RAIN WATER HARVESTING IN AFRICA

CALABASH TANK MANUAL 2016

www.degevuldewaterkruik.nl

Foreword Hans Hartung

Hans Hartung is an independent water and energy consultant with more than 30 years' experience in the sector. He is associated to FAKT (Stuttgart, Germany) and is a former vice-president of IRC-SA (International Rainwater Catchment Systems Association)

Dear reader,
Here you have a simple, low cost and sturdy tank. Get yourself engaged in spreading the tank! Many ideas are possible: building the tanks yourself after you got training, get trainers trained, finance the training of trainers and/or the materials for the tanks, spread the idea and distribute this booklet. You can be assured that: many people benefitting from rainwater of the tanks will be thankful to you!

Congratulations to Paul Akkerman,
Congratulations to Sadjaliu Djalo, Julio Nahonta and all the other trainers and masons in Guinea Bissau!

Your work, as I have seen it, is truly impressive. The speed of scaling up rainwater harvesting in Guinea Bissau especially (and other countries as well) is impressive. And you have done this without big international or national backing. It shows how the approach and the technology is valued by the people in need of clean water.
The impressive thing is not only the numbers of rainwater tanks built and used, but also the constant improvements of the tanks. They are made simpler to construct and sturdier. The new Calabash tank is the optimised tank incorporating a long experience.

It deserves to be spread to countries in Africa and beyond in big numbers!


Hans Hartung


Han Heijnen

Foreword Han Heijnen

Han Heijnen is Vice President (external relations) of IRCSA (International Rainwater Catchment Systems Association) and President of IRHA (International Rainwater Harvesting Alliance)

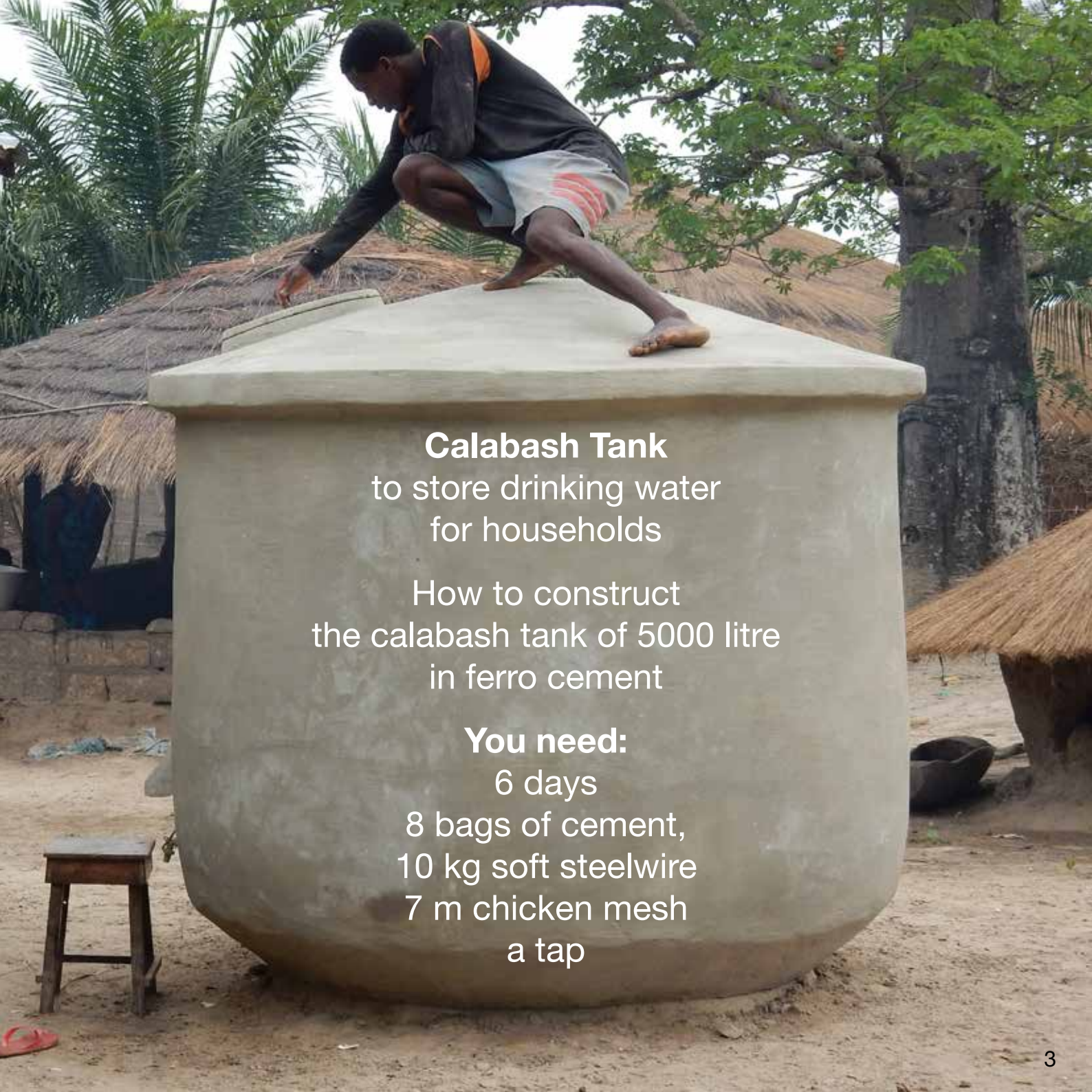
Dear reader
This manual describes in detail the construction of the Calabash Tank. In doing so, it shares the experience of developing a good design with all who want to copy the tank in their own locality. There are many parts of Africa and the wider world that can benefit from the Calabash experience. The readiness of the project team to provide training to interested colleagues will create further capacity to apply this technique.

