CHAPTER SIX

Water

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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 Central Pollution Control Board in collaboration with State Pollution Control Board is operating the Water Quality Monitoring Network comprising of 784 stations in 26 States and 5 Union Territories spread over the country for monitoring of aquatic resources. The monitoring is undertaken on monthly/quarterly basis in surface water and half yearly basis in cases of groundwater. The monitoring network covers 168 rivers, 53 lakes, 5 tanks, 2 ponds, 3 creeks, 3 canals, 12 drains and 181 groundwater wells. This is done through three major schemes 1) Global

Environmental Monitoring System (GEMS)- 2) Monitoring of Indian National Aquatic Resources (MINARS) - and 3) Yamuna Action Plan (YAP)

6.4 The monitoring results obtained during year 2003 indicate that organic pollution continues to be the predominant form of pollution of aquatic resources. The organic pollution measured in terms of bio-chemical oxygen demand (BOD) & coliform count gives the indication of extent of water quality degradation in different parts of country. It is observed 67% of the observations, out of nearly 3000 observations are having BOD less than 3 mg/l, 18% between 3-6 mg/l & 15% above 6 mg/l. Similarly Total & Faecal coliform, which indicate presence of pathaogens in water, are also of major concern. About 45% observations are having Total coliform and 58% observations are having Faecal coliform less than 500 MPN/100 ml.

Biological Water Quality Evaluation and Criteria

6.5 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-invertibrate 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

6.6 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.

6.7 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.

6.8 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 6.1.2 : SUB DIVISIONAL ACTUAL AND NORMAL RAINFALL

(Millimetre)

Sl. No.	Sub Divisions	1999		2000		2001		2002		2003		2004	
		Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Andaman & Nicobar Islands	2395.0	2965.0	2386.2	2964.7	2935.1	2934.7	2310.7	2945.5	2446.9	2945.7	2508.1	3060.7
2	Arunachal Pradesh	2796.0	2955.0	2762.0	2847.1	2199.9	2844.5	2559.6	3329.8	2761.2	3003.2	2922.6	2927.5
3	Assam and Meghalaya	2625.0	2817.0	2696.3	2771.2	2260.0	2768.9	2530.7	3163.1	2835.1	2817.2	3055.7	2792.9
4	Nagaland, Mizoram, Manipur & Tripura	1877.0	2007.0	1998.3	2029.9	1962.9	2027.3	1960.8	2154.1	2029.0	2100.2	2075.1	1969.5
5	Sub-Himalayan West Bengal & Sikkim	3007.0	2682.0	2559.7	2661.8	2620.1	2645.5	2820.1	2683.6	3288.5	2808.8	2768.3	2644.9
6	Gangetic West Bengal	1850.0	1448.0	1590.2	1448.5	1460.0	1435.8	1597.6	1518.7	1457.8	1461.3	1488.0	1494.1
7	Orissa	1527.0	1497.0	1163.0	1488.7	1777.4	1488.4	1166.5	1415.8	1750.6	1450.3	1337.7	1459.1
8	Jharkhand	1782.0	1314.0	1360.4	1312.6	1397.8	1311.8	1315.5	1293.3	1299.0	1296.3	1157.8	1328.8
9	Bihar	1434.0	1178.0	1302.9	1178.8	1353.8	1178.9	1193.3	1186.7	1454.8	1192.5	1077.0	1230.6
10	East Uttar Pardesh	1031.0	1022.0	1027.9	1021.7	1025.7	1021.5	795.8	1013.3	1177.1	1020.9	849.3	1038.3
11	West Uttar Pradesh	851.0	893.0	838.0	890.6	696.0	892.0	729.0	880.5	1129.5	873.3	647.2	887.1
12	Uttaranchal	1508.0	1669.0	1935.6	1668.0	1460.7	1667.9	2188.5	1556.0	1903.7	1586.2	1605.7	1553.8
13	Haryana, Chandigarh & Delhi	464.0	617.0	539.1	616.2	617.2	616.0	488.7	618.7	720.7	619.5	524.0	570.9
14	Punjab	570.0	651.0	544.2	649.5	634.4	649.8	446.1	643.2	645.0	652.2	445.1	649.1
15	Himachal Pardesh	1118.0	1341.0	1113.9	1341.1	1102.7	1340.4	1075.5	1370.7	1268.9	1396.1	766.4	1252.3
16	Jammu & Kashmir	789.0	1065.0	825.4	1075.1	795.5	1077.5	750.5	900.5	1106.1	1030.0	919.5	1124.5
17	West Rajasthan	275.0	312.0	236.7	312.8	294.3	312.5	118.9	330.7	386.7	325.7	190.4	298.9
18	East Rajasthan	590.0	679.0	481.6	680.4	579.7	680.6	307.1	703.2	629.6	685.4	627.5	677.7
19	West Madhya Pradesh	1143.0	1012.0	625.5	1015.5	830.9	1015.4	807.8	991.2	1011.0	991.0	839.6	987.8
20	East Madhya Pradesh	1308.0	1307.0	863.6	1313.0	1334.5	1298.4	1075.7	1254.0	1532.5	1252.3	946.8	1227.1
21	Gujarat Region	917.0	1113.0	788.4	1110.4	1007.6	1110.0	705.4	1002.6	1259.5	1084.0	1004.2	977.8
22	Saurashtra, Kutch	350.0	581.0	320.1	585.8	532.5	580.9	402.7	570.7	733.1	587.8	498.5	517.4
23	Konkan & Goa	2894.0	2998.0	3134.5	2998.2	2373.7	2998.4	2324.2	2964.4	2828.5	2985.5	2911.6	2981.7
24	Madhya Maharashtra	874.0	904.0	789.9	902.6	866.6	903.6	711.6	926.3	740.3	902.6	883.3	852.7
25	Marathwada	845.0	844.0	863.9	845.6	849.1	845.2	704.7	803.5	645.2	833.9	676.4	838.8
26	Vidarbha	1119.0	1111.0	1024.1	1113.9	1107.3	1114.1	1045.4	1074.4	1032.9	1096.8	796.3	1104.7
27	Chhattisgarh	--	--	--	--	--	--	--	--	1702.7	1318.3	1174.3	1362.5
28	Coastal Andhra Pradesh	849.0	1034.0	1043.1	1034.7	1051.6	1034.4	757.3	1000.7	1118.6	1015.9	933.6	1012.7
29	Telangana	866.0	946.0	1074.2	945.3	896.0	946.0	767.7	945.7	1009.4	946.0	761.7	942.3
30	Rayalaseema	587.0	679.0	861.4	679.4	860.3	679.1	504.4	695.9	654.0	684.0	655.9	679.5
31	Tamilnadu & Pondicherry	840.0	984.0	784.9	996.9	785.5	991.1	723.4	918.6	925.0	960.7	1104.5	11.4
32	Coastal Karnataka	4071.0	3654.0	3542.5	3653.3	3589.3	3653.7	2920.9	3583.4	3086.5	3638.5	3061.6	3620.2
33	North Interior Karnataka	738.0	700.0	746.5	698.1	609.6	698.2	556.3	706.6	473.6	711.5	644.6	725.6
34	South Interior Karnataka	1210.0	1071.0	1241.5	1072.2	1010.4	1072.5	869.1	1305.8	817.9	1064.8	1028.3	1018.4
35	Kerala	2871.0	3108.0	2465.7	3107.6	2910.6	3107.0	2457.3	2863.7	2275.8	3065.5	2977.3	3158.6
36	Lakshadweep	1858.0	1496.0	1372.7	1495.5	1383.7	1495.3	1034.4	1579.5	1532.8	1582.3	2096.8	1583.4

Source : Indian Meteorological Department

TABLE 6.1.3 : ANNUAL ACTUAL RAINFALL BY METEOROLOGICAL SUB-DIVISION

(Millimetre)

Sl. No.	Sub-Division	Actual Rainfall										
		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Andaman & Nicobar Islands	3045	3084	3118	2354	2823	2395	2386	2935	2311	2447	2508
2	Arunachal Pardesh	2142	2971	2662	2752	3684	2796	2762	2200	2560	2761	2923
3	Assam and Meghalaya	2351	2719	2683	2440	2994	2625	2696	2260	2531	2835	3056
4	Nagaland, Mizoram, Manipur & Tripura	1413	1686	1609	1833	1851	1877	1998	1963	1961	2029	2075
5	Sub-Himalayan West Bengal & Sikkim	1868	2934	2531	2350	3275	3007	2560	2620	2820	3289	2768
6	Gangetic West Bengal	1357	1762	1399	1669	1589	1850	1590	1460	1598	1458	1488
7	Orissa	1780	1696	1042	1547	1334	1527	1163	1777	1167	1751	1338
8	Jharkhand	1470	1422	1062	1515	1540	1782	1360	1398	1316	1299	1158
9	Bihar	958	1128	1131	1344	1373	1434	1303	1354	1193	1455	1077
10	East Uttar Pradesh	985	907	1048	1021	1147	1031	1028	1026	796	1177	849
11	West Uttar Pradesh	852	869	953	888	1073	851	838	696	729	1130	647
12	Uttaranchal	1269	1413	1271	1432	1902	1508	1936	1461	2189	1904	1606
13	Haryana, Chandigarh & Delhi	749	1013	872	864	925	464	539	617	489	721	524
14	Punjab	673	829	747	897	845	570	544	634	446	645	445
15	Himachal Pardesh	1421	1454	1254	1370	1385	1118	1114	1103	1076	1269	766
16	Jammu & Kashmir	1095	847	1137	1045	1000	789	825	796	751	1106	920
17	West Rajasthan	509	455	457	573	389	275	237	294	119	387	190
18	East Rajasthan	863	798	941	799	667	590	482	580	307	630	628
19	West Madhya Pradesh	1351	930	1143	1149	954	1143	626	831	808	1011	840
20	East Madhya Pradesh	1742	1204	1127	1316	1061	1308	864	1335	1076	1533	947
21	Gujarat Region	1933	887	1182	1407	1399	917	788	1008	705	1260	1004
22	Saurashtra & Kutch	772	413	480	659	707	350	320	533	403	733	499
23	Konkan & Goa	3069	2696	2656	2897	3263	2894	3135	2374	2324	2829	2912
24	Madhya Maharashtra	1106	868	966	1061	1151	874	790	867	712	740	883
25	Marathawada	608	808	844	809	1245	845	864	849	705	645	676
26	Vidarbha	1443	1055	844	1078	1156	1119	1024	1107	1045	1033	796
27	Chhattisgarh	--	--	--	--	--	--	--	--	--	1703	1174
28	Coastal Andhra Pradesh	1034	1337	1251	1077	1319	849	1043	1052	757	1119	934
29	Telangana	883	1194	1014	855	1139	866	1074	896	768	1009	762
30	Rayalaseema	580	758	1305	795	952	587	861	860	504	654	656
31	Tamilnadu & Pondicherry	953	865	1231	1207	1030	840	785	786	723	925	1105
32	Coastal Karnataka	4360	3632	3123	4107	4172	4071	3543	3589	2921	3087	3062
33	North Interior Karnataka	701	754	816	726	943	738	747	610	556	474	645
34	South Interior Karnataka	1320	1041	1149	1232	1223	1210	1242	1010	869	818	1028
35	Kerala	3432	2994	2685	3213	3122	2871	2466	2911	2457	2276	2977
36	Lakshadweep	1566	1679	1603	1764	1979	1858	1373	1384	1034	1533	2097

