Hand dug wells - Field experience from Ethiopia

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ABSTRACT

Despite the efforts of Governmental and Non Governmental Organizations during the International Drinking Water Supply and Sanitation Decade, many communities in rural Ethiopia are still without access to a reliable supply of potable water. Some of these efforts have already ended in failure. Why is this? What have we learnt? How can we improve? Oxfam and the Water Supply and Sewerage Authority have gained some experience in the different components required for a sustainable hand dug well water supply. The emphasis of near future work will be rehabilitation of existing projects rather than construction of new.

Key words : Ethiopia; hand dug wells; sustainability; rehabilitation.

INTRODUCTION

Following the severe drought and famine which affected many people in Ethiopia during 1983-85, over 40 Non Governmental Organizations (NGOs) put together project proposals for work in the water and sanitation sector. Between 1986-90, these NGOs invested US $56 million in the sector, which was three times the investment of UNICEF during the same period, and 45 per cent more than the rural water supply expenditure of the Water Resources Commission of the Government of Ethiopia (ref.1). However, within the initial planning and programming of these projects, little time was given to; definition of objectives; baseline surveys; discussion with communities; details of design and construction; and perhaps the greatest omission - consideration of operation and maintenance. Toward the end of the Decade, Government and the NGOs began to seriously question the impact and sustainability of the work which had been undertaken.

Between 1986-90, Oxfam constructed 90 hand dug wells in Wollayta, Southern Ethiopia. The average well depth was 20 m over a range 6-39 m in clay loam soil. Water depths, recorded at the time of construction, varied between 1-6 m. The well lining followed the Water Supply and Sewerage Authority (WSSA) standard of 600 mm internal diameter precast concrete rings. Unfortunately, this diameter was too narrow to allow subsequent manual deepening of the wells by caissoning.

In 1991, the spectre of drought and famine once again haunts the people of Ethiopia, including those in Wollayta. A rapid survey of the 90 wells was conducted during February 1991 by a community participation promotion agent from the WSSA. The survey was based on discussion with members of the community, and the results indicated that;

(a) 60 per cent of the wells dried for a period of time during each day causing severe queuing, and 5 per cent of the wells were completely dry.

(b) 50 per cent of the drainage aprons were in a poor sanitary condition.

(c) 40 per cent of the Monolift handpumps were broken and out of use.

The lessons learnt from the survey were;

(a) a well must be capable of being deepened at times of low water table.

(b) the headworks must freely drain wastewater to a soakaway without creating an environmental health hazard.

(c) the water lifting system must be within the capability of the community to operate and maintain.

As a result of the survey, a three year rehabilitation programme was proposed to Oxfam for implementation commencing July 1991. The objectives of the programme are;

(a) to ensure a reliable and potable water supply for communities by deepening of existing wells and renovation of drainage aprons.

(b) to minimize the reliance of the community on WSSA for handpump maintenance through the introduction of Village Level Operation and Management of Maintenance VLOM handpumps, training of handpump caretakers, and strengthening of community water and health committees.

(c) to maximize the impact on health by targetting specific hygiene education at women and older children.

(d) to monitor well water quality and groundwater level fluctuations.

PLANNING and PROGRAMMING

The rehabilitation programme personnel comprise; 1 programme manager, 1 social and 1 technical coordinator, 9 social staff, 7 technical staff, 8 support staff. All social staff are women recruited from the programme area. Transport needs of the programme are met by 1 station wagon, 2 pickups, 2 motor cycles, 1 tipper truck, and 16 bicycles.

Baseline social and technical surveys

Social data is collected at the water site by the locally recruited women social staff, and involves informal discussion with the women and children collecting water. Figure 1 summarizes social data collected from a project in Wollo, Northern Ethiopia.

Technical surveys include; consideration of the local geology; hand auger and pump testing; pH, conductivity, fluoride, iron, and bacteriological water quality.

DESIGN

The community plays an important role in the design of hand dug wells, in particular through feedback on prototype headworks. The design shown in figure 2 has evolved from three years experience in Northern and Southern Ethiopia. The key features are;

(a) the pre cast reinforced concrete cover slab, weighing 560 kg, can be easily removed to allow caissoning.