De Gevulde Waterkruik - The Jar full of Water- project team has shown that rainwater harvesting is a viable and appreciated source of water in the islands and coastal areas of Guinea-Bissau. During the last decade a team of local artisans has developed and refined their skills in constructing reservoirs that are sturdy, based on local solutions and – with a little support - affordable for a household.

Rainwater that is collected from a clean surface will further improve during storage. Bacterial die-off in the tank can be substantial while bio-films developing at the tank-water interface are also considered to have a positive effect on the water quality. Thus, a well-managed tank should only be cleaned every 3-4 years. (More information about water quality and treatment further in the Manual.
Safely collected rainwater provides good quality water for drinking and cooking. It is a source of enjoyment and health. Use it well!

I wholeheartedly commend the Guinea-Bissau team for promoting Rain Water Harvesting as a component of the Pure Water – Healthy Village Project.

Good luck for all rainwater harvesting practitioners in using this inspiring manual!



Calabash Tank
to store drinking water
for households

How to construct
the calabash tank of 5000 litre
in ferro cement

You need:
6 days
8 bags of cement,
10 kg soft steelwire
7 m chicken mesh
a tap

Dear Friends and Practitioners of Rain Water Harvesting,

My friend Bicosse Nandafa and I started the work in his village Bedanda, because many families were in urgent need for safe drinking water. That was 12 years ago. Today Bedanda and many other villages in Guinea-Bissau can manage their water stress. Our work continues in Guinea-Bissau.

To you, we hand over our experience in this manual, because thousands of families with children in other African countries suffer from water related diseases and are in the same need for pure water. A big need of practical training and friendship over the world can be fulfilled.

This booklet is also meant as an ode to thousands of small African farmers, working hard and building tanks to survive with little help from governments. An ode as well to all who believe in our work and support it.

