

**Quality of Drinking Water in South Delhi District  
A Pilot Study on Bacteriological Contamination**



**Livpure Foundation**

(A national level non-profit making and non-sectarian social service organization)

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I am confident that this pilot study report would provide a strong baseline for further and more detailed studies and will help the policy makers in their efforts of tackling the crisis of clean drinking water in Delhi and its neighborhoods. The report would also be helpful to academicians and researchers in understanding the problems of water crisis at large and especially in the context of South Delhi.

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## EXECUTIVE SUMMARY

Water is most precious gift of nature to the earth. It is synonymous to “life” as well as “development”. Clean water is essential for human health, wildlife, and for a sustainable environment. Access to safe drinking water on sustainable basis constitutes as one of the fundamental and inalienable human rights for everyone in India. According to an estimate 67 per cent of the Indian households do not treat their drinking water, even though it could be bacterially or chemically contaminated. Only a quarter of population in India has drinking water on their premises. Situation is bleaker in metropolitan city like Delhi where access to safe drinking water is still a daunting task, with unauthorized colonies and *jhuggi jhonpri* clusters having much poorer access to water supply compared to other settlements. The residents in these and some other settlements also suffer due to the poor quality of water. Deficit of raw water, leakage from pipelines and deteriorating quality of surface water of the Yamuna are major drivers of water woes across Delhi. The DJB estimates a distribution loss of around 40 per cent of the total water supplied owing to leakages. The situation perpetuates in lack of knowledge about source protection, preservation, conservation, contamination caused by numerous external and internal carriers and judicious usage of water. Besides, seven of the nine revenue districts are said to have poor groundwater availability. The South and South-West districts have been declared as notified areas wherein there is to be no more extraction of groundwater. East, New Delhi, North-East, North-West and West Delhi districts have also been declared as ‘over-exploited areas’ by the government, the report notes.

The growing number of population mingled with poverty, unemployment, rampant migration of population and settlement of slums and squatters make the problem more challenging for governments and civil bodies. In order to diagnose the problem in totality, the Livpure Foundation carried out a quick pilot survey using random sampling method in South Delhi district of NCT Delhi State. Samples were collected from 300 spots that comprised households, schools, offices, public places, restaurants and *dhabas*, etc. The main aim of the survey was to test the contamination water supply in these areas and create a baseline for further, even larger studies about quality of existing potable water, the various methods available for treatment of water and after all ascertain availability of quality of water and information and knowledge about water to various stakeholders. Additionally, the survey report will be used as a tool for evidence based advocacy as well as sensitizing communities about various forms of water contamination and usages of safe drinking water across the state through “School ambassadors Programme”

The study finds that regular supply of water is a major concern in identifies sample areas. 22% of all collected samples have bacteriological contamination. The rate of contamination is higher in schools where 40% of the samples are infected with bacteria. At household levels, contamination rate is 23% of all household samples while in Dhabas/food joints, 17% samples were found to be contaminated. While analyzing rate of contamination at water sources, the study noticed that 24% of samples collected from tap had been contaminated and almost similar rate existed in water sourced from bore well. The report found that about 50% of the sampled population did not use any method for filtering drinking water .Thus high level of contamination must be driving numerous diseases which is of course a serious issue for further research. The level of awareness among the people about the ill-effects of consuming contaminated water and various treatment technologies available is abysmally low. The knowledge of proper storage and sanitation practices was also seen missing from most of these areas. Awareness about the concept of supply and proper storage of water needs to be increased and besides awareness, the availability of treatment methods is also an area to be looked into.

## INTRODUCTION

India has about 15% of the world's total population and only about 4% of the world's water resources are in this country. Crisis of safe drinking water are already becoming evident in several parts across the country. A national water policy was drafted in 1987 which was subsequently revised in 2002 and then, 2012. Water quality monitoring is being given high priority since 2000 and institutional mechanisms have been developed at national, state, district, block and panchayat levels. However, maintaining the water quality is not the government's work alone; the communities also have to play a key role in maintaining hygiene near water sources. Users have to improve the ways in which they collect and store water so as to avoid contamination while collection, storage and use.

