

BEFORE THE HON'BLE NATIONAL GREEN
TRIBUNAL, CENTRAL ZONE BENCH, BHOPAL

ORIGINAL APPLICATION NO.214/2024(CZ)

(O.A.NO.1076/2024-PB)

NEWS ITME PUBLISHED IN DAINIK BHASKAR

DT.13.08.2024 entitled as "सांवेर रोड़ के 53 इलाकों के भूजल में ममले घातक रसायन

400 उद्योगों पर शक, नोटिस 50 को, काययवाई मस 7 पर" (SUOMOTO)

INDEX

SL.NO.	PARTICULARS	PAGE NO.
1.	REPLY/REPORT ON BEHALF OF CENTRAL GROUND WATER BOARD	2 TO 7
2.	ANNEXURE-A PHOTOCOPY OF THE NEWS PAPER ARTICLE OF DEC. 2021	9
3.	ANNEXURE-B COPY OF THE TABLE OF PLACES FROM WHERE WATER SAMPLES WERE TAKEN	10
4.	ANNEXURE-C COPY OF THE REPORT OF WATER SAMPLES TAKEN	11 to 57
5.	ANNEXURE-D COPY OF THE LIST OF INDUSTRIES WHICH WERE EXEMPTED UNDER MSME	58
6.	ANNEXURE-E COPY OF THE LIST OF INDUSTIRES WHICH WERE TAKEN NOC	59
7.	VAKLATNAMMA	60

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**REPLY ON BEHALF OF CENTRAL GROUND WATER
BOARD(R-6)**

1. That the present reply/report is filed by श्री.मो. पार्वती पटेल
व/ो. सुनील कुमार aged 31 yrs Working as
Scientist (HA) Office at CGWB, NCR, Bhopal.
2. That I have gone through the official records maintained by the Respondent
No.6 and well versed with the facts and circumstances of the present case.
3. That I am competent and authorized to file the present reply on behalf of the
Respondent No.6.
4. That it is submitted that the issue mentioned in the Present Original
Application, Central Ground Water Board, NCR, Bhopal had initiated a suo -
motu study in January 2022, prompted by another newspaper article published
in the "नई दुननया: पड़ताल" daily in the month of December -2021, titled
"सांवेर रोड औद्योगिक क्षेत्र में भूजल पीने योग्य नह ां". The copy of the News Paper article


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भारत सरकार / Govt. of India भोपाल / Bhopal

is annexed as **Annexure-A**.

5. That the Central Ground Water Board has took samples from various locations in and around Kumedi Village, Sanwer Block, District Indore, M.P.. The table of places where the samples were taken is annexed as **Annexure-B**.

6. The published report titled "*Hydro Geo-Chemical Investigation in and around Kumedi Village, Sanwer Block, District Indore, M.P.*" had the following key points related to water quality.

- a. Groundwater samples were collected from 29 different locations, including dug wells (2), hand pumps (5), and bore wells (22) in and around Kumedi village in the Sanwer industrial area. The details of the sampling locations are provided in Table 1 and Figure 1
- b. The following water quality parameters were analysed: temperature, pH, electrical conductivity (EC), total hardness, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, fluoride, nitrate, sulfate, phosphate, silica, along with selected trace/heavy metals such as antimony, arsenic, cadmium, chromium, copper, iron, lead, nickel, manganese, mercury, tin, uranium, and zinc.
- c. The electrical conductivity of water in and around Kumedi village ranged in between 990 to 5390 $\mu\text{S}/\text{cm}$ at 25°C. The electrical conductivity more than 3000 $\mu\text{S}/\text{cm}$ at 25°C was recorded in 7 locations namely BW-02, HP-01, HP-05, BW-12, BW-13, BW-18 and BW-19. The maximum electrical conductivity i.e. 5390 $\mu\text{S}/\text{cm}$ at 25°C was recorded at HP-1 of Ram Mandir, Kumedi village.
- d. The study area found free of carbonate concentrations. The bicarbonate concentration observed in between 43 to 616 mg/l. The maximum bicarbonate concentration was found at Ram Mandir, Bhangiya (HP-05: 616 mg/l).


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- e. The Chloride concentration was observed in between 79 to 1010 mg/l. The chloride concentration of more than the permissible limit of 1000 mg/l was observed at the house of Rakesh Panchal, Bhangiya village (BW- 12: 1010 mg/l).
- f. The sulphate concentration ranged in between 37 to 477 mg/l. The maximum sulphate concentration which is also more than the BIS permissible limit i.e.400 mg/l was observed at Ram Mandir, Kumedi village (HP-1: 477 mg/l).
- g. The fluoride concentration in water samples observed in between 0.26 to 3.40 mg/l. The fluoride concentration in all water samples was found within the maximum permissible limits of BIS (1.50 mg/l) except the three locations namely: BW-11(2.35 mg/l); BW-18(3.10), and HP-04(3.40 mg/l).
- h. The nitrate concentration in ground water samples ranged in between 5 to 400 mg/l. Out of 29 ground water samples; 8 samples (27.6%) recorded nitrate concentration within the BIS acceptable limit (45 mg/l), whereas 72.4% (21 nos.) samples recorded more than 45 mg/l. The maximum concentration of nitrate was observed at Ram Mandir, Kumedi (HP-01; 400 mg/l). It is worthwhile to note that nitrate salts are highly soluble in groundwater whose presence is tied to nature's nitrogen cycle. The primary sources of nitrate introduction in groundwater come from the decomposition of animal and plant waste, septic systems, or agricultural field run-off from fields fertilized with ammonia.
- i. There is no nutritional basis for the regulation of phosphorus levels in the Indian drinking water supplies. The World Health Organization (WHO,1999) recommends 0.1 mg/l and 1.0 mg/l concentrations of PO₄— respectively as desirable and permissible levels for drinking water. In all locations except one DW-12(0.2 mg/l), the phosphate concentration in the study area was observed Below Detection limit (BDL).
- j. There are no agreeable primary or secondary contaminants limits of silica for drinking water prescribed either by Bureau of Indian Standards (BIS) or any other slimier agency like US EPA, WHO. The silicate concentration in

- the samples around study area ranged from 27 to 60 mg/l.
- k. The total hardness of water samples in Kumedi village industrial area ranged in between 120 to 1760 mg/l. The total hardness observed more than BIS maximum permissible limit i.e. 600 mg/l was recorded in 68.9% of samples (20 out of 29 samples). The maximum concentration of total hardness was observed in ground water of HP-01 (1760 mg/l).
 - l. The calcium concentration in water of Kumedi industrial area ranged in between 32 to 328 mg/l. The calcium concentration observed more than BIS permissible limit i.e. 200 mg/l in 11 samples out of 29. The maximum concentration of calcium was observed in ground water of HP-01 (328 mg/l).
 - m. The magnesium concentration in water of Kumedi village industrial area ranged from 2 to 229 mg/l. The magnesium concentration observed more than BIS maximum permissible limit i.e. 100 mg/l in 7 out of 29 ground water samples. The maximum concentration of magnesium concentration has been observed in ground water of HP-01 (229 mg/l).
 - n. The sodium concentrations in the study area were observed in between 22 to 380 mg/l. The maximum concentration was found in HP-1 of Kumedi (380 mg/l). It is worthwhile to note that BIS did not prescribe either desirable or permissible limits for sodium.
 - o. The potassium concentrations in the study area were observed in between 1.5 to 189 mg/l. The maximum concentration has been found in Ram Mandir, Bhangiya (HP-5: 189 mg/l). It is worthwhile to note that no numerical BIS drinking water quality guideline exists for potassium
 - p. The iron concentration was found in the range of 0.009 to 0.735 mg/l and it was within BIS permissible limit i.e. 1.0 mg/l. The maximum iron concentration was observed in the BW-06 (0.735 mg/l) situated in the agriculture field of Mr. Prakash owner in Kumedi village.
 - q. Zinc is an essential micro-nutrient and beneficial element for human bodies. The Bureau of Indian Standards prescribed desirable and

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permissible limits as 5.0 and 15.0 mg/l respectively. The concentration of Zn in water samples varied from 0.026 to 2.8 mg/l and in all locations, it was within the BIS desirable limit. The maximum concentration of zinc was observed in the ground water sample taken from hand pump (HP- 01) near Ram Mandir in Kumedi village (2.8 mg/l).

- r. The permissible BIS limit of Nickel in drinking water is 0.02 mg/l with no relaxation. In our study area the Nickel concentration was recorded in between 0.007 to 0.194 mg/l. Four out of 29 (13.7%) samples recorded nickel concentration more than 0.02 mg/l. The maximum concentration (0.194 mg/l) was observed in the sample taken from the premises of Atulit Chemical Pvt Ltd, Kumedi, (BW-01).
- s. The BIS has set health-based desirable and permissible guideline values for manganese in drinking water as 0.1 mg/l (100 ppb) and 0.3 mg/l (300 ppb) respectively to ensure protection against manganese toxicity. The manganese concentration in the study area was found in all samples within permissible limit in between 0.016 to 0.184 mg/l. The maximum concentration was observed in the bore well inside the Narwal Mukthi Dham Centre, Near Sector-F, Narwal village (BW-19: 0.184 mg/l).
- t. The permissible limit of uranium concentration set by BIS and AERB (Atomic Energy Regulatory Board) are respectively 30 and 60 ppb for drinking water. In our study area, the uranium concentration was recorded within the BIS permissible limit with maximum as 10.12 ppb in the sample taken from the hand pump near Ram Mandir in Kumedi village (HP-01).
- u. The other heavy metals i.e. Arsenic (As), Antimony (Sb), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), and Tin (Sn) were reported concentrations below detectable limit (BDL).

The copy of the said report is annexed as **Annexure-C.**

7. The water samples from Kumedi village, Indore, showed a temperature range between 20°C and 29°C, with the highest temperature recorded at Mukthi


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Dham Centre, Narwal. The pH levels were within BIS permissible limits (6.5 to 8.5), ranging from 6.72 to 8.18. Electrical conductivity varied between 990 to 5390 $\mu\text{S}/\text{cm}$ at 25°C, with seven locations exceeding 3000 $\mu\text{S}/\text{cm}$, the highest being at Ram Mandir, Kumedi. Bicarbonate concentrations were observed between 43 and 616 mg/l, with the highest at Ram Mandir, Bhangiya. Chloride levels ranged from 79 to 1010 mg/l, with one location exceeding the permissible limit. Sulfate concentration peaked at 477 mg/l, exceeding the BIS limit of 400 mg/l in Ram Mandir, Kumedi. Fluoride concentrations, while mostly within limits, exceeded BIS guidelines in three locations, with a maximum of 3.40 mg/l at HP-04. Nitrate levels were concerning, with 72.4% of samples exceeding the acceptable limit, the highest being 400 mg/l at Ram Mandir, Kumedi. Phosphate levels were below detection in most samples except for one, and silica concentrations ranged from 27 to 60 mg/l. Total hardness exceeded the permissible limit in 68.9% of samples, with a maximum of 1760 mg/l at HP-01. Calcium and magnesium concentrations were also high in several locations, with maximums of 328 mg/l and 229 mg/l, respectively. Sodium and potassium concentrations showed notable variability, though BIS guidelines for these elements are not well-established. The iron, zinc, and manganese concentrations were within permissible limits, with the highest zinc level at Ram Mandir, Kumedi (2.8 mg/l). Nickel levels exceeded the BIS limit in 13.7% of samples, with the maximum at Atulit Chemical Pvt Ltd (0.194 mg/l). Uranium concentrations were within permissible limits, with the highest at 10.12 ppb. Other heavy metals like arsenic, antimony, cadmium, and mercury were below detectable levels.

7. That some of the industries in the area in question have taken exemption through NOCAP portal as per CGWA notified guidelines dated 24.09.2020 for extraction of ground water less than 10 kld and being MSE's. The list of those industries which were given exemption are annexed as **Annexure-D**.



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8. That some of the industries in the area in question have been given NOC's issued by the CGWA after following the due process of law as per the guidelines issued by the Ministry of Jal Shakti, Govt. of India. The details of the said industries is annexed as Annexure-E.
9. That the Central Ground Water Board(R-6) will file additional report/reply if required as and when directed by this Hon'ble Tribunal.



For Central Ground Water Board

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Annexure A

सांवेर रोड औद्योगिक क्षेत्र में भूजल पीने योग्य नहीं

खतरा • कुमेड़ी में नलकूप खनन में निकला लाल पानी, जांच में पीएच स्तर 8.4, टीडीएस मिला 1500



उद्योग प्रशाप सिंह • इंदौर

सांवेर रोड के कई उद्योग रसायनयुक्त पानी नलों में दोहन कर रहे हैं, लेकिन जल स्रोत का भूजल भी प्रदूषित हो गया है। पारवती में कुमेड़ी गांव में नया बरखाने की शुरुआत करने के लिए नलकूप खनन कराया गया था। जिसमें नलकूप खनन रंग का पानी निकलने लगा। 23 सितंबर को निजी प्रयोगशाला में जांच में पाया गया कि पानी का पीएच लेवल 8.4 है व पीटी कुंठेद पैर 1500 मिलीग्राम है।

500
टीडीएस और पीएच स्तर का 7 सप्ताह नलकूप के पानी में



कुमेड़ी गांव के औद्योगिक क्षेत्र में एक क्यूरी के नलकूप से

400
मीटर पर ही कुमेड़ी में सांवेर रोड का पानी मिलने लगता है

- यदि भूजल प्रदूषित है तो उसे इससे पुनः ठीक बनाने असंभव
- उद्योगों से रिसकर भूजल तक दूषित करने पहुंचने की आशंका
- अंतरराष्ट्रीय मेसॉर रोड के हैडक्वार्टर में भी मिल चुका है लाल रंग का पानी

गंदगी नालों में छोड़ने पर छह कारखाने सील, दो के बिजली कनेक्शन काटे

इंदौर • औद्योगिक गंदगी स्रोत नती एवं नलों में छोड़कर पानी को प्रदूषित करने वाली औद्योगिक इकाइयों के खिलाफ प्रशासन की कार्रवाई लगातार जारी है। शुक्रवार को कुमेड़ी, सांवेर रोड औद्योगिक क्षेत्र और खालीपुरा सुदुर्गम में छह कारखानों को उपचारन इकाई सील की गई। इनमें कुमेड़ी की टेक्सटाइल प्राइम, प्रीमियर फैब्रिक प्राइम, सांवेर रोड औद्योगिक क्षेत्र में गैलरी इंडस्ट्रीज, मेसॉर फुलक्या इंडस्ट्रीज, खालीपुरा सुदुर्गम मिडल अजिमेन्ट फार्मिडक और बिजोस इंटरप्र्राइजेस शामिल हैं। ये कारखानों के बिजली कनेक्शन काटे गए। प्रशासन और प्रदूषण नियंत्रण मंडल के जल में छह कारखानों का औद्योगिक निरीक्षण किया। इस दौरान पाया गया कि टेक्सटाइल इंडस्ट्री के परिसर में ज्वेटी इन्फ्यूज टैंक में पानी (डिट्रीज) रखा गया नहीं है और औद्योगिक अम्लिकृत स्रोत नाले में बहाया जा रहा है। प्रीमियर फैब्रिक और इन्फ्यूज टैंक में पानी भी खर पाया गया। कुमेड़ी फार्मिडक बैटरी से जल बचाने वाली गैलरी इंडस्ट्रीज में उद्योग का जल पानी किता उपचार की संयुक्त उपकरण उपचार संकेत (सिटीटीसी) में जा रहा था। कुलुका इंडस्ट्रीज का इन्फ्यूज टैंक में पानी भर किता उद्योग कारखाने का गंगा पानी स्रोत नाला नाले में बहाया जा रहा था। खालीपुरा में अजिमेन्ट फार्मिडक के कारखाने में जल नाले स्रोत को परिसर के बाहर बेंकरा जा रहा था। यह उद्योग बंकरा नदी के पास है। कारखाने का उपचारन लगाना जांच



औद्योगिक अम्लिकृत को नाले में छोड़ना जरूरी है। • नंददुर्गा

विशेषज्ञों के अनुसार इस तरह का पानी पीने योग्य नहीं है। यदि उप उपचारन व उपकरण उपचार रोड के उपचार सांवेर रोड के उद्योग बंकरा के साव को भूजल को खतरनाक ठीक से प्रदूषित कर रहे हैं। जल को में कुमेड़ी में उद्योग का जल निर्यात कर रहे हैं। निर्यात कर ले जाया है नलकूप खनन में 400 पीटी कुंठेद पैर लगाने का पानी 380 लगा। इसकी जांच में पीएच 8.4 और पीटी कुंठेद पैर 1500 मिलीग्राम है। यह पानी, खलीन पानी है। इस पानी में सोडियम और सल्फेट की मात्रा भी उच्च मिली है।

यदि कुमेड़ी क्षेत्र में नली नलकूप खनन में लाल रंग का पानी आ रहा है तो उसको जांच कराया जाए।
आज के गुप्त, खलीन अतिरिक्त प्रशासन विभाग, सांवेर रोड, इंदौर

कुमेड़ी में टिंसा पानी की जांच की गई, इसमें पीएच व पीटी कुंठेद पैर 8.4 कापी उच्च पाया गया है। अज्ञात है कि कौन से इकाई भूजल प्रदूषित हुआ है। यह पानी पीने योग्य नहीं है। जिला प्रशासन व मा प्रदूषण नियंत्रण मंडल के अधिकारी जो को जांच भूजल के स्तर के दूषित होने वाले कारखानों को खोजकर सांवेर रोड पर कार्यवाई करने का पानी भूजल प्रदूषित हो गया तो इसे ठीक करना प्रथम अग्रता है। - **सुधीर मोहन शर्मा** जल प्रकल्प विभाग

कुमेड़ी क्षेत्र में नलकूप खनन में लाल रंग का पानी आने की जांच करी हमें नहीं मिली है। अज्ञात माह में अंतरराष्ट्रीय मेसॉर रोड के क्षेत्र में कुछ हैडक्वार्टर में लाल रंग का पानी मिलने की रिपोर्ट मिली थी। इस क्षेत्र में बंकरा कारखाने होने से पानी का रंग लाल मिलने की संभावना थी। हमने भूजल बेंड की जांच

कुमेड़ी में निकले लाल रंग के पानी को जांच रिपोर्ट से जांच कराया है कि इस क्षेत्र में भूजल में कार्बनिक रसायन जा रहे हैं। इन कारण यह पानी पीने योग्य नहीं है। कुमेड़ी के इलाके में लाल रंग का पानी का उपचारन होना है। इस उद्योग से भी भूजल में रसायनयुक्त पदार्थों की आशंका है। इस क्षेत्र में खलीन के भी कारखाने हैं। इन्हें भी जांच की जा रही है। इस क्षेत्र में मा प्रदूषण नियंत्रण मंडल के अधिकारी जो को जांच भूजल के स्तर के दूषित होने वाले कारखानों को खोजकर सांवेर रोड पर कार्यवाई करने का पानी भूजल प्रदूषित हो गया तो इसे ठीक करना प्रथम अग्रता है। - **सुधीर मोहन शर्मा** जल प्रकल्प विभाग

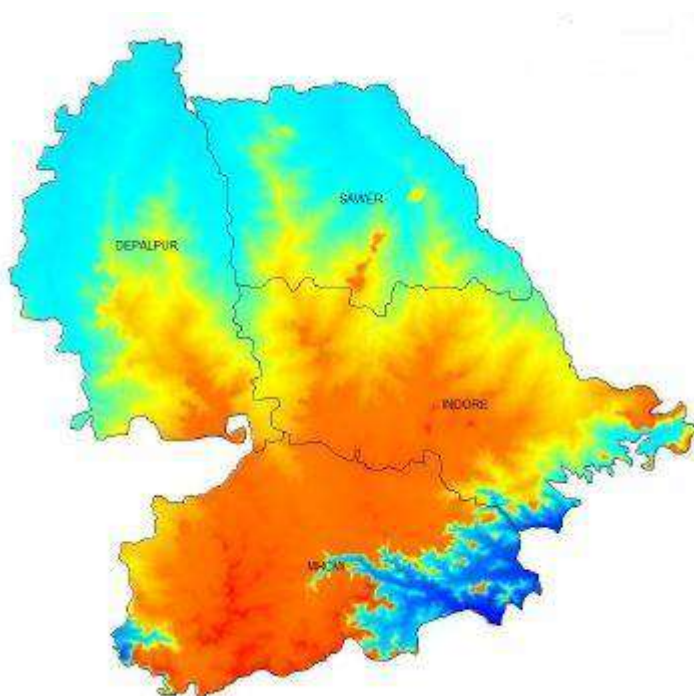
के पानी को जांच कर रिपोर्ट में मिलेगी। मेरे कारखाने में सांवेर रोड औद्योगिक क्षेत्र में भूजल की जांच नहीं हुई है। भूजल में 6.5 से 8.5 तक पीएच स्तर और 1100 टीडीएस मिलना सामान्य है। - **सुधीर मोहन शर्मा** अतिरिक्त, मा प्रदूषण नियंत्रण मंडल, इंदौर

