

## How can access to safe water be improved in Zombodze?



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## **Abstract**

Water is a necessity for sustaining or increasing the standard of living in almost all of southern Africa. Therefore we decided to investigate the problem of “how can access to safe water be improved in Zombodze”. We looked at how the present water situation was and investigated former project to find out what to be aware about when trying to improve the situation.

We found that there was actually quite a lot of water in Zombodze but that it was difficult to get it distributed to the people. Many projects had encountered problems due to conflicts between different sub-communities. We felt that many of these conflicts were related to poor organizational practises both during the implementation and during the actual running of the projects. Therefore we feel that the most important thing to do is to improve the organization both within Zombodze and within the different sub-communities

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# 1 Introduction

Access to safe and clean water is one of the most basic human needs and some argue that it is a fundamental right in itself. In many developing countries the issue of access to safe water is of great importance both in terms of drinking water and of agricultural production. Water is an essential natural resource and in Swaziland the National Water Policy states that all people are entitled to a minimum of 30 litres of safe and clean water per capita per day at a cartage distance of no more than 200 metres. The policy will be a point of reference during the report.

Zombodze is a rural community located in the region of Shiselweni in the southern part of Swaziland and lies within the high- and middleveld zones. The elevation is between 750 and 1150 meters above sea level and the main agricultural crop in the area is maize. The annual precipitation average for Swaziland is 788 mm, but may range from 500 to 1500 depending on the region. This rainfall is highly seasonal with a wet summer season from October to March and a dry winter season the rest of the year ([www.fao.org](http://www.fao.org))<sup>1</sup>. In general though the rainfall is quite unreliable and varies a lot from one year to the next. Furthermore the area is prone to droughts as Zombodze experienced in 2001 and 2002 (Area description, 2003). However, according to local sources this particular area is one of the safest and most reliable in terms of rainfall.

In Zombodze, one third of the people rely on surface water for drinking. The surface water resources of Swaziland consist of four main river systems, two of these rise within the country and flow to South Africa and Mozambique, and the other two rise in South Africa and flow into Swaziland. Because of Swaziland's dependence on neighbouring countries for surface water any developments in river potential in South Africa as a study<sup>2</sup> conducted in 1981 shows would reduce their access to surface water with 13.3 pct. ([www.fao.org](http://www.fao.org))<sup>3</sup>. The groundwater resources of Swaziland are described by the FAO<sup>4</sup>

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<sup>1</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 1 - 17.11.03

<sup>2</sup> The study was conducted by US corps of engineers

<sup>3</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 1f - 17.11.03

<sup>4</sup> Food and Agriculture Organization of the United Nations

as: "...the potential groundwater is thought to be limited, due to the general absence of formations with intergranular porosity and permeability." (www.fao.org)<sup>5</sup>. These mentioned water resources together with unreliable rainfall indicate that water is a scarce and vulnerable resource in Swaziland.

It is estimated that 46 pct. of rural population of Swaziland in the years 1993-96 had access to safe water. In 1998 the percentage had decreased to 37 pct. of the rural population<sup>6</sup>. The reason for the decline could be a higher level of contamination of surface water to mention one example. The lack of access to safe water resources can cause water borne diseases such as diarrhoea, cholera or bilharzias, which means that also the quality of water is an important issue when studying the resources of Zombodze.

Irrigation has become a priority for the government of Swaziland and for donor agencies due to the constraints to the agricultural production that are caused by droughts and irregular rainfalls (Dlamini, 2003). In terms of poverty alleviation, smallholder irrigation is an option for Swaziland because it provides a better alternative than other farming systems (Dlamini, 2003). Focusing on the effects of irrigation on Swazi Nation Land where the smallholders live, FAO (1997) states in Dlamini (2003) that irrigation has increased the farmers' income, and created employment opportunities.

As mentioned, the water resources of Swaziland are limited and Zombodze is not seen as being any different in that regard. We find it important to look at the management of water resources so problems concerning shortage, access and quality can be overcome and possibilities for improvements can be proposed. To study the water management in Zombodze, the following aim and objectives were decided upon as being of great interest for the community:

**Aim:**

*How can access to safe water be improved in Zombodze?*

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<sup>5</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 4 - 17.11.03

<sup>6</sup> Swaziland Human Development Report 2000 - economic growth with equity, UNDP and Swaziland Human Development Forum, Mbabane, oct 2001, page 59

By access we mean peoples' possibilities for using different water resources.

By safe water we will use the definition used by Swaziland Human Development Report 2000 that states the following: "Safe water access: the percentage of the population or of households with reasonable access to safe water supply, including tap water and water from protected or treated sources"<sup>7</sup>. We will elaborate on this definition in the chapter "The water resources of Zombodze".

To answer our aim we have formulated the following four objectives:

**Objectives:**

- To assess the current water situation in Zombodze with regard to access and quality.
- To determine the impact of the current water situation on the health and productivity.
- To assess the main water projects in Zombodze.
- To determine the socio-economic constraints and opportunities of improvements related to water management.

## **1.1 Methodology**

In this section the methods that were used for gaining information are described and the reasoning for choosing these specific methods will also be presented.

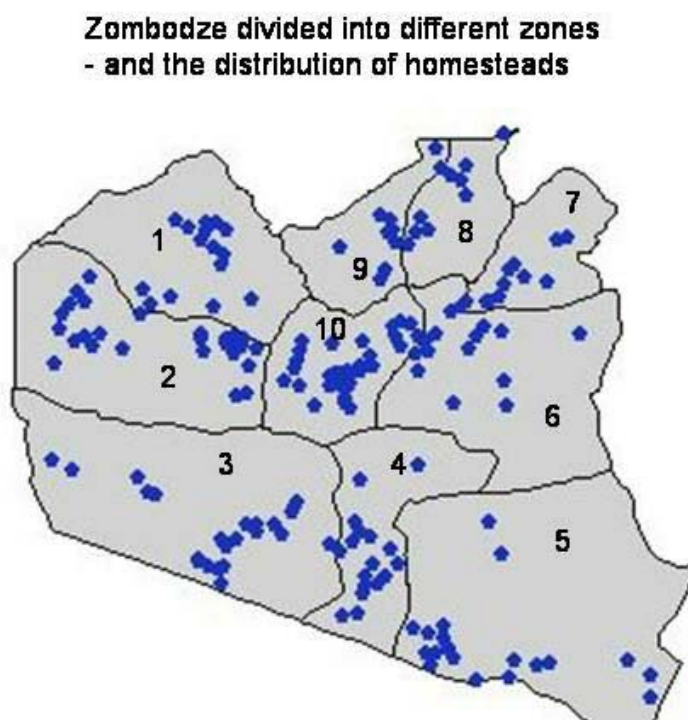
A general questionnaire was used for getting basic background information about a variety of aspects of the life in Zombodze eg. the agricultural production, the access to fuelwood and the participation in projects etc. For our specific purpose we gained information about the available water resources and whether or not these were used for irrigation. Apart from learning about the different water resources, the questionnaire was also used for the initial sampling of the homestead interviews. The questionnaire proved

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<sup>7</sup> Swaziland Human Development Report 2000 - economic growth with equity, UNDP and Swaziland Human Development Forum, Mbabane, oct 2001

to be extremely useful, as it made it possible to get information about most of the homesteads in Zombodze.

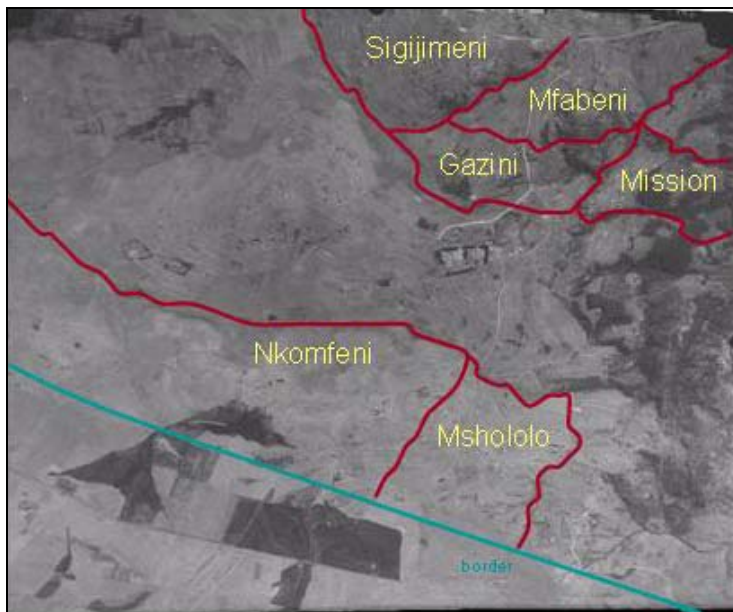
All five groups doing fieldwork in Zombodze carried out the questionnaire. The community was divided arbitrarily into 10 zones each with more or less the same number of homesteads and each group was then responsible for carrying out questionnaires in two of these zones over the course of two days. The zones are shown in map 1.1.



**Map 1.1:** Distribution of the households where questionnaires were conducted and the location of the 10 zones.

In our following work the most important way of getting information was by semi-structured interviews that were conducted with both homesteads and key informants. As mentioned, most of the homesteads were sampled by using the questionnaires while some of the key informants were selected already before going to Zombodze, as the current Induna, the MP and a nurse or doctor from the clinic. Both for the homesteads and for the key informants the list of possible informants were updated as new information was gained from the interviews that had already been done. An interview guide (appendix A)

was prepared for the different informants before going to Zombodze but it was only used for the initial interviews. As new information was obtained the focus of the interviews changed and therefore the initial interview guides were no longer needed. Instead the focus of the different interviews was discussed within the group prior to each new interview. For instance the focus changed as we learned which aspects were important in determining the success or failure of the water projects. We had to reprioritize the importance of technology, instead we placed emphasis on how unity and jealousy played a role. We realized that Zombodze is divided into a number of sub-communities covering different chiefdoms and these sub-communities are of great importance for the management of water projects, see 1.2.



**Map 1.2:** Distribution of the relevant sub-communities.

In addition to the interviews, the aspect of water quality was examined by doing tests of the water in a few chosen locations. We tested for pH, for the content of phosphate and nitrate, conductivity and of some of the samples the content of *e.Coli* bacteria was also tested. The locations were chosen either because they were identified by people living in the area as being the cause of diseases or if the water was from a kind of source that had not been tested. In this way it was possible to get an indication of the water quality from a variety of the different resources that are used in the area.



