Hydrogeological characterization and assessment of groundwater quality in shallow aquifers in vicinity of Najafgarh drain of NCT Delhi

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Najafgarh drain is the biggest drain in Delhi and contributes about 60% of the total wastewater that gets discharged from Delhi into river Yamuna. The drain traverses a length of 51 km before joining river Yamuna, and is unlined for about 31 km along its initial stretch. In recent times, efforts have been made for limited withdrawal of groundwater from shallow aquifers in close vicinity of Najafgarh drain coupled with artificial recharge of groundwater. In this perspective, assessment of groundwater quality in shallow aquifers in vicinity of the Najafgarh drain of Delhi and hydrogeological characterization of adjacent areas were done. The groundwater quality was examined in perspective of Indian as well as World Health Organization's drinking water standards. The spatial variation in groundwater quality was studied. The linkages between trace element occurrence and hydrochemical facies variation were also established. The shallow groundwater along Najafgarh drain is contaminated in stretches and the area is not suitable for large-scale groundwater development for drinking water purposes.

1. Introduction

The National Capital Territory (NCT) of Delhi (figure 1) is one of the fast growing metropolitan cities in the world. It faces a massive problem of voluminous generation of wastewater. This wastewater is mainly contributed by numerous drains of NCT Delhi that have considerable impact on surface water and groundwater systems of the territory. The effect on surface water is visible from river Yamuna where upstream of Wazirabad, the colour of river water is bluish/greenish which changes to dark grey downstream of Wazirabad, from where the Najafgarh drain joins river Yamuna (figure 1). Henceforth, a series of 19 drains joins river Yamuna, making it a giant drain. The impact

of this wastewater on the groundwater system is even more profound. There is considerable contamination of groundwater by industrial and domestic effluents mostly carried through various drains (Singh 1999).

The Najafgarh drain is the biggest drain in NCT Delhi, discharging 287.5 million litres per day (MLD) (0.2875 million m³/day) wastewater into river Yamuna (NEERI 2002). The Najafgarh drain contributes about 60% of the total wastewater that gets discharged from Delhi into river Yamuna (Kumar *et al.* 2006).

The Najafgarh drain enters Delhi from Haryana from the south-west corner of Delhi. It traverses a length of 51 km before joining river Yamuna (INTACH 2003). In its initial stage through

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Figure 1. Delhi map with inset of India map, showing Najafgarh drain.

south-west district of NCT Delhi, the drain carries flood water, wastewater from Haryana and surface runoff from the adjoining catchment. Out of the 51-km stretch of the drain, nearly 31-km stretch of the drain passes through south-west district from near Dhansha to Kakraula (Jindal 1975) (figure 1). Thus, nearly 60% of the length of Najafgarh drain flows through south-west district of NCT Delhi and this entire stretch of the drain is unlined. Moreover, from Dhansha to Kakraula (figure 1), very few (may be 2–3 drains) subsidiary drains join this big drain and subsequently after Kakraula, nearly 38 big and small drains (figure 2) join Najafgarh drain (WAPCOS 1999). Thus, apparently (on visual observation) the quality of water flowing through the drain is better in the stretch from Dhansha to Kakraula (figure 1). There were proposals (Bajpai

2011; INTACH 2003; Shekhar 2006) suggesting limited groundwater withdrawal coupled with artificial recharge in this stretch of aquifer along the Najafgarh drain from Dhansha to Kakraula. However, it was also argued that unlined drains in recharge areas act as a source of pollution to groundwater (Kumar *et al.* 2006). In this perspective, it becomes important to assess groundwater quality in shallow aquifers in the vicinity of the Najafgarh drain.

2. Hydrogeology of the study area

The Najafgarh drain traverses through south-west, west, north-west and north districts of NCT Delhi

Figure 2. Map showing drains joining Najafgarh drain: 1. Palam drain, 2. Bupania drain, 3. Pankha road drain, 4. Vikaspuri drain, 5. Niloti drain, 6. Sayed Nangloi drain, 7. Keshopur drain, 8. Subhash Nagar drain, 9. Khyala drain, 10. Jawalaheri drain, 11. Raghubir Nagar drain, 12. Madipur drain, 13. Ring Road drain, 14. Basai Darapur drain, 15. Ramesh Nagar drain, 16. Moti Nagar drain, 17. Punjabi Bagh drain, 18. Jaidev Park drain, 19. Shakur Basti drain, 20. Tulsi Nagar drain, 21. Anand Nagar drain, 22. Kanhiya Nagar drain, 23. Daryai drain, 24. Rana Pratap Bagh drain, 25. Shakti Nagar drain, 26. Shakti Nagar drain-2, 27. Gur Mandi drain, 28. G.T. Road drain, 29. Kamala Nagar drain, 30. Roop Nagar drain, 31. Vijay Nagar drain, 32. Hansraj drain, 33. Patel Chest drain, 34. Mall road drain, 35. Mall road drain-2, 36. Timarpur drain, 37. Power house drain, 38. Wazirabad drain.

