Performance Study of Tank Water and Groundwater Quality and Its Social Significances

[1]Dr.M.Suganthi, [2]Dr.C.T.Sivakumar

[1]Asst.Professor, [2]Professor, Department of Civil Engineering, Mahendra Engineering College, Namakkal

Abstract- **Water is essential for life and access to clean drinking water is a necessity for good health. However, clean drinking water is not available everywhere, due to water scarcity and pollution of existing water resources. The pollution can be in the form of natural or anthropogenic activities. This study focuses on the Impact of anthropogenic activities on the water quality of 4 tanks in Coimbatore city and its contribution to the groundwater quality. Due to encroachment and other anthropogenic activities, the quality of water is being depleted rapidly. Disposal of municipal waste and waste from other various industries into the tank will deplete the quality of water in the tank. This water along with the leechate may percolate through the pore spaces between the soil particles and interact with the groundwater. Because of this interaction the quality of groundwater will also be affected. The contaminants will be transported and contribute to the nearby well head and affect the quality of water in the well too. Therefore, in this study, water quality parameters for both surface and groundwater will be tested and spatially interpolated using ArcGIS. After obtaining the spatially interpolated water quality map, the social consequences will be analysed using PRA tools (Questionnaire survey).**

Key words- Water quality, Spatially Interpolated Water quality map, PRA Tools.

I.INTRODUCTION

Water is the basic element of social and economic infrastructure and is essential for a healthy society and sustainable development**.** Water that exists in the pore spaces and fractures in rock and sediment beneath the Earth surface is called Ground water. Groundwater is being the favourite alternative to water provided through taps, is facing threats due to anthropogenic activities in India, which has led to deterioration of ground water quality. Hence, monitoring of ground water quality has become indispensable. The water used for drinking purpose should be free from any toxic chemicals, living and non living organism and excessive amount of minerals that may be hazardous to health. At present, groundwater is not excessively used for drinking purpose except in few areas. The quality of groundwater is influenced by the surface wáter quality upto some extend depending upon the lithological charateristics. Therefore it is important to assess both the surface and ground wáter quality in order to study about the impact of these wáter on human health.

Waste disposal has always been an important issue for human societies. Solid wastes are disposed on or below the land surface resulting in potential sources of groundwater contamination. As the natural environment can no longer digest the produced wastes, the development of solid waste management has contributed to their automated collection, treatment and disposal.However in many landfill sites because of lack of lining and precautions in the construction, the seepage of leachate is found. Leachate is defined as the polluted liquid emanating from the base of the landfill. The downward transfer of leachate contaminates groundwater resources, whereas the outward flow causes leachate springs at the periphery of the landfill that may affect surface water bodies. Hence, leachate seepage is a long- term phenomenon that must be prevented in order to protect natural water resources.The waste generated from biomedical waste, clinics, hospitals, nursing homes, pathological laboratories, blood banks and veterinary centers have also been disposed along with municipal solid waste at disposal site. This waste is hazardous to human being and environment.

II. SCOPE

Groundwater is one of most important alternative source which could be used for drinking, when there is a demand for surface water. However, clean drinking water is not available everywhere, due to water scarcity and pollution of existing water resources. The pollution can be in the form of natural or anthropogenic activities. Fluoride contamination of groundwater is a growing problem in many parts of the world. The major sources of fluoride in groundwater are due to fluoride- bearing minerals such as fluorspar, cryolite, fluorapatite and hydroxylapatite in rocks. Some anthropogenic activities such as use of phosphatic fertilizers, pesticides, sewage and sludge, depletion of groundwater table etc., contribute to water scarcity and pollution. In the places like Coimbatore which is rapidly

developing, the water quality parameters of groundwater have to be tested and inferred whether it could be made use for drinking purpose.Since the water quality parameters are spatially varied it is important to spatially interpolate it using ARCGIS software. Impact of this polluted water on human health and other social consequences can be assessed using Participatory Rural Appraisal (PRA) Tools.