Delhi is not only the National Capital Territory of India, but also the second most populous urban agglomeration in the world.<sup>1</sup> According to a 2011 census, Delhi has a population of nearly 16 million residents out of which about 2.7 million people reside in South Delhi area.<sup>2</sup> South Delhi is an administrative district of the National Capital Territory of Delhi in India. It is encircled by the Yamuna River to the east, the districts of New Delhi to the north, Faridabad District of Haryana state to the southeast, Gurgaon District of Haryana to the southwest, and South West Delhi to the west.<sup>3</sup> Administratively, South Delhi has its headquarters at Saket and its subdivisions are Kalkaji, Defence Colony and Hauz Khas. 30 percent of Delhi's population lives in slums. Technically many of these settlements are illegal; therefore there is no investment into its facilities. Self appointed Cluster leaders take advantage of their illegal status by dominating the water supply and making profit from other people's plight. Some of those in South Delhi are Sangam Vihar, Said-ul-ajab, Hauz Rani, Batla House, etc.



**Figure 1: Delhi Map**

Source: [www.delhi.gov.in](http://www.delhi.gov.in)

The daunting task of meeting the drinking water needs of the large population of Delhi is done by the Delhi Jal Board (DJB) which was constituted under the Delhi Water Board Act, 1998. DJB is responsible for procurement and treatment of allocated raw water to Delhi. In the area of

Municipal Corporation of Delhi, DJB is responsible for supply of drinking water with its own trunk, peripheral and distribution network. Raw water is being made available to Delhi from Ganga River (240 MGD), Yamuna River (310 MGD) and Bhakra Beas Management Board (140 MGD). About 115 MGD of ground water is also being explored through Ranney Wells and Tube Wells of Delhi Jal Board.<sup>4</sup> The projected population of Delhi would be over 20 million by 2021. Considering per capita requirements of 60 gallons per day, current requirement of potable water in Delhi has been calculated to be 1025 MGD. Against this, the current production is only about 818 MGD due to shortage of water, leaving a gap of 207 MGD.



However, shortage of water supply is not the only problem faced by Delhi, the demand for good quality water not only exceeds the supply, **but the quality of the water itself is also a matter of great concern.**

A report by CPCB in 2011<sup>5</sup> surveyed a total of 102 water bodies in Delhi, which included 5 rivers, 70 groundwater bodies and 6 water treatment plants. The report states that out of 52 samples of surface water analysis, 77% were violating to DO and 94% is not complying to Total Coliform (TC), out of 119 observations 89% is not confirming to BOD, out of 42 observations 88% is not complying to Fecal Coliform (FC), out of 120 observations 1% is not complying to pH. Water Quality of river water data analysis of 32 observations points out that 63% are violating to DO, 3% are violating to pH, 61% are not confirming to BOD, 85% is not confirming with FC and 91% is not confirming with TC.

Recent reports of untreated industrial waste that was released into the river through the Panipat drain in Haryana, made headlines for increasing the pollution levels in Yamuna in January, 2014. DJB reported a huge increase in ammonia levels in the Yamuna (1.2 parts per million against the limit of 0.2 ppm) forcing the Delhi Jal Board to cut production at the Wazirabad and Chandrawal water treatment plants by 50 per cent. As a result, water supply across the city was affected and several areas in Central, Old, North, parts of South Delhi received reduced supply at low pressure for a couple of days.

Reports<sup>6</sup> have also stated that rainfall in Delhi hasn't replenished the groundwater tables, especially in many parts of South Delhi. According to the latest CGWB recordings of pre-monsoon water levels of 120 wells, the level of water even after rains was found to be similar as the amount recorded in November 2013 and January 2014, which shows that the post-monsoon levels are no better. When compared to 2007 data, water levels in most South Delhi wells have fallen by more than a meter.

