



CENTRAL POLLUTION CONTROL BOARD
(Ministry of Environment, Forests and Climate Change)
'PariveshBhawan', East Arjun Nagar,
Delhi – 110032

**REPORT ON ASSESSMENT OF IMPACT OF LOCK DOWN ON
WATER QUALITY OF RIVER YAMUNA – DELHI STRETCH**

1. BACKGROUND

Various photographs and videos were circulated among different social media platforms claiming improved water quality of river Yamuna due to lock down of NCT of Delhi in amid crisis of COVID-19. A visit was made to verify the status of water quality of river Yamuna on 06/04/2020 between 9 AM to 1 PM by the CPCB Team comprising following officials: -

- (1). Dr. Yashpal Yadav, Scientist 'B', Bio-Lab, CPCB, Delhi, and
- (2). Shri Anand B Salve, JSA, Bio-Lab, CPCB, Delhi.

Sampling of river Yamuna at 3 locations viz., Palla (Entry point of river Yamuna in Delhi), Nizamuddin bridge (between Wazirabad barrage and Okhla barrage – 14 drains contributing discharges), Okhla barrage Upstream (after discharge of 16 drains) and two major drains (which are contributors of both hydraulic & pollution load in river Yamuna) namely Najafgarh drain and Shahdaradrain following the standard protocols for collection, transportation and further analysis were carried out in CPCB Central Laboratory. Approximately, river Yamuna stretch between collected water sampling locations i.e., between Palla and Wazirabad Barrage is about 22KM, between Wazirabad Barrage to Nizamuddin Road Bridge is about 13.5 KM, Nizamuddin Bridge to Okhla Barrage is about 7.5 KM. At the time of sampling, no human activity such as bathing, washing of clothes at Dhobi Ghats, religious activities, throwing of flowers, garlands and other worship materials, was observed by the monitoring team in the vicinity of the sampling locations. Photographs of river Yamuna and drains taken during the visit is annexed as **Annexure-I**.

2. INTRODUCTION–ABOUT RIVER YAMUNA WITHIN DELHI STRETCH

River Yamuna enter Delhi at village Palla, traverse 22 Km to Wazirabad barragewhere entire water is impounded to meet the drinking water requirement of Delhi.River Yamuna cease to exist downstream of Wazirabad Barrage during major part of the year and gets its flow from Najafgarh drain at Wazirabad downstream.No major fresh water is allowed to flow downstream of Wazirabad barrage except for monsoon season. As the river traverses further downstream the flow is blocked by a barrage at Okhla. The major part of the water is diverted to Agra canal.

2.1 DRAINAGE PATTERN OF RIVER YAMUNA-WITHIN DELHI STRETCH

There are 23 drains discharging wastewater in river Yamuna i.e., 16 drains discharging wastewater in river Yamuna stretch between Wazirabad downstream to Okhla Upstream and 04 drains meet Yamuna in downstream of Okhla Barrage and 03 more drains which discharge their wastewater directly to Agra Canal and Gurgaon Canal. 05 out of 23 drains are having interception and diversion provision of sewage to the nearby STPs for ensuring further treatment. Schematic flow diagram of river Yamuna contributing to pollution in river Yamuna within Delhi stretch is given in **Figure 1**.

Based on the assessment carried out for the year 2019 (**Table 1**), out of all the drains that flow into the river Yamuna, the drains viz., Najafgarh drain (including Supplementary drain), Delhi Gate drain, Sen Nursing Home drain, Barapulla, Tughlakabad and Shahdara drain contribute about 86% of hydraulic load (Volume of Waste Water) and 75 % of organic load (BOD i.e., amount of organic matter).Main causes for pollution in river Yamuna are (i) discharge of treated or untreated sewage, (ii) discharge of treated and untreated industrial effluents, (iii) bathing by the general public, (iv) washing of clothes on the banks, (v) performing poojas, (vi) throwing of worship materials including idols made of Plaster of Paris (PoP) and decorated with toxic paints during festival season,(vii) disposal of solid waste, and (viii) Flood plain farming and other activities etc.,

Table 1: Waste Water Discharges through Drain into River Yamuna (2019)

S.No.	Name of Drain	Avg. Flow (MLD)	Avg. BOD Load (TPD)
1.	Najafgarh Drain	1938.38	133.82

S.No.	Name of Drain	Avg. Flow (MLD)	Avg. BOD Load (TPD)
2.	Shahdara Drain	500.97	61.44
3.	Waste water input into abandoned Agra Canal	117.93	21.54
4	Barapulla Drain	151.77	10.46
5	Tuglakabad Drain	22.10	3.42
6	Delhi Gate (Power House) Drain	39.02	3.43
7	Sen Nursing Home Drain	31.53	4.69
8	Abu Fazal Drain	28.94	0.88
9	ISBT + Mori Gate Drain	37.94	2.67
10	SaritaVihar Drain	35.68	7.73
11	Maharani Bagh Drain	30.16	3.51
12	Jaitpur Drain	19.58	3.07
13	Molar Bandh Drain	22.17	2.36
14	Kailash Nagar Drain	9	2.70
15	Tonga Stand Drain	4.46	0.59
16	Shastri Park Drain	5.76	0.75
17	Drain No.14	6.54	0.07
18	Magazine Road Drain	4.32	0.30
19	Civil Mill Drain	11.14	0.67
20	Metcalf House Drain	3.45	0.11
21	Sweeper Colony Drain	5.4	0.10
22	Khyber Pass Drain	NF	NF
Total		3026.24 MLD	264.31 TPD
Note: NF- No Flow			

