CHAPTER SIX

WATER

6.1 **Water**

6.1.1 Water as a resource, is critical to sustainable development. Besides meetting basic human needs, it is a major source of energy in some parts of the world, while in others its potential as an energy source remains largely untapped. Water is also necessary for agriculture and for many industrial processes. And in more than a few countries, it makes up an integral part of transport systems. With improved scientific understanding, the international community has also come to appreciate more fully the valuable services provided by water-related ecosystems, from flood control to storm protection and water purification.Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand.

6.1.2 India is rich in surface water resources. Average annual precipitation is nearly 4000 billion cubic meter. and the average flow in the river system is estimated to be 1869 cubic km. Because of concentration of rains in the three monsoon months, the utilizable quantum of surface water is about 690 BCM. However, conditions vary widely from region to region. Whereas, some regions are drought affected, others are frequently flooded. In India also, 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.

6.1.3 The following table 6.1.1 indicates the estimated water demand in India for different sectors.

Table 6.1.1 Projected Water Demand in India (By Different Use)

Sector	Water Demand in BCM(Billion Cubic Meter)								
	Standing Sub-Committee of MOWR			NCIWRD					
	2010	2025	2050	2010		2025		2050	
				Low	High	Low	High	Low	High
Irrigation	688	910	1072	543	557	561	611	628	807
Drinking Water	56	73	102	42	43	55	62	90	111
Industry	12	23	63	37	37	67	67	81	81
Energy	5	15	130	18	19	31	33	63	70
Other	52	72	80	54	54	70	70	111	111
Total	**813**	**1093**	**1447**	**694**	**710**	**784**	**843**	**973**	**1180**

Source: Basin Planning Directorate, CWC, XI Plan Document.
Report of the Standing Sub-Committee on "Assessment of Availability & requirement of Water for Diverse uses-2000"

Note: NCIWRD: National Commission on Integrated Water Resources Development
BCM: Billion Cubic Meters
MOWR: Ministry of Water Resourses.

6.1.4 The details of water availability in India is presented in table 6.1.2

Table 6.1.2 : Water Availability in India

Sl.No	Items	Quanitity
1	**2**	**3**
1	Annual Precipitation (including snowfall)	4000 BCM
2	Average Annual Availability	1869 BCM
3	(i) Per Capita Water Availability (2001) in cubic metres	1816Cu.M
	(ii) Per Capita Water Availability (2010) in cubic metres	1588Cu.M
	(iii) Per Capita Water Availability (2015) in cubic metres	1720.29Cu.M
4	Estimated Utilizable Water Resources	1123 BCM
	(i)Surface Water Resources	690 BCM
	(ii) Ground Water Resources	433 BCM

Source: Central Water Commission-2015
BCM : Billion Cubic Meter. Cu.M - Cubic Meter.

6.2 Rain Water

6.2.1 India is home to an extraordinary variety of climatic regions, ranging from tropical in the south to temperate and alpine in the Himalayan north, where elevated regions receive sustained winter snowfall. The nation's climate is strongly influenced by the Himalayas and the Thar Desert. The Himalayas, along with the Hindu Kush mountains in Pakistan, prevent cold Central Asian katabatic winds from blowing in, keeping the bulk of the Indian subcontinent warmer than most locations at similar latitudes. Simultaneously, the Thar Desert plays a role in attracting moisture-laden southwest summer monsoon winds, that, between June and September, provide the majority of India's rainfall. The rainfall in the country is mostly confined to four monsoon months between June to September during which almost 80% of the total rainfall takes place.

The table 6.2.1 gives the detailed information about the year-wise monsoon performance (June- Sept.) in the Country.

Table 6.2.1 Monsoon performance 1998-2014

(June-September)

Sl. No.	Year	Number of Meteorological Sub-Divisions			Percentage of Districts With Normal/Excess Rainfall	Percentage of Long Period Average Rainfall for the Country as a Whole
		Normal	Excess	Deficient/Scanty		
1	2	3	4	5	6	7
1	1998	22	11	2	83	105
2	1999	25	3	7	67	96
3	2000	23	5	7	65	92
4	2001	28	1	6	68	91
5	2002	14	1	21	37	81
6	2003	23	8	5	76	105
7	2004	23	0	13	57	87
8	2005	24	8	4	73	99
9	2006	21	6	9	60	100
10	2007	18	13	5	73	106
11	2008	31	2	3	77	98
12	2009	11	3	22	42	78
13	2010	17	14	5	70	102
14	2011	26	7	3	76	102
15	2012	22	1	13	58	93
16	2013	16	14	6	73	106
17	2014	24	1	11	54	88

Source : India Meteorological Department, Ministry of Earth Sciences.

Category: % Age from LPA(Long Period Average)

E-Excess ,+20% or more D- Deficient ,-20 to -59%

N-Normal ,+19% to -19% S-Scanty ,-60% to -99%

For the country as a whole, the rainfall for the season (June -September) was 88% of its long period average (LPA). Out of the total 36 meteorological subdivisions, only one subdivision received excess season rainfall, 24 subdivisions received normal season rainfall and the remaining 11 subdivisions received deficient/scanty rainfall.

As it is evident from the chart 6.2.1, the rainfall in India fluctuated considerably in the past.

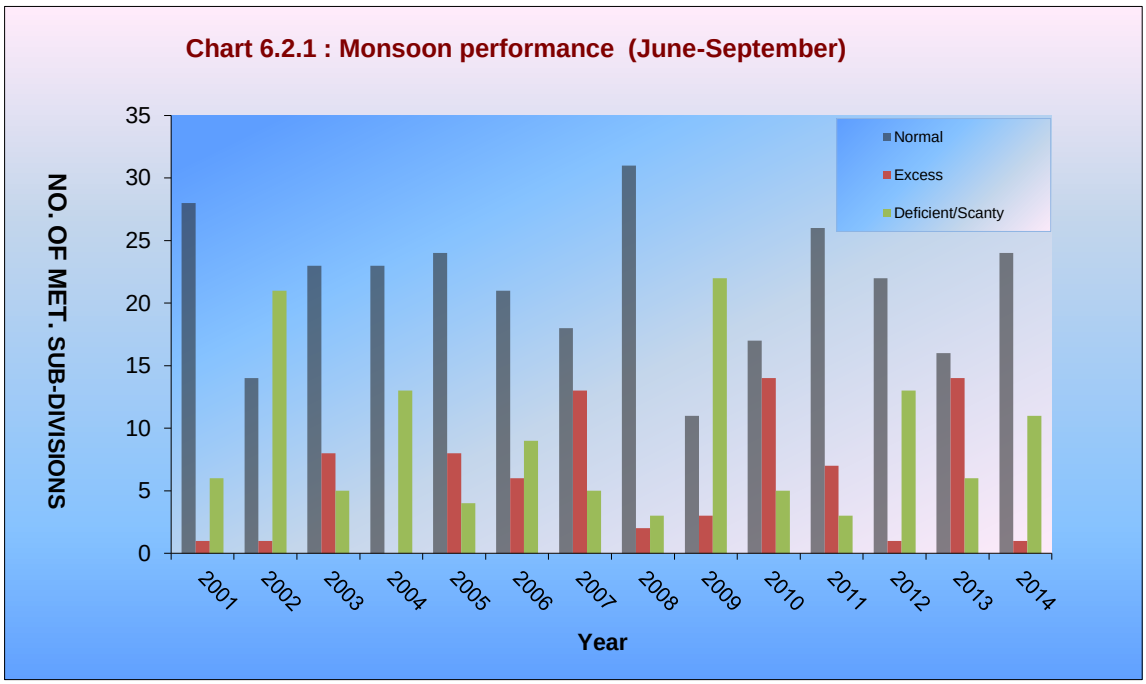


Table 6.2.2 : Sub divisional actual and normal rainfall

(Millimetre)

Sl. No.	Meteorological Sub-divisions	2002		2004		2006		2008		2009		2010		2011		2012		2013		2014	
		Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal
1	2	3	4	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	Andaman & Nicobar Islands	2310.7	2945.5	2508.1	3060.7	2447.9	3001.8	3335.2	3001.8	2614.3	3001.8	3147.8	2980.1	3833.6	2926.3	3515.9	2926.3	3757.8	2926.3	2622.4	2926.3
2	Arunachal Pradesh	2559.6	3329.8	2922.6	2927.5	2107.9	2935.9	2470.5	2935.9	2163.2	2935.9	2397.6	2785.9	1923.4	2933.7	2760.9	2933.7	2042.9	2933.7	2403.2	2933.7
3	Assam and Meghalaya	2530.7	3163.1	3055.7	2792.9	1777.5	2817.1	2271.1	2802.2	1863.0	2802.0	2499.7	2897.7	1758.5	2624.9	2321.3	2624.9	1811.5	2624.9	2171.9	2624.9
4	Nagaland, Mizoram, Manipur & Tripura	1960.8	2154.1	2075.1	1969.5	1561.5	1920.6	1481.7	1920.6	1446.5	1920.0	2023.3	2142.9	1655.1	2278.0	1669.2	2278.0	1557.2	2278.0	1599.9	2278
5	Sub-Himalayan West Bengal & Sikkim	2820.1	2683.6	2768.3	2644.9	2304.5	2617.0	2618.9	2617.0	2275.4	2617.0	2844.0	2603.8	2359.9	2708.9	2630.2	2708.9	2406.1	2708.9	2322.6	2708.9
6	Gangetic West Bengal	1597.6	1518.7	1488.0	1494.1	1587.2	1494.6	1580.6	1494.6	1322.5	1494.6	1081.4	1493.4	1671.7	1527.2	1258.3	1527.2	1804.7	1527.2	1241.7	1527.2
7	Odisha	1166.5	1415.8	1337.7	1459.1	1810.0	1472.5	1600.4	1472.5	1397.7	1472.5	1332.3	1478.6	1300.4	1460.5	1430.2	1460.5	1632.4	1460.5	1536.9	1460.5
8	Jharkhand	1315.5	1293.3	1157.8	1328.8	1356.0	1321.9	1200.6	1317.3	1061.1	1320.1	806.1	1307.4	1274.7	1296.3	1102.0	1296.3	1253.6	1296.3	1156.6	1296.3
9	Bihar	1193.3	1186.7	1077.0	1230.6	1000.4	1233.2	1306.7	1230.8	993.6	1230.8	943.4	1213.7	1217.3	1205.6	924.2	1205.6	1069.9	1205.6	1061.0	1205.6
10	East Uttar Pradesh	795.8	1013.3	849.3	1038.3	771.4	1041.9	1121.9	1041.9	711.1	1041.9	758.5	1035.9	874.7	1018.6	853.6	1018.6	1042.1	1018.6	701.4	1018.6
11	West Uttar Pradesh	729.0	880.5	647.2	887.1	510.6	888.8	840.5	888.8	552.5	888.8	818.9	885.0	775.9	886.2	582.8	886.2	925.9	886.2	487.0	886.2
12	Uttarakhand	2188.5	1556.0	1605.7	1553.8	1264.8	1582.6	1298.6	1582.6	1076.0	1582.6	1863.9	1562.8	1708.3	1580.9	1309.7	1580.9	1735.4	1580.9	1287.4	1580.9
13	Haryana, Chandigarh & Delhi	488.7	618.7	524.0	570.9	377.0	567.5	632.9	567.5	350.5	567.5	597.7	562.6	433.2	562.8	313.6	562.8	461.3	562.8	305.6	562.8
14	Punjab	446.1	643.2	445.1	649.1	544.7	648.8	708.9	648.8	403.9	648.8	502.1	640.4	533.5	635.9	338.9	635.9	586.6	635.9	382.7	635.9
15	Himachal Pradesh	1075.5	1370.7	766.4	1252.3	895.8	1323.8	1049.0	1323.8	805.6	1323.8	1220.2	1323.8	1051.7	1373.9	1035.1	1373.9	1216.9	1373.9	1019.9	1373.9
16	Jammu & Kashmir	750.5	900.5	919.5	1124.5	1477.3	1246.0	1087.2	1246.0	872.7	1246.0	1240.7	1227.6	1122.2	1205.3	1116.5	1205.3	1193.8	1205.3	1278.4	1205.3
17	West Rajasthan	118.9	330.7	190.4	298.9	362.4	297.0	309.6	297.0	166.6	297.0	473.2	295.7	426.6	299.2	318.3	299.3	389.4	299.3	302.4	299.2
18	East Rajasthan	307.1	703.2	627.5	677.7	711.7	678.2	627.1	678.2	460.6	678.2	741.5	684.7	849.1	671.3	695.8	671.3	834.9	671.3	683.0	671.3
19	West Madhya Pradesh	807.8	991.2	839.6	987.8	1140.5	987.9	747.8	987.9	797.2	987.9	818.2	987.8	1062.2	956.3	1012.3	956.3	1396.3	956.3	864.9	956.3
20	East Madhya Pradesh	1075.7	1254.0	946.8	1227.1	1007.7	1229.3	989.7	1229.3	910.5	1229.3	966.6	1219.3	1220.7	1169.4	1097.0	1169.4	1521.9	1169.4	924.1	1169.4
21	Gujarat Region	705.4	1002.6	1004.2	977.8	1458.1	979.1	932.4	979.0	649.6	979.1	1059.7	954.1	903.9	943.4	652.0	943.4	1250.5	943.4	792.2	943.4
22	Saurashtra, Kutch	402.7	570.7	498.5	517.4	702.9	518.3	572.3	518.3	616.9	518.3	1073.9	519.2	725.1	507.0	315.2	507.0	823.9	507.0	467.8	507
23	Konkan & Goa	2324.2	2964.4	2911.6	2981.7	3379.0	2978.5	3051.5	2778.5	2738.2	2978.5	3749.0	2975.4	3842.6	3100.2	2993.9	3100.5	3684.9	3100.5	2913.2	3100.2
24	Madhya Maharashtra	711.6	926.3	883.3	852.7	1180.5	850.4	858.9	850.4	918.1	850.4	1006.1	849.7	842.9	876.8	664.2	876.8	962.4	876.8	838.0	876.8
25	Marathwada	704.7	803.5	676.4	838.8	819.2	840.4	651.0	840.4	687.5	840.4	1039.3	845.9	685.7	821.6	538.4	821.6	888	821.6	548.9	821.6
26	Vidarbha	1045.4	1074.4	796.3	1104.7	1276.5	1104.6	855.7	1104.6	804.1	1104.6	1355.2	1103.7	958.5	1084.5	1090.3	1084.5	1520	1084.5	919.2	1084.5
27	Chhattisgarh	--	--	1174.3	1362.5	1231.4	1368.4	1144.0	1368.4	859.7	1368.4	1145.7	1363.8	1313.0	1290.7	1366.8	1290.7	1418.3	1290.7	1274.7	1290.7
28	Coastal Andhra Pradesh	757.3	1000.7	933.6	1012.7	1067.2	1011.2	1057.2	1011.2	745.2	1011.2	1614.0	1011.6	835.5	1024.2	1183.4	1024.2	1081.8	1024.2	777.4	1024.2
29	Telangana	767.7	945.7	761.7	942.3	1044.5	942.7	998.1	942.7	665.8	942.7	1247.6	941.7	739.6	942.6	972.8	942.6	1272.1	942.6	685.6	942.6
30	Rayalaseema	504.4	695.9	655.9	679.5	608.9	677.9	795.0	677.9	672.8	677.9	915.8	677.8	642.9	706.1	665.3	706.1	677.2	706.1	523.4	706.1
31	Tamilnadu & Puducherry	723.4	918.6	1104.5	911.4	911.8	911.6	1195.7	910.3	934.3	911.3	1118.8	908.7	1013.2	914.4	709.6	914.4	741.9	914.4	913.2	914.4
32	Coastal Karnataka	2920.9	3583.4	3061.6	3620.2	3865.9	3613.2	3050.9	3613.3	3798.2	3613.2	4007.6	3612.8	4146.4	3526.3	3395.0	3526.3	4044.6	3526.3	3563.9	3526.3
33	North Interior Karnataka	556.3	706.6	644.6	725.6	627.9	720.1	700.5	720.1	977.1	720.1	857.3	719.9	620.1	740.3	529.4	740.3	723.2	740.3	756.8	740.3
34	South Interior Karnataka	869.1	1305.8	1028.3	1018.4	951.0	1014.8	1105.7	1014.8	1177.3	1014.8	1308.7	1029.5	1040.6	1019.2	832.1	1019.2	1110.7	1019.2	1184.1	1019.2
35	Kerala	2457.3	2863.7	2977.3	3158.6	3297.8	3097.5	2534.1	3097.5	2816.0	3097.5	3141.9	3094.6	3041.2	2924.3	2187.5	2923.4	3255.4	2923.4	3046.4	2924.3
36	Lakshadweep	1034.4	1579.5	2096.8	1583.4	1695.4	1584.7	1726.4	1584.7	1572.5	1584.7	1725.4	1584.7	1531.4	1600.0	1433.2	1600.0	1426.3	1600.0	1395.0	1600

