Evaluation of Ground Water Artificial Recharge Wells in Chandigarh (U.T)

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Abstract- **Chandigarh is a rapidly growing city with a population growth rate of 40 percent in the last decade. The density of population is 7900/sq-km which is one of the highest in the country and the demand for water is estimated to grow steeply. It is estimated that by 2025, the water demand will be 800 mld, thereby indicating an increase of 58% over the present requirement. There is also a great demand of water for horticulture purpose as one third of the total area of city is under green spaces. Bhakra Main Canal is the main source of water supply and already there is a dispute concerning distribution of water for the next two phases of supply. Deep confined aquifers in this city are not naturally recharged thus leading to steep decline in ground water level. Hence there is an urgent need for augmenting the ground water supply by means of artificial recharge using injection wells and also to evaluate the effect of this process on ground water table and its quality. Ground water samples were collected from four different locations during pre-monsoon and post-monsoon season and tested for various physical and chemical parameters. The study revealed that the ground water is more turbid in post-monsoon than in pre-monsoon which may be due to some colloidal and other fine impurities present in the incoming surface water**

Keywords: Ground water quality, Artificial recharge, Bhakra Main Canal

I. INTRODUCTION

Ground water is an essential and vital component of our life support system. The ground water resources are being utilized for drinking, irrigation and industrial purposes. However, due to rapid growth of population, urbanization, industrialization and agriculture activities, ground water resources are under stress. Chandigarh widely known as City Beautiful is already having a population more than double the planned capacity of the city. In addition there is large floating population and a slum population that is being rehabilitated. Several new initiatives and large scale projects such as IT Park , Shopping malls etc. have also been undertaken in recent years. All these factors have led to severe water shortage and the residents used to protest against this problem especially during peak summers. Conjunctive use of surface and ground water is the need of the hour to face this problem of acute shortage. It is therefore very important to improve the ground water level by adopting to artificial recharge. The process should take care of the quality of recharge water and also provide long term benefits. The present study was conducted to determine the infiltration rate of filter media and the extent of ground water contamination.

The following were the objectives of study:

- To investigate the changes in the water table of recharge wells in the study area.
- To determine lithological composition, drainage characteristics of the surrounding soil and hence infiltration rate of filter media.
- To collect ground water samples from the recharge wells and test for various physical, chemical and biological parameters.
- To analyse the samples for possible contamination on the basis of performed tests.
- To evaluate the effect of changing seasons on ground water quality.

II. METHODOLOGY AND EXPERIMENTAL PROCEDURE

Ground water samples collected from different sources/places were tested for different parameters as per codal provisions to determine the level of pollutant. Undisturbed soil from these sites were also collected and tested to determine the permeability characteristics and infiltration rate of filter media.

A. Sampling Sites :

National Institute of Technical Teacher Training Institute is situated in Sector 26 of Chandigarh and office compound has total catchment area of 1.84 ha .Normal Annual rainfall of the area is 1074 mm. Total available water for recharge to ground water is 17276 m^3. This available water can be utilised for recharging the aquifer system of Chandigarh where ground water is being tapped through tubewells indiscriminately.

Location-1 : Near Gate no.1 of NITTTR

Location-2 : Near Gate no.2 of NITTTR

Location-3 : Near Canteen of NITTTR

Location-4 : Near basic medical science block of Punjab University

Fig. 1 Recharge Wells of NITTTR

Fig. 2 Recharge Well of Punjab University

Table 1: Parameters analyzed, Test method and instrumentation

Sr No	Parameters	Test Method	Instrument/Equipment
1	pH	Electrometric	Microprocessor based pH meter.
2	Conductivity($\mu s/cm$)	Electrometric	Microprocessor based conductivity/TDS meter.
3	TDS(ppm)	Electrometric	Microprocessor based conductivity/TDS meter.
4	Turbidity(NTU)	Photometric	Digital NephloTurbidity meter
5	Nitrate(mg/L)	Colorimetric	Colorimeter (Rotating Disc)
6	Fluoride(mg/L)	SPADNS method	Colorimeter for Fluoride
7	Sulphate(mg/L)	Spectrophotometric method	PC based double beam spectrophotometer
8	Calcium(mg/L)	Titration method(EDTA)	Glasswares: Burette, Pipette, Volumetric flask
9	Magnesium(mg/L)		
10	Hardness(mg/L)		
11	Chlorides(mg/L)	Argentometric Titration	
12	Arsenic(mg/L)	APHA approved HACH method	HACH Arsenic Kit
13	Iron(mg/L)	FerroVer method	Iron kit,strip
14	BOD(3 days at 27^0 C)	3 days incubation at 27 ^{0}C in incubator	BOD Incubator, Luminescent DO meter.

