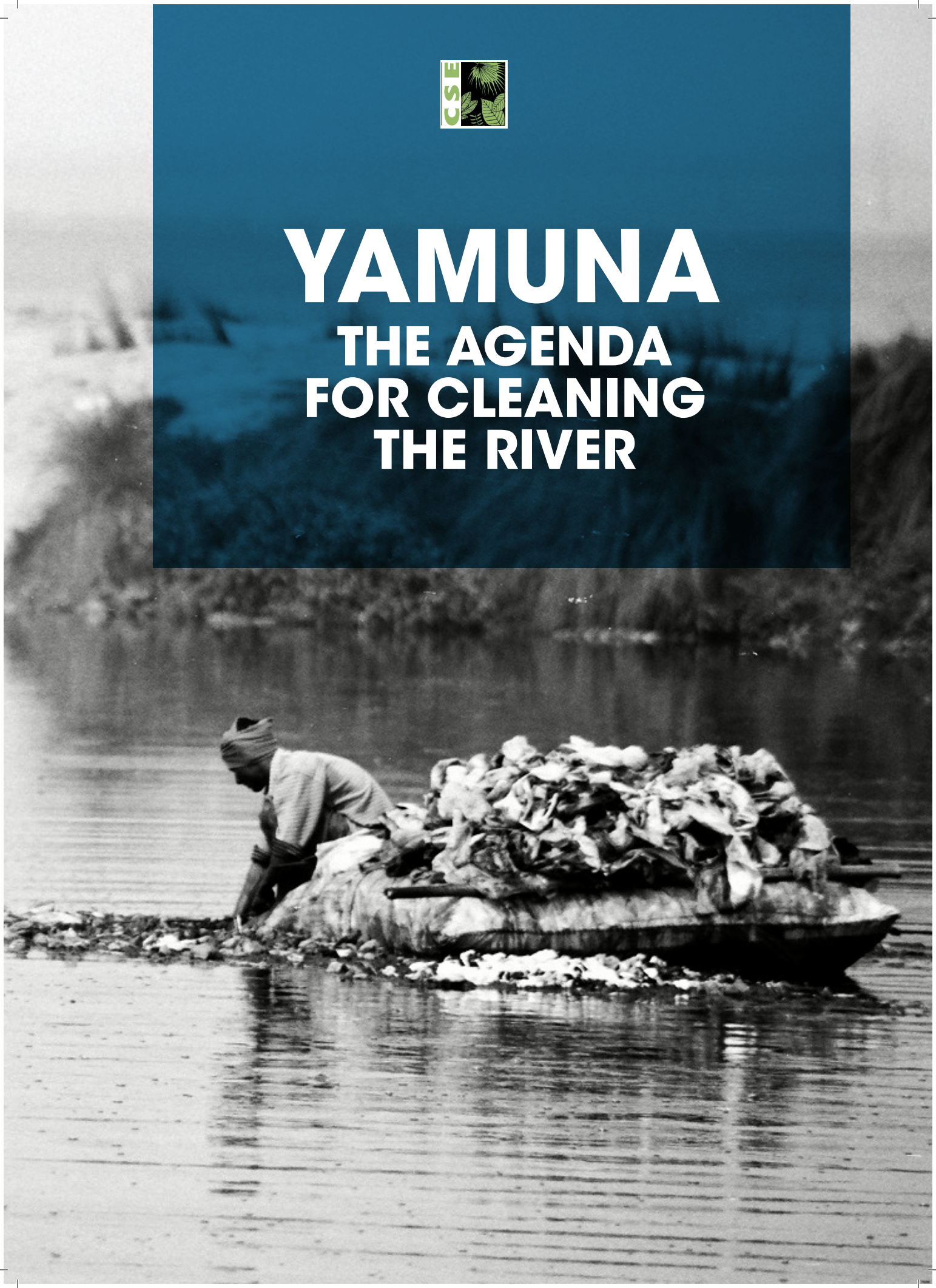
YAMUNA

THE AGENDA FOR CLEANING THE RIVER



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YAMUNA

THE AGENDA FOR CLEANING THE RIVER

CONTENTS

The 22-km stretch of the Yamuna in Delhi, which is barely two per cent of the total length of the river basin, continues to contribute over 80 per cent of the pollution load in the entire river. There is no water in the river for virtually nine months. The city impounds the river's water at a barrage in Wazirabad where the river enters Delhi. What flows in the river subsequently is just sewage and waste from Delhi's 22 drains. In this way, the river ceases to exist at Wazirabad (see *Map: The Yamuna: A bird's eye view*).

The agenda for cleaning the Yamuna is critical as the 'death' of the river is not just a matter of shame for the city, but it also adds to the burden of providing clean water both to Delhi and to the downsteam cities. However, it is clear that 'cleaning' the river will require more than money; it will need a plan, which recognizes the reality that Delhi, like many other cities of India, is a city where the bulk of its people live in unauthorized areas, where sewage is not intercepted and therefore, not treated. It also must recognize the need to intercept this sewage, but then to treat it so that it is reused and not released back into the same drains that carry untreated sewage. It must also recognize the need to ensure that the 22 drains are releasing only 'clean' water. This needs us to think and act differently.

BETWEEN 2017 AND 2022, MORE THAN Rs 6,856 CRORE HAS BEEN SPENT TO CLEAN THE YAMUNA, SAYS DELHI ENVIRONMENT DEPARTMENT

Delhi's environment department, in response to an Assembly question on March 22, 2023, had said that more than Rs 6,856.91 crore had been spent to clean the Yamuna in just four years between 2017 and 2022[1] by different departments of the Delhi government. The main work has focused on construction of new sewage treatment plants (STPs), upgradation of the existing sewage plan, desilting of sewer lines and controlling the flow in the major drains in Delhi. Thirty-seven STPs have been constructed and around 80 per cent of the city has been sewered. However, it is clear that in spite of this, the river continues to be polluted and worse, the river fails to rejuvenate itself even during monsoons. The Delhi Pollution Control Committee (DPCC) says in 2024, dissolved oxygen in midstream and downstream areas was nil even during monsoons. Biochemical oxygen demand (BOD) was 40-50 times higher than the permissible limit at these points. Faecal coliform (FC) counts reached over two lakh in the downstream point during dry spells. The BOD and FC counts clearly indicate that there is large scale dumping of raw sewage into the river, making its water unfit for human consumption throughout the year.[2]

The Yamuna: A bird's eye view

The Yamuna runs for 22 km in Delhi. Barely two per cent of the river's total length, this stretch contributes over 80 per cent of the pollution load in the river

● River monitoring stations I WYC: Western Yamuna Canal I EYC: Eastern Yamuna Canal

