

# Irrigation and Water Resources Department

State Government of Mizoram



## Officers' Manual Strengthening of WUA for O&M of Irrigation Scheme

January 2023



Project on Capacity Enhancement for  
Sustainable Agriculture and Irrigation  
Development in Mizoram



सत्यमेव जयते  
State Government of Mizoram



Japan International Cooperation Agency



The cooperation between JICA and Government of Mizoram dates back to 2013 when JICA conducted a development study from 2013 to 2015 during which a 'Master Plan' for management and development of land & water resources for sustainable agricultural development in Mizoram was formulated.

In order to properly implement the approaches and projects in the Master Plan, this Technical Cooperation Project, entitled "The Project on Capacity Enhancement for Sustainable Agriculture and Irrigation Development in Mizoram" is carried out during July, 2017 to March, 2023.

It is my pleasure to acknowledge the hard work and dedication of JICA Project Team and all other officials involved in formulating the much needed Manuals viz. 1) Officer's Manual for Construction Management, 2) Manual for Strengthening of WUA for O&M of Irrigation Schemes 3) DPR Preparation Guideline, which is one of the outcomes of Technical Cooperation Project (TCP) between JICA and Government of Mizoram.

As there is neither any particular manual that is endorsed by IWRD nor any has been prepared till date for construction of irrigation projects in the state, these Manuals will be the first of their kind for the department. I am confident that these manuals will prove to be a turning point for construction management of irrigation facilities in a systematic and improved manner. I pray that these manuals will be properly utilized and the farmers will reap the benefits.



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This Officers' Manual and Training Material for the Strengthening of Water Users' Association (WUA) for the Operation and Maintenance (O&M) of irrigation project was prepared with the initiatives of several line departments in the state, namely: Irrigation and Water Resources Department (IWRD), Department of Agriculture (DOA), Department of Horticulture (DOH), and Land Resources and Soil and Water Conservation Department (LRSWCD) under the Japan International Cooperation Agency (JICA) Project of Capacity Enhancement of Sustainable Agriculture and Irrigation Development in Mizoram (Mizo-CESAID). This manual advises government officials, especially the officers in IWRD, on how to establish and develop the capacity of WUA for better O&M of irrigation projects. By observing the past and present systems of the state, IWRD is mainly focusing on the construction part and not on O&M. The IWRD has survey and design and work sections but no operation and maintenance section. However, focusing on operation and maintenance is the one of the most important matters to materialize the benefit from the amount of investment. Under the state government rule, the constructed irrigation facilities are handed over to WUA, which is empowered fully for the operation and maintenance of the facilities. However, no capacity development training is given to them before handing over the facilities. The development of the technical and management capacity of WUA is an essential and shortcut way to extract the maximum benefit from the constructed facility with continuous monitoring and support from IWRD.





## Awareness and Discussion on Role of WUA

An awareness programme on the role of WUA has to be conducted. For this purpose, the introduction of a model WUA or Farmer's Organization can be done and the following key organizational characteristics of successful WUAs should be highlighted in the presentation:

- degree of spontaneous action
- periodic discussions
- planning by members
- record keeping
- fund raising and credit activities,
- co-operative /group actions, and unity

It is necessary to carry out discussions on each of the above mentioned points with the farmers / group and decide which of these points are important for the WUA they would like to establish.

According to the findings from the visual presentation for advanced WUA, officers will facilitate the discussion on the benefit of group activities such as:

- Operation and maintenance of irrigation facilities.
- Any type of negotiations with government and private sector (purchasing of inputs or selling of harvest).
- Co-operative purchasing and shipping



The officers will facilitate necessary actions to achieve the above and review previous activities and try to set up a self-organized WUA based on the farmers' positive ideas.

Rules and regulations form an integral part in the performance of WUA. It is advised to show model rules and regulations. At this stage, farmers have basic knowledge and sense of anticipation to establish their WUA.

It is important that the facilitators and members introduce necessary items for the preparation of the WUA's rules and regulation (by-law), preparation of draft of rules and regulations based on a model documentation of WUA (by-law), presentation of draft of rules and regulation, and finalization of the draft rules and regulations.

The draft rules and regulations should include the following:

- Area of operation and WUA's vision.
- Formation of WUA
- Other conditions for membership



## Establishment and Registration of WUA

For the proper functioning of WUA in all aspects and for availing the available financial support(s) from the government or other organizations, it is important that the WUA is registered in IWRD and necessary actions are taken to get the WUA's registration under the Register of Firms and Societies in accordance with Mizoram Societies Registration Act 2005 (Act No.13 of 2005). Under the Mizoram Societies Registration Act 2005, societies to be formed by memorandum of association are provided as below. The IWRD officers will support to prepare the documents necessary for the registration of WUAs for their irrigation schemes.

- Minimum seven persons can form a society under this act.
- Memorandum of Association (MOA) should be formed for proper functioning of the society. MOA should go hand in hand with rules and regulations of the society.
- The following should be in the MOA
  - Name of society
  - Address
  - Aims of the society
  - List of members of the governing body and their designation.
- Register of members
  - Name and complete address.
  - Date of member registration.
  - Date of expiration of membership.
- Annual and other report to be forwarded to the registrar:

The following should be submitted to the registrar within 30 days of the Annual General Meeting:

- Governing body list- name, address and occupation
- Annual activity report (previous year's tax)
- Annual audit report (previous year's tax)



Certificate of Registration  
(Sample)



## Organizational Capacity Development Training

The IWRD will support to develop two main aspects of WUA's capacity, which are technical and management capacities. This training is focus on the management capacity development of WUA by providing two major trainings to WUA, namely, organizational capacity development training and financial management training.

The outline of these two training programs is as follows. The contents of the organizational capacity training are (1) Importance of group formation, (2) Structure of the group, (3) Basic elements of the group, (4) Possible activities by the group, and (5) Evaluation of the group performances.

The outline of these contents is as follows:

### Importance of group formation

This is the introduction section of the training and will lecture and discuss the benefit and key points of group formation. Key points include (a) equitable opportunity for efficient and effective interaction by member, (b) participatory interaction rather than one-way communication process, (c) cooperation of the group is ensured as intervention of outsiders is minimal for a small group, (d) transparent in financial activities and (e) link with other organization in the village.

### Structure of the group

In this section, WUA member are given the knowledge on the key staff on the group and their roles. Specially (1) president, (2) secretary and (3) treasurer should be nominated in WUA. Their role will be explained as follows.

- Role of President (the Group Leader)
  - Provide leadership for the group
  - Organize group meetings
  - Chair meetings and summarize proceedings at the end of meeting
  - Encourage members to participate in discussions, decision making and other activities constructively
  - Ensure group performance according to the constitution of the group
  - Ensure correct performance of treasurer and secretary
  - Maintain cohesiveness in the group
  - Represent the group in other meetings

- Role of the Secretary
  - Prepare meeting agenda and keep record of discussion
  - Maintain all group documents except financial matters
  - Read and explain minutes of meetings
  - Attend to all correspondence and literary work in the group
  - Assist group leader in group matters
- Role of the Treasurer
  - Keep financial records of the group
  - Ensure security and proper management of the group fund
  - Maintain transparency of all financial matters
  - Assist group leader when necessary

## Basic elements of the group

Four basic elements namely 1) leadership, 2) contribution, 3) constitution and 4) record keeping of the group will be explained to WUA for management capacity development. The constitution is an accepted document in the group, which explains rules and regulations to guide the group. The constitution helps to minimize problems and to understand the role and responsibilities of office bearers and members in the group. Also, the constitution keeps group members in a given frame. Soon after the formation of the group, group members can get together and prepare the constitution. Here, group can obtain the assistance of facilitators for correct guidance. The facilitator may be another group leader with experience of having group activities for years or a person from an outside agency. Each and every member in the group should have a copy of the constitution. The group treasurer keeps the financial records and the group secretary keeps other office records. There is no need to have a full set of financial management books like in a big organization; it is more than enough to maintain a book for receipts and payments with supporting documents such as vouchers and bills; in this book, separate pages could be maintained for different activities like one page for membership fee collection, another page for other income, another page for payments etc. The secretary can keep one book for recording discussions and two files for incoming and outgoing documents.

