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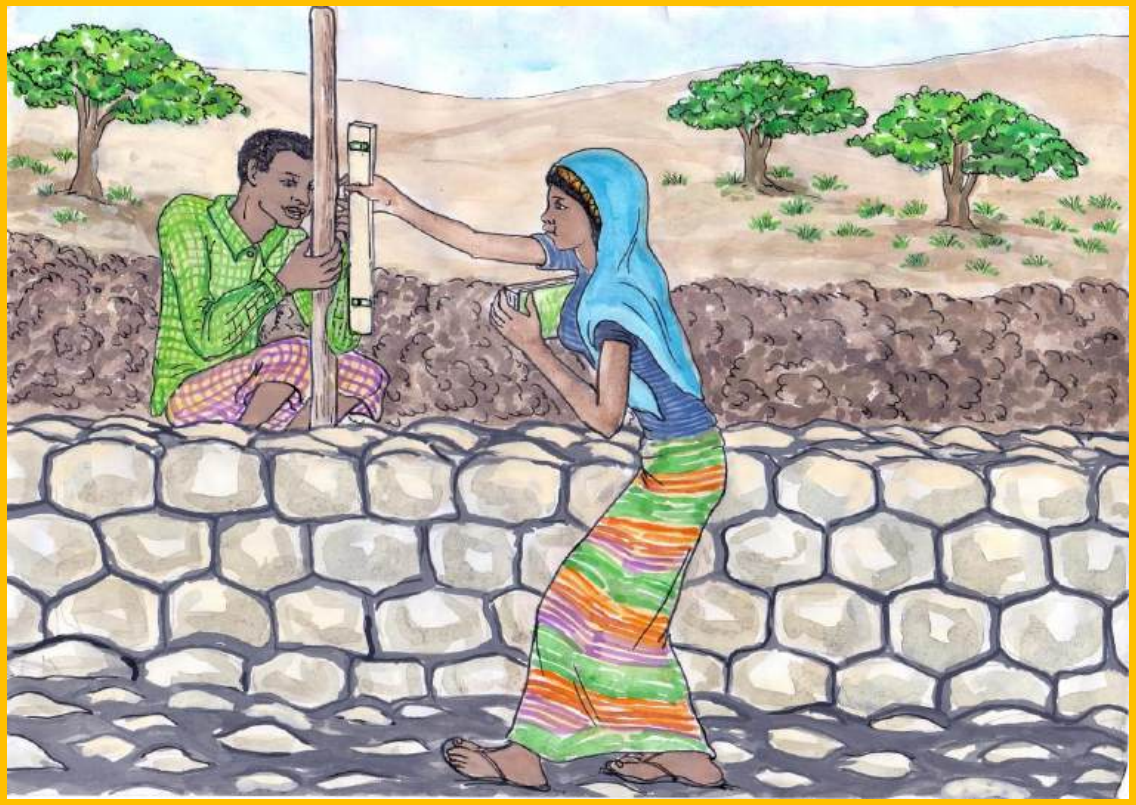
MINISTRY OF AGRICULTURE

Rehabilitating and Restoring Degraded Areas in Ethiopia's Arid and Semi-Arid Lowlands



Teaching and Learning Guide Water-Spreading Weirs

First Edition

Contents

How to use this teaching and learning guide

This Teaching and Learning Guide is part of a series of three Teaching and Learning Guides on:

- Community Awareness Creation, Gender and By-Law development;
- Water Spreading Weirs;
- Dry Stone Measures.

The authors emphasise that comprehensive, gender-based community awareness creation and by-law development and implementation are crucial for optimal planning, construction, use and maintenance of Dry Stone Measures. It is extremely important that development agents are confident and able in these areas when conducting community development activities. A solid understanding of the technology of Water Spreading Weirs is also invaluable.

Teachers and learners should also familiarise themselves with these so-called 'soft skills' by beginning with Teaching and Learning Guide on Creating Community Awareness, Gender Awareness and By-Law Development before continuing with the guides on Water Spreading Weirs and Dry Stone Measures. These latter guides make regular reference to the Teaching and Learning Guide on Creating Community Awareness, Gender Awareness and By-Law Development but mention only some aspects of community awareness and gender awareness creation which are specific to WSWs and DSMs respectively. Similarly, the correct development and practical application of by-laws are crucial for the protection, utilisation and maintenance of the physical structures.

This guide is arranged around four sections or Learning Outcomes (LOs):

Learning Outcome 1	Objective and Benefits of Dry Stone Measures
Learning Outcome 2	Area Selection
Learning Outcome 3	Constructing a Water Spreading Weir
Learning Outcome 4	Utilisation and Maintenance of a Water Spreading Weirs

Each Learning Outcome section comprises:

- Introduction with specific learning outcomes;
- An instruction sheet for teachers suggesting a teaching methodology, time needed and guidance through all worksheets;
- An instruction sheet for learners;
- Information sheets on the implementation steps, guiding questions for discussion and self-check test questions;
- Operational sheet, explaining, how to proceed to implement, what is described in the information sheet, indicating the required resources.
- LAP-Test

The guiding questions for discussion are designed to enhance understanding, learning and reflection on the section's content as well as to serve as a form of self-evaluation.

As a whole, the guide is centred on active participation of students, integrating what they already know in accordance with key adult learning principles and detailing each topic with discussions, outdoor sessions and / or role plays.

A glossary of technical terms at the end of the document explains technical vocabulary and phrases.

Also, since many students of the ATVET colleges are future Development agents (DA), the Teaching and Learning Guide focuses on their role and tasks.

Content that is especially relevant to development agents is marked throughout the document by this illustration of a meeting:

Small case studies in coloured text boxes illustrate the technical aspects and give examples of communities involved in Water Spreading Weir (WSW) construction, as well as use of the resulting rehabilitated land.

Hints and Tips for Teaching and Training

Adult Learning

Adults learn differently from children and so teaching techniques for adults therefore need to be different from those used with children. The main difference is that adults have considerably more life experience. As a result, adults are keenest to gain information that is most relevant to this lived experience and are inclined to be less interested in that which is not. Key points which help adults learn therefore include the following:

Meaningful information	Starting by helping the learners understand why the topic is important and how it can help them – see also Specific Learning Outcomes.
Experience	Recognising that the learners already have considerable knowledge and life experience, and drawing out this experience as often as possible during learning.
Respect	Adults respond best when they feel that they are respected and that they are part of the learning process. Talk with them, not at them.
Self-exploration	Provide time for adult learners to explore ideas (on their own or in small groups). Let them consider how they might use and apply the learning material.

Teaching through facilitation

Facilitation is an important skill that takes practice and patience to improve. It is much easier for teachers to lecture and to give instructions than to facilitate. However, in order to make learning interesting and to get the best results, a teacher facilitates effectively by assuming the following roles:

- The role of a mentor who assists students with empathy, understanding and encouragement;
- The role of a leader and organiser who initiates, demonstrates, sets goals as well as boundaries;
- The role of a coach who listens, comments, gives feedback and inspires.

Conducting an activity

- Communicate clearly and confidently with your students by speaking and writing clearly.
- Make eye contact and try to be calm and confident with your body language.
- When a student asks a question or makes a point, listen carefully, do not interrupt them, and repeat or summarise what you have heard for everyone before responding - or asking others to respond - to it.
- When explaining ideas, regularly cross-check whether your students have understood what you have said by asking them to summarise, either as individuals or collectively by contributing points.
- As often as possible, elicit information from your students by asking open questions – Why? What? How? – rather than closed Yes-No questions.
- Try to encourage everyone in a group to participate and avoid individuals dominating.

Brainstorming ideas

A brainstorm is a bit like a real storm: it happens quickly. Participants pour out their ideas as soon as they come into their heads, like rain falling.

Brainstorming is a particularly effective teaching method for adults because it draws out students' existing knowledge and experience as a starting point for the learning exercise. It is student-centred and if it is a written brainstorm rather than a verbal one, all of the ideas that have been contributed can be ordered, prioritised and / or reworked from their position on the blackboard or on cards.

Group work

Some of the most productive adult learning takes place during group work. Working in groups places both responsibility for learning and empowerment for self-discovery onto the student, making them active learners rather than passive consumers of information.

Before breaking into groups and starting a given task, it is essential to clarify both the objective and the time frame. Breaking into groups can be done randomly across the class (such as by using a counting system of say 1-2-3-4-5 or by height order), or in a more structured way by grouping friends, neighbours or regular working partners.

Leaders almost always emerge from group work, and so it is often helpful to select a group moderator whose responsibility is to steer the work towards the objective as well as encouraging all members, recording and summarising information.

Groups should never be left alone, rather the facilitator should circulate between groups, observing how each group manages the activity and making suggestions or asking helpful questions if necessary. If a group is off track from the topic, give support and guidance to try and lead the group back toward the objective.

Role Plays

A role play brings a slice of reality into a session. By directly simulating reality, the role play discussion, drama session or game raises questions which require discussion, assessment, negotiation and understanding of real scenarios. In this way role plays are learning experiences for both the actors and the observers.

Evaluation

The Self-Check Test at the end of each Information Sheet, and the LAP-Test after each Operational Sheet of the Teaching and Learning Guide, are designed to help the student reflect on the overall content of a given section. Completing both Self-Check Test and LAP-Test will reinforce what is understood and learned as well as underlining what needs further reflection, reading, discussion or study.

Specific learning objectives

After you have finished working through this guide you should be able to:

- Explain the principles, functions and importance of Water Spreading Weirs in lowland areas, including in terms of community awareness;
- Work closely with communities throughout the process of planning, implementing, utilising and maintaining WSWs, including in terms of community awareness, gender awareness and by-laws;
- Prepare for the rehabilitation of degraded areas;
- Accompany the planning and construction of WSWs;
- Execute the role of a development agent in the overall process.

You should also be fully aware of how to combine physical and biological conservation measures in order to maximise the livelihood benefits of WSWs.

Learning Outcome 1: Objective and Benefits of Water Spreading Weirs

At the end of working through this section, as a development agent you should be able to describe and explain the benefits of Water Spreading Weirs and the procedures involved in constructing them to community members and other stakeholders.

Instruction Sheet for Teachers

- As you go through this section together with your class, do not start by lecturing them about Water Spreading Weirs from the Information Sheet. Instead, read the Specific Learning Outcome with them and brainstorm ideas about soil and water conservation methods that they already know.
- Then ask them to list the different characteristics of highlands versus lowlands.
- Work through the Information Sheet.
- Show a short video of overflowed Water Spreading Weirs and discuss it with your students. Alternatively, you could also use the video as the entry point to the lesson.
- Ask students to suggest examples of where WSWs might be most suitable. Ask them to explain why.
- Discuss the Guiding questions for discussion.

Teaching methodology

Brainstorming, interactive teaching and learning, group work (listing), discussions.

Session Plan

- 10 minutes looking at the introduction and brainstorming
- 45 minutes for the Information Sheet;
- 5 minutes for the video
- 20 minutes for the Guiding Questions;
- Total time: 80 minutes.

Instruction sheet for Learners

1. Read the introduction with the specific learning objective for Learning Outcome 1. Familiarise yourself, as a potential future development agent, with your role in the process.
2. Read the Information Sheet on Water Spreading Weirs (WSW).
3. Write down any questions you have.
4. Ask your teacher for support and seek answers to your questions.
5. Try to answer the Guiding questions for discussion and discuss them with classmates about the advantages, disadvantages and other factors regarding WSW.
6. Test your knowledge by completing the Self-Check Test.

Information Sheet

Desertification, aggravated by climate change and population growth, is one of the main reasons for poverty across northern and eastern Africa. Erosion caused by the superficial run-off of rainwater dramatically reduces the amount of land available for agriculture, livestock feed and food for people.

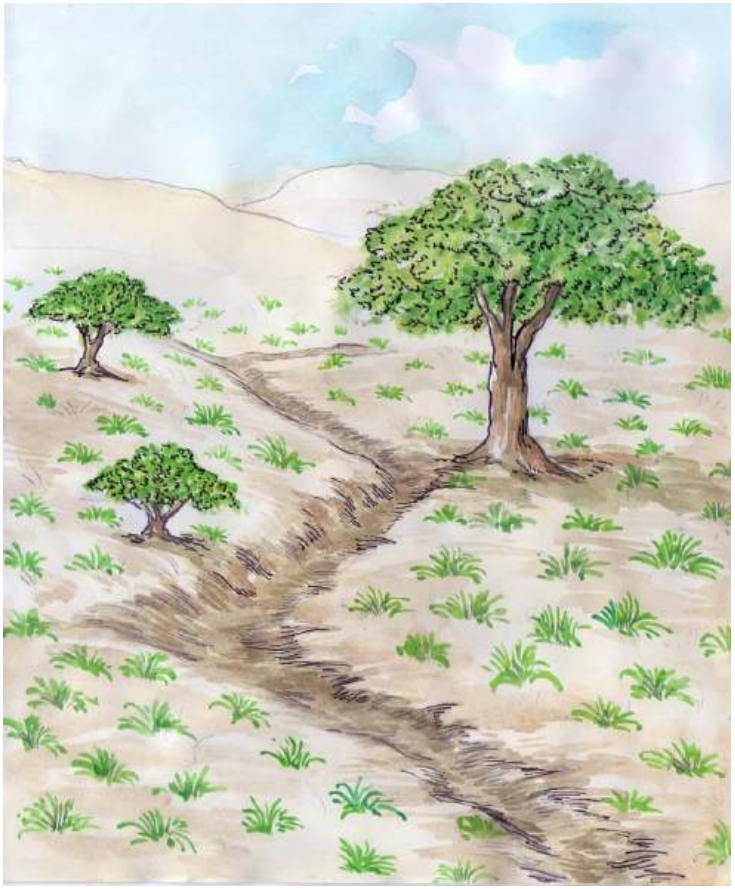


Illustration 1: superficial run-off of rainwater can dramatically reduce the amount of land available for agriculture, livestock feed and food for people

Competition and conflict over decreasing land and water resources are logical consequences. In areas where rain only falls a few times per year, seasonal streams can swell to large rivers which carry run-off waters with enormous power. These deluges remove huge amounts of top soil and water, causing gully erosion and with very little infiltration into the ground, especially in the valley bottom – see Illustration 2.

