SFD Report

Bongaon
India

Final Report

This SFD Report –Comprehensive level - was prepared by Centre for Science and Environment.

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SFD Report Bongaon, India, 2017

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This Executive Summary and SFD Report are available from:

www.sfd.susana.org

1. The SFD Graphic

Produced with support from the SFD Promotion Initiative with funding from the Bill & Melinda Gates Foundation.
The SFD Promotion Initiative recommends that this graphic is read in conjunction with the city's SFD Report which is available at: sfd.susana.org

2. Diagram information

SFD Level:

Comprehensive

Produced by:

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3. General city information

Bongaon city lies in the state of West Bengal, India. It is one of the five sub-divisional towns in the district of North 24 Parganas having the district headquarters at Barasat. Bongaon is located at 23.04° N 88.83° E and at an average altitude of 7 meters (22 feet) above Mean Sea Level. The National Highway (NH) No-34 goes through the Bongaon subdivision."Chakdah Road" is the connector/bypass between NH-34 and NH-35.The town is located at a distance of 77.5 km from the capital city, Kolkata, and shares its border with Bangladesh (BM, 2016).

The soil type in the town varies from sandy to clay loam and is considered very fertile. The average rainfall received is 1,579 mm/year. The maximum and minimum temperature is 41 °C in summer and 10 °C in winters respectively (BM, 2016).

As per Census of India 2011, Bongaon has a population of 108,864.Bongaon Municipality (BM) is spread over an area of 14.274 sq.km. It is divided into 22 municipal wards. The population density of the city is 7,629 persons per sq.km which is high in comparison to the density of West Bengal, i.e. 1,028 persons per sq.km (BM, 2016a).The slum population of Bongaon is 40,328 which is 37.04% of the total population (Census,2011).

4. Service outcomes

An overview on technologies and methods used for different sanitation systems through the sanitation service chain is as follows:

Containment: All households are dependent currently on Onsite Sanitation Systems (OSS).The most prevalent containment system is a pit system (single & twin-pit).These are constructed using concrete or mud rings, each ring having a diameter of 0.7 m to 0.9 m and a height of 0.25 m. The average depth of pits ranges from 2.4 m to 12.1 m (BM, 2016a). The pit system is used by 73% of the population according to the field survey. The size and no. of rings to be installed is based on the space availability and affordability of the respective households. The average size of a septic tank seen during field visit varies from 2.4 m x 1.2m x 1.52 m to 3.6m x 1.5 m x3 m. Although, there is no standard size being followed for construction of septic tanks (BM, 2016a). From the field survey, it was inferred that 22% of the population use septic tanks connected to soak pits and 3% of the population use lined tank with impermeable walls and open bottom connected to a soak pit and 2% of the population use septic tank connected to an open drain.

99% of the containment systems installed in the city pollute the environment and are considered to be not contained. The municipality claims that action is taken against those whose septic tank is not connected to a soak pit and the effluent from the outlet is directly discharged into an open drain.

Emptying: The emptying services are provided by BM. There are a total of 3 vacuum tankers plying in the city. Two of the vehicles have a capacity of 3,000 litres and 1 vehicle has a capacity of 1,500 litres. To avail the service, an application form is to be purchased for Rs.10 from the municipality and submitted to the municipality. A fee is charged based on whether the applicant belongs to the Below Poverty Line (BPL) or the Above Poverty Line (APL) category. The emptying charges for a family belonging to BPL is INR 550 (USD 8.41) and APL is INR 850 (USD 13). The emptying service is provided within a week. Emptying is done mechanically only. In a day, around 25-30 trips are done cumulatively by the 3 vehicles. The time taken to empty each containment is 1-2hrs. During the emptying process, the labourers use gloves and masks thereby taking some of the necessary safety measures.

Transportation: The vehicle used for emptying is a tractor-mounted tanker. The tractor vehicle with a smaller capacity tank is most often used to access the narrow lanes. Vacuum tankers are stationed at Shimultala. This facility is separately provided for parking of vehicles, which is located at 1 km distance from the Bongaon Municipality office.

Figure 1: Emptying of a septic tank (Source: Anil/CSE, 2016)

During emptying operation due to the presence of solidified Faecal Sludge (FS) and less suction capacity of the pump, there are instances of inlet hose pipe getting choked. In this case, the choking is cleared manually by a labourer after entering the tank. Supernatant (SN) is attributed to be from 1% of the population which is generated from a septic tank connected to an open drain.

Treatment and disposal: The town does not have any treatment facility for FS. After emptying, the faecal waste is dumped into a solid waste landfill site in Milanpalliin Ward No.10. This landfill is situated next to a large pond.

Figure.2: Septage discharged at solid waste dump yard (Source: Anil /CSE, 2016)

The Census 2011 shows that the population using sewer system is 3.7%. But, as per the random household survey, which was conducted in all wards, it was concluded that there is no sewerage network present in the town. Nevertheless, laying of sewerage network is planned for the whole town. According to Census 2011, the OSS such as septic tanks connected to open drain, pit latrines and of public latrine connected to septic tank is 8%, 51.1% and is 3.2% respectively.

In Bongaon, the septic tank connected to the open drain is used by 2% of the population. There is no clear differentiation between the volume of SN and solid FS generated from the septic tank connected to open drain, hence to reduce maximum error it is assumed to be 50% each. Hence, the SN is 50% of the 2%, i.e. 1%.

'FS not contained' is attributed to 99% of the population which use the systems: septic tank connected to open drain (2%) + septic tank connected to soak pit (22%) + lined pit with semi-

permeable walls (73%) + lined tank with impermeable walls connected to soak pit (3%). FS not contained implies that FS infiltrates and pollutes the high ground water table and the SN from the septic tank connected to open drain reaches Ichamati River passing through the city.

From 99% of the FS not contained, 49.5% is solid FS and 49.5% is liquid. It is also assumed that 90 % of the FS is emptied during the emptying process, thereby leaving 10% of FS in the containment system itself. Hence, out of 49.5% solid FS, 45% FS is emptied, leaving behind 4.95%, which is not emptied. The 49.5% liquid component which gets infiltrated together with the 4.95% which is left behind in the containment system constitute the 54% of the 'FS not contained-not emptied'.

As represented in the graphic, 45% FS, which gets emptied, is transported and discharged untreated into solid waste landfill site. Therefore, it can be concluded, excreta of 100% of the population are not managed safely.

5. Service delivery context

The National Urban Sanitation Policy (NUSP) was issued in 2008, by the Ministry of Urban Development (MoUD, GoI). The policy aims to: raise awareness, promote behaviour change; achieve open defecation free cities; develop citywide sanitation plans; and provide 100% safe confinement, transport, treatment and disposal of human excreta and liquid wastes. The NUSP mandates state to develop state urban sanitation strategies and work with cities to develop City Sanitation Plans (CSPs).

NUSP identifies the constitution of multi-stakeholder task force, known as city sanitation taskforce (CSTF) as one of the principal activities to be taken up to start the city sanitation planning process. CSTF has now been renamed as Swachh Bharat City Level Task Force (SBCLTF) (MoUD, 2014).

The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 have provisions relating to sanitation services and environmental regulations. It applies to households and cities with regard to disposing wastes into the environment. ULBs (Urban Local Bodies)/ utilities also have to comply with discharge norms for effluent released from sewage treatment plants and to pay water cess under the Water Cess Act, 1977 (MoUD, 2013).

In February 2017, MoHUA issued the National Policy on Faecal Sludge and Septage Management (FSSM). The policy aims to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city in India (MoUD, 2017).

There are various schemes launched by central government, like Swachh Bharat Mission (SBM), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), National Mission Clean Ganga (NMCG) etc. to provide basic civic amenities including improvement of urban sanitation. The Mission Nirmal Bangla aims to achieve Open Defecation Free (Nirmal Gram) status for all the Gram Panchayats of the state on or before 2nd of October 2019.

The municipality did a rapid assessment of Faecal Sludge Management (FSM) in the city, the budgetary provision required for capital expenditure for FSM is INR 8,940.52 lakh (13.4 million USD). Whereas, the operation and maintenance (O&M) cost associated with the emptying services and treatment operations is estimated to be INR 2,285.33 lakh (3.4 million USD) for 5 years (MoUD, 2016).

6. Overview of stakeholders

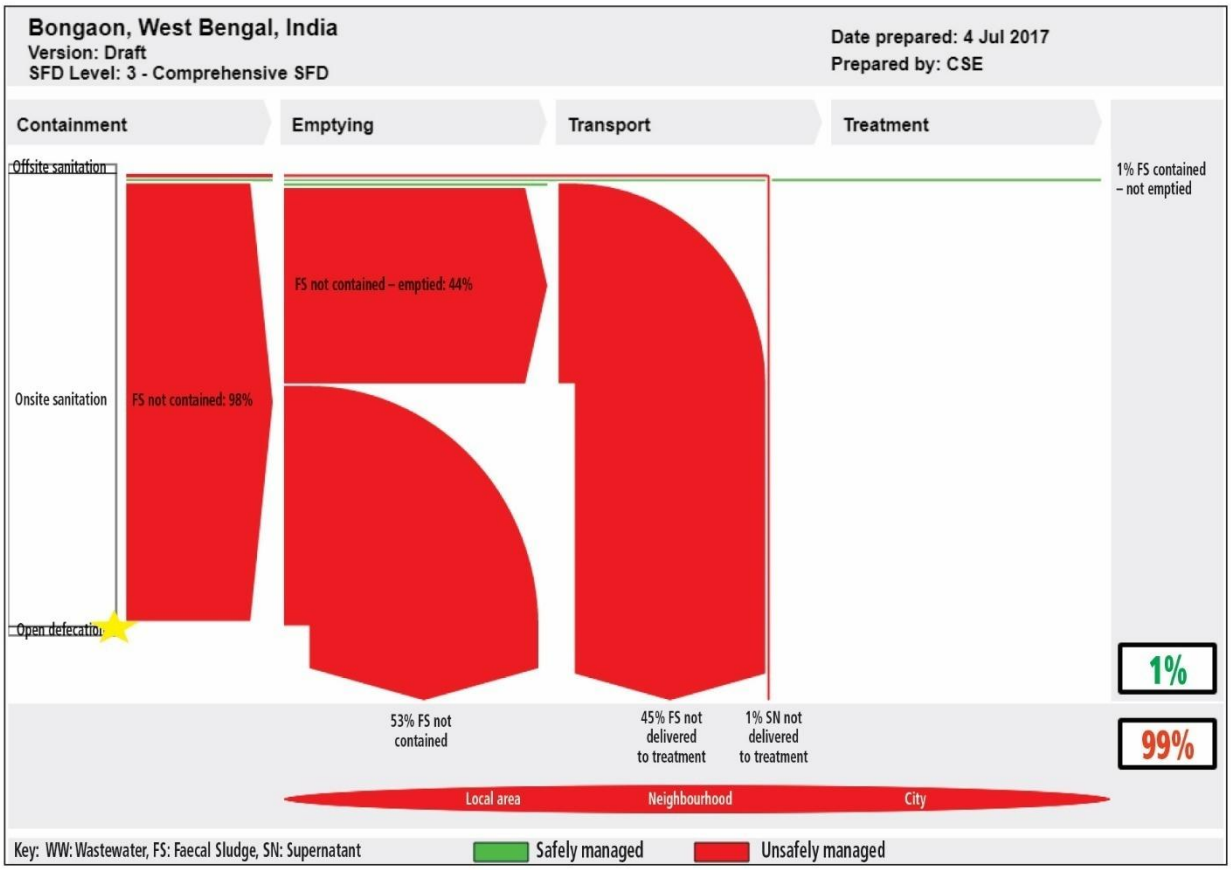
The 74th Constitutional Amendment Act of 1992 reformed the sector by transferring responsibility for domestic, industrial and commercial water supply and sewage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water Boards, to Urban Local Bodies (ULBs). This transfer has resulted in a variety of implementation models, as well as lack of clarity in the allocation of roles and responsibilities between state and local agencies, which sometimes results in delay in implementation (USAID, 2010).Table 1 depicts the stakeholders which are responsible for sanitation service delivery in Bongaon.

