Choosing technologies...

Some options for water supply for household and agricultural use in the Bohlabela District

Working Draft 1

July 2003

Working with water...

Water is our most valuable natural resource. All plants and animals – including people – need water to live. It is also essential for agriculture and is needed for almost all industrial processes. As our area's population grows and develops, water supply needs to be expanded. Water has to be shared between our people, their livestock and crops, industry and services which provide employment and generate revenue, and the natural environment which provides the water.

In many parts of our municipal district, access to water and the benefits it provides are not shared fairly. For example, research shows that in some areas irrigation schemes use a lot of water in inefficient ways, while in other areas, people have to walk for many kilometres to fetch water for drinking. At a village level, access to water is also often inequitable. We need to find a way to make access to water equitable. In terms of the water law, nobody is more important than anybody else. All have a right to enough water for their basic needs and to have access to the benefits that water use brings.

25 litres of water a day is enough only to meet our demands for water for drinking, cooking and washing ourselves, our clothes and our dishes.It is not the only water that we need. In order to alleviate poverty in our area, people will need to access more water than this to grow vegetables and fruit, to water their livestock, and to support other productive activities (such as brickmaking, beer making, bread baking, hairdressing). The law refers to these kind of water uses as Schedule 1 uses. How much water do we need to support these activities? And how are we going to access it?

This support material describes a few options for accessing water at a village and household level. These are some of the ways we can participate in accessing and managing our water resources.

There are three major water sources available for household and agricultural use:

1. **groundwater**: water which is stored below the ground surface in aquifers.
2. **surface water**: water in rivers, springs and dams, and
3. **rainwater**.

There are a number of different ways of accessing and storing water. When considering which **technology** to use, consideration should be given to:

1. **affordability**: what are the sources of income in the community, and what money is available to pay for water

2. **access to spares**: what spare parts will the chosen technology need and where can they be bought?

3. **skilled maintenance**: what skills may be needed if the technology breaks down, are the skills available locally, and how much may it cost? Can the Municipality help?

4. **reliability of source**:
    a. Has the source been test pumped, if not can it be?
    b. Has the spring flow been checked for the whole year?
    c. What is the available recharge for the dam?
    d. What are the rainfall figures for your area?

5. **potability**: has the water quality been checked?

Is there someone that you can ask to check all these things for you? For example, a local NGO may be able to help.

Summary

Technology	Capital cost	O/M cost	Life
Human power	Medium R40-50 000 High R86 000	R100/year	20 years +
Rainwater	Low. R1 000-4 000	R50/year	15 years +
Tube well	Low R 6 000 High R36 300	R50/year	10 years +
Small dam	Low. Labour	Labour only	20 years +
Diesel/electric	High.R1 500 per person	R36 000/year 20 years pipes	8 years engine
Spring	Low.R10 000	R100/year	20 years +

Useful contacts

Local NGOs with experience in water AWARD: Acting Director Tsogang: John Kings	 015 793 3991 015 307 2673
Pipe supplies Petzetakis	 015 293 2780
Pumping equipment Barloworld	 015 297 3603
Groundwater investigation, pump testing: WSM Pierre Mouton	 015 291 5191
Water system design Ndodana and Becker; Ivan Falleyn	 015 307 3603

