
CHAPTER SIX

Water

CHAPTER SIX

WATER

6.1 India is rich in surface water resources. Average annual precipitation is nearly 4000 cubic km. and the average flow in the river system is estimated to be 1880 cubic km. Because of concentration of rains only in the three monsoon months, the utilizable quantum of water is about 690 cubic km. However, conditions vary widely from region to region. Whereas, some regions are drought affected, others are frequently flooded. With the rapid increase in the population, the demand for irrigation, human and industrial consumption of water has increased considerably, thereby causing depletion of water resources. The assumption that “Fresh water is a gift of God which would continue to be available in perpetuity and in abundance” is under challenge. The main preoccupation of water resources development in the country is the extension and improvement of irrigation and hydel power generation. Water requirements for industrial and domestic use are met partly from reservoirs constructed and managed by the irrigation department. The agriculture production technologies have put a lot of stress on underground water resources.

River Water

6.2 Rivers are the lifeline of majority of population in cities, towns and villages and most of these are considered as sacred. Every river stretch has a distinct water use like bathing, drinking, municipal supply, navigation, irrigation and fishing, sports, etc. Simultaneously, it is also used as receptacle for discharge of industrial effluent, municipal sewage and dumping of solid wastes. The Water (Prevention and Control of Pollution) Act, 1974 is aimed to support the quality

of various designated best uses of water bodies. The Water Quality Atlas of the Indian River System has been prepared by CPCB on the basis of five major uses of the river water such as:

- (a) Drinking water source without conventional treatment but after disinfection;
- (b) Outdoor bathing organized;
- (c) Drinking water source but with conventional treatment followed by disinfection;
- (d) Propagation of wildlife, fisheries;
- (e) Irrigation, industrial cooling, controlled waste disposal.

For maintaining the quality of river water, the pollution levels in rivers have been detected by monitoring limited number of the physico-chemical parameters, which could only determine the changes in chemical characteristics of water bodies. Deterioration in water quality, over the past several years has gradually rendered the river water quality unsuitable for various beneficial purposes.

Monitoring of Rivers

6.3 The river water quality monitoring is most essential aspect of restoring the water quality. The Central Pollution Control Board (CPCB) has undertaken the responsibility to monitor the quality of water through 495 monitoring stations located in various water bodies all over the country. This is done through three major schemes 1) Global Environmental Monitoring System (GEMS)- 50 stations, 2) Monitoring of Indian National Aquatic Resources (MINARS) - 430 stations and 3) Yamuna Action Plan (YAP) - 15 stations.

Biological Water Quality Evaluation and Criteria

6.4 There are two methods adopted for water quality evaluation which are complementary to each other.

1. Saprobic Score (BMWP)

This methodology involves inventory of the presence of benthic macro-invertebrate fauna up to the family level with the taxonomic precision. All possible families having saprobic indicator value are classified on score scale of 1 to 10 according to their preference for saprobic water quality. The saprobic scores of all the families are registered and averaged to produce BMWP score.

2. Diversity Score (Sequential Comparison)

This method involves pairwise comparison of sequentially encountered individuals and the difference of two benthic animals can be observed upto the species level, where no taxonomic skill is required. The diversity is the ratio of total no. of different animals (runs) and the total number of organisms encountered. The ratio of diversity has a value between 0 and 1.

Water Pollution

6.5 The types and sources of water contamination include “point” sources of pollution which usually refers to wastes being discharged from a pipe; and “non point” sources, which means all other sources such as storm water runoff (which picks up oils and other contaminants from various areas), irrigation (which carries fertilizers and pesticides into groundwater), leaks from storage tanks and leakage from disposal

sites. The non-point sources are technically the most difficult to regulate in India. Water pollution comes from three main sources: domestic sewage, industrial effluents and run-off from activities such as agriculture. Water pollution from domestic and human wastewater causes many severe water borne diseases. The problem of water pollution due to industries is because of the inadequate measures adopted for effluent treatment than to the intensity of industrial activities. The 13 major water polluting industries have been identified and are closely monitored by the Central Pollution Control Board.

6.6 Access to safe drinking water remains an urgent need as about 70.5% of the households in the urban area and 8.7 % in rural areas receive organized piped water-supply and the rest have to depend on surface or ground water which is untreated. The diseases commonly caused due to contaminated water are diarrhea, trachoma, intestinal worms, hepatitis, etc. The most common contamination in the water is from the disease bearing human wastes, which is usually detected by measuring fecal coliform levels. Inadequate access to safe drinking water and sanitation facilities leads to higher infant mortality and intestinal diseases.

6.7 An uncontrolled disposal of urban waste into water bodies, open dumps and poorly designed landfills, causes contamination of surface water and ground water. For industries, surface water is the main source for drawing water and discharging effluents. Industrial wastes containing heavy metals such as mercury, chromium, lead and arsenic can threaten or destroy marine life besides polluting aquatic food resources.

TABLE 6.1.1 : Performance of Monsoon

Sl. No.	Year (June-Sept.)	Number of Meteorological Sub-Divisions According to Rainfall*			Percentage of Districts with Normal/ Excess Rainfall	Percent of Long Period Average Rainfall for the Country as a Whole
		Normal	Excess	Deficient/ Scanty		
1	2	3	4	5	6	7
1	1991	26	1	8	68	91
2	1992	30	2	3	65	93
3	1993	29	2	4	78	100
4	1994	13	12	10	77	110
5	1995	26	7	2	79	100
6	1996	22	10	3	82	103
7	1997	26	6	3	81	102
8	1998	20	13	2	81	106
9	1999	25	3	7	67	96
10	2000	23	5	7	66	92
11	2001	29	1	5	68	92

Source: Economic survey 2001-2002

* : Total number of Meteorological sub-divisions is 35.

TABLE 6.1.2 : SUB DIVISIONAL ACTUAL AND NORMAL RAINFALL

GROUND WATER

Sl. No.	Sub Divisions	(Millimetre)									
		1997		1998		1999		2000		2001	
		Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1	2	3	4	5	6	7	8	9	10	11	12
1.	Andaman & Nicobar Island	2321.30	2961.20	2354.00	2966.00	2395.00	2965.00	2386.20	2964.70	2935.10	2934.70
2.	Arunachal Pardesh	1795.60	2678.50	2752.00	2926.00	2796.00	2955.00	2762.00	2847.10	2199.90	2844.50
3.	Assam and Meghalaya	2190.30	2747.60	2440.00	2885.00	2625.00	2817.00	2696.30	2771.20	2260.00	2768.90
4.	Nagaland, Mizoram, Manipur & Tripura	1666.90	1917.30	1833.00	1910.00	1877.00	2007.00	1998.30	2029.90	1962.90	2027.30
5.	Sub-Himalayan West Bengal & Sikkim	2127.70	2696.60	2350.00	2682.00	3007.00	2682.00	2559.70	2661.80	2620.10	2645.50
6.	Gangeatic West Bengal	1262.80	1427.40	1669.00	1445.00	1850.00	1448.00	1590.20	1448.50	1460.00	1435.80
7.	Orissa	1405.40	1512.00	1547.00	1489.00	1527.00	1497.00	1163.00	1488.70	1777.40	1488.40
8.	Jharkhand	982.00	1325.00	1515.00	1309.00	1782.00	1314.00	1360.40	1312.60	1397.80	1311.80
9.	Bihar	779.20	1201.40	1344.00	1179.00	1434.00	1178.00	1302.90	1178.80	1353.80	1178.90
10.	East Uttar Pardesh	842.40	1022.80	1021.00	1022.00	1031.00	1022.00	1027.90	1021.70	1025.70	1021.50
11.	West Uttar Pradesh	783.60	898.90	888.00	891.00	851.00	893.00	838.00	890.60	696.00	892.00
12.	Ultranchal	1214.50	1673.70	1432.00	1669.00	1508.00	1669.00	1935.60	1668.00	1460.70	1667.90
13.	Haryana, Chandigarh & Delhi	527.10	610.90	864.00	616.00	464.00	617.00	539.10	616.20	617.20	616.00
14.	Punjab	562.90	646.30	897.00	646.00	570.00	651.00	544.20	649.50	634.40	649.80
15.	Himachal Pardesh	1323.00	1346.20	1370.00	1343.00	1118.00	1341.00	1113.90	1341.10	1102.70	1340.40
16.	Jammu & Kashmir	1098.80	908.10	1045.00	982.00	789.00	1065.00	825.40	1075.10	795.50	1077.50
17.	West Rajasthan	600.40	321.10	573.00	318.00	275.00	312.00	236.70	312.80	294.30	312.50
18.	East Rajasthan	804.50	679.30	799.00	679.00	590.00	679.00	481.60	680.40	579.70	680.60
19.	West Madhya Pradesh	829.10	1016.20	1149.00	1007.00	1143.00	1012.00	625.50	1015.50	830.90	1015.40
20.	East Madhya Pradesh	1124.80	1340.90	1316.00	1308.00	1308.00	1307.00	863.60	1313.00	1334.50	1298.40
21.	Gujarat Region	1135.60	1098.50	1407.00	1091.00	917.00	1113.00	788.40	1110.40	1007.60	1110.00
22.	Saurashtra, Kutch	597.00	572.80	659.00	581.00	350.00	581.00	320.10	585.80	532.50	580.90
23.	Konkan & Goa	2727.20	2998.30	2897.00	2999.00	2894.00	2998.00	3134.50	2998.20	2373.70	2998.40
24.	Madhya Maharashtra	810.40	904.30	1061.00	904.00	874.00	904.00	789.90	902.60	866.60	903.60
25.	Marathwada	732.10	847.00	809.00	845.00	845.00	844.00	863.90	845.60	849.10	845.20
26.	Vidarbha	1080.10	1118.40	1078.00	1113.00	1119.00	1111.00	1024.10	1113.90	1107.30	1114.10
27.	Coastal Andhra Pradesh	944.20	1034.70	1077.00	1031.00	849.00	1034.00	1043.10	1034.70	1051.60	1034.40
28.	Telangana	788.90	954.80	855.00	934.00	866.00	946.00	1074.20	945.30	896.00	946.00
29.	Rayalaseema	572.20	683.50	795.00	675.00	587.00	679.00	861.40	679.40	860.30	679.10
30.	Tamilnadu & Pondicherry	952.30	992.60	1207.00	994.00	840.00	984.00	784.90	996.90	785.50	991.10
31.	Coastal Karnataka	3780.40	3500.90	4107.00	3466.00	4071.00	3654.00	3542.50	3653.30	3589.30	3653.70
32.	North Interior Karnataka	724.80	732.90	726.00	739.00	738.00	700.00	746.50	698.10	609.60	698.20
33.	South Interior Karnataka	1325.50	1174.20	1232.00	1122.00	1210.00	1071.00	1241.50	1072.20	1010.40	1072.50
34.	Kerala	3293.70	3063.60	3213.00	3106.00	2871.0	3108.00	2465.70	3107.60	2910.60	3107.00
35.	Lakshadweep	1581.40	1495.80	1764.00	1313.80	1858.00	1496.00	1372.70	1495.50	1383.70	1495.30

