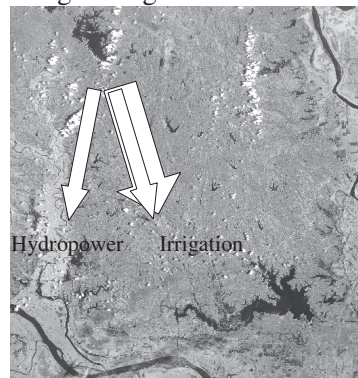
### Depleted fraction trend over scales



### Water Savings vs. Water Productivity

- The depleted fraction of inflow: **0.88** meaning only **12%** of irrigation and rainfall is flowing out of the basin!
- Can we still save water?
- Can we increase the water productivity?
- Change of Flow Paths
  - From less to more beneficial, lower to higher valued

### Zhanghe Irrigation District



Thank You!

**Annex 9**  
**List of members**  
**conducting RAP**



**The initial of RAP Field Work Assessment**  
**24 July – 26 August 2006**

**LIST OF PARTICIPANTS**

**Cambodia**

**Facilitators:**

1. Dr. Zhijun Chen Water Resources Development and Conservation Officer, FAO
2. Mr. Fongsamuth Phengphaengsy Program Officer of Irrigation, AIFP/MRCS

**Coordinator:**

3. Mr. Sok Khom AIFP coordinator, Cambodian National Mekong Committee (CNMC)

**Implementing Team:**

4. Dr. Theng Tara Director of Water Resources Management and Conservation, MOWRAM
5. Mr. Thach Sovanna Deputy Director of Water Resources Management and Conservation, MOWRAM
6. Mr. Sao Samphois Deputy Director of Administrator and Human Resources Department, MOWRAM
7. Mr. Hong Kimsan Deputy Director, Department of Water Resources and Meteorology of Battambang Province
8. Mr. Meas Peov Technical Officer of Agronomy and Agriculture Land Improvement Department, MAFF

**Lao PDR**

**Facilitators:**

1. Dr. Zhijun Chen Water Resources Development and Conservation Officer, FAO
2. Mr. Okudaira Hiroshi Senior Advisor of AIFP/MRCS
3. Mr. Fongsamuth Phengphaengsy Program Officer of Irrigation, AIFP/MRCS

**Implementing Team:**

4. Mr. Khammay Vongsathiane Deputy Director, Technical Division, Irrigation Department, MAF
5. Mr. Phouthone Siriphanthong Deputy Director, Operation and Maintenance Division, MAF
6. Mr. Saykham Phengkhammy Deputy Chief, Irrigation Section, Vientiane Capital
7. Mr. Bounhab Vongvichith Project Director, Nam Houm Irrigation Project

## Thailand

### Facilitators:

- |                                 |  |
|---------------------------------|--|
| 1. Mr. Thierry Facon            | Senior Water Management Officer, FAO     |
| 2. Mr. Okudaira Hiroshi         | Senior Advisor of AIFP/MRCS              |
| 3. Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

### Coordinator:

- |                            |  |
|----------------------------|--|
| 4. Mr. Satit Sueprasertsuk | Coordinator of AIFP, Department of Water Resources, Thai National Committee (TNMC) |
|----------------------------|--|

### Implementing Team:

- |                                |   |
|--------------------------------|---|
| 5. Mr. Chatchai Boonlue        | Director, Foreign Financed Project Administration Division, Royal Irrigation Department (RID)                                     |
| 6. Mr. Sathaporn Namamnath     | Chief of O&M Branch, Huay Luang O&M Project, Royal Irrigation Department (RID)  |
| 7. Mr. Suvech Kitchakarn       | Chief of Contracts Administration Branch, Foreign Financed Project Administration Division, Royal Irrigation Department (RID)     |
| 8. Mr. Somsak Vivithkeyoonvong | Engineer Grade 6, Foreign Financed Project Administration Division, Office of Project Planning, Royal Irrigation Department (RID) |
| 9. Mr. Pramote Phuengphian     | Irrigation Technician Grade 6, Chief of Operation and Maintenance Zone 3, Huay Luang O&M project, Royal Irrigation Department     |
| 10. Mr. Sathapat Hansakunathai | Irrigation Engineer, Royal Irrigation Department  |
| 11. Mr. Pordee Hunsodnoen      | Head of Water User Association, Huay Luang O&M project, Royal Irrigation Department   |

## Viet Nam

### Facilitators:

- |                                 |  |
|---------------------------------|--|
| 1. Mr. Thierry Facon            | Senior Water Management Officer, FAO     |
| 2. Mr. Fongsamuth Phengphaengsy | Program Officer of Irrigation, AIFP/MRCS |

### Implementing Team:

- |                           |  |
|---------------------------|--|
| 3. Dr. Vo Khac Tri        | Division Chief –Southern Institute for Water Resource Research, Ho Chi Minh City               |
| 4. Mr. To Quang Toan      | Senior staff, Southern Institute for Water Resources Research                                  |
| 5. Mr. NPham Duc Nghia    | Senior staff, Southern Institute for Water Resources Research                                  |
| 6. Mr. Ung Hong Nghi      | Deputy Director, Company for hydraulic construction exploitation, Tien Giang Province          |
| 7. Mr. Nguyen Xuan Truong | Senior staff of sub-national institute for agriculture planning & projection, Ho Chi Minh City |
| 8. Mr. Truong Van Phuong  | Technical Officer, department of Agriculture and Rural Development, Bac Lieu province          |

- 9. Ms. Huynh Dang Ngoc Lan                      Technical Officer, Southern Institute for Water Resources Research, Ho Chi Minh city
- 10. Ms. Vu Nguyen Hoang Giang                Technical Officer, Southern Institute for Water Resources Research, Ho Chi Minh city
- 11. Mr. Ung Hong Nghi                            Deputy Director of the Company of Hydraulic Construction Exploitation, Tian Giang province
- 12. Mr. Do Thanh Son                            Chief of Go Cong irrigation project, Company of Hydraulic Construction Exploitation, Tian Giang province
- 13. Mr. Huynh Hai                                Director of Department of Agriculture and Rural Development, Tien Giang province.

\*\*\*\*\*



# **Annex 10**

## **Procedure of field work**



# Outline of Conducting RAP

21 June 2006

## 1. Introduction

The Mekong River Commission Secretariat (MRCS) is implementing the project “*Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin (IIEPF)*” in order to contribute to improvements in irrigation efficiencies of the schemes through introduction of basic guidelines covering institutional, managerial and technical aspects of irrigation facilities operation. Rapid Appraisal Process (RAP) is proposed for evaluating irrigation system performance as one of the specific inputs provided by FAO under collaboration framework between MRCS and FAO.

Following to the RAP training workshop on 18-21 July 2006 in Vientiane, RAP is going to be conducted at the proposed pilot project site in each member country. The detailed information is described as follows.

## 2. Purposes of RAP conducting at initial stage of field observation

- On the job training : follow-up of RAP training workshop on 18-21 July 2006
- Initial assessment by RAP: estimating performance level of the pilot scheme based on available data and identify options for improvement

## 3. Date and Duration

RAP is to be conducted with 5 or 6 days (including traveling days) each in every member country. The date and duration of conducting RAP in tentative is scheduled as follows:

Lao PDR	: 24-28 July 2006	(5 days)
Cambodia	: 31 July - 5 August 2006	(6 days)
Thailand	: 07 - 12 August 2006	(6 days)
Vietnam	: 21-26 August	(6 days)

## 4. Participants

- The participants of RAP training workshop plus other field observation work team members
- One or two staff from MRCS, and
- One instructor from FAO

## 5. Venue

The RAP conducting will be held at the project site of each member country

## 6. Implementing Agency

MRCS with collaboration of FAO

## 7. Instructors

In Laos and Cambodia : Dr. Zhijun Chen (Water Resources Development and Conservation Officer, FAO)  
In Thailand and Vietnam : Mr. Thierry Facon (Senior Water Management Officer, FAO)

## 8. Materials and Preparation

The participants are expected to bring their own personal computers (1 or 2 computers should be enough to share for the whole team members), and the training material or related handouts which provided in the training workshop on 18-21 July 2006 for reference when conducting RAP.

