Farmers' Groundwater Skimming Practices

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ABSTRACT

The farmers of the project area have some know how about the skimming well technologies. The local drillers have developed expertise on the installation of multi-strainers and single strainer wells. Moreover, they are trained enough to diagnose and solved problems relating to skimming well technology. Priming is their main problem. The selection of well type is quite arbitrary. Moreover, the issues of number of strainers, horizontal distances of strainers from the pump, length of strainers, discharge need to be refined, to make the system efficient and cost effective.

INTRODUCTION

A well that can extract water from the shallow fresh water layer overlying a saline water layer has been termed as a skimming well. Since in the project area, the water table is high enough, therefore in most cases centrifugal pumps are being used/installed at certain depths to pump water from shallow fresh layers. However, different design of skimming wells has been adapted by the farmers. Two kind of skimming wells are commonly used in the area.

Single strainer well

Conventionally, a bore of varying sizes is bored into the soil through a permeable layer generally, 30 m depth. 24 to 27 m length strainer is installed at the bottom. 3 to 6 m length blind pipe extends to the surface. Generally, a suction pipe is lowered into the blind pipe and is attached to the centrifugal pump (Figure 1). Water is then pumped by the centrifugal action. Plates 1 to 3 show the parts of the single strainer well. All these parts are locally available.

Advantages

- Low cost
- Reasonable discharge
- Provides fresh water
- Easy to install with common boring equipment

Disadvantages

- Initial priming is difficult
- Since it is installed to a relatively greater depth, therefore the pumping of saline water from the deep layer is possible.

