

RADIAL COLLECTOR WELL

A SOURCE OF SUSTAINABLE WATER SUPPLY FOR CITIES AND INDUSTRIES

Dr. AMRUT D. KADIWALA

M.E. (GEOTECH), PH. D., MIE (IND) FIGS
PRINCIPAL CONSULTANT (LABORATORY)
MO.: +91 9426 083766

MARS PLANNING & ENGINEERING SERVICES PVT. LTD., AHMADABAD

RADIAL COLLECTOR WELL:

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PANCH MAHABHOOT, AGNI, VAYU, JAL, PRITHVI, AKASH

- 1 WATER IS ONE OF PANCHMAHABHOOT AGNI, VAYU, JAL, PRITHVI, AKASH
WATER IS THE INTEGRAL PART OF HUMAN BODY-WHICH KEEPS THE HUMAN
BODY AT REQUIRED TEMPERATURE
- 2 THE MAIN SOURCE OF WATER ON EARTH IS SEA BUT THE SEA WATER IS NOT
USEFUL FOR DRINKING PURPOSE.
THE SEA WATER IS HEATED DUE TO SUN RAYS, GETS EVAPORATED AND CLOUDS
ARE FORMED, THE CLOUDS THEN CAUSE SHOWERS AND RAIN.
- 3 THE RAIN IS THE MAIN SOURCE OF POTABLE CLEAN WATER. THE RAIN WATER
FLOWS IN FORM OF SURFACE WATER. PART OF THE FLOWING RAIN WATER
PERCOLATES IN THE GROUND AND TAKES THE FORM OF SUBSURFACE WATER

SURFACE WATER : RIVER, LAKE, CANAL ETC
INFILTRATION GALLERY-INTAKE WELL ETC

SUB SURFACE : PITS IN RIVER BED, DUG WELL,
HANDPUMP- MECHANICAL PUMP
TUBEWELL ETC.

SMALL TOWNS ARE SETTELLED- SITUATED ON RIVER BANKS.
- 4 FOR LARGE QUANTITY: INTAKE WELL IN GUARANTED SURFACE FLOW,
NUMBER OF TUBEWELL OR
RADIAL COLLECTOR WELL (FRENCH WELL) IN
GUARATED SUBSURFACE FLOW.

WHEN MINIMUM QUANTITY REQITRED IS 5.00 MGD (25 MLD) THE RADIAL
COLLECTOR WELL MAY BE ECONOMICAL.
- 5 WHAT IS RADIAL COLLECTOR WELL? HOW IT FUNCTIONS?

RADIAL COLLECTOR WELL IS A VERTICAL CAISSON OF 5.0 TO 6.0 M DIA. IN REVER
BED WITH RADIAL PERFORATED PIPES IN DIFFERENT DIRECTIONS TO DRAW THE
CLEAN FILTRED WATER INTO THE MAIN PUMPING WELL FOR A DIRECT SUPPLY
WITHOUT ANY TREATMENT.

NUMBER OF RADIAL 24 TO 32. THE DIA. OF THESE M.S. PERFORATED PIPE IS 300 MM (THE SLOTS 10MM DIA. * 40MM – 30% TO 50%). THE LENGTH OF RADIAL DEPENDS UPON THE SUB SURFACE STRATA. THE LENGTH MAY VARY FROM 10 M TO 40 M.

THE RADIAL DRAW SUB SURFACE WATER FROM A DISTANCE OF ABOUT 300M TO 400M FROM THE MAIN WELL. THE DISTANCE IS KNOWN AS RADIUS OF INFLUENCE. THIS LIMITS THE DISTANCE BETWEEN TWO SUCH WELLS TO 800 M.

THE DEPTH OF UNCONFINED SAND BED (AQUIFER) SHOULD BE MINIMUM 8 TO 10 M. THE DEPTH OF SATURATED AQUIFER SHOULD BE 5 TO 7 M AROUND THE MAIN WELL TO FUNCTION RADIAL WELL SUCCESSFULLY.

5 HISTORY OF RADIAL COLLECTOR WELL

THE FIRST SUCCESSFUL R.C.WELL WAS BUILT IN 1934 A.D. SUPPLYING ABOUT 2 MGD OF PURE FILTERED WATER. IT WAS APPROXIMATELY EQUAL TO 40 DUG WELLS IN THE SAME AQUIFER FOR THE SAME DEPTH.