2.2 STATUS OF WASTEWATER GENERATION AND TREATMENT CAPACITY

There are 41 STPs and out of which 33 STPs are operational and remaining 08 STPs are observed non-operational. The total installed capacity of wastewater in Delhi is 3149.3 MLD and operational capacity of 33 STPs are 2801.27 MLD and capacity of non-operational 08 STPs is 348.03 MLD. Out of 2801 MLD of operational capacity, actual treatment capacity utilization is 2254 MLD.

Delhi Jal Board (DJB) has initiated Interceptor Sewage Project (ISP) to trap untreated sewage from 108 drains out-falling into Najafgarh, Supplementary and Shahdara drains. Currently, 94% of project work has been completed i.e., out of proposed 916 MLD (242 MGD) drain flow to be trapped under ISP, 476 MLD (125.8 MGD) of sewage flow from drains has been trapped so far and provision of trapping of sewage from drains about 583 MLD (154 MGD) is expected to be completed by October, 2019.

2.3 INDUSTRIAL EFFLUENT

There are 28 Approved Industrial Estates/Areas in Delhi and 28117 industrial units are operating in these industrial estates/areas as per online Delhi Pollution Control Committee (DPCC). Out of 28117 industrial units, 1516 industrial units are water polluting and have installed captive Effluent Treatment Plants (ETPs). Main sources of water by industries in Delhi is groundwater and through tankers. Total waste water generation from these industrial estates/areas is 35.98 MLD. Also, there are 13 CETPs to cater the waste water generated from 17 Approved Industrial Estates/Areas with total treatment capacity of 212.3 MLD.

In view of the lockdown due to COVID-19 pandemic, all the industries are not operational and therefore, at present, there is no discharge (both domestic sewage and industrial effluent) from all the industries located in Delhi State. However, during the lock down period, discharge of partially treated and untreated domestic wastewater continues to be in same proportion as in business as usual days. Shutting down of industrial activity will only result in reduction of 35.9 MLD of industrial effluent and still BOD load about 260 TPD is expected to be discharged through drains.

