SFD Report

Faridpur
Bangladesh

Final Report

This SFD Report- Level 2- was prepared by
CWIS-FSM Support Cell, DPHE

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SFD Report Faridpur, Bangladesh, 2023

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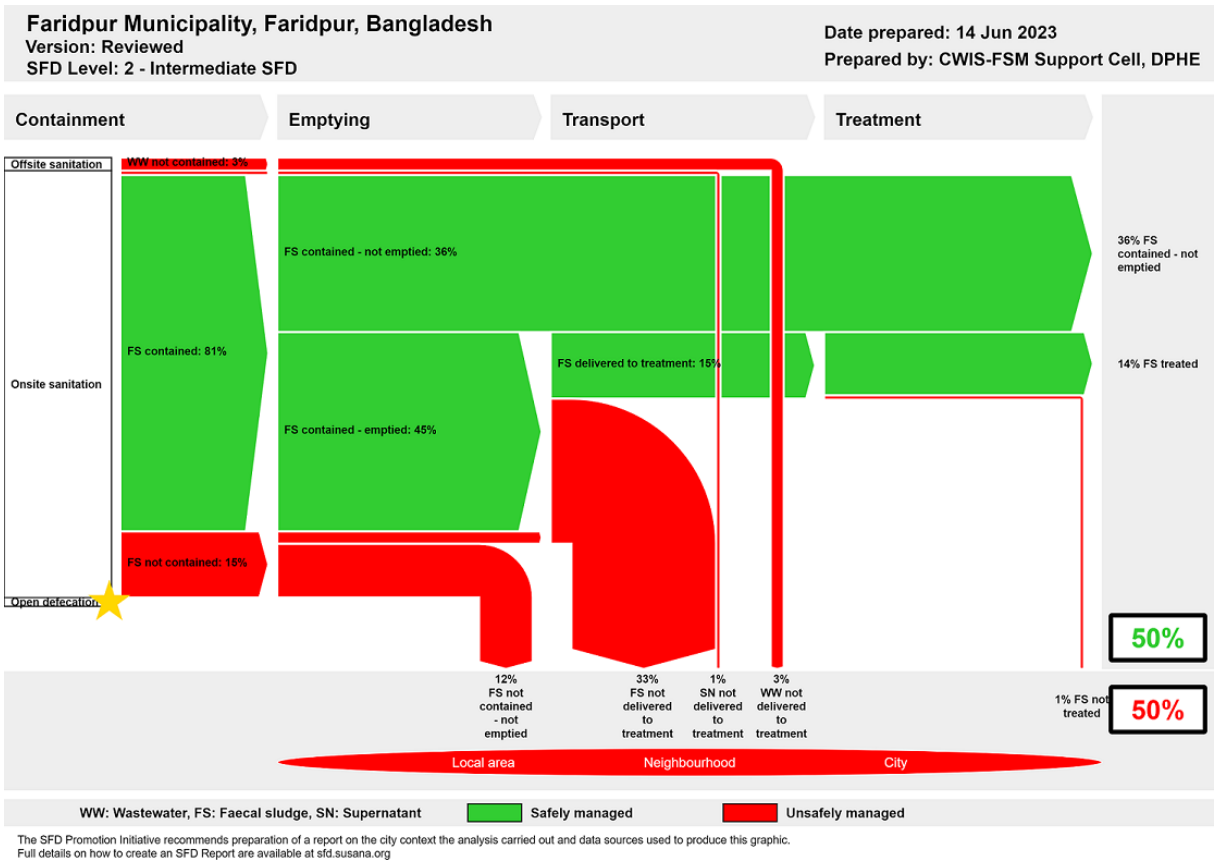
1. The SFD Graphic



The SFD Promotion Initiative recommends preparation of a report on the city context the analysis carried out and data sources used to produce this graphic.
Full details on how to create an SFD Report are available at sfd.susana.org

2. Diagram information

SFD Level:

Intermediate-Level 2 Report.

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Collaborating partners:

DevCon, Tiller and Faridpur Municipality played vital roles in collecting and sharing data, and producing this SFD graphic and SFD report.

Status: Final SFD report.

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3. General city information

Faridpur Municipality is a fast-growing city, which is 116 km away from the Dhaka city. It is beside the Padma River and it is well connected with road, water, and railways. It is one of the oldest towns and was declared 'A' class Municipality in 1986. Faridpur is one of the 53 district level municipalities in the country.

The Municipality covers an area of 19.07 square kilometres. The current population of Faridpur Municipality is nearly 1.6 lakhs[1]. The city has about 171.68 km of drains which includes 13 km of brick, 21.62 km of reinforced cement concrete, 67.06 km of primary drain and 70 km of earthen drain.

The present (2020) population is estimated to be around 163,700. According to the Bangladesh Meteorological Department, the

[1] 1 lakh = 10^5

city area has a tropical monsoon climate. The maximum mean temperature is 31.3-34.2°C between April-August and the minimum mean temperature is between 12.1-13.7°C in January. The annual average rainfall is about 1,953 mm, according to BMD (1981-2017).

4. Service outcomes

The overview of different sanitation technologies across the sanitation value chain in the Municipality is briefly explained in this section. All data in this section is from the household survey conducted for this study (DPHE, 2020).

Containment:

Almost all the households (98%) in the city have their own toilets and only a few use community toilets (1.75%) and neighbour's toilet (0.2%). For flushing the toilet pan, mostly a pour flush system is used (86%) while some households (14%) use a cistern flush.

According to the survey, more than one-quarter of the households (30%) use septic tanks. About 68% of the households use pit latrines while 1% do not have any type of containment (DPHE, 2020).

Emptying and Transportation:

The solid materials in the septic tanks accumulate with time and usually need to be emptied or desludged within two to three years of use. Around 50% of the septic tanks are never desludged and the outlets of such septic tanks are mostly connected to drains and open environment. Only a small portion (13.3%) are connected to soak-away pits. More than half of the septic tanks are desludged within three years. Desludging of the septic tanks are mostly done by private sweepers (71%).

More than one-quarter of the desluding is done by municipal sweepers (27%) and family members (2%). Most (71%) of the withdrawal is done manually using bucket and rope. This method highly risks the health and safety of the workers. A few number (6%) use electric pumps and less than one-quarter (24%) use vacu-tags.

Faridpur Municipality has taken initiative to provide formal service of pit emptying to the city people. According to Focus Group Discussions (FGD) and Key Informant Interviews (KIIs), the municipality has started the desludging business with the pit emptiers cooperative and faecal sludge is dumped into the treatment plant- these reflect the use of the higher level of technologies by some of the workers. Faridpur municipality has a total of seven vacu-tug for mechanical collection of sludge, where two of them are continuously used for sludge emptying and transportation purposes.

Treatment and Disposal:

There is a faecal sludge treatment plant in Faridpur Municipality. The third Urban Governance & Infrastructures Improvement Project (UGIIP-III) has built the treatment plant in this municipality. The treatment capacity of the treatment plant is 24-42 m^3/day. Disposal of sludge to the treatment plant is already started in this municipality. Around 12-16 m^3/day is disposed of into the treatment plant. Compost production from faecal sludge has started in the treatment plant of Faridpur. The compost production capacity of the treatment plant is 100 tons per year. However, only about 3-4 tonnes of compost is produced per month.

The SFD graphic shows that 50% of the excreta generated are safely managed while 50% are unsafely managed. The safely managed excreta generated by 36% of the population is temporary. So, once the containments get filled and FS from the containments is emptied, the percentage of unsafely managed excreta could increase.