Pic 1 "नई दुनिया: पड़ताल" दिनांक 16-02-2022

Table 1 Showing the Sample Locations and Code of Study Area					
S. No.	Location	Source	Code	Longitude	Latitude
1	In the premises of Atulit Chemical Pvt Ltd, Kumedi	Bore Well	BW-1	75.8581	22.7853
2	Tripati Balaji Industries, Kumedi	Bore Well	BW-2	75.8603	22.7845
3	In the premises of Choksi Laboratories, Kumedi	Bore Well	BW-3	75.8595	22.7871
4	MR 10 Road, Before house of Rajendra Madanlalji Panchal, Kumedi	Bore Well	BW-4	75.8702	22.7811
5	In the Agriculture field of Prakash owner (Old BW), back side of Pallavi food Pvt Ltd, Kumedi	Bore Well	BW-5	75.8552	22.7872
6	In the Agriculture field of prakash owner (new BW), Kumedi	Bore Well	BW-6	75.8536	22.7865
7	In the Agriculture field of Subam Patel, Bhawrasla	Bore Well	BW-7	75.8406	22.7988
8	Before house of Kripal Singh, MR 12 Road, Jakhya	Bore Well	BW-8	75.848	22.7989
9	Back side of Jagadish Yadav house, Bhangiya	Bore Well	BW-9	75.8666	22.7986
10	In the Agriculture field of Ramesh Chandra Mouriya, Bhangiya Kakad	Bore Well	BW-10	75.873	22.7883
11	Before house of Nitesh Dubolya, Bhangiya	Bore Well	BW-11	75.8718	22.7931
12	Before house of Rakesh Panchal, Bhangiya	Bore Well	BW-12	75.8705	22.7933
13	Before house of Ram Chandraji, Bhangiya	Bore Well	BW-13	75.8679	22.7921
14	Before house of Mahesh Dukat, Kalindi Gold Sec, Bhangiya	Bore Well	BW-14	75.8659	22.7923
15	opposite house of Primod Patithor, 100m of Krishna kunj shop, Kumedi	Bore Well	BW-15	75.8731	22.7923
16	In the Agriculture field of Mangilal Pithambaram, Kumedi	Bore Well	BW-16	75.8596	22.788
17	Inside of Saraswati Resort marriage garden, Kumedi Kakad	Bore Well	BW-17	75.8586	22.7801
18	Inside DMC Dilkush, Tirupati Industries, Kumedi	Bore Well	BW-18	75.8653	22.7863
19	Inside Narwal Mukthi Dham Centre, Near Sector F, Narwal	Bore Well	BW-19	75.8518	22.7711
20	In the Agriculture field of Dinachand Prohit, Love Kush Chouraha, Bhawrasla	Bore Well	BW-20	75.8477	22.7892
21	51A, Sec-F, in the campus of NAFD, Bhawrasla	Bore Well	BW-21	75.8507	22.7812
22	Before house of Pintu Shukla, Near Agarbatti Industry, Bhawani nagar	Bore Well	BW-22	75.854	22.7933
23	Back side of Ajmera Metals Pvt Ltd, Kumedi	Dug Well	DW-1	75.8584	22.7837
24	owner Neemba Bhailwan Yadav, side of Arbindo Hospital, Bhawrasla	Dug Well	DW-2	75.8461	22.7996
25	Before Ram Mandir, Kumedi	Hand Pump	HP-1	75.8639	22.7826
26	Before house of Ram Yadav, Bardari road, Bhawrasla	Hand Pump	HP-2	75.8399	22.793
27	Before house of Jagadish Awlia, Bhangiya	Hand Pump	HP-3	75.8696	22.7943
28	By the side of Crematorium tent, Bhangiya	Hand Pump	HP-4	75.8731	22.7923
29	Back side of Ram Mandir, Bhangiya	Hand Pump	HP-5	75.8716	22.7933



Hydro Geo-Chemical Investigation in and around Kumedi Village, Sanwer Block, District Indore M.P.



**Government of India
Central Ground Water Board
Ministry of Jal Shakti
Department of Water Resources, River Development &
Ganga Rejuvenation**

Contents

CHAPTER-1	3
1.0 Introduction	3
1.1 Purpose of the Study:	4
1.2 LOCATION AND APPROACHIBILITY	6
1.3 Climate and Rainfall	7
CHAPTER-2	8
2.0 GROUND WATER SCENARIO	8
2.1 Physiography and Geomorphology	8
2.2 Soil	9
2.3 Drainage Pattern:	10
CHAPTER-3	12
3.0 MATERIAL AND METHODS: -	12
3.1 Geology of Study area	12
3.2 Hydrogeology	16
CHAPTER-4	22
4.0 Ground Water Quality.....	22
4.1 Ground Water Sample Collection and Analysis	22
4.2 Ground Water Quality Assessment	25
4.3 Water Type and Relationships (Hydro-chemical Diagrams)	35
CHAPTER-5	40
OBSERVATIONS AND DISCUSSIONS	40
CHAPTER-6	42
Conclusions and Recommendations	42
Annexures	43

CHAPTER-1

1.0 Introduction

Water is an extremely important part of our lives. It is used for irrigation, cooking, washing, cleaning, drinking, etc. Water is essential for maintaining good health as it helps in regulating body temperature, carries out normal functioning, aids in digestion and removes toxins from the body. Water also acts as a major controlling factor of all the organisms. The quantity and quality of water is also valuable for physiological activities of living organisms. It presents only 3% of total water resources are non-saline fresh water on earth. A very small quantity of water is present in rivers and lakes. Approximately 80% of India's surface water is polluted; the Central Pollution Control Board has estimated that domestic sewerage contributes to 75% of water pollution by volume. Besides, in recent years, the untreated sewage that flows into water bodies including rivers has also doubled. Groundwater depletion and extreme pollution have added to the social and economic crisis. Over the past few years, there has been a growing need for India's water requirements.

Kumedi village is an industrial area near Sanwer road, Indore situated about 9.2 km away from Indore city, M.P. It lies in the Malwa region of western Madhya Pradesh. Kumedi has a big industrial complex developed by various industries which manufactures a variety of products including dyeing agents, Namkin, Chocolates, Bread and Mustard Oil etc. All these industrial units discharge effluents to the Khan River through nearby Nala. The location map of the study area is shown in the **Fig-1.1**.

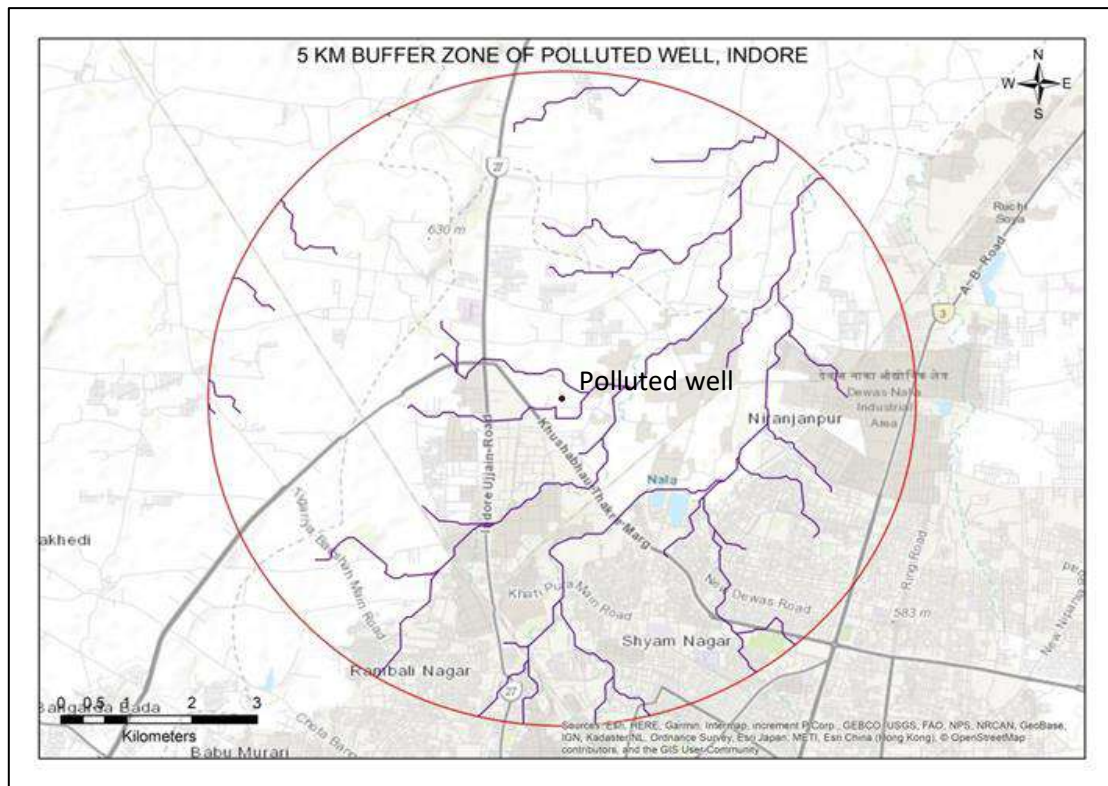


Fig-1.1 Location Map of the Study Area

1.1 Purpose of the Study:

Industrial activities surrounding Kumedi village had resulted considerable deterioration of Groundwater and surface water quality that has been noticed in change in physical properties of water. The problem has been occurred before 5 years and published in local newspaper (Fig- 1.2). The problem came into notice to district authorities as well as Central Ground Water Board and the study was started. The main purpose of the study was to locate the source and cause of pollution in and around Kumedi village. The polluted water came to notice before 5 years after development of Industries surrounding that village.

सांवेर रोड औद्योगिक क्षेत्र में भूजल पीने योग्य नहीं

खतरा • कुमेड़ी में नलकूप खनन में निकला लाल पानी, जांच में पीएच स्तर 8.4, टीडीएस मिला 1500



उदयप्रताप सिंह • इंदौर

सांवेर रोड के कई उद्योग रसायनयुक्त पानी नालों में छोड़कर अभी तक कान्ह नदी को ही वृत्तित कर रहे थे, लेकिन अब क्षेत्र का भूजल भी प्रदूषित हो गया है। फरवरी में कुमेड़ी गांव में नए कारखाने की शुरुआत करने के लिए नलकूप खनन करवाया गया था। विसंवर में नलकूप खनन का उपयोग शुरू हुआ तो लाल रंग का पानी निकलने लगा। 23 विसंवर कोे निजी प्रयोगशाला में जांच में पाया गया कि पानी का पीएच लेवल 8.4 है व पार्टिकुलेट मैटर 1500 तक मिला है। विशेषज्ञों के अनुसार इस तरह का पानी पीने योग्य नहीं है। चरिष्ठ अभियंता व वास्तुकार अतुल शेट के अनुसार सांवेर रोड के उद्योग कान्ह के साथ ही भूजल को खतनाक तकरीके से प्रदूषित कर रहे हैं। हाल ही में कुमेड़ी में उद्योग का नव निर्माण कार्य शुरू किया गया तो चर्चा हुए नलकूप खनन में 400 फीट गहराई पर लाल रंग का पानी आने लगा। इसकी जांच में पीएच 8.4 और पार्टिकुलेट मैटर 1500 मिला है। यह पूर्णतः क्षारीय पानी है। इस पानी में सोडियम और सल्फेट की मात्रा भी ज्यादा मिली है।

यदि कुमेड़ी क्षेत्र में कहीं नलकूप खनन में लाल रंग का पानी आ रहा है तो उसकी जांच करवाएंगे।

- आर के गुप्ता, क्षेत्रीय अधिकारी/मध्य प्रदूषण नियंत्रण बोर्ड, इंदौर

500
टीडीएस और पीएच लेवल सेवा है 7 सामान्य नलकूप के पानी में

400
मीटर पर ही कुमेड़ी में लाल रंग का पानी मिलने लगा है

यदि भूजल प्रदूषित हो गया तो इसे पुनः ठीक करना असंभव

उद्योगों से रिसकर भूजल तक प्रदूषित पानी पहुंचने की आशंका

असरावद व नेमावर रोड के डेडपानी में भी मिल चुका है लाल रंग का पानी

कुमेड़ी गांव के औद्योगिक क्षेत्र में एक फिक्ट्री के नलकूप से

कुमेड़ी में जिस पानी की जांच की गई उसमें पीएच व पार्टिकुलेट मैटर काफी ज्यादा पाया गया है। आशंका है कि कपड़ों में डारैकरने वाली किसी कारखाने से इस तरह भूजल प्रदूषित हुआ है। यह पानी पीने योग्य नहीं है। जिला प्रशासन व मध्य प्रदूषण नियंत्रण मंडल के अधिकारियों को जल्द भूजल के स्तर के दूषित होने वाले कारणाों को खोजकर संबंधित उद्योग पर कार्रवाई करनी चाहिए। भूजल प्रदूषित हो गया तो इसे ठीक करना लगभग असंभव है।

- सुधीर मोहन शर्मा
जल प्रकान विशेषज्ञ

कुमेड़ी क्षेत्र में नलकूप खनन में लाल रंग का पानी आने की जानकारी हमें नहीं मिली है। अगस्त माह में असरावद व नेमावर रोड के क्षेत्र में कुछ डेडपानी में लाल रंग का पानी मिलने की शिकरयत मिली थी। उस क्षेत्र में शकर कारखाने होने से पानी का रंग लाल मिलने की संभवना थी। हमने भूजल बर्ड को यहां

कुमेड़ी में निकले लाल रंग के पानी की जांच रिपोर्ट से यह स्पष्ट है कि इस क्षेत्र में भूजल में कार्बनिक रसायन जा रहे हैं। इस कारण यह पानी पीने योग्य नहीं है। कुमेड़ी के इलाके में खंडों में काह नदी के पानी का उपयोग होता है। इस प्रक्रिया से भी भूजल में रसायनयुक्त पहुंचने की आशंका है। इस क्षेत्र में डेडपानी के भी कारखाने हैं। डैट-भट्टी भी है। ऐसे में यह भी संभावना है कि इनके माध्यम से भी भूजल दूषित हुआ है।

- डा. सदीप नारुत्कर
आयुष्य एवं विकास संरक्षण अनुसंधान एवं विकास संस्थान

कुमेड़ी की जांच कर रिपोर्ट भी भेजी थी। मेरे कार्यकाल में सांवेर रोड औद्योगिक क्षेत्र में भूजल की जांच नहीं हुई है। भूजल में 6.5 से 8.5 तक पीएच लेवल और 1100 टीडीएस मिलना सामान्य है।

- एस एन पाटिल, मुख्य प्रयोगशाला अधिकारी, मध्य प्रदूषण नियंत्रण मंडल, इंदौर

गंदगी नालों में छोड़ने पर छह कारखाने सील, दो के बिजली कनेक्शन काटे

इंदौर। औद्योगिक गंदगी सीधे नदी एवं नालों में छोड़कर पानी को प्रदूषित करने वाली औद्योगिक इकाइयों के खिलाफ प्रशासन की कार्रवाई लगातार जारी है। शुक्रवार को कुमेड़ी, सांवेर रोड औद्योगिक क्षेत्र और खातीपुरा सुखलिया में छह कारखानों की उत्पादन इकाई सील की गई। इसमें कुमेड़ी की टेक्नोक्राफ्ट प्रालि, प्रतिभा फैब्रिकेल् प्रालि, सांवेर रोड उद्योगिक क्षेत्र में गोन्डी इंस्टीटून, मेसर्स गुरुकृपा इंस्टीटून, खातीपुरा सुखलिया स्थित अनिकेल् ल्वास्टिक और बिशोर इंटरप्राइजेस शामिल हैं। दो कारखानों के बिजली कनेक्शन काटे गए। प्रशासन और प्रदूषण नियंत्रण मंडल के कल ने इन कारखानों का औचक निरीक्षण किया। इस दौरान पाया गया कि टेक्नोक्राफ्ट इंस्टीटू के परिसर में क्रेई इंफ्लुएंट ट्रीटमेंट प्लांट (ईटीपी) स्थापित नहीं है और औद्योगिक अपशिष्ट सीधे नाले में बहाया जा रहा है। प्रतिभा फैब्रिकेल् का इंफ्लुएंट ट्रीटमेंट प्लांट भी बंद पाया गया। पुरानी प्लास्टिक बीटरी से बना बनाने वाली गोन्डी इंस्टीटून में उद्योग का वृत्तित पानी बिना उपचार ही संयुक्त अपशिष्ट उपचार संयंत्र (सीईटीपी) भेजा जा रहा था। गुरुकृपा इंस्टीटून का इंफ्लुएंट ट्रीटमेंट प्लांट बंद मिला और कारखाने का गंदा पानी सीधे नरवल नाले में बहाया जा रहा था। खातीपुरा में अनिकेल् प्लास्टिक के कारखाने में वृत्तित जल सीधे ही परिसर के बाहर फेंक जा रहा था। यह उद्योग कान्ह नदी के पास है। कारखाने का उत्पादन तत्काल बंद



औद्योगिक अपशिष्ट को नाले में छोड़ा जा रहा है।

• नन्दुनिया

करवाकर सील किया गया और बिजली कनेक्शन भी काट दिया गया। खातीपुरा में ही बिशोर इंटरप्राइजेस इलेक्ट्रो प्लेटिंग इकाई का वृत्तित जल कान्ह नदी के किनारे फेंका जा रहा था। इस कारखाने को भी सील करके बिजली कनेक्शन काटा गया। जांच बल ने वेदास नाका स्थित इंदौर दुग्ध संघ की दूध प्रसंस्करण इकाई और रुचि सोया का निरीक्षण भी किया। यहां स्थिति संतोषजनक पाई गई। जिन कारखानों में ईटीपी बंद पाए गए उनके संचालकों को 4-6 घंटों में ईटीपी प्लांट शुरू करने के निर्देश दिए और जिन कारखाने में ईटीपी नहीं है, उनको चेतावनी दी गई कि ईटीपी स्थापित करने के बावजूद कारखाना चालू किया जा सकेगा।

Fig-1.2 Local newspaper cutting

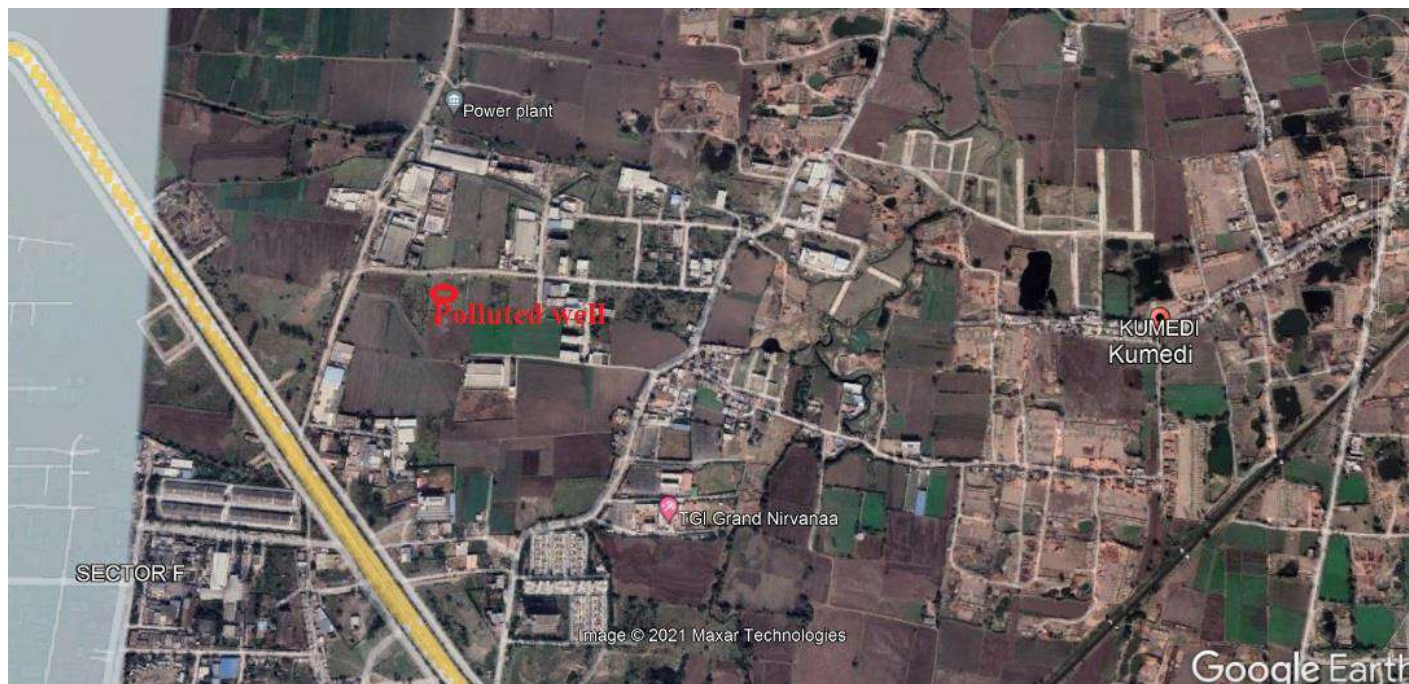
The figures (1.3, 1.4 and 1.5) below illustrate the development of the industrial sector around Kumedi village over the past 5-6 years. It highlights significant growth in various industries



(Fig-1.3 Google map of study area in 2014)



(Fig-1.4 Google map of study area in 2017)



(Fig-1.5 Google map of study area in 2020)

1.2 LOCATION AND APPROACHIBILITY

Geographic coordinates:

Latitude: 22.7853696 N, Longitude: 75.8579789E.