Key Stakeholders	Institutions/organizations
Public Institutions	Ministry of Housing and Urban Affairs(MoHUA), National Ganga Council(NGC), Bongaon Municipality(BM), Department of Municipal Affairs, Urban Development Department (UDD), State Urban Development Agency(SUDA), State Water Investigation Directorate(SWID), Public Health Engineering Department(PHED), West Bengal Pollution Control Board (WBPCB)
NGOs	Centre for Science and Environment

Table 1: Key stakeholders (Source: Compiled by CSE)

UDD is responsible for administrative and financial management of municipalities. SUDA is responsible for ensuring proper implementation and monitoring of the centrally assisted programmes for the alleviation of poverty throughout the state. WBPCB is responsible for monitoring effluent standards. Swachh Bharat City Level Task-Force (SBCLTF) is a multi-stakeholder platform comprising representatives from different sectors of society, including agencies directly responsible for sanitation, agencies indirectly involved or impacted eminent persons, practitioners, NGOs and sanitary workers.

7. Description of context-adapted SFD graphic



8. Context - adapted SFD graphic

The entire population of Bongaon is dependent on onsite sanitation systems. 2% of the population is dependent on septic tanks connected to open drains, which contributes to 'FS contained'. 22% is dependent on septic tanks connected to soak pits, 3% is connected to lined tanks with impermeable walls and open bottoms and 73% of the population is dependent on lined pits with semi permeable walls & open bottoms, all of which contributes to 'FS not contained'.

The only difference suggested in the context-adapted SFD is at containment stage for correctly designed septic tanks, though connected to open drains.

An assumption is made that 50% of the content in a septic tank connected to open drain is solid FS and the rest of the 50% is supernatant. Hence, both SN and FS attribute to 1% of the population each, out of the 2% of the population dependent on septic tanks connected to open drains.

According to the SBCLTF, the solid FS present in the septic tank connected to open drain (attributed to 1% of the population) should be considered as contained as it is neither polluting the groundwater nor the solid excreta are overflowing into the open drain. Hence, FS attributed to 1% of the population is considered to be contained (represented in green colour). Whereas the supernatant generated from the septic tank flows in the open drain and is therefore considered not contained (represented in red colour).

The 'FS not contained' changes from 99% to 98%, 'FS contained' becomes 1% and 'SN not contained' remains 1% when compared to SFD generated through graphic generator.

Overall, the excreta of 1% of the population are safely managed and excreta of 99% of the population are unsafely managed.

9. Process of SFD development

The data are collected through secondary sources. The city is visited to conduct random surveys, FGDs and KIIs with relevant stakeholders, to fill in the data gap and to cross-check the data collected.

To start with, a relationship between sanitation technologies defined in Census of India and that defined in the project is established. The survey

data are quantified and cross-checked with FGDs and KIIs.

The data are fed into the SFD graphic generator to calculate the excreta flow in terms of percentage of the population and produce the SFD graphic.

The SFD graphic of Bongaon city, developed using graphic generator is not able to capture the correctly designed fully functional septic tanks as a contained system, as based on feedback from SBCLTF. Hence, a context-adapted city specific SFD graphic is manually corrected to convey the substantial picture of the excreta management in the city.

Overall, 99% of excreta are unsafely managed and discharged into the environment.

10. Credibility of data

The key sources of data include Key Informant Interviews (KIIs), Census of India (2011) and Focus Group Discussions (FGDs). The KIIs and FGDs were conducted with different stakeholders across the town and sample household surveys from 22 wards were done.

There were three major challenges faced during the development of the SFD. The Census was not able to provide (i) up-to-date data on containment (ii) detailed typology of containment and (iii) actual information about FSM services provided in households. For this reason, comprehensive field based studies were conducted to validate the data provided by secondary sources.

The Census mostly differentiates between types of user interfaces or between septic tanks and pit latrines but does not give information about the design of actual containment systems on ground or the disposal of generated septage.

The objective of the survey conducted was to obtain a more accurate measure of how excreta are managed through stages of sanitation service chain (from containment to end-use or disposal). For the validation of the SFD prepared for the city, the graphic with a brief report was shared with the ULB for feedback and no objection was raised by them for the context adapted version of the SFD.

11. List of data sources

Below is the list of data sources used for the development of the SFD.

- Published reports and books
  - Census of India 2011, houselisting and housing data, Government of India
- KIIs
  - Officials from Bongaon Municipality
  - Local Masons
- FGD
  - Emptying and transportation facilitators
  - Bongaon Municipality administrative staff
  - Public toilet operators
  - Ward councilors
  - SBCLTF members
- Random household surveys

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
APL	Above Poverty Line
BIS	Bureau of Indian Standard
BPL	Below Poverty Line
CAPEX	Capital Expenditure
CDP	City Development Plan
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health & Environmental Engineering Organization
CSP	City Sanitation Plan
CSTF	City Sanitation Task Force
DUDA	District Urban Development Authority
EWS	Economically Weaker Sections
FGD	Focus Group Discussion
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
Ft.	Feet
GoI	Government of India
GoWB	Government of West Bengal
HFA	Housing For All
HHs	Households
INR	Indian National Rupee
KII	Key Informant Interview
Lpcd	Litres per Capita per Day
M	Meter
mbgl	Meters below ground level
MHUPA	Ministry of Housing and Urban Poverty Alleviation
MIS	Management Information System
MLD	Million Litres per Day
MoHUA	Ministry of Housing and Urban Affairs
MoUD	Ministry of Urban Development
MoWRRD&GR	Ministry of Water Resources, River Development and Ganga Rejuvenation
NFSSM	National Faecal Sludge and Septage Management Alliance
NIC	National Informatics Centre
NIUA	National Institute of Urban Affairs
NMCG	National Mission for Clean Ganga
ODF	Open Defecation Free
OPEX	Operating Expenditure
PMAY	Pradhan Mantri Awas Yojna
PPE	Personal Protective Equipment
SBCLTF	Swachh Bharat City Level Task Force
SBM	Swacch Bharath Mission

SFD	Shit Flow Diagram
SLB	Service Level Benchmarks
SLIP	State Level Improvement Plan
SMP	Septage Management Sub Plan
SN	Supernatant
SPS	Sewage Pumping Station
Sq.km	Square Kilometre
SUDA	State Urban Development Agency
SWM	Solid Waste Management
UDD	Urban Development Department
ULB	Urban Local Body
USAID	United States Agency for International Development
USD	United States Dollar (INR = 66.5 USD)
WSS	Water Supply and Sewerage
WW	Waste Water

1 City context

Bongaon city lies in the state of West Bengal, India. It is one of the five sub divisional towns in the district of North 24 Parganas having the district headquarters at Barasat. Bongaon town is located at23.04° N 88.83° E and at an average altitude of 7 meters above mean sea level. The National Highway 34 goes through the Bongaon subdivision. The town is located at a distance of 77.5 km from Kolkata and shares its border with Bangladesh. River Ichamati flows through Bongaon town. Bongaon is the last station on the Sealdah-Bongaon section of Eastern Railway, 77 km from Sealdah Station. The Sealdah-Bongaon railway was built between 1882 and 1884 and was subsequently extended up to Petropole, the terminal station at the Indo- Bangladesh border (BM, 2016d).

As per Census, 2011, Bongaon has a population of 108,864. The area of Bongaon Municipality (BM) is 14.27sq.km.There are 22 municipal wards in total among which ward no.19 is the most populous ward with a population of 7,385 and ward no. 18 is the least populous ward with a population of 3,305. Population density of the town is 7,626 persons per sq.km, which is high in comparison to the density of West Bengal, i.e. 1,028 persons per sq.km.(Census, 2011). The population growth since 1991 shows a steady rise due to migration towards the peri-urban area. The city also shares its border with Bangladesh due to which there is heavy traffic of heavy vehicles for import and export of goods. Table 1 depicts the decadal population growth rate since 1991.

Table 1: Population growth rate

Census year	Population	Growth rate (%)
1991	79,571	---
2001	102,115	28.3%
2011	108,864	6.60%

Source:Census, 2011

The maximum and minimum temperature in Bongaon is 41°C in the month of May and 10°C in the month of January respectively. The average rainfall received is 1,579 mm and the relative humidity varies from 50% in March and 90% in July (BM, 2016d). Bongaon lies in the Ichamati basin of the gangetic alluvial zone of North 24 Paraganas.The soil type varies from mature black or brownish loam to recent alluvium (Census, 2011).

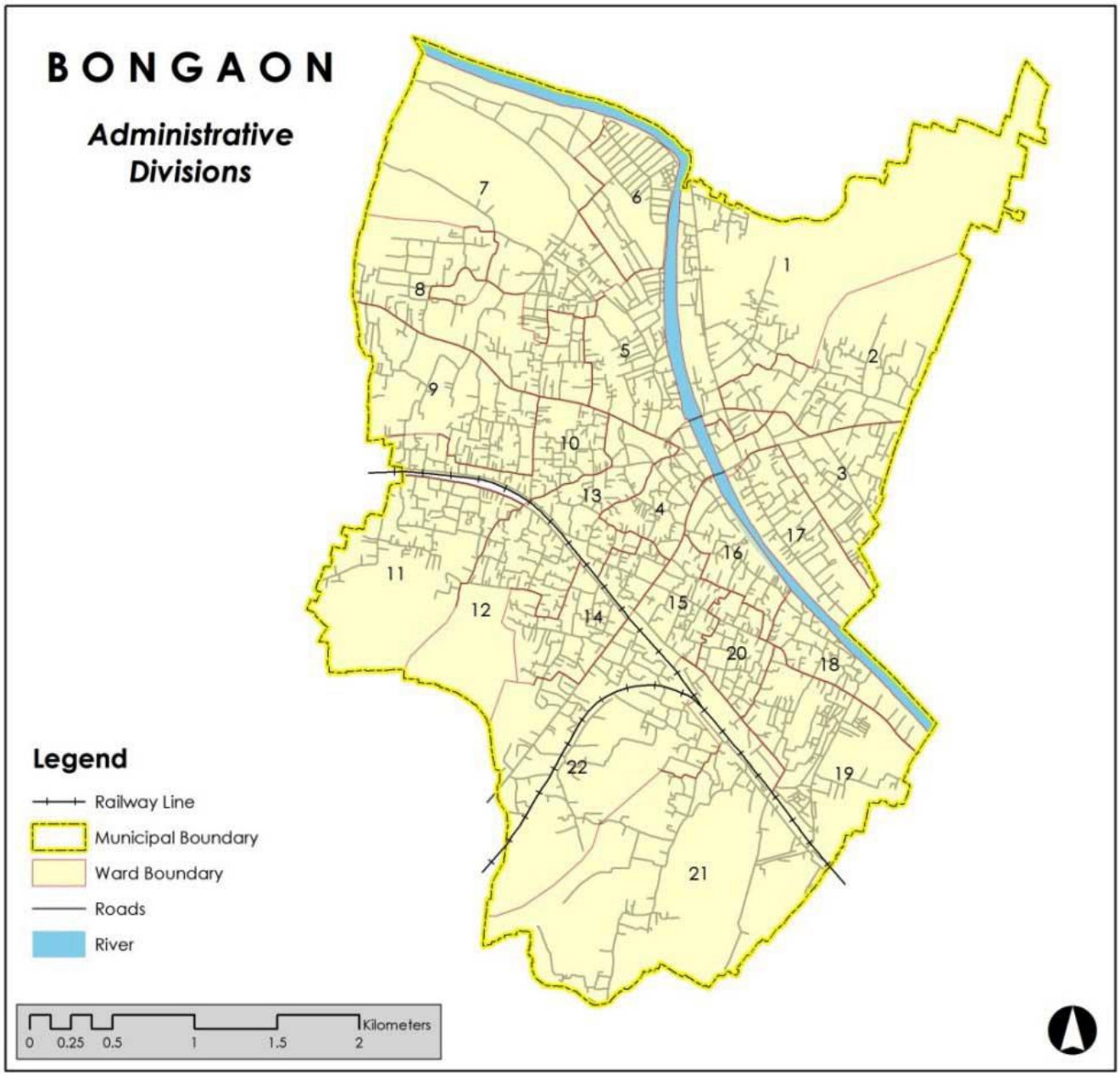

Figure 1: Ward map of Bongaon (Source: CSE, 2016)

