SUSTAINABLE WATER RESOURCES FOR SUB-SAHARAN AFRICA:

A MATTER OF APPROPRIATE TECHNOLOGY AND GENDER AWARE COMMUNITY PARTICIPATION

A REPORT PRODUCED BY WATER WORKS

WATER WORKS

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Content:

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Acronyms and Abbreviations:

Afridev – African Development Hand Pump

CIDA – Canadian International Development Agency

DFID – Department for International Development

JMP - The World Health Organization's and Unicef's Joint Monitoring Program

MDG – Millennium Development Goal

MDG 7C1 – The Water Part of the Millennium Development Goal 7 Target C

RWSN - Rural Water Supply Network

UN – United Nations

Unicef – United Nations Child Fund

VLOM – Village Level Operation and Maintenance

WEDC – Water Engineering and Development Centre

WHO – World Health Organization

WSP – Water and Sanitation Program

Introduction:

Safe drinking water, basic sanitation and the use of good hygiene practices are fundamental for health, livelihood, gender equality and development. However, for countless years, the World's poorest people have not had these basic needs met (WHO/UNICEF 2006:2). In 1990, the United Nations estimated that 28 percent of the population in developing countries, some 1.2 billion people, did not have access to safe drinking water, and 57 percent, 2.5 billion people, did not have basic sanitation facilities (JMP n.d. a). The shortage of safe drinking water, basic sanitation facilities and the use of bad hygiene practices sentences people to a life of sickness, squalor and enduring poverty. In 1990 water related disease accounted for over 2.2 million deaths and millions more suffered a life of diminished opportunity due to ill health (WHO/UNICEF 2000:v). It is women and girls who suffer the most from not having access to safe drinking water or basic sanitation as they are often burdened with the task of fetching water, maintaining household hygiene and caring for sick family members (UN-Habitat 2006a:2).

The importance of clean water and basic sanitation is not doubted within the international community, and much attention has been given to its provision over the past three decades. The ambitious "International Drinking Water and Sanitation decade" of the 1980's was a program to provide clean water and sanitation for all by 1990 (WHO 1981:1). Needless to say, it failed miserably. The campaign was reiterated in the 1990's with the same aim, but with a deadline of 2000 (WHO/UNICEF 2000:v). At the beginning of 2000, 21 percent of the population in developing countries, some 1.1 billion people, did not have access to safe drinking water, and 50 percent, 2.6 billion people did not have basic sanitation facilities (JMP n.d. a). The failings of the International Drinking Water and Sanitation Decades led to the recent, much more modest, Millennium Development Goal (MDG) target of "halving, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation" (UN 2010:58). The most recent figures state that as of 2008, 16 percent of the population in developing countries, 880 million people, did not have access to safe drinking water, and 46 percent, 2.6 billion people, did not have basic sanitation facilities (JMP n.d. a). While it is recognized that the world is failing to meet the sanitation targets, the 2010 Millennium Development Goals report states that "the world will meet

or even exceed the MDG drinking water target" (UN 2010:58). This statement will be the focus of this thesis.

The first chapter uses an analysis of statistics to show that the target will only be met in Northern Africa, Latin America and the Caribbean, Eastern Asia and South-Eastern Asia. It is argued that these areas surpassing their targets has drawn attention away from the failings in Sub-Saharan Africa and Oceania, where little or no progress has been made (JMP n.d. a). The second chapter argues that the water coverage statistics that show improvement in Sub-Saharan Africa are inaccurate due to many water points falling into disrepair but still being included as an area with water supply. The focus of this chapter is how the inappropriate use of technology and lack of community participation has led to communities being unable to maintain of the water points. The chapter offers a more sustainable approach through the use of traditional technologies and gender aware community participation techniques. The final chapter documents a case study of good practice, where the British charity Water Works◊ assisted a rural Malawian community to meet their water needs using the methods detailed in this thesis*.

◊*The author is the founder member of the British charity Water Works, which was registered with Scottish Charity Regulator in 2009. Water Works assists rural communities in Malawi to provide safe drinking water and sanitation facilities for themselves without the reliance on external assistance*.

* *While this thesis briefly mentions the importance of hygienic sanitation facilities and good hygiene practices, the focus is on sustainable water facilities. The author would like to stress that access to safe drinking water makes little difference to the health of a community if there are no hygienic sanitation facilities and if bad hygiene practices are used. Even though it has not been detailed in this thesis, the reader should be aware that during the improvement of the wells in the case study, a hygiene education program was run by the charity Action Aid. Also, the villagers were encouraged to build their own latrines and were given guidance and materials where necessary.*

Aim's, Objectives and Outcomes:

Aim:

Provide an alternative, more sustainable, approach to rural water supply in Sub Saharan Africa by developing and piloting a strategy that engages the community and uses appropriate technology.

Objective 1:

Provide an analysis of statistics on the progress made towards meeting the water part of the MDG 7 on a global and regional level with a focus on rural sub-Saharan Africa.

Actions:

Conduct desk-based research using statistics compiled by the United Nation Child Fund (Unicef) and World Health Organization (WHO) Joint Monitoring Program (JMP).

Outcomes:

i. Identifies progress made towards meeting the water part of MDG 7C globally and regionally.

ii. Identifies the disparities between urban and rural water provision in sub-Saharan Africa.

Objective 2:

Investigate sustainability issues with current rural water development with a focus on gender aware community participation and the use of technology.

Actions:

Perform a literature review on why water points fall into disrepair and whether there is an alternative, more sustainable, approach.

Outcomes:

i. Highlights that the current method of water supply in rural sub-Saharan African communities is unsustainable due to the use of inappropriate technology and the lack of community involvement, especially the involvement of women.

ii. Details a technology, and a gender aware community participation strategy, that will increase the sustainability of rural water facilities and lead to the empowerment of women.

Objective 3:

Conduct a pilot of the appropriate technology and gender aware community participation strategy developed in the thesis.

Actions:

Assist an African community meet their water requirements by providing training on the technology in a gender mainstreaming community participation approach.

Outcomes:

Identifies whether the method developed in the thesis can meet its goal of improving the sustainability of water resources in rural sub-Saharan Africa.

Chapter 1: MDG 7C1 Progress

The United Nations Millennium Development Goal 7 Target C1 (MDG 7C1) is to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water", set against 1990 levels. According to the 2010 United Nations Millennium Development Goals Report, "the world will meet or even exceed the MDG drinking water target" (United Nations 2010:58). This chapter provides an analysis of the statistics on the progress made towards meeting MDG 7C1. All the statistics have been taken from the World Health Organization's and Unicef's Joint Monitoring Program, which is "the official United Nations mechanism tasked with monitoring progress towards MDG 7C" (JMP b).

Global Analysis:

Figure 1: Percentage Access to Improved Drinking Water Sources in Developing Countries

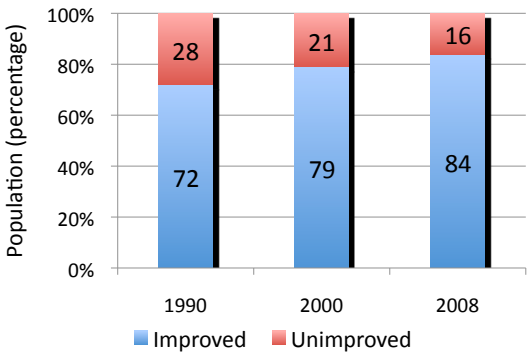
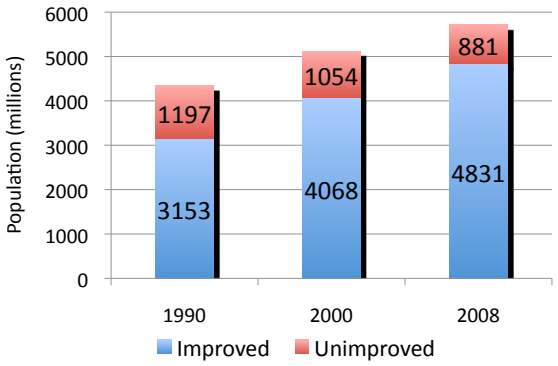


Figure 2: Absolute Access to Improved Drinking Water Sources in Developing Countries



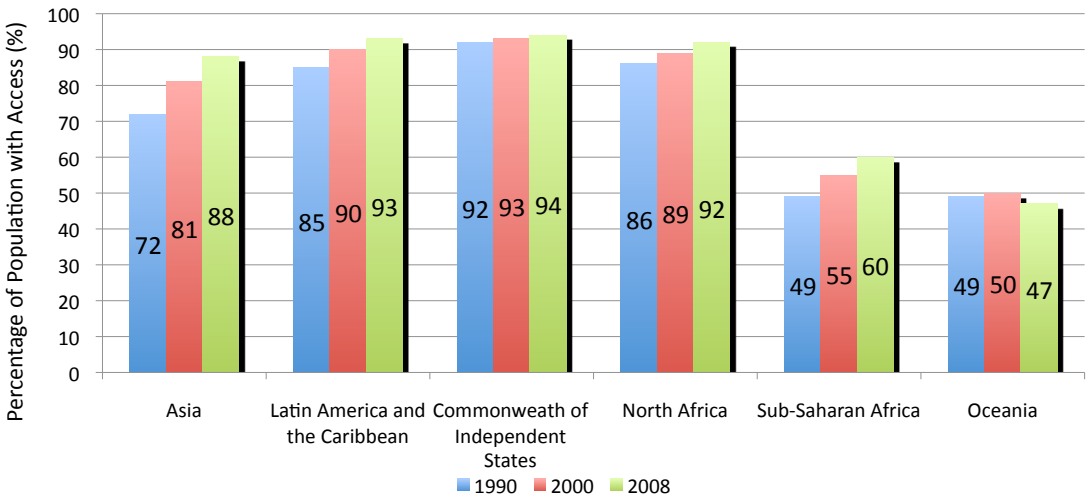
The introduction mentioned that the MDG 7C1 is a modest target compared to the 1980 and 1990 decades of "clean water for all" (WHO 1990:1, WHO/UNICEF 2000:v). A closer look at the statistics reveals the lack of ambition. From 1990 to 2000 the proportion of people without access to safe water had reduced by a quarter. Therefore, setting a target to halve the proportion of people without access by 2015 against 1990 levels, means that the world was already over half way towards achieving the goal before it even started. Given the extra five years, even with a slowing of pace, the target could still be met. The MDG 7C1, is a 'goal' in the very loosest sense of the word.

