JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Characterization of Drinking Water in Rural and Urban Periphery of Nagpur City

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Abstract: Water is the most significant resource for fulfilling need for drinking water, water system, modern, business, and different purposes. India is the world's biggest client of groundwater. It drinks around 230 cubic kilometers of groundwater every year. Ground water is utilized in over 65% for flooding farmland and 30% for drinking water supply and rest of the ground water is utilized for other reason. Water is the main hotspot for provincial and metropolitan regions among the three types of ecological media (air, soil, and water). It intends that in India, both metropolitan and provincial drinking water supplies are unequivocally dependent on precipitation designs.

Water pollution and general wellbeing are becoming key worries because of expanded industrialization and commercialization in the metropolitan and provincial periphery areas of urban communities. Ground water levels are quickly diminishing, and ground water tainting is turning into an inexorably difficult issue. When the hydrological, geographical, and climatic conditions are not helpful for the cycle, direct removal of wastewater on open land brings about soil contamination along with ground water contamination. Taking into account this ground water (drinking water) contamination in the metropolitan and country periphery regions, this study presents a detail assessment, examination and conversation the impact of fundamental factors causing drinking water effect and general wellbeing risk in metropolitan and rustic periphery region of the Nagpur city.

***Index Terms* – Drinking Water, Water Treatment, Waste Water Treatment, Low Cost Waste Water Treatment**

I. INTRODUCTION

Around 71 % of the world's surface is covered with water, and the seas hold around 97 % of the world's water for example saline water, consequently there is just 3 % is in a usable structure. Out of this 3.5 %, just 0.5 % of water is in fluid structure and accessible in streams, lakes, lakes, and groundwater and the leftover 2.5 % of water is in frozen structure and accessible in ice sheets. Water was generally used for homegrown and irrigational purposes a long time earlier, yet in view of quick metropolitan and modern turn of events, a tremendous proportion of water is presently being used in collecting creation lines for taking care of, cooling, cleaning, and various purposes. Because of quick urbanization and evolving ways of life, there has been an ascent in water interest for both modern and homegrown purposes, expanding wastewater age. A ton of rough sewage is delivered straightforwardly in the normal water sources like streams, lakes, and lakes due to lacking sewage movement and treatment offices. The normal water source creates critical financial action, upholds endless vocations, particularly among unfortunate ranchers, and altogether changes the water qualities of regular streams. Water request keeps on ascending because of fast modern turn of events and rising per capita water interest, environmental change causing moving atmospheric conditions in populated regions, and rising populace and relocation from dry season inclined regions.

Most family and business wastewater is delivered without any treatment or exclusively after fundamental treatment in many non-industrial countries. Pretty much 15% of produced wastewater in Latin America continues through treatment plants. Indeed, even in exceptionally evolved nations like China, almost 55% of waste is released untreated. The consolidated sewage age of India's group I and class-II urban areas is 62000 MLD in the year 2014-15. Though complete treatment limit, including existing and arranged or under development stages, is just 23277 MLD. It implies there is as yet a 62.46 % hole in sewage treatment limit. Civil and business wastewater is the most broadly perceived sorts of wastewater in the low-hearty waste stream, which is portrayed by low regular strength and high residue division. The accessibility of wastewater treatment offices is critical on the grounds that wastewater contains an immense volume of natural and inorganic matter that retains the broke up oxygen accessible in freshwater when released straightforwardly into normal water sources, causing oxygen misfortune and the mortality of oceanic life. Untreated wastewater can likewise contain supplements like nitrogen and phosphorous, which animate amphibian plant development and cause eutrophication in water bodies. This additionally incorporates microbes that cause water-borne infections which influence both human and creature wellbeing. Because of an absence of treatment framework, wastewater becomes caught in the waterway or channel, making natural matter decay and the creation of rotten gases. Sewage treatment plants, either concentrated or decentralized, may deal with metropolitan sewage. Albeit enormous modern offices can have broad in-plant treatment, a few production lines spill wastewater straightforwardly into water sources, which is unsuitable.

The metropolitan and country drinking water supplies in India transfer on vigorously on precipitation design spatial dissemination of precipitation has been upset because of a worldwide temperature alteration and other worldwide peculiarities like Elnino and so forth. Administration of India has guaranteed drinking water at the rate 50 to 150 LPCD in rustic and metropolitan region separately. LPCD around 80% of these amounts rising as waste water, sewage water, dim water. It is realized that sewage is still to be given to metropolitan and country region.

1.1. Aim of the Study:

This study means to fundamentally examinations the savoring water metropolitan and provincial periphery region of the Nagpur city and give fitting suggestions to decrease the water contamination in view of the outcomes acquired.

