SFD Report

Bansberia
India

Final Report

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

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SFD Report Bansberia, India 2017

Produced by:

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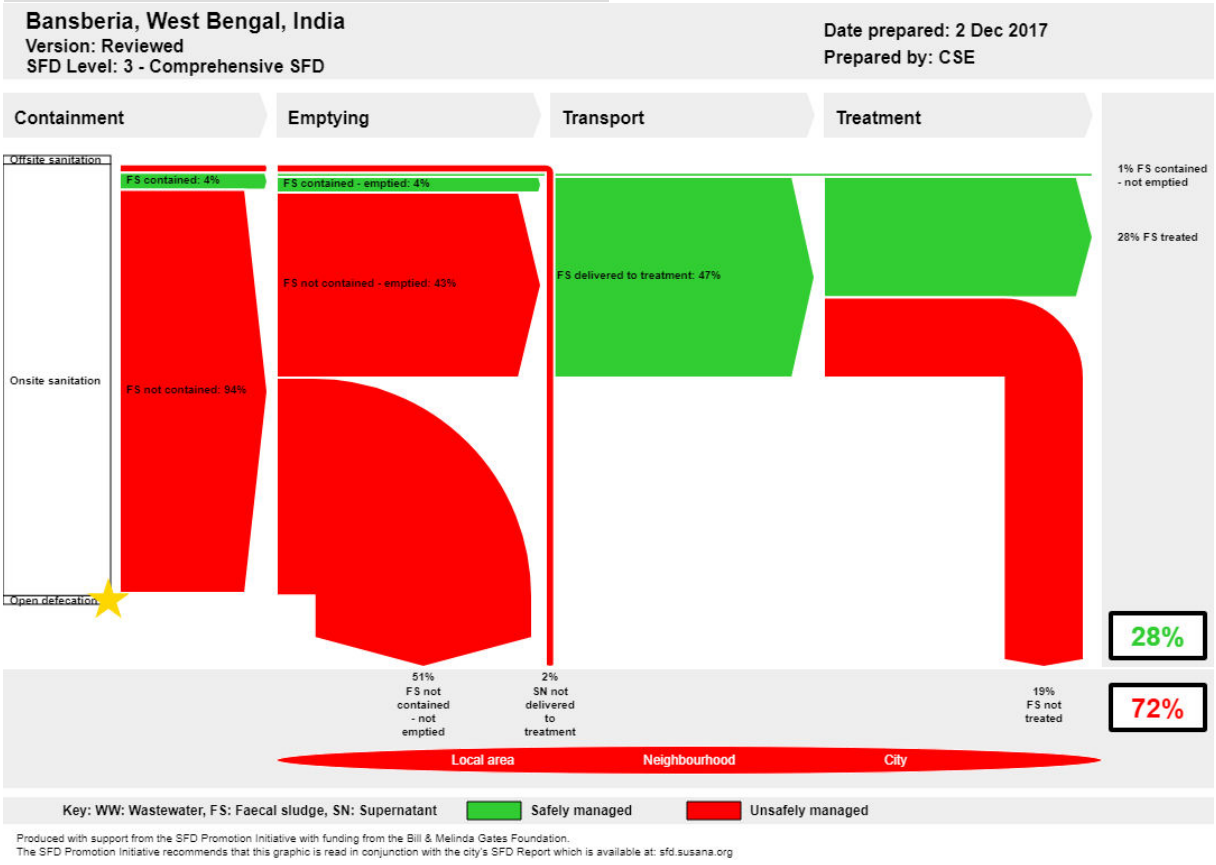
1. The SFD Graphic



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

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3. General city information

Bansberia is a town in the Hooghly district of West Bengal, India. Bansberia Municipality was the nerve centre of *"Saptagram"*, a port city, famous for its inland and foreign trades with Europe since 17th Century. It is rich in its heritage and tradition and has a number of historical sites such as Hanseswari Temple and Zafar Khan Ghazi Mosque and Dargah. (BM, 2015).

As per Census of India, 2011, Bansberia has a population of 1,03,799. The area of Bansberia Municipality is 9.07 sq. km. and covers 0.29% of the total area of Hooghly district. It is divided into 22 wards. The population density of the city is 11,445 persons per sq.km (Census, 2011), which is high in comparison to the population density of West Bengal, i.e. 1,028 persons per sq.km (BM, 2015) . The slum population of Bansberia is 38,604 which is 37.19% of the total population (Census, 2011). The average maximum and minimum temperature during summers and winters are 38°C and 12°C respectively and the soil type is mostly sandy, clay soil and alluvial soil (BM, 2015).

4. Service outcomes

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

Containment: All households are dependent on onsite sanitation systems. The containment systems in Bansberia mainly comprises of septic tanks and pits. Septic tanks do not adhere to the standards prescribed by the Bureau of Indian Standards (BIS). Following types of containment systems were found in Bansberia; septic tank connected to soak pit (20% population), septic tank connected to open drain (4% population), fully lined tank with no outlet (4% population) and the most common containment system found in the city, which is the twin-pit system (72% population) (BM, 2016).

Emptying: Emptying service is provided by Bansberia Municipality. The municipality has one vacuum tanker which has two tanks of 2,000 litres coupled with a tractor. There are no private emptiers plying in the city. The frequency of emptying per household is once in 5 years for houses having septic tanks and once in 2 years for houses having pits. The fees for emptying depend on the type of containment system (tank or pit), length of extraction pipe and the volume of FS to be emptied. Emptying charges varies from INR 400 (USD 6.11) to INR 500 (USD 7.64). The fees increase with an increase in volume beyond 250 cu.ft (7 m^3) and with an increase in the length of the pipe used. The time is taken to empty a septic tank range from 40 minutes to 1 hour. There is no use of personal protective equipment during emptying, thereby causing high risk to health (BM, 2016).

Figure 1: Emptying of a twin-pit latrine (Source: Anil/CSE, 2016)

Transport: There is only one vacuum tanker having a capacity of 4,000 litres. Price of the vehicle is around INR 15 lakhs (22.909 USD) and is assembled at Chandan Nagar, situated 20kms from the city. The suction pump is located in the front of the tanker and the capacity of the pump is 5HP with a head of 20 ft (6 m). On an average, three trips are completed per day that includes emptying of 1 septic tank and 2 pits. The average distance travelled per trip is 5km. The supernatant (SN) from septic tanks is conveyed through open drains to Hooghly River. All the faecal Sludge (FS) emptied is transported to the treatment facility.

Treatment and disposal: The treatment facility is a joint venture of Bansberia Municipality with Greenery Bio-compost and Animal Farming Pvt. Ltd. (GBAF) where faecal and poultry waste is treated and converted into bio compost. Almost 100% of the faecal sludge post dewatering is treated (GBAF, 2016).

According to Census of India, 2011, 5.8% of the city is dependent on offsite systems of which, population connected to sewer line is 5.7% and user interface discharging directly into open drain or open ground is 0.1%. But from the field survey conducted, it was observed that there is no offsite sanitation system in the city.

Figure 2: Final product after treatment (Source: Aishwarya/CSE, 2016)

According to Census of India, 2011, 91.4% population is dependent on onsite sanitation systems of which, 33.9% use septic tanks and 39.9% use pits and 16.6% use public latrines. According to the field survey conducted, 72% population use lined pits with semi-permeable walls, 20% use septic tank connected to soak pit, 4% use septic tank connected to open drain, 4% use fully lined tank with no outlet.

FS is considered not contained in Bansberia when the FS infiltrate pollutes the high ground water table and if the supernatant from septic tank flows into open drains. The septic tank connected to open drain is used by 4% population. There is no clear differentiation between the volume of SN and solid FS generated from septic tank connected to open drain, hence to reduce maximum error it is assumed to be 50% each. Therefore, the supernatant and FS from septic tank connected to drain is considered 2% each. FS not contained is attributed to 94% population that uses the following systems: septic tank connected to soak pit (20%), lined pit with semi-permeable walls and open bottom (72%) and septic tank connected to open drain (2%). FS contained is attributed to 4% population that uses fully lined tank with no outlet.

In FS not contained systems, 50% is considered as FS in pits and 50% is considered as infiltrating. It is also assumed that 90% of FS is emptied during the emptying process thereby leaving 10% FS in containment system itself. Out of the 94% FS not contained, 47% is considered as infiltrating and 47% is solid FS. Out of 47% solid FS, 43% is emptied leaving behind 4% FS not emptied. The 47% infiltrates together with the 4% FS left behind in the containment system constitute the 51% FS not contained-not emptied. The FS contained-emptied is attributed to 4% population. 43% FS not contained –emptied and4% FS contained- emptied, together constitute the 47% which gets delivered to the treatment plant. Assuming that 60% is treated out of 47% FS which reaches the treatment plant, 28% FS gets treated and 19% FS is not treated. Overall, 28% FS is safely managed and 72% FS in unsafely managed.

According to Census of India, 2011, 2.7% population practices open defecation. But it was learnt, through field survey, that Bansberia has been officially declared as an open defecation free city in the year 2016 (BM, 2016).

5. Service delivery context

National Urban Sanitation Policy (NUSP) was issued in 2008, by the Ministry of Housing and Urban Affairs (MoHUA, GoI), formerly known as Ministry of Urban Development (MoUD). 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 states to develop state urban sanitation strategies and work with cities to develop City Sanitation Plans (CSPs).

NUSP identifies the constitution of the 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 of waste into the environment. Urban Local Bodies (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 (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 the 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. Around 98% of the slum residents have their own individual toilets with twin pit system that is built under SBM and state scheme *Mission Nirmal Bangla*.