2 Service outcomes

The analysis is based on data available from Census 2011, published reports of government, non-profit organizations and reconnaissance household survey. Data collected from secondary sources are triangulated through field-based study. Data on the containment are available in Census 2011 and has been cross-checked and updated by KIIs and FGDs. According to the SFD promotion initiative (PI) definitions of sanitation systems, the types of containments prevalent in the wards are examined through random sample surveys. Data on emptying, transport, treatment and disposal of FS are collected through KIIs with Urban Local Body (ULB is the local governing body in a city responsible for providing basic infrastructures like water supply and sanitation along with health facilities as per standards and norms, to all the citizens, in Bongaon, the ULB is called Bongaon Municipality), private emptiers and parastatal body. However, most of the data are qualitative.

2.1 Overview

To start with, a relationship between sanitation technologies defined in Census of India and the ones defined in the project is established. Then the population dependent on those systems is represented in terms of percentage of the population as shown in Table 2.

Table 2: Sanitation technologies and corresponding percentages of population

S. No.	Sanitation technologies and systems as defined by:		SFD reference variable	Percentage of population
	Census of India	SFD Promotion Initiative		
1	Piped sewer system	User interface discharges directly to a centralized foul/separate sewer.	T1A1C2	3.7
2	Septic tank	Septic tank connected to open drain or storm sewer	T1A2C6	8
3	Other systems	User interface discharges directly to open ground	T1A2C8	4.3
4	Pit latrine with slab	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, general situation	T1A5C10	51.1
5	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	9.1
6	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	0.6
7	Service latrine	User interface discharges directly to ‘don’t know where"	T1A1C9	1
8	Public latrine	Septic tank connected to open drain or storm sewer	T1A2C6	3.2
9	Open defecation	Open defecation	T1B11C7 TO C9	19

Source: Census, 2011

2.1.1 Sanitation facilities

This section presents on existing sanitation facilities in institutions, commercial establishments’ and slums.

Community/public toilets (CT/PT): There are a total of five public toilets and community toilets each in the city. The containment system present in all of them is a septic tank connected to either a soak pit or an open drain.

School and hospital sanitation: There are 75 government schools in total out of which 59 are primary schools. The containment system present in schools is either a septic tank or a pit. There is only one sub-divisional hospital in Bongaon and the containment system present in the toilet facility is a septic tank (BM, 2016d).

Institutions and commercial establishments: The commercial establishments do not have individual toilets in shops. Public toilets are present in the main market area. However, people are dependent on either household toilets or practice open defecation (BM, 2016d). Institutional establishments have toilet facility connected to septic tank which is further connected to soak pit. Since there is a lack of data on the excreta generated from institutions and commercial areas, it has not been taken into consideration for production of SFD.

Figure 2: Public toilet near city hospital (Source: Anil/ CSE, 2016) Figure 3: A toilet withtwin pit system at school (Source: Anil/ CSE, 2016)

2.1.2 Containment

According to Census 2011, 77.3% population uses OSS, 3.7% population uses offsite sanitation system and 19% population defecates in open. As per the random survey, the entire city's population is dependent on OSS and there is no existing sewerage system, although a sewerage network has been proposed. The city has been declared as Open Defecation Free (ODF). The most prevalent containment system is pit system (single and twin-pit) which is constructed using concrete or mud rings, each ring having an average diameter of 0.7 m to 0.9 m and a height of around 0.25 m. One can increase the depth of the pit as much as they want. The average depth of pits ranges from 2.4 m to 12.1 m (BM, 2016d). The pit system is used by 73% population according to the field survey done. The size and no. of rings to be installed are based on the space availability and affordability of the respective HHs. During the monsoon season, due to high groundwater table, the pit/*kuan* soaks in water from nearby sources and gets filled up soon because of which they need to get frequently emptied.

Figure 4: Flooding of *kuan*/pit during monsoon season (Source: Anil/CSE, 2016)

Figure 5: Twin-pit system (Source: Anil/CSE, 2016)

Septic tanks connected to soak pit is attributed to 22% of the population and septic tanks connected to open drain is attributed to 2% of the population. The septic tanks constructed do not adhere to the design prescribed by BIS. The average size of a septic tank observed during field visit varies from 4.5m^3 to 16.9m^3. 100% of the population use containment systems which, in some way pollute the environment and are considered to be 'not contained'.

2.1.3 Emptying

The emptying service is provided by Bongaon Municipality only and there are no private emptiers in the town. The emptying services are managed and regulated by Bongaon Municipality. There are a total of three vacuum tankers that are tractor mounted tanker, of which, two of them have a capacity of 3,000 litres each and one has a capacity of 1,500 litres (BM, 2016d). To avail the service, an application form must be submitted by resident to the Bongaon Municipality. The form is available by paying a minimal charge of INR 10 (0.15 USD) at the municipality office. A fee for emptying septic tank/pit is charged based on whether the applicant belongs to Below Poverty Line (BPL) or Above Poverty Line (APL) category. The list of BPL category is attached with the application form. The price for emptying for a person belonging to BPL is INR 550 (8.4 USD) and APL is INR 850 (13 USD). The submitted form is then given to the incharge in the conservancy department after which it is sent to the head office. A receipt for the payment is given to the applicant. The emptying service is provided to the applicant within a week (BM, 2016d).

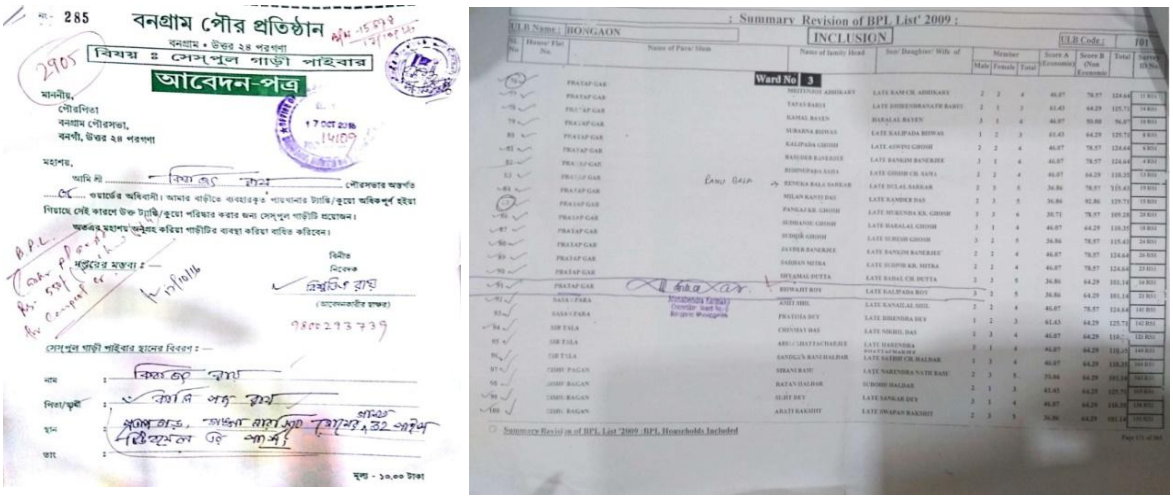

Figure 6: Application form attached with BPL list (Source: Anil/CSE, 2016)

The emptying operation is carried out by 3 to 4 labourers and a driver. In a day, around 25-30 trips are completed cumulatively by all three vehicles. However, all the trips are not recorded in the record book. The general time taken to empty the system is 1-2 hours per containment. During the emptying operation, the labourers use personal protective equipment thereby taking necessary safety measures to some extent.

Certain critical issues regarding the proper functioning of vacuum tankers occur during emptying operation. At times, while emptying, due to solidified FS, the inlet hose pipe gets choked. In this case, the choked pipe is cleared manually by a labourer after entering into the tank. Due to this, the entire schedule of emptying gets halted for a day at times and causes inconvenience to everyone involved (BM, 2016b).

Figure 7: Desludging of septic tank (Source: Aishwarya/CSE, 2016)

Table 3: Emptying records of Bongaon Municipality

No. of tanks emptied	Time duration
891	January – December 2014
1188	January – December 2015
849	January – October 2016

Source: BM, 2016

2.1.4 Transportation

FS is transported by a tractor mounted vacuum tanker. The tractor vehicle with the smaller capacity tank is most often used to access narrow lanes. The typical no. of trips completed by the tankers in a day is about 25. The average distance travelled per trip is about 5km. Vacuum tankers are stationed at Shimultala. This facility is separately provided for parking of vehicles, which is located at 1 km distance from Bongaon Municipality office. A generator of 5 horse power is attached with the tanker for suction of septage from OSS (BM, 2016b).The SN from the septic tank is transported through the open drain and ultimately lands up in River Ichamati.

Figure 8: Tractor mounted vacuum tanker owned by Bongaon Municipality(Source: Anil/CSE, 2016)

Figure 9: Smaller vacuum tanker with generator in narrow lanes (Source: Aishwarya/CSE, 2016)

2.1.5 Treatment and disposal/end use

The town does not have any treatment facility for FS. The FS generated from the city after emptying is dumped into a solid waste landfill site in Milanpalli in Ward no.10.

Figure 11: Discharge of FS into solid waste dumping ground (Source: Anil /CSE, 2016)

Figure 10: Solid waste landfill site situated in vicinity of a pond (Source: Anil/CSE, 2016)

This landfill is situated next to a large pond. The landfill being insanitary in nature, leachate from it discharges into the pond thereby causing pollution (BM, 2016d).

2.2 SFD matrix

The SFD matrix is shown in Appendix 7.7 and the final SFD graphic for Bongaon is given in Appendix 7.3

2.2.1 SFD matrix explanation

Definition and estimation of different variables (used to make SFD) are explained below in Table 4 and 5.