III.GROUNDWATER POLLUTION

Ground water is a long-term reservoir of the natural water cycle, which originates from rainfall or snow and is dynamic in nature.It is a globally important and valuable renewable resource for human life and economic development. It constitutes a major portion of earth's water circulatory system known as hydrological cycle and occurs in permeable geologic formation known as aquifers i.e. formations having structure that can store and transmit water at rates fast enough to supply reasonable amounts to wells. These are affected by factors such as, the expansion of irrigation activities, industrialization and urbanization. Hence, monitoring and conserving this important resource is essential. The quality of water is defined in terms of its physical, chemical and biological parameters. Ascertaining the quality of groundwater is crucial before its use. Groundwater assessment has been based on laboratory investigation, but the advent of Satellite Technology and Geographical Information System (GIS) has made it very easy to integrate various databases.

Groundwater pollution may be defined as the artificially induced degradation of natural groundwater quality. Pollution can impair the use of water and can create hazards to public health through toxicity or the spread of disease. Most pollution originates from the disposal of waste water which is being used for variety of purposes. In contrast with surface water pollution, subsurface water pollution is difficult to detect and is even more difficult to control, and may persist for decades. With the growing recognition of the importance of underground water resources, efforts are needed to increaseto prevent, reduce, and eliminate groundwater pollution.

IV. STUDY AREA DESCRIPTION

Coimbatore city is an Upland plateau region with hill ranges, hillocks and undulating plain. The major drainages of the city are Bhavani, Noyil, Amaravthi and Ponnani rivers.

Coimbatore city has 8 surface water tanks along the noyal river stretch. There are 21 Anaikuts and 31 Tanks in noyal river system, Among them 8 tanks are located in Coimbatore namely, Narasampathi, Krisnampathi, Selvampathi, Kumarasamy tank, Selvasindhamani, Ukkadam periyakulam, Valankulam, Singanallur tank, that serves Coimbatore district in noyal river system.All these tanks are located to the north of Noyal River. Among these tanks, our study area is 4 downstream tanks. Since the downstream tanks are comparatively more polluted the study will be carried over there. Flow through all these tanks are only through gravity.

Chitrachavadi anaikut has been constructed across the Noyal River to divert water into Chitrachavadi canal which is 11.75 kms long.The first five tanks are being fed by the Chitrachavadi canal.Coimbatore anaikut has been built across the Noyal river, near perur to divert the water into Coimbatore canal located 3kms away from Coimbatore big tank. Coimbatore Big tank is being fed by this Coimbatore canal. The surplus water from Coimbatore big tank is fed into Valankulam. Singanallur anaikut has been constructed across noyal river system to Serve Singanallur tank which is located 3kms away from the anaikut. More waste from government hospitals has been dumped into valankulam. More drainage waste are being dumped into singanallur tank. The concentration of the contaminants and the type of contaminant vary from tank to tank. Hence, samples are collected separately at various locationof all the four tanks and the water quality parameters are also spatially interpolated.

4.1.1 RAINFALL AND CLIMATE

This region receives rainfall at the time of shifting Climaticwindbelts, but it is in the rain shadow track during the southwest monsoon. During the Northeast monsoon season, due to its interior location the amount of rainfall received is also limited wen compared to oter districts of Tamilnadu. Coimbatore has a pleasant, salubrious climate due to its proximity to thickly forested mountain ranges and the cool breeze blowing through the Palghat gap which makes the consistently hot temperatures pleasant. The average annual rainfall is around 700 mm (27.6 in) with the North East and the South West monsoons contributing to 47% and 28% respectively to the total rainfall. This rainfall is not enough to sustain the needs of the city for the entire year and the shortage is made up through water supply schemes like Siruvani, Pilloor and Athikadavu.

4.1.2 GROUNDWATER STATUS

Groundwater level in the district has gone down drastically in a few places. Recent reports with the Tamil Nadu Water Supply and Drainage Board suggests that the average drop in water level is five metres in the district. The

Board monitors water supply twice a year before and after monsoon in May and January using the 38 observation wells it has dug across the district, covering all the 12 panchayat unions. The Board also studies the water level, which it says is potable in many rural areas. The worst affected areas in the district are the northern and eastern pockets.

