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COMMUNITY WATER AND SANITATION  
PROJECT, INHAMBANE PROVINCE

FINAL PROJECT EVALUATION

FOR

CARE INTERNATIONAL  
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# INHAMBANE COMMUNITY WATER AND SANITATION PROJECT (CWSP) Final Evaluation Report

## EXECUTIVE SUMMARY

1 The Inhambane Community Water Supply and Sanitation Project has run for three years, since January 1995. During this period it has metamorphosed from an emergency to a development programme, has worked with over 100 communities and constructed 84 new boreholes as well as rehabilitating a further fourteen wells. The areas in which has been concentrated exhibited a high demand for water, with very few alternative dry season sources, and long distances for water collection.

2 The Project has been designed to implement the National Water Policy (PNA), particularly with regard to sustainability and the demand-driven approach. Strategies adopted include the key PNA principles of -

- community level pump maintenance
- increasing levels of cost recovery and
- greater involvement of the private sector

The Project has acted as a catalyst to community development, building on the priorities, problem-solving and management capacities which each identified.

3 The main technology option adopted is boreholes with handpumps because of the depth to groundwater and lack of shallow groundwater or perennial surface water in most areas. Research has also been carried out on rainwater harvesting which is traditional in some areas. It offers a more expensive alternative but one which is more flexible in terms of employing only materials and skills available locally and so can be implemented as households feel the need and have the resources to carry out construction or rehabilitation.

4 The development of private sector interest in selling pump spare parts has taken time to develop and been undermined periodically by government distribution of free parts. However vendors are now investing in unsubsidised spare parts, and forming trading relationships with communities which include some credit facilities. They have also formed links with manufacturers which are strong enough to allow return and replacement of sub-standard items.

5 Establishment of de-centralised maintenance systems includes building up the capacity of community leadership in fund-raising and management of a communal facility, and of a specific maintenance and repair group (GMR) for each handpump (Afridev). Unlike most other areas of the country, these groups have, as a result of their training, adopted the principle of 'a stitch in time saves nine' and most undertake routine replacement of basic parts. This preventive measure has helped keep pumps in operation when many are working near or beyond the recommended limit of operation in terms of depth, number of users and water quality. 40% of pumps have never broken down and 97% were working at the time of the 1997 inventory.

6 Hygiene education is regarded as an integral part of the programme, to maximise benefits from water supply. The Project approach includes the training of local health promoters (one for ten houses), emphasis on role models, and the use of self monitoring as a tool for communities to make and modify their strategies, as they seek to improve their environmental health.

7 Impact on water use is clearly apparent with 60-80% increase in the volumes used per head. The level of increase is linked to provision of health education. Other positive changes include safe disposal of faeces, greater use of soap which may link also to improving socio-economic conditions. Longer-term and in some cases more continuous monitoring is necessary to separate trends from 'noise' which is difficult with only two sets of data. This is particularly true for incidence of diarrhoea in which very little change is apparent.

8 The Project has built up a very good base of information on its findings, but could still develop more the linkages which would allow the wider use of the material. These linkages could also help in

- providing longer-term support for communities as the Project phases out
- assisting in transference of some monitoring responsibilities to other organisations
- reducing costs in any continuation of the Project or other future sector activities in the region

9 The total costs per head and particularly per community are quite high relative to other programmes in the sector, even where there is also a high hygiene education component. This is partly due to the experimental nature of much of what has been done, and the Project's keenness to modify and improve its impact as it progressed. For any future inputs to the sector, however, it is important for CARE to analyse the inputs and benefits of the various cost components, now that methodologies are mostly well-established.

10 Three years is a short period for a rural water supply and sanitation project, especially where methodologies are being developed as it goes along. The time taken for communities and others to change attitudes and behaviour, and for communal funds and spare parts systems to develop means that there are still lessons to be learnt from the experience of the area as it develops. Without having found all the answers, CWSP has much experience of relevance to the implementation of the PNA and the Transition Plan, and the potential to develop further.

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Special thanks go to Ana Lucia Obiols who gave much time, cheerfulness and experience of this and other projects his at a time when she was already overwhelmed with all the stresses and strains of leaving a job and a team to which she has given so much and which have themselves given so much to the Project

## LIST OF ABBREVIATIONS

CAA	Community Aid Abroad
CCB	Communications and Capacity Building Team
CHAEM	Centre for Environmental Hygiene and Medical Testing
CIDA	Canadian Agency for International Development
CWSP	Community Water and Sanitation Project
DA	Department of Water formerly
DAR	Directorate for Rural Water (at present PRONAR)
DHS	Demographic Health Survey (See References)
DNA	National Directorate of Water
DPPF	Provincial Directorate for Planning and Finance
DPOPH	Provincial Directorate of Public Works and Housing
DPS	Provincial Health Department
EC	(Community) Executive Committee
EOPS	End of Project Survey
EPAR	Provincial Workshop for Rural Water Supply
GEOMOC	State Enterprise for Drilling and Geophysics
GMR	(Community) Maintenance and Repair Group
GOM	Government of Moçambique
IE	Irish Embassy
IRWSP	Integrated Rural Water Supply Project
KAP	Knowledge, Attitude and Practice
MOPH	Ministry of Public Works and Housing
MOH	Ministry of Health
Mt	Metacais
NGO	Non-government Organisation
ORS	Oral re-hydration solution
ORT	Oral re-hydration therapy
PAP	Participatory action planning
PEC	Participation and Community Education
PL	Local (Health) promoter
PLNI	Programme for the Coastal Area of Northern Inhambane
PRA	Participatory Rural Appraisal
PRONAR	(Office of) National Programme of Rural Water
PSAA	Small piped water supply
RWS	Rural Water Supply
SARAR	Participatory methods for community education
SDC	Swiss Agency for Development and Co-operation
SPFF	Provincial Physical Planning Service
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
URTI	Upper respiratory tract infections
VLOM	Village Level Operation and Maintenance
WASH	Water, sanitation and hygiene
WASHE	Water, sanitation and health education as an intersectoral approach
WATSAN	Water and Sanitation

# 1 INTRODUCTION

## 1.1 Background to the Project

1.1.1 Following on an emergency water supply project started in 1993, CARE has been involved in the Second Phase of a Community Water and Sanitation Project (CWSP) which started in January 1995. This phase was planned to be for three years and has concentrated on development issues, particularly those relating to sustainability and encouragement of demand-responsive approaches. The move from emergency to development is seldom easy, as it requires the change of attitude of all involved, at community, project and government levels, and thus evolves gradually, rather than being an instantaneous transformation. During this evolution, CARE has encountered and overcome several problems which result from being an organisation at the forefront of such a change, and which, it is hoped, CARE's experience and solutions may help others to avoid.

1.1.2 The development objective of the project is to 'improve the health status of at least 44,500 people in Northern Inhambane'.<sup>1</sup> Intermediate goals are -

- to improve access to adequate water supplies for 44,500 people and to
- to maximise benefits of improved supply through adopted (good) environmental sanitation and hygiene practices<sup>2</sup>

1.1.3 The activities of the Project are confined to the four northernmost districts of Inhambane Province, Govuro, Inhassoro, Mabote and Vilankulo (see Fig 1.1). For effective logistical support and maximum impact within these four districts, activities are concentrated in cluster areas identified with district administration as being those areas with greatest problem of access to water. Of the ten agreed cluster areas, the Project has worked primarily in three each year. The three main interventions are the establishment of -

- sustainable water supply systems
- a regional de-centralised maintenance system,
- a participatory hygiene education programme

1.1.4 Funding has come from USAID, British ODA, CARE Germany, and the LeBrun Foundation and has totalled some 2.8 million US dollars. The project will continue, using these funds, until around June 1998, but with reduced levels of activity.

## 1.2 Outline of relevant characteristics of the area

1.2.1 The area consists of a coastal plain, and an interior plateau, with shallower groundwater, higher rainfall (around 0.8m/yr) and more dispersed settlement in the former. In Mabote rainfall averages only around 0.6m/yr, and depths to water over 30m. Over the major part of the region, groundwater tends to be high in dissolved solids, especially in the South of the region and near the Rio Save. The demand for water is such that only one well has been abandoned completely because of high salinity, but it does mean that when rainwater can be collected it tends to be preferred, both for its taste and for the lesser consumption of soap for washing clothes.

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<sup>1</sup> See log frame ref 14

<sup>2</sup> See TOR for Final Evaluation

1 2 2 The major part of the region is underlain by limestones, and so surface water is rare, except short-lived ponding during the rainy season. Unlike many other parts of the country there are few perennial water sources, except for the Rio Save in the North, and also a few lakes. Combined with the great depth to groundwater, there are therefore few alternative dry season water sources, and traditionally women have often had to often walk for many hours to make a single trip for water collection. For wet season supplies there is some tradition of collecting rainwater, either by scooping it into storage containers (varying size from a bucket, to a baobab tree and to cisterns), or by funnelling it off impermeable surfaces into large cisterns. However most of the latter systems were destroyed or fell into disrepair during the war.

1 2 3 For the wells constructed in 1995 and 1996 (see Fig 1 2) the average depth was just under 60m and the average dynamic water level just under 50m. Drilling then requires medium-sized rotary rigs and means that most handpumps (including Afridevs) are operating against greater head than their design optimum (see Section 3 2). In Massinga to the South average depths to water are even greater (average well depth being almost 90m), requiring different pump technologies.

1 2 4 Especially in the eastern part of the area, the population is very dispersed, with houses typically several hundred metres apart. Nucleated *aldeias* are rare except in the interior. This affects the possibility of siting water supplies within 1km of users' houses, and the ease with which communities can call or attend meetings for decision-making and training. However the high priority given to water means that such a disadvantage for community participation has much less effect than it would have in other parts of the country.

Inhambane was one of the first provinces to begin to recover from the war, and, as a result, communities in this region are better established, and less subject to continued migration than many other parts of the country.

1 2 5 Overall, the high demand for water and lack of alternative sources combined with the relative stability of the rural population presents a favourable environment for developing demand-driven approaches. However since large parts of the country have greater access to alternative sources, using similar methods may not always be guaranteed to lead to similar results elsewhere.

1 2 6 In terms of national statistics it appears that the lack of much surface water in the region has some positive effects on health. According to the Demographic Health Survey (Ref 21), Inhambane Province, along with Gaza, exhibit half to a third of the incidence of diarrhoea found in any other provinces. This is at odds with Project surveys (Refs 1,2,4) which cite diarrhoea as the commonest disease, with as many as 40% of children under 5 with diarrhoea in the previous 2 weeks (cf DHS 7 6%). It has also reportedly a lower incidence of malaria than is common elsewhere in the country.

### **1 3 Other organisations active in the sector in the region**

1 3 1 Whilst CARE is a major agency at present working in the area, there are and have been others active in the sector. The CARE 1997 inventory of all wells in the four districts suggests there are just over 400 wells and boreholes in total, of which CARE has been responsible for the construction or rehabilitation of around 170 or 42%. Other agencies involved in well construction include EPAR and the Ministry of

Agriculture, and ENH and PLNI and just recently GTA (*Grupo de Trabalho Ambiental*) with shallow wells in Inhassoro CAA are working on rural water supplies as part of community development in neighbouring Massinga MOPH have the responsibility to plan and oversee well construction in the province as a whole, and have a regional office in Vilankulo, but most decisions are taken in HQ Maxixe, or by DNA/PRONAR in Maputo, whose ability to visit the area has been limited

1 3 2 In the past DA/ EPAR have planned and constructed wells through UNICEF (Canadian) funding, and the government has previously tried to set up some elements of de-centralised maintenance in the province This has included PEC activities in introducing communities to the basics of handpump maintenance, and trying to get traders interested in stocking spare parts, and in 1994 the training of some area pump mechanics However the initiatives were not co-ordinated and in general it was regarded that CARE was covering these aspects within its area of operations Government interventions have suffered from lack of consistency in policies to date, with free spare parts sometimes being distributed, and at other times their being sold through government offices rather than through traders Such incidences, and lack of support from most local politicians (with the notable exception of the provincial governor) for sustainable initiatives has made a difficult environment in which to set up clearly defined cost recovery systems In future, the move to implement the National Water Policy (see Section 2) and consequent increased political support at national level should make it easier to establish sustainable systems along similar lines to those that CARE has implemented

## **1 4 Terms of reference for the Final Evaluation**

1 4 1 It is within the context of the above environment that the Project has been operating, and within which the achievements of the project should be reviewed The Terms of Reference (see Appendix 1) require the evaluation team and project staff to

review achievements of project outputs according to specified indicators assess the Project's final impact, using data from the end-of-project survey as well as qualitative field participatory activities, with special reference to

- 1 the capacity of communities to maintain and operate their pumps and the sustainability of the system
- 2 behavioural changes adopted by target beneficiaries
- 3 the activities impact in relation to the perceived needs of the population of the districts
- 4 the effectiveness and sustainability of the private sector in terms of the commercial supply of spare parts to the participating communities

1 4 2 Other issues to be addressed include -,

- have changes in water sector policies and the subsequent political environment in the province had an impact on project implementation?
- have changes over the past 24 months in project strategy been appropriate in terms of the new water policy adopted by GOM
- What further programmatic tuning or changes are recommended in the light of the new water sector policies, and particularly in relation to a more demand-driven approach to water delivery?

## **1 5 Sources of information and methodology for the evaluation**

1 5 1 The CWSP is a very well documented project which has both a series of detailed progress reports and strategy papers from within the project and several reviews carried out by outside consultants (see list of references Appendix 2) There has been careful project tracking of inputs and outputs set out in annual progress reports, which have formed part of the basis of the evaluation, but the progress report for the period to the end of 1997 was still being completed at the time of the drafting of this report in early January 1998 As far as possible information for the period post-March 1997 has been included

1 5 2 The Project has made considerable efforts to set up a database to facilitate evaluation of impact, first by undertaking a KAP survey in 1995 (Ref 2) in search of relevant and appropriate indicators, and then a baseline survey in 1996 (Ref 1) A further end-of project survey undertaken in 1997 (Ref 4) was designed to give a measure of changes in water use, behaviour, and disease incidence as a result of Project interventions This is considered further in Section 6 Measuring impact over such a short time span can be difficult when many changes take time to take effect, and may require a more continuous monitoring (as has been started through communities carrying out their own surveys) However such systems are complicated and time is needed to iron out the problems and inconsistencies (noise), and to show significant changes and their causes Unfortunately time is not something the Project has at present, unless its life is extended The carrying out of surveys at different times of year (cool dry and hot dry) has also introduced an additional variable which is likely to affect several indicators of behavioural change Nevertheless the surveys prove a useful basis for preliminary assessment of impact and indicate how such methods could be further refined to provide a methodology applicable elsewhere in the country

1 5 3 The evaluation team consisted of three members from outside the project, working with the members of the CWSP These three were -  
Felicidade Afonso , Head of PEC, PRONAR, Maputo  
Belmiro Manuel Nhassango, Tecnico medio hidraulico, DPOPH, Maxixe  
Dr Sally Sutton, SWL Consultants, Shrewsbury UK (Team leader)

1 5 4 In addition to using existing documentation, the review was carried out through -

- discussion with project staff
- field visits in three groups including CARE Vilankulo and field based staff to some 20 communities in 3 districts
- group discussion with facilitators and CARE Vilankulo of their findings on project strengths and weaknesses from their experience and the above field visits
- interviews with traders stocking pump spare parts
- meetings with provincial administration (Governor, Director DPOPH, Head of DA)
- meetings with national organisations (DNA, UNICEF, CIDA, DFID, USAID, Irish Embassy) which are have recently been or plan to be involved in the sector and its funding in Inhambane As it was the period for DNA and PRONAR annual planning workshops, a de-briefing with GOM and donors proved impossible to arrange

Communities visited included - in Inhassoro/ Vilankulo districts - Pinzuca, Maole, Mucuche, Manjangane, Mangove 1 and 2, Mavanza, Mahilene, Guambe, Nhapele/ Catine, Colonga, Chiguela, Maimelane, in Govuro district - Luido, and in Mabote district - Pangue Tsumbo Chigamane Chitofu (Not project), Chitanga

1 5 5 The evaluation took place during the last ten days of the Project Co-ordinator's contract, which was at a time when many different wrapping-up activities were occurring. Everyone contributed as much as was possible, but it did mean that some things could not be achieved. This included any team member being able to see how participatory hygiene education sessions were carried out. The views expressed on hygiene education are therefore based largely on discussions with the two project co-ordinators and also with facilitators, promoters and ordinary members of communities, and on observations made during previous reviews (see Refs 3 and 5)

1 5 5 The findings of the team and the project are set out in the subsequent sections, all of which are relevant to consideration of the sustainability of the rural water supply systems established, and the degree to which methodologies developed by CARE might be transferable to other parts of the country. Sections 3-5 refer particularly to the outputs relating to the first intermediate goal, whilst subsequent sections look more at behaviour change, project impact and cost effectiveness. Elements include -

- Changes in national policies and how well the systems developed by CARE fit into the national plan and are supported by national and provincial administration (Section 2)
- The technologies chosen and how reliable, and easily maintainable they are (Section 3)
- The willingness and capacity of communities to organise themselves and fund supply maintenance (Section 4)
- The involvement of the private sector in many aspects of construction and maintenance systems (Section 5)
- Hygiene education and behaviour to change which maximise project impact, and increase priority given to water (section 6 and 7)
- Organisational aspects including linkages which reduce dependency on the project so that its phasing out does not jeopardise sustainability (Section 8)
- Cost effectiveness which relates inputs to outputs (Section 9)
- A summary of conclusions and recommendations

The final Project Progress Report being drawn up by the Project Manager will contain the detailed logical framework and quantitative indicators of the degree to which outputs have been achieved. This report therefore concentrates more on the qualitative aspects

## 2 NATIONAL CONTEXT

### 2.1 Main issues in the National Water Policy

2.1.1 As Moçambique has moved from an emergency situation to a more stable environment, development issues can be tackled systematically and at a pace more in keeping with the wishes of the client population. The National Water Policy reflects this and is set out in *Boletim da Republica number 34, Politica Nacional de Águas* (PNA), of August 1995. It establishes that priority be given to rural people and low income groups.