5. Service delivery context

The 2009 Paurashava Act states that, "A municipality shall make adequate arrangements for the removal of refuse from all public streets, public latrines, urinals, drains, and all buildings and land vested in the municipality and for the collection and proper disposal of such refuse." Although the term 'faecal sludge' is not specifically mentioned in the act, it is clear that the responsibility of management of faecal sludge lies with the municipality.

The Institutional and Regulatory Framework (IRF) for Faecal Sludge Management (FSM) states that the municipality shall execute these responsibilities in accordance with the provisions of the 2009 Paurashava Act. However, if a municipality deems necessary, it may formulate rules, regulations and by-laws according to the provisions of the act. The municipality (known as 'paurashava' in Bangladesh) may collaborate with the Department of Public Health Engineering (DPHE), Local Government Engineering Department (LGED) and private sector to plan and implement FSM infrastructure and services (IRF, 2017). The municipality is required to take steps to include provision of infrastructure for the implementation of FSM services in its master plan.

According to sub-section 4.2.3 of the IRF, The Paurashava shall be responsible for proper execution of the entire FSM service chain, including collection (emptying) and transportation. The Paurashava shall carry out and/or oversee the collection (emptying) and transportation, making sure that these operations are carried out in a hygienic manner without adversely affecting health and safety of emptiers, the public and the environment. In the sub-section 4.2.4, the municipality is given the responsibility for proper execution of faecal sludge treatment, disposal and end-use. It is stated that the municipality shall carry out and/or oversee these operations. Until a treatment facility for faecal sludge is built, the sludge shall be disposed in a land/area designated by the municipality by digging pits/trenches in the ground.

6. Overview of stakeholders

The municipal authority is the lead government institution in delivery of Water, Sanitation and Hygiene (WASH) services in the city. The municipality has taken a lot of initiatives with the development partners in recent years to improve the full sanitation value chain. As a part of those initiative, it formed two pit emptier co-operatives. Private partners are also very active in this municipality, including the Society Development Committee (SDC), which got registration from RJSC (Registrar of Joint Stock Companies and Firms) as SDC Agro for composting and market promotion.

In addition, a good number of local entrepreneurs are producing rings, slabs and other products to meet local demand. The municipality is eager to engage private stakeholders in this sector, through a GO-NGO partnership approach.

Table 1: Stakeholders in Faridpur Municipality.

Key Stakeholders	Institutions / Organizations /
Public Institutions	Local Government, Municipality
Local NGO's	Society Development Committee (SDC)
Development Partners, I/NGO's	Practical Action Bangladesh
Others	DPHE,ITN-BUET

7. Process of SFD development

This SFD report used the baseline study done by Department of Public Health Engineering from the project titled "Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level municipalities and 8 City Corporations" as a guiding document (DPHE, 2020).

In addition, another study done by Practical Action titled "Final evaluation of "Up scaling Faridpur city best practices and continued support in Faridpur City, Bangladesh" is also considered as a reference document.

Percentage of emptying of different sanitation facilities was calculated from the number of total trips of the vacu-tug. Therefore, this SFD report represents the present scenario of the municipality.

8. Credibility of data

Required data for the preparation of the SFD graphic were collected from 'Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations' September 2020 (DPHE, 2020).

This survey consisted of household interviews and desk review of relevant documents. Key informant interviews were also conducted. Discussions were held with conservancy staff, town level coordination committee members and sweepers. The amount of faecal sludge collected and treated was collected from the FSTP treatment plant operated by Society Development Committee (SDC). In addition a key informant interview was also conducted for this purpose.

9. List of data sources

The list of data sources to produce this executive summary is as follows:

- Bangladesh Bureau of Statistics (BBS), 2011.
- DPHE 2020. Baseline Survey of the project "Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations", Department of Public Health Engineering (DPHE), Dhaka, Bangladesh (December 2020).
- Final evaluation of "Up scaling Faridpur city best practices and continued support in Faridpur City, Bangladesh" project, March 2023, Practical Action.
- Population and Housing Census, 2011.
- The revised 'National Strategy for Water Supply and Sanitation, 2021'.

Faridpur Municipality, Bangladesh, 2023

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Abbreviations

BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
DPHE	Department of Public Health Engineering
FGD	Focus group discussion
HH	Household
IRF	Institutional and Regulatory Framework
LGED	Local government engineering department
OSM	Open Street Maps
SFD	Shit Flow Diagram
SW	Solid Waste
WASH	Water, Sanitation and Hygiene
WB	World Bank
WFP	World Food Programme

1 City context

Faridpur is a fast-growing city, which is 116 km away from the Dhaka city (Figure 1). It is beside the Padma River and well connected with road, water, and railways. It is one of the oldest towns and was declared 'A' class Municipality in 1986. Faridpur is one of the 53 district level Municipalities in the country. The Municipality covers an area of 19.07 square kilometres. The Faridpur Municipality is governed by a mayor, nine reserved women councillors and 27 councillors. Despite being an old municipality, Faridpur Municipality offers several civic amenities and recreational facilities under planned development.