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Source : Indian Meteorological Department

TABLE 6.1.3 : ANNUAL ACTUAL RAINFALL BY METEOROLOGICAL SUB-DIVISION

(Millimetre)

Sl. No.	Sub-Division	Actual Rainfall									
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	2	3	4	5	6	7	8	9	10	11	12
1	Andaman & Nicobar Island	2321	2426	3045	3084	3118	2354	2823	2395	2386	2935
2	Arunachal Pradesh	1796	2825	2142	2971	2662	2752	3684	2796	2762	2200
3	Assam and Meghalaya	2190	3021	2351	2719	2683	2440	2994	2625	2696	2260
4	Nagaland, Mizoram, Manipur & Tripura	1667	2376	1413	1686	1609	1833	1851	1877	1998	1963
5	Sub-Himalayan West Bengal & Sikkim	2128	2801	1868	2934	2531	2350	3275	3007	2560	2620
6	Gangeatic West Bengal	1263	1660	1357	1762	1399	1669	1589	1850	1590	1460
7	Orissa	1405	1391	1780	1696	1042	1547	1334	1527	1163	1777
8	Jharkhand	982	1227	1470	1422	1062	1515	1540	1782	1360	1398
9	Bihar	779	1241	958	1128	1131	1344	1373	1434	1303	1354
10	East Uttar Pradesh	842	863	985	907	1048	1021	1147	1031	1028	1026
11	West Uttar Pradesh	784	820	852	869	953	888	1073	851	838	696
12	Ultranchal	1215	1511	1269	1413	1271	1432	1902	1508	1936	1461
13	Haryana, Chandigarh & Delhi	527	661	749	1013	872	864	925	464	539	617
14	Punjab	563	694	673	829	747	897	845	570	544	634
15	Himachal Pradesh	1323	1186	1421	1454	1254	1370	1385	1118	1114	1103
16	Jammu & Kashmir	1099	847	1095	847	1137	1045	1000	789	825	796
17	West Rajasthan	600	391	509	455	457	573	389	275	237	294
18	East Rajasthan	805	692	863	798	941	799	667	590	482	580
19	West Madhya Pradesh	829	1068	1351	930	1143	1149	954	1143	626	831
20	East Madhya Pradesh	1125	1231	1742	1204	1127	1316	1061	1308	864	1335
21	Gujarat Region	1136	1236	1933	887	1182	1407	1399	917	788	1008
22	Saurashtra & Kutch	597	398	772	413	480	659	707	350	320	533
23	Konkan & Goa	2727	3231	3069	2696	2656	2897	3263	2894	3135	2374
24	Madhya Maharashtra	810	1078	1106	868	966	1061	1151	874	790	867
25	Marathawada	732	822	608	808	844	809	1245	845	864	849
26	Vidarbha	1080	994	1443	1055	844	1078	1156	1119	1024	1107
27	Coastal Andhra Pradesh	944	878	1034	1337	1251	1077	1319	849	1043	1052
28	Telangana	789	808	883	1194	1014	855	1139	866	1074	896
29	Rayalaseema	572	818	580	758	1305	795	952	587	861	860
30	Tamilnadu & Pondicherry	952	1171	953	865	1231	1207	1030	840	785	786
31	Coastal Karnataka	3780	3431	4360	3632	3123	4107	4172	4071	3543	3589
32	North Interior Karnataka	725	811	701	754	816	726	943	738	747	610
33	South Interior Karnataka	1326	1172	1320	1041	1149	1232	1223	1210	1242	1010
34	Kerala	3294	2816	3432	2994	2685	3213	3122	2871	2466	2911
35	Lakshadweep	1581	1471	1566	1679	1603	1764	1979	1858	1373	1384

Source: India Meteorological Department

GROUND WATER

**TABLE 6.1.4 : STATE-WISE DISTRIBUTION OF NO. OF DISTRICTS WITH EXCESS,
NORMAL, DEFICIENT, SCANTY AND NO RAINFALL***(01-06-2001 TO 30-09-2001)*

SI. NO.	STATE/UT	E	N	D	S	NR	ND	Total
1	2	3	4	5	6	7	8	9
1	Andaman & Nicobar Island	0	0	1	0	0	0	1
2	Arunachal Pradesh	1	0	4	0	0	0	5
3	Assam	0	8	8	0	0	0	16
4	Meghalaya	0	2	0	0	0	0	2
5	Nagaland	0	0	1	0	0	0	1
6	Manipur	0	1	0	0	0	0	1
7	Mizoram	0	1	0	0	0	0	1
8	Tripura	0	1	0	0	0	0	1
9	Sikkim	0	0	1	0	0	0	1
10	West Bengal	1	13	2	0	0	0	16
11	Orissa	6	7	0	0	0	0	13
12	Jharkhand	3	5	1	0	0	3	12
13	Bihar	4	17	2	0	0	4	27
14	Uttar Pradesh	5	24	19	0	0	0	48
15	Uttaranchal	1	3	4	0	0	0	8
16	Haryana	3	8	5	0	0	0	16
17	Chandigarh	0	1	0	0	0	0	1
18	Delhi	0	0	1	0	0	0	1
19	Punjab	2	6	3	0	0	1	12
20	Himachal Pradesh	1	5	6	0	0	0	12
21	Jammu & Kashmir	1	7	1	1	0	2	12
22	Rajasthan	2	13	16	1	0	0	32
23	Madhya Pradesh	1	16	20	0	0	1	38
25	Gujarat	0	14	5	0	0	0	19
26	D. & N. Haveli & Daman	0	1	0	0	0	0	1
27	Diu	0	0	0	0	0	1	1
28	Goa	0	0	1	0	0	0	1
29	Maharashtra	0	23	7	0	0	0	30
24	Chhattisgarh	2	5	0	0	0	0	7
30	Andhra Pradesh	1	19	3	0	0	0	23
31	Tamil Nadu	1	12	9	0	0	0	22
32	Pondicherry	0	1	0	0	0	0	1
33	Karnataka	6	13	8	0	0	0	27
34	Kerala	0	10	4	0	0	0	14
35	Lakshadweep	0	1	0	0	0	0	1

Source : India Meteorological Department.

Legend :

E : Excess

N : Normal

D : Deficient

S : Scanty

NR : No Rain

TABLE 6.1.5 : LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL*(01-06-2000 TO 30-09-2000)*

State/UT	Districts	State/UT	Districts
1	2	1	2
I. A & N Islands	1 A & N Islands	XV. Madhya Pradesh	1 Betul
II. Arunachal Pradesh	1 Tirap		2 Bhind
III. Meghalaya	1 Khasi & J Hills		3 Bhopal
IV. Assam	1 Karbi-Along		4 Chhatarpur
V. Nagaland	1 Nagaland		5 Chhindwara
VI Orissa	1 Bolangir		6 Damoh
	2 Cuttack		7 Datia
	3 Ganjam		8 Dewas
	4 Sambalpur		9 Dhar
	5 Sundargarh		10 Gwalior
VII. Jharkhand	1 Singbhum		11 Hoshangabad
VIII. Bihar	1 Saran		12 Indore
	2 Siwan		13 Jhabua
IX. Uttar Pradesh	1 Ballia		14 Khandwa
	2 Hardoi		15 Khargon
	3 Rae Bareilly		16 Mandasour
	4 Agra		17 Morena
	5 Aligarh		18 Narsingpur
	6 Etah		19 Raisen
	7 Etawah		20 Rajgarh
	8 Jhansi		21 Ratlam
	9 Rampur		22 Sehore
	10 Lalitpur		23 Seoni
X. Uttaranchal	1 Garhwal Tehri		24 Shajapur
XI. Haryana	1 Bhiwani		25 Shivpuri
	2 Gurgaon		26 Tikamgarh
	3 Hissar		27 Ujjain
	4 Jind		28 Balaghat
	5 Karnal		29 Bastar
	6 Kurukshetra		30 Durg
	7 Mahendragarh		31 Panna
	8 Panipat		32 Raigarh
	9 Rewari		33 Raipur
XII. Delhi	1 Delhi		34 Rajnandgaon
XIII. Punjab	1 Bhandinda		35 Rewa
	2 Faridkot		36 Setna
	3 Gurdaspur		37 Sidhi
	4 Jalandhar	XVI. Maharashtra	1 Dhulie
	5 Ludhiana	2 Pune	2 Amraoti
	6 Sangrur	XVII. Tamil Nadu	1 Chengalpattu M.G.R.
XIV. Himachal Pradesh	2 South Arcot		
1 Chamba	3 Thanjavur		
2 Kangra	4 Tiruchirapalli		
3 Lahaul & Spiti	5 Nagapatinam Q.E.M.		
4 Sirmur			
5 Solan			

TABLE 6.1.5 : LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL -ConId*(01-06-2000 TO 30-09-2000)*

State/UT	Districts	State/UT	Districts
1	2	1	2
XVIII. Jammu & Kashmir	1 Anantnag 2 Srinagar 3 Kupwara 4 Badgam 5 Baramula 6 Ladakh	XX. Kerala	1 Kozhikode 2 Cannur 3 Malapuram 4 Thiruvananthapuram 5 Kasargode 6 Wynad, Trisur
XIX. Rajasthan	1 Churu 2 Sri Ganganagar 3 Hanumangarh 4 Jaisalmer 5 Jodhpur 6 Pali 7 Alwar 8 Banswara 9 Bharatpur 10 Bhilwara 11 Bundi 12 Chittorgarh 13 Dausa 14 Dholpur 15 Dungarpur 16 Jhalawar 17 Jhunjhunu 18 Karauli 19 Rajsamand 20 Sawai Madhopur 21 Sikar 22 Sirohi 23 Tonk 24 Udaipur	XXI. Gujarat	1 Banaskantha 2 Baroda 3 Broach 4 Dangs 5 Gandhinagar 6 Kaira 7 Mehsana 8 Panchmahal 9 Sabarkantha 10 Surat 11 Amreli 12 Bhavnagar 13 Diu 14 Junagarh 15 Kutch 16 Rajkot 17 Suendranagar
		XXII. Sikkim	1 Sikkim

Source : India Meteorological Department.