As per the rapid assessment of FSM in city done by BM, the budgetary provision required for capital expenditure for FSM is INR 6,181.53 lakh (9.37 million USD). Whereas, the operation and maintenance (O&M) cost associated with the emptying services and treatment operations is estimated to be INR 2,109.87 lakh (3.19 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 Sewerage (WSS) from state agencies, such as Departments of Public Health Engineering and State Water Boards, to 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 implementation (USAID, 2010).

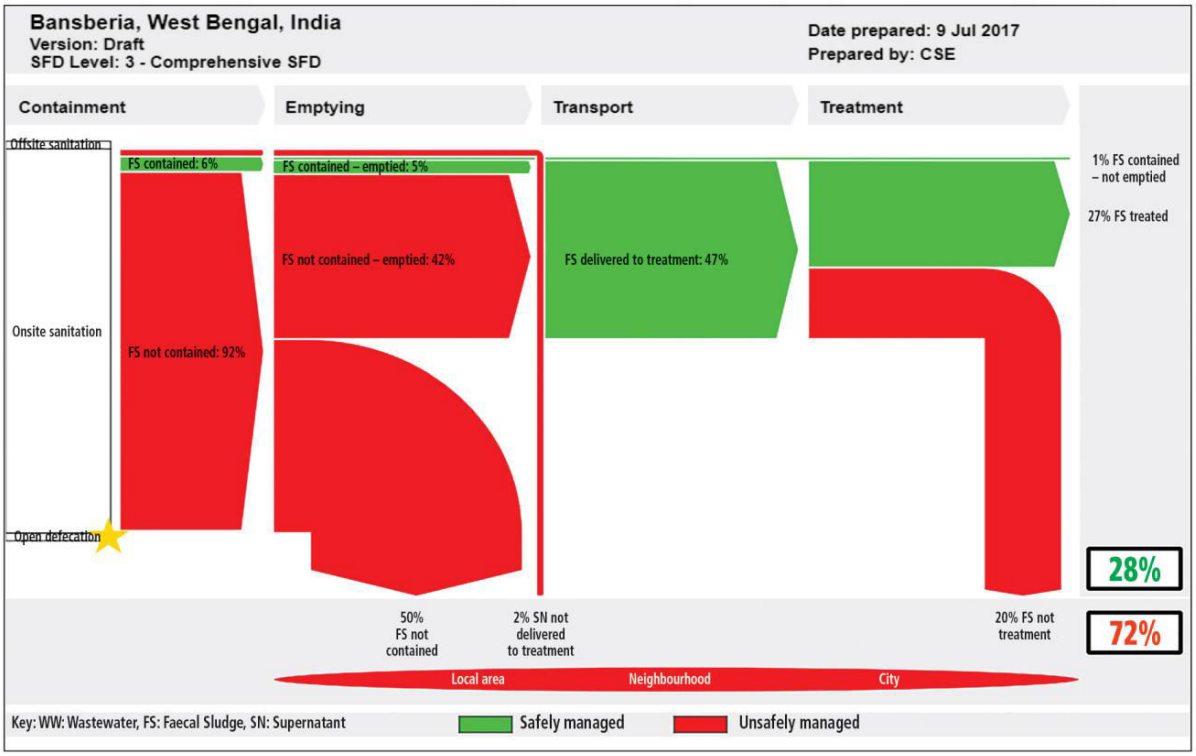
Key Stakeholders	Institutions/organizations
Public institutions	Ministry of Housing and Urban Affairs (MoHUA), National Ganga Council(NGC), Bansberia Municipality(BM), Department of Municipal Affairs, Urban Development Department (UDD), State Urban Development Agency(SUDA), State Wate Investigation Directorate(SWID), Public Health Engineering Department(PHED), West Bengal Pollution Control Board (WBPCB), State Programme Managemen Group (SPMG)
NGOs	Centre for Science and Environment
Private Sector	Greenery Bio-compost and Animal Farming Pvt. Ltd. (GBAF), local masons

Table 1: Key Stakeholders (Source: Compiled by CSE, 2017)

UDD is responsible for administrative and financial management of municipalities, implementation of development programmes. 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. GBAF Pvt. Ltd. treats collected FS to produce fertilizer. SPMG coordinates and oversees the implementation of projects sanctioned by Government of India under National Ganga Council (NGC).

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



The entire population of Bansberia is dependent on onsite sanitation systems, out of which 4% of the population is dependent on septic tanks connected to open drain or storm sewer. This, along with 20% population dependent on septic tank connected to soak pit and 72% population dependent on lined pit with semi permeable walls with an open bottom are attributed to be FS not contained. The 4% population dependent on fully lined tank with no outlet is attributed to be FS contained.

8. Context-adapted SFD graphic

The only difference suggested in the context-adapted SFD is at containment stage for correctly designed septic tanks, changes from 4% to 6% and 'SN not contained' remains 2% when compared to SFD generated though connected to open drains. Hence in the context adapted SFD 'FS not contained' changes from 94% to 92%, 'FS contained' through graphic generator.

An assumption is made that 50% of the proportion of the content in a septic tank is solid FS, and rest of the 50% is supernatant. Hence, both supernatant and faecal sludge attribute to 2% population each, out of the 4% population who use septic tank connected to open drain. According to SBCLTF, the solid FS present in the septic tank connected to open drain (attributed to 2% 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 6% population is considered contained (represented in green colour). 5% FS contained is emptied and the remaining 1% FS remains in the tank and does not get emptied.

Overall, the excreta of 72% population are not safely managed according to the context-adapted SFD.

9. Process of SFD development

Data are collected through secondary sources. The city is visited to conduct the 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 also produce the SFD graphic.

The SFD graphic of Bansberia city, developed using the graphic generator was 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.

10. Credibility of data

The key sources of data used are Census of India, 2011, City Development Plan of Bansberia and other published documents of relevant departments. Most of the data are then updated with KIIs and FGDs. Overall 7 KIIs and 5 FGDs were conducted with different stakeholders across the town.

There were three major challenges faced during the development of the SFD. Census of India and published/unpublished reports were not able to provide (i) up-to-date on containment (ii) detailed typology of containment and (iii) actual information about FSM services provided in households. 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 (refer section 1) with brief report was presented with the SBCLTF, based on their feedback a context adapted SFD is prepared.

The secondary 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 also produce the SFD graphic. Overall, 28% of excreta are safely managed in the city and the rest 72% is unsafely discharged into the environment.

For this reason, field based studies were conducted to validate the data provided by secondary sources The Census mostly differentiates between systems connected to the 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 wastewater 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. .

The objective of the random 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)

11. List of data sources

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

- Published reports and books:
  - Census of India,2011, House listing and housing data, Government of India
  - Groundwater Year Book, Central Groundwater Board, 2014
  - City Development Plan of Bansberia Municipality,2015
- KIIs with representatives from
  - Bansberia Municipality
  - Greenery Bio-compost and Animal Farming Pvt. Ltd.
  - Local masons
- FGDs
  - BM staff
  - Ward councillors
  - BM emptiers and transportation in-charge
  - Slum dweller representatives
  - SBCLTF members

Bansberia, India, 2017

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BIS	Bureau of Indian Standards
BM	Bansberia Municipality
CAPEX	Capital Expenditure
CGWB	Central Ground Water Board
CDP	City Development Plan
CPHEEO	Central Public Health and Environmental Engineering Organization
CSE	Centre for Science and Environment
CSP	City Sanitation Plan
CSTF	City Sanitation Task-force
CT	Community Toilet
FGD	Focus Group Discussion
FS	Faecal Sludge
FSM	Faecal Sludge Management
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
GBAF	Greenery Bio Compost and Animal Farming
GoI	Government of India
GoWB	Government of West Bengal
HFA	Housing for All
ICAR	Indian Council of Agricultural Research
IMIIP	Intra Municipal Infrastructure Improvement Plan
INR	Indian Rupee
KII	Key Informant Interview
KMDA	Kolkata Metropolitan Development Authority
lpcd	Litres per capita per day
MoHUA	Ministry of Housing and Urban Affairs (formerly known as Ministry of Urban Development)
MoUD	Ministry of Urban Development
NBC	National Building Code
NFSSM	National Faecal Sludge and Septage Management Alliance
NGC	National Ganga Council
NH	National Highway
NIUA	National Institute of Urban Affairs
NITI	National Institution for Transforming India (formerly Known as Planning Commission)
NMCG	National Mission for Clean Ganga
NUSP	National Urban Sanitation Policy
OD	Open Defecation
O&M	Operation and Maintenance
OPEX	Operational Expenditure
OSS	On-Site Sanitation Systems
PHED	Public Health and Engineering Department
PMAY	Pradhan Mantri Awas Yojna
PPE	Personal Protective Equipment

PPP	Public Private Partnership
PT	Public Toilet
SAAP	State Annual Action Plan
SBCLTF	Swachh Bharat City Level Task Force
SBM	Swacch Bharat Mission
SFD	Shit Flow Diagram
SLB	Service-Level Benchmark
SLIP	Service Level Improvement Plan
SMD	State Mission Directorate
SMP	Septage Management Sub-Plan
SN	Supernatant
Sq.km	Square Kilometer
STP	Sewage Treatment Plant
SUDA	State Urban Development Agency
ULB	Urban Local Body
USD	United States Dollar (1 USD = 65.46 INR)
WBPCB	West Bengal Pollution Control Board
WSS	Water Supply and Sewerage
WW	Wastewater

1 City context

Bansberia is a small town in the Hooghly district of West Bengal in India. It was established on 1st April 1869, covering two historical villages, namely Bansberia and Tribeni (BM, 2015). Bansberia was the nerve centre of "Saptagram", a port city, famous for its inland and foreign trades with Europe since the 17thcentury. The word "Saptagram" means seven villages and includes Bansberia as one of the seven villages. Bansberia is rich in its heritage and tradition and has a number of historical sites such as Hanseswari Temple and a Shrine, Zafar Khan Gazi Dargah which have been declared a national heritage under the Monuments and Archaeological Sites and Remains Act 1958. Bansberia is situated on the western bank of the River Hooghly, a tributary of Ganga River in West Bengal.