1.2. Problem Identification:

Drinking water quality in the Nagpur city is draining step by step because of ascend in the commercialization and industrialization encompassing the city. Lately, people groups seeing a large number of the water related issues in the city, for example, exhausting the water quality status of the local area or individual water wells, tube wells and surface water sources in metropolitan and country periphery region of the city. Resolving this issue will give fitting arrangement over the tainting of the water bodies and give perfect, usable, and consumable water to the living local area. It will likewise add to neighborhood specialists like Municipal Corporations, Gram Panchayats to get genuine status of the water bodies and ideal medicinal measures to control the tainting.

1.3. Objectives of Project:

1. To fundamentally examine the boundaries of the drinking water gathered from the metropolitan and provincial periphery region of the Nagpur City in various times of the year.
2. To screen and examine change in the qualities of the water from the testing locales all through the year by gathering and breaking down the water tests in unambiguous time spans.
3. To Suggest the fitting proposals and great practices to the neighborhood bodies like Gram Panchayats, Nagar Nigam and Municipal Corporation in decrease of water contamination.
4. To propose and plan the minimal expense treatment offices to the neighborhood bodies to stay away from the tainting of the dirtied water in consumable water.

II. METHODOLOGY

This study is completed on the drinking water tests gathered from the metropolitan and country periphery region of the Nagpur city. At first the locales for the inspecting are distinguished in view of the specific measures like momentum accessibility and wellspring of water and its status. The testing locales are the drag wells or dug well and other surface water source agreeing the accessibility. After the site choice of examining destinations, the real water inspecting was completed and the water tests are then dissected completely in the testing lab. The impending areas makes sense of the insights regarding site choice, example assortments, examination and results.

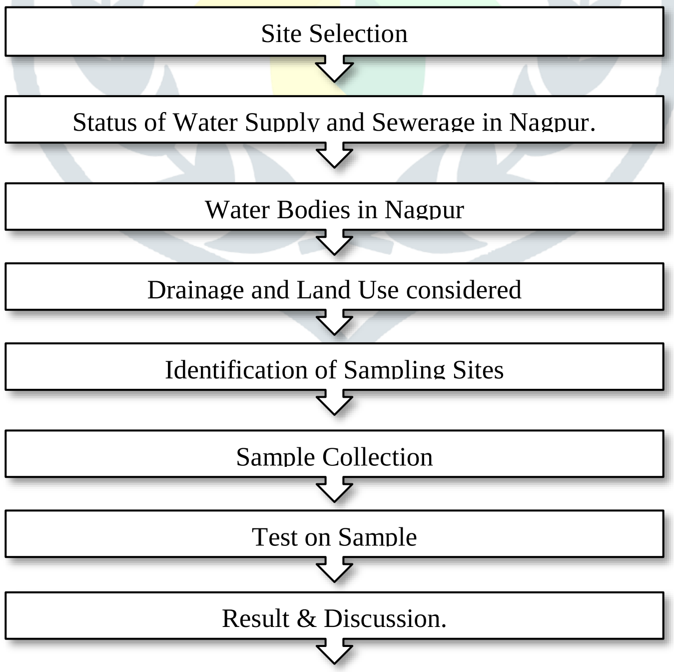

Fig: Flow chart of Methodology

2.1. Site Selection.

Nagpur is one of the significant urban communities of the Maharashtra territory of India and it is greatest city in the Vidarbha area. It lies on 21° 09' N scope and 79° 09' E longitude at a height of 310 m from mean ocean level (MSL) and has an area of 227 km2. The number of inhabitants in Nagpur city according to 2011 statistics is 2,405,665 out of which 1,225,405 are male and 1,180,260 are female. The typical proficiency pace of the city populace is 91.92% and sex proportion is 963. The way of life of individuals of this metropolitan city is great since it has various offices including medical care, instructive, water supply and disinfection offices, framework, power, business and work open doors and so on. Albeit the city has various offices still these are not sufficient because of constant expanding populace and never-ending suburbia.

2.2. Status of Water Supply and Sewerage in Nagpur.

Nagpur Municipal Corporation is answerable for giving urban conveniences remembering water supply and disinfection offices for Nagpur. Nagpur Municipal Corporation has channeled water supply admittance to 80% of its residents. The current water treatment limit and water supply in Nagpur city is almost 650 MLD and the wellspring of crude water are three surface water sources in particular Pench Canal, Kanhan stream, and Gorewada Tank.