CONCEPTUALLY A RADIAL COLLECTOR WELL IS NOTHING BUT NUMBER OF VERTICAL WELLS LAID IN HORIZONTAL PLANE TO INCREASE THE CONTACT AREA WITH THE GROUND WATER. THESE LATERALS DISCHARGE INTO VERTICAL CAISSON.

THE RADIAL COLLECTOR WELL IS KNOWN AS "RENNEY WELL" ON THE NAME OF FRENCH ENGINEER. IN FRENCH IT IS KNOWN AS "DRAINS RADIANT" BUT POPULARLY KNOWN AS "FRENCH WELL". (FIG. NO. 1 TO 4)

IN BHARAT SUCH WELLS HAVE BEEN BUILT DURING LAST FOUR DECADES IN RIVER YAMUNA NEAR DELHI, RIVER VAIGA NEAR MADURAI, AND RIVER NAGAVALLI NEAR RAIGADHA IN ORISSA.

NUMBERS OF SIMILAR WELLS HAVE BEEN CONSTRUCTED IN RIVER SABARMATI NEAR AHMEDABAD AND GANDHINAGAR IN RIVER MAHI NEAR VADOADARA AND IN RIVER TAPI NEAR SURAT. TABLE 1, SHOWS THE DETAILS.

THE YIELDS FROM SUCH WELLS VARY CONSIDERABLY. THE DETAILED STUDY OF PARAMETERS AND FACTORS AFFECTING THE YIELDS FROM SUCH WELLS IS VERY IMPORTANT. TAKING THESE FACTS INTO CONSIDERATION THE STUDY NAMED "BOUNDARY EFFECTS ON DISCHARGE OF RADIAL COLLECTOR WELL" WAS DONE WITH THE HELP OF SAND MODEL TO ENRICH THE SUBJECT.

THE INITIAL COST OF RADIAL COLLECTOR WELL EXCEEDS CONSIDERABLY THAT OF A VERTICAL TUBEWELL BUT THE LARGE YIELDS OBTAINED UNDER THE LOW PUMPING HEAD AND LOW MAINTENANCE COST LOWER ITS COST PER CUMEC OF WATER LIFTED.

VERTICAL TURBINE PUMPING UNIT IS USED TO PUMP THE WATER WHICH FLOWS INTO THE CAISSON THROUGH THE LATERALS.

COLLECTOR WELLS ARE PARTICULARLY EFFECTIVE IN SHALLOW SAND AND GRAVEL DEPOSITS NEAR STREAMS. THE YIELDS OF COLLECTOR WELLS NEAR STREAMS ARE GENERALLY SUBSTANTIALLY INCREASED DURING HIGH STAGES OF STREAMS.

COMPARISON OF RADIAL COLLECTOR WELL WITH VERTICAL WELL

THE GREATEST FIELD OF APPLICATION OF RADIAL COLLECTOR WELL IS FOUND WHERE LARGE AMOUNT OF WATER HAS TO BE ABSTRACTED FROM LIMITED DEPTH. VERTICAL WELLS COULD BE USED IN SUCH A CASE, BUT TO KEEP THE ENTRANCE VELOCITY LOW, A LARGE AREA OF CONTACT WITH THE AQUIFER WOULD BE NEEDED REQUIRING NUMBER OF WELLS TO BE INSTALLED. SUCH A WELL SYSTEM CAN BE REPLACED BY A SINGLE RADIAL COLLECTOR WELL.

- 1 THE SAVING OF PUMPING HEAD AND COST OF ENERGY THROUGH THE SMALLER DRAW DOWN.
- 2 IN UNCONFINED AQUIFER R.C.WELL ALLOW ABSTRACTION AT A GREAT DEPTH BELOW THE G.W.TABLE FORCING WATER PERCOLATING DOWN FROM GROUND SURFACE TO TRAVEL THROUGH AN APPRICIABLE SATURATED THICKNESS OF THE AQUIFER AND SO REMOVING MOST OF THE ACCOMPANYING POLLUTION.
- 3 A RADIAL COLLECTOR WELL RECOVERING WATER AT ONE POINT ONLY INSTEAD OF FROM A NUMBER OF VERTICAL WELLS, DOES AWAY WITH THE NEED FOR LONG SUCTION LINES OR SEVERAL PUMPING UNITS WITH ALL THEIR ACCESSORIES OPERATION AND MAINTENANCE THUS WILL BE SIMPLER AND ECONOMICAL