## 9. Issues to be clarified in advance

*For RAP:*

1. ~~Project site of Cambodia & Vietnam~~
2. ~~Traveling duration from city to project site~~
3. Appointment with WUGs, gate operators, and farmers on the field observation days
4. Points to be observed ( shown by Map)
5. etc

*For other logistics:*

6. Minibus/cars service arrangement
7. Flight time ( arrive & departure time) for participants & trainers
8. Training facilities at discussion venue (including projector, whiteboard and markers)
9. Accommodation arrangement
10. Lunch and other payment arrangement
11. etc

## 10. Prior data collection

Each pilot project shall select and analyze below basic information and data, and enter into the electric RAP worksheets before *RAP training workshop on 18-21 July 2006*, prior to the conducting of RAP:

- 1) Sheet 1-Sheet 3, for input year1-input year 3 (enter data for at least one year);
- 2) Data for line 3 to 77, and line 218 to 225 in sheet 5, project office questions;
- 3) Data for line 2 to 94 in sheet 7, WUA questions.

Attention:

- \* Make a blank copy before data entry;
- \* Only enter data into blank cells; don't touch red and blue figures and values in the sheets;
- \* Don't touch the calculation zones at the far right side of each sheet

## **Tentative Program for Conducting RAP in Lao PDR**

### Day 1: Monday (24 Jul. 2006)

08: 00 - 09: 00      Vientiane City → NumHum project  
09: 00 - 10: 30      Meet project officers for general information and checking available data  
10: 30 - 12: 00      Visit headwork: Reservoir, spillway and head regulators  
12: 00 - 13: 00      Lunch at project site  
13: 00 - 17: 00      Observe main and secondary canals: travel to down stream areas and stop at  
all cross regulators  
Interview gate operators/water masters  
17:00 - 18:00      NumHum project → Vientiane City

### Day 2: Tuesday (25 Jul. 2006)

08: 00 - 09: 00      Vientiane City → NumHum project  
09: 00 - 12: 00      Observe tertiary canals and field distribution systems  
Interview gate operators and farmers  
12: 00 - 13: 00      Lunch at project site  
13: 00 - 17: 00      interview heads of WUGs  
17: 00 - 18: 00      NumHum project → Vientiane City

### Day 3: Wednesday (26 Jul. 2006)

08: 00 - 12: 00      Fill RAP worksheets (computer entry) at MRCS meeting room  
12: 00 - 13: 00      Lunch in Vientiane City  
13: 00 - 17: 00      Continue filling RAP worksheets  
Question and Answers

### Day 4: Thursday (27 Jul. 2006)

08:00 - 09:00      Presentation and general discussion of indicator results at MRCS meeting  
room  
09:00 - 09:30      Instruction on system improvement planning  
09:30 - 12:00      Plan system improvement  
12:00 - 13:00      Lunch in Vientiane City  
13:00 - 17:00      Continue to plan system improvement  
Presentation of system improvement plan  
Closing of RAP

### Day 5: Friday (28 Jul. 2006)

AM                      Vientiane → Bangkok (only FAO participant - Dr. Chen)

## Tentative Program for Conducting RAP in Cambodia

### Day 1: Monday (31 Jul. 2006)

08:15- 09:30 Bangkok (FAO) → Phnom Phenh; ? - ? Phnom Phenh → Battambang  
10:10- 12:00 Vientiane (MRCS) → Phnom Phenh; 12:00-17:00 Phnom Phenh → Battambang

### Day 2: Tuesday (1 Aug.2006)

08: 00 - 09:00 Battambang town → Komping Pouy Project  
09: 00 - 10:00 Meet project officers at Community Office for general information, and checking available data  
10: 00 - 12: 00 Visit headwork: reservoir and head regulators  
Observe main canal: travel to down stream areas and stop at all cross regulators  
Interview gate and zone-man operators  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue observing main canal and secondary canals  
Interview gate operators/water masters  
16: 00 - 17: 00 Komping Pouy Project → Battambang town

### Day 3: Wednesday (2 Aug.2006)

08: 00 - 09:00 Battambang town → Komping Pouy Project  
09: 00 - 12: 00 Continue observing tertiary canals and related structures  
Interview gate operators/water masters  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue observing quaternary canals and field distribution systems  
Interview farmers and Heads of WUAs  
16: 00 - 17: 00 Komping Pouy Project → Battambang town

### Day 4: Thursday (3 Aug.2006)

09: 00 - 12: 00 Fill RAP worksheets (computer entry) at irrigation provincial office in Battambang town  
12: 00 - 13: 00 Lunch at Battambang town  
13: 00 - 17: 00 Continue filling RAP worksheets  
Question & Answer

### Day 5: Friday (4 Aug.2006)

09: 00 -10: 00 Presentation and general discussion of indicator results at irrigation provincial office in Battambang town  
10: 00 -10: 30 Introduction on system improvement planning  
10: 30 -12: 00 Plan system improvement  
12: 00 -13: 00 Lunch at Battambang town  
13: 00 -17: 00 Continue to plan system improvement  
Presentation of system improvement plan  
Closing of RAP

### Day 6: Saturday (5 Aug.2006)

? - ? Battambang → Phnom Phenh; 10:30-11:35 or 20:25-21:30 Phnom Phenh→ Bangkok (FAO)  
09:00-14:00 Battambang → Phnom Phenh; 15:30-16:45 Phnom Phenh → Vientiane (MRCS)

## Tentative Program for Conducting RAP in Thailand

### Day 1: Monday (7 Aug. 2006)

AM-PM Bangkok (FAO & RID) → Udon City  
Vientiane (MRCS) → Udon City

### Day 2: Tuesday (8 Aug.2006)

08: 00 - 09: 00 Udon City → Huay Luang project  
09: 00 - 10: 30 Meet project officers for general information, and checking available data  
10: 30 - 12: 00 Visit headwork: reservoir, spillway and head regulators  
Observe left main canal: travel to down stream areas and stop at all cross regulators  
Interview gate operators/ water masters and zone-man operators  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue observing secondary and tertiary canals and on-farm level  
Interview gate operators, head of WUAs, and farmers  
16: 00 - 17: 00 Huay Luang project → Udon City

### Day 3: Wednesday (9 Aug.2006)

08: 00 - 09: 00 Udon City → Huay Luang project  
09: 00 - 12: 00 Observe right main canal: travel to down stream areas and stop at all cross regulators  
Interview gate operators/ water masters and zone-man operators  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue observing secondary and tertiary canals and on-farm level  
Interview gate operators, head of WUAs, and farmers  
16: 00 - 17: 00 Huay Luang project → Udon City

### Day 4: Thursday (10 Aug.2006)

08: 00 - 09: 00 Udon City → Huay Luang project  
09: 00 - 12: 00 Fill RAP worksheets (computer entry) at conference room of Huay Luang project office  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue filling RAP worksheets  
Question & Answer  
16: 00 - 17: 00 Huay Luang project → Udon City

### Day 5: Friday (11 Aug.2006)

08: 00 - 09: 00 Udon City → Huay Luang project  
09: 00 - 10: 00 Presentation and general discussion of indicator results at project office  
10: 00 - 10: 30 Introduction on system improvement planning  
10: 30 - 12:00 Plan system improvement  
12: 00 - 13:00 Lunch at project site  
13: 00 - 16:00 Continue to plan system improvement  
Presentation of system improvement plan  
Closing of RAP  
16: 00 - 17: 00 Huay Luang project → Udon City

### Day 6: Saturday (12 Aug.2006)

PM Udon City → Bangkok (FAO & RID)  
Udon City → Vientiane (MRCS)

