SFD Promotion Initiative

Dhaka, Bangladesh

Final Report

This SFD Report was created through desk based research by
WEDC as part of the SFD Promotion Initiative.
It is primarily based on a recent World Bank FSM diagnostic report.
See Acknowledgments.

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SFD Promotion Initiative

sustainable sanitation alliance

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On behalf of Federal Ministry for Economic Cooperation and Development

UNIVERSITY OF LEEDS

WORLD BANK GROUP Water

wsp water and sanitation program

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Sandec Sanitation, Water and Solid Waste for Development

Bill & Melinda Gates foundation

SFD Report **Dhaka, Bangladesh**, 2016

Produced by:

Claire Furlong

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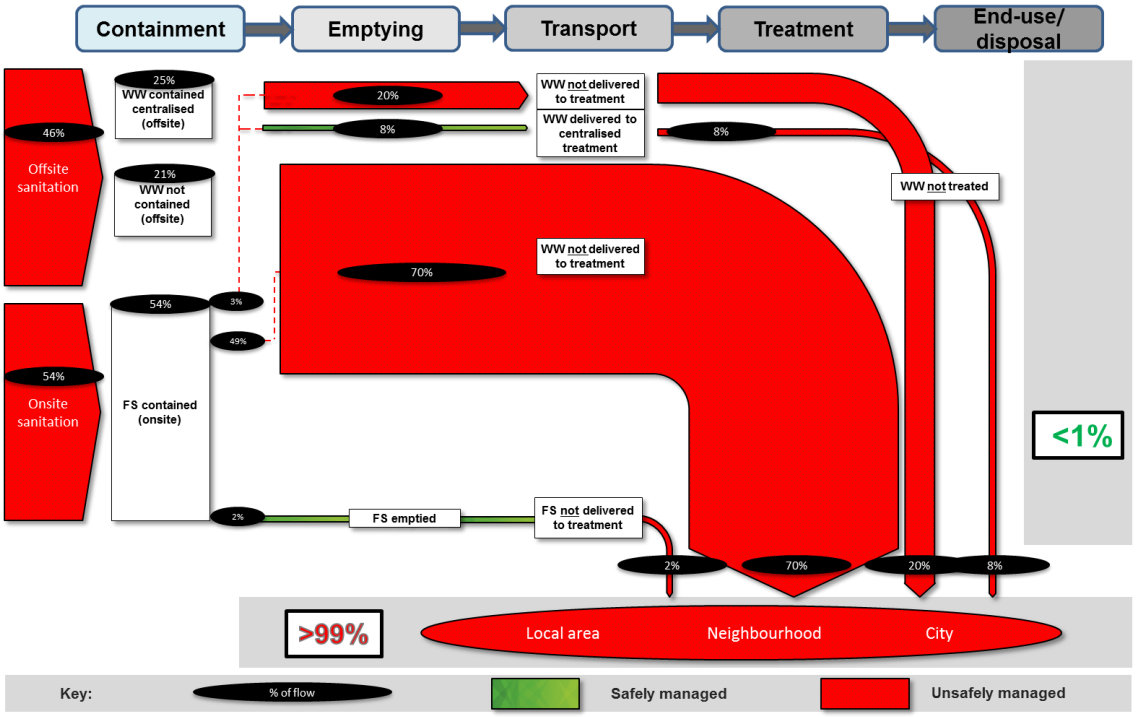
1. The Diagram

Dhaka, Bangladesh, 23 March 2016
Desk based



2. Diagram information

The excreta flow diagram (SFD) was created through desk based research by WEDC (Water, Engineering and Development Centre) Loughborough University.

Collaborating partners:
The World Bank Water and Sanitation Program and Oxford Policy Management Ltd.
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3. General city information

Dhaka, the capital of Bangladesh, is one of world's most populated cities. The city lies between 2 to 13 m above sea level, on the eastern bank of the Buriganga River.

Much of the city sits on a layer of Madhupur clay that extends to a depth of approximately 10m. Other areas sit on a variety of soil types, including loose and soft silty clay, clayey silt or organic clay (Sarkar & Ali, 2009). Poor infiltration combined with the urban density and destruction of water bodies leaves Dhaka highly susceptible to seasonal flooding.

Dhaka has a tropical savannah Climate (Köppen classification: Aw) (Climatetemp, 2016), with all monthly mean temperatures above 18°C. It has a pronounced dry season from November to January (Weather and Climate, 2016). The wettest months are during the monsoon season (April to October) when the country gets over 85% of the annual average rainfall.

Dhaka is reported to be the fastest growing city in the world, the annual growth rate is estimated to be 3.6% (Indexmundi, 2015). For the purpose of this report the 'Dhaka City' is defined as the areas under the jurisdiction of the two Dhaka City Corporations (DCCs). The population therefore covered is 6.8 million (which excludes those living in the Military Cantonment and Biman Bandar areas of the city). In 2005 it was estimated that there were over 3 million slum dwellers residing in 5,000 low income areas (LIAs), comprising 35% of the population of Dhaka city.