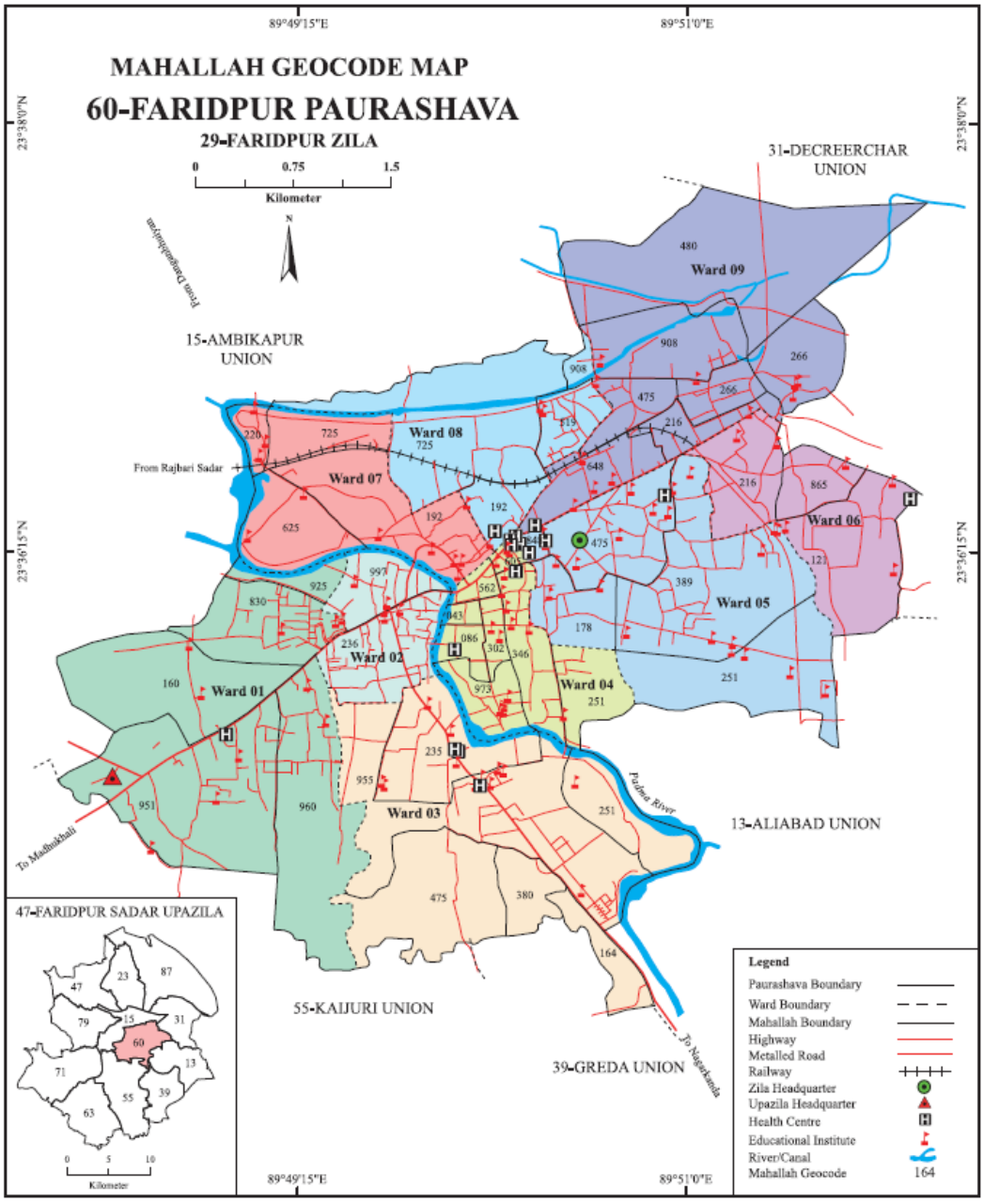

Figure 1: Faridpur Ward Boundary Map.

1.1. Population

The current population of Faridpur Municipality is nearly 1.6 lakhs[2]. According to the population census in 2011 by the Bangladesh Bureau of Statistics (BBS), the Faridpur city population was 121,632. The urban population growth in Bangladesh is 3.5% per year. Considering 10% floating population, such as farmers and traders, comes to the city every day, the present (2020) population is estimated to be around 163,700. The present growth rate of 2.27% is expected to continue till 2025 after which it is expected to reduce to 2.22- 2.15% the projected population for 2025, 2035, and 2040.

The density is high in the centre of the Municipality, ranging from 14,001 to 15,956 per sq. km. The population density in the West is lower, ranging from 4,633 to 5,000 per sq. km. At present, Faridpur Municipality has 264.15 km road and 171.68 km of drainage networks.The municipality area is made of very low to high land. The Padma River passes east side of the Municipality. It falls under Low Ganges River Flood plain. The general soil type include Deltaic silt and Marsh Clay and Peat.

1.2. Climate

According to the Bangladesh Meteorological Department, the city area and surrounding area experience a tropical monsoon climate. It is characterized by warm, humid summers and cool, and dry winters. There is a climatological station within the Municipality. Weather data from this station were collected from 1981 to 2017. About 90% of the total annual rainfall occurs in the period from May through October. The driest months of the year are November to March. The maximum mean temperature observed is 31.3-34.2°C between April-August and the minimum mean temperature is between 12.1-13.7°C in January. The annual average rainfall is about 1,953 mm, according to BMD (1981-2017).

[2] 1lakh = 10^5

2 Service Outcomes

2.1 Overview

Data on sanitation situation were collected through a household survey (DPHE, 2020). Further details are presented in Appendix 2. The results obtained after the triangulation and validation of the data with all the data sources including literature reviews, Key Informant Interviews (KIIs) and a validation workshop is presented in this section.

2.1.1 Summary of the sanitation service delivery chain

There is no centralised sewer in Faridpur. The most common on-site containment system is a pit latrine in the households of Faridpur. However, in recent years, it has become common practice to build septic tanks when constructing new buildings. The number of septic tanks is likely to increase in the near future. A small portion of the population use community latrines, which use septic tank technology. Most commercial enterprises have septic tanks in their buildings. Pit latrines do no need outlets as the liquid portion of the waste is absorbed in the surrounding soil. The semi-treated liquid waste from the septic tanks is passed on to soak-away pits or other treatment units according to design regulation. However, many households do not follow the regulations and dispose of the untreated liquid waste into the environment. Some number of households use soak pits and the majority disposes of the liquid waste in nearby drains, open ground or water bodies. More than half of the septic tanks are desludged within three years.

In Faridpur Municipality there is a treatment plant. In addition, the Municipality has seven vacu-tug for mechanical collection of faecal sludge, where two of them are continuously used for sludge emptying and transportation purposes. These vacu-tug collect the faecal sludge from septic tanks, pits and transport the sludge to the only treatment plant in the municipality. A significant number of people are using a formal service of pit emptying given by the municipality. Customers have to fill in a form to apply for this service, and wait for their number to come up before they receive the service. There is a charge for this service. There are also some private sweepers, who empty pits and septic tanks manually using a bucket and rope, with little support and no safety protocol.

2.2 SFD Matrix

The city does not have a dedicated sewerage system and most sanitation systems available in the town are classified as onsite systems (97%). The remaining 3% corresponds to a toilet connected to an open drain, which is considered as an offsite system. The main types of toilet facilities are septic tanks connected to a soak pit, to an open drain, to a water body or to open ground, and lined tanks or lined pits, with no outlet or overflow. Figure 2 the SFD selection grid of the sanitation systems found in the municipality.

List A: Where does the toilet discharge to? (i.e. what type of containment technology, if any?)	List B: What is the containment technology connected to? (i.e. where does the outlet or overflow discharge to, if anything?)									
	to centralised combined sewer	to centralised foul/separate sewer	to decentralised combined sewer	to decentralised foul/separate sewer	to soakpit	to open drain or storm sewer	to water body	to open ground	to 'don't know where'	no outlet or overflow
No onsite container. Toilet discharges directly to destination given in List B					Significant risk of GW pollution Low risk of GW pollution	T1A1C6				Not Applicable
Septic tank					Significant risk of GW pollution T1A2C5	T1A2C6	T1A2C7	T1A2C8		
Fully lined tank (sealed)					Significant risk of GW pollution Low risk of GW pollution					
Lined tank with impermeable walls and open bottom	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution	Significant risk of GW pollution Low risk of GW pollution					Significant risk of GW pollution T1A4C10
Lined pit with semi-permeable walls and open bottom	Not Applicable									Significant risk of GW pollution T1A5C10
Unlined pit										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied but abandoned when full and covered with soil										Significant risk of GW pollution Low risk of GW pollution
Pit (all types), never emptied, abandoned when full but NOT adequately covered with soil										
Toilet failed, damaged, collapsed or flooded										
Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded										
No toilet. Open defecation	Not Applicable									Not Applicable

Figure 2: SFD selection grid.

Table 1 summarizes the sanitation systems in use, as well as estimates of the population connected to each system. For the onsite sanitation systems, it shows the proportions of each from which faecal sludge is then emptied, transported to treatment and treated. For the offsite systems (toilet discharging to open drain), it shows the proportion of wastewater delivered to treatment and treated.

Table 1: SFD Matrix for Faridpur Municipality.