Illustration 2: run-off waters remove huge amounts of top soil and water, causing gully erosion

Indeed, the drainage effects of gully erosion are more harmful to the environment than soil erosion itself. The visible surface degradation, as well as the lack of infiltration and permeation, reduces biodiversity, biomass and yields, leaving the soil structure vulnerable to further damage.

Illustration 3: the drainage effect of gully erosion is more harmful to the environment than soil erosion itself and causes speed-up of land degradation on a large scale

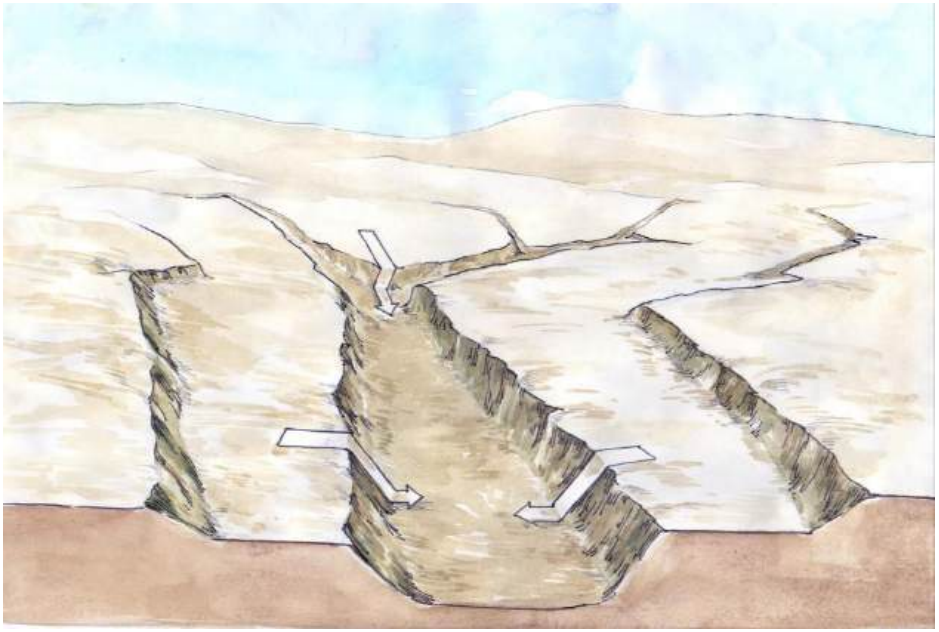


Illustration 4: the lack of infiltration and permeation, reduces biodiversity, biomass and yields, leaving the soil structure vulnerable to further damage

What is a Water Spreading Weir?

WSWs are masonry structures that span the entire width of a river bed or large parts of a valley floor to spread floodwater over the adjacent land area. They are designed to spread and redistribute as much floodwater – including its sediment load – as possible, as well as to reduce soil erosion.

Different from a dam, which is designed to retain water, a WSW is not blocking the water flow completely but spreads water and its sediments, reducing the velocity of water flow by enhancing the length of the water way. The areas upstream and adjacent to a weir are temporarily flooded, allowing water to infiltrate into the soil and sedimentation to accumulate, thereby recharging groundwater stores, increasing vegetation and creating favourable drainage patterns. Water Spreading Weirs are low-based structures made of natural stones and cement. Each weir consists of a spillway, one or more basins in the riverbed itself, and lateral abutments or 'wing walls' which decrease in height away from the spillway – see Illustration 5.

Illustration 5: a WSW spreads water and its sediment and reduces the velocity of water flow by enhancing the length of the water way

Illustration 6: The WSW causes temporary flooding and sedimentation above the main wall and along the wings

Illustration 7 shows the technical plan of a WSW. It is essential that every development agent understands the basic principles of the technical plan because he or she will be decisively influential in implementing it correctly on the ground. See also Learning Outcome 3 on construction steps.

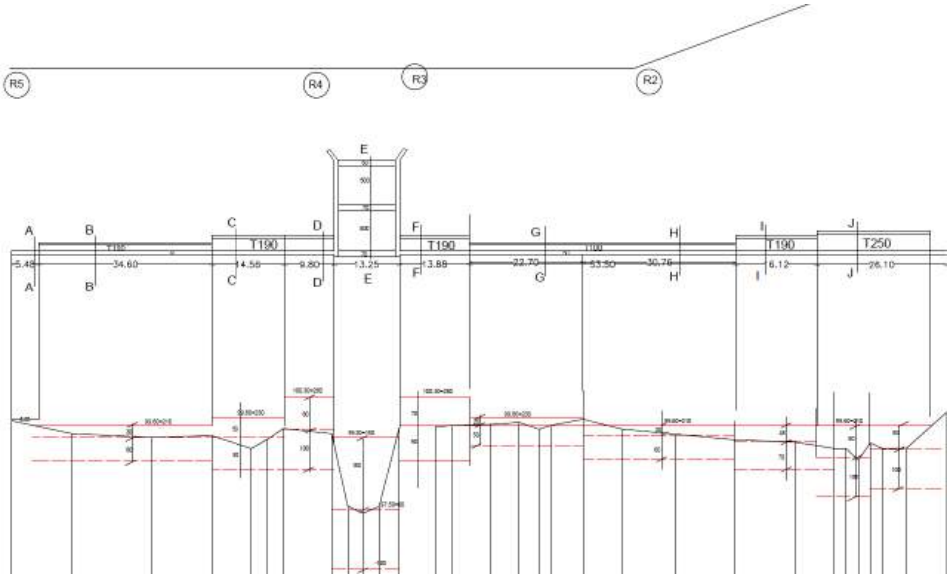


Illustration 7: The technical plan of a Water Spreading Weir shows the spill over basins in the riverbed with stabilizing abutments left and right, as well as the different sections of the wings in relation to the profile of the river bed and the adjacent valley floor.

Variations in rain and floodwater quantities

When rain and floodwater are light, the water remains within the riverbed. When rain and floodwater levels increase, the ends of the wings overflow in proportion to their varying height. The wall across the spillway and its wings cause the riverbed upstream of a weir, including any gully or other eroded waterways, to fill up with sediment. This gradually raises the riverbed up to the level of the spillway. Meanwhile, the abutments at the sides of the spillway, which strengthen the structure, are designed to only be overflown with exceptionally high volumes of water. Illustration 8 shows an overflown WSW after heavy rain. See also the video footage available at your ATVET or other institution.

Illustration 8: A Water Spreading Weir is overflown.

Water Spreading Weirs modify the valley floor by increasing infiltration and retention of moisture. One weir alone will seldom solve all the erosion problems of a wide valley: weirs are usually constructed in cascades, at certain intervals down the river valley, in order to reduce the speed of floodwater in steps. They are also combined with other soil and water conservation measures such as Dry-Stone Measures (DSM) and biological conservation such as planted sisal, elephant grass or others.

Their construction needs detailed planning knowledge and technical skills, involving engineers, Development Agents (DAs), NRM experts from PADO, contractors and the local community.

Optimising use of rehabilitated land

The enrichment of the land around a WSW during the rainy season is shown in Illustration 9.

Illustration 9: Sedimentation after heavy rains above the wing of a Water Spreading Weir.

Grass will grow and recover fast, especially if germination and growth of the young plants is protected by area enclosures, as in Illustration 10.

Illustration 10: Area enclosure above the weir allows for natural regeneration of grasses that can be used as animal fodder by pastoralists

The land downstream and to the sides of the weir is flooded and erosion is reduced. Topsoil is not washed away: rather, it accumulates and sediments are added as more water infiltrates. This makes the land surrounding the WSWs especially suitable for post-rainy season crops, as shown in Illustration 11.

Illustration 11: improved agricultural use downstream of the Water Spreading Weir.

Illustration 12: Natural rehabilitation above the weir stabilizes the valley. Stored water below the surface eases the workload of women.

The main uses of land rehabilitated by WSWs are agriculture, horticulture and/or tree, shrub and grass planting; utilisation varies according to the social and land use patterns of the communities. Area enclosure for grazing, tree and grass planting and horticulture for food production and income-generating activities further add to the potential of these areas. See also the Information Sheet in Learning Outcome section.

Stakeholders

A Water Spreading Weir can only function and be sustainable if it is correctly planned, constructed, used, and maintained. The most important stakeholder groups are as follows:

- Community members who will most directly benefit from, but also use and protect a WSW system must be involved right from the planning and use determining stages. They are the main stakeholders and should feel responsible for maintenance after construction.
- Pastoral Agricultural Development Office (PADO) is the Government authority responsible for the agro-pastoral development at Woreda level and below. Three Development Agents (livestock development, crop production, NRM) are to live and work in each Kebele. PADO is the main partner to the community in the implementation and maintenance of Water Spreading Weirs. Though, the PADO head is the process owner, work in the area of Water Spreading Weirs is supervised by the NRM experts at Woreda level.
- Executing agencies can be an international or national NGOs, a bilateral or multilateral development partner or the Ethiopian Government. They support PADO and the local communities in planning, financing and construction of WSWs. As the construction of Water Spreading Weirs requires in depth technical knowledge, executing agencies can provide engineering teams. Alternatively, PADO can subcontract a construction company.

Benefits of Water Spreading Weirs

Water Spreading Weirs have positive effects on people and on nature. Some effects can be on the short term, others on long term. Effects can be classified into

- Production, resilience and livelihood benefits:
    - these are often the direct benefits for rural people. Some of them short-term benefits;
- Ecological benefits:
    - these are mostly indirect benefits for rural people, impacting on the medium to long term;
- Socio-cultural benefits:
    - these are benefits are mostly indirect benefits, impacting on the medium to long term.

Benefits of Water Spreading Weirs: The case of Zehara Arba

"Zehara Arba, aged 40, is married with ten children. She is an agro-pastoralist in Teaboy Kebele in the Shakayboru Village of Chifra District. Prior to the construction of Water Spreading Weirs (---) in her village, Zehara's livestock suffered from shortages of pasture and fodder. At that time, she had little knowledge of crop and fodder cultivation due to the low availability of water. The family was food insecure, supported by relatives who donated livestock fodder from their irrigated plot near the Mille River. 'Since the Water Spreading Weirs have been built,' she explains, 'rainwater spreads onto the plain, allowing us to grow crops and fodder for the first time on this land. Last season I grew maize, sorghum and mung beans on 1.5 hectares, which we eat at home. The straw from this also made enough fodder for the livestock to last three months.

Zehara added that now she even provides straw for her relatives when they face shortage."

(Source: GIZ-SDR: Innovation in pastoral contexts: How local masons ensure their communities food security)

Productivity, resilience and livelihood benefits

- Increase of cultivated area
- Increased availability of water
- Reduced workload for women
- Increase of productivity through increased yields or second crop
- Increased fodder production
- Increased grazing area and animal production
- Increased resilience to dry spells
- Increased resilience to heavy rainfalls
- Increased resilience to climate change in regions experiencing higher variability of rainfall
- Improved food security

Ecological benefits

- Increased water availability
- Increased soil moisture
- Reduced surface runoff
- Reduced soil loss
- Recharge of groundwater table
- Increased biomass
- Increased soil organic matter
- Increased animal and plant diversity

Socio-cultural benefits

- Increased options for income generating activities (IGA), alternative skills development
- Improved community organization /strengthening of community institutions
- Improved natural resource management and conservation knowledge

Guiding questions for discussion

1. Can you explain the benefit of a WSW to your classmate?
2. What will be the direct benefit of a WSW to pastoral population?
3. How would you explain the WSW to a community leader?
4. How will a WSW or a cascade of them improve the rehabilitation of land?
5. How is the WSW causing the flooding of the area besides the weir?
6. Which stakeholders do you see in the construction of a Water Spreading Weir?
7. Which particularities have to be considered when working with a pastoralist society?

Self-Check Test

Name	
Date	
Time started	
Time finished	

Instructions

Answer all the questions listed below.

Part I: Multiple choices

The structural part of WSW that is constructed at the valley bottom is: (1pt)

1. Counter wall
2. Wing walls
3. Spillover basin
4. Micro basin

One of the stakeholders is not directly involved in the construction of WSW: (1pt)

1. Local community in the area
2. Executing agencies
3. PADO
4. Office Manager

All options below are real benefits/functions of WSW EXCEPT: (1pt)

1. Decrease water infiltration into the soil
2. Increase water table/ groundwater recharge
3. Trap sediments and organic matter
4. Reduce surface run-off

Part II: Short Answer

Write at least three impacts of WSW in the boxes below *(9 pts)*

Production/resilience impact (3pts)	Ecological impact (3pts)	Socio-cultural impact (3pts)

Describe the difference between dam/barrage and WSW (4pts.)

How would you explain the structure/function/objective of a Water Spreading Weir to a community leader (4pts)?

1. Objectives of WSWs

2. Structure of WSWs

3. Functions of WSWs

Note: Satisfactory rating points 10.5 and above. Unsatisfactory points below 10.5

You can ask your instructor for a copy of the correct answers.