Thank you,
Paul Akkerman

September 2016

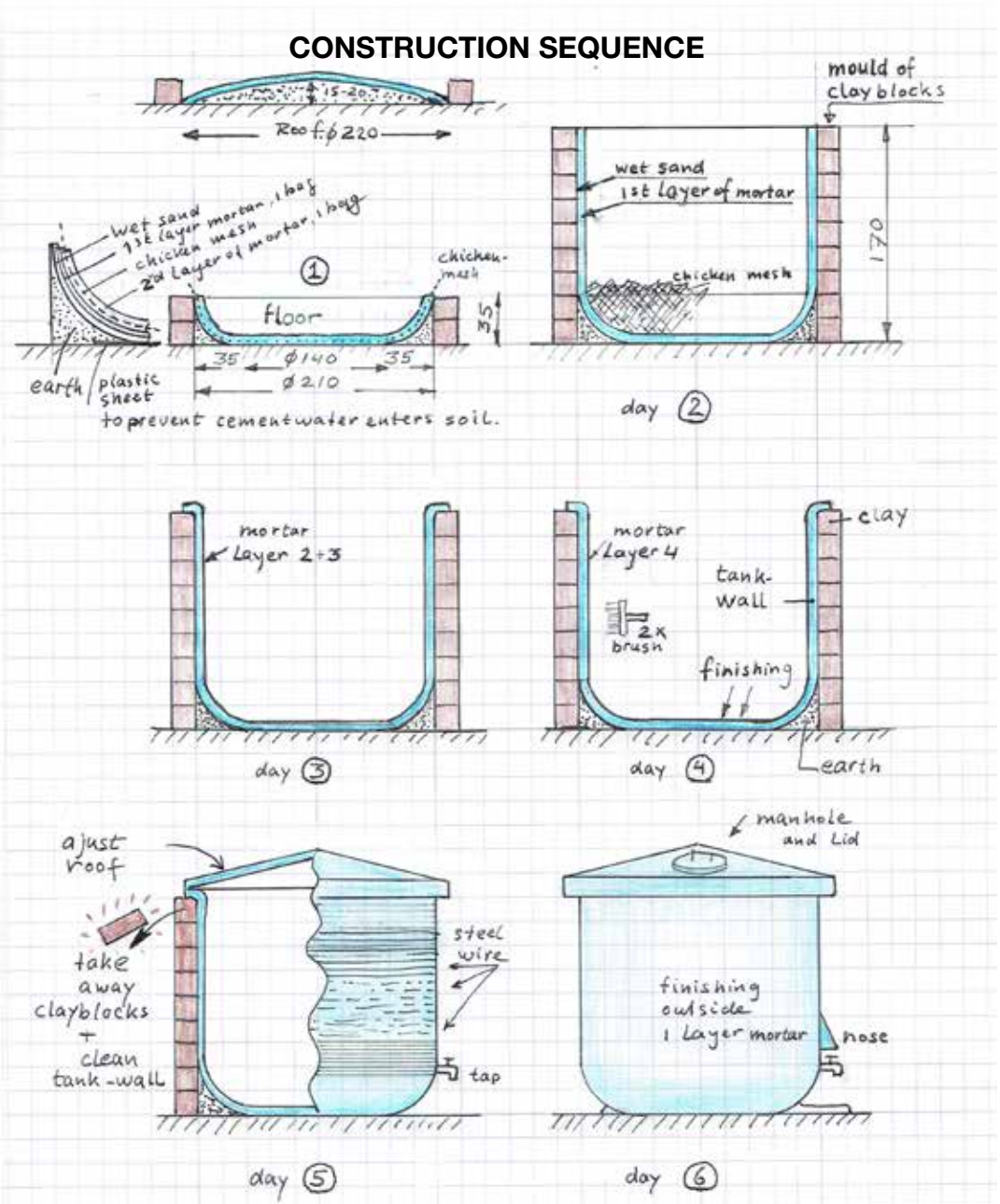
2005

2016

Paul Akkerman is an independent consultant and has been working with farmers in Guinea-Bissau during 25 years. Since 2005 he has been adapting rain water harvesting as an important source of drinking water for the population. He has initiated the construction of more than 2000 domestic rainwater tanks in the country. Now he is spreading the technology in other African countries by means of training.

Above: normal clay blocks (± 40 x 20 x 17 cm) can be used for the mould. They are of the same size as the blocks that are used for the construction of houses. Below: Mortar is a mixture 1 : 3 of cement with sand. A proper mix is essential in order to get a watertight tank.

CONSTRUCTION SEQUENCE



The construction system of our tanks is based on a mould of clay blocks. The cement tank is constructed inside this mould ① and ②. Near the end of the construction process ⑤ the masons remove the clay blocks of the mould. The blocks can be used several times. The clay blocks are commonly used in many African countries for the construction of houses. In other parts of the world cement blocks can be used.

