Small town sanitation learning series Sakhipur, Bangladesh

July 2020

▼ View of the co-composting plant and its drying beds in the foreground

WaterAid/ Al-Emran

Key messages

1. The small town of Sakhipur is on track to achieve town-wide safely managed sanitation, the result of technical excellence (including its co-composting plant), political drive, a clear vision, and support by WaterAid Bangladesh.
2. Local partnerships are vital to close the sanitation service chain such as the Agricultural Extension Department.
3. The sanitation vision includes both considering sanitation as a service and using the principles of circular economy.
4. Fostering municipal leadership and ownership is a slow but critical process, which can be the focus of national level advocacy for future replication.

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1. Introduction

WaterAid Bangladesh (WAB) and the Bangladesh Association for Social Advancement (BASA) have supported Sakhipur Municipality both technically and financially to establish a co-composting plant in 2015. The plant treats both faecal sludge and organic solid waste to produce compost. The technical achievement has been well recognised and documented. This brief is mainly focusing at non-technical aspects, especially how this plant (and work around it) is paving the way for full safely-managed sanitation in the town, what has led to this success, and how it could be replicated.

2. Context

Bangladesh has impressively reached almost zero open defecation and is now facing the "second generation" challenge of faecal sludge management (FSM) – with 32% "safely managed sanitation" in rural areas, and no urban estimate. Bangladesh has adopted a Faecal Sludge Management Institutional Regulatory Framework (FSM-IRF) in 2017 for different local government institutions e.g. rural, municipalities, city corporations and Dhaka. The pourashavas are effectively responsible for FSM services as well as solid waste management, yet small towns may not have the adequate human resources, budget or incentives to deal with the issue.

Sakhipur is a town of Tangail District located in the north-central part of Bangladesh. It comprises about 33,182 people with a density of around 1,814 people / km^2. According to a 2015 baseline report, it had 4,959 pit latrines and 288 septic tanks; the town was generating almost 10 tonnes of solid waste and around 15 m^3 of faecal sludge per day. Sakhipur's sanitation situation in 2015, before the plant entered service, is shown in a retrospective Shit-Flow Diagram (SFD), below, when sludge was either left in full pits and septic tanks, or emptied and discharged unsafely, causing environmental contamination and health concerns.

