

# Improved Water Quality of River Ganga during the Covid-19 Pandemic

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**Abstract**— Many countries shut themselves off from the work due to the novel corona virus disease pandemic (COVID-19) that hit the world severely in the first quarter of 2020. The nationwide lockdown in India was imposed on March, 25, 2020, to curb spread of COVID-19. Since the industries and people's activities have been shut off for a month or more in many parts of the world, it is expected to show some improvement in the prevailing conditions in the aforementioned spheres of environment. Here, a comparative assessment of pollution levels during pre-lockdown and lockdown periods was made through analysis of data generated from 36 Real Time Water Quality Motoring Systems. It showed overall improvement in water quality of River Ganga especially with regard to increased Dissolved Oxygen (DO) and reduced nitrate concentration. This may primarily be attributed to absence of industrial wastewater discharge, agricultural runoff and increased fresh water flow. The reduction in Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) concentration was relatively less due to continued discharge of domestic wastewater into the river, with estimated quantity of 3500 MLD (Million Litres per Day) of sewage, out of which 1100 MLD is treated. Industrial effluent is estimated to be about 300 MLD, which is about 9% of total wastewater being discharged into the river every day. Reduced activities at Ghats and entrainment of solid organic waste into the river may also have contributed to better water quality.

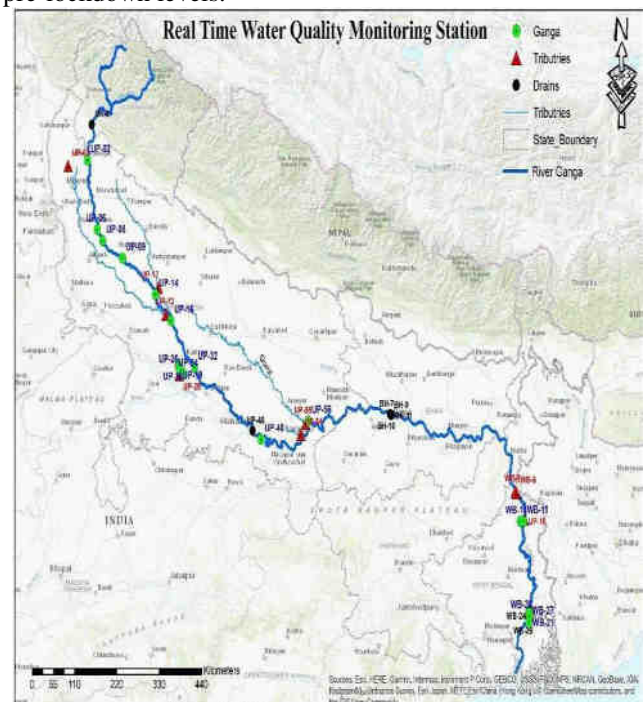
## A. INTRODUCTION

As of mid-April 2020, the disease caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) is affecting about 210 countries and territories around the world (Worldometers.info 2020). Since there is no vaccine or medicine currently to prevent or cure the COVID-19, the World Health Organization and governmental bodies requested people for practicing social distance, avoid public transportation, and separate oneself from other people. Several countries and territories made swift and stern action to keep people stay at their homes by shutting down schools, industries, businesses, suspended travels, and closed the international and state boundaries.

It is stated and proved in several studies that anthropogenic activities are considered as one of the key drivers of pollution in all spheres of the environment (Akimoto 2003; Volkamer et al. 2006; Masood et al. 2016; Schlacher et al. 2016). Since people's movements and industrial activities are closed down for weeks, it is expected that pollution loads to the environment also get decreased. Ganga (or Ganges) is the largest river in India, the river provides water to about 40% of India's population across 11 states, serving an estimated population of 500 million people which is more than any other river in the world. The Ganges is threatened by severe pollution. poses significant threats to human health and the

larger environment. Severely polluted with human waste and industrial contaminants. It is estimated that every day, almost 40 million litres of wastewater enters rivers and other water bodies; only 37 per cent is adequately treated. According to CPCB, more than half of wastewater treatment plants in the basin do not comply with the discharge norms. Today, the Ganges is considered to be the sixth-most polluted river in the world.

The Ganges turns cleaner at several places during the nationwide lockdown period that started on 25th March 2020 (Mani 2020). A comparative assessment of pollution levels during pre-lockdown and lockdown periods was made through analysis of data generated from 36 Real Time Water Quality Motoring Systems (18 on river Ganga, 09 on its tributaries and 09 on a few drains). The concentration data for Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Nitrate ( $\text{NO}_3^-$ ) and Ammoniacal Nitrogen ( $\text{NH}_3\text{-N}$ ) were examined for (i) Pre-lockdown period (March 15- 21, 2020) and (ii) Lockdown period (March 22 - April 15, 2020). Lockdown phase was further sub-divided into (i) Week I - March 22 to 28, 2020 (ii) Week II - March 29 to April 4, 2020 (iii) Week III - April 5 to 11, 2020, and (iv) Week IV - April 12 to 15, 2020. During March 14 to 16, 2020 there were rains in this part of the country that may have resulted in increased flow providing dilution during the first week of lockdown, however, the second week and after that it got reduced to the pre-lockdown levels.



2. IMPACT OF LOCKDOWN ON MAIN STREAM

Figures 1 & 2, 3 & 4, 5 & 6, 7 & 8 and 9 & 10 show variations in DO, BOD, COD, NO<sub>3</sub>- and NH<sub>3</sub>- N, respectively at various locations along Ganga from Bijnore (UP) to Howrah (WB) during pre-lockdown (March 15 to 21) and lockdown weeks – Week 1 (March 22 to 28), Week 2 (March 29 to April 4), Week 3 (April 5 to 11) and Week 4 (April 12 to 15).

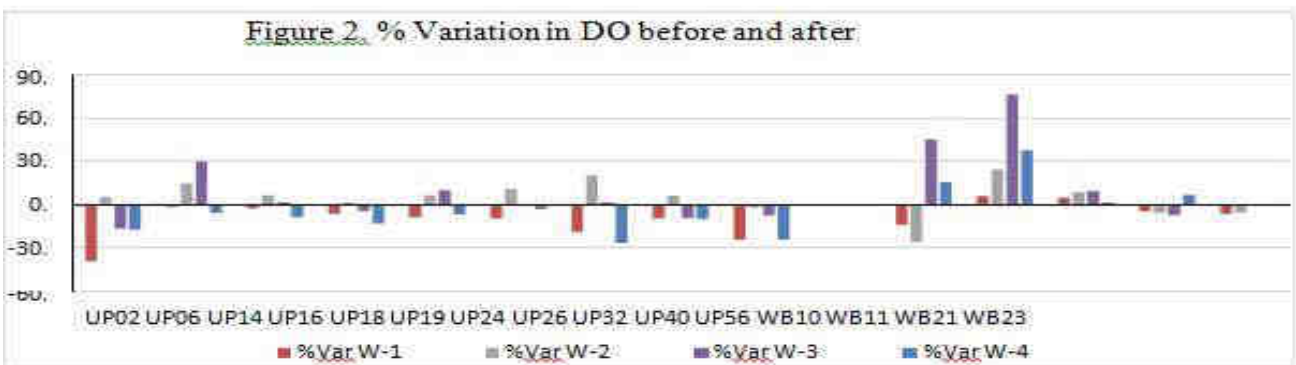
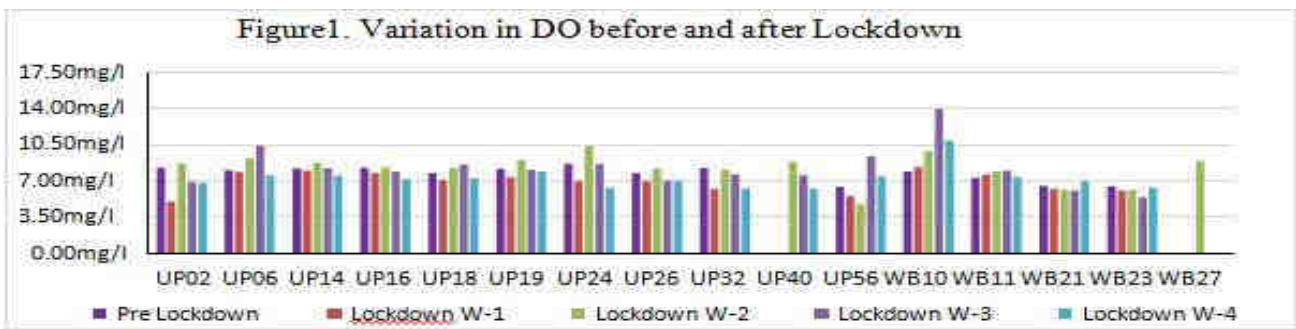
A. Dissolved Oxygen (DO)

Figure 1 depicts the values of DO in river Ganga at various monitoring stations from Madhya Ganga Barrage (UP02, Bijnore, UP) to Millennium Park Bridge (WB27, Howrah, WB) during pre-lockdown period up to the 4<sup>th</sup> week of lockdown. Figure 2 shows %variation in DO relative to its value during the pre-lockdown period.