Sewage age in the city is almost 550 MLD out of which 330 MLD of sewage is being treated at different sewage treatment plants arranged in the city. For the most part a piece of treated and untreated sewage is released into water bodies like Nag stream and Pili waterway and some piece of treated sewage is being reused. The current STPs are 130 MLD limit sewage treatment plant at Bhandewadi in Nagpur grew mutually by Nagpur Municipal Corporation and MAHAGENCO and second sewage treatment plant of limit 200 MLD created under PPP model for Nagpur Municipal Corporation. The treated sewage of 130 MLD limit STP is being reused by Koradi Thermal Power Station of MAHAGENCO. Third STP of 150 MLD limit is at arranging stage which is probably going to be begun toward the finish of 2020. There is additionally plan for reuse of treated sewage from third STP by NTPC's Mouda Thermal Power Station close to Nagpur. There are plans for decentralized wastewater treatment at little STPs along the stretch of Nag stream and Pili waterway to save these streams from contamination due to immense amount of untreated sewage.

2.3. Water Bodies in Nagpur.

The city of Nagpur has many water bodies including Ambazari lake, Futala Lake, Gorewada Lake, Telangkhedi lake, Sonegaon and Gandhisagar lakes and so forth and a few little lakes including Naik Talav. Streams like Nag waterway, Pilli nadi, and some other regular nallah course through city shaping normal seepage example of the city. Aside from every one of these water bodies accessible in the Nagpur city. The drinking water supply of the city is subject to the outside water supply like dam water. The dam supplies like Pench, Vadgaon, Gorewada, Kunwara Bhimsen repositories satisfy the water need of the city. Alongside these water sources a significant number of the region in the city utilizes a water sources like cylinder wells, wells and other surface water sources like lakes and lakes. The wells and cylinder wells are either private individual or might be NMC given. The majority of the wells and cylinder wells are as of now being used by the occupant close by and a large portion of the wells and cylinder wells are viewed as bountiful. The water from these sources are for the most part utilized for the drinking and other family use. A portion of the occupant who having their own wells are involved that water for the planting and washing reason moreover.

At the point when discuss the rustic periphery region of the Nagpur city, the greater part of the occupants is basically depending upon their own water source like open dug well or bore wells. The provincial periphery region encompassing the Nagpur city incorporates large numbers of towns which are straightforwardly associated with the city water supply. A portion of the towns are taking benefits of the Municipal companies everyday water supply. Be that as it may, here are a portion of the towns found which are absolutely reliant upon their own wellspring of water. The well and cylinder well water is for the most part utilized for the drinking and other family utilized alongside the rural use too.

2.4. Drainage and Land Use.

To comprehend the regular waste example of the Nagpur city alongside the country periphery region, the seepage guide of the encompassing area of sweep 10 km from the focal point of the city is ready. The seepage map as Digital Elevation Model (DEM) is displayed in the figure.

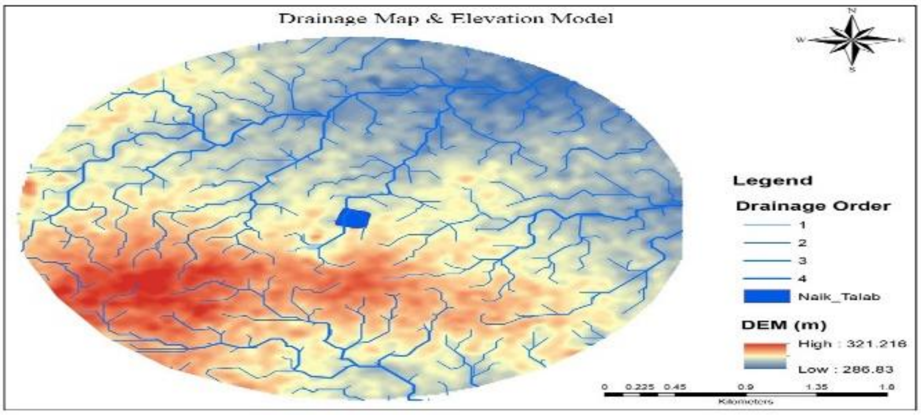

Figure 2.1: Drainage Map and Digital Elevation Model of Urban and Rural area of Nagpur City.

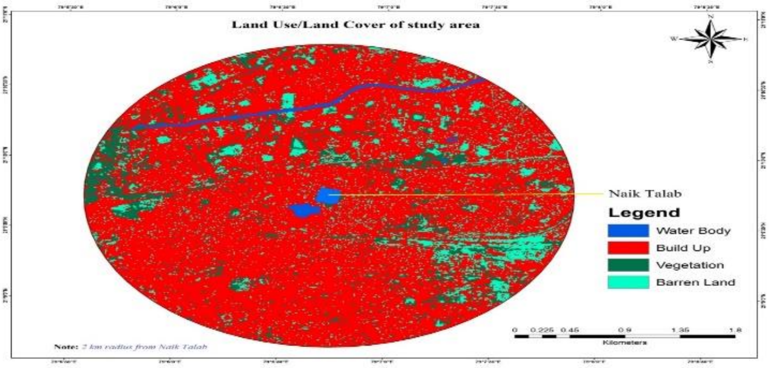

Figure 2.2: Land Use-Land Cover Map of the Nagpur's Urban and Rural Fringe Area.