Meeting the 'actual' target of reducing the proportion of the world's population without access to safe drinking water by a quarter from the year 2000 to 2015 requires a mere 7% decrease in the

population of developing countries without access to safe water. The most recent findings show that, in 2008, the population decrease has been 5%. Thus, to meet the MDG 7C1 target, a further 2% population reduction is required. At current rates, this will happen in 2011*. Therefore, on the grand scale, the world is on track to meeting the modest MDG 7C1 target. However, analyzing the progress by grouping all developing countries together does not reveal the whole story as some regions have performed better than others, which has distorted the data. The next section separates developing countries into 6 regions (Asia, Latin America and the Caribbean, Commonwealth of Independent States, North Africa, sub-Saharan Africa and Oceania), to reveal if all areas are on track to meet MDG 7C1.

Regional Analysis:

Figure 3: Percentage Access to Improved Drinking Water Sources in Developing Countries, Separated by Region



There are significant variations between regions in the starting water coverage levels in 1990, with the largest disparities occurring between sub-Saharan Africa's and Oceania's alarmingly low coverage of 49% compared with Asia's, Latin America and the Caribbean's, the Commonwealth of Independent States' and Northern Africa's relatively high coverage of 84%. This makes achieving the MDG 7C1 target much harder for sub-Saharan Africa and Oceania who require a 25.5% improvement, while Asia et al. only require 8% (set against 1990 levels). It is therefore not surprising that Asia et al. have already achieved their goal with an 8% improvement since 1990, and that they will surpass it by 2015. It is also not surprising that sub-Saharan Africa is not on track for

* The estimation has been calculated from the average yearly reduction in the population without access to safe drinking water between 2000 and 2008, which is 0.625%.

meeting its target, though its lack of progress certainly is concerning. Sub-Saharan Africa is less than half way towards meeting its target with an 11% increase in access since 1990, and at current rates, it will miss its target by two fifths◊. Worryingly, Oceania has not made any progress at all. In fact, it has gone backwards, with a 2% reduction in access since 1990. The United Nations (2010:58) analysis of measuring progress towards meeting the MDG 7C1 target by grouping all developing regions together has shown that the world is on track. However, this has masked sub-Saharan Africa's and Oceana's dire situation, as Asia et al.'s surpassing their targets has covered up sub-Saharan Africa's and Oceania's failures.

The following section delves deeper into sub-Saharan Africa's failures and identifies areas where improvements are most needed by analyzing the coverage patterns in urban and rural areas. Sub-Saharan Africa has been chosen over Oceania as that is where the author's knowledge lies.

Sub-Saharan Analysis:

Figure 4: Percentage Access to Improved Drinking Water Sources in Urban and Rural sub-Saharan Africa

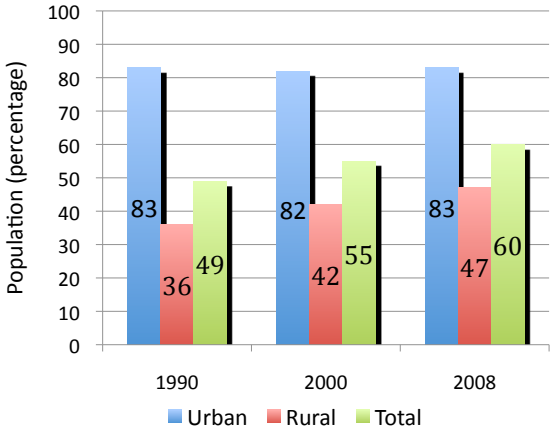
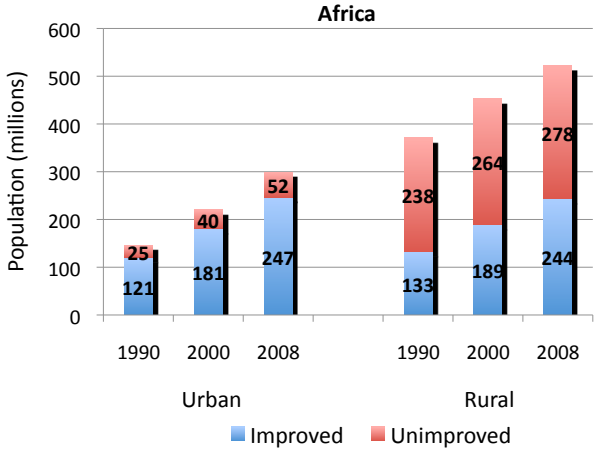


Figure 5: Absolute Access to Improved Drinking Water Sources in Urban and Rural sub-Saharan Africa



There are significant disparities between rural and urban water coverage in sub-Saharan Africa. In 1990, a relatively high 83% of the urban population had access to improved drinking water sources compared with a dismal 36% in rural areas. Even though there has been no progress made in urban areas, and without dismissing the need for action, the remainder of this section focuses on rural areas.

◊ The estimation has been calculated from the average yearly reduction in the population without access to safe drinking water between 2000 and 2008, which is 0.625%.

Halving the proportion of people without access to safe drinking water in rural sub-Saharan Africa requires a 32% coverage improvement. While there has been some progress, with an 11% increase in access from 1990 to 2008, attaining the MDG 7C1 target is very much off track. In addition, due to population growth, the actual number of people without access to safe drinking water in rural areas has increased from 238 to 278 million between 1990 and 2008. At current rates, in 2015, there will be 285 million people, 49% of the rural population, without access to safe drinking water. Rural sub-Saharan Africa's MDG 7C1 target will be missed by half[Δ].

[Δ] The estimation has been calculated from the average yearly reduction in the population without access to safe drinking water between 2000 and 2008, which is 0.625%.

Chapter 2: Appropriate Technology and Community Participation

Chapter 1's statistics portray a dire state of affairs in rural sub-Saharan Africa, but in fact, the actual situation is much worse, as the statistics are inaccurate. The modern technologies currently used in rural water development, and a lack of involvement of the communities during the implementation process, has meant that many water points have fallen into disrepair shortly after their installation, but these areas are still included in the official 'with' access to 'improved' resources statistics (Parry Jones 2001:iv, WaterAid 2003:1). The Rural Water Supply Network (2007) suggests that, on average, 35 percent of hand pumps are non-functioning in sub-Saharan Africa. In Malawi, the 2005 official statistics state that rural water coverage was 70 percent (JMP n.d. a). However, a water point mapping survey performed by the British charity WaterAid (n.d.:1) found that, due to pumps failing, rural water coverage in Malawi in 2005 was 57%, 13% less than the official figures. This chapter builds on the argument that the use of inappropriate technologies and the lack of community involvement has led to many water points falling into disrepair in rural sub-Saharan Africa. The chapter offers an alternative, more sustainable, solution.

Part 1: Appropriate Technology

The Problem

The most commonly used technology in sub-Saharan African rural water development is a drilled borehole fitted with an expensive hand pump. As governments do not have the time or resources to perform hand pump maintenance, the responsibility is given to communities. As such, modern hand pumps have been designed with the intention of being easily operated and maintained by communities themselves, called Village Level Operation and Maintenance Pumps (VLOM) (Parry-Jones et al. 2001:12). However, the mechanics of these pumps are too difficult to understand for non-engineers, as the following description demonstrates. A typical VLOM pump, the African Development Hand Pump (Afridev), is shown on the right. It works through the principle of suction. The action of moving the piston (comprising of a handle and pumprod) up and down creates low pressure above the body of water in the well, causing the water to flow upwards through the rising main and out of the spout. At the bottom of the airtight pump rod, a non-return valve called the foot valve is fitted. The foot valve allows water to flow into the rising main but prevents it from flowing back out again (RWSN 2005:3).

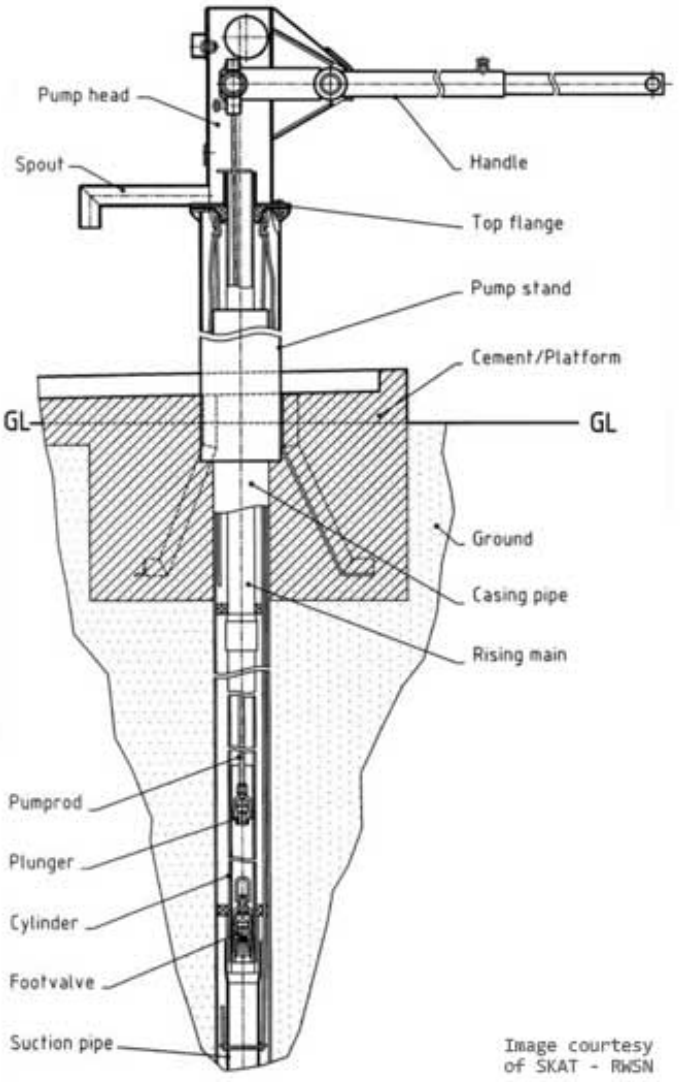


Figure 6: Diagram of the African Development Pump

In order for communities be able to fix breakdowns, it is essential to know how the pump works. However, as can be seen from the description above, this is difficult. Over time, each component of the pump will break and need replacing, but it is not possible to identify the broken component

without a firm grasp of the technology (Hankin 2001:121). Furthermore, certain technical issues regarding the maintenance of the VLOM pumps are almost always beyond the capabilities of the communities (RWSN 2009a, Wood 1994:133).