Source : Indian Meteorological Department, Ministry of Earth Sciences

Table 6.2.3 : State-wise distribution of number of districts with excess, normal, deficient, scanty and no rainfall

(01.10.2015 to 31.12.2015)

Sl. No.	State/UT	Excess	Normal	Deficient	Scanty	No Rainfall	No data	Total
1	2	3	4	5	6	7	8	9
1	Andaman & Nicobar Islands	0	2	1	0	0	0	3
2	Arunachal Pradesh	0	1	6	4	0	5	16
3	Assam	1	6	11	8	0	1	27
4	Meghalaya	0	0	3	3	0	1	7
5	Nagaland	0	1	2	1	0	7	11
6	Manipur	0	0	2	1	0	6	9
7	Mizoram	0	0	2	0	0	7	9
8	Tripura	0	0	3	1	0	0	4
9	Sikkim	0	1	2	1	0	0	4
10	West Bengal	0	0	4	14	1	0	19
11	Odisha	0	1	5	24	0	0	30
12	Jharkhand	0	0	6	18	0	0	24
13	Bihar	0	0	2	26	10	0	38
14	Uttar Pradesh	0	1	16	51	3	0	71
15	Uttarakhand	0	0	3	10	0	0	13
16	Haryana	0	0	2	17	2	0	21
17	Chandigarh	0	0	0	1	0	0	1
18	Delhi	0	0	0	8	1	0	9
19	Punjab	0	0	2	15	3	0	20
20	Himachal Pradesh	0	2	7	3	0	0	12
21	Jammu & Kashmir	11	3	2	1	0	5	22
22	Rajasthan	1	4	3	12	13	0	33
23	Madhya Pradesh	3	4	16	24	3	0	50
24	Gujarat	0	0	1	17	8	0	26
25	D. & N. Haveli & Daman	0	0	0	1	0	0	1
26	Diu	0	0	0	1	1	0	2
27	Goa	0	0	2	0	0	0	2
28	Maharashtra	0	4	9	22	0	0	35
29	Chhattisgarh	1	0	1	15	1	0	18
30	Andhra Pradesh	4	0	8	1	0	0	13
31	Telangana	0	0	1	9	0	0	10
32	Tamil Nadu	21	11	0	0	0	0	32
33	Puducherry	2	0	0	0	0	2	4
34	Karnataka	8	7	12	3	0	0	30
35	Kerala	9	5	0	0	0	0	14
36	Lakshadweep	1	0	0	0	0	0	1
Total		**62**	**53**	**134**	**312**	**46**	**34**	**641**
Categorywise distribution of districts out of the 607 districts whose data was received		**10%**	**9%**	**22%**	**51%**	**8%**		

Source : India Meteorological Department, Ministry of Earth Sciences

Table 6.2.4 : List of districts with deficient or scanty rainfall

March-May 2015

MET. Sub Division	Districts	MET. Sub Division	Districts
1	2	1	2
Arunachal Pradesh		**Bihar**	
	Changlang		Jahanabad
	Dibang Valley		Monghyr
	East Kameng		Nawada
	Tirap		Patna
Assam & Meghalaya			Saharsa
	Jaintia Hills		Sheohar
	Karimganj		Sitamarhi
	N.C. Hills	**East Uttar Pradesh**	
	Nagaon		Kushi Nagar
Nagaland, Mizoram, Manipur		**Jammu and Kashmir**	
and Tripura	Lungle		Ladakh (Leh)
	Mamit	**Gujarat**	
	Saiha		Panchmahal
	Phek		Tapi
	Wokha	**Maharashtra**	
	Chandel		Mumbai Suburban
		Dadra & Nagar Haveli	
	Imphal East	**Daman & Diu**	
	Thoubal		Jamnagar
	Senapati		Surendranagar
	Kolasib	**Coastal Andhra Pradesh**	
Sub-Himalayan West Bengal			
& Sikkim			East Godavari
	West Sikkim		Vishakapatnam
	South Dinajpur		Vizianagaram
Odisha			West Godavari
	Angul		Guntur
	Cuttack		Krishna
	Jagatsinghpur		Prakasam
	Balasore		Srikakulam
	Jharsuguda	**Jharkhand**	
	Kendrapara		Chatra
	Bolangir		Simdega
	Boughgarh	**Chhattisgarh**	
	Gajapati		Kowardha
	Ganjam		Jashpur
	Kandhamal		Narayanpur
	Keonjhargarh		Raigarh
	Khurda	**Gangetic West Bengal**	
	Sundargarh		Hooghly
			South 24 Parganas

Source: Indian Meteorological Department

6.2.2 The record of rainfall received over the years - Meterological Sub-division wise is in table 6.2.2 . State wise distribution of districts as per the rainfall received is given in table 6.2.3 . The list of districts with deficient/ scanty rainfall is in table 6.2.4 . The tables 6.2.5 (a) & (b) give the trend of rain fall in India as per meteorological sub divisions and districts during June –September.

Table 6.2.5(a) : Number of meteorological sub-divisions with excess/ normal and deficient/scanty rainfall (June-September)

Sl. No.	Year*	No. of Sub-Divisions	
		Excess/Normal	Deficient/Scanty
1	2	3	4
1	1995	33	2
2	1996	32	3
3	1997	32	3
4	1998	33	2
5	1999	28	7
6	2000	28	7
7	2001	29	6
8	2002	15	21
9	2003	31	5
10	2004	23	13
11	2005	32	4
12	2006	27	9
13	2007	31	5
14	2008	33	3
15	2009	14	22
16	2010	31	5
17	2011	33	3
18	2012	23	13
19	2013	30	6
20	2014	25	11

Source : India Meteorological Department - Ministry of Earth Sciences

* Updated values for the years 1996 yo 2014 as per the available records at HQ.

6.2.3 Rainwater harvesting can enable households, factories, schools and offices to overcome their problems of irregular and inadequate water supply or water supply of poor quality. The process involves storing rainwater that falls within one's premises and re-using it after basic treatment. By using equipment that is easily available, rainwater is diverted towards existing underground tanks or terrace fitted tanks and then supplied to the taps. The purification methods can be used by households, factories and offices to treat rainwater. Treated rainwater is safe not just for cleaning and washing but also for cooking and personal consumption. The amount of rainfall notwithstanding, people living and working in various types of geographical terrains can harvest rainwater. In the long run, rainwater harvesting can replenish India's rapidly depleting ground water levels, and lead to water security and sustainability.

Table 6.2.5(b) : Percentage of districts with excess/normal and deficient/scanty rainfall (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	34
11	2001	68	32
12	2002	37	56
13	2003	76	25
14	2004	57	45
15	2005	72	28
16	2006	60	40
17	2007	73	27
18	2008	76	24
19	2009	41	59
20	2010	69	31
21	2011	76	24
22	2012	59	41
23	2013	72	28
24	2014	54	46
25	2015	51	49

Source : India Meteorological Department, Ministry of Earth Sciences.

6.3 Surface Water- River and Other Inland Water

6.3.1 Inland Water resources of the country are classified as rivers and canals; reservoirs; tanks & ponds; beels; oxbow lakes; derelict water; and brackish water. Approximately 74 Lakh Hectares of water bodies are available in the country. The state wise details of various types of inland water resources are given in table 6.3.1.

Table 6.3.1 : State-wise details of inland water resources of various types

(Lakh Hectares)

Sl. No.	Name of the State/UT.	Rivers & Canals (Length in kms.)	Water Bodies				
			Reservoirs	Tanks, Lakes & Ponds	Floodplain Lakes & Derelict Water (Lakh Ha)	Brackish Water	Total
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	Chhattisgarh	3573	0.84	0.63	-	-	1.47
6	Goa	250	0.03	0.03	-	NEG	0.06
7	Gujarat	3865	2.43	0.71	0.12	1.00	4.26
8	Haryana	5000	NEG	0.10	0.10	-	0.20
9	Himachal Pradesh	3000	0.42	0.01	-	-	0.43
10	Jammu & Kashmir	27781	0.07	0.17	0.06	-	0.30
11	Jharkhand	4200	0.94	0.29	-	-	1.23
12	Karnataka	9000	4.40	2.90	-	0.10	7.40
13	Kerala	3092	0.30	0.30	2.43	2.40	5.43
14	Madhya Pradesh	17088	2.27	0.60	-	-	2.87
15	Maharashtra	16000	2.99	0.72	-	0.12	3.83
16	Manipur	3360	0.01	0.05	0.04	-	0.10
17	Meghalaya	5600	0.08	0.02	NEG	-	0.10
18	Mizoram	1395	-	0.02	-	-	0.02
19	Nagaland	1600	0.17	0.50	NEG	-	0.67
20	Odisha	4500	2.56	1.23	1.80	4.30	9.89
21	Punjab	15270	NEG	0.07	-	-	0.07
22	Rajasthan	5290	1.20	1.80	-	-	3.00
23	Sikkim	900	-	-	0.03	-	0.03
24	Tamil Nadu	7420	5.70	0.56	0.07	0.60	6.93
25	Tripura	1200	0.05	0.13	-	-	0.18
26	Uttar Pradesh	28500	1.38	1.61	1.33	-	4.32
27	Uttarakhand	2686	0.20	0.01	0.00	-	0.21
28	West Bengal	2526	0.17	2.76	0.42	2.10	5.45
	Union Territories						
29	Andaman & Nicobar Islands	-	-	NEG	-	0.33	0.34
30	Chandigarh	2	-	NEG	NEG	-	0.00
31	Dadra & Nagar Haveli	54	0.05	-	-	-	0.05
32	Daman & Diu	12	-	NEG	-	NEG	0.00
33	Delhi	150	0.04	-	-	-	0.04
34	Lakshadweep	-		-	-	-	0.00
35	Puducherry	247	-	NEG	0.01	NEG	0.01
Total		**195095**	**29.26**	**24.33**	**7.98**	**11.55**	**73.13**

Source : Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture (Annual Report 2014-15)

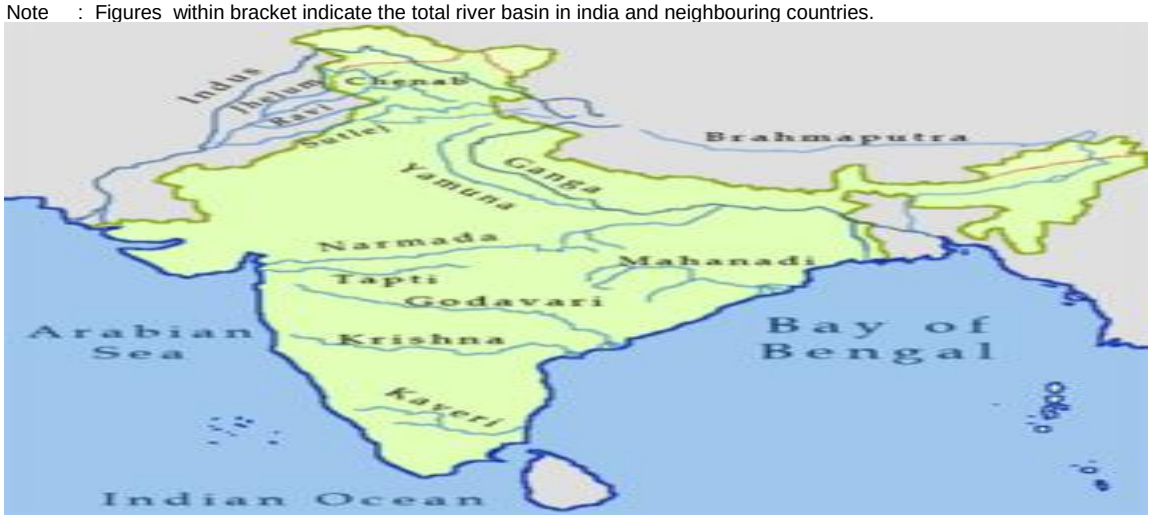
NEG: Negligible

6.3.2 India is blessed with many rivers. Rivers are the lifeline of majority of population in cities, Towns and villages. Water resource development is a must for economic prosperity. Twelve of them are classified as major rivers i.e. rivers with catchment area more than 20,000 sq.kms. each. These account for total catchment area of 252.8 million hectare (M.Ha). Of the major rivers, the Ganga - Brahmaputra Meghana system is the biggest with catchment area of about 110 M.Ha which is more than 43 percent of the catchment area of all the major rivers in the country. The details on catchment area are presented in Table 6.3.2.

Table 6.3.2 : 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 : Ministry of Water Resource
Note : Figures within bracket indicate the total river basin in india and neighbouring countries.



6.3.3 The water resources potential of the country which occurs as natural run off in the rivers is estimated as about 1869 BCM, considering both surface and ground water as one system. The details are exhibited in Table 6.3.3.

Table 6.3.3: Water resources potential in river basins of India

(Unit :BCM)

Sl.No.	River Basin	Catchment Area (Sq. Km.)	Average Annual Potential in the River	Estimated Utilisable flow (excluding ground water)
1	2	3	4	5
1	Indus (Up to Border)	321289	73.31	46.00
2	a) Ganga	861452	525.02	250.00
	b) Brahmaputra	194413	537.24	24.00
	c) Barak & Others	41723	48.36	
3	Godavari	312812	110.54	76.30
4	Krishna	258948	78.12	58.00
5	Cauvery	81155	21.36	19.00
6	Subernarekha*	29196	12.37	6.80
7	Brahamani & Baitarni	51822	28.48	18.30
8	Mahanadi	141589	66.88	50.00
9	Pennar	55213	6.32	6.90
10	Mahi	34842	11.02	3.10
11	Sabarmati	21674	3.81	1.90
12	Narmada	98796	45.64	34.50
13	Tapi	65145	14.88	14.50
14	West Flowing Rivers From Tapi to Tadri	55940	87.41	11.90
15	West Flowing Rivers From Tadri to Kanyakumari	56177	113.53	24.30
16	East Flowing Rivers between Mahanadi & Pennar	86643	22.52	13.10
17	East Flowing Rivers between Pennar & Kanyakumari	100139	16.46	16.50
18	West Flowing Rivers of Kutch and Saurashtra including Luni	321851	15.10	15.00
19	Area of Inland drainage in Rajasthan	-	Negl	NA
20	Minor River Draining into Myanmar (Burma) & Bangladesh	36202	31.00	NA
	TOTAL		**1869.37**	**690.32**

Source: B.P. Directorate, Central Water Commission: BCM- Billion Cubic Meter

1 Reassessment of Water Resources Potential of India March 1993, CWC.

2 Report of the Standing Sub-Committee for assessment of availability and requirement of water for diverse uses in the country, August,2000.

