7th REPORT ON PK KAUL COMMITTEE RECOMMENDATIONS
In Writ Petition{C} No 914/1996 in response to the letter from the Amicus Curiae

January , 2007

ENVIRONMENTAL POLLUTION (PREVENTION AND CONTROL) AUTHORITY
FOR THE NATIONAL CAPITAL REGION
New Delhi

1. Background

On September 28, 2006, the Hon'ble Supreme Court while discussing the case observed the following:
"During the course of hearing, we suggested that the water should be taken to Kondli from Kalyanpuri instead of taking it to Chilla and from there lift it to Kondli and also whether the flow of untreated/sewerage between Kalyanpuri to Chilla can be treated by any other technology like on-line treatment."

The Court also directed the Counsel for the parties to find out as to what would be the flow of water at Kalyanpuri excluding the treated water at Yamuna Vihar STP, which would be taken from Yamuna Vihar to River Yamuna. Further to this order, on October 12, 2006, A K Ganguli, the amicus curiae in a letter addressed to the Chairman, Environment Pollution (Protection & Control) Authority (EPCA) for the NCR requested the authority to submit a duly considered report on the following aspects:

- **Issue 1:** Quantity of untreated water that will flow through Kalyanpuri after completion of diversion of treated effluents from the Yamuna Vihar STP:
- **Issue 2:** Quantity of sewage that is discharged from the Janta Flats Area after Kalyanpuri.
- **Issue 3:** Whether it would be possible to treat the residual sewage passing reaching Chilla regulator at an STP
- **Issue 4:** Technologies for on-site treatment of drains

This report is in response to the issues raised by the *amicus curiae* through his letter.

2. Action taken report

On October 20, 2006 EPCA requested Dr R C Trivedi, Additional Director, Central Pollution Control Board (CPCB) to look into the issues raised by the learned amicus curiae and submit a report:. Accordingly a report was filed in November 2006 on the flow of wastewater at three points--Shahdara drain at Atta bridge after the Chilla regulator and before the outfall into the Yamuna, Shahdara link drain before its confluence with the Shahdara drain at Chilla and the Kalyanpuri drain before the Kalyanpuri bridge.
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3. EPCA's findings and recommendations

Issue 1: Quantity of untreated water that will flow through Kalyanpuri after completion of diversion of treated effluents from the Yamuna Vihar STP:

The CPCB found that the wastewater flow in the Shahdara drain after Chilla regulator to be 594.8 mld. This is less than the average flow of 642.38 mld measured during January-December 2005.

This discharge observed at Atta bridge (594.8 mld) comprise of the following:

- 34 mld treated effluent from Yamuna Vihar STP ***(before Kalyanpuri)***
- 127 mld wastewater from Uttar Pradesh flowing through Loni and Sahibabad drains ***(before Kalyanpuri)***
- 30 mld wastewater flowing from Kalyanpuri drain near Kalyanpuri bridge ***(before Kalyanpuri)***
- 8.8 mld wastewater from the drain flowing through Chilla Village ***(after Kalyanpuri)***
- 19.2 mld wastewater from Sahahdara link drain ***(after Kalyanpuri)***
- 205 mld treated wastewater from the Konldi STP ***(after Kalyanpuri)***

Flow at Kalyanpuri available for tapping: As can be seen in the table below, after deducting the contributory flows after Kalyanpuri, the flow observed at Kalyanpuri is 361.8 mld. (See Table: Wastewater discharge profile of Shahdara drain at different locations). This is obtained by deducting the treated effluent discharge from Kondli, discharge from the drain from Chilla village and discharge from the Shahadara link drain.

