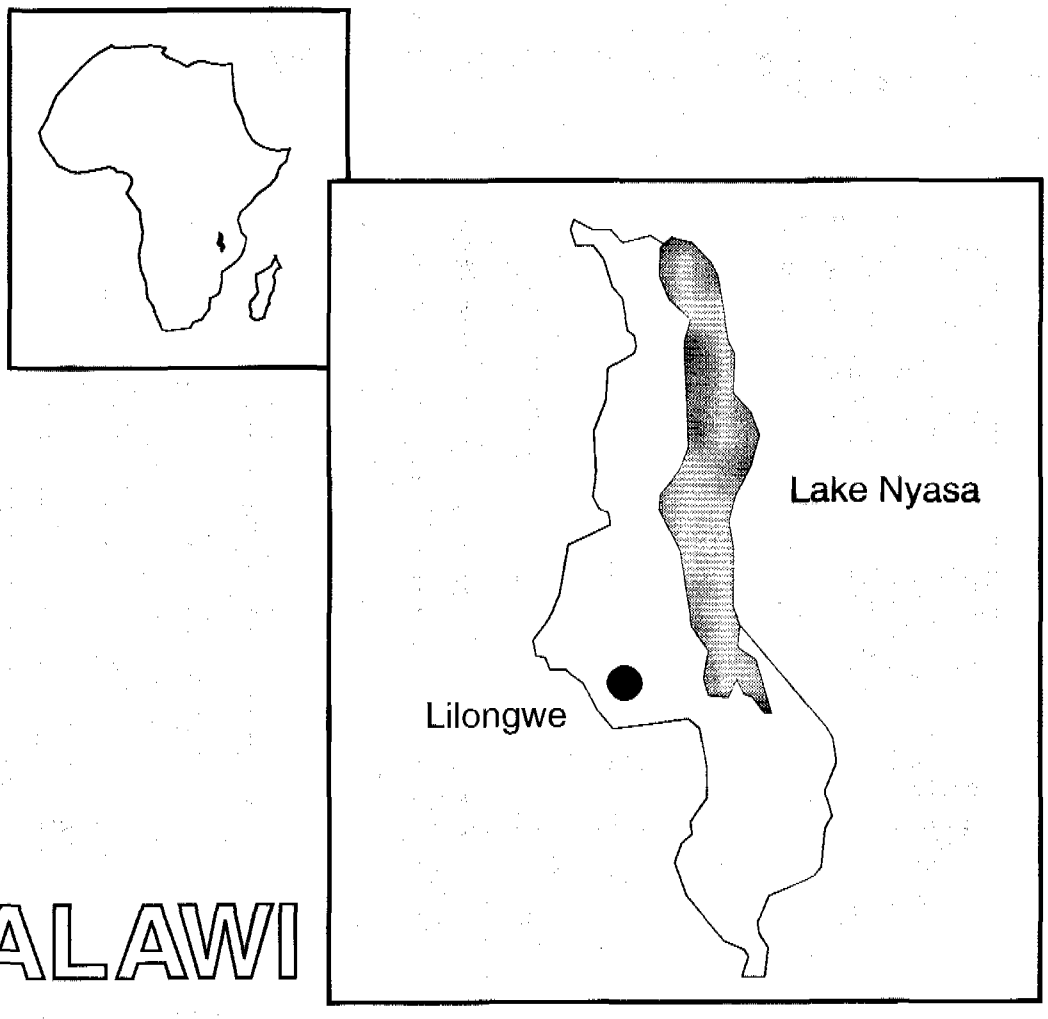
Danida

Village Level Operation and Maintenance of Handpumps

Experiences from Karonga, Malawi



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Experiences from Karonga, Malawi

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IRC International Water and Sanitation Centre
DANIDA Danish International Development Assistance

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List of Acronyms and Abbreviations

An attempt has been made to dispense, as far as possible, with the use of abbreviations. Those which appear in the text are given below:

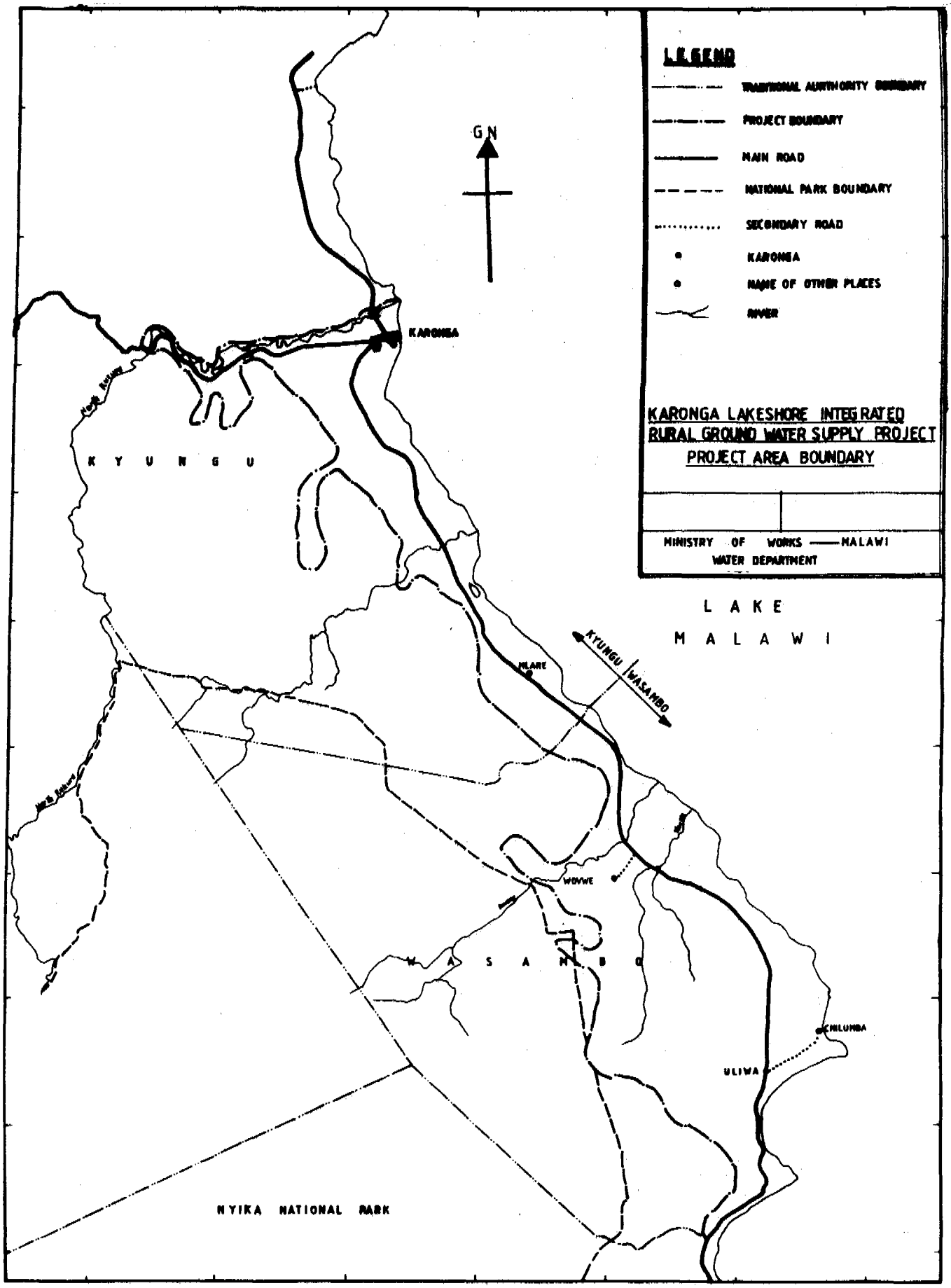
DAC	Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD)
DANIDA	Danish International Development Assistance
NGO	Non-governmental organization
O&M	Operation and Maintenance
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
VLOM	Village Level Operation and Maintenance/Management

Abbreviations used in some figures and diagrams include:

MA	Maintenance Assistant
PA	Pump Attendant
PC	Pump Committee
VWHC	Village Water and Health Committee
WMF	Waterpoint Maintenance Fund

This document is based on experiences from the Karonga Lakeshore Integrated Rural Groundwater Supply Project, usually referred to in the text as 'the Karonga Project' or simply 'the Project'. In some of the diagrams, the abbreviation KIP has been used.

Figure 1. *The project area in context*



Foreword

Rural water supply and sanitation programmes in many developing countries are not sustainable and face several problems such as lack of community ownership. Government commitment to water and sanitation programmes is sometimes there but this is hampered by an acute shortage of both financial and human resources. Research and development programmes on the *use* of appropriate technologies are also limited. Donors and recipient governments get frustrated by this state of affairs.

Malawi has 85 percent of its population living in the rural areas and only 57 percent of this population has access to safe water supply, as compared to 85 percent coverage in the urban areas. Water resource assessment also indicates that 75 percent of the rural population will be served by groundwater sources, compared to 25 percent that would tap their water supply from surface sources through gravity schemes. Hence, there is a lot of emphasis on groundwater development for the rural areas. Development of groundwater is limited in certain areas due to occurrences of localised groundwater quality problems.

Since the early 1980s, Malawi has actively been exploring ways on how to combat these problems. Investigations in the use of appropriate technologies for rural water supplies included: the development of a Village Level Operation and Maintenance (VLOM) handpump, called the MALDEV, which was further developed into the Afridev handpump; the development of appropriate designs for boreholes using polyvinyl chloride (PVC) casing materials; and the establishment of community-based management systems for the waterpoints.

An outline on policy and strategy on water and related environmental matters was declared in Malawi's National Development Policy in 1987. More recently (in 1994) the Government of Malawi has developed the Water Resources Management Policy and Strategies Document at the initiation of the World Bank-supported National Water Development Project (NWDP). This was followed by the United Nations-supported Rural Water Supply and Sanitation Sector Study in Malawi in May, 1995. All these policies and strategies aim at systematic development and management of the country's water resources which emphasize community-based management for rural water supplies and the involvement of NGOs and the private sector in the implementation of water and sanitation programmes.

The Karonga case attempted to demonstrate the solutions to some of the problems outlined above when village level operation and maintenance was made a key component of the project. The authors of this publication have ably documented the Karonga Lakeshore Groundwater Project VLOM activities so that the experiences may be widely shared. The experiences may be unique to Malawi, but there is all the hope that the information contained within these pages will help to sustain rural groundwater-supply programmes, not only in developing countries, and also to help those actively involved in research programmes in appropriate technologies. As demonstrated by the Karonga case, community empowerment, behaviour change and women's involvement are the key to sustainability of rural water supply programmes.

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Acknowledgements

This document has been prepared by the team which has been closely involved with the Karonga Lakeshore Integrated Rural Groundwater Supply Project during the design and implementation of its operation and maintenance phase.

Of the four main contributors, Claus Branner Jespersen, the Project Coordinator in Karonga, and Karin Hyde, of the Centre for Social Research in Zomba, were based in Malawi, while Bent Kjellerup, water engineer, and Dolf Noppen, sociologist, contributed as external advisers recruited through Danish International Development Assistance (Danida). All have contributed to the text, which has been edited and revised for publication by Dolf Noppen.

The document was prepared for publication by the IRC International Water and Sanitation Centre with financial support from Danida. The views presented in the document are the sole responsibility of the authors and do not necessarily reflect the official sector policy.

In the preparation of the present document, strong support was obtained from Mr. Henning Jensen of Danida.

Throughout the period during which the Karonga VLOM activities were being designed, tested and implemented, constant support and encouragement were received from the Government of Malawi, through the Water Department in the Ministry of Works. The personal interest of the Controller of Water Services, Mr. E. Laisi, and the Chief Water Resource Officer, Mr. R. Kafundu, have been decisive factors in the development of the system. In the field, three people deserve special mention. The two development assistants, Mr. M.A. Chirambo and Mr. G.S. Zenizeni, who worked with the project from its inception and knew the location of all waterpoints by heart, were known and accepted by all communities and, as such, facilitated the vital exchange of opinions and ideas. As for monitoring and maintenance, the Senior Maintenance Assistant, Mr. T.D. Malinda, ensured both the quality of monitoring data and that users gained the necessary confidence and skills to do their own pump maintenance and repair.

The Director of the Centre for Social Research (CSR) at the University of Malawi, Mr. L.H.A. Msukwa, had pioneered sociological research within the water sector in Malawi. Mr. Msukwa and a number of other researchers at the CSR were involved in the design of the sociological monitoring activities and analysis of the results. Special credit goes to Ms. Cathy Gaynor who was responsible for the detailed design of the sociological monitoring procedures, and the data analysis and final editing of the first two sociological and technical monitoring reports.

Introduction

This document introduces the experiences from a small rural water supply project in northern Malawi to a wider audience. The authors suggest that these experiences have an application which is far broader than the geographical area to which the project was confined.

The justification for this document lies in the assumption that most of the technical developments required for a handpump suitable for village level operation and maintenance (VLOM) have been met. The message at the heart of this document is the belief that VLOM is not a technical concept but a community concept. So far, experience has focused on pump testing and pump technology. This document contends that technology is only one element of a jigsaw of pieces which have to fit together if there is to be any chance that the pumps installed will be maintained by the community and will continue to function.

What is perhaps unique with the Karonga project is that, while it has adopted a technology - advertised as VLOM - it has, in addition, designed an operation and maintenance system based on community ownership and on support from the private sector. The project philosophy was grounded on a minimalist role for government (low-key, low-involvement, low-cost) which, *even if it were not carried out,* would not hamper the regular maintenance of the pumps and would let the community go about its daily life without external involvement. Government's role was seen within the enabling environment, encompassing monitoring activities and decisions at the policy level, such as standardization of pumps and spare parts, facilitating local production, etc. But keeping out of any involvement in distribution and sale of spare parts, and in maintenance.

This was easier said than done. The Karonga Project started off just like any other rural water supply water project at the beginning of the International Drinking Water Supply and Sanitation Decade (IDWSSD) with an emphasis primarily on technical aspects such as the hydrogeology of the area, the design of the pumps, supervision of the contractors, etc. It was not until the end of the implementation phase that the project came to the conclusion that just because a pump advertised as VLOM had been installed, this did not mean that the resulting maintenance system which followed would also be VLOM. In fact, a Review Mission concluded that the maintenance system had been given insufficient attention, and that if the facilities had simply been handed over at the end of the project period - as had been foreseen - it would not have been long before things started to fall apart. Therefore, instead of withdrawing its support, the donor decided to continue to support the Project in order to assist with the development of a sustainable community-based maintenance system which would function after the phasing out of technical assistance.

This document describes that process. The main message of the document is that VLOM is not a technical but a community concept, and that its best chance of success is if government's role is pared down to a minimum. Hard and fast rules imposed from outside are, by definition, external. Communities cannot be told 'this is what you must do', but rather, 'these are the possibilities, here are some possible solutions' and 'this is the kind of assistance you can be given'. The external agencies, sometimes in the form of a project, will provide the enabling environment within which to operate. This may change between countries and regions, as may the technology which has been called 'VLOM'. Communities must be allowed to retain freedom of choice if they are to feel ownership. This also means that communities have to be taken into the decision-making process from the very start, even those which lead to the choice of technology.

Figure 2: VLOM is a community concept.

Finally, this document does not focus on the 'mistakes' made by the Project, many of which were typical of their time. Rather the attempt has been to focus on what was learned in order to give a 'practical guide' for VLOM which looks beyond what happened in Karonga.

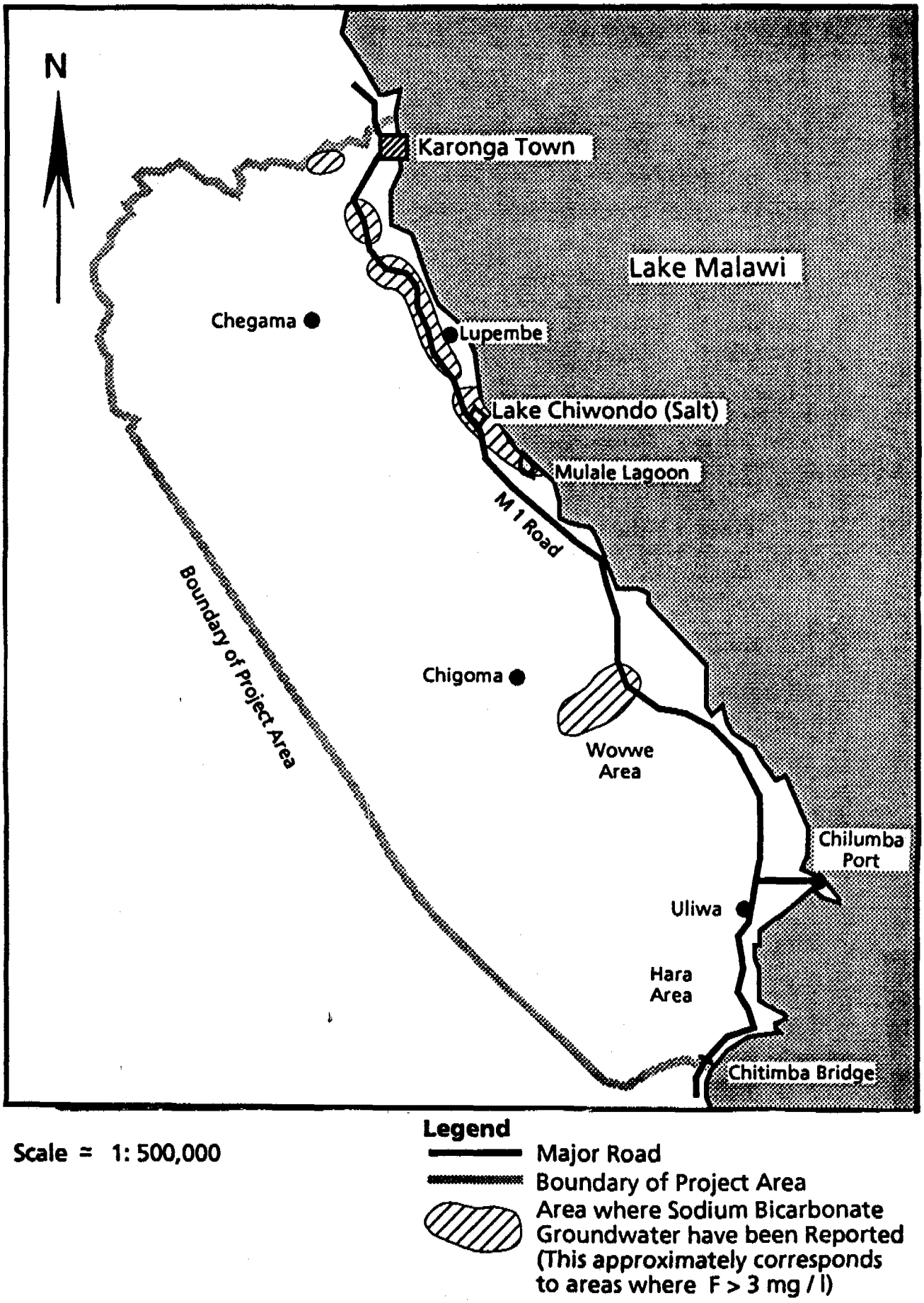

Figure 3. Map of project area.