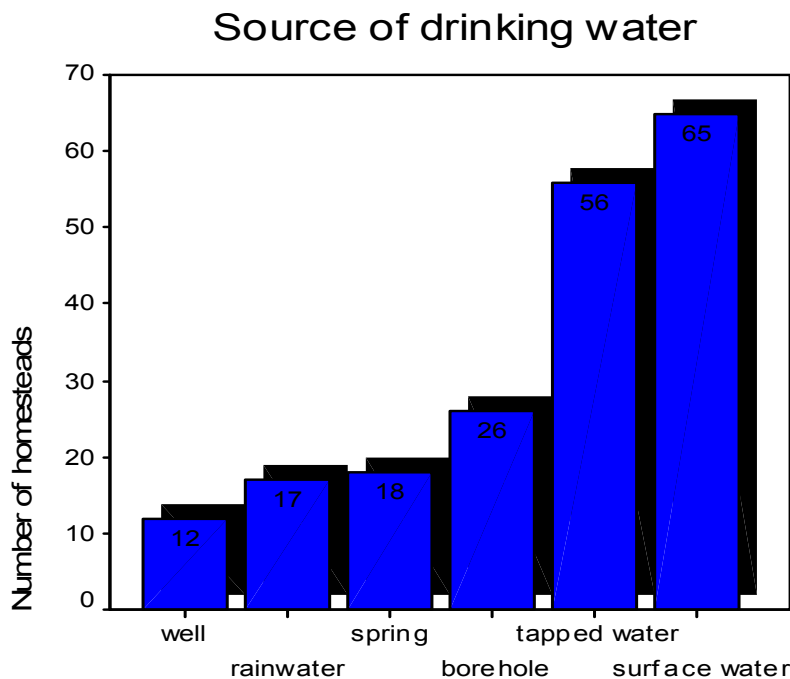
Another method used during the fieldwork was observations. The observations did not in itself give answers to the problems raised in the introduction. But evaluating the information from the interviews would have been almost impossible without the knowledge gained by observing the water practices and the everyday life during our stay in Zombodze. For example we saw different irrigation systems and how they were working.

## 2 The water resources of Zombodze

This chapter is divided into two parts. First we will present the different water resources within Zombodze and quantity of these resources. In the second paragraph we will look into the quality of the water resources and the effect that these have, both on health and productivity.

### 2.1 The quantity and access of the water resources

The main water resources in the region of Zombodze are surface water, tapped water, boreholes, springs, wells and rainwater. Water is a common resource and everyone has access to the streams and rivers in the area. The extent to which these different resources are used can be seen in figure 2.1.



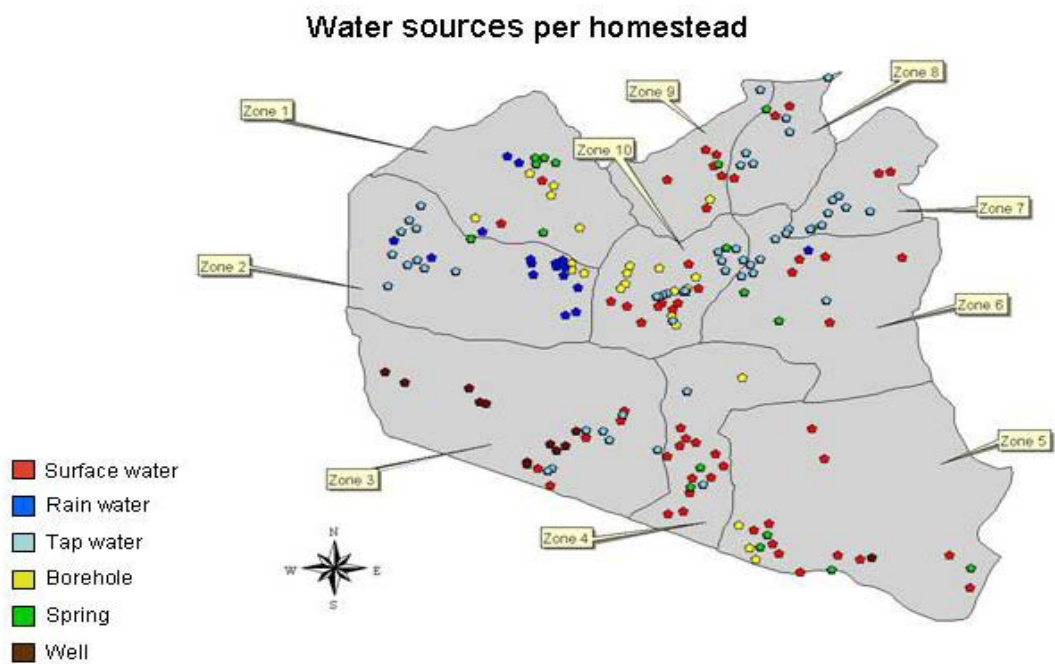
**Figure 2.1:** Distribution of which water resources that are the main source of water for household consumption.

The principle of tapped water can easily be explained: Water from a source is brought to a tank where pressure will then build up inside the tank due to the inflow of water and this pressure will then drive the water through pipes to taps located around the area. The whole system works on gravity so naturally the source has to be located above the rest of the system.

This system of gravity flow is the one that has been used in relation to all the projects working on tapped water in Zombodze. The boreholes in the area were driven either by electricity or by a manually operated pump. The boreholes are mostly privately owned and used by a single homestead or a smaller group of homesteads. Surface water is water that is collected at the streams that flow through Zombodze. The category spring include the homesteads that collect water directly at a natural spring. The wells are like dams of water and are mostly uncovered.

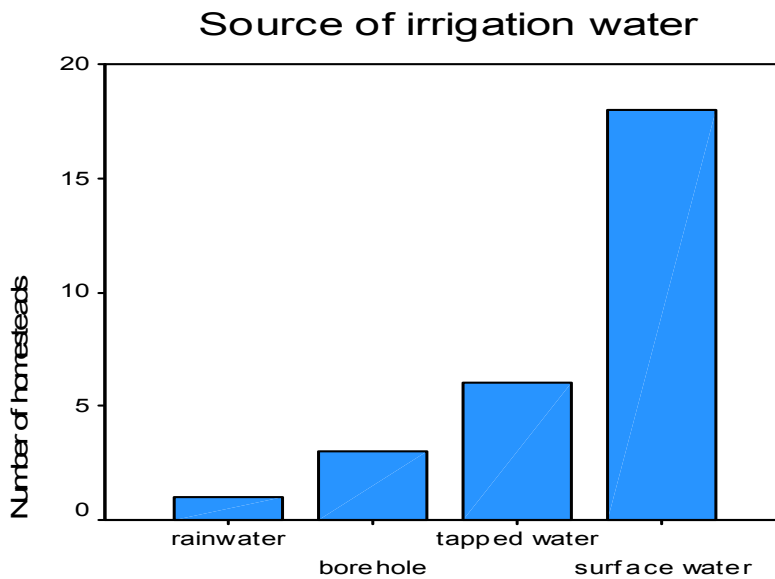
Only few of the community homesteads have water resources within their homestead and therefore most people have to transport water from the source to the homesteads. Most often 25 liter barrels are used for collecting water, which is then either carried or driven on wheelbarrows to the homesteads. Collection of water normally takes place once or twice a day for all resources that are being collected outside the homestead.

It was found that the access to the different water resources was very dependent on the geographical location of homesteads. The population of zones 7 and 8 have the best possibilities to access tapped water, while people from zones 4 and 5 depend mainly on surface water. This distribution can be seen in map 2.1 on next page.



**Map 2.1:** Distribution of homesteads and their sources for drinking water.

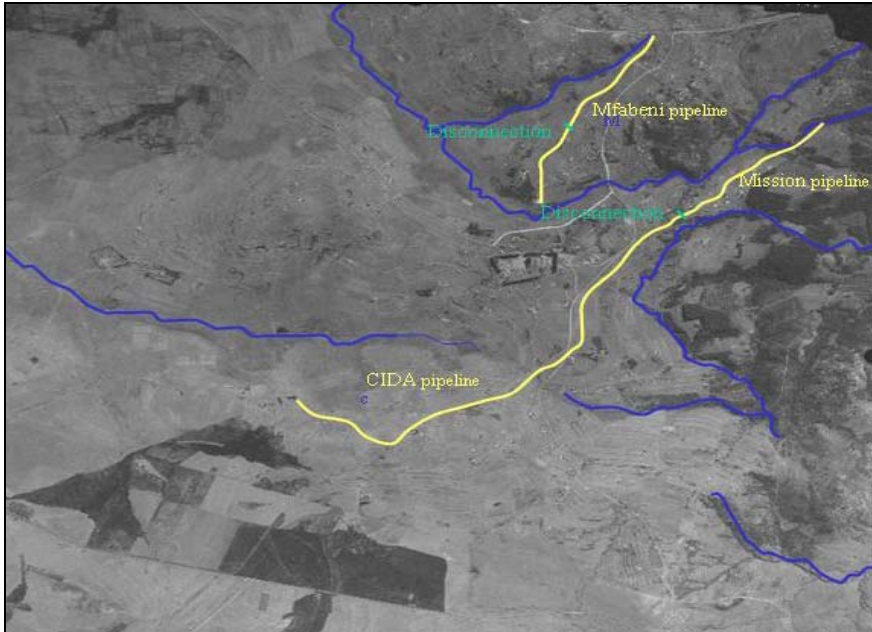
Within a homestead water for drinking and household consumption has the highest priority with any possible extra resource being used for irrigation purposes. The sources of irrigation water are mainly surface water and taps as seen in figure 2.2.



**Figure 2.2:** number of homesteads according to which sources of irrigation water they use.

### **2.1.1 Presentation of pipeline systems**

The largest of the pipeline systems with taps in Zombodze was implemented by the Canadian International Development Agency (CIDA) in 1997. The pipeline supports about 30-40 homesteads in the sub-community of Nkomfeni but the supply is not constant. The taps are only open on certain times on Wednesdays and Saturdays. The inclination of the pipeline is approximately 1.7 pct. The reasons why there is not a constant flow of water in the taps will be discussed in the next section. The location of all the pipelines can be seen on map 2.2.



**Map 2.2:** Location of the CIDA, Mission and Mfabeni pipelines as well as the location of the main river systems in Zombodze.

