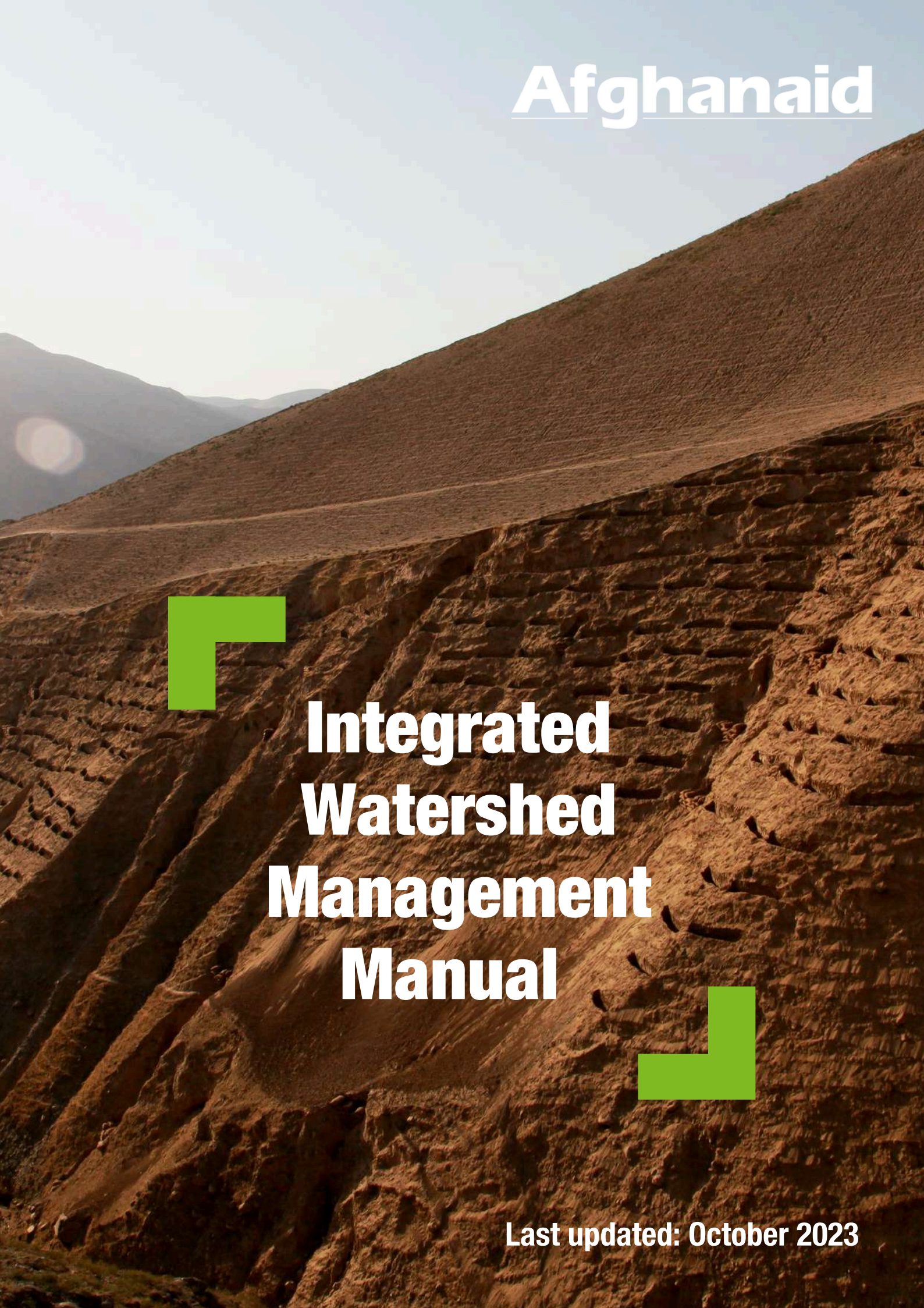

Integrated Watershed Management Manual

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Introduction

Afghanaid, an International Non-Government Organization (INGO) has been promoting and implementing Integrated watershed management (IWM) for and with the rural and mountain communities of Afghanistan since 2017.
It has studied and learned from watershed management principles and projects undertaken in different countries and applied them in Afghanistan.

