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Appropriate water technology in Somalia's refugee camps

GENERAL SITUATION

There are appr. 500,000 refugees from Ethiopia living in Southern Somalia for more than 4 years. They live in 28 refugee camps situated close to the rivers Juba and Shabelle. New camps are currently being set up to accomodate the recent influx of more refugees.

Refugee camps in Somalia

WATER SUPPLY

Suitable ground water has been found only in a few camps. Most camps rely on purified river water. The purification system in use when the author arrived in Somalia in the middle of 1983 was set up within an emergency phase. It was dependent on considerable amounts of chemicals (for flocculation and desinfection). One of the basic objectives of the refugee water supply is to reduce the dependency on continued external inputs such as chemicals and fuel. Three efforts to achieve this goal are presented in this paper.

- pumping of water with stream powered pump
- prefiltering of river water
- introducing easy and fast to erect slow sandfilters (Oxfam Treatment Package).

STREAM POWERED PUMP

Since the refugee camps in Southern Somalia are situated near the river and rely on river water, it seems only logical to make use of the energy of this river.

Concept

A relatively simple concept was put into practise: an easy-to-fabricate propeller is driven by the river current. The energy thus produced in used to pump water with a 3 piston pump. Propeller and pump are both installed on a float in order to follow seasonal differences of discharge of the river. They are working below the water level and cannot be seen during operation. For maintenance or servicing, the whole assembly can easily be brought above water level.

Stream powered pump being serviced

Experience

The pump has been in operation for one year. At high water levels of the river, branches and other floating material got cought at the pump and had to be removed almost daily.

The connecting rod bearings of the piston pump had to be replaced twice. They showed increased wear due to the high sediment load of the river. This led to a completly changed concept: a centrifugal pump has replaced the piston pump. It is connected by a planetary gear to the propeller. Model tests with the new pump are very encouraging and at the days of this conference, the new pump is tested out on a river in Europe.
After careful examination, it was decided not to incorporate the stream powered pump into the Refugee Water Supply. The main reason was, that the river Juba is between 2 and 5 months too low for the stream powered pump to operate. A stand-by diesel pump does not comply with our overall concept of only one standardized pump for one water supply plant. But a great potential has been identified to use this pump for irrigation purposes.

PREFILTERING

Concept

Riverbed sand can be used as a filter medium in the purification of river water. Methods as used when dewatering construction sites are taken and applied to the exploration and installation of prefilter systems.

Exploration

For the exploration of the underground, test holes are jetted into the ground. The material actually around the tip of the jetting pipe is washed up to the surface and can easily be examined. If a thick and sufficiently extended layer of sand in hydraulic continuity with the river has been found, a test filter is installed in one of the test holes to get information on quality and quantity of water.

Installation

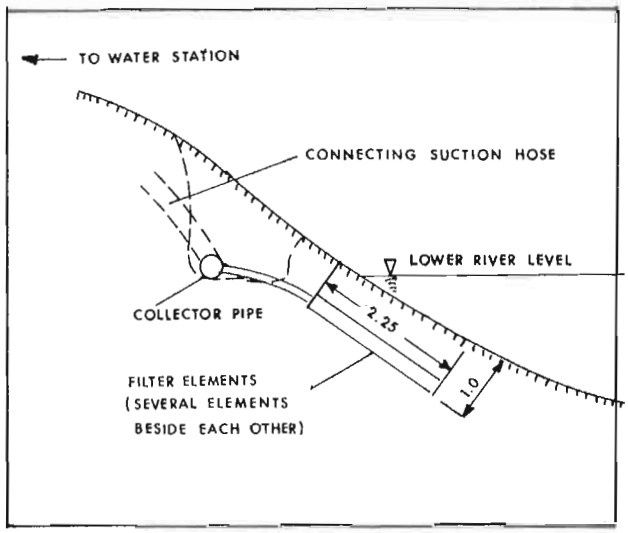
The installation of the prefilter system is adapted to the conditions at the specific site, taking into consideration

- permeable layers of sand, their thickness, extension and permeability
- location of the prefilter system with regard to river bank and riverbed (and its possible shifting) and the existing water station in the camp
- the enccountered water quality (we found quite often salty water in the Juba sandbeds).

The installation can take place only at low river levels.