2.1.2 In the past rural water supply in Moçambique mainly provided under emergency programmes in which responsibility for maintenance and most construction lay with GOM. Supply users regarded the systems as belonging to government and expected government to look after them and repair them, a role that GOM did not have the resources to fulfil. The result was a system which relied heavily on outside funding, with little or no ownership or financial contribution from consumers, and which quickly fell into disrepair. It is partly to make a clear break with this assumption that the PNA was proposed and adopted in 1995. It accentuates not only the sustainability triangle, but the organisational triangle in which the consumers at the apex becoming clients / beneficiaries whose demand are fulfilled either by their own efforts or by the private sector and only by government (as monitor of standards) where neither of these proves viable, or where funds need to be mobilised from outside.

2.1.3 The main principles are -

- Beneficiaries should be involved in all stages from planning to management of operation and maintenance
- Water supply and sanitation services should be de-centralised and local management and funding be strengthened. A pilot project of provincial level planning especially in urban water and sanitation will be implemented (in Nampula)
- The government will no longer be involved in implementation
- Existing sources will be put back into working order
- De-centralisation will require the strengthening of provincial and district capacity, by recruiting people with higher qualifications, training those already in employment and providing adequate incentives
- The capacity of the private sector should be used to improve service levels, through contracts, management of concessions and direct investment

2.1.4 In terms of rural water supply the National Water Policy establishes goals and priorities up to the year 2000. It proposes a target coverage of 40% for rural water supply including handpumps and small piped water supplies. Coverage is defined as a safe source supplying 500 people within 500m.

Priority is given to

- areas of lowest coverage
- small piped supplies, in that schools, hospitals and commercial establishments which they serve are fundamental to the re-activating of social and economic infrastructure in rural areas

### 2 1 5 Strategies include -

- Community level of handpump maintenance, strengthened by effective maintenance of the source itself
- Gradual increase in cost recovery in relationship to capacity and willingness to pay
- Government seeking/providing funds, which may eventually be channelled through beneficiary communities themselves, rather than through implementing agencies
- Greater involvement of the private sector in well construction
- State input where the participation of the private sector is not viable

2 1 6 Policies on rural sanitation are limited to the promotion of local initiatives, the mobilisation of resources and the setting up of provincial low cost sanitation groups (PNSBC) in each province. Initiatives include the researching of sanitation solutions which use local materials and public health education programmes

2 1 7 As a first step in adopting the new policy, DNA contracted Cowater to undertake a study of the institutional arrangements in the sector<sup>3</sup>. This clearly outlines a strategy for moving towards a -

- demand driven
- de-centralised
- sustainable

system for provision of services to client communities. Such a system would be based on facilitation of communities to prioritise their problems and to choose sustainable solutions on well-informed grounds

2 1 8 This requires both a major change in approach at all levels, and the building up of capacity to facilitate the demand-driven approach at community level. Early stages include the re-organisation and definition of roles and responsibilities in the overall management structure which are at present poorly defined. There is a proposal from CIDA/ World Bank to set up a programme in Inhambane Province as a national pilot province to test the strategies which are being proposed, for rural and small piped (PSAA) supplies

## 2 2 Present organisational structure

2 2 1 The present organisational framework is that PRONAR (*Gabinete do Programme Nacional de Agua Rural*), as the department of DNA (*Direcção Nacional de Aguas*) within MOPH (*Ministerio de Obras Publicas e Habitação*) with responsibility for rural water, co-ordinates and plans activities nationally, and manages well construction funding and contracts. At provincial level this is carried out by DA (*Departamento de Agua*), which is the department of DPOPH which supervises activities in the field and certifies work for payment through PRONAR and for some NGOs. It also collects information for planning and funding proposals. Within DA there are sections for urban and small piped supplies, wells and boreholes, and hydrology as well as administration and finance. DA has seconded one technical assistant to CARE.

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<sup>3</sup> Study of the Institutional Arrangements for the Provision of Rural Water Supply and Sanitation services in Moçambique. Cowater International Inc. March 1997

2 2 2 Whilst this structure will remain essentially the same, roles and responsibilities will change as government withdraws from implementation and develops its facilitatory and monitoring capacity. This requires considerable change in attitudes, especially among sections which are principally technically orientated. The transition plan intends to strengthen and develop existing capacity as far as possible.

### **2 3 The PNA (National Water Policy) Transition Plan**

2 3 1 This is a plan set out by GOM to establish rules and guidelines to 'assist all actors in the sector to implement the PNA in a consistent and uniform manner'. It views the demand-based, community managed approach as one which is an entry point for further sustainable development initiatives to be taken by the community.

2 3 2 The Rural Water Transition Plan (RWTP), is designed to co-ordinate the development of the new strategies at national, provincial and community levels. It will be led by a Steering Committee of MOPH, INDER, DAR/PRONAR and DNA, and will start by raising the awareness of national level staff of the implications of the PNA/ RWTP, and setting up a plan for capacity building.

2 3 3 Within the plan, DAR/DNA will be looking at particular aspects which are of interest to CARE:

- government subsidies and tariffs, which appear to cover rural point supplies as well as piped systems
- Contracts and procurements procedures
- Development of methodologies to support implementation of plan where donor support is low (ie at levels affordable to GOM and within GOM systems)
- Monitoring of 'lessons learnt' from experience of project implementation

2 3 4 At provincial level there will be two simultaneous processes - the re-structuring of the sector and the implementation of the PNA rural component. For this technical assistance will be needed in:

- experience in implementing the PNA
- institution and capacity building
- adult education and communication for behaviour change
- monitoring and evaluation

all of which are areas in which CARE has exhibited its expertise in Northern Inhambane.

2 3 5 DA will be seeking to contract community mobilisation teams, and will also be seeking trainers to build up the capacity of the private sector in this field. They will make beneficiary assessments, assist DPOPH/DA to select communities which are prioritised on an agreed basis. Communities will be trained in four main areas -

- collection and management of funds
- community organisation for water and sanitation management
- technical choice and relevant costs
- hygiene and sanitation issues

These are the aspects in which CARE has been most involved so far, and has developed methodologies as yet not seen elsewhere in the country. Some are still developing (see Ch 6) and some have already shown significant impact.

## 2 4 CARE's response to the PNA

2 4 1 Since 1996 the CWSP in Inhambane province has been developing systems which conform with the National Water Policy This is providing helpful indicators of what is practicable at community level, and the time needed -

- to make the required changes in attitudes, in terms of ownership, willingness to contribute to capital and recurrent costs,
- to set up community management systems,
- to engage the private sector in spare part provision and other aspects of RWS (see Section 4),
- and to increase awareness of health issues to a level at which communities give safe water a high enough priority to cover the most frequent costs, if not yet the most major ones

2 4 2 As the Transition Plan points out, there is a major need for changing the attitudes at all levels, from one where water supply as a service provided by government or NGO, to one which is the choice of the user, depending on their economic status, the priority they give to improvement of supply and improved health To date CARE has concentrated most on the community level of this, and links to provincial and national level could perhaps have been stronger However, the situation of DPOPH management in Inhambane has, until recently made fruitful co-operation quite difficult, and stronger links are now being made Such links are also assisting in increasing the awareness of PNA issues at provincial, regional and district levels On policy matters such as

- pre-payment for pumpheads by communities, and
- stopping of free distribution of spare parts which were undermining the fragile but growing private sector spare parts stocking and sale,

the Governor's office has been particularly helpful, and this has helped in the changing of attitudes of some local politicians, and communities However these changes have taken time, and effort and have led to some delays which have had cost implications to the Project, and which are likely to be experienced by others working in the same field, especially during the transition period

2 4 3 The involvement and active role of representatives of PRONAR/DAR and of DA Maxixe in the present evaluation are a sign of CARE's growing awareness of the importance of stronger links to government to ensure better feed-back on experience in the implementation of PNA, and more government input to the form of any project in the future

2 4 4 Table 2 1 outlines the steps which CARE has taken to respond to the PNA and to build up sustainable systems since 1995 In line with the PNA it has also identified, with district/ provincial administration, cluster areas, within which

**Table 2 1 Development of project approaches**

Aspect	Before PNA	Response to PNA
De-centralised maintenance	<ul style="list-style-type: none"> <li>• 1994 government initiative gave spare parts to traders</li> <li>• CARE took responsibility for repairs until 1995</li> </ul>	<ul style="list-style-type: none"> <li>• Communities with responsibility for maintenance and repairs</li> <li>• Traders procure spare parts direct from manufacturers</li> <li>• Return of sub-standard spares negotiated</li> <li>• 1996 Traders keep pumps for community collection and sale of first spares kit</li> <li>• 1997 Traders hold pumps till community pay pre-payment completed</li> <li>• Smaller traders provide credit system or act as bank</li> </ul>

Importance of hygiene education	<ul style="list-style-type: none"> <li>• Secondary to construction</li> <li>• Mainly limited to hygiene practices around the well</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction of hygiene education first at community level and then since 1997 at household level</li> <li>• HE given greater emphasis than well construction</li> <li>• Monitoring of behaviour change established</li> <li>• HE emphasis changed 1997 to concentrate on behaviour /attitude change not hardware (latrines pot racks) etc</li> </ul>
Community contribution to construction	<ul style="list-style-type: none"> <li>• Labour to improve access</li> <li>• Clear round well</li> </ul>	<ul style="list-style-type: none"> <li>• As previously plus</li> <li>• 1996 Collect pump and buy one set of spare parts</li> <li>• 1997 Pay 3 3 million MT</li> </ul>
Roles of executive committee	<ul style="list-style-type: none"> <li>• Not existing until 1996</li> </ul>	<ul style="list-style-type: none"> <li>• Census of families and collection of contributions</li> <li>• Organise zoning and amount of contributions</li> <li>• making people aware of the need to contribute</li> <li>• Accounting to community for sums spent</li> <li>• Keeping funds safe</li> <li>• Problem solving (eg non-payers)</li> <li>• Participate in education of GMR and PLs</li> <li>• Buying pump spare parts and keeping stocks</li> <li>• Inspecting works of GMR</li> <li>• Presenting PLs to community &amp; dividing community into 10 house groups</li> <li>• Planning and monitoring the work of PLs</li> <li>• Monitoring 19 households</li> <li>• Production of a written summary of community monitoring</li> <li>• Make long-term comparisons between changing behaviour and disease incidence</li> </ul> <p>Since Sept 1997</p> <ul style="list-style-type: none"> <li>• Transform their house into a model house</li> </ul>
Roles of maintenance group	<ul style="list-style-type: none"> <li>• Organize zoning &amp; amount of contributions</li> <li>• Routine maintenance</li> <li>• Look after pump and surroundings</li> <li>• Organise queuing and times when pump is locked</li> <li>• Keep spare arts in stock and keep funds safe</li> <li>• Control the amount of water drawn per family where necessary</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance and repairs</li> <li>• Keep spare parts in stock</li> <li>• Look after pump and surroundings</li> <li>• Organise queuing and times when pump is locked</li> <li>• Control the amount of water drawn per family where necessary</li> <li>• Participate/ assist in courses to form PLs</li> <li>• Installation of the pump</li> <li>• Diagnose problems and inform CE of parts needed</li> </ul>
Roles of promoters	<ul style="list-style-type: none"> <li>• Not existing until 1996</li> </ul>	<ul style="list-style-type: none"> <li>• Till mid 1997 two promoters per community then one per 10 houses</li> <li>• Monitor 10 houses</li> <li>• Analyse problems and with CE and rest of community decide on solutions</li> <li>• Deliver health messages at household level</li> <li>• Monitor and analyse behaviour changes</li> <li>• Set house as model for others</li> </ul>

problems of water supply were regarded as being the highest It is within these areas of provincial demand that response to community demand is being concentrated

## 2 5 Recommendations

2 5 1 CARE should increase its advocacy at provincial and district levels on sustainability and cash contributions as an expression of demand A regular forum at which GOM could discuss these issues with NGOs would encourage the adoption of similar strategies throughout the province

2.5.2 There is very little provincial awareness of national level plans for implementation of PNA in Inhambane, which leads to a danger that it will be regarded as being foisted on them, rather than helping the need for it to be turned into a demand from the province. CARE should offer to play a part in this exercise as it faced a similar difficulty at various stages.

### 3. TECHNOLOGY OPTIONS AND PHYSICAL OUTPUTS

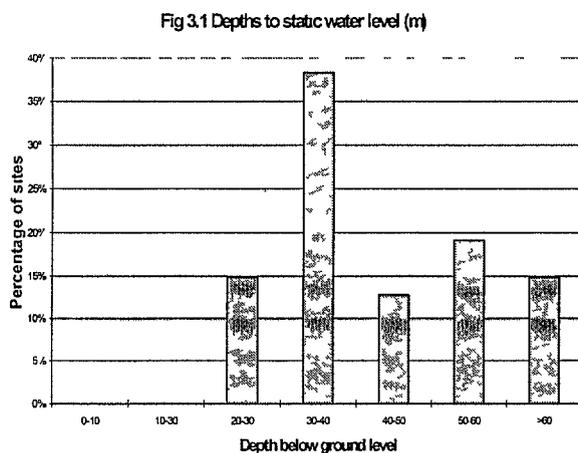
**Intermediate goal #1** To improve access to adequate reliable water for 44,500 people

**Output 1** 90 boreholes constructed or rehabilitated with apron, drain, and handpump mounted and 12 wells rehabilitated

**Output 4** A pilot project for construction of local rainwater catchment systems implemented

#### 3 1 Communal water sources

3 1 1 Groundwater levels throughout most of the cluster zones lies at more than 20m (see Fig 3 1) so leading to little alternative to drilling to provide communal water supplies



Some determined attempts have been made to construct hand-dug wells, including one that reached over 60m and took ten years to dig, but except in a few instances where hand-dug wells have been rehabilitated (mainly in Mabote), boreholes offer the only reliable year-round source of water. Small retention dams are unlikely to be successful with the prevailing geology.

Borehole yields are adequate for handpump discharges, and no

boreholes were found where yield could not be maintained throughout the day

3 1 2 The variability of limestone permeability led to five 'dry' holes drilled in 1995/6. To increase the probability of positive results, the Project has developed a system using GIS to combine topographic and geological information for better siting. This was combined with a geophysical survey (ref 8) and led to there being only one negative ('dry') hole of the 40 scheduled drilling sites in 1997.

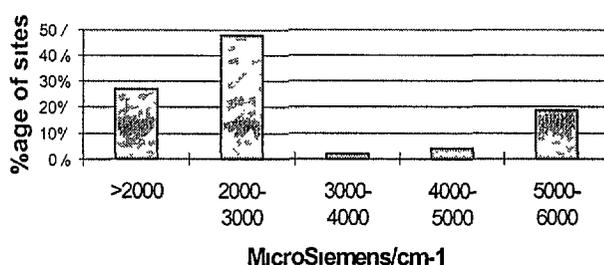
3 1 3 Five wells have been abandoned or replaced, four because of sanding and one because of high salinity. Most of those sanding were constructed during the emergency phase, or rehabilitated by the Project. However rehabilitation of sanding wells will not provide a reliable supply, unless new screen and gravel pack can be installed, which is seldom possible, so that sanding wells are generally not counted in totals.

3 1 4 Prior to 1997 there have been several wells whose verticality was insufficient for good pump operation, leading to frequent wearing of riser pipes which has put undue strain on the communities paying for repairs. However since improved drilling specification, supervision and inspection, and also the calling of contractors to account for sub-standard construction, this is no longer a problem. The one poorly aligned borehole drilled in 1997 is at present awaiting re-drilling by the contractor. Especially for deep boreholes, this shows the importance of contractual responsibility for poor construction, and its clear specification in contract documents. The Project with DA provided contract supervision and also contracted

DNA to provide inspection on completion. Contractors used have included GEOMOC (1995) Modrill and Mozagua and all have operated acceptably although Mozagua still have the one sub-standard borehole to replace

3 1 5 Water quality in boreholes is variable, being often brackish and/ or hard (See Fig 3 2). One third of wells constructed during the second phase contain water of over 3000 microSiemens/cm<sup>1</sup>, which may be regarded as brackish and exceeds national and international recommended limits. The hardness of some of the water is such that women say that when they have time they walk to a further well (more than 2 km away) to wash clothes as they can then use less soap. However the general scarcity of water sources means that the borehole water is generally regarded as acceptable for all uses in the dry season (see also Section 6). DNA mapping of water quality (see Fig 3 3) suggests that this is a regional problem and

**Fig 3 2 Electrical conductivity of Phase 2 borehole waters**



that changes in siting or well design would not lead to any improvements

3 1 6 The sources constructed by CWSP have proved, with very few exceptions, to be of good reliability and construction quality. The benefits arising from these sources are therefore likely to be available as long as the handpumps on them are

maintained. The average cost per borehole was US\$ 4,800 for the 1997 drilling contract (or \$86/metre)

To give an indicative cost of the whole installation, to this should be added US\$ 1000 for a handpump and some \$3,400 for supervision and 'fiscalização', geophysical survey and pump installation, giving a total of around \$9,200 per well<sup>4</sup>

3 1 7 The total number of operating sources constructed or rehabilitated by CARE is, according to the 1997 inventory 12 hand-dug wells and 156 boreholes. Of these 86 new boreholes (including 2 for UNICEF schools project) and 14 well and borehole rehabilitations have been completed by the project in the second phase. This exceeded the original planned output of 60 new boreholes (later increased to 75 in line with the recommendations of the MTE), both by the inclusion of rehabilitation of old sources in the cluster areas and the expansion of drilling contracts as improved cost effectiveness allowed transference of more funds to borehole construction. Five wells remain to be rehabilitated before the end of the Project

## 3 2 Well heads and handpumps

3 2 1 The project has undertaken a considerable amount of research on the Afridev and its performance, and has developed several useful measures to improve sustainability. The maximum recommended depth of the pump is around 45 m and the national recommendation is to use Volanta pumps below this depth. However, after considering the alternatives the Project decided to adopt the use of the Afridev on all wells even where dynamic water levels exceed 60m (about one in ten wells). This decision was based on the realisation that it was unlikely that traders would stock the high cost Volanta spare parts where so few pumps were installed, and also that experience has shown that pumps with regular breakdowns tend to be

<sup>4</sup> A L Obiols Pers comm Jan 1998

better maintained than those with few, but costly, repairs needed (see also Section 5.2.2). 97% of pumps are working and the 3% permanently not working are wells from the previous phase and/or because of poor well construction. This suggests that at least in the first years of operation this assumption has proved correct.