1. The Project Area and the Background to Danida Involvement

1.1 The project area

The Karonga Lakeshore Integrated Rural Groundwater Project is located in Malawi's northern Karonga district. With a total land area of nearly 3,000 square kilometres, the district is bordered by Tanzania in the north, by Lake Malawi to the east, and by Chitipa District, the Nyika National Park and Rumphi District to the west. (The figures quoted are taken from the Project's Baseline Study of 1990).

The project area, which does not cover the whole of Karonga District, encompasses the two large Traditional Authorities of Kayungu and Wasambo. It stretches for almost 100 kilometres north to south, with the width of the area being roughly 25 kilometres, but where some of the inland areas below the Nyika Escarpment are difficult to access during the rainy season.

The population density of Karonga District is low, with 50 people per square kilometre (compared to the national average of 85). Population in the project area was - in 1990 - estimated at 84,000 which, at that time, already exceeded by 20,000 the estimates made by the Danida Appraisal Team which visited the area in 1985. Approximately 57 percent of the total district population live in the project area. The rate of female-headed households is much lower than in the rest of the country, while polygamous marriages are far above the national average - 48 percent as compared to 27 percent nationally.

Migration - both within the district, and between Karonga and other districts - appears high. While the reasons for migration into the district were not investigated, the serious flooding of the lakeshore areas in 1980, which necessitated the shifting of large numbers of people to upland areas, was the prime reason for migration within the district. Water levels have since fallen and reverse population movement has also taken place. As a result of these migrations, and the fact that households often have land in more than one area, it is difficult to establish precise population figures.

The mainstay of the district's economy is agriculture, with maize, rice, cassava and groundnuts as principal crops. Irrigated rice was first introduced into the area in 1968, and the production of the rice schemes in the project area has contributed towards making Karonga one of the most important rice producing areas in the country. In addition, Karonga has one of the highest populations of cattle per head of any district in Malawi. As regards distribution, it has been estimated that 42 percent of households in Karonga keep cattle, while 85 percent keep some kind of livestock (as compared to 78 percent for the whole country). Although its proximity to the lake might suggest otherwise, fishing is, nevertheless, not a main occupation, with only 4 percent of households claiming this as a principal activity.

Agriculture also provides the main source of income. The harvest (sometimes in connection with other sources) was reported as the main income source for nearly three-quarters of those interviewed in the baseline survey. Additional sources of income are salaries or wages from jobs such as school teacher or other government employment. Smuggling appeared to be a major but under-reported factor in the household economy. The Baseline Survey Team suggested that the remuneration from smuggling made a significant contribution to the relatively high income levels of the people of Karonga District.

Existing domestic water supply - before the advent of the Project - was limited mostly to unprotected 'traditional sources' (the Lake and open wells), plus a network of Climax pumps installed on boreholes. Most of these pumps - which were scattered throughout the project area - were permanently out of action. Government (the Department of Water Affairs) was responsible for their maintenance but did not possess the capacity to keep the pumps operational (lack of funds, technicians and spare parts, etc.).

1.2 Donor involvement

In April 1984, the Government of Malawi requested Danida to finance an 'integrated rural groundwater supply project' in the northern lakeshore district of Karonga. The primary objectives of the project were to improve the living conditions of the estimated 60,000 inhabitants of the two Traditional Authorities which constituted the proposed project area, by supplying clean and potable water which would be reasonably accessible to the people. Each household was to have a maximum walking distance of 500 metres to a waterpoint, while each waterpoint would serve a maximum of 250 people and be capable of providing 27 litres of water per person per day. As objectives, these were very similar to those of thousands of other water projects being designed during the early 1980s.

The technology to be used was decided on during the planning phase: boreholes (machine-, or hand-drilled, or rehabilitation) fitted with handpumps (two models - the Afridev and the Bucket Pump).

It was foreseen that the project would further enhance basic living conditions in the area by virtue of its 'integrated' nature, which would incorporate complementary components such as sanitation (with the introduction of sanitation platforms, or sanplats), and health education. These additional components will not be discussed in great detail apart from remarking that they formed part of a package approach. In addition, it may be mentioned that the project successfully utilized local drama and drama groups as an integral part of the health education component. Soil conservation activities, which were introduced at one stage, later developed into a separate project under the Department of Agriculture.

A critical aspect of the Project was seen as being the introduction of village level (community) operation and maintenance of the waterpoints. The concept, known by its acronym VLOM, was very *à la mode* during that period, except that nobody really knew what the concept involved. It was assumed, at the time, that by choosing a pump technology which claimed to be VLOM, that this would be sufficient in itself to secure that the community would automatically be capable of operating, maintaining and managing its own water supply.

Part of the lesson had been learned, however. A style of community involvement was practised from the very start of project activities; one which included involving traditional leaders in discussions pertaining to activities which would take place in their village. However, the responsibility which was to be given to the villagers was relatively minor:

- the pump committee and villagers will be given talks with regard to cleanliness at the pumps, on checking and tightening bolts on the pumps and on exchange of minor parts (*Plan of Operations, November, 1987*).

This would fit into a wider maintenance structure, where government personnel (the Maintenance Assistants) would actually be responsible for pump repair. Danida funds would contribute to the establishment of this maintenance system which would gradually (over a five year period) be fully financed by the Government of Malawi. The possibility that the villagers themselves ould eventually take over the full responsibility for operation and maintenance of the waterpoints was not raised at this stage.

The 1985 Danida mission which appraised the proposed project agreed that this was an appropriate project requiring urgent development activity, the reasons for the urgency being that most of the existing 108 boreholes in the area required rehabilitation and that 43 percent were polluted with faecal material. The Government Agreement between Denmark and Malawi was formalized in 1985. This visualized a three-phase project (preparation, execution and operation), where the operation phase would overlap with execution, and run from 1988 until 1992. Subsequent Project Reviews later extended the 'operations' phase to 1994.

1.3 From implementation to operation and maintenance

According to the initial project agreement, as incorporated into the Plan of Operations, the management phase was to end on 31st December 1990, at which time all external assistance was to have been withdrawn. After this period, donor involvement was supposed to have been limited to financial support - on a declining scale - to the Government of Malawi's maintenance budget. All financial support was to have terminated in 1994. This changed as a result of the 1989 and 1990 Project Reviews.

In reality, the Project's implementation phase focused principally on the achievement of physical targets: number of boreholes drilled, number of pumps installed, etc. It was only towards the end of this phase that the implications of handing the pumps over to community management began to be realized. The turning point came at the time when many of the technical problems surrounding the implementation were beginning to be solved and the Project started to consider the mechanics of handing over. It was then realized that earlier assumptions related to operation and maintenance were not sustainable. Only at this stage did operation and maintenance start to become an issue. From this point on, the project started its attempt to reformulate the VLOM concept to a community-based approach, rather than a technical concept tied to a particular piece of hardware.

This break from the traditional approach came in 1990. Following a Danida Review, the primary focus of the Project changed to one where priority was given to setting up a sustainable operation and maintenance system. Implementation activities - the drilling campaign, pump installation, etc. - continued, but focus turned to the development of a future maintenance system. This change was also reflected in project staffing. The technical focus of project management was replaced by an emphasis on interpersonal skills and the budget was revised to extend management support into the operation and maintenance phase. At this time too, a decision was taken to start shifting responsibility from the Project to the community, rather than handing over responsibility to government agencies. Traditionally, 'projects' had handed-over to government after a period of implementation, on the assumption that government would then take over responsibility for securing future operation and maintenance.

It was felt that this approach, having proved unsuccessful in other projects, should not be followed in Karonga. Rather, a new approach was suggested, which meant deviating from the original

project concept. This approach was based on the conclusion that government, by its nature, cannot be expected to involve itself successfully in the myriad activities of village life, certainly not on a sustainable basis. Therefore, as stated in the 1990 Review report, if water supplies are to be kept operational then:

> operation and maintenance for reliable service require delegation of such responsibilities to the lowest possible level.

This is easier said than done, mainly because communities have both little experience with managing facilities traditionally seen as belonging to government and misgivings about their own lack of capacity and experience, but also because government departments and expatriates in donor-supported projects, generally speaking, share the villagers' own views that 'simple peasants' cannot be entrusted to manage and repair even the most basic kind of equipment.

Figure 4: *The community **can** be trusted - community members removing pumprods and rising main.*

This attitude is not found only in the water sector, but is a frequently observed phenomenon. Everybody working with development projects has witnessed the 'expert' becoming impatient with the fumbling attempts of a villager, taking up the tools, and making the repairs himself ... and then driving away, maybe never to come back to that village as there are no funds left in the budget for fuel. Or, if he returns and the pump is broken again, saying. 'see, didn't I tell you they couldn't manage'.

The traditional project sequence - on which the original project Plan of Operation was based - is shown in the diagram at Figure 5, in comparison with the recommended model based on the experience of the Karonga Project, which is discussed in more detail in Chapter 7.

VLOM SEQUENCE	
Traditional	**Recommended**
- Preparation - Mobilization - Construction - Handover	- Preparation - Technical and Social Mobilization - Establishment of VLOM System - Construction and Simultaneous Handover to Users

Figure 5. Alternative project sequences.

It should be noted that neither the 'traditional model' nor the 'recommended model' were ever fully implemented by the Project. The Karonga Project has ended up as a hybrid between the two approaches, combining an overlap of the traditional approach with the recommended approach. As operation and maintenance only started to be given serious consideration in project thinking towards the end of the implementation phase, a number of activities had already been set in motion which made it impossible to follow the course which - with hindsight - would have been preferable.

1.4 Key project data and events

Danida provided the funds for project implementation and, together with the Government of Malawi, funds for the first five years of the operation and maintenance phase. For the first year of operation and maintenance, Danida provided 100 percent of the costs, while in year five (1994), this had been reduced to zero. The government also provided funds for implementation and operation and maintenance through paying the salaries of local staff.

Following the 1990 Review Mission, Danida's role was extended into the operation and maintenance phase through the continued provision of technical assistance, principally in the form of a two year extension of the management contract. This included the monitoring and evaluation of the project, as well as the continued funding of an expatriate Project Coordinator. Apart from the regular formal project reviews (1988, 1989, 1990, 1992), Danida was involved in a regular backstopping of the project, both with regard to the sociological as well as the technical components. The interaction between external donor, national government and project organization was the key to the flexibility which allowed for the project to evolve through time.

The project time frame, with key dates and data is shown below.

Project time frame - key dates and data

1986	Initial village inventory of existing boreholes, and population census of the project area.		
1987	Plan of Operation formulation and technical mobilization.		
1990	Completion of borehole rehabilitation and drilling programme, with simultaneous installation of pumps.		
	Final Result	75	rehabilitated
		95	hand-drilled
		133	machine-drilled
	Total	**303**	
	Of these, 295 were fitted with Afridev pumps. The rest were fitted with Climax pumps due to the requirement of pumping into overhead tanks at institutions (clinics, livestock stations).		
1990	First formulation of VLOM system.		
1991	Handover of pumps to communities and introduction of VLOM to communities.		
1992	Opening of retail outlets for spare parts.		
1993	Wholesale chain for spare parts operational.		
1994	External support to Project ceases.		

2. *Technical Considerations*

2.1 Handpump selection

At the inception of the Project, decisions had to be made regarding the type of handpump technology to be installed. The main factors considered in this connection were:

- ***Lift requirement***
  Within the project area the exploitable groundwater table varies from 2 to 3 metres below the surface up to a maximum of 40 metres. Theoretically this would mean that the project could have used handpump models of all three lift categories (suction, medium and deep). Instead, in an effort at standardization, the project installed Afridevs on all its boreholes, even at shallow depths where its performance is less than ideal. An Afridev installed to serve suction and medium lift ranges will be more expensive to operate (cost per litre) than a pump designed to operate within those parameters, while giving less water per stroke.

- ***Water quality***
  Analyses and practical experiences from the field indicated that it was not necessary to take special action against corrosive water. Groundwater will always be corrosive to some extent but within the project area it was at a level which would not create any major problem. Situated within the African Rift Valley system, other problems could have been expected. Sulphur and salt did occur in certain places, and fluoride was a definite problem in some of the boreholes.

- ***Ease of maintenance, investment cost and running cost***
  The fact that the project was supposed to operate after VLOM principles meant that an 'easy-to-maintain' pump was required. Likewise, running costs should be at a level where users would be willing to bear the running cost, whereas the installation cost was of less importance as this was being borne by the donor. The actual cost of the handpump was probably seen as being of secondary importance as, firstly, handpumps were being provided under an external grant and, secondly, compared to the costs of drilling boreholes, handpump costs are much less significant. Selection of a cheaper pump would have had only a very limited impact on total construction costs.

- ***Reliability***
  Only a reliable pump will be able to meet the expectations of the community. That meant that the pump should have a high degree of annual operation days. In this connection the *number* of breakdowns is less important than the *time and cost* which it takes to bring the pump back to normal operation.

Other points could easily be added to this list, such as: community acceptance, technical capacities, reliability of government support services, spare parts quality and availability, local manufacture, etc. Perhaps with all the above points in mind it was decided centrally (by the donor and the government) to select the Afridev handpump as the main pump of choice for the project. It may also be that only some of these points were considered in making the decision but that the final choice was made based on less obvious criteria. Certainly what is clear from project documentation is that it was felt important to choose a pump which was described in the literature as being VLOM. In addition, it was decided that a number of so-called bucket pumps should be installed for testing and demonstration purposes.

Figure 6: The Afridev handpump.

2.2 Design changes in the Afridev handpump

At the end of the day, the selection of the Afridev handpump proved to have been the right decision. However, the choice of a handpump which had not been fully tested and developed when it was chosen, did result in a number of problems. Handpump design changes meant that, on more than one occasion, the project had to replace various parts in all pumps already installed. This also influenced the community's attitudes and expectations as to what the project was supposed to deliver. These changes in the standard specifications, which were actually part of the pump testing process, were not always communicated to either the Water Department or to the project. Thus, while Malawi had 'standardized' on the Afridev, this became rather meaningless when replacement parts started arriving in the country with 'standard' specifications different from those of the pumps which were already installed.

The history of the design changes related to the Karonga Project is summarized below. It is worth labouring this point because it underlines the technical approach to VLOM taken by the UNDP/ World Bank Handpump Project, which often proved to be at the expense of the community approach to VLOM.

Design changes to the Afridev pump installed in Karonga

1. ***Pump rod centralizer***

   The original pump was supplied with a pump rod centralizer of a design which proved not to be appropriate. This rubber part with a metal inner part would, after some time, wear down and the metal part would be exposed and start scratching, and eventually ripping, the PVC raising main. This part had to be replaced by a new rubber part without metal. This problem caused a number of perforations of the rising main. The repair of these faults and supply of new centralizers was carried out by KIP on all installed pumps, as a kind of guarantee work.

2. ***Rod hanger***

   The original design was based on pump rods being connected to the rod hanger by a threaded connection. This was superseded by a design where a bolt clamps the pump rod to the rod hanger. Again, this involved returning to the pumps and replacing the old design hangers with the new designs in all cases where these had already been installed.

3. ***Length of pump rods***

   The replacement pump rods are shorter than those initially installed and, as a result, are not interchangeable with the present design. If an old pump rod is replaced with a new one, the plunger will move 12.5 cm upwards for each pump rod replaced.

None of these design changes were ever communicated to the Karonga Project or to the government; they were noticed only when the new parts started arriving in Karonga. Nonetheless, the project took upon itself the responsibility to ensure that all pumps conformed to a uniform 'standard design' before the Project was closed down.

These design changes raise two groups of issues:

1. Is it possible for a project to build up confidence in a community when the community sees project staff regularly replacing and repairing pumps? And will communities have confidence in a pump for which it has been necessary to replace parts (for all the pumps installed) several times? The experience of introducing VLOM in Karonga showed that this did indeed make community confidence-building more difficult and this kind of approach is definitely not recommended.

2. How will communities manage design changes like this after withdrawal of the project? Community capacity to do this is doubtful; it is therefore suggested, under Lessons Learned in Chapter 6 below, that the government's role must be to protect these consumers by preventing the uncontrolled introduction of changes - even if they reflect engineering breakthroughs - which rock the basis of community VLOM.

2.3 The bucket pump

As an alternative to the Afridev, the project proposal also called for the installation of a few pumps of an alternative model, the so-called bucket pump. This was seen as a possible alternative to the Afridev for smaller communities where maintenance capacity and ability to pay were likely to be more limited, and where the groundwater table was not far below the surface.

Figure 7: A forlorn, disused bucket pump.

One of the ideas behind this was to investigate the possibilities of establishing private sector capacity for drilling wells by using hand-operated rigs and fitting these wells with the bucket pump. The idea was never implemented in any systematic or serious way. The pump was rejected on the grounds that the windlass was classified as 'unsafe' for young children and the handling of the bucket and chain may result in a degree of contamination. No attempt was made, during the project's implementation phase, to experiment with this pump in order to see, for example, whether it was a more appropriate technology for smaller communities or whether it was more appropriate for certain hydrogeological settings. No experience was gained as to whether it would have been simpler, cheaper or easier to maintain than the Afridev. Although the project did experiment with an unfinished and unproven Afridev pump - and probably contributed to its development - the same effort was not put into investigating the possibilities of the bucket pump. Fortunately, this was done elsewhere by other projects. A more detailed description of the bucket pump technology is given in Appendix 2.

2.4 Pump installation

The Afridev pump is installed on top of a drilled tubewell, around which a pump platform is built. The platform layout was designed bearing in mind that a number of water-related activities should take place at the pump side, notably laundry. A quite substantial washing slab therefore formed part of the installation, together with an extended runoff, or drain. Considerable effort went into designing this washing slab, the final design being a joint effort between the project and a women's group in Karonga.

Figure 8: Afridev pump installation.

Although it was expected that many water-related activities would take place at the waterpoint, some which might have been expected to take place were not catered for in the design, especially the watering of livestock and washing or bathing. The latter are fairly well controlled by the pump committees through byelaws which prohibit washing at the waterpoint. However, these byelaws cannot prevent livestock watering, which results in a concentration of animals around the waterpoint during the dry season, with the ensuing pollution. There is no reason why such activities should not be carried out at the waterpoint, if demanded by the community, but the construction, management and maintenance of suitable facilities need to be a community responsibility. The solution does not lie in banning these activities, which is impossible, but in incorporating them in the planning stage during the discussions with the community on siting, ownership and design of the waterpoint and its environs.

3. *Project Organization and the Institutional Environment*

3.1 The institutional environment in Karonga

The Karonga Project fell under the auspices of the Water Department within the Ministry of Works and Supplies. The Water Department is headed by the Controller of Water Services and has formal responsibility for the supply of treated water in urban centres and protected piped water or groundwater to rural areas. The Department is divided into two divisions, namely, Water Resources and Water Supply.