The slight decrease in DO observed at all places during the first week after lockdown may be due to the increased levels of suspended solids and turbidity in the river water because of heavy rains.

Beginning the second week, DO level has shown slight improvement towards the saturation DO. It is observed that on an average there is about 3 to 20% decrease, however the Station UP02 (Bijnore) has recorded 40% decrease during the first week (Fig 2). Monitoring location WB10 (Behrampore) recorded high DO of 14 mg/l, which may be due to local condition such as presence of high chloride concentration. On an average, DO concentrations remained above the bathing criteria norms (5 mg/l or more) at all locations.

In UP, the DO during lockdown week 4 has shown a decreased value as compared to the pre-lockdown period at most of the locations. However, in West Bengal the DO has increased in lockdown week 4 (except WB23). The graph clearly indicates an increasing trend in the values of DO of the river at most of the monitoring locations in week 2 & 3. This may be attributed to reduced release of industrial waste and reduced discharges/dumping of wastes from various non-point sources in the river stream because of the imposed lockdown.



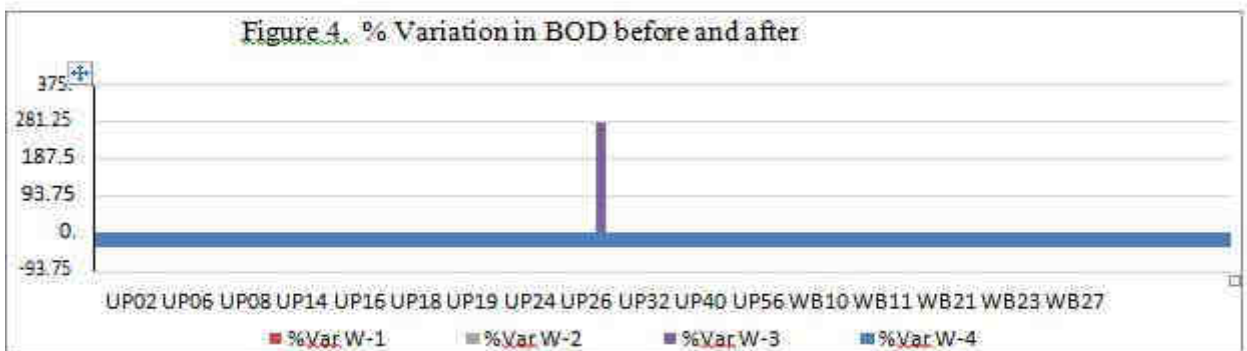
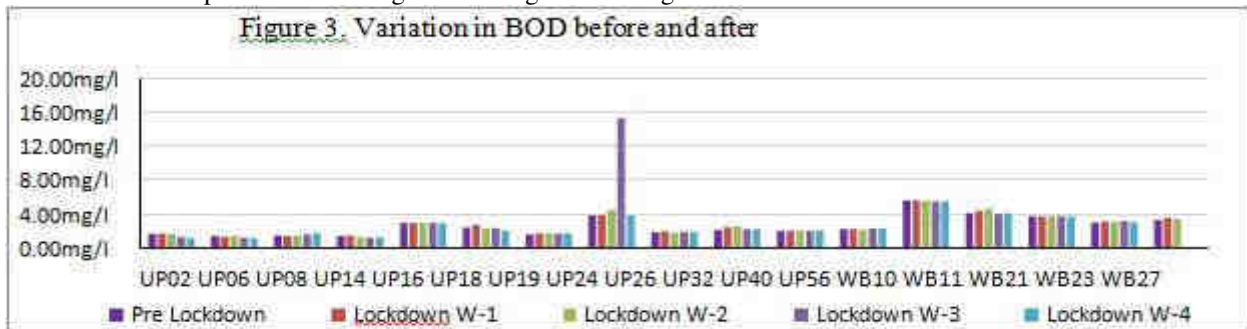
B. Biochemical Oxygen Demand (BOD)

Figure 3 depicts concentration (mg/l) and figure 4 depicts percentage variation for BOD for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020).

Overall, there was no steep reduction in BOD at most monitoring stations, though lower BOD values were recorded during fourth week as compared to previous weeks. There is gradual increase in BOD in the river water along its downstream stretch, with the maximum being in its WB stretch. It is seen that the BOD level up to Station UP14 (Farrukhabad) has remained below 3mg/l and no effect of lockdown is discernible. It is seen that at Station UP24 (Dhodhi Ghat, Kanpur) the BOD has shown an increasing trend during lockdown period with high value of around 15mg/l. The station UP32 (Fatehpur) has shown higher BOD during the lockdown period that may be attributed to the discharge of polluted wastewater through Pandu River. In the remaining stretch of river within UP, the BOD has remained unchanged. In the entire WB stretch of the river BOD concentrations varied from 3 to 5mg/l and has shown a marginal increase over the pre-lockdown level. There is a positive

impact, though not substantial, of lockdown on BOD level. The increased levels observed at Stations UP16 (Kannauj), UP24 (Kanpur), UP32 (Fatehpur) and WB-11 (Behrampore, West Bengal) indicate continual discharge of wastewater.

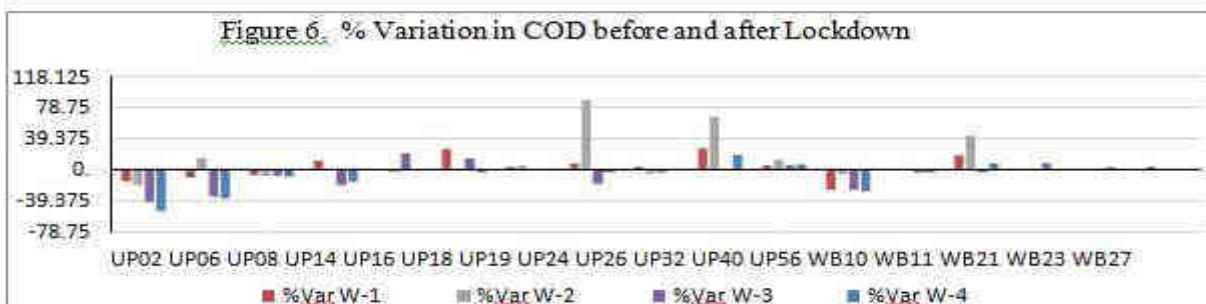
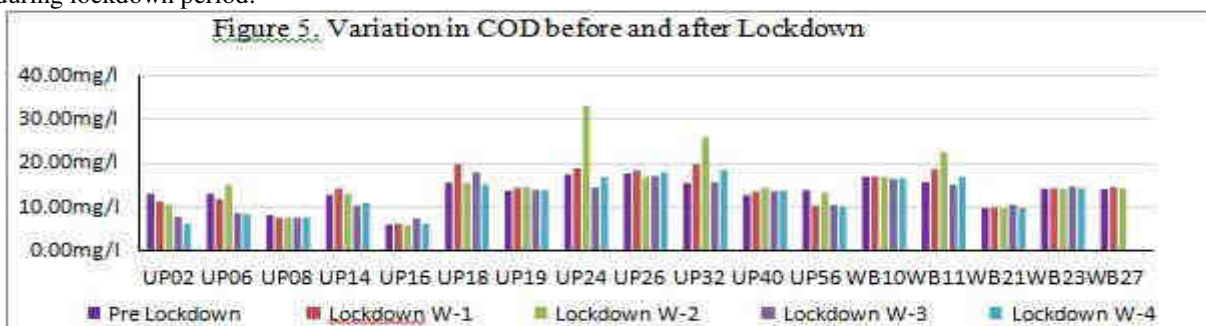
BOD value ranged between 1.13 mg/l to 5.56 mg/l during lockdown period (with an exception of 15.29mg/l at Kanpur, UP-24), more or less similar to pre-lockdown range of 1.37 mg/l to 5.58 mg/l.



### C. Chemical Oxygen Demand (COD)

Figures 5 & 6 depict concentration (mg/l) and percentage variation for COD for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

Some locations in the upper stretch in UP, have recorded a decreasing trend in the COD levels. However, a few stations such as UP18 (Kannauj), UP24 (Kanpur), UP32 (Fatehpur) and WB11 (Behrampore) recorded high values. This variation is not in consonance with the variation observed for BOD and can be attributed to continued wastewater discharge. The high COD values recorded at stations UP18 (Bithoor), UP24 (Kanpur), UP32 (Fatehpur) and WB11 (Behrampore) support this observation. It is evident from Fig. 6 that there has been marginal reduction in COD values during the lockdown period, except at four locations as mentioned above. The range of COD was 6.14 mg/l to 17.7 mg/l during pre-lockdown and 6.0 mg/l to 33.2 mg/l during lockdown period.