## Possible activities by the group

The possible activities to be carried out by the group in general will be discussed in this section. Individuals can do many things but when they get together, they can do wonders. Depending on the objectives, the group activities may vary. However, some of the activities common to many groups are,

- Helping each other
- Credit through savings
- Income generating activities
- Represent the area as a group in public activities.
- Collective purchasing
- Effective and efficient contacts with mother organization in the village

## Evaluation of the group performances

A lecture on how to evaluate and the importance of evaluation of the group activity will be given to WUA. It is true that it takes time for the development of small groups and for them to achieve sustainable level. But in a given period of time, the group can evaluate its performance, and determine whether it is going forward or backward. With the help of a facilitator, the group can develop evaluation indicators. These indicators may vary according to the objectives of the group. However, some of the common indicators that could be used for many small groups are given below.

- Attendance of members in group activities
- Holding meetings as scheduled
- Active participation of members in the process of decision-making
- Changing leadership timely
- Membership fee
- Development of group fund

## Financial Management Training



The newly formed WUA needs to be educated and trained in different aspects of management for better organization and progress. One such aspect is financial management, as an association, the WUA will deal with money for different purposes like operation, maintenance, repair etc. So for such matters, better management and handling of money is essential for the smooth working of the WUA and to avoid any problems regarding mishandling, shortage, over expenditure etc.

The IWRD should conduct the training on financial management for community-based organizations to educate and develop them to better manage the organizations. So, this part of the manual will give guideline and instructions to the officers on how to conduct training and what points to focus on financial management.



The training should focus on the following contents:

- Need of keeping account
- Role and responsibilities of the treasurer of community-based organization
- Introduction to basic account books
- Maintaining cash book
- Monthly cash balance
- Preparation of cash summary
- Common problems in financial activities

At the end of the training, after the above topics have been covered, the trainees should be able to

- Explain the importance of record keeping pertaining to financial matters
- Identify the documents and ledgers needed for community-based organization and make use of them properly
- Explain and maintain the income and expenditure records of the community-based organization.
- Balance the cashbook
- Prepare a summary of monthly receipts and payments.
- Find solutions for financial problems arising in the community-based organization.

Firstly, for a successful and educational training, the IWRD staff should play a major role in motivating and educating the trainees. So, for this training, a skilled and trained person should be selected by the department. Proper financial management plays a vital role in the progress of an organization and without proper management, it can lead to the failures of organizations. The success or failure of an organization depends largely on the efficient utilization of financial resources, so it is important for the office bearers and key members of the organization to have the necessary knowledge and skillset for handling financial activities in the organization. So, this training aims to promote economic stability and successful working of the organization by improving the finance handling management capabilities of the organization.

Therefore, the IWRD staff should be skilled and well prepared before starting the training for successful interaction with trainees and for accomplishing the training

objectives. The IWRD staff may relate to the following points for better preparation before the start of the training:

- Carefully study the training manual before training.
- Preparation before training is essential. Study the session plans, discuss with co-IWRD staffs and make plans on how to conduct the training. Consider any problems and constraints which might arise. The IWRD staff must have a clear understanding and plan in mind of what he wants to do and how he wants to do it before conducting the training.
- Stick to the session plan. The IWRD staff will discuss pre planned; pre-arranged subject matter in a limited time.
- If any visual aid is required for better presentation, it should be identified and procured in advance for practice.
- The session plans have been prepared to direct the participants for specific objective. As this is entirely depending on the IWRD staff, he should always keep the training objectives in mind.
- Training evaluation should be done at the end of the training session/program. This will measure the success of the training and also reflects the competence of the IWRD staff.
- Remember that a good IWRD staff is always learning from trainee feedbacks and therefore, after the training, the session plans and training materials can be improved if necessary, according to the experiences gained through the training.
- Never forget to arrange follow-up sessions to have real practical implementation in the field with the organizations.

## Technical Training

The farmers should be able to manage their own irrigation system by contributing their knowledge, skills, and participation. In addition to the basic knowledge and skills gained through the training, the farmers would be able to make use of this knowledge in real operational activities in the field.

The objective of this training is to enhance the knowledge, attitude, and skills of the community and stimulate them to take the responsibility for the rehabilitation activities of irrigation project. IWRD should take a great responsibility to convince farmers about the importance of active participation in the training program. The IWRD staff may consider the points below for a successful interaction with the participants to achieve the training objectives.



The objectives of the training are as follows.

1. Operation of irrigation facilities
  - Water distribution plan and nomination of controller
  - Normal operation and emergency measures
  - On-farm water management
  - Measurement and recording
2. Maintenance of irrigation system
  - Preparation of maintenance plan
  - Role and responsibilities
  - Maintenance activities
  - Budget allocation and financial management

During the training on maintenance activities, some skills for construction works are required especially for conducting minor repairing works of the irrigation canals and related structures. Although these skills are also obtained through the community managed construction works, training should focus on the works below.

1. Earthworks
  - Suitable soils for filling and making bund
  - Forming canal bund
2. Concrete works
  - Materials for concrete works
  - Mixing, pouring and curing concrete
  - Shuttering and reinforcement
3. Other works
  - Masonry and gabion
  - Brick works



The farmers should be able to manage their own irrigation system by contributing their knowledge, skills and participation. In addition to the basic knowledge and skills gained through the training, the farmers would be able to make use of this knowledge in real operational activities in the field.

Officers of IWRD should conduct various training to WUA for the operation of irrigation systems constructed /rehabilitated by IWRD, which includes operation plan, role and responsibilities of WUA, operation rules, operation activities, etc.

## Water Distribution Planning

WUA is to prepare water distribution schedules indicating the time and date when every farmer gets his turn of the irrigation. It should be prepared based on crop farming plan in consultation with BAIDC member.

Normally, irrigation water is scheduled to be supplied for:

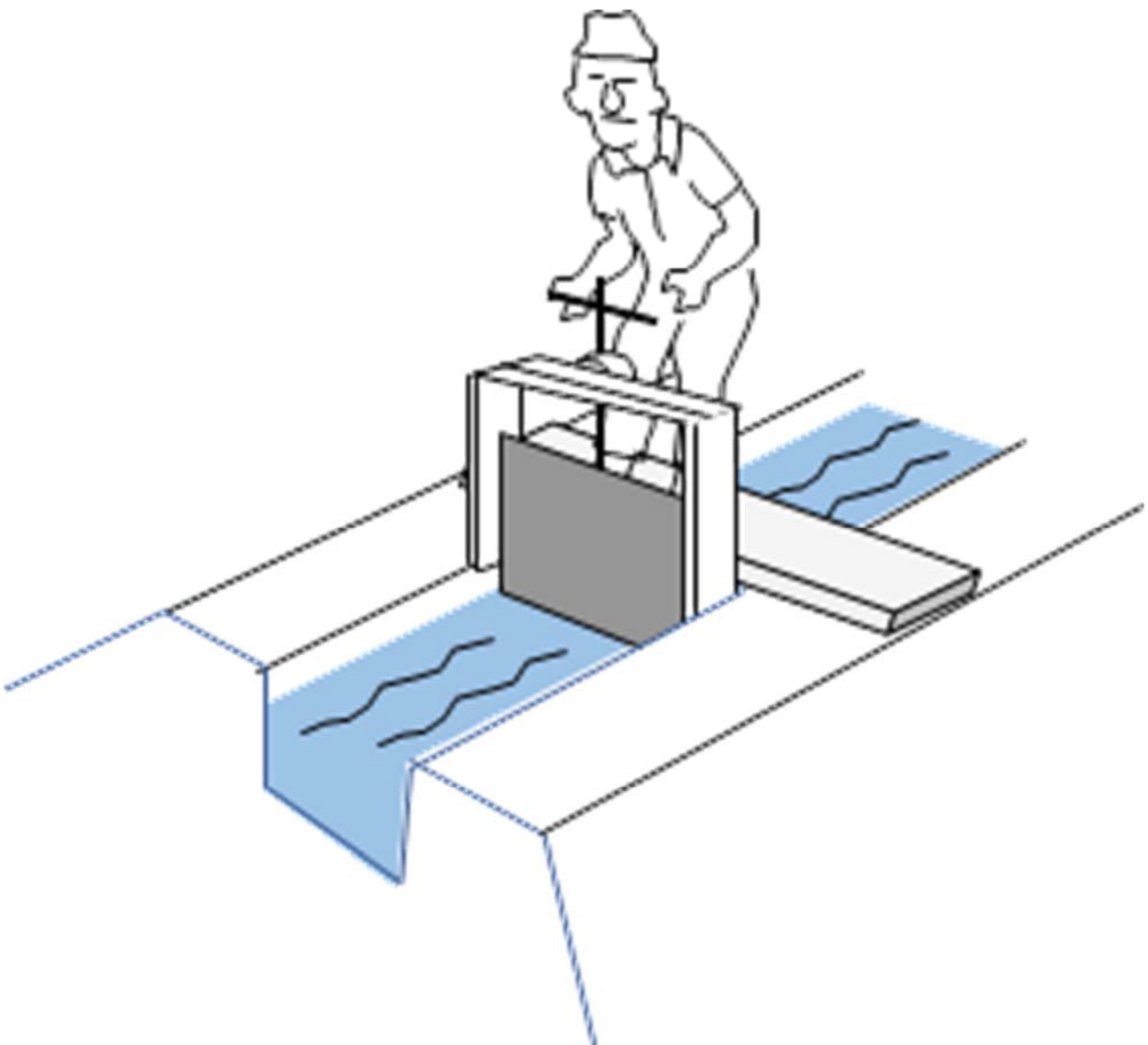
- Karif season: Supplementary irrigation with maximum utilization of rainfall, and
- Rabi season: Full irrigation based on crop water requirement in each growing stage of crops

