Water Quality & Waste Water Management-Vision 2012-17

J.S.Kamyotra
Member Secretary
Central Pollution Control Board

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Water Quality Monitoring

Water is Precious and scarce Resource

- Only a small fraction (about 3%) is fresh water
- Rainfall is highly uneven with time and space
- On an average there are only 40 rainy days
- Out of 4000 BCM rainfall received, about 600 BCM is put to use so far
- Water resources are over-exploited resulting in major WQ problems

ANNUAL WATER REQUIREMENT FOR DIFFERENT USES (in km^3)

Uses	Year 1997-98	Year 2010			Year 2025			Year 2050		
		Low	High	%	Low	High	%	Low	High	%
Irrigation	524	543	557	78	561	611	72	628	807	68
Domestic	30	42	43	6	55	62	7	90	111	9
Industries	30	37	37	5	67	67	8	81	81	7
Power	9	18	19	3	31	33	4	63	70	6
Inland Navigation	0	7	7	1	10	10	1	15	15	1
Environment –Ecology	0	5	5	1	10	10	1	20	20	2
Evaporation Losses	36	42	42	6	50	50	6	76	76	7
Total	629	694	710	100	784	843	100	973	1180	100

(NCIWRD, 1999)

Major Water Quality Issues

- Pathogenic (Bacteriological) Pollution
- Oxygen Depleting organic pollution
- Salinity
- Toxicity (micro-pollutants and other industrial pollutants)

Surface Water

- Eutrophication
- Oxygen depletion
- Ecological health

Ground Water

- Fluoride
- Nitrate
- Arsenic
- Iron
- Sea water intrusion

OBJECTIVE OF WATER QUALITY IN RIVERINE SYSTEM

- River are perfect eco system and therefore ultimate goal is to conserve the ecosystem in the river
- Ecological flow throughout the year to support all forms of aquatic life
- Maintenance of wholesomeness of water bodies

WATER QUALITY MONITORING NETWORK (NWMP)

- Present network -1700 stations - 27 States and 6 Union Territories.
- Monitoring - Monthly - Surface waters ,Half yearly - Ground water.
- Monitoring network - 353 Rivers, 107 Lakes, 9 Tanks, 44 Ponds, 8 Creeks, 14 Canals, 18 Drains and 490 Wells.
- Monitoring stations - 980 on rivers, 117 on lakes, 18 on drains, 27 on canals, 9 on tank, 15 on creeks/seawater, 44 on pond and 490 groundwater stations.
- Three-tiered programme- GEMS, Monitoring of Indian National Aquatic Resources System (MINARS) and Yamuna Action Plan (YAP).
- Analysis- 28 parameters consisting of physico-chemical and bacteriological parameters.
- Trace metals (9) and pesticides (28) analyzed in selected samples.
- Biomonitoring is carried out on specific locations.

Strengthening of Water Quality Monitoring Network

- Number of monitoring stations will be increased to 2500 by the end of 11th Plan and 5000 by 2017.
- The optimum network shall be 10000 monitoring stations.
- Monitoring of micro pollutants will be strengthened with quality assurance.

IDENTIFICATION OF POLLUTED RIVER STRETCHES

Water quality observations exceeding the water quality criteria are analysed and locations are identified as polluted.

Polluted locations in a continuous sequence are defined as polluted river stretches and are prioritised.

Priority	BOD Exceedance (mg/l)	Number of Stretches
Priority 1	> 30	35
Priority 2	~ 20-30	15
Priority 3	~10-20	26
Priority 4	~ 6-10	38
Priority 5	~ 3-6	36
Total		**150**

STATEWISE LIST OF POLLUTED STRETCHES

STATES	PRIORITY-1 No. of Stretches	PRIORITY-2 No. of Stretches	PRIORITY-3 No. of Stretches	PRIORITY-4 No. of Stretches	PRIORITY-5 No. of Stretches	TOTAL
ANDHRA PRADESH	2	-	1	3	3	9
ASSAM	2	-	1	1	-	4
BIHAR	-	-	-	1	-	1
CHATTISSGARH	-	-	-	2	1	3
CHANDIGARH	3	-	-	-	-	3
DELHI	1	-	-	-	-	1
GUJARAT	4	-	4	4	7	19
HARYANA	3	-	1	-	1	5
HIMACHAL PRADESH	1	-	-	2	-	3
JHARKHAND	-	-	1	1	-	2
KARNATAKA	-	1	3	2	5	11
KERALA	-	-	1	-	2	3
MADHYA PRADESH	2		2	3	2	9

STATEWISE LIST OF POLLUTED STRETCHES (CONTD.)

STATES	PRIORITY-1	PRIORITY-2	PRIORITY-3	PRIORITY-4	PRIORITY-5	TOTAL
	No. of Stretches	No. of Stretches	No. of Stretches	No. of Stretches	No. of Stretches	
MAHARASHTRA	8	3	8	7	2	28
MANIPUR	-	1	-	-	-	1
MEGHALAYA	-	-	-	2	-	2
NAGALAND	-	-	-	-	1	1
ORISSA	-	-	-	1	3	4
PONDICHERRY	-	-	-	1	-	1
PUNJAB	2	-	-	-	-	2
RAJASTHAN	-	4	-	1	-	5
SIKKIM	-	-	-	-	4	4
TAMILNADU	3	1	-	4	1	9
TRIPURA	-	-	1	-	1	2
UTTAR PRADESH	4	2	3	1	2	12
UTTARAKHAND	-	3	-	-	-	3
WEST BENGAL	-	-	-	2	1	3
TOTAL	**35**	**15**	**26**	**38**	**36**	**150**

Status of Ground Water Contamination

Ground Water Resources

- Groundwater is used for various purposes including drinking vastly in India
- The quality of water and its distribution over different regions is uneven and causes problems of scarcity and suitability
- This scarce commodity be used as rationally and efficiently as possible

Urban Scenario

- Rapid increase in population in large urban agglomerations associated with industrial growth resulted in massive increase of wastewater and solid wastes and ultimately deteriorated the water quality of aquatic resources
- Inadequate arrangements for collection and treatment of municipal wastewater and municipal solid waste, major part of the wastewater as well as leachate from solid waste dump sites being stagnating and percolating in the urban areas and polluting the groundwater

Ground Water Quality Assessment

- CPCB conducted studies of groundwater quality in urban centres
- Studies revealed that the concentration of various pollutants are increasing in urban areas
- Higher concentration of total dissolved solid and micro pollutants are detected in pockets
- Coliform bacteria, which are indicator of fecal contamination, are also detected in aquifers of urban centers
- Presence of α-BHC, endosulphan and methoxychlor pesticides in ground water of the metropolitan cities is observed but their content are well within the permissible limits for drinking water
- Presence of pesticides in ground water attributed to their use in vector control programmes and agricultural activities