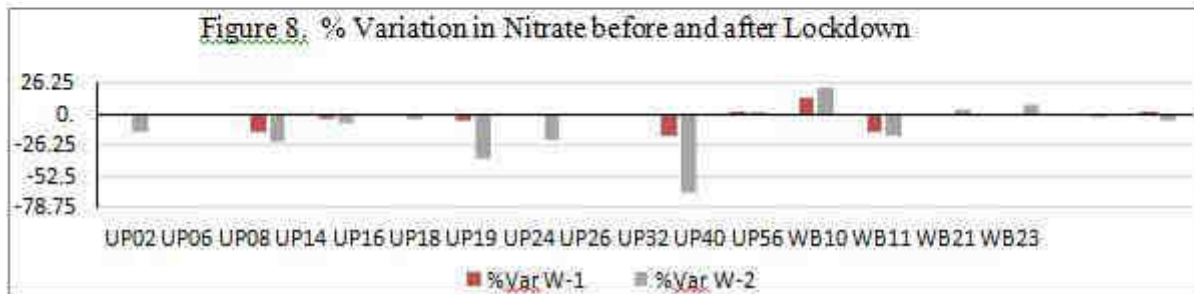
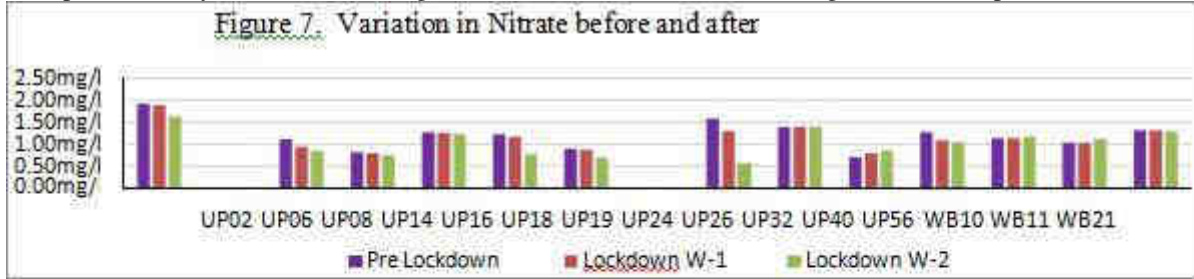


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### D. Nitrate (NO<sub>3</sub>-)

Figures 7 & 8 depict concentration (mg/l) and percentage variation respectively for Nitrate during pre-lockdown (March 15-21, 2020) and lockdown period (March 22-April 15, 2020), respectively.

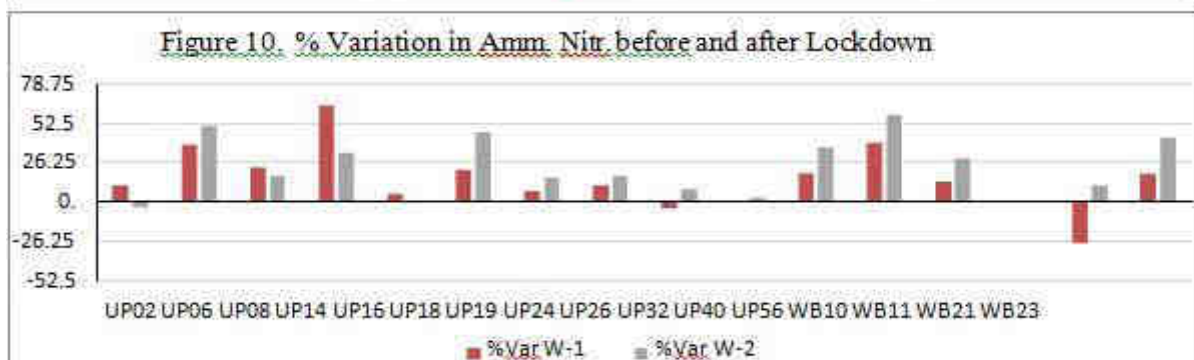
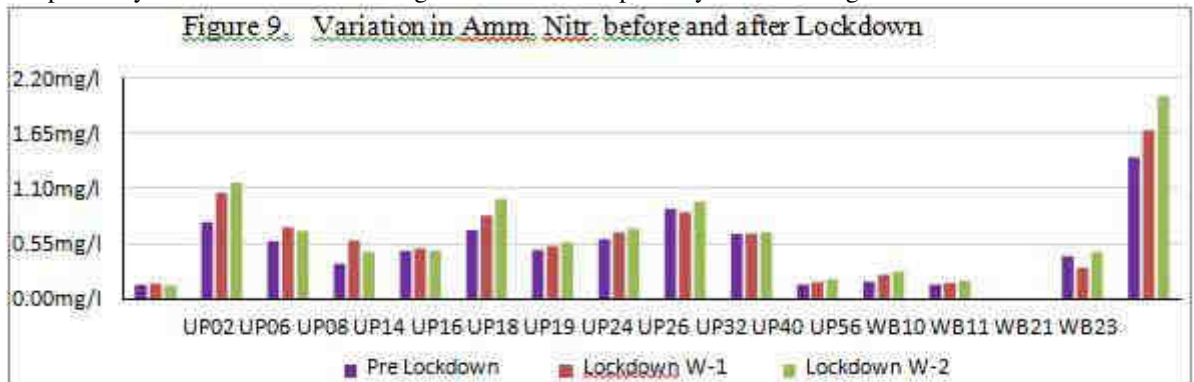
In view of limited industrial and agricultural activities during the lockdown, a declining trend in nitrate concentration was observed. Nitrate levels, on an average, varied from 0.5 to 2mg/l. Most stations recorded a decrease (varying from 2% to 66%) except the stations UP32 (Fatehpur), UP40 (Allahabad), WB10 (Behrampore), WB11 (D/s Behrampore) and WB21 (Srirampore) (which observed increase ranging from 0.07 to 21%) and a few stations recorded no change in the nitrate levels during this period. It may be inferred that in general nitrate levels came down during the lockdown period.



### E. Ammoniacal Nitrogen (NH<sub>3</sub>-N)

Figures 9 & 10 below depict concentration (mg/l) and percentage variation for Ammoniacal nitrogen for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

Ammoniacal nitrogen has shown increased levels, from 0.15 to 2 mg/l. All stations except UP02 (Bijnore), UP26 (Shuklaganj, Kanpur), WB21 (Srirampore) and WB27 (Howrah) have shown increasing trend in both weeks of lockdown. This can be attributed primarily to the increased discharge of untreated or partially treated sewage into the river.



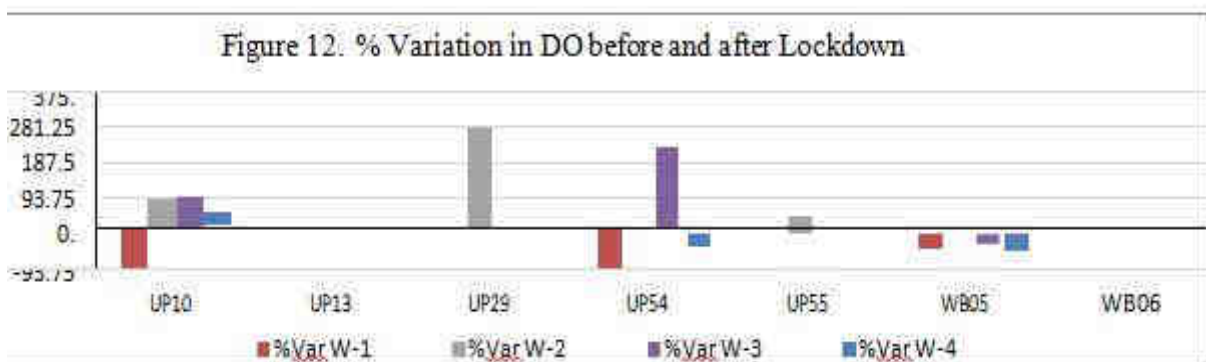
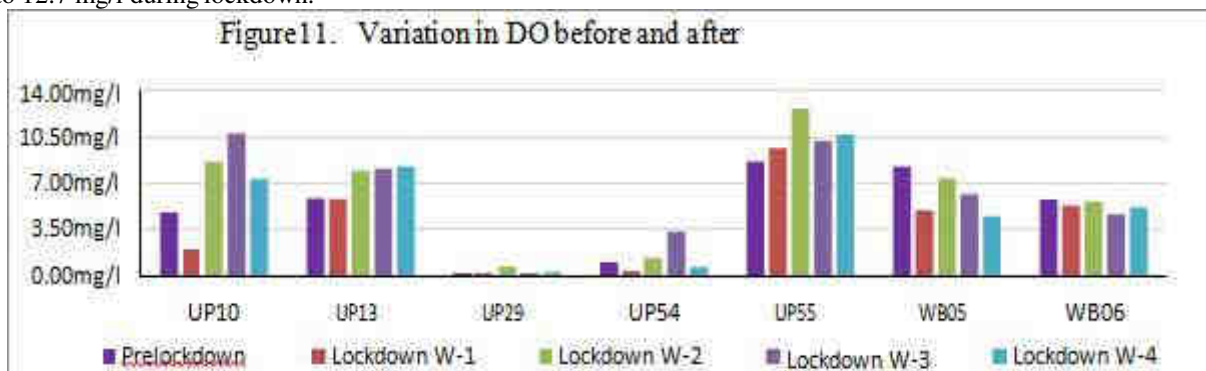
### 3. IMPACT OF LOCKDOWN ON TRIBUTARIES

