

Climate-Resilient and Inclusive Rural Water Caretaker **TRAINER'S MANUAL**



Water and Sanitation Division,
Department Of Infrastructure Development,
Ministry Of Infrastructure and Transport

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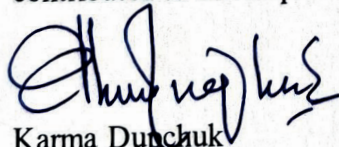
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Foreword

In 1974, the Royal Government of Bhutan with assistance from UNICEF, launched the Rural Water Supply Programme with the aim to improve access to safe drinking water for its rural population. In the early 1990s, the initiative was given renewed national priority with the issuance of the Royal Decree on Water and Sanitation by His Majesty, the Fourth Druk Gyalpo, in 1992. Since then, water and sanitation have been on the national priority of every five-year plans. In the 12th Five-Year Plan (FYP), the Royal Government prioritized the Water Flagship Programme (WFP), focusing on providing 24/7 access to safe drinking water and irrigation as one of the major plan activities. While the construction of water supply schemes made significant progress, with over 98.8% of households now having access to basic drinking water, challenges remain, particularly in the areas of management, operation and maintenance, which are crucial for the long-term sustainability of these systems. Reports indicate that many rural water schemes lack caretakers, and many water sources are drying up.

To ensure sustainability of the water supply schemes, it is critical to equip village water caretakers with the knowledge and skills necessary for effective management, operation and maintenance, including nature-based water source management. In order to respond better to the impact of the climate change, the existing water caretaker manual have been reviewed and revised to the Climate Resilient and Inclusive Rural Water Caretaker Trainer's Manual with support from SNV. This manual aims to support water caretakers in managing rural water supply systems with a focus on both climate resilience and inclusivity. It provides a comprehensive framework for training caretakers in water source management, as well as in the operation and maintenance of water supply systems in the face of climate change. The manual emphasizes practical skills for monitoring and ensuring the sustainability of water supply schemes with inclusive community participation.

We hope this manual will serve as a valuable guide for trainers, empowering them to build the capacity of village caretakers to effectively manage, operate and maintain the water supply systems in face of the climate change. I thank SNV Bhutan and every individual who have contributed to development of this guide.



Karma Dupchuk

Director General

Department of Infrastructure Development



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INTRODUCTION

The Rural Water Supply (RWS) Programme was initiated in 1974 with the mandate to provide a safe drinking water supply to all the rural communities, including the schools, monastic institutions and health care centers in the country. The RWS inventory study carried out in 2014 revealed that even though 5,514 RWS schemes were constructed, the functional supply line is less than 75.55%. At the same time, a 2015 report from the Ministry of Health (MoH) estimated that 93% of the rural water schemes have no water safety plans, 48% have no caretakers and 70% have no management committees. Although the access to water supply in the country is 99%, the report revealed that only 63% of households have a 24-hour access to drinking water. Additionally, the Ministry of Agriculture (MoA) reported in 2020 that 35% of the water sources are drying up¹ and most of the rural water schemes have no water safety plans². Even as Bhutan celebrated 100% of improved sanitation coverage in 2022, the climate-change is already impacting the functionality of the pour-flush toilets predominantly used in the rural communities. While research on the intersection between climate-change, gender equality and social inclusion in Bhutan is limited, a study conducted in May 2022 examining the risks, hazards and WASH vulnerabilities of different population groups identified that the children, people with disabilities and women have the highest risk of being negatively affected by the climate-change and, they generally have a lower coping capacity and higher hygiene needs.

The current situation is a big concern as the climate projections as reflected in the Third National Communication to the UNFCCC 2020 shows an increasing trend in temperature and rainfall, which are likely to exacerbate flash floods, landslides and droughts in the future. This fact, combined with the limited water management arrangements, increases water stress, and absence of trained water caretaker will undermine and reverse the gains achieved over the past decade.

Recognizing these issues, the Royal Government of Bhutan (RGOB) prioritised the Water Flagship Programme (WFP) in the 12th Five Year Plan (2018 – 2023) with significant investment in a four-pronged strategic approach focusing on (1) Declaration and protection of critical watersheds; (2) Development of adequate and climate- resilient infrastructure; (3) Improvement of drinking water quality surveillance; and, (4) Better implementation of water legislation and governance. To improve the WASH governance and sustainability of the rural water supply scheme, the ministry has given importance in revising the existing Rural Water Caretakers Trainer’s Manual, to help equip the rural water caretakers with the necessary skills on climate-resilient operation, maintenance and consideration of gender equality, disability and social inclusion (GEDSI), while empowering them to take the ownership and contribute to the long-term viability of rural water supply infrastructure.

Hence, in Bhutan, the integration of Water Flagship Programme with effective management and governance practices, and training of water caretakers on climate-resilient operation and management (O&M) reflects a comprehensive approach to addressing the water challenges faced due to climate-change and enhancing the community resilience and contribution to sustainable and improved water accessibility and availability.

1 MoA report 2020

2 MoH report 2015



REVISED RURAL WATER CARETAKER TRAINER'S MANUAL

The Rural Water Caretaker Trainer's Manual is developed and put in place for use by the Water and Sanitation Division (WSD) of the Department of Infrastructure Development (DoID), and the DoW/ District Engineer/Technician trainers who are responsible to implement the training courses for the rural water caretakers to help them better understand the importance of a Rural Water Caretaker's roles, build their capacity on the climate-resilient operation and maintenance of rural water schemes, and to make GEDSI considerations to ensure availability and accessibility of drinking water for all throughout the years.

This revised manual responds to the wider community needs in incorporating climate-resilience and gender equality considerations to create a holistic and sustainable approach to water management. By incorporating climate-resilience, the caretakers would gain the knowledge and skills needed to anticipate and adapt to the impacts of climate-change on water resources, thereby ensuring the long-term viability of the water systems. Additionally, integrating GEDSI considerations would ensure that the needs and voices of all community members, including the women, marginalized groups and persons with disabilities, are taken into account in the decision-making processes of water governance, management and service provision. By integrating these elements into the manual, the trainers can promote equity, foster community participation, and empower the caretakers to implement sustainable and resilient water management practices that benefit all, contributing to the overall well-being and resilience of the communities.

It is strongly advised that the trainer reads the manual a few days in advance, rehearse the demonstrations with a helper and ensure that all materials are available.

The manual is designed for both the trained (old) and un-trained (new) caretakers of Rural Drinking Water Schemes. The advantage of having the old caretakers as participants will be in sharing their practical experiences and challenges faced due to climate hazards (such as drying up of water sources, freezing of pipes, water sources/pipes washed away by landslides, etc) and supporting the new caretakers during the practical sessions. However, there will also be caretakers who have not done any of the work till now. For them everything is new, and they need to be supported during the training with full attention.



TIPS AND HINTS FOR THE TRAINERS

First of all, a good planning and preparation before the start of the training is important. Secondly, you have to pay attention to your performance as a trainer. The trainer is a very important person during the course and is often the centre of attention. If she/he does well, the training is already half a success.

PREPARING FOR A TRAINING

Good Time

The training activities should be planned at a time that suits the Caretakers as well as the Trainers. The timing of the training is an important part of planning a training, as a good timing is very critical for the maximum and effective participation. Therefore, the timing of the training must be scheduled, when:

- It is not the seasons for agricultural or farming activities (sowing, weeding, and harvesting, etc);
- The weather is good;
- It is not the time of local festivals;
- The staffs and resources such as budget are available.

Good Venue

A training must be conducted at a suitable venue and place that has adequate space convenient for practical training sessions. To encourage more female participants, consider to choose a venue that has safe accommodation facilities. Including a female-trainer/co-female facilitators will help to make the women participants feel more comfortable and reduce their concern on their safety.

Number of Participants and Facilitators

Ideally, a training should be limited to 20-25 participants and facilitated by two to three trainers..At least one facilitator should be a female, so that women participants are encouraged to participate and engage themselves freely in the training sessions.

Selection of Schemes and Participants

All new water schemes under construction or rehabilitation, or an existing water scheme that does not have a trained caretaker should be given the priority for the selection for a training. Additionally, the schemes that are not functioning well due to a major breakdown should be selected. For such schemes, it is better to wait till the rehabilitation starts.

Generally, for the new or rehabilitation schemes, the caretakers are appointed during the community

meetings that are organised before the start or completion of the construction work. For the existing schemes without trained caretakers, Gewog leaders should be consulted to select the caretakers through a community meeting. It is important for such a meeting to stress on the importance of a caretaker, agree on fair compensation and discuss the duties of caretakers.

Invitation and Venue

Invitation of the training participants/caretakers should be done well in advance through the local Leaders. The invitation should mention the name of the scheme, village and caretaker so that the right person is nominated and attend the training.

Organise the training, if possible, close to the villages from where the caretakers are invited and has easy access to the water scheme.

Training Materials

All the required training materials must be kept ready prior to the training. Make sure to bring the caretaker tool boxes and check if you have sufficient HDPE pipes, GI pipes, CPVC and PPR Pipes for the practical sessions. Each participant can use two metres of small diameter [Ø 20 to 32 mm] and one metre of big diameter [Ø 50 or 63 mm] HDPE pipe. Also bring the GI, CPVC and PPR fitting materials, posters and this Trainers' Manual.

Communication Skills

The trainer or facilitator is the key to the success of a training. While explaining, discussing or demonstrating a skill, you as the trainer need to be open, friendly, positive, enthusiastic, patient and active. Make the training course enjoyable for you as well as the participants.

Effective Communication

To be effective as a trainer, check the following Do's and Don'ts.

Do's	Don'ts
✓ Use the local language.	●✘ Be bossy.
✓ Pay attention to all participants.	●✘ Be un-prepared.
✓ Avoid complicated technical terms.	●✘ Show off and make things complicated.
✓ Listen carefully to the participants.	●✘ Make false promises.
✓ Speak clearly and lively.	
✓ Know your subject.	

Demonstration Technique

The purpose of a demonstration is to clearly show and verbally explain the skills that will be practised later. During the demonstration, the participants will see the skills, but the session is short and not all participants will have had a chance to practise during the demonstration.

While demonstrating a skill, keep the following in mind:

- You must know the skill well and have practised it before hand;
- Be well prepared and organised;
- Arrange the demonstration in a manner that all the participants around you can see what you are doing;
- Do it step-wise and explain each step carefully;
- Concentrate on the essentials, and do not drift away;
- Keep contact with the participants. Ask open questions to repeat important information or steps.

AGENDA FOR THE 5 - DAY WATER CARETAKERS' TRAINING

Day - 1

Morning Session

- 08:30AM – 09:00AM : Registration of participants.
- 09:00AM – 09:30AM : Participant's introduction and briefing on the logistics.
- 09:30AM – 09:45AM : Welcome and opening remarks.
- 09:45AM – 10:30AM : Programme and training objectives.
- 10:30AM – 11:00AM : Tea break and Group Photo
- 11:00AM – 12:00AM : Caretaker's roles and responsibilities, and its importance in the rural water scheme.
- 12:00AM – 01:00PM : Gender Equality, Disability and Social Inclusion (GEDSI) and Climate resilience.

Afternoon Session

- 01:00PM – 02:00PM : Lunch break
- 2:00PM – 03:30PM : Introductions on the water supply components (Mapping): Source protection (climate resilient), Functions (Float valve, Air Release Valve (ARV), Air vent after gate valve, Scour Valve (SCV), Break Pressure Tank (BPT) W/Wo Float valve etc.
- 03:30PM – 03:45PM : Tea break
- 03:45PM – 04:45PM : Introduction to tools & usages - item wise.
- 04:45PM – 05:00PM : Wrap-up of Day 1.

Day - 2

Morning Session

- 09.00AM – 09:15AM : Recap of Day 1
- 09:15AM – 09:30AM : Theory on different types of HDPE pipe sizes, pressure ratings and pipe joints (Strainer, Butt, T, Y, Reducer, Flange Set Adapter).
- 09.30AM – 10:30AM : Demonstration on different sizes of HDPE pipe cutting & joining.
- 10: 30AM – 10:45AM : Tea break
- 10: 45AM – 01:00PM : Practical training on different sizes of HDPE joints.

Afternoon Session

- 01:00PM – 02:00PM : Lunch break
- 02:00PM – 03:30PM : Continuation of practical training.
- 03:30PM – 03:45PM : Tea break
- 03:45PM – 04:45PM : Continuation of practical training.
- 04:45PM – 5:00PM : Wrap-up of Day 2

Day - 3

Morning Session

- 09.00AM – 09:15AM : Recap of Day 2.
- 09:15AM – 10:30AM : Theory and demonstration on different types of GI pipes, sizes, pressure ratings, fittings and joints (Brass Union and Flange Set).
- 10:30AM – 10:45AM : Tea break
- 10:45AM – 01:00PM : Practical training on different types of GI pipes and pipes fittings.

Afternoon Session

- 01:00PM – 02:00 PM : Lunch break
- 02:00PM – 03:30PM : Bibcock repair and washer change & continuation of the practical training on different types of GI pipes and CPVC/PPR pipes fittings.
- 03:30PM – 03:45PM : Tea break
- 03:45PM – 04:30PM : Practical session on climate resilient adaptation and solution (insulation of pipes etc)/nature-based solutions/GEDSI solutions.
- 04:30 PM – 05:00 PM : Planning for field visit and SW mapping usage and wrap-up of Day 3.

Day - 4

- 9:00 AM – 5:00PM : Field visit to the water scheme: Practical session on Operation and Maintenance (O&M) of RWSS components. (Use SW Map)

Day - 5

Morning Session

- 9.00 AM – 10.30 AM : Field visit: Experience and lessons learnt.
- 10: 30 AM – 10:45 AM : Tea Break
- 10:45 AM – 12:00 PM : Detailed mapping of the individual water scheme (Name of the water source, yield, pipe length, types, FCR/BPT, location, T/Y points/ elevation, tap points.
- 12:00 PM -1:00PM : Wastewater management /Rainwater harvesting / water storage provisions (24/7) individuals etc.

Afternoon Session

- 01:00 AM – 02: 00 PM : Lunch break
- 02: 00PM – 03: 30 PM : Development of the way forward action planning (using the Hazard analysis form)
- 03:30PM – 03: 45PM : Tea Break
- 03: 45M – 4:30 PM : WASH Business (products & services) sales and prospecting
- 04:30PM - 4:45PM : Feedback and Evaluation of the RWSS Caretaker Training
- 04:45PM – 05:00 PM : Closing

DAY - 1

(COURSE CONTENT)



DAY 1 : SESSION – 1

Activity

1

PARTICIPANTS REGISTRATION

Print registration form as the sample below.

Sl. No.	Name	Gender	Age	Village	Contact No.	Name of water scheme	Photo and video consent and Signature
1							
2							
3							
4							

The trainer must ensure to complete the registration form.

Activity

2

PARTICIPANTS' INTRODUCTION AND LOGISTICS BRIEFING

1. Ask the participants to introduce themselves (name, village, Gewog and any experiences of being a water caretaker in the past or present).
2. Ask the participants to share at least one thing they are proud of being a caretaker.
3. Inform the participants on the logistics arrangements made during the training: Food, accommodation, training duration and DSA, etc.

Activity

3

GROUND RULES

1. Inform the participants that they will make the ground rules to be observed during the training to make the training sessions effective.
2. Paste a chart paper on the wall.
3. Invite/ask the participants to make suggestions for 'Dos' and 'Don'ts' for the training, and seek consensus of the rest of the participants to have each point as a rule.
4. Write the 'Dos' and 'Don'ts' on the chart paper on the wall.
5. Invite suggestions for actions if the ground rules are violated, and note them.

Activity 4

WELCOME AND OPENING REMARKS

1. The trainer will make a brief remarks to welcome the participants and guests.
2. After welcome remarks, the trainer will provide a brief background of the training, including the duration and training sessions.
3. Invite the Chief Guest to make his/her opening remarks.
4. After the Chief Guest has finished his/her remarks, thank the Chief Guest for his remarks, and invite the Chief Guest and participants for a group photo.

Note: A suitable arrangement for a Group Photo must be made in advance, and while inviting the participants and guests for the group photo session, it is better to indicate where the group photo will be taken.