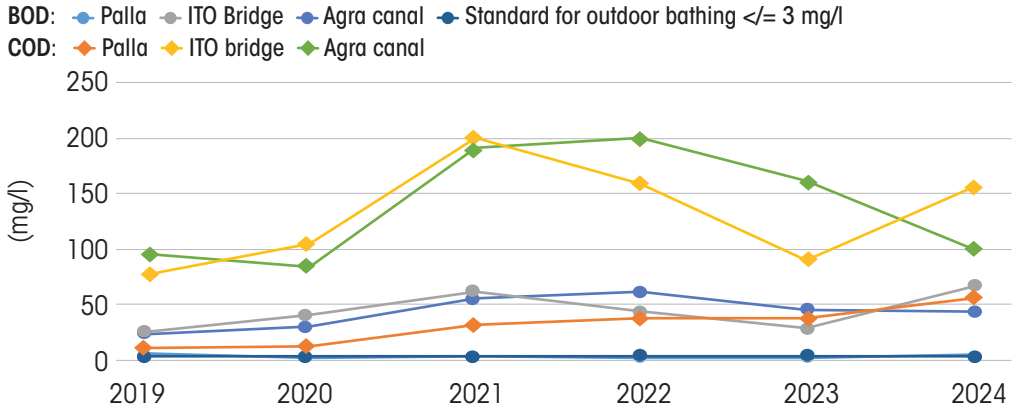
Source: Sunita Narain *et al* 2007, Sewage Canal: How to Clean the Yamuna, Centre for Science and Environmentl, New Delhi

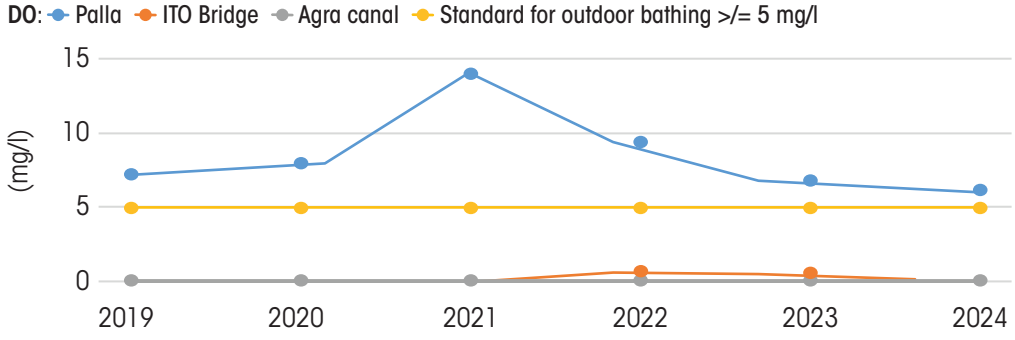
So how polluted is the Yamuna?

The DPCC monitors, each month, the pollution in Yamuna in the stretch of Delhi. It has selected eight points — from when the river enters Delhi at Palla to close to when it leaves at Agra Canal at Okhla Barrage and then at Asgarpur, after the confluence of two major drains, Shahdara and Tuglakabad. In addition, it monitors the flow and pollution at 27 drains, which discharge into the river. Its monthly data, available on its website, shows that pollution over the years has increased. Worse, even as the river has 'life' at the time it enters Delhi at Palla and Wazirabad — with a dissolved oxygen level between 5-6 mg/litre (against the standard of 5 mg/litre) — by the time it reaches the next monitoring point at ISBT, it drops to zero; in other words, the river is now officially without life (see *Graphs 1-2: How polluted is the Yamuna*).

Graphs 1-2: How polluted is the Yamuna

BOD, COD (Graph 1) and DO (Graph 2) levels are not meeting the bathing criteria of the river





Source: Delhi Pollution Control Committee, December data

YAMUNA IN THE COURTS

The battle for saving the Yamuna began in courts with the first public interest litigation in the early 1990s. Here are some more recent milestones:

- **September 2013:** In response to a 2012 PIL and Miscellaneous Applications 2013 and 2014, National Green Tribunal (NGT) directs environment ministry to constitute a three-member committee for cleaning the Yamuna.
- **July 2018:** NGT constitutes monitoring committee (Yamuna Monitoring Committee) comprising of its former expert member B S Sajwan and former chief secretary of Delhi, Shailaja Chandra.
- **October 2018:** Action plan submitted by the Yamuna Monitoring Committee (YMC) to NGT. Recommends a 16-point action agenda.
- **January 2019:** YMC report notes that FC count was up to 6,400 times more than the prescribed standards — only 14 per cent of the 1,797 colonies had sewage pipelines
- **July 2019-February 2020:** YMC submits more reports to NGT.
- **March 2020:** NGT says there is continued failure of compliance by authorities in spite of repeated directions of the Supreme Court and the Tribunal in the last more than 25 years. YMC is wound up; monitoring to be continued by a Special Purpose Vehicle (under the Delhi Development Authority); Delhi government directed to set up Integrated Drain Management Cell (IDMC) under the chief secretary.
- **January 2023:** Another PIL filed on polluted Yamuna. NGT orders chief secretary of Delhi to monitor progress in coordination with other authorities and chief secretaries of Haryana and UP. High Level Committee headed by Delhi Lt Governor V K Saxena set up. Status report submitted to NGT in January and July 2023.
- **October 2023:** NGT pulls up Delhi government for not completing work on tapping of drains, laying sewer lines in unauthorised colonies and JJ clusters, STP construction/upgradation, management of industrial waste and faecal sludge and reuse of wastewater.
- **August 2024:** NGT takes *suo-motu* cognisance of the matter of Yamuna pollution, highlighting concerns over pollution levels in the river and efficiency of STPs managed by Delhi Jal Board (DJB).
- **November 2024:** NGT pulls up DJB for not taking steps to manage the sewage flowing from stormwater drains into the Yamuna. DJB and Municipal Corporation of Delhi fined Rs 25.22 crore.
- **January 2025:** High Court of Delhi pulls up DJB for not following court's order over discharge of effluents from existing STPs.

Note: The box does not deal with cases on the Yamuna flood plains.
Source: India Environment Portal

The faecal coliform — the pollutant which tells us about the sewage load in the river — jumps to levels that can only say that this is not a river, but a sewage canal. The data also shows that there is no improvement in the quality of water in the river, and this in spite of the huge investment and attention, driven in part by the legal cases in different courts of the city — from the Apex court to National Green Tribunal (see Box: *Yamuna in the courts*).

What is being done to clean the Yamuna: The government's action plan

Each month, the DPCC files a monthly progress report to the secretary, Ministry of Jal Shakti, Government of India, with information on the work done on the river cleaning action plan. This is done in compliance with the orders received from the court. The action plan as detailed in the progress report of February 2024 is as follows:

Building sewage treatment capacity and improving its utilisation so that the generated sewage is treated

Delhi, with its 37 sewage treatment plants (STPs) of 3,033 MLD, has the capacity to treat over 84 per cent of the generated sewage, estimated at 3,600 MLD. Of the installed capacity, some 2,574 MLD is being utilized — roughly 85 per cent. In other words, over 70 per cent of the generated wastewater is now being treated, which is a marked improvement over the last decade.

