

# Premonsoon Study of Water Quality Status of Arpa River at Bilaspur (C.G.)India

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## **ABSTRACT**

Arpa River is Life line of Bilaspur Township. It is tributary of Shivnath river travel about 100 k.m. to join Shivnath river at Masturi. The river continuously receives agricultural runoff, domestic solid and liquid wastes, industrial effluents, consequently the Arpa river water system is contaminated by the various kinds of undesirable materials. We have taken extensively study of the Arpa river water at Bilaspur and its surrounding areas we have also selected 10 sampling spots in this river and its tributary ; Kharun river and Gokhneanallahas .Water samples were collected in premonsoon-2022 subsequently analyzed for the Fe,As,Cr,Hg and Cd.The finding results were compared with the WHO (2011) and BIS (2012). The r values for the different parameter were also calculated .Finally the WQI was calculated by the standard method, indicated the water status of Arpa river in extremely poor, Before use purification is mandatory.

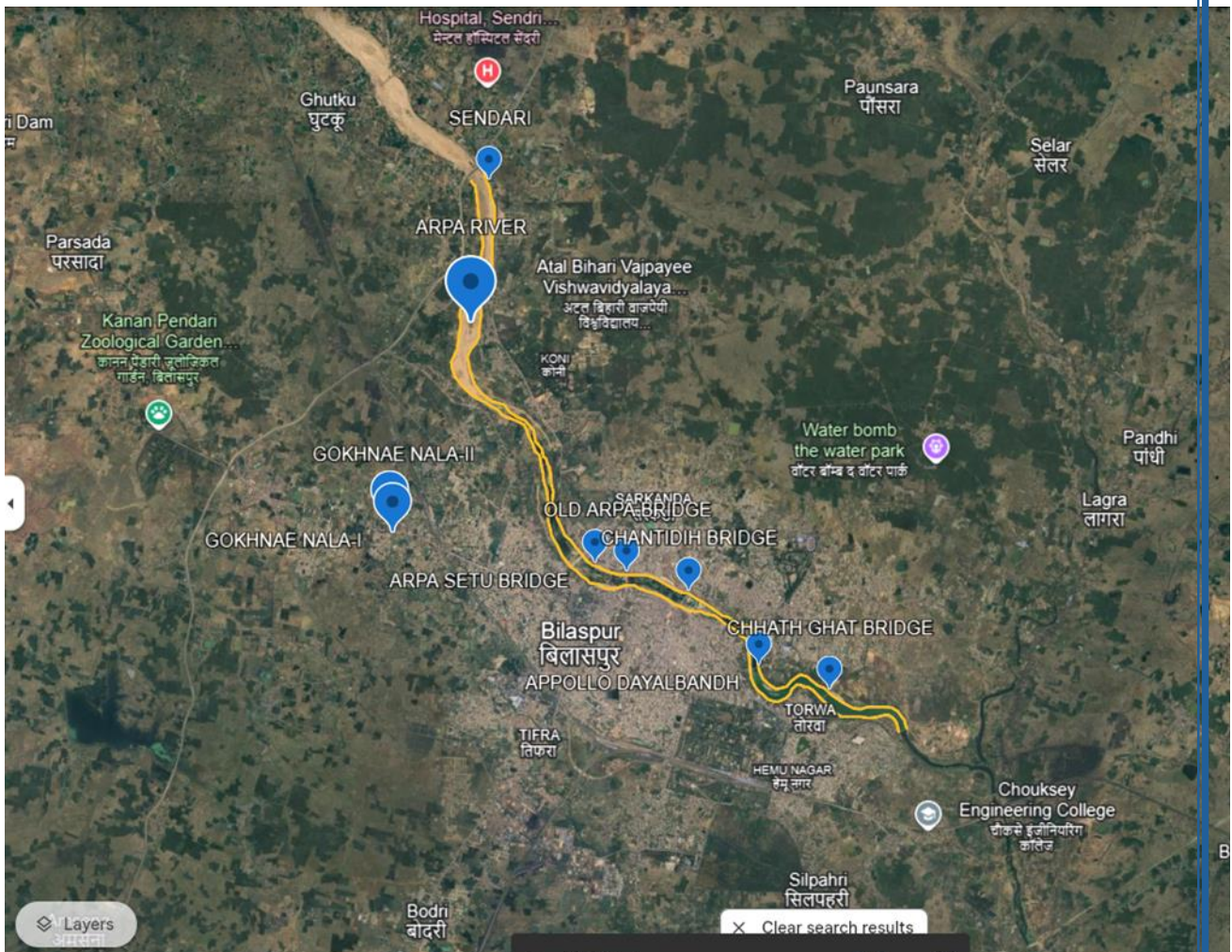
## **Introduction :-**

Water is one of the vital cum prime<sup>1</sup> natural sources among the soil, air, plants and animals in earth planet. 79% areas of the blue planet is occupied by the precious source of nature; Aquatic system. All these amenities are necessary for survive and perntence of living organism<sup>2</sup>. In the earth crust water is bounded 7.5<sup>3</sup> and it is crucial ingredient of animal and plant life<sup>4</sup> Good quality of water without deleterious chemicals and microbes is essential for health of living beings<sup>5</sup>, without it life can't exist, water has multiaplicable source such as bathing, irrigation, industrial, washing, recreation purpose.Water is occur in nature in different form such as sea, oceans, glaciers, cannal, rivers, ponds etc. The river water system is lifeline of the city, which add as the main source of domestic and other development purpose<sup>6</sup>. As a resulting of fast urbanization, industrialization, the river water system received a huge waste product, consequently, the main water system became unfit for the use of humans development.