4. Service delivery context

The Local Government Act (2009) gives the local governments the responsibility of ensuring provision of sanitation and other services; this is then reiterated in the City Corporation Act (2009) and National Sanitation Strategy (2005). The Environmental Conservation Rules (1997) under the Environmental Conservation Act (1995) set the National Environmental Quality Standards for inland surface water, sewerage discharge and industrial wastes (LDG, 2011).

The Water and Sanitation Authority Act (1996) describe the roles and responsibilities of the Water

Supply and Sewerage Authorities (WASAs) (LGD, 2011). It covers the provision of offsite sanitation and water by Dhaka Water Supply and Sewerage Authority (DWASA), it does not currently cover not onsite sanitation.

The National ***Policy*** for Safe Water and Sanitation (1998) is the most significant policy in this sector (LGD, 2011). It aims to promote capacity in the sector, decentralisation and participation of users. It promotes self-sustaining sanitary latrines for onsite sanitation and obliges local authorities to provide them (DWASA, 2014).

The Bangladesh Building code was most recently updated in 2014 and is legally binding. It states that all premises shall have excreta disposal facilities and dictates that this should be a septic tank. This code also licences plumbers and builders in this sector. These building codes are not enforced.

The current Water Supply and Sanitation Sector Development Plan (WSSSDP) 2011-2025 aims to provide a framework for planning, implementing, and monitoring all activities in this sector. It also provides a roadmap for sector development and a sector investment plan (LGD, 2011). The WSSSDP also reviewed the legal framework for this sector, it found that:

•There was overlap in roles and responsibilities of sector agencies e.g. the Department of Public Health Engineering and DCC.

•There is on enforcement of existing local Acts (LGD, 2011.)

It is known that local bylaws exist encouraging containment of faecal waste and forbidding the connection of toilets and septic tanks to the stormwater drains in the city, however these are not enforced.

There is little mention of faecal sludge management (FSM) in any of the major sector policy documents in Bangladesh. The focus of most policy documents is on eradicating open defecation and promoting safe sanitation. The recent DWASA Sewerage Master Plan mentions an increasing role for DWASA in FSM, but this requires agreement of the DCCs. The recently drafted National Water Supply & Sanitation Strategy has a chapter on FSM and a draft FSM Framework for Dhaka has been written by Bangladesh University of Engineering and Technology. This framework lays out the roles and responsibilities for the various organizations, including DWASA who are given responsibility for FSM. This has led to the creation of a Ministry steering committee to oversee the development of a national framework for FSM.

At the national level the Local Government Division (LGD) is responsible for the development of the water and sanitation sector. The Department of Public Health Engineering (DPHE) and the Water Supply and Sewerage Authorities (WASAs) are under the administrative control of LGD. The DPHE implements public sector sanitation projects in the urban environment that is not covered by the WASAs. The DPHE are also partially responsibility for drainage projects in urban areas. DPHEs power and involvement in the urban sanitation sector is being devolved to local governments.

Dhaka comprises of 92 wards governed by two DCCs, DNCC contains 36 wards and DSCC contains 56 wards. Each DCC is headed by a government-appointed administrator. They are autonomous bodies with responsibility for municipal services (i.e. public health, water supply and small-scale drainage, roads, etc.) and are responsible for planning, implementing and monitoring onsite sanitation (DWASA, 2014). They have fund-raising powers including levying of rates, fees and rents. The Government reserves the right to intervene in their affairs, e.g. by appointing the Chief Executive Officer, or transferring functions. In Bangladesh, the role of managing sanitation is assigned to local governments under the respective City Corporation, Paurashava and Union Parishad Acts. DWASA has sole rights for the provision of sewage, large-scale drainage and water services in its service area and to collect fees for these services.

WSSSDP aims to provide 100% of improved sanitation services by 2025. This includes expanding sewers connections to 60% of the population in Dhaka by 2025 (LGD, 2011). This plan prioritises the following sanitation activities in urban areas:

• Rehabilitation of sewers.
• Expansion of the networked sanitation coverage including construction of treatment plants.

Where sewered connections cannot be constructed in a timely manner it is recommended that appropriate onsite sanitation systems be constructed with the accompanying faecal sludge management treatment plants (LGD, 2011).

The budget to achieve this overall development plan is estimated to be approximately US$ 21,000 million. It is assumed that the majority of these funds will come from public sector investment (50%), revenue from utilities (30%) and household investment (15%) (Nyenrode Business Universiteit, 2014).

Private sector involvement in the sanitation is only happening on a small scale, there is limited private

sector involvement in the utilities market. Private investment would be regulated through the Private Sector Infrastructure Guidelines (2004), as water and sanitation is one of the eligible sectors (LGD, 2011).

In Dhaka, the emptying of pits and septic tanks is undertaken by private sweepers, with clearing and unblocking drains undertaken by government contract sweepers. As manual emptying of faecal sludge is informal, it is an unlicensed sector. Two NGOs operate motorised emptying systems in Dhaka. They have been given permission by DWASA to discharge the faecal sludge at two sewage pump stations.