If your answer differs from that of your instructor for a very single point do not proceed to the next learning, rather better work on the same information sheet until you acquire all the necessary information

Score:

Rating:

Learning Outcome 2: Creating Community Awareness and Area Selection

By the end of working through this Learning Outcome

- You will understand the basics and criteria of how to select an area for the construction of a Water Spreading Weir and how to prepare for degraded area rehabilitation.
- You will also be familiar with some particularities of community awareness creation for Water Spreading Weirs.
- You will understand your role as a future DA in the planning process.

Instruction Sheet for teachers

- Ask one of your students to read aloud the Introduction of Learning Outcome 2. Ask your students what they understand from the Introduction, and ask what they expect to learn from this section.
- Inform your students what is this step about and what they will learn and understand, when working through the second step
- Subsequently, ask your students which area might be suitable for a Water Spreading Weir after all they had learned and discussed in Learning Outcome 1. What might be the criteria for area selection?
- Complement with the information of the information sheet on area selection.
- After working on the text take your students out of the classroom. Ask them, which patterns they are confronted with around the college area.

Do they see erosion? How are the rainfall/ flood patterns? Is the area around the college suitable for a Water Spreading Weir? Why? Why not?

- Discuss the Guiding Questions outside. Ask one or two students to take notes.
- Continue with the Operational Sheet. Sit outside the classroom under a tree, pretending a community awareness creation meeting. Work with your students on the procedures. What comes first? What follows? Work through the text.

Teaching methodology

Brainstorming, discussion, interactive teaching and learning, outdoor sessions.

Session Plan

- 10 minutes for looking at the Specific Learning Outcome and the brainstorming;
- 45 minutes for the information sheet ;
- 15 minutes for the outdoor session, including the Guiding Questions;
- 60 minutes for the Operational Sheet.
- Total: 130 minutes.

Instruction Sheet for Learners

1. Read the Introduction of Learning Outcome 2 again.
2. Read Information Sheet.
3. Write down any questions of clarification, that you might have.

4. Ask your teacher for support, and get answer to your questions.
5. Try to answer the Guiding Questions.
6. Complete the self-check-test.
7. Read the Operational Sheet..
8. Repeat steps 3, 4 and 5.
9. Make a list of open questions to your teacher and request answers
10. Complete the LAP-Test.

Information Sheet

Deep and thorough creation of community awareness creation about the concept and potential benefits of a proposed intervention – in this case, WSW – is the starting point of any successful development measure. As has been said earlier, before working through this document it is essential that you first work through the separate Teaching and Learning Guide on Creating Community Awareness, Creating Gender Awareness and Developing By-Laws.

Creating community awareness

Any plan to implement a WSW should:

- begin with careful planning;
- involve all community leaders (administrative, traditional, other influential people) and all community members or those of an administrative sub-unit of a community;
- be gender-sensitive (see separate Teaching and Learning Guide)
- explain very well the benefits and impacts of a WSW to the community;
- obtain the approval and commitment of the respective community or community group to implement WSWs at a given site or collection of sites;
- make the community fully aware of the working responsibilities, procedures and working rules during construction;
- make the community fully aware of the maintenance responsibilities and the community's role in it. It must be made especially clear to the community that WSWs require attention regularly, especially after heavy rainfall;
- include by-laws for ownership, maintenance and utilization of the WSW after its completion;
- include a community-action plan which has been developed by the community themselves.

The development agent is of great importance within a community because he / she must:

- facilitate community awareness by organising meetings and overseeing resource mapping and WSW implementation;
- link local people to the PADO office at woreda level and/or to the engineering team of the executing agencies;
- link people to other DAs in the village. For example, if the DA for natural resource management is in charge of accompanying WSW planning and implementation, he/she will contact and team up with the DAs for agriculture and livestock because the rehabilitated land will be used for agriculture and/or livestock keeping;
- advise community members while recognising and integrating local indigenous knowledge;
- continually create awareness among local people about the benefits, use and maintenance of WSWs;
- support the PADO and the executing agency in participatory planning processes.

See also the Operational Sheet for more details of the specific tasks of the Development Agent at this step.

Illustration 13: Community awareness meeting in the planning process of a Water Spreading Weir

Gender awareness

When talking to a community it is easy to talk only or mainly to men as they are usually the ones who attend meetings in the first place, in greater number and contributing most vocally. On the other hand, making an effort to involve women equally not only respects their human rights, but it is also a crucial part of social development and project sustainability. This is because women bring specific skills and strengths into community development activities which are different from, but equally important to, those of men.

It is therefore essential that they are given equal voice, opportunities and encouragement to participate and feel ownership of WSWs by DAs, peers and all other stakeholders. For details on a gender-sensitive approaches and gender awareness, refer back to the Teaching and Learning Guide on Creating Community Awareness, Gender Awareness and By-Law Development.

With regard to WSWs, it should be universally recognised that:

- WSWs bring more benefits than only higher and longer water availability;
- While men might be most interested in water access for their livestock or agriculture, women are often involved in a broader number of water-related topics due to gender-specific roles in rural households;
- WSWs can increase the availability of water for household consumption, livestock and clothes washing. This can serve as an entry point for development agents to show the immediate effects of WSWs for both sexes;
- 50% women's participation throughout the process should be set as a criterion;
- Specific necessities of women with children should be considered when planning meetings, involving women as daily-labourers and providing training.

Site selection

Site selection requires the community, the DA, representatives of PADO and an engineer to collaborate and fully map the layout of the land in the designated area or watershed, in order to ensure that an optimal site is selected. The technical, resource-based and social criteria for selecting optimal WSW sites are as follows:

Technical criteria

- A shallow seasonal riverbed with a flat or gentle slope;
- Natural inundation of the surrounding area by small or medium flood waters does not occur due to the drainage effect of smaller erosion gullies;
- Degraded land with reduced biodiversity and soil fertility.

Illustration 14: Example of an area selection team, taking the profile and measurements.

Resource-based criteria

- Local availability of stones, sand and water;
- Feasible means and distance for transport of materials to construction site.

Illustration 15: Women provide water from a nearby water source, while men contribute stones.

Social criteria

- Community presence, permanent or semi-permanent;
- Community ready and keen to be involved in both construction and maintenance;
- The Kebele leader is motivated and ready to involve in the organisation of his community;
- DA is ready to lead the community together with community leaders (Kebele leader, clan leader and elders);
- Local PADO ready to support the community and the DA.

Are community leaders strong? Is the community active? Does the community stay in the village during parts of the dry season, at the time when the weir will be built?

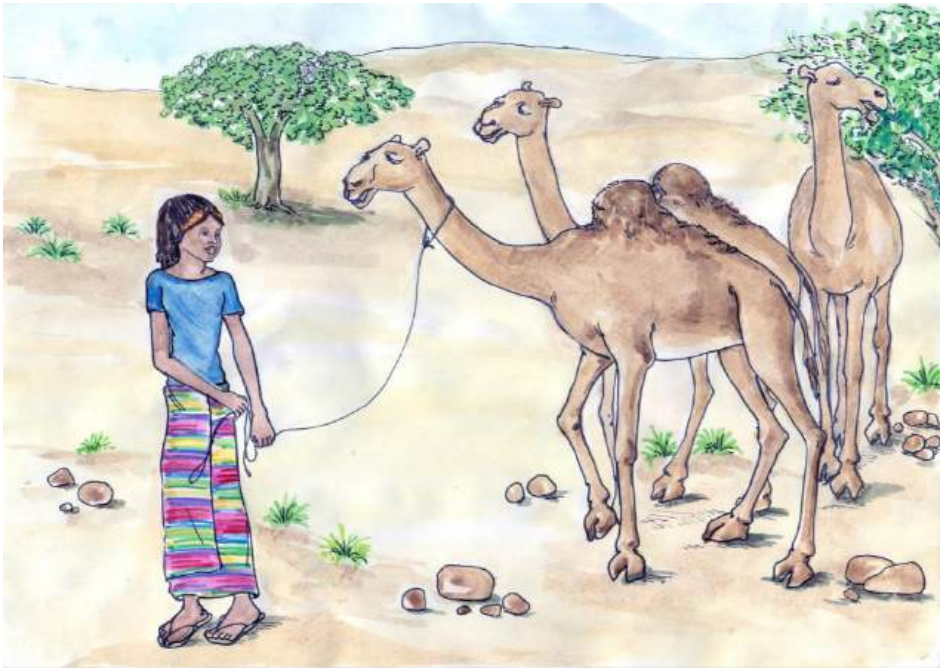


Illustration 16: In a valley, near to a planned Water Spreading Weir

The case of Hidelu Kebele, Awra Woreda (Afar Region)

"Until the early 2000s, water was available in the Kille riverbed all year round. Four rainy seasons per year allowed rich vegetation and fodder grasses such Durfu grass to grow up to 3 metres high. Water availability for human and livestock was not a problem: many households owned 100 camels or more. Milk was abundantly available, supplying families for days at a time.

By 2015 the area had entered a downward ecological spiral. There was only one proper rainfall season per year. Vegetation had declined to bare land in places, with few trees and very poor grass cover. Soil erosion from rainfall had caused huge gullies and reduced the availability of pasture. Valuable tree species such as Hebeleita (serving for human food) and Aishadudha (serving as fodder for livestock) had disappeared. Stock sizes had declined to less than 10 camels per household. Community members had to walk four hours per day (about 14km one way) with the animals to fetch water. The milk production of livestock had been reduced to about half of the amount of earlier times. In the dry season the milk was given only to children, while the rest of the family ate traditional Afar bread (moffe) made of wheat flour earned from food-for-work programmes. In spite of these many challenges there remained strong social cohesion among the villagers.

In 2014, three WSWs along the Kalkalsa, Udaledullul and Kille Rivers were designed by GIZ experts and built with the participation of the community, in close cooperation with Awra Pastoral and Agricultural Development Office (PADO). The sequence of weirs along the riverbed reduced the energy of water flow. Sedimentation within the riverbed triggered by the weir simultaneously reduced the velocity of water flow and thus the destructive forces of floods. Eroded gullies were refilled with sediment and pasture land could recover.

The positive consequences were as follows:

100 households of the surrounding two villages benefited from the water provided by the weirs;

Up to 120 households from neighbouring kebeles were able to use the water;

Water availability in the dry season increased significantly;

The distance to find water was reduced from four hours to 10-30 minutes per day;

Awareness about the potential to reverse natural resource degradation and motivation to continue with positive measures is considerably higher.

For the first time ever, the community dug a floodwater-harvesting structure together;

The first tree (a date palm) was planted by the village leader.

(Source: GIZ-SDR, 2015)

Illustration 17: wind erosion and harsh condition on degraded land.

Illustration 18: restoration with a Water Spreading Weir

Guiding questions for discussion

1. Which technical criteria for area selection do you know?
2. Why is it important that community members are not only involved but also active?
3. Who are the stakeholders that have to be included in area selection?
4. What can we learn from the example of Hidelu Kebele (Chifra Woreda)?

Self-Check-Test

Name	
Date	
Time started	
Time finished	

Instructions

Answer all the questions listed below.

Part I: Choose the best answer

1. All of the following activities form part of the role of Development Agents during community awareness creation and area selection process, EXCEPT: (1pt)
    a. Facilitate community activities
    b. Linking the community with institutions
    c. Advise the local people
    d. Make rules (Bylaws)

2. EXCEPT one, the community awareness creation for water spreading weirs should specifically: (1pt)
    a. Start with the planning and well before any construction activity;
    b. Follow a continuous process before, during and after construction;
    c. Apply a gender-sensitive approach
    d. Underestimate community values

3. All are resource based criteria in area selection for WSWs, EXCEPT: (1pt)
    a. Stones are locally available;
    b. Sand is locally available;
    c. Local institutions are availability
    d. Water is locally available;

4. Which one of the following is a technical criterion for the area selection for WSWs? (1pt)
    a. Availability of local stone
    b. Transportation access
    c. Degraded area with reduced biodiversity and soil fertility
    d. Willingness of local institutions and leaders

5. Which one is NOT a technique used to select an appropriate area for WSWs. (1pt)
    a. Transect walk
    b. Topographic map and aerial photo interpretation
    c. Participatory mapping
    d. Social media chatting

Part II: Matching

Match column A with column B. Use each letter only once and write it in the blank space provided (1 pt each).

Insert letter	Column A
	Attract the attention of rural women to
	A technical criteria for area selection is
	A social criteria for area selection is
	Development Agents are
	A gender aspect that maximizes impact is

	Column B
A	Shallow seasonal river bed with flat/gentle slope
B	Increase availability of water in the area
C	Equal participation of men and women
D	Sand and stone availability
E	Community support and availability of institutions
F	Facilitators

Part III: Short Answer questions

1. What aspects of community awareness creation are important for WSW construction? (5 pts.)
2. How do you attract the attention of the rural community to get their involvement? (1 pts.)
3. Describe the role of a Development Agent in the community awareness creation. (3 pts.)
4. What are technical criteria for the area selection for WSW construction? (3 pts.)
5. Who are the stakeholders that have to be included in area selection? (3 pts.)

Note: Satisfactory rating points 13 and above. Unsatisfactory points below 13.

You can ask your instructor for a copy of the correct answers.

If your answer differs from that of your instructor for a very single point do not proceed to the next learning, rather better work on the same information sheet until you acquire all the necessary information

Score:

Rating:

Operational Sheet

As the DA of your kebele you must lead the community awareness creation process together with the influential people of the village (elders, kebele leader, clan leader) and with PADO representatives such as the NRM expert.

Objective

Men and women of the community are aware of the benefits of WSWs and agree to participate in site selection and construction

Resource requirements

- Venue and materials with which to hold community meetings.
- People willing to participate in a transect walk.
- Optional: Paper and pens for resource mapping.

How to proceed

The following chapters depict the sequence of activities to conduct the community awareness creation process. After completing the activities accompany the construction and support the community members actively.

