The Second Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project (IIEPF)

Workshop Proceedings

25 March 2008
Vientiane, Lao PDR

Organised by the Mekong River Commission Secretariat
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REPORT ON THE SECOND REGIONAL WORKSHOP

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

(25 March 2008, Mekong River Commission Secretariat, Vientiane, Lao PDR)

1. Background

The Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project (IIEPF) is aimed at improving the efficiency of irrigation through the introduction of guidelines covering the technical, managerial and institutional aspects of irrigation schemes and of the operations of the facilities.

The project is funded by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan under the framework of the "Programme to Analyse and Evaluate Water and Ecosystems in Asian Paddy Fields". The project is implemented by the Mekong River Commission Secretariat (MRCS) in close cooperation with the National Mekong Committees (NMCs) and their relevant line agencies.

The first regional workshop to finalise the project document and to discuss the outline of future project activities was held in May, 2006 at the MRCS in Vientiane, the Lao PDR. Immediately after this regional workshop, the MRCS conducted a Rapid Appraisal Process (RAP) training workshop in July 2006 with technical assistance provided by the FAO Regional office in Bangkok. These workshops were followed by the initial scheme performance appraisals at the four pilot sites. Once the baseline data for these four pilot sites had been set up, the country teams assisted by the MRCS conducted intensive field observations covering two crop seasons (2006 to 2007). In parallel with these field observations, the MRCS together with the consultant from NIRE, Japan conducted two field surveys and interviews between the middle to the end of 2007.

On the completion of the field activities including the analysis of the collected data, this second regional workshop was held in order to share all the activities and their outputs/findings under the IIEPF with member countries including field activities, the various publications produced mainly by the MRCS and the guidelines being drafted by the NIRE consultant. The second regional workshop also aimed to discuss the outline of the draft guidelines and asked opinions and comments of the member countries for further improvement.

The Workshop Agenda is given in Annex 1.

2. Organisation

2.1. Participants

A total of 23 participants attended the Workshop. These included five (5) participants each from Cambodia and Thailand, four (4) from Lao PDR, two (2) participants from Viet Nam, one (1) resource person from NIRE, Japan, one (1) diplomat from the Embassy of Japan to

the Lao PDR and five (5) professional and support staff from the MRCS. Two officials from VNMC were forced to cancel their participation by conflict of the schedule and sudden accident.

The list of the participants is given in Annex 2

2.2. Opening Remarks

The workshop began at 09.00 on Tuesday, 25 March 2008 in the MRC Conference Room, Vientiane, the Lao PDR with an opening address by Mr Do Manh Hung, the Director of the Operations Division and the Officer-in-Charge of the Mekong River Commission Secretariat. This was followed by an address by Mr Metoku Yuichi, Second Secretary of the Embassy of Japan to the Lao PDR.

Mr Hung expressed his appreciation for the support given to the MRC by the Ministry of Agriculture, Forestry and Fisheries of Japan and for the significant technical support to implementation from the FAO in Bangkok. He also acknowledged the work of the member countries, NMCs and the line agencies in terms of their contribution of fieldwork, and the analysis of the resulting data. He emphasised that irrigation development is expected to play a key role in the pro-poor development of agriculture which together with hydropower are key factors in the achievement of the MRC's overall objective "to support Member States for more effective use of the Mekong's water and resources for poverty alleviation" as set out in the Strategic Plan (2006-2010). He pointed out that this project had been created in response to the need to share the limited water resources efficiency between agriculture and the other sectors. He concluded by asking for constructive and critical comments to improve the final technical guidance document.

Mr Metoku stated that the Government of Japan was eager to support the development of the Mekong Region through both bi- and multi-lateral channels. This was illustrated by the "Japan-Mekong Foreign Ministers Meeting" held in Tokyo earlier this year in January. This meeting identified many "candidate projects for the Cambodia-Lao PDR-Viet Nam Development Triangle". He confirmed continuing support and funding by the Japan-ASEAN Integration Fund (JAIF). He also mentioned that the Ministry of Agriculture, Forestry and Fisheries of Japan is especially active in the development of land and water resources for agriculture and informed the participants that the third series of contributions focused on the use of water for irrigation purposes pledged by the MAFF Japan at the annual consultation meeting in this year since the Ministry recognizes the challenges still facing effective water management for irrigation.

These speeches by Mr Do Manh Hung and Mr Metoku Yuichi are given in Annex 3.

3. Presentations and discussions

3.1. Workshop Agenda

The AIFP Senior Advisor outlined the agenda for the workshop;

1. the morning session would be devoted to listening to the presentations of the four Member countries detailing their observations and findings; and

2. the afternoon session would begin with a presentation of the concepts behind the technical guide, followed by a consultation of how these should be applied to the four schemes and would finish with input from the Member countries.

A questionnaire to evaluate the project concept and design was distributed. The results of this questionnaire are given in Paragraph 6.

3.2. Overview of IIEPF implementation and progress

The AIFP Senior Advisor presented an overview of IIEPF implementation and progress. He began by describing the funding arrangements. The Ministry of Agriculture, Forestry and Fisheries of Japan provided approximately US$ 1 million for three years corresponding to the Japanese fiscal years 2005 to 2007.

The Senior Advisor then reminded the participants of the project structure and emphasised the importance of the fieldwork. He presented the objectives; the overall objective was to contribute to an improvement of the efficiency of irrigation, with immediate objectives of an appraisal of the scheme performance, an enhancement of the capacity of the stakeholders and the production of guidelines. Under each immediate objective the planned activities were set as follow:

Performance Appraisal included:

- Field (scheme) level data collection
- Water balance analysis
- Scheme management appraisal
- Rapid Appraisal Process (RAP)

Capacity Enhancement included:

- Regular backstopping
- A RAP training workshop and an initial assessment
- National workshops

Guidelines activities included:

- A review of the information and data collected
- Field surveys and interviews
- Consultations through workshops

The participants were reminded that the last activity on this list would be conducted in the afternoon session of this workshop.

In terms of the plan and progress there had been no significant delays apart from a delay in the data analysis and the production of the guidelines. The outputs achieved included the completion of the initial assessments together with RAP training, and the collection and analysis of data in three countries during the 2006/07 dry season and the 2006/07 winter-spring crop in the tidal irrigation scheme in Viet Nam. The Senior Advisor also listed the various publications issued and the outputs currently in hand. This workshop would be the

first opportunity to discuss the guidelines and that due to both the time and budget restraints set by the completion date of June 2008, would be the only opportunity. The Senior Advisor asked for active participation and comments including those on a suitable title. In answer to a question from a member from Cambodia, he replied that his personal view was that perhaps "Guidelines" was too strong a title since the final product should not be seen as rules or regulations but rather as a presentation of the technical aspects together with suggestions. The member then went on to comment that the guidelines had already proved very useful and he saw no problem with the name. He was thanked and informed that this would form part of the afternoon's discussion. The Senior Advisor then introduced the first of the member country presenters.

The overview is outlined in Annex 4.

3.3. Field observations and analysis by the country teams

Representatives from the four Member countries presented their field observations and analyses. Each presentation included details of the location, the size, a brief description of the irrigation scheme and its management, and the methods used in collecting the field data.

Long Hai Irrigation Area, Gocong Irrigation Project, Viet Nam

A member of the Viet Nam team gave the first presentation since their scheme, the Long Hai Irrigation area, Gocong Irrigation Project in the Mekong Delta, was the only example of a tidal irrigation scheme. The key function of the project is aimed at irrigation, drainage and salinity prevention. The analysis showed that irrigation efficiency was higher in the winter-spring crop but lower in the summer-autumn crop. Average productivity through three crop seasons accounts for 0.78kg per one cubic meter of water diverted into the command area. Each family earned 86% of their annual income from an average plot of 0.58 ha.

Huay Luang O & M Project, Udon Thani, Thailand

The second presentation was on the Huay Luang O & M Project in Udon Thani in Thailand. This gravity irrigation project covers some 13,917.9 ha and provides water for both domestic and industrial consumption. The reservoir with 118.8 MCM (Million Cubic Meters) of storage capacity provides 4.2 MCM for industry and 22.6 MCM for domestic use. However intensive field observation was carried out at the area under the left main canal, which provides irrigation for 7,912 ha in the wet season and 2,988 ha in the dry season. Although paddy is the main production in the region, non-paddy crops grown in the dry season accounted for more than 20% of the total area. There was a strong recommendation that the MRCS should provide equipment, and should not only fund but also provide training for the development of human resources.

Kamping Puoy Scheme, Battambang Province, Cambodia

The third presentation was on the gravity scheme of Kamping Puoy in Battambang Province in Cambodia where rice is grown in both the wet and dry seasons. The water management is through a water allocation plan agreed upon by Farmer Water User Committees. Although the team presented many field observation results it was pointed out that some of the data may not be absolutely reliable since problems had been encountered thus some data was either not recorded or not included. There was a request that the MRCS should allow for one

more year of research so that there would be more data for analysis and some information gaps could be filled in. However the members of the team had learnt a great deal and had gained much experience in conducting measurements in terms of the efficiency of irrigation water use and, on the operation and management of irrigation systems.

Nam Houm Irrigation Project, Vientiane Capital, the Lao PDR

The last country to present their findings was the Lao PDR. The Nam Houm Irrigation Project, a gravity scheme which has the objective of generating household income for families and of supporting and promoting the industrialisation of agriculture through the provision of irrigation services. The water is supplied solely for agricultural use and not for domestic or any other uses. From the field observations it was concluded that the low efficiency resulted from the poor facilities giving rise to water loss and drainage spill. The loss along canal and irrigation structures was estimated at 30% of total supply. Problems of water shortage are not adequately addressed by the system of water allocation since there is no feedback mechanism. The higher efficiency observed in the wet season (78.17%) results from the reduced demand then, while the higher productivity in the dry season (US$ 0.11/m^3 of water consumption) is due to the higher prices of paddy and non-paddy products and their production. In order to increase both the efficiency of water use and water productivity trials of better management practices need to be implemented.

All these presentations are given in full in Annex 5. Full text of country reports from NMCS are also placed in the CD.

3.4. Summary of the technical backstopping work under IIEPF in 2006/07 dry-season cultivation

The morning session closed with the AIFP Programme Officer presenting a summary of the technical backstopping work under IIEPF in the 2006/07 dry-season cultivation. The AIFP Programme Officer first apologised for the fact that this summary covered only the dry season cultivation since he had just received the wet season data and needed time to complete the analysis. He began with an overview of agriculture and irrigation in the Lower Mekong Basin, pointing out that the ever increasing population in the region makes an ever increasing demand on agriculture for food. Most agriculture in the region still depends on the rainfall between the months of April to November. However a significant gap between rainfall and the water demand by crops can be observed at the end of the rainy season (November) especially in northeast Thailand. He re-iterated the IIEPF Project objectives and described their expected impact. He then presented the results of the year long field observations for three gravity schemes followed by those from the tidal irrigation scheme. He concluded that high efficiencies were due to the water balance approach and the outstanding performance at the pilot sites. Moreover the high productivity was observed in schemes where there were multiple agricultural activities. He concluded with the comment that a similar practical approach was expected to be applied to irrigation systems throughout the Lower Mekong Basin.

This presentation is made available in Annex 6.

Mr Horikawa Naoki, the consultant from NIRE, Japan first presented the key concepts of the guidelines for the efficient use of water in irrigation. He began by saying that three indicators had been chosen, namely; reliability, flexibility and equity, and that these indicators were reflected in the chapters of the draft outline, the overall purpose of which is to describe the options in the improvements of the efficiencies of irrigation systems in the Mekong River Basin. The guidelines are focused on the management phase of a project and since most of the irrigation schemes in the Mekong Basin are open channel they focus on such schemes. Mr Horikawa explained the guidelines contained seven chapters dealing with (1) Water Allocation; (2) Water Distribution; (3) Canal Operations; (4) Management of Waters in Tertiary Canals; (5) Distribution; (6) Improvement of Physical Structures and (7) Technical and Management Aspects. He explained how these chapters reflected the three indicators. Mr Horikawa then gave further details; explaining and commenting on each chapter. He emphasised that decisions were often quite difficult to take since there were always many options, and that often there were both disadvantages and advantages.

His presentation and outline are in Annex 7.

3.6. Application to the pilot sites (case study)

Mr Horikawa Naoki, the consultant from NIRE, Japan, then went on to demonstrate how these draft guidelines could be applied to the pilot sites. He had made two visits to each site and since full details and descriptions of the sites had already been presented he would not repeat these.

Nam Houm Irrigation Project, Vientiane Capital, the Lao PDR

First Mr Horikawa commented on the Nam Houm Scheme where there was supplementary irrigation in the wet season. This water supply did not reflect the situation in the paddy fields. Overall the Nam Houm Project had mastered water allocation, and had reached an almost constant level of water distribution satisfying the first two indicators of reliability and flexibility. Their next step should be a consideration of the aspects of equity addressing; dry season rotation of the irrigation from tertiary canals, a flexible irrigation supply and the optimum operations of the reservoir to facilitate an increase of the crop intensity.

Huay Luang O & M Project, Udon Thani, Thailand

Next Mr Horikawa considered the Huay Luang O & M Project where irrigation efficiency is higher in the wet season than in the dry, and the water distribution to the four zones is controlled well. In relation to the chapters and indicators of the guidelines this site's next steps should be to consider water management in the tertiary canals focusing on; low measurements at turnouts, feedback to intake to ensure flexibility, the assignment of dry season crop areas and the strengthening of the tertiary level of the Water User Groups.

Kamping Puoy Scheme, Battambang Province, Cambodia

The Kamping Puoy Scheme, Battambang Province was the next site for Mr Horikawa's attention. In this site water is drawn from a nearby river and there are plans to extend the canal to provide for an additional irrigated area. In terms of their irrigation plan the consultant

felt there was not enough information for the wet season. There was room for improvement. However he acknowledged the difficulties associated with small staff numbers. The next steps should be; monitoring of the reservoirs, measurements of the flow rates at turnouts to the tertiary canals, the training of the leader of the Water User Groups at the tertiary canal level and the optimum operation of the reservoir.

Long Hai Irrigation Area, Gocong Irrigation Project, Viet Nam

The final site for comments was that of the Long Hai Irrigation Area, Gocong Irrigation Project. Because of the uniqueness of tidal irrigation, the water management of this scheme relies heavily on natural phenomena and this limits opportunities for improvement. However the consultant presented some recommendations in that the next steps for this scheme should be at the institutional level, namely; quality control to reduce flush water and an analysis of the water balance.

Presentation for this session is also in Annex 7.

3.7. Feedback from the Member Countries

Member countries were then invited to make comments. The AIFP Programme Officer was the facilitator and began by asking the Senior Advisor to present the key issues to be discussed. These included clarification by questions and answers, discussion on an appropriate title for the guidelines and the next process to be undertaken.

This presentation is in Annex 8.

The first question for clarification came from the Cambodian team who asked about the seasonal irrigation plan – how could they make a plan to cover the wet and the dry seasons? In the dry season water is taken from the reservoir. Mr Horikawa's response was that there was no need for a wet season plan.

A member from Thailand then enquired about the next step which had been recommended and asked for a further explanation of what 'feedback to intake' meant. The response was that there should be a more flexible water management first in each zone and then between the zones.

Next came another comment from the Cambodian team regarding the next step of monitoring the water level in the reservoir (currently monitoring is done at the gate), and the question of how can leakage between the gate and the paddy fields be controlled. Mr Horikawa replied that since it is intended to extend the beneficiary area by 2,000 ha the project should know how many hectares can be irrigated, and so it is necessary to know how much water there is in the reservoir and what the water volume in the rivers is. These measurements are necessary to ensure future sustainability.

A member from Thailand asked how was it possible to deal with water shortages resulting from concentration of planted paddy plots as suggested by the consultant. Mr Horikawa explained that the concentration in the dry season of each year should be to places agreed upon by the water user groups, but that the places of concentration could be rotated each year. The Senior Advisor once again stressed that the need to consider the basic concept of

the guidelines. What are guidelines? Are they rules or are they simply for reference? Mr Horikawa then reminded the participants that in each country there are different social aspects so it is impossible to generalise for all countries. He asked that participants should remember that the guidelines are not the final answer applicable everywhere.

Another suggestion was that the guidelines should contain a section on the maintenance of the systems. Mr Horikawa agreed that maintenance was important and said that this would be considered.

A member from Cambodia asked what exactly was meant by 'monitoring of the reservoir' and could the consultant please elaborate on this. Mr Horikawa gave a more practical explanation and agreed that reservoir monitoring was difficult, however measurements could be handled by the leaders of the water user groups. He described the current situation which was control by the community leader who had to do so by trial-and-error with visual checking. If flow measurements could be introduced then this would make his job easier. Mr Horikawa continued by saying that training was very important especially for control in the tertiary canals since the people involved are not trained irrigation engineers. And in terms of the optimum management of the reservoir this crucial issue had already been covered. A further comment from the Cambodian team was that they were still unclear in how to monitor the reservoir. Mr Horikawa explained this could be achieved by measuring the differences in water levels, by calculating the discharge into the main canal and the water diverted from other areas to the project area. Clearer references between the case study and relevant parts of guidelines will be prepared by the consultant later.

A member from Viet Nam then referred Mr Horikawa to his suggested next step of quality control to reduce the flush water. Mr Horikawa replied that in the wet season water is drained to maintain the water quality so maybe quality control is not so important at that time, however during the dry season there is not enough water so the water quality is degraded. It may not be necessary to reduce the flush water but his suggestion should be retained if production was to be improved.

The Senior Advisor then intervened to say that enough time had now been spent on the case study and perhaps the members could give their feedback on the guidelines.

A member from the Lao team commented that the guidelines were very good and would be of great help in the Nam Houm Project where they would be distributed and used to improve the knowledge of the local staff.

The team from Thailand queried Item 5.2 – the Restriction of Land Use which they felt may give rise to problems particularly with land use changes. This may be difficult to achieve. They acknowledged the result could be a low efficiency in irrigation but it also involved other issues for example like those connected with salinity intrusion where paddy fields and sea water fish ponds were in close proximity. These issues could lead to disputes between farmers. They suggested that there could perhaps be a different wording. The consultant took note and will respond to this comment by adding a supplementary explanation when finalising the guidelines.

A member of the Lao team referred to Item 6 – the Improvement of Physical Structures. He pointed out that in the Lao PDR there were no automatic gates (Item 6.5) and that funds would be needed for training in remote monitoring and control systems. The Senior Advisor

once again stressed that following the guidelines was not compulsory. They are intended to simply give countries ideas and suggestions, which may be realised within the longer term.

A member from Cambodia commented that Item 4 –Water Management in the Tertiary Canals was too limiting and should be expanded to include both the main and secondary canals. The consultant responded that Item 1 to 3 covered both main/secondary and tertiary canal management and Item 4 included special considerations for tertiary canal in a separate chapter. This structure will be clearly shown in the next version.

The Senior Advisor thanked all the members for their contributions and asked for their comments on the term 'guidelines'. Did they think that it was too strong and was it misleading? He asked them to remember that it deals mostly with technical issues and provides hints for water management for irrigation engineers. It does not intend to lay down rules. A member from Cambodia replied they had no objections but asked for alternatives. The Senior Advisor responded with some possibilities that he had in mind such as; Technical Guidance, Best Practices or Water Management Principles. He then concluded that since there seemed to be no strong objections perhaps the MRCS could be allowed to decide. He went on to say that since time and budget restraints made it unlikely that there would be the opportunity for another workshop further clarification would be through e-mail. Some consultation meetings were possible.

3.8. Wrap-up of the workshop discussion

The Senior Advisor began by apologising for the necessity for a very quick wrap-up because time was running out. He thanked everybody for their active participation and the various valuable comments particularly those on the possibility of the inclusion of a chapter on maintenance, and their comments on the issues of water shortages and changes in land use. He assured everyone that their comments would be incorporated in the final draft. There would also be further discussions on a suitable title and the next step would be decided. In this connection he again emphasised that further support and cooperation by member countries is still required.

All the member country delegates agreed that the MRCS could decide on the further processes towards finalisation of the guidelines, including the title and style appropriate for the final clarification. In general the member countries also showed their satisfaction with the progress and achievement of the IIEPF implementation up till now and supported the next steps toward completion of the IIEPF proposed by the MRCS at this workshop. A Thai delegate added his appreciation for the IIEFP which was one of the successful MRC projects under AIFP.

4. Closing Remarks

Mr Hung, the Director of the Operations Division and the Officer-in-Charge of the MRCS began his closing remarks with an apology for not having been able to attend the whole workshop. Although there had not been a huge amount of comments he understood that the members needed time to carefully read and digest the contents of the guidelines. He encouraged further consultations amongst team members and after this to send their suggestions. He understood that the time for this workshop was limited. Mr Hung thanked all members for their active participation.

The workshop finished at 17.00 on Tuesday 25 March 2008.

5. Social activity

A dinner to honour the participants was hosted by the MRCS in the evening of 25 March, 2008, at the Fu Man Lou Chinese restaurant in Vientiane. This gave the workshop participants the opportunity for informal discussions and allowed them to congratulate each other on their hard work and active involvement during the implementation of the project.

6. Questionnaire for project evaluation

An evaluation of the IIEFP project was conducted at the request of the MAFF, Japan through their own questionnaire format. It was suggested to the member countries that they should give at least two replies from each country. However the Lao PDR and Thailand voluntarily replied to more than the number requested.

In general, the evaluation revealed positive support for the IIEPF project. The majority supported the idea of an extension of the implementation period and an expansion of the pilot sites. Supporting activities to share findings and disseminate the project outputs such as training were also suggested. Another common suggestion was the challenge of the need for structural improvement although it had been clearly explained at the first regional workshop that this approach was outside the focus of the IIEPF, mainly because of budgetary constraints.

A Cambodian delegate greatly appreciated the IIEPF as a unique trial.

The Lao delegates repeated that at the development stage, the engineers' skills and other capacities of the individual countries should be taken into consideration, although this point was clarified during the workshop discussion.

As the Thai team is now conducting follow-up activities in training their own staff and carrying out further data collection, they made a strong request to be able to keep the current meter provided.

A Viet Nam delegate suggested that the guidelines should go through the MRC clearance process before dissemination.

The questionnaire and summary of responses are attached as Annex 9.