**TABLE 6.1.6(a) : NUMBER OF METEOROLOGICAL SUB-DIVISIONS WITH EXCESS/
NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE END
OF MONSOON SEASON (JUNE-SEPTEMBER)**

Sl. No.	Year	No. of Sub-Divisions	
		Excess/Normal	Deficient/Scanty
1	2	3	4
1	1991	27	8
2	1992	32	3
3	1993	31	4
4	1994	25	10
5	1995	33	2
6	1996	32	3
7	1997	32	3
8	1998	33	2
9	1999	28	7
10	2000	28	7
11	2001	29	6

Source : India Meteorological Department

**TABLE 6.1.6(b) : PERCENTAGE OF DISTRICTS WITH EXCESS/NORMAL AND
DEFICIENT/SCANTY RAINFALL AT THE END OF MONSOON
SEASON (JUNE-SEPTEMBER)**

Sl. No.	Year	Percentage of Districts	
		Excess/Normal	Deficient/Scanty
1	2	3	4
1	1991	68	32
2	1992	65	35
3	1993	78	22
4	1994	77	23
5	1995	79	21
6	1996	82	18
7	1997	81	19
8	1998	83	17
9	1999	67	33
10	2000	65	35
11	2001	68	32

Source : India Meteorological Department

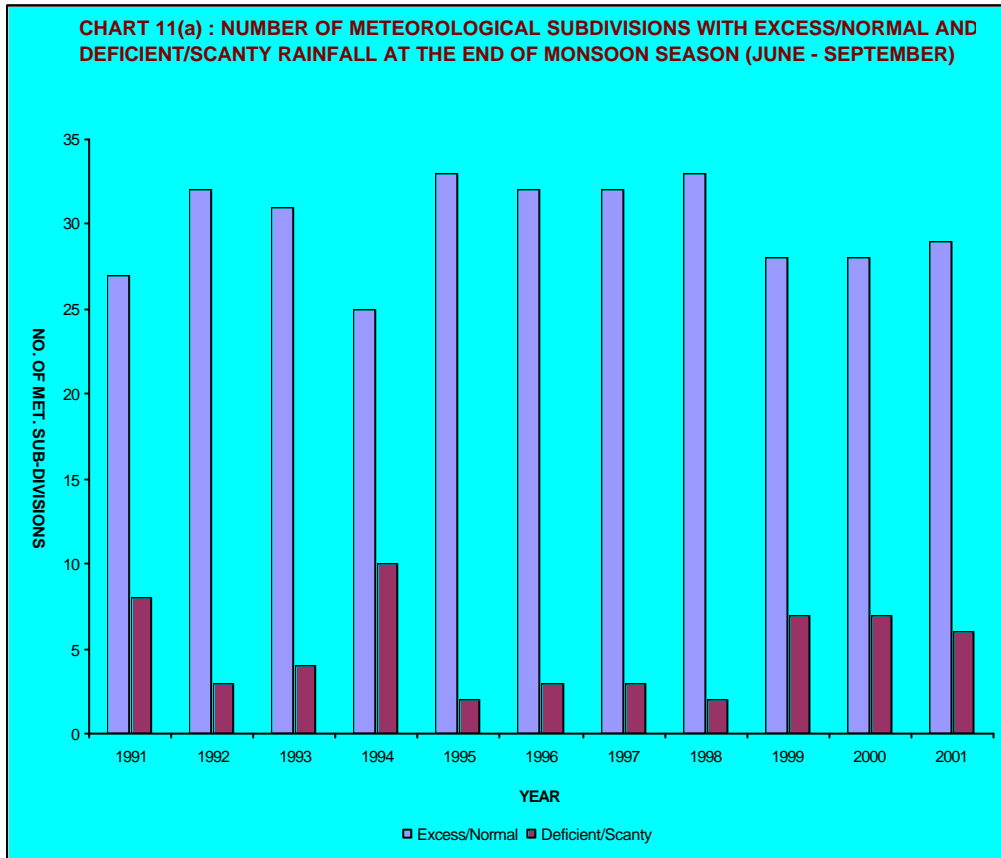


CHART 11(b) : PERCENTAGE OF DISTRICTS WITH EXCESS/NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE - SEPTEMBER)

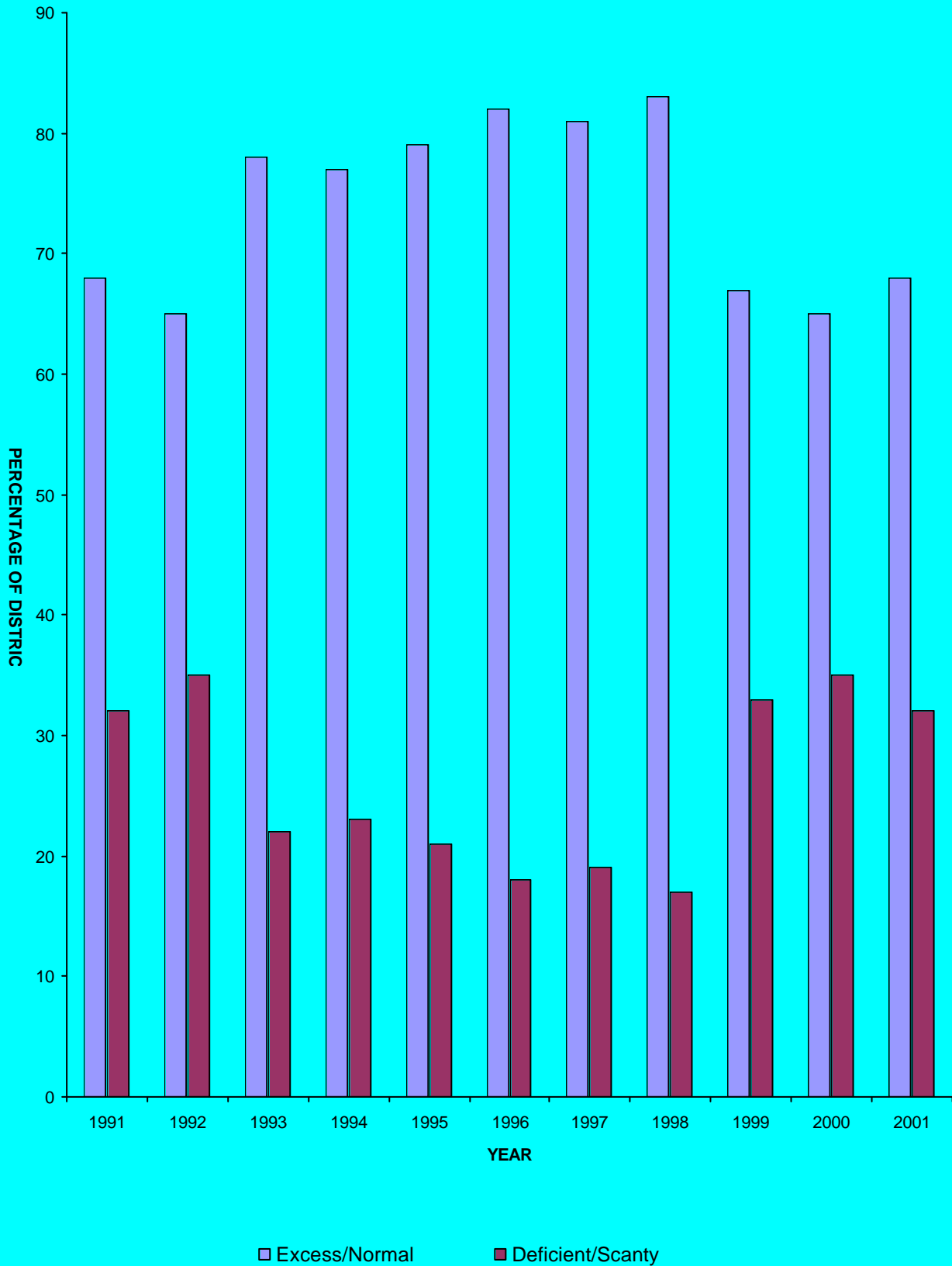


TABLE 6.1.7 : WATER FLOW IN STREAM FOR THE YEAR MENTIONED IN THE TABLE*(Cusecs)*

Sl. No.	Name of Basin/River	Name of Guage Station		No. of CWC Sites	* Year for Which Data Given	Maximum Flow		Minimum Flow	
		First Site	Last Site			First Site	Last Site	First Site	Last Site
1	2	3	4	5	6	7	8	9	10
1	Mahi	Mataji	Khanpur	6	1996-97	10257.00	7796.00	0.00	11.00
2	Tapi	Dedtalai	Ghala	12	1998-99	13000.00	10040.00	0.00	10.00
3	Narmada	Dindori	Garudeshwar	21	1998-99	1256.00	21743.00	1.28	54.71
4	Godavari	Ghargaon	Polavaram	58	2000-01	242.20	35215.00	0.00	67.62
5	Cauvery	Kudige	Musiri	16	1998-99	2265.00	6400.00	0.00	0.20
6	Krishna	Karad	Vijaywada	57	1998-99	2944.00	25082.00	0.00	19.61
7	Mahanadi	Baronda	Tikarpara	21	2002-03	406.70	12306.00	0.00	154.10
8	Subarnarekha	Muri	Ghatsila	3	2002-03	74.57	2037.00	0.42	11.33

Source : Central Water Commission.