Activity 5

PROGRAMME AND TRAINING OBJECTIVES

1. The trainer shall ask a few questions to participants, such as:
 - (a) 'Who nominated you for the training?'
 - (b) 'Why do you think you have come for the training? How do you expect the training to benefit you or your community?'
2. The trainer shall, then, introduce the water caretaker training programme and its objectives to the participants.

Programme and training objectives:

In brief, share with the participants that at the end of the five-day training, they will be able to:

1. Define what or who is a water caretaker and its importance.
2. Learn about the aroles and responsibilities of a water caretaker.
3. Familiarise on the tools and components of a water scheme.
4. Learn about the standard procedures of pipe fittings/joining, and the minor repair works.
5. Learn the skills necessary to carry out the regular inspection, preventative maintenance, and report to WSP team/water user associations (WUA) for siscussion/further action.
6. Understand the basics of climate-resilient adaptative measures and nature-based solutions.
7. Identify the challenges faced by the marginalized groups in the community.

DAY 1 : SESSION – 2

Activity 1

CARETAKER'S ROLES AND RESPONSIBILITIES, AND THEIR IMPORTANCE IN THE RURAL WATER SUPPLY SCHEME

Activity objectives:

At the end of the session, the participants should be able to:

1. Mention the 4 main categories of roles and responsibilities of a water caretaker.
2. Appreciate the functions/roles of a water caretaker.
3. Mention 7 types of works a caretaker is supposed to carry out, and understand the difference between major and minor maintenance in this training course (Refer Annex).

Materials: (4 posters)

- 1.1 Pema Dorji (PD) cleaning stream intake and Ugyen Wangmo (UW) cleaning reservoir.
- 1.2 PD repairing HDPE pipe and UW repairing brass tap.
- 1.3 PD storing tools and materials and UW going to hardware shop (sanitary store).
- 1.4 PD and UW discuss with the WUAs/Gewog.

The trainer shall start the discussion on the roles and responsibilities of water caretakers by distributing the posters among the participants and give them a few minutes to take a good look at them.

Ask each of them, one by one, to stand up, come in front, show the poster to the other caretakers, and explain (or narrate the story in a lively way) what is on the poster. Clarify, or, if necessary, repeat so that all the caretakers have heard the explanation. (Remember repetition is important in the process of learning).

Activity:

- (Poster 1.1) This is Pema Dorji, he is a male caretaker and is living in the village in this house. Next to him is Ugyen Wangmo, she is a female caretaker. Both of them have been trained in the five-day caretakers' training and now they regularly look after their RWS schemes. Because of their roles and activities, the RWS scheme is working well and everyone in the village can collect water from a nearby tap stand. But, what is the work that Pema Dorji and Ugyen Wangmo are doing as Caretakers? Regular Inspection and cleaning of the RWS structures. In this training, you will learn how to clean the spring or stream intake, the reservoir tank and all the BPTs.
- (Poster 1.2) Minor repair. In this training, you will learn how to repair the pipes, replace valves, work with cement to repair a tank or tap stand and how to repair the fencing.
- (Poster 1.3) Storing the tools and materials. You will get a toolbox and the proper use of each of the tools will be demonstrated and exercised. This task also comprises of getting a good-quality spare parts from the market, if necessary, in co-ordination with the Gewog/BHU and the District engineers/technician.

- (Poster 1.4) Informing/discussing with WUAs/Gewog on the condition of the RWS Scheme. In this training, you will learn about: the different responsibilities of the caretaker and the maintenance committee members; the difference between minor and major repair and internal rules that you can have or make for your scheme.

All these tasks are your responsibility as the caretakers. You will learn about how to carry out and perform these tasks correctly in this 5-day training course.

TRAINER'S NOTE:

Introduction

A caretaker is somebody who pays close attention and looks after somebody or something (e.g. a house, a bridge, a school etc.). In this manual, we will be talking about a caretaker as a person who looks after a village water supply scheme. A caretaker can be compared to a babysitter. Just as a babysitter takes care of a baby at home, a caretaker takes care of the water supply scheme in a village. A village water supply scheme is the baby of a caretaker, which needs a close attention to keep it functioning every day. A caretaker can be a woman or a man.

Job of a caretaker

The job of a CT is at two levels:

A) Role in relation to technical work

- Regularly inspects the water supply network to identify areas that need maintenance/repairs.
- Identifies and carries out repairs which she/he is able to do.
- Identifies and handles the stock of spare parts needed for the smooth running of the scheme.
- Keeps a record of all repairs.
- Safekeep the toolbox with all the tools.
- Keeps a list of all tap points including the map of the water scheme.
- Supervises activities in the catchment area on behalf of the WUA.
- Monitors the water supply scheme together with the WUA.

B) Responsibilities to the Water User Association (WUAs)

The caretaker works for the community and is under the supervision of the WUA. Thus, she/he is expected to do the following:

- Takes instructions from the WUA.
- Participates in WUA meetings.
- Reports to WUA on his/her activities.
- Informs WUA when the community is required to participate in maintenance activities like cleaning of tanks or clearing of catchment areas. This information should be given on time to permit the WUA to mobilize the community.
- Reports to the WUA of lost, stolen, damaged or worn-out tools. It is left upto the WUA to decide to replace the tool.
- Submits to a check of stock by the WUA at any time.

Qualities of a good caretaker

To be able to properly take care of a village water supply, the caretaker must have these qualities:

- Have technical knowledge in repairs/maintenance of water supply structures and fittings.
- Be hardworking, punctual, and smart.

- Live in the village and be available.
- Know the importance of clean drinking water.
- Be a good communicator.
- Not be too money minded.
- Be trustworthy.
- Know how to plan and coordinate work.
- Be healthy and strong.
- Know how to read and write.

The importance of a caretaker

She/He is important for various reasons:

- If water is life, then a caretaker contributes to enhancing life. She/he works hard to ensure a continuous flow of clean drinking water.
- Without a caretaker, repairs become costly and cannot be carried out quickly since a technician must come from outside the village.
- Without a caretaker, there will be nobody to technically guide and coordinate the community works on the village water supply scheme.

Summary

From this lesson, it is evident that the success of a water supply in the village will depend much on a caretaker. His/her importance cannot be underestimated. It is the caretaker who does or reports on the conditions and status of a rural water supply scheme so that all maintenance or repairs can be done effectively on time. She/he is, however, functions under the direct supervision of the WUA.

Activity 2

GENDER EQUALITY, DISABILITY AND SOCIAL INCLUSION (GEDSI)

Activity Objectives:

By the end of the activity, the participants should be able to:

1. Understand the challenges faced by women and person with disabilities during water shortage.
2. Provide timely support and facilitate access to safe drinking water and WASH facilities for vulnerable households.
3. Encourage the participation of women as water caretakers.

Materials: Refer pictures in the annexure (supported household including PWD and unsupported household including PWD and vulnerable groups).

The trainer(s) should lead the group work with the following questions:

1. 'Where is your water tap? Who performs the task of collecting the water and filling the storage buckets?' If the response is both – 'who does it most of the time?'
2. 'Do you store water in the toilet, and for cooking and washing? Who ensures that water is always available?'
3. 'Are there any households in your community that are impacted by the water shortage?'
4. 'Who are the most impacted?'

At the end of the group discussion, the trainer can show the pictures and ask the question below:

5. 'What is the difference between the two pictures? As a caretaker, how do you see yourself playing the role of ensuring that no one is left behind and support in minimising the impact?'

FACILITATORS NOTE

Women and girls, including the care givers of the persons with disabilities, often bear the primary responsibility for water collection and management. Yet, they, along with the persons with disabilities, are frequently underrepresented in the decision-making roles. Incorporating women and the persons with disabilities into these roles helps address gender and accessibility disparities, ensuring that the water management systems are both inclusive and equitable.

Women possess invaluable knowledge about water needs and face specific challenges related to water that may be inadequately addressed if not incorporated into the training, policies and guidelines. By empowering women and girls through the targeted water caretaker trainings, we can enhance their skills and create greater access to economic resources and opportunities. For instance, the female water technicians are rare, and the targeted awareness and training initiatives can help increase their numbers, leading to more diverse and effective water management solutions.

Moreover, an increased awareness and trainings are only effective if women and the persons with disabilities are actively encouraged to participate in decision-making meetings. Failing to seek their perspectives and include their voices in discussions means that decisions may lack comprehensiveness and fail to address all community needs. Therefore, the active participation of women, persons with disabilities, and their caregivers in the training and decision-making processes is crucial for creating well-rounded and effective water management plans and programs.

Activity 3

CLIMATE RESILIENCE

Activity objectives:

At the end of the activity, participants will should be able to:

1. State at least 3 different climate hazards impacting their water supply.
2. Identify climate-resilient adaption and mitigation measures.
3. Recognise the heterogeneity of groups (including the women, children, elderly people, persons with disabilities, etc) in the community.
4. Identify households in the community that may be disadvantaged, marginalized or vulnerable.

Materials: Animation video on springshed/sources by Tarayna Foundation, PPT, pictures of freezing water source and tap stands, and landslides washing away of water pipelines.

The trainers should show posters of freezing water source/tap stands, landslides and washing away of water pipeline.

The trainer should ask the following questions based on the activity to generate discussion and identify local nature-based solutions:

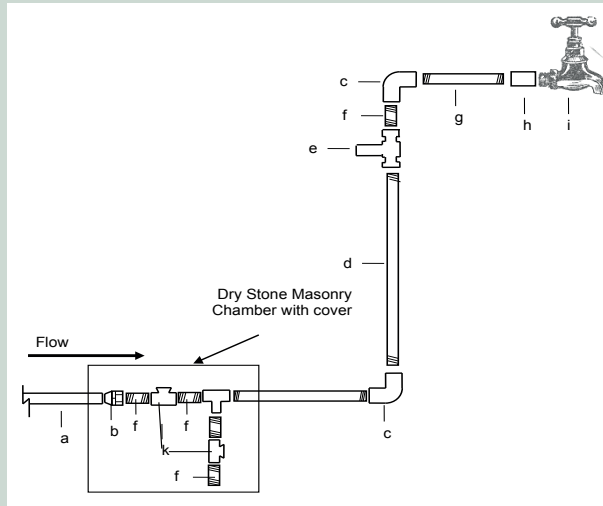
1. 'What did you see in the picture?'
2. 'Do these events happen in your community?'
3. 'What would happen if these events occur to your water scheme?'

Climate-resilient adaptation and nature-based solutions

The trainer should share on the following:

1. Burial of pipes to avoid freezing, and protection against fire, sun and wild animals -
 - a) HDPE pipes should be buried at least 2 feet underground. A depth of 3 feet is recommended in extreme cold climatic conditions and cultivated fields.
 - b) If HDPE pipes are exposed in unavoidable cases such as hard bedrocks, it is recommended for pipe bedding.
 - c) For the pipes exposed over a cliff, it is recommended to insulate with the locally available materials (jute, old cloths, etc) and plaster with cement mortar (CM 1:4) over the insulated pipes.
2. Climate-resilient structures -
 - a) Construct catchment infrastructure intake to protect from the high and low levels water flow, and to maintain continuous water flow downstream and avoid water hammering.
 - b) Explore and identify alternative water sources. Promote storage (supply should last atleast for 48 hours) at the household level incase of water source/pipeline disruptions.
3. Source conservation –
 - a) Show the video on springshed management (identify the local/nature-based solutions).
 - b) It is always advised to have native trees planted at the source.
 - c) Trenching above the source (nature-based solution) helps water recharge, avoid surface run-off and promote biodiversity.
 - d) In consultation and support from the Local Governemnt and other relevant authorities, carry out the potential recharge mapping. Accordingly,protect and avoid cutting trees around the catchment areas and surroundings.
4. Promote safe water storage at the household levels –
5. Encourage the practice of rainwater harvesting at the household levels -
6. Adopt antifreezing solutions at tap stand, such as –
 - a) Installation of drain-out fittings at the base of the tapstand to drain out the stored water in the tapstand pipe. It should be practiced every evening during the freezing season.

See example of taps and fittings with anti-freezing system shown in the diagram below:



FITTINGS REQUIRED
½"/20 mm Brass Union
½" GI Pipe, 120 cm long
½" GI Elbow
½" GI Pipe, 130 cm long
½" Brass Regulating valve
½" GI Nipple
½" GI Elbow
½" GI Pipe, 45 cm long
½" Socket
½" Brass Tap
½" Globe Valve
½" Equal Tee

- b) Insulate exposed pipes with locally available materials (old cloths, sacks, jute);
- c) Install climate resilient pipes such as PPR.

DAY 1: SESSION – 3

Activity 1

Introductions on the water supply components (Mapping)

All the caretakers may not be familiar with the different components of the RWS schemes they maintain. And, if the caretaker is not familiar with all the water supply components, the scheme may eventually go out of order, resulting in a water problem for the beneficiaries.

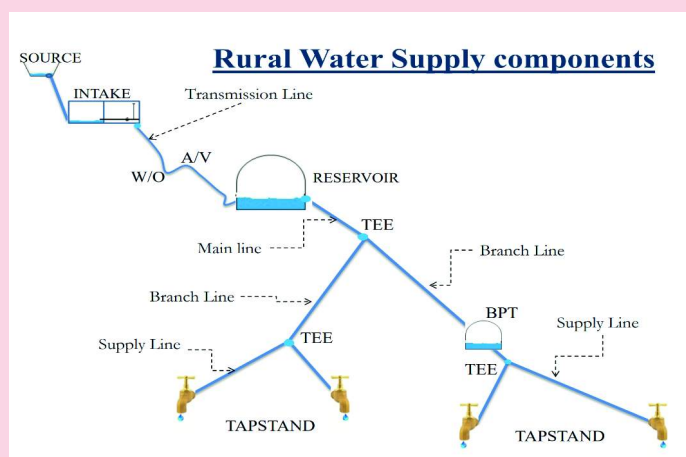
Activity objectives:

At the end of the session, participants should be able to:

1. Map their water scheme.
2. Identify and mention the different RWS components of the scheme.
3. Name, and identify the fittings and functions of RWSS components.
4. Mention the regular maintenance task they must carry out for each component.

Materials required:

1. Chart paper, marker pen, cello/masking tape, pencil and eraser.
2. Pictures of the RWS components (on flip charts) such as: Float valve and regulating valve, Air Release Valve (ARV), intake, FCR, Break Pressure Tank (BPT) with and without Float valve, tap stand, Air vent after gate valve and Scour Valve (SCV).



Activity: Mapping of water scheme and its components

Break the participants into groups and ask the groups to draw water scheme mapping. Let each group explain the water scheme map they have drawn, and each component from the source till the consumer point.

After the participants have finished explaining their water scheme map and its components, the facilitator will ensure to make the participants discuss and understand the different structures in a rural water supply scheme. Each structure has its own function, and each structure needs its own maintenance.

Discuss one by one as follows, each structure and its Five important points, that as a caretaker must remember when checking the scheme:

- A. Spring intake** (Spring intake + Collection tank): Ask what they see and understand. Explain that this is a spring protection intake. Explain its function. “In order to avoid pollution of the water or damage of the structure by animals and humans, it should be made inaccessible with shrubs or barbed wire.”

Mention and point out on the poster the 5 important points for spring protection intake:

- Fencing or shrubs, which make the spring inaccessible.
- No grazing of animals or cutting of trees.
- The surroundings must be clean.
- Repair of leaks.
- Maintain the surface drain above the spring.

Let the participants repeat these five important points and count the points so that it is clear that there are five points to remember.

- B. Collection Tank** (Spring intake + Collection tank): Ask the participants what they see and understand. Explain that this is a collection tank. Explain where it is and its function. “It is found after an old design stream intake. If several sources join, it is also found at the point of joining, as in this poster. It collects the water and brings it in the pipe.”

The five importance points to check for at the collection tank are, whether:

- the fencing is maintained;
- the strainer is in place and if it is clean;
- the surrounding is clean;
- the inner side of the collection chamber (including strainer) is clean;
- the leakages are repaired, or need repair.

Ask the participants to recall those five points.

- C. Stream intake:** Ask what they see and understand. Explain that this is a stream intake. Explain its function. “In order to avoid pollution or destruction by animals and people, it should be well fenced to make it inaccessible.”