Within the Water Resources Division, the Groundwater Section is responsible for all groundwater activities in Malawi. With the shift from implementation to operation and maintenance, these responsibilities started to shift towards the districts. Initially, operation and maintenance was seen as linking in with existing administrative structures within the districts. At the district level, the ultimate responsibility was seen to lie with the District Development Committee, as the coordinating body for all development activities in the district. An overview of the project level organizational structure within Karonga District is given in Figure 9. Reporting was done to the Water Department in Lilongwe as the lead agency, with copies to cooperating ministries at headquarters and regional levels. It was difficult to achieve the direct involvement of other ministries at either national (policy) level or local (implementation) level in a situation where limited recurrent budgets made fieldwork difficult.

The composition of the District Development Committee was revised in the light of the new multiparty environment following the 1994 elections. The District Commissioner remains chairman, while members include the district chairpersons of all political parties, chiefs, heads of government departments, religious leaders and representatives from the business community. These changes took place after the cessation of external support, but the Third Sociological and Technical Monitoring Exercise, which took place prior to the elections but after Malawi had opened up for multi-party democracy, found that the switch is likely to enhance the sustainability of the operation and maintenance system, as it follows a similar switch away from single party membership of Village Water and Health Committees (VWHC) and Pump Committees (PC). Although local government organizations will continue to exist in the future, it can not be assumed that the existing local government system will necessarily continue in its present form.

3.2 Project organization

The Karonga Project existed as an independent unit within the Water Department, reporting to both the Water Department and Danida. Throughout both the implementation and the Operation and Maintenance phases it was headed by an expatriate project manager/coordinator.

During the Construction Phase, the Water Department provided the Deputy Project Manager and the drilling supervisor, plus junior staff involved in various project activities (rehabilitation of boreholes, hand-drilling, pump testing and installation, as well as administration and accounting). On completion of construction activities, and in line with the overall aim of handing increased responsibility to the communities and phasing out government involvement, staff returned to the Water Department, which redeployed rehabilitation and hand-drilling crews and rigs to other parts of the country. A Senior Maintenance Assistant was then attached to the project for Operation and Maintenance activities.

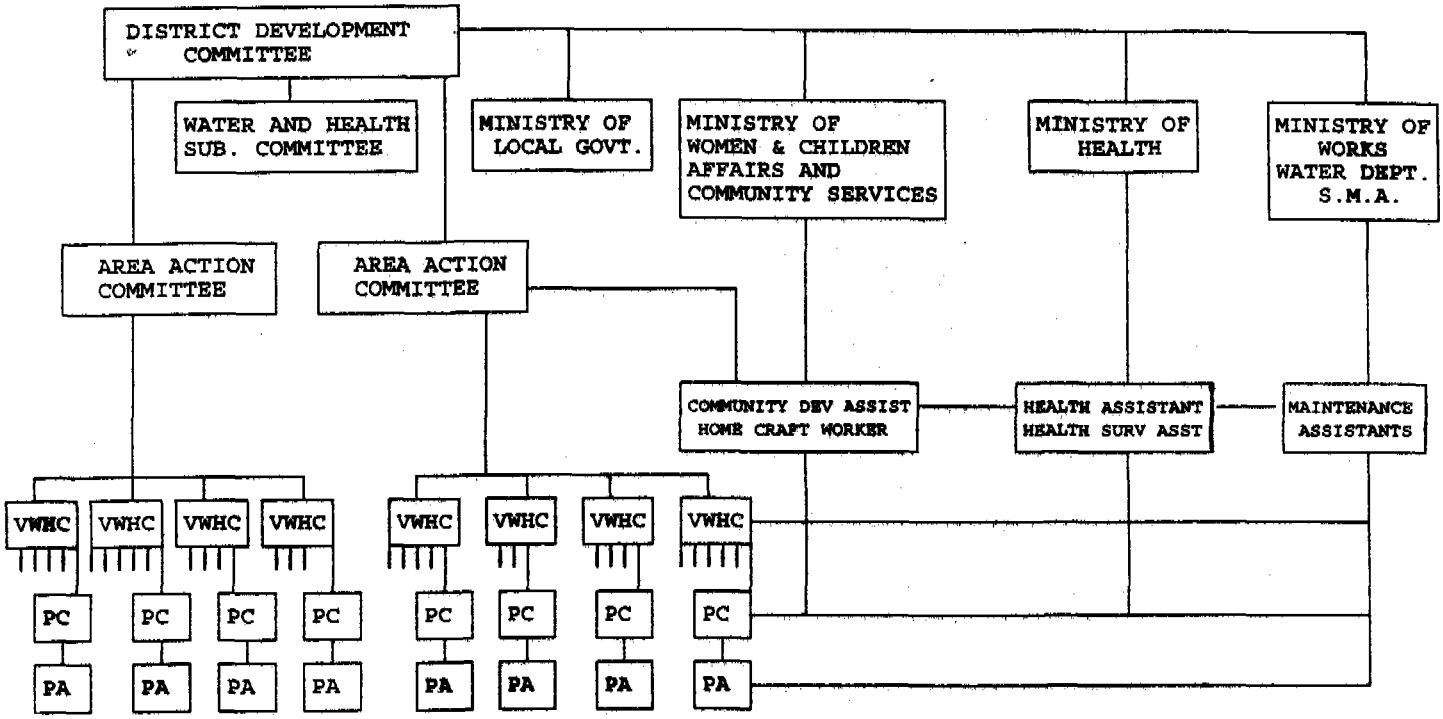

Figure 9: Project organizational structure.

The Senior Maintenance Assistant, together with four Maintenance Assistants and two Community Development Assistants, spearheaded the change in focus away from construction towards operation and maintenance by becoming the project's main link with the communities. However, their role was limited to facilitation and support in building community capacity, rather than direct 'hands-on' involvement with the pumps. Maintenance Assistants were not allowed to carry out repairs themselves, but were expected to help those responsible and show them how to carry out repairs. In parallel with this shift of emphasis came the involvement of the private sector in the marketing and sale of spare parts.

3.3 Construction Unit

Design, planning and supervision during the construction phase were project responsibilities. Other activities, notably the hand drilling programme and the concomitant testing and modifying of the Vonder hand-drilling rigs were also carried out. The machine drilling activities were tendered out to a Zimbabwe-based drilling contractor. Here, the project was responsible for borehole design and for supervising the contractor's activities, including final pump testing of boreholes.

Responsibility for the construction of superstructures (i.e. pump pedestals, aprons, washing slabs and soakaways) was shared between the project and the community. The communities provided the burnt bricks, collected sand, stones, gravel and water, and also assisted the project mason with construction and curing the concrete of the finished structure.

Pump installation was also a shared responsibility. Installation activities were carried out by the project with assistance from the community. The initial training of Pump Attendants and Pump Committees was part of this activity.

3.4 Community Mobilization and Training Unit

This Unit was headed by the Community Participation Coordinator and a core staff of two Community Development Assistants assigned to the project. They worked with extension staff from their own and other ministries stationed in the District, who were trained by the project and provided with bicycles to assist their mobility. Although government field staff were badly paid, and received little supervision from their parent ministries, it was felt that to pay them from the project budget would create a non-sustainable situation. This meant that, in practice, field staff from other departments provided very little active support to project activities. This underlined the project's belief that the main focus of training had to be at community level, giving the community the essential skills to allow them to manage on a daily basis without government support. The District Development Committee was trained twice, but the main focus of training activities was on the Village Water and Health Committees and the Pump Committees and Pump Attendants.

During the Operation and Maintenance Phase, the project's own Maintenance Assistants had to take on the community mobilization role, rather than a traditional pump maintenance role. Their work became increasingly facilitative, supporting community efforts in pump maintenance and community management.

Figure 10: Training being carried out by Maintenance Assistants.

3.5 Maintenance and Monitoring Unit

In addition to their facilitative and supportive role to the communities, the four Maintenance Assistants, supervised by the Senior Maintenance Assistant, monitored the implementation of the operation and maintenance system. For maintenance and monitoring purposes, the project area was divided into four zones. One Maintenance Assistant was stationed in each zone, where distances were short enough for them to do their rounds by bicycle. They followed a planned schedule which was communicated to the Pump Committees and Pump Attendants. The communities knew when they would be coming and could ask questions and get help. Initially, these visits took place once a month. After two years this changed to every quarter. The purpose of these visits was two-fold; first, to support the communities with encouragement, and secondly, to carry out technical monitoring of the state of the pump and the repairs which had been undertaken.

Another aim of these visits was to promote the purchase of spare parts on a purely commercial basis. Initially, the Maintenance Assistants carried fast-moving spare parts with them, while other spares were available at their duty station. To introduce the idea of paying for the service, the prices of spares carried were more than those of the same items when bought from the office or duty station outlet. The four spare parts stores in the Maintenance Assistants' offices were seen as a first step in familiarizing users with the concept of taking charge of their own pumps and becoming financially responsible for their maintenance. Subsequently, retail outlets were established in fifteen village shops, ensuring that 95 percent of the Pump Committees had less than 5 kilometres to travel to the nearest supply point for essential fast-moving spares. Once private retail outlets were established, sales by Maintenance Assistants were stopped to avoid competition. This was part of the strategy to shift the dependency relationship away from government services and to underline the fact that buying through private outlets would, in the long run, be more reliable.

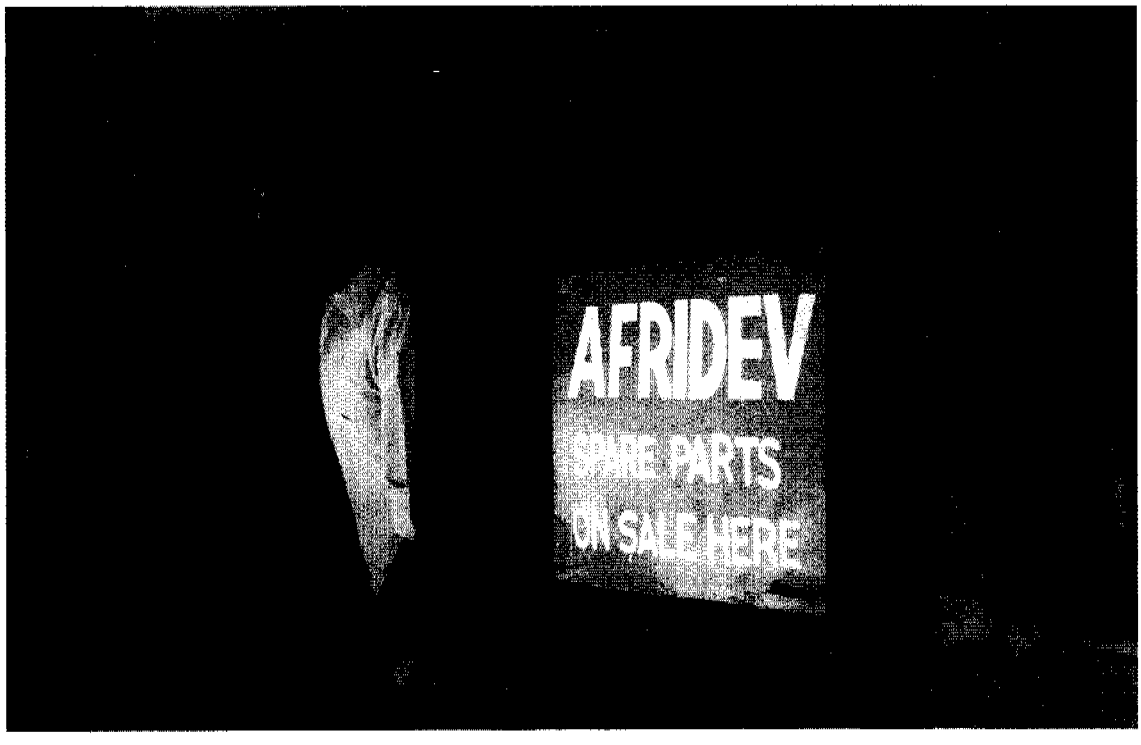

Figure 11: Local sale of spare parts.

3.6 Centre for Social Research, University of Malawi

The Centre for Social Research (CSR) of the University of Malawi was heavily involved in the Operation and Maintenance Phase of the project. Although it had not, unfortunately, been asked to carry out a baseline survey prior to the project's inception, the CSR was contracted at the start of this phase to carry out a series of sociological studies, beginning with a baseline study in April and May 1990, followed by three sociological monitoring exercises in 1991, 1992 and 1993. The results of these monitoring exercises, combined with the ongoing technical monitoring described below, fed directly back into project management and design.

At the start of these activities, the CSR saw itself very much as an external and academic institution. This changed over time as it became more involved in the project as its internal sociological monitoring arm, enabling monitoring information to be used directly to influence project activities. As time went by, the CSR also developed an understanding of the concept of VLOM and of its own role as a team member rather than an academic observer.

The advantages of using a local institution for this exercise cannot be emphasized enough. Although capacity problems at the Centre meant that advisers seconded under a UNICEF support programme took a large share of the responsibility for research implementation, the fact that the capacity was in the country meant that much more flexible working arrangements could be devised. This suited both the project and the CSR, and meant that a link was created between two Malawi-based institutions. This flexibility would not have been possible if the research activities had been contracted to externally-based agencies.

3.7 The monitoring and evaluation system

This was an integrated technical and sociological monitoring and evaluation system. Technical monitoring was carried out by the Maintenance Assistants attached to the project, while sociological monitoring was undertaken by the Centre for Social Research. The technical monitoring system had the following features:

- it was simple (the questionnaire used is reproduced at Appendix 4);
- the results from each exercise could be computed in two days by the project management in Karonga;
- the results were available by the end of every month;
- the results were used extensively as a management tool and provided the basis for monthly discussions with the Maintenance Assistants, which gave both the Maintenance Assistants and project management a clear picture of what was happening in their area and provided an agenda for discussion.

The results of the technical monitoring were included in all the project's monthly and quarterly reports, while the results of the combined monitoring exercises were integrated in Sociological and Technical Monitoring Reports. The indicators on which the sociological monitoring exercises were based are presented in Appendix 5.

The monitoring and evaluation system thus combined quantitative information with in-depth qualitative research on a regular basis. The results guided the project towards changes in its approach, not only towards the community, but also towards its own staff, government agencies and even the pump manufacturers.

4. *Sustainability*

4.1 A modest definition

Sustainability of project outputs after withdrawal of external support is what most projects strive to attain. What exactly is covered by the term? As a concept, 'sustainability' has been bandied about at a theoretical level. Put crudely, the discussion can be placed between two extremes: is a project sustainable if it can replace itself after, say, ten years lock, stock and barrel (i.e. capacity to effect a complete replacement of both pumps and boreholes); or is a project sustainable if communities merely succeed in maintaining and keeping the pump working during that same period of time?

Even the favoured definition of sustainability provided by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) and adopted also by Danida does not settle this argument one way or the other:

> A development programme is sustainable when it is able to deliver an appropriate level of benefits for an extended period of time after major financial, managerial and technical assistance from an external donor is terminated.
>
> (Danida, 1993: *Guidelines for evaluation of the sustainability of projects in the water supply sector.*)

The use of the term 'sustainability' in the present document tends towards the lower end of the scale of ambitions, namely, keeping the pumps operational and maintaining them as and when they break down. The 'lock, stock and barrel' approach tends to move the concept out of the water supply sector and to place it fairly and squarely within a national developmental context; in other words, 'sustainability' becomes a function of overall national economic development instead of a community's capacity to sustain a localized, sectoral development project.

While the Karonga Project established a regular procedure for monitoring sociological and technical indicators, it did not see as its role the monitoring of national development indicators; rather the monitoring system focused on localized, sectoral indicators to measure 'sustainability'. After handing over the installed handpumps to the users, a monitoring period followed, during which the project attempted to measure whether the pumps would keep functioning within the Karonga-style VLOM context.

The aim of the project was to ensure a constant and regular water supply to those communities in Karonga served by the project. The key indicator was whether or not communities were able to collect reasonable quantities of water from the pumps on a regular basis. One way in which the achievement of this objective could be measured was by observing how many pumps were in operation at any given time. Over an extended period of monitoring, the results were very positive.

Throughout the monitoring period, between 95 and 97 percent of project handpumps were always operational. At the time of the September 1993 monitoring exercise on which these figures are based, all pumps had been in installed for more than two and a half years, with the oldest pumps having been in operation for more than five years. Out of a total of 295 pumps, the

maximum number out of order at any time was sixteen. Three of these were continually out of order: one only yields water during the rainy season, and two have been non-functional as a result of a dropped rising main and lack of fishing tools. The remainder were temporarily out of order due to mechanical faults and, in general, were repaired before the next technical monitoring took place.

The monitoring data collected have shown that, over time, user groups have built up the required self-confidence to carry out the required repairs without external assistance. Here it should be noted that the essential element is not the degree of simplicity or complexity of the technology; rather it relates to user group confidence in themselves and in the ability of 'their' Pump Attendants. Whether user groups can afford to bear the running costs over a longer period still remains to be seen. The critical item here appears to be external to the community, notably the guaranteed local availability of spare parts supplied through the private sector. This part of the VLOM system remains to be tested over a longer period of time.

4.2 Confidence building

Confidence in their own capacity, rather than technical skills, was seen as the key to sustainability at community level. The socio-technical monitoring exercise had revealed a lack of community confidence in their own capacity to manage what was being demanded of them in the terms of both technical skills and financial management. It was noted, for example, that at the start of the operation and maintenance period, the Pump Committees dissuaded the Pump Attendants from carrying out even minor maintenance because they lacked confidence in the attendants' abilities; a lack shared by the Pump Attendants themselves. Communities used to government taking on the role of 'patron', doubted their capacity to maintain pumps and sustain VLOM, given their conviction that they, themselves, would have problems carrying the financial and technical burdens.

This was recognized by the project, which commented that:

> it is important with intensive support during the initial period (of operation and maintenance), to ensure that users are not discouraged due to lack of experience.

Communities initially responded with surprise and dismay when the project started to hand over technical, financial and management responsibility to them. This shock had much to do with the existing dependency relationship and the feeling of suddenly being cast adrift. Could communities really afford their pumps? From this point on, the major focus of project activities became one of convincing communities that they did, in fact, have the capacity within themselves to take charge of the technology.

An issue of self-confidence was also a major factor in the financial discussion centred around the maintenance funds and the costs of spare parts. One may distinguish between three levels or sets of activities in this respect: first, there is a theoretical willingness and ability to contribute funds for pump maintenance; secondly, there is the actual collection of money and the establishment of a maintenance fund; and thirdly, there is the utilization of these funds for pump repairs. The third stage is clearly the most difficult.

The question of how to manage community funds after collection has been fraught with complications, not only in water supply projects but in all development projects. Negative

experience from the past reinforces these difficulties. In Karonga, the issue of how to manage the use of funds was seen as being very closely linked to that of confidence in the ability of both Pump Attendant and Pump Committee. Hence, confidence building became the focus for training.

In the early stages of the operation and maintenance phase, communities also doubted their ability to raise sufficient funds to sustain VLOM. This was related, to a certain extent, to the circulation of the price list for spare parts for the pump. This price list included both the expensive parts which would need to be replaced only under exceptional circumstances, as well as the much cheaper fast-moving spares. Although contributing to community fears, circulation of the price list had two purposes. First, it gave the communities an idea of the total cost of the pump, to which, after all, they were not being asked to contribute. Secondly, it demonstrated that, if maintenance was not carried out, the pump would become increasingly expensive to repair. For example, if worn out bushings (costing 8 Kwacha) were not replaced, then the more expensive bearing (costing 100 Kwacha) would be destroyed. Thus, under normal circumstances, communities should have no difficulties in raising the funds required to keep their pumps working. No handpump is maintenance free. As with all handpumps, the Afridev's parts will also need replacement from time to time, with some parts needing frequent replacement. Luckily, these are also the cheapest parts.