First meeting at Kebele level

In an initial meeting between kebele representatives such as the kebele leader, the clan leader, elders, the DA(s) and the PADO, you should support the kebele and/or clan leader to facilitate the meeting. Together with the PADO representative for natural-resource management (NRM), you should explain the objective and benefit of Water Spreading Weirs.

A transect walk to verify the area with the community representatives should be called. As DA you should guide and support this process. You should act as a focal person between the executing agency, the Woreda NRM expert and the community.

First community meeting

Following the first meeting and area selection, which might go along with a transect walk through the valley, call for a full community meeting to explain WSWs fully to the kebele leader, clan leader and elders. Also discuss the selected area. Invite the PADO to this meeting as well as the DAs for agriculture and animal production. The DA for agriculture and livestock will be involved later in technical assistance about the use of the rehabilitated land.

Together with the kebele leader and the NRM expert, describe the following using clear and simple words and explanation:

- show what a water-spreading weir looks like (including using pictures and posters);
- explain the main steps of the construction process;
- give concrete examples of the direct short- and medium-term benefits of WSWs, as well as the possibilities of utilisation by the community, such as:
    - improved grazing;
        - increased water availability;
        - reduced work load for women;
        - possibility of a (second) crop, eg. vegetables after the rains;
        - possibility of area closure for natural regeneration of fodder grasses and shrubs;
    - possibility of area closure for natural regeneration of fodder grasses and shrubs;
    - land below the dam being protected from erosion and used for agriculture;
    - improved yields from agriculture through enriched soil;
- explain ecological medium- to long-term benefits;
- the role and contribution of the community in both construction and maintenance;
- the role of the community in construction, including food or cash for work (time and date for work, payment arrangements, rules and regulations);

Ask community members to think about and describe how the landscape and their livelihoods changed since their own childhoods. How many rains per year did they see back then? How many camels and cattle did they own? Did they grow any crops?

Then ask community members to describe their own traditional indigenous soil- and water-conservation measures. What experience do they have? How do they use the area currently? How will they use the area in the future when the land has been improved?

If time and number of participants are sufficient (but not numbering more than 50), divide them into groups and ask them to draw a map of their area showing spatial arrangement of all of the available resources, then ask them to describe it and compare their maps. The exercise helps the community to pool their knowledge and understanding of the landscape. It also can raise discussions about challenges, providing key information to you and other DAs and even to the kebele leader.

- Having built awareness, seek the community's approval to contribute to restoring the area with WSWs in cooperation with PADO and the executing agency. If the weir construction has been tendered out, there will also be a construction company involved.
- Be sure to give women equal voice in the discussion! Facilitate discussions of organisation and provision of labour. True ownership of the WSW will be achieved if overall construction follows a free labour scheme, because then people will fully realise that the construction belongs to them.
- If food-for-work is used it must be done with the support of the PADO. Explain the procedures fully and ensure that the respective PADO representative is present to answer questions and agree of the optimum time to arrange for construction to begin.
- In the case of food-for-work schemes, help to negotiate the community contribution in terms of labour and / or other ways. Again, the higher the community's contribution, the more ownership they will feel.

- Be sure to remind participants that community by-laws must be developed prior to construction starting, and explain why – see the by-laws section of the separate Teaching and Learning Guide in order to understand this fully.

Discuss and verify during the meeting clear definitions of roles and tasks of the different stakeholders during each of the planning, construction, utilisation and maintenance stages. In other words, who will do what?

- What are the role and tasks of the DA?
- What are the role and tasks of the community representatives (kebele leader, clan leader, elders)?
- What are the role and tasks of community members?
- What are the role and tasks of the PADO?
- What are the role and tasks of the executing agency?

Final area selection

A second or final site selection might take place with community representatives and the NRM expert of the PADO based on the resource mapping and results of the meeting. Be sure to join this final selection process and oversee the demarcation of the proposed WSW.

The executing agency should then take profile data of the valley in order to determine the construction details and create a design plan. This plan can contain a cascade of WSWs or a combination with drystone measures, depending on the landscape pattern.

Illustration 19: This valley has been selected for Water Spreading Weir construction.

Second community meeting

Call for a second community meeting, using also local information systems such as daagu.

Remind the community what was discussed in the first meeting and what has happened since. Keep them informed and answer their questions! Then explain clearly, together with the kebele or clan leader and elders, the final plan in terms of how many weirs are planned, where they will be situated, and the justification / explanation for this. Recap with participants what was discussed in the first meeting and what has happened since. Keep them informed!

Further activities

- Ask the community not to remove the demarcation sticks and remind them again of the time schedule.
- When mobilising and organising the community contribution, remember that the larger the better! Register community members' names for participation in the construction. If food-for-work is being provided by the PADO, help to register all interested community members.
- Repeat community awareness creation meetings with those who were not able to attend the main meeting. Also use market days and festive days to meet people and to talk to them informally.
- Accompany the construction process closely and support all participating community members

LAP-Test

Name	
Date	
Time started	
Time finished	

General Instructions:

- You are to accomplish the tasks provided in the specific instructions.
- You are given 2 hours to complete them.
- All your questions and clarifications should be addressed to the teacher only.
- Submit the documented results of your tasks to your teacher upon completion.

Tasks

1. Prepare the necessary resource requirements for Community awareness creation and area selection operation.

2. Organize and facilitate community meeting and capacity building.

3. Conduct a transect walking. Consider:
    a. Observation
    b. Discussion
    c. Note down (record information)
    d. Participatory mapping

4. Finalize, document and report the selected areas for WSW

Learning Outcome 3: Constructing Water Spreading Weirs

By working through this Learning Outcome section:

- you will understand the basics of water-spreading weir construction (even though technical planning and construction will be supervised by an engineering team).
- you will be able to support implementation, both technically and in terms of community involvement.

Instruction Sheet for Teachers

1. As usual, start from the Introduction; what do we want to achieve from this Learning Outcome?
2. Before starting with Information Sheet (construction steps), ask the students to mention all steps that have already been completed by the different stakeholders and by the DA.
3. Look at Information Sheet (construction steps). Go through each construction step, one by one, using the illustrations and asking students to explain each step to their classmates. Continue the same procedure for all steps, adding information that was not mentioned by the students and correcting or clarifying misunderstandings.
4. Then go through the guiding questions and ask the students to try answering them, especially the more technical questions. If you think it is necessary and helpful to increase memorisation of the construction steps, think of your own additional questions to ask.
5. Continue with Information Sheet on dos and don'ts. Repeat the same procedure as for the previous Information Sheet.

6. Take your group out of the classroom for ten minutes and look for unpainted walls nearby. Look at them, analyse them, and discuss with your students each wall's stability. What would need to be different if it was to stand as the wall of a WSW?
7. Work through the Operational Sheet. Nominate students to read aloud the different points listed. Stop after each point or operation and ask students to explain what is meant and why, in their own words. This interactive teaching will help students to memorise the topic better.
8. Finalise the Learning Outcome using the guiding questions of the Operational Sheet. Discuss especially the role of the development agent.

Teaching methodology

Brainstorming, interactive teaching and learning, discussions.

Session Plan

- 60 minutes for Information Sheet – construction steps
- 45 minutes for Information Sheet – dos and don'ts
- 15 minutes for the outdoor exercise
- 45 minutes for the Operational Sheet
- **Total:** 165 minutes.

Instruction Sheet for Learners

1. Read the Introduction.
2. Work through Information Sheet (construction steps) and note down any clarification questions you have.
3. Ask support from your teacher to get answers to your questions.
4. Try to answer the guiding questions and discuss them with your classmates.
5. Note down any extra questions for your teacher and get the answers from them afterwards.
6. Complete the self-check test.
7. Continue with Information Sheet on dos and don'ts.
8. Try to answer the guiding questions.
9. Note down any extra questions for your teacher and get the answers from them afterwards.
10. Complete the self-check test.
11. Work through the Operational Sheet and again try to answer the guiding questions.
12. Complete the LAP-Test.

Information Sheet: Constructing a Water Spreading Weir

If you have worked through Learning Outcomes One and Two thoroughly, you will know that a lot is finalised before construction itself begins, for example:

- Community awareness creation and decision making have happened;
- Site selection has happened;
- The community has developed their own by-laws and developed a community action plan;
- Community contribution work procedures have been agreed upon and organised – community members have been organised to carry out the physical construction work (or food-for-work procedures with free community contribution);
- The PADO and the executing agency or/and a construction company have made their necessary agreements, including a complete construction plan;
- Demarcation has been finalised by the DA and/or the NRM expert from the woreda PADO office.
- Setting out and taking measurements has been done by a foreman.

Once all of these are in place, construction can begin. It follows the sequence described in the construction steps below.

Setting out and drawing up the technical profile

Setting out translates the technical plan to the reality on ground by placing wooden sticks and other markers to guide construction of the water-spreading weir. Setting be done should be guided by a trained foreman but it is also essential that the development agent participates in the setting out of the WSW in order to understand exactly how construction will be done and so that the DA can inform and lead the community accordingly.

The technical profile, which indicates heights, diameters, lengths and reference points of the planned structure, will have been drawn up and finalised by the technical team. The example in shows the sections (each letter stands for a different section). Illustration 20 shows the main spill way and spill over basin (D) and the sections of the lateral wings (A-C and E-G). The double lines between B and B, C and C (and so on) show the longer main wall upstream and the slightly shorter counter wall downstream. The main wall ends as a single wall at the outer ends, without counter wall (A and G). In the illustration, see if you can recognise the main wall, the spill-over basin, the counter wall and the wings.

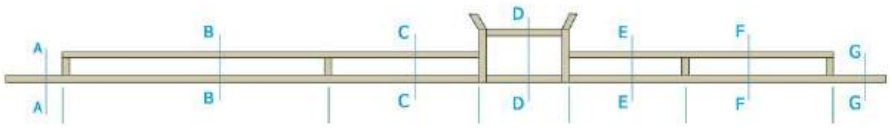


Illustration 20: technical plan of a Water Spreading Weir

Excavation

The base for the WSW will be excavated section by section. Illustration 21 shows the excavation for the wing walls. The illustration shows the outer end of the wing of the weir, with the riverbed far in the background. A similar wing is constructed to the other side of the riverbed, stretching in the other direction.

Illustration 21: the excavation for the wing to one side of the center of the weirs about 150 meters long, it ends in a shallow wall and will be combined with a drystone measure to control erosion of a smaller gully on the outer end

Illustration 22 shows the main spillway. If the gully is deep, there can be two or three basins, placed into the riverbed in a cascade.

Illustration 22: excavation of the main spillway and basin, with the dry riverbed above.

Preparing mortar

To prepare the mortar, cement and sand are mixed in a ratio of 1:4 – meaning 1 part of cement with 4 parts of sand. This is then mixed with plenty of water.

Illustration 23: Sand and cement are mixed.

New skills for pastoralists - Trained masons work on WSWs and more: The case of Abdu Mohammed

"A full-time Afar pastoralist and a father of thirteen children, Abdu Mohammed is an example of surviving the challenges of harsh lifestyle.

Based in Hedelu Kebele of Awra District but required to cover large distances for food and fodder for his family and livestock, Abdu regularly crossed into neighbouring districts with his cattle and his camels. The rise of resource-based conflict, as well as severe drought conditions, have been a constant source of worry for his family, undermining the stability of their life.

In 2015 Abdu was included in Basic Masonry Training. 'The course was a great chance for me to understand and answer my curiosity about concrete construction,' he explains. Skilled manpower is regularly needed to satisfy Afar's recent boom in construction, and so Abdu and his fellow trainees immediately had the opportunity to apply their new skills.

Abdu started taking jobs as a mason and carpenter. He worked on various buildings in Awra and Teru Districts including a primary school and public toilets, and the jobs continued to come for him. 'The training has not only boosted my confidence: I have now upgraded from being a basic mason to an 8th-grade contractor with 50,000 birr capital. This means that I can take on both government and private construction jobs.'

In this way Abdu has not only diversified his livelihood quickly, he has also become a role model for other young pastoralists in the area."

Source: *GIZ-SDR Innovation in pastoral contexts: how local masons ensure their communities' food security.*

Preparing the basins of the wings and their foundations

After the foundation for the basin has been excavated the ground is watered and mortar is applied. The masons then place stones for the foundation – see Illustration 24.

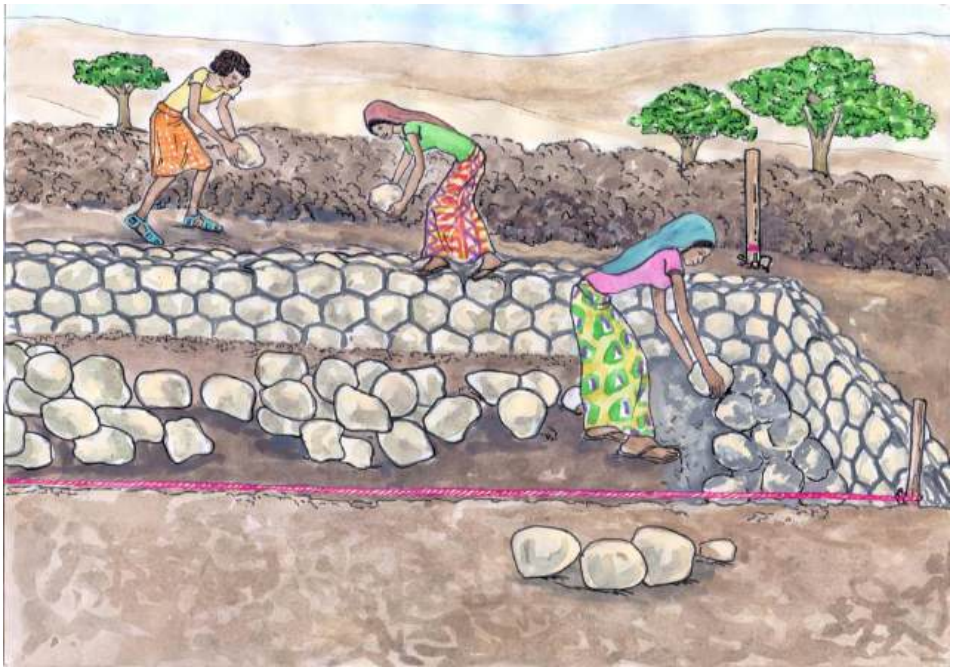


Illustration 24: Preparing the foundation of the basins of the wings.