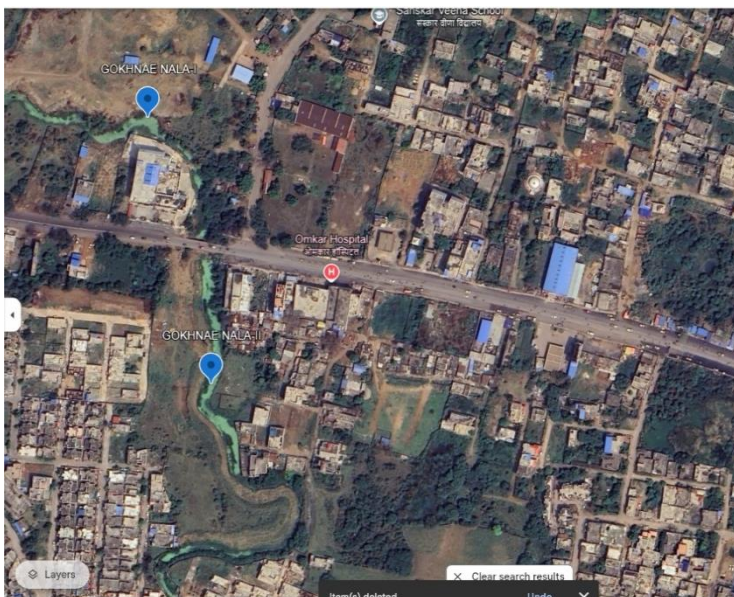
## **About the study fields:-**

We have taken comprehensive study of Arpa river, Gokhnea nallas and Kharun river water, Arpa river is a life line of the Bilaspur city, originated from the high hills of the Maikal range of Central India Khondri-khangsara. It is run 147 Kms with catchment areas 2020 squarare Kms and joined in Shivnath river at Nandghat.The river Arpa and its tributary nallahas; Gokhnea and Kharun river continuous received a large quantities of domestic sewage in solid and liquid as industrial effluents and agricultural runoff as resulting the river Apra is highly polluted at Bilaspur city and around areas.

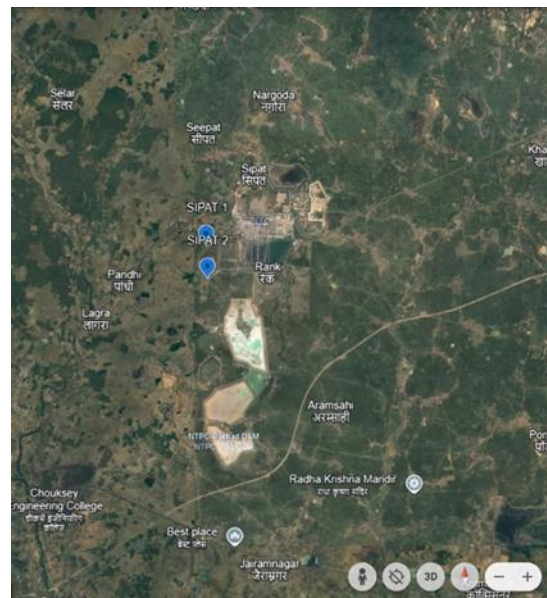




Arpa River (Bilaspur and its surrounding areas)



Gokhane Nala



Kharun River

**GokhneaNallah:-**The river Gokhnea Nallah is tributary of Arpa river; It is flows in western direction of Bilaspur city in Uslapur. It is consumed undesired material through different point and non point sources, consequently the Arpa Gokhnea Nallah became polluted.

**Kharun River:-**The River Kharun is also tributaries & Arpa river, which flow at near Seepat NTPC. The Kharun river water is also polluted due to mixing of domestic; industrial and agricultural runoff. The river joined in Arpa River at Masturi.

In view of above discussion, we have undertaken the project to complete exploration cum assessment of water qualities of Arpa River and their tributaries. In this paper we have described the qualitative and quantitative, estimation of heavy toxic elements and their some physico-chemical qualities in pre-monsoon (2022). For carryout this work we have selected following sampling location cum spots, which environmentally valuable, and discussed as follows (Table-1).

(Table-I).

