

Selection of Well Construction Methods

UNICEF, Practica and Enterprise Works/VITA have developed a toolkit for African countries wishing to embark on the professionalisation of manual drilling. This toolkit includes Technical Notes, Technical Manuals, Advocacy Materials, Mapping of suitable areas for manual drilling, Case Studies, and Implementation and Training Manuals. This initiative builds the capacity of the local private sector in order to respond to the ever increasing demand for safe water in rural areas. This Technical Note is the **third** in a series of five.

Overview

For the construction of safe groundwater points different well construction methods exist. Wells can be drilled with machines, drilled manually or dug by hand. Before selecting the most appropriate method, several criteria, such as geology, depth of aquifer, yield and location should be reviewed.



Manual Drilling

Selection Criteria

Machine drilled wells are very high in quality, but also very expensive. The cost of a machine drilled well varies between countries and will generally be in the range of US\$ 5,000 – 15,000 for a 30-meter deep well. Hand dug wells are very useful in formations with low permeability due to their capacity to store water which will seep in overnight. However, the total yield/day may be low. Hand dug wells exist

in a wide range of cost and quality categories. In some countries hand dug wells are dug in clay without any lining. These have a very low cost (US\$ 100) and a very low yield. When a hand dug well is put in a permeable layer and lined with concrete rings, the yield will be high, but the price will come close to that of a machine drilled well.

In many countries manual drilling techniques are or can be used as an alternative. Costs of 30-meter deep wells vary from about US\$ 100 – 2,500, depending on geology, country and application (small scale irrigation wells or high quality community wells for portable water).

Going to scale

As mentioned above, machine drilled wells are very high in quality and a good way to construct safe water points for large communities and piped water supply schemes. However, the investment cost for an enterprise to purchase additional machines is high (estimated > US\$ 100,000), making it difficult to rapidly scale-up the capacity in the local private sector.



Machine Drilling

In the case of manual drilling and digging, much less expensive tools are required, making the capital investment (US\$ 3,000) for an enterprise to enter the market or to expand capacity much easier. In addition, the drilling time required for manually drilled wells (1 day – 2 weeks) is much less than the time needed to

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construct a lined hand dug well (1-3 months). These different factors make manual drilling an attractive option, where the hydrogeology is suitable, with a very high potential to scale up the capacity of the sector.

Additional information:

Manual: Understanding groundwater and wells in manual drilling

Desk study: Inventory of manual drilling techniques

Map of suitability for manual drilling

The RWSN hand drilling cluster group, see the website www.rwsn.ch

These Technical Notes and other materials are available in UNICEF web, www.unicef.org/wash/index_watersecurity.html



Concrete lined dug-well

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HOW TO CHOOSE THE MOST APPROPRIATE METHOD

Criteria	Machine Drilling	Manual Drilling	Concrete Lined Dug Well
Static Water Level	0-200 meters	0-40 meters	0-30 meters
Depth of Well	0-200 meters	0-50 meters	0-35 meters
Geological Profile	All types of formations including hard rock	Soft formations: sand, clay, soft consolidated formations	Soft formations; clay, soft consolidated formations
Aquifer Yield	Very permeable (sand, gravel, and weathered rock formations)	Very permeable (sand, and gravel)	Lower permeability (sandy clay or clay)
Cost	>\$10,000	\$400-2,500	\$2,500-10,000
Access to Well Site	All weather roads are required to move heavy machinery	Easy to transport because equipment and materials are light	Less easy to transport: equipment is light but concrete rings or materials (cement, gravel, and rebar) are heavy.
Drilling Time	1 day - 2 weeks	1 day - 2 weeks	1-3 months
Season for Drilling	Year round if site is accessible	Year round	Dry season only