

# Pipeline Extension from Wellhead to Hand Pumps in Villages

This technical briefing note looks at the criteria for selecting 'Pipeline Extension from Wellhead to Hand Pumps in Villages' in all settings (e.g. early recovery, recovery, rehabilitation, development) except first phase response, including its construction, operation and maintenance

## Abstract

A simple pipeline extension from a wellhead to hand-pumps in selected villages ensures easy access to adequate and safe water among targeted households. A traditional borehole (dia 1.5 inch pvc pipes and filter) is constructed at suitable aquifer location. 1.25 inch dia pvc coil pipelines are then extended from the head of the borehole pipe and attached to the hand pump. A simple non-return valve is placed in-between the top of the well-pipe and the extension pipeline to ensure water storage inside the well-pipe and extension pipe. The entire extension pipeline is placed into the trench and buried with soil. A proper sanitary platform along with waste water drainage system is constructed surrounding the hand-pump.

This technology not only ensures adequate and safe water for the targeted community but also reduces travel distance and water collection time primarily for women and adolescent girls. It also ensures their privacy & dignity and allows them to spend more time to work with their partners. A single system can provide adequate and safe drinking and cooking water for 140 or more individuals. The technology is feasible in the villages where underground aquifers are highly contaminated with saline and arsenic, and surface water is not available or available but not in usable condition.

## The concept

The traditional hand pump installation concept is to attach the hand pump directly to the head of the borehole/well pipe. This concept is widely used around the world and only feasible where suitable aquifer is available within the target village locations. Hand pump technology is known as affordable, acceptable by all, easy to operate & maintain, comparatively low-cost and sustainable water

supply option. It is therefore, rural community mostly prefer to have hand pumps rather than other water supply technology.

To keep this in mind, 'Pipeline Extension from Wellhead to Hand Pumps in Villages' concept is introduced in saline and arsenic prone locations. The key differences between traditional and this concept is –

- Hand pump is always attached to the extension pipeline instead to well pipe head.
- Borehole/well pipe is installed within a distance of 500m to 1,500m at suitable aquifer location instead of directly connecting to the well-head in the village.
- An additional non-return valve is placed on top of the well pipe head, while no non-return valve is used with traditional concept.
- With new concept, both well pipe and extension pipeline is mandatory to bring water from borehole while with traditional concept only well pipe is required.
- Complete installation cost for new concept is much higher compared to traditional concept.

## The technology

The complete technology consists of major four components, such as –

- **The borehole** which is equipped with PVC pipes and filters that is lowered into the borehole.

Normally 1.5 inch dia pvc pipes and filters are used for the construction of well pipe.



The borehole is constructed at suitable aquifer depth within the distance of 500m to 1,500m from a

village. Skilled labour is required for the construction of quality borehole. Local skill labour is always preferred as they are well aware about the local context.

- **The extension pipeline** is placed in-between well pipe and pump head. One end of the extension pipeline is connected to the wellhead through a non-return



valve and the other end is connected to the bottom of the hand pump. Normally 1.25 inch dia pvc coil pipes are used as extension pipeline. A 12 inch wide and 12-24 inch deep (depend on the local situation)



trench is dug from well pipe to pump head where the extension pipelines are laid & buried with soil. Un-skilled labour can be used to perform this work with close supervision and monitoring of a technically skilled person.

- **Hand pump head** consist of foot-valve assembly, piston assembly with handle and pump head cylinder. Extension pipelines are connected to the bottom of the pump head through a 1-2 feet long GI pipe. Traditional # 4 or # 6 cast iron pump head is widely used. Sometimes locally fabricated hand pump head is also



used for the same purpose. In case of #4 or #6 cast iron hand pump, entire pump head body is placed on top of the ground level while only 3 feet of the locally

fabricated Pakistani hand pump are exposed to the surface.

- **Sanitary platform** is equipped with 4 feet x 5 feet or 5 feet x 6 feet (rectangular) or 5-6 feet dia (circular) cement concrete (CC) or reinforce cement concrete (RCC) platform, a waste water drainage system and a



soak way.

After successful construction of borehole at suitable aquifer depth:

- well pipes & filter are lowered into the borehole and fixed with proper sand packing,
- a non-return valve on the top head of well pipe is fixed,
- extension pipelines are placed in-between well pipe and pump head,
- finally pump head is attached with the extension pipeline to extract water from borehole.

This technology works as suction mode and is feasible up to 7m depth of static (standing) ground water level condition. It can produce 0.3 litres per second of clean water with a depth of 3-4m of static (standing) ground water level.