As per Census, 2011, Bansberia has a population of 1,03,799. The area of Bansberia Municipality (BM) is 9.07 sq.km and covers 0.29% of the total area of Hooghly district (BM, 2015) .There are 22 wards in the city among which ward no. 10 is the most populous ward with a population of 10,000 and ward no. 1 is the least populous with a population of 2,089. The population density of the city is 11,445 persons per sq.km (Census,2011), which is high in comparison to the density of West Bengal, i.e. 1028 persons per sq.km (Census, 2011). The slum population of Bansberia is 38,604 which is 37.19% of the total population(Census, 2011).

Table 1: Population growth rate

Year	Population	Growth rate(%)
1991	93,381	-
2001	1,04,412	11.81%
2011	1,03,920	-0.47%

Source: BM,2015

The town is located at 22.97°N and 88.40°E. The average maximum temperature is about 38˚C during summers and the average minimum temperature remains at about 12°C during winters. The rainfall varies from 150 cm to 160 cm and the soil type is mostly sandy clay soil and alluvial soil (BM, 2015) .According to planning commission agro-climatic zones and sub-agro climatic zones, Bansberia is located in the lower Gangetic plain region (III). According to Indian Council for Agricultural Research (ICAR), the agro ecological sub region for Bansberia experiences a hot sub humid (moist) to humid climate and is located in the Bengal and Assam plains. (NICRA-ICAR, 2010).

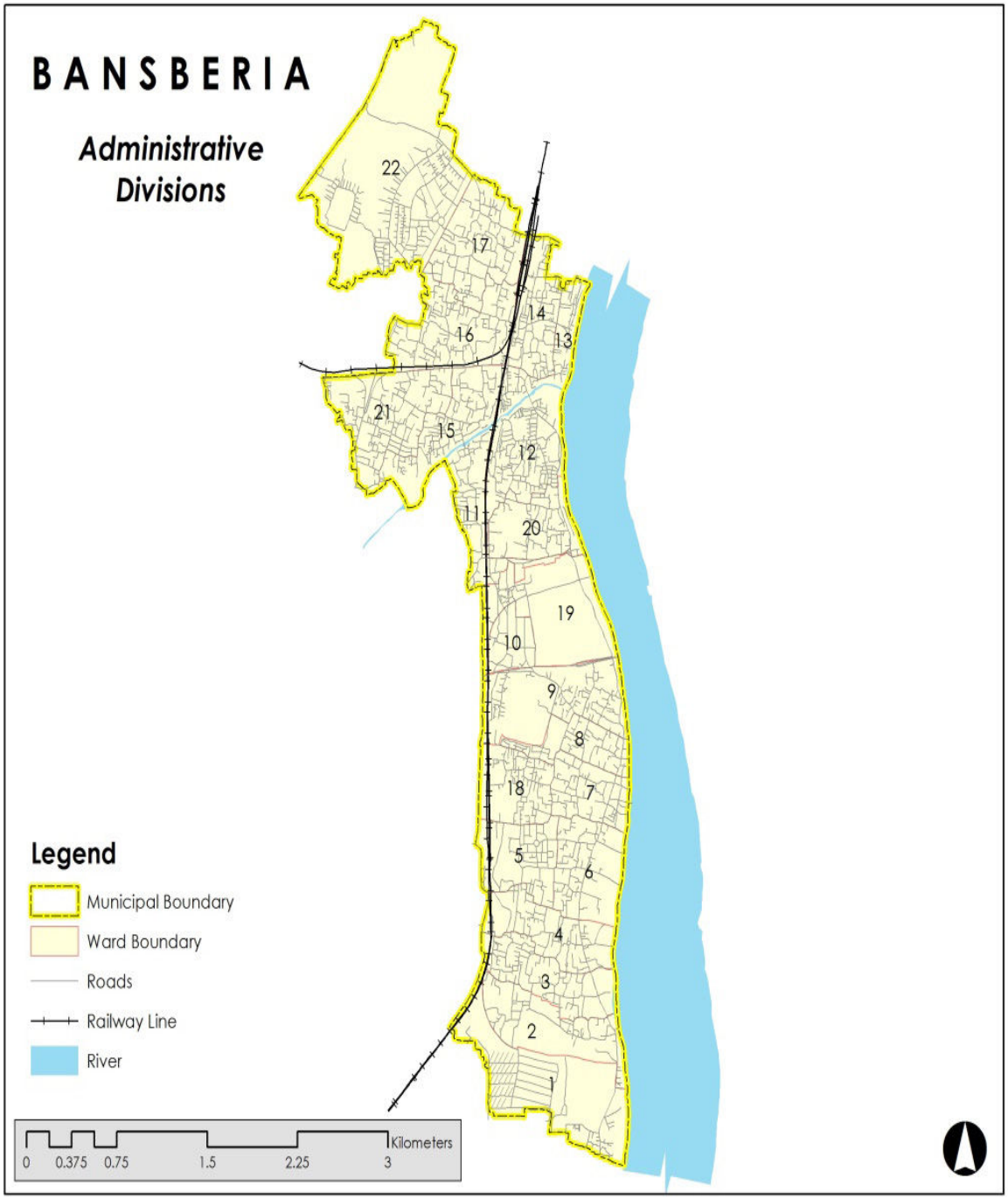

Figure 1: Ward map of Bansberia (Source: CSE, 2017)

2 Service outcomes

The analysis is based on data available from published/unpublished reports and sample household survey. Data collected from secondary sources are triangulated in the field based study. Data on the containment are available in Census, 2011. Data have been cross-checked and updated by Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). According to the SFD promotion initiative (PI) definitions of sanitation systems, the types of containments prevalent in the wards are examined through sample survey (Table 2). Data on emptying, transport, treatment and disposal of FS are collected through KIIs with ULB, 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 the table below.

Table 2: Sanitation technologies and corresponding percentage of population

S. No.	Sanitation technologies and systems as defined by:		SFD Reference Variable	Percentage of Population
	Census of India	Sanitation systems defined by SFD Promotion initiative		
1.	Piped sewer system	User interface discharges directly to centralized separate sewer	T1A1C6	5.7
2.	Septic tank	Septic tank connected to open drain or storm sewer	T1A2C6	33.9
3.	Other systems	User interface discharges directly to open ground	T1A1C8	1.1
4.	Pit latrine with slab	Lined pit with semi-permeable walls and open bottom, no outlet or overflow, general situation	T1A5C10	39.7
5.	Pit latrine without slab	Unlined pit no outlet or overflow, general situation	T1A6C10	0.2
6.	Night soil disposed into open drain	User interface discharges directly to open drain or storm drain	T1A1C6	0.1
7.	Service latrine	User interface discharges to “don’t know where”	T1A1C9	0
8.	Public latrine	Septic tank connected to open drain or storm sewer	T1A2C6	16.6
9.	Open defecation	Open defecation	T1B11C7 to C9	2.7

Source: Census of India, 2011

2.1.1 Sanitation facilities

This section presents on existing sanitation facilities: community/public toilets, institution, industries and commercial establishments.

Community/public toilets: There are two public toilets present in Bansberia. The public toilet situated near *Hanseswari* and *Basudev* Temple in ward no.8 was constructed under the Kolkata Metropolitan Development Authority under the project of the Ganga Action plan in 1986. The pay and use public toilet charges a user fee of INR 2 (USD 0.03) for a urinal use, INR 4 (USD 0.06) for toilets and INR 5 (USD 0.08) for a lavatory use and are currently being

maintained by BM. The containment system present in the public toilet is a septic tank of size 15ft x 7ft x 8ft (4.5m x 2.1m x 2.4m) and is connected to an open drain which further opens into a water body.

Institutions and commercial establishments: Bansberia city has small markets, hence people go to neighbouring areas where bigger markets are available for trade and commerce. The commercial establishments do not have individual toilets in shops. Public toilets are not present in the market area except at one location. However, people are dependent on either household toilets or practice open defecation (BM, 2016) . Institutional establishments have toilet facility connected to septic tank which is further connected to soak pit or 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.

2.1.2 Containment

There is no sewerage network present in Bansberia. The town has been declared as an open defecation free town in August 2016 (BM, 2016) . According to Census, 2011, 91.6% population uses OSS, 5.7% population uses offsite sanitation system and 2.7% population practice open defecation. But according to field observation, KIIs and FGDs, 100% population depends on OSS as there is no offsite sanitation system present in Bansberia. The OSS includes septic tanks and pits.

The most prevalent containment system found is twin-pit system with semi-permeable walls and open bottom which is used by around 72% population according to the sample household survey. The diameter of the pit ranges from 2.50ft (7.6m) to 3ft (0.9m) and the depth ranges from 8ft (2.4m) to 15ft (4.5m). The septic tanks constructed do not adhere to the design prescribed by Bureau of Indian Standards (BIS). The effluent (it is called supernatant if it goes into open drain) from the septic tank flows into soak pits or open drains. The average size of the septic tank in Bansberia is 3ft x 4ft x 6ft (0.9m x 1.2m x 1.8m). The WW and residential septage from the jute mill (in ward no.10, 11 and 19) get discharged directly into the drains which further terminate into Hooghly River. The Jute mill area does not fall under municipal jurisdiction. The containment system in these 3 wards is considered to be lined pit with semi-permeable walls and open bottom.