* : Latest year data available in Hydrology Data Directorate, Information System Organisation

TABLE 6.1.8 : STATE-WISE DETAILS OF INLAND WATER RESOURCES OF VARIOUS TYPES, 1993
(Lakh Hectares)

Sl. No.	State/UT	Rivers & Canals (Length in Kms.)	Reservoir	Tanks, Lakes & Ponds	Beels, Oxbow, Lakes & Derelict Water	Brackish Water	Total Water Bodies
1	2	3	4	5	6	7	8
	States						
1	Andhra Pradesh	11514	2.34	5.17	----	0.64	8.15
2	Arunachal Pradesh	2000	----	0.01	0.03	----	0.04
3	Assam	1820	0.55	0.21	1.10	----	1.86
4	Bihar	3200	0.60	0.95	0.05	----	1.60
5	Goa	250	0.03	0.03	----	----	0.06
6	Gujarat	3865	2.43	0.71	----	0.95	4.09
7	Haryana	5000	Neg.	0.10	0.10	----	0.20
8	Himachal Pradesh	3000	0.40	0.01	----	----	0.41
9	Jammu & Kashmir	27781	0.07	0.17	0.06	----	0.30
10	Karnataka	9000	2.11	3.52	----	0.08	5.71
11	Kerala	3092	0.30	0.03	2.43	2.43	5.19
12	Madhya Pradesh	20661	2.91	1.17	----	----	4.08
13	Maharashtra	3200	2.79	0.32	----	0.10	3.21
14	Manipur	3360	0.01	0.05	0.40	----	0.46
15	Meghalaya	5600	0.08	0.02	Neg.	----	0.10
16	Mizoram	1743	----	0.02	----	----	0.02
17	Nagaland	1600	0.17	0.50	Neg.	----	0.67
18	Orissa	4500	2.56	0.64	1.80	4.33	9.33
19	Punjab	15270	Neg.	0.07	----	----	0.07
20	Rajasthan	N.A.	1.20	1.80	----	----	3.00
21	Sikkim	900	----	----	0.03	----	0.03
22	Tamil Nadu	7420	0.53	2.24	5.24	0.56	8.57
23	Tripura	1200	0.05	0.12	----	----	0.17
24	Uttar Pradesh	31200	1.50	1.62	1.33	----	4.45
25	West Bengal(P)	2526	0.17	2.76	0.42	2.10	5.45
	Union Tetitories						
1	A. & N. Island	115	0.01	0.30	----	1.15	1.46
2	Chandigarh	2	----	Neg.	Neg.	----	0.00
3	D. & N. Haveli	54	0.05	----	----	----	0.05
4	Daman & Diu	12	----	----	----	----	0.00
5	Delhi	150	0.04	----	----	----	0.04
6	Lakshadweep		----	----	----	----	0.00
7	Pondicherry	247	----	Neg.	0.01	0.01	0.02
	Total	170282	20.90	22.54	13.00	12.35	68.79

Source : Fisheries Division, Department of Agriculture & Cooperation, Ministry of Agriculture

N.A. : Not Available

(P) : Provisional

Neg. : Negligible

TABLE 6.1.9 : TOTAL LENGTH OF IMPORTANT RIVERS - BY STATE
(As on 2000-01)

				(Km.)
Sl. No.	State	River	Total Length	
1	2	3	4	
1.	Andhra Pradesh	Godavari Krishna Others *	757 386 1997	3140
2.	Assam (a)	Brahmputra Buridhing Disang Gangadhar Subansiri Kapali Kolodeye Kolong Katakhal Panchas Others	724 161 129 113 143 103 112 121 161 105 1967	3839
3.	Bihar	Ganga Gandak Koshi Ghaghra Sone Damodar Others	631 300 233 100 226 200 2724	4414
4.	Gujarat (b)	Narmada Tapti Others	230 200 N/A	N/A
5.	Karnataka	Cauvery Tungabhadra Krishna Malaprabha Sharavathi Bheema Others	270 375 325 230 250 860 513	2823
6.	Orissa	Mahanadi Brahmani Baitarani Others	493 541 344 N/A	N/A
7.	Kerala	Pamba Manimala Kurumali Chalkudi Mahi Valappattanam Chaliyar Puzha Kuttiyadi Others **	275 135 64 130 54 110 207 74 2869	3918
8.	West Bengal	Hooghly Mahananda Ajoy Jalangi Dwarka Bakreswar Damodar Dwarekeswar Silabati Kumari Ichamati Others @	580 206 174 232 129 102 437 103 135 308 232 2103	4741
9.	Goa	Mandovi Zuari Mapusa Chapora Others	78 56 26 34 N/A	N/A

Source : Transport Research Wing, Ministry of Surface Transport

@ : Includes 268 Kms. Pertaining to canals.

** : Includes 1234 Kms. Pertaining to canals.

* : Including canals

(a) : Relates to 1993-94

(b) : Relates to 1994-95

Notes : In respect of other States, information is not available.

TABLE 6.1.10: GROUND WATER RESOURCE POTENTIAL AS PER BASIN (PRORATA BASIS)

Sl. No.	Basin	Total Replenishable Ground Water Resource (M.C.M/Yr)	Provision for Domestic Industrial & Other Uses (M.C.M/Yr)	Available for Irrigation (M.C.M/Yr)	Net Draft (M.C.M/Yr)	Balance for Future Use (M.C.M/Yr)	% Level of G.W. Development
1	2	3	4	5	6	7	8
1	Brahmaputra	26545.69	3981.35	22564.34	760.06	21804.29	3.37
2	Brahmani with Baitarni	4054.23	608.13	3446.09	291.22	3154.88	8.45
3	Cambai composite	7187.25	1078.09	6109.16	2449.06	3660.10	40.09
4	Caveri	12295.71	1844.35	10451.35	5782.85	4668.50	55.33
5	Ganga	170994.74	26030.47	144964.26	48593.67	96370.56	33.52
6	Godavari	40649.82	9657.69	30992.12	6054.23	24937.90	19.53
7	Indus	26485.42	3053.95	23431.47	18209.30	5222.17	77.71
8	Krishna	26406.97	5578.34	20828.63	6330.45	14498.19	30.39
9	Kutch & Saurashtra	11225.09	1738.10	9486.99	4851.87	4791.02	51.14
10	Madras & Southern	18219.72	2732.95	15486.77	8933.25	6553.52	57.68
11	Mahanadi	16460.55	2471.10	13989.45	972.63	13016.81	6.95
12	Meghna	8516.69	1277.48	7239.21	285.34	6953.87	3.94
13	Narmada	10826.54	1653.75	9172.79	1994.18	7178.61	21.74
14	Northeast Composite	18842.61	2826.39	16016.22	2754.93	13261.29	17.20
15	Pennar	4929.29	739.39	4189.89	1533.38	2656.51	36.60
16	Subranarekha	1819.41	272.91	1546.50	148.06	1398.43	9.57
17	Tapi	8269.50	2335.79	5933.70	1961.33	3972.38	33.05
18	Western Ghat	17693.72	3194.78	14499.18	3318.12	11181.06	22.88
Total		431422.93	71075.02	360348.15	115223.93	245280.08	31.92

Source: Central Ground Water Board

Out of the total replenishable ground water; about 84% is made available for agriculture and livestock, the rest 16% is made available for domestic consumption, industrial use and power generation. However, not all the water abstracted is effectively used, there are sizeable losses in conveyance and application of irrigated water, a large part of water used by industry and domestic purposes is returned to the streams as effluent waste; and most of the water drawn by power station is used for cooling purposes and is available for reuse.

The water pollution in India comes from three main sources : domestic sewage, industrial effluents and run off from activities such as agriculture. Major industrial sources of pollution in India include the fertilizer plants, refineries, pulp and paper mills, leather tanneries, metal plating and other chemical industries.

TABLE 6.1.11 : GROUND WATER RESOURCES

Sl. No.	States	Total Replenishable Ground Water Resource	Provision for Domestic Industrial & Other Uses	Available Ground Water Resource for Irrigation in Net Terms	Utilizable Ground Water Resource for Irrigation in Net Terms	Gross Draft Estimated on Prorata Basis	Net Draft	Balance Ground Water Resource for Future Use in Net Terms	Level of Ground Water Development
		MHaM/Yr	MHaM/Yr	MHaM/Yr	MHaM/Yr	MHaM/Yr	MHaM/Yr	MHaM/Yr	MHaM/Yr
1	2	3	4	5	6	7	8	9	10
	States	43.30063	7.09873	36.20191	32.58033	19.25207	13.47627	22.72564	37.23
1	Andhra Pradesh	3.52909	0.52936	2.99973	2.69975	1.11863	0.78304	2.21668	26.10
2	Arunachal Pradesh	0.14385	0.02158	0.12227	0.11005	-	-	0.12227	-
3	Assam	2.24786	0.33718	1.91068	1.71962	0.20356	0.14249	1.76819	7.46
4	Bihar	2.69796	0.40470	2.29327	2.06394	1.17895	0.82527	1.46800	35.99
5	Chhattisgarh	1.60705	0.24106	1.36599	1.22939	0.10925	0.07647	1.28952	5.60
6	Goa	0.02182	0.00327	0.01855	0.01669	0.00219	0.00154	0.01701	8.30
7	Gujarat	2.03767	0.30566	1.73199	1.55881	1.21895	0.85327	0.87872	49.27
8	Haryana	1.11794	0.16769	0.95025	0.85523	1.02637	0.71846	0.23179	75.61
9	Himachal Pradesh	0.02926	0.00439	0.02487	0.02238	0.00591	0.00413	0.02073	16.63
10	Jammu & Kashmir	0.44257	0.06640	0.37620	0.33860	0.00586	0.00403	0.37217	1.07
11	Jharkhand	0.66045	0.09907	0.56138	0.50525	0.17352	0.12146	0.43992	21.64
12	Karnataka	1.61750	0.24186	1.37564	1.23665	0.64973	0.45481	0.92083	33.06
13	Kerala	0.79003	0.13135	0.65869	0.59281	0.17887	0.12509	0.53360	18.99
14	Madhya Pradesh	3.48186	0.52228	2.95958	2.66362	1.05494	0.73846	2.22112	24.95
15	Maharashtra	3.78677	1.23973	2.54704	2.29233	1.26243	0.88370	1.66334	34.70
16	Manipur	0.31540	0.04730	0.26810	0.24129	Neg.	Neg.	0.26810	Neg.
17	Meghalaya	0.05397	0.00810	0.04587	0.04128	0.00260	0.00182	0.04405	Neg.
18	Mizoram	Not Assessed							
19	Nagaland	0.07240	0.01090	0.06150	0.05535	Neg.	Neg.	0.06150	Neg.
20	Orissa	2.01287	0.30193	1.71094	1.53984	0.37196	0.26037	1.45057	15.22
21	Punjab	1.81923	0.18192	1.63730	1.47357	2.30028	1.61020	0.02710	98.34
22	Rajasthan	1.26021	0.19977	1.06044	0.95440	1.10350	0.77245	0.28799	72.84
23	Sikkim	Not Assessed							
24	Tamil Nadu	2.64069	0.39610	2.24458	2.02013	2.00569	1.40398	0.84060	62.55
25	Tripura	0.06634	0.00995	0.05639	0.05075	0.02692	0.01885	0.03754	33.43
26	Uttar Pradesh	8.25459	1.23819	7.01640	6.31476	4.25171	2.97619	4.04021	42.42
27	Uttaranchal	0.28411	0.04262	0.24149	0.21734	0.09776	0.06843	0.17306	28.34
28	West Bengal	2.30914	0.34637	1.96277	1.76649	0.90250	0.63175	1.33102	32.19
	Union Territories	0.0853	0.02782	0.03358	0.03022	0.03966	0.02777	0.00581	
1	Andaman & Nicobar	Not Assessed							
2	Chandigarh	0.00297	0.00044	0.00252	0.00227	0.00351	0.00245	0.00007	-
3	Dadar & Nagar Haveli	0.00422	0.00063	0.00359	0.00323	0.00065	0.00046	0.00313	12.81
4	Daman	0.00071	0.00011	0.00060	0.00054	0.00069	0.00048	0.00012	80.00
5	Diu	0.00037	0.00006	0.00031	0.00028	0.00042	0.00029	0.00002	94.84
6	NCT Delhi	0.02916	0.01939	0.00977	0.00879	0.01684	0.01180	-0.00203	120.78
7	Lakshadweep	0.03042	0.00456	0.00195	0.00176	0.00109	0.00076	0.00119	39.12
8	Pondicherry	0.01746	0.00262	0.01484	0.01335	0.01645	0.01152	0.00332	77.63
	Grand Total	43.38593	7.12665	36.25938	32.63345	19.29173	13.50404	22.73145	37.24

Source: Central Ground Water Board

For resources available to meet the needs, it is useful to distinguish between (a) total volume of water resources from surface flow and ground water recharge available in a year ; (b) the volumes which are considered to be utilizable ; (c) actual utilization.