3.2.2 Analyses by the project of pump breakdowns (ref 18) suggests significantly higher rates of parts failure in pumps installed in 1993-4. What is not clear is whether this is a function of:

- a) age
- b) different installation practices during the emergency phase
- c) the lesser training in maintenance during that phase

Longer term monitoring is necessary to provide indications of how the Afridev may be expected to perform and the associated maintenance costs as the pumps age. It is particularly the higher cost, infrequent repairs for which no system of back-up at present exists (see Section 5), on which more information is needed.

3.2.3 The number of breakdowns per well depends on -

- a) the degree to which routine maintenance is undertaken,
- b) the number of users and
- c) the head against which the pump operates and the length of riser pipe

40% of pumps had had no breakdown since installation according to the 1997 inventory and included some pumps installed in 1993, although most were those installed more recently. Per well, those with pumps installed at more than 45m were much more likely to have problems with disconnection of pipes or the cylinder, and of splits in the pipe or at the joints. With the subsequent withdrawal of the whole riser pipe this leads to greater risks with the increased number of joints and dangers of pipes falling into the well. The PVC joints provided by the manufacturer with the pump have proved of insufficient strength for deep installation, and the Project has therefore developed its own system of making collars by heating and expanding pipe which provides a thicker and stronger union. However there are wells at which the number of joints has now become so high (eg Mavanza/ Mupalau) that cracking is becoming common and the whole pipe needs replacement.

Shallower wells have more problems with bearings and rods (Ref 18), but this may partly reflect lower frequency of routine maintenance. In all cases the number of users is very high, and pumps are often in constant use all day, which is not usually the case in most other parts of the country.

3.2.4 Apart from the riser pipes on deep wells, the Afridev has so far proved itself to be reliable in operation in most situations. However the poor galvanising of the pumphead was found to have led to bad corrosion in several instances, especially where water was brackish. Better quality control during manufacturing and insistence on high quality hot-dip galvanising is needed.

3.2.5 In 1996 Afridev handpumps cost from around \$900 to \$1,400 depending on the depth of installation, not including delivery from Maputo. Prices are fluctuating since the establishment of a second factory, but this has proved so far unwilling to provide spare parts or to undertake small orders.

3.2.6 Well head construction of aprons, drainage and wellhead seals has generally been of high quality, as observed by DPOPH representatives. There is generally quite high wear of the slab where containers are placed, but these have reinforcing rods set in them to stop concrete getting more worn away. Drainage is generally good, with no ponding of water observed. Many communities had instigated controls on people walking on aprons except when washing and filling containers, to reduce the build up of sand and the wear of the concrete.

3 2 7 There are few measurements of faecal coliform but those that there are suggest that it is possible that of the early boreholes, the seal to exclude return of surface water may not be effective in just over one quarter of the sites. There is no comparable information for later boreholes.

### **3 3 Household water supplies**

3 3 1 There is a history of rainwater harvesting in the region, especially where distances to water have, in the past, been at their greatest. The cisterns and impermeable areas constructed could usually provide sufficient water for a family of eight people for the whole year. On a smaller scale, households would scoop puddled water into containers, small cisterns or even into baobab trees for temporary storage.

3 3 2 The project has carried out considerable research and undertaken pilot rehabilitation of ten systems (ref 9). However with the high workload associated with borehole construction and community education it curtailed its activities with rainwater collection systems in line with the recommendations of the Mid-Term Evaluation (MTE, ref 5). Initial interventions were confined to improving catchment area impermeability and extent, and repairing existing cisterns. In addition rainfall has been monitored at Mangove, an area with a high number of cisterns for rehabilitation.

3 3 3 The improvements made were found to have increased the efficiency of water collection and the quality of water stored. Households interviewed, who have cisterns in disrepair, suggested that they have not given priority to such repairs since the provision of new wells has reduced the distance they have to walk to collect water. However as their socio-economic condition improves they would perhaps wish to improve their systems, and the piloting of technological options could encourage the establishment of systems which are replicable using local materials and skills, without the dependence on outside inputs which boreholes require. Such an option gives communities an opportunity to choose their own level of technology. This is especially desirable while numbers using handpumps put unacceptable pressure on the system, but less desirable if they reduce the number of households contributing to handpump maintenance below a sustainable level. Many cisterns in the past apparently gained income from selling water so the degree to which subsidy is required should be limited and might be better established as a credit system.

3 3 4 The cost of rehabilitating existing systems is comparable to that of constructing a borehole and mounting a handpump (assuming both require similar levels of community/ household motivation), the cost of the latter being around \$100/ family, and that of the former being \$100-240 depending on the type of catchment surface. The construction of new rainwater collection and storage systems would therefore only prove economic where groundwater is too deep or too salty for exploitation. This holds true while supplies are subsidised, but obviously would change where individuals begin to have the capacity to cover all costs and so make decisions based on convenience, not simply on cost and minimum supply considerations.

### 3 4 Conclusions

3 4 1 The above section relates to Output #1 which is “ **Sixty (later increased to 90) drilled and developed boreholes with apron, drain and handpump, mounted on a sealed well head**” These wells, according to the project proposal are to serve 500 people within a 2 km radius, with a target of serving over 44,500 in total

Table 3 1 Number of people served

Total no of wells	Year	Number of people served				Total
		Inhassoro	Govuro	Vilankulo	Mabote	
35	1994	4,868	-	15,504	-	20,372
27	1995	8,280	-	4,842	3,420	16,542
28	1996	3,774	840	4,186	3,447	12,247
45	1997	6,240	228	13,037	6,085	25,590
35	First phase	4,868	-	15,504	-	20,372
100	Second	18,294	1,068	22,065	12,952	54,379
135	Total	23,162	1,068	37,569	12,952	74,751

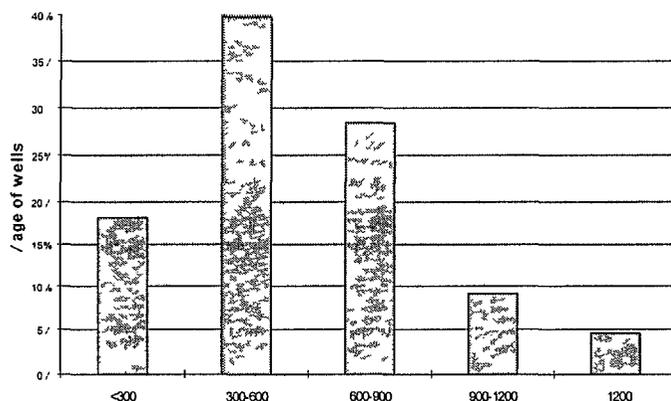
Thus the target number of beneficiaries and number of boreholes can be seen to have been exceeded and information on the quality of installations suggests that the technical quality of outputs is high

3 4 2 The number of people served varies both between communities and in different districts The average number of people served in each district is as follows

Inhassoro	474
Govuro	180
Vilankulo	690
Mabote	510

suggesting that even with the high number of wells constructed in Vilankulo, there is still considerable pressure on the new water sources

Fig 3 4 Number of beneficiaries per well (Sample 88)



The average ( approximately 550) also masks the fact that some 40% of wells serve over 600 people (see Fig 3 4)

3 4 3 The number of pump users is high both in relation to national standards (500) and pump manufacturers usual recommendations of some 250-300 people per well, suggesting that pump wear may become more of a

problem with time, and that there is scope still to reduce pressure by construction of further boreholes in specific areas where pumps may be regarded as over-utilised

3 4 4 Despite operating both near the limit of its operational capacity, both in terms of depth to pumping water level and number of people served, the Afridev has proved reliable, mainly as a result of routine preventive maintenance (see Section 4 2 2)

### **3 5 Recommendations**

3 5 1 Quality control on handpump manufacture, particularly the need for good hot-dip galvanising if brackish water is to be pumped, should be insisted upon by pump purchasers and by DAR/PRONAR, and may need re-assessment of the current national specification. The production of stronger unions for deep wells should also be discussed, if there is significant demand from other parts of the country as well. There is also significant deviation in the thickness of riser pipe walls which makes chemical welding of joints difficult and may need higher specification of PVC pipes.

3 5 2 Where groundwater of acceptable quality lies within 50m of the surface, boreholes will be a more economic alternative than rainwater catchment even where systems only require rehabilitation. However the cost-benefit of combining zinc roof catchment with tanks might be further discussed, as this gives a combined benefit, and has already been adopted by a significant number of households who have invested in zinc roofs.

3 5 3 Performance of the Afridev should continue to be monitored, with increasing DA input for which funding should be sought. The very testing conditions under which the pumps are operating will lead to the ageing process being speeded up in this area. Continued monitoring will therefore provide useful indicators of the types of problem and their frequency, to assist in planning for other parts of the country and for furnishing traders with information on the business potential for spare parts sales. It will also allow DNA/DAR/PRONAR to see whether the national guidelines should be re-assessed in the light of the performance and maintenance costs of Afridevs at depths greater than 45m.

## **4 INVOLVEMENT OF THE PRIVATE SECTOR**

**Project output 2** - commercialised spare parts supply facilitated for at least 80 new Afridev handpumps and 40 old Afridevs

**PNA policy** - The capacity of the private sector should be used to improve service levels through contracts, management of concessions and direct investment

### **4 1 Commercialised spare parts supply**

4 1 1 Both CARE and GOM have gone through several stages of encouraging the commercialisation of spare parts. The stages include -

- 1 Free provision of spare parts to traders
- 2 Subsidised spare parts, traders paying for parts at factory cost price (GOM or NGO covering procurement and transport costs)
- 3 Traders deal direct with manufacturers or with agent in province
- 4 Buying spare parts and pumps at local traders reducing subsidies until traders gave competitive prices compare to those given by the manufacturers

CARE has encouraged traders to reach the third and fourth stage, whilst DA elsewhere in the province has reached an intermediate point between the first and second

4 1 2 Whilst it is a GOM policy both to involve the private sector more and to increase the levels of cost recovery through community contribution, there have been fairly conflicting messages from local politicians, and at times from national organisations such as PRONAR. Politicians have at times discouraged communities from paying for parts or solving their own problems, and at other times spare parts have been available free through DA or EPAR. As recently as 1997 new pumps and spare parts were being distributed free within the province, undermining local traders' initiatives to invest in spare parts and sell them at commercial prices. CARE has had to contend with these conflicting messages and the effects they have had on communities. The support of the provincial governor has proved invaluable both in agreeing to support a policy of pumphead purchase and in putting pressure on DA to stop the free distribution of spare parts.

4 1 3 It is within this environment that CARE has encouraged traders to stock spare parts in Vilankulo, Mabote and Morure. There is an additional trader in Massinga, which is nearer for some communities, who obtains stocks through DA Maxixe, but charges comparable prices. There have, at various times been seven traders stocking spare parts in the region, partly under the GOM initiative of 1994, but those in Inhassoro, Mavanza and Mapinhane and a previous trader in Vilankulo have ceased selling Afridev spares.

4 1 4 CARE moved from undertaking repairs (emergency phase), to providing traders with spare parts to sell, the subsidy being successively reduced as new orders were processed, until they were removed completely at the end of 1996. To re-inforce the idea that there was a viable market and to create links between traders and communities, in 1996 CARE required communities, where new boreholes were to be constructed, to arrange collection of the pump from the nearest spare parts stockist, and to buy a spare part kit at the same time, before a rig would mobilise to site. Since 1996, CARE has bought all Afridev pumps and the spare parts through the local vendor in Vilankulo. In 1996, CWSP decided to pay 10% over the price given by Stenaks, to encourage the trader and cover costs of transportation and

procurement The price given by the trader became highly competitive with the wholesalers in Maputo (Stenaks and AgroAlfa) By 1997, Machado e Filhos gave better prices than Stenaks

4 1 5 The aspects to which CARE has paid special attention are the links between vendor and manufacturer and between community and vendor Vendors now deal directly with manufacturers, or through the largest trader in Vilankulo All traders stock the parts required for routine maintenance, but there does seem a lack of basics such as bolts, which are not specified for maintenance, but may need replacing because of rusting, or being lost down the borehole To stock more than just those parts required for routine maintenance requires a sizeable investment in parts which are rarely called for Small traders who stock stainless steel pump rods at around \$45 each may only sell one a year Thus it is mainly the trader in Vilankulo who has taken the financial risk of stocking higher cost parts, and then selling them on ( at little increase in price) to those in Mabote and Morure With vehicles going every week to Maputo he can usually provide any part within ten days of order Traders note a large seasonal fluctuation in demand for parts, with fewer sales in the wet season Demand is likely to increase as pumps age, most at present being under three years old

4 1 6 Through the catalytic role of CARE, the main trader (*Machado e Filhos*) now has a sufficiently strong relationship with Stenaks, the main manufacturer to require quality control and to return sub-standard parts for replacement He has also established contact with AgroAlfa, the other manufacturer and looked into purchasing parts from Swaziland, but found both alternatives uncompetitive

4 1 7 All the traders offer a system taking part payments, the smaller ones act more as a local bank ( keeping spare part fund credits for some communities, or accepting payment in stages but releasing the part before full payment) the main trader accepts part payment and retains the part till payment is completed There is little awareness by traders of the accumulation of funds at community level or discussion with executive committees of how this could be put to commercial use, so there may be scope for this aspect to develop further Traders stated that the spare part was not a significant proportion of their trade, nor one which provided much profit, but that it was a useful service to the community (and perhaps also one which brought people in to purchase other goods as well) They also expressed reluctance to invest more in items which were so vulnerable to government action, such a free spare part distribution and still fear the effect of the phasing out of the Project

4 1 8 All communities visited had purchased spare parts and knew of the nearest trader and of the main one in Vilankulo There was considerable reservation over the distances to the nearest trader One community was beginning to discuss whether it should use its accumulated funds to buy additional spare parts with a view to selling them on to neighbouring communities

4 1 9 Most sales of parts are to communities trained in maintenance by CARE, but some others also purchase parts There are some 70 other Afridev's in the region, according to the 1997 inventory, and a further 70 other pumps, mostly 'Rural', Progress and Climax If all these were brought into the standardised system, the potential market for traders would almost double

## 4 2 Involvement of the private sector

4 2 1 A basic tenet of the National Water Policy is that role of government should be to create and maintain a favourable environment for the development of water supply and sanitation but no longer be the implementer (see Section 2 1) Until recently the private sector had little part to play in rural water supply and changing this requires changes in attitude of consumers, traders, government and non-government organisations This is partly because, government provision of supply services such as spare parts and well construction (eg EPAR and GEOMOC) was highly subsidised by outside funding, and so private contractors, who had to buy their own equipment and cover overheads, could not compete This has begun to change, and CARE has put particular emphasis on devising methodologies which develop commercial skills, and encourage greater private sector involvement

4 2 2 For drilling and geophysics CARE has employed GEOMOC, Mozagua and Modrill and also a private consultants for geophysics (Hidrom Lda) For contract supervision DA Maxixe were contracted to carry out the work, but it was eventually done by the DA technician seconded to the Project and other Project staff Post completion inspection (*fiscalização*) was contracted to DNA Maputo who provided a competitive tender to that of the provincial DA There has therefore been capacity building both within GOM and the Project or personnel with experience in contract management and supervision

4 2 3 The Project has employed local consultants to assist in the preparation in training manuals/ guidelines for facilitators, executive committees and GMRs, and also tried to contract the University of Eduardo Mondlane to assist in research on rainwater harvesting (see Ref 13) Neither move (nor that contracting DA for site supervision) was particularly successful, the Project ending up largely having to undertake the work itself On most other occasions, consultants contracted have not been local companies or GOM personnel, which would contribute to long-term capacity building Perhaps if outside consultants are employed, they could, as was the case of the present evaluation, work alongside GOM personnel and/or local consultants to provide continuity and linkages as well as capacity building Whether this should be a CARE or GOM policy may need discussion by both

4 2 5 A commercialisation issue on the doorstep of the Project itself is that of what should be done with the resources and expertise of the project Since this will be reducing its activities and planning to phase out, there needs to be some discussion of whether some aspects can be commercialised and so remain available for future programmes (eg CIDA) in the province There is perhaps too little time to introduce this unless some further funding is forthcoming, but there may be scope for selling expertise in the Training of Trainers, participatory education and PRA at community level and community monitoring In addition, assets such as the water quality testing kit, photocopier and vehicle repair services could provide an income to a small group

### **4 3 Conclusions**

4 3 1 Three vendors have set up adequate systems for spare part sales However stocking of major parts is constrained by low turnover and low profit margins Travel time between buyers and sellers is large and often expensive, and there is therefore a need for at least routine maintenance parts to be stocked in more places There is scope for communities to use some accumulated funds to buy spare parts which they sell on to neighbouring communities at higher price, avoiding delays and travel to the trader

4 3 2 There are almost an equal number of handpumps not maintained through a system similar to the one developed by CARE. The potential market for traders is therefore greater, with some 70 other Afridevs already installed and a further 70 pumps from earlier construction programmes needing replacement. This requires some co-ordination by DA, and a provincial policy on pump types and maintenance systems so that all NGOs adopt similar systems, wherever physically possible.

4 3 3 There is scope for local agents such as Machado to operate in other areas of RWSS, such as acting as agent for drilling companies, or consolidating orders for boreholes. Small NGOs and commercial enterprises wanting their own water supplies have to pay inflated prices where a contractor mobilises for only one or two boreholes. There is also the possibility to encourage local traders to use their own network of small vendors (i.e. Morure has a network of vendors, barracas, that are near at the communities) to distribute spare parts for routine maintenance at community level.

4 3 4 The private sector is still only just beginning to develop in relation to RWSS. CARE has used it as far as possible, but has come up against some of its limitations, especially in early drilling and local consultancy contracts. There is also the possibility to encourage local traders to use their own network of small vendors (i.e. Morure has a network of vendors, barracas, that are near at the communities) to distribute spare parts for routine maintenance at community level.

#### **4 4 Recommendations**

4 4 1 Through discussion with groups of communities, the possibility of bulk purchase of spare parts using accumulated maintenance funds could be explored. DA should consider seeking funds to incorporate all handpumps of lifts to 60m in the same maintenance system to maximise the market for and availability of spare parts.