On the rare occasions when communities have the technical expertise to perform hand pump maintenance, one of the greatest limitations of modern VLOM pumps is that the spare parts are made in factories abroad, which makes them hard to access (Hankin 2001:121). It is often impossible for rural villages to procure parts as they cannot be made locally or bought from local markets. In addition, even if the spare parts were available locally, their cost is out of reach for the majority of rural villages (Parry Jones et al. 2001:1). The expense of the parts creates an additional sustainability issue. A rural water point sustainability survey conducted by the British charity Water Works in Malawi in 2009, found that of the 40% of pumps that had fallen into disrepair, the vast majority had been vandalized for their parts (Water Works 2009a).

For a hand pump to be sustainable, the community must have the technical skills required to carry out the maintenance, and the funds available and easy access to spare parts for the repairs (WaterAid 2003:2). It is clear that the current VLOM pumps do not meet these requirements.

The Solution

It is unnecessary for rural water development to use modern technologies that are expensive, inappropriate and unsustainable. There are traditional, simple, small-scale technologies available, that are much more economically and technically suitable, thus sustainable (Missen 1990:9). One such technology is the rope pump, as shown on the right. The principle behind the rope pump is water lifting. The action of turning the handle (crank) pulls a loop of rope around a wheel, through a guide at the bottom of the well and up a plastic pipe (ascending pipe) that is

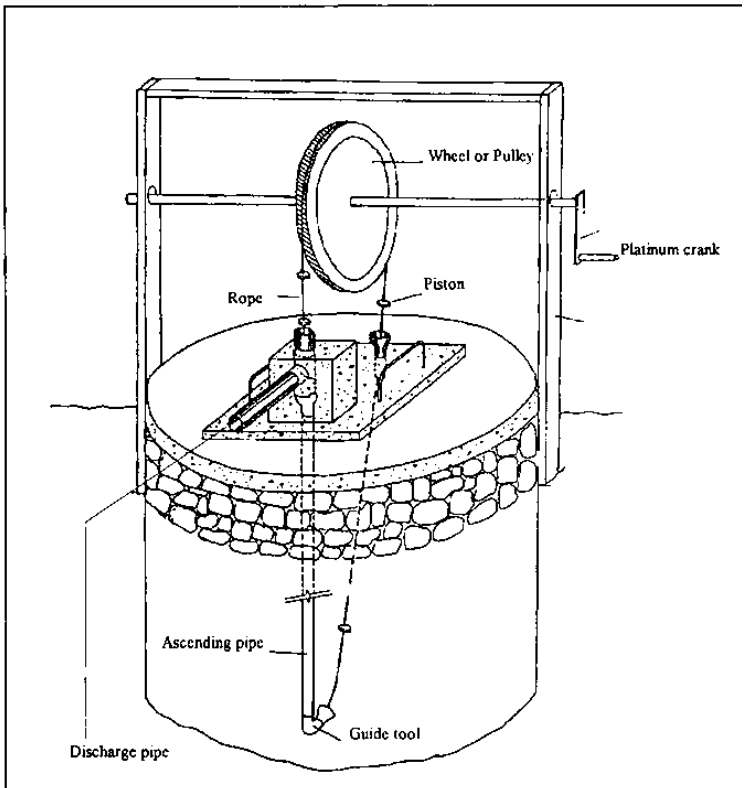


Figure 7: Diagram of a Rope Pump

submerged under water. The rope has equally spaced circular disks (pistons) along its length. These disks trap water in the ascending pipe and lift it into the discharge pipe. The simplicity of the pump means that with a short training course, communities are capable of installing and maintaining it by themselves (WSP 2001:4). All the components of the pump can be made from materials found locally to rural villages or can be bought at low cost from local rural markets. Thus, procuring spare parts for repairs is easily possible. In addition, the inexpensive materials mean that the rope pump is unlikely to be vandalized for parts.

The renowned Water Engineering and Development Center (WEDC) completed a study comparing the rope pump against conventional VLOM pumps and found that the rope pump outperformed modern VLOM pumps in terms of capital costs, maintenance costs, maximum pumping heads, flow rate and turbidity, and that there was no difference between the microbiological water quality from the two pumps. The rope pump has been successfully implemented in Nicaragua since the 1980's, and in 2006, more than 30,000 rope pumps were being used and maintained by local communities, providing water for 25% of the population. The rope pump has also been successfully introduced in parts of Zimbabwe, Madagascar, Kenya, Mozambique, Uganda and Zambia (Harvey and Drouin 2006:500-505).

In addition to the rope pump not falling into disrepair, and 'actual' sustainable progress made towards meeting the MDG 7C1, the simple technology, low cost and easy access to materials means that a larger number of pumps can be built, resulting in the MDG 7C1 target being reached earlier. Firstly, the installation and maintenance cost of the rope pump used in Nicaragua is a tenth of the Afridev pump (WSP 2001:3). Secondly, VLOM pumps such as the Afridev are installed over boreholes; a borehole is drilled with machinery that costs US$500,000 and that needs to be operated by skilled highly paid workers. The expense of the machinery and labor means that there are not enough funds to pay for sufficient drilling rigs to meet demand (Missen 1990:5). The rope pump is most often installed on a hand-dug shallow well, approximately 3 to 15m in depth, although they can operate up to a depth of 50 meters (WSP 2001:1). Community members themselves can easily dig shallow wells, and, as the majority of rural villages are situated close to a water source where the water table is high, the installation of a simple shallow well protection is a better and much more affordable option than the drilled borehole (Water for People 2006). The sparsely populated nature of rural villages means that there are few sources of contamination, thus

the ground water quality is high, even at low depths, and the wells can easily be positioned away from any sources of contaminants such as latrines and fertilized crops. Finally, the low cost and easy availability of parts and the simplicity of the pump means that once villagers have been given a short training course, they can build further pumps by themselves without the reliance on outside assistance. As such, the rope pump is not only sustainable, it promotes a cycle of self-supply.

The Abakus Pump

While the rope pump can be made from locally available and affordable materials and skills, current designs, such as the Nicaraguan rope pump and the Zimbabwean charity Pump Aid's 'Elephant Pump' have their parts pre-manufactured (RWSN 2009b, Water Works 2009b). To some extent, this defeats the purpose of the rope pump, as all components should be able to be made by the community themselves. With this in mind, the British charity Water Works designed a version of the rope pump called the 'Abakus' pump, shown below. All the parts can either be found or made locally or bought from local markets. The Abakus pump is made from a bicycle wheel, a rope, a bicycle tire, plastic pipe and some wood. For more information about how to make the Abakus Pump, please refer to the manual in Appendix A.

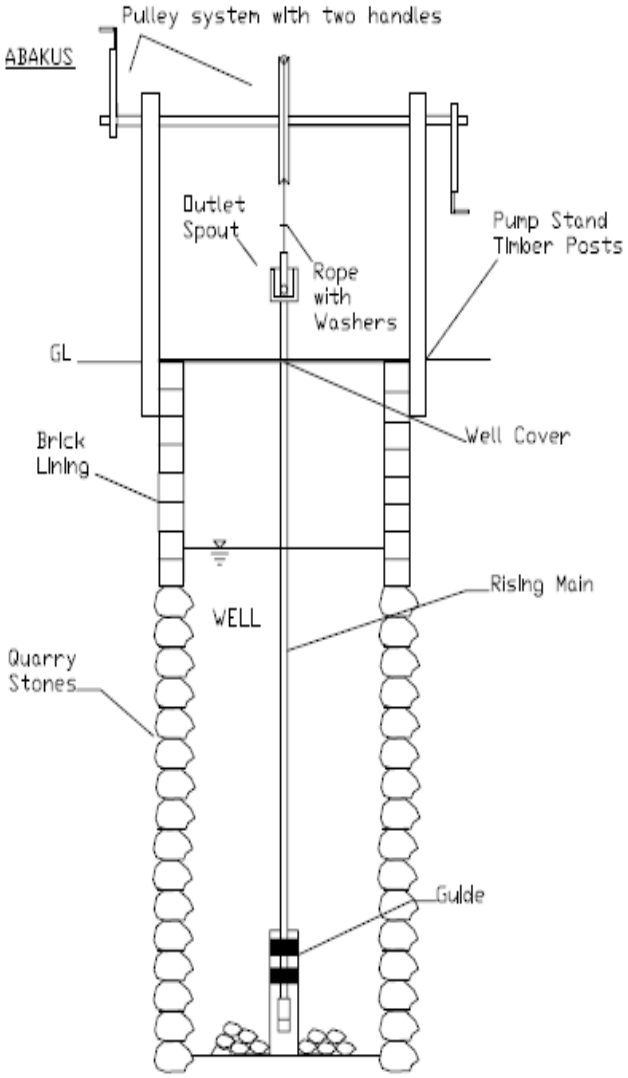


Figure 8: Diagram of the Abakus Pump

Figure 9: Photograph of the Abakus Pump Without Protection

Figure 10: Photograph of the Abakus Pump with Protection

Part 2: Gender Aware Community Participation

It is widely accepted that community participation is fundamental for the sustainability of a rural water supply scheme (Kleemeier 2000:929). However, present operational procedures are failing to adequately involve the community in developments. There are several reasons for this. Firstly, the high cost of the modern technologies and skilled workers used in current rural water development means that little time can be spent involving the community, as it is too costly for the machinery to sit idly. Secondly, the pressure to meet the MDG 7C1 target has meant that many water points have been built hastily, without the involvement of the community (Missen 1990:5). Finally, there is a lack of knowledge on the community participation techniques.