The project site, identified as the Reported Polluted Well, is located 9.2 kilometers from Indore, Madhya Pradesh, along Ujjain Road. It is situated within the revenue land of Kumedi village and lies at the heart of the industrial sector (**Fig-1.6**) in Block Sanwer, District Indore.

The site is well connected to Indore and other major locations by Indore- Ujjain Highway, which connects the site to the towns of Indore and Ujjain. Nearest railway station is Indore and the nearest Airport is at Indore, Madhya Pradesh at a distance of 30 and 20 km respectively.

DEMARCATION OF THE PROJECT AREA



Fig-1.6 Demarcating the location polluted well

1.3 Climate and Rainfall

The area is characterized by hot summer and well distributed rainfall during the south west monsoon. The normal annual rainfall is 976.8 mm. The winter commences from the December and last till the end of February. The period from the month of March to about the first week of the June constitutes the hot weather. May is the hottest month of the year. The south west monsoon starts from the middle of June and continues up to the first week of October. October and November are the post monsoon/retreating monsoon season.

CHAPTER-2 2.0 GROUND WATER SCENARIO

The study includes investigations on Geology, Geomorphology, Hydrogeology, Land use to find and analyse the impact on groundwater regime in the vicinity of the Reported Polluted Well.

2.1 Physiography and Geomorphology

At a regional level the geomorphology surrounding that area is characterized by flat topped hills typical of the Malwa Plateau which is a part of the Deccan Plateau of the western India formed by sequential piling of solidified lava flows of Basaltic lava one over the other. The maximum elevation of about 740m above mean sea level is observed in the south west of the industrial area and lowest elevation is 340m towards north. The geomorphological map of the study area is shown in the **Fig-2.1**.

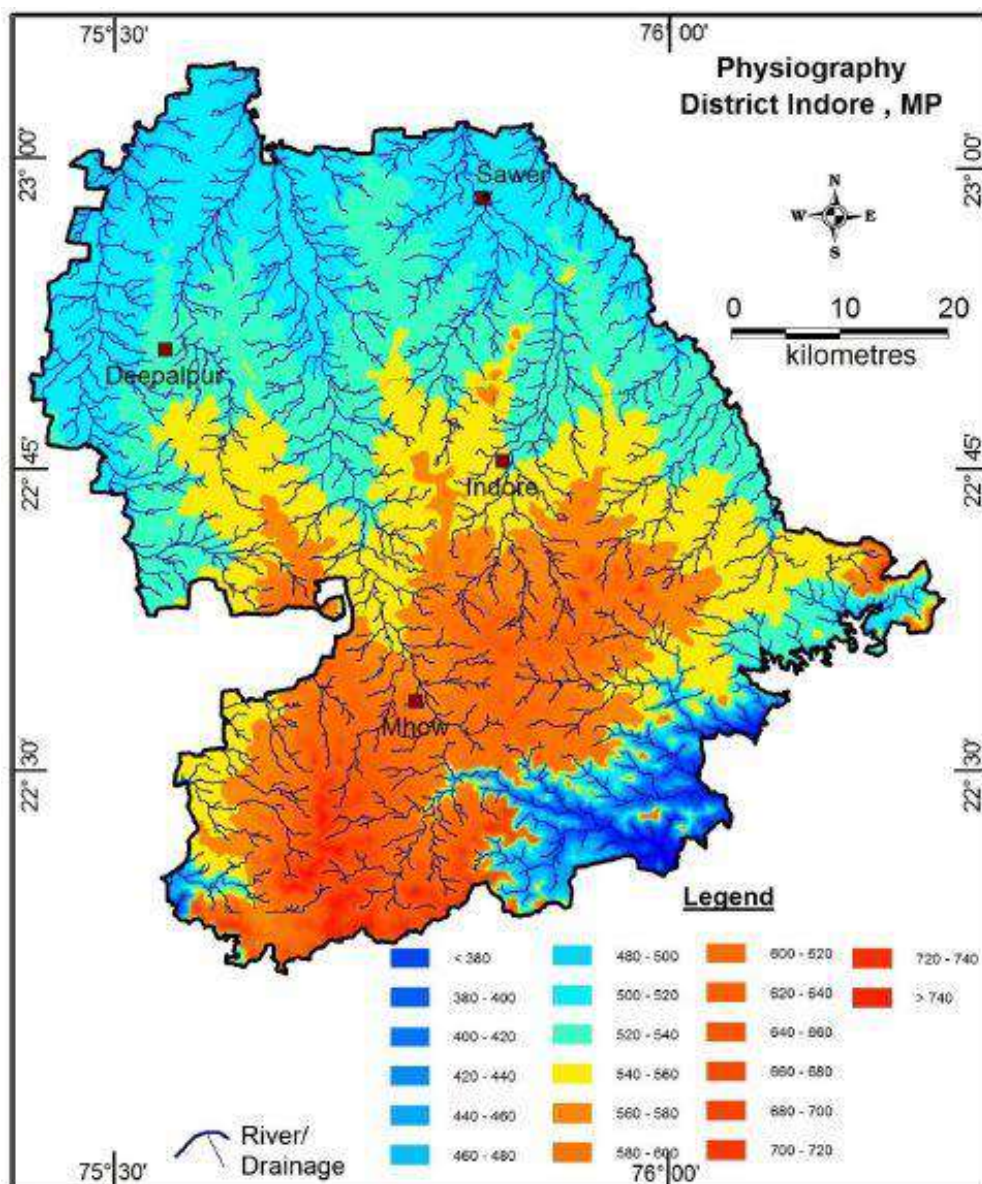


Fig-2.1 Showing the Geomorphology map of Indore district.

2.2 Soil

Kumedi village, located in Indore, Madhya Pradesh, primarily features clayey and loamy soil types (**Fig 2.2**). The clayey soil retains moisture well, making it suitable for agriculture, while the loamy soil provides good drainage and nutrient content, supporting diverse crop growth. Additionally, the region may have areas of sandy soil, particularly near water bodies, which can influence local farming practices. Overall, these soil types contribute to the agricultural viability of the area.



Fig. 2.2 : Fine clayey soil of Kumedi village

2.3 Drainage Pattern:

The drainage pattern of Kumedi village in Indore is typically characterized by a dendritic pattern, which resembles the branches of a tree. This pattern forms due to the gentle slopes and the uniform geological structure of the area, allowing water to flow naturally towards lower elevations. Additionally, seasonal streams and drains may be present, effectively managing surface runoff during the monsoon season. Overall, the drainage system supports agricultural activities by helping to maintain soil moisture and reducing waterlogging. Major streams flow from South to North (**Fig-2.3 a and 2.3 b**).

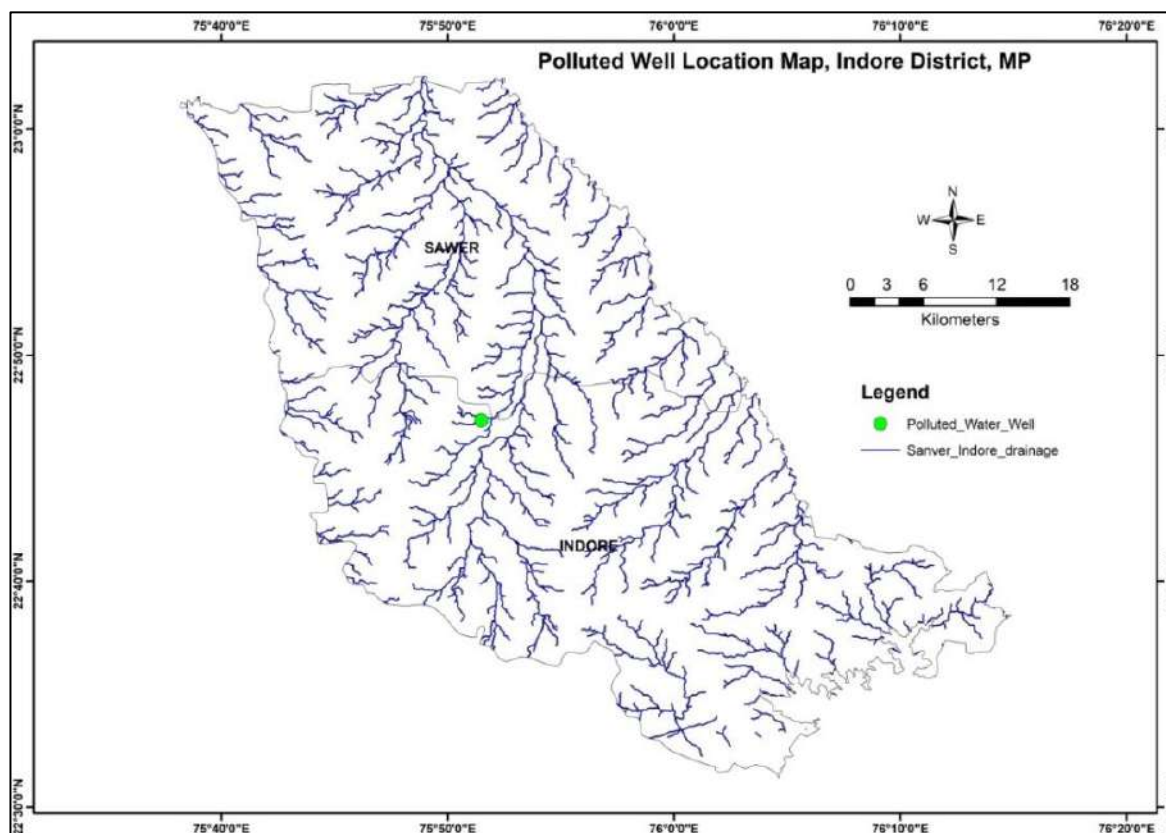


Fig. 2.3 a: Drainage map on regional scale

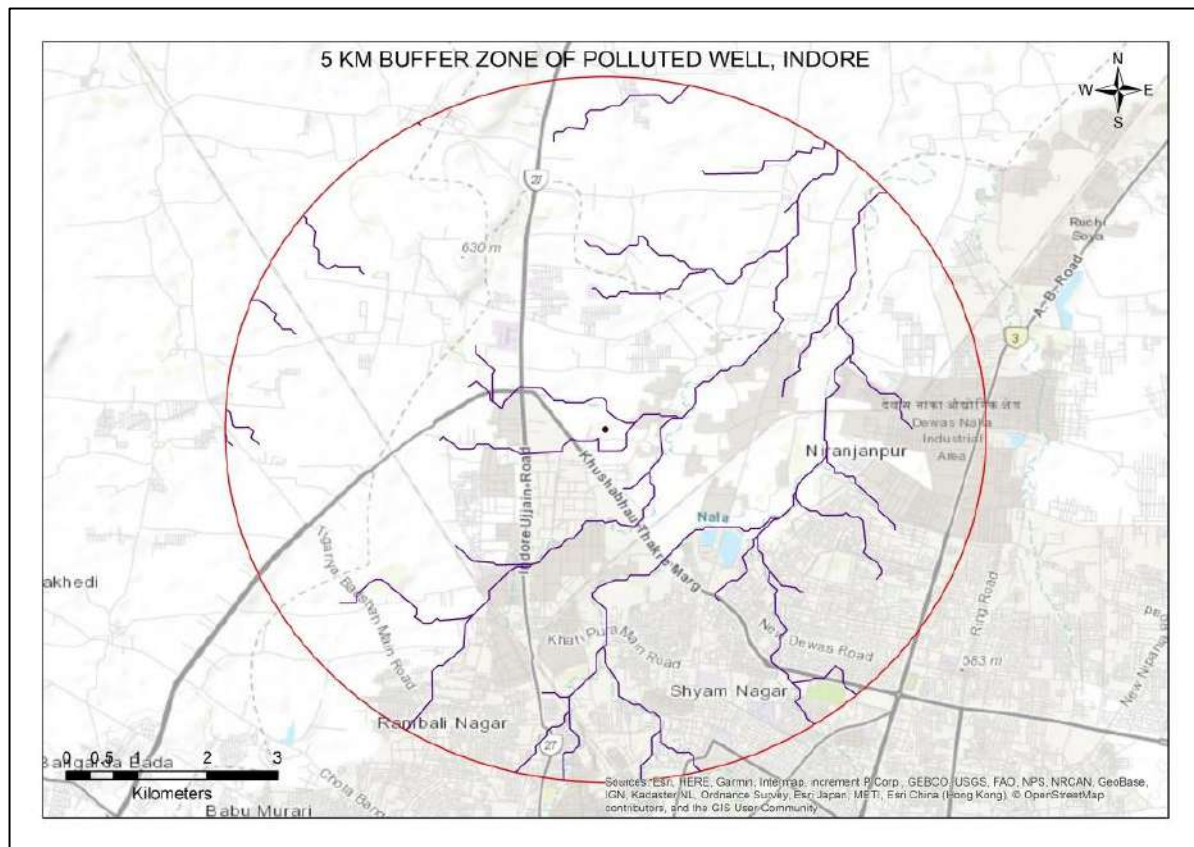


Fig. 2.3 b: Drainage map of the study area

Irrigation

In Kumedi village, Indore, irrigation and agricultural practices are essential for supporting local farming. The primary sources of irrigation include tube wells and bore wells, which tap into underground water supplies, especially during dry periods. Additionally, some farmers utilize surface water from nearby streams and reservoirs.

The agricultural practices in Kumedi typically involve the cultivation of a variety of crops, including cereals like wheat and rice, as well as pulses and oilseeds. Farmers often employ mixed cropping techniques to enhance soil fertility and reduce pest infestations. Traditional methods are still prevalent, although some farmers are gradually adopting modern techniques and machinery to increase efficiency and yield. Organic farming practices are also gaining traction, with an emphasis on sustainable agriculture to improve soil health and reduce chemical usage. Overall, these practices contribute to the village's agricultural productivity and economic stability.

CHAPTER-3

3.0 MATERIAL AND METHODS: -

Both hydrogeological and geochemical studies were conducted to gain a comprehensive understanding of the ground water scenario of the area. The hydrogeological studies focused on the assessment of groundwater availability, movement, and the interaction between surface and subsurface water. Meanwhile, the geochemical studies analysed the chemical composition of the water, identifying potential contaminants and evaluating water quality.

Hydrogeological investigations were carried out by examining the bore wells and dug wells. Well inventory and Monitoring of water level was carried out from Dug wells, Bore wells, Hand pumps to understand the behaviour of ground water regime of shallow and deep aquifers. Ground water samples were collected from dug wells, hand pumps, tube wells and surface water from the nala close to Atulit Chemicals Pvt Limited to understand the water quality.

The samples were analysed by following different standard method as mentioned in APHA 23rd Ed. by using microprocessor based pH meter, Electrical Conductivity meter, UV-VIS Spectrophotometer (Shimadzu, UV-1201), Flame photometer (Systronics-128) and Atomic Absorption Spectrometer (PG Instrument). The chemicals/ reagents were used of analytical grade (AR). The assessment of ground water quality status in and around industrial area of Nagda has been done by comparing observations of different parameters against Bureau of Indian Standard (BIS - 10500, 2012).

3.1 Geology of Study area

3.1.1 Regional Geology

Geologically almost entire Indore district is occupied by Deccan Trap basalts (**Fig-3.2 a**). Occurrence and movement of groundwater in Basalt is mainly controlled by secondary porosity through joints and fractures. Presences of vesicle in basaltic lava flow of Deccan Traps play an important role in groundwater movement. Groundwater in general occurs under unconfined to semi-confined conditions. The regional Geological succession in the area is as follows **Table 3.1**:

Table 3.1 Geology of the district

Approximate age in million years	Stratigraphic units		Lithological Units
	Era	Period	
136-65	Mesozoic	Cretaceous to Palaeocene Period	Decan Trap

3.1.2 Geology of study area

The basalts underlie the project site and the groundwater occurs under phreatic conditions in shallow weathered, jointed and fractured horizons. Basalts does not exhibits uniform occurrence of groundwater both vertically and laterally. Physiographic location, thickness of weathered mantle, degree of jointing, fracture or shear zones, characteristics of vesicular horizons and their inter-connected pores are important factor, which play a deciding role in the yield capacity of the tube wells tapping shallow aquifers. The marginal alluvium comprising fine clay and fine to medium grained sand occurs along the Khan River. (Fig.3.1)



Fig. 3.1: Fine clay along the Khan river

The deeper aquifer system however supports the groundwater regime. It appears to be under unconfined to semi-confined conditions with the lava flow sequence which shows alternate units of vesicular and massive horizons, forming the aquifers. The deeper aquifer is more likely to be governed by the secondary porosity.

Jointed/ fractured form of massive units is creating possibilities of their acting as leaky confining bed consequently resulting into semi-confined condition for water bearing vesicular units occurring below it.

Basaltic rock is sub divided into 3 distinct units-

- I. Red bole (inter trapeean clay)
- II. Vesicular/ Amygdular basalt
- III. Massive and compact basalt

Red bole clay:

The reddish-brown clay material, termed as “Red bole” which at places is represented by greyish clay. The thickness of red bole varies from few centimetres to few meters.

Vesicular/ Amygdular basalt:

The vesicular unit of each flow forms the upper horizon and ranges in thickness from 1.5 meters to as much as 6 m forming 25 to 30% of the total thickness of flows. It is softer than massive basalt and vesicles are commonly filled with secondary mineral like calcite, Zeolites and quartz.

Massive Basalt:

It is fine to medium grained compact, dark greenish to grey colour which from 60 to 70% of the flow unit.

3.1.3 Sub Surface Geology

The local ground water potential was investigated by subsequent well inventory at 29 locations (**Fig-3.2**) in 2.5km radius of that polluted well. The Lithologs are prepared on the basis of observations, information provided by the villagers/ Farmers. The site under study belongs has good to very good ground water potential due to the presence of Fracture zone/ Vesicular. The weathering thickness varies between 10m to 25m. The proposed project site has shallower aquifer at 30m to 45mbgl and deeper aquifers at 110 m to 120 mbgl. The details of sampling point is attached in **Annexure-1**.