Water distribution plan includes

- Crops, varieties, areas, and cropping calendar (sowing and harvesting dates) under different crops
- Water available from canal
- Total water available for the season, i.e. from other sources
- Total quantity of water required
- Critical growth stages of principal crops when water supply is most essential
- Dates of opening/closing canal, and periods of water supply (frequency of irrigation)
- Irrigation method (supply basis or request basis (on-demand))
- Irrigation method (constant flow or rotational supply)

## Nomination of Controller

For efficient and effective water distribution among the farmers, a person can be selected from the farming community. The performance of such a person depends on the interest and support extended by the consumers or farmers. It is the responsibility of everybody to share and assist him to carry out the business entrusted by the farmers' organization. This shall be emphasized to the farmers through discussion with the participants.



## WUA's Role and Responsibilities for Operation

For proper operation of irrigation system, WUA's role and responsibilities are:

- to prepare the schedules of water deliveries,
- to avoid and prevent misuse and wastage of water,
- to supply water to all members as per the approved terms,
- to use water economically and furnish data to the IWRD on water use, irrigated area, irrigation efficiency and crop yield, to maintain a register of land holders,
- to prepare and maintain an inventory of the irrigation system within the area of operation,
- to resolve the disputes, if any, between a member and other member(s) in its area of operation,
- to maintain accounts,
- to conduct meetings,
- to inspect water utilization by the farmers,
- to impose and recover penalties or fines for misuse and wastage of water and tempering or damaging, and
- to improve the system for efficient and economical use of available / allocated water, for efficient production of crops;



## Basic Rules for Operation

- The gates shall be operated by an authorized personnel (gate controller) only. The facilities equipped with gate shall be locked always and their keys shall be kept by controller. One set of spare keys shall be kept in the WUAs office.
- The facilities shall be operated in accordance with appropriate manners and method in conformity to their structural and mechanical function. The controller shall well understand the mechanism, control sequence and maintenance method of the facilities.
- The facilities shall be operated in accordance with the predetermined operation schedule or revised one.
- Before the commencement of the operation and during the operation procedure, the operator shall pay attention to the condition of the service facilities to keep them in good condition. If problem is observed, it shall be reported to WUA and shall be repaired as soon as possible.
- The operator shall have around-the-clock responsibilities especially during the period of commencement of operation, changing of the diversion discharge, and especially during heavy rain.

## Operation Rules and Method for Intake Gate and Valve

- The gate and valve are regulating facilities without flow measuring function. This opening height should be adjusted through reading the discharge at the other measuring devices (or visual checking of water depth flowing in the channel) by gate controller regularly, at predetermined time, to meet the diversion discharge in accordance with the schedule.
- Control procedure of intake gate and valve
  - Read the gauge in the measuring device (if available) and compare this reading with the scheduled discharge
  - Adjust the opening of gate or valve to meet the required discharge
  - Repeat this procedure till the discharge is balanced at the scheduled discharge.
  - If measuring device is not available, water level in the canal should be checked and controlled.



## Flexibility of Irrigation Practice

- The planned discharge shown in the irrigation schedule may be the goal or target, during the course of irrigation. When the planned discharge shown in the irrigation schedule is allowed, the following actions may be taken.
  - If a farm land needs more water than scheduled, the inspector should check whether it is allowed to reduce the supply of water to some other farm under his management and divert the amount of water thus saved to the farm land, which needs additional water. The excess or deficit of irrigation water supply to different farms should be adjusted and balanced within one irrigation block.
  - If it is found that the adjustment cannot satisfy the needs of all farmland in the block, the WUA should be requested to make adjustment of related gates including upstream, and make adjustment at the intake gate, as needed.

## Measures under Unusual Conditions (Emergency)

### Heavy Rain

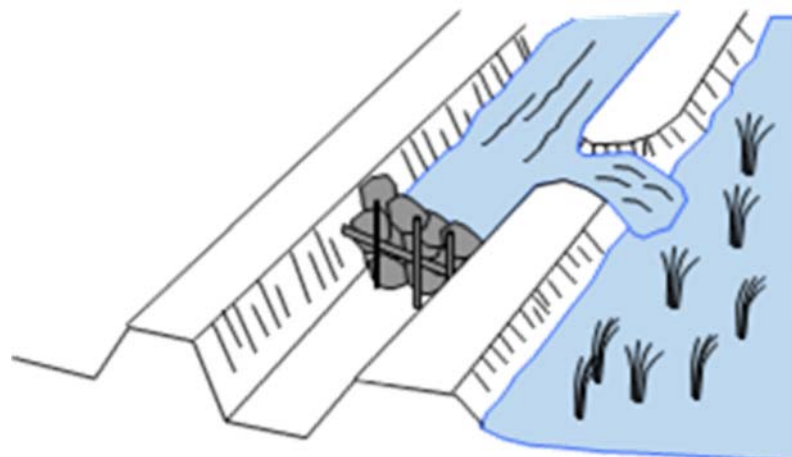
- In case of heavy rains during the Kharif season, the supply of irrigation water should either be reduced or entirely stopped, through the following procedure:
  - The field situation should first be investigated. If the irrigation water tends to increase the inundation, the irrigation water may drain first to the field drains, then WUA should be requested to stop or reduce the water from the intake.
  - Only after the water has been reduced or stopped from the intake or valve, can the other gates or stop log be regulated to reduce or entirely stop the delivery of water.
  - After few days of stoppage, the operation should be resumed and continued according to the field condition.

## Canal Breaching

- In case of breach in the canal, the following actions should be taken immediately:
  - Closure of the concerned upstream gate (or intake gate)
  - Shifting water from the breached canal to several adjacent canals, which are in good order and are capable to discharge without causing damage.
  - Shutting of the water supply to the breached canal for rehabilitation.
  - Instruction should be given to farmers in the affected area to be vigilant and change their farming activities.
  - Rehabilitation of the broken canal should be carried out as soon as possible. If rehabilitation works take more than 10 days, the construction of by-pass canal or the use of small pumps should be considered.
  - The rehabilitation works should, in principle, be conducted by the WUAs, except large and serious damage of the facilities.

## Prevention of Free or Illegal Use of Water

- When a farmer is applying irrigation water based on the rule, and another farmer applies irrigation water from another outlet freely, WUA needs to prevent such an illegal use of water.
- WUA is advised to prepare a punitive clause. Regarding this matter, WUA needs to discuss and decide.



## Water Distribution Method

### Farmer's Request Basis (On-demand)

In the request method, the farmers apply their request to the controller before their irrigation.

- Farmers can decide their irrigation frequency.
- If many members request irrigation in the same day, it is difficult to coordinate many requests at the same time.
- In case of farmers who depend only on rainfall, they don't have information on how much water they should irrigate. Therefore, if the farmers cannot receive good information, they will not apply enough irrigation water to meet the water requirement of the crop.

### Supply Basis (Pre-planned Rotation)

The farmers can apply irrigation water based on the irrigation schedule of the system. Each farmer has a specific time for irrigation depending on the cultivable area. This method can be used by considering not only the area, but also the crop.

- This method can ensure equitable water distribution, even if the number of farmers using irrigation water is large, because WUA fixes the irrigation schedule before each season.
- If farmers cannot receive good information on the water to be applied, they will not irrigate sufficiently compared with the ideal water requirement for the crop.
- If there are many part-time farmers in a project site, it will be difficult to follow the schedule without hiring labour or getting the cooperation of their family members
- This method needs a strong organizational power to implement because all the farmers need to obey the fixed irrigation schedule.