ANNEXES

Annex 1: Workshop Agenda

Workshop Agenda

The Second Regional Workshop on the Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong River Basin Project (IIEPF)
25 March 2008, MRCS, Vientiane, Lao PDR

Time	Sessions
08:30-09:00	**Registration**
09:00-09:10	**Opening Remark** By Dir. Do Manh Hung (Director, Operations Division, MRCS)
09:10-09:20	**Remark** By Mr. Metoku Yuichi (Second Secretary, Embassy of Japan)
09:20-09:30	**Introduction of Participants** Facilitated by Mr. Okudaira (Senior Advisor, AIFP)
09:30-09:35	**Outlining Workshop Agenda** By Mr. Okudaira
09:35-10:00	**1. Overview of IIEPF Implementation and Progress** By Mr. Okudaira
10:00-11:40	**2. Report on Field Observation and Analysis by Country Teams** Facilitated by Mr. Okudaira
10:00-10:20 10:20-10:40	Vietnamese team Thai team (Each session is composed of 15 minutes presentation followed by 5 minutes for clarification)
10:40 -11:00	*Coffee Break*
11:00-11:20 11:20-11:40	Cambodian team Lao team (Each session is composed of 15 minutes presentation followed by 5 minutes for clarification)
11:40-12:10	**3. Major Findings for Technical Backstopping Work** By Mr. Fongsamuth (P.O, AIFP)
12:10 -13:30	*Lunch at MRC courtyard*
13:30- 14:30	**4. Key Concept of the Technical Guide** By Mr. Horikawa (consultant, NIRE, Japan)
14:30-14:50	*Coffee break*
14:50 - 15:10	**5. Application to the Pilot Sites (Case Study)** By Mr. Horikawa
15:10-16:10	**6. Feed Back from Member Countries** Facilitated by Mr. Fongsamuth
16:10-16:20	**Wrap-up the Workshop Discussion** By Mr. Okudaira
16:20-16:30	**Closing Remark** By Dir. Hung
18:00-21:00	*Diner at Fu Man Lou Chinese Restaurant*

Annex 2: List and photograph of Participants

The Second IIEPF Regional Workshop
Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin
25 March 2008, Vientiane, Lao PDR

List of Participants

Cambodia

1.	H.E. Mr. Kol Vathana	Deputy Secretary General, CNMC
2.	Dr. Theng Tara	Director of Water Resources Management and Conservation Department, MOWRAM and Focal Point of IIEPF
3.	Mr. Hong Kimsan	Deputy Director of Water Resources and Metrology Department of Battambang Province
4.	Mr. Meas Peov	Technical Officer of Agronomy and Agricultural Land Improvement Department, MAFF and Focal Point of IIEPF
5.	Mr. Sok Khom	National AIFP Coordinator, CNMC

Lao PDR

6.	Mr. Khammay Vongsathiane	Director of Technical Division, Irrigation Department/ MAF and IIEPF Country Team Leader
7.	Mr. Phouthone Siriphanhthong	Deputy Director of Operation and Maintenance Division, Department of Irrigation/MAF
8.	Mr. Bounhap Vongvichith	Nam Houm Irrigation Project Director
9.	Mr. Phonepaseuth Phouliphanh	Programme Coordinator, LNMC

Thailand

10.	Mr. Chatchai Boonlue	Director of Foreign Financed Projects Administration Division, Royal Irrigation Department
11.	Mr. Somsak Vivithkeyoonvong	Irrigation Engineer (RID)
12.	Mr. Suwat Krajangmontree	Chief of Operation and Irrigation Improvement (RID)
13.	Mr. Pramote Phuengphian	Chief of Water Operation and Maintenance Branch 3 (RID)
14.	Mr. Satit Sueprasertsuk	AIFP Coordinator, Department of Water Resources

Viet Nam

15.	Mr. To Quang Toan	Southern Institute for Water Resources Research
16.	Mr. Huynh Phuoc Hai	Tien Giang Provincial Department for Agriculture and Rural Development

Resource Person

17.	Mr. Horikawa Naoki	Consultant, NIRE, Japan

Donor Representative

18.	Mr. Metoku Yuichi	Second Secretary, Embassy of Japan

MRC Secretariat

19.	Mr. Do Manh Hung	Director, OPD/OIC, MRCS
20.	Mr. Okudaira Hiroshi	Senior Advisor, AIFP
21.	Mr. Fongsamuth Phenphaengsy	Programme Officer, AIFP
22.	Ms. Maureen Frances Brown	Editorial Consultant
23.	Ms. Aksone Phaniphong	Secretary, AIFP

Photograph of participants

Director Do Manh Hung and Mr. Yuichi Metoku

Participants

Presenter (Mr. Okudaira, MRCS)

Presenter (Mr. Horikawa, NIRE)

Presenter (Mr. To Quang Toan, SIWRR/Vietnam)

Presenters (Mr. Somsak and Mr. Pramote, RID/Thailand)

Presenter (Dr. Theng Tara, MOWRAM, Cambodia)

Presenter (Mr. Khammai, DOI, MAF, Laos)

Discussion at coffee break time

Closing remark by Dir. Hung

Annex 3: Opening Remarks

Opening Remark by Mr Do Manh Hung
Director Operations Division and Officer-in-Charge, Mekong River Commission Secretariat

The Second Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project
25 March 2008
MRC Secretariat, Vientiane, Lao PDR

Mr. Metoku, Second Secretary, Embassy of Japan,
Representatives from the member countries,
Distinguished participants,
Ladies and Gentlemen,

On be half of the Mekong River Commission Secretariat, I would like to extend a warm welcome to all of you to the Second Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project (IIEPF). This project is supported by the Ministry of Agriculture, Forestry and Fisheries, Japan.

On this occasion, I would like to express our high appreciation on the close cooperation and continuous support from the Ministry to MRC in general and the Agriculture Irrigation and Forestry Programme (AIFP) in particular.

Under the current MRC strategic plan (2006-2010) we have set our overall objective "to support Member States for more effective use of Mekong's water and related resources for poverty alleviation" and set four strategic goals in order to achieve it. One of those is "to promote and support pro-poor development." To realise this pro-poor development in this region, hydropower and agriculture, especially irrigation development are expected to play a key role. In this line, newly started BDP phase 2 also puts big emphasis to enhancement of those two sectors.

Agriculture is just one of the many water users but with more than 80 percent of water withdrawal in the Lower Mekong countries. Therefore agriculture is sometimes accused that it is primarily responsible for potential or substantial water dispute with other sectors. In response to increasing demand from other sectors, agriculture is expected more effort to share limited water resources for equitable access to others. Responding to this concern, the MRC Secretariat designed a project focusing on improvement of irrigation efficiency.

Financial support from the MAFF Japan has realized this IIEPF project, but for project implementation, I would also appreciate significant technical support from FAO headquarters and regional office in Bangkok. They have provided in-kind contribution through project designing and scheme performance appraisal.

My appreciation would also go to member countries, NMCs and line agencies, which have assisted the Secretariat to conduct fieldwork, provided valuable information including field data and its analysis. Without your active involvement, the Secretariat

alone could have never implemented the project smoothly. I would again appreciate your active involvement.

With all above support by three parties, in these three years, the IIEPF project has carried out intensive field observation and, based on collected information, prepared a draft technical guidance for better water management. Today's workshop aims to share the project outputs, which include observation and analysis by member countries and a guidance drafted by the consultant team.

Due to delay of some activities, the technical guidance we could provide today is only the first version of the draft and it would need your constructive and critical comments for more improvement. However because of time and budget limitation, we may not have another occasion to meet together to discuss its next version. Therefore I would highly appreciate your idea/opinions/comments for further improvement today. Your ideas for any improvement proposed today will be appropriately incorporated through the finalization process, which the Secretariat together with the consultant continues to work on. We would promise to share the finalized document with all of you once completed. I believe that with your active participation our workshop will be successful.

Thank you very much for your kind attention

Remarks by Mr Metoku Yuichi
Second Secretary, Embassy of Japan in Lao PDR

The Second Regional Workshop on Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin Project
25 March 2008
MRC Secretariat, Vientiane, Lao PDR

Mr. Do Manh Hung, OIC of MRC Secretariat,
Participants from the MRC member countries,
Ladies and Gentlemen,

It is my honour to share time with you today at the second regional workshop of the IIEPF project, which has been funded by the Ministry of Agriculture, Forestry and Fisheries Japan since 2005. On be half of the Government of Japan, I would like to deliver a few remarks on this occasion.

As OIC Mr. Hung also mentioned in his opening remarks, the Japanese Government is keen to support the development of the Mekong region through both bi-lateral and multi-lateral channels. One visible example of Japan's recent initiative is "Japan-Mekong Foreign Ministers' Meeting" held in January this year in Tokyo. Through this meeting, we have identified numerous "candidate projects for the Cambodia-Lao PDR-Viet Nam development triangle" and confirmed stable cooperation between Japan and three countries by a memorandum signed by ministers. Identified projects are to be immediately funded by the Japan- ASEAN Integration Fund (JAIF) once feasibility is confirmed.

As a list of the candidate projects includes transportation, agriculture & community development, hydropower, health care & water supply, and education, the Japanese government has acknowledged pro-poor development is still one of the key challenges in this region. In this line, our government keeps steady support in agricultural development in association with the MAFF, JICA and other governmental bodies.

The MAFF is especially active in land and water resources development in agriculture. It has started to provide trust fund to the MRC since 1998 and by now it has kept stable contribution year by year. Its third series of contribution focuses on irrigation water use, which is the current project – IIEPF. The MAFF still understands effective water management for irrigation which requires further challenges in the region, it has pledged continuous support to the MRC with similar theme and budget size since 2008 at the annual consultation meeting this year. I would share this pleasant information with you on this occasion.

Coming back to the IIEPF project, I would say that water is fundamental asset for agricultural production, however with growing demand by population and industry in the world and also in this region, it is facing competition with other sectors or even sometimes among different crops. In order to contribute solving this situation, the

IIEPF project has started three years before aiming to provide technical guidance for more efficient irrigation water use, if I correctly understood.

The project has come to conclude its activity to end up its designed project term. I would expect today that the Secretariat well organizes this workshop and provides opportunity to share collected information/data/knowledge/findings from the project activities with all the participants and to collect feedback putting into the project final outputs. I wish this workshop may provide significant contribution to the project through your active participation.

Thank you for your attention.

Annex 4: Overview of IIEPF Implementation and Progress

Overview of IIEPF implementation & progress

Okudaira Hiroshi
AIFP/MRCS

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Funding arrangement

by: Ministry of Agriculture, Forestry & Fisheries (MAFF) Japan

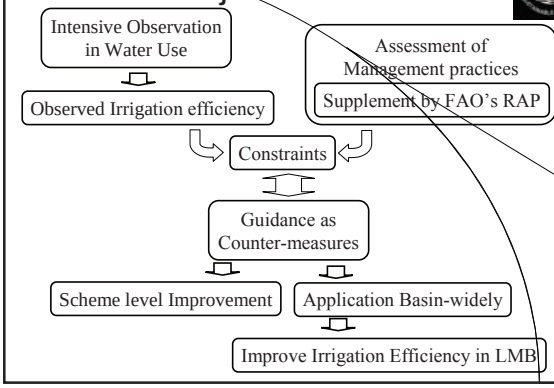
for: 3 years (JFY 2005 to 07)

with: approx. 1 million USD

started: June 2005 (ending June 2008)

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Project structure

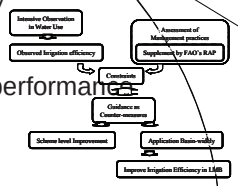


IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Objectives

Overall objective:
aims to contribute improvement of irrigation efficiency

Immediate objectives:
- to appraise scheme performances
- to enhance capacity
- to produce guideline



IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Performance appraisal

Planned activities:
- Field (scheme) level data collection
- Water balance analysis
- Scheme management appraisal
- Rapid Appraisal Process (RAP)

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Capacity enhancement

Planned activities:
- Regular backstopping
- RAP training workshop & initial assessment
- National workshops

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25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Guideline

Planned activities:

- Review collected data/info.
- Field survey/interview
- Consultation thru workshop

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25 March 2008
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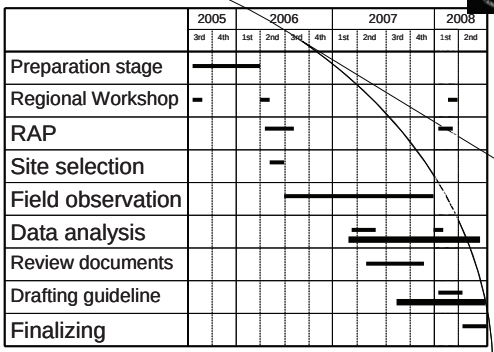
Vientiane, Lao PDR

Plan & progress



IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Activities & agenda

	2005 3rd	2005 4th	2006	2007	2008
Preparation stage					
Regional Workshop					
RAP					
Site selection					
Field observation					
Data analysis					
Review documents					
Drafting guideline					
Finalizing					

am	1. Overview of the project
	2. Country reports
	3. Findings from field observation
pm	4. Key concept of technical guide
	5. Application to pilot sites
	6. Feedback discussion

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Achieved outputs

- Initial assessment b
- Dataset collected
- Other publications

06/07 dry season practices in three countries

06/07 W-S crop in VN tidal irrigation

compiled by interim reports

1. CREST 2nd Int'l symposiu
2. Int'l conference in Chaing
3. PAWEES 6th int'l conference in S
4. SE Asia water forum in K.L. (Oct
5. GMS Agricultural Conference in Nakho

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Outputs under work

- Guideline
- Field observation final reports
- More publications (technical papers)

2 crop seasons at 4 pilot sites

Irrigation & water productivity in gravity system
Water use efficiency in tidal irrigation system
Comparison of gravity system performances
Irrigation schedule improvement (all provisional)

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

toward Completion

Current situation:

- Delay of the prog
- Discussion prema
- Time & budget co

By June 08

Issues to be discussed:

- Suggestions for improvement
- Title of the final output
- Further process

Outline just delivered
Discussion at this WS

Guideline TOO strong

Depends on today's

am	1. Overview of the project
	2. Country reports
	3. Findings from field observation
pm	4. Key concept of technical guide
	5. Application to pilot sites
	6. Feedback discussion

Annex 5: Presentations of Fieldwork by Member Country

Vietnam National Mekong Committee

Mekong River Commission Secretariat

IMPROVEMENT OF IRRIGATION EFFICIENCY ON PADDY FIELDS IN LMB

CASE STUDY: LONG HAI IRRIGATION AREA GOCONG IRRIGATION PROJECT MEKONG DELTA, VIETNAM

VTE, 25th Mar, 2007

CONTENTS

- Introduction
- Outline of field observation
- Result of field observation data
- Analysis and discusion
- Key findings
- Recomendation

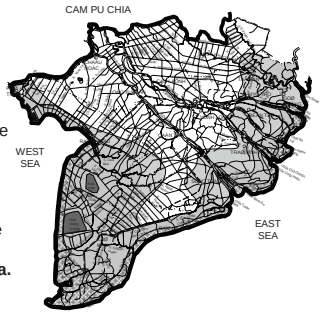
Introduction

Introduction

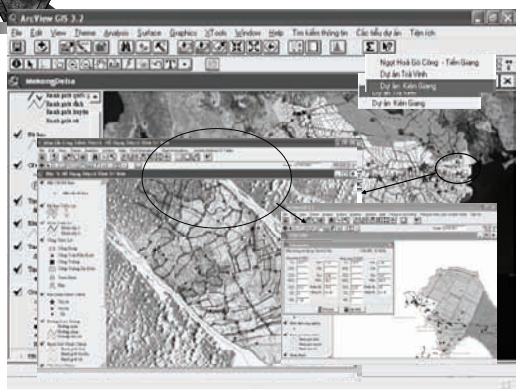
Within past decades, the production of agriculture has increased quickly in Mekong delta.

- The delta contributed about 40% of agricultural production, and half of rice production in the country.
- Rice production is 11 million tons. Accounts for 85% of exported rice for Vietnam.

One successful reason is the improvement of water management in Mekong Delta.



IRRIGATION SYSTEMS IN MK DELTA



IRRIGATION SYSTEMS IN MK DELTA

Some Large Irrigation Projects in Mekong Delta (1990 – 2005)

NO.	NAME OF THE IRRIGATION SYSTEMS	LOCATION	SERVICE AREA (HA)	FUNCTIONS
1	Go Cong	Tien Giang	54,000	Fresh water supply, salinity control
2	Tiep Nhat	Soc Trang	53,910	Fresh water supply, salinity control
3	South Mang Thit	Vinh Long, Tra Vinh	225,682	Fresh water supply, salinity control
4	Quan Lo – Phung Hiep	Soc Trang, Bac Lieu	178,888	Fresh water supply, salinity control
5	Nhat Tao Tan Tru	Long An	13,320	Fresh water supply, salinity control
6	Ba Lai	Ben Tre	50,800	Fresh water supply, salinity control
7	Ba Rinh – Ta Liem	Soc Trang, Can Tho	30,944	Fresh water supply, salinity control
8	Huong My	Ben Tre	17,000	Fresh water supply, salinity control
9	Ba The – Tri Ton	An Giang, Kien Giang	43,700	Soil reclamation, Flood control
10	Cai San – Thot Not	Can Tho, Kien Giang	58,000	Fresh water supply, Flood control
11	Ke Sach	Soc Trang , Can Tho	32,000	Fresh water supply, salinity control

THE PROBLEMS OF IRRIGATION SYSTEMS IN MEKONG DELTA

Irrigation Structures Performance

- Low efficiency of structures such as pump stations, canals, and regulators, due to degradation and poor maintenance.
- Old technology for the regulation and monitoring system
- Lack of water quantity control system

Water Resources Development

- impacted by many factors such as flooding or spring tide, acidity pollution or salinity intrusion,
- polluted by domestic and agricultural wastewater disposals such as fertilizers, pesticides and solid wastes,
- conflicts over water because farmers change from freshwater rice to brackish water shrimp cultivation of higher value

THE PROBLEMS OF IRRIGATION SYSTEMS IN MEKONG DELTA

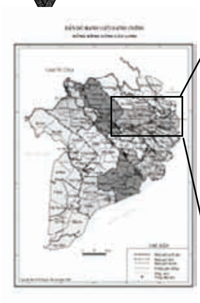
The policy of water management

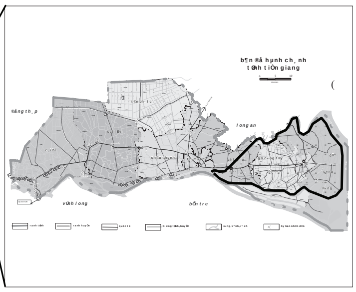
- Water prices and tariffs for irrigation in Vietnam are rather low so that Irrigation Management Company (IMC) can not generate enough revenue for operation and maintenance of systems. Tariffs are set by politicians of the Provincial Committees, not by IMC.
- The farmers, who are clients of an IMC, are still not organized into Water Users Associations (WUAs). There is no legal framework in place to take over, operate and maintain the newly controlled tertiary level.

Operation and Maintenance

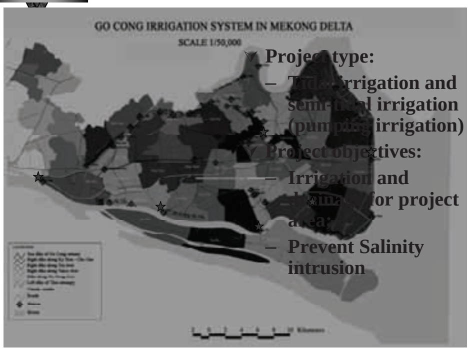
- Lack of procedures or guidelines for the operation and maintenance of most systems,
- have not installed a monitoring system for water level, water quantity and quality in the intakes/ off-takes,
- The power of managers is not strong enough to solve the conflicts between water users.

GO CONG IRRIGATION PROJECT



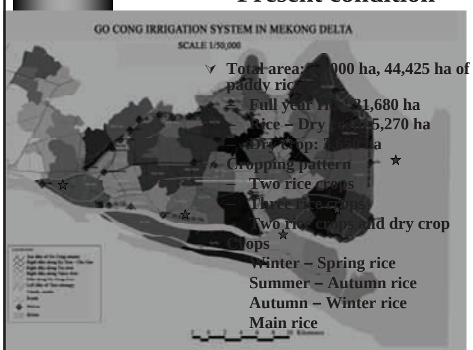


GO CONG IRRIGATION PROJECT
Background



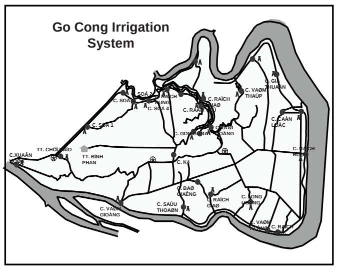
- Project type:
  - Tidal irrigation and semi-tidal irrigation (pumping irrigation)
- Project objectives:
  - Irrigation and drainage for project area
  - Prevent Salinity intrusion

GO CONG IRRIGATION PROJECT
Present condition



- Total area: [illegible]000 ha, 44,425 ha of paddy rice
  - Full year rice: 31,680 ha
  - Rice – Dry crop: 5,270 ha
  - Dry crop: [illegible] ha
- Cropping pattern
  - Two rice crops
  - Three rice crops
  - Two rice crops and dry crop
- Crops
  - Winter – Spring rice
  - Summer – Autumn rice
  - Autumn – Winter rice
  - Main rice

INFRASTRUCTURES OF GO CONG PROJECT
Present condition

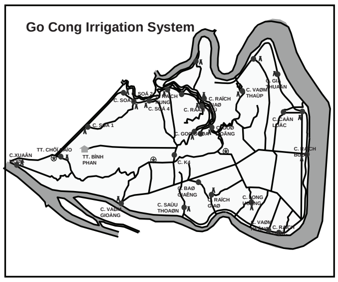


Main canal network :

- 14 canals, total length of 157 km

Keânh Xuaân Hoøa

INFRASTRUCTURES OF GO CONG PROJECT
Present condition

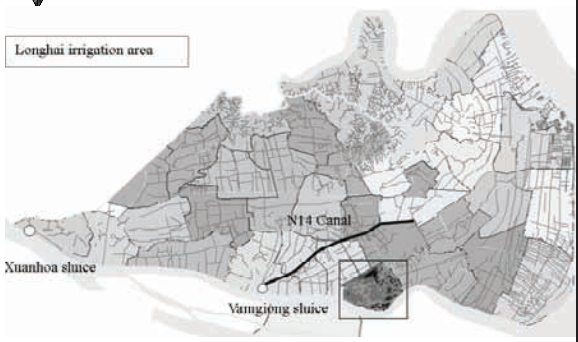


Sluices :

54 sluices with the width of 1.5 m to 32 m

Xuaân Hoøa sluice Wc =32 m

Introduction

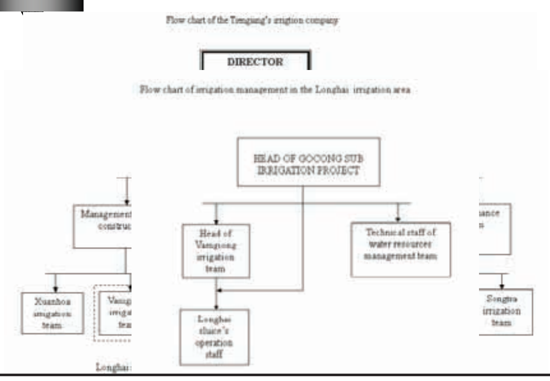


LONG HAI IRRIGATION AREA (LHIA)

- **Total area: 950 ha**
- **Agri. area: 707 ha**
- **Population: 6176**
- **Consists Longbinh and Binhtan communes**
- **Croping pattern: W-S, S-A and A-W**
- **Water sources: HL6 and Longhai sluices**
- **Water management: Under Gocong management board, Tien giang IMC**

Introduction

Organization chart



Water management activities

- Project authorities
  - Responsible for the head works (sluices) and the main and secondary canals;
  - Planning for water supply;
  - Monitor gate operation and water quality;
  - Informing farmers the operation schedule on time.
- Water users
  - Maintenance and management of tertiary canals;
  - Pay water fee to IMC via local taxmen;
- Agreement between IMC and WUs by contract, total irrigation area by each farmer each year;
- Priority for water distribution: limited by condition of salinity intrusion.