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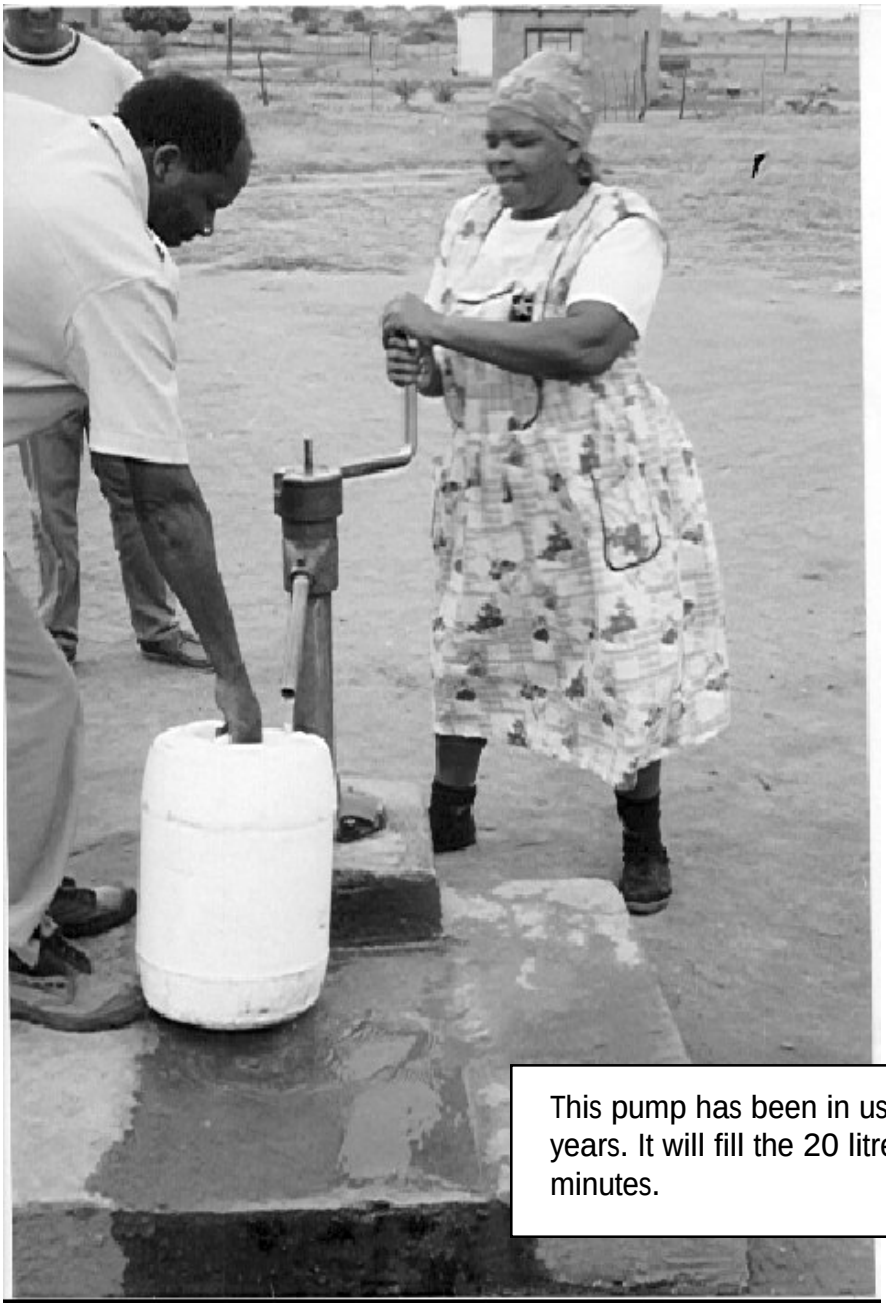
Human-powered pumps



This pump has been in use for 10 years. It will fill the 20 litre drum in 2 minutes.

A hand pump or foot pump uses human power to lift water in a borehole up to the surface.
There are many types of hand and foot pumps used in the world, and they are very simple to operate. Maintenance is very simple and spare parts are cheap, or can be made by the users.
A properly installed hand pump will last for more than 20 years.

In South Africa we have two main types of these pumps: the VLOM (village level operations and maintenance) which come from a number of different manufacturers (for example, India, Volante, Consallen, Bush Pump, Afridev) and the longer lasting, more expensive, minimal maintenance pumps like the Mono and Barry range. It is also possible to buy foot operated pumps, which work like a treadle on a sewing machine, and chain pumps that are the simplest of all.

The major issue in the selection of this technology is the availability of spares: closeness to the community, cost. This is called the supply chain and is a major item in pump selection.

It is possible for hand pumps to supply all the drinking water needs of a small community. One handpump can supply up to but not more than 250 to 300 people, around 50 households. A hand pump can also be a useful back up to reticulated supplies – during a breakdown, or when the reservoir is being cleaned for instance. Hand pumps are also useful in emergency situations, like a drought, because they can be installed very quickly.