Source: India Meteorological Department

TABLE 6.1.4 : STATE-WISE DISTRIBUTION OF NUMBER OF DISTRICTS WITH EXCESS, NORMAL, DEFICIENT, SCANTY AND NO RAINFALL

(01-06-2004To 30-09-2004)

SI. NO.	STATE/UT	E	N	D	S	NR	ND	Total
1	2	3	4	5	6	7	8	9
1	Andaman & Nicobar Islands	0	1	1	0	0	0	2
2	Arunachal Pradesh	6	2	3	1	0	1	13
3	Assam	4	13	4	0	0	1	22
4	Meghalaya	1	0	0	1	0	1	3
5	Nagaland	0	2	1	1	0	0	4
6	Manipur	0	1	0	0	0	2	3
7	Mizoram	1	1	0	0	0	0	2
8	Tripura	2	1	0	0	0	0	3
9	Sikkim	0	0	1	0	0	0	1
10	West Bengal	0	14	3	0	0	0	17
11	Orissa	0	19	9	0	0	0	28
12	Jharkhand	0	6	4	1	0	1	12
13	Bihar	2	4	8	14	1	0	29
14	Uttar Pradesh	1	23	35	4	0	1	64
15	Uttaranchal	4	3	4	0	0	1	12
16	Haryana	0	7	12	0	0	0	19
17	Chandigarh	0	1	0	0	0	0	1
18	Delhi	0	0	1	0	0	0	1
19	Punjab	0	2	8	6	0	0	16
20	Himachal Pradesh	0	1	10	1	0	0	12
21	Jammu & Kashmir	0	4	5	1	0	1	11
22	Rajasthan	2	10	20	0	0	0	32
23	Madhya Pradesh	2	24	19	0	0	0	45
24	Chhattisgarh	0	7	9	0	0	0	16
25	Gujarat	4	18	3	0	0	0	25
26	D. & N. Haveli & Daman	1	0	0	0	0	0	1
27	Diu	0	0	0	0	0	1	1
28	Goa	0	1	0	0	0	0	1
29	Maharashtra	4	15	14	0	0	0	33
30	Andhra Pradesh	0	14	9	0	0	0	23
31	Tamil Nadu	13	14	2	0	0	0	29
32	Pondicherry	1	0	0	0	0	0	1
33	Karnataka	4	18	5	0	0	0	27
34	Kerala	0	6	8	0	0	0	14
35	Lakshadweep	0	1	0	0	0	0	1
	Total	**52**	**233**	**198**	**30**	**1**	**10**	**523**
Percent distribution of 513 districts received		10%	45%	39%	6%	0%		

Source : India Meteorological Department.

Legend :

E : Excess
N : Normal
D : Deficient
S : Scanty
NR : No Rain
Blank figures indicate nil

TABLE 6.1.5 : LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL

(01-06-2004 TO 30-09-2004)

Sub Division		Districts
1		2
A & N Islands	**1**	Andaman
Arunachal Pradesh	**1**	Changlang
	2	Lower Subansiri
	3	Upper Suubansiri
	4	West Siang
Assam & Meghalya	**1**	Jaintia Hills
	2	Jorhat
	3	Kamrup
	4	Morigaon
	5	Nowgong
NMMT	**1**	Mon
	2	Tuensang
SHWB & Sikkim	**1**	Sikkim
	2	South Dinajpur
Gangetic WB	**1**	Howrah
	2	Murshidabad
Orissa	**1**	Bolangir
	2	Deogarh
	3	Dhenkanal
	4	Ganjam
	5	Jaipur
	6	Khurda
	7	Puri
	8	Rayagada
	9	Sonepur
Jharkhand	**1**	Gumla
	2	Pakur
	3	Palamau
	4	West Singbhum
Bihar	**1**	Aurangabad
	2	Begusarai
	3	Bhojpur
	4	Buxar
	5	Gopalganj
	6	Katihar
	7	Khagaria
	8	Kishanganj
	9	Madhepura
	10	Monghyr
	11	Nalanda
	12	Patna
	13	Rohtas
	14	Samastipur
	15	Saran
	16	West Champaran

Sub Division		Districts
1		2
East Uttar Pradesh	**1**	Azamgarh
	2	Ballia
	3	Deoria
	4	Fatehpur
	5	Gazipur
	6	Gonda
	7	Jaunpur
	8	Kanpur Dehat
	9	Lucknow
	10	Maharajganj
	11	Pratapgarh
	12	Sahuji Mharajnagar
	13	Sant Ravidas Nagar
	14	Sonbhadra
	15	Sultanpur
	16	Unnao
	17	Varanasi
West Uttar Pradesh	**1**	Agra
	2	Aligarh
	3	Auriya
	4	Badaun
	5	Baghpat
	6	Bareilly
	7	Bulandshahr
	8	Etah
	9	Etawah
	10	Firozabad
	11	Hamirpur
	12	Jalaun
	13	Jhansi
	14	Lalitpur
	15	Mahamaya Nagar
	16	Mainpuri
	17	Mathura
	18	Meerut
	19	Muzaffarnagar
	20	Pilibhit
	21	Rampur
	22	Shahjahanpur
Uttaranchal	**1**	Garhwal Tehri
	2	Hardwar
	3	Nainital
	4	Rudraprayag
Haryana, Chandigarh, Delhi	**1**	Delhi
	2	Fatehbad
	3	Gurgaon
	4	Hissar
	5	Karnal
	6	Kurukshetra
	7	Mahendragarh
	8	Panchkkula
	9	Rewari'
	10	Rohtak
	11	Sirsa
	12	Sonepat
	13	Yamuna Nagar

TABLE 6.1.5 : LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL -Contd

(01-06-2004 TO 30-09-2004)

Sub Division	Districts	
1	2	
Punjab	1	Amritsar
	2	Bhatinda
	3	Faridkot
	4	Fatehgarh Sahib
	5	Ferozpur
	6	Grudaspur
	7	Hoshiarpur
	8	Jalandhar
	9	Kapurthala
	10	Ludhiana
	11	Moga
	12	Muktasar
	13	Nawashahar
	14	Sangrur
Himachal Pradesh	1	Bilaspur
	2	Chamba
	3	Hamirpur
	4	Kangra
	5	Kinnaur
	6	Kulu
	7	Lahaul & Spiti
	8	Mandi
	9	Simla
	10	Sirmur
	11	Solan
Jammu & Kashmir	1	Baramula
	2	Kathua
	3	Leh
	4	Pulwama
	5	Srinagar
	6	Udhampur
West Rajasthan	1	Barmer
	2	Bikaner
	3	Churu
	4	Hanumangarh
	5	Jaisalmer
	6	Jalore
	7	Jodhpur
	8	Nagaur
	9	Pali
	10	Sri Ganganagar
East rajasthan	1	Alwar
	2	Baran
	3	Bharatpur
	4	Bundi
	5	Dausa
	6	Jaipur
	7	Jhunjhunu
	8	Karauli
	9	Sawai Madhopur
	10	Sikar

Sub Division	Districts	
1	2	
West M.P.	1	Betul
	2	Bhind
	3	Bhopal
	4	Datia
	5	Guna
	6	Harda
	7	Indore
	8	Khandwa
	9	Morena
	10	Raisen
	11	Sheopur
	12	Shivpuri
East M.P.	1	Balaghat
	2	Chhindwara
	3	Seoni
	4	Shahdol
	5	Sidhi
	6	Tikamgarh
	7	Umaria
Gujrat Region	1	Banaskantha
SAU., Kutch & Diu	1	Kutch
	2	Porbandar
Madhya Maharashtra	1	Pune
	2	Nanded
	3	Osmanabad
Marathwada	1	Parbhani
Vidarbha	1	Akola
	2	Amraoti
	3	Bhandara
	4	Buldana
	5	Chandrapur
	6	Gadchiroli
	7	Gondia
	8	Nagpur
	9	Washim
	10	Yeotmal
Chhattisgarh	1	Danteware
	2	Dhamtari
	3	Janjgir
	4	Kanker
	5	Koriya
	6	Kowardha
	7	Raigarh
	8	Raipur
	9	Surguja
Coastal A.P.	1	West Godavary

TABLE 6.1.5 : LIST OF DISTRICTS WITH DEFICIENT OR SCANTY RAINFALL -Contd

(01-06-2004 TO 30-09-2004)

Sub Division	Districts	
1	2	
Telangana	**1**	Adilabad
	2	Hyderabad
	3	Karimnagar
	4	Mahabubnagar
	5	Medak
	6	Nagonda
	7	Nizamabad
	8	Rangareddy
Tamilnadu & Pondicherry	**1**	Namakkal
	2	Tiruvallur

Sub Division	Districts	
1	2	
Coastal Karnataka	**1**	Uttar Kannada
N.I. Karnataka	**1**	Bidar
	2	Gulbarga
	3	Raichur
S.I. Karnataka	**1**	Hassan
Kerala	**1**	Alapuzha
	2	Ernakulam
	3	Kasargode
	4	Kottyam
	5	Kozhikode
	6	Malapuram
	7	Trissur
	8	Wynad

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
12	2002	15	21
13	2003	33	3
14	2004	23	13

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
12	2002	44	56
13	2003	75	25
14	2004	55	45