This section starts by highlighting the importance of community participation in rural water developments and provides details of the basic principles. The latter part of the section stresses that incorporating gender awareness into community participation strategies is paramount for the success of a rural water supply project. The gender mainstreaming approach to community water development is presented.

Community Participation Principles:

Without the required operational and maintenance training (both preventative and corrective), communities will not know how to efficiently use their hand pump or repair it when it breaks. This seems obvious, but adequate training is often not provided. However, thorough training is just a small, although vital, part of ensuring community participation and sustainability. Providing training without participation in the planning, installation and management of the facilities will not increase ownership of the facilities, which is the key to the sustainability of a resource. If communities do not feel like the resources are theirs, they may not use them, and there will be a lack of desire to perform maintenance when the pump fails (Parry Jones et al. 2001:19). To ensure ownership, there must be a demand and willingness to pay for the facilities, and communities must participate in the decision-making and management of the project.

Demand and willingness to pay

Demand is a crucial factor in whether communities will take ownership of the facilities and perform hand pump maintenance (Harvey and Reed 2003:117). One of the most common reasons for hand pumps' failing is that communities revert back to old unsanitary ways of collecting water when their hand pump falls into disrepair - not because they cannot perform the repairs, but because the financial costs of the repair outweigh its perceived benefits (RWSN 2009c:2). If the community is happy with their existing resources, even though they may participate in the installation of the project, they are unlikely to continue with the maintenance (Parry Jones et al 2001:20). It is necessary for the community to explicitly request the provision of new or improved water supply system (Collins 2000:7). In addition, training must be provided regarding the need for improved facilities, such as the health benefits of safe water. Running a hygiene education program will also raise awareness of the need for improved facilities.

Communities should contribute to the cost of the facilities as this shows that there is a demand for the resources and it increases ownership. If the communities contribute to the cost of installing the facilities, they are more likely to keep on top of the maintenance (Harvey and Reed 2003:2.117). If the community cannot afford to contribute to the cost of buying materials, then they should contribute by collecting materials and providing of labor. Communities must carry out most of the work themselves, only then will they feel that the pump is theirs (Parry Jones et al. 2001:20).

For many women in sub-Saharan Africa, water collection provides an opportunity for social interaction, which is an important part of the day and gives them time away from their often oppressive husbands. In some circumstances, the installation of an upgraded water facility may be unwanted due to concerns about altering social patterns and traditions. It is extremely important for women to want the new resources, as the social impacts of losing an important role in society (water collection) can be devastating (Collins 2000:12).

Decision Making

To increase ownership, communities must take part in all decisions regarding the project. Open discussions with the community must be held to ascertain priorities with regard to water supply in particular and the overall development of the community in general (Collins 2000:7). It is essential to have good lines of communication from the very beginning of the project (Parry Jones et al.

2001:22). The community must be well informed about the options, costs, potential problems and solutions of each technology and given a choice. Even though technologies such as the Abakus pump are simpler, more cost effective and easier to maintain than the commonly used Afridev pump, a choice must be given to ensure acceptance of the technology. The lack of involvement in the choice of technology will lead to a lack of ownership and a likely lack of willingness to carry out maintenance (Harvey and Reed 2003:117, Parry Jones et al. 2001:19).

Management

Communities managing the project themselves is crucial to enhance ownership of the facilities (RWSN n.d.:5). Training should be provided to develop the management capacity among the end users, as this will ensure that the community will be able to perform such tasks as efficient operation, preventive and corrective maintenance, financial management, routine cleaning and resource management in times of scarcity (Collins 2000:7). A group should be elected from the village community to form "a water committee" (SDC 2009:3). The committee should be provided with the necessary training, tools and skills from the beginning of the implementation of the project, which will help them clarify their duties, roles and responsibilities (Parry Jones et al. 2001:116). A water committee should have approximately ten members. Spreading the management of the facility over several members makes it more likely that maintenance will be performed, serves as a better mechanism for allowing users to express demands, makes it easier to collect contributions from the entire village for spare parts, and allows for the tragic fact that many people die in rural sub-Saharan Africa (SDC 2009:4).

The Gender Mainstreaming Approach

Before detailing the gender mainstreaming approach, it is important to put into context the particular importance of the inclusion of women in community water development.

Why Women?

The lack of safe drinking water affects everyone, but it is women and girls that suffer the most, as they are generally burdened with the task of fetching water (UN-Habitat 2006a:2). Women and girls often have to spend many hours of their day fetching heavy loads of water to meet their family's needs. This prevents girls from attending school or women from doing more productive endeavors such as gainful employment or tending to crops (WaterAid 2007:1). The World Health Organization estimates that in Africa, 40 billion work hours are lost every year by women fetching water (WHO 2010:28). A World Bank study found that having a water point close to the household increases girls' school attendance by 20 percent (UN Water 2006:3). In addition to the time lost, carrying heavy loads of water causes damage to women's and girls' backs and necks and increases the risk of sexual abuse or assault through having to walk through potentially dangerous areas (WaterAid 2007:1). Furthermore, when family members fall ill from drinking dirty water, it is women and girls that are burdened with the responsibility of looking after them, again preventing them from working or attending school (UN Habitat 2006a:2).

Through the responsibility of water collection and looking after household health and hygiene, women have gained considerable knowledge about the quality, location and use of water resources (UN Water 2006:1). Therefore, the inclusion of women in technical and managerial roles is essential for the quality and sustainability of community water development. Despite this, and the fact that women will be the primary users of the new facilities, it is often the men that are trained to site and manage the hand pumps (WaterAid 2007:2). This often leads to facilities that are unsuitable for women's needs, so they do not use them (SDC 2005:5). WaterAid (2007:2) has noted that sometimes the boreholes are too heavy for women and children to use. In addition, as water collection is seen as a 'women's job', men do not fulfill their role in managing the pumps, so they fall into disrepair (SDC 2005:5). To ensure appropriate facilities that are sustainable, and actual progress towards meeting the MDG 7C1 target, it is imperative that women are fully included in the

in the planning, implementation and management of rural water developments. Pro-poor gender-aware policies such as gender mainstreaming will ensure this (UN Habitat 2006a:2).

Background of the Gender Mainstreaming Approach to Community Water Development

The international community has long recognized that involving women in the development of water programs is vital for their sustainability. The 1977 United Nations conference at Mar del Plata, Argentina, called for the inclusion of women throughout the International Drinking Water and Sanitation decades from the 1980's (UN 2004:4). The Dublin Principles, which were adopted at the International Conference on Water and the Environment in Dublin, Ireland, in 1992, place gender considerations at the heart of water resource development. The third principle states that "women play a central role in the provision, management and safeguarding of water" and calls for developments that address women's needs and "equip and empower women to participate at all levels in water resources programs, including decision making and implementation" (UN Documents 1992). In 1995, the strategy of gender mainstreaming was adopted at the Beijing Fourth World Conference on Women and has become the widely accepted approach to ensure gender equality in water developments (UN 2006:iii).

The gender mainstreaming approach to community water development aims to achieve gender equality and the promotion of women's rights by encouraging women's active and equal participation in all aspects of decision-making, planning, implementing, and management of a project. This will ensure that issues important to women as well as men about the requirements for the water resource development are raised. It will lead to facilities that are more satisfactory for the community, enhancing ownership, thus making sure that the facilities are used effectively and maintained properly (UN Habitat 2006b:12,13). Firstly, a gender analysis is performed to assess the impact on women and men of any planned action. Secondly, women's as well as men's concerns, inputs, experiences and expertise are made an integral dimension of the design and implementation of the programs to make sure that women and men benefit equally from the project (United Nations 1997, GWP nd.:1). Finally, the project is monitored and evaluated to assess whether it has been successful in meeting its goals (Hunt 2004:140). While there is an emphasis on the need for women to participate in all aspects of the project and have an equal say in the decision-making, the approach is not solely based on women needs. It is acknowledged that men and women have different needs, interests and priorities for the improvement of the water

resources and these differences are incorporated into the project so that both women's and men's priorities are equally met. However, as women are normally responsible for water collection and use, their needs are generally greater, and they are more adversely affected by the lack of facilities. Therefore, the projects may be designed to pay particular attention to the needs of women (UN Habitat 2006b:12).

By actively including the input of the users (predominantly women) in the design, implementation and management of the water resources, gender mainstreaming approaches ensure efficient and sustainable projects that are suited to the needs of those that are responsible for operating and managing them (GWP n.d.:1). Projects will no longer fall into disuse by not being suited to women's needs. Providing maintenance training and managerial roles for the users ensures that broken facilities are repaired quickly. The sustainability of the facilities will not only result in 'actual' progress towards meeting MDG 7C1, but will also promote women's rights by incorporating women into decision-making, increasing their self esteem and helping reduce social discrimination. Therefore, progress will be made towards meeting the MDG 3 of "promoting gender equality and the empowerment of women" (UN 2010:20). In addition, access to sustainable facilities will free up time for women and girls, saving them from having to spend much of their day collecting water. Girls will be able to attend school and women will be able to work or pursue other productive endeavors. This, again will further the achievement of MDG 3 of "gender equality and women empowerment", plus help make progress towards meeting the MDG 2 of "achieving universal primary education" (UN 2010:20,16).

Despite the wide acceptance of gender mainstreaming strategies leading to more sustainable projects, there has been little implementation in the field due to a lack of clear understanding of the concepts and strategies for its implementation (Thomas n.d.:3). Women's concerns remain invisible in decision making, women are generally given little training and policy reforms have not paid attention to gender issues (UN Habitat 2006b:13). The following provides the methodological framework for the gender mainstreaming approach.

Methodology of the gender mainstreaming approach

Community Participation

An obvious way to increase participation is to hold consultations about the project design, implementation and management with both gender groups prior to and throughout the project (UN Habitat 2006b:12). However, typical rural sub-Saharan communities are male dominated and women may not feel that they are able to speak out in public consultations when men are present (SDC 2005:15). It is important to raise awareness within the consultations about gender issues, highlighting that women should have an equal role in decision-making and management. Women should be encouraged to take part in the consultations without fear of being criticized for crossing social norms (UN Habitat 2006a:18). Initially, separate meetings could be held for men and women, followed by a mixed meeting to discuss the issues raised. The single gender meetings foster women's collective identity, which gives women the confidence to speak out in the subsequent mixed meeting. Having a woman chair would also encourage the participation of women from the community (SDC 2005:16).

