Design Manual: Contour Trenches

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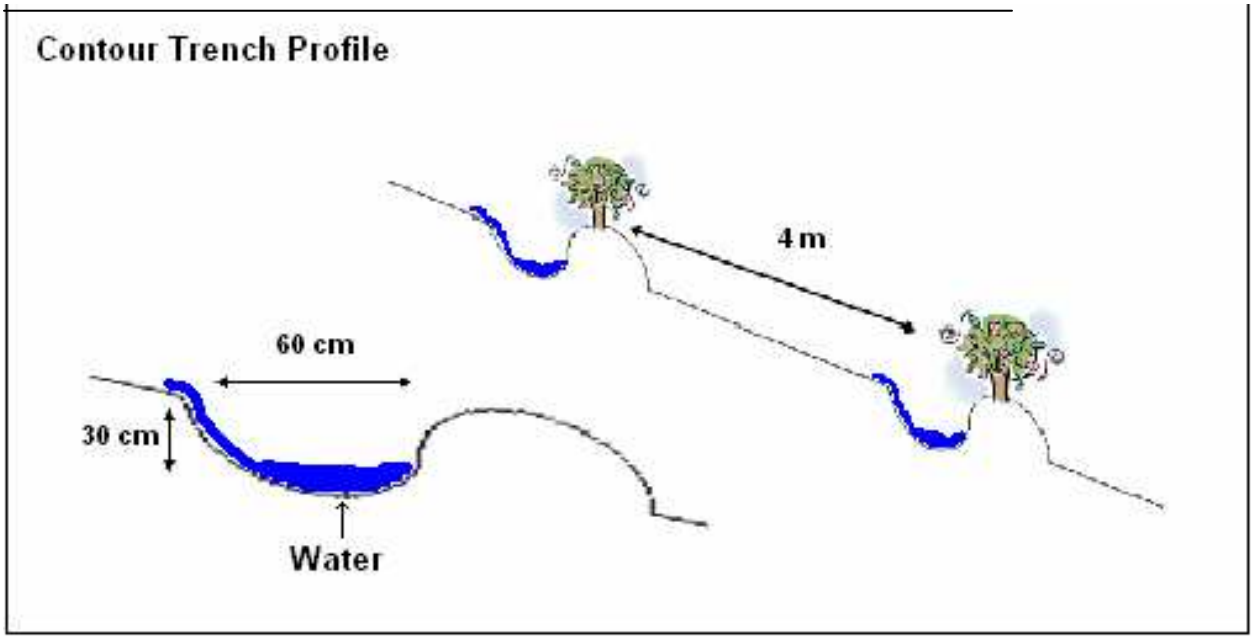
Description: At its simplest, contour trench construction is an extension of the practice of plowing fields at a right angle to the slope. Contour trenches are ditches dug along a hillside in such a way that they follow a contour and run perpendicular to the flow of water. The soil excavated from the ditch is used to form a berm on the downhill edge of the ditch. The berm is planted with permanent vegetation (native grasses, legumes) to stabilize the soil and for the roots and foliage in order to trap any sediment that would overflow from the trench in heavy rainfall events.

Purpose: Reduce surface water flow velocity, promote infiltration, and prevent pollutants from draining into water bodies (suspended sediments, nitrogen, phosphorous).



Design Considerations: The below table provides guidelines for how much space to allow between trenches based on slope percentage. Alternatively, trenches should be one adult human's height apart in elevation.

Table 1. Trench spacing interval by hillslope (MANAGE 2007).

Hillslope (%)	Distance between trenches
0 to 4	10 to 12 m
4 to 8	8 m
8 to 15	6 m
15 to 33	4 m

The measurements of each trench: 60 cm wide x 30 cm deep.

In order to construct a properly functioning contour trench it is important that the trench accurately follow the contour of the hill. A low cost method to determine the contour is to build an A-frame level. After the level contour is found, it is marked with stakes for excavation.

For detailed instructions on how to build an A-frame and mark contours, see below.