Source : India Meteorological Department

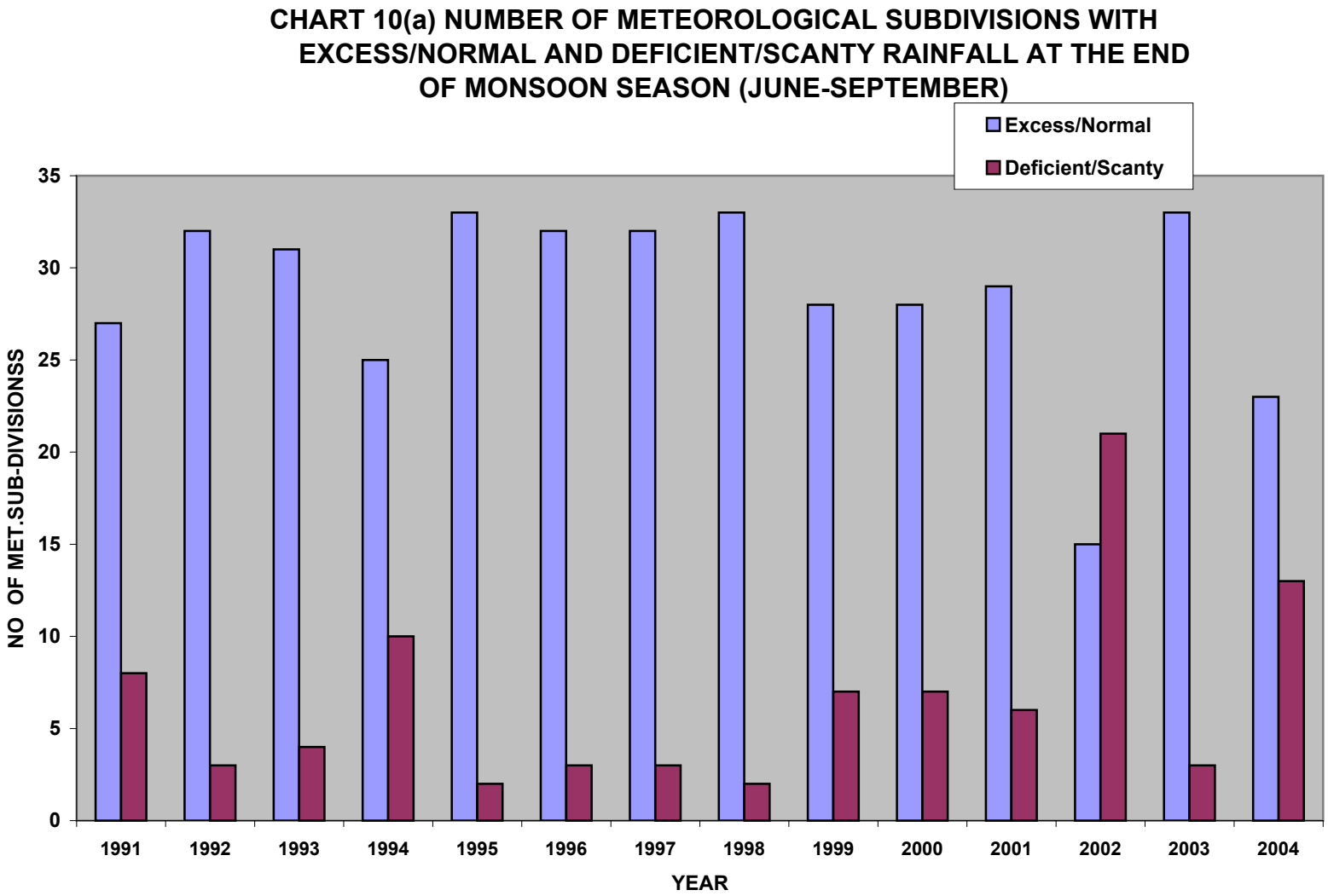
CHART 10(a) NUMBER OF METEOROLOGICAL SUBDIVISIONS WITH EXCESS/NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE END OF MONSOON SEASON (JUNE-SEPTEMBER)
Excess/Normal
Deficient/Scanty
NO OF MET.SUB-DIVISIONSS
35
30
25
20
15
10
5
0
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
YEAR

CHART 10(b): PERCENTAGE OF DISTRICTS WITH EXCESS/NORMAL AND DEFICIENT/SCANTY RAINFALL AT THE AND OF MONSOON SEASON (JUNE-SEPTEMBER)

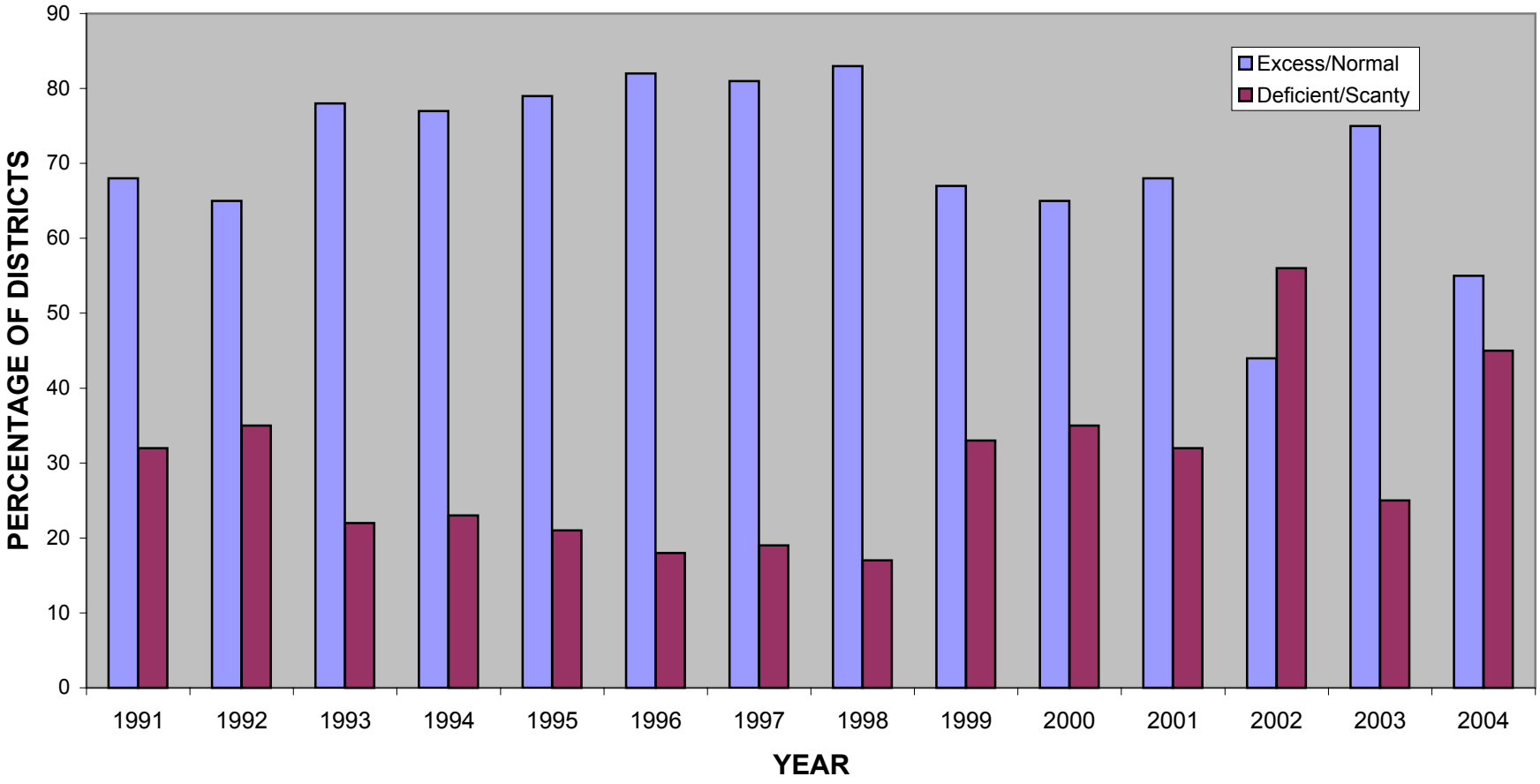

TABLE 6.1.7 : WATER FLOW IN STREAM FOR THE PERIOD 1997-98 to 2002-03

(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	1997-98	2210.00	11956.00	0.00	7.748
2	Tapi	Dedtalai	Ghala	12	1998-99	13000.00	10040.00	0.00	10.000
3	Narmada	Dindori	Garudeshwar	21	1998-99	1256.00	21743.00	1.28	54.710
4	Godavari	Ghargaon	Polavaram	58	2000-01	242.20	36215.00	0.00	67.620
5	Cauvery	Kudige	Musiri	16	1999-2000	2265.00	6400.00	0.00	0.000
6	Krishna	Karad	Vijaywada	57	2000-01	774.10	8140.00	0.00	5.482
7	Mahanadi	Baronda	Tikarpara	21	2002-03	406.70	12306.00	0.00	154.100
8	Subarnarekha	Muri	Ghatsila	3	2002-03	74.57	2037.00	0.42	11.330

Source : Central Water Commission.