An attempt was made to calculate expected breakdowns under normal operating conditions in order to assess the likely financial implications per pump and per community. Because of the community's own expressed fear of the costs involved in effecting repairs, the project encouraged the establishment of a Waterpoint Maintenance Fund which, assuming regular contributions, would ensure that there would always be sufficient funds available to meet most maintenance situations. Based on expected breakdowns, levels of contribution to a Waterpoint Maintenance Fund, were worked out. Encouragement was given to the communities to contribute to and manage such a fund. As such a fund was, initially, seen as an important indicator of a community's commitment to maintenance, the amount of money held in the Fund was originally included in the regular monitoring programme. This condition was later dropped; in any case, it was no longer a useful indicator, as communities had started to find their own ways and means of fund raising. This may mean, in cases where expensive repairs are required, that the pump may be out of action while funds are being raised.

There also appeared to be an encouraging willingness by local storekeepers to provide credit. As it is, only selected stores carry spare parts for the pumps; these stores were initially selected by the community because of the storekeeper's position within or involvement with the surrounding community. Community assistance in pinpointing appropriate sales outlets for parts seems to have had positive results. This suggests an alternative to the non-existent banking system. Although this has not yet happened, perhaps in future the selected storekeepers could look after the funds raised on behalf of the community. Expenditure could still be incurred with the involvement and signature of the responsible member of the Pump Committee and accounts could be left for inspection at the stores. However, even storekeepers have limited resources. Many of the shops in the project area are small and the owners have neither large profit margins nor significant amounts of cash to play with. Thus, while user groups and storekeepers may come to certain arrangements as regards the cheaper fast-moving spares, the financial implications related to the purchase of the more expensive spare parts are more difficult to resolve. The most workable alternative is to keep stocks of these at the wholesaler's regional warehouses.

Waterpoint maintenance funds - are they necessary?

In the past, projects have imposed Waterpoint Maintenance Funds on communities as conditions linked to pump installation. While the Waterpoint Maintenance Fund (WMF) may be a useful guide as to whether communities are preparing themselves for breakdowns, etc., the issue at stake is, who can be trusted to keep the money? The amount of money involved is too small to put into a bank account. In situations comparable to that of Karonga, the only alternative appears to be that funds are entrusted to appointed members of the community.

The project's monitoring reports noted that there was suspicion in some communities that money collected had been used for other purposes than for pump maintenance. In order to prove that there was money in the Fund, those entrusted with it had, in some cases, used it to pay for a community party. While this might cement community bonding, it is hardly conducive to maintaining a sufficient level of funds for pump repairs. Problems with inflation and unstable currencies may also discourage a community from holding too much money in a Maintenance Fund.

While funds in a WMF are an indicator, it is important to remember that communities may find alternative solutions which outsiders may not have thought of; and, on a point of principle, when the pumps have been handed over, the project can only make suggestions, not impose conditions - certainly not after project staff have been withdrawn.

The WMF is only one indicator as to whether the community has the capacity to maintain their pump. It is not a *sine qua non*; ultimately, the measure of success is whether the pump is working or not.

Finally, as regards affordability, some communities will have more problems raising funds than others. In particular, smaller, more remote, communities may have more difficulty raising cash than larger communities. On the other hand, being smaller, there is less wear and tear on the pumps.

4.3 Community institutions

During the early days of the project, efforts were made to ensure that village headmen and other traditional leaders did not dominate when the project made contact with the community, even to the extent of re-siting a borehole if, in the view of the project, it was too close to the village headman's house.

Two institutions, the Village Water and Health Committee and the Pump Committee, were set up in each of the villages covered by the project. These committees were intended to be responsible for water, health and sanitation activities as well as the administration and repair of the pumps. Initially, separate responsibilities were assigned to each committee by the project, with the Pump Committees being meant to defer to the Water and Health Committees. Members of these community committees were elected and membership was voluntary and unpaid. It is interesting to note that committee membership was not only drawn from prominent members of the community but also reflected the national political debate, especially the move towards multi-party democracy. Thus, while some of those elected held office in religious groups, both Christian and Muslim, members were also drawn from political groups, particularly AFORD (the Alliance for Democracy). In this could be seen a clear shift away from the earlier situation where many committee members also held office in the Malawi Congress Party when it was still the only legal party.

Village Health and Water Committees and Pump Committees were formed following elections at public meetings supervised by the Area Action Committees. The latter are sub-regional government committees falling under the District Development Committee, a government committee chaired by the District Commissioner. It was envisaged that Area Action Committees would be responsible for ensuring that the village level committees were functioning properly and to ensure that elections take place every three years. The first re-elections took place after handover of the installations at the start of the operation and maintenance phase - a process during which the project acted as a much more prominent facilitator than the Area Action Committee.

Cooperation with the Area Action Committees has not always been easy. Until the 1994 elections, this committee was dominated by the Malawi Congress Party. Under the previous government, Malawi was very centralized with local initiative strongly discouraged. This made it difficult for government committees like the Area Action Committee and the District Development Committee to do much more than implement directives from above. Village and community committees, and villagers in general, were suspicious of government intentions, if not downright hostile. In this situation, the project - seen as external to this power struggle - enjoyed more legitimacy than the government institutions with their appointed and *ex officio* members.

Theoretical divisions of labour between the Pump Committees and the Village Water and Health Committees had been drawn up by the project in the form of guidelines which were used during the training sessions. (The original and revised responsibilities for Village Water Health Committees and Pump Committees, as recommended by the project, are presented in Appendix 6). By and large, however, these guidelines were adapted by the users, with the committees developing their own *modus vivendi*. In practice, the Pump Committees, with their closer direct day-to-day contact with the pump and its users, have taken on a much more important role than was originally envisioned. For example, in many cases responsibility for the finances (such as management of the Waterpoint Maintenance Fund) lies at Pump Committee level, rather than at the Village Water and Health Committee level.

Sustainability ultimately relates to that which works best for each user group. To the project's credit, it has let these village-level institutions develop their own way of doing things. After all, whether the pump is functioning or not is more important than following slavishly a set of guidelines developed in an office.

4.4 Developing technical skills in the community

During the operation and maintenance phase of the project, priority was given to the establishment of sufficient technical skills within the community, rather than within government technical departments. The aim was to familiarize communities with the handpump, to de-mystify the technology as much as possible, and to build up community self-confidence in their own technical and financial management skills. The main focus of the training was on the Pump Attendants, who would have the daily maintenance responsibility. Whenever possible, members of Pump Committees also took part in the training sessions. The logic behind this was two-fold:

- First, by involving both the Pump Attendants and the Pump Committees in the training sessions, an attempt was made to convince the users that pump repairs were not something mysterious which only the Water Department's 'experts' could be entrusted with, but that the technology could also be mastered and managed by the community.

- Secondly, by providing training to as many individuals as possible, a certain critical mass of knowledge will be created within the community. This should make it easier to find and train replacement Pump Attendants when new ones are required. In fact, by the time the project withdrew, there were already some examples of Pump Attendants training newcomers to replace those who had left the job.

Every month, approximately 10 percent of the pumps installed have been repaired and maintained on an ongoing basis. All the repairs registered were done by the Pump Attendants, and included changing of u-seals, bearings, bobbins and pump rod centralizers. This shows that repairs which could be termed 'routine maintenance' can be undertaken by the user group at community level.

There is expanding confidence among the users as their awareness of their own ability to carry out repairs increases, and a number of communities do almost all repairs themselves. However, some repairs can still not be undertaken at community level, not because of a lack of user group capacity, but because the appropriate VLOM tools for certain operations have not yet been designed. For example, removal of broken pump rods still requires the removal of the rising main. Most of these repairs could quite easily be done if simple fishing tools had been developed; but developing appropriate community level tools is less interesting than designing handpumps, and the project faced a lot of difficulties in acquiring international assistance to carry out this work.

Figure 12: On-the-spot repairs to the rising main.

This underlines the earlier statement that the engineers working on this so-called VLOM pump have been more captivated with designing a handpump than with getting the technology to work within a community setting. VLOM has been seen as a technical challenge rather than a community activity. Operationalizing the concept was possibly not seen as being as exciting a challenge as designing and testing a new pump.

Eventually, a Malawi-based NGO, working together with the project, designed and perfected a fishing tool suitable for all complicated down-hole operations. By June 1994, when external support for the project was being withdrawn, development work on this tool, undertaken by Concern Universal, was finalized and the tool put into production for distribution to user groups. With the full range of tools now developed and available, Pump Attendants now have both the technical capacity and the tools required for complete operation and maintenance at the village level.

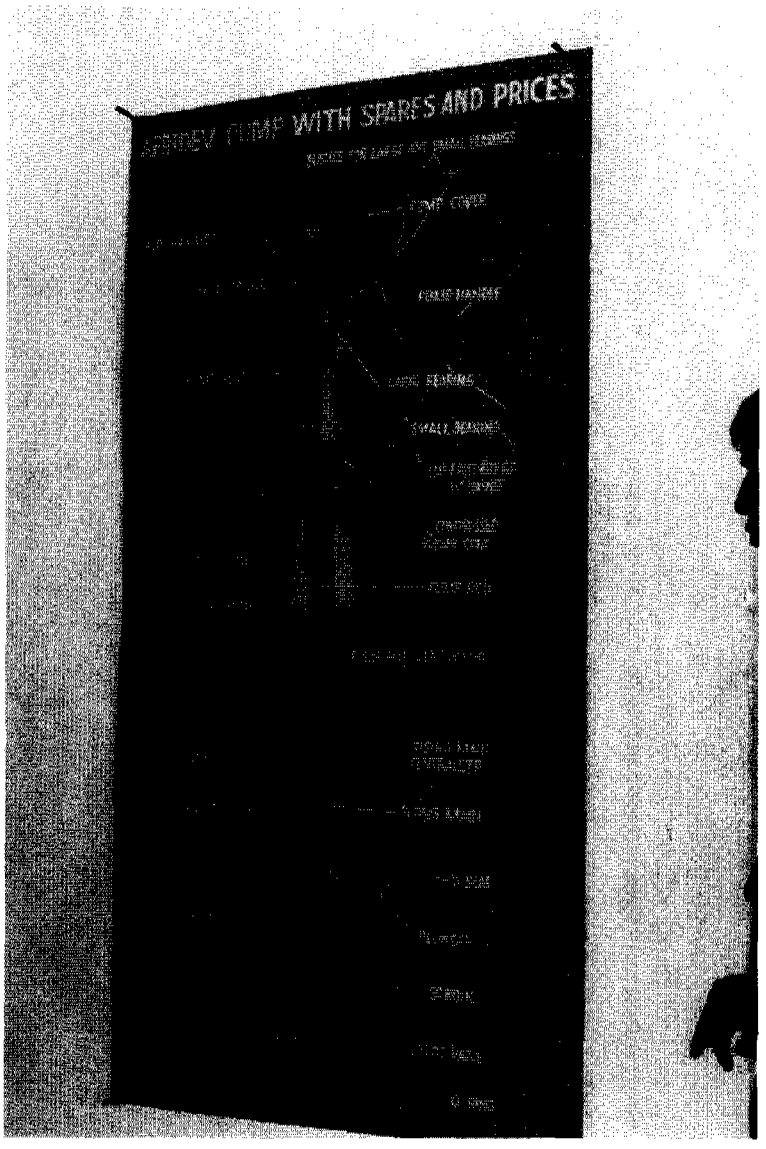

Figure 13. Diagram of the pump and its parts, and price list.

The skills built up within the project area, through both formal training by the project and informal training of one Pump Attendant by another, have so far been able to take care of all required repairs. It is worth noting that, the more complicated the technology, the more demand is put on an external backup organization, be it government or private. The Afridev is so simple that most repairs and emergencies can be handled by local Pump Attendants.

4.5 Supply and availability of spare parts

One of the basic requirements for VLOM is the availability of spare parts within a reasonable distance of the waterpoints. This process was facilitated by the project which ensured distribution and sale of spare parts while, at the same time, building up the capacity of the private sector to take this over completely. Initially the project itself set up four spare part stores within the project area, at the duty stations of the Maintenance Assistants attached to the project. In Karonga, the main store at the Water Department Yard supplied the three other stores as well as local consumers. Price lists were distributed to all Village Water and Health Committees and Pump Committees. Four large diagrams showing the pump, its spares and their prices were displayed at each store.

Organization of the sale of Afridev spare parts

Sales of spare parts started in April 1991. Initially, the project's Maintenance Assistants carried fast-moving spares on their monitoring trips as well as selling spares from the store at their duty station; spares sold at the pumps were sold at a higher price than at the duty station to encourage users to utilize the stores. Sales increased as pumps aged. The stores managed by the Maintenance Assistants were open every Monday and Saturday from 7.00 to 12.00 am, while the Karonga store followed government working hours.

With effect from October 1992, arrangements with fifteen village shops were concluded. Fast-moving spares such as u-seals, o-rings, bushes, bobbins and pump rod centralizers were supplied to these shops by the project, with shop owners receiving a 10 percent commission on sales. At this stage, the Maintenance Assistants stopped selling spares and concentrated on their training and monitoring tasks.

Village shop owners obtain their everyday supplies at two wholesale stores (the Chipiku Stores) situated in the Karonga District. A wholesale agreement covering all pump spare parts was concluded with Chipiku Stores Division in March 1993. An estimated one year's supply of spares for all pumps was transferred by the project (initially on commission) to Chipiku Stores, with the agreement that future supplies should be purchased from emerging local producers of Afridev spares or from the Water Department's central stores in the capital, Lilongwe.

With the introduction of a wholesale link, shop owners were required to purchase their supply of pump spares from Chipiku. Realizing that shop owners could not afford to invest in stocks, the project facilitated the introduction of this change by delivering to all fifteen shops an equal amount of fast-moving spares free of charge. This support amounted to K85.00 (US$ 20.00) per shop and functioned as start-up capital for a revolving fund.

Over a period of time, the project facilitated the complete privatization of the supply and sale of spare parts to the community, through an existing network of wholesale and retail outlets. Here also, the project saw its role as a transitory one, assisting with the development of a privatized retail network for spare parts and then pulling out when this was operational. This allowed the project to close its own sales outlets 18 months after they were first opened. The sequence of events is described below.

From the start of the operation and maintenance phase, privatization of sale and distribution of spare parts had been envisaged. The plan had been to introduce the sale of pump spare parts from already established village shops, which among their general assortment of daily necessities, also

carried bicycle spares. However, as these proposals were new, untried and untested, there was an understandable fear among these small shopkeepers that they were being asked to take on risky business. Therefore the project took the initial risks and, with the assistance of the user communities, chose those outlets in which the communities had most confidence.

In order for the distribution of spare parts to be privatized, shopkeepers had to be convinced that they would not lose money in providing a community service which, in the past, had been seen as the government's role, even though government had never been able to fulfil this role adequately. Pump Committees were generally satisfied with the new system, apart from having to travel to Karonga Township or Uliwa for the more costly or slower moving spares which the retail outlets did not stock.

In general, shop owners felt that stocking the parts was essentially a community service. Profit margins were regarded as small and had they not themselves been beneficiaries of the waterpoint, they would have been less willing to stock the parts. While turning down requests to stock the more expensive parts, feeling that this would compromise their cash flow, they all expressed a great willingness to continue stocking the parts they did have, i.e. u-seals, bobbins, bushes, o-rings and pump rod centralizers. Representatives of the national wholesaler also commented on the low profit margins from the sale of the parts. However, here also a willingness was expressed to continue stocking the parts because of the perceived importance of a functioning water supply. With the introduction of sales from village shops, consumer prices as charged by the project were maintained. With the involvement of the national wholesaler, Chipiku, a 12.5 percent commission is absorbed by the wholesale chain, while shopkeepers receive a 15 percent profit on sales. Prices to consumers remained unchanged over a three year period (April 1991 - April 1994).

Figure 14: Distributing spare parts through a national wholesaler.

Locally produced fast-moving spares are currently being manufactured at a price that would allow retail prices to remain stable. However, manufacture, distribution and sale of Afridev spare parts cannot be divorced from the overall political and economic situation of the country. It remains to be seen what overall effects the political changes taking place in Malawi as a result of the introduction of a multi-party system will have on the ground, not just in terms of water supply.

4.6 Monitoring and evaluation - a permanent information tool?

Monitoring and evaluation, as with other external institutional contacts with the user groups in the project area, may be characterized by its planned obsolescence, i.e. a useful but temporary function which is performed for a while but which fades away when it is no longer useful.

At the start of the operation and maintenance phase, the project's monitoring activities constituted an essential management tool. Results from both the monthly technical monitoring activities and the yearly sociological monitoring activities fed straight into project management and were used both as a method of increasing the commitment of the project's own field staff (notably the Maintenance Assistants) but also in addressing the user groups' concerns. These concerns related not only to technical aspects of the pump but, more importantly, to the community's own capacity to manage its maintenance.

The frequency of these activities was gradually reduced in keeping with the project's phasing out philosophy. However, some continued monitoring is necessary. It can be argued that it is a government responsibility to carry out such activities in order to be able to plan for the future. However, the burden must be light if it is to be sustained by government. In addition, the user groups should not be affected if these activities are not carried out. Following the completion of the project and the withdrawal of external support, therefore, only the most basic monitoring activities will be required, and these need not be very frequent.

4.7 The enabling environment

Clearly, the role of government as a provider is not sustainable. While donor assistance through government agencies has kept the myth alive during a transitional period, the role of the state in post-independence Africa as the provider of all goods and services is no longer viable. In the introduction to this chapter, a modest definition of sustainability was adopted, which was linked to the expectation that overall national economic performance would not have improved sufficiently over the coming decade to enable the country to replace all installations after a 'normal' lifetime using the country's own resources. It is anticipated that continued donor assistance will be required - and not only in the water sector.

This leaves the question: what role should government have? Is it an implementor or should it assure the 'enabling environment', for example through securing access to the required external resources for financing such activities as the drilling of new boreholes and ensuring the continued availability of spare parts? There is still a need for continued donor assistance in such areas, in the absence of sufficient levels of economic development. An alternative to this - instead of taking loans and thus contributing to increasing indebtedness and impoverishment - would be, for example, to retain local tax revenues at district level and plough them back into community projects such as water supply. Progress has been made with this approach in a number of African countries, particularly Uganda.

At the level of the user, considerable emphasis has been given to the minimalist role that government should play, in contrast to the key roles allocated to user groups and the private sector. Nevertheless, the government's minimalist role is still very important, even if it is performed at levels remote from direct contact with the user groups. The government has a key role to play in all issues concerning pump standardization and local manufacture of components, to ensure that consumers are both protected from design changes and, where appropriate, also benefit from them.