Table: Wastewater discharge profile of Shahdara drain at different locations

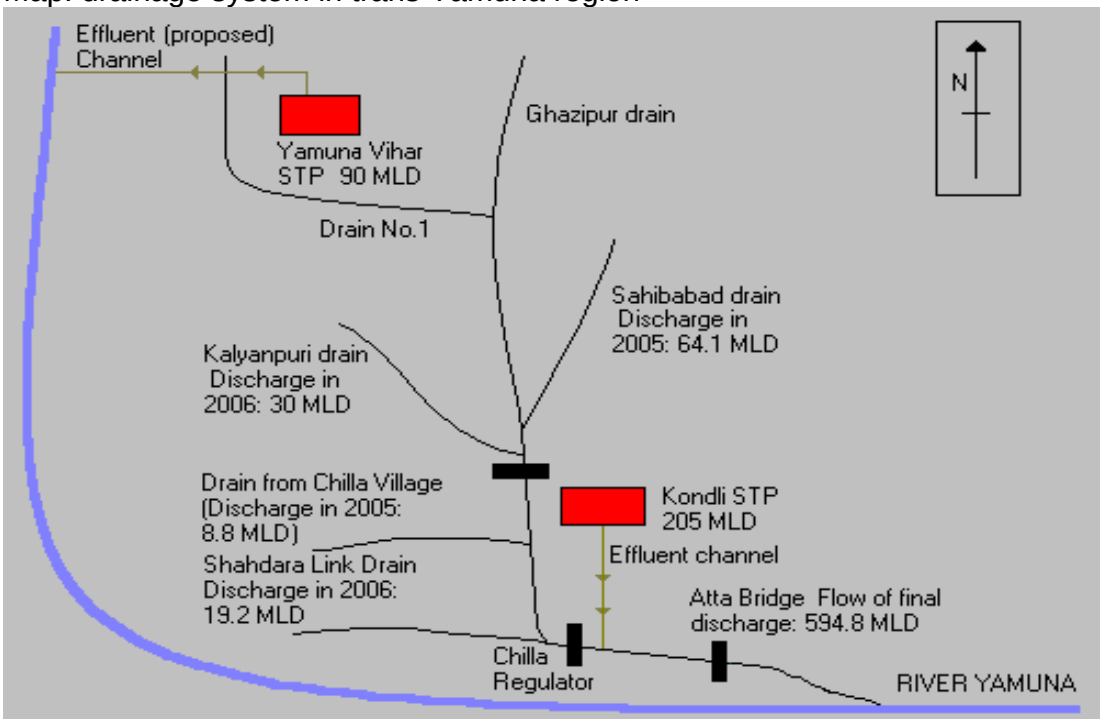
S No	Location	Flow (mld)
1	At Atta bridge	594.8
2	Contributory flows Kalyanpuri	
a	Drain from Chilla village	8.8
b	Shahdara link drain	19.2
c	Treated effluent from Kondli STP	205
d	Total contributory flows after Kalyanpuri (a+b+c)	233
3	**Flow at Kalyanpuri (1-d)**	**361.8**
4	**Flows that can be stopped before Kalyanpuri**	
a	Treated effluent from Yamuna Vihar STP	36
b	Additional waste that can be trapped and treated at Yamuna Vihar	54
c	Sahibabad and Loni drains	127
d	**Total flows that can be stopped before Kalyanpuri (a+b+c)**	**217**
5	**Waste available for tapping at Kalyanpuri**	**144.8**

The sewage treatment plan at Yamuna Vihar with a capacity of 90 mld is located right at the banks of drain no 1 which joins the Ghazipur drain and flows as the Shahdara drain. This STP treats only 36 mld wastewater and discharges the treated effluent into drain no 1. At current rate of utilization the volume of waste that would reach Kalyanpuri after diversion of 36 mld treated Yamuna Vihar STP effluent would be 325.8 mld (i.e., 361.8 mld minus 36 mld).

However being at the banks of the drain no 1 gives the Yamuna Vihar STP an opportunity to achieve full capacity utilization by tapping additional 54 mld waste from the drain no 1. If this is treated and diverted into the Yamuna, then the flow at Kalyanpuri would reduce to 271.8 mld (i.e., 361.8 mld minus 90 mld). (see Map: drainage system in trans Yamuna region)

It is also important to note that Shahdara drain at Kalyanpuri also receives waste from the Sahibabad industrial area and also from Loni (both in Uttar Pradesh) to the tune of 127 mld as measured during 2005. The learned amicus curiae and the EPCA in its fifth and sixth report have pointed out this. EPCA has also directed the Uttar Pradesh government to stop these flows. However, no action has been taken so far. If this 127 mld waste is stopped then the flow would reduce to 144.8 mld (i.e., 361.8 minus 90 mld minus 127 mld).

Map: drainage system in trans Yamuna region



As the volumes are measured in November 2006, it corresponds to dry weather flow and will be different from the annual average flow. The annual average flow observed in the Shahdara drain at Atta bridge during 2005 was 642.8 mld.

