TOWARDS DAY ZERO

India is fast running out of water due to pollution, over-extraction and changing climate

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India has lost 90 per cent of its major surface water sources due to pollution and encroachment. A September 2018 report by the Central Pollution Control Board (CPCB), along with analyses from different state pollution monitoring agencies, confirms this. A 2015 report by London-based non-profit WaterAid, which based its analysis on government data, also found that 80 per cent of the surface water in the country is polluted. The report holds domestic sewerage, inadequate sanitation facilities, poor septage management and the near absence of sanitation and wastewater policy frameworks responsible for the growing pollution. Though groundwater has so far been considered a reliable and safe source of water—it remains protected from surface contamination by geological filters that remove pollutants when water percolates through the soil—it is no longer absolutely free from all pollutants (see 'All pervasive', *p22*). What's worse, our rivers, the main source of surface water, are dying, and so are the ecosystems that feed them.

Other than pollution, the rivers are being affected by diversion of flows, disappearing

biodiversity, sand mining and loss of catchment areas. Waterbodies like lakes, ponds and tanks have also been either encroached upon or have become receptacles of sewage and waste. The news of toxic foam due to untreated sewage and industrial effluents entering Bellandur and Vathur lakes of Bengaluru have hit the headlines several times. Deepor Beel in Assam, like many other lakes, has been scrutinised by the National Green Tribunal (NGT) because people and industries keep encroaching it and dumping solid waste in it.

Of India's 29 states and seven union territories, 27 have critically polluted river stretches (Daman and Diu, and Dadra and Nagar Haveli have been bracketed by CPCB as a single unit), according to a 2018 CPCB report. The report identifies 351 polluted stretches on 323 rivers in these states and union territories. Maharashtra has the highest 53 polluted river stretches followed by Assam, Madhya Pradesh, Kerala, Gujarat, Odisha, West Bengal, Karnataka, Uttar Pradesh, Goa, Uttarakhand, Mizoram, Manipur, Jammu & Kashmir, Telangana, Meghalaya, Jharkhand, Himachal Pradesh, Tripura, Tamil Nadu, Nagaland, Bihar, Chhattisgarh, Andhra Pradesh, Sikkim, Punjab, Rajasthan, Puducherry, Haryana and Delhi. CPCB's previous report on river stretches for restoration of water quality, published in 2015, records 302 polluted stretches on 275 rivers.

DATA
P 42
↘ State of water pollution

In some river stretches, the quality of water is so poor that it requires immediate intervention. CPCB puts a waterbody under this category when its Biological Oxygen Demand (BOD, a parameter to measure pollution) exceeds 30 mg/litre. In fact, the number of such critically polluted stretches has increased across the country—from 32 to 45 in last three years (see 'Bad to worse' on *p*23). The maximum number of critically polluted river stretches is in Maharashtra (9) followed by Gujarat (5).

But states do not seem to be agreeing with the CPCB report. For instance, there is a disagreement between CPCB and the Maharashtra Pollution Control Board (MPCB) on the number of polluted stretches in the state. While CPCB says there has been an increase in pollution stretches, MPCB says the number has decreased from 49 to 34 in last three years. As per a September 2018 presentation to NGT, CPCB, which is keeping an eye on the pollution of river stretches in India, analysed 672 waterbodies in Maharashtra and found that 86 per cent of them had polluted water. However, media reports say MPCB has categorised only one stretch, in the Mithi river, as most critically polluted.

Ganga, Yamuna continue to languish

The debate surrounding the pollution level in the Ganga, however, is a cause of worry. Pollution levels recorded in the country's national river across years question the efforts of various governments to clean it. In August 2018, NGT asked CPCB to mark the stretches on the Ganga that are fit for bathing and drinking. The Board came up with a map that showed alarming pollution levels, which make the water even unfit for bathing, along the main stretch of the river. The map, based on September 2018 data, shows that the stretch remains majorly polluted even during the post-monsoon period and does not fall in Class A or Class C of CPCB. Class A of CPCB means "drinking water source without conventional treatment but after disinfection" and Class C means "drinking water source after conventional treatment and disinfection". But the map does not indicate whether outdoor bathing can be allowed in the whole stretch, which was NGT's main query. Water quality belonging to Class C does not mean that it will fulfil the criteria of Class B. For classes B and C, the BOD level should be maximum of 3 mg/l but Dissolved Oxygen (DO) for outdoor bathing should be 5mg/l (Class B) and 4 mg/l (Class C). Again, the Total Colliform (TC) for outdoor bathing is 500 mpn/100ml which is one-tenth of TC standard for Class C. The map needs to indicate clearly the points where people can go for outdoor bathing.