From Uttar Pradesh (UP) to West Bengal (WB) there are 09 real-time water quality monitoring stations (RTWQMS) on rivers Banganga, Rāmgangā, Kali, Pandu, Varuna and Gomati located in UP, and Falguni and Maya located in WB (Annexure-1). These tributaries of river Ganga receive both domestic and industrial effluent from cities, towns and industries situated along their course before joining Ganga. In view of this, water quality data for these tributaries were also analyzed.

#### A. Dissolved Oxygen (DO)

Figures 11 & 12 below depict concentration (mg/l) and percentage variation for dissolved oxygen for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

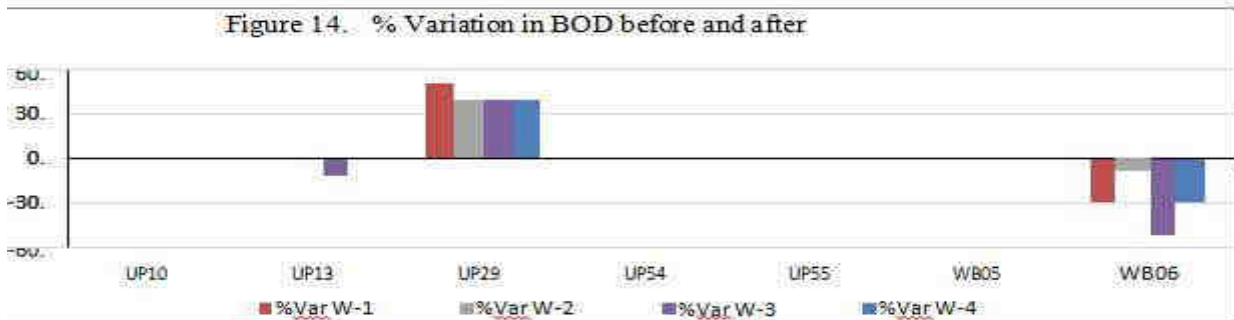
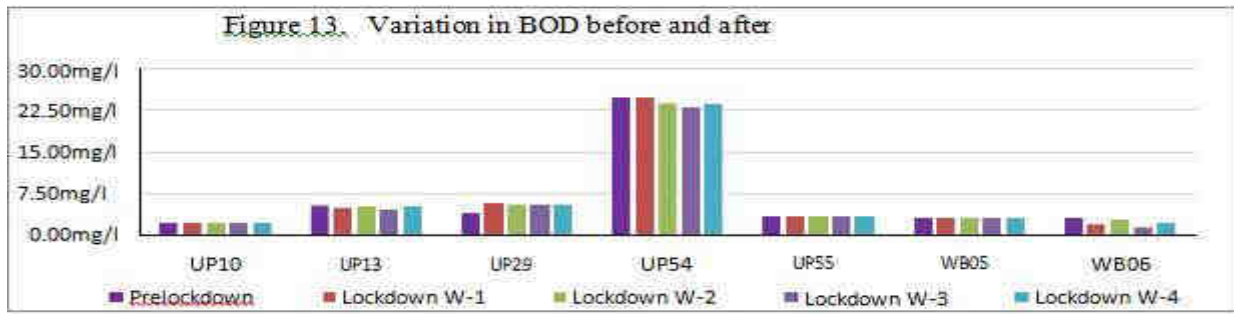
There is a large variation in the dissolved oxygen level (0.2 to 12.7 mg/l) in these rivers. Extremely low values of DO were recorded in Pandu (UP29, Hamirpur-Kanpur Road) and Varuna (UP54, Varanasi). It may be appropriate to mention that these two rivers do not have their own natural water flow, all that they carry is sewage, agricultural run-off, storm water flow, and industrial effluent. The velocity of water flow is extremely slow and insufficient to cause aeration through atmospheric oxygen. High value of DO (>12mg/l) recorded in UP55 (Gomati) is likely to be due to photosynthetic activity of algal growth in the river. Except during pre-lockdown period, all rivers in UP have shown increase in DO level beginning second week of lockdown. But, slight decrease in DO has been recorded in WB rivers. Most of stations have recorded increase in DO, high increase has been observed at UP10(Ram-ganga), UP 29 (Pandu) and UP54 (Varuna), which may be attributed to the suspension of industrial activity in the industrial areas of Kanpur (Panaki, Kakanagar, Rooma, etc.), and Fatehpur, etc. Also appreciably low discharge of wastewater from hotels, vehicle repairing shops and other small industries situated in city limits may have contributed to improved water quality. The concentration range varied from 0.2 to 8.66 mg/l during pre-lockdown and 0.21 to 12.7 mg/l during lockdown.



#### B. Biochemical Oxygen Demand (BOD)

Figures 13 & 14 depict concentration (mg/l) and percentage variation for BOD for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

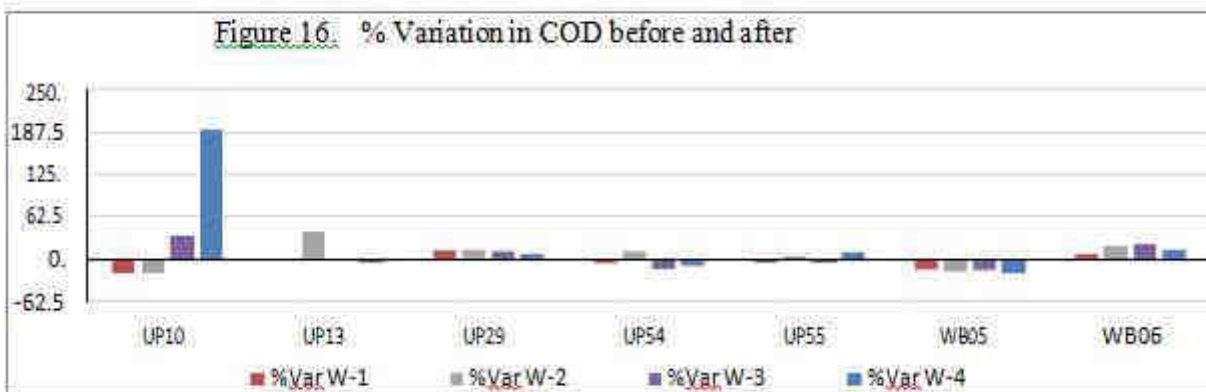
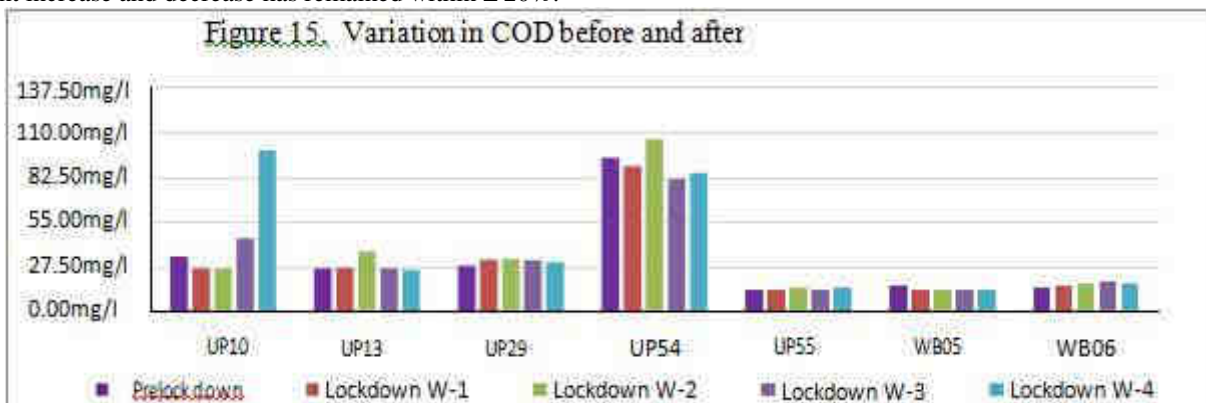
BOD in various tributaries has varied from as low as 2.0 (WB06, Maya) to as high as 25 mg/l (UP54, Varuna). In comparison to pre-lockdown period almost all stations have recorded marginal decrease in BOD values. Station UP29 (Pandu) has recorded higher BOD (>5mg/l) value during lockdown weeks. Station UP54 (Varuna) has consistently recorded very high BOD values (23 to 25mg/l) though during lockdown period it has recorded a consistent decrease. All stations, except UP29 (Pandu), have recorded a decrease during the lockdown weeks compared to the pre-lockdown period that has varied from about 2 to 10%. The highest decrease (8 to 50%) is recorded at station WB06 (Maya). Station UP29 (Pandu) recorded an increase of 50% during first week that got reduced to 40% during subsequent weeks. This is likely to be due to continual discharge of untreated wastewater.