Several organisations have the responsibility to monitor in this sector:

• The Capital Development Authority (RajUK) regulates household relating to the containment of faecal sludge

• The DCCs are responsible for regulating and managing onsite sanitation systems and private sector involvement

No monitoring data could be found online. Additionally the author is unsure of the national reporting mechanisms for sanitation in Bangladesh.

5. Service outcomes

25% of the populations' excreta discharges directly to sewers. A further 3% of the populations' excreta is first contained in sealed tanks and then discharged to sewers. Of this 28% only 8% is delivered to sewage treatment due to leakage in the sewer network. This then passes through the sewage treatment plant without effective treatment due to poor operation and maintenance of the plant.

21% of the populations' excreta discharges directly into the cities extensive drainage system. A further 49% of the populations' excreta is first contained in sealed tanks and then discharges to the drainage system. This 70% of excreta eventually discharges untreated into the environment. Only 2% of the populations' excreta is contained onsite in sealed tanks. These tanks are generally emptied every 12 months or more frequently by manual emptiers. The waste from these systems is then discharged untreated into the local environment.

6. Overview of stakeholders

Nationally the Ministry of Local Government, Rural Development & Co-operatives are in charge of sanitation and drainage. They also oversee DWASA. The Ministry of Housing and Works oversees urban planning and building regulations related to onsite sanitation infrastructure. The Ministry of Environment and Forests control environmental standards. Two DCCs (North and South) are responsible for ensuring adequate onsite sanitation and managing small-scale drainage networks. DWASA manage sewerage and large scale stormwater drains. Dushtha Shasthya Kendra (DSK) is the major NGO working in this sector in Dhaka.

7. Credibility of data

A majority of the data in this report unless stated otherwise is taken from:

The World Bank Water and Sanitation Program 2016 Report: Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Dhaka, Bangladesh.

The World Bank study was based on a household survey, transect walks, observations, key informant interviews and focus group discussions. It also incorporates a review of the enabling environment for FSM in Dhaka. It should be noted that no other stakeholders were involved in the production of this report.

8. Process of development

The fate of infiltrate from soakaways and pit latrines has been disregarded in the SFD. It was deemed to have little, if any, direct impact on health or the local environment (through ground water pollution). The SFD represents only the flows of wastewater and faecal sludge through the sanitation service chain.

9. References

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SFD Dhaka, Bangladesh, 2016

Produced by:
WEDC, Dr Claire Furlong in collaboration with the World Bank Water and Sanitation Program and Oxford Policy Management Ltd.

This Executive Summary and the SFD Report are available from:
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Abbreviations

DCC	Dhaka City Corporation
DNCC	Dhaka North City Corporation
DPHE	Department of Public Health Engineering
DSCC	Dhaka South City Corporation
DWASA	Dhaka Water Supply and Sewerage Authority
FSM	Faecal Sludge Management
JMP	Joint Monitoring Programme
LGD	Local Government Division
LIA	Low Income Area
NGO	Non-Governmental Organisation
PSTC	Population Services and Training Center
RaJUK	Capital Development Authority
SFD	Excreta Flow Diagram
STP	Sewage Treatment Plant
US$	US dollars
WASA	Water Supply and Sewerage Authority
WEDC	Water, Engineering and Development Centre
WSP	Water and Sanitation Program
WSSSDP	Water Supply and Sanitation Sector Development Plan

1 City context

Dhaka, the capital of Bangladesh, is also the principal city of Dhaka District and Dhaka Division. It is one of world's most populated cities (Section 1.3). Dhaka City stands on the eastern bank of the Buriganga River, located in the central part of the Bengal/Ganges delta. Due to the different definitions of the city (Table 1) the area covered ranges from 126 km^2 to 767 km^2. The area of the city covered by this report was 103 km^2, which is the area that comes under the jurisdiction of the Dhaka City Corporations North and South excluding the Military Cantonment (8.6 km^2) and Biman Bandar airport (14.5 km^2) (City Population, 2016).

1.1 *Geography*

The topography is extremely flat and between 2 to 13 m above sea level. Much of the city sits on a layer of Madhupur clay that extends to a depth of about 10m. Other areas sit on a variety of soil types, including loose and soft silty clay, clayey silt or organic clay (Sarkar & Ali, 2009). It is widely recognised that, as these soil types have low infiltration capacity and are not suited to the infiltration requirements of onsite sanitation systems. Poor infiltration combined with the urban density and destruction of water bodies leaves Dhaka highly susceptible to seasonal flooding. Data from a study by Sarkar & Ali (2009) of nine wells across the city, showed the water table to be below 20 meters at all times of the year.

1.2 *Climate*

Dhaka has a tropical savannah climate (Köppen classification: Aw) (Climatetemp, 2016), with all monthly mean temperatures above 18°C. It has a pronounced dry season which runs from November to January (Weather and Climate, 2016). The wettest months are during the monsoon season (April to October) when the country gets over 85% of the annual average rainfall.