A few of the projects Afghanaid has implemented which include watershed management activities are: Strengthening Resilience of Afghan Communities Against Disasters (SRACAD) funded by DFID, Community Based Eco-DRR (CBED) funded by SIDA, Rangeland Management (RAMA) funded by SDC and Forest Land Restoration (FLR) funded by GIZ. Over the years, Afghanaid has learned which watershed management practices work best and most effectively in the specific social and topographical context of Afghanistan. This manual aims to compile them together for use by development practitioners and supporters in the future.

Where we work

Afghanaid holds its headquarters in Kabul and currently works through four provincial offices in Badakhshan, Samangan, Ghor, and Daykundi.

We also work through partners in nine others provinces: Herat, Faryab, Jawzjan, Sar-i-Pul, Balk, Bamyan, Takhar, Khost and Paktya.

What is a Watershed?

A watershed is an area of land and water bounded by a drainage divide within which the surface runoff collects and flows out of the watershed through a single outlet into a larger river or lake. In other words, a watershed is a geo-hydrological unit or piece of land that drains through a common point or a common drainage channel. The components of a watershed include all of its natural and artificial features such as geological and topographical settings including ridges/divides, hill slopes, gullies, flood plains, perennial channels, vegetation, soil, aquifers and bedrock. Larger watersheds may comprise of many smaller watersheds known as micro-watersheds.

What is Watershed Management?

Watershed management requires a discerning use of resources from the watershed such as the land, water and vegetation, treating them all as interdependent of each other to alleviate drought, moderate floods, prevent soil erosion, improve water availability and increase food, fodder and fuel on a sustainable basis. The task of watershed management includes the treatment of land by using the most suitable engineering and biological measures. Some practitioners argue the goal of watershed management is to, "Conserve the rainwater where it falls" and "Let the water walk, not run." Others describe watershed management as "The process of formulating and pursuing a course of action involving manipulation of resources in a watershed and considering social, economic and institutional factors operating within the watershed to provide goods and services without adversely affecting the soil and water base." A basic requirement for watershed management is to incorporate a "ridge to valley" approach. The ridge is the top of a hill and the valley lies at the bottom, so a ridge to valley approach basically means that the watershed activities should start from the top and go down.

What is Integrated Watershed Management?

Watershed management comprises several components, all of which are inter-related to deliver the full benefits of the watershed. Only when all components are delivered together and correctly with a ridge to valley approach, can watershed activities function proerply. Compromising some of these components due to budget limits causes more harm than good. Therefore, all components should be implemented when conducting integrated watershed management activities.

Derived benefits of Integrated Watershed Management

Farmers in communities where large scale watershed management activities were undertaken, consistently expressed great degree of satisfaction from its results. Specifically, they mentioned the following:

1. Flash flood has been controlled. Quantity and speed of flood water that used to flow down from the mountains during rains have been significantly reduced. Stones that used to roll down along with the flood water and getting deposited in the agriculture land has been significantly reduced too. Their land, buildings and roads have been protected. They can now live peacefully during flood season.
2. Ground water in the valley has increased. Large numbers of farmers are able to drill wells, install solar pumps and access water for irrigation. Cultivating cash crops in their limited land they are able earn decent income and even repay back cost of solar pumps purchased on credit. Wherever streams were present, water in those streams have also increased providing irrigation water to more farmers.

Steps for Integrated Watershed Management

Based on experience, Afghanaid has divided the entire process of Integrated Watershed Management into 7 steps, which are:

Step – 1: Identify the right watershed
Step – 2: Prepare the community
Step – 3: Undertake participatory assessment
Step – 4: Undertake technical survey
Step – 5: Develop watershed master plan
Step – 6: Construct Soil and water conservation structures
6a: Gully plugs
6b: Trenches
6c: Terraces
6d: Check-dam, if feasible
6e: Trees and grasses
6f: Water tank, if feasible
Step – 7: Hand over

All these steps are vital for the success of the watershed management. Ideally, it should take two to three years to complete these steps and achieve the desired result. The following pages detail each step.

1.Identifying the Right Watershed

Choosing the right watershed is critical for the optimal success of the watershed management. Once implementation begins in a selected watershed, it is impossible to change the watershed, so it is crucial to select the right one from the start. From experience, Afghanaid has found the following considerations and criteria to be the most helpful in choosing the right watershed:

- Prone to flood: Afghanaid promotes the implementation of watersheds as a Disaster Risk Reduction (DRR) strategy against floods. Therefore Afghanaid staff identifies watersheds that are prone to flash floods and cause significant damage to the communities living in the watershed.
- Prone to drought: Afghanaid promotes the implementation of watersheds as a Climate Change Adaptation (CCA) strategy against drought. Therefore, Afghanaid staff selects areas most impacted by drought to implement watershed management.