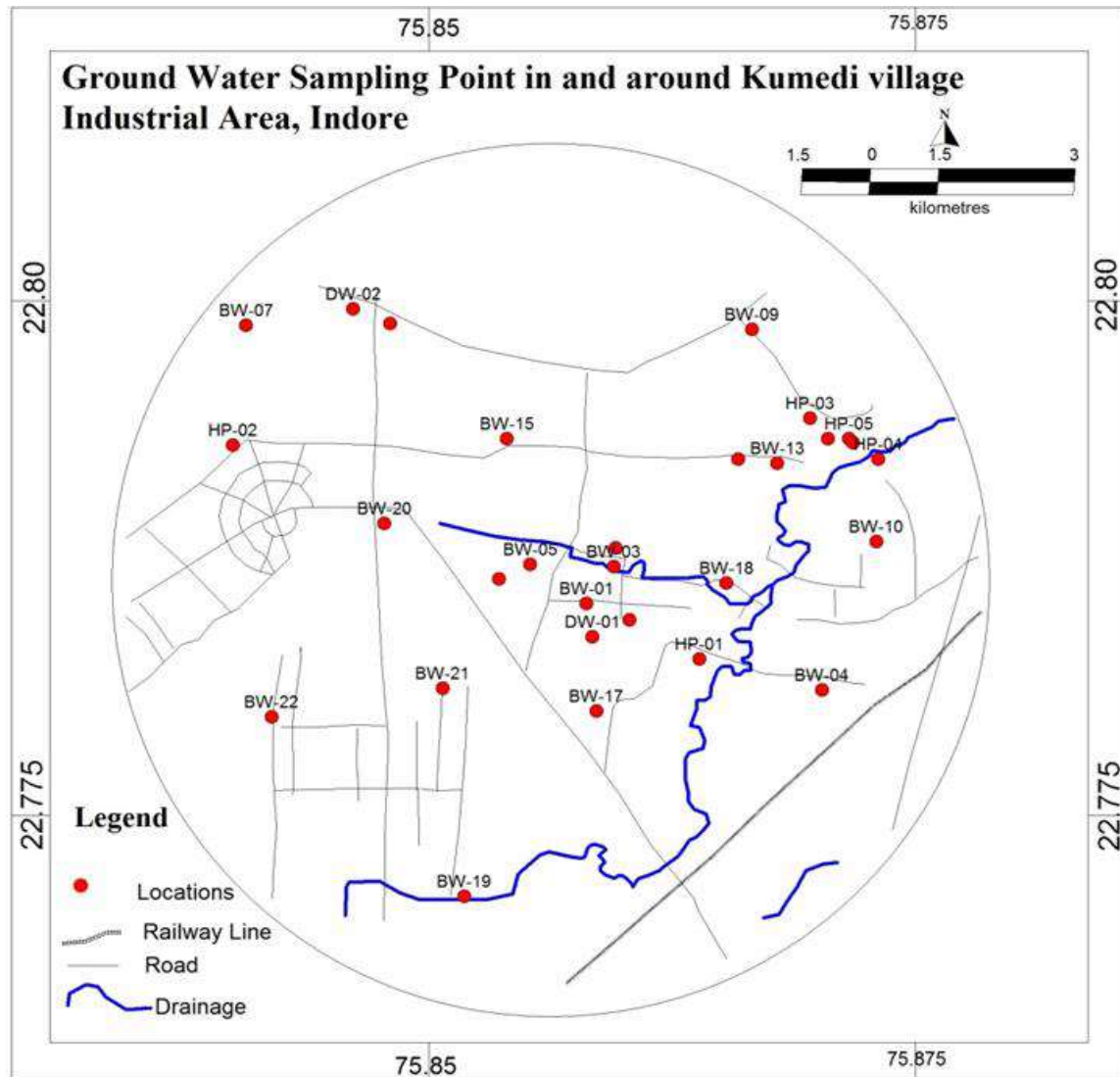


Fig. 3.2: Sampling point in and around Kumedi village

3.2 Hydrogeology

Hydrogeology of the area is mainly controlled by geomorphological and geological setup and also by climatic condition. General Hydrogeology of the district is shown in **Fig. 3.2 (a)**. The depth to water level of the district during Pre monsoon period ranges from less than 4 to more than 12 mbgl (**Fig 3.3-a**). Depth to water level during post monsoon period is less than 6 mbgl (**Fig 3.3-b**). The ground water flow direction is from north-west to south-east. (**Fig-3.2-b**)

The occurrence and movement of groundwater depend on the hydrogeological condition of the subsurface formations. The geological formations vary greatly in their lithology, thickness of weathering, texture and structure which in turn influence their hydrogeological characteristic. Depending upon the geological setup, water bearing and water yielding properties, two major hydrogeological units have been identified in the area such as:

1. Unconsolidated formation comprising of marginal alluvium and highly weathered and vesicular basalt.
2. Semi-consolidated / consolidated formation comprises of fractured vesicular basalt.

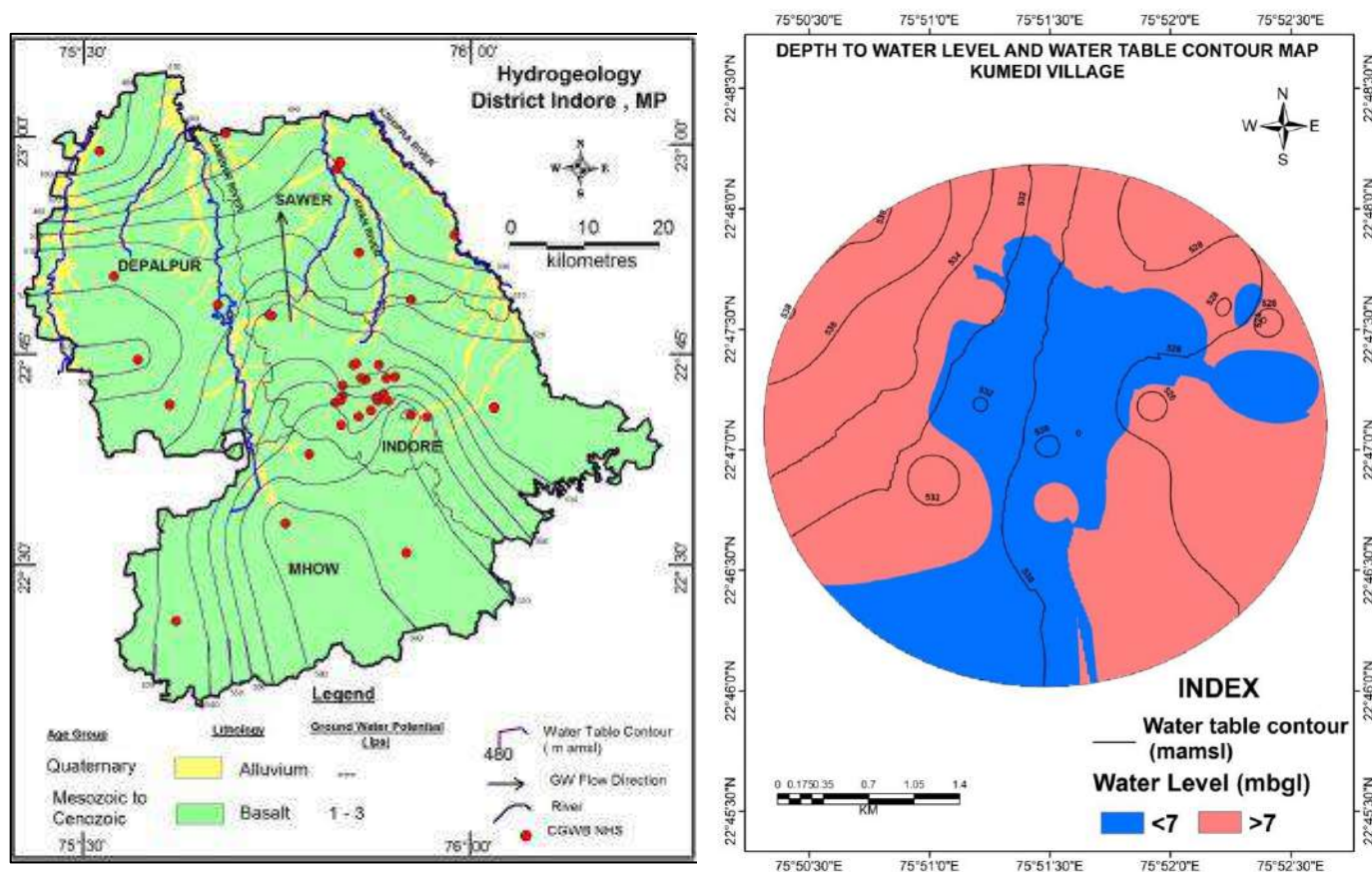


Fig. 3.2(a): General Hydrogeology of the Indore district **Fig. 3.2(b):** Water table contour map of study area

3.2.1 Unconfined aquifer:

The marginal alluvium deposit is confined along the Khan River. The alluvium and weathered vesicular/ jointed/ fractured basalt forms the unconfined aquifer. Total thickness of unconfined aquifer is about 20 meters observed near Ajmer industries with yield varying from 0.8 to 3 lps. Hydrogeological map of the area is given as **Fig-3.2a**. Depth to water level of (dug wells, hand pumps and tube wells) is given in **Table 2**. The post monsoon water level of the district ranges from 2.0 to 8.0 m bgl in the month of January 2021 and pre monsoon water level ranges from 3.0 to 12.0 mbgl (fig 13- a and b). Average water level of the study area in the month of January is 7.5 m bgl. A shallow water level (water logged condition fig -3.4) in the middle part of study area and towards the eastern part of Kumedi village with the water level ranging from 5.8 to 6.2 m bgl (**Fig. 3.2-b**) and having high electrical conductivity (greater than 3000 $\mu\text{S cm}^{-1}$ at 25°C). The first order stream with seepages is observed in water logged area (**Fig-3.4**) and many man made drainages are also observed which are joined with the main nala of that area.

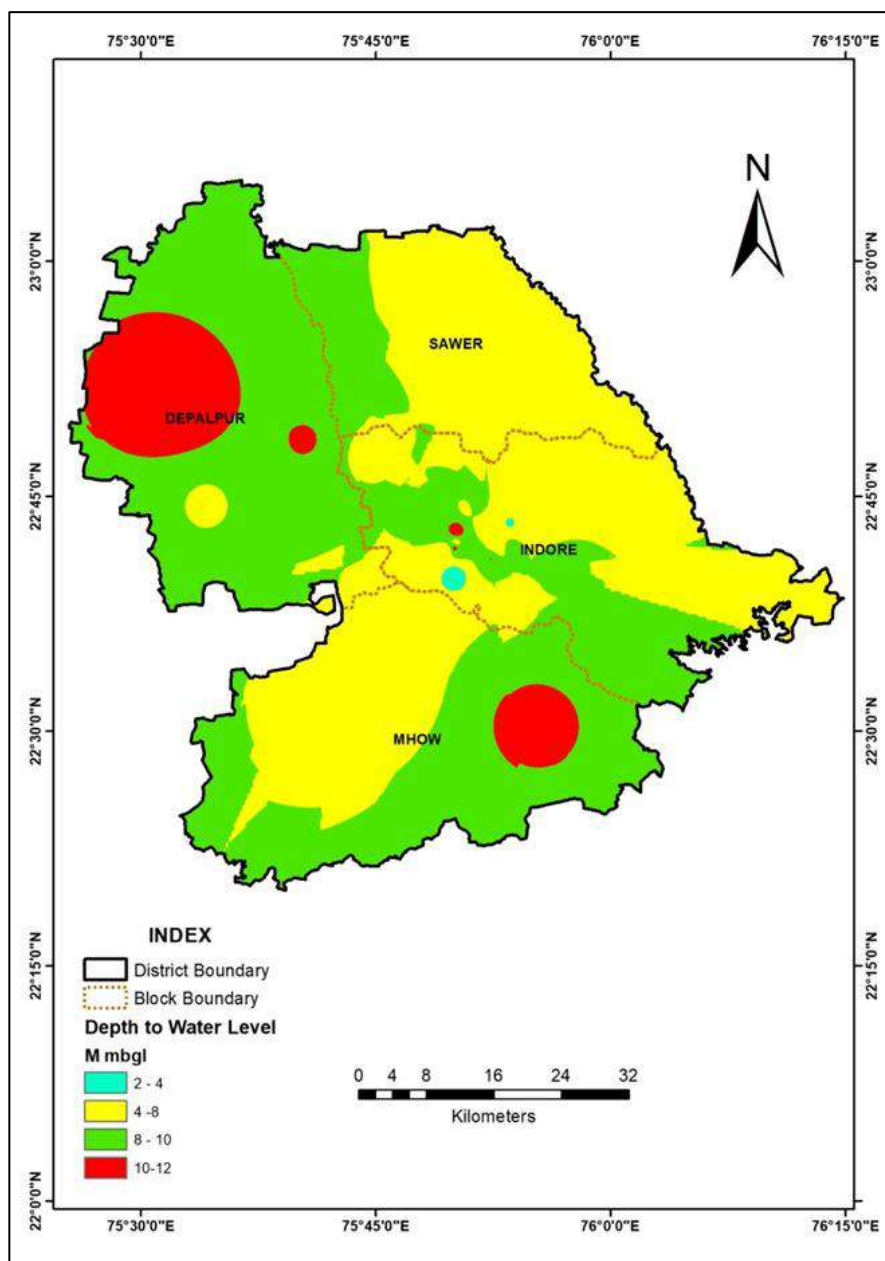


Fig- 3.3(a) Pre monsoon depth to water level map of the district Indore

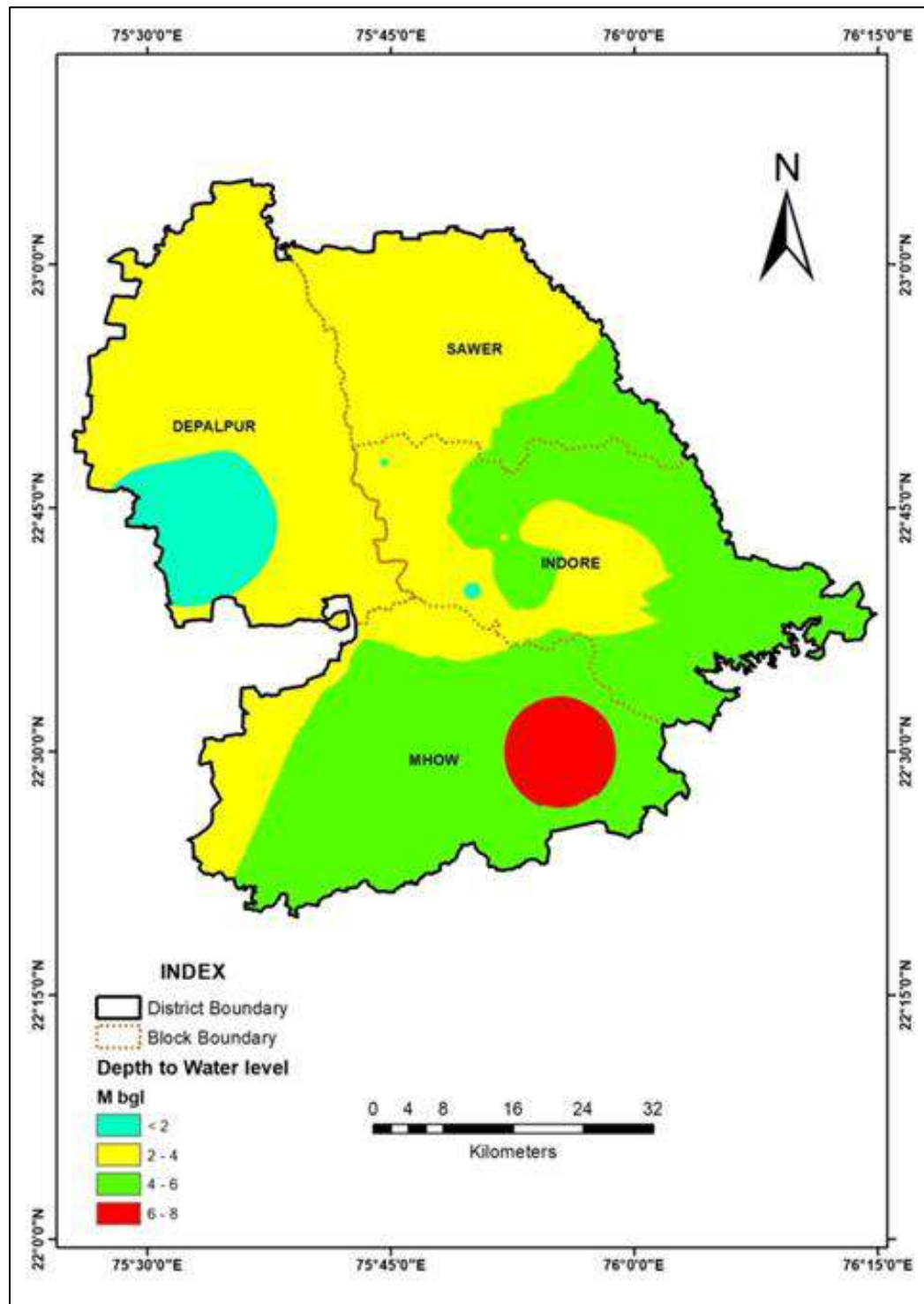


Fig- 3.3 (b) Post monsoon depths to water level map of the district Indore



Fig- 3.4 Water logged area of Kumedi village

3.2.2 Semi-confined/ confined aquifer:

Ground water occurs under Semi confined to confined conditions in fractured basalt / vesicular basalt. The water bearing zones are encountered at depth range 30 to 40 meter with discharge of 2 to 4 lps. Depth to water level measured in deeper hand pump and tube wells during the month of January 2022 are ranging from 6 to 9mbgl (**Annexure-2**). The average water level of deeper aquifers is 7.5 m bgl of the study area. The bore wells and hand pump data were collected during well inventory around the study area and based on the data the 2-D lithological models were prepared (**Fig-3.5 a and b**).

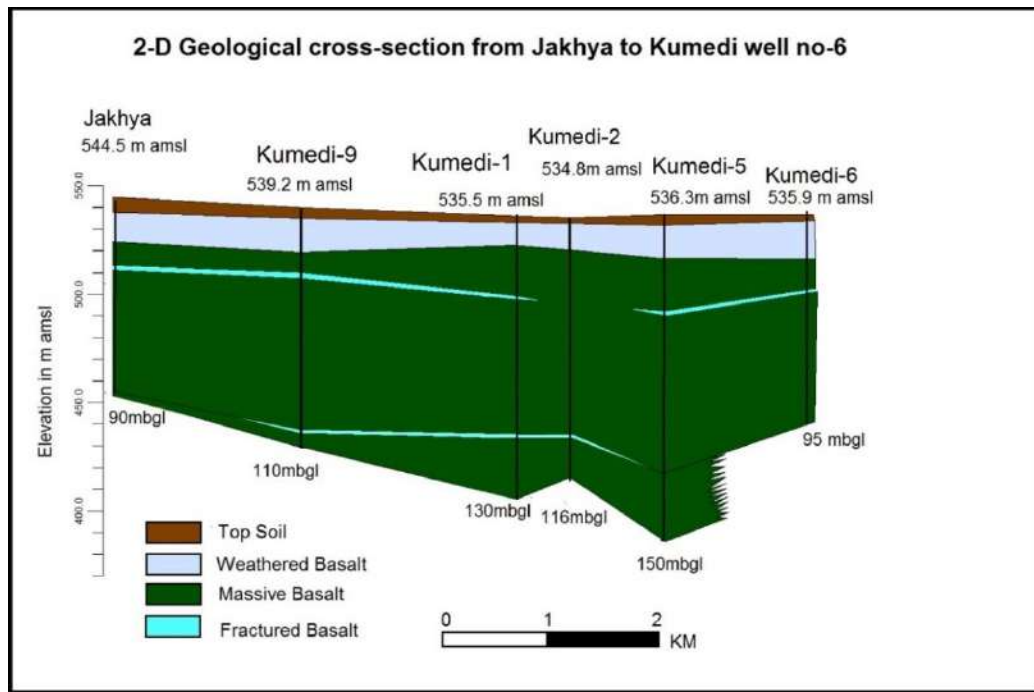


Fig- 3.5 a 2-D Geological cross-section from Jakhya to Kumedi well no-6

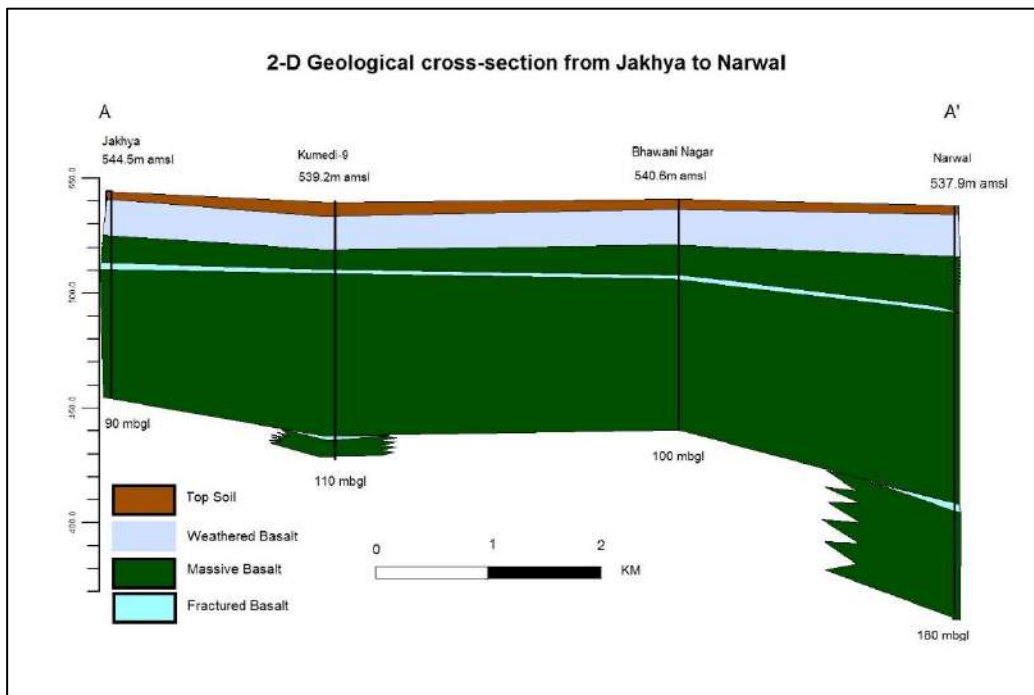


Fig 3.5 b 2-D Geological cross-section from Jakhya to Narwal

The findings from the hydrogeological investigation revealed several key insights about the groundwater scenario in the area.