Table 4: Containment systems and corresponding percentage of population

S. no.	Variables	Description	Percentage of population
1	T2A5C10	Lined pit with semi-permeable walls and open bottom with no outlet or overflow, where there is a 'significant risk' of pollution	73
2	T2A2C5	Septic tank connected to soak pit where there is 'significant risk 'of groundwater pollution	22
3	T2A4C5	Lined tank with impermeable walls and open bottom connected to soak pit where there is a 'significant risk' of groundwater pollution	3
4	T1A2C6	Septic tank connected to open drain or storm sewer	2

Source: CSE, 2016

Table 5: Description of variables used in SFD

System type	Variables	Description	Percentage of population
Onsite	SN not delivered to treatment	SN from septic tank is discharged into open drain (T1A2C6) which finally lands up in Ichamati River	1
	FS not contained	FS from the onsite sanitation technology (T2A2C5, T1A2C6, T2A4C5 and T2A5C10), where the depth of ground water is low and there is significant risk of groundwater contamination or the system is connected to open drain	99
	FS not contained – emptied	FS is emptied from the onsite sanitation technology (T2A2C5, T1A2C6, T2A4C5 and T2A5C10) using motorized emptying equipment	45
	FS not delivered to treatment	FS is transported and discharged into a solid waste dump yard and does not undergo any treatment	45
	FS not contained-not emptied	FS from onsite sanitation technology (T2A2C5, T1A2C6, T2A4C5 and T2A5C10), which remains in the system or infiltrates through soak pit and pits	54

Source: CSE, 2016

Offsite systems

According to Census 2011, 4.3% of the city is dependent on offsite systems of which, population connected to sewer line is 3.7% and user interface discharging directly into open drain or open ground is 0.6%. But field based study including KII with ULB revealed that there is no offsite sanitation system present in the city.

Onsite sanitation systems
According to Census 2011, 96.3% population is dependent on OSS of which, 8% have septic tanks, 60.2% have pit latrines and 3.2% depend on public latrines.

In Bongaon, the septic tank connected to open drain is used by 2% population. Since there is no clear differentiation between the volume of SN and solid FS generated from septic tank connected to open drain, to reduce maximum error it is assumed to be 50% each. Hence, the SN is 50% of the FS present i.e.1%.

FS is considered not contained in Bongaon as the FS infiltrate pollutes the high ground water table and also the SN from the septic tank is connected to open drain.

FS not contained is attributed to 100% population who use the systems: septic tank connected to open drain (2%) + septic tank connected to soak pit (22%) + lined pit with semi-permeable walls and open bottom (73%) + lined tank with impermeable walls connected to soak pit (3%).

The 45% FS which gets emptied is transported and disposed into the landfill thereby leaving it untreated.

It is also assumed that 90 % of FS is emptied during the emptying process thereby leaving 10% of FS in the containment system itself. Out of 99% FS not contained, 49.5% is the solid FS and 49.5% is the liquid component. Out of 49.5% solid FS, 45% FS is emptied (9.9% from septic tank connected to soak pit +0.9% from septic tank connected to open drain + 1.35% from lined tank with impermeable walls and open bottom + 32.85% from lined pit with semi-permeable walls) leaving behind 4.95% which is not emptied. The 49.5% liquid component which gets infiltrated together with the 4.95% which is left behind in the containment system constitute the 54% FS not contained-not emptied.

Open defecation
Bongaon has been declared as an Open Defecation Free (ODF) city (BM, 2016d). ODF city means that everyone in the city will have access to toilet, even if there is no toilet at house the people would have an approachable PT and CT. It also means that at any given time no one would be seen defecating in the open. No open defecation was observed during the field visit.

Hence it can be concluded that excreta of 100% population are unsafely managed.

2.2.2 Risk of groundwater contamination

The SFD assessment includes the risk of groundwater pollution as an important factor in determining whether excreta are contained or not contained. The type of onsite sanitation technology in use also has an influence on infiltration of liquid into the groundwater and therefore on the potential risk of groundwater pollution.

The town lies in the Ichamati basin of the gangetic alluvial zone of North 24 Paraganas district. The soil type varies from mature black or brownish loam to recent alluvium (Census, 2011).The soil of northern part of the district is sandy, in the central middle part it is sandy with clay loam and in southern side it is clay loam. The physical geography is mostly plain.

The average depth of water table from which ground water can be extracted is 4.87m. (BM, 2016d). Central part of West Bengal state recorded water level in the range of 5-10 mbgl and

also 10-20 mbgl in the year 2014. The pre monsoon ground water levels recorded in West Bengal in the year 2013 ranged from 0.33 mbgl to 31.43 mbgl (CGWB, 2014).At present, the entire city's population is dependent on ground water. The groundwater quality is not good for drinking purpose as it contains fair amount of arsenic. To avoid this contamination, the municipality has a total of 220 deep tube wells. Each deep tube well has an underground depth of approximately 195 m. The deep tube well is only for portable water and has a6 m filter at the bottom. For extraction of non-potable water, the municipality has installed 500-600 *chapakals* (hand pumps). The *chapakal* has a depth of 15.2 m only. The per capita supply of water in the town is 40 lpcd. The municipality is working to get pipe water supply with a water treatment plant. The source of water supply is River Ganga which is 50km away from the city. It is designed to provide 135 lpcd. Based on the survey with HHs and KIIs and on considering worst case scenario during monsoon period, it was decided to characterize all the existing sanitation containment systems as having high risk of groundwater pollution as the average ground water table is less than 10 mbgl. According to Census, 15.8% population receives drinking water from bore well/tube well, 6.6% population receives drinking water from treated source through tap water and 72% population receives drinking water from hand pump.

2.2.3 Discussion of certainty/uncertainty levels of associated data

There were three major challenges to develop the SFD. Published/unpublished reports were not able to provide completely (i) up-to-date data on containment (ii) detailed typology of containment and (iii) actual information about FSM services provided to households. For this reason, field based studies were conducted to validate the data and triangulation of data provided by secondary sources.

The Census mostly differentiate between systems connected to user interface, if any, but does not give information about the design of actual containment systems on ground level or about the disposal of septage and WW generated. Therefore, a sample household survey was conducted in each ward of the city to identify and cross-check the data collected from secondary sources.

There is some uncertainty in the data collected through the field survey as well. The data were collected from all the 22 wards and by considering 4-5 sample household survey per ward. Although the number of households considered per ward was less to represent the whole city, the households surveyed were from different typology of settlements and different socio-economic backgrounds.

CSE's representatives have conducted the KIIs, FGDs and random sample surveys for data triangulation.

The census data are solely derived from the responses of the head of the household. Since, there is no mechanism to cross verify the responses, there could be misreporting of the information due to various reasons including inadequate knowledge of the respondents or enumerators.

The assumption regarding the volume of FS emptied as compared to FS generated has high impact on the overall SFD. A reliable method for estimating quantities of FS generated on a citywide scale do not yet exist, and it is complicated because the containment size and emptying period greatly vary. Since there is no clear differentiation between volume of

effluent/SN and septage generated from septic tanks and lined tanks, hence it's assumed to be 50% each. Based on the survey, it is assumed that respondents getting their OSS emptied within 10 years are using their systems with emptying and respondents getting their OSS emptied after 10 years are using their system without emptying. In the matrix, it is assumed that 90% of the population gets their containment systems emptied when full.

The objective of the survey conducted was to obtain a more accurate measure of how excreta are managed through stages of sanitation service chain (from containment to end-use or disposal). To reduce the uncertainty around the data collected, the draft context adapted SFD was prepared based on the analysis done and was shared with the ULB, where no objection was raised.

2.3 Context-adapted SFD

According to the Swachh Bharat City Level Task Force (SBCLTF), SFD generated by the graphic generator is not sufficiently visualizing the actual situation at containment stage of the sanitation chain. According to the stakeholders the properly designed septic tanks, which are regularly emptied should be considered contained even if the supernatant is discharged into open drains. Hence, a context-adapted city specific SFD graphic is manually corrected to convey the true picture of the excreta management in the city.

Please refer Appendix 7.5 for the context adapted SFD graphic. There is no major change done in the graphic. The only difference suggested in this context is at containment stage i.e. for correctly designed septic tanks. The entire population of Bongaon is dependent on onsite sanitation systems. 2% of the population is dependent on septic tank connected to open drain which is attributed to be FS contained. 22% is dependent on septic tank connected to soak pit, 3% is connected to lined tank with impermeable walls and open bottom and 73% of the population is dependent on lined pit with semi-permeable walls & open bottom, all of which is attributed to be FS not contained.

An assumption is made that 50% of the proportion of the content in a septic tank is solid FS and the rest of the 50% is supernatant. Hence, both SN and FS attribute to 1% of the population each, out of the 2% of the population dependent on septic tank connected to open drain.

According to the SBCLTF, the solid FS present in the septic tank connected to open drain (attributed to 1% of the population) should be considered as contained as it is neither polluting the groundwater nor the solid excreta are overflowing into the open drain. Hence, FS attributed to 1% of the population is considered to be contained (represented in green colour) and the supernatant generated from the septic tank is considered not contained as it flows in the open drain. As the SN is unsafely managed it is represented in red colour.

The 'FS not contained' changes from 99% to 98%, 'FS contained' becomes 1% and 'SN not contained' remains 1% when compared to SFD generated through graphic generator. Overall excreta of 99% of the population are not managed safely and the excreta of 1% of the population are managed safely according to the context-adapted SFD.

3 Service delivery context description

3.1 Policy, legislation and regulation

3.1.1 Policies, legislations and regulations at national level

In 2008, the Ministry of Housing and Urban Affairs (MoHUA), formerly known as Ministry of Urban Development (MoUD) issued the National Urban Sanitation Policy (NUSP). The policy aims to raise awareness, promote behaviour change; achieve ODF cities; develop citywide sanitation plans; and provide 100% safe confinement, transport, treatment and disposal of human excreta and liquid wastes. The NUSP mandates states to develop state urban sanitation strategies and work with cities to develop City Sanitation Plans (CSPs). NUSP specifically highlights the importance of safe and hygienic facilities with proper disposal and treatment of sludge from on-site installations (septic tanks, pit latrines, etc.) and proper operation and maintenance (O&M) of all sanitary facilities. Furthermore, it explicitly states that cities and states must issue policies and technical solutions that address on-site sanitation, including the safe confinement of faecal sludge (FS) (USAID, 2010). The objectives of NUSP are to be realized through CSPs and state sanitation strategies. NUSP identifies the constitution of the multi-stakeholder task force as one of the principal activities to be taken up to start the city sanitation planning process. As per the requirement of CSP, a major role is to be played by the members of institutions, organizations, individuals, NGOs, academics, media representatives, local councillors, industry owners, consultants, representatives of private sector etc. Constitution of SBCLTF formerly known as City Sanitation Task-force (CSTF) is facilitated by drawing members from these groups in consensus with citizens who will be constantly supporting the CSP preparation by analysing the strengths and competencies required to overcome the current situation and for better sanitation facilities (MoUD, 2014).

The advisory note on septage management in urban India, issued by MoHUA in 2013, recommends supplementing CSPs with a Septage Management Sub-Plan (SMP) be prepared and implemented by cities. Septage refers here broadly to not only faecal sludge removed from septic tanks, but also that removed from pit latrines and similar on-site toilets. This advisory provides references to the Central Public Health and Environmental Engineering Organization (CPHEEO) guidelines, Bureau of Indian Standard (BIS) standards, and other resources that users of this advisory may refer for details while preparing their SMP (MoUD, 2013). It clearly discusses on techno- managerial and socio- economic aspects of Septage management in India and provides guidelines for Urban local bodies (ULBs) to plan and implement SMPs.

The Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974 have provisions relating to sanitation services and environmental regulations. It applies to households and cities with regard to disposing wastes into the environment. ULBs/ utilities also have to comply with discharge norms for effluent released from sewage treatment plants and to pay water cess under the Water Cess Act, 1977. The ULB is responsible for ensuring the safe handling and disposal of septage generated within its boundaries, for complying with the Water Act and for meeting all state permit requirements and regulations (CSE, 2010). Municipal acts and regulations usually refer to the

management of solid and liquid wastes but may not provide detailed rules for septage management (MoUD, 2013).

The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act is enacted in 2013. This act prohibits employment of manual scavengers and insanitary latrines - Laying strong emphasis on rehabilitation of manual scavengers. The broad objectives of the act are to eliminate insanitary latrines, prohibit the employment of manual scavengers and the hazardous manual cleaning of sewer and septic tanks, and to maintain a survey of manual scavengers and their rehabilitation (MoSJE, 2014).

In February 2017, MoHUA issued the National Policy on Faecal Sludge and Septage Management (FSSM). The policy aims to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city in India (MoUD, 2017).

The Fourteenth Finance Commission (FC-XIV) was constituted by the President of India under Article 280 of the Constitution on 2 January 2013 to make recommendations for the period 2015-20. Its assignments include distribution of revenue between union and state; devising formula for grant; suggesting method to augment resources for local bodies; and taking care of any matter referred to it (NIUA, 2015).

Model Municipal Building Bye-laws 2016 prepared by Town and Country Planning Organization (TCPO) is used to regulate coverage, height, building bulk, architectural design and construction aspects of buildings so as to achieve orderly development of an area. They are mandatory in nature and serve to protect buildings against fire, earthquake, noise, structural failures and other hazards. It includes chapters on green buildings and sustainability provisions, rainwater harvesting, wastewater (WW) reuse and recycle, installation of solar roof top photo voltaic norms, revised norms for adequate toilet facilities for women and public conveniences in public buildings and mandatory provisions for segregated toilet facilities for visitors in public buildings (TCPO, 2016).

3.1.2 Policies, legislations and regulations at state level and ULB level

According to the Constitution of India, water and sanitation are state subjects. Statutory powers are conferred to the state for making laws on water and sanitation. Some of the policies, laws and regulations are listed below:

The West Bengal Municipal Corporation Act, 2006

It states that the obligatory duty of the corporation is to make reasonable and adequate provisions for the following matters within the jurisdictional area.

(i) Construction, maintenance and cleaning of sewers and drains, sewerage and drainage works, public latrines and urinals.

(ii) In scavenging, removal and disposal of filth and other obnoxious polluted matters.

(iii) Conversion of all service privies into sanitary latrines and providing adequate facilities for sanitation so that open defecation may be completely eliminated

The Act also states that no latrine or cesspool shall be constructed within twenty feet of any well, tank, water pipe or cistern in any position where it is likely to be injured or the water inside is likely to be polluted (WBMCA, 2006)

The West Bengal Municipal (Building) Rules, 2007

The Building rules on planning and construction of sanitation systems states the following:

- The planning, design and construction of water supply, drainage and sanitation shall be in accordance with the provisions of water supply, drainage, sanitation or plumbing services of the latest edition of National Building Code of India.
- Septic tanks, pits of pit privy must be located in the building such that it is easily accessible.
- Soak pits may be constructed on the side of buildings at right angles to the slope of land and there must be a minimum clearance of 2.1 meters between the foundation and the soak pit to minimize the chances of dampness due to seepage from the soak pit

The 4th State Finance Commission of West Bengal is a committee pertaining to the state of West Bengal, established with a purpose of reviewing the financial implementations of the state. It is constituted by the State Government under clause (1) of Article 243-1 and clause (1) of Article 243-Y of the Constitution of India, along with the provisions of the West Bengal Finance Commission Act, 2011 (WBMBR, 2007).

West Bengal Urban Health Strategy, 2008

The state has prepared an urban health strategy, the objective of which is to improve health of all urban populations with a special focus on the poor, underserved and vulnerable population. The strategy states that the government is committed to ensuring accessible, equitable and quality health care services to the urban population of the state. It also states that the Department of Health and Family welfare and Department of Municipal Affairs and Urban Development propose to contextualize the strategic framework within which the state shall seek to address the health concerns of the urban poor (WBUHS, 2008).

3.1.3 Institutional roles

The MoHUA is the nodal ministry for policy formulation and guidance for the urban water supply and sewerage sector. The ministry's responsibilities include broad policy formulation, institutional and legal frameworks, setting standards and norms, monitoring, promotion of new strategies, coordination and support to state programmes through institutional expertise and finance. The ministry is also responsible for managing international sources of finance. The CPHEEO, created in 1953, is the technical wing of the MoHUA, which advises the ministry on all technical matters and collaborates with the State Agencies about water supply and sanitation activities. CPHEEO plays a critical role in externally funded and special programmes. CPHEEO also plays a central role in setting design standards and norm setting for urban water supply and sanitation (Planning Commision, 2002).

The 74th Constitutional Amendment Act of 1992 reformed the sector by transferring responsibility for domestic, industrial, and commercial water supply and sewerage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water

Boards, to Urban Local Bodies (ULBs). This transfer has resulted in a variety of implementation models, as well as a lack of clarity in roles and responsibilities of state and local agencies, resulting in large gaps in implementation (USAID, 2010).

Management and delivery of urban basic services in Bongaon is governed by various institutions. The following are the institutions responsible for policy making, service provision and regulation of urban services:

Table 6: Institutional roles and responsibilities

Institutions	Roles and responsibilities
Urban Development Department (UDD)	Administrative and financial management of municipalities, implementation of development programmes, policy formulation, preparation of municipal laws, monitoring and evaluation of programmes and in collaboration with external funding agencies.
State Water Investigation Directorate (SWID)	To carry out investigation and quantitative and qualitative assessment of water resources in the state. It also shares expertise with various government developmental agencies in various groundwater and surface water projects for agriculture, industrial and drinking water development in the state.
State Urban Development Agency (SUDA)	To ensure proper implementation and monitoring of the centrally assisted programmes for generating employment opportunities and alleviation of poverty throughout the State.
Public Health Engineering Department (PHED)	Controls the water supply and sanitation budget of the state government and undertakes programmes of implementation of water supply and sanitation services in the state, mainly through Public Health Engineering Directorate under its administrative control.
West Bengal State Pollution Control Board (WBPCB)	It is the statutory agency for ensuring proper implementation of several statues, judicial and legislative pronouncements to improve and protect the state of the environment of West Bengal.
Bongaon Municipality (BM)	Bongaon Municipality is the main governing body in Bongaon and is in charge of maintaining the town in various sectors such as providing basic infrastructures like water supply, sanitation, communication and storm water drainage, solid waste management along with health facilities as per standards and norms to all the citizens.

Source: (CSE, 2016)

3.1.4 Service provision

Institutional arrangements for water supply and sanitation in Indian cities vary greatly. Typically, a state-level agency is in charge of planning and investment, while the local government (ULBs) is in charge of operation and maintenance (NIUA, 2005) .Some of the largest cities have created municipal water and sanitation utilities that are legally and financially separate from the local government. However, these utilities remain weak in terms of financial capacity. In spite of decentralization, ULBs remain dependent on capital subsidies from state governments. Tariffs are also set by state governments, which often subsidize operating costs (Planning Commission, 2002).

Furthermore, when no separate utility exists, there is no separate allocation of accounts for different activities within a municipality. Some states and cities have non-typical institutional arrangements. For example, in Rajasthan, the sector is more centralized and the state government is also in charge of operation and maintenance while in Mumbai the sector is more decentralized and local government is also in charge of planning and investment (NIUA, 2005).

In Bongaon, sanitation and solid waste management services are delivered by Conservancy Department of Bongaon Municipality. A conservancy department in charge has been appointed in the municipality to look after all issues pertaining to sanitation.

3.1.5 Service standards

1. Service Level Benchmarks (SLB), 2008: Issued by the MoHUA in 2008, the SLB seek to
   (i) Identify a minimum set of standard performance parameters forthe water and sanitation sector that are commonly understood and used by all stakeholders across the country.
   (ii) Define a common minimum framework for monitoring and reporting on these indicators.
   (iii) Set out guidelines on how to operationalize this framework in a phased manner. The SLB refers to improving service through better provision and delivery. It evaluates the performance of urban services provided by different ULBs throughout the country.
2. General Standards for Discharge of Environmental Pollutants Part-A: Effluents-The Environment (Protection) Rules, 1986 (Schedule VI): Issued by, Central Pollution Control Board (CPCB), a statutory organization constituted in September 1974 under the Water (Prevention and Control of Pollution) Act, 1974.It specifies the effluent standards from different pathways.
3. Code of Practice for Installation of Septic Tanks, 1985, issued by BIS. The code specifies standards and design consideration for installation of septic tanks.
4. Manual on Sewerage & Sewage Treatment, Second Edition, 2013: This manual was developed by CPHEEO. It provides detailed designs and guidelines for various technologies of wastewater management.

3.2 Planning

3.2.1 Service targets

State governments must put in place targets for delivery of essential services provided by the local bodies for four services viz., water supply, sewerage, solid waste management and storm water drains on lines of handbook for SLB by MoHUA. State government must notify or cause all ULBs to notify by the end of a fiscal year the service standards and targets (PAS, 2009-16).

The Swachh Bharat Mission (SBM), one of the flagship programmes of the government of India, launched on October 2nd 2014 by the MoHUA and MoDWS. SBM aims to eliminate open defecation, eradicate manual scavenging, capacity augmentation of ULBs and generate awareness about sanitation and its linkage with public health during the mission period till 2019. The SBM (urban) aims to ensure that no new insanitary toilets are constructed during the mission period and that pit latrines should be converted into sanitary latrines. The target group for construction of household units of toilets thus is (i) 80% of urban households engaging in open defecation, remaining 20% of households practicing open defecation are assumed to be catered by community toilets due to constraints of space(ii) all households with insanitary latrines (iii) all households with single-pit latrines (MoUD, 2014). Table 7 provides an overview of service delivery progress in accordance with SBM.

Table 7: Service delivery targets in accordance with SLBs

Sanitation service chain	Parameter	National benchmark	Timeframe to achieve benchmark
Containment	Coverage of toilets	100%	2019
Transport	Coverage of sewer network services	100%	2031
	Collection efficiency of the sewerage network	100%	2031
Treatment	Adequacy of sewage treatment capacity	100%	2031
	Quality of sewage treatment	100%	2031
End-use/disposal	Reuse and recycling	20%	2031
Other	Cost recovery	100%	2031
	Efficiency of collection of charges	100%	2031
	Redressal of customer complaints	80%	2031

Source: Adapted from (MOUD, 2008), (MOUD, 2010)

Table 8 shows targets of the proposed project "Implementation of sewage system within Bongaon Municipality" under Atal Mission for Rejuvenation and Urban Transformation (AMRUT) scheme.