ADVANTAGES

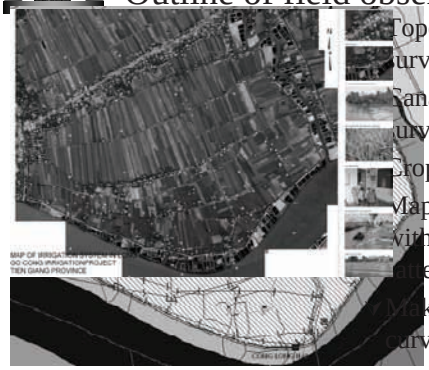
Criteria	Gocong Project	Longhai irrigation area
Location	Closer (100 km)	Closer (150 km)
Size	Large (44,425 ha)	Large (700 ha)
Boundary	Closed	Closed
Management condition	Good	Good
Maintenance condition	Good	Good
Available data	Good	To be collected
Water fee collection	Good (90%)	Good (90%)
Available facilities	Good	Rain gause

Outline of field observation

Outline of field observation

- Irrigation system and command area map
- Water flow measurement
- Monitor irrigation water applied
- Cropping pattern, calendar and record multiple use of water, obtain all kind of production…

Outline of field observation



- Topographic survey
- Canal system survey
- Crop area survey
- Map dizitiged with assisted from satelite image
- Making Z-W curve of canal

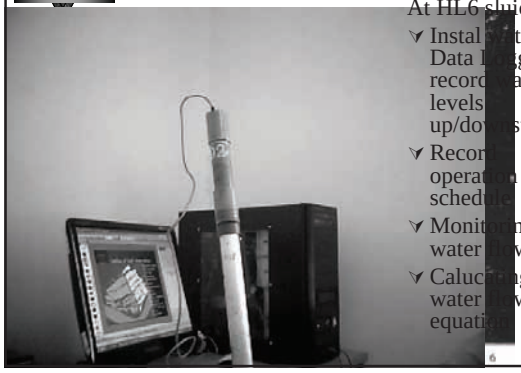
Outline of field observation

At Longhai sluice

- Instal water level sensors to record water levels up/downstrean
- Record operation schedule
- Record rainfall and evaporation
- Monitoring the water flow
- Calucating water flow by equation

Outline of field observation

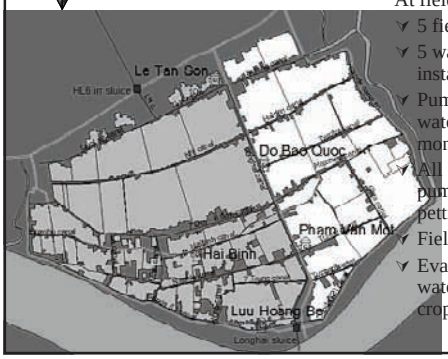
Outline of field observation



At HL6 sluice

- Instal ter Data l ger to record ater levels up/do stream
- Recor operat n schedule
- Monit ng the water w
- Calcu ng water w by equati

Outline of field observation



At field level

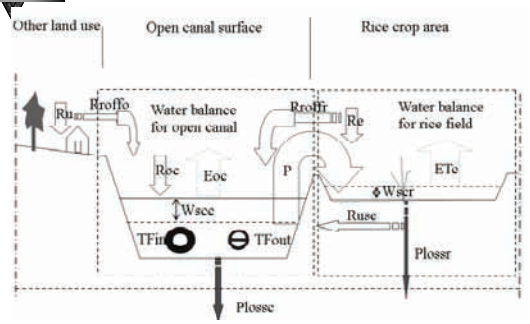
- 5 field plots selected
- 5 water metters installed at each field
- Pump and drainage water, water level monitored
- All expenditure for pump, fertilizer and petticides monitored
- Field survey form
- Evaluation of actual water used for rice crop and the expend

Outline of field observation

Outline of field observation

- Recording cropping pattern, calendar, multiple use of water, production, actual irrigated area, multiple water use , at 2 communs with survey form
- Data analysis and evaluated information for Longhai area

Outline of field observation



Water balance: Separated water balance for canal system and rice fields

Results of field observation

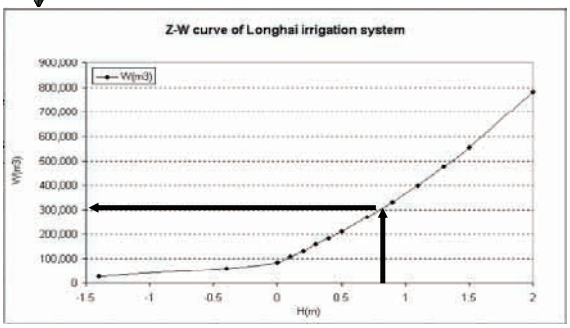
Result of field observation data

- Elevation rangers from 0.75-1.35 m
- <0.85:2.5%
- <1m: 34.4%
- 0.95-1.15: 73%

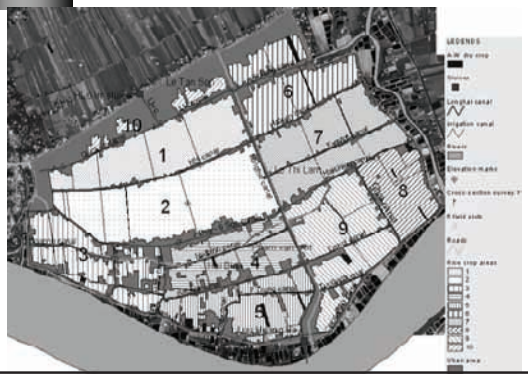
Result of field observation data

No	Name of canal	Length (m)	Bed elevation (m+MSL)	Surface width (m)	Surface area (m2)
1	7 Duy - 6 Son canal	2,820	-0.4	10.0	28,200
2	7 Trung canal	811	-0.4	5.0	4,055
3	Bolang canal	886	-0.7	13.0	11,518
4	Capde canal (left)	3,676	-0.2	18.0	66,168
5	Capde canal (right)	4,458	-1.2	22.0	98,076
6	Giua canal	904	-0.1	7.5	6,780
7	Haibinh canal	1,367	-0.2	8.5	11,620
8	Haichieu canal	1,557	-0.6	7.5	11,678
9	Haiden canal	1,301	-0.1	10.0	13,010
10	Hangnhi canal	2,191	-0.5	11.0	24,101
11	Huonglo 6 canal	4,050	-1.1	13.0	52,650
12	Hoaphu canal	915	-0.5	9.5	8,693
13	Hong canal	672	-0.3	7.0	4,704
14	La channel	591	-0.3	10.0	5,910
15	Mieu canal	833	-0.2	5.5	4,582
16	Quoian canal	1,353	-1.2	6.0	8,118
17	Rachla canal	2,087	-0.4	8.0	16,696
18	Tamtot canal	1,452	-0.1	9.0	13,068
19	Tumoi canal	1,004	-0.5	6.0	6,024
20	Tuphen canal	508	-0.1	8.0	4,064
	Total length	33,436			40(ha)

Result of field observation data



Result of field observation data



Result of field observation data

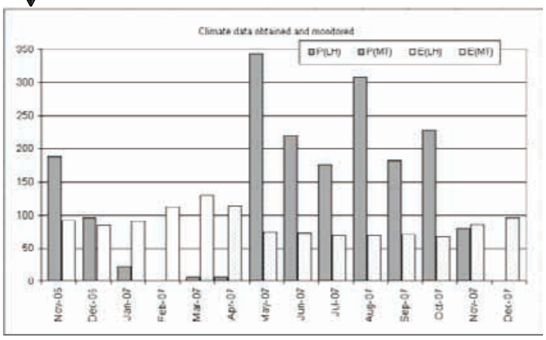
Table 3: Land use of the project area during 3 crop seasons in 2007

No	Land use type	Abbreviation	Area for each crop season (ha)			Remark
			WS	SA	AW	
1	Agricultural area	TRA	707.3	707.3	707.3	Surveyed data
	- Rice crop	TRA	697.1	704.8	701.7	Surveyed data
	- Dry crop (water melon)		10.2	2.5	5.6	Surveyed data
2	Open canal system	TCSA	40.0	40.0	40.0	Calculated
	Open canal surface (at level of 0.8 m)	TCOWA	30.0	30.0	30.0	Calculated
3	Other land	TOA	201 3	201 3	201 3	Based on GIS data
	Total		948.6	948.6	948.6	Based on GIS data

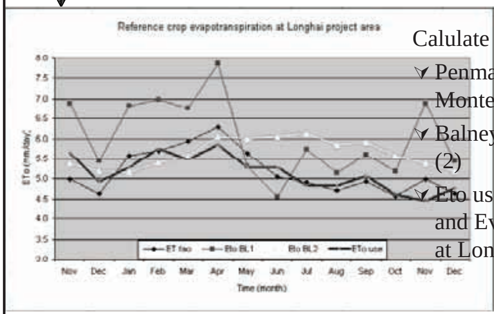
Result of field observation data

- 100% agricultural area relys on canal water
- Negligible water use for other purpose
- 100% agricultural area got irrigation water

Result of field observation data



Result of field observation data



Calulate Eto

- Penman Monteith (FAO)
- Balney-Criddle (2)
- Eto use (FAO and Evaporation at Longhai)

Result of field observation data

Table 7: Basic information and calculated flow at the HL6 sluice

No	Month	Average water level (cm)	Data available	Average discharge during measured period (cms)	Total water flow through HL6 sluice (m^3)	Total water flow during the crop season (m^3)	Crop season
(1)	(2)	(4)	(5)	(6)	(7)	(8)	
1	Dec-06		No data		1,756,757		
2	Jan-07	78.7	25-31 Jan	0.34	923,002		
3	Feb-07	57.6	Full	0.70	1,690,754		
4	Mar-07	43.3	Full	0.66	1,762,612	3,679,876	W-S
5	Apr-07	12.2	No				
6	May-07	49.7	Full	[illegible]	[illegible]		
7	Jun-07	74.4	Full	0.24	614,565		
8	Jul-07	78.8	Full	0.45	1,216,147		
9	Aug-07	67.1	Full	-0.18	-201,095	1,796,921	S-A
10	Sep-07	69.2	1-19 sep	0.41	646,720		
11	Oct-07	65.0	23-31 oct	-0.50	365,549		
12	Nov-07	69.1	Full	1.10	2,843,966	3,856,243	A-W
13	Dec-07	75.9	Full	0.66	1,756,757		
14	Jan-08	87.7	No data				

Result of field observation data

Table 8 : Basic information and calculated flow at the Longhai sluice

No	Month	Number of operation day (day)	Number of operation for irrigation	Total drainage water (m^3)	Drainage of water for each purpose: Due to rainfall (m^3)	Drainage of water for each purpose: On scheduled (m^3)	Total flow for irrigation (m^3)
1	Dec – 06	2	-	115,839	-	115,839	-
2	May – 07	5	-	651,091	437,763	213,328	-
3	Jun – 07	3	-	469,010	469,010	-	-
4	Jul – 07	4	-	469,249	-	469,249	-
5	Aug – 07	12	6	1,197,955	235,610	962,345	886,096
6	Sep – 07	9	4	1,096,906		1,096,906	700,252
7	Oct – 07	7	5	1,169,903	206,740	963,163	1,165,245
8	Nov – 07	7	-	821,177	315,937	505,240	-
9	Total	49	15	5,981,190	1,665,060	4,316,130	[illegible]
10	W-S			115,839	-	115,839	-
11	S-A			2,777,306	1,142,383	1,634,923	886,096
12	A-W			3,088,046	522,677	2,565,369	1,953,497

Result of field observation data

Table 9: Summary of irrigation water used at 5 selected pilots

Crop	No	Information	Unit	Family name 1 Diep	2 Son	3 Be	4 Binh	5 Mot	Average of 5 plots
W-S	1	Area	Sqm	3,368	4,968	2,701	5,757	7,257	4,808
	2	Amount of used water	m^3	[illegible]	[illegible]	[illegible]	4,130	6,002	3,851
	3	Water use/ha	m^3/ha	9,280	9,040	8,137	7,190	8,271	7,799
	4	Number of irr. application	Time	17	14	18	20	13	17
	5	Daily average of irrigation	cm/day	1.25	0.73	1.33	1.26	1.06	1.13
S-A	6	Area	Sqm	3,250	4,960	5,000	5,757	7,257	5,208
	7	Amount of used water	m^3	[illegible]	[illegible]	[illegible]	3,071	3,445	2,090
	8	Water use/ha	m^3/ha	2,111	2,000	8,263	4,334	4,747	4,480.8
	9	Number of irr. application	Time	6	4	15	13	8	9
	10	Amount of drainage water	m^3	146.7	651.5	468.0	-	287.0	388.2
	11	Drainage volume per ha	m^3/ha	437.0	1,311.4	1,725.3	-	387.9	766.3
A-W	12	Area	Sqm	3,368	4,968	2,701	5,757	7,000	4,757
	13	Amount of used water	m^3	[illegible]	[illegible]	1,462	4,802	3,716	2,262
	14	Water use/ha	m^3/ha	1,566	1,625	5,402	8,341	5,309	4,488.6
	15	Number of irr. application	Time	5	3	11	12	7	8

Result of field observation data

Table 10: Basic information evaluated from data collected from 120 farmers

	No	Items	Unit	Information from 120 selected farmers	Account in %, or area	Evaluated data for Longhai
	(1)	(2)	(3)	(4)	(5)	(6)
A-W	1	Average of length of crop	day	93		93
	2	First crop grown	date	15-Aug		
	3	Last crop harvested	date	18-Dec		
	4	Area grow from 15/08 to 31/08	ha	28.859	41.32%	289.9
	5	Area grow from 1/09 to 10/09	ha	26.61	38.10%	267.3
	[illegible]	Area grow from 11/09 to [illegible]	ha	[illegible]	[illegible]	144.5
	7	First crop harvested	date	04-Nov		
	8	Last crop harvested	date	18-Dec		
	9	Total area harvested in Nov	ha	18.709	26.78%	
	10	Total area harvested in Dec	ha	51.14	73.22%	
	11	Yield of A-W crop	Ton/ha	4.48		4.48

Result of field observation data

Table 11: Information and production of Longhai project area during 2007

No	Information	Unit	Crop season			Overall 2007
			W-S	S-A	A-W	
7	Total expend for pump in project area	1000 VND	353,335	183,817	155,961	693,113
		USD/ha	21,974	11,431	9,699	43,104
8	Total benefit for project area	1000 VND	6,941,961	5,141,240	7,036,656	19,119,857
		USD/ha	431,714	319,729	437,603	1,189,046
9	% Benefit from other income in compare with from rice	%	3.7	17.7	21	14
10	Benefit from other activities	1000 VND	256,853	909,999	1,477,698	2,644,550
		USD	15,973	56,592	91,897	164,462
11	Total benefit of the project area	1000 VND	7,198,813	6,051,239	8,514,354	21,764,406
		USD	447,687	376,321	529,580	1,353,508
12	Income for each	1000 VND/per	1,166	980	1,379	3,524
		USD/per	72	61	86	219

Analysis and discusion

Analysis and discusion

Table 12: Calculation of crop water requirement of the Longhai project area during year 2007

Crop season		Grown duration	% crop area (%)	Crop area (ha)	Total crop water requirement (m^3)	Total crop water requirement - Pe (m^3)	Total irrigation water requirement (m^3)
Abbreviation				TA	TCWR	TCWR-Pe	TIWR
W-S	Nov	1st-30th	24.6	171.6	2,530,090	2,268,027	4,199,547
	Dec	1st - 10th	52.8	368.1	2,456,194	2,407,625	4,152,137
	Dec	11th - 20th	19.0	132.4	660,921	659,066	4,255,472
	Dec	21st - 31st	3.6	25.1	174,094	174,094	4,001,199
	Evaluated for W-S			697.1	3,470,741	3,343,471	16,598,354
	Daily average (mm/day)						
S-A	May	1st - 20th	40.1	282.3	2,171,560	908,234	1,297,344
	May	21st - 31st	53.7	378.4	2,063,885	1,086,231	1,734,517
	June	1st-30th	6.3	44.1	2,079,360	843,600	1,945,752
	Evaluated for S-A			704.0	6,314,805	2,838,065	4,977,613
	Daily average (mm/day)						
A-W	Aug	15th - 31th	41.3	289.9	1,895,732	980,085	2,098,193
	Sep	1st - 10th	38.1	267.3	1,804,560	1,098,533	2,350,764
	Sep	11st - 30th	20.6	144.5	1,791,829	1,216,564	2,496,200
	Evaluated for A-W			701.7	5,492,111	3,295,182	6,944,157
	Daily average (mm/day)						

Analysis and discusion

Total irrigation water applied for irrigation in Longhai project area

No	Information	Abbr.	Unit	Crop season		
				W-S	S-A	A-W
1	Crop Area	TA	ha	697.1	704.8	701.7
2	Water use/ha	TIW1ha	m^3/ha	7,779	4,489.8	4,448.8
3	Total irrigation water applied	TIW	m^3	5,436,371	3,164,411	3,121,723

Analysis and discusion

Evaluation of scheme water requirement

No	Information	Unit	Crop season			Overall year 2007
			W-S	S-A	A-W	
(1)	Total irrigation requirement of the scheme (TIWR)	m^3	5,849,141	2,418,768	3,733,806	12,001,715
(2)	Total irrigation water applied of the scheme (TIW)	M^3	5,436,371	3,164,411	3,121,723	11,722,505
3	(2)/(1)*100	%	92.9	130.8	83.6	97.7

Analysis and discusion

Calculation of water balance on the canal

No	Information	Abbr.	Unit	Crop season			Overall 2007
				W-S	S-A	A-W	
9	Open evaporation from the canal	Eoc	m^3	125,130	85,470	66,750	277,350
10	Total rainfall to the open canal	Roc	m^3	26,040	419,160	196,120	641,320
11	Rainfall runoff from rice fields	Rroffr	m^3	0	907,466	0	907,466
12	Rainfall runoff from other lands	Rroffo	m^3	53,345	1,267,989	452,120	1,773,454
13	Change on storage volume of canal	Wscc	m^3	-131,236	277,894	-52,886	93,772
(14)	Irrigation water used evaluated from equation (1)	IWused	m^3	3,649,527	2,136,962	3,356,069	9,142,559
15	Irrigation water used per ha	IWused/ha	m^3/ha	5,236	3,032	4,783	13,039
16	Ratio (14)/(3)*100	IWused/TIW	%	67.1	67.5	107.5	78.0

Analysis and discusion

Calculation of water balance on the rice field

No	Information	Unit	W-S	S-A	A-W
1	Irrigation applied per ha (TIW)	M^3/ha	7,799	4,490	4,449
(2)	Irrigation module per day (TIW/day)	mm/day	8.2	4.7	4.7
3	Average of (ETc-Pe) per day	mm/day	5	2.2	2.8
4	Drainage water, Tdf	mm/day	0	0.8	0
5	Storage water changed,Wscr	mm/day	0	0	0
(6)	Plossi+Ruse	mm/day	3.2	1.7	1.9
7	(6)/(2)*100	%	39.1	35.8	40.2

Analysis and discusion

Evaluation of overall command area efficiency

No	Information	Abbr.	Unit	Crop season			Overall 2007
				W-S	S-A	A-W	
(1)	Total crop water requirement –Pe	CRW-Pe	m3	3,343,471	1,536,513	1,759,001	6,638,985
(2)	Total irrigation water requirement	IWR	m3	5,849,141	2,418,768	3,733,806	12,001,715
3	Diverted water via Longhai sluice		m3	-	886,096	1,953,497	2,839,593
4	Diverted water via HL6 sluice		m3	3,679,875	1,796,921	3,856,243	9,333,038
(5)	Total diverted to system	TFin		3,679,875	2,683,017	5,809,740	12,172,631
(6)	Total water applied to fields by pump	TIW	m3	5,436,371	3,164,411	3,121,723	11,722,505
(7)	CEA=(1)/(5)*100		%	90.8	57.3	30.3	54.5
(8)	CEA=(1)/(6)*100		%	61.5	48.6	56.3	56.6
9	CEA=(2)/(5)*100		%	158.9	90.2	64.3	98.6
10	CEA=(2)/(6)*100		%	107.6	76.4	119.6	102.4

Analysis and discusion

Evaluation of water productivities

No	Information	Abbr.	Unit	Crop season			Overall 2007
				W-S	S-A	A-W	
(1)	Average of rice yield per ha		Ton/ha	4.93	4.14	4.49	13.6
(2)	Diveted water per ha through HL6 and Longhai	TFin/ha	m^3/ha	5,279.1	3,808.8	8,279.5	17,365.4
(3)	Diverted water to field by pump	TIW/ha	m^3/ha	7,799.0	4,489.8	4,448.8	16,738
4	POW=(1)/(2)*1000		Kg/m^3	0.93	1.09	0.54	0.78
5	POW=(1)/(3)*1000		Kg/m^3	0.63	0.92	1.01	0.81

Key findings

The results of field observation data analysis

- 100% of irrigation area has relied on the water from the canal system;
- There was an average of 47 m length of the canal per ha of the cultivated area or 35 m length per ha in comparison to the overall natural area;
- The elevation of the rice crop area in the project area ranges from 0.75 to 1.35 m+MSL, the most common area has elevation ranges from 0.95 to 1.15 m+MSL (73.3%). Therefore, improvement of water management in the project area should be taken into account this common area;
- Rice is the most common crop in the project area as it is accounted for more than 98.6% of the total cultivated area during three crops in 2007;
- An average area for each family is 0.58 ha, and an average of 86% of the income for the families is from the rice cultivation;

Key findings

Results of surveyed crop data analysis

- W-S rice seeds in December accounted for 75% and in November 25%;
- S-A rice seeds in May accounted for 93.7%;and in June 6.3%;
- W-S rice seeds in Aug accounted for 41.3% and in September 59.7%;
- The average crop length is 95 days for W-S and S-A and about 93 days for A-W crop.
- Highest rice yield production is in W-S (4.93 ton/ha), the lowest yield production is in S-A (4.14 ton/ha);
- An average of seeds is 190 kg/ha for W–S, 174 kg/ha for S-A and 188 kg/ha for A-W;
- The VD20 and 3536 is considered as the dominated rice varieties of the LHIP it is accounted for more than 50% of the rice cultivated area;
- Average of benefit from rice cultivation is 566 USD/ha/crop, the highest benefit is 624 USD/ha come from A-W rice,
- Average of total expenditure for irrigation, pesticide and fertilizer is about 475 USD/ha/crop;
- The net income per person is about 3.52 MVND/per or $219/person.
- Farmers implimented an average of 17 irrigated times, 6 fertilized times and 5 used times for pesticides during W-S, and an average of 9 irrigated times, 4-5 fertilized times and 4-5 used times for pesticides during S-A and A-W.