Undisturbed soil samples were collected from Location-1 and Location-2 and the following tests were conducted to determine the type of soil and drainage characteristics.

(i) Liquid Limit and Plastic Limit
(ii) Permeability Coefficient

Test results shows that the soil contains predominantly inorganic silt of high plasticity and is also permeable thereby indicating that the infiltration rate of filter media is good.

III. OBSERVATION

A. Variation in ground water table and analysis

The site observation reveals that during Pre-monsoon season the depth of Ground

Water table (GWT) as measured from Ground level(GL), varied from 6 m at Location No.1 and 4 to a maximum of 8.23m at Location No. 3. During Post-monsoon season the depth varied from 15.85m at Location No. 4 to 49.39m at location No.3.

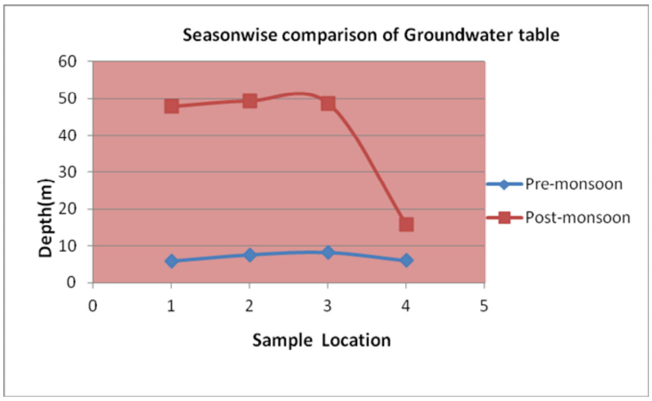
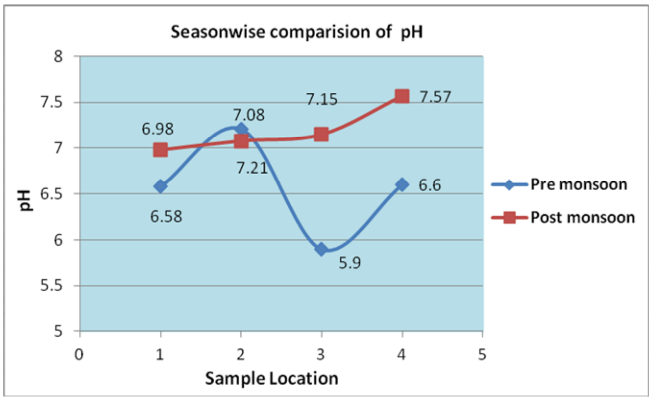
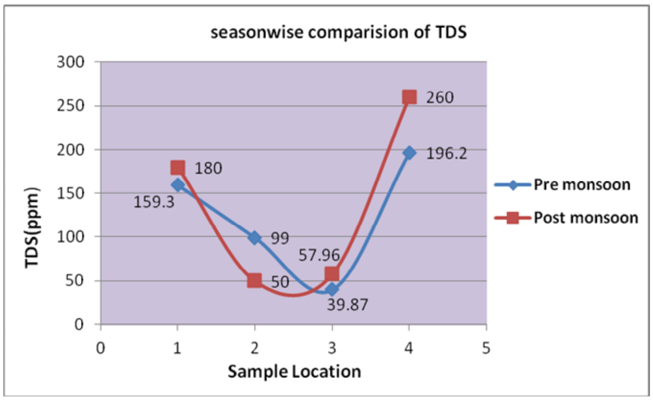
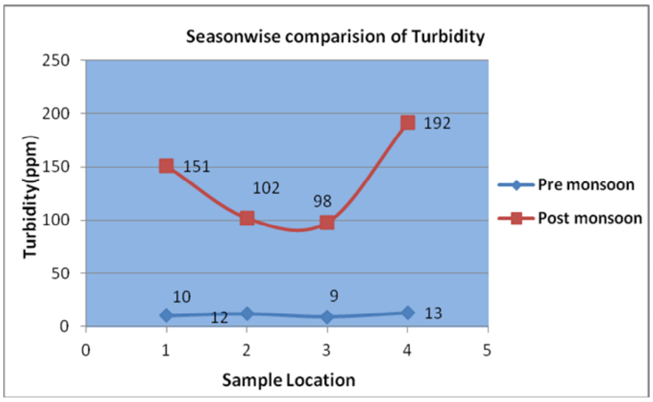