The aim of achieving pump standardization in the Karonga Project has been difficult. Although the project aimed to standardize on the Afridev pump, the question of which Afridev model should be regarded as the standard has not been satisfactorily resolved. As design mistakes were ironed out and technological advances made, new models with different specifications were introduced with spare parts which, though interchangeable, created new training needs. In many ways it appears as if the project was used as a testing ground for prototype models of a pump which had not yet been fully developed and tested.

It needs to be emphasized strongly that VLOM is, first and foremost, a question of *community organization* of maintenance and only in the second place, of the technology to which it is related. If design changes are continuously foisted on a community, it becomes very difficult to build up a maintenance organization which is sustainable.

Here again we find a place for the 'enabling environment'. There is a role for government, at the national level, in interpreting standardization and deciding which design changes to support. Even under privatization, there will still be a role for government in facilitating the smooth introduction of design changes. While it is accepted that improvements can always be made, their introduction should help the community rather than come as an additional burden.

Finally, government has a role to play in defining and monitoring water quality norms and standards, passing legislation related to water rights, setting drilling standards and vetting contractors.

5. *Conclusions and Lessons Learned*

5.1 Conclusions

The Karonga Project has combined a number of characteristics which have blended together into a rural water supply project which meets many criteria for sustainability. These are:

- a very simple and easily maintainable pump;
- an almost 100 percent maintenance capacity at village level;
- a poor community with a low level of technical skills;
- a privatized spare parts sale and distribution system, and;
- a government which seems to be committed to privatization.

The main conclusions from the project are that it seems possible to establish a sustainable rural water supply system which is based on users' own resources (organization, manpower, administrative and technical skills) and which is linked with a distribution system for spare parts supplied through private outlets (a one-tier system as an alternative to the two- and three-tier systems generally in operation). This may even be termed a 'no-tier' concept. In other words, some communities may be able to manage everything using the resources available within their own 'network'; others will be more dependent on 'buying' help from outside. But in order for this to be viable, there must continue to be certain support provided by the external (enabling) environment. This need not necessarily be provided by government. It will range from a supportive legislative environment to ensuring supplies of spare parts, but will vary depending on community skills and economic resources. Nevertheless:

> There are roles for government and there are roles for the private sector. Policy-making regarding handpump standardization is an important role for government in a situation where the private sector is not strong and where communities have neither a strong economic base nor great technical skill. It is less important where communities possess both economic resources and technical skills.

The key appears to be 'flexibility' and the avoidance of a rigid framework which defines to the last letter everybody's responsibilities. Rather, communities or user groups should be involved in establishing the framework or environment within which the project is implemented. In the Karonga case, the project provided the 'learning how to ride a bicycle function' and gradually withdrew support as confidence built up. A basic requirement for the system to function is user confidence in their own abilities to manage VLOM in respect to organization, finance and technical aspects. This can take time, and will be different for each intervention and for each user group.

In the case of the Karonga project, the building up of confidence was reached through training and support over a four-year period. This support was characterized by diminishing levels of intensity as confidence built up. In other words, a gradual phasing out, rather than an abrupt handover. But there can never be 100 percent withdrawal. There will always be a minimal role which external agencies - normally the national government or a regional administration - must continue to play. Support, in the sense of 'the enabling environment' should continue indefinitely - but the level of intensity may vary. The levels of intensity appropriate in Malawi may be different from what is required in other situations, such as Pakistan, Uganda or Denmark, but some form of external support can never be totally dispensed with.

The question is:

> at which stage should 'the project' withdraw and when should Government take up its role?

The project (with its external technical and financial assistance) is a catalyst with short term, high intensity capacity which is neither replicable nor sustainable by a government service - nor should it be. The 'planned obsolescence' - phasing out and handing-over - depends on the capacity of the community, rather than the government, to take over the management. This implies that some communities need less support than others and, by the same token, VLOM also varies between communities and user groups. One of the requirements of the project preparation phase should be to identify the strengths and weakness of communities and institutions. This then becomes the basis for the intervention strategy. Sometimes, when the community needs a lot of support, the 'project approach' may be the right one. When less, or different, support is required, or where government institutions are stronger, other approaches may suffice.

Flexibility in project interventions is essential. This can be linked to the discussions on 'blueprint' and 'process' approaches. The use of monitoring as a management tool requires funding agency flexibility and acceptance of immediate shifts from one budget line in the 'blueprint' to another. In some cases monitoring will reveal the need for additional budget lines and related funding in excess of the original budget. While donor and government procedures are most comfortable with a blueprint approach, this is based on the false assumption that all essential information can be gathered during the preparation phase and that implementation is not a dynamic process with unpredictable results. Rather, in the case of community-managed water supply, external support needs to be based on both a knowledge of users' demands from, and reactions to, the structures and function of the VLOM system introduced. These will vary between communities.

Again, these structures need to be set up as part of the discussion process with the community and the institutions (government and private). While external agencies (not expatriate but external to the community) may technically, and in all other ways, have more experience and expertise than the community, the fact that the community is supposed to take responsibility afterwards means that it also has to be involved in the discussions during the planning phase. Communities may be 'ignorant' but they are not 'stupid'.

Monitoring activities are part of this process. From very intense monitoring during early phases to low-level, low-key during later phases, the results need to be both useful and used if monitoring is to have any meaning. Monitoring at community level will have to start to give information on which the Pump Committee and the Village Water and Health Committee can take management decisions. This monitoring will particularly relate to functioning and use of the systems and to behavioural changes (water handling practices, etc.). The government will continue to monitor, using also monitoring data from the community committees for district and national planning and policy purposes, as part of the government's role in providing an enabling environment.

Government is also a source of information for what happens in 'the rest of the world'. Design engineers will not lay down their tools just because the people of Karonga are happy; they will continue within their own professional fields and some of their ideas may develop into superior technologies. At a certain stage, government should be in a position to say 'there is a major improvement in technology which we recommend and your pumps are starting to wear out ... so this is what we are going to suggest'.

Whatever government's role, if it were not carried out it should not hamper the daily maintenance of the pumps. At the same time, a certain level of involvement has to be maintained because society is not static. Communities change, expand, move, and develop, as does technology. A solution which is adequate today may be inadequate in 10 to 15 years' time. Planning for these eventualities is a government responsibility, as also is the provision or procurement of funds for new developments.

In some countries, government actually takes on the role of donor. Even where this is not the case, government agencies need to be involved with donors in the procurement of funds. This links back to the previous chapter's discussion on sustainability. Is it reasonable to expect communities to be in a position to totally replace their pumps ten years down the road, or even to expect Malawi, presently one of the world's poorest nations, to be in a position to replace their existing handpump stock without external donor assistance?

The remaining sections in this chapter take these conclusions as a point of departure. The lessons drawn from the Karonga experience are at several levels, and include lessons which were actually implemented during the project's lifetime, whilst others fall more into the category of lessons learned which need consideration when developing a VLOM system. Nonetheless, one lesson is that each situation is unique. Hence, these lessons are not a script to be slavishly followed but which should be drawn on where it seems applicable: if the shoe fits, wear it.

5.2 Community institutions and organization

The community institutions for VLOM need to be developed early, even before sites for the waterpoints are identified and the drilling campaign starts. In this way, community institutions can be incorporated into the planning process from the very beginning and one avoids the resistance towards full community responsibility that is still evident among some of the project communities in Karonga.

There is a fundamental difference between *advising* communities on the tasks involved and the kind of activities which they will have to undertake, on the one hand, and *dictating* that communities *must* have a Village Water Health Committee and a Pump Committee - each with specified responsibilities - and that all communities *must* have a Waterpoint Maintenance Fund in which there *must*, at all time, be a certain minimum cash amount available.

This can also be seen in the dynamics of institutional development. The Village Water and Health Committees and the Pump Committees, seen by the project as the main vehicles for community management of the pumps, have developed in their own different ways, as a result of the differing demands placed on them by the communities in which they need to function. Although the project had made terms of reference for them to start off with, it is a mistake to assume that a project or even a government institution can dictate to a community how to organize itself around the pumps. This is an important principle. Hence:

> Ownership of waterpoints, community participation and self determination will reduce the possibilities of funding agency preferences in relation to system capacity, distance requirements and selection of technology. It is important to take these issues up during the planning phase and not at the end of the implementation phase.

Finally, institutions which have been created initially to support pump maintenance may develop in completely unexpected ways. Self-confidence, ability to handle money and belief in technical capacity may become a basis for something which the project planners never imagined.

5.3 The cultural context

It is important to take the cultural context into account when designing or developing training needs. For example, the contradictions inherent in trying to make women actively part of all phases and aspects of VLOM, in a society where women are not known for their community management roles, need to be explicitly addressed. Instructions by the project as to the proportion of women 'required' in the community VLOM institutions went some way to ensuring the participation of women. However, there was a need to go further to ensure that women were actually able to participate in all aspects of VLOM, including the technical aspects, and to counter the natural conservative tendency within communities to confine women to their usual menial roles. The project conditions required women's participation and also obtained it. Pump Committees had significant female membership, and all pumps had at least one female Pump Attendant.

The point here is that the project took a position on the fact that it was desirable to have women participating as fully-fledged members, in the face of local opposition. Such a position can be taken by the donor or external agency as a 'pre-condition' for support if the donor or government agency feels strongly enough about a certain issue. It is not always a good thing to impose such conditions, and the implications of doing so should be carefully weighed.

Donors are the new missionaries of our times with their strongly held beliefs and messages: women's rights, multi-partyism, human rights, transparency, etc. Donors with the funds, the 'correct attitudes' and the 'flavour-of-the-month' are in a position to impose certain preferences which may go against established local traditions and beliefs. But unless there is a genuine change of attitude by their target groups, compliance will only be temporary and skin deep. An external agency (whether donor or government) can thus facilitate but not force acceptance of its beliefs and messages, whether they concern the involvement of women, human rights, or whatever.

On the gender issue, an external agency's position may also be supported by the choice of technology. A technology which is dependent on outside support for maintenance will relegate women to the role of sweepers of the pump surroundings, while one which can be maintained at the community level favours the integration of women into all aspects of maintenance, including management and the collection of funds.

5.4 Financial arrangements

There must be mechanisms whereby individuals who embezzle funds from the users can be dealt with by the users. The project recommended a number of safeguards in this respect, and these seemed to be in place and were generally followed. Records were kept of receipts and expenditures and accounts were presented to users; but, human nature being what it is, some thefts will inevitably occur. Communities will have to find their own response to this, but clearly, transparent accounting for funds collected is an important basis for apportioning blame.

Waterpoint Maintenance Funds are one way of controlling funds. Other methods exist also. What is important is that it should be possible for the community to access adequate maintenance funds

as and when these are required. The problem of financing spare parts may always remain a difficult problem for small communities which have been given a technology for which they have neither the financial nor managerial capacity. Waterpoint Maintenance Funds and Maintenance Assistant visits will not be able to rescue these communities.

Vegetable gardening, as a means of raising funds for maintenance, has been tried numerous times throughout the history of the project, but has been marked mostly by failure. One reason is the lack of markets; another is the unresolved issue of land ownership and use. As a form of community support to the pump attendants rather than a commercial enterprise, vegetable gardening could be a possibility if the land question could be sorted out. This approach would also create an incentive for the pump attendants to be close to the pump on a regular basis.

In Malawi, as almost everywhere else, the holding of sums of money on behalf of a group of people creates its own problems. The temptation will always exist to misuse this money, to 'borrow' from the fund, or simply to abscond with it if the amount is large enough. This argues against retaining large amounts in a Waterpoint Maintenance Fund; but so does inflation in countries where the currency is not stable. This is probably the case in most countries where rural water supply projects such as Karonga have been, and are being, implemented. Even in West Africa, the once stable CFA franc saw its value slashed in half in 1994, by implication reducing the value of the funds held in all village cash boxes.

This has implications for how money is collected. One way is to collect money regularly, for example, at the pump, related to the amount of water taken, or even as a monthly contribution. The alternative is to wait until maintenance is required and then send the hat round for contributions. This may mean that a pump will be non-operational for a few days or even for a month, depending on the nature of the repairs required, and recourse will have to be made to other water sources. This emphasizes the importance of including existing water sources in project planning from the very outset.

There are no easy solutions to these problems. Each community will have to try to make its own arrangements, whether it be a Waterpoint Maintenance Fund or whatever, and hope that the people to whom they have entrusted the task are trustworthy. It is difficult for a project, or a government institution, to dictate how a community should raise and manage the funds required - they can only advise. What the Karonga Project could do - and did - was to ensure that spare parts were available locally and to give the communities the confidence and knowledge that, *if they wanted to*, then they could take charge of the pumps and keep them working.

5.5 Project personnel

The importance of project personnel, particularly those responsible for the transfer of technical and community development skills, should not be underestimated. The messages they convey to communities, either explicitly or implicitly, have a powerful impact on the eventual success of the project. Their training and orientation should be given emphasis, and re-training and re-orientation should be built into the project plans to ensure they continue to give out the appropriate messages. But who decides what is an appropriate message? Are such messages 'designed' outside the project context and disseminated; or are they designed together with 'the target group'? As with the technology approach to VLOM, it is much easier to design externally but designing *with* the community works much better - it just takes much longer.

Extension staff such as community development workers have a special role to play. They are the first to get in contact with project communities. As such they create the foundation of trust (or suspicion) on which future interaction between the recipients and the project is based. Extension workers must therefore identify themselves with their communities and speak the local languages. It is also important to retain key field workers over longer periods of time (as well as to quickly dismiss or transfer any obstructionists).

Adequate gender representation on the project team should be a prerequisite, but here the Karonga Project failed to implement its own good intentions. It was difficult to resolve the contradiction between the key 'project message' of promoting the role of women while at the same time having a project team on which there were only men. While it was recognized that there is a considerable role model advantage in having women - even technicians - as part of the project team, especially during the implementation and maintenance phases, it was impossible to recruit any to the project. A great deal of unrewarded effort went into trying to recruit women, especially into community participation activities, but conservatism, remoteness and religion all played their part in making it difficult to recruit women to work in the northern region of Malawi. In such a situation, consideration should be given to recruiting an expatriate woman to the project team. Men, by their very nature - if not behaviour - are difficult to use as role models for women.

5.6 Programme spread

The Karonga experience suggests that a number of concentrated programmes covering a district or part of a district have distinct advantages over large, nation-wide handpump/borehole rehabilitation programmes. Concentrated, area-based programmes:

- reduce transport costs
- increase the efficiency of supervision
- increase the efficiency of training programmes
- increase the possibility of inter-community support
- increase the viability of privatizing spare part distribution and sales
- avoid social tension in villages as all waterpoints are covered, not only one or a few.

The focus on a more limited geographical area also allows for the involvement of the local administration in the programme, in planning, implementation and follow-up. In large-scale nation-wide implementation of water programmes, for example, the local area basis necessary for operation and maintenance, and also essential for future planning, may be lost. Large-scale, nation-wide handpump programmes are also more open to manipulation by national politicians anxious to impress their constituency with their commitment to local service delivery and 'development'. This approach can largely be characterized as one of 'tokenism', as the focus is on *delivering* service to impress constituents, rather than on *maintaining* that service.

5.7 VLOM sequence

The traditional model for the design and implementation of rural water supply schemes had the following sequence of activities:

Preparation - Mobilization - Construction - Handover to Users

In this sequence, *Operation and Maintenance* did not always form part of the blueprint. Assumptions tended to be made that operation and maintenance was either a government responsibility or that it wasn't a problem.

In the traditional model, users are not involved in the construction of the waterpoints, but are simply taught certain maintenance skills after the pumps have been installed. This does not allow communities to develop a strong sense of ownership of, and responsibility for, the waterpoints. Experience from Karonga suggests that (as illustrated in Figure 5) the sequence should be changed to:

> Preparation - Technical and Social Mobilization - Establishment of Operation and Maintenance (VLOM) system - Construction and Simultaneous Handover to Users

In other words, a great deal of effort should be put in at the start of the project to mobilize communities and prepare and train them for their roles in VLOM. Before the waterpoints exist it should be clear to the community that ownership and responsibility for the waterpoints and their surroundings are theirs and theirs alone. This will slow down construction activities, but will ensure community participation throughout and in this way prepare for sustainability.

This can prove complicated if a project is introduced in an area where there is no tradition of community involvement in maintenance, as was the case in Karonga. What needs to be stressed here is that while this can never be a blueprint, planning and preparation for the maintenance system is a required prerequisite. This will make the establishment of the VLOM system easier when physical implementation takes place and the community experiences the practical problems. At this stage, there needs to be a flexible approach as each community works out its most appropriate solutions within the framework as defined by the 'enabling environment' (especially as regards alternative technical solutions and availability of parts and service).

But does VLOM mean that the external agency (donor agency, government institution) decides which technology to use and then discusses this with the community? Or does it mean that the community is involved, not only in siting and land allocation, but also in technology choice?

There may be different answers to this question depending on the community's own capacity and technical background as well as on the range of appropriate technical solutions. The point has been made earlier, as regards the ability of small communities to financially maintain the Afridev, that a cheaper VLOM technology might have been more appropriate in less populated locations where the economic capacity of the community to raise sufficient funds for maintenance was lower than in more densely populated areas. The danger of not taking part in such discussions is that it may force a technology, technically described as 'VLOM', on to a community which cannot VLOM it. The question of technology choice will, however, always remain a difficult one to resolve. A sufficiently large number of pumps within a given area will always be necessary if there is to be a sustainable supply of spare parts through private channels. Again, technology choice will depend on the technological capacity of the community: whereas some communities can be trained in the maintenance of the Afridev, they may lack the capacity (whether technical or financial) to maintain a pump requiring more complicated tools and external maintenance support, such as the India Mark II.

Communities should be involved in technology choice, but the technology options and the range of conditions will be subject to a set of external decisions which set the limits, including Government policies on standardization of handpumps. Such limits are set by what the external agency considers 'reasonable' or 'sustainable'. The decision as to what is reasonable may be linked to a political or financial decision regarding a 'basic service level' for water supply.

5.8 Basic service level as a concept

Designs for water supply may be guided by what is considered to be the provision of a Basic Service Level. For example, the following definition of a basic service level for households might be proposed:

> A protected year-round supply of 20 litres per capita per day, preferably within 250 to 500 metres of all households and serving 250 to 300 persons per outlet. (Outlets could include: multi-tap standpost, handpump, protected spring, protected well).

After the establishment of such a definition (which would normally be set externally rather than by the users), an external financing agency (donor agency, national government) may be requested to provide the funds required to bring the community's water supply up to the basic service level. The national government should in principle be responsible for providing a basic service level to all communities, whether through its own means, such as taxation, or from external sources such as donor grants or loans. Following this same argument, the community and the affected individuals and institutions, should be required to bear all additional costs if they want to opt for a higher service level (for example a motorized pump with overhead storage, instead of a handpump).

The danger with rigid definitions is that they can very easily influence a supply-driven rather than a demand-driven design choice. The alternative is to use the basic service level concept as a method for calculating the size of the external financial grant rather than as a basis for a final technical design. By doing so, the community can still arrive at a water supply model of its choice, based on a balance between what it wants and what it (or those individuals, institutions and industries which want a higher service level) can afford, and the technical feasibility of the choice. Using this approach, government's main responsibility will be to ensure that all residents within the project area are covered by a basic service level for domestic water supply. The provision of additional supplies to include, for example, water requirements for livestock or gardening, becomes a community financial responsibility.