Table 8: Implementation of sewerage system within Bongaon Municipality under AMRUT scheme

S. No.	Project name	Year in which to be implemented	Year in which to be completed
1.	Laying of sewer network	2016-2017	2018-2019
2.	Installation of sewage treatment plant	2016-2017	2018-2019
3.	Installation of pumping station	2016-2017	2018-2019
4.	Laying of pumping main	2016-2017	2018-2019
5.	Sewer links for house service connection	2016-2017	2018-2019
6.	Infrastructure works	2016-2017	2018-2019

Source: (BM, 2016a)

Table 9: Target set for the construction of the STP

Project name	Physical components	Change in service levels		
		Indicator	Existing (As Is)	After (To-be)
Implementation of sewage system in Bongaon Municipality on whole town approach	• Sewage treatment plant • Pumping station • Pumping main • Main sewer network • Sewer links for house service connection • Supportive infrastructure works	Coverage of latrines (individual or community)	75%	100%
		Coverage of sewage network services	0%	100%
		Efficiency of collection of sewage	0%	100%
		Efficiency in treatment: Adequacy of sewage treatment capacity	0%	100%

Source: (BM, 2016a)

Table 10: Baseline and annual targets for services provided

Proposed projects	Project cost	Indicator	Baseline	Annual targets				
				FY2016		FY 2017	FY 2018	FY 2019
				H1	H2			
Implementation of sewage system in Bongaon city	Rs.163.50 Cr	Coverage of latrines (individual or community)	72%	0%	8%	10%	10%	
		Coverage of sewage network services	0%	0%	0%	15%	35%	50%
		Efficiency of collection of sewage	0%	0%	0%	15%	35%	50%
		Efficiency in treatment: adequacy of sewage treatment capacity	0%	0%	0%	15%	35%	50%

Source: (BM, 2016a)

According to rapid assessment of FSM in city done by Bongaon Municipality, the city would need thirteen emptying trucks which will improve the emptying services. Each vehicle is expected to complete 2 trips per day with an average distance of round trip being 10 km. In addition, the city would be required to treat FS of 89 m^3/day and 98 m^3/day in 5 years.

3.2.2 Investments

The city has proposed 100% sewerage system for WW management. The total cost of the project is 163.5 Crores (24.57 million USD). The following table depicts the investment details of the project.

Table 11: Phasing of Investments in the sewerage sector

S.No.	Name of the Project	Share in percentage			Total project cost in INR Crores
		GoI	State	ULB	
1.	Installation of sewage treatment plant	50	45	5	30.60 (4.6 million USD)
2.	Installation of pumping station				9.50 (1.4 million USD)
3.	Laying of pumping main				11.40 (1.7 million USD)
4.	Laying of main sewer network				94.4 (14.1 million USD)
5.	Sewer links for house service Connection				9.10 (1.3 million USD)
6.	Infrastructure works				8.50 (1.2 million USD)
Total					163.50 (24.57 million USD)

Source: (BM, 2016a)

As per the rapid assessment of Faecal Sludge Management (FSM) in city done by Bongaon Municipality, the budgetary provision required for capital expenditure for FSM is around INR 8,940.52 lakh (13.4 million USD). Whereas, the O&M cost associated with the emptying services and treatment operations is estimated to be INR 2,285.33 lakh (4.3 million USD) for 5 years (MoUD, 2016). Further details of CAPEX and OPEX are provided in the Table 12.

Table 12:CAPEX and OPEX for FSSM (INR in lakhs)

S. No.	Component	CAPEX	OPEX	Total
1	Faecal sludge management	1,689.89 (2.5 million USD)	1,613.71 (2.4 million USD)	3,303.59 (4.9 million USD)
2	Liquid waste management	7,250.63 (10.9 million USD)	671.63 (1 million USD)	7,922.26 (11.9 million USD)
3	FSSM Total	8,940.52 (13.4 million USD)	2,285.33 (3.4 million USD)	11,225.85 (16.8 million USD)

Source: (MoUD, 2016)

3.3 Reducing inequity

3.3.1 Current choice of services for the urban poor

The slum population of Bongaon is 40,328 which is 37.04% of the total population (Census, 2011). There are 38 slums in total out of which 22 are notified and 16 are non-notified. The structure of the houses was mostly *kuccha* or *semi-pucca* made out of temporary materials such as bamboo sticks, tin, mud bricks, clay, tiles etc. Refer Figure 12 for reference.

Figure 12: Existing slums in Bongaon (Source: Anil/CSE, 2016)

The slum dwellers are dependent on deep tube wells for water which is provided by Bongaon Municipality. Out of the ten deep tube wells in every ward, two have been introduced in each slum. The slum dwellers rely on deep tube wells for water supply provided by Bongaon Municipality. Some of the Households (HHs) have separate hand-pumps installed within the premises. Most of the slum HHs have access to toilet facility with twin pit as containment system. Only a very few do not have toilets who are using community toilets. Under the HFA scheme, 800 HHs have been newly built and allotted to the slum dwellers. The houses are built with bricks and are in good structural form. The allotted houses are equipped with toilet facility with twin–pits as containment system. However, there is no management of grey water as per the surveys conducted and the waste water generally ends up in the nearby water bodies, partially mixed with solid waste (BM, 2016d).

Figure 13: Allotted houses to slum dwellers with toilet facility under HFA (Source: Anil/CSE, 2016)

3.3.2 Plans and measures to reduce inequity

PMAY, HFA (Urban) project is aimed at urban areas with following components: (i) Slum rehabilitation of slum dwellers with participation of private developers using land as a resource; (ii) Promotion of affordable housing for weaker section through credit linked

subsidy; (iii) Affordable housing in partnership with public & private sectors; and (iv) Subsidy for beneficiary-led individual house construction or enhancement.

Dwelling units constructed under the scheme should essentially have toilet facility with containment. The scheme also has provision of civic infrastructure as per applicable state norms/CPHEEO norms/BIS Code/National Building Code for connection sewer, if existing or has to be made through convergence of other national or state schemes (MHUPA, 2016). The present status of housing schemes is given in Table 13.

Table 13: Status of the housing schemes for urban poor

S. No.	Scheme name	No. of dwelling units proposed	Sent for approval to the State	Approved and sanctioned	No. of dwelling units to the beneficiaries
1	HFA	12,500	3,500	1,500	800
2	Housing for urban poor	121	121	121	121
3	Geetanjali	235	235	235	235

Source:(BM, 2016d)

Under the HFA scheme, Bongaon Municipality has the target to construct 12,500 dwelling units, of which, proposals for 3,500 have been sent to the state for approval. A total of 1,500 dwelling units have been sanctioned, out of which 751 have been completed and allocated with toilet connected to twin pit system. Under state mission Nirmal Bangla scheme, a total of 2200 twin-pit latrines have been completed. All urban poor HHs have access to toilet at present and there is no practice of open defecation (BM, 2016d).

3.4 Outputs

3.4.1 Capacity to meet service needs, demands and targets

Municipal expenditures in India account for 1.1% of the country's Gross Domestic Product, compared to 6.9% in South Africa and 9.7% in Switzerland. ULBs, therefore, rely mainly on national or state grants (AFD, 2014). The municipality's sources of income (both revenue and capital) are through grants from finance commission, HFA, AMRUT, SBM and Geetanjaliis Scheme and other remaining is generated through taxes and user charges. Shortage of man power is observed in the Bongaon Municipality. It largely relies on staff hired on a contractual basis to provide the daily service needs to the public. The municipality consists of 192 permanent employees and 415 employees on contract (BM, 2016d).

3.4.2 Monitoring and reporting access to services

Data on service levels should be collected, documented and reported to MoUD according to the format prescribed by SLB framework. SLIPs are prepared with yearly targets. It has to be reviewed each year and progress has to be monitored. The planning documents like CDP and CSP have to be reviewed once in 5 years. This gives an opportunity to monitor the progress on service level improvement.

The progress of SBM gets reflected on mission progress dashboard in the SBM-Urban website. Of 4,041+ Municipalities in 650+ districts, 3,802 ULBs are active. 75 million plus cities are being monitored separately.

A handwritten record has been maintained to track the number of septic tanks and pit latrines which have been emptied over the years. These data can be used to quantify septage emptied. The officials of Bongaon Municipality do not carry out regular site inspections to check the quality of emptying services. The conservancy department in the municipality looks after issues pertaining to sanitation services in the city. The sub assistant engineer from the Public Works Department (PWD) is in charge of inspection of the construction of septic tanks around the city. No regular monitoring or inspection of septic tanks is carried out after its construction (BM, 2016d).

3.5 Expansion

In 2016, MoHUA initiated a rapid assessment of 131 flagship cities to estimate the budgetary requirement for implementing Faecal Sludge and Septage Management (FSSM) in selected cities across the country, supported by the National Alliance for Faecal Sludge and Septage Management (NFSSM). The flagship cities include 100 smart cities, 12 cities in Ganga basin and others across India. A declaration was signed – for cities journey beyond ODF - mainstreaming effective FSSM by key decision makers and NFSSM alliance members.

Bongaon is one of the flagship cities and has undergone the assessment and it is covered under the AMRUT programme. The SAAP prepared under the AMRUT programme is prepared to reflect the demand of the state with respect to National Service Benchmark for the expansion of services like water supply, sewerage and FSM. It is also used to select the relevant schemes which need to be funded every year. The basic building block of SAAP is SLIP (SMD, 2015).

3.5.1 Stimulating demand for services

The following activities may stimulate demand for services:

- Awareness generation on septic tank construction, regular emptying of septic tanks through awareness campaigns
- Awareness campaigns on ill effects of environmental degradation because of disposal of untreated septage into local environment
- Capacity building of ULB staff on septage management
- Skill development for local masons and plumbers

It is recognized that the end objectives and corresponding benefits of SBM cannot be achieved without proper management of FS and septage across the sanitation service chain. Further, it is well understood that sewerage coverage will not meet the complete sanitation needs in all areas, and a strategy which is a combination of OSS and off-site (decentralized and centralised) must co-exist in all cities and must be given equal attention. However, the current policies are not explicit enough and also do not provide an outcome-focused direction on this issue (MoUD, 2017).

3.5.2 Strengthening service provider roles

SBM majorly provides funds for access to toilets but thereafter lacks funds for treatment and disposal of sewage and FS throughout the service chain. The service delivery of sewage and FS treatment and disposal can be met through converging the two-national flagship programmes SBM and NMCG. The ULB can take the benefit of the programmes and strengthen the services along the value chain and achieve the goals of both programmes.

Bongaon Municipality is the only service provider for emptying services and they are also responsible for O&M of public toilets. There are no private players in the city, providing such a service.

Funding is estimated for septage management initiatives under rapid assessment for FSSM supported by MoHUA. These funds can be used to buy vacuum tankers and building or upgrading the existing treatment facility. BM has to make use of these funds to strengthen the services. At present, there are no detailed plans for strengthening service delivery.

4 Stakeholder engagement

4.1 Key informant interviews

The KIIs were conducted with the stakeholders having a role or interest in sanitation and FSM services within the city. The relevant departments were contacted through e-mail, letter, and call to visit to the concerned departments. The purpose of the SFD study and depth of data required was conveyed through an introductory letter to respective departments. Overall, three KIIs were conducted with different stakeholders like government functionaries (from Bongaon Municipality), and masons (see Appendix 7.2). Apart from KIIs, the survey was also conducted, which included interviews with representative from market areas, institutions and other establishments. Indeterminate information was available prior to the field based research about the type of containment, emptying service, transportation and disposal of sewage generated by the city. The visit enabled in enhancing data collection through gathering progress details of SBM, published and unpublished reports like CDP, etc. Interview with the emptiers and other stakeholders provided additional insight into the service delivery context.

4.2 Field observations

In order to get a better picture of variety/topology of OSS, random households' surveys were conducted. The sample was carefully chosen to get a good spatial representation of each ward considered. Apart from the household surveys, public and community toilet surveys were also conducted and on site field observations regarding the sanitation scenario in Bongaon was noted and considered. Such surveys, observations and KIIs helped to produce a more credible and accurate SFD, as well as provides more precise qualitative and quantitative data. It is observed that over a period of time, the pit latrines are in need of frequent emptying due to two reasons: First, during monsoon season, the ground water level increases and seeps into the containment system (pits).Second, the pits are constructed using mud rings and these results in decreasing the depth of the pit over a period of time due to breaking down of the rings. Hence, the pit/*Kuan*get filled up soon and require frequent emptying. Choking of hose pipe during emptying is a big problem for the workers, it delays the operation to a day or two.