RADIAL WELL CAN NOT BE SUCCESSFUL IN

- 1 ROCKY AREA
- 2 CLAYEY STRATUM
- 3 SMALL SUBSURFACE FLOW IN SANDY STRARA

NECESSARY CARE (PRECAUTIONS)

- 1 AS A RADILA COLLECTOR WELL HAS A HIGH COST OF CONSTRUCTION AND SUCH A CAPITAL INVESTMENT IN A SINGLE UNIT IS ONLY WARRANTED AFTER EXTENSIVE GEO HYDROLOGICAL INVESTIGATION FOR THE WELL AT THE CHOSEN LOCATION BEYOND ANY REASONABLE DOUBT.
- 2 GUARANTED SUBSURFACE FLOW
- 3 PROTECTION OF RADIALS BY MINIMUM 6M OVERBURDEN OF SAND AQUIFER- TO BE SAFE AGAINST SCOUR.
- 4 THE SAFETY AGAINST HFL, SCOUR, ACCESSIBILTY THROUGH APPROACH BRIGE.
- 5 PROTECTION AGAINST SURFACE/SUBSURFACE POLLUTION
- 6 MINIMUM DISTANCE BETWEEN TWO R.C.WELLS AS 800M

TABLE 1. ~~XXXX~~

DATA OF RADIAL COLLECTOR WELLS IN GUJARAT (As on 31-12-2018)

RIVER	OWNER OF WELL	TOTAL LENGTH OF RADIALS (M)	DEPTH OF SATURATED AQUIFER (M)	PERMEABILITY K (M/HR)	DISCHARGE Q (MGD) <i>Before Naxosoda without A.S.I. Van</i>
Muhli	GSFC	550	7.00	7.48	4.00
	IPCL(J)	510	6.00	10.00	6.50
	IPCL(K)	525	7.50	10.00	6.50
	BMC(P)	508	7.80	14.00	10.00
	BMC(R)	550	7.50	14.00	6.50
	Gujarat Refinery(A)	400	7.00	18.00	7.50
	Gujarat Refinery(B)	400	6.00	18.00	6.00
	Sabar-mati	AMC(Camp)	550	6.50	5.45
AMC(Bhadreshwar)		605	8.25	10.00	10.00
AMC(Kotarpur)		611	11.50	16.00	10.00
Gandhinagar Township		560	13.00	18.00	10.00
ABCo.		600	11.00	10.00	10.00
QEB		550	12.00	10.00	8.00
Tapi	Baroda Rayon	600	7.00	16.00	9.00
	SMC(A)	550	7.50	16.00	8.00
	SMC(B)	550	7.50	16.00	6.00

~~Note: one MGD is 37.85 MLD.~~

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TABLE ~~1~~ 2EFFECTIVE RADII OF COLLECTOR WELLS^(a)

Vertical Production Well Effective radius (m)	Collector well Construction features
22	Five laterals projected in a fan shaped pattern ranging in length from 18 to 36 m and totalling 140 m around 180° of circumference.
18	Four laterals projected to length about 30 m Each around 90° of circumference.
22	Seven laterals 40 to 55 m In length around 130° of the circumference.