Building the counter wall

Construction of the counter wall follows installation of the foundation. Masonry comprising large stones and mortar is used for all walls and basins.

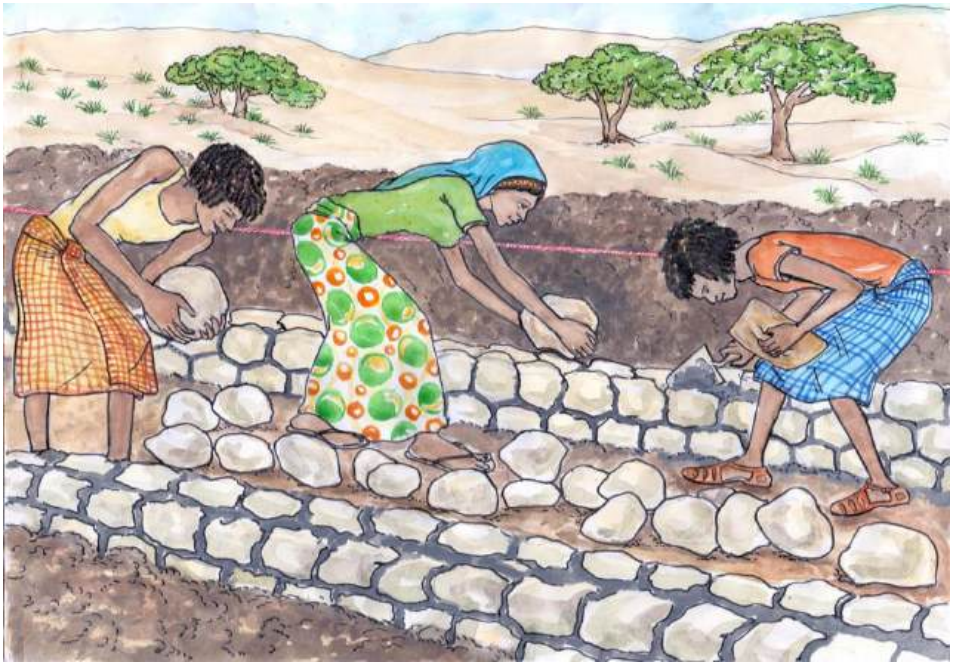


Illustration 25: The counter wall on the left was constructed and the main wall is under way of construction.

Constructing the main wall

The main wall of the weir is constructed as a straight wall. If needed, triangular supporting buttresses can be added at right angles, built upwards from the base of the structure for reinforcement. All excavated soil should then be filled back to the main wall, to improve its stability and prevent water to be channeled by the excavated soil. The prepared mortar should be filled in carefully between the stones, followed by rendering where necessary. See Illustration 26 and underlying text. See also the do's and don'ts for masonry work in Information Sheet on dos and don'ts.

Illustration 26: skilled masonry work done by trained village men.

Constructing the main spillway and basin

Constructing the main spill-over basin of the WSW is the last section to be built, following completion of the foundation, the main wall, abutments and counter walls. This is because any unexpectedly early rains could damage or demolish any unfinished construction in the riverbed itself. Illustration 27 shows excavation of the main spill-over basin at right angles to the water flow direction.

The main wall and basin are designed to a specific ratio: the volume of water flow is estimated and the width of the basin is decided upon accordingly. In general terms, the higher the main wall and the larger the expected water flow, the wider the basin.

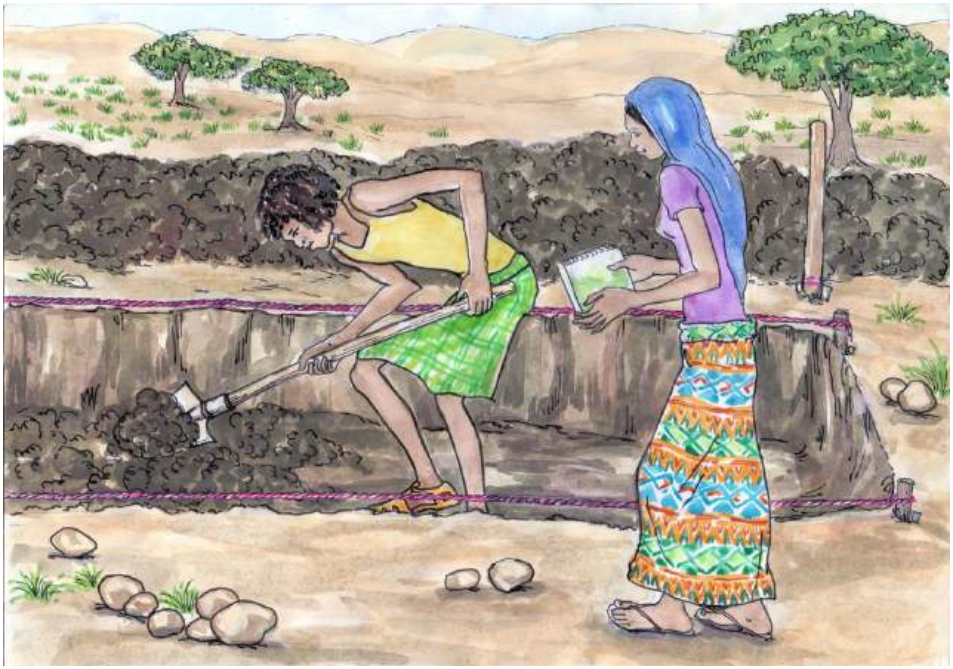


Illustration 27: Excavation of the main spill over basin in the riverbed itself. The DA is supporting the supervision of the work.

Watering

The chemical reaction between cement and sand needs water to take place. It should be remembered that hot conditions cause high evaporation which reduces the water content of the cement-sand-water-mix, even if the water content was correct when preparing the mixture. As a result, the mortar cannot harden properly and prompt cracks are the result.

To avoid this and to ensure a stable structure, sufficient watering of all rendered walls and basins is important. It must be carried both during construction and daily for 4-5 days after construction.

Illustration 28: watering of completed walls is extremely important.

Guiding questions for discussion

1. From your memory, draw a diagram of a Water Spreading Weir. Add arrows to indicate the name of each structural section (foundation, main wall, counter wall, spill-over basin(s), lateral abutments, wings). Also add an arrow to indicate the direction of water flow.

2. Which is constructed first, the main wall or the foundation?

3. Which are the lateral abutments and what is their function?

4. What are the inputs and/or resources needed to build a Water Spreading Weir?

5. Why does the whole structure have to be watered regularly both during and for up to 5 days after construction?

Information Sheet: Dos and Don’ts for Construction

Water Spreading Weirs are exposed to enormous powers of water and sediment flowing over them. They therefore need to be extremely strong and stable.

Several mistakes can be done during construction which hugely weaken the overall structure and result in unnecessarily high damage, frequent maintenance requirements, unsustainability and less-than-intended impact.

It is therefore extremely important to follow the simple dos and don’ts illustrated of the following pages during planning and construction of the weir.

DO!

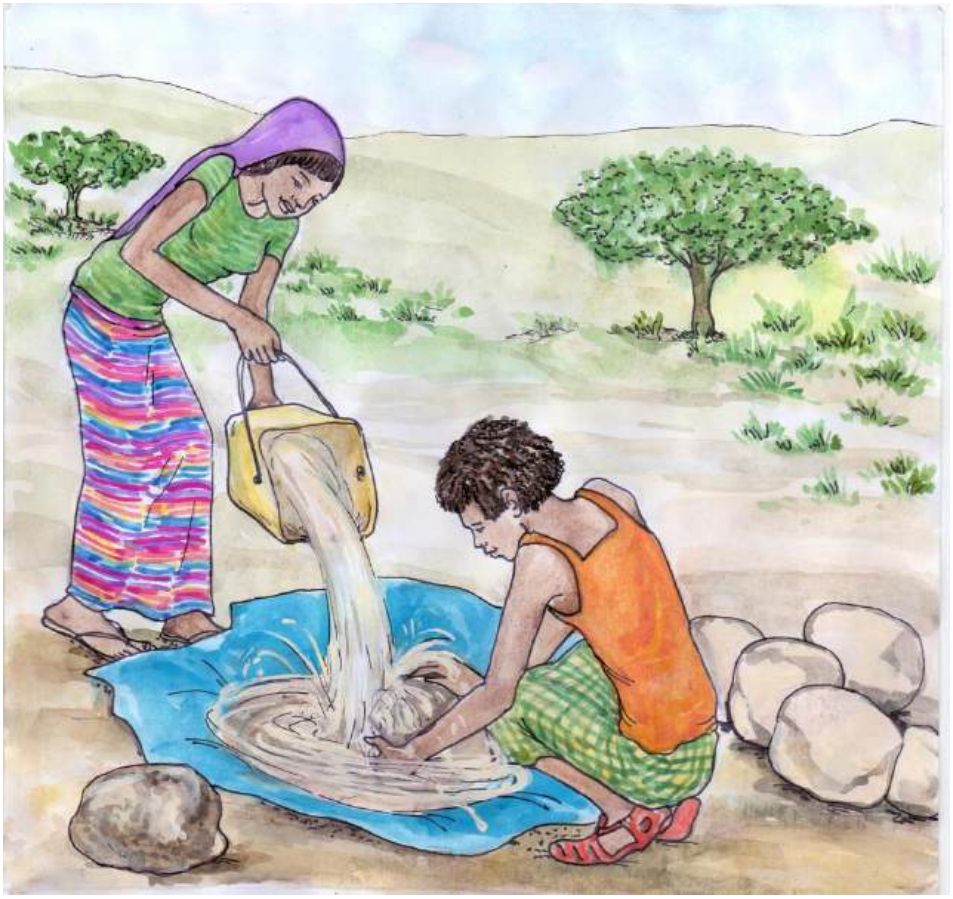


Illustration 29: Remove dirt from stones before constructing with them.

DON'T!

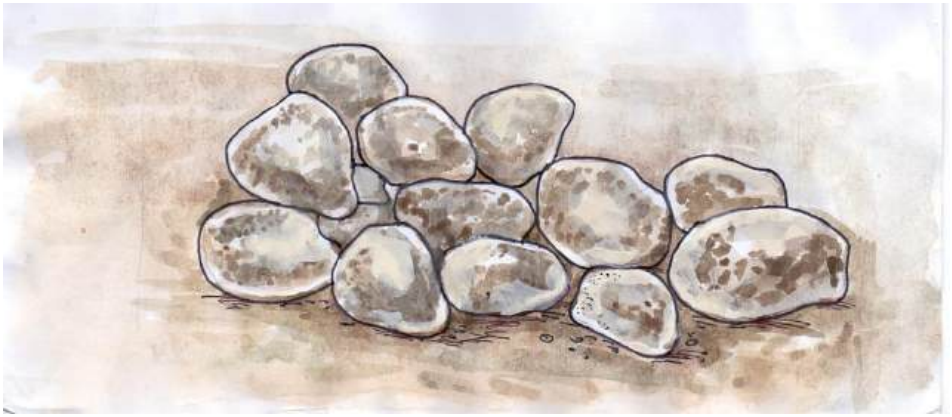


Illustration 30: Never work with dirty stones – the weir will not be stable!

DO!

Illustration 31: Lay stones and mortar together at the same time

DON'T!

Illustration 32: Never lay mortar only! Mortar without stones is unstable and useless.

DO!

Illustration 33: Lay stones as closely and tight-fitting as possible

DONT'T!

Illustration 34: Never lay stones loosely together or widely spaced apart: the weir will not be stable

DO!

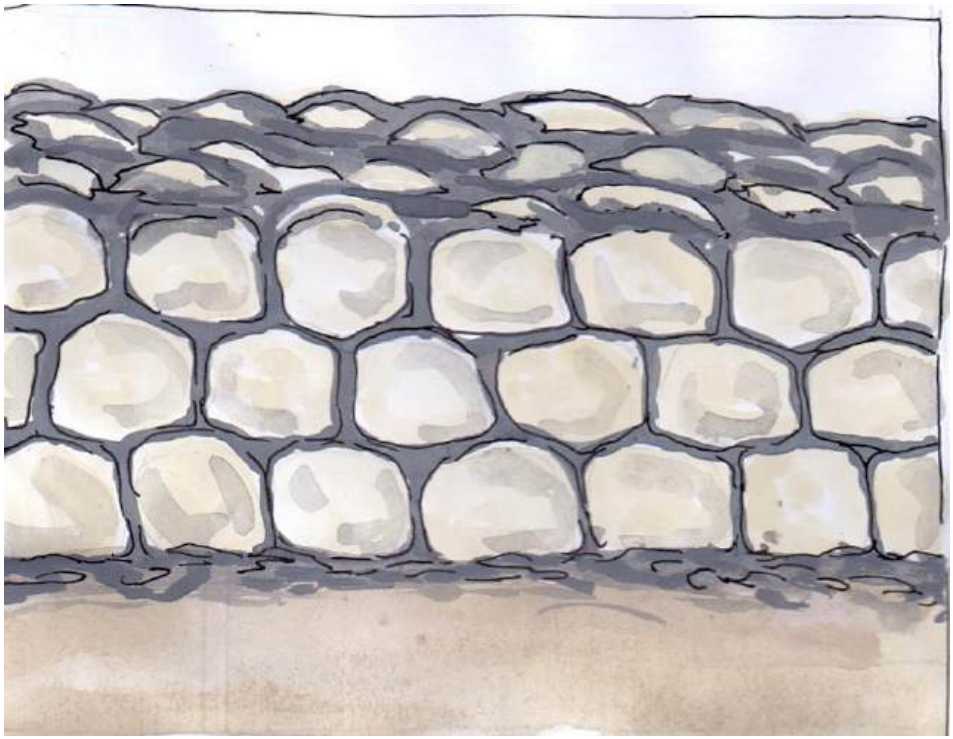


Illustration 35: Build shifted rows.