## ABOUT THE STUDY

### Objectives:

The objectives of the study were

1. To analyze the current crisis of drinking water in select areas of South Delhi
2. To test the quality of drinking water in the above said areas
3. To sensitize communities directly and indirectly

### Study Area:

Random areas were selected in South Delhi by the volunteers

Figure 3: Location study area



South Delhi map

Source: [www.delhi.gov.in](http://www.delhi.gov.in)

### Methodology:

A survey was conducted in 20 areas of South Delhi which included private colonies with random sampling that comprised DDA flats, illegal settlements, schools, colleges, hospitals, government and private offices, restaurants, roadside *dhabas*, taxi and bus stands and also MCD water carts. The survey was conducted in the month of May and June, 2014. A questionnaire and onsite observation was used as methods of onsite data collection and administered to 300 source points. The questionnaire comprised of questions, both qualitative and quantitative in nature.

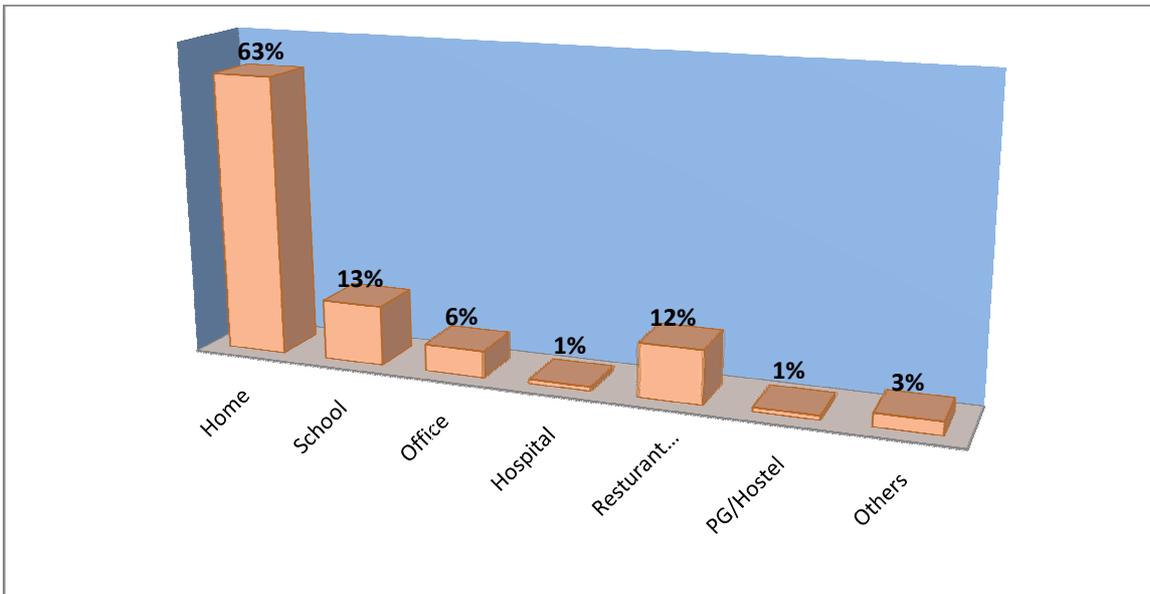


Figure 4: Sample collection from different source



## Water Testing

Drinking water sources from various locations were tested for contamination. To get an overview of the drinking water quality of the project targeted area, all types of functional drinking water sources along with its geographical spread have been considered.

Figure 5: Contaminated water samples



These include tankers, hand pumps, tube well, open well, Delhi Jal board supply water as well as stored water at homes. Water was collected in vials called “Bacteriological H<sub>2</sub>S strip test”. Water samples were kept in these vials for 24 hours and if it turns black, it would give positive confirmation of bacteriological contamination.