2.5. Identification of Sampling Sites.

For the recognizable proof of the testing locales, a surveillance overview is led according to the information of wells, tube wells and surface water sources in metropolitan and rustic region of the Nagpur got by the civil company. From the observation review, a basic investigation has been finished over the studied destinations and precise examining locales is then recognized. The review is then separated into two sections metropolitan water sources and rustic water sources.

Table 2.1: Urban Sources of Wells/Tube Wells/Surface Source

Sr. No	Name of Source	Fringe	Type of Source	Depth of Water (Ft.)
1	ST. Vincent Paloti	Urban Area	Dug Well	20
2	Ramdaspeth	Urban Area	Dug well	22
3	Raghuji Nagar	Urban Area	Dug Well	19
4	Ganeshpeth	Urban Area	Dug Well	30
5	Cotton Market	Urban Area	Dug Well	50
6	Jaripatka	Urban Area	Dug Well	20
7	Panchpouli NMC	Urban Area	Bore Well	40
8	Shakardhara Lake	Urban Area	Surface water/ Lake	-
9	Suretech RO Outlet	Urban Area	Dug Well	15
10	Pardi , Rani sati	Urban Area	Dug Well	26
11	Dhantoli	Urban Area	Bore Well	55
12	Spandhan Heart	Urban Area	Dug Well	22
13	Reshambagh	Urban Area	Dug Well	25
14	Nandanvan	Urban Area	Dug Well	60
15	Wardha Road	Urban Area	Dug Well	20
16	Naik Lake	Urban Area	Surface water/ Lake	-
17	Manish Nagar	Urban Area	Dug well	25
18	Suraynagar	Urban Area	Bore Well	55
19	Jafar Nagar	Urban Area	Dug well	23
20	Gandhi Nagar hill	Urban Area	Dug well	20
21	Civil Lines	Urban Area	Dug well	15
22	Golibar Chowk	Urban Area	Dug well	22

Table 2.2: Rural Sources of Wells, Tube Wells and Surface Source

Sr. No	Name of Source	Fringe	Type of Source	Depth of Water (Ft.)
1	Jindal steel power	Rural Area	Dug Well	22
2	Mahalgaon	Rural Area	Dug Well	15
3	Hingna	Rural Area	Bore Well	55
4	Umread road	Rural Area	Bore Well	60
5	Balaji kalmeshwar yerla	Rural Area	Dug Well	59
6	Arneja rice mill katol	Rural Area	Bore Well	40

7	Bhilgoan Bore well	Rural Area	Dug well	25
8	Vihar ,Kamptee	Rural Area	Dug well	23
9	Bharathwada	Rural Area	Dug well	20
10	Saraswati Nagar	Rural Area	Dug well	15
11	Dighori	Rural Area	Bore Well	65
12	Shankarpura	Rural Area	Dug Well	25
13	Ghogli	Rural Area	Dug Well	15
14	Hudkeshwar	Rural Area	Bore Well	50
15	Koradi Thermal Plant	Rural Area	Dug Well	25
16	Wadi	Rural Area	Dug Well	30
17	Fetrigaon	Rural Area	Dug Well	35
18	Khaparkheda Thermal	Rural Area	Surface Water/	-
19	Lonaregaon	Rural Area	Dug Well	15
20	Kapsi	Rural Area	Surface	-
21	Gonhi	Rural Area	Dug Well	23

2.6. Sample Collection.

After complete the site determination, the wells, tube wells and surface water source are organized in metropolitan and rustic periphery class. According to our targets of the review we need to break down the drinking water quality in the metropolitan and rustic periphery region of the Nagpur city, thus I chose to take tests from the recognized destinations when the storm season. The rainstorm season is generally influencing the nature of ground water because of the weakening impact. The examining is then ordered in two classifications.

A) Pre-Monsoon Sampling, B) Post-Monsoon Sampling.

III. RESULTS AND DISCUSSION

After the successful sampling, the water sample was then properly stored in a controlled environment and then transfer to the chemical laboratory facility for additional chemical and biological examination. The example testing was acted in the CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur. The CSIR-NEERI is an exploration establishment made and subsidized by Government of India. It was laid out in Nagpur in 1958 with center around water supply, sewage removal, transferable sicknesses and somewhat on modern contamination and word related illnesses tracked down normal in post-autonomous India. NEERI is a trailblazer lab in the field of ecological science and designing and part of Council of Scientific and Industrial Research (CSIR).