The city has proposed a piped water supply which consists of a 118 km of pipeline. The project is funded under AMRUT. The consequences this may have, if the resulting wastewater is not managed adequately, are not discussed.

4.3 Focus group discussion

The FGDs were conducted to complement, validate and challenge data collected during literature review and interviews. In total, three FGD sessions were conducted. FGDs were held with officials of Bongaon Municipality, emptiers and sanitary workers. The questionnaires for FGDs were prepared in English, but the interviewer asked the questions, translating into the Hindi language.

The findings from the FGD sessions revealed information that increased the understanding of the sanitation and septage management in Bongaon. FGDs were useful in data triangulation. The random survey helped in validating secondary data and data provided by different stakeholders. It resulted in depicting the actual and true SFD of the city.

Stakeholders were identified and task force was formulated and notified under the mandate by NUSP (see Appendix 7.8).

5 Acknowledgement

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7 Appendix

7.1 Stakeholder identification

Table 14: Stakeholder identification

S. No.	Stakeholder group	In Bongaon context
1	City council / Municipal authority / Utility	Bongaon Municipality
2	Ministry in charge of urban sanitation and sewerage	Department of Municipal Affairs, GoWB
3	Ministry in charge of urban solid waste	Department of Municipal Affairs, GoWB
4	Ministries in charge of urban planning finance and economic development	State Urban Development Authority
	Ministries in charge of environmental protection	Environment Department, GoWB
	Ministries in charge of health	PHED
5	Service provider for construction of onsite sanitation technologies	Local masons
6	Service provider for emptying and transport of faecal sludge	Bongaon Municipality
7	Service provider for operation and maintenance of treatment infrastructure	N/A
8	Market participants practicing end-use of faecal sludge end products	N/A
9	Service provider for disposal of faecal sludge (sanitary landfill management)	Bongaon Municipality
10	External agencies associated with FSM services: e.g. NGOs, academic institutions, donors.	Centre for Science and Environment, New Delhi

Source: (CSE, 2016)

7.2 Tracking of engagement

Table 15: Tracking of engagement

S. No.	Name of Organization	Designation	Date of engagement	Purpose of engagement
1	Bongaon Municipality	Ward Councillor	19/10/2016	FGD
2	Bongaon Municipality	Sanitary workers		
3	Bongaon Municipality	Bongaon Municipality officials		
4	Bongaon Municipality	Conservancy Department In charge	19/10/2016	KII
5	Bongaon Municipality	Sub-Assistant Engineer	20/10/2016	KII
6	Private	Local Mason	21/10/2016	KII
7	Bongaon Municipality	Emptiers and Transportation Facilitators	21/10/2016	FGD

Source: CSE, 2016

7.3 SFD graphic

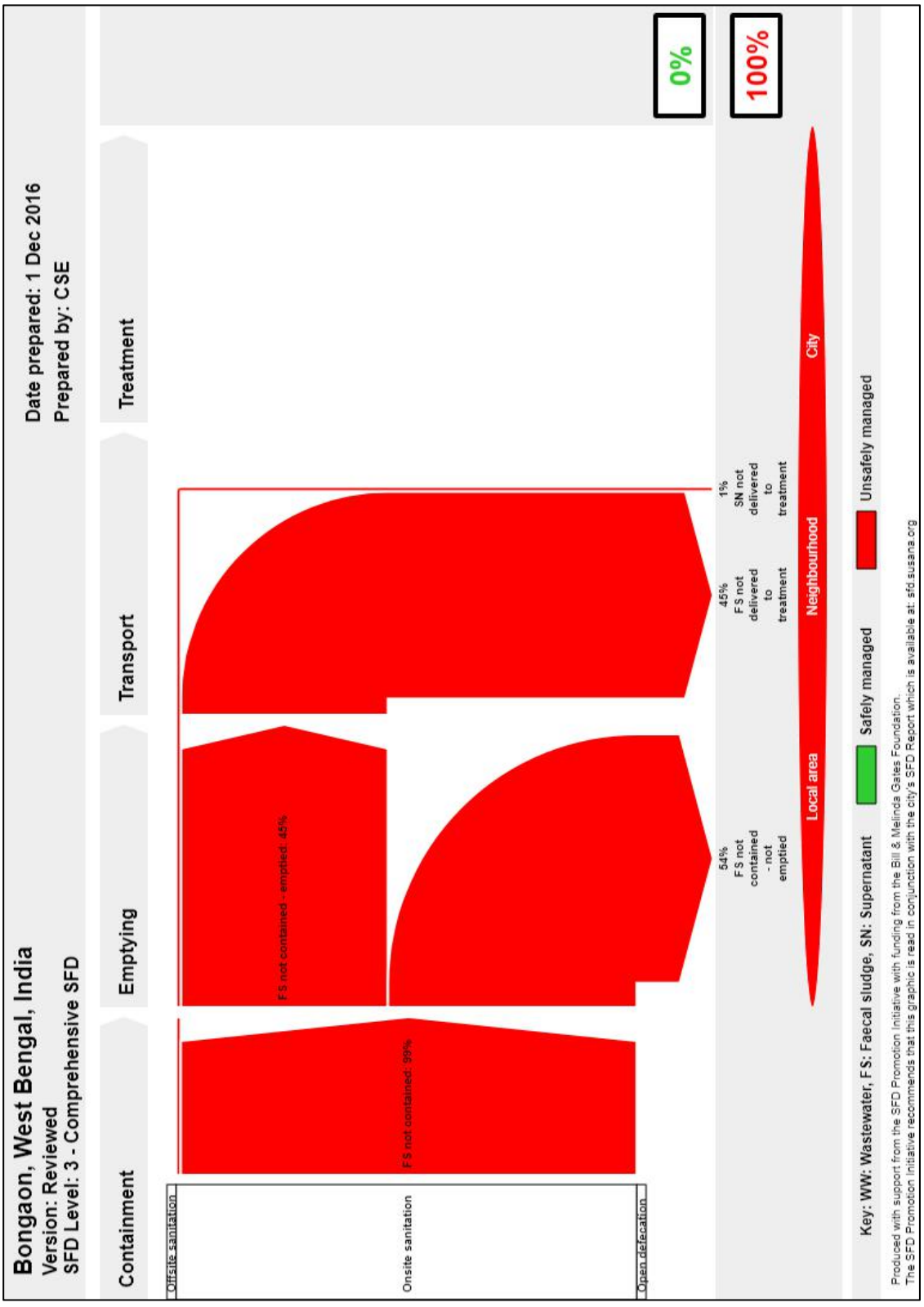

Figure 14: SFD graphic (Source: SFD graphic generator)

7.4 SFD brief explanation

Table 16: Percentage of the population using each system technology and method

System Type	Containment	Emptying	Transport	Treatment	End-use/ disposal
Offsite	No offsite system present in Bongaon				
Onsite	T2A2C5: 22% of population is dependent on septic tank connected to soak pit. T1A2C6: 2% of population is dependent on septic tank connected to open drain. T2A4C5: 3% of population is dependent on lined tank with impermeable walls and open bottom connected to soak pit. T2A5C10: 73% of population is dependent on lined pit with semi-permeable walls and open bottom with no outlet.	Since most of the population is getting their systems emptied, it is assumed 90% of population has their onsite technology emptied. Since there is no clear differentiation between percentage of septage and SN, it is assumed to be 50% each. SN is assumed to be 1% and FS not contained - emptied comes out to be 45% and FS not contained-not emptied becomes 54% (including infiltrate).	FS is transported in vacuum tankers SN from the septic tank connected to open drain is discharged into the Ichamati River via the drains	No treatment facility exists hence no FS/WW/SN is treated; therefore FS treated is 0%.	All the FS emptied ends up in solid waste dump yard situated next to a large pond.
Open defecation	Bongaon is an ODF town				

Source: (CSE, 2016)

7.5 Context-adapted SFD graphic

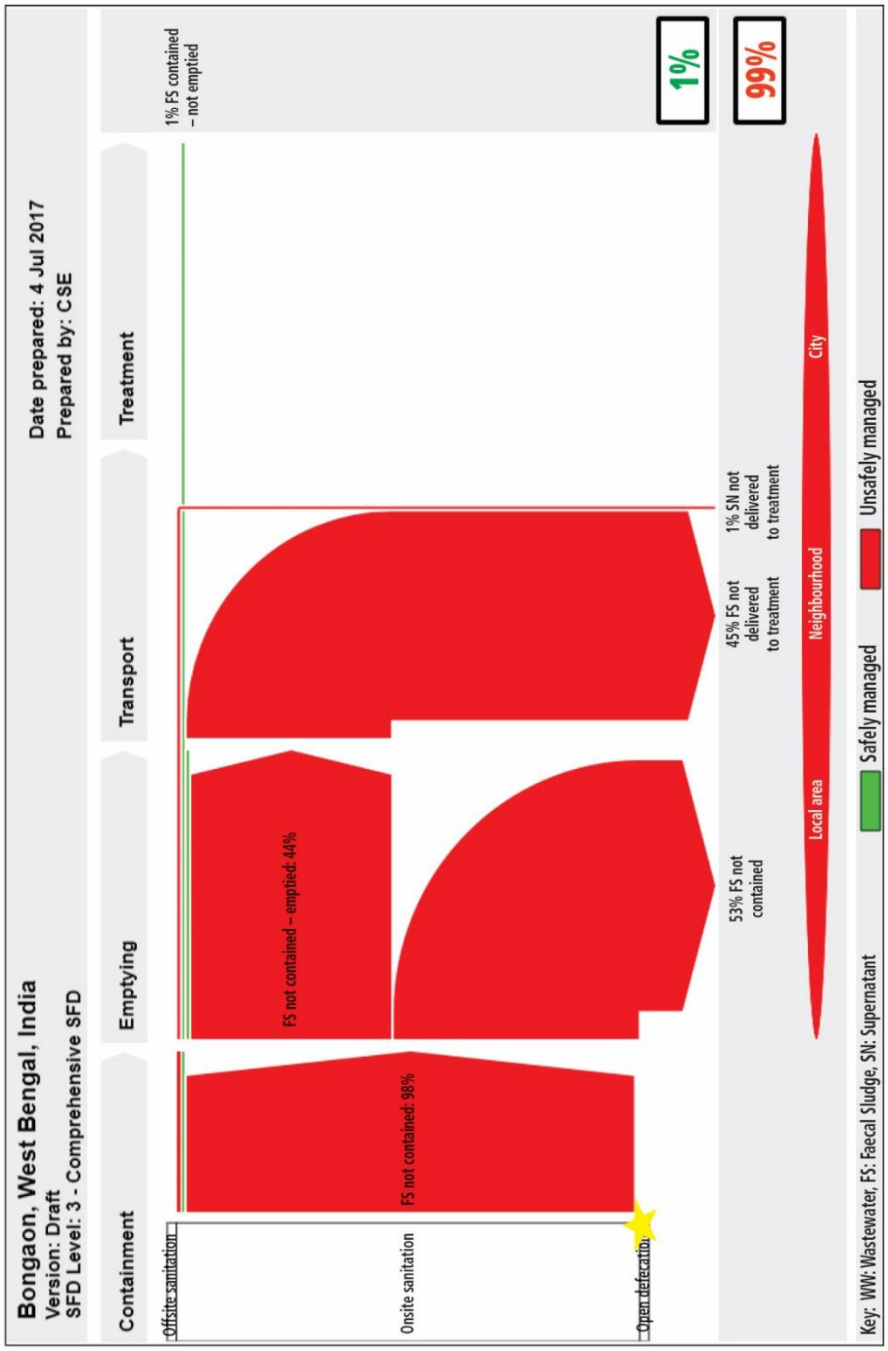

Figure 15: Context-adapted SFD graphic (Source: CSE)