OVER 70 PER CENT OF THE GENERATED WASTEWATER IS NOW BEING TREATED — A MARKED IMPROVEMENT OVER THE LAST DECADE

According to the action plan, the focus now is to improve the capacity of the existing STPs and building new plants at Okhla, Delhi Gate and Sonia Vihar. These additions/enhancements are expected to add another 560 MLD capacity by March 2025, which will be sufficient, as per this document, to meet the wastewater generation of the future (this is calculated based on 80 per cent of the water supplied, which is pegged at 4,300 MLD. In other words, as per this plan, the authorities are closing the gap between generation and treatment by March 2025, which means all the wastewater will be treated before discharge, leading to a cleaner river.

It is important to review why, despite the increased capacity and improvement in utilization and treatment, the river has not seen any visible change (see *Table 1: Sewage treatment in Delhi*).

Table 1: Sewage treatment in Delhi

Quantity of sewage generated 2024 (MLD)	Installed capacity of STPs (MLD)	Utilisation of STPS (MLD)	% of wastewater treated before discharge	Additional capacity being installed by March 2025 (MLD)	Total installed capacity as planned by March 2025	As per this planned capacity to treat sewage by March 2025
3600	3033	2574	71	560	3593	99%

Source: DPCC report submitted to NGT in April, 2024

Working on improvement of quality of treatment so that the STPs can meet discharge standard set out by the Central Pollution Control Board (CPCB) and DPCC

According to the Central Pollution Control Board's 2023 assessment of sewage treatment in the city, only 3 per cent of the installed plants met the standards for effluents. The February 2024 DPCC progress report says that 14 sewage treatment plants meet the standards prescribed by CPCB/DPCC. In other words, 23 STPs are not compliant with standards.

EFFLUENT DISCHARGE STANDARDS ARE NOW VERY STRINGENT. BOD AND TSS NORM IS 10 MG/L, MUCH LOWER THAN THE NATIONAL NORM OF 30 MG/L

The catch here is that the standards have been revised since the plants have been constructed. (see *Table 2: Revised effluent standards for Delhi as compared to rest of the country*). The effluent discharge standards are more stringent than prescribed by the Union Ministry of Environment, Forests and Climate Change, but have been directed by CPCB specifically for Delhi. As per these standards, BOD and TSS norm is now 10 mg/l, which is much lower than the national 30 mg/litre. This is presumably being done because of the lack of assimilative capacity in Yamuna, but it therefore presumes that all treated wastewater would be discharged directly into the river, which should not be the case if reuse is to be incentivized.

This tightening of effluent standards has meant that the existing plants now need to be refurbished so that they become compliant.

Table 2: Revised effluent standards for Delhi as compared to rest of the country

Parameter	Standard prescribed for Delhi (mg/l)	MoEF&CC Notification, 13th October, 2017 (mg/l)	NGT Order 2019 (Mega and metropolitan cites) (mg/l)
BOD	10	20 (metro cities 30 (rest)	20
TSS	10	50 (metro cities 100 (rest)	20
pH	6.5-9.9	6.5-9.9	6.5-9.9
COD	50	50	50
Ammoniacal Nitrogen	5	Below 5	
Total Nitrogen	10	Below 10	Below 10
Dissolved Phosphorous	5	-	Below 1
Faecal coliform	230 MNP/100 ml	Below 1000	230 MNP/100 ml

Source: Compiled by CSE

Various reports say 'e-flow' needs to be maintained in Yamuna for dilution

E-flow is the water regime provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated. A report of the Standing Committee of Water Resources (2023-24) says it is imperative to maintain the Yamuna's e-flow. The National Institute of Hydrology in Roorkee recommends an e-flow of 23 cumecs (cubic metre per second) in the lean season. The Department of Water Resources, River Development and Ganga Rejuvenation (DoWD, RD and GR) has reviewed the report and concluded that there is almost no flow of freshwater in the river downstream of Wazirabad during lean season — only 10 cumecs is being released by Haryana at Hathanikund. This is inadequate and most of it evaporates or percolates before it reaches Wazirabad, says the Department. There is almost no environmental flow in nine out of 12 months downstream of the Wazirabad barrage, after Yamuna enters Delhi. The demand of Delhi that upstream states should release more water for dilution is clearly untenable, given that all 'water' in the river is easily diverted for supply. Therefore, if Delhi needs water for dilution and to increase the assimilative capacity of its river stretch, then it needs to develop an action plan for this. This could include reducing intake; adding storage and discharging treated and clean water directly into the river.

Note: The box does not deal with cases on the Yamuna flood plains.
Source: India Environment Portal

This needs additional investment, which it is not clear will lead to the desired outcome of a cleaner river. The focus then moves to refurbishing existing STPs and not to intercepting more sewage — both from sewered and non-sewered areas.

Also, it is not clear why the effluent standards do not consider the point of discharge for the treated water. For instance, if the treated effluent is to be discharged on land then standards could be higher for certain parameters, including for nitrogen which is a soil enrichment agent. This will also incentivize reuse as standards for quality of effluent are determinants of the cost of technology for treatment.

If treated effluents are discharged directly into the river, which has little assimilative capacity, it is understandable that Delhi needs such stringent treated effluent standards. But as most of the treated wastewater is discharged into existing drains with high pollution load this cost of cleaning is negated.

But the action plan does not account for this as it states that all existing and new STPs are targeted to achieve the standards prescribed by DPCC by March 2025.

Building interceptor sewers to tap 1,100.86 MLD of flow in drains and tapping drains

The Delhi government's Interceptor Sewer Project (ISP) has been planned for abatement of pollution in the Yamuna. Under this project, 108 drains will be trapped and 900 MLD of flow will be then intercepted and planned to be diverted for treatment. According to the Delhi Economic Survey 2023-24, a provision has been made to trap over 1,000 MLD of which about 800 MLD has been intercepted and treated at the various STPs. As of this report, the entire flow will be trapped and treated by March 2024 after rehabilitation of Rithala and Kondli STPs, which are being built under Yamuna Action Plan (YAP) phase III.

ACCORDING TO THE DELHI ECONOMIC SURVEY 2023-24, A PROVISION HAS BEEN MADE TO TRAP OVER 1,000 MLD OF WHICH ABOUT 800 MLD HAS BEEN INTERCEPTED AND TREATED AT THE VARIOUS STPS

It further states that out of the 22 drains which fall into Yamuna, nine drains have been tapped and two more — Delhi Gate and Sen Nursing Home — are partially tapped. In the case of Najafgarh and Shahdara, it says that as these are large drains it is not technically feasible to 'tap' the entire drain but with the completion of the Interceptor Sewer Project substantial flow will be tapped and treated. Furthermore, work is in progress to tap the flow of the remaining nine drains, which once done will be diverted for treatment to STPs.