(b) the largest lined internal diameter of 1300 mm will allow for two additional stages of caissoning, the first of 1000 mm at the end of the dry season, the second of 700 mm in times of severe drought.

(c) the drainage apron has a radial and circmferencial slope of 2 per cent which channels all wastewater to a cattle trough and soakaway.

(d) the manhole cover, weighing 120 kg, can be removed to give access to the well water in case the handpump breakdown is beyond the scope of the caretaker to repair, and a maintenance team from WSSA is required.

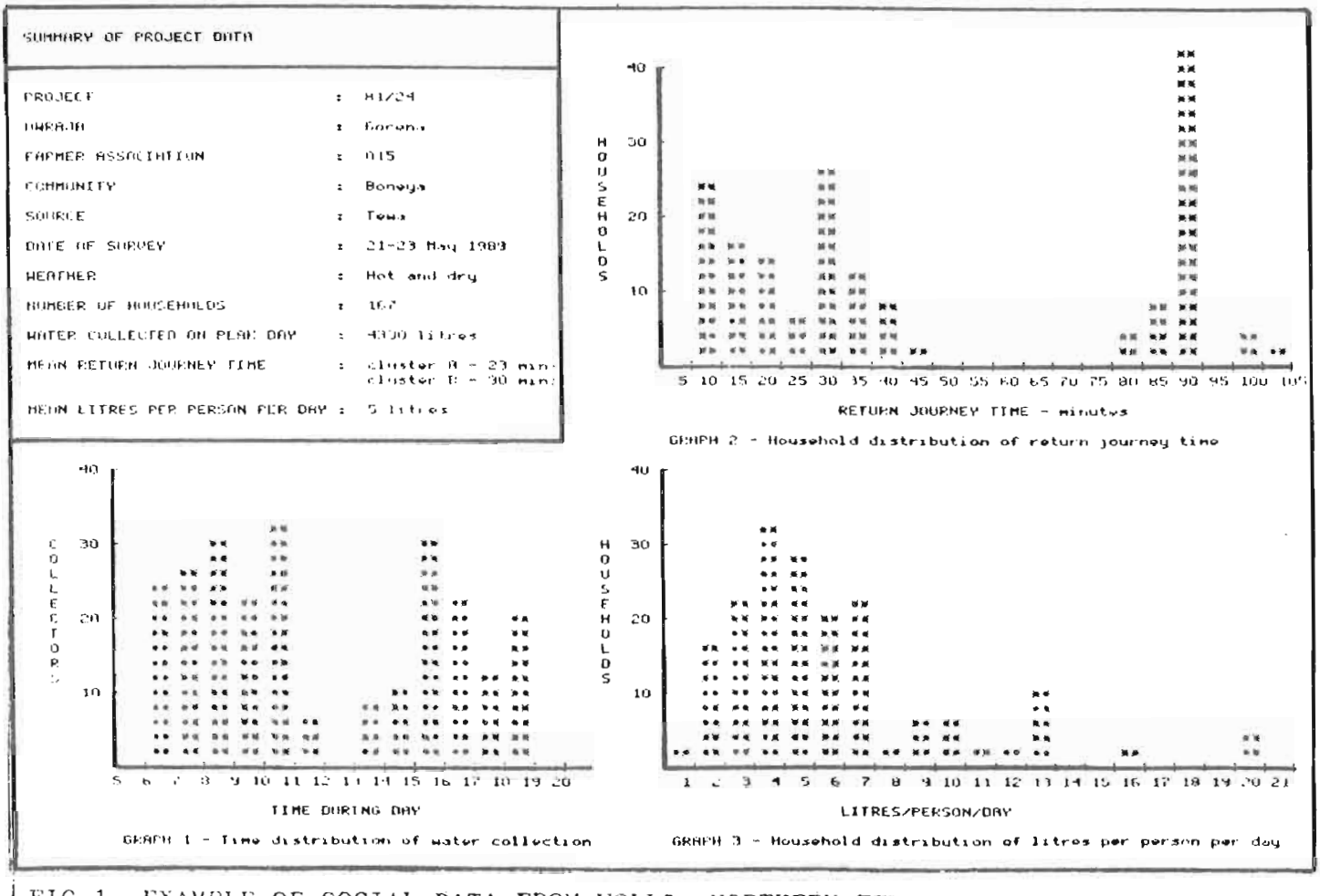

FIG.1. EXAMPLE OF SOCIAL DATA FROM WOLLO, NORTHERN ETHIOPIA.