(figure 1). The stretch of the drain through south-west and west districts is unlined, while stretch of the drain through north-west and west districts is lined. The borehole data and geophysical study reveals that subsurface formation along the area closely adjacent to drain has alternate fluvial and aeolian bands distributed sporadically. The alluvial deposits are Pleistocene in age with interbedded, lenticular and interfingering deposits of silty sand, clay and kankar. The proportion of finer sediment is higher. Goel (1990) in sieve analysis of borehole sediments from Dhulsiras (figure 1) revealed that in-depth range of 0 to 45 m below ground level (mbgl), nearly 60% is finer sand composition and rest is mixture of silt and clay. INTACH (2003) reported average rate of infiltration at the bed of the Najafgarh drain in south-west district of Delhi as 0.21 mm/h. They mention permeability of the subsurface formations below and adjacent to the Najafgarh drain in the stretch of the drain from Dhansa to Kakraula (figure 1) as ranging from 3 to 6 m/day to 28.11 m/day and transmissivity of the formation as ranging from 63.05 m²/day to 927.7 m²/day.

Throughout south-west district and major part of west district, the depth to bedrock below Najafgarh drain and its adjacent area is in the

range of 200–300 mbgl (Shekhar 2004). As the drain in its later part takes a bend from N–S orientation to nearly E–W and flows eastward to join river Yamuna, it is gradually moving towards surface exposure of hard rocks (CGWB 2006) (figure 3). Thus, thickness of the non-indurated aquifers that are more prone to contamination decreases towards later part of the drain.

The Najafgarh drain and its tributaries show the effect of recharge from the water being carried by drain and it is evident in the form of greater depth to fresh/saline interface in groundwater (Shekhar *et al.* 2005). Shekhar *et al.* (2005, 2006) envisaged an elongated fresh groundwater lens along the Najafgarh drain in south-west district stretch of the drain. The salinity of groundwater increases as depth increases. The shallower groundwater all along Najafgarh drain and its close vicinity has lower salinity. The fresh groundwater aquifer thickness along Najafgarh drain is more in the unlined section of the drain. The surface water level along the drain from Dhansa to Kakraula (figure 1) is such that there is some depth of water in the drain throughout its length even when there is no flow. This situation helps in recharging groundwater in favourable conditions (when water table is below the water level in the drains). Bajpai (2011) established through remote sensing study that the Najafgarh drain and its tributaries in its initial stretch through south-west district of Delhi (figure 1) flows through a naturally defined valley setting. Thus, the hydrogeological equilibrium of the water in the drain and the adjacent aquifer in its initial stretch is similar to stream–aquifer interaction.

Shekhar *et al.* (2006) mentioned that in aquifers adjacent to the Najafgarh drain, there are isolated patches showing concentration of fluoride beyond permissible limit. Since groundwater in the fluoride-affected areas has higher salinity, it is possible that the high level of fluoride is due to localized effects of natural sources.

2.1 Depth to water level in the study area

A regional depth to water level map (figure 4) including areas much beyond close vicinity of the Najafgarh drain was prepared to gain an insight into regional and local variations in depth to water level of the area. The depth to water level in the areas closely adjacent to the drain varies in the range of 3 to 16 mbgl (figure 4). The shallower depth to water level is noticed in initial part of the drain where it enters Delhi and in later part of the drain where it meets river Yamuna. The relatively deeper water levels are found in middle stretch of the drain. In areas to right in

Figure 3. Depth to bedrock map in the study area.