# MAJOR FINDINGS

## Water Quality Test

Out of the total 300 samples collected from various areas in South Delhi, 67 water samples were found to be unfit for use which constitutes more than 22 percent of the samples. The maximum number of contaminated water samples was recorded from Sangam Vihar area of South Delhi. Approximately 84 percent of samples were found to be contaminated out of the 19 samples collected from this area which indicates a serious water issue in that area. Most of the samples from Sangam Vihar were collected from its residential area. Sangam Vihar is the largest unauthorized colony of Asia. Water crisis is a huge issue in Sangam Vihar. Water supply is not regular and frequency of supply can vary from once a day to once a month. Extreme overcrowding and high density of population is one of the reasons for lack of proper hygiene in that area. Maximum number of contaminated water samples was obtained from the same area.

Figure 6: Sangam Vihar at a glance



9 schools out of a total of 23 schools also had contaminated water. Contaminated water in institutions like schools is a matter of worry. Waterborne diseases like cholera, diarrhea, typhoid, etc. tend to be more prevalent among children because of their lower immunity and can hamper their growth and development severely.

Samples were collected from a total 182 homes, out of which 23 percent samples were found to be contaminated. 39 percent samples from a total of 23 schools and 17 percent samples from a total of 46 restaurants and *dhabas* were also found to be contaminated. The water source of majority of the contaminated samples was found to be taps and tube wells. More than 24 percent of the water samples collected from 161 taps was found to be contaminated and approximately 25 percent of the water samples collected from 90 tube wells were contaminated indicating that both the water supply and groundwater quality is questionable. However, source of water supply cannot be solely held responsible for contamination of water; other factors such as storage of water also need to be analyzed.

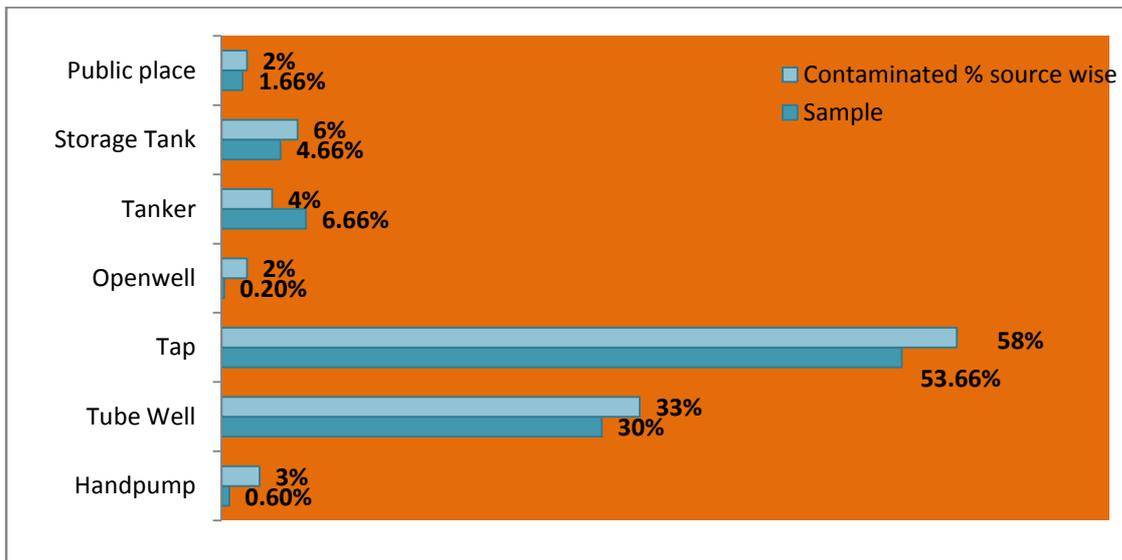


Figure 8: Percentage breakup of contaminated sample source

## Water Storage and Treatment

Data also shows that majority of people store their water in plastic tanks. Approximately 22 percent of water samples collected from 164 plastic tanks was found to be contaminated. Unfortunately, 61 percent of homes store their water in these plastic tanks and 64 percent of them were found to be contaminated.