.

V. METHODOLOGY

The quality of groundwater is influenced by the surface wáter quality upto some extend depending upon the lithological charateristics. Therefore it is important to assess both the surface and ground wáter quality using some laboratory experiments such as physico-chemical tests. In order to study about the impact of these wáter on human health and other social consequences, PRA tools can be used. After obtaining the test results a integrated water quality map of study area will be prepared considering the ground water quality parameters obtained from the laboratory test results using GIS software (ARCGIS).

VI. RESULTS AND DISCUSSION

Water quality parameters were obtained by testing the samples in the laboratory and the obtained parameters were spatially interpolated along the study area(Selvacindamani Tank, Ukkadam Tank) using ARCGIS software. The results are shown below

TEST RESULTS FOR SELVACHINDAMANI TANK

Lat	Long	ALKALINIT	EC(ms/cm	CL(mg/l)	TDS	pH	TURBIDITY	TOTAL HAF
10.9937	76.9463	700	3.74	349.83	50	8.23	83.2	310
10.9938	76.9491	915	2.13	165.92	30	7.17	6.2	800
10.9989	76.9444	605	2.77	223.89	40	8.3	3.8	115
10.994	76.9481	630	3.23	277.86	60	7.11	4.5	615
10.993	76.9493	745	3.52	237.88	90	8.33	5.1	100
10.9925	76.9463	995	3.41	177.91	140	7.41	8.3	955
10.9934	76.9485	805	3.49	129.94	50	7.18	6.2	725
10.99	76.9462	1105	3.44	157.92	60	8.23	4.2	85
10.991	76.9481	1150	3.39	193.9	40	7.27	6.2	645
10.9912	76.9492	550	5.26	543.73	120	7.28	8.4	1205
10.9925	76.9475	1375	3.13	209.9	10	7.42	5.9	895
10.9897	76.9457	835	4.79	355.82	90	7.21	6	620

TEST RESULTS FOR UKKADAM TANK

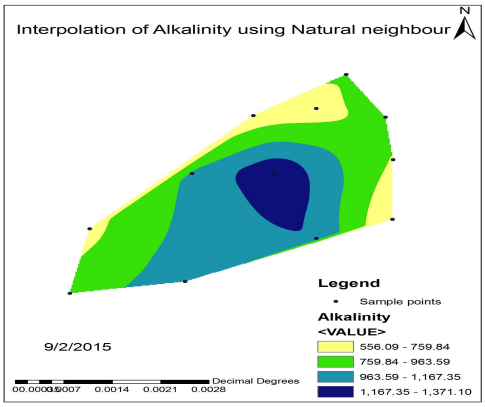
Lat	Lon	ALKALIN	pH	TURBIDI	CHLORII	EC(ms/cm	TOTAL H	TDS
10.9789	76.9599	455	7.52	42.3	917.54	1.91	175	40
10.9843	76.9494	570	7.11	5.8	353.82	7.9	525	40
10.98806	76.961	360	7.13	5.3	143.93	1.9	650	20
10.9813	76.9617	595	7.06	5.7	479.76	3.48	1260	40
10.9778	76.9619	575	7.8	5.6	123.94	3.79	450	40
10.98545	76.9629	575	7.25	6.6	163.93	4.46	365	90
10.98683	76.9563	470	7.24	6.2	139.93	3.47	300	30
10.97875	76.9476	365	7.08	5.6	223.89	1.92	720	20
10.9776	76.959	580	7.11	5.8	513.74	3.79	1710	30
10.978	76.9555	495	7.65	37.2	345.83	4.29	200	50
10.9867	76.9565	340	7.77	49.9	463.37	1.94	210	10
10.9889	76.9594	525	7.33	43.5	248.57	2.77	260	30