Figure 4. Depth to water level map in the study area.

downstream of the drain, depth to water level increases as one moves in south-east direction and reaches a maximum of 65 mbgl, some kilometres ahead (these areas are adjacent to the hard rocks). Shekhar *et al.* (2009) also mentions about deeper depth to water level in the range of 40–60 mbgl in these areas of Delhi shown in figure 4. In areas to left of the drain, relatively shallower depth to water level is found, reaching to maximum of 20 mbgl in Najafgarh and Ojwah areas (figure 4). The groundwater in areas with relatively shallower depth to water level is more vulnerable to anthropogenic contamination.

2.2 Water table elevation in the study area

A regional water table elevation map (figure 5) including areas much beyond close vicinity of Najafgarh drain was prepared to gain an insight into regional and local variations in water table elevation of the area. The water table elevation in areas adjacent to Najafgarh drain is found in the range of 197 to 206 m above mean sea level (mamsl) (figure 5). The higher water table elevation is noticed in initial part of the drain where it enters Delhi and in later part of the drain (later half segment of the drain before it joins river Yamuna). The lower water table elevations are found in the N–S stretch of the drain (figure 5). The regional water trough near Ojwah defined by 194 mamsl contour has a tremendous influence on groundwater flow to the extent that in first half stretch of the Najafgarh drain, groundwater flow from areas

adjacent to the drain and others converge towards it. Thus, in this stretch of the drain on left-side areas, groundwater flow seems to be away from the drain, while on right side of the drain, groundwater flow is towards the drain (figure 5). In later half stretch of Najafgarh drain apparently on left side of the drain, groundwater flow is towards the drain. While in areas on right side in downstream of the drain, in some stretches, there seems to be not much of groundwater flow; and in some areas/stretches, groundwater seems to be flowing away from the drain (figure 5). In areas where groundwater flow is away from the drain, there is possibility that contaminants entering the groundwater system are transported to relatively greater distance by advection along with the groundwater flow direction. The above-mentioned hydrogeological characteristics of the area (depth to water level, water table elevation, aquifer parameters, aquifer material, infiltration rates, etc.) hint at dynamic interaction between the water flowing through the drain and groundwater, thereby affecting the quality of groundwater.

3. Methodology for assessment of groundwater quality

The approach to assessment of groundwater quality in shallow aquifers in the vicinity of Najafgarh drain of NCT Delhi involved groundwater sampling at evenly distributed locations all along the

Figure 5. Water table elevation map of the study area.

drain. The sampling was done mainly during pre-monsoon period in May from hand pumps in the areas adjacent to the drain.

Acid-treated samples were collected for trace element/heavy metal analysis and normal samples for major element analysis. The samples were analysed at Central Ground Water Board (CGWB) chemical laboratory at Chandigarh using atomic absorption spectroscopy (AAS), ion chromatography and volumetric titration techniques (Shekhar 2008). Sampling locations varied from sites located approximately at a distance of 3–600 m from the drain (figure 6). It was observed subsequently during analysis that the samples, which were relatively away from the drain, had lesser amount of anthropogenic contaminants. The variations in concentration of the chemical components were studied in the perspective of permissible limit of drinking water following Bureau of Indian Standards (BIS 1991) and World Health Organization standards (WHO 2011). The variation in chemical constituents in groundwater was also studied to observe the pattern of similarity/dissimilarity in various chemical constituents in space, and to account for the observed patterns. The study of hydrochemical facies of the groundwater was conducted with the help of Hill–Piper Trilinear plot. The Hill–Piper trilinear plot was prepared for 21 groundwater samples where all the necessary data for hydrochemical facies classification was present.

AquaChem software was used for creating multiple parameter plot (Hill–Piper trilinear plot) and correlation matrices (Sarkar 2011).

4. Results

In perspective of BIS standards for drinking water (1991), 88% of the collected groundwater samples showed concentration of iron beyond permissible limit prescribed for drinking water of 1 mg/litre (BIS 1991) and 23% of groundwater samples showed concentration of manganese beyond their prescribed permissible limit for drinking water of 0.3 mg/litre (BIS 1991). It must be mentioned that WHO (2011) gives no specific guidelines for permissible limit of iron and manganese in drinking water. In about 42% of the samples, concentration of nitrate exceeded the permissible limit prescribed for drinking water of 45 mg/litre (BIS 1991); while in perspective of WHO (2011) standards, about 35% samples had concentration of nitrate beyond the permissible limit prescribed for drinking water of 50 mg/litre. Arsenic exceeded their prescribed permissible limit for drinking water of 0.01 mg/litre (BIS 1991), (WHO 2011) in about 3% of the samples. Cadmium exceeded their prescribed permissible limit for drinking water of 0.01 mg/litre (BIS 1991) in about 3% of the samples; while in

Figure 6. Map showing sampling locations of the study area.