Ground Water Quality Monitoring Network

State	No. of Locations	State	No. of Locations
Andhra Pradesh	24	Madhya Pradesh	18
Assam	32	Maharashtra	30
Bihar	45	Manipur	5
Chandigarh	7	Meghalaya	5
Chhatissgarh	4	Mizoram	2
Daman, Diu, Dadra and Nagar Haveli	12	Nagaland	-
Delhi	-	Orissa	15
Goa	6	Pondicherry	15
Gujarat	42	Punjab	6
Haryana	-	Rajasthan	37
Himachal Pradesh	41	Sikkim	-
Jammu & Kashmir	-	Tamil Nadu	2
Jharkhand	-	Tripura	7
Karnataka	-	Uttar Pradesh	40
Kerala	30	Uttarakhand	1
Lakshadweep	15	West Bengal	49
Total			**490**

Ground Water Quality Hot Spots

- Unconfined aquifers are extensively tapped for water across the country and are of paramount importance
- Chemical parameters like TDS, Chloride, Fluoride, Iron, Arsenic and Nitrate etc are main constituents defining the quality of ground water in unconfined aquifers
- Parameters in ground water exceeding permissible limit in the absence of alternate source has been considered as ground water quality hotspots

<u>Parametric Limits (</u>Bureau of Indian Standards for drinking water)

Electrical Conductivity (>750 and >3000 micromhos/cm)

Chloride (<250 mg/l)

Fluoride (>1.5 mg/l)

Iron (>1.0 mg/l)

Arsenic (>0.05 mg/l)

Nitrate (>45 mg/l)

- Distribution of exceedance of electrical conductance (salinity), chloride, fluoride, iron, & nitrate are regional in nature

Ground Water Quality Hot Spots

Studies carried out by various monitoring agencies at Central and State Level

Districts Affected by Salinity in Ground Water

S. No.	State	Parts of districts having EC > 3000 µS/cm.
1.	Andhra Pradesh	Anantapur, Kurnool, Kadapa, Nellore, Prakasam, Guntur, Mahabubnagar, Nalgonda, Krishna, Khammam, Warangal, Medak, East Godavari, Srikakulam, Visakhapatnam, Vizianagaram
2.	Delhi	North West, West, South West
3.	Gujarat	Ahmdabad, Amreli, Anand, Bharuch, Bhavnagar, Banaskantha, Dohad, Porbandar, Jamnagar, Junagadh, Kachchh, Mehsana, Navsari, Patan, Panchmahals, Rajkot, Sabarkantha, Surendranagar, Surat, Vadodara
4.	Haryana	Bhiwani, Fatehabad, Gurgaon, Hissar, Jhajjar, Kaithal, Mahendergarh, Rewari, Rohtak, Sirsa, Sonepat
5.	Karnataka	Bagalkot, Belgaun, Bellary, Davangiri,Gadag, Gulburga, Raichur
6.	Kerala	Palakkad
7.	Maharashtra	Akola, Buldhana,Jalna, Jalgaon ,Nasik, Satara
8.	Madhya Pradesh	Bhind, Indore, Jhabua, Sheopur, Ujjain
9.	Punjab	Firozepur, Faridkot, Bhathinda, Mansa, Muktsar, Sangrur
10.	Rajasthan	Ajmer, Alwar, Barmer, Bharatpur, Bhilwara, Bundi, Bikaner, Churu, Chittaurgarh, Dhaulpur, Dausa, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalor,Jhunjhunun, Karoli, Nagaur, Neemuch, Raja Samand, Sirohi, Sikar, Swai Madhopur, Tonk, Udaipur
11.	Tamil Nadu	Dharmapuri, Pudukkottai, Thoothukkudi, Coimbatore, Dindigul, Ramanathanpuram, Salem, Karur, Namakkal, Perambalor, Thiruvannamalai, Vellore, Villupuram, Cuddalore
12.	Uttar Pradesh	Agra, Hathras,Mathura,
13.	West Bengal	Haora, Medinipur, S- 24 Parganas,

Source: CGWB, March 2008

Districts Affected by Chloride in Ground Water

Sr. No	State	Parts of District having Chloride conc. > 1000 mg/l
1	Andhra Pradesh	Prakasam , Nellore, Guntur, Mahaboobnagar, Nalgonda, Krishna, Khammam, Warangal, Srikakulam
2	Delhi	North West, West, South West
3	Gujarat	Ahmedabad, Amreli, Bharuch, Bhavnagar, Banaskantha, Porbandar, Jamnagar, Junagadh, Kachchh, Dohad, Patan, Panchmahals, Sabarkantha, Surendranagar, Surat, Vadodara, Rajkot
4	Haryana	Rohtak, Bhiwani
5	Karnataka	Bagalkot, Belgaum, Gadag, Dharwar
6	Madhya Pradesh	Bhind, Ujjain
7	Punjab	Firozepur, Muktsar
8	Rajasthan	Barmer, Bharatpur, Bikaner, Churu, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalor, Jhunjhunun, Jodhpur Nagaur, Sirohi, Nagaur, Sikar, Tonk
9	Tamil Nadu	Pudukkottai, Thoothukkudi, Ramanathanpuram, Namakkal, Cuddalore, Thirunamalai, Thanjavur, Shivaganga
10	Uttar Pradesh	Mathura, Agra
11	West Bengal	S-24 Parganas, Haora

Source: CGWB, March 2008

Districts Affected by Fluoride in Ground Water

State	Parts of Districts having F> 1.5mg/l
Andhra Pradesh	Adilabad, Anantpur, Chittoor, Guntur, Hyderabad, Karimnagar, Khammam, Krishna, Kurnool, Mahabubnagar, Medak, Nalgonda, Nellore, Prakasam, Ranga Reddy, Visakhapatnam, Vizianagaram, Warangal, West Godavari
Assam	Goalpapra, Kamrup, Karbi Anglong, Nagaon,
Bihar	Aurangabad, Banka, Buxar, Bhabua(Kaimur), Jamui, Munger, Nawada, Rohtas, Supaul
Chhatisgarh	Bastar, Bilaspur, Dantewada, Janjgir-Champa, Jashpur, Kanker, Korba, Koriya, Mahasamund, Raipur, Rajnandgaon, Surguja
Delhi	East Delhi, North West Delhi, South Delhi, South West Delhi, West Delhi
Gujarat	Ahemdabad, Amreli, Anand, Banaskantha, Bharuch, Bhavnagar, Dohad, Junagadh, Kachchh, Mehsana, Narmada, Panchmahals, Patan, Rajkot, Sabarkantha, Surat, Surendranagar,Vadodara,
Haryana	Bhiwani, Faridabad, Gurgaon, Hissar, Jhajjar, Jind, Kaithal, Kurushetra, Mahendergarh, Panipat, Rewari, Rohtak, Sirsa, Sonepat
Jammu & Kashmir	Rajaori, Udhampur
Jharkhand	Bokaro, Giridih, Godda, Gumla, Palamu, Ranchi
Karnataka	Bagalkot, Bangalore, Belgaun, Bellary, Bidar, Bijapur, Chamarajanagara, Chikmagalur, Chitradurga, Davanagere, Dharwad, Gadag, Gulburga, Haveri, Kolar, Koppala, Mandya, Mysore, Raichur, Tumkur
Kerala	Palakkad

Districts Affected by Fluoride in Ground Water (contd.)