The two other pipeline systems in the community are the pipeline in the Mission sub-community and the pipeline running between the Mfabeni, Sigijimeni and Gazini sub-communities. The Mission pipeline was constructed at the same time as the CIDA pipeline and has an inclination of 3.5 pct. The pipeline supports 19 homesteads with water and it is functioning well. The last pipeline system, Mfabeni, was initiated as far back as 1984 with inspiration from the women’s group. The pipeline covers around 40 homesteads in the two sub-communities of Mfabeni and Sigijimeni and the inclination of the pipeline is 3.7 pct. The system worked well and in 1992 it was extended to also include the downhill community of Gazini. After this it worked well until a few years ago when shortage of water was first experienced. Due to gravity the downhill community of Gazini did not suffer from this problem and the pipes were disconnected. Today, Gazini does not have any tapped water supply. This has naturally resulted in some conflicts between the different sub-communities and these will be described further in the next chapter.

### **2.1.2 The National Water Policy**

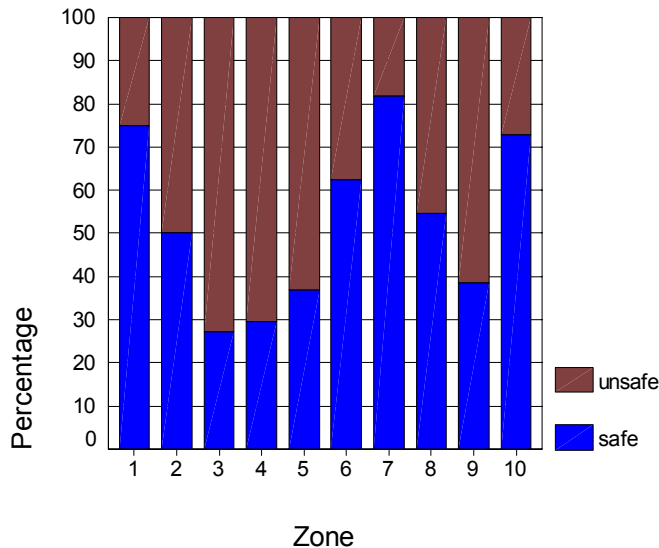
As mentioned in the introduction the National Water Act states that all people in Swaziland should have access to 30 liters of safe water per person per day at a cartage distance of no more than 200 meters. Regarding our definition of safe water supply this includes water from taps and water from protected or treated sources. When we apply this definition to the sources present in Zombodze, we find that safe water must include water from taps and boreholes, the latter because it is protected.

When assessing spring water we would argue that it can be a safe source if the water is collected just where the spring appears and if it is protected from contamination. With rainwater it is the same story as with springs that the water can be safe but that it depends on the ways in which the water is collected and stored. The unsafe water sources are coming from wells and what we have called surface water. These sources are not protected and people are using the water for laundry and for watering animals.

In figure 2.3 we have defined the category unsafe water as surface water, water from wells and rainwater; and safe water as water coming from taps, boreholes and springs. As it is open to discussion whether a source is safe or unsafe we only see the graph as an indication of the availability of safe water in the different zones in Zombodze.

## Safe/unsafe drinking water

### defined per zone



**Figure 2.3:** Percentage of homesteads using safe water sources divided into zones.

The distance to a given water resource vary with the season even though there did not seem to that big quality variations. It was not completely clear how much water each homestead had access to but in general people said that in their homestead they used between 50 and 75 liters a day. Even though some homesteads even used 100 liters per day it is not even close to the goal of 30 liters per person as there live an average of 10 people in a homestead. Furthermore it is important to mention that just because people are not using 30 litres it does not mean that they do not have access to it. We assume that if people increased their water consumption to 30 litres per person per day there would not be sufficient water in Zombodze. What we have experienced concerning the tap systems in Nkomfeni and Mfabeni is that the amount of water is relatively scarce, which indicate that an increased use from one homestead could have a significant impact on the access to water of the neighbouring homesteads.

And even though people say they have enough water, also in the dry season, there is an indication that the amount of water would not be sufficient to a large increase in consumption by the community members.



In regard to the distance we estimated that around half of the homesteads had more than 200 meters to their water resource while the rest had less. Of course this varies as many people have to walk for longer distances in the dry season.

## **2.2 The quality of the water resources and their impact on health**

We have done 15 water tests with water collected at as many different locations as possible. In all 15 places we investigated the pH level, the content of phosphate ( $\text{PO}_4^{3-}$ ) and nitrate ( $\text{NO}_3^-$ ) as well as the electrical conductivity. The results (appendix C) showed that the pH-level was quite constant with all results lying in the range of 6,1 to 7,6. The level of phosphate was very low and even though the test kit were supposed to measure amounts between 0 and 3  $\text{mg}\cdot\text{l}^{-1}$  we did not find any measurable phosphate in any of the samples. Therefore the nitrate levels were also expected to be very low. The low content of minerals shows that the cultivation of land is not a pollution factor in Zombodze. Two tests were done at locations where it was expected to find some of the highest nitrate content but only 7 and 10  $\text{mg}\cdot\text{l}^{-1}$  was found in those samples.

Due to the fact that more water samples were likely to be infected with bacteria than with different minerals we also tested for the presence of *e.Coli* bacteria to get an idea of level of pollution. With the *e.Coli* test kit we were limited to 7 tests, which we decided to use on as many different sources as possible (a tap, a spring, a stream, a well and from within a homestead). Even though the results (appendix C) can only be used as indications due to the low number of replicates it seems as if the water from the more open sources is more infected than those sources that are covered (the second highest count was found in the open well and the lowest count was found in the water from a tap). This finding supports our definition of safe water; that safe water among other things has to do with covered sources. Another more important finding might be the quality of water found within a homestead. From our findings we found that it had the highest level of *E.coli* infection. This very clearly shows the importance of good hygiene in relation to drinking water. It also shows that in many cases the way of handling the water within the homestead eg. to have clean and covered storage barrels may be more important than the level of infection at the source.

According to South African standards drinking water should not contain more than 10 *e.Coli* bacteria per ml. but three of the tests that we conducted resulted in higher amounts. Drinking water of such a quality can cause diseases such as diarrhea, bilharzia and cholera and according to the clinic nurse and the rural health officer there had been quite a number of incidences of water borne diseases like diarrhea and bilharzia especially during the rainy season. We were informed that the clinic is educating the people on how to treat the water by either boiling the water before use or disinfecting it with JIK (household bleach containing chlorine).

Despite the fact that the aspect of water borne diseases seems to be prioritized quite high by the clinic and the Rural Health Officer it did not seem to be that big a problem to the people in Zombodze. Very few people directly mentioned that they had problems with the quality of water and when the aspect of water quality was mentioned it was just as often in relation to people washing their clothes in the river as it was concerning outbreaks of diarrhea or cholera. This shows that the local population does not perceive the aspect of water quality to be as important as the clinic and the rural health officer might do. This is also seen by the fact that we did not find anyone who boiled their water before drinking it and even though most people know how to use JIK we did not find anyone presently using it. Many people said that they used it in certain periods, if they were informed by the clinic that it was crucial but at other times they did not use it.

### **3 Water projects**

In this section some of the different projects related to both drinking water and irrigation are discussed. We have chosen two pipeline systems and one borehole project that we will analyze in order to assess how joint water projects are managed in the community of Zombodze. The pipeline systems we have chosen are from the main external donor funded project the CIDA pipeline system in Nkomfeni - Mshololo that joined the Mission Community pipeline for a short(er) period. The other pipeline system is a community project in the sub-communities of Mfabeni, Sigijimeni and Gazini. We have chosen these areas because we find it interesting especially in order to discuss which constraints that are related to the cooperation between different sub communities. We will focus on the implementation process; the inputs given concerning money, labour, maintenance and responsibility of the projects. Our intention with this section is to describe how the overall process has been organized and discuss which factors are of importance regarding the management of the joint water projects. We'll also give a short presentation of one borehole project.

#### **3.1 CIDA and Mission Community pipeline systems**

According to the elected Induna, Themba Dlamini, the aim of the CIDA project was to supply clean water for the community and it was hoped to supply at least one tap for every 10 homesteads. It is not clear whether the community organization in Nkomfeni contacted CIDA for support or it was CIDA that came to the area and chose to cooperate with Nkomfeni. The elected Induna says that the community organization in Nkomfeni applied the Canadian government for assistance using the Swazi government as mediator. In this case it seems like the community members organized themselves. Another version told by an informant from Nkomfeni is that when the project was initiated, the donor agency called a meeting with all Zombodze community and briefed them about the project intentions, requesting them to form themselves into an organization. The

informant explains further that because only the residents of Nkomfeni organized themselves, the project was done in their sub-community.

The matter of who made the initial contact meaning if the water supply was given to the community or if they requested it themselves due to lack of clean water is interesting when discussing the participation of the homesteads involved in the water project. The participation rate often seems very important for the success of a given project because participation often indicates an interest in carrying out the project and make it fulfill the needs requested. While there is uncertainty of when the Nkomfeni Community became organized, we know that the Mission Community organized themselves in order to improve their water supply. This indicates a good starting point of the project.

### **3.1.1 The implementation process**

Before CIDA came to Zombodze the Mission Community had had meetings discussing their water situation and was in the process of constructing a pipeline system with taps using a nearby spring. They began constructing the system themselves but due to shortage of money the process did not progress quickly. In the middle of the process CIDA came to the area and decided to fund the Mission Community project with materials.

In Nkomfeni where the original CIDA project was set up, the residents used to obtain water for household purposes from the Thibela River. While implementing the CIDA project it was soon realised that the water supply would not be sufficient enough, so an agreement was made with the Mission Community about joining their pipeline. The aim was to take advantage of the more reliable source being used by the Mission Community. The general sentiment in Nkomfeni is that the system was working well in the beginning and that they had enough water all 24 hours a day. Because of the sufficient water supply in Nkomfeni discussions were started with Mshololo, a neighbouring downhill community about supplying their homesteads with water from the same pipeline system. All these connections were not realised as planned because some homesteads in Mshololo succeeded in having their own taps connected whereas others for several years have been

promised to be connected but never have. Our explanation is that at the time when the connections of the Mshololo homesteads were undertaken the decrease of water supply arose and therefore not everybody was connected to the pipeline. When being in Zombodze, the only answer provided by our informants as to why the water supply is decreasing is the technical explanation that the pipe system is based on gravity. Our impression is that it could either have been an environmental problem such as that the source had become scarce or that it has to do with a considerable over-consumption of water.