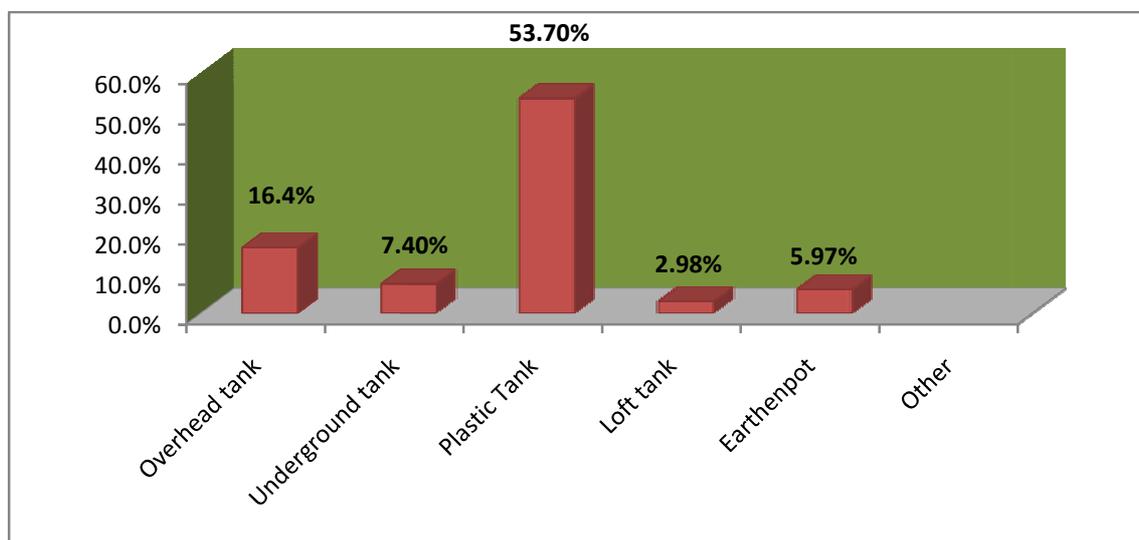
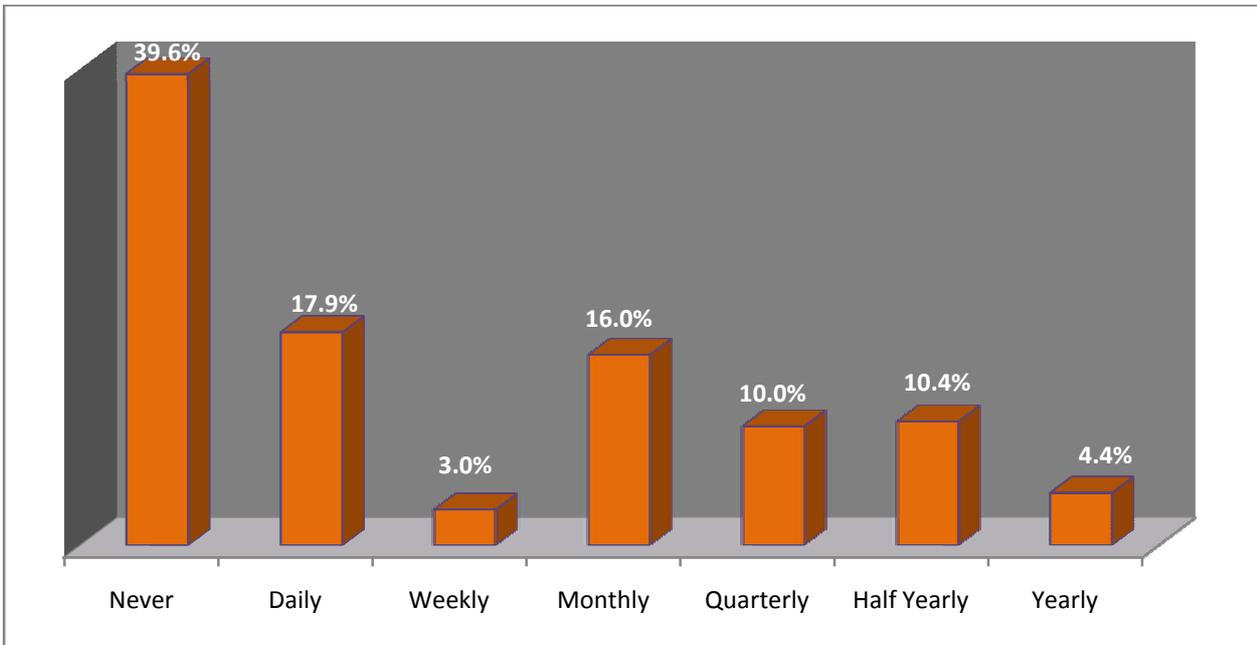