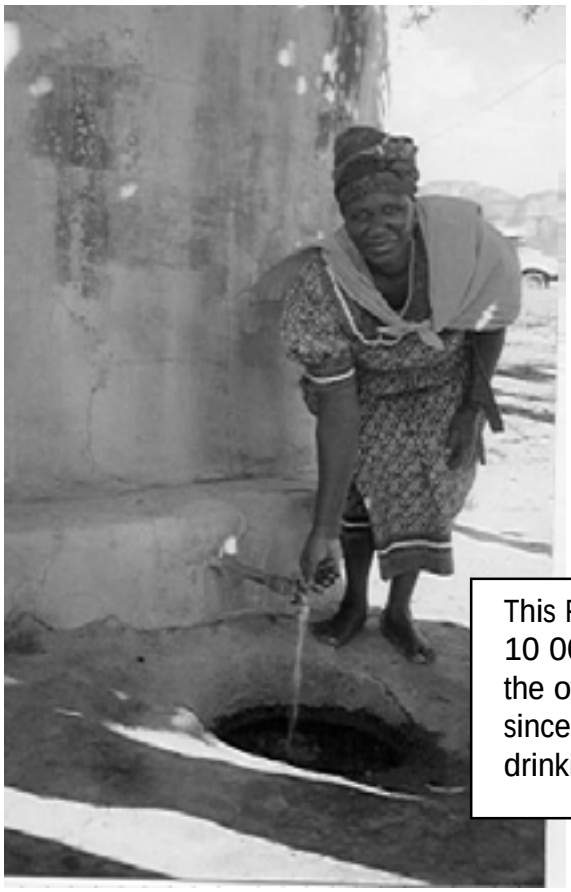
Hand pumps can be installed in boreholes where the yield is too low to support an engine (less than half a litre per second) and can be installed at depths from 5m to 75m below the surface. The cost will depend on the depth of the borehole. More than one pump can be placed in one borehole.

A hand pump can be installed and maintained by the members of the community with a little training, and there is no need to call on the Municipality or contractors for maintenance. Depending upon the available pump, maintenance can consist of renewing a leather washer, or replacing a worn bush once a year. The committee should make sure that they collect money from the community to pay for these.

It is a good idea to visit a community where a handpump is being used, so that people can be asked about it: does it work OK? How much maintenance does it need? How much does it cost? Discussing these things with a community who already use a hand pump will help in decision making.

Costs:	
Borehole drilling	R20 000 - R36 000
Test pumping	R4 000 - R6 000
Purchase of pump	R8 000 - R15 000
Installation incl. slab	R3 000 - R5 000
Maintenance training 2 days	R4 000 - R6 000
TOTAL	**R39 000 - R86 000**
Spares/year	R200 - R600
Repair and maintenance by outside contractors	R1 000- R2 000

Rainwater harvesting



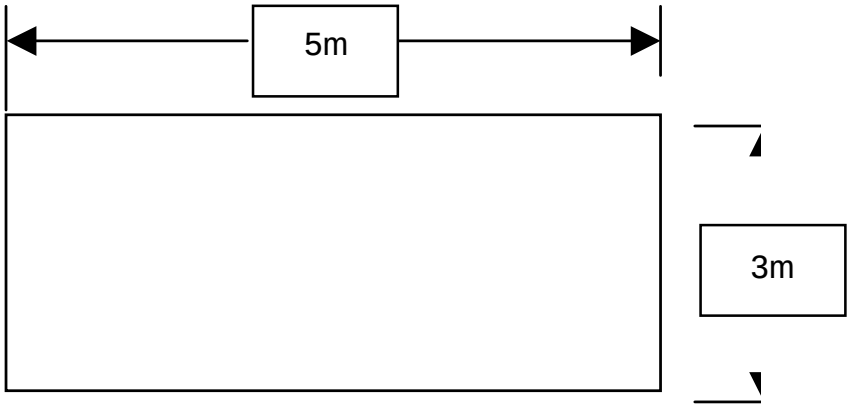
This Ferro cement tank holds 10 000 litres of rainwater, and the owner has been using it since the drought of 1993 for drinking and cooking.