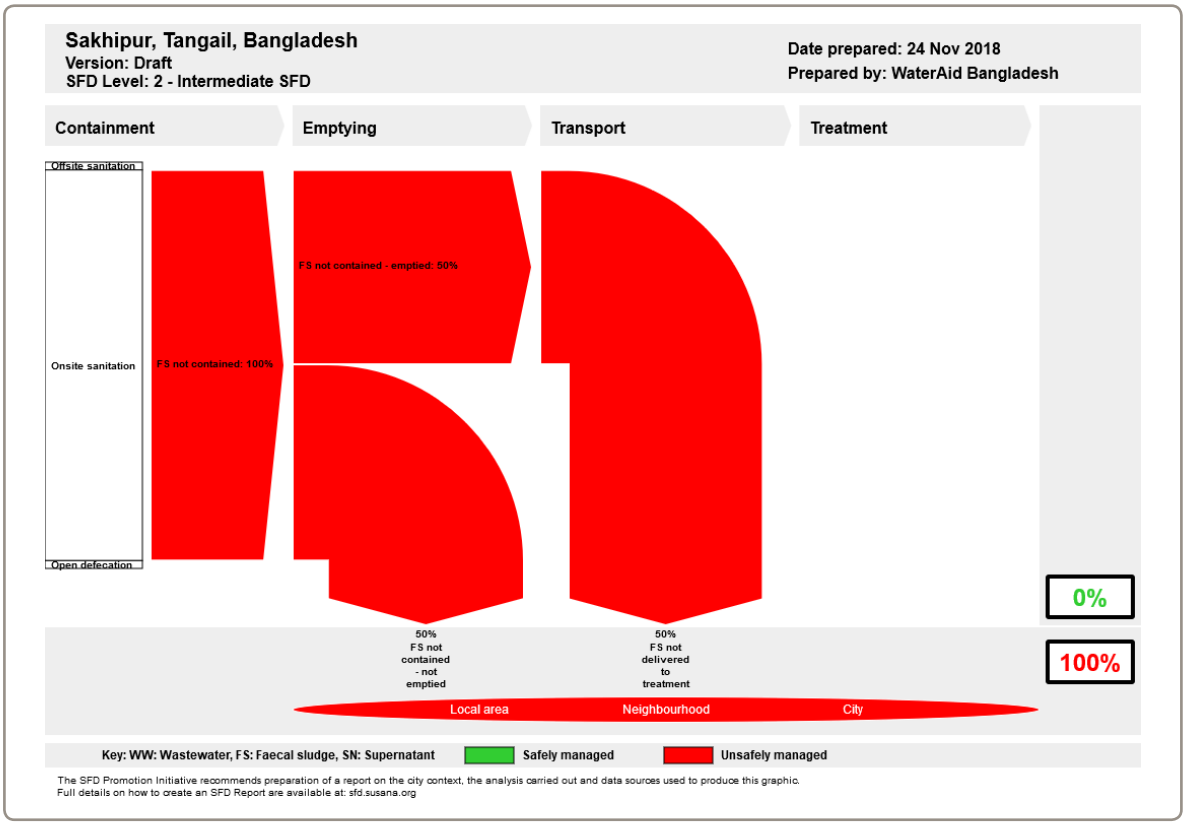

Figure 1 - Retrospective Shit-Flow Diagram (SFD) showing the situation before the intervention during 2015

3. The project and its result

Project history

WAB and BASA have been working in Sakhipur since 2010 on various WASH initiatives, for instance by installing a decentralised wastewater treatment plant (DEWATS) in the Rakibnagar community. As part of WAB's WASH programme in small towns, identifying solutions for FSM for the whole town started in 2012. Following a context assessment, links with the municipality, and discussions about potential options, they opted for an FSM chain including Vacutug pit emptying and an FSTP introducing unplanted drying beds and a co-composting plant. The construction of the plant started in 2015 and it is in operation since 2016.

Sanitation chains and plant

There are two main waste streams of note:

1. Faecal sludge, accumulating in pits and septic tanks. It is collected by workers employed by the municipality using a Vacutag (truck-mounted 1 m^3 tank and mechanical pump), on demand for a fee of Tk 1,000 (as of 2019) – the fee started at Tk 500 to create the market and gradually increased. The emptiers usually do 4 to 7 trips per day.
2. Organic waste, i.e. usually household kitchen waste is collected regularly by workers employed by the municipality for a monthly fee of Tk 60 (as of 2019). Waste is generally segregated by entrepreneurs after collection, although waste is now segregated at source in increasing rate. The municipality is actively involved to initiate source separation of organic and inorganic waste by creating awareness of the city dwellers.