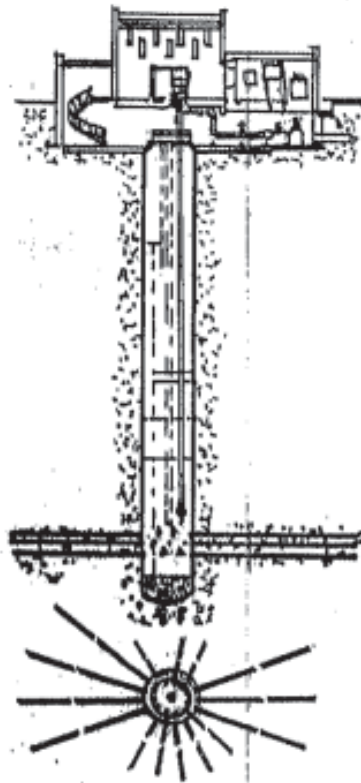


FIG: 1. RADIAL COLLECTOR WELL WITH PUMP HOUSE BUILT ON TOP

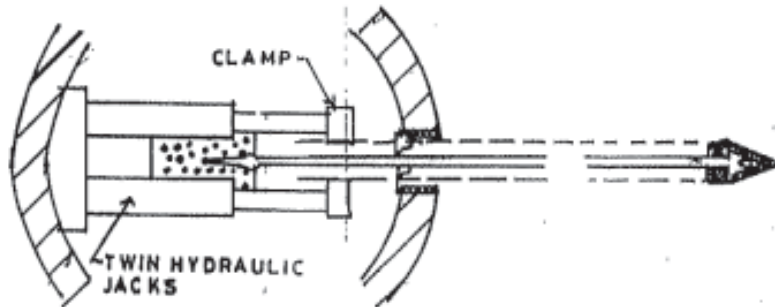
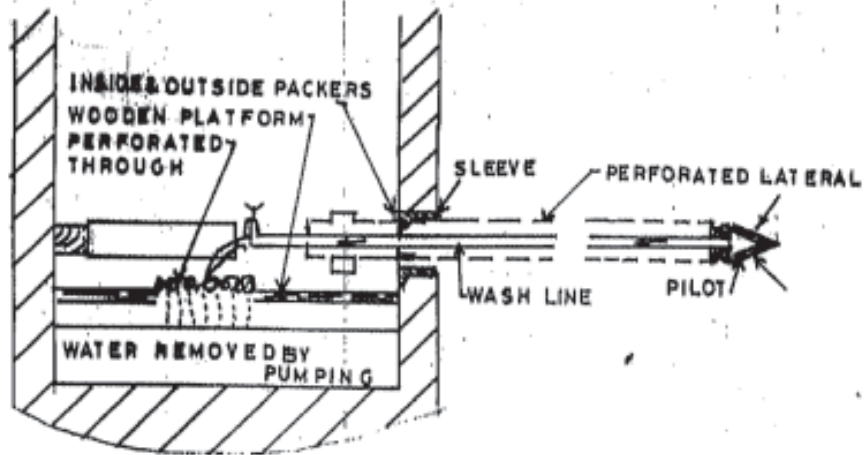


FIG: 2. RANNEY METHOD OF WELL CONSTRUCTION

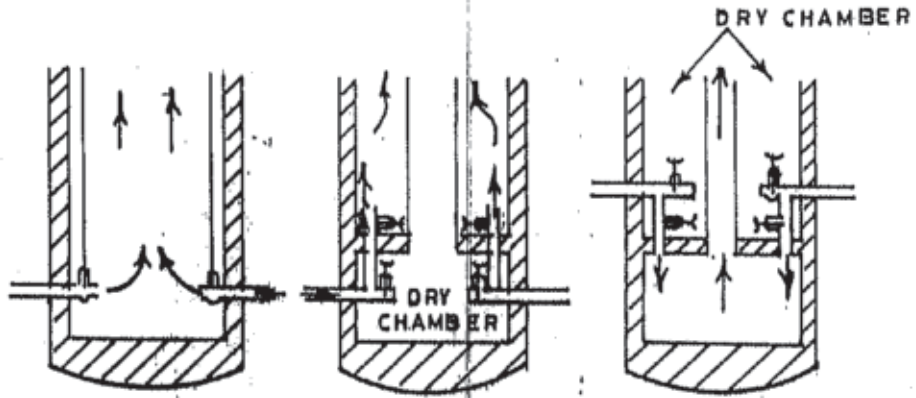


FIG. 3. ACCESSIBILITY OF INDIVIDUAL COLLECTORS

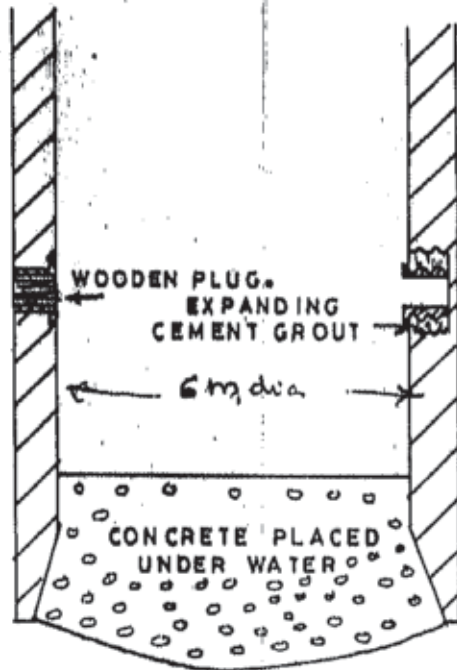


FIG. 4. PREFABRICATED AND POST INSTALLATION PORT HOLES