S. No.	State	Parts of Districts having F> 1.5mg/l
12.	Maharashtra	Amravati, Chandrapur, Dhule, Gadchiroli, Gondia, Jalna, Nagpur, Nanded
13.	Madhya Pradesh	Bhind, Chhatarpur, Chhindwara, Datia, Dewas, Dhar, Guna, Gwalior, Harda, Jabalpur, Jhabua, Khargaon, Mandsaur, Rajgarh, Satna, Seoni, Shajapur, Sheopur, Sidhi
14.	Orissa	Angul, Balasore, Bargarh, Bhadrak, Boudh, Cuttack, Deogarh, Dhenkanal, Jajpur, Keonjhar, Suvarnapur
15.	Punjab	Amritsar, Bhatinda, Faridkot, fatehgarh Sahib, Firozepur, Gurdaspur, Mansa, Moga, Muktsar, Patiala, Sangrur
16.	Rajasthan	Ajmer, Alwar, Banaswara, Barmer, Bharatpur, Bhilwara, Bikaner, Bundi, Chittaurgarh, Churu, Dausa, Dhaulpur, Dungarpur, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalor,Jhunjhunu, Jodhpur, Karauli, Kota, Nagaur, Pali, Rajasamand, Sirohi, Sikar, SawaiMadhopur, Tonk, Udaipur
17.	Tamil Nadu	Coimbatore, Dharmapuri, Dindigul, Erode, Karur, Krishnagiri, Namakkal, Perambalor, Puddukotai, Ramanathanpuram, Salem, Sivaganga, Theni, Thiruvannamalai, Trichurapally, Vellore, Virudhunagar
18.	Uttar Pradesh	Agra, Aligarh, Etah, Firozabad, Jaunpur, Kannauj, Mahamaya Nagar, Mainpuri, Mathura, Maunath Bhanjan
19.	West Bengal	Bankura, Bardhaman, Birbhum, Dakhindinajpur, Malda, Nadia, Purulia, Uttardinajpur

Source: CGWB, March 2008

Districts Having Arsenic (>0.05mg/l) in Ground Water in Different States of India

S. No.	State	Parts of Districts having As> 0.05mg/l
1	Assam	Dhemaji
2.	Bihar*	Begusarai, Bhagalpur, Bhojpur, Buxar, Darbhanga, Katihar, Khagaria, Kishanganj, Lakhiserai,Munger, Patna, Purnea, Samastipur, Saran, Vaishali
3	Chhatisgarh	Rajnandgaon
4	Uttar Pradesh	Agra, Aligarh, Balia, Balrampur, Gonda, Gorakhpur, Lakhimpur Kheri*, Mathura, Muradabad
5	West Bengal*	Bardhaman, Hooghly, Howrah, Malda, Murshidabad, Nadia, North 24 Praganas, South 24 Pragannas

* Source-Task Force/ State Agencies

Districts Showing Localized Occurrence of Nitrate (>45mg/l) in Ground Water in Different States of India

Sl. No.	State	Parts of Districts having Nitrate> 45mg/l
1.	Andhra Pradesh	Adilabad, Anantpur, Chittoor, Kadapa, East Godavari, Guntur, Hyderabad, Karimnagar, Khammam, Krishna, Kurnool, Mahabubnagar, Medak, Nalgonda, Nellore, Nizamabad, Prakasam, Ranga Reddy, Srikakulam, Visakhapatnam, Vizianagaram, Warangal, West Godavari
2.	Bihar	Aurangabad, Banka, Bhagalpur, Bhojpur, Bhabua, Patna, Rohtas, Saran, Siwan
3.	Chhatisgarh	Bastar, Bilaspur, Dantewada, Dhamtari, Jashpur, Kanker, Kawardha, Korba, Mahasamund, Raigarh, Raipur, Rajnandgaon
4.	Delhi	Central Delhi, New Delhi, North Delhi, North West Delhi, South Delhi, South West Delhi, West Delhi
5.	Goa	North Goa
6.	Gujarat	Ahemdabad, Amreli, Anand, Banaskantha, Bharuch, Bhavnagar, Dohad, Jamnagar, Junagadh, Kachchh, Kheda, Mehsana, Narmada, Navsari, Panchmahals, Patan, Porbandar, Rajkot, Sabarkantha, Surat, Surendranagar,Vadodara,
7.	Haryana	Ambala, Bhiwani, Faridabad, Fatehabad, Gurgaon, Hissar, Jhajjar, Jind, Kaithal, Karnal, Kurukshetra, Mahendergarh, Panchkula, Panipat, Rewari, Rohtak, Sirsa, Sonepat, Yamuna Nagar
8.	Himachal Pradesh	Una
9.	Jammu & Kashmir	Jammu, Kathua
10.	Jharkhand	Chatra, Garhwa, Godda, Gumla, Lohardega, Pakur, Palamu, Paschimi Singhbhum, Purbi Singhbhum, Ranchi, Sahibganj
11.	Karnataka	Bagalkot, , Bangalore, Belgaum, Bellary, Bidar, Bijapur, Chamarajanagara, Chikmagalur, Chitradurga, Davanagere, Dharwad, Gadag, Gulburga, Hassan, Haveri, Kodagu, Kolar, Koppala, Mandya, Mysore, Raichur. Shimoga, Udupi, Uttar Kannada
12	Kerala	Alappuzha, Idukki, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur, Wayanad
13.	Maharashtra	Ahemnagar, Akola, Amravati, Auragabad, Beed, Bhandara, Buldana, Chandrapur, Dhule, Gadchiroli, Gondia, Hingoli, Jalgaon, Jalna, Kohlapur, Latur, Nagpur, Nanded, Nandurbad, Nashik, Osmanabad, Parbhani, Pune, Sangli, Satara, Solapur, Wardha, Washim, Yavatmal

Districts Showing Localized Occurrence of Nitrate (>45mg/l) in Ground Water in Different States of India (contd.)

14.	Madhya Pradesh	Anuppur, Ashok Nagar, Balaghat, Barwani, Betul, Bhind, Bhopal, Burhanpur, Chhatarpur, Chhindwara, Damoh, Datia, Dewas, Dhar, Gwalior, Harda, Hoshangabad, Indore, Jabalpur, Jhabua, Katni, Khandwa, Khargaon, Mandla, Mandsaur, Morena, Narsimhapur, Neemuch, Panna, Raisen, Rajgarh, Ratlam, Rewa, Sagar, Satna, Sehore, Seoni, Shahdol, Shajapur, Sheopur, Shivpuri, Sidhi, Tikamgarh, Ujjain, Umaria, Vidisha
15.	Orissa	Angul, Balasore, Bargarh, Bhadrak, Bolangir, Boudh, Cuttack, Deogarh, Dhenkanal, Gajapati, Ganjam, J.Singhpur, Jajpur, Jharsuguda, Kalahandi, Kendrapara, Keonjhar, Khurda, Koraput, Malkangiri, Mayurbhanj, Nawapada, Nayagarh, Phulbani, Puri, Sambalpur, Sundergarh, Suvarnapur
16.	Punjab	Bhathinda, Faridkot, Fatehgarh Sahib, Firozepur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Mansa, Moga, Muktsar, Nawan Shaher, Patiala, Rupnagar, Sangrur
17.	Rajasthan	Ajmer, Alwar, Banaswara, Baran, Barmer, Bharatpur, Bhilwara, Bikaner, Chittaurgarh, Churu, Dausa, Dhaulpur, Dungarpur, Ganganagar, Hanumangarh, Jaipur, Jaisalmer, Jalor, Jhalawar, Jhunjhunu, Jodhpur, Karauli, Kota, Nagaur, Pali, Partapgarh, Rajasamand, Sirohi, Sikar, Swai Madhopur, Tonk, Udaipur
18.	Tamil Nadu	Chennai, Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Kancheepuram, Kanyakumari, Karur, Madurai, Namakkal, Nilgiris, Perambalor, Puddukotai, Ramanathanpuram, Salem, Sivaganga, Theni, Thiruvannamalai,Thanjavur, Tirunelveli, Tiruvallur, Trichi, Tuticorin, Vellore, Villupuram, Virudhunagar