TABLE 6.1.8 : STATE-WISE DETAILS OF INLAND WATER RESOURCES OF VARIOUS TYPES

(Lakh Hactares)

Sl. No.	Name of the State/UT.	Rivers & Canals (Length in Kms.)	Reservoirs	Tanks, Lakes & Ponds	Beels, Oxbow Lakes & Derelict Water Bodies	Brackish Water	Total Water Bodies
1	2	3	4	5	6	7	8
	States						
1	Andhra Pradesh	11514	2.34	5.17	-	0.60	8.11
2	Arunachal Pradesh	2000	-	2.76	0.42	-	3.18
3	Assam	4820	0.02	0.23	1.10	-	1.35
4	Bihar	3200	0.60	0.95	0.05	-	1.60
5	Goa	250	0.03	0.03	-	NEG	0.06
6	Gujarat	3865	2.43	0.71	0.12	1.00	4.26
7	Haryana	5000	NEG	0.10	0.10	-	0.20
8	Himachal Pradesh	3000	0.42	0.01	-	-	0.43
9	Jammu & Kashmir	27781	0.07	0.17	0.06	-	0.30
10	Karnataka	9000	4.40	2.90	-	0.10	7.40
11	Kerala	3092	0.30	0.30	2.43	2.40	5.43
12	Madhya Pradesh	17088	2.27	0.60	-	-	2.87
13	Maharashtra	16000	2.79	0.59	-	0.10	3.48
14	Manipur	3360	0.01	0.05	0.04	-	0.10
15	Meghalaya	5600	0.08	0.02	NEG	-	0.10
16	Mizoram	1395	-	0.02	-	-	0.02
17	Nagaland	1600	0.17	0.50	NEG	-	0.67
18	Orissa	4500	2.56	1.14	1.80	4.30	9.80
19	Punjab	15270	NEG	0.07	-	-	0.07
20	Rajasthan	5290	1.20	1.80	-	-	3.00
21	Sikkim	900	-	-	0.03	-	0.03
22	Tamil Nadu	7420	5.70	0.56	0.07	0.60	6.93
23	Tripura	1200	0.05	0.13	-	-	0.18
24	Uttar Pradesh	28500	1.38	1.61	1.33	-	4.32
25	West Bengal (P)	2526	0.17	2.76	0.42	2.10	5.45
26	Andaman & Nicobar Islands	115	0.01	0.03	-	1.20	1.24
27	Chandigarh	2	-	NEG	NEG	-	0.00
28	Dadra & Nagar Haveli	54	0.05	-	-	-	0.05
29	Daman & Diu	12	-	NEG	-	NEG	0.00
30	Delhi	150	0.04	-	-	-	0.04
31	Lakshadewwp	-		-	-	-	0.00
32	Pondicherry	247	-	NEG	0.01	NEG	0.01
33	Chhattisgarh	3573	0.84	0.63	-	-	1.47
34	Urraranchal	2686	0.20	0.01	0.00	-	0.21
35	Jharkhand	4200	0.94	0.29	-	-	1.23
	TOTAL	**195210**	**29.07**	**24.14**	**7.98**	**12.40**	**73.59**

Source : Department of Animal Husbandary and Dairing, Ministry of Agriculture
NEG: Negligible

TABLE 6.1.9 : NAVIGABLE WATERWAYS IN INDIA, 2002-03

(Km.)

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4
1	**ANDHRA PRADESH**		
	Godavari	757	206
	Krishna	386	35
	Others *	1997	258
	Total	**3140**	**499**
2	**ASSAM**		
	Brahmaputra	891	891
	Borak	140	140
	Subansiri	35	20
	Kapali	70	30
	Joljoli	35	15
	Dhansiri	100	22
	Dikhow	42	15
	Total	**1313**	**1133**
3	**BIHAR**		
	Damodar	…	---
	Ganga	510	510
	Gandak	300	300
	Koshi	233	160
	Ghaghra	100	100
	Sone	226	31
	Mahananda	140	--
	Burhi Gandak	400	--
	Punpun	200	--
	Phalgu Harihar	300	--
	Kiul	100	--
	Kari Koshi	150	--
	Chandan	100	--
	Karmnasha	144	--
	Total	**2903**	**1101**
4	**GOA**		
	Mandovi	78	65
	Zuari	56	45
	Mapusa	26	20
	Chapora	34	25
	Tiracol	29	15
	Sal	20	15
	Cumbarjua Canal	17	17
	Others	--	12
	Total	**260**	**214**

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4
5	**KERALA**		
	Pamba	275	194
	Manimala	135	105
	Kurumali	64	64
	Chalkudi	130	130
	Mahi	54	54
	Valappattanam	110	45
	Chaliyar Puzha	207	65
	Kuttiyadi	74	74
	Vamanapuram	86	15
	Neyyar	56	15
	Karamana	67	22
	Kallada	66	12
	Achen Coil	191	75
	Vadathalthodu	4	4
	Cochin Lake	25	25
	Anachal	8	8
	Chittattukarathodu	8	8
	Bharathapuzha	289	25
	Manali	36	--
	Karuvannur	17	17
	Keeranallur	8	7
	Kadalundi	130	19
	Tirur-Ponnanipui	30	30
	Akalapuzha	13	13
	Ponurpuzha	60	30
	Thalssery	8	8
	Dharmadam	4	4
	Kariangoda	50	15
	Kavvai	31	8
	Perumba	51	8
	Ramapuram	19	5
	Kuppan	82	30
	Manjeswaram	16	--
	Uppala	30	4
	Shiriya	40	8
	Mogral	34	4
	Chandragiri	105	12
	Chittari	25	3
	Nileswaram	46	5
	Total	**2684**	**1170**

: Data not received from the State Government

TABLE 6.1.9 : NAVIGABLE WATERWAYS IN INDIA, 2002-03-Concld.

(Km.)

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4
6	**JAMMU AND KASHMIR#**		
7	**GUJARAT**		
	Narmada	230	160
	Tapti	200	45
	Others	--	72
	Total	**430(b)**	**277(b)**
8	**ORISSA**		
	Mahanadi	493	199
	Brahmani	541	277
	Baitarani	344	32
	Subarnarekha	--	50
	Budha Balanga	--	35
	Dhamara	--	20
	Salandi	--	17
	Panchputra	--	21
	Pernei	--	45
	Hatel	--	30
	Bansagadal	--	32
	Hansua	--	37
	Tirkota	--	18
	Jamboo	--	6
	Gobari	--	16
	Ramchandi	--	16
	Kharansi	--	14
	Batigharia	--	14
	Birupa	--	110
	Genguti	--	45
	Luna	--	37
	Devi	--	20
	Pradhi	--	15
	Kadha	--	30
	Kusavadra	--	25
	Daya	--	9
	Rajua	--	7
	Makara	--	11
	Ohers *	--	356
	Total	**1378**	**1544**

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4
9	**TAMIL NADU #**		
10	**MAHARASHTRA #**		
11	**KARNATAKA**		
	Sharavathi	250	13
	Tungabhadra	375	375
	Malaprabha	230	230
	Ghataprabha	160	160
	Krishna	325	325
	Cauvery	270	34
	Kabini	117	22
	Arkavathi	32	6
	Hemavathi	174	16
	Bheema	860	125
	Sita	15	1
	Netravathi	15	1
	Total	**2823**	**1308**
12	**UTTAR PRADESH #**		
13	**WEST BENGAL**		
	Hooghly	580	580
	Mahananda	206	58
	Ajoy	174	174
	Jalangi	232	232
	Dwarka	129	129
	Bakreswar	102	102
	Damodar	437	437
	Dwarekeswar	103	103
	Silabati	135	135
	Kumari	308	308
	Ichamati	232	232
	Others @	2103	2103
	Total	**4741**	**4593**

Source : Transport Research Wing, Ministry of Surface Transport

** : Includes 1234 Kms. Pertaining to canals.

@ : Includes 268 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.

Data not received from state government

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. Develop-ment
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	Krisnhna	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 BCM/Yr	Provision for Domestic Industrial & Other Uses BCM/Yr	Available Ground Water Resource for Irrigation BCM/Yr	Projected Net Draft (as on 2003) BCM/Yr	Balance Ground Water Resource for Future Use (As on 2003) BCM/Yr	Level of Ground Water Development (As on 2003) [%]
1	2	3	4	5	6	7	8
	States	**43.4771**	**71.4020**	**363.3696**	**149.8151**	**213.5991**	**41.23**
1	Andhra Pradesh	35.2909	5.2936	29.9973	8.5687	21.4286	28.56
2	Arunachal Pradesh	1.4385	0.2158	1.2227	-	1.2227	Neg.
3	Assam	22.4786	3.3718	19.1068	1.8390	17.2678	9.62
4	Bihar	26.9796	4.0470	22.9327	10.6284	12.3043	46.35
5	Chhattisgarh	16.0705	2.4106	13.6599	0.8102	12.8497	5.93
6	Delhi	0.2916	0.1939	0.0977	0.1180	0.0000	120.78
7	Goa	0.2182	0.0327	0.1855	0.0154	0.1701	8.30
8	Gujarat	20.3767	3.0566	17.3199	9.5546	7.7653	55.17
9	Haryana	11.1794	1.6769	9.5025	8.1316	1.3709	85.57
10	Himachal Pradesh	0.2926	0.0439	0.2487	0.0314	0.2173	12.61
11	Jammu & Kashmir	4.4257	0.6640	3.7620	0.0306	3.7314	0.81
12	Jharkhand	6.6045	0.9907	5.6138	1.8390	3.7751	32.75
13	Karnataka	16.1750	2.4186	13.7564	4.7599	8.9965	34.60
14	Kerala	7.9003	1.3135	6.5869	1.4606	5.1263	22.17
15	Madhya Pradesh	34.8186	5.2228	29.5958	8.0179	25.7793	27.09
16	Maharashtra	37.8677	12.3973	25.4704	9.4352	16.0352	37.04
17	Manipur	3.1540	0.4730	2.6810	Neg.	2.6810	Neg.
18	Meghalaya	0.5397	0.0810	0.4587	0.0182	0.4405	3.97
19	Mizoram	1.4000	0.2100	1.1900	Nil	1.1900	Neg.
20	Nagaland	0.7240	0.1090	0.0.615	Neg.	0.0.615	Neg.
21	Orissa	20.1287	3.0193	17.1094	3.6086	13.5008	21.09
22	Punjab	18.1923	1.8192	16.3730	16.3972	0.0000	100.15
23	Rajasthan	12.6021	1.9977	10.6044	9.2583	1.3462	87.31
24	Sikkim	0.0736	0.0108	0.0628	Neg.	0.0628	Neg.
25	Tamil Nadu	26.4069	0.3.961	22.4458	14.4539	7.9929	64.39
26	Tripura	0.6634	0.0995	0.5639	0.1885	0.3754	33.43
27	Uttar Pradesh	82.5459	12.3819	70.1640	32.3337	37.8304	46.08
28	Uttaranchal	2.8411	0.4262	2.4149	0.8208	1.5941	33.99
29	West Bengal	23.0914	3.4637	19.6277	7.4967	12.1310	38.19
	Union Territories	**0.8877**	**0.0976**	**0.5510**	**0.1600**	**0.1100**	
1	Andaman & Nicobar	0.3263	0.0134	0.3129	Neg.	0.0319	Neg.
2	Chandigarh	0.0297	0.0044	0.0252	0.0245	0.0007	97.34
3	Dadar & Nagar Haveli	0.0422	0.0063	0.0359	0.0046	0.0313	12.74
4	Daman	0.0071	0.0011	0.0060	0.0048	0.0012	80.00
5	Diu	0.0037	0.0006	0.0031	0.0029	0.0002	94.84
6	Lakshadweep	0.3042	0.0456	0.0195	0.0077	0.0119	39.21
7	Pondicherry	0.1746	0.0262	0.1484	0.1155	0.0329	77.85
	Grand Total	**435.6592**	**71.4997**	**364.1595**	**149.9751**	**213.7090**	**41.18**