Materials needed:

A-Frame level:
- wood
- string
- weight (rock)

Trenches:
- stakes
- shovels
- picks
- tractor (slope dependent)
- crops

Marking Contour Lines (Tearfund)

These are imaginary lines across a slope which are the same height at all places along the slope. Water cannot flow along a contour line - it is completely level. Most soil erosion control methods are built along the contour lines to have maximum effect.

Contour lines cannot be guessed - they need to be measured. How can contour lines be measured without expensive surveying equipment? An A-Frame can be made at no cost, from material readily available to every farmer, and used by one

or two people. The Hose Level needs materials which cost a small amount of money and either two or three people, but it is quicker to use.

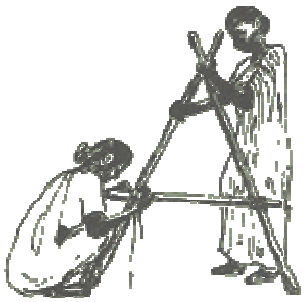
A word of warning: **In areas which have very heavy storms it may be dangerous to prevent the water completely from flowing down a slope. Build waterways or drains at a slight angle (½º-1º) so that excess water is safely channelled away.**

The A-Frame

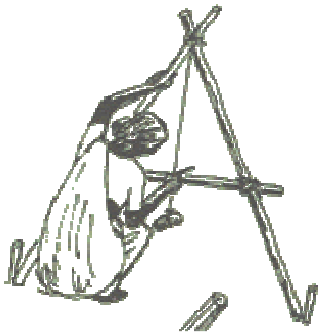
Materials needed

- 2 poles about 2 metres long
- 1 shorter pole about 1 metre long
- some string
- a stone

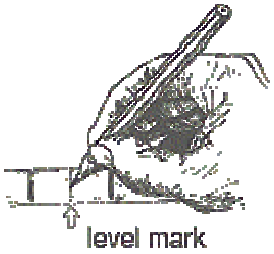
Step 1
Tie the poles very tightly together to make the shape of a letter A. Hang the stone from the top of the A-Frame, making sure the stone hangs below the cross bar.



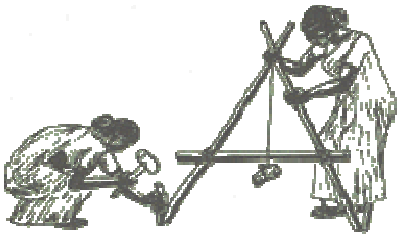
Step 2
Holding the frame upright, mark with two sticks exactly where the poles touch the ground. When the stone stops moving, mark where the string crosses the cross bar. Turn the A-Frame around, placing the poles in exactly the positions marked by the two sticks. Again mark where the string crosses the cross bar.



Step 3
Mark the level mark on the cross bar - exactly half way between the previous marks. If the first two marks happen to be on the same place - this is the level mar



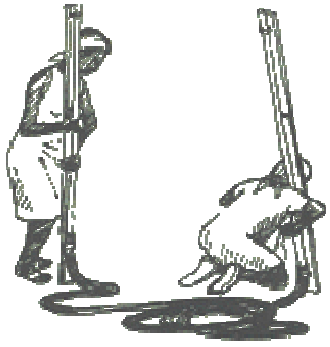
Step 4
Before using the A-Frame, collect a number of sticks. Begin, ideally withle, at one side of the field where the first contour line is wanted. Hold one pole firmly on the ground. Move the other pole until both poles are on the ground with the string touching the level mark. Place a stick into the soil by each pole. Move the A-Frame along, by turning it around (pivoting), keeping pole 1 in exactly the same place. Move pole 2 until the string touches the level mark and place another stick into the ground by pole 2. Carry on in this way, pivoting the A-Frame across the field.



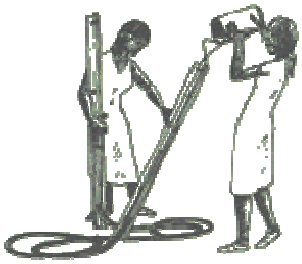
The Hose Level

Materials needed

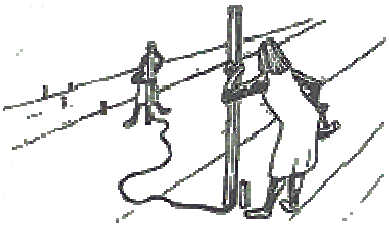
- Two poles about 2 metres long
- Length of clear plastic tubing 10-25 metres long and about 1 cm in diameter
- Small amount of string or adhesive tape



Step 1
Tie the ends of the tubing securely to the two poles in several places. Carefully fill the tubing with clean water, making sure no air bubbles are trapped inside, until nearly full. Hold the poles side by side, with their lower ends resting on the ground, until the water level settles at exactly the same level on each pole (ideally where it is easy to see without bending). Mark this level clearly on each pole.