### **3.1.2 Inputs given to the project**

Up until the moment when CIDA decided to fund the Mission Community water project, the former MP, Justice Nsibandze, had given them 300 m of pipes with the expectation that the community would contribute the labour. As well, all the 19 homesteads participating in the project were required to pay E 100 each. In Nkomfeni - Mshololo CIDA donated all the construction materials such as taps, pipes and tanks, and the Nkomfeni community was asked to provide labour for the project. We have no data about whether Mshololo contributed with labour or not. While the homesteads within Nkomfeni contributed E 30 each to join the pipe system, E 350 was requested from each homestead in Mshololo.

The amount of money and labour contributed to the implementation process can be an indication of the level of ownership that the homesteads are having towards the projects. The amount of money paid and the contributed labour can say something about the motivation for getting a tapped water supply.

### **3.1.3 Disconnection of pipelines and how to solve the problems**

In 1997, the Nkomfeni-Mshololo pipeline was joined with the Mission Community's pipeline, but the agreement between the communities about joining pipes is not clear. In the Mission Community it is said that they were only asked for the overflow of water from their system, but what happened was, as the Mission Community states, Nkomfeni took all the water by attaching their pipes to the main system instead. There is a degree of uncertainty of this statement, as it has not been confirmed from other informants. And yet

despite the uncertainty, there still remains a question due to the unreliability of the water source. Given the limited supply of water without the extension to Nkomfeni, it does not seem realistic from our perspective that an agreement was made allowing CIDA to use the overflow of the water. If CIDA had already realised in the implementation process that the water would not be enough why did they believe that taking the overflow would provide a sufficient supply. The confusion about the disregarded agreement might be the explanation for the Mission Community to legitimise their cutting the pipes.

The water supply with one single pipe system was operating for a period of 14-18 months according to the data we have. The Mission Community disconnected their pipes from the one going to Nkomfeni with support from the former Induna who proposed the disconnection and today two different pipeline systems are operating. The story is repeating itself as Nkomfeni Community cut the pipes going to Mshololo so that they today do not have any tapped water supply.

In all these sub-communities an explanation of the problems of the pipe systems for the uphill community is the lack of water. Nearly all informants have told us that as the system is based on gravity it does not supply satisfactorily the uphill community as the water runs downhill. We assume that because it is a technical problem that might be possible to overcome easily with the appropriate technical skills. But as of yet, these skills have not appeared in Zombodze and external bodies that could supervise the situation are not present.

In Nkomfeni informants also mention the problem of jealousy particularly regarding ownership of the source as it is situated in the Mission Community. It is said in the Nkomfeni Community, that they have talked to the Mission Community about how to solve the problems with the broken system but there has not been any understanding. In Mshololo it is said that the plan for the future is to ask Nkomfeni for a meeting about their problems. The sub-communities have not been able to solve the problems between them even though meetings have been held. We assume that a reason why the meetings have not solved the problems may be that it is a very tense and sensitive issue to discuss

water supply, as it is a basic human need. In other words, drinking water is fundamental for survival, which makes every individual fight for access to the common resource. The issue about the individual right to common resources will be discussed further in next chapter.

### **3.1.4 Maintenance of pipe systems**

Before leaving, CIDA designated and trained three volunteers in the Mission Community and three in Nkomfeni to be responsible of maintenance. The ways in which the sub-communities are managing the maintenance of the pipeline systems and how they are sustaining the projects is indicative of the organizational practices within the single sub-communities.

Regarding the people in charge of maintenance, one of those responsible in the Mission Community tells that in practice he has never repaired the system. We assume that this is because the system is working well there might not until now have been any necessity of repair.

Mr. Titus Thwala, current MP, states a serious critique of the CIDA project regarding the maintenance as he means that the communities were never given the skills to repair the systems themselves. Besides, he thinks that the project lacked the inclusion of educated members of the community, and as such the ability of the expertise to help maintain the system. The maintenance is also of great importance for the elected Induna when he explains what he thinks is the reason for failure. The Induna thinks that it is solely due to poor maintenance on the part of the community as it was their responsibility for providing the follow up service and maintenance.

Regarding the cost of the repairs, in Nkomfeni each homestead contributes E 2 every month for the maintenance and monthly meetings are held where the community members are supposed to be briefed about the project status. Though, it has also been said that they are no longer paying each month and they have stopped the meetings. Since our data is not pointing in the same direction, we might assume that the organization in

Nkomfeni is not optimal, perhaps because other informants tell us that there is no account of how the money has been utilised.

During the winter months, two people from the Mission Community hold meetings for all the participating homesteads every second month where they discuss the status of the system and if any changes need to be done.

Discussing the organizational practices, in Nkomfeni the homesteads first organized when CIDA came with the funding for the water project. As such, the organization is very young and it does not seem very embedded in the sub-community. The reason why we say this is that meetings about the status of the water project are no longer held and no monthly cost is paid for the maintenance. Furthermore there is a board that makes all the decisions regarding the project and the person who does the repairs, pays for them himself or collects money by asking each homestead individually. This gives an indication of how low the participation level is in the water project and very little organizational practice among the homesteads in Nkomfeni.

The Mission Community has had better success with organizing themselves. They were able to improve their water situation by articulating their needs and seeking a solution. So far they are still having monthly meetings in the winter season where they discuss the status of the project. These issues indicate that the organization is working well. We did not come across to ask how many people who participate in the meetings which could have sustained a high motivation of the people involved or on the contrary could indicate if the project is solely based on few peoples' input to it. An advantage of the Mission Community might be that it is a smaller organization with only 19 participating homesteads and therefore it can be easier to run.

### **3.1.5 Status of projects**

The general statement in Nkomfeni - Mshololo is that the CIDA pipeline today is not a success as the supply of water is not reliable. The current Induna sees the CIDA project as having some good as well as some bad components. He talks about a maintenance failure but at the same time calls the project a success as it provides clean water to the Nkomfeni Community. Though the water supply is most problematic in the Mshololo



area where they do not have any tapped water at all and no compensation was given when the pipes went cut.

Regarding the cooperation between the different communities, the persons in charge have been told by CIDA that they should solve the problems between the communities themselves. The lack of unity within Zombodze is a factor that we have come to understand as a very important constraint. We have in this section mentioned participation and the organizational processes of the implementation and the maintenance which all are factors that contribute to the discussion of unity.

### **3.1.6 Lack of unity**

We were surprised to find out that the community of Zombodze is divided into around 10-12 sub-communities which are defining themselves as members of such subdivisions. We did not find out how each sub-community differ from on another or what they mean to the people in relation to identity or ways of behaviour. From our own observations we did not see any clear difference between the sub-communities as such but we did notice differences in economic status between the various areas.

The differences in socio-economic level cannot explain all the aspects in relation to the lack of unity between the different sub-communities. It is a discussion about whether or not subsistence farmers are having problems with working together as they are living mostly of their own agricultural production and are to some degree not dependent on one another.

In Zombodze there is jealousy towards people having more water than others and jealousy in the sense of ownership eg. towards those that have the source within one sub-community while the water is running downhill to another sub-community. It is important to mention that the most common answer during our interviews to what went wrong according to broken pipeline systems was jealousy. It is difficult to assess more specifically what is lying underneath the feeling of jealousy and why it appeared, as mentioned our impression is that it has something to do with the lack of unity within Zombodze.

### **3.2 Mfabeni-Sigijimeni-Gazini pipe system**

The homesteads in Mfabeni and Sigijimeni built the pipe system themselves. The project was sponsored with cement and pipes by the Department of Water Supply, and the homesteads that participated paid E 5 each, which was increased, to E 10 because of increased expenses.

In the first years the system was working very well and in 1992 the uphill Mfabeni and Sigijimeni decided to extend the system by building another tank for storing more water, so the water could be distributed to the neighbouring downhill Gazini Community.

It worked for 10 years but in 2003 the Mfabeni Community cut the main pipe for the first time. From the point of view of Gazini the pipe was cut exactly when homestead connections were made in Gazini. It was impossible for Mfabeni to get homestead connections and from a Gazini perspective it was because of jealousy that they cut the pipes. From the point of view of Mfabeni the level of water was decreasing and especially in the winter season there was not enough water. The decrease of water from a Mfabeni perspective has to do with the usage of the water as they think that Gazini also watered their gardens which was against their common agreement which stated that the water was only for homestead consumption. In Gazini they have got another impression of the water supply as it was explained that the water source was of very good quality, also reliable in quantity and they state that the agreement was that water could be used for small gardening projects also.

When the first pipe was cut a meeting was held for Mfabeni and Gazini and the communities agreed on not cutting the pipes anymore. But the tampering of the pipes has still happened several times since that meeting. In the beginning every two or three months the pipes were cut by the Mfabeni Community but continued to be repaired by the Gazini Community. The main pipe has been cut twice and was only repaired once so today the residents of Mfabeni go to the broken pipe to collect water.

There is disagreement between these sub-communities as to why the pipeline has been cut. On one side it is because there has been a decrease of water and on the other side

there is the matter of jealousy regarding having homestead taps or not. For us it is difficult to follow the idea that the Mfabeni Community cut the pipes simply because they could not have homestead taps. It does not seem as a proper explanation as the pipeline system had been working satisfactorily for 10 years and people must have been used to walk a little distance to the taps (Mfabeni is a little area with several taps so they could not have been walking that far). Besides, to cut the main pipe so that people of Mfabeni themselves had to walk even longer than before to collect water, only because of jealousy towards homestead taps does not seem realistic. In this case the decrease of water seems like the more realistic reason for cutting the pipes which as result have had that the Gazini Community has to collect water elsewhere.

From what we understand of this case, what happened was that Mfabeni was facing some serious problems with decrease of water supply and as the system had been working for many years without problems they began to accuse the recently connected community Gazini for not keeping the agreement about not watering gardens. What could be learned from this is that in the first place when agreements are not being followed some external body or institution should intervene to help solve the problems. It seems like no one is actually supervising the joint water projects, and no help are given from anybody to avoid conflicts. What makes it even more difficult is that when agreements first have been broken it is very difficult for a sub-community to make sanctions towards somebody not keeping the promises. Finally the sub-community facing the water shortage does not see any other option than cutting the pipes. The other community does not have any sanctions either, when they may feel that tampering of the pipe system has occurred without reasons, because no police are coming to arrest the people being involved.