## Tentative Program for Conducting RAP in Vietnam

### Day 1: Monday (21 Aug. 2006)

08:55-10:25 (TG) BKK (FAO)→ HCM; ?-? HCM → Tiengiang province (My Tho City)  
10:10-13:00 VTE (MRCS)→ HCM; 13:00-17:00 HCM→ Tiengiang (My Tho City)

### Day 2: Tuesday (22 Aug.2006)

08: 00 - 09: 00 My Tho City → Go Cong Irrigation project (Long Hai Station Office)  
09: 00 - 10: 00 Meet project officers for general information, and checking available data  
10: 00 - 11: 00 Long Hai Station Office → Long Hai Project areas  
11: 00 - 12: 00 Visit main intake at Tien river gate and interview gate  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Observe along main canal and travel to up stream areas and stop at gate of up-stream intake  
16: 00 - 17: 00 Long Hai Station site → My Tho City

### Day 3: Wednesday (23 Aug.2006)

08: 00 - 09: 00 My Tho City → Long Hai Station site  
09: 00 - 12: 00 Continue observing secondary and tertiary canals and related structures  
12: 00 - 13: 00 Lunch at project site  
13: 00 - 16: 00 Continue observing quaternary canals and field distribution systems  
Interview farmers and Heads of WUAs  
16: 00 - 17: 00 Long Hai Station Site → My Tho City

### Day 4: Thursday (24 Aug.2006)

09: 00 - 12: 00 Fill RAP worksheets (computer entry) at Tiengiang Irrigation Management Company (IMC) in My Thao City  
12: 00 - 13: 00 Lunch at My Thao City  
13: 00 - 17: 00 Continue filling RAP worksheets  
Questions &Answers

### Day 5: Friday (25 Aug.2006)

08: 00 - 09: 00 Presentation and general discussion of indicator results at Tiengiang IMC office  
09: 00 - 09: 30 Introduction on system improvement planning  
09: 30 - 12: 00 Plan system improvement & Presentation of system improvement plan  
Closing of RAP  
12: 00 - 13:00 Lunch at project site  
13: 00 - 17:00 Tiengiang Province → Ho Chi Minh City

### Day 6: Saturday (26 Aug.2006)

12:35- 14:00 HCM → BKK (FAO)  
14:00- 17:00 HCM → VTE (MRCS)

# **Annex 11**

## **Internal indicators**



**Points for understanding this Indicator Summary**

1. This spreadsheet only applies to INTERNAL indicators. A separate spreadsheet is used for EXTERNAL indicators such as Irrigation Efficiency and Relative Water Supply.
2. The majority of the values on this worksheet are automatically transferred from previous worksheets in this spreadsheet.
3. Some of the indicator values on this worksheet must be assigned by the user.
4. The organization of this worksheet is as follows:
  - a. The alpha-numeric label for each indicator is found in Column A
  - b. The Primary Indicator name is given in Column B
  - c. The Sub-Indicator is described in Column D
  - d. The assigned value for each Sub-Indicator is found in Column E. Also, computed values for each Primary Indicators are found here.
  - e. The weight assigned to each Sub-Indicator is given in Column F.
  - f. The original indicator labels, as found in FAO Water Reports 19, are given here.
  - g. The worksheet in which the original data were entered is given.

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	Luang Project	RMC Project	Go Cong Project/ Long Hai Sta.
	<b>SERVICE and SOCIAL ORDER</b>							
I-1	Actual Water Delivery Service to Individual Ownership Units (e.g., field or farm)			1.5	0.9	1.3	1.8	2.7
I-1A		Measurement of volumes	1.0	2.0	0.0	0.0	0.0	0.0
I-1B		Flexibility	2.0	1.0	1.0	0.0	2.0	3.0
I-1C		Reliability	4.0	1.0	1.0	2.0	1.0	2.0
I-1D		Apparent equity.	4.0	2.0	1.0	1.5	3.0	4.0
I-2	Stated Water Delivery Service to Individual Ownership Units (e.g., field or farm)			1.2	2.0	2.5	2.5	2.7
I-2A		Measurement of volumes	1.0	1.0	0.0	0.0	0.0	0.0
I-2B		Flexibility	2.0	0.0	1.0	2.0	2.0	3.0
I-2C		Reliability	4.0	1.0	2.0	2.0	2.0	3.0
I-2D		Apparent equity.	4.0	2.0	3.0	4.0	4.0	3.0
I-3	Actual Water Delivery Service at the most downstream point in the system operated by a paid employee			0.7	0.9	1.4	1.4	2.6
I-3A		Number of fields downstream of this point		0.0	0.0	0.0	0.0	1.0
I-3B		Measurement of volumes		0.0	0.0	0.0	0.0	0.0
I-3C		Flexibility	4.0	0.0	1.0	2.0	2.0	4.0
I-3D		Reliability	4.0	1.0	1.0	1.5	2.0	3.0
I-3E		Apparent equity.	4.0	2.0	2.0	2.5	2.0	4.0

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Poy Project	Num Houm Project	Luang Huay Project	RMC Project	Go Cong Project/ Long Hai Sta.
I-4	<u>Stated</u> Water Delivery Service at the most downstream point in the system operated by a paid employee			1.7	1.4	0.8	0.8	1.4
I-4A		Number of fields downstream of this point	1.0	1.0	0.0	0.0	0.0	0.0
I-4B		Measurement of volumes	4.0	0.0	0.0	0.0	0.0	0.0
I-4C		Flexibility	4.0	2.0	2.0	1.5	1.5	0.0
I-4D		Reliability	4.0	2.0	2.0	1.0	1.0	3.0
I-4E	Apparent equity.	4.0	3.0	2.0	1.0	1.0	3.0	
I-5	<u>Actual</u> Water Delivery Service by the Main Canals to the Second Level Canals			1.8	2.2	1.2	1.4	0.0
I-5A		Flexibility	1.0	2.0	2.0	1.5	2.0	0.0
I-5B		Reliability	1.0	2.0	2.0	2.0	2.5	0.0
I-5C		Equity	1.0	1.0	3.0	2.0	2.0	0.0
I-5D		Control of flow rates to the submain as stated	1.5	2.0	2.0	0.0	0.0	0.0
I-6	<u>Stated</u> Water Delivery Service by the Main Canals to the Second Level Canals			2.8	1.6	3.3	3.3	1.8
I-6A		Flexibility	1.0	3.0	1.0	1.5	1.5	3.0
I-6B		Reliability	1.0	3.0	2.0	3.5	3.5	3.0
I-6C		Equity	1.0	2.0	2.0	4.0	4.0	2.0
I-6D		Control of flow rates to the submain as stated	1.5	3.0	1.5	4.0	4.0	0.0
I-7	Social "Order" in the Canal System operated by paid employees			2.3	0.0	2.8	3.0	4.0
I-7A		Degree to which deliveries are <b>NOT</b> taken when not allowed, or at flow rates greater than allowed	2.0	2.0	0.0	2.5	3.0	4.0
I-7B		Noticeable <b>non</b> -existence of unauthorized turnouts from canals.	1.0	2.0	0.0	3.0	3.0	4.0
I-7C		Lack of vandalism of structures.	1.0	3.0	0.0	3.0	3.0	4.0