C. Chemical Oxygen Demand (COD)

Figures 15 & 16 below depict concentration (mg/l) and percentage variation for COD for pre- lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

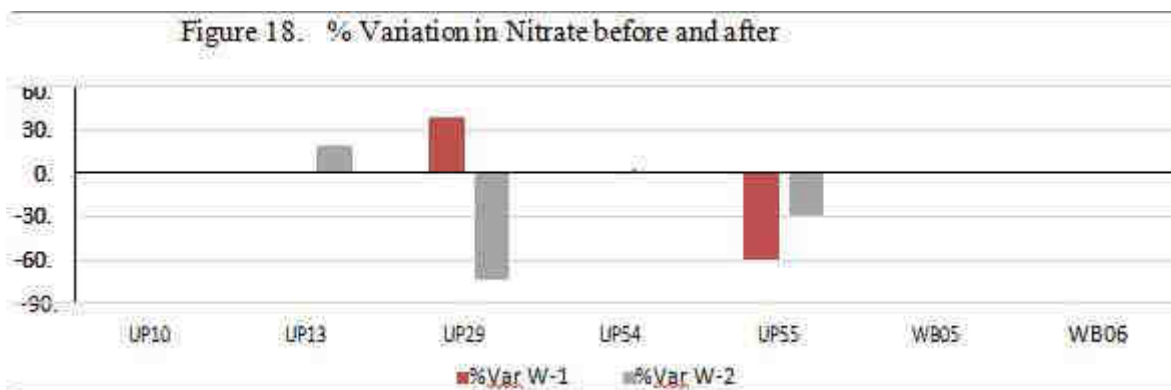
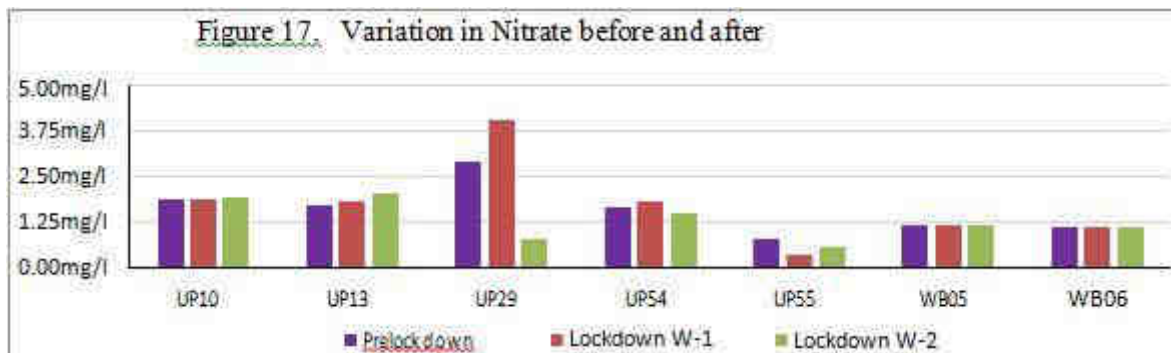
The COD levels varied from 16 to 106 mg/l. The reason for high values during the fourth week at Station UP10 (Ramganga) may be due to sudden discharge of effluent from some source or data could be an outlier. The high COD value recorded at Station UP54 (Varuna) is commensurate with the trend exhibited by BOD values at this station. Such high values of COD are likely to be due to unabated discharge of domestic sewage and other effluents. It may be concluded that both increase and decrease in COD levels have been observed during lockdown weeks. However, except for Station UP10 (Ram- ganga) the percent increase and decrease has remained within  $\pm 20\%$ .



D. Nitrate (NO<sub>3</sub>-)

Figures 17 & 18 depict concentration (mg/l) and percentage variation for BOD for pre-lock- down (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

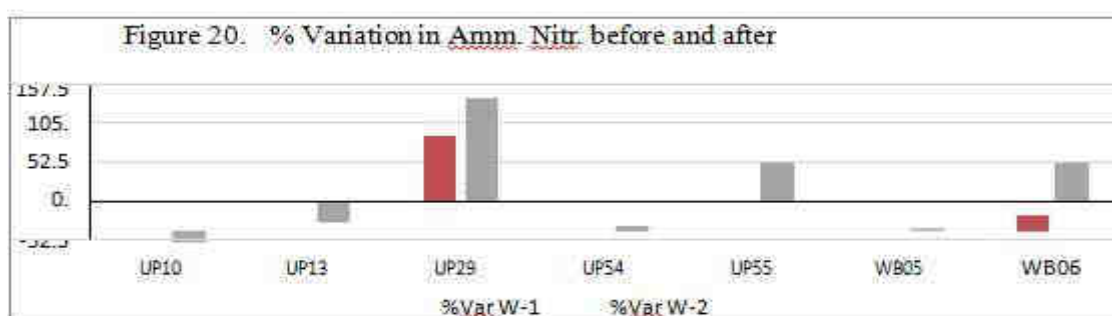
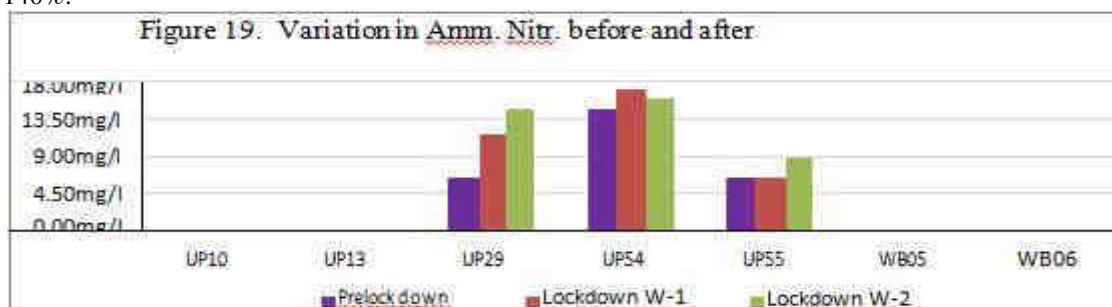
Nitrate levels in various tributaries varied between 0.3 to 4.00 mg/l. During lockdown weeks, it has either marginally increased or remained unchanged. Three stations UP29 (Pandu), UP54 (Varuna) and UP55 (Gomati)) recorded decrease from 10 to 74% during the second week. On all other locations, an increasing trend has been observed.



E. Ammoniacal Nitrogen (NH<sub>3</sub>-N)

Figures 19 & 20 depict concentration (mg/l) and percentage variation for ammoniacal nitrogen for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

NH<sub>3</sub>-N levels varied from very low values (0.2mg/l) at WB05 (Falguni) and WB06 (Maya) to ~9 mg/l at UP55 (Gomati) and 16mg/l at stations UP29 (Pandu) & UP54 (Varuna). The higher values of NH<sub>3</sub>-N in case of stations UP29, UP54 and UP55 may be attributed to continual discharge of un- treated sewage and some agricultural and storm runoff. Except UP10 (Ramganga) and UP13 (River Kali), all other stations have recorded increased concentrations, varying from 3 to 140%.