Also, the volumes are going to be higher during the monsoon season.

Conclusion: If the Yamuna Vihar STP is operated at full capacity by tapping drain no 1 and the 127 mld flowing through Loni and Sahibabad drain are stopped, then according to the dry weather flow measured in November 2006 the flow available at Kalyanpuri works out to 144.8 mld. In other words, a minimum discharge of 144.8 mld would be available at Kalyanpuri for tapping. But enough buffer will have to be created to account for population growth and annual average flow observed in the drain.

As per the documents submitted by DJB, 90 mld augmentation is being planned at Yamuna Vihar whereas in Kondli STP 205 mld is being planned.

Issue 2: Quantity of sewage that is discharged from the Janta Flats Area after Kalyanpuri.

Flow from the Janta flats are in Chilla village: The flow measurement conducted by CPCB in 2005 found that the flow in this drain was 8.8 mld. This drain meanders through the colonies in Mayur Vihar and hence could be tapped to the existing sewerage system. As the Sewage Pumping Station (SPS) at Kalyanpuri is close by, it is also possible to tap this drain to a sewer leading to the SPS. As a second alternative, on-site treatment (as detailed later in this report) could be explored.

Flow in the Shahadra link drain: The CPCB monitoring of November 2006 estimated the flow in this drain to be 19.2 mld.

Issue 3: Whether it would be possible to treat the residual sewage passing reaching Chilla regulator at an STP

Flow reaching Chilla regulator: If the entire flow in the Shahdara drain is stopped and diverted at Kalyanpuri to the Kondli STP, then the flow reaching the Chilla regulator would be due to the Shahdara link drain and the drain from Chilla village. The cumulative flow as measured by CPCB amounts to 28 mld.

EPCA's 5th report has looked at the possibility of having compact STP with smaller foot prints than the standards set by the DJB which one acre of land for every 4.5 mld (1 million gallons per day) wastewater to be treated. In fact there two STPs in Delhi which have a much smaller foot prints in order to ascertain the land requirement. In these STPs, the land requirement worked out to 400 square metre per mld as compared to 900 sq m as projected by DJB (See Table 2: Land requirement and capital costs of treatment plants in Delhi).

Table 2: Land requirement and capital costs of treatment plants in Delhi

S No	***Name of the STP***	**Land area** m^2
1	Delhi gate (10 mld)	4000
2	Sen Nursing Home (10 mld) with 2 mld UV disinfection unit	4000

Source: Delhi Jal Board

Going by the standards as available from Delhi, (i.e., 400 m^2 per mld) a 28 mld say 30 mld plant would require 12,000 m^2 (i.e., 3 acres). As 2.5 acres is already available finding 0.5 acres (or more as per the flow) to treat the residual wastewater at Chilla should not be a problem for the authorities concerned. Hence it is possible to have a compact STP at Chilla. Also, it is practice to design civil engineering structures as per the land availability.

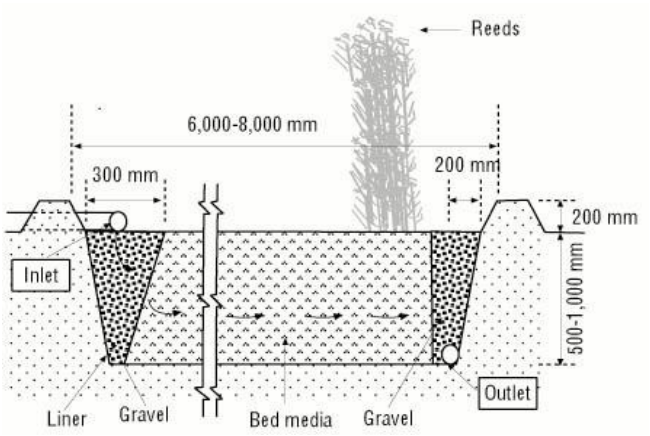
The treated effluents from this STP could then be released into the Hindon Cut, which joins the Yamuna after travelling 200 metres.

Issue 4: Technologies for on-site treatment of drains

The two drains in question are the drains from Chilla village and Shahdara link drain. It was informed by the CPCB that a pilot scheme for on-site treatment of the Shahdara link drain has been initiated. This project based on bio blocks concept is likely to be completed in six months. After evaluation of the performance the CPCB would consider the replication of the same.