INFORMATION

The Calabash Tank is developed in West Africa. It can store rainwater that can be used as safe drinking water for families. The local name of our project is: **IAGU LIMPO – TABANKA SAN,** it means **CLEAN WATER – HEALTHY VILLAGE.**
This manual shows the practical knowledge of dozens of masons. Together we have constructed more than 2000 water tanks during our 12 years of existence. Twice a year we train guests from other countries

Materials to be bought for one tank

8 bags (50 kg) of cement
10 kg of soft steel wire
7,5 m. of chicken mesh (1 m. wide)
8 m. of plastic sheet (2m. wide) to protect the wet cement (this sheet can be reused!)
One 50 cm steel bar D6 or D8 for the handle of the lid

Materials to be provided by the tank owner

200 clay blocks (+/- 17 x 20 x 40 cm) for the mould
22 wheelbarrows with sand for the mortar
600 l. water for the mortar

Tools

1 wheelbarrow
3 shovels
3 trowels
3 cement plates (masonry float)
1 tape measure of 3 m.
1 levelling tool
1 pincer to cut the steel wire
1 hack
1 machete or chopper knife
2 brushes for the cement water
1 steal brush
1 ladder to enter the inside of the tank and mould

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Partition of costs in Guinea-Bissau

Material:	50 % of total cost
Tools:	01 % (spread over 50 tanks)
Transport:	10 %
labour:	29 %
coordination:	10 %

The total cost of one 5000 l. tank is € 240,-.
€ 460, 00 for a 10.000 liter tank (Guinea-Bissau)

diameter outer circle: 210 cm
diameter inner circle: 140 cm

A strong wellshaped floor is essential for the construction. Page 10 - 15

Above:
adjust the clay blocks in the upright position.

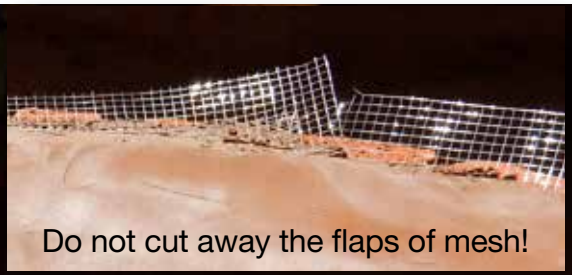
Below: place a plastic sheet to prevent the water from the mortar leaking away into the ground.

Above: Shape by hand a regular hollow curved surface in the sand, it will give an attractive and strong body of the tank. Above and below: The construction of this part of the mould is done in two layers: Dry sand and wet sand or plastic.

The construction of the floor is done in 3 layers:①mortar (1st bag of cement)②chicken mesh③mortar (2nd bag). The mortar lies on the wet sand or plastic sheet to prevent that it will dry out.

Cut and adjust the chicken mesh on the first layer of the wet mortar and cover it with the second layer of mortar (2nd bag). The chicken mesh serves the purpose of reinforcement inside the cement.

Do **not** cut away the flaps of the chicken mesh, later they must enforce the connection between the floor and the wall. Make an overlap of at least 20 cm.



Do not cut away the flaps of mesh!

Above: construct the mould with clay blocks in + 9 rows to reach a height of 1.70 m. Below: apply 1 layer of wet sand for a smooth inside surface of the mould. Use a lever to make a vertical wall.

Construction of the wall during day 2, 3 and 4

Above: mortar on wet sand. The mortar is curved over the edge of the mould. Below: apply a total of 4 layers of mortar during 3 days. Cover the chicken mesh only after the first layer of mortar.

Control the thickness of the plaster with a stick.

Above: cover the flap of chicken mesh only after the first layer of mortar. **Below and right:** use a mixture of water and pure cement and apply this with a brush on the 3rd and 4th layer of mortar. This makes the tank water tight.