- Hilly topography: Watershed management is an appropriate intervention for hilly and sloped topography, where water usually runs quickly down the surface carrying with it, topsoil and stones. Afghanistan is predominantly a mountainous country making it highly appropriate for watershed management intervention. Therefore Afghanaid staff identifies a watershed whose topography is hilly and sloped, as opposed to flat.
- Cooperative community: Land where watershed activities are done usually belong to the community. Community acceptance is critical to undertake any watershed activities in their land. Therefore Afghanaid staff selects watersheds among communities that are open and willing to participate in watershed interventions in their public and private land, and avoids communities with open inter-community conflict.
- Government acceptance: Provincial Governments in Afghanistan play a key role in allowing development projects to be implemented in their respective provinces. Therefore Afghanaid staff coordinate with Provincial authorities and also accommodate their preferences to select the watershed.

Once a watershed is selected, Afghanaid staff undertake a rapid assessment and collect preliminary information on the watershed boundary, size of the watershed, communities within the watershed and physiography, slope, soil depth, surface texture, land use, land cover, erosion and existing management practices of the watershed.

2. Preparing the Community

For Afghanaid, community is integral to the success of watershed management. The organization strongly believes in community participation while planning, implementing and sustaining watershed interventions. Therefore preparing the community and building their capacity is a critical step to watershed management. Based on experience, the following steps are required to prepare communities:

- Mobilize the community: Initially, Afghanaid staff visits the community and contacts the head of the Community Development Council (CDC) and community elders briefly informing them about the project, and requesting they organize a big gathering on a subsequent day where at least 60% community members are present. During that gathering, Afghanaid staff informs the community about the project objective, implementation approach and potential benefits. Afghanaid staff encourage community members to ask questions and provide clarification.

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- Form Watershed Management Committee: For every watershed, Afghanaid forms a Watershed Management Committee (WMC) as the key Community Institution with members nominated by the community. WMC usually has 15-20 members with 50% men and 50% women across various social and vulnerable groups within the community. WMC further nominates 4 office bearers – President, Vice-president, Secretary and Cashier. As the activities progress, members also form different sub-groups based on need to take care of various activities.
- Train the community: All physical activities of the project are done as cash-for-work by the community. Therefore Afghanaid organizes practical training sessions so community members can carry out the physical activities effectively.
- Establish Gabion weaving center: Gabion nets and boxes are a key component of the construction of gully plugs and check dams. Afghanaid has introduced gabion weaving as an activity to be done by groups of women. Afghanaid trains women in gabion weavings and supports them in setting-up a group training center. Afghanaid provides them raw materials and buys back gabion nets to be used in a gully plug and check dam construction. Culturally when women are not allowed to work outdoors, this activity allows them to work indoors and contribute significantly to watershed management.

3. Participatory Assessment

People living in the community are the most knowledgeable about information regarding their watershed. Their knowledge is critical for planning and implementing watershed management activities. Therefore, Afghanaid engages intimately with communities, particularly with the WMC to collect this information. Afghanaid has employed Participatory Rural Appraisal (PRA) tools in Focus Group Discussions and Transect/Group walk. The information Afghanaid collected includes:

- Social map: Social mapping explores where and how people live and the available social infrastructures such as roads, drainage systems, schools, drinking-water facilities, etc. A social map is made by local people and is not drawn to scale, illustrating what the local people believe to be relevant and important for them. This method is an authentic way of determining what the social reality looks like for locals through social stratification, demographics, settlement patterns, social infrastructure, etc.
- Resource map: The village resource map is a tool that provides important information about a community and their resource bases like field and land uses, water location, soil types and hills. The primary concern is not to develop an accurate map, but to accumulate useful information about local perceptions of resources. The map is drawn by local people as they have in-depth knowledge of the surroundings in which they live.
- Hazard map: Hazard maps are developed to highlight areas that are impacted by or vulnerable to a particular hazard. They are typically made for natural hazards such as earthquakes, floods, and landslides.
- Historical timeline: Historical timeline shows the history and major events of the community in a timeline map. This could include when and how people came into the area, when major disasters happened and how people were impacted etc.
- Seasonal calendar: A seasonal calendar helps to visualize patterns and trends throughout the year. This information includes rainfall distribution, food availability, agricultural activities, disease prevalence etc.