The post-monsoon data (August 2018) for the stretch between Kannauj and Ghazipur has been marked as unsatisfactory by the Uttar Pradesh Pollution Control Board, except at Mirzapur and Varanasi. However, these points show TC above

THE DRY FACE OF INDIA

Early in 2018, the South African city of Cape Town grabbed headlines for running out of water. To tide over the crisis, the city administration started water rationing and cut down on water supply per household. The individual limit stood at just 50 litres per person per day. With these strict restrictions in place, the city narrowly escaped the Day Zero situation, when all the taps were supposed to run dry. However, the winter rains came to Cape Town's rescue.

As per studies published by several research organisations, there are many such cities which will face the same situation if they do not pay heed to water conservation. A 2018 report by the World Wildlife Fund (WWF) says many cities are struggling to make the transition to climate-resilient water budgets that reduce demand and increase reuse and recycling. WWF took into account the supply versus demand, droughts recorded in last three years and future projection of 2050, along with the Urban Water Blueprint 2014 data from The Nature Conservancy, US-based charitable environmental organisation, to chalk out a list of 20 most water-stressed cities in the world. These cities urgently need to reuse water, reduce demand, strengthen governance and adopt conservation models, the report says. Of these 20 cities, 10 are in India.

Another WWF report published that year assigns water stress score to cities based on water depletion, recent droughts, aridity and future projections. Among the top five cities in this category, Chennai, Hyderabad and Kolkata are in India. Delhi and Mumbai are also in the list. News reports cite that Veeranam reservoir near Chennai, which supplies water to the city, dried up after a failed monsoon in 2016. This led to a severe water crisis in Chennai, with three in 10 people suffering from drinking water shortage. With reduced water level in many reservoirs, Indian cities have also started rationing water like Cape Town.

Mumbai is already cutting supply. In November 2018, the Brihanmumbai Municipal Corporation (BMC) announced a 10 per cent cut in the city's water supply. The supply timing was reduced by 15 per cent. Mumbai's water supply comes from Modak Sagar, Tansa lake, Vihar lake, Tulsi lake, Upper Vaitarana dam, Bhatsa dam and Middle Vaitarna dam. Bhatsa and Upper Vaitarana fall under the state government control while the other water bodies are maintained by BMC. Compared to 2017, water stock in these seven water bodies was 15 per cent less in 2018. This is not the first time Mumbai is facing water rationing: 20 per cent was imposed in 2014 and 2015, and 30 per cent in 2009. BMC has announced that rationing will continue till the rains arrive in 2019.

Even before the monsoon ended in September 2018, Jaipur started water rationing due to reduced flow from Bisalpur dam, the main source of water in the city. The Public Health Engineering Department (PHED), which is responsible for water supply, received complaints on weak monitoring and improper rationing. PHED now supplies water for 45 to 70 minutes as against one-and-a-half hours in 2017. The supply has reduced from 440 million litres per day (MLD) to 350 MLD. To tide over the gap, the city was relying on groundwater extraction. PHED had planned to dig 279 new tubewells and restore 273 old ones, as per news reports.

Chennai has not started rationing as yet. In the beginning of November 2018 media reports stated that the reservoirs supplying water to the city had only storage worth 15 days left. If situation not improved, Chennai would reel under water crisis. The Sholavaram and Chembarambakkam lakes were almost dry, holding just 2 per cent and 6 per cent of their total storage. The combined storage in the city's four reservoirs stood at 1,758 million cubic feet (MCFT) on November 3, 2018 against 2,114 MCFT in 2017.