1. **Groundwater Availability:** The ground water occurs in unconfined to semi-confined state in the study area. Comparatively shallow water level found in the central part of the study area.
2. **Aquifer Characteristics:** Deccan basalt forms the principal aquifer in the study area. Different aquifer types were mapped, the unconfined aquifers ranges up to 20-25 mbgl and shallow aquifer ranges 40-50 mbgl and deeper aquifer ranges 90-120 mbgl.
3. **Flow Direction:** The investigation determined the direction of groundwater flow, which is crucial for understanding water distribution and potential contamination pathways. In the study area, the ground water flow direction changes depending upon the ground water abstraction from the bore wells and hand pump as well.
4. **Seasonal Variability:** It was observed that the polluted water, characterized by a reddish hue, continues to contaminate the groundwater, particularly during the pre-monsoon period when water levels are deeper. However, after the monsoon, the dilution effect makes the discoloration less noticeable.
5. **Contamination Risks:** The study noted potential contamination sources, such as agricultural runoff and industrial discharges, which could impact groundwater quality.

CHAPTER-4

4.0 Ground Water Quality

The ground water quality is an important factor for domestic, irrigation and industrial purposes. Ground water has unique chemistry due to several processes like soil/ rock/ water interaction during recharge, movement, prolonged storage in the aquifer and dissolution of mineral species.

4.1 Ground Water Sample Collection and Analysis

The ground water samples were collected in clean poly ethylene bottles from 29 different locations. Ground water samples are collected from dug wells (2nos.), hand pumps (5 nos.), Bore wells (22 nos.) in and around Kumedi village of Indore industrial area. The lists of sampling locations are given in **Table 4.1** and **Fig 4.2**.

The following water quality parameters were analysed namely: Temperature, pH, Electrical Conductivity (EC), Total hardness, Calcium, Magnesium, Sodium, Potassium, Carbonate, Bi-carbonate, Chloride, Fluoride, Nitrate, Sulphate, Phosphate, Silica and selective trace/ heavy metals viz. Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, , Nickel, Manganese, Mercury, Tin , Uranium and Zinc.

The samples are analyzed by following different standard method as mentioned in APHA 23rdEd. by using microprocessor based pH meter, Electrical Conductivity meter, UV-VIS Spectrophotometer (Shimadzu, UV-1201), Flame photometer (Systronics 128) and Atomic Absorption Spectrometer (PG Instrument). The chemicals/ reagents were used of analytical grade (AR). The assessment of ground water quality status in and around industrial area of Kumedi has been done by comparing observations of different parameters against Bureau of Indian Standard (BIS - 10500, 2012) and World Health Organization (WHO). The basic and heavy metal analysis data is presented in **Table-4.3**.

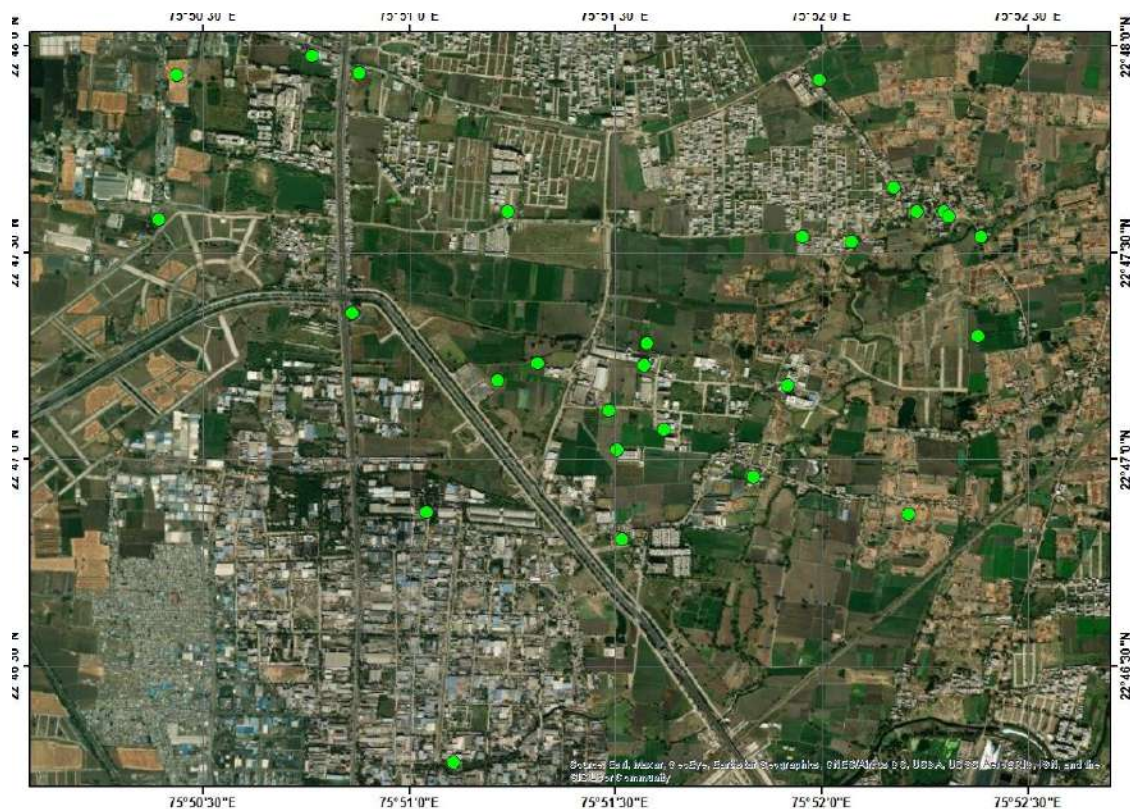


Table:-4.1- Water Sample Locations and code for Kumedi village industrial area, Indore.

S. No.	Location	Source	Code	Longitude	Latitude
1	In the premises of Atulit Chemical Pvt Ltd, Kumedi	Bore Well	BW-1	75.8581	22.7853
2	Tripati Balaji Industries, Kumedi	Bore Well	BW-2	75.8603	22.7845
3	In the premises of Choksi Laboratories,Kumedi	Bore Well	BW-3	75.8595	22.7871
4	MR 10 Road, Before house of Rajendra madanlalji Panchal, Kumedi	Bore Well	BW-4	75.8702	22.7811
5	In the Agriculture field of Prakash owner (Old BW),back side of Pallavi food Pvt Ltd, Kumedi	Bore Well	BW-5	75.8552	22.7872
6	In the Agriculture field of prakash owner (new BW), Kumedi	Bore Well	BW-6	75.8536	22.7865
7	In the Agriculture field of Subam Patel, Bhawrasla	Bore Well	BW-7	75.8406	22.7988
8	Before house of Kripal Singh,MR 12Road, Jakhya	Bore Well	BW-8	75.848	22.7989
9	Back side of Jagadish Yadav house, Bhangiya	Bore Well	BW-9	75.8666	22.7986
10	In the Agriculture field of Ramesh Chandra Mouriya, Bhangiya Kakad	Bore Well	BW-10	75.873	22.7883
11	Before house of Nitesh Dubolya, Bhangiya	Bore Well	BW-11	75.8718	22.7931
12	Before house of Rakesh Panchal, Bhangiya	Bore Well	BW-12	75.8705	22.7933
13	Before house of Ram Chandraji, Bhangiya	Bore Well	BW-13	75.8679	22.7921
14	Before house of Mahesh Dukat, Kalindi Gold Sec, Bhangiya	Bore Well	BW-14	75.8659	22.7923
15	opposite house of Primod Patithor, 100m of Krishna kunj shop, Kumedi	Bore Well	BW-15	75.8731	22.7923
16	In the Agriculture field of Mangilal Pithambaram, Kumedi	Bore Well	BW-16	75.8596	22.788
17	Inside of Saraswati Resort marriage garden, Kumedi Kakad	Bore Well	BW-17	75.8586	22.7801
18	Inside DMC Dilkush, Tirupati Industries, Kumedi	Bore Well	BW-18	75.8653	22.7863
19	Inside Narwal Mukthi Dham Centre, Near Sector F, Narwal	Bore Well	BW-19	75.8518	22.7711
20	In the Agriculture field of Dinachand Prohit, Love Kush Chouraha, Bhawrasla	Bore Well	BW-20	75.8477	22.7892
21	51A, Sec-F, in the campus of NAFD, Bhawrasla	Bore Well	BW-21	75.8507	22.7812
22	Before house of Pintu Shukla, Near Agarbatti Industry,Bhawani nagar	Bore Well	BW-22	75.8540	22.7933
23	Back side of Ajmera Metals Pvt Ltd,Kumedi	Dug Well	DW-1	75.8584	22.7837
24	owner Neemba Bhailwan Yadav, side of Arbindo Hospital, Bhawrasla	Dug Well	DW-2	75.8461	22.7996
25	Before Ram Mandir, Kumedi	Hand Pump	HP-1	75.8639	22.7826
26	Before house of Ram Yadav, Bardari road, Bhawrasla	Hand Pump	HP-2	75.8399	22.793
27	Before house of Jagadish Awlia, Bhangiya	Hand Pump	HP-3	75.8696	22.7943
28	By the side of Crematorium tent, Bhangiya	Hand Pump	HP-4	75.8731	22.7923
29	Back side of Ram Mandir, Bhangiya	Hand Pump	HP-5	75.8716	22.7933

4.2 Ground Water Quality Assessment

I. Temperature and pH:

The temperature of water samples has been observed in between 20 to 29 °C. The maximum temperature (29°C) has been measured in Mukthi Dham Centre, Narwal. The pH of water samples has been recorded in between 6.72 to 8.18. pH of all the samples were observed within permissible limits of BIS i.e. 6.5 to 8.5.

II. Electrical Conductivity (EC)

The electrical conductivity of water in and around Kumedi village ranges between 990 to 5390 $\mu\text{S}/\text{cm}$ at 25°C. The electrical conductivity of more than 3000 $\mu\text{S}/\text{cm}$ at 25°C in the ground water (Hand pumps, and Bore wells) observed at 7 samples. The maximum electrical conductivity i.e. 5390 $\mu\text{S}/\text{cm}$ at 25°C recorded at HP-1 of Ram Mandir, Kumedi. The map of electrical conductivity in and around Kumedi village is shown in **Fig.4.2**.

III. Carbonate and Bicarbonate

The carbonate concentration of ground water samples was absent around industrial area of Kumedi village. The bicarbonate concentration observed in between 43 to 616 mg/l. The maximum bicarbonate concentration has been found at Ram Mandir, Bhangiya (HP-05: 616 mg/l).

IV. Chloride

Chloride concentration has been observed in between 79 to 1010 mg/l. The chloride concentration of more than the permissible limit of 1000 mg/l is observed at the house of Rakesh Panchal, Bhangiya (BW-12: 1010 mg/l).

V. Sulphate

The sulphate concentration has been found in the range of 37 to 477 mg/l. The sulphate concentration of more than the permissible limit of 400 mg/l is observed at the location of Ram Mandir, Kumedi (HP-1: 477 mg/l)

VI. Fluoride

The fluoride concentration in water samples observed in between 0.26 to 3.40 mg/l. The fluoride concentration in all water samples have been found within permissible limits of BIS (1.50 mg/l) except the three locations namely: BW-11: 2.35 mg/l; BW-18: 3.10 and HP-04: 3.40 mg/l. The point value map of fluoride concentration in Kumedi village industrial area is shown in **Fig.4.3**.

VII. Nitrate

The nitrate concentration in ground water samples ranged in between 5 to 400 mg/l. In the analysis of 29 nos. water samples; 27.6% water has recorded nitrate concentration within the acceptable limit whereas 72.4% (21 nos.) ground water samples recorded more than 45 mg/l as per BIS recommendation. The maximum concentration of nitrate has been observed at Ram Mandir, Kumedi (HP-01: 400 mg/l). The point value map of nitrate concentration in Kumedi village industrial area is shown in **Fig. 4.4**.

VIII. Phosphate

The phosphate concentration in water samples around Kumedi area is observed Below Detection Limit.

IX. Silicate

The silicate concentration in water samples around Kumedi village industrial area is ranged from 27 to 60 mg/l.

X. Total Hardness

The total hardness of water samples in Kumedi village industrial area ranged in between 120 to 1760 mg/l. The total hardness is observed more than BIS permissible limit of 600 mg/l in 68.9% of samples (20 out of 29 samples). The maximum concentration of total hardness has been observed in ground water of HP-01: 1760 mg/l.

XI. Calcium

The calcium concentration in water of Kumedi industrial area ranged in between 32 to 328 mg/l. The calcium concentration is observed more than BIS permissible limit of 200 mg/l in 11 out of 29 ground water samples. The maximum concentration of calcium has been observed in ground water of HP-01: 328 mg/l.

XII. Magnesium

The magnesium concentration in water of Kumedi village industrial area is ranged from 2 to 229 mg/l. The magnesium concentration is observed more than BIS permissible limit of 100 mg/l in 7 out of 29 ground water samples. The maximum concentration of magnesium concentration has been observed in ground water of HP-01: 229 mg/l.

XIII. Sodium

In Kumedi village industrial area, ground water samples (dug well, hand pump, and bore well) observed sodium concentration ranged from 22 to 380 mg/l. The maximum concentration has been found in HP-1 of Kumedi (380 mg/l).

XIV. Potassium

In industrial area of Kumedi village potassium concentration was observed in between 1.5 to 189 mg/l. The maximum concentration has been found in Ram Mandir, Bhangiya (HP-5: 189 mg/l).

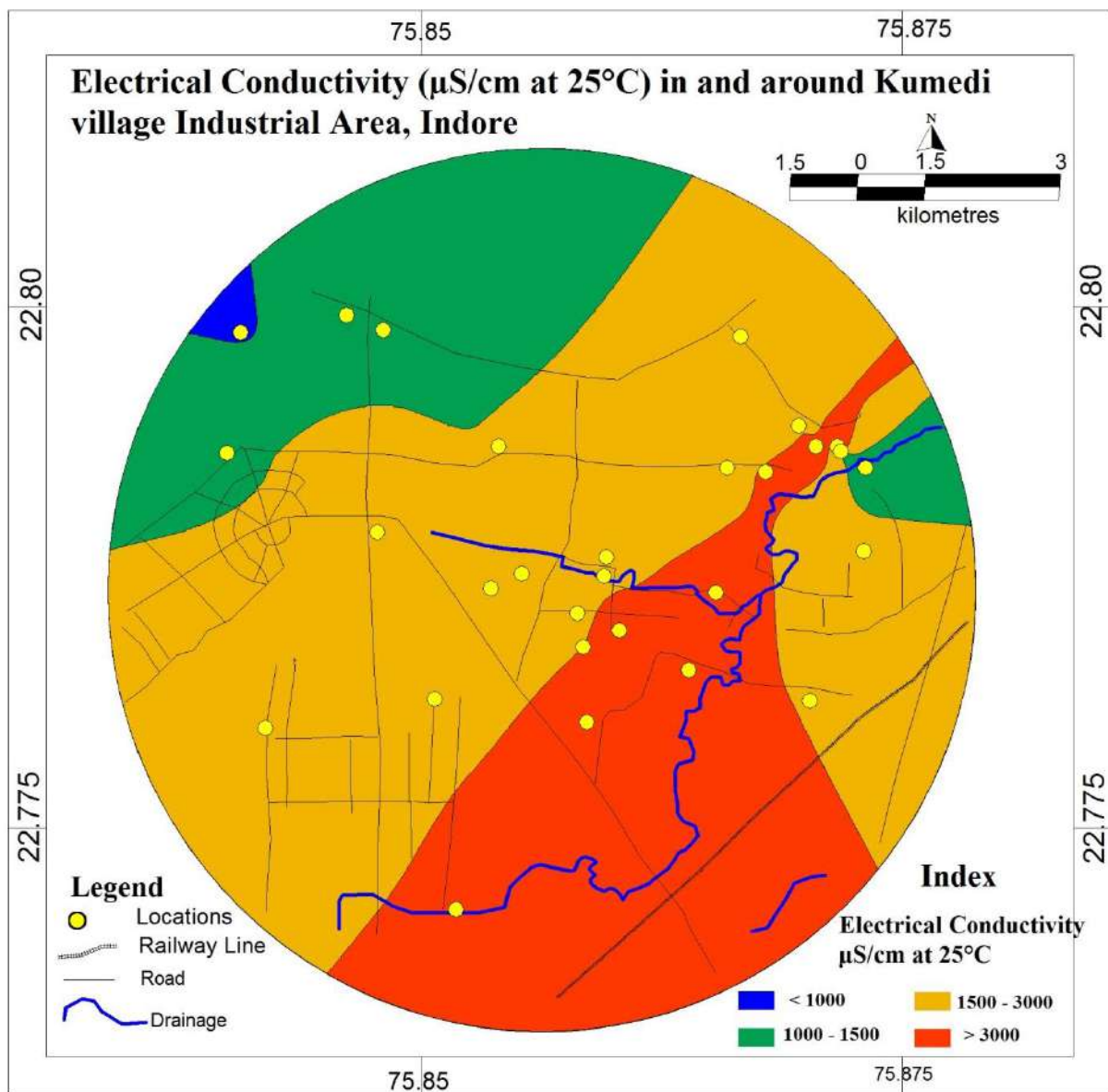


Fig.4.2:- Electrical Conductivity ($\mu\text{S}/\text{cm}$ at 25°C) in and around Kumedi village industrial area, Indore.

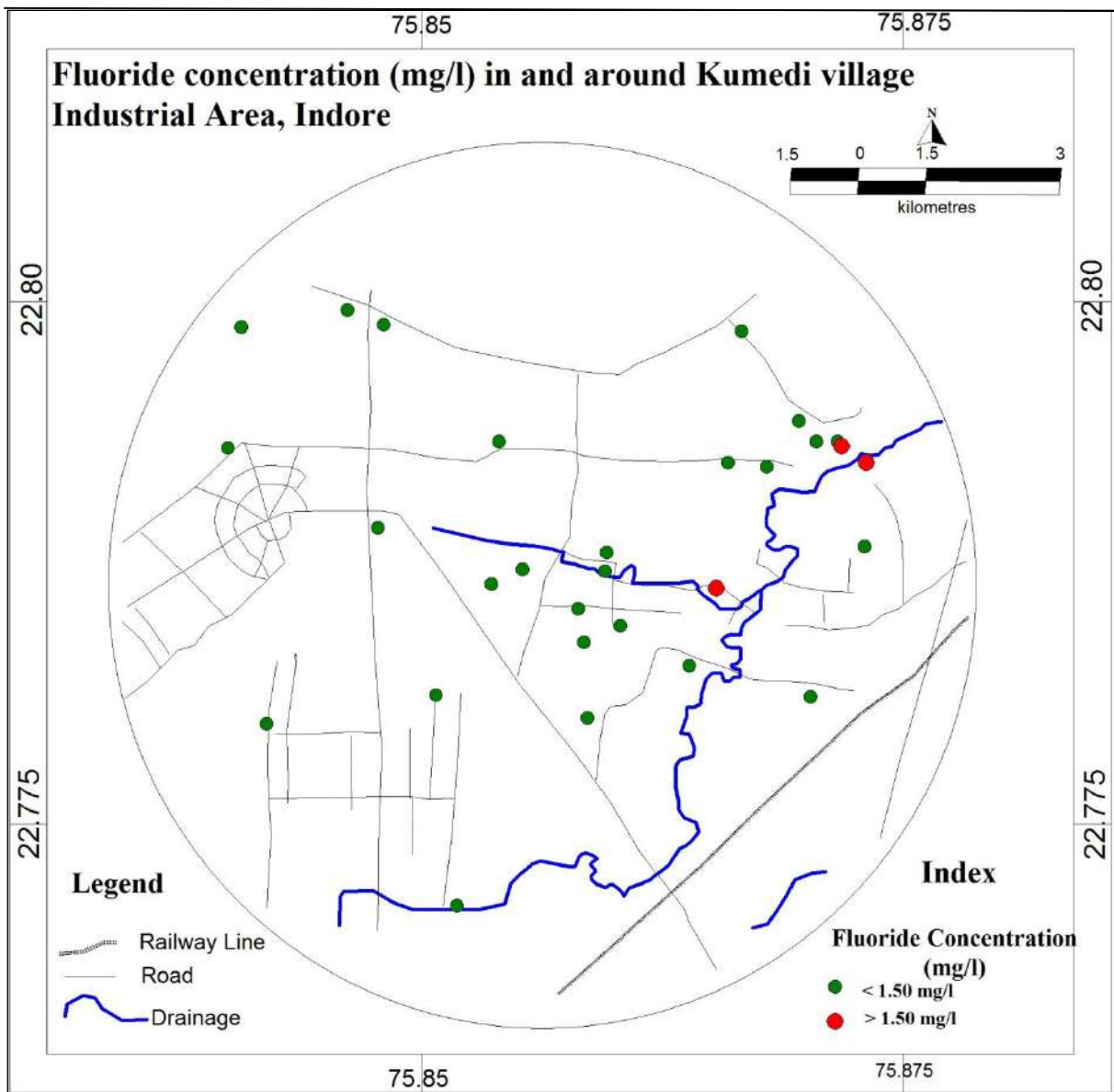


Fig.4.3: Point value Map of Fluoride concentration in and around Kumedi village industrial area, Indore.