Gender Analysis

The backbone of the gender mainstreaming strategy is gender analysis (GWP n.d.:3). Gender analysis uses community participation methods to assess the impact that the project will have on both genders so as to ensure that the projects are designed to enhance the effectiveness and sustainability of the facilities, and to identify areas that need priority action in order to promote gender equality (Hunt 2004:139). Both women's and men's existing roles are examined along with their capabilities, priorities and needs in relation to water provision. Gender gaps in representation, ownership and control, and access and entitlements to the water resources are identified (GWP n.d.:3). There are four main sections to the gender analysis framework. Firstly, the 'activity profile' identifies who collects the water and how much time this takes. The second section, the 'access and control profile' questions who can access the current facilities, who manages them, and who is in charge of making decisions. The third section, the 'analysis of factors and trends', identifies how the first two sections, the 'activity profile' and access and control' profile, are influenced by cultural factors. The fourth and final section, the 'program cycle analysis', addresses the gender specific actions that are required to promote equality between men and women in the project planning and design, implementation, and management (GDRC n.d.).

Project Design

The sex disaggregated data collected from the gender analysis is used to design a project that meets the needs of both women and men while incorporating measures to close the gaps between them (GWP n.d.:4, SDC 2005:9). Specific areas to be addressed are women and men's preference for location and the type of technology (SDC 2005:14). The differing roles, responsibilities and expertise that men and women have in the society are identified; expertise is harnessed and the unequal power relationships are addressed (SDC 2005:9, UN Habitat 2006b:12). Specific roles for women and men are assigned based on the current expertise collected from the analysis, while, at the same time, promoting gender equality. While the gender mainstreaming approach attempts to work within the existing social relationships and power dynamics of the society, if women's rights are not being met or women are not treated as equals, the project design may necessitate changes to the society's power structure. The project is designed to ensure continued gender sensitive participation and consultation throughout so that the gender awareness is not lost in implementation with a retreat to old power relationships (SDC 2005:9-17). The project design requires continued consultations to identify the goals, needs and constraints of the project.

Project Monitoring and Evaluation

Indicators are developed from the data collected in the gender analysis to monitor whether the project has been successful in meeting its goals in terms of participation, benefits, effectiveness, sustainability and gender relationships (Hunt 2004:140). The gender evaluation compares the situation at the start and end of the project in terms of women's roles, involvement in decision making and management of the facilities (UN Habitat 2006b:14). Monitoring and evaluation is important as it addresses any failures and identifies adjustments that are required in the gender mainstreaming strategy (Brambilla 2001:1).

Chapter 3: A Case Study of Good Practice*

Malawi Rural Water Point Sustainability Survey

In June 2009, the British charity Water Works conducted a rural water point sustainability survey in Malawi. Numerous rural villages were investigated around the country to assess the type of water resource, functionality of the water points and management of the facilities. The objective was also to listen to the users' experiences and challenges, their demand for improved facilities and their current limitations and struggle to meet their goals. The survey confirmed what has been written above in this report. In the villages that had an improved water point, almost all had the Afridev hand pump, which was installed by the government or an NGO. In many rural communities it was found that the pumps had fallen into disrepair shortly after their installation, as the villagers had not been given training to perform maintenance and / or they could not locate or afford the spare parts required for the repair. As part of the survey, Water Works consulted with United Nations Child Fund (Unicef) (2009), the Malawian Ministry of Water and Irrigation (2009), Canadian International Development Agency (CIDA) (2009) and WaterAid (2009), who all confirmed that the lack of sustainability of water points was a huge problem in Malawi and as many as 40 percent of water pumps had fallen into disrepair.

Project Selection

During Water Works' rural water point sustainability survey, it was found that many villages collected their water from unprotected sources such as rivers, lakes or shallow hand dug wells. One such area was the district of Likuni, on the outskirts of the capital Lilongwe. Water Works, along with a water and sanitation specialist from the CIDA completed a site survey of eight villages in Likuni. In these eight villages, there were 36 unprotected hand dug shallow wells that had been built by the community, serving a population of 1200 people. Water was collected using a rope and bucket, and as can be seen from the photographs below, the water quality was very poor and likely to cause disease.

* Water Works took all photographs in the case study with the permission of the photographed person, who granted publishing approval.

Figure 11: Photograph of a typical well in the villages of Likuni

Figure 12: Photograph of the poor water quality from the Likuni wells

Some of the community members were asked about their water and sanitation issues, and their demand for improved facilities. The villagers were very aware of the health problems faced by the lack of access to safe drinking water and sanitation and many people suffered from constant diarrhea. In the previous rainy season eight people had died from cholera. In an attempt to improve their situation, the villagers had established a water committee. The committee planned to grow vegetables and sell them at the local market to raise funds to buy one Afridev pump for each of the eight villages. However, the people of Likuni were very poor and could not afford to buy the fertilizers to grow the crops. If Water Works were to assist Likuni in meeting their goals, the committee expressed their willingness to provide the bricks, collect other materials and contribute to the construction of improved facilities in the form of labor. They indicated that they would attempt to raise some funds, but as many of the villages struggled against poverty, this would prove difficult.

The knowledge of the dangers of drinking dirty water, the establishment of a water committee and the willingness to contribute to improving the wells shows that there was a strong 'demand', 'willingness to pay' and a high level of managerial capabilities within the villages. Therefore Water Works accepted the water committee's request to improve one well in each of the eight villages of Likuni and returned the following year to complete the project.

Project Planning

The first stage of the project was to meet with the community to assess and promote demand, encourage community participation, present the choice of technology and perform a gender analysis. Everyone in the community was encouraged to attend and it was made sure that there was a roughly equal representation of women and men. The village headmen were also invited as it is the tradition in rural communities for the village headmen to make or approve all decisions. It is therefore essential for the approval of the project and a matter of respect for local custom that the village headmen are consulted.

Figure 13: Photograph of the initial meeting between Water Works and the villagers of Likuni

Gender Analysis

There were approximately forty community members attending the meeting, with an equal number of women and men. A male representative from Water Works and two male members of the Likuni water committee chaired the meeting. Ideally, there would have been one female and one male representative from both Water Works and the committee. However, there were only male members of the Water Works team, and none of the women in Likuni spoke English and the Water Works representative did not speak the local language of Chichewa. The two representatives from the Likuni water committee acted as translators between Water Works and the community. The language barrier between Water Works and the Likuni women meant that a separate single gender meetings could not be held.

The Water Works representative opened by encouraging the participation of everyone, stressing the importance that women should participate as equals, as they are the ones that are generally responsible for water collection and the health and hygiene of the family. Both the women and the men met this with a round of applause, which was an encouraging sign for the acceptance of gender equality within the community. However, it was apparent that women are not currently treated as equals. The above picture shows that the women congregate together, sitting on the floor slightly back from the men. The seats were reserved for the village headmen and Water Works. In addition, the women did not contribute that much to the meeting despite active encouragement by Water Works. This may be for several reasons. Firstly, not having the single sex meetings meant that the women's collective identity was not fostered, thus they may not have felt confident to speak out. Secondly, the language barrier may have prevented active participation. Thirdly, not having a female representative chairing the meeting promoted male domination. Finally, the simple act of encouraging women to contribute is not strong enough to overcome generations of inequality.

As part of the gender mainstreaming gender analysis, it was found that the women of Likuni were responsible for water collection, but as the water points are situated close to the home it does not take much of their day to perform this task. The men of the village had built the current water facilities and they were the ones responsible for making decisions, managing and maintaining them. Likuni has the characteristics of a typical sub-Saharan African rural village where women are not treated as equals. However, there were some encouraging signs of the acceptance of women's contribution to decision making. To further encourage women's equality it was decided that the current water committee should be expanded to have equal numbers of women and men serving on it. Water Works requested the community to elect one man and one woman from each village to serve on the water committee (building on the current membership). The water committee were advised that they would lead the project with every member, women and men, having an equal role in making the decisions, contributing towards the installation of the pumps and the management of the facilities.

Demand

The first topic on the agenda was a discussion about the health problems associated with the poor water quality and lack of hygienic sanitation. This emphasized the importance of improving the facilities. Water Works explained the link between dirty water, poor sanitation and bad hygienic

practices with ill health. The survey conducted in the previous year highlighted that many people suffered from regular diarrhea and that there had been some cases of cholera in the previous rainy season. In this meeting nobody actually stated that they suffered from diarrhea and there had been no recent cases of cholera. It is suspected that there were still cases of diarrhea but admitting that you suffer from diarrhea is embarrassing, especially in a large group of people. The initial survey was with a small group of approximately five people. However, there was explicit demand expressed by both the women and the men for the improvement of the existing facilities.

Community Participation

Water Works advised that they were only there to assist the community in improving their own water facilities. Emphasis was placed on the fact that the community was in charge of the project and Water Works would provide training in how to improve the existing water resources. The community was asked if they would be willing to contribute to the project in the form of material procurement and labor. However, Water Works did state that they would provide the materials that the community could not afford. The community understood their role, was happy to provide the materials and was keen to be in charge of the project.

Choice of Technology

As the villagers of Likuni struggled with poverty, it would be very unlikely that they would be able to afford the spare parts of modern VLOM pumps. However, to ensure acceptance and ownership of the facilities the community must be given a choice of the technology (Harvey and Reed 2003:117, Parry Jones et al. 2001:19). The options presented were the Water Works Abakus pump and the Malda pump, which is the typical modern VLOM pump used for shallow well protections. The advantages and limitations of the Abakus pump were presented in comparison with the Malda pump by means of pictures and discussions. It was stated that the Malda pump is more aesthetically pleasing, but is difficult to maintain and the spare parts are very expensive. While accepting that the Abakus pump may not be as aesthetically pleasing, Water Works advocated for it, promoting its low cost and easy availability of spare parts, and ease of installation and maintenance. To help the community understand the workings of the Abakus pump, the manual was presented (see appendix A).