Mention and point out the following five important points to check for at the stream intake:

- the fencing around the stream intake and channel is maintained and slab covered.
- there is no grazing or cutting of trees.
- the surrounding is clean.
- the channel and perforated plate (or screen and gravel box if present) is cleaned.
- the channel well covered with slabs.

Let the participants repeat these five points and do not forget to count them. Ask them who of the caretakers has a spring and who has a stream as their water source. Some also might not know it but maybe you or the plumber does.

- D. Reservoir with valve box:** Ask the participants what they see and understand. Explain that this is a reservoir with valve box. A reservoir is different from a BPT in the following ways: it is always much bigger, it has a manhole at the side (not on top), and

it has a stone-masonry valve box with concrete slab. Explain its function (it fills at night with water, which is used during the next day, like a container). It is not a bathtub for washing or bathing!

The five important points to check for at the reservoir are:

- Whether the fencing is maintained;
- Check the valves to ensure all leakages are repaired;
- Plastering is intact;
- It is clean inside and strainer is present;
- Clean surroundings.

Let the participants repeat those five points and count the points.

- E. Break pressure tank (BPT) with valve box:** Ask the participants what they see and understand. Explain that this is a BPT with a valve box. A BPT is smaller than a reservoir, has a manhole in the middle and has no masonry valve box but GI valve box. Explain its function (Ask the question: “In a two storied house, is the wall on the first floor thick or on the second floor? Why?” Answer: The down wall has to be bigger, because there is something on top. Likewise, there is more pressure down in the pipe. When it becomes too much the pipe would break. The BPT reduces the pressure.

Show a real sample of a float valve. Explain: “When the BPT is nearly full, this valve should stop the water from coming in. Even if there is a problem with the BPT or this float valve, it should not be bypassed, because the pipe below may burst due to high pressure.”

The five important points to remember for the BPT are:

- Fencing;
- Float valve stops the flow when BPT is full;
- Other valves are working (repair leaks);
- Clean inside and strainer clean and in place;
- Plaster is intact.

Ask the participants to repeat the five points. Also, ask why not to bypass a BPT when the float valve is broken.

- E. Show a real piece of HDP and GI pipeline:** Ask what this is. Explain that GI is used when the pipe cannot be buried and needs to be supported well. HDPE pipe must be buried preferably two feet deep and covered with soil or sand. However, do not cover it with big and sharp stones to prevent it from damage.

The five important points for the pipe line are:

- HDPE pipe is buried;
- HDPE repair is done by welding with heating plate;
- GI pipe is well supported or buried;
- GI repair is done by fitting with sockets and unions;
- Detect blockage (session will come).

Let the participants repeat those five points.

- G. Tap-stand with a control valve:** Ask the participants what they see and understand. Explain the function of the control valve: “If the flow to one tap is too big, the washer

spoils fast. It should be controlled by using this valve. Also, if some tap stands have insufficient water and others have more, then, the flow to tap stands with more water should be reduced. Regularly open the valve boxes and grease the thread. If you do not do that for a long time, it will rust and you can never open it again.”

“Good drainage away from the tap-stand is important. If there is a dirty pool of water near the tap, there will be many flies and mosquitoes, which can cause diseases.”

Important points for the tap-stand:

- Check the drainage pipe: No stagnant water near the tap;
- Bibcock is not leaking;
- Control valve adjusted to have the correct flow;
- Grease the GI cap of the valve box;
- Platform well supported on all sides, and no erosion.

Let the participants repeat those five points for the tap-stand.



This is the first time that the caretakers hear about this, so they will not remember all 5 points immediately. You will repeat this several times with them so that at the end of the training all caretakers can mention the five points for all the different structures.

Go back to the water scheme map and ask the participants again what she/he remembers from the map (Type of structure, functions, and the five important points to remember?). Be happy and satisfied if they can remember 1 or 2 of the five important points.

DAY 1: SESSION – 4

Activity 1

INTRODUCTION TO THE TOOLS & THEIR USAGES

Activity objectives:

At the end of the session, the participants can:

1. Mention or describe the tools needed for HDPE, GI, and CPVC/PPR joining.
2. Demonstrate the correct use of the following tools (e.g Wrenches, Hacksaw with blade, Heating plate and Teflon cover, etc).

Materials required:

Tool box set.

The trainer will show the tools, explain them and demonstrate their functions along with their components (eg. Air vent after gate valve, Heating plate, pipe wrench and sliding wrench, etc).

Introduction to the activity

Most of the pipes in the scheme are made of HDPE. Pipes can leak and therefore it is important to know how you can repair the pipes when they are broken or leaking. Say that you now will show the tools needed for HDPE pipe joining, one by one. Then show clearly all the tools and mention their names. Do not yet explain the details of the tools because that is the next part. Explain to the participants the objective of this demonstration. You will demonstrate the use of two important tools for the fitting of GI-pipes. Demonstration on fitting the GI-pipes will be made later.

- **Hacksaw frame and blade:** This is a hacksaw frame, and this is a hacksaw blade, they are to cut the pipes. The teeth of the hacksaw blade should face away from your body because it is easier to push than to pull. Finally, ask questions like: ‘In which direction should the teeth of the saw blade point? What are the three causes for the saw blade to break?’
- **Heating Plate and Teflon Cover:** This is a heating plate and this is a Teflon cover, they are to join pipes together. The function of the heating plate is to heat the HDPE pipe so that the pipes can be joined together. The function of the Teflon cover is to cover the heating plate so that the HDP pipe does not stick to the heating plate. The Teflon cover should be placed only after heating and must be clean with no sand, grease or dust on it.

While heating the heating plate, it is important for both sides to become equally hot. The heating plate should not be either too hot or cold to join pipes. To test the correct temperature, we use Thermochrome chalk, show the Thermochrome chalk.

- **Thermochrome Chalk:** Its function is to check the temperature of the heating plate. Show the chalk to all. Explain the method of testing by counting. While counting ...One, ...Two, ...Three, the blue colour should change to grey-white. If the heating plate is too cold the

blue colour will not change to grey-white, and we must heat it longer. If it is too hot, the blue colour changes immediately and burns. We can cool it by waiting or by rubbing it over the grass.

- **Half round Files and Knife:** A file or knife is used to make the cut surface of the HDPE pipe smooth and clean. The ends of two pipes that you want to join should fit exactly to each other, without any gaps. Explain and show that the half round file is for the inside of the pipe. The file will work only in one way in the push direction like the hacksaw.
- **Sliding wrench:** Show the sliding wrench. Explain and show that it is used to tighten the nuts and bolts of the manhole covers or the flange-set, etc. Tell and show that it is used also to fit small globe-valves, gate-valves, air-release valves, brass unions, and bibcock. The sliding wrench grips if there are flat sides. The sliding wrench cannot be used on GI pipes because the sliding wrench has no teeth to grip, and the pipe has no flat sides. Thus, the sliding wrench will always slip.

Show how the opening of the sliding wrench can be made smaller and bigger by turning the wheel in the middle. Explain that turning the wheel in one direction will open the wrench and that turning the wheel in the other direction will close the wrench. Explain that there should be no free space between the nut and the wrench. Free space would easily spoil the nut.

- **Pipe Wrench:** Show the pipe wrench and explain that it is used to hold the GI pipe or to hold the nuts and brass valves with the teeth that are too large for the sliding wrench. Get a piece of pipe and adjust the opening to the correct size. Then show how you must assist the wrench in gripping the pipe. Push the wrench with your thumb over the pipe. Explain to position the two wrenches opposite to tighten the socket on to the pipe.

DAY 2

(COURSE CONTENT)



DAY 2 : SESSION –1

Activity 1

DIFFERENT TYPES OF HDPE PIPE SIZES, PRESSURE RATING AND PIPE JOINTS

Activity Objectives:

At the end of the session, the participants can:

1. Mention or describe the different types of HDPE pipe sizes, length and their pressure ratings.
2. Tell different types of pipe joints and their functions.

Time: 30 minutes

Materials:

HDPE Pipe (different sizes): Have all the different sizes of HDPE pipes ready for demonstration.

Standard Pipe Size in Rural Water Supply Scheme (RWSS)

The facilitator will explain to the participants on the different types and standards of pipes used under the RWSS.

Most of the pipes used in the RWSS scheme are made of High Density Polyethylene (HDPE).

There are different sizes of HDPE with different working pressure (PN).

Internal Diameter (ID)	HDPE pipe	Working Pressure (kg/cm ²) or PN
15	20mm	12.5,16 & 20
18.9	25mm	12.5 & 16
24	32mm	8, 10, 12.5 & 16
33.7	40mm	8, 10, 12.5 & 16
42.2	50mm	6,8, 10, 12.5 & 16
53.4	63mm	6,8, 10, 12.5 & 16
76.3	90mm	6,8, 10, 12.5 & 16




The PN (Kg per CM²) in HDPE pipes stands for Nominal Pressure. It is a term used to describe the maximum pressure that the pipe can withstand without failure at a specified temperature range. For example, PN 16 pipe means the pipe can withstand a pressure of 16 bar (or 160 mts vertical height) without failure.



The higher the PN value, thicker the pipe, the greater the pressure the pipe can withstand.

Activity 2

HDPE JOINTS AND FUNCTIONS

Explain to the participants the different types of joints and their functions as described below.

Types of Joints		Use/Functions
Butt Joint		Butt joint is used for connecting two straight HDPE pipes. It is a method of joining the pipe ends. Butt welding is the most common type of welding process used to join the HDPE pipes. The process involves the joining of two flat surfaces against each other by way of heating.
L Joint		Used to join two HDPE pipe in an L shape or 90 degree angle.
Tee Joint		Used to change the direction of the discharge water flow from the main line to the branch line where three HDPE pipes are joined together. The Tee's ends are of the same size.
Y Joint		It facilitates smooth water flow from the mainline to the distribution/or supply line. Generally, the angle between the two branches should be maintained below 45 degrees for the smooth water flow. It is usually used on slopy areas.
Reducer		A reducer is a fitting that changes the pipe from a larger to a smaller size. A reducer allows for a change in pipe size to meet the flow requirements or to adapt to existing piping. <i>Note: During fabrication, the reducers are fabricated from a smaller pipe to make into a bigger diameter.</i>

<p>Flange Set Adapter</p>		<p>A flange set is used to connect two pipes together either HDPE to GI. The use of flange set allows easy maintenance and repair of the pipe system. <i>Note: The flange adapter can be fabricated on site using HDPE pipe (63mm and above pipe size)</i></p>
<p>Strainer</p>		<p>Strainer removes the contaminants from small to large debris and are used for filtration process. Strainer serves as pre-filters, removing the particles/debris from the water before they make their way to the transmission and distribution supply lines to prevent blockage in the water pipes. They are placed in the components (outlet of the intakes, reservoirs and BPTs).</p>

DAY 2 : SESSION – 2

Activity 1

DEMONSTRATION ON DIFFERENT TYPES OF HDPE JOINING AND MAKING A HDPE STRAINER

Activity Objectives:

At the end of the demonstration, the participants will be able to:

1. Know the complete procedure for making different types of HDPE joints;
2. Mention the steps in the right order for welding the HDPE pipes together;
3. Have observed the process of making a strainer.

Time: 30 minutes

Materials: Hacksaw and blades, knife and file, heating plates with Teflon cover, Thermo-chrome chalk, HDPE pipe of different sizes, fire to heat the heating plates and 6mm MS rod or 6 inch nail.

Preparation:

- Have a fire set to heat the heating plate.
- Have heating plates ready.
- Have all the required tools and materials ready for the demonstration.

Remember:

Arrange all the participants in a way they can see what you are doing during the demonstration.

Introduction

- Inform that you/the trainer will demonstrate how to join HDPE pipe using the heating plate. Ensure that the heating plate is heated to the required temperature. This could be checked by using the Thermo-chrome.

Step 1: Prepare the pipes

- First, cut the HDPE pipe into two pieces. Place the pipe on a proper support while cutting it. Explain the importance of the need to cut it straight. Show the rough sides of the pipe and explain that all the loose parts of both inside and outside must be removed with a file or a knife.
- Remove the rough parts and demonstrate how to test whether the pieces fit together or not. Put the two pieces together and hold against the light to see the spaces between the pipes. When they do not fit, continue with the file or knife. Do Not touch the cut ends with greasy or dirty fingers. Ensure that the pipe joining ends are dry and free from moisture.

Step 2: Check the temperature of the heating plate

- Take the heating plate and show how the Thermochrome reacts on the cold/unheated plate.
- Take the heating plate with the correct temperature and show again what happens. Count 1....,2....,3, and show the changed colour from grey-white. Repeat this for a few times so that all participants will have seen the change in colour. (Remember that a small amount of chalk is enough. If you put too much now, they will put too much later). Place the heating plate back into the fire.
- Lastly, take the hot heating plate and show again the change in colour that is now taking place in only one count. Make sure that all participants have seen from nearby. It is necessary to repeat this a few times.

Step 3: Actual welding of the pipes

- Take the heating plate with the correct temperature and check the temperature once again before putting it in the Teflon cover. Place the Teflon cover with the help of an assistant over the heating plate. Do it in the same way as you showed before. Be careful, the plate is hot!
- Squat and hold the heating plate in the front, with the other trainer pressing the two pieces of the pipe against the heating plate. Explain that when you see the two small, melted rings (approximately 3mm) at both ends of the pipe, it means that the pipe is correctly melted and ready for bringing the two pieces together. It should be melted all around uniformly.
- Bring the two pieces immediately together in ONE action and press them firmly together. Continue pressing while counting loud and clear till ten (10). Do not twist the pipes! After counting to ten you can stop pressing and let the joint pipe slowly cool down. Cooling down takes a few minutes.
- Place heating plate back into the fire.

Repetition by two volunteers

- Ask two volunteers to repeat the demonstration. Repeat all the steps right from the beginning. So, start with Step 1: cutting and preparing the pipe.
- Before each step, ask the participants what they will do next. If they do not know the answer, ask the other participants to give the answer, If the right answer does not come, give the answer yourself. Always clearly repeat the answers of the volunteers for clear information to the other caretakers.
- At the end, compliment the caretakers with their first HDPE joining. Tell everyone that they will soon practice this themselves, with the tools provided.

Activity 2

REPEAT THE DEMONSTRATION TO MAKE HDPE BEND, TEE'S, Y-JOINTS AND REDUCERS

Activity Objectives

At the end of this demonstration, the caretakers:

1. Will have seen how to make HDP bend, Tee, Y, and reducer.
2. Can mention the steps in the correct order to make HDP bend, Tee, Y, and reducer.

Time: 30 minutes

Materials: Hacksaw, File/knife, Heating plate, Teflon cover, Thermochrome chalk, Fire to heat the heating plate, HDP pipes of both the small and large diameter.

Introduction

- Explain the objective of this demonstration session. Arrange the participants in such a way that all can see clearly what you will demonstrate.
- Explain that they will need the HDP bend only on a rare case. However, a bend is also the beginning for making a Y or a Tee. The function of a Y or TEE is to supply water in two directions.

Making a Bend (5 minutes)

- Cut with a helper the 40mm pipe under 45° angle. Show how the 90° corner of the toolbox can be used to make a good 45° angle. Alternatively, use the frame box (see below picture) for cutting the pipes.
- Ask the participants if they remember what to do next before the welding can be done. Answer: Remove the burrs with the use of the knife or file and clean the pipe. This is the same thing that is done to make a straight joint. Remove the burrs clearly in front of the caretakers.
- Check the temperature of the heating plate, count till 3 and show that the colour of the Thermochrome changes. Put the Teflon cover over the plate. Do the actual welding together with your helper. (Remember to count loud and clear till ten before releasing the pressure.) How long should we wait before the joint is cooled down? Yes, at least five minutes.

Making a TEE (5 minutes)

- Explain the cutting required to make a Tee. Show again how to get a nice 90° angle by using the corner of a toolbox. Do the cutting and remove the burrs inside and outside with a knife or a file. Explain that the outside of the welded pipe should not be cut flat.
- Ask the participants what to do next. Correct! We must check the temperature of the heating plate before putting the Teflon cover and making the welding. Do not forget to count again.