Key findings

Results of monitored data analyses:

- The average of CWR was 461 mm/ha/crop, the highest CWR was 497.0 mm/ha for W-S rice crop;
- The average of CWR-Pe was 315 mm/ha/crop, the lowest value was 206 mm/ha for S-A rice crop;
- The average of IWR was 580 mm/ha/crop and the highest IWR was 835 mm/ha for W-S rice crop;
- Farmer used an average of 7,799 m3/ha of water in W-S, 4,489.8 m3/ha in S-A and 4,448.8 m3/ha in A-W;
- Total irrigation water diverted to the system over the year 2007 in gravity condition was 12,172 thousands m3 it was approximated equal to the TIWR of the system (12,000 thousand m3);

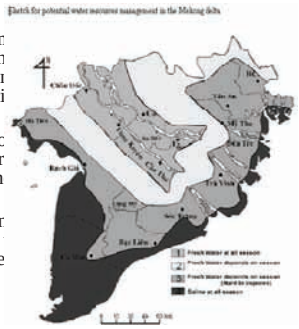
Key findings

Results of monitored data analyses:

- Overall CAE at the field level in 2007 was about 56.6%, the highest CAE at the field level was 61.5% in W-S;
- Overall CAE at the system level in 2007 was about 54.5%, the highest CAE at the system level was 90.9% in W-S, the lowest CAE at the system level was 30.3% in A-W;
- The POW at system level in 2007 was 0.78 kg/m3 and the POW at the field level was 0.81 kg/m3;
- Pumping is main mean of irrigation for all rice crop in the LHIA, there was only 2.5 % of the cultivated area could get gravity irrigation condition for a total of 2.5 months over the year;

Recomendation

- Some farmers took water r needed in comparison with requirement, therefore to ir the system the basic experi be useful;
- The irrigation expend is nc with the total expend, ther rice cultivation to the farm introduce;
- This is considered as the ir zone in the Mekong delta, a similar study could make Mekong delta.

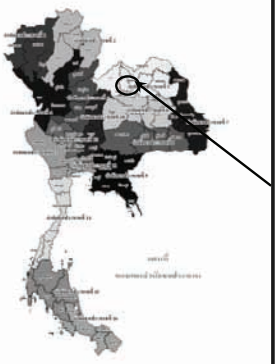


THANK YOU

FOR YOUR KIND ATTENTION

Thai Working Team
Royal Irrigation Department (RID)

1. Mr.Chatchai Boonlue (RID HQ)
2. Mr.Somsak Vivithkeyoonvong (RID HQ)
3. Mr.Suwat Krajangmontre (Huay Luang O&M Proj.)
4. Mr. Pramote Pungpeun (Huay Luang O&M Proj.)
5. Mr. Sathit Sueprasrtsuk (DWR)



IIEPF

Huay Luang O&M Project
Udon Thani Province,
Thailand
Latitude : 17.3 N.
Longtitude : 102 E.

Huay Luang Reservoir

Project feature
Headwork
Length 4.9 km., Width 6.00 m., Height 12.5 m.
Retention capacity 118.362 mcm.
Retention water surface area 32.00 sq.km.
•Avg. annual run-off 160.17 mcm.
•Avg. rainfall intensity 1,249.95 mm./yr.
•Evaporation 1,504.79 mm./yr.
•Avg. temperature 26.5 cc.
•Avg. humidity 71%

Spillway

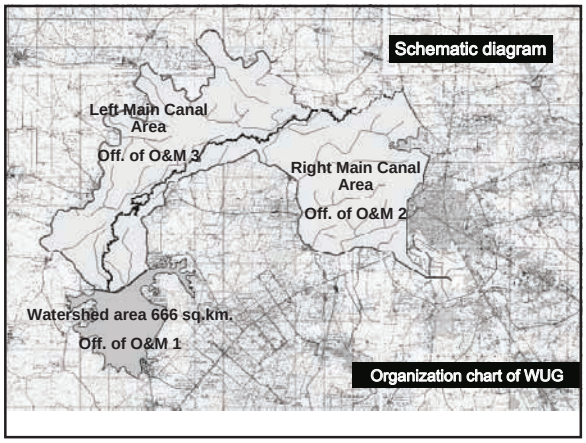
Huay Luang O&M Project covers irrigation area of 13,917.9 ha.

Qmax = 12.423 cms
Farmers 3,832 households

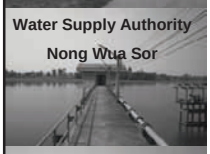
Qmax = 10.348 cms
Farmers 3,244 households

LMC area 7,912.16 ha.
Office of O&M Branch 3

RMC area 6,005.76 ha.
Office of O&M Branch 2




Water Supply Authority
Kud Jab District


Water Supply Authority
Nong Wua Sor


Water Supply Authority
Udon Thani

Water for domestic consumption

Unit : cu.m/year

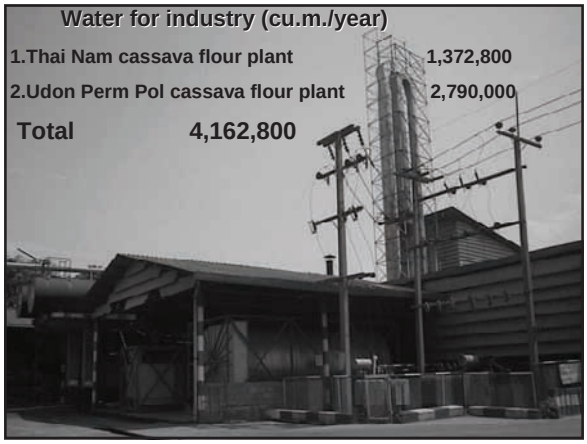
1. Udon Thani Water Supply Authority	21,000,000
2. Kud Jab Water Supply Authority	540,000
3. Nong Wua Sor Water Supply Authority	540,000
4. Kok Sa-ard Water Supply Authority	50,400
5. Ban Nam Pon Water Supply Authority	504,000
Total	22,634,400

Water for industry (cu.m./year)

1.Thai Nam cassava flour plant 1,372,800

2.Udon Perm Pol cassava flour plant 2,790,000

Total 4,162,800



IIEPF activities conducted in the pilot schemes

Irrigation Efficiency
Flow measurement at 9 points in each canal level (twice a week/point)

- LMC1 , LMC2 , LMC3 , LMC4
- 1R-L, 3R-L
- 1L-3R-L , 2L-3R-L , 3L-3R-L

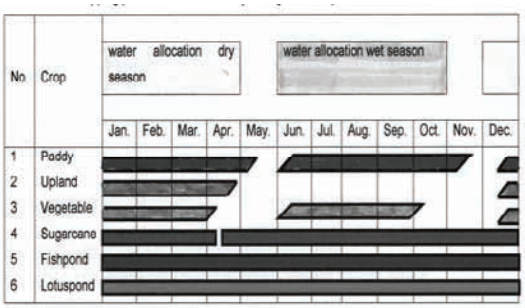
IIEPF activities conducted in the pilot schemes

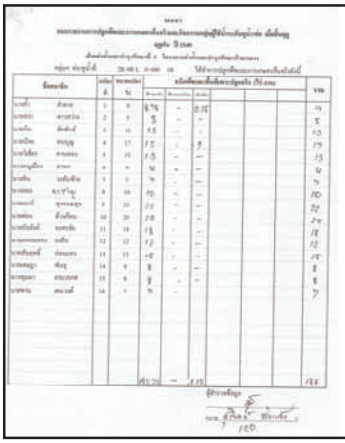
- Daily percolation measurement in paddy field of each zone
- Daily Water level measurement in fishpond of each zone

IIEPF activities conducted in the pilot schemes

- Conveyance efficiency examination
  - 1 Left main canal
  - 10 Lateral canals
  - 3 Sub-lateral canals
  - 6 Ditches
- Calibration of 10 farm turnouts

Cropping pattern calendar of Huay Luang O&M Project





- **Actual crop cultivation survey form (M&E 2)**

Crop cultivation area in dry season 2006/2007

2,988 ha. (paddy 1,878 ha.)

Crop cultivation area in rainy season 2007

7,396 ha. (paddy 7,007 ha.)

Farmers' participatory irrigation water management

1. Official inform available water to farmers and farmers inform crop growing intention

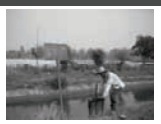
2. Water allocation plan, approved by JMC

3.Ditch & sub-lateral canal cleaning by WUG before water distribution

4. Meeting of head of ditch for water rotation

Farmers' participatory irrigation water management

5.IWUG & officials making water rotation plan and cropping calendar



6.WUG operate farm turnout according rotation plan

7.JMC's monthly meeting for water allocation and water rotation plan

8. Crop yield survey and satisfaction and repot to JMC for improving management

Analysis results and major findings

Percolation (mm.) in paddy field

	Dry season 2006/2007	Wet season 2007	Average
Zone 1	1.906	2.330	2.118
Zone 2	1.418	2.136	1.777
Zone 3	2.539	2.745	2.642
Zone 4	2.923	2.795	2.859
Branch 3	2.197	2.502	2.349

Analysis results and major findings

ETo – Modified Penman (mm./day)

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
3.75	4.59	5.56	6.03	5.19	4.59	4.53	4.20	4.41	4.53	4.04	3.61

Crop coefficient (Kc)

Week	Transplanting paddy	Broadcast paddy	Upland crop	Vegetable	Orchard	Fishpond
1	0.90	0	0.53	0.67	0.60	1.00
2	0.94	0.90	0.53	0.67	0.60	1.00
3	0.98	0.94	0.30	0.67	0.60	1.00
4	1.13	0.98	0.30	0.67	0.60	1.00
5	1.21	1.13	0.70	0.67	0.60	1.00
6	1.27	1.21	0.70	0.67	0.60	1.00
7	1.32	1.27	0.90	0.67	0.60	1.00
8	1.30	1.32	1.20	0.67	0.60	1.00
9	1.26	1.30	1.00	0.67	0.60	1.00
10	1.21	1.26	1.00	0.67	0.60	1.00
11	1.11	1.21	0.70	0.67	0.60	1.00
12	0.85	1.11	0.50	0.67	0.60	1.00
13	0.75	0.85		0.67	0.60	1.00
14		0.75		0.67	0.60	1.00

Analysis results and major findings

Dry season 2006/2007

Water Requirement of each plant (cu.m.)

Land Preparatio.	Nursing stage	Transplanting paddy	Broadcast paddy	Upland crop	Vegetable	Orchard	Fishpond
5,235,390	0	6,850	10,000,395	2,180,539	275,659	30,907	1,386,717
Area (ha)		6	1,875.96	722.52	68.48	9.2	235.32

Water Requirement of each plant (cu.m.)					Water Supplied	Rainfall (mm.)	Effective rainfall (cu.m.)
Sugar	Lotus	grass	percolation	Total			
93,331	19,452	325,801	5,629,130	25,184,169	38,214,129	28.25	685,389
15.96	3.2	51.84		2,987.84			

Analysis results and major findings

Wet season 2007

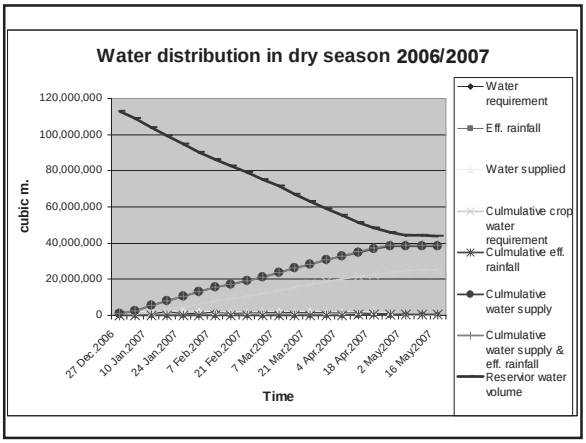
Water Requirement of each plant (cu.m.)							
Land preparation	Nursing stage	Transplanting paddy	Broadcast paddy	Upland crop	Vegetable	Orchard	Fishpond
14,014,480	434,156	29,389,280	1,112,820	17,152	7,167	92,407	1,411,954
Area (ha.)		6,751.5	255.7	1.8	1.9	27.3	265.4

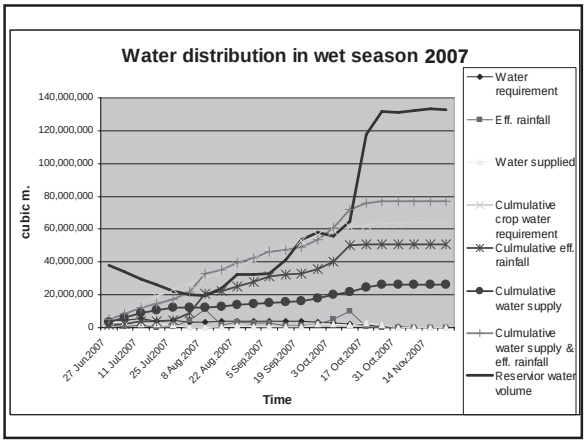
Water Requirement of each plant (cu.m.)					Water Supplied	Rainfall (mm.)	Effective rainfall (cubic meter)
Sugar	Lotus	grass	percolation	Total			
91,055	14,887	236,094	17,441,345	64,262,797	26,097,553	873	50,956,035
15.9	2.7	52.3		7,395.6			

Analysis results and major findings

Conveyance efficiency

Canal	Responsible area (ha.)	Conveyance efficiency (%)
Left main canal	2,919	92.86
Lateral canal	3,450	89.99
Sub-lateral canal	2,263	88.17
Ditch		82.73
Left main canal water distribution	7,912	68.93





Conclusion

	Dry season 2006/07	Wet season 2007	Unit
Total scheme water requirement	25,184,169	64,262,797	cu.m
Water delivered to users	38,214,129	26,097,553	cu.m
Effective rainfall	685,389	50,956,035	cu.m
Water delivered per cultivated area	12,789.2	3,528.6	cu.m/ ha.
Irrigation efficiency	64.11	50.99	%
Field efficiency	93.01	73.97	%
Income from crop productivity	113,940,338	251,273,525	Baht
Investment cost (machinery , seed, fertilizer, insecticide , labor)	53,417,978	106,614,650	Baht
Net income from agriculture	60,522,360	144,658,876	Baht
Crop productivity per irrigated water	2.98	9.63	Baht/c

Conclusion & Recommendation

- 1. Water allocation mostly meet the water requirement except during the shortage of rainfall period in wet season.
- 2. Water productivity is based on irrigation water supply only.
- 3. IIEPF should continue to cover another area of the Huay Luang O&M Proj. in order to evaluate overall system.
- 4. IIEPF result is very useful for decision making for better improvement of the irrigation water management.
- 5. To sustain efficient irrigation water management, not only human resource skill but also necessary equipments. Working team strongly recommend MRC to provide some equipments so that IIEPF could be sustainable development.
- 6.IIEPF is not only give the financial and technical supports but also chance for officials and WUG to improve and develop knowledge and experience. It is recommended training or seminar the officials are very important and MRC should provide some opportunities.

Board of Irrigation Water Management, Water Allocation Branch 3

Irrigation Official (8 prs.)

1. Water Master
2 Chief of water allocation
3. Chief of Repairment
4. Chief of Administration
5. Chief of Zone 1
6. Chief of Zone 2
7. Chief of Zone 3
8. Chief of Zone 4

Water Users' Organization (18 prs.)

1. Chairman of Integrated Water User's Group (IWUG) (9 Group, 1 prs./ group)
2. Vice Chairman of Integrated Water User's Group (IWUG) (9 Group, 1 prs./ group)

Advisor (Government Official)

Integrated Water User's Group at Lateral Level

Chairman of IWUG (1)

Vice Chairman
Administration (1)
- Secretary (1)
- Registra (1)
- Facilitatior (2)
- Treasurer (2)

Vice Chairman
Operation & Maintenance (1)
- Head of Chak

Vice Chairman
Career Development (1)
- Livestock (1)
- Fishery (1)
- Land Development (1)
- Agricultural Promotion (1)

Water Users' Group (Basic Group)

Chariman
(Ditch)

Vice Chairman
(Ditch)

Member

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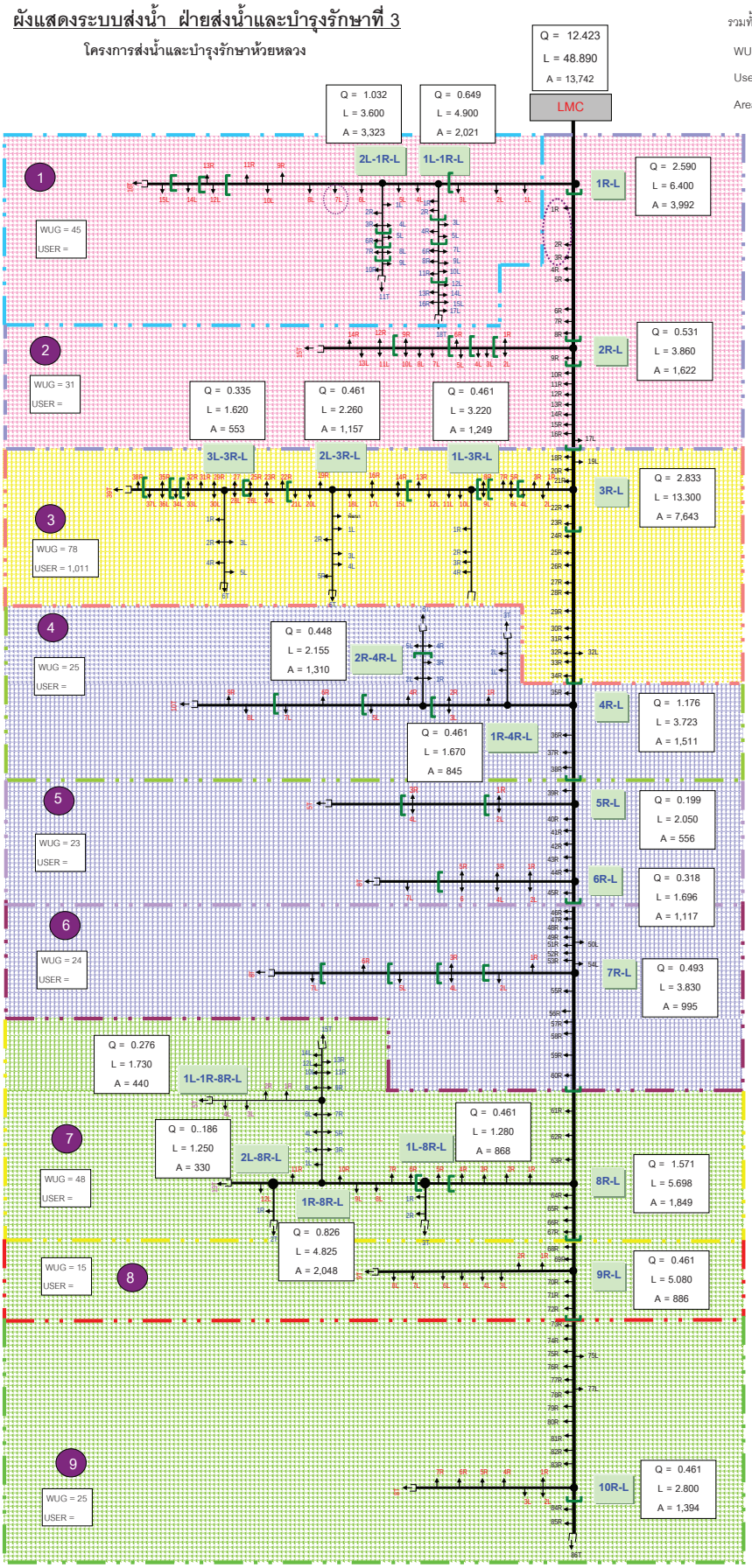
ผังแสดงระบบส่งน้ำ ฝ่ายส่งน้ำและบำรุงรักษาที่ 3

โครงการส่งน้ำและบำรุงรักษาห้วยหลวง



รวมทั้งสิ้น

WUG = 314 กลุ่ม (จำนวนคูส่งน้ำทั้งสิ้น 300 คูส่งน้ำ)