4. IMPACT OF LOCKDOWN ON DRAINS

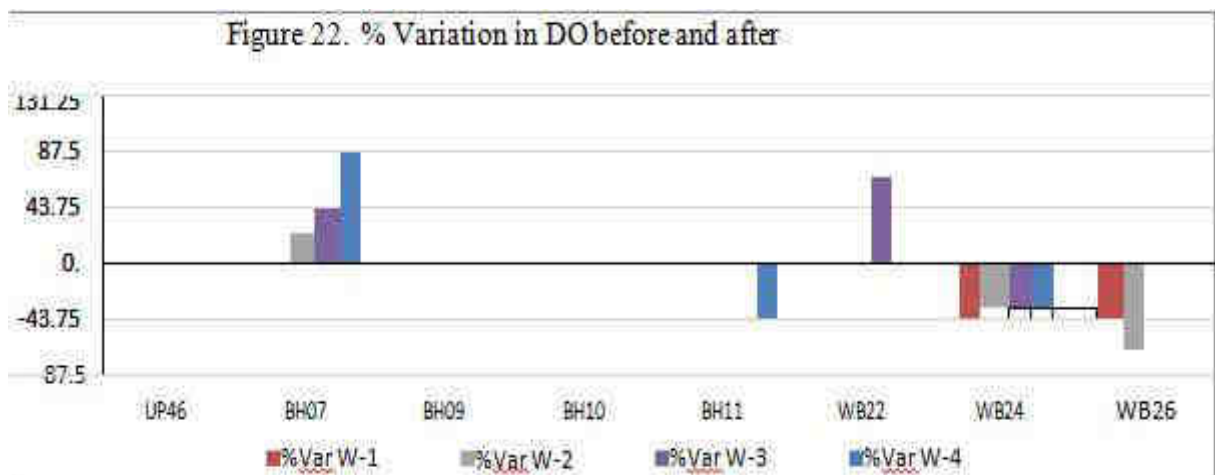
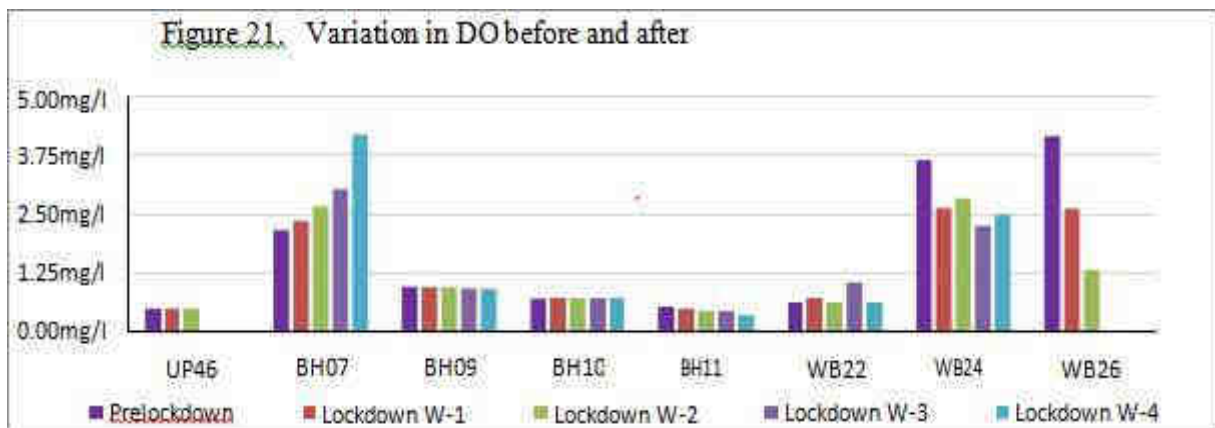
There are 09 real-time water quality monitoring stations (RTWQMS) on various drains/nallahs namely Jagajeetpur STP drain (UK08), Mawaiya Naalah (UP46), Kurzi Nallah (Bh07), Rjapul Nallah (Bh09), Mandiri Nallah (BH10), Antaghat Nallah (BH11), Nallah near Sirampur (WB12), Ballykhal Nallah (WB24) and Chitpur Nallah (WB26), located in UK, UP, Bihar and WB (Annexure-1). These drains receive storm water flow and domestic & industrial effluent from towns, villages and industries situated along their course before joining Ganga directly or through one of the tributaries. Data for these drains were also examined for pre- and lockdown periods.

A. Dissolved Oxygen (DO)

Figures 21 & 22 below depict concentration (mg/l) and percentage variation for DO for pre- lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

It is observed that DO levels in various drains varied widely, ranging from 0.4mg/l at UP46 (Mawaiya nallah) to around 4.1mg/l at BH07 (Kurjee naalah) and WB26 (Chitpur drain). This variation may be linked to the type and volume of flow being received by drains and the distance it travels before reaching the monitoring station. Except Station BH07, the DO level in all drains has shown a decreasing trend during the lockdown period.

Except BH07 (Kurjee naalah) and WB22 (Srirampore), all stations have recorded decrease in DO varying from 1% (UP46, Mawaiya nallah) to more than 50% (WB26, Chitpur nallah). Station BH07 and WB22 have recorded increase varying from 5 to 90%.

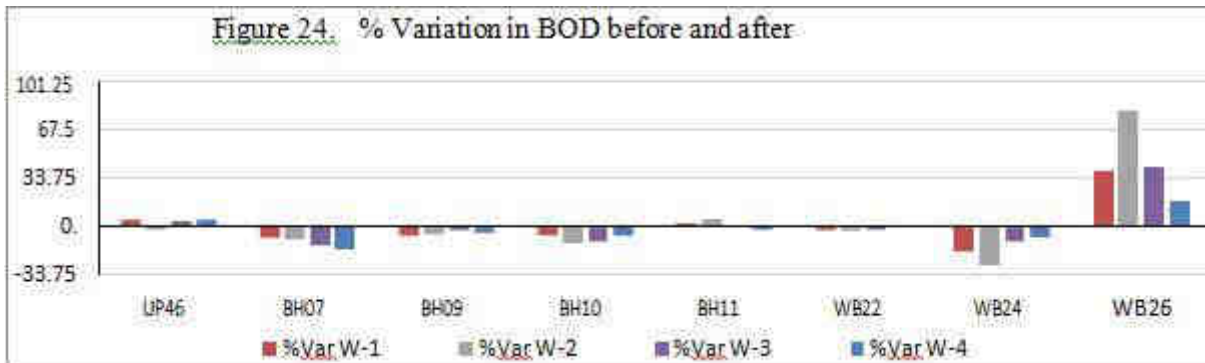
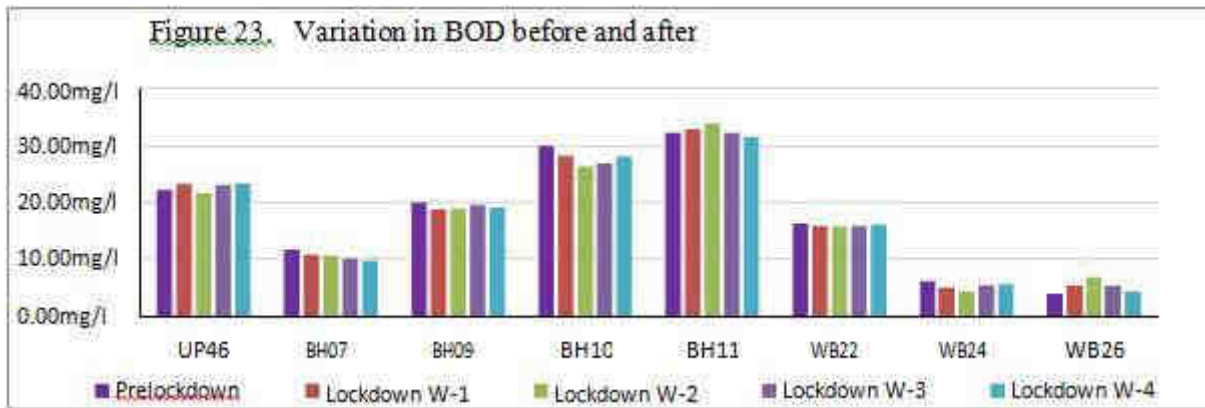


B. Biochemical Oxygen Demand (BOD)

Figures 23 & 24 depict concentration (mg/l) and percentage variation for BOD for pre-lock- down (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

The average variation in BOD during pre-lockdown and four weeks of lockdown is 3 to 32mg/l. On an average, BOD has either remained unchanged or decreased in most cases except in case of Station UP46 (Mawaiya nallah) and WB26 (Chitpur nallah) where an increase of 5 and 20%, respectively has been observed in lockdown week-4. It is seen that except Stations UP46, BH11(Antaghat nallah) and WB26 in all other drains decrease (2 to 20%) in BOD has been recorded. Maximum increase has been recorded in case of Station WB26.