DON'T!

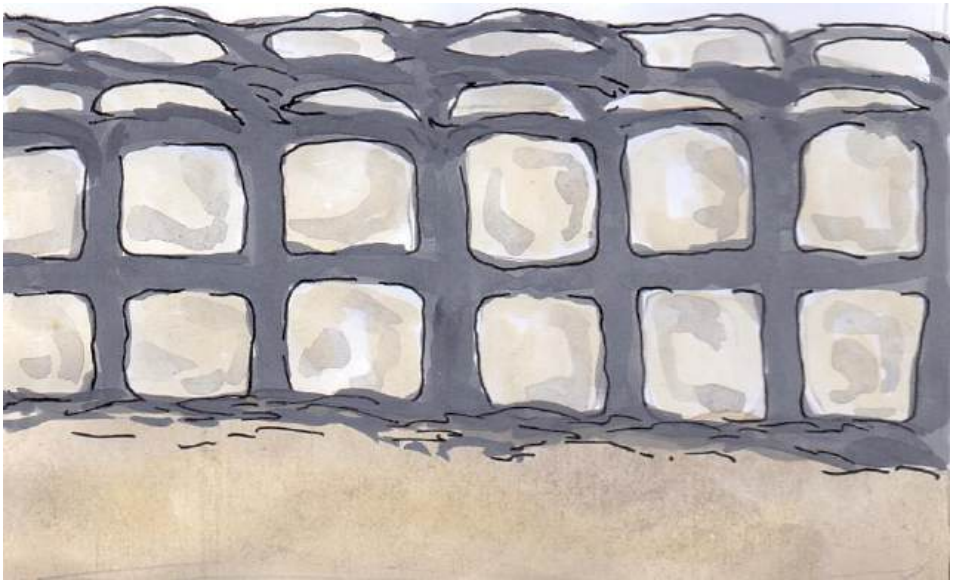


Illustration 36: Don't lay stones in vertical lines.

DO!

Illustration 37: Build a rough surface along the top of the weir:it is more effective at slowing down surface water

DON'T

Illustration 38: Do not waste mortar making the surface smooth and flat. You are not building a garden or house wall and roughness will do more to slow water.

DO!

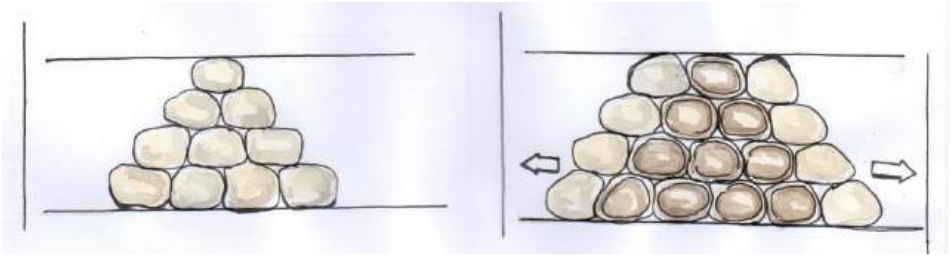


Illustration 39: First build one high triangle then build outwards to widen it.

DON'T!

Illustration 40: Never build a straight long wall without buttresses: it will not be stable and will not last.

DO!

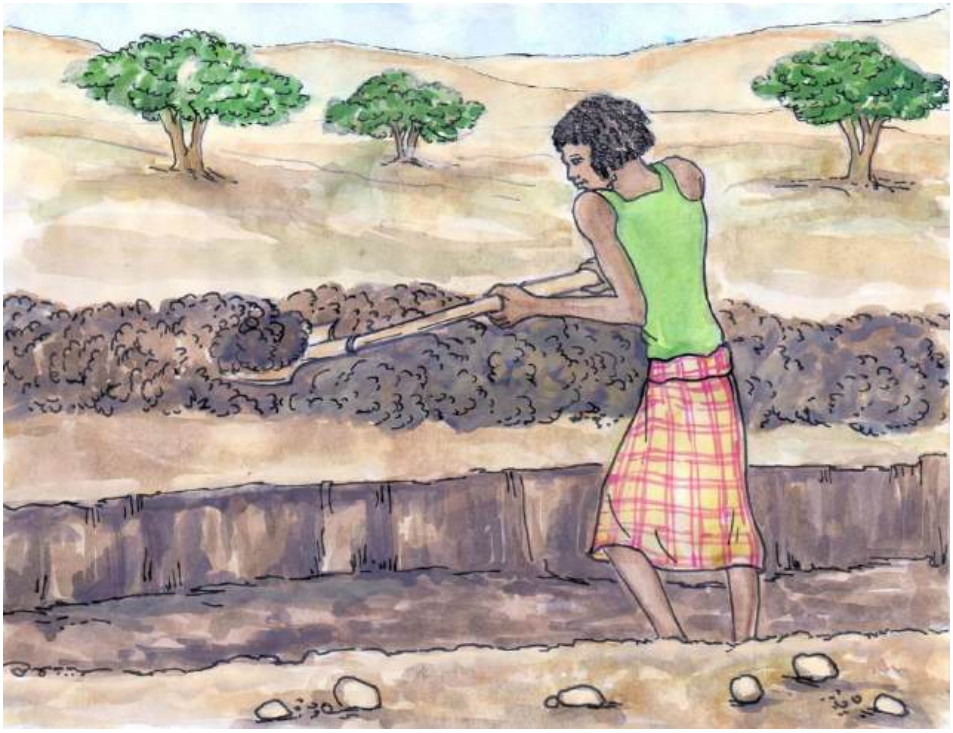


Illustration 41: Place excavated soil on the upper side of the weir, at the end of construction soil is filled back right up to the finished walls.

DON'T!

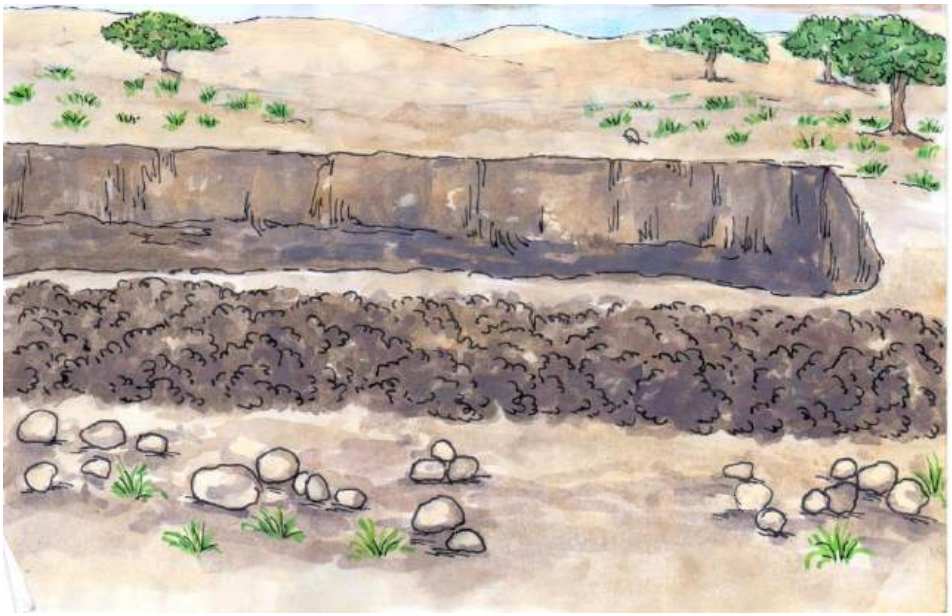


Illustration 42: Don't leave excavated soil downstream

DO!

Illustration 43: Work with big stones

DON’T!

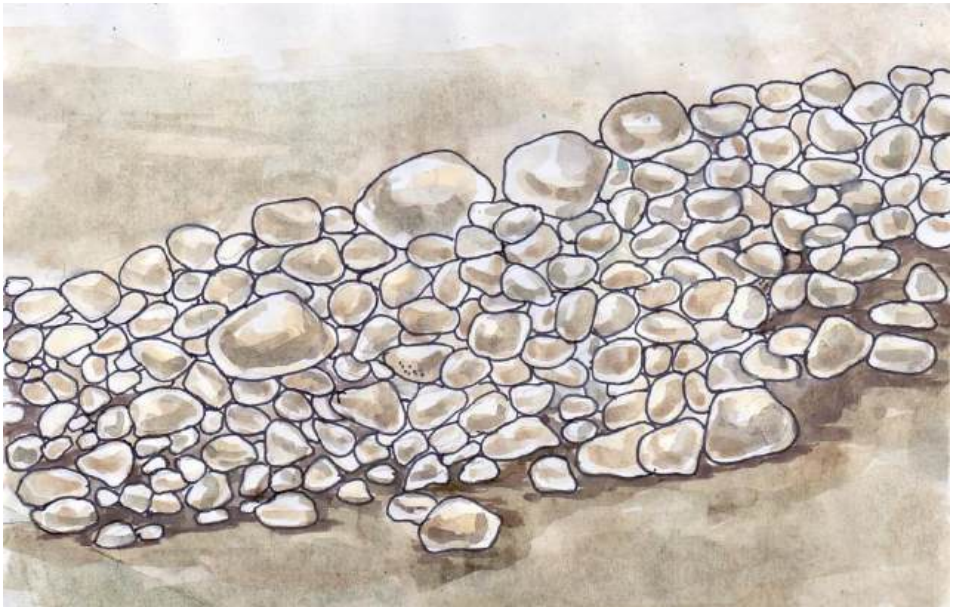


Illustration 44: Don’t work with small stones or split big stones into smaller ones.

As a Development Agent (DA) it is your task to support community members and to ensure that they follow these do's and don'ts.

Guiding questions for discussion

1. Why is it so important to follow the dos and to avoid the don'ts?

2. Can you name at least five dos from memory without looking at the text?

3. Which of the dos and don'ts do you consider might be the most difficult for the community to follow?

4. What is your role as a DA regarding the dos and don'ts? How can you best ensure that all of the dos are followed and all of the don'ts are avoided?

5. Can you think of any additional dos and don'ts, based on traditional community practices that you know?

Self-Check-Test

Name	
Date	
Time started	
Time finished	

Instructions

Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

1. List the steps for the construction of WSW (5 points)

2. What are the components of mortar? (5 points)

3. Why is it important to water the newly built WSW structure? (5 points)

4. Mention at least three mistakes that can happen during construction of WSW that would weaken the overall structures. (5 points)

5. Write down the main parts of WSW structure. (5 points).

Note: Satisfactory rating points 25 and above. Unsatisfactory points below 25.

You can ask your instructor for a copy of the correct answers.

Score: **Rating:**

Operational Sheet

The DA has a crucial role in in all implementation steps of the WSW. He / she cannot implement the weir construction with the community alone. However, together with the kebele or clan leader, he/she will lead the community and liaise closely with the executing agency, the engineer and the PADO in order to help with construction, supervise the workers and ensure smooth and timely operations.

As the DA of the kebele you will oversee the entire construction process. This includes attending and observing the training given to some community members prior to construction.

Objective

A Water Spreading Weir is constructed and the community is guided and technically supported by the development agent.

Resource requirements

- Large stones
- Cement: around 60-70 kg per m^3 of masonry
- Water
- Hand tools: shovels, pick axes, crow bar
- Spirit level, meter, wooden sticks, string
- Labour force: 2 masons and 3 daily labourers compile one team.

Construction Process

Your work will be much easier and more successful if the kebele leader and the DAs for animal production and agriculture are all on board and actively involved. Work together with the clan leaders and PADO expert. Talk to the community members, answer all their questions and generally make sure that they fully understand the benefits and processes of WSW implementation and maintenance. Explain clearly and repeatedly, so that everybody is well informed. Make sure that women are given equal chances to be involved and participate.

1. Organise the interested community members in groups to work together with a foreman. Explain the number of working hours, the type of work to be done by different people and the rules and regulations that will apply.
2. Support all the construction steps, starting with the excavation. You should know every measurement and landmark, and should have the latest version of the technical plan in your hand. Make sure that the excavation follows the rope, to the correct depth, as indicated by the foreman. Also ensure that the working teams put the excavated soil on the upstream side. Help to measure the depth.
3. Supervise the working teams' carrying and unloading of stones, sand and cement, and ensure that sufficient water is available.
4. The foundation of the wings is constructed first, followed by counter wall and main wall – see again the Information Sheet (construction steps). Make sure that large stones are used and that mortar doesn't dry out on top of the structure.
5. Make sure that you know the ratio of cement to sand that is needed for the mortar – refer to Information Sheet (construction steps) if necessary. Supervise the foreman to make sure that the correct ratio is used. This is essential to the stability and durability of the weir.
6. Oversee levelling of the walls and ensure correct heights as per the technical plan (Illustration 45).
7. Supervise and ensure the community workers follow the dos and don'ts throughout.

