Rural Water Supply in Developing Countries

Proceedings of a workshop on Water Supply held in Zomba, Malawi, August 1980
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Proceedings of a workshop on training held in Zomba, Malawi, 5–12 August 1980

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Role of Operation and Maintenance in Training (with Emphasis on Hand Pumps)

Aseged Mammo

The Ethiopian Water Resources Authority (EWRA), like its equivalent organization in most developing countries, has the immense task of supplying clean water to the country's rural population. To do that, however, it must overcome many shortcomings: organizational, financial, and human to name but a few.

Training at the EWRA is geared toward alleviating the shortage of skilled manpower, its most pressing need at present. To achieve that goal, the EWRA's training programs cover all relevant positions from pump attendant to postgraduate courses outside of Ethiopia.

This report will look at the training of field personnel who are involved with the maintenance of engine-driven rural water points. Comparative analyses of the operation and maintenance of hand pumps installed in various regions of the country will be discussed in detail. Thus, it is suggested that the reader be acquainted with the designs of some hand pumps currently used in Ethiopia as described by the author in a report presented earlier in these proceedings.

Engine-Driven Pumps

Of the numerous water points made by the EWRA in rural Ethiopia, the most scattered, costly, and relatively "fragile" are the diesel-powered deep well and submersible pumps used in boreholes. Training at the EWRA concentrates on providing skilled and semi-skilled labour for borehole drilling and the maintenance and operation of pumps installed within these boreholes.

There are four levels of training for rural water supply operation and maintenance. The relatively short course for pump attendants covers diesel engine operation, daily maintenance of the engine and pump units, and writing reports on their performance. The course for plumbers and welders deals with the installation, maintenance, and repair of equipment for water supply and piping networks in rural areas. Field mechanics are trained as "maintenance mechanics," and they make up a mobile unit responsible for routine inspections and subsequent preventive maintenance on units in the field. The course covers diesel and gasoline power plants, deep well "mono" and submersible pumps, hand pumps, and cutting and welding. The fourth course, designed to train mechanics to overhaul the equipment at regional levels in the field, is yet to be started.

Status of Hand-Pump Maintenance

Compared with motor-driven pumps, hand pumps are cheaper, simpler, more numerous, and serve a much smaller community per pump. They are widely...
scattered and in many cases access to them is difficult, even by four-wheel drive vehicles. If they fail, the people using them just open the manhole cover and use the inefficient and unsanitary, but reliable, bucket at the end of a rope. Therefore, efforts by the EWRA to train mechanics to perform routine inspections and maintenance on all hand-pump installations becomes unrealistic.

The following is a short description of the status of some hand pumps with respect to training at the EWRA. The pumping elements of the mono pump are basically the same as those of an engine-driven pump, thus making the hand pump version very expensive but reliable. This pump is, therefore, included in the syllabi of the maintenance and overhaul mechanics' courses. The other unit is a hand piston pump. A demonstration model (Boswell pump) can be found at the training centre. This design is rather inefficient but is included in the syllabus as an introduction to all hand piston pumps and as a possible "heir" to the imported versions (although part of it is still imported) because some of the stands are being manufactured at the EWRA's premises.

Comparative Analysis of Pumps and Users

Maki

In this area, 130 km south of Addis Ababa, are found the mono, Consallen, Boswell, and EWRA/International Development Research Centre (IDRC) type pumps. These hand pumps have been in use here for some years now. Installation and maintenance on the mono and Boswell pumps are carried out by the United Nations Children's Fund (UNICEF), on the EWRA/IDRC pumps by this project, and on the Consallen pump, at one time, by the Central Region. Since the United Kingdom government stopped providing direct aid, however, the Consallen pumps have been neglected. The problem is aggravated by the fact that the level of water in the wells drops during periods of drought, in some cases completely drying up the well. This is a result of inadequate information on water depth when the well was originally developed. Abuse of pumps by the local population is relatively minor.

Awara Melka

The only pumps found in this area are of the EWRA/IDRC type, the first of which was installed in May 1979. Since that time, 10 pumps have been put into operation within 25 km of the town. The people of this area are largely nomadic herdsmen and training them is of little value. Abuse of the pumps is exceptionally high. In one instance, about 6 mm of steel were worn away from the handle of a type BPL hand pump in less than 3 months of operation!

The need for water in this semi-arid region, 200 km southeast of Addis Ababa, is immense. Engine-driven water points are not necessary because the area is scarcely populated. The only time pumps in this area are kept in proper working order is when a village chief is willing to take care of them. A fence is constructed around the water point to keep cattle away and the key to the door lock remains in the nearby chief's hut overnight. Attempts to fix the pumps by the user have so far resulted in worsening the situation.

Maintenance is carried out by research crews only, because the well digging crews do not have the tools required to deal with the pumps. It is difficult for the research crews to work in this area, however, because it is normally very hot and dusty, and access is often limited to four-wheel drive vehicles. At two sites, the temperature of the water in the dug wells was 50–70°C. Without a proper well-draining pump the digging could not continue. Furthermore, it is not possible to install any type of hand pump under these conditions.

A short-term solution may be to train the well digging crews in the installation and maintenance of these pumps, and station them permanently in the area. However, a lasting solution will come only when the nomadic Afar people are settled. Until then, wells employing buckets as water-lifting
devices are the only realistic option. Designs to keep wells more sanitary during operation should also be developed.

**Assossa and Hosanna**

In these two areas, which are located 800 km west and 250 km southwest of Addis Ababa, respectively, wells for EWRA/IDRC pumps were prepared by the Evangelical Church Mekane Yesus (ECMY). The wells are relatively shallow, 1-6 m, in most places. In the Assossa area, the traditional lift pumps with piston and cylinder above the well, and mono pumps have been installed, in some cases more than 10 years ago. The immediate surroundings of most of the pumps in both areas are heavily populated. However, there is little pump abuse.

In Assossa and Hosanna, as well as any other area where the ECMY produces wells, it is now agreed that they (ECMY) will provide the installation and maintenance with their own development crews. Initially, installation was carried out by the research crew. The ECMY technicians have received no formal training, but some relatively novel aspects (e.g., cementing of bell-end joints) were demonstrated and/or explained to their field personnel in letters. Feedback to and from the research crew is in 2 or 3 months. In two cases, pump stands that were sent for installation in Assossa would not fit into the well covers. These pumps are now being used for well draining during the digging of new wells. The ECMY has so far solved all of its field problems without the help of the EWRA.

**Goba (Robé)**

This new settlement area, 250 km south of Addis Ababa, is a prospective candidate for hand-pump installation. The United Nations Children's Fund has dug about 20 wells and installation will be carried out, in part, by the research crew. All subsequent installation and maintenance will be the responsibility of the settlement's craftsmen.

At present, this arrangement seems to be the most suitable for a hand-pump program. The "villages" concerned will be virtually self-sufficient to the extent of producing spare parts from local materials. Manufacturing of the pumps by the research crew and preparation of the wells by UNICEF are well under way.

**Conclusions**

This report has attempted to point out that all hand pumps, unlike engine-driven pumps, cannot be installed and maintained by a central government unit. These numerous pumps can only be successfully handled at the small community level.

Based on the experience of the hand pumps installed by the EWRA/IDRC research project, it was found that the more successful programs were located in those areas where maintenance was carried out from within the community itself. Continued research, until an economical and robust local pump is produced, should be encouraged.

In view of all this, Ethiopia now has a considerable advantage over many other developing countries because most of its rural population comes under well-organized peasants' associations. Taking care of pumps installed to supply cleaner water to a community should be a relatively straightforward procedure.