Faridpur Municipality, Faridpur, Bangladesh, 14 Jun 2023. SFD Level: 2 - Intermediate SFD
Population: 163700
Proportion of tanks: septic tanks: 90%, fully lined tanks: 0%, lined, open bottom tanks: 100%

Containment								
System type	Population	WW transport	WW treatment	FS emptying	FS transport	FS treatment	SN transport	SN treatment
	Pop	W4c	W5c	F3	F4	F5	S4e	S5e
System label and description	Proportion of population using this type of system (p)	Proportion of wastewater in open sewer or storm drain system, which is delivered to treatment plants	Proportion of wastewater delivered to treatment plants, which is treated	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
T1A1C6 Toilet discharges directly to open drain or storm sewer	3.0	0.0	0.0					
T1A2C5 Septic tank connected to soak pit	13.3			43.0	54.0	95.0		
T1A2C6 Septic tank connected to open drain or storm sewer	6.0			20.0	0.0	0.0	0.0	0.0
T1A2C7 Septic tank connected to open water body	5.2			20.0	0.0	0.0		
T1A2C8 Septic tank connected to open ground	4.5			20.0	0.0	0.0		
T1A4C10 Lined tank with impermeable walls and open bottom, no outlet or overflow	6.0			83.0	15.0	95.0		
T1A5C10 Lined pit with semi-permeable walls and open bottom, no outlet or overflow	62.0			57.0	33.0	95.0		

2.2.1 Technologies and methods used

The percentages presented in Table 1 and discussed in this section are based on data collected from a household survey and KIIs (DPHE,2020).

Containment

The entire population of Faridpur uses a toilet of some sort. These toilets are connected to a range of containment systems, including (Table 2):

- Toilet connected to an open drain,
- Septic tank connected to a soak pit.
- Septic tank connected to open drain or storm sewer.
- Septic tank connected to open water body.
- Septic tank connected to open ground.
- Lined tank with impermeable walls and open bottom, no outlet or overflow.
- Lined pit with semi-permeable walls and open bottom, no outlet or overflow.

Survey result shows that almost all the households (98%) have their own toilets and only a few use community latrines (2.0%) and neighbour's toilet (0.2%). For flushing the toilet pan, mostly pour flush system (86%) is used while some number of households use cistern flush (14%).

Table 2: Summary of the containment options and the equivalence according to the SFD-PI methodology (DPHE,2020).

System	System label	Proportion of people using this system	Comments
Toilet conneccted to open drain	T1A1C6	30%	-
Septic tank connected to a soak pit	T1A2C5	13.3%	Low risk of groundwater pollution
Septic tank connected to open drain or storm sewer	T1A2C6	6.0%	-
Septic tank connected to open water body	T1A2C7	5.2%	-
Septic tank connected to open ground	T1A2C8	4.5%	-
Lined tank with impermeable walls and open bottom, no outlet or overflow	T1A4C10	6.0%	Low risk of groundwater pollution
Lined pit with semi-permeable walls and open bottom, no outlet or overflow	T1A5C10	62.0%	Low risk of groundwater pollution

From the household survey, it was found that more than one-quarter of the households (29.0%) use septic tanks and about 62.0% of the households use pit latrines. The risk of groundwater pollution in this area is low as shown in Table 2. Different types of sanitation systems are shown in Figure 3 and Figure 4.

Figure 3: Septic tank connected to nearby water body.

Figure 4: Toilet pipe connected to open drain.

Emptying

Desludging of the septic tanks are mostly (71%) done by private sweepers. More than one-quarter of the desluding is done by municipal sweepers (27%) and family members (2%). In addition, the sludge withdrawal from the septic tanks is done by using various means. Most of the withdrawal (71%) is done manually using bucket and rope. This method highly risks the health and safety of the workers. A few number (6%) use electric pumps and less than one-quarter (24%) use vacutags – these reflect the use of the higher level of technologies by some of the workers (Figure 5).

Almost all the septic tanks were constructed during the last two decades although a handful of septic tanks (~1%) was reported to be few decades old. Majority (91%) of the septic tanks were constructed during the last five years. As about half of the septic tanks were reported to be not ever desludged and many would need desludging within 3 to 5 years, it is expected that the demand of desludging septic tanks would increase shortly.

Figure 5: Sludge dumping from vacutags at planted drying bed (Photo courtesy: Practical Action, Bangladesh).

Transport

The term transport refers to the manual or motorized conveyance of faecal sludge emptied from onsite sanitation systems in a pre-specified dumping station. In Faridpur Municipality there are seven vacutug for sludge transportation to the treatment plant. In this municipality, dumping faecal sludge into the treatment plant is running smoothly. A significant number of people are using the formal services of pit emptying given by the municipality. These formal service providers dumped the sludge to the treatment plant.

From the households' survey, it was found that less than half of the households (46%) can be reached by regular desludging vehicles, however, suction pipes to withdraw septage are usually limited with 30m. For one-quarter of the households (25%), conventional desludging vehicles can be used. Similarly, for less than one-third of the households (32%), smaller desludging vehicles can be used (DPHE, 2020).

Importantly, for the majority of the cases, special types of vehicles or other innovative withdrawal equipment (e.g. pumps) and transport vehicles would be needed. The lids of the septic tanks are required to be opened for desludging (Figure 6). Most of the lids (72%) are accessible, however, in some cases (28%) are not readily accessible mainly because of being under some structure or underground.

Around 54% of the faecal sludge emptied from septic tanks connected with soak pit (T1A2C5, F4 = 54%), 15% of faecal sludge emptied from lined tanks with impermeable walls and open bottom, no outlet or overflow (T1A4C10, F4 = 15%), 33% of faecal sludge emptied from lined pits with semi-permeable walls and open bottom, no outlet or overflow (T1A5C10, F4 = 33%) is delivered to the treatment plant (DPHE, 2020).

Figure 6: Desludging of septic tank with submersible pump (Photo courtesy: Practical Action, Bangladesh).

Treatment

There is a Faecal Sludge Treatment Plant (FSTP) in Faridpur Municipality. Figure 7 shows the aerial view of the Faridpur FSTP.

Figure 7: Aerial view of the Faridpur FSTP (Photo: CWIS FSM Support Cell 2023).

This plant is built under the third Urban Governance & Infrastructures Improvement Project (UGIIP-III). The treatment capacity of the plant is 24-42 m^3 /day. Around 12-16 m^3 of faecal sludge is disposed of to the treatment plant (Table 3).

Table 3: Details of the treatment system at the Faridpur FSTP.

Design Criteria	Treatment Systems	
	Unplanted	Planted
Density of raw FS	15 kg TS/m^3	15 kg TS/m^3
Moisture Content	90%	90%
Leachate Production	0.9 m^3 per m^3 fresh FS	0.9 m^3 per m^3 fresh FS
FS Loading Rate	200 kg TS/m^2/year	200 kg TS/m^2/year
Drying Time	15 days min.	1 year min.
Thickness of Sludge	0.2 m	0.2 m

In addition, this plant has a facility of co-composting from the treated faecal sludge. Compost production capacity of the treatment plant is 100 tons per year. However, only about 3-4 tonnes of compost is produced per month. The treatment plant uses a gravity flow system to separate the solid and liquid part of the faecal sludge. Figure 8 shows the treatment flow of the Faridpur FSTP.