4 4 2 Discussions are needed with provincial administration (DA and Governor's office) on a more standardised approach to spare part purchase and use of local traders by NGOs and perhaps even GOM for pump purchase. In this way traders may be encouraged to invest more in RWSS.

4 4 3 Similarly any advocacy on PNA and the CIDA programme should include the private sector, to convince traders that any investment in RWS is not as risky as it has been in the past when so many conflicting messages were received, and to establish whether the programme will support traders by purchasing pumps through them. Local traders could be made more aware of other commercial possibilities as outlined in 4 3 3, and enter discussions with other NGOs.

4 4 4 CARE should look at the potential of commercialising aspects of Project resources, and the demand within the Project to do so. Discussions are also needed on the demand for management training so that skills can be well marketed and personnel are confident in their ability to seek contracts and manage them.

4 4 5 In relation to consultancy, capacity could be strengthened by any external consultants being required to work with a local consultant or person from GOM. This was done for this evaluation, and appeared to prove fruitful to all concerned.

## **5. DE-CENTRALISED MAINTENANCE SYSTEMS**

**Intermediate Goal #1 Output 3** Sustainable decentralised maintenance system capable of managing, maintaining and repairing at least 100 handpumps

### **5 1 Organisation and training**

5 1 1 Community maintenance is organised by the Maintenance and Repair Group (GMR) with fund-raising and decision-making undertaken mainly by the Executive Committee. Initially this division of responsibilities, and the formation of the EC was primarily project-driven. In the past year, however, it has become much more a product of the communities' own response to identifying the problems they will face and their proposal of organisational structures which they feel will best help them to provide solutions. The role of these groups, and how they have evolved is set out in Table 2 1

5 1 2 The training of the GMR consists of three sessions, each of which may take a day or more. They firstly get to know the names and costs of all spare parts and cannot progress to the next stage until all members of the team can do so. Where a member proposed by the community cannot manage this, the community usually proposes his/her substitution by someone else. The group is then taught how to carry out various repair procedures, such as gluing pipe joints, fixing rods, making unions etc, followed by diagnosis of faults and regular replacement of parts in routine preventive maintenance. The GMR then installs the pump.

5 1 3 The EC receives most of its training through on-the-job working with the Project. Since the facilitators are in close contact with each community over several months training is gradual and responds to committees needs. The first communities to be involved in the project had only maintenance groups, as is the standard elsewhere in the country (where Water and Health groups are also designed to be set up under the PEC system). These early-formed groups have been re-visited and re-trained, and in most cases an Executive Committee has been added, where the community felt that the GMR consisted of people with insufficient power of leadership to undertake the roles of fund-raising and decision-making. Until 1996 CARE undertook repairs for those pumps installed in the emergency phase, but has now trained groups to take over this responsibility.

5 1 4 As a result of these formation and training processes only some 3% of the 150 communities monitored by the Project are said to have no GMR or EC, whilst 2/3 have groups which function well (i.e. making decisions on well protection, carrying out routine maintenance regularly, holding regular meetings to discuss health and water issues with health promoters and/or the community, and tending to raise funds on a regular basis). The other third function adequately, solving problems as they arise and collecting funds on a crisis management basis (see also Section 5 3). All communities visited had active GMRs.

### **5 2 GMR capacity for preventive maintenance and repairs**

5 2 1 The fact that all handpumps were working when monitored in Nov 1997 suggests that the maintenance system is working well. During visits in December two wells had been out of action for over two weeks, one because the foot valve had failed and the repairers were waiting for the spare part which was having to be ordered from Maputo by the local trader. The second had run out of glue, having

repaired the riser pipe several times. In both cases the communities were actively making effort to solve the problem. Monitoring of 'down-time' for pumps in Feb 1997 (Ref 18) found that it averaged less than ten days in most districts, except Mabote, where it exceeded 20 days, partly because of the limited stock of spare parts held locally.

5.2.2 In December all communities visited were found to have undertaken routine maintenance, the frequency depending to some degree on the depth to water. It is thought that perhaps the name of the groups, emphasising the dual role of routine maintenance as separate from repairs may help re-inforce the idea, promoted during training, of replacing parts regularly or when there are signs of wear. This contrasts with the practice in other parts of the country where repairs tend only to be carried out when water stops coming out of the pump. According to project staff not all communities were so conscientious as those visited, especially where depths to water are less. Since routine maintenance does not require the removal of the riser pipe, GMRs at those wells with fewer breakdowns or with less distance to the water table tended to lose confidence in their ability to make repairs, especially where these involved withdrawing the riser pipe. Without fairly constant practice (at least once or twice a year) GMRs found that they had forgotten the procedures. Thus the wells which needed greatest repairs were the ones where GMRs were most confident. Several GMRs expressed a wish for refresher training.

5.2.3 In normal PEC training of maintenance groups under the PRONAR system, people are not trained to remove riser pipes, putting reliance on centralised maintenance which is too expensive for communities to cover their full cost. The Project's experience is that GMRs are quite capable of doing this work, and mistakes are rare. However longer-term monitoring is necessary to see whether there are unusual numbers of pipe and joint failures where GMRs do remove riser pipes. At present CARE facilitators provide back-up and advice when necessary, but the Project is trying to develop the capacity of local pump mechanics, to provide long-term support to communities, so that responsibility for more complicated repairs may devolve from GMRs where they do not feel capable of undertaking the work, and where communities are prepared to pay a mechanic (although some do work for free). The existence of some of the local pump mechanics stems from the 1994 government initiative to establish community-based maintenance. Other mechanics are members of GMRs who are regarded by their community as being especially knowledgeable and whose reputation has spread more widely so that they are consulted by others. The Project will offer further training to area mechanics, but will expect them to make some payment (however symbolic) for it.

5.2.4 The GMR includes a *pedreiro* to undertake repairs to the slab. In the last set of boreholes constructed, the Project stepped back from constructing the apron, and gave the GMR mason the experience of carrying out all steps in its construction.

5.2.5 ECs, being closely related to the traditional community structure tend to consist mainly of men. Although women are included in the GMR their role is generally confined to cleaning around the well, sometimes to organise queues and to hold tools. Some women were more involved in repairs but changes only take place slowly and require men to acknowledge, and grow to respect women's capacity to undertake technical tasks. This might require more positive discrimination during training, and was not a major objective of the Project.

### 5.3 Fund-raising and ownership

5 3 1 The initial test of new ECs has been the raising of 3 3 million Mt, which was required of each community before drilling of boreholes in 1997. This meant on average collecting some 30,000 per household, but in some communities (eg Pinzuca) as much as 50,000. Those who were unable to raise this much borrowed money (without interest) from other members of the community until harvest time. On rare occasions, where communities had raised almost all the money but were unable quite to reach the target, the Project provided the balance. Many communities are to some degree dependent for cash on remittances from family members working in South Africa. Some took almost a year to raise the money, others achieved it in a month.

5 3 2 Many communities have now set up regular payments on a monthly, or quarterly basis. Monthly payments range from 2-5,000 Mt. Most have also developed coping mechanisms for those who have difficulty to raise cash, which has exercised the management abilities of the ECs. Solutions include payment in kind (eg a chicken, wood or labour in fields) or patronage by an individual who gives a goat for sale, and proceeds go to the well fund. A mutually beneficial system is that a landowner contracts villagers to work on his fields and their payment is given to the funds. Various systems are growing up in different communities and none of those asked had so far found a problem of fund raising that they could not solve, although there is a fear that with poor rains fund-raising is difficult. Where individuals were reluctant to pay, ECs had different approaches, ranging from reminding those collecting water, to limiting water collection by non-payers to an amount sufficient only for drinking.

5 3 3 The need to raise funds is not only developing management within communities but is, in some cases leading to linking of communities to solve problems, and to a strong feeling of ownership. At Mavanza (Mupalau) the pump was installed in 1994, without any payment, or even initially any payment for repairs. A second well was installed within 5 km in 1996 and a third in 1997, because of the high number of users. When the third was installed the users of the first well contributed to the 3 3million in order a) to reduce pressure on their own supply and b) to give them a stake in the new supply should their own ever be out of operation. They now require some 2 million to replace their riser pipe and may try and solicit funds from the other communities. These aspects of community management are developing spontaneously. They underline both the capacity of communities and the degree to which the Project has set up management systems which have been encouraged to solve their problems independently.

5 3 4 The feeling of ownership is evident in the way in which communities have established rules for pump use, including regulations on access to the apron, locking of the handle to avoid vandalism, and putting up bars to stop undue wearing of bearings. Elaborate fencing, well tended drainage, organised queuing all bear tribute both to good management and pride in ownership. One rusting pump head had been painted by the GMR in an effort to reduce corrosion. The EC at Mavanza (Mupalau) commented that they preferred the system of paying an initial contribution as this had made the whole community feel it owned the pump and should take care of it. They would wish to do the same again, and indeed were prepared to raise the money to do so.

5 3 6 As a result of regular payments, which exceed the amount needed for routine maintenance, a number of communities have accumulated in excess of a million Mt. Some lodge spare funds with a trader as credit for later purchases, but most keep the money with the chairman or treasurer. In Zambezia and Nampula (Ref 19) it has been found that the willingness to make regular payments falls off when large

amounts accumulate and remain unused. Trust in the EC weakens, and the value of the money reduces over time. At the same time communities are still rarely able to cover the full cost of major repairs such as replacement of riser pipes or rods, fishing for dropped parts or cleaning out of wells. Methods for exploiting this potential for communal development funds need to be explored.

## **5.4 Conclusions**

5.5.1 The established maintenance system at community level has so far proved capable of keeping pumps in operation. In the past year CARE has only provided major assistance on five occasions, and is planning to develop area pump mechanics to provide this back-up in the future. Of the handpumps under the CARE programme, 97% are working, while only 52% of other handpumps in the region were found working during monitoring.

5.5.2 Those communities where only routine maintenance has been undertaken and/or where there have been few repairs needed have expressed a need for refresher training for repairs, especially those requiring removal of riser pipes and cylinder.

5.5.3 The development of ECs has generally provided improved management capacity over that provided when only GMRs were established. Various mechanisms for fund raising have evolved which are managed by ECs.

5.5.4 Fund raising is well accepted by communities, if not always by local politicians. It has helped strengthen a feeling of ownership, especially when initial payment for the pumphead and cylinder was introduced.

5.5.5 Communal funds raised for pump maintenance can be collected on a regular basis. There is little encouragement to do so when there are no mechanisms for investing the accumulated fund to retain or increase its value, thus many communities prefer only to collect money as it is needed. This limits the size of payment a community can make when a problem arises.

## **5.5 Recommendations**

5.5.1 Pump repairs should be monitored to see whether riser pipe removal should be regarded as a task for GMRs or whether, in terms of policy, it would be better to encourage area pump mechanics to undertake this task.

5.5.2 Strategies for greater protection and growth of funds created through regular contributions by users for pump maintenance needs further research and development. It is a countrywide problem and with pumps so widely scattered any centralised rural tariff system would be very expensive to run, and therefore community based solutions need to be explored. Linking to agricultural programmes and considering aspects such as investment in livestock (especially oxen for ploughing) offer wider economic benefits to the community as well as greater security of supply.

## 6 PARTICIPATORY HYGIENE EDUCATION

**Intermediate Goal #2** To maximise benefits of improved water supply through adopted environmental sanitation and hygiene practices

**Output 1** Participatory hygiene education programme implemented

### 6 1 Objectives and outputs

6 1 1 The main aim of hygiene education is to maximise the potential health benefit which can be achieved in association with a safe and reliable water supply. This involves promotion of good environmental sanitation which consists of a set of independent factors, such as hygiene practices, faecal and solid waste disposal, safe water use and the management and maintenance of a healthy community environment. Impact of project hygiene education on these aspects is discussed in Section 7. It should be noted that communities also receive some health education through the church and other agencies such as health posts.

6 1 2 Until 1996 hygiene education referred mainly to cleanliness around the well, and the adoption of good practice for water collection and storage, combined with construction of latrines. Since early 1996, the objectives have been expanded to embrace the wider issues of environmental sanitation and behaviour change.

6 1 3 Hygiene education usually targets -

- a) behaviour to reduce health risks and
- b) attitude to lead to greater willingness to cover costs of maintaining water supply, and so improved sustainability

However, the dry season difficulties of access to any alternative supply mean that willingness to pay is already high (if somewhat seasonally), as a result of the easily apparent reduction in distance for water collection. With the benefit of the supply so obvious to most, the direct impact on behaviour is the main target. This requires both acquisition of knowledge and change in practice.

6 1 4 The MTE helped to bring about a change from concentrating on physical outputs of numbers of latrines constructed to exploring ways to increase people's awareness of health issues. In some cases this would include latrine building but the primary objectives were KAP changes not physical construction. This was logical for many reasons, including the fact that populations were generally very dispersed and that latrine use was culturally foreign in some areas. Latrine construction did not, therefore, necessarily have any impact on health risks as construction did not equate to usage.

6 1 5 The key desired practices are -

- control of animals so they do not contaminate food or water or utensils
- using a latrine
- burial of faeces
- cleaning of collection and storage vessels
- washing of hands before preparing food and before eating, after defecation or caring for a child which has defecated
- storing of water in clean closed vessels on raised platforms
- keeping the surroundings of the house clean
- washing self

- washing children
- using clean scoop for taking water from storage vessel
- putting rubbish in rubbish pit

## 6 2 Methodologies

6 2 1 In order to bring messages to household level Project facilitators do not work directly with the community, but train the promoters to do so. The Project's ten facilitators originally covered all old and new communities and trained two promoters in each. However in May 1997, this changed to establishing one promoter for every ten houses, so that health promotion became more personal. In September 1997, partly in response to the TA consultancy of June 1997 (Ref 3) promoters' and EC members' houses became 'Model houses' which emphasised their responsibility as role models. The Project has kept in contact with promoters and works with them periodically but has now stopped working with pre-1997 communities.

6 2 2 Participatory methods are used throughout the communications programme on health and hygiene issues. The main aim is to reduce health risks in ways that people find most appropriate to the diseases they identify as being the most frequent. This follows certain strategies which include -

- participatory identification of problems
- volunteering of promoters to carry hygiene education to household level
- the use of monitoring by promoters and ECs as a method for defining community strategies
- inputs from the Executive Committee to support promoters and establish community priorities and strategies

6 2 3 Promoters undertake a three day training which includes

- demonstration of good practices in handwashing, and water treatment,
- making up of songs and stories to promote messages,
- discussion of how diseases are caused and prevented
- community transects for risk analysis with facilitators
- explanation and trials with monitoring forms

6 2 4 There are advantages in bringing hygiene education to a personal or household level, and combining the forces of Executive Committee members (who tend to be the more traditional leaders of the community) and the promoters (who tend to be the more confident women with an interest in improving their quality of life). In most communities visited the EC and promoters met quite regularly (weekly or monthly) to discuss problems and families whose behaviour was regarded as below the standards the community wanted to set for itself. Strategies were then worked out as to how these could be encouraged to change their ways. This is the ideal situation and the cooperative link is not always so strong between ECs and promoters.

6 2 4 While most promoters are women, those interviewed said that they found little problem to work with the men of the house as well as the women. This compares with conventional community level sessions which tend to involve mainly the women. However there are also problems in the 'Chinese whispers' principle, where messages are handed on from one to another, and may change or become confused on the way. The ability of Project facilitators to train promoters seemed to be quite variable, and the same is likely to be true of promoters passing on messages to the next level. Promoters are likely to require continued support and

encouragement, which is not available in a short-term project, unless other long-term extension workers are also involved, and can take over the supporting role. There is some involvement of the church, and of one or two health extension workers, but generally there is a need to increase the involvement of such sub-district level support and to raise awareness of how it can assist over the next few years, to reinforce the efforts made by the Project so far.

### **6.3 Community level monitoring**

6.3.1 The project has developed community level monitoring to be carried out by ECs and by promoters. The former choose 19 houses at random, the latter monitor all ten of the houses for which they have responsibility. The two combine to discuss the results and work out their strategy. This system has potential to be used at various levels, and although first used in 1996 is still evolving. The aspects monitored are the key behaviours listed in 6.1.5, combined with asking questions on household incidence of diarrhoea, eye infection and skin infections in under fives to give a measure of impact of any behaviour changes noted. Uses include -

- assessing situation before programme implementation
- designing relevant health education programme with promoters
- allowing promoters to identify the effect they are having
- providing information to Project and donors

6.3.2 The monitoring forms provide a useful tool to generate discussion of health/hygiene topics at all levels in the community, and perhaps also to provide status to promoters. Where well understood and regularly filled in they could also be of value to the Project, to show trends, seasonal variations, and links between behaviour and disease incidence. However this is quite a sophisticated level of using the forms, and would require considerable further input by facilitators in most areas. It could perhaps be limited to a few communities for the purpose of Project monitoring, making use of those facilitators who have proved best at training promoters, and of the Project's limited capacity to carry out data processing when so many other activities are also under way.

6.3.3 The monitoring system has great potential, especially as a tool to build community awareness of health/hygiene issues and to assist them to form their own strategies. It does require some follow-up by the project to see what changes are needed and how information can be more reliably entered. Few promoters appeared to use it regularly and for more than noting which house should be reported to the EC. Several of those met (some 20 in 7 communities) were very confused as to how to fill them in, and none seemed to know how to use them to compare whether the situation was changing. Several aspects such as washing children, washing hands before cooking could not easily be scored by observation and yet were not easily asked directly.

6.3.4 Household level monitoring of diarrhoea on a regular basis would be very useful as a measure of impact. However it is not clear how marking a house as having diarrhoea (in the previous two days in a child under five) can be used where, according to the 1995 KAP survey (Ref 2) 40% of houses have no children under 5, and the other 60% tend to have two. Aspects such as this may need further attention if the system is going to be adopted elsewhere, but do not invalidate the approach.

## 6 4 Conclusions

6 4 1 For a development project with major goals of behaviour change, three years is a short period to build up relevant methodologies and skills to promote such changes. It is even shorter where, as in this case, there are also large components of well construction and sustainability of maintenance being addressed at the same time. The evolution to one promoter per ten houses and of model houses is relatively recent and therefore the impact may not yet be apparent (see next Section). The Project has built up useful strategies during this time (Ref 12), but has not had the opportunity to go back to community level to see how this is working.