Laying sewage pipelines in unauthorized colonies

The progress report states that 1,064 sewerage lines have been completed and the rest are in various stages of completion.

Managing faecal sludge

The Delhi Urban Development Department had on November 12, 2018 notified the Septage Management Regulation 2018, under which it registers vehicles that collect and empty septage. By February 2024, DJB had registered 160 private de-sludging vehicles and designated 86 points where this would be taken for treatment. As per this, on an average 1.5 million litre of septage was being collected and treated each day. In February, 42 million litre of septage was collected and treated, says the report. DJB has also issued penalties for non-compliance against operators that do not register their vehicles or do not take the septage to the designated point for treatment.

BY FEBRUARY 2024, DJB HAD REGISTERED 160 PRIVATE DE-SLUDGING VEHICLES AND DESIGNATED 86 POINTS WHERE THIS WOULD BE TAKEN FOR TREATMENT

Treating industrial pollution

The industrial pollution from 17 of the 28 approved industrial areas is intercepted and treated in common effluent treatment plants. As per this, some 29.65 MLD of effluents are generated in the 28 approved industrial areas, of which the bulk, 25.57 MLD is from the 17 approved industrial areas, which have CETPs. It further states that 13 CETPs have the capacity to treat 212.3 MLD, of which 32 per cent is utilized. The quality of treatment is a matter of concern, and it is not clear where the treated effluents are discharged.

The catch here is the word "approved" — as it is well understood that large numbers of industrial units have shifted to what is known as unauthorized areas and this means that pollution is unchecked as well. The matter of dying of jeans in the colony of Shiv Vihar had come to light when the blue dyes were found contaminating drains leading to Yamuna. There are many other such Shiv Vihar's in the city (see *Box: Cost of "cleaning" 22 km of the Yamuna*).

Cost of "cleaning" 22 km of the Yamuna

Over the years, governments have been spending crores to clean the river's 22-km stretch as it flows past Delhi. It is difficult to estimate just how much has been expended on this, as allocation is done from different heads and agencies. The Delhi government has stated that between 2017 and 2022, Rs 6,856.91 crore has been spent by different departments for cleaning the Yamuna. It can be assumed that part of this funding has come from the Central government's Yamuna Action Plan (YAP), which is currently in Phase III of its programme implementation.

According to data provided in the report of the Lok Sabha Standing Committee on Water Resources for 2024-25, on the 'Review of the Upper Yamuna River Cleaning Project' up to Delhi, under YAP Phase-I and II, an expenditure of Rs 1,514.70 crore has been incurred till date. This has been spent on building new sewage treatment capacity of 942 MLD and rehabilitation of 328 MLD capacity in Haryana, Delhi and Uttar Pradesh.

The National Mission for Clean Ganga (NMCG) has informed the committee that it has, in addition, sanctioned 34 projects costing Rs 5,834.71 crore for cleaning the river. Under this, another 2,110 MLD STP capacity would be created across four Yamuna states and UTs – Himachal Pradesh, Haryana, Delhi and Uttar Pradesh. In Delhi, under NMCG, a total of 11 projects are at various stages of implementation. This includes building 1,268 MLD sewage capacity at a cost of Rs 2,009.12 crore and other sewage-related infrastructure projects.

The data shows that the bulk of the expenditure on cleaning the Yamuna is being expended on building and refurbishing sewage treatment capacity and rehabilitating sewage pipelines.

Table: Expenditure under YAP-III

STPs and other sewage pipeline-related activities make up the bulk of projects

S No.	Project component	Cost (administrative approval and expenditure sanction) Rs in crore	Budget head
1	Rehabilitation of Trunk Sewer No 4 in Kondli Wastewater Treatment Plant (WWTP) catchment	87.43	YAP III

S No.	Project component	Cost (administrative approval and expenditure sanction) Rs in crore	Budget head
2	Rehabilitation of Trunk Sewer No 5 in Kondli Wastewater Treatment Plant (WWTP) catchment	83.4	YAP III
3	Providing and laying pressure mains of 700-900 mm diameter ductile iron (DI) pipes in Kondli WWTP catchment	59.13	YAP III
4	Rehabilitation of sewers of sizes varying from 600 mm to 1,400 mm in Ashok Vihar and Jahangirpuri in Rithala, in the Rithala WWTP catchment	43.92	YAP III
5	Providing and laying 1,200-mm diameter DI -- rising mains from Bharat Nagar SPS to Pitampura in Rithala WWTP catchment	45.4	YAP III
6	Rehabilitation and upgradation of existing 182-MLD Rithala Phase-I STP	211.79	YAP III
7	Rehabilitation and upgradation of Kondli Phase-I, II and III WWTPs (45, 114, 45 MLD)	239.11	YAP III
8	Construction of 564 MLD WWTP at Okhla	665.78	YAP III
9	Construction of 318 MLD WWTP with 10 years' O&M on Design, Build and operate (DBO) basis at Coronation Pillar, Delhi	515.08	Non EAP (External Aided Project) – Namami Gange Programme
10	Public outreach (ongoing)	20.46	YAP III
11	Consultancy services (ongoing)	37.62	YAP III
TOTAL		2009.12	

Source: Report of the Standing Committee of Water Resource (2024-25) presented to the Lok Sabha on March 11, 2025

So, with this done, why is Yamuna still polluted?

The action plan of the government — both Union and Delhi — have all the elements that are purportedly needed to clean rivers; Delhi has a vast network of underground drainage and according to its data, the bulk of the sewage generated is intercepted and not allowed to flow directly to the open drains or through stormwater systems. The Delhi Economic Survey 2023-24 states that DJB has a network of branching, peripheral sewers of about 10,000 km and a network of 200 km of trunk sewers. This is massive. It also has 37 sewage treatment plants, with a capacity of over 3,000 MLD, which as per the official data, treat over 70 per cent of the wastewater generated in the city. This gap of 30 per cent between generation of sewage and its treatment is not enough to explain the deterioration of Yamuna's water quality and more importantly, the lack of improvement, despite progressive and substantial investment in this hardware. All the other parts of the Yamuna action plan are also designed towards river cleaning, but the question remains: why is this is not adding up?

37 SEWAGE TREATMENT PLANTS, WITH A CAPACITY OF OVER 3,000 MLD, TREAT OVER 70 PER CENT OF THE WASTEWATER. THIS GAP OF 30 PER CENT IS NOT ENOUGH TO EXPLAIN THE DETERIORATION OF YAMUNA'S

An assessment of ground realities suggests that government needs a shift in the focus of the Yamuna cleaning programme. This is not to say that what is being done is incorrect. But what is needed is to re-prioritize the entire effort so that it is built on the understanding of these issues.