Figure 2: Septic tank connected to soak pit (Source: Aishwarya/CSE, 2016)

Figure 3: Twin pit latrine (Source: Anil/CSE, 2016)

2.1.3 Emptying

Emptying service is provided only by the municipality and there are no private emptiers in town. There is only one vacuum tanker for emptying which has two tankers each with 2,000 litres capacity. An application form must be submitted by a resident to the BM to avail the emptying service. The form is available by paying a minimal charge of INR 2 (USD 0.03) at the municipality office. The emptying fee is charged on the basis of containment size. The sanitary inspector sends an official for inspection to find out details about the containment system in the house. If the house has the containment system of a pit latrine with 15 rings, INR 400 (USD 5.86) is charged. This applies if the hose pipe length used for emptying service covers a distance of 50 ft (15.2m). For an increase in hose pipe length by 50ft (15.2m), an additional INR 50 (USD 0.76) is charged. For a septic tank with a capacity of 250cu.ft (7m^3), INR 500 (USD 7.65) is charged. INR 100 is charged extra for an additional 100 cu.ft (2.8m^3) (BM, 2016).

The emptying fee is not the same for all the residents as it depends on two factors. One is the type of containment system and second is whether the OSS belongs to HH in the category of Above Poverty Line or Below Poverty Line. Personal protective equipment is not used by workers while emptying thereby causing high risk to health (BM, 2016).There have been no instances of manual emptying reported.

Figure 4: BM vacuum tanker used for emptying septic tank/twin pit system (Source: Anil/CSE, 2016)

2.1.4 Transportation

FS is transported by a tractor mounted vacuum tanker to the treatment plant named Greenery Bio-compost and Animal Farming (GBAF) Pvt.Ltd. where the faecal waste is dried on a sludge drying bed and converted into bio compost. The vacuum tanker usually covers a distance of 5 km per trip and the average no. of trips made in a day are three. A pump of 5HP is assembled with the tanker for suction of septage from OSS (BM, 2016) . The supernatant from the septic tank connected to open drain is discharged into a field or a water body without any kind of treatment.

Figure 5: Tractor-mounted vacuum tanker (Source: Anil/CSE, 2016)

Figure 6: Suction pump of 5HP assembled with the tanker (Source: Anil/CSE, 2016)

2.1.5 Treatment

The FS emptied is taken to the treatment facility which is functional and located within the municipality. The treatment facility is a joint venture project of BM on PPP model with GBAF Pvt. Ltd. GBAF is a private organization in Bansberia which treats FS and converts it into bio-compost. Almost 100% of the faecal waste generated in the city is given to the treatment plant for production of manure (GBAF, 2016) . The capacity of this treatment unit is around 1,500 metric tons/yr, around 300-400 tons of FS is collected from the city every year. The treatment plant is spread over an area of 2.75 ha and the technology used is sludge drying

beds. The septage and WW generated from the jute mill wards (ward no 10, 11 & 19) get directly discharged into drain and further into the river without getting treated in the treatment plant. However, there is no treatment of supernatant liquid which is either discharged into River Ganga or contaminates the ground water through seepage. The treatment process is described in steps in Appendix 7.8.

2.1.6 Disposal

100% of the septage emptied each day is disposed into treatment plant only. Serious action is taken by municipality if septage is discharged anywhere else. Connecting the outlet of septic tank into open drains is discouraged by municipality. Official notification from municipality is issued if someone is found doing so, then he/she will be punished as per norms (BM, 2016).There is no separate treatment facility for liquid (separated from septage) at treatment plant, this liquid gets majorly evaporated (GBAF, 2016) . As per our field observations, there might be some seepage of liquid component coming out from the sludge drying beds which find its way into the Hooghly River passing just behind the plant.

Figure 7: Discharging of septage at FSTP facility (Source: Anil/CSE, 2016)

Figure 8: WW conveyed through big drain (Source: Aishwarya /CSE, 2016)

Figure 9: WW discharged into the Hooghly river (Source: Aishwarya/ CSE, 2016)

2.2 SFD matrix

The SFD matrix is shown in Appendix 7.7 and the final SFD for Bansberia is presented in Appendix 7.3.

2.2.1 SFD matrix explanation

Definition and estimation of different variables to make the SFD are shown in Table 3 and 4.

Table 3: Description of variables used for defining containment systems

S.No.	Variables	Description (city context)	Percentage of population
1.	T2A2C5	Septic tank connected to soak pit, where there is significant risk of groundwater pollution because of the high ground water table	20%
2.	T1A2C6	Septic tank connected to open drain or storm sewer	4%
3.	T1A3C10	Fully lined tank(sealed), no outlet or overflow	4%
4.	T2A5C10	Lined pit with semipermeable walls and open bottom, no outlet or overflow, where there is a "significant risk" of pollution. (2-pit and 1-pit system)	72%

Source: CSE, 2017

Table 4: Description of variables used in SFD

Types of Sanitation systems	Variable Technology	Description with respect to city context	Percentage of Population
Offsite	Not applicable (Since the town does not have an offsite sanitation system)		
Onsite	FS contained	FS from the onsite sanitation technology, (T1A3C10) where the FS is contained in the system and does not contaminate the environment or groundwater.	4%
	FS not contained	FS from the onsite sanitation technology (T2A2C5, T1A2C6, and T2A5C10), where the depth of ground water is low and there is a significant risk of groundwater contamination or the system is connected to open drain and SN pollutes the environment.	94%
	FS contained-emptied	FS which is emptied from the containment systems, where FS is contained. (Assumption made that 90% FS is emptied from a given containment system)	4%
	FS contained-not emptied	10% FS which does not get emptied from the containment systems, where FS is contained.	1%
	FS not contained-emptied	FS is emptied from the onsite sanitation technology (T2A2C5, T1A2C6, and T2A5C10) using the motorized emptying equipment.	43%
	FS not contained-not emptied	FS from the OSS (T1A2C6, T2A2C5, T2A5C10) which gets infiltrated and the 10% FS which remains in the containment system during the emptying process from the OSS (T2A2C5, T1A2C6, T1A3C10, T2A5C10)	51%
	FS delivered to treatment plant	FS that is delivered safely to the treatment plant at Greenery bio-compost and animal study Pvt.Ltd.	47%
	SN not delivered to treatment plant	Supernatant from the onsite sanitation technology (T1A2C6) that is discharged to the environment (to an open drain, to a water body)	2%
	FS treated	FS that gets treated at the treatment plant and gets converted into bio compost.	28%
	FS not treated	FS (the liquid portion) which does not get treated at the treatment plant and is discharged either into water body	19%
Open defecation	It is an open defecation free town		

Source: CSE, 2017

Offsite sanitation system

According to Census 2011, 5.8% of the city is dependent on offsite systems of which, population connected to sewer line is 5.7% and user interface discharging directly into open drain or open ground is 0.1%. But from the field survey conducted, it was observed that there is no offsite sanitation system present in the city.

Onsite sanitation system

According to Census 2011, 94.2% population is dependent on onsite sanitation systems of which, 33.9% use septic tanks and 39.9% use pits, and 16.6% use public latrines.

The OSS is divided into two categories. The containment system in which FS is contained and one in which FS is not contained. FS is considered not contained in Bansberia when the FS infiltrate pollutes the high ground water table or if the supernatant from the septic tank connected to open drain is disposed into the open drain. In Bansberia, the septic tank connected to open drain is used by 4% population. There is no clear differentiation between the volume of SN and solid FS generated from septic tank connected to open drain, hence to reduce maximum error it is assumed to be 50% each, therefore, the SN is 2%.

FS not contained is attributed to 94% population who use the systems: septic tank connected to soak pit (20%), lined pit with semi-permeable walls and open bottom (72%) and septic tank connected to open drain (2%). FS contained is attributed to 4% population who use fully lined tank with no outlet.

In the FS not contained systems, 50% is considered as solid FS and 50% is considered as the liquid FS component (infiltrate). 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 the 94% FS not contained, 47% is considered as the liquid component (infiltrate) and 47% is the solid FS. Out of the 47% solid FS (not contained), 43% is emptied (32.4% from lined pit with semi-permeable walls and open bottom + 9 % from septic tank connected to soak pit +1.8 % from septic tank connected to open drain) leaving behind 4% FS which is not emptied. The 47% infiltrates together with the 4% FS which is left behind in the containment system constitute the 51% FS not contained- not emptied. The FS contained- emptied which is attributed to less than 4% population along with 43% FS not contained -emptied together constitutes around 47%, which gets delivered to the treatment plant. Assuming that 60% is treated out of the 47% FS which is delivered to the treatment plant, it is observed that 28% FS gets treated and 19% FS is not treated. Overall, 28% FS is safely managed and 72% FS (51% FS not contained- not emptied + 2% SN not delivered to treatment plant + 19% FS not treated) in unsafely managed.

There is 1% error, seen in the SFD graphic which shows 1% FS contained –not emptied. This represents 10% of the 4% FS from containment system where FS is contained, i.e. Fully lined tank(sealed), no outlet or overflow.

Open defecation

According to Census, 2011, 2.7%, population practices open defecation. But after field survey, it was learnt that Bansberia has been officially declared as an open defecation free city.

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. If the risk of contamination to groundwater is low, the FS is considered contained. The type of onsite sanitation technology in use also has an influence on the infiltration of liquid into groundwater and therefore on the potential risk of groundwater pollution.