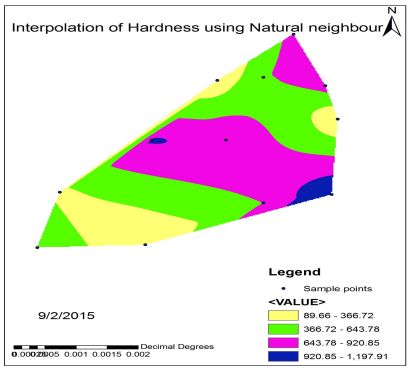
The permissible limits for drinking water according to IS: 10500.1991 are,

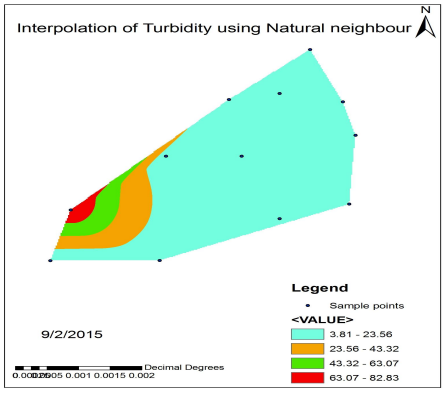
PARAMETER	PERMISSIBLE LIMIT
PH	6.5 to 8.5
Turbidity	5 to 10 NTU
Hardness	300 to 600 mg/l
Chloride	250 to 1000 mg/l
TDS	500 to 1000 mg/l
EC	< 2500 µS/cm
Alkalinity	200 to 600 mg/l

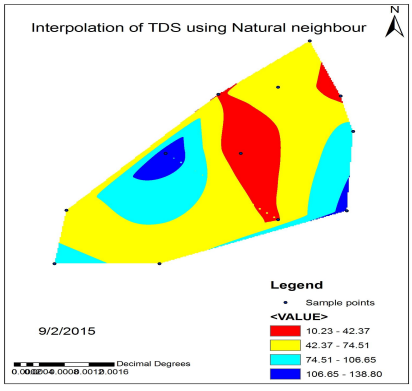
By Comparing the Obtained results with the permissibe limits according to IS: 10500.1991, we could infer that the parameters such as Alkalinity , Hardness, Turbidity etc.., for both the tanks are not witin the permissible limits.

6.3 SPATIALLY INTERPOLATED WATER QUALITY MAP FOR SELVACHINDAMANI TANK



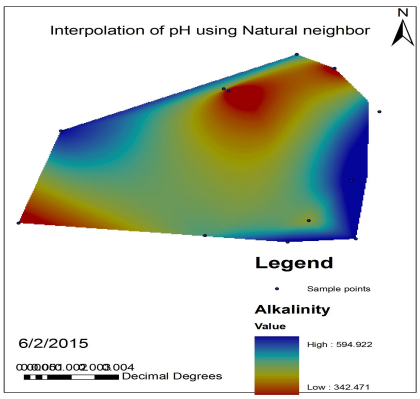


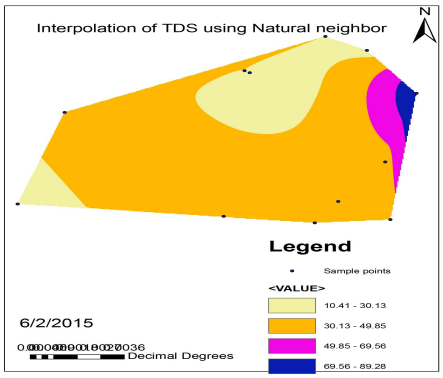


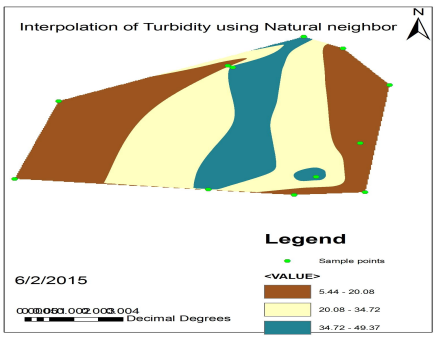


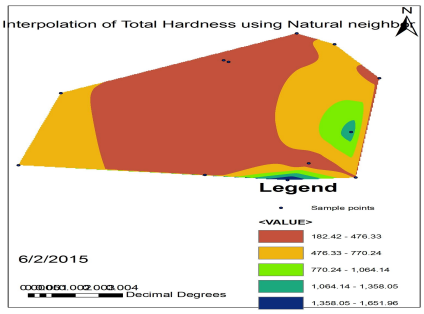
On viewing the Spatially Interpolated water quality map, the sample points whose parameters are exceeding the permissible limits could be identified.