This is not just about Delhi, but about all river action plans in the country. The underlying issues that need to be addressed are as follows:

We do not know how much wastewater is generated

The current method to estimate wastewater quality is based on a simple calculation that 80 per cent of the water supplied by the city utility is returned as waste. It is also widely suggested that 80 per cent of the pollution load is domestic sewage and the rest is industrial discharge. But there are challenges in this estimation. The CPCB assesses the quality of sewage generated in the country by multiplying the estimated urban population with a water supply of 185 litre per capita per day (LPCD). The rate of sewage generation is taken as 80 per cent of the water supply. However, there are data challenges, which leave a gaping gap in our estimation.

Firstly, since the last Census done was in 2011, the population can only be projected at best. Population was 16.7 million; using the projection provided in Census 2011, it would have been 24 million in 2021. However, there is no clear data on the number, particularly as it is well known that population has boomed in the outskirts of the city, where millions live in what is known as unauthorized settlements. Therefore, it is hard to estimate wastewater based on population numbers.

HOUSEHOLDS MAKE UP THE GAP BETWEEN DEMAND AND SUPPLY BY USING GROUNDWATER AND TANKERS. ALL THIS UNOFFICIALLY SUPPLIED WATER ENDS UP IN WASTEWATER ACCOUNTS OF THE CITY

Secondly, there are gaps in the quality of water that is supplied and that reaches households. According to government's own estimates roughly 40-60 per cent does not account for the water supply that is 'lost' in distribution. This is "unaccounted" water, which then means that households make up the gap between demand and supply by using groundwater and tankers. All this unofficially supplied water would end up in wastewater accounts of the city.

All this shows up in the estimations done:

- The Central Pollution Control Board (CPCB) in its 2023 national inventory estimates that Delhi generated around 3,491 million litre per day (MLD) of wastewater in 2023.[3] According to it, 85 per cent of the total wastewater flow is domestic sewage. It makes this estimation based on the water supply data, which would be close to 3,600 MLD.
- The Economic Survey also says that roughly 1,600 MLD is 'water sold' by DJB to domestic and other customers. It takes the population of Delhi at 21.5 million to estimate water requirement at close to 4,800 MLD. The water treatment capacity is pegged at 3,500 MLD.
- In another estimation, the Economic Survey 2023-24 says Delhi's water demand is close to 6,000 MLD, of which 4,500 MLD is supplied and based on this, the wastewater generation is 3,632 MLD (taken as 80 per cent of water supplied). It then goes on to say that the 'gross wastewater to treatment' is 4,500 MLD.
- The DPCC in its monthly report for February 2024 says it estimates wastewater generation at 3,600 MLD, which it pegs to 80 per cent of the total water supply.

What is clear is that this estimation is as good as it gets, but it is not accurate and cannot be used to measure the generation of wastewater. This then compromises the river cleaning programme as much of the wastewater generated is not accounted for; it is flowing in the many drains of the city and eventually makes its way to the river.

Wastewater must be accounted for from both sewered and non-sewered areas

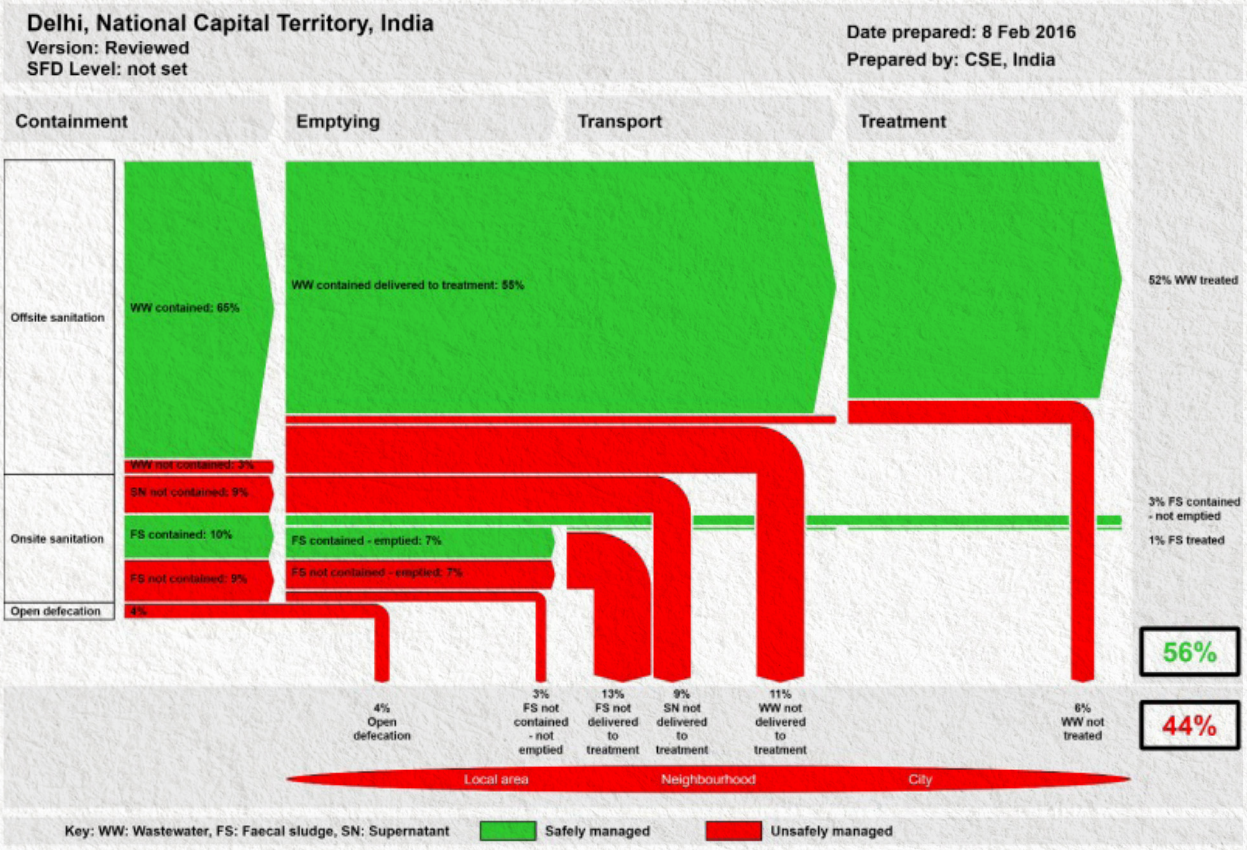
In its 2016 study, CSE had estimated based on the 2011 Census that 68 per cent of the city population was dependent on "offsite" sanitation systems — where toilets are not connected to underground sewerage systems. So, even if the household has a flush-toilet, this is the receptacle for excreta, but it does not necessarily imply that the excreta is conveyed in underground systems. Also, due to space constraints in increasingly densely populated low-income colonies, households are compelled to have minimal sanitation facilities within their premises. As a result, tanks are designed with an outlet connected to open drains. The Economic Survey 2021-22 estimates that more than 30 per cent of Delhi's urban population lives in such unauthorized colonies — but it could be much more. Then, while it is stated that these colonies have been provided sewerage, it is evident that this is not the case in most areas.