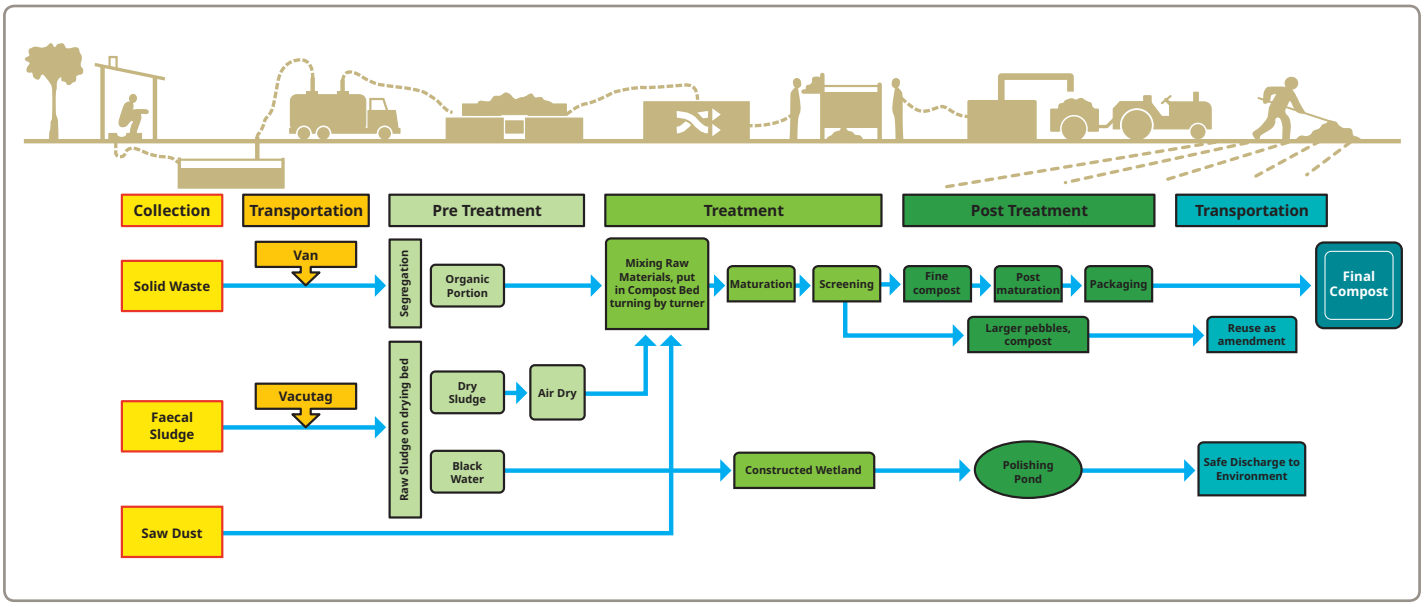

Figure 2 - Retrospective Shit-Flow Diagram (SFD) showing the situation before the intervention during 2015

Both waste loads are brought to the co-composting plant. Faecal sludge is dewatered and dried on drying beds, and then mixed with sorted organic waste, regularly turned mechanically, so that it turns into compost within 8 weeks. After another 2 weeks of maturation and safety period the compost is packaged for sale as "Shakhi Compost". The process makes use of the high nitrogen content of faecal sludge, and high organic carbon content of organic waste. The process takes about twelve weeks from sludge delivery to final compost for reuse.

The plant features many innovations, such as the clear covering on drying beds, the dedicated machines to turn the compost and the final high-temperature treatment stage in a hot exchanger unit through hot air circulation inside compost matrix.

This brief description cannot do justice to the work that has gone to build and operate the plant, and the resulting quality. For more in-depth information about the technological details, consult for instance the WEDC conference paper, the FSM4 conference case study and the concept video.

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Results

According to design, the plant can treat 125 tonnes of solid waste and 1,200 tonnes of faecal sludge per year and produces 24 tonnes of compost. An SFD was done in 2018 and showed that 43% of the town's sludge is now safely managed. There is still work to do to reach 100% safely managed sanitation, as discussed below in section 5.