### Rotational Irrigation

Project area is divided into several blocks and the day of the week for providing irrigation in every block is decided before the crop season. Farmers can submit their request within this limitation.

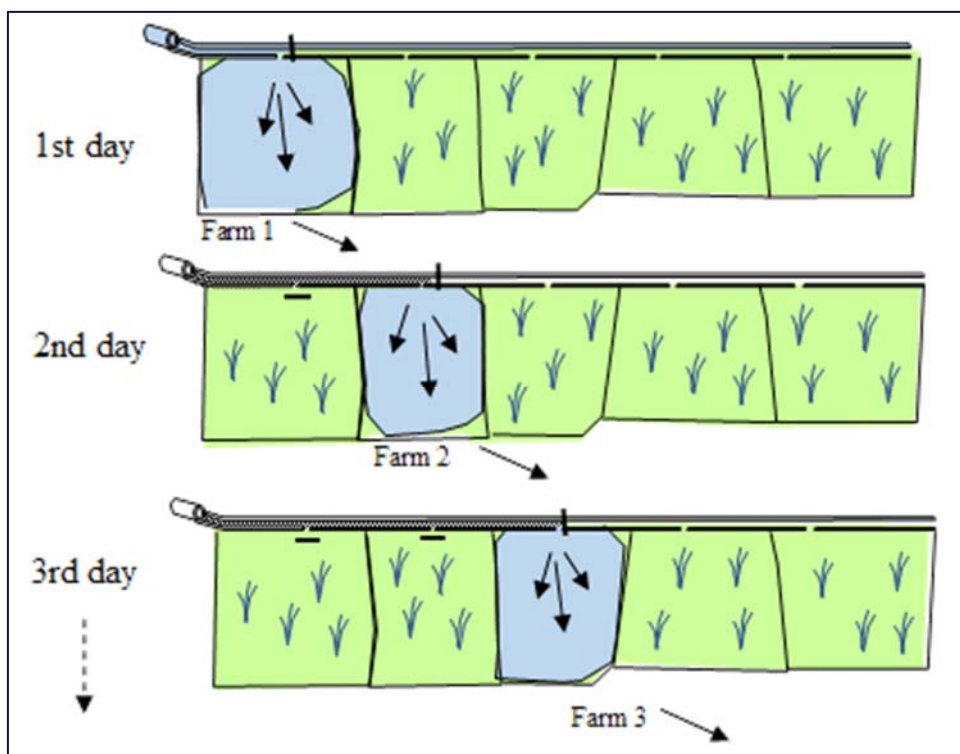
## Water Supply to each Crop

### Water Supply to Paddy Field

Paddy crop in WRC area is typically grown in bunded fields that are continuously flooded up to 7–10 days before harvest. It is strongly influenced by water supply. Water should be kept standing in the field throughout the growth period. Continuous flooding helps ensure sufficient water and control weeds. In water scarcity areas, saturated soil in a chemical reduced stage is desirable. To effectively and efficiently use water and maximize rice yields, the following good water management practices can be done:

### Rotational Irrigation to Paddy Field

Rotational operation is applied within the on-farm level commanded by a water course, which is through ON/OFF operation at the distribution box/outlet on the distribution channel or water courses. Rotation cycle and ON/OFF period should be determined by water consumption based on the type of crops, their growing stage, and farming area.



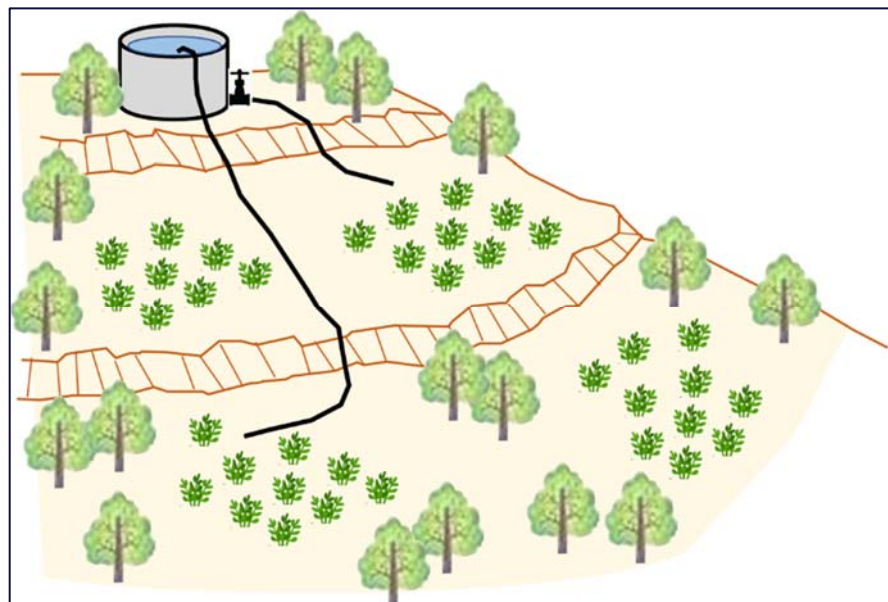
## Water Supply to Upland Crops in the Rabi Season

Vegetables during the Rabi season require a consistently moist soil. The key to keeping plants healthy and hydrated is to maintain an even and consistent soil moisture level. This means plants should never dry out or live in sopping wet, swampy conditions. The daily amount of water it takes to keep the soil around the plants evenly moist depends on a variety of factors, such as the temperature and location.

In case of cabbage, for example, while it will not tolerate sitting in wet, soggy soil, it needs regular watering to produce its leafy heads. Water should be supplied once a week. If the soil is dry, supply water is required more frequently. Water should be supplied in the morning to avoid water sitting on the plant's leaves, which encourages pests and diseases.

## Water Supply in Tank System

A tank is a cylindrical concrete structure constructed on sloping land for storing water. Tanks are used to provide storage of water for use in irrigation farming for mainly upland crops during the Rabi season.



The tank is filled with water from the main reservoir through the pipeline system, and water can be distributed by gravity to the lower fields, using rubber tube. The tanks are equipped with outlet pipe and valve, but it can shed water by siphon.



Normally, a tank is owned by one farmer, and hence he can manage by himself to use stored water to irrigate his land, while a main reservoir is commanding several tanks, requiring distribution to each tank equitably and effectively. The outlet valve of the main reservoir should be operated by authorized personnel only. Although water delivery to each tank should refer to the predetermined schedule, it can be changed or adjusted according to the actual situation of the urgent necessity of water and request by the farmers.



To manage the irrigation facilities, record keeping is important because WUA can deal with a problem accurately based on the noted facts. Activities of water management and maintenance of irrigation facilities need to be recorded and reported to all the members. Moreover, the transparency of running the organization and the motivation for participation will be enhanced by reporting/sharing the records to all the members in WUA general meetings. Therefore, IWRD needs to provide proper support in record keeping. Records needed for WUA are shown in the following table:

SN	Name of Record	Main Contents
1	Proceedings record	✓ Minutes of the meetings
2	Irrigation record	✓ Irrigation period ✓ Total irrigation area ✓ Daily gate operation record ✓ Maintenance charge record
4	Maintenance records	✓ Inspection record ✓ Record of cleaning activities ✓ Record of repair
5	Monitoring sheet for crop cultivation	✓ Area of each crop ✓ Production of each crop

To enhance their sense of ownership and responsibilities, the prospective beneficiaries should be involved right from the start of the project formulation stage to post-project management after the completion of the project. Besides, the participation of project beneficiaries promotes transparency for the irrigation schemes. For this purpose, necessary training for beneficiaries must be conducted. In this regard, the preparation of inventory list of facilities, preparation of maintenance plan, and conduct of trainings on minor concrete works and minor earthworks are necessary, as discussed in the following paragraphs.

## **Preparation of Inventory List of Facilities**

The preparation of inventory list of facilities or facility layout map is necessary which will be shared with WUA as well as concerned departments or organizations. The facility layout map is prepared including the following information:

- Existing road, stream, river and farmland
- Direction and scale
- Grid of coordinates and contours (if necessary)
- Location and name of irrigation facilities
- Irrigation facility list, which includes name, quantity, size, and dimensions.

The prepared layout map will be used for the ratification of the project and for the preparation of the O&M plan. The O&M plan is prepared in association with IWRD division office, which targets all irrigation facilities such as intake, canal, and pond that were developed by IWRD. WUA selects all O&M works regarding the irrigation facilities. Items of the works are generally patrol, water management, removing sedimentation soil, removing weeds, and rehabilitation. The implementer and frequency are decided for each O&M work.