19.	Uttar Pradesh	Agra, Aligarh, Allahbad, Ambedkar Nagar, Auraiyya, Badaun, Baghpat, Balrampur, Banda, Barabanki, Bareilly, Basti, Bijnour, Bulandsahar, Chitrakoot, Etah, Etawa, Fatehpur, Firozabad, GB Nagar, Ghaziabad, Ghazipur, Hamirpur, Hardoi, Jaunpur, Jhansi, Kannauj, Kanpur Dehat, Lakhimpur, Mahoba, Mathura, Meerut, Moradabad, Muzaffarnagar, Raibarelli, Rampur, Sant Ravidas Nagar, Shajahanpur, Sitapur, Sonbhadra, Sultanpur, Unnao
20.	Uttrakhand	Dehradun, Hardwar, Udhamsinghnagar
21.	West Bengal	Bankura, Bardhaman

Source: CGWB March 2008

WASTEWATER MANAGEMENT

Urbanisation and Wastewater Management

- Urban India has become a massive reality as far as waste management is concerned.
- This country can no longer afford to allow urban areas constituting cities and towns of varying magnitude to take care of themselves.
- Urban Centres in India lack infrastructure for sanitation
- The wastewater generated in Urban Centres are not managed appropriately.
- Inadequate treatment facilities for sewage have deteriorated the water quality of aquatic resources.
- They need the full and undivided attention of our planners and decision makers for protection of environment, aquatic resources and ultimately for better management of health aspects.

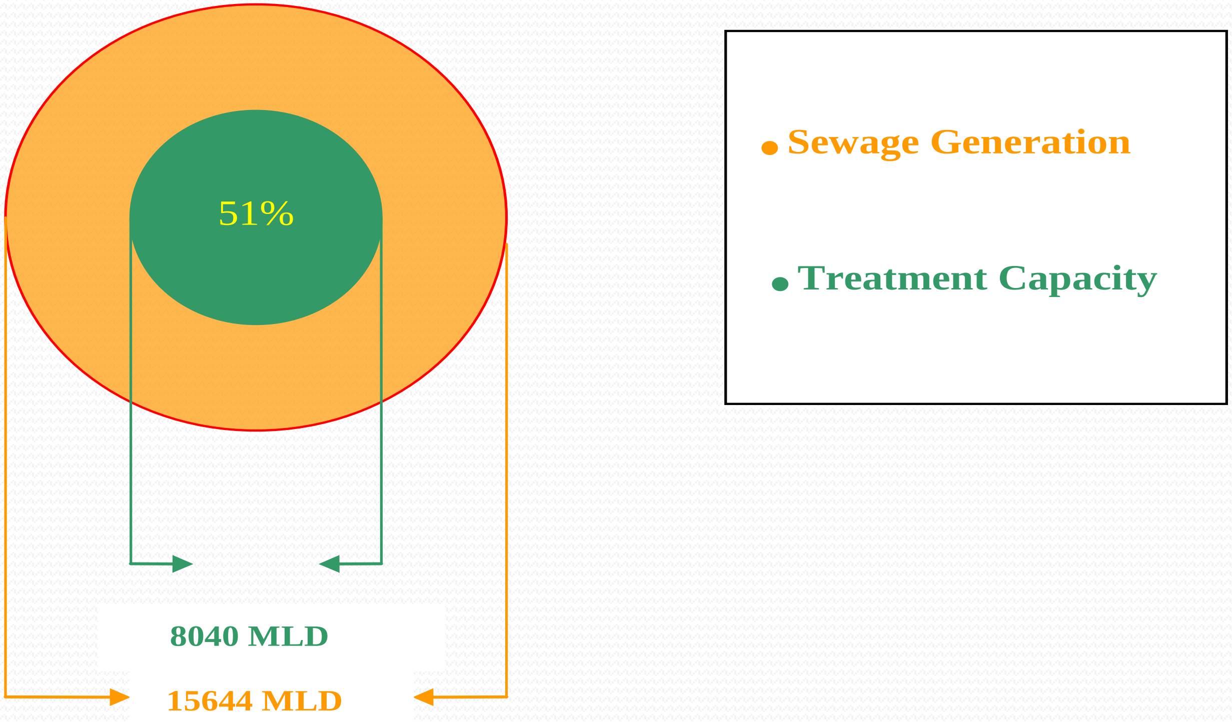
WASTEWATER GENERATION AND TREATMENT

- Study to assess the status of wastewater generation and treatment in Class I Cities (Population > 100,000) and Class II Towns (Population Between 50,000 and 100,000) carried out during 1978-79,1989-90, 1994-95,2003-04 and 2009.
- The latest study indicate that about 38000 million litre per day (mld) is the wastewater generation from 921 Class I Cities and Class II Towns in India that houses more than 70% of urban population.
- About 11700 mld is the municipal wastewater treatment capacity developed so far in India that account for about 31% of wastewater generation in these two classes of urban centres.
- Information on other class of cities - III to VI however shall be gathered to assess the overall wastewater generation from urban sector.