Note *: Combining Subernarekha and other small rivers between Subernarekha and Baitarni.

6.3.4 In hydrology, discharge is the volume rate of water flow, including any suspended solids dissolved chemical species and/or biologic material which is transported through a given cross-sectional area. The water flow and water discharge in major river basins of India is presented in table 6.3.4 and table 6.3.5

6.3.5 The sediment delivered - and transported by a stream is its sediment load. This can be classified in - three types, depending on sediment size and the competence of the river. The coarsest sediment, consisting of boulders and cobbles as well as sand, moves on or near the bed of the stream and is the bed load of the river. The finer particles, silts and clays, are carried in suspension by the turbulent action of flowing water; and these fine particles, which are moved long distances at the velocity of the flowing water, constitute the suspended load of the river. The remaining component of the - tal sediment load is the dissolved load, which is composed of chemical compounds taken in - solution by the water moving on or in the soils of the drainage basin. These three types of sediment constitute the - tal sediment load of the stream. Table 6.3.6 gives the details of sediment load in Major river basins in 2011-12

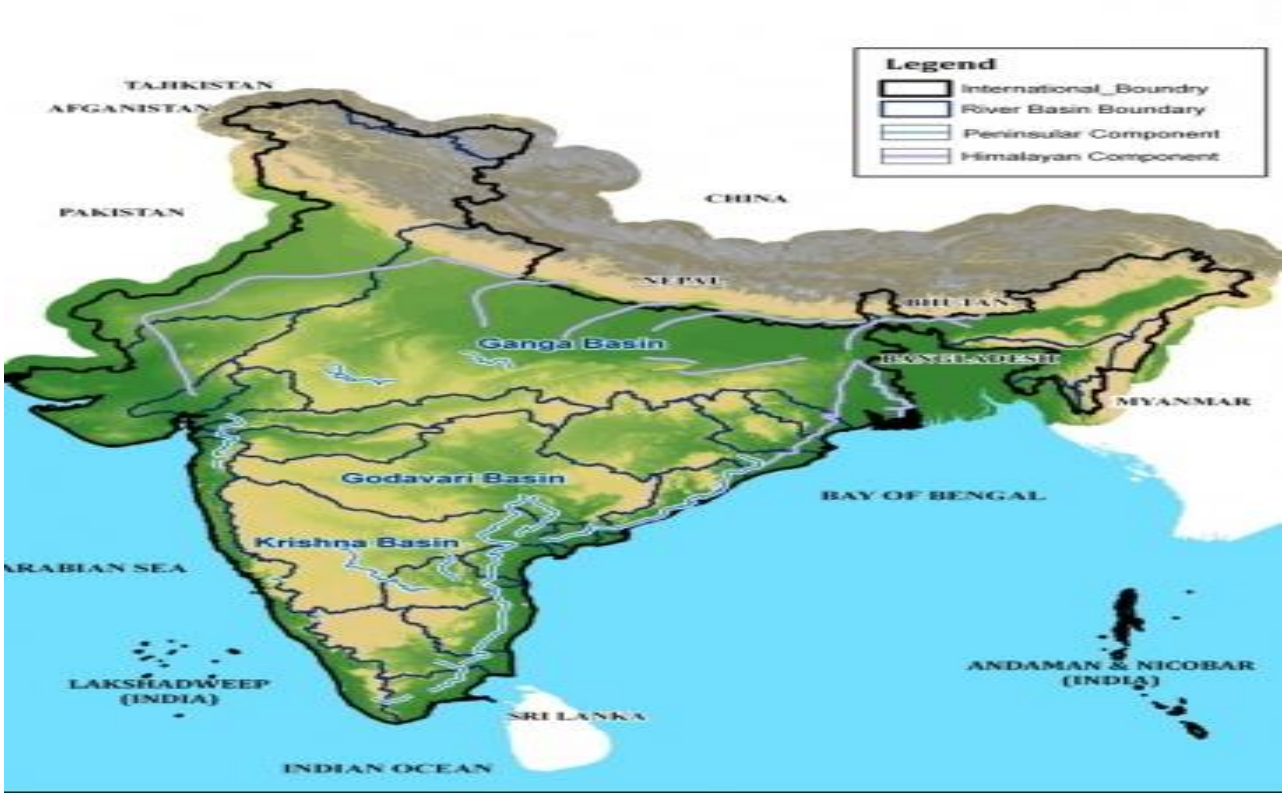


Table 6.3.4 : Water flow in stream

(MCM)

Sl. No.	Name of Basin/River	Average#			Minimum#			Maximum#		
		Monsoon	Non-Monsoon	Annual	Monsoon	Non-Monsoon	Annual	Monsoon	Non-Monsoon	Annual
1	2	3	4	5	6	7	8	9	10	11
1	Mahanadii	6419	410	6788	292	0	305	39915	5311	45227
2	Subernekha etc.	5355	319	5048	506	27	506	12681	1194	13876
3	Brahmani	10002	805	10807	831	68	899	18488	3428	21915
4	Rushikulia etc.	1333	113	1446	833	36	873	1797	213	1955
5	Godavari	6495	446	6941	62	0	62	50737	5171	55818
6	Krishna	3144	214	3358	0	0	0	13437	2257	14134
7	Cauveri	1363	320	1682	2	0	2	7154	2667	9820
8	East Flowing Rivers	220	85	305	0	0	0	2034	414	2448
9	West Flowing Rivers	2370	212	2583	4	0	4	11930	1513	12152
10	Tapi	3444	7	3452	600	0	601	6202	36	6202
11	Narmada	7626	985	9203	415	0	415	33194	4428	44849
12	Mahi, etc	947	70	1018	0	0	0	4787	732	5014

Sources :CWC, Intergrated Hydrological Data Book, 2015

Average, minimum and manimum values of respective sites of each Basin/River

Table 6.3.5 : Water discharge in major river basins

(Cumecs)

Sl. No	Name of Basin/River	No of C.W.C Sites	Reference Period	Maximum Discharge		Minimum Discharge		Basin Range	
				Highest	Lowest	Heighst	Lowest		
				Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value	Maximum	Minimum
1	2	3	4	5	6	7	8	9	10
1	Mahanadi	19	1971- 2012	Basantpur (26874.00)	Andhiyarkore (694.64)	Tikarpara (131.30)	Andhiyarkore (0.00)	694.64 to 26874.00	0.00 to 131.30
2	Brahmani	6	1972-2012	Jaraikela (12539.00)	Altuma (892.68)	Jaraikela (25.20)	Tilga (0.00)	892.68 to 12539.00	0.00 to 25.20
3	Godavari	34	1964-2012	Koida (70792.94)	Kosagumda (893.53)	Koida (85.10)	Ambabal (0.00)	893.53 to 70792.94	0.00 to 85.10
4	Krishna	36	1965- 2012	Bawapuram (36303.25)	Hoovinahole (111.90)	Vijaywada (13.52)	Arjunwad (0.00)	111.90 to 36303.25	0.00 to 13.52
5	Cauvery	34	2011-2012	Kollegal (2348.8)	Thoppur (0.663)	Kodumudi (40.30)	Bendrehalli (0.00)	0.663 to 2348.8	0.00 to 40.30
6	West Flowing River	29	2011-2012	Bentawal (2709.00)	Vandiperiyar (52.60)	Bentawal (123.10)	Addoor (0.00)	52.60 to 2709.00	0.00 to 123.10
7	Tapi	5	1972-2012	Burhanpur (26683.00)	Gopalkheda (1872.00)	Burhanpur (0.00)	Burhanpur (0.00)	1872.00 to 26683.00	0.00 to 0.00
8	Narmada	27	1971- 2012	Garudeswar (60642)	Dhulsar (616)	Garudeswar (55.00)	Chandawada (0.00)	616.00 to 60642.00	0.00 to 55.00
9	Mahi, Sabarmati & others	22	1970- 2012	Khanpur (31061.914)	Chitrasani (127.200)	Khanpur (7.900)	Mataji (0.00)	127.200 to 31061.914	0.00 to 7.900

Source : Integrated Hydrological Data Book, 2015, CWC.

Table 6.3.6 : Sediment load in major river basins - 2011-2012

Sl. No	Name of Basin/River	Monsoon Flow (Million Metric Tonnes)		Non-Monsoon Flow (Million Metric Tonnes)		Annual Flow (Million Metric Tonnes)		Basin Range (Million Metric Tonnes)		
		Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Monsoon	Non-monsoon	Annual
		Highest flow	Lowest flow	Highest flow	Lowest flow	Highest flow	Lowest flow			
1	2	4	5	6	7	8	9	10	11	12
1	Mahanadi	Kantamal (5.578)	Rajim (0.002)	Tikarapara (0.031)	Manendragarh (0.000)	Kantamal (5.578)	Rajim (0.002)	0.002 to 5.578	0.000 to 0.031	0.002 to 5.578
2	Brahmani	Panposh (18.823)	Tilga (0.721)	Jenapur (0.270)	Tilga (0.001)	Panposh (18.837)	Tilga (0.722)	0.721 to 18.823	0.001 to 0.270	0.722 to 18.837
3	Godavari	Perur (59.054)	Dhalegaon (0.034)	Konta (0.174)	Pathaguden (0.000)	Perur (59.062)	Dhalegaon (0.034)	0.034 to 59.054	0.000 to 0.027	0.034 to 59.062
4	Krishna	Kurundwad (1.987)	Byladahalli (0.804)	Wadenpalli (0.039)	Takali (0.000)	Kurundwad (1.987)	Byladahalli (0.005)	0.804 to 1.987	0.000 to 0.039	0.005 to 1.987
5	Cauvery	T. Narsinpur (0.251)	Thengudi (0.001)	Kudimodi (0.059)	Thengidi (0.002)	T. Narsinpur (0.263)	Thengudi (0.002)	0.001 to 0.251	0.002 to 0.059	0.002 to 0.263
6	West Flowing River	Kumbidi (0.401)	Karathodu (0.000)	Ramamanglam (0.013)	Kalampur (0.000)	Kumbidi (0.405)	Karathodu (0.00)	0.000 to0.255	0.000 to 0.013	0.00 to 0.256
7	Tapi	Sarankheda (5.232)	Yearli (1.281)	Burhanpur (0.000)	Burhanpur (0.000)	Sarankheda (5.232)	Yearli (1.281)	1.281 to 5.232	0.000 to 0.000	1.281 to 5.232
8	Narmada	Sandia (37.841)	Gurudeshwar (0.084)	Hoshangabad (0.122)	Chandwada (0.000)	Sandia (38.338)	Gurudeshwar (0.084)	0.084 to 37.841	0.000 to 0.122	0.084 to 38.338
9	Mahi, Sabarmati & Others	Durvesh (2.257)	Ganod (0.007)	Durvesh (0.001)	Derol Bridge (0.000)	Durvesh (2.258)	Ganod (0.007)	0.007 to 2.257	0.000 to 0.001	0.007 to 2.258

Source :CWC, Integrated Hydrological Data Book (Non- Classified River Basin)2015

6.4 Ground Water

6.4.1 Groundwater is water that is found underground in the cracks and spaces in soil, sand and rock. Groundwater is stored in and moves slowly through layers of soil, sand and rocks called aquifers. Groundwater comes from rain, snow, sleet, and hail that soaks into the ground. Water moves down into the ground because of gravity, passing between particles of soil, sand, gravel, or rock until it reaches a depth where the ground is filled, or saturated, with water. The area that is filled with water is called the saturated zone and the top of this zone is called the water table. Water table may be very near the ground's surface or it may be hundreds of feet below.

6.4.2 The ground water availability estimates in various States/ UTs of India and Ground water resources and Ground water resource potential as per river basin are exhibited in Tables 6.4.1 & 6.4.2

6.4.3 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.

Table 6.4.1 : Ground water resources — **Unit:BCM/Yr**

Sr. No.	States	Annual Replenishable Ground Water Resources				Total	Natural Dischage during non-monsoon season	Net Annual Ground Water Availability	Annual Ground Water Draft			Projected Demand for Domestic and Industrial uses upto 2025	Ground Water availability for future irrigation	Stage of Ground Water Development (%)
		Monsoon Season		Non-monsoon Season					Irrigation	Domestic and Industrial uses	Total			
		Recharge from rainfall	Recharge from other sources	Recharge from rainfall	Recharge from other source									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Andhra Pradesh	17.25	6.29	5.38	6.97	**35.89**	3.32	32.57	13.18	1.33	**14.51**	2.81	16.97	45
2	Arunachal Pradesh	3.36	0.00	1.15	0.00	**4.51**	0.45	4.06	0.00	0.00	**0.00**	0.01	4.05	0.08
3	Assam	17.90	1.64	8.64	0.34	**28.52**	2.73	25.79	2.86	0.64	**3.50**	0.78	22.14	14
4	Bihar	19.54	3.95	3.40	2.44	**29.33**	2.47	26.86	10.25	1.70	**11.95**	2.51	14.10	44
5	Chhattisgarh	9.90	0.70	0.87	0.94	**12.41**	0.79	11.63	3.43	0.62	**4.05**	0.76	7.44	35
6	Delhi	0.11	0.10	0.02	0.08	**0.31**	0.02	0.29	0.14	0.25	**0.39**	0.26	0.01	137
7	Goa	0.16	0.01	0.01	0.07	**0.25**	0.10	0.15	0.01	0.03	**0.04**	0.04	0.10	28
8	Gujarat	12.79	2.55	0.00	3.23	**18.57**	0.98	17.59	10.75	1.11	**11.86**	1.48	5.87	67
9	Haryana	3.65	2.77	1.01	3.35	**10.78**	0.99	9.79	12.35	0.71	**13.06**	0.76	-3.31	133
10	Himachal Pradesh	0.39	0.02	0.10	0.05	**0.56**	0.03	0.53	0.25	0.13	**0.38**	0.13	0.15	71
11	Jammu & Kashmir	1.45	2.06	0.36	0.37	**4.24**	0.43	3.83	0.20	0.61	**0.81**	0.76	2.87	21
12	Jharkhand	4.75	0.13	1.06	0.36	**6.30**	0.55	5.76	1.31	0.55	**1.86**	0.76	3.69	32
13	Karnataka	6.81	4.17	2.67	3.38	**17.03**	2.22	14.81	8.59	0.82	**9.41**	1.06	6.53	64
14	Kerala	4.85	0.06	0.63	1.15	**6.69**	0.61	6.07	1.30	1.53	**2.83**	1.71	3.07	47
15	Madhya Pradesh	28.22	1.17	0.79	4.87	**35.05**	1.75	33.29	17.48	1.35	**18.83**	1.91	13.90	57
16	Maharashtra	22.36	1.68	1.84	8.07	**33.95**	1.80	32.15	16.15	1.03	**17.18**	1.97	14.48	53
17	Manipur	0.23	0.01	0.19	0.01	**0.44**	0.04	0.40	0.00	0.00	**0.00**	0.05	0.35	1.02
18	Meghalaya	1.68	0.03	0.07	0.01	**1.79**	0.18	1.60	0.00	0.00	**0.00**	0.23	1.37	0.08
19	Mizoram	0.03	neglible	0.01	neglible	**0.04**	0.00	0.03	0.00	0.00	**0.00**	0.00	0.03	3.52
20	Nagaland	0.40	neglible	0.21	neglible	**0.61**	0.06	0.55	0.00	0.03	**0.03**	0.04	0.51	6.13
21	Odisha	11.29	2.53	1.33	2.63	**17.78**	1.09	16.69	3.81	0.92	**4.73**	1.24	11.64	28
22	Punjab	5.82	10.64	1.33	4.74	**22.53**	2.21	20.32	34.17	0.71	**34.88**	0.98	-14.83	172
23	Rajasthan	8.78	0.68	0.28	2.20	**11.94**	1.11	10.83	13.13	1.71	**14.84**	1.89	0.91	137
24	Sikkim	-	-	-	-	**-**	-	0.04	0.00	0.01	**0.01**	0.01	0.03	26
25	Tamil Nadu	7.38	10.28	1.69	2.18	**21.53**	2.15	19.38	13.17	1.76	**14.93**	1.82	4.39	77
26	Tripura	1.25	0.00	0.74	0.60	**2.59**	0.23	2.36	0.09	0.07	**0.16**	0.20	2.07	7
27	Uttar Pradesh	42.13	11.57	5.15	18.34	**77.19**	5.53	71.66	48.74	4.04	**52.78**	6.55	19.64	74
28	Uttarakhand	1.09	0.26	0.20	0.49	**2.04**	0.04	2.00	1.10	0.03	**1.13**	0.90	0.80	57
29	West Bengal	18.53	5.72	1.42	3.58	**29.25**	2.67	26.58	9.72	0.97	**10.69**	1.48	15.38	40
	TotalStates	**252.10**	**69.02**	**40.55**	**70.45**	**432.11**	**34.55**	**397.60**	**222.18**	**22.67**	**244.85**	**33.10**	**154.35**	**62**
30	Andaman & Nicobar	0.262	Nil	0.046	Nil	**0.308**	0.022	0.286	0.001	0.012	0.013	0.014	0.272	4.44
31	Chandigarh	0.015	0.001	0.005	0.001	**0.022**	0.002	0.019	0.000	0.000	0.000	0.000	0.000	0
32	Dadar & Nagar Haveli	0.043	0.003	0.009	0.007	**0.062**	0.003	0.059	0.007	0.006	0.013	0.010	0.042	22
33	Daman & Diu	0.014	0.002	0.000	0.002	**0.018**	0.001	0.017	0.014	0.002	0.016	0.003	0.000	97
34	Lakshadweep	0.000	0.000	0.000	0.000	**0.000**	0.007	0.004	0.000	0.002	0.002	0.000	0.000	67
35	Puducherry	0.089	0.060	0.008	0.032	**0.189**	0.019	0.170	0.124	0.029	0.153	0.032	0.057	90
	Union Territories	**0.42**	**0.07**	**0.07**	**0.04**	**0.60**	**0.05**	**0.55**	**0.15**	**0.05**	**0.20**	**0.06**	**0.37**	**36**
	Grand Total	**252.52**	**69.08**	**40.62**	**70.49**	**432.71**	**34.60**	**398.16**	**222.33**	**22.72**	**245.04**	**33.16**	**154.72**	**62**