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 Metres

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	Mansarovar (Tibet)	1114 (2880)	321289 (1165500)
2	a) Ganga	Gangotri (Uttaranchal)	2525	861452 (1186000)
	b) Brahmaputra	Kailash Range (Tibet)	916 (2900)	194413 (580000)
	c) Barak & other rivers flowing into Meghna like Gomti, Muhari, Fenny etc.	Manipur Hills (Manipur)		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 (Maharashtra)	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 6.1.12 : 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 Metres

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	Mansarovar (Tibet)	1114 (2880)	321289 (1165500)
2	a) Ganga	Gangotri (Uttaranchal)	2525	861452 (1186000)
	b) Brahmaputra	Kailash Range (Tibet)	916 (2900)	194413 (580000)
	c) Barak & other rivers flowing into Meghna like Gomti, Muhari, Fenny etc.	Manipur Hills (Manipur)		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 (Maharashtra)	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 WaterSource 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 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 Characteristic	Water Quality Class	Indicator Colour
1	2	3	4	5	6	7
1	Ephemeroptera, Plecoptera, Trichoptera,	7 and more	0.2 - 1	Clean	A	Blue
2	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Planaria,	6 - 7	0.5 - 1	Slight Pollution	B	Light Blue
3	Ephemeroptera, Plecoptera, Trichoptera, Hemiptera, Odonata, Crustacea, Mollusca, Polychaeta, Coleoptera, Diptera,	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	Treatment		Mode of Disposal
				Domestic	Industrial	Total	Volume (mld)	%	(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 Valley
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, Irrigation
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, Irrigation
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	79.6	45.0	Y	Y	Agricultire
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

Table 6.1.18 (a): Water Quality in Indian Rivers-2002

Sl. No.	Name of Basin/River	Length (km)	No. of Monitoring locations	Observed Range of Water Quality Parameters							
				Temprature °C	PH	Conductivity (µmhos/cm)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
1	2	3	4	5	6	7	8	9	10	11	12
1	Ganga	2525	34	3-34	6.4-9.0	19-2720	2.7-11.5	0.5-16.8	1-30	$300\text{-}25\mathbf{x}10^5$	$20\text{-}11\mathbf{x}10^5$
2	Yamuna	1376	23	3-34	6.7-9.8	56-1959	0.1-22.7	1.0-36	1-112	$27\text{-}26\mathbf{x}10^6$	$11\text{-}17.2\mathbf{x}10^5$
3	Sabarmati	371	8	12-32	2.9-8.6	269-13530	0.6-7.9	0.8-475	4-1794	$210\text{-}28\mathbf{x}10^5$	$28\text{-}28\mathbf{x}10^5$
4	Mahi	583	7	19-34	7.1-9.2	175-5720	0.2-8.5	0.1-3.0	9-163	3-2400	3-75
5	Tapi	724	10	20-40	7.4-9.0	76-700	4.8-8.8	0.6-10.0	8-40	40-2100	2-210
6	Narmada	1312	14		6.9-9.3	102-1341	5.8-9.8	0.1-3.8	6-47	9-2400	2-64
7	Godavari	1465	11	22-35	7.0-9.0	118-1400	3.1-10.9	0.5-78.0	3-96	8-5260	2-3640
8	Krishna	1401	17	18-33	6.8-9.5	28-11050	2.9-10.9	0.2-10.0	3-88	17-33300	3-10000
9	Cauvery	800	20	21-37	2.0-9.2	31-53100	0.1-12.6	0.1-26.6	30	39-160000	2-28000
10	Mahanadi	851	16	18-38	7.3-8.9	114-15940	1.3-10.4	1.0-7.6	7-39	15-30000	50-17000
11	Brahmani	799	11	20-38	7.0-8-4	81-376	5.2-9.8	1.5-6.0	8-13	80-90000	40-60000
12	Baitarni		5	24-36	7.3-8.3	54-78400	6.8-9.3	2.0-6.8	7	900-22000	700-11000
13	Subarnarekha	395	6	18-36	6.5-8.0	113-355	5.2-8.5	0.2-12.0	4-96	150-1800	70-540
14	Brahmaputra	916	6	15-32	6.5-9.0	104-684	1.1-10.5	0.1-3.9	6-11	360-240000	300-24000
15	Pennar	597	4	-	7.5-8.7	364-978	6.0-9.3	1.0-2.9	14-16	-	-
16	Satluj	1078	20	9-32	6.8-8.8	131-819	3.8-11.4	0.1-45.0	1-80	8-35000	2-3500
17	Beas	460	19	3-32	7.1-8.7	53-517	5.2-11.5	0.3-5.0	1-13	2-2400	2-1600
18	Ghaggar	291	15	11-33	7.0-9.5	320-1012	2.6-9.6	1-180	4-560	43-14000	9-2500
19	Amlakhedi	-	1	27-32	1.7-7.2	7160-16770	0-0	485-1561.6	1821-3860	28-1100	3-28
20	Kali East	-	2	15-30	7.2-8.7	24-1930	6.7-11.9	1.9-67.0	66-421	2100-48000000	100000-360000

Source:Status of Water Qualtiy in India 2002-2003

Table 6.1.18 (b) Water Quality Status of Indian Rivers-2003

Sl. No.	Name of Basin/River	Temprature °C		PH		Conductivity (µmhos/cm)		DO (mg/l)		BOD (mg/l)		COD (mg/l)	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Beas	4	29	7.3	8.9	76	559	7.0	12.0	0.1	6.0	1.0	18.0
2	Satluj	5	30	6.9	8.9	164	1226	3.4	11.5	0.1	24.0	0.8	61.0
3	Jhelum	6	38	7.2	8.6	78	629	4.9	11.8	0.1	1.2	1.0	18.0
4	Ganga	4	34	6.8	8.9	49	1323	4.0	11.0	0.8	24.8	2.0	47.2
5	Yamuna	2	38	6.6	10.0	45	3500	0.3	22.8	1.0	58.0	1.0	187.0
6	Gandak	10	39	6.4	8.6	21	2390	0.8	11.5	0.6	149.0	8.8	552.0
7	Dohad	2	36	6.2	9.3	119	8800	1.0	10.8	0.3	30.0	2.0	46.0
8	Rupnarayan	22	39	6.9	8.9	209	11660	3.5	9.9	0.4	6.0	10.0	34
9	Brahmaputra	-	-	6.4	8.4	77	570	1.2	11.5	0.4	3.5	4.8	27.4
10	Dhansiri	-	-	6.4	8.2	53	508	2.5	17.3	0.5	10.6	9.6	9.6
11	Teesta	-	-	5.9	7.0	30	320	14.0	26.0	1.0	12.0	-	-
12	Ranichu+	-	-	6	8.8	30	760	1.4	30.0	0.4	76.0	4.3	97.3
13	Mahi*	-	-	7.0	8.8	97	750	2.9	10.1	0.5	3.9	7.0	30.2
14	Sabarmati #	-	-	5.6	9.1	278	31400	1.2	17.5	0.6	1867.0	4.0	6437.0
15	Narmada and Chota Tawa	-	-	7.1	8.5	95	441	4.5	9.5	0.4	3.3	7.0	29.0
16	Tapi and Girna	18	36	3.1	9.2	119	1130	3.1	10.4	1.0	10.0	10.0	44.0
17	Mahanandi	17	37	6.5	8.6	77	83600	4.7	10.1	0.3	5.6	10.0	70.0
18	Seonath^	19	36	6.5	8.5	55	425	4.5	14.2	0.3	5.1	9.5	40.0
19	Brahmani	17	34	6.6	8.4	69	501	6.1	10.2	0.2	3.3	4.2	4.2
20	Baitarni	18	36	6.7	7.8	75	54802	5.4	11.3	0.3	3.5	230.0	9000
21	Subarnarekha	22	35	7.3	8.3	133	346	6.4	8.4	1	2	-	-
22	Godavari	17	44	6.9	9.0	90	1350	3.2	9.3	1.0	53.0	5.0	188.0
23	Krishna	18	35	6.7	8.9	36	40000	0.7	12.6	0.7	17.0	10.5	68.0
24	Maneru>	18	40	6.1	9.8	60	2750	1.3	10.5	0.1	84.0	13.2	99.0
25	Penneru	21	30	7.1	8.5	387	987	5.7	8.4	1.0	6.3	15.0	16.0
26	Cauvery	8	34	5.4	9.3	18	57200	2.1	13.5	0.2	10.0	3.2	128.0

Source:Status of Water Qualtiy in India 2002-2003

+ Including Subansiri, Burhidihing, Disang, Jhanji, Bhogdoi, Mora Bharali, Borak, Digboi, Bharalu, Deepar Bill, Dickchu,Maney Khola

* Includings Tributaries Panam ad Anas

Includings Tributaries Shedi and Khari

^ Includings Kharoon, Hasdeo, IB, Kuakhai, Kathajodi and Biruoa

>Including Bhima, Panchganga, Ghatprabha, Malprabha, Nira, Tyngbhadra, Tunga, Bhadra, Musi, Palleru

Table 6.1.18 (b): Water Quality Status of Indian Rivers-2003 (concld)