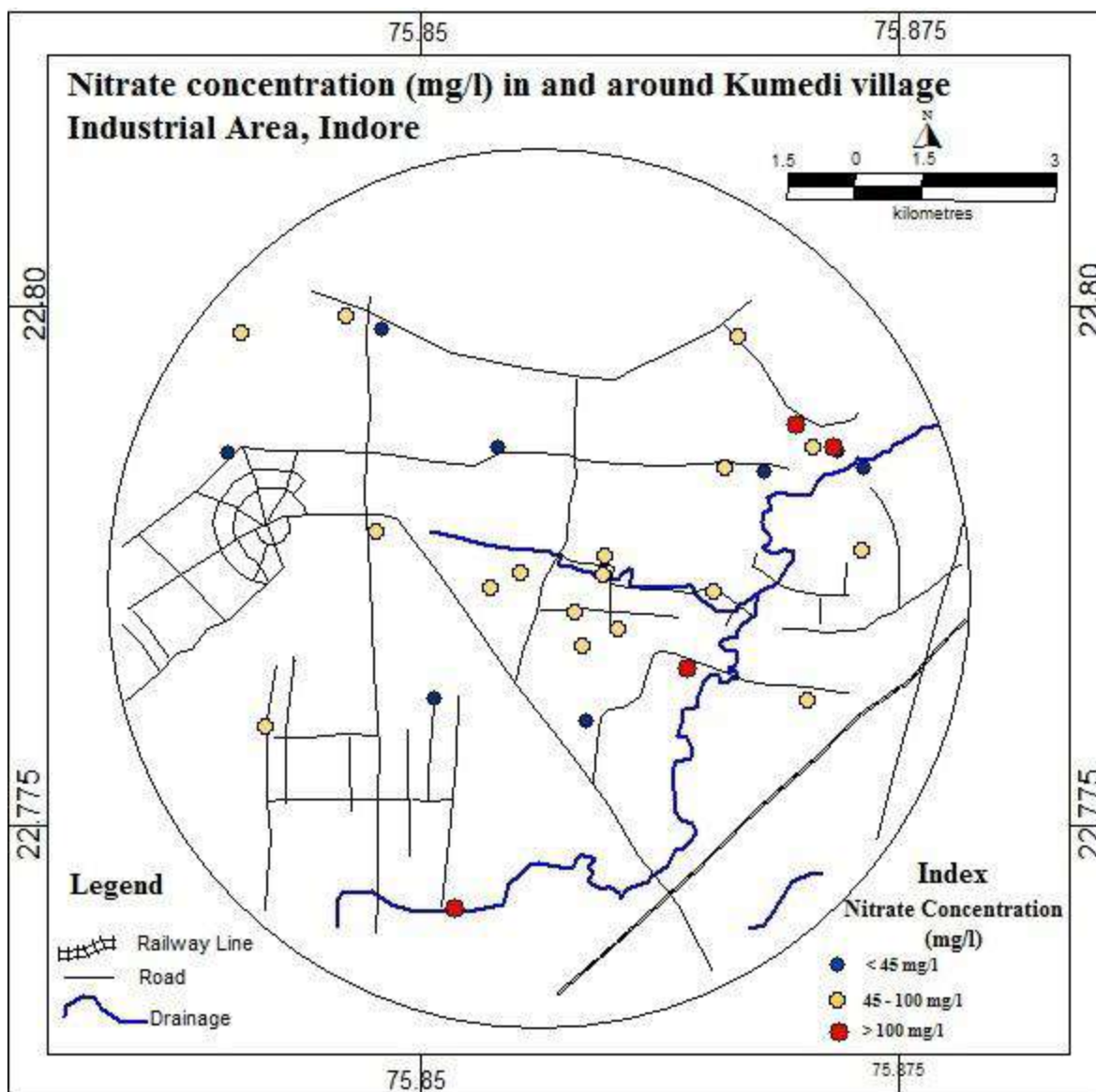


Fig.4.4 : Point value map of Nitrate concentration in and around Kumedi village industrial area, Indore.

XV. Trace Metals in ground water

Presence of the trace metals in ground water are cause of concern because of their harmful and aesthetic effects on human, however some trace metals are essential for human health. Results of analysis for key metals i.e. Iron, Copper, Zinc, Manganese, Nickel, Cadmium, Lead, Antimony, Tin, Chromium, Arsenic, Mercury and Uranium are summarized below (**Table 4.2**) and are discussed hereunder:

XVI. Copper (Cu)

The concentration of copper in water samples of Kumedi village industrial area is in the range of 0.057 to 0.218 mg/l and all values are within the BIS permissible limit. The maximum concentration of copper has been observed in the premises of Atulit Chemical Pvt. Ltd, Kumedi, (BW-01: 0.218 mg/l).

XVII. Iron (Fe)

The BIS has set the permissible limit for iron in drinking water i.e. 1.0 mg/l. The iron concentration has been found in the range of 0.009 to 0.735 mg/l. The iron concentration is within the BIS permissible limit. The maximum concentration of iron has been observed in the agriculture field of Mr. Prakash owner, Kumedi, new BW (BW-06: 0.735 mg/l).

XVIII. Zinc (Zn)

Zinc is an essential micro-nutrient and beneficial element for human bodies. The Bureau of Indian Standards prescribed permissible limits up to 15.0 mg/l. The concentration of Zn in water samples varies from 0.026 to 2.8 mg/l. All values of samples are within the BIS permissible limit. The maximum concentration of zinc has been observed in the ground water of hand pump before Ram Mandir, Kumedi (HP-01: 2.8 mg/l).

XIX. Nickel (Ni)

The Nickel concentration in water samples has been found between 0.007 to 0.194 mg/l. The acceptable limit of Nickel in drinking water is 0.02 mg/l. The nickel concentration is observed more than acceptable limit in 13.7 % of ground water samples (4 out of 29). The maximum concentration has been observed in the ground water of premises of Atulit Chemical Pvt Ltd, Kumedi, (BW-01: 0.194 mg/l). (**Fig-4.5**)

XX. Manganese (Mn)

The manganese concentration in water samples has been found between 0.016 to 0.184 mg/l. The permissible limit of manganese in drinking water is 0.3 mg/l. The manganese concentration has been found within the permissible limit. The maximum concentration has been observed in the ground water inside the Narwal Mukthi Dham Centre, Near Sector-F, Narwal (BW-19: 0.184 mg/l).

XXI. Uranium (U)

The uranium concentration in water samples has been found between 0.47 to 10.12 ppb. The permissible limit of uranium concentration set by WHO guidelines i.e. 30 ppb and Atomic Energy Regulatory Board (AERB) i.e. 60 ppb for drinking water. The uranium concentration has been found within the permissible limit. The maximum concentration has been observed in the ground water of hand pump before Ram Mandir, Kumedi (HP-01: 10.12 ppb).

Arsenic (As), Antimony (Sb), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), and Tin (Sn) have been also analysed and the results reveals that the concentration of all metals are below detectable limit (BDL).

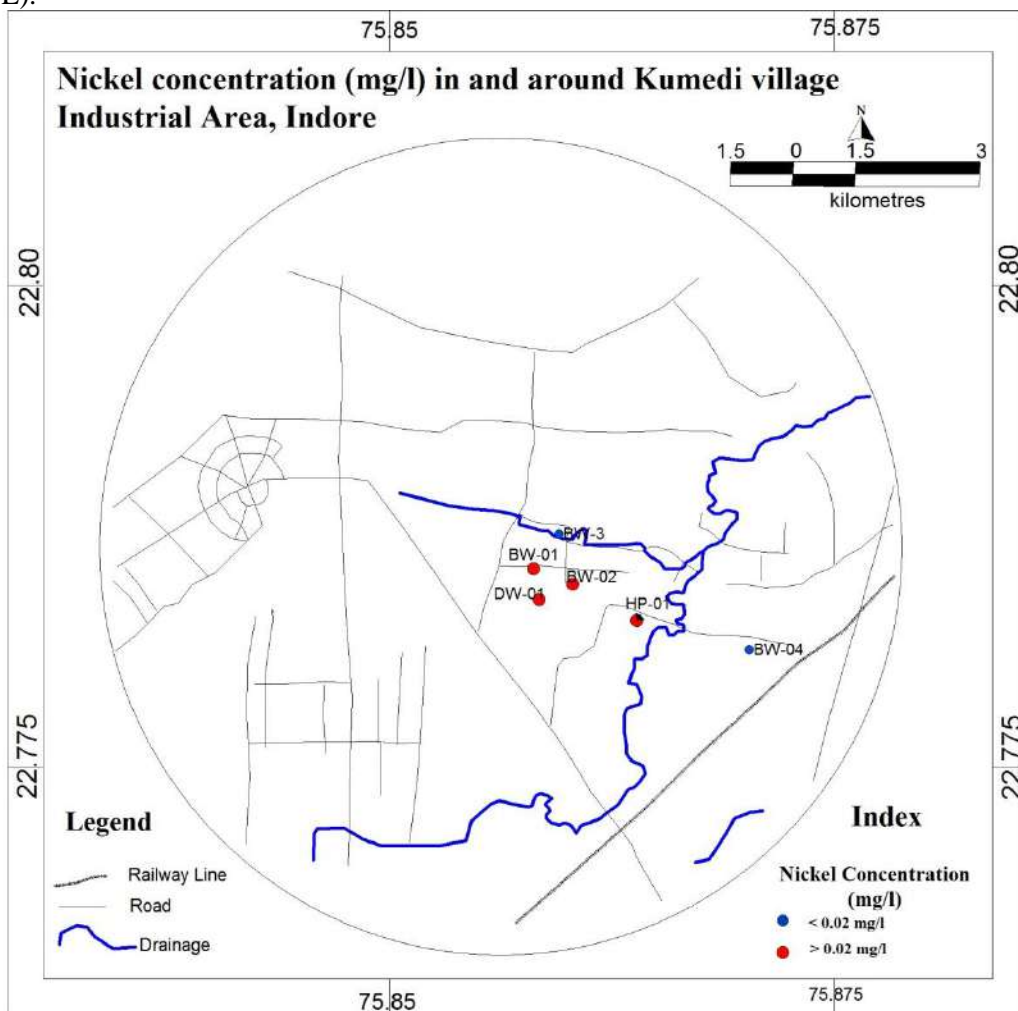


Fig.4.5 : Point value map of Nickel concentration in and around Kumedi village industrial area, Indore.

Table:-4.2 Trace/ Heavy metal analysis results of ground water samples collected from in and around Kumedi village industrial area, Indore, Madhya Pradesh

S. No.	Source	Fe	Cu	Zn	Mn	Ni	Cd	Pb	Sb	Sn	Cr	As	Hg	U
		ppm										ppb		
	Permissible Limit	1.0	1.5	15	0.3	0.02	0.003	0.01			0.05	10	1	30
1	BW-01	0.52	0.218	0.158	0.167	0.194	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.1
2	BW-02	0.52	0.16	0.114	0.016	0.163	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5.9
3	DW-01	0.385	0.172	0.133	0.024	0.101	BDL	BDL	BDL	BDL	BDL	BDL	BDL	4.6
4	BW-3	0.412	0.16	0.126	0.024	0.007	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.62
5	HP-01	0.358	0.114	2.8	0.134	0.038	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.12
6	BW-04	0.385	0.091	0.17	0.024	0.007	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.83
7	BW-05	0.439	BDL	0.101	0.024	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.55
8	BW-06	0.735	BDL	0.095	0.033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.17
9	DW-02	0.063	0.068	0.051	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.92
10	BW-07	0.009	0.057	0.245	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.48
11	HP-02	0.358	BDL	0.233	0.024	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.16
12	BW-08	0.09	BDL	0.145	0.024	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.57
13	BW-09	0.063	BDL	0.039	0.033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.11
14	HP-03	0.063	0.103	0.126	0.033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.76
15	HP-04	0.09	0.08	0.451	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.92
16	BW-10	0.009	0.091	0.045	0.033	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.97
17	HP-05	0.063	0.103	0.32	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5.59
18	BW-11	0.251	0.057	0.033	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.47
19	BW-12	0.17	0.103	0.026	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	7.72
20	BW-13	0.305	BDL	0.039	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.54
21	BW-14	0.036	BDL	0.076	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	2.82
22	BW-15	0.063	BDL	0.051	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.83
23	BW-16	0.063	BDL	0.064	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.84
24	BW-17	0.063	BDL	0.089	0.041	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.23
25	BW-18	0.385	BDL	0.095	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5.07
26	BW-19	0.143	BDL	0.139	0.184	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	5.58
27	BW-20	0.17	BDL	0.12	0.058	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.72
28	BW-21	0.197	BDL	0.564	0.092	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.16
29	BW-22	0.466	BDL	0.108	0.067	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1.51

BDL: Below Detectable Limit

Table :-4.3 Chemical analysis results of ground water samples collected from in and around Kumedi village industrial area, Indore, Madhya Pradesh

S. No.	Source	Field Temp. (°C)	pH at 25°C	EC $\mu\text{S/cm}$ at 25°C	CO ₃	HCO ₃	Cl	SO ₄	NO ₃	F	PO ₄	SiO ₂	TH	Ca	Mg	Na	K
					mg/l												
			6.5 to 8.5	3000 $\mu\text{S/cm}$ at 25°C		600 mg/l	1000 mg/l	400 mg/l	45 mg/l	1.5 mg/l		600 mg/l	200 mg/l	100 mg/l			
1	BW-01	25	7.28	2670	0	351	530	210	72	0.70	BDL	40	700	192	54	289	2.3
2	BW-02	25	7.14	3435	0	413	668	355	66	0.69	BDL	36	900	192	102	373	3.2
3	DW-01	23	7.09	3000	0	370	584	265	73	0.59	BDL	41	990	224	105	222	2.8
4	BW-03	26	7.00	2800	0	401	530	225	64	0.41	BDL	45	890	208	90	229	2.7
5	HP-01	25	7.11	5390	0	585	950	477	400	0.40	BDL	29	1760	328	229	380	81.5
6	BW-04	20	7.22	2760	0	431	564	130	71	0.75	BDL	27	790	156	97	253	3.1
7	BW-05	24	7.11	2000	0	419	342	75	85	0.35	BDL	48	710	176	88	123	2.6
8	BW-06	25	7.09	1820	0	394	292	108	67	0.32	BDL	51	660	176	54	112	2.5
9	DW-02	21	7.52	1150	0	364	114	50	65	0.30	0.2	50	500	144	34	30	2.6
10	BW-07	26	7.13	990	0	314	79	50	80	0.32	BDL	52	440	132	27	22	1.5
11	HP-02	27	7.37	1450	0	333	262	37	32	0.29	BDL	43	370	120	17	160	2.3
12	BW-08	25	7.06	1390	0	388	198	57	35	0.26	BDL	60	450	124	34	110	2.4
13	BW-09	24	7.43	1700	0	407	262	102	47	0.49	BDL	48	480	104	54	168	2.5
14	HP-03	25	6.99	2600	0	413	535	105	103	0.32	BDL	45	900	204	95	177	2.8
15	HP-04	26	8.09	1125	0	86	247	67	35	3.40	BDL	34	200	32	29	164	3.0
16	BW-10	24	7.21	1745	0	407	262	88	65	0.68	BDL	29	630	108	88	110	2.2
17	HP-05	25	6.88	3600	0	616	723	160	109	0.36	BDL	33	1010	208	119	250	189.0
18	BW-11	27	8.18	1170	0	43	346	50	5	2.35	BDL	32	120	44	2	210	5.1
19	BW-12	27	6.80	4200	0	511	1010	160	92	0.44	BDL	36	1560	316	187	242	6.5

20	BW-13	26	6.93	3100	0	444	723	120	43	0.33	BDL	41	960	232	92	269	3.6
21	BW-14	26	7.19	2230	0	388	426	125	60	0.57	BDL	29	720	160	78	179	3.2
22	BW-15	26	7.20	1515	0	413	228	70	11	0.72	BDL	46	530	132	49	102	2.7
23	BW-16	24	6.92	2540	0	431	470	189	52	0.32	BDL	45	920	216	92	158	3.6
24	BW-17	24	7.22	2110	0	511	307	165	32	0.45	BDL	38	510	112	56	247	3.2
25	BW-18	26	6.97	3430	0	413	733	275	49	3.10	BDL	48	1250	288	129	210	4.6
26	BW-19	29	6.72	3720	0	585	757	200	107	0.40	BDL	46	1180	276	119	300	18.8
27	BW-20	26	7.21	1805	0	401	252	100	74	0.42	BDL	58	660	152	68	109	3.6
28	BW-21	28	6.89	2670	0	357	599	136	42	0.27	BDL	44	1100	292	90	106	3.3
29	BW-22	27	7.11	1890	0	370	292	117	63	0.28	BDL	46	710	172	68	105	3.3

BDL: Below Detectable Limit

4.3 Water Type and Relationships (Hydro-chemical Diagrams)

Water type, relationships and hydro-chemical diagrams are distinct zone having cations and anions concentration describes composition/ category of ground water quality around Indore industrial area.

4.3.1 Piper Tri-Linear Diagram

The Piper trilinear diagram has been widely used to graphically representation of dissolved constituents in natural water from different sources. The concentration of parameters in ground water can be express by three points located in three different fields. The point represents as: (1) Percentage of three major cations constituents (Ca^{++} , Mg^{++} and $\text{Na}^+ + \text{K}^+$) in a cation triangular field; (2) percentage of three major anions ($\text{CO}_3^- + \text{HCO}_3^-$, Cl^- and $\text{SO}_4^{--} + \text{NO}_3^-$) in an anions triangular field and (3) the points in the diamond shaped field represents the geochemical evaluation/ hydrochemistry of ground water. The Piper-trilinear diagram (**Fig. 4.6**) of Kumedi village industrial area shows water are Ca- Cl_2 type (3 nos.); Na-Cl type (3 nos.); Ca-Mg-Cl type (20 nos.) and Ca- HCO_3 type (3 no.) of water (**Table-4.4**).