Chennai receives 675 MLD from different reservoirs and desalination plants, of which it supplies 520 MLD to households against the demand of about 830 MLD. To meet the deficit, the city authorities were extracting water from irrigation wells in adjoining rural areas, which led to farmers' protests. Since 2015, the authorities

500mpn/100 ml; but BOD and DO are within limits of Class B. The CPCB map, which has been termed as "Suitability of River Ganga", has highlighted points which do not fall in classes A and C and where drinking is allowed only after organised conventional or advance treatment, including disinfection. Such a class has not been categorised in CPCB's original "Water Quality Criteria". The Board also did not explain what is "advanced treatment" or "organised conventional system" and how it is different from the conventional treatment mentioned in Class C. As per a 2017 NGT order, the government has spent ₹7,304.64 crore between 2015 and 2017 on cleaning the Ganga without any significant improvement in the water quality of the river or its tributaries. The data of the Central Water Commission collected between May 2016 and June 2017 shows that the average BOD of the Ganga between Garhmukteshwar in Uttar Pradesh and Shahzadpur in Haryana was not even suitable for outdoor bathing.

The Yamuna, too, has shown little improvement in water quality since 2014, when the

have secured 350 MLD of water from Veeranam reservoir and Nemmeli and Minjur desalination plants. Yet, officials say they are able to supply water only on alternate days. Chennai now depends on more than 4,000 private water tankers for its daily water needs. The government also runs the "dial a tanker" service to meet water demand. According to the Chennai Private Water Tanker Lorry Association, which has over 1,000 members, each tanker makes up to five trips a day, ferrying water from the outskirts of the city to apartments, hotels, malls and offices. Altogether, the tankers deliver 200 MLD of water to Chennai.

Towards the end of 2018, Nagpur was also preparing itself for water cuts because of the poor storage in the Pench reservoir. The District Water Reservation Committee had reduced water supply to the city and other towns in the district due to lower water reserve in the reservoir. From November 1, the committee made an allocation of 155 million cubic metres (MCM) to the Nagpur Municipal Corporation as against 195.43 MCM.

The situation was equally precarious in Punjab's Bathinda and Uttar Pradesh's Lucknow. These cities depend on single major sources of water and do not have a sustainable supply plan. So last year, when the water utility board in Bhatinda had to repair the Sirhind canal, it cut water supply by 50 per cent and placed a water rationing system in place. To meet the demand-supply gap, most people resorted to the contaminated groundwater. Similarly, several localities in Lucknow, such as Gomtinagar and Indira Nagar, depend on the Kathauta lake which sources water from Sharda canal. But in mid-November last year, when the canal was closed for maintenance, the lake had a stock for only seven days. The authorities reduced the water supply to five hours daily from 16 hours. Residents say they face the problem every year which forces them to depend on groundwater or tanker supply. Alternative sustainable sources are yet to be planned for many such areas in the country.

Cities bracing for acute water crisis

Sources: WWF 2018 reports and *Nature Sustainability*, volume 1, pages 51-58 (2018)

Consider Greater Visakhapatnam Municipal Corporation (GVMC). There have been predictions of low rainfall in 2019 monsoon. Fearing water crisis, GVMC in December 2018 announced a supply cut of 25 per cent from its Tatipudi and Raiwada reservoirs to industries.

The NITI Aayog report, *Composite water management index—a tool for water management*, published in June 2018, states that 54 per cent of India's groundwater wells are declining and 21 major cities are expected to run out of groundwater as soon as 2020, affecting almost 100 million people. Hence, bridging the groundwater gap is not at all a feasible solution, experts say. A Water Aid report states that the number of people living in urban areas increased by 1.6 times in 2011 in comparison to 377 million in 2001. So, the demand of water will also increase. It becomes crucial, therefore, to create institutions with clearly-defined roles and responsibilities, along with clear lines of accountability. It also means ensuring leadership role to the community and various stakeholders in implementing the solutions.

Cape Town is investing on urban wastewater management to face any disaster in future. The need of the hour is to focus on solutions which are local and traditional. Indian mega cities should invest in water harvesting, along with preservation of waterbodies and wastewater recycling.