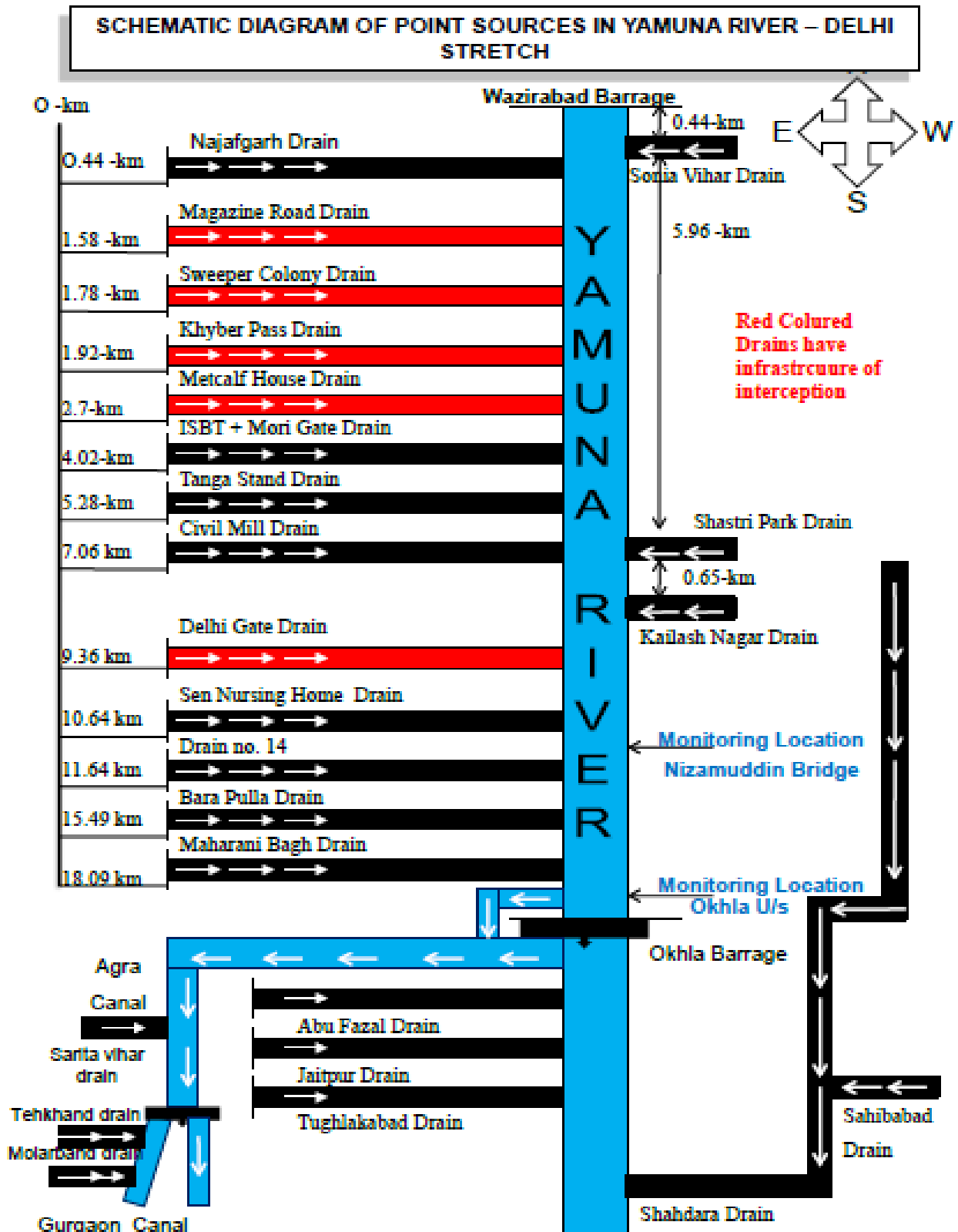


Figure 1: Schematic Flow Diagram of River Yamuna - Delhi Stretch

3. WATER QUALITY OF RIVER YAMUNA AND TWO DRAINS

As stated earlier, sampling of river Yamuna were carried out at 3 locations i.e., Palla, Nizamuddin Bridge, Okhla upstream and major two drains carrying wastewater namely Najafgarh drain and Shahdara drain on 06/04/2020. Also, CPCB has been carrying out monitoring of river Yamuna at these locations on monthly basis. Analytical results of afore mentioned locations are compared with data for the period March 2020 and April 2020 and same are given in **Table 1 and Table 2 below**. Water Quality Trend of river Yamuna as well as Two Drains (Najafgarh and Shahdara drain) with respect to pH, EC, DO, BOD and COD as observed during Pre-lockdown (March 04, 2020) and Lockdown period (April 06, 2020) are depicted in **Figure 2 to Figure 6**.

Table 1: Water Quality of River Yamuna - Delhi Stretch

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria (% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
Palla								
pH	6.5-8.5	8.3	7.8	8.1	8.7	8.7	7.8	Non-Complying in April 2019 and March 2020
Conductivity, μ S/cm	-	1215	1115	531	440	668	273	Decrease (59.13 %)
DO, mg/l	5.0	7.3	7.1	10.0	8.2	17.1	8.3	Complying (Decrease 51.46 %)
BOD, mg/l	3.0	3	3	1.8	8.8	7.9	2.0	Not complying in April 2019 and March 2020. But complying in April 2020 (Decrease 74.69 %)
COD, mg/l	-	28	15	14	26	28	6	(Decrease -

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria(% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
								78.57 %)
Nizamuddin Bridge								
pH	6.5-8.5	7.4	8.0	7.1	7.2	7.3	7.2	Complying (Slight Increase 1.37 %)
Conductivity, μ S/cm	-	1906	2120	1140	1140	1369	460	Decrease (66.40 %)
DO, mg/l	5.0	1.8	1.2	1.9	1.0	Not Detected	2.4	Not complying during Pre-Lockdown and Lockdown, but improvement in lockdown period
BOD, mg/l	3.0	42	39	21	18	57	5.6	Not complying during 2018, 2019 and in 2020 (Pre-lockdown and Lockdown). But, considerable decrease in BOD Value in April 2020 (Decrease 90.18%)
COD, mg/l	-	140	100	81	71	90	16	(Decrease 82.22 %)
Okhla U/s								
pH	6.5-8.5	7.3	7.5	7.2	7.3	7.2	7.1	Complying (Slight

Parameters	Primary Water Quality Criteria for Outdoor Bathing Notified Under E (P) Rules, 1986	2018		2019		2020		Remarks- Compliance Status w.r.t Primary Water Quality Criteria(% Increase or Decrease during Pre-Lockdown and Lock Down Period)
		March	April	March	April	March*	April ** (06.04.2020)	
								Increase 1.39 %)
Conductivity, μ S/cm	-	990	1132	914	1230	861	488	(Decrease 43.32 %)
DO, mg/l	5.0	1.2	1.0	0.9	1.9	Not Detected	1.2	Not Complying
BOD, mg/l	3.0	18	18	20	19	27	6.1	Not Complying But, considerable decrease in BOD value in April 2020 (Decrease 77.41 %)
COD, mg/l	-	81	67	66	67	95	18	Decrease (81.05 %)
Note: <i>*Pre- lockdown (04.03.2020) **Post-lockdown (06.04.2020)</i>								

Table 2: Water Quality of Najafgarh and Shahdara Drain (Sample collected on 06.04.2020)

Parameters	2018		2019		2020		Remarks	
	March	April	March	April	March*	April**	Comparison between April 2019 and April 2020)	Comparison between March 2020 (Pre-lockdown) and April 2020 (Lockdown Period)
Najafgarh Drain								
pH	7.3	7.2	7.4	7.3	7.3	7.3		-
SS, mg/l	282	264	201	200	152	106	Decrease	Decrease