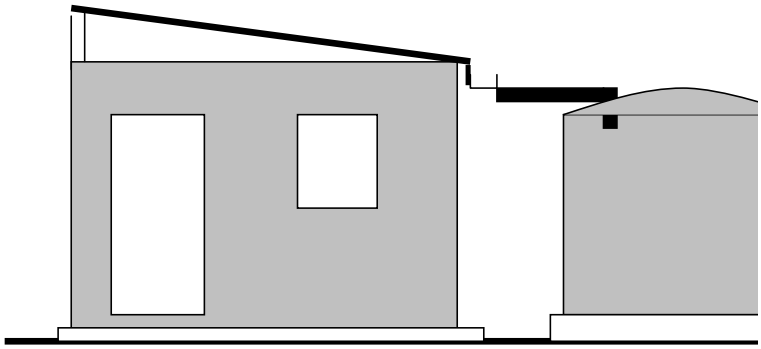
Rainwater is a renewable resource, which can be collected, stored and used like any crop, hence the word harvesting. Filtered and disinfected rainwater is perfectly clean and safe to use as drinking water. Rainwater can be stored for use during the breakdown of a piped supply; it can be used to supplement a piped supply – to make it cheaper for instance. Rainwater can be used for drinking when the available supply, river water for instance, is unsafe. Rainwater can be collected from any sloping surface, a school roof, a thatched roof, or a large granite rock. It can even be collected from a school playground or threshing floor into an underground tank. It can be stored in any sized container depending on the funds available: a Ferro cement tank, a jo jo (plastic tank), a recycled drum, or a bucket. Gutters can be made of plastic, galvanised iron, split bamboo or old roof purlins. Household rainwater storage makes water available close to the family, and gives them the choice of how to utilise it. For every square meter of roof that water is collected from, 1mm of rain can provide up to 1 litre of water. Annual rainfall in our area varies from an average of 500 mm per year in the Manyaleti area to 650mm a year around Acornhoek, and up to 750mm per year towards the mountains.

If rainwater stands in a tank for 24 hours before it is used, any dirt and solids will settle to the bottom of the tank. This will have to be cleaned out once a year, so the tank should be cleaned whenever it is empty. The gutters should also be cleaned at the same time. The user will determine the use of rainwater. Some people save it for the dry season, when other water sources may not be available. Some save it for emergencies; some use it for drinking only when the regular supply is unsafe.

This rock slab is being used to supply water to a school. The water runs into two brick tanks for storage.

This roof is
5m x 3m = 15 square metres in area.
If 50mm of rain fell on it, there would be a yield of
15 x 0.05 = 0 .75 cu m or 750 litres.This much rain often falls in one day!





This diagram shows how a rainwater catchment system can work on a house using a Ferro cement tank or a Jo Jo.