Making a Y joint (5 minutes)

- Explain the cutting required to make a Y-joint. Do the cutting and remove the burrs inside and outside with a knife or file.

- Check if the two parts fit together by holding it against the light.
- Repeat all the steps and make a Y joint. Explain that the outside of the welded pipe should not be cut flat.

Making a Reducer (5 minutes)

- Show a reducer and ask: Do you remember what is this called? Then: What is the function of it?
- Explain the use of a reducer and how to make a reducer. First, demonstrate without heating the pipe to show that nothing happens.
- Explain that it is important to constantly rotate the HDPE pipe in the fire or flame for equal heating. After cooling, the end should be cut off to make it fit to the larger size pipe.

Activity 3

PRACTICAL TRAINING ON DIFFERENT TYPES OF HDPE JOINING (TEE'S & YEE'S AND REDUCER)

Objectives

At the end of this practical activity, all the participants should have made at least:

1. 3 small diameter 90° Bends, of which at least one is acceptable;
2. 3 small diameter TEE's, of which at least one is acceptable;
3. 2 small diameter Y joints, of which at least one is acceptable;
4. 2 large diameter TEE's, of which at least one is acceptable;
5. 2 reducers, of which at least one is acceptable.

Time: 4 hrs

Materials: Tin and Matchbox(to make fire), smaller and larger diameter HDPE pipes, and tool boxes.

Preparation:

- Cut the pipe (2 meters-20mm or 25 mm) and distribute to the participants before the practical activity starts.
- Have the fire ready in an empty can/tin to heat heating plates. This will save time and give more opportunity for practice by the participants. This means that one of the training helpers should make fires during the demonstration.
- Ask the participants to bring their toolboxes.

Activity:

- 1) Group the participants in pairs (possibly with a mix of gender) to learn about Pipe preparation, checking of temperature and actual welding;

- 2) First, ask the participants to make two pieces of small diameter of pipe ready for the straight joint. (cut with hacksaw and clean with the file or knife);
- 3) Participants can join the pipes only after the trainer(s) have checked the pipes and the way it was cut. After welding, check the joints by inspecting and provide feedback to the participants. Check the strength of the joint by bending. Continue with the cutting and welding of the pipe with small diameter. Give enough time for practice.
- 4) After the participants have learned to join the bigger diameters comfortably, ask them to make two pieces of small diameter of pipe ready for the 90° bend (cut the pipe under 45° with hacksaw and clean with the file or knife). Use the corner of a toolbox to get the right angle. Alternatively, try using the Frame box (as shown in the diagram).
- 5) Go around and assist the participants. Also, get help of the experienced participants.
- 6) The caretakers can join the pipes only after the trainers have checked the pipes and the way it was cut. After welding check the joints by inspection and give feedback to the caretakers. Check the strength of the joint by bending but do this only after the pipe is completely cooled.
- 7) Continue with cutting and welding to make the small diameter bends followed by TEE's and Y-joints to get enough practice.
- 8) Having made at least 5 TEE's or Y-joints of small diameter, the participants can try for the big diameter, which is more difficult.

Remember: *Go around and help the participants. If there are female participants, encourage them by giving examples and best practices of women engagement in other parts of the country. Giving help and feedback is the most important task of a trainer. For this part of the practical session, also get the help of the experienced plumbers.*

It is not the time to relax and disappear from the site. Give time to the caretakers to experiment the lessons. Allow them to make small mistakes and then correct them in a friendly way. DO NOT take it over from them. They are the learners.

Diagram: Use of alternative frame box to cut pipes

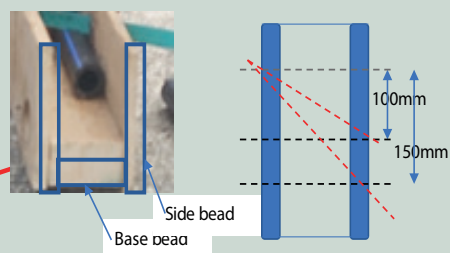
HDPE Pipe cutting frame box (L and T-joints and Y-joints for all pipe sizes)

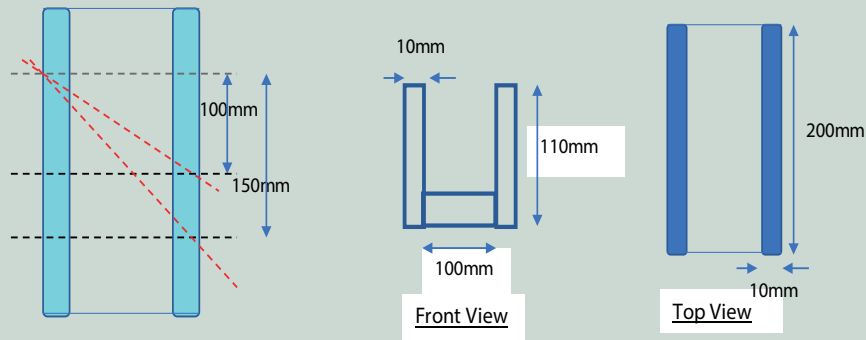


Material required: wooden bead

Base bead: 100mm x 10mm x 200mm = 1no.

Side bead: 110mm x 5mm x 200mm = 2no.





Step by Step process to make the Joints.

HDPE 90° bend

- Cut two pipes of equal diameter
- Cut diagonally from half the diameter of two pipes end only on one side pipe piece on both sides.
- Weld together to form a sharp 90° turn.

HDPE Equal Tee

- Cut three pipes of equal diameter.
- Cut diagonally from half the diameter of three pipes end only on one side.
- Weld two pipes together to form a sharp 90° turn.
- Now cut diagonal about a diameter of pipe from the end point of 90° bend
- Weld bend with the left over pipe to form a T-shape bend.

HDPE Unequal Tee

- Cut three short pieces of equal diameter and a short piece of small diameter pipe.
- Fabricate an equal tee from three equal diameter pipes.
- Fabricate a reducer from a small diameter pipe.
- Weld Reducer to one of the piece end of Tee to fabricate HDPE Unequal Tee.

MAKING A STRAINER

HDPE Y-joint

- Cut three pipes of equal diameter.
- Cut diagonally at a distance of one and half the diameter of the two pipes. Cut at one end only.
- Weld two pipes together to form a sharp 67 ½ degree.
- Now cut vertically about a diameter of pipe from the end point of 67 ½° joint .
- Weld 67 ½° joint with the left over pipe to form a Y-shape joint.

HDPE Cross

- Cut four pipes of equal diameter.
- Cut diagonally from half the diameter of two pipes end only on one side.
- Weld two pipes together to form a sharp 90° turn.
- Now cut diagonal about a diameter of pipe from the end point of 90° bend.
- Repeat same procedure to produce another 90° bend.
- Join these two bends to form 90° Cross.

HDPE Reducer

- Cut a short length of smaller pipe diameter that has to be joined with bigger diameter.
- Heat the smaller pipe by rotating the end of pipe over the fire.
- Remove from the fire when the pipe end size increases. To make the desired size, use an inch's size of smooth stick and rub slowly against the inside wall surface of the pipe. Leave to cool the job piece for a minute or two.
- Cut the end surface of enlarged pipe to smooth and equal to larger pipe to join.

HDPE Flange Adapter

- Cut a short piece of pipe to equal diameter of attached flange adapter.
- Heat the end pipe by rotating the end of pipe over the fire.
- Remove from the fire when the pipe end heated. Uses an inch size smooth stick flatten out slowly pressing down at 20cm from inside wall surface of the pipe.
- Now stand the flattened HDPE pipe on a flat surface, GI flange disc is inserted from the cool end of HDPE pipe and press over the flattened pipe. Left to cool the job piece for a minute or two.
- HDPE Flange Adapter is ready for butt welding with HDPE pipe.

Tell the participants that you will now explain and demonstrate how to make a strainer.

Ask one of the participants if they could remember the function of a strainer from the previous sessions and where it can be found?

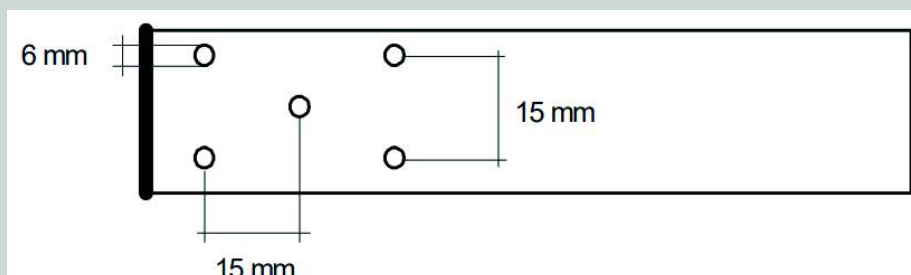
Explain to the participants the sizes of the HDPE Strainers required as per the GI pipe outlets and the number of holes as per the diameter of the hole. Refer the table below to explain.

Demonstrate how to make holes in the HDPE pipe with a big hot nail or better with a hot piece of MS-Steel rod. Preferably, it should not be bigger than 6 or 8 mm. Explain that enough holes should be made to get sufficient water to the reservoir. See the Table below for number of holes.

HDPE strainer size as per the GI pipe outlet, number of holes needed in a HDPE Strainer and the required gap between the holes.

GI pipe outlet (inches)	HDPE Strainer size (mm)	Length (cm) to cut	Number of holes required (Nos.)	Gap between the holes	Diameter of the hole
1	32	25+5	40	15mm	6mm - 8mm
1 ½	50	35+5	100		
2	63	50+5	160		
3	90	55+5	325		

Figure. Diameter of hole and gap between the holes of the strainer.



Remove all the inner and outer burrs from the stainer with the file and or knife.

Finally, show how to close the top of the strainer with a piece of HDPE. Remind them that the closing of the top of the stainer should be done only after cleaning the burrs.

Note:

It is important to explain its function and repeat about the number of holes and removing the burrs on the inside and outside. The last step is to close the top after removing all burrs.

DAY - 3

(COURSE CONTENT)



DAY 3 : SESSION – 1

Activity

1

DIFFERENT TYPES OF GI PIPES, SIZES AND FITTINGS

Activity objectives:

At the end of the session, the participants would be able to mention the:

1. Types of GI pipe sizes and the types of fittings used.
2. The steps in GI pipe fittings.

Time: 30 minutes

Materials: Hemp/jute, compound, or thread seal tape, GI-pipe, elbow, socket, Tee, union and tools.

Preparation:

- Keep the GI pipes and fittings ready.
- Check the threads of pipes and fittings for smooth running. If necessary, clean them before the demonstration.

Activity:

Show the type of GI pipe sizes that are available and explain their working pressure and its functions.

Internal Diameter (ID)	GI pipe (Medium duty)	Working Pressure (kg/cm ²)
100mm	4"	14.1 - 21.1
80mm	3"	14.1 - 21.1
50mm	2"	14.1 - 21.1
40mm	1½"	14.1 - 21.1
25mm	1"	14.1 - 21.1
15mm	½"	14.1 - 21.1

Show one by one the following fittings, and mention the names of the different types of fittings (such as Socket, Tee, Elbow and GI-Union). Explain their uses and functions.

Activity 2

DEMONSTRATION ON DIFFERENT TYPES OF GI PIPE, SIZES, AND FITTINGS

GI Pipe and Socket

Prepare a threaded pipe. In case the threaded pipe is not available or if it is mismatching with the site requirement, you are advised to seek assistance from the Gewog/Dzongkhag.

The trainer(s) will demonstrate the following steps, while clearly explaining the correct way of fitting GI pipe and Socket:

- Clean the thread of pipe and socket using a brush or jute;
- Screw the two parts together to check if they fit well and then unscrew them again;
- Take the correct amount of jute and wind it around the threaded pipe;
- Place the jute and explain the correct direction (clockwise direction) of winding it on the thread;
- Put sufficient pipe joining compound uniformly over the jute;
- Screw together with the pipe wrench;
- Tie the fittings with 2 pipe wrenches and stress about the correct direction of the wrenches.

Ask any two participants to come forward and fit the two pieces together:

- First, ask them to unscrew the pieces;
- Ask the participants to repeat the steps to join the fittings. Firstly, they should explain the step by steps of fittings.

Finally ensure to close the compound container to avoid drying.

GI Union

Show the union and two pieces of pipe. Then, the trainer will demonstrate the following steps:

- Fit the complete union as one piece to the GI pipe;
- Open the union using a pipe wrench;
- Show the washer inside and explain the importance as water seal;
- Fit the other side of the union to the pipe (remember to put the collar ring first over the GI-pipe and mention this);
- Place the washer on one side;
- Close the collar ring, using the pipe wrench. Tight only slightly and do not use a hemp!

DAY 3: SESSION – 2

Activity

1

PRACTICAL GI PIPE FITTING AND GI UNION

Activity Objectives:

At the end of the session the participants should be able to:

1. Demonstrate the correct use of the tools used for GI fitting;
2. Show in the right order of the steps in fitting GI pipe and Socket or other fittings together;
3. Show how to open, close and fit a GI Union to GI pipe.

Time: 60 minutes

Materials: Toolbox, pieces of GI pipe, sockets, unions, elbows, hemp and compound.

Activity:

After the demonstrations on GI pipe, tools and GI fitting, the participants need to practice on how to do it.

- 1) Divide the participants in groups of three to four, and give one toolbox per group.
- 2) Give the materials (GI-pipe and fittings), and ask them to carefully follow all the steps to fit the pipe and fittings together. **USE COMPOUND AND JUTE/HEMP.**
- 3) The trainer(s) will help the participants to do the correct way of pipe fittings. Check for the essential points like using sufficient hemp, compound and fitting it tight enough.
- 4) Continue fitting elbows etc. on the other side of the pipe. Make sure that everyone has the chance to do all the different tasks.
- 5) Lastly, ask the participants from all groups to connect all their parts together. This is a good moment to explain the use and function of a union because without the union, it will be very difficult to fit all the parts together.
- 6) Now include fitting unions. Most likely, the participants will forget certain steps such as putting the collar ring first, but that is no problem. **Let them find out themselves!**
- 7) Explain to the caretakers that it is important to close the compound after its use. Otherwise, it will dry and cannot be used later.
- 8) End the practical session by removing all the joints, and remove the hemp and compound from the pipes and fittings. Clean the threads of the pipes and remove the compound as much as possible before drying.

Activity 2

PRACTICAL SESSION ON HDPE-GI CONNECTIONS, BRASS UNION AND FLANGE SET

Activity Objectives:

At the end of the session, all the participants will have:

1. Individually opened, fitted and closed a Brass Union and can demonstrate the right order of fitting to the other caretakers;
2. Fitted a flange set to the GI pipe and closed the flange. Welding the HDP pipe is not necessary.

Time: 60 minutes

Materials: Brass Unions, flange-sets, Caretaker toolboxes, Hemp and Compound.

Activity

So far, you have only demonstrated the use and way of connecting HDP and GI pipes together with a Brass union, and flange set. It is now time to let all participants experiment with the different fittings. Only through this practice, the participants will really learn how to use these fittings.

- 1) In groups, distribute a brass-union each or a Flange set (make as many groups as you have materials for them to practise on). Also, distribute the other materials such as HDPE and GI pipes, Hemp, compound, etc.
- 2) Ask the participants to get their own toolbox to work with during this practical session.
- 3) Get the attention of all participants and explain the objectives. They should fit the union and flange with the GI pipe and other fittings.
- 4) Make sure that everyone in the group has a chance to try fitting the brass union.
- 5) After some times, circulate the different items to other groups so that finally all groups will have worked with the Brass-Unions and the Flange set.
- 6) During the practical session, watch for the following common mistakes, and correct them by explaining to all the groups.



You, as a trainer, have the important task to go around and assist the participants in the practical sessions. Of course they will do the fittings but you and the other trainers should explain and repeat the demonstration, whenever required throughout the practical session.

The possible mistakes to be made by the participants that the trainer need to observe and pay attention to for correction:

A. Mistakes with the Brass Union:

- Forgetting to push the brass ring and the (white) plastic ring over the HDPE pipe before placing the inserter in the HDPE pipe.