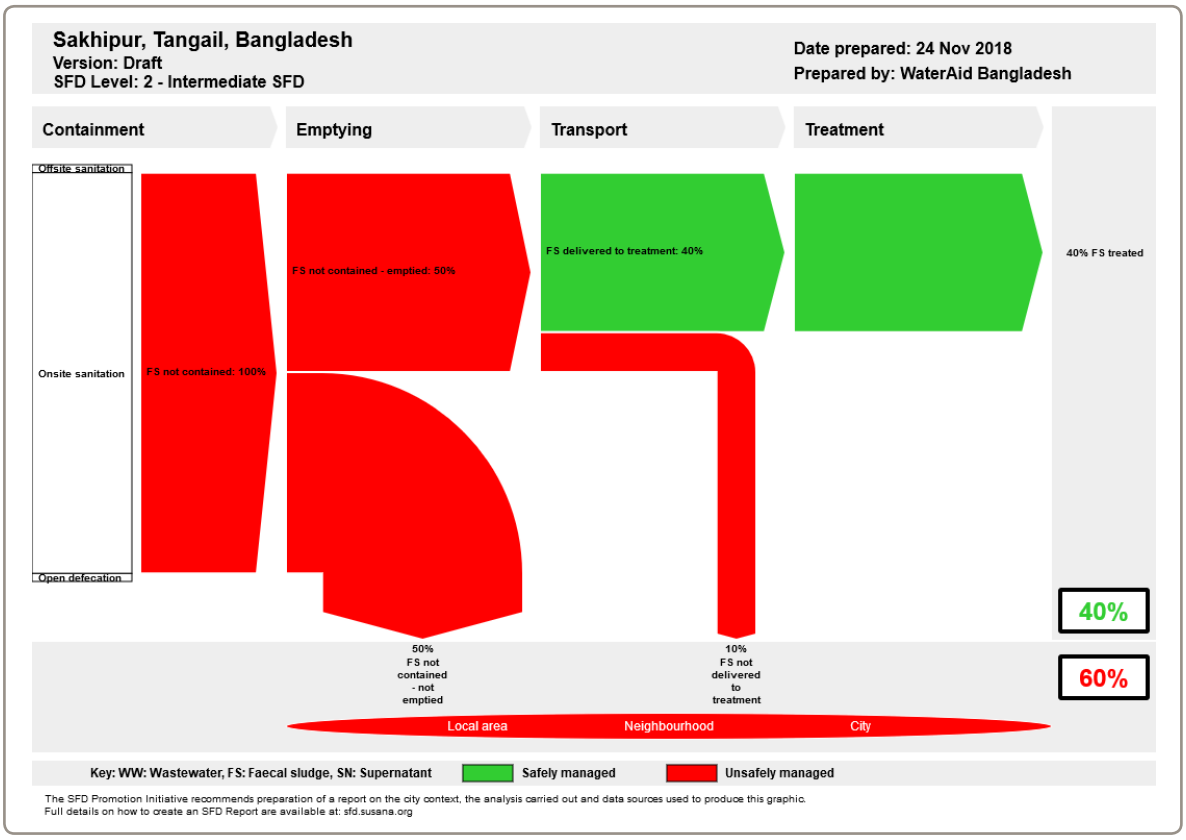

Figure 3 - SFD done in 2018

The municipality is championing the approach and technologies used. The sanitation workers (pit emptiers) report higher job satisfaction, notably because of using protective equipment, mechanical pumps, and the improvement of health & safety rules improving how residents perceive them.

Beyond the expected impacts in the town itself, this project has had wider impacts. The Mayor and the municipality have become more vocal about sanitation and FSM, hosting learning visits for other town authorities, research institutions, academicians, and applying for national awards.

4. Success factors

This section attempts to identify the main factors that have led to Sakhipur's sanitation success, as well as blockages on the way.

WaterAid's role and vision

WAB and BASA had developed excellent knowledge of the town over the years: its socio-economic and physical conditions, but also the political and financial matters at hand. This has allowed a fruitful engagement to take place with relevant stakeholders. WAB also took a **slow and steady approach** to develop this project "organically" over more than 5 years: developing relationships and waiting for good political moments; identifying solutions; obtaining land and building an access road. These kinds of activities require flexible funding (usually unrestricted funds), and WaterAid's value of courage.

WAB also has high technical capacity and employed many technical specialists who used their expertise on the project. This allowed a vision for sanitation to emerge along two principles: Sanitation as a service; and Circular economy.

Circular economy: working with agriculture

In opposition to traditional or linear waste management, which often aims to just dispose of waste safely, circular economy principles aim to create products from biological waste such as fertiliser, proteins, energy sources, etc. and recover nutrients and water. When using such an approach, a first step is to look at which products would be in demand locally, and which waste streams could be appropriate; you therefore work "backwards" in the sanitation chain, to identify what could make good end products.

In the case of Sakhipur, one issue identified was the cost and availability of fertiliser, and the decreasing quality of the topsoil experienced by farmers nearby because of overuse of chemical fertiliser. Another issue was the presence of poultry farming, with 20 tonnes of chicken litter produced daily in the municipal area. This motivated the Mayor of the municipality to look at solutions and ask BASA for possible ideas: the co-composting of faecal sludge and solid waste. plant was originally developed to include poultry litter as a third waste stream. However poultry litter was already reused for fishfeed, so co-composting it would not have brought benefits.

This led to a **second vital partnership** (besides the municipality): the Department of Agricultural Extension (DAE), which undertakes agricultural research. The DEA played a key role to reach out to farmers, hold workshops, identify potential test sites for compost, test and help certify the compost, and recommend it in training sessions. This has proved critical in a small town with strong agricultural links.

Sanitation as a service: working with the municipality

When viewing sanitation as a service (rather than, for instance, a chain of technologies), WAB focused on how the municipality could truly understand and own sanitation, and reach all residents. This has meant **working on politics**, to get authorities interested; **on municipal budgeting** to see what the town can afford; geography and socio-economic conditions, to analyse how to reach more marginalised communities.