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Poy Project	Num Houm Project	Luang Project		Go Cong Project/ Long Hai Sta.
						LMC	RMC	
	<b>MAIN CANAL</b>							
I-8	Cross regulator hardware (Main Canal)			<b>1.7</b>	<b>1.9</b>	<b>3.3</b>	<b>1.9</b>	<b>Not conducted</b>
I-8A		Ease of cross regulator operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the cross regulators to meet the targets.	1.0	3.0	3.0	3.0	3.0	Not conducted
I-8B		Level of maintenance of the cross regulators.	1.0	2.0	2.0	3.0	3.0	Not conducted
I-8C		Lack of water level fluctuation	3.0	1.0	0.0	3.0	1.0	Not conducted
I-8D		Travel time of a flow rate change throughout this canal level	2.0	2.0	4.0	4.0	2.0	Not conducted
I-9	Turnouts from the Main Canal			<b>2.7</b>	<b>1.7</b>	<b>2.8</b>	<b>2.3</b>	<b>Not conducted</b>
I-9A		current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets.	1.0	3.0	1.0	2.5	3.0	Not conducted
I-9B		Level of maintenance	1.0	3.0	2.0	3.0	2.0	Not conducted
I-9C		Flow rate capacities	1.0	2.0	2.0	3.0	2.0	Not conducted
I-10	Regulating Reservoirs in the Main Canal			<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>Not conducted</b>
I-10A		Suitability of the number of location(s)	2.0	0.0	0.0	0.0	0.0	Not conducted
I-10B		Effectiveness of operation	2.0	0.0	0.0	0.0	0.0	Not conducted
I-10C		Suitability of the storage/buffer capacities	1.0	0.0	0.0	0.0	0.0	Not conducted
I-10D		Maintenance	1.0	0.0	0.0	0.0	0.0	Not conducted
I-11	Communications for the Main Canal			<b>1.9</b>	<b>1.9</b>	<b>2.9</b>	<b>2.5</b>	<b>Not conducted</b>
I-11A		Frequency of communications with the next higher level? (hr)	2.0	1.0	1.0	2.0	2.0	Not conducted
I-11B		Frequency of communications by operators or supervisors with their customers	2.0	4.0	1.0	4.0	4.0	Not conducted
I-11C		Dependability of voice communications by phone or radio.	3.0	1.0	3.0	3.0	2.0	Not conducted
I-11D		Frequency of visits by upper level supervisors to the field.	1.0	2.0	2.0	2.0	2.0	Not conducted
I-11E		Existence and frequency of remote monitoring (either automatic or manual) at key <b>spill</b> points, including the end of the canal	1.0	0.0	0.0	3.0	2.0	Not conducted
I-11F		Availability of roads along the canal	2.0	3.0	3.0	3.0	3.0	Not conducted

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Kongping Pouy Project	Num Houm Project	Luang Project		Go Cong Project/ Long Hai Sta.
						LMC	RMC	
I-12	General Conditions for the Main Canal			<b>1.8</b>	<b>2.0</b>	<b>2.6</b>	<b>1.8</b>	Not conducted
I-12A		General level of maintenance of the canal floor and canal banks	1.0	2.0	2.0	2.5	1.0	Not conducted
I-12B		General lack of undesired seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired).	1.0	2.0	3.0	2.5	2.0	Not conducted
I-12C		Availability of proper equipment and staff to adequately maintain this canal	2.0	1.0	1.0	2.0	1.0	Not conducted
I-12D		Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment)	1.0	3.0	3.0	4.0	4.0	Not conducted
I-13	Operation of the Main Canal			<b>2.1</b>	<b>2.1</b>	<b>2.3</b>	<b>2.1</b>	Not conducted
I-13A		How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times.	2.0	1.3	2.7	1.3	1.3	Not conducted
I-13B		Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur AFTER a change has been made.	1.0	2.7	2.7	2.0	1.3	Not conducted
I-13C		Clarity and correctness of instructions to operators.	1.0	2.7	1.3	2.7	2.7	Not conducted
I-13D		How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal.	1.0	2.7	1.3	4.0	4.0	Not conducted

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	Hay Project	Luang Project	Go Cong Project/ Long Hai Sta.
	<b>Second Level Canals</b>							
I-14	Cross regulator hardware (Second Level Canals)			<b>1.0</b>	<b>1.3</b>	<b>1.6</b>	<b>1.4</b>	<b>1.1</b>
I-14A		that the current targets are being met; rather this rating indicates how easy or difficult it	1.0	3.0	3.0	2.5	3.0	0.0
I-14B		Level of maintenance of the cross regulators.	1.0	2.0	2.0	3.0	3.0	0.0
I-14C		Lack of water level fluctuation	3.0	0.0	0.0	0.0	0.0	FALSE
I-14D		Travel time of a flow rate change throughout this canal level	2.0	1.0	2.0	3.0	2.0	4.0
I-15	Turnouts from the Second Level Canals			<b>3.0</b>	<b>2.3</b>	<b>2.8</b>	<b>3.0</b>	<b>2.7</b>
		Ease of turnout operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets.						
I-15A			1.0	3.0	3.0	2.5	3.0	4.0
I-15B		Level of maintenance	1.0	2.0	2.0	3.0	4.0	2.0
I-15C		Flow rate capacities	1.0	4.0	2.0	3.0	2.0	2.0
I-16	Regulating Reservoirs in the Second Level Canals			<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>3.7</b>
I-16A		Suitability of the number of location(s)	2.0	0.0	0.0	0.0	0.0	4.0
I-16B		Effectiveness of operation	2.0	0.0	0.0	0.0	0.0	4.0
I-16C		Suitability of the storage/buffer capacities	1.0	0.0	0.0	0.0	0.0	4.0
I-16D		Maintenance	1.0	0.0	0.0	0.0	0.0	2.0
I-17	Communications for the Second Level Canals			<b>1.6</b>	<b>2.1</b>	<b>2.5</b>	<b>2.7</b>	<b>2.8</b>
I-17A		Frequency of communications with the next higher level? (hr)	2.0	1.0	3.0	1.0	2.0	4.0
I-17B		Frequency of communications by operators or supervisors with their customers	2.0	3.0	1.0	4.0	4.0	4.0
I-17C		Dependability of voice communications by phone or radio.	3.0	0.0	3.0	3.0	3.0	1.0
I-17D		Frequency of visits by upper level supervisors to the field.	1.0	4.0	2.0	3.0	2.0	3.0
I-17E		Existence and frequency of remote monitoring (either automatic or manual) at key <b>spill</b> points, including the end of the canal						
I-17E		General lack of undesired seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired).	1.0	0.0	2.0	0.0	1.0	2.5
I-18B		Availability of proper equipment and staff to adequately maintain this canal	1.0	2.0	3.0	3.0	3.0	4.0
I-18C		Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment)	2.0	0.0	1.0	0.0	1.0	2.0
I-18D			1.0	2.0	3.0	4.0	4.0	3.0

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	Luang Project	RMC Project	Go Cong Project/Long Hat Sta.
I-19	Operation of the Second Level Canals			2.4	2.1	2.5	2.3	1.3
I-19A		How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times.	2.0	2.7	2.7	2.0	1.3	0.0
I-19B		Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur AFTER a change has been made.	1.0	2.7	1.3	2.0	2.2	0.0
I-19C		Clarity and correctness of instructions to operators.	1.0	1.3	2.7	2.7	2.7	4.0
I-19D		How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal.	1.0	2.7	1.3	4.0	4.0	2.7