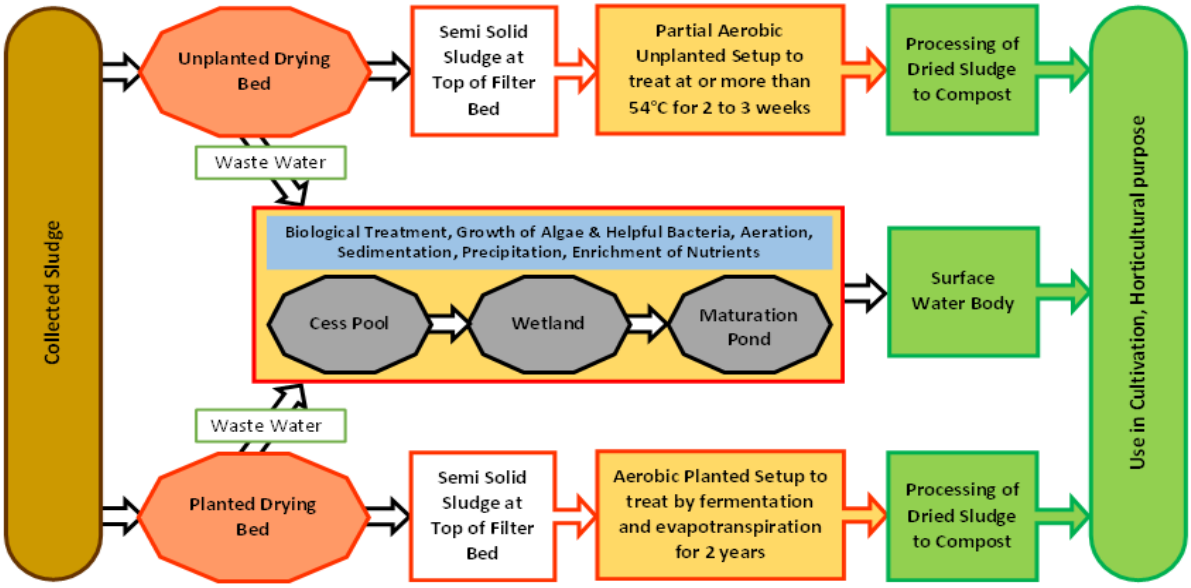

Figure 8: The treatment flow of the Faridpur FSTP.

Open Defecation

From the survey, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs), it was found that 100% of the citizens use some kind of toilet in the municipality. Thus, from the sanitation point of view, the town is considered an open defecation-free town (DPHE, 2020).

2.2.2 Risk of groundwater contamination

The depth to groundwater in the city ranges from 1-7 m. There are various drinking water sources used in the city. Among them, one quarters of the households use their own tube well fitted with electric motor and 32% use own hand tube well. More than one-third household (34%) use supply water. Lateral separation between sanitation facilities and water sources varies from one area to another. Tube wells of different sizes and depths are generally used to pump water from the subsurface confined aquifers (Figure 9).

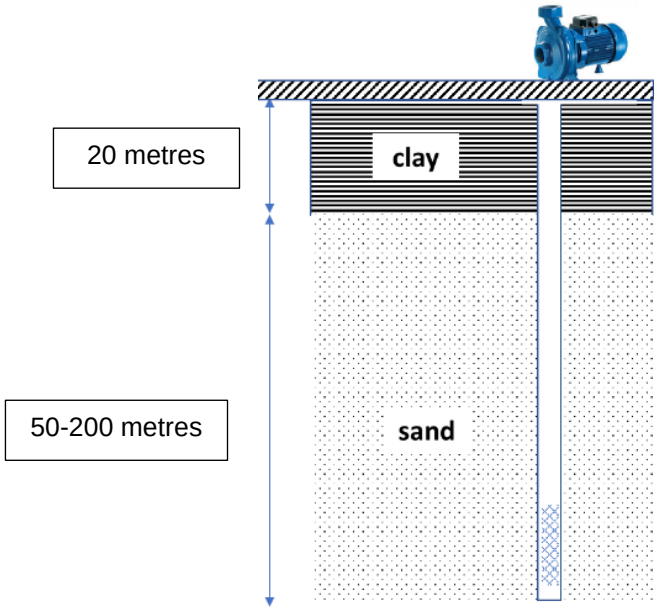

Figure 9: Soil profile in Faridpur district and location of tube well screen.

During the household visits and FGDs, it was found that less than 25% of sanitation facilities are located within 10 metres from the groundwater source. Besides, due to the geographical situation, sanitation facilities are not located uphill of the groundwater sources (DPHE, 2020).

According to a survey report on 'Hydrogeological screening, slug test and geophysical logging on observation well units', conducted by the Department of Public Health Engineering (DPHE) on March 2017, drinking water is collected from the confined aquifer (25m – 200m) through pumps. Hence, considering all these factors, it is considered that there is not any significant risk of groundwater contamination in the city. Therefore, a low risk of groundwater contamination is considered in the city.

2.2.3 Credibility of data

This report is produced based on the baseline survey conducted in September 2020 which contains detailed data on different stages of the sanitation value chain (DPHE, 2020).

The SFD matrix is generated from these data, collected during sample household surveys, along with informal interviews, open-ended consultations, key informant interviews and focus group discussions with the municipality officials, town level coordination committee, households, social workers, business persons, pit emptiers and the citizens including women in all the wards of the municipality.

Finally, data from all these sources were triangulated to produce the SFD matrix, the SFD graphic and the SFD report.

2.3 Summary of Assumptions

The last census was carried out about 10 years ago. So, the actual population, household, and sanitation data are not updated yet. Most of the households with septic tanks do not know the actual type, size, and design desludging periods. Also, a large number of pit users are unaware of the emptying events and frequency of the emptying of their pits. Due to all these data gaps,

some assumptions have been made to produce the SFD graphic. These assumptions were shared with key informants at the municipality and accepted by them. The following assumptions were made for developing the SFD graphic for Faridpur Municipality:

- ✓ The proportion of FS in septic tanks was set to 90%, the proportion of FS in fully lined tanks was set to 0% and the proportion of FS in lined tanks with impermeable walls and open bottom and all types of pits was set to 100% according to the relative proportions of the systems in the municipality, as per the guidance given in the Frequently Asked Question (FAQs) in the sustainable Sanitation Alliance (SuSanA) website.
- ✓ According to the population census in 2011 by the Bangladesh Bureau of Statistics (BBS), the population of Faridpur Municipality was 121,632. The urban population growth in Faridpur is 3.5% per year. Considering 10% floating population, such as farmers and traders, comes to the city every day, the present (2020) population is estimated to be around 163,700.
- ✓ There are around 6% of twin pit latrines in the containment system. So, it is assumed that all these twin pit containment technologies are defined as a lined tanks with impermeable walls and open bottom (system T1A4C10, 6%). Based on the household survey, variable F3 for system T1A4C10 is set to 83%.
- ✓ There are around 62% of single pit latrines in the containment systems. So, it is assumed that all these single pit containment technologies are defined as lined pits with semi-permeable walls and open bottom, no outlet or overflow, where there is no 'significant risk' of groundwater pollution (system T1A5C10, 62%). Most of the single pit latrines are found to be emptied within 1-2 years. Based on the household survey, variable F3 for system T1A5C10 was set to 57%.
- ✓ 13.3% of septic tanks are connected to soak pits (system T1A2C5). They are well-constructed as per the field visit observation. The risk of groundwater contamination was deemed low, therefore that option was selected in the SFD Matrix.
- ✓ Around 43% of households have emptied their septic tank with a soak pit with a desludging frequency of 2-5 years. Based on the household survey, variable F3 for system T1A2C5 is set to 43%.
- ✓ There are 15.7% of septic tanks connected to the open drain, water bodies and open ground which are emptied within 2-5 years. Based on the household survey, variable F3 for systems T1A2C6, T1A2C7 and T1A2C8 are set to 20%.
- ✓ Wastewater in T1A1C6 and supernatant in T1A2C6 are directly discharged into the river or the environment untreated. Therefore, variables W4c, W5c, S4e and S5e were set to 0%.
- ✓ Values for variable F4 for systems T1A2C5, T1A4C10 and T1A5C10 were set to 54%, 15% and 33%, respectively.These values are derived from the household survey and KIIs with the service providers.
- ✓ There is one faecal sludge treatment facility present at the town. The treatment plant is fully functional. It can treat 95% of faecal sludge that gets delivered there. Thus, variable F5 for all sanitation systems where the FS is delivered to treatment, is set to 95% (T1A2C5, T1A4C10 and T1A5C10).

