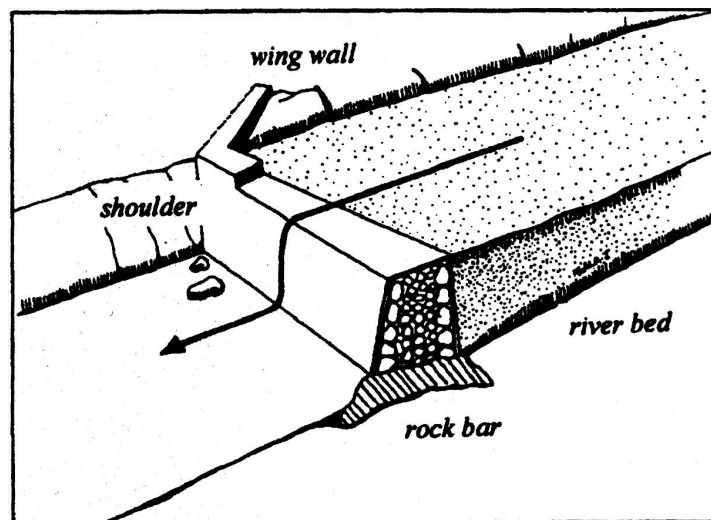


The technology

The idea of a sand dam is, to provide a sand bed in front of an artificial barrier that can conserve water in the form of ground water. After constructing a barrier out of local available materials on a suitable spot in a river reach, gradually the reservoir in front of the dam will fill up with sand. Depending on the sand load of the water, the filling process will take a certain time. This technology is not applicable, when the sediment load in an area is very small. The reservoir will fill up in the wet seasons thus providing water supplies for the dry seasons that can be exploited using scoop holes or shallow wells in the sand bed of the river.



Sand-storage dam

A sand dam has several advantages. The construction is relatively cheap in comparison to other water conserving methods like roof catchments and boreholes. Also, the amount of water available in a reservoir is very large, especially when the riverbanks are permeable enough for infiltration and thus provide extra storage capacity. Because of these, the price of water per m^3 is very low. Another advantage of sand dams is that when the reservoir is filled up with sand, the water can be considered groundwater, thus being bacteriological reliable as long as certain sanitary precautions are taken: there should be no contaminating sources nearby water providing sources like livestock droppings, latrines and wash facilities. And last but not least: surface water is a source of disease spreading organisms like malaria and bilharzia. Creating a sub surface reservoir prevents these illnesses from spreading.

The location

Kitui district, Kenya, is located approximately 150 km east from Nairobi. Though some higher parts can be relatively wet, this district can be considered to be one of the driest parts of Kenya. It has two rainy seasons: March until April and November until January. Rain mostly comes in fierce showers. Most streams in Kitui district are seasonal. They all drain their water into Athi River, a perennial river that flows all through the year.

Kebwea sub-location in Kitui south is very dry. The area has few inhabitants compared to other parts of Kitui district. The area of interest here concerns Ngunga River, a seasonal river. The communities in the area have to face many problems concerning water. First of all, water is hardly conserved. Most water of the fierce showers runs off very fast on the mostly impermeable rocky and steep soils. Secondly, the amount of precipitation is very unreliable. Periods of extreme drought are common all over Kitui district. Finally, the timing of the rains is also very unreliable. The best moment to plant crops is hard to estimate. Bad timing of planting is mostly resulting in large losses and thus fewer yields.

The project

To support the community in Kebwea sublocation, a new sand-storage dam will be constructed next year.

The site for the dam has to be selected. A group of representatives of the local NGO visits the community to discuss the potential sites.

There has been a pre-selection with a small committee, reducing the options to 3 sites. Characteristics of the sites are shown below.