BCM: Billion Cubic Meter.

Source: Central Ground Water Board, Dynamic Ground Water Resources of India, (as on 31st March, 2011)

Total may not tally due to rounding off.

: The stage of Ground water development is to be computed as : E/N (Where E: Existing Gross draft for all uses and N: Net annual availability.)

Table 6.4.2: Ground water resource potential as per basin (Prorata Basis)							
Sl. No.	Basin	Total Replenishable Ground Water Resource (M.C.M/Yr)	Provision of 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	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

MCM/yr : Million Cubic Metre/Year

6.5 Water quality

6.5.1 Rivers are also used 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.

6.5.2 According to this concept, outnof several used water body is put to, the use which demands highest quality is termed as "designated best use" and accordingly the water body is designated. Primary water quality criteria for different uses have been identified. A summary of the use based clasification is given in Table 6.5.1.

Table 6.5.1 : Use based classification of surface waters in India

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 20oC 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 20oC 3mg/l or less.
3	Drinking Water Source after conventional treatment and disinfection	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 20oC 3mg/l or less.
4	Propagation of Wild Life and Fisheries	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 disposal	E	1 pH between 6.0 to 8.5 2 Electrical conductivity at $25^{o}C$ Micro mhos/cm Max 2250. 3 Sodium Absorption Ratio, Max 26 4 Boron, Max 2mg/l

Source : Status of Water Quality in India - 2012, Central Pollution Control Board

6.5.3 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 Dissolved Oxygen, 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. The Biological water quality criteria is shown in table 6.5.3.

Table 6.5.2: 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

6.5.4 The tables 6.5.4 and 6.5.5 present the water quality in major Indian rivers and selected major river basins. Table 6.5.6 presents the river basin wise distribution of water quality monitoring centres. Table 6.5.7 presents the state-wise river water quality.

Table 6.5.3: Water Quality in Indian Rivers – 2002 to 2012										
Name of the River	Length (Km)	No of Monitoring locations	Year	Observed Range of Water Quality Parameters						
				Temp.(^{o}C) (Min-Max)	pH	Conductivity(µ mhos/cm)	DO(mg/l)	BOD(mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
Ganga	2525	34	2002	3-34	6.4-9.0	19-2720	2.7-11.5	0.5 – 16.8	300-25x10^{5}	20-11x10^{5}
		34	2003	4-34	6.8-8.9	49-1323	4-11	0.8-27	47-45x10^{5}	26-12x10^{5}
		34	2004	5-35	7-8.8	72-4080	0.3-13.2	0.7-14.4	11-45x10^{5}	11-7x10^{5}
		39	2005	4-39	6.1.-9	23-1696	3.2-12.8	0.1-15.2	13-45x10^{5}	13-11x10^{5}
		39	2006	9-33	7.0-8.88	97-5620	2.2-11.9	0.1-16.4	1-25x10^{5}	17-11x10^{5}
		39	2007	4-33	6.1-8.8	23-5040	1.4-11	0-14	0-28x10^{5}	0-7 x10^{5}
		39	2008	2.5-35.5	6.1-8.9	39-6320	1.2 - 11.6	0.5-21.0	0- 101 x10^{5}	0 - 85 x10^{5}
		57	2009	4-37	6.5-8.9	68-4460	4.3-11.2	0.2-16	2-65 x10^{4}	0-4 x10^{4}
		57	2010	4-35	6.7-9.0	21-5250	3.6-12	0.2-15	3-14 x10^{5}	2-4 x10^{5}
		61	2011	3-37	6.7-9.1	49-10240	4-14.3	0.2-11	5-25 x10^{5}	5-11 x10^{5}
		61	**2012**	**8-35**	**5.9-9.1**	**18-6220**	**0.6-14.1**	**0.7-27**	**30-5x10^{6}**	**21-3x10^{6}**
Yamuna	1376	23	2002	3-34	6.7-9.8	56-1959	0.1-22.7	1.0 – 36	27-26.3x10^{6}	11-17.2x10^{5}
		23	2003	2-38	6.6-10	45-3500	0.3-22.8	1-58	110-171x10^{7}	40-203x10^{6}
		23	2004	7-35	6.8-9	76-2150	0.3-19.5	1-40	21-1103x10^{6}	18-62x10^{6}
		23	2005	11-37	6.8-9.1	90-2290	0.5-17.3	0.8-59	14-307x10^{6}	11-52x10^{5}
		23	2006	4-34	7.14-9.5	220-1876	1.3-18.8	1.0-144	7-231x10^{7}	2-13x10^{6}
		23	2007	6.5-34	5-8.4	57-1940	0-17.7	0-93	0-32 x10^{7}	0-23 x10^{6}
		23	2008	7.5-32	6.8 - 9.5	40-3340	0.0 - 20.6	0.4-70.0	0 - 103x10^{6}	11 -109x10^{5}
		27	2009	5-35	7.0 - 8.8	80 - 3040	0.0 - 17.9	0.2 - 103	4 - 23 x10^{9}	9 - 21 x10^{8}
		27	2010	5-35	6.1-9.4	100-2220	0.0-21.1	08-84	13 - 39x10^{7}	9 - 29x10^{6}
		27	2011	4-38	6.9-8.8	60-1905	0-17	0.2-41	10-16 x10^{7}	4-11 x10^{8}
		27	**2012**	**3.2-35**	**6.1-8.9**	**52-1110**	**0.0-11.4**	**0.8-113**	**12-20x10^{8}**	**6-20x10^{8}**
Mahi	583	7	2002	19-34	7.1-9.2	175-5720	0.2-8.5	0.1 – 3.0	3-2400	3-75
		7	2003	18-34	7-8.8	97-750	2.9-10.1	0.5-3.9	4-2400	2-28
		7	2004	20-34	7.4-9.2	166-650	2.7-8.7	0.3-4.9	4-1600	2-28
		9	2005	20-32	7.5-9	182-7080	4.1-11.1	0.2-5.9	3-14x10^{3}	2-1x10^{3}
		9	2006	16-28	7.2-8.9	263-580	7.3-12.1	1.1-8.5	3-180	2-9
		9	2007	20-31	7.6-8.89	234-3720	0.4-10.7	0.3-5.7	4-160	0-11
		9	2008	20- 32	7.2-8.9	225-1660	4.6-13	0.2-6.8	0-210	0- 18
		9	2009	22-32	7.1-10	160-766	3.5-8.6	0.1-4.0	3-170	0-9
		9	2010	20 - 34	7.4 – 8.7	230-7234	3.5 – 9.9	0.22- 4.0	4 - 110	0 -7
		11	2011	18-36.5	7.1-9.1	256 -1310	3.2-8.9	0.6 -8.0	7-28	2-9
		11	**2012**	**23-32**	**7.43-8.6**	**192-1276**	**4.41-20**	**0.3-6**	**4-210**	**1-21**

Name of the River	Length (Km)	No of Monitoring locations	Year	Observed Range of Water Quality Parameters						
				Temp.(°C)	pH	Conductivity(µ mhos/cm)	DO(mg/l)	BOD(mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
Tapi	724	10	2002	20-40	7.4-9.0	76-700	4.8-8.8	0.6 – 10.0	40-2100	2-210
		10	2003	18-36	3.1-9.2	119-1130	3.1-10.4	1-10	30-930	2-230
		10	2004	13-39	3.1-9.5	190-790	1.2-8.7	0.7-36	$3\text{-}5X10^5$	$2\text{-}9X10^4$
		13	2005	26-30	7.2-9.4	186-1084	4-8.4	1-25.1	$2\text{-}46X10^4$	$2\text{-}15X10^4$
		13	2006	14-31	7.7-9.28	161-923	4.6-9.7	0.3-24	$5\text{-}11X10^4$	$2\text{-}11X10^4$
		14	2007	23-39	7.3-8.5	210-581	3.7-8.7	1.1-25	$17\text{-}46 x10^3$	$7\text{-}15 x10^3$
		14	2008	19-41	6.6-8.9	132-26000	2.1- 8.8	0.1-21	$0\text{-}46 X10^4$	$0\text{-}24 X10^4$
		14	2009	18-42	6.2-8.9	173-45400	3.7-8.2	0.6-12	14-39000	0-14000
		14	2010	15 - 42	7.0-8.7	125- 39400	1 -8.1	0.4 - 16	9- 9300	0 - 4300
		14	2011	24-41.5	7.0-8.7	172-41836	3.2-7.6	1.2-10	22-24000	9 -9000
		14	**2012**	**20-43**	**7.02-8.8**	**125-39720**	**3.3-7.7**	**0.8-18**	**26-1600**	**1-50**
Narmada	1312	14	2002	-	6.9-9.3	102-1341	5.8-9.8	0.1 – 3.8	9-2400	2-64
		14	2003	12-31	7.1-8.5	95-441	4.5-9.5	0.4-3.3	4-1600	1-110
		14	2004	15-34	7-8.6	181-815	5.5-9.6	0.2-3.8	3-2400	2-15
		15	2005	21-30	7.3.9	190-1746	4.8-10.9	0.6-4.5	3-2400	2-210
		15	2006	9-32	7.1-8.6	188-682	6.2-11	0.4-3.7	3-2400	0-39
		15	2007	19-31	7.5-8.8	244-1629	6.2-10.4	1.2-3.5	7-1600	0-15
		21	2008	14-32	6.8-10	180-853	4.9- 13	0.2 -11.4	0-2400	0-140
		21	2009	17-33	6.5-8.9	178-1930	4.2-11.5	0.2-30	2-1600	0-90
		21	2010	19 - 39	7.2 – 8.5	194 -727	4.8 - 11	0.21- 5.4	4 - 11000	0 - 4600
		26	2011	14.7-38	7.1- 8.6	217-651	6.2- 9.9	0.8- 5.0	4-1600	0-17
		26	**2012**	**17-32**	**7.1-8.8**	**206-710**	**5.8-13**	**0.1-7.9**	**5-900**	**3-30**
Godavari	1465	11	2002	22-35	7.0-9.0	118-1400	3.1-10.9	0.5 – 78.0	8-5260	2-3640
		11	2003	22-37	7.1-8.7	115-1350	3.2-9.3	1.7-53	70-68200	3-1400
		11	2004	21-35	6.5-9	86-1290	2.4-9.2	0.2-15	$4\text{-}22 x 10^4$	$2\text{-}5 x 10^4$
		18	2005	23-32	6.7-9.1	121-1300	0.8-8.7	0.5-20	$2\text{-}33 x 10^3$	$1\text{-}10 x 10^3$
		18	2006	19-34	6.65-9.11	75-691	1.1-9.6	1.2-32	$2\text{-}31 x 10^3$	$2\text{-}6 x 10^3$
		18	2007	20-37	5.9-8.9	126-918	3.2-7.5	0.2-36	0-2200	5-36 x10
		35	2008	13-35	5.2-9.6	114-3994	1.2-11.3	0.2-20	$3\text{-}28 x10^3$	0-800
		35	2009	15-41	6-9.2	115-3169	3.2-12.3	0.0-26	5-16000	0-340
		35	2010	12-40	5.4-8.9	91-1670	1.8-14.2	0.3-60	2-2400	1-1600
		35	2011	18-40	6.4-9.1	132-1959	1.2-12.2	0.0-37	7-2400	1-500
		35	**2012**	**17-38**	**6.51-9.3**	**113-2985**	**0.0-12.6**	**0.1-40**	**3-2700**	**2-1600**