In these areas, which have 'on-site' sanitation, households have no option but to depend on tankers to empty their chambers, if these are not connected already to open drains. CSE's 2024 study on what is often termed now as one of India's largest unplanned settlements — Sangam Vihar in the south of the city — found that almost all households were dependent on faecal sludge emptying services. These household septic tanks were either lined or unlined, but all needed to be desludged and for this households would call upon private tanker owners.

THE ECONOMIC SURVEY 2021-22 ESTIMATES THAT MORE THAN 30 PER CENT OF DELHI'S URBAN POPULATION LIVES IN UNAUTHORIZED COLONIES — BUT IT COULD BE MUCH MORE

According to CSE's 2016 survey it estimated that over 350-400 vacuum tankers are running in the city. This would have increased manifold in the past decade. The emptying vehicle used is a tractor or a mini truck with a tank attached to it. The 2024 Sangam Vihar study finds that households spend anywhere up to Rs 3,000 annually for emptying the septic tank.

Figure: Shit Flow Diagram (SFD) — Delhi 2016



Source: Rohilla, S.K.; Luthra, B.; Varma, R.S.; Padhi, S.K.; Yadav, A. (2016). SFD Report - Delhi, India SFD Promotion Initiative Centre for Science and Environment (CSE), New Delhi

The 2016 'Shit Flow Diagram' for Delhi, which was done to estimate the quantity of on-site and off-site excreta systems had found that as much as 44 per cent of the wastewater was not treated or safely disposed (see Figure: *Shit Flow Diagram — Delhi 2016*). Instead, Yamuna became the major receptacle of this partially treated and untreated sewage, as tankers would empty the excreta into stormwater systems with, open drains leading to the river or even directly into the river.

As is evident from the recent study of Sangam Vihar, this situation has not changed in the past decade. If at all, given the population increase on the outskirts of the city, this can only become worse. This is evident also from the deteriorating situation of the river.

The 2019 Action Plan by the River Rejuvenation Committee for River Yamuna had also pointed out that 50 per cent of the city population lives without sewerage and that this contributes to the discharge of untreated waste in the drains and eventually the river.

The action plan must be based on this reality of 'unofficial' sewage: what does not flow from households connected to officially connected underground drains — once that happens, there would emerge huge opportunities to treat this waste. The fact is that septic tanks are decentralised waste collection systems. Instead of thinking of building an underground sewerage network—that is never built or never completed—it would be best to think of these systems as the future of urban sanitation. After all, we have gone to mobile telephony, without the landline. Individual septic tanks could be the way to achieve full sanitation solutions.

50 PER CENT OF THE CITY POPULATION LIVES WITHOUT SEWERAGE. THIS CONTRIBUTES TO DISCHARGE OF UNTREATED WASTE IN THE DRAINS AND EVENTUALLY THE RIVER. THE ACTION PLAN MUST BE BASED ON THIS REALITY OF 'UNOFFICIAL' SEWAGE

This demands three changes. One, governments recognise that these systems exist, and what is needed is to incorporate them in future sanitation plans. Two, they provide minimal regulation for the business of collection and transportation of faecal sludge so that waste is taken for treatment, and not dumped somewhere.

And most critically, city governments must work out the treatment system for faecal sludge. This is where the real rub lies. The fact is that this sludge is nutrient rich. Today, the global nitrogen cycle is being destroyed because we take human excreta, which is rich in nutrients and dispose it in water. In this case, we can return the human excreta back to land, use it as fertiliser and reverse the sanitation cycle. The faecal sludge, after treatment, can be given to farmers and used as organic compost. Or, it can be treated and mixed with other organic waste—like kitchen waste—and used for biogas, or to manufacture fuel pellets or ethanol.

Delhi's Septage Management Regulation 2018 provides for registration of such vehicles that collect and empty septage. But the last count of February 2024 of 160 such private de-sludging vehicles, is not sufficient. It is clear that the scale of this operation is much bigger.

More needs to be done — as has been done in different cities of India — to regulate this business. Each tanker needs to be connected to GPS and this needs to be tracked. Furthermore, the quantum of penalties must be increased so that illegal desludging or illegal dumping is dissuaded. This needs a much higher order of attention.

According to the February 2024 progress report, Delhi Jal Board has designated 86 points where faecal sludge would be taken for treatment. But it is not clear how this is being treated; how much is being treated and where it is being safely disposed of. This is the agenda that needs the city government's attention for the clean Yamuna programme to succeed.

DELHI HAS 22 OPEN STORMWATER CHANNELS THAT ARE SUPPOSED TO CARRY CLEAN WATER INTO THE YAMUNA. THE PROBLEM IS THAT THESE DRAINS ARE NOW POINTS WHERE DIFFERENT STREAMS OF WASTE GET MIXED

The mighty drains of Delhi are its mixing points for treated and untreated sewage

The city of Delhi has 22 open stormwater channels, that are supposed to carry clean water into the Yamuna.

The problem is that these drains are now points where different streams of waste get mixed. The problem is that when treated waste is mixed with untreated waste then the result is pollution.

The drains receive untreated waste from either unsewered colonies or through tankers. But in many instances, the sewage treatment plants, after treating the wastewater reasonably effectively, end up releasing it into the same channels that carry untreated sewage (see Map: *Drains and STPs of Delhi*).

For instance, take the case of Yamuna Vihar STP. This plant is situated in a densely populated part of eastern Delhi; it treats the sewage and then discharges it into the drain (Link Drain 1), which in turn passes through unsewered areas. The drain carries sewage and the clean treated effluent only dilutes it but does not clean it. In fact, all pollution abatement technologies work on the principle of load — that is the volume of water; even if the level (say, of BOD) is low but the flow is high, the load of pollution will be high. This also increases the cost.

Drains and STPs of Delhi

Najafgarh, Shahdara, Sarita Vihar, Delhi Gate and Barapulla drains add 84 per cent of the pollution load. According to the Delhi Pollution Control Committee, the 37 sewage treatment plants Delhi has, can treat about 70 per cent of the sewage.