## The costs

Complete installation cost depends on borehole depth, length of extension pipelines, geo-physical condition (level or un-even) and type of hand pump head. Average complete installation cost in Pakistan (Thatta district of Hyderabad) is GBP 275-300 with 50 feet well depth, 1,200 feet extension pipelines and #6 cast iron or locally made hand pump head.

Although there is no routine running and maintenance cost involved but there will be

definite maintenance cost incurred in future related to replacement of piston cup seal/washer, foot/check valve, handle, nuts & bolts of the hand pump head. A minor maintenance cost will also be incurred for the repairing of sanitary platform, drainage system and soak way pit.

## Handing over

A single hand pump can provide adequate and safe water up to 140-150 individuals.

Before handing over a hand pump to the users, water quality test with numbers of parameters e.g. arsenic, chloride, iron, turbidity, pH, conductivity etc is performed. Test results are shared with users in order to make them aware about the hazards, possible risk and effect of these chemical contaminations (if any).

A practical training on operation and maintenance is provided to the selected caretakers. These caretakers are fully equipped with a set of necessary tools.

Initiative is also taken to ignite users for raising funds that will be utilized for future operation & maintenance.

## Field testing

The technology was introduced in late 2010 in Thatta district of Hyderabad, Sindh, Pakistan by Laar Humanitarian Development Programme (LHDP), a local NGO with technical support of Oxfam GB flood response PH team. Around 220 hand pumps have been installed in this area during November 2010 – February 2011, under emergency flood response programme. Average borehole depth of these hand pumps varies from 40-50 feet and distance of the borehole from the village is between 500m – 1,500m. More hand pumps are planned to be installed in the same area in early recovery programme, March 2011 onward.

In the year of 2009 in Bangladesh, during cyclone Aila response programme in coastal areas, nearly similar technology was introduced. With this technology, 3-4 hand pumps were connected to a single wellhead pipe using around 400 feet long extension pipelines. 1.5 inch dia well pipes, filters and extension pipelines were used for this

technology. There were around 5 systems constructed during Aila response programme in the affected areas.

## Context

Thatta district is a coastal area that is prone to cyclone and flood. Underground shallow aquifer is highly contaminated with salinity. Deep aquifers are yet to be explored. Surface water is also contaminated/ polluted with saline water due to the super flood in August 2010.

Therefore, clean water scarcity is acute in these villages. Sweet water aquifer is not readily available right in the villages or nearby, but there are few pockets (e.g. along with irrigation canal where sweet water is flowing round the year) which can be found in distant. These irrigation canals are normally 500m to 2,000m distant away from villages.

Before introducing this technology, villagers especially women and adolescent girls had to travel long distances to collect sweet water (not safe) from these canals. They spent around 3-4 hours in a day to collect water for meeting their daily needs.

## Achievement

Through introducing this technology, several social and technological obstacles have been overcome. These are as follows –

- ensure access to sustainable, adequate and safe water option nearby within short distance
- more privacy is ensured for the women and adolescent girls
- saves water collection time that can be spent on other livelihood activities
- ensure adequate and safe drinking water especially for women and adolescent girls

The technology can be adopted in similar context with minor modification (if needed) based on local context.

## Future initiatives

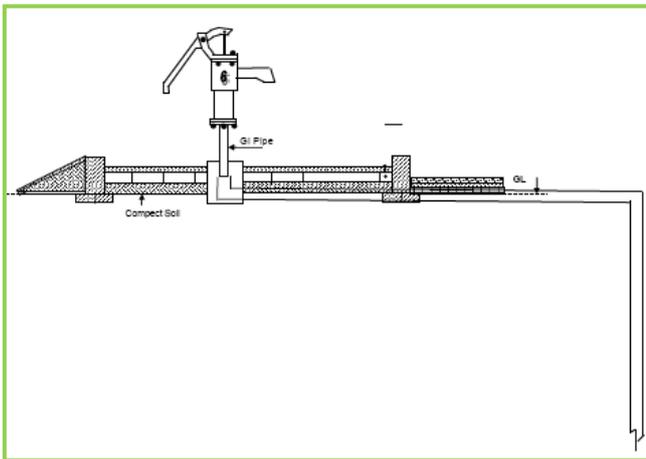
Though this technology is successfully bringing water from a borehole located at 1,200 feet distance but its optimum capacity is yet to be explored.

Only one non-return valve is used however it is not known whether one or more non-return valve is required when increasing the length of extension pipeline.

Presently dia 1.5 inch well pipe and dia 1.25 inch extension pipeline is used but the most favourable size for greater output or multiple connections is not found yet.

Currently single extension pipeline is connected to the wellhead while for multiple connections of extension pipeline and hand pump in different villages is yet to be discovered.

## Layout



## Further information

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