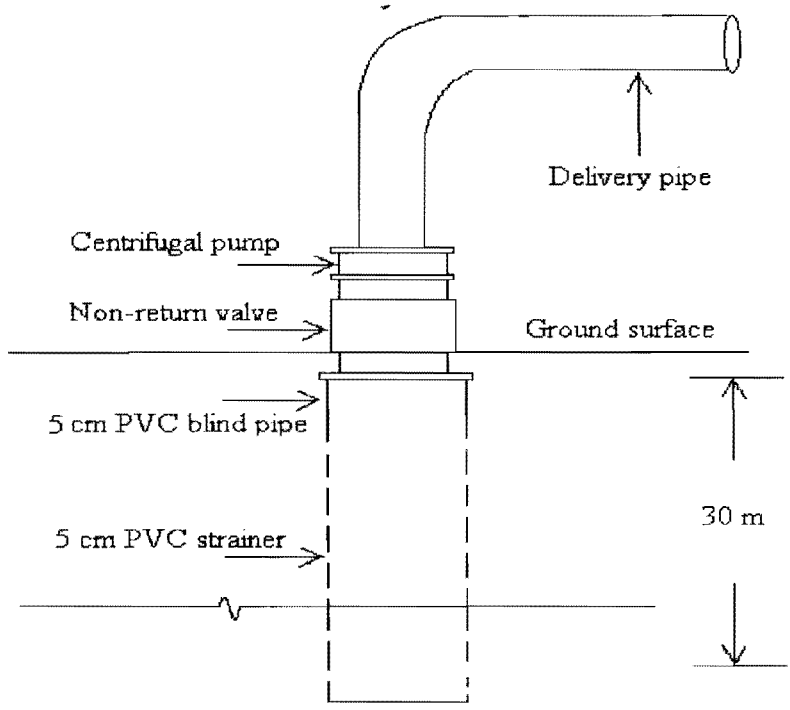

Figure 1. **Schematic diagram of a single strainer centrifugal pump.**

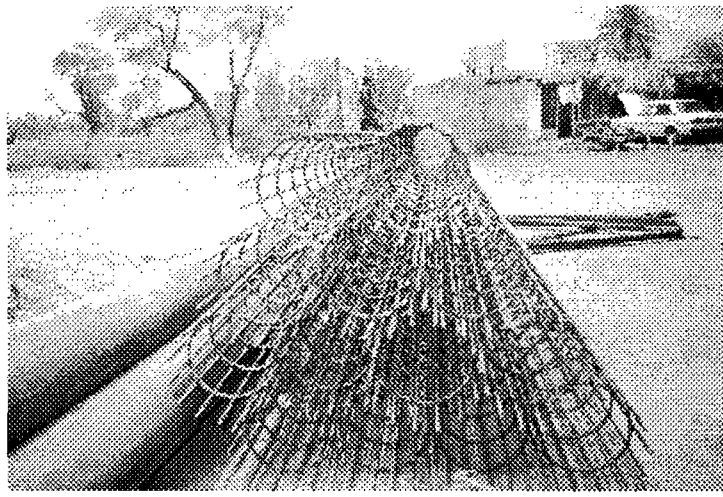

Plate 1. **Locally manufactured coir for single-strainer skimming well.**

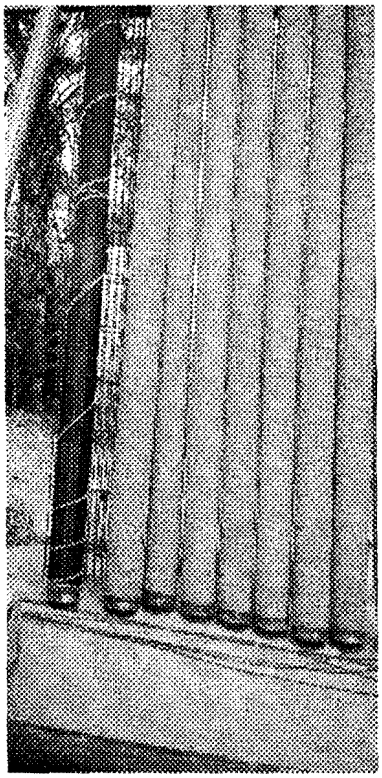

Plate 2. **Jute and nylon-wir wrapped coir as strainer in single strainer skimming well.**

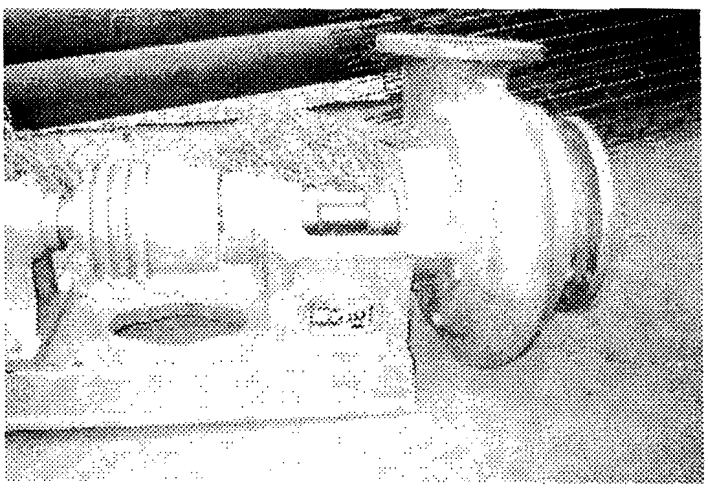

Plate 3 **Locally available centrifugal pump used in single strainer skimming well.**

Multi-Strainers Well

The discharge of a single strainer tubewell is relatively low and the cost of bore is high since it has to be bored, generally not less than 30 m. Therefore, now the people are using multi-strainer shallow wells (Figure 2). Normally, PVC pipes of 5 cm are bored into soil at shallow depths, generally 12-15 m depths. Bottom 9 m is perforated that acts as strainer whereas the upper 6 m is blind. These pipes are connected to cross (T) (Figure 2, Plate 4).

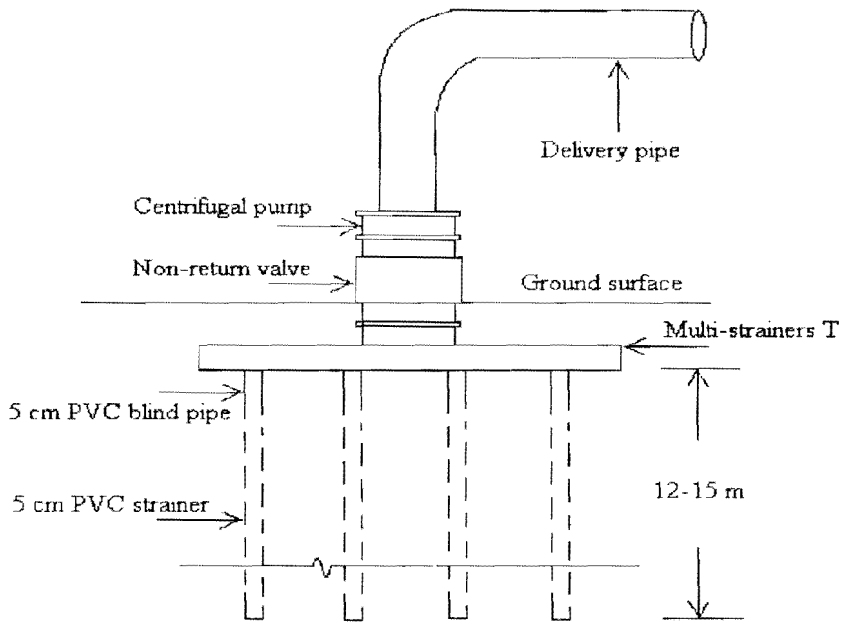

Figure 2. Schematic diagram of multi-strainers skimming well.