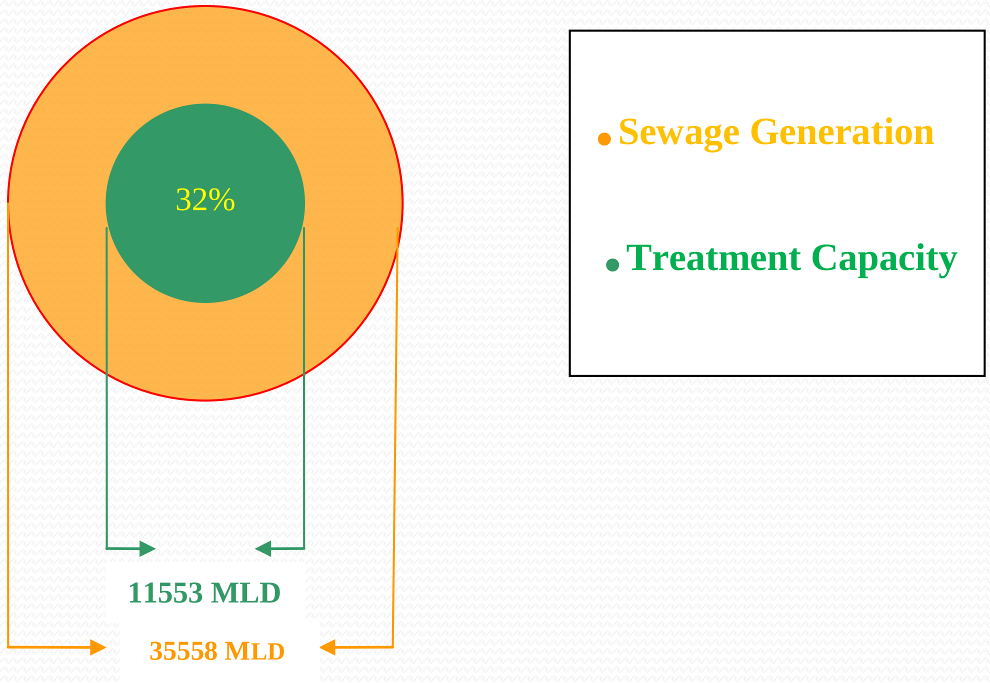
Decadal Trend of water supply and wastewater generation and treatment in Class I Cities and Class II towns

Parameters	Class I Cities					Class II Towns				
	1978-79	1989-90	1994-95	2003-04	2009	1978-79	1989-90	1994-95	2003-04	2009
Number	142	212	299	423	423	190	241	345	498	498
Population (millions)	60	102	128	187	187	12.8	20.7	23.6	37.5	37.5
Water Supply (mld)	8,638	15,191	20,607	29782	44448	1533	1622	1936	3035	3371
Waste water Generated (mld)	7,007	12,145	16,662	23826	35558	1226	1280	1650	2428	2696
Wastewater treated (mld)	2,756 (39%)	2,485 (20.5%)	4,037 (24%)	6955 (29%)	11553	67 (5.44%)	27 (2.12%)	62 (3.73%)	89 (3.67%)	234
Wastewater untreated (mld)	4,251 (61%)	9,660 (79.5%)	12,625 (76%)	16871 (71%)	24004	1160 (94.56%)	1252 (97.88%)	1588 (96.27%)	2339 (96.33%)	2463