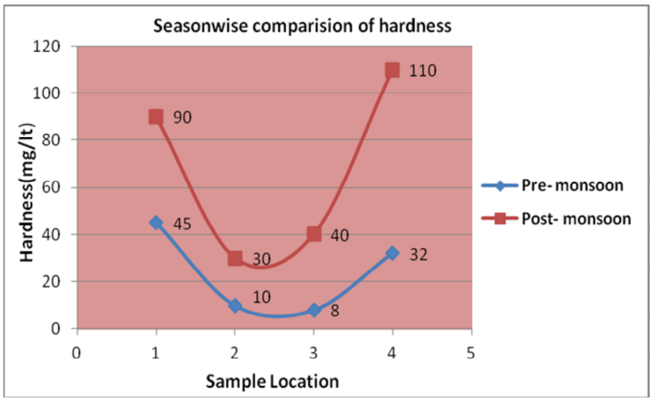
Fig 3

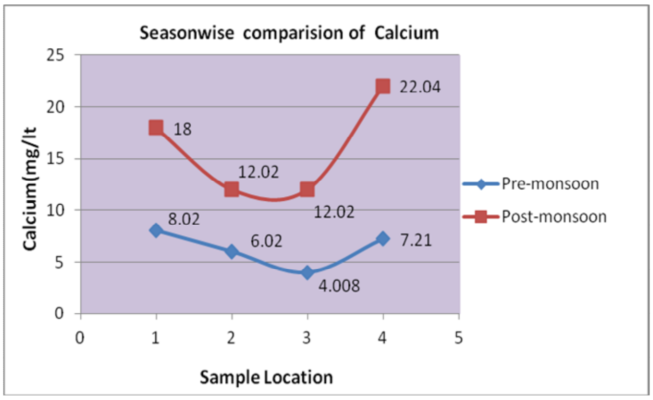
Decrease in Depth of Ground water level was observed during Pre-monsoon season, which may be due to heavy percolation of rainwater through the soil and subsequent rise in water table.

