

In Goa water sources (*i.e. perennial water sources*), which are being monitored by the Goa State Pollution Control Board (GSPCB) to ascertain its physico-chemical and microbial parameters through financial assistance by the Central Pollution Control Board (CPCB) under the National Water Monitoring Programme (NWMP), have been categorized based on the guidelines stipulated by the CPCB into –

1. Saline water bodies – Class SW-II
2. Freshwater bodies – Class C
3. Groundwater (*i.e. borewells*) – Class A

Under the said NWMP programme, the GSPCB monitors the water quality at 50 locations in the State, out of which 34 locations have been classified and approved by the CPCB based on the classification criteria (*refer Table-1 and Table-2*), while 16 remaining locations yet to be approved by the CPCB.

Based on the general interpretation of data analysis conducted, it could be concluded that relatively higher microbial contamination (*i.e. coliform content*), especially during monsoon seasons, is probably attributed to surface run-off vis-a-vis localized site-specific human interference (*i.e. anthropogenic impact*) and/or shallower water depth at sampling locations which may render higher microbial concentration due to presence of suspended organic matter owing to mechanism of resuspension.

Table – 1
Designated best use classification (Water quality standards) of surface waters
(i.e. fresh waters) such as rivers, lakes, wells, bore-wells, etc.,

Designated Best Use	Quality Class	Primary Water Quality Criteria
Drinking water source without conventional treatment but with chlorination	A	Total coliform organisms (MPN*/100 ml) shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6 mg/l or more, and Biochemical Oxygen Demand 2 mg/l or less
Outdoor bathing (organized)	B	Total coliform organisms(MPN/100 ml) shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5 mg/l or more, and Biochemical Oxygen Demand 3 mg/l or less

Contd. /-2

Drinking water source with conventional treatment	C	Total coliform organisms(MPN/100 ml) shall be 5000 or less pH between 6 and 9 Dissolved Oxygen 4 mg/l or more, and Biochemical Oxygen Demand 3 mg/l or less
Propagation of wildlife and fisheries	D	pH between 6.5 and 8.5 Dissolved Oxygen 4 mg/l or more, and Free ammonia (as N) 1.2 mg/l or less
Irrigation, industrial cooling and controlled disposal.	E	pH between 6.0 and 8.5 Electrical conductivity less than 2250 micro mhos/cm, Sodium Absorption Ratio less than 26, and Boron less than 2 mg/l

* MPN: Most Probable Number

Table – 2

Designated best use classification (water quality standards) for Coastal waters and marine outfall

Class	Designated best use
SW-I	Salt pans, Shell fishing, Mariculture and Ecologically Sensitive Zones
SW-II	Bathing, Contact water sports and Commercial fishing
SW-III	Industrial cooling, Recreation (non-contact) and Aesthetics
SW-IV	Harbour
SW-V	Navigation and Controlled waste disposa

Source – CPCB Publications, June 2010

National Water Quality Monitoring Programme

The Goa State Pollution Control Board conducts monitoring at selected locations within water bodies Rivers, Lakes, Wells, Canals, Reservoir and Creek located in the State under the project National Water Quality Monitoring Programme (NWMP) supported by the Central Pollution Control Board (CPCB), New Delhi. The rivers include two major rivers i.e., River Mandovi and River Zuari which are estuarine water bodies. In addition, water intake points at water treatment plants for public water supply, i.e., fresh water points in various rivers. Ground water sources (well water) located within the selected Industrial Estates is monitored. These locations were selected to check the ground water quality in and around the industrial estates.

The following monitoring locations are in the North District:

Sr. No	Type	Rivers/ Lake/Canals/ Wells	Location	CPCB code	Period of sampling
1	R	Rv. Tiracol	Tiracol	3188	Monthly
2	R	Rv. Chapora	1.Near Alorna Fort, Pernem	2275	Monthly
3	R		2.Siolim	3189	Monthly
4	R	Rv. Kalna	Chandel, Pernem	1543	Monthly
5	R	Rv. Madei	Dabos, Valpoi	1545	Monthly
6	R	Rv. Valvanti	Sankli, Bicholim	1544	Monthly
7	R	Rv. Bicholim	Varanzan Nagar, Bicholim	2276	Monthly
8	R	Rv. Assanora	Assanora	1548	Monthly
9	R	Rv. Sinquerim	1.Candolim Side Near Bridge	3190	Monthly
10	R		2.Nerul Temple	3191	Monthly
11	R	Rv. Khandepar	Opa - Ponda	1546	Monthly
12	R	Rv. Mandovi	1.Tonca, Marcela	1476	Monthly
13	R		2.Amona Bridge	3185	Monthly
14	R		3.Mandovi Bridge	1400	Monthly
15	R		4.IFFI Jetty	3186	Monthly
16	R		5.Near Hotel Marriot	3187	Monthly
17	R	Rv. Mapusa	Culvert on Mapusa-Panaji Highway	2274	Monthly
18	L	Anjunem Lake	Anjunem	3175	Monthly
19	L	Mayem Lake	Mayem, Bicholim	2269	Monthly
20	L	Carambolim Lake	Carambolim, Old Goa	3177	Monthly
21	C	Cumbarjua Canal	Corlim(Discharge Point of Syngeta Ltd.)	2268	Monthly