<i>Site</i>	<i>Distance to main settlement</i>	<i>Rocks</i>	<i>Banks</i>	<i>Materials</i>
1	1000 meters	At 4 meters depth	Barren, 3 meters high	Abundant stones
2	300 meters	At the surface	Barren, 1 meter high	Probably abundant stones
3	1500 meters	At 1.5 meters depth	Vegetation, 3 meters high	Abundant stones

Criteria for site selection

1. Enough local materials must be present. Water, needed for the construction must be available in a maximum radius of 1 km.
2. At least 30 households must be participating for 2 reasons:
 - There is more labour power available.
 - More people benefit one dam. This enlarges cost-effectiveness. Cement makes the largest expenses.
3. The site must be easily accessible. Mostly a dam downstream, close to a road is best.
4. Riverbanks must be suitable:
 - Banks must be high enough: at least 1.5 meters to prevent the construction from being too large.
 - Soil must be firm enough. Soft soil needs large wings to stabilize the construction. Based on experience, SASOL uses 7 meter wings for soft soils (only if there are no other possible locations) and 5 meter for firm soils.
5. Scoop holes provide an indication of present natural barriers. Scoop holes that dry up during the dry season are considered good locations for a dam. 'Wet' scoop holes already provide water all through the year. This information is obtained from users.
6. Reservoir volume: Gradient and recharge possibilities are used as an indication of the volume of a reservoir. A smaller gradient makes a larger reservoir; also more recharge will increase the volume of the reservoir.
7. Risks of bypass: A dam can't be built in a bend since this will cause bypasses.
8. A possible natural barrier can be used as foundation for a dam. Note: there are risks of seepage when the rock is not impermeable. Scoop holes upstream that dry up very fast after the rainy season are suspicious.
9. There must be enough inflow (in mainstreams, this is never a problem).
10. Soil in banks: Kunkar limestone and Black Cotton Soil (BCS) have the habit to cause piping very easily because the soil flushes out or dissolves (kunkar limestone).
11. The location should be at least 3 km away from an earlier built dam because of social aspects:
 - Certain communities might get more water then needed when dams are too close to each other.
 - Water sources will be too far away for certain communities when no attention is paid to the allocation.
12. The river must flow from time to time:
 - To provide water for storage.
 - To provide a sand load to fill the reservoir in front of the dam.
13. The depth of the rocks in the banks upstream of the dam location: the deeper the rock, the larger the reservoir volume
14. Does the location fit in the philosophy of creating bigger water availability by building a series of dams?
15. Water quality: how is the water quality at the upstream side of the site



Dam under construction and nearly completed dam in the dry season in Kitui, Kenya



Sand storage dam during and after a flash flood, Voi, Kenya



Voi River after and during a flash flood

The NGO team

The community should be involved in the decision making process, as they have to build the structure.

The technical expertise, however, is with the NGO team.

How to make clear to the community that for technical reasons the preference for the dam site selection is site 3, with site 1 as a possibility, and 2 as undesirable.

The male community member

You are not fetching water anyway.

As it will be in the dry season, you will not be involved in the construction process as you will be away during the construction phase to work in Nairobi.

You support the idea of a sand dam.

Taking into account how the exchange of ideas is going, you support the most convenient solution.

The female community member

You are the one who fetches water and will continue to fetch the water.

You support the idea of a sand dam, under the condition that it is not further away than about 600 meters, 1000 meters at the most.

Construction will take place in the dry season. You will be involved in the construction process. This will take considerable time and effort. You consider that each extra meter to dig to find rock bottom will be an extra two weeks of work. This means that finishing the structure in the dry season will probably not be possible when one has to dig deeper than 3 meters.

No other community may use the water you have worked so hard for!

The village head

You support the idea of the sand dam.

You want the dam to be as big as possible, as this will increase the number of bags of cement. In such a way, it might be easier for a bag of cement to 'walk into your direction'.

The money lender

You live near site 2, all you want is to have the structure there. And after all, it is closest to the main settlement of the community, is it not?

It might be useful to make the village head and community members remember that they still owe you considerable money. You know, however, that the NGO does not like your practices.

The district representative

Ok, a sand dam is fine, but there are other communities who suffer a lot more. Site number 3 is the best, as another community close to that site can be supported in that case too.

The traditional doctor

You live near site 3, all you want is to have the structure there.

Water is an important item in traditional healing.