## Required Works and Optimum Maintenance Cycle

Type of Maintenance Work	Maintenance Cycle
Removing excessive deposit of silt in canals and storage tank	Before every crop season
Re-shaping canal section	Every year
Weed clearance	Before every crop season
Repair of lining concrete and brick masonry	3 ~ 5 years (as and when required)
Repair of structure	Occasionally (as and when required)
Repair or replacement of pipeline	Occasionally (as and when required)
Greasing gate hoist	Before every crop season
Painting gate	1 ~ 3 years
Painting water level marker, including repairing	1 ~ 3 years (as and when required)

## Annual Maintenance Plan

Annual maintenance plan should be prepared in association with IWRD division office and should indicate i) facility to be maintained, ii) work item, iii) person in charge, iv) frequency, and time schedule, as shown below

[ Example ]

SN.		Name of Facilities		Items		Implementer	Frequency	Schedule											
								Jan.	Feb.	Mar.	Apr.	May	Jun	Jnl.	Aug.	Sep.	Oct.	Nov.	Dec.
1	No.1 Diversion Weir	Patrol		Person in charge		Every week	-----												
		Water management		Person in charge		Every day	-----												
		Maintenance	Removing sedimentation soil		All beneficiaries		Every month	■	■	■	■	■	■	■	■	■	■	■	■
			Removing weeds		All beneficiaries		4 times per year			■		■			■			■	■
		Rehabilitation		All beneficiaries		2 times per year				■	■							■	■
4	No.3 Main Canal	Patrol		Person in charge		Every week	-----												
		Water management		Person in charge		Every day	-----												
		Maintenance	Removing sedimentation soil		All beneficiaries		Every month	■	■	■	■	■	■	■	■	■	■	■	■
			Removing weeds		All beneficiaries		4 times per year			■		■			■			■	■
		Rehabilitation		All beneficiaries		2 times per year				■	■							■	■
Crop season								Dry (Rabi)		Summer			Rainy (Kharif)				Dry (Rabi)		

Maintenance works are categorized into the following three types,

Type of Maintenance Work	Description
Members' voluntary works	clearing canal and vegetation control of the smaller canals which are adjacent to the farmers' own farm plot,
Participatory works	clearing canal, vegetation control, repair of the damaged canals and minor repair of structures, which are managed by WUA
Contract works	comparatively major repair of concrete structures and metal works, which can be sublet to contractor(s)

For the maintenance works as shown above, the WUA's role and responsibilities are;

- to prepare maintenance schedules,
- to carry out timely maintenance and repairs to the distributary system including drains, structures, farm roads and other properties,
- to organize working team for repairs by the farmers, free of cost or on payment,
- to procure contractor(s) and supervise the works
- to procure necessary materials,
- to prepare and maintain an inventory of the irrigation system,
- to maintain accounts,
- to maintain records, and
- to conduct meetings,



**Required maintenance works are classified as below,**

## **Inspection**

- checking the operational conditions or functions of the facilities by visual inspection, measurement, hand operation or others, and recording the status/conditions of the facilities

## **Routine patrol and maintenance**

- removal of floating debris in the canals and water distribution structures, and debris blocking the water flow,
- closing illegal opening of bund and concrete wall, and
- repair of damaged bank caused by animals.

## **Periodical maintenance**

- manual removal of excessive deposition of silt and sediments,
- cutting excessive growth of vegetation and weeds by manual labor,
- repair of unstable canal reaches causing erosion and bank slippage,
- repair of scoured portion downstream of the structures, and
- greasing gate, hoist and painting gate leaf etc.

## **Special maintenance**

- repair of damaged canal reach (collapsed or seepage at canal embankment and serious erosion) and lining concrete and brick masonry, and
- repair and restoration of defective or damaged structures, gates and accessories

## **Emergency repair**

- any temporary measures for the damage that occurred during the operation (over-topping, collapse, of the canal embankment, which should be repaired completely after the irrigation season

## Maintenance Record

Record keeping is important because the WUA can deal with a problem accurately based on the noted facts. Moreover, it should be used for the maintenance plan for the next year. Cost for the maintenance actually paid should also be reviewed to decide the amount of maintenance charge in the next year.

Date	Name of Facility / Location	Maintenance Works	Nos. of Participants or Name of Contractor	Expenditure



## Maintenance Cost

In general, maintenance cost consists of the followings:

- Material cost (cement, reinforcement bar, aggregate, paint, etc.) for maintenance and repair works,
- Material cost (pipe, valve, gate, etc.) for replacement
- Equipment rental fee for maintenance works,
- Payment for workers,
- Payment for transportation and material delivery to the site (fuel, etc.), and
- Miscellaneous including stationary

## Maintenance Charge

It is recommended that WUA decides the collection of maintenance charge in order to finance the O&M costs of the facilities or for other purpose. In this case, farmers can pay maintenance charge based on landholding area every month when they use irrigation water. In some cases, WUA can set additional collection on top of the normal maintenance charge.

The method of collecting maintenance charge should be discussed and approved in WUA general meeting. It should be reminded that the farmers will accept to pay their maintenance charge only if they are satisfied with the irrigation, and that successful operation will realize steady collection of maintenance charge.



## Financial Management for Maintenance

In addition to the maintenance charge, the WUA may raise funds for other activities. For example, voluntary deposits from its members, contributions in emergency, budget grant from the government and other financial assistance from the government, any savings from the works/contract undertaken by the WUA, resources raised from other financing agency for undertaking any economic development activities in the area, money received from any other source, etc.

All the capital investment of WUA will be in long-term fixed deposits, with instructions to deposit the interest in a savings account. The WUA will deposit its operative funds in a savings account in the approved bank. The savings account will be operated jointly by the treasurer and any other member.

## Application to CSS Budget

In case of any heavy damage or corruption of the irrigation system due to unpredictable disaster, the rehabilitation and/or re-construction of the system will be beyond the capacity of the community. In such case, the community should search necessary budget and expected financial sources under the Centrally Sponsored Scheme (CSS), such as NABARD and PMKSY. The application for CSS fund should reach to IWRD through the proper channel.

## Regular Meeting with WUA

After the completion of construction of the irrigation project, the IWRD will give the necessary support to WUA for the proper operation and maintenance of the facilities based on the prepared O&M plan. IWRD should conduct regular meeting with WUA after the completion of the construction works, so as to maintain good relationship between both parties for the smooth functioning, operation and maintenance of the irrigation scheme by sharing ideas and thoughts. IWRD will remind and educate WUA to conduct the operation and maintenance activity from time to time. IWRD will know the capacity development needs of WUA through regular meetings and organize the demanded trainings to WUA.

Monitoring of the water flow is one of most important activities during operation, which will be evaluated for charging the maintenance charge and also utilized for feedback and future improvement of the operation. The WUA should monitor the water level at the head of canals and outlets to ensure that the authorized discharge is flowing through the channels. Any deviation in the discharge in the channels should be reported to the IWRD officials.

In the meeting at the end of the season, the WUA, assisted by IWRD, should evaluate the O&M performance, based on the following parameters, among others:

- Quantity of water planned to be delivered at outlets and actually delivered
- Comparison of planted area between area planned to be irrigated and actually irrigated
- Comparison of yields of crops under irrigation between planned and actual
- Comparison of production of principal crops under irrigation between planned and actual
- Total number of disputes in sharing water
- Total number of irrigation offences
- Record of maintenance and repairing activities
- Maintenance charge assessed and actually recovered



## Update WUA Information

After the registration of the information of WUA, IWRD should update the information related to WUA every year to monitor the WUA activity without time lag and provide necessary services on time. The details of the WUA should be up to date and reliable at all times during the follow-up period.

Information of WUA to be updated at the end of each cropping season should include the following basic registered items.