Union government started implementing river cleaning programmes with a missionary zeal. It seems only the cleaning of Ganga has been on the priority list of the government. Despite several orders by the Supreme Court and NGT, almost the entire stretch of the Yamuna in Delhi continues to remain severely polluted. Except Palla and Surghat (downstream of Wazirabad), the river is biologically dead even in the post-monsoon period. Now all eyes are on two interventions—implementation of NGT's Mailey se Nirmal Yamuna programme and laying of interceptor sewage lines along Delhi's three biggest drains. These are likely to be completed by January 2019. The Ganga has all the political attention. But to declare India clean in all respect, the government should take up cleaning of all waterbodies.

Away from public eye, groundwater gets polluted

Groundwater has emerged as the democratic source of water and poverty reduction tool, says Sudhir Kumar Srivastava, scientist at CPCB. Due to its low capital cost, it is the most

ALL PERVASIVE

Groundwater is polluted in most of India's 640 districts. It is the source of 80 per cent of rural drinking water

Contaminant	States affected	Districts affected
Fluoride	20	276
Nitrate	20	387
Arsenic	10	86
Iron	24	297
Heavy metals (lead, cadmium, chromium)	15	113
Uranium*	14	61

Source: Central Groundwater Board
*A 2018 study by Duke University, the US

preferred source of water in India, he adds. According to a 2009 estimate by researchers at Jamilia Millia Islamia, Delhi, groundwater accounts for nearly 80 per cent of the rural domestic water needs, and 50 per cent of the urban water needs in India. The percentage of dependence is increasing every day. However, a variety of land and water-based human activities are polluting this reliable and safe source of water. Over-exploitation and unscientific extraction is also resulting in an increase in contaminants in groundwater. Worse, unlike surface water which receives a lot of attention because of visible pollution, polluted groundwater keeps affecting public health slowly and silently.

The major pollutants in groundwater are related to salinity, chloride, flouride, nitrate, iron and arsenic. A 2018 study in journal *Environmental Science and Technology Letters* states that aquifers in as many as 16 states of India are contaminated by uranium, whose presence in drinking water has been linked to chronic kidney disease by several studies. More importantly, uranium does not figure on the list of contaminants monitored under the Bureau of Indian Standards' drinking water specifications. The study was carried out by a team of researchers led by Avner Vengosh, professor of geochemistry and water quality at the Nicholas School of the Environment, Duke University, US. The main source of this contamination is natural. But groundwater depletion by extensive withdrawal of water for irrigation and nitrite pollution due to the excessive use of nitrogenous fertilisers may be exacerbating the problem, states the study. "Nearly a third of all water wells we tested in Rajasthan contained uranium levels that exceed the World Health Organization's safe drinking water standards," says Vengosh, in a statement. The World Health Organization (WHO) has set 30 parts per billion as the provisional safe drinking water standard for uranium. The scientists, who analysed data from 68 previous studies of groundwater geochemistry in Rajasthan, Gujarat and 14 other states, also found that the problem is widespread across aquifers in 26 districts in northern states of Punjab and Haryana, and in some districts in southern and eastern states.

At the same time, groundwater is becoming increasingly contaminated by seawater intrusion, industrial effluents and unsustainable agricultural practices.

Once contaminated can groundwater be cleaned?

The question is difficult to answer. Research has shown that levels of fluorides, arsenic, salinity/hardness can be reduced by dilution of groundwater by rainwater. But strong recharge schemes and policies have to be implemented at war footage. "A Master Plan for Artificial Recharge of Groundwater" has been developed by the Central Ground Water Board (CGWB) in 2013. According to this plan, over 85 billion cubic metres will be recharged in rural and urban areas in a phased manner by 2023. Technically feasible methods to clean polluted water often do not exist due to highly toxic substances in trade effluents, as seen in a 1983 case near Udaipur district of Rajasthan, where a sulfuric acid manufacturing unit rendered drinking water source in 22 villages useless. In India's context, it is not economically viable to clean aquifers, states an article by M Dinesh Kumar and Tushaar Shah, published in the 2003 *Survey of the Environment* by *The Hindu*. The article pegged the cost of cleaning the aquifer in Rajasthan at ₹40 crore.

In India, groundwater quality monitoring is primarily the concern of CGWB and state groundwater agencies, where each of them set up their monitoring network. But there are issues concerning adequacy of scientific data available from them because the number of monitoring stations is not enough and CGWB generally does not record the pollution caused by fertiliser and pesticide, heavy metals and other toxic effluents. But now CPCB and state pollution control boards are recording the pollution aspects of groundwater.