S.No.	Locati on No	Location Name	Geographical Location	Altitud e (Feet)	Nature of the Spots
1.	BC <sub>1</sub>	Arpa River (Sendari)	22°09'35.342"N 82°07'25.913"E	806.4F	Agricultural runoff
2	BC <sub>2</sub>	Arpa River (Indira Setu Bride)	22°05'39.236"N 82°08'38.563"E	785.4F	Domestic sewage
3.	BC <sub>3</sub>	Arpa River (Old Arpa Bridge)	22°05'32.244"N 82°08'56.360"E	776.2F	Domestic sewage
4 .	BC <sub>4</sub>	Arpa River (Chantidih Bridge)	22°05'20.914"N 82°09'41.759"E	774.9F	Immersion worship waste
5.	BC <sub>5</sub>	Arpa River (Apollo Dayalbandh)	22°04'32.425"N 82°10'29.992"E	802.8F	Domestic sewage and Hospital waste
6.	BC <sub>6</sub>	Arpa River (Chanthghate Bridge)	22°04'3.732"N 82°11'13.167"E	752.3F	Domestic sewage and worship waste
7.	BC <sub>7</sub>	Kharun River (Seepat –I)	22°05'45.682"N 82°16'57.219"E	784.4F	Agricultural runoff and Industrial wastes
8.	BC <sub>8</sub>	Kharun River (Seepat –II)	22°05'45.554"N 82°16'5.005"E	784.4F	Agricultural runoff and Industrial wastes
9.	BC <sub>9</sub>	Arpa River (Gokhenea Nallah-I)	22°06'0.152"N 82°06'6.243"E	794.6F	Domestic water and Agricultural
10	BC <sub>10</sub>	Arpa River (Gokhenea Nallah-II)	22°05'58.25"N 82°06'6.013"E	798.4F	Domestic water and Agricultural



## Material and Methods:-

The ten different sites were "selected in Arpa river and its tributary; Gokhenea nallah and kharun river as per pollution loading point of view at the study period. The sample bottles were washed in different steps as per prescribed procedure' The water samples were collected from selected sampling sites: Bank of rivers, where domestic wastes, and industrial effluents discharge and agricultural runoff mixing in river water systems, in rinsed polythene bottles of one liters capacity. The samples kept in refrigerator at 4°C up to analysis. The conc. Nitric acid (2ml) added in water samples to avoid precipitation. The samples were brought to the Laboratory for complete analysis, Temp, pH, EC, turbidity were fixed at the sampling spot-by electronic analyzer kit, total solids were measured by the Gravimetric cum filtration method. Total alkalinity, total hardness, Chloride,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{HCO}_3^-$  and  $\text{CO}_3^{2-}$ , were determined by the volumetric method, Fluoride ion was detected by the Ion selective electrode method. Nitrate, Sulphate and Phosphate were analyzed by the spectrophotometer. Sodium and Potassium by the flame photometer. DO, BOD and COD was measured by the standard method<sup>7-9</sup> Selected heavy metals were tested by the Atomic Adsorption spectrophotometer, Chemical Laboratory: Chhattisgarh Council of Science and Technology<sup>10</sup>, TSS, SAR, PS and RSC were calculated by the mathematical tools. The obtained results were compared with the standard value stipulated by the BIS (2012)<sup>11</sup> and WHO (2011)<sup>12</sup>.

**Result and Discussion :** The result of the experimental values of different parameters are given in Table-II,III,IV

**Table-II**  
( Premonsoon-Aprail-2022 )

Sr. No.	Name of Parameter	Name of Sampling spot									
		Sendari	Indra setu Bridge	Old Arpa Bridge	Chantidih Bridge	Apollo Dayalband h	Chant ghat Bridge	Seepat -I	Seepat-II	Gokanenal a-I	Gokanenal a-II
		BC <sub>1</sub>	BC <sub>2</sub>	BC <sub>3</sub>	BC <sub>4</sub>	BC <sub>5</sub>	BC <sub>6</sub>	BC <sub>7</sub>	BC <sub>8</sub>	BC <sub>9</sub>	BC <sub>10</sub>
1	2	3	4	5	6	7	8	9	10	11	12
1.	Temperature	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
2.	pH	6.5	6.61	6.6	6.6	6.7	6.71	6.65	6.8	6.8	6.9
3.	EC	1.181mS	0.685mS	0.613mS	0.697mS	1.242mS	1.086mS	0.735mS	0.387mS	1.149mS	1.115mS
4.	TS	661	705	778	668	705	696	709	653	599	647
5.	TDS	530ppm	380 ppm	340 ppm	380 ppm	490 ppm	560ppm	370ppm	240 ppm	530 ppm	530ppm
6.	TSS	131	325	438	288	215	136	229	407	179	123
7.	Turbidity	>5	>5	>5	>5	>5	>0.312	>0.312	>5	>5	>5
8.	Total Hardness	118.410	135.20	145.06	160.027	200.513	190.07	302.6	298.50	205.89	305.50
9.	Total alkalinity	>250	>250	>250	>250	>250	>250	>250	>250	>250	>250
10.	Cholride	451	395	390	441	431	299	386	392	399	408
11.	Nitrate	19.61	16.28	109.14	83.09	44.96	30.65	27.43	80.42	129.03	62.30
12.	Sulphate	09.54	01.59	16.24	11.06	42.25	27.26	81.35	11.67	53.30	31.85
13.	Fluoride	0.216	0.248	0.163	0.363	1.553	0.300	0.228	0.244	0.175	0.960
14.	Phosphate	1.05	1.50	7.30	0.98	0.78	0.80	1.21	0.78	1.05	1.41
15.	DO	177.6ppm	173.8ppm	176.8ppm	176.9 ppm	163.4ppm	187.9 ppm	186.2 ppm	182.5 ppm	190.8 ppm	199.6ppm
16.	M.V.	-985.6	-979.3	-1008.9	-1041.6	-919.5	-935.8	-1022.9	-1054.5	-974.8	-980.8
17.	Salinity	0.884ppt	0.510 ppt	0.453 ppt	0.523 ppt	0.923ppt	0.803 ppt	0.524ppt	0.295ppt	0.855ppt	0.829ppt
18.	Na	56.6	69.5	77.5	87.1	92.0	104.0	25.0	14.8	73.1	73.6
19.	K	15.0	6.2	12	13.6	11.1	10.6	10.6	3.5	15	15
20.	As	0.003	0.04	0.405	0.505	0.040	0.001	0.001	BDL	0.002	0.003
21.	Cr	0.001	0.03	0.302	0.202	0.021	0.002	0.002	BDL	0.001	0.004
22.	Hg	0.001	0.002	0.003	0.001	BDL	BDL	BDL	BDL	BDL	BDL
23.	Cd	0.100	0.100	0.008	0.011	0.008	0.005	0.005	0.007	0.007	0.011
24.	Cr	0.041	0.042	0.002	0.060	0.043	0.029	0.001	0.009	BDL	BDL
25.	Fe	0.010	0.166	0.073	0.030	0.103	0.185	0.006	0.005	0.058	0.033
26.	BOD	6	6.8	7.5	9.0	8.0	5.5	11.00	7.8	4.8	9.50
27.	COD	10.50	13.50	14.50	15.0	13.30	11.50	9.50	12.50		