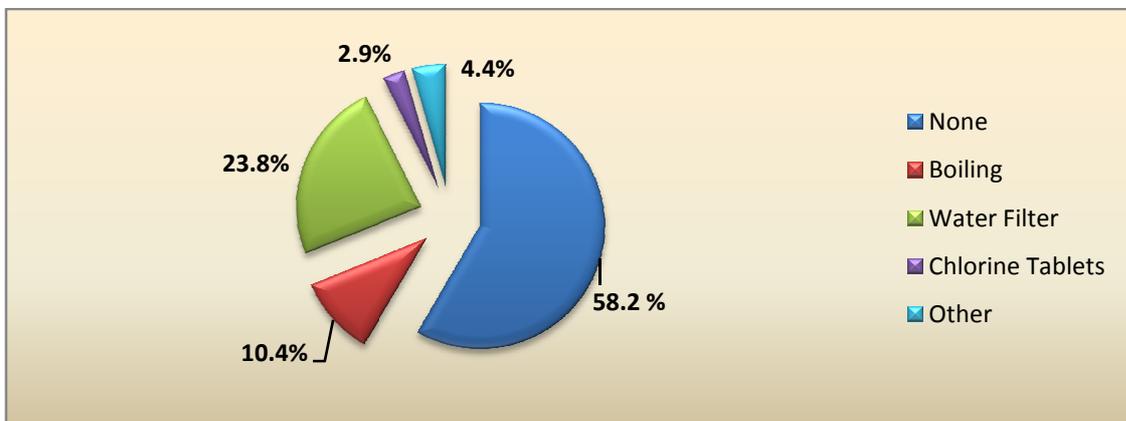
Figure 9: Percentage breakup of contaminated sample storage

When asked how often everyone cleans their water storage containers, almost 35 percent people responded never cleaning these storage areas. 23 percent of the total 104 people who never cleaned their water storage areas were found to have contaminated water.



**Figure 10: Frequency of cleaning water storage container-Percentage breakup of contaminated samples**

Cleaning methods also hugely affected the results of the data. 48 percent collected water samples had not been cleaned by any methods prior to usage, out of which 26 percent samples were found to be contaminated as compared to only 18 percent of samples that were found contaminated even after being cleaned by various methods.



**Figure 11: Purification methods-Percentage breakup of contaminated samples**

## ANALYSIS

The study highlights that water is definitely a concern for the respondents and others in their community. Test takers reported that majority of the respondents faced shortage of water supply. Sangam Vihar was observed to have high water crisis and is faced by almost 80% of the population. Very few people in that area reported to get daily supply of water. Majority of the respondents living in the internal areas of Sangam Vihar reported only weekly and sometimes monthly supply of water. However, one of the major reasons for widespread bacteriological contamination as seen in the study area, are the external conditions especially sanitation related facilities. Many schools were also reported to have contaminated waters even though had some water filter in the school. Principal of one of the schools in the Jamia Nagar wasn't cooperative and insisted that the school has a water filter, though the test taker was unable to find any. On testing, the water sample was found to be contaminated.