### **3.2.1 Status of the project**

In Mfabeni they would like some external institution to come and assess the situation so the problems with broken pipes can be solved. In the data we have about the joint water projects only in one single case did an external body interfere and that was when the Mission Community was advised by the former Induna to disconnect their pipeline. This intervention was not even external in a broader sense as it is coming from the community of Zombodze.

In Gazini, they have the impression that the individual projects work out better than joint projects since there is more commitment and diligence by individuals compared to community projects where people just drag their feet, expecting others to do all the work. We will discuss further which implications it has had for Zombodze that no external institution is supervising or assisting the joint water projects after the implementation.

### **3.3 Irrigation schemes**

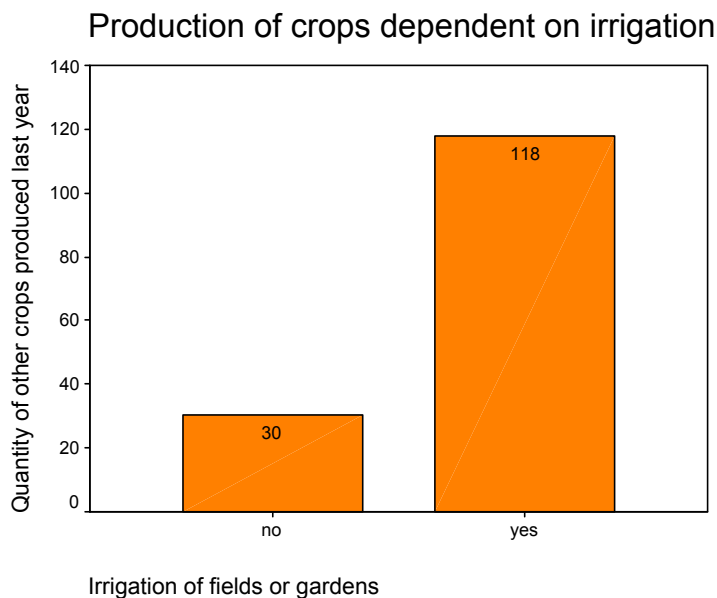
The irrigation schemes that are described in this section are all private. The only joint irrigation scheme that we came across was the community garden. However we did not investigate this but learned through conversation that the system had been out of order for the last 10 months due to mud in the furrows that was to lead the water to the garden.

The importance of irrigation is widely recognised by the farmers in Zombodze. However only quite few households has undertaken private initiatives to irrigate their crops, and in almost all cases it is only the garden that is being watered.

The irrigation that has been initiated by private households range from the simplest techniques to quite advanced. The simplest schemes that were investigated involved simply going to the river and then carry the water to the garden in buckets, collecting rainwater or building dams which where filled with water from nearby furrows. Depending on the size of these dams water was used to irrigate anything from minor gardens to most of the fields. In the more technological end private households initiated a couple of boreholes. Water was then pumped from underground using electricity and the water was used for household purposes, for irrigation or for both.

The implementation of these different irrigation schemes has been undertaken for different reasons but generally it is the extra income that can be gained from growing cash crops such as cabbage, beetroot, potatoes, carrots, sweet potatoes and spinach that is the motivating factor. However there where also one person who started irrigating simply because he was tired of going to the market for vegetables. He is now completely self sufficient with vegetables.

Generally those households that uses irrigation of their homegarden (or all their fields) have a substantially higher income than the households that are only depending on rainwater do. Most likely this was also the case before they started irrigation, as that was how they paid for the different irrigation schemes. But in addition to that there has been an additional increase in income due to the irrigation (see figure 3.1 on next page).



**Figure 3.1:** Yield of other crops than maize depending on whether or not irrigation is being used.

In more or less all instances the different irrigation schemes has been initiated without any help from outside even though one of the boreholes received a little help from government officials in surveying the groundwater resources before drilling for the borehole. The prices for the implementation of these schemes vary depending on the complexity. The collection of rainwater and stream water was undertaken at almost no cost while dams varied in price from E400 to a few thousand but maintenance cost is not included in these prices and for instance for furrows the price must be quite high at least in terms of opportunity cost.

Naturally the boreholes were more expensive ranging from E8.000 and up to E16.000. Generally the finance of the more expensive systems has been made possible by the households themselves and often by off-farm income.

Previously there were more and larger dams as well as there were a lot of small gardens close to the streams. Today many of the dams are broken and there are very few gardens left. The reasons for this transition were however not investigated and no real conclusion can be drawn from this change.

It is a bit unclear if more people could use the different irrigation schemes described in this section in the future. One household indicated that they had enough water in their borehole to share with neighbours if only they would pay for it but others said that there was not enough water for everyone in the area to construct dams. But in any case it was seen that even though there were also opportunities for the less well off households most of the initiatives still required capital before they could be undertaken. Financing could however be overcome with a favoured location, which for instance could be close to a stream. And if irrigation was undertaken it resulted in a significant improvement for the household.

With all the advantages of irrigation that has been outlined it can seem strange that a number of small gardens schemes as well as the community garden is presently not working. This aspect could also have deserved some more attention as we do not have much information of it.

## 4 Discussion

In this chapter we will discuss the aspects that are related to answering our aim and objectives. There are two important issues that will be discussed. These issues are related to access and quality. First the simple physical access; the quality; and the consequences that these can have will be discussed and then all the socio-economic factors that are related to the water situation will be presented. On this basis we will look into some of the possible ways of improving the access to safe water in Zombodze.

During our stay in Zombodze we found out that the quality of the water was generally not seen as a serious problem. In that sense we would argue that the results of the quality tests seem much more problematic in terms of bacteria than the picture we got when talking to people in the community. The reason few people see the water quality as a serious problem is related to the fact that there have not been that many incidences of water borne diseases in the last years. Three years ago there was a case of cholera and since then there has only been some cases of diarrhoea. So in practice, the level of bacteria in the water is not a limiting factor in terms of living.

Another important issue aside from health and the quality of water, is the importance of a reliable water source in relation to farming. There was a clear correlation between those persons that irrigated their gardens and those having a higher yield. Off course some of this can be attributed to the fact that most of the people that implemented irrigation already had a higher income before, as that was how they could afford the implementation of these different systems. However this cannot explain all of the difference as we got clarification through the interviews that there clearly was an income gain from being able to grow other crops and to grow these all year around while those with no irrigation could only grow crops in the wet season. The possibility that one farmer has towards implementing an irrigation scheme is based on his or her economic resources and skills which might lead to a social bias, resulting in those who have access to resources will prosper even more.

In relation to the different pipeline systems it is mentioned by several informants that the amount of water available seems to be decreasing. In all the pipeline projects everything was going well for a period and then the amount of water seemed to decline which then led to different conflicts in the communities. The conflicts can be explained as that way that the problems arise if many individual homesteads are using a scarce and common resource, or what Hardin (1968) called *The tragedy of the commons* (Ostrom, 1990). For Ostrom who has developed Hardin's statements, to overcome the problems of the governing of the common goods it is important to have well defined boundaries for the number of people using the resource as well as some agreements about the governing of the resources.

However it needs to be remembered that most informants in Zombodze (even though far from everyone) said that there was actually enough water within the community and this gave us the indication that the problem was more related to access and how the water was being distributed.

During the interviews the most common answer, when asking people in the community why some of the projects did not work, was that it was due to jealousy. There seemed to be a strong sense of ownership towards the water resources while any uneven distribution of the water would result in some people feeling mistreated. Often it was not until the piped systems were extended to cover extra homesteads that they started having problems. So there are several possibilities, either the level of water in the area is actually decreasing or people have a very strong sense of ownership towards the water resources or maybe the projects were simply not designed to cover that many homesteads. It seems as if the last option could be what is really happening as there has not been any decline in the amount of water in the pipeline in the Mission community. Here no extra houses have been connected and the aspect of jealousy between communities has been eliminated as the pipeline only supplies one community.

The aspect of lack of unity across the borders of sub-communities is also related to the aspect of unity both within the different sub-communities but even more between them. Often the members of a sub-community would discuss an issue between them and



conclude on what to do before involving other sub-communities even though the decision might affect both communities. This aspect of unity and organization within and between the communities is an aspect that was especially mentioned by the more influential members of Zombodze. Here there seemed to be a general agreement that the most central aspect regarding the degree of success of a project is related to the organization of the people/communities that are involved.

This shows that the communities are not jealous to begin with but that the jealousy is a consequence of some other disagreements. In relation to the different disagreements and the pipes that has been cut it was also seen as a problem that there were no officials from outside that could or were willing to intervene. This could be either because of a general unwillingness or simply because of weak bureaucracy. Here it could probably have been useful if those that help fund the projects, other higher institutions or maybe even the police were able to intervene. This might make the different sub-communities more willing to start a debate about their problems if they could see that they might gain from it, before they felt forced to cut the pipes.

Generally the problems with the different water projects cannot be attributed to just one thing. The type of system used had something to do with it as it is often a source of problem because it did not sufficiently take into account that the gravity system would favour some homesteads over others. Also the issues of jealousy, unity and organization made it a lot harder to solve these problems when they arose and there were also a poor level of support from the local government as well as from the foreign donors. All these aspects had their part in many of the projects not functioning properly today but in our opinion the issues of unity, jealousy and organization are what are most important. It is not realistic to expect all projects to take place without at least some minor difficulties (such as the problems with the gravity system), but with the proper dialogue and cooperation these problems can be overcome. It is important that not just the different sub-communities are organized but also that there is some sort of cooperation between these communities.

## **4.1 Future projects**

From the members of the community the future project that has received the most attention is a big pipeline system proposed by the present MP, Mr. Titus Thwala. The system builds on the same principle of gravity flow as the other pipelines but to overcome the problems with the lack of gravity the plan is to place the main water tank as high as possible and then pump the water to this tank with an electrical pump. According to both Mr. Thwala and many of the community members this is the best solution to the problems that the other projects have faced. The higher altitude difference will take care of the gravity problem and the fact that it is supposed to supply the whole community should also result in better distribution and less jealousy between the different sub-communities. Another project is phase two of the CIDA project where a dam is to be built over one of the rivers and this should then supply more homesteads with water. The members of the community do not have a lot of faith in this project. Both because of the failure with phase one of the CIDA project but also because CIDA did not give any assistance when the project started having problems. It should however be remembered that it was the plan from the beginning that CIDA would implement the project and then leave it to the community to sort out any problems that might occur.