Parameters	2018		2019		2020		Remarks	
							Comparison between April 2019 and April 2020	Comparison between March 2020 (Pre-lockdown) and April 2020 (Lockdown Period)
	March	April	March	April	March*	April**		
							(47 %)	(30.26 %)
BOD, mg/l	50	62	128	90	78	55	(Decrease (38.89 %))	Decrease (29.49 %)
COD, mg/l	319	258	314	316	271	150	Decrease (52.53 %)	Decrease (44.65 %)
Conductivity, μ s/cm	-	-	-	-	-	1501	-	-
Shahdara Drain								
pH	7.1	7.2	7.3	7.1	7.1	7.2	Increase in Alkalinity (9.86 %)	Increase in Alkalinity (9.86%)
SS, mg/l	276	260	481	380	464	305	Decrease (19.74)	Decrease (34.27 %)
BOD, mg/l	46	56	114	128	163	89	Decrease (30.47 %)	Decrease (45.4%)
COD, mg/l	296	311	551	412	574	383	Decrease (7.04 %)	Decrease (33.28 %)
Conductivity, μ s/cm	-	-	-	-	-	1657	-	-
Note: **Pre lockdown(04.03.2020) ***Post lockdown (06.04.2020)								

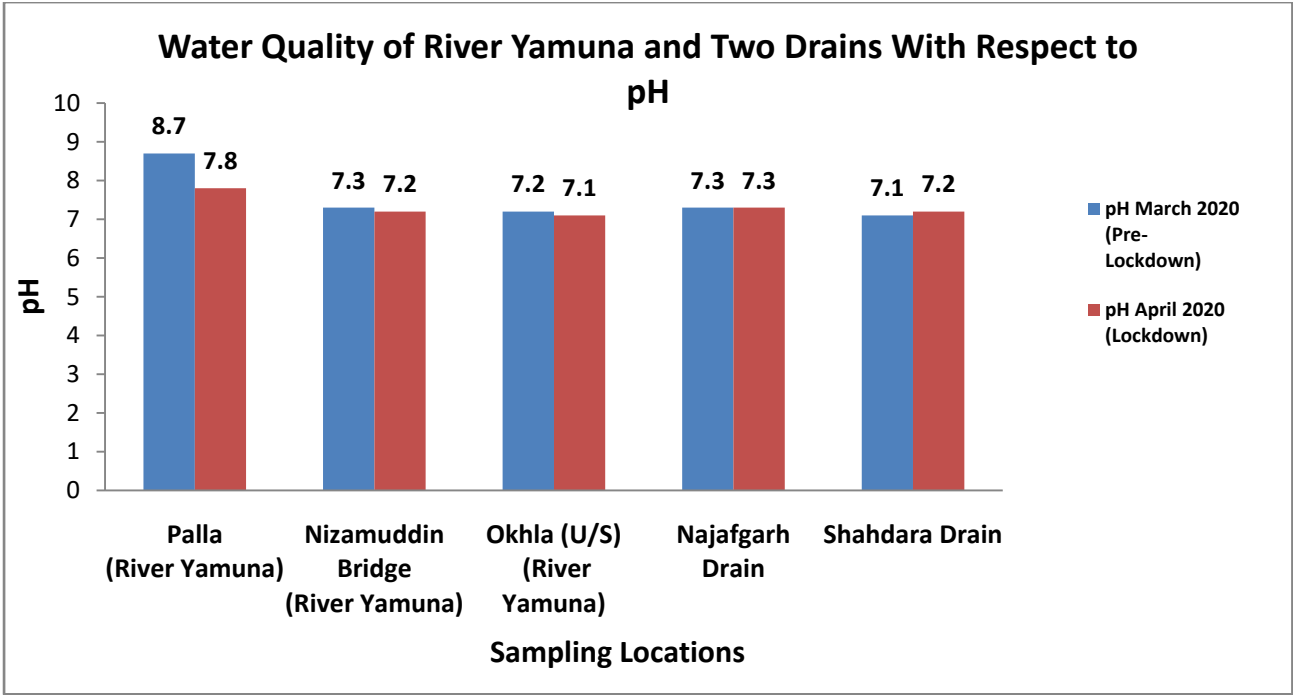


Figure 2: Water Quality of River Yamuna with respect to pH (Pre-Lockdown and During Lockdown)