The community, including the women, unanimously voted in favor for the Abakus pump. The villagers understood the concept and there was much enthusiasm for it. They agreed that the Malda pump would be hard to maintain and that once equipped with the technology of the Abakus pump, they would be able to easily maintain it and build further pumps by themselves. Therefore Water Works suggested that a pilot project was undertaken using the Abakus pump to teach the community how to build it. After the pilot was completed, a second meeting would be held for the community to make the final decision of which pump to install in the remaining villages.

Pilot Project Installation

The Water Committee was put in charge of selecting the wells to improve, including which one should be the pilot. Water Works made sure that the wells selected met well siting requirements, such as proximity to contamination (e.g. latrines), demand, quality of water and whether the well would dry up when there was no rainfall.

The aim of the pilot project was to train the water committee how to install, manage and maintain the pump so that on Water Works' departure the committee would be able to complete the additional seven wells. Therefore, all members of the committee were asked to be on site for the entirety of pilot project. Prior to the start of the pilot, further technical information on the Abakus pump was introduced, and committee members were given a manual on how to construct it. The committee was asked to study the manual in preparation for the start of the pilot project.

Material Collection

Figure 14: Photographs of the community members procuring materials

As discussed in the community participation section, ownership, thus sustainability, is increased through the community providing or at least contributing to the materials required for the development (Harvey and Reed 2003:2.117). Prior to the start of the project, the villagers were asked to make or buy the required materials. The materials requested were sand, gravel, bricks, a bicycle wheel, bicycle pedals, timber planks, quarry stones, a pine log, pipes, a rope and scrap metal. It was acknowledged that the community would struggle to buy cement, which was provided by Water Works.

The community managed to procure bricks, sand, a bicycle wheel, bicycle pedals and scrap metal. The water committee advised that they would be able to raise the funds from the community to buy the timber, rope and pipes from the local markets, but it would take some time. Ideally, the project would have been delayed, but due to limited time, Water Works decided to purchase the remaining materials. Members of Water Works and the committee bought the materials together from local markets to encourage community participation as much as possible.

Construction

Figure 15: Photograph of both the community women and men contributing to the construction of the pilot project

Despite the request for all members of the water committee to be on site throughout the project, only four male members were constantly in attendance. Other members, including the women, did participate on occasion, as shown by the above picture. However many of the committee members could not be there all the time as they had to work or perform daily tasks. The literature stresses the importance of all members of the water committee participating throughout the entire project (UN Habitat 2006b:12). This is unrealistic as people have other commitments, especially women. Rural sub-Saharan African women are responsible for looking after families, collecting water, preparing food, tending to crops. They simply do not have any time to spare.

While still encouraging active participation of all members of the committee, especially the women, it was decided to equip the four members that were constantly on site, the 'water team', with the managerial skills to train the other committee and community members in the installation and maintenance of the seven remaining pumps. The team accepted this task and were made aware of their role, especially the importance of training women in how to manage and maintain the pumps. As the water team would commit more time than initially planned and have to take time off work, it was decided that they should be paid a local wage. This goes against the community participation approach but it is not realistic for people to give up weeks of their time without money for food.

Water Works trained the water team how to make the pump but did not do any of the work themselves. The water team was extremely capable of building the pump and enthusiastically completed the project without difficulty as shown by the pictures below. Through their active participation, they became extremely committed to the project and the reasons behind it. They expressed a feeling of empowerment to be able to provide water for themselves without the reliance on outside assistance and to help their neighboring villages do the same. A further sign of ownership of the facilities is that they painted the pumps to make them more aesthetically pleasing.





Figure 17: Photographs of the water team constructing the Abakus Pump

Inauguration

The purpose of the inauguration was to familiarize the committee and community with the pump, and to teach them how to construct and maintain it. At the end of the inauguration the committee would be able to make an informed decision about whether they want the remainder of the village wells to be improved with the Abakus or Malda pump.

Figure 17: Photographs of the water team demonstrating the Abakus Pump to the community

While it was accepted that all members of the water committee could not fully participate in the installation of the pilot pump, it was made sure that everybody would attend the inauguration. In addition, other members of the community and the village headmen were encouraged to attend. There were approximately 40 people in attendance, 30 women and 10 men. The gender mainstreaming approach states that there should be roughly equal numbers of women and men present in meetings (UN Habitat 2006b:12). However, as the women did not participate that much in the initial meeting when there were equal numbers, it was decided that having more women than men might encourage their participation. In addition, to encourage women's participation, Water Works recruited a female volunteer who spoke the local language of Chichewa. Having a woman as a Water Works' representative, especially one that spoke the local language, proved to be extremely beneficial for the active engagement of the women in the community as the women fully participated in the discussions.

As can be seen from the above pictures, the male representatives of Water Works had little involvement the pump inauguration, passing the responsibility to the water team who proved their

capability throughout the pilot project. Having community members demonstrate the pump not only addressed the language barriers, it promoted a community led project, enhancing community ownership.

There was much enthusiasm for the Abakus pump among everyone who attended the inauguration. Even so, the options of the Abakus pump and Malda pump were presented again. The vast majority chose the Abakus pump for the remaining villages. However, there were a few people that asked about the Malda pump as they did not know anything about it. It is unrealistic to expect that all the villages would know what the typical modern VLOM pumps were. As such, offering a choice in pump technology is perhaps tokenistic without actually installing both pumps. Even so, the Malda pump was explained in as much detail as possible and all of the villages agreed that the Abakus was the better option.

Acceptance Issues

During the inauguration, the pump was demonstrated without the housing or the completed surrounding structure, as it was much easier to show how it worked. It was explained that the well was going to be protected with a surrounding concrete slab and a roof to keep contaminants away. A step would also be built to allow women and children to easily use the pump. The day after the inauguration, a male member of the water committee that did not attend the inauguration said he did not want the pump for his village as it looked too 'temporary' and hard to use for women and children. The woman member of the water committee of the same village did attend the inauguration and chose the Abakus pump. However, despite setting up a water committee where women and men would have an equal role in the decision making, her voice did not count compared to a man's, and the village decided not to install the Abakus pump.

Community Led Project

Figure 18: Photograph of the water team training women community members how to construct the Abakus Pump

Figure 19: Photograph of the Abakus Pump built entirely by the community

Following the inauguration, the water team took over Water Works' role to teach the water committee members and villagers how to build the pump in other villages. The lesser involvement of Water Works greatly increased the ownership of this project and the water team took great pride in demonstrating the pump to the other villagers. As can be seen from the above pictures, the water team managed to involve the women in the design and installation of the pump much more than the Water Works team. Furthermore the water team was far more capable of building the pump and teaching other villagers how to make it than Water Works. The community-led pump ended up being far superior to the pilot project with the water team making upgrades to Water Works' design. It had a more hygienic outlet spout and sturdier handles. It was easier to operate, had greater flow rate, was more robust and aesthetically pleasing. After seeing the community led pump, the village that decided they wanted the Malda pump changed their mind as the community led pump met their requirements after all.

Project Hand Over, Monitoring and Evaluation

Figure 20: Photograph of the project hand over

The success of the community led project demonstrated that there was the technical, managerial and organizational capability within the community to install and maintain the remaining six projects without outside assistance. Therefore the project was handed over from Water Works to the water committee during a ceremonial lunch. All the members of the water committee and the headman of each village attended the lunch. This cemented their commitment to continue building the wells. The departure of Water Works was a symbolic transition that greatly enhanced community ownership.

Water Works produced a monitoring form that the committee would fill in every other week while the pumps were being constructed and every month after the installation. The monitoring period has been set to be one year. The CIDA representative would fax the completed forms to Water Works every month. The monitoring form included sections that could be used to assess whether the remaining projects were successful in terms of performance, sustainability, gender aware participation and gender equality (a copy of the form is supplied in Appendix B)

At the time of writing, one month has past since Water Works left the community. In this month, there have been two additional wells installed in the communities. The community members, especially the women, have been involved in the decision-making and installation of the pump.

There have been a couple of performance issues regarding the rope slipping off the wheel. However, the community has managed to easily fix the problems. The water team, not the community members, has carried out the repairs. It is expected that, over time, the community members will take over this role as it has been demonstrated that the water team have successfully trained communities in the technology.

It is too early in the monitoring process to assess the true sustainability of the rope pump in Likuni. However, the signs so far are very promising.

Conclusion:

The United Nations (2010:58) declare that the world is on track to meeting the water part of Millennium Development Goal 7 Target C to "halve the proportion of people without access to safe drinking water by 2015". While this is true on a global scale, it has been shown that sub-Saharan Africa is very much failing to meet its target. Furthermore, it has been argued that the statistics which show some, albeit little, progress in sub-Saharan Africa's rural water coverage are inaccurate due to water pumps falling into disrepair but still being included in the areas with access to improved facilities statistics (Parry Jones 2001:iv, WaterAid 2003:1). The lack of sustainability of current water developments has been attributed to the inappropriate use of technology and the lack of community involvement. Firstly, the modern technologies that are currently used are too complicated and too expensive for rural villages. Maintaining these pumps requires technical expertise, which is not often available within rural communities, and the spare parts required for the repairs are not locally available and are too expensive (RWSN 2009a, Wood 1994:133, Parry Jones et al. 2001:1). Secondly, the lack of community involvement has stemmed from the rush to meet the MDG 7C1, resulting in many water points being built hastily (CIDA 2009). This has led to communities not being given the required maintenance training to know how to repair the water pumps when they break. In addition, by not being included in the development, there is a lack of ownership of the facilities; thus the community may not use them and there will be a lack of desire to perform maintenance when the pumps fail (Parry Jones et al. 2001:19).

To ensure actual and quicker progress towards meeting MDG 7C1 in sub-Saharan Africa, this thesis offers an alternative more sustainable approach to rural water development. The approach is based on the use of a water pump technology called the Abakus pump that the British charity Water Works has developed, and a gender aware community participatory approach.

The Abakus pump is a simple technology based on the traditional rope pump, which can easily be made by rural communities with locally available and affordable materials. It is as efficient and provides as clean water as the modern expensive pumps, but it can be easily funded, made and maintained by rural communities, unlike the expensive pumps.

