MALAWI GRAVITY-FED RURAL PIPED-WATER PROGRAMME

A Case Study

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Foreword

Approximately half the world's population does not have access to safe drinking water. This is particularly the case in rural settlements. Although most rural settlements have developed where water is available, many rural residents still have to travel long distances to a water source, usually of dubious quality. Even these sources of water often run dry during periods of dry weather, necessitating the abstraction of water further afield.

The problem of supplying water to rural settlements is complicated by many factors not least of which are the limited ability of users to pay for service, the dispersed nature of the settlements, the lack of awareness of the benefits of safe water, and the gross numbers lacking service. In the face of limited investment resources and equally limited revenue-generating prospects, innovations are required to install self-sustaining water-supply programmes. The dissemination of information on successful experience should aid in dealing with this problem.

The Malawi gravity-fed piped-water programme is an example of what can be achieved, despite constraints peculiar to rural settlements. The involvement of beneficiary communities at all stages of project implementation and the emphasis given to operation and maintenance are two exemplary features of the programme. The positive impact of the programme and its ability to be self-perpetuating should encourage governments and local administrations to address the problems of providing water to rural communities. I am confident that this publication will provide useful insights to policy-makers, engineers and other professionals who are actively engaged in extending water-supply services to rural communities.

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Executive summary

The Malawi rural gravity-fed piped-water programme began in 1968 when the only protected rural water supplies were approximately 1,000 boreholes serving 6 perc ent of the population. The piped-water programme grew out of a request for water from a group of villages, encouraged through discussion with the Ministry of Community Development and Social Welfare. After the successful completion of the first scheme, an institutionalized programme was established. The capacity to execute projects was expanded, with each project relying on the previous to generate demand and train personnel.

By 1987 there were 47 completed gravity-fed piped-water schemes with nine under construction. They serve 1,010,000 rural inhabitants or 13 per cent of the population with a minimum of 27 litres per day per person of untreated water. By 1990, gravity- fed piped-water schemes are expected to serve 1.5 million people, representing 20 per cent of the population. In the long term, the number of people who can be served by piped-water schemes will depend on the development of appropriate water-treatment and dam technologies which increase the number of feasible sites.

A rural gravity-fed piped-water scheme consists of two main elements - the physical installation and the people supporting it. The physical installation is an intake, screening and sedimentation tanks and piping carrying the water by gravity down to the community. The main groups of people supporting the physical installation are the users, the Malawi Congress Party (MCP) and the Government. The users, who include every adult in the community, are organized into three levels of committees, elected by the users to represent and supervise them in planning, execution, operation and maintenance. Members of MCP participate fully in projects, as community members and in their official capacities as co-opted members of certain user-committees: the MCP organizational structure is made available to the project to assist in supervision and motivation. The Government's Ministry of Works and Supplies, Rural Water Section, provides the logistical support, materials and technical advice required by users to construct and maintain their scheme.

From the inception of the first project, a number of principles have served to guide the programme. These guiding principles are:

- The scheme belongs to the users;
- The users need to be involved to the maximum in every aspect of their scheme: planning, execution, operation and maintenance;
- The Malawi Congress Party needs to be involved as one of the driving forces in the community.
- The role of project staff is exclusively advisory (the responsibility for making programmes, assigning tasks and supervising labour belongs to local leaders);
- Procedures are standardized wherever possible, in order that the best of the cumulative experience is employed on current projects, and the supervision required reduced;
- Evaluation and continual improvement are needed to stay abreast of new situations and opportunities.

There are two elements of the Malawian context which have contributed significantly to the piped-water projects:

- The existence of numerous perennial streams the water of which can be used untreated and the location and discharge of which are such that water can be distributed to thousands of inhabitants merely by the force of gravity.
- The Malawi Congress Party is well organized and its authority respected right down to the village level.

All levels of staff have contributed substantially to the smooth operation and effective participation of users. Staff effectiveness and dedication are due to:

- A rigorous selection process which retains only people well adapted to the job;
- Intensive and practical training courses with annual refreshers;
- A policy of promoting from within the programme before recruiting from outside;
- Strong leadership;
- A challenging job with deadlines and obstacles plus sufficient support to achieve the goal of a completed project.

To satisfy user-needs in the long term, the physical installation of a scheme is designed in the following way:

- The physical installation is conceptually very simple;

- Scheme components are standardized wherever possible, to simplify training, supervision and stocking of spare parts;
- The scheme is easily installed using unskilled labour-intensive techniques and simple tools;
- The system is easily operated, even by young children;
- The scheme is easily maintained by users, involving a minimum of time and people;
- The scheme is easily repaired by users, with techniques employed during construction;
- Materials are selected for a scheme according to availability consonant with construction deadlines;
- Materials and equipment are easily transported on rough roads in four-wheel-drive vehicles (volume and weight are kept to a minimum);
- Cost of construction is reasonable enough to be acceptable to donors;
- Cost of operation is low enough to be supported by users;
- Cost of maintenance and repair is minimal, so that it can be supported by users and government without looking for donors;
- The system supplies enough water to meet user-needs;
- The system is reliable, i.e., frequency of breakdown and length of time before repair are acceptable to users.

Aspects of planning and execution which contribute to programme success are:

- Every project is initiated by the users;
- Before construction begins, users are well aware of what the physical installation is like and what their role will be;
- Scheduling of project activities is adjusted to the daily and annual work-patterns of the users;
- Details of planning, division of labour and supervision of labour are done by local leaders.