Generally the pipeline project proposed by Mr. Thwala has some of the conditions for being a success while the CIDA does not have a lot of support in the area, and it would also be expected to be water of a quite poor quality that could be collected from an open dam. There is however still aspects such as involving the community and organizing maintenance that need to be sorted out before this pipeline project could work.

## **4.2 Where to invest**

The whole aspect of improving the access to safe water is no simple task. As mentioned above many different factors are involved. So it can be very complicated for any donor or governmental institution to find out where to invest in relation to water. As we have mentioned no aspect can be left out if one wants a project to succeed but it is however not all things that are equally important. In our opinion all future projects need to put

emphasis on the aspect of unity and organisation. Of course this alone will not make a project successful but it will definitely play a big role. One way of trying to solve the conflicts between the different sub-communities might be to have a water board within Zombodze that are responsible for all aspects related to water. Representatives from the different sub-communities could then work together for the mutual benefits of everyone and the community members would have someone to contact if problems arise.

Representatives would then also have better opportunities in getting knowledge and funding to the community as the level of organisation often plays a role for a potential donor as it was the case with CIDA.

In relation to the quality of water the problems do not seem to be that big and it would definitely be better to invest in some more information on the handling of water and signs of the water being contaminated, rather than trying to set up different purification schemes. So naturally the quality of water is important and it could also be improved but there are many other areas that deserve more interest before focus is put on improving the quality since it is not that critical. It is important to be aware that even if information on treatment of water is given it is a change in peoples' habits towards water practices that also needs to take place which requires time and money.

There also seems to be a general tendency that the boreholes in the area are working quite well. The boreholes are fairly expensive to set up and even though we do not have the costs of building a pipeline system we got the indication that it was a lot cheaper than building boreholes. The advantage of the borehole is however that they could be placed in areas that are harder to supply with gravity pipelines. Besides this there are fewer possibility for people to destroy the system without being affected themselves. Therefore boreholes might be the best solution in some areas but it is still important that there is someone responsible for maintenance or that there is somewhere that people can get assistance if they experience problems.

## 5 Conclusion

First of all, the quantity of water in Zombodze is not as scarce as we had expected, even in dry season the sources are generally supplying people with enough water to sustain a living. The overall problem as we have come across is the distribution of water to the different homesteads.

It is however still so that the aims of the National Water Policy that every person is entitled to a minimum of 30 liters of safe water per day at a cartage distance of 200 m are far from being met. On average each person consumes between 5 and 10 liters of water per day. We feel sure that problems would arise if everyone in Zombodze were to use 30 liters per day as this would lead to water scarcity. According to the distance of the source, we estimated that the homesteads were quite evenly distributed between those having more than 200 meters and those having less. Though, in the dry season people often have to walk longer distances. In terms of safe water, we defined it as water from boreholes, taps and springs which are sources that 52 pct of the people rely on. We found content of bacteria in every water quality test also in the sources defined as safe but in practice the community did not have serious problems with diseases. We find that in relation to hygiene the water practices are of greater importance than the content of bacteria in the source.

In a general perspective water is a common good that everybody has the right to use. It happens that some peoples' access to water limits the access of other people. When this situation occurs, the access to water will be a fight between those who have enough water and those who do not. In a rural area as Zombodze, the distribution of water is not organized at the community level and therefore every single homestead or sub-community is fighting for a sufficient supply of water for their own benefit.

We have identified the fight for access to water, when assessing some of the pipeline systems in the area. The main problem was that people did not have enough water in the up-hill end of the pipeline due to technical gravity problems or because of overuse by the people living in the down-hill end of the line. To secure a sufficient water supply of the

ones having too little, the only solution they saw was a disconnection of the pipelines. Today, the people who are not favoured in regard to a sufficient water supply are the ones who have a broken pipeline system, they are forced to collect water at other sources where the quality might be worse and the distance is longer.

The governing of the common natural resource has not been successful in Zombodze. We mainly see the problem as a lack of organizational practices which as result has that no common agreements are made concerning water management. Without rules or practices it is almost impossible to solve the problems with an uneven distribution of water supply.

The organization of the people is one of the most crucial aspects we would focus upon if we should propose where to invest money in Zombodze. The governing of water as a common good is too problematic without agreements and the organization could have other effects such as an interest from donors to fund projects. In practice, the organising could be to create a Water Board with representatives from all the sub-communities in the area. The matter of distribution might be improved when people are forced to work together for common interests.

Another suggestion we would come up with is to invest resources in communal irrigation schemes. There is already a community garden in Zombodze but there is no supply of water due to poor maintenance. We have seen the importance that irrigated farming can have and the higher yield from such a garden could give homesteads a surplus of agricultural production or help to finance future projects.

In all, the water management of Zombodze is facing some difficulties regarding an uneven distribution of the resources. To overcome problems with distribution we would suggest focusing more on organization of people towards creating agreements about how to manage a common resource. A water management in which people are participating is one of the ways in which the access to safe water can be improved.

## **6 Reflections upon methods**

When looking back on the methods that were used for gathering information it is obvious that there were things that could have been improved. We feel that one of the things that could have benefited our information gathering could have been a group interview. It could have been very interesting to have a discussion between some of the sub-communities about all the aspects of conflicts, jealousy and the cutting of pipes.

The importance of these aspects was not realised from the beginning so at the time that we discovered their importance we did not feel that we had the time to carry out a group interview. We felt at that time that it was more important to do some more in depth personal interviews as we still had some interesting sub-communities that we had not yet covered. We are however aware that a lot of interesting information could have been obtained by doing a group interview as it could have given us a better opportunity to get both sides of some of the conflicts that has been related to the different water projects.

Other participatory methods such as for instance ranking sessions of which resources were preferred by people, what the biggest constraints of water projects were, what it was most important to improve etc. could all had been interesting but as with the group interviews we choose to prioritize otherwise and do more individual interviews.

All in all we feel that there were definitely things that could have been done better, such as including group interview(s) and having a better cooperation within our group, but we still feel that we gained a lot of useful information that helped us to answer the aim of our project.

### **Acknowledgement**

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We would also like to thank our supervisors Andreas de Neergaard and Quentin Gausset for good and constructive feedback during the whole process. We also want to thank fellow student Paris Alexandra Marshall Smith for constructive criticism on the written part of the project.

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## **Internet**

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## **Maps**

The maps we have created for this report is based on an aerial photo  
Publishd by the Surveyor General's Department, Ministry of Natural resources and  
Energy, Mbabane, Swaziland.



# Appendix A

## Interview Guide

Homestead No.

GPS:

Name:

Distance to water source:

How often they collect water:

Time taken to collect:

Responsability (gender):

Means of collection and size:

Amount (litres):

Good source of water:

Do you believe your water source is impacting on your health/productivity?

Do you have any problems with your water source?

Perception on water needs (ideas about water supply and sources)?

Water storage?

Hygiene practices and sanitary facilities?

Sanitation and water services influence environment/surroundings?

Does the government do enough to improve the water situation?

Perception:

Need for water:

Do you have any other issues or concerns that you would like to raise in regard to water services?

## **About pipelines**

Who initiated the project?

Knowledge?

Tools?

Inspiration?

How is project driven?

Project success/failure?

Where you involved in the project/process?

Who participated?

Expectations of the participants?

Why participating (drinking or irrigation)?

Skills (government, community, NGOs)?

Funding (government, community, NGOs)?

Resources (government, community, NGOs)?

### Project responsibility:

Funding?

Training?

Maintenance?

Resources used?

Other projects?

More projects implemented along same lines?

- Why?

Situation before project initiated?

Situation after project:

- needs covered?

- Worth undertaken?

- Irrigation/Drinking water?

## Appendix B

### Informants

Name	Date	Zone	Home- stead no.	Key words
Dlamini, Flora	24.01	9	-	Used to have tap water, Gazini
Dlamini, Gertrude	21.01	-	-	Uses rainwater for laundry and washing
Dlamini, Moses	22.01	6	10	Sprinklers for garden irrigation
Dlamini, Themba	20.01	-	-	Elected Induna of Zombodze and chairman of SMART
Dludlu, Sarafina	24.01	3	-	Uses tap when operating otherwise uses well, Nkomfeni
Gumede, Zephaniah	22.01	8/9	-	Used to have tap water, uses well, Gazini
Hlophe, Mzamo (Prosper)	20.01	6	-	In charge of repairing CIDA pipe, Mission
Khubeka	24.01	4	-	Used to get water from a CIDA tap, Mshololo
Khumalo	20.01	2	5	Uses an electric borehole for drinking and for irrigation
Lushaba, Gesta	21.01	6	-	Owens tank/dam for irrigation, Gazini
Magagula, Deivid	20.01	7	6	In charge of Mission Community pipeline
Mamba, Fikile	21.01	7	2	Lives above CIDA and Community tap
Manyatsi, Dr. Absalom	21.01	-	-	Lecturer UNISWA
Mashewula	25.01	3	-	Repairs the CIDA pipes, Nkomfeni
Masuku	21.01	3	-	Chairman of CIDA project, Nkomfeni
Mavuso	24.01	9	-	Used to have tap water, Mfabeni
Mduli, Leonard	20.01	1	8	Did buy water from town, uses manual borehole
Mhlungu, Philimon	21.01	10	-	Uses a private borehole
Mngomezulu, Londiwe	22.01	8	-	Interpreter
Mngomezulu, Luke	20.01	1	-	Interpreter
Msimango, Elias	21.01	7	5	Not enough water in community tap, in charge of Mission Community tap
Mthembu	20.01	8	1	Uses a pipe system for irrigation, Gazini
Mthembu, Linah	21.01	8	1	Used to have tap water, Gazini
Ngozo	20.01	2	2	Too much water in the ground