User = 3,832 ครัวเรือน

Area = 49,451 ไร่ (พื้นที่กลุ่มผู้ใช้น้ำ 45,991 ไร่)

หน่วยของ Q = ลบ.ม./วินาที

หน่วยของ L = กิโลเมตร

หน่วยของ A = ไร่ (พื้นที่ชลประทาน)

Check

โซน 1

โซน 2

โซน 3

โซน 4

[4]IWUG diagram2007.xls/Lmc (2)

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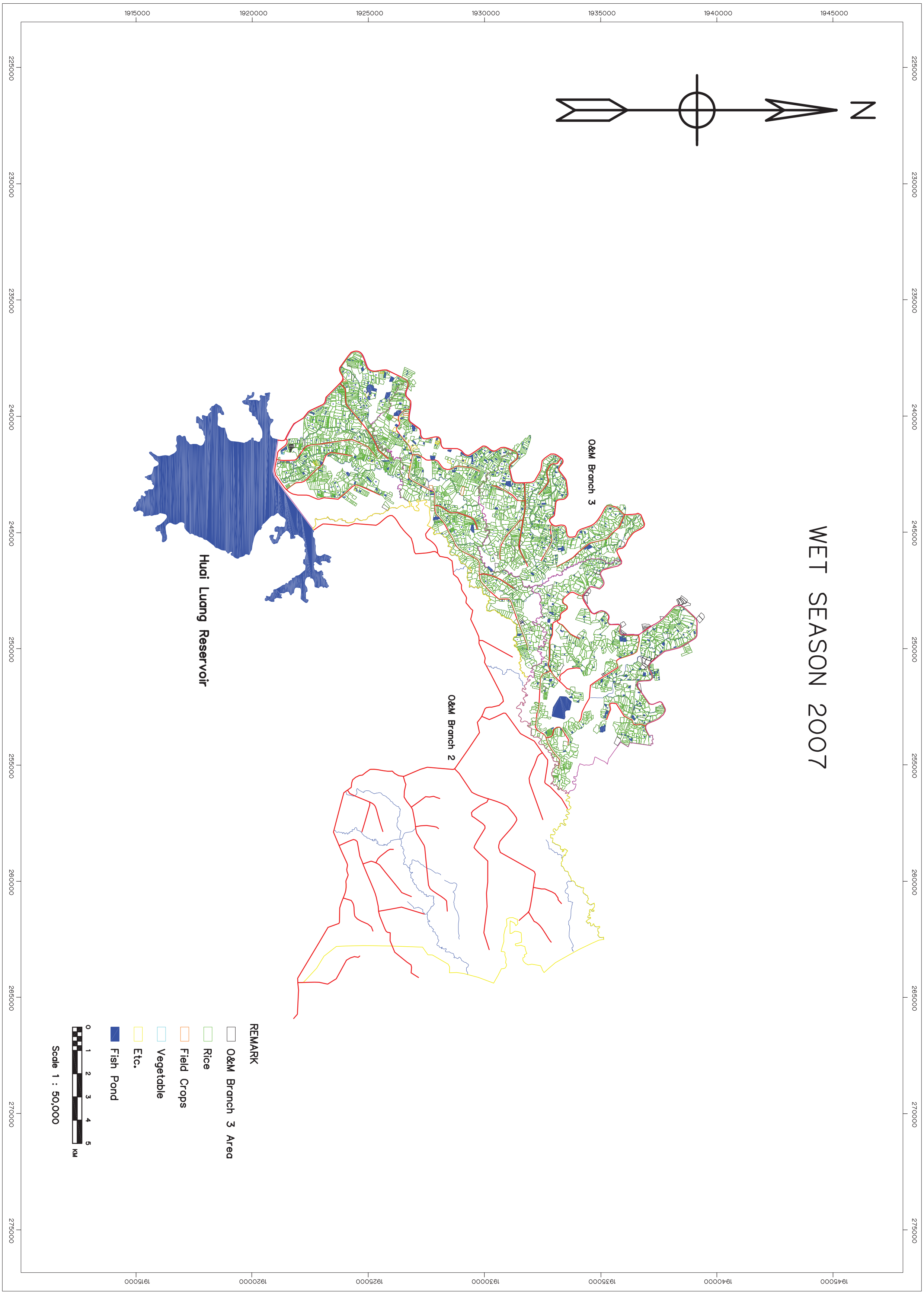
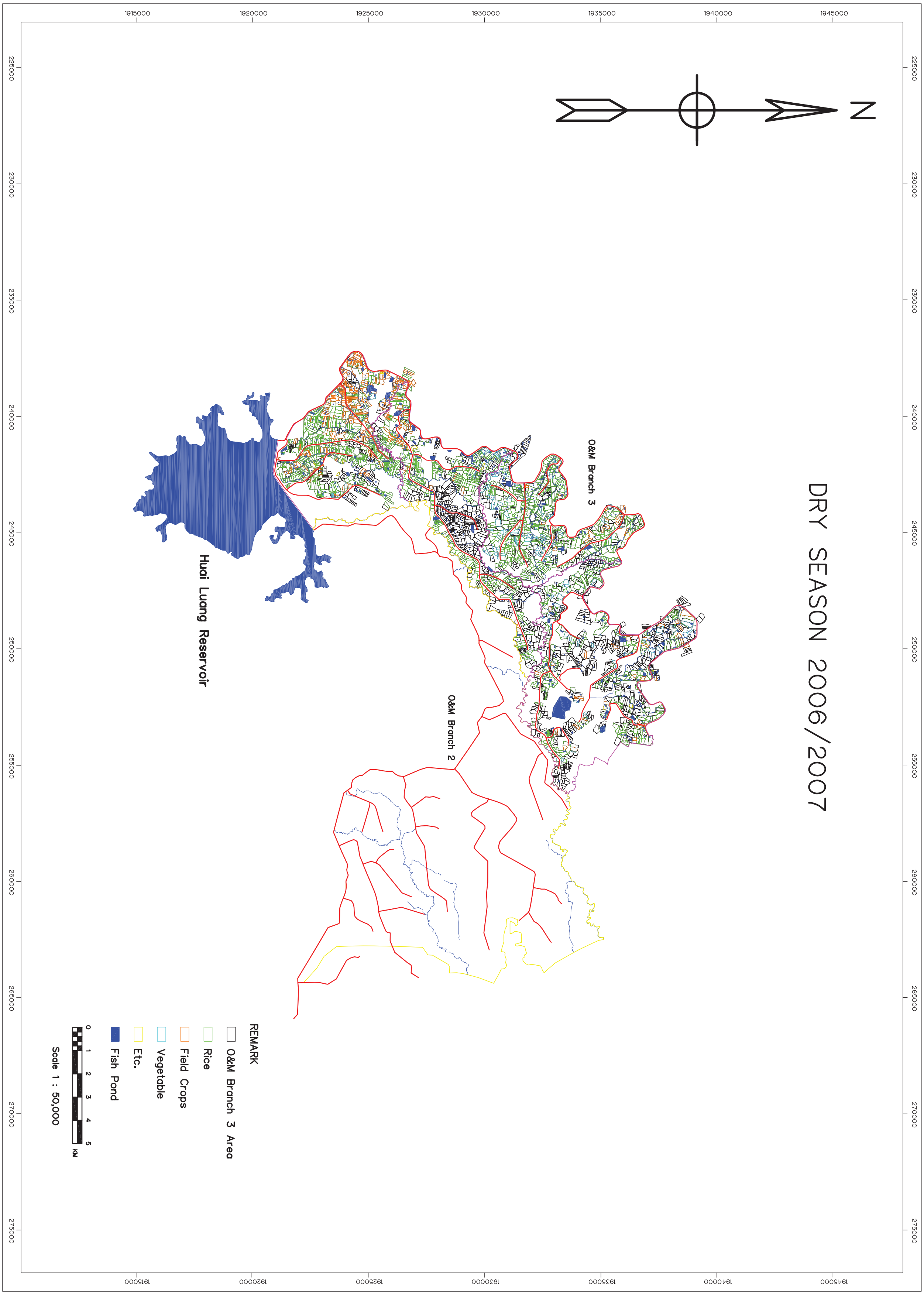

WET SEASON 2007
N
O&M Branch 3
O&M Branch 2
Huai Luang Reservoir
REMARK
O&M Branch 3 Area
Rice
Field Crops
Vegetable
Etc.
Fish Pond
0 1 2 3 4 5 KM
Scale 1 : 50,000


DRY SEASON 2006/2007
N
O&M Branch 3
O&M Branch 2
Huai Luang Reservoir
REMARK
O&M Branch 3 Area
Rice
Field Crops
Vegetable
Etc.
Fish Pond
0 1 2 3 4 5 KM
Scale 1 : 50,000

Regional Workshop

on

IMPROVEMENT OF IRRIGATION EFFICIENCY ON PADDY FIELDS IN THE LOWER MEKONG BASIN PROJECT (IIEPF)

Cambodia Study Team

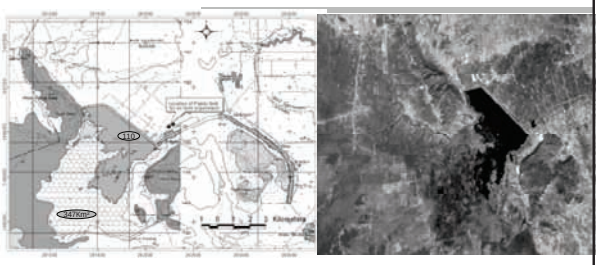
Background

- The project was funded by the MRC under the Framework of Program to analyze and evaluate water and ecosystem in Asia paddy fields.
- **Period** : 0ne year from February 2007 to February 2008
- **Team members:**
  - **Dr. Theng Tara** (Team leader, MOWRAM)
  - **Mr. Thach Sovanna** (Report assistance, MOWRAM)
  - **Mr. Meas Peov** (Field assistance, MAFF)
  - **Mr. Sao Sam Phors** (Field assistance, MOWRAM)
  - **Mr. Hong Kim San** (Field work, Battambang PDOWRAM)
  - **Mr. Sok Khom** (Facilitator, CNMC)

  has two teams: Field Team and Management team
- *overall objective*

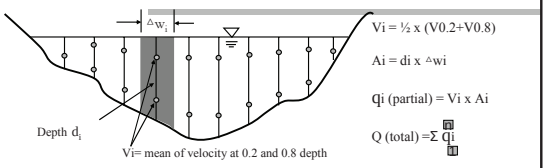
  is to extract information on water demand for rice plants and to improve irrigation efficiency on paddy fields.

Location of Study Areas



- Kamping Puoy scheme is one gravity type of irrigation system.
- located in Banan district, about 25 Km from Battambang province.
- Catchment area A = 347 km², W = 110,000,000m³,
- Total Irrigated area 1,1000 Ha
- has two main dams with the length of about 14 Km and some intakes structure
- The irrigation canal network consists of:
  - one main canal 9Km
  - three secondary canals 27Km
- Only Rice is growing in the scheme wet and Dry seasons.

1- Conducting inflows and outflows measurements
23 points inflows and 18 outflows (dry),25 inflow+20 outflow (wet)



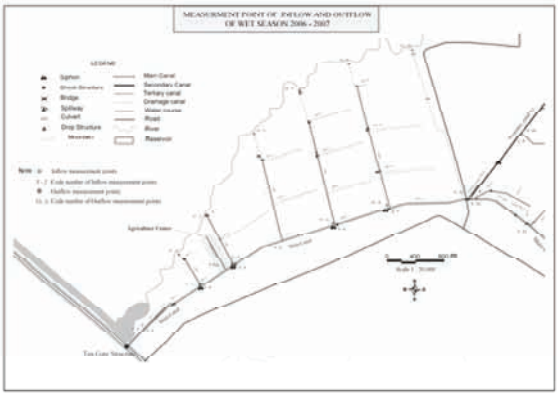
Vi = ½ x (V0.2+V0.8)

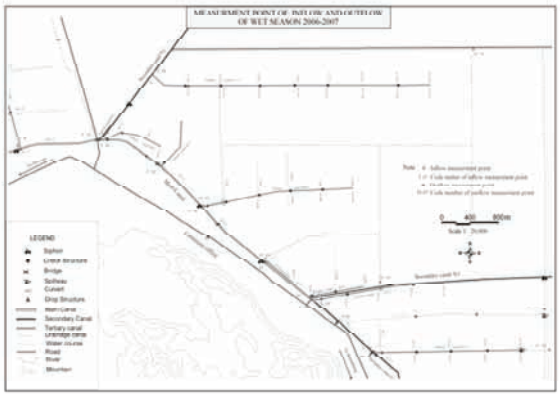
Ai = di x Δwi

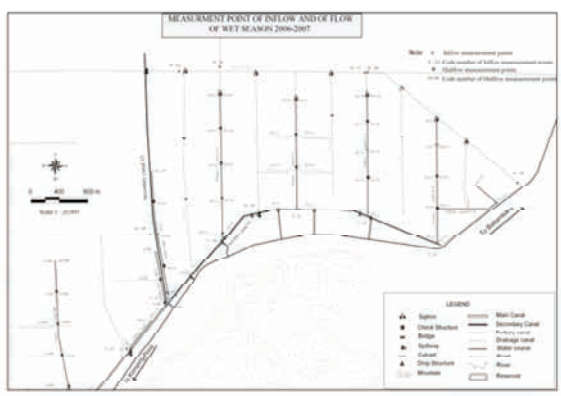
q_i (partial) = Vi x Ai

Q (total) =Σ q_i

- **Measuring flow with current meter at a selected location in the canal,**
- **cross section is divided vertically into sub segment**
- **Total discharge is attained by summarizing of partial discharges**



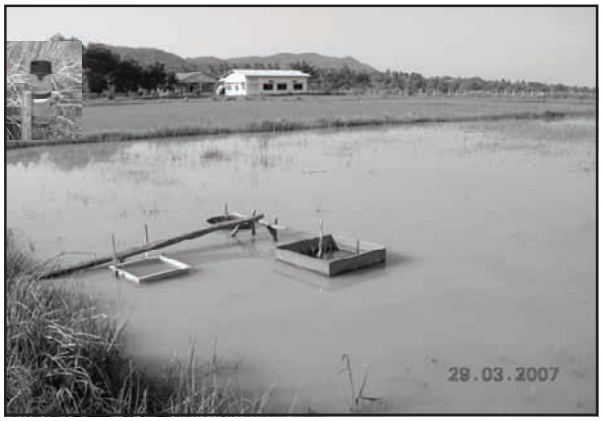




2- Record water level in rice paddy field

Locations:		Coordinate (X, Y)	
W.L 1 : In	Agriculture center	282688	1447120
W.L 2 : In	M9-2 rice field	284462	1447838
W.L 3 : In	M19-1 rice field	287976	1447377
W.L 4 : In	N2-3-2 rice field	290300	1444956
W.L 5 : In	N2-5-1 rice field	290576	1444112
W.L 6 : In	M23 rice field	289567	1446009

Tank with bottom with rice	E + T +R
Tank without bottom with rice	E + T + P + R
Wooden Staff gate with scale	E + T + P + S + R
Tank with bottom without rice	E + R
Rainfall recorder	R



3- (ETc) was calculated by two methods:

1- Averaging from field measurement and

2- FAO formula

ETc = ETo x Kc, Where:

ETc : crop water requirement or Evapo-transpiration requirement mm/day

ETo : reference crop Evapo-transpiration mm/day

Kc : Crop coefficient

4- The percolation is determined by using the percolation apparatus

Percolation = Water loss in depth – Evapotranspiration

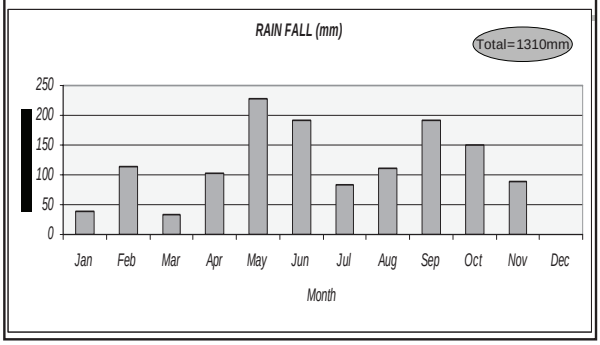
5- Effective rainfall for rice crop was calculated following by the method that was use by FAO.

Pe = P*0.6-10 if P<75mm and Pe = P*0.8-25 if P>25mm

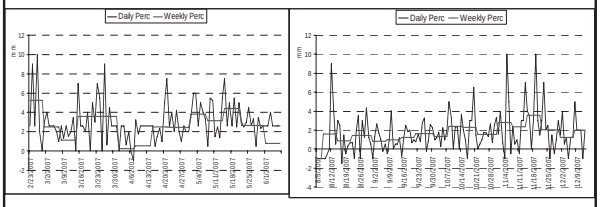
6- Record cropping pattern and crop calendar

10 days in one time by the farmer

RAINFALL



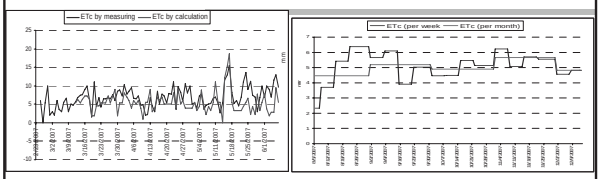
Percolation



2.12 3.94 1.85 3.52 2.14 3.06 2.61

1.80 1.02 2.03 2.91 0.89 2.01 1.71

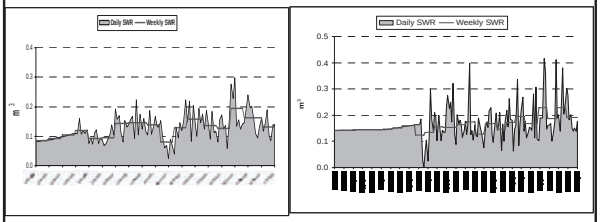
Crop Water Requirement



6.44 6.27 7.13 7.86 6.61 6.84 6.87

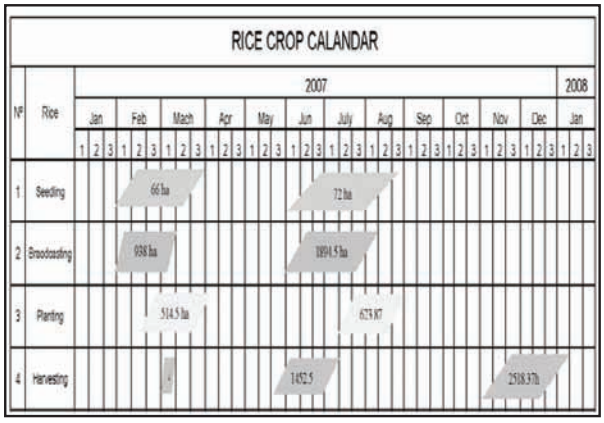
4.91 5.73 4.82 5.62 5.31 4.89 5.11

Total Scheme Water Requirement



Dry=16,12 MCM

Wet = 30.15 MCM



7- Identify actual irrigated area

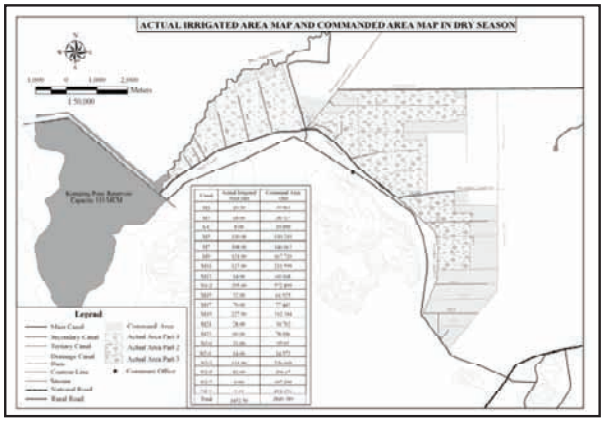
a) Provided by the farmer

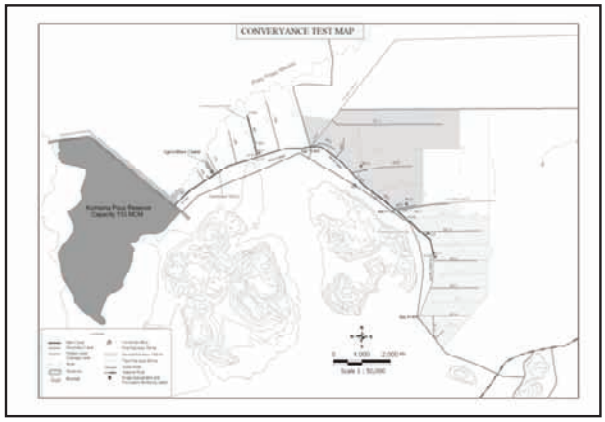
b) GPS equipment to record the points and boundaries

8- Conduct conveyance lost test along the canals

On main Canal, secondary canal N2 and tertiary canal

- ❖ Prepare table for recording data
- ❖ Select measurement point
- ❖ Draw cross section of canal
- ❖ Define depth point of canal from left to right
- ❖ Define point to measure water velocity
- ❖ Measure depth of canal from bridge to bottom
- ❖ Draw cross section of canal by AUTO CAD software
- ❖ Equipments preparation (Current meter instrument)





1- CONVEYANCE LOSSE ON MAIN CANAL

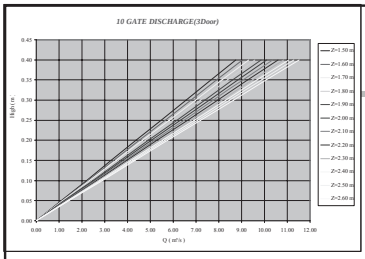
N°	Name Canal	Station	Discharge (m³ /s)	Lose (m³ /s)	Length (Km)	Lose/km (m³ /s)	Remake	Condition
1	M.C	I-1 Pk 0+300	4.508	0.574	3.165	0.181	Have 5 Structure	Structure
2	M.C	Br-M9 Pk 3+465	3.934					
3	M.C	Br-M19 Pk 7+535	0.957	0.108	0.845	0.128		Non Structure
4	M.C	Br-M21 Pk 8+380	0.849					

2- CONVEYANCE LOSSE ON SECONDARY CANAL

8	N2	I-18 Pk 0+020	0.576	0.039	0.510	0.077		Non Structure
9	N2	Br N2-1` Pk 0+530	0.537					
10	N2	Br N2-5 Pk 2+140	0.371	0.205	2.120	0.097	Have 2 Structure	Structure