The thesis pays much attention to the importance of gender aware community participation in rural water developments. It starts off by detailing the general, non-gender specific principles of community participation, where it is emphasized that through active participation, ownership is increased, which is the key to ensuring a sustainable development (Parry Jones et al. 2001:19). The participatory principles increase ownership through several means. Firstly, demand for the improvement of the water resources is promoted through discussions with the community about the links between dirty water and ill health (Harvey and Reed 2003:117). Secondly, the community is put in charge of the project. They are consulted about the various options regarding the improvement of the water resource and are given the role of making the decisions, including the choice of technology (Collins 2000:7, Harvey and Reed 2003:117). Thirdly, the community is encouraged to contribute to the cost of the project in the form of materials and labor (Harvey and Reed 2003:2,117). Finally, a 'water committee' is elected by the community and placed in charged of planning, installing, managing and maintaining the project. The outside agency provides training to the water committee, giving them the technological and managerial skills to fulfill their role (Collins 2000:7, SDC 2009:3). The importance of incorporating gender concerns into the community participatory principles is a prevalent part of this thesis. It is women who are burdened with the task of collecting water to meet their families' needs (UN-Habitat 2006a:2). Through this responsibility, women have acquired considerable knowledge about water resources, thus their expertise should be harnessed (UN Water 2006:1). In addition, as women are the ones that use the resources, the facilities should be tailored to their needs. Thirdly, it is more likely that maintenance will be performed promptly if the users (women) are given technological training and managerial roles (SDC 2005:5). Finally incorporating gender concerns into the developments promotes gender equality. The thesis details the gender mainstreaming approach, which encourages active participation of both women and men and in all aspects of planning, implementing and managing the project. Women and men are given equal role in decision-making, and projects are designed that address gender disparities within the community (UN Habitat 2006b:12,13).

The final part of this thesis details a case study where the British charity Water Works assisted the rural Malawian community of Likuni reach their water supply goals through the use of the Abakus pump and a gender mainstreaming participatory approach.

The case study proved that the Abakus pump meets its sustainability criteria of being easy to make and maintain by rural communities with locally available and affordable materials. In a matter of days, the community managed to locally source all of the materials (although Water Works did pay for some of these materials). A community water team, which was set up to manage the project, was easily able to build the Abakus pump with a short training course from Water Works. In fact, they were so proficient at making the pump that, when left to construct it without the guidance of Water Works, they were able to build a far superior pump than Water Works' pump designers. The training of the water team in the technological, managerial and gender aware community participation approaches became integral to the success of the project as the water team was able to teach other community members, especially the women, how to make and maintain the pumps, with much more success than Water Works.

Through active and regular consultations, the community understood the reasons behind the Abakus pump and felt empowered to able to provide water for themselves, without the reliance on outside assistance. By taking a lead role in the decision-making and construction of the pump, the community developed ownership of the facilities. This ownership greatly increased as Water Works' involvement decreased.

At the time of writing, there has been one month of monitoring performed since the departure of Water Works. In this month, a further two wells have been built by the community and the maintenance has been performed with ease. It is too early to truly asses the sustainability of the water pumps, but indications suggest that the community will easily be able to build the additional pumps required to meet their needs and that maintaining them will not be a problem.

Despite the undoubted success of the project thus far, there were some areas that could have been improved. The lack of a female Water Works representative and the inability to speak the local language resulted in difficulties encouraging community participation in the project planning meeting (despite having a translator), especially by the women as, they could not speak any English. Due to the communication difficulties between the Water Works team and the women, the gender mainstreaming methodology of single sex meetings could not happen. This could have furthered the lack of participation by the women. The importance of having a female representative who spoke the local language became very apparent in the project inauguration, where Water

Works recruited a female volunteer who spoke the local language. The difference in participation of the local women was remarkable and they became actively involved in the discussions.

There are also some practical limitations to the community participatory principles and the gender mainstreaming approach. Firstly, the community participation principles state that a choice of technology should be given to enhance ownership (Harvey and Reed 2003:117). Without building both technologies and allowing communities to test them for a long period of time, communities can not make an informed decision about which technology is more suitable for them. In fact offering this 'tokenistic' choice may put doubt into the community's minds whether they made the right decision. Secondly, the community participatory gender mainstreaming approach states that both the women and the men in water committee should be actively involved in the construction process (UN Habitat 2006b:12). This is unrealistic, as it would require people to take time away from their jobs or daily duties. Women in rural sub-Saharan Africa are responsible for tending to crops, caring for the family, preparing food and collecting water to name a few. They are far too busy to be able to spend their entire day on the construction site. Finally, the gender mainstreaming approach also states that women and men should have an equal role in decision-making (UN Habitat 2006b:12,13). Water Works set up a water committee with equal numbers of men and women with the premise that decisions need to be made by the group with everyone having an equal say. However, when there was divided opinion about the choice of technology in one village. The woman's voice did not count compared to a man's. The simple act of advocating for gender equality and setting up mechanisms that in theory give women and equal say will not overcome generations of inequality. That being said, at times, the gender mainstreaming approach did manage to actively engage women in the project, which is a start on the long process towards achieving gender equality.

To sum up, all indications thus far, prove that using simple technologies such as the Abakus pump and gender aware community participatory approaches will lead to more sustainable water resources, thus 'actual' and quicker progress towards meeting the MDG 7C1 in sub-Saharan Africa.

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APPENDIX A:

MANUAL FOR THE ABAKUS PUMP

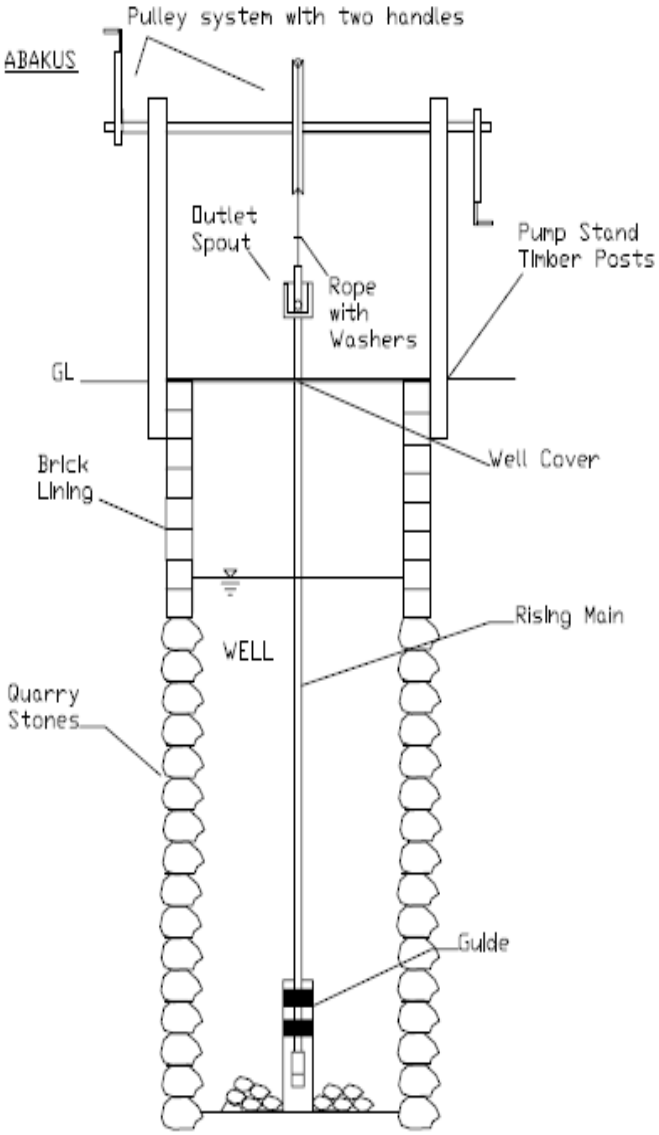
Manual for the Abakus Pump:

A non-technical guide in how to build the Abakus Rope Pump for shallow well protections

Document prepared by Water Works, September 2010.

WATER WORKS

How the Pump Works



- The rope is turned by the bicycle wheel.
- The knots on the rope are pulled by the clamps on the bicycle wheel. This makes the rope turn.
- The rope goes through a guide at the bottom of the well and up the pipe.
- The washers (rubber disks) on the rope trap water in the pipe and lift the water out of the top of the pipe and into the outlet spout.

How to Make the Pump

1. The Posts:

The posts hold the shaft (see page 13).

Materials you need:

- *2 x 6 m (11cm x 4.5cm) soft wood planks*
- *nails*

Tools you need:

- *a hammer and a spirit level*

When building the well wall, leave space for the posts to be placed in the ground. The hole should be between 35cm and 50cm in depth.

The poles need to be spaced so that the shaft (see page 13) fits perfectly between them.

Fix the posts together at the bottom and middle. Do not fix the posts together at the top. This will be done later.

Space the posts apart with a plank of wood (called the stiffener) so that they fit in the middle of the holes. The plank will also make sure that the posts are aligned.

Cast the posts in concrete making sure they are perfectly straight using a spirit level.

2. The Guide

The guide feeds the rope (and washers) into the pipe.

Materials you need:
- *a timber log*

Tools you need:
- *a chisel*

Inlet (Side 1):

Outlet (Side 2):

Inlet Side:
The Inlet side is where the rope goes through. The edges must be smooth to stop the rope from getting torn and to stop the washers from breaking.

Outlet Side:
The outlet side is where the pipe is attached, where the rope goes out and into the pipe. The groove is made in the wood to make sure the hole in the pipe allows the rope (and washers) to go through it without catching the edges of the pipe.

3. The Wheel

The wheel turns the rope.

Materials you need:

- *bicycle wheel with spokes and tyres*
- *hardwood plank for the hub*
- *screws*

Tools you need:

- *wood saw*
- *chisel*
- *screw driver*
- *a piece of string*
- *pliers*

Remove the spokes from the wheel. They will be used later.

Cut a piece of wood so that it fits perfectly in the middle of the wheel.