2.4 SFD Graphic

The outcome of the SFD graphic shows that fifty percent (50%) of the excreta flow is classified as safely managed, and the remaining fifty percent (50%) is classified as unsafely managed (Figure 10).

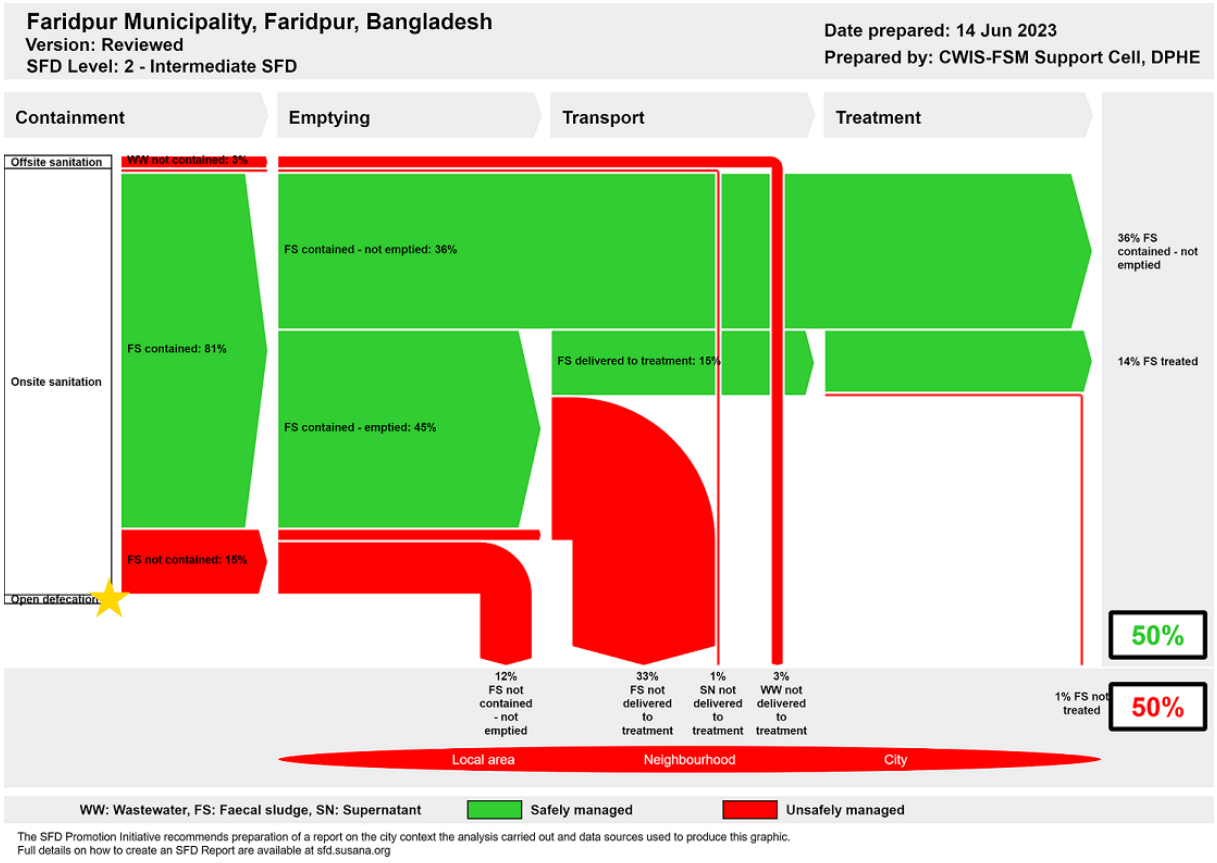

Figure 10: SFD Graphic.

The unsafely managed excreta originate from wastewater not delivered to treatment (3%), Faecal Sludge (FS) both contained and not contained - not delivered to treatment (33%), FS delivered to treatment but not treated (1%), FS not contained - not emptied (12%) and supernatant not delivered to treatment (1%).

The safely managed excreta originate from FS contained - not emptied (36%) and FS treated (15%). However, the 36% resembles the FS stored in containments without significant risk to groundwater pollution. Thus, the safely managed percentage of FS generated by this 36% of the population is temporary until the FS from the containments is emptied. Therefore, these systems will require emptying services in the short and medium term as they fill up.

3 Service delivery context

3.1 Policy, legislation and regulation

3.1.1 Policy

According to the regulatory guidelines, it is a major responsibility of the municipality to manage all kind of wastes, specifically 'solid waste and 'liquid waste'. However, existing policy in the Paurashava Act provides no specific instructions regarding 'faecal sludge'. Faecal sludge is considered a different type of waste. With the characteristics of both solid and liquid waste, faecal sludge needs to be managed using specific technologies and treatment options. Although the term 'faecal sludge' is not specifically mentioned in the policy, it is clear that the responsibility of management of faecal sludge lies with the municipality.

The institutional and regulatory framework for Faecal Sludge Management (FSM) states that the Department of Public Health Engineering (DPHE) and the local government engineering department (LGED) shall support the implementation of the FSM system in the municipality. This is a clear indication that the DPHE and LGED should be included as the key institutions in developing the institutional framework on FSM in Faridpur Municipality.

The 2009 Paurashava Act, requires each municipality to take steps to include provision of infrastructure for the implementation of FSM services in its master plan. However, most municipalities have yet to even create a master plan, even though they may seek expert support from the external sources to assist with this complex process. Also, in the absence of a building code for septic tanks, it is not a requirement that development of multi-storey buildings include construction of septic tanks.

3.1.2 Institutional roles

In general, the municipal authority is responsible for providing basic services to citizens. Chapter two of the 2009 Paurashava Act mentions the responsibility and function of municipalities with regard to Water, Sanitation and Hygiene (WASH). According to clause (50) (2), the municipality is responsible for (a) Water supply for residential, industrial and commercial use, (b) Water and sanitation, (c) Waste management, and (d) Issuing plans that promote economic and social justice. Even though it is not mentioned explicitly, faecal sludge management is considered to be included in the Clause (50)(2)(b) on water and sanitation and therefore is the responsibility of the municipality.

Ministries are responsible for securing funding and formulating policy, strategy and amendments. The DPHE and LGED provide technical assistance, and the municipalities are responsible for FSM services, including engaging and supporting all stakeholders (the government, non-government organisations, development partners, research organisations, civil society and the media) in raising awareness, developing FSM infrastructure and effective delivery of FSM services.

3.1.3 Service provision

Faridpur Municipality has seven vacu-tug for mechanical collection of sludge from septic tanks or pits. Using a vacuum cleaner has became common practice in these days at Faridpur Municipality. For reaching narrow roads, special types of vehicles or other innovative withdrawal equipment (e.g. pumps) and transport vehicles are needed for wider coverage.