## Organization of WUAs

- Name of President, Secretary and other committee members
- List of member farmers

## Area data

- Irrigable area
- Planted area of each crop during the Kharif and Rabi seasons

## Yield and production

- Yield of each crop
- Production of each crop

## Updated inventory list of irrigation and related facilities

- List of canals
- List of structures



The Project on Capacity Enhancement  
for Sustainable Agriculture and Irrigation Development  
in Mizoram

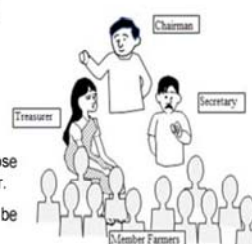
## Training Material For Strengthening of Water Users' Association (WUA) for O&M of Irrigation Scheme

Version 1.0

1

### Water Users' Association (WUA)

- WUA is expected to be established during planning stage of a project
- In accordance with the Government guidelines and by-laws of WUA, WUA's and members are expected to,
  - operate irrigation system properly and equitably,
  - maintain facilities,
  - participate in activities, and
  - collaborate with co-members and partners
- WUA is organized to make sure that;
  - the membership is active,
  - contributing happily to the goals of the WUA, and
  - supportive of each other
- WUA members have a right to chose Chairman, Secretary, and Treasurer.
- VCP/Local Council Chairman will be ex-officio member of the WUA



2

### Objectives of Water Users' Association (1/2)

- to function in democratic manner through consensus respecting the rights and duties of all members,
- to make their organization a viable, vibrant and functioning entity,
- to ensure equitable distribution of water to all farmers, even to tail end farmers,
- to utilize their assets in a manner that is essential, productive, beneficial and sustainable,
- to work in close coordination with the IWRD and other concerned departments
- to maintain the irrigation system for sustainable water supply
- to ensure that structures are preserved and
- to work towards maintaining and sustaining an ecological balance and prevent degradation of the environment particularly soils and quality of water,

3

### Objectives of Water Users' Association (2/2)

- All farmers must have responsibility and ownership to the irrigation facilities for benefit of irrigation,
- All activities for operation and maintenance are based on understanding and cooperation of all members of WUA,
- to receive water according to an agreed time schedule and quantity for distribution among the water users on agreed terms of equity and social justice,



4

### Responsibilities of Water Users' Association (1/2)

- to enter into an agreement for achieving the objects and functions of the WUAs
- to prepare the schedules of water deliveries,
- to avoid and prevent misuse and wastage of water,
- to supply water to all members as per the approved terms,
- to carry out timely maintenance and repairs to the irrigation system including drains, structures, farm roads and other properties,
- to organize repairs of the system by the farmers, free of cost or on payment,
- to use water economically and furnish data to the I&WRD on water use, irrigated area, irrigation efficiency and crop yield, to maintain a register of land holders,
- to prepare and maintain an inventory of the irrigation system within the area of operation,

5

### Responsibilities of Water Users' Association (2/2)

- to resolve the disputes, if any, between a member and other member(s) in its area of operation,
- to maintain accounts,
- to cause annual audit of its accounts,
- to maintain records,
- to conduct meetings,
- to inspect water utilization by the farmers,
- to impose and recover penalties or fines for misuse and wastage of water and tempering or damaging,
- to improve the system for efficient and economical use of available / allocated water, for efficient production of crops;



6

## Rights of the Member Users

- to suggest improvements / modifications in water deliveries,
- to get information relating to water availabilities, allocation, opening / closing of canals and outlets, period of supply and its frequency,
- to receive water as per specified quota for use,
- to have the freedom of growing any crop, other than those prohibited by law, adjusting the crop within the water allocated and the overall cropping plan of the commanded area,
- to participate in the meeting and receive annual reports; and
- to receive equitable benefits from the activities of the organization.



7



8

## Preparation of Irrigation Schedule (1/2)

- Crop Farming Plan and Water Delivery Plan

WUAs should prepare crop farming plan and water delivery schedule in consultation with BAIDC

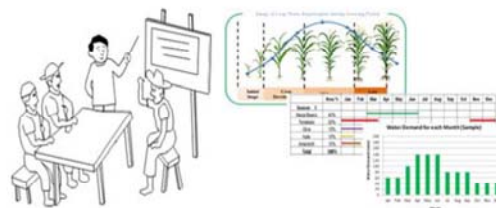
- Water available from canal
- Total water available for the season, i.e. from other sources
- Crops, crop varieties, areas, and cropping calendar (sowing and harvesting dates) under different crops
- Total quantity of water required
- "Critical growth stages of principal crops when water supply is most essential"
- Dates of opening/closing canal, and periods of water supply (frequency of irrigation)



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## Preparation of Irrigation Schedule (2/2)

- Normally, irrigation water is scheduled to be supplied; and
  - for Rabi season : Full irrigation based on crop Water requirement in each growing stage of Crops
  - for Karif season : Supplementary irrigation with maximum utilization of rainfall
- WUAs is to prepare water distribution schedules indicating the time and date when every farmer, below the outlet, gets his turn of irrigation.



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## Operation Rules and Method for Intake Gate

- The gate is a regulating structure without flow measuring function. The gate operator should adjust the gate opening while reading the discharge using measuring device (if available) to meet the diversion discharge in accordance with the schedule.

- Gate control procedure

- i) Read the gauge in the measuring device (if available) and compare this reading with the scheduled discharge
- ii) Adjust the gate opening to meet the required discharge
- iii) Repeat this procedure till the discharge is balanced at the scheduled discharge.
- iv) If measuring device is not available, water level in the canal should be checked and controlled.



11

## Maintenance Works

- In order to use the irrigation facilities smoothly and effectively for a longer time, WUA should carry out periodic maintenance works.
- Maintenance works are composed of works related to canals, pipelines, water tanks and related structures.
- If the facilities are not maintained properly, the repair costs of the facilities will increase.
- Good maintenance will;
  - ensure good operating conditions of the irrigation system at all times,
  - maximize use of facilities without major rehabilitation, and
  - ensure sustainable benefits to WUA, the community and family
- Before cropping season, maintenance plan should be discussed and fixed in the WUA meeting

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## Broken Canal and Type of Damages (1/2)



Collapsed canal section



Broken floor slab mainly due to poor workmanship during construction

Cracks growing on the wall of channel

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## Broken Canal and Type of Damages (2/2)



Broken brick masonry and plastering, mainly due to poor workmanship during construction and less maintenance



Damage to concrete channel by growing tree / roots

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## Type of Maintenance Works (1/3)

### ➤ Inspection

- Checking the operational conditions or functions of the facilities by visual inspection, measurement, hand operation or others, and recording the status/conditions of the facilities

### ➤ Routine patrol and maintenance

- removal of floating debris in the canals and water distribution structures, and illegal debris blocking water flow,
- closing illegal opening of bund and channel wall, and
- repair of damaged bank caused by animals.

### ➤ Periodical maintenance

- manual removal of excessive deposition of silt and sediments,
- cutting excessive growth of vegetation and weeds by manual labor,
- repair of unstable canal reaches causing erosion and bank slippage,
- repair of scoured portion downstream of the structures,
- greasing gate, hoist and painting gate leaf etc.

15

## Type of Maintenance Works (2/3)

### ➤ Special maintenance

- repair of damaged canal reach (collapsed or seepage at canal embankment and serious erosion) and lining concrete and brick masonry,
- repair and restoration of defective or damaged structures, gates and accessories

### ➤ Emergency repair

- any temporary measures for the damage occurred during the operation (over-topping, collapse, of the canal embankment, which should be repaired completely after irrigation season

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## Type of Maintenance Works (3/3)

### ➤ Members' voluntary works

- clearing canal and vegetation control of the smaller canals which is adjacent to the farmers' own farm plot,

### ➤ Participatory works

- clearing canal, vegetation control, repair of the damaged canals and minor repair of structures, which are managed by WUA

### ➤ Contract works

- comparatively major repair of concrete structures and metal works, which can be sublet to the contractor(s)

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## Role and Responsibility of Maintenance Works

WUA	IWRD
<ul style="list-style-type: none"> <li>• to prepare maintenance schedules,</li> <li>• to carry out timely maintenance and repairs to the distributary system including drains, structures, farm roads and other properties,</li> <li>• to organize working team for repairs by the farmers, free of cost or on payment,</li> <li>• to procure necessary materials,</li> <li>• to prepare and maintain an inventory of the irrigation system,</li> <li>• to maintain accounts,</li> <li>• to take and keep maintenance records, and</li> <li>• to conduct meetings,</li> </ul>	<ul style="list-style-type: none"> <li>• to assist and advise WUA for preparation of maintenance plan</li> <li>• to conduct necessary training to WUA</li> <li>• to supervise and monitor maintenance works done by WUA</li> <li>• to assist and advice for procurement of construction materials</li> <li>• to organize joint meeting with WUA and BAIDC member(s)</li> <li>• to procure contractor(s) and supervise the works</li> </ul>

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## Optimum Maintenance Cycle and Standard Frequency

