International Workshop on 'Rural Hydrogeology and Hydraulics in Fissured Basement Zones', 1984
Silver Jubilee Year, Department of Earth Sciences, University of Roorkee, Roorkee

Maintenance of Water Wells-Progress and Prospects

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ABSTRACT

Technology has an obvious role in development. The pressing need for self sufficiency in food to cope with the expanding population strengthens the cause of technology despite age old inertia of the conservative Indian society to accept and adapt newer technological solutions. On the other hand, the organized sectors of industry, controlled by the urban economy and specialised educational institutions seem to be eagerly in favour of promoting anything that belongs to the school of high technology. Under this contradictory set up the choice of technology of the rural water programmes may not have been quite appropriate. The maintenance of the water wells promoted by high technological supports are becoming exceedingly difficult in absence of suitable infrastructures, dissemination of technology and delegation of appropriate responsibility. Partly our infrastructural lay-out to deal with the situation is responsible which is a managerial problem that too a dominating one. Mainly the schemes and programmes of water wells in the country are implemented by the governmental agencies and a significant majority of the existing community (rural) drinking water schemes consist of wells fitted with a hand pump. Though this technological outfit is apparently simple, the handpump is yet to prove itself as a viable alternative to dug wells. Partly the technology has succeeded in terms of VLOM (village level operation and maintenance) pumps, India MKII is one good example. It seems however, that the planners, specialists and the implementing agencies on one hand and the community on the other hand must understand the vital limitation of a technological solution . The technology must basically reach the level at which it has to work. The community must be in a position to participate in the total process of transformation. This would be possible only if our approach is fundamentally people oriented.

HISTORY

Traditionally the open dug wells served the cause of rural drinking water supply for the entire Indian sub-continent. The dug wells in penisular India are excavated manually through the loose mantle of soil & highly weathered crystalline rocks. Often it is extended through the fresh and compact fractured rocks which are resistant to hand excavation. Wells in Rajasthan desert are extended upto a depth as high as 100 metres which people constructed almost without any external help. The dug wells in the rural areas were managed farily well despite their inherent weakness.

In the alluvail areas in particular people had gradually switched over to tubewells which again were drilled with the help of village artisans. Many such artisan groups could be seen in the Gangetic and coastal plains. These wells used to be fitted with handpumps which again were installed and repaired with the help of local enterpreneurs. This however, was confined to urban to semi-urban localities and seldom they had penetrated into the rural scene in the true sense.

Needless to mention that these tubewells were of a standard that was adequate only to serve the need for domestic water quantity-wise. The qualitative standard of water and the life of such tubewells as such seldom fulfilled the requisite spedifications of the modern day.

For the past 20 years or so, India has been passing through a series of droughts at irregular intervals which among other things necessitated mobilization of resources for

combating drinking water scarcity specially in the rural areas. This situtation was predominant in the penisular India though apparent in other areas as well. Development of high technology in terms of sophisticated drilling machines and qualified engineers and scientists involving professional agencies was witnessed as a result. Its actual impacts and effects, however, has not been quite penetrating to serve the cause on a long term basis. The programmes of rural drinking water in India has entered an ascending stage with the commencement of International Drinking Water and Sanitation Decade(IDWSD)of the UN.

The drilling machines that entered the scene in mid sixties were modified slightly from the blast hole techniques, which was thus far confined exclusively to the mining industry. In this method compressed air was utilized facilitating mobility by eliminating high water requirement at the drilling sites. This technique has now been highly modified with the import of the so called 'new generation' drilling rigs. The entire question of maintenance of water wells is related to this apparently rapid progress of water well industry at least in the Indian context. In the process of this high technology being promoted through the highly professional sales systems, the labour oriented and hand operated boring and drilling techniques (e.g. hand percussion and calyx) have been grossly ignored

HYDROGEOLOGICAL SETTING

Barring a few areas in Rajasthan where water table is particularly deep, (at times more than 100m.) the entire penisular India - covered by crystalline rocks has certain similarities in hydrogeological characters. Initially one has to penetrate a depth of overburden consisting of soil and wheathered /altered rock. This is obviously followed by an appreciably deep zone of fractured crystalline rock which is penetrated by means of drilling in order to intercept a number of fractures/conduits/formational contacts (and all other such areas of weaknessess) that serve as the permeable zones. The casing is used only to cover the upper overburden as no casing is required to hold the bore through the massive rock which is strong enough to hold itself for years. There are exceptional areas where a soft formation may also occur in-between two layers of massive rocks at great depth.