Sl. No.	Name of Basin/River	Faecal Coliform (MPN/100 ml)		Total Coliform (MPN/100 ml)		Nitrite (mg/l)		Nitrate (mg.l)		Ammonical Nitrogen (mg/l)	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
1	2	15	16	17	18	19	20	21	22	23	24
1	Beas	2	1600	2	2400	0.10	0.20	-	-	0.10	2.6
2	Satluj	1	1300	3	30000	0.06	0.60	-	-	0.10	2.0
3	Jhelum	2	810	5	1600	0.20	-	-	-	0.2	0.20
4	Ganga	26	1200000	47	4500000	0.002	1.800	0.002	8.29	0.006	5.00
5	Yamuna	40	203000000	110	890000000	0.001	0.374	0.01	7.5	0.078	2.621
6	Gandak	40	46000000	52	190000000	0.002	3.54	0.045	12.6	0.004	48.41
7	Dohad	9	220000	7.0	14500000	0.002	0.008	0.020	0.380	0.020	0.6
8	Rupnarayan	200	1100000	800.0	4500000	0.001	0.688	0.142	1.611	0.120	0.156
9	Brahmaputra	300	240000	360.0	240000	-	-	-	-	-	-
10	Dhansiri	360	240000	1500	240000	-	-	-	-	-	-
11	Teesta	30	240	40	300	-	-	-	-	-	-
12	Ranichu+	23	240000	360	240000	-	-	-	-	-	-
13	Mahi*	2	28	4	2400	-	-	-	-	-	-
14	Sabarmati #	4	24000000	9	24000000	-	-	-	-	-	-
15	Narmada and Chota	1	110	4	1600	-	-	-	-	-	-
16	Tapi and Girna	2	230	40	930	0.005	0.290	0.062	5.017	0.006	1.250
17	Mahanandi	50	28000	4	35000	0.001	4.900	0.001	2.584	0.101	0.710
18	Seonath^	130	24000	6	92000	0.001	5.23	0.001	2.173	0.073	2.000
19	Brahmani	60	14000	90	24000	0.001	2.355	0.018	7.056	-	-
20	Baitarni	230	9000	.001	16000	0.002	4.932	0.002	0.152	-	-
21	Subarnarekha	130	3300	300	7900	0.002	0.025	0.014	0.896	-	-
22	Godavari	4	18400	10	64000	0.003	0.634	0.021	10.63	0.038	2.031
23	Krishna	2	20000	6	12000	0.001	9.91	0.006	59.540	0.006	3.190
24	Maneru>	4	4000	35	44000	0.001	9.00	0.036	57.30	0.060	0.590
25	Penneru	2	3	58	1100	0.440	2.420	-	-	-	-
26	Cauvery	2	4000	4	22000	0.001	1.210	0.030	4.000	0.001	0.018

Source:Status of Water Qualtiy in India 2002-2003

+ Including subansiri, Burhidihing, Disang, Jhanji, Bhogdoi, Mora Bharali, Borak, Digboi, Bharalu, Deepar Bill, Dickchu,Maney Khola
* Includings Tributaries Panam ad Anas
# Includings Tributaries Shedi and Khari
^ Includings Kharoon, Hasdeo, IB, Kuakhai, Kathajodi and Biruoa
>Including Bhima, Panchganga, Ghatprabha, Malprabha, Nira, Tyngbhadra, Tunga, Bhadra, Musi, Palleru

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	pH				Specific Conductance				Calcium (Ca**)			
		First Site	Last Site		Tolerance Limits (Units)-> 6.5-8.5				Max= 2250.00 (Micromho/cm)				Max= 80.00 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
					First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Mahanadi	Baronda	Tikarpara	2002-03	7.51	7.40	7.95	8.20	64	146	134	200	0.548	0.720	0.75	0.096
2	Brahmani	Jenapur	Tilga	2002-03	7.2	7.1	8.1	7.8	101	50	290	150	0.480	0.240	1.4	0.640
3	Godavari	Ghargaon	Polavaram	2003-04	8.3	7.5	9.3	8.7	321	126	583	232	25	12	42.0	39
4	Krishna	Karad	Vijaywada	2002-03	7.92	7.60	8.67	8.65	122	337	392	481	735	0.40	1.25	2.83
5	Cauvery	Kudige	Musiri	2000-01	7.70	7.89	8.20	8.72	42	169	104	630	0.21	1.04	0.57	1.92
6	Tapi	Dedtalai	Ghala	1998-99	7.60	7.70	8.20	8.20	131	128	839	333	1.277	1.238	1.20	1.600
7	Narmada	Dindori	Chandwada	1999-2000	7.88	8.10	8.43	8.48	126	169	373	300	0.753	1.238	1.66	1.522
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	7.80	7.5	8.2	8.1	172	180	1455	2629	1.440	1.440	1.901	1.901
10	Mahi	Mataji	Khanpur	1997-98	7.700	7.89	8.200	8.20	138	150	320	687	1.198	1.238	1.600	1.68

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Magnesium (Mg**)				Iron (Fe ***)				Free Amonia (NH4**)			
		Tolerance Limits (Units)->			Max =24.00 (mg/l)				Max = 50.00 (mg/l)				Max= 1.20			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	18	19	20	21	22	23	24	25	26	27	28	29
1	Mahanadi	Baronda	Tikarpara	2002-03	0.110	0.240	0.247	0.640	-	0.003	-	0.023	-	0.000	-	0.031
2	Brahmani	Jenapur	Tilga	2002-03	0.160	0.080	0.800	0.480	0.001	0.030	0.090	0.016	0.001	0.002	0.041	0.016
3	Godavari	Ghargaon	Polavaram	2003-04	7.5	0.5	7.8	13.6	0.00	0.00	0.0	0.01	0.00	0.00	0.00	0.50
4	Krishna	Karad	Vijaywada	2002-03	0.01	0.08	3.48	3.21	0.003	0.000	0.030	0.011	0.000	0.000	0.023	0.000
5	Cauvery	Kudige	Musiri	2000-01	0.12	1.26	0.40	2.32	0.00	0.004	0.41	0.010	0.14	0.002	0.37	0.004
6	Tapi	Dedtalai	Ghala	1998-99	0.321	0.321	1.056	0.559	0.002	0.001	0.019	0.011	0.000	0.000	0.006	0.002
7	Narmada	Dindori	Chandwada	1999-2000	0.576	0.313	1.580	0.477	NIL	0.000	NIL	0.001	NIL	0.001	NIL	0.001
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	0.395	0.477	1.138	1.191	0.002	0.004	0.020	0.090	0.000	0.002	0.007	1.368
10	Mahi	Mataji	Khanpur	1997-98	0.321	0.395	0.559	0.715	0.001	0.002	0.006	0.011	0.000	0.000	0.002	0.003

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS ….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Chloride (Cl)				Fluroide (F)				Sulphate (SO_4)			
		Tolerance Limits (Units)->			Max =600.00 (mg/l)				Max =1.50 (mg/l)				Max= 1000.00 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	30	31	32	33	34	35	36	37	38	39	40	41
1	Mahanadi	Baronda	Tikarpara	2002-03	0.105	0.214	0.226	0.438	-	0.000	-	0.000	0.075	0.042	0.156	0.183
2	Brahmani	Jenapur	Tilga	2002-03	0.217	0.163	0.657	0.295	0.000	0.000	0.000	0.000	0.009	0.012	0.087	0.630
3	Godavari	Ghargaon	Polavaram	2003-04	18	2	34.00	26.00	0.3	0.03	0.62	0.47	23.00	1.00	24.00	13.00
4	Krishna	Karad	Vijaywada	2002-03	0.070	1.46	0.75	4.65	0.000	0.000	0.015	0.047	0.000	0.55	0.500	1.61
5	Cauvery	Kudige	Musiri	2000-01	0.05	0.63	0.56	1.62	0.003	0.021	0.044	0.063	0.00	0.199	0.12	0.723
6	Tapi	Dedtalai	Ghala	1998-99	0.169	0.169	2.535	0.732	0.002	0.001	0.017	0.008	0.118	0.101	0.593	0.326
7	Narmada	Dindori	Chandwada	1999-2000	0.144	0.338	0.288	0.901	0.000	0.007	0.016	0.031	0.052	0.080	0.362	0.172
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	0.225	0.338	3.887	9.014	0.001	0.005	0.019	0.038	0.101	0.299	0.552	4.625
10	Mahi	Mataji	Khanpur	1997-98	0.169	0.169	0.451	1.972	0.001	0.003	0.006	0.013	0.076	0.093	0.267	0.372

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Nitrate (NO_3)				Dissolved Oxygen (DO)				Biochemical Oxygen Demand (BOD)			
		Tolerance Limits (Units)->			Max =50.00 (mg/l)				Max =6.00 (mg/l)				Max=3.00 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	42	43	44	45	46	47	48	49	50	51	52	53
1	Mahanadi	Baronda	Tikarpara	2002-03	-	0.032	-	0.132	7.66	0.1	8.62	8.54	0.31	0.38	1.35	1.63
2	Brahmani	Jenapur	Tilga	2002-03	0.017	0.013	0.171	0.074	5.58	5.40	8.54	0.4	0.41	1.02	1.10	1.10
3	Godavari	Ghargaon	Polavaram	2003-04	0.6	0.03	1.00	3.60	4.7	5.4	5.7	7.9	1.6	0.2	1.8	1.2
4	Krishna	Karad	Vijaywada	2002-03	0.000	0.007	0.027	0.086	3.9	-	6.8	-	0.50	0.0	3.60	2.00
5	Cauvery	Kudige	Musiri	2000-01	0.00	0.039	0.078	0.345	7.2	6.1	9.9	7.7	0.1	0.5	1.7	2.5
6	Tapi	Dedtalai	Ghala	1998-99	0.000	0.000	0.007	0.003	-	-	-	-	-	0.20	-	1.50
7	Narmada	Dindori	Chandwada	1999-2000	0.008	0.003	0.069	0.005	-	RD	-	RD	-	0.2	-	0.6
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	0.000	0.001	0.006	0.016	-	-	-	-	0.1	8.6	1.0	13.0
10	Mahi	Mataji	Khanpur	1997-98	0.000	0.000	0.002	0.005	-	-	-	-	0.100	0.4	1.800	1.0

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Total Coliform				Arsenic (As)				Boron (B)			
		Tolerance Limits (Units)->			Most Probable Number =5000.00				Max =0.20(mg/l)				Max=2.00 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	54	55	56	57	58	59	60	61	62	63	64	65
1	Mahanadi	Baronda	Tikarpara	2002-03	-	-	-	-	-	-	-	-	-	0.00	-	0.00
2	Brahmani	Jenapur	Tilga	2002-03	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00
3	Godavari	Ghargaon	Polavaram	2003-04	-	-	-	-	-	-	-	-	0.00	0.00	0.21	0.14
4	Krishna	Karad	Vijaywada	2002-03	-	-	-	-	-	-	-	-	0.33	0.00	1.20	0.75
5	Cauvery	Kudige	Musiri	2000-01	-	-	-	-	-	-	-	-	0.0	0.30	-	0.48
6	Tapi	Dedtalai	Ghala	1998-99	-	-	-	-	-	-	-	-	-	-	-	-
7	Narmada	Dindori	Chandwada	1999-2000	-	RD	-	RD	-	RD	-	RD	-	RD	-	RD
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	-	-	-	-	-	-	-	-	-	-	-	-
10	Mahi	Mataji	Khanpur	1997-98	NF	-	SNR	-	-	-	-	-	-	-	-	-

