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Study on Surface Water Quality in and Around Integrated Steel and Power Plant Mandir Hasoud Raipur, India

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***Abstract*: The physical, chemical parameters and heavy metals were analysed from samples of selected surface water bodies during Monsoon, Post- monsoon, winter and Pre-monsoon seasons in year 2011-12 and 2012-13. The studied ponds situated near about an integrated steel and power plant at Mandir Hasoud, Raipur, Chhattisgarh, India. The colour, Odour, Turbidity, TDS, Total Hardness, Alkalinity, Chloride, Sulphate, Nitrate, Calcium and Magnesium and all the heavy metals were found well within the prescribed norm. The Fluoride concentration in the site SW-1, SW-2 and SW-4 found slightly higher than desired limit but under permissible limit of BIS. Iron concentration found higher than permissible limit in all the samples. The higher concentration of iron may be due to deposition of suspended particulate matter from atmosphere to surface that is emitted from nearest an integrated steel and power plant.**

Keywords: **Pollution, Water, Quality, Contamination, Treatment**

I. INTRODUCTION

The water is most important natural resources for substances of life on biosphere. It is medium in which all living process occurs. Water dissolves nutrients and distributes them to cells, regulates body temperature, support structures, and remove waste products. About 60 % of our body is water. We can survive for week without food, but not only few days without water [1]. The analysis of water both in term of quality and quantity is essential for the very existence of mankind [2], [3], [4], [5]. Water is mainly used for drinking, bathing, fisheries and other domestic purposes. Lack of awareness and civic sense, use of inefficient methods and technology lead to more than 50% of water wastage in domestic, agriculture and industrial sector [6], [7], [8]. Water pollution is rendering much of the available water unsafe for consumption. In India, most of the population is depend on surface water. Chhattisgarh state is enriched with a lot of ponds and rivers. Major portion of the population of this state is dependent on pond water for their daily water needs like bathing, washing clothes, cleaning utensils, irrigation etc. Rain water is collected in studied ponds through surface runoff rain water. In natural surface, if there is no pollution then water is also not polluted which collected in ponds through surface runoff rain water. But if surface is polluted by various personal and industrial activities then collected water in ponds will get polluted.

In the present study, four ponds namely Serikheri pond, Nawagon pond, Kurud Tank and Lohara Pond in Mandir Hasoud Region, Raipur were selected for physicochemical and heavy metals analysis. All these ponds are located in buffer zone (within 10 km radius) of M/s Monnet Ispat and Energy Limited Raipur, Chhattisgarh. Locations of sampling station with respect to the above steel and power industry are given below in Table-1.

II. MATERIALS AND METHODS

Surface water samples from four selected village's ponds were collected in pre-cleaned polythene bottles. The water samples were collected four times in a year in different seasons like Monsoon Season (Jun – Aug), Post- monsoon season (Sep – Nov), winter season (Dec – Feb and Pre-monsoon season (Mar – May) for two consecutive year i.e. 2011-12 and 2012-13 from different ponds of study area by adopting grab sampling method. Analysis was carried out according to standard method [9], [10], [11], [12], [13]. Description of sampling sites is given in below Table -1.

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Table – 1: Location of sampling station

Station No.	Location	Distance from industry	Direction w. r. t. Industry
SW1	Serikheri Pond	2.10	W
SW2	Nawagaon pond	5.79	SE
SW3	Kurud tank	1.56	NE
SW4	Lohra Pond	6.14	NNW

III. RESULTS

To evaluate water quality of surrounding area of industry, four water samples were taken from the different ponds. Various physico-chemical parameters and heavy metals like Colour, Odour, Turbidity, pH, TDS, Alkalinity, Total hardness, Chloride, Sulphate, Nitrate, Fluoride, Iron, Calcium, Magnesium, Cu, Mn, Hg, Cd, Se, As, Pb, Zn, Cr, Al and Boron in both the year and in all the season were analysed. The water of all the ponds was colorless and odorless. Turbidity was found very low from the standard, whereas, heavy metals are not detected. The results of other parameters are given in Fig.1 to Fig. 22.