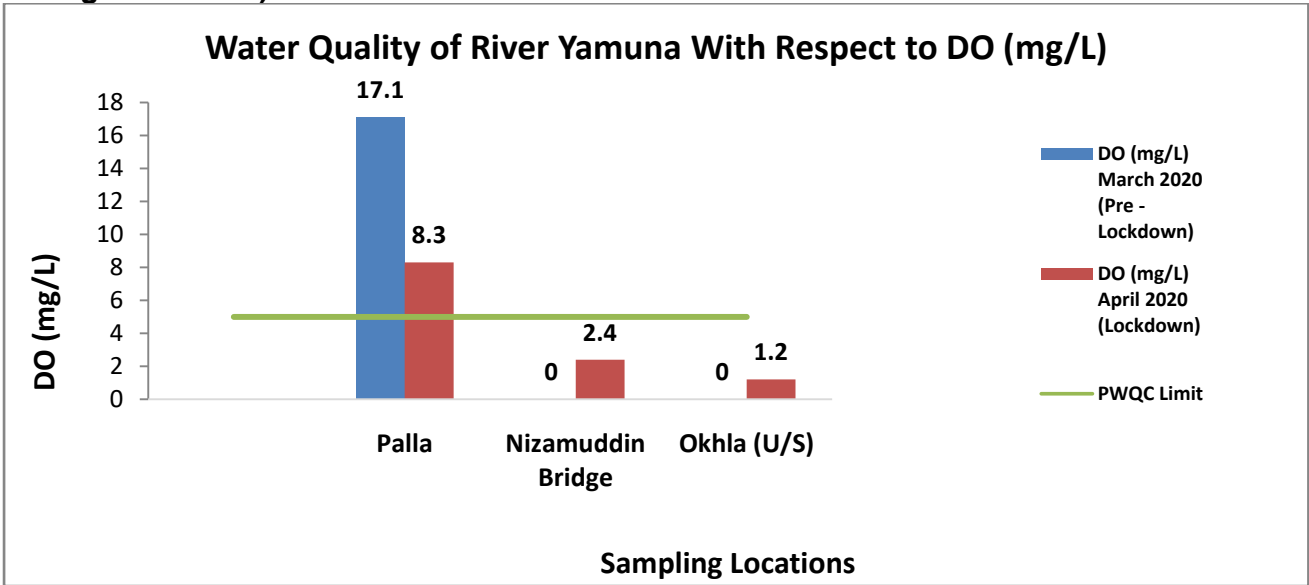


Figure 3: Water Quality of River Yamuna with respect to DO (during Pre-Lockdown and Lockdown)

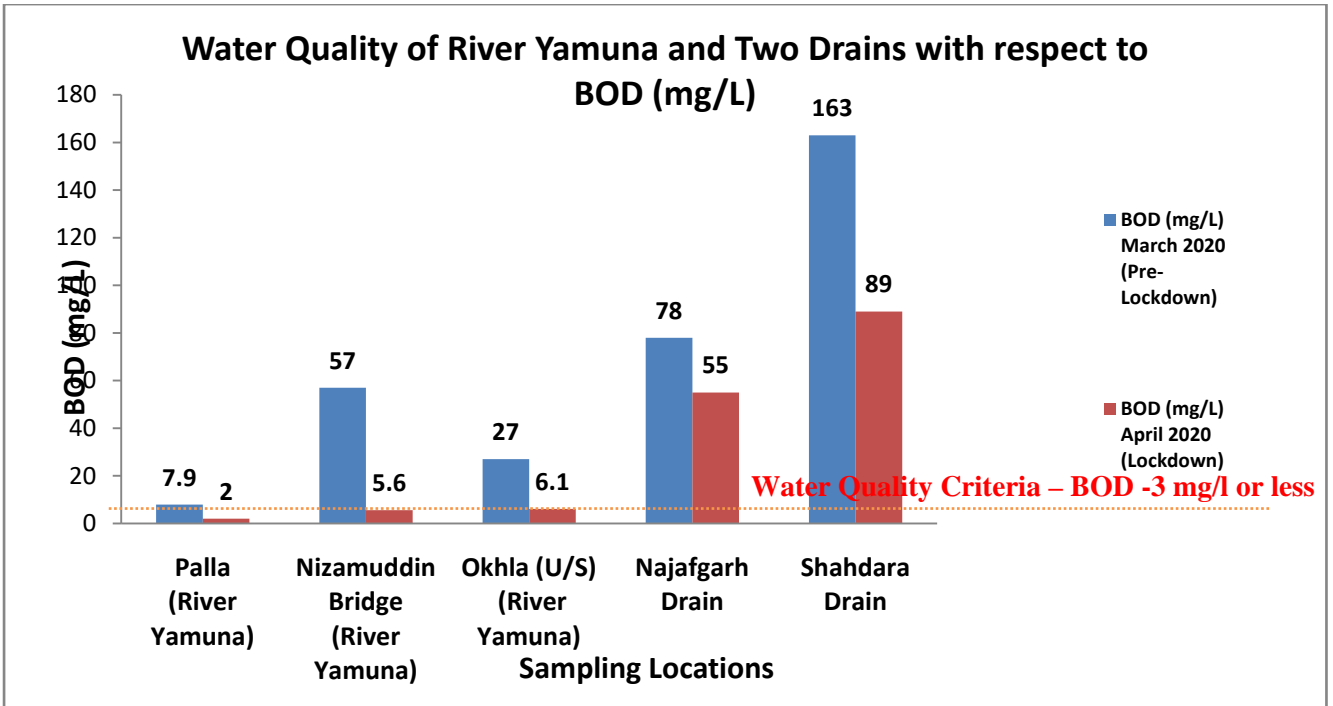


Figure 4: Water Quality Trend of River Yamuna and Two Drains with respect to BOD(during Pre-Lockdown and Lockdown)