Name of the River	Length (Km)	No of Monitoring locations	Year	Observed Range of Water Quality Parameters						
				Temp.(°C)	pH	Conductivity(µ mhos/cm)	DO(mg/l)	BOD(mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
Krishna	1401	17	2002	18-33	6.8-9.5	28-11050	2.9-10.9	0.2 – 10.0	17-33300	3-1 x 10^3
		17	2003	18-35	6.7-8.9	36-40000	0.7-12.6	0.5-17	6-7 x 10^4	2-2 x 10^4
		17	2004	18-38	6.7- 9	71-44000	0.4-9.2	0.3-9	15-124 x 10^3	3-28 x 10^3
		21	2005	24-37	6.5-9.9	69-43300	1.4-8.8	0.4-40	17-84 x 10^3	1-34 x 10^3
		19	2006	15-40	6.32-9.30	76-2580	3.0-8.5	0.4-14.8	4-86 x 10^3	1-6 x 10^3
		19	2007	13-38	6.2-9.1	69-23400	3.0-10	0.1-9.8	0-71x10^3	0-1600 ^{3}
		22	2008	17.3-39	5.8-8.9	44-14290	1.1-9.8	0.2-17.6	8-16 x 10^3	0-3 x 10^3
		22	2009	18.4-41	6.7-9.0	75-19960	0-12.6	0.3-9.6	8-170000	0-1400
		24	2010	17-39	6.5-9.1	42-16720	1.5-11.8	0-10	2-4000	0-1600
		26	2011	19.2-38	6.9-8.7	99-8570	1.7-15.8	0.4-16	4-16000	2-9000
		26	**2012**	**17-36**	**6.15-8.8**	**77-14140**	**0.0-15**	**0.0-24**	**50-2700**	**2-900**
Cauvery	800	20	2002	21-37	2.0-9.2	31-53100	0.1-12.6	0.1 – 26.6	39-16 x 10^3	2-28 x 10^3
		20	2003	8-34	7-9.2	42-57200	2.1-13.5	0.2-10	4-22 x 10^3	2-4 x 10^3
		20	2004	19- 35	6.6-9	35-39720	3.3-9.9	1-9	2-5 x 10^4	2-17 x 10^3
		20	2005	20-37	6.2-9.5	28-48700	0.3-9.8	1-12	2-9500	1-3 x 10^3
		20	2006	20-34	7.0-9.3	26-1694	2.7-8.9	1-6	90-3500	3-1400
		20	2007	19-32	6.5-8.8	28-56500	0-12.4	0.1-38	40-28 x10^3	4-17 x10^3
		20	2008	20-35	6.5-8.8	27-28700	0.6-14	0.1-23	27-5400	0-3500
		20	2009	20-34	6.5-8.9	65-81800	1.5-10.3	0.1-17	7-9200	2-5400
		29	2010	21-30	6.5-8.9	18-8430	0.4-12.2	0.1-27	70-15000	20-12000
		31	2011	20-34	4.3-8.9	7-3640	1.7-10.9	0.1-7.2	90-6200	20-2200
		31	**2012**	**20-37**	**6.6-9.1**	**5-4110**	**1.3-12.9**	**0.0-21.9**	**2-22000**	**2-11000**
Mahanadi	851	16	2002	18-38	7.3-8.9	114-15940	1.3-10.4	1.0 – 7.6	15-30000	50-17000
		16	2003	17-37	6.5-8.6	77-83600	4.7-10.1	0.3-5.6	4-35X10^3	50-28X10^3
		16	2004	17- 34	6.3-8.8	105-20700	4.4- 9.4	0.2-4	3-92X10^3	27-24X10^3
		21	2005	22-34	6.1-8.7	75-36279	4.5-10	0.2-16	3-92X10^3	78-54X10^3
		21	2006	20-32	6.97-8.9	113-34587	4.7-8.5	0.2-3.8	14-92X10^3	68-54X10^3
		21	2007	26-33	7.3-8.54	102-813	6.2-8.9	1.2-3.6	27-35 x10^3	700-17 x10^3
		22	2008	18-36	6.7-8.8	109-29400	0.8-8.9	0.2-4.6	15-16 x10^4	310- 54 x10^3
		22	2009	17-39	6.7-8.8	103-48830	0.2-11	0.2-7.1	5-1600000	110-160000
		22	2010	17-39	7.0 – 9.3	92 - 42350	4.4-11	0.2 – 14.3	10 - 160000	45 - 92000
		23	2011	18-36	7.1–8.5	90 - 13190	4.9 -10.5	0.6 -3.6	10- 160000	78-160000
		23	**2012**	**20-37**	**7.0-8.4**	**39-39030**	**4-12**	**0.4-4.9**	**11-200000**	**5-156000**

Name of the River	Length (Km)	No of Monitoring locations	Year	Observed Range of Water Quality Parameters						
				Temp.(°C)	pH	Conductivity(µ mhos/cm)	DO(mg/l)	BOD(mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
Brahamani	799	11	2002	20-38	7.0-8.4	81-376	5.2-9.8	1.5 – 6.0	80-90000	40-60000
		11	2003	17-35	6.6-8.4	69-501	6.1-10.2	0.2-6	$90\text{-}24x10^3$	$60\text{-}14x10^3$
		11	2004	16-28	6.3-8.4	47-402	6-9.6	0.2-7	$490\text{-}28x10^3$	$22\text{-}13x10^3$
		11	2005	16-34	6.3-8.7	65-850	5.1-13.8	0.3-5.2	$490\text{-}16x10^4$	330-16x1
		11	2006	18-32	6.9-8.4	102-380	4.6-8.9	0.3-5.4	940-5400	630-2400
		15	2007	20-40	6.7-8.5	91-582	1.9-8.9	0.3-4.9	$210\text{-}54 x10^3$	$110\text{-}22 x10^3$
		16	2008	18-38	6.4-8.4	93- 664	5.3- 9.7	0.4-6.2	$750\text{-}21 x10^3$	$110\text{-} 14 x10^3$
		16	2009	12-40	6.6-8.5	70-431	4.5-18.3	0.2-5.8	940-22000	460-13000
		16	2010	17-37	6.6-8.5	97-623	5.6-12	0.4-5.6	330-92000	130-35000
		16	2011	15-38	6.7–8.5	93 - 458	5.0 -9.9	0.6 - 6.6	330-92000	170-35000
		16	**2012**	**19-37**	**64-8.5**	**99-363**	**5.2-12.0**	**0.6-7**	**78-200000**	**20-92000**
Baitarni		5	2002	24-36	7.3-8.3	54-78400	6.8-9.3	2.0 – 6.8	900-22000	700-11000
-		5	2003	18-36	6.7-7.8	75-54802	5.4-11.3	0.3-3.5	$330\text{-}16x10^3$	$230\text{-}9x10^3$
		5	2004	18-32	6.6-8.1	64-29118	5.9-9.8	0.4-2.6	640-92000	$310\text{-}35x10^2$
		5	2005	24-34	7-8.6	68-42257	5.2-8.8	0.4-4.3	$790\text{-}24x10^3$	$3330\text{-}11x10^3$
		5	2006	15-25	7.6-8.4	90-2287	7.4-8.0	0.3-1.8	1400-4300	790-1700
		5	2007	22-35	7.3-8.2	136-19450	5.6-8.8	0.4-2.2	330-5400	170-2200
		5	2008	22-36	7.5-8.2	75-48400	6.3-9.2	0.8-2	940-5400	700-3500
		5	2009	25-38	6.7-8.4	69-28400	6.1-9.0	0.6-3.4	630-5400	230-2800
		5	2010	18 - 36	6.6-8.3	98 - 33320	5.6 – 8.8	0.4 – 2.6	470 - 16000	210 - 5400
		5	2011	15-36	7.1-8.4	83- 32540	5.2-11.9	0.3- 3.2	350 - 54000	140 - 24000
		5	**2012**	**19-37**	**7.1-8.4**	**93-42560**	**5.6-10**	**0.3-2.8**	**230-17000**	**130-11000**
Subarnarekha	395	6	2002	18-36	6.5-8.0	113-355	5.2-8.5	0.2 – 12.0	150-1800	70-540
		6	2003	22-35	7.3-8.3	133-346	6.4-8.4	1-2	300-7900	130-3300
		6	2004	24-28	7.8-8.3	152-623	7.1-7.5	0.4-2.5	470-2200	270-700
		6	2005	20-36	6.8-8.3	130-405	5.5-8.6	1.0-4.7	110-1400	78-700
		6	2006	19-34	6.9-7.9	192-15013	5.8-8.2	0.3-4.6	2200	1300
		6	2007	19-37	6-8.1	134-740	4.6-8.7	0.9-8.0	540-2400	200-920
		12	2008	19-35.5	6.5-8.0	119-332	5.1-8.9	0.0-10.5	540-3500	200-1700
		12	2009	19.5-40	6.4-8.4	164-717	4.0-8.5	0.4-6.3	280-2400	70-1300
		12	2010	19-38	6.8-8.0	152-244	5.9-8.2	0.4-2.8	-	-
		12	2011	15-38	6.5-8.4	126-408	3.0-8.6	0.2-7.0	750-43000	110-15000
		12	**2012**	**18-39**	**6-8.5**	**82-1211**	**3.6-8.4**	**0.3-8**	**640-92000**	**90-54000**

Name of the River	Length (Km)	No of Monitoring locations	Year	Observed Range of Water Quality Parameters						
				Temp.(°C)	pH	Conductivity(µ mhos/cm)	DO(mg/l)	BOD(mg/l)	Total Coliform (MPN/100 ml)	Faecal Coliform (MPN/100 ml)
Brahmaputra	916	6	2002	15-32	6.5-9.0	104-684	1.1-10.5	0.1 – 3.9	360-240000	300-24000
		6	2003	14-32	6.4-8.4	77-570	1.2-11.5	0.4-3.5	360-24x10^4	300-24x10^4
		6	2004	15-34	5.2-9	91-445	1.1-9.4	0.4-4.3	360-24x104	300-24x10^4
		10	2005	-	5.9-7.6	20-408	2-10.5	0.3-6.2	300-24x10^4	150-24x10^4
		10	2006	18-30	6.9-8.0	55-485	4.2-10.2	0.3-5.7	1-24x10^4	300-24x10^4
		10	2007	18-32	5.9-7.9	76-645	5.1-10	0.1-3.4	0-24 x10^4	0-24 x10
		10	2008	12-32	6.1-8.1	75-460	3.3-9.6	0.4-5.4	1-24 x10^4	0-24 x10^3
		10	2009	17-31	6.1-8.1	69-303	4.4-10.5	0.3-5.4	1-24000	0-1100
		10	2010	18-32	6.5-8.1	49-371	3.6-9.4	0.6-6.3	0-3000	0-360
		10	2011	17-32	6.1-8.5	68-238	4.4-30	0.3-9.2	0-15000	0-1500
		10	**2012**	**17-32**	**6.6-8.1**	**67-359**	**4.2-11**	**0.4-3.6**	**0-2800**	**0-910**
Satluj	1078	20	2002	9-32	6.8-8.8	131-819	3.8-11.4	0.1 – 45.0	8-35000	2-3500
		20	2003	5-30	6.9-8.9	164-1226	3.4-11.5	0.1-24	3-3x10^4	1-1300
		20	2004	9-29	7.1-8.3	144-694	1.6-10.3	0.1-64	7-2x10^5	2-9x10^4
		21	2005	10-28	7.1-8.3	150-818	2.8-14.2	0.1-40	1-35x10^4	1-11x10^4
		21	2006	7-28	7.1-8.26	160-958	2.8-10.6	0.1-32	1-17x10^4	1-5x10^4
		21	2007	2-26	7-8.6	145-865	3.2-11.9	0-28	3-17 x10^4	0-9 x10^4
		21	2008	4.5-23	7.0-8.5	162-843	1.2 - 12.4	0.0-48	12- 11 x10^4	0 - 10 x10^3
		22	2009	7.5-26	6.3-8.5	124-932	0.6-11.4	0.1-55	4-250000	0-110000
		23	2010	4-27	4.2-8.6	155-982	4.1-11.1	0.1-40	6 -1 x10^5	2-5 x10^4
		23	2011	1.8-25	6.8-8.69	87-1022	3.8-12	0.1-32	4-90000	2 - 50000
		23	**2012**	**2.3-26.9**	**6.8-8.7**	**73-664**	**4-12**	**0-27**	**27-100000**	**4-70000**
Beas	460	19	2002	3-32	7.1-8.7	53-517	5.2-11.5	0.3 – 5.0	2-2400	2-1600
		19	2003	4-29	7.3-8.9	76-559	7-12	0.1-6	2-2400	2-1600
		19	2004	2-29	6.9-8.5	60-396	6.8-11.8	0.2-4.8	2-5x10^4	2-3500
		19	2005	4-27	7-8.8	54-395	4.8-13	0.2-10	2-11x10^3	2-1100
		19	2006	4-27	7.0-8.2	94-395	5.8-11.0	0.2-3.2	2-11x10^3	2-1100
		19	2007	2-22	6.2-8.9	86-470	5.9-12.8	0.1-2.9	0-2400	0-2400
		19	2008	1.5-22	7.0-8.4	53-432	3.8-12.5	0.1-7.6	2-1600	2-1600
		23	2009	5- 26	7.1-8.5	46-338	6.4-11.8	0.1-4.3	7-2400	2-1600
		23	2010	5-26	6.2-8.8	63-548	5.8-11.2	0.1-2.8	7-39000	2-7000
		23	2011	2.5-24	6.5-8.87	49-638	5-12.5	0.1-1.5	8-2400	0 - 920
		23	**2012**	**2-29.5**	**6.6-7.9**	**47-513**	**3.8-12**	**0.1-8.7**	**34-1600**	**11-900**

BOD : Biological Oxygen Demand ; DO- Dissolved Oxygen.

(µmhos/cm) : Micromhos per centimeter; MPN: Most Probable Number

Source: Central Pollution Control Board.

Table 6.5.4: Water quality in major river basins

Sl. No	Name of Basin/River	Reference Period	pH				Specific Conductance			
			6.5 - 8.5				Max= 2250.00 (Micromho/cm)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	4	5	6	7	8	9	10	11
1	Mahanadi	2011-2012	Tikarapara (7.6)	Bamnidhi (6.0)	Tikarapara (8.6)	Ranim (7.8)	N.A	N.A	N.A	N.A
2	Brahmani	2011-2012	Gomlai (7.5)	Tilga (7.0)	Kamalanga (8.6)	Tilga (8.3)	N.A	N.A	N.A	N.A
3	Godavari	2011-2012	P.G.Bridge (8.3)	Perur (7.5)	Asthi (9.0)	Konta (8.2)	N.A	N.A	N.A	N.A
4	Krishna	2011-2012	Wadenpathy (26)	Honnali (6.1)	Wadenpathy (28)	Takli (7.1)	N.A	N.A	N.A	N.A
5	Cauvery	2011-2012	Kudlur (8.2)	Sakaleshpur (6.2)	Menangudi (9.4)	Sakaleshpur (7.1)	N.A	N.A	N.A	N.A
6	West Flowing Rivers	2011-2012	Kuzhithwat (7.7)	Kalampur (5.3)	Mankara (8.5)	Kidangoor (6)	N.A	N.A	N.A	N.A
7	Tapi	2011-2012	Sarangkheda (7.6)	Burthanpur (6.6)	Gopalkheda (8.2)	Sarangkheda (7.6)	Gopalkheda (338)	Dedtali (178)	Ghala (1217)	Gidhade (397)
8	Narmada	2011-2012	Kegaon (8.4)	Chandwada (6.8)	Handia (8.7)	Chandwada (7.7)	Rajghat (247)	Mohgaon (130)	Rajghat (886)	Mandleshwar (229)
9	Mahi,Sabarmati & other Basins	2011-2012	Kamalpur (8.3)	Pingalwada (6.5)	Pingalwada (9.3)	Durvesh (7.5)	Motinaroli (451)	Durvesh (139)	Vautha (3692)	Durvesh (292)

TABLE 6.5.4 : Water quality in major river basins ….contd

Sl. No	Name of Basin/River	Reference Period	Calcium (Ca**) Max= 80.00 (mg/l)				Magnesium (Mg**) Max =24.00 (mg/l)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	12	13	14	15	16	17	18	19
1	Mahanadi	2011-2012	Jondra, Andhiyar Khore (18)	Mahendragarh (5)	Simga (67)	Baronda (10)	Andhiyar Khore (10.7)	Tikarapara (1.9)	Simga (39.7)	Rajim (5.8)
2	Brahmani	2011-2012	Rsp Nala (22)	Tilga (5)	Tilga (96)	Jenapur (26)	Panpash (1.0)	Rsp Nala (0.1)	Kamalanga (21.4)	Beahmani (6.8)
3	Godavari	2011-2012	Satrapur (33)	Pathagudem (5)	Pathagudem (59)	Konta (18)	Dhalegaon (21.3)	Pathaguder (1.9)	Satapur (46.5)	Konta (9.7)
4	Krishna	2011-2012	Chalachagudda (38)	Honnali (3)	T. Rampuram (80)	Simoga (11)	T. Ramapuram (19.9)	Honnali (1)	T.Ramapuram (45.2)	Simoga (1.0)
5	Cauvery	2011-2012	T. Bekuppe (58)	Nellithurai (3)	Elunuthimangalam (99)	Sakaleshpur (8)	Thoppur (34.4)	Nellithurai (1.0)	Elunuthimangalam (110.8)	Muthankera (3.5)
6	West Flowing Rivers	2011-2012	Pudur (28)	Yennehole (2)	Mankara (38.4)	Yennehole (3)	Pudur (12)	Ayilam (0.5)	Pudur (9.4)	Kuttyadi (1)
7	Tapi	2011-2012	Gopalkheda (35)	Sarangkheda (30)	Gopalkheda (36)	Sarangkheda (30)	Gopalkheda (608)	Burhanpur (5.8)	Patau (39.9)	Sarangkheda (5.8)
8	Narmada	2011-2012	Chanwada (32)	Bamni (11)	Patau (65)	Bamni (28)	Dhulsar(16)	Patan (3.2)	Kogaon (48.6)	Garudeshwar (8.2)
9	Mahi,Sabarmati & other Basins	2011-2012	Ganod (58)	Luwara (13)	Luwara (205)	Durvesh(31)	Voutha (12.6)	Mataji (5.8)	Luwara (92.3)	Kamalpur (6.8)