Many people also had the concept of "direct water" from the tap which to them is uncontaminated and they didn't have to store it. However, 23 percent of these "direct" water samples were found to be contaminated. Not only the water supply but also the water storage and treatment by the users affected the percentage of contaminated samples. The impact of these factors is clearly reflected in the health condition of the inhabitants. There are instances of cases of jaundice, cholera, typhoid, diarrhoea and other gastrointestinal infection. Though it is not clear whether these diseases are directly related to the water supply in these areas or not. The tendency of respondents was to not give importance to the occurrence of these diseases. This is also reflected in the survey numbers.

From the study, it appears that water treatment is not a priority for the communities. With almost 50 percent of the respondents not treating their water, 26 percent of the samples were found to be contaminated which is a cause for major concern as water quality testing suggests that treatment is critical for these areas. Respondents believed that the water they drink is fine and stomach ailments, most probably a consequence of poor water quality are a part of life. The project communication will stress on the need for safe water in addition to treatment options to address this issue.



**Fig: 12** Microbiologist examining the contaminated sample at Livpure research laboratory

## CONCLUSION

DJB asserts to conduct extensive quality checks of water supply starting from raw water stage upto the consumers as per standards of BIS 10500-2012. They have seven laboratories installed at water treatment plants and six zonal laboratories located at various parts of the city work round the clock to ensure supply of potable water at the consumers end. The data given on their official website<sup>7</sup> for daily drinking water quality is questionable since most of their samples from various areas of Delhi are “satisfactory” according to their norms. This data needs to be validated by external sources.

This pilot survey report is an insight to quality of water in South Delhi; however, a larger and more uniform study which covers every possible aspect needs to be done for better results. There can be little doubt that water is a basic necessity for the survival of humans. There is interplay of various factors that govern access and utilization of water resources and in light of the increasing demand for water it becomes important to look for holistic approaches for water management.

Clearly, drinking water is too fundamental and serious an issue to be left to one institution alone. It needs the combined initiative and action of all, if at all we are serious in socioeconomic development.

## FIELD BASED LEARNING AND EXPERIENCES

While interviewing the respondents field investigators also noted down some of their experiences on the survey form. These experiences were either the observations the volunteers made while collecting the samples or conversations they had with the respondents.

- The investigators who visited schools in Jamia Nagar and Okhla reported that the principals of the schools were not cooperative and didn't want to answer any questions of the questionnaire.
- The Principal of Jamia School was reluctant on providing the water sample to the volunteers and insisted that the school has a water filter even though the volunteer couldn't find any. When examined, water samples turned out to be contaminated. In Srinivas Puri, people complained about low and untimely supply of drinking water leading to acute shortage. Many even reported to use packaged or bottled drinking water for cooking and drinking and not relying on the DJB supply.
- Volunteers who surveyed Vasant Vihar reported that drinking water was not easily available and some pipelines were also found to have leakages.
- Crisis of water was also noticed by volunteers in Pillanji Village (South Delhi) where the respondents reported to receive irregular supply of water and usually at odd timings, at 12 at noon and 2 am.
- Residential colonies in Okla. and Okhla Vihar were reported to receive inadequate water supply and the frequency of supply was fortnightly.
- Several volunteers reported that most of the water collection sources of the illegal settlements were located nearby septic and unhygienic areas like sewers, drains, landfills, etc. and water from areas was visibly contaminated.
- Many of the *dhabas* and temples, where 100-200 people visit every day, were found to store water in unclean tanks which was served to the people. Most of the people visiting these *dhabas* were from low income groups.
- Many families in the areas of Sangam Vihar, Hauz Rani and Said-ul-ajab (the illegal settlements) had dug their own bore wells because of the huge crisis of water supply. However, upon examining these samples, many of them were found to be contaminated suggesting the quality of groundwater also needs to be checked.