3.1.4 Service standards

Under the 2009 Paurashava Act 2009, municipalities are responsible for the execution of the entire FSM service chain. They are also in charge with ensuring that this is carried out in compliance with existing rules and regulations on the disposal of liquid effluent and quality of end products such as compost, and without adversely affecting health and the environment.

Until further treatment facilities are built, faecal sludge will continue to be disposed of in pits or trenches dug on land designated by the municipality. The Ministry of the Environment and Forestry through the Department of Environment is responsible for ensuring that all relevant environmental laws, regulations and principles are followed to the letter by all concerned throughout the FSM service chain.

3.2 Outputs

3.2.1 Monitoring and reporting access to services

In the Institutional and Regulatory Framework (IRF) for FSM, different institutions have been identified for playing effective roles in the overall planning, development, implementation, practice and monitoring and evaluation of faecal sludge management in municipalities. The Ministry of Environment and Forest (MoEF) through the Department of Environment (DoE) shall ensure that all relevant environmental laws, regulations and principles are strictly followed by all concerned throughout the FSM service chain.

4 Stakeholder Engagement

Discussions were held with the municipal authority throughout the whole process. The results of the study are shared with the municipal authority and are considered as a basis for preparing investment projects by the government and development partners, and sustainable plans for operating and maintaining the systems by the municipal authorities.

Table 4: List of key stakeholders for KIIs.

KII code	Name	Designation	Organization	Purpose	Date
KII_1	Mr. Shaikh Mahtab Ali Methu	Mayor	Faridpur Municipality	To know the sanitation service delivery mechanism of the municipality	26.09.2020
KII_2.	Mr. Md. Shahjahan Miah	Chief Executive Officer	Faridpur Municipality.	To know the existing scenario of sanitation value chain and business model	26.09.2020
KII_3	Mr. Md. Mamun Hossain	Sanitary inspector	Faridpur Municipality	To know the containment, desludging and treatment mechanism for the municipality	27.09.2020
KII_4	Md. Abu Bakar Siddiq	Urban Planned	Faridpur Municipality	To know the city service facility and infrastructure system	27.09.2020
KII_5	Mr. Mollah Md. Shafiqul Islam	Executive Engineer	, Faridpur Municipality	To know the treatment plant efficiency and condition of the containment	28.09.2020
KII_6	Mr. Syed Ahaduzzaman Kiran	Slum Development Officer	Faridpur Municipality.	To know the low income community infrastructure and service delivery mechanism and special tariff	28.09.2020

5 Acknowledgements

We would like to thank Mr. Shaikh Mahtab Ali Methu, Mayor, Faridpur Municipality, Mr. Md. Shahjahan Miah, Chief Executive Officer, Mr. Mollah Md. Shafiqul Islam, Executive Engineer; Mr. Syed Md. Ashraf, Assistant Engineer (Water and Sanitation), Mr. Syed Ahaduzzaman Kiran, Slum Development Officer, Faridpur Municipality, for providing all the required primary and secondary data and cooperating for Key Informant Interviews (KIIs) & Focused Group Discussions (FGDs). This report would not have been possible to produce without the constant support of Mr. Shaikh Mahtab Ali Methu, Mayor, Faridpur Municipality, who helped in conducting sample surveys and FGDs in the field.

6 References

- 'At a Glance: Faridpur Municipality', by municipal office.
- Bangladesh Bureau of Statistics (BBS), 2011.
- DPHE,2020. Baseline Survey of the project "Feasibility for Implementing of Solid Waste and Faecal Sludge Management System in 53 District Level Municipalities and 8 City Corporations", Department of Public Health Engineering (DPHE), Dhaka, Bangladesh (December 2020).
- Final evaluation of "Up scaling Faridpur city best practices and continued support in Faridpur City, Bangladesh" project, March 2023, Practical Action.
- Population and Housing Census, 2011.
- Report on 'Hydrogeological Screening, Slug Test and Geophysical Logging on Observation Well Units' under Bangladesh Rural Water Supply and Sanitation Project (BRWSSP), Arsenic Management Division, Department of Public Health Engineering (DPHE) (March 2017).
- The revised 'National Strategy for Water Supply and Sanitation, 2021'.

7 Appendix

7.1 Appendix 1: Stakeholder identification

Name	Designation
Mr. Shaikh Mahtab Ali Methu	Mayor, Faridpur Municipality.
Mr. Md. Shahjahan Miah	Chief Executive Officer, Faridpur Municipality.
Mr. Md. Mamun Hossain	Sanitary inspector, Faridpur Municipality.
Md. Abu Bakar Siddiq	Urban Planned, Faridpur Municipality.
Mr. Mollah Md. Shafiqul Islam	Executive Engineer, Faridpur Municipality.
Mr. Syed Ahaduzzaman Kiran	Slum Development Officer, Faridpur Municipality.

7.2 Appendix 2: Household survey

In-depth information and data were collected for the towns which included project documents, master plans and baseline reports from town and national levels, statistical data like population and household income expenditure, GIS data other geospatial data, satellite images and Open Street Maps (OSM).

Traditional paper questionnaire was not used rather android powered tab was deployed to collect household information. Questions were converted to appropriate format to use in KOBO toolbox. Data collected through KOBO Toolbox are directly stored in a web-based database which is connected online with a website designed for this study (Figure 11).

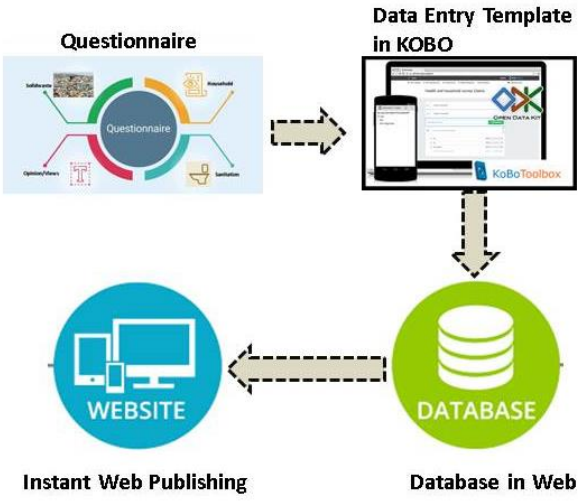

Figure 11: Workflow of KOBO Toolbox on HH survey.

KOBO toolbox has been used for several reasons. It ensures the quality of data collection. It saves time and error in data entry. Moreover, for data analyst and field supervisor, it is convenient to examine data in real-time. The added advantage of this GIS tool is that it also stores the location information of the household surveyed. It helps to prepare maps and visualize the spatial pattern of any phenomena.

Extensive household questionnaire surveys were conducted for 378 households for Faidpur Municipality. This sample size ensures, at least, a confidence level of 95% with a margin of error of 5%. Different type of information is collected like demographic, socio-economic, household characteristics, status of water supply, existing practices of sanitation including faecal and and solid waste management at the household and town levels, gender, financial and environmental status. Four separate sets of questionnaires were prepared for i) single-storied households, ii) multi-storied buildings, iii) institutions like offices and iv) low-income communities.

To rationalize the sample distribution, the city was divided into a number of equal grids (Figure 12). The total number of calculated samples were distributed to the grids proportional to their number of buildings. In addition to the total calculated samples, about 10% more samples were allocated to some grids based on factors like diversity of houses and business and potential rapid future growth. The steps in field survey consist of downloading the mobile App. for the four set of questionnaires and the town map from the database, then conducting the

questionnaire survey and finally transferring data to the central server. During the time of the questionnaire survey, geo-coordinates of the household and a photograph of the respondent (with her/his permission) were taken and uploaded.