**Table-II**  
( Premonsoon-May-2022 )

Sr. No.	Name of Parameter	Name of Sampling spot									
		Sendari	Indra setu Bridge	Old Arpa Bridge	Chantidih Bridge	Apollo Dayalbandh	Chanth ghat Bridge	Seepat -I	Seepat- II	Gokanenala- I	Gokanenala- II
		BC <sub>1</sub>	BC <sub>2</sub>	BC <sub>3</sub>	BC <sub>4</sub>	BC <sub>5</sub>	BC <sub>6</sub>	BC <sub>7</sub>	BC <sub>8</sub>	BC <sub>9</sub>	BC <sub>10</sub>
1	2	3	4	5	6	7	8	9	10	11	12
1.	Temperature	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
2.	pH	6.45	6.51	6.56	6.6	6.6	6.75	6.78	7.0	6.9	6.9
3.	EC	0.368mS	0.828ms	0.893mS	0.861mS	0.853mS	0.638mS	0.735mS	0.884mS	1.108mS	1.147mS
4.	TS	669	778	784	669	691	680	638	666	651	679
5.	TDS	220ppm	430ppm	470 ppm	440 ppm	480 ppm	430ppm	400ppm	425 ppm	540 ppm	545ppm
6.	TSS	449	348	314	229	211	250	251	254	98	121
7.	Turbidity	>5	>5	>5	>5	>5	>5	>5	>5	>5	>5
8.	Total Hardness	125.40	135.03	140.067	155.027	169.513	165.007	314.50	312.50	179.89	331.50
9.	Total alkalinity	>250	>250	>250	>250	>250	>250	>250	>250	>250	>250
10.	Cholride	459	464	978	479	378	351	330	354	338	361
11.	Nitrate	28.79	10.76	52.64	14.95	51.86	74.40	31.74	84.13	58.81	37.51
12.	Sulphate	07.73	88.18	45.84	123.53	143.29	120.02	304.89	325.45	133.53	127.40
13.	Fluoride	0.313	0.647	0.100	0.092	0.230	1.046	0.106	0.173	0.176	2.715
14.	Phosphate	1.29	1.53	1.31	0.92	0.70	0.69	1.31	0.50	1.10	1.44
15.	DO	190.8ppm	178.5ppm	180.9ppm	182.2ppm	184.1ppm	181.3ppm	183.7 pp	182.9pp	186.8 pp	195.8ppm
16.	M.V.	-1064.3	-1049.7	-1037.3	-1041.2	-1031.1	-1045.4	-1034.3	-1066.8	-1029.8	-1045.6
17.	Salinity	0.273ppt	0.614 ppt	0.664 ppt	0.618 ppt	0.655ppt	0.639 ppt	0.541ppt	0.658ppt	0.810ppt	0.854ppt
18.	Na	34.4	68.9	81.3	73.5	101.0	114.0	26.9	24.4	88.8	85.0
19.	K	12.6	7.9	12.2	9.7	13.3	8.1	11.6	6.3	19.4	17.9
20.	As	0.004	0.500	0.605	0.601	0.412	0.002	0.001	BDL	0.003	0.103
21.	Cr	0.002	0.030	0.303	0.203	0.023	0.003	0.003	BDL	0.001	0.004
22.	Hg	0.002	0.102	0.004	0.002	0.123	0.123	0.243	BDL	0.243	0.124
23.	Cd	0.004	0.007	0.003	0.008	0.005	0.011	0.008	0.007	0.010	0.009
24.	Cr	0.024	BDL	0.007	BDL	BDL	BDL	BDL	BDL	0.020	BDL
25.	Fe	0.077	0.112	0.156	0.065	0.127	0.074	0.013	0.065	0.127	0.306
26.	BOD	7.50	6.90	9.10	9.10	6.50	4.9	7.98	6.50	3.50	8.41
27.	COD	11.50	14.51	13.71	14.00	12.20	9.41	14.01	13.50	11.51	10.04