1.3 *Population*

Dhaka is a rapidly growing city, estimates of annual growth rate are as high as 3.6% (Indexmundi, 2015), with an estimated half a million people per year being added to the population. As with many cities there are differing definitions of the city boundary which impact the area and population (Table 1). For the purpose of this report the 'Dhaka City' is defined as the areas under the jurisdiction of the two Dhaka City Corporations (DCCs); Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC). The population therefore covered is 6.8 million (as it excludes those living in the Military

Cantonment (131,864 people) and Biman Bandarairport area (10,626 people) (City Population, 2016).

Table 1: Differing definitions of Dhaka boundaries

	Area (km^2)	Households	Population	Explanation
Dhaka mega-city (Dhaka Action Plan area)	767	3,337,130	14,171,567	This includes adjoining urban areas, some of which are outside Dhaka district.
Greater Dhaka	316	2,034,146	8,906,039	Dhaka City Corporations + 17 rural unions.
Dhaka City	126	1,576,746	6,970,105	Dhaka City Corporations + 1 Cantonment & Birman Bandar.

In 2005 it was estimated that there were over 3 million slum dwellers residing in 5,000 low income areas (LIAs), comprising 35% of the population of Dhaka city. Slums and squatter settlements are increasingly concentrated on the fringes of the city, due to an acute demand for land and high land prices, especially in the central zones and upper class residential areas.

2 Service delivery context description

2.1 *Policy and Laws*

The Local Government Act (2009) gives the local governments the responsibility of ensuring provision of sanitation and other services; this is then reiterated in the City Corporation Act (2009) and National Sanitation Strategy (2005). The National Sanitation Strategy goes also encourages water supply and sewerage authorities to partner with local government institutions to provide services in low income areas (CST, 2015).

The Environmental Conservation Rules (1997) under the Environmental Conservation Act (1995) set the National Environmental Quality Standards for inland surface water, sewerage discharge and industrial wastes (LDG, 2011). This Act also includes the procedures and requirements for Environmental Clearances required for different industries and development projects. Environmental Clearance Certificates are obtained from the Department of the Environment (Table 2). It should be noted that this Act does not have any specific measures for the regulation of wastes, treatment of wastes, sludge management or

sewage treatment plants, amendments have been suggested in the Water Supply and Sanitation Sector Development Plan (WSSSDP) (LDG, 2011). It is unclear if these amendments have been made.

The Water and Sanitation Authority Act (1996) describe the roles and responsibilities of the Water Supply and Sewerage Authorities (WASAs) (LGD, 2011). It covers the provision of offsite sanitation and water by Dhaka Water Supply and Sewerage Authority (DWASA), it does not currently cover not onsite sanitation. The National Policy for Safe Water and Sanitation (1998) is the most significant policy in this sector (LGD, 2011). It aims to promote capacity in the sector, decentralisation and participation of users. It promotes self-sustaining sanitary latrines for onsite sanitation and obliges local authorities to provide them (DWASA, 2014). The Bangladesh Building code was most recently updated in 2014 and is legally binding. It states that all premises shall have excreta disposal facilities and dictates that this should be a septic tank. This code also licences plumbers and builders in this sector.

The National Policy for Safe Water Supply and Sanitation (1998) recognised water and sanitation as social and economic good (LGD, 2011). In 2005 the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Co-operatives prepared a WSSSDP this was superseded by a new WSSSDP (2011-2025) in 2011 (Section 2.3). The objective of this plan is to provide a framework for planning, implementing, and monitoring all activities in this sector. It also provides a roadmap for sector development and a sector investment plan (LGD, 2011). The WSSSDP also reviewed the legal framework for this sector it found that:

- There was overlap in roles and responsibilities of sector agencies e.g. the Department of Public Health Engineering and DCC
- There is on enforcement of existing local Acts (LGD, 2011)

It is known that local bylaws exist encouraging containment of faecal waste and forbidding the connection of toilets and septic tanks to the stormwater drains in the city, however they are not enforced. The Ministry of Environment and Forests has dedicated significant resources to regulating industrial effluent, but has neglected the regulation of sewage and faecal sludge.

There is little mention of faecal sludge management (FSM) in any of the major sector policy documents in Bangladesh. The focus of most policy documents is on eradicating open

defecation and promoting safe sanitation. The recent DWASA Sewerage Master Plan mentions an increasing role for DWASA in FSM, but this requires agreement of the DCCs. The recently drafted National Water Supply & Sanitation Strategy has a chapter on FSM and a draft FSM Framework for Dhaka has been written by Bangladesh University of Engineering and Technology. This framework lays out the roles and responsibilities for the various organizations, including DWASA who are given responsibility for FSM. This has led to the creation of a Ministry steering committee to oversee the development of a national framework for FSM.

2.2 *Institutional roles*

At the national level the Local Government Division (LGD) is responsible for the development of the water and sanitation sector (Table 2). The Department of Public Health Engineering (DPHE) and the Water Supply and Sewerage Authorities (WASAs) are under the administrative control of LGD. The DPHE implements public sector sanitation projects in the urban environment that is not covered by the WASAs. The DPHE are also partially responsibility for drainage projects in urban areas. DPHEs power and involvement in the urban sanitation sector is being devolved to local governments (LGD, 2011).