Type of Maintenance Work	Maintenance Cycle
Removing excessive deposit of silt in canals and storage tank	Before every crop season
Re-shaping canal section	Every year
Weed clearance	Before every crop season
Repair of lining concrete & brick masonry	3 ~ 5 years (as and when required)
Repair of structure	Occasionally (as and when required)
Repair or replace of pipeline	Occasionally (as and when required)
Greasing gate hoist	Before every crop season
Painting gate	1 ~ 3 years
Painting water level marker	1 ~ 3 years (including repairing as and when required)
Gate repair / replacement	5 ~ 10 years
Supplementation of wooden stop log	3 ~ 5 years

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## Annual Maintenance Plan

- Preparation of inventory list of facilities and maintenance Plan
  - preparation of inventory list of facilities or facility layout map is necessary which will be shared with WUA as well as concerned departments or organizations.
- Preparation of operation and maintenance plan
  - The O&M plan is prepared based on O&M plan by WUA in association with I&WRD division office.
  - The plan targets all irrigation facilities such as diversion weir, intake, canal, and pond which are developed by I&WRD. WUA selects all O&M works regarding

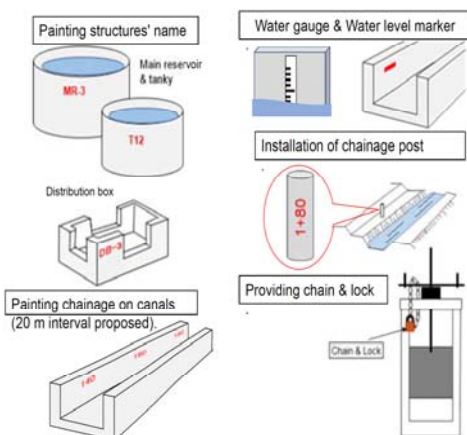
Sample

(a)	Name of Facility	Area	Structure	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Diversion Weir	100m	Concrete	Annual												
2	Canal	100m	Concrete	Annual												
3	Gate	100m	Concrete	Annual												
4	Water Level Marker	100m	Concrete	Annual												
5	Gate	100m	Concrete	Annual												
6	Gate	100m	Concrete	Annual												
7	Gate	100m	Concrete	Annual												
8	Gate	100m	Concrete	Annual												
9	Gate	100m	Concrete	Annual												
10	Gate	100m	Concrete	Annual												

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## Preparatory for O&M

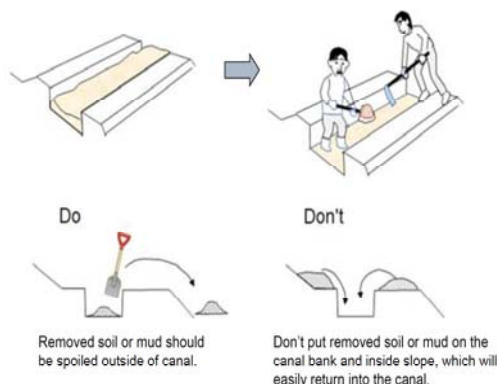
For proper operation, monitoring, recording and reporting



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## Maintenance Activities

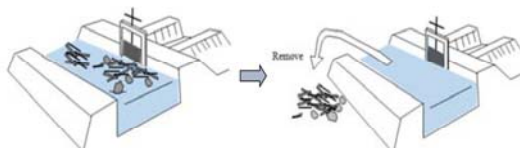
Removal of Excessive Deposition of Silt and Sediments



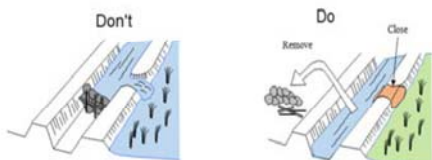
22

## Maintenance Activities

Removal of Floating Debris in Canals and Structures



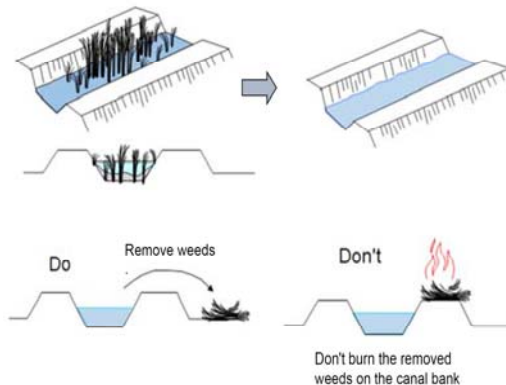
Removal of Illegal Abstraction of Water



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## Maintenance Activities

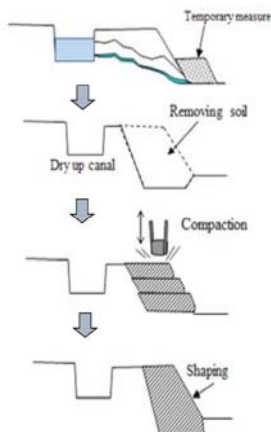
Removal of Weeds and Cutting Excessive Growth of Vegetation



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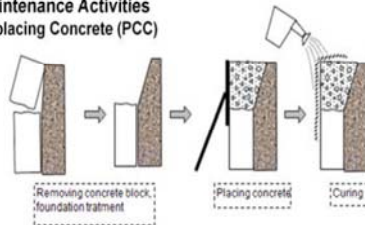


## Maintenance Activities Repair of Seepage

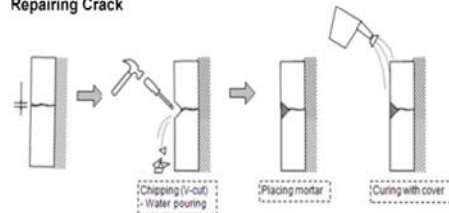


25

## Maintenance Activities Replacing Concrete (PCC)

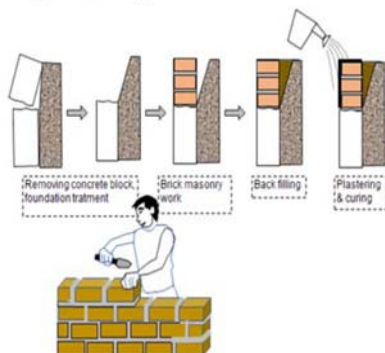


## Repairing Crack



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## Maintenance Activities Replacing Brick Masonry

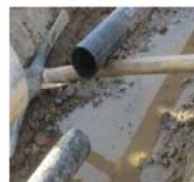


27

## Maintenance Activities Repair of Pipeline

### Repair of Pipeline Leakage

- Water leakage will occur sometimes in pipeline. If the leakage were left, it will be difficult to take water from that line. Leakage will grow and more serious in future.
- The leakage needs to be repaired as soon as possible



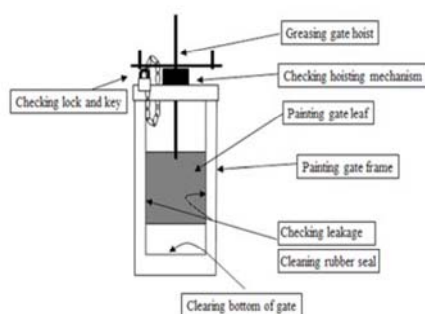
Replacing of leaking pipe



Rapping at leakage point (Temporary measure)

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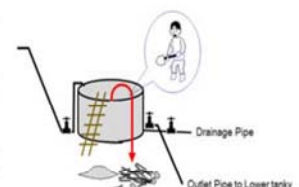
## Maintenance Activities Maintenance of Gates



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## Maintenance Activities Clearing Water Storage Tank (Main Reservoir and Water Tank)

- There are many foreign materials which can pollute the water, such as silt, tree leaves, shrubs and algae, which are collected in water storage tank. Because of this, tank is required to be cleaned at a certain time interval.
- The water storage tanks must be kept clean to prevent slogging, sedimentation and thus prevent from clogging.
- Empty the storage tank by a drainage pipe.
- The internal surfaces are washed with plain water to remove all impurities.
- Silt, tree leaves, shrubs and algae are to be removed manually.



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# Appendix-I : Training Material to WUA

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## Maintenance Record

- Record keepings is very important, because WUA can deal with the problem accurately based on the noted facts
- Moreover, the transparency of running organization and the motivation for participation will be enhanced by reporting/sharing the records to all the members.