Figure 7. Line plots showing spatial variation in cadmium (Cd), lead (Pb), copper (Cu) and chromium (Cr) for 1. Rawta, 2. Shikarpur road, 3. Shikarpur-2, 4. Nanakheri, 5. Isapur Khera, 6. Dhulsiras, 7. Chhawla, 8. Kutub Vihar, 9. Dwarka Sec. 19, 10. Dwarka Sec. 16 STP, 11. Dharampura, 12. Dwarka Sec. 16 J Flat, 13. Nand Vihar, 14. Ghasipura, 15. Deep Enclave, 16. Vikash Nagar, 17. Ranhola, 18. Nathan Vihar, 19. Chander Vihar, 20. Nihal Vihar, 21. Karampura, 22. Shashtri Nagar, 23. Roop Nagar, 24. Timarpur, 25. Nehru Vihar D-9, 26. Nehru Vihar C-280 groundwater sampling locations.

Figure 8. Line plots showing spatial variation in Iron (Fe) and Manganese (Mn) for 1. Rawta, 2. Shikarpur road, 3. Shikarpur-2, 4. Nanakheri, 5. Isapur Khera, 6. Dhulsiras, 7. Chhawla, 8. Kutub Vihar, 9. Dwarka Sec. 19, 10. Dwarka Sec. 16 STP, 11. Dharampura, 12. Dwarka Sec. 16 J Flat, 13. Nand Vihar, 14. Ghasipura, 15. Deep Enclave, 16. Vikash Nagar, 17. Ranhola, 18. Nathan Vihar, 19. Chander Vihar, 20. Nihal Vihar, 21. Karampura, 22. Shashtri Nagar, 23. Roop Nagar, 24. Timarpur, 25. Nehru Vihar D-9, 26. Nehru Vihar C-280 groundwater sampling locations.

perspective of the WHO (2011) prescribed permissible limit for drinking water, it exceeded the limit of 0.003 mg/litre in about 69% of the samples. As per WHO (2011) guidelines, chromium exceeded the prescribed permissible limit for drinking water of 0.05 mg/litre in about 12% of the samples; while in perspective of BIS (1991) prescribed permissible limit for drinking water, all the samples were well within the prescribed permissible limit of 0.1 mg/litre. In about 69% of the samples, lead exceeded the prescribed permissible limit for

drinking water of 0.01 mg/litre as per WHO (2011) guidelines; while in perspective of BIS (1991) standards for drinking water, about 19% samples had lead concentration in groundwater above the prescribed permissible limit of 0.05 mg/litre. The groundwater quality database used in the study is attached as supplementary material with the paper (Appendix A).

The concentration of chemical constituents such as chromium, copper, lead and cadmium in groundwater when plotted with respect to the

in Najafgarh drain catchment and concluded that these samples had high concentration of heavy metals such as chromium, copper and nickel which are linked to industrial sources.

Manganese showed significant positive correlation coefficient value with arsenic indicating a common source for both of them. In about 23% of the samples, manganese concentration in groundwater was beyond the prescribed limit for drinking water of 0.3 mg/litre (BIS 1991). Since it has been established that high concentration of heavy metals is linked to industrial sources, it is possible that higher concentration of manganese in groundwater is also contributed by industrial wastes. It suggested that the geogenic inputs of manganese in groundwater system was further enhanced by anthropogenic sources. Since arsenic correlated well with manganese, its concentration in groundwater could be linked to anthropogenic sources. Lalwani *et al.* (2004) had a similar observation and opined that the arsenic contamination in groundwater of Delhi could be from the arsenic present in garbage of open landfill sites rich in chemicals. Dubey *et al.* (2012) confirmed anthropogenic source for arsenic contamination in groundwater of Delhi.