The estimates of surface flows continue to be based largely on empirical formulae relating rainfall to surface runoff. The lack of data based on measurement of actual flow in the main river and tributaries of different river systems over sufficiently long periods (30-40 years observations are considered to be reasonable basis) remains one of the most serious handicaps in the planning of water resources development. The states have their own gauges, but since many rivers are the subject of inter-state disputes, they are unwilling to provide the data on observed flows.

Table 6.1.12 : PROJECTED ANNUAL REQUIREMENT OF WATER (BY DIFFERENT USES)*(In BCM)*

Sl. No.	Different Uses of Water	Year				
		1990	2000	2010	2025	2050
1	2	3	4	5	6	7
1	Domestic	32	42	56	73	102
2	Irrigation	437	541	688	910	1072
3	Industry	--	8	12	23	63
4	Energy	--	2	5	15	130
5	Others	33	41	52	72	80
Total		502	634	813	1093	1447

Source : Central Water Commission

BCM : Billion Cubic Meters

TABLE 6.1.13 : CATCHMENT AREA OF MAJOR RIVER BASINS

Sl. No.	Name of the River	Origin	Length (Km.)	Catchment Area (Sq. Km.)
1	2	3	4	5
1	Indus	Mansarover (Tibet)	1114 (2880)	21289 (1165500)
2	a) Ganga	Gangotri (Uttaranchal)	2525	61452 (1186000)
	b) Brahmaputra	Kailash Range (Tibet)	916 (2900)	194413 (580000)
	c) Barak & other rivers flowing into Meghna like Gomti, Muhari, Fenny etc.			41723
3	Sabarmati	Aravalli Hills (Rajasthan)	371	21674
4	Mahi	Dhar (Madhya Pradesh)	583	34842
5	Narmada	Amarkantak (Madhya Pradesh)	1312	98796
6	Tapi	Betul (Madhya Pradesh)	724	65145
7	Brahmani	Ranchi (Bihar)	799	39033
8	Mahanadi	Nazri Town (Madhya Pradesh)	851	141589
9	Godavari	Nasik (Maharashtra)	1465	312812
10	Krishna	Mahabaleshwar	1401	258948
11	Pennar	Kolar (Karnataka)	597	55213
12	Cauvery	Coorg (Karnataka)	800	81155
Total				2528084

Source : Central Water Commission

Note : Figures within bracket indicate the total river basin in india and neighbouring countries.

Table 6.1.14 : PRIMARY WATER QUALITY CRITERIA

Sl. No.	Designated Best Use	Class of Water	Criteria
1	2	3	4
1	Drinking Water Source without Conventional Treatment but after Disinfection	A	1 Total Coliforms Organised MPN/100ml shall be 50 or less 2 pH between 6.5 & 8.5 3 Dissolved Oxygen 6mg/l or more 4 Biochemical Oxygen Demand 5 days 20°C 2mg/l or less.
2	Outdoor bathing (organised)	B	1 Total Coliforms Organism MPN/100ml shall be 500 or less 2 pH between 6.5 & 8.5 3 Dissolved Oxygen 5mg/l or more 4 Biochemical Oxygen demand 5 days 20°C 3mg/l or less.
3	Drinking Water Source	C	1 Total Coliforms Organism MPN/100ml shall be 5000 or less 2 pH between 6 & 9 3 Dissolved Oxygen 4mg/l or more 4 Biochemical Oxygen demand 5 days 20°C 3mg/l or less.
4	Propagation of Wild Life	D	1 pH between 6.5 & 8.5 Fisheries 2 Dissolved Oxygen 4mg/l or more 3 Free Ammonia (as N) 1.2 mg/l or less
5	Irrigation, Industrial Cooling, Controlled Waste	E	1 pH between 6.0 or 8.5 2 Electrical conductivity at 25°C Micro mhos/cm Max 2250. 3 Sodium Absorption Ratio, Max 26 4 Boron, Max 2mg/l

Source : Water Quality - Status & Statistics (1996 & 1997), Central Pollution Control Board

The water quality at any location is determined as the one which is satisfied at least 80% of time by all the criteria parameters. To further elucidate on this as if at a location 80% of the time DO, pH were in the range specified for class A, BOD for class B and total coliforms for class C, then the existing status is determined as C.

TABLE 6.1.15 : BIOLOGICAL WATER QUALITY CRITERIA (BWQC)

Sl. No.	Taxonomic Groups	Range of Saprobic Score (BMWP)	Range of Diversity Score	Water Quality Characteristics	Water Quality Class	Indicator Colour
1	2	3	4	5	6	7
1	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Diptera	7 and more	0.2 - 1	Clean	A	Blue
2	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Planaria, Odonata, Diptera	6 - 7	0.5 - 1	Slight Pollution	B	Light Blue
3	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Odonata, Crustacea, Mollusca, Polychaeta, Coleoptera, Diptera, Hirudinea, Oligochaeta	3 - 6	0.3 - 0.9	Moderate Pollution	C	Green
4	Hemiptera, Mollusca, Coleoptera, Diptera, Oligochaeta	2 - 5	0.4 & less	Heavy Pollution	D	Orange
5	Diptera, Oligochaeta, No Animal	0 - 2	0 - 0.2	Severe Pollution	E	Red

Source : Central Pollution Control Board

TABLE 6.1.16 : PHYSICO - CHEMICAL AND BIOLOGICAL WATER QUALITY OF POLLUTED STRETCH OF RIVER YAMUNA AND AGRA CANAL

Sl. No.	Location	Water Quality Class		Water Quality (Biological)
		Physico - Chemical (PWQC)	Biological (BWQC)	
1	2	3	4	5
1.	Okhla Barrage (River Yamuna)	E	E	Severe Pollution
2.	Inlet of BTPP at Agra Canal	E	E	Severe Pollution
3.	Mixing of BTPP outlet at Agra Canal	E	E	Severe Pollution

Source : Central Pollution Control Board
BTPP : Badarpur Thermal Power Plant

TABLE 6.1.17 : WASTE WATER GENERATION, COLLECTION, TREATMENT IN METRO CITIES : STATUS

Sl. No.	Name of Metro City	Total Population	Municipal Population	Volume of Waste Water Generated (mld)			Waste Water Collected		Capacity (mld)	Treatment		Mode of Disposal
				Domestic	Industrial	Total	Volume (mld)	%		Primary	Secondary	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Ahmedabad	3312216	2876710	520.0	36.0	556.0	445.0	80.0	430.0	Y	Y	Sabarmati river
2	Bangalore	4130288	4130288	375.0	25.0	400.0	300.0	75.0	290.0	Y	Y	V. Valley,Ksc
3	Bhopal	1062771	1062771	189.3	--	189.3	94.6	50.0	87.0	Y	Y	Agriculture
4	Bombay	12596243	12288519	2228.1	227.9	2456.0	2210.0	90.0	109.0	Y	Y	Sea
5	Kolkata	11021918	9643211	1383.8	48.4	1432.2	1074.9	75.1	--	--	--	Hughly river/ Fish Farm
6	Coimbatore	1100746	816321	60.0	--	60.0	45.0	75.0	--	--	--	Nayal river,
7	Delhi	8419084	8419084	1270.0	--	1270.0	1016.0	80.0	981.0	Y	Y	Agriculture, Yamuna River
8	Hyderabad	4344437	4098734	348.3	25.0	373.3	299.0	80.1	115.0	Y	--	River, Irrigation
9	Indore	1109056	1091674	145.0	--	145.0	116.0	80.0	14.0	Y	--	Khan River,
10	Jaipur	1518235	1458483	220.0	--	220.0	165.0	75.0	27.0	Y	Y	Agriculture
11	Kanpur	2029889	1874409	200.0	--	200.0	150.0	75.0	41.0	Y	Y	Ganga, Sewage
12	Kochi	1140605	670009	75.0	--	75.0	45.0	60.0	--	--	--	Cochin Back waters
13	Lucknow	1669204	1619115	106.0	--	106.0	80.0	75.5	--	--	--	Gomati River
14	Ludhiana	1042740	1042740	94.4	--	94.4	47.0	49.8	--	--	--	Agriculture
15	Madras	5421985	4752974	276.0	--	276.0	257.0	93.1	257.0	Y	Y	Agriculture, Sea
16	Madurai	1085914	940989	48.0	--	48.0	33.6	70.0	--	--	--	Agriculture
17	Nagpur	1664006	1624752	204.8	--	204.8	163.0	78.6	45.0	Y	Y	Agriculture
18	Patna	1099647	917243	219.0	--	219.0	164.0	74.9	105.0	Y	N	River, Fishries
19	Pune	2493987	2244196	432.0	--	432.0	367.0	85.0	170.0	Y	Y	River
20	Surat	1518950	1498817	140.0	--	140.0	112.0	80.0	70.0	Y	-	Garden/Creek
21	Vadodara	1126824	1031346	120.0	20.0	140.0	105.0	75.0	81.0	Y	Y	river, Agriculture
22	Varanasi	1030863	1030863	170.0	--	170.0	127.0	74.7	101.0	Y	Y	Ganga, Agriculture
23	Vishakhapatnam	1057118	752037	68.0	--	68.0	55.0	80.9	--	--	--	--
Total		70996726	65885285	8892.7	382.3	9275.0	7471.1	80.6	2923.0			

Source : Central Pollution Control Board
 Note : Data Collected During 1995-96

Y = Yes N = No

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GROUND WATER

TABLE 6.1.18 : WATER QUALITY OF YAMUNA RIVER (DELHI STRETCH) IN RESPECT OF SELECTIVE PHYSICO-CHEMICAL PARAMETERS, DURING 2000.