- *Fitting the HDPE pipe before the GI pipe.*
- *Using the Hemp and compound on the HDPE side.*
- *Making the pipe thinner with a knife or file. Only the burrs should be removed.*
- *Inserting the HDPE pipe not far enough in the brass union.*

B. *Mistakes with the Flange set:*

- *Not placing the steel ring washer with bolt holes over the HDPE pipe before joining the HDPE flange and HDPE pipe.*
- *Not placing the rubber ring or gasket between the two flanges.*

DAY 3: SESSION – 3

Activity

1

DEMONSTRATION AND PRACTICAL TRAINING ON CPVC AND PPR PIPE, FITTINGS AND JOINTS

Activity objectives:

At the end of the activity, the participants should be able to mention:

1. The other types of pipes such as CPVC and PPR (climate-resilient options) and the types of fittings used;
2. The steps in fitting the CPVC and PPR pipes, and fitting them together.

Time: 30 minutes

Materials: Solvent glue, CPVC and PPR pipes, elbow, socket, Tee, union, toolbox with tools.

Preparation:

- Check and keep the CPVC and PPR pipes and the fitting ready.
- Select only those materials from the toolbox that will be used for demonstration, including the glue.

Activity:

First, show the CPVC pipe and the fittings one by one mentioning the names and their functions such as the Socket, Tee, Elbow and Union.

Explanation on CPVC Pipes and fittings: Chlorinated polyvinyl chloride (CPVC) is significantly more flexible than PVC and can also withstand higher temperatures. The CPVC fittings are used for distribution of hot and cold drinking water in the residential and industrial projects as well as in the water treatment plants.

CPVC plumbing pipes are available in sizes of 15mm (1/2”) to 50mm (2”).

After the participants have seen and understood about the CPVC, show them the PPR pipe and the fittings. Explain on their functions and use as an alternative product to resist cold weather due to climatic conditions.

PPR pipes and fittings: PPR pipes (Polypropylene Random Copolymer pipe) are a high-technology plastic pipes, and they are an important solution to modern plumbing for hot water systems when compared to the cold galvanized pipes. PPR pipes are designed to withstand high temperatures and can handle hot water up to 95 degrees Celsius.

Compared with the other pipes, the PPR pipes are energy-saving, environmentally friendly, and lightweight with high strength performance and outstanding corrosion resistance. Hence, it's widely used for water supply in the residential, municipal, industrial and agricultural fields.

The maximum size, length and pressure of a PPR pipe is:

Diameter: 20mm, 25mm, 32mm. Maximum Length: 4m.

Max Pressure: 12.5PN.

CPVC/PPR Pipe and fittings (Socket/unions etc.)

Demonstrate the following steps, while clearly explaining their functions:

- Clean the pipe and fittings from any dirt and grease;
- Place the two parts together to check if they fit well and then pull them out again;
- Apply uniformly enough amount of solvent (Glue);
- Place them back together with your hands and hold for a few seconds;
- The pipe and the fittings will bind in a short while.

Ask any participants to come forward and perform the same steps to join the pipe and fittings, etc. First, they should explain the step before the pipe fittings.

Finally explain that the glue must be carefully closed after use.

DAY 3 : SESSION – 4

Activity 1

DEMONSTRATION ON REPAIR OF BIB COCK

Activity objectives:

At the end of the activity, the caretakers should be able to mention:

1. The 4 places where the bibcock can leak;
2. The steps to repair the 4 different possible leakage's;
3. The 3 alternative materials for making washers.

Time: 90 Minutes.

Materials: 4 to 5 Bibcocks with GI sockets and 4 to 5 GI pipes of 50 cm long 14” pipe wrench, sliding wrench, pliers, hemp and compound, tyre tube, poster/pictures of bibcock leaking at four places.

Activity

Divide the participants into groups of 3 to 5 members. If necessary, group the fast and slow learners in different groups.

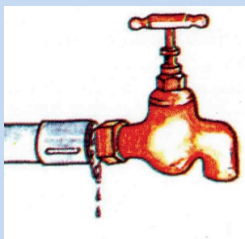
Get everybody's attention and explain the objective of this session. Then distribute the materials (bibcock, socket and pipe) to each group.

Show the bibcock with the pipe and explain that it can leak at different places. Give some time for the participants to observe their own taps. Point out the following four places of leakage, referring to the poster, if you like:

- The socket between pipe and bibcock;
- Between the top and the handle of the tap;
- In the middle of the bibcock;
- From the bibcock mouth when the bibcock cannot be closed.

After this, show the four different places of leakage one by one.

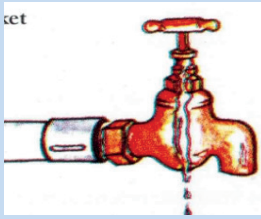
(a) Leakage from socket between the pipe and bibcock



Explain how to repair the leakage from the socket between the pipe and bibcock. The solution is to fit the bibcock and socket nicely again with a hemp and pipe joining compound. Or, replace the socket if it is cracked.

(NOTE: Wind the hemp clockwise on the threaded end of nipple and the bib cock then smeared pipe compound joining over the hemp. First tie the Socket on the nipple and tie the Bib Cock to the socket.)

(b) Leakage between the top and the handle of the tap

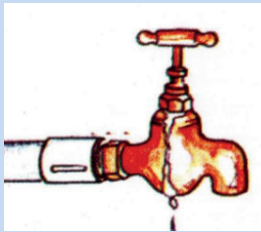


The next leakage problem is when the water is coming from the top part of the tap. **Explain and demonstrate** how to repair the leakage between top part and handle. The solutions are: first, check with a sliding wrench or pliers if the top nut is properly tied. Try to tie it a little more and see if the leakage stops. If the leakage does not stop, it means that the rubber ring inside is spoilt and needs to be replaced.

Explain and demonstrate at the same time the following steps to replace this rubber ring:

- Close the control-valve at the back of the tapstand.
- Open the top nut with a sliding wrench or pliers, and remove the broken ring.
- On the threaded part, wind the hemp and pipe compound joining and tie back.

(c) Leakage from the middle of the bibcock

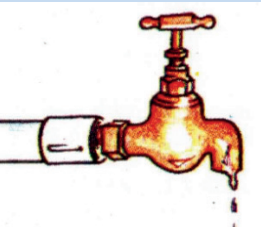


The third leakage problem is when the water is coming out from the middle of the bibcock. **Explain and demonstrate** how to repair the leakage from the middle of the bibcock. The solutions are: first, check with a sliding wrench if the middle part of the bibcock is properly tied. Try to tie it a little more and see if the leakage stops. If it does not stop, it means that the big washer between middle and bottom parts of the bibcock is spoilt and needs to be replaced.

Explain and demonstrate the following steps to replace this big washer:

- Close the control-valve at the back of the tap-stand;
- Open the top nut with a sliding wrench or plier, and take out the saddle where the washer is.
- Take out the small washer out by unscrewing the small nut.
- Cut a new washer from a tyre-tube of same thickness and diameter as the old washer. Fix the washer on the saddle and place back to the tap.
- On the threaded part, wind the hemp and pipe compound joining and tight it.

(d) Leakage from the bibcock mouth



Finally show the leakage of water from the tap even when the tap is closed tightly. **Explain and demonstrate** how to repair the leakage from the mouth of the bibcock. The solution is to replace the small washer inside which is spoilt. The following are the steps to replace this small washer inside.

- Close the control-valve at the back of the tap-stand;
- Open the top nut with a sliding wrench or plier and take out the saddle where washer is;
- Take out the small washer out by unscrewing the small nut;
- Cut a new washer from a tyre-tube of same thickness and diameter as the old washer; Fix the washer on the saddle and place back to the tap. (Other locally available rubber materials such as “old Chappel” can also be used as a temporary measure.).
- On the threaded part, wind the hemp and pipe compound joining and tight it.

Explain that, when the thread of the handle inside the tap is spoilt, nothing can be done to repair the bibcock. Replacing the bibcock with a new one is the only solution to solve the leakage problem.

Ask if they are aware of and know the problem with bibcock, which has not been mentioned. When they point out other problems, briefly, discuss the possible solutions on how to repair them.



Ask any participants to come in the front to explain, mention and point out on a tap the different places of leakage and how to repair the four possible areas of leaking socket. Ask also what alternative materials can be used for the replacement of washers.

Make sure that everyone can explain and get an opportunity to practice.

Activity 2

BLOCKAGE DETECTION

Activity Objectives:

At the end of the activity, the participants will be able to:

1. Mention the two different types of pipe blockage (air/dirt);
2. Mention the 6 most common places where blockage can occur;
3. Judge if the water is flowing in the pipe;
4. Locate the blockage in a systematic way;
5. Clear the blocks without damaging the scheme.

Time: 60 minutes

Materials:

- Posters with different types of air-release valves and two posters of schemes (Poster: An Easy scheme, and Poster 2: Complex scheme).

Activity

The blockage of a pipe is a common problem. The caretakers should have an idea on how to find the blockage without digging up the complete scheme. Some analytical thinking before getting to work can save a lot of time and resources.

- 1) Explain the objective of this activity, which is to detect a blockage in a water supply scheme. Tell the participants that this is a difficult subject because a blockage can occur at many different places, each of them with a solution of their own. It is important to think carefully about the blockage problem before a caretaker starts digging up pipeline.

2) Explain the following:

- Many blockages can be prevented by cleaning regularly the water source and reservoirs. It is better to prevent a blockage as it will save much time and resources.
- Basically, there are two types of blockages. One type of blockage is the blockage caused by the air trapped in a high point of the pipeline. The other type of blockage is caused by the dirt entering the pipe and getting stuck somewhere on the way to the reservoir or tap stand.
- The air blockage can only occur at places where the pipeline passes through between the two low points. Sometimes, air blockages can also happen when you have cleaned the intake and opened the valves to the reservoir again. At some high points, air-release valves are installed to release the air automatically from the pipe.

Show samples or drawings of the three different types of air-release valves. Operation and maintenance of air-release valves is discussed under activity 3 below. Air blockages occur at:

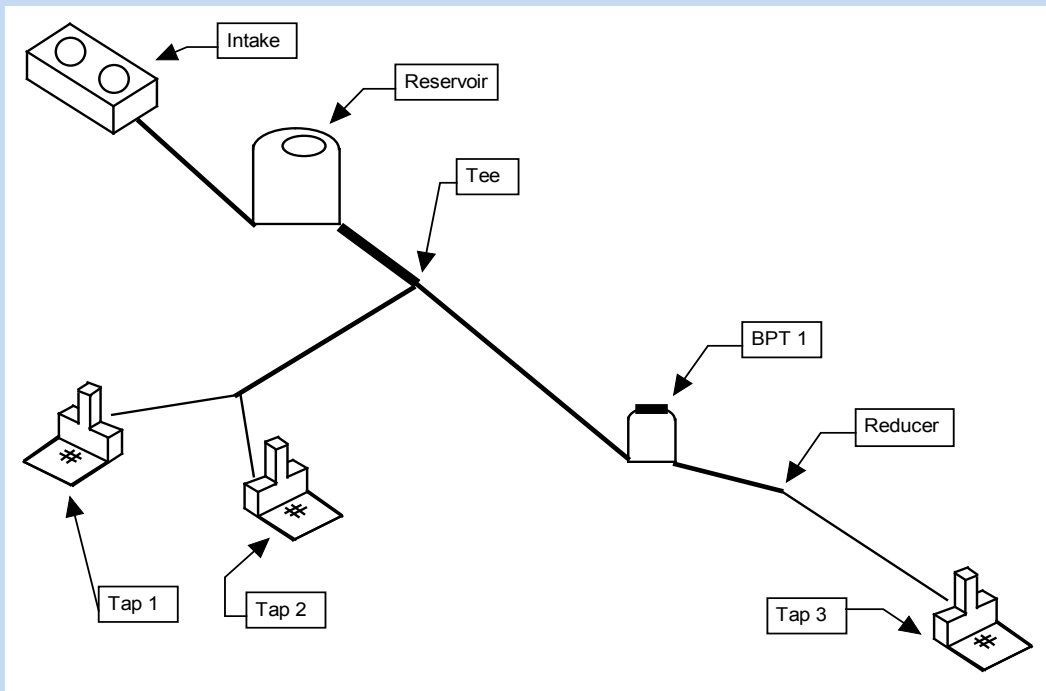
- High points in the pipeline and between the two low points.
 - High points, especially when the pipe layout is horizontal.
 - Intake or reservoir when the outlet valve is closed and opened.
- Because of a missing strainer, or a dirty source or reservoir, dirt and other larger particles can enter the pipe. This dirt, most likely, gets stuck at the following places:
- Just after a tank (reservoir, BPT).
 - Control valves before the tapstand.
 - Bibcock of the tapstand.
 - TEE's and Reducers in the pipeline.
 - Low points in the pipeline (U profile).
 - Float valves in the BPT.

3) Ask the participants: How do you know that a pipeline is blocked? Answer: When there is no water running from an open tap! This is correct, but is there water in the reservoir and is the pipeline not broken? There are many reasons why there is no water coming from the tap. If it is a blockage, then, where can this blockage be found? We will now see and learn about how to find the blockage.

Blockage from dirt

- 4) Explain that if there is no water from a tap, the caretaker should find out the whole situation of the scheme. This means that the caretaker should ask himself/herself the following
- Which taps have no water?
 - Is there water flowing in the nearest BPT above the tap?
 - Is there water in the reservoir and is there a water flowing into the reservoir?
 - What is the condition of the source?
- 5) By knowing the answers to all these questions, it is easier to find if there is any blockage. Show poster 1, an example of an easy scheme.

Poster 1: Easy Scheme - Blockage detection Example 1



- 6) Then, explain the following situation of the example scheme. The water is in the BPT above the tapstand and is also flowing out of the float-valve, but is not flowing out of tap 3 and the pipe is not broken. In this case, there a blockage is most likely somewhere in the pipe, but where? Needs to find out the exact spot.
- 7) Explain the following steps to locate the blockage. This is the first example. Thus, you might have to tell and explain more than they can answer your questions.

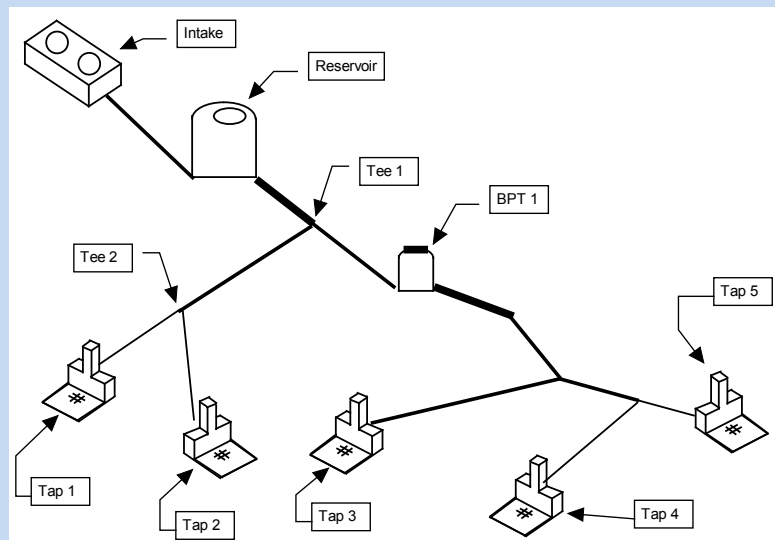
Blockage detection Example 1: Steps

1. First check the strainer of the BPT;
2. Check if the bibcock is open and working? OK, but no water
3. Check if the control valve near the tapstand is open? OK, but no water
4. Remove the bibcock from tapstand with a pipe wrench. Done, but no water
5. Dig up the control-valve and open the plastic adapter between HDPE and GI. Done, but no water
6. Check if the pipe above the reducer is filled with water. You can check this by banging gently on the pipe. 'Hollow' sound means empty, and 'solid' sound means full. If the pipe above the reducers is full, the blockage is probably at the reducer. Dig up some more pipeline and bang the pipe. If this does not help to remove the blockage, only then cut the pipe at 20 cm above the reducer, and remove the blockage.
7. If the pipe above the reducer is empty, the blockage is somewhere between the BPT and the reducer. If there are no other reducers, then the blockage can be at any joint in the pipe line. If the caretaker still remembers where these joints are, then he/she should check there first.