6 4 2 Indications from discussions during the evaluation were that the transference of information varies considerably in effectiveness. At community level the understanding of aspects such as what causes diseases, which was found to be low in the 1995 KAP survey, remains limited. No women below promoter level in the communities visited knew what the causes of diarrhoea or the more commonly cited 'stomach ache' (*barriga*) were, or what actions helped to avoid it. Badly washed greens and the season were the most commonly cited reasons, with bad water coming third. No-one mentioned hand-washing or any other form of washing, except two promoters after some probing. Similar responses were noted during the technical assistance consultation of June 1997 (Ref 3). Unfortunately the EOPS and baseline surveys do not include questions on knowledge, to indicate whether people's observed behaviour reflects lack of knowledge or simply a choice to follow a particular practice despite knowing the risks. Because of the lack of rural health services for many years, a greater lack of knowledge on health issues is found in Mozambique than in neighbouring countries where primary health care programmes have been running for some time.

6 4 3 Promoters raised the issue that they did not know enough about how to treat diseases, (for instance what to do for children with diarrhoea, to a) avoid their becoming more sick and b) to rid them of the diarrhoea). They found that while monitoring households they might find children with diarrhoea and mark this down, but could not help the mother if she asked what she should do. Facilitators do encourage feed-back from promoters, but the variability in knowledge and understanding seems to require further attention. It should be mentioned that some facilitators still seem confused about the monitoring forms and also that knowledge of diarrhoeal therapies such as ORT has not formed part of facilitator training so could not be expected to reach community level.

6 4 4 The monitoring system, and health education in general is still quite Project dependent, and is unlikely to continue as strongly after the Project withdraws. This does not matter if the desired impact has been achieved, as the intensive inputs which the project and promoters have provided cannot be expected to continue for ever. There did not seem to be a clear picture yet within the project of how long support for hygiene education is necessary, mainly because of all the changes that have been taking place. All promoters said that they were expecting to carry on the role for as long as it took to raise the health of the community, but this would seem hard to achieve unless Ministry of Health or Education are encouraged to provide some of the support at present provided by the Project.

6 4 5 Children are not very involved in the hygiene education at present. As -

- generally poor latrine users,
- most susceptible to water and faecal borne diseases,
- the host to most worms,

- the worst polluters, but
- good routes of communication for health messages and
- tomorrow's adults

their greater involvement would be beneficial. The June 1997 TA consultancy also mentions the scope for Child to Child programmes, and there is time to try again to build links with the Ministry of Education and individual schools. Limited attempts were made previously, but presenting it as a Project driven, rather a combined, effort. Any such initiative would require longer than the time span remaining but is a logical extension for this, or any other programme wishing to build on the experience of this one.

6.4.6 The changing of behaviour is the most difficult part of the Project, one which can be tackled in many different ways and one which has altered much since its inception. The changes have been so many and over such a relatively short time span, that the impact of different approaches is difficult to separate out. This may partly be because, while there has been continuity of Project staff, there has been much influence of consultants who have come to review various aspects at approximately six month intervals. Each consultancy has been by a different person, not previously acquainted with the project, so that each has only a limited snap-shot picture of the way that things are being done. Each has contributed useful ideas, and experience from elsewhere, but the overall result may be that Project staff get a bit confused. Each reviewer wants to make constructive comments but also to change something, often when there has been insufficient time to see what is the impact of existing practices.

## 6.5 Recommendations

6.5.1 The Project should try to include a self-evaluation of the levels of understanding and practices of facilitators, promoters and general community members to see whether all or only some of the desired messages are being effectively passed from one level to the next.

6.5.2 The Project and others have identified some weaknesses in the community monitoring system. This should not discourage its use if there is time for one or two Project staff to carry out a careful appraisal of its uses, common mis-understandings, statistical linkages between behaviour and disease incidence. Such an appraisal should also look at whether a few pilot communities could be selected where extra effort would be made to get accurate data which could be used to augment, at low cost, the project's own EOP and Baseline surveys.

6.5.3 Barriers to behaviour change need further definition and solutions. Handwashing practice, if it is to change, is still not well understood in terms of what will encourage change. The lack of facilities such as small containers which release sufficient volumes are one constraint, which the project could discuss with communities and schools to encourage local low cost solutions, alongside further analysis of how impact can be increased.

6.5.4 The three year time frame for developing and completing a water and sanitation project is very short, especially where behaviour change is regarded as important as the improvement in access to safe and reliable water supplies. If there is to be a commitment through the implementation of the PNA to change attitudes and behaviour to maximise benefits of water supplies and to increase their sustainability, then the experience of CARE Vilankulo, and its continued

development and monitoring would greatly assist the designing of any hygiene education programme

6 5 5 Links need to be developed which allow devolution of community support to other permanent extension workers local NGOs (eg churches) Project dependency can then be reduced, and community environmental strategies continue to be stimulated Which links will be most active and effective in the different cluster zones will need some research Use of radio, and other channels of communication could also be explored

## **7 MONITORING AND IMPACT**

**Indicators for Goal#2** To maximise benefits of improved water supply through adopted environmental sanitation and hygiene practices

### **7 1 Surveys carried out by the Project**

7 1 1 CARE has considered the need to be able to measure impact of interventions since 1995 when activities began to be development-orientated. The initial ('KAP') survey (Ref 2) was designed to establish target behaviours for hygiene education and indicators of impact, as well as to define characteristics relevant to overall programme formulation. Aspects included socio-economic indicators and also knowledge of common diseases, their causes and prevalence, reasons for constructing latrines, time to water source and demographic characteristics. Since it was carried out in areas where the project was already working and 7 out of 9 communities already used a borehole as their main source of water, it is a little difficult to establish the general situation before CARE interventions using the KAP survey. However trends can be identified.

7 1 2 Surveys done in May 1996 (Ref 1) and November 1997 (Ref 4) allow comparisons to assess project impact, especially in terms of amounts of water used, and also some behavioural changes. The surveys were carried out in different seasons, (cold-dry and hot-dry respectively) this may mask or accentuate some changes. In addition the time elapsed since health education in some cases is very short for impact to be felt. Whilst the second and third surveys refer to the same communities, those of first are different, making statistical comparison difficult.

7 1 3 In order to allow some assessment of the relative impact of provision of water and addition of hygiene education, these aspects have been separated in grouping the communities of the 1997 survey. However, the baseline survey was only done 18 months before, and includes communities with and without boreholes constructed under the project. The resultant figures have been lumped together and since the original information is no longer available, direct comparison of individual groups with the baseline is generally not possible. The control group of 1997 therefore, which consists of communities where no interventions by CARE have taken place, provide a better (if less statistically significant) baseline from which to judge impact (see Appendix 3).

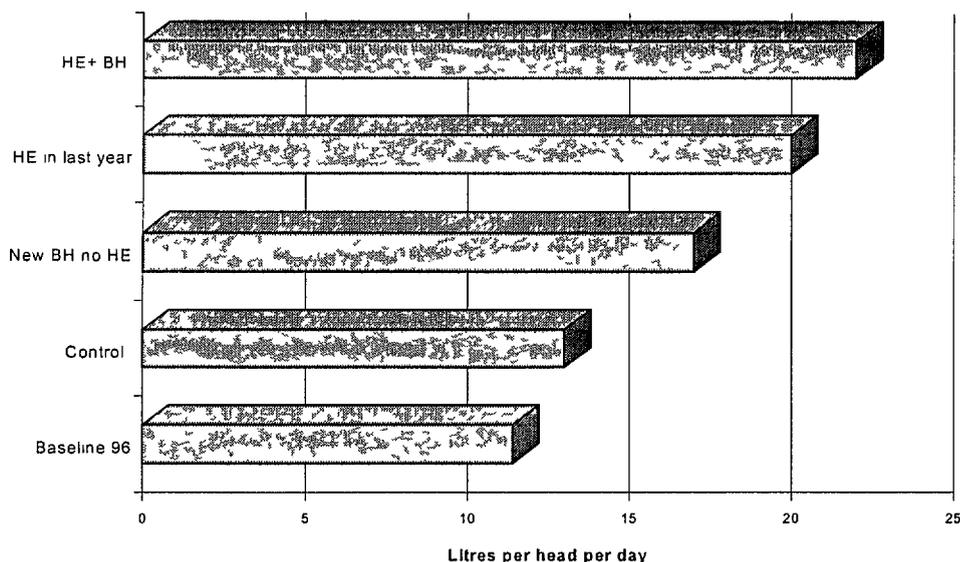
7 1 4 The results of the 1997 survey indicate that 'noise' levels are high (ie standard deviations are large) and that statistical significance with a limited number of communities (51) is therefore low. However the survey provides indications of trends and is a first step in a field within which it is notoriously difficult to achieve unambiguous results.

### **7 2 Water use**

7 2 1 This aspect is the one in which most marked change has occurred. It is also the greatest benefit which communities mention. Since there are few alternative water sources, water for bathing must be carried to the house, and almost all people asked during field visits mentioned the new advantage of being able to wash more easily. The resultant increase in number of bathhouses was also talked of, and

observed by J F Afonso as a significant change that had occurred in the past seven years

Fig 7 1 Estimated water use



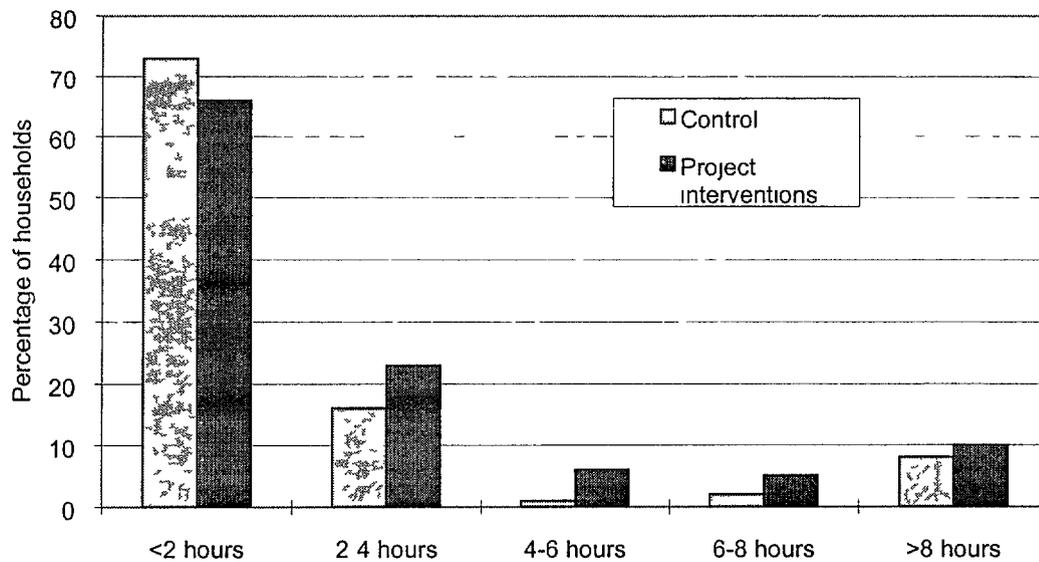
7 2 2 The difference in consumption between the control and the baseline (in Fig 7 1) may be due to the seasonal difference, people feeling a lesser need to wash when it is cooler. Water use has increased by some 7- 9 litres/hd/day in the most recently served communities, or by nearly 55-70%. Only half the increase was found in communities where health education had not been included.

7 2 3 Amount of water used fell markedly with distance, and also with number of people in the household (See Table 7 1). Unfortunately comparative data is not available for the KAP or Baseline Surveys and comparison between control and other communities from the EOPS data does not indicate what changes may be taking place (see Fig 7 2). In both cases over two thirds of households spend less than 2 hours collecting water. However since the amount of water collected has increased significantly (See Fig 7 1), time to collect water is obviously not a direct

Table 7 1 Water use by time and household size (Litres Per person per day)

TIME REQUIRED FOR WATER COLLECTION				
< 2 hours	2-4 hours	4-6 hours	6-8 hours	>8 hours
20	15	12	12	11
SIZE OF HOUSEHOLD				
<=4 members	5-8 members	8-11 members	12+ members	
20	19	18	13	

**Fig 7 2 Time spent collecting water**



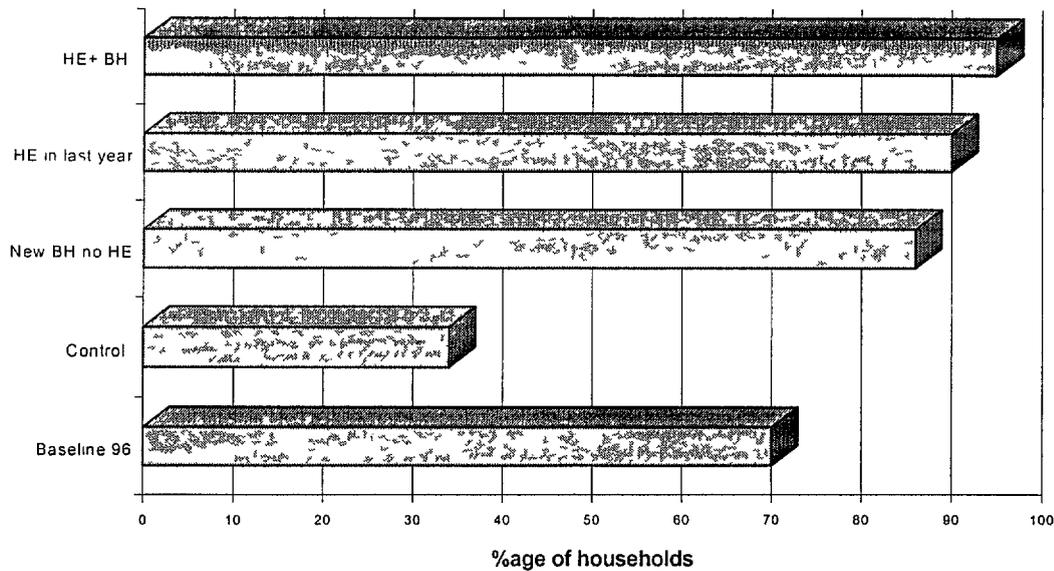
expression of distance to water, but apart from the longest times, tends to express the amount of time people are prepared to spend collecting water. Rather than translating lesser distance into spending more time on other activities, women appear to spend some part of it collecting more water, at least where the source is within 2 km. This decision is, however, considerably affected by health education as the control group and the group with highest level of project activity have approximately the same proportion of families living within 2 hours of a water source. However, whilst 95% of those with health education and a new borehole make more than one trip a day, only 57% of those in the control group do the same.

7.2.4 The higher proportion of people collecting water in journeys of 2-4 hours from Project wells may reflect the wish to use a reliable good quality source, but there is insufficient information to confirm this.

### 7.3 Wet and dry season water sources

7.3.1 Boreholes provide a reliable year-round supply. This is reflected in the high proportion of people who use them in the dry season (see Fig 7.3). The remainder mainly use hand-dug wells which are closer, but in the control group (several of which are near the River Save, and a long way from a borehole), most use rivers and lakes, even in the dry season.

Fig 7 3 Source of drinking water, dry season



7 3 2 The choice to change from a borehole source to another (rivers, rainwater capture) in the wet season appears to be little affected by whether there has been health education, and is probably more linked to considerations of distance to water and taste. Several people mentioned that they used fresher water when they could get it, even if it were surface water. Water is also scooped from puddles into receptacles, but this was said only to be used for washing. The boiling of drinking water is mentioned, but appears not to be closely linked to health education. This may be because the question was not asked specifically for harvested rainwater, and also may have been affected by health messages from other agencies. In baseline and control communities only 2% of households boiled water, but it averaged 16% in those where CARE had been working, even where health education had not been given.

7 3 3 It would be useful if the EOPS data could be tied to community monitoring to see if promoters find the incidence of diarrhoea is higher in the wet season. If so, this fact could be used in training promoters and discouraging people from scooping water for drinking without treatment. (Conversely if no such pattern is found this element could be omitted from hygiene education altogether.)

## 7 4 Disposal of faeces and use of soap

7 4 1 Hygiene education concentrates on the safe disposal of faeces, and leaves it up to the community as to whether they see this as requiring latrine construction. If burying faeces and disposal in the latrine are both seen as acceptable methods of 'safe disposal' in areas where houses are far apart, then there would seem to have been a significant impact of health education. See Fig 7 4. It is apparent from observation, and from the survey that more people are building latrines on their own initiative, although many mentioned that latrines were not so much part of the culture of that area, and that bathhouses tended to be the first thing people built after their house, pot rack and food storage 'clamp'. The investment in permanent structures indicates the changing attitude of people as they begin to feel more secure and able to invest effort and materials in bringing their way of life back more towards the levels it had reached before the war. It may also be a result of the influence of other

agents of change, such as the church. As far as disposal of children's faeces is concerned, the proportion of households using a latrine is twice as high where there has been Project health education than in the control group and three times as much as the baseline survey.