(e) a small pipe is cast into the manhole cover to allow easy access for water level monitoring.

(f) a durable masonry fence prevents cattle from defecating on the headworks, and assists women and children in placing their clay pot water container onto their back. Wooden fences are expensive to construct and need renewing each year.

CONSTRUCTION

Safety

Hand dug well construction is a potentially dangerous activity unless planned and supervised by competent staff. The engineer has a duty to his/her colleagues and the community, often in the absence of local health and safety legislation, to ensure that all aspects of the work are conducted in a safe and responsible manner. One of the safest methods of construction is to caisson reinforced concrete rings as deep into the aquifer as dewatering pumps will allow at the time of excavation. One of the safest methods of dewatering is with a portable diesel engine compressor above ground operating an air diaphragm pump in the well.

Concrete ring lining

Concrete rings are made on site by community labour using steel ring moulds. A 1300 mm ring weighs about 630 kg so adequate lifting equipment is required to lower the rings safely into the well. This is done using a steel tripod with 2 ton chain block.

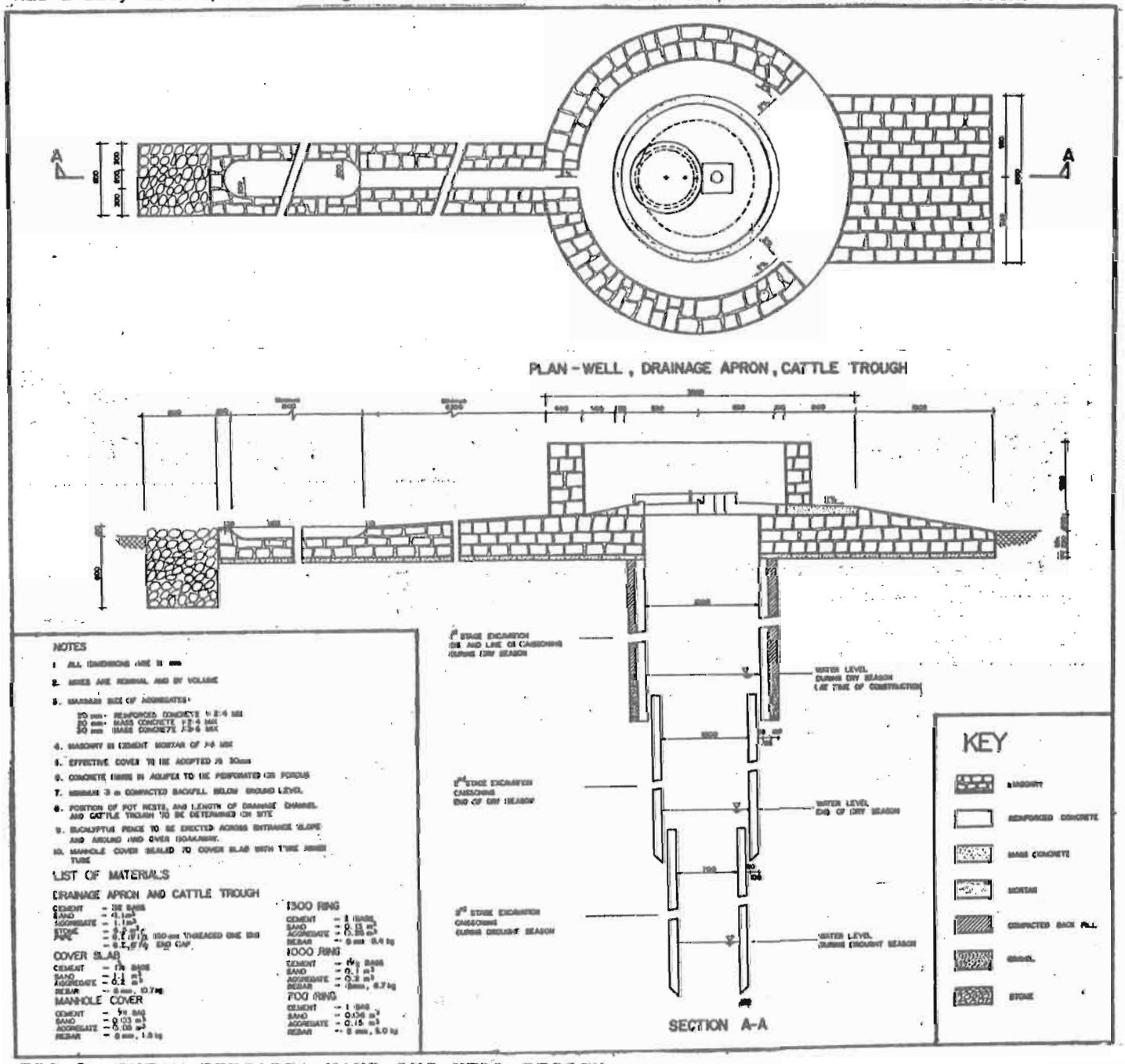

FIG.2. OXFAM ETHIOPIA HAND DUG WELL DESIGN

Handpump installation

The handpump is installed by the community handpump caretakers, mainly women, with guidance from project social staff. Subsequent practical training on routine maintenance follows. The programme has decided to replace all Monolift handpumps with a VLOM Afridev handpump. The advantages of the Afridev over the Monolift are;

(a) the rising main is made out of plastic rather than metal so heavy lifting gear such as a tripod is not required for installation and maintenance.

(b) only one spanner and one fishing tool is required rather than a complete technician toolkit.

(c) a version of the Afridev, called the Ibex has been developed in Ethiopia by the WSSA Research and Development Services. It is possible that full scale manufacture of handpumps and spare parts will commence in country in the near future.

Hygiene education

The social team together with a community health agent give a specific hygiene message targetted at the water collectors, the women and older children. The message will be given to a group of five neighbouring households at a time, during a 30 minute session held at the well site. The message will concentrate on;

(a) how to use the handpump correctly.

(b) how to keep the drainage apron clean.