7.6 SFD selection grid

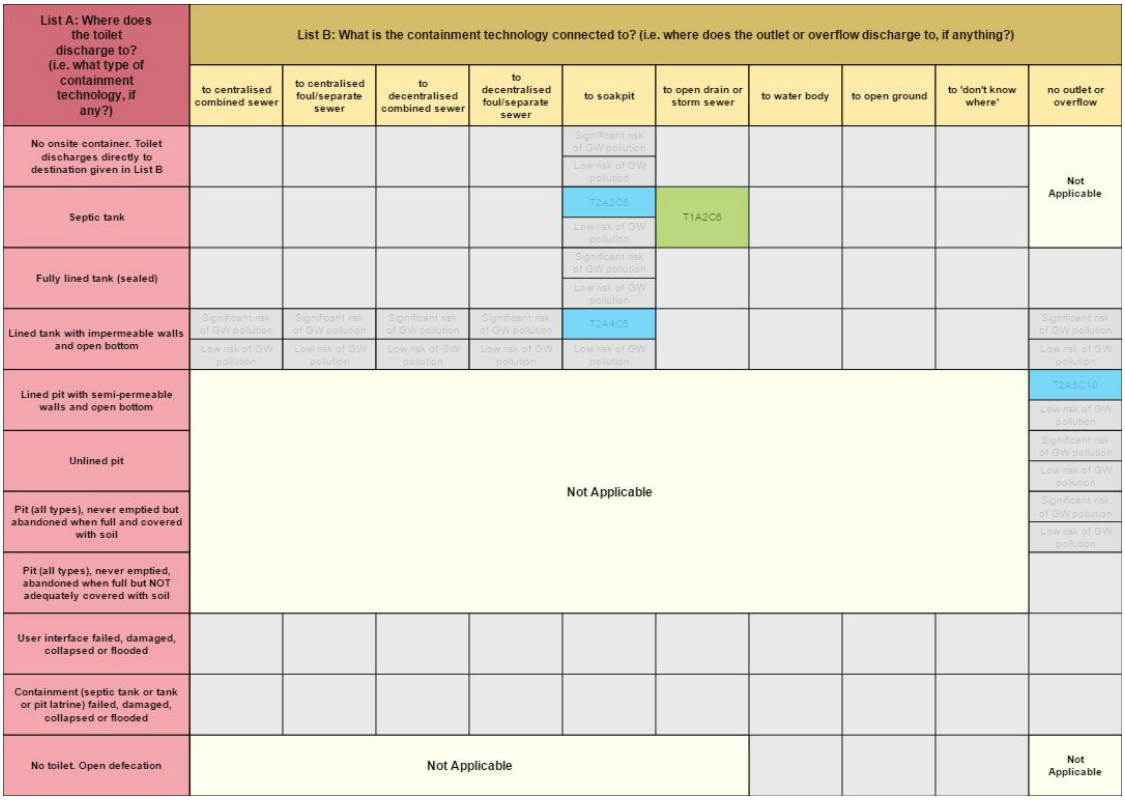

Figure 16: SFD selection grid (Source: SFD graphic generator, 2016)

7.7 SFD calculation grid

Table 17: SFD matrix

Bongaon, India, 01 Dec 2016. Field based study
Population: 108864
Proportion of tanks: septic tanks: 50%, fully lined tanks: 50%, lined, open bottom tanks: 50%

System label	Pop	F3	F4	F5	S4e	S5e
System description	Proportion of population using this type of system	Proportion of this type of system from which faecal sludge is emptied	Proportion of faecal sludge emptied, which is delivered to treatment plants	Proportion of faecal sludge delivered to treatment plants, which is treated	Proportion of supernatant in open drain or storm sewer system, which is delivered to treatment plants	Proportion of supernatant in open drain or storm sewer system that is delivered to treatment plants, which is treated
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	22.0	90.0	0.0	0.0		
T1A2C6 Septic tank connected to open drain or storm sewer	2.0	90.0	0.0	0.0	0.0	0.0
T2A4C5 Lined tank with impermeable walls and open bottom, connected to a soak pit, where there is a 'significant risk' of groundwater pollution	3.0	90.0	0.0	0.0		
T2A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of groundwater pollution	73.0	90.0	0.0	0.0		

Source: SFD graphic generator, 2016

7.8 Community/public toilets

Table 18: Details of community/public toilets

S.No	Public Toilet/Community toilet	No of users per day	Tick appropriate one		No. of functional toilet seats (both men & women)				Operation & Maintenance by			Toilet connected to (septic tank/pit /open drain	Septic tank size in feet LxBxH	Emptying frequency in yrs	No of trips
			Ward No	Pay & use toilet	Men		women		ULB	PPP	Community				
					Urinal	Seat	Urinal	Seat							
1	CT	100	1	X	3	3	1	1	✓ ✓	X	X	ST	15'x10'x10	6 months	2
2	CT	200	6	X	3	3	1	1	✓	X	X	ST			2
3	CT	300	19	X	3	3	1	1	✓	X	X	ST			2
4	CT	120	15	X	2	2	2	2	✓	X	X	ST			2
5	CT	120	11	X	2	2	2	2	✓	X	X	ST			2
6	PT	200	1	✓	3	3	6	3	✓	X	X	ST			2
7	PT	300	14	✓	3	2	3	3	✓	X	X	ST			2
8	PT	300	4	✓	3	3	3	3	✓	x	x	ST			2
9	PT	300	10	✓	3	3	6	3	✓	X	X	ST			2
10	PT	500	16	✓	5	5	5	5	✓	X	X	ST			2

Source: (BM, 2016d)

7.9 Swachh Bharat City Level Task Force (SBCLTF) – Bongaon

Table 19: SBCLTF list of members

S/N	Name of the members	Position / Designation
1	Mr. SankarAddhya, Bongaon Municipality	Chairman
2	Mr. Krishna Roy, Bongaon Municipality	Vice Chairman
3	Mr. DiptenduBIkasBairagi , Bongaon Municipality	Councillor
4	Somanjana Mukherjee, Bongaon Municipality	Chairman in Council
5	ShubhenduMistril, Bongaon Municipality	Councillor
6	AnindaChattapadhyay	Additional District Inspector of School (Secondary Education), Bongaon
7	Bidisha Das	Inspector of School (Primary Education), Bongaon
8	Dalia Acherjee	Child Development Project Officer, Bongaon
9	SatarupaBasu	Assistant Chief Medical Official, Health, Bongaon
10	Rabindranath Das	Ex Teacher of Secondary School
11	Indranil Sarkar	Asst Engineer of P.W.D
12	Dr. Suresh Kumar Rohilla	Programme Director- Water Management
13	KalyaniMondal , Bongaon Municipality	Treasurer
14	Indrani Chowdhury, Bongaon Municipality	Treasurer
15	AnjanaPramanik, Bongaon Municipality	Secretary
16	Archana Sarkar, Bongaon Municipality	Secretary

Source: Compiled by CSE, 2016

7.10 SBCLTF meeting

Figure 17: SBCLTF meeting held in Bongaon Municipality (Source: BM, 2016)

7.11 Photographs captured during field visit

Figure 18: Community toilet in slum (Source: Anil/CSE, 2016)

Figure 19: KII with mason (Source: Aishwarya/CSE,2016)

Figure 20:Sample survey in slum (Source: Anil/CSE,2016)

Figure 21: Drain carrying waste water(Source: Anil/CSE, 2016)

7.12 Household survey questionnaire

CENTRE FOR SCIENCE AND ENVIRONMENT, NEW DELHI
Focus Group Discussion (FGD)
QUESTIONNAIRE

Date: ___/ ___ / ___, **Area Name:** _____, **Ward:**_____,

Co-ordinates:_____, **No. of Participants (4-10)** _____

Group Profile
No. of Male: No. of Female:

Respondents	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Gender										
Age										
Marital Status ((U/M)										
Household size										
Social category (G, OBC, SC, ST										
House Structure (P,K, SP)										
Latrine facility (IT, ST, CT, PT, ODF)										
IT: Individual Toilet, ST: Shared toilet, CT: Community Toilet, PT: Public Toilet, ODF: Open Defecation										
Who constructed toilet (SF, Govt.,Pvt.,NGO)										

Respondents	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Does the current state of toilet cause trouble (Y/N)? State reasons??										
Do all females use toilet (Y/N)?										
Do all males use toilet (Y/N)?										
Do all children use toilet (Y/N)?										
Types of toilet (ISP, Western)										
ISP: Indian Squatter Pan										
Kind of flushing (PF/CF)										
PF: Pour Flush, CF: Cistern Flush										
User interface connected to(S,ST,PL,OD, OG,LIC/O,LSC/ O)?										
S: Sewer, ST: Septic Tank, PL: Pit Latrine, OD: Open Drain, OG: Open Ground, LIC/O: Lined tank impermeable/Semipermeable walls with closed/open bottom,										
Details of the tank										
Circular/rectangular/Square (C/R/S)										
Length: Breadth: Depth										
Comment:										

2

Figure 22: Household questionnaire used during random survey (Source: CSE, 2016)

7.13 FS emptiers questionnaire

CENTRE FOR SCIENCE AND ENVIRONMENT, NEW DELHI
Septic tank Cleaner Survey

Date: ...../Nov/2016 Time: ..... Place: .....

1. Owner name & Mob. No. .....
2. De-sludging process (Manual/Mechanical/Semi M.M) .....
3. Reasons for adopting the process.....
4. Type of vehicle used for transportation (Tractor/Truck/trolley/others)

   .....
5. Price of vehicle.....
6. Type of ownership (Own vehicle /hire from others) .....
7. Number of vehicles (total in your area). . .....
8. Capacity of vehicles .....
9. Typical age of Vehicles .....
10. Vehicle Assembling point.....
11. Vehicle Details.

New or second hand	
Mileage	
Durability of vehicle (Max.)	
Capacity of pump (in HP)	
Location of pump on vehicle	
Tank maintenance details (if any rupture etc.)	
Tank durability (max.)	

12. Typical No of trips per day .....
13. Average distance per trip.....
14. Area of responsibility.....
15. Fees charge/trip.....
16. Time taken for desludging activity.....
17. Where is sludge dumped .....
18. Where should be disposal site to be located? .....
19. Official dumping site for city.....
20. Reuse for sludge .....
21. Total Quantity of faecal sludge received per day per trip (Approx.).....
22. Septic tank location (top place used for any activity or unused).....

    .....
23. Septic Tanks details (Capacity, dimension, materials used for construction, Inlet and outlet baffle etc.....
24. Areas having highest demand for sludge clearing .....
25. Frequency of desludging per household.....
26. Fees Charges /Trip (Competitors) .....
27. NO. Of private Operators in your area .....
28. Are you maintaining any register/produce any bill for payment? .....
29. Is the current practice suitable for the you (Suggest any changes)

    .....
30. Major issue running in the business

    .....
31. Safety Measures if any during desludging process .....
32. Marketing Strategy.....
33. Why you are doing this work?

    .....

Figure 23: Survey questionnaire used during emptiers interview (Source: CSE/2016)