Finishing the water bed

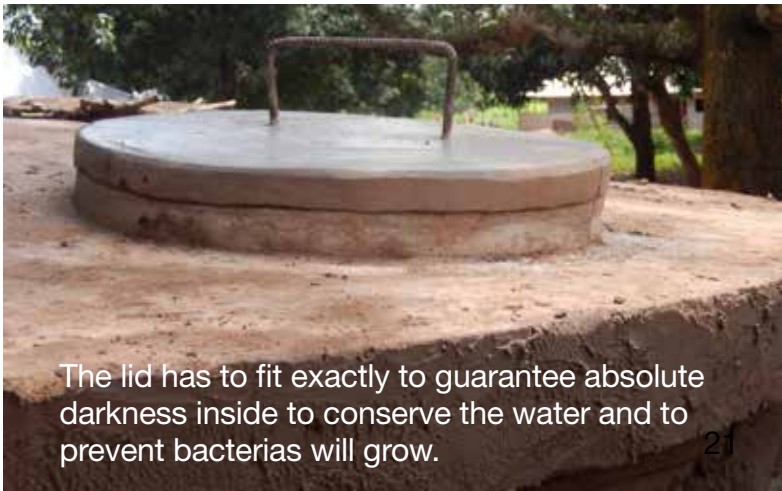
Wet paper of cement bag

The construction of the roof. Above: the dome shaped roof is at least 15 centimetres high in the middle. Below: use a tub too shape the manhole of ± D 40 cm.

Above: the roof is reinforced with 3 or 4 circles of twisted steel wire.

Below: the lid has to fit exactly on the manhole to guarantee absolute darkness inside.

Paper in between



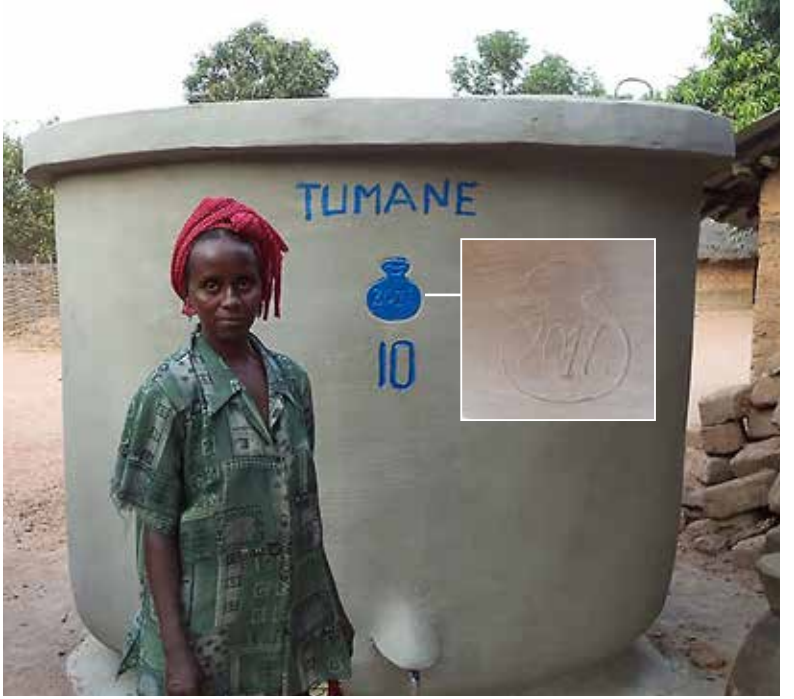
The lid has to fit exactly to guarantee absolute darkness inside to conserve the water and to prevent bacterias will grow.

After the roof has hardened for 4 days you can lift it and carefully adjust it onto the wall of the tank. It is a heavy job and it can be dangerous. Make sure that the team is strong and coordinated. Two persons support the roof from the inside of the tank while lifting it step by step over the tank wall, as this could damage it!

Above: then take away the clay blocks and store them away so that they can be used once more! **Below:** clean the sand from the wall with a shovel and a steel brush.

Above: a good connection between the floor and the wall is essential. Insert a socket and a PVC tube in the fresh cement wall. Adjust the tap and make sure, for later, that you can use pincers to change the tap. **Below:** the nose above the tap is meant to avoid people from stepping on it, to climb the tank.