Put a piece of bicycle tyre on the edge of the wood and nail the wood to the wheel.

Find the middle of the wheel by using two pieces of string.

Cut a hole in **exactly** the middle of the wood so the shaft fits in it perfectly (see page 13)

Use the spokes to make clamps on the wheel. These clamps grab the knots in the rope so that the rope does not slip as it is turned (see below).

To increase the grip between the wheel and the rope, strap two bands of rubber bands over the clamps. This will also protect the rope and washers from wear.

3. The rope with Washers (rubber disks):

The washers are attached to the rope. They lift the water up the pipe.

Materials you need:

- *30 metres of rope*
- *bicycle tyre or tough rubber*

Tools you need:

- *a sharp knife or strong scissors*
- *screw driver*

The washers are circular rubber disks made from bicycle tyres or similar strong rubber. They need to be cut so that they are 1 to 2mm smaller than the hole in the pipe.

Make a hole exactly in the middle of the washer using a screwdriver that has been heated in a fire.

Place the washers on the rope spacing them at 1m apart. Make sure that all the washers are facing the same way (curving in the same direction) on the rope. Tie a knot on each side of the washer to keep it in place. **Also tie a knot in the rope in-between (in the middle of) the washers.**

Stretch the rope. This is very important.

4. The Turning Shaft

The wheel is attached to the shaft. The shaft turns the wheel.

Materials you need:

- *2 metre shaft of hard wood. 2in x 2in*

Tools you need:

- *chisel*
- *pieces of broken glass*

Make a smooth circle in the shaft to rest on the posts. Make sure that the smooth circles are spaced the same distance as the posts are spaced apart.

5. The Handles:

The handles are used to turn the shaft. There are several ways to make these handles. Below, two options are presented.

Option 1:

Materials you need:

- *2 bicycle pedals*
- *Soft wood plank*
- *Lashing rubber band*

Tools you need:

- *wood saw*
- *chisel*

On one side of a piece of plank, make a square hole having the same dimensions as the shaft. On the other side of the plank, make a groove to fit a bicycle pedal. Once the pedal has been fitted, fasten it using a rubber band.

Finish off by cutting the edges of the pedal to make it a grip. To make the grip more comfortable, lash it with rubber bands.

Option 2:

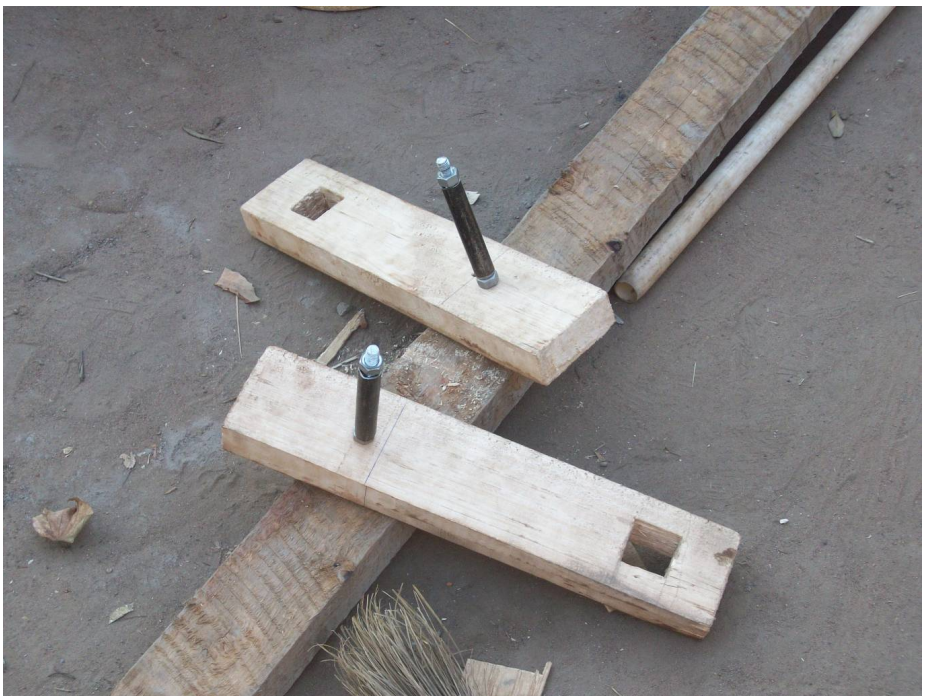
Materials you need:

- *2 bolts with knots*
- *Soft wood plank*
- *Steel tubing*

Tools you need:

- *chisel*
- *wood drill*
- *super glue*

Use the same size of wood and cut the square in the same place as option 1. Proceed by drilling a hole where a bolt can be placed and attached by knots. Use steel tubing to make a smooth grip. This grip should be able to rotate as the pump is operated.



6. The outlet Spout

The outlet spout catches the water from the pipe and brings it to the surface for collection. There are several ways to make the outlet spout. Below, two options are presented.

Option 1:

Materials you need:

- *soft wood planks*
- *nails*
- *wood glue*
- *rubber for insulation*

Tools you need:

- *wood saw*
- *hammer*

Using pieces of plank, the outlet spout can be made as a “wood box” which is nailed to the stiffener and rests on the well edge. Use wood glue to carefully seal all cracks.

Once installed, enclose the top of the outlet spout with planks allowing only a little opening for the water to come out.

Option 2:

Materials you need:

- *1 metre of 40mm PVC pipe*
- *0.5 metre of 110mm PVC pipe*
- *Solvent cement and rubber washers*

Tools you need:

- hack saw

Construct a T junction out of the 110mm PVC pipe and the 40mm PVC pipe. Use rubber washers and solvent cement to hold the pieces together.

Attach the outlet spout to the pipe using planks of wood. Since the outlet spout pipe is bigger than the rising pipe, the water will exit out of the spout and not back down.

Installing the Pump

Step 1:
On the posts, attach blocks of wood (called bushings) with nails at the desired shaft height. Make sure that the shaft is completely level when placed on the bushings. Attach sheets of scrap metal to the bushings to decrease friction.

Proceed by placing the shaft, with the wheel and the handles attached, on the bushings. Finally, turn the wheel to make sure that it spins steadily. If this is not the case it may be necessary to adjust the wheel with wood stiffeners. Making sure that the wheel spins steadily is very important!

Step 2:
Empty the well of water and make sure that the base of the well is level.

Step 3:
Attach the pipe to the guide using inner tube rubber with the fat end of the pipe at the bottom. Feed the rope (with washers attached) through the guide and pipe.

Step 4:
Place the guide at the bottom of the well making sure that the pipe is going straight up and is in line with the pulley wheel. **Carefully**, place stones on the plate attached to the guide so that the guide is fixed.

Step 5:
Install the outlet spout (see pictures page 16 and 17). Regardless of the 2 options chosen it is important to install it is before the rope is fully attached. Make sure that the outlet spout allows the rope to go straight on the wheel!

Step 6:
Connect the rope ends with a knot which will not come undone. Wrap the ends with rubber and metal wire so that they do not catch on the guide when the pump is used. It is important to find the correct tension in the rope. If too tight it will be hard to use, if too loose then the rope will slide on the wheel and not work.

Step 7:
Test the pump to make sure it is working properly. If not, do the following checks:

- Is the wheel spinning steadily?
- Is the rope at a correct tension?
- Are there sufficient spokes on the wheel?
- Is the guide, pipe, outlet spout and wheel perfectly aligned?

APPENDIX B

MONITORING FORMS

Likuni water project monitoring scheme

To be filled in by the water committee and handed to Mr. Mambulu every second week starting from 4th of October 2010.

	Day:	Month:	Year:
Date			

Village

Well

Making of the pump	**Finished**	**Not yet finished**	**Not needed for this well**	**If finished, date of completion**	**Who Completed the Work (more than one box may be checked)**				
					Water Team	**Committee**		**Villagers**	
						Men	**Women**	**Men**	**Women**
Make the poles and attach them to the stiffener									
Place the poles with the stiffener in cement									
Make the guide									
Make the shaft									
Make the wheel									
Attach the wheel to the shaft									
Make the handles									
Make the rope with knots and washers									
Attach the pipe to the guide									
Place the guide in the well									
Make the outlet spout									
Attach the outlet spout to the well									
Attach the handles to the shaft									
Attach the shaft on the poles									
Assembly of all parts - finishing of pump									

If well protection and pump not completed

Please specify why it is not finished. If it was a conscious decision not to finish it, who made that decision including their gender

Making of the well protection	**Finished**	**Not yet finished**	**Not applicable to this well**	**If finished, date of completion**	**Men**	**Men**	**Women**	**Men**	**Women**
Gather bricks and sand									
Dig a ring around the well - 2 bricks wide and at least 100 cm deep									
Cover the bottom of the ring with a layer of cement									
Build the well wall with bricks									
Make the drainage channel with plaster									
Make platform around well with plaster									
Plaster well wall									
Build the well roof									
Landscape the ground around the well to make sure rain water flows away from the well									
Make fence around the well									
Make gate in the fence to let well-users in and keep animals out									
Finishing of the well protection									

If well protection and pump not completed

Please specify why it is not finished. If it was a conscious decision not to finish it, who made that decision including their gender

Likuni water project monitoring scheme

To be filled in by the water comittee and handed to Mr. Mambulu every month starting from 4th October 2010.

	Day:	Month:	Year:
Date			
	Village	Well owner	
Well			

Operation of well and pump

1. Is the pump working?	**YES**	**NO**
If no, answer question 2 to 3		
If yes, answer question 4 to 7		

2. Which part(s) of the pump broke and why?:

3. Will the pump be repaired?	**YES**	**NO**

If no, please specify why and who decided including their gender:

4. Has any maintenance been done on the pump in the last two weeks?	**YES**	**NO**

If yes, please specify what and who by including their gender:

5. Has the pump broken down in the last two weeks?	**YES**	**NO**

If yes, which part(s) of the pump broke and how was it fixed? Who fixed it including their gender?:

6. How many people are currently using the well?

7. Are people happy using the well?	**Women**	**Not Happy**	**Happy**	**Very Happy**
If not happy, please specify which gender and why:	**Men**	**Not Happy**	**Happy**	**Very Happy**