Discussions with the community during the Preparation and Technical and Social Mobilization phases will thus lead to a final concept which may be called the *chosen service level (CSL).* This will be the final technology choice arrived at, probably involving a compromise between community and the external agency. Financial responsibility will then rest with the user group. In other words, the community would be responsible for the additional capital cost if their chosen service level is higher than the basic service level, as well as being responsible for all recurrent costs for operation and maintenance.

There is another side to this argument, however. A community may decide for a service level which is *lower* than the Basic Service Level - for example, a protected well instead of a handpump. Here, initial capital costs may be higher than for a handpump, while maintenance costs may be considerably lower and skills may already exist within the user group. Pre-supposing a lack of technical knowledge - which will probably be the case for most communities targeted for rural water supply projects - it could be argued that the external agency (which could be represented by a project organization) should retain responsibility for technical design and supervision as well as for training, monitoring, etc. This would accommodate the fear that communities might opt for technically inappropriate choices or non-sustainable technologies (in the sense that spare parts would not be available, etc.), and help to ensure that their choices were based on appropriate information, especially as regards the technical and financial implications for maintenance.

These points may seem somewhat theoretical, but they are raised here because it is too easy simply to make assumptions *on behalf of* the user group, instead of *with* them. Essentially, this is about the difference between a *demand-driven* and a *supply-driven* approach. If the external agency has, from the outset, already pawned its soul to a specific technology, the demand-driven approach runs into the proverbial brick wall. In such a situation, to paraphrase Henry Ford: *You can have any pump you like, as long as it's the Afridev.*

5.9 Choice of technology

Choice of technology must be related to the society in which it is being introduced. In areas where various technologies can be maintained and spare parts obtained through already established mechanical enterprises and shops, it becomes easier to give the users greater freedom of choice. However, this will still require that the external agency informs and discusses with the users the pros and cons of various choices, for example with regard to spare parts, repairs and price.

In areas where there is no tradition of mechanical repairs it is a long process to establish a sustainable operation and maintenance system. In such areas only one specific handpump should be introduced as a basic service level, with protected wells and springs retained as possible alternatives. Only one type should be introduced, regardless of depth. The advantages of a unified operation and maintenance system based on a single, standardized technology, with uniform stocks of spares, tools and training programmes far outweigh the economics of using different pumps for different depths.

With the acquisition of user confidence in handling one technology and the establishment of locally-based mechanical repair skills, additional types of pumps can be introduced. By then communities will have acquired practical experience and be in a position to make an informed choice among alternatives.

5.10 Spare part distribution

When starting a spare part distribution system, a distinction needs to be made between fast- and slow-moving spares. In societies with no tradition of mechanical repairs, introducing the sale of fast-moving spares should be done using already existing village shops, but in consultation with the local communities. The community's preferences for shop and location are important, but the shop owners' local standing and social engagement and their own dependence on the water supply are deciding factors in ensuring the continued stock of spares. Project support in supply of the initial stock to the shop should be considered, with funds for replenishment of stocks coming from sales of the initial supply.

With regard to the wholesale supply of both fast- and slow-moving spares, large shops and wholesalers which already supply goods to village shops should be selected. Initially, they might require spares on commission from project or government. This could change to full responsibility for both purchase and sales as demand for new stocks grows.

5.11 Ownership

Ownership of the waterpoints and the surrounding land must be clearly defined - not only ownership of the installations and their downhole components and the land upon which they rest, but also a piece of the surrounding land for possible use for irrigated gardening or livestock watering.

In Karonga, this was not done at the time when waterpoints were sited. If there is no agreement that the pumps' environs are 'common property', recommendations to start gardens as income-generating activities will remain mostly hot air. The situation where only the pump and its immediate surroundings are 'community property' means that there will be continual land use conflicts regarding the land bordering the waterpoint area. All kinds of activity, whether agriculture, vegetable gardening, cattle watering or dumping of rubbish, may take place without community influence or participation. The ideal situation, where there is sufficient land in community ownership around the pump, will allow for community decisions on how best to use this land - for livestock watering, vegetable gardening, laundry and for fetching drinking water - without creating environmental pollution.

Figure 15: Risks of environmental pollution from cattle watering.

Vegetable or other production around the waterpoint must be very carefully planned. In many cases, there is no market for this production and it can therefore not be suggested as a means of income generation. But the yields from a vegetable garden may provide a welcome supplement to the Pump Attendants' diet and go some way towards recompensing them for their work on the pump. Livestock is another question of concern. In areas of high density, their water supply will influence choice of technology.

These considerations may be related to the earlier discussion on the difference between basic service level and chosen service level. If the community - or some individuals within it - have water requirements over and above those which will be met by a basic level of service, they should provide the additional finances needed to reach the higher service level. The alternative is to force them to accept the basic service level technology knowing full well that system capacity will be overstretched, leading to increased maintenance costs, decreased yields, longer queues, etc. This is

already the case in Karonga, where, during the dry season, cattle are watered at the waterpoints - with all the inconvenience, environmental pollution, and over-use of the pump which this entails. The assumption was that the pumps would only be used for domestic water supply, but this has proved not to be the case.

Questions of access to the waterpoint, the sharing of contributions to waterpoint maintenance and the provision of, for example, a watering trough for livestock, should be decided by each community during the preparation phase. The possibility of an increase in the numbers of livestock due to more water now being available should not be forgotten.

A project cannot prevent the community watering their cattle at their own waterpoints. It is preferable to plan for this possibility instead of trying to instruct people not to water their cattle at the pump. Health campaigns, too, will not have any effect on livestock watering near the pumps. Such campaigns will not change the felt need for cattle, goats, pigs, etc. to drink.

It is difficult to see any alternative to the suggestion made earlier, that the issue of land rights and the possibility of community management of the area around the waterpoint, and not just of the waterpoint alone, should be taken up. Fencing off the area, with a communal garden instead of a soakaway, plus a livestock watering area, is an option which needs to be explored. This is a model which has been applied with some success in parts of Zimbabwe.

5.12 Health impacts and continued use of existing water sources

A water supply system will not, by itself, contribute either to an increased quality of life of the population in general, nor to improved health. The main issues taken into consideration by households are often related to convenience and distance to water source, rather than improved health. This is the case no matter how many health campaigns are run. Hence, it is doubtful if a pump will continue to be used unless it is within a reasonable distance. If the pump is too far away, households will often fetch water from the nearest source, even if it is unprotected. The reality is that many existing unprotected water sources will continue to be used. This need not be seen as a problem; rather the other water sources, such as wells, springs, rivers, streams and lakes should be incorporated into the project. For most water uses, many of the present water sources may be perfectly adequate, especially for washing and bathing, and maybe also cooking and drinking. After all, the local people have always had to quench their thirst at these sources. In this sense, the new handpump will become an additional water source, rather than a substitute for the existing sources. The basis for including other water sources in a project relates to whether households are willing to pay to maintain the improvements to water supplies provided through project assistance.

The focus on a single water supply technology can easily result in bypassing the generally accepted target groups: the poor, the women, the children, etc. By accepting that water supply systems have to be paid for (at least the daily running), the poorest groups will end up consuming the least and will continue to make use of their existing sources. Attempting to force people to use the 'project' water supply is not an acceptable solution, especially as even a 100 percent dependence on the system is unlikely to have any noticeable health impact without accompanying behavioural change and where, moreover, ownership has been officially handed over to the communities. If there is to be any health impact, an approach has to be followed which includes all present and potential waterpoints and sources, as well as their seasonal variations, rather than focusing on a single solution, such as a particular handpump technology.

Appendices

Appendix 1: Bibliography

Baumann, Erich (1991). *Mission Report: visit to Kwale, Kenya and Karonga and Dedza, Malawi.* UNDP-World Bank Regional Water and Sanitation Group, Accra. Accra.

Chirambo, M.A., Malinda, T.D., Mandala, L.P., Matayataya, V.P., Zenizeni, G.S. (1992) *Report on Pump Committee and Pump Attendants Training, April-September 1992.* Karonga.

DANIDA (1992). *Danida sector policies for water supply and sanitation.*

DANIDA (1985). *Evaluation of four water supply projects and appraisal of Karonga Integrated Rural Groundwater Supply Project.*

DANIDA (1992). Guidelines for project preparation.

Gaynor, C. *and* Ntata, P.R.T. (1992). *Survey of social concepts, structures and practices - Karonga Agricultural Development Division.* University of Malawi, Centre for Social Research.

Gaynor, C., Jespersen, C.B. *and* Banda, G. (1992). *First Sociological and Technical Monitoring Report.*

Gaynor, C. *and* Jespersen, C.B. (1992). *Second Sociological and Technical Monitoring Report.*

Hyde, K.A.L *and* Jespersen, C.B. (1994). *Third Sociological and Technical Monitoring Report.*

Karonga Integrated Rural Groundwater Supply Project (1992). *Achievements and Failures 1991 - 1992. Year Report based on Project Logical Framework.* Karonga.

Karonga Integrated Rural Groundwater Supply Project (1991). *Instruction Manual for VLOM - Village Level Operation and Maintenance.* Karonga.

Karonga Integrated Rural Groundwater Supply Project. *Monthly Progress Reports.*

Karonga Integrated Rural Groundwater Supply Project (1990). *Operation and Maintenance Manual.* Draft.

Karonga Integrated Rural Groundwater Supply Project. *Pump Attendants Diary 1992 - 1993.*

Karonga Integrated Rural Groundwater Supply Project (1990). *Pump Caretaker Diary.* Draft.

Karonga Integrated Rural Groundwater Supply Project (1991). *Report prepared for Danida by a Water Quality Review Mission visiting Malawi from 14th February to 8th March 1991.*

Karonga Integrated Rural Groundwater Supply Project (1988). *Review report.* Prepared for Danida by a mission visiting Malawi from 7th to 16th June.

Karonga Integrated Rural Groundwater Supply Project (1989). *Review report.* Prepared for Danida by a mission visiting Malawi from 6th to 16th June, 1989.

Karonga Integrated Rural Groundwater Supply Project (1990). *Review report.* Prepared for Danida by a mission visiting Malawi from 23rd October to 3rd November 1990.

Karonga Lakeshore Integrated Groundwater Supply Project (KIP) (1987). Plan of operation (vols. 1 and 2). (Revised November 1987).

Morgan, Peter (1990). *Rural water supplies and sanitation: a text from Zimbabwe's Blair Research Laboratory.*

Report on Karonga District Development Committee (1992). *Second Seminar on VLOM. 19th May 1992.* Karonga.

Roe, Gillian *and* Gaynor, C. (1991). *Proposal for a Monitoring and Evaluation System (Amended).*

Roe, Gillian (1990). *Results from the Baseline Survey.* University of Malawi, Centre for Social Research, and KIP.

Sinyangwe-Chitafuma, B. (1992). *Report on VLOM Seminars for Village Water and Health Committees.* District Development Committees, Area Action Committees and Extension Workers. Karonga.

Appendix 2: The Bucket Pump

One of the most simple ways of utilizing ground water is to dig an open well and draw water from it by using a rope and bucket. This concept constitutes the simplest and cheapest way of collecting groundwater. The main drawback of such a system is related to the fact that it is difficult to keep such a water source clean and safe. The rope - often used for many other purposes - will often be the maximum source of pollution. But also the fact that the well is not sealed will make it exposed to some pollution.

To overcome some of these shortcomings a concept has been developed which consists of a drilled well with casing, or a dug well with casing, into which a specially designed bucket can be lowered with help of a chain and a windlass.

Figure A.2.1: The bucket pump in use in Zimbabwe.

The well may be drilled by using a hand operated simple drilling rig (like the Vonder rig), where most of the labour input is provided by the user group. Alternatively, the well may be either machine drilled or hand dug. In the latter case, the well design follows the classic hand-dug well model with a cement slab mounted on top which seals the well, preventing pollution and providing a base onto which to mount the bucket pump.

Handling of bucket and rope (or, in this case, a chain) is the critical point in this concept. The use of a windlass reduces contact between the chain and users. Furthermore the bucket is designed in such a way that by placing it on top of a specially designed opening device, automatically a valve in the bottom of the bucket will open and the water will run out into a vessel placed underneath.

This concept is very simple, building on age-old traditions, and maintenance costs are low. It can be regarded as a minimum concept useful in households, small communities or groupings of households where hygienic behaviour can be controlled more easily, rather than for larger communities where, in any case, higher yielding pumps would be more appropriate.

The bucket pump concept is well described in the publication by Peter Morgan cited in the Bibliography (Appendix 1).

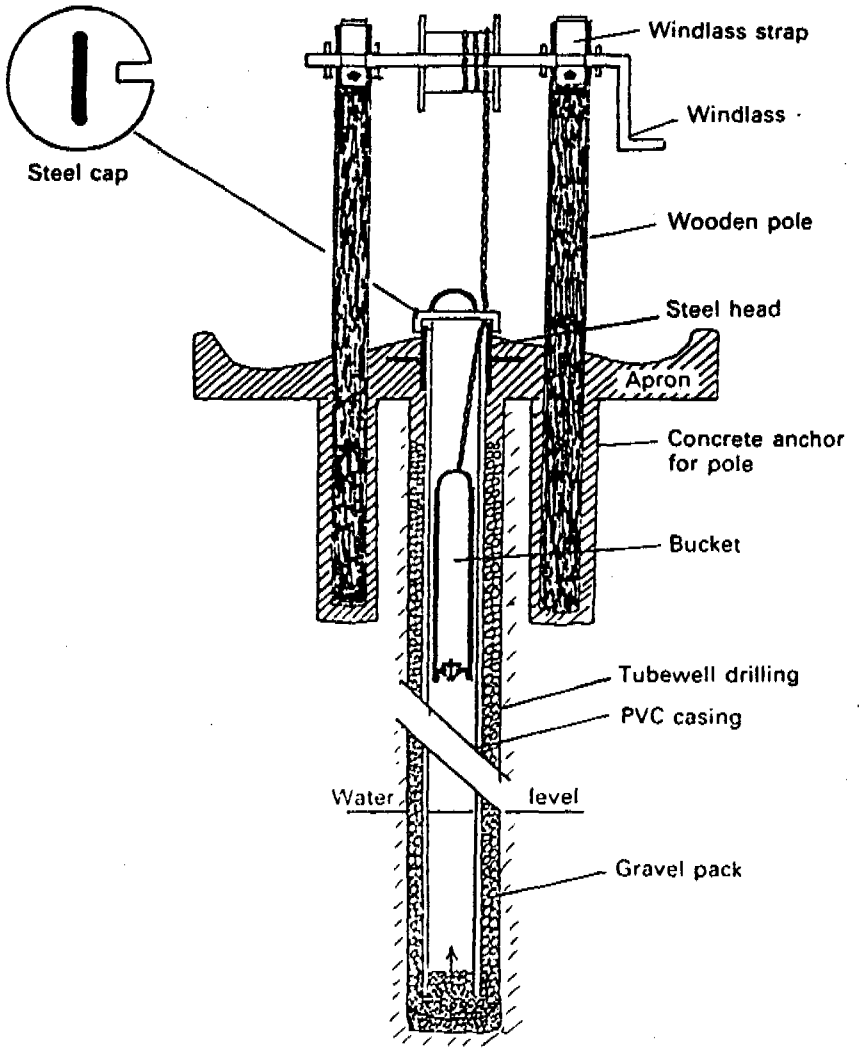

Figure A.2.2: Handmade bucket pump.

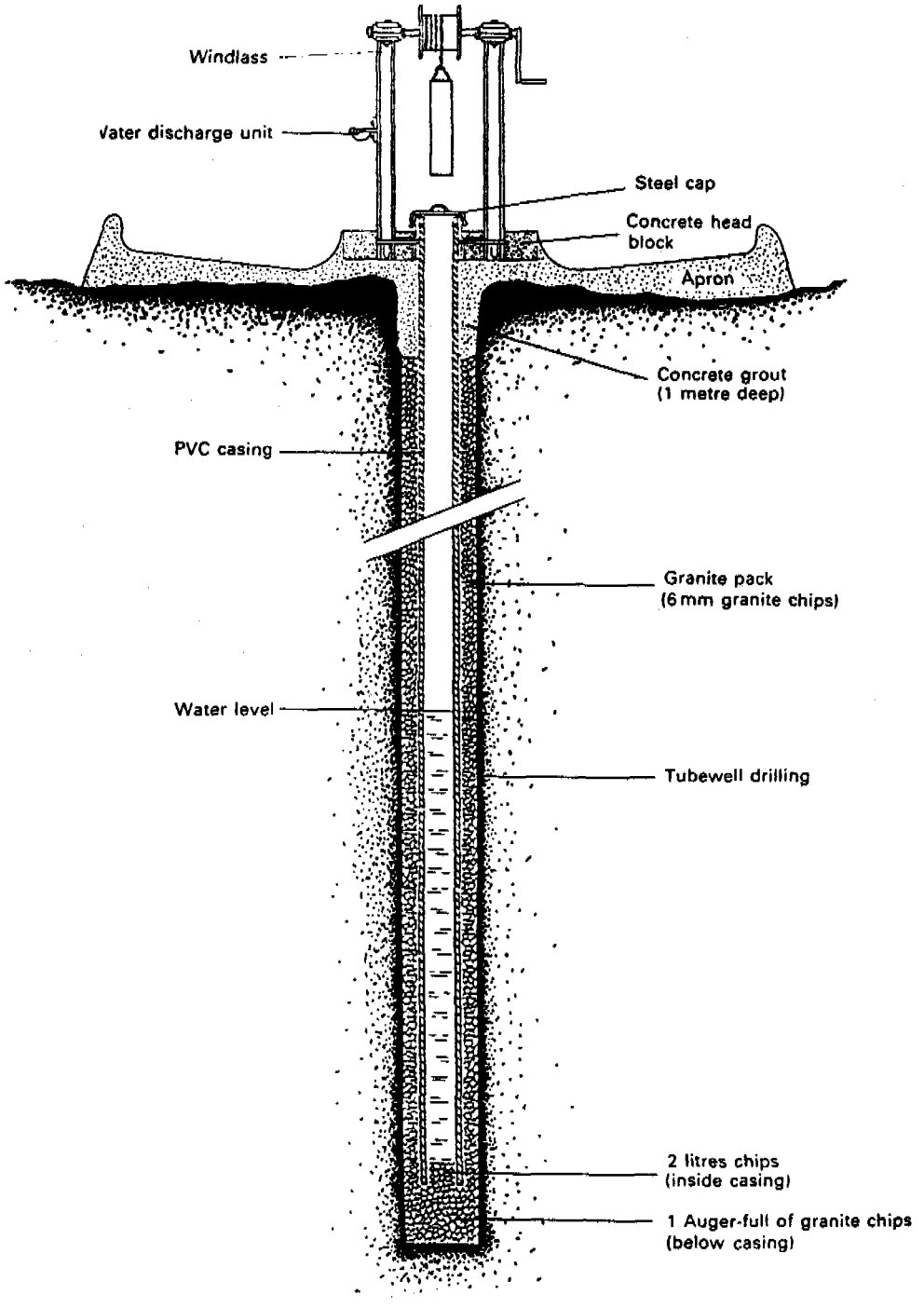

Figure A.2.3: Bucket pump fitted on a tubewell.

