

THESIS

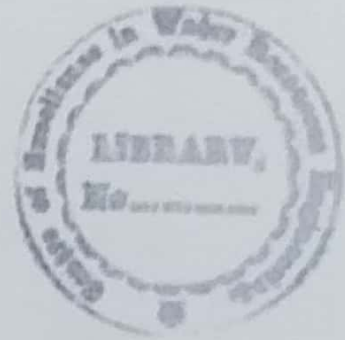
GROUND WATER EXPLOITATION MODES IN DEEP AND
SHALLOW WATER TABLE AREAS



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ABSTRACT

Ground water is pumped by tube wells, turbines and skimming wells. Design of ground water extraction mechanism is in continuous evolution due to changes in depth of water table, availability of technology, availability of electricity, cost of installation and operating of tube wells, etc. This study was undertaken to document the evolving ground water exploitation modes in two areas, one deep water table area and other shallow water table area.

Survey was conducted for two (deep and shallow) ground water table depth areas. The deep ground water table area was selected in Tehsil Chichawatni of District Sahiwal. The shallow ground water table area was selected in Tehsil Khanpur of District Rahim Yar Khan. From each area three villages were selected and their water wells data was collected and detailed analysis were carried out to study the existing water pumping modes, their designs, and major constraints. Interviews were conducted from farmers, drillers and other related professionals from both deep and shallow ground water table areas. Operational hours of tube wells were also recorded.

In deep water table area, with depth of ground water table 45 to 55 feet, ground water extraction is carried out by tube wells with centrifugal pump (75%) and turbines (25%). Centrifugal pump is placed in deep well sump and operated with electricity (73%) and tractor with pulley arrangement (27%); all well sumps were deepened 2 to 3 times up to 10 feet. Turbines are operated with electricity (80%) or tractor (20%). There is one well for 75 acres. Turbine is emerging mode due to access to electricity and increased water table depth and no new centrifugal pumps are being installed.

Discharge of tube wells varies from 0.6 to 2.5 cusecs with mean of 0.9 cfs. Discharge of turbines varies from 0.9 to 3.0 cusecs with mean of 1.2 cfs. Bore depth

of tube wells varies from 120 to 230 feet and is 120, 150 and 230 feet for 1.0 cfs, 2.0 cfs and 2.5 cfs wells respectively. Bore depth of turbines varies from 155 to 300 feet and is 160, 220 and 300 feet for 1.0 cfs, 2.0 cfs and 3.0 cfs wells respectively. Generally bore depth is deeper for turbines. Screen length of tube wells varies from 120 to 230 feet and is 120, 150 and 230 feet for 1.0 cfs, 2.0 cfs and 2.5 cfs wells respectively. Screen length of turbines varies from 155 to 300 feet and is 160, 220 and 300 feet for 1.0 cfs, 2.0 cfs and 3.0 cfs wells respectively. Generally screen length is deeper for turbines.

Tube well utilization factor in deep water table area varies from 5% to 19% with mean utilization is 13%. Turbine utilization factor varies from 8% to maximum of 19% with mean of 14%. Cost of 1 acre foot of pumped water for 1 cfs electric and tractor operated tube well is Rs. 2284 and Rs. 7469, respectively and for 1 cfs electric and tractor operated turbine is Rs. 3000 and Rs. 6694, respectively.

In shallow water table area, with depth of ground water table 10 to 15 feet, ground water extraction is carried out by single strainer tube wells with centrifugal pumps (71%) and skimming wells with multiple strainers (29%). For tube wells centrifugal pump is placed on ground and operated with peter engine (46%) or tractor with pulley arrangement (54%). Skimming wells with average of 6 strainers are operated with peter engine (60%) or tractor (40%). There is one well for 50 acres.

Discharge of tube wells varies from 0.8 to 1.5 cusecs with mean of 0.8 cfs. Discharge of skimming wells varies from 0.85 to 1.5 cusecs with mean of 0.85 cfs. Bore depth of tube wells varies from 80 to 120 feet and is 80, 100 and 120 feet for less than 1.0 cfs, 1.0 cfs and 1.5 cfs wells respectively. Bore depth of skimming wells varies from 50 to 60 feet and is 50, 55 and 60 feet for less tha 1.0 cfs, 1.0 cfs and 1.5 cfs wells respectively. Generally bore depth is deeper for tube wells. Screen length of

tube wells varies from 40 to 50 feet and is 40, 45 and 50 feet for less than 1.0 cfs, 1.0 cfs and 1.5 cfs wells respectively. Screen length of skimming wells varies from 20 to 35 feet and is 20, 25 and 35 feet for less than 1.0 cfs, 1.0 cfs and 1.5 cfs wells respectively.

Tube well utilization factor in shallow water table area varies from 11% to 22% with mean utilization as 16%. Skimming wells utilization factor varies from 8% to maximum of 19% with mean of 14%. Cost of 1 acre foot of pumped water for 1 cfs engine and tractor operated single strainer tube wells is Rs. 2884 and Rs. 3154, respectively and for 1 cfs engine and tractor operated skimming wells with multiple strainers is Rs. 2162 and Rs. 2631, respectively.

In centrifugal tube wells gravel pack should be used. Ground water regulating laws must be formed to check the excessive lowering of water table. Government should provide subsidy on electricity and diesel fuel used for ground water pumping.

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