**Table-III**  
**(Statistical parameters premonsoon-2022)**

Sr.No	Parameters	Ranges	Min.	Max.	Mean	Std.Dev.	%CV	Std.Error
1.	Temperature	26.7-26.7	26.7	26.7	26.7	0.00	0.00	0.00
2.	pH	6.45-7.0	6.45	7.00	6.69	0.12	0.02	0.04.
3.	EC	0368-1.242	0.368	1.242	0.86	0.18	0.21	0.06
4.	TS	599-784	599	784	686.30	44.86	0.07	14.18
5.	TDS	220-560	220	560	436.50	71.19	0.16	22.51
6.	TSS	98-449	98	449	249.80	85.01	0.34	26.88
7.	Turbidity	0.3125-5000	0.312	5.00	4.00	4.00	4.00	4.00
8.	Total Hardness	118.41-331.5	118.41	331.5	204.51	76.70	0.38	24.25
9.	Total alkalinity	250->250	250.00	>250	>250	NA	NA	NA
10.	Cholride	299-978	299	978	424.20	100.92	0.24	31.91
11.	Nitrate	10.76-129.03	10.76	129.03	52.43	26.43	0.50	8.36
12.	Sulphate	1.59-325.45	1.59	325.45	85.30	57.37	0.67	18.14
13.	Fluoride	0.092-1.553	0.092	1.553	0.50	0.092	0.230	1.046
14.	Phosphate	0.5-7.3	0.5	7.3	3.9	NA	NA	NA
15.	DO	173.8-199.6	173.8	199.6	183.13	6.82	0.04	2.16
16.	M.V.	-919.5--1066.8	-919.5	-1066.8	-1017.46	24.51	-0.02	7.75
17.	Salinity	0.273-0.923	0.273	0.923	0.65	0.14	0.21	0.04
18.	Na	14.8-114	14.8	114	68.57	29.22	0.43	9.24
19.	K	3.5-19.4	3.5	19.4	17.20	17.20	17.20	17.20
20.	As	0.001-0.605	0.001	0.605	0.16	0.22	1.35	0.07
21.	Cr	0.001-0.303	0.001	0.303	0.06	0.05	0.80	0.02
22.	Hg	0.001-0.243	0.001	0.243	0.2	0.2	1.14	0.01
23.	Cd	0.004-0.1	0.004	0.1	0.01	0.01	0.85	0.0
24.	Cr	0.001-0.06	0.001	0.06	0.01	0.01	0.85	0.00
25.	Fe	0.005-0.185	0.005	0.09	0.05	0.5	0.59	0.02
26.	BOD	3.5-11	3.5	11	7.31	1.71	0.23	0.54
27.	COD	9.5-15	9.5	15	12.93	1.43	0.11	0.45

**Temperatures:** Temperature was measured instantly as the sampling spots and recorded as ranging from 26.7 °C and no changing in the all spots of the choosed location.

**pH:** The conc. of hydrogens ion was measured immediatly at the sampling spots and measured as pH from low value 6.45 at the spot BC<sub>1</sub>, (Sendari) to max 7.0 at the spot BC<sub>8</sub> (Seepat -II). These ranges values indicates the nature of river water is from acidic to neutral<sup>13-15</sup>.

**EC:** The observed value note down for electrical conductivity in froms min. 0.368 ms at the month of May-2022 at the Sendari to 1.242 ms at the Apollo Dayalbandh in the month of April 2022. The EC is also under the permissible level as per BIS (2012) and WHO (2011) standard for drinking water. The high value of EC is generated of almost all the crops. would be affected and It may result reduce the yield<sup>16-17</sup>.

**TS:** Total Solid included dissolved and suspended particles as ions. In Our study period, we have observed the total solid in mg/L 599 at the Spot BC<sub>9</sub>, in the month of April 2022 to 784 mgL<sup>-1</sup> at the spot BC<sub>3</sub>, in the month of May-2022. The changes in conc. of TS from April-2022 to May- 2022 due to increase in atmospheric temp. as resulting evaporation of water is high consequences, the values of TS became high in the month of May-2022.

**TDS:** This parameter reflex the dissolved ions aquifer and positive correlated with electrical conductivity. The high value of TDS may effected the palatability, unfavorable physiological reaction, laxative and constipation effect<sup>18,19</sup>. In our investigation period, the observed value obtained 220 mgL<sup>-1</sup>, as min. at the spot BC<sub>1</sub>, in the month of May-2022 and max value recorded 560 ppm at the spot BC<sub>6</sub> in the month of April -2022.