The static water level is around 35- 45 ft (10.6 - 13.7m) and the sub soil water level is 15-20 ft (4.5 - 6.0m) (BM, 2016). Based on the survey with the households and KIIs in Bansberia, it was decided to characterize all the existing sanitation containment systems as having a high risk of groundwater pollution. BM comes under the Chinsura- Mogra block of West Bengal which is 2.39 metres below mean sea level. The post monsoon hydraulic head over there was recorded as 0.35-2.11 meters (CGWB, 2014). According to Census, 3.7% population receives treated drinking water from bore well or tube well and 91% population receives drinking water from surface water. The surface water is treated before supply.

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 (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 provided by secondary sources.

The Census mostly differentiates 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 waste water 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 9 wards considering 4-5 households per ward. Although a very small sample was considered to represent the whole city, the households surveyed were a good mix of planned and unplanned areas and different socio-economic backgrounds.

The assumption regarding the volume of FS emptied as compared to the FS generated has a high impact on the overall SFD.A reliable method for estimating quantities of FS generated on a citywide scale does not exist, and it is complicated because the containment size and emptying period greatly vary within the city.

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 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 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 to 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. Out of 100% of the population, 20% population dependent on septic tank connected to soak pit and 72% population dependent on lined pit with semi-permeable walls with an open bottom are attributed to be FS not contained. 4% population dependent on fully lined tank with no outlet is attributed to be FS contained. 4% population dependent on septic tank connected to open drain is attributed to be FS contained.

The only difference suggested in the context-adapted SFD is at containment stage for correctly designed septic tanks, changes from 4% to 6% and ‘SN not contained’ remains 2% when compared to SFD generated though connected to open drains. Hence in the context-adapted SFD ‘FS not contained’ changes from 94% to 92%, ‘FS contained’ through graphic generator.

An assumption is made that 50% of the proportion of the content in a septic tank is solid FS, and rest of the 50% is supernatant. Hence, both supernatant and faecal sludge attribute to 2% population each, out of the 4% population who use septic tank connected to open drain. According to SBCLTF, the solid FS present in the septic tank connected to open drain (attributed to 2% 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 6% population is considered contained (represented in green colour). 5% FS contained is emptied and the remaining 1% FS remains in the tank and does not get emptied.

Overall, the excreta of 72% population are not safely managed according to the context-adapted SFD. The graphic is well received by the stakeholder's group and city’s authority has agreed that the context adapted SFD graphic represents a much closer picture of the ground conditions.

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 the Ministry of Urban Development (MoUD) issued the National Urban Sanitation Policy (NUSP). 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 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, 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 Swachh Bharat City Level Task-force (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 to (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 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). Building Byelaws 2016 is used to regulate coverage, height, building bulk, and 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:

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).

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).

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. 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 commission, 2002).

National Council for Rejuvenation, Protection and Management of River Ganga referred as National Ganga Council formerly known as National Ganga River Basin Authority (NGRBA) is the implementation wing of National Mission for Clean Ganga (NMCG), which was constituted under the provisions of the Environment (Protection) Act (EPA), 1986. The council aims at ensuring effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectorial co-ordination for comprehensive planning and management, maintenance of minimum ecological flows in the river Ganga with the aim of ensuring water quality and environmentally sustainable development (NMCG, 2011).

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 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 Bansberia is governed by various institutions. The following are the institutions responsible for policy making, service provision and regulation of urban services:

Table 5: Institutional roles and responsibilities

Institutions	Roles and responsibilities
Urban Development Department	Administrative and financial management of municipalities, implementation of development programmes, policy formulation, preparation of municipal laws, monitoring and evaluation of programmes and external funding agencies.
State Water Investigation Directorate	To carry out investigation, quantitative & 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)	SUDA was set up in 1991 with a view to ensuring proper implementation and monitoring of the centrally assisted programmes for generating employment opportunities and alleviation of poverty throughout the State.
West Bengal Pollution Control Board (WBPCB)	WBPCB 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.
Public Health Engineering Department	Controls the water supply & sanitation budget of the state government and undertakes programmes of implementation of water supply and sanitation services mainly through Public Health Engineering Directorate under its administrative control.
State Programme Management Group	It is an implementing arm of NMCG in the state. Coordinates and oversee the implementation of projects sanctioned by Government of India under NGRBA. Takes all such action and to enter all such actions as may appear necessary or incidental for the achievements of the objectives of the NGRBA.
Bansberia Municipality BM	Overall management of the civic services in the city. Public sanitation, solid waste management, public health and education.

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 O&M (NIUA, 2005). Some of the larger cities have developed municipal water and sanitation utilities that are legally and financially separated 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 even 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).

The Intra-Municipal Infrastructure Improvement Plan is the backbone on which the scope for better municipal service stands in Bansberia. It includes the infrastructure projects and services at the ULB level which are either wholly located within a ward or cut-across more than one ward but are entirely located within ULB boundaries. The infrastructure services provided by the municipality include drinking water supply, sewerage and sanitation, drainage and solid waste management among the many other facilities (BM, 2015).

In Bansberia, water supply and sanitation department is in charge of the various water and sanitation services provided in the city. A Sanitary Inspector has been appointed in the municipality to look after the sanitation services being provided and maintain data pertaining to sanitation (Sanitary, 2016).

3.1.5 Service standards

1. Service Level Benchmarks (SLB), 2008: Issued by the Ministry of Urban Development in 2008, the SLB seeks to (i) identify a minimum set of standard performance parameters forth 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 and (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 ULBs in providing urban services.
2. General Standards for Discharge of Environmental Pollutants Part-A: Effluents-The Environment (Protection) Rules, 1986 (Schedule VI): Issued by, Central Pollution Control Board, 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, a national standard setting body of India. 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. SBM-Urban aims to eliminate open defecation (OD) by the year 2019, eradicate manual scavenging, capacity augmentation of ULBs and generate awareness about sanitation and its linkage with public health. The SBM (urban) aims to ensure that no new insanitary toilets are constructed during the mission

period and that pit latrine 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 (OD), remaining 20% of households practising (OD) 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 latrine. Service delivery targets in accordance with SLBs (MoUD, 2014).

Table 6: Service delivery targets in accordance with SLBs

Sanitation service chain	Parameter	National benchmark	Time frame 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, 2008)

The Intra Municipal Infrastructure Improvement Plan (IMIIP) under the City Development Plan (CDP) of Bansberia aims to provide drinking water supply, storm water drainage among many other services. Table 7 shows information on the percentage of the covered area which is provided with the above-mentioned services.

According to rapid assessment of FSM in city done by BM, they would need eleven emptying trucks, which will improve the emptying services provided by them. Each vehicle is expected to complete 2 trips per day with an average distance of round trip being 10 km. It has also proposals for septage treatment facilities for next 5 years as the current FSTP only treats the sludge and not the liquid component of FS.

Table 7: Service delivery progress in accordance to IMIIP

S.No.	Name of main service area	Percentage of covered area out of total municipal area	Areas to be improved
1.	Drinking water supply	95	Replacement of old pipe lines, maintenance pump house, O&M overhead reservoir
2.	Storm water drainage	90	Kaccha drain to be upgraded to Pucca drain

Source: BM, 2015

3.2.2 Investments

Under Mission *Nirmal Bangla*, INR 76, 78,390 (0.12 million USD) has been invested for the construction of latrines by the state government (Sanitary, 2016) . Under SAAP, the total funds estimated for water supply is INR 76.5 crores (11.59 million USD) and the total funds estimated for building a sewerage system is INR 155.88 crores (23.62 million USD) for the

city. The municipality receives funds from the central and state government for various planning and infrastructural developments. Table 8 depicts the funds from 14th Finance Commission and SBM which have been allocated during 2013 – 2019.

Table 8: Funds allocated under central grants & schemes

S.no.	Source of fund	Funding agency	Fund received (INR in lakh) (2013-14)	Proposed allocation of fund in 5 years (INR in lakh) (2014-15 to 2018-19)					Total (INR in lakh)
				Allocation of fund for 14-15 and 15-16		Proposed allocation of fund for 3 years			
				14-15	15-16	16-17	17-18	18-19	
1.	14th Finance Commission Grant	GoI	64.16	129.5	320	320	320	320	1,409.5
3.	SBM	GoWB	-	-	301.5	279.2	279.2	279.2	1,139.1

Source: BM, 2015

As per the rapid assessment of FSM in city done by BM, the budgetary provision required for capital expenditure for FSM is INR 6,181.53 lakh (9.37 million USD). Whereas, the O&M cost associated with the emptying services and treatment operations is estimated to be INR 2,109.87 lakh (3.19 million USD) for 5 years (MoUD, 2016). Further details of CAPEX and OPEX have been provided in table 9.

Table 9: CAPEX and OPEX for FSSM

S.no	Component	CAPEX	OPEX	TOTAL
		INR in lakhs		
1.	Faecal Sludge Management	1,491.42	1,510.49	3,001.91
2.	Liquid Waste Management	4,690.11	599.38	5,289.49
3.	FSSM Total	6,181.53	2,109.87	8,291.40

Source: MoUD, 2016

Table 10 shows various initiatives taken by the central and state government in the field of water and sanitation.