Nhlabatsi	25.01	5	-	Uses a well, in dry season the stream
NN Mahlabatsini	25.01	5	-	Uses water from a spring, Mahlabatsini
NN Mshololo	24.01	4	-	Still not connected to CIDA tap even though they did pay, Mshololo
NN Nkomfeni	24.01	3	-	Uses CIDA tap otherwise river, Nkomfeni
Nsibandze, Hekiel	22.01	-	-	Former elected Induna
Nsibandze, Justice	21.01	-	-	Former MP
Shongwe, Albertina	21.01	-	-	Rural Health Motivator
Stewart, Zondwe Kunen	20.01	-	-	Nurse at the clinic
Thwala, Mthokozisi (MT)	21.01	7	-	Head of youth group, Mission
Thwala, Titus	18.01	7	-	MP, Mission
Treasurer	25.01	3	-	Treasurer of CIDA project in Nkomfeni
Tsabedze, Jabulani	21.01	-	-	Interpreter

Gladys Zwane	21.01	10	1	Furrow irrigation
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## Appendix C

Location	pH	Phosphate (mg/l)	Nitrate (mg/l)	Conductivity (mScm-1)	e.coli (bact. per ml)
Tap by the school	6.3	0	.	0.22	0.36
Tap close to tank	6.5	0	.	0.13	.
Open borehole	6.2	0	10	0.12	38
Working pump	6.5	0	.	0.24	.
Well with pipe	6.5	0	.	0.21	3.8
Household sample (uses spring)	6.8	0	.	0.17	.
Household sample (uses stream)	7.2	0	.	0.40	360
Household sample (uses stream)	7.4	0	7	0.33	.
Stream	6.1	0	.	0.06	.
Stream	6.1	0	.	0.06	2.3
Community garden dam	6.5	0	.	0.10	.
Dam/wetland	7.6	0	.	0.13	.
Community garden inlet (dry)	7.2	0	.	0.05	.
Source for CIDA-project	6.3	0	.	0.10	1.3
Source for Mission-project	6.5	0	.	0.08	11

## **Appendix D**

### Diary for Ditte Holm Jensen

#### **Friday 16th:**

- Arrival to Zombodze
- Welcome

#### **Saturday 17th:**

- Questionnaire in zone 3
- Discussion on the status of questionnaires

#### **Sunday 18th:**

- Questionnaire in zone 7
- Interview with Titus Thwala
- Group meeting concerning coming interviews
- Preparation for presentation

#### **Monday 19th:**

- Collecting water samples in all of Zombodze
- Group meeting
- Making water tests

#### **Tuesday 20th:**

Interviews:

- Themba Dlamini (induna)
- Luke Mngomezulu
- Mzamo Hlophe
- Deivid Magagula
- Mr. Mthembu

- Preparation for presentation

#### **Wednesday 21st:**

Interviews:

- Jabulani Tsabedze
- Fikile Mamba
- Elias Msimango
- Gesta Lushaba

#### **Thursday 22nd:**

- SPSS

- Making maps
- Typed interviews and list of informants

Interviews:

- Moses Dlamini

**Friday 23rd:**

- Day off
- Preparation for presentation
- Presentation

**Saturday 24th:**

- GPS measurements in zone 1, 2, 3 and 4
- Arranged for interviews on Sunday

Interview:

- Flora Dlamini
- Khubeka
- Mavuso
- Sarafina Dlodlu

**Sunday 25th:**

- Checking of the results from the water tests

Interviews:

- Nhlabatsi
- Mashewula

**Monday 26th:**

- Typed interviews
- Preparation for presentation
- Presentation

**Tuesday 27th:**

- Left Zombodze
- Group meeting

**Wednesday 28th:**

- Typed the last interviews
- Mapped the GPS points
- SPSS
- Structured presentation
- Divided the presentation to different group members

**Thursday 29th:**

- Prepared for presentation

- Group meeting

**Friday 30th:**

- Party

Diary for Simon Mundus

**Friday 16th:**

- Arrival to Zombodze
- Welcome

**Saturday 17th:**

- Questionnaire in zone 3
- Discussion on the status of questionnaires

**Sunday 18th:**

- Questionnaire in zone 7
- Interview with Titus Thwala
- Group meeting concerning coming interviews
- Preparation for presentation
- Presentation

**Monday 19th:**

- Collecting water samples in all of Zombodze
- Group meeting
- Making water tests

**Tuesday 20th:**

Interviews:

- Zondwe Kunen Stewart (clinic nurse)
- Ngozo
- Khumalo
- Leonard Mduli

- Preparation for presentation

**Wednesday 21st:**

Interviews:

- Fikile Mamba
- Elias Msimango
- Gesta Lushaba
- Gertrude Dlamini
- Philimon Mhlungu



**Thursday 22nd:**

- SPSS
- Making maps
- Typed interviews and list of informants

Interviews:

- Moses Dlamini

**Friday 23rd:**

- Day off
- Preparation for presentation

**Saturday 24th:**

- GPS measurements in zone 1, 2, 3 and 4
- Arranged for interviews on Sunday

Interview:

- Khubeka
- Sarafina Dlodlu

- Football match

**Sunday 25th:**

- Checking of the results from the water tests

Interviews:

- Nhlabatsi
- Mashewula

**Monday 26th:**

- Typed interviews
- Preparation for presentation

**Tuesday 27th:**

- Left Zombodze
- Group meeting

**Wednesday 28th:**

- Typed the last interviews
- Mapped the GPS points
- SPSS
- Structured presentation
- Divided the presentation to different group members

**Thursday 29th:**

- Prepared for presentation
- Group meeting

**Friday 30th:**

- Presentation
- Party

## Appendix E

# Water management in Zombodze



Exposed pipes laid out:

[www.jica.go.jp](http://www.jica.go.jp)

By

Ditte Holm Jensen, RUC

Simon Mundus, KVL

Rolandas Stankevicius, KVL

Supervised by

Quentin Gausset

Andreas de Neergaard

SLUSE - ILUNRM course - synopsis - 12.12.2003

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## **Introduction**

Access to safe and clean water is one of the most basic human needs and some argue that it is a fundamental right in itself. In Swaziland, the National Water Policy states that all people are entitled to a minimum of 30 litres of safe and clean water per capita per day at a cartage distance of no more than 200 metres (Area description). In other words, water is an important natural resource and has to do with both food security and agricultural production; therefore we find it crucial to investigate water related issues in order to improve living conditions.

The overall issue of this synopsis is which constraints to the management of water exist in the community of Zombodze in the region of Shiselweni, Swaziland. By water management we mean the issues that directly (or indirectly) are influencing the use of water for household consumption and irrigation purposes and furthermore the possibilities of improving the access and quality of water.

## **The water resources of Swaziland**

The water resources consist of four main river systems (Komati - Lomati, Mbuluzi, Usutu and Ngavuma)<sup>1</sup>. As the river systems are crossing the borders the distribution of water resources calls for agreements between the neighbouring states. To give an example of this, a study<sup>2</sup> conducted in 1981 points out that if full river development in South Africa would be implemented (potentially 21 dams) the surface water resources in Swaziland would be reduced by 13.3 pct (www.fao.org<sup>3</sup>). This reduction is problematic because smallholder irrigation is dependent upon adequate river flow (Funnell, 1986). The shortage of water is not only a problem related to rivers; the groundwater resources are also limited: "...potential groundwater is thought to be limited, due to the general absence of formations with intergranular porosity and permeability." (www.fao.org<sup>4</sup>).

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<sup>1</sup> Ngavuma and Mbuluzi rise within the country and flow to South Africa and Mozambique and Komati - Lomati and Usutu rise in South Africa and flow into Swaziland

<sup>2</sup> The study was conducted by US corps of engineers

<sup>3</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 1f - 17.11.03

<sup>4</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 4 - 17.11.03

In relation to the quality of the water, a study conducted in 1994 showed that 65 pct. of the rural population in Swaziland were using contaminated water sources which cause water-related diseases such as diarrhoea and cholera ([www.jica.go.jp](http://www.jica.go.jp)<sup>5</sup>).

The precipitation is seasonal with a wet summer season from October to March and a dry winter season. The annual precipitation average is 788 mm., but ranges from 500 - 1500 mm. depending on the region ([www.fao.org](http://www.fao.org)<sup>6</sup>). The rainfall also varies a lot from one year to another and has been quite unreliable the past years. These mentioned water resources together with unreliable rainfalls indicate that water is a scarce and vulnerable resource in Swaziland and improvements are needed to secure sufficient water supplies.

### **The local context**

Zombodze is a community lying within the High- and Middleveld zones in the southern part of the country, and has an elevation of 800-1100 meters above sea level. The community of Zombodze is under the Swazi Nation Land Tenure System (SNL) which implies that the land is communally owned and managed and distributed to the citizens by a traditional chief (Area description, 2003). That Zombodze is under SNL might have some implications on the access and the ownership to the water resources which we will investigate further during our fieldwork.

The area is watered by a number of small streams which have been harnessed for small individual irrigation purposes as well as domestic water supply. The water resources of Zombodze are streams, furrows, dams, water tanks, wells, boreholes, pipelines, tapped water and others that we do not know beforehand. The biggest stream in the area is the Mzinsangu<sup>7</sup>. In 2001 and 2002 the region where Zombodze is situated experienced serious droughts which among other things influenced the non-irrigated agricultural production (Area description).

### **Irrigation**

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<sup>5</sup> [http://www.jica.go.jp/english/activities/jicaaid/project\\_e/swa/001/](http://www.jica.go.jp/english/activities/jicaaid/project_e/swa/001/) - 18.11.03

<sup>6</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 1 - 17.11.03

<sup>7</sup> <http://www.agsci.kvl.dk/~adn/Swazi2003/site.htm> - 08.12.03

Due to the constraints to the agricultural production which are caused by droughts and irregular rainfalls, irrigation has become a priority for the government of Swaziland as for donor agencies (Dlamini, 2003). In 1994, 35.2 pct of the cultivated land was under water management which means that it is under full or partial control irrigation schemes (www.fao.org<sup>8</sup>). It is important to mention that 95 pct of the irrigation schemes are concentrated in large scale commercial farming (Dlamini, 2003). Smallholder irrigation is in terms of poverty alleviation an option for Swaziland because it provides a better alternative than other farming systems (Dlamini, 2003). Focusing on the effects of irrigation on SNL where the smallhold farmers live, FAO (1997) states in Dlamini (2003) that the irrigation has increased the farmer's income and created employment opportunities.

The water resources in Swaziland are limited and a proper management of the resources are crucial to a sustainable living both for households and for farming purposes. With these issues showing the importance of water for the rural population in the country, we have come up with the following research question:

*How can access to safe water be improved in Zombodze?*

We will investigate what can be done to improve the access to water resources where the use of water does not cause any diseases. We have divided our research in two parts; one is concerning the water situation (resources, access and consequences) and the other is about the water management (technology and socio-economic factors). The latter is our main research area. Our investigation is structured by key questions, the first two covers the water situation and the last two the management.