It was chosen to figure out drinking water quality list for the sources which are being involved by purchasers in metropolitan and country periphery region, then snatch test were gathered and broke down by routine water quality measures boundary according to IS 10500 and IS 3025 (PH, Color, Alkalinity, TDS, Total Hardness, Turbidity, Calcium Hardness, Magnesium Hardness, Chlorides, Sulfates, Total Bacteria, Coliform, and E-Coli). The investigation of the example was completed according to the standard technique for assessment of drinking water, laid by the Bureau of Indian Standards (IS10500).

Convergence of the break up solids are relying upon land separation of the example and ecological area. Request was made for presence of line water supply on to the area Drinking water quality standards Index was determined by two techniques in particular Average Weighted number-crunching mean strategy, and Hourtels strategy.

pH, and temperature were estimated at site during the example assortment and staying physicochemical and bacteriological tests were directed in research center. The test aftereffects of tests gathered during the pre-storm season in shows in table.

3.1. Pre-Monsoon Results.

3.1.1. Test Results for Urban Water Source.

3.1.2. Test Results for Rural Water Source

3.2. Post-Monsoon Results.

3.2.1. Test Results for Urban Water Source

3.2.2. Test Results for Rural Water Source

Table 3.1.1: Test results for urban water source (Pre-Monsoon Results)

Sr. No	Parameters →	pH	Color	Alkalinity	Turbidity	TDS	Total Hardness	Chlorides	Sulphates	Total Bacteria	Coliform	E-Coli
Units	Source ↓	-	Pt. Co. Scale	mg/l	NTU	mg/l	mg/l	mg Cl/l	mg SO_4/l	Count/ ml	Count/ 100 ml	Count/ 100ml
	Permissible Limits (WHO)	6.5-8.5	15	500	5	1500	500	250	400	100	0	0
1.	ST. Vincent Paloti	7.2	4	200.90	2.78	918	224.08	123.40	132.45	20	0	0
2.	Ramdaspeth	7.1	3	150.78	1.50	1150	124.19	78.54	231.32	7	0	0
3.	Raghuji Nagar	6.9	2	300.45	3.46	1256	234.36	100.32	78.45	2	0	0
4.	Ganeshpeth	7.4	5	250.30	1.20	782	132.45	125.56	234.49	10	0	0
5.	Cotton Market	7.1	18	490.57	10.42	1980	650.78	306.45	415.70	135	8	5
6.	Jaripatka	6.8	7	320.59	3.41	820	230.43	78.32	142.10	12	0	0
7.	Panchpouli NMC	7	5	140.56	2.67	1127	137.69	98.34	98.10	5	0	0
8.	Shakardhara Lake	7.3	4	240.56	2.43	1287	123.67	132.67	85.54	3	0	0
9.	Suretech RO Outle	6.9	3	232.34	1.45	962	321.45	342.56	100.34	1	0	0
10.	Pardi, Rani sati	6.7	1	123.25	3.33	845	232.42	123.43	241.21	4	0	0
11.	Dhantoli	7.5	5	432.46	1.34	910	132.56	212.32	98.45	2	0	0
12.	Spandhan Heart	7.0	2	234.24	1.12	1230	45.21	67.76	245.53	15	3	1
13.	Reshambagh	7.1	1	98.35	2.23	987	154.67	98.42	231.87	5	0	1
14.	Nandanvan	7.5	18	524.67	8.45	1780	492.12	263.78	489.82	105	8	3
15.	Wardha Road	6.9	2	154.35	2.67	798	213.76	124.43	143.35	20	0	0
16.	Naik Lake	6.8	21	687.45	15.54	2059	667.43	309.89	469.76	89	10	5
17.	Manish Nagar	7.3	6	234.22	1.54	1140	231.22	132.54	112.34	3	0	0
18.	Suraynagar	7.0	8	125.45	2.32	1007	234.54	234.32	321.12	1	0	0
19.	Jafar Nagar	7.2	10	213.47	1.67	837	321.78	98.67	213.96	4	0	0
20.	Gandhi Nagar hill road	6.8	3	254.21	3.10	985	124.32	155.65	224.58	3	5	3
21.	Civil Lines	7.0	7	143.56	1.32	1189	98.43	132.56	115.43	2	0	0
22.	Golibar Chowk	6.7	10	435.34	4.78	1350	428.64	245.67	392.76	35	8	3

Table 3.1.2: Test results for rural water source (Pre-Monsoon Results)