Appendix 3: Fishing tools for broken pump rods

1. Introduction

The Afridev pump was comprehensively field-tested and went through a number of modifications before it could be said to be working satisfactorily. However, little thought appears to have been given to the parallel development of a sufficiently broad range of maintenance tools to allow for all repairs - and not only the most simple - to be undertaken at community level.

The conclusion reached by the Karonga project was that virtually all repairs to the Afridev could quite easily be carried out locally if simple fishing tools could be developed and made available. Given that the engineers designing the pump had not, at the same time, designed a range of tools for community maintenance purposes, the project approached a Malawi-based NGO to assist with the design and development of the appropriate tools to deal with the more complicated down-the-hole maintenance problems.

Most of these down-the-hole repairs could have been carried out quite simply if appropriate fishing tools had been available for dealing with broken pump rods. As it was, the rods below the point of breakage could only be reached by lifting out the whole of the rising main. While, in the absence of appropriate tools, the project did develop a methodology for extracting rising mains, too many disadvantages are attached to this method. It is labourious and there is a risk of damage to, or breakage of the rising main. In addition, removal of the rising main increases the risk of contaminating the well.

As a result of the project's initiative, the NGO, Concern Universal, together with the project, designed and perfected THE fishing tool for all complicated down-hole operations involving the extraction of broken pump rods. By June 1994, when external support was in the process of being withdrawn, development work on this tool was finalised and the fishing tool was put into production for distribution to the user groups.

2. The problem

Pump rod breakage occurs mainly at three different points: on the stem between connectors; at the hook on the connector; or at the eye on the connector.

Whereas breakage of the stem is a more straight forward problem, breakage at the hook and eye creates more serious difficulties, especially with the breakage of the hook because the pump rod centralizer remains in place.

3. Test of prototypes of fishing tools

Two types of fishing tools have been constructed and tested, one for broken stems and one for broken hooks or eyes.

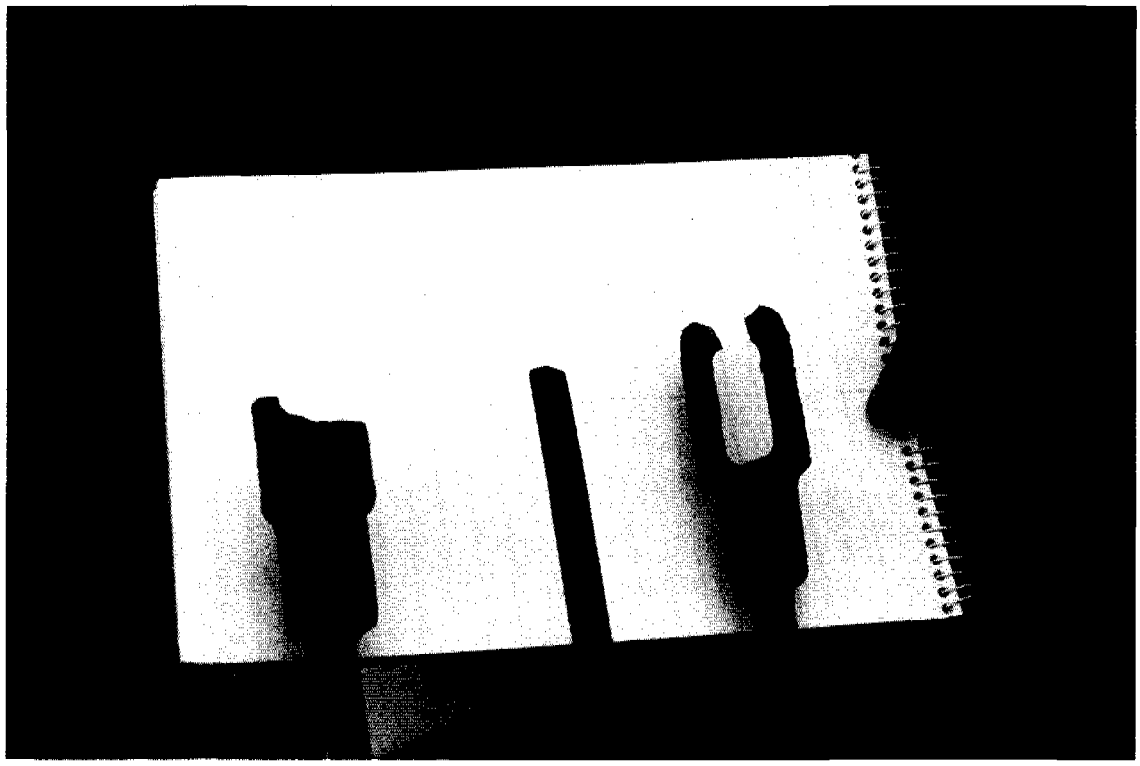

Figure A.3.1: The problem: broken hooks, eyes and pump rods.

4. Broken stem (The Hourglass)

The tool consist of a 60mm diameter, 30cm long iron pipe, open at the bottom and inside, formed as an hourglass with a wedge in the upper compartment. This wedge can pass half way through the narrow part between the upper and lower part of the hourglass. The top is closed upon which is welded the eye of a pump rod for connection purposes. Small holes are drilled into the side near the top rim to allow water to pass through.

When the stem of a broken pump rod, due to the conical form of the bottom hourglass is led into the narrow section between the upper and lower part of the hourglass arrangement, the wedge is pushed up, allowing the rod to pass through. Upon lifting upwards the wedge is forced down into the narrow section of the hourglass, thus gripping the rod and ensuring that it follows the tool up and out. Field tests showed that this tool will often only catch on old rods with rough surfaces.

5. Broken hook or eye (The Chimney)

The tool consist of a 60mm diameter, 20cm long pipe welded on to the end of 0.50m galvanised 50mm pipe. The tool is hollow. On top is welded a u-rod with the eye of a pump rod attached to act as connector.

The catching device is a concave metal flap situated inside and pivoting on a fulcrum welded into a half circle incision cut in the 60mm pipe, five centimetre from the bottom edge. The tool will allow any length of rod to pass through 'The Chimney', allowing the metal flap to grab the rod somewhere below the first available eye.

If the pump rod centralizer remains in place when the breakage occurs, it will prevent the rod entering 'The Chimney'. This problem has been solved by honing the first 1cm inside the tool thus producing a cutting edge and increasing the opening diameter. This allows the tool to squeeze itself around the centralizer and catch and retrieve it during the first fishing operation; subsequently the rods can be retrieved.

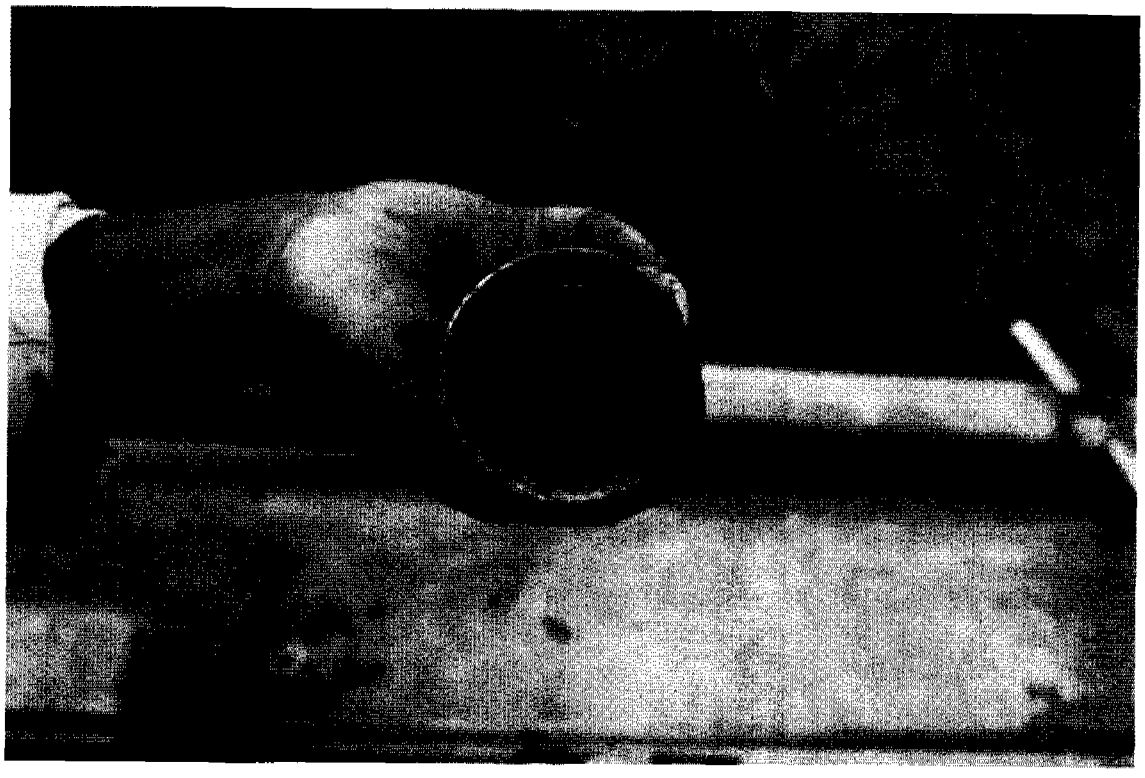

Figure A.3.2: The Chimney, showing hinged flap mechanism and honed edge of cylinder.

6. Conclusions

Field testing proved that the fishing tool named 'The Chimney' can be used for all complicated down-hole operations involving the extraction of broken pump rods. However, extended use will surely lead to refinements of the technology.

Figure A.3.3: The Chimney in action gripping pump rod centralizer with the hinged flap.

Appendix 4: Technical monitoring questionnaire

KARONGA LAKESHORE INTEGRATED RURAL GROUNDWATER SUPPLY PROJECT
P.O. BOX 98, KARONGA,
MALAWI

TECHNICAL MONITORING QUESTIONNAIRE

VILLAGE LEVEL OPERATION AND MAINTENANCE

SECTION A **V L O M**

Identification

Village: ..... Date: .....

KIP No.: .....

M.A. Name: ..... M.A. Station: .....

SECTION B

ASSESSMENT OF VILLAGE LEVEL OPERATION AND MAINTENANCE INSTITUTIONS

1.	**Village Water and Health Committee (VWHC)**	
1.1	Are any members of the Village Water and Health Committee present?	1. Yes 2. No
1.2	If yes, please give position.	1. Chairman 2. Secretary 3. Treasury 4. Member
1.3	Are the members of the Village Water and Health Committee present, the usual members?	1. Yes 2. No
1.4	If no, please indicate who has changed.	1. Chairman 2. Secretary 3. Treasury 4. Member

1.5	If any member of the Village Water and Health Committee is present, please ask if the VWHC has one Pump Maintenance Fund for all their pumps or they have a separate fund for each pump.	1. One fund 2. Separate funds
1.6	If they have separate pump maintenance funds, please ask who is responsible for the management of these funds.	1. VWHC 2. P.C.
1.7	If the Village Water and Health Committee has one fund, please ask how much money is available at present.	1. ..... Kw 2. Do not know

2. Pump Committee (P.C.)

2.1	Are any of the members of the Pump Committee present?	1. Yes 2. No
2.2	If yes, please indicate position.	1. Chairman 2. Secretary 3. Treasury 4. Member
2.3	Are they the usual members?	1. Yes 2. No
2.4	If no, please indicate who has changed.	1. Chairman 2. Secretary 3. Treasury 4. Member
2.5	If any of the Pump Committee members are present, please ask if the Pump Committee has a Pump Maintenance Fund.	1. Yes 2. No
2.6	If the Pump Committee has a Pump Maintenance Fund, please ask how much money is available at present.	1. ..... Kw 2. Do not know

3. Pump Attendant

3.1	Are any Pump Attendants present?	1. Yes 2. No
3.2	If yes, please indicate whether it is one or both attendants.	1. One 2. Both

3.3	If one attendant is present, please indicate whether it is a male or female.	1. Female 2. Male
3.4	If both attendants are present, please indicate whether they are.	1. One female, one male 2. Two females 3. Two males
3.5	Are they the usual Pump Attendants?	1. Yes 2. No
3.6	If no, please indicate who has changed.	1. 1 female, 1 male 2. 2 females 3. 2 males

SECTION C

ASSESSMENT OF THE BOREHOLE, THE PUMP, THE PHYSICAL STRUCTURES AND THE PUMP SURROUNDINGS

1. Pump Condition

1.1	How is the pump working?	1. Working well 2. Working poorly 3. Not working
1.2	If pump is working poorly or not working, how many days has this lasted?	1. ..... days
1.3	If working poorly or not working, give assessment of fault.	1. Mechanical 2. Raising mains 3. Water level 4. Don't know
1.4	If mechanical, please give reasons for working poorly or not working.	1. No spares 2. PA not able to repair 3. Nobody to explain 4. Don't know
1.5	If Pump Attendant not able to repair, please explain why.	1. Cannot repair 2. Are not interested/busy with other things 3. Have no spares 4. Repair beyond his/her knowledge
1.6	If Pump Attendant cannot repair, please explain whether you trained him/her during your routine visit or arranged training later in the month.	1. Trained during routine visit 2. To be trained later in the month

2. Pump Repairs

2.1	From the Pump Attendants Diary please extract the information regarding repairs done to the pumps since your last visit.	0. None 1. U-seal changed 2. O-Ring changed 3. Bobbin changed 4. Large bearing bush assembly changed 5. Small bearing bush assembly changed 6. Large bearing changed 7. Small bearing changed 8. Flange bolt changed 9. Plunger changed 10. Footvalve changed 11. Hanger changed 12. Pump rods 1.4 changed ..... 13. Pump rods 1-14 changed ..... 14. Ring spanner changed 15. Socket spanner changed 16. Pump Head cover changed 17. Pump Head cover bolt changed 18. If others, please explain..... 19. No information 20. P.A. not present
2.2	Who has done the above mentioned changes?	1. P.A. 2. M.A. 3. S.M.A. 4. Others
2.3	From where did the Pump Attendant get the above changed spare parts?	1. VLOM 2. M.A. 3. M.A. Store 4. Main store in Karonga 5. Local shop 6. Others, please specify: ....
2.4	Please indicate if spare parts were supplied during this visit.	1. Supplied 2. Not suppl.

2.5	If spare parts supplied by you during your present visit, please indicate items and number of items.	1. U-seal 2. O-ring 3. Bush Bearing assembly 4. Pump rod centralizer 5. Flange bolt with washer and nut 6. Bobbins 7. Others, please specify: ....
2.6	If spare parts supplied, please indicate if money was received and indicate receipt no.	1. Money not received 2. Receipt no. for money received
2.7	If spare parts not supplied, please indicate the reason.	1. No request 2. Requested but no money 3. Requested but authorizing person with money not available
3.	**<u>Problem Anticipation</u>**	
3.1	In your view which parts will need replacement within the next 3 months?	1. None 2. U-seal 3. Bobbin 4. Large bearing bush assembly 5. Small bearing bush assembly 6. Large bearing 7. Small bearing 8. Flange bolts ..... 9. Plunger 10. Footvalve 11. Hanger 12. Pump rods 1-14 ..... 13. Pump rod centralizers 1-14 ..... 14. Ring spanner 15. Socket spanner 16. Pump Head cover 17. Pump Head cover bolt 18. If others, please explain ....

4.	**Physical Structures**	
4.1	Please give your evaluation of the physical structures and recommend if they need repair.	1. Pedestral complete 2. Pedestral needs repair 3. Apron complete 4. Apron needs repair 5. Washing slab complete 6. Washing slab needs repair 7. Spillway complete 8. Spillway needs repair
4.2	If any of the above structures need repair, please indicate if cement is available in the village for repair.	1. Cement available 2. Cement not available 3. Don't know
5.	**Pump Surroundings and Drainage**	
5.1	Please indicate if the pump surroundings are very clean, clean or dirty	1. Very clean 2. Clean 3. Dirty
5.2	If dirty, please explain what this consists of.	1. Grass 2. Debris 3. Animal manure
5.3	Please indicate the condition of drainage	1. Well drained 2. Small dirty pool 3. Large dirty pool
5.4	If there is a small or large dirty pool, please explain if this is used by	1. Cows 2. Pigs 3. Both cows and pigs 4. None
5.5	Please explain if there is a communal activity in connection with waste water drainage.	1. Vegetable garden 2. Tree planting 3. Nothing

Departure on ..... at ..... hrs

Signed by: .....

Appendix 5: Indicators for sociological monitoring system

CENTRE FOR SOCIAL RESEARCH
INDICATORS FOR SOCIOLOGICAL MONITORING SYSTEM
KARONGA LAKESHORE INTEGRATED RURAL GROUNDWATER SUPPLY PROJECT

Indicator	Purpose of Indicator	Specifications	Data Needs	Periodicity
COMMUNITY INSTITUTIONS 1. Proportion of communities with (a) VWHC (b) PC and functioning	To ensure that village level structures are in place and operating	Numbers, composition when established, meetings held	AAC reports on new elections SME 91/92 MA monthly records CDA visits VWHC/PC records Ext. worker reports	Ongoing Reviewed ever 2 months
2. The degree to which committees are representative of all sectors of the community. (VWHC/PC/PAs)	To ensure that communities will support the established structures. To indicate where training, mobilization and elections are required.	- Gender - Traditional Authority - MCP - Other power/influence - Elected/coopted - Method and frequency of communication	SME 91/92 MA Monthly records CDA visits Training records	Ongoing
3. Proportion of committees who understand their responsibilities in relation to VLOM. (VWHC/PC/PAs)	To identify training needs and need for institution building.	Responsibilities of each linkages Training received	Training records and follow up SME 91/92 MA Monthly records CDA visits VWHC/PC records	Ongoing
4. Proportion of communities who have established a viable revolving fund for O&M	To identify training and community mobilization/support needs	Ability to pay Type of arrangements - Collection mechanisms - Accounting procedures - Defaulters - No. of users per pump - Time lapse for repair	SME 91/92 MA records CDA visits Training records VWHC/PC records	Ongoing

SME - Sociological Monitoring Exercise **CDA** - Community Development Assistant **VWHC** - Village Water & Health Committee **PC** - Pump Committee **PA** - Pump Attendant **MA** - Maintenance Assistant **VLOM** - Village Level Operation & Maintenance **O & M** - Operation and Maintenance **FHH** - Female headed household

Indicator	Purpose of Indicator	Specifications	Data Needs	Periodicity
5. Degree to which communities understand and accept their role in VLOM	To identify training/support and mobilization needs	Communication with communities Community understanding of VLOM Acceptance of level of financial contribution	VWHC/PC records User interviews MA records CDA visits Extension workers reports SME 91/92	Ongoing Especially crucial in year 1
<u>DEVELOPED SKILLS</u> 6. The proportion of PAs who have the required level of skill and who remain in post	To identify training needs Make provision for retraining and refresher courses Establish criteria for effectiveness of PAs	Turnover Gender Age Education Marital status Level of Activity	MA reports SME 91/92	Monthly
7. The adequacy of skills at all levels	To identify training gaps and needs, refresher courses, technical support etc.	MAs PAs Extension workers Project staff VWHC/PC Communities	Technical Monitoring SME 91/92 VWHC/PC records Project meetings Training records and follow-up	Ongoing Systematic
8. The degree of involvement of women in all aspects of O&M	To ensure adequate analysis of the roles and needs of women in VLOM and maximization of the benefits of women's participation.	Committee structure Training/gender Consultations mechanisms PAs FHH	Project records Training records MA reports CDA visits VWHC/PC records PA diaries SME 91/92	Ongoing, Systematic

Indicator	Purpose of Indicator	Specifications	Data Needs	Periodicity
<u>INSTITUTIONAL SUPPORT</u> 9. The degree of inter-sectoral cooperation at field level	To identify training and coordination needs of extension workers	Numbers Meetings Networking Community training	Ext. workers Ext. wk. reports Tr. records & follow up Community feedback	Periodic Workshops Monthly Reports
10. The degree of co-operation and linkage between community level institutions and establish-ed institutions at AAC and DDC level	To strengthen structural linkages for VLOM	- Reporting mechanisms - Supervisory role - Agenda items - Training received - Support Systems	AAC/DDc Consultation, Agenda & Minutes Training records and follow up SME 91/92	Ongoing Especially crucial Year I
<u>SANITATION AND HEALTH</u> 11. Proportion of households who have installed sanplats (where training of leaders was given)	Identify training or other inputs needed to facilitate the trickle down of the sanitation component of communities	- Number VWHC trained - Gender disaggregation - Communities trained by VWHC - Sanplats constructed - Affordability of Const. - Socio-Ec. status of those with sanplats - Geographic dist. of sanplats	- Training records - Questionnaire - SME 91/92 (Interviews with VWHC & users) - Project records	SME in 91/92 cannot generate the same degree of statistical data as Baseline. Household level data is required here.
12. Level of awareness of advantages of sanplats and importance of hygiene	To identify health related training and education needs	- By block/cultural group/VWHC - By level of ed. - By gender - By distance from proj.Hq./San Centre - Health education messages and media	- Health attendants - Questionnaire (household) - Health records - Training records	As above, needs household level follow-up

Appendix 6: Responsibilities of Village Water and Health Committees (VWHCs), Pump Committees (PCs) and Pump Attendants (PAs)

The following materials were prepared by the project, respectively for Village Water and Health Committees, Pump Committees and Pump Attendants. Revisions to these guidelines, based on the project's experience, are also included for each category.