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Kongping Poy Project	Num Houm Project	Huay Project		Go Cong Project/ Long Hat Sta.
						LMC	RMC	
	<b>Third Level Canals</b>							
I-20	Cross regulator hardware (Third Level Canals)			<b>1.0</b>	<b>1.0</b>	<b>1.9</b>	<b>1.4</b>	<b>1.1</b>
I-20A		Ease of cross regulator operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the cross regulators to meet the targets.	1.0	3.0	3.0	2.5	4.0	0.0
I-20B		Level of maintenance of the cross regulators.	1.0	2.0	2.0	3.0	2.0	0.0
I-20C		Lack of water level fluctuation	3.0	0.0	0.0	0.0	0.0	FALSE
I-20D		Travel time of a flow rate change throughout this canal level	2.0	1.0	1.0	4.0	2.0	4.0
I-21	Turnouts from the Third Level Canals			<b>2.3</b>	<b>2.0</b>	<b>2.8</b>	<b>2.7</b>	<b>2.7</b>
I-21A		Ease of turnout operation under the current target operation. This does not mean that the current targets are being met; rather this rating indicates how easy or difficult it would be to move the turnouts and measure flows to meet the targets.	1.0	3.0	3.0	2.5	3.0	3.0
I-21B		Level of maintenance	1.0	2.0	1.0	3.0	3.0	3.0
I-21C		Flow rate capacities	1.0	2.0	2.0	3.0	2.0	2.0
I-22	Regulating Reservoirs in the Third Level Canals			<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>3.3</b>
I-22A		Suitability of the number of location(s)	2.0	0.0	0.0	0.0	0.0	4.0
I-22B		Effectiveness of operation	2.0	0.0	0.0	0.0	0.0	4.0
I-22C		Suitability of the storage/buffer capacities	1.0	0.0	0.0	0.0	0.0	2.0
I-22D		Maintenance	1.0	0.0	0.0	0.0	0.0	2.0
I-23	Communications for the Third Level Canals			<b>1.2</b>	<b>1.5</b>	<b>2.4</b>	<b>3.1</b>	<b>2.0</b>
I-23A		Frequency of communications with the next higher level? (hr)	2.0	2.0	1.0	1.0	2.0	4.0
I-23B		Frequency of communications by operators or supervisors with their customers	2.0	2.0	1.0	4.0	4.0	4.0
I-23C		Dependability of voice communications by phone or radio.	3.0	0.0	3.0	3.0	4.0	0.0
I-23D		Frequency of visits by upper level supervisors to the field.	1.0	3.0	2.0	3.0	4.0	2.0
I-23E		Existence and frequency of remote monitoring (either automatic or manual) at key <u>spill</u> points, including the end of the canal	1.0	0.0	1.0	0.0	0.0	0.0
I-23F		Availability of roads along the canal	2.0	1.0	0.0	2.0	3.0	2.0

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	Huay Luang Project	RMC Project	Go Cong Project/ Long Hai Sta.
I-24	General Conditions for the Third Level Canals			<b>2.8</b>	<b>2.0</b>	<b>2.0</b>	<b>2.1</b>	<b>2.0</b>
I-24A		General level of maintenance of the canal floor and canal banks	1.0	2.0	3.0	3.0	2.5	1.0
I-24B		General lack of <u>undesired</u> seepage (note: if deliberate conjunctive use is practiced, some seepage may be desired).	1.0	1.0	2.0	3.0	2.0	4.0
I-24C		Availability of proper equipment and staff to adequately maintain this canal	2.0	0.0	1.0	0.0	1.0	1.0
I-24D		Travel time from the maintenance yard to the most distant point along this canal (for crews and maintenance equipment)	1.0	2.0	3.0	4.0	4.0	3.0
I-25	Operation of the Third Level Canals			<b>1.8</b>	<b>2.4</b>	<b>2.3</b>	<b>1.3</b>	<b>1.9</b>
I-25A		How frequently does the headworks respond to realistic real time feedback from the operators/observers of this canal level? This question deals with a mismatch of orders, and problems associated with wedge storage variations and wave travel times.	2.0	1.3	2.7	1.3	0.0	0.0
I-25B		Existence and effectiveness of water ordering/delivery procedures to match actual demands. This is different than the previous question, because the previous question dealt with problems that occur <u>AFTER</u> a change has been made.	1.0	1.3	1.3	2.0	0.0	4.0
I-25C		Clarity and correctness of instructions to operators.	1.0	1.3	2.7	2.7	2.7	4.0
I-25D		How frequently is the whole length of this canal checked for problems and reported to the office? This means one or more persons physically drive all the sections of the canal.	1.0	4.0	2.7	4.0	4.0	1.3

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	Luang Project	RMC Project	Go Cong Project/ Long Hat Sta.
	<b>Budgets, Employees, WUAs</b>							
I-26	Budgets			<b>0.0</b>	<b>1.2</b>	<b>0.8</b>	<b>0.8</b>	<b>2.0</b>
I-26A		What percentage of the total project (including WUA) Operation and Maintenance (O&M) is collected as in-kind services, and/or water fees from water users?	2.0	0.0	2.0	0.0	0.0	2.0
I-26B		Adequacy of the actual dollars and in-kind services that is available (from all sources) to sustain adequate Operation and Maintenance (O&M) with the present mode of operation.	2.0	0.0	1.0	0.0	0.0	3.0
I-26C		Adequacy of spending on modernization of the water delivery operation/structures (as contrasted to rehabilitation or regular operation)	1.0	0.0	0.0	4.0	4.0	0.0
I-27	Employees			<b>2.0</b>	<b>2.4</b>	<b>2.1</b>	<b>2.1</b>	<b>2.9</b>
I-27A		Frequency and adequacy of training of operators and middle managers (not secretaries and drivers). This should include employees at all levels of the distribution system, not only those who work in the office.	1.0	2.0	2.0	2.0	2.0	3.0
I-27B		Availability of written performance rules	1.0	1.0	4.0	3.0	3.0	4.0
I-27C		Power of employees to make decisions	2.5	2.0	3.0	2.0	2.0	2.0
I-27D		Ability of the project to dismiss employees with cause.	2.0	2.0	0.0	0.0	0.0	2.0
I-27E		Rewards for exemplary service	1.0	3.0	1.0	1.5	1.5	4.0
I-27F		Relative salary of an operator compared to a day laborer	2.0	2.0	4.0	4.0	4.0	4.0
I-28	Water User Associations			<b>1.5</b>	<b>1.8</b>	<b>2.0</b>	<b>0.6</b>	<b>0.6</b>
I-28A		Percentage of all project users who have a functional, formal unit that participates in water distribution	2.5	1.0	1.0	3.0	0.0	0.0
I-28B		Actual ability of the strong Water User Associations to influence real-time water deliveries to the WUA.	1.0	2.0	2.0	1.0	2.0	0.0
I-28C		Ability of the WUA to rely on effective outside help for enforcement of its rules	1.0	2.0	2.5	2.5	1.0	3.0
I-28D		Legal basis for the WUAs	1.0	2.0	3.0	2.0	1.0	1.0
I-28E		Financial strength of WUAs	1.0	1.0	1.5	0.0	0.0	0.0
I-29	Mobility and Size of Operations Staff			<b>0.0</b>	<b>3.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
I-30	Computers for billing and record management			<b>0.0</b>	<b>0.0</b>	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>
I-31	Computers for canal control			<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	LMC Huay Project	RMC Luang Project	Go Cong Project/ Long Hai Sta.
		<b>INDICATORS THAT WERE NOT PREVIOUSLY COMPUTED</b>						
		<b>THESE INDICATORS REQUIRE THE INPUT OF VALUES (0-4) IN EACH OF THE BOXES</b>						
I-32	Ability of the present water delivery service to individual fields, to support pressurized irrigation methods	4 - Excellent volumetric metering and control; 3.5 - Ability to measure flow rates reasonably well, but not volume. Flow is well controlled; 2.5 - Cannot measure flow, but can control flow rates well; 0 - Cannot control the flow rate, even though it can be measured.		2.5	2.2	0.0	0.0	3.3
I-32A	Measurement and control of volumes to the field	1.0	1.0	2.5	2.0	0.0	0.0	3.0
I-32B	Flexibility to the field	4 - Arranged delivery, with frequency, rate and duration promised. All can be varied upon request; 3 - Same as 4, but cannot vary the duration; 2 - 2 variables are fixed, but arranged schedule; 0 - Rotation	1.0	2.0	2.0	0.0	0.0	3.0
I-32C	Reliability to the field	4 - Water always arrives as promised, including the appropriate volume; 3 - A few days of delay occasionally occur, but water is still very reliable in rate and duration; 0 - More than a few days delay.	1.0	3.0	2.5	0.0	0.0	4.0
I-33	Changes required to be able to support pressurized irrigation methods			2.5	1.5	2.0	2.0	3.3
I-33A	Procedures, Management	4 - No changes in water ordering, staff training, or mobility; 3.5 - Improved training, only. The basic procedures/conditions are just fine, they just are not being implemented to their full extent; 3.0 - Minor changes in water ordering, mobility, training, incentive programs; 2.0 - Major changes in 1 of the above; 1 - Major changes in 2 of the above; 0 - Need to completely revamp or convert almost everything.	1.0	2.0	1.0	2.0	2.0	3.5
I-33B	Hardware	4 - No changes needed; 3.5 - Only need to repair some of the existing structures so that they are workable again.; 3.0 - Improved communications, repair of some existing structures, and a few key new structures (less than US\$300/ha needed), OR...very little change to existing, but new structures are needed for water recirculation; 2 - Larger capital expenditures - \$US 300 - \$US 600/ha; 1 - Larger capital expenditures needed (up to \$US 1500/ha); 0 - Almost complete reworking of the system is needed	1.0	3.0	2.0	2.0	2.0	3.0
I-34	Sophistication in receiving and using feedback information. This does not need to be automatic.	4 - Continuous feedback and continuous use of information to change inflows, with all key points monitored. Or, minimal feed back is necessary, such as with closed pipe systems.; 3 - Feedback several times a day and rapid use (within a few hours) of that information, at major points.; 2 - Feedback once/day from key points and appropriate use of information within a day; 1 - Weekly feedback and appropriate usage, or once/day feedback but poor usage of the information; 0 - No meaningful feedback, or else there is a lot of feedback but no usage.		0.0	1.0	0.0	0.0	0.0