8. Support the foreman to oversee construction of the main spillway and basin(s).
9. Ensure that mortar and rendered walls are watered constantly for up to 5 days after construction. In other words, visit the site on the days after construction has been finished to ensure that this crucial step is also followed.
10. Constantly check the working times and the work quality of each labour team.
11. Address any conflict or disagreement immediately, calling on clan leader and elders if necessary.

After the construction process is completed, together with the kebele leader, call for a community meeting to organise utilization and maintenance of the WSW.

Illustration 45: the DA checks on the newly constructed part using the spirit level.

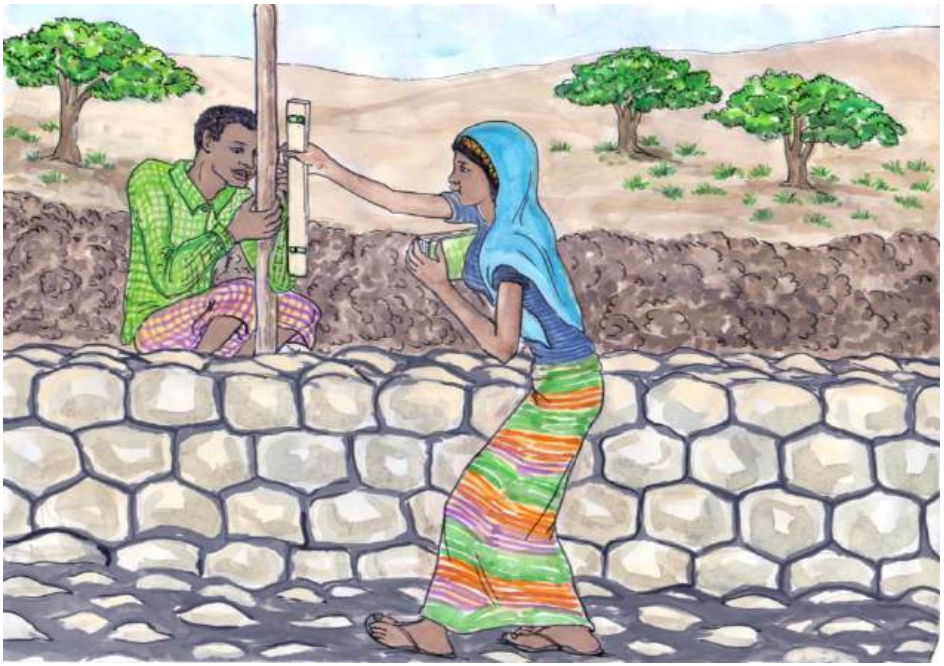


Illustration 46: The DA controls the height of the main wall, the engineer of the executing agency supervises.

Guiding questions for discussion

1. What is the role of the DA during the construction process?

2. Are you aware of any additional tasks (not mentioned) for the DA?

3. Why are continuous supervision and quality control by the DA so important? What might happen if the DA is a passive person who observes the process but is not actively involved or managerial?

LAP-Test

Name	
Date	
Time started	
Time finished	

General Instructions:

- You are to accomplish the tasks provided in the specific instructions.
- You are given 4 hours to complete them.
- All your questions and clarifications should be addressed to the teacher only.
- Submit the documented results of your tasks to your teacher upon completion.

Tasks

1. Design and set out a WSW
2. Excavate and prepare a part of the WSW basin
3. Construct part of a counter wall, main wall and main spill way
4. Water a part of the WSW structure

Learning Outcome 4: Utilising and Maintaining Water Spreading Weirs

By working through this Learning Outcome you will deepen your knowledge and understanding of:

- how to make the best use of Water Spreading Weirs;
- the link between utilization, benefits and maintenance;
- the duties of the development agent in guiding and supporting the community
- through the process.

Instruction Sheet for Teachers

1. Start by reading through the introduction with the specific learning objectives.
2. Ask your students to give their ideas on how the land around the weir can be utilized, why optimum utilization is important, and what are keys to the sustainability of the weir.
3. Complement the missing information from the text in Information Sheet: Utilisation of the Weir.
4. Complement the missing information from the text in Information Sheet: Maintaining Water Spreading Weirs.
5. Discuss the guiding questions at the end of Information Sheet: Maintaining Water Spreading Weirs.
6. Discuss with your students how they would proceed to implement what is explained about utilization and maintenance in both Information Sheets.
7. Work through the Operational Sheet.
8. Set up group role plays modelling a community meeting about utilisation and maintenance. If you want you can assign specific roles to members of the role play actors, such as:
    a. somebody not wanting to repair a weir;
    b. somebody unsure about the benefits of a weir;
    c. somebody wanting to leave everything to the PADO and the executing agency;
    d. clan leader, DA, community member (men and women), and so on.
9. After 15 minutes ask for feedback from each group about what was discussed. If appropriate, ask some groups to repeat their role play if appropriate.

Teaching methodology

Brainstorming, interactive teaching and learning, role plays.

Session Plan

- 15 minutes for the learning goal and brainstorming
- 20 minutes for the text on utilization in Information Sheet: Utilisation of the Weir
- 15 minutes for brainstorming about maintenance
- 20 minutes for the text on maintenance in Information Sheet: Maintaining Water Spreading Weirs
- 20 minutes for the guiding questions
- 15 minutes for brainstorming and idea sharing prior to working through Operational Sheet.
- 15 minutes for Operational Sheet.
- 30 minutes for the role play (including preparation and discussion).
- Total: 150 minutes

Instruction sheet for Learners

1. Work through Information Sheet: Utilisation of the Weir and note down any clarification questions, you have.
2. Ask support from your teacher to get answers to your questions.
3. Try to answer the guiding questions, and discuss them with classmates.
4. Work through Information Sheet: Maintaining Water Spreading Weirs and note down any clarification questions, you have.
5. Continue with Operational Sheet..
6. Try to answer the guiding questions.
7. Note down any additional questions that you have for your teacher and make sure you get the answers later.
8. Complete the LAP-Test

Information Sheet: Utilisation of the Weir

After construction has finished and the weir has been officially handed over to the community officially, is the work of the community now finished? If not, what comes next?

The land around and along a Water Spreading Weir is normally distributed among the community members by the clan leader. Despite this, continued monitoring of land utilisation and weir maintenance by community members is still required by an enthusiastic development agent and an active kebele or clan leader. This is especially important considering the pastoralist (rather than the agricultural) way of life in Ethiopian lowlands. Good facilitation and community development skills, especially on the part of the DA, are essential.

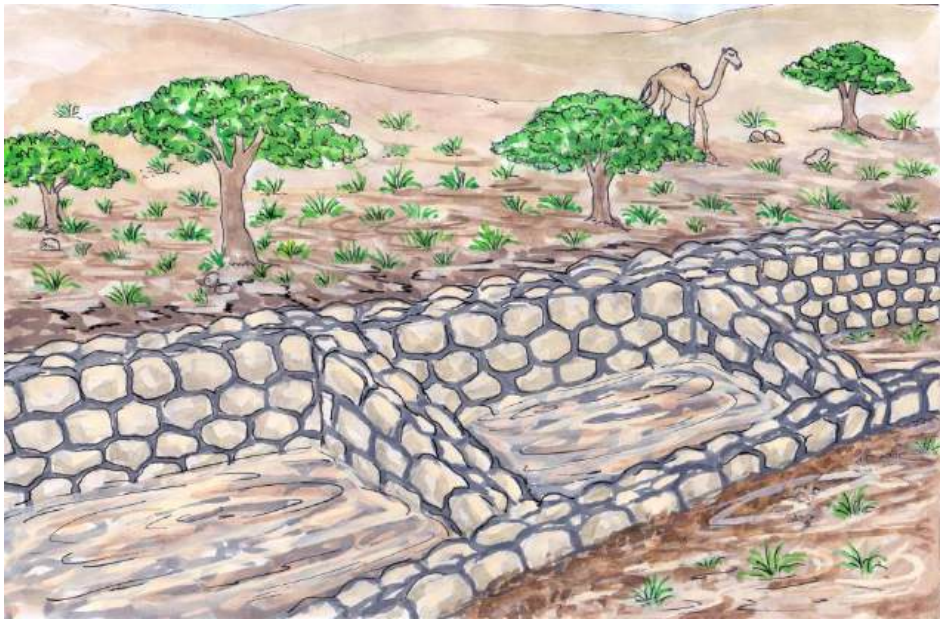


Illustration 47: Strong sedimentation upstream of the Water Spreading Weir.

Sedimentation upstream of the weir will be considerable after just one rainy season. Accordingly, optimal use of the land should be made in order to make use of the infiltrated water and sedimented, fertile soil. The quicker the land is developed and made use of, the less evaporation takes place.

Illustration 48: Rains have brought a lot of sedimentation – land that could be used for a second crop.

Using the new resources and the improved land

Some community members might be hesitant at the beginning, preferring to observe than being involved. This is where raising community awareness again comes into play. The development agent must support review of the by-laws. What has been agreed in terms of utilisation of the land? What inputs are needed (if any), and what is possible without any additional inputs or support?

Area enclosure

An enclose patch of land prevents spontaneous livestock grazing, preserving the site for later grazing when dry soil in the surroundings have ceased to provide fresh grasses. A cut and carry-system of grasses can also be practiced feeding animals around homesteads. Seed production of those grasses which are appreciated locally and enrichment of the grazing area can also be carried. The DA should advise on the pros and cons of each of these practices. Provision of seeds or cuttings can possibly be arranged in coordination with PADO, especially of vigorous species such as elephant grass.

Planting trees, shrubs and fodder

Cattle, camels, sheep and goats will benefit from protein-rich shrubs or trees, while shade is also produced for both humans and animals from plants. Plants such as the easy growing and drought-resistant mung bean (lablab) are protein rich and fix additional nitrogen into the soil. Planting of trees and shrubs along the edges of wings or next to the main basin of a weir also helps to stabilise the soil and reduce erosion. Valuable tree species adapted to the Ethiopian lowlands include hebeleita (serving for human food), aishadudha (serving as fodder for livestock) and the date palm.

Illustration 49: date palms are suitable for dry lowland areas

The case of Ahmed Wagris of Sheqayiboru Kebele

"In the beginning, I did not believe that the Water Spreading Weirs could support my livelihood: I simply took part in their construction to earn a wage,' explains agro-pastoralist Ahmed Wagris of Sheqayiboru Village in Chifra District. Aged 30 and with six children, Ahmed is one resident of the village who benefits from the water-spreading weir structures built nearby.

I had a dry field that could never produce enough harvest because of uncertain rains. Even to have enough feed for my livestock I had to spend 1,500 ETB per month and to ask for support from my relatives who own irrigated farm plots around the Mille River. Now I can grow better crops and fodder."

This season Ahmed has grown elephant grass, mung beans and maize on his 1.5 hectares of land. The straw fodder from this will last three months as well as earning him 2,000 ETB from the sale of straw, with which he can buy food, clothes and exercise books for his children.

***Source:** GIZ-SDR, 2017: Innovation in pastoral contexts: how local masons ensure their communities food security.*

Agricultural use

Varieties with short growing seasons are important for agro-pastoralists so that they can harvest before migrating to other areas. The crop production DA should advise on planting techniques and correct agricultural practices and should liaise with the PADO if specific seeds are needed. The DA should also support selection, improvement and multiplication of local seed varieties that are in danger of being lost.

Illustration 50: a promising maize field nearby a Water Spreading Weir.

Second crop

An additional post-rainy season crop such as beans or vegetables can be cultivated both up- and downstream of the weir. After the rainy season land will not flood anymore but it will have a higher groundwater level and soil-moisture content, favouring crops with short vegetation periods.

Illustration 51: beans are planted in contour lines on the moist and fertile soil.

Horticulture

Especially for women, an additional income could be generated from planting vegetables. However, women must have some basic initial knowledge because growing vegetables needs dedication, daily follow up and watering. The DA can support this by giving technical advice.

Information Sheet: Maintaining Water Spreading Weirs

If all has proceeded correctly, the rules and proceedings for maintaining the weir have already been decided and incorporated into the by-laws. It is therefore necessary at this point to look back into the by-laws with the community and remind everybody of what has been agreed upon.

The organisation of maintenance procedures differs from community to community: while some communities could set up a permanent maintenance team, others would prefer rotating systems.

It is crucial that the responsibility for the organisation of maintenance is clearly stated in the by-laws as well as understood and assumed by the specific individuals and / or groups.

A maintenance committee, of which the DA should be a member, should perform regular monitoring visits, especially after each heavy rain or flood event, to check on the physical structure and identify any damage or weaknesses promptly. Smaller repairs can be made immediately while more extensive damage might need the support of the PADO.

Maintenance activities that can be done immediately by community members and / or the maintenance committee include:

- removing branches, trees or waste carried onto or near the weir by the flood – see Illustration 52 ;
- repairing all parts that have damaged cement and/or stones.

Illustration 52: good rains have flooded the land and brought sedimentation. Removing branches and stems of trees is an easy maintenance work to be done by the maintenance team itself or a small community group.