TABLE 6.5.4 : Water quality in major river basins ….contd

Sl. No	Name of Basin/River	Reference Period	Iron (Fe ***) Max = 50.00 (mg/l)				Free Amonia (NH_4**) Max= 1.20			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	20	21	22	23	24	25	26	27
1	Mahanadi	2011-2012	Tikarpara (0.0)	Baribda (0.0)	Simga (0.4)	Baronda (0.0)	N.A	N.A	N.A	N.A
2	Brahmani	2011-2012	Jaraikela (0.0)	Tulga (0.0)	Panposh (0.2)	Tilga (0.0)	N.A	N.A	N.A	N.A
3	Godavari	2011-2012	Saigaon (0.3)	Konta (0.1)	Nandgaon (1.0)	Dhalegaon (0.11)	Dhalegaon (0.2)	P.G. Bridge (0.0)	Sastrapur (0.78)	Dhalegaon (0.11)
4	Krishna	2011-2012	Phulgaon (1.0)	Vijayawada (0.0)	Phulgaon (1.1)	Vijaywada (0.0)	Vijaywada (0.0)	Vijaywada (0.0)	Wadenpalli (0.32)	Vijaywada (0.0)
5	Cauvery	2011-2012	Thengudi (0.1)	Annavasal (0.000)	Muthankera (1.5)	Annavasal (0.0)	Muthankera (0.04)	Musiri (0.04)	T.Bekuppe (.35)	Akkihebbal (0.00)
6	West Flowing Rivers	2011-2012	Kuzhithural (1.5)	Haladi (0.000)	Ramamangalam (20)	Haladi (0.000)	Kuzhithural (0.6)	Mankara (0.0)	Ramamangalam (0.6)	Kunigil (0.06)
7	Tapi	2011-2012	-	-	-	-	Gopalkheda (0.08)	Burthanpur (0.05)	Buehanpur (0.16)	Sarangkheda (0.06)
8	Narmada	2011-2012	-	-	-	-	Chandwada (0.06)	Garudeshwar (0.05)	Chandwada (0.09)	Garudeshwar (0.1)
9	Mahi,Sabarmati & other Basins	2011-2012	Paderdibadi (0.5)	Derol Bridge (0.1)	Vautha (1.0)	Derol Bridge (0.1)	Vautha (1.01)	Mataji (0.05)	Vautha (37.45)	Durvesh (0.09)

Table 6.5.4: Water quality in major river basins ….contd

Sl. No	Name of Basin/River	Reference Period	Chloride (Cl)				Fluoride (F)			
			Max=600.00(mg/l)				Max= 1.50(mg/l)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	4	5	6	7	8	9	10	11
1	Mahanadi	2011-2012	Jondhra (6.5)	Baronda (1.1)	Simga (52.3)	Baronda (5.7)	Pathardih (0.16)	Basantpur (0.05)	Andhiyar Khore (0.40)	Tikarpara (0.05)
2	Brahmani	2011-2012	Jaraikela (11.3)	Gomlai (7.5)	Rsp Nala (60.4)	Jaikaikeal (30.7)	Jaraikela (0.05)	Tilga (0.05)	Jaraikela (0.08)	Panposh (0.05)
3	Godavari	2011-2012	Dhalegaon l (24.3)	Jagdalpur (1.0)	Bamni (114.3)	Konta (9.1)	Dhalegaon (0.39)	Polavaram (0.05)	Pathagudem (1.70)	Dhalegaon (0.39)
4	Krishna	2011-2012	T. Ramapuram (123)	Shimga (3.9)	T. Ramapuram (398.4)	Simoga (14.9)	Keesara (0.92)	Honnali (0.0)	Halia (4.1)	Maral (0.11)
5	Cauvery	2011-2012	Elunuthimsngalam (245.5)	Nellithurai (3.2)	Elunuthimangalam (1121)	Muthankeara(13)	Thevur (.88)	K.M. Vadi(0.00)	Thoppur (1.65)	Kudigi (0.1)
6	West Flowing Rivers	2011-2012	Mankara (26)	Haladi (3.9)	Mankara (70)	Haladi (4.3)	Kuzhithural (2.5)	Santeguli (0.0)	Pudur (4.46)	Aversha (0.00)
7	Tapi	2011-2012	Gopalkheda (128.17)	Burahnpur (25.6)	Gopalkheda (142.2)	Burhanpur (0.12)	Burhanpur (95.5)	Sarangkheda (0.08)	Burahnpur (0.26)	Sarangkheda (0.08)
8	Narmada	2011-2012	Chandwada (93.7)	Chhidgaon (3.5)	Chandwad (293)	Handia (11.7)	Dhulsar (0.14)	Sandia (0.05)	Hoshangabad (0.42)	Chandwada (0.1)
9	Mahi,Sabarmati & other Basins	2011-2012	Pingalwada (152.1)	Kamalpur (12.0)	Luwara (1161)	Kamalpur (12.0)	Chitrasani (0.73)	Gadat (0.05)	Luwara (1.2)	Gadat (0.06)

Table 6.5.4: Water quality in major river basins…..contd

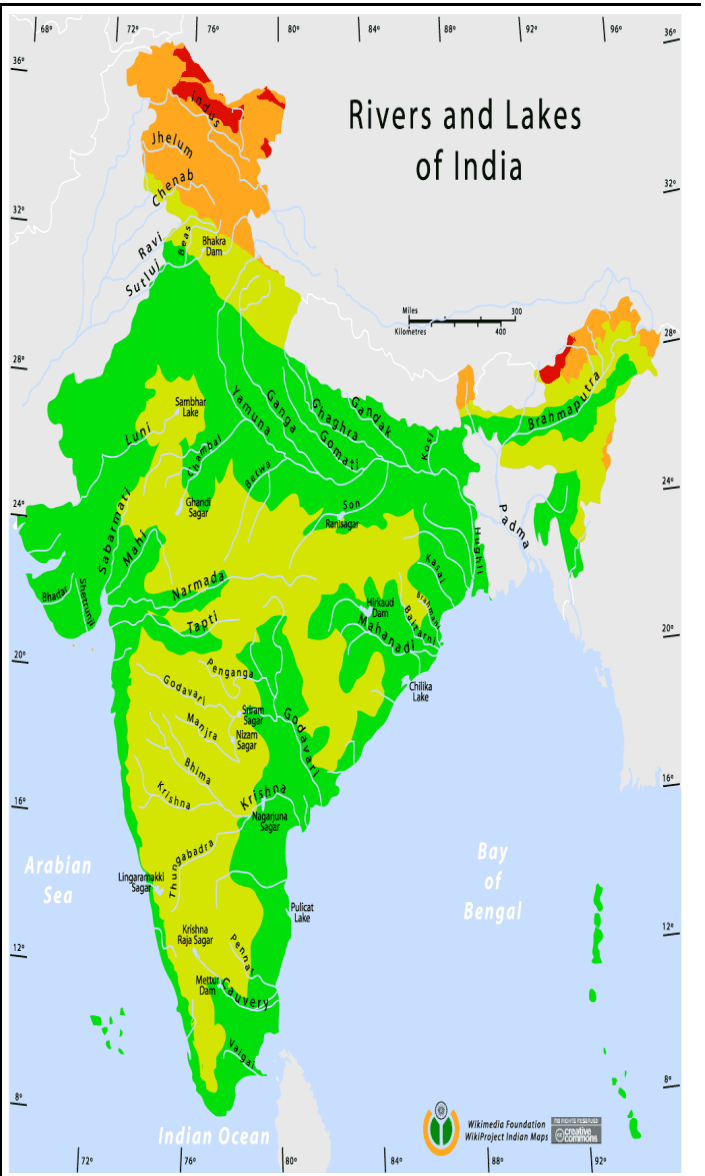
Sl. No	Name of Basin/River	Reference Period	Sulphate (SO_4) Max= 1000.00 (mg/l)				Nitrate (NO_3) Max= 50.00 (mg/l)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	12	13	14	15	16	17	18	19
1	Mahanadi	2011-2012	Basantpur(18.0)	Sundargarh (1.2)	Andhiyar Khore (76.0)	Tikarapara (12.4)	Tikarpara (-)	Rajim (-)	Sundergarh (-)	Selebhata (-)
2	Brahmani	2011-2012	Kamalnga (10.6)	Panposh (1.0)	Kamalange (58.6)	Tilga (7.1)	Jaraikela (0.34)	Jenapur (0.21)	Tilga (0.41)	Panposh (0.36)
3	Godavari	2011-2012	Dhalegaon (29.5)	Konta (0.0)	Satrapur (54.2)	Jagdalpur (4.2)	Dhalegaon (1.00)	Perur (0.00)	P.G. Bridge (2.64)	Konta (0.35)
4	Krishna	2011-2012	T.Ramapuram (182)	Simoga (1.9)	T.Ramapuram (542)	Shimoga (3.0)	Takli (1.51)	Vijaywada (0.0)	Vijaywada (2.750)	Kerlodu (1.1)
5	Cauvery	2011-2012	Thoppur (69.8)	Nellethori (0.3)	Elunuthimangalam (258.3)	Muthankera (1.0)	Sevanur (4.9)	Menangudi (10.1)	T. Bekuppe (18.4)	Nellithurai (0.38)
6	West Flowing Rivers	2011-2012	Badlapur (3.4)	Kalampur (0.01)	Ambarampalayam (28.5)	Malakkara (0.12)	Kuzhithural (1.3)	Kuttyodi (0.01)	Pudur (5.34)	Mangaon (0.3)
7	Tapi	2011-2012	Gopalkheda (15.5)	Bushanpur (10)	Bashanpur (26.4)	Sarankheda (10)	Gopalkheda (0.19)	Sarangkheda (0.1)	Burahnpur (0.25)	Sarankheda (0.1)
8	Narmada	2011-2012	Dhulsar (9.9)	Hoshangabad (1.3)	Dhulsar (21.3)	Belkheri (5)	Dhulsar (2.73)	Mohgaon (0.01)	Pati (21.92)	Chandwada (0.12)
9	Mahi,Sabarmati & other Basins	2011-2012	Vautha (24.3)	Godat (6.1)	Luwara (133)	Derel Bridge (9.6)	Ganod (4.57)	Pingalwada (0.06)	Luwara (6.69)	Gadat (0.1)

Table 6.5.4: Water quality in major river basins ….contd										
Sl. No	Name of Basin/River	Reference Period	Dissolved Oxygen (DO)				Biochemical Oxygen Demand (BOD)			
			Min=6.00 (mg/l)				Max=3.00 (mg/l)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value	Site Name/Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	20	21	22	23	24	25	26	27
1	Mahanadi	2011-2012	Kurubhata (6.5)	Simga (2.8)	Simga (9.3)	Ghatora (6.8)	Jondhra	Kurubhata (0.2)	Simga (4.2)	Manendragaeh (1.0)
2	Brahmani	2011-2012	Jenapur (6.8)	Rsp Nala (2.8)	Gomlai (8.7)	Rsp Nala (6.9)	Jenapur (1.0)	Gomlai (0.2)	Nsandira (3.8)	Gomlai (1.6)
3	Godavari	2011-2012	Dhalegaon (6.8)	Bamni (0.0)	Bhatpally (11.5)	Saigaon (6.4)	P.G. Bridge (1.3)	Mancheual (0.1)	Bamni (45.0)	Saigaon (0.8)
4	Krishna	2011-2012	Yadgir (64)	Paleru Bridge (1.9)	Yadgir (84)	Paleeu Bridge (5.6)	Horalahalli (1.7)	Paleru Bridge(0.1)	Bawapuram (3.3)	T. Ramapuram (0.8)
5	Cauvery	2011-2012	Nellithurai (7.5)	T. Bekuppe (2)	Nallamaran (8.7)	T.Bekuppe (4.7)	T. Bekuppe (6.8)	Akkihebbal (0.1)	T.Bekuppe (14.5)	M.H. Halli (1.2)
6	West Flowing Rivers	2011-2012	Aversha (7.3)	Badlapur (4.3)	Perumannu (7.8)	Kumbidi (6.8)	Aversha (1.3)	Badlapur (0.1)	Ambarampaleyam (2.8)	Haladi (0.2)
7	Tapi	2011-2012	-	-	-	-	Sarangkheda (2.6)	Beeshanpur (0.6)	Burhanpur (4.3)	Gopalkheda (1.8)
8	Narmada	2011-2012	Handia (5.3)	Dindori (1.5)	Patan (8.1)	Kogaon (5.4)	Handia (0.9)	Banni (0.1)	Chandwada (3)	Dhulsai (1.2)
9	Mahi,Sabarmati & other Basins	2011-2012	Kamalpur (9.0)	Voutha(0)	Paderdibadi (12.3)	Luwarea (7.4)	Vautha (4.2)	Abu Road (0.2)	Voutha (38)	Mahuwa (0.8)

Table 6.5.4: Water quality in major river basins….contd										
Sl. No	Name of Basin/River	Reference Period	Total Hardness ($CaCo_3$)				Sodium Percentage			
			Max=300 (mg/l)				Max=60.00(mg/l)			
			Minimum		Maximum		Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest	Highest	Lowest	Highest	Lowest
1	2	3	4	5	6	7	8	9	10	11
1	Mahanadi	2011-2012	Salebhata (89)	Manendragaon (24)	Simga (334)	Baronda (48)	Ghatora (20)	Kucubhata (6)	Andhiyarkhode (46)	Rajim (20)
2	Brahmani	2011-2012	Rsp Nala (69)	Tilga (16))	Jaraikela (285)	Jenapur (101)	Gomlai (15)	Tilga (2)	Tilga (33)	Tolcher (16)
3	Godavari	2011-2012	Dhalegaon (159)	Pathagudem (20)	Bamni (300)	Kamnta (87)	Mancherial (29)	Bamni (3)	Mancherial polavarum (50)	Jagelapur (21)
4	Krishna	2011-2012	T.Rampuram (165)	Honalli (12)	T. Rampuram (389)	Hounali (48)	Kellodu (68)	Dameracherea (0.0)	T. Bowapuram (76)	Dameshvella (3.1)
5	Cauvery	2011-2012	Thopper (323)	Nellethori (12)	Elunuthimangalam (630)	Sakaleshpur (40)	Elunuthimangalam (47)	Thengumarhada (11)	Elunuthimangalam (75)	Thengumarhada (19)
6	West Flowing Rivers	2011-2012	Pudur (120)	Haladi (8)	Ambarempalayam (157)	Haladi (12)	Kuzhithural (36)	Badlapur (21)	Haladi (46)	Belne Bridge (24)
7	Tapi	2011-2012	Gopalkhda (116)	Sarangkheda (99)	Gopalkheda (129)	Sarangkheada(99)	Gopalkheda (54)	Burahnpur (21)	Goplkheda (55)	Buehanpur (48)
8	Narmada	2011-2012	Kogaon (136)	Chhidgaon (54)	Patau (273)	Bamni (107)	Chandwada (48)	Beikheeri (17)	Chandwada (74)	Barman (15)
9	Mahi,Sabarmati & other Basins	2011-2012	Ganod (169)	Luwara (77)	Luwara (716)	Durvesh (106)	Pingalwada (55)	Kamalpur (14)	Pingalwada (74)	Kamalpur (14)