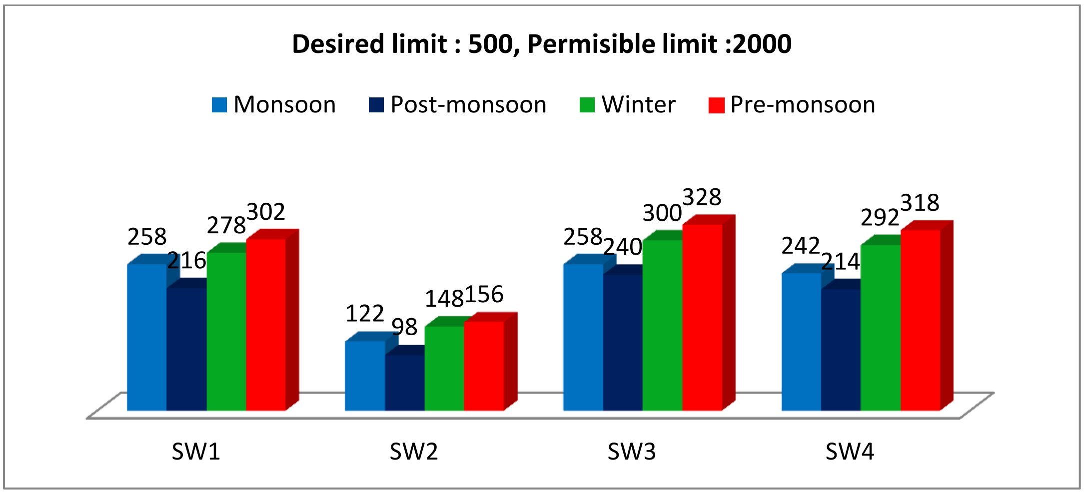

Fig. 1: TDS in mg/l for all locations in year 2011-12

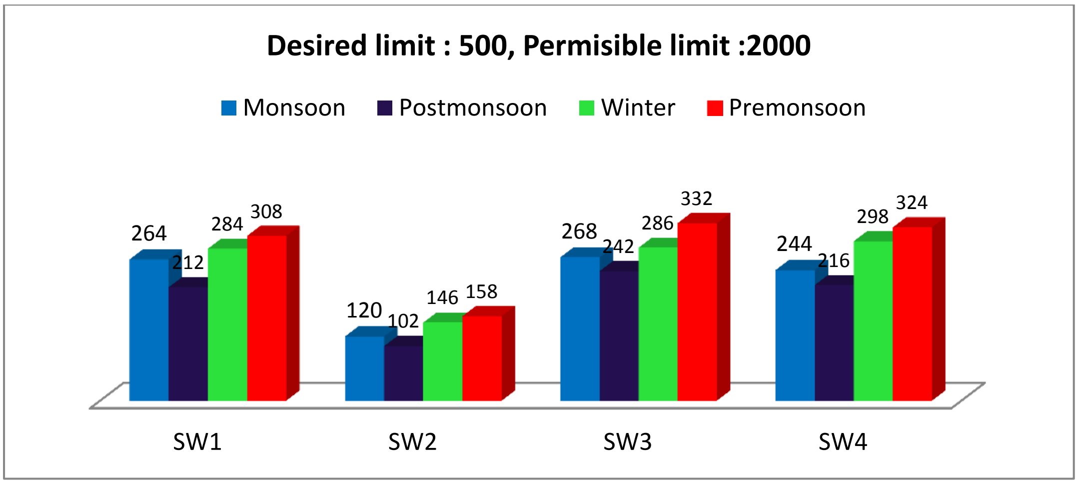

Fig. 2: TDS in mg/l for all locations in year 2012-13

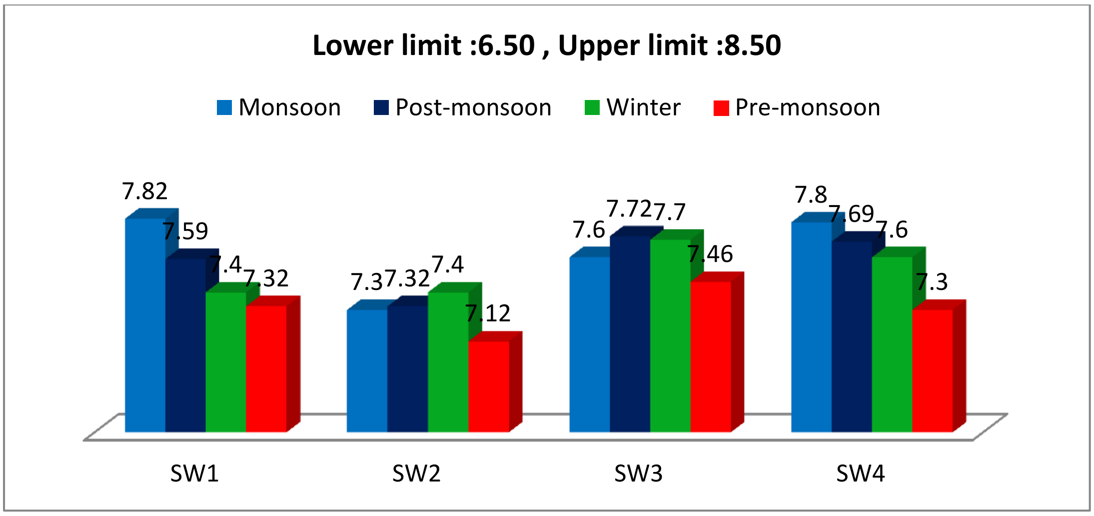

Fig. 3: pH values for all locations in year 2011-12

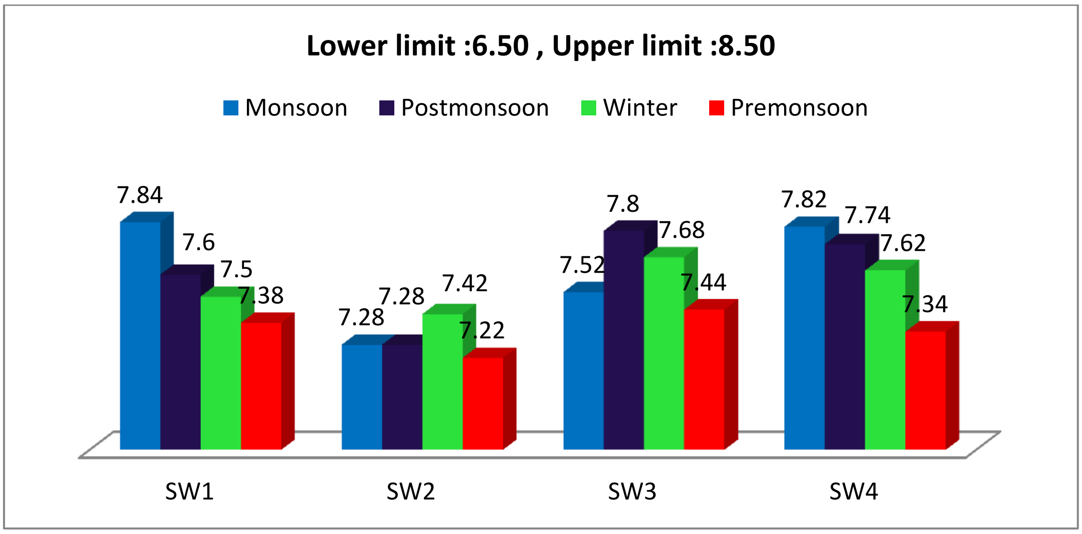

Fig. 4: pH values for all locations in year 2012-13

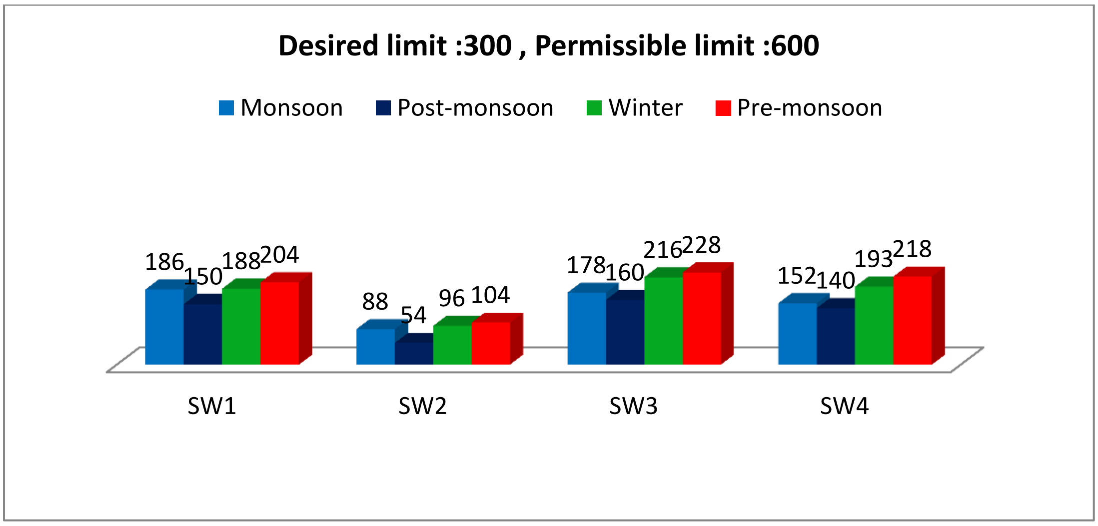

Fig. 5: Total Hardness in mg/l for all locations in year 2011-12

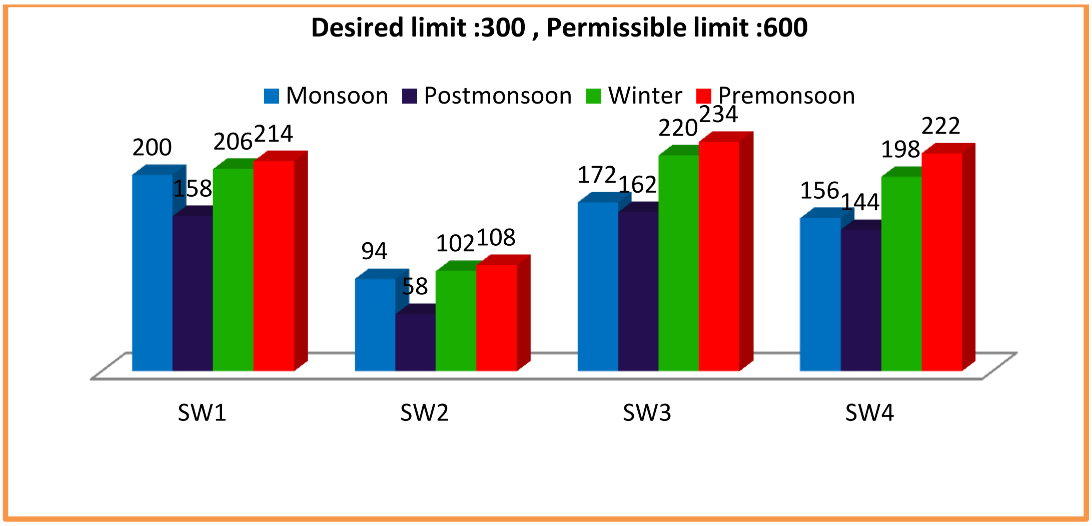

Fig. 6: Total Hardness in mg/l for all locations in year 2012-13

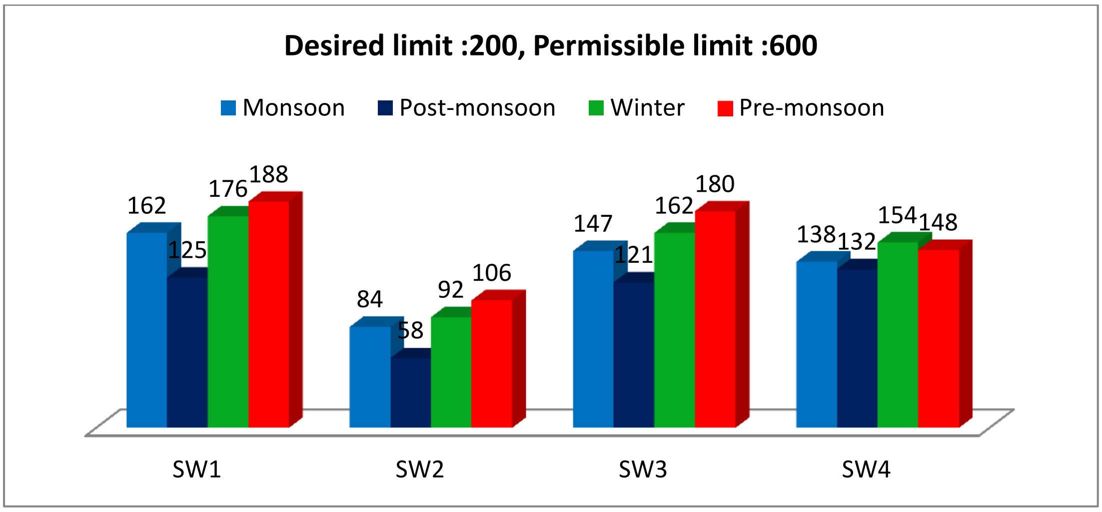

Fig. 7: Alkalinity in mg/for all locations in year 2011-12