Above: wind soft steel wire around the tank for reinforcement. Start as low as possible. The distance between the wires should be ± 2 cm. Cut the edge of the roof and the wall into the right shape. **Below:** apply mortar to attach the roof to the wall. Apply the final outside layer of mortar.



Finishing touch: give the tank our symbol, the year of construction, the name of the village and number for administration and control.


Beautiful

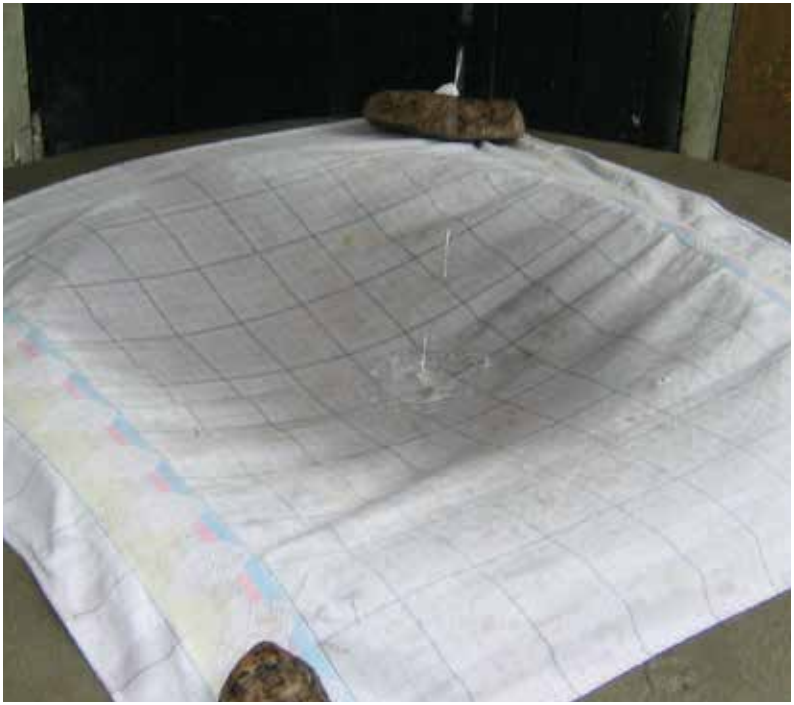

JORDAN


ONG
lagu limpu
Nº 6 2015

How to catch the rain

The manhole and the lit

Women lock the tap during the night



Cover the manhole with a cloth or a gauze during the water catchment to prevent dirt enters the water.

You can seal the lid with clay or soft cement to prevent that insects will enter the filled tank.