Sl. No.	Parameters	Value	Palla (Upstream Wazirabad)	Nizamuddin		Agra Canal (Originated from Okhla Barrage)	
				Midstream Sample	Quarterstream Sample	Midstream Sample	Quarterstream Sample
1	2	3	4	5	6	7	8
1	pH (units)	Minimum	7.18	6.97	7.01	6.90	7.07
		Maximum	8.18	7.84	7.85	7.94	7.98
		Average	7.75	7.31	7.30	7.35	7.32
2	Dissolved Oxygen (mg/l)	Minimum	5.91	--	--	--	--
		Maximum	9.80	6.14	7.70	3.25	2.91
		Average	7.84	1.42	1.60	1.11	1.11
3	BOD (mg/l)	Minimum	1.00	3.00	4.00	4.00	5.00
		Maximum	3.00	51.00	43.00	21.00	25.00
		Average	1.54	21.16	20.66	12.66	13.75
4	Fecal coliform Nos. / 100 ml	Minimum	34	13000	12000	5000	4000
		Maximum	5000	6600000	4100000	1380000	1250000
		Average	883	1279500	1158250	370666	408000
5	Total coliform Nos. / 100 ml	Minimum	600	43000	31000	14000	16000
		Maximum	69000	179000000	185000000	142000000	151000000
		Average	21408	20856250	22641667	14365500	16531750
6	COD (mg/l)	Minimum	2.00	18.00	11.00	14.00	15.00
		Maximum	22.00	104.00	108.00	80.00	76.00
		Average	11.83	61.41	59.50	47.33	45.16
7	Ammonical Nitrogen (mg/l)	Minimum	0.02	0.74	1.02	1.28	1.14
		Maximum	1.25	31.00	31.00	25.00	23.00
		Average	0.26	13.05	13.08	9.21	9.35

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GROUND WATER

Source : Central Pollution Control Board

TABLE 6.1.19 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS AT CWC SITES ON WEST FLOWING RIVERS (JUNE 1994 TO MAY 1995)

GROUND WATER

Sl. No.	Name of the Site	Name of the River/Stream	pH Value		Specific Conductance in Micromhos/cm at 25 °C		Sodium Absorption Ratio (%/cm)		Cl	SO ₄	NO ₃	Fe	Mg	SP Max.	RSC Max.	Total Hardness
			Min.	Max.	Min.	Max.	Min.	Max.								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Gadat	Ambika	7.60	8.20	170.00	475.00	0.29	1.53	1.13	0.35	0.00	0.01	0.72	1.05	0.40	115.97
2	Kamalpur	Banas	7.80	8.10	178.00	432.00	0.22	1.57	1.35	0.34	0.00	0.02	0.96	9.73	0.22	135.94
3	Chitrasani	Balaram	7.61	8.00	444.00	269.00	0.95	1.31	1.01	0.27	0.00	0.01	0.80	6.98	0.24	128.04
4	Aburoad	Banas	7.60	8.11	224.00	717.00	0.44	2.87	2.48	0.38	0.01	0.03	1.04	3.57	0.67	146.87
5	Ganod	Bhadar	7.80	8.20	248.00	751.00	0.60	3.73	2.99	0.57	0.01	0.02	1.20	1.08	1.05	147.95
6	Pingalwada	Dhodar	7.70	8.21	178.00	1866.00	0.46	9.24	8.11	1.54	0.01	0.03	1.13	8.63	2.76	161.83
7	Motinaroli	Kim	7.80	8.20	220.00	1765.00	0.52	9.06	7.55	0.59	0.01	0.03	0.96	8.47	2.69	143.95
8	Khanpur	Mahi	7.80	8.20	188.00	591.00	0.38	1.59	1.13	0.36	0.01	0.01	0.72	3.63	0.43	119.99
9	Padardibadi	Mahi	7.80	8.20	229.00	553.00	0.51	1.56	1.18	0.38	0.00	0.01	0.80	1.74	0.40	123.97
10	Rangeli	Som	7.70	8.20	185.00	654.00	0.28	1.91	1.41	0.34	0.00	0.01	0.72	46.59	0.65	115.76
11	Mataji	Mahi	7.80	8.20	166.00	686.00	0.29	2.11	1.58	0.43	0.00	0.02	0.72	8.15	0.25	123.85
12	Mahuwa	Purna	7.70	8.20	187.00	466.00	0.29	1.54	1.01	0.17	0.00	0.01	0.72	42.38	0.42	115.97
13	Nabohi	Sabarmati	6.50	8.10	266.00	4504.00	0.64	12.20	15.44	7.71	0.02	0.09	2.50	80.63	2.31	391.39
14	Wautha	Sabarmati	5.60	7.90	257.00	4542.00	0.65	11.59	16.00	7.46	0.02	0.22	3.46	74.29	1.48	432.34
15	Derol Bridge	Sabarmati	7.70	8.20	178.00	1402.00	0.52	4.68	3.83	0.51	0.01	0.03	1.20	64.52	1.62	155.09
16	Lowara	Shetrunji	7.80	8.20	167.00	1083.00	0.29	3.94	3.32	1.01	0.01	0.02	0.95	61.01	0.24	142.35
17	Ghala	Tapi	7.70	8.20	186.00	341.00	0.29	0.77	0.56	0.28	0.00	0.01	0.64	27.13	0.12	108.17
18	Sarangkheda	Tapi	7.80	8.10	229.00	523.00	0.52	1.54	1.13	0.38	0.01	0.02	0.72	41.11	0.41	119.78
19	Gidhade	Tapi	7.80	8.20	211.00	653.00	0.45	2.26	1.69	0.39	0.01	0.02	0.80	49.90	0.47	124.05
20	Morane	Panshara	7.80	8.20	202.00	414.00	0.36	1.51	1.07	0.39	0.00	0.02	0.72	40.27	0.16	119.99
21	Malkheda	Bori	7.90	8.20	240.00	547.00	0.60	1.64	1.18	0.38	0.01	0.02	0.72	43.15	0.38	115.97
22	Savkheda	Tapi	7.80	8.20	172.00	628.00	0.29	2.30	1.41	0.43	0.01	0.02	0.72	50.71	0.40	119.99
23	Dapuri	Girna	7.60	8.20	204.00	431.00	0.36	1.53	1.13	0.34	0.01	0.02	0.72	41.07	0.27	116.00
24	Yerli	Purna	7.80	8.20	211.00	770.00	0.44	3.44	2.54	0.51	0.01	0.02	0.96	60.19	0.80	127.93
25	Gopalkheda	Purna	7.80	8.20	211.00	845.00	0.56	2.98	2.59	0.51	0.01	0.02	0.96	50.90	1.10	135.82
26	Lakhpuri	Purna	7.70	8.20	255.00	898.00	0.61	3.66	3.10	0.56	0.01	0.03	1.04	60.75	1.04	127.96
27	Burhanpur	Tapi	7.60	8.20	163.00	750.00	0.28	3.16	2.54	0.50	0.01	0.03	1.04	56.73	0.84	140.05
28	Dectalai	Tapi	7.70	8.20	176.00	991.00	0.36	4.77	3.66	0.57	0.01	0.02	0.94	66.75	1.21	136.02
29	Durvesh	Vaitama	7.40	8.20	165.00	202.00	0.30	0.70	0.45	0.20	0.00	0.01	0.48	25.33	0.14	99.95

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Source : Central Water Commission

Remarks :

pH : The logarithm to the base 10 of the reciprocal of Hydrogen ion concentration

Cl : Chlorine SO₄ : Sulphate NO₃ : Nitrate Fe : Iron Mg : Magnesium

SP : Sodium Percentage RSC : Residual Sodium Carbonate me/l : Milli equivalent per litre

**TABLE 6.1.20 : MINIMUM & MAXIMUM OF OBSERVED VALUES OF WATER QUALITY PARAMETERS
AT CWC SITES ON EAST FLOWING RIVERS (JUNE 1995 TO MAY 1996)**

Sl. No.	Name of the Site	Name of the River/Stream	pH Value		Specific Conductance in Micromhos/cm at 25 °C		Sodium Absorption Ratio (%/cm)		Cl	SO ₄	NO ₃	Fe	Mg	SP	RSC	Total Hardness						
			Min.	Max.	Min.	Max.	Min.	Max.									Maximum (9me/l)				Max.	Max.
			4	5	6	7	8	9									10	11	12	13	14	15
1	Tikarapara	Mahanadi	7.10	8.49	140	227	0.26	0.65	0.381	0.19	0.101	0.011	0.560	29.32	0.80	84.07						
2	Kantamal	Tel	7.19	8.21	99	234	0.33	0.67	0.530	0.18	0.770	0.013	1.000	29.90	0.55	105.08						
3	Salebhata	Ong	7.61	8.04	200	487	0.60	1.14	0.500	0.14	0.010	0.024	1.250	34.57	0.80	175.14						
4	Sundergarh	lb	7.38	8.12	130	158	0.26	0.59	0.270	0.10	0.015	0.005	0.700	27.85	0.30	70.06						
5	Kurubhanta	Mand	6.36	8.01	82	192	0.10	0.32	0.300	0.51	0.102	0.001	0.900	17.19	0.18	75.06						
6	Basantpur	Mahanadi	7.53	8.21	103	260	0.36	0.70	0.435	0.26	0.097	0.014	0.640	31.83	0.18	104.08						
7	Barnidhi	Hasdeo	7.28	8.10	91	159	0.17	0.73	0.321	0.30	0.098	0.015	0.480	32.98	0.03	60.05						
8	Rampur	Jonk	7.42	7.96	123	277	0.33	0.85	0.400	0.11	0.046	0.004	0.800	32.11	0.61	125.10						
9	Jondhra	Seonath	7.22	8.10	480	518	0.92	1.83	1.690	0.71	0.244	0.001	2.400	40.17	0.64	365.29						
10	Andhiyarkora	Hamp	7.20	8.32	220	860	0.61	2.66	0.610	2.44	0.158	0.005	3.450	44.71	1.48	340.27						
11	Simga	Seonath	7.29	8.28	183	458	0.42	1.58	0.710	1.04	0.086	0.007	1.400	38.61	1.10	162.63						
12	Rajim	Mahanadi	7.43	8.02	92	263	0.12	0.76	0.330	0.28	0.196	0.006	0.800	30.72	0.30	120.10						
13	Baronda	Pairi	6.94	8.12	76	163	0.16	0.40	0.400	0.15	0.046	0.004	0.800	22.92	0.24	75.06						
14	Jenapur	Brahmani	7.51	8.40	88	145	0.31	0.53	0.217	0.26	0.155	0.013	0.400	27.56	0.01	48.04						
15	Telecher	Brahmani	7.62	8.26	81	310	0.30	0.65	0.536	0.81	0.138	0.019	0.880	27.66	0.06	116.09						
16	Gomlai	Brahmani	7.63	8.22	70	204	0.32	0.56	0.435	0.33	0.670	0.024	0.560	31.43	0.10	76.06						
17	Jaraikela	Koel	7.74	8.20	83	198	0.31	0.54	0.965	0.17	0.256	0.011	0.960	25.35	0.20	84.07						
18	Anandpur	Baitarni	7.10	8.26	106	178	0.27	0.71	0.702	0.23	0.158	0.082	0.320	34.85	0.21	60.05						
19	Ghatsila	Subarnarekha	7.72	8.50	145	390	0.36	1.27	0.761	1.79	0.547	0.325	0.880	36.27	0.10	128.10						
20	Jamshedpur	Subarnarekha	7.70	10.70	183	610	0.41	1.42	0.707	0.70	0.122	0.130	1.200	33.11	0.77	188.15						
21	Adityapur	Karkai	7.81	8.66	141	820	0.41	1.02	0.653	0.31	0.175	0.014	0.800	32.59	0.24	104.08						
22	Muri	Subarnarekha	7.47	8.63	133	273	0.51	1.76	0.857	0.28	0.113	0.025	0.480	50.54	0.46	92.07						
23	Kashinagar	Vamsadhara	7.35	8.15	140	520	0.44	1.11	1.073	0.34	0.188	0.200	1.281	33.23	0.45	176.19						
24	Tilga	Sankh	7.66	8.21	46	110	0.36	0.60	0.324	0.18	0.071	0.024	0.240	39.25	0.13	36.08						
25	Bolani	Brahmani	7.63	8.20	95	247	0.31	0.57	0.375	0.42	0.696	0.014	0.720	25.38	0.07	100.08						