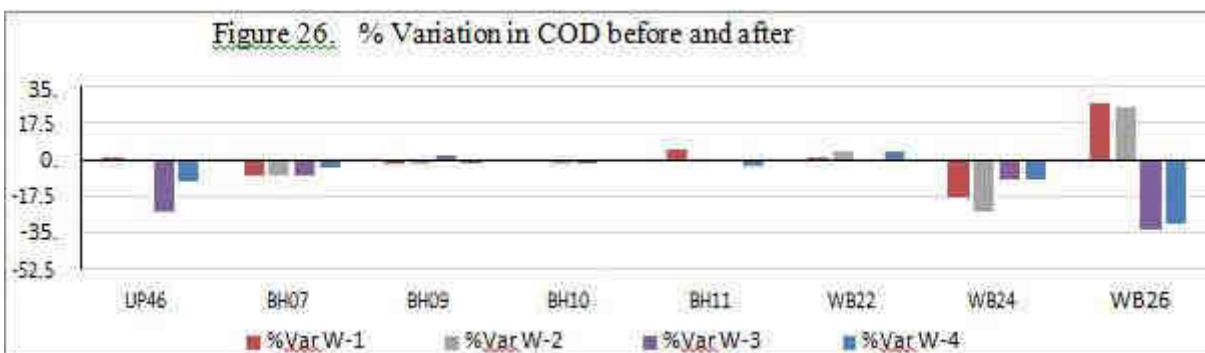
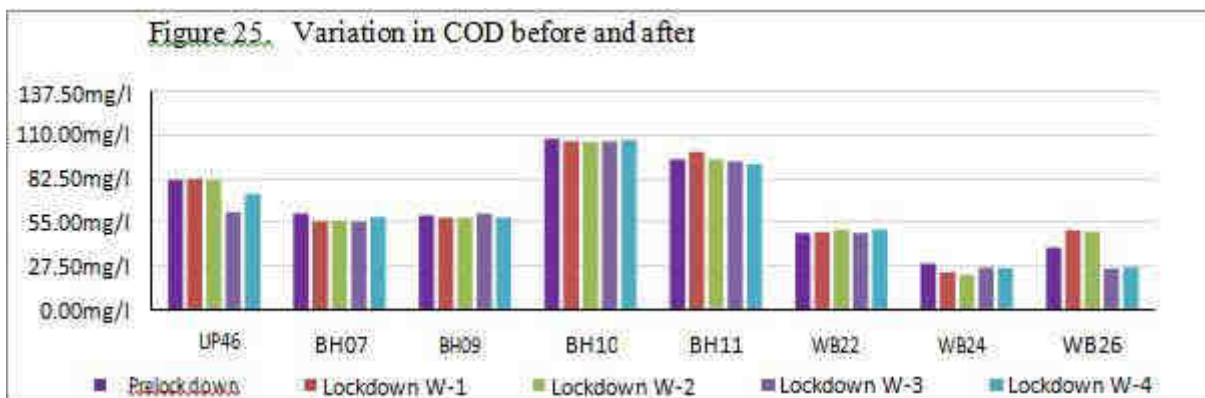




C. Chemical Oxygen Demand (COD)

Figures 25 & 26 depict concentration (mg/l) and percentage variation for COD for pre-lock- down (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

The COD level has varied from 22 to 107 mg/l. The COD values recorded at various stations have either remained more or less constant or decreased marginally. It is seen that stations BH11 (Antaghat nallah), WB22 (Srirampore) and WB26 (Chitpur nallah) have recorded slight increase over the pre-lockdown values, which have varied between 0.2 to 27%, however, in consecutive week these stations have also recorded decrease in COD value. The decrease observed at locations BH09 (Rajapur nallah), BH11 (Antaghat nallah) and WB26 (Chitpur nallah) varied from 2 to 34%. Thus, there is no positive influence of lockdown may be inferred from COD data.

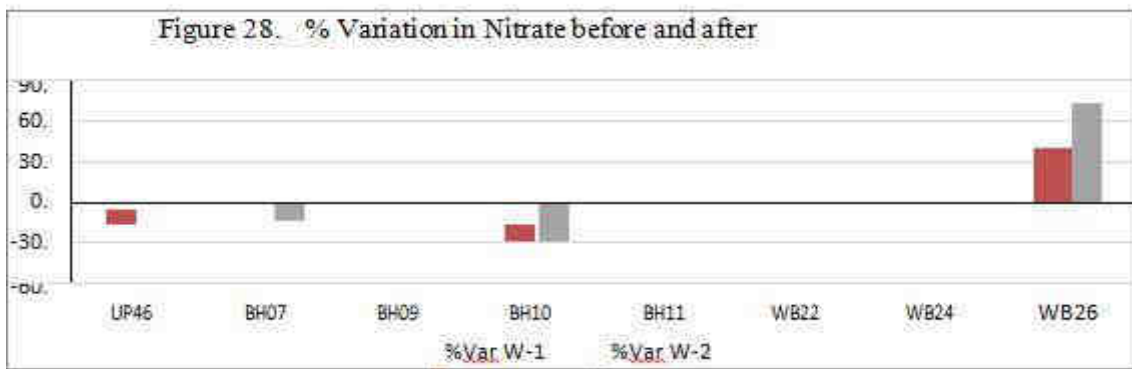
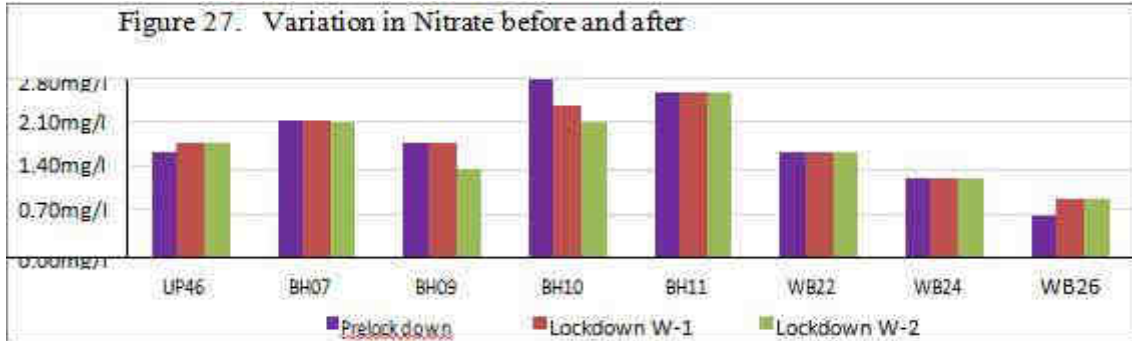


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### D. Nitrate (NO<sub>3</sub>-)

Figures 27 & 28 depict concentration (mg/l) and percentage variation for Nitrate for pre-lock- down (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

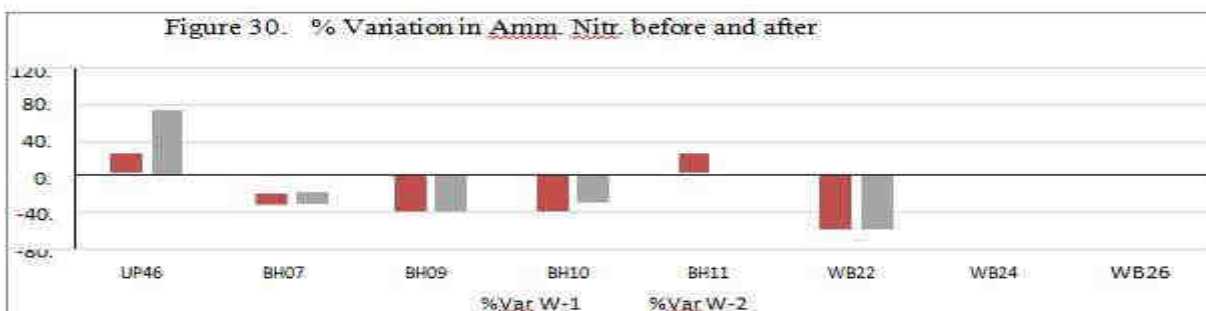
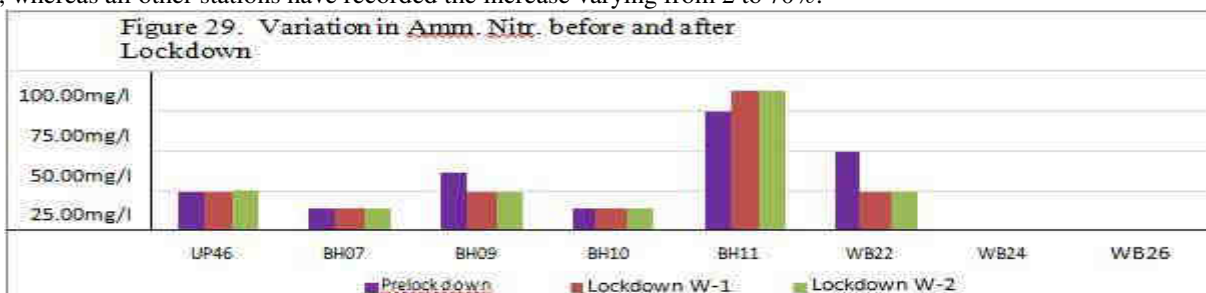
It is seen that the average nitrate level has varied from 0.6 to 2.6mg/l. It is also seen that except UP46 (Mawaiya nallah), BH11, WB24 (Ballykhal nallah), and WB26 (Chitpur nallha), all other stations have recorded decreased nitrate levels during first two weeks. It is seen that Stations UP46, WB24 and WB26 have recorded increase in nitrate varying from 2-3% at WB24 to 70% at WB26.