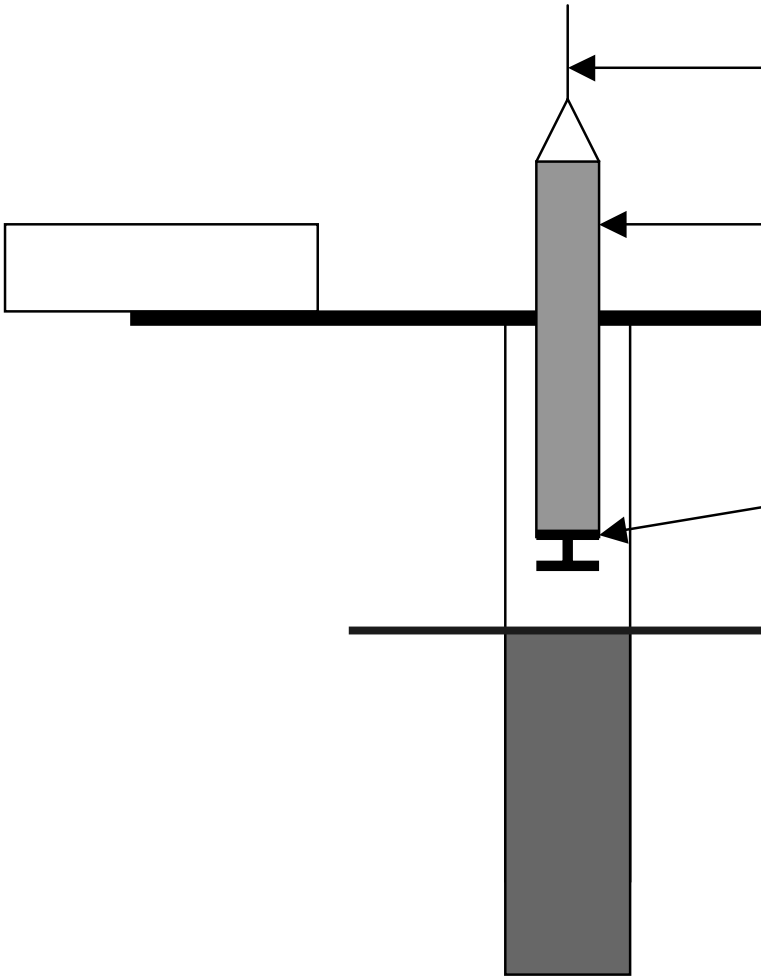
This tap is located so that it only takes clean water from the tank, about 300mm from the bottom.

Costs	
Gutters	R150 - R250 galvanised
Down Pipes	R25
Tank (ferro cement - 6kl)	R1 900 - R4 000
Jo Jo (10 kl)	R5 700
Steel Drum	R50
Maintenance:	Cleaning only

The village of Enable has shutters for the household Ferro cement tank, which they will rent out, and they have builders that are experienced in the technology.

Tube well

Where the water table is shallow, up to 20 metres below the surface, water can be lifted easily from a tube well: A hole is dug or drilled, sleeved with a plastic pipe and a special pipe lowered by hand into the water. This pipe holds water by using a simple flap valve, until the pipe is lifted out of the well, and emptied into a container.

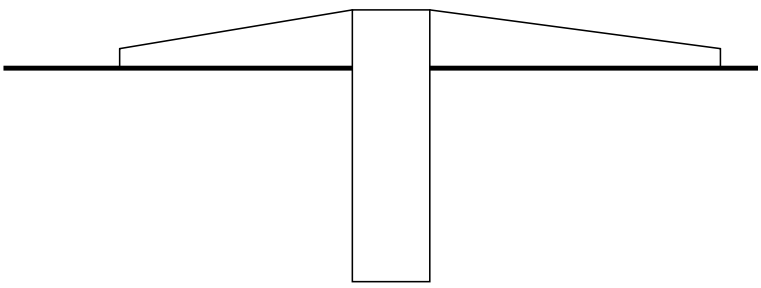


Almost any pipes can be used, as long as one fits easily inside the other. A local welder can make the flap valve and the hook for the lifting rope.

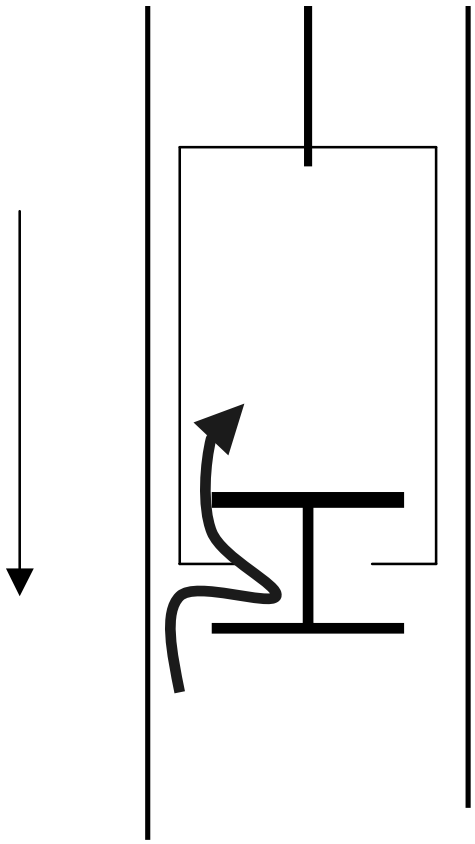
It is a good idea to make a simple cover for the well when it is not being used, to prevent stones and rubbish from falling in.