4. Technical Survey

After the participatory assessment is completed, Afghanaid sends a team of technical staff to collect required technical data from the watershed, which is critical for detailed planning of the watershed management interventions. The team goes to the site with engineering tools for about a week, conducting the technical survey and collecting the following information:

- GPS points: GPS points are collected from various points in the watershed. It is extremely important to ensure that the GPS points are correct. To ensure accuracy, the team needs to have proper GPS devices and people who are fully trained in collecting the GPS points.
- Satellite maps: By plotting GPS points on Google earth, the team collects the Satellite map of the watershed, determining the watershed boundaries and calculating the size of the watershed. The satellite map helps the team to get a clear understanding of the watershed.
- Physical characteristics: By using various physical measurement tools, the team determines the physical characteristics of the watershed. These include finding out the slope of the land and the location & depth of gullies. With this, the team also draws contour lines or the line connecting the same elevation. This helps to identify the location of various watershed interventions.
- Assessing flood: The technical team undertakes a more in-depth investigation of flood patterns. These include the volume of water, the force of flood water, the timing of the flood and the path the flood follows etc.
- Assessing Agriculture: The team undertakes a detailed assessment of soil type, water availability, agriculture and cropping practice followed by the farmers in the watershed area.

5. Watershed Master Plan

After completing all assessments and surveys and compiling and analyzing the data, Afghanaid team develops a detailed Watershed master plan. The master plan comprises the following topics:

- Background
- Social map
- Resource map
- Hazard map
- Historical timeline
- Seasonal calendar
- Satellite map
- Description of physical characteristics
- Physical activity plan narrative
- Intervention map (watershed intervention plan shown on satellite map)
- Intervention timeline
- Physical activity budget

Subsequently, technical drawings, Bill-of-quantity (BOQ) and estimated costs are prepared for each physical activity.

6. Soil and Conservation Structures

6a. Gully plugs

Gullies are narrow depressions or ravines in the mountain where rainwater first gets collected and flows down. The mountains normally have a network of small to big gullies carrying the rain water to streams and rivers. The speed of water in the gullies erodes the sides and widens the gullies over a period of time causing them to carry more water. Excess water in the gullies creates a flash flood. Gully plugs are physical obstructions created or constructed on the gully that reduce the speed of water. When a series of gully plugs are constructed along the gullies, it reduces the occurrence of floods. Afghanaid has successfully implemented 4 types of gully plugs:

- Soil gully plugs: In this type of gully plug, soil is filled in gunnysacks and placed in the gullies. This is done when stone in large quantities is not locally available and is too expensive to buy. Sometimes it is also done where the gully is small and there is not enough water pressure to wash the soil sacks away.
- Gabion gully plugs: In this case, stone is packed in wire net boxes and placed in the gullies. This is done without using cement, saving on the cost of cement, sand and mason. Space within the stones allows water to pass, but the speed is reduced, and soil and stones carried by flood water are stopped. Boxes with stones become too heavy for the flood water to break or destroy.
- Concrete gully plugs: In this case, the gully plug is constructed from stone with cement concrete reinforcement. This gully plug is very strong and is constructed in places where the water pressure is very high and where weaker structures are prone to break.
- Loose stone gully plugs: In this case, large sized loose stones are placed in the gullies. This is also done when there is not enough water pressure to wash the structure away. Sometimes to reduce cost of the gully plugs, some loose gully plugs are placed between two strong gully plugs.

For effectiveness, a number of gully plugs must be constructed in each gully. All gullies put together reduce the speed of flood water and stop small stones rolling down to the fields. Trees should be planted on both sides of the gully plugs to further reinforce it.