Table 10: Various initiatives taken in the field of water and sanitation by the Government

S. No.	Nature of work	Proposed	Period						
		GoI	2014-15 (Year-1)			2015-16 (Year-2)			Year 1 and Year 2
		Scheme	Capital exp (INRin lakh)	O& M cost (INRin lakh)	Total (INRin lakh)	Capital exp (INRin lakh)	O& M cost (INRin lakh)	Total (INRin lakh)	Total (INRin lakh)
1.	Construction of 2,100 low cost sanitary latrines	SBM	5.28	0.72	6	8.8	1.2	10	16
2	Construction of 10 community toilet	Housing for All (HFA)	7.92	1.08	9	13.2	1.8	15	24

3	Construction of 10 Nos. of Community toilet	SBM	12.67	1.728	14.4	21.12	2.88	24	38.4
4.	Construction of total 25 km. pucca drain	HFA	26.8	3.65	30.45	44.66	6.09	50.75	81.2
5.	Construction 5 km High drain	AMRUT	21.56	2.94	24.5	35.86	4.89	40.8	78.8
6.	Construction of 16 km drainage network	AMRUT	42.94	5.856	48.8	71.5	9.75	81.3	130.1

Source: BM, 2015

3.3 Reducing inequity

3.3.1 Current choice of services for the urban poor

The slum population of Bansberia is 38,604 which is 37.19% of the total population (Census, 2011). There are 118 slums, 88 are notified and 30 are not. 98% of the slum residents have their own individual toilets with twin/single pit system which is built under the SBM and state scheme Mission *Nirmal Bangla*. The remaining 1-2% residents use community toilet. There is no practice of open defecation. 75% of containment systems in slums are pit latrines and the remaining 25% are septic tanks (BM, 2015).

Figure 10: Slum in Bansberia (Source: Anil/CSE,2016)

The municipality provides emptying services in slums as well. Access to toilets is not a problem for the slum dwellers, however; grey water management is missing in slums. Hence, most often the grey water finds its way into the nearby water bodies.

3.3.2 Plans and measures to reduce inequity

Pradhan Mantri Aawas Yojna (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 and private sectors; and (IV) Subsidy for beneficiary-led individual house construction or enhancement.

All houses built or expanded under the mission should essentially have toilets facility. The mission has the 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 the convergence of other national or state schemes (MHUPA, 2016).

Under the PMAY/HFA scheme by the Govt. of India, 6191 dwelling units were proposed for the slums out of which 2022 dwelling units have been approved but not sanctioned and 305 dwelling units have been approved as well as sanctioned for the financial year 2015-2016 by SUDA. Under the Housing for Urban Poor scheme, 36 houses have been approved and sanctioned by SUDA. Under the state scheme *Geetanjali*, 37 houses have been approved and sanctioned by the District Magistrate. Under these schemes, the slum dwellers will be provided with the facility of toilet connected to twin pit system, water supply, drainage and roads.

Table 11: Schemes and proposals for slum dwelling units

S.no	Scheme name	Proposal for no of dwelling units	Approved & not sanctioned	Approved and sanctioned
1	HFA	6,191	5,886	305
2	Housing for urban poor	36	-	36
3	Geetanjali	37	-	37

Source: BM, 2016

3.4 Outputs

3.4.1 Capacity to meet service needs, demands and targets

ULB has insufficient financial resources to provide basic sanitation services. Municipal expenditures in India account for 1.1% of the country's GDP, compared to 6.9% in South Africa and 9.7% in Switzerland. ULBs, therefore, rely mainly on national or state grants (CGWB, 2015). In the context of Bansberia, the major source of income (both revenue and capital) is through grants from Finance Commission, HFA and *Geetanjali* Scheme and the remaining is generated through taxes and user charges. BM also receives funds for sanitation infrastructure development from SBM. There is a shortage of human resource witnessed in BM.BM consists of 137 permanent employees and 415 employees on contract. There is a shortage of 166 permanent employees in the municipality (BM,2016).

3.4.2 Monitoring and reporting access to services

Data on service levels should be collected, documented and reported to MoHUA 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 BM occasionally carry out site inspections to check the quality of emptying services. The sanitary inspector is supposed to inspect the design of septic tanks and their adherence to standards at the time of construction, but due to shortage of staff, it is missed out many times. The BM also takes serious action against discharging of supernatant to open drain. Official notification is released for the same (BM, 2017).

Table 12 depicts the total number of pits and septic tanks which have been emptied from 2014 to 2016 and the revenue generated during this period.

Table 12: Revenue generated from the pits/septic tanks emptied during 2014-2016

SL. No	Year	No. of tanks/ pits emptied	Revenue generated (INR)
1.	2014- 2015	531	2,65,500 (3982 USD)
2.	2015- 2016	513	2,56,500 (3847 USD)

Source: BM, 2016

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 Open Defecation Free (ODF) - mainstreaming effective FSSM by key decision makers and NFSSM alliance members.

AMRUT, a mission to provide basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities to improve the quality of life for all. The cities are required to submit Service Level Improvement Plan (SLIP) documents (includes details on funding of specified projects by ULB) to the state. The state then prepares State Annual Action Plan (SAAP) document compiling all the details given in SLIPs. SAAP will then be forwarded to the MoHUA for sanction of funds. It has been decided to divide the projects into two phases.

Bansberia is one of the flagship cities and has undergone the assessment and it is covered under the AMRUT programme. The SAAP, produced 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. The basic building block of SAAP is SLIP (SMD, 2015).

National Mission for Clean Ganga, develop such infrastructure or make such infrastructure functional, as the case may be, for collection, storage, transportation and disposal of sewage in the territorial area of the local authority through its *Namami Gange* programme- an integrated Ganga conservation programme (NMCG, 2011). Under this mission, 118 towns have been identified as priority towns for the interventions near the main stem of Ganga. Bansberia city is one of the cities listed in 118 urban habitations.

Nirmal Dhara is proposed under *Namami Gange* Programme – an initiative ensuring sustainable municipal sewage management. The programme plans for (NMCG, 2011):

- Project prioritization in coordination with MoHUA.
- The incentive for states to take up projects on Ganga main-stem by providing an additional share of central grants for sewerage infrastructure.
- Uniform standards for both MoHUA scheme and *Namami Gange programme*, 10 years mandatory O&M by the same service provider at par with NGRBA programme and Public- Private Partnership (PPP), mandatory reuse of treated water.
- Expanding coverage of sewerage infrastructure in 118 urban habitations on banks of Ganga- estimated cost by MoWRRD & GR is INR 51000 crores (0.77 Billion USD).

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 the local environment.
- Capacity building of ULB staff on septage management.
- Skill development for local masons and plumbers.
- Monitoring and regulation of private emptiers.

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 centralized) must coexist 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.

The municipality provides the emptying services and they are also responsible for operation and maintenance of public toilets and community 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 (only 1 tanker at present) 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, call and fax prior to the visit to the city. The purpose of the SFD study and depth of data required were conveyed through an introductory letter to respective departments. A total of 5 KIIs were conducted with the government functionaries, emptiers, transportation and treatment facilitators and local masons

Limited information was available prior to the field based research about the type of containment, emptying service, transportation and disposal point for sewage generated in the city. The visit enabled in enhancing data collection through gathering progress details of SBM and similar schemes implied in Bansberia. Interview with BM and other stakeholders provided additional insight into the service delivery context.

4.2 Field observations

A field visit was undertaken to understand the emptying process and identify disposal point of both sewage and septage. During the emptying process, it was observed that the price charged for emptying starts from INR 400 (USD 6.13) and it differs from one household to another, depending on whether the HH belongs to the category of Above Poverty Line or Below Poverty Line. Unlike many other towns in West Bengal, Bansberia is unique as it has its own faecal sludge treatment facility.

Information on the OSS in the three wards (ward no.10, 11 and 19) in Bansberia has not been obtained clearly as these three wards are not in the jurisdiction of municipality any more. The three wards are primarily only for the staff and workers of jute mill which has a population of about 15,000 and are administered by jute mill owners. Lined pit with semi-permeable walls and open bottom are common containment systems in this area. They have their own emptying vehicles which discharge septage into open drains that are connected to Hooghly River, flowing next to the settlement (BM, 2016).

4.3 Focus group discussions

The FGDs were conducted to complement, validate and challenge the data collected during literature review and interviews. The FGDs were held with emptying service providers and local masons. The questionnaires for FGD were prepared in English, but the interviewer asked the questions, in Hindi (local language).The findings from the FGD have revealed information that increased the understanding of the sanitation and septage management in Bansberia. FGDs were useful in data triangulation. The sample survey helped in validating the secondary data provided by different stakeholders. In total five FGDs were conducted, each conducted with the ward councillors, transport and emptying service providers, BM staff, slum dweller representatives and SBCLTF members. Stakeholders were identified and the task force was formulated and notified under the mandate by NUSP (refer appendix 7.9 for more details).