Date	Name of Facility / Location	Maintenance Works	Nos. of Participants or Name of Contractor	Expenditure
		Sample		

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## List of Irrigation Facilities to be Maintained (Tuikhurlui MIP)

Canal Name	Canal Type	Length (m)
1 Pipeline (Existing)	GI Pipe	000
2 Pipeline (New)	GI Pipe	363
3 Main Channel (New)	Rectangular open channel (PCC & Brick masonry)	687
4 Distribution Channel I (Rehabilitated)	Rectangular open channel (PCC & brick masonry)	760
6 Distribution Channel I-2 (New)	Rectangular open channel (PCC & brick masonry)	000
7 Distribution Channel I-3 (Rehabilitated)	Rectangular open channel (PCC & brick masonry)	160
8 Distribution Channel II (Existing)	Rectangular open channel (PCC & brick masonry)	96

Note: Distribution Channel I-1 was cancelled

Canal Name	Station No. (Rd Dist.)	Structure
1 Water Harvesting Pond		Spillway R. Spillway L.
2 Main Channel	BP	Outlet Box I. XXX Distribution box I.
3 Distribution Channel I	XXX	Distribution box III XXX Distribution box IV
4 Distribution Channel II	BP	Outlet Box II 94 Public Pond

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## List of Irrigation Facilities to be Maintained (Laului MIP)

No.	Canal Name	Canal Type	Length (m)
<b>Thingkhung System</b>			
1 Main Canal 1-1	Rectangular open channel (Brick masonry)	145	
2 Secondary Canal 1-1	Rectangular open channel (Brick masonry)	300	
3 Secondary Canal 1-2	Rectangular open channel (Brick masonry)	255	
4 Tertiary Canal 1	Rectangular open channel (Brick masonry)	133	
5 Main Canal 1-2	Rectangular open channel (Brick masonry)	169	
<b>Vavunak Irrigation System</b>			
6 Main Canal 2-1	Rectangular open channel (Brick masonry)	1357	
7 Main Canal 2-2	Rectangular open channel (Brick masonry)	554	

Canal Name	Station No. (Rd Dist.)	Structure
Main Canal 1-1	BP	Thingkhung Intake I
	145	Division box M1-1-1
Secondary Canal 1-1	300	Division box SI-1-1
Secondary Canal 1-2	255	Division box SI-2-1
Tertiary Canal 1-1	110	Division box TI-1-1
Tertiary Canal 1-2	133	Division box TI-2-1
Main Canal 1-2	BP	Thingkhung Intake II
	169	Division box M1-2-1
Main Canal 2-1	BP	Vavunak Intake I
	60	Desiltation tank
	1007	Support passage
	135	Division box M2-1-1
	250	Division box M2-1-2
	380	Division box M2-1-3
	510	Division box M2-1-4
Main Canal 2-2	BP	Vavunak Intake I
	280	Division box M2-2-1
	554	Division box M2-2-2

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## List of Irrigation Facilities to be Maintained (Lumtui MIP)

Canal Name	Length (m)	Canal Type
1 Main Canal	XXX	Rectangular open channel (PCC and brick masonry)
2 Distribution Canal I	250	Rectangular open channel (PCC and brick masonry)
2 Distribution Canal II	XXX	Rectangular open channel (PCC and brick masonry)

Canal Name	Station No. (Rd Dist.)	Structure
Main Channel	BP	Intake
	100	Desiltation box
	155	Division box
	950	Slab culvert
	994	Box Culvert
	1800	Super passage
Distribution Canal 1		
Distribution Canal 2		

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## List of Irrigation Facilities to be Maintained (Dilhnua MIP) 1/2

Name of Pipeline	Type of Pipeline	Length (m)
1 Main Line 1	GI Pipe (405mm)	363
2 Main Line 2	GI Pipe (405mm)	472
3 Distribution line 1	GI Pipe (312mm)	268
4 Distribution line 2	GI Pipe (312mm)	327
5 Distribution line 3	GI Pipe (312mm)	240
6 Distribution line 4	GI Pipe (312mm)	240
7 Main Line 3	GI Pipe (405mm)	225
8 Distribution line 5	GI Pipe (312mm)	285
9 Distribution line 5-1	GI Pipe (312mm)	261
10 Distribution line 5-2	GI Pipe (312mm)	197
11 Distribution line 6	GI Pipe (312mm)	300
12 Distribution line 7	GI Pipe (312mm)	360
13 Main Line 4	GI Pipe (405mm)	360
14 Distribution line 8	GI Pipe (312mm)	438
15 Distribution line 9	GI Pipe (312mm)	41

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## List of Irrigation Facilities to be Maintained (Dilhnua MIP) 2/2

Pipeline	Station No. (Rd Dist.)	Structure	Pipeline	Station No. (Rd Dist.)	Structure
Main Line 1	BP	Nat Luu Intake	Distribution line 5-2	558	Main Reservoir 5
	12	Desiltation Tank 1		628	Proposed Tank 8
	412	Main Reservoir 1		705	Proposed Tank 9
Distribution line 1	BP	Main Reservoir 2	Distribution line 6	323	Main Reservoir 4
	268	Tank 1		367	Proposed Tank 10
Distribution line 2	BP	Main Reservoir 2		523	Existing Tank 6
	100	Existing Tank 1	Distribution line 7	223	Main Reservoir 4
	193	Existing Tank 2		342	Tank 11
	300	Tank 2		583	Tank 12
	327	Tank 3	Main Line 2	BP	Tuikhur Intake
Distribution line 3	BP	Main Reservoir 2		12	Desiltation Tank 3
	120	Existing Tank 2		350	Desiltation Tank 2
	175	Tank 4	Main Line 4	BP	Kayman Intake
	240	Tank 5		12	Desiltation Tank 2
Distribution line 4	BP	Main Reservoir 2	Distribution line 8	360	Main Reservoir 3
	240	Tank 6		390	Tank 13
Main Line 4	BP	Kayman Intake		798	Tank 14
	12	Desiltation Tank 2	Distribution line 9	412	Main Reservoir 1
Distribution line 5	323	Main Reservoir 4		453	Existing Tank 7
	321.5	Existing Tank 4			
Distribution line 5-1	558	Main Reservoir 5			
	658	Proposed Tank 7			
	769	Existing Tank 5			

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## Maintenance Cost

- In general, maintenance cost consists of the followings;
  - Material cost (cement, reinforcement bar, aggregate, paint, etc.) for maintenance and repair works,
  - Material cost (pipe, valve, gate, etc.) for replacement
  - Equipment rental fee for maintenance works,
  - Payment for workers,
  - Payment for transportation and material delivery to the site (fuel, etc.)
  - Miscellaneous including stationary

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## Typical Cost Estimate for Annual Maintenance

Sample

Type of Maintenance Work	Cost Estimate
Removing excessive deposit of silt in canals and storage tank	Manpower : Unskilled worker 00 person x 00 days = 000 m-day 000 m-day x INR 00/day = INR.0000
Weed clearance	Manpower : Unskilled worker 00 person x 00 days = 000 m-day 000 m-day x INR 00/day = INR.0000
Re-shaping canal section & Structures	Manpower : Unskilled worker 00 person x 00 days = 000 m-day 000 m-day x INR 00/day = INR.0000 Material : Cement 00 bags/m x 000 m = 00 bags 00 bags x INR 00/bag = INR.0000 Material : Sand 00 m <sup>3</sup> x INR 00/bag = INR.0000 Manpower : Skilled worker 00 person x 00 days = 000 m-day 000 m-day x INR 00/day = INR.0000
<b>Total</b>	<b>INR0,000.00</b>

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## Cost Sharing and Available Fund for Maintenance (1/2)

### Maintenance Charge

- Commended that WUA decide collection of maintenance charge in order to finance O&M costs of the facilities or other purpose. In this case, farmers can pay maintenance charge based on land holding area every month when they use irrigation water.
  - In some cases, WUA can set additional collection in addition to normal maintenance charge.
  - The method of collecting maintenance charge should be discussed and approved in WUA general meeting. It should be remembered that the farmers will accept to pay their maintenance charge only if they are satisfied with the irrigation facility, and successful operation will realize steady collection of maintenance charge.
  - All the capital investment of WUA will be in term fixed deposits, with instructions to deposit the interest in the savings account. The WUA will deposit its operative funds in a savings account in the approved bank. The savings account will be operated jointly by the treasurer and Chairman of WUA.

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## Cost Sharing and Available Fund for Maintenance (2/2)

### Periodical Deposit of Maintenance Fund

- Other than, or in addition to the maintenance charge, the WUA may raise funds for O&M cost and other activities, for instance, periodical or on-demand deposits from its members, and contributions in emergency cases, etc,

### Application to State/CSS Budget

- In case of heavy damages or corruption of irrigation system due to natural disaster etc., where the rehabilitation and/or re-construction of the system is beyond the capacity of the WUA, State/CSS Fund may be sought.
- The application to State/CSS fund should reach IWRD through BAIDC and get reflected in the BAIDC Annual Plan.

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