Indicator Label	Primary Indicator Name	Sub-Indicator Name	Weighting Factor	Komping Pouy Project	Num Houm Project	LMC Huay Project	RMC Project	Go Cong Project/ Long Hai Sta.
I-35	Turnout density	<b>SPECIAL INDICATORS THAT DO NOT HAVE A 0-4 RATING SCALE</b> Number of water users downstream of employee-operated turnouts (Number of turnouts operated by paid employees/(Paid Employees) (Actual/Stated) Overall Service by the Main Canal (Actual/Stated) Overall Service at the most downstream point operated by a paid employee (Actual/Stated) Overall Service to the Individual Ownership Units						
I-36	Turnouts/Operator		20	15	12.0	11.0	1.0	
I-37	Main Canal Chaos		1.8	40.6	4.7	4.7	1.5	
I-38	Second Level Chaos		0.64	1.38	0.37	0.43	n.a.	
I-39	Field Level Chaos		0.41	0.67	1.71	1.17	1.88	
			1.23	0.45	0.50	0.71	1.00	



**Annex 12**  
**Modernisation plan –**  
**guidance of presentation**



## APPRAISAL

<p><b>Results</b></p> <ul style="list-style-type: none"> <li>○ Cropping intensity</li> <li>○ Average crop yields</li> <li>○ Yield/Unit of water consumed</li> <li>○ Downstream environmental impacts</li> </ul>	<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>○ % collection of water fees</li> <li>○ Viability of water user associations</li> <li>○ Condition of structures and canals</li> <li>○ Water theft</li> </ul>
<p><b>Service</b></p> <ul style="list-style-type: none"> <li>○ Actual level and quality of service delivered               <ul style="list-style-type: none"> <li>● To fields</li> <li>● From one level of canal to another</li> </ul> </li> </ul>	
<p><b>Water Management strategy</b></p>	
<p><b>Factors influencing service quality</b></p>	
<p><b>Hardware design</b></p> <ul style="list-style-type: none"> <li>○ Turnout design</li> <li>○ Check structure design</li> <li>○ Flow rate measurement</li> <li>○ Communication system</li> <li>○ Remote monitoring</li> <li>○ Availability of spill sites</li> <li>○ Flow rate control structures</li> <li>○ Capacity of canals</li> <li>○ Regulating reservoir sites</li> <li>○ Density of turnouts</li> <li>○ Drainage network</li> <li>○ Intake structure</li> <li>○ Recirculation of drainage and spills</li> </ul>	<p><b>Management</b></p> <ul style="list-style-type: none"> <li>○ Water control strategies</li> <li>○ Instructions for operating check structures</li> <li>○ Frequency of communication</li> <li>○ Maintenance schedules</li> <li>○ Understanding of the service concept</li> <li>○ Frequency of making flow changes</li> <li>○ Quality and types of training programs</li> <li>○ Monitoring and evaluation by successive levels of management</li> <li>○ Existence of performance objectives</li> </ul>
<p><b>Physical constraints</b></p> <ul style="list-style-type: none"> <li>○ Dependability of water supply</li> <li>○ Adequacy of water supply</li> <li>○ Availability of groundwater</li> <li>○ Climate</li> <li>○ Silt load in the water</li> <li>○ Geometric pattern of fields</li> <li>○ Size of fields</li> <li>○ Quality of seed varieties</li> <li>○ Field conditions               <ul style="list-style-type: none"> <li>● Land leveling</li> <li>● Appropriate irrigation methods for the soil type</li> </ul> </li> </ul>	<p><b>Institutional constraints</b></p> <ul style="list-style-type: none"> <li>○ Adequacy of budget</li> <li>○ Size of water user association</li> <li>○ Existence and type of law enforcement</li> <li>○ Purpose and organizational structure of WUA</li> <li>○ Destination of budget</li> <li>○ Method of collecting and assessing water fees</li> <li>○ Ownership of water and facilities</li> <li>○ Ability to fire inept employees</li> <li>○ Staffing policies, salaries</li> <li>○ Availability of farm credit</li> <li>○ Crop prices</li> </ul>
<p><b>Constraints</b></p>	

## MODERNIZATION PLAN

<b>VISION</b>	
<p><b>Results/Objectives</b></p> <ul style="list-style-type: none"> <li>○ Cropping intensity</li> <li>○ Average crop yields</li> <li>○ Yield/Unit of water consumed</li> <li>○ Downstream environmental impacts</li> </ul>	<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>○ % collection of water fees</li> <li>○ Viability of water user associations</li> <li>○ Condition of structures and canals</li> <li>○ Water theft</li> </ul>
<b>Service</b>	
<ul style="list-style-type: none"> <li>○ Level and quality of service delivered                             <ul style="list-style-type: none"> <li>● To fields</li> <li>● From one level of canal to another</li> </ul> </li> </ul>	
<b>Water Management strategy</b>	
<b>Factors influencing service quality</b>	
<p><b>Hardware design</b></p> <ul style="list-style-type: none"> <li>○ Turnout design</li> <li>○ Check structure design</li> <li>○ Flow rate measurement</li> <li>○ Communication system</li> <li>○ Remote monitoring</li> <li>○ Availability of spill sites</li> <li>○ Flow rate control structures</li> <li>○ Capacity of canals</li> <li>○ Regulating reservoir sites</li> <li>○ Density of turnouts</li> <li>○ Drainage network</li> <li>○ Intake structure</li> </ul>	<p><b>Management</b></p> <ul style="list-style-type: none"> <li>○ Water control strategies</li> <li>○ Information</li> <li>○ Instructions for operating check structures</li> <li>○ Frequency of communication</li> <li>○ Maintenance schedules</li> <li>○ Understanding of the service concept</li> <li>○ Frequency of making flow changes</li> <li>○ Quality and types of training programs</li> <li>○ Monitoring and evaluation by successive levels of management</li> <li>○ Existence of performance objectives</li> </ul>
<b>Constraints</b>	
<p><b>Physical constraints</b></p> <ul style="list-style-type: none"> <li>○ Dependability of water supply</li> <li>○ Adequacy of water supply</li> <li>○ Availability of groundwater</li> <li>○ Climate</li> <li>○ Silt load in the water</li> <li>○ Geometric pattern of fields</li> <li>○ Size of fields</li> <li>○ Quality of seed varieties</li> <li>○ Field conditions                             <ul style="list-style-type: none"> <li>● Land leveling</li> <li>● Appropriate irrigation methods for the soil type</li> </ul> </li> </ul>	<p><b>Institutional constraints</b></p> <ul style="list-style-type: none"> <li>○ Adequacy of budget</li> <li>○ Size of water user association</li> <li>○ Existence and type of law enforcement</li> <li>○ Purpose and organizational structure of WUA</li> <li>○ Destination of budget</li> <li>○ Method of collecting and assessing water fees</li> <li>○ Ownership of water and facilities</li> <li>○ Ability to fire inept employees</li> <li>○ Staffing policies, salaries</li> <li>○ Availability of farm credit</li> <li>○ Crop prices</li> </ul>