3- CONVEYANCE LOSSE ON TERTIARY CANAL

5	M-9	1 -6 Pk = 33	0.353	0.032	0.449	0.071		Non Structure
6	M-9	Pk = 4 82	0.321					
7	M-9	Pk = 1+540	0.049	0.304	1.507	0.202	Have 5 Structure	Structure

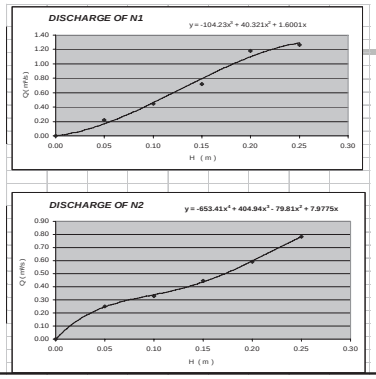


H-Q curve of 10 Gates

$$Q = \mu . S. \sqrt{2.g.Z}$$

Q : Discharge m³/s
S : Area of opening gate m²
μ : Discharge Coefficient
g : Gravitational Acceleration
Z : Head Loss

N1 and N2 H-Q curve



9- Water Management

- Scheme is owned by Battambang PDWRAM under supervision of the MOWRAM
- FWUC is responsible for the whole scheme management activities and plays an important role in the operation and maintenance works in consultation with PDWRAM
- Meeting of FWUC to review, prepare principle and plan for Implementation
- FWUC meets and extends on principles and plan to their members
- FWUC meet and make decision on principle and plan for implementation
- FWUC prepare water sharing and distribution calendar and submit to Battambang PDWRAM for decision
- FWUC meet and design plan to clear forest, repair and improve all canals
- FWUC meet and review water fee collection service for the season before starting implementation
- Implementation the plan

- All members shall contribute for the operation and maintenance of all facilities irrigation system,
- Secondary canal, tertiary canal and all related structures are responsible by the FWUC, but main canal and main structure are responsible by the PDWRAM or MOWRAM
- All the paddy fields in the scheme shall have sufficient water for crop production,
- Upper members should allow water flow to the lower part.
- All committees shall have a water allocation plan,
- The water allocation shall follow according to the water allocation plan and also refer to the meeting,
- The water utilization shall follow to the irrigation condition,
- If the land is not smoothly, higher and far from the water source, this land has a first priority for irrigation,
- When the gate open and water flow to the paddy field, all members should wait and see until water sufficient in the field and also look at the losing of water through the dike,
- The members do not have a right to open the water without permission from the committee

Analysis Results and Major Finding

- Total actual irrigated area: dry season is 1452.5 ha and wet season is 2,518.37ha,
- The rainfall from February-December 2007 was 1310 mm,
- The average of CWR: Dry 6.87 mm/day, Wet 5.11 mm/day,
- The average of percolation: Dry 2.61 mm/day; Wet 1.71 mm/day,
- The total of land preparation was 193.4 mm,
- The total SWR: Dry 16.12 MCM ; Wet 30.15

- The volume of water diverted to the system: Dry 23.50 MCM; Wet 29.59 MCM,
- The volume of water delivered by system: Dry 13.85 MCM; Wet 14.61 MCM,
- Conveyance efficiency: Dry 72.54% ; Wet 84.15 %,
- Overall project command area efficiency: Dry 72.38% ; Wet 86.28%,
- The average yield: Dry 0.371Kg/m²; Wet 0.33 Kg/m²,
- The water productivities: Dry 0.023 kg/m³; Wet 0.28Kg/m³.

Recommendation and Conclusion

- It is not expected that the data from the field observation is perfect. Many troubles happened when we took the data such as crab broke the levee or dike is made a hole, water overflow into the tank, there are too much rain etc... Therefore, in the process of calculation, we cancel some data or we do not take it.
- Based on the above research, we propose and request that the MRC should add one or 2 year more research in order to have more data for analysis and fill some gaps that we face in the previous study.

- From this research, we learnt and received a lot of data and experiences of how to conduct water use efficiency for irrigation and also this data are very useful for the operation and management of irrigation system.
- In the future, the Royal Government of Cambodia (MOWRAM) must strongly continuous this research activity from MRC and take consideration on the collection of data and information related to the water use in the irrigation systems because it is very useful for irrigation water use efficiency, preparing water use planning, and also for operation and maintenance of irrigation system.

THANK YOU

FOR

YOUR KIND ATTENTION

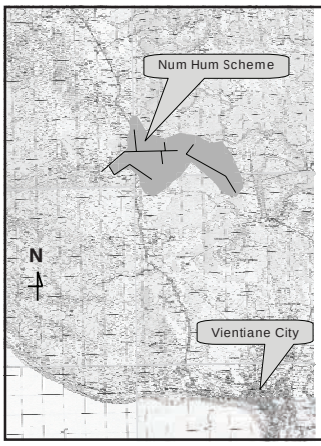
Field Observation & Analysis Work of IIEPF in the

Nam Houm Irrigation Project

2nd IIEPF Regional Workshop
25 March 2008

Prepared by Lao Team IIEPF
LNMC & MAF
Backstopped by Fongsamuth (MRCS)

Contents



1. Location

- Located in Vientiane Capital
- 35 Km from Vientiane Capital City by road No. 13 to the north
- Project areas cover two districts:
  - Naxaythong District
  - Xaythany District

3

2. Scheme Outline

Constructed in 3 phases:

Phase 1 : 1978 - 82
The construction works included: Dam, intake, spillway, main canal, and some on - farm canals (irrigated 150 ha) by govt. budget with loan from OPEC & grand aid from Japanese govt.

Phase 2 : 1990 - 93
N1 secondary canal (400 ha) with financial assistance from Italian govt. through interim Mekong Committee.

Phase 3 : 1997- 2000
Additional main canal (2.3 km) , secondary and the remaining canals (completed 3000ha) by govt budget.

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2. Scheme Outline (1)

Project Type:

Gravity Basin Irrigation

Scheme Overall Objective:

Generating household income surrounding Vientiane capital and supporting & promoting agricultural industrialization with irrigation service

Scheme Specific Objective:

Mainly supply water for dry-season agricultural activities & supplementary supply water for wet-season agriculture, but not supply water for domestic & other water uses

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2. Scheme Outline (2)

Project Major Duties:

- Reservoir Watershed Management
- Irrigation Infrastructure Operation and Maintenance
- Irrigation Water Delivery Service & Management

Benefit Area :

- Original Designed Command Area : 2,400 ha
- Dry Season (2006-07) : 1,525.7 ha
- Wet Season (2007) : 2,263.2 ha

Benefit People:

- 17 Villages
- 18, 879 farmers

6

2. Scheme Outline (3)

Storage Capacity

Maximum Storage : 60 MCM

Active storage : 54 MCM

Canals : 60.635 km

MC : 9.30 km

SC : 46. 84 km

TC : 4.50 km

(367 gates + check structures)

7

- Unstable rainfall ----> shortage water in some years (1995 & 2005, 2007)
- Strict water management needed

2 July 19, 2007 Vientiane Times

Nam Houm reservoir abnormally low

KHONESAVANH LATSAPHAO

THE Nam Houm reservoir in Naxaithong district, Vientiane is abnormally low this year, because there has not been the usual amount of rain.

Normally, the volume of the water is 60 million cubic metres at this time of year, the Deputy Head of Agriculture and Forestry Extension in Naxaithong district, Mr Nantha Phandavong said.

"This is the first time that the volume of water has fallen to 44 million cubic metres," he said.

This year the rain has arrived so late that rivers and waterfalls are also affected and show lower levels of water than usual for this time of year.

However, the reservoir still supplies water to over 100 hectares of wet-season rice fields through the irrigation system.

If the level of water remains at 44 cubic metres until the dry season, the reservoir will not have enough water to provide rice fields.

All farmers in the area of the Nam Houm irrigation system will use water from these channels to supply their dry-season rice fields.

Nam Houm reservoir is about 26 km from Vientiane, and is a popular place for locals and foreigners to have picnics.

Many people like to visit this area on Saturday and Sunday, because the reservoir has a waterfall called Tad Houm. But now only a few people go there, because of the lack of water feeding the waterfall, Mr Nantha said.

3. Field Activities

Major Field Activities:

- Conducting RAP as first system performance assessment
- Identifying cropping pattern
- Monitoring ETo, ETc, Percolation, rainfall ----> water requirement
- Flow measurement in & out of system & inside system ------> water balance
- Conveyance efficiency test
- Crop production survey
- Overall command area efficiency
- Water productivity
- Identifying management appraisal

Not all activities presented

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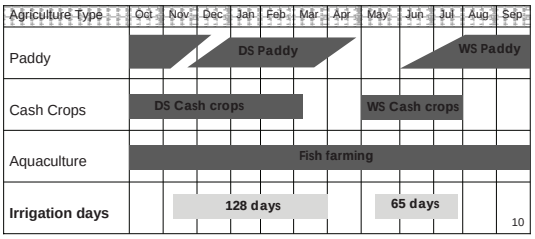
3. Field Activities & Its Results (1)

Irrigation days & Cropping Pattern

- 90 days of dry-season rice & 120 days of wet-season rice
- Cash crops mainly grown in dry season & beginning of wet season (not heavy rain period)
- Fish farming practiced thought the year
- Irrigation in wet season mainly in Land preparation &Transplanting period s



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3. Field Activities & Its Results (2)

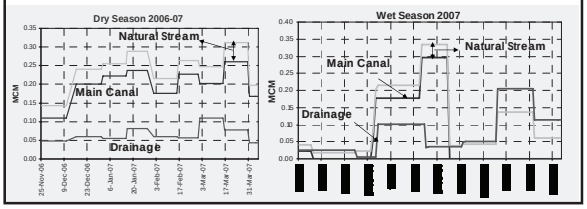
Flow Monitoring:

- Construction of Bamboo bridges at all measurement points
- Every 15 days (7 days spending for each measurement)
- 2 measurement teams
- Total 44 points (5 natural inflow streams, 4 natural outflow streams)
- 7 places of conveyance tests

3. Field Activities & Its Results (3)

Summary of Total Flows

	Dry Season	Wet Season
Original Design Capacity	46.6 MCM (6 m³/s)	
In flow from main canal into system	27.33 MCM	7.31 MCM
Inflow from natural stream into system	5.59 MCM	12.21 MCM
Drainage (outflows)	9.16 MCM	16.12 MCM

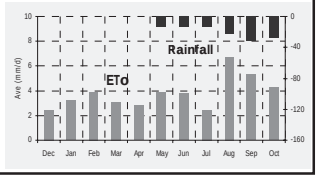


3. Field Activities & Its Results (4)

ET_o & Rainfall

- Daily measurement
- No rainfall in dry season (Dec- April)
- High rainfall in Aug & Sep
- **Dry Season**: High ETo in Feb.
- **Wet Season**: High ETo in Aug & Sep

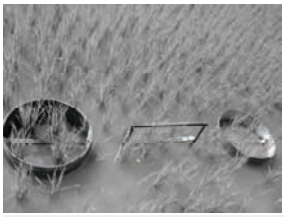
	ETo (mm/d)	Rain (mm/d)
Dry S.	3.08	0.07
Wet S.	4.04	20.36



3. Field Activities & Its Results (5)

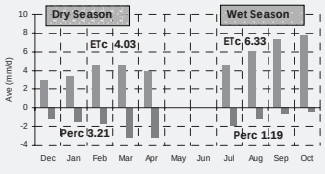
ETc

- Lesser in Dry Season
- Dry Season: high in Feb & March
- Wet Season: High in Sep & Oct



Percolation

- Higher in dry season
- Dry season: High in Mar & Apr
- Wet Season: high in July & Aug



3. Field Activities & Its Results (6)

Crops Production Survey

- Apply Unit harvested method (1 m X 1m) for collecting paddy production
- Total samples of 24 points in dry seasons & 20 points in wet seasons
- Collecting value cross checked with farmers' interview

(Price in 2006-07)

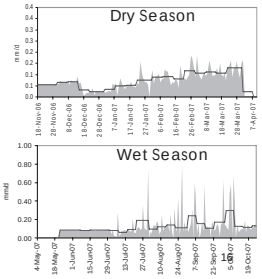
Crop Types	Dry Season Area ha	Area %	Yield (T/ha)	Price (US$/T)	Wet Season Area ha	Area %	Yield (T/ha)	Price (US$/T)
Paddy	1,485.2	97.4	3.88	239.65	2,236.48	98.8	2.85	217.86
Cash crops	18.78	1.2	8.93	167.72	5	0.2	2.15	108.93
Aquaculture	21.72	1.4	4.07	1,307.35	21.72	1	4.05	1,089.32
Total	**1,525.7**				**2,263.2**			

4. Major Findings (1)

Summary of Water Requirement (WR)

WR of each sector	Dry Season	Wet Season
Paddy (MCM)	9.817	20.370
Cash Crops (MCM)	0.078	0.006
Aquaculture (MCM)	0.234	0.296
Total (MCM)	**10.129**	**20.672**
Total (mm)	**663.90**	**913.7**

- Higher WR in wet season due to longer period & larger planted areas
- **Dry Season** : high WR in Dec. (Land Preparation stage) & in Feb. & Mar. (flowering stage)
- **Wet Season**: WR fluctuated due to rainfall, high WR in early Sep. & Oct.



4. Major Findings (2)

Efficiencies & Water Productivities

- Conveyance Efficiency: The same value used in both dry & wet seasons because the test conducted at one time
- Higher overall efficiency in wet season due to shorter irrigation days, although much more rainfall observed
- Higher water productivity in dry season due to higher yields & higher price

	Dry Season	Wet Season
Conveyance Efficiency (canal off-takes/canal intakes)	69.06 %	
Overall Command Area Efficiency (SWR-ER)/(total inflow * Conveyance Effi.- drainage)	65.30 %	78.17 %
Water Productivities (US$/$m^3$ of water use)	0.114 US$/$m^3$	0.097 US$/$m^3$

SWS : System Water Requirement
ER : Effective Rainfall

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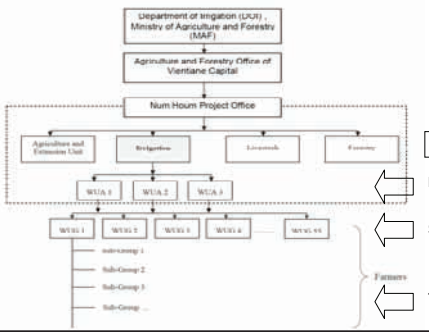
4. Major Findings (3)

Organization & Water Management



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4. Major Findings (4)

Water Allocation

- Water allocation plan for every dry- season cultivation, but not for wet season
- Continues/free water supply (no control) when full storage of reservoir
- Rotation in 3 zones when less reservoir storage (unstable rainfall

- Water supply plan fixed (no flexibility)
- Few feedback system
- Less monitoring

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4. Major Findings (5)

Irrigation Service Fee - ISF

- Water fee important for water management as covering facility maintenance & incentive for staff
- Rate of ISF: 150,000 Kip/ha
- 47 % collected in 2006-07 & 40% collected in 2007-08

Project Constraints

- Poor irrigation infrastructures
- Lack of effective water distribution plan & monitoring system
- Lax enforcement regulation in water management practice
- Low skill of staff on proper water management

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5. Conclusion

- High efficiency compared with other schemes in Laos (40-50% in general)
- Outflows not observed & controlled by the project
- Water allocation plan not suitable with actual water requirement, adoption plan needed
- Higher efficiency in wet season because of shorter irrigation days (lesser irrigation water Supply)
- Water productivity in dry season higher than wet season due to higher paddy yield and higher production prices
- Good water management practice needs to be implemented to trail the best solution in order to increase water use efficiency, water productivities & farmers' income household

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Thank You for your Kind Attention

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Annex 6: Presentations of Technical Backstopping

Summary of Technical Backstopping Work under IIEPF/AIFP in the Dry-Season Cultivation (2006-07)

The 2nd IIEPF Regional Workshop
MRCS Conference Room, Vientiane, Laos
25 March 2008

Fongsamuth Phengphaengsy
AIFP, MRCS

Project is funded by Government of Japan, MAFF with technical cooperation of FAO-RAP

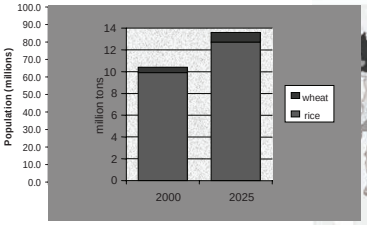
1

Content

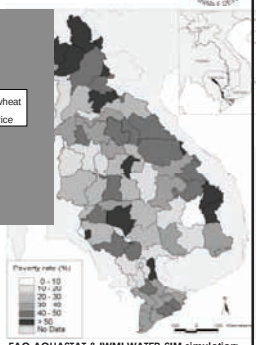
- **Agriculture & Irrigation in the Basin**
- **IIEPF Project**
- **Summary of Field Activities**
- **Summary of Major Findings**
- **Conclusion**

2

1. Agriculture & Irrigation in LMB



Agriculture, in the future, still needs to meet growing demand



FAO AQUASTAT & IWMI WATER-SIM simulation

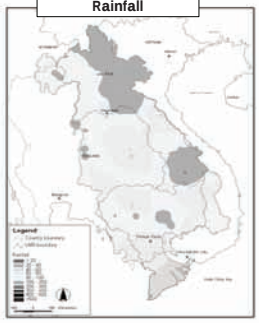
1. Agriculture & Irrigation in LMB

April

2004

Rice Planted Areas

Rainfall



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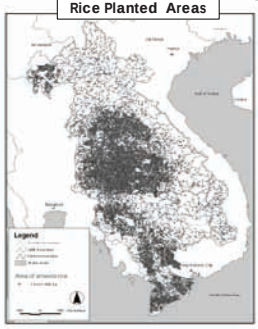
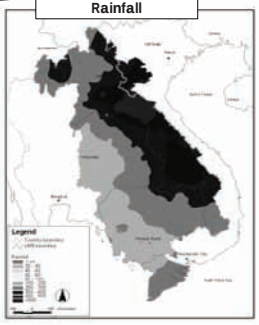
1. Agriculture & Irrigation in LMB

August

Rice Planted Areas



Rainfall

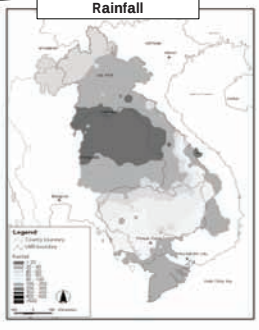


1. Agriculture & Irrigation in LMB

November

Rice Planted Areas

Rainfall



5

1. Agriculture & Irrigation in LMB

Cambodia	2.7
Laos	3.0
NE Thailand	9.4
Vietnam Delta	26.3
Vietnam Highlands	0.5
LMB total	41.8

- **8.8%** of annual discharge (475 bill. m^3)

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2. IIEPF Project- Objectives

- to appraise irrigation efficiencies in selected irrigation systems
- to enhance the capacity of stakeholders in using up-to-date concepts of irrigation efficiency and water balance tools and procedures for their assessment
- to produce guidelines for improving irrigation efficiency on paddy fields based on actual water use practices in the LMB member countries

8

2. Expected Impact

Improve livelihood of people

Maintain the ecology and environment of the river basin

Minimize gap between crop water requirement & actual water use

Effective of Water Use

Increase Efficiency and Water Productivity

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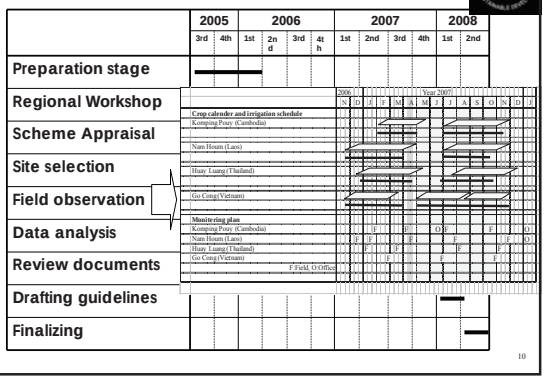
3. Field Monitoring



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4. Major Findings

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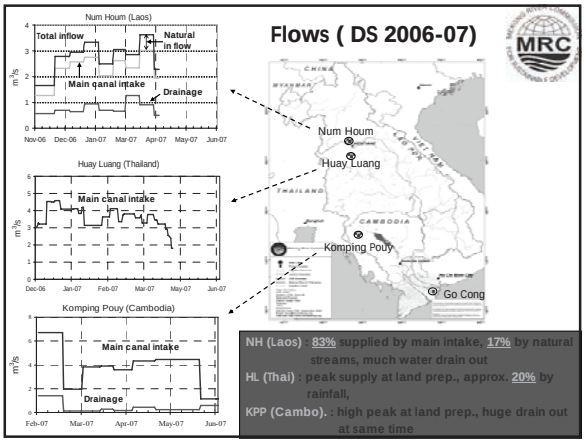

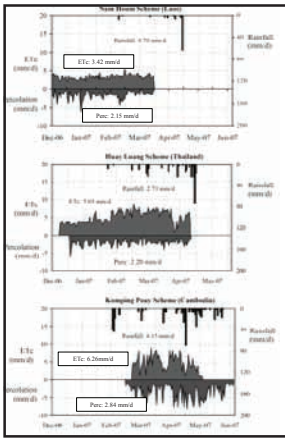

Rain, ETc, and Perc. (DS 2006-07)

- Rainfall
  more in lower basin
  peak Apr – May
- ETc
  constant in L.
  clear variation in T.
- Percolation
  high-initial, low-late in L.
  constant in T.
  big fluctuation in C.