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Cadmium (Cd)				Chromium (Cr)				Copper (Cu**)			
		Tolerance Limits (Units)->			Max= 0.01 (mg/l)				Max =0.05(mg/l)				Max=1.50 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	66	67	68	69	70	71	72	73	74	75	76	77
1	Mahanadi	Baronda	Tikarpara	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
2	Brahmani	Jenapur	Tilga	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
3	Godavari	Ghargaon	Polavaram	2003-04	-	0.001	-	0.003	-	0.000	-	0.051	-	0.002	-	0.012
4	Krishna	Karad	Vijaywada	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
5	Cauvery	Kudige	Musiri	2000-01	-	-	-	-	-	-	-	-	-	-	-	-
6	Tapi	Dedtalai	Ghala	1998-99	-	-	-	-	-	-	-	-	-	-	-	-
7	Narmada	Dindori	Chandwada	1999-2000	-	RD	-	RD	NIL	RD	NIL	RD	-	RD	-	RD
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	-	-	-	-	-	-	-	-	-	-	-	-
10	Mahi	Mataji	Khanpur	1997-98	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Cyanide (Cn)				Lead (Pb)				Maganese (Mn)			
		Tolerance Limits (Units)->			Max= 0.05 (mg/l)				Max =0.10 (mg/l)				Max=0.50 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	78	79	80	81	82	83	84	85	86	87	88	89
1	Mahanadi	Baronda	Tikarpara	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
2	Brahmani	Jenapur	Tilga	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
3	Godavari	Ghargaon	Polavaram	2003-04	-	-	-	-	-	0.004	-	0.035	-	-	-	-
4	Krishna	Karad	Vijaywada	2002-03	-	-	-	-	-	-	-	-	-	-	-	-
5	Cauvery	Kudige	Musiri	2000-01	-	-	-	-	-	-	-	-	-	-	-	-
6	Tapi	Dedtalai	Ghala	1998-99	-	-	-	-	-	-	-	-	-	-	-	-
7	Narmada	Dindori	Chandwada	1999-2000	-	RD	-	RD	NIL	RD	-	RD	-	RD	-	RD
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	-	-	-	-	-	-	-	-	-	-	-	-
10	Mahi	Mataji	Khanpur	1997-98	-	-	-	-	-	-	-	-	-	-	-	-

Source : Central Water Commission

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….contd

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Mercurry (Hg)				Zinc (Zn)				Total Harfness ($CaCO_3$)			
		Tolerance Limits (Units)->			Max= 0.001 (mg/l)				Max =15.00 (mg/l)				Max=300 (mg/l)			
					Minimum		Maximum		Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	90	91	92	93	94	95	96	97	98	99	100	101
1	Mahanadi	Baronda	Tikarpara	2002-03	-	-	-	-	-	-	-	-	32.93	50.04	49.84	72.06
2	Brahmani	Jenapur	Tilga	2002-03	-	-	-	-	-	-	-	-	34.03	20.02	108.09	56.04
3	Godavari	Ghargaon	Polavaram	2003-04	-	-	-	-	-	-	-	-	93	44	137	106
4	Krishna	Karad	Vijaywada	2002-03	-	-	-	-	-	-	-	-	52.00	133	232	238
5	Cauvery	Kudige	Musiri	2000-01	-	-	-	-	-	-	-	-	19	136	43	196
6	Tapi	Dedtalai	Ghala	1998-99	-	-	-	-	-	-	-	-	75.92	77.91	140.05	107.95
7	Narmada	Dindori	Chandwada	1999-2000	-	RD	-	RD	NIL	RD	-	RD	66.00	78	160	100
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	-	-	-	-	-	-	-	-	91.74	95.85	151.97	180.8
10	Mahi	Mataji	Khanpur	1997-98	-	-	-	-	-	-	-	-	75.916	81.61	107.951	119.78

Source : Central Water Commission

TABLE 6.1.19 (a): WATER QUALITY IN MAJOR RIVER BASINS….concld

Sr. No	Name of Basin/River	Name of the Site		Year for which data given	Sodium percentage				Sodium Adsorption Ratio (SAR)			
		Tolerance Limits (Units)->			Max= 60.00				Max =26.00			
					Minimum		Maximum		Minimum		Maximum	
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	First Site	Last Site
1	2	3	4	5	102	103	104	105	106	107	108	109
1	Mahanadi	Baronda	Tikarpara	2002-03	9.14	15.23	15.14	26.11	0.07	0.32	0.21	0.57
2	Brahmani	Jenapur	Tilga	2002-03	22.76	19.43	52.88	37.70	0.39	0.38	0.39	0.38
3	Godavari	Ghargaon	Polavaram	2003-04	36.65	12.23	40.34	35.34	1.13	0.23	1.60	0.99
4	Krishna	Karad	Vijaywada	2002-03	28.74	15.00	54.29	40.00	0.62	0.47	2.151	1.76
5	Cauvery	Kudige	Musiri	2000-01	7.41	23.58	49.46	43.43	0.08	0.89	0.97	6.05
6	Tapi	Dedtalai	Ghala	1998-99	13.84	13.32	56.15	32.32	0.29	0.29	3.09	1.00
7	Narmada	Dindori	Chandwada	1999-2000	8.7	-	19.5	-	0.11	-	0.54	-
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	12.3	18.29	66.50	77.89	0.27	0.44	4.78	10.09
10	Mahi	Mataji	Khanpur	1997-98	13.596	13.32	24.862	54.72	0.289	0.29	0.683	2.70

Source : Central Water Commission
Note: '-' indicates that analysis of particular parameter has not been carried out
NA : Not available
RD : River Dry NF : No Flow SNR : Sample not received.

TABLE 6.1.19 (b) : WATER DISCHARGE IN MAJOR RIVER BASINS

Sr. No	Name of Basin/River	Name of the Guage Station		No of C.W.C. Sites	Year for which data	Maximum Discharge (Cumeces)		Minimum Discharge (Cumeces)		Basin Range (Cumeces)	
		First Site	Last Site			First Site	Last Site	First Site	Last Site	Maximum	Minimum
1	2	3	4	5	6	7	8	9	10	11	12
1	Mahanadi	Baronda	Tikarpara	21	2002-03	406.70	12306	0.00	154.1	0.00-12306	0.00-880.00
2	Brahmani	Jenapur	Tilga	5	2002-03	2005	662.3	48.82	0.00	0.00-3288	0.00-631.8
3	Godavari	Ghargaon	Polavaram	56	2003-04	1592	25860	0.00	49.49	0.00-32540	0.00-5080
4	Krishna	Karad	Vijaywada	57	2002-03	1121.00	158.7	0.00	2.874	0.00-4632	0.00-223.1
5	Cauvery	Kudige	Musiri	16	2000-01	2265	6949	0.2	0.36	688-7500	0.00-19.74
6	Tapi	Dedtalai	Ghala	12	1998-99	13000	10040	0.00	10.00	0.00-25261	0.00-480.00
7	Narmada	Dindori	Chandwada	23	1999-2000	1891	1550	1.09	0.00	0.00-30534	0.00-1289
8	Pennar	Nellore	Nagalamadike	8	1999-2000	21.72	18.6	0.00	0.00	0.00-519	0.00-49.50
9	Sabarmati	Kheroj	Nabhoi	6	1997-98	401	2380	0.00	0.00	0.00-2380	0.00-61.48
10	Mahi	Mataji	Khanpur	6	1997-98	2210	11956	0.00	7.748	0.00-11956	0.00-146.1

Source : Central Water Commission

TABLE 6.1.19 (b) : WATER DISCHARGE IN MAJOR RIVER BASINS …contd

Sr. No	Name of Basin/River	Name of the Guage Station		Year for which data given	Mansoon Flow (M.C.M.)		Non- Mansoon Flow (M.C.M.)		Annual Flow (M.C.M)		Basin Range (M.C.M.)		
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	Monsoon	Non-monsoon	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Mahanadi	Baronda	Tikarpara	2002-03	637.74	19870	8.18	4804	548.93	24674	88.17-19870	0.00-4804	88.14-24674
2	Brahmani	Jenapur	Tilga	2002-03	14171	1983	2673	59.86	16874	2042.86	1983-14171	59.86-2673	2042.86-16844
3	Godavari	Ghargaon	Polavaram	2003-04	408.30	72386	0.00	2901	408.3	75287	87.80-85688	0.00-3701	87.40-83989
4	Krishna	Karad	Vijaywada	2002-03	2035.00	4493	509.00	1533	2544	6026	.00-11992	0.00-3396	.00-12521
5	Cauvery	Kudige	Musiri	2000-01	2262	7590	174	2129	2436	9719	212-7590	22-2241	140-9719
6	Tapi	Dedtalai	Ghala	1998-99	3617	1529	129.00	1455.00	3746	2984	8.80-6254	0.03-1455	8.83-6404
7	Narmada	Dindori	Chandwada	1999-2000	1099.62	211.96	80.38	13.52	1180	225.48	211.96-21616.	13.52-5342.50	225.48-26959.37
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	189.50	202.60	0.80	4.00	190.3	206.6	23.04-202.60	0.00-119.40	23.04-284.70
10	Mahi	Mataji	Khanpur	1997-98	877.90	476.30	12.20	315.2	890.1	791.5	26.45-877.90	0.53-315.20	26.98-890.10

Source : Central Water Commission

Note : NA : Not available

TABLE 6.1.19 (b) : SEDIMENT LOAD IN MAJOR RIVER BASINS Concld.