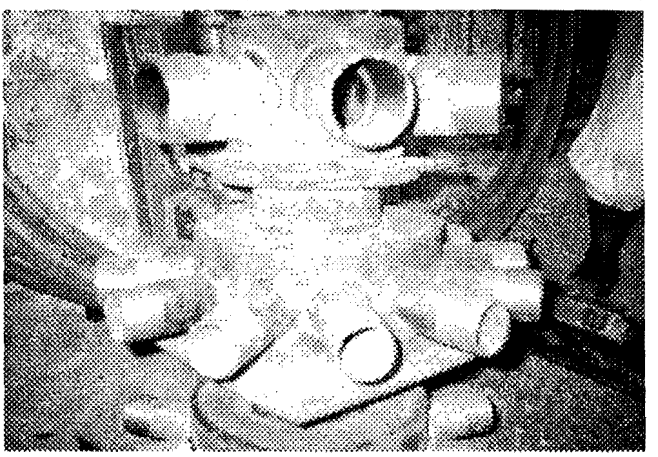

Plate 4. T-joint for connecting strainers to the pump.

The cross is attached to a non-return valve (Plate-5). The non-return valve is connected to a centrifugal pump. No foot valve is used inside strainers. Priming is done through the delivery pipe. When engine/tractor starts, the air is removed from the escape valve of the centrifugal pump while priming is kept continued. As soon as air is removed, the pump starts pumping. When pump stops pumping, the water inside delivery pipe exerts pressure on non-return valve and closes it therefore, the water in the pipes held due to hydrostatic pressure on the non-return valve.

Plate 5. Farmers'/local drillers' intervention: non-return valve to be attached directly to the pump.

Up to 25 strainer pipes have been used. However, 10 strainer are commonly used in the project area. The strainers are normally installed at the same depth (generally at 15 m depth) but at varying distance from the pump. Generally, strainers are installed at 1.5, 2.5, 3 and 3.5 m distances from the pump. In farmers perceptions, if these are installed at the same horizontal distances, they take the water of each other thereby reducing over all discharge. All parts of the multi-strainer wells are locally available. Technical know how and services are also available to some extent. Multi-strainers tubewells are becoming famous among the farming community and single strainers pumps are being replaced by these wells. Only in one village 6 SB, near Bhalwal city, 7 farmers have installed multi-strainers wells.

Table 1 and 2 gives the basic information of the tubewells installed in 6 SB and Nabi Shah. During the discussion, the farmers told that the deep groundwater of their area is brackish due to which their land was being deteriorated. The saline water also badly affected the existing crops and citrus trees. The source of their knowledge is the white patches on the soil they observe after irrigating the fields with deep water. Since water table in these areas is high (3 m) therefore, there is no difficulty in pumping water from these wells. These tubewells not only provide supplemental irrigation

to crops but also keep the water table below the root zone. The discharge of a well with 10 strainers is almost equal to the discharge of the single strainer pump i.e. in the order of 28 lps (1.0 cusecs).

Table 1. Multi-strainers-skimming wells installed by the farmers of village 6 SB

Name of farmer	No. of strainers	Size of strainer (cm)	Length of strainer (m)	Size of blind pipe (cm)	Length of blind pipe (m)	Water quality (ppm)
Altaf Hussain	7	5	9	5	6	384
Altaf Hussain	1	20	24	15	6	1100
M. Hayat	8	5	9	5	6	403
Ghulam Rasul Aasi	10	5	11	5	6	-
Ali Muhammad Aasi	4	7.6	9	5	6	896
Ahmad Khan Aasi	4	7.6	9	5	6	716
Wazir Ali Ranjha	7	5	9	5	6	-
Ghulam Rasul Jalip	10	5	9	5	6	-