(c) basic explanation of why the well water is better than the traditional surface water sources.

OPERATION and MAINTENANCE

Water and health committee

Prior to any construction activity, a water and health committee, comprising five representatives from the farmer, women and youth associations, are elected by the community as the link between the programme staff and the community, and between the WSSA and the community.

Cost recovery

The committee are empowered to control the access to the handpump, and to collect a monthly contribution from households using the handpump. This cost recovery should not be seen as a charge for water, but rather as a charge for the maintenance of the water supply. The money collected will be used, to pay the handpump caretakers, and for the purchase of spare parts for routine maintenance. Oxfam have imported 10 years worth of spare parts for each Afridev handpump. These will be purchased by the individual water committees, until such time as local production and marketing of spare parts becomes established in Ethiopia. Major repair will still be the responsibility of WSSA through mobile maintenance crews, and the cost to poor communities will need to be subsidized by WSSA.

MONITORING and EVALUATION

Monitoring of work is undertaken by a WSSA construction inspector and water quality technician. Final project completion reports are submitted to WSSA and entered into a database to be used by the WSSA maintenance crews. Evaluation will be undertaken by the Water Resources Commission.

FINANCE

The rehabilitation programme budget is US $750,000 with the following breakdown;

- staff salaries – 41%
- new capital equipment – 17%
- vehicle maintenance – 13%
- construction materials – 10%
- local labour – 8%
- staff subsistence – 7%
- vehicle fuel – 4%

The budget does not include existing capital equipment purchased during 1986-90. An investment cost of US $10 per person is estimated for the programme.

CONCLUSIONS

Sustainable hand dug well water supplies can be achieved through sensitive attention to the social, technical,and institutional aspects of planning, design, construction, operation, and maintenance. If any of these components is neglected, the water supply will die young, living only in the forgotten archives of wasted development aid. Engineers have a responsibility to communities and donors to maximize the benefits of investment in rural water supply, and by so doing will contribute to the goal of Water and Sanitation for All by the Year 2000.

REFERENCES

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