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Water Requirement *(Observed Value VS Plan Value)*

- Almost the same between NH & HL
- Gap between observed & planned values
- High gap in Num Houm (Laos) & Komping Pouy (Cambodia)
- Gap filled if increasing water use efficacy
- Huay Luang (Thai) adapt to actual observed value

	System (observed) (m^3/ha)	Planned Value (m^3/ha)
	12,000.23	20,000
	13,185.62	15,625 in HL (18,750 in NE Thai)
	15,667.94	20,000

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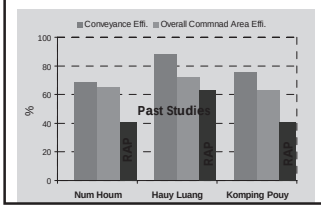
Efficiencies

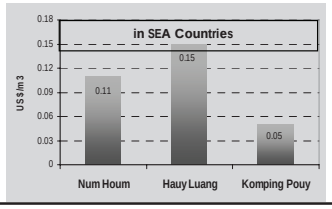
- High efficiency caused by Water Balance Approach
- Active & intensive water man… in Huay Luang ---> high efficiency
- Poor irrigation fac… (WR-ER)/(Inflow * Conveyance Effi.-Drainage) cause by reuse of drain water, less out flow observed
- Too large capacity of main canal compared with planted area ,but water allocation schedule often feedback



Water Reuse in Num Houm

Water Productivity

- Low value in general
- High value in scheme practicing multiple crops & variety agriculture diversification
- Low value in scheme practicing single crop e.g. Komping Pouy
- Fish farming & cash crops give high value because of high price
- Scheme with high water use efficiency also provide high water productivity



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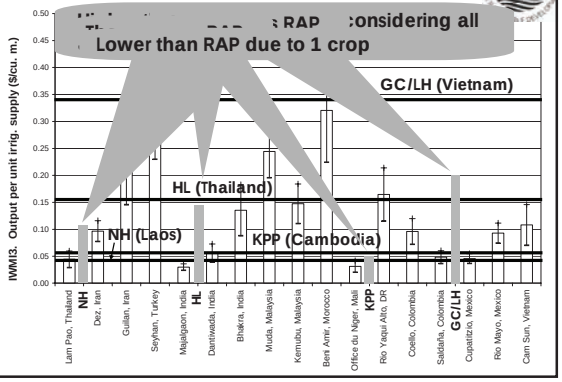
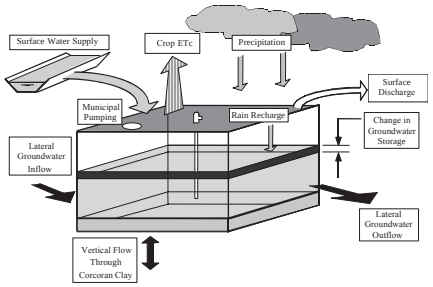
Water Productivity - *RAP & Field Analysis*

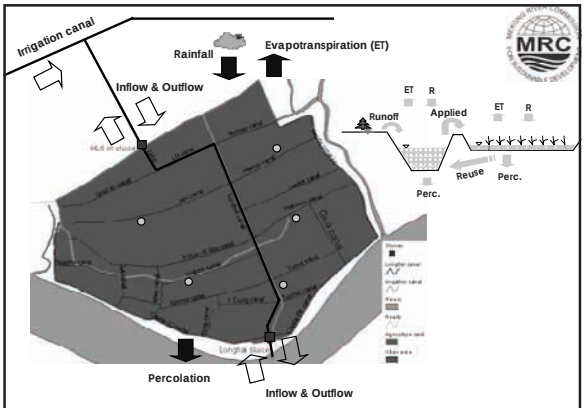


Tidal Irrigation (GoCong/Longhai Project)

Water Balance Concept



Source: FAO



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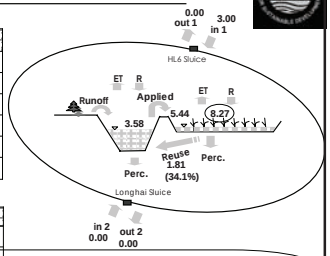
Water Balance Results

Crop Water Requirement (CWR)	3.47
Effective Rainfall (ER)	0.29
Irrigation Water Requirement (IWR)	8.28
Actual Water Applied (AWS)	5.44
Available Water in Canal (AWC)	3.58
Reuse Water (return to canal)	1.81



(CWR-ER) / (AWS)	58.80
(IWR-ER) / (AWS)	152.20
(CWR-ER)/ (Intake Diverted)	105.84
(IWR-ER)/ (Intake Diverted)	275.80

Total production / Volume of Intake Diverted	1.18	0.24
Total production / Volume of Applied Water	2.65	0.25
Total production price/AWC	1.0	0.20

- With total IWR, 36.3% from diverted water from sluice, 8.9 % from rainfall ---> shortage water ?
- Canal functions as water as on farm storage
- Water available in canal less than applied amount to paddy field, but the gap filled by recycling water returned into canal after being applied
- Recycling amount account for 34 % of total applied amount

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Major Findings-*Tidal Irrigation*

Role of Water Management

- Maintain good water quality inside command area & diverting fresh water as much as possible to replace the stagnant condition of water
- To ensure availability of water in the canal, raising up water level to support gravity condition
- Conveyance efficiency has no meaning since no control & service by each canal level
- No requirement of farmer participation in managing water distribution

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Conclusion

- Examining irrigation water use efficiency for one year crops, interesting results found
- High efficiencies due to the water balance approach & outstanding performance pilot sites
- High water productivity observed in scheme where combine multiple agriculture activities

- Similar practical approach expects to be applied for whole basin to understand situation of irrigation system in LMB

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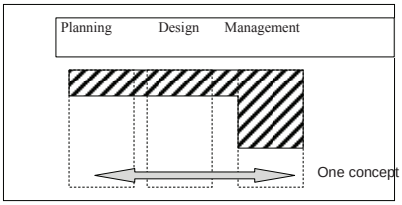
Annex 7: Outline of the Guidelines and Supplementary Document

Guidelines for efficient irrigation water use

Naoki HORIKAWA
National Institute for Rural Engineering

Objectives and Scope

The purpose of this guideline is to describe options to improve irrigation efficiencies of the irrigation systems in the Mekong river basin.



3 Phase of irrigation project and scope of this guideline

Features of irrigation projects in the Mekong river basin

	Mekong river basin	
Canal Type	Open channel	Pipeline
Farm size	Small farms	Estates
Main crop	Rice	Upland crop
Irrigation	Supply oriented	Demand oriented
Climate	Tropical monsoon	

Contents of the guideline

7. Technical and managerial aspects

Water requirement
Monitoring
Organization

1.Water allocation (Seasonal Irrigation plan)

2.Water Distribution (Irrigation scheduling)

3. Canal operation

4. Water management of tertiary canal

5.Institution

6.Improvement of physical structures

Reliability

Flexibility

Equity

1.Water allocation (Seasonal Irrigation Plan)

articles	contents	Related analysis
Seasonal Irrigation plan	What is the irrigation plan?	
Procedure	How are water users involved in the decision making process?	
Monitoring and survey	What should be measured or surveyed prior to seasonal irrigation plan?	
Estimation available water and water requirement	How are water supply and water demand compared?	
Optimal Reservoir operation	How much water can be used in reservoir storage?	Simulation Dynamic Programming
Functions	What should be decided in the seasonal irrigation plan? What would be limited if available water is less then water demand?	
Allocation of irrigated area	How is restriction on irrigated area allocated?	
Area water level control	Irrigation plan of tidal irrigation area	Water balance , inundation analysis
Announcement	Irrigation plan should be informed to farmers.	

Estimation of available water and water requirement

	Estimated water resources	Effective rainfall
Pessimistic	Present reservoir storage	0
	Using record of draught year or other certain year	
Optimistic	Present reservoir storage + average inflow into reservoir	Estimated based on average rainfall

High production
Failure of water supply

$$\text{Irrigation area} = \frac{\text{Estimated water resources} - \text{water demand for other purpose}}{\text{Irrigation demand for unit area} - \text{estimated effective rainfall}}$$

Optimum Reservoir operation

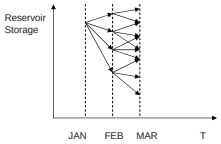
Dynamic programming (DP)

When reservoirs are large enough to keep water storage beyond one irrigation season, estimation of reservoir storage change is estimated for a longer period.

- Dynamic programming is the method that can directly find the policy that can generate the maximum benefit under conditions given and an evaluate function such as the rice production.

$$f(S_t) = \max_{R_t}\left(\sum_{T} P(I_t)\{g(R_t) + f(S_{t+1})\}\right)$$
$$S_t + I_t - R_t = S_{t+1}$$

R: Release from reservoirs
I: Inflow into reservoirs from catchments
g(R): Function which stand on benefit caused by release
S: Storage
f(S): Evaluate function

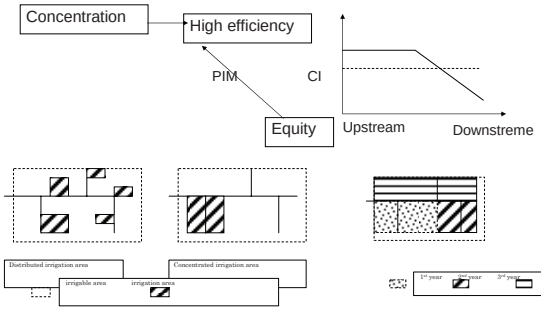


Restriction

The seasonal irrigation plan is calculated after comparing estimated available water and irrigation water demand calculated by a temporal plan. When the former is less than the latter at any period of next irrigation season, a temporal plan must be revised as for cultivated crop, irrigated area, crop establishment, The staring date of irrigation.

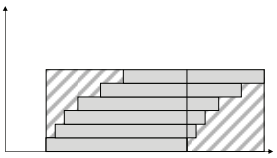
- Cultivated Crop
- Irrigated area
- Crop establishment method
- Delay of planting

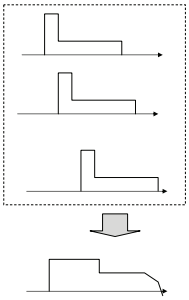
Allocation of irrigated area



Distribution of irrigation implementation

Irrigation should be started at the same time at tertiary level to reduce the duration of irrigation.
While, start date of irrigation should be distributed for cut peak of water demand (land preparation) at project level

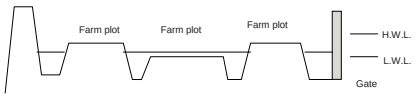




Area water level control (1)

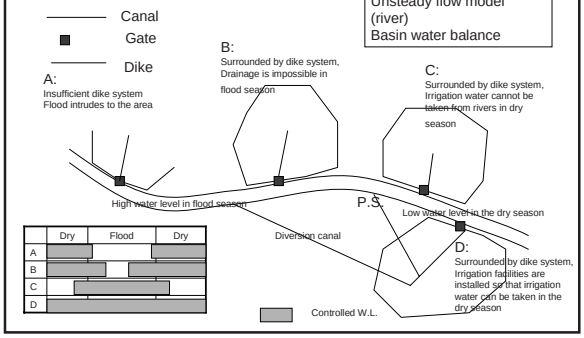
- Water can be distributed evenly if irrigation project area is very flat and canals have enough capacity. This irrigation system called as Tidal Irrigation etc. can achieve high irrigation efficiencies by controlling water level. Target water level should be decided at some points and in some periods. Target water level depends on the location of irrigation project.

Tidal Irrigation
Creek Irrigation
Flood Irrigation
Storage Irrigation



Are water level control (2)

Inundation analysis
Flood estimation
Unsteady flow model (river)
Basin water balance

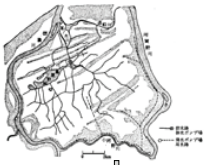


Inundation analysis

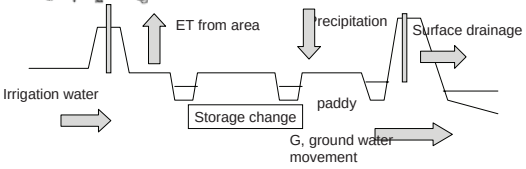
Schematic diagram of channel networks

Forecasting of operation
Design of canal system and structures

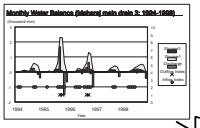
Basin Water balance

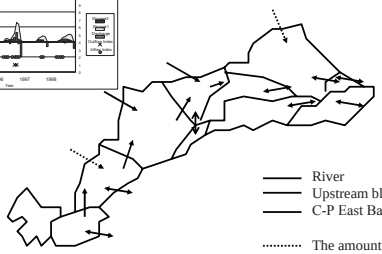


Monthly storage change
Ground water movement



Flood water intrusion estimation





River
Upstream block
C-P East Bank

The amount is too small to be estimated

2.Water distribution (Irrigation Scheduling, weekly or daily distribution plan)

	contents	Related Analysis
Irrigation scheduling	What is the irrigation scheduling	
Type of water distribution	Flexibility and water distribution	
Interval, frequency	When is the water distribution decided.	
Monitoring and Procedure	How is it decided.	
Continuous water supply and intermitted water supply	Which can improve irrigation efficiencies	
Flood introduction	Management to utilize water resources	
Reservoir operation	Water management in water shortage	Simulation

Flexibility and water supply method

Supply - oriented water control is control in which manager of irrigation canal have initiative. In open channel farmers use water within the amount which is intake or conveyed. The amount of water diverted into canal have no relation with the water demand witch cause on farm fiscally. The water manager decide the amount to divert or distribute by their own judgment .

The most simple method to supply water is to distribute fixed discharge to each branch canal . In this method it may create water which go through in valid . To decrease ineffective water the water manager must estimate water demand correctly . It is difficult to estimate water demand . In Japan there are three method to estimate water demand practically . As special case , the water manager operate to irrigate each farm plot instead of farmers in some irrigation project . This case is classified to supply oriented water control .

Demand oriented water control
Supply oriented water control
- Fixed distribution without reflect water demand change
- Distribution in obedience to water demand
  - Estimate by field survey
  - Estimate by monitoring
  - ordering
- Distribution to farm plot by water manager
- Others

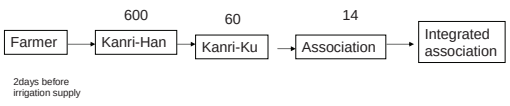
Mixed water control

classification of water supply method

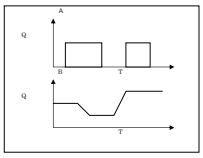
Procedure of ordering

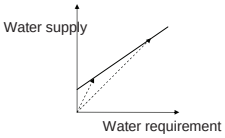
In some projects, farmers apply for irrigation water to water manager in advance . The water manager divert water from intake to main canal and distribute to each branch canals according to farmers application . If farmers use water as much as they applied , there is no difference between supply and demand . In general farmers careless about saving water . In this project area , water demand is more than their maximum of water supply . Water shortage happen every year . Farmers recognize that it is important to save water and this water management system can be carried out .

Example



Continuous irrigation supply and intermitted (on-off) irrigation supply

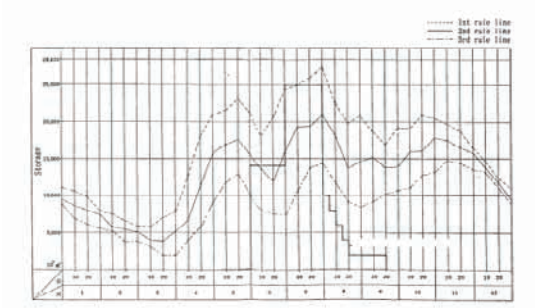




Continuous	Control supply volume by flow rate Flexible Main canal
On-off	Control supply volume by duration High irrigation efficiency, equity with poor management Tertiary canal

Multiple use
Minimum flow

Reservoir operation rule

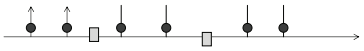


3. Canal operation

Canal operation and spill	To reduce spill from main or secondary canals
Operation of turnout works	Monitoring and control
Operation of cross regulator	Upstream control or Downstream control
Communication	Communication between operators

Control of turnout works

		Operation
A	Flow rate control (measurement) at main turnouts	From upstream to downstream
B		Several times a day (long canal system)
C	Flow rate control (measurement) at key points Water level control (measurement) at main turnout	Several trial or experience
D	Water level control (measurement) at main turnouts	Several trial or experience
E		Rotation between turnouts
F		Proportional distribution without reflection of changing demand

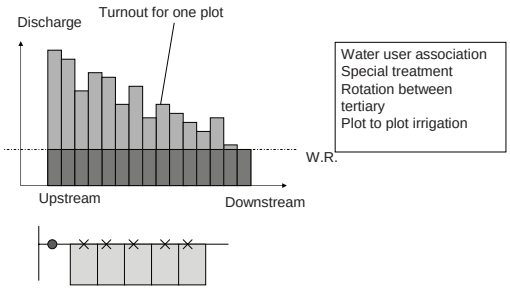


Once flow rate measurements is established, flow rate control is easier than Water level control.

Operation of cross regulator

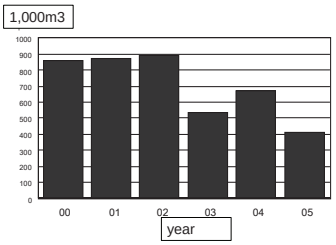
- the gate which keeps constant upstream level automatically was introduced to irrigation canal system in some projects.
- This gate keep upstream level mechanically at division points . Introduction of this type of gates makes operation simple . Managers only have to operate intake gate and division gate which discharge must be varied . The open degree of division gate obey only its discharge .
- But some problems remains or caused . In irrigation canal system , upstream branches have advantage than down stream branches . If there were no check gates , even most upper weir can't get their require water . But if there were check gates , upstream weir can get all they want . There is no problem if operators of branch gate follows general manager of total canal system instructions . Thus construction of the automatic weirs which control constant upper level may cause water shortage at last .

4.Water management of the tertiary canal



Water user association
Special treatment
Rotation between tertiary
Plot to plot irrigation

Special treatment



Annual water volume for terticary canal

Water Use Mapping
(water flowchart by farmers)

- Creation of a water flowchart (creation of water flowchart to show the flow of water in and out by plot to plot irrigation of each farmer's own fields based on paddy field maps) to confirm the relationships between farmers and to create communication for carrying out collective work

Tomosho et al.(2006), JIID(2007)

5.Institution

- Water right
- Restriction of land use
- Water quality protection rule
- Re-plotting system in land consolidation

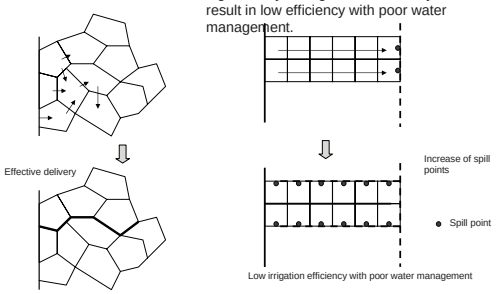
6. Improvement physical structures

	Contents	Related analysis
Regulation reservoir	Capacity needed	Unsteady flow model
Cross regulator	Weir and gate	
Canal system	Reduction of direct turnout	
Tertiary canal	Advantage and disadvantage	
Remote monitoring and remote control system	Outline	
Automated gate	What is controlled?	

Construction of tertiary canal

Number of spill points
Traveling time

Construction of tertiary canal would improve irrigation efficiencies of plot to plot system. But high density of irrigation canals may sometimes result in low efficiency with poor water management.



Remote monitoring and control system(1)

It is desirable to operate facilities in higher degree by less stuff . To enable this , remote control and monitoring systems are introduced in Japan. Remote monitoring system collects many data such as rainfalls , water levels and water discharges . Water manage can observe these data at control center .

Collected data are displayed to digital or analog meter on graphic panel (panel graph) .

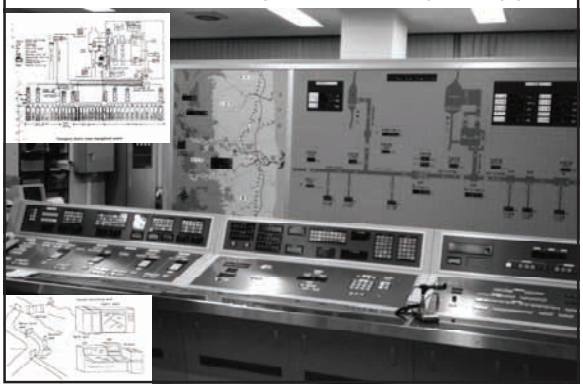
The manager decide how to operate water facilities such as gates , bulbs and pumps by judging according to observed data . Facilities operations are executed by using operation console .

As a communication between control center and on -site station , there are three types communication. There are wireless , exclusive communication line and commercial line .

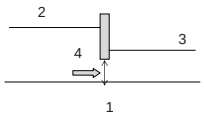
The purpose of remote control and monitoring system is as follows .

1 Equal water distribution
2 Utilization of water resources without wasting
3 Elimination of labor
4 Prevention of disaster in facilities
5 Adjust of data

Remote monitoring and control system(2)



Automated gate



Automatic gate
Sluice gate controlled by computer

1. Gate opening — Stability
2. Upstream water level
3. Downstream water level — feedback
4. Flow rate (discharge)

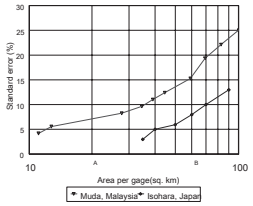
7.Managerial and technical aspects

Monitoring
- Frequency and period
- Rainfall
- Reservoir
- Flow
- Field survey
- Farmer requests

Water requirement
- Net water requirement
- Gross water requirement
- Irrigation efficiency
- Effective rainfall
- Pre-saturation water depth

Organization
- Structure
- Operator
- PIM

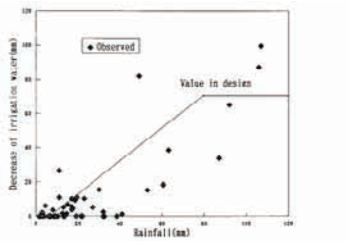
Monitoring Rainfall Depth area analysis



Large-scale irrigation projects consisting of reservoirs contribute towards stabilizing rainy season rice cropping in Southeast Asia, but the water storage capacity of some reservoirs is not sufficient for double cropping. Therefore it is necessary to promote appropriate release reduction by monitoring the average am0unt of rainfall in irrigation systems. This study aims to propose a method for evaluating rainfall station density.

Water requirement: Effective rainfall

Concept of water requirement estimation is same used for seasonal irrigation plan and irrigation scheduling. When the same was used for irrigation project planning, related factors, such as irrigation area, irrigation efficiencies etc. should be revised



PIM and irrigation efficiency

Objectives of Participatory Irrigation Management

- Establishment of communication between irrigation projects and water users
- Effective irrigation managements

→ Improvement of Irrigation efficiency

- Sustainable water management (collection of water fee)
- Irrigation Management Transfer

→ Temporary lower irrigation efficiency

Guidelines for efficient irrigation water use

Outline

1. Water allocation

1.1 Seasonal Irrigation plan

Seasonal irrigation plan determines crop, crop area, irrigation period and irrigation water delivery for the coming irrigation season to ensure the reliable water supply, based on careful studies of water resources, water requirement, and other related factors. Present and future water resources are allocated into irrigation use and other uses in the plan.