DRAINS

1. Supplementary Drain
2. Najafgarh Drain
3. Magazine Road Drain
4. Sweeper Colony Drain
5. Khyber Pass Drain
6. Metcalf House Drain
7. Tonga Stand Drain
8. Civil Mill Drain
9. Kailash Nagar Drain
10. Link Drain No. 1
11. Delhi Gate Drain
12. SEN Nursing Home Drain
13. Drain No. 14
14. Barapulla Drain
15. Maharani Bagh Dra
16. Shahdara Outfall
17. Drain Near Sarita Vihar Bridge (Mathura Road)
18. Tuglakabad Drain
19. Jaitpur Drain

Map not to scale

Source: Compiled by CSE as per data from different government departments

It is for this reason this 'mixing' of treated and untreated sewage must be avoided at all costs. Currently, the action plan of government includes the idea of using or reusing treated effluents in horticulture and other purposes. This needs to be done at speed and scale.

Not all drains are equal in pollution

There are 22 main drains that are the source of pollution in the Yamuna in the Delhi stretch. The DPCC has been monitoring the drains from 2019 on a monthly basis and there is no visible improvement in the quality. What is important is to understand the pollution load that is contributed by these drains — and it is not equally divided.

Table 3: Discharge of wastewater and BOD from major drains into river Yamuna in Delhi

Place	Wastewater %	BOD %
Najafgarh	68.71	70.00
Shahdara Drain	10.90	13.95
Sarita Vihar	–	3.14
Barapulla	3.15	2.02
Delhi Gate	2.40	2.80
Tughlakabad	1.42	1.04
Ababdoned Agra Canal	1.15	0.90
Jaitpur	1.06	1.12
ISBT	1.02	0.82
Sen Nursing Home	0.87	1.04
Metcalf House	0.79	0.54
Molar Bandh	0.64	0.68
Maharani Bagh	0.53	0.48
Abu Fazal	0.40	0.28
Drain No. 14	0.36	0.20
Shastri Park	0.34	0.33
Magazine Road	0.30	0.20
Tonga Stand	0.17	0.08
Civil Military	0.15	0.10
Khyber Pass	0.15	0.08
Sweeper Colony	0.09	0.14
Kailash Nagar	0.04	0.04
Total	94.64	99.98

Source: High level Committee under NGT, 2023 data

Najafgarh and Shahdara: Deteriorating despite interceptor scheme

What is worse is that over the years, the contribution of the Najafgarh drain towards the flow of wastewater has increased from 60 per cent in 2017 to close to 70 per cent in 2023; the contribution of BOD load has also gone up from roughly 50 to 70 per cent (see Table: The deadliest drains).

Table: The deadliest drains

	Percentage of contribution				Percentage of BOD load			
Drain	2017	2018	2019	2023	2017	2018	2019	2023
Najafgarh drain	59.2	63.2	64.1	68.7	48.8	47.0	50.6	70.0
Shahdara drain	14.9	14.5	16.6	10.9	15.2	18.1	23.2	14.0

Sources: River Rejuvenation Committee, Government of NCT, Delhi, 2020, Action plan for rejuvenation of river Yamuna (Wazirabad to Asgarpur village -22 km, Priority –I stretch); High Level Committee appointed by NGT Presentation in 2023

This is despite the ambitious interceptor scheme of the government, under which 108 drains, with outfalls into Najafgarh, Supplementary and Shahdara, were to be 'trapped' — intercepted and diverted for treatment. Under this project, there were six packages — that were planned in terms where it would be intercepted and where the sewage would be treated. According to the 2019 report of the River Rejuvenation Committee, out of the 900 MLD that was planned to be intercepted, roughly half had been completed by 2019 — 400 MLD. By 2024, it was claimed that 800 MLD is now being intercepted, but it is not clear how much of this is from the six packages for the key drains. This is also when pollution load has continued to increase in both Najafgarh and Shahdara, which clearly suggests that there is an urgent need to review and rework the plan.

The DPCC monthly data does not include information on flow or volume, which is critical to understand the strategies for these drainage points and if it changes over the years or in seasons.

However, the 2019 report of the River Rejuvenation Committee and then more recently, the DPCC department-wise action plan for Rejuvenation of River Yamuna provide this information.

From this, it is clear that the bulk of the pollution load (the quantity of flow x BOD) — as much as 92 per cent — is from five drains:

Najafgarh, Shahdara, Sarita Vihar, Delhi Gate and Barapulla. Out of these, just two, Najafgarh and Shahdara contribute 84 per cent of the pollution load.

This would mean that if pollution from these two sources can be abated, then Yamuna can be vastly improved. It also means that the pollution load from other drains is relatively small and therefore, actions can be taken quickly.

Cleaning the Yamuna: An agenda for action

Ensure focus on non-sewered faecal sludge collection and treatment

Currently, even as this is part of the action plan, it is getting the attention it needs. The fact is that in large parts of Delhi people have no option but to depend on desludging tankers for their septage management. The good news is that in this case, people are managers of sewage — they do not want sewage to contaminate their homes and so they will call for desludging to be done. Furthermore, the state does not have to invest in building and refurbishing sewage pipelines and extending these to unconnected areas — growing hugely as cities expand. The cost and more importantly delays in completing sewage pipelines can be avoided. The strategy for sewage interception and treatment is faster and cost-effective. The key step is to ensure that all desludging tankers are registered; they have GPS installed and that a control room is set up to monitor the movement of these tankers. In addition, it is important that the desludged material is taken to treatment points where the used water and sludge is reused.

TREATED EFFLUENTS NEED TO BE COMPLETELY REUSED AND RECYCLED — THE COST OF TREATMENT IS LOST AND THE IMPACT ON POLLUTION CONTROL IS NEGATED IF THIS IS NOT DONE

Ensure that treated water is not discharged into drains, where it is mixed with untreated wastewater

These treated effluents need to be completely reused and recycled — the cost of treatment is lost and the impact on pollution control is negated if this is not done. If treated wastewater is not discharged into the drain leading to Yamuna, it will reduce the pollution load and make the final outlet easier to treat. Only if the sewage plant is located close to the river then treated effluents could be discharged into the river, but after ensuring that these are not mixed. It is to be noted that Yamuna has no assimilative capacity by the time it reaches the first monitoring station at the Inter-State Bus Terminal (ISBT) — its dissolved oxygen is zero.