An analysis of the performance of the Gujarat Pollution Control Board (GPCB) by

Kumar and Shah in the Sabarmati river basin shows that of the four priority areas identified by the board for operations, its performance has been satisfactory in only identification of areas facing severe pollution. The monitoring ability itself was doubtful because the agency maintains only two observation wells for groundwater quality monitoring in the entire basin. GPCB also lacks adequate staff to carry out its functions, found the analysis.

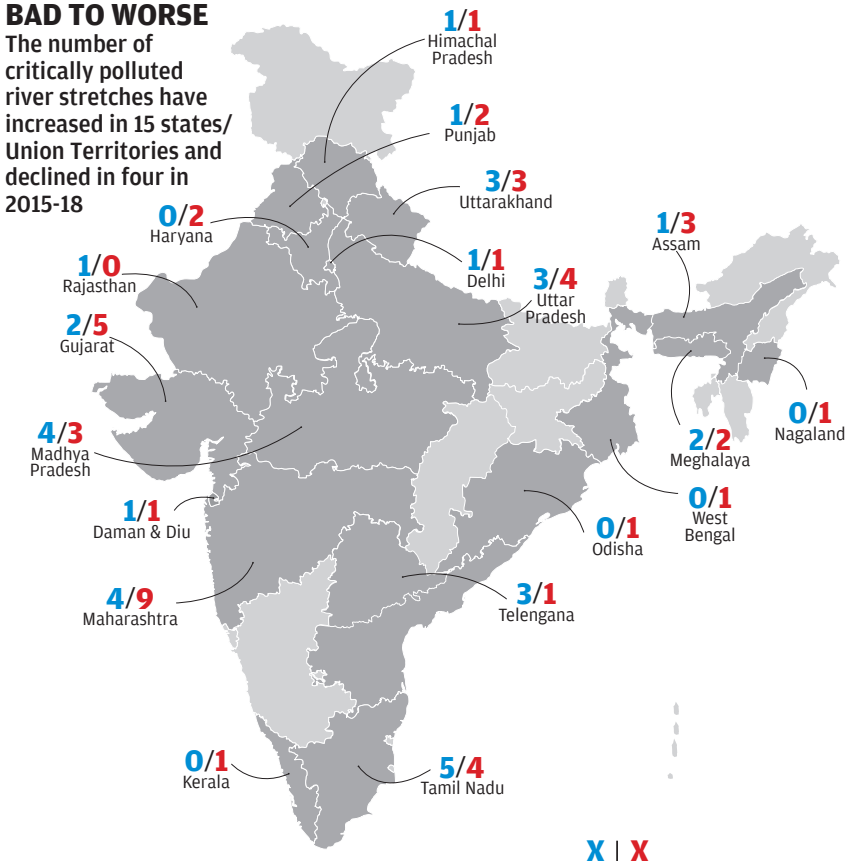
The authors also add that there are problems associated with institutional design itself. State pollution control boards perform the dual functions of monitoring pollution and enforcing pollution control norms. They lack the legal and administrative apparatus to penalise polluters. This reduces their efficacy in enforcing pollution control norms.

India has several legislations and programmes to protect groundwater. The Groundwater (Sustainable Management) Bill, 2017; Water (Prevention and Control of Pollution) Act, 1974; Environmental Protection Act, 1986; the creation of Arsenic task force in West Bengal in 2005 and the launch of Salinity Ingress Prevention Scheme in Gujarat in 2008 are a few such Acts and programmes. In 2016, the Union government launched the National Project on Aquifer Management. The project proposes to cover 1.4 million sq km under aquifer mapping between 2017 and 2022. But implementation is the key requirement now.

Polluted surface and groundwater is pushing India towards a dark future. The absence of proper implementation of water conservation measures is making the situation grave. If implementation of proper water management plans does not take place, all the cities of India will soon face Day Zero. ■

BAD TO WORSE

The number of critically polluted river stretches have increased in 15 states/ Union Territories and declined in four in 2015-18



Source: Central Pollution Control Board

RESOURCES

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- Monthly reports published by the Delhi Pollution Control Committee