**MODERNIZATION OPTIONS**

**MODERNIZATION PLAN**

**SHORT TERM – 2004**

<p><b>Results/Objectives</b></p> <ul style="list-style-type: none"> <li>○ Cropping intensity</li> <li>○ Average crop yields</li> <li>○ Yield/Unit of water consumed</li> <li>○ Downstream environmental impacts</li> </ul>	<p><b>Symptoms</b></p> <ul style="list-style-type: none"> <li>○ % collection of water fees</li> <li>○ Viability of water user associations</li> <li>○ Condition of structures and canals</li> <li>○ Water theft</li> </ul>
<p align="center"><b>Service</b></p> <ul style="list-style-type: none"> <li>○ Level and quality of service delivered             <ul style="list-style-type: none"> <li>● To fields</li> <li>● From one level of canal to another</li> </ul> </li> </ul>	
<p align="center"><b>Water Management strategy</b></p>	
<p align="center"><b>Factors influencing service quality</b></p>	
<p><b>Hardware design</b></p> <ul style="list-style-type: none"> <li>○ Turnout design</li> <li>○ Check structure design</li> <li>○ Flow rate measurement</li> <li>○ Communication system</li> <li>○ Remote monitoring</li> <li>○ Availability of spill sites</li> <li>○ Flow rate control structures</li> <li>○ Capacity of canals</li> <li>○ Regulating reservoir sites</li> <li>○ Density of turnouts</li> <li>○ Drainage network</li> <li>○ Intake structure</li> <li>○ Intake structure</li> <li>○ Recirculation of drainage and spills</li> </ul>	<p><b>Management</b></p> <ul style="list-style-type: none"> <li>○ Water control strategies</li> <li>○ Information</li> <li>○ Instructions for operating check structures</li> <li>○ Frequency of communication</li> <li>○ Maintenance schedules</li> <li>○ Understanding of the service concept</li> <li>○ Frequency of making flow changes</li> <li>○ Quality and types of training programs</li> <li>○ Monitoring and evaluation by successive levels of management</li> <li>○ Existence of performance objectives</li> </ul>
<p align="center"><b>Constraints</b></p>	
<p><b>Physical constraints</b></p> <ul style="list-style-type: none"> <li>○ Dependability of water supply</li> <li>○ Adequacy of water supply</li> <li>○ Availability of groundwater</li> <li>○ Climate</li> <li>○ Silt load in the water</li> <li>○ Geometric pattern of fields</li> <li>○ Size of fields</li> <li>○ Quality of seed varieties</li> <li>○ Field conditions             <ul style="list-style-type: none"> <li>● Land leveling</li> <li>● Appropriate irrigation methods for the soil type</li> </ul> </li> </ul>	<p><b>Institutional constraints</b></p> <ul style="list-style-type: none"> <li>○ Adequacy of budget</li> <li>○ Size of water user association</li> <li>○ Existence and type of law enforcement</li> <li>○ Purpose and organizational structure of WUA</li> <li>○ Destination of budget</li> <li>○ Method of collecting and assessing water fees</li> <li>○ Ownership of water and facilities</li> <li>○ Ability to fire inept employees</li> <li>○ Staffing policies, salaries</li> <li>○ Availability of farm credit</li> <li>○ Crop prices</li> </ul>

**MODERNIZATION OPTIONS**

**MODERNIZATION PLAN**

**MEDIUM TERM – 2008**

<b>Results/Objectives</b>		<b>Symptoms</b>	
<ul style="list-style-type: none"> <li>○ Cropping intensity</li> <li>○ Average crop yields</li> <li>○ Yield/Unit of water consumed</li> <li>○ Downstream environmental impacts</li> </ul>		<ul style="list-style-type: none"> <li>○ % collection of water fees</li> <li>○ Viability of water user associations</li> <li>○ Condition of structures and canals</li> <li>○ Water theft</li> </ul>	
<ul style="list-style-type: none"> <li>○ Level and quality of service delivered                             <ul style="list-style-type: none"> <li>● To fields</li> <li>● From one level of canal to another</li> </ul> </li> </ul>		<b>Service</b>	
<b>Water Management strategy</b>			
<b>Factors influencing service quality</b>			
<b>Hardware design</b>		<b>Management</b>	
<ul style="list-style-type: none"> <li>○ Turnout design</li> <li>○ Check structure design</li> <li>○ Flow rate measurement</li> <li>○ Communication system</li> <li>○ Remote monitoring</li> <li>○ Availability of spill sites</li> <li>○ Flow rate control structures</li> <li>○ Capacity of canals</li> <li>○ Regulating reservoir sites</li> <li>○ Density of turnouts</li> <li>○ Drainage network</li> <li>○ Intake structure</li> <li>○ Intake structure</li> <li>○ Recirculation of drainage and spills</li> </ul>		<ul style="list-style-type: none"> <li>○ Water control strategies</li> <li>○ Information</li> <li>○ Instructions for operating check structures</li> <li>○ Frequency of communication</li> <li>○ Maintenance schedules</li> <li>○ Understanding of the service concept</li> <li>○ Frequency of making flow changes</li> <li>○ Quality and types of training programs</li> <li>○ Monitoring and evaluation by successive levels of management</li> <li>○ Existence of performance objectives</li> </ul>	
<b>Physical constraints</b>		<b>Institutional constraints</b>	
<ul style="list-style-type: none"> <li>○ Dependability of water supply</li> <li>○ Adequacy of water supply</li> <li>○ Availability of groundwater</li> <li>○ Climate</li> <li>○ Silt load in the water</li> <li>○ Geometric pattern of fields</li> <li>○ Size of fields</li> <li>○ Quality of seed varieties</li> <li>○ Field conditions                             <ul style="list-style-type: none"> <li>● Land leveling</li> <li>● Appropriate irrigation methods for the soil type</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>○ Adequacy of budget</li> <li>○ Size of water user association</li> <li>○ Existence and type of law enforcement</li> <li>○ Purpose and organizational structure of WUA</li> <li>○ Destination of budget</li> <li>○ Method of collecting and assessing water fees</li> <li>○ Ownership of water and facilities</li> <li>○ Ability to fire inept employees</li> <li>○ Staffing policies, salaries</li> <li>○ Availability of farm credit</li> <li>○ Crop prices</li> </ul>	

**MODERNIZATION OPTIONS**

## **Instructions for presentation**

Appraisal of present situation

Modernization plan

VISION and objectives

Modernization strategy

SHORT TERM PLAN – 2004

Budget:

Specific objectives

Service objectives

Water Management Strategy

Steps with specific improvements, actions and details

Costs and benefits

MEDIUM TERM PLAN 2005 – 2008

Budget:

Specific objectives

Service objectives

Water Management Strategy

Steps with specific improvements, actions and details

Costs and benefits



**Annex 13**  
**Modernisation plan –**  
**presentation handout**



**5 years - Modernization Plan  
Nam Houm Irrigation Scheme (Laos)**

**Results from July 2006  
RAP Training Workshop  
MRC, Vientiane**

*Prepared by Lao Participants*

**Content**

1. Vision
2. Objective
3. Strategies, options & cost estimation

**Vision**

**“Model irrigation system with complete infrastructure, effective management, and empowered WUAs”**

**Objectives**

1. To increase water use efficiency and productivity
2. To increase farmer’s income
3. To achieve sustainable system operation

**Strategies**

1. Hardware
  - 1) Rehabilitate & improve irrigation facilities e.g. canals, gates, roads...etc.
  - 2) Improve drainage
  - 3) Improve & construct field/on farm system e.g. farm ditch, farm turnouts...etc.
  - 4) Provide water measurement and monitoring devices for water distribution, spill and runoff
  - 5) Improve IT system between project and farmers level for adjustment & improvement of water delivery
  - 6) Strengthen protection of irrigation facilities
  - 7) Provide project equipments for maintenance activity