The correlation matrix could be an effective tool to understand the relationship among different

major physiochemical parameters and trace elements, but hydrochemical facies could be further used to assess the nature and portability of groundwater. The Hill–Piper plot is one of the premier graphical plots for delineating hydrochemical facies. The Hill–Piper plot was prepared for the 21 samples, which provided sufficient information. The plot (figure 9) revealed that the major water facies types in the studied locations were Na-Mg-Cl-HCO₃, Na-Mg-HCO₃-Cl, Na-Cl-HCO₃, Na-HCO₃-Cl, Na-Mg-Ca-HCO₃-Cl, Na-K-Cl-SO₄ and Mg-Na-Ca-Cl-HCO₃ types (Sarkar 2011). It becomes clear from the trilinear plot (figure 9) that the dominant cations in the hydrochemical facies are prominently sodium with magnesium, while the anions vary mainly from chloride to the bicarbonate end of the plot. As mentioned earlier, the bicarbonate ions showed good correlation with nickel and sulphate ions showed good correlation with nitrate, while chloride ions do not show prominent correlation with any trace element and moderate correlation with nitrate. In this context, it can be inferred that originally the groundwater facies in the area was chloride type, the process of dilution by influx of drain water into groundwater system could have led to the changes in the groundwater facies originally from chloride type towards bicarbonate type. Thus, it can be said

Figure 9. Hill–Piper plot for the groundwater quality data.

that the anthropogenic contamination of groundwater system by the drain water and the trace element in the drain water simultaneously changed the groundwater facies.

5. Discussion

Hydrogeological characteristics of the catchment of the Najafgarh drain system and aquifer parameters of the formation along the Najafgarh drain establish vulnerability of groundwater to contamination by wastewater flowing through the drain. It has also been indicated by isotopic study (Datta *et al.* 1996) that there is seepage recharge from surface water courses in Delhi. In case of the Najafgarh drain, mixing of seepage recharge from the drain with water coming from adjacent highlands has been reported (Kumar *et al.* 2011).

The Najafgarh drain water was reported to contain considerable concentration of heavy metal contaminants such as iron, lead, manganese, copper and nickel (Sharma *et al.* 2004). Hence, it is quite possible that along with seepage recharge from the drain, the heavy metal contaminates the groundwater as well. However, a recent study by Lorenzen *et al.* (2011), based on bank filtration technique, proposed groundwater extraction from the aquifer near the drain for drinking purposes. The shallow aquifer in this area is contaminated in different stretches. Thus, any groundwater development for emergency requirement should be preceded by microlevel groundwater quality study. The groundwater pumping in such areas must be staggered in space and time to control saline water upconing (Rao *et al.* 2006, 2007).

A system simulation and numerical modelling study can suggest optimal pumping from the aquifer under different possible scenarios. The model can incorporate possibilities of contaminant transport from sampling locations where contaminants have been reported. It is also suggested that the sewage treatment level can be estimated so that the drain bank filtrated water into aquifer attains portable drinking water standards. This can be enforced on the concerned authorities undertaking sewage treatment projects along the drain.

6. Conclusion

The study gives a detailed insight into hydrogeology of the area adjacent to the Najafgarh drain and groundwater quality in shallow aquifers along the Najafgarh drain. It establishes contamination

of groundwater system in vulnerable stretches by wastewater flowing through the drain. It has been established that originally the groundwater in the aquifers had evolved to chloride facies, where the total dissolved solutes in groundwater was contributed mainly by geogenic sources. The groundwater recharge to shallow aquifers along the drain caused dilution of the chloride facies water leading to re-evolution of the groundwater facies towards bicarbonate type. In this process, the groundwater quality was degraded by anthropogenic contaminants from wastewater flowing through the drain. Thus, recharge through drain water led to influx of trace element/heavy metals in groundwater. This establishes the fact that anthropogenic contamination of the groundwater simultaneously leads to changes in the hydrochemical facies of the groundwater. The influx of contaminants into groundwater system through network of subsidiary drains is also evident from the pattern of spatial variation in the concentration of the groundwater contaminants. Hence, the study on anthropogenic contamination of groundwater system should be coupled with hydrochemical facies analysis for comprehensive assessment of groundwater quality.

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Appendix A

Table showing the location of sampling stations and the concentration of different chemical parameters. Cd – Cadmium, Cr – Chromium, Cu – Copper, Fe – Iron, Mn – Manganese, Ni – Nickel, Pb – Lead, Zn – Zinc, As – Arsenic, EC – Electrical conductivity, Cl – Chloride, SO₄ – Sulphate, NO₃ – Nitrate, F – Fluoride, Ca – Calcium, Mg – Magnesium, Na – Sodium, K – Potassium, HCO₃ – Bicarbonate, N.A. – Not analysed/data not available.