6.4 SPATIALLY INTERPOLATED WATER QUALITY MAP FOR UKKADAM TANK









This spatially interpolated water quality map will be helpful in determining the contamination range troughout the boundary of the tank.

VII. CONCLUSION

In this paper, the water quality parameters are obtained by doing physico-chemical test in the laboratory. After obtaining the test results, Sample collection points are located in ARCGIS Software and Spatially interpolated water quality map are obtained. On viewing the map, the range of contamination troughout the boundary of the tank can be determined. After knowing the range and amount of contamination, Semi-structured interview could conducted to know about the health impacts of the people residing in and around the study area and other social consequences.

REFERENCES

[1] Abdesselema Kabour, Heni Azedine, Chebbah Lyndac, Sadek Younesa (2012), "Wastewater Discharge Impact on Groundwater Quality of Béchar City, Southwestern Algeria: An Anthropogenic Activities Mapping Approach" *Procedia engineering* vol: 33, pp.242-247.

[2] Asadi.S.S , Padmaja Vuppala, M. Anji Reddy(2007),"Remote Sensing and GIS Techniques for Evaluation of Groundwater Quality in Municipal Corporation of Hyderabad (Zone-V), India", International journal of Environmental research and public health, vol:4, pp: 45-52 ..

[3] Balacandar.D,Sundararaj P, Rutharvel Murthy.K. Kumaraswamy.K (2010), "An Investigation of Groundwater Quality and Its Suitability to Irrigated Agriculture in Coimbatore District, Tamil Nadu, India – A GIS Approach", International Journal of Environmental sciences, Vol;1,2, pp.176-190.

[4] Barde Anupama, Jain.S.S, Mali.S.T (2014), "Groundwater Contamination due to Landfill Leachate at Urali devachi and Validation with Argus One", International Journal of Research in Advent Technoloy, vol.2, pp.438-453.

[5] El-Hames A.S, M. Al-Ahmadi, N. Al-Amri(2011), "A GIS approach for the assessment of groundwater quality in Wadi Rabigh aquifer, Saudi Arabia",Enivironmental earth science,vol.63.pp.1319-1331.
[6] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.
[7] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
[8] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
[9] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
[10] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.
[11] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.
[12] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
[13] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749
[14] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
[15] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
[16] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019
[17] Sanjay Kumar Goyal, B. S. Chaudhary, Omvir Singh, G.K.Sethi, Praveen K. Thakur,(2010), " GIS based spatial distribution mapping and suitability evaluation of groundwater quality for domestic and agricultural purpose in Kaithal district, Haryana state, India", Environmental Earth Science, vol: 61,pp: 1587–1597.
[18] Suryawanshi Rajkumari, Khan.I.A (2014), "Assessment of Ground Water Quality and its Spatial Distribution Near Old Landfill Site of Kothrud, Pune", The International Journal Of Science & Technoledge, vol.2, pp.201-207..
[19] Jin-zhu MA, LAI Tian-wen, LI ji-jun (2002), "The impact of human activities on groundwater resources in the south edge of tarim basin, xinjiang" Chinese geographical science, vol: 12(1), pp.50-54.
[20] Yadav Arun, Abhijit Sonje, Priyanka Mathur, Amrish Chandra, Jain.D.A and Chandrakant Pardeshi (2012),"Detailed Study Of Ground Water, Contamination Sources & Approches To Clean Ground Water",International Journal Of Comprehensive Pharmacy,vol.3,pp.201-207.