Sr. No	Name of Basin/River	Name of the Guage Station		Year for which data given	Mansoon Load Million Metric Tonnes		Non- Mansoon Land Million Metric Tonnes		Annual Load (Million Metric Tonnes)		Basin Range (Million Metric Tonnes)		
		First Site	Last Site		First Site	Last Site	First Site	Last Site	First Site	Last Site	Monsoon	Non-monsoon	Annual
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Mahanadi	Baronda	Tikarpara	2002-03	0.066	1.985	0.000	0.180	0.066	2.165	0.050-2.400	0.000-0.180	0.00-2462
2	Brahmani	Jenapur	Tilga	2002-03	1.678	1.107	0.070	0.001	1.748	1.108	1.107-3.430	1.001-1.008	01.117-4811
3	Godavari	Ghargaon	Polavaram	2003-04	0.100	42.85	0.000	0.218	0.100	43.068	0.012-44.204	1.00-0.218	0.012-4.811
4	Krishna	Karad	Vijaywada	2002-03	0.087	0.573	0.003	0.027	0.090	0.600	0.00-3.804	0.00-0.087	0.00-1.736
5	Cauvery	Kudige	Musiri	2000-01	0.087	0.573	0.033	0.132	0.090	0.705	0.004-0.939	0.001-0.132	0.002-0.973
6	Tapi	Dedtalai	Ghala	1998-99	4.737	0.792	0.003	0.828	4.770	1.620	0.061-15.662	0.00-2.852	0.064-15.747
7	Narmada	Dindori	Chandwada	1999-2000	7.257	6.159	0.004	0.000	7.261	6.159	1.698-73.140	0.00-0.952	1.698-73140
8	Pennar	Nellore	Nagalamadike	1999-2000	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Sabarmati	Kheroj	Nabhoi	1997-98	NA	NA	NA	NA	NA	NA	NA	NA	NA
10	Mahi	Mataji	Khanpur	1997-98	1.569	3.355	0.012	0.003	1.581	3.358	0.017-3.355	0.001-.012	0.018-3.358

Source : Central Water Commission

Note : NA : Not available

Table 6.1.20 : RIVER-BASIN WISE 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 (1).	15
3	**Brahmputra (6)**	Burhidihing (1), Dhansiri (6), Disang (1), Jhanji (1), Subansiri (1), Bhogdoi (1), Bharalu (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), Hemavati (1)	35
5	**Ganga (28)**	Barakar (1),, Betwa (3), Chambal (8), Damodar (5), Gandak (1), Saryu-Ghaghra (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),Sankh(1), Gohad (1), Kolar(1). Churni (2), Tons (Himachal Pradesh) (1)	118
6	**Godavari (11)**	Manjira(2), Maner(2), Nira(I),), Wainganga{3), Wardha(I)	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), Kathajodi (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	**Subarnerekha (6)**	----	6
15	**Tapi (10)**	Girna (2).	12
		240	

Table 6.1.20 : RIVER-BASIN WISE 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), Ulhas -Kalu (1) Imphal (4), Mandovi (2), Palar (1), Pamba (3), Pariyar (3), Rushikulya (2), Tambiraparani (7), Achankoil (2), Chalakudy (1), Damanganga (6), Ghaggar (16), Kallada (1), Kali Karnataka (1), Manimala (2), Mindhola (1), Nagavalli (3), Amlakhadi (1), Chaliyar (2), Iril (2), Kharkhala (1), Karmana (1), Kolak (2), Kundalika (1), Meenachil (1), Muvattupuza (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).	105
17	**Lakes**	Hussainsagar (1), Saroornagar (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), Periar (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 (2), Pichola (1), Udaisagar (1), Ramgarhjaipur (1), Pushkar (1), Fatehsagar (1), Kalyana (1), Nakki (1), Udhagamadalam (1), Kodaikanal (1), Yercaud (1), Lakshminarayan Baridigh (1), Rudrasagar (1), Ramgarh-Uttar Pradesh (1), Naini (1), Rabindrasarovar (1)	64
	Tanks	Dharamsagar (1), Bibinagar (1), Kistrapetrareddy (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**	----	180
		Total	**784**

Source: Central Pollution Control Board.
G - GEMS (Global Environmental Monitoring System),
M - MINARS (Monitoring of Indian National Aquatic Resources)
YAP- Yamuna Action Plan

TABLE 6.1.21 : ANNUAL INTERNAL RENEWABLE WATER RESOURCES & WATER WITHDRAWALS IN SELECTED COUNTRIES OF WORLD

Sl. No.	Country	Annual Renewable Water Resources		Annual Withdrawals					
				Year of Data	Total Cubic Kilometers	Sectrol Withdrawals Percent			Per Capita * Cubic Metres
		Total (Cubic kilometres)	Per capita (Cubic Metres)			Domestic	Industry	Agriculture	
1	USA	3069.40	10837	1993	479.29	13	46	41	1689
2	India	1869.00	1820	2000	634.00	7	1	85	629
3	China	2829.57	2259	1993	525.48	5	17	78	360
4	Spain	111.50	2794	1993	35.90	10	22	68	837
5	Japan	430.00	3383	1993	88.83	19	18	63	718
6	Canada	2902.00	94353	1993	45.10	18	70	12	1415
7	Turkey	229.30	3439	1993	35.81	14	10	76	476
8	Brazil	8233.00	48314	1993	36.47	43	17	40	216
9	France	203.70	3439	1993	36.63	17	73	10	590
10	South Aftica	50.00	1154	1993	13.75	17	10	73	288
11	Mexico	457.22	4624	1993	77.81	17	5	78	785
12	Italy	191.30	3325	1993	43.04	18	35	46	983
13	UK	147.00	2465	1993	11.72	20	77	3	201
14	Australia	492.00	25708	1985	14600.00	65	2	33	786
15	Norway	382.00	85478	1993	2.10	19	70	11	461
16	Germany	154.00	1878	1993	46.33	11	69	20	712
17	Albenia	41.70	13306	1993	1.05	1	4	95	57
18	Romania	211.93	9445	1993	24.89	8	34	58	1155
19	Zimbabwe	20.00	1584	1993	2.50	7	3	90	98
20	Thailand	409.94	6527	1993	82.23	2	2	96	528
21	Swedan	174.00	19679	1993	2.93	36	55	9	333
22	Bulgaria	21.30	2680	1993	3010.00	4	81	15	1566
23	Switzerland	53.50	7462	1993	1.19	23	73	4	351
24	Austria	77.70	9616	1993	2.52	36	63	1	304
25	Czech-Republic	13.15	1280	1993	2.74	41	57	2	269

Source: Water profile of Selected countries complied by ISO, CWC
Note : Sector Q1 percentages data year of Annual Withdrawal Data
* : Per Capita withdrawls are estimated for 2000

TABLE 6.1.22 : STATE-WISE ESTIMATED ANNUAL REQUIREMENT OF WATER FOR DOMESTIC PURPOSES

Sl. No.	State/UT	Population in Thousand					Water Requirement in BCM				
		1991	2001	2004	2006	2025	1991	2001	2004	2006	2025
1	2	3	4	5	6	7	8	9	10	11	12
1	Andhra Pradesh	66508	75728	78527	80430	94276	2.06	2.60	3.45	2.97	4.01
2	Arunachal Pradesh	865	1091	1139	1170	1429	0.03	0.04	0.05	0.04	0.06
3	Assam	22414	26638	28050	29009	36766	0.70	0.92	1.23	1.07	1.56
4	Bihar	86374	82879	87810	90830	114845	2.68	2.85	3.86	3.36	4.88
5	Chandigarh	642	901	969	1013	1642	0.02	0.03	0.04	0.04	0.07
6	Chhattisgarh	@	20796	22011	22859	29513	@	0.71	0.97	0.84	1.26
7	Goa	1170	1344	1451	1537	2703	0.04	0.05	0.06	0.06	0.11
8	Gujarat	41310	50597	53195	54814	67402	1.28	1.74	2.34	2.03	2.87
9	Haryana	16464	21083	22296	23040	28941	0.51	0.72	0.98	0.85	1.23
10	Himachal Pradesh	5171	6077	6294	6425	7345	0.16	0.21	0.28	0.24	0.31
11	Jammu & Kashmir	7719	10070	10935	11603	21767	0.24	0.35	0.48	0.43	0.93
12	Jharkhand	@	26909	28303	29173	35730	@	0.93	1.24	1.08	1.52
13	Karnataka	44977	52734	54824	56137	65879	1.40	1.81	2.41	2.07	2.8
14	Kerala	29099	31839	32862	33569	38360	0.90	1.09	1.45	1.24	1.63
15	Madhya Pradesh	66181	60385	64237	66801	88062	2.05	2.08	2.82	2.47	3.75
16	Maharashtra	78937	96752	101275	104104	127719	2.45	3.33	4.45	3.85	5.43
17	Manipur	1837	2389	2499	2561	3128	0.06	0.08	0.11	0.09	0.13
18	Meghalaya	1775	2306	2411	2472	3021	0.06	0.08	0.11	0.09	0.13
19	Mizoram	690	891	932	955	1167	0.02	0.03	0.04	0.04	0.05
20	Nagaland	1210	1989	2090	2132	2606	0.04	0.07	0.09	0.08	0.11
21	Orissa	31660	36707	38139	39053	45763	0.98	1.26	1.68	1.44	1.95
22	Punjab	20282	24289	25336	25976	30609	0.63	0.84	1.11	0.96	1.3
23	Rajasthan	44006	56473	60127	62431	80005	1.37	1.94	2.64	2.31	3.4
24	Sikkim	406	540	566	579	708	0.01	0.02	0.02	0.02	0.03
25	Tamil Nadu	55859	62111	64019	65261	73569	1.73	2.14	2.82	2.41	3.13
26	Tripura	2757	3191	3326	3421	4180	0.09	0.11	0.15	0.13	0.18
27	Uttar Pradesh	139112	166053	176765	183856	245772	4.32	5.71	7.77	6.80	10.45
28	Uttaranchal	@	8480	8925	9216	11506	@	0.29	0.39	0.34	0.49
29	West Bengal	68078	80221	83585	85780	103194	2.11	2.76	3.68	3.17	4.39
30	A. & N. Islands	281	356	377	394	606	0.01	0.01	0.02	0.01	0.03
31	D. & N. Haveli	138	220	237	248	429	0.00	0.01	0.01	0.01	0.02
32	Lakshadweep	52	61	64	66	97	0.00	0.00	0	0.00	0
33	Pondicherry	808	974	1013	1042	1427	0.03	0.03	0.04	0.04	0.06
34	Delhi	9421	13783	15128	16065	28394	0.29	0.47	0.67	0.59	1.21
35	Daman & Diu	102	158	170	178	301	0.00	0.01	0.01	0.01	0.01
	TOTAL	**846303**	**1027015**	**1079887**	**1114200**	**1398861**	**26.26**	**35.31**	**47.49**	**41.18**	**59.5**

Source: Central Water Commission

BCM : Billion Cubic Metres

Note : + : All India figures relate to the estimated requirement as worked out by the standing sub committee for Assessment of availability and requirement of water for diverse uses in the country, 2000. (distributed prorata in the states in proportion to population).

@ : Three States namely Jharkhand, Uttaranchal & Chhatisgarh have been formed after 1991 as such their population as well water requirement in year 1991 have been included in the respective states: Chhattisgarh in M.P, Jharkhand in Bihar and Uttaranchal in Uttar Pradesh.

TABLE 6.2.1: 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 prefering	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 6.2.2 : 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 temprature 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 6.2.3 : "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 population 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 6.2.4 : 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)	Maximum	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