Table 2. Skimming wells installed by the farmers of Nabi Shah

Name of farmer	No. of strainers	Size of strainer (cm)	Length of strainer (m)	Size of blind pipe (cm)	Length of blind pipe (m)	Water quality (ppm)
Muhammad Akram	16	5	9	5	6	819
Muhammad Akram	10	5	9	5	6	736
Muhammad Akram (Hand Pump)	1	5	6	5	4	454
Lal Shah	1	20	24	15	6	704
Lal Shah (Hand Pump)	1	5	6	5	4	1113
M. Imtiaz	1	20	24	15	6	851
MN-93	1	-	-	-	-	1171

The cost comparison of single and multi-strainers pumps is given in Table 3. The farmers prefer to install more number of strainers with the intention that, with the passage of time, if some strainers have to be closed due to one or the other reasons, the remaining strainers will remain functional without reducing discharge significantly.

Table 3. Cost comparison of skimming wells installed in the project area.

Name of farmer	No. of strainers	Size of strainer (cm)	Length of strainer (m)	Size of blind pipe (cm)	Length of blind pipe (m)	Cost (Rs)
Single strainer	1	20	24	15	6	20,000
Multi-strainer	4	5	9	5	6	10,000
Multi-strainer	4	7.6	9	7.6	6	13000
Multi-strainer	6	5	9	5	6	12,000
Multi-strainer	6	7.6	9	7.6	6	17,000
Multi-strainer	8	5	9	5	6	14,000
Multi-strainer	10	5	9	5	6	16,000
Multi-strainer	16	5	9	5	6	20,000

Nazir (1993) reported that similar multi-strainers skimming wells were installed in LBOD areas where the water table lies within 1.5 to 3 m. However, most of the area has usable water within a depth of 15-30 m. In Gaga area of Kotri, shallow tubewells, having three to four strainers, 15-30 m apart, were installed and water was pumped by centrifugal pumps. The tubewell discharge was more than 28 lps and these remained operational for about 10 years. Later on these tubewells were closed due to financial problems.

Advantages

- Low cost
- Reasonable discharge
- Provides fresh water
- Easy to install with the hand pump boring equipment

Disadvantages

- Initial priming is difficult
- If one pipe leaks, all the pipes will stop pumping.

Problems and solutions

Priming has been a major problem of a centrifugal pump. Single strainer and multi-strainers pumps are not the exemption. If suction breaks,

the suction pipes (strainers) are examined for any leakage. Two methods are commonly used by the drillers or farmers to find out the problem of suction break. (i) The pump is kept running and the hissing sound of the air is listened from the pipes. The pipe that has the leakage, gives the hissing sound. It is either repaired/replaced or plugged permanently. (ii) A hand pump assembly is used to detect the problem from the strainers (Figure 3). The strainers are detached from the T and are attached to the hand pump. If the pump lifts water, it shows that the strainer is functional. If the hand pump does not lift water, it indicates that there is problem some where in the strainer. It is then repaired/ replaced or closed permanently.

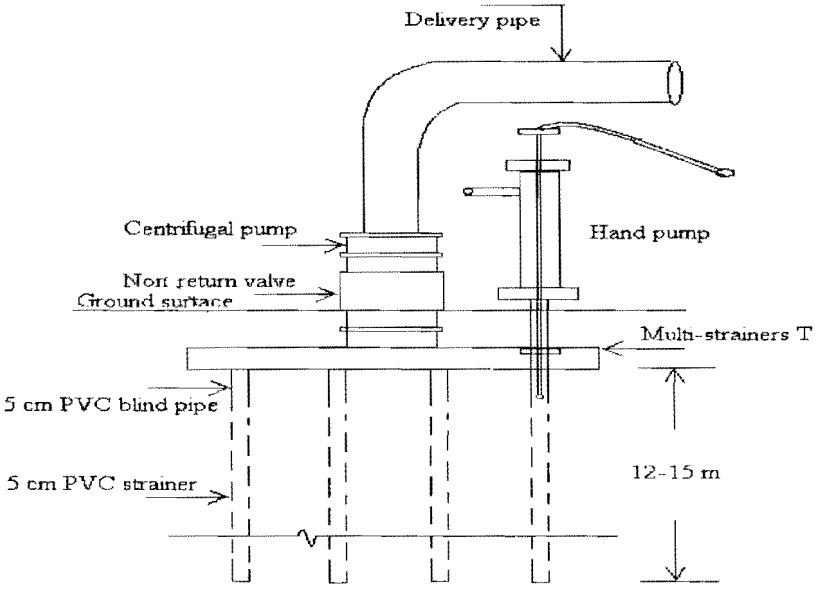

Figure 3. **A hand pump to diagnose the suction problems in the multi-strainers pumps.**