Dhaka comprises of 92 wards governed by two DCCs, DNCC contains 36 wards and DSCC contains 56 wards. Each DCC is headed by a government-appointed administrator. They are autonomous bodies with responsibility for municipal services (i.e. public health, water supply and small-scale drainage, roads, etc.) and are responsible for planning, implementing and monitoring onsite sanitation (DWASA, 2014). They have fund-raising powers including levying of rates, fees and rents. The Government reserves the right to intervene in their affairs, e.g. by appointing the Chief Executive Officer or transferring functions. In Bangladesh, the role of managing sanitation is assigned to local governments under the respective City Corporation, Paurashava and Union Parishad Acts . DWASA was formed in 1963 and its service area covers 360 km^2 (i.e. beyond the boundary of this report). It has sole rights for the provision of sewage, large-scale drainage and water services in its service area and to collect fees for these services. DWASA's main focus is on the provision of drinking water (Sections 3.7).

The institutional roles that generally relate to sanitation in the city can be seen in Table 2. It should be noted that this list is not exhaustive.

Table 2: Roles assigned to key stakeholders

Categories	Stakeholder	Areas and assigned roles
National government	Local Government Division of the Ministry of Local Government, Rural Development & Co-operatives	**Sanitation, Drainage and Solid Waste Policy** - Oversees DWASA - Set and monitor FSM standards - Set and monitor drainage & solid waste standards
	Ministry of Housing and Works	**Urban and Housing Policy** - Spatial planning (Department of Urban Development) - Development of the Building Code (Housing and Building Research Institute)
	Ministry of Environment and Forests	**Environmental Standards** - Assessing the environmental impact of large projects and issuing Environmental Clearance Certificates - Setting the environmental standards - Regulation of industrial discharge permits
	Ministry of Water Resources	**Water Resources Policy** - Regulation of water resources -Setting of water quality standards
	National Forum for Water Supply and Sanitation	**National Level Coordination of Sector Stakeholders**
Local government	RaJUK (Capital Development Authority)	**Planning & Building Standards** -Implementation of the building standards in Dhaka -Issuing and regulating building permits -Issuing and regulating land use permits -Regulation of the building industry in Dhaka
	Dhaka City Corporations (North & South)	**Ensure Sanitation** - Provision of sanitation, waste management and water supply - Building inspection powers (building code) - Inspection of buildings for sanitary compliance - Issuing and regulating occupancy permits - Issuing and regulating trade licenses i.e. builders - Management of open drains & small bore drains
	Dhaka Water Supply & Sewerage Authority (DWASA)	**Water Supply, Sewage & Drainage Provision** - Management of sewers, sewage pumps and treatment plants - Management of storm water drainage system
Private sector & NGOs	Property Developers	-Installation of sanitation technology
	Households	- Engage emptiers to remove fecal sludge from septic tanks & unblock sewers
	Sweepers	- DCC contract sweeper staff that clean DCC roads & open drains & storm water drains
	Dushtha Shasthya Kendra (DSK)	- Manages VacuTug collection services in low income communities
	Population Services and Training Center (PSTC)	-Manage VacuTug collection services in low income communities

2.3 *Service provision*

The National Campaign for Sanitation started in 2005 and included the 'Sanitation for All by 2013' initiative. Since this campaign the budget allocations for sanitation increased each year. This campaign is widely credited for the huge decrease in open defecation that was achieved (WSP *et al.,* no date). WSSSDP aims to provide 100% of improved sanitation services by 2025. This includes expanding sewered connections to 60% of the population in Dhaka by 2025 (LGD, 2011). This plan prioritises the following sanitation activities in urban areas:

- Rehabilitation of sewers.
- Expansion of the networked sanitation coverage including construction of treatment plants.

Where sewered connections cannot be constructed in a timely manner it is recommended that appropriate onsite sanitation systems be constructed with the accompanying faecal sludge management treatment plants (LGD, 2011).

The budget to achieve this overall development plan is estimated to be approximately US$ 21,000 million. It is assumed that the majority of these funds will come from public sector investment (50%), revenue from utilities (30%) and household investment (15%) (Nyenrode Business Universiteit, 2014). Presently private sector involvement in the sanitation is only happening on a small scale such as latrine manufacturers' hardware markets and motorised emptiers. There is limited private sector involvement in the utilities market (Nyenrode Business Universiteit, 2014), although studies have shown that there is good potential for private investment (LGD, 2011). Private investment would be regulated through the Private Sector Infrastructure Guidelines (2004), as water and sanitation is one of the eligible sectors (LGD, 2011).

In Dhaka, the emptying of pits and septic tanks is undertaken by private sweepers, with clearing and unblocking drains is undertaken by government contract sweepers. Trade licenses (issued by DCCs) are generally required for those engaged in formal trade. As manual emptying of faecal sludge is informal, it is an unlicensed sector. Two NGOs operate motorised emptying systems in Dhaka (Table 2). They have been given permission by DWASA to discharge the faecal sludge at two sewage pump stations.