Larger damage that might require support from the PADO includes:

- broken parts of the outer wall at the edges of the weir (as in Illustration 51);
- erosion along the abutments of the main basins (as in Illustration 52);

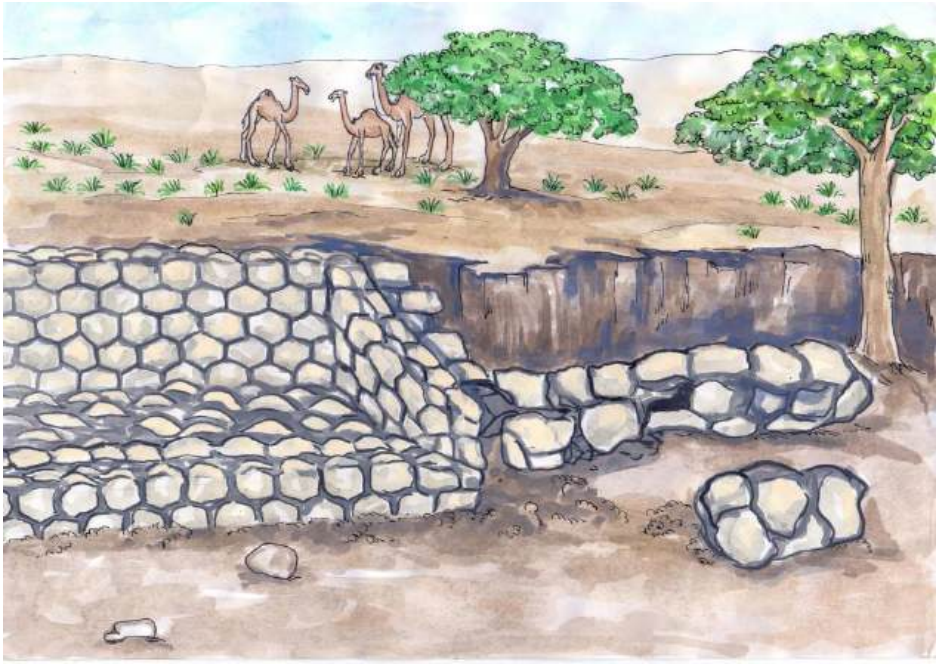


Illustration 51: The end of the outer wing wall broke – cement and technical advice will be needed, to rebuild the wall. PADO needs to be contacted.

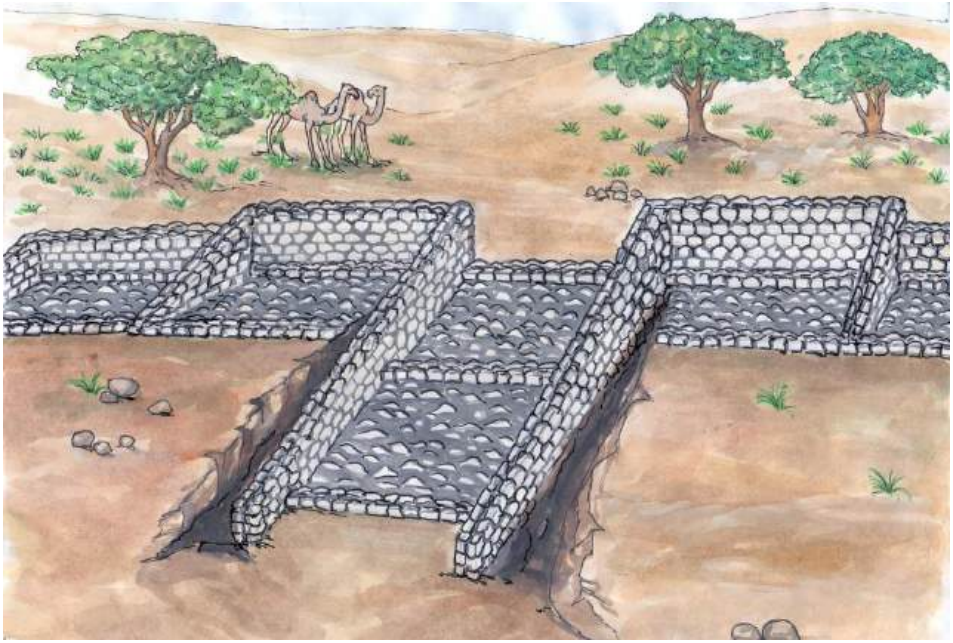


Illustration 52: Erosion along the abutment of the main basin. External technical advice is necessary. PADO and the executing agency must be contacted to support maintenance.

Should a maintenance system prove unpractical or not bring the expected result, by-laws can be changed at any time with the agreement the community. The more people use and benefit from the land along, upstream and downstream of the weir, the more they will be interested in maintaining the physical structure.

In terms of maintenance, the development agent should:

- remind, advise and mobilise people into action, based on the by-laws;
- contact the woreda PADO office for materials such as cement to repair the weir;
- be an active part of the maintenance committee, including making people aware of the need to maintain regularly.

To encourage ownership and responsibility, larger repairs should not involve cash or food for work: community members should only be supported technically or with materials such as cement.

Guiding questions for discussion

- What are the links between utilisation and maintenance of WSWs?
- What is the role and task of the DA in organising maintenance?
- Why is community awareness creation important at this stage?
- What is the task of the maintenance committee?

Operational Sheet: Using and maintaining WSWs

As the development agent you are expected to:

- provide technical advice about land use options.
- facilitate and organise community maintenance and natural resource management.

Objective

Communities utilise and benefit from the land around WSWs, developing ownership and maintaining the structures.

Procedures

1. Together with the kebele or clan leader, call for a community meeting as soon as construction of the weir is complete.
2. Facilitate the discussion on use and maintenance of the land by reminding people what was agreed upon in the by-laws, starting with utilisation.
3. Give women a say. What was agreed? Who will use which land plots, and how?
4. Which technical support is needed from you, as the DA? Avoid relying on requests for external supply of seeds and inputs: what can be done with the locally available resources?
5. How can further community members such as young men and older men be included and involved?
6. What can be done immediately in terms of, say, organising seed planting? What will be done as soon as the rains come? What will be done after the first rains?
7. One person should take notes and write down all decisions agreed upon.

8. Follow up the decisions after the meeting.
9. Call for a second meeting – or, if time allows and depending on the community's wishes – use the same meeting to discuss maintenance possibilities.
10. Look back into the by-laws. Are the by-laws clear regarding maintenance? Remind the community.
11. Set up a maintenance committee if not yet done. Be part of it in order to support and follow up with the community.
12. Carry out a WSW inspection and, if necessary, immediate maintenance, right after the meeting. Is everything intact with the structure? Was watering of the walls carried out for 4-5 days following construction?
13. Remind people also of the meeting intervals agreed upon in the by-laws and help them to fix the date for the next meeting.
14. Together with the kebele leader, write up full meeting minutes and keep them on file.
15. Remind people on the date of next WSW inspection or agree to make the inspection as soon as it has rained.
16. Support maintenance as explained in the Information Sheet. For small items such as removing debris and washed down trees, the committee can handle this during the inspection itself. For larger damages, call the PADO at Woreda level to support with cement and / or to organise technical advice.
17. Follow up whether planned maintenance has actually been carried out.
18. Continue community awareness creation for maintenance at all opportunities, during community meetings and during discussion of by-laws.

After completing the activities continue to provide technical assistance on land use options around the WSW, and support communities to organise their own maintenance.

LAP-Test

Name	
Date	
Time started	
Time finished	

General Instructions:

- You are to accomplish the tasks provided in the specific instructions.
- You are given 1 hour to complete them.
- All your questions and clarifications should be addressed to the teacher only.
- Submit the documented results of your tasks to your teacher upon completion.

Tasks

1. Identify the construction materials that are used to maintain Water Spreading Weirs (3 points)

2. Identify and prepare tools and equipment for maintenance (2 points)

3. After you identified the damaged parts of the water spreading weir, maintain the weir and drop structure (basin) using required construction materials supplied (5 points)

Note: Satisfactory rating – 5 points. Unsatisfactory - below 5 points

Glossary of Technical Terms

Arable Land	Land which is capable of being ploughed and used to grow crops
Biodiversity	Abbreviation of 'biological diversity'. Variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Catchment area	The area from which rainfall flows into a river, lake, or reservoir.
Desertification	Land degradation as a reduction or loss in arid, semi-arid or dry sub-humid areas of biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, or range, pasture, forest, woodland etc. Desertification is caused by (i) wind- and/or water-induced soil erosion, (ii) deterioration of physical, chemical, biological or economic properties of soil, and / or (iii) long-term loss of natural vegetation and biodiversity. .
Drystone measure (DSM)	DSMs are designed to reduce degradation, increase water infiltration and prevent (gully) erosion over large areas of land. They reduce the speed of water flow, retain organic matter and deliver a water-spreading effect (although less than a water-spreading weir). DSMs function best in combination with biological protection
Drystone Structure	Dry-stone structures are semipermeable and made of natural stones only. They are built at right angles to a slope (ie. at right angles to the direction of water flow), forming a horizontal line along the upstream facing side. Series of structures can span a whole valley or they can be focused in

	small gullies in order to specifically slow gully formation and to disperse runoff.
Evaporation	The change by which any substance is converted from a state of liquid to vapour.
Groundwater	(1) Water content within the earth that supplies wells and springs. (2) Water contained in the zone of saturation, in which all openings in rocks and soil are filled and the upper surface of which forms the water table.
Gully erosion	A gully is a landform created by running water eroding sharply into soil on a hillside or slope. Gullies resemble large ditches or small valleys and they vary from being less than a meter to tens of meters in depth and / or width. When water flow rate is substantial, its cutting action into soil is deeper and more substantial. Gully erosion is a serious problem in arid and semi-arid areas where vegetative cover is poor. In Ethiopia, gully erosion is widely caused by runoff from untreated farmland, slopes, roads and urban areas.
Infiltration	The penetration of water through the ground surface into sub-surface soil.
Land degradation	A reduction or loss of the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland or range, pasture, forest, and woodland.
LAP Test	Learning Accomplishment Profile Test, examined by an assessor.
Participatory resource mapping	Participatory resource mapping captures and represents – usually (but not necessarily) spatially, in map form – the resources available to a community within a given physical area. Mapping also captures and represents other physical features of relevance. Resources listed and placed on a map

	typically include slopes, water sources, water courses, designation of land use (such as fields or settlement) and vegetation types. Similar to a social or village map, a resource is not drawn accurately to scale; rather it is compiled collectively (in a participatory way) by stakeholders, based on their knowledge and experience of the surroundings (usually from having lived and worked there for a long period of time). A resource map reflects people's perceptions of the reality of their natural resources rather than precise measurements.
Pasture land	An area of land on which animals feed on the grass contained therein. Pasture constitutes both enclosed tracts of farmland which are grazed by domesticated livestock and open, unenclosed land which is grazed in a less regulated way by both livestock and wild animals. The vegetation of tended pasture often consists of grasses interspersed with legumes and other forbs (non-grass herbaceous plants).
Resilience	The ability of an ecosystem to maintain or restore biodiversity, biotic integrity and ecological structures and processes both during and following a disturbance event..
River basin	The area drained by a river and its tributaries.
Runoff	Surface water entering rivers, lakes or other reservoirs.
Sediment	Particles, derived from rocks or biological materials, which are suspended or settled in water, having been transported by a fluid or other natural process..
Siltation	The deposition of fine soil and rock particles on the bottom of streams, riverbeds and lakes or other reservoirs.
Slope	The side of a hill or mountain, the inclined face of a cutting, canal or embankment, or other inclination from the horizontal. The steepness of a slope can be expressed as a percentage, the term 'gradient' also being used.
Soil Erosion	The wearing away of the land surface by physical forces such as rainfall, flowing water, wind, ice, temperature change,

	gravity or other natural or anthropogenic agents that abrade, detach and / or remove soil or geological material from one point on the earth's surface to another. Soil erosion is normally a natural process occurring slowly over extensive geological timescales, but wherever the natural rate has been accelerated by anthropogenic activity, soil erosion becomes a process of rapid degradation and an immediate and identifiable threat to soil.
Spillway	A structure over or through which flood water or run-off is discharged. If the flow is controlled by gates it is called a 'controlled spillway'. If the elevation of the spillway crest is the only control, it is an 'uncontrolled spillway'
Stakeholder	Stakeholders are either individuals or groups that hold a real or a potential interest in a process or project and its change objective, and / or they are individuals or groups who are affected directly or indirectly in terms or power, privileges, business, livelihoods or physicality by the process or project.
Stilling Basin	A basin constructed to dissipate the energy of fast-flowing water, such as from a spillway or outlet, in order to prevent undercutting of a dam or other structure and in order to protect the streambed from erosion.
Sustainable development	A process of change or advancement that is considered to be both positive and meeting the needs of the present without compromising in any way the ability of future generations or entities to meet their own needs.
Transect	Also known as a 'transect walk'. This is a method used to explore the spatial dimensions of people's realities by factoring social aspects of a community into the layout of its natural and other resources. A transect is normally conducted following resource mapping the village in order to facilitate triangulation of the data generated on a resource map. The transect depicts a cross-section of agro-ecological zones and provides a comparative assessment of these zones in terms of topography, land type, land use, ownership, access, soil type, soil fertility, vegetation, crops, problems, opportunities, solutions and other parameters.

Tributary	A stream that contributes its water to another stream or body of water.
Water harvesting	The collection and concentration of runoff for productive purposes such as crops, fodder, pasture, trees, livestock and / or water supply. Water harvesting includes all methods of concentrating, diverting, collecting, storing, utilising and managing runoff for productive purposes.
Watershed	(1) A land area which is defined by the drainage of water towards a common watercourse in a natural basin. (2) The dividing line between two adjoining river systems
Watershed Approach	A framework for coordination and implementation of activities that addresses prioritised problems within hydrologically defined geographical areas
Watershed Management	Water resource protection, enhancement and restoration. Optimum watershed management sees the development of solutions that consider all of the problems facing a watershed, include all of its stakeholders in defining these problems, propose solutions, and involve all stakeholders in the implementation of these solutions
Water Spreading Weir (WSW)	A WSW spans the entire width of a valley to spread floodwater over the adjacent land area. Water encounters the weir and spreads off its side wings onto a larger surrounding area, including over the sides of the river bed. WSWs increase water infiltration into permeable soil and recharge groundwater. By detaining sediments they also foster the accumulation of breeding plants and natural biological protection measures.

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