## GLIMPSES FROM THE FIELD



Drinking water sample collection from a taxi stand in Saket



Sample collection from water push cart



Water sample collection from households in Sangam Vihar



People waiting in queue for collecting water from public tap, Sangam Vihar

## ABBREVIATIONS

BIS - Bureau of Indian Standards Act, 1986

BOD - Biological Oxygen Demand

DJB - Delhi Jal Board

DO - Dissolved Oxygen

FC - Fecal Coliform

MCD - Municipal Corporation of Delhi

MGD - million gallons per day

NDMC - New Delhi Municipal Corporation

NEERI - National Environmental Engineering Research Institute

PPM - parts per million

TC - Total Coliform

WHO - World Health Organization

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<sup>2</sup> South Delhi District : Census 2011 data; <http://www.census2011.co.in/census/district/176-south-delhi.html>

<sup>3</sup> Organization Structure, South Delhi; [http://delhi.gov.in/wps/wcm/connect/doiit\\_dc\\_south/DC%28South%29/Home/Organization/](http://delhi.gov.in/wps/wcm/connect/doiit_dc_south/DC%28South%29/Home/Organization/)

<sup>4</sup> Water Supply & Sanitation, <http://www.delhi.gov.in/wps/wcm/connect/9efb73804c2c48a08208869991226613/23+-+36+Water+Supply.pdf?MOD=AJPERES&lmod=-336094425&CACHEID=9efb73804c2c48a08208869991226613>

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<sup>6</sup> “Rain can't restore water table, experts worried”, The Times of India, June 5, 2014; <http://timesofindia.indiatimes.com/city/delhi/Rain-cant-restore-water-table-experts-worried/articleshow/36077587.cms>

<sup>7</sup> Daily Drinking Water Quality, Delhi Jal Board Official Website; [http://www.delhi.gov.in/wps/wcm/connect/doiit\\_djb/DJB/Home/Water+Quality](http://www.delhi.gov.in/wps/wcm/connect/doiit_djb/DJB/Home/Water+Quality)

# ANNEXURE

## Survey Questionnaire

### LIVPURE FOUNDATION

Water quality testing format

1	Name of volunteer				Date		
2	Name of Respondent				Sample code no.		
3	No. of family members						
4	Address				Colony	Ward	ID#
5	Phone no.				Email		
6	Source of sample	A. Hand pump	B. Tube well/Overhead	C. Tap	D. Open well	E. Filter	F. Storage tank
7	Please specify if the source is near to septic tank/toilet/sulabh sanchhalaya/sewerage channel etc.				1. Yes		
					2. No		
8	Sampling Area/Place	A. Home	B. School	C. Office	D. Hospital	E. Restaurants/Duka	F. Public
9	Use of water	A. Drinking		B. Cooking	C. Washing/laundry	D. Other (specify)	E. Total use of water
10	Any incidence of Water born diseases in last six months	A. Diarrhea	B. Gastro	C. Typhoid/typhus	D. Other please specify		E. None
11	If yes, how many times						
12	Where do you store water	A. Overhead tank	B. Underground tank	C. Rain tank	D. Pot/tank	E. Earthen pot	F. Other
13	How often you clean your tank	A. Never	B. Monthly	C. Quarterly	D. Half Yearly		E. Yearly
14	If yes, What method is being applied to clean drinking water	A. Boiling		B. Water filter	C. Chlorine tablets		D. Other (specify)
15	Foaming/Experiences/Observation volunteer please (write in 100 words)						
16	Time of water sample collected (inoculation) in hrs			Observation after 1. 24 hrs:		2. 48 hrs:	
17	Result:	1. Positive (+ve) - Water turns to black			2. Negative (-ve) - Water soft/No colour change		
18	If water turns to black after incubation, suggest to boil before drink.						

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