5 Acknowledgements

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7 Appendix

7.1 Stakeholder identification

Table 13: Stakeholder identification

S. no.	Stakeholder group	In Bansberia context
1.	City Council/ Municipal authority/Utility	Bansberia 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 Agency
5.	Ministries in charge of environment protection	Environment Department
6.	Ministries in charge of health	PHED
7.	Service provider for construction of onsite sanitation technologies	Local masons
8.	Service provider for emptying and transport of faecal sludge	Bansberia Municipality
9.	Service provider for operation and maintenance of treatment infrastructure	Greenery Bio-compost and Animal Farming Pvt. Ltd.
10.	Market participants practising end-use of faecal sludge end products	Farmers
11.	Service provider for disposal of faecal sludge (sanitary landfill management)	Bansberia Municipality
12.	External agencies associated with FSM services: eg: NGOs, academic institutions, donors	N/A

Source: CSE, 2016

7.2 Tracking of engagement

Table 14: Tracking of engagement

S.no	Name of Organization	Designation	Date of Engagement	Purpose of engagement
1.	BM	Chairperson, Bansberia Municipality	18/10/2016	FGD
1.	BM	Urban Planner	16/10/2016	
2.	BM	Sanitation Inspector	16/10/2016	
3.	BM	Chairman of Council, Water supply &Sanitation	16/10/2016	FGD
4.	BM	Superintendent, Water works	16/10/2016	
5.	Greenery Bio-compost and Animal Farming	Director	17/10/2016	KII
6.	BM	Caretaker of vacuum tankers	17/10/2016	FGD
7	BM	Field In charge of desludging tanker	17/10/2016	
7.	BM	Surveyor	18/10/2016	KII
9.	Private	Local Mason	18/10/2016	KII
10.	Hanseswari temple	Public Toilet Caretaker	18/10/2016	KII
11.	BM	Sub Assistant Engineer	18/10/2016	KII
12.	Slum dweller representatives		18/10/2016	FGD
13.	Ward Councillors		18/10/2016	FGD

Source: CSE, 2016

7.3 SFD graphic

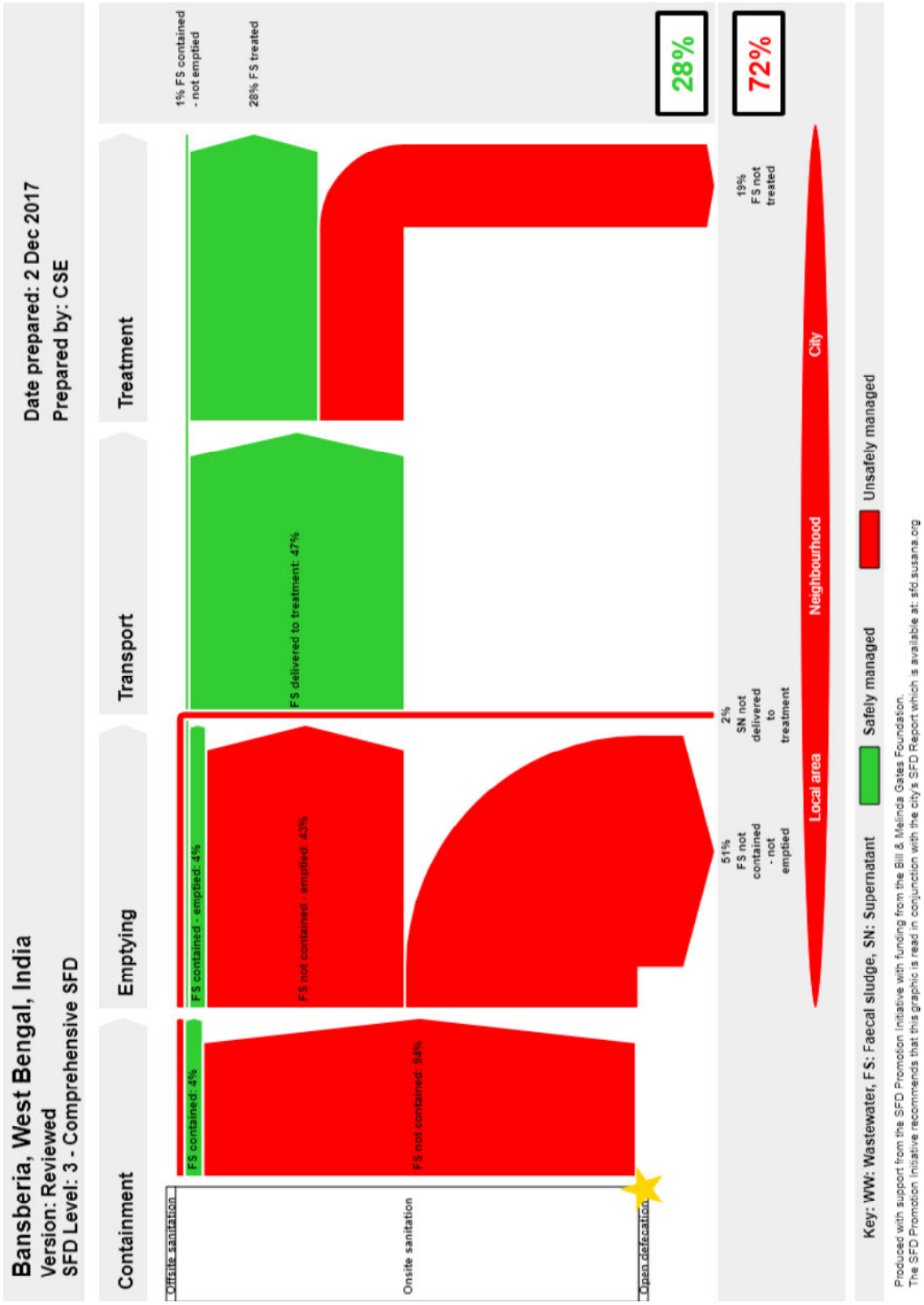

Figure 11: SFD graphic (Source: SFD graphic generator, 2017)

7.4 SFD brief explanation

Table 15: Percentage of the population using each system technology and method

System type	Containment	Emptying	Transport	Treatment and End-use/disposal
Offsite	No offsite system present in Bansberia			
Onsite	T2A2C5: 20% population is dependent on septic tank connected to soak pit where there is a significant risk of groundwater pollution T1A2C6: 4% population is dependent on septic tank connected to open drain or storm sewer T1A3C10: 4% population is dependent on fully lined tank, no outlet or overflow T2A5C10: 72% population is dependent on lined pit with semi-permeable walls and open bottom, no outlet or overflow, where there is a significant risk of groundwater pollution	It is assumed that 90% of FS is emptied during the emptying process leaving 10% FS behind in the system. Since there is no clear differentiation between % of septage and supernatant, it is assumed to be 50% each. FS not contained - emptied comes out to be 43% (32.4% from lined pit with semi-permeable walls and open bottom + 9 % from septic tank connected to soak pit +1.8 % from septic tank connected to open drain) and FS not contained-not emptied becomes 51%. Together they constitute the 94% FS not contained	Since there is a functional treatment plant in Bansberia, the FS which is delivered to the treatment plant comes to be 47%. The 2% SN which is discharged from the septic tank connected to the open drain gets discharged into an open field/water body.	The FS treated comes to be about 28% assuming that 60% of the FS received (47%) is treated and the remaining gets discharged into the river untreated (19%). The total FS managed unsafely comes to 72% (51% FS not contained- not emptied + 2% SN not delivered to treatment plant + 19% FS not treated) All the FS emptied is converted into bio compost and put for sale.
Open defecation	Open defecation Free			

Source: CSE, 2016

7.5 Context-adapted SFD graphic

Figure 12: Context-adapted SFD graphic (Source: SFD graphic generator, 2017)

7.6 SFD Selection Grid

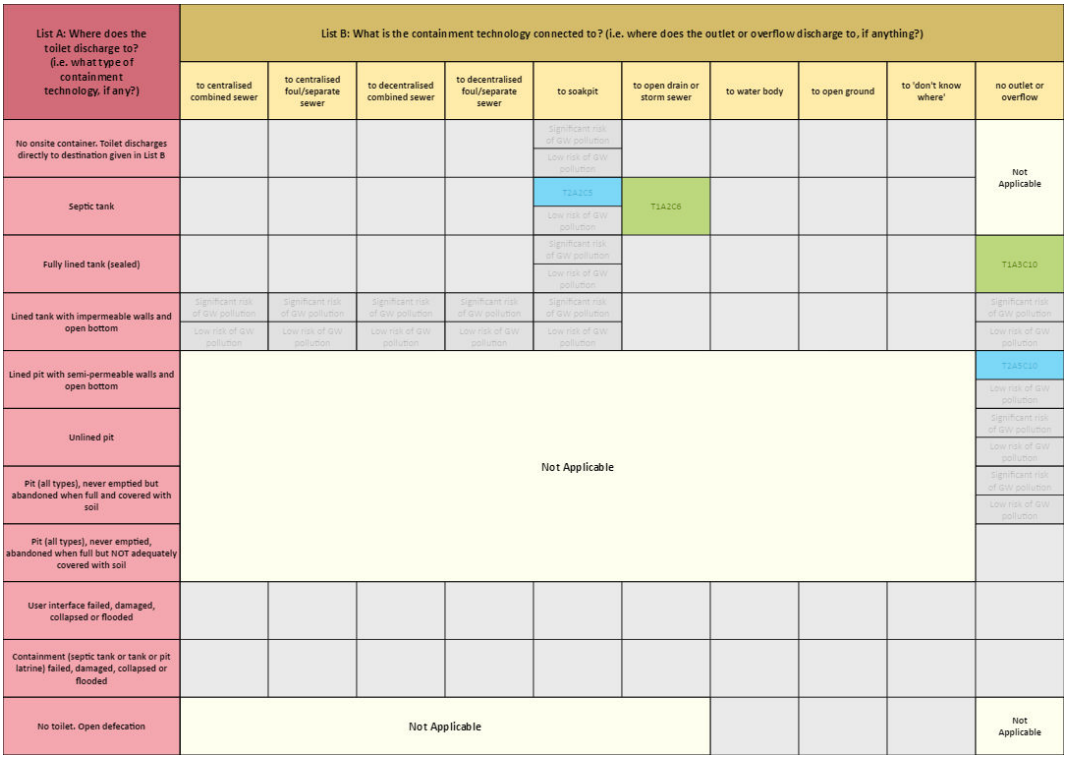

Figure 13: SFD selection grid (Source: SFD graphic generator)