Town leadership, ownership and vision

As of 2019, the Mayor speaks as a sanitation champion, advocating strongly for FSM and for solutions such as those in Sakhipur. He mentions the inspiration to have a clean and environmental town, coming from his visits overseas. He has hosted learning visits and has become a helpful ally to develop country-wide FSM. In short, he is the **ideal municipal sanitation champion** we should try to have. This shouldn't hide the work done behind the scenes by WAB and BASA during the past 7 years to foster this leadership. This work has included:

- Exposing the Mayor and municipal staff to other locations to "plant ideas";
- Accepting to fund some elements of the sanitation chain upfront, as an investment towards eventual municipal ownership

The Mayor's support was important to **obtain land** for the plant, a perennial blockage – especially as residents objected to the plant being built near them, notably because of concerns about smell. Yet even with a willing municipality, it took almost 2 years to obtain land.

Technology choice

The choice of co-composting has been partly informed by the circular economy principle (given the needs and availability in Sakhipur), partly by the expertise of WAB and BASA, and partly by a pragmatic consideration of what would motivate authorities. Yet it has disadvantages: such a plant is significantly more expensive to install and operate than, for instance, using drying beds and then burying / landfilling the dried sludge; the income from compost sale does not easily offset much of the operating costs (see table below); and it requires constant technical expertise and guidance to operate. However in the context of Bangladesh (with a push for fully safely managed sanitation and lack of space), it represents a viable compromise.

But a co-composting plant can also be seen as a "middle ground" between two opposite trends in small town sanitation: one tendency is to keep treatment simple with trenches or drying beds, as a first low-cost and low-risk step towards safe management; the other is to prefer more complex and expensive technologies like mechanical dewatering, or the Omniprocessor (which is being trialled in Bangladesh), which can afford better control of the treatment process and more reuse options.

As such, the plant can also be seen as:

1) An investment into making FSM more visible: in the case of Sakhipur, the investment is paying off in having a vocal sanitation champion in the Mayor, and visitors witnessing concrete ways to make FSM a reality.
2) A way to integrate with more sectors beyond WASH – like agriculture
3) A way to treat some of the solid waste, another major hurdle faced by municipalities.

Financial aspects

A study of the town sanitation business model done in 2018 was showing that the income from compost sale and emptying / collection fees was covering around 35% of operational expenses, although this had increased to more than 75% till September 2019. For comparison, the plant required an investment of Tk 11.4 million.

Average monthly financials	2017		2018		2019	
	BDT	% of revenue	BDT	% of revenue	BDT	% of revenue
Solid waste collection fees	12,278	21%	19,735	28%	17,185	21%
Faecal sludge collection fees	25,366	43%	34,500	50%	36,181	45%
Compost sale	14,968	26%	15,425	22%	27,014	34%
Total revenue (incl. misc.)	**58,693**		**69,660**		**80,380**	
Total expenditure	**159,081**		**155,390**		**116,748**	
Revenue as % of expenditure	37%		45%		69%	

Figure 4 - Selected financial aspects from the 2019-20 business model assessment

Demand for compost doesn't seem to be an issue because of the promotional activities among the farmers through DAE. Raising the price of Shakhi Compost is harder: the current price is Tk 18/kg; whereas chemical fertilisers cost around Tk 22-25 due to subsidies, and other organic fertilisers are not subsidised and are more expensive – a matter of ongoing advocacy.

Other ways to increase revenue can include expanding the solid waste and faecal sludge collection (see next section), and a more realistic allocation from central government.

5. Future

Towards 100% safe management in Sakhipur

WAB staff have a clear vision to reach 100% safely managed sanitation in the town. To achieve this, we can make a comparison with how to make the Shit-Flow Diagram entirely green: expanding horizontally can be seen as **improving services** along the chain (better emptying, a treatment plant, reusing products, etc.), expanding vertically is a matter of **reaching all residents** and institutions, and especially those harder to reach.

As of 2018, about 43% of the town's sludge was safely managed, with a target of 70% for 2020, and 100% by 2023. To achieve this, the main hurdle is making sure all pits can be accessed and emptied, that residents can afford the service, and are willing to use it. WAB staff would roughly divide the population as follows:

- 50% are accessible by emptiers with the Vacutag
- 25 to 30% are harder to access due to narrow lanes, but can be reached by a more portable pump (e.g. Gulper-like)
- And the remainder are hard-to-reach and would face issues of accessibility (requiring road construction) and/or affordability (requiring some form of direct or indirect subsidy).