Fig 7 4 Safe disposal of faeces

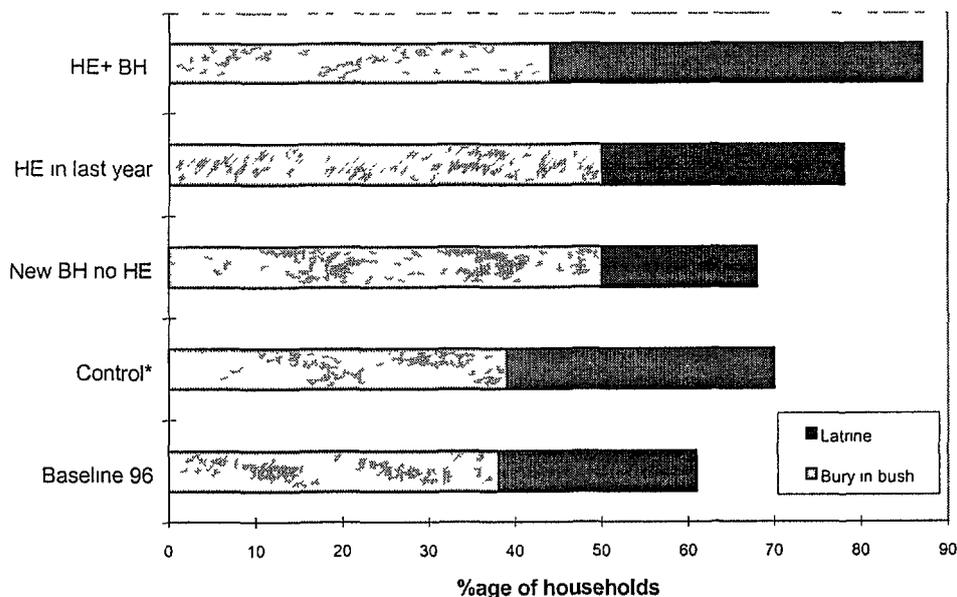
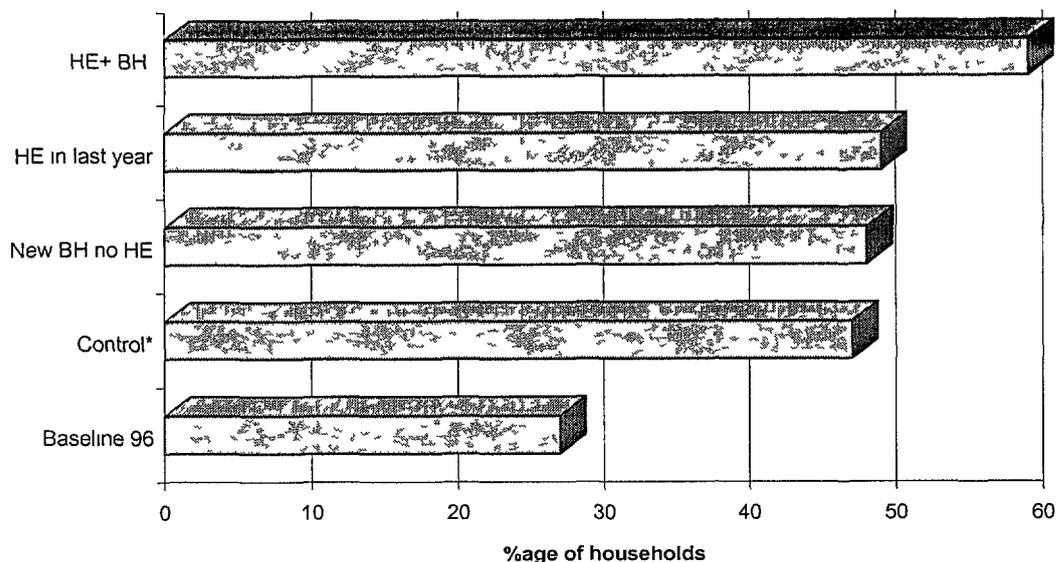


Fig 7 5 Use of soap for hand washing

Fig 7 5 Handwashing with soap

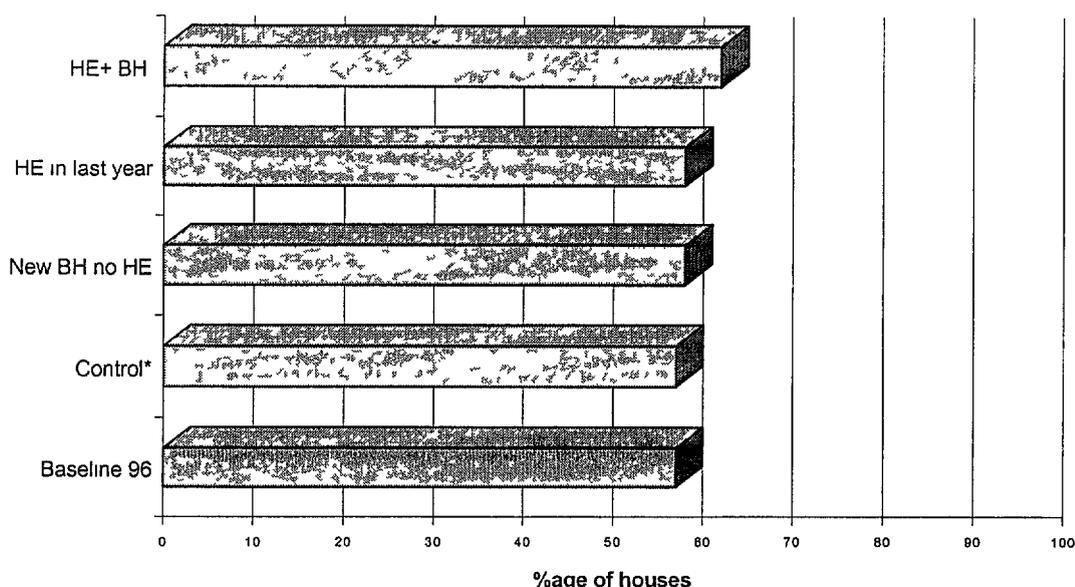


7 4 2 In aspects such as use of soap (Fig 7 5), all groups show an increase over the situation observed in 1996, probably also reflecting on the improvement of socio-economic conditions. Experience of health education seems to have had little effect, except perhaps in the most recently covered communities.

## 7 5 Effect on health

7 5 1 The changes in behaviour indicated, and the increased use of water are those actions assumed to lead to decreases in diarrhoea, and so improved health and well-being. So far the survey does not show this to be the case. Incidence of diarrhoea in houses sampled remains very much the same whatever the level of intervention (see Fig 7 6). Whether this reflects reality or is related to unclear definition of 'diarrhoea' is not known, but there is a remarkable consistency in

Fig 7 6 Houses without diarrhoea in under 5 s in last 2 weeks



results. These are also high compared with the DHS survey results which suggest that in the province as a whole only 7.6% of children under five will experience diarrhoea in the preceding two weeks. The definition of diarrhoea and the length of recall time may need modification. There is also likely to be a high temporal variability in diarrhoeal incidence, requiring more continuous monitoring to establish trends. Statistics obtained in Vilankulo suggest, however, that November (the time of EOPS) and May (the time of the baseline) do not vary greatly in incidence, with the former generally having a lower reported number of cases.

If individual communities are compared, the control community showed a 10% increase in diarrhoea and all others (whether with health education or not) showed a 3-6% reduction in incidence. This suggests that continuous monitoring is necessary for several months to identify short-term variations and separate them from long-term trends.

7 5 2 The low incidence of scabies and eye infections makes it difficult to identify changes, especially where the baseline data is lumped.

## 7 6 Conclusions

7 6 1 There have been very significant changes in the amount of water used, and in safe disposal of faeces. Health education, not just decreased distance to water, seems to have had a definite effect in increasing the amount of water people use,

and indicates the positive effect that the hygiene education programme is having alongside the construction of safe, reliable water supplies

7 6 2 There appears, in line with the greater amounts of water available, to have been an overall increase in the number of times people wash their hands, according to response to questions on frequency of hand washing (see Table 8 Appendix 3) Fewest people reported washing their hands after defecation and before feeding a child This may reduce the impact of using more water as these are two of the more critical occasions when hand-washing will establish a barrier to faecal contamination Similarly how people wash their hands, (with soap, returning water to a basin to be used by others, etc) will have considerable effect on the impact of the hand-washing

7 6 3 Well-being has definitely been improved, as all respondents met during the evaluation, mentioned They have chosen whether reduction in distance to water is translated into time used for other purposes, and it seems that where there has been hygiene education most people have decided to use at least part of the time to collect more water In communities visited during the evaluation almost everyone expressed extreme relief at being able to bath more often, it being the comfort which they appreciated, rather than viewing it as a potential health benefit This may relate to the fact that those displaced by the war were often in places with more water available than they were used to, and so perhaps noticed the hardships of lack of water more on their return

7 6 4 Despite significant increases in amounts of water used, safe disposal of faeces and use of soap, usually regarded as being key factors in reducing diarrhoea, incidence of diarrhoea does not appear to have changed This raises several questions -

- Is diarrhoeal incidence being measured in a reliable fashion?
- is 'good' behaviour being over reported as is quite common (Refs 22 and 23) when asked as a question rather than observed or elicited by other means such as blind voting?
- is over-emphasis being put on the effects of good hygiene behaviour when malnutrition, and living conditions remain much the same?
- is more time needed for resultant changes to become apparent?

7 6 5 There is a danger of raising expectations too high that immediate reductions in diarrhoea can be achieved by behaviour change However marked and rapid reduction in diarrhoea has been observed , (eg in Indonesia Ref 24) where hand-washing behaviour has dramatically changed, especially when linked to use of soap and washing after defecation or caring for children

## **7 7 Recommendations**

7 7 1 The EOP survey should be carried out again in the same month as the baseline to ensure that changes noted are not seasonal effects and to provide a greater time interval Also efforts should be made to develop better methods to collect information on handwashing (eg participatory discussion and 'blind voting' which can also have an educational role), and diarrhoea (better definition and more frequent monitoring in a few communities )

7 7 2 EOPS should be linked to community level monitoring in a few communities (selected for the quality of their facilitators and promoters, and with additional training) to see whether this can help clarify the reasons for apparent lack of impact on diarrhoea Facilitators could work with promoters to identify and highlight those

activities which are still causing most risk. This could be done by following through a typical day with several households, including some where diarrhoea is common, and others where it is not.

7.7.3 It appears that some of the statistical 'noise' may be due to other agencies carrying out health education. The Project should try and identify these and meet with them to assess jointly the different approaches and relative impact. Use of channels such as radio should also be considered.

7.7.4 Facilitators should carry out small evaluations in each other's areas to see how well promoters are understanding and passing on messages. Using a different facilitator for assessment and training may reduce bias in answers from promoters and community members. It will also give an indication of how well each facilitator is carrying out training.

## **8 ORGANISATION AND LINKAGES**

Includes **Intermediate Goal 2 Output 2** Information management system established to exchange information with GOM and other agencies

### **8 1 CARE Project structure**

8 1 1 The Project in Dec 1997 consisted of some 27 people based in Vilankulo or in the field. This constitutes a 20% reduction in staff from the time of the MTE and results mainly from a reduction in administrative personnel, without reducing Project activities. There is now a plan to phase staff redundancy as funds decline and activities have to wind down.

In December there were -

- 3 management
- 2 technicians
- 10 facilitators
- 2 pedreiros
- 4 administrators
- 5 drivers

8 1 2 Of the above staff most are employed by CARE. One technician is seconded from DA Maxixe. Since he has been involved in many activities including drilling supervision, well rehabilitation, geophysical surveys, rainwater harvesting research and also in planning and decision-making his secondment has led to considerable personal development and experience which will return with him to DA. The secondment has therefore benefited all parties. Secondment can help to forge strong links between organisations, where the person is still in regular contact with his parent organisation and shares his experience with others in the organisation. However in this case the move to the Project did not include defined links with DA so that this opportunity was perhaps not fully exploited.

8 1 3 The high proportion of project-employed staff means that there is a danger that much of the experience gained over the past three years will be fragmented and disappear when the Project closes.

8 1 4 The Vilankulo office has received support services from CARE Maputo, which has provided auditing and procurement, technical assistance and consultancy, soliciting of funds and links to CARE International, which also sources funding.

### **8 2 Information management system**

8 2 1 CWSP has built up a considerable databank in relation to its operations, pump performance, rainwater harvesting, regional well inventory and monitoring of de-centralised maintenance. Other aspects relating to hygiene education are still developing but manuals which provide guidelines for community support groups have also been produced. Manuals and databases are designed and up-dated by several members of staff.

8 2 2 Borehole information is passed to DNA for their data base, and it is from this and other information that DNA has drawn up for the Project the maps which form Figs 1 2 and Fig 3 3

8 2 3 Handpump performance details formed part of the basis for a seminar held on the commercialisation of spare parts in which PRONAR-Beira, DPOPH, Stenaks, AgroAlfa, local vendors and communities were involved. The discussions centred on private commercialisation, the need to enforce the use of AFRIDEV among NGOs ,

8 2 4 The new strategies drawn up in September 1996 have also been discussed with PRONAR to whom quarterly Project Implementation Reports (PIRs) are sent. PIRs have also been sent on a regular basis to DPOPH Maxixe and the Governor's office. The latter responded by asking DPOPH to make a plan for expansion of CARE strategies to the rest of the province, but this has not yet been done.

### 8 3 Linkages

8 3 1 Relationship to other organisations can take several forms signifying different levels of two-way communication. They include -

- distribution of information (eg reports, usually one-way with little response)
- discussion (presentation of information verbally with opportunity for direct feed-back and follow-up)
- joint venture (combined planning, monitoring and evaluating of activities)
- support services (another organisation, usually government identifies its priorities and demands and NGO/donor responds according to government proposal and planning of strategies, often by contract with government)

The Transition Plan is aiming for relationships which fall into the last category. CARE is at present in transition between the first and the second.

8 3 2 CARE has made considerable efforts recently to move from working in relative isolation, (albeit providing information to provincial and national authorities) to forming stronger two-way links with other organisations, especially GOM, CAA and GTA. Compared with the other outputs of the Project, however, this is still a weak aspect.

8 3 3 Recently the relationship with national DNA and PRONAR has developed, but part of the difficulty is logistical. Most contacts are made by project staff, on visits to Maputo. If CARE is to move towards supporting GOM initiatives, in line with the Transition Plan, this will require greater involvement of Maputo based staff to ensure good links and two-way information flow.

8 3 4 At provincial level CWSP has made good links with the Governor's office and received his support on several matters of policy (pre-payments, cost recovery for maintenance, demand driven approach). His experience with CARE has meant that he wishes to see communities enabled to solve their own problems through the establishment of local contractors in well construction, where this is technically possible.

8 3 5 Otherwise relationships at provincial level have been weak. DPOPH had management difficulties until recently which made communication difficult but there are other provincial level resources of relevance to CWSP. These include the PEC team of EPAR which has some experienced '*animadoras*' who work with communities on handpump maintenance and management. The Ministry of Health also have laboratories capable of water testing and two departments of health education (one under health and one under CHAEM for environmental sanitation) with which the Project could make contact. The involvement of these and also of Ministry of Education would offer the opportunity of longer-term support to communities, and also the possibility of short-term secondments for training and capacity building.

8 3 6 At local level links have been made more on a personal basis than as a CWSP policy or guideline to involve health posts, schools, teachers or women's groups. Most contact has been made with churches, but the greater the number of organisations aware of the support required and the problems which may arise, the greater the sustainability of the systems. Initial contacts with some schools did not meet with a positive response, but this may have been because the move was rather project centred and did not consult the teachers on what they felt was needed, what they could do and what assistance they might need to draw up a joint programme.

8 3 7 Such intersectoral initiatives would also require support at provincial level, for extension staff to become involved in activities which may not be in their job descriptions. An intersectoral forum, involving GOM and NGOs, (similar to the government WASHE programme in Zambia) is a development which would help in the co-ordination of health, water, sanitation and hygiene activities among all interested bodies. No such body yet exists and each NGO at present has its own policies and methodologies. CARE has links with CAA but more tenuous contact with PLNI and ENH working in the same areas. There is also potential for links to local NGOs, who can provide greater continuity of support. They may also offer the opportunity to establish commercial sections for community facilitation or well construction supervision, utilising the expertise built up by the Project during the past three years.

## **8 4 Conclusions**

8 4 1 Project structure has been stream-lined and mainly consists of personnel employed directly by the CARE. This asset will become fragmented when CWSP phases out.

8 4 2 CARE links have been strongest with communities and until recently weakest with national and provincial GOM and with sub-district extension workers. This has changed considerably in the last year.

8 4 2 Relations are still mainly limited to information exchange but have moved also to stronger two-way communication and discussion of the application of project findings to other parts of the country.

8 4 3 There has been little attempt to foster intersectoral links which are usually a great benefit to programmes combining water, health and education. Involvement of other organisations such as schools and health centres offers possibilities to increase effectiveness at little additional cost.

## 8 5 Recommendations

8 5 1 CARE should discuss with provincial and regional authorities whether an intersectoral forum could be established to encourage greater linkages between all organisations active in the sector

8 5 2 Ministry of Health (DPS) should be contacted to see in what ways Project findings and hygiene education methodologies could be of relevance to the DPS Discussions could also be held on how, over the next six months the two organisations could work together to establish a degree of continued support to initiatives on community monitoring and promoter training This would involve identification of those areas where health extension staff are available

8 5 3 At national and regional level CARE should look at the implications of the Transition Plan in terms of project '*modus operandi*' and the nature of organisational relationships which would need to develop in the future This is likely to include both greater national and provincial links with GOM if CARE is to play a role in the Transition Phase Aspects such as acting as a contractor for training and research for GOM and other NGOs should be explored

8 5 4 CARE should look at how the resources and expertise built up in Vilankulo might be transformed into sustainable units (eg in community facilitation) and the associated training needs and temporary support this might require

## 9 PROJECT COST EFFECTIVENESS

### 9 1 Total costs

9 1 1 There are various ways of calculating the cost of water supply and health education, depending on the degree to which overheads are included. The most direct way to assess cost effectiveness is to compare total inputs and outputs. In the case of this Project these have been as follows -

Table 9 1

Donors	Funds in US dollars		US Dollars	Project Costs	Cost per Community	Cost per head
	Phase 2	Phase 1				
UNHCR		134,551	First phase	876,351	25,039	43
CARE Germany	75,700		Second	2,805,064	26,715	52
ODA	470,100		Total	3,681,415	28,296	49
Le Brun	150,000					
USAID	2,109,264	741,800				
Total	2,805,064	876,351				

The above figures include the five communities with boreholes which still remain to be rehabilitated

9 1 2 It appears that despite the greater inputs at community level in the second phase, the costs per community have not increased greatly. This is partly by reducing project overheads in the Vilankulo office and concentrating efforts in cluster areas, with lower logistical costs. Per capita costs have risen mainly because the first wells served everyone, while the later infilling was designed to reduce the number of users per well from around 700 to around 550.