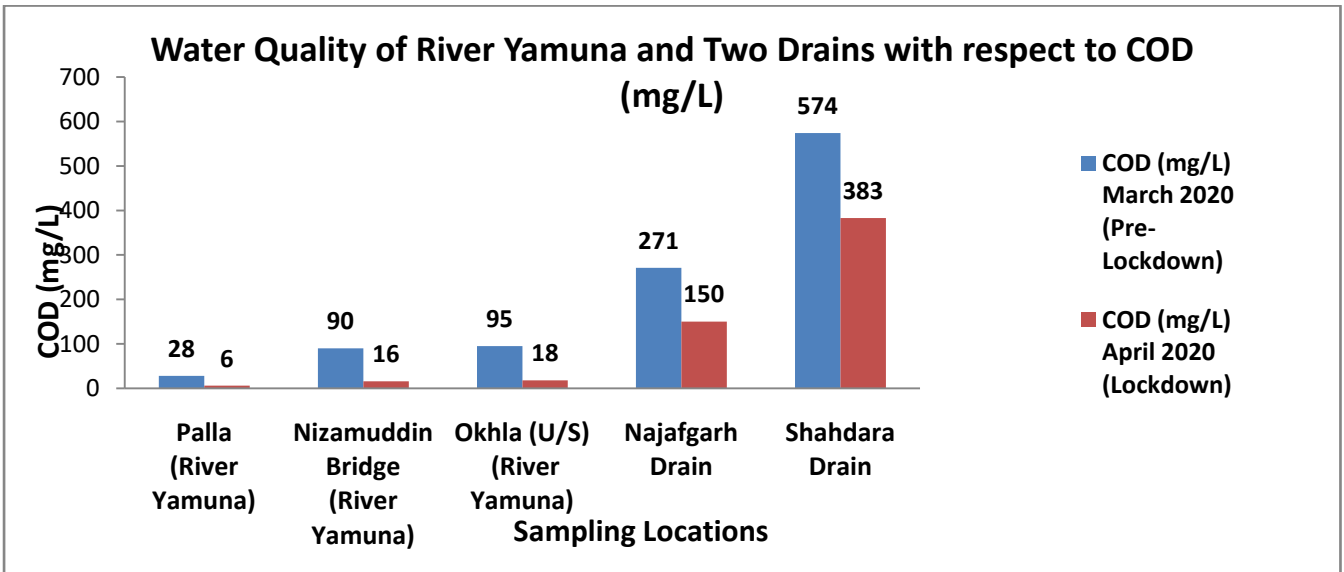


Figure 5: Water Quality Trend of River Yamuna and Two Drains with respect to COD (during Pre-Lockdown and Lockdown)

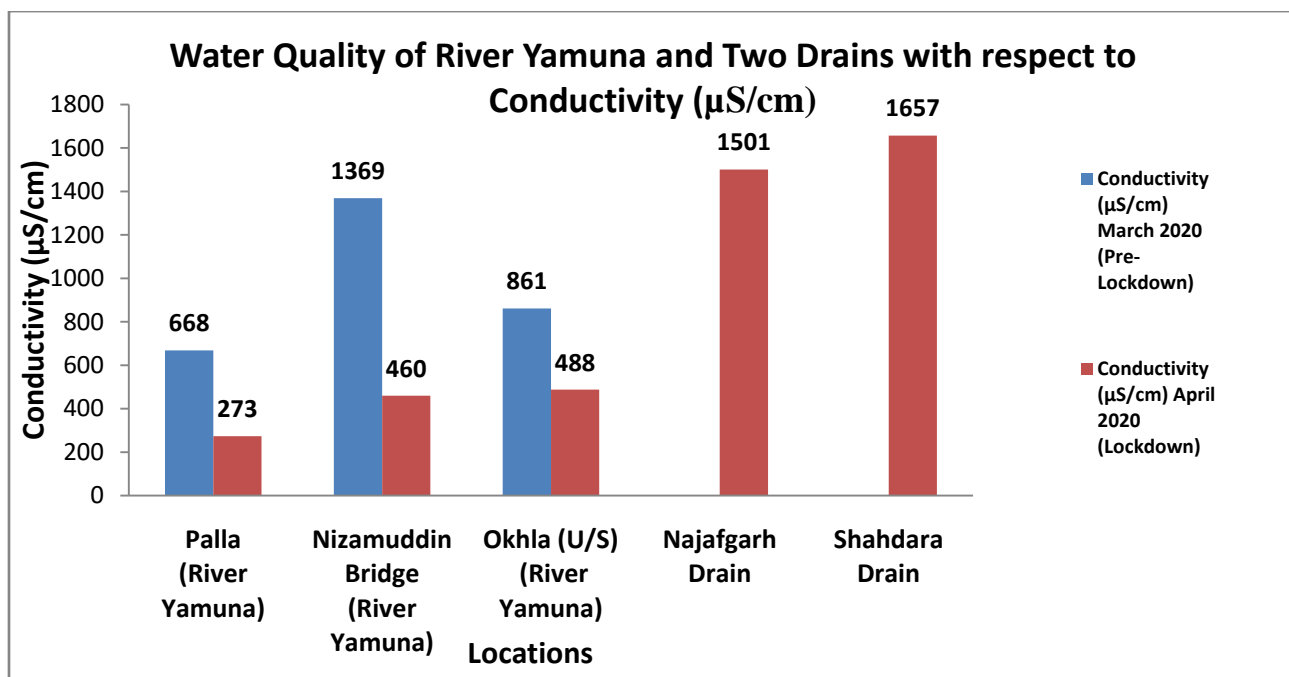


Figure 6: Water Quality Trend of River Yamuna and Two Drains with respect to EC (During Pre-Lockdown and Lockdown)