Table 6.5.4: Water quality in major river basins….contd

Sl. No	Name of Basin/River	Reference Period	Sodium Absorption Ratio (SAR) Max=26.00			
			Minimum		Maximum	
			Site Name/ Value	Site Name/ Value	Site Name/ Value	Site Name/ Value
			Highest	Lowest	Highest	Lowest
1	2	3	12	13	14	15
1	Mahanadi	2011-2012	Andhiyarkhode (0.6)	Baronda (0.1)	Andhiyarkhode (2.5)	Rajim (0.3)
2	Brahmani	2011-2012	Rsp Nala (0.4)	Tilga (0.1)	Rsp Nala (0.8)	Talcher (0.3)
3	Godavari	2011-2012	Mancherial (.9)	Bamni (0.1)	Nandgaon (2.4)	Jagdalpur (0.4)
4	Krishna	2011-2012	T. Rampuram (4.9)	Hounali (0.3)	T. Ramapuram (8.4)	Phulgaon (0.4)
5	Cauvery	2011-2012	Elunuthimangalam (3.6)	Thengumarhada (0.2)	Elunuthimangalam (14.9)	Arengaly (0.306)
6	West Flowing Rivers	2011-2012	Mankara (0.732)	Mangaon (0.2)	Mankara (1.404)	Burhanpur (2.3)
7	Tapi	2011-2012	Gopaikheda (3)	Burhanpur (0.6)	Gopalkheda (3.1)	Baraman (0.3)
8	Narmada	2011-2012	Chandwada (2.3)	Mandelshwar (0.2)	Chandwada (7.5)	Kamalpur (0.3)
9	Mahi,Sabarmati & other Basins	2011-2012	Pingalwada (3.3)	Kamalpur (0.3)	Luwara (14.2)	Mataji (0.9)



Sources:CWC, Integrated Hydrological Data Book (Non-Classified River Basin), 2015
Note: N.A - Not available

Table 6.5.5 : 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)** **Tributaries -Kusei (1)**	--------	6
2	**Tributaries**	Karo (1) Kharasrota (2), Koel (5), Sankh (1).	25
3	**Brahmputra (10)** **Tributaries**	Burhidihing (3), Dhansiri (7), Disang (2), Jhanji (1), Subansiri (1), Bhogdoi (1), Bharalu (1) Borak (2), Deepar Bill (1), Digboi (1), Mora Bharali (1),Teesta (5), Dickhu (1), Maney(2), Ranchu (2), Rangit (5), Jai Bharali (1), Kathakal (1), Kharsang(1), Kolong (2), Manas (1), Pagldia (1), Chathe (1), Dzu (1), Kapili (1), Beki (1), Kundil (1) Kushiara (1), Panchnai (1), Sankosh (1), Sonai (1), Kohara (1), Ranga (1), Bogindai (1), Dikhow (1), Kaljani (1), Karola (1)	68
4	**Cauvery (20)** **Tributaries**	Arkavati (1), Amravati (1), Bhawani (5), Kabini (4), Laxmantirtha (1), Shimsa (2), Hemavati (1) Vagachi (1)	36
5	**Ganga (52)** **Tributaries**	Alakananda-upper Ganga (4),Madakini -upper Ganga (1), Ajay (1) Ashwani (1), Barakar (2), Batta (2),Betwa (10), Bhalla (2), Bichia (1),Bihar (1), Bokaro (1), Burhi Gandak (1), Chambal(8),Churni (3), Daha (3), Damodar (12), Dhela (2), Dhous (1), Dwarakeshwari (1), Dwarka (2), Farmer (1), Gandak (3), Giri (3), Sot (1), Kamala (2), Kanshi (1), Khan (3), Kichha (1), Kolar (1), Konar (3), Koshi (2), Kosi (Uttarakhand) (1), Kshipra (3), Mahananda (3), Mandakini (Madhya Pradesh) (1), Manusmar (1), Matha Bhanga (1), Maurakshi (1), Nalkari (1), Nandaur (2), Pabbar (3), Parvati (4), Pilkhar (1), Ramganga (1), Ram Rekha (1), Rapti (2), Rihand (2), Ruppanarayan (2), Sai (2), Sankh (1), Silabati (1), Sindh (1), Sirsa (1), Saryu - Ghaghra (4), Sone (5), Suswa (1), Tons (Himachal Pradesh) (1), Tons (Madhya Pradeh) (2), VAruna (2), Vindyadhri (2), Yamuna (27)	233
6	**Godavari (35)** **Tributaries**	Manjira(6), Maner(2), Nira(I),), Wainganga{8), Wardha(6), Kolar (1), Kannhan (3), Purna (3), Indravati (2), Sankhani (1), Nakkavagu (1), Vamsadhara (1), Darna (5), Bindusar (1), Penganga (3), Wena (2), Kinnersani (1), Sabari (1)	83
7	**Indus**	Beas (23), Chenab (1), Jhelum (3), Larji (1), Parvati (3), Ravi (6), Sutlej (22), Tawi (1), Gawkadal (1), Chuntkol(1), Sirsa(3), Swan (1), Basoa (1), Binwa (1), Negual (1), Siul (1), Spiti (1), Suketi Khand (1)	72
8	**Krishna (22)**	Bhadra (3), Bhima (12), Ghataprabha (2), Malprabha (3), Muneru (1), Musi (3), Nira (5), Paleru (1), Tunga (1), Tungabhadra (6), Panchganga (4), Chandrabhaga (2),Kagin (1), Koya (1) , Mula (2), Mutha (4), Mula-Mutha (2), Venna (3), Pawana (6), Indrayani (3), Hundri (1), Kundu (1), God (1), Sina (1), Urmodi (1), Vel (1)	93
9	**Mahi (9)**	Anas (1), Panam(1), Jammer (1), Malei (1), Shivna (1), Chillar (1)	15
10	**Mahanadi (22)**	Ib (4), Hasdeo (2), Kathajodi (1), Kharoon (4), Kuakhai (3), Sheonath (3), Birupa (1), Apra (1), Kelo (2), Bheden (1), Tel (1), Serua (1), Daya (1), Sankha (1)	48
11	**Narmada (21)**	Chhota Tawa (1), Gour (1), Katni (1), Kunda (1)	25
12	**Pennar (5)**	----	5
13	**Sabarmati (9)**	Meswa (1), Shedhi (1), Khari (1).	12
14	**Subarnerekha (12)**	Jumar (1)	13
15	**Tapi (14)**	Girna (2).	30

Table 6.5.6 : River-basin wise distribution of water quality monitoring stations--Concld.

Sl. No.	River (main stream) Lake etc.	Tributaries	Total Stations
1	2	3	4
16	**Medium rivers**	Ambika (1), Ulhas (3), Ulhas-Bhasta (3), Ulhas -Kalu (1) Imphal (4), Mandovi (2), Palar (1), Pamba (3), Pariyar (7), Rushikulya (2), Tambiraparani (7), Achankoil (2), Chalakudy (1), Damanganga (14), Ghaggar (19), Kallada (1), Kali Karnataka (1), Manimala (2), Mindhola (1), Nagavalli (4), Amlakhadi (2), Chaliyar (2), Iril (2), Kharkhala (1), Karmana (1), Kolak (2), Kundalika (4), Meenachil (1), Muvattupuza (1), Patalganga (7), Umtrew (1), Vamanpuram (1), Zuari (2), Gumti (2), Kalna (1), Valvant (1), Madai (1), Khandepar (2), Asanora (1), Bhadar (1), Neyyar (1), Ithikkara (1), Kadalundy (1), Kuttiyady (1), Mahe (2), Kuppum (1), Neelsvaram (2), Karingoda (1), Chandergiri (1), Chitrapuzha (1), Nambul (2), Ganol (1), Simsang (1), Myntdu (1), Arasalar (1), Kodra (1), Haora (1),Khuga (1), Khujairok (1), Sekmai (1), Markanda (3), Sukna (1), Baleshwar Khadi (1), Netravati (1), Kumardhara (1),Purna (1), Kaveri(1), Dhadar (1), Tiawng (2),Tuirial (2), Talpona (1), Bhogavo (1), Tiveni Sangam (1), Mapusa (1), Bicholim (1), Chapora (1),Kushawati (1), Sal (2), Meethi (1),Savitri (5), Vashisti (3), Neyyar (1), Mamom (1), Ayroor (1), Pallickal (1),Karuvannurr (1),Puzhackal (1), Keecheri (1), Thirur (1), Kadalundi (1), Kallai (1), Korapuzha (1), Thallassery (1), Ancharakandy (2), Kuppam (1), Ramapuram (1), Peruvamba (1), Kavvai (1), Pullur (1), Mogral (1), Shriya (1), Uppala (1), Manjeswar (1) Korayar (1), Bharathapuzha (2), Kadambayar (2), Gautami- Godavari (2), Coringa (1), Budhabalanga (2), Vanshadhara(2), Kerandi (1), Amba (1), Kan (1), Muchkundi (1), Pehlar (1), Surya (3), Tansa (1), Vaitarna (1)	216
17	**Lakes (117)**	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) Nalsarovar (1), Bindusaraovar(1), Sahastriling Sarovar (1), LakhotaTalav (1), Narshimehta Talav(1),Nadiad city Lake (1), (RAnjitnagar TAlav(1),Ankleshwar reservoir (1), Dharoi dam(1), Kuwadava (1), Moticher lake (1), Mayem lake (1), Janunia talav (1),Yashwant sagar (1),Sirpur talav (1), Kali sindhi reserviur (1), Periat tank (1), Sgagpura (1), Madhav lake(1), Nagchun (1), Karwa dam (1), Khandari reservoir (1), Daloni Beel (1), Mer Beel (1), Govindgarh tank (1),Bilawali talav (1) Bhoothathankettu reservoir (1), Dimna lake (1), Edamalayar reservoir (1), Hazaribag Meethajhee (1), Kondacharala -aava lake (1), Laxnubarayan Chevuru (1), Malampuzha reserviur (1), Mirakam lake (1), Noor Md. Kunta (1), Oazgassu reserviur (1), Ranchi lake (1), Topchachi lake (1), Vembabadu lake (1), Chilka lake (1), Anshupa lake (1), Kawar lake (1), Moti Jheel (1), Samarpur lake (1), Shukra Tal (1), Khaziar lake (1), Raiwalsar lake (1), Belboni lake (1), Koch Bihar lake (1), Mirikh lake (1) Saheb bandh (1), Sinchal lake (1), Tarekeshwar lake (3), Delo reservoir (1)	170
	Tanks (9)	Dharamsagar (1), Bibinagar (1), Kistrapetrareddy (1), Goysagar (1),Gandigudem (1),Kajipally tank (1), Mallapur Tank (1), Premajipet tank (1)	
	Ponds (44)	Elangabeel System (1), Lakshadweep (1), Olpad village pond (1), Bishnu Pudhkst pukhuti (1), Bor Beel (1), Bor pukhuri (1), Botodriva pond (1), Chand dubi beel (1), Deepar Beel (1), Dighali pukhuri (1),Dhudia talav (1), Baskandi pond (1), Galabeel (1), Ganga pukhuri (1), Gaurisagar (1), Gopur tank (1), Padum pukhuri (1), Hordai pukhuri (1), Jaipal pukhuri (1), Mahamaya pukhuri (1), Rajdhania pukhuri (1), Raja pukhuri (1), Rajmaw pukhuri (1), Saranbeel (1), Sivasagar tank (1),Subhagya kund (1), Sai Chevuru (1), Asani kunta (1), Durgam Chevuru (1), Pedda Chevuru (1), Nalla Chevuru (1), Bhadrakali Chevuru (1), Shiv Ganga Pond (1), Padmanabha Swamy Temple Pond (1), Bindusagar (1), Narendra polhari (1), Markanda pokhari (1), Indradyumna (1), Swetaganga (1), Parvatisagar (1), Tighi Talab (1), Suraj Kund (1), Laxmi Pond (1), Maahil Pond(1)	
18	**Creeks, Canals and Drains**	Creeks (8),Sea Water (7), Agra Canal (1), Gurgaon Canal (1), Western Yamuna Canal (11), Agartala Canal (1),Cuncolim canal (2), Panoli canal (1), Narmada canal (1), Cumbvarja canal (1), Samarla Kota canal (1), Tulje Bagh Canal (1), Kharda canal (1), NOAI canal (1), Upper Ganga Canal (1), Taladanda canal (3), Drains (18)	60
19	**Groundwater**	----	490
		Total	**1700**

Source: Monitoring of Indian Aquatic Resources Series: MINARS/ /2009-10 ,Status of water quality in India- 2009 ,Central Pollution Control Board.

G - GEMS (Global Environmental Monitoring System),

M - MINARS (Monitoring of Indian National Aquatic Resources)

YAP- Yamuna Action Plan

Table 6.5.7 : State wise river water quality

Sl.No.	State	Dissolved Oxygen (mg/l)			pH			Conductivity (µmhos/cm)		
		MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
1	2	3	4	5	6	7	8	9	10	11
1	Andhra Pradesh	0	11.7	6.6	2	9.6	7.8	76	14920	641
2	Assam	0	18	7.2	5.8	8.1	7.2	43	868	193
3	Bihar	2.6	9.4	8.4	7.1	8.6	8	162	476	329
4	Chhattisgarh	0.8	8.5	7.3	7	8.8	7.7	85.5	755	258
5	Daman Diu	-	-	-	7.2	8.1	7.6	202	348	277
6	Delhi	0	10.5	2.6	7.1	8.3	7.7	230	1590	767
7	Goa	3.6	8.1	6.5	6.6	8	7.2	8.2	1370	118
8	Gujarat	0	12.8	6.1	6.8	8.9	8	138	55300	2627
9	Haryana	0.42	10.6	7.3	4.5	8.7	7.6	150	3640	665
10	Himachal Pradesh	2.2	13.3	8.8	7	8.7	7.8	53	1495	324
11	Jammu & Kashmir	1.8	9.8	7.5	6.7	8.8	7.6	163	548	247
12	Jharkhand	5.1	8.9	7.6	6	7.8	7	-	-	-
13	Karnataka	0.7	14	7.1	6	8.9	7.9	20	2400	482
14	Kerala	0	8	6.2	5.4	8.2	6.6	24	44000	923
15	Madhya Pradesh	0	16	7.1	6.8	10	7.8	104	9340	734
16	Maharashtra	0	9.9	5.8	5.8	8.9	7.6	44	55830	651
17	Manipur	3.8	9.6	7.2	6.5	8	7.4	141	735	404
18	Meghalaya	1.4	10	6.8	2.9	7.4	6.2	123	950	294
19	Mizoram	4.3	8.7	6.8	7.5	8.3	7.9	70	220	148
20	Nagaland	2.4	9.2	6.2	4.7	8.7	7.8	62	400	160
21	Odisha	3.4	9.7	7.7	6.7	8.5	7.8	17.4	48400	1384
22	Puducherry	6.6	7.6	7	6.7	8. 4	7.6	398	715	593
23	Punjab	1.2	8.9	6.2	6.5	7. 9	7.4	162	1600	575
24	Rajasthan	3.2	7.8	5.7	7.2	8.7	8.1	250	880	453
25	Sikkim	8	12.5	10.8	6	7.2	6.6	210	290	255
26	Tamilnadu	0.6	9.3	6.9	5.7	8.8	7.4	42	28700	556
27	Tripura	4.2	6.9	5.8	7.1	8.1	7.6	110	180	141
28	Uttar Pradesh	0	20.6	6.7	7	9.5	7.9	122	8010	610
29	Uttarakhand	5.6	10.2	8.5	6.5	8.4	7.3	40	398	154
30	West Bengal	2.5	15.2	6.7	6.8	8.7	7.9	60	68700	1244

cont..