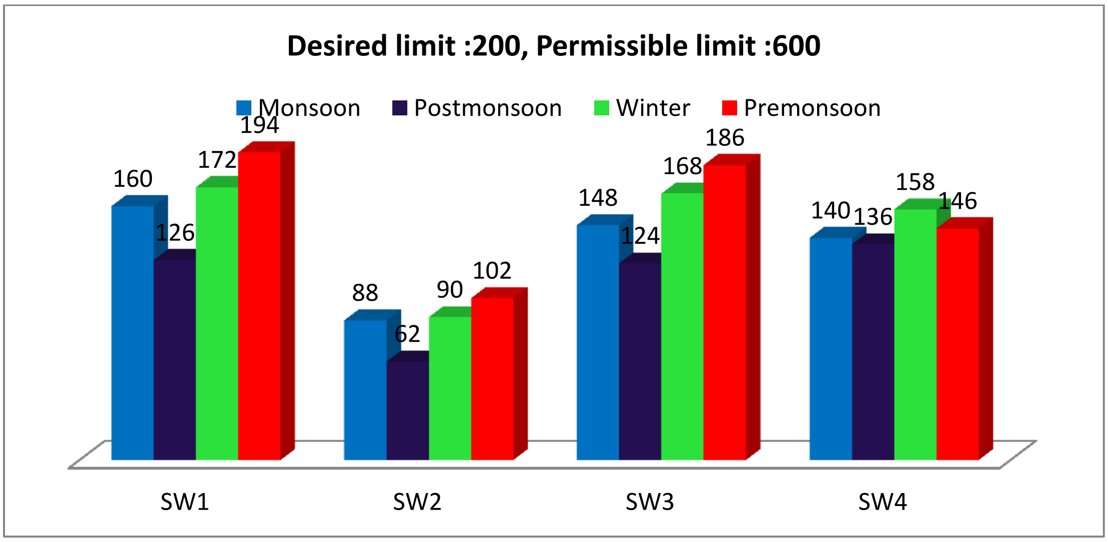

Fig. 8: Alkalinity in mg/for all locations in year 2012-13

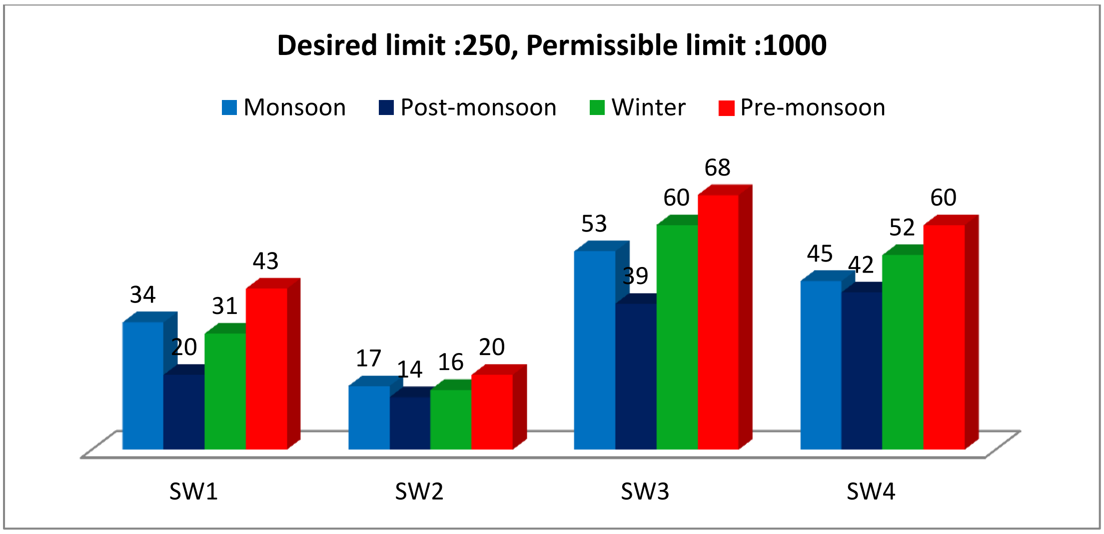

Fig. 9: Chloride in mg/l for all locations in year 2011-12

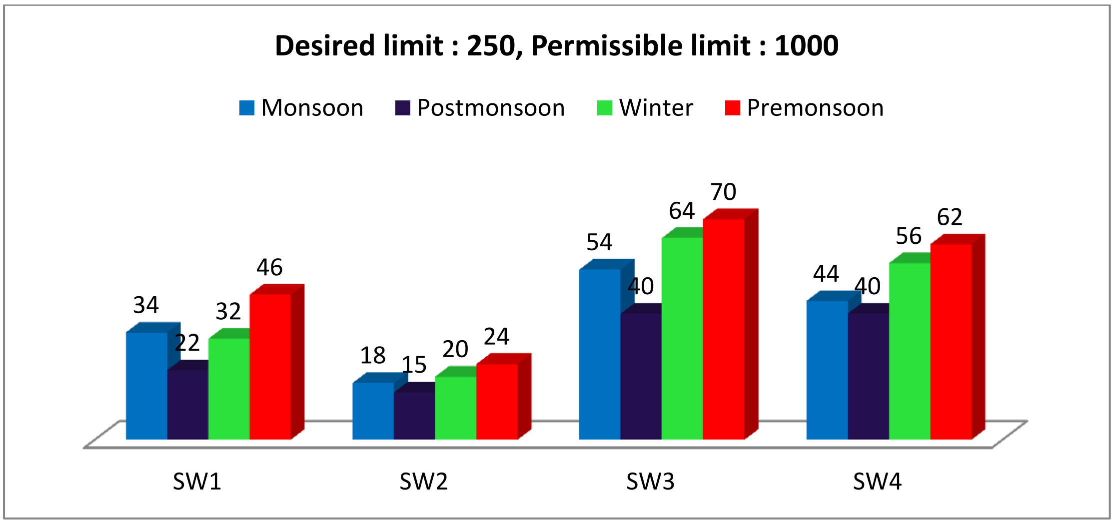

Fig. 10: Chloride in mg/l for all locations in year 2012-13

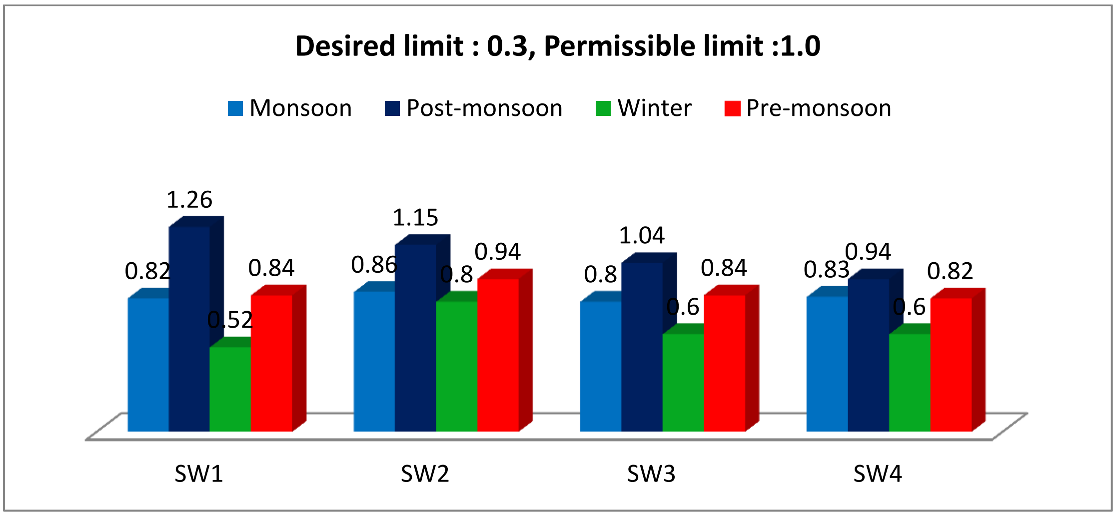

Fig. 11: Iron in mg/for all locations in year 2011-12

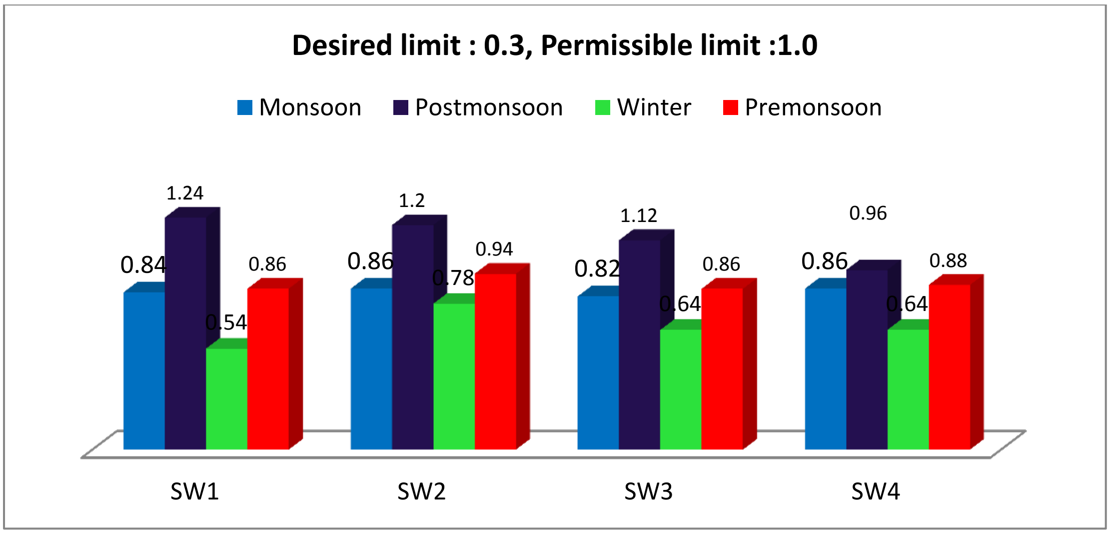

Fig. 12: Iron in mg/for all locations in year 2012-13

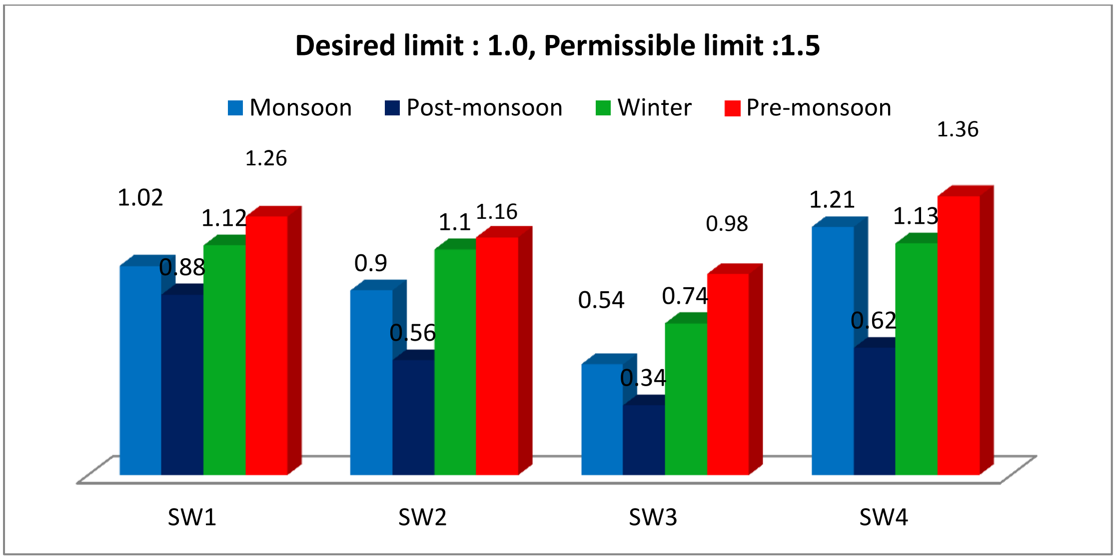

Fig. 13: Fluoride in mg/l for all locations in year 2011-12

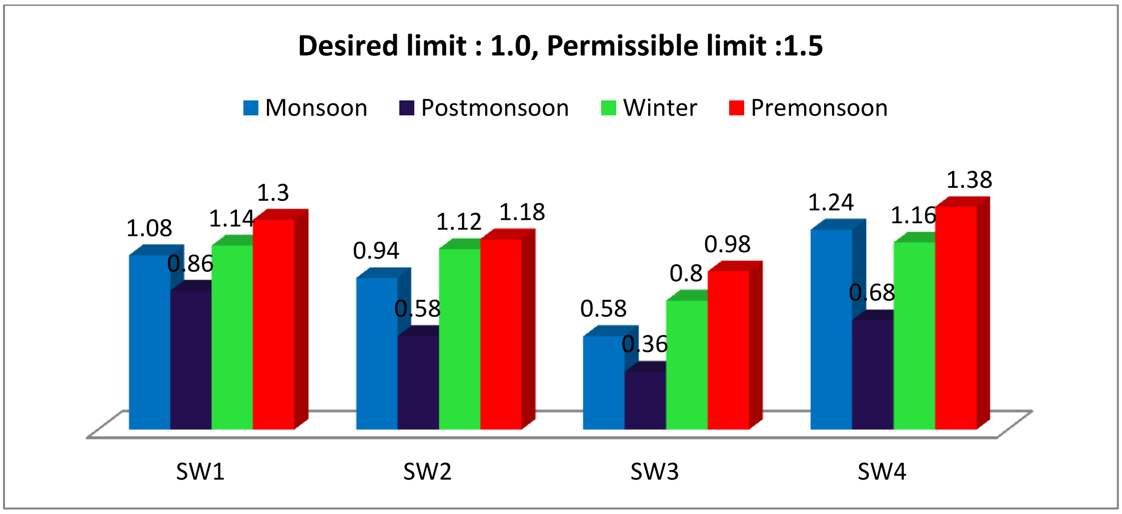

Fig. 14: Fluoride in mg/l for all locations in year 2012-13

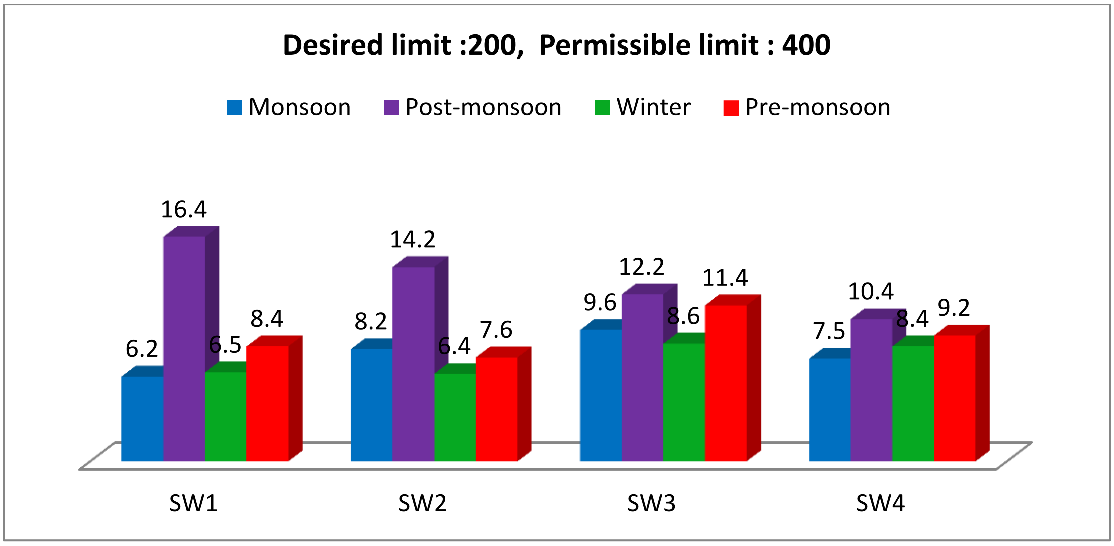