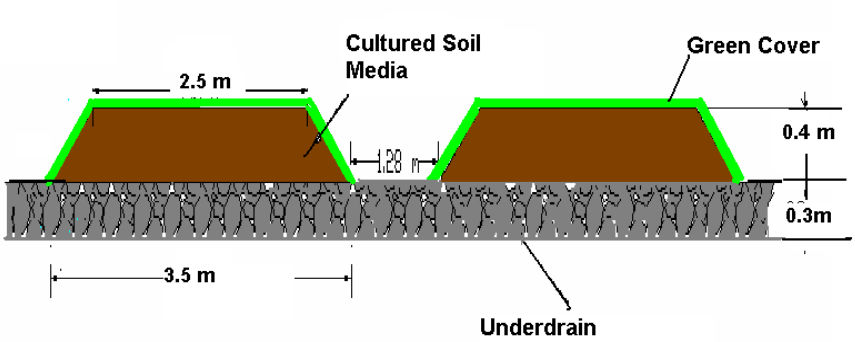
Besides bio blocks, there are various low cost online treatment technologies adopted in different parts of the country to deal with wastewater flow in the drains. These include root zone treatment and phyto-remediation using wetland systems as tested and evaluated by the Indian Institute of Technology Delhi, green bridge technology as experimented in Pune, soil bio-technology tested in Lajpat Nagar in Delhi and addition of catalysts (enzymes). A summary of these technologies as published in “A Wastewater recycling Manual” published by the Centre for Science and Environment is attached below:

a. Root Zone Treatment: This method of wastewater treatment involves the use of aquatic plants especially root zone oxidation plants in constructed wetlands. This is designed to treat water by natural processes, which include uptake of minerals and metals by plants and associated microbial organisms. This has been tried out in IIT Delhi and also in Ujjain.



The capital cost of the system at IIT, which treat 0.1mld was Rs 1 lakh.

b. Soil bio-technology: In this technology soil is used as a media for treating the wastewater. Here wastewater is pumped or sprayed on the top of the sand bed. The bed consists of cultured soil media consisting of layer of boulders, pebbles and sand. These filtering media is placed over a thick plastic sheet. The wastewater is repeatedly pumped on the top of the soil media and the treated or filtered water is collected in the furrows between the soil bunds and finally diverted to a collection well. The collection well also acts as aeration tank. This water is finally pumped and used for irrigation purposes. Locally available wild plants are grown on the top of soil to enhance the treatment process.
At Lajpat Nagar in New Delhi, the Delhi Transport and Tourism Development Corporation (DTTDC) has developed a pilot project to treat wastewater flow in drains.



c. Green bridge technology: This system has three components-- Green Bridge, Green Lake Eco-System and Stream Eco-System.

- The Green Bridge technology uses filtration power of cellulosic, fibrous material like coconut coir or dried water hyacinth or aquatic grasses. These are compacted and woven to form a bridge--porous wall like structure. All the floatable and suspended solids are trapped in this biological bridge and the turbidity of flowing water is reduced. It helps in more penetration of light that

promotes the autotrophic organisms, which increase the dissolved oxygen (DO) thereby facilitating the growth of aerobic organisms.

- Green Lake (or *macrophyte ponds*) uses floating, submerged or emergent aquatic plant species. The experiments done in Pune claim macrophytes absorb large amounts of inorganic nutrients such as nitrogen and phosphorus, and heavy metals such as cadmium, copper, mercury, and zinc etc. It is also said to promote growth of microbes to facilitate the degradation of organic matter and toxicants.
- Stream Eco-System is based on the natural principle of utilization of waste by one organism as another's food.

This system was set up in Pune over an area of 1,000 sq m over a length of 1.5 km in a wastewater drain (for 75 mld wastewater) at an investment of Rs 9 lakhs (at the rate of Rs 0.14 lakhs per mld). The running cost (operation and maintenance) is estimated to be Rs 0.60 lakhs per annum.

Catalysts: Various enzymes, which activate and enhance wastewater treatment is available. They reduce the sludge formation and speeds up the clean up.