Table 6.5.7 : State wise river water quality

(concluded)

Sl.No.	State	BOD (mg/l)			Total Coliform (MPN/100ml)			Fecal Coliform (MPN/100ml)		
		MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
1	2	12	13	14	15	16	17	18	19	20
1	Andhra Pradesh	0.1	50	2.7	3	28000	1888	0	800	44
2	Assam	0.3	32	1.9	1	240000	3816	0	24000	653
3	Bihar	1.7	2.9	2.3	700	90000	11707	300	50000	4823
4	Chhattisgarh	0.2	3.4	1.6	4	1100	110	0	0	0
5	Daman Diu	-	-	-	-	-	-	-	-	-
6	Delhi	1	70	19.9	19000	103000000	12024579	500	10900000	1256411
7	Goa	0.7	4.7	2	4	5400	511	2	1300	168
8	Gujarat	0.1	50	4.4	0	2100000	31885	0	460000	12567
9	Haryana	1	590	18.8	112000	6600000	804484	180	760000	76726
10	Himachal Pradesh	0.1	7.6	0.7	2	4400000	127730	0	430000	6349
11	Jammu & Kashmir	0.1	40	2.4	-	-	-	-	-	-
12	Jharkhand	0.4	10.5	2.9	750	2400	1516	110	930	287
13	Karnataka	0.1	7	1.7	1	160000	4791	0	90000	2031
14	Kerala	0.1	11	1.1	0	56000	2318	0	44000	1236
15	Madhya Pradesh	0.2	50	4.4	0	2400	349	0	280	7
16	Maharashtra	1.2	50	7.6	0	1800	439	0	1600	100
17	Manipur	-	-	-	5	415	101	-	-	-
18	Meghalaya	1	7.7	3.3	31	2200	552	23	1700	402
19	Mizoram	0.3	1.7	0.9	3	15	5	-	-	-
20	Nagaland	0.4	2.8	1.1	-	-	-	-	-	-
21	Odisha	0.4	6.4	1.9	630	1600000	18088	230	160000	6293
22	Puducherry	0	1	0.3	-	-		-	-	-
23	Punjab	0	50	9.9	35	2500000	81441	0	500000	13787
24	Rajasthan	0.1	6.2	1.7	4	210	32	3	14	4
25	Sikkim	2	3.8	2.8	80	350	238	40	220	118
26	Tamilnadu	0.1	23	1.7	21	5400	574	13	3500	375
27	Tripura	0.5	4	2.3	180	620	483	17	560	356
28	Uttar Pradesh	1	364	9.2	160	140000000	1808500	20	1790000	90302
29	Uttarakhand	0.9	7.6	1.8	0	10100000	559977	1	380000	27016
30	West Bengal	0	6.8	2.3	540	1400000	139135	280	850000	62013

Source: Central Pollution Control

Note : BOD : Bio chemical Oxygen demand

(µmhos/cm) : Micromhos per centimetre; MPN: Most Probable Number

6.6 Water Pollution –causes

6.6.1 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.

6.6.2 Water pollution 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. 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. 13 major water polluting industries have been identified and are closely monitored by the Central Pollution Control Board. A status report of the waste water generation, collection and treatment in metro cities is available in table 6.6.1

6.6.3 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.

6.6.4 Water pollution from domestic and human wastewater is severely harmful for humans too. The most common contamination in the water is from the disease bearing human wastes, which is usually detected by measuring fecal coliform levels. In some parts of the country, ground water is also found to be polluted. As elaborated in table 6.6.2 , the occurrence of Arsenic in ground water has been reported from a number of Districts in various States.

6.6.5 The diseases commonly caused due to contaminated water are diarrhea, trachoma, intestinal worms, hepatitis, etc. It is clearly evident that more stringent preventive and protective measures are required to tackle the impact of water pollution.

Table 6.6.1 : 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	Mumbai	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 Farm
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	Chennai	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	Agriculture
18	Patna	1099647	917243	219.0	--	219.0	164.0	74.9	105.0	Y	N	River, Fisheries
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
mld - Million Litre per day

Table 6.6.2: Occurrence of high arsenic in groundwater of some states of India

State	District	Blocks where high Arsenic is observed wells of CGWB
Assam	Dhemaji	Dhemaji, Bodordloni,Sisiborgaon
Bihar	Bhojpur	Barhara, Shahpur, Koilwar, Arrah, Bihiya, Udawant Nagar
	Bhagalpur	Jagdishpur,Sultanganj, Nathnagar
	Begusarai	Matihani, Begusarai, Barauni, Balia, Sabehpur Kamal, Bachwara
	Buxar	Brahmpur,Semary, Chakki, Buxar
	Darbhanga	Biraul
	Khagaria	Khagaria, Mansi, Godri, Parbatta
	Kishangarh	Kishanganj, Bahadurganj
	Katihar	Manasahi, Kursela, Sameli, Barari, Manihari, Amdabad
	Lakhiserai	Piparia, Lakhiserai
	Munger	Jamalpur, Dharhara, Bariarpur, Munger
	Patna	Maner, Danapur, Bakhtiarpur, Barh
	Purnea	Purnea East, Kasba
	Saran	Dighwara, Chapra, Revelganj, Sonpur
	Samastipur	Mohinuddin Nagar, Mohanpur, Patori, Vidhyapati Nagar
	Vaishali	Raghopur, Hajipur, Bidupur, Desri, Sahdei Bujurg
Chattisgarh	Rajnandgaon	Ambagarh Chouki
West Bengal	Bardhman	Purbasthali I & II , Katwa, I & II and Kala II
	Haora	Uluberia II and Shampur II
	Hugli	Balagarh
	Malda	English Bazar, Manikchak, Kaliachak I, II & III, Ratua I and II
	Murshidabad	Raninagar I & II, Domkal, Nowda, Jalangi,Hariharpara, Suti I & II, Bhagwangola I & II, Beldanga I & II, Berhampur, Raghunathganj I & II, Farakka, Lalgola, Murjigang, Samsherganj
	Nadia	Karimpur I & II, Tehatta I & II, Kaliganj, Nawadwip, Haringhata, Chakda, Santipur, Naksipra, Hanskhali, Krishnagarh,Chapra, Ranaghat I & II, Krishnanagar I & II.
	North 24 Parganas	Habra I & II, Barasat I & II, Rajarhat, Deganga, Beduria, Gaighata, Amdanga, Bagda, Boangoan, Haroa, Hasnabad, Basirhat I & II, Swarupnagar, Barackpur I & II Sandeshkhali II
	South 24 Parganas	Baruipur, Sonarpur,Bhangar I & II, Joynagar I, Bishnupur I & II, Mograhat II, Budge Budge II
Uttar Pradesh*	Agra	Agra, Etmadpur, Fatehabad, Khairagarh
	Aligarh	Jawan Sikandarpur
	Ballia	Belhari, Baria, Muralichapra, Reoati, Siar
	Balrampur	Gaindas Bujurg, Gainsari, Harraiyyabazar, Pachparwa, Sridatganj, Tulsipur
	Gonda	Bhelsar, Colonelganj, Haldarmau, Katrabazar, Nawabganj, Pandari Kripal, Tarabgani, Wazirganj
	Gorakhpur	Gorakhpur
	Lakhimpur Kheri	Daurahara,Ishanagar, Nighasan, Pallia, Ramia Vihar
	Mathura	Mathura
	Moradabad	Moradabad

Sources : Ministry of Water Resources, 2014

* Only in some locations

6.7 Navigable Inland Waterways

6.7.1 A stretch of water, not part of the sea, over which craft of a carrying capacity not less than 50 tonnes can navigate when normally loaded is termed a navigable inland waterway. This term covers both navigable rivers and lakes (natural water-courses, whether or not they have been improved for navigation purposes) and canals (waterways constructed primarily for the purpose of navigation).

6.7.2 India is endowed with a variety of navigable waterways comprising river systems, canals, back waters, creeks, and tidal inlets. However, navigation by mechanized crafts is possible only over a limited length. The Inland Water Transport (IWT) is functionally important in regions covered by the Brahmputra and the Ganges in the North East and Eastern parts of the country, Kerala, Goa and in the deltas of the rivers of Krishna and Godavari.

6.7.3 Length of waterways along with its navigable length is an indicator of inland water potential of a state. Table 6.7.1 gives a snapshot of the navigable waterways in the states.

Table 6.7.1 : Navigable waterways in India 2013-14

(Km.)

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length		Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4		1	2	3	4
1	**ANDHRA PRADESH**				5	**GUJARAT**		
	Godavari	1530	171			Narmada	161	50
	Krishna	1400	157			Tapti	140	15
	Others **	649	476			Ambica	136	20
	Total	**3579**	**804**			Auranga	75	4
						Puma	141	13
2	**ASSAM**							
	Brahmaputra	2800	891			**Total**	**653**	**102**
	Borak	900	152					
	Subansiri	468	111		6	**KARNATAKA**		
	Dhansiri	135	25			Sharavathi	80	27
	Manash	375	104			Tungabhadra	375	375
	Aai	.	64			Malaprabha	230	230
	Beki	85	55			Ghataprabha	160	160
	Jiabhoroli	90	60			Krishna	325	125
	Puthimari	..	64			Cauvery	270	34
	Disang	25	25			Kabini	117	30
	Kopili	50	50			Gurupur	80	20
	Dikhow	92	40			Gangolli	48	20
	Katakhal/Dhaleswari	150	120			Bheema	860	125
	Soani	.	48			Udyavara	37	14
	Mahura	.	32			Netravathi	96	26
	Buridihing	120	80			Kali	184	29
	Chiri	.	42			**Total**	**2862**	**1215**
	Jiri	.	64					
	Total	**5290**	**2027**		7	**KERALA**		
						Manjeswar	16	3.2
3	**BIHAR**					Uppala	50	-
	Damodar	…	---			Shiriya	67	4.8
	Ganga	510	510			Mogral	34	-
	Gandak	323	300			Chandragiri	105	12.8
	Koshi	236	160			Chittari	25	-
	Ghaghra	100	100			Nileswar	46	11.2
	Sone	226	31			Kariangoda	64	24
	Mahananda	140	--			Kavvai	31	9.6
	Burhi Gandak	400	--			Peruvamba	51	16
	Punpun	200	--			Ramapuram	19	6.4
	Phalgu Harihar	300	--			Kuppan	82	24
	Kiul	100	--			Valapattanam	110	44.8
	Kari Koshi	150	--			Anjara Kandy	48	27.2
	Chandan	100	--			Teiciherry	28	21.6
	Karmnasha	144	--			Mahe	54	24
	Others	860	290			Kuthiadi	74	9.6
	Total	**3789**	**1391**			Korapuzha	40	24.8
4	**GOA**					Kallai	22	9.6
	Mandovi	78	66			Chaliyar	169	68.4
	Zuari	68	68			Kadalundy	130	43.2
	Mapusa	27	27			Tirur	48	9.6
	Chapora	34	32			Bharathappujha	209	40
	Tiracol	29	23			Keecheri	51	-
	Sal	20	15			Puzhakkal	29	-
	Others	17	17			Karivannur	48	24
	Total	**273**	**248**			Chalakkudy	130	16
							1780	**474.8**

Table 6.7.1 : Navigable waterways in India 2013-14 .....Contd.

(Km.)

Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length		Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4		1	2	3	4
	Kerala	**1780**	**474.8**					
	Periyar	244	72		9	**ORISSA**		
	Muvattei Puzha	121	25.6			Mahanadi	493	199
	Meenachil	78	41.6			Brahmani	541	277
	Manimala	90	54.4			Baitarani	344	32
	Pamba	176	73.6			Subarnarekha	--	50
	Achan coil	128	32			Budha Balanga	--	35
	Pallickal	42	2			Dhamara	--	20
	Kallada	121	40			Salandi	--	17
	Ithikkara	56	16			Panchputra	--	21
	Ayroor	17	1			Pernei	--	45
	Vamanapuram	88	11.2			Hatel	--	30
	Mamom	27	1			Bansagadal	--	32
	Karamana	68	-			Hansua	--	37
	Neyyar	56	**-**			Tirkota	--	18
	Total	**3092**	**845.2**			Jamboo	--	6
						Gobari	--	16
8	**MAHARASHTRA**					Ramchandi	--	16
						Kharansi	--	14
	Dande River	2	1			Batigharia	--	14
	Pangere River	2	1			Birupa	--	110
	Girye River	3	1			Genguti	--	45
	Kajali River	35	5			Luna	--	37
	Kalbadevi River	10	2			Devi	--	20
	Are River	6	1			Pradhi	--	15
	Jog River	10	5			Kadha	--	30
	Kelshi River	10	3			Kusavadra	--	25
	Savitri River (Bankot to	45	40			Daya	--	9
	Kal River	6	4			Rajua	--	7
	Vaitarna River	24	9			Makara	--	11
	Ulhas River	32.5	28			Ohers **	--	367
	Mahim River (Bay)	1.5	1			**Total $**	**1378**	**1555**
	Amba River	23	20					
	Patalganga	11	6.5		10	**TAMIL NADU**		
	Kundalika River	16	16			Ananths Victoria Martha	27	12
	Mandad River (Rajpuri	14	10			North Buckingam Canal	58	.
	Mhasla River (Turmad	9	5			Central Buckingam Cana	7	.
	Vashisti River (Dabhol	45	38			South Buckingam Canal	105	.
	Jagbudi River	20	20			**Total**	**197**	**12**
	Shastri River/Jaigad	45	40		11	**UTTAR PRADESH**		
	Rajapur River	30	30					
	Vagothan	38	22			Gomti	960	
	Gad River (Kalaval	13	7			Rapti	778	
	Terekhol River/Creek	28	28			Ghaghra	1116	
	Karli River (Malva)	23	13			Ganga	2345	425#
	Others	129	105			Sai	760	
	Total	**631**	**462**			Tons	485	
						Total	**6444**	

Table 6.7.1 : Navigable waterways in India 2013-14				Table 6.7.1: Navigable waterways in India 2013-14 ….Concluded.			
Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length	Sl. No.	State/River/Canals/ Lakes	Total Length	Navigable Length
1	2	3	4	1	2	3	4
12	**WEST BENGAL**			13	**NAGALAND*** **		
	Hooghly	580	580		Doyans	185	105
	Mahananda	206	58		Tizu/Zungki	287	90
	Ajoy	174	174		Dhansiri/Chathe	170	75
	Jalangi	232	232		Dikhu	120	52
	Dwarka	129	129		Tapi-Yangnyn	95	18
	Bakreswar	102	102		Tsurang/Disai	60	15
	Damodar	437	437		Others	20	20
	Dwarekeswar	103	103		**Total**	**937**	**375**
	Silabati	135	135	14	**MIZORAM**		
	Kumari	308	308		R.TlawNg (Dhaleswari)	185	81
	Ichamati	232	232		R.Kolodyne (Chhimtuipo	138	80
	Others @	2103	2103		Khawtthlang Tuipui	128	63
	Total	**4741**	**4593**		R. Tuichawrg	174	73
					Tul River	138	51
					Others	24	24
					Total	**787**	**372**

Source : IWT Directorate of States & IWAI. Transport Research Wing, Ministry of Surface Transport

* Relates to 2012-13 ** Including Ca *** Related to 2007-08

@ Includes 268 Kms. Each of Total Length and Navigable Length pertaining to cannals.

\- Not available

\# Navigable length pertains to NW I for Allahabad-Buxar stretch in Uttar Pradesh is available.

$ Total length is less than navigable length as length of canals is not provided whereas navigable length of canals is provided.