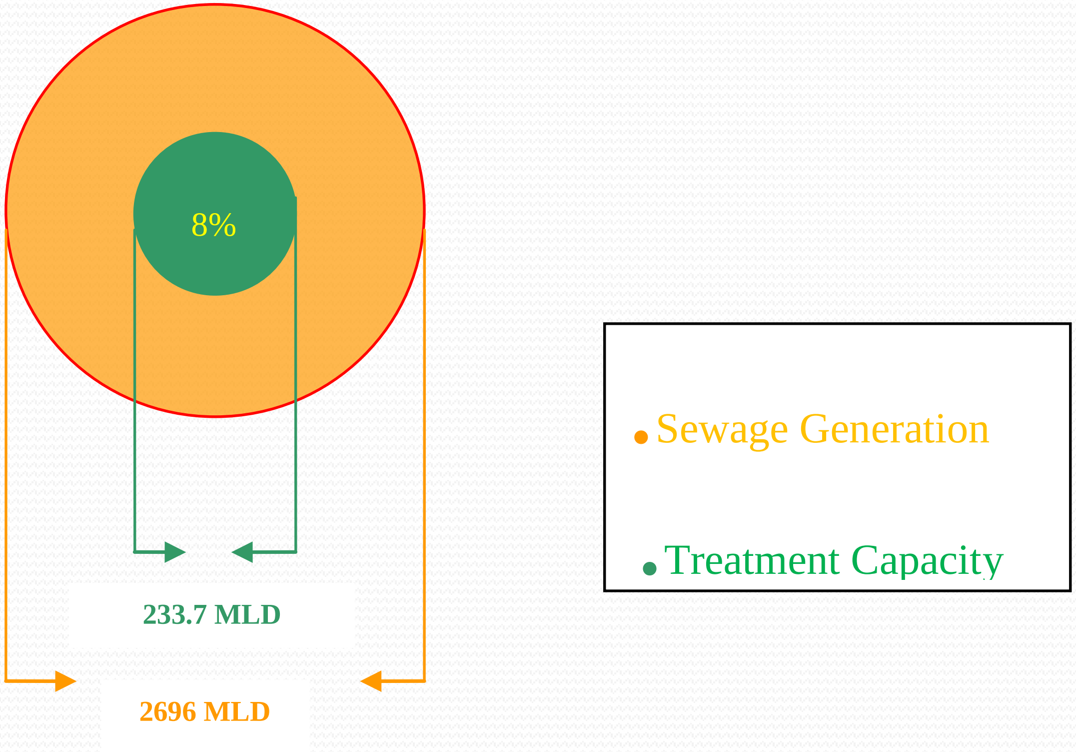
SEWAGE GENERATION AND TREATMENT CAPACITY IN METROPOLITAN CITIES



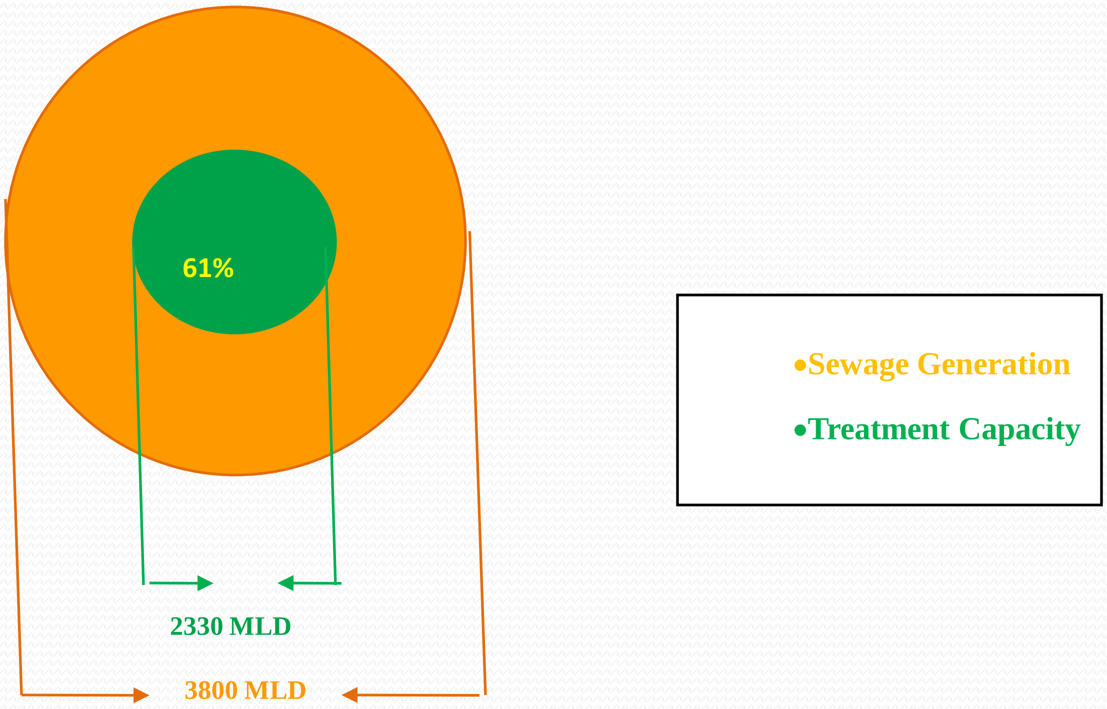
SEWAGE GENERATION AND TREATMENT CAPACITY IN CLASS-I CITIES



SEWAGE GENERATION AND TREATMENT CAPACITY IN CLASS-II TOWNS



SEWAGE GENERATION AND TREATMENT CAPACITY IN DELHI



SEWAGE GENERATION & TREATMENT CAPACITY IN GANGA BASIN

Class-I Cities	
Number of Class-I Cities	179
Sewage generation (MLD)	11386.6
Treatment Capacity (MLD)	4991.09
Class-II Towns	
Number of Class-II Towns	147
Sewage generation (MLD)	1023.9
Treatment Capacity (MLD)	78.88
Total Generation (MLD)	12410.5
Total Capacity (MLD)	5069.97

Future Scenario

- Population of India is likely to be stabilized by 2050 at the level of 1700-2000 million.
- Urban population for the year 2051 is likely to be more than 1000 million.
- Municipal wastewater shall be around 120000 MLD by 2051.
- Per capita water availability shall be reduced due to increase in population
- Wastewater generation in any urban centre will be the source for d/s located urban centres.
- In view of such situation there is a need to attain 100% wastewater treatment in each city with more stringent standard.

Projected population and respectively wastewater generation

Year	Urban Population (million)	Wastewater Generation (Litres/Capita/Day) (lpcd)	Gross Wastewater Generation (mld)
1977-78	72.8	116	7007
1989-90	122.7	119	12145
1994-95	151.6	130	16662
2003-04	243.5	121	26254
2009	316.15	121	38255
2051	1000 (Projected)	121 (Assumed)	120000 (Projected)

Experience of River Action Plan

- Major polluting sources (urban centres) were identified.
- Interception, diversion and treatment of wastewater was taken up in the major towns located along the rivers.
- During operational phase, several problems were faced- administrative as well as technical problem of operation and maintenance.
- Inadequacy in the design of treatment plants leads to problems – related to construction, operation and maintenance.
- Characteristics of sewage actually reaching the plant are much different from the design criteria.
- Plant designs are based on population based estimated BOD load, which is much higher than the BOD actually reaching to the plants.

Experience of River Action Plan (Contd.)

- Some plants were overdesigned.

- Treatment plants need skilled staff for operation and maintenance, besides being energy and cost intensive.

- All these factors resulted in malfunctioning of the Sewage treatment plant and jeopardize the objective of the River Action Plan.

- Based on the experience of River Action Plans focus is placed on systems which are less expensive, simple to operate and capable of functioning without high operational skill.

Experience of River Action Plan (Contd.)

- Large number of small-scale industries located in urban residential areas are compounding the problem by discharging industrial effluent in sewer line.

- Since wastewater contains large amount of organic matter & nutrients, it is worth to convert into energy & fertilizer that hampers the biological system in majority of sewage treatment plants.

- Efforts need to focus on use of wastewater for agriculture & recover energy from it as far as possible.

- Keeping in view of future scenario of wastewater generation for the year 2051 a definite road map is needs to be prepared by all concerns.

Performance of STPs

- Lack of Funds
- Power failures disrupting operations.
- Lack of Operation & maintenance
- Lack of good laboratories
- Lack of proper conveyance channels
- Un-skilled operators.
- Effluent not complying with standards.
- Not able to remove fecal coliform.

CPCB INITIATIVES
R&D SCHEMES

IN-SITU TREATMENT OF DOMESTIC WASTE WATER EMPLOYING MICROBIAL TECHNOLOGY

ELIMINATION OF ESCHERICHIA COLI AND OTHER COLIFORM BACTERIA THROUGH BACTERIOPHAGES

REJUVENATION OF RIVER SAHIBI TO ENSURE MINIMUM FLOW IN YAMUNA IN LEAN PERIOD

In-situ treatment of domestic waste water employing microbial technology

In-situ treatment of domestic waste water employing microbial technology

- In-situ treatment- treatment at original place/ without displacement of water, in running battery of water
- Microbial consortia- extra cellular enzyme
- Aerobic, an-aerobic, facultative
- Microbes used in free state/Adsorbed on Media/ Substratum
- Degradation organic matter of sewage and odoriferous/olfactory compounds.

In-situ treatment of domestic waste water employing Microbial technology (Contd.)

- Study proposed in different climatic conditions
- Demo-studies on 9 drains, followed by extension of study in other States/UTs based on findings
- Bharatpur : 1
- Indore : 1
- Allahabad : 2
- Varanasi : 1
- Patna : 2
- Kolkata : 1
- Farrukhabad : 1

In-situ treatment of domestic waste water employing microbial technology (Contd.)

Drain	Capacity (MLD)	Cost (Crore Rs.)
Assi, Varanasi	44.5 MLD	1.61
Bakarganj, Patna	2.5 MLD	3.64
Farukhabad City drain, Farukhabad	8 MLD	1.94
Mumford Ganj, Allahabad	40 MLD	4.88
Mori Gate, Allahabad	40 MLD	1.38
Tolly Nala, Kolkata	20 MLD	7.31

Elimination of Escherichia Coli and other Coliform Bacteria through Bacteriophages

“Elimination of Escherichia Coli and other Coliform Bacteria through Bacteriophages in Ganga”

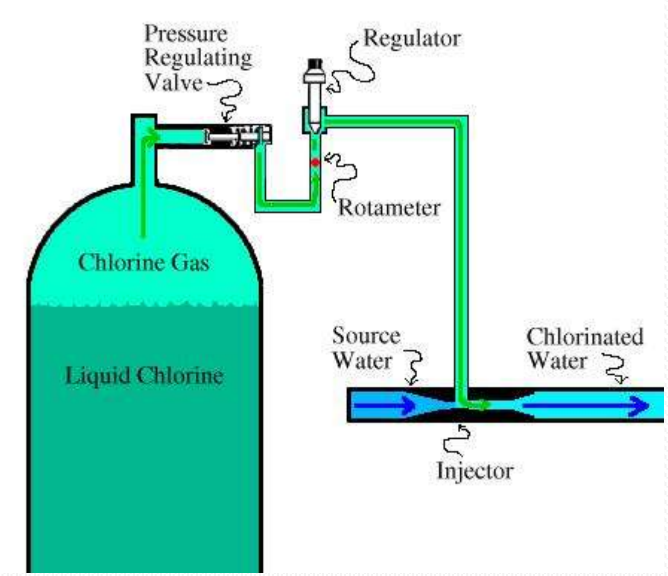
- Exceedance of Fecal coliform in Ganga
- Fecal coliform the cause of concern.
- Fecal coliform converts water unfit for Bathing and other designated best uses.