It is also important to tell children not to play around the well. If money and materials are available, a simple windlass can be made to make lifting easier, but otherwise, children can lift a pipe with 10 – 15 litres of water in it.

It is important to cast a concrete slab around the borehole so that wastewater can run away from the hole to prevent pollution.



These diagrams show how the valve works



The tube container and the valve can me made from scrap.

Costs	
Drilling new borehole	R10 000 - R25 000
Pump test	R6 000
Making container	R150 - R500
Slab	R150 - R1 000
TOTAL	**R16 300 - R32 500**

Diesel/electric pumps

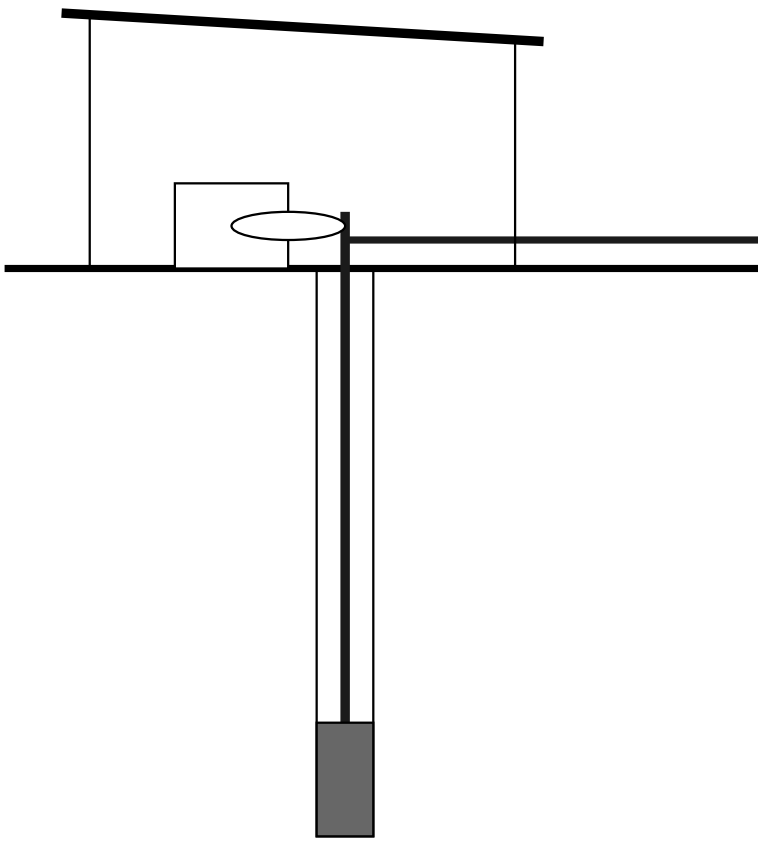
If the local available water supply is sufficient, an engine can pump a borehole with a rotary pump. A good borehole can yield from 30 000 to 150 000 litres per day, which can be delivered from the reservoir to standpipes by plastic pipes. These systems are expensive to install and very expensive to maintain. A diesel engine must be regularly maintained, and needs replacing every 10 years, taps need regular maintenance and pipes last for 20 years. An electric engine needs little maintenance but electricity costs are high as is the rental of the transformer.

If the community is large and has a high water demand, then, if a bulk water supply is not available, this is the best way to secure sufficient water on a permanent basis. However the costs involved will be high. This will include the services of a hydro geologist to find the groundwater, and an engineer to design the system. Other contractors will be needed to equip the borehole and build the reservoir and lay the pipes. The community should make sure that they are involved at all these stages so that they understand how the system works.

The community should also decide whether they need individual yard connections, or communal standpipes. The community should agree the sites for these. It is important that a tariff or fee for providing this water is agreed on before any work starts, at the design stage, because different levels of service have differing running costs. Typical costs for running schemes like these vary from R10 to R20 per family per month.