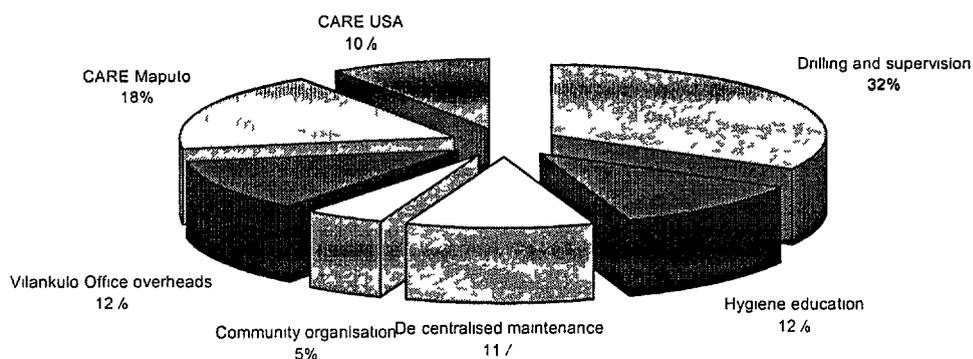
9 1 3 The average cost per community of US\$ 26,700 or just over \$50 per head includes all hardware and software in terms of personnel, vehicles, construction costs, training and community support as well as CARE back-up. Fig 9 1 shows the split of funds which contribute to the costs per unit. Construction costs, including surveys, supervision and '*fiscalização*' contribute one third of the total costs (some US\$ 9,200/ completed/ equipped borehole). CARE indirect costs, including some technical assistance contribute a further 28% of the total, which is slightly higher than UNICEF costs for similar projects in Zambezia and Nampula to date (20-26%). As with UNICEF, such levels may reflect times with few projects to support a centralised back-up which may not always be able to adjust immediately or sufficiently to changing circumstances. High CARE overheads also reflect the poor condition of infrastructure in Vilankulo which has necessitated keeping another office in Inhambane, for contact with Maputo, and a power supply to Vilankulo offices, which is a major budget element.

9 1 4 The overall costs per community are high partly as a result of overheads at three levels, but also because -

- strategies were being developed as the Project progressed, and so this involved re-visiting some communities and those from the emergency phase
- delays occurred as people began to adjust to the new National Water Policy (eg five months waiting for official approval from the Governor and DPOPH to charge for pumpheads and cylinders)
- there is a high input on community training and support (one facilitator per 5 new wells)

- a relatively high level of technical assistance was regarded as necessary during the transition from emergency to development strategies
- management effort was also put into building up links with traders and establishing their links with manufacturers

Fig 9 1 Cost allocation to Project activities



9 1 5 The costs of providing the water supply (the 'hardware cost') is one third of the total. Thus the direct software and management costs are around \$11,000 per well, or \$17,500 including all overheads. Other projects with high hygiene education inputs tend to exhibit somewhat lower costs, when calculated on the same basis. For example -

Non-hardware costs		
SNV Northern Province Zambia	350 communities	US\$ 12,000 reducing to 7,500
KfW/ Gauff Central Province Zambia	850 communities	US\$ 13,500
Irish Aid Northern Province Zambia	500 communities	US\$ 7000

In these cases costs appear lower for several reasons -

- most project staff are seconded from the government and much of the community work is undertaken by government extension workers
- the number of communities has been increased so that overheads are spread over a greater population
- the projects run for more than three years so that assets paid for at the beginning continue to be of service throughout a longer project life, reducing the effect of initial costs
- in the case of SNV, costs reduced by various measures such as concentrating all efforts in one area at a time reducing dependency on the project by using indirect monitoring systems

9 1 6 In comparison the 'non-hardware' elements elsewhere in Moçambique are at present much lower, but so is the overall impact and also the emphasis on

behavioural change For instance on the UNICEF Zambezia IRWSP these costs are approximately \$2,500-3,000 (Ref 19) EPAR non- hardware costs are about \$1,250 per community to include community training, initial surveys and office overheads It underlines that combining behaviour change and demand driven approaches which include strengthening of management at community level is very expensive in relation to the costs of simply planning and implementing construction of a water supply with a community and then providing training in maintenance and repair

9 1 7 For any future project CARE would need to look at ways to reduce unit costs, which could include some of the measures in 9 1 5, Consideration should also be given to whether CARE indirect overheads can be reduced

9 1 8 If CIDA/ World Bank funding is forthcoming for Inhambane Province it will be necessary to establish what level of software is envisaged If CARE wishes to promote the adoption of high cost support to communities it will need to be able to show that behaviour changes occur because of these inputs, and that such behaviour changes lead to tangible improvements in health It is therefore of great importance that the monitoring of diarrhoeal incidence is continued until, hopefully, trends can be identified

## **10. CONCLUSIONS AND RECOMMENDATIONS**

### **10 1 Introduction**

10 1 The Terms of Reference (see Appendix 1) relate to the two main intermediate objectives and the associated outputs. In addition they require an assessment of impact on specific aspects. They are followed by specific issues which relate particularly to national policies, project strategy and management. Table 10 1 presents the narrative summary of indicators.

### **10 2 Intermediate Goal 1 Outputs 1 and 4 Improved access to adequate reliable water for 44,500 75 boreholes constructed and 12 wells rehabilitated**

10 2 1 The CWSP has exceeded the target in terms of number of beneficiaries (see Table 3 1), and has responded to the demands of the local population. An indicator of the demand is that of the 42 communities who expressed interest, forty raised the necessary funds (over \$300) for the cylinder and pump head before the deadline. The degree of demand was also expressed by the Provincial Governor, who gave assistance to the project as a high priority in view of the provincial need. Whilst the target number of users has been exceeded, five wells remain to be rehabilitated before the end of the project. Average cost per borehole is \$9,200 for construction, supervision and inspection.

10 2 2 The chosen technology of boreholes and handpumps is the most cost effective and proves popular with users. This is indicated by all communities making considerable financial, physical and managerial efforts to keep pumps functioning. The main draw-back is the brackish nature of much of the water, which makes rainwater preferable for drinking, when available. Cisterns offer a technology which is appropriate in using locally available skills and materials, but at considerably higher per capita costs. They may therefore become a preferred and sustainable option as socio-economic conditions improve.

10 2 3 The quality of installations is generally high, except for some handpump parts, especially pumpheads and riser pipes, for which greater factory quality control is needed.

### **10 3 Intermediate Goal 1 Output 2 Commercialised spare parts supply**

10 3 1 Whilst this has been a national policy for more than three years, government actions have often threatened the success of private sector involvement. This is especially so since vendors, encouraged by CARE, have reached a stage where they sell unsubsidised spare parts and so have invested significantly in spare part stocks. The main stockist in Vilankulo sells to the two smaller vendors, and there is scope and demand for establishment of stocks at sub-district level. They sell parts at prices very similar to those recommended by government and sell to old and new

**Table 10 1 Summary of indicators from Terms of Reference**

NARRATIVE SUMMARY	Observed levels A= baseline B = Control 1= new well +HE 2= only HE since baseline 3 = only new well	COMMENTS
<p><b>Goal</b> To improve the health status of at least 44,500 people of Northern Inhambane Province</p> <p><b>INDICATORS</b></p> <ul style="list-style-type: none"> <li>40% reduction under the baseline survey of children under 5 years with diarrhoea during the last two weeks</li> <li>40% reduction under the baseline survey of inhabitants older than 5 years with diarrhoea during the last two weeks</li> <li>40% reduction under the baseline survey of inhabitants older than 5 years with conjunctivitis during the last two weeks</li> </ul>	<p>A= 43% B= 39% 1= 38% 2= 42% 3=42%</p> <p>A= 14% B= 19% 1= 17% 2= 18% 3= 14%</p> <p>A= 10% B= 11% 1= 12% 2= 10% 3 = 11%</p>	<p>Approximately 54,400 users of new boreholes and maintained handpumps</p> <ul style="list-style-type: none"> <li>Almost constant ( within sampling error)</li> <li>Almost constant</li> <li>Almost constant (low incidence) (see Appendix 3 Table 10)</li> </ul>
<p><b>Intermediate Goals</b> 1 To improve access to adequate, reliable water for 44,500 people</p> <p><b>INDICATORS</b></p> <ul style="list-style-type: none"> <li>80% of improved water points available at least 90%of the time</li> <li>50% increase over baseline of water use per person per day (L/hd/d)</li> <li>6 900 h/hs using new/rehabilitated water facilities</li> <li>6 900 h/hs with access to new/rehabilitated water facilities</li> </ul>	<p>A=11 4 B= 15 1 = 22 2= 20 3= 19</p>	<ul style="list-style-type: none"> <li>97% operating Average time out of action 10 days</li> <li>60% increase over control 80% increase over baseline</li> <li>c 9,000 households using new/ rehabilitated wells in dry season</li> <li>over 9,000 h/hs with access</li> </ul>
<p>2 To maximise benefits of improved water supply through adopted environmental sanitation and hygiene practices</p> <p><b>INDICATORS</b></p> <ul style="list-style-type: none"> <li>30% increase over baseline of # h/hs with clean and safe water container to store water</li> <li>30% increase over baseline of # h/hs with safe excreta disposal</li> <li>30% increase over baseline of h/hs bathing children under 5 every day</li> <li>30% increase over the baseline of mothers who know that they should wash their hands before eating and feeding the child</li> </ul>	<p>n/a</p> <p><u>Latrines</u> A= 23% B= 31% 1=18% 2=28% 3= 43%</p> <p><u>Average times bathed per week</u> A= 10 B= 11 1= 14 2= 12 3= 12</p> <p><u>Feeding child</u> A= 16% B= 29% 1=45% 2=21% 3=21%</p> <p><u>Preparing food</u> A= 69% B=56% 1+ 75% 2= 57% 3= 62%</p>	<ul style="list-style-type: none"> <li>20% more using latrine (cf baseline, 12% cf control)</li> <li>25% reduction disposing in the bush without burial</li> <li>Most children already bathed on daily basis</li> <li>Not asked as knowledge Approx 26% more say they wash before feeding a child and 12% more before preparing food</li> </ul>

Note indicators need to be adjusted to reflect baseline percentages now these have been established approximately

'CARE ' and Agua Rural customer communities All have a source of spares, even though this may be at considerable distance

10 3 2 At present the trade is not large enough to form a significant turn-over for vendors and they carry out the service partly as a service to communities and partly for the additional trade brought in when people come for parts. There is considerable potential for the market to expand, partly as pumps get older.

10 3 3 The relationship between vendors and communities is developing, including provision of saving and credit facilities. The signs are that the system will continue to develop and expand as long as government/NGO strategies remains consistent with PNA.

#### **10 4 Intermediate Goal 1 Output 3 A sustainable de-centralised maintenance system for at least 100 handpumps**

10 4 1 Maintenance teams are well established and carry out all repairs in most communities, partly because refresher courses have also been carried out where wells were constructed in 1993-4. Routine maintenance is a well-accepted, and practised concept with these maintenance groups (GMRs), unlike those in other parts of the country. The lack of confidence of some GMRs shows there is a need for a support network of local mechanics, which is being encouraged by CARE, but is still not operating throughout the region.

10 4 2 Fund raising systems are developing well and feeling of ownership is expressed both in the improvements which communities have made around wells, and the controls they have instituted. Many communities have accumulated funds but have no way to make sure that these retain or increase their value.

10 4 3 Maintenance systems are developing strongly and have enabled all pumps on operating wells to be kept in action. They are not yet generally able to cope with the most costly repairs such as replacement of riser pipes, but are increasingly finding the confidence and skills to solve such problems. Transitional centralised support is therefore still needed, but in a form that encourages development of an intermediate tier of local mechanics.

#### **10 5 Intermediate Goal 2 Maximise benefits of improved water supply Output 1 Participatory hygiene education and its impact**

10 5 1 Stimulating people to change their behaviour is a gradual process, partly carried out by people influencing each other. Three years is a short time both to develop methods to encourage behaviour change and for any measurable impact to be seen.

10 5 2 The Project has developed a programme which relies as far as possible on health promoters (volunteers with responsibility for ten houses each) to bring health education to household level. Promoters, with ECs generally work together to try and ensure that families follow acceptable practices which do not put others at risk in terms of faecal and solid waste disposal, as well as practising good personal hygiene. The degree to which promoters understand and pass on health messages is variable and needs further assessment.

10 5 3 There are noticeable changes in hygiene during the past year (see Table 10 1 and Section 7). Amounts of water used have increased greatly with the

provision of new sources, and even more where hygiene education has taken place. Some aspects such as latrine building and use of soap have partly increased as a result of the Project's inputs and partly because socio-economic changes are taking place. In general, changes in behaviour are positive and noticeable. However, their effect does not appear to be reflected in a significant reduction in disease incidence according to the EOPS. This calls in question the ways that both behaviour change and disease incidence are being measured. It also calls into question the assumption that disease incidence will reduce rapidly and significantly in a short time when many other variables, such as diet, are changing more slowly.

## **10.6 Intermediate Objective 2 Output 2 Information management system established to exchange information with GOM and other agencies**

10.6.1 The Project has documented its findings and activities very fully, and has shared much of the information with others, especially on pump performance. The level of information exchange has tended, until recently, to be mainly that of distributing reports, but has now moved more to discussing results as well. A two-way communication is therefore developing more strongly with GOM and some other agencies.

## **10.7 National Water Policy and its effect on the Project**

10.7.1 CARE, perhaps more than most other organisations, has responded to the National Water Policy and has experience of importance to those formulating strategies for the implementation of the Transition Plan. Some of the delays CARE has faced, and some of the lack of support from DPOPH in the past, are partly due to the Project trying to implement a policy before many others had adjusted to the policy principles. It is to the credit of the Project that it has kept to those principles and can now offer experience of some of the practicalities, costs and time implications which such principles imply.

10.7.2 Particular attention has been paid to sustainability which is closely tied to the demand-driven approach itself. It takes time to change people's attitude when they have been used to emergency provision of services and food, and to help them to see that they have to begin to seek their own solutions. It takes time for communities, once convinced, to set up management systems and collect together resources, but CARE has acted as a catalyst in helping communities to achieve this. However, some continued support will be necessary for communities for the next few years.

10.7.3 A dilemma arises with the demand-driven approach however, as far as behavioural change is concerned. Theoretically, if knowledge is imparted, individuals have the choice of whether to change behaviour or not. However, it has been found consistently (including by anti-smoking campaigns) that knowledge alone is not a sufficient stimulus to change, and that changing attitudes takes much longer. In the case of communities in the region, there has been a high demand to improve water supplies to reduce the burden of water collection. After this, there are many other priorities which have immediate benefit (eg. food production, education, clothes) according to the KAP survey of 1995. These may take precedence over hygiene behaviour change. Although family health was a high priority, the immediate effects of drugs from health centres are more likely to be sought before the less obvious partial effects of behaviour change. It is difficult to know at what stage emphasis on

the difficult task of changing attitudes should be given high priority, since it cannot be a demand-driven feature

10 7 4 Systems which assist the development of community management capacity and encourage behaviour change are expensive. Management is needed to transform demand into action, and must continue effectively long after the well is constructed, and needs some support in the early stages. The Project costs are some US\$ 26,700 per community, which, since the communities are large is around \$50 per head (around the usual donor maximum target). Of this sum, \$11,000 is for direct costs of community facilitation, or nearer \$US 17,500 including all overheads

## **10 8 Organisation and management**

10 8 1 The slight weakness of the Project in the past has been the lack of links made with GOM, both within and outside the sector. The Project has begun to make stronger links with GOM within the sector, but opportunities also exist to work with Ministry of Health and Education among others, in ways which could both improve sustainability and reduce costs

10 8 2 All except one of the Project staff are employed by CARE. Therefore if the Project ceases the experience gained will be fragmented. Only one member is seconded from DA and so could return to use his experience directly within GOM

10 8 3 CARE at national and international levels provides back-up to field-based projects. As a proportion of total costs this is a significant element. Links, as is often the case, between field and central offices could be stronger so that national level staff can provide more of the contact with GOM, and the relationship become more inter-active. If the Project continues, this will be needed when the Transition Plan begins to be implemented. At the same time, with de-centralisation, decisions will be more and more made in Maxixe, so that the CARE Inhambane office might still be needed

## **10 9 General conclusion**

10 9 1 The Vilankulo CWSP has achieved a great deal in a short time. It has developed strategies applicable elsewhere, some of which are still evolving. These strategies have been applied in a very water short area, where need and demand were equally apparent. Elsewhere the process may be even slower if need has first to be transformed into demand. The time taken for communities and others to change attitudes and behaviour, and for communal fund systems, spare parts networks to develop means that there are still lessons to be learnt from the experience in the area. Other projects would take some time to reach a similar baseline. Without having found all the answers, the CWSP has much experience of relevance to the Transition Plan and PNA, and could provide more solutions if it were to continue. It would be a pity if the momentum and experience were to be lost

## **10 10 Recommendations**

10 10 1 Recommendations mainly relate to improving the sustainability of what has been achieved so far, before the end of the Project. However the first recommendation must be to seek ways for the Project to continue and that on another occasion this might be timed better to ensure continuity of programme development

10 10 2 The Project should put much effort into further developing links with GOM and becoming involved with government initiatives at national, provincial and district levels, and discussing results with policy makers. The Transition Plan implies a change in the relationship between NGOs and donors with GOM.

10 10 3 Links should also be developed with other sectors at provincial and district levels especially in health, so that the permanent sub-district resources can prolong community support where necessary.

10 10 4 Ministry of Education could be approached to see what can be achieved in terms of schools acting as collectors as well as disseminators of information. If a Child to Child programme were to be developed this would need longer than the present project life, but would be likely to have significant impact. Both this and 10 10 3 could reduce costs of hygiene education and facilitators follow-up work in future programmes. Partnerships with local NGOs should also be explored.

10 10 5 CARE should analyse all cost elements and see where reductions might be possible in any future project. Overheads which are not directly project related should be included in the analysis.

10 10 6 Monitoring to date has provided very useful information for use within and outside the Project. This should be continued if at all possible. Discussions should be held with DA to see whether they can gradually take over the monitoring of handpump performance, and with Ministry of Health over support to community monitoring.

10 10 7 The EOPS has produced interesting and encouraging information. However it also leaves some questions unanswered, which are critical to the justification of including behavioural change as an output. It would assist in justifying relatively high 'software' costs if trends in diarrhoeal incidence could be better defined. The EOP survey should therefore be repeated in the same month as the baseline survey. The same questions should be asked, for direct comparison, but also questions more along the lines of the DHS which specifies exactly what is meant by diarrhoea for the purposes of the survey. Also trials should be made on collecting hand-washing and defecation practice information as part of group sessions using posters for discussion, rather than by direct questions to individuals.

10 10 8 Management of sizeable communal maintenance funds poses a problem throughout the country. The Project should explore with some communities ways in which such money could generate income to assist in community development and to be able to cover the larger infrequent costs which arise as handpumps get older. This could perhaps tie up with an agricultural programme such as the one which CARE is about to start.