Most of the operation and maintenance is controlled by factors already discussed under guiding principles and technical design. Additional factors contributing to long-term maintenance are:

- Spares are available to users, both physically and financially;
- Maintenance staff, known to the community from the construction phase, is available for technical assistance;
- A monitoring programme keeps track of scheme condition, encourages users to continue maintenance activities and prevents some failures.

Although the Malawi rural piped-water programme has been and is a resounding success, there are a few aspects which need to be improved. The most serious is that the project has not been able uniformly to teach users the concepts of wear and preventive maintenance, with the result that a continuing staff presence is required in the form of a monitoring programme. Secondly, there are no women on staff, and women's participation in user committees decreases as the level of importance of the committee increases. Although women support water schemes fully and participate well in the areas where they are involved, their dedication and sense of responsibility could be improved by sending out female staff to give women particular attention. Spare parts are currently obtained from the surpluses of construction projects and commodity aid. They are distributed to users free of charge, with the exception of taps which are subsidized to two thirds of the cost. This cannot go on indefinitely, as construction is likely to slow considerably in the 1990s. There are currently nine engineering staff positions in the rural water programme, of which only two are filled by people working on the programme. The number of staff positions reflects accurately the amount of work there is to do. The two existing engineers have made exceptional efforts to keep the programme running smoothly since the departure of the principal water engineer one year ago. However, it is unreasonable to expect that their unaided performance can be sustained.

I. INTRODUCTION

This case study has been written to document how one rural water- supply programme, the Malawi Rural Gravity-fed Piped-water Supply Programme, has been able to supply at least 27 litres per capita per day 90 per cent of the time for 19 years. This remarkable record has earned it the reputation of being one of the most successful rural water-supply programmes in Africa. Its success, as with any water- supply programme, has been measured by the degree to which the water- delivery system is operational. In describing the various aspects and phases of the Programme, special attention is given to the factors contributing to the continued operation of the water-delivery system.

A. Malawian context

Malawi is a small landlocked country, surrounded by Zambia to the west, the United Republic of Tanzania to the east and Mozambique to the south (see location in figure 1). It has a total surface area of 118,482 km 2 degrees stretching over 855 km in length and an average of 145 km in width. More than one fifth of this area is occupied by Lake Malawi.

The country is divided into three geographic zones - the Rift Valley, the Plateau and the Highlands. The altitudes, climates and land uses of these three zones are quite distinct. The Rift Valley which is the southern end of the East African Rift, lies between 50 and 150 metres above sea level (masl). It is hot, 4 degrees C higher than the national average, and used for agriculture where the availability of water permits. The rift-valley walls generally rise in an escarpment to the surrounding plateau. The plateau zones lie between 900 and 1500 masl and are inhabited by the bulk of the population. The highland zones are a series of erosional remnants, rising abruptly over the surrounding plateau to heights of 2000-3000 masl; their climate is cool and wet. All of the highland areas are protected as national parks, forest or game reserves.

There is one rainy season, occurring between November and April. About 90 per cent of the country receives over 800 mm of rainfall annually, with the windward slopes of highland areas receiving 2000 mm annually; the national average is 1125 mm. The rest of the year is effectively without rain. Temperatures are at a peak just before the rains break in October/November and are at a minimum in June and July.

Hydrologically, Malawi forms one unit, with all waters, including Lake Malawi, draining into the Shire River. The Shire flows into Mozambique to the Zambezi River and, finally, out to the Indian Ocean. Perennial rivers originate in the highlands and are augmented seasonally by flow from the dambos of the plateau areas. Dambos are broad treeless valleys lined with alluvial clays and sands. The clays store water throughout the year but become supersaturated during the rains, causing overland flow to the rivers.

Malawi has an abundance of water resources relative to demand. The total available surfacewater plus groundwater resources are estimated at 54.5 million cu m/day (Ministry of Works and Supplies (MOWS) and UNDP, 1986). The estimated daily requirement for 1985 was 140,000 cu m/day, and, even in 2000, the requirement is estimated at only 730,000 cu m/day.

Land use reflects both the geographic features of the country and the interests of the Malawian people and Government. Table 1 presents the main uses of land.

Table 1. Land use
(after MOWS and UNDP, 1986)
(Percentage)

Vacant land	26.2
Steep slopes (12%)	25.1
Agricultural activities	21.3
National parks, forests, game reserves	19.3
Swamps, flood plains	6.6
Human settlements, infrastructure	1.5
Total	100

The high percentage of steep slopes provides many potential sites for distributing water by gravity, while the high percentage of national parks, forests and game reserves provides intake sites where the water does not require treatment.

The 1977 census of Malawi showed a population of 5.5 million people, with an average annual population growth of 2.9 per cent: assuming this growth rate has remained constant, the 1987 population is roughly 7.5 million. Rural dwellers make up 90 per cent of the total population (6.7 million people): this proportion of the population is not expected to change over the foreseeable future. (Mainala, 1986) Malawi is one of the world's poorest nations with a per capita GNP of $US230 in 1980 and average life expectancy at birth is 44 years (1980). About 95 per cent of rural dwellers are involved in farming (80 per cent in subsistence farming of maize, groundnuts and cassava, and 20 per cent in estate farming to produce the export crops of tobacco, tea and sugar).

Most rural inhabitants live in houses constructed of compacted earth bricks or mud packed

Figure 1. Malawi