One issue is the red line under "transport" in the SFD: about 10% of the sludge is unsafely emptied and dumped by a few **informal manual emptiers**. Despite the risk and illegality, this service is more expensive than mechanical emptying (up to Tk 1,500 vs Tk 1,000), but is preferred by residents living on narrow roads, or who do not want to go the municipality to ask for emptying.

Solid waste management is another hurdle: **sorting organic waste** represents a significant portion of the plant's operational expenditure. A small but increasing number households are segregating their waste at the source, and WaterAid's behaviour change framework could be used to analyse ways to improve this. Some suggestions in early 2019 included: having distinct containers; promote it as an aspirational 'good practice'; educate residents on how waste treatment happens; offer rebates.

Finally, as there is increased ownership by the municipality, the question of an **exit strategy** for WAB and BASA remains open, especially for financial viability given the current operational losses. It cannot be expected that the whole costs of the town sanitation chain can be covered just from compost sale and collection fees; a life-cycle costing analysis could reveal the extent of public funding necessary to achieve full safe sanitation.

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Replicability and dissemination

Sakhipur is just one pourashava out of more than 300 in Bangladesh, and one question is how to make this process applicable elsewhere, especially considering the patient work of the partners to build political momentum, obtain land and develop services. There are several current initiatives on town sanitation such as investments from the Asian Development Bank, World Bank and Islamic Development Bank for further treatment plants; investments from the Bill and Melinda Gates Foundation to build capacity for City-Wide Inclusive Sanitation; and increased technical leadership from the DPHE.

The technical aspect is demanding to replicate given the level of expertise involved, but can be (and has been) documented to this effect. On the other hand the leadership side has been described as the **"least scalable aspect"** and could become the target of increasing advocacy efforts, to make sure that municipalities have not only the mandate but also the decision power, the incentives and initial funding to invest in sanitation, choose options wisely and reach those unreached so far.

6. Conclusion

The Sakhipur experience has shown how an impressive improvement in safely managed sanitation can come from a combination of technical innovation, strong local partnerships, and context-led choices.

Beyond the specific technology choices, what stands out is the vision leading to this progress:

- Seeing sanitation as a service, to gradually build the municipal leadership and ownership and aim to reach all residents; and
- Seeing sanitation as part of the circular economy, to start thinking about potential end-products and work recursively to find which solutions can produce them.

Acknowledgements

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- Municipality of Sakhipur: Mayor Abu Hanif Azad, municipal staff, pit emptiers
- International Training Network – Bangladesh University of Engineering and Technology: Md Ashraf Ali

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Acronyms

ASA	Bangladesh Association for Social Advancement
DAE	Department of Agricultural Extension
DPHE	Department of Public Health Engineering
DEWATS	Decentralised Wastewater Treatment Plant
FSM	Faecal Sludge Management
FSM-IRF	Faecal Sludge Management Institutional Regulatory Framework
SFD	Shit-Flow Diagram
Tk	Bangladeshi Taka. As of September 2019, US$1 = Tk 83, £1 = Tk 102
WAB	WaterAid Bangladesh

Sources and further reading

- PMID (2015), Baseline Survey on Faecal Sludge, Solid waste and Poultry litter Management in Shakhipur Municipality, prepared for WaterAid and BASA.
- ERG (2016), Political economy of fecal sludge management in a small town: case study of Sakhipur
- Government of Bangladesh (2017), Institutional and Regulatory Framework for FSM - Paurashavas
- Al-Muyeed et al. (2017), Co-composting of faecal sludge with solid waste to improve FSM practice in Sakhipur municipality, WEDC conference paper
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- Khairul Bashar (2018), Study on Developing Business Models of Faecal Sludge Management for Sakhipur Municipality, Tangail, prepared for BASA
- Al-Muyeed et al. (2018), SFD Report - Sakhipur, Bangladesh, SFD Promotion Initiative
- Rashmi Verma (2019), Both, solid waste and faecal sludge must be tackled for clean cities, Down To Earth

More information

You can find more information on WaterAid and sanitation at **https://washmatters.wateraid.org/small-town-sanitation**

This is part of a series of learning notes on small town sanitation with the link above.

WaterAid/ Al-Emran

▲ **Fig.5: A worker prepares to empty a Vacutag sludge pump in Sakhipur**

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