Thought should also be given to whether people want to use water fro gardens or small businesses, and how people will pay for this water.

A big decision is whether to use diesel or electricity to power the pump. The capital costs are similar, but the running costs are very different. A big problem is the threat of cut off of electricity if an account is not paid. The purchase of diesel fuel is in the hands of the water committee, but a diesel pump is more difficult to maintain.



All the pumping equipment must be secured in a shed for security and also to prevent pollution.

If we assume that the Botlhabela District is responsible for the capital costs, then the operation and maintenance costs for the community could be:

Diesel engine	
Diesel fuel for 25l/day pp	R1400 per month
Oil and filters for diesel service	R 55 per month
Payment for engine operators for 30 days	R 700 per month
Travel to service station for fuel etc.	R50 per month
Contingency fund for breakdowns	R500 - R 1 000 per month
Committee expenses	R200 per month
TOTAL:	**R2905/month**
Electric pump	
Electricity	R 750 per month (estimate)
Contingency fund for breakdowns	R500 - R1 000 per month
Committee expenses @	R200 per month
TOTAL:	**R1450/month**

Neither the diesel nor the electric pump will last for longer than eight years.

If the number of households were, for example, 600, then each household would pay R5/month for the diesel pump and R 3/month for electricity.

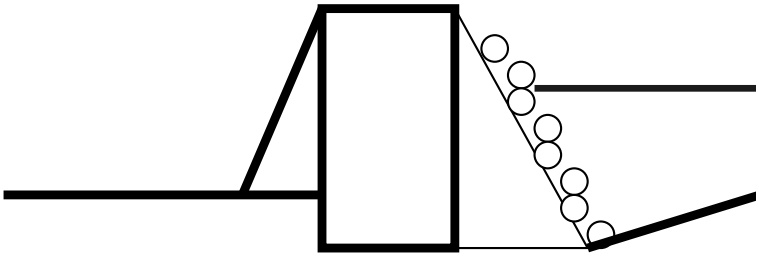
An important thing to remember is the **free water policy**, which should entitle people toi either 25 litres of water each per day for free or households to 6 000 free litres per month. The District Council should be involved at the start of the project to find out their strategy for providing free water. This will affect the monthly tariff paid. It is important to speak to your Ward Councillor and arrange these meetings in good time.