Key questions:

1) Assessment of the current access to water - who has access to water and of which quality?

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<sup>8</sup> <http://www.fao.org/docrep/V8260B/V8260B11.htm> page 3 - 17.11.03

- 2) What are the consequences of the present water situation? (health, productivity)
- 3) Which technological constraints and opportunities are related to the water management?
- 4) What are the socio-economic constraints of the water management?

### **Methodology**

In the following section we will describe the data we need to answer the key questions<sup>9</sup>.

First, we distinguish between two different ways in which the water is used; these are for household consumption and for farming (with the main focus on irrigation). This division is made to cover the usage more precisely as it allows us to adjust the methods to the exact purpose. The clinic and school will be categorized as households as their usage is similar and the community garden will be counted as a farming unit. When deciding which methods to use, we also need to be aware of how to deal with the differences between the wet and the dry season, as we are doing the field work only in the wet season.

The main background information that is needed to assess the water situation is the type of resources that are used and the access to these. Besides, we need knowledge about both the quality and quantity of these resources and also how the water situation has developed over time. This is in order to get a general view of the actual situation. Other aspects of the present water situation come by assessing the socio-economic factors which indicate the living conditions of the community members. The data we find convenient when describing these factors are the level of education, who is collecting the water, ownership of water resources, water supplies for irrigation etc. as all these data show the social and economic situation of the community in relation to water issues.

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<sup>9</sup> For an overview of this section see appendix 1



The last relevant issue we have defined to address the water situation is the consequences of water quality and water shortage which we assume affect most people in the community. We will investigate the consequences by focusing on the health of people and the productivity of agriculture because the diseases and the yield can give us a good idea of notable consequences of the water situation.

The main focus for our research is related to the improvement of water management which will be investigated by assessing the technology and several socio-economic factors. Technology refers in this case to the equipment needed for water extraction. We want to collect data concerning the type of equipment available and the possible improvements in technology eg. equipment for rainwater harvesting. When investigating technological issues the training in the use of equipment is also important to study as we assume that lack of knowledge can be a serious constraint.

The socio-economic factors that will be studied are social-, political- and economical constraints. These factors are chosen to get a general perspective of different aspects that influence the management of water at both national and community level. These constraints are related to local knowledge about water issues, legislation, implementation of laws, distribution of water rights and funds for water improvements. In relation to a better management it is important to know about the financing as many new schemes can be quite costly and the community might lack the financial resources. Another relevant topic is the local perception of both water needs and the possibilities for improving the water situation. The degree of success of any innovation is to a great extent determined by the attitude of the local community and therefore the perception is also investigated.

## **Methods**

In this section we will discuss which methods we have chosen in order to collect the data.

When arriving to Zombodze our first activity in the field will be doing a questionnaire. We decided to do a joint questionnaire together with the other groups because it will give us a general perspective of the community. The questions designed for our purposes cover some of our exact data such as which resources are used for household consumption and for irrigation (if the fields are irrigated) and the price if there is any. We will also expect to get some data of which kind of equipment is used.

The advantage of doing questionnaires is that a lot of quantitative data are collected quite fast and being many researchers we can cover most of the community in only two days. The exact data can be used for making statistics and for our purpose it is also useful for mapping the water resources by using GIS. Another positive effect is that it enables us to do a sampling of informants for the following interviews.

We are planning to do interviews to follow up on the information we have gained through the questionnaires and to get in-depth data mainly for those parts of the investigation concerning the management of water. To get a good understanding of the socio-economic constraints to water related issues interviews is a useful method, as we can gain local qualitative data. It is also the most convenient method to get closer to people's perception of water needs and possibilities of improvements.

The interviews we will hold are semi-structured (Kvale, 1997: 133ff) with defined research questions (the information we want to gain) and interview questions (the topics we will ask the informants about). The reason why the interviews will be semi-structured is that it will ensure that the topics treated in each interview will be of some similarity. We need to secure certain accordance as we will do the interviews in two subgroups. On the other hand the interview guide will be open in the sense that we only define within which topics we will ask questions, this will allow us to move in new directions and open up for information that we have not thought of. We will make three interview guides, one for household consumption, one for irrigation and one for the clinic, the latter as we assume that they have the best overview of the health status in the area.

It is our hope that a clear picture of the present situation will be gained, with personal observations reinforcing what we have gleaned from the community members themselves. The observations are relevant especially to assess the equipment available in the community but the observations can also inspire us to come up with possible improvements. While walking in the area doing observations GPS measurements will be done so the map of the different water resources can be made with exact projections.

In connection to the water quality we will also test for the presence of e.Coli bacteria which may be present in the water and is often a common cause of disease. We do not plan to test for other things as the low level of inputs into agriculture is expected to reduce the possibility of nutrient or pesticide pollution.

The use of literature is both logic and useful in our background investigation. It is useful when we are investigating the consequences that the lack of safe water might have on yield and health as these are complex matters which we will not spend much time on when being in the field. Besides, literature is also useful when looking into the possible improvements that can be done in relation to equipment and also when discussing the possible training in the use of this equipment. The literature is useful in giving good background knowledge so that we can better aim our field work at the most important aspects. Literature is also used in connection to those subjects that are too comprehensive

to cover during the two weeks in the field. This is especially so for the aspect of legislation which is very relevant but is too complex to include in the field investigation.

Many aspects are not available in literature (some legislation, area specific information, former projects etc.) and therefore a more appropriate search for information will be done. In this case internet and correspondence with development agencies are used. The development agencies that have worked in the area are expected to have some specific knowledge about this area and both on their homepages it is possible to find useful general information related to our subject. The internet and the correspondence with development agencies also have the advantage that the information can be expected to be quite new as opposed to much of the literature. It is also important to be aware of the possibilities of searching for literature while being in Swaziland as some literature may only be available on location.

We have chosen the methods we believe are the most convenient for our purpose, however it is still important to be aware of the limitations of the planned investigation.

### **Limitations**

We are limited in our field work by time constraints as we will only be in the area for 10 days. Having more time in the area might have made it possible for us to do a more thorough investigation of the situation and allowed us to do experiments about different irrigation schemes, water purification, water storage etc. Because of the time constraint and the problems with getting useful data, we have decided to limit the scope of this project by not looking thoroughly at the political situation related to water issues as it is too comprehensive and goes beyond the borders of Swaziland. We are aware of the influence the politics might have on the water situation and we will keep that in mind when discussing our findings.

While being in the area the field work might be constrained due to misunderstandings related to the interpreters or when working with the counterparts due to different ideas about the field work or other cultural differences.

We have encountered problems in our background study of literature, too. Here the problem is that the amount of literature on water resources and water laws in Swaziland is quite limited and aged as much of it is from the 1980's or even before and therefore outdated in its content and approach. It is important to be aware of the constraints and limitations of the investigation and we find it necessary to take them into account when analysing our findings.

### Time schedule

Saturday 17	Sunday 18	Monday 19	Tuesday 20	Wednesday 21
- Joint questionnaire - observations	- Joint questionnaire - observations	- Interview with the clinic - water quality tests - sampling of informants	- Observations and interviews	- Observations and interviews

Thursday 22	Friday 23	Saturday 24	Sunday 25	Monday 26
- Excursion	- Interview with somebody related to the community garden	- Observations and interviews	- Observations and interviews - evaluation of data <sup>10</sup>	- Observations and interviews

### Collaboration with counterparts

We plan to split in two subgroups when doing the questionnaires and interviews as we will have two interpreters. The different tasks of the field work will be handed out to different students depending on their background and knowledge. The subgroups will vary from day to day, so each group member can try different topics.

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<sup>10</sup> The evaluation of data refers to a status of the data we have been collecting and which data we still need to complete our field work

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<http://www.agsci.kvl.dk/~adn/Swazi2003/site.htm> - 08.12.03

## Appendix 1

<b>Issues</b>	<b>Topics</b>	<b>Data needed</b>	<b>Methods</b>
<b>WATER SITUATION</b>			
<b>Resources</b>	<ul style="list-style-type: none"> <li>- Households</li> <li>- Farming</li> <li>- History</li> </ul>	<ul style="list-style-type: none"> <li>- Quality</li> <li>- Quantity</li> <li>- Type of resource?</li> </ul>	<ul style="list-style-type: none"> <li>- Questionnaire</li> <li>- Interviews</li> <li>- Observations</li> <li>- GIS mapping</li> </ul>
<b>Access</b>	<ul style="list-style-type: none"> <li>- Distance</li> <li>- History</li> <li>- Socio-economic factors</li> </ul>	<ul style="list-style-type: none"> <li>- Quality</li> <li>- Quantity</li> <li>- Type of resource?</li> </ul>	<ul style="list-style-type: none"> <li>- Questionnaire</li> <li>- Interviews</li> <li>- Observations</li> <li>- GIS mapping</li> </ul>
<b>Consequences</b>	<ul style="list-style-type: none"> <li>- Health</li> <li>- Productivity</li> </ul>	<ul style="list-style-type: none"> <li>- Type of disease?</li> <li>- Yield?</li> </ul>	<ul style="list-style-type: none"> <li>- Interviews</li> <li>- Water quality tests</li> <li>- Literature</li> </ul>
<b>MANAGEMENT OF WATER</b>			
<b>Technology</b>	<ul style="list-style-type: none"> <li>- Equipment</li> </ul>	<ul style="list-style-type: none"> <li>- Type of equipment available?</li> <li>- Possible improvements?</li> <li>- Training?</li> </ul>	<ul style="list-style-type: none"> <li>- Questionnaire</li> <li>- Interviews</li> <li>- Observations</li> <li>- Literature</li> </ul>
<b>Socio-economic factors</b>	<ul style="list-style-type: none"> <li>- Social-, political and economic constraints</li> <li>- Perception of water needs</li> </ul>	<ul style="list-style-type: none"> <li>- Knowledge?</li> <li>- Legislation?</li> <li>- Implementation of water laws?</li> <li>- Who is paying?</li> <li>- Attitude towards</li> </ul>	<ul style="list-style-type: none"> <li>- Interviews</li> <li>- Literature</li> <li>- Internet</li> <li>- Correspondence with Development Agencies</li> </ul>



		water needs?	
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