Dimensionally, these bores may extend on an average upto a depth as high as 100m. The overburden depth ranges from 6m-30m with water table existing between 3m-30m. As least, for the purpose of discussing water wells and their maintenance this simplified hydrogeological setting should be assumed as adequate.

In general, all such wells in the penisular India would follow the above hydrogeological setting where country rock is granitic, basaltic, metamorphosed, or near metamorphic sediments like vindhyans and its equivalents.

Almost upto the mid sixties, the groundwater in the entire penisular region used to be tapped by means of dug wells. In summer, the water column in these wells would obviously tend to reach the bottom while in winter, the wells would hold a column of water extending 1-2m. The limitation in this water column is owing to the fact that digging can extend upto a maximum limit only during the peak summer when the digging would have to be terminated inter alia due to the high water seepage into the well.

Physiographically the crystalline area has a undulating landscape consisting of ridges and valleys. The dug wells in the ridges are more susceptible to drying up in summer than the ones in the valleys. The latter are more active during the recent years as best agricultural fields are obviously located in the valleys and these are gradally becoming crop intensive due to the increasing pressure on lands.

The particular strategy has necessitated the shift from dug wells to tubewells - both in the alluvial region as well as in the hard (crystalline) rock terrains. As scientists

we may bear this in mind that this shift is more or less obvious, and therefore the tube-wells should be regarded as the most promising alternative to the rural water supply source specially to serve the purpose of drinking water.

CHOICE OF TECHNOLOGY

The technological package for water wells consists of the following:

(A) Drilling unit which include the drilling rig, the carrier, support vehicles, and all accessories including the compressor etc.
(B) Well casings, filters and other spares for the well assembly.
(C) Pump.
(D) Testing equipments eg. geophysical etc.

The specialised agency choice for a drilling rig would obviously be a 'new generation' pneumatic drilling rig that is capable of drilling deep and versatile to penetrate every formation with utmost efficiently. This machine is highly mechanised so manpower requirement is also minimized - a distinct advantage for the manpower management aspects. It has been discussed time and again that the fast machines are killing the basic self help attitude of the rural community & all incentives for the slow drilling units which are labour oriented and semi-mechanised. From the point of view of peoples' acceptance of the new system, slow drilling methods has a distinct advantage. It remains on the job for 3-4 weeks. In this prolonged duration of drilling the community have to share and participate in various ways which brings them closer to the technology.

Due to logistics problems the slow drilling device could multiply much faster to grow as rural technology centres like a blacksmith's shop or a cycle shop enabling people to approach easily in the events of breakdowns.

The Casing and well assembly is an obvious component of the water well and they generally pose no major problems except that the newer innovations are becoming cheaper and handy.

A pump is dynamic device that makes an integral part of the well. While the former two water well components can be managed by the organized agencies and manpower, pump retains the link between the user - the common man, and the specialised agencies who are responsible for the installations.

VLOM Pumps

It was identified at the very early stage of the programme that the technological aspects of the hand pump device by itself is responsible to a greater extent for the failure of programmes. A number of voluntary agencies during early seventies has experimented on various innovations which was followed up by the organizations like UNICEF and UNDP.

The UNDP is presently engaged in the aspects of research and development on VLOM - village level operation and maintenance pumps. This is a global project under which a number of pumps have been identified from all over the world which are undergoing rigorous tests to qualify for the VLOM status. India Mark II hand pump which was basically developed in India and modified with the support of UNICEF was a forerunner in the VLOM concept.

MAINTENANCE PROBLEMS

Needless to say that the problems of water well maintenance are not quite significant in the urban context. If the consumer is urban and/or affluent he can buy the services of his choice and he may even opt for the most sophisticated device in terms of a drilling machine or a pump. In the event of breakdowns he takes initiative for necessary repairs and handles the device with proper care.