**Turbidity:** Turbidity makes water unfit for domestic purposes, food and beverage industries and may other industrial uses<sup>20</sup>. The observed values, ranging from min 0.312 NTU at the spot BC<sub>6</sub>, and BC<sub>7</sub>, in the month of April-2022, while max values was detected >5 NTU in sampling locations, these values were beyond the accepted values, ranges as per BIS ( 2012) and WHO (2011 ).

**Total Hardness:** water hardness in usually due to the multivalent metal ions<sup>21</sup>, which causes from natural and anthropogenic sources. In study period, the reported value was found at min. 118.41 mgL<sup>-1</sup> as the spot BC<sub>1</sub>, at the month of April-2022, While the max. value of TH was. detected as 331.50 mgL<sup>-1</sup> at the spot BC<sub>10</sub> in the month of May-2022.

**TA:** The parameter was detected by the volumetric method. At the period of study was finding results more than 250 mgL<sup>-1</sup> in all the sampling, location. This high value attributed to mixing of high conc. of carbonate and bicarbonate compounds in river water systems. The bicarbonate alkalinity is expressed as a total alkalinity<sup>22</sup>.

**Chloride :** The source of chloride ion in dumping water is discharging of agricultural runoff , industrial effluents and chloride rich rocks<sup>23</sup>. The acceptable ranges of chloride ion drinking water is 250 mgL<sup>-1</sup> to 600 mgL<sup>-1</sup> as per different water testing agency. In one study period the finding results were arranged as min 299 mgL<sup>-1</sup> at the spot BC<sub>6</sub> in the month of April- 2022, where as the max. conc. was detected 978 mgL<sup>-1</sup> at the spot BC<sub>3</sub> in the month. of May-2022.

**Nitrate :** Nitrate content in drinking water is considered as importance for its adverse health effect<sup>24</sup>. The high quantity nitrate ion in water is leading to gastric cancer, human teratogen leading to prenatal death due to casgenital malformations<sup>25,26</sup>. Nitrate conc. was analyzed in this pre-monsoon period as min. 10.76 mgL<sup>-1</sup> at the spot BC<sub>2</sub> in the month of May-2022. While in max conc. was observed as 129.03mgL<sup>-1</sup> at the spot BC<sub>9</sub>. This high value was observed due to the discharge and dumping of liquid and solid wastes.

**Sulphate:** The source of sulphate ion in nature is many soils, rocks, minerals, industrial discharges and deposition trans burning of fossil fuels<sup>27</sup>. In study period, the sulphate conc. was recorded as 1.59 mgL<sup>-1</sup> at the spot BC<sub>2</sub> in

the period of April .2022 where as the max. conc. was note down as the observed value  $325.45 \text{ mgL}^{-1}$  at the spot BC<sub>8</sub> at the period of the month of May-2022.

**Fluoride:** In investigation period, the quantitatively estimation of Fluoride ion has indicated as the varied from  $0.092 \text{ mgL}^{-1}$  at the spot BC<sub>4</sub> in the month of May -2022, but the max. conc. was seen as  $1.553 \text{ mgL}^{-1}$  at the spot BC<sub>5</sub> in the month of April -2022. The max. value was crossed the upper limit.  $1.50 \text{ mgL}^{-1}$  as per BIS (2012) and WHO (2011) standard.

**Phosphate:** Phosphorus is plant nutrient and their sources are chemical fertilizers. It is observed as aluminum or iron phosphate in acidic medium, whereas calcium phosphate in alkaline medium as resulting decrease in conc. of Phosphate in aquatic sources<sup>28</sup>. The estimations of phosphate ion in the river water system varied From  $0.5 \text{ mgL}^{-1}$  at the spot BC<sub>8</sub> in the month of May 2022 while the max. conc. was observed in the month of 7.3 at the BC<sub>3</sub> in the month of April-2022.

**DO :** The recommended DO level for drinking water is 3-5  $\text{mgL}^{-1}$  as per international water testing agency WHO (2011). The DO is measure the extent of organic and biological pollution load in aquatic system, it is also index of sanitary condition<sup>29</sup>. At the period of investigation the min.conc. of DO was noted in  $173.8 \text{ mgL}^{-1}$  at the spot BC<sub>2</sub> in the month of April-2022 while the max. conc. was seen.

**BOD :**AS per BIS (2012) and WHO (2011) the acceptable ranges of BOD is  $10 \text{ mgL}^{-1}$ . The high value of BOD indicated contaminationof biodegradable pollution<sup>29</sup>. The min. conc. was seen on  $3.5 \text{ mgL}^{-1}$  at the spot BC<sub>9</sub> in the month of May 2022 where as the max. conc. was find out  $11.00 \text{ mg/L}^{-1}$  at BC<sub>7</sub> in the month April -2022.