2.4 *Service Standards*

The national targets have been set in the WSSSDP (Section 2.3). Several organisations have the responsibility to monitor in this sector:

- The Capital Development Authority (RajUK) regulates household relating to the containment of faecal sludge.
- The DCCs are responsible for regulating and managing onsite sanitation systems and private sector involvement.

No monitoring data could be found online. Additionally the author is unsure of the national reporting mechanisms for sanitation in Bangladesh.

3 Service Outcomes

The sanitation types were recorded by the latest census in 2011 can be seen in Figure 1. According to the census nearly all of the population (95%) had access to "sanitary" latrines (Figure 1). Non-sanitary toilets are defined as having no facility to cover the waste. The definitions used only relate to the user interface. Additionally levels of open defecation were recorded as below 1%, which is due to the Governments drive to become open defecation free (Section 2.4). The Bangladeshi definitions of sanitation types are not comparable with JMP definitions of improved or unimproved sanitation. In 2009 85% of the Bangladeshi population had a latrine, but only 54% met the JMP standard for improved latrines (Nyenrode Business Universiteit, 2014).

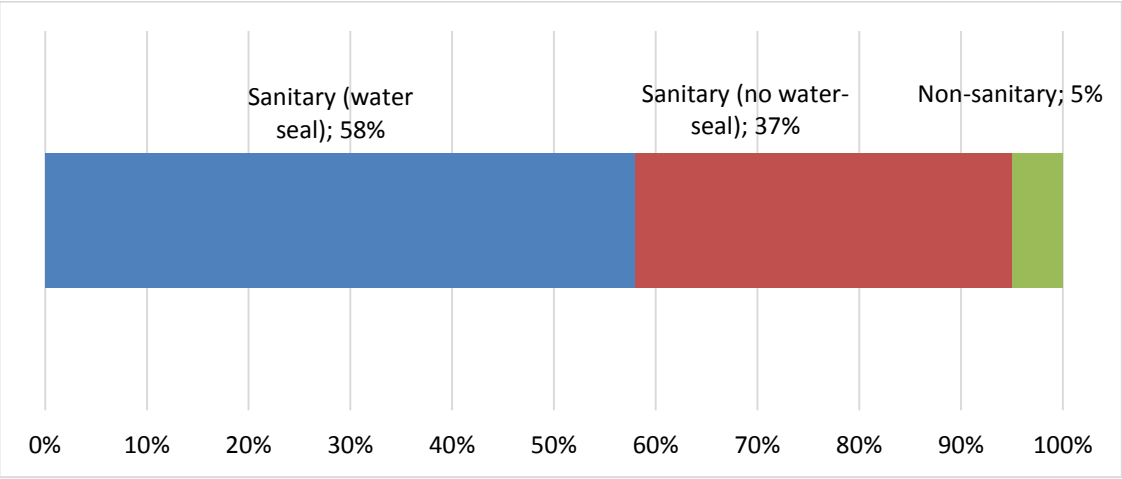

Figure 1 : Use of sanitation in Dhaka, by type of facility (World Bank, 2016)

3.1 *Offsite systems*

A sewerage system was first developed in Dhaka in 1923 (DWASA, 2014). The current network is 885 km long (DWASA, 2014) which serves 20% of the population (Water Aid, 2011). It should be noted that the northern parts of the city are not sewered i.e. Mirpur, Shyamoli, Uttara (DWASA, 2014). In 2016 the World Bank study found that 25% of households surveyed reported being connected to the sewer network, this data was used to generate the SFD as it is the most recent data.

Not all of the wastewater discharging into sewers reaches the treatment plant in Pagla, due to either leakage or non-functioning pumping stations leading to sewers discharging into nearby drains or watercourses (via overflows). The WSSSDP noted that the volume wastewater collected by the Dhaka sewers is three times the higher than the treatment capacity of Pagla sewage treatment plant (STP) (LGD, 2011).The DWASA Sewerage Master Plan notes that 9 of the 27 installed pumping stations are not functioning, while a further 10 have questionable functionality. Due to this it is estimated that 70% of the sewerage network is currently not operational. Therefore a majority of the sewage collected in the sewers is currently discharged into storm water drains and waterbodies. In terms of the SFD this means that only 30% of the wastewater collected in the sewers arrives at the STP.

Pagla STP is located on a 111 ha site to the south east of Dhaka City, approximately 8 km from the city centre. It has a design capacity of 96,000 m^3/day, and 120,000 m^3/day at peak flow rate (DWASA Sewerage Master Plan, 2013). The STP receives faecal sludge from motorised emptiers (Section 3.5.2) via two of its pumping stations. It is estimated that the flow entering the STP ranges from 30,000 to 40,000 m^3/day (DWASA Sewerage Master Plan, 2013), meaning that the STP is significantly under-loaded. It is known that the effluent quality does not currently meet the national standard for BOD_5.

In the World Bank study it was calculated that 1.2% of wastewater entering the STP was effectively treated, due to poor operation and maintenance, and performance of the STP. In terms of the SFD this results in 0.3% of the populations' total waste being treated at the STP.