Fig. 15: Sulphate in mg/l for all locations in year 2011-12

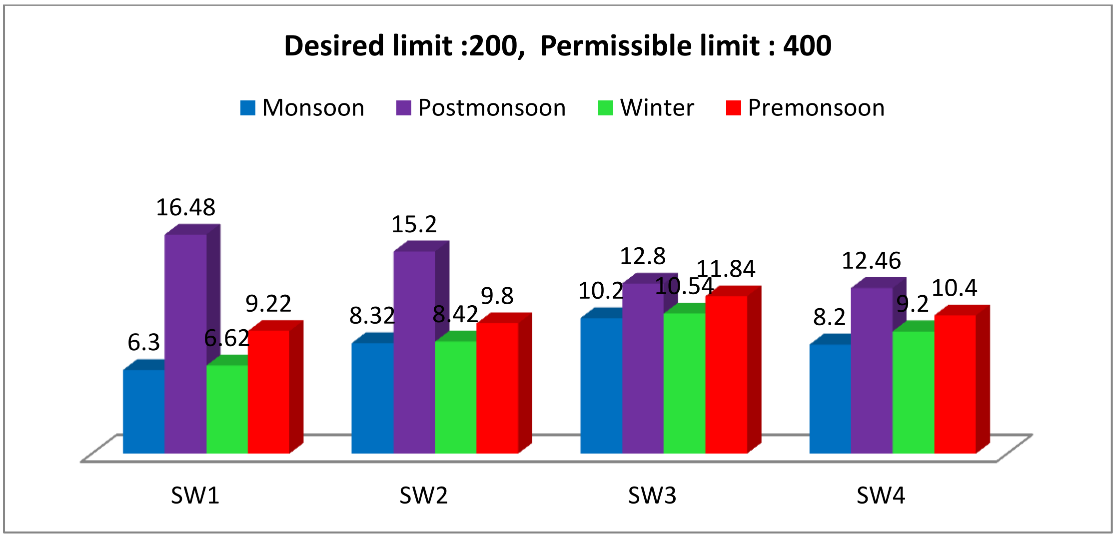

Fig. 16: Sulphate in mg/l for all locations in year 2012-13

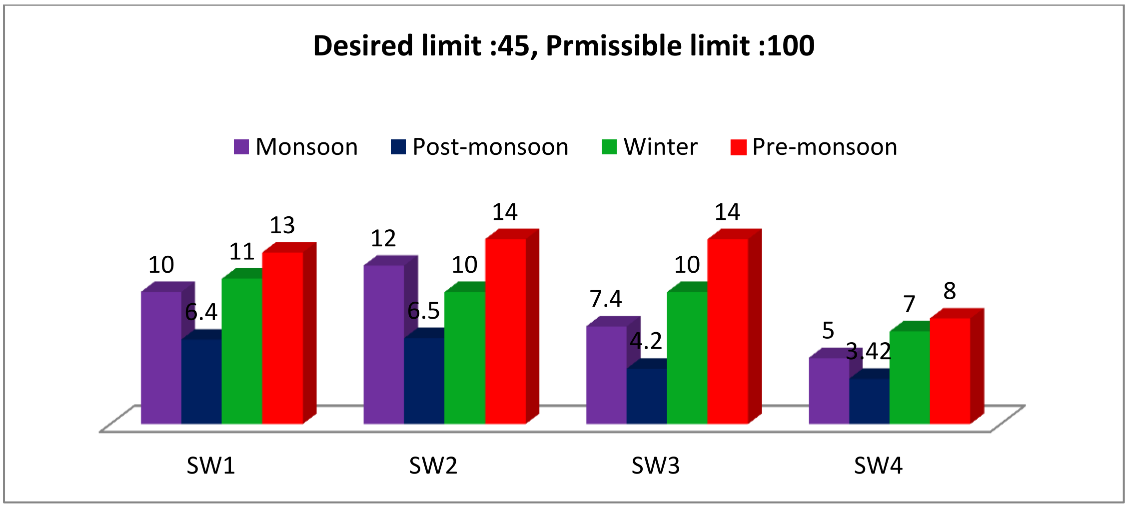

Fig. 17: Nitrate in mg/l for all location in year 2011-12

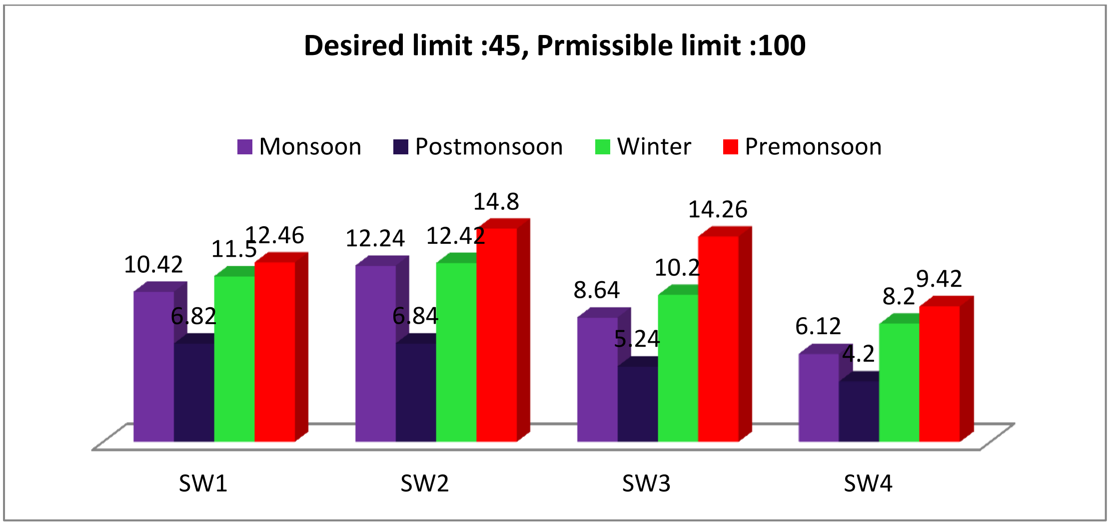

Fig. 18: Nitrate in mg/l for all location in year 2012-13

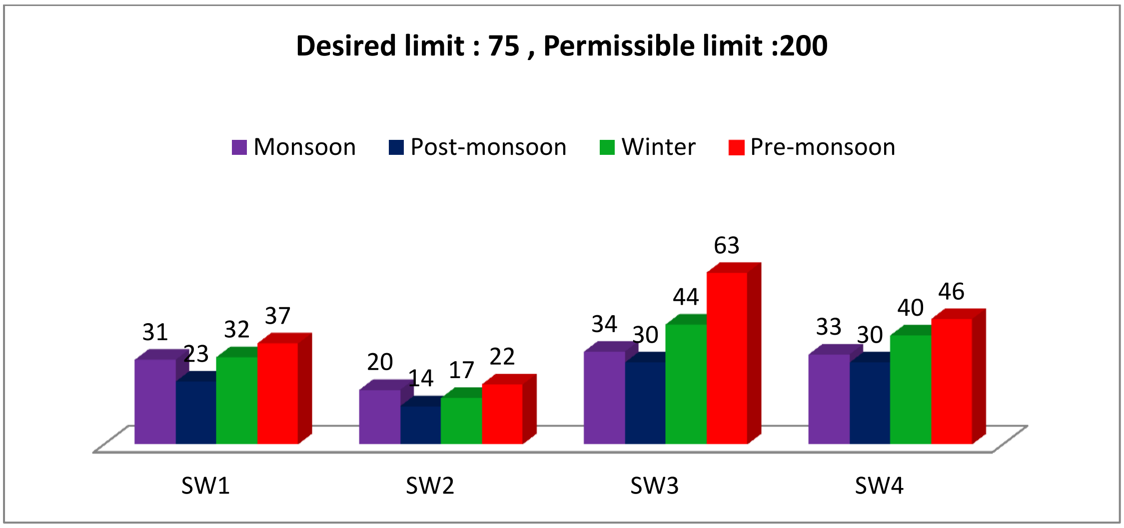

Fig. 19: Calcium in mg/l for all locations in year 2011-12

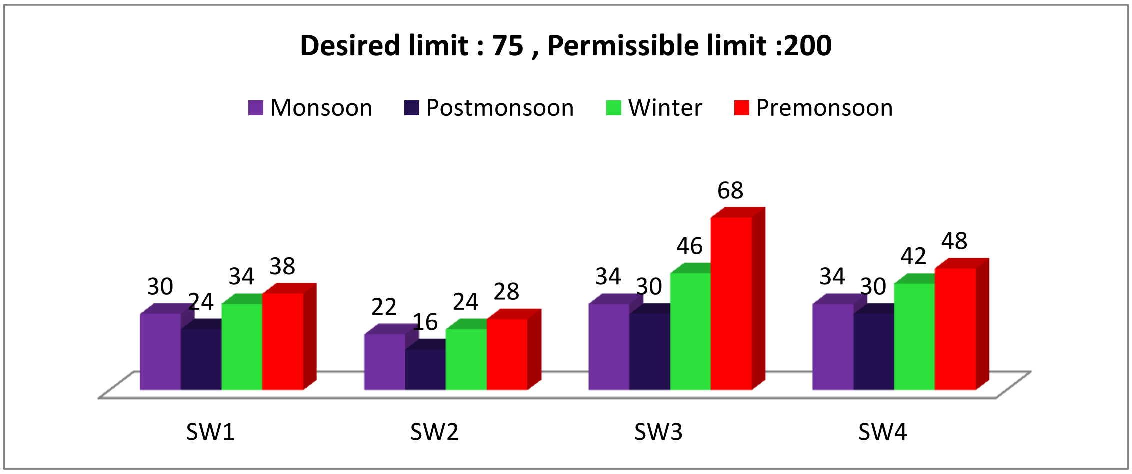

Fig. 20: Calcium in mg/l for all locations in year 2012-13

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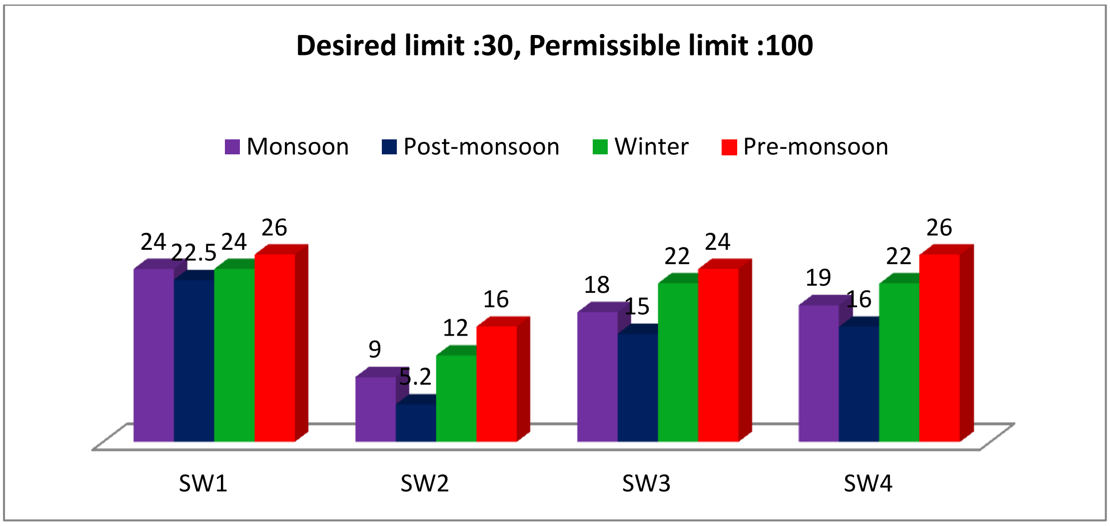

Fig. 21: Magnesium in mg/l for all locations in year 2011-12