**COD :**This water parameter is indirectly measure the amount of organic compounds in water<sup>28</sup>. The finding results were arranging in the ranges from min conc.  $9.41 \text{ mgL}^{-1}$  at the spot BC<sub>6</sub> in the mouth of May 2022 to max. value of conc.  $15.00 \text{ mgL}^{-1}$  at the spot BC<sub>4</sub> in the month of April -2022.

**Sodium :**The sources of sodium in aquatic system in natural geological source, detergents, domestic industrial discharge and mining water<sup>27</sup> in the study period , the conc. of Sodium varied from low value  $25.0 \text{ mgL}^{-1}$  at the spot BC<sub>7</sub> to max.  $114.00 \text{ mgL}^{-1}$  at the spot BC<sub>6</sub> in the month of may-2022.

**Potassium :** The permissible level of potassium in drinking water is  $10 \text{ mgL}^{-1}$  as per water monitoring agency as per BIS (2012)<sup>11</sup> and WHO (2011)<sup>12</sup>. The low conc. of potassium was  $3.5 \text{ mg.L}^{-1}$  at the spot BC<sub>8</sub> in the month of April-2022 while high conc. was detected as  $19.4 \text{ mgL}^{-1}$  at the spot BC<sub>9</sub> in the month of May-2022.

**Heavy Metals:-** At the period of extensively study we have selected six heavy cum hazardous metallic elements; As,Cr,Hg,Cd,Cr,Fe<sup>-</sup>. The results were detected as 0.405,0.505,0.50,0.605,0.601,0.412 $\text{mgL}^{-1}$  at the spot BC<sub>3</sub>,BC<sub>4</sub>,BC<sub>2</sub>,BC<sub>3</sub>,BC<sub>4</sub>,BC<sub>5</sub> in the month of April 2022 and May 2022 .Chromium was reported at the high conc.0.302,0.202,0.303,0.203 at the sampling spot BC<sub>3</sub>and BC<sub>4</sub>in the month of April 2022 and May 2022.Cadmium was observed in all the sampling site below the acceptable Limit in both assessment months .Mercury was detected in the same manner ; Below the lower limit as per different water monitoring agency . Iron was observed as in less quantities exception few location; BC<sub>10</sub>(0.306)<sub>2</sub>, BC<sub>2</sub>(0.166)<sub>2</sub>,BC<sub>6</sub>(0.185),BC<sub>3</sub>(0.156).

**Table-IV**  
**( Water Quality Index)**

**Table-V**  
**( Coorelation Matric)**

Season	Table-2. Seasonal Water Quality Index comparison									
	Sendari	Indra setu Bridge	Old Arpa Bridge	Chantidih Bridge	Apollo Dayalbandh	Chant ghat Bridge	Seepat -I	Seepat-II	Gokanenala-I	Gokanenala-II
	BC <sub>1</sub>	BC <sub>2</sub>	BC <sub>3</sub>	BC <sub>4</sub>	BC <sub>5</sub>	BC <sub>6</sub>	BC <sub>7</sub>	BC <sub>8</sub>	BC <sub>9</sub>	BC <sub>10</sub>
Pre-Monsoon	287.45	201.47	324.55	175.03	5008.94	5005.87	9820.44	143.02	9826.92	5054.32