7.7 SFD matrix

Table 16: SFD matrix

Bansberia, India, 02 Dec 2016. Field based study
Population: 103920
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
T2A2C5 Septic tank connected to soak pit, where there is a 'significant risk' of groundwater pollution	20.0	90.0	100.0	60.0		
T1A2C6 Septic tank connected to open drain or storm sewer	4.0	90.0	100.0	60.0	0.0	0.0
T1A3C10 Fully lined tank (sealed), no outlet or overflow	4.0	90.0	100.0	60.0		
Lined pit **T2A5C10** permeable walls and open bottom, no outlet or overflow, where there is a 'significant risk' of	72.0	90.0	100.0	60.0		

Source: CSE, 2017

7.8 Community/public toilets

Table 17: Details of community /public toilets

S.No.	Location of toilet	Public/ Community toilet	No. of Users per day	Ward No	No. of functional toilet seats (for both men and women)				O&M			Toilet connected to
					Men		Women		ULB	PPP	Community	
					Urinal	Seat	Urinal	Seat				
1.	Singh pura	CT	30	17	0	1	0	1	Yes			ST
2.	Nawab Palli	CT	100-150	21		2		5	Yes			
3.	Station Bazaar	CT	40	17	1	1	0	1	Yes			
4.	Sulabh Sancha-Tribeni burning ghat	PT	100	13	5	6	5	6		Yes		
5.	Anjuman Club	CT	40-50	19	3 (No segregation)				Yes			
6.	Jalia Para	CT	20-25	7	2 (No segregation)				Yes			
7.	Dunlop ghat	CT	20	2	1(No segregation)				Yes			
8.	Dunlop bazaar	CT	30-50	1	2(No segregation)				Yes			
9.	Hanseshwari Temple	PT		8	2	1		1		Yes		

Source: BM, 2016

7.9 Process of FS treatment at FSTP

Step 1:

The faecal sludge is collected in drying beds and is dried for around 2-3 weeks. Semi dried sludge consists of 1% nitrogen. In order to increase the nitrogen content, the poultry excreta which has 3% N content are mixed with it (GBFA, 2016).


Figure 14: Sludge drying beds (Source: Aishwarya/CSE, 2016)

Step 2:

Next, lime is added to the sludge in order to kill the pathogens. It takes around 3 weeks to dry this sludge. Once dried, it is stored in sacks for 2 weeks.


Figure 15: Dried faecal sludge stored in sacks of bags (Source: Aishwarya/CSE, 2016)

Step 3:

This dried sludge is then spread out in a small area and kept, for it to receive rainfall for at least a year. Plant growth is visible on this layer of dry sludge after a period of time. Due to its high nitrogen content, it becomes suitable for plant growth and the plants help in maintaining the pH of the sludge around 6.5 -7.

Figure 16: Visible plant growth after a year of rainfall (Source: Aishwarya/CSE, 2016)

Step 4:

A three-layer compost is prepared to form one-half of the bio compost. The above-mentioned dried sludge forms the first layer. Leather ash forms the next layer on top of this and *Kheri* forms the third layer. Leather ash which is high in N & K is the remnant which is formed after boiling the slaughter house leftovers such as animal skin.

Figure 17: Leather ash to be mixed with treated FS (Source: Anil/CSE, 2016)

Step 5:

"*Kheri*" (called in Hindi) forms the third layer on top of the leather ash. Animal blood from the slaughter house, coconut peel mixed with husk and forms *Kheri*. This layer is rich in Iron and calcium apart from the nitrogen present in it. All the three layers are mixed well and kept aside. This forms the faecal compost.

Figure 18: Kheri to be mixed with treated FS (Source: Anil/CSE, 2016)

Step 6:

Alongside the faecal sludge treatment, vermi composting of cow dung and kitchen waste also takes place separately. The vermi compost formed is mixed with the faecal compost and is sieved well. The final product after sieving is called as bio compost. In order to enhance the quality of the bio compost, *neem* (Azadirachtaindica) seed powder is added to it. The cost of the bio compost is RS 850/50kg.

Figure 19: Final product- bio compost (Source: Anil/CSE, 2016)

7.10 List of SBCLTF members

Table 18: SBCLTF list

S.No	Name of the members	Position / Designation
1	Smt Arijita Sil, Chairperson, Bansberia Municipality	Head
2	Honorable MIC Sri Tapan Dasgupta, Government of West Bengal	Honorable Member
3	Sri Aditya Neogy, Vice-Chairman, Bansberia Municipality	Member
4	Sri Subhamoy Banerjee, Chairman-in-Council (Health Education, Electricity) Bansberia Municipality	Member
5	Sri Ranjit Sarkar, Chairman-in-Council (PWD) Bansberia Municipality	Member
6	Sri Amit Ghosh, Chairman-in-Council (Sanitation, Water supply) Bansberia Municipality	Convener
7	Executive Engineer, Municipal Engineering, Hooghly	Member
8	MD Mustafa, Executive Officer, Bansberia Municipality	Member
9	Representative from Zilla Parishad, Hooghly	Member
10	Representative from Ganges jute Mill Pvt Ltd., Bansberia	Member
11	Child Development Project Officer, Bansberia	Member
12	Representative from centre for science and Environment New Delhi	Member
13	Dr Biswajit Banerji, Health Officer, Bansberia Municipality	Member
14	Sri Satayabrata Moulik, SAE, Bansberia Municipality	Member
15	Sri Swapan Kar, Water Works SUPDT, Bansberia Municipality	Member
16	Dr Sudipto Ghosh Urban Planner, Chairperson, Bansberia Municipality	Nodal Officer
17	Sri Amit Bhattacharjee, Sanitary Inspector, Bansberia Municipality	Member
18	Smt Sumita Kumar , Councillor, Bansberia Municipality	Member
19	Representative from Bandel Thermal Power station., Bansberia	Member

Source: CSE, 2017

7.11 Photographs captured during field visit

Figure 20: Sample survey in ward no. 20 (Source: Aishwarya/CSE, 2016)

Figure 21: Sample survey in ward no.11 (Source: Aishwarya/CSE, 2016)

Figure 22: KII with local masons (Source: Aishwarya/CSE, 2016)

Figure 23: FGD with ward councilors (Source: Aishwarya/CSE, 2016)

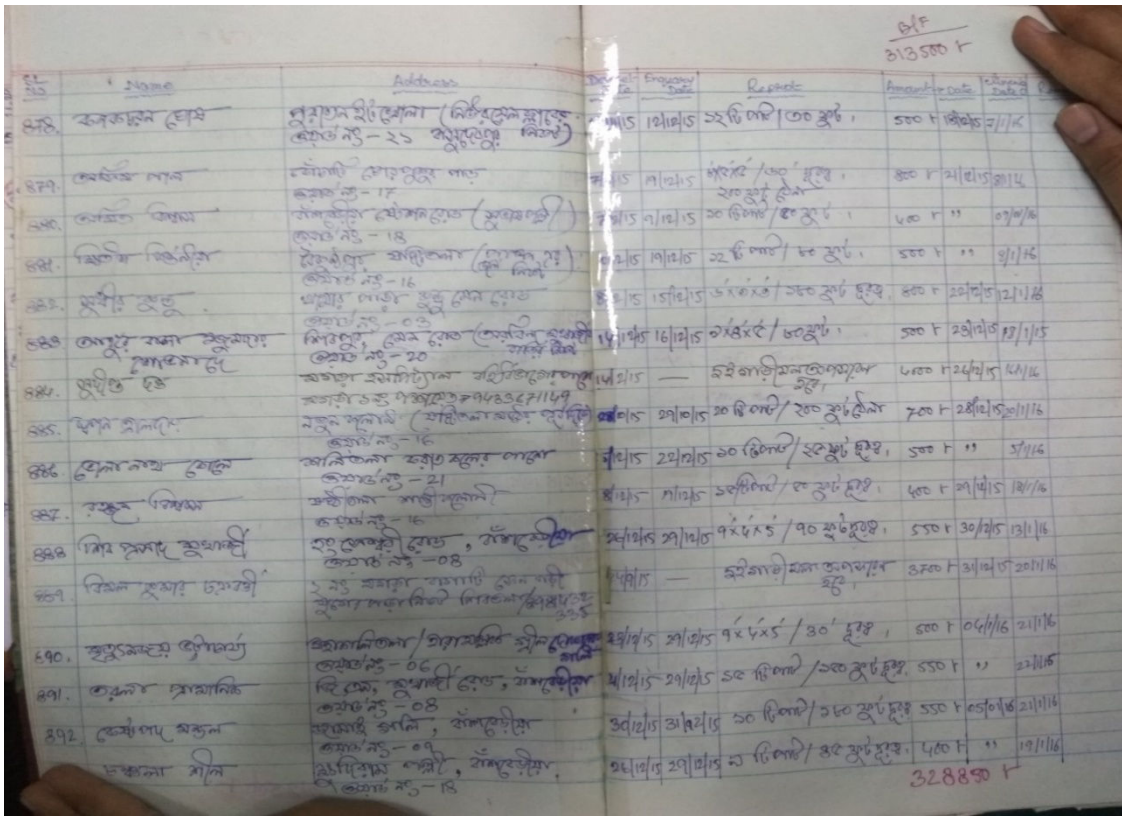

Figure 24: Record book of emptying services (Source: Anil/CSE, 2016)

Figure 25: Sludge drying facility at FSTP (Source: Anil/CSE, 2016)

Figure 26: Market area in Bansberia (Source: Aishwarya/CSE, 2016)

Figure 27: Public toilet connected to ST near Hanseswari Temple (Source: Aishwarya /CSE, 2016)

Figure 28: Sample survey (Source: Aishwarya/CSE, 2016)

Figure 29: Sample survey in ward no 10 (Source: Aishwarya/CSE, 2016)