Primary Water Quality Criteria for Bathing Water

1.	Fecal coliform (MPN/100ml)	:	500-Desirable 2500-Max Permissible
2.	Fecal streptococci (MPN/100ml)	:	100-Desirable 500-Max Permissible

Removal of Fecal Coliform (Methods)

- Physical : Radiation – UV/ Cobalt
- Chemical : Chlorination, Ozonation, H_2O_2
- Biological : Bacteria in STPs



International Patent

Chairman CPCB's

Personal International Patent

No.2907/DEC/2010 on "Use of Antagonists Bacteria and Bacteriophages in Sewage Treatment Plants before confluence to river stretches near habitats'"

Removal of Fecal Coliform

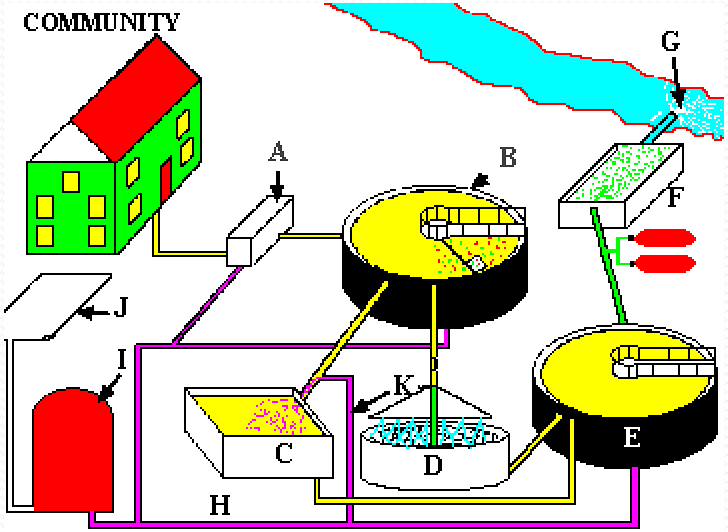
- Sewage Treatment Plants(STPs) are Primarily designed for removal of BOD and SS but;
- Not designed specifically to treat fecal coliform.
- Bactericidal actions like chlorination, UV radiation, Ozonation and other oxidants are employed.

  [Irradiation generates Mutants of un-known attributes]

Application of Bacteriophages

Application of Mass culture with pre-determined doses for removal of *E.coli* and other fecal coliform;

- ❖ Sewage Treatment Plants established under GAP
- ❖ Sewage drains joining river Ganga



Action Plan and Execution

Phage treatment demonstration

Installed STPs and Drains carrying sewage joining river Ganga in; Uttarakhand, Uttar Pradesh, Bihar and West Bengal.

Duration of Project : 18 months

Mass Culture (BP) and experimentation on

- Central Laboratory : CPCB, Delhi
- Uttarakhand : (SPCB)
- Uttar Pradesh : (Zonal Office of CPCB and SPCB at Lucknow/ Kanpur)
- Bihar : SPCB (Patna)
- West Bengal : Zonal Office of CPCB at Kolkata and SPCB

Wastewater Management in Tanneries

Lyophilization of hides and skins

Wastewater Management in Tanneries

Environmental Issues:

- High TDS concentration in tannery effluent due usage of salt for preservation of animal hides and skin.

- Salt preservation is the widely practiced method for preservation of hides/ skins throughout the world.

- In Indian practices, 50–60% (w/w) of common salt applied to preserve them.

- Typically some 50% of this amount of salt ends up in the tannery waste water as dissolved solids (TDS) leading to high levels of pollution in groundwater and rivers.

- Elimination of salt preservation means that the total salt freight of the wastewater to be reduced up to 60–70%.

Wastewater Management in Tanneries:

Innovative Technology: Lyophilization of hides and skins: Removal of moisture content of the skin/hides and making it suitable for preservation in ambient atmosphere.

This method of preservation enables preservation of hides and skins for a period more than 15 days thereby reducing salinity (TDS) of the effluent substantially.

The quality of leather to be comparable with salted leather and is acceptable by the tannery industry.

Techno-economically viable option for combating the pollution problem of TDS in Tanneries, arising from the salt curing method.

REJUVENATION OF RIVER SAHIBI TO ENSURE MINIMUM FLOW IN YAMUNA IN LEAN PERIOD

NEED OF AUGMENTATION OF WATER RESOURCES

- Abstraction of water directly from the river
- Over extraction of groundwater
- Untreated or partly treated municipal wastewater discharge into the catchment area
- Exhausting assimilative capacity of the river

REJUVENATION OF RIVER SAHIBI TO ENSURE MINIMUM FLOW IN YAMUNA IN LEAN PERIOD

CPCB has initiated a study for rejuvenation of river Sahibi to ensure minimum flow. Previously Yamuna used to get water from Sahibi through Najafgarh drain.

THE PROBLEM WITH YAMUNA

In non-monsoon period between October to June almost no water in the river to flow.

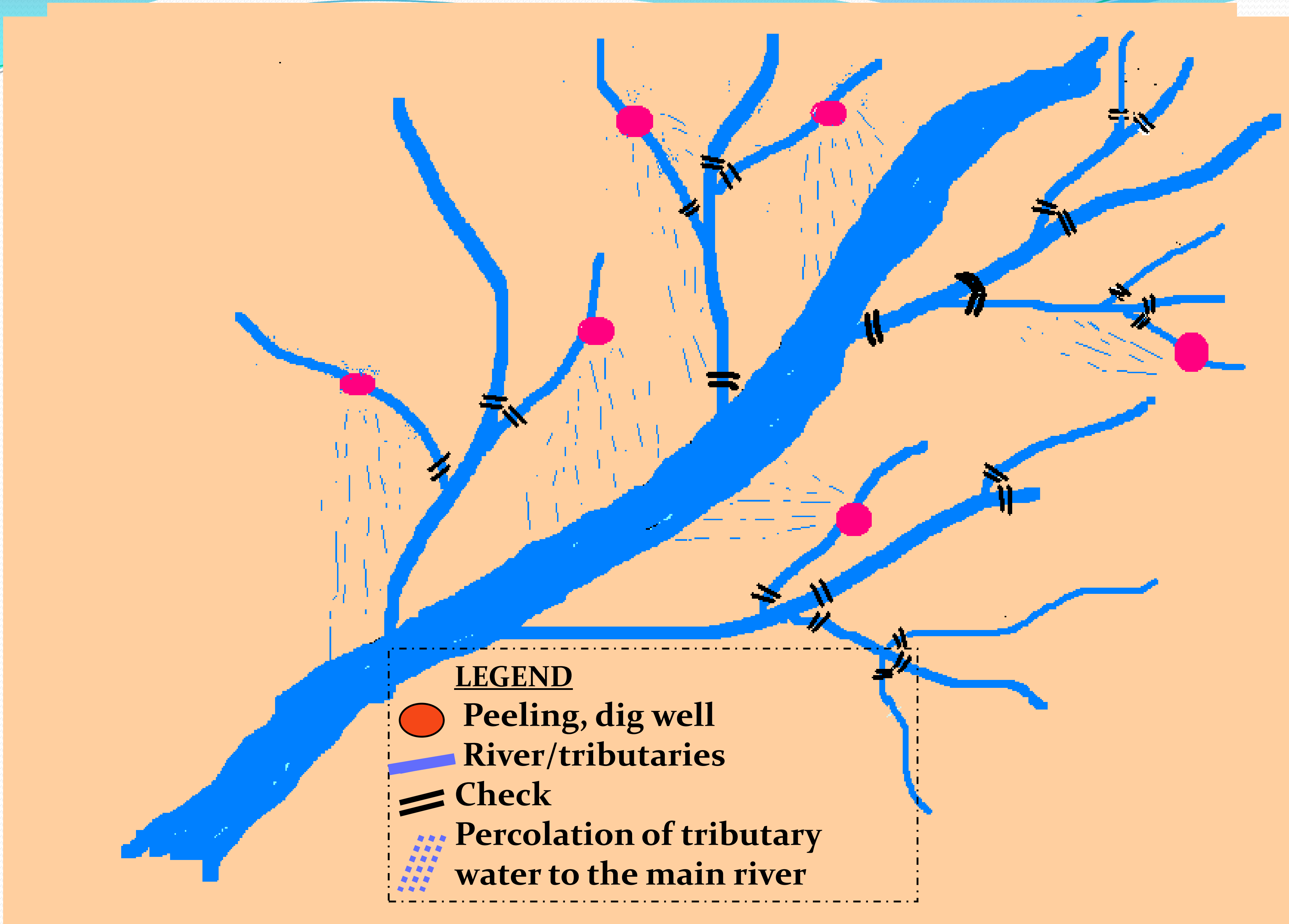
REJUVENATION OF RIVER SAHIBI TO ENSURE MINIMUM FLOW IN YAMUNA IN LEAN PERIOD (Contd.)