Sr. No	Parameters ⇨	pH	Color	Alkalinity	Turbidity	TDS	Total Hardness	Chlorides	Sulphates	Total Bacteria	Coliform	E-Coli
Units	Source ⇩	-	Pt. Co. Scale	mg/l	NTU	mg/l	mg/l	mg Cl/l	mg SO4/l	Count/ ml	Count/ 100 ml	Count/ 100ml
	Permissible Limit (WHO)	6.5-8.5	15	500	5	1500	500	250	400	100	0	0
1.	Jindal steel powe	6.2	3	120.80	3.77	1640	234.88	213.48	231.65	5	0	0
2.	Mahalgaon	7.3	1	156.88	2.59	1008	324.79	99.57	234.62	8	0	0
3.	Hingna	7.9	16	456.75	20.45	1967	625.56	306.36	535.95	56	10	7
4.	Umread road	6.6	3	320.50	2.24	890	432.45	180.54	352.79	15	0	0
5.	Balaji kalmeshwar yerla gaon	7.5	18	632.67	25.47	2075	616.28	402.47	534.40	118	40	21
6.	Arneja rice mill katol road	7.7	6	129.79	2.45	1130	240.73	214.38	213.60	45	7	1
7.	Bhilgoan Bore wel	6	4	132.53	4.37	1445	243.66	110.74	100.90	4	0	0
8.	Vihar ,Kamptee	7.3	5	253.59	6943	918	223.57	232.65	115.84	4	0	0
9.	Bharathwada	7.7	7	272.35	2.95	820	321.49	347.57	180.74	5	0	0
10.	Saraswati Nagar	6.8	2	113.24	3.32	765	242.62	233.93	341.91	2	0	0
11.	Dighori	7.1	6	472.49	2.33	1137	137.54	312.72	238.55	2	0	0
12.	Shankarpura	7.4	1	236.84	5.17	980	245.25	347.78	87.52	40	7	5
13.	Ghogli	6.1	5	100.85	1.23	1245	354.66	116.62	131.84	30	4	1
14.	Hudkeshwar	7.2	2	224.63	1.48	832	134.18	100.88	153.80	5	0	0
15.	Koradi Thermal Plant	6.8	18	592.36	18.64	2160	567.75	316.73	514.65	30	12	8
16.	Wadi	6.2	1	356.46	1.55	975	298.73	187.89	188.78	5	0	0
17.	Fetrigaon	6.3	8	264.92	2.56	1289	78.62	132.54	192.84	6	0	0
18.	Khaparkheda Thermal	7.3	22	718.85	30.38	2580	683.58	616.32	689.72	34	18	10
19.	Lonaregaon	7.2	11	273.46	2.87	1008	381.58	128.77	273.86	3	1	0
20.	Kapsi	7.8	6	154.24	1.10	1006	324.72	99.64	124.38	1	0	0
21.	Gonhi	6.0	21	618.36	23.38	1943	603.48	305.59	415.13	48	21	15

Table 3.2.1: Test results for urban water source (Post-Monsoon Results)

Sr. No	Parameters →	pH	Color	Alkalinity	Turbidity	TDS	Total Hardness	Chlorides	Sulphates	Total Bacteria	Coliform	E-Coli
Units	Source ↓	-	Pt. Co. Scale	mg/l	NTU	mg/l	mg/l	mg Cl/l	mg SO4/l	Count/ ml	Count/ 100 ml	Count/ 100ml
	Permissible Limit (WHO)	6.5-8.5	15	500	5	1500	500	250	400	100	0	0
1.	ST. Vincent Palot	6.3	5	300.34	1.93	671	192.65	143.45	156.34	67	0	0
2.	Ramdaspeth	7.2	4	178.34	2.67	563	307.43	207.34	208.23	32	1	2
3.	Raghuji Nagar	7.1	7	239.43	3.56	927	190.34	112.45	301.34	10	2	0
4.	Ganeshpeth	6.9	5	103.70	2.54	801	203.45	206.34	163.45	8	1	0
5.	Cotton Market	7.0	22	519.54	15.34	2201	837.10	483.56	682.43	201	13	9
6.	Jaripatka	7.5	11	100.34	5.52	718	301.23	98.34	289.43	43	0	1
7.	Panchpouli NMC	7.1	9	298.56	4.12	662	274.78	110.34	102.56	9	0	0
8.	Shakardhara Lak	6.5	4	245.34	4.23	567	302.45	182.51	178.23	29	1	0
9.	Suretech RO Outlet	6.4	5	303.45	3.34	453	104.56	206.34	301.23	7	0	0
10.	Pardi, Rani sati Enterprises	7.3	1	224.67	1.45	698	228.32	100.34	206.23	11	0	0
11.	Dhantoli	7.0	6	109.32	1.73	839	410.23	198.34	229.24	5	2	0
12.	Spandhan Heart	6.8	2	342.45	3.21	306	368.45	93.24	189.67	10	1	0
13.	Reshambagh	7.1	5	209.67	2.13	800	389.32	103.78	266.21	9	0	0
14.	Nandanvan	7.6	23	892.45	17.34	2308	894.21	982.45	779.34	115	10	6
15.	Wardha Road	6.9	10	453.82	4.23	564	207.34	100.20	100.46	4	1	1
16.	Naik Lake	8.0	18	692.56	20.4	1980	1004.37	732.24	645.04	105	8	2
17.	Manish Nagar	6.3	4	235.90	2.43	735	392.55	100.23	306.21	17	1	1
18.	Suraynagar	7.2	9	306.67	2.78	609	302.43	167.21	278.38	11	0	0
19.	Jafar Nagar	7.4	4	200.32	2.78	892	290.4	120.32	146.32	10	0	0
20.	Gandhi Nagar h road	6.8	2	129.43	1.22	566	387.3	111.34	114.21	4	0	2
21.	Civil Lines	7.1	1	100.32	4.21	590	170.34	178.31	200.21	7	1	1
22.	Golibar Chowk	7.0	6	197.34	1.45	693	200.32	100.21	301.34	2	0	0