1.2 Procedure of planning

Seasonal irrigation plan should be determined earlier enough before irrigation season starts. Water users such as farmers are involved to decision making process of this plan. Procedure of planning is informed stakeholders in advance. First related factors are investigated and draft of irrigation plan is made by irrigation managers. The draft becomes the irrigation plan after agreement of the meeting which reflects water users will.

1.3 Investigations

Present available water volumes such as reservoir storage are measured and historical meteorological and water use data are collected to estimate available water. Farmers and land situation are also surveyed. It is necessary to know water users will about water allocation.

1.4 Estimation available water and irrigation water demand

Available water is estimated by present available water, expected water resources in the next irrigation season, water use for other purpose such as municipal water and water volume which should be remained at the end of next irrigation season. Irrigation water demand are estimated by crop water requirement and effective rainfall.

1.5 Calculation of the seasonal irrigation plan

The seasonal irrigation plan is calculated after comparing estimated available water and irrigation water demand calculated by a temporal plan. When the former is less than the latter at any period of next irrigation season, a temporal plan must be revised as for cultivated crop, irrigated area, crop establishment, The staring date of irrigation. Once irrigation plan become feasible, irrigation area, irrigation period, cultivated crop and there are, irrigation water are determined.

1.6 Optimal reservoir operation

When reservoirs are large enough to keep water storage beyond one irrigation season, estimation of reservoir storage change is estimated for a longer period.

1.7 Allocation of irrigated area

When available water is not enough to irrigated whole irrigable area for crops desired by farmers, irrigated area or cultivated crops is limited. Such a limitation should be owed by related farmers equally. It is desirable to concentrate the irrigated area in order to reduce non-productive consumption.

1.8 Area water level control

Water can be distributed evenly if irrigation project area is very flat and canals have enough capacity. Target water levels are decided in these irrigation projects at some points and in some periods instead of canal flow rate. Target water level depends on the location of irrigation project. Intrude flood water, area water consumption are estimated for the next irrigation season.

1.9 Announcement

The seasonal irrigation plan is informed to water users to allow them to prepare for the next irrigation season through organizations or mass media.

2. Water distribution

2.1 Irrigation scheduling

Water supply is determined at a certain period, reflecting water demand change, climate or other related factors. Water scheduling determined the water supply at any canal level.

2.2 Determination of irrigation scheduling

Water scheduling are decided by monitoring, field survey or ordering.

2.3 Interval

It is desirable to establish daily irrigation scheduling to increase irrigation efficiencies. It should be examined at lease twice a month.

2.4 Monitoring and Procedure

Rainfall, water supply, and river flows to reservoirs, at intake points and at drainage canals are measured. Standing water depth of field, crop stage and actual crop area are useful for irrigation scheduling. When ordering system are adapted, water users requests are gathered.

2.5 Continuous water supply and intermitted water supply

In selection water supply method disadvantage and advantage are compared. Generally intermitted (on-off) irrigation reduce water loss at tertiary canals and continuous water supply are adapted in the main canal.

2.6 Food introduction

If there is available water, water is taken into canal system above water demand in the irrigation project which suffer from water shortage, which may be stored paddy fields, canals or ponds.

2.7 Reservoir operation

When reservoir storage go lower than planed level in the irrigation season, water supply may be reduced.

3 Canal operations

3.1 Canal operation and spill

Canal system is operated in order to deliver water to the field with reducing spill from main or secondary canals

3.2 Operation of turnout works

It is desirable to operate turnout works to control flow rate for gravity irrigation system. But operation type of turnout works depends on measurement system. When flow rates are not measured water level control or mixed control are adapted.

3.3 Operation of cross regulator

Cross regulators are operated in upstream control or downstream control. It depends on the physical and social situations.

3.4 Communication

Operators should to communicated to reduce spill from main and secondary canal

4. Water management of the tertiary canal

4.1 Water users association

Water users association acts a important role to reduce excess water intake at tertiary canal level. Water users upstream apt to take much water than needed, which results in increasing water demand at the turnout works to tertiary canals. Mutual monitoring or rules among water users in the tertiary canal is useful to reduce such actions.

4.2 Special treatment

The authorized one water managers operations of turnouts from tertiary canal to individual farmers farm plots decrease water loss which generated by each water users operations. Since this operation deprive water users of their own wager management, the water managers operation would be limited in severe water shortage period.

4.3 Rotation between tertiary

Inequity on water delivery is serious when water supply is not enough to the canal. On-off irrigation supply is one method to reduce the inequity on water delivery. When water users association dose not function well, rotation between tertiary canals is recommended to reduce inequity.

4.4 Plot to plot irrigation

Sometimes there are some conflicts between water users in plot to plot irrigation. Arrangement of water manager or leader of village can resolve these conflicts. It

is important for water users to recognize the irrigation flow route to corporate each other.

5. Institution

5.1 Water right system

Water right system is important to resolve conflicts between upstream and down stream water users at a tributary.

5.2 Restriction of land use

Distributed irrigated are results in reduction of irrigation efficiencies. Restriction of land use may prevent the generation of distributed irrigated area.

5.3 Water quality protection rule

Water is circulated within tidal irrigation area, which cause high irrigation efficiencies and degradation of water quality. Sometimes water in internal canals is drained to keep water quality, which volume should be diverted to the area. Water quality control can reduce the additional water demand.

5.4 Re-plotting system in land consolidation

Re-plotting system is useful to facilitate the construction of tertiary canals.

6. Improvement of physical structures

6.1 Regulation reservoir

Regulation reservoirs in the canal system reduce the gap between water demand and water supply which is caused traveling time of irrigation flow or delay of information. The maximum volume of regulating reservoir is determined by the physical structures of canal or river system and water demand fluctuations.

6.2 Cross regulator

There are manual gates, automatic gates and weirs as cross regulator. The type of gate is determined after examining functions, operation easiness and total costs.

6.3 Canal system

Construction of main canals or secondary canals without direct turnouts leads to less water level fluctuations, which facilitate canal system operation.

6.4 Tertiary canal

Construction of a tertiary canal enable to attain earlier water delivery than plot to plot irrigation system. On the other hand, spill point from farm plots may increase. The reduction of traveling time increase irrigation efficiencies and increase of

spill points in number may decrease irrigation efficiencies with poor water management. Construction of tertiary canals should be carefully examined.

6.5 Remote monitoring and remote control system

Introduction of remote monitoring and control system reduce irrigation loss through quick response to the change of water situation in a project.

6.6 Automated gate

Automated gate may increase water level fluctuation in poor manual gate managements at the same hydraulics system. It is desirable to introduce automated gate with improving manual gate operations.

7. Managerial and technical aspects

7.1 Monitoring

Real time monitoring is useful to recognized water demand or supply changes and respond to them immediately. Long record is also necessary for creating operation rules.

7.2 Water requirement

Concept of water requirement estimation is same used for seasonal irrigation plan and irrigation scheduling. When the same was used for irrigation project planning, related factors, such as irrigation area, irrigation efficiencies etc. should be revised.

7.3 Organization

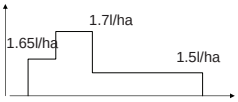
Participatory irrigation management is generally contributes irrigation efficiency improvement. But since some objective of PIM activities is not to improve canal operation, irrigation efficiency may be temporary decreased without appropriate measures.

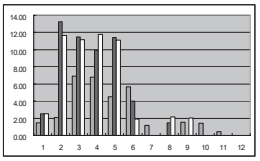
Water management of pilot projects

Naoki HORIKAWA
National Institute for Rural Engineering

Num Houm

•Supplementary irrigation in the rainy season
•High performance in the rainy season
•Water supply in the rainy season don't reflect water situation of paddy field.





Irrigation Plan

	NH	HL	KP	GC
Seasonal Irrigation Plan	November (dry) None (wet)	December (dry) June (wet)	November	December May
Functions	Crop area Rotation	Crop Irrigated area Delivery schedule Discharge (main, Lateral)	Area Irrigation times	
Estimation		Average rainfall		
Procedure	Meeting	Registration of farmers Meeting with IWUG	Community PWUC	Water council
Allocation	Non-rotation Concentrated	Rotated Distributed	Non-rotation Concentrated	
Water allocated to next season	allocated		allocated	
Concentration	Rotated 2 (water shortage year)		Concentrated	

Operation

		Operation
A	Flow rate control (measurement) at main turnouts	From upstream to downstream
B		Several times a day
C	Flow rate control (measurement) at key points Water level control (measurement) at main turnout	Several trial (experience)
D	Water level control (measurement) at main turnouts	Several trial
E		Rotation between turnouts
F		Proportional distribution without reflection of changing demand

7. Technical and managerial aspects

Water requirement
Monitoring
Organization

1.Water allocation (Seasonal Irrigation plan) — Reliability

2.Water Distribution (Irrigation scheduling) — Flexibility

3. Canal operation

4. Water management of tertiary canal — Equity

5.Institution

6.Improvement of physical structures

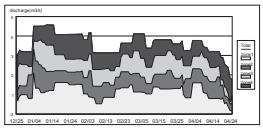
Next step

- Dry season
  Rotation irrigation between tertiary canal
- Flexible irrigation supply
- Optimum reservoir operation

to increase of crop intensity

→ Water user Association
→ Monitoring measurement

Huay Luang



Irrigation efficiency of the rainy season is higher than one of the dry season
Water distribution is well controlled in each zone.

Irrigation Plan

	NH	HL	KP	GC
Seasonal Irrigation Plan	November (dry) None (wet)	December (dry) June (wet)	November	December May
Functions	Crop area Rotation	Crop Irrigated area Delivery schedule Discharge (main, Lateral)	Area Irrigation times	
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D	Water level control (measurement) at main turnouts	Several trial
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7. Technical and managerial aspects

Water requirement
Monitoring
Organization

1.Water allocation (Seasonal Irrigation plan)

2.Water Distribution (Irrigation scheduling)

3. Canal operation

4. Water management of tertiary canal

5.Institution

6.Improvement of physical structures

Reliability

Flexibility

Equity

Next step

- Flow measurements at turnouts
- Feedback to Intake (flexibility)
- Dry season crop area assignment
- Strengthen WUG (tertiary level)

Komping Puoy

•Water is diverted from adjacent river (Mongkol Borey River)
•The canal will be extended for additional irrigation area
•Ordering system
•On-off irrigation in main canal level

Irrigation Plan

	NH	HL	KP	GC
Seasonal Irrigation Plan	November (dry) None (wet)	December (dry) June (wet)	November None	December May
Functions	Crop area Rotation	Crop Irrigated area Delivery schedule Discharge (main, Lateral)	Area Irrigation times	
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Operation

		Operation
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E		Rotation between turnouts
F		Proportional distribution without reflection of changing demand

7. Technical and managerial aspects

Water requirement
Monitoring
Organization

1.Water allocation (Seasonal Irrigation plan)

2.Water Distribution (Irrigation scheduling)

3. Canal operation

4. Water management of tertiary canal

5.Institution

6.Improvement of physical structures

Reliability

Flexibility

Equity

Next step

- Monitoring of reservoirs
- Measurements of flow rate at turnout to tertiary canal
- Training of WUG leader (tertiary canal)
- Optimum reservoir operation

Gocong

Tidal irrigation area
3 crops a year

Irrigation Plan

	NH	HL	KP	GC
Seasonal Irrigation Plan	November (dry) None (wet)	December (dry) June (wet)	November None	December May
Functions	Crop area Rotation	Crop Irrigated area Delivery schedule Discharge (main, Lateral)	Area Irrigation times	
Estimation		Average rainfall		
Procedure	Meeting	Registration of farmers Meeting with IWUG	Community PWUC	Water council
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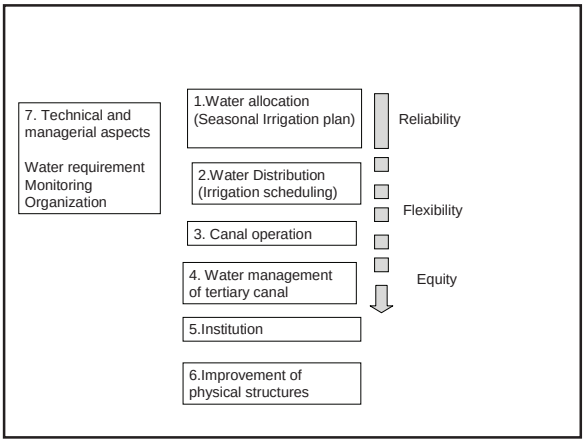


Next step (GoCong)

- Institutional issues
  Quality control to reduce flush water
  water right (master plan)
- Water balance analysis

Annex 8: Presentations of Key Issues for Discussion

Feed back from Mem. Countries

Okudaira Hiroshi (AIFP/MRCS)
Horikawa Naoki (NIRE Japan)

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Key issues to be discussed

- clarifications (Q&A)
  suggestions for improvement
- title of the final output
- further process

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

from the floor

- clarifications (Q&A)
- suggestions/comments for improvement

pls. focus on ideas/concepts
technical aspects

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Guideline - Isn't it too strong?

- more technical issues
- hints for water mgmt. engineers
- NOT aiming like WUP rules
- publish as MRC a product
  e.g. part of MRC Technical paper

IIEPF 2nd regional workshop
25 March 2008
@ MRC Secretariat
Vientiane, Lao PDR

Further process

- another WS unrealistic
- clarification thru email – easiest
- consultation meetings possible
- extension – last choice

MAFF Japan pledged in Jan 08

- another 3-year project (2008-11)
- similar budget size
- issue: irrigation water management

Annex 9: Project Evaluation

Project Policy Evaluation Questionnaire
on
Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project under the Programme to analyze and evaluate water and ecosystem in Asian paddy fields

Q1: First of all, please show us your background partly.

1. What country do you live? _____

2. What is your nationality? _____

3. Where are you working at?
   - ☐ Ministry / Government
   - ☐ Institute under the jurisdiction of the Government
   - ☐ International organisation
   - ☐ Institute under the jurisdiction of the international organisation
   - ☐ Union of cooperative
   - ☐ Private enterprise
   - ☐ Private farm
   - ☐ University
   - ☐ Non-Governmental Organisation (NGO)
   - ☐ JICA
   - ☐ The other

   Please write what is "the other", if you'd like.

   _____

4. What is your occupation?
   - ☐ Executive officer
   - ☐ Executive technical officer
   - ☐ Official / Secretary
   - ☐ Technical official
   - ☐ Resercher
   - ☐ Manager
   - ☐ Farmer
   - ☐ Professor / Assistant
   - ☐ Student
   - ☐ JICA staff
   - ☐ The other

   Please write what is "the other", if you'd like.

   _____

The outline of the project/study

Name of the Project/study: Improvement of Irrigation Efficiency on Paddy Fields in the Lower Mekong Basin project under the Programme to analyze and evaluate water and ecosystem in Asian paddy fields

Overall Goal: to improve irrigation efficiency on paddy fields in the Lower Mekong Basin

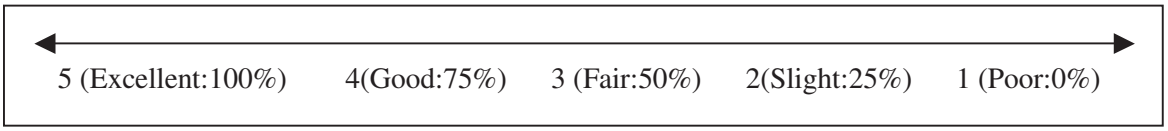
Project/study Goal:

1. to appraise irrigation efficiencies and the irrigation system based on the modern concepts in the selected irrigation schemes;
2. to develop capacity of the line agencies in using up-to-date concepts of irrigation efficiencies and water balance and modern tools and procedures for their assessment;
3. to produce guidelines for improving irrigation efficiency based on actual water use conditions in the member countries;
4. to identify capacity development requirement of line agencies for better adoption of the guidelines in the LMB countries;

Project/study Output:

1.1: Establishment of minimum set of data to evaluate irrigation efficiencies and irrigation system
1.2: Water balance and assessment of Efficiencies and water productivity
1.3: Appraisal of scheme management
1.4: Rapid Appraisal Process
2.1: Backstopping note for the implementing agencies
2.2: Training workshop on RAP
2.3: National workshops in the project countries
3.1: The guidelines
4.1: Report on assessment of existing capacity and recommendations for capacity development and training of the line agency staff.

The outline of the study is as above. Please express your evaluation on the study in figure by each question. “5” is the highest score, and “1” is the lowest score on the evaluation.



Q2: Please tick the check box in accordance with your feeling by each question.

(1. *relevance*)

1-1. This project is aiming to improve irrigation water use efficiency through the introduction of the guideline for efficient water use and expected to lead sustainable agricultural development in the MRC member countries. Do you think the context and achievements of the project is in accordance with the needs of the MRC member countries?

☐ 5. Execellent ☐ 4. Good ☐ 3 .Fair ☐ 2. Slight ☐ 1. Poor

(2. *effectiveness*)

2-1. Are you willing to disseminate and apply the guidelines, which will be produced through the project, for the purpose of efficient use of water resources of the MRC member countries?

☐ 5. Execellent ☐ 4. Good ☐ 3 .Fair ☐ 2. Slight ☐ 1. Poor

2-2. Please describe the problems on the dissemination and application of the guidelines if any.

2-3. Please describe your own ideas to improve the project concept or any other request, which will contribute to design the succeeding projects with the close concept.

(3. *efficiency*)

3-1. Do you evaluate the project is implemented efficiently, especially in terms of implementation arrangement such as work plan and other implementation protocol.

☐ 5. Execellent ☐ 4. Good ☐ 3 .Fair ☐ 2. Slight ☐ 1. Poor

(4. *impact*)

4-1. Do you think the guidelines for efficient water use will contribute the improvement of agricultural production and poverty alleviation?

☐ 5. Execellent ☐ 4. Good ☐ 3 .Fair ☐ 2. Slight ☐ 1. Poor

(5. *sustainability*)

5-1. Do you think physical and institutional framework to disseminate and apply the guideline is established (or will be established) in the MRC member countries?

☐ 5. Execellent ☐ 4. Good ☐ 3 .Fair ☐ 2. Slight ☐ 1. Poor

Please write your ideas and requests about the Project/Study below freely.

This is the end of the questionnaire. Ministry of Agriculture, Forestry & Fisheries of Japan thanks you for your cooperation.

Summary of Project Policy Evaluation Questionnaire

Project: Improvement of Irrigation Efficiency on Paddy Field in the Lower Mekong Basin project

this questionaire conducted on 25 March 2008, at 2nd Regional Workshop of the project

country	organization	occupation	Q1	Q2-1	Q3	Q4	Q5	Q2-2	Q2-3	other
Cambodia	Ministry/Government	Executive technical officer	5	5	5	5	5		For me I think that this research is perfect for Cambodia, that before we never doing. My request is that MRC should add one or 2 more research in order to collect data from the field and fill up some gap that missing in the previous time.	After making the guideline, MRC should monitor and apply to each country. Ex: workshop or training….
Cambodia	Ministry/Government	Official/Secretary National AIFP coordinator, CNMC	4	4	4	5	5		The concept or guideline for the MRC member countries should be based on the data or information at least 5 years research or study period.	The project should also study on soil structure that is also impact on water efficiency. Moreover the project should analyse on the comparison of the cost of wet and dry season yield.
Laos	Ministry/Government	Executive technical officer	4	4	4	4	4	Guideline can not cover all MRC member countries, should reconsider country situation.		IIEPF should continue to other projects.
Laos	Ministry/Government	Executive technical officer	5	4	4	4	3			If want to IIEPF so that needs improvement of physical structures and to establish modernization project for distribute knowledge to another project.
Laos	Ministry/Government	Executive technical officer	4	4	4	3	4	Guideline are not appropriated to each member country, if it's designed for the whole LMB.	Project concept should be reconsider to the country situation and needed of the country. It would be thinking to the country policy on water management.	Project study should be continuing step-by-step, it not just for guideline, but it shall have it own model for water management in the future, and project should not be data collection only in one pilot.
Laos	Ministry/Government	Technical official	5	5	5	5	5			If possible will practicing to another project to compare experiences like pumping scheme project for final evaluation to pumping scheme in nationwide.
Thailand	Ministry/Government	Technical official	3	4	4	4	4			
Thailand	Ministry/Government	Technical official	2	4	4	3	3	The working team is willing and has intention to disseminate knowledge gaining from the project. Unfortunately, the important equipment like velocity instrument and etc are requested to return to MRC immediately. Thai budget allocated is quite limited and is not set to first priority to proved such instruments. How will knowledge be disseminated and demonstrated properly?	To improve irrigation efficiencies needs both structural and non-structural method. The project emphasised to improve irrigation efficiencies using non-structural method. However trying to operate hydraulics structure without cooperation with farmers, and others may not reach the goal. In addition, some hydraulic structures at pilot area are mul-function or improper working which absolutely affect to irrigation efficiency.	1. To disseminate knowledge concerning participatory irrigation water management is very important therefore the project should support or contribute to training, seminar and etc. 2. Some necessary instruments should provide to the project in order to expand the area and try to improve irrigation efficiencies. **for 1.** Sustainable development needs the participation of stakeholders. It is not only to do the irrigation efficiency experiment, collect data, etc, but also awareness raising concerning water as economic goods and vulnerable particularly the farmers, the major consumers, by supporting the seminar, training, etc.
Thailand	Ministry/Government	Official/Secretary	4	3	4	4	4	- man - budget - measurements	Knowledge + process for man Budget for success project Technology for measurements	
Vietnam	Institute under the jurisdiction of the Government	Researcher	4	4	4	4	3	The guideline should be approved at a certain level of MRC before dissemination.	further study for other areas and extend the study for other climate condition (in each pilot study, carry the experiment for 3 years!)	- extend the experiment at a pilot for other year - extend the study for other areas - evaluation > guideline development > dissemination
Vietnam	the other	Official/Secretary	4	3	3	3	2			After this project, we installed measurement equipments, so it will be good way, you should expand study area (in Go Cong, for example) or continuous to study in other areas.

note: 5. Excellent
4. Good
3. Fair
2. Slight
1. Poor

Apparent errrors (both grammar and spelling) only fixed
Others remained as original