8. Now, you have finished the first example of blockage detection.

Show the second example as in the Poster 2, which is of a more difficult scheme. The way of analysing the problem is the same. Explain the following situation for the scheme of example 2. There is no water in taps 1 and 2 and the pipes are not broken. There is water in taps 3, 4 and 5. Where can be the location of the pipe blockage.

Poster 2: Complex scheme-blockage detection, example 2



Blockage detection, Example 2: Steps

Explain the following steps to locate the blockage. This is the second example. Thus, you can ask more questions to the participants to check whether they understand:

1. Ask the caretakers where, they think, is the blockage. Answer: At Tee 1, Tee 2 or somewhere in between. It can happen that the control-valves of both taps 1 and 2 are blocked at the same time, but it is not very likely. Thus, it is not necessary to look there first.
2. Bang the pipe between Tee 1 and Tee 2 gently to check if the pipe is filled with water. If the pipe is empty, then the blockage is in Tee 1. If the pipe is full, then it is more likely that the blockage is in Tee 2.
3. Dig up the chosen Tee and bang the pipe near the Tee. If this does not help, then cut the pipe above the Tee to remove the blockage. Join the pipe well after removing the blockage.

Air-blocks

Explain the following about the blockages by air:

- Air-blocks are always located at high points and at places where the pipeline runs almost horizontally. Air-blockages will often occur at the same place. Thus, remember the place and go there first, to check.
- If the water is not entering the pipe in the inlet chamber, reservoir or BPT and the pipe is not closed at the end, then there might be an air-block.
- Air-blocks can be found by banging the pipe gently at a high point. If the banging sound is 'hollow' then the pipe is empty, if the banging sound is 'solid', the pipe is filled.

- Take a piece of the HDPE pipe and bang it so that all can hear. Fill it with water and bang it again. Ask: Do you hear the difference? Ask participants one by one to come forward and let them bang the pipes with and without water. Repeat it, so that all have noticed the difference.
- The air should be released from the pipe, and this is normally done with an air-release valve. Sometimes an air-release valve is not placed during the construction and then an air-blockage usually happens. When there is an air-blockage in the pipeline, consult with a technician to install an air-release valve.

For the time being, one must remove the air from the pipe through a small hole which you can make with a nail (as a local solution, but this is not recommended usually). Note: Possible places of blockage are Tee 1, Joints in the pipe between Tee 1 and the BPT, and the control valve or float valve in the BPT.

Activity 3

VALVES (ALL TYPES)

Activity objectives:

At the end of the activity, the participants should be able to:

1. Mention and identify the 4 different types of valves, their functions and placement;
2. Demonstrate how to install them correctly, and carry out the maintenance of air-release valves and float valves.

Time: 30 minutes

Materials: Gate-valve, Globe-valve, Float valve complete with inlet fittings (2 types of valves, one local and the other imported), air-release valve (all types that are available), wrenches and pliers.

Activity

Gate-valve: (5 minutes)

1. Show a sample of a gate-valve, and demonstrate the steps to open and close.

Explain that a gate valve is used to stop or release the water flow in the pipe. Two gate-valves are placed in the intake, the reservoir and the BPT (outlet and washout)



Globe/Regulating valve: (5 minutes)

1. Show the sample of a globe/regulating valve and demonstrate on how it is opened and closed.
2. Explain that the purpose of a globe/regulating valve is to regulate the water to flow only in the direction of the arrow. Clearly show the arrow on the side of the valve.
3. A globe/regulating valve is located at the back or beside a tapstand, and placed at the inlet of BPT. The function of the globe-valve is to regulate the flow of water so that a required flow can be maintained to other branch-line or tapstand.



Air-release valve: (Time: 5 minutes)

1. Show a new model air-release valve (and, if available, also the old model).
2. Explain the following about the place and function of air-release valves. Show the video presentation if there are facilities available such as LCDs:
 - a. An air-release valve is found always on the peaks between the two low-points. Its function is to remove the trapped air from the pipe. Trapped-air can create air blocks, which prevent the water to flow. Air blocks can only occur at places where the pipeline passes through between two low points.



Open an air-release valve and show the small plastic part or the ball inside. When the ball is up, the valve opens to release the air from the pipeline. When the ball goes down, the valve closes and allow the water to flow.

3. Explain the following about required maintenance:
 - a. The caretaker should clean the surrounding of the valve and the valve box.
 - b. He/she should check the functionality of the air-release valves once a month.
4. Checking of an air-release valve is done in the following ways:
 - a. Remove the cap using the required tools.
 - b. While pressing the ball down, and on releasing the hissing sound, it indicates the air-release valve is functioning. If the water comes out instead of hissing sound, it indicates that the placement of the valve is incorrect.
 - c. Place the cap back on the valve and close the valve box.

Pipeline Scour valve (Time: 5 minutes)

1. Show a gate-valve and say that this is installed at a low point of the pipeline which goes up on both sides along the transmission pipeline.

2. At such low points, sand and dirt may get collected/deposited at the bottom of the pipeline that can be flushed out by installing a scour-valve.

The scour-valve should be cleaned every month, especially during summer.

Float-valve: (Time: 15 minutes)

1. Demonstrate and explain the following on the functioning of a float valve:

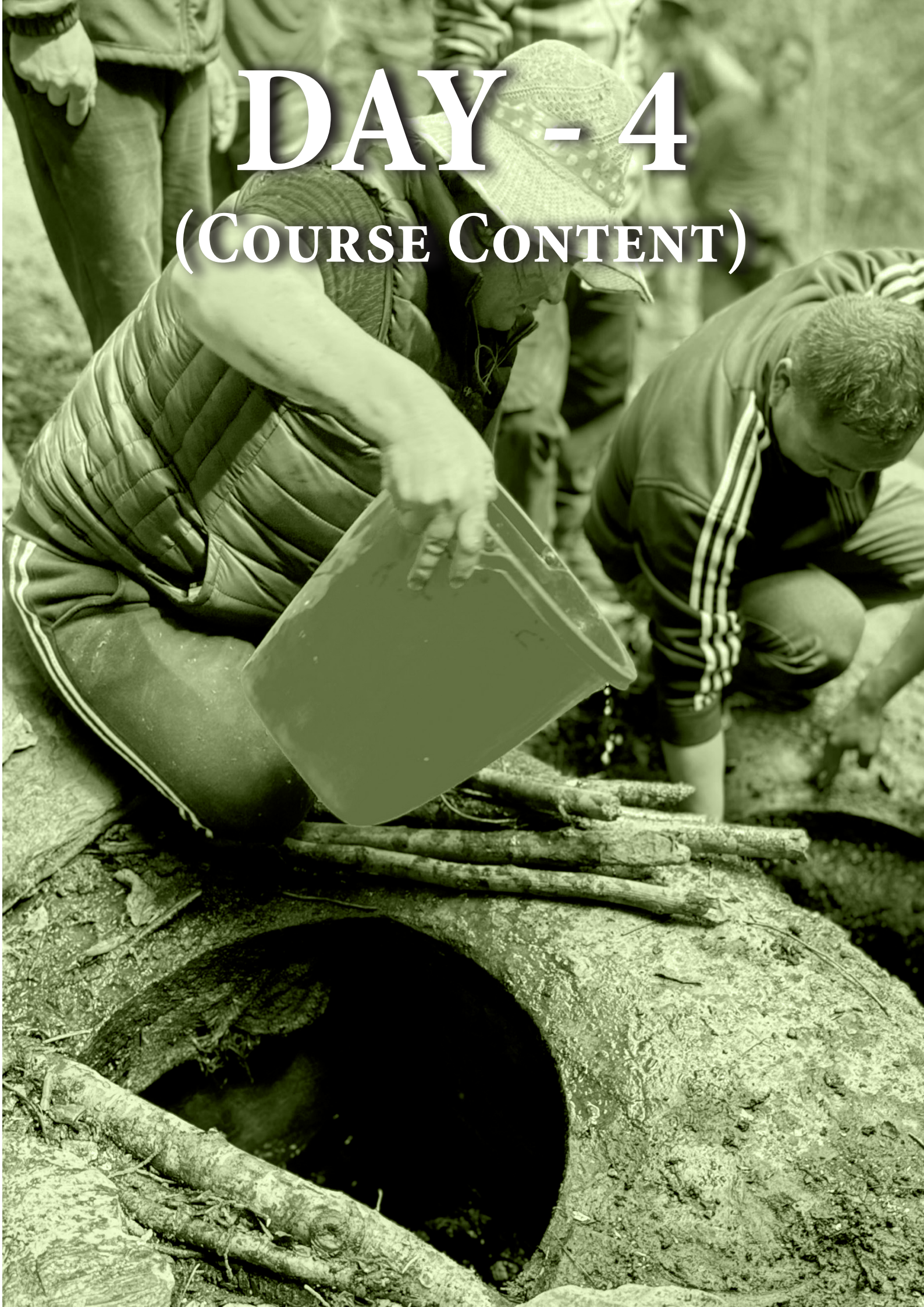
- a. Show a heavy-duty float-valve that is connected to the BPT inlet pipes and, demonstrate how the float-valve opens and closes. It can also be demonstrated by blowing the air with the mouth through the valve.
- b. The float-valve in the break-pressure tank is to stop the water-flow when the BPT is full.



2. Show a fabricated float-valve and explain about the weak points such as float-arm connection, leaking float, etc.
3. If a float-valve is not functioning, there will be no water storage in the reservoir.
4. Explain and demonstrate the following on how to adjust the float-valve for proper operation:
 - a. The valve closes because the float (ball) and arm will move up and close the valve or in other words stop the water.
 - b. If the float valve is not closed when the water is at the overflow level it needs to be adjusted.
 - c. First close the inlet Globe valve, then the adjustment can be done moving the ball back and forth by an adjustable wrench and pliers.
 - d. Adjust the arm at the rotating point of the valve such that the flow of water stops before the water level is same as the overflow level.
 - e. Tighten both nuts and bolts properly.
 - f. Check if the valve closes before the overflow level is reached.
5. It is important to repair the float-ball if it is leaking.
 - a. Seek technical support from gewog technician/engineer for repair if there is no working float valve in the BPT, one may use the globe valve on the inlet pipe to control/regulate the flow. After the explanation and demonstration, ask questions like:
 1. What is the difference between a gate-valve and a globe valve?
 2. Where do you find an air release valve?
 3. How to adjust a float valve?
 4. What happens if the float ball of the float valve is missing?

DAY - 4

(COURSE CONTENT)





DAY 4 : SESSION -1

Activity

1

FIELD VISIT

Activity objectives:

At the end of the field visit, the participants will be able to:

1. Co-relate the theoretical lessons about RWS components.
2. Measure source yield.
3. Carry out cleaning of all structures following the procedures.
4. Inspect and carry out minor repair of pipes and fittings.
5. Fill up the inspection checklist form.

Time: One full day

Materials required:

For spring source -

Tool set: Wrench, heating plate, hacksaw frame with blade, sliding wrench, measuring tape, knife (patang), sickle, spade, match box, empty tin box, bucket, one-liter empty mineral water bottle, inspection form, pen/pencil.

For stream source - refer the annexure on materials required and method

The participants will visit a water scheme; the facilitator will show the components of the scheme from source to consumer point. The guided questions (see below) will be used at each component (Source/intake, Reservoir/FCR, BPT, Pipelines and Tap) to initiate the discussion and fill-up the inspection checklist. The facilitator will make the participants to clean the components by following the correct procedures (see cleaning procedures).

Note: Remember that the procedures are more important than rushing for cleaning. Therefore, it is suggested to split in smaller groups of 5 to 10 persons (if the group is not formed in earlier session) so that you can attend to all the caretakers.

Guided questions for the facilitator

All the components of a water scheme have been discussed during the earlier sessions of the Caretaker Training. During the field visit, it will give the caretakers the chance to practically experience and show how much they have learnt. Before you start explaining what to do, start with asking questions as below, but wait till all the caretakers have arrived at the site. **Remember to ask questions on the impact of climate-change on the current context and/or possible impact that can happen in the future. Before asking questions on the structure, ask the participants about their experiences during the journey to the water source, in order to create a conducive environment.**

1. What is this structure?
2. What is the function of this structure?

3. What is the current condition of this structure? Is it in good condition, and, is it clean? What should the caretaker do to bring it to a good condition? What will happen if this structure is missing/defunct/not maintained?
4. What could be some of the possible impacts of climate change for the different structures?
5. What can be done to avoid any climate hazards?

Explain clearly how to do the following activities for the different structures and tell the caretakers what the consequences are if they are not doing them properly.

The following structures should be visited:

Intake/Source:

- 1) Always ask the caretakers what to do. But, don't let any of them start doing anything before you have discussed this question with all the caretakers.
- 2) Activities to do with the caretakers
 - Checking and cleaning of the surroundings of the spring or stream intake.
 - Checking and repairing (if necessary) the fencing and the door.
 - Cleaning the catchment area (tapping point) to the intake chamber, removing and cleaning the screen, and placing it back.
 - Cleaning and checking the intake chamber, removing (debris) mud, sand and leaves.
 - Checking the washout and outlet valves.
 - Practising the steps of maintaining the tapping point and intake with closing and opening of valves.

Steps to maintain TAPPING POINT (at source)

- a. Cleaning and making proper drainage above the spring source (if there is no drainage).
- b. Remove and clean the existing stone-sand screen and re-stacking it. Stack stones, if it is not done.

Steps to maintain Intake

- a. Clean the top surface of the intake.
- b. Remove the manhole cover of the collection and valve chamber.
- c. Close the gate valve of the outlet pipe (outlet pipe has air-vent pipe) in the valve chamber.
- d. Open the washout gate valve in the valve chamber.
- e. Stir and drain all the water from the collection chamber.
- f. Scrap the wall of the collection chamber to clean the algae grown there.
- g. Close the washout gate valve and open the outlet gate valve fully.
- h. Close both the manhole covers over the chamber.
- i. Clear the bushes grown around the intake tank.
- j. Check if the fencing is in intact, and the intake is free from cracks and leakages.

Pipeline

- 1) Activities to do with the caretakers:
 - Follow the pipe line as much as possible and check for leakages, damages and illegal tapping.
 - Check for blockage in the pipe line.
 - Check for exposed parts.

Steps to maintain pipeline

- a. Walk along the pipeline and check if any HDPE pipe is exposed and if there is leakages in the HDPE/GI pipe.
- b. Cover the exposed pipe immediately(if possible) and repair the leakages.
- c. Report to the WSP team/Water Users Association (WUA), for necessary actions.

Pipe-line scour-valve

- 1) Activities to do with the caretakers:
 - Open the gate-valve and flush out the water till a clear water is observed.
 - Close the valve and cover the chamber (if present).

Air-release Valve

- 1) Activities to do with the caretakers:
 - Remove the cap and press the ball. Water should come out.
 - Check if the valve is leaking.
 - Ensure it is functioning properly.
 - Check for proper valve box with cover.

Steps to clear THE Air Blockage and Sediments in the pipeline

- a. Air Block in a pipeline:

Air block is a bubble of air trapped in the pipeline. It interferes with the flow of water through the section.

 - Air-release valve is fixed at the highest point of the pipeline to release the air (between intake and reservoir). The valve will release the air automatically.
 - Air block can be released by puncturing the hole in the pipeline with nail. After releasing the air, the hole should be closed with a small pointed stick. However, it is not a good practice to be adopted.
- b. Sediments in a pipeline
Sediments are the sand particles accumulated at the lowest point of the pipeline that will disrupt the continuous flow of water.
 - Install a washout valve at the lowest point of the pipeline to release the sediment particles.
 - If the washout valve is installed at the lowest point, it needs regular draining of the sediments.

Ferro-Cement Reservoir

- 1) Activities to do with the caretakers:
 - Checking and repairing of the fencing and the door, if necessary.
 - Drain out all the water through the washout.
 - Check if there is debris (sand, mud, leaves) in the reservoir, and remove them if there are debris.
 - Before leaving the reservoir site, place the cover back with the nuts and bolts on the manhole and, close the fencing door.