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GROUND WATER

Source : Central Water Commission

pH : The logarithm to the base 10 of the reciprocal of Hydrogen ion concentration

Cl : Chlorine SO₄ : Sulphate NO₃ : Nitrate Fe : Iron Mg : Magnesium

SP : Sodium Percentage RSC : Residual Sodium Carbonate me/l : Milli equivalent per litre

Table 6.1.21 : RIVER-BASINWISE DISTRIBUTION OF WATER QUALITY MONITORING STATIONS

Sl. No.	River (main stream) Lake etc.	Tributaries	Total Stations
1	2	3	4
1	Baitarni (5)		5
2	Brahmani (11)	Karo (1), Koel (2), Sankh (2).	15
3	Brahmaputra (6)	Dhansiri (6), Disang (1), Jhanji (1), Subansiri (1), Bhogdoi (1), Bharalu (1), Bhuhidihing (1), Borak (1), Deepar Bill (1), Digboi (1), Mora Bharali (1), Teesta (4), Dickhu (1), Maney (2), Ranchu (2).	31
4	Cauvery (20)	Arkavati (1), Amravati (1), Bhawani (5), Kabini (4), Laxmantirtha (1), Shimsa (2), Hemvati (1).	35
5	Ganga (28)	Barakar (1), Betwa (3), Chambal (8), Damodar (4), Gandak (1), Saryu-Ghghra (3), Gomti (5), Hindon (3), Kali (West) (2), Kali Nadi (2), Khan (1), Kshipra (3), Mandakini (Madhya Pradesh) (1), Parvati (2), Ramganga (1), Rapti (1), Rihand (2), Rupanarayan (1), Sai (1), Sone (5), Tons (Madhya Pradesh) (2), Yamuna (23), Sind (1), Johila (1), Saonkh (1), Gohad (1), Kolar (1), Sal (1), Churnl (2), Tons (Himachal Pradesh) (1)	118
6	Godavari (11)	Manjira (2), Maner (2), Nira (1), Wainganga (3), Wardha (1).	20
7	Indus	Beas (19), Chenab (1), Jhelum (3), Larji (1), Parvati (1), Ravi (3), Sutlej (20), Tawi (1), Gawkadal (1) Chuntkol (1), Sirsa (2).	53
8	Krishna (17)	Bhadra (3), Bhima (9), Ghataprabha (2), Malprabha (3), Muneru (1), Musi (2), Nira (1), Paleru (1), Tunga (1) Tungabhadra (5), Panchganga (1).	46
9	Mahi (7)	Anas (1), Panam (1) .	9
10	Mahanadi (16)	Ib (4), Hasdeo (2), Kathajoda (1), Kharoon (1), Kuakhai (2) Sheonath (2), Birupa (1).	29
11	Narmada (14)	Chhota Tawa (1).	15
12	Pennar (4)	----	4
13	Sabarmati (8)	Meswa (1), Shedhi (1), Khari (1).	11
14	Subarnarekha (6)	----	6
15	Tapi (10)	Girna (2).	12

Table 6.1.21 : RIVER-BASINWISE DISTRIBUTION OF WATER QUALITY MONITORING STATIONS -Concl.

Sl. No.	River (main stream) Lake etc.	Tributaries	Total Stations
1	2	3	4
16	Medium rivers	Ambika (1), Ulhas (2), Ulhas-Bhasta (1), Imphal (4), Mandovi (2), Palar (1), Pamba (3), Pariyar (3), Rushikulya (2), Tambiraparani (7), Achankoil (2), Chalakudy (1), Damanganga (5), Ghaggar (16), Kallada (1), Kali Karnakaka (1), Manimala (2), Mindhola (1), Nagavalli (3), Amlakhadi (1), Chaliyar (2), Iril (2), Kharkhala (1), Karmana (1), Kolak (2), Kundalika (1), Meenachil (1), Muvattupuzha (1), Patalganga (2), Umtrew (1), Vamanpuram (1), Zuari (2), Gumti (2), Kalna (1), Valvant (1), Madai (1), Khandepar (1), Asanora (1), Bhadar (1), Neyyar (1), Ithikkara (1), Kadalundy (1), Kuttiyady (1), Mahe (1), Kuppum (1), Neelsvaram (1), Karingoda (1), Chandergiri (1), Chitrapuzha (1), Nambul (2), Ganol (1), Simsang (1), Myntdu (1), Arasalar (1), Kodra (1), Haora (1).	104
17	Lakes	Hussainsagar (1), Sarooranagar (1), Himayatsagar (1), Pulicate (1), Salaulim (1), Kankoria (1), Chandola (1), Ajwah (1), Sursagar (1), Brahamsarovar (1), Sukhna (1), Govindsagar (1), Pongdam (1), Renuka (1), Wuller (1), Dal (1), Ulsoor (1), Hebbala Valley (1), Oruvathikotta (1), Sasthamcotta (1), Ashthamudi (1), Paravur (1), Vembanad (1), Peryar (1), Kodumgallor (1), Kayamkula (1), Punnamadakayal (1), Pookotekayal (1), Upper Lake (1), Lower Lake (1), Multai Lake (1), Loktak (4), Umiam (1), Ward (1), Thadlaskena (1), Osteri (1), Bahour (1), Harike (1), Pichola (1), Udaisagar (1), Ramgarhjaipur (1), Pushkar (1), Fatchsagar (1), Kalyana (1), Nakki (1), Udhagamadalam (1), Kodaikanal (1), Yereaud (1), Lakshminarayan Baridigh (1), Rudrasagar (1), Ramgarh-Uttar Pradesh (1), Naini (1), Rabindrasarovar (1)	64
	Tanks	Dharamsagar (1), Bibinagar (1), Kistrapetareddy (1), Gandigudem (1), Goysagar (1)	
	Ponds	Elangabeel System (1), Lakshadweep (1)	
18	Creeks, Canals, Tanks, Ponds, Drains	Creeks (3M), Agartala Canal (1M), Gurgaon Canal (1M), Western Yamuna Canal (9M), Drains (12M)	26
19	Groundwater	----	181
Total			784

Source: Central Pollution Control Board.

G - GEMS (Global Environment Monitoring System),

M - MINARS (Monitoring of Indian National Aquatic Resources)

YAP- Yamuna Action Plan

TABLE 6.1.22 : ANNUAL INTERNAL RENEWABLE WATER RESOURCES & WATER WITHDRAWALS IN SELECTED COUNTRIES OF WORLD

GROUND WATER

Sl. No.	Country	Annual Internal Renewable Water Resources ^a		Annual Withdrawals			Sectoral Withdrawals (Percent)		
		Total (Cubic Kilometres)	1995 Per Capita (Cubic Metres)	Year of Data	% of Water Resources ^a	Per Capita (Cubic Metres)	Domestic	Industry	Agriculture
		3	4	5	6	7	8	9	10
1	Egypt	58.1	923	1992	97	956	6 ^d	9	85
2	Kenya	30.2	1069	1990	7	87	20 ^d	4	76
3	Nigeria	280.0	2506	1987	1	41	31 ^d	15	54
4	Bhutan	95.0	57998	1987	0	14	36 ^b	10	54
5	China	2800.0	2292	1980	16	461	6 ^b	7	87
6	India	2085.0	2228	1975	18	612	3 ^b	4	93
7	Indonesia	2530.0	12804	1987	1	96	13 ^b	11	76
8	Iran	117.5	1746	1975	39	1362	4 ^b	9	87
9	Japan	547.0	4373	1990	17	735	17 ^b	33	50
10	Korea, Rep.	66.1	1469	1992	42	632	19 ^b	35	46
11	Italy	167.0	2920	1990	34	986	14 ^d	27	59
12	Russian Federation	4498.0	30599	1991	3	790	17 ^d	60	23
13	United Kingdom	71.0	1219	1991 ^c	17	205	20 ^d	77	3
14	Argentina	994.0	28739	1976	4	1043	9 ^b	18	73
15	Brazil	6950.0	42957	1990	1	246	22 ^b	19	59
16	Mexico	357.4	3815	1991 ^c	22	899	6 ^b	8	86
17	Canada	2901.0	98462	1991 ^c	2	1602	18 ^b	70 ^b	12 ^b
18	United States	2478.0	9413	1990	19	1870	13 ^d	45 ^{b1}	42 ^{b1}

Source: Global Environment Outlook, 1997, United Nations Environment Programme

Notes :

- a : Annual Internal Renewable water Resources usually include river flows from other countries.
- b : Sectoral withdrawal percentages are estimated for 1987.
- c : Data are from early 1990s.
- d : Sectoral percentages date from the year of other annual withdrawal data.