Table-4.4 Water type of the study area

S. No.	Type of water (nos.)	Sample code	Type of Water
1.	Ca- Cl_2 type (3 nos.)	HP-01, HP-04, BW-11	Permanent hardness
2.	Na-Cl type (3 nos.)	DW-2, BW-05 and BW-22	Saline
3.	Ca-Mg-Cl type (20 nos.)	BW-01, BW-03, BW-04, BW-06, BW-07, BW-08, BW-09, BW-10, BW-12, BW-13, BW-14, BW-15, BW-16, BW-19, BW-20, BW-21, DW-01, HP-02, HP-03 and HP-05	Permanent hardness
4.	Ca- HCO_3 Type (3 no.)	BW-02, BW-17 and BW-18	Temporary hardness

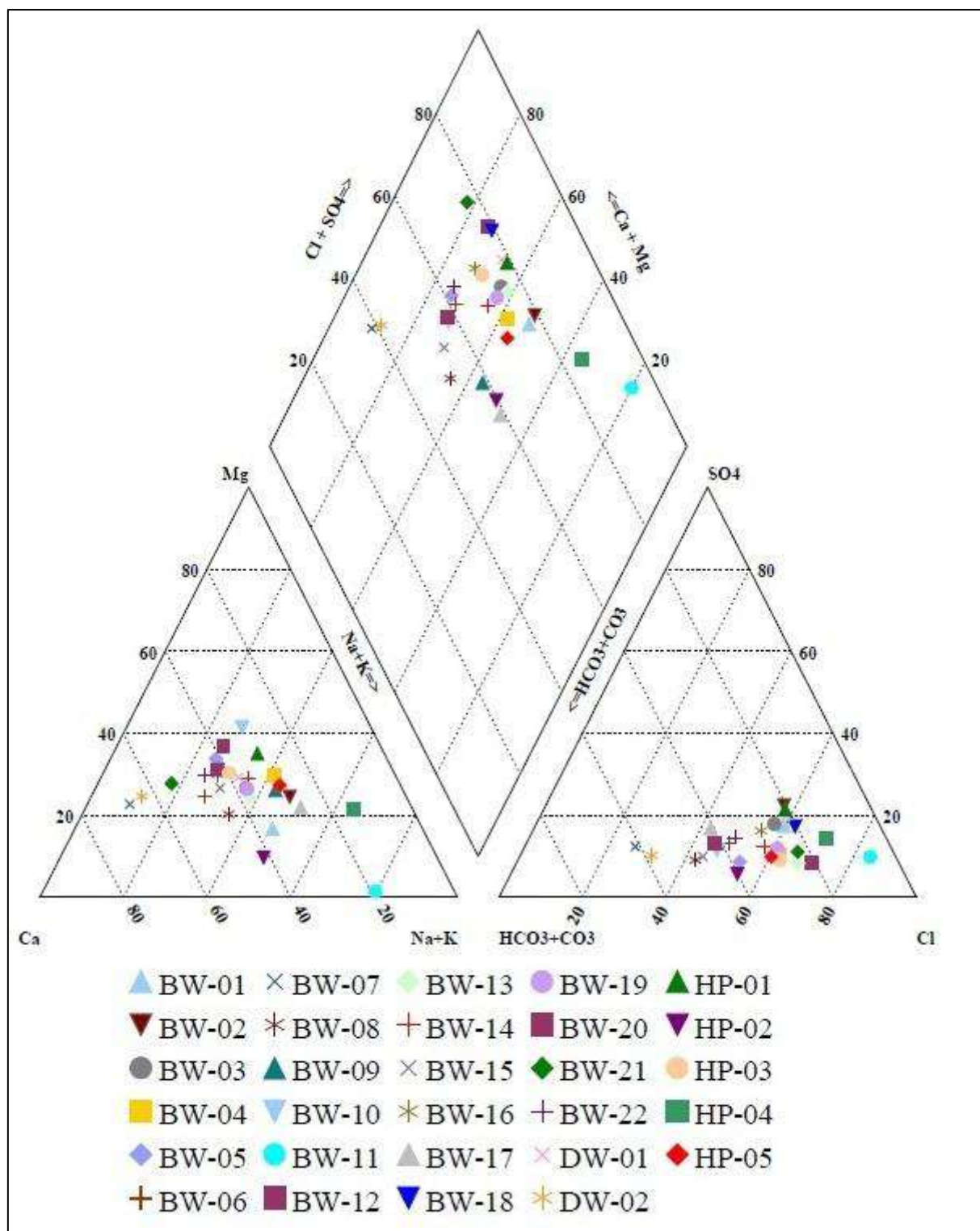


Fig 4.6 : Piper tri-linear diagram for ground water quality of Kumedi village industrial area, Indore.

US Salinity Diagram

The US Salinity Diagram classifies the water for irrigation purpose, it was suggested by the U.S. Salinity Laboratory in 1954 on the basis of electrical conductivity ($\mu\text{S}/\text{cm}$ at 25°C) and sodium adsorption ratio (SAR). The results of electrical conductivity and SAR of Kumedi village industrial area plotted on U.S. Salinity Laboratory diagram (**Fig. 4.7**).

The US Salinity Diagram shows 13 nos. of water samples are in the class of $C_3\text{-}S_1$ (High Salinity & Low SAR); 7 nos. of water samples show in the $C_4\text{-}S_1$ (Very high Salinity & Low SAR); 2 nos. are in the class of $C_3\text{-}S_2$ (High salinity and Medium SAR) and 7 nos. are in the class of $C_4\text{-}S_2$ (Very high Salinity & Medium SAR). It shows that the quality of water for irrigation is poor.

The water in the area may be used for irrigation purpose for satisfactory crop production is obtained under good management practices and favorable drainage conditions required for salinity control with proper soil management. The salinity class is shown in the **table 4.5**.

Table- 4.5 US Salinity class

S. No.	US Salinity Class and (Nos.)	Sample Code
1	$C_3 S_1$ (13)	BW-05, BW-06, BW-07, BW-08, BW-09, BW-10, BW-14, BW-15, BW-20, BW-22, DW-02, HP-02 and HP-04
2	$C_3 S_2$ (2)	BW-11 and BW-17
3	$C_4 S_1$ (7)	BW-03, BW-12, BW-16, BW-18, BW-21, DW-01 and HP-03
4	$C_4 S_2$ (7)	BW-01, BW-02, BW-04, BW-13, BW-19, HP-01 and HP-05

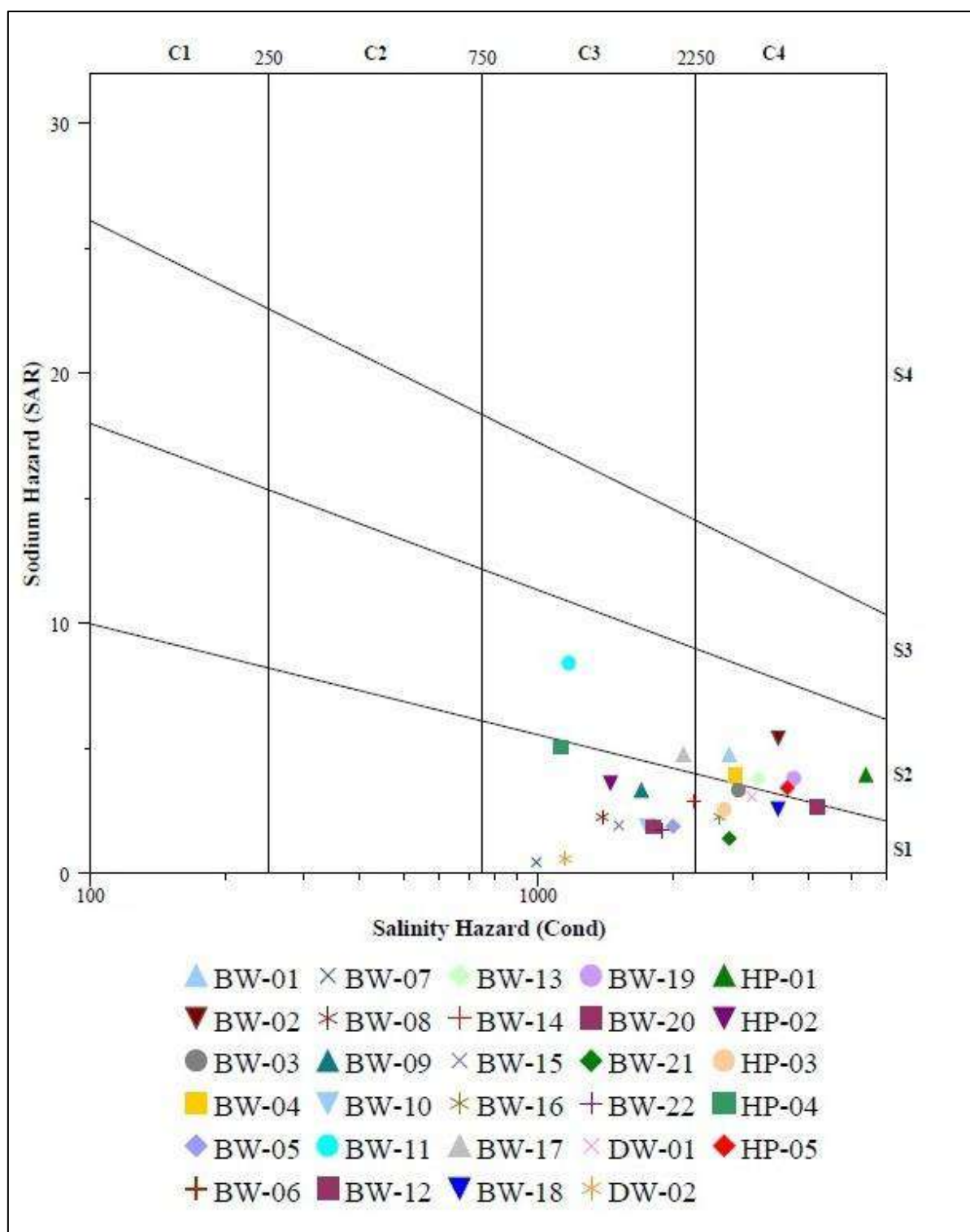


Fig.4.7 : U.S. Salinity diagram of Kumedi village industrial area, Indore.

Table.4.7: The Summary of Water Quality Data of Kumedi village industrial area, Indore compared with BIS (10500:2012) and WHO* guidelines.

Constituents	Unit	Concentration Ranges in Ground water	Acceptable - Permissible limit (BIS : 10500 :2012) and WHO*
Temperature	°C	20 – 29	
pH		6.72 – 8.18	6.5 – 8.5
Total Dissolved Solids	mg/l	598 - 3163	500/ 2000 (TDS)
Electrical Conductivity	μS/cm at 25°C	990 – 5390	-
CO₃+HCO₃	mg/l	43 – 616	200 – 600
Cl	mg/l	79 – 1010	250 – 1000
SO₄	mg/l	37 – 477	200 – 400
NO₃	mg/l	5 – 400	45
F	mg/l	0.26 – 3.40	1.0 – 1.5
PO₄	mg/l	BDL – 0.2	-
Ca	mg/l	32 – 328	75 – 200
Mg	mg/l	2 – 229	30 – 100
Na	mg/l	22 – 380	-
K	mg/l	1.5 – 189	-
Total Hardness as CaCO₃	mg/l	120 – 1760	200 – 600
SiO₂	mg/l	27 – 60	-
Cu	ppm	0.057 – 0.218	0.05-1.5
Fe	ppm	0.009 – 0.735	0.3
Zn	ppm	0.026 – 2.8	5 – 15
Mn	ppm	0.016 – 0.184	0.03
Ni	ppm	0.007 – 0.194	0.02
Cr	ppm	BDL	0.05
Cd	ppm	BDL	0.003
Pb	ppm	BDL	0.01
Sb	ppm	BDL	
Sn	ppm	BDL	
As	ppb	BDL	10
Hg	ppb	BDL	1
U*	ppb	0.47 – 10.12	30

CHAPTER-5 OBSERVATIONS AND DISCUSSIONS

- Geology of the area comprises Basaltic formation which is overlain by thin top soil and weathered formation. Top soil and weathered basalt form shallow aquifer ranging up to 20mtr.
- Groundwater occurs under semi confined to confined condition in fractured Basalt/ vesicular Basalt formation. Hydrogeology of the area is mostly controlled by geomorphological set up and climatic condition.
- There are two principal aquifer systems occur between 30m to 40m and 100m to 110 m depth in fractured Basalt/ vesicular basalt formation with a discharge of approximately 2-4 lps.
- Relatively Shallow water level (6m) observed at middle part of the study area and having high electrical conductivity (more than 3000 micro Siemens/cm at 25°C) along the nala towards east.
- The villages (Kumedi, Bhangia) located close to the nala are mostly affected. The ground water quality of Kumedi and Bhangia village before 8 years was good. After development of industrialisation, the polluted water (physically disorder) came into notice in borewell as well as hand pump to public as well as district administration.
- The pollutants follow the drainage system of the area and polluted both shallow and deeper aquifer of Kumedi and Bhangia village. The return seepage from surface water irrigation recharges the aquifer and deteriorates the groundwater quality of shallow aquifer.
- But the quality of ground water is good across the nala in all direction. The bore wells located away from the nala are being used for drinking as well as domestic purpose. However, the electrical conductivity is about 2760 micro Siemens/ cm.
- It was also observed that some bore wells provide fresh water after pumping of 1-2 hrs. Though the ground water of northern part of study area is pollution free, the polluted water is started to come out during summer when water level goes down.

The investigation carried out to assess the water quality status in Industrial Area of Kumedi village, Indore emerged the following findings:

- In the ground water of BW-01 observed brownish in color and concentration of nitrate (72 mg/l) and Total Hardness (700 mg/l) observed more than permissible limit compared with BIS (10500:2012). All remaining basic parameter are within permissible limit.
- In the ground water of BW-03, BW-16 and HP-04 samples observed slightly brownish in colour and rest of the samples were colorless. South-east of BW-01 sampling point far from 0.5 km sampling was done in Bore well (BW-02) observed colorless and Dug well (DW-01) observed slightly brown in colour.
- In and around of BW-01 location drainage channel flows effluent of different industries appeared in reddish color. These effluent flows towards Kumedi village. Far from BW-01 location color of water appeared colorless.
- It is observed in and around Kumedi village near to drainage channel shows discoloration of ground water during summer season.
- Ground water belonging to industrial area of Kumedi village did not show significant fluctuation in temperature since all the values set out in between 20 to 29 °C and pH value ranged in between 6.72 to 8.18.

- The Industrial Area of in and around Kumedi village has been found electrical conductivity ranging from 990 – 5390 $\mu\text{S}/\text{cm}$ at 25 °C indicating 8 no. of samples exceed conductivity $\geq 3000 \mu\text{S}/\text{cm}$ at 25 °C remaining of the samples belongs to less than 3000 $\mu\text{S}/\text{cm}$ at 25 °C.
- The industrial area of Kumedi village, Indore and its surrounding villages The fluoride concentration in all water samples have been found within permissible limits of BIS (1.50 mg/l) except the three locations namely BW-11: 2.35 mg/l; BW-18: 3.10 and HP-04: 3.40 mg/l.
- Nitrate concentration of Kumedi village, Indore and its surrounding village 72.4% (21 out of 29 samples) ground water samples recorded more than 45 mg/l as per BIS recommendation remaining samples are within the permissible limit. Contribution of nitrate may be use of fertilizer in agricultural field in and around Kumedi village and urban drainage flows towards Kumedi village.
- The total hardness of water samples in Kumedi village industrial area ranging from 120 to 1760 mg/l. 68.9% samples (20 out of 29 samples) exceed BIS permissible limit of 600 mg/l in the ground water. Waters belonging to in and around villages of Kumedi, Indore might be categorized as hard to very hard for household use as well as drinking purpose.
- The Piper tri-linear diagram of Kumedi village industrial area show water is permanent hardness, saline and temporary hardness type.
- The US Salinity Diagram shows C_3S_1 , C_3S_2 , C_4S_1 and C_4S_2 irrigation classes. It indicates that the quality of water for irrigation is poor to very poor class and it may be used for irrigation purpose for satisfactory crop production is obtained under good management practices and favourable drainage conditions required.
- Concentration of Copper, Zinc and Uranium metals in ground water samples are within the permissible limit whereas Arsenic (As), Antimony (Sb), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), and Tin (Sn) are below detectable limit (BDL).
- The Nickel concentration in water samples has been found between 0.007 to 0.194 mg/l. The nickel concentration more than acceptable limit is observed at 4 out of 29 ground water samples.
- The possible reason the water has turned brown is there may be too much iron and/or manganese in water. Although iron and manganese are considered contaminants, drinking water containing these elements actually doesn't harm you in any way as both of these are essential elements that the body requires to function effectively. But, our analysed results show iron and manganese concentration are well within the permissible limit.

CHAPTER-6

Conclusions and Recommendations

- Two aquifer systems are present in the area. Alluvium and weathered basalt forms shallow aquifer. Ground water occurs under semi-confined to confined conditions in fractured basalt/ vesicular basalt.
- Shallow water level area has been observed at the central part of the area. Central and Eastern part of water is poor in the villages Kumedi and Bhangia. The aquifers located close to the nala are severely affected.
- Special attention may be given to this area, source of pollution may be identified and steps should be taken to improve the ground water quality. Monitoring of quality of both surface and ground water may be carried out periodically.
- Poor quality of shallow ground water level may be pumped and used for gainful utilization for the industrial requirement after adequate treatment.
- The Pzs shall be constructed to monitor the water level of that area.
- The unconfined aquifer is polluted and not suitable for drinking as well as for irrigation to some extent.
- Artificial recharge technique may be adopted scientifically for recharging/ flushing the aquifer in the area in order to dilute the pollutants.
- High intensity study should be imposed to locate the source of pollution.

Annexures
Annexure-1 (Details of the Sampling point in the study area)

SI NO	District	Block	Locations	Source	Long	Lat	Reduced Level	PH
1	Indore	Sanwer	In the premises of Atulit Chemical Pvt Ltd, ,Kumedi	BW	75.8581	22.7853	535.5	7.1
2	Indore	Sanwer	Tripati Balaji Industries, Kumedi	BW	75.8603	22.7845	534.8	7.1
3	Indore	Sanwer	Back side of Ajmera Metals Pvt Ltd,Kumedi	DW	75.8584	22.7837	536.6	7
4	Indore	Sanwer	In the premises of Choksi Laboratories,Kumedi	BW	75.8595	22.7871	535.8	6.9
5	Indore	Sanwer	Before Ram Mandir , Kumedi main	HP	75.8639	22.7826	536.3	6.9
6	Indore	Sanwer	MR 10 Road, Before house of Rajendra madanlalji Panchal, Kumedi	BW	75.8702	22.7811	535.9	7.1
7	Indore	Sanwer	in the Agriculture field of Prakash owner(Old BW),back side of Pallavi food Pvt Ltd, Kumedi	BW	75.8552	22.7872	538	7
8	Indore	Sanwer	in the Agriculture field of prakash owner (new BW), Kumedi	BW	75.8536	22.7865	538.2	7.1
9	Indore	Sanwer	owner Neemba Bhailwan Yadav, side of Arbindo Hospital, Bhawrasla	DW	75.8461	22.7996	546.5	7.5
10	Indore	Sanwer	in the Agriculture field of Subam Patel, Bhawrasla	BW	75.8406	22.7988	548	7
11	Indore	Sanwer	Before house of Ram Yadav, Bardari road, Bhawrasla	HP	75.8399	22.793	545.5	7.2
12	Indore	Sanwer	Before house of Kripal Singh,MR 12Road, Jakhya	BW	75.848	22.7989	544.5	7
13	Indore	Sanwer	Back side of Jagadish Yadav house, Bhangiya	BW	75.8666	22.7986	536.3	7.3
14	Indore	Sanwer	Before house of Jagadish Awlia, Bhangiya	HP	75.8696	22.7943	536.4	6.8
15	Indore	Sanwer	By the side of Crematorium tent, Bhangiya	HP	75.8731	22.7923	531.9	8.3
16	Indore	Sanwer	in the Agriculture field of Ramesh Chandra Mouriya, Bhangiya Kakad	BW	75.873	22.7883	533.6	7.1
17	Indore	Sanwer	Back side of Ram Mandir Temple, Bhangiya	HP	75.8716	22.7933	536	6.7
18	Indore	Sanwer	Before house of Nitesh Dubolya, Bhangiya	BW	75.8718	22.7931	535.4	8.5

19	Indore	Sanwer	Before house of Rakesh Panchal, Bhangiya	BW	75.8705	22.7933	535.9	6.6
20	Indore	Sanwer	Before house of Ram Chandraji, Bhangiya	BW	75.8679	22.7921	535	6.7
21	Indore	Sanwer	Before house of Mahesh Dukat, Kalindi Gold Sec, Bhangiya	BW	75.8659	22.7923	534.8	7
22	Indore	Sanwer	opposite house of Primod Patithor, 100m of Krishna kunj shop, Kumedi	BW	75.854	22.7933	539.2	7
23	Indore	Sanwer	in the Agriculture field of Mangilal Pithambaram, Kumedi	BW	75.8596	22.788	535.6	6.9
24	Indore	Sanwer	Inside of Saraswati Resort marriage garden, Kumedi Kakad	BW	75.8586	22.7801	535.9	7
25	Indore	Sanwer	Inside DMC Dilkush, Tirupati Industries, Kumedi	BW	75.8653	22.7863	532.4	6.8
26	Indore	Sanwer	Inside Narwal Mukthi Dam Centre, Near Sector F, Narwal	BW	75.8518	22.7711	537.9	6.5
27	Indore	Sanwer	in the Agriculture field of Dinachand Prohit, Love Kush Chouraha, Bhawrasla	BW	75.8477	22.7892	542.5	7
28	Indore	Sanwer	51A, Sec-F, in the campus of NAFD, Bhawrasla	BW	75.8507	22.7812	540.6	6.7
29	Indore	Sanwer	Before house of Pintu Shukla, Near Agarbatti Industry, Bhawani nagar	BW	75.8507	22.7812	540.6	6.9

Annexure-2 (Well Details of the study area)