- Engineering innovation is necessary to utilise the flood water to recharge the depleted ground water table and retention of water round the year in the tributaries/rainy nallas.

Engineering Action

- Digging well/pond at the upstream of the catchment
- Creation of check dams on small tributaries
- Changing in the gradient towards proximal end of rainy nallas/tributaries
- Restriction in discharge of pollutants in catchment area

RECHARGING OF GROUNDWATER WITH EXCESS FLOOD WATER



REJUVENATION OF RIVER SAHIBI

River Sahibi originates in Rajasthan and after passing through Alwar District (Rajasthan) and Gurgaon District (Haryana) enters U.T. of Delhi near Dhansa.

Catchment	States	Area, Ha
Total Sahibi	Rajasthan, Haryana and Delhi	1295553
Part—I, above Massani Barrage	Rajasthan	493400
Part-II Between Massani and Dhansa	Delhi, Haryana and Rajasthan	251230
Part-III Below Dhansa Bundh upto Yamuna	Delhi and Haryana	282900

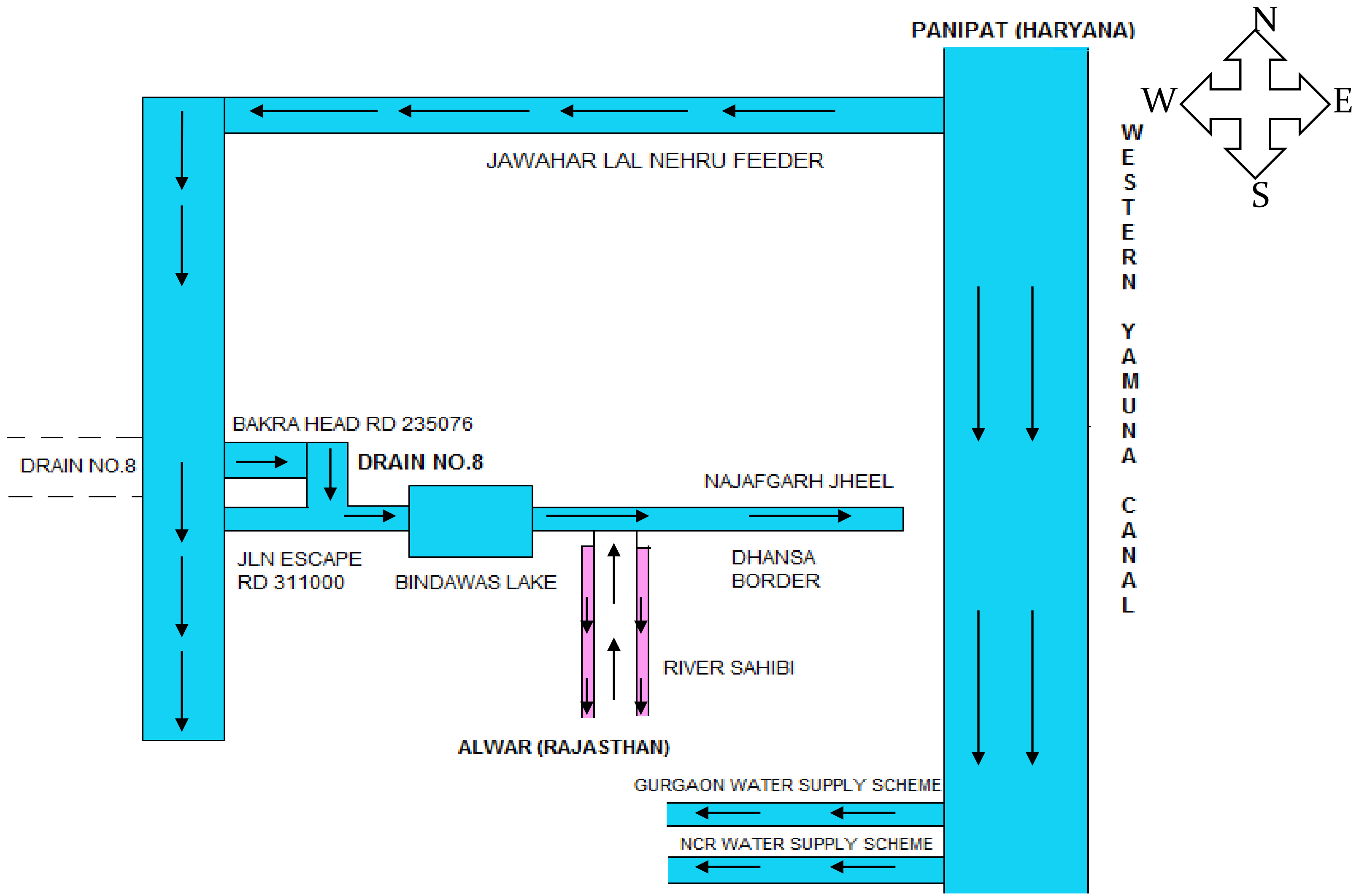


FIGURE 1: EXISTING SCHEMATIC NETWORK OF WESTERN YAMUNA CANAL, JLN FEEDER, DRAIN NO.8 AND RIVER SAHIBI

स्वच्छ पर्यावरण के लिए प्रतिबद्ध

Thank You

IN PURSUIT OF CLEAN ENVIRONMENT