Sl. no.	Locality	Cd	Cr	Cu	Fe	Mn	Ni	Pb	Zn	As	EC	Cl	SO ₄	NO ₃	F	Ca	Mg	Na	K	HCO ₃
1.	Rawta	0.007	0.032	0.003	3.885	0.017	0.007	0.02	0.01	0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A.	N.A	N.A
2.	Shikarpur road	0.005	0.029	0.011	3.381	0.114	0	0.02	0.101	0	2250	489	125	75	2.23	21	88	410	10	467
3.	Shikarpur-2	0.009	0.041	0.017	1	0.076	0	0.014	0.032	0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
4.	Nanakheri	0.004	0.013	0.007	3.072	0.026	0	0.04	0.2	0	2780	774	95	55	0.84	83	121	390	3	317
5.	Isapur Khera	0.005	0.042	0.003	0	0	0	0.02	0.025	0	2340	300	50	48	1.47	13	45	510	6	995
6.	Dhulsiras	0.002	0.017	0.073	1.7	0.182	0	0.04	4	0	2120	511	230	8	0.3	79	82	315	4	249
7.	Chhawla	0.009	0.046	0.003	1.7	0.045	0	0	1	0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
8.	Kutub Vihar	0	0.025	0.005	2.3	0.096	0	0.04	0.133	0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
9.	Dwarka Sec.19	0.003	0.046	0.001	2.259	0.029	0	0	0.11	0	1620	362	50	13	0.3	53	26	315	5	437
10.	Dwarka Sec.16 STP	0.006	0.025	0	0.2	0.211	0	0.003	0.4	0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
11.	Dharampura	0	0.016	0.008	2	0.224	0	0	0.164	0	4980	1548	370	149	0.43	290	238	570	13	196
12.	Dwarka Sec.16 J Flat	0.003	0.024	0.001	1.333	0.015	0	0	0.014	0	1100	223	105	10	0.5	53	52	135	6	234
13.	Nand Vihar	0.005	0.043	0.035	1.7	0.068	0	0.1	1.3	0	1180	113	50	9	1.2	41	32	175	4	459
14.	Ghasipura	0.003	0	0.001	1.4	0.113	0	0.02	5	0	1080	223	90	25	0.21	53	63	100	5	198
15.	Deep Enclave	0.009	0.007	0.001	1.055	0.421	0	0	0.8	0.0009	1325	223	50	0.2	0.14	60	37	200	14	458
16.	Vikash Nagar	0.005	0.031	0.005	7.4	0.358	0.014	0.04	0.6	0.0015	1470	287	100	0.4	0	51	29	260	12	351
17.	Ranhola	0.01	0.048	0.004	0.382	0.011	0	0.04	0.016	0.0019	2250	425	155	75	0.71	18	62	440	2	458
18.	Nathan Vihar	0.009	0.024	0.002	0	0	0	0	0.004	0.0026	6000	1297	1140	237	1.78	75	107	1100	650	679
19.	Chander Vihar	0.004	0.056	0.001	1.006	0.01	0	0.06	0.095	0.0019	2430	277	65	107	2.23	31	76	475	5	1007
20.	Nihal Vihar	0.011	0.031	0.006	4.879	0.496	0	0.08	0.154	0.001	2190	475	95	111	0.36	26	127	275	6	354
21.	Karampura	0.007	0.023	0.005	1.7	0.546	0.003	0.06	0.092	0.0013	3850	872	430	116	0.66	106	127	575	4	267
22.	Shashtri Nagar	0	0.053	0.003	1.667	0.031	0	0.04	8	0.0008	1100	142	115	0.2	0.05	82	21	150	7	344
23.	Roop Nagar	0.003	0.014	0.006	3.11	0.022	0	0.04	0.134	0.0028	2120	188	200	85	7.14	29	36	460	2	747
24.	Timarpur	0.006	0.047	0.001	1.615	0.149	0	0.08	0.047	0.0001	2530	305	385	261	1.25	71	96	425	3	488
25.	Nehru Vihar D-9	0.008	0.03	0.001	3.218	1.2	0.012	0.02	0.074	0.015	1255	184	25	28	2.93	68	48	150	7	466
26.	Nehru Vihar C-280	0.004	0.051	0.005	1.3	0.7	0	0.02	0.181	0.0003	755	113	32	4	0.45	40	39	73	2	259

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