3.2 *Onsite systems*

The World Bank study undertook a household survey across the city (*n=360*) to identify where toilets discharged to. As with the 2011 census they found that all households

surveyed used a sanitation system (either private or shared). The study noted an unexpected low prevalence of dry technologies such as pit latrines and hanging latrines. These technologies are known to be common in LIAs, where 33% of Dhaka' population live (Section 1.3). The low prevalence of these technologies was thought to be due to the sampling method, which possibly under-represented LIAs. The breakdown of where toilets discharge to can be seen in Table 3.

3.3 *Usage*

As the national census data concentrates on the user interface, rather than the technology type or the faecal wastes discharge point, the data used to generate the SFD was based on the World Bank study (Table 3). Although, in the census 95% of households are using sanitary latrines (although many are shared Section 3.4.1), it can be seen in Table 3 that most of the waste from the toilets ends up in the local environment via the drainage system. The data from Table 3 was deemed to be the best available data and was transposed and interpreted using the terminology for the SFD methodology (Table 4), this data was then used to generate the SFDs in the Executive Summary and Appendix 1.

Table 3: Where toilets discharge to

Discharge options	**Usage (*n=360*)**
Directly to piped sewer system	25 %
Septic tank connected to piped sewer system	3 %
Directly to ditch or drain	21%
Septic tank connected to drain	49%
Septic tank with no outlet	2%

* this is a sealed tank

3.4 *Categories of origin*

This report and the SFD are based on an *in-depth* World Bank study on household faecal sludge management. It does not consider non-household generated faecal sludge such as faecal sludge from schools. Schools were identified in the other city studies[1] as potentially a significant contributor to excreta flow across these cities. As in other city studies the flow from schools is not incorporated in SFDs. To include the flow of excreta from schools, a better knowledge of the use of school and home sanitation facilities is required, so usage could be split between locations and technology types.

[1] See reports for Kumasi, Nakuru, Niamey and Kisumu http://sfd.susana.org/

3.4.1 Shared or communal toilets

Shared sanitation is defined by Joint Monitoring Programme as a sanitation facility shared by two or more households. The average household size in Dhaka was found to be 4.8. The World Bank study found that 23% of households were using improved shared sanitation facilities citywide, but this increased to 65% of households in LIAs, with an additional 12% using unimproved shared facilities. In LIAs an average of 11 households shared a latrine (median value 7 households); compared to an average of 5 households sharing a latrine city-wide (median value 4 households). 35% of those in LIAs who use a shared latrine reported sharing their latrine with more than 30 individuals. To some extent, this can be explained by the use of public toilets, which are included in this study's definition. This data is supported by an earlier study which found that 78% (*n=354*) of households surveyed LIAs used shared toilets (Water Aid Bangladesh, 2012). 25% of these households were using either a community (22%) or public (3%) toilet (Water Aid Bangladesh, 2012).

3.5 *Emptying technologies for onsite sanitation*

As only 2% of sanitation systems citywide do not discharge to the drainage or sewer system (Table 3), which means there is a limited need for emptying services. The World Bank study recorded that only 13% of households' sanitation systems had ever filled up citywide. Of the households that had tanks or pits which filled in the past, a majority (94%) had them emptied, while 6% abandoned the pit or tank and left it unsealed. Where households have reported emptying their containment, a majority of households (49%, *n=28*) empty their facility every 12 months or less. This is probably due to a combination of heavy usage and the soil conditions which hinders infiltration. In the World Bank study it was estimated that 8% of households in Dhaka have their pits or tanks emptied. Of those that used emptying services, 97% used manual emptiers.

For this report and the production of the SFD (Appendix 1) it was assume that 2% of the populations waste was emptied, this is due to only 2% of the population having containment systems which are sealed and requires emptying (Table 3 and further explained in Section 4). Three types of empting options were found to be in use Dhaka:

- Private manual emptying (by *sweepers*)
- Manual emptying by family members
- Motorised emptying by VacuTug

3.5.1 *Manual emptying*

The 's*weepers*' historically comprised of Hindu Dalit caste employed by the municipality to clean roads and drains and remove solid waste. They are also engaged on a contract basis by private households to empty septic tanks and pit latrines, to unblock sewer lines and drains. They are easy to contact, have a quick response time, are able to accesses difficult locations and removal of sludge is included in their service charge. The cost of manual emptying ranged from US$13 to US$30. The actual number of *sweepers* active in Dhaka is difficult to estimate due to the informal and clandestine nature of this work.

The World Bank study found that a majority of the sludge emptied manually was reported as being directly discharged into the local environment (73%, *n=30*). In the other cases faecal sludge was first collected in a drum and then discharged into the local environment (23%, *n=30*) or directly buried in the compound (3%, *n=30*). In terms of the SFD this means that all of the faecal sludge emptied manually is discharged into the local environment without treatment.

3.5.2 *Motorised Emptying*

The VacuTug (a 2,000 litre tanker mounted on a small truck) is the only motorised emptying option operating in Dhaka. There are three VacuTugs in the city, two operated by DSK and one by PSTC (Opel & Bashar, 2013). Not all of the VacuTugs are operational, due to a lack of demand for their services.