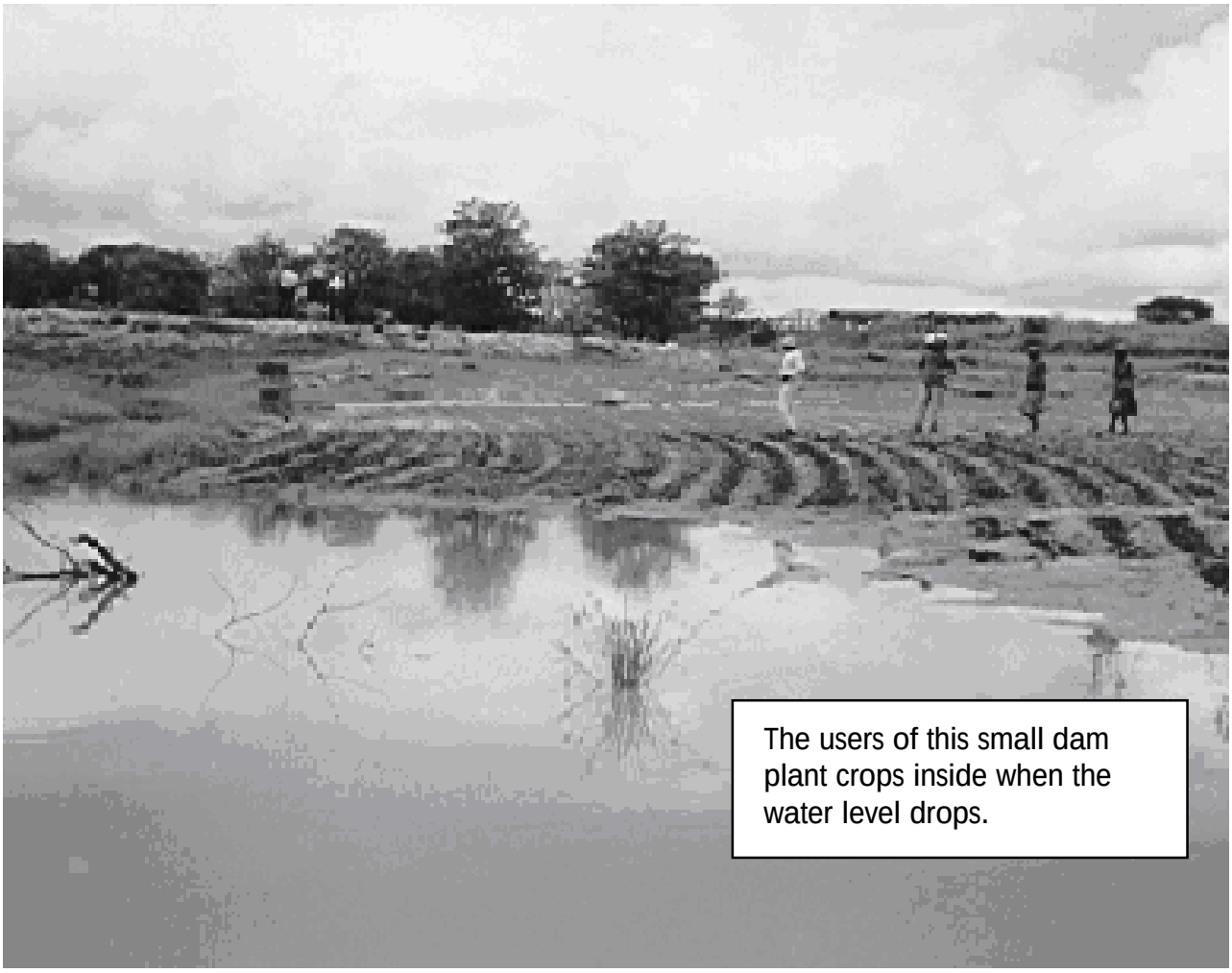
Small earth dam

If there is a place where water regularly runs off the land towards a river or stream, then that run off can be collected by making a dam or haffir. A dam is a wall built on the land; a haffir is dug out of the land. These small water collection points can be used for vegetable gardens, or for livestock watering.

The dam wall can be built by hand if enough people are available. It can be built using a dozer or mechanical digger, if one can be loaned from the roads department.

The waterside of the dam wall must be carefully faced with stones, or planted with vetiver grass, to stop erosion, and the top of the wall can be planted with vetiver grass to stabilise it. This grass can also be cut to feed livestock.





The users of this small dam plant crops inside when the water level drops.

Bunds

It is possible to use the same idea as that of earthdams on cultivated land to contain rainwater. Earth banks can be made along the contours of the land, to keep rainwater from running away. Crops are planted between the earth banks, which can use the rainwater collected there.

These women have dug rain-water collection ditches and planted crops in between

Bunds are earth walls that prevent rainwater run off, and allow plants to use the water between periods of rain and for longer than normal in the dry season. They can be dug in a yard garden or on a larger scale in community gardens. The bund should follow the contours of the land and not be too high.

No cost is involved in building these bunds, except for sweat equity.

Springs

Many communities in the West of Bohlabela have access to springs, and these can be a good source of water. The source should be covered to prevent contamination by animals and other pollution sources, and pipes used to carry the water to where it is needed. This can be to community gardens, a tap or a reservoir.

Local knowledge should know whether the spring is permanent or not, and how strongly it flows. If it is a good spring, an engineer can measure the output to decide if a number of taps can be used. Since the flow is 24 hours, an open pipe may be used instead of a tap.

The only costs involved are for stones or bricks to make the spring box, and piping to carry the water to where it is needed. High ground is often rocky so galvanised pipes may be needed for above ground.
If the spring is high above the outlet, then a tank may be needed to slow the water down.
This system works by gravity, so it is important to make sure that all the pipes run downhill. It may be advisable to employ an engineer to survey the land and mark the pipe routes if this is not obvious.