Village Water and Health Committee

I. General

With reference to the Area Action Committee, the overall responsibility of a VWHC is to ensure:

- that the village has a sufficient and continuous supply of water from installed waterpoints
- that villagers are instructed in the construction and use of sanplats on existing and/or new pit latrines
- that the villagers are made aware of the basic hygiene principles to ensure that maximum health benefits are obtained from the installation, operation and maintenance of their waterpoint.

II. Specifically, the VWHC will ensure:

1. Where agreed with the PC's, the establishment of a village waterpoint maintenance fund for the effective maintenance of village pumps, pedestals, washing slabs, aprons, spillways and drainage.
2. The management of the Village Waterpoint Maintenance Fund. This includes keeping accounts and supporting documents, which can be made available if requested for by the Pump Committees and villages.
3. Procurement of the necessary spares needed to ensure continuous operation of the waterpoints.
4. Propose and implement byelaws for the use and protection of the waterpoints and their surroundings.
5. Supervise pump committees including election/re-election after every two years.
6. Through the pump committees, ensure the proper use of water and care for the waterpoints.
7. Reporting to the MA when problems occur, which cannot be solved by the pump attendant.
8. Administer the system of fines, which aims at implementing the byelaws.
9. Arrangement of any self help activities required for the proper operation and maintenance of the waterpoints.
10. In cooperation with staff from Ministry of Health, provide health education to the villagers with respect to any water related problem affecting the village.
11. Organize village meetings for the users of the waterpoints whenever necessary and to ensure that in each meeting the responsibilities of each of the pump committees, i.e. VWHC, PC and PA is clearly explained and understood.
12. Conduct regularly scheduled meetings for the VWHC and keep minutes written down in the VWHC file.

Suggested Revisions (based on experience)

1. Reference to the Area Action Committee is difficult as their meetings are few or non-existent.
2. Management of WMF have been taken over by the PCs which themselves insisted that since the waterpoint is their property and its maintenance was their responsibility funds and their control should remain with them.
3. Spares are purchased by the PC or their PA.
4. Byelaws are proposed and effected by the PC.
5. Reporting of maintenance problems to the MA is done by the PC without involving the VWHC.
6. Fines received from breaking byelaws are collected and administered by the PC.

Pump Committee

I. General

With reference to the VWHC, the overall responsibility of a pump committee is to ensure:

- the proper maintenance and use of its waterpoint
- a clean area around the pump and its superstructure
- a proper use of waterpoint excess water either for trees or vegetables or divert it through the construction of a soakaway pit

II. Specifically the PC will:

1. Collect money from users of the waterpoint and purchase of spare parts. Where applicable, money should be deposited with the VWHC. Where the PC is responsible for the Waterpoint maintenance Fund, it should ensure proper safe keeping and use of the funds. If the VWHC is keeping a village waterpoint maintenance fund, money collected should be deposited with the VWHC.
2. Ensure proper handling of the pump. Nobody should be allowed to play with the pump or block the outlet. Users should not band the top when pumping but use long slow strokes to give the pump a longer life.
3. Avoid misuse/abuse of the pump and its surroundings and collect possible fines from implementation of byelaws where applicable for deposit with VWHC.
4. Ensure appointment of 2 PAs. Preferably, at least one should be a woman.
5. Keeping pump and its surroundings clean and free from rubbish.
6. Ensure that excess water is channelled away and if requested by the community used for a vegetable garden, for trees or diverted into a soakaway.
7. Ensure that the water does not gather around the pump nor in pools at the end of the drainage channel. If necessary, construct a soakaway pit with advice sought from MOH staff.
8. Discourage users from spilling water off concrete surroundings.
9. Keep animals away from the pump surroundings to avoid pollution and puddling the ground around the pump.
10. Avoid erosion around concrete structures, by filling with stones, soil or bricks.
11. Report breakdowns or problems which cannot be solved by the PA to the VWHC.
12. Organize meetings for the users of the borehole when necessary.
13. Attend the MA routine visits.

Suggested Revisions (based on experience)

1. General responsibilities should include: Creation and Maintenance of a WMF.
2. Point 1 should read: Collect money from users of the waterpoint for maintenance and purchase of spares. Ensure proper safe keeping, use and recording of funds.
3. Point 11 should be altered to report breakdowns to MA.
4. Add propose and effect byelaws.

Pump Attendant

I. General

With reference to the PC, the PA are overall responsible for maintenance of the pump.

II. Specifically, the PA overall responsible for maintenance of the pump

1. Carry out weekly checks.
2. Carry out fault finding and ensure repair if fault is identified.
3. Where needed, carry out one yearly preventive maintenance.
4. Keep the records in the PAs diary.
5. Discuss problems of water supply with the PC and the MA.
6. Report problems with the pump to the Pump Committee.
7. Attend the MAs routine visits.

Standard Equipment

1. One fork tool.
2. One No. 24 spanner.
3. One No. 19 spanner.

Suggested Revisions

1. Standard equipment to include: One fishing tool for the foot valve.

Appendix 7: The VLOM concept and its development

1. Introduction

The Karonga Project was supposed to be based on the concept of VLOM (village level operation and maintenance). When the project began, however, VLOM was little more than an unproven idea. This chapter will look at the concept and how it was developed and modified in Karonga.

2. Operation and maintenance of handpumps

Large scale community water supply based on handpumps is a relatively new concept. It started taking shape in the early 1970s. During a severe drought in India, it became apparent that public rural water supply had to be regarded as a separate sector with its own identity. As a logical consequence of this, the development of rural water supply technologies and organizational support structures became necessary. A brief outline of the development of handpump technology is provided below.

Handpump technology

Handpump technology has undergone a tremendous development since rural water supply was recognized as a sector with its own technology requirements. Today a wide range of field-tested handpumps is available from which to choose. This situation has been achieved through the combined efforts of the private sector, NGOs and the bilateral and multilateral donor agencies.

A major contribution has been made by the Global Handpump Testing and Development Project, financed by UNDP and executed by the World Bank. This project initiated laboratory and field testing of 70 different types of handpumps in more than seventeen countries and produced a significant report on its findings. *(Community Water Supply: The Handpump Option)*

The Global Handpump Project realized that the available handpump designs would not be able to meet the requirement of the sector for user-friendly handpumps. Therefore, it initiated the development of pumps which, technically, could be classified as VLOM. This included the TARA direct-action medium lift pump and the Afridev deep lift handpump. The Handpump Project also gave a significant contribution to the ongoing refinement of the India Mark II and Mark III handpumps.

These handpumps differ from most others which are available because their designs are in the public domain. The available specifications are very detailed and leave no room for manufacturers to short cut or introduce alternative designs.

The first pump developed within the public domain, produced by the private sector and supplied after third party inspection and quality control was the India Mark II. The development of this pump is to a great extent linked together with the development of the sector as a whole.

In 1979 the UN General Assembly declared the ten year period 1980 to 1990 the International Drinking Water Supply and Sanitation Decade (IDWSSD). In support of the IDWSSD and the target set by it, a number of research and development activities were initiated, including the Global Handpump Development and Testing Project, the Low Cost Sanitation Project, and the International Training Network, to mention a few.

The sector has developed tremendously since the early 1970s. Today, handpumps are available which will provide an acceptable service level if installed and operated properly. The development of drilling rig equipment, open well construction concepts, etc. have also had a positive impact on the sector.

Even though technically sound handpumps have now started to become available, this has only eliminated some of the technical problems related to the provision of a reliable water supply. The *organization* of operation and maintenance is a task which the sector is only beginning to come to grips with. This is now considered to be as important as the more technical aspects for which, to a certain extent, solutions have been found. But community organization for maintenance is not simply a technological issue. Rather, it is a coming together of technology, institutions and individuals or communities, for which it is much more difficult to find appropriate solutions.

Initially, it was taken for granted that, as technology advanced, the organizational problems at community level would solve themselves. Hence, all efforts and funds were devoted to the development of new technologies, and little thought was given to community involvement in the organization of operation and maintenance. More recent surveys have shown that achieving satisfactory long-term performance depends on giving careful attention to the organization and management of maintenance. In fact, maintenance is now starting to be seen as more of an organizational than a technical problem, and the organization and management of maintenance has now become one of the focal points for improving projects in the sector.

The first experience with an organizational model for handpump maintenance was the three-tier maintenance system developed in India for the India Mark II, outlined below.
The problems which need to be resolved may be summarized as follows:

The three-tier maintenance system for India Mark II

The first step towards organization of handpump operation and maintenance was the three-tier maintenance system introduced in India to support installed India Mark II pumps. This system is characterized by a top-down approach.

On the first and lowest tier, the influence which users have on the pump is limited to superficial activities such as tightening bolts and nuts and sweeping the surroundings. If anything major needs to be repaired, the users are obliged to report to the second tier.

The second tier consists of a locally-based mechanic - usually employed or paid by the government - with a basic set of tools and some spare parts. This mechanic can only manage the repair of the above-ground components; any repairs to the more vital below-ground components have to be referred to the third tier, where the services of a mobile unit, using a small truck or pickup, may be called upon.

Although theoretically this system should be able to cope with any repair problems which may arise, the running costs alone - in the range of US$ 50 to 100 per handpump per year - mean that it has only a limited chance of becoming effective in areas of low income and low technical skills. Countries with large-scale rural water supply activities based on handpumps will not be able to cover the cost of running such an expensive system.

- maintenance is often viewed as a system for repairing pumps after they break down, rather than one for preventing breakdowns
- the costs of despatching mobile maintenance teams from a central depot to a distant pump for routine maintenance, such as seal replacement, soon become impossible to sustain
- reduced performance is not used as an indicator of need of maintenance; only when no water comes out of the spout is any action taken
- lines of communication are often too long
- communities often develop an attitude of not reporting pump performance problems, based on their generally bad experience with a centralized maintenance system: 'why report, nothing will happen'.

When it was realized that centrally-based maintenance systems would not solve the problems of maintaining handpumps used within community settings, new solutions started to be looked for. Some stayed within the technical field as, for example, the search for a maintenance-free handpump which never breaks down. But gradually the shift has moved towards looking for solutions within the *organization* of the maintenance system. Thus a shift in focus has taken place over the last decade from central maintenance to decentralized village-based maintenance systems which increase responsibility for maintenance to those who are in daily contact with the handpump.

The lessons learned may be summed up as follows:
- (hand-)pump technology should be appropriate, i.e. possible for the villagers to maintain and repair themselves
- the involvement of user communities in maintenance is necessary; and
- decentralized maintenance and management is a must.

3. Handpump development for VLOM

The lessons learned during the first water decade provided a major step towards the introduction of a Village Level Operation and Maintenance or management concept, now known almost universally by its acronym, VLOM. The initial focus was still mostly hardware-related, concentrating on the development of technologies which would lend themselves to maintenance at community or village level. However, from a relatively hardware-oriented approach, the sector has now reached a stage where community involvement is regarded as absolutely essential.
The prevailing VLOM concept has emerged as the result of a three stage process.

At first, the concept focused mainly on the development of handpump technology. The aim was to install handpumps able to meet the following criteria:

- they could be easily maintained by a village caretaker, with minimum skills and few tools required
- they could be manufactured in-country, primarily to ensure the availability of spare parts
- they would be robust and reliable under field conditions; and
- they would provide cost-effective solutions.

Handpumps which could meet these criteria were expected to solve the performance problems experienced with existing handpump technology. But improved technology only partially alleviated the problems and led to a further reconsideration of the VLOM concept.

The second stage aimed at more involvement of user groups and less government responsibility for maintenance. The VLOM concept was expanded with 'software' elements relating to community responsibilities. This was expressed by adding the following to the VLOM concept:

- community choice as to *when* to service pumps;
- community choice as to *who* will service pumps; and
- *direct payment* to the pump mechanic by the community for service and repair work carried out.

The third stage relates to the responsibility and payment for operation and maintenance. This shifted from the situation where the agency which installed the handpumps continued to 'own' them and retained sole responsibility for ensuring acceptable performance, to one where handpumps were handed over to user groups. Thus, user groups should take full responsibility for the ownership and upkeep of installed handpumps.

This was easier said than done. Making user groups responsible by a stroke of the pen did little to improve pump repair and maintenance. In those cases where pumps had been installed with limited or no involvement by the user groups, the user group involvement in operation and maintenance was likewise limited. In such cases, encouraging communities to take responsibility for handpump repairs and maintenance was not successful. On the other hand, in those cases where communities had been involved at an early stage there were more positive results, and user acceptance of responsibility for maintenance was easier to achieve.

This led to the latest reconsideration of the VLOM concept, namely, one which aims at community involvement. With this approach, the community is, in theory, involved in the decision-making process right from the beginning of discussions on improving its water supply. This process covers the following main elements:

- user group organization
- site selection
- selection of technology
- financial contribution
- quality control (of boreholes and installed technology)
- responsibility for operation and maintenance
- ownership.

Many of these elements are difficult to realize as, traditionally, responsibility has belonged to the implementing institutions (often government agencies) who may be reluctant to relinquish control. Equally, user groups may lack the self-confidence to take on responsibility and may resist moves to make them less dependent on external agencies. VLOM should not be seen as the panacea of handpump maintenance. Rather, it is an approach which, if:

- adjusted to local traditions and needs
- introduced carefully with required resources allocated, and
- monitored and evaluated and, where necessary, modified accordingly

may result in a viable method for securing reliable provision of water to rural communities. The experience from Karonga suggests that this is possible.

4. VLOM within the Karonga setting

In broad terms the main requirement for a handpump to be able to claim VLOM status can be described as being:

> simple enough so that the community can have the installed technology under its (technical, financial and organizational) control.

This allows for a certain flexibility as regards the technical requirements of the 'hardware', i.e. the handpump. For example, a prosperous community does not need to be concerned whether installed handpumps are easy to repair or not; they will have the resources to hire a local mechanic to carry out repairs and will be capable both to raise the required funds as well as to administer them. An advanced technology handpump will in such cases also be 'VLOM'.

In a low technology environment, such as Karonga, a VLOM pump will need to have simpler technical specifications which will allow a community, even where the threshold of technical skills is low, both to maintain the pump and to raise and administer the necessary funds. In other words the conditions under which the pump is installed will also influence whether the installation can claim VLOM status.

The philosophy behind the VLOM approach adopted by the Karonga project was that *government involvement in maintenance should be minimal.* Government's role, if any, should be limited to low-key involvement which would not interfere with the maintenance of the pumps if, for some reason, it was not carried out. The approach thus focused on cutting dependency links with the state and shifting responsibility onto communities and onto the private sector. This could be termed a 'phasing out' rather than a 'handing over' strategy. At the end of the project there should be nothing left to hand over to government. No additional responsibilities would be created for the government services as a result of the project. Rather, government would find its role within the wider 'enabling' environment.

This was a major departure from the original project concept. It meant a change of attitude by all those involved, as neither the community nor the government services knew how to do this. All parties involved were used to the idea of government as the patron, the parent figure, with the community as its children.

This attitude was very prevalent and can even be found in the project's 'Baseline Study' - which, unfortunately, was carried out at the start of the operation and maintenance phase and not three years earlier, in 1987, when project implementation actually started. The 'Baseline Study' reported that communities were afraid to take responsibility; at the same time, the project (and its technical staff, the Maintenance Assistants) had difficulty accepting the fact that they were 'facilitators' rather than doers. It was difficult for them to accept that communities should learn to take responsibility and that they, the maintenance staff, should not touch the pumps but should, instead, fill in monitoring schedules, and advise and encourage.

Thus the view of the VLOM concept changed radically during the project's maintenance phase. But there is no 'final' model. The essential element is not what the model looks like, but that the community manages to keep the pump working. It is sometimes difficult to remember this when designing maintenance and monitoring systems. The issue is not *how much money* a community has in its Water Maintenance Fund but that it is *willing and able* to raise funds to pay for spare

parts to keep the pump functioning. As project and government relax their hold, the VLOM system functioning in one village may develop into a model which may be completely different from a system working very well in another village. This should be seen as a positive rather than a negative development - even if it makes monitoring more difficult. In fact, VLOM becomes a challenge to the users to adapt the VLOM model into one which is appropriate for the technology chosen and which can function within the unique situation of the user group or community.

In the Karonga Project, the Afridev handpump technology proved, in the end, to be well suited to most community settings. The result has been that Malawi has now standardized on the Afridev. Success with implementing the community-based VLOM system in Karonga has also given the impetus to an adoption of the same system on a nation-wide basis. So, although the Karonga Project was originally organized and implemented as a traditional handpump project, it was possible at a later stage to reformulate its approach and bring it on a course towards a community-based VLOM. The initial selection of the Afridev handpump contributed to make this change in approach possible. It is difficult to create a VLOM maintenance system where the pump technology is too advanced for the user group.