4. FINDINGS/OBSERVATIONS

Based on the field study and analytical results, following findings/observations are made:

- (i) During the visit on 06/04/2020, as informed by Delhi Jal Board (DJB), about 4145 cusec (hourly average) of fresh water is being released into river Yamuna from Wazirabad barrage, which is mainly due to (i) non-availability of adequate storage capacity at Wazirabad Barrage, (ii) more discharge of fresh water from Hathnikund Barrage, and (iii) unexpected or unseasonal snowfall or rainfall on U/s portion of river Yamuna and monthly average discharge of fresh water from Wazirabad barrage during the month of March, 2020 is 4863 cusecs. Maximum discharge of fresh water of 15,950 cusecs to river Yamuna was recorded on 16.03.2020. It was also observed that during last week of February, 2020 and first week of March, 2020, fresh water release from Wazirabad barrage were less than 1000 cusecs. Details of fresh water discharge from Wazirabad Barrage into river Yamuna for the months of February, March and April, 2020 is annexed (**Annexure-II**).

- (ii) In view of the lockdown due to COVID-19 pandemic, most of the industries located in Delhi are not in operation at present, total waste water discharge (both treated and untreated domestic sewage) from Delhi into river Yamuna is expected to be around 2990 MLD against estimated total wastewater discharge (both domestic and industrial wastewater) of 3026 MLD into river Yamuna during the pre-lockdown period (before 24.03.2020).
- (iii) The analysis results of collected water samples on 06.04.2020 during the lockdown period at Palla, Nizamuddin Bridge, Okhla Barrage U/s as well as Najafgarh Drain and Shahdara Drain are given in subsequent paras:-

Pre-lockdown period (i.e., before 23.03.2020) (in March 2020) and Lockdown Period (06.04.2020):-

At Palla, during pre-lockdown period in March 2020, the analysis results showed pH (8.7), EC (668 $\mu\text{s/cm}$), BOD (.7.9 mg/L), DO (17.1 mg/L), and COD (28 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.8), EC (273 $\mu\text{s/cm}$), BOD (2 mg/L), DO (8.3 mg/L) and COD (6 mg/L) and complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters pH, DO and BOD which shows improvement in water quality of river Yamuna at Palla. Also, comparative analysis results during pre-lockdown and lockdown period reveals that there is a considerable decrease in concentration of parameters i.e., EC (59.18 %), DO (51.46 %), BOD (74.69 %) and COD (78.57 %) which may be attributed to fresh water flow from upstream of river Yamuna and no human activity or industrial effluent discharge due to lockdown in view of COVID-19 pandemic.

At Nizamuddin Bridge, during pre-lockdown period in March 2020, the analysis results showed pH (7.3), EC (1369 $\mu\text{s/cm}$), BOD (.57 mg/L), DO (not detected), and COD (90 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.2), EC (460 $\mu\text{s/cm}$), BOD (5.6 mg/L), DO (2.4 mg/L) and COD (16 mg/L) and not complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters of DO and BOD. Comparative analysis results during pre-

lockdown and during lockdown reveal that there is a substantial decrease in concentration of parameters particularly w.r.t EC (66.40 %), BOD (90.18 %) and COD (82.22 %) which can be attributed to contribution of mainly from 14 drains discharging both treated and untreated sewage, no industrial effluent discharges from the industrial areas or no other human activities such as bathing, throwing of worship materials or solid waste and fresh water discharges from U/s of river Yamuna.

At U/s of Okhla Barrage, during pre-lockdown period in March 2020, the analysis results showed pH (7.2), EC (861 $\mu\text{s/cm}$), BOD (.27 mg/L), DO (not detected), and COD (95 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.1), EC (488 $\mu\text{s/cm}$), BOD (6.1 mg/L), DO (1.2 mg/L) and COD (18 mg/L) and not complying to the primary water quality criteria for outdoor bathing w.r.t analyzed parameters such as DO and BOD. Comparative analysis results (pre-lockdown and lockdown period) reveal that there is considerable decrease in concentration of parameters w.r.t analyzed parameters viz., EC(43.32 %), BOD (77.41 %) and COD (81.05 %) which can be attributed to contribution only from two drains carrying both treated or untreated sewage, no industrial effluent discharges and there is a river Yamuna stretch of about 7.5 KM (after Nizamuddin Bridge) and might be helping in self-purification of river Yamuna.

At Najafgarh Drain (which discharges 1938 MLD of wastewater into river Yamuna), during pre-lockdown period in March 2020, the analysis results showed pH (7.3), SS (152 mg/L), BOD (78 mg/L), COD (271 mg/L) whereas the analysis results during the lockdown period (on 06.04.2020) showed pH (7.3), SS (106 mg/L), EC (1501 $\mu\text{s/cm}$), BOD (55 mg/L), and COD (150 mg/L) Also, comparative analysis results (pre-lockdown and lockdown period) reveal that there is decrease in concentration of analyzed parameters i.e., SS (30.26 %), BOD (29.49 %), and COD (44.65 %) which can be attributed to carrying of untreated and treated sewage.