The maintenance of water wells pose problems in the context of community handpumps in the rural sector that have been installed or are being installed under the community drinking water programmes. The following chart (see box) on trouble shooting is indicative of the fact that at least the basic cause and effects of the handpump maintenance problems lie within

the system of planning, initiation and implementation of the programmes.

These programmes, IDWSD being the major one in the present day context, are being planned and implemented with a centralized approach. Whatever may be the reason, it is chiefly due to this centralised approach that the planning. choice of technology and installations are basically import oriented. The other related weaknesses with the status quo of rural water supply programmes are :

(a) Adhocism predominates for various reasons which are be attributed to the procedures and functions of the institutions/system that are responsible for the programme.
(b) Hardware component dominates so much so that the soft-ware components are more or less ignored. The components of training at all levels, data collection, processing & retrieval and mass education aspects are not taken into account.
(c) Assumptions and priorities are more than often divorced from the

TROUBLE SHOOTING ON HANDPUMP MAINTENANCE PROBLEMS

	Cause	Effect	Indicators	Impact
Related to Source				
1	Low well yield	Pump discharge not adequate	Frequent disorders	Community goes back to traditional sources leading to partial or total rejection
2	Deep Water Table	Pump Lever Heavy	Frequent major breakdowns requiring attention of mobile district team	Community goes back to traditional sources leading to partial or total rejection
3	Shallow Water Table	No apparent complaints	Contaminated water	Wells will not have impact on community health
4	High Water Table fluctuation	Pump discharge diminishes tending to zero in summer	Well out of function during peak summer	Well need commissioning almost every year - if not attended to well is naturally abandoned
Related to Installation				
5	Well was not properly developed	Sand (rock particles) is pumped with water	Frequent wear and tear of the leather washers	Great inconvenience leading community to go back frequently to the traditional sources
6	Well casing not fixed properly	Pump discharges occasional turbid water	Water may also be contaminated	Well will not have impact on community health
7	Pump level inadequate	Pump discharge diminishes tending to zero in summer	Well out of function during peak summer	Well needs commissioning almost every year - could be abandoned if not attended to
8	Drainage is poor	Leading to formation of muddy water pools around the well	Water prone to contamination. Increase in population of mosquitos and flies	Affects community health.
9	Planform is not properly constructed	Leading to broken platform etc.	Well is open to surface pollutants	Well will not have any impact on community health
Related to Planning and Programming				
10	Well located far from the target group	No apparent complaints	Community silently rejects the well and resorts to traditional sources	Well has no impact on the community
11	Well has to serve a high population	Mishandling of pumps if community does not organize itself, leading to frequent breakdown	Part of the community still depends on traditional sources even when the pump is functioning. Frequent breakdowns.	Well may not have impact on community health. Conflicts and dishormony due to the well

situations at the grassroots level.This is due to the inherent affinity for high technology and expert services.

(d) Local traditions and existing resources are not taken into account with the result a lot is expected from the rural community on one hand and on the other hand community is not taken into confidence in the entire process of implementation (see flow chart-towards a zero trouble handpump).

(e) The professional team does not get proper support to grow. Lack of professionalism is also due to the fact that the programmes are handled by traditional governmental agencies who were not technically oriented to take up the task. Due to the inherent adhocism, transformation has been weak. The departments like PHED and Irrigation which are basically derived from the PWD (specialised in buildings and roads) have not much changed since the data handling and training components are constantly being ignored.

(f) The social aspects are also ignored since the political decisions are imposed on to the professional agencies since they are controlled by government. In reciprocation the programmes are more or less imposed on to the people/community. This communication gap is presently predominating.

MODELS OF HAND PUMP MAINTENANCE

Three Tier Model

This is promoted by UNICEF basically from their experience in the districts of Tirunelveli and Thanjavur in Tamil Nadu. This envisages a total maintenance responsibility in the hands of PHED through a district unit spread-into into three tiers: a mobile team at the district headquarters, a block team at the block headquarter and a care-taker per well. The care-taker does the day-to-day upkeeping, greasing, cleaning etc. In the event of breakdowns the care-taker informs the block team who brings the pump back into operation if it involves minor repairs and summons the district team if major repairs are necessary.

The PHED in various other states have been working more or less in the same manner but there are various practical difficulties leading to delayed actions under this model. The gap between the breakdown and repairs at times are as high as six months causing serious interruption reuslting in people's rejecting the tubewell.