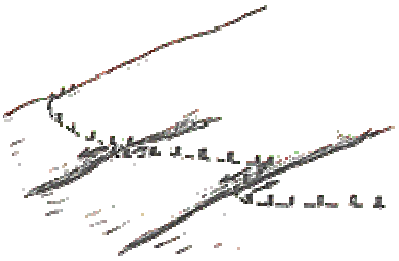


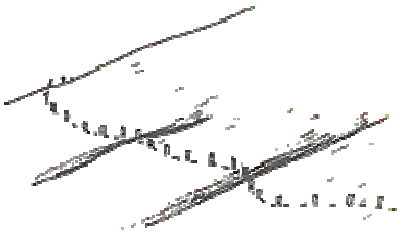
Step 2
When moving the poles, either use a thumb or fit some kind of plastic stopper to stop water spilling - these should be removed before measuring. Begin at one side of the field. One person stands still while the other moves their pole until the level mark is reached in both poles. As with the A-Frame, use marker sticks and move alternate poles so that any slight faults with the Hose Level do not affect the contour line.



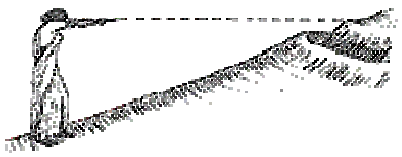
Marking the line

Whatever method has been used, the end result will be a line marked across the land with a series of sticks. If there are sharp bends in the line, then move a stick a little to make a smoother line. Such sharp bends are usually due to rocks or small holes which have affected one measurement. The contour line is now ready for whatever control measures are planned.





Where should the next line be?
The steeper the slope, the more contour barriers are needed to prevent erosion. Here is a very simple method for deciding where to mark the next contour line. Stand straight with one arm outstretched level in front. Walk backwards down the slope, looking at your outstretched hand, until the previous contour can be seen at the end of your hand. Make the next barrier where you are now standing.



Construction

- Once the contours have been marked the farmers can begin to excavate the trench.
- To maintain structural rigidity on the uphill slope of the hill, the shovel should be applied to the contour with the user faceing downhill, not along the contour, so that the uphill face of the trench is not structurally compromised.
- Place the excavated soil downslope along the edge of the trench.
- Pack excavated soil to create a berm on the downhill border of the trench.
- Plant native grasses, legumes, or perennials on the berm. These varieties have a root system capable of providing adequate structure to the berm.
- Apply mulch to berms to prevent erosion while the plants take root.
- If possible, trenches should be dug in the dry season so that the rain does not destabilize or wash away the berm before vegetations can provide stabilization.

Maintenance

- Over their lifetime the trenches will fill with sediment. Periodically, the sediment should be removed from the trench and re-applied to the field uphill from the trench.
- Removal should take place prior to tilling of the soil, so it can be incorporated into the soils of the new crop.
- Farmers should take care not to accidentally deepen the original depth of the trench during this maintenance step.
- Berms may need repair if the vegetation is still establishing itself as a stabilizing force.

Do's	**Don’ts**
o Plant grass on the embankments of all physical conservation structures. Banana trees can be planted along channels. o Repair the structures promptly if they are damaged and at the end of the season. o Choose structures carefully to suit the soil type and slope.	o Don't graze livestock directly on grass planted on the embankments or terraces.

References

MANAGE – National Institute of Agricultural Extension Management, Ministry Agriculture, Government of India. www.manage.gov.in, Last accessed 2/20/2007.

Footsteps, Tearfund. Tearfund International Learning Zone. Issue 15 http://tilz.tearfund.org/Publications/. Last Accessed 2/22/07.