Deep tubewells

Deep tubewells installed by the private sector are rarely available in the project area. A turbine pump (deep tubewell) costs 15 times a centrifugal pump. It cannot be used with multi-strainers to pump shallow water (Nazir, 1993). However, a significant No. of deep tubewells installed under the SCARP schemes are in operation in the public sector. These are being closed either due to the pumping of deep saline water to the surface or due to the huge costs of operation and maintenance. Since deep tubewells are not being installed in the project area therefore, information on the cost is not available from the local market or from the farmers.

Advantages

- High discharge
- Priming is not a problem

Disadvantages

- High cost
- May pump saline water from the deeper layers.

Replacement of suction pipe with non-return valve

Generally, when a centrifugal pump is installed, a suction of about 6 m length, containing a foot valve (non-return valve) is lowered in the bore and is attached to the centrifugal pump (Figure 4).

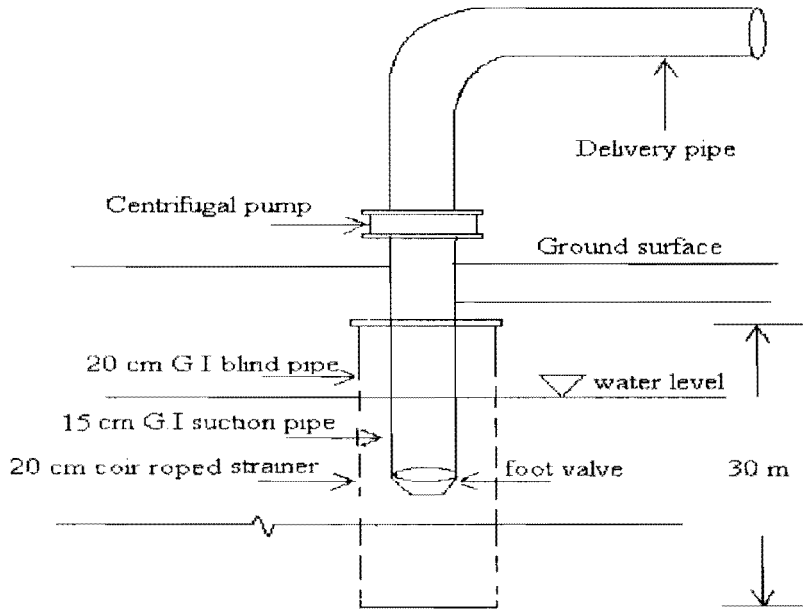

Figure 4. A schematic diagram of a tubewell with a suction assembly that is rarely used now.

This kind of arrangements is now rarely seen in the project area. The suction pipe and foot valve has been replaced by a single non-return valve by the local inventors. Now after boring and laying the strainer and blind pipe, a non-return valve (Plate-5) is attached to the upper end of the blind pipe. The non-return valve is then connected to the suction side of the centrifugal pump. After priming, a suction is applied through a peter engine or tractor PTO. At the same time, the air is removed from the non-return valve as well as from the pump through an escape valve provided in the pump casing. This process is repeated intermittently for about ten minutes. When all the air from the pipe is removed, the pumping starts pumping

water. When pumping is closed, the non-return valve is also closes due to pressure of water inside the pump and delivery pipe. Water in the suction pipe (blind pipe) is held by the non-return valve. A single priming may be sufficient for a longer period provided that there is no leakage in the system. Since in most instances, non-return valve is placed at the soil surface, it is easy to be detached and to be checked for trouble shootings.

CONCLUSIONS AND RECOMMENDATIONS

Based on their experience, the farmers of the area have some know how about the skimming well technologies. The local drillers have developed expertise on the installation of multi-strainers and single strainer wells. Moreover, they are trained enough to diagnose and solved problems relating to skimming well technology. However, the selection of well type is quite arbitrary. Moreover, the selection of No. of strainers, horizontal distances of strainers from the pump, length of strainers, discharge and HP requirement for pumping need to be re-addressed to make the system efficient and cost effective.

REFERENCE

Nazir A. (1993). Water resources of Pakistan. Shahid Nazir Publisher, 61-B/2, Gulberg-3, Lahore, Pakistan.