One Tier Model

This envisages training the rural youth under the TRYCEM (Training of Rural Youth for Self Employment)scheme. The un-employed youth will then come under the handpump mainteance scheme taking responsibility for the upkeeping of a certain number of pumps in a locality for which an annual fees (Rs.100 per pump per year) would be payable to him. This system is reported working satisfactorily in the Tilonia region of Ajmer District, Rajasthan . This takes into account the responsibility of the community towards maintaining the handpump to be the basic factor yet the system is not totally divorced from the inherent threats of a centralised approach since the operation and control partly falls in the hand of government sponsored authorities.

Cycle Shop Model

Bicycle is a relatively new technology for the Indian Villages. It is a development of past 40 years that the cycle has entered the most interior villages with the support of numerous cycle shops that have emerged in the rural scene more or less spontaneously. One can draw a parallel from the bicycle experience to provide 'cycle shops' for the hand pump programme. There can be conscious efforts towards promoting similar enterpreneurs to help implementation, maintenance and repairs. This idea can get further supported by the fact that the density of rural handpumps are increasing at a faster pace and the PHED may not be in a position to provide maintenance service perpetually. The cycle shop model basically envisages training of local youths and supporting them with basic tools mounted on a cycle (may be with bank loan arrangements)

TOWARDS A ZERO TROUBLE HANDPUMP

1.	Administratively cleared for funds etc.	Financing programming
2.	Hydrogeologically Investigated	Scientific Investigation data collection
3.	Other technical requirements fulfilled like road approach, convenience for the operation of the machine, Land Slope availability for drainage etc., etc	Technical Survey
4.	People consulted and consented	Motivation

→ LOCATION

5.	Local people cooperated with some assistance during drilling	Selfhelp
6.	Properly completed with fulfilling criteria for causing fixation etc.	Technical installation
7.	Properly developed	Technical installation
8.	Yield tested and pumping level established	Scientific investigation
9.	Chemical quality tested and remedial measures taken	scientific investigation
10.	Protection taken against bacteriological pollution	Technical installation aided by scientific investigation

→ Excavation (Drilling)

11.	VLOM pump chosen	Industrial inputs
12.	Pump material passes quality control tests	Industrial inputs
13.	Pump level takes into account maximum water table depletion during droughts.	technical installation aided by scientific investigation
14.	Platform and drainage construction fulfils standard criteria	technical installation

→ INSTALLATION

15.	Care-taker appointed and the handpump is linked to district handpump maintenance system/or, alternative maintenance measure adopted.	Administrative community action self help attitude
16.	Village leaders/community informed about the technical details	Dissemination
17.	Local people decides about long term arrangements-including funds - for future maintenance, set rules etc.	self help
18.	Children and adults trained on the handling of the hand pump mechanically.	dissemination
19.	People informed about the health and sanitation aspects.	dissemination

→ COMMISSIONING

and the community/panchayats buying their services as and when necesarry at their own initiative and through local finance.

This concept does not visualise organised support by the government or some such agencies but the initiative is expected to come voluntarily mainly through the specialised voluntary organizations who have been engaged in the water well drilling operation for the past 20 years or so.

CONCLUSIONS

There can be no zero trouble handpumps. The following flow chart (towards a zero trouble hand pump) would illustrate as to why it is rather utopean.

The issues that are open before us are :-

- Technological solutions alone cannot help this problem.
- The agencies and programmes must modify themselves suitably to be effective enough to serve the cause.
- There has to be enough room for peoples participation and nothing should tend to destroy the self help attitude of the rural community.
- The local traditions and particularly the traditional technology must find a due place in the programmes.

Since the programme is being implemented centrally and this cannot be apparently reversed, the ongoing progammes must be strengthened with:

- Scientific (hydrogeological)supports
- Technical training and dissemination
- Training, quality control and management for proper installations
- Peoples participation
- Training and dissemination for people (a proper understanding of handpumps, sanitation and health aspects.)

ACKNOWLEDGMENT

I am specially grateful to DANIDA for permitting me to participate in the workshop.

Mrs. A. Shankardass and Mr. Ravi Kumar have taken great care in preparing the text, their help is being gratefully acknowledged.

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