

Introduction

There are several methods of extracting water from a borehole or shallow well. The majority of people in the developing world gain access to ground water either by means of a bucket and rope, or by using a hand pump. Using a bucket and rope is disadvantageous as it does not allow the well to have a cover slab which seals against contamination, but is appropriate for bathing and laundry, etc. Therefore if the water to be raised from a shallow well or borehole is for people to drink, it is often preferable to install a hand pump. The community must be involved in selecting the correct hand pump for them, and the criteria is dependent upon cost, operation and maintenance. It cannot be stressed enough, that maintenance is the over-riding issue in terms of hand pump selection and its sustainability.

Hand pump principles

There are many different types of hand pumps, however, most of them in PNG are displacement pumps and have reciprocating pistons or plungers. In a piston pump, the piston is fitted with a non-return valve (the piston valve) and slides vertically up and down within a cylinder which is also fitted with a non-return valve (foot valve). Raising and lowering the handle of the pump causes vertical movement of pump rods which are connected to the piston. When the piston moves upwards, the piston valve closes and a vacuum is created below it which causes water to be drawn into the cylinder through the opening foot valve. Simultaneously, water above the piston, held up by the closed piston valve, is displaced upwards; and in a simple suction pump the water emerges through the delivery outlet. In a pump with a submerged cylinder the water is forced up the rising main. When the piston moves downwards, the foot valve closes, preventing back flow, and the piston valve opens; allowing the piston to move down through the water in the cylinder.

Hand pump selection

In Papua New Guinea there are three common types of hand pump available on the market; the MT90/91 known as the Chinese Dragon Pump, the Lohberger pump, and the Living Waters pump. The first pump is for shallow wells with a depth of 1-7m, and the other two are deep well pumps and

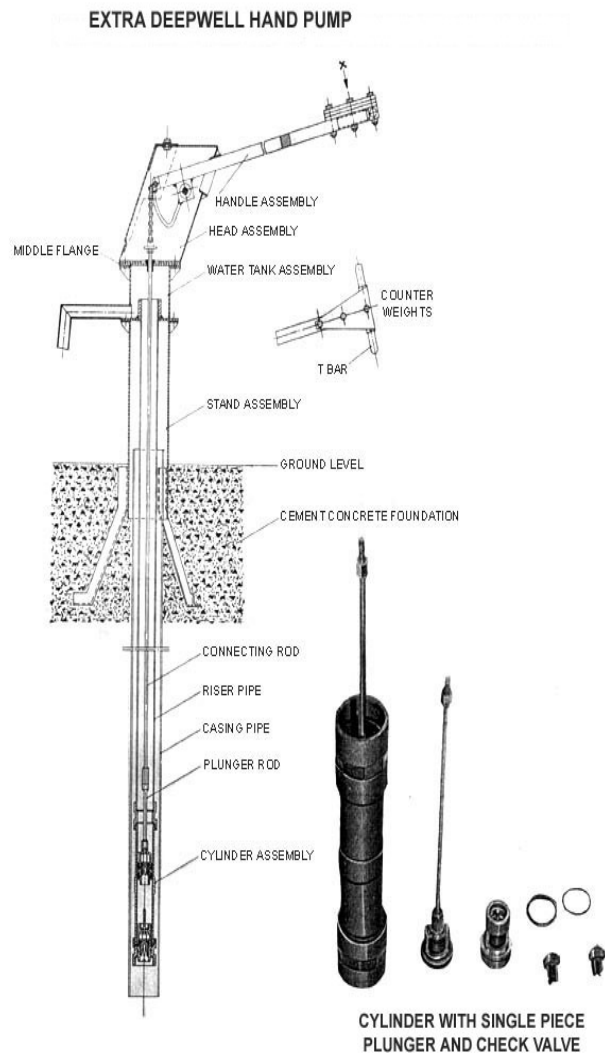
run at maximum efficiency at depths up to 25m. If other hand pumps exist in PNG, they should be assessed against relevant criteria in a table and presented to a community;

Hand pump	Availability of spare parts	depth	Litres / stroke	Capital cost (kina)	Maintenance cost / year (kina)
Lohberger	NCD & Lae only	45m	0.2 – 0.4		
Living Waters	NCD only	45m	0.2 – 0.4		
MT90/91	Most provincial towns	7 – 12m	0.5		

The community should be present in the selection of the pump, to determine which is the most appropriate for the village. The consideration of maintenance will be dependent on local availability of parts to maintain the pump.

Operation & Maintenance

Women and children are usually left with the responsibility of collecting water from the hand pump. Collecting water is a mechanical operation and requires quite an exact method of operation. Understandably, the handle will eventually break if smaller children regularly lean too heavily on the downward stroke. Grit may enter the screen at the bottom of the well, and cause valves to not open or close fully. The typical response to this by the user is to stroke the handle faster, which in turn pushes the pump cylinder harder. The rubber, leather or plastic cup valves wear away more quickly, and before very long will split or fracture. A newly installed pump will break down within a few months without maintenance. It would not be unreasonable in PNG, for 95% of newly installed pumps to stop working completely within 12 months of intervention. Therefore, maintenance is essential. On completion of a RWSS project involving hand pumps, a tool kit, and trained villagers are an important output. A deep well hand pump may take up to 6-8 women or men, to lift the parts of the pump from the rising main to replace parts on a periodic basis.



Concluding Comments

Hand pumps are the most maintenance intensive water supply option available to rural communities. Along with regular maintenance, they require regular tariff collections to pay for replacing parts. It is a routine, as opposed to a response. If the hand pump stops working for any reason, the community is in a mind-set of repair rather than maintenance. When this occurs, it can be argued that the NSA had failed to facilitate effective participatory planning.



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