TABLE 6.1.23 : STATEWISE ANNUAL REQUIREMENT OF WATER FOR DOMESTIC PURPOSES*(Cubic Km.)*

Sl. No.	Name of the State/UT	Water Requirement	
		During 1991	During 2001
1	2	3	4
1	Andhra Pradesh	2.548	2.927
2	Arunachal Pradesh	0.027	0.038
3	Assam	0.691	0.817
4	Bihar	2.746	3.237
5	Goa	0.053	0.074
6	Gujarat	1.731	2.052
7	Haryana	0.613	0.749
8	Himachal Pradesh	0.153	0.201
9	Jammu & Kashmir	0.284	0.371
10	Karnataka	1.809	2.120
11	Kerala	1.108	1.239
12	Madhya Pradesh	2.419	2.968
13	Maharashtra	3.466	4.044
14	Manipur	0.071	0.099
15	Meghalaya	0.061	0.085
16	Mizoram	0.033	0.046
17	Nagaland	0.041	0.058
18	Orissa	1.010	1.153
19	Punjab	0.803	0.942
20	Rajasthan	1.602	1.984
21	Sikkim	0.012	0.017
22	Tamil Nadu	2.332	2.599
23	Tripura	0.090	0.126
24	Uttar Pradesh	4.864	6.094
25	West Bengal	2.627	3.087
26	Andaman & Nicobar Island	0.011	0.015
27	Chandigarh	0.044	0.062
28	Dadra & Nagar Haveli	0.004	0.006
29	Daman & Diu	0.005	0.007
30	Delhi	0.643	0.981
31	Lakshadweep	0.003	0.004
32	Pondicherry	0.045	0.063
Total		31.949	38.263

Source : Central Water Commission

Norms

: Rural Water requirement = 70 Litres per Capita per day

: Urban Water requirement = 200 Litres per Capita per day

TABLE 6.2.1 : LENGTH OF COASTLINE AND POPULATION OF COASTAL STATES AND ISLANDS

Sl. No.	Name of State/ Union Territories	Length of Coastline (Km.)	Area(Thousand Sq. Km.)	Population 1991 (000000)
1	2	3	4	5
1	Gujarat	1600	196.00	41.20
2	Maharashtra	840	307.70	78.70
3	Goa	300	3.70	1.20
4	Karnataka	400	191.80	44.80
5	West Bengal	950	88.70	68.00
6	Tamil Nadu	720	130.10	55.60
7	Orissa	560	155.70	31.50
8	Kerala	1014	39.00	29.00
9	Andhra Pradesh	960	275.00	66.30
10	Andaman & Nicobar Islands	--	8.50	0.30
11	Lakshadweep	--	0.03	0.05

Source : The State of Environment, 1995, Ministry of Environment & Forests

India has a coastline of about 7515 Km., its peninsular shape jutting into the Indian Ocean. The major portion of the west coast is dominated by a scarp slope resulting in a well-drained, flood free hinterland. In the Gujarat area, the coastal zone is marked by low land, free from rocky terrain. The east coast is flatter and wider and tends to be better cultivated and more densely populated than the west coast.

The Indian coastline can be divided into the Gujarat region, the West Coast, the East Coast and the Islands. Gujarat region is made up of Kutch and Kathiawar peninsular to the west, separated by the Gulf of Kutch. This is a region of mudflats while the east, the Khambat region is made up estuaries and rias. The West Coast is made up of the Konkan Coast, the Karnataka Coast and the Malabar Coast. While North Konkan is low lying with sandy spits, the southern region is rugged and rocky. The Malabar Coast is characterized by sand dunes, backwaters and lagoons. The east-coast has extensive coastal plains and large deltas of the river Cauvery, Krishna, Godavari and Mahanadi. To the north lies the large delta of the Ganga and the Brahmaputra rivers. A number of sand dunes occur on this coast extending well inland.

The Lakshadweep group of islands are characterized by extensive coral reef system with lagoons and beach vegetation. The Andaman and Nicobar Islands are covered with dense forests from shore to the hills.

TABLE 6.2.2 : MAIN ACTIVITIES ALONG THE INDIAN COASTAL ZONE

1	2
Land Based :	
I. Coast dependent	Ports & Harbours Oil Terminals Paper & Pulp mills Metallurgical Plants Fish Processing Power Plants
II. Coast preferring	Urban, commercial & residential development Tourism & beach recreation Agriculture
III. Coast independent	Defence
Water based	Offshore oil and gas Offshore placer mining Navigation Naval defence Water sports Fishing

Source : The State of Environment, 1995, Ministry of Environment & Forests

Coastal areas are of enormous socio-economic importance, because of both their traditional resources viz. fish, tourist potential, commercial and residential development as well as the new types of resources using new technologies such as ocean thermal energy, wave energy, offshore mineral deposits, mariculture etc. The high economic value of these areas and the relative fragility and vulnerability to natural hazards, sea level rise and anthropogenic activities make the preservation and the management of coastal zone resources and its environment of enormous importance.

TABLE 6.2.3 : INDUSTRIAL & SEWAGE DISCHARGES TO THE COASTAL WATERS

Sl. No.	State/Coast	Industrial Waste Water(MLD)
1	2	3
1	Gujarat	566
2	Maharashtra	80
3	Goa	12
4	Karnataka	43
5	Kerala	151
6	Tamil Nadu	378
7	Pondicherry	6
8	Andhra Pradesh	2466*
9	Orissa	1
10	West Bengal	22
Total		3725

Source : Central Pollution Control Board

* : Including 2116 MLD from Aquaculture farms

Note : The data collected during 1995-96

TABLE 6.2.4 : POLLUTANTS AND THEIR IMPACTS ON THE MARINE ENVIRONMENT

Sl. No.	Sources	Impacts
1	2	3
1	Municipal and Domestic Waste	Reduce dissolved oxygen (DO); increase hydrogen sulphide levels; incidence of faecal coliform & faecal streptococci; high biological oxygen demand (BOD)
2	Industrial Waste	Affect DO, temperature, turbidity, pH, ammonia values; increases BOD, COD, suspended solids
3	Toxic Metals	Cause change in chemical and biochemical processes, increase in turbidity, lethal and sublethal effects on marine life
4	Oil Pollution	Causes smothering, clogging and toxicity
5	Fertilizers	Affect nutrient levels and may cause eutrophication
6	Dredging & Reclamation	Affect habitats of marine organisms; lethal and sublethal effects; affects flushing capacity of the waterbody
7	Siltation	Increases in nutrient levels and can cause excessive algal bloom; may also cause damage to coral reefs and coastal nurseries
8	Discharge of Coolant Waters	Raises the temperature of the water can cause the growth of the blue-green algae
9	Toxic Chemicals	Cause lethal and sublethal effects on marine organisms
10	Offshore Mining	Increases particulate loading which can lead to loss of light and reduced primary productivity ; smothering and clogging of benthic communities
11	Radionuclides	Bioaccumulation in fish and other benthic communities

Source : The State of Environment, 1995

TABLE 6.2.5 : "POTENTIAL HOTSPOTS" ALONG THE INDIAN COAST

Sl. No.	States	Coastal Cities/ Towns
1	2	3
1	Gujarat	Okha, Veraval
2	Maharashtra	Bassein, Bombay Harbour, Thane, Trombay, Versova, Ulhas creek, Mahim
3	Goa	Marmagoa
4	Karnataka	Karwar, Mangalore
5	Kerala	Kochin, Thiruvananthapuram
6	Tamil Nadu	Ennore, Madras Harbour, Cooum, Port Calimere, Koodankulam, Arumuganeri, Tuticorin
7	Andhra Pradesh	Vishakhapatnam
8	Orissa	Gopalpur, Paradip, Puri
9	West Bengal	Indo-Bangladesh border, Sandheads, Diamond Harbour

Source: State of the Environment, 1995

Pressures on the marine environment arise from both natural as well as anthropogenic activities. The latter occurs either due to overexploitation of coastal and marine resources or due to the use of the coastal and marine environment as sinks of pollutants and other wastes arising as by-products of development activities. There are various such sources of marine pollution, their impacts varying according to the nature of the coastal or marine environment impacted upon and on the nature of the pollutant itself.

Marine pollution occurs off most metropolitan cities and densely populated coastal towns in India, but there are 25 heavily polluted potential 'hot spots' along the Indian coast.

TABLE 6.2.6 : CRITERIA FOR CLASSIFICATION OF INLAND SURFACE WATER

Sl. No.	Parameter	Maximum / Minimum	Drinking Water without Conventional Treatment but after Disinfection	Outdoor Bathing Organized	Drinking Water with Conventional Treatment Followed by Disinfection	Propagation of Wildlife and Fishries	Irrigation, Industrial, Cooling etc.
1	2	3	4	5	6	7	8
1	Dissolved oxygen (mg/litre)	Minimum	6	5	4	4	-
2	Biological oxygen demand (mg/letre)	Minimum	2	3	3	-	-
3	Total coliform bacteria (most probable number per 100 millilitres)	Maximum	50	500	5000	-	-
4	Total dissolved solids (mg/litre)	Maximum	500	-	1500	-	2100
5	Chloride as chlorine (mg/litre)		250	-	600	-	500
6	Colour (hazen)	Mximum	10	300	300	-	-
7	Sodium absorption ratio	Maximum	-	-	-	-	26
8	Boron (mg/litre)	Maximum	-	-	-	-	2
9	Sulphates (mg/litre)	Maximum	400	-	400	-	1000
10	Nitrates (mg/litre)	Maximum	20	-	50	-	-
11	Free ammonia as nitrogen (mg/litre)	Maximum	-	-	-	12	-
12	Conductivity at 25°C(µs/cm)	Maximum	-	-	-	1	2.25
13	PH	-	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5	6.0-8.0
14	Arsenic (mg/litre)	Maximum	0.05	0.2	0.2	-	-
15	Iron (mg/litre)	Maximum	0.3	-	50	-	-
16	Fluorides (mg/litre)	Mximum	1.5	1.5	1	-	-
17	Lead (mg/litre)	Maximum	0.1	-	0.1	-	-
18	copper (mg/litre)	Maximum	1.5	-	1.5	-	-
19	Zinc (mg/litre)	Maximum	15	-	15	-	-

Source : TERI Energy Data Directory and Yearbook, 2002-2003