22	W	Well - Kudaim I.E.	M/s Cadila Healthcare Ltd.	2280	Half Yearly
23	W	Well - Corlim I.E.	Corlim Industrial Estate	2281	Half Yearly
24	W	Pilerne I.E.	Pilerne Industrial Estate	2282	Half Yearly
26	W	Borewell - Bethora I.E.	Bethora Industrial Estate	3194	Half Yearly
27	W	Borewell - Madkaim I.E.	Madkaim Industrial Estate	3195	Half Yearly

The following monitoring locations are in the South District:

Sr. No	Type	Rivers/ Lake/Canal /Wells	Location	CPCB code	Period of sampling
1	R	Rv. Zuari	1.Panchawadi	1475	Monthly
2	R		2.Borim Bridge	3181	Monthly
3	R		3.Marciam Jetty	3182	Monthly
4	R		4.D/S of point where Kumbarjua Canal Joins	1399	Monthly
5	L	Rv. Sal	1.Runder	3176	Monthly
6	R		2.Khareband, Margao	3183	Monthly
7	R		3.Pazarconi, Cuncolim (Near Culvert Margao- Cancona NH)	2271	Monthly
8	R		4.Orlim Bridge, Orlim	3184	Monthly
9	R		5.Near Hotel Leela, Mobor, Cavelossim	2273	Monthly
10	R	Rv. Talpona	1.Canacona	1547	Monthly
11	R	Rv. Khandepar	Codli near Bridge, u/s OPA waterworks, Sanguem	2270	Monthly
12	R	Rv. Kushawati	Near Bund at Kevona, Rivona, Sanguem	2272	Monthly
13	L	Salaulim Lake	Salaulim, Sanguem	1549	Monthly
14	L	Raia Lake	Curtorim	3178	Monthly
15	L	Saipem Lake	Saipem	3179	Monthly
16	L	Curtorim Lake	Curtorim	3180	Monthly
17	C	Agricultural Canal	Agricultural Canal upstream of Cuncolim I.E. (1 Km from M/s Nicomet Ind.)	2265	Monthly
18	C	Agricultural Canal	Agricultural Canal downstream of Cuncolim I.E. (1 Km from M/s Nicomet Ind.)	2266	Monthly
19	C	Dando Creek	Dando Mollo, Velsao, Marmugao	2267	Monthly

20	W	Well - Verna I.E.	M/s Cipla Limited	2277	Half Yearly
21	W	Well - Sancoale I.E.	Sancoale Industrial Estate	2278	Half Yearly
22	W	Well - Zuari I.E.	Zuari Industrial Estate, ZuariNagar	2279	Half Yearly
23	W	Borewell - Concolim I.E.	Cuncolim Industrial Estate	3193	Half Yearly

Water samples are analyzed for physico-chemical and bacteriological parameters i.e temperature, pH, Conductivity, Turbidity, DO, BOD, Nitrate, Nitrite, COD, Chloride, Phosphate, Ammonia, Fecal Coliform, Total Coliform, Iron, Manganese. apart from the on-site field observations. Besides, trace metals i.e. Nickel, Copper, Chromium, Cadmium, Zinc, Lead, Iron and pesticides (Alpha BHC, Beta BHC, Gama BHC (Lindane), Hexa chloro benzene, Heptachlor, Aldrin, Endrin, Dieldrin, Methoxychlor, P,P'-DDE, OP'-DDT, Heptachlor endo-epoxide, Alpha Endosulphan, Beta Endosulphan, Carboryl, Anilophos, Parathionmethyl, Malathion, Chloropyriphosare) are also analyzed once in a year along with additional parameters i.e TKN, TDS, Total Fixed Solids, Total suspended solids, Hardness, Fluoride, Boron, Sulphate, Total Alkalinity, P-Alkalinity, Sodium, Potassium, Calcium, Magnesium.

Increasing demand of water for human consumption, irrigation and growing industrial activities has impacted the water quality of rivers. The data of the water samples analyzed was interpreted using the Central Pollution Control Board classification on the designated best use of the water body. The water quality data indicates organic pollution, as inferred based on the coliform counts and Biochemical Oxygen Demand (BOD) and as such, continues to be the major water quality issue. The main cause may be due to discharge of untreated domestic effluents into the river. Secondly the receiving water bodies may not have adequate water for dilution and/or assimilative capacity in spite of tidal fluctuations, if any.

From the water quality data analysis it is found that the fecal coliform of River Mapusa, River Mandovi at Tonca Marcela and at Panaji, River Sal at Panzorconi and Mobor and Total Coliform of River Bicholim shows higher coliform levels throughout the year.

Further, it is informed that interpretation based on the data analysis of such monitoring of water quality parameters have been communicated and regularly updated to the Water Resources Department (WRD), Goa to initiate site-specific plan of action towards minimization of contamination as well as its remediation.