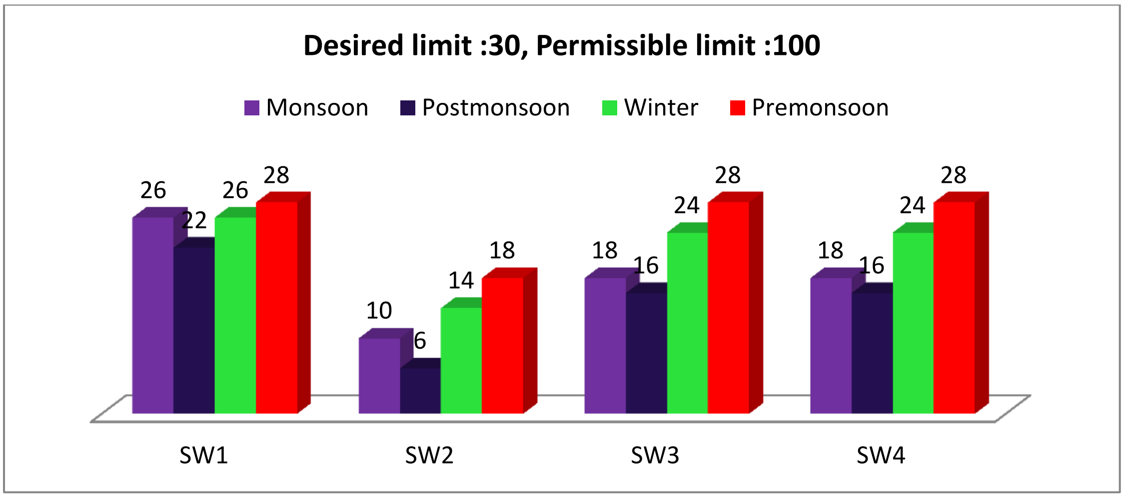

Fig. 22: Magnesium in mg/l for all locations in year 2012-13

IV. DISCUSSION

The pH is measure of the intensity of acidity or alkalinity and concentration of hydrogen ion. The pH has no direct adverse effect on health, however, higher value of pH hasten the scale formation in water heating apparatus and also reduce germicidal potential of chloride. High pH induces the formation of tri halo methane which is toxic (Jena et al., 2013). The pH values of selected water samples of present study ranged from 7.12 to 7.82 in year 2011-12 and from 7.22 to 7.84 in year 2012-13 which are within the prescribed norms of standards but slightly alkaline in nature [14].