**Strategies**

2. Software
  - 1) Improve project management plan
  - 2) Add more 3 project staff
  - 3) Strengthen WUAs : Training, strict implementing rules
  - 4) Increase collecting rate of ISF from 32% to 90%
  - 5) Improve system operation and irrigation service toward more flexible and user oriented model
  - 6) Improve monitoring and evaluation system for water distribution

### Cost Estimation

**1. Hardware : 2,208,500**

- 1) Rehabilitate irrigation facilities + drainage : US\$500/ ha
- 2) Construct field/on farm system :US\$ 300/ha
- 3) Current Meter & Flumes: 10,000/1set  
Water measurement & monitoring: US\$300/month/person
- 4) Improve IT system: Phony radio: US\$1500/1 set
- 5) Improve social authority: US\$0 (farmer's participation)
- 6) Provide project equipments for maintenance activity:
  - Back hoe loader : US\$ 100,000
  - Dam truck : US\$ 40,000
  - Tractor : US\$ 40,000 } US\$180,000

### Cost Estimation

**2. Software : US\$ 41,000**

- 1) Improve project management plan : US\$0
- 2) Add more 3 project staff : US\$ 0
- 3) Strengthen WUAs : Training, strict implementing rules: US\$2000/time ( 2 times a year)
- 4) Increase amount of ISF collection of more than 90% :0US\$
- 5) Improve water delivery regulation to be more strictly and effectively: US\$100/month
- 6) Improve monitoring and evaluation for whole system for water distribution: US\$3,000/time/year

**Total Budget Required: US\$ 2,249,500**

Thank you for your kind instruction

## Objective

### วัตถุประสงค์

1. ปรับปรุงประสิทธิภาพระบบการจัดการชลประทานในระดับคลองสายใหญ่และคลองสายย่อย  
- To improve Irrigation water management efficiency in main canal and lateral canal
2. เพื่อลดความเสี่ยงของการขาดน้ำเพื่อการปลูกพืชทั้งในฤดูแล้งและฤดูฝน  
- To reduce risk of lacking water for agriculture both dry and wet season

3. เพื่อพัฒนาองค์กรผู้นำให้สามารถเข้ามามีส่วนร่วมในการตัดสินใจเชิงปริมาณ  
- To strengthen for WUG in participation of decision making in terms of amount of water
4. เพื่อเสริมสร้างความรู้ความสามารถในการควบคุมอาคารชลประทานของเจ้าหน้าที่โครงการให้ถูกต้องตามหลักวิชาการ  
- To make capacity building to the officers to control and operate the hydraulic structure according to the technical
5. เพื่อเพิ่มผลผลิตต่อไร่  
- To increase yield crop per rai

## Problems

### ปัญหา

1. เกษตรกรขาดความรู้ในเรื่องปริมาณน้ำตามที่เจ้าหน้าที่บอก  
- Farmers are not know the quantity of water (just know the figure)
2. ขาดเครื่องมือ อุปกรณ์ ในการบริหารจัดการน้ำตามหลักวิชาการที่ต้องการ ความถูกต้องสูง  
- Lacking of equipment to technically operate
3. ขาดงบประมาณในการบริหารจัดการน้ำ  
- Lacking of budget for management

4. มีบางพื้นที่เพาะปลูกที่ไม่ได้รับน้ำตามความต้องการของพืช  
- Crop water requirement couldn't meet in some areas
5. การตรวจสอบอัตราการไหลของน้ำผ่านอาคารมีความยุ่งยากเนื่องจากมีอาคารชลประทานเป็นจำนวนมาก  
- Difficulty in controlling and operating amount of water through hydraulic structures because of many structures.
6. เกษตรกรบางส่วนทำการเกษตรเป็นอาชีพรอง  
- Some farmers don't get main income from agriculture.
7. เกษตรกรบางส่วนไม่มีที่ดินเป็นของตนเอง ทำให้การมีส่วนร่วมของเกษตรกรทำได้ยาก

## Propose & Solution

### ข้อเสนอแนะและแนวทางแก้ไข

1. พัฒนาบุคลากรให้มีความรู้ความสามารถในการปฏิบัติงานรวมถึงจัดหาบุคลากรที่มีศักยภาพในการปฏิบัติงานให้เพียงพอ  
- Capacity building to the RID officer including recruit the resource persons
2. จัดหาเครื่องมือ อุปกรณ์ ในการบริหารจัดการน้ำตามหลักวิชาการที่ต้องการความถูกต้องสูง  
Providing instruments for technical water management
3. จัดหางบประมาณในการบริหารจัดการน้ำ เช่น เงินค่าทำงานวันหยุด ค่าน้ำมัน  
- Allocating budget for water management such as overtime, gasoline, phone card
4. แผนการส่งน้ำควรมีการสำรองน้ำไว้ในช่วงที่อาจจะขาดแคลน  
- Making a plan for reserving water to use in the shortage period

5. ส่งเสริมให้มีการขุดบ่อน้ำในไรนาเพื่อสำรองน้ำไว้ใช้ทำนาที่เหมือน Regulating Reservoir  
- Promoting to excavate farm pond to reserve water and act as regulating reservoir
6. จัดฝึกอบรมเชิงปฏิบัติการให้กับเกษตรกรมีความเข้าใจในเรื่องน้ำเชิงปริมาณ  
- Providing training and seminar to the farmers in order to understand water quantity
7. จัดอบรมเจ้าหน้าที่เรื่องการบริหารจัดการน้ำตามหลักวิชาการอย่างต่อเนื่อง  
- Providing the training to officers in water management
8. จัดหาสิ่งจูงใจให้กับเจ้าหน้าที่ที่ปฏิบัติงานส่งน้ำ เช่น เงินรางวัลประจำปีให้สอดคล้องกับผลงาน  
- Providing incentive and rewards to officer such as bonus and etc. as the performance
9. จัดหางบประมาณเพื่อมาทำงานแบบบูรณาการกับหน่วยงานอื่น เช่น กรมส่งเสริมการเกษตร กรมพัฒนาที่ดิน ในการพัฒนาเพิ่มผลผลิตและปลอดภัย  
- Providing budget to respond with the other agencies such as Department of Agriculture Extension , Land Development Dept. in order to increase crop yield and food safety



## Results

Output per cropped area per (\$/ha)=368\$  
Output per unit irrigated supply (\$/m<sup>3</sup>): 0.0664  
Annual relative water supply: 6.2  
Annual relative irrigation supply: 1.0  
Water delivery capacity : 341%  
Percentage of O&M collected (%):  
Annual Project irrigation Efficiency(%): 61  
Annual Command Area Irrigation Efficiency (%):40

## Major Problems

1. Uncompleted infrastructure system
2. Low field irrigation efficiency
3. Low agricultural production
4. Irrigation water drained out of the command area
5. No Regulating Reservoirs in the command area
6. Lack of communication facilities and procedure
7. Poor physical condition of lower level canal system
8. Insufficient water control and measurement

## Vision

To ensure enough water for irrigation schemes, reduce water fee for increasing income for all the farmers and be sustainable management.

## Objective

- To improve existing irrigation area
- To rehabilitate and recover irrigation area
- To empower farmer water user groups

## Strategy

- To rehabilitate existing irrigation infrastructures
- To extent irrigation areas
- To strengthen capacity building of FWUC and WUGs
- To strengthen O&M

## Cost estimation

- To rehabilitate existing irrigation infrastructures:  
2,850ha x 350\$= 997,500\$
  - To extent irrigation areas:  
7,150ha x 800\$=5,720,000 \$
  - To strengthen capacity building of FWUC and WUGs  
200,000\$ for 5 years
  - To strengthen O&M  
500,000\$ for 5 years
- Total: 7,417,500\$