Components

The main components of the prefilter system are
- drainfilters, consisting of flexible drainage pipe 1 3/4" and covered with filter fabric or slotted, self jetting 2" filters
- collector pipes, connected to the drainfilters by flexible suction hoses
- self sucking pump which gets its water through drainfilters and collector pipes



Prefilter system in the river bank

Conclusions

The main purpose of the prefilter system is to supply sufficiently clean water for further treatment. This purpose has been achieved and could be demonstrated by a considerable reduction of water turbidity.
Reduction of coliform bacteria depends on the distance the river water has to travel through the

sand. At some places coliform bacteria were completely eliminated so that drinking water quality had been achieved.
The installation site plays the most important role. Many prefilter systems were destroyed, when the river was high and the riverbed sand shifted considerably. Therefore careful observation of the river and choosing a site which will not move (as e.g inner bend, stable bank) are absolutely necessary.
The system is universal and can be adapted to different situations:
- it is especially suitable as an easy and fast-to-erect water system in emergencies, if the prefiltered water is carefully treated and monitored
- it has been used to replace an insufficient borehole near the river bank
- it can be used to tap shallow groundwater resources.

SLOW SANDFILTER

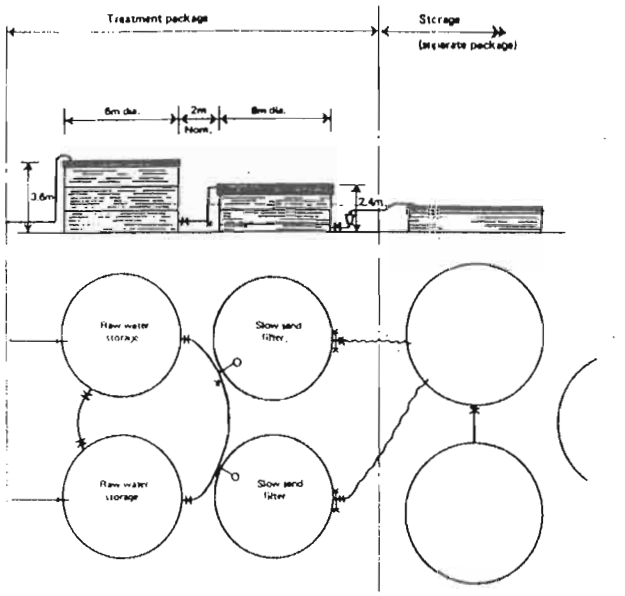
Task

As mentioned at the beginning, a simple chemical purification system was used in the camps as drinking water supply. It was erected as an emergency measure to be used for half a year. But in the meantime it was-and partly is-in use for more than 4 years.
It had to be replaced by a system meeting the criteria
- use no chemicals
- easy to erect
- inexpensive
- medium term solution. At least major components should be movable to be operated at new locations if refugees are shifted.

Solution

The ideal system to meet these criteria was found in the Oxfam Treatment Package. It is a slow sandfiltration system consisting of a basic unit of
- 2 raw water storage tanks, allowing a continuous inflow into the sandfilter tanks and serving as settling tanks at the same time
- 2 slow sandfilter tanks
- 2 clear water tanks as storage of the drinking water .

All the tanks consist of corrugated steel sheets that are bolted together and lined with a flexible butyl rubber membrane.



General arrangement of slow sandfiltration system

The slow sandfilter tanks are filled with around 30 cu.m of sand meeting specific criteria. The riverbed sand of the Juba was found suitable but had to be washed to eliminate sediments. On top of the sand, a filtermat is placed.
The underdrainage of the sandfilter has been changed from the original plastic slotted pipes to synthetic fabric covered drainpipes as used for prefiltering. Thus no gravel has to be used which simplifies the installation considerably. The link pipe work was adapted to the piping system in use within the water project.
The design capacity of the basic unit is 115 cu.m/d corresponding to a filter velocity of appr. 0.08m/s.

Experience

Sand for the slow sandfilter is taken from the sand banks in the river at low water level.
Installation time of the plant depends a lot on local conditions, available transportation and proper supervision. One unit with 2 raw water tanks and 2 sandfilter tanks was erected in one month. Two engineers, two local mechanics and 8

helpers were involved.
Prefiltering of the river water was found not necessary, although the turbidity of the Juba varies between 30 and 110 NTU.
Cleaning intervals average 3 months with water intake directly from the river. Filter speed appr. 0.05 m/h.
The cleaning consists of washing the filtermat (located on top of the filtersand) and scraping off a thin layer (appr. 3mm) of sediments on the sand surface.
Operation of the plant is extremely simple. Problems with our staff arose to operate the sandfilter plants continuously. They all worked before with chemical purification, which was a discontinuous process.
Water quality checks show no total coliform bacteria in the purified water when the plant is operated correctly.
The slow sandfilter plants have met the expectations so far i.e. after being in use for 9 months maximum. 4 plants are operating to date, 11 more will be installed to replace all chemical purification units.

Raw water and sandfilter tanks in Dorioley II refugee camp.