A summary of the experiences from various options as explained above are given in the table:

Technology	Flow treated	Raw sewage BOD (mg/l)	Raw sewage COD (mg/l)	Treated BOD (mg/l)	Treated COD (mg/l)	Capital cost	O&M cost
Reed bed-IIT model[1]	0.1 mld	30-40	100-120	15-25	40-70	Rs 1 lakh	na
Artificial floating islands-Ujjain[2]	na	Away from island: 40	Away from island: 62	Under the island: 23	Under the island: 32	Rs 15 lakh	na
Green bridge-Pune[3]	75 mld	470-480	870-880	40-50	115-125	Rs 9 lakh	Rs 0.60 Lakh PA
Enzymes-Manesar, Haryana[4]	0.55 mld	na	na	na	na	na	Rs 87,000 per month

Note: The use of EM solution (enzymes) was observed to reduce the coliform count from 14,100 to 1,600 MPN/100ml.

Source:

1. Anon undated, Pre-feasibility study on upgradation of wastewater from nala by using aquatic plants (phyto-remediation) and extension of this technology, Centre for rural development & technology, *mimeo*
2. S K Billore 2006, Vikram University, Ujjain
3. Anon 2005, Eco-technologies to restore the quality of nala and rivers, Shristi Eco-research Institute, Pune, *mimeo*
4. Anon 2005, A wastewater recycling manual for urban areas: Case studies, Centre for science and Environment

Suitability of on-site treatment in the two drains in question would also depend on the wastewater parameters flowing through them. Basic wastewater parameters to be considered for designing such systems are pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and coliform count. The quality of wastewater as observed in the November 2006 CPCB report is as follows:

- Khichripur drain: Ph 7.1; TSS 620 mg/l; COD 768 mg/l; BOD 320 mg/l
- Shahdara Link Drain: Ph 7.4; TSS 560 mg/l; COD 240 mg/l; BOD 205 mg/l

Most of the above mentioned techniques offer partial treatment of the waste in a natural environment. A system for drains in Delhi has to be designed in accordance to the desired out put quality. In the case of these two drains after partial treatment using any of these technologies (or a combination) can be treated at a compact STP at Chilla. This would reduce the load on the STP.

All the above-mentioned projects have been implemented on a site-specific basis. Therefore depending on the discharge, wastewater quality and quality of treated wastewater required, suitable technological options (or a combination of technologies) will have to be worked out for Delhi's drains.

As a first step, the government agencies under the guidance of the CPCB or the National Environmental Engineering Research Institute (NEERI) should be asked to carry out pilot projects and thereafter evaluate the effectiveness of these technologies before its replication.

Way ahead for sewage management in trans-Yamuna region

As discussed in the fifth and sixth reports of the EPCA, wastewater management in the trans-Yamuna region would need an action plan to achieve the following objectives

- **Objective 1:** To ensure that all waste in the existing drains of East Delhi is trapped and treated
- **Objective 2:** To ensure that the treated effluent is not mixed with untreated waste before it flows to Yamuna
- **Objective 3:** To ensure that the Shahdra Drain does not collect the untreated effluent of the Noida segment
- **Objective 4:** To ensure regular and accurate monitoring of quantity and quality

ENVIRONMENT POLLUTION (PREVENTION & CONTROL) AUTHORITY
for The National Capital Region

BHURE LAL
Chairman

EPCA-3/NCR/2004
January 3, 2007

To

The Registrar General,
Supreme Court of India,
Tilak Marg, New Delhi – 110 001

Kind Attention : Asst. Registrar (PIL Cell)

Sub.: Writ Petion Civil No. 914/1996 Sector 14 Residents Welfare Association, NOIDA and others Vs State of Delhi and others

Sir,

The Hon'ble Supreme Court on September 28, 2006,directed the Counsel for the parties to find out as to what would be the flow of water at Kalyanpuri excluding the treated water at Yamuna Vihar STP, which would be taken from Yamuna Vihar to River Yamuna. Further to this order, on October 12, 2006, Shri A K Ganguli, Amicus Curiae requested Environment Pollution (Protection & Control) Authority (EPCA) for the NCR to submit a fresh status report.

Please find enclosed 10 copies of the EPCA 7th Report on P.K. Kaul Committee recommendations. The report may kindly be placed before the Hon'ble Court.

Yours faithfully,

(Bhure Lal)

Copy to :

The Secretary,
Ministry of Environment & Forests,
Paryavaran Bhawan, CGO Complex,
Lodi Road, New Delhi-110 003

(Bhure Lal)

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