3.6 *End-use or disposal*

There is no faecal sludge treatment plant in Dhaka and currently no recognised end-use for faecal sludge.

3.7 *Drinking water supplies in the city*

Dhaka has 100% improved drinking water coverage (UNICEF, 2009) provided by 3040 km of water lines with 325,717 connections (DWASA, 2014). This is one legal connection per every 10 households. A majority of households gain their drinking water from a piped water supply either directly or indirectly (78%), the remaining coming from shallow tube wells (20%) and deep tube wells (4%) (UNICEF, 2009). 78% of the piped water supply comes from 644 deep tube wells. These are normally over 30 meters deep, but DWASA are now drilling additional wells at a depth of over 300 meters. The remaining 22% of piped drinking water comes from the Shitalaksha and Buriganga Rivers and is treated at four water treatment plants (DWASA, 2014).

3.8 *Risk to ground water*

In terms of identifying the risk to groundwater from sanitation sources, for generating the SFD it is assumed that clay is the predominant to be the rock type in the unsaturated zone (Section 1.1), and the depth to the stabilised water table is lower than 10 meters (Section 1.1). It is assumed that less than 25% of sanitation facilities are within 10 metres of groundwater source and that less than 25% of sanitation facilities are uphill of groundwater sources, due to the gradient of the city (Section 1.1). As ground water sources are used for a majority of the drinking water (i.e. piped water and well water) it is assumed that over 25% of the population use groundwater. Using these data a low ground water pollution risk was generated by the SFD matrix.

4 SFD Matrix

The data from Section 3 has been collated in Table 4 as the basis for generating the accompanying SFD. Due to the margins of error associated with the data collected only streams which represent 1% of the population or more are shown in the SFD.

The only difference in the data used to generate this SFD, compared to the World Bank study was that in this report it was assumed only 2% of onsite systems were emptied (Table 4), in the World Bank study it was estimated to be 8% of systems due to emptying in the past. 2% was selected for this study as:

- Only 2% of sanitation systems had no outlet (Table 3), therefore required continual emptying.
- The remaining 6% were discharging into drains or sewers (Table 3) therefore were occasionally being emptied.
- The reported emptying could be interpreted as unblocking pipes rather than physically emptying systems.

These differences in data make no difference to the overall SFD as both streams of excreta are released into the environment without treatment. The assumptions made were negotiated and agreed upon with the World Bank. These data were used to generate the SFD found in the Executive Summary and Appendix 1.

The tool has the ability to take into account the flow of infiltrate from soakaways and pit latrines, but as this stream was deemed to be safely managed (Section 3.7), it has been

disregarded in Dhaka. This was done to reflect the sanitation service chain more accurately in terms of wastewater and faecal sludge movement.

5 Stakeholder Engagement

The primary stakeholder in this process was the Water and Sanitation Program (WSP) of the World Bank who is the collaborating partner in this study. A majority of the data in this report unless stated otherwise comes from:

The World Bank WSP 2016 Report: Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Dhaka, Bangladesh.

The World Bank study was based on a household survey, transect walks, observations, key informant interviews and focus group discussions. It also incorporated a review of the enabling environment for FSM. It should be noted that no other stakeholders were involved in the production of this report, as the World Bank had consulted with major stakeholder during their research.

6 Prospects for uptake and use of this study

The World Bank WSP 2016 Report: Fecal Sludge Management: Diagnostics for Service Delivery in Urban Areas, Case study report – Fecal sludge management in Dhaka, Bangladesh. Is being used internally with stakeholders, to improve and plan urban sanitation in the city. This report will be available externally on http://sfd.susana.org/ and enable external organisations to gain an overview of the current situation in Dhaka.

Table 4: Data used to draw the SFD

Management of black water	SFD definition level 1	SFD definition level 2	Usage	How emptied	Emptied (%)	Going to treatment (%)	Treated (%)
Directly to piped sewer system	Offsite sanitation	No onsite containment discharged to centralised combined sewer	25%	-	-	30	<1%
Directly to drain/ditch		No onsite containment discharging to open drain or storm water sewer	21%	-	-	-	-
Septic tank connected to piped sewer system	Onsite transitioning to offsite	Sealed tank discharging to combined sewer	3%	-	-	-	-
Septic tank connected to drain		Sealed tank discharging to open drain or storm water sewer	49%	-	-	-	-
Septic tank no outlet	Onsite sanitation	Sealed tank with no outlet and no overflow	2%	Manually	99%	0	-

Acknowledgements

A majority of the data in this report unless stated otherwise is from the World Bank WSP Fecal sludge management: Diagnostics for service delivery in urban areas, case study report – Fecal sludge management in Dhaka, Bangladesh. That report was prepared by WEDC and Oxford Policy Management Ltd for the World Bank. This report was compiled as a part of the SFD Promotion Initiative project funded by the Bill and Melinda Gates Foundation.

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Appendix 1: SFD