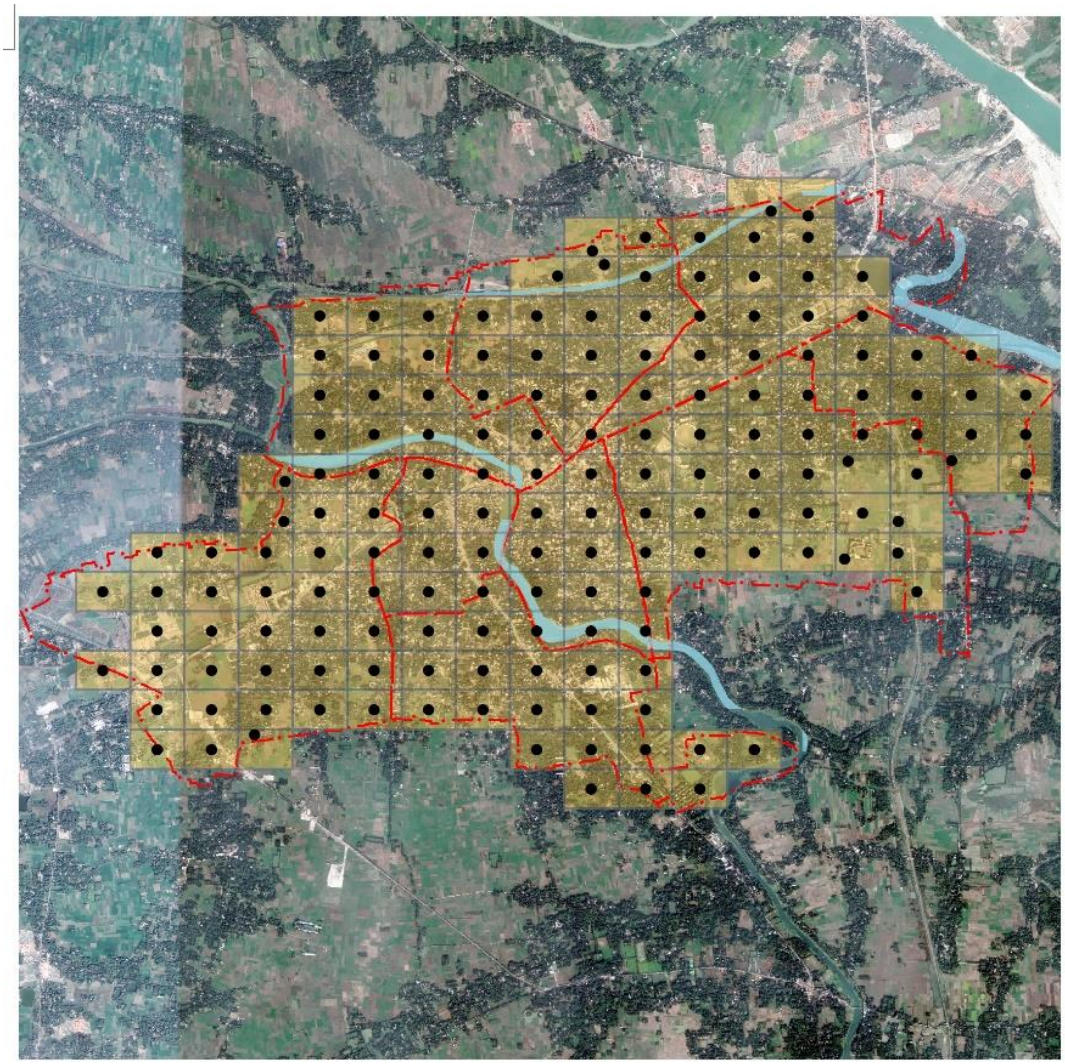

Figure 12: Sample grid of Faridpur Municipality.

In addition to ensure the field data quality, the data collection team (8-10 enumerators) for were properly trained.

Figure 13: Household survey and consultations.

A set of different questions were asked during the survey on the full sanitation value chain (Figure 13). Few of the relevant questions on sanitation were:

1) User interface of the toilet, 2) Way of toilet flushing, 3) Type of containment, 4) Type of building, 5) Outlets from the septic tanks, 6) Desludging of septic tanks and latrine pits, 7) Desludging frequency, 8) Responsibility of desludging, 9) Desludging process, 10) Location of sludge disposal, 11) Year of septic tank construction, 12) Access to septic tanks and pit latrines, 13) Water supply source and risk of contamination and 14) Transportation, treatment and reuse of faecal sludge. A map of the sanitation systems in use in the municipality is presented in Figure 14.

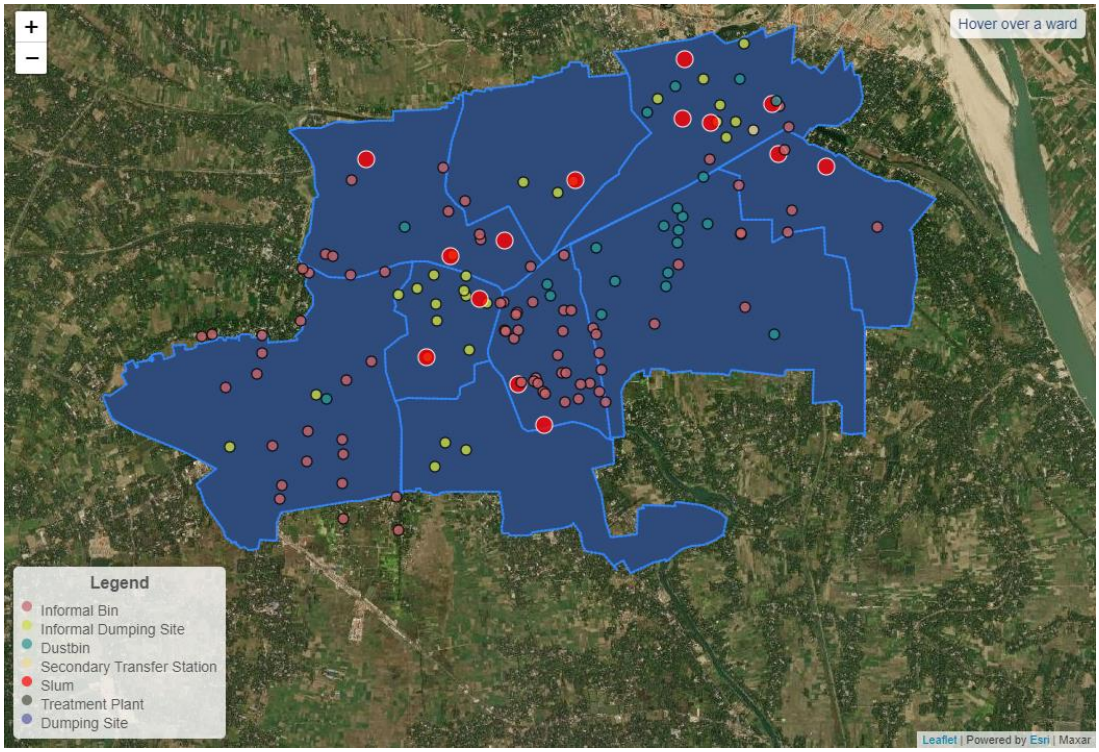

Figure 14: Sanitation systems in Faridpur Municipality (http://sanboard.gov.bd/).

Faridpur Municipality, Bangladesh, 2023

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