The TDS, Total Hardness, Alkalinity, Chloride, Sulphate, Nitrate, Calcium and Magnesium were found well within the prescribed norms of BIS [13]. The Fluoride concentration in the site SW-1, SW-2 and SW-4 found slightly higher than desired limit but under permissible limit of BIS [13]. There is positive correlation of pH with fluoride indicates that high alkaline natures of water format leaching of fluoride and thus effect the concentration of fluoride in water [14].

The Iron concentration found ranged 0.52 to 1.26 mg/l in year 2011-12 and from 0.54 to 1.24 mg/l in year 2012-13 which is higher than desired limit in all of the sampling stations. The Iron is generally present in atmosphere as a result of emission from the iron and power industry, thermal power plant and incineration [15]**.** The higher concentration of iron may be due to deposition of suspended particulate matter from atmosphere to surface that is emitted from nearest an integrated steel and power plant. The maximum iron concentration found in the Serikheri pond which is situated in the down wind direction with respect to the plant where dispersion of air pollutants may be greater than other locations. When concentration exceed 0.1 mg/l, Iron precipitate on exposure to air, decreasing pond clarity, potentially clogging irrigation pipes, and encouraging iron bacteria, which affect the flavor of both fish and water. Level of greater than 0.3 mg/l can cause staining on buildings and sidewalks when the water is used for irrigation [16].

V. CONCLUSION

The Fluoride concentration in the site SW-1, SW-2 and SW-4 found slightly higher than desired limit but under permissible limit of BIS. Iron concentration found higher than permissible limit in all the samples. The higher concentration of iron may be due to deposition of suspended particulate matter from atmosphere to surface that is emitted from nearest an integrated steel and power plant. The colour, Odour, Turbidity, TDS, Total Hardness, Alkalinity, Chloride, Sulphate, and Nitrate, Calcium and Magnesium and all the heavy metals were found well within the prescribed norm.

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