SI NO	District	Block	Locations	Source	Long	Lat	Reduced Level(m)	Water Level(m)
1	Indore	Sanwer	In the premises of Atulit Chemical Pvt Ltd, ,Kumedi	BW	75.8581	22.7853	535.5	5.98
2	Indore	Sanwer	Tripati Balaji Industries, Kumedi	BW	75.8603	22.7845	534.8	6.84
3	Indore	Sanwer	Back side of Ajmera Metals Pvt Ltd,Kumedi	DW	75.8584	22.7837	536.6	6.2
4	Indore	Sanwer	In the premises of Choksi Laboratories,Kumedi	BW	75.8595	22.7871	535.8	6.1
5	Indore	Sanwer	Before Ram Mandir , Kumedi main	HP	75.8639	22.7826	536.3	7.33
6	Indore	Sanwer	MR 10 Road, Before house of Rajendra madanlalji Panchal, Kumedi	BW	75.8702	22.7811	535.9	9
7	Indore	Sanwer	in the Agriculture field of Prakash owner(Old BW),back side of Pallavi food Pvt Ltd, Kumedi	BW	75.8552	22.7872	538	6.8
8	Indore	Sanwer	in the Agriculture field of prakash owner (new BW), Kumedi	BW	75.8536	22.7865	538.2	6.05
9	Indore	Sanwer	owner Neemba Bhailwan Yadav, side of Arbindo Hospital, Bhawrasla	DW	75.8461	22.7996	546.5	7.5
10	Indore	Sanwer	in the Agriculture field of Subam Patel, Bhawrasla	BW	75.8406	22.7988	548	7.63
11	Indore	Sanwer	Before house of Ram Yadav, Bardari road, Bhawrasla	HP	75.8399	22.793	545.5	7.4
12	Indore	Sanwer	Before house of Kripal Singh,MR 12Road, Jakhya	BW	75.848	22.7989	544.5	7.1
13	Indore	Sanwer	Back side of Jagadish Yadav house, Bhangiya	BW	75.8666	22.7986	536.3	8.99
14	Indore	Sanwer	Before house of Jagadish Awlia, Bhangiya	HP	75.8696	22.7943	536.4	7.8

15	Indore	Sanwer	By the side of Crematorium tent, Bhangiya	HP	75.8731	22.7923	531.9	8.1
16	Indore	Sanwer	in the Agriculture field of Ramesh Chandra Mouriya, Bhangiya Kakad	BW	75.873	22.7883	533.6	6.1
17	Indore	Sanwer	Back side of Ram Mandir Temple, Bhangiya	HP	75.8716	22.7933	536	6.42
18	Indore	Sanwer	Before house of Nitesh Dubolya, Bhangiya	BW	75.8718	22.7931	535.4	
19	Indore	Sanwer	Before house of Rakesh Panchal, Bhangiya	BW	75.8705	22.7933	535.9	8.4
20	Indore	Sanwer	Before house of Ram Chandraj, Bhangiya	BW	75.8679	22.7921	535	
21	Indore	Sanwer	Before house of Mahesh Dukat, Kalindi Gold Sec, Bhangiya	BW	75.8659	22.7923	534.8	
22	Indore	Sanwer	opposite house of Primod Patithor, 100m of Krishna kunj shop, Kumedi	BW	75.854	22.7933	539.2	7.1
23	Indore	Sanwer	in the Agriculture field of Mangilal Pithambaram, Kumedi	BW	75.8596	22.788	535.6	6.35
24	Indore	Sanwer	Inside of Saraswati Resort marriage garden, Kumedi Kakad	BW	75.8586	22.7801	535.9	7.19
25	Indore	Sanwer	Inside DMC Dilkush, Tirupati Industries, Kumedi	BW	75.8653	22.7863	532.4	7.23
26	Indore	Sanwer	Inside Narwal Mukthi Dam Centre, Near Sector F, Narwal	BW	75.8518	22.7711	537.9	6.8
27	Indore	Sanwer	in the Agriculture field of Dinachand Prohit, Love Kush Chouraha, Bhawrasla	BW	75.8477	22.7892	542.5	8
28	Indore	Sanwer	51A, Sec-F, in the campus of NAFD, Bhawrasla	BW	75.8507	22.7812	540.6	8.1

29	Indore	Sanwer	Before house of Pintu Shukla, Near Agarbatti Industry, Bhawani nagar	BW	75.8507	22.7812	540.6	6.36
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Sr.no.	Application Code	Application Type	Application Number	Application Status	MSME	Project Name	Date Of Commencement	Application Category Description	Ground Water Utilisation For	Proposed District Name	Proposed Sub-District Name	Proposed Village Name	Present Sub District Area Type Category Desc	Eligible For Exemption Letter	Net Ground Water Requirement(m3/day)	Issued Letter Type Name	Latitude	Longitude	Application Submitted Date
1	98044	Industrial	21-4/2340/MP/IND/2024	Exempted	No	HINDUSTAN PETROLEUM CORPORATION LIMITED (INDORE NEW IRD)	3/28/2017 0:00	Petroleum Products	ExistingIndustry	INDORE	SANWER	Mangrya Sadak	Over Exploited	YES	5	Exemption Letter			9/3/2024 19:57
2	97176	Industrial	21-4/2324/MP/IND/2024	Exempted	Yes	PUSHPNATH OVERSEAS PRIVATE LIMITED		Silk	NewIndustry	INDORE	SANWER		Over Exploited	YES	9	Exemption Letter			8/6/2024 14:00
3	95612	Industrial	21-4/2296/MP/IND/2024	Exempted	Yes	DM POLYMERS	9/5/2019 0:00	Rubber	ExistingIndustry	INDORE	SANWER	Bhawrasa	Over Exploited	YES	2.5	Exemption Letter			6/22/2024 20:17
4	93503	Industrial	21-4/2249/MP/IND/2024	Exempted	Yes	M/S. SUNDERLAL EXTRUSIONS PVT. LTD		Aluminium Industry	NewIndustry	INDORE	SANWER	Khakrod	Over Exploited	YES	3	Exemption Letter			4/29/2024 0:17
5	92127	Industrial	21-4/2208/MP/IND/2024	Exempted	Yes	HINDUSTAN EQUIPMENTS PVT LTD	9/11/1998 0:00	Engineering Goods Products	ExistingIndustry	INDORE	SANWER	Bardari	Over Exploited	YES	5	Exemption Letter			3/22/2024 7:13
6	91504	Industrial	21-4/2192/MP/IND/2024	Exempted	Yes	WOHILA FOODS PRIVATE LIMITED		Food Processing Industry	NewIndustry	INDORE	SANWER	Bardari	Over Exploited	YES	1	Exemption Letter			3/4/2024 15:24
7	90743	Industrial	21-4/2168/MP/IND/2024	Exempted	Yes	VYANKATESH POLYCHEM AND METALS PRIVATE LIMITED		Ferrous Metallurgical Steel	NewIndustry	INDORE	SANWER	Dhan Khedi	Over Exploited	YES	2.2	Exemption Letter			2/13/2024 9:09
8	84783	Industrial	21-4/1943/MP/IND/2023	Exempted	Yes	M/S. SHIVAARNA TECHNOFOAMS PRIVATE LIMITED (100 PERCENT SUBSIDIARY OF DUROFLEX P.LTD)	2/9/2019 0:00	Polyurethane Foam	ExistingIndustry	INDORE	SANWER	Hatuniya	Over Exploited	YES	5	Exemption Letter			8/30/2023 18:00
9	84432	Industrial	21-4/1925/MP/IND/2023	Exempted	Yes	IMPRO LECITHIN LLP	4/5/2023 0:00	Food Processing Industry	ExistingIndustry	INDORE	SANWER	Shahna	Over Exploited	YES	6	Exemption Letter			8/21/2023 20:21
10	83221	Infrastructure	21-4/1874/MP/INF/2023	Exempted	Yes	SURYANSH HOTEL AND RESORTS	11/15/2017 0:00	Hotel	ExistingIndustry	INDORE	SANWER	Mangrya Sadak	Over Exploited	YES	9.5	Exemption Letter			7/14/2023 12:28
11	82912	Industrial	21-4/1866/MP/IND/2023	Exempted	Yes	M/S KHK PRESSINGS AND FORGING PRIVATE LIMITED	12/1/2020 0:00	Ferrous Metallurgical Steel	ExistingIndustry	INDORE	SANWER	Panchderiya	Over Exploited	YES	9.8	Exemption Letter			7/6/2023 11:07
12	82465	Industrial	21-4/1848/MP/IND/2023	Exempted	Yes	M/S GEOFAST INDUSTRIES INDIA LIMITED		Food Processing Industry	NewIndustry	INDORE	SANWER	Baroda Arjun	Over Exploited	YES	9.5	Exemption Letter			6/23/2023 11:09
13	82255	Industrial	21-4/1845/MP/IND/2023	Exempted	Yes	CHOKSI LABORATORIES LIMITED	12/12/2020 0:00	Laboratory Equipments	ExistingIndustry	INDORE	SANWER	Kumerdi	Over Exploited	YES	9.9	Exemption Letter			6/16/2023 16:13
14	81751	Industrial	21-4/1829/MP/IND/2023	Exempted	Yes	GO GREEN TEXTILES INDIA	8/12/2012 0:00	Garment	ExistingIndustry	INDORE	SANWER	Bardari	Over Exploited	YES	2	Exemption Letter	22.79678	75.83146	5/31/2023 14:36
15	68368	Industrial	21-4/1396/MP/IND/2022	Exempted	Yes	REWA BEVERAGES	5/20/2019 0:00	Packaged Drinking Water Packaged Natural Mineral Water	ExistingIndustry	INDORE	SANWER	Bhawrasa	Over Exploited	YES	9.5	Exemption Letter	22.78647	75.84755	6/9/2022 10:24
16	67619	Industrial	21-4/1384/MP/IND/2022	Exempted	Yes	MEDIRICH INFUSIONS PRIVATE LIMITED	3/6/2019 0:00	Beverages	ExistingIndustry	INDORE	SANWER	Darjikaradia	Over Exploited	YES	9.5	Exemption Letter	22.93311	75.87002	5/11/2022 19:06
17	67576	Industrial	21-4/1382/MP/IND/2022	Exempted	Yes	NARBADA TEXTILES PVT LTD	12/31/2018 0:00	Garment	ExistingIndustry	INDORE	SANWER	Kumerdi	Over Exploited	YES	1	Exemption Letter	22.7854	75.8604	5/10/2022 15:30
18	67299	Industrial	21-4/1376/MP/IND/2022	Exempted	Yes	JASH PRECISION TOOLS PVT. LTD.	2/1/1990 0:00	Engineering Goods Products	ExistingIndustry	INDORE	SANWER	Rajoda	Over Exploited	YES	6	Exemption Letter	22.9042	75.84767	4/28/2022 16:05
19	65978	Industrial	21-4/1317/MP/IND/2022	Exempted	Yes	RINI LIFE SCIENCE PVT. LTD.	3/21/2021 0:00	Pharmaceuticals	ExistingIndustry	INDORE	SANWER	Bhawrasa	Over Exploited	YES	5.5	Exemption Letter	22.78529	75.84455	3/29/2022 12:49
20	62786	Industrial	21-4/1195/MP/IND/2021	Exempted	Yes	PRATIBHA PACKWELL PVT LTD	12/31/2015 0:00	Corrugated boxes	ExistingIndustry	INDORE	SANWER	Kumerdi	Over Exploited	YES	8.5	Exemption Letter	22.78821	75.85827	12/27/2021 19:30
21	58291	Infrastructure	21-4/1142/MP/INF/2021	Exempted	Yes	LIFE CARE LOGISTIC PVT. LTD.		Warehouse	NewIndustry	INDORE	SANWER	Pirkaradiya	Over Exploited	YES	9.5	Exemption Letter	22.88514	75.96522	7/3/2021 13:44
22	57437	Infrastructure	21-4/1135/MP/INF/2021	Exempted	Yes	ADVANTAGE WAREHOUSING LLP	10/1/2018 0:00	Warehouse	ExistingIndustry	INDORE	SANWER	Lasudiya Parmar	Over Exploited	YES	8.5	Exemption Letter	22.84691	75.9453	5/24/2021 15:18

Sr. no	Application Type	ApplicationNumber	Project Name	Date Of Commencement	Application Category Description	Ground Water Utilisation For	Proposed Sub-District Name	Proposed Village Name	Net Ground Water Requirement(m ³ /day)	Issued Letter Type Name	Latitude	Longitude	Validity Start Date	Validity End Date
1	Industrial	21-4/2306/MP/IND/2024	RUSOMA HEALTHCARE PRIVATE LIMITED		Pharmaceuticals	NewIndustry	SANWER	Mala Khedi	20	NOC Letter			6/26/2024 0:00	6/25/2026 0:00
2	Industrial	21-4/2238/MP/IND/2024	M/S. JDI FOODS PVT. LTD.		Food Processing Industry	NewIndustry	SANWER	Kadwali Khurd	80	NOC Letter			6/3/2024 0:00	6/2/2026 0:00
3	Industrial	21-4/2145/MP/IND/2024	NPL MANUFACTURING PRIVATE LIMITED		Chemical	NewIndustry	SANWER	Baroda Arjun	75	NOC Letter			3/26/2024 0:00	3/25/2026 0:00
4	Industrial	21-4/2086/MP/IND/2023	N R AROMAS UNIT-2		Cosmetic	NewIndustry	SANWER	Bardari	7	NOC Letter			2/1/2024 0:00	1/31/2026 0:00
5	Infrastructure	21-4/1924/MP/INF/2023	SAM INDUSTRIES LIMITED		Warehouse	NewIndustry	SANWER	Dakachya	162	NOC Letter			11/6/2023 0:00	11/5/2025 0:00
6	Infrastructure	21-4/1876/MP/INF/2023	LIFE CARE LOGISTIC PVT. LTD.		Warehouse	NewIndustry	SANWER	Pirkaradiya	27	NOC Letter	22.883822	75.964723	9/18/2023 0:00	9/17/2025 0:00
7	Industrial	21-4/1708/MP/IND/2023	UNITY FUN N FOOD		Food Processing Industry	NewIndustry	SANWER	Tarana	19	NOC Letter	22.919643	75.853736	4/15/2023 23:05	4/14/2025 23:05
8	Industrial	21-4/1579/MP/IND/2022	JASH ENGINEERING LTD. UNIT-II	7/12/2012 0:00	Engineering Goods Products	ExistingIndustry	SANWER	Bardari	31	NOC Letter	22.42	75.51	11/30/2022 14:23	11/29/2024 14:23
9	Infrastructure	21-4/1425/MP/INF/2022	RELIANCE RETAIL LTD		Warehouse	NewIndustry	SANWER	Lasudiya Parmar	9.5	NOC Letter	22.841341	75.943301	9/18/2022 13:27	9/17/2024 13:27
10	Infrastructure	21-4/1369/MP/INF/2022	JOHN DEERE INDIA PRIVATE LIMITED		Warehouse	NewIndustry	SANWER	Baroda Arjun	40	NOC Letter	22.874507	75.969202	5/23/2022 20:43	5/22/2024 20:43
11	Infrastructure	21-4/1297/MP/INF/2022	RELIANCE BP MOBILITY LIMITED	2/14/2015 0:00	Petroleum Retail Outlet	ExistingIndustry	SANWER	Lasudiya Parmar	2	NOC Letter	22.84178	75.94353	1/24/2023 16:38	1/23/2025 16:38
12	Industrial	21-4/1246/MP/IND/2022	ENVIRO RECYCLEAN PVT. LTD.		Waste Management	NewIndustry	SANWER	Rajoda	27	NOC Letter	22.94663	76.09514	3/10/2022 12:17	3/9/2024 12:17
13	Industrial	21-4/1188/MP/IND/2021	VARDHAMAN BAKERS PVT. LTD	5/17/2021 0:00	Biscuit and confectionary	ExistingIndustry	SANWER	Solsinda	20	NOC Letter	22.889751	75.842208	12/24/2021 15:08	12/23/2023 15:08
14	Industrial	21-4/995/MP/IND/2020	PUSHP BRAND (INDIA) PRIVATE LIMITED	5/21/2020 0:00	Food Processing Industry	ExistingIndustry	SANWER	Bhawrasla	6	NOC Letter	22.718	75.833	11/7/2020 12:37	11/6/2022 12:37
15	Industrial	21-4/994/MP/IND/2020	PUSHP BRAND (INDIA) PRIVATE LIMITED	5/1/2020 0:00	Food Processing Industry	ExistingIndustry	SANWER	Bardari	6	NOC Letter	22.718	75.833	11/7/2020 13:07	11/6/2022 13:07
16	Infrastructure	21-4/865/MP/INF/2019	M/S. DLF GARDEN CITY INDORE PVT LTD	4/8/2009 0:00	Residential plotted colony	ExistingIndustry	SANWER	Manglya Sadak	225	NOC Letter	22.807262	75.940899	10/12/2021 14:37	10/11/2023 14:37
17	Industrial	21-4/855/MP/IND/2019	HINDUSTAN PETROLEUM CORPORATION LIMITED	2/2/1995 0:00	Petroleum Products	ExistingIndustry	SANWER	Manglya Sadak	2	NOC Letter	22.818386	75.92311	10/30/2020 0:00	10/29/2022 0:00
18	Infrastructure	21-4/32/MP/INF/2008	M/S DLF GARDEN CITY INDORE PVT. LTD.		Residential township	NewIndustry	SANWER	Sula Khedi	1360	NOC Letter			4/8/2009 0:00	4/7/2011 0:00
19	Industrial	21-4/462/MP/IND/2017	RAMA PHOSPHATES LTD (OIL DIVISION)	11/1/1993 0:00	Oil refining	ExistingIndustry	SANWER	Rajoda	296	NOC Letter			4/8/2021 15:11	4/7/2023 15:11
20	Industrial	21-4/459/MP/IND/2017	RAMA PHOSPHATES LTD	3/20/1987 0:00	Fertilizer	ExistingIndustry	SANWER	Rajoda	343	NOC Letter			9/24/2021 12:53	9/23/2023 12:53
21	Infrastructure	21-4/163/MP/INF/2014	MGR PRINCES HILL-TOP		Residential township	NewIndustry	SANWER	Panchderiya	290	NOC Letter			9/5/2014 0:00	8/5/2016 0:00
22	Industrial	21-4/398/MP/IND/2017	POWERGRID CORPORATION OF INDIA	6/6/2010 0:00	Power Sector	ExistingIndustry	SANWER	Hatuniya	12	NOC Letter			1/15/2021 16:35	1/14/2023 16:35
23	Infrastructure	21-4/328/MP/INF/2016	MALWA COUNTY		Residential township	NewIndustry	SANWER	Rahu Khedi	345	NOC Letter			1/13/2017 0:00	1/12/2019 0:00

V A K A L A T N A M A

BEFORE THE NATIONAL GREEN TRIBUNAL, CZ, BHOPAL

Original Application No. 214/2024 (CZ)

Suo-Moto cognizance of News item published in Dainik Bhaskar dated 13.08.2024 titled "सांवेर रोड़ के 53 इलाकों के भूजल में मिले घातक रसायन 400 उद्योगों पर शक, नोटिस 50 को, कार्यवाई सिर्फ 7 पर"

Petitioners

Respondent No.6

On behalf of Regional Director Bhopal Central Ground Water Board, North Central Region Bhopal, M.P.

Know all men by these presents that by Vakalatnama I/We appoint the Advocates noted below or any of them my/our lawful Advocate or Advocates for filing **Affidavit** above matter for appearing in conducting and arguing the same, for depositing or withdrawing any money in connection therewith for moving the Court in any matter connected therewith, for preparing the paper book in the case and for putting in papers petitions etc. on my/our behalf for filing taking back any documents for withdrawing suits or appeals or petitions with permission to institute fresh suits etc. For signing and filing petitions of compromise in connections with said matter and for taking copies of paper form the Record and I/We further say that any act, done by my/one said Advocate or Advocates or by any of them after accepting this Vakalatnama, shall be considered as my/our true and lawful act.

And I/we further hereby agree and undertake to pay the said Advocates his or their fees are settled and all others sums that may be necessary to carry out the requisition of the Court and otherwise to enable the said Advocates to conduct properly. Failing which the said Advocates after notice to me/us will be liberty to withdraw form the further conduct to the case.

IN WITNESS WHERE OF I/We sign and execute this Vakalatnama on this the Wednesday day on 20/10/2024

NAME OF ADVOCATE

Gigi C George, Adv

Standing Counsel

Ch. No.336, Lawyers Chamber Block,

Saket District Court, New Delhi

Also at Ch.457, Block-1

Delhi High Court, New Delhi

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CLIENT

Shindal
20/10/24

Head of
CGWB, NCR
Bhopal