Steps to maintain The Reservoir

- a. Clean the top surface of the reservoir.
- b. Remove the manhole cover of reservoir and the valve-box.
- c. Close the gate valve of outlet pipe (Outlet pipe has air-vent pipe) in the valve chamber.
- d. Open the washout gate valve in the valve chamber.
- e. Stir and drain all the water from the reservoir .
- f. Scrap and clean the wall of the reservoir.
- g. Close the washout gate valve and open the outlet gate valve fully.
- h. Close both the manhole covers over the reservoir and the valve box.
- i. Clear the bushes grown around the reservoir.
- j. Check if the fencing is in intact, and the reservoir is free from cracks and leakages.

Break Pressure Tanks

- 1) Activities to do with the caretakers:
 - Checking and repairing the fencing and the door, if necessary.
 - Drain out all the water through the washout.
 - Check if there is debris (sand, mud, leaves) in the reservoir, and remove if there are debris.
 - Check if the arm of the float valve can move up and down, and if the valve closes when the arm is lifted up.
 - Show how to adjust the flow of water through the control valve.
 - Before leaving the break pressure tank site, place the cover back with the nuts and bolts on the man hole, and close the fencing gate.

Steps to maintain BPT

- a. Clean the the top surface of BPT.
- b. Remove the manhole cover from BPT and unscrew the cap from valve box.
- c. Close the gate valve of outlet pipe (Outlet pipe has air vent pipe) in the valve box.
- d. Open the washout gate valve in the valve box.
- e. Stir and drain all the water from the BPT.
- f. Scrap and clean the wall of the BPT .
- g. Close the washout gate valve and open the outlet gate valve fully.
- h. Close both the manhole covers over the BPT and the valve box, and screw the cap of valve box.
- i. Clear the bushes grown around the BPT.
- j. Check if the fencing is in intact, and the BPT is free from cracks and leakages.

Tapstands

- 1) Activities to do with the caretakers:
 - Show the regulating valve at the backside of the tapstand and demonstrate how to regulate the flow when the bibcock is fully open.
 - Apply grease and put back the GI-valve box cover.
 - Check if the bibcock is leaking when it is closed.
 - Ask one caretaker to demonstrate how to remove and replace a bibcock.
 - Ask another caretaker to open up the bibcock and point out the washer. Explain that the washer is the actual seal of the bibcock.
 - Check the drain pipe and explain how the drain can be cleaned. Ask the caretaker if the

tapstand is accessible by all? What can be done to make the water accessible by all (such as PWDs, elderly, children)?

- Who mainly does the collection of water from the tapstand for household and sanitation uses? What can be done to make the collection easier?
- What are some of the existing water storage practices in the households? How long will the stored water last? How often do you clean the storage containers?
- What can be done to ensure sustainable and safe household water storage practices?

Steps to maintain Tapstand

- a. Advise the household to clean the tapstand platform regularly.
- b. Inspect any leakages from the tap and repair immediately.
- c. Advise those household to close the tap after the use.
- d. Advise the households that do not have a bibcock to install one.
- e. Inspect and maintain proper drainage system.
- f. Check and regulate the flow of water from the tap.

Activity

2

FIELD VISIT ON THE WATER SOURCE YIELD MEASUREMENT

At the source, the participants should be oriented and demonstrated on the measurement of source yield, and explain the sufficiency of water.

The benefits of water yield measurement can be explained to the caretakers as follows:

1. Engaging a water caretaker in the process of measuring and monitoring water yields can raise awareness about the importance of water conservation, climate-change impacts and sustainable practices to the communities.
2. The monitoring and water yield measurement provides reliable and valuable data on the availability of water resources (sources drying up due to climate change, etc) that can help the communities to adapt to these changes.
3. By understanding the water yield, the communities can manage their water resources more sustainably, and make an informed decisions about the water conservation and allocation. This knowledge helps in planning the usage of water, thereby ensuring that the demand for water does not exceed the supply.
4. The caretakers must understand when the measurement of the source should be done: One measurement is done during the Dry/Lean season (February to April) - measuring during the dry season can provide insights into the minimum water yield, which is critical for understanding the lowest reliable water supply. The other measurement is done during the Wet season (June to August) - Measurement during the wet season can help assess the maximum yield and the potential for flooding or overflows. This is important for the infrastructure planning and managing the excess water.

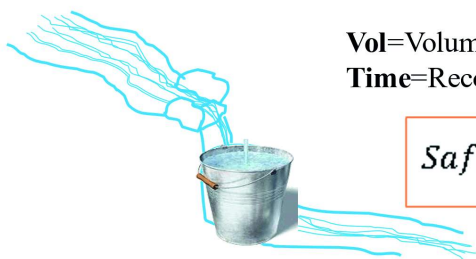
Measurement of Discharge/Yield (Volumetric Method)

Waterflows can be determined by measuring the volume. The equipment necessary are a wrist watch or timer, and a bucket of known volume. The method consists of determining the time

required to fill the bucket. For more accurate results, the measurement is repeated 3 to 7 times, and the average time of these trials is taken. Note that, using a bigger container will improve the accuracy of the measurement. In the example of Tanabji, Kana Gewog below, an empty bucket is used as the container.

The following diagram describes the procedure for measuring the flow of water from a spring. With climate-change making a significant impact on water yield, conducting yield measurement regularly will provide a more reliable information on sources drying up or risk of possible drying up in the future.

Source yield Measurement : Tanabji , Kana Gewog, Dagana



Vol=Volume of bucket (Use mineral bottle to measure)
Time=Record time in second (fill up to brim of bucket)

$$\text{Safe yield (SY)} = \frac{\text{Vol}}{\text{Time}} \text{ lps} * e\text{Flow}$$

Tanabji scheme Site visit:

Volume of bucket= 20 litres

Average time taken to fill the bucket = (12.13+13.01+13.36)/3 =12.83 sec

$$\text{Safe yield (SY)} = \frac{20}{12.83} * 0.7 \text{ lps} = 1.09$$

Note:

- As per the National Environment Protection Act (NEPA) 2007, the Water Act (WA) 2011 and its Regulation 2014, it is mandatory to maintain a minimum e-Flow (30%, 0.3 lps) for any diversion of natural water flow to maintain healthy ecosystems.
- Confirm the water allocation as per the government standards/ and water flagship programme.

$$\text{Daily Supply} = \text{Safe yield} * 24 * 60 * 60$$

$$\text{Therefore, Daily Supply} = 1.09 * 24 * 60 * 60 \text{ litres} = 94,176 \text{ litres}$$

$$\text{Daily Demand} = \text{Present population} * \text{Popn. growth factor} * \text{Consumption rate}$$

$$\text{Total household} = 17 \text{ nos.} \quad \text{Total population} = 17 * 4 = 68 \text{ people}$$

$$\text{Population growth factor} = 1.49 \text{ for 20 years life span}$$

$$\text{Consumption rate} = 135 \text{ lpd}$$

$$\text{Therefore, Daily Demand} = 68 * 1.49 * 135 \text{ litres} = 13,678.2 \text{ litres}$$

$$< 13,678.2 \text{ litres}$$

DAY - 5

(COURSE CONTENT)



DAY 5 : SESSION - 1

Activity

1

RECAP - EXPERIENCE SHARING AND LESSON LEARNT FROM THE FIELD VISIT

Activity objectives:

The caretakers have seen many new structures and practically learned how to clean the structures and repair the pipelines. Additionally, they have learnt how to measure the water yield, identify the hazards and filling up the the inspection checklist. This review session is to repeat whatever they have learnt during the field visit. If any caretaker has observed differences between the water supply system of the field visit and their water supply, let her/him share to the participants and discuss.

At the end of the session, each participant will be able to:

1. Share the lessons learned during the field visit;
2. Finalise the detailed map of the scheme visited.

Time: 30 minutes

Materials required

Chart paper, board marker, flat file, marker, masking tape, pens/pencils, punch, stapler, staples, scissors.

The facilitator will ask the participants to share the experience from the field visit made on the previous day, revisit the inspection form, calculate the functionality of the scheme, and finalise the water scheme map.

Activity:

- 1) Discuss with the participants the activities of yesterday's field visit.
- 2) Relate the answers to what was taught in the session on components. Make sure that the five important points of each structure/component are mentioned.
- 3) Ask the participants what they saw and what they did at the source, intake, pipeline, reservoir, break-pressure tank, air-release valve, scour valve and tapstand. Some possible responses are:
 - Source protection and possible spring shed/water shed management (eg. plantation or tree cutting around the source).
 - Cleaning of surroundings in and around the structures.
 - Drainage around the intake tank, intake protection from flooding and landslides.
 - Operation of valves while cleaning the tank.
 - Checking of fencing around the structures.,
 - Proper closing and locking of structures.

- 4) Ask one participant to come forward and explain what he has done and what must be done at the tapstand. Possible responses are:
 - Saw and checked the conditions of the tapstand, bibcock, platform and drainage.
 - Replaced with the new bibcock if the thread inside the bibcock was damaged.
 - Checked the cleanliness of the surroundings and talked to the users on the importance of a clean tapstand.
 - Learnt about maintaining a proper drainage system.

- 5) Regulating the water flow at the tap, and tools used: Ask what they have seen/found in or around the pipeline (freezing, damages etc) and explain the solution. Possible responses are:
 - Observed the exposed pipe and the need to properly bury the.
 - Leakages at joints and along the exposed HDPE pipe.
 - Illegal connection.

Activity 2

FINALIZING THE WATER SCHEME MAPPING

Time: 60 minutes

Ask the the participants to sit in their groups. Assign them to revisit the mqp and make any necessary changes based on the observations made during the field visit to the scheme.

(Details of the scheme)

- a. Name of the source:
- b. Source yield:
- c. Date of yield measurement:
- d. Source elevation:
- e. Source coordinate:
- f. Reservoir- capacity, elevation and coordinates:
- g. BPT- number of BPT with coordinates and elevation:
- h. Tap stands, no of households and population:
- i. No of ARV and SCV along the transmission line (between source and reservoir):
- j. Transmission and distribution line -: Pipe type and sizes:

Note: During the discussion, the facilitator should also highlight on the overflow of water/ wastewater management by asking the questions “Where does your over-flow water from the intake, reservoir and BPT go? Where does your waste-water from the tapstand go? The suggested answers are;

- a. Proper drainage/extended pipes for overflow water/washout to convey water to a safe place.
- b. No stagnation of water.
- c. Risk of landslides downstream as a result of inappropriate diversion of excess water.

DAY 5 : SESSION – 2

Activity

1

HAZARD MAPPING AND DEVELOPING THE ACTION PLAN

Activity objectives:

By the end of the activity, the participants will be able to:

1. Carry out the hazard analysis and control measures of the water scheme.

Time: 60 mins

Materials required: Chart paper, markers, masking tape.

Activity:

The facilitator will explain the hazard analysis and control measures. The facilitator will share the hazard analysis form to the participants to carry out the hazard analysis in groups and develop an action plan for the scheme they have visited. The respective groups of the participants will present their group works. The facilitator will initiate discussion and provide feedback to each group's action plan. Then the respective groups will finalize the hazard analysis and action plan (Refer annexure 5: The hazard analysis and control measure form).

Note: The facilitator should explain the importance of having a proper water-caretaker succession planning for the sustainability of the water scheme and should be included in the hazard analysis action plan.

DAY 5 : SESSION – 3

Activity

1

WASH BUSINESS PROSPECTS

Activity objectives:

At the end of the activity, participants will be able to:

1. Name some commonly WASH products used in rural areas.
2. Promote business opportunities in water and sanitation services.
3. Encourage female entrepreneurs in WASH business.

Time: 45 Mins

Materials required: Ppt, pictures of commonly used products for RWS, pictures of inclusive and climate-resilient products (such as the disability friendly products, climate-resilient pipes) and services.

Activity -

The facilitator will use the presentation to explain the business prospects/opportunities to encourage the caretakers to consider climate-resilient inclusive WASH products and services available to the communities.

After the presentation, ask the participants to write on a metacard/paper provided, what business opportunities they could think of or wish to do in their communities, specifically in the Water, Sanitation and Hygiene sector?

Note: To trigger the opportunity exploration of the participants, ask the following questions: Do the community, institutions and Gewog offices have functional water supply inside the toilets? Are there persons with disability in your village who could not have easy access to toilet, handwashing and water facility? Any idea to modify the existing toilets to make it disability-friendly? Is there WASH products easily available for repairing in the community? Any climate resilient products available?

Invite the participants individually and ask them to paste it on the wall and share their business ideas that they wish to venture into. Create a discussion on the feasibility of the business ideas presented in the context of their farming preoccupation and their role as caretakers.

Discussion:

Ask the participants to 'Discuss and rethink about their business ideas, and refine them thoroughly' in the context of whether they can exert efforts, given their current household activities (agriculture/livestock), community and social norms, and other circumstances. Identification of barriers and enablers of women's economic empowerment in WASH can also inform this iterative process and approach to address challenges.

The facilitator should screen out the opportunities and present what needs to be done to grasp

this opportunity to provide mentorship support by the facilitator. Local leadership's support for women masons or plumbing work, combined with the buyer incentives to employ women masons/plumbers, and specific targeting of households to recruit women labourers (such as women-headed households) needs to be considered to redress the limited demand.

Next, narrate the story of the lottery man!

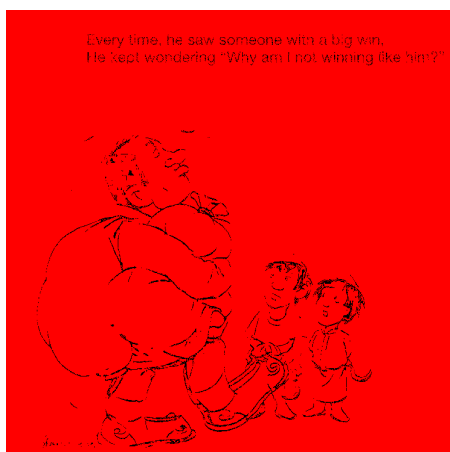
“Once upon a time in a village, there lived a man, who kept praying throughout his life wishing to win a lottery”. He kept praying and praying for many years. After many years, nothing happened to his wish and then he finally decided to consult his astrologer.

The Astrologer asked, ”What happened?”. The man replied, “I kept praying for the last 20 years to win a lottery and nothing has happened to me”. The Astrologer gave a thought and asked the man, “Did you buy any lottery ticket in the last 20 years?” The man replied, “NOT EVEN ONE”.

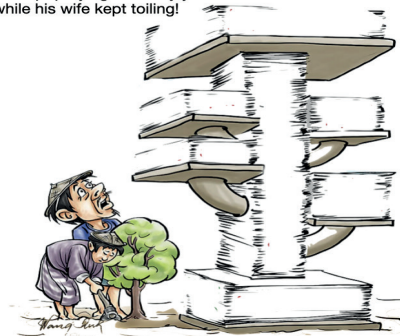
Then the Astrologer advised the man that, hence-forth, he should continue with the prayers, and also buy one ticket every month. One fine day, the man approached the Astrologer and reported that the astrologer was right, as he won the prize on the very first ticket.

Story line

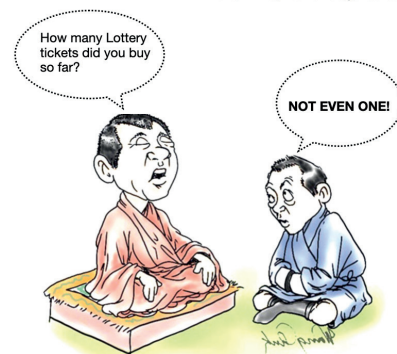
The following pictorial representation may be used to tell the story



A man kept praying, wishing to win a big sum of lottery one day. He kept praying for many years while his wife kept toiling!



After a While, the Astrologer asked!



Reflection of the story

- Ask the participants to reflect on the story.
- Listen to their reflections.
- Explain to them that while one can have wishes, they cannot be achieved without putting any effort and investment to reap the fruits.

Activity
2

TRAINING EVALUATION/FEEDBACK

Activity objectives:

At the end of the activity, participants will be able to:

1. Share their overall learning experience of the 5-day caretakers' training programme.
2. Share what they liked and disliked the most about the training (this will guide and provide an opportunity for the facilitator to improve the training programme in the future).

Time: 30 Mins

The trainer will ask participants to:

1. Note/share at least two learnings from the training and what areas they still feel incompetent?.
2. Share what they liked the most about the training and dislikes.