# APPENDIX 1 TERMS OF REFERENCE

## CARE INTERNATIONAL IN MOZAMBIQUE

### COMMUNITY WATER AND SANITATION PROJECT INHAMBANE PROVINCE

#### SCOPE OF WORK

#### FINAL PROJECT EVALUATION

**CARE Mozambique** Community Water and Sanitation Project Inhambane Province (Phase II)

**Project Funding Cycle** January 1995-December 1997

**Donors** USAID, ODA, CARE Deutschland, Le Brun Foundation, CARE USA

#### INTRODUCTION

CARE International in Mozambique is concluding a rural water and sanitation project in the northern region of Inhambane Province. The project area is about 29,800 square kilometres covering Govuro, Mabote, Inhasoro, and Vilankulo Districts. Based on the lessons learned since 1990 in central and northern Inhambane, the Community Water and Sanitation (CWS) Project started its second phase in January 1995. The aim of the project is to increase access to water for at least 44,500 people. It also aims to ensure a more sustainable impact than the emergency water supply strategies previously applied in the area through the adoption of improved hygiene, sanitation behaviours and strengthened decentralised community based maintenance and operation of the water systems.

The purpose of the evaluation is to assess what extent the project's goals and objectives have been attained, the achievement of outputs, and project impact in relation to baseline data. The evaluation will provide appropriate feedback and recommendations to improve programmatic approaches to be used for future interventions, particularly in relation to the changes being made to Mozambique's water sector policies.

CARE International in Mozambique is planning to undertake the final evaluation of the second phase of the CWS Project from November 25, 1997 over a three week period. A team of two evaluators will perform the final evaluation.

#### BACKGROUND

The CWS project has three main intervention strategies: a) the establishment of sustainable water systems, mostly handpumps; b) a regional decentralised maintenance program for Afridev, handpumps which are monitored and managed by the participants themselves; c) participatory hygiene education program focused in at least ten population clusters where CARE is rehabilitating or constructing a water point. Additionally, the project is working with local vendors to ensure the commercialisation of spare parts for the maintenance and repair of handpumps.

The project involves the participant communities as fully as possible in pump siting, construction, operation and maintenance planning and implementation. Participatory investigation and training techniques are used to involve communities in defining their own development priorities in the areas of water and environmental health education.

The project aims to improve use of water through the hygiene education activities with the purpose of promoting hygiene behavioral changes. Leaders and key community members analyze the main hygiene and sanitation problems and develop alternative solutions and define an implementation plan.

During its life, the project has targeted approximately 44,500 inhabitants through the construction of 80 boreholes, the rehabilitation of 12 boreholes and shallow wells and rainwater catchment rehabilitation. A hygiene education program focused on behaviour change has been implemented in at least 60 communities. Also, the project continued its activities to strengthen community organisation and capacity to undertake operation and maintenance activities supporting the water systems in both new communities targeted during the second phase, and communities reached during the project's previous phase (1993-1994).

### **SPECIFIC RESPONSIBILITIES**

With participation of project staff and targeted communities, the evaluation team will review achievement of project outputs according to indicators as detailed below.

**Intermediate Goal #1** To improve access to adequate reliable water for 44,500. This goal is to be achieved through the following project outputs:

- 1 90 boreholes constructed or rehabilitated with apron, drain, and handpump mounted, and 12 wells rehabilitated
- 2 Commercialised spare parts supply facilitated for at least 80 new Afridev handpumps and 40 old Afridevs
- 3 A sustainable decentralised maintenance system capable of managing maintaining and repairing of at least 100 handpumps
- 4 A pilot project for construction of local rainwater catchment systems Implemented

**Intermediate Goal #2** To maximise benefits of improved water supply through adopted environmental sanitation and hygiene practices. This goal was to be attained through the following project output:

- 1 Participatory hygiene education program implemented
- 2 In order to assure project sustainability and institutional building at national and local level, the project defined the following output:
  - 1 Information management system established to exchange information with GOM and other agencies

### **FINAL IMPACT**

The project undertook a baseline survey of 21 impact indicators in twelve cluster areas before project improvements. An end-of-project survey will be carried out in November '97.

The evaluation team will assess the project's final impact using data from the end-of-project survey as well as qualitative field participatory activities undertaken during the course of the final evaluation. The evaluation team will assess the following areas:

- 1 The capacity of communities to maintain and operate their pumps and the sustainability of the system
- 2 Behavioural changes adopted by target beneficiaries
- 3 The activities impact in relation to the perceived needs of the population of the districts
- 4 The effectiveness and sustainability of the private sector in terms of the commercial supply of spare parts to the participating communities

Project indicators for sustainability and impact are detailed as follows

<u>NARRATIVE SUMMARY</u>	<u>INDICATORS</u>
<p><u>Goal</u> To improve the health status of at least 44 500 people of Northern Inhambane Province</p>	<p>40% reduction under the baseline survey of children under 5 years with diarrhoea during the last two weeks 40% reduction under the baseline survey of inhabitants older than 5 years with diarrhoea during the last two weeks 40% reduction under the baseline survey of inhabitants older than 5 years with conjunctivitis during the last two weeks</p>
<p><u>Intermediate Goals</u> 1 To improve access to adequate, reliable water for 44,500 people</p>	<p>80% of improved water points available at least 90% of the time  50% increase over baseline of water use per person per day (Up/d)  6,900 h/hs using new/rehabilitated water facilities  6,900 h/hs with access to new/rehabilitated water facilities</p>
<p>2 To maximise benefits of improved water supply through adopted environmental sanitation and hygiene practices</p>	<p>30% increase over baseline of # h/hs with clean and safe water container to store water  30% increase over baseline of # h/hs with safe excreta disposal  30% increase over baseline of h/hs bathing children under 5 every day  30% increase over the baseline of mothers who know that they should wash their hands before eating and feeding the child cleaning agents</p>

**OTHERS ISSUES/QUESTIONS TO BE ADDRESSED**

- 1 Have changes in water sector policies and the subsequent political environment in the province had an impact on project implementation?
- 2 Have changes over the last 24 months in project strategy been appropriate in terms of the new water policy adopted by the GOM
- 3 What further programmatic tuning or changes are recommended in the light of the new water sector policies and particularly in relation to a more demand driven approach to water delivery? The consultants will take into evaluations, consultancies and others

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#### 4 Management issues within the project and CARE Mozambique

### **ACTIVITIES AND TIME FRAME**

The evaluation team will conduct the final evaluation on site in northern Inhambane. The evaluation will take place over a period of 30 days from November 25 through December 11, 1997. The final report must be submitted no later than September 20. An *illustrative* schedule of activities follows:

Nov 25-Nov 27 In Maputo, Review documents, interview government officials and donor representatives (USAID, ODA, PRONAR)

Nov 28 In Inhambane and Maxixe, interview government officials (Governor and DPOPH)

Nov 29 -Dec 7 In Vilankulo, interviews with local counterpart officials at DPOPH, and administrators, interviews with CARE staff/local participants

Dec 8 In Vilankulo, outline of evaluation report and preliminary findings presented to DPOPH, District Administrators and CARE staff for comments and input

Dec 9 -Dec 11 In Maputo, debriefing meeting with CARE donors, PRONAR, DNA

Dec 11-Dec 17 In England, preparation of report

Sept 20 In Maputo, Submission of Final Report

### **OUTPUTS**

The following outputs will constitute completion of the Final Evaluation:

1. Completion of all evaluative fieldwork as described above in this SOW, submitted in hard copy and diskette (Microsoft Environment)
2. Completion of written evaluation report (English or Portuguese) covering all areas described on this SOW, submitted in hard copy and diskette (Microsoft Environment)
3. Oral representation of findings at debriefing with donors

### **CRITERIA FOR SELECTION**

#### Team leader

- Broad rural water and sanitation programming
- Previous experience in community development projects
- Previous experience in project evaluation
- Previous experience in South Africa, Lusophone Africa preferred
- Proficient written and oral English
- Oral Portuguese preferred
- Ability to operate in remote rural settings

#### Other team member

- Broad knowledge of policy environment of the water sector in Mozambique
- Previous experience in rural water and sanitation programming
- Previous experience in Lusophone Africa
- Demonstrated complete in evaluation of community water and sanitation projects
- Proficient written and oral Portuguese

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Oral English, preferred  
Ability to operate in remote rural settings

**OTHERS**

The consultants should bring their own laptops. CARE will provide all necessary logistical support, transportation, accommodation and camping equipment. Telecommunication in project area is limited to CARE radios.

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## APPENDIX 2 REFERENCES

- 1 June 1996 Impact Indicator Survey Isabelle Schmidt
- 2 June 1995 Projecto de agua e Saneamento comunitario, Provincia de Inhambane Levantamento de dados basicos 1995 CARE
- 3 June 1997 TA consultation to CARE Community Water and Sanitation Project Marydeane Purves
- 4 Nov 1997 End of project survey Sally Wallace
- 5 July 1996 Mid-term evaluation Alan Malina
- 6 Sept 1996 Estrategia de Implementação do projecto 1996/97
- 7 Feb 1997 Monitoring of the Afridev Handpump Database CARE
- 8 May 1997 Estudo geofisico nas Localidades de Cubine, Mandla, Ngonhamo, Mabote Hidrom Ltda
- 9 Mar 1997 Progress report on rainfall harvesting pilot project implementation CARE
- 10 Nov 1996 Water sampling results for 1995 boreholes CARE
- 11 Undated Project proposal CWSP Inhambane, Jan 1995- December 1997
- 12 Sept 1996 Project Implementation strategy 1996/97 CARE A-LO
- 13 April 1996 Annual Progress report to ODA JFS April 1995-Mar 1996
- 14 April 1997 Annual Progress report to ODA JFS April 1996-Mar 1997
- 15 Nov 1994 Final Evaluation Report CWSP, Inhambane Province S Chanda
- 16 Nov 1997 Rural Water Transition plan Draft MOPH, DNA
- 17 Aug 1995 Boletim da Republica No 34 Politica de Aguas (PNA)
- 18 Feb 1997 Monitoria de Bomba Manual Afridev Julio Vicente, CARE Vilankulo
- 19 Nov 1996 Project Progress Evaluations IRWSP Provinces of Zambezia and Nampula UNICEF S Sutton
- 20 Politica de Aguas Agua Feb 1996
- 21 Demographic Health Survey Moçambique IDSM 1997
- 22 Curtis V et al Structured observations of hygiene behaviours in Burkina Faso, validity, variability and utility Bull WHO 71, 23-32
- 23 Stanton B f et al 24 hour recall, KAP questionnaires and direct observations of sanitary practices A comparative study Bull WHO 65 217-222
- 24 J M Wilson et al Handwashing reduces diarrhoea episodes a study in Lombok Indonesia Trans Royal Soc for Trop Medecine and Hygiene TRSTMH vol 85, p 819-821 1991
- 25 Gauff Ing Summary of different project approaches in Zambia in "RWSS Project Feasibility Study Eastern Province Zambia" May 1996

### APPENDIX 3 EOPS DATA SUMMARY

Table 1 Communities selected for the Inhambane EOPS

District	Zone/Localidade	Community	Project Activity Level	Est # of families	# of interviews
Vilankulo	1 Belane	1 Muahase	1	149	10
		2 Humulane	1	113	16
		3 Nguluine	2	65	9
		4 Ngumbane	2	210	19
		5 Mungondo	2	108	17
	2 Muabsa	6 Quequer	1	122	15
		7 Malatisi	3	85	8
		8 Mbovane	2	74	10
		9 Muabsa Sede	3	291	19
		10 Mboane	2	35	6
	3 Mapinhane	11 Machengue	3	?	8
		12 Koshua	3	?	10
4 Maimelane		13 Malangete 2	1	276	19
		14 Chitsecane 2	1	154	15
		15 Mucambe	1	60	5
	16 Matsazane 2	1	191	15	
	17 Maperepere	1	97	10	
5 Nhapele	18 Catina 1&2	2	148	14	
	19 Maole	1	115	15	
	6 Rumbat-satsa	20 Nhazuco	1	48	5
		21 Madacara	2	102	15
		22 Chicane/Chihicamina	3	?	4
		23 Tsasene	3	?	5

	7 Cometela/ Nhapele	24 Chiwemane 1&2	2	87	10
		25 Mahungane	2		19
		26 Chingaman e	2	46	6
		27 Chihamela 1	2	80	0
		28 Chihamela 2	2	136	0
Guvuro	8 Luido	29 Singaril	1	25	5
		30 Ngoma	2	53	10
		31 Cubime	3	71?	10
	9 Save	32 Mabongo	3	30	9
		33 Machacame	3	15	15
		34 Chindotane	3		16
Mabote	10 Mussengue	35 Bovanane	1	237	15
		36 Dimbene	1	89	10
		37 Xiterele/ Chonguane	1	59	10
		38 Mahitelene	2	162	15
	11 Nzimane	39 Massacasse	1	57	10
		40 Nzimane II	1	62	10
		41 Mahunzu- lucane	2	85	10
	12 Chitanga	42 Massinguir	1	245	20
		43 Tsumbo	1	235	21
		44 Pangué/ Madade	1	231	20

- 1 High project activity - Borehole(s) developed, pump maintenance groups trained, local water hygiene promoters selected and trained This was later split into those where only water availability only health education was subsequent to the baseline survey, and those which received both HE and borehole since baseline survey That data has been used in diagrams in Section 7
- 2 Low project activity - Borehole(s) developed, pump maintenance groups trained
- 3 Control - No CARE project activities carried out

TABLE 2 HOUSEHOLD DEMOGRAPHICS

	BASELINE	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Average Household Size	6.3	6	5	6
Average number of children under 5 in households with children under 5	2	2	1.9	1.8

TABLE 3 RAINY SEASON WATER SOURCES

Water Source - Rainy Season	BASELINE	END OF PROJECT SURVEY		
	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Borehole	30	56	31	11
Lake, dam, swamp	35	26	41	32
River	2	<1	-	19
Open well (communal)	10	2	8	13
Open well (yard)	<1	-	7	5
Closed well (communal)	<1	-	1	-
Cistern	N/A	2	2	1
Roof water	12	7	7	5
Puddles	10	6	5	14
%age of households that boil drinking water from unprotected sources	2	16	12	3

TABLE 4 WATER SOURCES AND USE-DRY SEASON

	BASELINE	EOPS		
Water Source - Dry Season	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Borehole	70	93	86	34
Open well (communal)	17	5	9	14
Closed well (communal)	5	-	1	3
Open well (yard)	<1	-	3	5
Lake, dam, swamp	2	2	1	9
River	7	-	-	36
Water Use-Mean per person per day (L)	11.4	21	17	13

TABLE 5 WATER USE BY TIME AND HOUSEHOLD SIZE

	TIME REQUIRED FOR WATER COLLECTION				
	<2 HOURS	2-4 HOURS	4-6 HOURS	6-8 HOURS	8+ HOURS
Water Use per person per day (L)	20	15	12	12	11
	SIZE OF HOUSEHOLD				
	<=4 MEMBERS	5-8 MEMBERS	8-11 MEMBERS	12+ MEMBERS	
	20	19	18	13	

TABLE 6 WATER COLLECTION ACTIVITIES-TIME AND FREQUENCY

	HIGH ACTIVITY (%)	LOW ACTIVITY (%)	CONTROL (%)
Indicator	EOPS	EOPS	EOPS
Time spent in water collection activities (walk to pump, wait in line, return)			
< 2 hours	74	58	70
2-4 hours	21	32	9
4-6 hours	5	8	2
6-8 hours	1	2	2
More than 8 hours	-	1	17
Water collection frequency			
More than 1 visit to water source per day	74	66	43
1 visit per day	22	25	36
1 visit every other day	2	8	13
2 visits per week	<1	-	6
Other frequency	1	1	2

TABLE 7 PERSONAL HYGIENE-CHILDREN UNDER FIVE

	BASELINE	EOPS		
Indicator	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Mean number of times per week children <5 are bathed	10	13	11	12
Observed cleanliness of children				
Dirty for more than 1 day	16	8	9	16
Dirty from playing	48	61	69	57
Clean	16	23	16	20
Not observed	18	8	7	7

TABLE 8 HANDWASHING PRACTICES

	BASELINE	EOPS		
Handwashing Practices % households reporting	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Before preparing food	69	66	59	59
Before feeding a child	16	33	26	26
After using toilet	26	45	28	36
Before eating	67	91	79	89
After returning from farm	56	76	68	58
Number of occasions when hands are washed (% reporting)				
1-2	30	13	20	18
3-4	54	50	59	60
5+	15	36	21	21
Material used for handwashing				
Soap and water	27	53	48	47
Water only	71	43	46	51
Ash	<1	2	6	1
Other	<1	2	1	1

TABLE 9 ENVIRONMENTAL HYGIENE

	BASELINE	EOPS		
Indicator Defecation habits % households reporting	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
% in bush-do not bury	39	15	28	36
% in bush-bury	38	46	48	34
% near yard-do not bury	<1	-	1	-
% near yard-bury	<1	2	-	-
% latrine	23	36	23	31
Disposal of children's faeces % households reporting				
% bury	60	66	68	69
% dispose of in bush	10	5	8	11
% dispose of in hole	3	-	2	4
% dispose of in latrine	8	26	17	13
% Wash and throw with water outside yard	15	2	2	1
% Do nothing	2	-	2	-
Disposal of household waste % of households reporting				
% dispose in hole	46	63	55	58
% dispose in bush	21	5	11	6
% dispose near yard	30	25	28	28
% bury	3	3	4	4
% burn	1	2	2	5
Observed cleanliness of yard area				
% with human/animal feces more than 1 day old present	12	14	30	21
% with human/animal faeces of 1 day or less present	30	25	18	16
% with no human/animal faeces present	58	60	53	63

TABLE 10 DISEASE INCIDENCE

	BASELINE	EOPS		
Indicator	ALL COMMUNITIES	HIGH ACTIVITY	LOW ACTIVITY	CONTROL
Diarrhoea (% of children under 5 years)	43	41	35	43
Diarrhoea (% of population over 5 years)	14	14	16	18
Scabies (% of total population)	3	18	15	31
Conjunctivitis (% of total population)	10	11	9	13