Ensure full utilization of treated wastewater and biosolid so that this does not add to the pollution load

Currently, according to the Delhi government Economic Survey, 331 MLD of treated wastewater is utilized. This is not sufficient and there

Table 4: Treated wastewater supply for various purposes

Details	Unit (MLD)
Treated effluent supplied from Keshopur STP for irrigation, horticulture	20.46
From Okhla STP to CPWD and Irrigation Department for horticulture/irrigation	137.64
From Coronation Pillar STP for DDA Golf Course at Bhalswa, Gammon India for construction purposes. Minor Irrigation Department at Palla	80.05
From Rithala STP to PPCL for their plant at Bawana and NDPL for their owner plant at Rohini, DDA for horticulture	26.60
From Vasant Kunj to Sanjay Van	12.65
From Mehrauli STP to Garden of Seven Senses	12.65
From Delhi Gate and Sen Nursing Home STP to PPCL	17.86
From Nilothi STP to Flood Control and Irrigation Department for irrigation purposes	1.86
From Papankalan STP for irrigation purposes to DDA	6.81
From Commonwealth Games Village STP to DDA horticulture	0.45
From Yamuna Vihar to STP's horticulture	1.86
From Narela to private agency for washing of vehicles	0.19
From Najafgarh to WTP Dwarka for horticulture	0.26
From Chilla STP to internal horticulture of STP	0.74
From Kondli STP to DDA, PPCL and for horticulture	11.16
Total	331.23

Source: Economic Survey of Delhi, 2023-24

needs to be a plan to ensure that all the treated effluent is reused. The quality of treated water will also depend on the 'used' water plan — that is if it is used for agriculture or land-based activities like horticulture, then the standards could be designed for land applications. But if it is used for industrial use or domestic purposes then the water quality standards and its treatment will have to be designed and done accordingly. What is important to ensure is that the plan for reuse does not end up adding to contamination through heavy metals or compromises the health of people through inadequate controls on faecal coliform. If there are limitations in the resources available, then the priority must be to lay pipelines for treated effluents.

Ensure focus on every drain that outfalls into the river, not just the four-five major drains

The plan has to be to firstly divert treated effluent; then to ensure that untreated sewage is not dumped into the drain and then with all this

done, during the dry months to make sure that treatment can be as close to the outfall points as possible so that only 'cleaned' wastewater is released. The first two steps will reduce the pollution load in the drain. If there is less volume, then pollution abatement will be easier. Data from DPCC reveals 16 drains, contribute one per cent of less of the discharge of wastewater. If there is an effective plan to divert wastewater (including treated wastewater) into the drains, then the volume of discharge can be reduced and a treatment plan can be made accordingly.

TREATED WASTEWATER CAN BE USED FOR REJUVENATION OF WATER-BODIES, THIS WILL ADD TO GROUNDWATER AND PROVIDE DRAINAGE IN THE TIMES OF EXTREME WEATHER EVENTS

Ensure rejuvenation of waterbodies with reuse of treated water and the recharge of groundwater

The city has multiple problems of water supply as well as flood mitigation. The approach of improving groundwater levels will also lead to lower distribution losses as water supply can be made more localized. This is a win-win approach where treated wastewater can be used for rejuvenation of waterbodies, which in turn will add to groundwater and provide drainage in the times of extreme weather events caused by climate change. The Delhi government has included this in its plan, but this needs now to be implemented at scale and speed.

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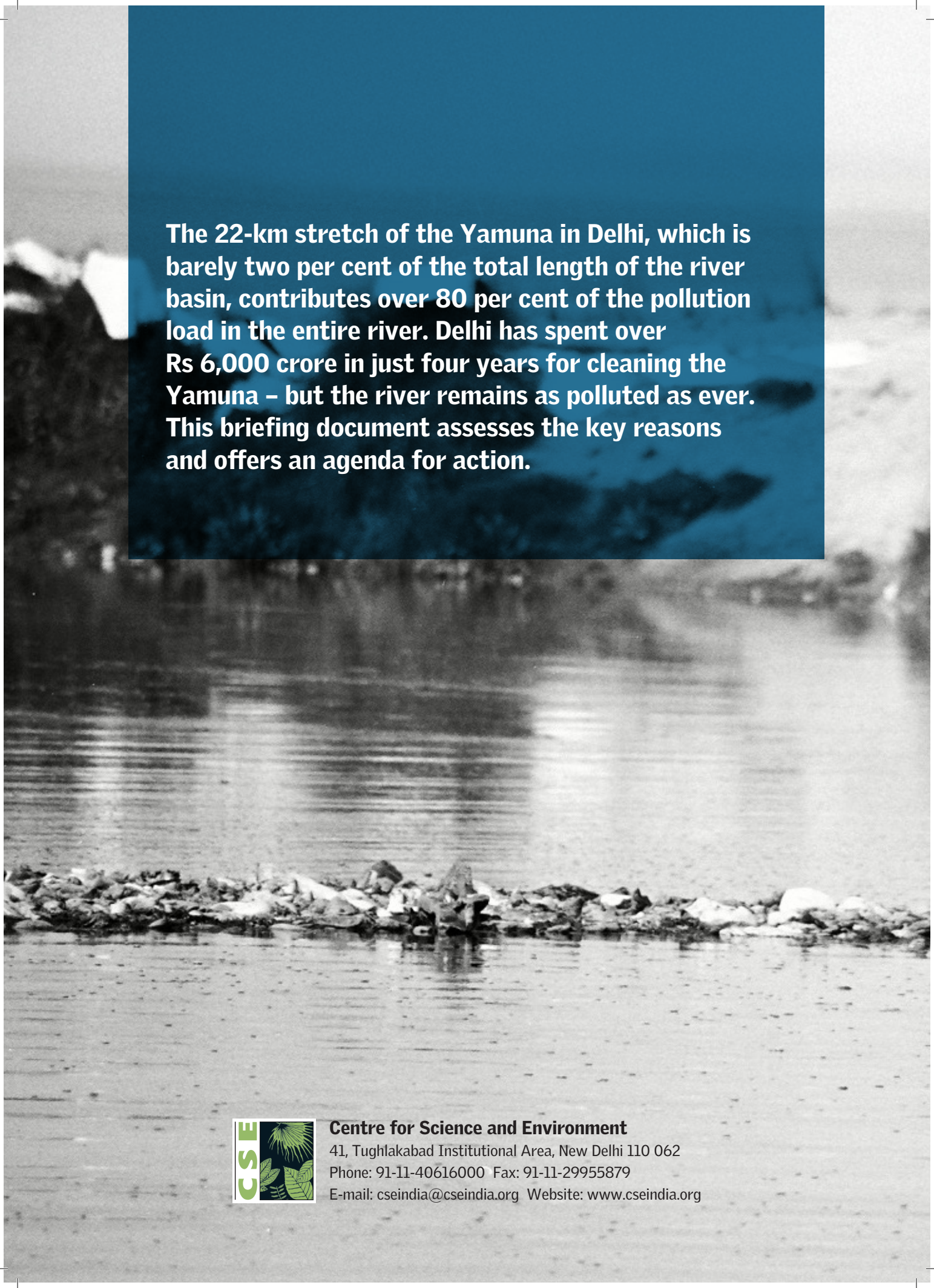

The 22-km stretch of the Yamuna in Delhi, which is barely two per cent of the total length of the river basin, contributes over 80 per cent of the pollution load in the entire river. Delhi has spent over Rs 6,000 crore in just four years for cleaning the Yamuna – but the river remains as polluted as ever. This briefing document assesses the key reasons and offers an agenda for action.

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