Table 3.2.1: Test results for urban water source (Post-Monsoon Results)

Sr. No	Parameters →	pH	Color	Alkalinity	Turbidity	TDS	Total Hardness	Chlorides	Sulphates	Total Bacteria	Coliform	E-Coli
Units	Source ↓	-	Pt. Co. Scale	mg/l	NTU	mg/l	mg/l	mg Cl/l	mg SO4/l	Count/ ml	Count/ 100 ml	Count/ 100 ml
	Permissible Limit (WHO)	6.5-8.5	15	500	5	1500	500	250	400	100	0	0
1.	Jindal steel powe	7.1	10	209.34	3.21	427	349.67	134.56	204.32	8	2	0
2.	Mahalgaon	6.9	4	398.32	1.35	572	239.31	104.67	103.21	4	1	0
3.	Hingna	7.0	17	580.56	21.21	2001	619.21	398.32	671.32	89	9	1
4.	Umread road	6.5	5	273.56	2.12	672	200.2	203.31	302.45	23	0	0
5.	Balaji kalmeshwa yerla gaon	6.9	20	782.45	18.42	1890	717.32	418.32	601.32	101	35	15
6.	Arneja rice mill katol road	6.5	3	365.65	3.65	1234	321.32	102.54	201.65	6	0	0
7.	Bhilgoan Bore we	7.4	4	345.43	2.76	1254	234.21	242.24	231.22	4	0	0
8.	Vihar, Kamptee	7.3	6	234.44	4.34	654	242.53	187.64	302.87	10	1	0
9.	Bharathwada	6.6	1	276.54	1.53	785	134.13	265.42	198.21	12	0	0
10.	Saraswati Nagar	7.7	4	347.25	3.56	1043	453.11	212.64	365.76	5	2	0
11.	Dighori	6.5	8	422.63	6.23	534	237.34	154.89	135.87	4	0	0
12.	Shankarpura	7.6	3	345.78	3.46	731	363.54	98.43	393.87	7	0	2
13.	Ghogli	6.8	4	134.42	2.42	1183	421.76	111.55	223.53	10	0	0
14.	Hudkeshwar	7.3	1	214.46	5.86	435	500.54	154.42	284.23	3	0	1
15.	Koradi Thermal	6.5	20	672.32	20.12	2001	589.32	410.21	601.31	25	10	6
16.	Wadi	6.5	3	156.86	3.53	657	342.45	102.53	103.90	8	3	0
17.	Fetrigaon	6.7	6	372.31	1.32	875	421.31	212.43	401.89	10	0	1
18.	Khaparkheda Thermal	7.1	15	620.32	25.32	2102	589.32	602.32	590.32	35	16	10
19.	Lonaregaon	6.5	10	206.64	4.56	503	302.32	100.21	302.23	10	0	0
20.	Kapsi	7.7	7	305.21	2.43	431	402.32	206.32	283.67	23	4	0
21.	Gonhi	6.7	9	200.44	3.78	250	305.44	120.33	201.32	17	2	0

During this study, including the rural and urban area of the Nagpur City, there are seven sites are found critical for the use of water. The water in the examined wells, tube wells and surface water source are being used by the surrounding community for the various purpose like drinking, washing, irrigation and other use. The surface water source like lakes are being used by the aquatic life, animals and birds for their survival. The contamination in such water bodies cause serious threat to the users, so that the immediate remedial measures are too important. Generally, the waste water generated in the city are treated by using domestic sewage treatment plants, but now a day, the working of such treatment facilities are serious concern because lack in funds availability and daily maintenance. The ground water and surface water sources are remains as it is, without any primary treatment. Due to the long storage and contamination of various toxic elements the ground water got polluted. To reduce the toxicity and have some control over the contamination, this study has been proposed some of the remedial recommendations as follows;