At Shahdara Drain, during pre-lockdown period in March 2020, the analysis results showed pH (7.1), SS (464 mg/L), BOD (163 mg/L), COD (574 mg/L) whereas the analysis results during the lockdown period (on

06.04.2020) showed pH (7.2), SS (305 mg/L), EC (1657 $\mu\text{s}/\text{cm}$), BOD (89 mg/L) and COD (303 mg/L) Also, comparative analysis results (pre-lockdown and lockdown period) reveal that there is decrease in concentration of analyzed parameters i.e., slight increase in alkalinity, SS (34.27 %), BOD (45.4 %) and COD (33.28 %).

5. Conclusion

Above analysis results indicate there is considerable improvement in water quality of river Yamuna (with respect to DO, BOD and COD when compared with pre-lockdown and lockdown period) at all the three monitored locations of river Yamuna. However, water quality of river Yamuna at Nizamudding and Okhla U/s not meeting the Primary water quality criteria for bathing standards with respect to DO and BOD.

Post –lock down, improvement in water quality can be attributed to (i) release of fresh water from Wazirabad Barrage and availability of dilution in river Yamuna, (ii) no industrial effluent discharge (about 35.9 MLD) at present due to lockdown in view of COVID-19 pandemic; (iii) Good penetration of solar radiation in water body can be expected due to washing out of bottom sediments as well as settleable and colloidal form of pollutants in river Yamuna, and (iv) Human activity such as throwing of Pooja materials, solid waste disposal, bathing, washing of clothes etc. minimized due to the ongoing lockdown due to COVID-19 pandemic.

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PHOTOGRAPHS OF RIVER YAMUNA (06.04.2020)



Figure 1: River Yamuna at Wazirabad Barrage

Figure 2: Najafgarh Drain



Figure 3: Confluence of Najafgarh Drain with River Yamuna at D/s Wazirabad Barrage



Figure 4: River Yamuna at D/s of ITO Barrage



Figure 5: Hindon Cut Canal



Figure 6: River Yamuna at Kalindi Kunj

ANNEXURE-II

**FRESH WATER DISCHARGE FROM WAZIRABAD BARRAGE INTO RIVER
YAMUNA
(IN CUSEC)**

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.02.2020	26000.00	1083.33
02.02.2020	42400.00	1766.67
03.02.2020	3800.00	158.33
04.02.2020	26600.00	1108.33
05.02.2020	25400.00	1058.33
06.02.2020	22800.00	950.00
07.02.2020	26800.00	1116.67
08.02.2020	30000.00	1250.00
09.02.2020	28000.00	1166.67
10.02.2020	18600.00	775.00
11.02.2020	20600.00	858.33
12.02.2020	21600.00	900.00
13.02.2020	15600.00	650.00
14.02.2020	15200.00	633.33
15.02.2020	10600.00	441.67
16.02.2020	9600.00	400.00
17.02.2020	7800.00	325.00
18.02.2020	7600.00	316.67
19.02.2020	12400.00	516.67
20.02.2020	13800.00	575.00
21.02.2020	9400.00	391.67
22.02.2020	11600.00	483.33
23.02.2020	13400.00	558.33
24.02.2020	25800.00	1075.00
25.02.2020	31400.00	1308.33
26.02.2020	26400.00	1100.00
27.02.2020	21200.00	883.33
28.02.2020	16000.00	666.67
29.02.2020	12200.00	508.33
Total Discharge	552600.00	23025.00
Avg. Discharge	19055.17	793.97

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.03.2020	13600.00	566.67

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
02.03.2020	14400.00	600.00
03.03.2020	12000.00	500.00
04.03.2020	9600.00	400.00
05.03.2020	10000.00	416.67
06.03.2020	18600.00	775.00
07.03.2020	19800.00	825.00
08.03.2020	20000.00	833.33
09.03.2020	23600.00	983.33
10.03.2020	68200.00	2841.67
11.03.2020	115200.00	4800.00
12.03.2020	103600.00	4316.67
13.03.2020	92000.00	3833.33
14.03.2020	74400.00	3100.00
15.03.2020	169600.00	7066.67
16.03.2020	382800.00	15950.00
17.03.2020	324000.00	13500.00
18.03.2020	235600.00	9816.67
19.03.2020	209600.00	8733.33
20.03.2020	178400.00	7433.33
21.03.2020	172800.00	7200.00
22.03.2020	154000.00	6416.67
23.03.2020	116800.00	4866.67
24.03.2020	129200.00	5383.33
25.03.2020	123200.00	5133.33
26.03.2020	106800.00	4450.00
27.03.2020	104400.00	4350.00
28.03.2020	124400.00	5183.33
29.03.2020	142800.00	5950.00
30.03.2020	152400.00	6350.00
31.03.2020	196400.00	8183.33
Total Discharge	3618200.00	150758.33
Monthly Average Discharge Rate	116716.13	4863.17

Date	Daily Discharge of the Day in Cusec	Average Hourly Discharge Rate in Cusec During the Day
01.04.2020	178000.00	7416.67
02.04.2020	142000.00	5916.67
03.04.2020	140800.00	5866.67

04.04.2020	136400.00	5683.33
05.04.2020	118800.00	4950.00
06.04.2020	45600.00	4145.45
Total Discharge	761600.00	33978.79
Avg. Discharge*	152320.00	6795.76

Source:- Delhi Jal Board (DJB)