Water Quality

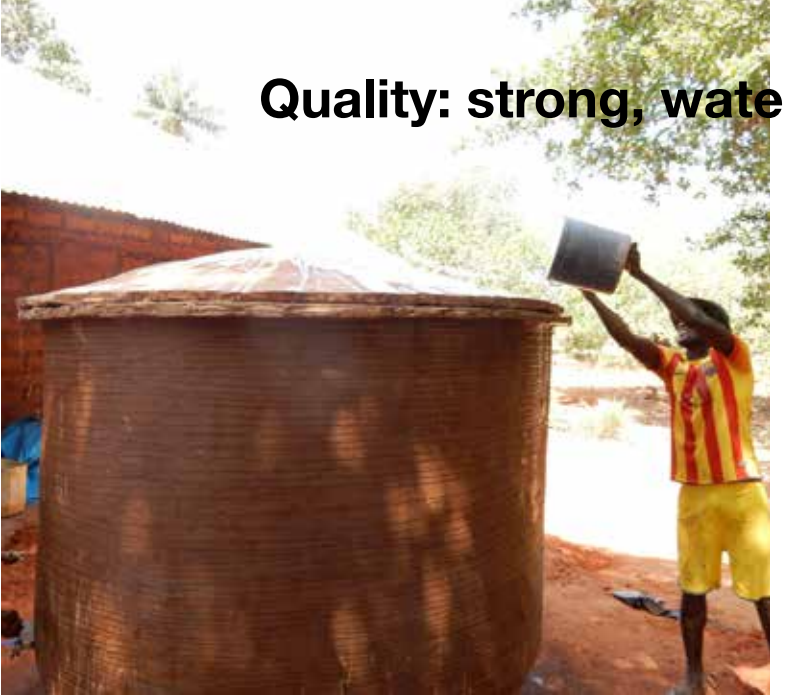
Remarks by Han Heijnen

- The Guidelines for Drinking Water Quality published by the World Health Organization in 2011 (4th ed.) recognize that a well-designed rainwater harvesting system with clean catchments, covered storage tanks and point-of-use treatment - as appropriate - can offer drinking water with very low health risks.
- Domestic rainwater harvesting systems really make a difference, in dry zone areas, in places where water is saline or contaminated with fluorides or other harmful chemicals, or to enjoy a better service,
- The use of a first flush device or an inlet filter provides a way to separate dirt from good rainwater. First flush means that the first rainfall after the dry season on a dusty dirty roof, is not collected in the tank. But it can certainly be used for watering plants
- Rainwater that is collected from a clean surface will further improve during storage. Bacterial die-off in the tank can be substantial while bio-films developing at the tank-water interface are also considered to have a positive effect on the water quality.
- Thus, to benefit from the bio-film effect it is better to clean the tank only every 3-4 years.
- Point-of-use treatment of water for drinking purposes should be considered (filtration, chlorination, boiling, SODIS etc.).
- Mosquito breeding in the tank needs to be avoided by ensuring that all entry points are closed and vents are fitted with mosquito gauze.

Observations by Hans Hartung

- The rainwater tanks are an integral part of life in the families. People appreciate them very much as a source of clean water for drinking, whereas water for other purposes (such as cleaning, washing) is usually coming from wells (there the quality maybe a bit salty)
- Water from tanks is especially valued at the end of the dry season (starting from February) when many wells dry up or have very little water.
- Water from the tanks is not the only source of water but an additional source, as people use different water sources for different water needs at different times of the year. Rainwater is especially liked for its good taste, its purity and its availability at the house (in the tank)
- Contrary to many beliefs, people collect water from (mostly) thatched roofs in a traditional way (binding the ends of the thatch together), collecting it in available vessels and then storing it in the tank. The brown colour disappears during the storage as well as bacterial count goes down significantly (as evidenced by our own earlier tests.
- Jane Heyworth studied a sample of 1000 school children living in South Australia who were regularly drinking rainwater. They were at no greater odds of gastroenteritis than children from the capital, Adelaide, who drank treated public mains water).

Quality: strong, watertight and wellshaped



Above: Always make the wall wet before you apply the next layer of mortar. This is important in order to create a good connection between the layers. Always cover the fresh layer of mortar against the sun with a plastic sheet until 7 days after you have finished the construction of the tank. Pour 10 baskets of water into the new tank on the day it is finished, the cement needs it…

Qualified masons with certificate in DR Cong
save water and employment

Qualified masons with certificate in Guinee Bissau
save water and employment

Bigger households need more tanks, on island Cataban Grande

More possibilities

Water tank filled by tank lorry in dry area's

The Netherlands

Ecological garden Croatia

More countries

Gambia

In DR Congo they sometimes use cement blocks for the mould

Tank nr. 23 in Menkao, DR Congo, 2016.

Information Rain Water Harvesting (not complete)

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- Hartung H., Akkerman P. (2014) 'Roofwater harvesting on the coastal islands of Guinea-Bissau: rainwater tank construction adapted to the local context', Waterlines, international journal of water, sanitation and waste Vol. 33 No. 2: 160-167 < http://dx.doi.org/10.3362/1756-3488.2014.017>

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OUR PURPOSE: CLEAN WATER – HEALTHY FAMILIES

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We are prepared to train your trainers and project leaders.
We like to meet new leaders in different African countries.

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Amadu Djau

Bacar Dabo

Paulo Djonde

Bitam Na Ifa

Sambu Na Sumba

Bucar Sambu

Ilna Nabanka

Domingos Na Naska

Sambis Na Mboto

Paul Akkerman
Coördinator The Netherlands

Trainers of masons