6b. Trenches

Trenches are rectangular pits excavated along the contour line (Line connecting points at the same altitude), which are also known as Contour trench. It is a practice of Afghanaid to excavate trenches along a uniform level across the slope of land. Bunds are formed along the trenches on the downstream side with material taken out of them. Trenches break the velocity of runoff and store the whole or part of the runoff. The intercepted runoff slowly percolates through the soil and recharges the groundwater. There are two types of Contour trenches:

- Continuous contour trenches: These are trenches in which there is no break in length and can be 10 to 20 meter long across the slope depending on the width of the field which are called Continuous Contour Trenches (CCT). Generally trenches are dug with a cross-section varying from 30cmX30cm to 45cmX45cm.
- Staggered contour trenches: The Staggered Contour Trenches (SCT) are scattered with interspace between them. In staggered trenching, the trenches are located directly below one another in alternate rows in a staggered fashion. Staggered trenches may be made to a length of 2-3 meters and spacing between the rows may vary from 3 to 5 meters.

Trenches should be made on slopes between 10% and 25%. Trenches should not be made where there is already dense vegetation. A-frame is a simple device used for demarcation of contours on the ground, as trenches are always laid along the contour lines. Once the contours are marked, people can begin to excavate the trenches. Trenches act as a barrier to the flow of water on the mountain slope, so that the speed of water flow is reduced. A portion of the water is also retained in the trenches, reducing the volume of water flowing downwards. Both these actions reduce the occurrence of floods. Trenches also act as a barrier to stones that are carried by the flood water and deposited in agricultural land.

6c. Terraces

Terracing is cutting, shaping and converting sloped land on a mountain into several steps of flat land. This flat land then becomes more useful for practicing agriculture. Terraces also reduce the speed of water flowing downhill, thus reducing the occurrence of floods.

There are five types of terraces:

1. Level
2. Inward sloping
3. Outward sloping
4. Puertorican type
5. Conservation bench terrace

Out of these, the Conservation Bench terrace is the most popular in Afghanistan because it is suitable for any range of rainfall.

The process involves:

1. Clearing the site, for example by removing all bushes/vegetation
2. Executing a topographic survey of the slope
3. Collection of data of soil depth and soil type
4. Preparation of layout plan
5. Demarcation of contours of the entire area using A-level
6. Execution of earthwork in excavation and filling, including properly dressing and compacting
7. Demarcation of the levels for cross sectional and longitudinal slopes and execution of earthwork
8. Demarcation of drop pits, vertical drain, toe drain and execution of earth work
9. Selection of a proper slope for the terrace riser and its maintenance
10. Demarcation and execution of shoulder bund

When preparing a terrace, the soil should be sufficiently compact. To achieve this, the soil should be firmly compacted after every 20 cm before placing the next batch of soil. After preparation, the terrace should be observed for stability after rainfalls, and periodically checked for slope failures,

6d. Check dam

A check dam is a small dam or reservoir built on a flood path to check and store water. A check dam is built very sturdy so that the structure can withstand the speed and pressure of flowing water. Check dams are also relatively expensive structures compared to watershed interventions. They can retain a large volume of water for longer periods of time. This allows for a substantial recharge of groundwater which lifts surface water for irrigation/plantation and channels water through canals for downstream irrigation, and domestic/drinking water for humans and animals.

The major components of a check dam are:

1. Dam
2. Pond or back-water area
3. Mechanical watergate
4. Spillway

Site selection criteria

1. From an economic point of view, a check dam should be located at a site where the most amount of water can be obtained with the least amount of costs of constructing the dam
2. The command area should be as close as possible to the dam site and suitable for agriculture
3. The soil should have low permeability, and be able to hold water for long periods of time. Check dams should never be built in absorbant, sandy soil areas.
4. The downstream area should permit natural passage for safe disposal of surplus water
5. The site should be at least half km from the settlement area

Limitations of a check dam:

1. They are the most expensive type of water harvesting structure.
2. They require a higher level of technical expertise to construct.
3. The check dams require watershed activities like check dams.
4. Proper treatment of catchment area is essential for maintaining a longer life of the structure.

6e. Trees and Grass

Trees that grow well in areas that require less water should be planted near trenches and gully plugs. Additionally fodder grass should be planted in the trench bonds. Trees and grass reinforce the structures, further stabilising the soil and improving the overall environment of the area.

6f. Water Tank

Cement concrete water tanks are constructed if there is a spring nearby, from where water can be carried through a pipe. Water from the tank is used to irrigate the trees as needed.

7. Handing over

After the project is completed, Afghanaid formally hands over the watershed including all its structures to the community. They sign a MOU with the Watershed Management Committee for maintenance of the watershed and equitably shares its benefits among the community members.

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