Correlation matrix Pre-Monsoon 2022

	Temp	pH	EC	TS	TDS	TSS	Turbidity	Total Hardness	Total alkalinity	Chloride	Nitrate	Sulphate	Fluoride	Free chlorine	DO	M.V.	Salinity	Na	K	Hg	Cd	As	Cr	Fe	COD	BOD
Temperature	1.0000																									
pH	0.5200	1.0000																								
EC	-0.8881	-0.4537	1.0000																							
TS	0.8881	0.6157	-0.7142	1.0000																						
TDS	0.4294	0.5413	-0.5704	0.4277	1.0000																					
TSS	-0.1381	-0.4202	0.4183	-0.1821	-0.3909	1.0000																				
Turbidity	0.6810	0.6126	-0.5586	0.6102	0.1752	-0.0373	1.0000																			
Total Hardness	0.3581	-0.1552	-0.3204	0.2468	0.4853	-0.4337	-0.0701	1.0000																		
Total alkalinity	0.5876	0.3701	-0.4829	0.5690	0.4404	-0.2983	0.2694	0.6830	1.0000																	
Chloride	0.0479	0.1046	-0.1283	0.0035	0.3183	-0.4278	0.0684	0.4806	0.7301	1.0000																
Nitrate	-0.5248	-0.3243	0.4382	-0.3827	-0.4411	0.3627	-0.2613	-0.7000	-0.3329	-0.6135	1.0000															
Sulphate	0.2375	0.2134	-0.2598	0.4774	0.4423	-0.3971	0.4409	0.4881	0.3729	0.2416	-0.2387	1.0000														
Fluoride	0.3018	0.2358	-0.4461	0.2668	0.2162	-0.1180	-0.1294	-0.0100	0.7701	-0.2423	-0.2456	-0.5002	1.0000													
Free chlorine	-0.3812	-0.2830	0.3082	-0.2989	-0.2394	0.1954	-0.1855	-0.4636	-0.3639	-0.7839	0.8911	-0.1013	-0.3177	1.0000												
DO	0.0394	0.3034	0.0200	-0.0176	0.2769	-0.2783	-0.3927	-0.0542	0.0441	0.0440	-0.1452	-0.5988	0.6007	-0.0700	1.0000											
M.V.	-0.0914	0.0287	0.3004	0.1316	-0.1681	0.2313	0.1487	-0.3771	-0.4180	-0.6843	0.4919	0.0071	-0.0988	0.4181	0.0233	1.0000										
Salinity	-0.8881	-0.4401	0.9983	-0.7124	-0.5378	0.4043	-0.1567	-0.2907	-0.4795	-0.1035	0.4118	-0.2543	-0.4901	0.3141	0.0347	0.2690	1.0000									
Na	0.7223	0.7876	-0.6178	0.6885	0.5498	-0.4239	0.8519	0.8843	0.3474	0.1876	-0.3294	0.5026	-0.1282	-0.1823	-0.0640	0.1207	-0.6000	1.0000								
K	0.3805	0.2642	-0.3541	0.3598	0.3002	-0.2743	0.6089	0.2945	0.2408	0.3172	-0.1217	0.7974	-0.0584	-0.0481	-0.6268	-0.2405	-0.3382	0.8534	1.0000							
Hg	-0.0249	0.6925	0.1467	0.2169	0.4413	-0.4036	0.1102	0.0787	0.3732	0.5482	-0.3398	0.2770	-0.0812	-0.3040	0.3856	-0.0075	0.1783	0.2598	0.1246	1.0000						
Cd	-0.8822	-0.4813	0.8214	-0.8159	-0.1166	0.1010	-0.4561	-0.9370	-0.6833	-0.2430	0.5432	-0.2835	-0.3870	0.4382	-0.0096	0.4031	0.7976	-0.4758	-0.3257	-0.0337	1.0000					
As	-0.3373	-0.0113	0.3637	-0.0902	-0.1702	0.1554	-0.1888	0.0712	0.1858	0.4062	-0.0835	0.3604	-0.4001	-0.1211	-0.3138	-0.4134	0.3846	-0.2334	0.2702	0.4382	-0.0455	1.0000				
Cr	-0.3191	0.1373	0.1135	-0.5835	0.0462	-0.2393	-0.1419	-0.1463	-0.0948	0.1580	-0.2128	-0.4018	-0.0807	-0.1678	0.3824	-0.4698	0.2430	-0.0911	-0.0331	0.2774	0.3116	0.0941	1.0000			
Fe	0.1853	0.0394	-0.4580	-0.0716	0.2103	-0.2749	0.1792	0.3819	0.2948	0.4619	-0.4889	0.0720	-0.1734	-0.3164	-0.1987	-0.3858	-0.4408	0.3825	0.5332	-0.2983	-0.2468	-0.2447	0.5148	1.0000		
COD	-0.2483	-0.4698	0.5751	-0.0653	-0.3577	0.3950	-0.4248	0.2952	0.0000	-0.1756	0.1038	0.1446	-0.3880	0.1137	-0.0194	0.3331	0.5885	-0.3854	-0.1378	0.0801	0.1874	0.3283	-0.3847	-0.4946	1.0000	
BOD	0.1316	-0.0009	0.2187	0.2788	-0.0283	0.1016	0.1041	0.5547	0.4285	0.2606	-0.3393	0.5794	-0.4899	-0.1909	-0.1739	0.2616	0.2531	0.1418	0.3570	0.4803	-0.1771	0.4483	-0.2379	-0.1360	0.7496	1.0000

**Correlation matrix :-**

In pre-monsoon assessment 2021 calculated the value of r between different parameter. The total correlation has been found 351, 191 positive 160 negative have calculated. The highest positive correlation was calculated between; Turbidity and sodium (+0.8519), Nitrated and free chlorin (+0.8911), +0.7974 (Sulphur and K), COD and BOD



(0.7456) Florida and DO (0.6007) The highest negative co-relation has been reported between TS and Cd (-0.8180), TDS and TSS (-0.9809). Total hardness and Nitrate (-0.7020) , Total alkalinity and Nitrate (-0.9029), Chloride and Nitrate (-0.8035).

The water quality index calculated in the ranges from min. 143.02 at the sampling center (BC<sub>8</sub>) to highest value 9823.92 at the center (BC<sub>9</sub>).

### **Conclusion :-**

We have concluded after the pre-monsoon assessment of Arpa river water and its tributary in the session of 2022. The water quality of the river water is not fit in perspective of Chloride, Potassium, Sodium, Iron, COD, Fluoride parameters owing to over burden cum discharging of domestic sewage in Arpa river water. Before the use of the Arpa river water purification is mandatory by the local cum indigenous technique.

### **Acknowledgement :-**

The authors are grateful to The Director General, Chhattisgarh Council of Science and Technology (CCOST) Raipur (C.G.) for testing of the selected heavy metal by the instrumental method and I am also deeply thankful to providing Research facility to Principal ,Govt Bilasa Girls P.G.College Bilaspur (C.G.)

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