1. **Restrict dumping of waste:**
   During the site visit it is observed that, the wells and surface lake are heavily contaminated with the solid waste materials like plastic, papers, cardboards, green waste etc. which cause the main reason of the contamination. To reduce this, the dumping of waste should be strictly prohibited.
2. **Restrict the entry of contaminated storm water:**
   During the rainy season, the contaminated water directly entered into the surface water sources like lake/ponds. This need to be diverted in the flowing water sources like rivers or nallahs.
3. **Provision of low cost wastewater treatment facilities:**
   The main reason of the water contamination is the direct disposal of wastewater into the clean water sources. The provision of low cost wastewater facilities can give treatment to the raw sewage up to certain extends to reduce its toxicity. This step can reduce the contamination of surface as well as ground water sources also.
4. **Lining of sewage conveyance system:**
   In the Nagpur city, mainly in the rural area, most of the sewage conveyance is done by the nallahs which are found totally unlined in nature. These nallahs need to line to avoid percolation of the sewage in surrounding ground water sources.
5. Periodical cleaning of the water resources:
   As stated earlier also, the solid waste is observed in the well in rural and urban area and also in the sewage conveyance system like nallahs. These need to be cleaned in periodical basis to avoid any further contamination and blockage of nallahs.
6. **Diversion of waste stream to centralized STP:**
   To avoid the entry of the waste carrying stream into the fresh water sources like ponds/lakes, the waste stream should be connected to the centralized Sewage Treatment Plants.
7. **Avoid dumping of raw sewage into natural water sources:**
   During the study it is observed that the, in the Hingna and Thermal Power Plant like industrial areas, the individual industries are dumping the raw sewage directly into the natural streams. This need to be avoided.
8. **Strict actions against the culprits:**
   Industries dumping raw sewage into the natural streams are need to penalized by the local authorities and shall enforce them to incorporate the onsite treatment facilities to avoid further contamination of natural water bodies.
9. **Reporting of water Polluters:**
   Many cases of illegal waste disposal and other forms of water pollution go unreported and often are not cleaned up. The local authorities need to create a reporting system where peoples can report the water pollution cases in their particular areas.
10. **Enhancing solid waste collection system:**
    The local authorities need to enhanced the regular solid waste collection system in the city to collect the waste on door to door basis, this is how peoples can avoid dumping of solid waste into the natural stream or wells.
11. **Beautification and rejuvenation:**
    The natural water sources in the city need to be rejuvenate by providing self sufficient water treatment facilities. The rejuvenation can avoid the eutrophication in
    the water bodies and can help to keep water clean. The beautification of the water bodies can attract the visitors and water bodies can be acts as a revenue source to the local authorities.
12. **Strict action against the encroachment:**
    During the study, encroachment is observed surrounding the Naik Lake. The local authorities need to take a strict action against the encroachment to avoid the shrinking in the lake area.
13. **Promote people to support environmental charities:**
    Many environmental charities are working in the Nagpur city which are taking effort to provide clean water in the city and surrounding villages. The peoples need to support these charities in terms of physical, technological and financial aspects.
14. **People's Awareness:**
    The local governance need to increase the awareness and literacy into the community regarding the effective disposal of the solid waste, raw sewage. Need to conduct water literacy programs and educate the peoples about the effective use of water resources.

IV. ACKNOWLEDGEMENT

With deep sense of gratitude, I would like to thanks all the people who have lit my path with their kind guidance. I am very grateful to these intellectuals who did their best to help during my project planning work. It is my proud privilege to express deep sense of gratitude to Prof. Dr. A. S. Maheshwari, Associate Dean of SOET, Sandip University Nashik, for his comments and kind permission to complete this project planning work. We remain indebted to Ass. Prof. Mrs. Pranoti Sabale, Civil Department for her timely suggestion and valuable guidance. The special gratitude goes to project guide, staff members and technical staff members of Civil Department for their excellent and precious guidance in completion of this work.

V. CONCLUSION

The water samples form the urban and rural fringe area of the Nagpur city in pre-monsoon period is critically examined by performing ten types of examination tests. There are three number of site namely Cotton Market, Nandanvan, and Naik Lake in urban area are identified as a critical site which having the parameters exceeding the permissible limits. These sites need and immediate remedial measures to reduce the contamination. There are four numbers of sampling sites namely Hingna, Balaji Kalmeshwar, Koradi Thermal Power Plant, Khaparkheda, and Thermal Power Plant form the rural area are identified as critical sites.

Form the test results we can conclude that the critical site found in the study are located in the industrial, commercial or either in agriculture area and water from them are being used for the various purposes. Hence there is urgent need to remediate all the critical sites by providing an effective, ecofriendly and sustainable low cost wastewater treatment.

RENEU is a low cost and effective wastewater treatment which can help to the local authorities to rejuvenate the water bodies by restricting the entry of raw sewage and allow only fresh and treated water into them.

Study also has recommended fourteen best possible recommendations to the local authorities and public to prevent the water bodies from the contamination. It can have believed that, by adopting the remedial measures all critical site can be rejuvenate.

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