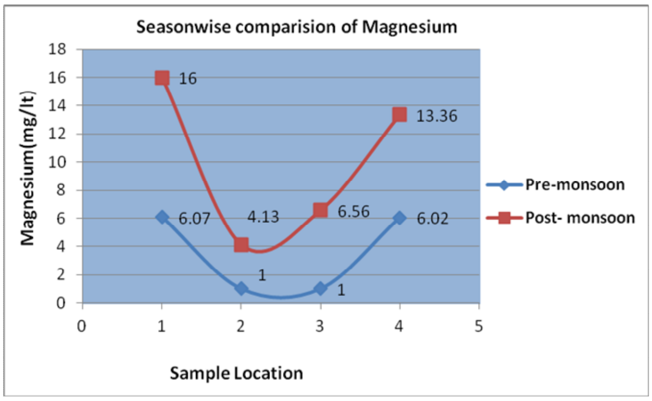












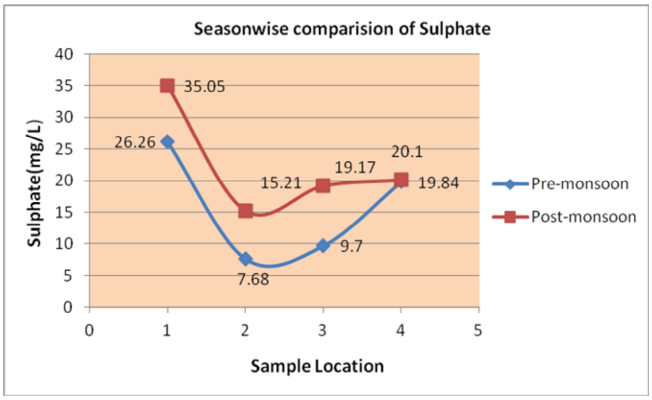


Fig 4 Season wise variation of parameters

IV. CONCLUSIONS

Majority of the tested parameters were found to be within the permissible limits and meets the criteria specified by WHO and BIS : 10500-1991 for safe drinking water. Turbidity value of ground water (Fig. 6) during post-monsoon is found to be much higher than the permissible limit, which may be mainly due to some colloidal and other fine impurities like clay, silt and organic matter present in the incoming surface water. Turbidity can promote growth of pathogens leading to outbreak of waterborne diseases. Although turbidity is not directly related to any health hazards numerous studied have shown a strong relationship between removal of turbidity and removal of protozoa. Hence it is very important to remove turbidity by filtration. Total Dissolved Solids (TDS) were found to be below 1000 ppm and the obtained pH value were approximately 7.00 at all locations indicating that the water is non saline. Most of the components of TDS were found (Fig. 7 to Fig. 10) to be more during post-monsoon than pre-monsoon season. This indicates that leaching and anthropogenic activities predominates over dilution of ground water. Ground water samples were also tested for arsenic and residual chlorine content and both these parameters were also found to be within the permissible limit. There is an urgent need for water quality management to monitor the quality of ground water regularly. Recharge wells should be properly constructed and provided with appropriate wellhead protection measures. Maintenance of these wells should also be carried out at regular intervals. Silt of upper layer should be removed in pre-monsoon and post-monsoon season and gravel should be changed in every four

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years. Wells should be located in areas where there is minimum potential for contamination so as to prevent intrusion of saline water in aquifers. Disinfection of water supplies should be carried out as it not only kills existing bacteria, but also take care of future contamination. A chlorine residual of 0.1 to 0.2 mg/L should be maintained throughout the distribution system and it is also important to ensure that elevated turbidity levels do not interfere with the disinfection and distribution of water supply.

Groundwater is the major source of drinking water in both urban and rural India. During the past two decades, the water level in several parts of the country has been falling rapidly due to an increase in extraction. Water extraction without proper recharge supplies and leachates from agriculture, industrial waste, and the municipal solid waste have also polluted surface- and ground-water. Public should be made aware about the health hazards caused by contamination of ground water and its subsequent consumption as it is evident from several case of fluorosis (due to presence of excess fluoride) occurring in different parts of the country. Recharging the ground water through artificial recharge techniques can improve the quality of ground water and lower the fluoride content in it. This process not only replenishes the depleting ground water level but also stores the surplus surface water and thus prevents the undue exploitation of this precious natural resource.

V. REFERENCES

[1] K.R. Karanth, “Ground water Assessment Development and Management”, Tata McGraw Hill Education Private Limited, New Delhi.
[2] CGWB (1994) Manual on artificial recharge of groundwater.
[3] EPA Guidance Manual (1999), Importance of Turbidity
[4] Patel Pratima , M.D. Desai, J. A. Desai (2011) “ Need to overcome the inadequacy of water to meet our demands by artificial ground water recharging”, International Journal of Earth Sciences and Engineering, pp 972-977.
[5] Martin Rygaard, Philip J. Binning, Hans-Jorgen, Albrechtsen, “Increasing urban water self sufficiency : New era, new challenges”, Journal of Environment Management (2011), pp 185 – 194
[6] Satyendra Kumar , S. K. Kamra, R.K. Yadav , J. P. Sharma (2012), “Evaluation of sand-based storm water filtration system for groundwater recharge wells”, Current Science, Vol.103, No. 4, 25August 2012.
[7] S.Selvam, Department of Geology, V.O.Chidambaram College, Tuticorin, “Groundwater quality to change impact of Climate change: a case study from Tuticorin, South Tamilnadu, India”
[8] http://ga.water.usgs.gov/edu/qa-usage-gw.html