### E. Ammoniacal Nitrogen (NH<sub>3</sub>-N)

Figures 29 & 30 depict concentration (mg/l) and percentage variation for ammoniacal nitrogen for pre-lockdown (March 15- 21, 2020) and lockdown period (March 22 - April 15, 2020), respectively.

It is seen that during this period, the recorded NH<sub>3</sub>-N level has varied from (2 mg/l) at station WB24 (Ballykhal nallah) to around 95mg/l at station BH11 (Antaghat nallah). Stations BH09 (Rajapur nallah), BH10 (Mandiri nallah) and WB22 (Srirampore) have recorded decrease in NH<sub>3</sub>-N levels during first two weeks but the values are considerably lower than corresponding pre-lockdown values. In case of all other stations, NH<sub>3</sub>-N levels are higher than the pre-lockdown values and have increased during next two weeks. It is seen that Station BH09, BH10 and WB22 have recorded decrease in NH<sub>3</sub>-N (30-60%), whereas all other stations have recorded the increase varying from 2 to 70%.



**CONCLUSION**

We selected one of the severely polluted river in India to evaluate the impact of the lockdown due to the COVID-19 spread on water quality. Following conclusions can be made on the basis of test results and water quality trends observed in Ganga River and that of her tributaries and drains ;

**A. Ganga River**

- I. During 1<sup>st</sup> week of lockdown period, Dissolved oxygen (DO) concentration decreased slightly almost in all monitoring locations, due to heavy rain leading to increase in suspended solids, organic load and turbidity. However, in the second, third and fourth week of lockdown the DO levels shown marginal increment in general in most stations except in few stations the increment was significant even up to saturation values.
  - In conclusion it may be stated that DO concentrations remained above the bathing water criteria norms (5 mg/l or more) at all locations prior to and during COVID-19 lockdown period, however there has been marginal increment in DO in 2<sup>nd</sup> week onwards in most stations and significant improvement in few monitoring stations.
- II. Reduction in BOD concentration has been less significant owing to continual discharge of untreated or inadequately treated sewage. Marginal reduction can be seen only in 4<sup>th</sup> week. Further, there is gradual increase in BOD levels towards downstream stretches of the river, with the maximum values in WB stretch.
- III. Reduction in COD concentration has also been less significant. Few locations show increase in the COD values, while in remaining stations reduction in COD levels was not significant. This marginal reduction can be attributed to due to stoppage of industrial activities.
- IV. A decreasing trend in nitrate levels can be seen however such trend was not significant in lower stretches of River towards West Bengal State. Ammonia-nitrogen concentration has increased in almost all monitoring stations.

**B. Tributaries of Ganga River**

With regard to water quality of tributaries of River Ganga, the concentration of DO increased during lockdown period. Initially the improvement was marginal due to heavy rains resulting in increased runoff, substantial increase was noted from second week onwards reaching saturation value at various locations. Overall, marginal decreasing trend in BOD, COD & Nitrate levels was observed compared to pre-lockdown phase at most locations. Marginal increase in ammoniacal nitrogen concentration was recorded at all location compared to pre-lockdown period. Water quality trends of tributaries to river Ganga is similar to the trends observed in River Ganga.

**C. Drains Discharging into River Ganga**

With respect to water quality of Drains discharging in River Ganga, the improvement was less significant. DO concentration remained unchanged or slightly inferior to pre-lockdown period, with exception of high concentration at a few locations owing to favourable localised conditions. No significant variation was observed with respect to BOD & COD concentration, which remained mostly unaffected or slightly reduced than before. The concentration of nitrate was reduced and ammoniacal nitrogen increased at most locations. Overall, impact of lockdown on water quality of drains was not much apparent due to undeterred flow of wastewater throughout the lockdown period.

Annexure I  
**List of Real Time Water Quality Monitoring Station (36 new stations)**

S. No.	State	Location	Station code	Landmark	Name of River
1	Uttar Pradesh	Madhya Ganga Barrage	UP-02	Station at Bijnore	River Ganga
2	Uttar Pradesh	AnupshaharGhat	UP-06	Station at Anupshahar	River Ganga
3	Uttar Pradesh	Narora Barrage	UP-08	Station at Narora	River Ganga
4	Uttar Pradesh	KachlaGhat Bridge	UP-09	Station at Badaun	River Ganga

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5	Uttar Pradesh	Ghatiyaghat Bridge	UP-14	Station at Farrukhabad	River Ganga
6	Uttar Pradesh	Manimau Bridge (MehendiGhat )	UP-16	Station at Kannauj	River Ganga
7	Uttar Pradesh	Pariyal Bridge	UP-18	Station at Bithoor	River Ganga
8	Uttar Pradesh	Ganga Barrage Bridge	UP-19	Station at u/s Kanpur	River Ganga
9	Uttar Pradesh	Shuklaganj Bridge	UP-26	Station at Kanpur	River Ganga
10	Uttar Pradesh	Deorighat (Maharajpur)	UP-24	Station at Bathing Ghat Kanpur	River Ganga
11	Uttar Pradesh	Bridge at Ansi	UP-32	Station at Fatehpur	River Ganga
12	Uttar Pradesh	Pontoon Bridge Sirsa	UP-40	Station at Sirsa, Allahabad	River Ganga
13	Uttar Pradesh	Chaudhary Charan Singh, Pump Canal	UP-56	Station at Ghazipur	River Ganga
14	West Bengal	Bridge at Behrampore	WB-10	Station at Behrampore	River Ganga
15	West Bengal	Bridge at d/s of Behrampore	WB-11	Station at d/s Behrampore	River Ganga
16	West Bengal	Ghat at Srirampore	WB-21	Station at d/s Srirampore	River Ganga
17	West Bengal	Intake Pumping station at Belgharia	WB-23	Station at Belgharia	River Ganga
18	West Bengal	Millennium Park_ Howrah Bridge	WB-27	Station at Howrah	River Ganga
<b>Tributary</b>					
<b>S.No</b>	<b>State</b>	<b>Location</b>	<b>Station code</b>	<b>Landmark</b>	<b>Name of River</b>



1	Uttar Pradesh	Bridge on SukratalGhat	UP-03	Station at Sukratal	River Banganga
2	Uttar Pradesh	Shahbad_MDR53W Bridge	UP-10	Station at d/s Moradabad	River Ramganga
3	Uttar Pradesh	Khudaganj Bridge	UP-13	Station at Kanpur-Farrukhabad Road	River Kali
4	Uttar Pradesh	Allahganj Bridge SH40,Kannauj	UP-17	Station at Farrukhabad	River Ramganga
5	Uttar Pradesh	Bhimgave Bridge	UP-29	Station at Hamirpur road, Kanpur	RiverPandu
6	Uttar Pradesh	Bathing Ghat 1	UP-54	Station at Varanasi	RiverVaruna
7	Uttar Pradesh	Bridge on River Gomti	UP-55	Station at Varanasi	River Gomti

8	West Bengal	Bridge on NH-34	WB-5	Station at Farrakha	River Falguri
9	West Bengal	Bridge on NH-35	WB-6	Station at Farrakha	River Maya

**Nallah/Drain**

S.No	State	Location	Station code	Landmark	Name of Drain
1	Uttarakhand	Jagjeetpur STP drain	UK-8	Station on STP_ Haridwar	Jagjeetpur drain
2	Uttar Pradesh	Mawaiyanala	UP-46	Station on Nalla_ Allahabad	Nallah
3	Bihar	KurziNalla	Bh-7	Station on Nalla_ Patna	Nallah
4	Bihar	RajapulNalla	Bh-9	Station at Rajapur old pump house	Nallah
5	Bihar	MandiriNalla	Bh-10	Station at Patna 3a	Nallah
6	Bihar	Anta GhatNalla	Bh-11	Station at Patna 3a	Nallah

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7	West Bengal	Nallah opposite d/s Srirampore	WB-12	Station at Srirampore	Nallah
8	West Bengal	BallykhalNala	WB-24	Station at Ballykhal Bridge	Nallah
9	West Bengal	ChitpurNala	WB-26	Station at Circular ca- nal_ Chitpur	Nallah

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