What they found easy and what they found difficult.

3. Share suggestions/feedback to improve the water caretakers' training in the future?

Activity 3: Closing

The facilitator will close the training and thank the participants.

ANNEXURE

ANNEXURE 1: IMPORTANCE OF MAINTENANCE

Objectives:	At the end of the session the caretakers can explain the importance of maintenance.	
Time:	30 Minutes	
Materials:	8 Posters showing:	
	8.1. Completed scheme in good condition.	8.5. HDP pipe welding + bibcock repair by caretaker.
	8.2. Completed scheme in bad condition.	8.6. Leakage in HDP pipe-line + bibcock.
	8.3. Repaired tank.	8.7. Woman carrying water in the jungle.
	8.4. Broken and leaking tank.	8.8. Woman filling the container under the tap.

Activity:

Well maintained scheme	Not maintained scheme
<ol style="list-style-type: none"> 1. Tanks in proper condition. 2. Water is flowing. 3. People taking clean water from the nearby tap. 4. No leakage in the pipe line. 	<ol style="list-style-type: none"> 1. Tank is broken and leaking. 2. No water is coming from the tap. 3. People are collecting water from a far away and dirty source. 4. Leakage in the pipe line.

- 1) Tell the caretakers that you are going to explain the importance of maintaining their own RWS scheme.

With a story and posters you will show the difference between a properly maintained scheme and a scheme which is not maintained at all.

- 2) (Posters 8.1 & 8.2) Show the two posters and discuss the differences between the two schemes.
- 3) (Posters 8.3 & 8.4) Show the posters of the damaged and repaired tank. Explain about the damaged tank and the need to repair it.
- 4) (Posters 8.5 & 8.6) Show the posters of the repaired and broken pipeline and explain why it is important to repair the pipe properly with a heating plate. Explain why just fixing it with a piece of rubber from a scooter tyre is not enough.
- 5) (Posters 8.5 & 8.6) Explain why it is important that bibcocks are not leaking and what happens if water is always flowing from the tap. (Muddy pools around the tapstand and no water storage in the reservoir, thus water shortage)

- 6) (Posters 8.7 & 8.8) Show the posters of the woman collecting water. Explain that this happens because of bad or no maintenance.
- 7) Now ask the caretakers whether they think that maintenance is required or not. If the caretakers say 'yes' then ask who should do the maintenance. Finally tell them that if they do regular maintenance there is always water from the taps and there is no need for major repairs which cost much money and take a lot of effort.
- 8) Ask participants to come forward and discuss each a pair of posters

ANNEXURE 2: DIFFERENTIATING BETWEEN MINOR AND MAJOR REPAIR

Objectives:

At the end of this session, the caretakers can:

1. Mention how to react on major or minor breakdown;
2. Mention the six minor breakdowns and mention 4 major breakdowns.

Time: 30 minutes

Materials: Seven posters, showing.

Minor repairs	Major repairs
1.1 Repair leaking HDP pipeline because of cutting and bibcock	1.5 Heavily damaged reservoir or BPT.
1.2 Rebury the pipeline in a trench.	1.6 Stream or spring intake damaged.
1.3 Repair fencing.	1.7 Pipe line washed away by landslide.
1.4 Repair or adjust float-valve.	

Activity:

- 1) Explain to the caretakers that you will now discuss with them the differences between minor and major repairs. Repair is needed after a scheme is broken down.
- 2) Ask the caretakers if they can mention a type of breakdown, which needs to be repaired. Take the responses one by one. When one of the caretakers mentions a breakdown for which you have a poster then show the poster.
- 3) Continue to ask for more responses and stimulate also the other caretakers to think about possible breakdown.
- 4) If no more responses come and you have still posters then show the posters and ask a caretaker to explain the poster.
- 5) Now ask the caretakers one by one to show a poster to the group and say if they as a caretaker can repair this breakdown or not. For minor breakdown, the answer should be 'yes', and for major breakdown, 'no'. Ask what should be done for a major breakdown.

Evaluation:

- 6) Go through all the posters once again. Start with the caretakers who did not talk yet (everyone should be given a chance to talk).
- 7) Ask the caretakers with the posters one by one to mention the breakdown, mention whether it is major or minor repair and what and who should do it.

ANNEXURE 3: FLOAT OR VELOCITY METHOD TO MEASURE STREAM SOURCE YIELD (Q)

The following step by step procedure to measure the stream source yield as follows:

<p>a. Find a suitable area that has about five-meter to seven-meter-long stream flow channel.</p> <p>b. Clear the boulder that obstructs the flow, aligning the side banks to flow as straight as possible.</p> <p>c. Measure the channel distance (<i>dist.</i>) in meters and should note down for calculating velocity.</p>	
<p>d. Ball/dry stick/paper roll is used as floating object (required five to seven dry pieces of stick about your thumb size or use roll paper pieces). Let the floating object to float from start of upstream until it reaches the end point of specific length. Note down the time taken in seconds by the floating object and repeat the procedure at least five times. Find the average time taken (<i>time_{sec}</i>)</p>	
<p>e. Calculate the velocity (<i>V</i>) in meter per seconds.</p>	
<p>f. Measure the width (<i>W</i>)of stream at three sections one at the end, one in the middle and one at the start of upstream in meters. Find the average width (<i>W_{avg}</i>)</p>	
<p>g. Measure the depth (<i>D</i>) in meters at equal distance from left to right bank or vice versa across the width of stream at all three sections. Find the average width (<i>D_{avg}</i>)</p>	
<p>h. Calculate the Cross-sectional Area (<i>A</i>) of the stream in square meter.</p>	

i. Source source yield (Q) is litres per second (lps)

Where c = velocity correcting factor

When $c=0.85$ for smooth concrete rectangular channel

$c=0.70$ If Area is greater or equal to 7sqm

$c= 0.45$ If depth is between 0.5-0.8m

$c= 0.30$ If depth is less than 0.5m

$$Flow(Q) = c * Vel(V) * Area * 1000$$

Multiplied by 1000 is to convert m^3/sec to lps

ANNEXURE 4: ENERGISER EXERCISE “HDP PIPE CONNECTION”

After a long lecture or discussion, the participants will feel tired and sleepy. They will find it difficult to pay full attention to the trainer. This is the right moment to play a short game or exercise.

Objectives:



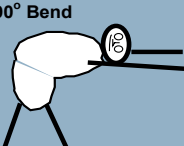
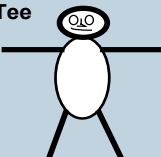

At the end of the session, the caretakers will:

1. Get more energy and be better prepared for the next session.
2. Be able to easily remember the names of the different HDP pipe connections.

Time: 10 minutes

Activity:

- 1) Ask the participants to stand up and spread over the class room.
- 2) Explain that this is a HDP pipe exercise and that they must do exactly what and how you are doing.
- 3) Demonstrate the following joints and ask the participants to do the same together with you.
- 4) The following joints or connections can be made:

<p>Straight</p> 	<p>Straight joint:</p>	<p>is arms above your head and hands together</p>
<p>Y joint</p> 	<p>Y-joint:</p>	<p>is arms above your head spreading like a Y</p>
<p>90° Bend</p> 	<p>90° degree bend:</p>	<p>is bend the body forward and stretch the arms horizontally out.</p>
<p>Tee</p> 	<p>Tee joint:</p>	<p>is stretch arms horizontally to both sides</p>
<p>Reducer</p> 	<p>Reducer:</p>	<p>is arms pointing downwards under a small angle with the body.</p>

- 5) Continue it for sometimes making the different types of joints while you are speeding up in changing the joints.
- 6) Finally say a different joint than you have shown to them. Stop and wait. Many will have made a mistake.

ANNEXURE 5: PICTURE OF TWO DIFFERENT HOUSEHOLDS :

1. Supported household including PWD;
2. Unsupported household including PWD and Vulnerable groups.



ANNEXURE 6: PREVENTIVE MEASURES IN WELDING

a. Misalignments

Misalignment of the welded ends of the pipes is the cause of insufficient contacts of the circumfacial area of the pipe walls. This shows ununiformity of beads and will have ugly visual appearance.

b. Air traps/Bubbles/water

Overheating and insufficient welding pressure are the main causes of air-traps or bubbles, besides too short timing applied for pressure. Such occurrence is most likely to happen on a thicker walled pipes.

c. Small weld bead

d. Glossy weld bead

Excessive heating for a prolonged time causes thermal degradation of the pipe materials and will result in a bad joint.

e. Foamy weld bead

Such occurrences are found due to overheating and uncleaned welding faces.

This happens due to:

- Insufficient mirror temperature.
- Short heating time.
- Long mirror change over time.
- Usage of worn out mirror.
- Insufficient weld pressure.

f. Collapsed weld zone

Such occurrences are often found in a thinner section pipe. This happens due to over heating and excessive weld pressure.

Note:

The welded joint should not be subjected to any external load for a period of at least two hours.

Pipe upto 63mm of outside diameter can easily be welded manually, diameter greater than 63mm requires Mechanical Jack to hold pipes in the required position, correct face to face alignments and application of uniform welding pressure which could not be achieved manually.

ANNEXURE 7: SYSTEM INSPECTION CHECKLIST FORM

Date: _____ Village/Project Name: _____

A. Scheme Component: FCRs (Ferro Cement Reservoirs)

In case of multiple sources, all the sources should be functional. If one of the sources is do not meet the following criteria, it is considered as “NO”

No.	Questions	Source 1	Source 2	Source 3	Source 4	Source 5	Note: If more than 5 sources, use additional sheet
1	Source and catchment area free from upstream contamination (cattle, houses, latrines, agriculture practices, industries/factories/mining, roads etc.)?						
2	The source area is free from landslides, flood etc.						
3	Water quality at the source appears to be clear and clean						
4	Intake area clean (free from bushes, debris, waste etc.)?						
6	Fencing around source intact? [stream source NA						
	Fencing around intake intact?						
	proper drainage around the intake/ extended pipes for overflow water/ washout to convey water to a safe place						
7	Vegetation/trees maintained at catchment area?						
8	Proper drainage above the spring source?						
9	Presence of Strainer inside collection tank?						
10	Inside of collection chamber clean and covered?						
	Collection chamber secured with nut and bolt / lock and key						
11	The collection chamber free of cracks?						
12	The valves and air vent in the valve box dry (water leaking or stagnation)						
	Valve box intact and secured with nut and bolt / lock and key?						
13	Alternative source identified?						
14	Yield measurement conducted annually (during the lean season)						

B. Scheme Component: FCRs (*Ferro Cement Reservoirs*)

In case of multiple reservoirs, all the reservoirs should be functional. If one of the reservoirs do not meet the following criteria, it is considered as “NO”

No.	Questions	FCR 1	FCR 2	FCR 3	FCR 4	FCR 5	Note: If more than 5 FCRs, use additional sheet
1	FCR free of cracks?						
2	Inside of FCR clean?						
3	FCR cover secured with lock and key/ nut and bolt?						
4	Area around FCR free of vegetation?						
5	FCR valves and air vent in the valve box dry (not leaking/ stagnation)						
6	Valve box intact and cover secured with lock and key or nut and bolt ?						
7	Fencing around FCR intact?						
8	proper drainage around the FCR/ extended pipes for overflow water/washout to convey water to a safe place						
9	FCR free from landslides and/ or flood						

C. Scheme Component: BPTs (*Break Pressure Tanks*)

In case of multiple BPTs, all the BPTs should be functional. If one of the BPTs do not meet the following criteria, it is considered as “NO”

No.	Questions	BPT 1	BPT 2	BPT 3	BPT 4	BPT 5	Note: If more than 5 BPTs, use additional sheet
10	BPT free of cracks?						
11	Inside of BPT clean?						
12	BPT cover secured with lock and key/ nut and bolt?						
13	Area around BPT free of vegetation?						
14	Float valves at the BPT after reservoir intact and functioning?						
15	BPT GI valve box intact and valve functioning?						
16	Fencing around BPT intact?						
17	<i>proper drainage around the BPT/ extended pipes for overflow water/ washout to convey water to a safe place</i>						

D. Scheme Component: Pipeline and valves.

Note: Take into account of the distribution lines

No.	Questions	Yes	No	N/A					Notes
18	Pipes free from leakage?								
19	HDPE pipes properly buried?								
20	Proper support for GI pipes (gully or stream crossing)?								
		1	2	3	4	5	<i>Note: If more than 5 Air/score valves, use additional sheet</i>		
21	Presence of air release valve at the summit of U-profile of transmission lines?								
22	Air release valves functional?								
23	Air release valve box intact with lock and key or nut and bolt?								
24	Presence of scour valve at the base of U-profile of transmission pipelines?								
25	Scour valves functional?								
26	Scour valve box intact with lock and key or nut and bolt?								

E. Scheme Component: Tap stand.

Note: Ensure to consider all tap point(s) within the households

No.	Questions	Tap stand 1	Tap stand 2	Tap stand 3	Tap stand 4	Tap stand 5	Yes-Y/ No-N/ Not applicable/NA
27	Platform area clean?						
28	Wastewater safely drained away?						
29	Structure free of cracks?						
30	Bibcock and regulating valve intact and functional?						
31	GI valve box and globe valve intact and functional for institutional multi-taps?						
32	Anti freezing system available in extremely cold weather?						

Scheme Component: Management					
33	water caretaker is aware of his/her responsibilities?				
34	Caretaker received adequate training?				
35	Caretaker(s) being adequately incentivized?				
36	Caretaker(s) have all required tools?				
TOTAL		X	Y	Z	

F. Scheme Component: User practices Note: Scoring not to be considered for the water scheme functionality

No.	Questions	Yes	No	N/A	Notes
37	Clean, closed and safe containers used to transport water from tap stand?				
38	Clean, closed and safe household storage/containers?				
39	Clean and safe handling practices? (Hand washing, use of ladle, avoid direct hand contact)				
40	Household Water Treatment System practiced (boiling, filtration etc.)?				
41	Tap point accessible for persons with disability?				
42	Rainwater harvesting and other alternatives source harvesting				
43	Household storage available? (48 hours or more)				
44	Bib-cock closed when the water is not in use				
45	Household storage has a float valve				

Hazard score is used to check the functionality of scheme by adding all the Yes (X), No (Y) and NA (Z)

$$\text{Scheme functionality (\%)} = \frac{\Sigma X}{\Sigma(X+Y-Z)} * 100$$

Definitions on functionality		
Overall Score	Functionality scale	Description of functionality scale
76-100	High	Water supply is functioning very well – and there is no immediate risk for scheme failure, deterioration or water contamination.
51-75	Medium	Water supply is functioning well – with some minor problems. There is no immediate risk for scheme failure, deterioration or water contamination
26-50	Low	Water supply is functioning – however needs improvement. There is a risk for scheme failure or water contamination and risk of scheme deterioration.
0-25	Non-functional	Water supply scheme is non-functional.

ANNEXURE 8: HAZARD ANALYSIS & CONTROL MEASURES (EXAMPLE ONLY)

Present Situation	Hazard	Risk level		Control Measure	Materials & Tools	When	Who	Verify
		High	Low					
Scheme Component: <u>Catchment, source and intake area</u>								
No strainer on intake pipe	Risk of blockage	X		Fix with HDPE strainer	63mm HDPE pipe =2m	30/09/12	Community	Geog and PHC
Fencing poles collapsed at source and reservoir	Animal entry and can cause damage & contaminate	X		Fencing properly	Wooden pole for source and reservoir	30/09/12	Community	Geog and PHC
Bushes growing around FCR	Roots may damage structure		X	Clear bushes	Sickle	30/05/13	Community	Geog and PHC
Scheme Component: <u>Pipeline and valves</u>								
Some HDPE pipe exposed in remote places in the jungle	Risk of pipe damage, water loss & contamination		X	Bury pipeline	Shovel, pick ax and spade from community	15/10/12	Community	Geog and PHC

Hazard analysis & control measures (FORM 5)

Date: _____ Village/Project Name: _____

Present Situation	Hazard	Risk level		Control Measure	Materials & Tools	When	Who	Verify
		High	Low					
Scheme Component:								

**Add extra sheets as necessary to complete the hazard analysis for the complete water scheme*



With the collaboration and support of:

